PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF ENVIRONMENT

HON. JAMES A. NIELSEN, *Minister* B. E. MARR, *Deputy Minister*

REPORT

of the

BRITISH COLUMBIA WATER RESOURCES SERVICE

YEAR ENDED

DECEMBER 31

1975

Printed by K. M. MACDONALD,
Printer to the Queen's Most Excellent Majesty
in right of the Province of British Columbia.
1976

March 22, 1976.

To Colonel the Honourable WALTER STEWART OWEN, Q.C., LL.D.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

Herewith I beg respectfully to submit the Annual Report of the British Columbia Water Resources Service of the Department of Lands, Forests, and Water Resources and Department of Environment for the year ended December 31, 1975.

JAMES A. NIELSEN
Minister of Environment

March 22, 1976.

The Honourable James A. Nielsen,
Minister of Environment.

SIR: I have the honour to submit the Annual Report of the British Columbia Water Resources Service for the 12 months ended December 31, 1975.

B. E. MARR
Deputy Minister

BRITISH COLUMBIA WATER RESOURCES SERVICE

DEPARTMENT OF ENVIRONMENT

December 31, 1975

B. E. MARR, *Deputy Minister*

G. E. SIMMONS, *Assistant Deputy Minister*

WATER RIGHTS BRANCH

H. D. DEBECK, *Comptroller of Water Rights*

A. K. SUTHERLAND, *Deputy Comptroller of Water Rights*

WATER INVESTIGATIONS BRANCH

P. M. BRADY, *Director*

T. A. J. LEACH, *Assistant Director*

POLLUTION CONTROL BRANCH

W. N. VENABLES, *Director*

R. H. FERGUSON, *Assistant Director*

H. P. KLASSEN, *Assistant Director*

ENVIRONMENTAL LABORATORY

A. J. LYNCH, *Chief Chemist*

INSPECTOR OF DYKES

K. J. CHISHOLM, *Inspector of Dykes*

W. S. JACKSON, *Assistant Inspector of Dykes*

ACCOUNTING DIVISION*

K. R. MACKAY, *Departmental Comptroller*

PERSONNEL OFFICE*

R. C. WEBBER, *Director of Personnel*

MAIL AND FILE ROOM†

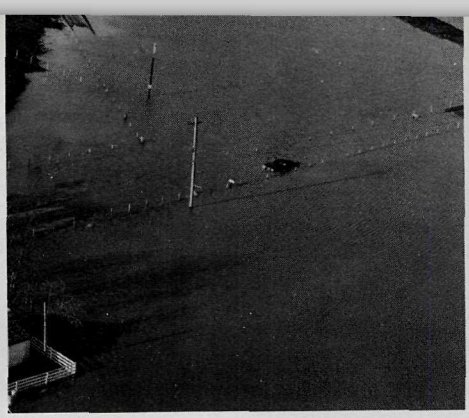
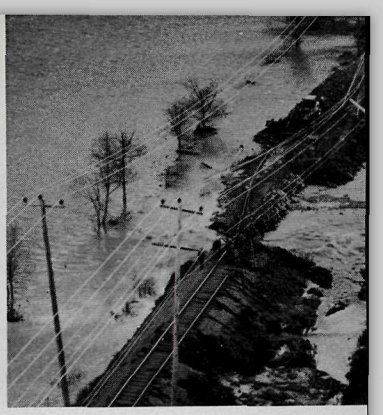
D. S. PRESTON, *in Charge*

PUBLIC INFORMATION OFFICER

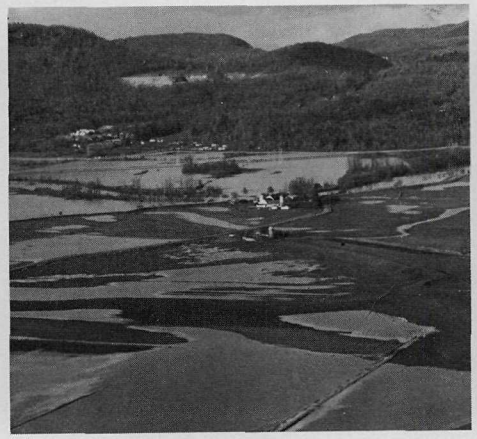
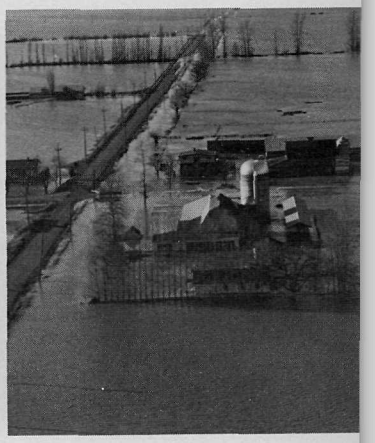
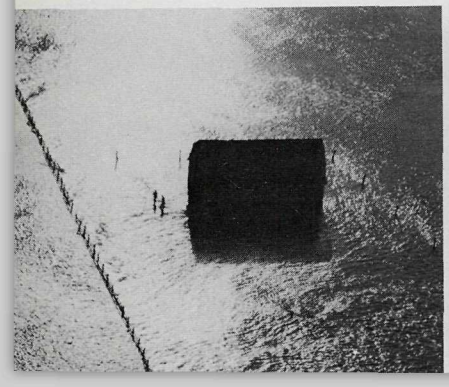
J. MCCROSSAN

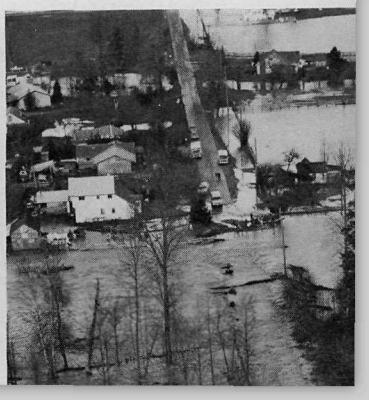
---

* Service shared with Lands Service.
† Service shared with Lands Service and Forest Service.

December 1975 saw serious flooding in the Lower Fraser Valley. Major trouble-spot was the break in the B.C. Electric Railway embankment in the Yarrow-Vedder area. These pictures were taken during a helicopter flight December 4th, the day after flooding peaked.



CONTENTS

	PAGE
British Columbia Water Resources Service—	
Report of the Deputy Minister	9
Water Rights Branch—	
Report of the Comptroller of Water Rights	15
Administrative Division	16
Regional Engineers Division	17
Power and Special Projects Division	19
Community Water Supply Division	27
Water Investigations Branch—	
Report of the Director	35
Flood Damage Prevention	35
Environmental Preservation	45
Water Resource Utilization	51
Pollution Control Board	59
Pollution Control Branch—	
Report of the Director	63
Municipal Division	65
Industrial Division	66
Regional Division	69
Environmental Laboratory	73
Inspector of Dykes	81
Personnel Services	85
Accounting Division	89

BRITISH COLUMBIA WATER RESOURCES SERVICE

B. E. Marr, P.Eng.
Deputy Minister

This is the thirteenth and last separate report of the Water Resources Service. In future, the activities of the Service will be incorporated in the Annual Report of the new Department of Environment.

The water supply situation was generally good in 1975 with about average snow-pack conditions and the spring-summer runoff pattern produced few flooding problems. Weather conditions were not so favourable later in the year when a combination of heavy rainstorms and snowmelt from rapidly rising freezing levels caused severe local flooding in the October to December period, resulting in a number of areas being declared eligible for assistance under the Provincial Major Disaster Fund.

To reduce flood risk and flood damage potential requires a combination of structural and nonstructural solutions. Included in the latter is the floodplain survey program to define flood-prone areas for planning purposes and a number of regional districts and municipalities have adopted flood zoning regulations in their building by-laws to complement Provincial legislation which applies to new subdivisions. The single largest flood control program covers the Lower Fraser Valley, where dykes, river-bank protection, and drainage works are being constructed under the Canada-British Columbia Fraser River Flood Control Agreement. Federal financial restraints limited the funding available under this cost-sharing program and total expenditures of $12,000,000 in 1975 were somewhat less than anticipated.

Organizational changes were made in the Water Rights Branch during the year, with the amalgamation of the Improvement Districts Division and Water Utilities Division into a new Community Water Supply Division to provide an expanded and more efficient service in the water supply field. The increased work load in the Branch and the greater involvement of staff in resource management problems has caused a backlog in the handling of water licence applications, and this problem must be addressed in the near future.

Annual rental rates were reviewed and increases proposed and adopted for power purposes. This is the first increase in the rates for this purpose since 1961, and the new rates are reflected in the financial statement for 1975, with total revenue of $11,168,181 as compared to $6,287,142 in 1974.

A major accomplishment in 1975 was the adoption and issuance, by the Pollution Control Board, of the Pollution Control Objectives for the Food-processing, Agriculturally Oriented, and Other Miscellaneous Industries and for Municipal Type Waste Discharges. This completes the program initiated in 1970 to adopt pollution control objectives for all major activities within the Province. Previously, objectives had been issued for the Forest Products Industry, the Mine, Mine-Milling, and Smelting Industry, and for the Chemical and Petroleum Industry.

The Pollution Control Branch continued to concentrate on the issuance of permits during 1975, with a high level of production only exceeded by 1974. The informal meetings being arranged in the field between parties involved in an application appears to be having some success in reducing conflicts and satisfying objectors. However, greater emphasis may have to be placed on the monitoring and policing functions of the Branch in the future.

Tertiary treatment of municipal effluents is being considered at a number of locations throughout the Province, particularly in the dry Interior, with land disposal as a possible option. Of interest in this connection is a report entitled *Health Aspects of Sewage Effluent Irrigation*, released in 1975. Also of interest in the municipal field is the report on *Alternative Methods for Treatment and Disposal of Community Wastewaters*, which has been widely distributed to local authorities, consulting engineers, and other interested parties.

The quality of lake waters and, particularly, the question of eutrophication has generated considerable public interest in recent years. The Environmental Studies Division of the Water Investigations Branch has initiated a number of studies in this area, including weed problems in the Okanagan lakes, the effect of urbanization on lakes in the Cariboo, the effects of recreational use and residential development on water supply lakes on Saltspring Island, and means of rehabilitating Kathlyn Lake near Smithers. In addition, the Branch is involved in water management studies for the Coquitlam River and the Salmon River tributary to Shuswap Lake, and continues the major air and water quality environmental baseline study for the Kootenays.

The Chemistry Laboratory was renamed the Environmental Laboratory to better reflect the wide range of testing now undertaken for the various branches of the Service as well as other Government agencies. The first year of full operation of the laboratory's computer system has reduced reporting-time and increased the efficiency of processing data.

Special note is made of the retirement of two long-service employees—F. C. Bett of the Water Utilities Division after 27 years' service with the Provincial Government, and Mrs. Pauline Dranfield after 22 years' service with the Water Rights Branch.

We are indebted to other departments of the Provincial Government and to the universities for their co-operation and assistance during the year.

Detailed reports on the activities of the various branches and divisions of the Service are given in the body of this Report.

PROVINCIAL MAJOR DISASTER FUND

Severe rainstorms in November and December caused a mud slide at Port Alice and flooding at a number of locations on northern Vancouver Island, Squamish, and in the Fraser Valley. Port Alice, Alert Bay, Sayward-Kelsey Bay, Squamish, Tofino, and Port Alberni were designated by the Province as being eligible for financial assistance from the Provincial Major Disaster Fund.

Port Alice experienced a mud slide of similar proportions to that which occurred in 1973. The extremely adverse weather conditions at the time led local officials to be concerned for the village, and an evacuation was ordered. Residents were moved to temporary accommodation in Port Hardy and Port McNeill, returning within a few days as local conditions and severed roads improved or were repaired.

Shortly thereafter, assistance was also approved for the areas in the municipalities of Chilliwhack and Abbotsford which experienced flooding when dykes and a railway embankment gave way on the Vedder River in mid-December. The low-lying lands in the old Sumas Lake bottom filled rapidly to depths of 2 feet and more, necessitating the evacuating of livestock in some areas. Assistance was also approved for Hatzic Prairie when runoff caused flooding from Hatzic Lake.

Claims for assistance from the Provincial Major Disaster Fund totalling 445 in number were appraised by representatives from the Canadian Independent Adjusters Conference and forwarded for approval. Settlements will extend in 1976 and final assessment is expected to be in excess of $700,000.

In addition, evacuation costs and expenditures made by municipalities for emergency actions will also be accommodated from the Fund. Totals for these items were not complete at year-end.

WATER RIGHTS BRANCH

The Water Rights Branch is the agency of the Provincial Government which administers the control and use of surface water under the authority of the *Water Act*.

The main principles of the *Water Act* regarding the use of water are:

(1) The property in and the right to the use and flow of all the water at any time in any stream in the Province are for all purposes vested in the Crown in the Right of the Province. The common law principle of riparian water rights has been abolished.

(2) Prospective users of water must file applications for water licences. There is a procedure for notifying the Deputy Ministers of Agriculture and Recreation and Conservation and all those whose rights may be affected, all of whom have a right of objection to water applications.

(3) Licence-holders have a right to the use of water under the terms and conditions of the water licence issued by the Comptroller of Water Rights. Earlier licences have priority over licences issued later.

(4) Retention of a water licence is dependent upon the beneficial use of the water, payment of the water licence rentals, and observance of the regulations of the *Water Act*.

(5) A water licence is generally made appurtenant to a parcel of land, mine, or undertaking, and it will pass with any conveyance or other disposition thereof.

(6) If it is necessary that a water licensee construct works on another person's land, he can expropriate the land reasonably required if a voluntary agreement cannot be reached. If the works will be on Crown land, the water licensee may acquire a permit to occupy Crown land for such purpose.

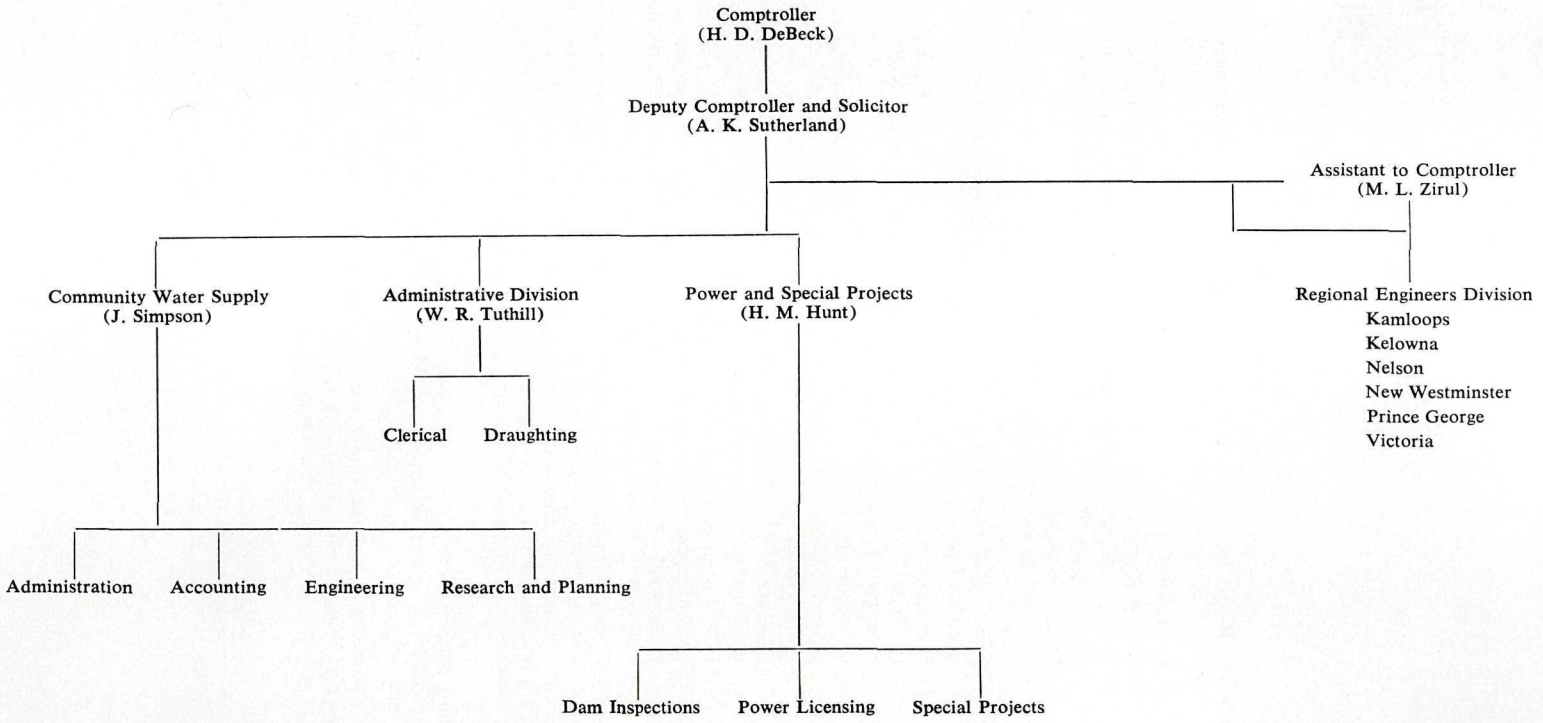
The second major function of the Water Rights Branch is to generally supervise and assist in the administration of the improvement districts which have been incorporated under the *Water Act* for irrigation, waterworks, drainage, dyking, and several other purposes. An improvement district is a self-governing public corporate body administered by elected Trustees. The undertaking of an improvement district can be financed by Provincially guaranteed debenture issues.

A third major function was assigned to the Water Rights Branch on July 15, 1973, when the Comptroller of Water Rights assumed responsibility for the administration of Water Utilities under the provisions of the *Water Utilities Act* and the *Energy Act*.

The administration of the *Water Act* and the *Water Utilities Act* is carried out by the Comptroller of Water Rights and his staff, who are located at a headquarters office in Victoria and district offices at Victoria, Kamloops, Kelowna, Nelson, Prince George, and New Westminster.

Water is a natural resource which often has a controlling influence on economic development of other resources and, therefore, is in competitive demand. Much of the vast industrial expansion of recent years in this Province is associated with the use of British Columbia water.

WATER RIGHTS BRANCH



WATER RIGHTS BRANCH

H. D. DeBeck, P.Eng.
Comptroller of Water Rights

The organization chart for the Water Rights Branch shown on the page opposite incorporates changes made in the organizational structure of the Branch in November 1975. The major change is the formation of a new division called "Community Water Supply Division" by the amalgamation of the former Improvement Districts Division and the Water Utilities Division. This was done to create a more flexible organization capable of dealing with the full range of water supply problems, and reflects a recognition of the growing need and public demand for assistance from the Provincial Government in planning and financing public water supplies, particularly in small communities.

The Power and Special Projects Division results from a change of name for the Power and Major Licences Division and represents a recognition of an evolutionary change in the responsibilities of this division. The Division remains responsible for providing the staff support to the Comptroller in connection with all aspects of major water licences for hydro-electric power, including approval of plans, inspection of works during construction, review of environmental studies, determining annual rentals, and operation of reservoirs for flood control and other nonpower benefits. In addition, a comprehensive program of dam inspections is carried out in consultation with the regional offices, as well as a wide range of water-related studies, particularly those involving several departments. The former Water Licensing Division has been renamed the Administrative Division. Although the administration of the sections of the *Water Act* dealing with water licensing is still its major duty, it has assumed an increasingly important role in carrying out general administrative duties for the Water Rights Branch as a whole.

The Regional Engineers Division comprises regional engineers and their staffs at Kamloops, Kelowna, Nelson, New Westminster, Prince George, and Victoria. The function of this division is to provide on-the-spot investigation and determination which has been a guiding principle in the administration of the *Water Act* for many years. In accordance with a general Government program of regionalization of resources management, increased emphasis has been given to the involvement of regional office staff in some phases of the work in all divisions of Water Rights Branch and Water Investigations Branch. Of particular importance is regional liaison with other Government departments through regional resource management committees and other personal contacts.

With increased public participation in the processes of resource management, work of this nature has required an increasing proportion of staff time in the regional offices, and this is to a considerable extent responsible for the serious backlog in water licensing work, particularly that relating to applications for water licences. The number of licence applications awaiting investigation and adjudica-

tion reached a new high of 3,530. The present water licensing system covers only surface waters, but the need to extend this system to include groundwater has become increasingly apparent. A committee was set up to review this need and the best means by which it could be met. The review included discussions with officials responsible for water administration in the other three western provinces and several western states. The conclusion reached was that a need for groundwater licensing was emerging, but that a very substantial staff establishment would be required to obtain any effective control of groundwater use.

The activities of the Water Rights Branch for 1975 are recorded in greater detail in the reports of the individual divisions of the Branch in the pages following.

ADMINISTRATIVE DIVISION

Water licences are issued for domestic, waterworks, irrigation, mining, industrial, power, storage, and other purposes. Licences are required, with few exceptions, before any person, company, corporation, community, or Government agency uses water from any surface water source.

As of November 30, 1975, the number of water licences in effect totalled 29,212, each of which authorizes the use of water for one or more purposes. There were 17,304 licences authorizing the use of water for domestic purposes, 1,201 for waterworks, 11,521 for irrigation, 295 for power, and 1,727 for storage purposes.

Applications for approvals under section 7 of the *Water Act,* either for the use of water for a period not exceeding six months or to authorize changes in and about a stream, increased to 211 from 126 in 1974. Applications for the amendment of existing licences by apportionment, transfer of appurtenancy, or changes of works or purpose have increased over last year's total and there are now 562 amendment applications pending. There are 96 water-users communities incorporated under the *Water Act,* compared with 95 in 1974.

The following tables show the staff establishments for the Licensing Division and the principal activities of the General and Draughting offices in the 12-month period ended November 30, 1975, together with the activity data for the five preceding years:

Staff, November 30, 1975

Administrative Officer 3: one

	General Office	Draughting Office		General Office	Draughting Office
Administrative Officer 1	1	--	Clerk-Stenographer 2	1	--
Clerk 6	2	--	Clerk-Typist 2	1	--
Clerk 5	--	1	Technician 2	--	1
Clerk 4	3	1	Draughtsman 4	--	1
Clerk 3	3	2	Draughtsman 3	--	2
Clerk 2	2	--	Draughtsman 2	--	4
Clerk 1	2	--	Draughtsman 1	--	2
Clerk-Stenographer 3	1	--			

REGIONAL ENGINEERS DIVISION

For administrative purposes the Province is divided into 27 water districts. These are administered from six regional offices located at principal Provincial centres. The location, Regional Engineer in charge, and water districts administered are listed below for the six regional offices:

Kamloops: D. E. Smuin, P.Eng.
- Kamloops
- Ashcroft
- Nicola
- Cariboo

Kelowna: E. D. Anthony, P.Eng.
- Revelstoke
- Vernon
- Princeton
- Grand Forks
- Fairview

Nelson: T. H. Oxland, P.Eng.
- Nelson
- Kaslo
- Cranbrook
- Golden
- Fernie

New Westminster: E. G. Harrison, P.Eng.
- Vancouver
- New Westminster

Prince George: C. E. Wilson, P.Eng.
- Prince George
- Quesnel
- Fort Fraser
- Hazelton
- Prince Rupert
- Peace River
- Liard
- Atlin

Victoria: P. G. Odynsky, P.Eng.
- Victoria
- Nanaimo
- Alberni

Staffing of the regional offices as at year's end is indicated in the following table:

	Regional Offices						
	Kamloops	Kelowna	Nelson	New Westminster	Prince George	Victoria	Totals
Engineer 5	1	1	1	----	1	----	4
Engineer 4	1	1	1	1	1	1	6
Engineer 3	2	1	1[1]	1	----	----	5
Technician 3	1	1	1[1]	1	----	----	4
Technician 2	----	1	----	----	----	----	1
Technician 1	4	2	3	2+1[1]	2+1[1]	1	16
Engineering Assistant	1	2	2	1	1[1]	1	8
Engineering Aide	1	1	----	1	1	1	5
Clerk-Stenographer	1	2	2	1	1	----	7
Clerk-Typist	----	----	----	----	----	----	----
Clerk	1	----	----	----	----	----	1
	13	12	11	9	8	4	57

[1] Indicates regular positions not filled at time of report.

Preparatory to establishing a separate "Skeena" Regional Office at some time in the future, a satellite or suboffice of the Prince George office under the charge of a Technician was established at Smithers during the year and proved efficient in giving immediate attention to problems of a local nature and in attending to routine duties associated with water licence administration for the area. A similar satellite or suboffice of the Kelowna Regional Office in the charge of an Engineering Assistant was established in Oliver to assist in administration of water licences and

related duties in the South Okanagan area. This has also proved successful and has appreciably reduced the amount of travel formerly required from the Kelowna office.

Duties of regional office staff include the administration of the *Water Act* within the water districts assigned; supervision of diversion and use of water under water licences granted under the *Water Act;* investigating and recommending on applications for new water licences; approvals under section 7 of the *Water Act,* and applications for amendment of existing licences; review of works constructed and use of water developed under conditional water licences and recommending on the conversion of these licences to final water licences; inspection of plans for water storage dams and other hydraulic structures and review of existing structures to ensure that no hazard to life or property has developed; participate in Task Force studies initiated by Environment and Land Use Committee; attend and provide input related to water use on Technical Planning Committee of Regional Districts, Inter-departmental Resource Management Committees, Resource Folio system; provide administrative and technical assistance where requested, to other divisions of Water Resources Service or branches of Government.

Routine work related to the administration of water licences and handling of applications for new licences for the 12-month period December 1, 1974, to November 30, 1975, is summarized in the following table:

	Regional Offices						Total
	Kamloops	Kelowna	Nelson	New Westminster	Prince George	Victoria	
Applications for water licences—							
On hand, December 1, 1974	601	172	672	128	299	79	1,951
Received during the year	361	308	363	166	217	233	1,648
Inspected and reported on	274	268	319	120	182	194	1,357
Cancelled or abandoned	84	26	36	17	45	10	218
On hand, November 30, 1975	604	186	680	157	289	108	2,024
Applications for approval under *Water Act* (sec. 7) reported on	22	16	39	20	26	22	145
Reports for final water licences	96	54	162	107	41	111	571
Water licence amendment reports—							
Apportionment	40	23	38	14	2	16	133
Transfer of appurtenancy	24	33	39	13	3	20	132
Change of works	31	21	39	23	6	12	132
Extension of time	11	9	8	9	0	45	82
Other	4	0	22	1	7	2	36
New conditional water licences	314	177	205	206	126	152	1,180
New final water licences	106	26	76	101	49	109	467

The following summarizes the numbers of water licence applications handled by the Division over the preceding 10 years:

Year	Applications Received	Reports Submitted	Cancelled or Abandoned	Total, Year-end
1966	1,275	1,013	117	948
1967	1,266	1,013	96	1,105
1968	1,385	1,334	112	1,049
1969	1,424	1,013	184	1,281
1970	1,562	1,279	125	1,439
1971	1,597	1,549	145	1,493
1972	1,376	1,393	114	1,362
1973	1,719	1,217	185	1,679
1974	1,807	1,279	256	1,951
1975	1,648	1,357	218	2,024

The water supply situation was generally good within all regions during 1975 and resulted in few instances of conflict arising from water shortage. Extreme snow-packs in some areas of the Okanagan Lake and Kettle River watersheds caused concern in the Kelowna Regional office with the possibility of floods. Moderate spring weather, however, permitted an orderly runoff with no major flooding, although Kalamalka Lake reached a level of 1,285.5 feet, 0.57 foot above normal maximum level. Vancouver Island experienced more than normal instances of localized flooding from heavy rains, particularly at Port Alberni, Port Alice, Comox, and Duncan. October was especially wet, registering a record of 9.16 inches of rainfall for the month at the City of Victoria, and many complaints of inadequate culverts, overflowing creeks, and flooded yards and basements were answered by the Victoria Regional Office.

All offices experienced an increase in demands for time required for review of applications referred to them for pollution control permits and land use or land lease permits, and input to the Resource Folio system. Interest in mining continued with special emphasis on water requirements for placer mining for gold in the Cariboo, Quesnel, and Prince George Water Districts. Use has been made of the Comptroller's authority to issue approvals under section 7 of the *Water Act* to cover a six-month period of use of water where this has appeared compatible with proposed placer operations, and this has eliminated the relatively long period otherwise required to obtain a water licence.

A number of engineering reports were prepared at the regional offices during the year dealing with various aspects of water supply systems and sources.

POWER AND SPECIAL PROJECTS DIVISION

Power Licence Administration

Applications

No applications for development of hydro power were received during 1975. Around a dozen applications to build small power plants for individual use were received and considered.

Mica Project

Mica Dam project is the last of the Columbia River water projects still under construction. Excavation for Mica powerhouse is complete and the emphasis is now being given to concrete placement, mechanical installations, and general clean-up work. The project completion date is September 1977. The dam, declared operational March 1973, is one of the largest of its type in the world.

Kootenay Canal Plant

At the Kootenay Canal project on the Kootenay River near Nelson, construction has been completed on the canal, intake structure, penstocks, and powerhouse intake headworks. Mechanical and electrical installations are being carried out to meet a completion date of late 1976.

The project consists of a 3-mile-long canal with its intake at Corra Linn Dam supplying water to a power plant just downstream from South Slocan Dam.

The power plant will contain four units, each of 125 MW. Installation of the first two units has been completed, while the remaining two are scheduled for late 1976.

Site One

The Site One project has begun with the construction of access roads and a cofferdam. Several suitable aggregate deposits have also been located. Powerhouse excavation is now complete with all contracts progressing on schedule.

The Site One plant will be near Hudson's Hope on the Peace River, about 12 miles downstream from Bennett Dam and will incorporate a concrete gravity dam with power plant on the left side and spillway on the right, approximately 1,000 feet long with a maximum height of 165 feet. The crest elevation will be 1,665.

The power plant will be 550 feet long, including service area, and will contain four units each rated at 175 MW. These units will be served by a 32-foot-diameter steel penstocks from the upstream face of the dam.

Owing to the relatively little volume of storage available behind the dam, run-of-river operation is intended and little or no draughting is anticipated.

Seven Mile Project

At the Seven Mile project on the Pend-d'Oreille River the British Columbia Hydro and Power Authority requested permission to construct the main access road to the project along the lower border of an important deer winter range. Permission was granted, following a public hearing at which it was demonstrated that there was no economically feasible alternative. The Order of Approval contained the proviso that the Hydro Authority make available to the Department of Recreation and Conservation the sum of $1.8 million to establish a wildlife management program for the Pend-d'Oreille Valley as compensation for possible wildlife losses.

The decision by the Comptroller of Water Rights, and a subsequent decision allowing improvements to be made on an existing road to the site, were appealed to the Lieutenant-Governor in Council by the Department of Recreation and Conservation in accordance with the provisions of the *Water Act*. Both appeals were disallowed by a Cabinet tribunal.

Approval of Plans

In addition to the major projects described above, several smaller projects were visited by Division staff to ensure approved construction practices were carried out for new projects as well as all reconstruction and rehabilitation developments.

Power Licence Rentals

On April 10, 1975, the Annual Rental Rates for Power Purpose were increased under the authority of an Order in Council. The new rates are, for plant under construction, 5 cents per kilowatt of capacity; for plant in operation, 50 cents per kilowatt of capacity, plus 25 cents per megawatt-hour of output.

The previous rates had been unchanged since 1961.

In 1975, rental statements totalling $10,281,892 were issued to major power licensees. In addition to power rentals, this figure includes $24,266 for reservoir storage licences, $526,458 for flooding of Crown land, and $1,568 for other uses of Crown land.

Flood Control

Snow-packs in the Province were generally average or below average in 1975. As a result, reservoir flood control operations did not have to be initiated. The runoff was in some cases so low that several major reservoirs failed to fill.

As part of the Coquitlam River Water Management Study, a study was initiated investigating the possibility of altering current operating procedures and modifying hydraulic control structures at Coquitlam Lake Dam with a view toward providing additional flood control benefits for downstream communities.

Kootenay Lake Board of Control

As a member of the Kootenay Lake Board of Control, the Divisional Chief participated in the joint submission of the Board's Annual Report for the calendar year 1974 to the International Joint Commission. Lake operation in that year conformed to prescribed limits except for minor violations in January and in March when the lake rose 0.8 foot and 0.1 foot respectively over the rule curve. Storage at Libby upstream greatly reduced the inflow to Kootenay Lake during the storage filling periods of drawdown. The area was inspected once by the Board during the report period.

Ice Studies

The Town of Peace River in the Province of Alberta frequently has experienced ice jams at the end of the winter season. A Joint Task Force representing British Columbia Hydro and Power Authority and the Governments of Alberta and British Columbia was established during 1974. Members of this Joint Task Force met in March 1975 and agreed that their representatives would participate in the 1975 ice break-up program for the Town of Peace River. Field staff of British Columbia Hydro and Power Authority recorded and analysed meteorological and hydrometric data at intervals from freeze-up till break-up. The Government of British Columbia underwrote the cost of air photographic coverage during the break-up period. The 1975 break-up was relatively uneventful and the ice rotted in place, slowly deteriorating under the combined influence of solar radiation and the river water flowing beneath it.

These studies will be continued during the winter of 1975/76.

Environmental Studies, Arrow Reservoir Study Group

This new study group has been formed jointly by several Provincial Government agencies and British Columbia Hydro and Power Authority to determine if, in view of increasing public use of the Arrow Reservoir, its operation and regulation could be modified for improved recreational, fishery and wildlife management, navigation, and environmental enjoyment purposes. The group has held three meetings under the chairmanship of the Chief of this Division and is engaged in a number of subsidiary studies in line with its objectives.

TRANSMISSION-LINES

Proposed transmission-line routes are now subject to approval by resource agencies and local authorities affected by such lines. This Division is responsible for co-ordinating Water Resources Service inputs with a view to avoiding or mitigating adverse effects on water use.

Nicola/Cranbrook Line

This proposed pair of lines will link the generating stations of the Nelson/Trail area with the remainder of the Province. In the future it will most probably form part of a trans-Canada power grid. Initial route selection procedures defined

a broad bank within which the route should lie. The Water Resources Service provided input at the second stage whereby options were narrowed down initially to corridors of 5 miles and subsequently 2 miles in width. The ultimate route of the line will be about 120 metres (400 ft.) wide and will most probably lie within the selected 2-mile corridor. The final selection has yet to be made as certain portions of the route are still under scrutiny.

Other Lines

A number of other transmission-line proposals have been or are being studied. Certain specific areas are receiving attention in view of their potential for damage to local water supply systems. These include lines near Revelstoke, Golden, and Prince George.

Williston Reservoir

This study was initiated in March 1974 under the chairmanship of the Secretariat to the ELUC to identify and assess resource potentials in and around Williston Reservoir. Water Resources Service input included a study by this Division in co-operation with British Columbia Hydro and Power Authority, or reservoir operation to maximize power output yet ensure control of flood flows downstream. The G. M. Shrum power plant currently supplies 60 per cent of the Provincial power demand and will continue to be a major source of power through the 1970's. It is estimated that by 1977/78 there is only a 77-per-cent chance that the reservoir will rise above 2,190, which is 15 feet below full pool; therefore, operation of the reservoir will have significant impacts on access, fisheries, management, and reservoir clearing. Future studies will undoubtedly clarify these interrelated matters.

Kootenay River (Canal Flats) Diversion

Under the Columbia River Treaty, Canada has the right as of September 1984 or thereafter to divert approximately 70 per cent of the average annual flow in the Kootenay at Canal Flats into the Columbia River for increased power generation by hydro-electric plants downstream on the Columbia.

Environmental and social impact studies, scheduled for 1975 and 1976 under joint supervision of the British Columbia Hydro and Power Authority and the Environment and Land Use Committee Secretariat, will concentrate on the effects of increased Columbia Valley flooding on wildfowl nesting and staging areas, the effect of reduced dilution of the already polluted Kootenay River downstream of the diversion site, and the effect of increased water levels on lakeside properties in the Windermere and other areas. Terms of reference of these studies were reviewed and potential problem areas visited prior to the awarding of an assignment to specialist consultants.

Electrical Generation and Load Growth

Each year at the end of July the Water Resources Service prepares and distributes a pamphlet entitled *Power in British Columbia—Annual Review,* as an interim report. The results of a quick year-end survey (*see* below) indicate that the consumption of electrical energy in the Province during 1975 dropped by 3.8 per cent from the figure for 1974. This relatively static growth is due to the considerable labour unrest experienced during the last two years. Lengthy strikes have curtailed electrical usage by several segments of industry, including mining, smelt-

ing, and wood products. It will be noted, however, that the "Utilities Thermal" component has increased due to the fact that hydro supplies were deficient during 1975.

The major power plant addition during 1975 was the placing on line of the first two units of the Kootenay Canal Plant, bringing the total Provincial installed capacity up to 7,226 megawatts at year-end.

Electrical Generation and Load During 1975 and Comparison With Preceding Year

	1974	1975	Change
Generation by utilities—	GWh	GWh	Per Cent
Hydro	23,646	21,655	−8.42
Thermal	357	1,906	+433.89
Subtotals	24,003	23,561	−1.84
Generation by industries—			
Hydro	10,202	9,414	−7.72
Thermal	1,463	990	−32.33
Subtotals	11,665	10,404	−10.81
Total generation	35,668	33,965	−4.77
Exports (net)	2,263	1,839	.....
Total load	33,405	32,126	−3.83

The above figures are subject to revision and more accurate and up-to-date information will appear in the next edition of *Power in British Columbia.*

Long-term Growth

The two graphs, one entitled "Peak and Average Energy Requirements" and the other "Total Installed Capacity," demonstrate the long-term growth in use of electricity in the Province. Over the 45-year period since 1930 the annual energy consumption has risen at an average rate of 7.28 per cent compounded, while installed capacity has risen at the slightly slower rate of 6.58 per cent compounded. Over the past 10 years the growth rates have been 5.42 per cent compounded for energy consumption, and 7.17 per cent compounded for installation.

Columbia River Treaty

Mica Reservoir

McNaughton Lake has almost completed its third year of operation under the Columbia River Treaty and, in the fall of 1976, will provide regulation for first power generation at Mica powerhouse. To accomplish this, 8 million acre-feet of dead storage is presently being accumulated toward a total ultimate storage of 20 million acre-feet. At the end of the 1975 refill period, just under one quarter of this initial amount remained to be impounded. Since that time, further impoundment has been effected by generating replacement energy at the Burrard Thermal Plant.

Benefits in Canada

The Treaty storages provide a considerable measure of flood protection within Canada. However, conditions during 1975 were such that there was no flood threat.

Since the completion of Duncan Dam, extra energy has been available at Cominco's Kootenay River plants, and this energy has been shared with the Canadian Entity (British Columbia Hydro and Power Authority). Effective from the

date upon which the Kootenay Canal Plan on the Kootenay River near Nelson commenced operation, the operation of this plant and those of the Cominco System is being co-ordinated to produce the optimum over-all benefit. Under this plan Cominco receives a guaranteed amount of firm power determined on the basis of that previously available, while the Hydro Authority retains the balance, which is largely made available as a result of the storage provided by Duncan and Libby Dams constructed under the Columbia River Treaty.

Libby Reservoir

The construction of the Libby Dam on the Kootenai River in Montana is the last major work to be authorized under the Columbia River Treaty. The Water Resources Service of British Columbia was assigned the role of co-ordinating agency for preparing the Canadian portion of the reservoir.

Storage of water to refill Lake Koocanusa commenced early in May 1975 and the reservoir reached its maximum elevation for the year (2,455.5 feet) on September 9, 1975, slightly below the normal full pool elevation of 2,459 feet.

All but five property owners have settled amicably with Government negotiators. Arbitration proceedings have now been initiated for these remaining properties.

The Fish and Wildlife Branch installed fish screens in Linklater and Plumbob Creeks as a contribution to the United States fish-tagging program for the reservoir. The Parks Branch is currently proceeding with development of waterfront parks and recreational facilities at Kikomun Creek and Wardner, and is studying the possibility of other recreational areas around the perimeter of the reservoir.

Permanent Engineering Board

The Chief of the Division is the designated alternate to the Deputy Minister on the Permanent Engineering Board (PEB) established under the terms of the Columbia River Treaty. The PEB reports annually to the United States and Canadian Governments on progress achieved under the Treaty. Board activities during the year included two meetings, a joint meeting with the Entity representatives, attendance at the dedication ceremonies for Libby Dam, and visits to Arrow, Kootenay Canal, and Mica projects. The Board's technical committee reviewed and commented upon a number of Entity reports that were presented to the PEB.

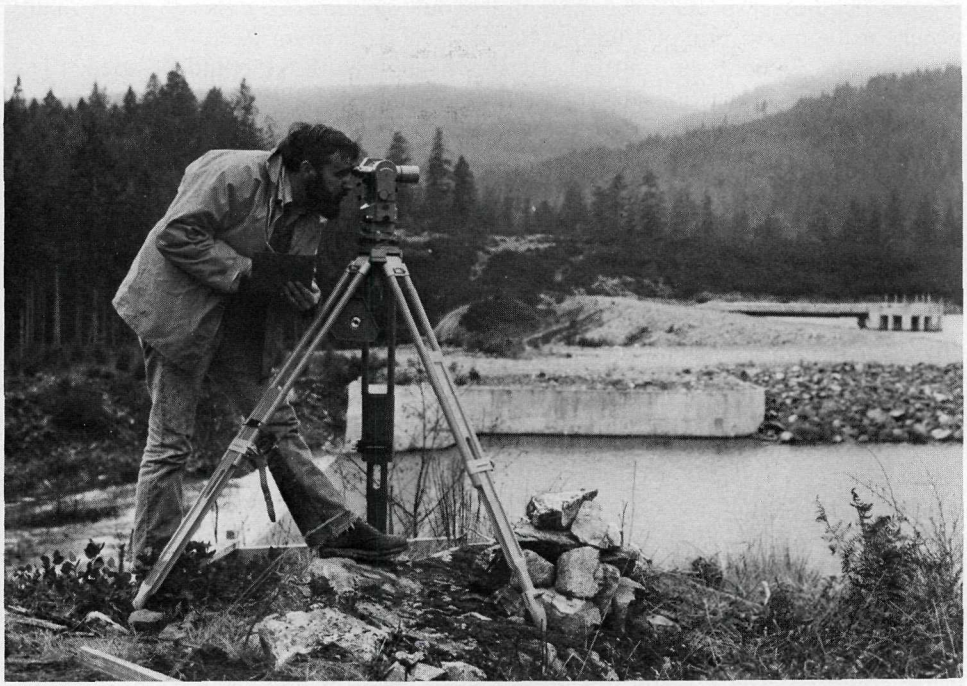
Dam Inspection

Many changes in the scope and magnitude of the dam inspection program were made in 1975. Classification of all large dams according to size, condition, and disaster potential was undertaken. Inspection procedures and record sheets were prepared and distributed to Regional Engineers to ensure uniformity in inspection reporting throughout the Province.

Twenty major dams and 35 smaller structures were inspected as part of the continuing program to ensure that adequate maintenance was being carried out and that no adverse conditions had developed in the four years interim since previous inspection. The inspections included underwater investigations if such appeared necessary. On those dams which were found to be in poor condition a consultant's report was requested from the owner preparatory to rehabilitation or removal. Several major dams under construction were also visited during the year to ensure compliance with previously approved plans.

Dam Instrumentation

A dam instrumentation program was introduced in 1975. With the co-operation of the Greater Victoria Water District, Sooke Lake Dam was instrumented and a triangulation network installed to measure surface deformation movements. In addition, several members of the Division attended a course on the instrumentation and reading of subsurface instruments, including inclinometers and pneumatic piezometers. A program to provide adequate instrumentation on new structures is now under review. Other investigations on aspects of dam safety were undertaken



Power and Special Projects Division is responsible for the inspection of all major dams in the Province. Here, a field staff member checks for deformation movement on Sooke Lake Dam, near Victoria.

Failure of a small dam on Vancouver Island due to lack of armour protection at the entrance to its concrete spillway.

during the year; these included dam stability studies, flood handling capability, and reservoir bank stability.

Other Projects

Steel Mill

A joint study by the Provincial Government and Nippon Kokan Kabushiki Kaisha of Japan was undertaken to determine the feasibility of an integrated steel mill located at either Prince George or Kitimat. Staff of the Division considered the physical feasibility and economics of supplying water to either site, and prepared reports on these aspects. The steel mill would require 42 c.f.s. of good-quality water for the production of 4 million tons of steel per annum.

For the Kitimat site, untreated water from Jesse Lake could be used. This would involve construction of approximately 18 miles of 39-inch-diameter pipeline. At Prince George, Fraser River water could be used but would require treatment.

Hat Creek: Gasification

The B.C. Energy Commission initiated a study of the economic feasibility of a coal gasification plant using the Hat Creek coal reserves. The Power and Special Projects Division prepared a report on the availability and cost of water supply for such a plant.

For the operation of a gasification plant, a continuous water supply of 16.7 c.f.s. would be required. This water could either be supplied from the Bonaparte River using upstream storage or by pumping from the Thompson River.

Thermal Generation

British Columbia Hydro and Power Authority is investigating a proposed thermal generating station using Hat Creek coal. Initially, the plant would generate 2,000 mw, which might subsequently be increased to 4,800 mw. Water required for the cooling towers and other operations would be in the order of 25,000 g.p.m. for a 2,000-mw station. Such a large quantity of water could only be supplied either by the Thompson River or the Fraser River. While the Thompson River water could be used directly, the Fraser River water would require pre-treatment due to its heavy silt content.

Metric Conversion

It is anticipated that, subject to Government approval, metric conversion of the Water Rights Branch will take place on January 1, 1977. This date is essential so as to coincide with the billings of 1977 annual rentals. The physical quantities already authorized under water licences will not be affected by the change of units as an accurate conversion will be made for these. New licences will, of course, be issued in the new units from the above date. Preparatory changes will take place during 1976.

The units that the Branch will use for licensing (i.e., as quantities allowed under a licence or permit) are as follows:

Rate of diversion	cubic metres per second or cubic metres per day or cubic metres per annum
Volume stored	cubic metres per annum or cubic hectometres per annum
Area	square hectometres
Length	kilometres

Heber Creek Diversion

An economic analysis of the Heber River Diversion was initiated comparing energy benefits to the Campbell River Generating System with estimated losses to the sports fishery resource resulting from reduction of natural river flows.

British Columbia Petroleum Corporation

This Division has investigated water supply required for a possible oil refinery complex in either the Merritt or Clinton areas. The plant at Merritt would take water from the Nicola River, while the Clinton plant would draw from the Bonaparte River. The anticipated water demand is 300 g.p.m. Both river systems should have sufficient water, although the Bonaparte River is already heavily licensed and upstream storage would be necessary.

COMMUNITY WATER SUPPLY DIVISION

Late in 1975 the staffs of the Improvement Districts Division and the Water Utilities Division were amalgamated and reorganized to form a single entity named the Community Water Supply Division, the object being to eliminate duplication of staff duties and to create an organization capable of dealing with a wider range of community water supply problems. Staff available to the Comptroller of Water Rights in the administration of the *Water Utilities Act,* the *Energy Act,* and the *Water Act* with regard to both privately owned and publicly owned water supply systems was thus brought together.

The Community Water Supply Division consists of four sections—Administration, Accounting and Financial, Engineering, and Research and Planning. Because the new Division has been in existence for only a short period of time prior to year-end, this report is based on the activities of the two former Divisions.

Improvement Districts—Activities

There are now 267 improvement districts incorporated under the *Water Act* and administered by the Comptroller of Water Rights. During 1975 the following districts were incorporated and dissolved:

Districts Incorporated	*Districts Dissolved*
Beddis Waterworks District.	Arden Improvement District.
Clayoquot Sound Waterworks District.	Brent-Davis Irrigation District.
Cormorant Island Improvement District.	Headquarters Road Irrigation District.
Florence Lake Improvement District.	Little River Improvement District.
Louis Creek Improvement District.	Port Clements Improvement District.
Parkdale Improvement District.	Radium Sewerage District.
South Lake Erroch Improvement District.	South Westminster Dyking District.
Williams Spring Waterworks District.	Willow River Forest Improvement District.

The Letters Patent of 39 other improvement districts were amended in 1975, most changes being boundary amendments.

There are now $14,102,900 of improvement districts' debentures guaranteed by the Province under the *Improvement Districts Assistance Loan Act,* of which $2,871,900 are serial debentures and $11,231,000 term debentures. Sinking funds

for redemption of the term debentures are held by the Province in the amount of approximately $1,205,370. During 1975, debentures of $2,388,000 were guaranteed.

Engineering Services

During the year, engineering and administrative staff of the Division met frequently with consulting engineers, district trustees, municipal officials, organizing committees, and land developers. About 140 visits were made to 90 districts regarding technical and administrative problems.

Reports Prepared and Under Preparation

Community	Subject	Status of Report at End of Year
Anmore, Belcarra, and Bedwell Bay	Cost of proposed domestic-water distribution system	Completed.
Bamfield	Updated proposal for domestic-water system	Study continuing.
Crooked River Waterworks District	Review of domestic-water system	Study continuing.
Decker Lake	Proposed domestic-water system	Study continuing.
Deep Cove Waterworks District	Cost of alternate well-sites	Completed.
Dewdney Area Dyking District	Appeal *re* tax assessment	Completed.
East Princeton Waterworks District	Cost of proposed modifications to domestic-water system	Completed.
Lantzville Improvement District	Bulk water supply agreement	Completed.
Lardeau	Domestic-water system	Completed.
Lund Waterworks District	Revised proposal for rehabilitation of domestic-water system	Completed.
Mesachie Lake Specified Area	Proposed rehabilitation of domestic-water system	Completed.
Mill Bay Waterworks District	Possible new sources of water	Completed.
	Appeal *re* tax assessment	Completed.
Okanagan Mission Irrigation District	Condition of 24-inch A.C. main as installed	Completed.
	Defective drain	Completed.
Olalla Improvement District	Appeal for irrigation service	Completed.
Ootischenia Improvement District	Proposed joint development of new water system with Castlegar Golf Club	Completed.
	Appeal for domestic service	Completed.
Piers Island Improvement District	Cost of proposed seasonal storage	Completed.
Proposed Old Highway Waterworks District	Proposed domestic-water system	Completed.
Rolla	Updated proposal for domestic-water system	Study continuing.
South Vernon Irrigation District	Complaint *re* low pressures	Completed.
Stillwater Waterworks District	Domestic-water system "as-built"	Completed.
Town of Ladysmith, Saltair Waterworks District, and Diamond Improvement District	Water supply	Completed.
Vananda Waterworks District	Revised proposal for rehabilitation of domestic-water system	Completed.
Village of Cumberland	Unauthorized connections to supply main of Royston Improvement District	Completed.
Village of New Denver	Updated proposal for rehabilitation of domestic-water system	Completed.
Village of Tofino	Flood damage to water system	Completed.
Village of Zeballos	Proposed renovation of domestic-water system	Completed.
Williams Spring Waterworks District	Cost of proposed domestic-water system	Completed.

Design and Engineering Services

Community	Project	Status of Project at End of Year	Estimated Cost
			$
Deep Cove Waterworks	Geotechnical investigations for groundwater	Completed.	1,800
	Supervision of well drilling	Completed.	7,600
Eagle Rock Waterworks	Supervision of repairs to pump and pipe	Completed.	1,000
Edgewater Improvement	Design for modifications of pressure-reducing stations	Completed.	1,000

Water Supply, Sewerage, and Other Proposals Reviewed

Community	Description of Proposal	Status of Project at End of Year	Estimated Cost
			$
Athalmer Improvement District	Sewer system	In abeyance.	173,650
Barriere Improvement District	New river intake and pump station	Under consideration.	100,000
Bennett Bay Waterworks District	Well and storage tank	Construction completed.	5,000
Blue Water Park Improvement District	Extension of domestic-water system	Construction imminent.	6,000
Canal Flats Improvement District	Fire hall	Planning stage.	80,000
Clearwater Improvement District	Extension of domestic-water system	Construction completed.	277,200
Deep Bay Waterworks District	Proposed water system	Under construction.	186,000
Eagle Rock Waterworks District	Well and pumping plant	Construction completed.	35,000
Fanny Bay Waterworks District	Extension of domestic-water system	Under construction.	39,500
Florence Lake Improvement District	Domestic-water distribution system	Under construction.	13,000
Gillies Bay Improvement District	Water quality		
Greater Campbell River Water District	Parallelling of supply main	Preliminary planning.	1,745,000
Lantzville Improvement District	Freeze on extensions of domestic-water system		
Lighthouse Point Waterworks District	Pumping plant	Construction imminent.	2,300
North Cedar Waterworks District	Extension of domestic-water system	Construction completed.	13,000
	New pump and main		
North Salt Spring Waterworks District	Extension of domestic-water system to Southey Point	Construction completed.	142,000
	Pumped supply from Maxwell Lake	Preliminary planning.	100,000
	Extension of domestic-water system to Cottonwood subdivision	Planning stage.	60,000
Okanagan Mission Irrigation District	Breaks in 24-inch supply main. Replacement of 24-inch supply main	Reconstruction completed.	95,000
Orde Creek Improvement District	Upgrading water supply system	Preliminary planning.	
Qualicum Bay-Horne Lake Waterworks District	New pumping station and extension of domestic-water system	Planning stage.	80,000
Radium Waterworks District	Upgrading and extension of sewer system	Preliminary planning.	657,000
Rayleigh Waterworks District	Extension of water and sewer system	Construction completed.	20,000
Ridgewood Improvement District	Rehabilitation of domestic water system	Planning stage.	60,000
Saltair Waterworks District	Water supply and distribution	Preliminary planning.	254,000
Sidney Waterworks District	Booster pump station	Construction imminent.	8,000
Sutherland Creek Waterworks District	Intake, sedimentation tank, pipeline, and chlorinator	Under construction.	24,000
Traders Cove Waterworks District	Interim water system	In abeyance.	10,000
Village of Fort Nelson	Renovation and extension of domestic-water system	Under construction.	2,862,900
Willow Point Waterworks District	Extension of domestic-water supply system and booster pumping (Stage 1)	Preliminary planning.	400,000
Wynndel Irrigation District	Renewal of supply main	Preliminary planning.	250,000

ARDA Projects Supervision

In the Federal-Provincial Agricultural and Rural Development Agreement under the *Agricultural Rehabilitation and Development (British Columbia) Act,* the Province has responsibility for ensuring the proper operation and maintenance of all works constructed under ARDA programs. Where improvement districts are concerned, Water Rights Branch personnel of the Community Water Supply Division carry out the routine inspection of completed ARDA projects, and offer advice and assistance on technical and administrative problems.

Improvement Districts Involved in ARDA Program

Districts	Completion Date of Original ARDA Projects	Remarks
Glenmore Irrigation	1964/72	Supplementary project in hand.
Vernon Irrigation	1964/65/73	Supplementary project in hand.
Scotty Creek Irrigation	1964/69	Supplementary project in hand.
Ellison Irrigation	1964/70	Supplementary project in hand.

Improvement Districts Involved in ARDA Program—Continued

Districts	Completion Date of Original ARDA Projects	Remarks
Heffley Irrigation	1964	
Canyon Waterworks	1965	
South End Kelowna Irrigation	1965	Supplementary project in hand.
Grandview Waterworks	1965/71	
Similkameen Improvement	1965/71	
Oyama Improvement	1966	
Kaleden Irrigation	1966/73	
Westbank Irrigation	1966/73	
Osoyoos Irrigation	1969	
Meadow Valley Irrigation	1969	
Black Sage Irrigation	1969	
Raspberry Irrigation	1969	
Naramata Irrigation	1969/73	
Lakeview Irrigation	1970	
West Bench Irrigation	1970	
Boundary Line Irrigation	1970	
Darfield Irrigation	1970	
Wood Lake Improvement	1970	
Sion Improvement	1971	
Winfield and Okanagan Centre Irrigation	1971	
Slocan Park Improvement	1971	
Peachland Irrigation	1972/73	
Otter Lake Waterworks	1972/73	
Larkin Waterworks	1972	Supplementary project in hand.
Keremeos Irrigation	1973	
Okanagan Falls Irrigation	1973	
Black Mountain Irrigation	1973	Supplementary project in hand.
Southern Okanagan Lands Irrigation	1974	
Chase Irrigation		Project in hand.
Robson Irrigation	1974	

Continuing development and the need to relate water services to land use planning are creating major problems for those water supply agencies whose basic system consists of works installed under the ARDA program the purpose of which was to provide water supply for seasonal irrigation and farm use. The limited staff carrying out the ARDA supervisory function have found that the water services planning aspects involved are, of necessity, taking precedence over the more local and detailed problems in the respect of which assistance from Water Rights Branch personnel has been traditionally available. This fact, together with administrative restrictions imposed upon staff during the year, has curtailed progress on some of the assignments, but those having urgent priority are receiving supplementary staff input from the Kelowna Regional Office.

The following studies are in hand:

District	*Study*
Okanagan Falls Irrigation	Proposed rehabilitation of water system in townsite area.
	Appraisal of existing water system capacity.[1]
Kaleden Irrigation	Design of supplementary works to serve residential development.
Oyama Irrigation	Appraisal of status of ARDA project.

[1] Completed.

The following studies are in hand:

District	*Study*
Wood Lake Improvement	Intake and sedimentation basin performance.
	Community planning (water services).
Sion Improvement	Appraisal of water system capacity.
Keremeos Irrigation	Investigation of additional sources of water supply.
Vernon Irrigation	Area Water Management proposal.
Lakeview Irrigation	Community planning (water services).
Winfield and Okanagan Centre Irrigation	Community planning (water services).
West Bench Irrigation	Appraisal of system operating characteristics.
Westbank Irrigation	Appraisal of system operating characteristics.
	Community planning (water services).
South East Kelowna Irrigation	Community planning.
Black Mountain Irrigation	Area water management.
Grandview Waterworks	Ancient subdivisions and land use planning.
Peachland Irrigation	Reappraisal of ARDA project.
	Community planning (water services).
Larkin Waterworks	Supervision of Crozier extension ARDA project.

[1] Completed.

WATER UTILITIES—ACTIVITIES

At the end of 1975 there were a total of 261 utilities subject to the supervision of the Comptroller of Water Rights under the *Water Utilities Act* and the *Energy Act*. Of these, 222 were privately owned waterworks systems and 39 were owned by municipalities supplying water outside their boundaries. There were 89 applications at the end of the year for certificate of public convenience and necessity to create new utilities or to extend the service areas of existing systems.

The policy of requiring all new utilities to establish maintenance reserve funds was continued during the year. These funds are held indefinitely to and for the sole discretion of the Comptroller of Water Rights against any unforeseen operating

contingency. The total amount on deposit in the various funds now exceeds $1.8 million and may be released in whole or in part by the Comptroller if and when the systems become self-supporting.

A number of public hearings were held by the Comptroller of Water Rights during the year dealing largely with applications for approval of rate increases.

Statistical data relating to the work of the former Water Utilities Division are as follows:

Applications for certificates of public convenience and necessity authorizing new utilities to commence service:
- (*a*) Investigated and granted 21
- (*b*) Under investigation at year-end 53

Applications for certificates of public convenience and necessity authorizing existing utilities to extend their service areas:
- (*a*) Investigated and granted 36
- (*b*) Under investigation at year-end 36

Applications to file tariffs and amendments to tariffs:
- (*a*) Investigated and accepted for filing 61
- (*b*) Under investigation at year-end 30

Orders requiring maintenance reserve funds and other special funds to be created 41

Orders approving transfer and sale of water utilities to new owners 10

Complaints dealt with regarding rates and adequacy of service 22

WATER INVESTIGATIONS BRANCH

The Water Investigations Branch was formed in late 1962 as a consequence of the creation of an independent British Columbia Water Resources Service.

The functions of the Water Investigations Branch, which is headed by the Director, are the evaluation, control, planning, and management of water resources of the Province where these do not directly come under the administration of the *Water Act* and the *Pollution Control Act, 1967*. These functions, carried out by various divisions of the Water Investigations Branch, are briefly summarized below.

(1) Hydrology Division:

(*a*) Snow surveys and snow-melt runoff forecasting to facilitate flood prevention measures and to guide judicious utilization of water supply.

(*b*) Hydrologic studies of the Province to compile and evaluate basic hydrometeorological data for use in planning, engineering studies, and related purposes.

(*c*) Hydrologic studies as components of interdisciplinary studies pertaining to multi-resource planning and management and environmental protection.

(*d*) Collection of existing groundwater data and investigation and evaluation of groundwater potential to encourage and guide the future use and conservation of this source of water supply.

(2) Planning and Surveys Division:

(*a*) Development of floodplain and flood-hazard maps in concert with management planning and control of floodplain development.

(*b*) Surveys and mapping in connection with water resource planning, investigations, and construction.

(*c*) Data collection in connection with water quality, water quantity, and reservoir storage-site investigations.

(3) Environmental Studies Division:

(*a*) To undertake environmental and management studies for purposes of preserving the quality of the water resource and ensuring its judicious usage.

(*b*) To carry out limnological and ecological surveys and studies directed toward resolving existing problems and facilitating water resource planning.

(4) Engineering Division:

(*a*) Processing of water project proposals made under the *Agricultural and Rural Development Act,* and investigations, design, and supervision of projects.

(*b*) Irrigation and domestic-water supply investigations to assist and advise in the development, planning, and management of water supply projects.

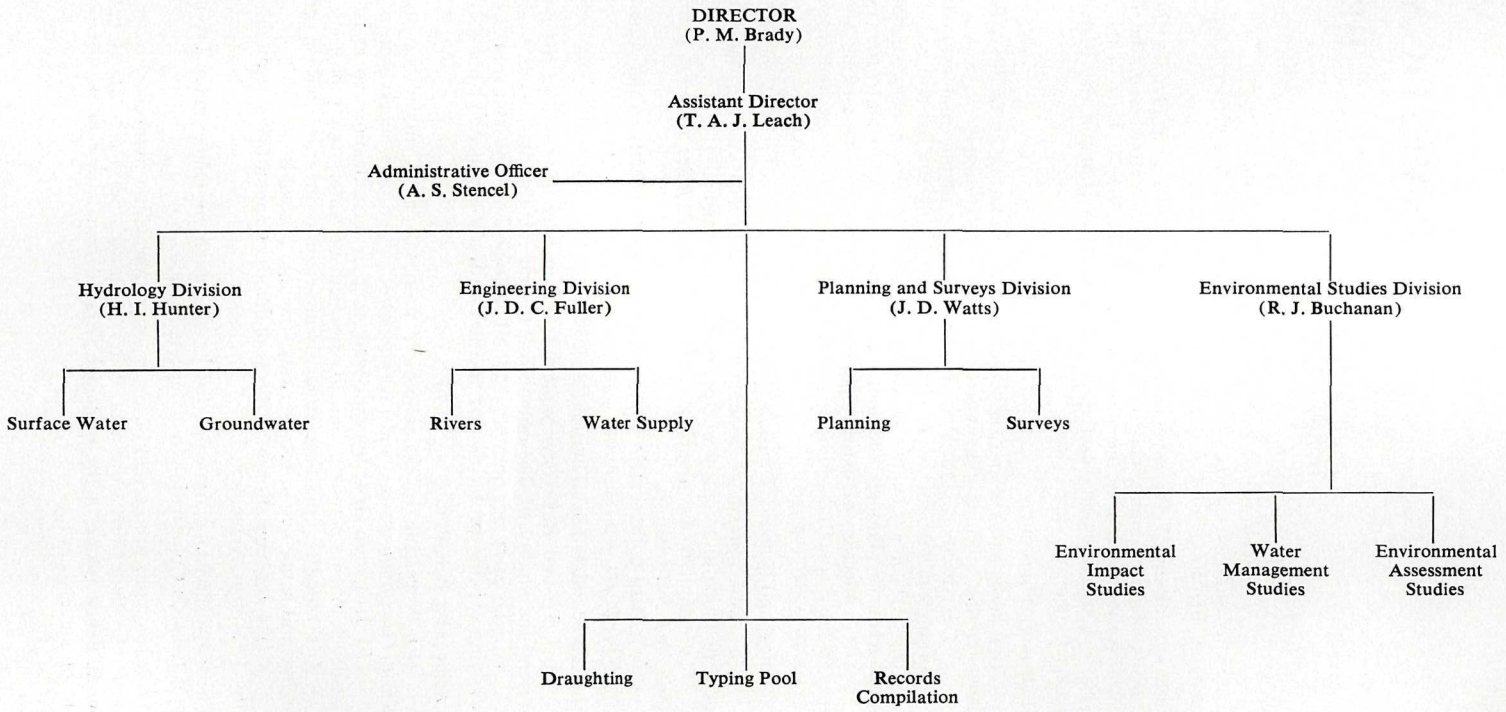
(*c*) Flooding, drainage, and stream-erosion investigations to give engineering advice and assistance in solving water-damage problems.

(*d*) Implementation of projects under the Canada-British Columbia Fraser River Flood Control Agreement.

(5) The above divisions are supported by a Draughting Office and a Typing Pool as well as a Records Compilation and Reports Section.

The above functions are carried out in co-operation with a number of other Governmental agencies to enable the British Columbia Water Resources Service to foster better use of the water resource, which is one of the principal physical foundations of the economic and social development of the Province.

WATER INVESTIGATIONS BRANCH



WATER INVESTIGATIONS BRANCH

P. M. BRADY, P.ENG.
DIRECTOR

The Water Investigations Branch is responsible for planning and development programs pertaining to utilization, preservation, and control of the Provincial water resource.

The Branch is organized as illustrated on the adjacent chart and comprises 140 permanent staff members. Responsibilities and activities are such that there is a significant proportion of staff with specialized training in a variety of technical and scientific fields.

Each of the four divisions contains experts in the appropriate disciplines and each division is responsible for the management of specific assigned programs and the associated tasks. The divisions do not function independently of each other but wherever necessary one supports the other by providing the needed expertise from its own team of specialists.

In turn each division receives significant technical support from the Draughting Office. The accounting and operational services so necessary for successful operation are provided by the Administrative Officer and the Records Compilation Section which he manages. The Typing Pool handles overloads from the divisions.

For the purposes of this Report the division lines have been ignored and the activities described under three major program headings entitled Flood Damage Prevention, Environmental Preservation, and Water Resource Utilization.

In addition to the activities and services described under the three major headings, the Branch provides consulting and technical services to other Government agencies and has staff representing it on more than 60 interagency and intergovernmental boards, committees, and task forces.

FLOOD DAMAGE PREVENTION

INTRODUCTION

Considerable development in the floodplains of British Columbia has taken place as a result of the topography and geology of the Province. The continual expansion of the population and economy, particularly outside the Greater Vancouver and Victoria areas, tends to propagate further development in flood-prone areas. As a result of this, high water levels will cause substantial flood damages and social disruption at an increasing rate unless preventive measures are undertaken. The necessary structural and nonstructural measures are being implemented under a comprehensive flood damage prevention program. They include flood forecasting, planning and control of floodplain development, regulation of flood flows, channel clearing, and construction of flood and erosion protection works. Details of these activities are given in this Report.

GENERAL FLOOD SITUATION DURING YEAR

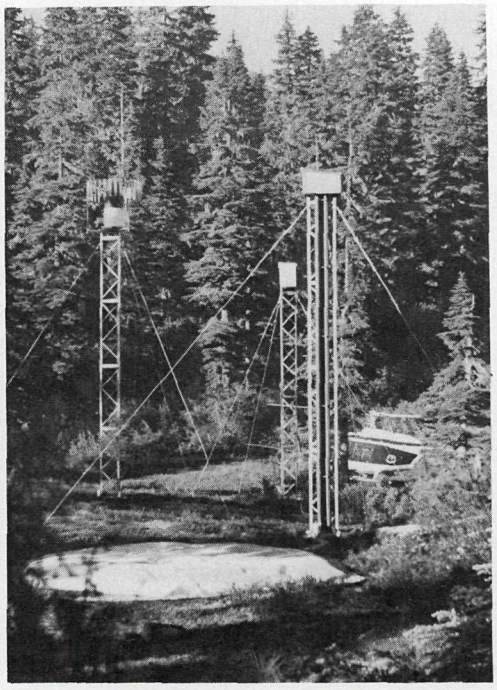
Snow-pack conditons were such that high spring runoff under normal melt conditions was not anticipated except in the Okanagan, Kettle, and Similkameen

watersheds. High flows in the Kamloops area resulted from heavy rain during the latter part of the melt period.

Heavy rains accompanied by snowmelt as a result of sharply raised freezing levels occurred periodically from October to December and caused high runoff in the south coastal area. Flooding and erosion damage occurred in many areas but was heaviest in the lower Squamish River Basin, the lower Bella Coola Valley, the lower Fraser River valley area, particularly along the Vedder River, and on Vancouver Island along the Somass, Zeballos, Salmon, and Oyster Rivers. Heavy runoff caused damaging mud slides and flooding at Alert Bay and Port Alice.

Streamflow Forecasting

Streamflow forecasting is the responsibility of the Surface Water Section of the Hydrology Division, which operates the Provincial snow survey network. A total of 1,142 snow surveys was made at 240 snow courses during 1975 by Hydrology Division personnel, co-operating agencies, and part-time local employees. The results were immediately relayed to Victoria, via Telex, telegraph, and telephone, where the snow survey data were compiled and together with meteorological and runoff data, analysed utilizing statistical methods and computer programs to produce seasonal volume forecasts for key locations throughout the Province. Snow survey data and runoff forecasts were published in the *British Columbia Snow Survey Bulletin,* which was issued on the first day of each month from February to June inclusive, with a mid-month edition published in May.



Boston Bar Creek snow pillow station in co-operation with the Design and Surveys Branch, Department of Highways.

Five new snow courses were established and four deleted during 1975. The number of snow pillow installations remained unchanged at eight. The first station to use a satellite relay system became operational in the Mission Creek watershed in the Okanagan Basin. This will provide daily information on snow-pack, temperature, precipitation, and groundwater levels at a key indicator site in the basin.

In the year 1975, field work activities included snow surveys, the training of observers, and maintenance and installation of equipment. Two hundred and fifty-three man-days were spent on this field work, and the Division's technicians travelled 21,340 miles by vehicle, 630 miles by helicopter, and 256 miles by oversnow machine.

Office work required to convert the snow survey data collection and compilation to the metric system was undertaken with metric units to be used in the 1976 bulletins.

During the snowbelt season a careful watch is kept on river stages throughout the Province, particularly on the Fraser and Thompson Rivers where flows are largely uncontrolled and where large sections of the floodplain have been developed. Daily

meteorological and streamflow data are analysed by the Modelling Subsection of the Hydrology Division to produce forecast flows and stages at key points throughout the Fraser River basin for up to five days in advance. Considerable use is made of hydrologic models to assist in the short-term forecasting process, and these computer programs are constantly reviewed and updated as time permits and the science of hydrology advances. This section also develops and operates specialized short-term forecasting models of areas such as Osoyoos Lake where high flows in the Similkameen can cause flooding.

Floodplain Development Control

1. *General*—The main activities in the control of floodplain development are floodplain surveys, hydrological analysis, and computation of flood profiles, floodplain mapping, input to local planning as related to flooding, including review and recommendation on zoning by-laws, and land use contracts, and consent for approval of subdivisions located in flood-prone areas.

2. *Floodplain surveys*—Floodplain surveys were undertaken by the Surveys Section of the Planning and Surveys Division. Some 8,730 man-hours were spent on topographic, bathometric, and control surveys in 10 river valleys during 1975. Surveys were undertaken for approximately 385 square miles of floodplain containing approximately 267 miles of river and 20 miles of lakeshore.

Establishing Water Resources Service reference monument for floodplain mapping in Shuswap River valley.

3. *Hydrologic analysis and computation of flood profiles*—Hydrologic analysis to determine the magnitude and frequency of flood flows is undertaken within the Modelling Subsection of the Hydrology Division. During the year this section considerably revised and expanded the existing computer program to meet the frequency analysis requirements of the Branch. The resulting program is a sophisticated package which analyses data according to four different distributions and gives both figures and graphical outputs. The frequencies of flood flows and lake

levels were determined for a total of 37 rivers and lakes during the year. The basic flow data are obtained from records published by the Water Survey of Canada. These records are obtained through a Province-wide hydrometric network operated under the terms of a Federal-Provincial agreement which came into effect at the beginning of 1975.

Where streamflow or lake data are not available, estimates of flood flows or lake levels are made by personnel of the Surface Water Section. This is done by utilizing available data such as rainfall records and by correlation techniques from nearby catchments. A regionalization procedure was developed for the south coastal portion of British Columbia which provides estimates of extreme flows for ungauged watersheds.

The Planning Section of the Planning and Surveys Division utilizes the flood flows to determine the flood profile, using a computer program designed for this purpose.

4. *Floodplain mapping*—Orthophoto mapping with spot heights and contours is undertaken by the Surveys and Mapping Branch of the Lands Service, using air photographs provided by its Field Operations Division and the survey control information provided by the Planning and Surveys Division. Some 62 mapping sheets were prepared during 1975 covering approximately 60 square miles.

The Planning and Surveys Division determines flood lines and adds these to the mapping along with other information to produce the final floodplain maps which are provided to other agencies and planning authorities.

The status of the floodplain mapping program at the year-end and documentation of associated tasks are summarized in Table 1.

5. *Planning and control of floodplain development*—The Planning Section of the Planning and Surveys Division assists in the plannnig and control of development within floodplains, assesses all subdivisions in areas that could be flooded and, where appropriate, prepares requirements that must be met as a condition of subdivision approval.

Planning and technical advice is given to local authorities to enable the flooding potential to be considered in the preparation of community plans. Control of development of land that is already subdivided takes place through review of all zoning by-laws covering floodplain areas in cases where the Department of Municipal Affairs must grant by-law approval. The Planning Section recommends appropriate clauses be incorporated in the by-laws or agrees with those proposed, and the Department of Municipal Affairs ensures that the final form of by-law is acceptable prior to granting approval. Land use contracts for areas subject to flooding are also referred to the Planning Section and recommendations pertaining to flood prevention requirements are provided to the Department of Municipal Affairs for inclusion in such contracts prior to approval. During 1975, approximately 210 zoning by-laws and 42 land use contracts were reviewed within the Planning Section. This compares with some 90 and 44 respectively for 1974. Zoning by-laws usually contain a clause which affords the opportunity for appeal to the Deputy Minister of Water Resources for reduction in or relief from the flood prevention requirements on a case-by-case basis. Some 55 appeals were processed during 1975.

The *Land Registry Amendment Act, 1974* requires that all approving officers refer proposed subdivisions in areas that could be subject to flooding to the Deputy Minister of Water Resources for consent, be it conditional or otherwise. The Planning Section reviews these proposed subdivisions and recommends consent, refusal, or provides requirements that must be met as conditions of consent. Some 388 proposed subdivisions were processed during 1975 compared with 50 in 1974.

Table 1—Floodplain Mapping, Status and Progress

Location	Approximate Floodplain Area	Length of River or Lakeshore	Per Cent Completed											
			Control Surveys		River Surveys		Mapping		Determination of Flood Flows		Calculation of Flood Profile		Floodplain Maps	
			During Year	To Year-end	During Year	To Year-end	During Year	To Year-end	During Year	To Year-end	During Year	To Year-end	During Year	To Year-end
Lower Fraser Valley—	Sq. Miles	Miles												
Chilliwack area	60	-----	-----	100	-----	-----	40	40	-----	-----	-----	-----	-----	-----
Coquitlam River area	20	11	100	100	100	100	-----	-----	100	100	-----	-----	-----	-----
South Thompson Valley (including Greater Kamloops)	60	35	-----	100	-----	100	50	80	100	100	-----	-----	-----	-----
North Thompson Valley	135	90	16	100	-----	-----	-----	-----	100	100	-----	-----	-----	-----
Coldwater River	2	2	50	50	50	50	-----	-----	-----	-----	-----	-----	-----	-----
Eagle River valley	30	19	45	95	45	95	-----	-----	-----	-----	-----	-----	-----	-----
Coquihalla River valley	5	10	35	70	40	80	-----	-----	-----	100	-----	-----	-----	-----
Shuswap River valley	80	40	60	60	65	65	-----	-----	25	25	-----	-----	-----	-----
Kitimat[1]	11	6	-----	-----	-----	-----	-----	-----	100	100	100	100	100	100
Cowichan Lake area[2]	16	20	60	60	-----	-----	-----	-----	100	100	-----	-----	-----	-----
Elk River valley	45	30	60	60	55	55	-----	-----	-----	-----	-----	-----	-----	-----
Skeena River valley	18	10	-----	-----	75	75	-----	-----	-----	-----	-----	-----	-----	-----
Columbia River valley (including Kicking Horse River)	30	16	-----	-----	75	75	-----	-----	100	100	-----	-----	-----	-----
Penticton—Control dam area[3]	1	0.5	-----	-----	95	95	-----	-----	-----	-----	-----	-----	-----	-----
Port Alberni	3	-----	100	100	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Courtenay and Sayward flooding (HWL's)	-----	2	-----	-----	40	40	-----	-----	-----	-----	-----	-----	-----	-----
Vernon Creek[3]	-----	6.5	-----	-----	90	90	-----	-----	-----	-----	-----	-----	-----	-----
Coldstream Creek[3]	-----	4	-----	-----	100	100	-----	-----	-----	-----	-----	-----	-----	-----
Totals	516	302												

[1] Interim maps using existing mapping.
[2] Interim maps using existing mapping issued in 1975.
[3] Part Okanagan Valley floodplain mapping project.

Runoff Regulation

1. *Okanagan Flood Control system*—Operation of the Okanagan Flood Control system, which consists of the control structures at the outlet of Okanagan Lake and on the Okanagan River downstream to Osoyoos Lake, is directed by the Hydrology Division. Seasonal inflow volume forecasts to Okanagan Lake are prepared by the Surface Water Section, with the system operated by the Modelling Subsection, using mathematical computer models as aids. The objectives are to prevent flooding during the snowmelt season and to store sufficient water to satisfy domestic irrigation and other water users during the summer. In anticipation of an unusually high runoff, Okanagan Lake was drawn down during the late winter and spring of 1975 to just below its normal lower operating limit. The resultant inflow was 22 per cent greater than average and the lake was filled to within 0.3 feet of its normal upper operating limit.

Due to the fact that the peak flow in the Similkameen River was less than 20,000 cfs, there were no problems with flooding around Osoyoos Lake with the maximum water level of 911.5 feet being below the flood damage level.

Work continued on refinement of the computer models with a view to ensuring optimum regulation of the important water resource contained in the Okanagan Valley system of lakes.

It was anticipated that efforts would be made during 1975 to improve the existing flood control system under the terms of a Federal-Provincial Implementation Agreement covering recommendations contained in the completed Okanagan Basin Report. Agreement in principle was given by the Federal Government; however, the Agreement remained unsigned at year-end.

2. *Upstream storage—Fraser River Basin*—Good progress was made toward completion of the upstream storage study under the terms of the 1968 Federal-Provincial Fraser River Flood Control Agreement. The study is co-ordinated by a steering committee appointed under the Fraser River Joint Advisory Board and comprises two representatives from the Federal Government and two from the Water Investigations Branch.

The object of this study is to develop an integrated plan for further flood protection, utilization, and control of the water resources of the Fraser River Basin. The study involves principally an examination of the projects comprising System E as contained in the 1963 report of the Fraser River Board, including flood control, hydro-electric power, ecological, economic, and other impacts thereof.

The environmental ramifications of developing upstream storage is a significant part of this study. The Director of the Branch chaired a committee established for these purposes which contains representation of Provincial resource agencies and the Federal Fisheries Service. The results of studies undertaken by all the agencies that participated were summarized by the Branch, and the summary report was submitted in the fall.

It is anticipated that this study will culminate around the middle of 1976 when the Fraser River Joint Advisory Board issues the final report.

Flood Control Program—Structural

Flood control program involving structural solutions to protect existing development are undertaken under the direction of the River Section of the Engineering Division. These programs can be categorized as follows:

(*a*) Implementation of design and construction under the 1968 Federal-Provincial Fraser River Flood Control Agreement.

(*b*) Investigation and construction of other flood and erosion protection works under agreements with local authorities outside the Fraser Valley and individuals throughout the Province. Projects are implemented under the River Protection Assistance Program.

(*c*) Channel clearing program.

(*d*) Drainage projects.

1. *Fraser River Flood Control Program*—This program provides for flood and erosion control and drainage improvements in the Lower Mainland areas in and adjacent to the Fraser Valley and in the Kamloops area. Project costs are shared equally by Federal and Provincial Governments. Activity was high during 1975; however, it was necessary to slow down the program in the latter half of the year because of limited available Federal funds. Drainage improvements, other than those forming a part of the dyking system and those already under way, also were postponed as a result of Federal limitations on annual funding in both 1975 and future years. The reduced target expenditure for fiscal year 1975/76 was $12 million and the amount actually spent is anticipated to be some $11.997 million. Program expenditures projected to the end of the current fiscal year are given in Table 2.

Table 2—Fraser River Program Fiscal Expenditures

Fiscal Year	Expenditure			
	Design	Construction	Upstream Storage Studies	Total
	$	$	$	$
1968/69	5,160	120,400	.....	125,560
1969/70	658,870	105,460	.....	764,330
1970/71	769,660	1,164,380	3,410	1,937,450
1971/72	592,110	1,214,640	492,530	2,299,280
1972/73	650,880	1,456,470	295,620	2,402,970
1973/74	867,540	5,167,870	64,990	6,100,400
1974/75	1,173,700	8,849,310	92,060	10,115,070
1975/76 (estimated)	1,115,260	10,833,460	47,730	11,996,450
Total expenditure to March 31, 1976	5,833,180	28,911,990	996,340	35,741,510

The status of active projects, including projected expenditures to the end of the current fiscal year, are in Table 3.

Table 3—Fraser River Program Project Status

Project	Date of Application	Design per Cent Completed at Year-end	Construction During Fiscal Year	Construction to End of Fiscal Year	
				Amount	Per Cent Completed
			$	$	
Kent	Mar. 5, 1969	100	10,000	2,515,000	100
Pitt Meadows	Mar. 3, 1969	44	.....	.....	0
Richmond	Mar. 3, 1969	78	5,200,000	7,437,000	52
Matsqui	May 15, 1969	100	18,100	3,289,400	100
Chilliwhack	Aug. 1, 1969	100	1,078,000	6,098,000	95
Delta	Aug. 1, 1969	75	4,250,000	6,395,000	45
Mission	Aug. 4, 1969	98	.....	.....	0
Surrey—					
Dams	May 6, 1969	100	37,000	1,176,300	100
South Westminster	May 6, 1969	32	.....	.....	0
Queensborough	Dec. 10, 1970	80	.....	.....	0
Coquitlam	Apr. 30, 1970	94	.....	.....	0
Oak Hills	Oct. 28, 1973	100	40,300	1,014,500	95
Emergency work	.....	.....	100,000	430,000	.....
Administration	.....	.....	100,000	556,800	.....
Totals	.....	.....	10,833,400	28,912,000	.....

Corporation of Delta reconstructed dyke along Boundary Bay—Fraser River Flood Control Program.

Corporation of Delta reconstruction of Green Slough Pump Station, Fraser River Flood Control Program.

2. *River Protection Assistance Program*—Under the River Protection Assistance Program the Provincial Government assists local authorities outside the Fraser Valley and individuals throughout the Province in the construction of dyking and

bank protection works. Upon receipt of a request for assistance staff from the Engineering Division and, in some instances, a Regional Office of the Water Rights Branch undertakes a site investigation. A report is subsequently prepared and the proposed project placed on a priority list. Offers of assistance within the limits of available funding are based on this list. Projects are implemented under written agreement between the applicant and the Branch under which the applicant receives technical and financial assistance and in turn contributes to the project, constructs the works, and undertakes maintenance responsibilities.

During 1975, projects were investigated or constructed in the lower Squamish Valley, Bella Coola Valley, Port Alice, Alice Arm, Slocan Valley-Lemon Creek, Duhamel Creek, Chase Creek, Oyster River, Quesnel, Grand Forks, Cowichan River, Mission Creek, Creston, lower Vernon Creek, Coldstream Creek, and for 112 individuals. Table 4 provides a summary of this year's activities and a comparison with 1974.

Table 4—Minor Flooding and Erosion Projects

Year	Requests for Assistance	Site Inspections	Reports Completed	Projects Implemented	
				Number	Amount
					$
1974	115	62	34	54	520,000
1975	93	104	87	24	1,179,000

Bank protection project along Fraser River at Quesnel.

3. *Channel-clearing Program*—Many channel-clearing projects were undertaken during 1975. The work did not involve construction of works that are permanent in nature but rather the removal of log jams and gravel bars deposited in

watercourses during the high runoff in 1974. Projects were initiated and undertaken by the Regional Engineers of the Water Rights Branch, in some cases with assistance from the Engineering Division. During 1975, 38 projects costing $54,000 were completed compared with 31 and $115,000 in 1974.

4. *Drainage schemes*—Investigations and construction relating to drainage projects were carried out during the year by the Water Supply Section of the Engineering Division. These projects are described in Table 5.

Table 5—Drainage Projects

Project	Description
Township of Chilliwack—Castleman Road	Construction of this drainage project near Chilliwack, under ARDA project 89050, is about 60 per cent complete. Expenditures during the year were $80,436 of an estimated $200,000 project cost.
Surrey drainage	Studies, including the collection and analysis of water quality data, continued during the year of the Nicomekl and Serpentine River basins in Surrey, where several proposals are being investigated to alleviate flooding, and provide irrigation water. In June 1975 a task force was formed under the Environment and Land Use Committee Secretariat to co-ordinate input, including that from agricultural and fish and wildlife interests.
McCoy Lake	A preliminary study was completed on proposed channel improvements to relieve flooding on McCoy Lake near Alberni.
Osoyoos West Bench	A report was completed on drainage proposals to alleviate seepage problems on Osoyoos West Bench.
Tugulnuit Lake	Final design was completed for a drainage pump installation for the Tugulnuit Lake Improvement District. Construction is scheduled for completion before the 1976 freshet.
Ptarmigan Flats	A study has been 10 per cent completed for a drainage scheme at Ptarmigan Flats, near Enderby.

Castleman Road drainage scheme. Grassway drain prior to final grading and seeding.

ENVIRONMENTAL PRESERVATION

Introduction

Activities relating to the economic and social development within the Province to a greater or lesser extent are reflected in the environment of our water resources. The Environmental Preservation Program is directed toward preservation of the water resource in areas where degradation potential is considered to be significant. The program also looks to the future with a view to facilitating environmental planning.

Program activities include resource inventory and monitoring, water and air conservation preservation planning studies, investigations and remedial programs for specific water quality problems, and protection of watersheds. The major part of this program is undertaken by personnel from the Environmental Studies Division; however, activities related to the protection of the water resource against possible adverse effects of development within watersheds are undertaken by the Hydrology Division and the Planning and Surveys Division.

Resource Inventory and Monitoring

This program involves sampling and monitoring of 10 widely scattered lakes which have diverse conditions and locations. Studies are undertaken to evaluate various methods of sampling, data analysis, and the use of different organisms for water quality monitoring purposes. During 1975, some 95 samples were collected and analysed. The program was curtailed to some extent due to staff limitations.

Water and Air Conservation and Preservation Planning Studies

Environmental impact, water management, and environmental assessment are the three major categories of conservation and preservation planning studies.

1. *Environmental impact studies*—Environmental impact studies are site specific studies to assess the impact proposed developments will have on the air and water resources of the Province, and to propose means of mitigating or reducing adverse effects. Activities include preparation of study guidelines and terms of reference for use by other agencies and industry, input to preparation of terms of reference related to water and air resources for studies to be undertaken by others, monitoring of studies by others, and undertaking the implementation and co-ordination of specific studies. The environmental impact studies that were active or completed during 1975 are listed in Table 6.

Six reports were completed during 1975.

2. *Water management studies*—Water management studies come under the direction of the Head of the Water Management Studies Section and involve assessment of basin management strategies to facilitate prudent use, preservation, and control of the water resource, and the preparation of a report recommending specific courses of action. Environmental concerns and flood control are also fully assessed as part of major studies in this category. This results in input from all divisions in the Branch. Studies are undertaken on a priority basis in basins that have existing and (or) potential problems related to multiple use of the water resource. Management studies active or completed during the year are described in Table 7.

Table 6—Environmental Impact Studies

Project	Description
British Columbia-Nippon Kokan Kabushiki Kaisha steel mill feasibility study	Provided information and data to ELUC Secretariat,[1] the Department of Economic Development and their consultants on water-based environmental aspects. Continuing.
British Columbia Petroleum Corporation refinery proposal and study	Provided initial participation to ELUC Secretariat[1] on water-based aspects.
Fort Nelson–Fort Simpson Highway	Prepared report for ELUC[1] on literature review and water-based impacts of the construction and use of the Fort Nelson–Fort Simpson Highway. Task report completed September 1975.
Hat Creek thermal plant (British Columbia Hydro and Power Authority)	Assistance to ELUC[1] in Provincial, multi-agency review of proposal and allied studies to develop a coal-fired thermal plant in the Hat Creek area. Continuing.
Proposed McGregor River diversion to Parsnip River (British Columbia Hydro and Power Authority)	Review and comments prepared on preliminary consultant report for B.C. Hydro and Power Authority.
Mohawk oil refinery proposal and study	Provided information to ELUC[1] on water and air-based environmental aspects.
North Cowichan water supply	Provided co-ordination as lead agency for the environmental aspects of an engineering feasibility study of alternative water supplies. Task reports of participating agencies and summary report completed December 1975.
Revelstoke Dam proposal (British Columbia Hydro and Power Authority)	Assistance to ELUC[1] in a Provincial, multi-agency review of the engineering proposal and environmental studies. Continuing.
Sage Creek Coal Study (Rio Algom Mines)	Co-ordination of Water Resources Service inputs to ELUC[1]. Multi-agency Provincial evaluation of a development proposal and allied reports for pit mining in the Flathead area (Cabin Creek) of southeast British Columbia. Continuing.

[1] ELUC=Environment and Land Use Committee Secretariat.

Table 7—Water Management Studies

Project	Description
Coquitlam River study	This study is examining a number of alternatives which would provide flood control, assure minimum river flow for fisheries and outdoor recreational pursuits with due respect being given to the rights of existing water users. A study outline was designed and most areas of study were well under way in 1975. A report is scheduled for completion in 1977.
Salmon River study	This study involves examination of water licensing, irrigation, fisheries requirements, and groundwater-surface water relationship to facilitate water allocation decisions.

The Branch is also responsible for the implementation of certain recommendations contained in study reports. For example, when the Federal-Provincial agreement for the implementation of certain recommendations contained in the Okanagan Basin Study report is signed, the Branch will undertake the implementation of certain recommendations pertaining to flood control and water quality monitoring.

3. *Environmental assessment studies*—Environmental assessment studies are nonsite specific studies directed toward environmental planning and control within an area or region. The studies include compilation and analyses of all available environmental data to define existing problem areas and to determine where data gaps exist, establishment of needed additional air and water quality monitoring stations, collection and analysis of data, and preparation of a report that provides a framework for environmental management. Resulting from this, the planning of future developments can be undertaken with an understanding of the sensitivity of the environment in various locations, and with some knowledge of ambient and (or)

existing conditions. This will facilitate more meaningful site specific environmental impact studies and assessment of impact following development.

A major environmental assessment study, directed and co-ordinated by the Head of the Environmental Assessment Studies Section within the Environmental Studies Division, is under way for the Kootenay region.

The area under study comprises the Regional Districts of Kootenay Boundary, Central Kootenay, and East Kootenay. The study will describe the present state of air, land, and water in the area, with a view to improving waste management and helping to plan future development. The study will take about two and one-half years and is being carried out in two phases.

Phase I is an evaluation of existing information to 1974. A large amount of air and water quality data has been collected over the years and is being interpreted as part of the Phase I study. The Phase I reports will include a description of discharge sources, an evaluation of all data collected and recommendations for corrective action or future monitoring as required. These reports are scheduled for completion next year.

In the spring of 1975, Phase II of the study was initiated. It comprises a data collection program lasting one and one-half years and is designed to fill gaps in our information as revealed by Phase I. The water and effluent sampling program has set up use in the order of 100 sites which are sampled on a regular basis. Sampling of aquatic biology is also carried out at a selected number of sites. In the air monitoring program, 10 stations have been established for comprehensive monitoring of ambient air quality and meteorological parameters. Numerous other stations exist to measure selected ambient air quality parameters at suitable locations. Study resources are divided approximately equally between the water and air field programs. The programs will terminate in .1976 and the data collected will be evaluated and presented with final recommendations in Phase II reports to be issued in 1977.

Weed growth in Okanagan Lake at Kelowna.

Specific Water Quality Problems

Where a water quality problem exists or there is concern that a problem may be developing, specific studies are undertaken in localized areas. Assessments are made of the aquatic environment, the problem, or its potential. Research and studies are undertaken, and a report is prepared proposing remedial measures or controls over development in certain drainage areas. In certain cases the Branch undertakes implementation of remedial measures.

Activities during 1975 are described in Table 8.

Table 8—Specific Water Quality Problems

Area	Description
108 Mile Lake (Cariboo)	A continuing investigation of the response of a small Cariboo plateau lake to residential development of the shoreline.
Williams Lake (Cariboo)	A continuing study of the effect of increasing urbanization upon the water quality of a representative Cariboo region lake.
McNaughton Reservoir (Columbia River)	A small-scale, continuing investigation of changes in water quality in the reservoir in the first years following impoundment behind Mica Dam.
Tie Lake (Kootenay Valley)	Investigation of the causes of periodic fish kills. Report completed.
Aquatic weeds, Okanagan Valley lakes	Continuing studies on the ecology and management of aquatic weeds. These include an interagency experiment on herbicidal control of plants at Kelowna, a joint project with the Okanagan Basin Water Board to test benefits and disbenefits of hydraulic dredging near Vernon, evaluation of rototilling, hydraulic washing and bottom barriers, documentation and mapping weed beds in all six Okanagan mainstem lakes and Mara Lake, detailed studies on hydrosoil and habitat characteristics related to Eurasian water milfoil were initiated.
Chain, Link, and Osprey Lakes (Okanagan area)	A continuing investigation of the effectiveness of artificial increase of the flushing rate of a lake in the control of cultural eutrophication. Data report for the period 1973 to 1975 in draft form.
Naramata Watershed (near Penticton)	Detailed follow-up to a 1971 study by the Pollution Control Branch. Determination of the effects of livestock and the livestock control measures implemented by the Forest Service. Project completed, report in final draft.
St. Mary, Cusheon, and Weston Lakes (Saltspring Island)	Continuing sampling to monitor the effects of recreational use and residential development of the watersheds upon water quality in these three lakes which supply domestic water to much of the population of Saltspring Island. Data reports for first year completed.
Kathlyn Lake (near Smithers)	Investigation of the condition of Kathlyn Lake and alternative means for rehabilitation and aquatic weed control. Incomplete; preliminary report in draft.
Gillies Bay water supply (Texada Island)	A brief field inspection and water quality analysis was performed for Water Rights Branch. Report completed.
Thompson River study	An investigation of complaints regarding deterioration of water quality in the Thompson River, carried out by a Federal-Provincial multi-agency task force. Task force report, *Summary Report on Sources and Effects of Algal Growth, Colour, Foaming, and Fish Tainting in the Thompson River System* was completed in December 1975.
Langford Lake (near Victoria)	Investigation of reported high heavy metals content in fish. Completed.

Weed dredging in Okanagan Lake near Vernon.

Miscellaneous Studies

At the request of other branches and agencies, the Branch undertook a number of research and site specific studies during 1975 that do not fall into any major category. Except where otherwise indicated in Table 9, these studies were undertaken within the Environmental Studies Division.

Table 9—Miscellaneous Studies

Title	Description
Alum treatment of Wood Lake	The recent Kalamalka-Wood Lake Basin Water Management Study identified alum treatment as a potential method for removal of algæ-stimulating phosphorus from Wood Lake (near Kelowna). Bench-scale experiments were carried out by consultants in preparation for a pilot scale experiment to be done *in situ* in early spring of 1976.
Canadian Cellulose Co. effluent evaluation, Prince Rupert Harbour	A study of the effects of pulp-mill effluent on the marine-receiving waters, including the bottom and intertidal zones, continued with the collection and analysis of field samples.
Health aspects of land disposal of sewage and sludge	An interagency study with the Department of Health and the Department of Agriculture. Completed. Report published.
Kelowna sewage treatment plant optimization	A joint investigation on the operation of the Kelowna sewage-treatment plant was carried out by staff of the Pollution Control Branch and Water Investigations Branch in co-operation with the Kelowna Engineering Department. Report completed.
Smithers area study	Input provided by the Hydrology Division, related to runoff and flow regime of main rivers in the Smithers area. Part of ELUC[1] study for northwest British Columbia.
Water quality in Hatzic Lake	The available information on water quality in Hatzic Lake was reviewed and interpreted to assist the Dewdney-Alouette Regional District in planning land use in the general area. Recommendations were offered on land use policies to control eutrophication and avoid waste-disposal problems.
Williston Reservoir Potentials Study	The Hydrology Division completed its input to the Williston Reservoir Potential Study (co-ordinated by the ELUC[1]) with the publication of the assessments of runoff, climate, and snow-pack conditions and recommendations for improving the hydrological data base.

[1] ELUC=Environment and Land Use Committee Secretariat.

Protection of Watersheds

The program for protection of watersheds is directed toward ensuring that land clearing, land use, and forestry activities are undertaken in such a way that individual and community water supplies are adequately protected and significant increases in downstream flooding, erosion, and deposition are avoided. This program requires the expertise of engineers, forestry hydrologists, watershed planners, and environmental experts. All divisions within the Branch are involved to some extent; however, the bulk of the tasks are undertaken by the Hydrology and the Planning and Surveys Divisions. A major activity within the Hydrology Division is the collection of data from all divisions and the establishment of guidelines as input to the B.C. Forest Service resource folio system. The Planning and Surveys Division is responsible for activities related to the preservation of community watersheds. Studies and activities during 1975 are described in Table 10.

Table 10—Watershed Protection Program

Study or Activity	Description
B.C. Forest Service resource folio input	Complete water resources data provided for 12 watersheds; partial input for 12 additional watersheds.
Community watersheds, general	Background information was provided for specific watershed areas where multi-use problems necessitated discussions by interested individuals, local authorities, and organizations. A program to classify the community watersheds in the Province was continued, using available information.
Community watershed, referrals	Reviewed and commented on approximately 180 land lease proposals referred by the Lands Service and 70 timber sale proposals referred by the Forest Service.
Kamloops District watershed study proposal	To quantify the effects of forest harvesting on streamflow.
Nahmint watershed study	Continuance of hydrometric program and completion of preliminary report. Estuarine biology aspects were undertaken by the Environmental Studies Division.
Salmon Arm burn study	Collection of hydrometric meteorological and water-quality data continuing.
Trout Creek ecological overview	Completed joint overview at Trout Creek watershed in conjunction with the Department of Recreation and Conservation. This overview included an assessment of watershed resources and of the Perpetual Slide.

WATER RESOURCE UTILIZATION

Introduction

The purpose of the water utilization program is to assist the citizens of this Province in obtaining a water supply which is adequate for their needs. This service function is provided through inventory programs, feasibility studies including the preparation of associated reports, detailed designs of water supply systems, and technical assistance in the construction of works.

Resource Inventory

1. *General*—An understanding of water resource potential is obtained through inventory of groundwater, surface water, and storage reservoir sites.

2. *Groundwater inventory*—The Groundwater Section of the Hydrology Division collects and compiles data obtained during well-drilling activities throughout the Province. The information is collected by Section staff or mailed in by private well-drillers and incorporated into a data system which in turn facilitates provision of information useful in determining location of future well-sites, drilling logistics, and the potential for success.

In the year under review, 2,383 well logs were collected and 2,200 compiled. Steps were taken toward computerizing the data recording and retrieval system.

Water-well maps and water chemistry are also of assistance in groundwater development. During 1975 some 264 water samples were collected and analysed. A computerized system for storage and retrieval of water chemistry data was adopted during 1975 and all past data converted to computer-readable form.

Some 250 requests for groundwater information were handled during the past year.

A groundwater observation well network is maintained to monitor water-level fluctuations and water chemistry in areas of high interest or potential conflict. The

network operated during 1975 comprised 58 continuous installations and 79 short-term special project installations. Progress was made toward storing the water-level information in a computer system.

Compilation of 40 flowing artesian well location maps and accompanying manuscript was completed.

3. *Surface water inventory*—Surface water inventory is obtained through a Province-wide hydrometric network operated by the Water Survey of Canada and through a much smaller network operated by the Water Investigations Branch.

The construction and operating costs of the network operated by the Water Survey of Canada is cost-shared by the Province under the terms of Federal-Provincial agreement which came into effect in 1975. The Hydrology Division receives requests for hydrometric stations from all Provincial agencies, continually reviews over-all network requirements, and decides on network changes. During the year the number of stations cost-shared equally with the Federal Government and paid for fully by the Province was 90 and 179 respectively.

The emphasis of the Branch-operated network is on small streams and lakes where data are required for operational or special studies purposes. Station requirements and compilation of data are the responsibility of the Surface Water Section. Field operations are undertaken by the Surveys Section of the Planning and Surveys Division. Sixty-one stations were operational during 1975 as compared with 75 last year.

Surveys Section staff metering the Ashnola River.

4. *Storage reservoir inventory*—Inventory of storage reservoirs is the responsibility of the Surveys Section and includes inventory of potential storage reservoir sites and the capacity of existing reservoirs. During 1975, field reconnaissance of potential sites and associated surveys were concentrated in the Similkameen River Basin where 14 sites were investigated. The program of inventory for existing storage reservoirs saw the completion of six surveys and preparation of inventory plans for 25 storages.

Water Supply Studies

Water supply studies are undertaken to assess the feasibility of the implementation of projects by small communities or, in the case of areas with significant agricultural content, of proceeding with a project under the *Agricultural and Rural Development Act.*

Comprehensive studies are undertaken within the Water Supply Section of the Engineering Division. Specific support studies or independent studies related to water resource availability are undertaken within either the Surface Water Section or the Groundwater Section of the Hydrology Division. The proving up of groundwater availability usually involves the well drilling and testing, followed by office analysis.

The studies active during 1975 are described in Table 11.

Table 11—Active Water Supply Studies

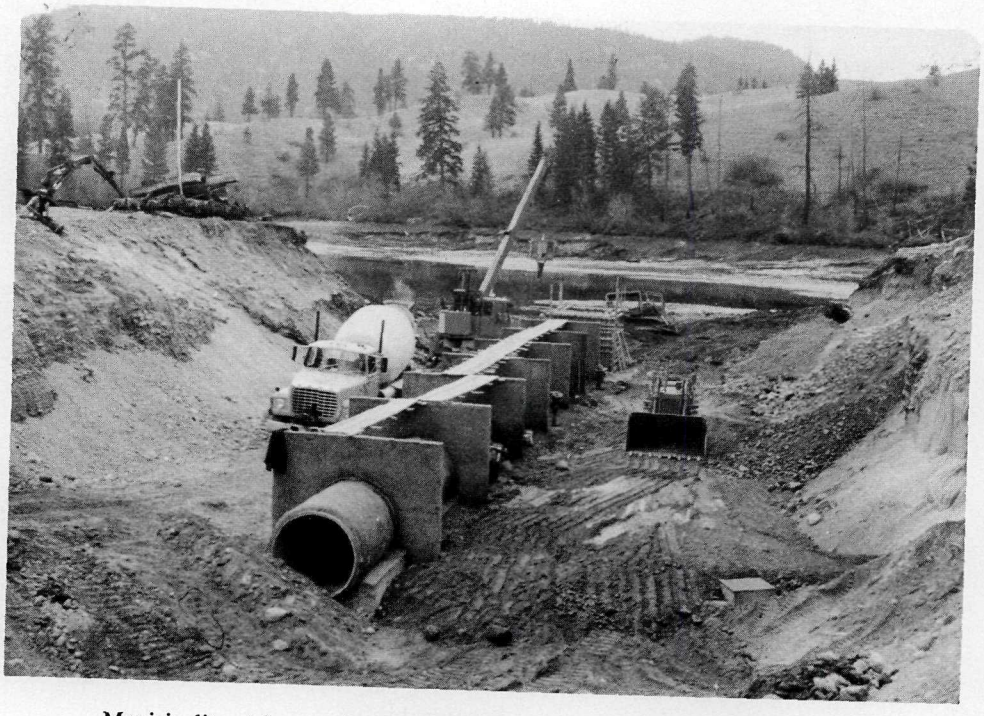
Area	Description
North Cowichan	A study was 85 per cent completed during the year on alternative water supply sources for the Municipality of North Cowichan.
Ashcroft	A study was 15 per cent completed on proposed storage dams for irrigation from Oregon Jack and Upper Hat Creek.
Deadman Creek	Preliminary design has been 10 per cent completed on a proposed storage dam on Snohoosh Lake for the Deadman Creek Improvement District near Savona.
Alert Bay	Preliminary design was 90 per cent completed on a groundwater pumping system to supply domestic water for the Village of Alert Bay. Wells were drilled and tested during the year.
Vinsulla	A feasibility study was completed on a proposed irrigation system for the Vinsulla Irrigation District.
Chinook Cove	A preliminary feasibility report was completed on construction of an additional storage dam for the Chinook Cove Water-users' Community.
Salmon River	A preliminary feasibility study was completed on storage development to supply irrigation water to the Salmon River Water-users' Community.
Kootenay Valley	A study was under way to determine the feasibility of irrigating 30,000 acres of benchland in the Kootenay Valley south of the Elk River.

Implementation of Water Supply Projects

Implementation of water supply projects includes both final design and construction supervision. With few exceptions, implementation activities during the year were limited to qualifying projects under the *Agricultural and Rural Development Act.* The Groundwater Section undertook the supervision of well testing and drilling. The final engineering design and construction supervision was undertaken by staff of the Water Supply Section of the Engineering Division, except in a few instances where consultants or specialists were employed, in which case the Water Supply Section assumed management responsibilities.

The status of projects that were active during 1975 is described in Table 12.

Glenmore Irrigation District ARDA Project, laying main line.



Municipality of Summerland ARDA Project, construction of main intake at Trout Creek reservoir.

Table 12—Status of Water Supply Projects at Year-end

Project Description	Design per Cent Complete at Year-end	Construction		
		During Year	To Year-end	Per Cent Complete at Year-end
ARDA Project 89043 (Southern Okanagan Lands Irrigation District)—Rehabilitation of system to supply irrigation and domestic water	100	96,532	3,517,897	100
ARDA Projects 89044 and 89057 (Corporation of the District of Summerland)—Rehabilitation of system to supply irrigation and domestic water	50	1,088,405	1,088,405	40
ARDA Project 89066 (Ellison Irrigation District)—Modification to system to supply domestic water	100	15,949	15,949	10
ARDA Project 89049 (Black Mountain Irrigation District)—Modifications to intake works	100	78,580	78,580	60
ARDA Project 89065 (Scotty Creek Irrigation District)—Modifications to system to supply domestic water	100	13,144	13,144	.....
ARDA Project 89031 (Southeast Kelowna Irrigation District)—Rehabilitation of system to supply irrigation and domestic water	100	260,338	4,675,937	100
ARDA Project 89039 (Chase Irrigation District)—Partial rehabilitation of irrigation system	100	72,135	112,461	75
ARDA Project 89055 (Larkin Waterworks District)—Extension of farm domestic-water system to Crozier area	100	117,513	117,513	100
ARDA Project 89051 (Vernon Irrigation District)—Construction of storage dams at Grizzly Swamp	80	.....	.....	.....
ARDA Project 89058 (Fairview Heights Irrigation District)—Rehabilitation of system to supply irrigation and domestic water	20	76,949	76,949	10
ARDA Project 89046 (Glenmore Irrigation District)—Rehabilitation of main line and intake works for irrigation and domestic water system	90	553,130	570,019	75
ARDA Project 89042 (Black Mountain Irrigation District)—Rehabilitation of Belgo and Graystoke storage reservoirs	100	456,162	1,195,950	100
ARDA Project 89054 (Peachland Irrigation District)—Modification to intake works	100	25,235	25,235	100
ARDA Project 89048 (Meadow Valley Irrigation District)—Partial rehabilitation of storage works	100	2,972	2,972	100

POLLUTION CONTROL BOARD

POLLUTION CONTROL BOARD

B. E. MARR, CHAIRMAN

The Pollution Control Board, as set up under section 3 of the *Pollution Control Act,* consists of a Chairman and eight members representing Government, university, and private interests.

B. E. MARR, Chairman,
Deputy Minister of Water Resources.

B. D. CAINE,
Assistant Director of Environmental Engineering,
Department of Health, Victoria.

HOWARD ENGLISH,
Retired farmer and conservationist, Victoria.

DR. C. J. G. MACKENZIE,
Head, Department of Health Care and Epidemiology,
Faculty of Medicine,
University of British Columbia, Vancouver.

DR. J. E. MCINERNEY,
Director of Bamfield Marine Station, Bamfield.

R. J. MILLER,
Director, Special Services,
Department of Agriculture, Victoria.

J. W. PECK,
Chief Inspector of Mines,
Department of Mines and Petroleum Resources, Victoria.

J. S. STOKES,
Deputy Minister of Forests, Victoria.

E. H. VERNON,
Associate Deputy Minister,
Department of Recreation and Conservation, Victoria.

The main functions of the Board are to act in an advisory capacity to the Government, to set standards for controlling pollution, to act as an appeal tribunal when an order of the Director of the Pollution Control Branch is appealed. The Pollution Control Board also hears appeals from the decision of the Director of Pollution Control (Air) of the Greater Vancouver Regional District. This agency assumed responsibility in 1972 for issuance of air emission permits within the boundaries of the Greater Vancouver Regional District.

Five appeals were heard by the Pollution Control Board in 1975; this is a significant drop from the 12 appeals heard in 1974.

Two appeals were withdrawn on the Board's suggestion that further discussion with Pollution Control Branch officials could probably resolve the question in dispute.

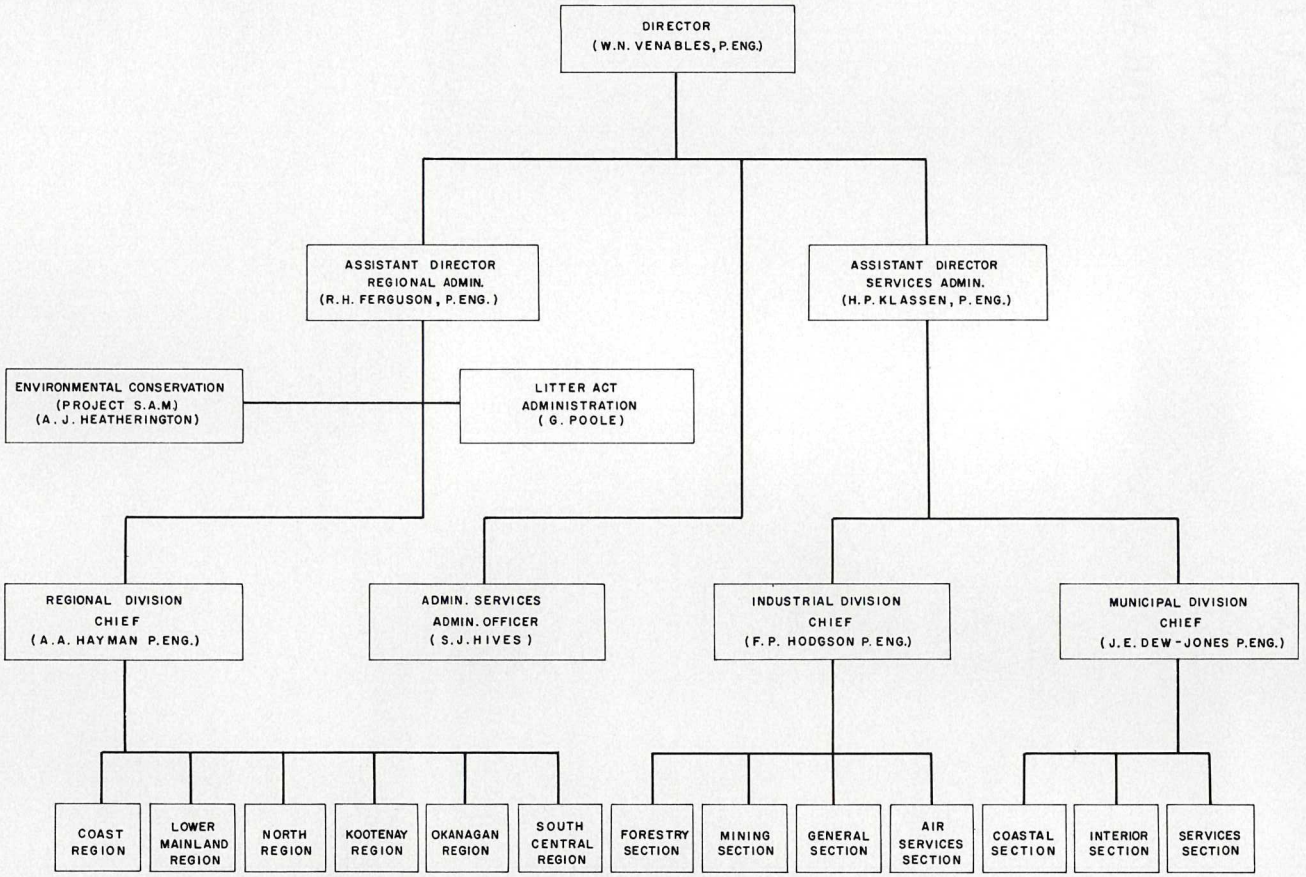
One appeal is unsettled pending applicability of recently adopted Municipal Objectives.

Two decisions of the Pollution Control Board were appealed to the Lieutenant-Governor in Council; one was subsequently withdrawn, and the second has been heard and is now awaiting a ruling. An appeal to the Lieutenant-Governor in Council in 1974 concluded in a judgment supporting the Pollution Control Board.

Recommended pollution control objectives for the agriculture and food-processing industry, and for municipal-type wastes, were carefully reviewed and adopted by the Board. This culminates a five-year program initiated by the Board in 1970 to establish pollution control guidelines for the major industries of British Columbia. During these five years the Pollution Control Branch conducted hearings throughout the Province to determine these requirements for the forest products industry, the chemical and petroleum industry, the mining industry, the agriculture and food-processing industry, and for municipal-type wastes. On the bases of these hearings, recommendations were prepared and submitted to the Pollution Control Board for review, and, where necessary, revision and, finally, ratification. These objectives will be reviewed every five years, starting next year with the forest products industry.

POLLUTION CONTROL BRANCH

WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH
ORGANIZATION STRUCTURE



POLLUTION CONTROL BRANCH

W. N. VENABLES, P.ENG.
DIRECTOR

DIRECTOR'S REPORT

In 1975 the first round in the establishment of pollution control objectives for major waste discharges in British Columbia was completed when the Pollution Control Board adopted as policy, with amendments, the Director's recommendations resulting from the public inquiries into waste management practices of the Food Processing, Agriculturally Orientated, and other Miscellaneous Industries, and also into municipal-type waste discharges. Pollution Control Objectives, as established through the public inquiry process, also exist for waste discharges from the Forest Products Industry, the Mining, Mine-Milling, and Smelting Industry, and for the Chemical and Petroleum Industry.

The anticipated review, at five-year intervals, of the existing objectives began when the Pollution Control Board appointed the Director to conduct an inquiry into the Pollution Control Objectives for the Forest Products Industry. The inquiry will take place in March 1976, and eight individuals and organizations have indicated that they will participate.

Project SAM, the program directed toward the reclamation of derelict automobiles, crushed approximately 10,000 hulks during 1975. In mid-1975, delivery of crushed hulks to the metal-shredding plant in Vancouver was suspended pending resolution of certain terms of the agreement with the shredding company. Agreement in principle was reached in the latter part of the year and delivery of stockpiled material resumed immediately with approximately 8,000 tons of material being delivered by year-end.

The day-to-day administration of the *Litter Act* consisted primarily of providing information to the public and following up on complaints regarding the return of beverage containers. As most complaints were found to be based on a misunderstanding of the legal requirements on the part of retailers, corrective measures were in the nature of warnings. No legal actions on beverage container returns have been necessary to date.

Field enforcement of the other provisions of the *Litter Act* is shared with a number of other authorities (peace officers, conservation officers, etc.) and no statistics are readily available regarding the number of charges laid; however, there are indications that they are considerable. In the year under review, 12 Branch staff members were assigned additional duties as enforcement officers under the *Litter Act*.

The number of waste discharges brought under control in the Province during 1975 rose to 3,226 with the issuance of 305 permits covering 745 points of discharge. In addition, 115 amendments were made to existing permits. Several of the permits that were issued in 1975 were very significant from the point of view of

complexity and magnitude of the operations covered. The following graph illustrates the cumulative increase in controlled points of discharge that are being administered by the Pollution Control Branch on a continuing basis:

The Branch is also responsible for the issuance of certificates for the construction of sewerage works and extensions thereto; 401 certificates for such facilities were issued in 1975.

Seven orders of the Director were appealed to the Pollution Control Board, five by the recipients of the orders and two by concerned third parties. Two of the appeals were allowed in total, one was allowed in part, one allowed conditionally, and two were withdrawn by the appellant. The seventh appeal has yet to be heard by the Board.

During the year a procedure of utilizing informal meetings involving concerned parties to applications was undertaken. Through this process a better understanding of positions was established among the parties involved through direct exchange and examination of information and facts. This process appears to have worked exceptionally well in achieving understanding of problems and general acceptance of solutions.

The report on the "Health Aspects of Sewage Effluent Irrigation," a multi-disciplinary, multi-agency review of the risks to public health associated with effluent irrigation, was completed and released. Considerable interest is being shown in sewage irrigation schemes by a number of municipal authorities in British Columbia.

Efforts by Branch staff continued to develop further the Environmental Quality Information System (EQUIS) data storage and retrieval program to include storage

of taxonomic data. This system is considered to be the most sophisticated environmental information system in North America and it is currently being used by other agencies of the Province.

MUNICIPAL DIVISION

The principal activity of the Municipal Division continued to be permit application processing, and in this regard efforts were particularly directed toward resolving the more difficult waste disposal problems being experienced by municipalities.

The Services Section further established itself in its role of providing assistance to municipal authorities in the operation of sewage-treatment facilities and in assisting other Branch staff in activities related to a wide variety of Branch work.

The mobile effluent sampling laboratory was commissioned this summer and carried out effluent sampling programs at Penticton, Kelowna, Armstrong, Vernon, Logan Lake, and Manning Park. These studies were related to either improving plant operation or assessing proposed upgrading programs.

In its capacity as co-ordinator, the Services Section was involved in seven new task groups on the following subjects: Assessing design of treatment plants, operations for the discharge of refuse on land, operating treatment works, environmental assessment studies, operations for the discharge of effluent on land, operations for sludge disposal to land, assessing design of refuse incinerators.

Four studies carried out at Regional Office request were completed this year, including the Phosphorus Reduction Study at Penticton, Alternative Methods for Upgrading Merritt S.T.P., Optimization of Kelowna S.T.P. performance, and a Preliminary Report on the Pearson College S.T.P.

Staff members are involved with the Federal Environment Protection Service on a new study for a national inventory of solid wastes and with the International Nitrogen Task Group's ongoing study on the effect on fish of nitrogen supersaturation below power dams.

Some other significant municipal undertakings which involved Branch staff in 1975 follow.

Construction of new sewage collection and treatment facilities at Greenwood and Castlegar will replace existing septic tank facilities. A new activated sludge plant under construction at Kent will replace an existing raw-sewage discharge.

A permit issued to the Regional District of Fraser-Cheam enables them to proceed with a regional sewage collection and treatment system for the Town of Hope, Kawkawa Lake, and Silverhope Creek areas.

Following issuance of a permit in August, a new secondary sewage treatment plant is at present under construction to serve both the City and Township of Chilliwack.

Existing sewage-treatment facilities are being upgraded and expanded at Cranbrook, Vernon, Fruitvale, and Squamish. The proposals at Vernon and Cranbrook involve spray irrigation of large quantities of sewage effluent in conjunction with agricultural enterprises.

As a result of findings of the Okanagan Study, several municipalities are studying the need for nutrient reduction in sewage effluent by means of tertiary treatment. In some cases, land disposal of the effluent is being considered as an alternative to tertiary treatment.

Acceptable methods for disposing of septic tank sludge are still being studied and an experimental scheme has received approval for a site near Kelowna operated by the Regional District of North Okanagan.

New primary sewage-treatment facilities have been constructed at Nanaimo and Annacis Island and are now operational. The Nanaimo plant serves the Greater Nanaimo area and replaces raw-sewage discharges to the harbour. The Annacis Island plant is the last of four major plants intended to serve the Greater Vancouver Sewerage and Drainage District.

Permits were issued to the District of Powell River for two secondary treatment plants intended to enable consolidation of existing discharges from the Powell River and Westview communities. Construction is scheduled for 1980.

A permit was issued for the discharge from a proposed multi-million-dollar hotel and marina facility between Nanaimo and Parksville.

At present under consideration is a proposal for a sewage collection and secondary treatment plant to serve the Parksville and Qualicum areas. It is intended that this system would replace existing septic tanks.

Approval in principle has been given allowing the District of Surrey to put to referendum a proposal for a sewage-collection system serving the Bridgeview and Port Kells areas. It is expected that these works will cost about $36 million over five years.

INDUSTRIAL DIVISION

While the bulk of the permits issued covered small- or medium-sized plants, a large part of the work of the Division in 1975 was directed toward the resolution of pollution control problems in major industry where prolonged assessment of the existing and proposed works are normally required. Notable among the major industries were Kaiser Resources, Cominco Kimberley, the Cominco Trail Smelter, the petroleum complex at Taylor, Alcan Aluminum, and many of the major pulp-mills.

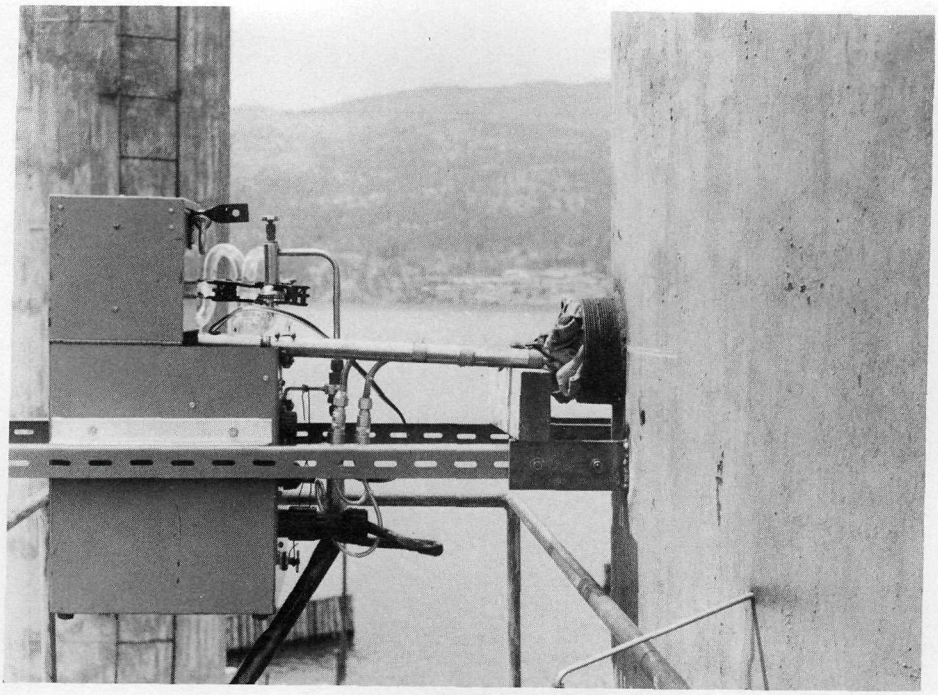
Labour problems, primarily in the forest products industry, had a serious effect on the installation of pollution control works at the pulp-mills, as a large part of the prime construction period was lost. In some cases the committed programs have been set back by nearly a year. In effect, practically all construction schedules will have to be renegotiated. This problem was compounded by price increases and shortages of materials and parts.

With concern over the availability of petroleum products and energy, the coal industry has been very active. During 1974, members of the Branch attended meetings at which seven different companies outlined plans for bringing coal properties into production. These included four companies in the East Kootenays and three in the east central area. It is expected that production will start in 1978 to 1979. In addition, B.C. Hydro outlined plans for the construction of a 2,000-MW thermal electric generating plant located near the Hat Creek coal deposit. Each of the proposed projects will require the installation of major pollution control works.

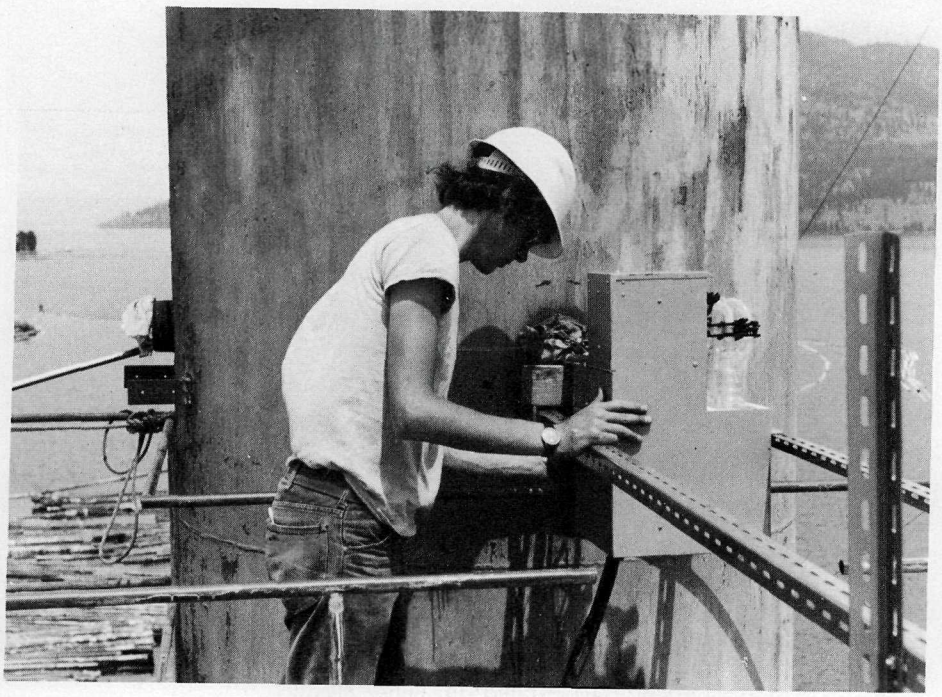
During the year the Mining Section has been in contact with Tech Corporation Ltd. regarding their proposed copper smelter for Afton Mines Ltd. at Kamloops.

As part of the continuing steel plant feasibility study, the Industrial Division developed guidelines and objectives for pollution control measures to be incorporated into the steel plant design and the base requirements would be common to any site chosen in the Province.

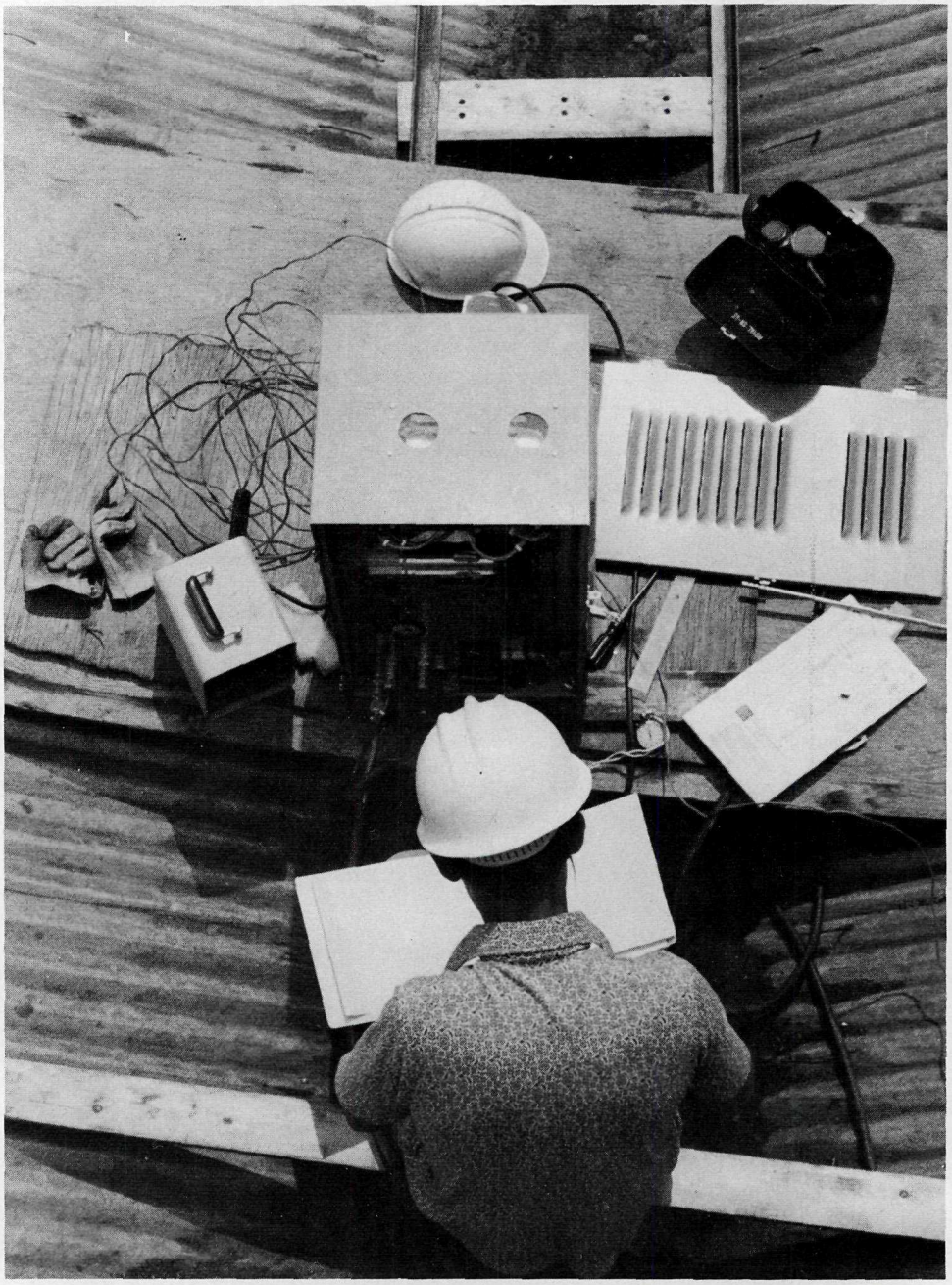
Industrial Division staff participated in task forces convened by the Federal Government to establish guidelines and (or) regulations for waste discharges in a number of industries. These included air emissions from asbestos mines, the natural gas processing industry, the petroleum refining industry, chlor-alkali plants,



A view of the RAC Staksampler in place for sampling during an air emission survey conducted by staff of the Okanagan Region on July 8, 1975.



Summer student Don May monitoring the operation of the RAC Staksampler.



Technician Calvin Price operating the Staksampler module.

pulp-mills, and emissions from thermal generating plants, as well as effluent from chlor-alkali plants, pulp-mills, base metal and aluminum smelters, and effluent from base metal, uranium, and iron mines.

Division staff actively participated in eight studies with other Provincial agencies or with industry.

Since 1972, staff within Air Section has established approximately 200 monitoring stations in the Province to provide data for permit enforcement, to record ambient air quality in a number of communities, and provide data for baseline studies.

These stations consist of one or more dustfall canisters, sulphation plates, high-volume samplers, or tape samplers.

In addition, mobile air quality laboratories are located at Abbotsford, Quesnel, and Victoria. Continuous analysers are located at Fort St. John, Kamloops, Port Alice, Kimberley, Quesnel, Prince George, and Squamish.

Two stations are operated as part of the National Air Pollution Surveillance Network, with equipment provided by the Federal Government.

REGIONAL DIVISION

The Regional Division is the expanding part of the Branch due to decentralization efforts and increasing work load, and it consists of six regions as follows:

Coast Region (Victoria). Field office, Courtenay.

Kootenay Region (Nelson). Field office, Cranbrook.

Lower Mainland Region (New Westminster).

North Region (Prince George). Field offices, Fort St. John and Terrace.

Okanagan Region (Vernon). Field offices, Penticton and Revelstoke.

South Central Region (Kamloops). Field office, Williams Lake.

The Regional Division is responsible for the administration of all permits and approvals issued by the Director of Pollution Control authorizing the discharge of liquid, solid, and gaseous wastes to the environment with the exception of permits and approvals issued by the Greater Vancouver Regional District for discharges of air contaminants within their regional district. During 1975 the Regional staff were assigned the additional responsibility of assisting in administration and enforcement of the *Litter Act*.

As part of their responsibilities the Regional Division carries out ambient environmental monitoring and waste discharge surveillance programs to provide the necessary data for waste management and the protection of the environmental resources. Regional staff also obtain site information for the Municipal and Industrial Divisions to aid them in their assessment of major permit applications.

With the commencement of 1975 the regions assumed responsibilities for processing certain permit applications considered to be within the competence and capacity of their staff. By year-end the regions had cumulatively processed 60 permits covering 89 points of discharge.

The procedure of holding meetings with objectors to pollution control permit applications to ensure complete understanding of positions and information by the various parties involved is the primary responsibility of Regional staff. Eleven such meetings were held at various locations throughout the Province during 1975. From the response of individuals involved, the efforts of the Branch in undertaking these meetings has been well received.

In addition to the new function of processing permits, the regions are also responsible for investigating and reporting on requests for short-term discharges, and their efforts in this regard led to the issuance of 82 approvals under the *Pollution Control Act, 1967*. The majority of such approvals were issued for transient-type operations such as asphalt plants for highway construction.

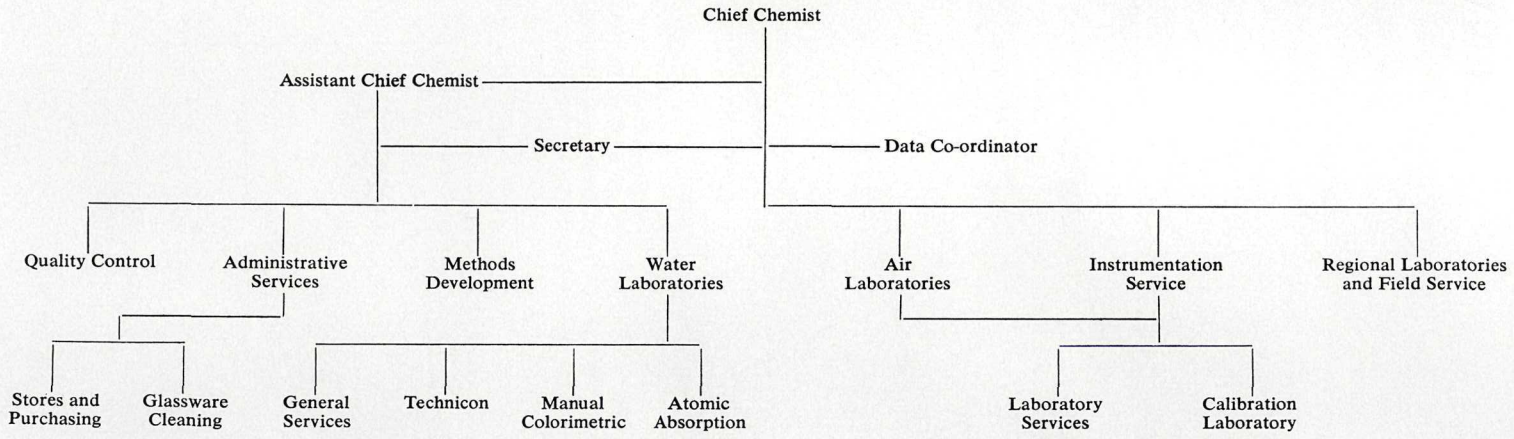
One of the primary responsibilities of Regional Division is enforcement of the requirements of permits. Enforcement efforts normally commence with persuasion through oral and (or) written communications which, in most cases, have been adequate to resolve problems. Additional enforcement measures involving the use of orders were found necessary in 24 situations and a total of 17 legal prosecutions were initiated by Regional staff in 1975.

During 1975, greater emphasis was given to Regional staff involvement in local resource management and planning groups and in the processing of major permit applications.

Regional staff were also involved in investigation and resolution of numerous complaints and they responded to emergency spill situations by either directing clean-up operations or providing advice and assistance to Provincial Emergency Programme staff in such matters.

ENVIRONMENTAL LABORATORY

ENVIRONMENTAL LABORATORY ORGANIZATIONAL STRUCTURE



ENVIRONMENTAL LABORATORY

A. J. LYNCH, B.SC., M.P.H.
CHIEF CHEMIST

The Environmental Laboratory of the Water Resources Service is a modern analytical laboratory equipped to perform many of the tests required for environmental monitoring programs. The functions of the Environmental Laboratory are to

(1) provide analytical support to the Pollution Control and Water Investigations Branches in enforcement of the *Pollution Control Act, 1967* and related environmental studies;

(2) provide service to any Provincial Government department requiring environmental analyses;

(3) provide service directly to the general public for the chemical analysis of private water supplies;

(4) operate an instrumentation maintenance and calibration service for environmental monitoring equipment;

(5) provide a quality control service (standard reference samples) for non-Government laboratories to assist in the evaluation of methods and monitoring data;

(6) operate a methods development program to investigate new procedures and aid in solving analytical problems.

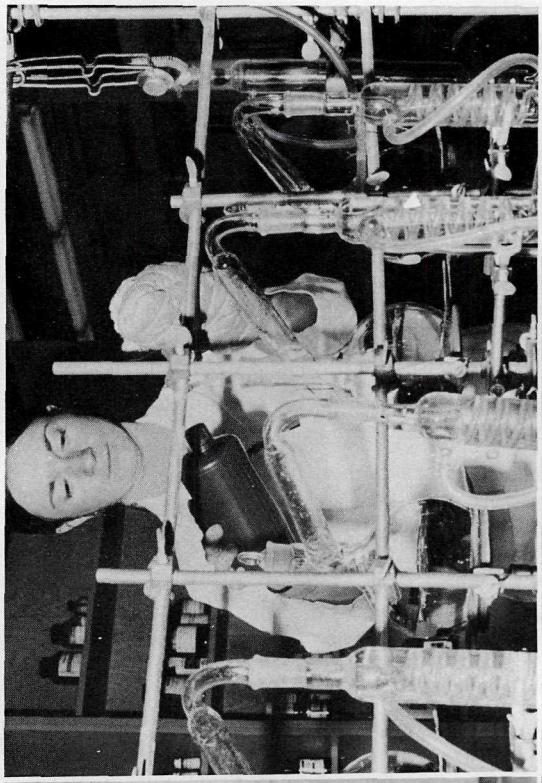
In 1975, approximately 224,000 tests were performed, an increase of 31 per cent over the 171,000 tests completed in 1974. The number of tests performed for each submitting agency is given in Table 1. The average work-load increase has been approximately 30 per cent per year, as shown in Figure 1.

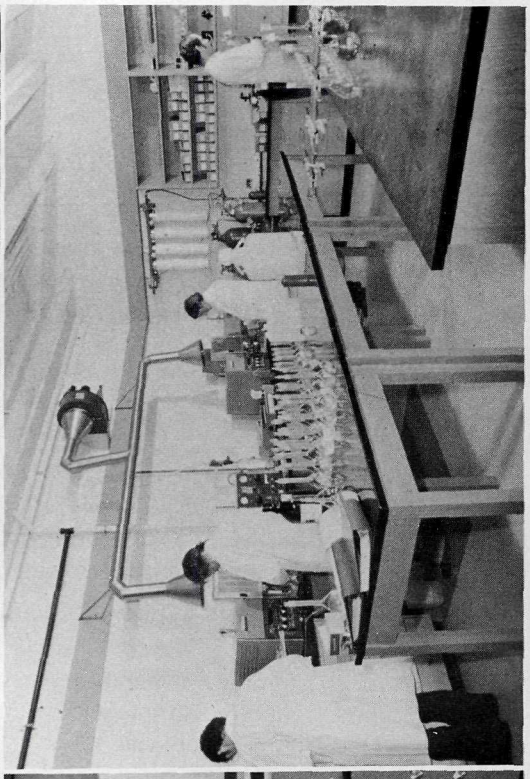
Planning for new laboratory facilities continued in 1975 with the completion of a functional program design by a consulting firm and the commencement of architectural design by the Department of Public Works. Approval in principle was received from the University of British Columbia for construction of laboratory facilities on university land adjacent to the B.C. Research building.

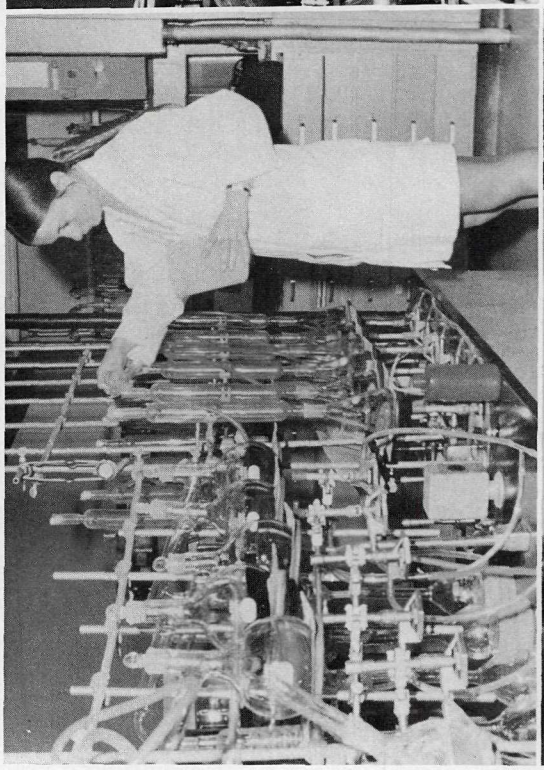
The year 1975 was the first full year of operation of the laboratory computer system (LABMAN). This system, consisting of a laboratory terminal interfaced with the Victoria computer facilities of the Department of Transport and Communications, is used for complete laboratory results recordkeeping and reporting functions. The system has been instrumental in reducing reporting-time, increasing efficiency, and providing valuable laboratory management data.

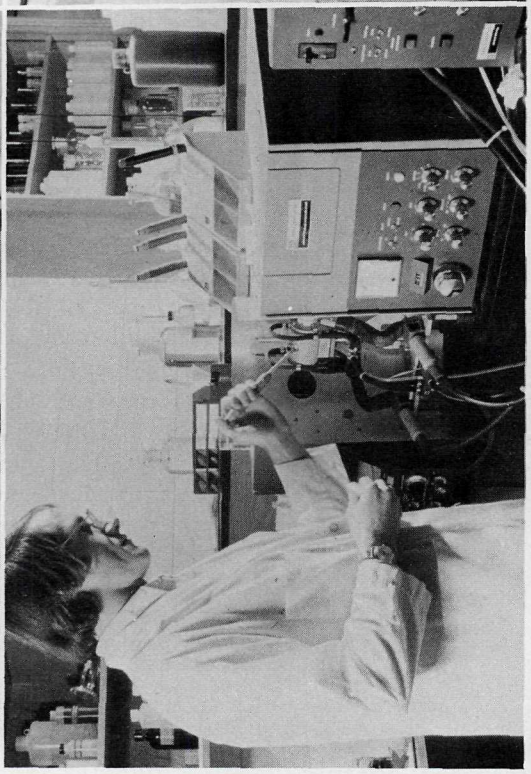
WATER QUALITY

In 1975 the Water Quality Division performed 211,000 routine chemical tests on water, wastewater, sediment, and biological tissue samples. In addition to the chemical analyses service, a small biological subsection was established for taxonomic identification of aquatic macro-invertebrates and algæ.









To meet the increasing demand for taxonomic services, two of the Water Quality staff members have enrolled in specialized taxonomy courses offered at the University of British Columbia to develop further their skills in this field.

Since the installation of the computer terminal at the laboratory in December 1974, necessary changes and addition quality control checks have been implemented to facilitate the prompt reporting of results.

A quality control service was introduced for non-Government laboratories to assist in the evaluation of methods and the monitoring of water quality data. Arrangements have been made for the distribution of synthetic and authentic samples for Study No. 1 BOD analyses to 20 participating laboratories.

Projects completed in 1975 are the following:

(1) Participation in the feasibility study for the introduction of a small computer-based data capture system for the instruments in the Atomic Absorption Section.

(2) Participation in lecturing and laboratory instruction on Atomic Absorption for the Trace Analysis Instrumentation course sponsored by Douglas College.

(3) Implementation of additional parameters for sediment analyses.

(4) Representation on the Pulp and Paper Task Force Analytical Methods Sub-Committee.

(5) Reports entitled

(*a*) *The Deterioration of Dilute Mercury Solutions During Storage.*

(*b*) *An Investigation for the Preservation of Trace Metals in Aqueous Solutions.*

In order to accommodate the peak summer work-load period, a second shift was established for the months of June to September to fully utilize the available instrumentation and laboratory facilities.

AIR QUALITY

The Air Quality Division of the Environmental Laboratory is responsible for performing laboratory air quality analyses for the Pollution Control and Water Investigations Branches. The number of air quality stations in the Province increased from 170 in 1974 to 212 in 1975. The number of environmental tests performed during 1975 was approximately 13,000. In addition, projects completed included the following:

(1) Revision of methods for the second edition of the air quality manual.

(2) Introduction of the analysis of fluoride in the ambient air by fluoridation plate.

(3) Modification of a sampling method for mercury in the ambient air.

(4) Provision of calibration services for the standard gases such as oxides of nitrogen and ozone to the Regional District of Greater Vancouver.

(5) Representation of the Environmental Laboratory at the joint Federal-Provincial task force for the chloro-alkali industry.

(6) Participation in the organization of the Pacific Northwest International Section of the Air Pollution Control Association conference held in November in Vancouver.

INSTRUMENTATION SERVICES

In 1975 the Instrumentation Services Section continued to carry out servicing and related testing on environmental instruments for Government agencies. The section completed 500 work requisitions for the Environmental Laboratory, Pollution Control Branch, and a number of other Government departments; this is an increase of 15 per cent in work requisitions over 1974.

During the year a calibration laboratory was constructed in the Instrumentation Section in which extensive testing will be undertaken for the production of high-reliability gaseous standards. The section has also set up an inventory of spare parts for the maintenance of Pollution Control Branch air and water monitoring systems throughout the Province.

FIELD AND REGIONAL LABORATORY SERVICES

In 1975 the handling of samples has increased by 20 per cent over 1974, with a resultant increase in services provided to submitting agencies; also, 12,900 water and 3,500 air samples were received, logged, and transferred to the analytical sections. During the year, shipments of chemicals and supplies were made to submitting agencies.

Services to Government agencies outside of Water Resources Service have increased significantly. The laboratory has co-operated with the Fish and Wildlife Branch, Department of Recreation and Conservation, in producing a sampling kit for field use. The finished kits provide bottles, preservation chemicals, and instructions for preparation of all water samples for the laboratory and they will be distributed throughout the Fish and Wildlife Branch in 1976.

Water Resources Regional Laboratories have operated very successfully through 1975, and

(1) 2,600 water samples were processed and tested for a total of 14,000 analyses;

(2) new quarters were occupied in Vernon by Okanagan Regional Laboratory;

(3) renovation of a new area within Water Resources headquarters in Kamloops for South Central Regional Laboratory have been drawn and are awaiting approval; North Regional Laboratory renovation plans have been temporarily halted until suitable space is found.

The Water Resources Regional Laboratories have become well established with a stable work-load pattern.

METHODS DEVELOPMENT

The Methods Development Section has been concerned with three major areas of interest in the field of environmental monitoring—gas chromatographic analyses, optical air particulate analyses, and review of methods for the analysis of air pollutants. The capabilities of the gas chromatographs have been extended into testing for pentachlorophenol, gasoline and related hydrocarbons, and frothing agents in use in the mining industry. Two studies were carried out to monitor the presence of organic materials in groundwater and their subsequent appearance in well waters and natural streams. A "Microvideomat" electronic particle-size analyser has been used for monitoring coal and burned-wood particles in general air particulate samples from various sources.

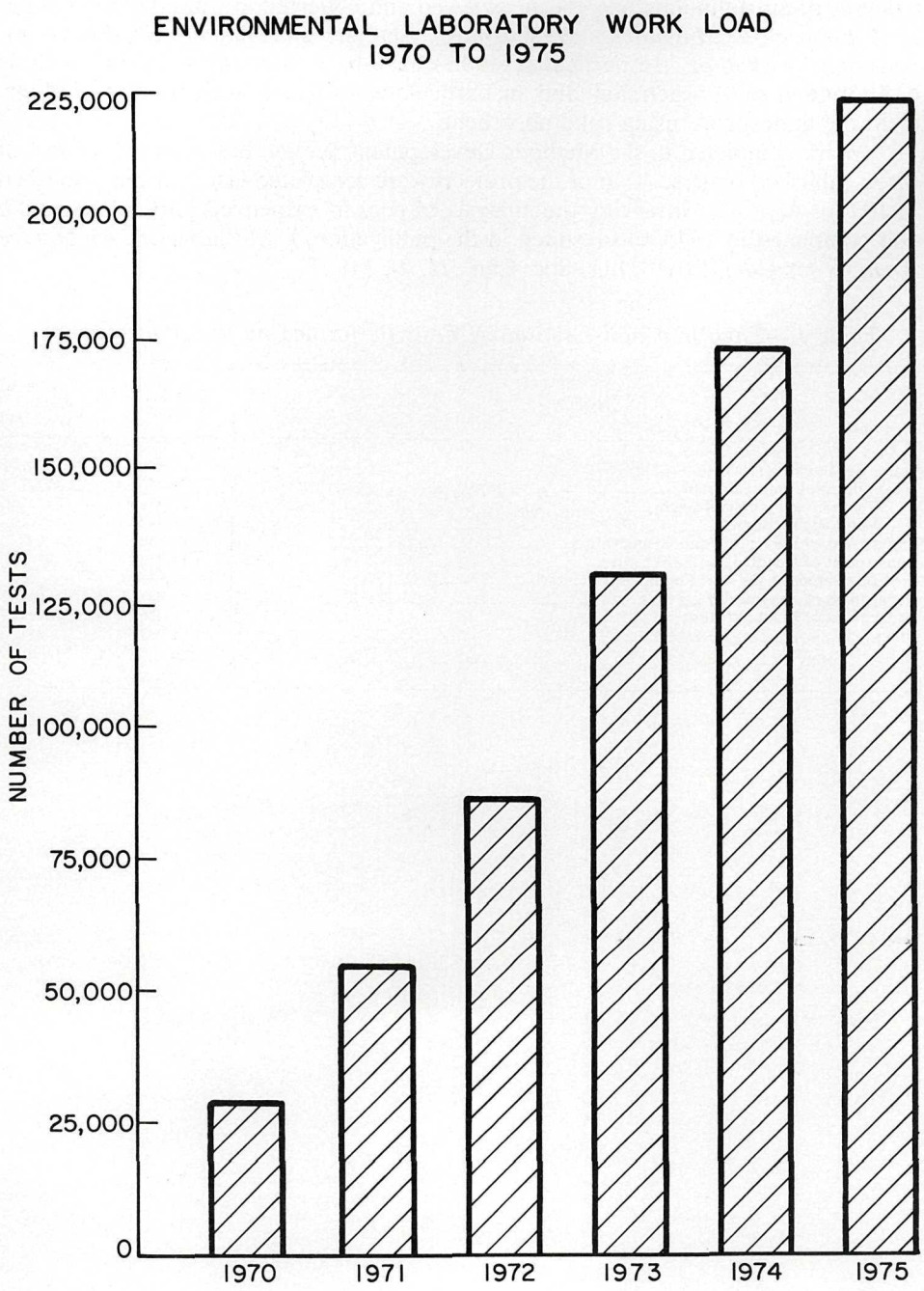

ENVIRONMENTAL LABORATORY WORK LOAD
1970 TO 1975
NUMBER OF TESTS
225,000
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
1970
1971
1972
1973
1974
1975

Figure 1

In co-operation with the Air Quality Section, all the test methods for the analyses of air pollutants have been reviewed and collected into the second edition of *A Laboratory Manual for the Chemical Analysis of Ambient Air, Emissions, Soils and Vegetation.* In particular, studies have been undertaken for the analysis of fluoride in soils, vegetation, and air particulates using an alkali fusion technique, or in the atmosphere using solid absorbent.

Work completed in the Methods Development Section has been the subject of three published papers. Two of the projects were completed last year but published in 1975. A project involving the analysis of coal in suspended particulate matter was completed in 1975 and resulted in the publication, I. M. Salomon, *An Optical Analysis for Coal,* Proc. Micr. Soc. Can., *II,* 22 (1975).

Table 1—Environmental Laboratory Tests Performed by Sampling Agency

Agency	Number of Tests	Per Cent of Annual Work Load
Water Resources Service—		
Pollution Control Branch	159,415	71.3
Water Investigations Branch	27,651	12.4
Water Rights Branch	442	0.2
Department of Recreation and Conservation	12,369	5.5
Department of Health	11,550	5.2
Environment and Land Use Committee Secretariat	2,944	1.3
Department of Agriculture	851	0.4
Department of Public Works	256	0.1
Other	8,089	3.6
Totals	223,567	100.0

INSPECTOR OF DYKES

INSPECTOR OF DYKES

K. J. CHISHOLM, P.ENG.
INSPECTOR OF DYKES

During the year the process of consolidation and transfer continued with the following changes in management or operation of dyking areas:

(*a*) Albion Dyking District assumed responsibility for its own administration on January 14.

(*b*) Dewdney Area Improvement District assumed responsibility for its own administration on January 13.

(*c*) Nicomen Island Improvement District assumed responsibility for its own administration on January 13.

(*d*) Trethewey-Edge Dyking District assumed responsibility for its own administration on January 14.

(*e*) South Westminster Dyking District was dissolved on April 10 and its operation, assets, and liabilities were assumed by the District of Surrey.

(*f*) Sumas Drainage, Dyking, and Development District was dissolved on May 1 and its assets and liabilities transferred to the municipalities of Chilliwhack and Abbotsford. The operation of the former dyking district was assumed by the District of Abbotsford.

Negotiations continued with the municipalities concerned for the transfer of the Coquitlam Dyking District to municipal control. It is expected that the District of Coquitlam and the City of Port Coquitlam will reach agreement on future operation of the dyking district in early 1976 and negotiations can be finalized which will effect the dissolution of the Coquitlam Dyking District.

During 1975 the following statistical data were recorded:

(*a*)	Dyking certificates issued	247
(*b*)	Title searches made	253
(*c*)	Tax notices issued	1,623
(*d*)	Tax receipts issued	738
(*e*)	Tax roll amendments made	166
(*f*)	Court of revision notices sent	2,251
(*g*)	Maps indexed	1,485

PERSONNEL SERVICES AND ACCOUNTING DIVISIONS

PERSONNEL SERVICES

R. C. WEBBER
DIRECTOR

This office provides personnel services to the Lands Service and the Environment and Land Use Committee Secretariat as well as to the Water Resources Service.

Activity during the year continued at a rapid pace despite a downswing in recruiting activity over previous years. It is felt that the main reason for this was the continuing high demand from union negotiations and classification plus an increase in union grievances and contract interpretations as a result of the new contracts, as well as an increase in statistical reports required due to Treasury Board's cutback in hiring.

Organization of the Personnel Services Office

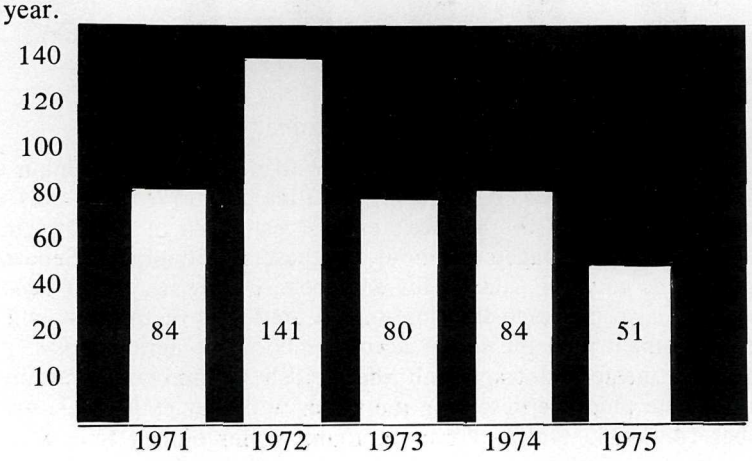
Director
R. C. J. Webber

Personnel Adviser K. H. Knight	Office Manager H. A. Cote	Personnel Adviser R. M. Renaud
Clerk C. I. Dye	Stenographer M. A. Sledz	Clerk/Typist C. Wong

SUMMARY OF PERSONNEL SERVICES ACTIVITIES, 1975

RECRUITMENT OF CONTINUOUS STAFF

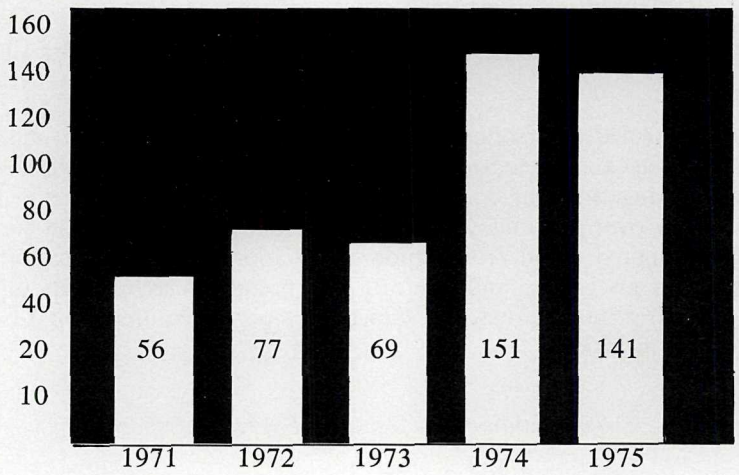
In early 1975 the Government placed restrictions on the number of vacant positions that could be filled, resulting in a decrease in recruiting activity from the previous year.



SEASONAL AND SHORT-TERM APPOINTMENTS

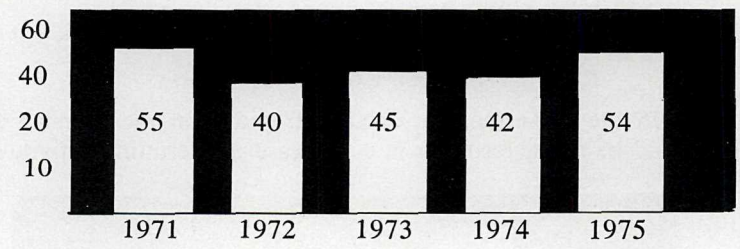
Short-term hiring was down slightly in 1975 in comparison with 1974. The main reason for this was a reduction in the funds made available to the Service

by the Department of Labour under the summer Work in Government Program (W.I.G.). Another reason for the decrease was the increased salaries which meant that fewer students could be hired with the funding available.



Reclassification

The completion and implementation of a much needed review of Pollution Control Branch Engineering Technicians contributed to the increase in reclassification activity for 1975.



Labour Relations

The Government signed its first contract with the British Columbia Government Professional Employees' Association on June 20, 1975. As this contract covers a high percentage of the Service's employees, much of the Director's time was spent in providing management input for these negotiations. Separate component negotiations covering salaries for engineers, geologists, senior accountants, and agriculturists also occupied the time of our staff. As of the year-end we had not reached agreement with the senior accountants or the agriculturists.

The second master contract with the British Columbia Government Employees' Union, the union representing the majority of our employees, was signed on November 14, 1975. Only a limited amount of this office's time was devoted to this contract, but we have become very much involved in developing greater Departmental involvement, at the line level, in component negotiations.

Reorganizations

A major reorganization change occurred in the Water Rights Branch during 1975 with the amalgamation of the Water Utilities and the Improvement Districts

Divisions into the Community Water Supply Division. J. Simpson has been appointed head of the new division.

Principal Promotions, Appointments, and Transfers Within the Water Resources Service During 1975

R. J. O'Regan, appointed as Economist.
J. H. Doughty-Davies, promoted to Head, Planning Section, Planning and Surveys Division, Water Investigations Branch.
J. Wester, promoted to Head, Rivers Section, Engineering Division, Water Investigations Branch.
J. B. Brodie, promoted to Head, Mining Section, Industrial Division, Pollution Control Branch.
F. P. Hodgson, promoted to Chief, Industrial Division, Pollution Control Branch.
H. P. Klassen, promoted to Assistant Director, Pollution Control Branch.

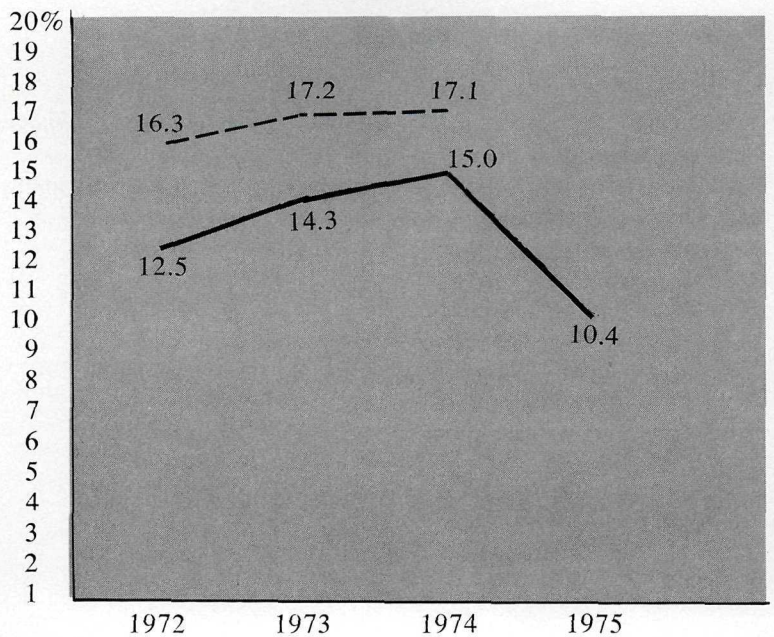
Establishment at December 31, 1975

Number of established positions, 505.
Number of vacant established positions, 57.
Number of temporary employees on staff, 93.
Total number of employees on staff, 541.

Turnover

It is suspected that the higher wages brought about through collective bargaining and the relatively high levels of unemployment in the country had a significant effect upon the reduction in staff turnover in 1975.

------- Government-wide (figures not available).
—— Water Resources Service.



Staff Training

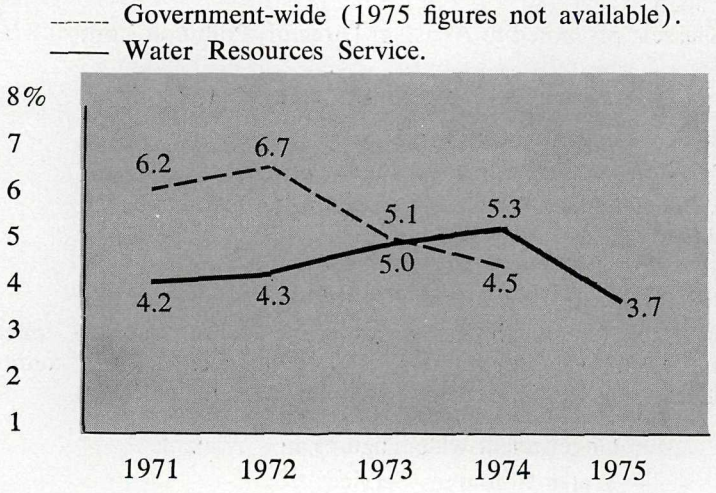
Executive Development Training Plan 1975 graduates:

J. H. Morley, Engineer, Water Investigations Branch.
G. G. Soellner, Technician, Pollution Control Branch.

Additionally, employees received financial assistance on 53 courses that would assist them in developing their skills and increase their potential within the British Columbia Government.

Sick Leave

One significant reason that might account for the drop in sick leave in 1975 was the inclusion of a clause, in the master contract signed in the summer of 1974, which provides for the payment of a portion of the unused sick benefits on retirement.



Retirements

The following employees retired in 1975:

Francis C. Bett, Administrative Officer, Water Utilities Division, after 27 years' service.

Pauline Dranfield, Clerk-Stenographer, Water Rights Branch, after 22 years' service.

ACCOUNTING DIVISION

K. R. MacKay
Departmental Comptroller

This Division provides accounting services for the Lands Service and the Environment and Land Use Committee Secretariat as well as the Water Resources Service. These services include assistance with the preparation of estimates, budgetary control, the preparation and distribution of payroll data, the processing of accounts payable and purchase requisitions, the billing and collection of Water Rights, Lands Branch, and Surveys and Mapping revenue, and the preparation of various reports and summaries for other Provincial and Federal Government departments.

Because of staff turnover, increased expenditure, and numerous complexities and adjustments arising from the collective bargaining process, it has been a very hectic year for the Payroll and Accounts Payable Sections. Serious delays in payments which occurred during the year were somewhat alleviated in October when we were permitted to add one temporary employee to each section. The staff additions also made it possible to focus more attention on expenditure control.

During the year the Division lost to the Emergency Health Services Commission its Comptroller, Bruce Maclean, who had been with us for 22 years, and Ron Bowes, from the Accounts Payable Section, who had been with the Division for 10 years.

Water Rights revenue increased by $4,881,039 in 1975 and this was due mainly to an increase in charges for power usage.

Division staff members assisted Water Rights staff and the Data Centre in the design of new forms, ledger cards, billing statements, and envelopes which are required to meet new postal and metric requirements.

Following is a statement of Water Rights revenue for 1975 by major purpose and also a statement of comparative revenue for the past 10-year period:

	$
Domestic, incidental use, and fees	625,280
Waterworks	193,385
Irrigation	22,905
Power	10,274,077
Funds received on application	52,534
	11,168,181

Comparison of Revenue for 10-year Period, 1966–75, Inclusive

	$		$
1966	2,285,932	1971	4,076,598
1967	2,431,010	1972	4,923,346
1968	2,749,848	1973	5,404,106
1969	3,364,577	1974	6,287,142
1970	3,716,932	1975	11,168,181

Printed by K. M. MacDonald, Printer to the Queen's Most Excellent Majesty
in right of the Province of British Columbia.
1976

2030-476-7217