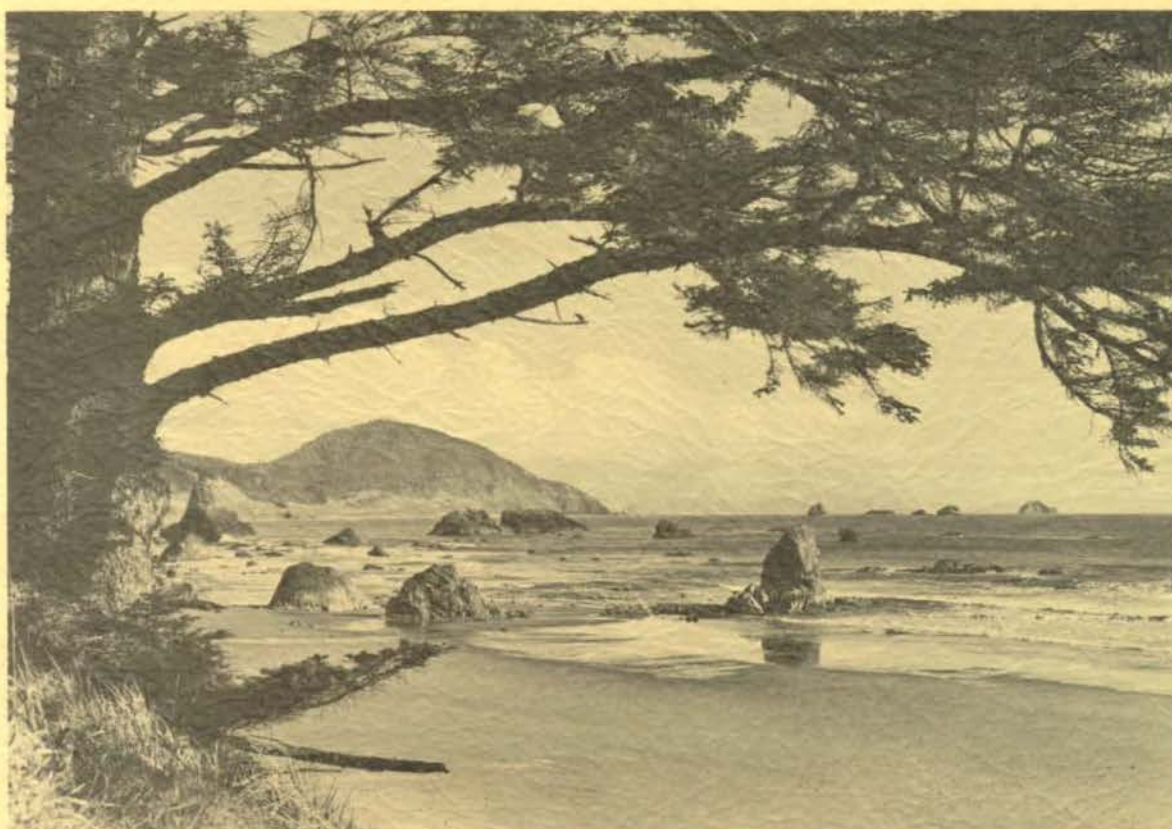


**EIGHTEENTH
BIENNIAL REPORT
OF THE
STATE OF OREGON
DEPARTMENT OF GEOLOGY
AND MINERAL INDUSTRIES
1970-1972**



THE COVER

Humbug Mountain, the highest prominence on the southwestern Oregon coast, as seen looking southeast from near Port Orford. The mountain is composed of massive conglomerates 130 million years old. The offshore stacks are separated from the onshore cliffs by a fault and are perhaps more than 10 million years older.

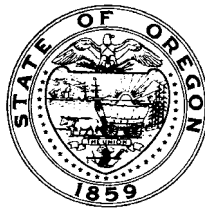
A report on this geologically interesting and scenically spectacular area was published by the Department as its Bulletin 69, *Geology of the Southwestern Oregon Coast*, during the biennium.

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1069 State Office Building
Portland, Oregon 97201

BULLETIN 76

EIGHTEENTH BIENNIAL REPORT OF THE STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

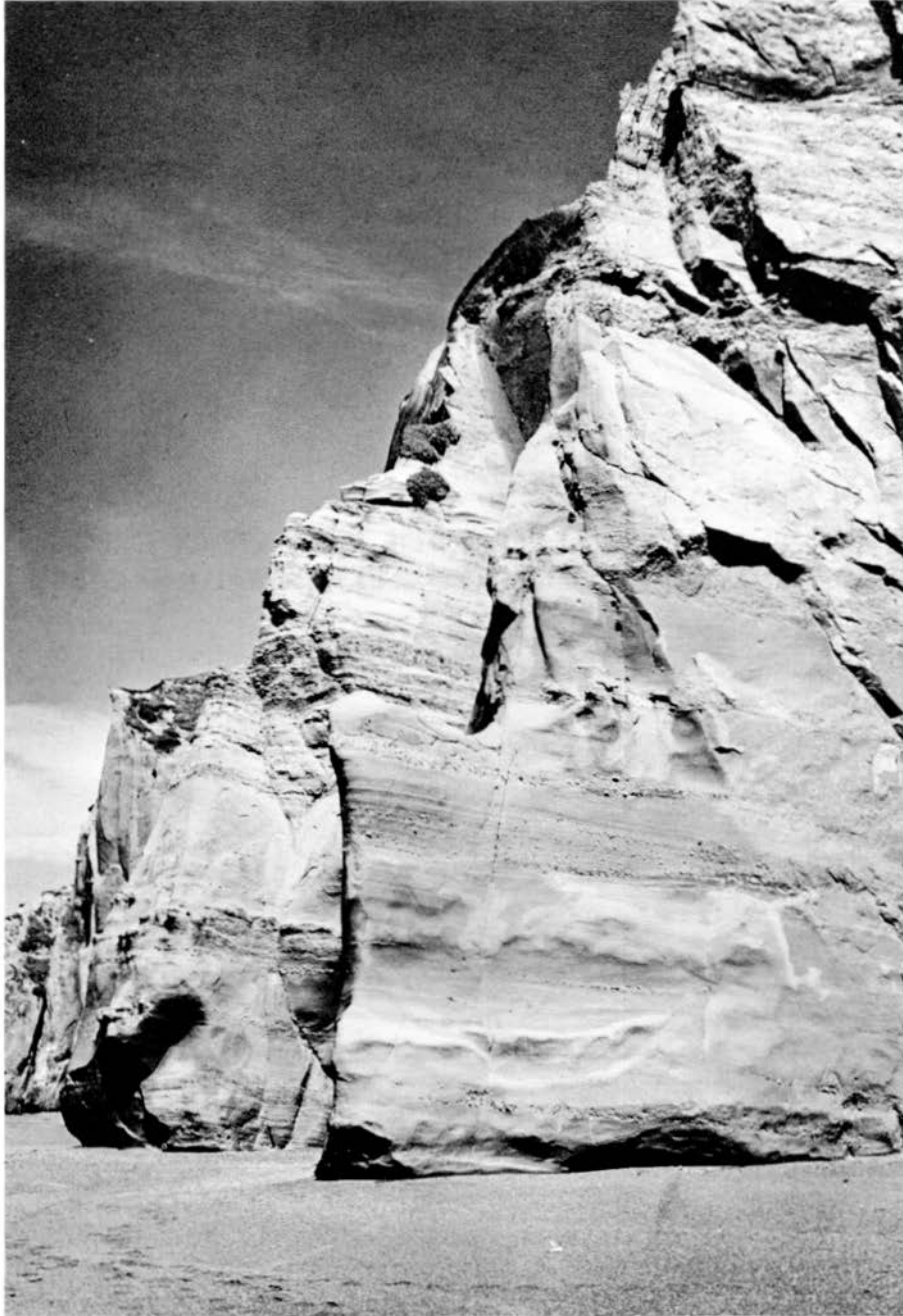
1970 - 1972



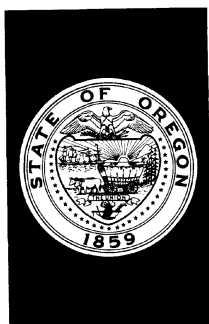
1972

STATE GOVERNING BOARD
R. W. deWeese, Portland, Chairman
William E. Miller, Bend
Donald G. McGregor, Grants Pass

STATE GEOLOGIST
R. E. Corcoran



The Oregon coast is the battleground where the erosive forces of wind and wave attack the various rock formations which protect 400 miles of the state's shoreline. The geological hazards of the coastal zone prompted a detailed study in Tillamook and Clatsop Counties by the Department during the biennium. The report was published as Bulletin 74.



DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

ADMINISTRATIVE OFFICE

1069 STATE OFFICE BLDG. • PORTLAND, OREGON • 97201 • Ph. (503) 229-5580

TOM McCALL
GOVERNOR

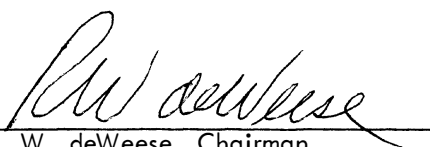
STATE GEOLOGIST
RAYMOND E. CORCORAN

To His Excellency, The Governor
of the State of Oregon
and to
The Fifty-seventh Legislative Assembly
of the State of Oregon


Sirs:

We submit herewith the Eighteenth Biennial Report of
the State Geologist, covering activities of the Department of
Geology and Mineral Industries for the period from July 1, 1970,
to and including June 30, 1972.

Respectfully,


R. W. deWeese, Chairman
of the Board


William E. Miller, Member


Donald G. McGregor, Member

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BRIEF HISTORY OF THE DEPARTMENT

- 1872 First State Geologist, Dr. Thomas Condon, appointed by Legislature.
- 1911 Legislature creates Bureau of Mines of Oregon, located at Oregon Agricultural College.
- 1913 Legislature renames Bureau the Oregon Bureau of Mines and Geology and expands its responsibilities.
- 1923 Bureau incorporated into School of Mines at Corvallis.
- 1925 Legislature creates Oregon Mining Survey but without office or staff.
- 1929 Legislature creates State Mining Board with no office or staff.
- 1937 Legislature creates State Department of Geology and Mineral Industries, with offices in Portland, Baker, and Grants Pass.
- 1941 Legislature creates Spectrographic Laboratory, with installation in the Portland office of the Department.
- 1943 Department consolidates all analytical laboratories and assay services in the Portland office of the Department.
- 1953 Legislature adopts Oil and Gas Conservation Act (ORS 520.005) and assigns regulatory responsibilities to the Department.
- 1965 Legislature passes an act (ORS 517.410) requiring agencies to consult with Department before issuing leases for mining or for oil and gas exploration.
- 1971 Legislature passes the Geothermal Resources Act (ORS 522.101) assigning regulatory authority to the Department.
- 1971 Legislature passes Mined Land Reclamation Act (ORS 517.750) and assigns enforcement responsibility to the Department.

FUNCTIONS OF THE DEPARTMENT

The Department serves as a geological services facility for the citizens of Oregon, for local and state governments, for educational institutions, and for industry.

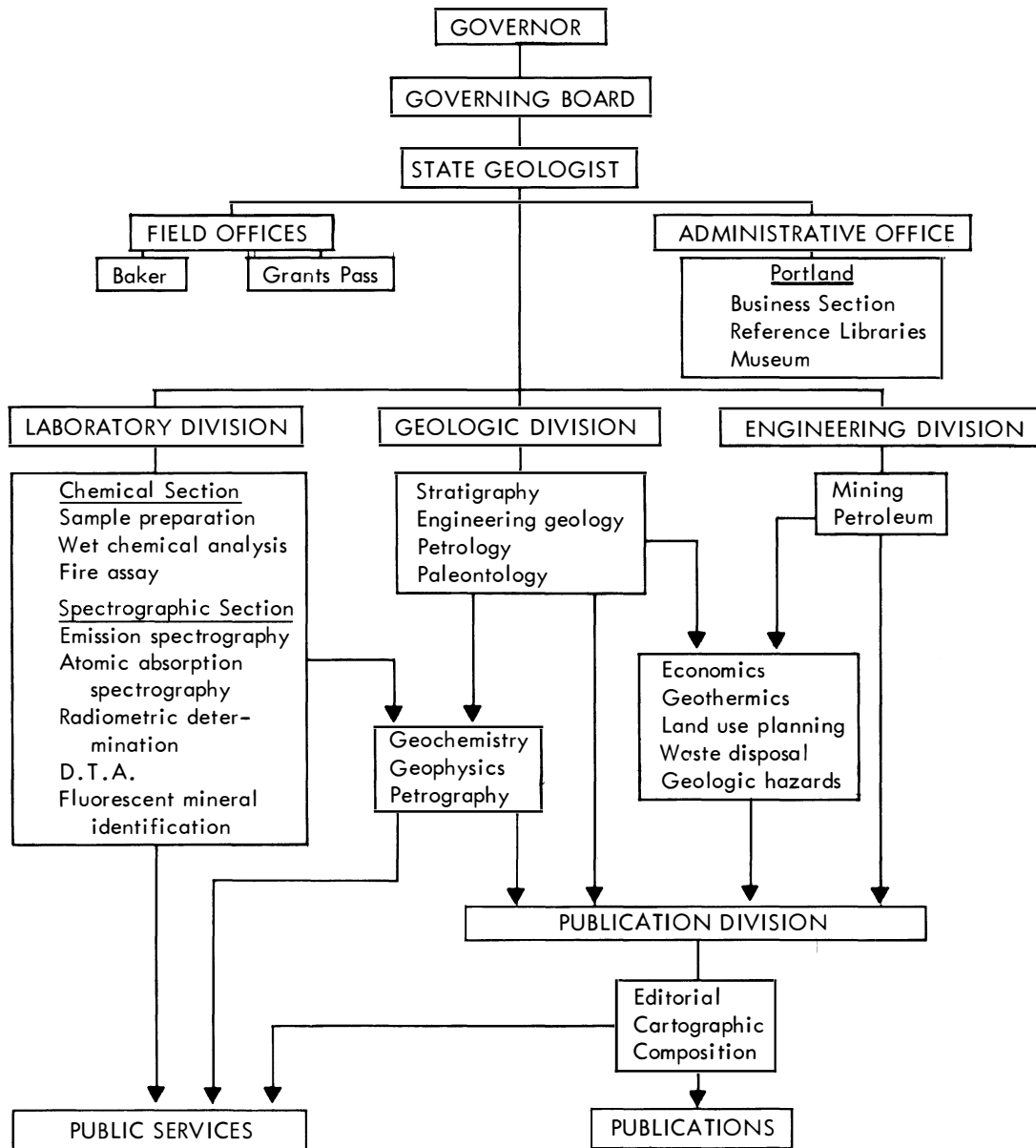
Specifically, the Department:

- (1) Furnishes detailed information to local governments and planning commissions on the engineering capabilities and liabilities of geological formations.
- (2) Provides data on the state's mineral resources for producers and consumers of mineral products, the financial community, planning commissions, state and local governments, and the public generally.
- (3) Supplies a wide variety of basic geologic data to all sectors of the state's economy.
- (4) Advises on the recreational and educational aspects of geology and attendant geologic hazards to residents of the state and its visitors.
- (5) Administers the Oil and Gas Conservation Act, the Geothermal Resources Act, and the Mined Land Reclamation Act.



One of the many functions of the Department is to conduct geological field trips for professional groups and laymen.

ORGANIZATION CHART



COMPARATIVE STATEMENT OF EXPENDITURES

	1969-1971 Total Expenditures <u>7/1/69-6/30/71</u>	1971-1973 Estimated Expenditures <u>7/1/71-6/30/73</u>	1973-1975 Funds Requested
<u>Personal Services:</u>	\$519,008.00	\$599,043.00	\$685,055.00
<u>Services and Supplies:</u>			
Travel in-state and regional	25,317.00	44,008.00	49,840.00
Travel, out-of-state	2,692.00	2,928.00	3,000.00
Office expenses	16,511.00	21,565.00	24,566.00
Fiscal control	1,155.00	4,350.00	4,468.00
Publications	19,598.00	35,875.00	49,550.00
Professional services	11,043.00	47,640.00	36,000.00
Insurance	1,080.00	1,300.00	1,308.00
Employee improvement	1,425.00	1,440.00	1,350.00
Housing expenses	30,193.00	39,177.00	44,585.00
Departmental supplies and expenses	4,859.00	35,851.00	57,500.00
Other services and supplies	237.00	1,213.00	471.00
	<u>114,110.00</u>	<u>235,347.00</u>	<u>272,638.00</u>
<u>Special Requests:</u>			
State geological survey	13,876.00	- - - -	- - - -
<u>Capital Outlays:</u>			
Office furniture and fixtures	5,674.00	1,696.00	3,660.00
Motor vehicles	2,576.00	2,887.00	2,800.00
Laboratory and technical	6,828.00	7,214.00	1,200.00
Library			1,800.00
	<u>15,078.00</u>	<u>11,797.00</u>	<u>9,460.00</u>
Total Expenditures	<u>\$662,072.00</u>	<u>\$846,187.00</u>	<u>\$967,153.00</u>
Subject to reversion to General Fund by Emergency Board action		52,925.00	
<u>Source of Funding:</u>			
General Fund	\$633,433.00	\$609,377.00	\$647,253.00
Other funds	28,639.00	194,310.00	193,400.00
Federal funds		42,500.00	126,500.00
	<u>\$662,072.00</u>	<u>\$846,187.00</u>	<u>\$967,153.00</u>

THE APPROPRIATION - - -

(1971-1973 Fiscal Biennium)

Personal Services	\$599,043.00	70.8%
Services and Supplies	235,347.00	27.8
Capital Outlays	<u>11,797.00</u>	<u>1.4</u>
Total	\$846,187.00	100 %

- - - AND WHAT IT PAID FOR (1970-1972 Reporting Period)

85,550 Copies of The ORE BIN	143 Field investigations
9,663 Chemical analyses	70 Geothermal gradients logged
6,268 Geochemical analyses	51 Field trips for groups
2,529 Mineral identifications	50 Geothermal gradient wells drilled
1,215 Spectrographic analyses	34 Mined Land Reclamation Act applications processed
1,035 Square miles mapped geologically	19 Office tours
828 Radiometric determinations	18 Oil and Gas Act inspections
321 Petrographic examinations	12 Major publications issued
195 Talks	10 Television and radio appearances
145 Fossil identifications	9 Exhibits judged
82 Cooperative projects with other agencies	1 Court appearance as expert witness

PLUS

Thousands of requests for miscellaneous geological information from more than 20,000 visitors to the Department's three offices. Also large numbers of phone calls and letters. More than 60,000 pieces of mail (exclusive of bulk mail) were handled.

WHAT THE DEPARTMENT DOES

There has been a dramatic change in the nature of Department activities since the end of World War II. Formerly the Department was heavily involved in studies related to mining and mineral production. Today increasing emphasis is being applied to a wide variety of services and projects related to enhancement of the environment. The chart on page 8 traces the changes of emphasis in Department activities since creation of the Department in 1937.

The Department provides geologic engineering information of many types to other state agencies, local governments, citizen groups, and the public generally. A great deal of effort was expended in several cooperative projects for Councils of Government, with funding by the Federal government, the local governments, and the state.

The Department is charged with the administration of three laws concerned with the conservation of natural resources and the protection of the environment. These are: The Oil and Gas Conservation Act, the Geothermal Resources Act, and the Mined Land Reclamation Act. The latter two acts became effective late in the biennium and their full impact on the work load of the Department cannot be determined accurately at the present time.

Requests for information on geologically oriented recreational activities is increasing. Information provided ranges from suggestions for places to hunt for fossils, minerals and placer gold, to the geologic processes involved in the formation of Crater Lake, the Cascade Mountains or the spectacular scenery along the Oregon Coast.

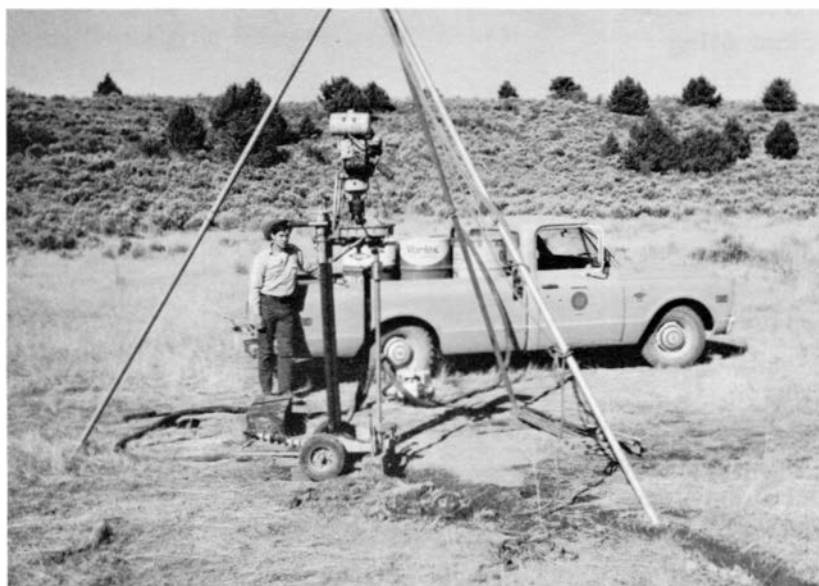
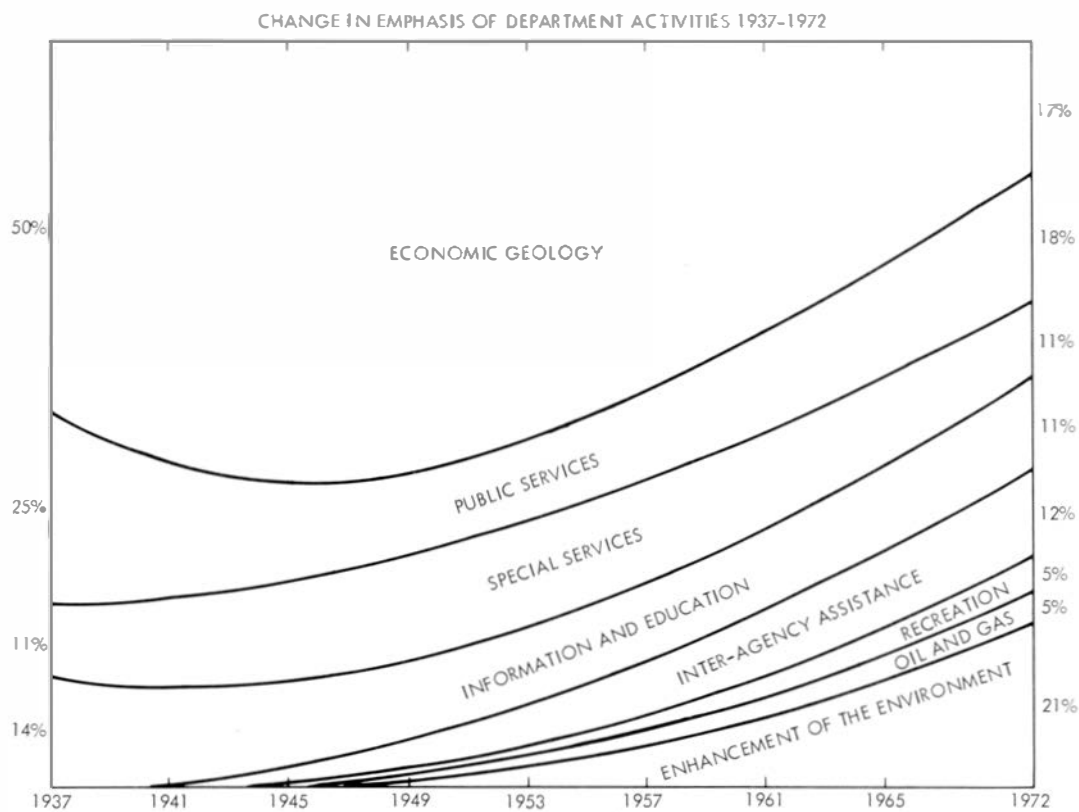
Much of the Department's work results, ultimately, in the publication of a report. Printed materials include geologic maps, reports on the engineering geology of problem areas, studies on economic geology, a monthly newsletter designed to disseminate information of interest to the layman, industry, and local governments, and numerous leaflets on a variety of popular subjects.

Department policy is to make a small charge for all of its publications. This is designed to recapture the basic printing costs and assure that the publications will be available to those who really need them.

As time and funding permit, the Department extends the geologic mapping of the state. This is a long-range program which will provide information on the extent of various geologic formations and rock types, the structure of surface and subsurface formations and the geologic capabilities and liabilities of the various areas. The maps are useful to planning agencies, local governments, the extractive mineral industry, and the general public.

TYPICAL DEPARTMENTAL ACTIVITIES

Activity	Gen. Public	Local Gov't	Beneficiary		Schools Univ.s
			State Agencies	Indus- try	
<u>Laboratory</u>					
Fire assays	x				x
Chemical analyses	x				x
Differential thermal analysis	x				x
Petrographic	x	x		x	x
Radiometric	x				x
Atomic absorption				x	x
Fluorescence	x				x
Mineral identification	x	x	x		x
Fossil identification	x				x
<u>Research</u>					
Mineral resources	x	x	x	x	x
Geologic liabilities and capabilities	x	x	x	x	x
Areal mapping	x	x	x	x	x
Engineering geology		x	x	x	x
Economic geology		x	x	x	x
Recreational geology	x	x	x		x
<u>Regulatory</u>					
Oil and gas conservation	x		x	x	
Geothermal resources	x		x	x	
Mined land reclamation	x	x	x	x	
Nuclear plant siting	x		x	x	
<u>Information and Education</u>					
<u>Publications</u>					
The ORE BIN	x	x	x	x	x
Bulletins	x	x	x	x	x
Miscellaneous Papers	x	x	x	x	x
Leaflets	x				x
Library service	x	x	x	x	x
<u>Public Services</u>					
Talks to service groups	x				
Talks to professional societies				x	x
Talks to local governments		x			
Radio and TV programs	x				x
Field trips	x	x	x	x	x
Information supplied by mail, tele- phone, over counter	x	x	x	x	x



Department diamond drill rig at Klamath Hills disposal site investigation core hole 3-70 (Bob Dolen, driller). Cooperative project with OSU Department of Environmental Sciences.

PUBLICATIONS

The Department issued twelve major publications during the biennium. Subject material ranged from a geologic study of some lava tubes in Central Oregon to an environmental geological report on the coastal zone of Tillamook and Clatsop Counties. The monthly newsletter, The ORE BIN, now in its 34th consecutive year of publication, was distributed to 2118 paid subscribers. The ORE BIN provides a speedy method of disseminating geologic information to the general public, industry, legislators, planning groups, and local governments.

Currently the Department has only 32 titles in print out of a total of 132 major maps and publications issued to date. Demand for out-of-print material continues at a brisk pace, and many machine copies are supplied at cost from reserve copies. Two bulletins which went out of print have been reprinted privately at no cost to the Department and are purchased for resale as needed.

Over the years the emphasis on Department publications has shifted from those concerned with mining and mineral economics to reports on the geologic capabilities and liabilities of lands lying within various counties or cities. The geologic discipline provides benchmark data useful to planners in arriving at the best possible use for a wide variety of lands.

Multi-color geologic maps are prepared by Department cartographers and sent to the printer color-separated and ready for plate making. The map-making techniques developed in the Department have been adopted by many other agencies since greater quality control and economy are possible.

PUBLICATIONS UNDERWAY DURING BIENNIUM

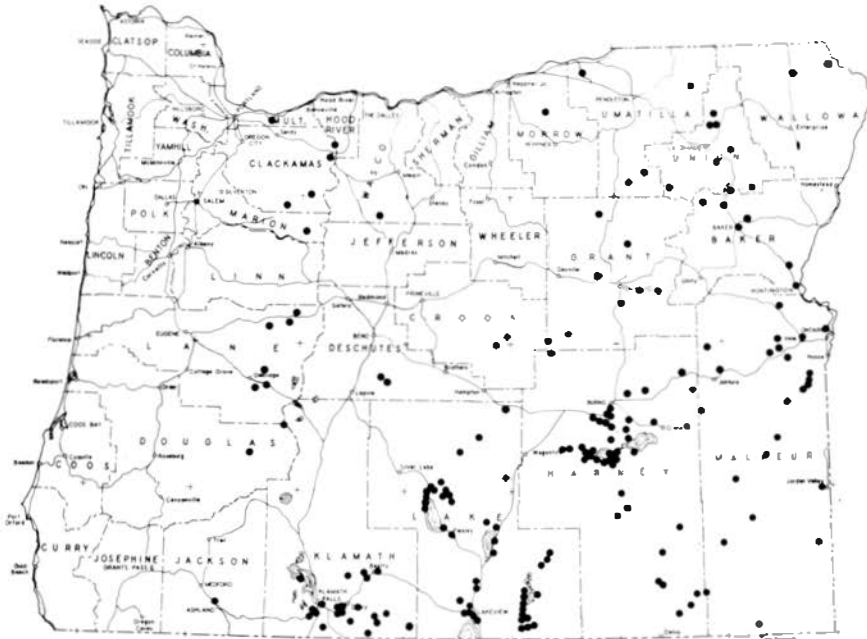
<u>Publication</u>	<u>Gen. Public</u>	<u>Local Gov't</u>	<u>State Agencies</u>	<u>Indus- try</u>	<u>Schools Univ.</u>	<u>Date Ready</u>
1. Geology and Mineral Resources of Douglas County	x	x	x	x	x	12-72
2. Bibliography Supplement	x		x	x	x	2-73
3. Field Trip Logs for Geol. Soc. of America Conference	x	x	x		x	3-73
4. Marquam Hill Study		x			x	3-73
5. Geology and Mineral Resources of Coos County	x	x	x	x	x	6-73
6. Environmental Geology of Lincoln County	x	x	x	x	x	9-73
7. Geology of the Baker AMS quadrangle	x	x	x	x	x	10-73
8. Geology and Mineral Resources of Kalmiopsis Wilderness Area	x		x		x	4-74
9. Environmental Geology of Uplands Region, Tillamook and Clatsop Counties	x	x	x	x	x	9-73

PUBLICATIONS ISSUED DURING THE BIENNIUM

<u>Publication</u>	<u>Gen. Public</u>	<u>Local Gov't</u>	<u>State Agencies</u>	<u>Indus- try</u>	<u>Schools Univ.</u>
1. Seventeenth Biennial Report			x		
2. Geology of the Southwestern Oregon Coast	x	x	x		x
3. Geologic Formations of Western Oregon	x			x	x
4. Geology of Selected Lava Tubes in the Bend area	x				x
5. Bedrock Geology of the Mitchell Quad.	x			x	x
6. Geologic Formations of Eastern Oregon	x			x	x
7. Environmental Geology of the Coastal Region, Tillamook and Clatsop Counties	x	x	x		x
8. The ORE BIN (montly newsletter)	x	x	x	x	x
9. Annual Report of the State Geologist			x		
10. Quicksilver Deposits in Oregon (map)	x		x	x	x
11. Geology of the Powers Quadrangle (map)	x		x	x	x
12. Gold and Silver in Oregon (reprinted)	x		x	x	x
13. Lunar Geological Field Conference Guidebook (reprinted)	x				x
14. Geologic Map of Oregon (postcard)	x				
15. Engineering Geology of La Grande Area, Union County	x	x	x		
16. Geologic Map of the Susanville-Vinegar Hill Area, Grant County	x			x	x

GEOHERMAL INDICATORS

The abundance of thermal springs and wells, as indicated by this map, along with the presence of recent lava flows and volcanoes combine to show that Oregon lies in an area of high heat flow. A major Department activity has been the study of this geothermal phenomenon to encourage its development for the production of electricity, for space heating, and for industrial processing heat.



Hot-water geyser in Lake County



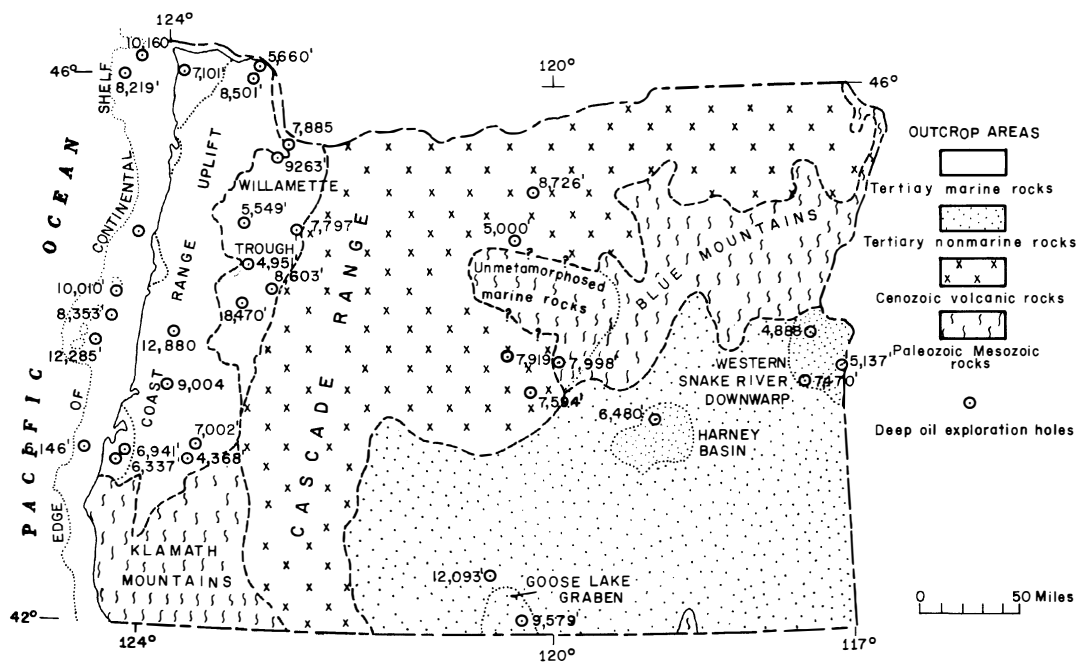
Steam vented from hot-water heating system in Klamath Falls.

OIL AND GAS

Approximately 185 wells have been drilled in Oregon since the early 1900's in search of oil and gas. This number is insignificant, however, when compared to active regions of the United States, where several thousand wells are drilled each year. Commercial amounts of hydrocarbon have not yet been discovered in the state. Some traces of oil and numerous gas shows have been found in the drilling ventures in Oregon. The Pacific Northwest was the site of great volcanic activity over past millions of years, but there are many locations where contemporaneous conditions were favorable to generation of hydrocarbons.

Marine sedimentary rocks are the most promising places to look for oil and gas. These are indicated on map as Tertiary marine and Mesozoic-Paleozoic marine outcrops. Significant wells are also shown with depths reached. The western Snake River Basin is the most likely prospect of the non-marine basins.

Exploration activity: The two-year period covered in this report was a slack interval for oil and gas activity. The offshore search ended in disappointment, and oil companies moved to Alaska and the North Atlantic in their search for fossil fuels. Two or three companies stayed to continue long-term studies in Oregon, where much is to be learned about subsurface geology. These field studies included geological work in western Oregon by one major company and geophysical and geological work in eastern Oregon by a second major oil company.



Major rock types and deep exploratory wells.

OFFSHORE ACTIVITY

Union Oil Co.	Union dropped its two remaining leases on Federal offshore leases off the coast of Oregon in Dec. 1969. The moratorium following the Santa Barbara blowout precluded Union from drilling the last of its Oregon leases.
Texaco, Inc.	Texaco maintained Federal and state offshore exploration permits during the biennium but did not conduct studies.
Shell Oil Co.	Shell dropped its Federal offshore exploration permit in June 1969.
Mobil Oil Co.	Mobil conducted limited geophysical surveys under its OCS permit in 1969 and 1970.
Humble Oil Co.	Humble maintained its OCS permit until April 1971. Limited studies were reportedly run.
Standard Oil Co.	Standard maintained its state offshore exploration permit through the biennium. Probably only limited studies were conducted in the 2-year period.

LEASING ACTIVITY ONSHORE (Estimated)

Mobil Oil Co.	50,000 acres in western Oregon (Columbia, Washington, Clatsop, Coos and Douglas Counties)
Standard Oil Co.	10,000 acres in western Oregon (Columbia, Washington Counties)
Texaco, Inc.	5,000 acres in western Oregon (Columbia, Washington Counties)
Texaco, Inc.	175,000 acres in eastern Oregon (Crook County)

THE METALS

Gold mining as a business enterprise has practically ceased to exist in Oregon. After 120 years of activity, the gold miner, faced with a frozen (until recently) price for gold and steadily increasing operating costs, finally decided that "it was deep enough" and quit. In sharp contrast, however, the week-end and vacationing gold miner is appearing in greater numbers each season. Lightweight, portable equipment, coupled with more leisure time and the age-old lure of raw placer gold, make this activity extremely popular with people of all ages.

Oregon is the only state in the Union producing nickel. The Hanna operation at Riddle has been in production since 1954 and is currently smelting about 8% of the U.S. consumption. Mercury producers faded from the scene during the biennium when world market prices tumbled precipitously. The state's two aluminum smelters were cut to one for a time, but production was resumed at Reynold's Troutdale plant near the close of the biennium.

The exotic metals complex centered in Albany reacted to industry trends resulting from the supersonic program cutback. The titanium sponge plant of Oregon Metallurgical closed due to lessened demand for this lightweight metal. Other segments of the space-age metals industry were active throughout the period. Peruvian iron ore, brought to Portland as a slurry, is reduced to iron in Oregon Steel Mills Rivergate plant. The ore handling system has attracted international attention.

The best estimate of the gross annual metallurgical production for the state is in the neighborhood of \$650 million. This places it well up the economic impact ladder, occupying the rung above agriculture and below forestry.

INDUSTRIAL MINERALS

Oregon's industrial minerals, by and large, do not stray very far from home once they have been mined. Sand and gravel and crushed rock constitute the greater part of the state's total mineral production, which in 1971 was \$68.4 million. Mineral aggregates find their way into all types of engineering projects, such as dam and highway construction, concrete buildings, filter beds, and dozens of other uses including spawning and rearing beds for fish. Control of sand and gravel pit reclamation is discussed under "Mined Land Reclamation." Aggregate production is critical to community development, and supplies must be obtainable locally since costs skyrocket when long hauls are involved.

Other industrial minerals produced in the state include limestone, shale, clay, pumice, cinders, emery, diatomite, bentonite, building stone, perlite, silica, and gemstones.

The economic impact of the mineral industry in Oregon is perhaps best illustrated by the fact that in 1970 two-thirds of the counties in the state reported mineral production in excess of half a million dollars. Eight of these counties produced over one million dollars and one county exceeded eleven million. In addition, \$21 million of the state total is reported as "undistributed" to avoid disclosure of individual company data. Commodity prices reported in the state canvass are generally at the pit price level. Value of the delivered and beneficiated product would generally be several times the reported figure.

SOME OF OREGON'S MINERALS AT A GLANCE

<u>Mineral</u>	<u>1970</u>	<u>1971</u>
Clays	\$ 180,000	\$ 255,000
Copper	W	3,000
Diatomite	5,000	1,000
Gem stones	750,000	755,000
Gold (recoverable content of ores)	9,000	10,000
Lime	1,777,000	1,989,000
Mercury	112,000	W
Nickel	W	W
Pumice and volcanic cinder	1,221,000	1,239,000
Sand and gravel	25,978,000	28,707,000
Silver (recoverable content of ores)	6,000	6,000
Stone	20,948,000	26,708,000
Value of items that cannot be disclosed: Bauxite (1970), cement (portland and masonry), clay (fire) (1970), talc, tungsten (1971), and values indicated by symbol W	17,095,000	18,212,000
Totals	\$68,081,000	\$77,885,000

MINED LAND RECLAMATION

Every community in the state will eventually be affected by the Mined Land Reclamation Act (ORS 517.750) which was passed by the 1971 session of the Legislature. The Act took effect on July 1, 1972, and is administered by the Department.

The thrust of this legislation is to ensure that open pits in the state are reclaimed after abandonment. All operations coming under the Act must pay an annual fee, secure a performance bond to ensure that reclamation work will be done in a prescribed manner, and prepare a reclamation plan that is acceptable to the various natural resource agencies and local governments. Any operation which annually excavates more than 10,000 cubic yards or disturbs more than two acres of land comes under the Act. Certain "grandfather" provisions relieve some operators from the necessity for submitting a performance bond or reclamation plan.

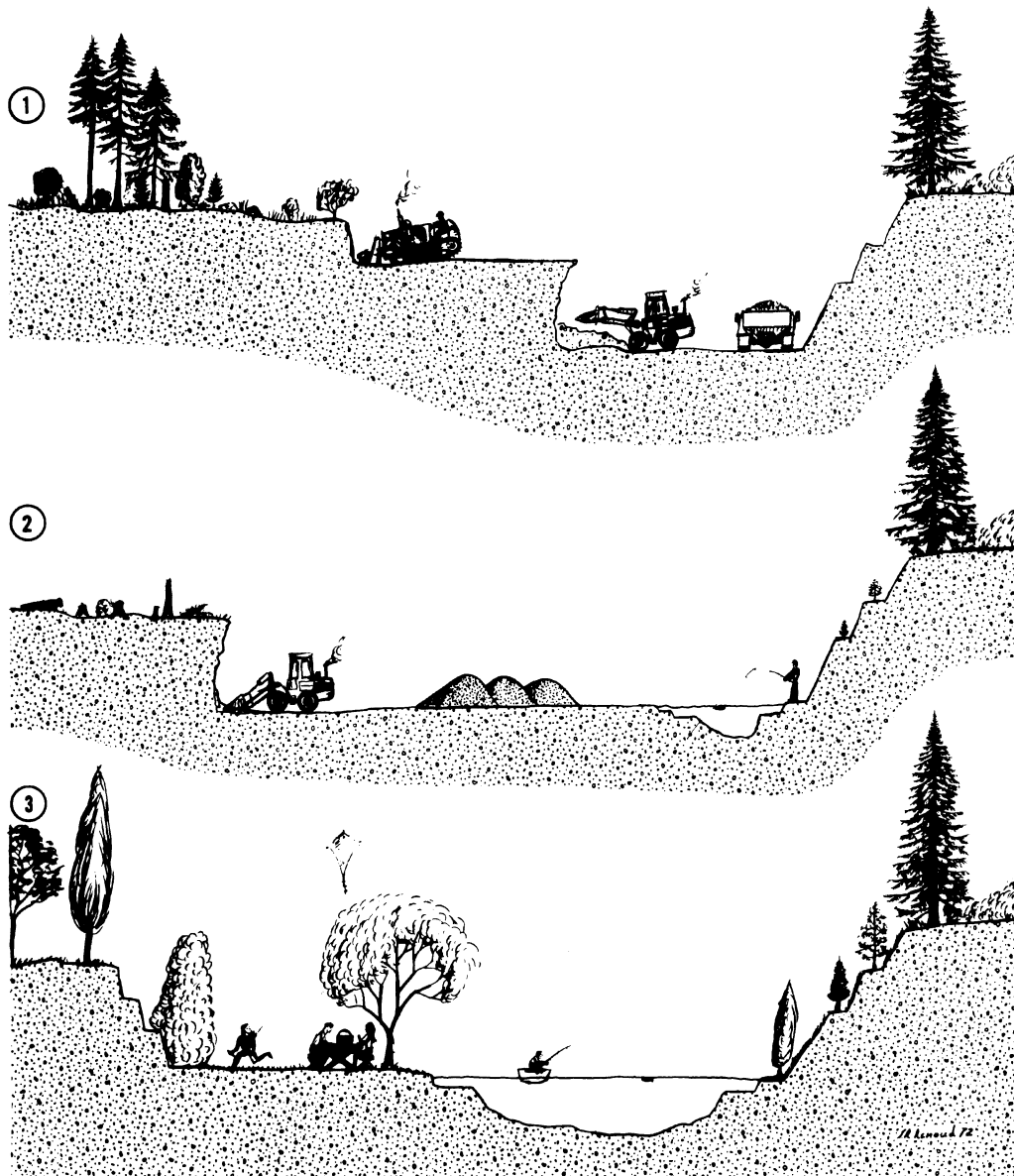
Prior to the enactment of the Act no detailed canvass of the sand and gravel operators, who constitute by far the largest number of all the operators in the state, had ever been made. As a first order of business, the Department undertook a canvass of all aggregate producers. As of November 1972 a total of 418 quarries had been tabulated, with a projected total for the state of about 950. This latter figure is almost precisely double the best estimates available prior to the canvass.

No general funds were made available for the enforcement of the Act and operations to date have been conditioned upon the monies received from the permit fees. To properly administer the Act, additional funds will be required. It is anticipated that at least one pit site inspection will have to be made each year, plus additional visits in response to complaints, inquiries by local governments, and operational problems. Every abandoned quarry will also have to be inspected to determine whether or not the operator has properly reclaimed the site.



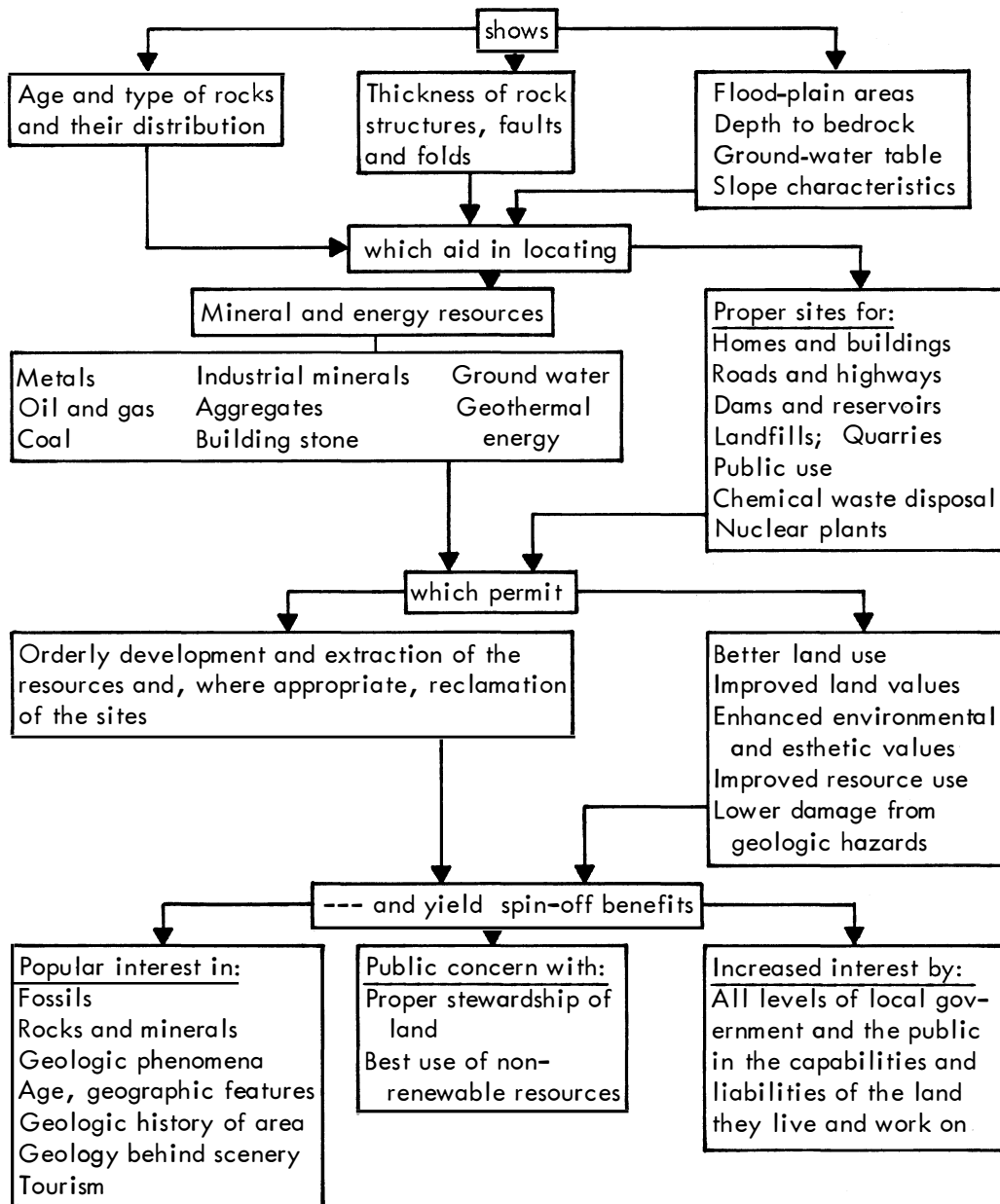
Waverly Lake, Albany. A former gravel pit reclaimed and extensively used as a public recreation site.

HOW TO RECLAIM A GRAVEL PIT



The reclamation of gravel pits may be achieved in many ways; here is a possible solution. (1) Benching of the walls as gravel pit is deepened; (2) early planting of visual screening on benches, and progressive reclamation even while operations continue; and (3) eventual conversion of the site to a public park complete with picnic facilities and a lake for fish and boating.

A GEOLOGIC MAP



ENVIRONMENTAL GEOLOGY

Man has been improving the earth ever since he invented the shovel and axe nearly 6000 years ago. The "improvements" were intended to be of direct benefit to man and all other considerations were secondary. The damage to many sectors of the environment as a result of this single-minded activity has only recently become apparent to the general public.

Today there is a growing concern over how we are treating, and mistreating, the earth. Each parcel of the earth's surface has certain capabilities and liabilities. The agricultural character of the land has long been known. More recently the nature of ground water has been studied. It has not been until the past few decades, however, that the geologic nature of the earth's surface and the space lying immediately below the surface has even been considered as a factor in land use planning.

An environmental geology study is not an end in itself, but a tool useful to state and local governments, planning commissions, developers, and land-owners. A study of this type provides data on the critical interface between the earth and the structures and improvements that man places on it. Environmental geology studies are designed to provide information useful in the selection of engineering and natural resource sites which will have the least possible adverse impact on the environment when they are developed. Conversely the study indicates those areas where only limited, if any, development should be undertaken.

During the biennium the department conducted an environmental geological mapping program in the coastal zone of Clatsop and Tillamook Counties and published a report on the geologic hazards, the engineering characteristics of the various geologic units, the economic mineral resources, and the regional geology. The 164-page report was supplemented with 18 maps in color. Immediately following publication of the report, the department was requested to make a companion study of the upland sections of the two counties.

A similar study was inaugurated during the summer of 1972 for Lincoln County. An earlier study covering portions of the northern Willamette Valley was recessed early in the biennium due to a lack of cooperative funding.

The city of LaGrande requested some detailed mapping and appraisal of an undeveloped section of the city prior to granting building permits. Following field work, the department prepared a report and map which provide information on the capabilities and liabilities of the area's surface and subsurface.

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