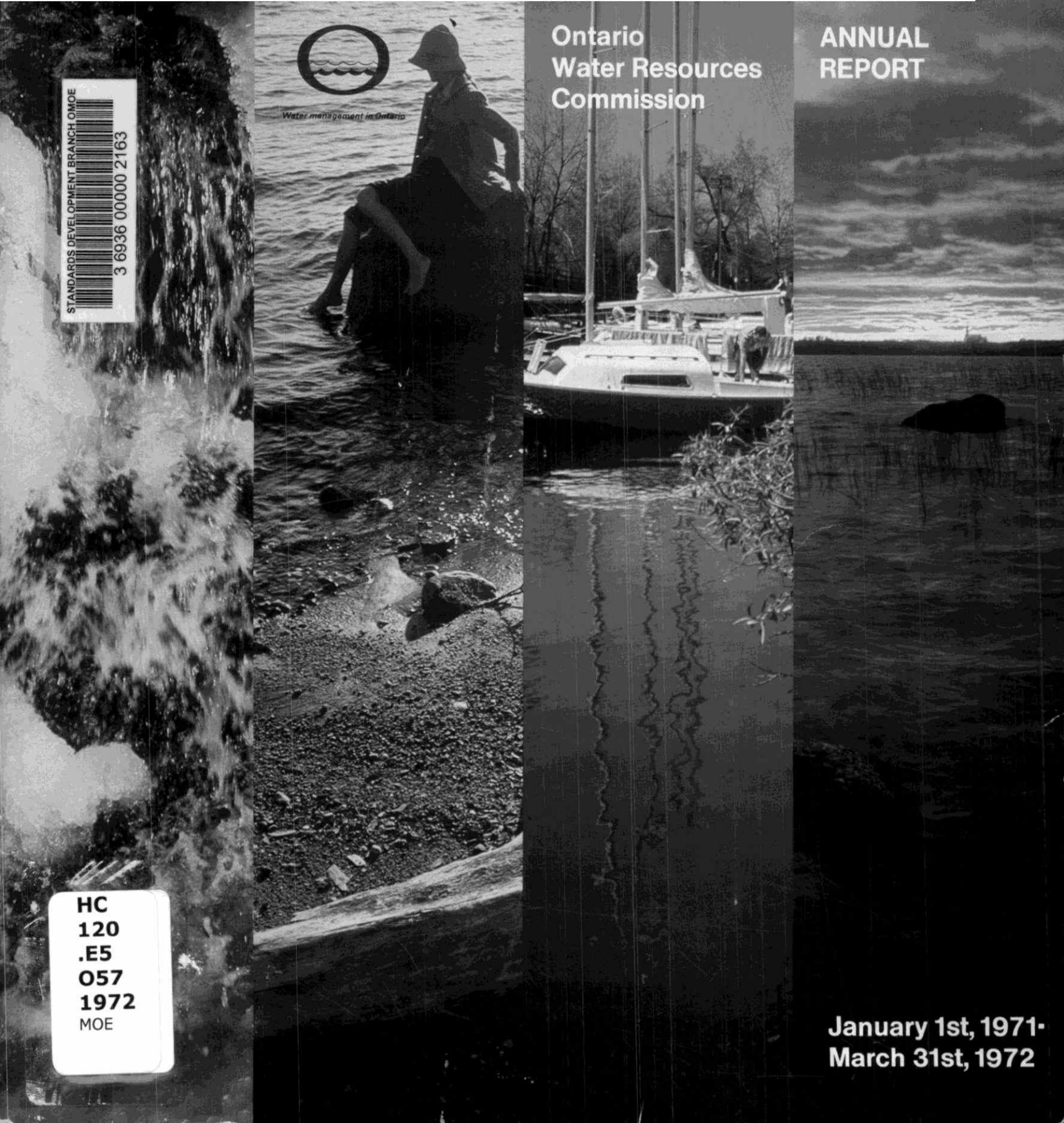
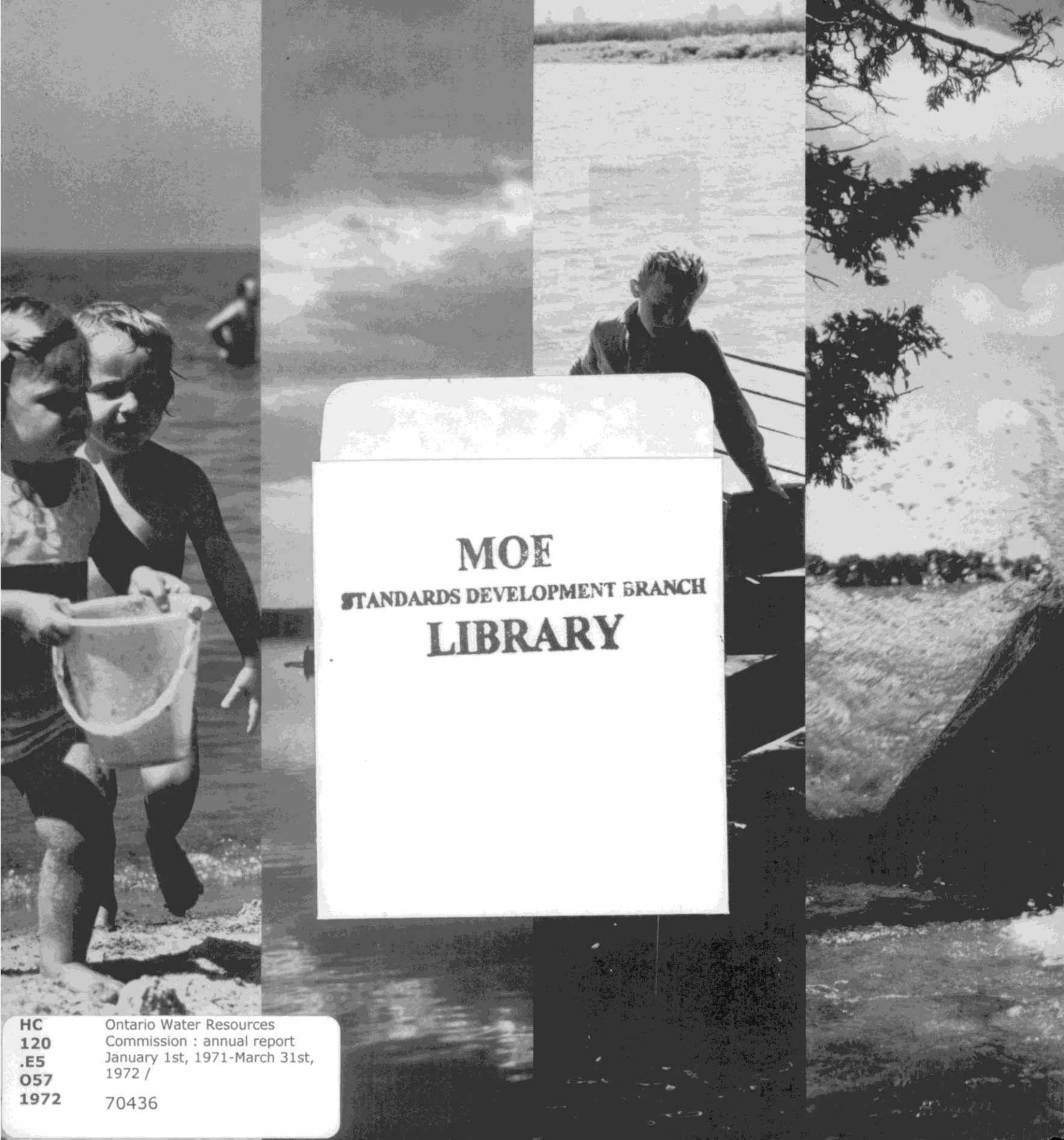


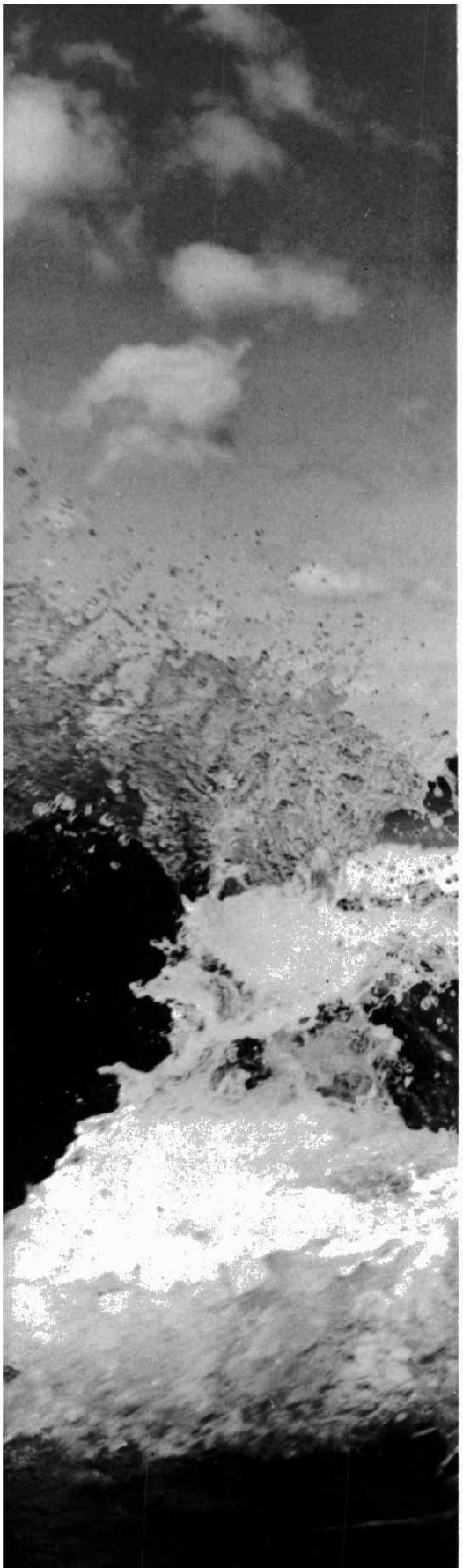
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Ontario Water Resources Commission : annual report January 1st, 1971-March 31st, 1972 /

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ONTARIO

WATER RESOURCES COMMISSION

135 St. Clair Avenue West
Toronto 7, Ontario

March 31, 1972

The Honourable J.A.C. Auld,
Minister of the Environment,
135 St. Clair Ave. West,
Toronto 195, Ontario.

Dear Mr. Auld.

In conformity with and under the provisions of the Ontario Water Resources Commission Act, I have the honour to present to you the Sixteenth Report of the Ontario Water Resources Commission covering the period January 1, 1971 to March 31, 1972.

Respectfully submitted,

John H Root

Chairman

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

March 31, 1972

Mr. J.H.H. Root, M.P.P.,
Chairman,
Ontario Water Resources Commission,
135 St. Clair Ave. West,
Toronto 195, Ontario.

Dear Mr. Root:

I have the pleasure in presenting to you and the other members of the Ontario Water Resources Commission the Sixteenth Report of the Commission covering the period January 1, 1971 to March 31, 1972.

Yours truly

General Manager

Ontario Water Resources Commission

Chairman
J.H.H. Root

Commissioners
H.E. Brown
F.S. Hollingsworth
Dr. C.A. Martin
D.A. Moodie
L.E. Venchiarutti

Commission Secretary
W.S. MacDonnell

Assistant to the Chairman
M. Weissengruber

STAFF ORGANIZATION
AS OF MARCH 31, 1972

General Manager D.S. Caverly
Assistant General Managers R.K.D. Sachse, K.H. Sharpe, F.A. Voege, A.K. Watt
Assistant to the General Manager
M.J. Cathcart
Environmental and Technical Advisor
W.A. Steggles

ADMINISTRATIVE BRANCHES
Legal: Senior Solicitor (Acting) P.B. Currie
Personnel: Director J.C. Arber
Public Relations and Information: Director
M.F. Cheetham

DIVISION OF ADMINISTRATIVE SERVICES
L.M. Tobias *Director*
G.W. Edwards *Assistant Director*

DIVISION OF CONSTRUCTION
J.C.F. Macdonald *Director*
C.J.K. Wilson *Assistant Director*

DIVISION OF FINANCE
E.F. Heath *Comptroller and Director*

DIVISION OF INDUSTRIAL WASTES
D.P. Caplice *Director*
H.A. Clarke *Assistant Director*

DIVISION OF LABORATORIES
J.H. Neil *Director*
G.C. Ronan *Assistant Director*

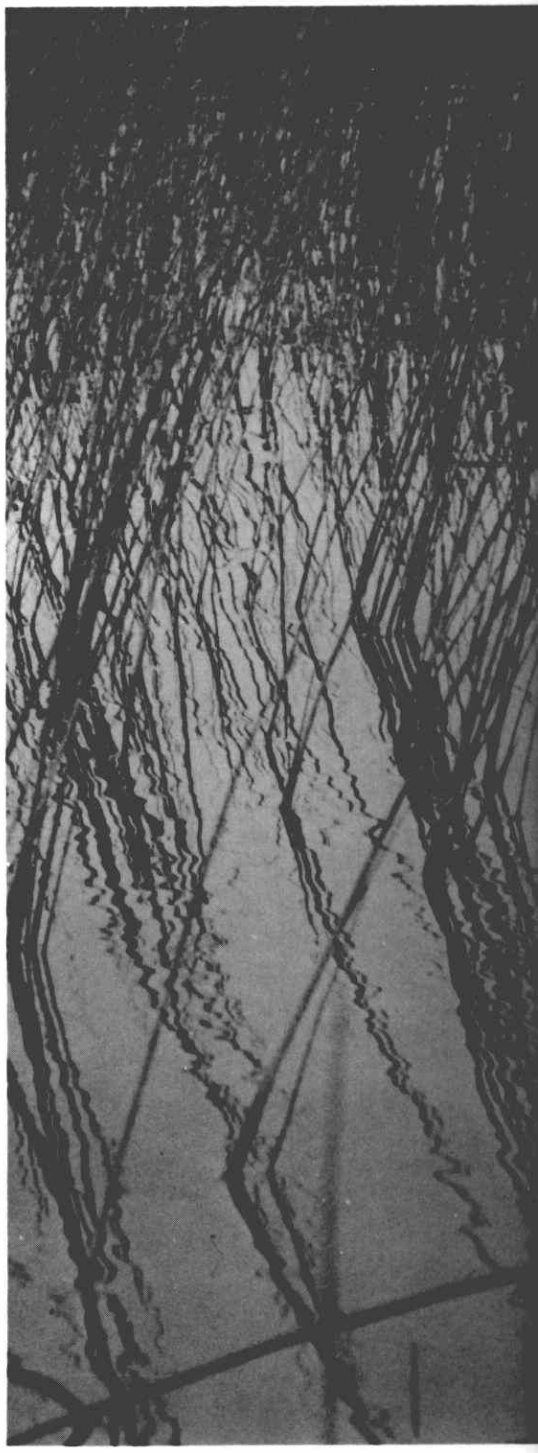
DIVISION OF PLANT OPERATIONS
D.A. McTavish *Director*
C.W. Perry *Assistant Director*

DIVISION OF PROJECT DEVELOPMENT
P.G. Cockburn *Director*
L.F. Pitura *Assistant Director*

DIVISION OF RESEARCH
A.J. Harris *Director*

DIVISION OF SANITARY ENGINEERING
J.R. Barr *Director*
G.R. Trewin *Assistant Director*

DIVISION OF WATER RESOURCES
K.E. Symons *Director*
D.N. Jeffs *Assistant Director*



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ANNUAL REPORT

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January 1st, 1971– March 31st, 1972

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Introduction

Water is undoubtedly one of our most valuable assets. It is also one of the most versatile. Man drinks it, baths in it, cooks in it, grows food with it and uses it to manufacture goods and power. He swims in it, cools buildings with it, fights fire with it, sails on it and flushes away his wastes with it. It is easy to understand, therefore, why, as our population increases and the industrial sector of our economy expands, the needs for water are becoming paramount in ever widening areas of our Province.

During 1971, the Ontario Water Resources Commission undertook to meet these needs by carrying out extensive water management programs. Contained in this Report is a detailed account of the Commission's activities for the period January 1, 1971 to March 31, 1972. The Report represents the final Annual Report of the Commission in view of the fact that, as of the 1st of April, 1972, the Commission will be integrated into the new Ministry of the Environment. The integration will take place as a result of the passing of Bill 27 in the Ontario Legislature (An Act to provide for the Reorganization of the Government of Ontario). Future reports on water management will, therefore, be made through that Ministry.

One of the most significant activities of the Commission during this period was its involvement with other provincial, federal and state agencies in meetings concerning the international aspects of water management. Noteworthy were the joint Canada – United States ministerial meeting on Great Lakes pollution, the Second Great Lakes Environment Conference and the meeting of the Legislative Committee on Lake Erie, details of which are contained in this Report.

Municipal water supply and pollution control programs continued at a high level of activity. The number of certificates issued by the Commission in 1971 in connection with water and sewage works applications totalled 2,062, representing a total estimated value of $272.7 million. A further 614 certificates of approval were issued during the first quarter of 1972, valued at $95.2 million. Since 1957, the Commission has issued certificates for water and sewage works valued at more than $2.6 billion.

Inspections were carried out at 1,092 municipal and private water supply systems and at 969 municipal water pollution control plants in connection with the Commission's responsibility for the supervision of water works and sewage works in the Province. Numerous investigations of water supply and pollution problems referred to the Commission by the public were also undertaken.

The Recreational Lakes Water Pollution Control Program was continued, with some 22 lake areas being surveyed in conjunction with the work being done by the Department of Health.

Early in 1971, a province-wide nutrient control program was initiated. Designed to improve water quality in existing problem areas and to protect prime recreational areas, the program has established 1973 and 1975 deadlines for the installation of phosphorus removal facilities at some 210 municipal sewage treatment plants. Under terms of the Canada – Ontario Agreement on the Lower Great Lakes, procedures were developed by the Commission for administering the allocation to municipalities of a $25 million fund for phosphorus removal treatability studies. This joint federal-provincial program is designed to meet the full cost of the process studies which will be required at all plants in the implementation of the phosphorus removal program. To date, some 69 studies have been undertaken.

Major water supply and pollution control studies were carried forward in various parts of the Province, some of which are being undertaken on a watershed basis. The drainage basin planning report for the Ottawa River was completed and an interim report on the Grand River Basin was prepared. Work continued on the Thames River Basin, Lake Simcoe, the Kawartha – Trent River Basin, the Kaministikwia River – Thunder Bay area as well as other drainage basins.

The publication in May 1971 of "The Interim Province of Ontario Contingency Plan for Spills of Oil and Other Hazardous Materials" – a plan developed in co-operation with federal and provincial government departments and agencies and the petroleum industry – provides an important means of notification of spills which may affect the Province's waterways.

The Commission's industrial waste pollution abatement program continued unabated. During the period, some 97 full-scale surveys were undertaken and about 3,800 field contacts were made with the industries of the Province. Details are provided in this Report of the progress being made by the various industries of the Province, including iron and steel, chemical and petroleum, food processing, mining and metallurgical, and pulp and paper as well as secondary industries. Some 171 certificates of approval were issued for industrial waste treatment works, involving an estimated expenditure of over $56 million. Since the inception of the issuing of certificates of approval by the OWRC in mid-1965, 624 certificates have been approved, involving an estimated cost to industry of $127 million.

Interest on the part of municipalities in having necessary water supply and sewage treatment facilities constructed on the basis of provincial financing continues to grow. Furthermore, the availability of financial assistance in high cost areas has provided a stimulus to the number of projects being undertaken. During the fifteen month period ending March 31, 1972, 56 provincial programs (where ownership is vested in the Province) were undertaken, involving 37 municipalities. This latter figure brings the cumulative total to 462 since this program was introduced in 1965. Thirty-four municipal projects were also undertaken during the same period based on OWRC/Municipal Agreement. In addition, area water and sewage proposals were under consideration for such areas as Central York, Belleville/Trenton and Lambton County.

The large number of projects under development resulted in an upward trend in construction during this period. A total of 65 contracts were completed in 1971 at a cost of $37.19 million, with a further 121 contracts being under construction at the end of the year. As of March 31, 1972, some 390 projects were being operated by the Commission in 228 municipalities and 7 industries.

Detailed hydrologic studies were undertaken of five representative river basins in southern Ontario in 1971 as part of the Commission's contribution to the International Hydrologic Decade. In co-operation with other agencies in Canada and the United States, it participated in a special

Commissioner's Report

water balance study of Lake Ontario in connection with the International Field Year for the Great Lakes.

The inventory and assessment of the water resources of northern Ontario continued, with the collection of hydrologic and hydrometric data. Specific areas of study in 1971 included the Pickle Lake area and the Attawapiskat, Moose and Albany river basins.

The evaluation of ground water conditions for municipal water supply purposes, the administration of the water and well management program through the permit system and the investigation of water supply problems formed an important part of the Commission's quantitative water management programs, as well.

Effective support services were provided by various divisions of the Commission during this period and these kept pace with the expanding programs of the operating divisions. The analytical services of the laboratory, the varied research programs and particularly those undertaken in connection with the establishment of integrated phosphorus removal techniques at sewage treatment plants, the Commission's legal, financial and administrative services all made a significant contribution to the furtherance of water management programs in Ontario during this fifteen month period.



During 1971, several changes occurred in the formal operation of the Commission. In May of 1971, Mr. D.J. Collins, Chairman since 1969, was appointed Deputy Minister of Trade and Development. Mr. R.D. Johnston, formerly Deputy Minister of Civil Service, was appointed Chairman and occupied this position until December 22 when he became Deputy Minister of Labour. Mr. J.H.H. Root, M.P.P., who had occupied the position of Vice-Chairman of the OWRC since 1964, was then appointed Chairman. He will continue in this capacity until April 1, 1972, when the Commission will be integrated into the Ministry of the Environment.

The Commission is comprised of individuals from all walks of life. Chairman Root has a background in agriculture and farm marketing and church work. He has served twenty years in the Legislature, and was a member of Cabinet for three years. Commissioner H.E. Brown is an accountant and is a former Deputy Provincial Treasurer. Commissioner D.A. Moodie has a background in agriculture, and has served twenty years in municipal government as Reeve, County Warden, and as a member of Regional Government. Commissioner L.E. Venchiarutti is an architect and planner, and heads his own firm. Commissioner C.A. Martin is a medical doctor and has been active for thirty years in municipal and conservation authority programs, and as a businessman and farmer. He has served on hospital, educational and financial institutions. Commissioner F.S. Hollingsworth has extensive experience in business and hospital administration as well as in financial management. He has also served in voluntary capacities in his community.

This diversification of background has been very helpful to the Commission in arriving at balanced, practical policies and decisions.

In spite of many internal changes and the re-organization of government programs, the Commission considerably extended its activities in 1971. It continued to sit weekly to discuss and develop policies to be implemented by staff and to make those decisions which are required of it by the OWRC Act. The Commissioners are kept informed of the various programs of the Commission so that guidance can be provided to staff as required on matters related to Commission policy.

In recognition of the increasing importance of local participation, several members of the Commission chaired local advisory boards concerned with the operation of area sewage and/or water schemes. Mr. Brown chaired the South Peel Advisory Committee and the Belleville/Trenton Area Advisory Board. Mr. Moodie acted as Chairman of the Lambton Area Water Advisory Board. Mr. Root chaired the Blenheim Area Water Advisory Board and, subsequently, turned this responsibility over to Dr. Martin upon assuming the Chairmanship of the Commission.

In recognition of the growing need to decentralize the adminstration of local programs, Commissioners were actively engaged in all parts of the Province in a variety of meetings and hearings. During 1971, forty-four public hearings were held throughout the Province on the advisability of municipal sewage treatment plants being constructed in certain areas. In addition, five industrial waste hearings were held which also considered the advisability of certain waste treatment facilities being constructed for industries. By allowing full local participation and discussion prior to the construction of pollution control works, the industry or municipality can explain the proposal and local persons can question and express their views, all of which assists the OWRC when it makes a decision which must be in the public interest. Since its inception, the Commission has held over 340 public hearings which have helped to make the public aware of the importance of pollution control and the various methods which can be employed to deal with a variety of situations and all types of wastes. In addition to public hearings, Commissioners have participated in many meetings with the public, municipal councils and industries for the purpose of exchanging views and information.

Administrative Branches

Legal Branch

P.B. Currie - Acting Senior Solicitor

The Legal Branch is responsible for the general legal services of the Commission which include:

– prosecutions of offences under the Act, the preparation of Requirements and Directions, Reports to Municipalities and the provision of advice to crown attorneys, municipalities and individuals with respect to private prosecutions under the Act;

– the provisions of advice on drafting and revision of contracts with municipalities, consultants and others relating to the construction, operations and financing of sewage and water works;

– the administration, negotiation and settlement of claims filed under The Public Works Creditors Payment Act and The Mechanics' Lien Act and arising out of construction contracts;

– the provision of advice on and attendance at arbitrations relating to construction contracts.

Eighteen convictions were obtained against individuals or corporations for the offence of impairing the quality of water.

There were three convictions obtained against one municipality and two corporations for the offence of constructing sewage and water works without approval, and there were two convictions under the Boating Regulation. In addition, Requirements and Directions were issued pursuant to Section 69 of the Act against seven corporations. A number of draft reports to municipalities pursuant to Section 51 (1) were prepared. The municipalities, however, complied with the terms of the draft reports and no formal reports were required.



Personnel Branch

J.C. Arber, Director

The Branch's major project for the period was the completion of the classification program. The majority of positions were reviewed and classified in accordance with the project objectives. The Memorandum of Understanding with the C.S.A.O. concerning employees in the Division of Plant Operations was ratified, covering a contract period from January 1, 1971 to June 30, 1972.

The recruitment program was somewhat restricted by limitations placed on staff complement, with the result that fewer new employees were required. Liaison was maintained with universities and colleges. Because of general economic conditions in the Province, a significant number of applications were received. There were 144 full-time staff recruited and 128 employees terminated for Head Office. There were 73 full-time staff recruited and 36 employees terminated for sewage and water treatment plants.

More students were available for summer employment than in any previous year. A total of 175 were employed. In addition, 46 students were employed through participation in the University of Waterloo Co-op Program.

Employees continued to show good interest in attending extension courses and 90 were granted financial assistance for educational purposes. Three members of staff returned to university supported by bursaries.

On March 31, 1972, the staff of the Commission was as follows:

Head Office	
Full-time	804
Casual	60
Plant Operations (sewage and water treatment plants)	
Full-time	361
Casual	22

Public Relations and Information

M.F. Cheetham, Director

Concern for the environment in 1971 and during the first quarter of 1972 closely paralleled that of 1970, although individual willingness to becoming personally involved in the issues still leaves a lot to be desired. The OWRC has conducted annual opinion research surveys since 1968 to determine the degree of public concern for water pollution. This concern has increased substantially in the last four years and currently ranks second only to the public concern for unemployment. Indeed, if the concern readings for water pollution and air pollution were to be combined, they would even exceed the rating for unemployment as the most important problem facing the country today.

When the respondents in the 1971 survey were asked, however, what they intended to do in order to become involved in the pollution issue, over 80% didn't answer the question when faced with the challenge of committing themselves to such suggested alternatives as attending pollution meetings, joining public citizens' groups or declining to purchase items considered to be pollutants. This individual reluctance to become committed was even higher in 1971 than it was in 1970.

Unless the individual establishes a 'new moral commitment' to his environment, unless he starts to practice what is merely being talked about, then the success of environmental protection programs such as those administered by the OWRC will be limited.

The current communications program of the Commission's Public Relations and Information Division is designed to effect a real change in individual attitudes towards the environment. In the last four years it has concentrated on making the public aware of the fact of pollution. To a great extent this objective has been achieved. During the past fifteen months, accelerated activity occurred in all program areas of Public Relations and Information, in keeping with the objectives of the Division. These objectives are to develop and execute an internal-external educational and information program designed to create an awareness of the need for effective water management in Ontario, and to elicit the support for the acceptance of and citizen involvement in the overall goals of the Commission as a whole.

PR&I's operational programs are divided into four communication areas: editorial, audio-visual, educational resources and ancillary services. Each section is supported by office services whose responsibility, in addition to program implementation, includes publication inventory and distribution, advertisement placement for tender calls and public hearings, film print distribution, public enquiries and correspondence.

EDITORIAL SECTION

The Editorial Section is responsible for the development of news releases, feature articles, employee communications, specialized pamphlets and brochures and other areas of written communication. Special events, such as the publicizing of conferences and seminars, press conferences, news media liaison, as well as the production of the Commission's bi-monthly tabloid "Watertalk", and the quarterly "OWRC News", are also an integral part of the operations of this section of PR&I.

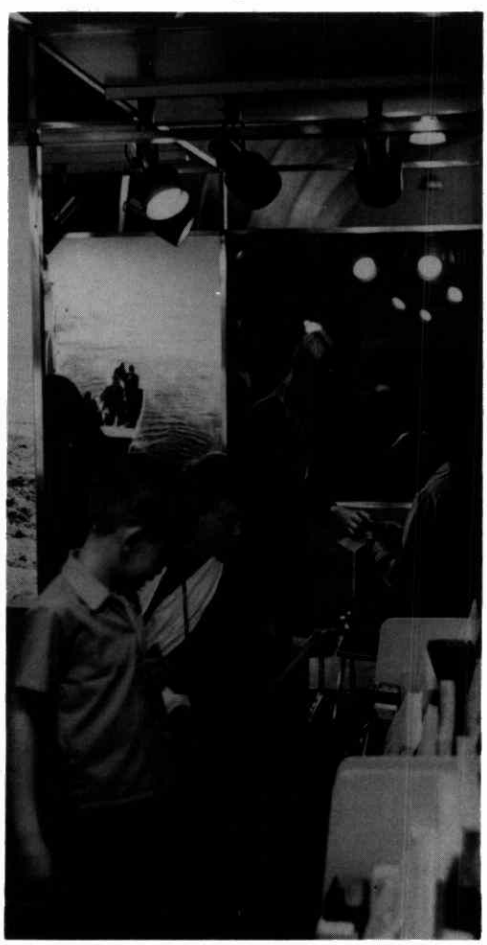
Five issues of "Watertalk" were produced in 1971, and one early in 1972, incorporating some 124 articles concerning various aspects of water management. Noteworthy in this year's issues were articles dealing with the OWRC's phosphorus removal program, the recreational lake pollution control program, industrial pollution control, sanitary engineering and research projects.

One hundred and nine news releases concerning OWRC activities were forwarded to news media throughout the Province. Subjects covered included the approval of waste treatment facilities for industries, water and sewage treatment plant construction programs, miscellaneous contract awards, senior personnel appointments and summary statements on various water quality reports produced by the Commission. Mailing lists for the distribution both of news releases and "Watertalk" were reviewed and updated. In order to ensure the best possible use of its news stories, PR&I utilizes a regional distribution system for its releases, rather than blanketing the media of the Province.

The Editorial Section worked with both print and broadcast media in the preparation of feature material on the Commission and water management. Included were the Toronto Globe & Mail, the Toronto Star and the Toronto Telegram, Civic Administration, Water and Pollution Control, Campus, Maclean's Magazine, and other daily and weekly newspapers, the CBC and other radio and TV stations.

Initial work was completed on the production of a special version of "Watertalk" for publication in 1972. This issue is intended as a handout at fairs and exhibitions and will contain up-to-date information on water management programs being undertaken by the Commission. Two issues of the Commission's internal publication "OWRC News" were produced and distributed to all employees.

Student Educational Program



AUDIO-VISUAL SECTION

Like the other communication programs within PR&I, the Audio-Visual Section's activities were considerably accelerated. Over 4,000 feet of motion picture film was shot, 3,000 still photographs were taken, 1,000 colored slides were produced, 28 fairs and exhibitions were attended, and 6,000 slides on Commission activities were catalogued.

Scripting and production of a new motion picture on the biological aspects of water management began in mid-year. The film will be completed and in circulation by the commencement of the recreational season in 1972. The film deals with the recreational lake pollution problem as seen through the eyes of the biologist, the cottager and youth and, for the first time, synchronized sound will be incorporated in a PR&I documentary film production. Two television public service news clips were produced, with prints being made available to stations throughout the Province. The clips cover winter and summer recreational activities and their impact on water quality. The Section also conceived and produced five cable television programs on different aspects of the Commission and it was successful in having these received by the cable TV networks in Metropolitan Toronto and Hamilton. The series was produced in collaboration with the Environmental Protective Association in Toronto. Subjects covered included Commission policy and programs, water and waste treatment facilities, industrial wastes, biological aspect of water management, and education and information.

During the period, an estimated 56,000 people (exclusive of TV viewers) saw OWRC films through the services of PR&I's film distribution agency, Modern Talking Picture Service. Films shown on TV were viewed by an estimated audience of 600,000.

Photographic assignment highlights included extensive coverage of the recreational lake pollution abatement programs, the installation of phosphorus removal equipment, special water quality studies on the Great Lakes, the production of slide programs on both the boating and marina regulations and their implementation, aerial photography of dye tests in Lake Ontario,

weed cropping, photographic coverage of conferences, sod-turning ceremonies and plant openings, the signing of the Canada-Ontario Agreement, and inspection tours of the Elgin Area Water System and the South Peel Sewage System.

Slide series produced the previous year as an educational aid continued to be used, as were the TV and radio public service news clips and spot announcements. Requests from news media and vertical business publications for illustrative photographs on pollution and water management continued to be received at a regular pace, while internal requests for slides, pictures, audio-visual presentations, charts, graphs and illustrated material accelerated.

EXHIBIT SECTION

Exhibit activities were at a peak. Three mobile units were on view at 28 exhibitions and fairs during the year. Locations included Thunder Bay, Timmins, Maxville, Leamington, Sutton, Peterborough, Ottawa, Picton, Renfrew, London, Welland, Collingwood, Stratford, Barrie, Simcoe, the International Plowing Match at Jarvis, the Royal Winter Fair in Toronto, the Water Well Drillers Conference, the Canadian Education Showplace, the International Boat Show, the Mayors and Reeves Conference, the Queen's Park Book Fair, Laurentian University 'Straight Goods' Conference, the Industrial Wastes Conference and the International Campers and Hikers Association Convention in Brantford.

Four university students were taken on staff for the summer to assist with the manning of the displays. After undergoing a training program, the students travelled with the units and participated in the main regional exhibitions as well as in some of the smaller fairs.

The Commission, together with the Department of the Environment, collaborated on the Environmental Park exhibit at the Canadian National Exhibition. The permanent display at the Government of Ontario Exhibit Centre in Niagara Falls continued.

Two new displays were constructed. One, a three-module 30 foot exhibit, covers the development of the Commission, its programs and the role of the citizen in



Film Making

pollution abatement. It was used at the major exhibitions throughout the Province, while two of the previously constructed 10 foot modules were used at smaller fairs. The second unit constructed was designed primarily for conferences, seminars and speaking engagements; it is completely portable and incorporates general information on the OWRC and its programs.

As a result of this exhibit activity, over 260,000 pieces of literature, book covers, posters, lapel stickers, buttons, bookmarks and similar promotional items were distributed to the general public, a major portion of which were young people.

EDUCATIONAL RESOURCES SECTION

Providing Ontario's primary and secondary schools with educational resource material on water management and pollution control continued to be the focal point of activity insofar as the Educational Resources Section of PR&I was concerned.

New publications produced included "Water Pollution, What Can I do?", "Man and Water", "Readings in Water Management ment", an updated bibliography, "Ontario's Phosphorus Removal Program", a bookmark with suggestions on pollution abatement, and revised and redesigned versions of the publications and film services pamphlets. All were integrated into the educational program as well as being used in the external information programs. Several of the Commission's existing publications were reprinted in larger quantities to meet the public demand for material.

A program was initiated to supply all public libraries in Ontario, and their branches, with copies of OWRC student and general resource kits for reference purposes. By the end of the year all had been initially serviced, with several writing for additional materials because of the size of their membership. Two further educational programs included the servicing of all Department of Tourism information booths with a supply of the new pamphlet "Cottagers' World of Water", and the introduction of OWRC's educational materials to student teachers at the University of Toronto's College of Education, the Lakeshore Teacher's College, and the Toronto Teacher's College.

The educational co-ordinator also acted as a consultant to summer school teachers at Trent University in Peterborough in the development of a teaching methodology to be used in studies of environmental problems. A similar function was performed at the 'Straight Goods' Conference held at Laurentian University in Sudbury where 350 students from Ontario High Schools met and discussed the "pros and cons" of pollution with university professors, government resource people, and industrial representatives as well as with each other.

An education program for the Ford Motor Company in Windsor was developed, with publications and posters being provided for the 1,000 employees. During the summer months, several day camps within Metropolitan Toronto were visited with some 700 youngsters being addressed on the Province's water management programs.

PR&I continued a job-training program for third year Communications Arts Students at the Humber College of Applied Arts and Technology. This training program was initially developed at the request of the College in 1970. Selected students serve a tenure of nine working days with the Division during which time they study its operations and participate in its programs.

Seventeen presentations on the OWRC's educational resources program were given to environmental science teacher conferences. Nearly 1,000 schools in the Province were supplied with resource kit materials, over 8,000 students were addressed, and 41,000 resource kits representing over 200,000 individual pieces of literature were distributed.

The latter kits, incorporating various resource materials produced by the OWRC to assist the student in his studies of enviromental management and pollution control, are geared to Grades 1 to 9 and 10 to 13 and are accompanied by a companion teacher's resource guide.

Providing the general public with information on water management is one of the major responsibilities of PR&I's staff.

Over 23,000 telephone calls, 2,900 office visits and 31,000 mail request were handled. As a result of these contacts with the public, in excess of 785,000 individual pieces of literature were distributed.

SPECIAL EVENTS

Plant-opening and sod-turning ceremonies, tours of facilities, conferences and meetings, and public speaking engagements further occupy the time of PR&I staff.

There were 10 plant-opening and sod-turning ceremonies, and a tour of both the Elgin Area Water System and the South Peel Sewage System. Dedication ceremonies were held in Stayner, Port Stanley, Campbellford, Blenheim, Richmond, Cayuga, Eganville, Amherstburg, Wallaceburg and Port Burwell. PR&I was responsible for all arrangements for each of the ceremonies as well as for the attending liaison with news media, preparation of news releases and background material, program organization and execution.

Over 50 conferences and meetings were attended by PR&I staff and 42 public speaking engagements undertaken before service clubs, church groups, women's groups, youth gatherings and similar public meetings.

ANCILLARY SERVICES

A paid advertising program, supported by a public service media program, concentrated on the recreational lakes pollution abatement problem. Monies were also expended on an outdoor billboard campaign, weekly newspaper and ethnic press advertising, and radio spot announcements. In general, this program was carried out through media serving recreational lake areas or in metropolitan areas where there is a major egress of the population to lakes during the summer months.

The billboard campaign, which was undertaken in 39 areas throughout the Province and utilized 147 billboards, stressed the theme."It's Our Water, Let's keep It Clean" with a water-frolicking family in the illustration. Fifty-two weekly newspapers carried a similar theme over several consecutive weeks, while 19 radio stations aired 50 spot announcements each, these being concentrated over each weekend to reach those leaving the urban areas for the lakes. In addition, PR&I produced its own radio and TV spot announcements which were distributed to all stations within the Province, both in English and French, with the request that they use the message as a public service, whenever possible. Support for this request from the audio-visual media was most gratifying.

Four new outdoor posters were produced directing messages to campers, cottagers, boaters and winter recreationalists. The message of each poster covered specific topics rather than utilizing a general pollution abatement theme. The posters have been distributed among cottagers' and campers' associatons, Department of Lands and Forests district offices, snowmobile clubs, outfitters' offices, marinas and power squadrons.

Research into the public's attitude toward pollution, the cause and the corrective programs, was again undertaken through the purchase of the independent study conducted by Market Facts of Canada. The results of this study, which paralleled those of the previous year, will again be used as a guideline for the development of the Commission's public relations and information programs over the ensuing months.

GENERAL

Counselling and supportive informational programs are available to agencies having common objectives with the Commission. Included are such organizations as the Federation of Cottage Owners Associations, the Campers and Hikers Association, the Anglers and Hunters Association, Boy Scout troups and Girl Guide companies, and the Environmental Protective Association. Similar services were also utilized by professional organizations, internal government study committees and public service bodies.

This was a most active period for PR&I staff, with the programs undertaken taxing the resources of the Division to the fullest. Based on the statistics, it was also a most successful period, and, even though the program deals somewhat in intangibles, the coverage by the media, the interest of the general public and the concern for the environment would indicate that the OWRC's Public Relations and Information objectives are being met to a considerable degree. More can still be done.



Division of Construction

J. C. F. Macdonald, Director
C. J. K. Wilson, Assistant Director

The Division of Construction is responsible for the administration of contracts let by the Commission for the construction of water works or sewage works which are undertaken for municipalities, or groups of municipalities, as Commission-financed projects. This administration includes the overall supervision of the engineering services provided by consultants and of the work carried out by contractors.

The Division is responsible for the co-ordination of the preselection of equipment to be used in plants and pumping stations. During the design stage of projects, the Division is also involved, in conjunction with other divisions, in the review of reports, drawings, documents and specifications submitted by consultants.

During the course of construction, engineers and technicians make regular visits to the construction sites to review quality and progress. At the same time, liaison is maintained with municipal officials and representatives to exchange information and to try to minimize disruption of traffic where excavation involves municipal streets and roads.

In 1971 the upward trend in the volume of work under construction continued, as reflected in the tables below:
(Years shown are calendar years).

CONTRACTS EXECUTED

	1969	1970	1971	1972 To Mar.31
Total No.	36	50	91	25

CONTRACTS COMPLETED

	1969	1970
Total No.	34	40
Cost of sewage works	$ 5.87m	$ 7.76m
Cost of water works	$ 4.50m	$ 7.08m
Total	$10.37m	$14.84m

	1971	1972 To Mar.31
Total No.	65	15
Cost of sewage works	$25.87m	$14.87m
Cost of water works	$11.32m	$ 3.32m
Total	$37.19m	$18.10m

CONTRACTS UNDER CONSTRUCTION

	1969	1970	1971	1972 To Mar.31
Total No.	55	76	121	83

Of the 91 contracts executed in 1971, 63 were for sewage works with a value of $41.26m., 24 were for water works with a value of $17.52m. and 4 were contracts covering both sewage works and water works with a value of $3.97m., making a total value of $62.75m.

Of the 25 contracts executed in the first three months of 1972, 15 were for sewage works with a value of $13.72m., 9 were for water works with a value of $5.15m., and 1 contract valued at $1.95m. was for both sewage works and water works.

While the need for increased standardization of documents and procedures was clearly evident, the increased work load made it impossible for staff to devote much time to the accomplishment of this objective.

A summary of the OWRC projects under construction during 1971 and the first quarter of 1972 follows:

AILSA CRAIG (5-0041-67)

Description of Project: Water supply and distribution system.
Consulting Engineers:
Contract 1 – James F. MacLaren Ltd., Toronto
Contract 2 – R.V. Anderson Associates Ltd., Toronto.
Contract 1 – Water supply pipeline.
Completed – December 1971.
Estimated contract cost – $82,000.00
Contract 2 – Water distribution system.
Expected completion date – May 1972.
Estimated contract cost – $240,000.00.
Estimated Project Cost: $322,000.00.

ALLISTON (1-0074-67)

Description of Project: Sewage treatment plant, trunk sewer, forcemain and pumping station.
Consulting Engineer: Proctor & Redfern Ltd., Toronto.
Contract 'A' – Construction of a 0.77 MIGD extended aeration and sewage treatment plant.
Expected completion date – October 1972.
Estimated contract cost – $600,000.
Contractor started work during February 1972. Some excavation and structural work had been done by the end of March.
Contract 'B' – Construction of approximately 5,500 lin. ft. of 24-inch dia. trunk sewer, approximately 1,100 lin. ft. of 16-in. dia. forcemain and a prefabricated sewage pumping station.
Expected completion date – June 1972.
Estimated contract cost – $340,000.00.
Contractor started work in February 1972. Approximately 1,000 lin. ft. of 24 in. dia. trunk sewer was completed by the end of March 1972.
Estimated Project Cost: $1,075,000.00.

ANSON, HINDON & MINDEN (6-0188-68)

Description of Project: Extensions to water system.
Consulting Engineers: Totten, Sims, Hubicki Associates Ltd., Whitby.
Completed: July 16, 1971.
Estimated Project Cost: $72,798.00.

BELLEVILLE (1-0004-66)

Description of Project: Extensions to sewage works.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Contract 1 – Extensions to sewage treatment plant.
Completed – August 1971.
Final contract cost – $1,857,731.00.
Contract 2 – Forcemain.
Completed – August 1971.
Final contract cost – $147,701.00.
Estimated Project Cost: $3,100,000.00. (This figure includes the cost of purchasing the existing sewage treatment plant and pumping station which were constructed as an OWRC/Municipal project.)

BELLEVILLE-THURLOW (1-0220-70)

Description of Project: Trunk Sewer.
Consulting Engineers: City of Belleville Engineering Dept.
Contract 1 – Trunk sewer in river bed.
Expected completion date – August, 1972.
Estimated contract cost – $1,018,442.00.
Contract 2 – Trunk sewer on Compton Road.
Expected completion date – July 27, 1972.
Estimated contract cost – $288,762.00.
The contractor on Contract 1 will not start work until May 1972 due to the fact that his section of trunk sewer is located in the Moira River bed and the river is high until that time.
The contractor on Contract 2 started work in February 1972 but little work was done prior to March 31, 1972.
Estimated Project Cost: $1,540,000.00.

BLEZARD VALLEY WATER AND SEWAGE SCHEME – WATER SUPPLY SCHEME (5-0030-67)

Description of Project: A water supply system to provide water to the townships of Valley East, Rayside and Balfour consisting of wells, storage facilities and trunk watermains.
Consulting Engineers: Kilborn Engineering Ltd., Toronto.
Contract 5 – Construction of approximately



42,600 lin. ft. of 24-inch diameter watermain and 17,700 lin. ft. of 6-inch to 12-inch diameter branch mains complete with appurtenances and related work.
Expected completion date – December 1972.
Estimated contract cost – $2,472,000.00.
This contract is approximately one-third of the pipelaying requirement for the trunk water system. Work commenced on October 4, 1971.

Contract 6 – Construction of approximately 42,400 lin. ft. of 24-inch diameter watermain, complete with appurtenances and related work.
Expected completion date – December 1972.
Estimated contract cost – $1,870,000.00.
This contract is approximately one-third of the pipelaying requirement for the trunk water system. Work commenced on November 23, 1971.

Contract 7 – Construction of approximately 22,400 lin. feet. of 18-inch diameter, 7,700 lin. ft. of 14-inch diameter and 2,200 lin. ft. of 12-inch diameter watermain, complete with appurtenances.
Expected completion date – December 1972.
Estimated contract cost – $1,267,000.00.
This contract is approximately one-third of the pipelaying requirement for the trunk water system. Work commenced on November 23, 1971.

Estimated Project Cost: $8,600,000.00.

WATER AND SEWAGE SCHEME – TOWNSHIP OF RAYSIDE (5-0046-67, 1-0108-67)

Description of Project: A water distribution and sewage collection system for the Community of Azilda.
Consulting Engineers: Kilborn Engineering Ltd., Toronto.

Contract 52 – Construction of approximately 21,300 lin. ft. of 6-inch and 8-inch watermain with hydrants, connections and other appurtenances; approximately 19,900 lin. ft. of 8-inch to 24-inch diameter sewers, a pumping station, standby power facility and 6,400 lin. ft. of forcemain.
Expected completion date – October 1973.
Estimated contract cost – $2,071,000.00.
Construction of Brabant Creek pumping station had commenced.

Contract 53 – Construction of approximately 28,600 lin ft. of 6-inch and 8-inch diameter watermain with hydrants, connections and other appurtenances; approximately 24,000 lin. ft. of 8-inch to 14-inch diameter sewers, a prefabricated sewage pumping station, a standby power facility and 3,300 lin. ft. of 12-inch diameter forcemain.
Expected completion date – March 1973.
Estimated contract cost – $1,950,000.00.
Work is expected to commence in April.

Contract 54 – Construction of approximately 11,350 lin. ft. of 6-inch and 8-inch diameter watermain with hydrants, connections and other appurtenances; approximately 19,600 lin. ft. of 8-inch to 18-inch diameter sewers, two prefabricated sewage pumping stations each with standby power facilities, 1,000 lin. ft. of 8-inch and 10-inch diameter forcemain.
Expected completion date – January 1973.
Estimated contract cost – $1,340,000.00
Work had commenced on the pumping stations.

BRADFORD (1-0035-66)

Description of Project: A high rate treatment plant and alterations to existing pumping station.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Completed: December 27, 1971.
Estimated Project Cost: $880,000.00.
Work progressed at a slower rate than anticipated and completion of the works was some six months behind schedule.

BRANTFORD (2-0271-69)

Description of Project: Modifications to the sewage treatment plant.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Expected Completion Date: July 1972.
Estimated Project Cost: $300,000.00.
The order to commence work was issued on December 1, 1971.

BRIGHTON (6-0187-68)

Description of Project: Watermain extension.
Consulting Engineers: Totten, Sims, Hubicki & Associates Ltd., Whitby.
Completed: October 12, 1971.
Estimated Project Cost: $175,000.00.

CAMPBELLFORD (1-0028-66)

Description of Project: Trunk sanitary sewers, forcemain pumping stations and sewage treatment plant.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd., Don Mills.
Contract A – Trunk sanitary sewers and forcemain.
Completed – February 22, 1971.
Final contract cost – $139,056.00.
Contract B – Sewage treatment plant.
Completed – February 22, 1971.
Final contract cost – $853,348.00.
Estimated Project Cost: $1,112,600.00.

CANNINGTON (1-0016-66)

Description of Project: Sanitary sewers, Pumping station, forcemain and two-cell lagoon.
Consulting Engineers: Oliver Lloyd & Associates Ltd., Don Mills.
Completed: December 20, 1971.
Estimated Project Cost: $975,000.00.

CARLETON PLACE (1-0009-66)

Description of Project: Sanitary interceptor sewer and sewage treatment plant.
Consulting Engineers: J.L. Richards & Associates Ltd., Ottawa.
Contract 1 – Sewage treatment plant.
Expected completion date – April 1972.
Estimated contract cost – $550,812.00.
Contract 2 – Trunk sanitary sewer.
Completed – April 30, 1971.
Final contract cost – $147,505.70.
Estimated Project Cost – $784,000.00.

CAYUGA (1-0043-66)

Description of Project: Sanitary sewers, pumping station, forcemain and sewage treatment plant.
Consulting Engineers: Walter, Fedy, McCargar, Hachborn, Kitchener.
Contract 1 – Sewers.
Completed – July 1971.
Final contract cost – $533,256.16.
Contract 2 – Pumping station and sewage treat-

ment plant.
Completed – March 1971.
Final contract cost – $223,724.52.
Estimated Project Cost: $892,000.00

CHALK RIVER (6-0193-68)

Description of Project: Watermain extensions.
Consulting Engineers: Wyllie & Ufnal Limited, Ottawa.
Completed: Qctober 13, 1971.
Estimated Project Cost: $124,700.00.

COMBER (5-0148-71)

Description of Project: Trunk watermain and revisions to pumping station.
Consulting Engineers: LaFontaine, Cowie,Buratto & Associates, Ltd., Windsor.
Expected completion date – June 5, 1972.
Estimated project cost – $221,842.00.
The order to commence work was given on January 17, 1972 and by March 31, the pipeline was 99% complete.

CONISTON (2-0259-69)

Description of Project: Approximately 5,200 lin. ft. of sanitary relief sewers; 2,300 lin. ft. of 10-inch diameter forcemain, one custom built sewage pumping station and an extension to the existing sewage treatment plant.
Consulting Engineers: Canadian Mitchell Associates Ltd., Bramalea.
Expected Completion date: November 26, 1972.
Estimated Project Cost: $1,201,000.00.
Work commenced on October 4, 1971 and the contractor concentrated on installing relief sewers and the foundation of the plant extension. Progress has been good and is on schedule.



CORUNNA (2-0275-69)

Description of Project: Sanitary sewer extension.
Consulting Engineers: Nisbet, Letham Ltd., Sarnia.
Completed: February 1972.
Estimated Project Cost: $133,800.00.

DESERONTO (1-0010-66)

Description of Project: Sanitary sewers, pumping stations and treatment plant.
Consulting Engineers: Hisey & Barrington Ltd., Willowdale.
Contract 1 – Sanitary sewers, forcemain and pumping stations.
Estimated contract cost – $914,000.00.
Completed – December, 1971.
Contract 2 – Sewage Treatment Plant.
Estimated contract cost – $384,000.00.
Completed – October 1971.
Estimated Project Cost: $1,510,000.00.

DETROIT RIVER WATER WORKS SYSTEM (5-0026-66)

Description of Project: A system of treatment, distribution and storage of water to supply the Town of Amherstburg, the Township of Anderdon and the Township of Malden.
Consulting Engineers: C.G. Russell Armstrong Associates Ltd., Windsor.
Contract 1 – 500,000 Imperial gallon elevated tank.
Completed – January 16, 1970.
Final contract cost – $199,096.00.
Contract 2 – Trunk watermains.
Completed – February 17, 1970.
Final contract cost – $567,502.00.
Contract 3 – Water treatment plant.
Completed – September 15, 1971.
Final contract cost – $2,271,818.00.
Estimated Project Cost – $3,200,000.00.

DUTTON (1-0042-66)

Description of Project: Sewage collection system, pumping station and lagoon.
Consulting Engineers: James F. MacLaren Ltd., Toronto.
Expected completion date: September, 1972.
Estimated Project Cost: $482,000.00.
Work got under way in December and progress has been slow.

EAR FALLS (1-0061-67, 5-0031-67)

Description of Project: Municipal services for commercial area.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Completed: October 15, 1971.
Estimated Project Cost: $90,000.00

EGANVILLE (1-0007-66)

Description of Project: Sewage treatment plant and sewerage system.
Consulting Engineers: J.L. Richards & Associates Ltd., Ottawa.
Contract 1 – Sewers, forcemain and two pumping stations.
Completed – June 1, 1971.
Final contract cost – $562,756.93.
Contract 2 – Prefabricated sewage treatment plant.
Completed – December 1, 1971.
Estimated contract cost – $277,243.07.
Estimated Project Cost: $840,000.00.

ELGIN AREA WATER SUPPLY SYSTEM: (5-0002-65)

Description of Project: Water supply system from Lake Erie to the St. Thomas area.
Consulting Engineers: James F. MacLaren Ltd., Toronto.
Contracts 1 to 5, 8, 9 – Completed prior to 1969.
Contract 6 – Water treatment plant.
Completed – August 19, 1971.
Final contract cost – $3,123,760.33.
Cost of equipment purchased by OWRC – $446,000.00.
Estimated Project Cost: $12,000,000.00.

ELGIN AREA SECONDARY WATER SUPPLY SYSTEM (5-0087-68)

Description of Project: 20 miles of 12-inch diameter pipeline and an elevated steel tank to supply the Port Burwell area.
Consulting Engineers: James F. MacLaren Ltd., Toronto.
Contract 1 – 12-inch diameter pipe.
Completed – November 1, 1971.
Final contract cost – $1,093,399.65
Contract 2 – Elevated tank.
Completed – September 20, 1971.
Final contract cost – $195,891.50.
Estimated Project Cost: $1,500,000.00.

EMO (1-0047-66, 5-0017-66)

Description of Project: Complete sewage works and water works systems.
Consulting Engineers: W.L. Wardrop & Associates Ltd., Winnipeg.
Contract 1 – Sanitary sewerage and water distribution systems, sewage pumping station, sewage lagoon and raw water intake.
Completed – December 4, 1970.
Final contract cost – $577,138.00.
Contract 2 – Water treatment plant.
Completed – May 25, 1971.
Final contract cost – $242,645.00.
Estimated Project Cost: $947,574.00.



ESSEX (1-0056-66)

Description of Project: Trunk sewer, pumping station, forcemain and three lagoons.
Consulting Engineers: LaFontaine, Cowie, Buratto & Associates, Windsor.
Expected Completion Date: June 1972.
Estimated Project Cost: $340,000.00.
The order to commence work was given on November 4, 1971 and by the end of March construction was 70% completed.

FERGUS (2-0264-69)

Description of Project: Extension to the existing plant, including aeration tanks, secondary clarifier, return sludge pumping station and a new chlorine contact chamber.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Expected Completion Date: April 1972.
Estimated Project Cost: $345,000.00
Work commenced in May 1971 and progress was very good. All equipment in the new plant has been installed. The plant extension was put into partial operation in February.

FOREST (1-0122-67)

Description of Project: Sanitary sewer system, pumping station, forcemain and lagoon.
Consulting Engineers: Monteith-Ingram Engineering Limited.
Contract A – Sanitary sewer system, South half of the Town.
Expected completion date – March 1973.
Estimated contract cost – $593,200.00.
Contract B – Sanitary sewer system, North half of the Town.
Expected completion date – March 1973.
Estimated contract cost – $795,700.00.
Contract C – Pumping station, forcemain and lagoons.
Expected completion date – December 1972.
Estimated contract cost – $191,000.00.
Work commenced on all contracts in February 1972 and is proceeding on schedule.
Estimated Project Cost: $1,862,700.00.

GALT (6-0216-70)

Description of Project: 2.5 million gallon reservoir and pumping station.
Consulting Engineers: James F. MacLaren Ltd., Toronto.
Completed: September 1971.
Estimated Project Cost: $425,460.00.

GRAND VALLEY (1-0018-66)

Description of Project: Sanitary sewage works.
Consulting Engineers: Triton Engineering Services Ltd., Orangeville.
Contract A – Outfall sewer from the plant into the Grand River, sanitary sewers and services, underground pumping station and forcemain.
Expected completion date – June 1972.
Estimated contract cost – $517,348.86.
Work commenced in September 1971, and proceeded steadily with some interruption caused by weather conditions.
Contract B – Sewage treatment plant consisting of a sewage pumping station, oxidation ditch, grit channel clarifier, sludge storage tank, equipment building and a chlorine contact chamber.
Expected completion date – June 1972.
Estimated contract cost – $185,074.00.
Work commenced in September and proceeded steadily, until Mid-March when construction was suspended due to weather conditions.
Estimated Project Cost: $780,000.00.

HAMILTON (1-0215-69)

Description of Project: Extensions to the existing 60 MIGD primary treatment plant to provide secondary treatment facilities.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Expected Completion Date: Summer 1972.
Estimated Project Cost: $22,570,000.00.
The contract was awarded on January 15, 1970 and work started immediately. Progress has been very good and by the end of March about 97% of the work had been completed. The required completion date is July 20, 1973.

HEARST (1-0057-66)

Description of Project: Sanitary trunk sewers, pumping stations, lagoon.
Consulting Engineers: Northland Engineering Ltd., North Bay.
Expected Completion Date: August 1972.
Estimated Project Cost: $820,000.00.
The project was to be completed in 1971 but extremely unfavourable weather will result in a delay of completion to August 1972.

HESPELER (1-0033-66)

Description of Project: Trunk sewers and sewage treatment plant.
Consulting Engineers: Marshall, Macklin Monaghan Ltd., Don Mills.
Contract 1 – Trunk sewers.
Expected completion date – September 1972.
Estimated contract cost – $240,700.00.
Work commenced on November 15, 1971 and, following a three-month delay in delivery of pipe, satisfactory progress is now being made.
Contract 2 – Sewage treatment plant.
Expected completion date – September 1972.
Estimated contract cost – $915,200.00.
Work commenced in October 1971 and good progress on structural work has been achieved.
Estimated Project Cost: $1,300,000.00.

IGNACE (1-0060-67)

Description of Project: Sanitary sewerage, forcemain, sewage pumping station and a prefabricated sewage treatment plant.
Consulting Engineers: W.L. Wardrop & Associates Ltd., Thunder Bay.
Contract 1 – Sanitary sewers and forcemain.
Expected completion date – August 1972.
Estimated contract cost – $415,000.00.
Work started during the first week of October 1971 and due to winter weather conditions was closed down by the end of November.
Contract 2 – Prefabricated sewage treatment plant and a sewage pumping station.
Expected completion date – August 1972.
Estimated contract cost – $425,000.00
Work commenced just before the end of March.
Estimated project cost: $830,000.00.

INGERSOLL (1-0076-67)

Description of Project: Extension to existing sewage treatment plant and 36-inch diameter sanitary trunk sewer.
Consulting Engineers: R.V. Anderson & Associates Ltd., Toronto.
Contract A – Extension to sewage treatment plant.
Expected completion date – December 1972.
Estimated contract cost – $1,169,000.00.

Installation of piping and electric controls was under way.
Contract B – Trunk sewer.
Completed – November 1971.
Final contract cost – $137,995.95.
Estimated Project Cost: $1,560,000.00

KENT COUNTY REGIONAL WATER SUPPLY SYSTEM: (5-0022-66)

Description of Project: Intake works and pumping station at Lake Erie, together with a 36-inch diameter trunk watermain for the supply of raw water to the City of Chatham.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Contract 1 – Intake works.
Expected completion date – October 1972.
Estimated contract cost – $425,700.00.
The order to commence work was given on December 13, 1971 and on-shore work was in progress.
Contract 2 – Pumping station and flow regulating structure.
Expected completion date – December 1972.
Estimated contract cost – $1,500,000.00.
The order to commence work was issued on March 13, 1972.
Contract 3 – 36-inch diameter trunk watermain.
Expected completion date – December 1972.
Estimated contract cost – $3,080,000.00.
The order to commence work was issued on March 13, 1972.
Contract 4 – Standpipe.
Tenders will be called in June 1972.
Estimated Project Cost: $6,000,000.00

KINCARDINE (2-0282-70)

Description of Project: Sanitary sewers, factory-built underground pumping station with diesel standby generator and forcemain.
Consulting Engineers: B.M. Ross & Associates Ltd., Goderich.
Completed: February 1972.
Estimated Project Cost: $400,000.00

TOWNSHIP OF KING (6-0180-68)

Description of Project: Well pumping station.
Consulting Engineers: Totten, Sims, Hubicki & Associates Ltd., Whitby.
Completed: March 12, 1971.
Estimated Project Cost: $92,100.00.

LAKE TIMISKAMING WATER SUPPLY SYSTEM (5-0015-66, 5-0099-69)

Description of Project: Water supply system comprising a reservoir, treatment plant and watermains.
Consulting Engineers: Canadian Mitchell Associates Ltd., Bramalea.
Contract A – Water treatment plant in Haileybury.
Completed – November 1971.
Final contract cost – $1,052,869.00.
Contract B – 400,000 gallon below ground reservoir and pumping station in Haileybury.
Completed – November 1971.
Final contract cost – $262,765.00.
Contract C – 10-inch diameter trunk watermain from the reservoir to North Cobalt.
Completed – November 1971.
Final contract cost – $125,374.00.
Estimated Project Cost: $1,640,000.00.

LAKEFIELD (1-0062-67)

Description of Project: Sanitary sewers, pumping stations, forcemains and lagoon.
Consulting Engineers: R.V. Anderson & Associates Ltd., Toronto.
Contract A – Sanitary sewers, pumping stations, forcemain and lagoon.
Expected completion date – May 26, 1973.
Estimated contract cost – $940,070.65.
Contract B – Sanitary sewers.
Expected completion date – March 3, 1973.
Estimated contract cost – $748,145.00.
The contractor on Contract A started work in March 1972 so very little was completed by March 31, 1972.
The contractor on Contract B expects to start work in April 1972.
Estimated Project Cost: $1,950,000.00.

LITTLE CURRENT (2-0267-69)

Description of Project: Approximately 410 linear ft. of 10-inch diameter and 1,060 linear ft. of 8-inch diameter sewer together with service connections and manholes.
Consulting Engineers: Kilborn Engineering Ltd., Toronto.
Completed: December 21, 1971.
Estimated Project Cost: $98,000.00.
Work was commenced on August 12, 1971 and substantially completed on November 17, 1971.

LONGLAC (1-0014-66, 6-0189-68)

Description of Project: Sanitary sewerage and water distribution systems, forcemains, four pumping stations and a prefabricated sewage treatment plant.
Consulting Engineers: W.L. Wardrop & Associates Ltd., Thunder Bay.
Contract 1 – Sanitary sewers, forcemains and water distribution system.
Completed – November 30, 1971.
Final contract cost – $640,195.00.
Contract 2 – Prefabricated sewage treatment



plant and four sewage pumping stations.
Expected completion date – July 1972.
Estimated contract cost – $315,000.00
Pumping stations have been completed.
Estimated Project Cost: $1,200,000.00.

LUCAN (1-0107-67)

Description of Project: Extension to existing sewage collector system and lagoon.
Consulting Engineers: M. M. Dillon Ltd., London.
Expected Completion Date: August 1972.
Estimated Project Cost: $344,700.00.
Installation of the sewers is 60% completed.

MADOC (1-0017-66)

Description of Project: Sewage lagoon and gravity trunk sewer.
Consulting Engineers: J.D. Lee Engineering Ltd., Kingston.
Expected Completion Date: June 1972.
Estimated Project Cost: $173,000.00.
Work was delayed due to inclement weather and poor ground conditions.

MARKHAM (2-0279-70)

Description of Project: Construction of facilities for the removal of phosphates, as well as extending the present plant capacity from 0.8 to 1.2 MIGD.
Consulting Engineers: R.V. Anderson & Associates Ltd., Toronto.
Expected completion date: July 1972.
Estimated Project Cost: $230,000.00
Contractor started work early in February 1972. Some excavation and structural work was completed by the end of March 1972.

MARKHAM (6-0219-70)

Description of Project: Extension to existing watermains.
Consulting Engineers: York Engineering Limited.
Expected Completion Date: May 15, 1972.
Estimated Project Cost: $152,350.00.

MARMORA (6-0199-68)

Description of Project: Extension to existing watermains.
Consulting Engineers: R.V. Anderson & Associates Ltd., Toronto.
Completed: October 1, 1971.
Estimated Project Cost: $280,000.00.

MEAFORD (1-0003-66, 2-0251-68)

Description of Project: Sanitary sewerage works.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Contract A – Sewage treatment plant consisting of inlet works clarifiers, digester and control building.
Completed – January 29, 1971.
Final contract cost – $564,313.48.
Contract B – Outfall sewer from the plant into Georgian Bay, trunk sanitary sewer, factory built underground pumping station and about 5,000 lin. ft. of forcemain.
Completed – March 9, 1971.
Final contract cost – $445,485.46.
Estimated Project Cost: $1,158,000.00

TOWNSHIP OF MOUNTJOY (1-0123-67)

Description of Project: Extensions to sanitary sewerage system.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Completed: March 1972.
Estimated Project Cost: $575,000.00.

NANTICOKE AREA WATER PROGRAM (5-0109-69)

Description of Project: Water supply channel.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Expected Completion Date: July 1973.
Estimated Project Cost: $475,000.00.
The raw water channel, partly open and partly covered, was 90% completed.

NEELON & GARSON (2-0273-69)

Description of Project: A two-cell sewage lagoon of 50 acres in area, 1,706 lin. ft. of 12-inch diameter forcemain and related structures.
Consulting Engineers: Northland Engineering Ltd., Sudbury.
Completed: October 1971.
Estimated Project Cost: $312,000.00.

NEWMARKET

Description of Project: Addition of full scale nutrient removal facilities at the existing sewage treatment plant.
Completed: March 15, 1971.
Estimated Project Cost: $95,071.85.
The project was designed to remove phosphorus compounds from the sewage using the lime process developed by the Division of Research.

PICKERING (1-0015-66)

Description of Project: Extension to sewage collector system.
Consulting Engineer: Totten, Sims, Hubicki Associates Ltd., Whitby.
Expected Completion Date: June 1972.
Estimated project cost: $15,500.00.
The contract was executed in March.

PORT BURWELL (5-0013-66)

Description of Project: Water distribution system.
Consulting Engineers: Crysler, Davis & Jorgensen Ltd., Toronto.
Completed: October 22, 1971.
Estimated Project Cost: $315,000.00.

PORT COLBORNE (2-0243-68)

Description of Project: Rosemount Area sewerage system.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd., Don Mills.
Contract A – Three sewage pumping stations.
Completed – March 22, 1971.
Final contract cost – $274,431.96.
Contract B – Sanitary sewers and forcemain.
Completed – March 1, 1971.
Final contract cost – $906,343.51.
Contract C – Sanitary sewers.
Completed – March 1, 1971.
Final contract cost – $168,026.17.
Estimated Project Cost: $1,700,000.00.

PORT COLBORNE (2-0278-70)

Description of Project: Steele Street Sanitary sewer.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd., Don Mills.
Completed: April 30, 1971.
Estimated Project Cost: $75,000.00.

PORT COLBORNE (2-0276-70)

Description of Project: Extension of Rosemount South sewer area.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd., Don Mills.
Completed: July 19, 1971.
Estimated Project Cost: $170,000.00.

PORT COLBORNE (2-0260-69)

Description of Project: Modifications to Fretz and Elm Street sewage pumping stations.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd., Don Mills.
Completed: January 1972.
Estimated Project Cost: $60,000.00.

PORT PERRY (1-0005-66)

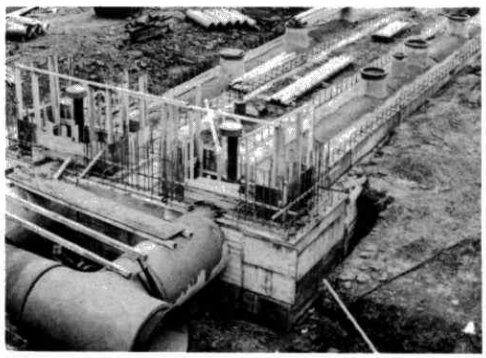
Description of Project: Sanitary sewers, forcemain, pumping station and lagoon.
Consulting Engineers: Canadian Mitchell Associates Ltd., Bramalea.
Completed: September 14, 1971.
Estimated Project Cost: $1,785,600.00.

PORT PERRY (1-0005-66)

Description of Project: Extensions to sewage collector system.
Consulting Engineers: Knox Martin Kretch Ltd., Bramalea.
Expected Completion Date: August 1972.
Estimated Project Cost: $107,000.00.
The contract was executed in March, 1972.

PORT ROWAN (1-0102-67)

Description of Project: A sanitary sewer system, pumping station, forcemain and lagoon.
Consulting Engineers: Woodstock Engineering Consultants Ltd., Woodstock.
Contract 1 – Sewers and pumping station.
Expected completion date – November 1972.
Estimated contract cost – $465,000.00.
The order to commence work was issued December 1, 1971, but work was suspended from early February until late March.
Contract 2 – Forcemain and lagoon.
Expected completion date – October 1972.
Estimated contract cost – $100,000.00.
Tenders are scheduled to be called in May 1972.
Estimated Project Cost: $651,000.00.



PORT STANLEY (1-0024-66)

Description of Project: Sanitary sewer system, pumping stations, forcemain and lagoon.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd., Don Mills.

Stage

Contract A – Three pumping stations.
Expected completion date – July 1972.
Estimated contract cost – $360,000.00.
Concrete work was completed on pumping stations and installation of equipment was in progress.
Contract B – Sewers.
Completed – December 13, 1971.
Final contract cost – $1,084,000.00.
Contract C – Sewers.
Completed – January 1972.
Estimated contract cost – $1,100,000.00.
Contract D – Lagoon.
Completed – November 19, 1971.
Final contract cost – $199,943.17.
Contract E – Sewer in tunnel.
Completed – November 1971.
Final contract cost – $195,394.20.
All road restoration has been deferred to spring 1972.

Stage II – Sewers, pumping station and forcemain.
Expected completion date – May 1972.
Estimated contract cost – $144,175.00.
Installation of sewers commenced December 12, 1971, and was completed by March 31, but testing is outstanding.
Estimated Project Cost: (Stages I & II) – $3,500,000.00.

PRESCOTT (1-0023-66)

Description of Project: Interceptor sewer, sewage pumping stations, and sewage treatment plant.
Consulting Engineers: J.D. Lee Engineering Ltd., Kingston.
Contract 1 – Sanitary sewers, forcemain, two factory built sewage pumping stations, and outfall to the St. Lawrence River.
Completed – March 1971.
Final contract cost – $675,236.00.
Contract 2 – Sewage treatment plant and two built-in-place sewage pumping stations.
Completed – November 1, 1971.
Estimated contract cost – $645,800.00.
Estimated Project Cost: $1,560,500.00.

RICHMOND (1-0044-66)

Description of Project: Sanitary sewers, forcemain, pumping station and lagoon.
Consulting Engineers: J.L. Richards & Associates Ltd., Ottawa.
Completed: April 1, 1971.
Estimated Project Cost: $641,800.00.

RICHMOND (1-0044-66)

Description of Project: Sewer Extensions.
Consulting Engineers: J.L. Richards & Associates Ltd., Ottawa.
Expected completion date: June 1972.
Estimated Project Cost: $104,000.00
The order to commence work was issued December 17, 1971 and the project was 90% completed by the end of March.



RICHMOND HILL (2-0256-68)

Description of Project: An 85 ft. diameter clarifier and ancillary works to increase capacity of the existing plant.
Consulting Engineers: Hisey & Barrington Ltd., Toronto.
Completed: July 1971.
Estimated Project Cost: $266,000.00.

ROCKLAND (5-0052-67)

Description of Project: Water treatment plant.
Consulting Engineers: J.L. Richards & Associates Ltd., Ottawa.
Expected Completion Date: June 1972.
Estimated Project Cost: $575,850.00.
Work commenced in July 1971. Installation of equipment was well advanced.

ST. JACOBS (1-0063-67, 5-0033-67)

Description of Project: Provincial water and sewage works.
Contract 1 – Watermains and sanitary sewers.
Consulting Engineers: LaFontaine, Cowie, Buratto Associates Ltd., Windsor.
Expected Completion Date – May 1972.
Estimated contract cost – $1,037,400.00.
Construction was 80% completed by the end of March.
Contract 2 – Water treatment plant and pollution control plant.
Consulting Engineers: Walter, Fedy, McCargar, Hachborn, Kitchener.
Expected completion date – July 1972.
Estimated contract cost – $495,400.00.
Construction was 55% completed by the end of the year.
Estimated Project Cost: $1,740,000.00.

ST. MARYS (1-0030-66, 2-0252-68, 2-0254-68)

Description of Project: Storm and sanitary sewers and pollution control plant.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Contract 1 – Sewers west of the Thames River.
Expected completion date – October 1972.
Estimated contract cost – $812,000.00.
Contract 2 – Sewers east of Thames River and North of Trout Creek.
Expected completion date – April 1972.
Estimated contract cost – $507,400.00.
Contract 3 – Sewers south of Trout Creek and between Thames River and CNR tracks.
Expected completion date – October 1972.
Estimated contract cost – $1,234,000.00.
Contract 4 – Sewers in the south east area.
Expected completion date – June 1972.
Estimated contract cost – $486,000.00.
Contract 5 – Pollution control centre.
Expected completion date – July 1972.
Estimated contract cost – $1,160,000.00.
Estimated project Cost: $4,200,000.00.

SEAFORTH (1-0071-67)

Description of Project: Sewage pumping station, forcemain and three 10-acre lagoons.
Consulting Engineers: James F. MacLaren Ltd., Toronto.
Expected Completion Date: November 1972.
Estimated Project Cost: $394,400.00.
Work started in December. The forcemain is installed and work on the pumping station excavation commenced.

SOUTH PEEL AREA SEWAGE SYSTEM PROJECTS (1-0053-66)
(The numbers below indicate sub-projects)

–01 – Extensions to the Lakeview water pollution control plant.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Contract 1 – Digestion, heating and grit removal facilities.
Completed – February 1972.
Estimated contract cost – $3,695,294.00.
Contract 2 – Settling and aeration works.
Completed – February 1972.
Estimated contract cost – $6,414,921.00.

–02 – North part of east trunk sewer.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Contract 4 – Dundas Street to Baseline.
Completed – December 17, 1971.
Final contract cost – $552,989.00.
Contract 4A – Section through Markland Woods Golf Course.
Completed – July 27, 1971.
Final contract cost – $624,111.03.
Contract 5 – Baseline Rd. to Brittania Road.
Completed – January 1972.
Final contract cost – $823,768.00.
Contract 6 – Brittania Road to Steeles Avenue.
Completed – January 1972.
Final contract cost – $891,550.00.
Contract 7 – Brittania Road to Brampton treatment plant.
Completed – January 1972.
Final contract price – $636,020.00.

–03 - West trunk sewer.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd. Don Mills.
Contract 9 – Clarkson W.P.C.P. to Southdown Rd.
Completed – January 1972.
Final contract price – $242,288.00.
Contract 10 – Southdown Road to Clarkson Road North (Tunnel)
Expected completion date – July 1973.
Estimated contract cost – $2,979,070.00.

This contract was awarded in September but got off to a slow start on account of negotiations in connection with sub-letting and a request by the contractor for a major change in the sewer alignment. By the end of the year the main access shaft had been constructed. The rate of tunnelling improved during early part of 1972.

Contract 11 – Clarkson Road North to Blyth Road (Tunnel)
Expected completion date – July 1973.
Estimated contract cost – $5,500,000.00.

Although this contract was awarded in August, construction did not start until December. Progress has been slow.

Contract 12 – Blyth Road to ½ mile north of Erindale W.P.C.P.
Expected completion date – October 1972.
Estimated contract cost – $953,462.00.

Work started in late November 1971 and continued at a good pace during early 1972.

Contract 13 – ½ mile north of Erindale W.P.C.P. to Streetsville, W.P.C.P.
Expected completion date – October 1972.
Estimated contract cost – $1,378,693.00.

Work started in December but ground conditions proved more difficult than anticipated and the contractor's initial progress was slow; however the scheduled rate of progress was maintained during early 1972.

–04 - Clarkson water pollution control plant.
Consulting Engineer: Gore & Storrie Ltd., Toronto.
Expected completion date – July 1973.
Estimated contract cost – $6,570,000.00.

Work started in February and good progress was achieved.

–05 – Chinguacousy Branch of East Trunk sewer.
Consulting Engineers: Canadian Mitchell Associates Ltd., Bramalea.
Expected completion date – November 1972.
Estimated contract cost - $572,548.00.

Tenders were received on March 30.

–06 – South part of East trunk sewer.
Consulting Engineers: Marshall Macklin Monaghan Ltd., Toronto.
Estimated construction cost – $3,500,000.00

Tenders have yet to be called.

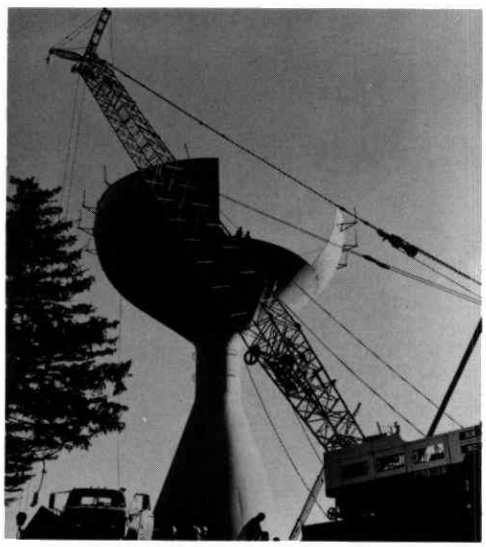
–07 – Lakeview W.P.C.P. extension to 50 MIGD.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Estimated construction cost – $6,500,000.00.

Tenders have yet to be called.

–08 – Modifications to Beach Street pumping station.
Consulting Engineers: McCormick Rankin & Associates Ltd., Port Credit.
Completed – February 1972.
Estimated contract cost – $25,000.00

–09 – Lakeview water pollution control plant. Sludge handling facilities.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Estimated construction cost – $5,500,000.00.

Tenders have yet to be called.



SOUTH PEEL AREA WATER SYSTEM PROJECTS (5-0020-66)

(The numbers below indicate sub-projects)

–02 – Lakeview water purification plant.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Contract 3 – Filters 11 – 18
Completed – June 30, 1971.
Final contract cost – $2,406,434.00.
Contract 4 – Additions to low and high lift pumping stations.
Completed – July 27, 1971.
Final contract cost – $722,564.00.

–06 – Beckett-Sproule reservoir and pumping station.
Consulting Engineers: W.O. Chisholm & Associates (Eastern) Ltd., Scarborough.
Contract 8 – Permanent pumping station and reservoir.
Completed – January 1972.
Final contract cost – $1,783,576.00.

–08 – Hanlan feedermain – Burnhamthorpe to Hanlan.
Consulting Engineers: Canadian-British Engineering Consultants (1971) Ltd.,Don Mills.
Contract 6 – Base Line to Hanlan.
Completed – November 24, 1971.
Estimated contract cost – $630,635.00.

–09 – Silverthorn pumping station revisions.
Consulting Engineers: Gore & Storrie Ltd., Toronto
Contract 9 – Discharge main.
Completed – July 27, 1971.
Final contract cost – $563,218.00.
Contract 10 – Increase in pumping capacity.
Completed – January 1972.
Final contract cost – $806,662.00.

–10 – Hanlan pumping station revisions.
Consulting Engineers: Proctor & Redfern Ltd., Toronto.
Expected Completion Date: April 1972.
Estimated Project Cost: $1,966,000.00.

Work continued steadily but the project was slightly delayed because of the crane operators' strike.

–15 – Herridge reservoir and pumping station.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Expected Completion Date: December 1972.
Estimated Project Cost: $3,159,000.00.

Work started on August 1, 1971 and continued on schedule for the rest of the year but the rodman's strike delayed progress in 1972.

–16 – Thomas Street reservoir feedermain.
Consulting Engineers: Marshall Macklin Monaghan Ltd., Toronto.
Completed: September 21, 1971.

Estimated Project Cost: $1,202,418.00.

–17 – Thomas Street reservoir and pumping station.
Consulting Engineers: R.V.Anderson Associates Ltd., Toronto.
Contract 11 – Reservoir.
Completed – January 1972.
Estimated contract cost – $611,145.00.
Contract 11A – Temporary pumping station.
Completed – October 1, 1971.
Estimated contract cost – $50,000.00.

–18 – Silverthorn 60" feedermain – Queensway to Silverthorn Crescent.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Completed: September 28, 1971.
Estimated Project Cost: $735,966.00.

–20 – Streetsville elevated tank.
Consulting Engineers: Gore & Storrie Ltd., Toronto.
Expected Completion Date: May 1972.
Estimated Project Cost: $350,000.00

Work was completed by March 31, 1972 except for the painting of the tank.

TILLSONBURG (1-0137-67)

Description of Project: Extension to sewage treatment plant, modifications to pumping station and new forcemain.
Consulting Engineers: R.V. Anderson & Associates Ltd., Toronto.
Expected Completion Date: April 1972.
Estimated Project Cost: $800,000.00.

All concrete work was completed. Installation of mechanical and electrical equipment was underway.

TRENTON (2-0272-69)

Description of Project: Extension to existing trunk sewers.
Consulting Engineer: Gore & Storrie Ltd., Toronto.
Completed: November 3, 1971.
Estimated Project Cost: $124,000.00.

WALLACEBURG (1-0087-67)

Description of Project: A sewage treatment plant, sewage pumping stations, forcemains and sanitary sewers.
Consulting Engineers: Todgham & Case Ltd., Chatham.
Gore & Storrie Ltd., Toronto.
Contracts 1, 2, 2A, 3, 4, 7 and 11 – Completed prior to 1971.
Contracts 5A, 5B and 5C – Sanitary sewers and forcemain.
Expected completion date – October 1972.
Estimated contract cost - $1,638,000.00.
Work started in November, with good progress being made on Contract 5B but slower progress on the other two contracts.
Contracts 6, 8, 9, 10 and 12 – Sanitary sewers and pumping stations.
Estimated contract cost – $1,800,000.00.
Tenders have not yet been called. Application for approval of expenditure on these works is with O.M.B.

WEST LORNE (1-0117-67)

Description of Project: Sewage collector system, pumping station and lagoons.
Consulting Engineers: LaFontaine, Cowie, Buratto & Associates Ltd., Windsor.
Expected Completion Date: August 1972.
Estimated Project Cost: $1,020,000.00.

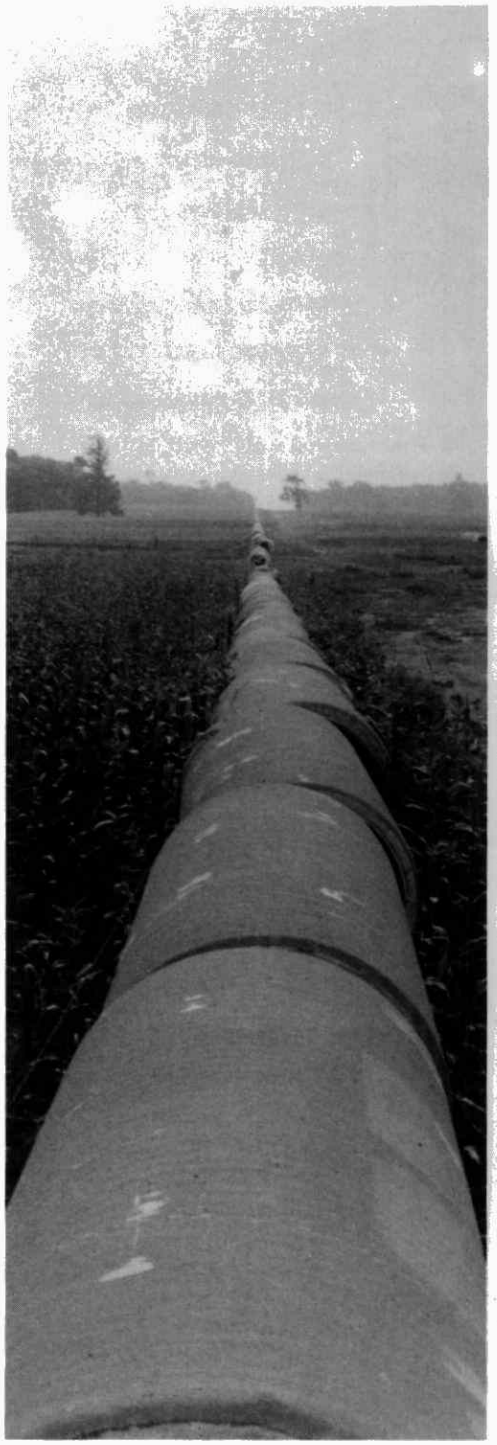
Difficulties had been experienced in ensuring that the contractor restored the disturbed areas to ensure minimum disruption and inconvenience. Work was suspended in February and March.

TWP. OF WICKSTEED (Hornepayne) (5-0131-70)

Description of Project: Extensions of watermain system.
Consulting Engineers: Kilborn Engineering Ltd., Toronto.
Completed: September 4, 1971.
Estimated Project Cost: $59,522.31.

WINCHESTER (1-0120-67)

Description of Project: Sewer system extensions (sewers, two pumping stations and second cell to lagoon).
Consulting Engineers: J.L. Richards & Associates Ltd., Ottawa.
Completed: December 1971.
Estimated Project Cost: $1,740,000.00.



Divisions of Finance and Administrative Services

DIVISION OF FINANCE
E.F. Heath, Director and Comptroller

DIVISION OF ADMINISTRATIVE SERVICES
L.M. Tobias, Director
G.W. Edwards, Assistant Director

The appointment during the year 1971 of a new Assistant General Manager – Finance and Administration, brought the divisions of Finance and Administrative Services under a single executive head. A review of the role of these two service organizations was started and some reorganization took place. These were:

– the development, under the Director of the Division of Administrative Services, of an operations research group. The first task of the head of this group was to set up a task force to determine how the Commission should go about planning. This task force consists of a six man team representing six of the Commission's divisions.

– the development within the Division of Finance of a Management Reporting Branch. This Division became responsible for the budget preparation and the monthly management report. Its prime objective is to take the wealth of data available within the Commission, particularly within the Division of Finance, and translate it into meaningful management reports.

– the placing of the balance of the accounting functions under the Assistant Director of Finance. These functions broadly break down into the General Accounting Branch and the Project Accounting Branch. This latter Branch is mainly concerned with the accounting for municipal and provincial water and sewage works projects.

– the placing, under the Assistant Director of the Division of Administrative Services, of all administrative services and office service branches. This structure leaves the Director with more time to devote to the major service areas and with less involvement in the smaller, but important, daily operating problems.

In addition, a review was conducted of the other branches within the two divisions to ensure that their activities were relevant and effective for the current organization. It is expected that this review will result in some modification of central services. Some other measures of progress and accomplishments are listed below:

– The development of a record and forms management program.

– The development of a computer-based water quality information system.

– The development of a computer-based water well data system.

– The development of a computer-based water quality simulation model.

– The development of a computer-based information system concerning consultants, contractors and bonding companies, utilizing the newly released "generalized information system" software.

– Improved efficiency and effectiveness in the Commission's library service.

– Increased emphasis on the management audit function in the Audit Branch.

– Significantly more interaction between the Division of Finance and other divisions in the senior management decision-making processes.

A general increase in workload took place in both divisions as a result of:

- an increase in the number of sewer and water projects managed, from 429 in 1970 to 462 in 1971, with 15 additional projects being taken over by March 31, 1972;
- an increase in information requirements for recent federal/provincial financial negotiations;
- the start of construction of the new $11 million Laboratory addition;
- the pending merger into the new Ministry of the Environment;
- the Divisions' involvement in the Task Force on Planning;
- expanded water programs such as the recreational lakes program and the research and treatability studies program under the Canada/Ontario agreement on the Lower Great Lakes.

These increases were met with no increase in the budget of the divisions.



Division of Industrial Wastes

D.P. Caplice, Director
H.A. Clarke, Assistant Director

The Division of Industrial Wastes is responsible for the administration of the OWRC industrial pollution control program and performs a regulatory function, principally under Sections 32, 42 and 69 of the OWRC Act, Revised Statutes of Ontario, 1970. The activities of the Division are coordinated by the Administration Branch and fall into three general areas: Field Services, Design Approvals and Special Projects.

The Field Services Branch regularly surveys all sources of industrial waste discharged to the aquatic environment and prepares reports describing the quality and quantity of the discharges. The status of pollution control at each industry is assessed and appropriate remedial measures are recommended where required to bring effluent quality in line with OWRC objectives. An extensive surveillance program is maintained throughout the Province to ensure continuous and satisfactory quality control on discharges to water courses. Problems associated with existing discharges of industrial wastes to municipal sewerage systems are investigated.

The Design Approvals and Special Projects Branch carries out the following functions: (a) it reviews engineering plans from industry where the effluent from the proposed treatment works is to be discharged to a watercourse or storm sewer, and issues certificates of approval under the terms of Section 42 of the OWRC Act; (b) it arranges public hearings concerning applications where the proposed treatment works are to extend from one municipality to another; and (c) it provides specialized technical appraisal of difficult waste control problems on an individual-company or industry-wide basis.

A more detailed account of the activities of the branches during 1971 and the first quarter of 1972 follows:

FIELD SERVICES BRANCH

Decentralization of the Division's field activities continued in 1971, with staff now being located in eight field offices. An office was opened in Kenora to serve the Province's far western resource-based industries of pulp and paper and mining. As noted in the 1970 annual report, closer attention is being given to local pollution problems, response to public complaints is more efficient, investiga-

tions of accidents and spills are conducted quickly and information dissemination programs are much improved. As the public become aware of the offices in their areas, staff are required to provide expanded services.

Field personnel conducted 97 full-scale surveys, made about 3,800 field contacts and produced 51 detailed industrial waste reports. The normal procedure was followed in forwarding copies of these reports to the companies in question, with the request that appropriate remedial actions be implemented to control the discharge of polluting materials. Field staff participated in 727 meetings with industrial officials and their consultants with a view to providing assistance in the development of acceptable waste treatment and disposal programs. Routine surveillance visits and unannounced spot-checks of industry continued in order to evaluate the efficiency of treatment plants and to monitor the quality of the effluent being discharged to receiving watercourses.

With the recently-passed legislation requiring industry, municipalities and persons to report unusual spills, many accidents of a type not previously reported are now brought to the attention of staff. Major accidents necessitate much time being spent in the investigation, implementation of remedial action and monitoring phases. As an example, the loss, on one occasion during the year, of approximately 1,000 tons of concentrated sulphuric acid to the Pickerel River because of a train derailment presented unusual problems and about 75 man-days were spent in the field before a satisfactory resolution of all matters was achieved. Some 235 complaints were received concerning a variety of pollution problems and 345 spills and accidents involving various materials were recorded.

Although industrial expansion slackened during the period because of economic conditions, staff provided important advice to a number of companies concerning the environmental suitability of sites for new plants, and also to municipalities regarding the controls which should be imposed on plants in order to protect sewage treatment systems.

Basic Iron and Steel

During the period, the basic iron and steel producers continued the comprehensive waste control programs which were initiated in 1969. Twelve certificates of approval were issued for waste control facilities valued at approximately $13 million, with works estimated at a further $5 million being under consideration.

At the Algoma Steel Corporation, Limited, in Sault Ste. Marie, improvements were made to the settling basin serving the bar and strip mill effluent, and an oil separator was constructed to serve the 166" mill. Development work was carried out on a basin for control of the heat output from a proposed oxygen steel plant, and on a clarifier for treating gas cleaning wastes. In addition, investigations continued on the slag bed treatment system for coke plant wastes, and acidification of the blast furnace cooling water for cyanide control.

Dominion Foundries and Steel, Limited, Hamilton, completed facilities for the reduction of waste constituents from the coke plant area. Ammonia is now removed from the coke oven gases, and new indirect gas cooling facilities have eliminated wastes formerly discharged to Hamilton Harbour. Two major items in the Company's program – a filtration plant for hot mill wastes and an acid regeneration plant – are under construction and nearing completion. A third major item – the treatment of cold mill wastes – was investigated and a suitable system has been designed for construction in 1972.

The Steel Company of Canada, Limited, also located in Hamilton, has completed an expansion to its acid regeneration plant. This has permitted the acceptance of pickling acid from other steel plants. Segregation of contaminated and uncontaminated wastes was accomplished from one blast furnace, and this reduced the loading on existing treatment facilities. The segregation is part of the overall scheme for the recycling of blast furnace wastes. Under construction were a filtration and recycle system for the Page Hersey Works in Welland, a filtration system for the proposed bloom and billet mill, additional cooling facilities for the coke plants and an oil treatment system. Investigations completed or initiated included the standby treatment facilities for the blast furnace area, the biological treatability of coke plant wastes, ion exchange for the tin line effluent, and alternative schemes for the control of cold mill wastes.

Atlas Steels in Welland began sewer segregation work which involved tunnelling under process areas. This is the first stage of the Company's program leading to a filtration system for the control of suspended solids and oil.



Chemical and Petroleum

The chemical and petroleum industries made considerable advances in the abatement of pollution. Sixty-two applications for the installation of pollution abatement works were approved, covering an estimated capital expenditure of approximately $8.5 million. This figure does not include the necessary annual expenditures for operating and maintaining treatment works at petroleum and chemical plants throughout the Province, nor does it include costs incurred to abate pollution by such measures as process modification, conservation and re-use of water and materials, and other procedures not requiring OWRC approval. Nevertheless, these latter measures are also very significant in controlling pollution and costs incurred are often very high.

Major pollution abatement projects were undertaken or completed during this period by the following companies: Sun Oil Company Limited, Sarnia; Imperial Oil Enterprises Ltd., Sarnia; Polymer Corporation Limited, Sarnia; Canadian Industries Limited, Township of Sombra; Dow Chemical of Canada, Limited, Sarnia; Allied Chemical Canada, Ltd., Amherstburg; BSAF Wyandotte Corporation, Wyandotte, Michigan, (wastes treated in the Township

of Sandwich West); Domtar Chemicals Limited, Beachville; Forsythe Lubrication Limited, Breslau; Bruce Heavy Water Plant, Township of Bruce; Dryden Chemicals Limited, Dryden; Puritan-Bennett Canada Limited, Township of Augusta; Howards & Sons (Canada) Ltd., Cornwall; and Du Pont of Canada Limited, Maitland.

Dow Chemical of Canada, Limited, in Sarnia started construction of a new multi-million dollar chlor-alkali complex that is scheduled for completion in early 1973. This facility will replace existing mercury-cell plants, thus eliminating the potential for mercury losses to the environment. In addition, the change in processing will lead to a significant reduction in the amount of chlorides discharged to the St. Clair River.

In the petroleum and petrochemical field, conventional waste treatment systems, which have been considered acceptable in the past, are now being augmented by additional facilities to provide for even better oil removal efficiencies. In this regard, filtration and air flotation systems have been installed or are being developed at Sun Oil Company Limited, Shell Canada Limited, Imperial Oil Enterprises Ltd., and Polymer Corporation Limited, in the Sarnia area.

More emphasis was placed on the removal of dissolved organics in petroleum and petrochemical plant wastewaters which contribute to toxicity, taste and odour problems and studies have been started by some companies to develop facilities to achieve the necessary improvement in effluent quality. During 1971, OWRC biologists conducted an intensive study on the St. Clair River, adjacent to one of the large petrochemical complexes, to assess more accurately the effects of such wastes on the aquatic environment. It is hoped that the results of this and other studies will provide some guidance in developing satisfactory control programs to deal with dissolved organics in wastewaters.

The petroleum and chemical industry continued to develop plans and procedures and install equipment to minimize the incidence of pollution due to factors such as spills and operational upsets. The establishment and improvement of effluent monitoring systems and the installation of dykes around storage areas represent significant undertakings in this area. Many marketing depots and bulk plants in the petroleum industry made progress by installing facilities to prevent accidental losses of materials to watercourses.

Deep-well disposal of chemical wastes in the Sarnia area continued to be a major issue of debate and staff spent considerable time in assisting in the development of guidlines for proper use of underground formations.

Food Processing

This industrial category includes meat, vegetable, fruit and milk processing plants, breweries and distilleries. Twenty-four certificates of approval were issued in 1971 and the first three months of 1972 by the Commission to industries in this category for the installation of treatment facilities costing approximately $1,000,000.

Continuing progress was made in the canning industry, with improved waste treatment facilities being installed at a number of the larger plants including Green Giant of Canada, Limited, in the Town of Tecumseh, Libby, McNeill & Libby of Canada, Limited, in Wallaceburg and H.J. Heinz Company of Canada Ltd., in Leamington.

In the meat processing industry, very few waste disposal problems remain to be corrected. Construction of waste treatment facilities at Tend-R-Flesh Limited in the Township of Wilmot was essentially completed in 1971, and pretreatment facilities were installed at Checkerboard Farms in Aurora to meet the municipal by-law limits for discharge to the municipal sewage treatment system. Sherwood Farms Ltd., formerly Dundas Producers Limited, a poultry processing plant in the Township of Beverly, tabled comprehensive plans for treatment of its wastes before discharge to Spencer Creek.

The waste disposal practices of the breweries and distilleries in the Province are generally satisfactory. Also, in the milk processing industry, nearly all plants now have treatment facilities, comprised, for the most part, of spray irrigation or other land disposal techniques. When operated properly, these systems provide adequate treatment; however, as mentioned in previous annual reports, constant monitoring of these systems is required, as it has been found that operators of land disposal systems do not always provide the attention which such systems constantly require. Little progress was made with the problem of whey disposal since area schemes designed to effect more efficient utilization of whey by converting greater quantities of this material into edible products did not materialize.

Mining and Metallurgical

This industrial classification includes limestone quarries, sand and gravel operations, hard rock mining and/or milling, and smelting and refining operations.

During the period, a total of 16 certificates of approval were issued to the mining industry. The estimated capital and engineering costs of the treatment works proposed in these applications totalled $15,971,000 and consisted of the following breakdown:

Timmins:	
(a) Ecstall Mining Ltd.	$11,390,000
(b) Noranda Mines Ltd. (Langmuir)	$322,000
Sudbury:	
Falconbridge Nickel Mines	$167,000
Elliot Lake:	
(a) Rio Algom Mines	$129,000
(b) Denison Mines	$46,000
Sturgeon Lake:	
Mattagami Mines Ltd.	$1,070,000
Thunder Bay:	
Inco – Shebandowan	$2,667,000

In addition, major applications for waste treatment systems under review will involve additional expenditures of about $5,300,000 by The International Nickel Company of Canada, Limited, in the Sudbury area.

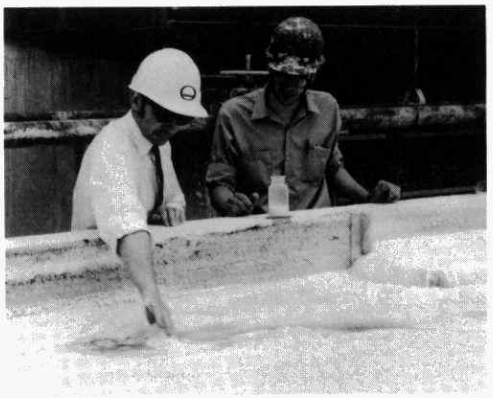
With a view to meeting increasingly stringent regulations, the mining industry is now recognizing the need to have long-range pollution control programs and many of the certificates of approval issued by the Commission cover operations for ten, twenty-five and even fifty years, depending on known ore reserves at the mines. These waste treatment systems cover all phases of operation, including start-up, operation of a tailings pond, chemical treatment and/or recycle of effluent waters when required, collection of seepage flows, stabilization of tailings dams, and rehabilitation of tailings

areas through revegetation schemes. Many mining companies have undertaken extensive greenhouse experimental programs to develop the necessary expertise for growing successful vegetative covers on tailings areas.

An updated water quality report was issued in 1971 on the effects of past waste disposal practices by the uranium mining camps in southern Ontario. It was concluded that the uranium mining and milling industry in the Elliot Lake area had caused serious damage to water quality and indigenous aquatic biota in the Serpent River basin through chemical and radioactive contaminants. In the Bancroft area, impairment of the aquatic environment was less extensive and was limited to the immediate vicinity of the tailings areas. Major progress has been achieved in alleviating adverse conditions over the past five years but further measures are required to correct the existing situation. The remaining operating uranium mining companies in the Elliot Lake area are carrying out good pollution control programs despite the depressed economic condition of the industry.

Pulp and Paper

Notwithstanding the construction of two new mills, there was a continuing reduction in the usage of water at the pulp and paper mills in Ontario, resulting in a net decrease of 10 million gallons per day, for a total water consumption by the industry of approximately 450 million gallons per day. There was also a net reduction in suspended solids discharges during 1971 of approximately 120 tons per day and this is directly attributable to the external waste treatment facilities completed at a number of mills. The present level of total suspended solids discharges is approximately 440 tons per day. Biochemical Oxygen Demand (BOD_5) levels associated with the total mill waste discharges show an increase of approximately 150 tons per day, resulting in a total level of approximately 1,120 tons per day. Most of this increase is attributable to improved sampling and analytical techniques. Sixteen certificates of approval for waste treatment works were issued during this period, involving an estimated expenditure of some $14,200,000. This raises the total number of certificates issued to this industry since 1965 to 46, involving an estimated total expenditure of approximately $29 million.



Industrial Waste Neutralization

Construction of two new mills was completed during 1971. A 100 ton-per-day tissue mill was brought into operation by Kimberly-Clark of Canada Limited, at Huntsville. Waste treatment facilities include vacuum filtration, clarification and polishing lagoons, with a large percentage of wastewaters being recycled. OWRC requirements for effluent discharge are being met with no difficulties. The Ontario-Minnesota Pulp and Paper Company, Limited, started up its new 500 ton-per-day bleached kraft pulp mill at Fort Frances in November. Waste treatment facilities include two parallel, 12-hour sedimentation ponds for suspended solids removal, followed by a 5-day aerated lagoon. Treated wastes are discharged to the Rainy River via a submerged diffuser outfall. Full production has not been achieved at the mill and an assessment of the efficiency of the waste treatment facilities is only in its initial stages.

During 1971, seven existing mills (exclusive of the two new mills) installed external facilities to treat waste effluents for the removal of suspended solids. Five of these mills installed mechanical clarifiers with vacuum filtration for sludge dewatering and the remaining two mills installed sedimentation lagoons. In addition, construction of mechanical clarification systems was started at four mills and these systems are expected to be in operation by the spring of 1972. Scheduled programs for the reduction of suspended solids at an additional four mills were established during 1971. Two other mills submitted technical programs but the scheduling of these has not been resolved. There are five remaining mills for which programs have not been received but, in each case, the companies are engaged in developing programs.

Only minor progress was made in the area of "secondary treatment" during 1971. Kraft mills are faced with an OWRC requirement to install five-day aerated lagoon systems and each mill in the Province has been examining the feasibility of implementing this requirement with respect to its particular problems. Feasibility reports and scheduled programs should be available during 1972 for these mills.

Although no secondary treatment facilities to reduce organic waste loads were installed at any of the existing pulp and paper mills during 1971, work commenced on the installation of a "Copeland" Chemical Recovery System to treat spent sulphite liquors at The Ontario Paper Company, Limited, mill in Thorold. This system is to be completed before the end of 1972.

The OWRC is faced with a major problem in formulating requirements for the many small sulphite-pulping operations, particularly at newsprint mills. Chemical recovery systems are favoured by the OWRC but the industry claims that capital and operating costs of such systems are high enough to force closure of some mills if these systems were made a mandatory requirement without accompanying government financial assistance. The very high cost of chemical recovery systems has caused two mills to investigate the feasibility of treating spent sulphite pulping liquors by biological oxidation. One mill, a neutral sulphite semi-chemical operation, has concluded bench-scale pilot studies and is presently operating a large-scale external pilot plant to determine optimum design parameters. The second mill, a magnesium-base bisulphite operation, is conducting bench-scale pilot studies on aerated lagoon systems and variations of the activated sludge process.

The Domtar Fine Papers, Limited, mill at Cornwall completed a major study which compared the effectiveness of various chemical treatment and biological oxidation systems in overcoming the problems of taste and odour and the tainting of fish flesh associated with its kraft hardwood and calcium-base sulphite pulping operations. This mill does not have land readily available for the installation of a 5-day aerated lagoon and the prime objective of the study was to find an alternative treatment system which would be acceptable to the OWRC.

The National Regulations for the Pulp and Paper Industry were promulgated in the fall of 1971. These regulations are expected to provide a long-awaited stimulus to the industry acreoss Canada and should assist the OWRC in resolving some of the outstanding problems, in view of the fact that the Ontario section of the industry has maintained in the past that it did not wish to put itself at an economic disadvantage by moving too far ahead of the rest of the country in pollution control.

Two diffuser outfall systems were installed at mills in 1971. OWRC staff played a major role in the design of these systems by promoting the use of scientific design principles to ensure that the diffuser outfall would provide the desired degree of dispersion in the receiving watercourses.

Commission Orders under Section 69 of the OWRC Act, RSO, 1970 Chapter 332 (formerly Section 50 of the OWRC Act, RSO, 1960 Chapter 281) were issued against four mills during 1971. In each case, these Orders were based on technical programs submitted to the Commission by the mills in question.

Secondary Industries

This industrial classification includes tanneries, textile mills, automotive industries, metal plating and fabricating plants, rendering plants, manufacturers of building products and service industries. Many of these industries discharge their wastes to local sewage treatment works, although pretreatment is necessary in some instances.

During the period, forty-one certificates of approval were issued for treatment works, involving estimated capital expenditures of approximately $13.5 million. The effluents from these works discharge to streams or watercourses as opposed to municipal sanitary systems. Some of the larger projects approved were for the Hydro Electric Power Commission (Pickering Generating Station); Dome Petroleum Limited, Township of Sarnia; Norton Company, Welland; and Androck Company Limited, Watford. Installation of major works approved in previous years was completed at Ford Motor Company of Canada Limited, Windsor; DeLong-Scovill Limited, St. Mary's; Windsor Chrome Plating Limited, Windsor; and Ford Motor Company of Canada Limited, Niagara Falls.

An investigation was carried out into the water pollution potential of the liquid fertilizer (aqua-ammonia) industry. It was concluded, after discussions with representatives of this industry, that it would be comparatively easy to upgrade present practices so as to eliminate wastes from processing and storage facilities.

Through consultation with the Ready-Mix Concrete Association of Ontario, the most desirable method of disposal of liquid wastes from this industry was found to be the sedimentation of the solids and re-use of the liquid portion of the wastes. Several companies have installed such a re-use system and others are actively considering it.

There was a noticeable improvement in the control of oily wastes from railway maintenance and fuelling stations as a result of preventative measures implemented over the past two years.

Enforcement Measures

Although co-operation from industry was good, in general, it was necessary to take legal action against firms which failed to develop satisfactory pollution abatement programs. In some cases, negligence or lack of supervision of employees resulted in pollution mishaps, and appropriate legal action was initiated.

Eighteen charges were laid against thirteen companies under Section 32 of the OWRC Act which prohibits the discharge of materials which may impair the quality of water. Convictions were gained on 15 separate counts and fines totally approximately $6,000 were levied.

Commission Orders under Section 69 of the Act were issued in 1971 to four pulp and paper mills and one mining operation in order to establish firm commitments for



abatement programs. This Section permits the Commission, with the Minister's approval, to order a company to adopt measures to eliminate or control pollution within a stated time schedule. These companies were permitted hearings before the Commission to state their cases before the final Orders were issued.

Amendments were made to the OWRC Act in late 1970, which provided for substantially increased fines ($5,000 – first offence; $10,00 – second offence) and imposed a requirement on industry to report unusual spills of materials without delay to the OWRC. Both of these measures appear to have had the desired effect in that companies are now much more cognizant of their responsibilities with respect to pollution control. A great many more spills were reported and it was possible to initiate corrective action more promptly. In addition, many firms began to examine the potential for spills and accidents in their plants in an attempt to prevent these accidents from occurring.

DESIGN APPROVALS AND SPECIAL PROJECTS BRANCH

(a) Design Approvals

Control of industrial waste disposal is regulated through the administration of Section 42 of the OWRC Act which requires industries to submit application to the Commission for approval of plans for the collection, transmission, treatment and disposal of industrial wastes. Applications are reviewed by this Branch, and if found satisfactory, certificates of approval are issued. Prior to the approvals being issued, however, consideration is given to the holding of public hearings under Sections 43 and 44 of the Act. Hearings are mandatory on industrial applications if the treatment works are to extend across municipal boundaries but optional in other cases where the Commission deems it desirable to have the public informed of such matters.

News releases announcing OWRC approvals are prepared to inform industry, other government agencies and the public of the continuing growth of industrial waste treatment in the Province.

Table I summarizes the activity of the Branch and the applications processed in 1971 and the first quarter of 1972. Table II presents a breakdown, by industrial classification, of the 171 certificates issued involving estimated expenditures of some $56,300,000. In addition, concurrences were given with respect to 41 other submissions involving an estimated cost of approximately $2,300,000. These latter facilities were not subject to Section 42 of the Act as they were classed as non-effluent systems – that is, systems involving wastewater re-use, in-plant control measures, or pretreatment with discharges to municipal sewage treatment plants. At the end of March, 1972, 38 applications were outstanding, involving an estimated expenditure of $19,600,000. Since the inception of the issuance of certificates of approval in mid-1965, 624 certificates have been approved involving an estimated cost of $127 million. Figure I graphically represents the progress made in this area.

The largest single proposal for an industrial waste treatment system in terms of cost – $11,400,000 – was made by Ecstall Mining Limited, a wholly-owned subsidiary of Texas Gulf Sulphur Company, which is a zinc mining and refining complex processing approximately 10,000 tons of ore per day in the Timmins area. The system was designed to handle tailings from the mill for a 50-year period and also process wastes from a new zinc refinery to be established adjacent to the mill. The Company proposed a four-square mile tailings impoundment basin to serve both the existing milling and the new refining operations since there is insufficient capacity in the existing basin. Seepage from the dams forming the basin will be collected in a series of perimeter ditches and returned to the impoundment basin. To conserve storage volume, the tailings from the concentrator will be thickened in a 360-foot diameter clarifier and will be discharged at the centre of the basin to form a "cone of tailings" with the apex in the middle and the sides spreading out towards the periphery dams. Wastewaters from the zinc plant will be neutralized and clarified and then discharged to the same impoundment basin. Upstream of the basin decant structures, a pumping station will be installed to recycle a major portion of the wastewater to the mill for re-use. Lime addition facilities will also be provided to precipitate heavy metals and to ensure an acceptable effluent discharge to the Porcupine River. A public hearing was held on the application in Timmins and, as no objections were expressed, the application was subsequently approved and the company proceeded with construction. The system is expected to be completed by the summer of 1973 and will convert the mill to a substantial water re-use program while upgrading the quality of its effluent discharges.

An application from Sherwood Farms Ltd., formerly Dundas Producers Limited, a poultry processor in the Township of Beverly, exemplifies the co-operative effort required between industry, consulting engineers, government agencies and the public, if suitable waste treatment programs are to be developed. During the period that the company was investigating improved waste treatment facilities, the Hamilton Regional Conservation Authority announced the development of a multi-purpose recreational area on Spencer Creek to serve the City of Hamilton and adjacent municipalities. The company, which was located on this creek,

TABLE 1
SUMMARY OF PROJECTS FOR JAN 1. 1971 – MAR. 31, 1972

	Items	Estimated Capital Cost
Applications outstanding as of December 31, 1970	46	
Applications received – Jan. 1, 1970 – Mar.31,1972	220	
Total	266	
Certificates of Approval issued	171	$56,258,500
Applications reviewed – Concurrence given	41	$ 2,322,700
Total	212	$58,581,200
Applications reviewed – Approval not given	16	
Applications outstanding as of March 31, 1972	38	$19,600,000
Project Meetings	231	
Public Hearings	4	

TABLE 2
CERTIFICATES ISSUED JAN. 1, 1971 – MAR. 31, 1972

Industrial Classification	Number of Certificates	Capital Cost
Basic Iron and Steel	12	$13,105,500
Chemical	32	4,300,000
Food Processing	24	1,002,100
Metal Working, Plating and Finishing	12	528,250
Mining and Metallurgical	16	15,970,700
Miscellaneous Manufacturing	16	689,100
Petroleum	30	4,236,000
Pulp and Paper	16	14,230,600
Service Industries	11	2,042,700
Tanning and Rendering	2	151,500
TOTAL	171	$56,258,500

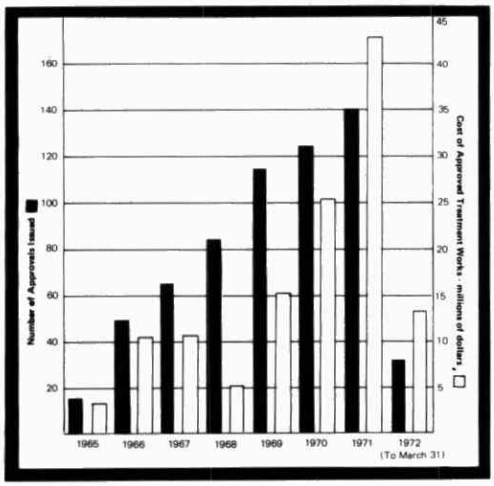


FIGURE 1.
Certificate of Approval
and Estimated Cost of Treatment Work
July 65 - March 72

was required to provide a non-effluent system and thereupon investigated this approach with the assistance of soils experts. However, insufficient land of a suitable type was available and, as a result, the company presented eight alternative treatment systems to the OWRC, all with discharges to Spencer Creek. These alternatives were presented through a consulting engineer who had completed extensive in-plant, waste treatability and receiving watercourse studies. A public hearing was held to afford an opportunity for all interested parties to become aware of the Company's plans and to make any comments or representation to the Commission concerning the proposed treatment facilities. Subsequent to the hearing, the company modified its plans and proposed additional advanced waste treatment facilities. The system eventually approved by the Commission included wastewater screening, equalization, activated sludge biological treatment, chemical precipitation for phosphorus removal, secondary settling, multi-media filtration and chorination. Conditions attached to the approval certificate limit the company's effluent discharge to existing levels, hence no expansion can take place until the first stage treatment facilities have been fully tested and proven adequate. The approval also requires emergency wastewater holding provisions, operator training, plant shutdown under certain circumstances, continuous effluent monitoring and liaison with the Hamilton Regional Conservation Authority. The system, estimated to cost the company $170,000, will be operational by the summer of 1972 and is expected to produce an effluent in keeping with the water quality criteria for a recreational watershed.

In accordance with the terms of The Pollution Abatement Incentive Act, 1970, the Design Approvals Branch continued the function of reviewing applications from industry for grants up to the equivalent of the retail sales tax on equipment installed for pollution abatement purposes. Recommendations were made for grants totalling some $556,000 relative to 226 applications.

(b) Special Projects

Acid Mine Drainage

Considerable effort was directed in 1971 toward the growing problem of acid mine drainage from the uranium and base-metal mining and milling operations in Northern Ontario. Two technical papers were presented at conferences on this subject during the year. In addition, a very detailed report entitled "The Problem of Acid Mine Drainage in the Province of Ontario" was initiated early in 1971 and was published in the first quarter of 1972.

Mineral Industries Information Study

A twenty-one page questionnaire, designed to obtain precise information from any mining company coming into production, was completed and now serves as a formal part of the design approval system. Two other questionnaires (one designed to obtain detailed water use information at mining operations, the other related to tailings area size, extent of revegetation, etc.) were completed and sent to all significant mining operations in the Province. A response of almost 100 percent was obtained.

Toxicity of Mine-Mill Reagents

A major report entitled "The Toxicity of Mine-Mill Reagents" was initiated in 1971. Samples of all reagents that find significant use in the mining industry in the Province of Ontario were obtained and multiple bioassays were conducted on each reagent. Work on this report is nearing completion.

Wastewater Recycle in Mining

The discharge of large quantities of dissolved salts from the mining industry in Northern Ontario can pose problems to aquatic life in these soft water areas. The benefits to the lakes and rivers of wastewater recycle were brought more vigorously to the attention of the mining industry during the year, wherever possible. As a result, several mining operations, both active and in the design stage, are or will be shortly on wastewater recycle, in varying degrees. An intensive study on this matter is planned for 1972.

Effluent Requirements for Mining Industry

Much time was spent in developing specific effluent requirements for the mining industry in Ontario. It is anticipated that this work will be completed in 1972.

Advisory Committee on Energy (Energy and Environment Subcommittee)

Staff represented the OWRC on the Energy and Environment Subcommittee of the Advisory Committee on Energy. The Subcommittee is carrying out a study into the probable environmental impact associated with energy usage to the year 1991. The OWRC input consists of an assessment of the environmental impact on water quality arising from the obtaining, processing, and utilizing the energy content of coal, oil, natural gas, uranium and hydro power.

Task Force on Generating Station Siting

Staff of the Division represented the OWRC on an interdepartmental Task Force on Generating Station Siting which was formed to ensure that adequate consideration is given to all relevant factors for station sites recommended by Ontario Hydro. The Task Force is currently developing criteria for quantitatively evaluating the suitability of recommended sites.

Bruce Heavy Water Plant Safety Advisory Committee, Reactor Safety Advisory Committee

The Bruce Heavy Water Plant Safety Committee and the Reactor Safety Advisory Committee, established by the Atomic Energy Control Board (AECB) to ensure that the design, construction, and operation of the Bruce Heavy Water Plant and Nuclear Power Reactors, respectively, are as safe as possible, met on numerous occasions. Items of direct concern to the OWRC which were considered at these meetings included a treatment system for removal of hydrogen sulphide from the heavy water plant effluent, and the release of radioactivity to the aquatic environment from nuclear reactors.

Canada-U.S. Working Group on Great Lakes Pollution

As in 1970, staff were active in the sub-groups formed by the Canada – U.S. Working Group on Great Lakes Pollution. The report of the sub-group considering "Pollutant Materials – Handling Hazards on Land" was finalized. In addition, staff were represented on the sub-groups concerned with "Water Quality Objectives", "Contingency Planning", "Pollutant Materials – Handling Hazards on Water", and "Co-ordination of Action to meet Special Situations". Staff are continuing work on the water quality objectives for radioactivity in the Great Lakes basin. This remains as one of the last items to be finalized by the sub-group concerned with Water Quality Objectives.

Task Force Hydro

An 'OWRC Brief to Task Force Hydro" was prepared in co-operation with other OWRC personnel. The brief outlines a number of areas of special concern to the OWRC such as use conflicts created by siting, the discharge of heat, radioactivity and other contaminants, and the adverse effects of streamflow regulation and diversion. The brief also contains the OWRC recommendation that Ontario Hydro place increased emphasis on environmental matters to ensure that the development of exponentially increasing power generation capacity does not lead to serious environmental problems in the future.

Thermal Discharges

Considerable progress was made in the matter of thermal discharges during the period. The scope of environmental studies necessary to ensure that serious problems would not arise due to the development of generating station sites was finalized in discussion with Ontario Hydro. These studies will determine the suitability of proposed sites from an aquatic environment viewpoint and will enable the plant to be designed to eliminate or minimize thermal pollution problems. Environmental baseline studies in Lake Erie, off the Nanticoke area, continued and a report will be issued in the fall of 1972 describing physical, chemical and biological conditions prior to the start-up of the Nanticoke Generating Station.

Radioactivity Releases

Work continued with the Atomic Energy Control Board and other federal and provincial government departments to establish comprehensive radioactivity surveillance programs at nuclear generating stations in Ontario. In this regard, a routine effluent sampling program is expected to be underway by mid-1972. Based on available information, it is known that radioactivity release rates have been well below the permissible limits set by the AECB; however, staff will continue to explore the possibility of reducing even further the discharges of radioactivity to the aquatic environment.

Contingency Planning

The Interim Province of Ontario Contingency Plan for spills of oil and other hazardous materials was published in June and given wide distribution. It was recognized during the preparation of the Contingency Plan that use should be made of the resources available to other government departments. The Interdepartmental Task Force on Contingency Planning was therefore formed to consider all aspects of contingency planning and to ensure that a fully co-ordinated provincial effort could be mobilized in the event of a major spill in provincial waters. One of the most significant events occurred in December when the Lambton County Regional Operations Team (ROT) was formed. The ROT, consisting of members of the OWRC, the Federal Department of Transport and the Ontario departments of the Environment, Transportation and Communication, and Lands and Forests, will be the technical team on the scene of a major spill. It is expected that similar teams will be established throughout the Province by the fall of 1972, following which the Ontario Contingency Plan will be published in its final form.



Industrial Wastes Sampling

Aromatic Chlorinated Hydrocarbons

Documentation of the usage and disposal practices of polychlorinated biphenyls (PCBs) in the industrial sphere continued during the year. Work was also started on assembling information on hexachlorobenzene and hexachlorobutadiene (HCBs).

Division of Laboratories

J. H. Neil, Director
G. C. Ronan, Assistant Director

Metals

Potential mercury and cadmium losses from industry were monitored closely, and a study was completed on the quantities and fate of metals such as zinc, nickel, chromium and copper in municipal sewerage systems. From the sewage treatment plants examined, it was clear that the majority of such metals were removed in the treatment process, with only minor concentrations remaining in the STP effluents. Further studies are required on a number of related issues, including the disposal of metal residues retained in sewage sludges.

Specialty Chemicals

Preliminary investigations have been conducted into the potential environmental effects of the wide variety of special purpose chemicals used in industry. These chemicals may be used for boiler and cooling water treatment, as corrosion inhibitors, as agents for the control of slime growths in process streams and equipment, as cleaners, for metal treating and in a variety of other specialized applications. At present, such usage is essentially unregulated, except in specific areas which may have implications in public health or agriculture. The purpose of these investigations is to assess the pollution effects of certain specialty chemicals occurring in industrial waste discharges with a view to developing guidelines for proper usage so as to ensure the adequate protection of the environment.

Conferences and Courses

The 18th Annual Industrial Wastes Conference, the only conference of its kind in Canada, was held in June 1971 in Niagara Falls and attracted 360 registrants. This conference continues to serve as a most useful forum for the exchange of ideas and practical experience in pollution control. Staff of the Division play a lead role in the selection of speakers and topics for discussion at the conference. In addition, the Division successfully organized the third Industrial Waste By-Law Enforcement Course in Toronto. Fifty-four persons representing municipalities, industries and consulting engineers attended. The demand for this course suggests that it will be repeated again in 1972.



The Division of Laboratories provides analytical services to support the water quality management programs of the OWRC operating divisions. Four branches operate within the Division: the Chemistry I Branch, which analyses samples for all the routine chemical parameters associated with water quality and pollution control; the Chemistry II Branch, which performs a wide spectrum of complex tests on water and wastewaters; the Bacteriology Branch, which provides a routine analytical service to determine the bacteriological quality of municipal waters, surface waters and wastewaters; and the Biology Branch, which is responsible for assessing the biological aspects of water supply and pollution control.

In addition to the above functions, staff of the laboratory play an important role in supplying some of the specialized scientific expertise necessary to successfully carry out the various Commission pollution abatement programs. Staff also work on a co-operative basis with personnel from other divisions in planning, organizing and implementing a variety of field programs.

The Division of Laboratories operates two regional laboratories, one in London, the other in Thunder Bay. Staff at these laboratories handle local routine water and pollution analyses and also carry out biological field studies.

The growth in demand for analytical services and the need to develop more sophisticated analytical procedures to monitor the rapidly growing number of pollutants in the environment created a need for additional laboratory space. Treasury Board approval was granted to proceed with construction of a new laboratory wing and research test area, and work commenced late in 1971.

Numerous requests were received to visit the laboratory facilities. Division staff provided lectures and group tours to interested parties.

The Division co-operated in developing an automated data handling system for processing all the laboratory analytical work. Pending Treasury Board approval, the laboratory will shortly implement this data handling system, thereby providing a facility capable of maximizing the use of available scientific data for management purposes.

TABLE 1

NUMBER OF SAMPLES

	1970	1971*
Bacteriology	53,791	85,364
Biology	11,168	13,832
Chemistry	77,866	110,533
TOTAL	142,825	209,729

NUMBER OF TESTS

	1970	1971*
Bacteriology	204,964	269,134
Biology	19,580	27,230
Chemistry I	495,040	652,275
Chemistry II	64,778	93,950
TOTAL	784,362	1,044,458

An increase occurred in both the number of samples processed and the tests performed. Table 1 and Figures 1 and 11 indicate in some detail the sources and types of samples processed and tests performed.

A significant feature of the laboratory operation was the major effort put forward by laboratory staff in acquiring, equipping and maintaining three mobile laboratories for field use. The laboratories were stationed at various locations in the Muskoka – Rideau – Haliburton – Kawartha regions throughout the summer and fall. On-site analysis was carried out on twenty-seven lakes which were surveyed as part of the Recreational Lakes Program.

SUMMARY OF SAMPLE SOURCES

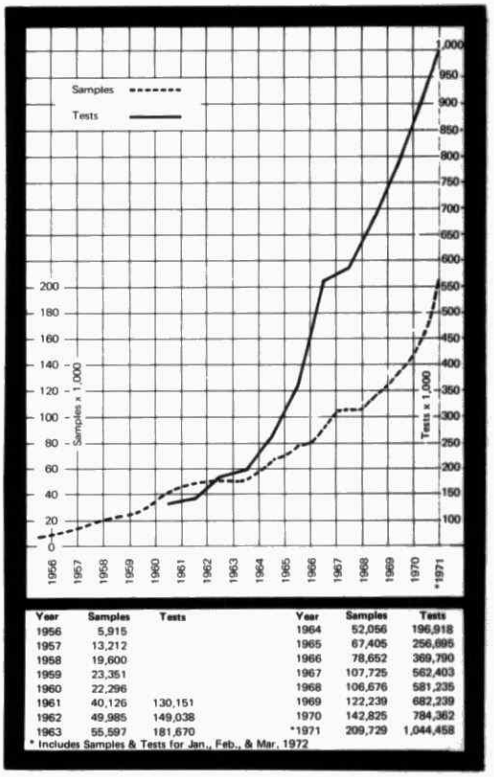
OWRC Divisions	Bacteriology	Chemistry	Biology	Total
Sanitary Engineering	38,677	34,565	234	73,476
Plant Operations	11,564	12,629	7	24,200
Research	761	13,778	163	14,702
Industrial Wastes	71	6,606	30	6,707
Laboratories	422	21,033	10,416	31,871
Water Resources & Others	1,081	2,010	271	3,362
OWRC Sub-Total	52,276	90,621	11,121	154,318
Non-OWRC Agencies				
Ontario Government	2,144	4,238	1,518	7,900
Federal Government	391	915	832	1,381
Municipal	28,210	11,698	1,034	40,942
Commercial	727	2,016	26	2,769
Private & Misc.	1,316	1,045	58	2,419
non-OWRC Sub-Total	32,788	19,912	2,711	55,411
TOTAL	85,364	110,533	13,832	209,729

SAMPLE DISTRIBUTION BY LABORATORY

Year	Toronto Lab	London Lab	Thunder Bay Lab	Mobile Lab	Total Labs
1971*	164,911	18,496	10,359	15,963	209,729
1970	114,680	15,268	7,320	5,557	142,825
1969	104,539	15,430	2,270		122,239
1968	93,313	13,363			106,676
1967	93,289	14,436			107,725
1966	72,300	6,352			78,652
1965	67,405				67,405
1964	52,056				52,056

*1971 figures include January, February & March of 1972

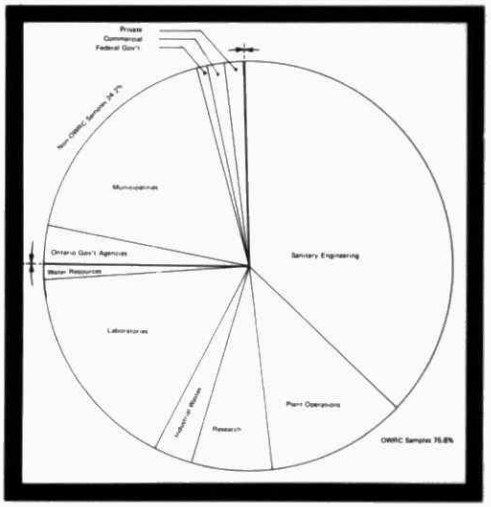
Fig. 1.
Annual Samples Received and the Number of Tests Performed. (1956-1971)



Year	Samples	Tests	Year	Samples	Tests
1956	5,915		1964	52,056	196,918
1957	13,212		1965	67,405	256,695
1958	19,600		1966	78,652	369,790
1959	23,351		1967	107,725	562,403
1960	22,296		1968	106,676	581,235
1961	40,126	130,151	1969	122,239	682,239
1962	49,985	149,038	1970	142,825	784,362
1963	55,597	181,670	*1971	209,729	1,044,458

* Includes Samples & Tests for Jan., Feb., & Mar. 1972

Fig. 2.
Summary of Sample Sources



BACTERIOLOGY BRANCH

The number of samples and determinations conducted in the Bacteriology Branch showed an increase, as in previous years. The sample increase was mainly due to more samples being derived from lake, river, sewage and solid waste management sources. The determinations increase was due to more samples being analysed for three pollution indicator groups, namely coliforms, fecal coliforms and fecal streptococci. A large portion of the increase in sample numbers was due to the Recreational Lakes' Program.

An increase in sample submissions occurred at both the London Regional Laboratory and the Thunder Bay Regional Laboratory. These laboratories also performed analyses on a larger number of samples for coliforms, fecal coliforms and fecal streptococci.

Drinking Water Section:

Quarterly reports on the drinking water quality of samples submitted by various municipalities to the OWRC Bacteriology Branch were distributed to district engineers in order to assist them with their evaluation of the effectiveness of respective water treatment plants.

Meetings were held with the district engineers to discuss the OWRC (bacteriological) Drinking Water Objectives. The objectives were revised to permit the use of the presence-absence (P-A) test results in evaluating the quality of drinking water supplies.

About 25 additional municipalities were notified that their drinking water samples would be receiving presence-absence (P-A) tests, bringing the total number of municipalities receiving this type of analysis to over 110.

A paper was prepared for the Sixth Water Works' Seminar on "Biological Problems in Water Supplies". The topic discussed was "Bacteria and Viruses in Water Supplies" and dealt with practical examples of pollution indicator bacteria in municipal supplies. The value of doing analyses for a variety of organisms other than coliforms was also discussed in the paper with respect to overall water quality including pathogenic bacteria, viruses and nuisance organisms. Lectures were also given at the Senior Water Works' Course and a Water Well Contractor's Conference.

River Section:

The bacteriological data from surveys of the Ottawa River were compiled and analysed and material was generated for both the Part 1 and Part 2 of the Ottawa River reports.

Intensive surveys were completed on the East River. Results for coliforms, fecal streptococci, sulphur oxidizers, sulphate reducers and cellulose decomposers were compiled and these results are being analysed and compared with the previous year's data. A report is in preparation.

A survey of various watercourses emptying into Lake Simcoe from the south was undertaken, in co-operation with the Department of the Environment. The information gathered from this survey was to be used in conjunction with a study of the water quality of Lake Simcoe organized and completed in co-operation with the Biology and the Water Quality Surveys branches. Monitoring runs were made every two weeks (from May to September) of the entire lake as well as eleven-day intensive surveys of Cook Bay, Shingle Bay and Kempenfeldt Bay. The data have been compiled and analysed and a report was submitted to the Canada, Ontario, Rideau, Trent, Severn Committee (CORTS).

Recreational Lakes Program:

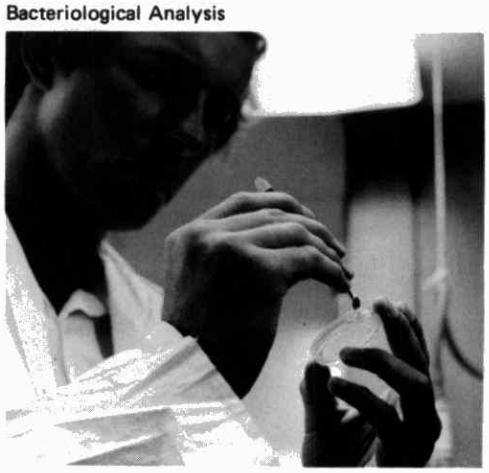
During the summer of 1970, as a result of the "Report of Advisory Committee on Pollution Control on Environmental Management of Recreational Water in Cottage Areas of Ontario", bacteriological surveys were carried out on fifteen lakes in Southern Ontario. Analysis of the bacterial results and other information from these surveys was initiated in September 1970 with the first report on Stony, Clear and Lovesick lakes being completed in late 1970. Reports on Cameron Lake, Balsam Lake, Sparrow Lake, Riley Lake, Bass Lake, Kushog Lake, Jack Lake, Steenburry Lake, Otter Lake, Six Mile Lake and Lower Beverley Lake were completed in 1971.

In the early reports, geometric mean bacterial levels at individual stations were used for the interpretation of the quality of the lake water. Later reports introduced additional concepts of statistical summarization. Bacterial counts were used as replicate results representing a station or geographic location which in the analysis of variance allowed for the grouping of stations on the basis of similar bacterial populations. These groupings were then used as entities in the interpretation of water quality and to assess pollution inputs.

Because of increased statistical and computational facility required for the analysis of variance, a computer program for this analysis (ANOVA–CRE) was organized with the aid of a statistician at the University of Toronto. After initial runs and modification at the University of Toronto, the computer program was transferred to the Department of Highways for more extensive testing and operations. This computer program was being run with the 1971 recreational lakes data and was appended to the water quality data retrieval system of the OWRC for future use with the system.

Plans for three new mobile laboratories were drawn up and construction of these laboratories was completed in time for the 1971 May surveys. A staff of twelve people were required for the operation of the mobile laboratories. Responsibilities included undertaking the field analysis, keeping the units supplied with media and equipment, compiling and sorting data and keeping the trucks and trailers in good condition for travelling around to the various lakes.

Bacteriological Analysis



Meetings were held with the District Engineers Branch, and sample stations were designated and locations and facilities for mobile laboratories were organized. A total of 23 lakes were surveyed three times during 1971, before, during and after the peak recreational use, for periods of five or eleven consecutive days. A further four lakes were surveyed twice for five consecutive days each and a special eleven-day survey was completed on Muskoka Bay. The results were compiled, organized and sent to the Systems and EDP Branch for analyses by the ANOVA–CRE program. Further manual analyses and the writing of the reports are in progress.

Self-Help Program:

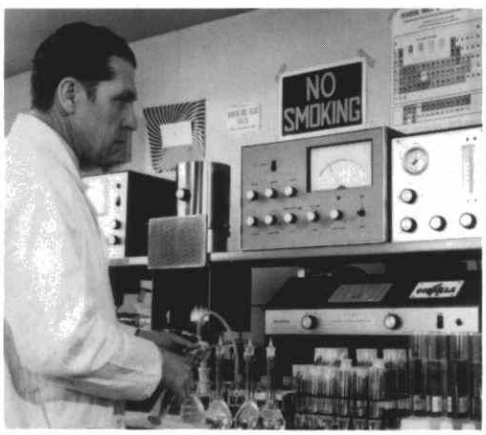
In addition to the extensive recreational water pollution control program, a "self-help" program was instituted. This program consisted of organizing a number of cottage associations into groups to take samples on their own lakes which were not covered by the regular OWRC programs. Seminars were held at which time sampling procedures, sampling points, and times for taking samples were established. A considerable saving in cost was experienced because OWRC personnel were not required to send their own crews to these lakes for sampling purposes. A total of nine lakes were examined by this method. The data have been analyzed and reports are being written which will give a more comprehensive picture of the pollution levels in these lakes than would otherwise have been obtained if the cottagers had simply brought a random selection of samples to the laboratory for analysis.

Great Lakes:

In line with the 1969 IJC recommendation that monitoring activities be maintained on the IJC referenced waters, mobile laboratories support was provided for surveys carried out on the St. Lawrence River, the lower Great Lakes and their interconnecting channels. The St. Marys River, the St. Clair River, the Detroit River, Lake Huron and Georgian Bay were also monitored. Special surveys were carried out at Ontario Place, Toronto Harbour and in the St. Marys River. The Great Lakes mobile laboratory and the Toronto laboratory provided the bacteriological facilities for analysis of the samples generated by the above surveys.

The Lake Ontario Waterfront Survey was reorganized to include routine analysis of samples taken by health units along the Lake Ontario waterfront from Oshawa to Burlington. During July, a bacteriologist accompanied the samplers on routine runs, aiding them by improving sampling techniques and determining sample point locations. The data collected from these surveys were incorporated into the Great Lakes computer program and a report is now in preparation.

At the request of the Public Relations and Information Branch, the Great Lakes technicians attended the International Plowing Match near Jarvis, Ontario. A demonstration of bacterial procedures was set up in mobile laboratory #4 and questions by the public were answered.



Metal Analysis by Atomic Absorption

Sewage and Waste Samples:

Three bacteriological surveys were completed on 5 lagoon systems associated with hotels and a correctional camp in Muskoka. The results of these surveys were analyzed and presented in a seminar held by the OWRC for the hotel managers in an attempt to initiate spray irrigation of the lagoon effluents.

Studies were initiated into methods of isolating and identifying *Klebsiella pneumoniae* which were allegedly present in large numbers in the aerated lagoons treating pulp and paper effluents.

Samples were taken (in November and December) from lagoons that were allegedly causing air pollution problems with H_2S production. The work was started at the request of the Kingston Air Management Branch and involved the Strathcona Paper Mill lagoons and the Appleton, Collie Woollen Mill. The work should be completed in 1972.

Taxonomy Studies:

In an attempt to investigate the bacterial populations associated with water of differing trophic levels, the total plate count parameter was incorporated into the survey of some of the Kawartha Lakes sampled in the Recreational Lakes program in 1970. The laboratory work required for the primary identification tests on the 2,500 isolates and the secondary identification tests on the 1,200 Enterobacteriaceae cultures occupied the Taxonomy Section until early in 1971. The analysis of the data and other information from this testing resulted in a report which suggests a direct correlation at the familial level between the bacterial population and the trophic level of the water. When the isolated bacteria were grouped according to taxonomic families, the Pseudomonadaceae and Achromobacteriaceae were shown to increase as Enterobacteriaceae decreased. In an oligotrophic lake, a higher proportion of the isolates belonged to the Enterobacteriaceae family. This finding has suggested an enlarged function for bacteriological testing and implies that bacterial populations do reflect nutrient enrichment problems.

In conjunction with the above work, a commercially prepared biochemical characterization scheme was evaluated as to its applicability in the identification of Enterobacteriaceae cultures and a report was prepared.

The identification systems for the faecal streptococci were examined with the aim of increasing the Branch's knowledge of this parameter. A report was prepared on the systems which were tested and this work will be continued.

Discussions and advice were given to many individuals concerning the statistical evaluation of bacterial, biological and chemical information. In addition, a bac-

teriologist attended the Data Processing Seminar for Middle Management held at the Staff Development Centre on Kempenfeldt Bay near Barrie.

Media Section:

The Media Section prepares the media and solutions required for all bacterial analyses. A total of 3,700 litres of bacteriological media and 10,800 litres of buffered water was prepared. A portion of this work required the production of 31,400 agar plates of various kinds and 7,600 agar slants.

BIOLOGY BRANCH

The activities of the Biology Branch encompass both field and laboratory studies and investigations. The total program of the Branch is designed to clarify pollutional effects of industrial and municipal discharges, enrichment phenomena associated with nutrient increases in lakes, and the effects of pesticides and other toxic materials in the aquatic environment. In addition, it evaluates and regulates chemicals and other aquatic control agents used to enhance multiple water use through the control of excessive algae, aquatic vegetation and other nuisance conditions.

The Branch is sub-divided into three major areas of technical responsibility – Regional Biology Section, Toxicity and Pesticides Section and Phytoplankton and Eutrophication Section.

Regional Biology Section:

Regional biologists were resident in four of the six administrative regions of the Province, namely, London, Toronto, Kingston and Sault Ste. Marie.

Biological surveys, designed to provide information for the development of sound water use plans, were completed by regional biology staff both on a major scale involving entire river basins and on a less intensive scale designed to demonstrate the effects of specific pollution sources on the receiving water. In addition to conducting biological surveys, regional biologists had extensive involvement in the investigation of complaints of fish kills and aquatic nuisance problems and in public relations activities.

Major survey programs were mounted on Lake Nipissing, Lake Simcoe, the Kawartha Lakes – Trent River system, and the Thames River watershed. The first summer of a two year study of Lake Nipissing was devoted to the assessment of the status of enrichment of the lake. Further work on Lake Nipissing in 1972 will entail detailed investigations of the effect of specific waste sources. On Lake Simcoe, emphasis was placed on the investigation of the extent and type of aquatic weed growths, hypolimnetic oxygen depletion and its effects on fish and their food organisms and the condition of fish spawning shoals. In connection with the Kawartha Lakes Water Management Study, investigations were undertaken to determine the potential effects of large-scale weed control on the production of fish food organisms. The Thames River survey entailed the evaluation of bottom fauna and fish population to assess the impact of industrial and municipal waste discharges on the river and its tributaries.

In a continuation of a program initiated in 1970, rainfall and snow samples were collected and analysed from stations in the Sudbury area in an attempt to ascertain the effects of smelter fallout on lake fauna. A similar program was initiated to study the effects of air-borne contaminants on aquatic resources in the vicinity of the mining operation at Wawa.

Surveys of a somewhat narrower scope were carried out in Northern Ontario to monitor water quality conditions associated with mining waste discharges to Gorden, Werner, Sturgeon, Confederation and Nighthawk lakes, the Kamiskotia River, Massey Creek and an unnamed creek flowing through the Coppercorp Mining property, near Sault Ste. Marie. Studies related to domestic waste discharges were undertaken to determine the associated changes in water quality of the Atikokan River below Atikokan, Pelican Lake at Sioux Lookout and the Agimac River below Ignace. Additional spot surveys carried out on northern waters included investigations of enrichment problems in Lulu Lake near Kenora and the Otter-Oastler Lakes near Parry Sound, the C.P.R. sulphuric acid spill in the Pickerel River and the influence of wastes from a landfill site on the Root River near Sault Ste. Marie.

Samples of fish, algae and benthic invertebrates from Lake Ontario at Pickering and Lake Huron at Douglas Point were submitted to the Department of Health for radiological analyses in order to monitor the levels of radionuclides in the aquatic food chain associated with the operation of nuclear power generating stations at these locations.

Further surveillance work was undertaken in the vicinity of Port Elgin and Southampton to re-assess the growths of Cladophora.

A post-operational evaluation of water quality conditions in the East River near Huntsville was undertaken to provide data for comparison with information collected prior to operation of the new Kimberly-Clark tissue mill. Field investigations were completed on the Sherwood Swamp in the Township of Sherwood in order to assess the recreational use potential of a proposed hydro storage reservoir. Hunsburger Creek was surveyed in order to determine the potential effects of reducing water flows in the creek as a result of ground-water withdrawals by the City of Kitchener.

Additional spot surveys were carried out to monitor water quality conditions associated with industrial or municipal discharges to Canagagigue Creek, the mid-Maitland River and Moira Lake and enrichment problems in Slocombe, Thompson and Wagner lakes.

Algae Identification



Survey reports were finalized in connection with water quality evaluation of the Penetang – Midland – Pt. McNicoll – Waubaushene Area of Georgian Bay, the Speed – Eramosa River, Hunsburger Creek, Kempenfeldt Bay and the Niagara River. Preoperational water quality reports were issued prior to commencement of the base-metal mining and milling operations on Sturgeon Lake, Attikwa Lake and Confederation Lake. A report on the distribution of Cladophora in waters surrounding Pelee Island was issued and a report entitled 'Aquatic Weed Growths in Lake Simcoe' was finalized for distribution in 1972. A further report dealing with factors affecting productivity in Pre-Cambrian Shield lakes was submitted by a member of staff and approved as partial fulfilment of a degree of Master of Science at McMaster University and subsequently revised for release as a Commission report.

Branch inputs were also completed for Commission reports dealing with investigations on the Ottawa River, the uranium mining industry in the Elliot Lake and Bancroft areas and the effects of smelter fallout on lakes in the Sudbury area. In addition, a report on water use requirements in the Grand River Basin was completed for use of Treasury Board in preparing a planning report for the basin and inputs were provided for the CORTS reports dealing with Lake Simcoe and the Bay of Quinte.

Reports neared completion on the water quality of Butler, Spencer and Massey creeks, the Atikokan, Kapuskasing, Pickerel, Maitland and St. Clair rivers, the Manitouwadge Chain of Lakes, the St. Lawrence River in the vicinity of Cornwall and the Muskoka Lakes.

Toxicity and Pesticide Section:

The Toxicity and Pesticides Section undertakes laboratory and field studies to investigate the effects of pesticides and other toxic materials on aquatic organisms. The use of chemical agents for the control of excessive algae, aquatic vegetation and other nuisance conditions is monitored by a permit system which regulates the application of chemicals to surface waters within the Province. Additionally, this section monitors and co-ordinates all fish kill investigations undertaken by the Commission.

Industrial waste bioassays were carried out at Polymer Corporation at Sarnia and in two areas in northern Ontario. At Sarnia, fish were exposed to water pumped from the St. Clair River at the site of three major outfalls from the Polymer Corporation. After a period of time the fish were subjected to flavour evaluation tests and results were compared with tests on control fish taken from the river upstream from the outfalls. In addition, threshold odour evaluations were carried out on water samples from the area. The mobile bioassay laboratory was deployed at Manitouwadge where toxicity effects associated with base metal mining operations in the area were evaluated. The laboratory was later moved to the Killarney area where a series of toxicity tests, designed to measure the potency of the effect of copper and zinc on fish in poorly buffered waters, were conducted. This work was closely co-ordinated with other studies relating to atmospheric fallout from Sudbury mining operations and it is anticipated that this investigation will continue in 1972. A Biological Information Sheet, designed to assist industries in determining the toxicity of waste discharges prior to making application for an effluent permit, neared completion.

A number of programs with regard to pesticide evaluations were carried out. A co-operative study, involving the Department of Agriculture Research Station at London, was designed to compare pesticide residues in agricultural areas of southwestern Ontario with those resulting from forest spraying and biting-fly programs in recreational areas of south-central Ontario. The distribution of snails in Golden Lake in the Upper Ottawa Valley was recorded in connection with a study of control methods for the Swimmer's Itch malady. An aircraft was used to spray the mosquito larvicide 'Abate 4E' in an experimental mosquito control program in the Township of Mara on Lake Simcoe. In order to assess the efficiency of the treatment, the adult mosquito population was sampled throughout the summer and the results were compared to data collected in a pre-treatment sampling program conducted in 1970.

An outline of the status of DDT contamination in the Muskoka Lakes was prepared for inclusion in a major branch survey of the Muskoka Lakes. The field investigation was designed to measure the differences in DDT occurrence in widely separated areas of the system and to detect annual changes which may reflect an improvement in the contamination levels in these lakes, following the banning of the use of this chemical. Sediment cores were procured from Inner Long Point for analysis for DDT content as part of a program designed to trace the contribution of the Big Creek watershed to the total pesticide input into Lake Erie.

Two aquatic herbicide evaluations were undertaken during 1971. The algicide "Cutrine" was tested in two ponds where dense growths of filamentous green algae were hampering fisheries management, and experimental applications of three different mixtures of paraquatdiquat were undertaken to determine their effectiveness in the control of tapegrass.

The number of permits issued to authorize the use of aquatic nuisance control agents reached 212 in 1971, an increase of 30 over 1970. The breakdown with regard to permits issued is as follows:

Aquatic plants and algae control	184
Coarse fish control	17
Mosquito and Blackfly larviciding	9
Swimmer's Itch control	1
Leech control	1
Total	212

Photographing Microscopic Algae



Approximately 1,050 enquiries were answered concerning regulatory practices and permissible control techniques. A member of staff continued to act as an aquatic specialist on the Ontario Herbicide Committee and recommendations for aquatic weed control were prepared for inclusion in the 1971 Research Report of the Eastern Section of the Canada Weed Committee.

A total of 42 fish kills were reported. Causes of these mortalities were determined to be as follows:

Natural causes	37%
Industrial wastes	24%
Agricultural wastes	10%
Pesticides	10%
Other	5%
Cause not identified	14%

In addition to the above mentioned mortalities, the death of thousands of alewives in the Lower Great Lakes was recorded. This mortality occurs annually owing to rapidly changing temperature conditions.

Phytoplankton and Eutrophication Section:

The Phytoplankton and Eutrophication Section provides laboratory services for the identification and enumeration of samples collected by Commission personnel and by outside groups. Field studies to determine the status of enrichment of lakes and rivers are undertaken to aid in the development of comprehensive water management policies for large recreational areas of the Province. Another major program responsibility of this section is to evaluate the suitability of water as a potential source of potable supply and to assist municipalities in the operation of water treatment plants by providing advice and instruction concerning plytoplankton problems.

The principal activity of this section in 1971 was the initiation of a Kawartha Lakes Water Management Study. The broad objective of the study is the optimization of water use in the Kawartha Lakes – Trent River recreational area. It is expected that at least four years will be required to complete the study. A mobile laboratory was developed at Trent University, Peterborough, where it served as a base headquarters and provided facilities for the analysis of chemical and biological field samples. Aerial photographs of two lakes were taken using heat sensitive infra-red film in an attempt to map the distribution and extent of weed beds, and detailed physical, chemical and biological data were collected from the entire system. Numerous discussions were held with personnel from universities and other government groups in order to coordinate activities and obtain background data for the study.

A program involving the collection of water quality data by individual cottagers on a number of recreational lakes was initiated during 1971. In connection with the 1971 Recreational Lakes Water Pollution Survey, a procedures manual was prepared to provide field staff with details relative to a standardization of field chemical and biological methodology and related analytical procedures.

Other field programs which were carried out included the continuation of studies, initiated in 1970 in co-operation with the Department of Lands and Forests, to assess the relationships between aquatic plants and fish production in a number of farm ponds. In connection with these studies, laboratory experiments on the uptake of nutrients by aquatic plants were also initiated during 1971. In an effort to develop techniques for re-establishing bottom waters with sufficient oxygen to support deep-water species of game fish, artificial destratification experiments were carried out in three small lakes. Biological and chemical data were collected weekly from Gravenhurst Bay on Lake Muskoka to evaluate the effectiveness of the phosphorus removal program at the Gravenhurst sewage treatment plant. Finally, a number of techniques were evaluated with respect to the assessment of periphytic (filamentous green algae, attached diatoms, and weeds) growths in the Speed River. The most useful technique will be employed in a full-scale survey to be undertaken in 1972.

Reports were completed on the status of enrichment of Walker's Lake (District of Bays), Riley Lake (Township of Ryde), and Baldwin Pond (Township of Georgina). In addition, reports were finalized on the 1970 water quality evaluation of Apsey Lake and on the suitability of Robin Lake and Barry's Bay as sources of municipal water supplies. Brief reports were provided on phytoplankton conditions in Lake Nipissing, Confederation Lake, and the Grand River. Reports neared completion on the 1969-1970 Muskoka Lakes eutrophication study, and the physical-chemical conditions and ecology of aquatic plants in southern Ontario impoundments.



Biology Branch staff contributed to a number of important educational programs and presented several technical papers dealing with biological aspects of water management. The role of the OWRC in water management and pollution abatement was described in addresses presented at several universities including McMaster, Guelph and Laurentian, and at a meeting of the North Bay Pollution Probe Organization. Staff participated in environmental teach-ins, library workshops and general discussions on the various biological aspects of pollution at several secondary schools across the Province. In addition, talks on various aspects of pollution biology were presented as part of a training course at Dorset for Department of Lands and Forests Conservation Officers. A member of staff participated in the production of a series of five educational television programs on the OWRC and its role in water management in Ontario. Staff participated in a television program, produced in Thunder Bay, concerning the ecological implications of pollution and two members of staff participated in the production of a film by the OWRC Public Relations and Information Branch. A member of staff contributed to the OWRC exhibit at the 1971 Royal Ontario Winter Fair. Lectures concerning

eutrophication in recreational lakes were presented to several groups, including the Gordian Club of Toronto, several cottagers' associations, and students from Conestoga College. An address outlining pollution problems which stem from the agricultural industry was presented to the southwest branch of the Ontario Institute of Agrologists. A paper entitled "Province of Ontario Management Policy for Lake Superior" was given at a symposium on management of Lake Superior, held at Michigan University in Marquette, Michigan. A technical paper on the limnological and biological aspects of water supply was presented at the Ontario Section meeting of the American Water Works Association Conference.

CHEMISTRY I BRANCH

A record number of chemical samples were processed. The major sources of increases were additional samples contributed by the divisions of Sanitary Engineering and Laboratories.

The laboratory sampling programs which showed the greatest increase were the mercury studies, and a number of other studies, conducted by the Biology Branch, including eutrophication and recreational lakes studies; toxicity, pesticide and pond studies; and regional survey studies.

Analytical Methods Development

With the adoption by Standard Methods of a new definition of low-level standard turbidity units, based on a reliable formazin turbidity compound, it was hoped that the difficulties of calibration of the new turbidimeters would be solved. Calibration of standards was, in fact, entirely successful, but in attempting to test samples, it was found that the instruments were so designed that they gave wildly fluctuating readings if any large particles were present. A combined approach, employing the services of a local instrument specialist and the ingenuity of one of the Branch technicians, resulted in the improvisation of electronic and mechanical modifications to the instrument which are showing every prospect of operating successfully.

The evaluation of a new conductivity meter was also carried out. Techniques were developed to apply the meter to the analysis of all samples commonly encountered in the Commission laboratories. The new meter provides an improvement, in that measurements are actually obtained at the reference temperature, 25°C, instead of being corrected to this temperature by slightly approximate mathematical calculations. A modification developed by staff, for the cell employed in this instrument, allows samples to be examined in rapid sequence, semi-automatically, thus improving productivity. It is hoped to adopt this instrumental technique at the Main Laboratory, and at the Commission's other laboratories, to largely replace the present gravimetric determination of dissolved solids, which is considerably less productive in comparison.

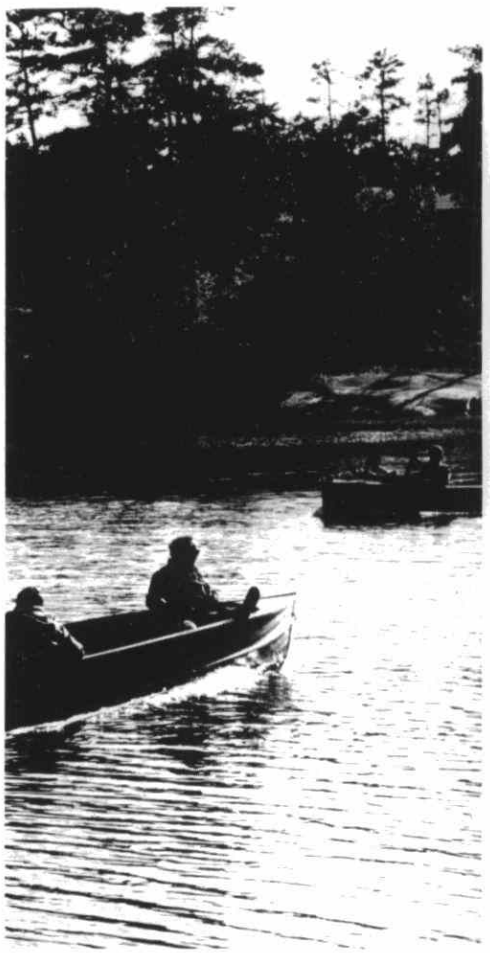
A Quality Control Committee was formed to establish more formalized procedures for evaluating the precision and accuracy of the analytical methods currently employed in the Laboratory.

Another valuable committee, on Methodology, was set up to document detailed written test procedures. Branch staff took a leading role in the committee, and plans were formulated to complete this endeavour. The provision of these written procedures for general distribution will assist in training new staff and in diminishing any tendency to attempt to hasten test procedures by shortcuts.

Some exploratory methods development was devoted to the Unicam Pye AC60, a promising automated colorimetric analytical system. Modifications were worked out mainly to improve detection sensitivity, and 'running-in' problems were solved. The unit will be further tested next year to evaulate its on-line use in a high production multiple test context.

Further successful methods development was devoted to the Auto Analyser readout operation. A design for a homemade 'Chart-Reading' instrument, reported in the literature, was built on contract by a local specialist in instrument manufacture. On-line evaluation was used to improve the design for Branch purposes. Compared to the manual readout method presently employed, this 'Chart-Reader' accessory displays substantial promise of at least two-fold increase in output, of eliminating possible day-to-day variations in operator discrimination, and of rapid linear recalibration for varying tests, modes, and base line drift, eliminating the compromises required by the curved line calibration graphs now employed. Continuation of methods development in 1972 will allow the final evaluations of this device to be completed.

A series of changes in work organization and laboratory layout in the Pollution Section, made possible by laboratory renovations, were phased throughout the summer. Substantially increased capacity for total phosphorus and total kjeldahl analyses was obtained, plus additional capacity for COD, turbidity, conductivity and 'soluble nutrient' analyses, with the result that peak work loads were handled with less overtime than otherwise would have been necessary.



REGIONAL LABORATORIES

Thunder Bay:

The Thunder Bay Laboratory was provided with an Atomic Absorption Spectrophotometer early in 1971, and staff members visited the Main Laboratory for initial training in its use for the routine analysis of metals. Capability in this analytical field is required at the Thunder Bay Laboratory because of the concentration of mining activities in this region, with concomitant metallic pollution problems. Due to the increased routine workload developing at this laboratory, it was only possible to complete acceptance tests and solve some 'running-in' problems on the Atomic Absorption unit during the summer. Major development work in the application of the instrument will be undertaken in 1972.

London:

Regional samples continued to increase at the London Laboratory.

The Scientist-in-Charge of the London Laboratory was sponsored by the OWRC in a postgraduate course in Water and Air Pollution Control at Western University, leading to a Master's Degree in the spring of 1972.

Plans for the Laboratory floor of the new combined London Regional Laboratory and Office were finalized early in 1971.

GREAT LAKES LABORATORIES

Reductions in the level and duration of Great Lake sampling allowed economies to be achieved by an early reduction in casual staff hired for Great Lakes analytical work. Permanent staff of the section prepared the standard quality control samples which were circulated to all sections of the laboratory under the Quality Control Program.

SPECIAL PROJECTS

A member of staff published three papers, whose reception by the scientific community reflected favourably on the OWRC: 'Chlorophyll-Phosphorus Relationships in Lake Erie', 'An Intensive Survey in Western Lake Erie', and 'Eutrophication of Recreational Lakes – A Possible Explanation'.

Staff participated in a project to induce destratification of recreational lakes suffering from problems caused by anoxic conditions in the bottom water layers.

Staff also assisted in the planning and evaluation of numerous OWRC surveys, notably those on recreational lakes, northern waters, and eutrophication studies.

CHEMISTRY II BRANCH

During the 15 month period, the activities of the Branch continued to expand and this is reflected in the increased number of tests completed.

Opportunities were taken by members of the staff to contact scientists from other agencies involved in similar work, thus enabling them to exchange ideas and realistically assess the present standards of the laboratory and the future tasks which it will face. The Branch's laboratory participated in a series of inter-laboratory quality control studies involving the exchange of reference samples and the results indicated that analytical work continues to be carried out by laboratory staff. In some areas of specific interest, such as mercury and polychlorinated biphenyls, the Commission's leading role is generally recognized and its contributions at various seminars and conferences concerned with these fields were very well received by the scientific community.

Several members of the staff attended conferences, technical seminars and instrument demonstrations. In several court cases, members of the staff were requested to provide expert testimony.

Organic

Further experiments were carried out regarding mercury contamination.

The laboratory took the initiative in developing a reliable method of determining trace amounts of chlorinated compounds. A series of chlorinated compounds, among them the chlorinated biphenyls, have extensive industrial applications, and traces of these toxic compounds are widespread in the environment. The method was accepted for publication and is in routine use at several laboratories.

Petroleum hydrocarbons are another group of pollutants frequently encountered. Several techniques were perfected to detect, identify and quantitate residues of these products. Infrared, gas chromatography and fluorophotometry techniques were used for this work.

Methods were improved, or new ones were developed, for many other common industrial pollutants such as amines, fatty acids, paint materials, plasticizers and polymers. The analysis of carbon filter extracts was extended to pesticide residues and, in special cases, the identification of individual organic micropollutants, such as antioxidants, and chlorinated phenols. A summary report on organic micropollutants in the Lower Great Lakes as a result of three years' carbon filter sampling is being prepared.

Inorganic

Analysis of metals in soils, lakes, and in rain water throughout the Province formed an integral part of the Commission's attempts to determine the effects of industrial fallout on the aquatic environment. Analyses arising from pre-operational surveys of waters and lake-bottom sediments are important in order to preclude any adverse effect of mining activity on wilderness areas.

Atomic absorption spectrophotometric methods were improved for many elements. A pre-concentration step was developed, allowing the analysis of down to 5 ppb for many metals in water. A method for measuring lithium was refined to permit quantitation at 2 ppb, which is also the level attained by a co-precipitation method for lead.

Fluorimetry was used in developing a uranium method with a sensitivity of 10 ppb. There were several highly sensitive cloroimetric methods developed for titanium, vanadium, aluminium, antimony and molybdenum.

Numerous studies involving metals in the environment were undertaken. Lead from gasoline and exhaust fumes, arsenic in fish, sediments and water, and the effects of many metals from sludge used as fertilizers were investigated. In each case, improved methods of analyses resulted from the work. Metals in fish became increasingly important, and thousands of metal analyses on fish tissue were run in order to establish reliable methods and to determine background levels and actual concentrations in contaminated areas.

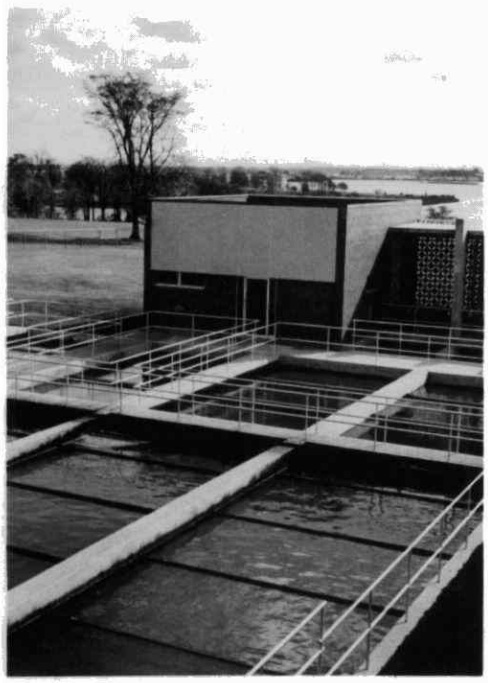
Division of Plant Operations

D.A. McTavish, Director
C.W. Perry, Assistant Director



Safety Inspection

Cornwall Pollution Control Plant



The Division of Plant Operations supervises the operation of all water and sewage works financed and constructed by the Commission. As of March 31, 1972, there were 390 projects operating in 228 municipalities and 7 industries (municipal: 141 water, 200 sewage; provincial: 20 water, 29 sewage) with a total of 386 plant operators being on staff. Figures 1–4 graphically illustrate the total field staff, the number of projects in operation, the total capital costs and the total operating costs for the period 1957-1971. Figure 5 indicates the distribution of operating costs during 1971.

ADMINISTRATION

The Division becomes involved in each new project during its design stage. Reports, plans and specifications submitted by consulting engineers are reviewed by the Division, in conjunction with other divisions, to ensure the provision of adequate works. The Division is also responsible for investigating and initiating enlargement of existing projects, where such enlargement is necessary. The Division has an involvement in the initial setting of rates for Provincial works and later in the altering of these rates, when conditions warrant, within the terms of the initial agreement.

For purposes of administration, the Province is divided into six regions, the projects in each region being the responsibility of a regional operations engineer. Major Provincial projects are the responsibility of an engineer-manager. The operations engineer and the engineer-manager report to a supervisor, who participates in the development of policies established at the divisional level, and thus ensures a high standard of operation.

The operations engineers and the engineer-managers prepare annual estimates of the project operating costs, determine staff requirements, and maintain liaison with local officials. They also ensure that adequate preventative maintenance of equipment is practised and that the plant process provides the maximum treatment. They are responsible for initiating expansion programs and for establishing andmaintaining communication with present and prospective project participants, as well as with other provincial departments having an interest in the field of water and sewage treatment.

Three sections – project services, maintenance and safety – contribute to the overall administration and operation of the projects. These sections are described below:

PROJECT SERVICES SECTION

The project services section, including a statistical group, assists in process problems and maintains data on project operation. It investigates operating field problems, evaluates operating results, appraises new chemicals and processes, reviews plans and specifications for certain new projects and prepares special reports for the Division The project services engineer also supervises the activities of the Division's statistical and brochures section and acts as the Division's liaison officer with the Commission's Systems and Electronic Data Processing Branch and the Division of Public Relations and Information.

Process and sampling statistics on all projects were maintained by the statistical section. The brochures section prepared copy material for 58 annual operating summaries, which were subsequently printed and distributed. In addition, a general news bulletin and a maintenance bulletin for plant operators were produced at regular intervals.

The project services section prepares and prints summary reports on the operation of water pollution control plants, water treatment plants and waste stabilization ponds operated by the Division. The section provided training in laboratory techniques for field personnel at a number of plants and assisted in establishing new or improved laboratory facilities at several plants.

MAINTENANCE SECTION

The maintenance section, consisting of mechanical, electrical and electronic operations engineers and engineer-managers and technologists, assists the operations engineers and engineer-managers in establishing adequate maintenance programs.

High standards of maintenance and a preventative maintenance program ensure continuity of services at all water treatment and pollution control facilities and protect the Commission's capital investments.

The technical services group, consisting

of qualified technologists and technicians reporting to the maintenance engineer, provides a services function to the Division. This group is responsible for the continued development of the overall maintenance program and for assisting the operations staff in its implementation. The group's primary services include trouble shooting, planned repair, inspection, modification, contract maintenance supervision, engineering and training.

Project maintenance assistance and coordination of project preventative maintenance is provided by the regional maintenance technician who reports directly to the regional operations engineer.

Close liaison between the regional operations staff and the technical services group results in a province-wide standard but flexible maintenance program. A reporting system permits continuous evaluation of the maintenance program and offers the basic information required for the evaluation of equipment. This information, when correlated, provides data which are used in the selection of materials and equipment for new projects and the upgrading of existing treatment process equipment.

SAFETY SECTION

The safety section, consisting of two safety officers reporting to the supervisor of the technical services group makes routine inspections of all projects, looks into the safety aspects of the operation and ensures that the safety regulations are adhered to. The section investigates lost-time accidents, provides training to operators, participates in training courses and arranges first-aid and fire-fighting drills.

The section maintains close liaison with the Department of Labour and its Safety and Technical Services Division and assists in the development of regulations relating to industrial safety and field safety.

Papers were presented by the section to AWWA conferences and seminars.

There were no fatalities or permanent injuries suffered during 1971 by the Division's operating personnel. Disabling injuries, frequency rates and severity rates are compared for the years 1966 to 1971 in the following table:

Year	Disabling Injuries	Frequency Rate*	Severity Rate**
1966	19	26	256
1967	9	17	260
1968	22	37	724
1969	18	29	496
1970	18	27	277
1971	15	22	585

* Disabling injuries per million man-hours worked.
** Man-days charged to disabling injuries per million man-hours worked.

MAJOR PROVINCIAL WORKS

Lake Huron Water Supply System

The main project of the Lake Huron Water Supply System consists of a treatment plant at Grand Bend on Lake Huron and a 48-inch diameter pipeline with an ultimate capacity of 72 MIGD. The present installed capacity of the filtration and pumping equipment is 37 MIGD. The system serves a population of approximately 220,000. The total volume of water delivered in 1971 was 8,225 MIG. The peak day flow was 35.3 MIG. The City of London and the Township of London are on the main pipeline. Branch pipelines serve the Village of Grand Bend and the Town of Parkhill. A branch pipeline and distribution system for the Village of Ailsa Craig were under construction at the end of the year. Agreements for water supply to the Townships of Stephen and Bosanquet were concluded and the preliminary system design was started. Connections to supply the townships of East Williams and McGillivray were discussed with the municipalities.

Lambton Area Water Supply System

The Lambton Area Water Supply System (See Figure 6) is being constructed and operated by the OWRC in response to a need to service a developing area and to upgrade existing facilities which have been in operation for more than 50 years. The system will serve the City of Sarnia, the townships of Moore, Sarnia and Sombra and the villages of Courtright and Point Edward. It is comprised of a 40 million gallon per day complete water treatment plant, approximately 40 miles of watermain ranging in size from 10" to 36" in diameter, three elevated water storage tanks, two ground reservoirs and a booster pumping station.

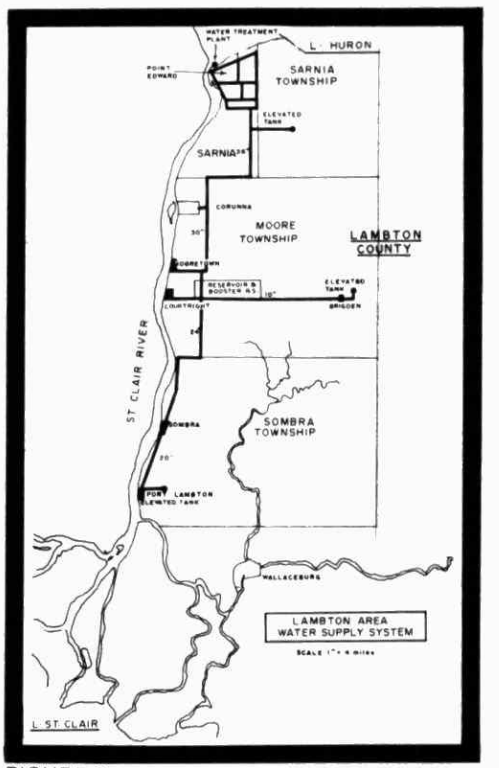


FIGURE 6.
Lambton Area Water Supply System

Elgin Area Water System

The Elgin Area Water System serves the City of St. Thomas and the Ford of Canada automobile assembly plant at Talbotville. The operation of the City of St. Thomas treatment and pumping plant, which was purchased by the OWRC in 1969, was continued until September 30, with the Kettle Creek source being supplemented by raw water taken from the Lake Erie pipeline. The new water treatment pumping plant near Port Stanley was placed in service on October 1st. Three 5 MIGD capacity pumps and a 1,000 KVA sub-station were installed at the booster pumping station for supplying treated water to the City of St. Thomas and the Township of Southwold. The total volume of water delivered was 1,268 MIG, with the peak day flow being 5.9 MIG. A 22-mile-long branch pipeline and a provin-

cially-owned water distribution system in the Village of Port Burwell were completed. The supply of water to the townships of Yarmouth, Malahide and Southwold was discussed with the municipalities.

The Lake Huron Water Supply System and the Elgin Area Water System are supervised by the engineer-manager located at the OWRC Regional Office in London.

South Peel Water & Sewage Systems

The South Peel Water & Sewage Systems (See Figures 7 and 8) began operation in June, 1969. The Provincially-financed system amalgamated all existing municipal and OWRC water supply and sewage treatment facilities in the southern half of Peel County.

Municipalities within the South Peel system are the towns of Brampton, Mississauga, Port Credit and Streetsville and that part of the Township of Chinguacousy south of #17 sideroad. The combined population of over 250,000 people is provided with a lake water supply and sewage treatment facilities by the system.

In spite of delays occasioned by the necessity to expropriate properties, the Commission successfully met the timing requirements of the five participating municipalities for water and sewage service. The initial three-year construction program was nearing completion. The major 48 MIGD water treatment plant was fully operational. The change in concept to ground level reservoirs floating on the system enabled the relocation of the Dixie elevated tank to north of Streetsville and increased the storage on the second pressure zone from one-half million gallons to ten million gallons. Completion of the Thomas Street reservoir and temporary pumping station added increased capability in the Streetsville area.

The progress on the construction of major sewage treatment facilities on Lake Ontario enabled a start on the Commission's policy of removing upstream sewage treatment plants from service.

Region I

Fifty-eight projects were in operation of which eight are water plants, six are mechanical water pollution control plants and nine are waste stabilization ponds. The

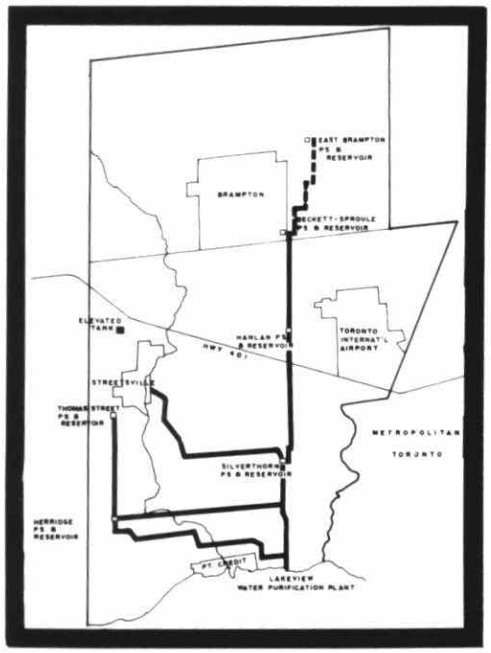
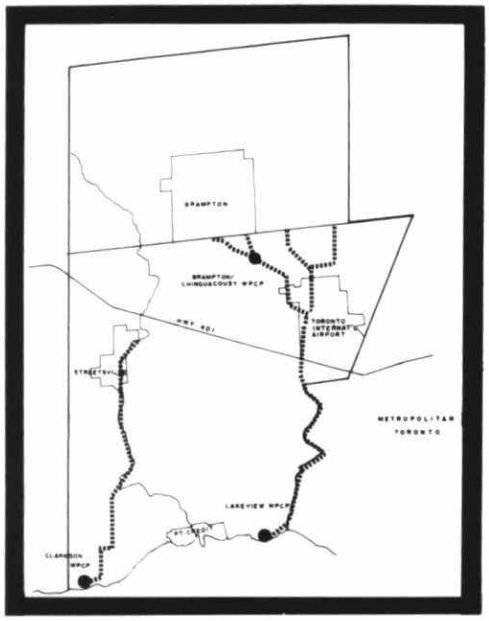


FIGURE 7
South Peel Water Supply System

FIGURE 8
South Peel Sewage System



remainder consist of watermains, sewer systems, storm sewers and pumping stations. Seventy-two additional projects were at various stages of development.

During February 1971, the Ontario Hospital School water plant at Cedar Springs was acquired as an OWRC project and a watermain was completed to the Town of Blenheim by the end of June. The new water treatment plant at Amherstburg was placed in operation during September. Expansion of the Tillsonburg and Ingersoll sewage treatment plants commenced during the summer and a new well was completed at Thedford. Expansion of the Goderich water plant was accomplished by changing the filter media to the dual media type and by re-rating the filters to double the original capacity. The new aerated cell at Listowel was completed in August. Construction was also started at West Lorne on a lagoon system, at St. Mary's on a sewage treatment plant, and on a watermain to Comber.

Design work was completed on the Kent County raw water pipeline and pumping station and on the Lambton Area water treatment plant at Sarnia. Arrangements were completed for the OWRC acquisition, on December 31st, of the existing water plant at Sarnia and the existing sewage treatment plant at Ingersoll.

Region II

The twenty-six projects in operation consisted of nineteen treatment facilities and seven distribution or collection systems.

A Provincial sewage system became operational in Cayuga.

Twelve of the present facilities are in various stages of expansion, with construction of completely new works being prepared at six other projects. Construction commenced during the fall on the doubling of the capacity of the Fergus WPCP, with the completion date expected to be in 1972.

The use of polymer at the Elora WPCP proved very successful and it is being continued on an interim basis until the proposed expansion of the plant is completed.

Staff of the divisions of Research and Plant Operations have been conducting full plant phosphorus removal studies at the

Orangeville WPCP and the Shelburne lagoon system.

Chlorine contact chamber retention and mixing studies, undertaken with the staff of the Division of Research, were conducted at the Elora, Brantford and Paris plants.

Sludge handling at the Brantford WPCP, by means of digested liquid sludge disposal on sludge fields, continues to be a successful operation. The use of sludge lagoons for digested sludge at the Kitchener WPCP is also continuing to be very successful.

The successful experimental use of the centrifuge for handling sludge at the Simcoe facilities warranted the purchase of a new centrifuge for permanent installation at the plant.

Composite sampling studies were conducted on all projects with waste stabilization ponds to accurately determine the organic loadings.

The Regional Municipality of Niagara operated nine pumping stations in the City of Port Colborne for the OWRC.

Region III

There were fifty-two sewage treatment and water supply facilities in operation, consisting of the following:

- 14 staffed pollution control plants
- 4 part-time staffed pollution control systems
- 12 pollution control facilities where assistance is provided by municipal staff
- 1 staffed water supply system
- 2 part-time staffed water supply systems
- 19 water supply facilities where assistance is provided by municipal staff

There were several plant enlargements under consideration and five new pollution control systems are expected to become operational in 1972.

Region IV

A total of forty-six minicipalities have now been provided with either water or sewage services. These facilities consist of the following:

- 10 waste stabilization ponds
- 10 small water distribution systems with well water source
- 6 small water distribution systems with a surface water source
- 7 activated sludge sewage treatment plants
- 3 primary treatment plants
- 1 trickling filter plant
- 1 sedimentation chlorination sewage tank

There were ten projects under construction. Six of these projects were completed before the end of 1971; the remaining four projects are scheduled for completion in 1972. One of these is an OWRC/Municipal project, while the remaining nine are Provincial projects. A contract was awarded in late 1971 for an additional Provincial project. The Winchester sewage treatment system was taken over as a provincially-financed system and construction commenced on its enlargement to serve the whole municipality.

There are twelve OWRC/Municipal projects that require enlargement. Nine design reports for the enlargement of these projects were completed by December.

A large number of provincially-financed projects throughout the region are in various stages of design. It appears that a substantial number of these projects will reach the tendering stage in 1972.

The Belleville/Trenton public water and sewage areas were established under Section 61 (2) of the OWRC Act. Conceptual briefs were presented on both the sewage and water schemes in addition to a design report providing for an area water treatment plant with associated trunk feeder mains.

Region V

There were nineteen sewage and eight water projects in operation. Regular supervision was provided on a full-time basis at nine sewage projects and four water projects.

Expansion of ten of the above projects is being undertaken. Construction of the oxidation ditch at Coniston was begun late in the year and expansion of the North Bay WPCP reached the design stage.

The lagoon extension for the United Townships of Neelon and Garson has been completed and is in operation. The pumping station for the project will be completed in 1972.

Approximately forty-two new water and sewage projects are under various stages of development. Design of facilities to treat the wastes from the communities of Porcupine and South Porcupine was underway. Construction of parts of the Blezard Valley Scheme was also underway.

The Lake Timiskaming water treatment plant began supplying water to the Town of Haileybury in October.

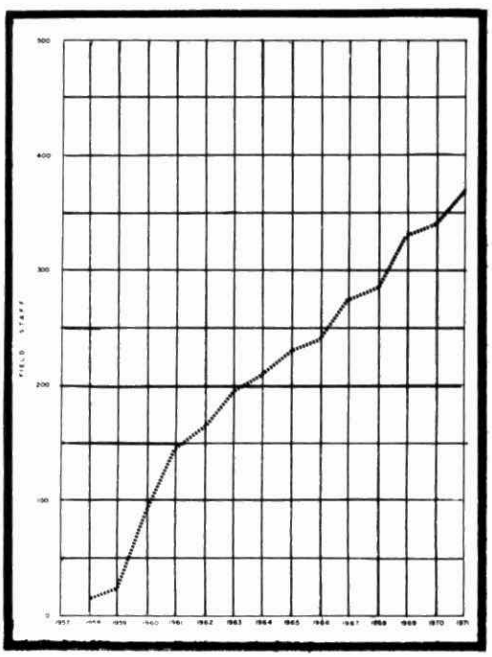
Region VI

A total of twenty-four projects were operational. Of these, seventeen were municipally-financed, the remainder were provincially-owned and financed. The nine sewage treatment facilities and fifteen water supply projects required thirty full-time staff, two part-time staff and nine operating contracts. One major project was under construction and several minor extensions were completed.

Major extensions at the Thunder Bay and Sault Ste. Marie sewage projects were in the design stage.

Twenty-one Provincial projects were at some stage of development.

Figure 1 Total Field Staff



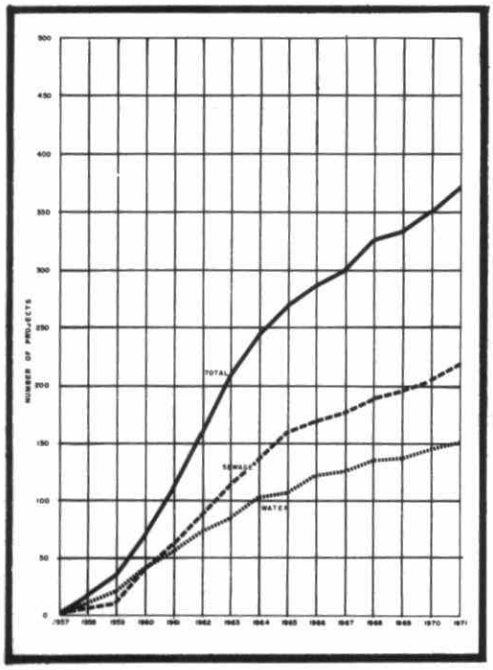


Figure 2 Projects in Operation

Figure 3 Total Capital Costs

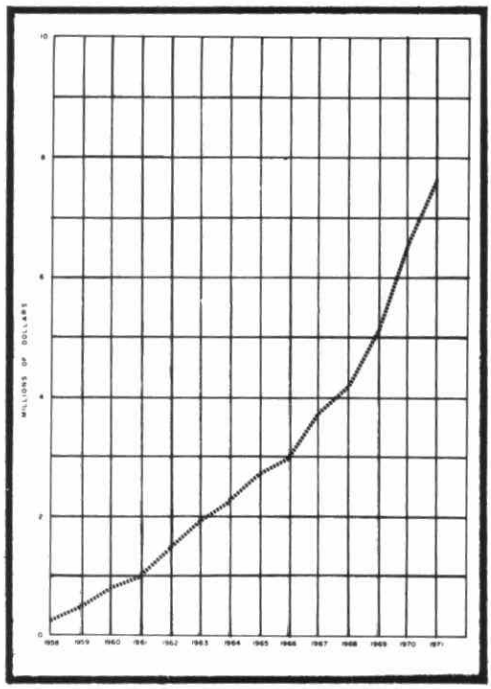
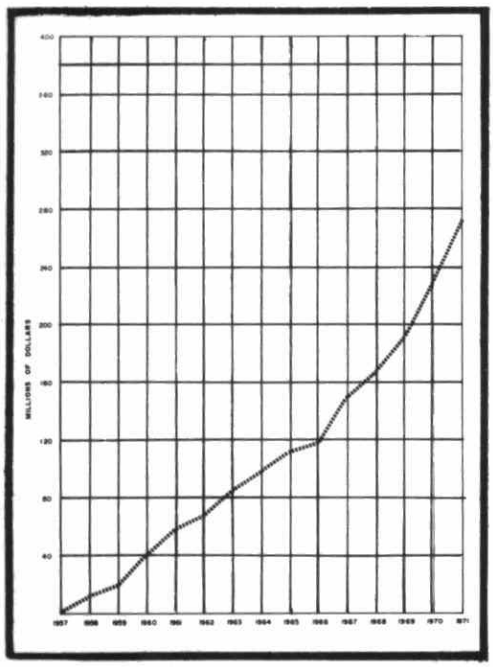
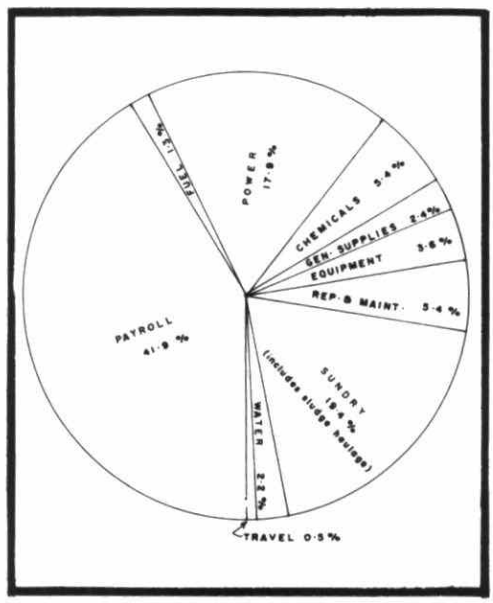


Figure 4 Total Operating Costs

Figure 5 Distribution of Operating Costs







Division of Project Developement

P.G. Cockburn, Director
L.F. Pitura, Assistant Director

The Division of Project Development is responsible for the development of OWRC-financed water and sewage works systems. Details concerning the responsibilities and activities of the various branches are presented later in this report.

During the period there were several significant developments which affected the functions of the Division. The highlights of these are summarized below.

FINANCIAL ASSISTANCE TO SMALL MUNICIPALITIES

The availability of provincial financial assistance continued to provide a stimulus with respect to the undertaking of OWRC-financed projects. The number of projects underway continues to remain at a high level, with the size of the municipalities requesting projects being largely concentrated in the 1,000 population range.

In spite of the availability of a subsidy of almost 50 per cent of the capital costs, some projects, because of their remote location, together with difficult subsurface conditions, are faced with excessive costs as they affect the householder. Towards the end of 1971, studies were initiated to investigate the ways and means of adjusting the policy on subsidies and yet remain within budget restraints for the next fiscal year.

REGIONAL MUNICIPALITIES

Staff of the Division continued to participate in the liaison committee meetings which were held with the regional municipalities of Niagara, Ottawa–Carleton, and York and the District of Muskoka. The committees, involving senior representatives of the municipalities, have met regularly. Their purpose is to facilitate the orderly integration and development of the existing water and sewage works schemes and to provide a means of communication with the Commission. Standard procedures have been evolved and, following completion of their work, the committees can be disbanded or, conversely, convened again as required.

It is anticipated that the OWRC will continue to develop both major works and local systems for regional municipalities and area municipalities, depending upon circumstances.

EXPROPRIATIONS

The awareness of the public concerning their rights under the Expropriation Procedures has increased the time required to negotiate settlements required for either freehold or easement purposes. During the period there was an increase of 15 expropriations over 1970.

In addition to the above items, other activities were carried out by the Division which merit reporting. For example, there were several meetings held with Indian bands regarding the possibility of the OWRC providing water and sewage works systems in a manner similar to that used in providing facilities for municipalities. Unfortunately, due to jurisdictional issues concerning the Indian bands, it was not possible to provide any concrete proposals to the Indian people during the year. However, it is anticipated that discussions on the subject will continue in the years ahead in an attempt to provide a solution to the environmental problems on Indian reserves.

Another item that is of considerable interest to areas in Northern Ontario is the attempt by the Division to promote a policy involving some form of financial assistance to unorganized municipalities. This policy would primarily assist existing hamlets where services already exist. The proposed policy could provide a means of maintaining and replacing existing works. It is anticipated that this subject will be presented in the form of a report to the Treasury Board for further consideration later in 1972.

The Division was also involved in numerous meetings with other departments, both provincial and federal, to exchange information on OWRC projects and, in some cases, to develop projects for other Government departments. At the end of 1971, discussions were initiated with a federal department concerning the possibility of the OWRC acquiring federal facilities to serve certain Ontario communities.

The major difficulty facing the Division in the coming year is the time required to bring projects into operation. Under the present method, anywhere from two to four years may be required for this purpose, following acceptance of the project by the Commission. Considerable time is required in the pre-design function and in the obtaining of approvals from the Ontario Municipal Board. In many instances because of the increased tax load which will be placed upon the ratepayers, the municipalities themselves appear reluctant to take the necessary action to expedite the completion of by-laws in order that applications may be presented to the OMB. Several procedures have been implemented in an attempt to improve the timing and additional measures will be considered during 1972 in order that projects may be placed in operation in a shorter period.

Municipalities are becoming increasingly dependent on staff to guide them in determining special charges to be levied on ratepayers. This demand will continue as the Commission becomes more involved in providing works for smaller municipalities. Another activity that is requiring more staff participation is the attendance at public meetings at the request of the municipalities. This activity will probably continue to be expanded in the years ahead as the municipal ratepayers become more involved and more interested in their environment.

PROVINCIAL PROJECTS BRANCH

The function performed by the Provincial Projects Branch is basically a co-ordinators role in the development of projects under Sections 17 and 18 of the OWRC Act. It involves discussions with municipal officials, consulting engineers, and with other members of Government departments, and attendance at public meetings for the purpose of explaining the proposed project. Because of the many details and the preciseness required when dealing with the projects as they proceed through the various stages, the workload has become extremely heavy. However, considerable progress is being made, as is evident by the number of projects, to date, which have received Ontario Municipal Board approval and have progressed through the preparation of final design, calling of tenders, award of contract, construction, to finally being placed in operation.

During the 15 month period ending March 31, 1972, the Provincial Projects Branch received a total of 68 new applica-

tions for water and sewage projects from 52 municipalities throughout the Province of Ontario. By the end of the period, the Commission had approved 56 of these applications, involving 37 municipalities. The balance were under consideration. The total number of new projects accepted by the Commission, combined with the total number of projects previously accepted by the Commission, brings the total number of water and sewage projects currently under active development with this Branch to 384.

There were 51 applications made to the Ontario Municipal Board during this 15 month period. As a result of these applications, 42 hearings were held by the Ontario Municipal Board at which representatives from the Division were required to attend. The Board approved 5 applications without a hearing and approved 41 other applications as a result of the various hearings. The Board has deferred its decision on 7 of the 51 applications. The total estimated capital cost of the applications approved by the Board exceeds $38 million.

As a subsidiary development to the placing of these water and sewage systems in operation, the Branch has become involved in a number of matters associated with requests for extensions and advice on billing procedures. In addition, some of the projects which have been previously placed in operation require rate reviews in accordance with the agreements. As a result, the Branch is asked to comment on these rate reviews prepared by the Division of Finance.

The philosophy behind the development of the provincial-ownership plan is based on the recovery of capital and operating costs from a service rate which is calculated on anticipated use over a 20-year period. As a result of this new method of financing, it has come to light that a large number of smaller municipalities do not meter water customers on an individual basis. Some system of flat rate charges has, therefore, to be established. There is a discrepancy, however, between the municipality's flat rate charges to its customers and the OWRC's charge to the municipality which is based on metered flows. The Branch has attempted to reduce this problem by carrying out, when possible, detailed discussions and analysis of the municipality's rates prior to by-laws being passed by the municipality.

In 1969, the Government agreed to provide financial assistance in connection with high cost water and sewage projects for small municipalities. This policy has significantly reduced the financial burden on the homeowner and has enabled small communities throughout the Province to proceed with the development of the needed facilities.

A tabulation of activities is provided below.

	Cumulative to end of 1970	Jan. 1, 1971 to Mar. 31 1972	Total
Applications Received for Sewage Works	252	37	289
Applications Received for Water Works	131	31	162
Provincial programs accepted by the Commission	406	56	462
Total Provincial programs (excluding Area Studies)	406	33	439
Engineering agreements executed for retaining consulting engineers	225	54	279
Municipalities participating in Provincial programs (excluding those municipalities participating in Area Studies)	256	23	279
Reports received from consulting engineers (draft, preliminary, final design)	254	121	375
Tentative rates approved by the Commission	202	37	239
Agreements for final design executed	129	44	173
Provincial programs under active development			384

SUMMARY OF PROVINCIAL PROGRAMS

Figure 1

NEW PROJECTS REQUESTED – WATER & SEWAGE

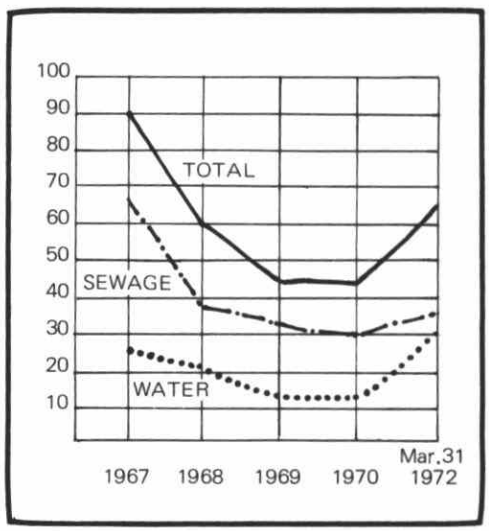
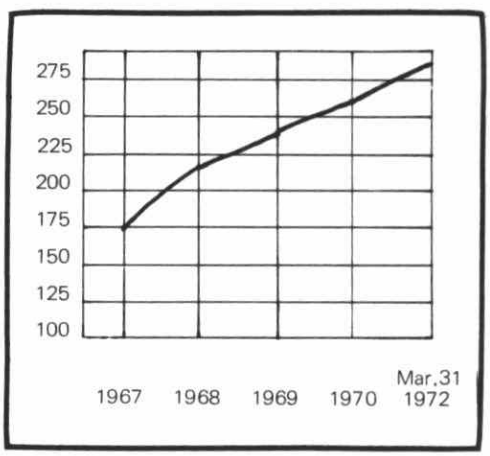


Figure 2

MUNICIPALITIES PARTICIPATING IN PROGRAMS – CUMULATIVE



AREA PROJECTS

Towards the end of 1970, a Supervisor was appointed to undertake the responsibilities of administering area projects being developed by the OWRC. These projects are primarily related to those areas where public water and sewage service areas have been established under the OWRC Act. The following is a report on the projects affected:

CENTRAL YORK AREA

Following the release by the Government of Ontario of the population targets for the York Central Area in August of 1971, the Commission was instructed to finalize a report on its proposals for the provision of water and sewerage services for the south-central area of the Regional Municipality. Work was well advanced by the end of 1971 and the consultant's report was received early in March of 1972. To assist in the orderly integration by the Region of a large number of water and sewage works programs throughout the Region, a Liaison Committee was established and met regularly during the latter half of the year. This committee has made an important input to the central servicing proposal.

BELLEVILLE/TRENTON PUBLIC WATER & SEWAGE SERVICE AREAS

Consulting Engineers' reports dealing with an area water supply system and two other reports for area sewerage services for Belleville and Trenton were presented in October in some detail to the Advisory Board established for the area. Consideration is being given to the best method of implementing these area proposals.

BLENHEIM PUBLIC WATER SERVICE AREA

In June of 1971, filtered Lake Erie water was made available to the Town of Blenheim and enroute consumers from the recently acquired Cedar Springs water treatment plant. Consideration is being given to the development of secondary systems to service smaller communities within the Public Service Area.

LAMBTON COUNTY AREA

Early in 1971, a public hearing was held in Sarnia to advise the municipalities involved in the area system concerning the works which the Commission proposes to build and the rates which will be assessed for the supply of water to the area. A Commission order formalizing these matters was issued and appeals against the order were filed with the Cabinet by the City of Sarnia and the Township of Sombra. The Cabinet dealt with and rejected the appeals in November. The final design of the works is now nearing completion and construction of the facilities is expected to commence early in 1972.

OWRC/MUNICIPAL PROJECTS BRANCH

OWRC/Municipal sewage and water works projects are developed under Section 52 of the OWRC Act. In comparison with the previous year, the number of projects under development has decreased slightly. However, due to the fact that the development period for the projects often extends beyond a single year, the number of individual functions related to projects carried out by the Branch increased over the previous year.

In addition, the Branch has been responsible for the co-ordination of the information provided by the various OWRC divisions in the preparation of special agreements and financing arrangements before final submission is made to the Commission.

Based on a formula approved by the Treasury Board in July, 1970, several OWRC/Municipal projects were granted provincial financial assistance. Utilizing the same formula, the Branch also calculated and provided the amounts of subsidies given to extensions constructed under the Provincial program. In addition, the Branch was involved in legal matters relating to agreements affecting OWRC activities with Regional Municipalities.

From January 1, 1971 to March 31, 1972, 21 water works projects at an estimated cost of $4,187,091 and 13 sewage works projects at an estimated cost of $6,115,581 were accepted by the Commission. A tabulated summary of the development of these projects from 1965 to March 31, 1972 follows:

	1965	1966	1967	1968	1969	1970	1971 to Mar.31, 1972
New Projects Requested	35	29	27	36	43	33	33
New Projects Accepted	33	26	31	21	36	33	34
Preliminary Agreements Executed	31	28	23	15	22	19	28
Final Agreements Executed	35	30	22	37	17	13	32
Rating Proposals Prepared	34	32	33	20	21	21	35
Final Statements Prepared	27	27	30	29	15	14	21
OMB Notices Prepared	26	24	25	21	18	13	15
OMB Hearings	15	9	12	5	4	2	4



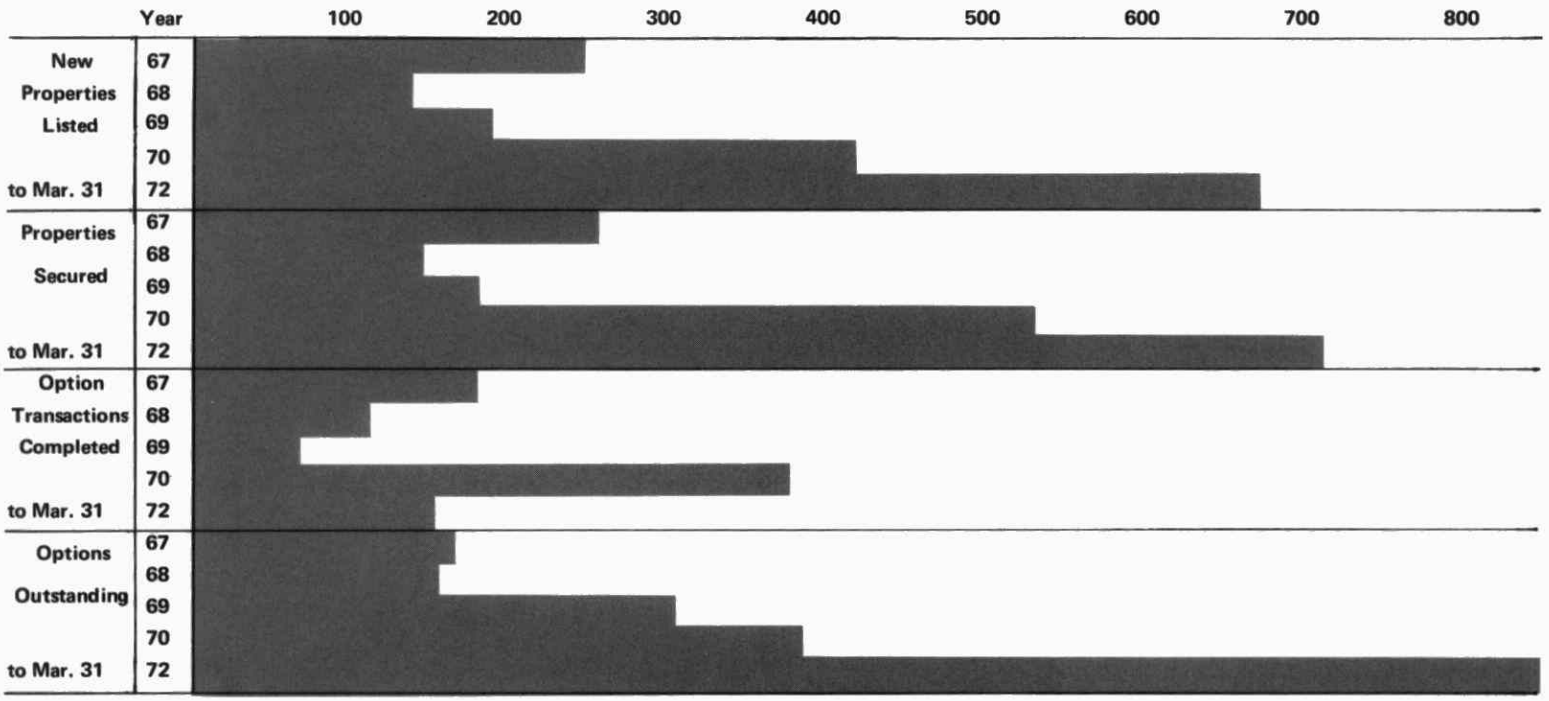
PROPERTY BRANCH

The number of property acquisitions continues to increase from year to year. The use of outside negotiators to secure options and purchase land has enabled the Branch to remain at the same complement.

Work generated by expropriation proceedings under the Expropriations Act has continued to require considerable attention.

The statistics for the period, as tabulated below, indicate an overall increased workload for the Property Branch.

STATISTICS FOR THE PERIOD 1967 TO MARCH 31, 1972.



STATISTICS FOR PERIOD JANUARY 1, 1971 – MARCH 31, 1972.

Properties

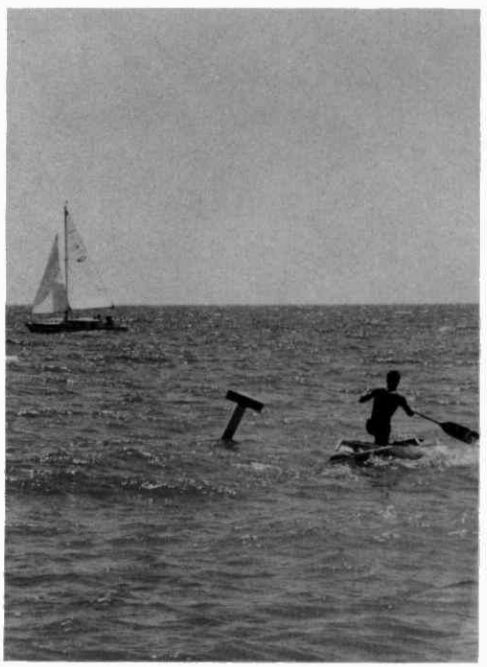
Properties under negotiation at end of previous year	66
New Properties listed for acquisition during period	670
Properties obtained or otherwise acquired	702
Properties under negotiation at end of period	34

Options

Options held at end of previous year	340
New options acquired during period	658
Transactions completed during period	159
Options outstanding at end of period	839
Options pending final agreement	517
Options being processed	322

Expropriations

Expropriations outstanding at end of previous year	109
New expropriations	15
Expropriations settled or file closed	36
Outstanding expropriations	88



Division of Research

A. J. Harris, Director

The principal responsibility of the Division of Research is to make available accurate research information drawn from the current and rapidly expanding technical knowledge of the aquatic environment and water and waste treatment processes.

Requests for information regarding new materials, new applications of existing theory or processes, the enhancement of existing processes, the effect of new or existing waste discharges, or the re-evalution of conventional processes in the field of both water and wastewater are referred to the Division of Research, where, by application of existing knowledge, literature review and experimental testing, data are collected, analysed and reported.

Reports are provided to the Commission, to management or to other divisions. Information is also made available to municipalities and consultants for incorporation into the design and operation of treatment works. Official research reports and papers are published and receive wide circulation, including distribution to federal and provincial agencies, universities and the United Nations.

The staff of the Division currently comprises 44 employees, the majority of whom have advanced degrees representing various disciplines. The Division is organized into four branches – Administration, Applied Sciences, Technical Advisory Services and Nutrient Removal – Special Studies.

In June of 1971, the Division of Research moved to separate quarters at the Experimental Station, 4375 Chesswood Drive, to alleviate the overcrowded situation at the Resources Road Laboratories and Research Building where an extensive expansion to provide enlarged laboratory and research facilities is underway. In preparation for the re-location, many of the test-floor projects were terminated early in the year or moved to field sites for uninterrupted study.

Throughout the period, Division staff actively participated in a variety of workshops, panels, seminars, courses, conferences and committees, including the Canada – U.S. Working Groups on Great Lakes Pollution, the Committee on the Canadian National Report on Phosphorus Removal for the Organization for Economic and Co-operative Development, the Task Force on Research



of the Advisory Committee on Pollution Control, the National Research Council Civil Engineering Grant Selection Committee, the Research Committee of the American Waterworks Association and the Technical Committee to the Board of Review of the Canada-Ontario Agreement.

The commencement in 1971 of the implementation program for the installation of phosphorus removal facilities at municipalities in the Province of Ontario necessitated heavy shift of emphasis from innovative research projects and assistance concerning perplexing process problems at water and wastewater treatment plants to technical assistance for the establishment of integrated phosphorus removal techniques at existing sewage treatment plants. Preliminary studies were completed at about 55 sewage treatment plants to establish which chemical and point of addition produced the optimum results in preparation for the installation of permanent phosphorus removal processes at these plants. Because of the dependency of the process on local conditions, each plant must be individually assessed. After completion of the preliminary treatability tests, some 30 municipalities proceeded with temporary installations to implement full-scale phosphorus removal. Essentially, these full-scale studies confirm the suitability of the existing treatment plant facilities for the addition of phosphorus removal processes without major capital costs.

The following brief descriptions detail some of the more significant activities of the Applied Sciences, Technical Advisory Services and the Nutrient Removal/Special Studies branches:

APPLIED SCIENCES BRANCH

The Applied Sciences Branch, at the request of the Commission, investigates and reports on innovative and unusual processes and concepts with regard to their application to water and waste-water treatment and water resource management.

The projects undertaken, which are generally of an engineering nature associated with water, are of relatively long duration, extending over a period of one to three years. At the conclusion of a project

or at a discrete phase of a project, a report is prepared and distributed, with the responsibility for application of the relevant theory or concept assigned elsewhere.

In addition to formal projects, the staff of the Branch acts in an advisory or consultant position on miscellaneous problems. Approximately 80 of these consultant assignments required formal memorandum reports during the period.

A brief description of the major Branch assignments follows:

Enhanced Biological Removal of Phosphorus

A laboratory study designed to determine the phosphorus removal capabilities of the activated sludge process was completed. Bench scale experiments, using settled domestic sewage, showed that modifications in the hydraulic characteristics and air supply rates were effective in improving capability without chemical addition. Effluent phosphorus concentrations were reduced to 2.5 – 7.5 mg/1, compared to 6 – 14 mg/1 before the modifications were incorporated. A study of the relationship of phosphorus removal effectiveness to the ratio of organic substrate, or Bio-chemical Oxygen Demand to phosphorus, in the influent indicated that enhanced phosphorus removal is accomplished in the aeration tank through incorporation with the sludge floc by microbial growth and is dependent on a high ratio of BOD to phosphorus compared to the available BOD. Low BOD to phosphorus ratio generally precludes high (〉80 percent) removals of phosphorus biologically. A report presenting the results is being prepared.

Nutrient Removal from Waste Stabilization Pond Effluents

Laboratory studies indicated that direct injection of a chemical coagulant into raw sewage feedline of a waste stabilization pond can effect an ultimate removal of 90% of the total influent phosphorus. This process is particularly suited to a continuous overflow pond.

A system was set up for injecting aluminum sulphate into the influent of the east cell of the Shelburne waste stabilization pond. The addition of alum at a mixed concentration between 150 and 200 mg/1 has resulted in an overall reduction in total phosphorus at the effluent of 82%, as opposed to the control cell which provides approximately 48% removal at the end of two theoretical turnover periods.

A heavy blue-green algal bloom, which was attributed to the alum, persisted throughout the summer and dissipated with the advent of cooler weather. Chemical treatment of the east cell at Shelburne is continuing and other waste stabilization ponds are being tested for phosphorus removal by using ferric chloride and lime separately.

Spray Irrigation of Waste Stabilization Pond Effluent

As an alternative to the chemical treatment of waste stabilization pond influent, effluent was sprayed on eight acres of grassland with a soil of moderate permeability and two acres of forested land. A spraying program was set up so that the grassland areas received a total of either 4" or 2" per week and the forested area 1" per week. This program could be carried out during August and September but in October the 4" per week rate appeared to be too high and was reduced to 2" per week.

An extensive monitoring program to evaluate the efficacy of the soil in treating the effluent and to trace changes in the groundwater has been carried out. The first 6" of soil removed 95% of the total phosphorus and 90% of the total nitrogen present in the lagoon effluent. No contamination of the groundwater by viral pathogens has been observed. There was no damage to groundcover or trees. The original spray area will be used again during 1972, and a new separate area will be set up to investigate a runoff system on less permeable soil. The equipment for the second test is now on site.

Individual Sewage Disposal Systems

A preliminary report, containing research recommendations, was prepared to define current technology concerning self-contained individual sewage disposal systems for use primarily in the cottage country. Based on available literature, the report states that the standard septic tank – soil absorption system is satisfactory in areas where soil conditions are suitable. For other areas with impervious soils or otherwise unsuitable conditions, where this method has not been completely successful, the report indicates that alternative systems are available. In summary, the report concludes that research and development of new and improved individual sewage disposal systems should be continued to ensure safe disposal practices.



Control of Sewage Treatment Plant Odours

The Division of Research, in co-operation with the Air Management Branch of the Department of the Environment, began an investigation of nuisance odours from operating sewage treatment plants, as part of a general study of odour source and control methods. The purpose of these investigations is to provide practical, economical methods for controlling unpleasant odours, based on field work results. The study is continuing.

Chlorination of Sewage Effluents

Tracer studies were conducted to determine hydraulic characteristics and residence times in chlorine contact basins of sewage treatment plants. Several of these tests were carried out at plants operated by the Division of Plant Operations.

Test studies were undertaken to evaluate a SANURIL Wastewater Chlorinator for its usefulness in disinfecting effluents from small package sewage treatment plants. This device was developed recently and is said to be capable of overcoming problems experienced in other methods of chlorination. It utilizes and dispenses chlorine in patented, sanitizing tablets. The test studies are continuing.

Weeping Tile Flow

Staff co-ordinated a program for the joint committee of the City Engineers Association and the OWRC to assess the quantity and quality of weeping tile flow connected to sanitary sewers. Measurements of rainfall and corresponding flow from weeping tile were made at five sites, each of which differ in soil type, roof drainage, backfill and type of tile. The flow from the different sites was observed to vary between 6,000 and 40,000 Imp. gallons per year. Chemical tests show that the water is of a very high quality. The data obtained will enable municipalities to set more meaningful criteria regarding the connection of weeping tiles to sanitary sewers. A report presenting the results of these measurements is being prepared for general circulation.

Use of Plastic Pipe for Sewers

In response to increased interest, the Commission authorized an investigation of the use of plastic pipe for buried, gravity-flow sewer installations. Data have been compiled and a report will be completed by May of 1972.

Water Pollution Caused by Two-Cycle Outboard Marine Engines

Because of the increased use of outboard motors, concern has arisen that the exhaust products from these engines may become a significant source of pollution in the Province's lakes and rivers. A study has been undertaken in which four outboard motors of different horsepower and manufacture were operated in tanks of water to determine the quantities of pollutants discharged, based on fuel consumed and engine speed. In addition, laboratory jar tests were carried out to determine the effect which exhaust products have on algal growth. The results of this study, based on an evaluation of published data and laboratory tank tests, indicate that the most significant problem is the effect of exhaust products on water taste and odour and in the tainting of fish flesh. Because of the large quantities of water diluting the exhaust products in actual situations, hydrocarbons, lead, phenols, and nutrients discharged in the exhaust gases do not appear to be significant pollutants.

Oil Spill Clean-up Technology

Tests and evaluations of various oil spill cleanup agents were continued. During the year, a brief report on the evaluation of sorbent materials was published.

At the request of the Department of Natural Resources, samples of corrosion inhibitors and acidizing wastes from gas-well drilling operations were tested for their pollutional effects on the receiving waters.

Phosphorus Removal Experiments



Marine Toilet Studies

Four samples of commercial chemicals formulated for use as disinfectants and deodorants in recirculating toilets were evaluated in the laboratory for their effects on the biological processes in the sewage treatment systems. These evaluations were submitted to the Plumbing and Boating Branch of the Division of Sanitary Engineering in order that a decision might be reached on whether they might be approved for use in toilets and holding tanks on board ships and pleasure boats.

Oil Leak Tracers

Two incidents of stream pollution caused by leakages from underground furnace oil supply tanks were investigated. Attempts were made to ascertain the source of these leaks by adding tracers in the suspected tanks. To date, it has not been successful. In connection with this work, several oil-soluble dyes were examined and tested to determine their suitability as tracers for future use.

Frazil Ice

One of the difficulties encountered in the collection and distribution of water is the blockage or partial blockage of intake structures by anchor ice and frazil ice. To aid water works authorities in Ontario in the action to be taken to alleviate such problems, and also to facilitate the review of new intake designs, the Division of Research was requested to conduct a study to review the literature and to conduct a survey of experiences at water works in Ontario.

Experiences at water works in the Great Lakes indicate that designing the intake crib with a low profile to obtain maximum water depth over the area of water movement at the inlet reduces the probability of frazil ice or slush ice, produced in the surface layers of the lake water, being drawn into the intake. Research indicates that ice has less tendency to build up or crystallize on materials with a low thermal conductivity and smooth surface properties, such as fibreglass and plastic. Coating underwater structures and conduits in the zone where icy crystals are actively produced with a

material such as bituminous paint appears to inhibit ice formation. Other factors, including the degree of turbulence of ice-producing water, the amount of super-cooling, and the shape of the underwater structures, appear to influence the rate at which ice adheres and grows on underwater structures.

Cold Weather Water Transmission

As part of a water supply system being installed in Northern Ontario, the OWRC is installing 5000 feet of 24 inch diameter water main insulated by "Styrofoam" sheets. The Applied Sciences Branch is installing and will monitor soil thermistors to obtain vertical temperature profiles over a period of at least two years. The data will provide design criteria for future installations.

Reverse Osmosis

Preliminary studies were conducted to determine the efficacy of the reverse osmosis process for improving the chemical quality of extremely hard and highly mineralized waters presently used as municipal water supplies in the Province. Field and laboratory tests with a small, portable reverse osmosis unit were carried out on samples of water from Acton, Arthur, Caledonia, Comber, Perkinsfield, Smithville and Walkerton.

TECHNICAL ADVISORY SERVICES BRANCH

As in the past, most of the work of the Technical Advisory Services Branch was carried out in co-operation with the divisions of Sanitary Engineering, Plant Operations and Industrial Wastes. Through these divisions, the facilities of the Branch are available to all municipalities and industries, particularly those encountering difficulties in the operation of their water and wastewater treatment plants.

Wastewater Section

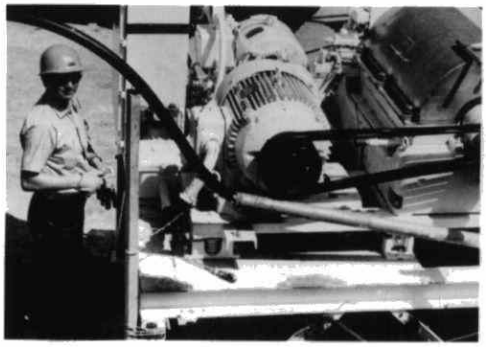
As in previous years, considerable technical assistance has been provided to municipalities and industries encountering operating problems at their treatment plants. Although activity of this nature has previously constituted the largest single workload, the technical implementation of the phosphorus removal program this year was responsible for a significant portion of the Branch's functions.

In 1970 and 1971, a trend toward employing chemical and improved physical methods for treatment of wastewater was noted. However, the introduction of the phosphorus removal requirement for many treatment plants has resulted in Branch efforts being directed to a wide range of phosphorus removal considerations.

At an inter-divisional meeting, held to review the technical aspects of the proposed phosphorus removal program, it was concluded that additional technical information was required in specific areas. A program described as Chemical Process Criteria for Phosphorus Removal was undertaken to provide the necessary information when phosphorus removal was being considered for various types of wastewater treatment facilities, e.g. aerated lagoons, oxidation ditches, extended aeration plants, contact stabilization plants, lagoons, etc. As part of this program, full-scale phosphorus removal was effected at nine WPCPs, using one of the three prime coagulants, alum, iron salts, or lime. Perhaps the most significant outcome of this study was the fact that phosphorus removal can be readily implemented within an existing WPCP with no major modifications being required. In some cases, a flash mixer was the only additional equipment required to obtain satisfactory precipitation of phosphorus.

Considerable technical assistance was provided to several municipalities interested in conducting their own phosphorus removal studies. This assistance ranged from discussion and review of proposed studies to actual field investigations and assessment of ongoing studies.

In order to implement phosphorus removal on a wide scale, it was necessary to establish a technique that would allow the development of phosphorus removal process criteria at a particular WPCP. In this regard, a method of jar testing data analysis and in-plant evaluation was established for obtaining these criteria. This has become the basic method for conducting "treatability studies" at a WPCP with respect to proposed phosphorus removal.



Centrifugation Study of Lime Sludge

As a result of this work on phosphorus, there was a marked increase in the sample load submitted to the Branch analytical laboratory. The number of analyses completed increased from 14,050 to 29,092.

In conjunction with the Division of Sanitary Engineering, staff participated in a seminar on phosphorus removal. This seminar was presented primarily for consultants and dealt with the technical aspects of implementing a phosphorus removal study.

Staff conducted a training program at the Kitchener WPCP for some laboratory technicians of the Division of Plant Operations which proposed to undertake preliminary studies required for phosphorus removal at its WPCPs. Jar test procedures and process design considerations for phosphorus removal facilities were reviewed.

In order to provide direction for phosphorus removal at WPCPs which were in final design stages for proposed expansion, staff conducted the required jar tests at many municipalities.

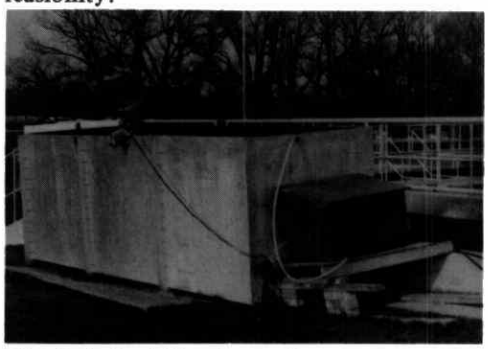
An effluent polishing study, originally started in 1970, was continued. This study concluded that effluent quality from a filtration unit was not a function of media size or filter type; however, both of these parameters would influence the mode of operation of such an effluent polishing unit. From the data obtained to date, it does not appear that a high quality effluent, i.e. less than 5 mg/l 5-day Biochemical Oxygen Demand and Suspended Solids, can be obtained through secondary effluent filtration alone. The results obtained indicated that approximately 50 to 60% reduction in SS would result from effluent filtration.

In an attempt to further improve the effluent quality at the Elmira WPCP, a pilot-scale ozonation system was placed into operation. Preliminary laboratory results had indicated that good colour removal and phenol reductions could be obtained through the application of intermediate ozone dosages. Subsequent pilot-scale results did not yield the improvement in effluent quality expected. The Uniroyal Company took advantage of the presence of the ozonator to conduct preliminary studies on treatment of particular in-plant wastes. This additional work did not yield any promising results either. Following a strike at Uniroyal Limited, the effluent at the WPCP deteriorated considerably when production resumed. As a result, the Company has been restricted to approximately one-half of its previous daily volumetric discharge.

In conjunction with staff of the Division of Industrial Wastes, staff have been participating in the inspection and review of operating data from piolot-scale studies for wastewater treatment at various pulp and paper mills. While general aerated lagoon design criteria previously established for other types of wastewaters appear applicable, various problems unique to particular mills have arisen.

Following several meetings held with the supplier of cage rotors used in oxidation ditches, it was decided to accept the tap-water oxygen transfer capacity of cage rotors operating at speeds of up to 90 rpm. The oxygen transfer problems encountered at several existing ditch installations have likely been the result of deviations from ideal design. The equipment supplier of the cage rotor is to supply a check-list of specific criteria which need to be satisfied for satisfactory design of oxidation ditches.

A laboratory investigation was conducted into the application of a Purifax unit for treating sewage sludges. In this laboratory unit, batch treatment of sludges is effected by application of high dosages of chlorine at pressures of 10 to 30 psig for approximately a 2-minute contact time. This unit stabilizes sludge rather than reducing volatile matter content. The laboratory results indicated that sludges treated in this manner would be stable for periods of at least 30 days (stability as measured by Oxidation-Reduction Potential values). Plant-scale application of the unit would allow for further evaluation of economic feasibility.



Pilot Scale Denitrification Studies

Water Section

As in previous years, a number of treatability studies were carried out to determine which water treatment processes would produce optimum results for new water plants for communities such as Hearst, Odessa, Espanola, Hastings, Clarence Creek and St. Pascal. Detailed recommendations for plant designs were then prepared by the Branch. General reviews of plant capacities and operating characteristics were provided for other communities such as Cochrane, Napanee, Tilbury, Whitby, and Red Rock and for a number of industrial water consumers. Coagulant and filter aids such as activated silica and polyelectrolytes, and the study of which chemical dosages and points of application would give optimum results, were used to improve treated water quality.

A number of communities were given assistance with regard to the pH adjustment needed to obtain a treated water supply with a Langelier index within the non-corrosive range.

The use of sodium silicate addition as a method of iron control in water supplies was initiated in Bondhead and Gravenhurst. Determinations of the amount of silicate needed for this method of control were made at Holtyre, Waterloo, Norwich, Nobleton, King City, Wingham, Ignace, Woodstock and Kapuskasing. These communities are considering changing to or initiating this method. Experience in this method of iron and manganese control resulted in a member of staff making a visit to Dartmouth, at the request of the Government of Nova Scotia, to provide technical assistance to the local task group working on the manganese deposition problem in the City's surface water supply.

Problems with taste and odour in the water supply at a number of communities were successfully overcome by additional or more efficient chlorination. However, a more persistent and unusual taste problem was encountered at the Township of Markham plant. A strong medicinal flavour would develop when the water from the German Mills wells was chlorinated. Superchlorination, application of chlorine dioxide and ozonation failed to remedy the problem, whereas filtration through the Steeles Avenue plant, which was re-opened to resolve the immediate supply problem, successfully removed the medicinal taste. The taste component was difficult to identify analytically. Carbon column extracts were taken, the analyses of which inferred that organic nitrogen compounds were responsible for the flavour. The filter bed at the Steeles Avenue plant has been shown to be bacteriologically active and it appears that a biological removal of the taste-producing compounds occurs during filtration. Based on these indications, and filter test evaluations, design criteria for a proposed new filter system at the Township of Markham plant were prepared.

Assistance was provided when the filters at Goderich water treatment plant were changed to high rate and plant scale tests were carried out to determine the effectiveness of conventional sedimentation as a pretreatment for the removal of diatoms. Pilot filter studies were made at the Lake Huron water treatment plant, using alum flocculated raw water, to examine larger anthracite media as a method of extending filter run times when the raw water has a high diatom concentration. The use of a 2mm coarse anthracite layer on top of the existing multimedia filter showed promise, with an increase of up to fourfold of filter run times being experienced. Further pilot studies at Harrow evaluated the effect of media size on filter run times and on treated water quality during high rate, high raw water

turbidity filtration. Excellent treated water quality was attained using alum flocculation prior to filtration through coarse media (1.7mm effective size anthracite) over 0.45mm sand. Utilization of this coarse media in filter clogging studies, using microstrainer backwash water containing a high concentration of diatoms, increased filter runs up to threefold compared to filtration through standard media. A recommendation has been made, following the results of the coarse media filtration pilot studies, that one of the filters at the Lake Huron water treatment plant be changed to coarse media in order to carry out a full-scale test during the spring diatom surge.

A model solids contact clarifier was operated at Lindsay in order to determine the chemicals and operational conditions for optimum algae removal from the raw water. Experiments using ferric chloride as the prime coagulant together with chlorine, silica and lime additions gave algal removals of up to 90%. This level of removal appeared to be independent of flash mixing speed or contact time.

A number of proposals for the new treatment system for treating Vermilion River water as a supply for the International Nickel Company of Canada Ltd. and the Sudbury area were reviewed. A pilot plant installation of F. Hankin & Co. was visited at the Vermilion River; it was designed to provide both turbidity and colour removal at low alum dosage utilizing a microstrainer, two ozonation columns and a high rate dual media filter.

While this Branch devotes most of its time to providing technical service, it also carries out some direct research projects. A summary of this activity follows:

Taste and Odour

A major part of the work on taste and odour was directed towards production, extraction and identification of the major odour component of a species of Actinomycetes. Water, artificially contaminated with this component, was subjected to various treatments, (chlorination, ozonation, gamma irradiation, etc.) the efficiencies of which were compared. A paper reporting the results of gamma irradiation treatment of water containing Actinomycete tastes and odours was presented at the Annual Conference of the AWWA at Denver, Colorado.

Upon the conclusion of the study, a report summarizing current knowledge and treatment practices was prepared (Research Report 48).

Removal of Organics by Sand Filtration

A pilot-scale sand filter has been constructed to study the removal of taste-causing organics and other material from water at various flow rates, and to correlate this removal with the biological organisms present in the sand.

For eight weeks the filter was run at a slow flow rate (about 0.002 gpm/sq. ft.) using a simulated raw water, comprising tap water mixed with 2-3% of secondary sewage effluent. After three weeks, some growth was evident on the sand surface; after four weeks, it was completely covered. This layer, the schmutzdecke or autotrophic zone, consists of algae and zooplankton. The filter run lasted eight weeks before the filter needed to be cleaned. During the run, coliform counts were carried out on the influent and effluent. There was a tenfold reduction in the count after passing through the filter. In addition, the filter was examined for its ability to remove virus, which was added to the water overlying the filter. Samples of water were removed from various levels of the sand bed in order to monitor the passage of the virus through the filter. The virus used was a bacteriophage of E Coli B. Runs were completed at all stages of filter operations, including immediately following cleaning.

Gamma Irradiation

Studies were carried out to determine the application of gamma irradiation in the treatment of secondary sewage effluents. A paper entitled "Application of Gamma Irradiation to the Disinfection of Municipal Wastes" (Research Paper 2027) was prepared.

Several meetings were held with representatives of ESI (Energy System Inc.) to expedite plans for the installation and testing of a pilot-scale irradiation plant at an existing sewage treatment plant. The plant performance will then be monitored to determine the feasibility of large irradiation installations.

Recently, further studies have indicated that the application of fairly low doses of irradiation (about 50,000 rads) improves the diatomaceous earth filterability of secondary sewage effluent from extended aeration plants.



Virus Monitoring

In co-operation with the Virology Section of the Ontario Department of Health Laboratories, virus monitoring programs were undertaken at two sites where research waste disposal studies were being carried out.

At Shelburne, effluent from a sewage lagoon was sprayed on agricultural land for irrigation purposes. Monitoring for coliforms, Salmonellae, E coli B bacteriophage (a bacterial virus, which was being studied for use as a possible indicator of virus transfer through soil) and enteric viruses was undertaken at several observation wells, in addition to wells used for municipal or private potable supplies. Results have indicated that where ground water levels are close to the surface, allowing little percolation distance, ground water may become contaminated with fecal organisms as a result of spray irrigation.

A site at Wallaceburg was used as an area for the spreading of sewage sludge; the field was supplied with underdrains (agricultural field tile) whose effluent was sampled at intervals and examined for coliforms, Salmonellae, E coli B bacteriophage and enteric viruses. Again, results showed the possibility of contamination of surface water from the disposal site, particularly after periods of rainfall.

Hospital Wastes

As a result of several enquiries regarding the subject, a paper (Research Paper 2027) was completed outlining the special problems associated with the disposal of wastes from hospitals and sanitoria, particularly with respect to a possible public health hazard.

Eutrophication of Soft-Water Lakes

In 1970, three small soft-water lakes in the Elliot Lake area were fertilized with various simulated domestic waste treatment effluents. Monitoring of the lakes was continued in order to study the recycling of the nutrients added in 1970. This project offered a unique opportunity to measure the persistence of nutrients in the lakes after all sources of artificial enrichment had been eliminated.

The information gathered should aid in the prediction of the rate of recovery in a autrophic receiving water, where various improvements in nutrient input from waste treatment plants have been introduced.

Bottom Fauna

Work has continued on the species identification of benthic invertebrates in order to build a functional reference collection. The emphasis this year has continued on molluscs and midges.

Nutrient Removal from Fill-and-Draw Lagoons

Experiments were initiated to assess various chemicals, dosages, and methods of application for the batch treatment of lagoons to precipitate most of the phosphorus prior to discharge of the lagoon. To this end, various chemical coagulants were used in regular jar experiments and further tested in enclosures within the lagoons at Listowel and Arthur. Of those chemicals which have been tested thus far, alum appears to be the most efficient for use on hard-water areas. Full-scale treatment of a lagoon was conducted at Arthur. Liquid alum at a dosage of 325 ppm was added, using two outboard motor boats to disperse the chemical. Chemical results indicate that the total phosphorus levels were reduced by 97-99%. The bacteria levels were also substantially reduced and the Secchi disc reading increased from 8 inches to over 5 feet. On the day following treatment, the lagoon discharge was initiated and it was completed 5 days later. Field studies are underway to determine the recirculation pattern of the precipitated nutrients.

Phytoplankton – Tastes and Odours

Laboratory studies to investigate the treatability of tastes and odours associated with three types of blue-green algae – Oscillatoria, Anabaena, Microcystis – were carried out in co-operation with staff of the Applied Sciences Branch. The effects of various treatments including superclorination, ozonation, gamma irradiation, etc. in eradicating odourous materials were tested.



Use of Lime in Phosphorus Removal

Phytoplankton – Nutrient Relationships

Bay of Quinte: A report describing the physical, chemical and phytoplankton characteristics of the Bay of Quinte has been completed. Significant correlations were obtained between phytoplankton densities and water transparency, turbidity, silicate availability and total phosphorus, but not nitrogen. The nutrient condition of the entire Bay of Quinte varies from eutrophic to polytrophic. The maximum observed ratio between phytoplankton density and total phosphorus was about 1000 $cm^3.M^{-3}$ algae per 1 $gm.M^{-3}$ total phosphorus. Critical examination of biomass versus nutrient contents of suspended solids suggests that a bloom quantity of algae – 10 cm^3 or greater – required only about 0.004 mg P, and 0.07 mg N.

Trent Watershed: Relationships between the nutrient contents of samples from eight lakes of the Trent River watershed in comparison to phytoplankton densities are being examined. The results to date corroborate findings outlined above from the Bay of Quinte. Further statistical analyses of these data are underway.

Lake-on-the-Mountain: Extensive in situ investigations of phytoplankton responses to fertilization of lake samples contained in large plastic bags were carried out during 1971. Phytoplankton enumeration and chemical analyses of seston and periphyton have been partially completed. Compilation and statistical examination is now in progress.

Kushog Lake: Preliminary limnological studies of Kushog Lake, a soft-water environ, were carried out in preparation for future in situ nutrient bag experiments.

Phytoplankton – Laser Beam Studies

Consultation was held with Dr. R. M. Measures of the Aerospace Institute, University of Toronto. Dr. Measures is currently investigating the application of laser beam technology as a water quality monitoring tool.

NUTRIENT REMOVAL – SPECIAL STUDIES BRANCH

The Nutrient Removal – Special Studies Branch is involved primarily with pilot and full-scale investigations of nutrient removal processes of a magnitude specifically designed for field studies. Laboratory analytical determinations and laboratory scale studies are an integral part of the activities of this group. Basically, the work of the Branch centered around the full-scale nutrient removal facility at the Newmarket/East Gwillimbury Water Pollution Control Plant.

Full-scale Nutrient Removal Facility

During the winter of 1970/71, a permanent installation of the lime treatment process for phosphorus removal was made at the Newmarket/East Gwillimbury WPCP. This facility was established for research and demonstration purposes, following



successful trials of the lime treatment process at Richmond Hill and Sault Ste. Marie. The facility, operational since early spring of 1971, effects phosphorus reduction in a range of 80 to 85%. Many visits to this installation and enquiries concerning it, have been made by interested corporations, consulting firms and agencies and foreign interests.

From this facility, information is being obtained concerning the following: lime feed rate control parameters; effect of primary sludge recycle; primary clarifier loading rates; primary sludge handling, treatment and disposal; effect of lime on the remainder of the plant process; and, lime treatment process economics.

Lime Sludge Centrifugation

From July to September 1971, a pilot centrifuge, made available from Sharples-Stokes Division, Pennwalt Corporation, was tested, using the lime sludge produced at the Newmarket phosphorus removal facility. Results of these tests indicated the dewatering of lime sludge by centrifugation to be an economically viable process. Sludge cakes of 25 to 30% by weight solids, with 95 to 98% recovery, were achieved at a polymer cost of less than $2.00 per ton dried solids. The results of this investigation have been prepared as Research Paper No. 2030.

Biological Nitrification-Denitrification

Because of the high degree of nitrification being achieved during the aeration process of the Newmarket nutrient removal facility, studies are being carried out to determine the amenability of the aeration mixed liquor to biological denitrification. Nitrate removals of up to 80% have been achieved.

A 60% reduction in nitrate would achieve an overall plant reduction in total nitrogen of about 85%. Preparations have been made to convert one empty aeration tank to a denitrification tank for full-scale denitrification trials.

Chemical Sludge Toxicity and Fertility

With guidance from the University of Guelph, greenhouse studies are being carried out to determine the relative toxicity and fertility of alum and lime sludges produced by phosphorus-removal processes on two crops, in two contrasting soils. Various application rates of the two sludges are being investigated.

Changes in some of the soil characteristics of the farmland receiving the Newmarket lime sludge are also being followed.

Phosphate Release from Chemical Sludges

Laboratory investigations have been carried out to obtain some insight into the phosphate release properties of lime and alum sludges resulting from phosphorus precipitation processes. The results of these investigations have been prepared as Research Paper No. 2035.

Physical/Chemical Treatment of Sewage

The Bala pilot chemical sewage treatment plant installed during May, 1970, is still in operation, effecting a 90% to 95% reduction in the phosphorus contained in the effluent from the Bala percolating filter. At present, the pilot plant is being operated and maintained by the District Municipality of Muskoka. Further studies of the condition of CNR Bay during the summer of 1971 have indicated an almost complete reversion of the Bay to its original highly eutrophic state prior to the alum treatment of its contents. It is hoped that some improvement within the Bay will be apparent by the summer of 1972.

A similar pilot plant has been installed at the Department of Lands & Forests Experimental Station in Maple. An attempt is being made to determine the effect of the high degree of phosphorus removal on the quality of the receiving stream and its ponds.

Phosphorus Removal from Seasonal Discharge Lagoons

Following extensive laboratory and field work, an application of alum was made to one of the Arthur seasonal discharge lagoons just prior to its fall discharge. The purpose of this application was to precipitate the phosphorus and algae from the lagoon contents prior to discharge to the receiving water.

The alum application effected a 98.9% removal of phosphorus, resulting in a phosphorus concentration of the lagoon discharge of 0.1 mg/1.

Although this application proved to be highly successful, there are still some major questions concerning its useage. A further application is being scheduled for the spring of 1972.

Phosphorus Removal from Eutrophic Lakes

As a result of cottagers' complaints concerning algal growths in a Central Ontario resort area lake, laboratory and field studies are being carried out to investigate the feasibility of applying chemicals to the lake surface to precipitate its phosphorus.

Tests to date indicate the application of low to moderate levels of aluminum to be highly effective; however, the logistics of application must still be determined.

Farm Animal Manure Management

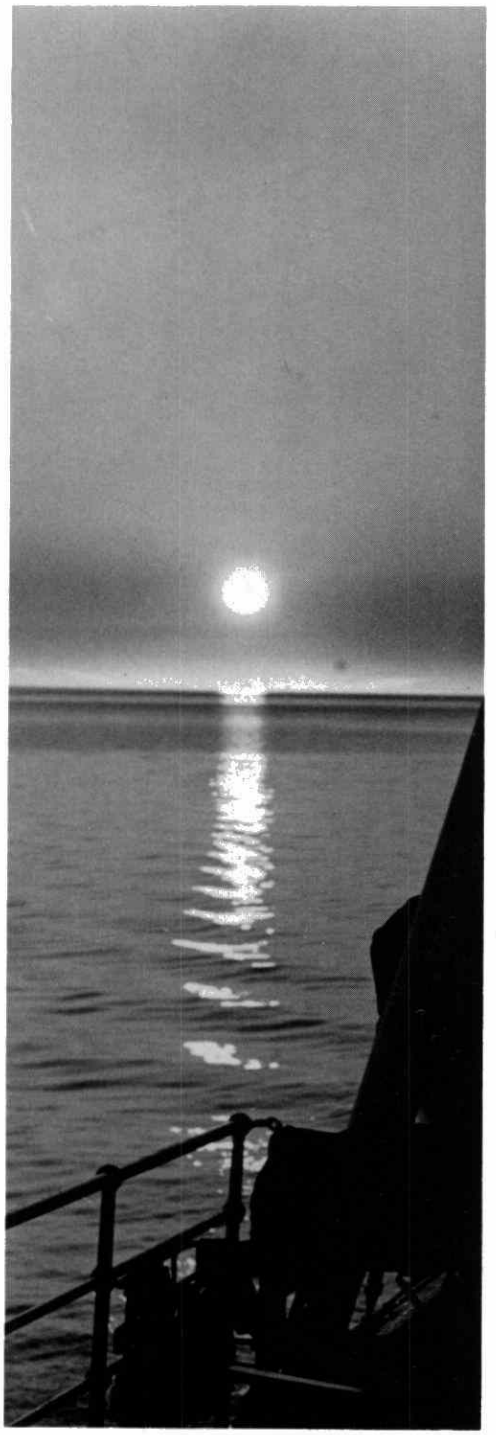
Involvement in farm animal manure management has been continued through the following activities:

- presentation of papers to various agricultural organization meetings;
- participation in a panel discussion at the annual meeting of the Canadian Association of Laboratory Animal Science, Toronto;
- representation on the now-defunct University of Guelph Animal Waste Utilization Committee;
- participation in the preparation of a report on the water pollution potential of farm animal and poultry manures for the combined Canada/U.S. Report on Agricultural Pollution of the Great Lakes Basin;
- giving advice and guidance to the agricultural industry, other governmental agencies and individuals; and keeping abreast of developments throughout the world on the farm animal manure management problem.

Division of Sanitary Engineering

J. R. BARR, DIRECTOR

G. R. TREWIN, ASSISTANT DIRECTOR



The programs of the Division of Sanitary Engineering deal with the management of water under four categories: water quality control, water supply, pollution control, and the regulation of plumbing. The program responsibilities are handled by six activity-related branches and two staff positions. The branch functions are:

– the evaluation of plans of proposed water supply and wastewater treatment installations;
– a field activity program including pollution surveys and pollution complaint review, subdivision review, and the promotion, inspection and supervision of water and wastewater treatment plants;
– the supervision of plumbing and the control of pollution from watercraft;
– the planning of regional water supply and wastewater treatment facilities;
– the training of water and sewage works operators;
– a water quality guidance program including basin studies, wastewater treatment evaluations as related to the effect of inputs on receiving waters, and the surveillance and monitoring of water quality.

The two staff functions are concerned with the Division's water supply and wastewater treatment programs.

Public Hearings

An important function of the Commission is the holding of public hearings with respect to sewage works. When a municipality intends to install sewage works in another municipality, the Commission, as required under the OWRC Act, must hold a public hearing. In addition, the Commission may hold public hearings before approving sewage treatment works to be located within the municipality to be served or with respect to works which are to be privately-owned and operated. The purpose of the hearings is to ensure that the intended works will not adversely affect adjacent properties, as well as to inform the local residents of the nature and extent of the proposed works.

During 1971, 44 public hearings were held in municipalities regarding proposed sewage works. In the first three months of 1972 an additional 11 hearings were held. Twenty-one of the hearings in 1971 and 7 in 1972 involved Provincial projects being developed by the OWRC. There have been 321 hearings held since 1959.

DESIGN APPROVALS BRANCH

The Design Approvals Branch appraises engineering reports, plans and specifications submitted for the approval of water works and sewage works in accordance with sections 41 and 42 of the Ontario Water Resources Commission Act.

Applications and Approvals

The Branch processed 2,138 applications and engineering reports during 1971. These resulted in a total of 2,062 certificates of approval being issued, representing a total estimated value of $272.7 million.

Certificates issued for water works applications totalled 823 and involved an estimated expenditure of $84.7 million, compared with 821 certificates and an estimated expenditure of $64.6 million in 1970.

In the sewage works field, 1,239 certificates were issued during the year, at an estimated cost of $188.0 million, compared with 1,027 certificates in 1970 at an estimated cost of $153.7 million.

During the first quarter of 1972, the Branch processed 647 applications and engineering reports, resulting in the issuance of 614 certificates of approval. This compares with 448 applications and engineering reports and 427 certificates of approval in the same period of 1971. Total value of the works approved in the first quarter of 1972 was $95.2 million, compared to $55.5 million during the first quarter of 1971.

Table 1 provides a breakdown of the total estimated value of works with respect to the type of approval issued in 1971 and the first quarter of 1972. Comparative 1970 figures are also provided.

Of the total number of certificates issued in 1971, 23 were for OWRC/Municipal water works projects, and 30 were for OWRC/Municipal sewage works projects. Estimated costs of the projects were $1.2 million for water works and $5.0 million for sewage works. Also included in the total number of certificates issued were 22 for Provincial water works projects and 39 for

TABLE 1

SUMMARY OF WATER AND SEWAGE WORKS APPROVALS

WATER WORKS

Estimated Costs	1970 (12 months)	1971 (12 months)	1st Quarter 1972
Extensions to existing systems	$ 53,646,578	$ 59,057,563	$ 18,747,463
Supply and purification	10,202,738	17,286,356	12,637,262
New systems	776,826	8,355,161	4,489,342
Total for water works	$ 64,626,142	$ 84,699,080	$ 35,874,067

SEWAGE WORKS

Extension to existing systems	$131,718,769	$131,708,136	$ 49,428,831
Treatment and disposal	14,849,078	41,850,872	4,224,912
New systems	7,120,589	14,486,930	5,680,789
Total for sewage works	$153,688,436	$188,045,938	$ 59,334,532

TABLE 2

OWRC/MUNICIPAL AND PROVINCIAL PROJECTS

	1970 (12 months)	1971 (12 months)	1st Quarter 1972
OWRC/MUNICIPAL			
Water works	$ 1,546,847	$ 1,203,880	$ 836,000
Sewage works	2,206,573	5,031,780	–
	$ 3,753,420	$ 6,235,660	$ 836,000
PROVINCIAL			
Water works	$ 14,543,290	$ 22,290,263	$ 16,921,967
Sewage works	32,474,161	34,300,317	11,519,494
	$ 47,017,451	$ 56,590,580	$ 28,441,461

Provincial sewage works. Estimated costs for these projects were $22.3 million for water and $34.3 million for sewage.

During the first quarter of 1972, there were 41 certificates for a total value of $29.3 million.

Table 2 provides a summary of the value of works with respect to OWRC/Municipal and Provincial works.

Sewage Treatment Plant Approvals

Approvals were issued for the construction of 16 new municipal sewage treatment plants and for extensions to 16 existing plants in 1971.

During the first quarter of 1972, approvals were granted for the construction of 4 new municipal plants and extensions to 3 existing plants.

Table 3 indicates the municipalities for which these approvals were issued.

The graphs indicated in Figures 1 and 2 show the value of water and sewage works systems approved from 1957 to 1971.

Miscellaneous

The Branch repeated the annual survey of all municipalities using controlled fluoridation.

TABLE 3

MUNICIPAL WATER POLLUTION CONTROL PLANT APPROVALS

Municipality	New Plant or Extension	Estimated Cost
1971		
Alliston (Prov.)	New Plant	$ 439,500
Barrie	Extension	223,100
Burk's Falls (Prov.)	New Plant	198,000
Coniston (OWRC)	Extension	257,000
Delhi	Extension	277,640
Dutton (Prov.)	New Plant	40,000
Essex (Prov.)	New Plant	104,150
Forest (Prov.)	New Plant	186,640
Galt (Prov.)	Extension	724,000
Grand Valley (Prov.)	New Plant	87,840
Hearst (Prov.)	New Plant	377,000
Hespeler (Prov.)	New Plant	960,000
Ingersoll (Prov.)	Extension	1,298,500
Lakefield (Prov.)	New Plant	125,680
London (Greenway)	Extension	380,000
London (Pottersburg)	Extension	711,500
Longlac (Prov.)	New Plant	176,000
Lucan (Prov.)	Extension	55,000
Markham (OWRC)	Extension	148,500
Mississauga (Clarkson – Prov.)	Extension	8,211,000
Oshawa	Extension	1,800,000
Ottawa (Green Creek)	Extension	5,397,500
Port Hope	Extension	525,000
Port Stanley (Prov.)	New Plant	300,000
Richmond Hill (North Don)	New Plant	1,420,000
St. Marys (Prov.)	New Plant	1,070,000
Sault Ste. Marie (OWRC)	Extension	1,019,000
Seaforth (Prov.)	Extension	229,600
Toronto	Extension	6,684,700
West Lorne (Prov.)	New Plant	155,000
Whitby	New Plant	1,453,830
Woolwich (St.Jacobs - Prov.)	New Plant	304,400
1st Quarter 1972		
Ear Falls (Prov.)	New Plant	380,000
Preston (Prov.)	Extension	1,221,000
Ridgetown (Prov.)	New Plant	240,000
Streetsville (Prov.)	Extension	100,000
Sturgeon Falls (Prov.)	New Plant	1,116,000
Norwood (Prov.)	New Plant	227,175
Vaughan	Extension	69,000

The responsibility for processing municipal CMHC loan applications for Commission certification continued as a Branch function. A total of $41.0 million was made available by CMHC for municipal projects in 1971, approximately $30 million of which was allocated to municipalities within the Lower Great Lakes drainage basin.

The Branch continued its role of certifying the validity of claims for rebate under the Pollution Abatement Incentive Act. Twenty-two claims were reviewed in 1971 and 20 in the first quarter of 1972.

Fig. 1
Summary of Water Works Approvals

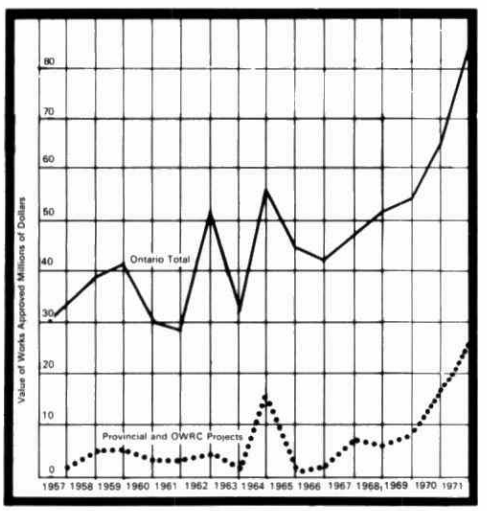
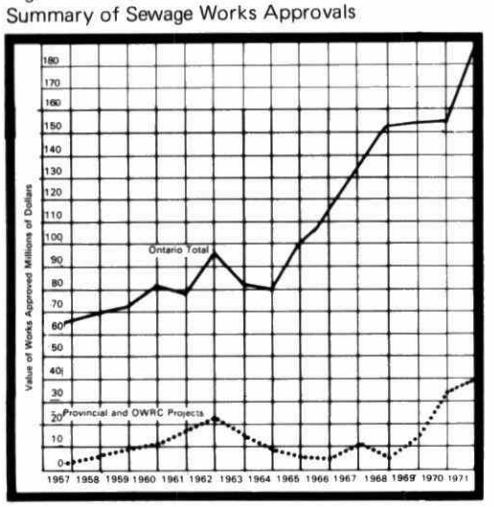


Fig. 2
Summary of Sewage Works Approvals



DISTRICT ENGINEERS BRANCH

The District Engineers Branch is the field-oriented Branch of the Division. Professional and technical staff are located in Toronto, London, Kingston, Sault Ste. Marie, Thunder Bay, Kenora, Sudbury, Galt, Peterborough, and Ottawa. The Branch is responsible for both service and regulatory functions. Its program includes:

– the inspection of all municipal and private water-supply and pollution-control facilities. Cattle feed lots, piggeries and poultry-raising operations are also checked relative to the possibility of their contributing to water pollution;

– the carrying out of surveys of the status of existing pollution control facilities in municipalities throughout the Province. Where problems are found, projects are promoted to correct them, including the construction of new plants or extensions of watermains and sewers;

– the examination of official plans, and subdivision applications with regard to the suitability of water and sewer servicing proposals; and

– the investigation of complaints and the satisfying of enquiries from the general public relative to the OWRC Act.

The Branch has recently undertaken the implementation of two special programs – the Recreational Lakes Water Pollution Control Program, and the Nutrient Removal Program.

Routine Programs

During 1971 and the first three months of 1972, staff carried out inspections at the 1,092 municipal and private water supply systems in the Province. In some cases, the same system was checked on more than one occasion, as required. In all, 1,331 inspections were performed. In addition, 969 inspections were completed at the 653 municipal water pollution control plants in the Province.

Surveys were undertaken to check the status of pollution control in 222 municipalities. Appropriate recommendations for corrective action were made, where necessary, and follow-up work is continuing.

To ensure the provision of proper water supply and sewage disposal, and particularly to keep pace with municipal development, the staff of the Branch provides to the Department of Municipal Affairs an assessment of servicing proposals contained in each official plan and subdivision proposed for development in the Province. There were 229 official plans and amendments processed during the year and 1,221 subdivision and revised subdivision proposals were checked.

A considerable portion of staff time is devoted to handling complaints, answering enquiries and performing investigations of water supply and pollution problems raised by the public. In the fifteen month period, staff handled 1,539 such matters, with follow-up action being undertaken with respect to 519 of them. In certain cases this is still continuing.

Staff attended 1,592 meetings and hearings. This is an important aspect of the District Engineers Branch activities as it brings about a direct contact between local officials and the Commission in initiating projects for the installation of necessary water and sewage facilities and the correction of associated problems.

Recreational Lakes Water Pollution Control Program

The Recreational Lakes Water Pollution Control Program has now completed its second year of operation. Following recommendations made in 1970 by the Task Force established by the Deputy Ministers' Committee on Pollution Control, the Branch in co-operation with the Division of Laboratories has carried out the task of evaluating the water quality of selected lakes. This work is being done in conjunction with the on-shore detection and correction teams of the Department of Health.

During 1971, three crews conducted surveys on 22 lake areas during the pre-tourist, the mid-tourist and the post-tourist seasons. The lakes are located in the terminal drainage basins of the Bay of Quinte, Georgian Bay, the St. Lawrence River and the Ottawa River.

A total of 15,000 bacteriological samples, 850 chemical samples and 700 biological samples were obtained for laboratory analysis. In addition to the collection of water samples, field determinations of

dissolved oxygen, temperature, pH and conductivity were carried out on each lake. Water temperature profiles were carried out during each survey to establish the existence of water stratification. Dissolved oxygen profiles were carried out to determine the concentration of dissolved oxygen at the various lake depths.

Water quality reports which are prepared during the winter months will also include an input from the Bacteriology, Chemistry, and Biology branches of the Division of Laboratories.

Nutrient Removal Program

Several years of intensive study of eutrophication problems in the Lower Great Lakes, the Ottawa River system and inland recreational waters culminated in early 1971 with the formulation of a province-wide nutrient control program. Intended to improve water quality in existing problem areas and protect prime recreational areas, the program establishes 1973 and 1975 deadlines for the installation of phosphorus removal facilities at 210 municipal sewage treatment plants.

Program details were forwarded to the 187 municipalities involved, and follow-up meetings were held with 18 councils and four regional works committees.

A one-day seminar on phosphorus removal, arranged for Commission staff and consulting engineers, was attended by approximately 175 persons, one-half of which were consultants. Papers were presented at meetings of the Engineering Institute of Canada and the Canadian Institute on Pollution Control. A further paper was prepared for inclusion in an international report on eutrophication by the Organization for Economic Co-operation and Development. The report will be released in 1972.

Under terms of the Canada-Ontario Agreement on the Lower Great Lakes (1971), administrative procedures were developed for handling the allocation to municipalities of a $25 million fund connected with phosphorus removal treatability studies. This joint federal-provincial program is intended to meet the full cost of the process studies which will be required at all plants. To date, studies have been initiated or completed at 69 treatment plants.

PLUMBING AND BOATING BRANCH

It is the responsibility of the Plumbing and Boating Branch to administer the Provincial Plumbing Regulation 647, and to enforce the Ontario Boating and Marina Regulations 644 and 646, respectively. The Branch consists of two sections, plumbing and boating.

Plumbing Section

A number of major revisions were incorporated into the Plumbing Regulation during the year. The efforts of the Plumbing Advisory Committee and its Technical Committee were directed to reviewing new plumbing materials, and recommending additional revisions to the Regulation.

A monthly "News Letter" has been instituted for the purpose of reaching municipal plumbing inspection authorities on a regular basis. A number of favourable comments on this news letter have been received and the continuation of its publication is planned.

The recent consolidation of all Ontario Regulations, which takes place once every ten years, has had a significant effect on the Plumbing Regulation. The Plumbing Code which has for the past ten years been identified as Regulation 471 is now Regulation 647. Municipal by-laws making reference to Regulation 471, or any section thereof, will require amendment.

The Plumbing Regulation amendments, which were passed during the year, were too late to be included in the consolidation and a supplement was produced by the office of the Registrar of Regulations relating the 1971 amendments to the 1970 consolidation.

There were two zone meetings held in 1971 by the Plumbing Inspectors' Association. In addition, the annual conference of the inspectors in Ottawa was very well attended and, with the 1971 amendments being published just prior to the convention, the widespread dissemination of the latest code changes was effectively achieved. The plumbing supervisor attended several committee meetings of the National Building Code group, which is still striving toward a National Plumbing Code, and although some provinces have taken advantage of the N.B.C. document to improve their own code, the full realization of a single code, administered universally across the ten provinces, does not appear imminent.

The 1971 annual meeting of the Canadian Standards Association Advisory Council on Plumbing was also attended, the three-day meeting being held in Edmonton, Alberta. These meetings seem to be producing more agreement on the need for CSA certification of plumbing products and priorities have been set out for developing new standards.

Boating Section

For the fourth consecutive year, staff manned the OWRC booth at the Annual Canadian Boat Show held at the Canadian National Exhibition grounds in Toronto.

Two charges of ferry boats violating Section 32(1) of the OWRC Act and two charges of pleasure boats contravening the Ontario Boating Regulation were heard in Wiarton. In addition, a trial, involving the assault by a marina operator of a Commission employee, took place in the Belleville Court House. Convictions were recorded in all cases.

The final report on "Pollution from Watercraft" was completed by Sub-Group 4 of the Canada – U.S. Working Group on Great Lakes Pollution. Also, the Maritime Research Information Service report on "Treatment and Disposal of Vessel Sanitary Wastes" was published and released by the U.S. National Academy of Sciences. Staff participated on panels responsible for the production of both reports.

Three thousand and eleven pleasure boats, consisting of 2,208 Ontario-based and 803 visiting craft, were inspected. On the initial inspections, 93% of the Canada-licenced boats were in compliance with Ontario's Boating Regulation. In comparison, 82% of the boats were in compliance in 1970. Two hundred and twenty-four marinas and yacht clubs were equipped with pump-out facilities during 1971. This compares to 142 during the 1970 boating season.

Seventy-three areas were checked to control pollution from ice fishing huts. Meetings were held with other government



Installing a Current Meter in Lake Ontario

departments to discuss the merits of regulating fish huts by registration. No final decision has been made in this regard. It is interesting to note that 20% of the fishing in Ontario is done in the winter time.

Inspections of commercial vessels were made at winter lay-up ports to ensure satisfactory disposal of seacock filler and possibly other pollutants.

Three members of the boating staff were relocated to the Commission's regional offices at Kingston, London, and Sault Ste. Marie.

REGIONAL SERVICES PLANNING BRANCH

The activities of the Regional Services Planning Branch can be divided into four general categories:

– the preparation of preliminary engineering reports on area water supply and pollution control facilities;

– the participation in Government interdepartmental committees and task forces involved in the preparation of provincial and regional plans, as well as direct liaison with other Government departments;

– the evaluation of planning, development, and servicing proposals presented by other government agencies, municipalities, planning boards, consulting engineers, and developers; and

– the provision of assistance to other branches and divisions in the Commission which are responsible for implementing the Branch's reports or other interrelated projects.

Preliminary Engineering Reports

The final report of the "Province of Ontario – South-Western Area Water Supply Study" was completed early in 1971. At the same time, the Hamilton – Wentworth Water Supply and Pollution Control Study was initiated. Data inputs from the various branches of the OWRC and provincial and municipal agencies were assembled, and the analysis of this information for incorporation into the report continued as time permitted. Some preliminary work was also done on the Halton – North Peel Water Supply and Pollution Control Study, pertaining to population and land use. These studies are being continued in 1972.

Interdepartmental Liaison

The increased liaison between all levels of government continues to have a major effect upon the activities of the Branch. There is a growing awareness that the functioning of individual government departments as isolated entities is no longer adequate to cope with increasingly complex planning and development issues. Hence, the Branch's role in the overall planning and development policies of the Province, as they relate to water management, and including the provision of water supply and sewage disposal facilities, has increased. A liaison role is accomplished through three distinct activities: by participation on interdepartmental committees and task forces; by direct contact with federal, provincial and municipal agencies; and by liaison with the various branches and divisions within the OWRC which are responsible for development of water supply and water pollution control facilities. The committees which accounted for the major portion of Branch staff involvement were the following:

– Liaison Committee for Central and Southwestern Ontario
  i) Parkway Belt Task Force
  ii) Toronto Centred Region Refinement Team
– Waterloo-South Wellington Area Study
– Haldimand-Norfolk Planning and Development Study
– Committee on Airport Expansion
– Task Force on Air Rights and Multiple Use and Joint Development of Service Corridors
– Treasury Board Grand River Watershed Study

The Liaison Committee for Central and Southwestern Ontario is responsible to the Advisory Committee on Regional Development. This is a Deputy Minister's Committee endeavouring to co-ordinate programs for economic planning and development in the Province. During 1971, a new Cabinet Ministers' Committee was formed to which the Advisory Committee reports. A number of meetings of the Cabinet Committee were attended by Branch staff. These dealt with subjects such as target populations, requirements for water and sewage works in the Regional Municipality of York, and the water and sewage rates for the South Peel Water and Sewage Works Systems.

Some of the subjects considered during the Liaison Committee meetings were the refinement of the Toronto Centred Region Plan, the Parkway Belt Task Force reports, proposed Hydro rights-of-way, the Equalization of Industrial Opportunities program, and the integration of provincial and municipal planning policies. Regional development reports on the Lake Ontario, the Lake Erie, and the Lake St. Clair economic regions

were also considered during the year.

Upon the recommendation of the Liaison Committee, an interdepartmental task force was set-up to refine the Toronto Centred Region concept. A member of the Branch staff was seconded for fulltime duty on this Committee.

Staff participated in all the activities of the Parkway Belt Task Force. In addition to its regular meetings, the Task Force conducted field trips to a number of areas and met with municipal planning and administrative officials, and private developers. Six reports on the Parkway Belt dealing with sections located in Mississauga, Burlington, Vaughan and Markham were completed. A special report outlining the principles of the Parkway Belt System and methods of implementation was also prepared and forwarded to the Advisory Committee.

The Branch participated in the Treasury Board's Grand River Watershed Study. This included the costing of various pipeline systems, and the researching and reporting on advanced waste-water treatment systems, including the treatment of combined sewer overflows.

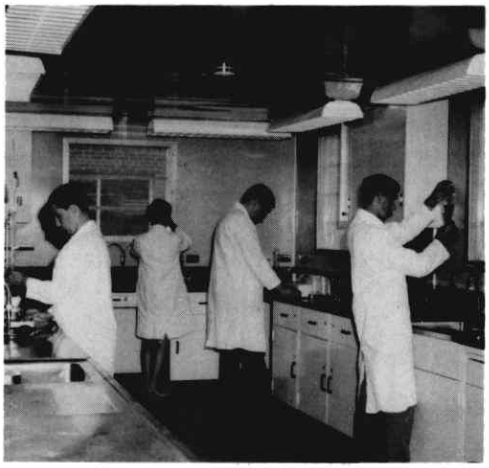
Further inputs concerning water and sewage works facilities were provided for the Haldimand - Norfolk and the Waterloo - South Wellington Area Studies. The Waterloo - South Wellington Area study is now nearing completion, with draft copies of the report being edited.

The direct liaison of the Branch with government departments continued to increase. The Department of Transportation and Communications has established an Environmental Studies Office, and several meetings were held with that Department in which the effects of different highway alignments upon ground and surface waters have been considered. Meetings of a similar nature were held with Ontario Hydro concerning the environmental effects of establishing new generating stations in various areas, and the impact of the influx of Hydro workers upon local water supply and sewage treatment facilities.

The Branch participated in the discussions leading to the selection of the North Pickering airport site. These discussions took place at meetings with the Federal Ministry of Transport and at meetings of the provincial Committee on Airport Expansion. Information supplied by the Branch included comparison of the relative impacts of the sites proposed on water resources in general and on available water and sewer services in particular. Where water and sewer services were not readily available, possible methods of providing these facilities were reviewed.

In addition to the formal interdepartmental liaison activities, representatives of the Branch attended public meetings and hearings concerning the Toronto Central Harbour, regional government in Waterloo, development policy for the Township of Pickering, the inclusion of Pickering as a Borough of Metropolitan Toronto, and the development of Metro Centre.

Mobile Laboratory



Planning Evaluations

Planning evaluations completed during the period included development proposals for the Toronto Central Harbour, Metro Centre, Harbour City, and official plans for the City of Hamilton Beach Strip, the City of Peterborough, the Town of Port Perry and the Township of Pickering.

Municipal and Interdivisional Liaison

Activities associated directly with the development of water and sewage works facilities increased during the period. These activities were carried on essentially through liaison with municipalities and with other branches and divisions of the OWRC. As an example, staff has been participating in the OWRC – Regional York Liaison Committee which was formed in 1971. The concern of the Branch has been to ensure consistent provincial and municipal planning policies as a basis for the development of the York Central Water Supply and Sewage Works System. In this regard, meetings have also been held with the Minister of the Environment, the Department of Municipal Affairs, Metropolitan Toronto, the Township of Pickering, and with Management and branches of the OWRC.

Meetings were held with the Regional Development Branch of the Department of Treasury and Economics in order to resolve population figures for the South Peel Area. Subsequently, meetings were held with other branches of the Commission to provide population projections upon which the calculation of rates for the area municipalities served by the South Peel Water and Sewage Works System could be made. Population projections to be used in the Belleville – Trenton Water Supply report were also agreed upon at several meetings with the consultants working on that study.

Other interdivisional liaison work included the provision of population projections for selected municipalities to the other branches and divisions. Figures for several municipalities were provided to the Division of Finance as the basis for rate reviews of provincial water and sewage works systems. Data on capacity and use of water and sewage works facilities in Ontario were also provided to the Division of Finance in regard to its five-year budget forecast. Meetings were held within the OWRC concerning the Oxford County Regional Study, and the City of Toronto Planning Board's Central Harbour Report, and a number of municipal council meetings were attended along with representatives of other branches on matters related to the development of water and sewage works.

TRAINING BRANCH

The OWRC has been conducting training courses for water and sewage works operators since 1960. While these one week courses (Basic – Intermediate – Senior) exposed the operator to a great deal of in-

formation, it became evident that they did not meet all of his training needs. "In-depth" and practical "hands-on" type workshops and courses were required. This led to the establishment of a Training Branch charged with the responsibility of developing a comprehensive new program.

In the spring of 1971 the last Senior Water Works Operators Course was given, and a seminar on the topic of "Metering and Leak Surveys" was held, co-sponsored by the Ontario Section, A.W.W.A.

The new Branch began its work by developing a one-week Basic Gas Chlorination Workshop. The first workshop was held during the week of November 15 - 19, 1971, and was attended by 27 men. Developmental work was begun on other workshops dealing with water filtration, lagoon operations and collection systems, and basic test procedures in pollution control plants.

The Branch employed the Behavioral Objectives Approach to Training (BOAT) and has found the results quite rewarding, judging by the performance of the trainees at the Basic Gas Chlorination Workshop held in November, when the competence level of trainees (based on pre-tests and post-tests) rose from an average of 55.3% to an average of 83.0%.

Liaison has been established between the Branch and the departments of Labour and Education. The supervisor also acts as a member of the Provincial Consultative Committee on Natural Resources (Community Colleges).

WATER QUALITY SURVEYS BRANCH

The Water Quality Surveys Branch is responsible for water quality management programs and related pollution controls in the drainage basins of Ontario. The functions of the Branch are as follows:

– Inventories are maintained of municipal, industrial and other sources of pollution.

– Water quality evaluations are made of water required for various purposes including domestic, industrial and agricultural water supply, recreation and aesthetics, fish, aquatic and wild life needs.

– Drainage basin planning investigations are undertaken which define:

(i) the environmental limits of the drainage basin;

(ii) the land and water uses that influence or are influenced by water quality; and

(iii) land and water use limitations, including necessary waste discharge restrictions.

– Water quality standards and effluent requirements or specifications for municipalities and industries are developed for the implementation of the "Guidlines and Criteria for Water Quality Management in Ontario".

– Studies of environmental water quality in the river systems and near-shore coastal waters and harbours of the Great Lakes and their connecting channels are carried out on a regular basis.

– Environmental water quality studies are undertaken in the river systems, near-shore coastal waters and harbours of the Great Lakes and the interconnecting channels on a regular basis.

– Investigations are carried out into the distribution of mercury and other environmental toxicants.

– Reports of spills of oil and other hazardous materials are processed through the Ontario Operations Center and an inventory of containment equipment and spill control techniques is maintained.

– Summary reports reviewing developments in municipal and industrial waste treatment and reporting on the quality of the Great Lakes, interconnecting channels and tributary streams are prepared in co-operation with other agencies for presentation to the International Joint Commission.

The Branch's programs are administered by three sections: Water Quality Control and Basin Planning, Surveys and Investigations and Technical Services. The responsibility of each section is outlined below. A further activity, Interagency Technical Co-ordination, which involves liaison with various agencies is also described.

WATER QUALITY CONTROL AND BASIN PLANNING SECTION

The Water Quality Control and Basin Planning Section plans and co-ordinates the development of studies and reports on drainage basin problems and evaluates the compliance of waste treatment proposals with water quality standards. This section offers solutions to water pollution problems and defines waste loading limitations in order to ensure restoration and maintenance of water quality conditions.

Drainage Basin Studies

The major drainage basin planning report for the Ottawa River was completed and released during 1971. An interim report on the Grand River Basin and a summary report on radiological pollution in the Elliot Lake and Bancroft areas were published. Work which commenced in 1970 on a water-use planning study in the Thames River Basin continued and a two-year water quality study on Lake Simcoe was initiated. Staff participated in a water management study in the Kawartha – Trent River Basin which is also expected to continue over the next two years. Report preparation on the Kaministikwia River – Thunder Bay study undertaken in 1970 was well advanced. Current meter studies planned for 1971 in Thunder Bay were re-scheduled for 1972. Reports on the investigations undertaken last year at Terrace Bay and Marathon on Lake Superior were nearing completion.

Ottawa River Basin

The report "Ottawa River Basin – Water Quality and its Control – Volume I" presents the findings of the joint study undertaken by Ontario and Quebec concerning pollution of the Ottawa River. Released in 1971 by both governments, it is an investigation of the effects on water quality of the variety of uses of water in the basin and the controls required for restoration and maintenance of water quality for the future. The information upon which the report is based was compiled by the Ontario Water Resources Commission and the Quebec Water Board over a three year period commencing in 1967.

This report gives recognition to the need for:

– significantly reducing the waste loads presently being discharged to the Ottawa River by municipalities and industries;

– immediately establishing, on an interim basis, a plan to provide ongoing protection for the river by temporarily curtailing industrial operations when water quality is likely to fall below minimum acceptable levels;

– developing integrated contingency measures for the control of spills of oil and hazardous substances.

Negotiations are proceeding between the Ontario, Quebec and the federal governments to formulate an agreement for the implementation of the remedial measures necessary to curtail pollution of the Ottawa River.

Grand River Basin

The interim report "Wastewater Loading Guidelines for the Grand River Basin" was published. It reviews the water quality problems of the drainage system, with particular emphasis on nutrient enrichment and on the response of the Grand River in the major urbanized areas to treated wastewater loadings. The Branch also contributed to a comprehensive basin survey and report, coordinated by the Management Science Branch of Treasury Board, on long-term water management of the Grand River. This report reviews alternatives for water supply, water quality, flood control and variations related to the many uses of the river.

Measuring Dissolved Oxygen Content



Radioactive Pollutants

The summary report on "Water Pollution from the Uranium Mining Industry in the Elliot Lake and Bancroft Areas" was published. This report reviews the effects of radioactive and chemical pollutants on the environment and defines the measures necessary to control water pollution. It provides a basis for evaluating future uranium mining operations and waste treatment requirements. A technical supporting volume will be released in 1972.

Thames River Basin

The water use planning study initiated in 1970 in the Thames River Basin will continue over the next two years with the publication of a report on a comprehensive basin study on long-term water management. The report will provide water quality standards for the river as well as a water quality control plan for the restoration and maintenance of water quality related to the many uses of the river. Fifty sampling stations were added to the routine water quality monitoring network within the basin in 1971 to supplement the data needed for the report. Intensive studies were also conducted below six municipalities to determine the effects of domestic and industrial wastewater discharges from these communities on downstream water quality.

Lake Simcoe Study

The Lake Simcoe Water Quality Study was designed to evaluate the biological, bacteriological and chemical conditions in the basin. In 1971, water quality data were collected throughout the lake with studies being conducted in Cook Bay, Kempenfeldt Bay and Shingle Bay. Nutrient enrichment is evident in these areas due to inputs from municipal, agricultural and natural sources. A water quality management plan will be formulated to provide for the maintenance of water quality related to the many uses of the lake. A report of the findings will be prepared following completion of field investigations in 1972.

Kawartha–Trent Basin

Staff participated with other branches and the Department of Lands and Forests in the Kawartha – Trent River Basin Study. This three year study, initiated early in 1971, is designed to develop a water management plan which will protect and enhance desirable water uses within the basin, particularly recreational. The Branch is involved in several phases, including an assessment of nutrient inputs, the collection and assessment of water chemistry data and the preparation of a watershed users questionnaire. Other branches are evaluating fish, and other aquatic life and plant interactions, under various management programs, including the cutting and harvesting of aquatic plants.

Water Quality Standards

Thirty-three proposals for effluent discharges were examined for compliance with the "Guidelines and Criteria for Water Quality Management in Ontario". Water quality standards for river basins are being developed and referenced for the determination of permissible waste loadings. In the process of establishing water quality standards and effluent requirements, it becomes necessary to define mixing zones in the vicinity of waste discharges.

A review of water quality standards from the point of view of radioactivity was underway at the year end.

Waste Input and Pollution Abatement Inventory

An inventory is maintained of all industrial and municipal waste sources, proposed programs for pollution abatement and the expected completion date of these programs in the Great Lakes drainage basin and elsewhere in the Province.

SURVEYS AND INVESTIGATIONS SECTION

The Surveys and Investigations Section carried out field-work for drainage basin studies, environmental system response studies, surveillance and monitoring of the Great Lakes and their connecting channels and the inland streams. Other work included evaluations of dredging and marine construction proposals and investigations of spills of oil and other hazardous materials. Investigations initiated in 1970 into the

distribution of mercury and other environmental toxicants were continued.

Drainage Basin Studies

Major studies undertaken during the year included fieldwork in the Lake Simcoe Basin, the Abitibi River and the Spanish River. Fieldwork in the Thames River Basin initiated in 1970 continued. Other surveys to evaluate the effects of municipal, industrial and natural sources of pollution on water quality were conducted in the Red Lake area, Cootes Paradise, the Kawartha – Trent River Basin, the Ottawa River, the Credit River, the English River system and the Sudbury area. Data collected during the majority of these studies are being used to prepare schedules of restrictions for treated wastewater discharges that will result in water quality conditions compatible with existing and future water uses.

Spanish River and Abitibi River Studies

Intensive water quality studies in the Abitibi River below the Abitibi Paper Co. Ltd. at Iroquois Falls and in the Spanish River below the E.B. Eddy pulp and paper mill at Espanola were designed to provide information for the development of a mathematical model relating dissolved oxygen concentrations in the rivers to organic waste loadings. From the model, waste loading guidelines for each industry have been established. Reports on each investigation will be completed early in 1972.

Red Lake

A study was carried out in the Red Lake area of northwestern Ontario. During the study, 450 samples were collected to measure the effects of leaching from mine tailings and wastewater discharges from the Town of Red Rock on water quality. Background levels of heavy metals from areas of known ore outcroppings and areas devoid of such outcroppings were also determined.

Cootes Paradise

A water quality study was conducted in Cootes Paradise to measure the effects of the wastewater discharge from the Dundas sewage treatment plant. A draft report evaluating several alternative sites for the relocation of the municipal outfall sewer is being prepared.

Surveillance and Monitoring

The monitoring program provides information on water quality throughout the Province. Fifteen sampling runs were carried out at 650 locations on inland streams. In the Great Lakes, 1,500 stations were occupied, representing a decrease of 500 stations from 1970 following an evaluation and optimization of the sampling effort. Three cruises were completed on Lake Ontario, two on Lake Erie and one on Lake Huron – Georgian Bay. Six surveys were carried out on each of the St. Clair and Detroit rivers, four on each of the St. Marys and Niagara rivers and three on the St. Lawrence River. The OWRC was assisted in the monitoring of inland waters by local conservation authorities, health units and the Ontario Department of Lands and Forests. Co-operative programs to provide better data by increasing the frequency of water quality monitoring were established with the U.S. Environmental Protection Agency on the St. Marys and St. Clair rivers and with the Michigan Water Resources Commission on the Detroit River. Aerial and vessel surveillance was maintained of waste sources to detect the presence of oil and other material spills.

An investigation on the St. Marys River in co-operation with Canadian and U.S. federal, provincial, and state agencies was carried out to determine the effects of low flows on downstream water quality and dispersion patterns.

The Branch co-ordinated the establishment of a Lake Ontario waterfront sampling program in the Metro Toronto, Halton, Peel and Ontario county areas for the determination of bacteriological contamination. Sampling was carried out by the respective Health agencies while the sample examinations and data handling functions were carried out by the OWRC.

Environmental Systems

A manual on measuring near-shore currents on the Great Lakes was prepared for the International Field Year for the Great Lakes, as requested by the co-ordinating committee. The manual details the methods used by the Commission to measure currents



Robot Monitor, Ottawa River

in both summer and winter. Presently, the Commission is one of the few agencies which successfully measures water movement on the lakes during the winter under ice conditions. The Great Lakes Institute of the University of Toronto has assisted in these studies by providing the C.C.G.S. Porte Dauphine for the winter installations.

The robot monitors on the Ottawa and St. Clair rivers were modernized with the installation of digitizers. Previously, chart records were produced which were not directly computer compatible. Dissolved oxygen, temperature, pH, conductivity and chlorides are continuously recorded by these units. Mathematical modelling of the data was commenced.

Much time was devoted to consultation on water intake and waste outfall locations and designs. Reports were prepared on the proposed locations for the South Peel, Central York and Keswick water pollution control plant outfalls and the proposed water intake for the Belleville – Trenton area. Meters were operated at all of these locations and dye dispersion studies were conducted in connection with the outfall studies. Meters for the South Peel outfall positioning studies were installed in December. Design evaluations were also prepared for three new major industrial diffuser outfalls and water hammer protection designs for several water distribution systems.

Mathematical modelling of the near-shore processes of the lakes was initiated and continues. The purpose of the models is to develop a tool for water management on a regional basis so that the effects of changing the location or introducing a new waste outfall to an area can be assessed on a statistical basis. These models are extensive computer computations which are adjusted numerically using field surveys.

The section continued to provide statistical assistance to other branches and divisions on water quality data and assisted the laboratory with an analysis of the dynamics of lake aeration systems.

Dredging and Marine Construction

Arrangements with the Canada Department of Public Works, the Ministry of Transport, the St. Lawrence Seaway Authority, and others, provide for the review of dredging proposals and marine construction in the Great Lakes and inland waters by the OWRC. Since dredged materials may contain any number of elements deleterious to water quality, dredging techniques and disposal areas have to be carefully selected. In 1971, the Commission increased its surveillance of marine construction to minimize water quality impairment from landfill projects, under-water pipelines and cables, and shore protection works. Construction techniques and scheduling are reviewed by the Branch and recommendations to minimize water quality impairment are frequently provided on these projects. During the year, 100 proposals were evaluated, compared to 55 in 1970.

Contingency Plan – Ontario Operations Center

In May 1971, the "Interim Province of Ontario Contingency Plan for Spills of Oil and Other Hazardous Materials" was published. This plan, developed in co-operation with federal and provincial government departments and agencies and the petroleum industry, provides a notification framework for spills which may affect Ontario waters.

The Ontario Operations Center which receives reports on all major spills provides expertise on containment and removal procedures and advises on the availability of resources required to mitigate the adverse effects of a spill. During the fifteen month period, 428 incidents were reported to the Center.

To co-ordinate contingency planning within the Province, an "Interdepartmental Task Force on Contingency Planning" was formed. In Lambton County, a Regional Operations Team was established to develop local response capabilities following a major spill in that area.



Collecting Aquatic Plants, Water Quality Studies

TECHNICAL SERVICES SECTION

The Technical Services Section provides the supporting marine operations and instrumentation services for the Surveys and Investigations Section and also maintains the office and draughting services.

The O.W.R.L. "MONITOR I", O.W.R.L. "MONITOR II", and O.W.R.V. "MONITOR III" were operated on the Great Lakes and inter-connecting channels, in conjunction with three service vehicles. A fourth vessel, O.W.R.L. "MONITOR IV", was purchased and placed in service towards the end of 1971. Repairs and modifications to the vessels were effected by marine staff during the winter months. A Marine and Equipment Superintendent was appointed to direct marine operations and associated services. A variety of water quality testing equipment was maintained and serviced, including three robot monitors. Digitizers were installed on each of these units to produce records which were directly computer compatible.

The Office Services Section maintained budget control, requisitioning of supplies, recording of data from the radiological and mercury investigations, secretarial, stenographic and general office support for the Branch.

The Draughting Office completed 602 assignments which included numerous maps and graphs for the Ottawa River Basin report. Index level coding of lakes and streams in the Lake Ontario, Ottawa River and St. Lawrence River basins for locating stream sampling points, water intakes and waste outfalls was completed. Coding of other areas will be continued in 1972.

INTERAGENCY TECHNICAL CO-ORDINATION

Numerous meetings were attended with federal, provincial, state and other agencies. Noteworthy were the Joint Canada – United States Ministerial Meeting on Great Lakes Pollution, the Second Great Lakes Environmental Conference and the Legislative Committee on Lake Erie.

The Joint Canada – United States Ministerial Meeting on Great Lakes Pollution held in Washington was attended by ministers and representatives of the governments of Canada and the United States, the provinces of Ontario and Quebec and the Great Lakes states. The ministers and representatives reviewed a report by the Canada – United States Working Group on Great Lakes Pollution, which had been established at the June 1970 meeting in Ottawa, and accepted its major recommendations for concerted action to protect and enhance water quality in the Great Lakes. It was agreed that Canada and the United States would execute a Great Lakes Water Quality Agreement before the end of 1971. However, they were unable to do so. In December, officials met in Ottawa to finalize negotiations for the proposed agreement which is expected to be signed in April, 1972. In preparation for the implementation of the Canada – United States agreement, Canada and Ontario signed an agreement providing the necessary funds for capital works and research to effect the desired pollution abatement programs and water quality standards in the Lower Great Lakes. As part of the latter agreement, financial assistance has been made available to municipalities in the Lower Great Lakes Basin to meet the full cost of treatability studies for phosphorus removal.

The Second Great Lakes Environmental Conference convened by the State of Michigan in August was attended. The state and provincial goals at the conference were given, respectively, in addresses by the governors, or their representatives, of each of the eight Great Lakes States and the Premier of Ontario. A status report was presented on the negotiations for the Canada – United States Great Lakes Water Quality Agreement and resolutions by the governors and premier were discussed and adopted.

Three meetings of the Legislative Committee of Lake Erie composed of elected representatives from the states of Michigan, Ohio, Pennsylvania and New York were attended. Through co-ordination of legislative activities and the exchange of information, the objective of the Committee is to improve the environmental quality of Lake Erie. Although Ontario is not a member, the OWRC upon invitation meets with the Committee. The report of the Canada – United States Working Group on Water Quality Objectives and Standards and nutrient regeneration in the central basin of Lake Erie were two of the items discussed. Model legislation for the control of phosphates in detergents was developed and adopted by resolution for recommendation to the four state legislatures.

In addition, the Branch is active in several other inter-agency and technical committee study programs outlined in the following list:

Advisory Boards to Internation Joint Commission on Control of Pollution of Boundary Waters:

- Lakes Superior-Huron-Erie Board (Connecting Channels)
- Lakes Erie-Ontario Board (Connecting Channels)
- International Lake Erie Water Pollution Board
- International Lake Ontario-St. Lawrence River Water Pollution Board
- International Rainy River Water Pollution Board

International Great Lakes Levels Board:

- Shore Properties, Regulation and Regulating Works Sub-committees

International Field Year on the Great Lakes

Canadian Committee on Oceanography:

- Great Lakes Working Group

International Great Lakes Study Group

Canada–United States Working Group on Great Lakes Pollution

Canada – United States Great Lakes Water Quality Agreement Negotiating Team

Ontario Department of Transportation and Communications:

- Salt Contamination Committee

Nanticoke Environmental Committee

Ottawa River Intergovernmental Committee

Canada-Ontario Rideau-Trent-Severn Committee

International Contingency Plan

Inter-departmental Task Force on Contingency Planning



Recreational Lakes Survey

Division of Water Resources

K. E. Symons, Director
D. N. Jeffs, Assistant Director

The Division of Water Resources is responsible for the inventory, assessment and management of surface and ground water resources with respect to quantity, and also for the protection of ground-water quality. The programs are carried forward through four branches and include the collection, analysis and publication of basic hydrometric and hydrologic data, the assessment of water resources through surveys and interpretation, the development of water supplies by test-drilling and well-construction projects, the management of resource use through a water-permit system, the regulation of the water-well industry, and scientific hydrologic studies. The programs include regulatory, planning and inventory assignments.

The work of the Division is described below according to broad divisional as well as specific branch activities. Attention is directed to the substantial increase in investigations related to ground-water pollution.

International Hydrological Decade

The International Hydrological Decade (IHD) is an international program, designed to advance the science of hydrology and the assessment and management of regional and global water resources over the period 1965 to 1974.

The Commission's contributions to the IHD program are made by the River Basin Research Branch through detailed hydrologic studies of five representative river basins in southern Ontario and by the Hydrologic Data Branch through its regular inventory programs of ground-water and surface-water assessment.

The International Field Year for the Great Lakes project is a special co-operative water balance study of Lake Ontario, involving many disciplines and agencies in Canada and the United States. As a participant in the IFYGL study, the River Basin Research Branch is determining the groundwater contribution to the lake from the Ontario side of the basin and has become involved in the remote sensing programs of NASA (National Aeronautical and Space Administration) and the University of Michigan.

Division representatives supported the Ontario Committee for IHD and its scientific and educational sub-committees and participated in discussions of the Steering Committee for the IFYGL, the Canadian Project Management Team, the Terrestrial Water Balance Panel and its Ground Water Subgroup and the Biological-Chemical Panel.

Northern Ontario Water Resources Studies

The Division continued its inventory and assessment of the water resources of northern Ontario. The Hydrologic Data Branch proceeded with the collection of basic hydrometric data through its own activities and through co-operation with the Water Survey of Canada and the Atmospheric Environment Service of Canada. The Surveys and Projects Branch proceeded with field studies of water quality and hydrologic characteristics. Modelling or simulative techniques for surface-water analysis were continued.

The Division participated in the work of the Federal–Provincial Co-ordinating Committee on Northern Ontario Water Resources Studies. Close co-ordination was maintained through this Committee and by means of previously-established working arrangements.

Cartography

The Cartography Section supports the programs of the Division by preparing maps, charts and diagrams; by procuring, from a variety of sources, maps, plans, aerial photographs, and mosaics, and by providing or arranging for the reproduction of these for internal and publication purposes.

Multicolour maps printed in 1971 included: Essex County Ground Water Probability, Upper Albany Drainage Basin, and six maps for the Upper Nottawasaga report (bedrock geology, surficial geology, aquifer distribution, hydrometric stations, water quality and water use).

During the 15-month period, the Section completed 20 large maps, 232 small maps and diagrams and plotted the locations of 1,038 sources of water for which permits have been issued.

Data Processing Activities

Through the Division Liaison Engineer, close co-ordination was maintained with the Systems and EDP Branch of the Division of Administrative Services in the use and further development of the Water Well Record System and the use of the federal Streamflow Data System. A number of computer programs of scientific nature were developed and implemented in support of studies related to hydrology and hydrogeology.

Water Well Record System

The Hydrologic Data Branch continued the location plotting, co-ordinate determination and data coding of water-well records. A total of 28,689 records were coded and submitted to the Systems and EDP Branch for computer storage. The total number of records in storage at the end of the period was 159,941.

With the finalization of the computer program to print the future Ground Water Bulletins and associated tables, interim use was made of the program to print summaries of water-well data for internal use by the Commission and other government agencies and departments. A total of 24 retrieval requests were processed in support of projects undertaken by the four branches of the Division, the Department of Transportation and Communications, the Ontario Department of Mines and Northern Affairs and the federal Inland Waters Branch. A data printout for the proposed publication "Water Well Records for the Northern Area, 1946-1969" was issued and was under review by the Hydrologic Data Branch.

The preliminary design of a general data retrieval and plotting program was completed and presented to the Division hydrogeologists for discussion. This program will reduce the manual workload associated with compilation, plotting, and contouring from well-record data. Using the contouring package program of the Ontario Department of Mines and Northern Affairs, trial runs were made with water-well record data to produce bedrock-contour maps.

Streamflow Data System

Using the streamflow data as provided on magnetic tapes by the Water Survey of Canada, routine analyses of low flow, flow duration, frequency and polynomial regression were carried out in support of regional studies, drainage basin surveys, surface water assessment and water manage-

ment studies undertaken by the Division.

The digitizing and processing of stream water-level charts were continued by the River Basin Research Branch and the Hydrologic Data Branch and a computer program to plot annual streamflow hydrographs was written.

The computing facilities employed to handle these programs were those of the Department of Transportation and Communications (DTC), Downsview.

Scientific Programs

Several additional computer programs were in use by the branches, using the DTC facilities and the CALL/360 terminal of the OWRC Systems and EDP Branch to aid in research studies and water resources surveys.

Seven staff members attended a familiarization seminar on the CALL/360 time-sharing system. CALL/360 statistical package programs were used and three new programs were developed by the River Basin Research Branch to carry out chemical parameter conversions and to analyze snow survey, streamflow, precipitation and soil moisture data for the IHD representative basin studies.

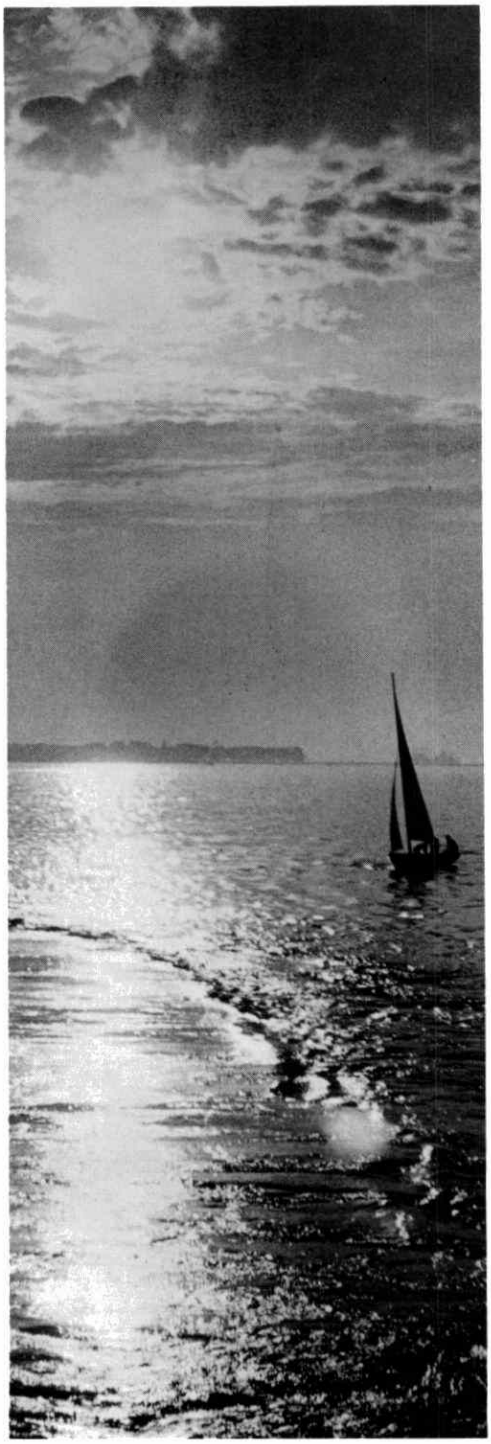
Using the DTC facilities, a ground-water modelling program was implemented to assist in the projection of future ground-water conditions near Wilmot Centre – a study undertaken by the Water and Well Management Branch.

EDP General

Meetings were held with the Systems and EDP Branch and Water Quality Surveys Branch to examine existing mathematical modelling programs and to initiate the mathematical modelling of IHD representative basins for the River Basin Research Branch.

Discussions were undertaken to examine the feasibility of computer assistance for the simulation of hydrologic data for the Surveys and Projects Branch's Northern Ontario Water Resources Survey, to examine the proposed development of a ground-water quality data system by the Hydrologic Data Branch and to review the status of the STORET System coding.

A study was undertaken by the Systems and EDP Branch to examine present operations of the Water Taking Permit System and the feasibility of converting it to an EDP System.



Liaison was maintained with DTC in the development of its Geocoding System in rural areas. STORET stream codes, as developed by the Water and Well Management Branch, in co-operation with the Division of Sanitary Engineering, were submitted to DTC for inclusion in the Geocoding System.

Using DTC facilities, a UTM-Latitude-Longitude conversion program was implemented for the IFYGL study being undertaken by the River Basin Research Branch.

Division staff attended the workshop seminar on "Hydrologic Systems and Their Applications", sponsored by the federal Inland Waters Branch, and the workshop seminar on "Computer Storage and Processing of Hydrologic Data" in Quebec City. A short course "Simulation of Water Resources Systems" was also attended at the University of Nebraska.

Task Force on Streamflow Data Analysis

The Task Force on Streamflow Data Analysis completed its work in reviewing and documenting methods of streamflow data analysis. Eighteen meetings were held during which discussions pertained to correlation and simulation and baseflow analysis techniques. Members of the four branches of the Division participated.

SURVEYS AND PROJECTS BRANCH

The Surveys and Projects Branch conducted municipal ground-water surveys, municipal test-drilling and well-construction projects, drainage basin surveys, and special investigations of ground-water pollution and water-supply problems. It also participated in regional water-resources studies.

The number of requests for advice and investigations related to potential or actual ground-water pollution problems continued to increase, reflecting the growing concern of the public. Advisory and consultative services were provided to the Waste Management Branch, Department of the Environment, with respect to the hydrogeologic suitability of waste disposal sites and with

respect to the locations, construction, operation and monitoring of deep disposal wells. Opinions were provided to other divisions on certain municipal and industrial sewage disposal works, such as sewage lagoons, and to the Ontario Operations Centre on accidental chemical spills. Close liaison was maintained with the Energy Branch, Department of Labour, in instances where leakage of petroleum products was involved.

Studies completed or in progress during the 15-month period included five drainage basin surveys in southern Ontario, the Northern Ontario Water Resources Survey, two regional studies, 29 municipal groundwater surveys, 21 test-drilling or well-construction programs and 254 special investigations comprised of 181 pollution investigations, and 73 water-supply investigations. Tables 1 and 2 summarize these activities. For the purposes of comparison with previous years, Figure 1 indicates the surveys, projects and investigations undertaken during 1971.

Northern Ontario Water Resources Survey

Work continued on the quantitative and qualitative assessment of water resources in northern Ontario.

Studies continued on the development and the testing of methods for establishing the relationship between runoff and precipitation at stations where long-term data were available in order to estimate runoff for areas of short-term data. There are significant problems to be resolved in the development of a mathematical model to simulate monthly flows from monthly precipitation data.

The assessment of ground-water resources continued through test drilling and collection of hydrogeologic, hydro-chemical and well data in the vicinity of Pickle Lake. Groundwater quality and hydraulic conductivity of aquifers in the Attawapiskat and Albany River basins were further evaluated.

A representative surface-water sampling program was carried out in the Albany and Moose river basins to provide data on the chemical and biological quality of the waters.

Drainage Basin Surveys

Work proceeded on water resources studies of five drainage basins in southern Ontario. The surveys cover the availability and quality of water resources in the basin, uses of water and opportunities for resource development and management. The report on the Big Creek basin was published; the final review of a draft report for the Upper Nottawasaga River basin was almost completed; field work was completed and reports were being prepared for the Moira River basin and the Rouge River – Duffin Creek basins, and planning and office studies were underway for the Holland River basin survey.

Regional Studies

Regional studies involve the assessment of the availability of ground-water and surface-water resources. Most of these are in support of water and sewage works planning reports co-ordinated by the Division of Sanitary Engineering. Contributions were completed for two regions – the Grand River basin and the Hamilton-Wentworth County area. The Hamilton-Wentworth material will be used by the Division of Sanitary Engineering in reports on regional water-supply and/or pollution control requirements. The material provided for the Grand River basin was utilized in the Grand River Planning Report prepared by the Treasury Board Secretariat.

Municipal Ground Water Surveys

The Branch undertook 29 surveys to evaluate groundwater conditions for municipal water-supply purposes. Fourteen of the surveys were continued from the previous year and 15 were new surveys. Thirteen ground-water survey reports were released and four reports were under review at the end of the period. Poor-to-marginal prospects for community ground-water supplies were reported for Dryden, Finch, Melbourne and Plantagenet. Favourable conditions for the development of municipal ground-water supplies were indicated for nine municipalities.

Test Drilling and Well Construction Projects

The Branch participated in 16 test-drilling projects and two well-construction projects. One well-construction project was carried forward from the previous year. Three test-drilling programs were active at the end of 1971. In addition, tenders had been called on two test-drilling programs and one well-construction program, with work to commence in 1972. The total price of approved contracts amounted to about $470,000.

Test-drilling projects resulted in the location of suitable water supplies at Finch, Hornepayne, Ignace, Newcastle, Thamesville, and Wasaga Beach. A marginal supply was developed at Glencoe. Efforts were unsuccessful in locating sufficient supplies at Echo Bay, Embrun, Kakabeca Falls, the OWRC Laboratory and Verner.

Special Investigations – Ground Water Pollution

One hundred and eighty-one investigations into existing or potential groundwater pollution problems were completed or were in progress. Twenty-five investigations were carried forward from the previous year and 67 were in progress at the end of the period. One hundred and fourteen reports were released. Twenty-five investigations involved solid waste disposal sites and 14 involved deep disposal wells. Fifteen of the waste disposal sites were referred to the Branch by the Waste Management Branch of the Department of the Environment and the remainder by other OWRC divisions or directly by the public.

Special Investigations – Water Supply

Seventy-three investigations into water-supply problems and well performance were in progress or completed. Fifteen investigations were carried forward from the previous year and nine were in progress at the end of the period. Sixty-four reports were released. Twenty-six of the investigations involved the testing of project wells and analyzing well and aquifer performance to provide advice to the Division of Plant Operations on changes in production potential. A pre-project well field and aquifer analysis in the Glencoe area was undertaken and completed.

One hundred and three consulting engineers' reports for proposed provincial and municipal OWRC projects were reviewed as a part of the Branch's support to the Design Approvals Branch of the Division of Sanitary Engineering.

TABLE 1

SUMMARY OF SURVEY ACTIVITIES – January 1, 1971 to March 31, 1972

		Survey Status		Report Status	
Activity	**Location**	**Initiated**	**Completed**	**In Progress**	**Released**
Northern Ontario Water Resources Survey		X			
Drainage Basin Surveys	Big Creek		X		X
	Holland River	X			
	Moira River		X	X	
	Rouge River – Duffin Creek		X	X	
	Upper Nottawasaga R.		X	X	
Regional Studies	Grand River Planning				X
	Hamilton-Wentworth County				X
Municipal Ground Water Surveys	Alfred	X			
	Almonte	X			
	Arkona*	X			
	Ayr*		X		X
	Braeside*		X		X
	Burlington		X		X
	Dobie*	X			
	Dryden		X		X
	Elk Lake*	X			
	Finch		X		X
	Frankford		X		X
	Grimsby		X		X
	Hammond*		X		X
	Ignace*		X	X	
	Kimberley		X	X	
	Melbourne*		X		X
	Merrickville		X		X
	Newbury*	X			
	Paipoonge Township	X			
	Paisley		X	X	
	Pic Indian Reserve*		X	X	
	Plantagenet*		X		X
	Rodney		X		X
	Smith Township*	X			
	Stayner	X			
	Thamesville*		X		X
	Turkey Point*		X	X	
	East Flamborough Twp.*	X			
	Wasaga Beach*				X

* Proposed provincially-owned system.

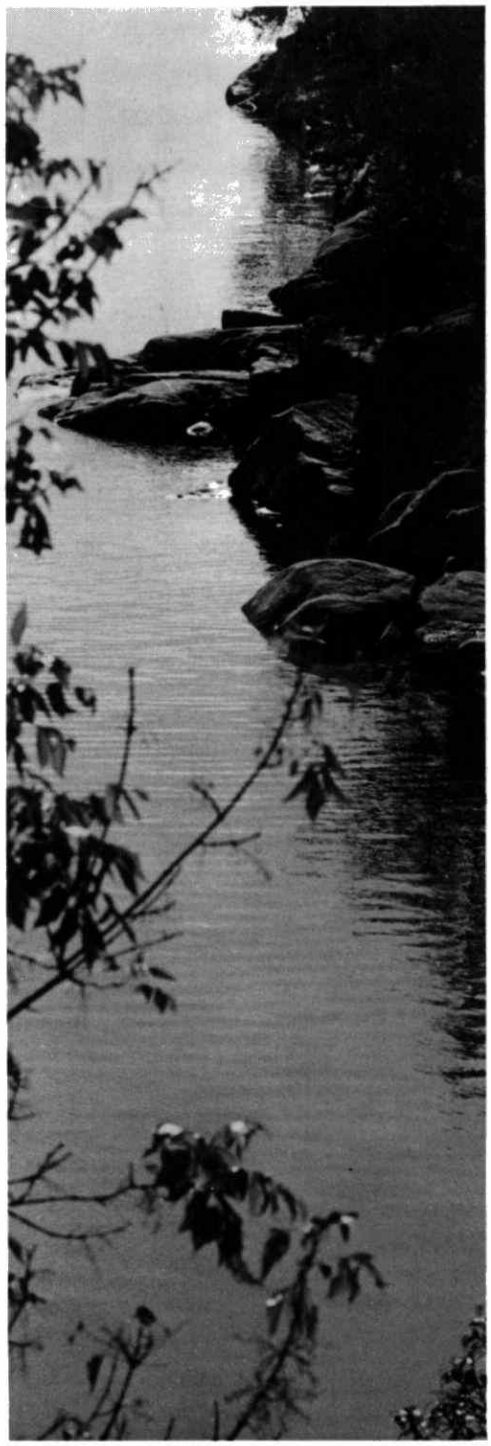
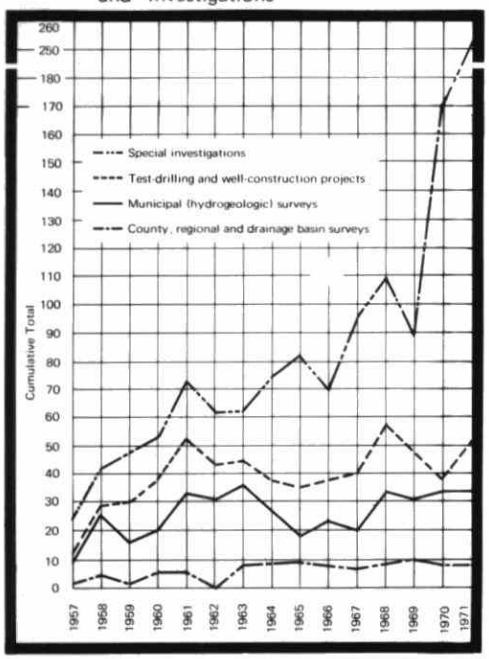


TABLE 2

SUMMARY OF PROJECT ACTIVITIES – January 1, 1971 to March 31, 1972

Activity	Location	Tendered	Field Work Active	Report Released	Test Wells	Completed Production Wells	Cost Estimated or Final*
Test Drilling	Ayr		X		3		$ 19,500
	Echo Bay			X	5		19,200
	Embrun			X	16		29,500
	Finch			X	2	2	14,500
	Glencoe			X	13	1	16,514*
	Hornepayne			X	7		16,088*
	Ignace			X	8		15,106*
	Kakabeka Falls			X	5		15,440*
	Lansdowne	X					17,000
	l'Orignal II		X		2		24,500
	Melbourne	X					18,250
	Newcastle			X	17		15,360*
	OWRC Laboratory			X	2		4,200*
	Thamesville			X	11		16,020*
	Verner			X	5		6,684*
	Wasaga Beach I			X	17		16,970*
	Wasaga Beach II				6		23,030
	Winchester		X		1		19,500
Test Drilling and Well Construction	Blezard Valley			X	21	5	116,524*
	Caledon East	X					23,930
	Thedford				1	1	22,621*

Figure 1 Active and Completed Surveys, Projects and Investigations



WATER AND WELL MANAGEMENT BRANCH

The activities of the Water and Well Management Branch were carried out under two programs: water-management and well-construction management.

Under the water-management program, the taking of water is controlled to promote its efficient development and beneficial use through water-use studies and through a permit system which involves regulation of withdrawals and investigation of interference complaints. The main activities of the program include processing applications for permits for the taking of water, reporting on complaints concerning alleged interference with water supplies, enforcing associated legislative and permit requirements, and undertaking water-use studies.

Under the well-construction management program, water-well contractors and well-construction practices are regulated to ensure the installation of safe water wells and to protect the quality of ground water. The main activities of this program concern licensing water-well contractors, checking locations and sanitary construction features of wells, and investigating complaints against water-well contractors and possible infractions of statutes and regulations.

Figure 2 shows graphically the number of surface-water and ground-water investigations carried out each year since 1961 and well-construction investigations since 1965.

WATER MANAGEMENT PROGRAM

Applications and Permits

Table 3 shows a summary of water-permit data for 1971. Of the 400 permits issued, 218 were for irrigation purposes, 70 for industrial purposes, 50 for municipal-supply purposes, 51 for recreational purposes, and 11 for commercial purposes. Two hundred and fifty-two permits were cancelled, most of these because of a change in ownership of properties, and sixty-five were amended. One application was refused because of predictable interference with streamflow.

Similar data for the period January 1 to March 31, 1972, are presented in Table 3A. Of the 105 permits issued, 65 were for irrigation purposes, 16 for industrial purposes, 13 for municipal-supply purposes, 9 for recreational purposes and 2 for commercial purposes. In this three-month period, 70 permits were cancelled and 4 were amended.

Tables 4 and 4A show, for 1971 and the first three months of 1972 respectively, the maximum daily amounts of taking authorized, according to drainage basin, source, and purpose. Table 5 is a summary of amounts of water taking approved since 1961. Figure 3 shows graphically the amounts and purposes of surface-water and ground-water takings authorized since 1961. At the end of March, 1972, there were 4946 permits in effect, authorizing a maximum total taking of 12.5 billion gallons per day. This includes six takings totalling 9.5 billion gallons per day for cooling purposes at thermal generating plants.

Renewal Applications and Permits

Permits To Take Water are valid for specified periods (normally five or ten years)

and are subject to renewal at the end of that time. Four renewal applications were carried forward from 1970, and 503 renewal applications were received in 1971, an increase of 345 from the previous year. This increase was due to the fact that, as approximately 2,000 permits will be subject to renewal in 1972, several permittees were requested to submit renewal applications earlier than required. Permit review staff were assisted by water-management investigation staff in dealing with this increase.

By December 31, 1971, 224 permits had been renewed, 26 renewal applications had been withdrawn, and 257 were being processed. During the period January 1 to March 31, 1972, 218 renewal applications were received and 322 renewal permits were issued.

Field Investigations

Streamflow and water-taking data were collected to aid in the quantitative aspects of watershed management in the Bailey, Dedrich, Horner, Mill, South Otter, and Young Creek basins.

A study was undertaken to determine the streamflow reduction which will likely occur in Etobicoke Creek when sewage treatment plants discharging to the stream are phased out of operation. A report was prepared. Four golf courses are authorized by permit to take water from the stream, and the report dealt with the minimum downstream flow which each should be required to maintain, and their need for additional storage or alternative supplies to meet their irrigation requirements.

Through field visits, water-taking practices of 74 permittees were checked, and 79 permit applications were obtained.

In addition, 67 persons were visited specifically to obtain data required to process applications.

Water Management Investigations

One hundred and thirty ground-water and surface-water interference problems were investigated during 1971, the largest number since the water-management program was initiated in 1961. Two factors were responsible for this increase: Precipitation was significantly below average during 1971 in the south-western part of the Province, resulting both in an increased water demand, and in a considerable number of invalid complaints in which the abnormally-low rainfall was the actual cause of the problem. Also, public awareness of the services available through the water-management program had increased.

The problems, based on alleged and actual causes, can be classified as follows: gravel-pit and quarry operation – 24; irrigation withdrawals – 23; road, ditch, sewer and watermain installation – 21; impoundment of streamflow for recreational purposes – 18; municipal withdrawals – 17; industrial withdrawals – 9; and miscellaneous – 18.

During the period January 1 to March 31, 1972, ten new interference problems in the following categories were investigated: road, ditch or watermain installation – 5; gravel-pit operation – 1; industrial withdrawals – 1; municipal withdrawals – 1; miscellaneous – 2.

Ground Water Interference Investigations

Eighty-four investigations of ground-water interference problems were carried out and reports were completed for 72 of these during 1971. In some instances, a particular taking reportedly affected several individual water-supplies, and some of the investigations required repeated field trips to assemble sufficient data to clearly establish causes and responsibilities. In the first three months of 1972, 10 additional problems were investigated and reports completed for eight of them.

The municipalities in which investigations were carried out are indicated below. The figures in brackets indicate the number of separate problems where more than one was investigated.

Township: Albion (4), Aldborough, Ancaster, Anderdon, Anstruther, Beverly, Binbrook, Blanshard (2), Brantford (2), Caledon (2), Cameron, Chinguacousy (3), Clarke, Colchester South, East Garafraxa, East Gwillimbury (2), East Luther, Ekfrid, Esquesing (2), Franklin, Harwich, Henwood, Hinchinbrooke, Houghton, Innisfil, Lobo, London, Madoc, Malden, Markham, Medora, Nassagaweya, North Cayuga, North Dumfries, North Oxford, Nottawasaga, Oliver, Osgoode, Oso, Pickering, Ramsay, Reach (4), Saltfleet, Sarnia (3), South Dumfries (2), South Monaghan, South Norwich (2), Tecumseth, Tiny, Tyendinaga, Townsend, Wallace, Walpole, Waterloo(2), West Oxford, Whitchurch, Wilmot (3), Winchester, Woolwich.
Towns: Bradford, Caledonia, Collingwood, Haileybury, Mississauga (3), Pelham, Stayner.
Cities: Galt, Guelph, Sault Ste. Marie.
Regional Municipalities: Ottawa-Carleton(2)
Borough: Scarborough

The well-interference studies in the townships of North Cayuga, Walpole and Wilmot were complex and required numerous field investigations. Studies were continued in the Town of Bradford. Details of two of these investigations follow:

Township of Walpole

Several private well owners expressed concern that their water supplies would be seriously affected by the expansion of a quarry operation near Hagersville. A water-level monitoring program, including the installation of three automatic recorders, was commenced prior to the expansion. Evaluation of subsequent complaints of alleged well interference was complicated by prolonged, below-average precipitation co-incident with the quarry expansion and by erratic water-level fluctuations in several private wells. These difficulties necessitated continued data collection.

Township of Wilmot

Several local residents expressed concern that the operation of two new municipal wells commencing in 1972 would seriously affect surface and ground-water supplies. Studies were made of existing water use and water availability and a biological study of Hunsburger Creek was undertaken by the Biology Branch. By the end of the period a draft report was in preparation, summarizing the results of these studies and recommending the conditions under which operation of the wells should be permitted. In addition, staff participated in a public meeting in the Township, and in two meetings with local

representatives in the Minister's office, to outline the protection afforded to private water supplies in the event of serious interference.

Surface Water Interference Investigations

Forty-six complaints of surface-water interference were investigated and 43 reports were completed.

Eighty percent of the investigations were related to problems caused by excessive withdrawals for irrigation (19 complaints) and the improper impoundment of water in privately-owned recreational ponds (18 complaints).

The municipalities in which investigations were carried out are listed below, with the bracketed figures indicating the number of investigations where more than one problem occurred.

Township: Albion (2), Aldborough, Arthur, Bayham (2), Brantford (2), Caradoc, Darlington, Delaware, East Flamborough (3), Esquesing, Holland, Houghton, King (2), Markham, Mulmur (2), North Dumfries, North Oxford, Orford (2), Osprey, Otonabee, Pickering, Reach, Tecumseth, Townsend, Uxbridge (2), Waterloo, Wellesley, Whitchurch (3), Yarmouth.

Towns: Clinton, Mississauga, Oakville, Thorold

Cities: Brantford, Thunder Bay

Water Use Studies

The water-use studies section dealt with an increased number of requests for information during its second year of operation, due to an increasing awareness that this service was available. The majority of these requests came either from other divisions of the Commission or from other provincial agencies and reflected an encouraging increase in interdepartmental liaison.

Five detailed water-use studies were undertaken; by the end of 1971, two were completed and three were in progress. Additional details are outlined below.

Credit River Basin

In co-operation with other divisions of the Commission, a detailed inventory was made of existing water uses and water-use conflicts in the Credit River basin.

Hunsburger Creek Area

A detailed inventory of existing water uses in the Hunsburger Creek area was completed. This study was undertaken as part of the evaluation of existing conditions in this portion of the Township of Wilmot prior to the proposed operation of two high-capacity municipal wells.

Lynn River Basin

A draft report on water use and water availability in the Lynn River basin was completed and submitted for review.

Rouge-Duffin Basin

A detailed water-use inventory was in progress for inclusion in a report by the Surveys and Projects Branch on the water resources of the Rouge-Duffin Basin.

Thames River Basin

Staff participated in the preparation of a formal proposal to the Commission for a proposed inter-divisional study of the Thames River Basin. In addition, an initial assessment of existing water takings and water-taking conflicts was begun.

At the request of six branches of the Commission and six other government departments, approximately 25 general water-use studies were carried out during 1971. These included providing information concerning: water takings in the Grand River basin, the Hamilton-Wentworth area, the Niagara Peninsula and the Moira River basin; major takings for cooling purposes at thermal generating plants; and a procedure for the coding of stream networks. During the first three months of 1972, three additional general water use studies were completed.

The compilation of basic water-use data was continued but could not be accelerated as planned. However, initial processing of all of the 3,120 water-taking records submitted by permittees was completed, and daily rates and amounts of taking were calculated for most of the records. By March 31, 1972, processing of the 695 water-taking records received during the first three months of 1972 was in progress.

WELL CONSTRUCTION MANAGEMENT PROGRAM

Well Contractors

Four hundred and twenty-five licences were issued in 1971 for the business of boring and drilling wells for water; 23 licences were issued to boring contractors and 402 licences were issued to drilling contractors. Records for 10,732 water-wells were received during 1971. The number of records received annually for the years 1957 to 1971, inclusive, is shown in Figure 4. The inspectors visited water-well contractors on 1,212 occasions and made 1,447 inspections for sanitary well construction. With the assistance of a seasonal casual employee and staff of the water-management program, the locations of 10,832 wells were checked.

In the first three months of 1972, 16 boring and 341 drilling contractors' licences were issued and 3,158, water-well records were received. The inspectors visited water-well contractors on 362 occasions, inspected 204 wells for sanitary construction, and checked the location of 2,138 wells.

A two-day conference for water-well contractors was held at the OWRC Laboratory with a total registration of 136. The conference dealt with topics of practical interest to drillers and included papers on hydrogeology, well-construction techniques, water treatment methods and water pollution prevention.

Members of the Branch staffed a display booth at the Canadian Water Well Contractors Associaton Annual Convention and contributed an article for the official program.

Investigations concerning Well Regulations

Twenty-six investigations concerning well regulations were carried out during the period in the following municipalities:

Townships: Arthur, Binbrook Blandford, Brantford, Chaffey, Clarke, Dawn, Emily, Esquesing, Hamilton, Innisfil, Medora, Mono, Nassagaweya, Proton, St. Joseph, Seymour, Tosorontio, Uxbridge.

Village: Lancaster

Towns: Aurora, Grimsby

City: Guelph

Borough: Scarborough

A draft report concerning the backhoe construction of water wells was prepared and submitted for review. The report dealt with the prevalence of such wells, the quality of water obtained, the construction techniques, and the need for regulation of such installations.

Figure 2
Types of Investigations

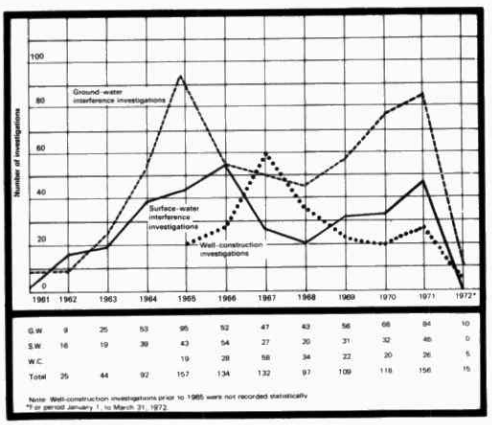


Figure 3
Amount of Water Taking Authorized by Permit According to Year and Source – All Purposes.

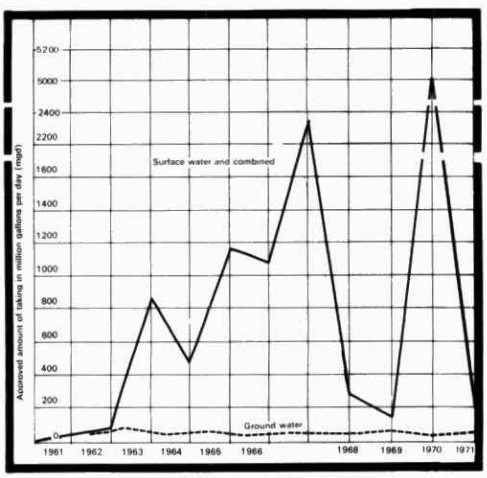


TABLE 3

SUMMARY OF WATER PERMIT DATA FOR 1971

APPLICATIONS

SOURCE	Carried Forward from 1970	Received in 1971	Refused Withdrawn or not Required	Approved By Letter	Approved By Permit	Under Consideration by December 31, 1971	Amount of Water Taking Approved by Permit* (MGD)
Ground Water	7	152	11	48	85	15	35,934,840
Surface Water	34	342	27	–	305	44	179,059,976
Ground and Surface Water	–	15	1	–	10	4	4,479,500
Total	41	509	39	48	400	63	219,474,316

*Does not include water taking approved by letter of approval or by permits where conditions of taking rather than amounts were specified.

TABLE 3A

SUMMARY OF WATER PERMIT DATA – JANUARY 1 to MARCH 31, 1972

APPLICATIONS

SOURCE	Carried Forward from 1971	Received between Jan.1 & Mar.31 1972	Refused Withdrawn or not Required	Approved By Letter	Approved By Permit	Under Consideration on March 31, 1972	Amount of Water Taking Approved by Permit* (MGD)
Ground Water	15	32	3	8	27	9	14,583,820
Surface Water	44	57	1	–	74	26	34,931,280
Ground and Surface Water	4	3	–	←	4	3	2,581,200
Total	63	92	4	8	105	38	52,096,300

*Does not include water taking approved by letter of approval or by permits where conditions of taking rather than amounts were specified.

HYDROLOGIC DATA BRANCH

The activities of the Hydrologic Data Branch centered around the collection, analysis and distribution of hydrologic data, with emphasis being placed on the provision of basic ground-water and surface-water data for general and specific programs and for public purposes.

Observation Wells

The observation well network which is operated by the Branch to monitor ground-water fluctuations throughout the Province was expanded to 229 wells by a net addition of 33 wells. Eighty-nine wells were equipped with water-level recorders and 140 were measured manually. Branch members made manual measurements at 35 wells,

TABLE 4 PERMITS ISSUED AND TAKINGS AUTHORIZED IN 1971 ACCORDING TO DRAINAGE BASIN, SOURCE AND PURPOSE

Drainage Basin	SURFACE WATER					GROUND WATER					COMBINED TAKING					Totals
	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	Comm.	Ind.	Irr.	Mun.	Rec.	
Ottawa River	1 .72	4 11.03	3 .53				1 .02	4 .32								13 12.62
St. Lawrence River				1 .02		1 .05	2 .73		4 .59							8 1.39
Lake Ontario	2 .16	10 37.48	43 + 1 11.60	2 10.07	+18		11 9.63	1 .01	14 2.57				1 .23		1 .03	85 + 19 71.78
Lake Erie & Lake St. Clair		9 + 1 5.13	133 39.82		1 + 7 0.10	1 .04	7 7.34	7 1.65	7 4.78		1 .22	1 2.70	3 1.25		1 .02	171 + 8 63.05
Lake Superior		1 .47	1 .36													2 .83
Hudson Bay		6 6.31	1 .02						1 .04							8 6.37
Lake Huron	2 + 1 .14	13 + 1 49.48	20 5.60	1 .02	+22	2 1.71	3 3.94		19 2.51					1 .03	+1	61 + 25 63.43
Totals	5 + 1 1.02	43 + 2 109.90	201 + 1 57.93	4 10.11	1 + 47 0.10	4 1.80	24 21.66	12 1.98	45 10.49		1 .22	1 2.70	4 1.48	1 .03	2 + 1 .05	348 + 52 219.47
Grand Totals			254 + 51 179.06					85 35.93					9 + 1 4.48			

TABLE 4A FOR THE PERIOD JANUARY 1 TO MARCH 31, 1972

Ottawa River																
St. Lawrence River																
Lake Ontario		2 10.53	8 3.16		+ 1		2 6.12	1 0.50	5 1.10			1 1.29	1 0.42			20 + 1 23.12
Lake Erie & Lake St. Clair		2 3.14	50 18.01		+ 1		2 3.17	4 0.45	2 1.03	1 0.09			1 0.82			62 + 1 26.71
Lake Superior		+ 1														+ 1
Hudson Bay																
Lake Huron	+ 1	2 0.09			+ 6		4 1.62		6 0.50		1 0.05					13 + 7 2.26
Totals	+ 1	6 + 1 13.76	58 21.17		+ 8		8 10.91	5 0.95	13 2.63	1 0.09	1 0.05	1 1.29	2 1.24			95 + 10 52.09
Grand Totals			65 + 9 34.93					27 14.58					4 2.58			

NOTE: (i) In each square the number of permits issued appears above with the amount of authorized water taking in IMGD.
(ii) The number following a "+" shows the permits issued under special conditions and having no rate or amount specified.
(iii) Purposes: Comm. – Commercial; Ind. – Industrial; Irr. – Irrigation; Mun. – Municipal; Rec. – Recreational.

TABLE 5

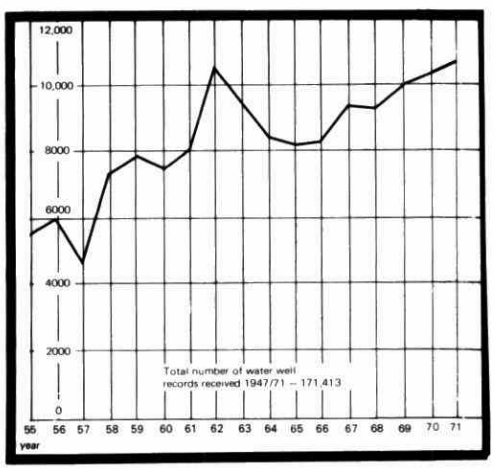
SUMMARY OF AMOUNTS OF TAKING APPROVED BY PERMIT FOR VARIOUS PURPOSES

PURPOSE	1961 MGD	1962 MGD	1963 MGD	1964 MGD	1965 MGD	1966 MGD	1967 MGD	1968 MGD	1969 MGD	1970 MGD	1971 MGD	1972* MGD
Commercial	0.28	3.88	0.36	1.48	0.36	1.45	0.48	0.61	1.94	1.37	3.04	0.05
Industrial	10.34	10.45	26.38	329.14	947.91	1,310.08	2,238.94	55.58	53.85	4,757.11	134.26	25.96
Irrigation	0.38	8.88	774.09	51.49	134.82	94.23	96.46	69.11	86.18	73.74	61.39	23.36
Municipal	6.53	12.13	21.24	103.62	31.49	17.69	18.16	162.15	33.88	203.01	20.63	2.63
Recreation	–	–	0.93	0.23	0.05	0.07	4.31	0.02	0.18	0.31	0.31	0.09
TOTALS	17.53	35.34	823.00	485.96	1,115.63	1,423.52	2,358.35	287.47	176.03	5,035.54	219.47	52.09

NOTE: The amounts do not include water takings approved by letters of approval or by permits where conditions of taking rather than amounts were specified.

* For period January 1 to March 31, 1972.

Figure 4
Number of Water Well Records Received Annually



conservation authorities' personnel at 28, other governmental or municipal employees at 14 and private citizens at 63. Figure 5 shows the historical development of the observation well network.

Fifteen additional observation wells were operated to serve specific development or management needs. Five of these wells were fitted with water-level recorders; the other ten were measured manually.

Hydrogeologic Data

Water Resources Bulletins 2–8, 2–10 and 2–11 were published. These bulletins, in the ground water series, contain data from the water-well records for the southeastern area of the Province for the years 1960 to 1964, the southwestern area for the years 1964 to 1967 and the south-central area for the years 1965 to 1967, respectively.

Nearly 16,500 water-well records, received through the Water and Well Management Branch from water-well contractors, were placed on open file. By the end of March 1971, a special work force had processed the remaining 20,000 water-well records to convert a manual file system to an electronic data processing system. This completed the processing of over 150,000 well records submitted by licensed water well contractors for wells completed before the end of 1967. The Inland Waters Branch of the Federal Government was a co-operating agency in this project and supplied the location co-ordinates for the wells in certain counties in the Lake Ontario basin. Regular staff coded more than 9,000 current records for computer storage.

A retrieval system was developed by the Systems and EDP Branch and print-outs of the well data have been used extensively within the Commission. Print-outs for 19 counties and districts have been supplied upon request to other governmental agencies. A format to be used in the production of Water Resources Bulletins has been developed. A print-out is being checked and verified for printing of Bulletin 2–9 which will contain well record data for the northern area for the years 1946 to 1969.

Public Enquiries

The public demand for hydrogeologic information continued. As a result of enquiries, 59 summaries of ground-water conditions were prepared, 452 letters written and 10,219 copies of water-well records were made available to private citizens, consulting engineers, university researchers and others interested in locating and developing ground water or in assessing ground water resources. Two hundred and seventeen visitors consulted the records or discussed ground-water conditions with staff members. Nearly fourteen hundred enquiries were dealt with by telephone.

Ground Water Assessment Program

Ground water probability maps for the counties of Kent and Essex were published and distributed. These maps show the probable yield of the most commonly used aquifers, the depth to water bearing formations and ground-water quality at selected locations within the counties. A similar map for the County of Elgin was under preparation and is scheduled for publication in 1972.

An intensive study was carried out on the recovery of the artesian sand and gravel aquifer of the White Oak municipal well field which was formerly used by the City of London. The report on the study will be presented at the 24th International Geological Congress to be held in August, 1972, in Montreal.

Work proceeded on the assessment of aquifers in three areas. In the Township of Albion the installation of two piezometers in the overburden completed the field construction for a study to evaluate aquifer conditions in the overburden and the Meaford-Dundas shale bedrock. The preparation of a report "Aquifer Characteristics of the Overburden and the Bedrock in the Township of Wainfleet, Ontario," was commenced. In the Township of Morris, near the Village of Brussels, two wells were drilled to the Bois Blanc limestone formation. One well was equipped with three 2-inch diameter piezometers and the other one was equipped with three 1-inch diameter piezometers and one 5-inch diameter casing at different levels in the overburden and the bedrock. The construction of a third well and a pumping test are planned for 1972. The purpose of the testing program is to determine the regional hydrogeologic characteristics of the limestones of the Detroit River Group and of the overburden.

Surface Water Data and Studies

Streamflow data were assembled through the operation of gauging station and flow metering by the Branch and through co-operative arrangements with the Water Survey of Canada. A summary of streamflow gauging stations by operating agency is presented in Table 6 and a historical record of the types and numbers of streamflow stations operated each year since 1963 is shown in Figure 6.

At the request of the Branch, the Water Survey of Canada increased the number of streamflow gauging stations which it operates under a cost-sharing agreement from 67 to 77 and continued to operate 5 lake gauges in the Hudson Bay drainage basin under the same agreement.

Most of the 137 streamflow stations operated by the Branch serve current programs of the various divisions and are related to biological, water quality, project and management studies and to basin planning. Thirty-two stations are network stations and are operated to improve the surface water data inventory. Some of these stations were initially requested by other branches but were added to the network stations when the specific need for data at these stations terminated.

During the summer months, 600 measurements were made at 70 other metering sites in southern Ontario. These sites were selected to meet requests for data for streams not gauged in the area, to evaluate sites as potential gauging stations which will fit into the Branch's network, or to provide data at locations of potential water use.

The streamflow data collected in 1970 at 11 automatic recording and three manual stations with daily records were sent to the Water Survey of Canada for inclusion in its annual publication "Surface Water Data – Ontario". All 1971 data from 17 recording stations and seven manual stations with daily data are being processed and will be submitted to the Federal Government for publication with its 1971 data.

Data collected in 1970 in southern Ontario at 57 other stations and 95 miscellaneous measurement sites were published in OWRC Water Resources Bulletin 3–5. Corresponding data collected for 1971 were assembled and the manuscript was forwarded to the printer for publication as Bulletin 3–6.

The Branch obtained hydrometric data for a number of specific studies. Examples of support to these studies are as follows:

– The potential of Brennan Creek in the Village of Killaloe Station as a source of municipal water supply was assessed; streamflow data were collected and flow analyses undertaken.

– A streamflow data network was developed by the Branch and hydrometric data for the Kawartha Lakes Study was collected.

– The Branch assisted the Division of Research in its study at the Shelbourne lagoon by installing a flow recorder and weir at the outlet to the lagoon.

– Assistance was provided to the Water and Well Management Branch through the installation of a flume and water-level recorder on Mill Creek near Lambeth to monitor continuous low flows of the Creek.

– Assistance was given to the Department of Lands and Forests in assembling and analysing the data collected at Midhurst at its proposed fish hatchery site.

– Branch staff conducted an office study on the flow regime of the Veuve River and prepared a report on simulated streamflows for the Veuve River at Warren on behalf of the Division of Sanitary Engineering.

Northern Ontario Water Resources Studies

The collection of hydrologic data was continued in the Hudson Bay drainage basins. Eighty-eight streamflow measurements were made at 12 sites throughout the summer. Bubble-type automatic water-level recorders were installed and operated at 12 sites. Eight are being operated year round and four were operated for the summer period only. Under this program, the Water Survey of Canada operates 27 recording streamflow gauges and five lake-level gauges on a shared-cost basis. The Branch requested and shared in the construction of two new stations on the Missinaibi River above the Moose River junction and the Ogoki River above White Clay Lake.

Water-level measurements were taken at 27 observation wells. Two observation wells were discontinued and 14 new ones were added to the network. One lake level station and one river level station were established near Nakina, for the open-water season, to assist a ground-water study of the area.

RIVER BASIN RESEARCH BRANCH

The activities of the River Basin Research Branch were largely concentrated on scientific hydrologic studies of five characteristic drainage basins in southern Ontario. These basin studies, along with the studies of ground-water inflow to Lake Ontario for the International Field Year for the Great Lakes program, comprise a substantial portion of the Commission's contribution to the International Hydrological Decade program. Other specialized work undertaken included ground geophysical surveys, gamma and electric well logging and soil analyses.

Representative Basin Studies

The study of hydrologic and hydrogeologic processes was continued in five drainage basins representative of major physiographic and geomorphologic regions in southern Ontario. This program is de-

TABLE 6

NUMBER AND TYPE OF STREAMFLOW GAUGING STATIONS BY MAJOR BASIN OPERATED OR SUPPORTED BY OWRC

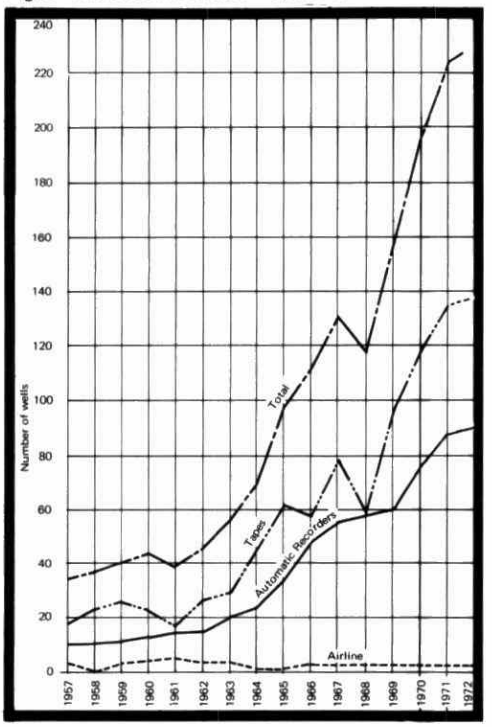
Operating Agency	St. Lawrence Drainage Basin		Hudson Bay Drainage Basin		Total Ontario
	Recording	Manual	Recording	Manual	
Hydrologic Data Branch	17*	108**	12***	0	137
River Basin Research Branch	20	13	0	0	33
Water Survey of Canada (supported by the Division of Water Resources)	42	6	27	2	77

* Includes 4 recorders operated during the open-water season only.

** 101 stations were read at irregular intervals.

*** 4 operated during open-water season only.

Fig. 5 Observation Wells in Operation



signed to develop new techniques and improve existing methodology in water resources evaluation and management and, as such, will provide a significant contribution to the program of the International Hydrological Decade.

With the completion of the instrumentation and preliminary data collection stages within these basins, studies have become more complex as data evaluation and statistical analyses were undertaken in preparation for mathematical modelling of the basins.

Fig. 6
Streamflow Guaging Stations Operated by the Branch or Maintained Co-operatively with the Federal Government.

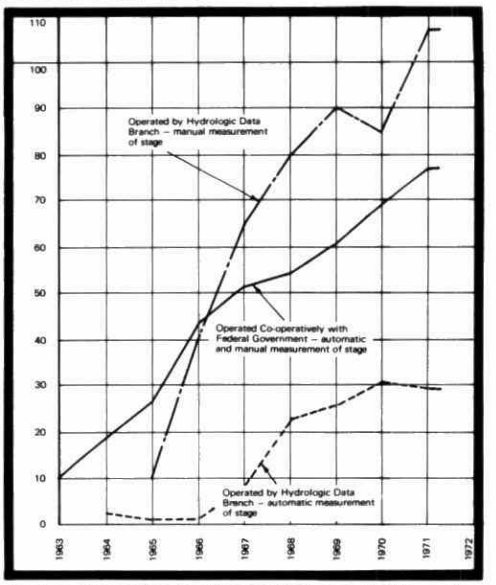


Table 7 provides a summary of the hydrometric stations operated by the Branch in its five representative basins. In general, the number of stations has remained relatively constant since 1970. The number of necessary routine field measurements at streamflow gauging stations was reduced as rating curves and instrument operations became more reliable and efficient.

Blue Springs Creek IHD Basin

The collection of streamflow data, observation-well data and meteorological data was continued for analysis and input to the hydrogeologic study of the basin. In support of this study, a detailed ground-water sampling program was undertaken and chemical analyses were carried out by the OWRC Laboratories for the delineation of ground-water flow systems in the basin.

As a co-operating agency under the IHD, the University of Guelph continued its monitoring of streamflow at two stations in the basin and routinely submitted samples of surface water to the OWRC Laboratories for analyses.

Bowmanville, Soper and Wilmot Creeks IHD Basin

The routine collection of hydrologic data from existing stations in the basin was continued throughout the period. Regular surveys of streamflow were supplemented during periods of unusual flow in order to obtain more accurate continuous records. All observation wells were checked and measured regularly by Branch staff and private observers. Meteorological data were also collected routinely by private observers in the basin, in co-operation with the Federal Atmospheric Environment Service.

In order to aid in the collection of streamflow data during periods of unusual flow, two automatic recording stations were modified to include a telemetering system, providing readings of streamflow by telephone relay. The abstraction of pertinent data from the stream water-level charts was aided significantly through the use of the digitizing and computing facilities of the Department of Transportation and Communications, where a total of 579 station-months of back-data were processed to yield daily mean streamflows for twelve stations in the basin.

Two reports dealing with streamflow station operation and data analysis entitled "Effects of Natural Stream Channel Changes on Streamflow Measurements", and "Hydrograph Separation in the Wilmot Creek Basin Using Recession Factor Analysis and Chemistry of Streamflow" were published and distributed. Through the use of a conductivity recording instrument installed at a streamflow gauging station, data were collected for a study attempting to derive

TABLE 7

SUMMARY OF HYDROMETRIC STATIONS OPERATED BY THE RIVER BASIN RESEARCH BRANCH IN REPRESENTATIVE BASINS

BASIN	METEOROLOGICAL STATIONS		SNOW COURSES	STREAMFLOW GAUGING STATIONS		OBSERVATION WELLS		SOIL MOISTURE STATIONS
	Main	Satellite		Recording	Manual	Recording	Manual	
Blue Springs Creek	–	–		–	6	5	11	–
Bowmanville, Soper & Wilmot Creeks	2	12	12	13	2	12	40	16
East & Middle Oakville Creeks	1	6	9	4	2	2	27	5
Venison Creek	1	3	–	2	1	4	3	–
Wilton Creek	2	6	–	1	2	4	11	–
TOTALS	6	27	21	20	13	27	92	21

a relationship between stream conductivity, surface run-off and baseflow.

To aid in the delineation of the ground-water flow systems in the basin, an intensive ground-water sampling survey was carried out and chemical analyses were performed by the OWRC Laboratories. Hydrogeological studies of the basin were continued with the determination of aquifer yields and ground-water storage changes, using existing water-well record data supplemented by observation-well and pumping-test data. A report entitled "Evaluation of the Ground Water Storage Capacity in the Soper Creek Sub-Basin Using the Physical Parametric Approach" was prepared and published.

During the winter months, bi-monthly snow surveys were carried out in the basin to determine areal estimates of snow depth and water equivalents. In the latter part of 1971, readings of incoming and reflected radiation (albedo) were added to the routine survey measurements. Current snow data were made available to the provincial Conservation Authorities Branch and the federal Department of the Environment to assist in flood forecasting programs and lake level assessment, respectively. Tabulation and statistical analyses of the 1970-71 snow data were undertaken using the CALL/360 facilities of the Systems and EDP Branch of the Division of Administrative Services.

During the crop-growing season, bi-monthly readings of soil moisture using the neutron probe technique were obtained in the Wilmot Creek sub-basin, supplemented with spot measurements from the Soper Creek sub-basin satellite network. Calculation to determine soil moisture by volume, basin indices of water content and preliminary analyses of the data were undertaken using the CALL/360 terminal.

Preparation and preliminary analysis of precipitation data were undertaken as part of the accuracy and network evaluation study. The abstraction of daily net radiation data for two stations in the basin was commenced by the federal Atmospheric Environment Services Branch; 34 station-months of back-data were processed. The monitoring of ground temperature was continued at the two main meteorological stations during the freezing periods.

In preparation for the mathematical modelling of the basin and its associated hydrologic processes, reduction and compilation of the basin physiographic parameters, streamflow data, ground-water level data, precipitation data, soil moisture and snow survey data were undertaken. Preliminary concepts were outlined for ground-water flow simulation and streamflow correlation and synthesis.

Operations of the IHD representative basin studies were outlined for the students of the Faculty of Forestry, University of Toronto, and for senior management personnel of the Commission during field trips through the basin.

East and Middle Oakville Creeks IHD Basin

Routine station maintenance and data collection surveys were conducted in the basin throughout the period, obtaining data on streamflow, observation-well water levels and samples of ground water for chemical analyses. Streamflow measurements were supplemented during periods of unusual flow in order to obtain more reliable records for those periods. In order to monitor streamflow entering the newly-completed Scotch Block reservoir in the basin, two manual gauging stations were established. A telemetering device was installed at one automatic streamflow gauging station to provide streamflow information by telephone relay. Meteorological data were also collected routinely by private observers in the basin, in co-operation with the federal Atmospheric Environment Service.

During the winter months, bi-monthly snow surveys were conducted to obtain readings of snow depths and water equivalents. The snow survey data for 1970-71 and 1971-72 seasons were tabulated and distributed to other government agencies carrying out assessment studies. Using the CALL/360 computing terminal, statistical analyses programs were run with the 1969-

70 and 1970-71 snow data. The results of the 1968-69 season, and accompanying data evaluation were published and distributed in the Climatic-series Bulletin "Snow Survey Report – East and Middle Oakville Creeks Drainage Basin 1968-1969".

To provide more reliable estimates of infiltration and consumptive use in future mathematical simulation studies of the basin's hydrologic processes, the installation of a soil moisture measurement network was commenced. Using the Branch's drilling rig, a total of 15 access tubes were installed at five sites in the basin.

Venison Creek IHD Basin

Routine station maintenance and data collection surveys were carried out in the basin, obtaining information on streamflow and water-level fluctuations in observation wells. A report entitled "Preliminary Evaluation of Streamflow Gauging Stations in the Venison Creek Basin" was published and distributed. Meteorological data were collected routinely by private field observers.

In preparation for the development of a mathematical model of the basin processes, statistical analyses using the CALL/360 terminal were carried out to evaluate the precipitation network and the accuracy of the data collected from it. A report outlining the results of this evaluation was under preparation.

Wilton Creek IHD Basin

Routine surveys were conducted in the basin throughout the period to carry out station maintenance and measure streamflows and fluctuations of water level in the observation wells. In co-operation with the federal Atmospheric Environment Services, field observers continued the collection of meteorological data.

An office compilation of water-well records was undertaken in the basin in order to examine hydrogeologic characteristics of the overburden and bedrock aquifers. An intensive ground-water sampling program was completed and the results of the chemical analyses, as performed by the OWRC Laboratories, were used to determine the ground-water flow systems in the basin.

One field trip was conducted in the basin for the students of the Water Science Group, Loyalist College.

Mathematical Modelling

A draft report outlining the conceptual framework for OWRC–IHD representative basin modelling was prepared. Meetings were held with representatives from the Water Quality Surveys Branch, Division of Sanitary Engineering, and Systems and EDP Branch, Division of Administrative Services, to discuss mutual interests and co-operative programs in mathematical modelling studies.

Geophysical Investigations

Geophysical activities of the Branch included surface electrical resistivity surveys, seismic refraction surveys, and gamma and electric well-logging for scientific studies and water-supply development projects.

Scientific geophysical studies were carried out in support of hydrogeologic investigations in the East and Middle Oakville creeks basin. A surface resistivity sounding-profiling method was used experimentally in a selected area of the basin to test the method for finding and tracing sand and/or gravel deposits in buried channels. In conjunction with driller' logs, vertical electrical sounding and seismic refraction work, these results will be combined with hydro-geologic data for the preparation of a water-probability map of the basin. As part of this study, bedrock topography maps will be prepared manually and by computer and compared against each other to determine the relative degree of reliability.

A seismic survey was conducted in the vicinity of the Police Village of Verner, Township of Caldwell, to assist in a ground-water survey undertaken by the Surveys and Projects Branch.

A set of master curves, published in the form of tables, was plotted. The master curves enable more suitable techniques to be employed when interpreting vertical electrical sounding data obtained by using the Wenner electrode configuration.

To assist in the stratigraphical interpretation of well logs obtained from test-drilling projects, natural gamma ray and electrical logging were carried out in seven wells for the Surveys and Projects Branch and in two wells for the Hydrologic Data Branch. In addition, two wells were logged in the Duffin Creek basin, as a part of the International Field Year for the Great Lakes program.

Regular meetings of CEGS (Canadian Exploration Geophysicists Society) were attended for tours and discussions with geophysical personnel in other areas of the government and in industry.

Soils Laboratory Studies

In support of Branch programs and test-drilling projects, geologic investigations and special studies carried out by other branches, 413 soil samples were analysed in the Branch's soils laboratory.

Sieve analyses were completed for 199 samples, hydrometer analyses for 116 samples, carbonate analyses for 68 samples and heavy mineral separations for 30 samples. The majority of the sample analyses were carried out for the Surveys and Projects and the River Basin Research branches of the Division; occasional analyses were undertaken for the Water Quality Surveys Branch of the Division of Sanitary Engineering.

International Field Year for the Great Lakes (IFYGL)

Hydrogeologic studies were continued in the Lake Ontario drainage basin to determine the ground-water inflow to the lake, a project forming a large part of the Commission's contribution to the IFYGL program. Studies were undertaken in representative areas of six hydrogeologic provinces in the lake basin, using existing water-well record data, observation-well data and chemical analyses of ground water to estimate the ground-water discharge to the lake.

Forty Mile Creek

Water-level data were collected routinely from 15 private wells and the 28 piezometers previously installed in the basin. Ground-water samples were taken from wells for chemical analyses to aid in the interpretation of flow systems in the basin. In order to evaluate amounts of ground-water dis-

charge from the Niagara Escarpment, flow measurement of local discharge streams was continued.

The 14th Conference on Great Lakes Research was attended and the paper "Hydrogeology of the Forty Mile Creek Drainage Basin on the South Shore of Lake Ontario" was presented.

Oakville Creek

To continue the evaluation of the ground-water contribution from the Oakville Creek area, data from the East and Middle Oakville creeks IHD representative basin were evaluated and extended toward the lake. In addition, water-level measurements were taken routinely from the 26 piezometers previously installed in the Oakville Creek basin. An additional six piezometers were installed at two sites using the Branch's drilling rig. Water samples for chemical analyses were taken from wells and springs to aid in the determination of the ground-water flow systems.

Duffin Creek

To evaluate the ground-water contribution to the lake from the Duffin Creek area, data, originally collected for the Surveys and Projects Branch's Duffin Creek-Rouge River drainage basin survey, were studied and the evaluation was extended to cover an area to the lakeshore. Using aerial photographic interpretation, a reconnaissance of the surficial geology was made to aid in the selection of test-drilling sites. Nine piezometers were installed at three sites using the River Basin Research Branch's drilling rig and routine measurements of water level were taken.

Bowmanville, Soper and Wilmot Creeks

To determine the ground-water contribution to the lake from the aquifer systems in the Bowmanville area, data from the Bowmanville, Soper and Wilmot creeks IHD representative basin study, supplemented with information from available water-well records for the area between the basin and the lake, were evaluated. Detailed hydrogeologic maps were prepared for the area south of the old Lake Iroquois shoreline. As part of this study, a two-dimensional, steady-state, finite-element ground-water flow system model was constructed using data from a hydrogeologic cross-section in the Newcastle area.

Moira River

As part of the IFYGL program to determine ground-water inflow to the lake, compilation of data from water-well records at the Lake Ontario shore was carried out in this area.

Thousand Islands Area

As part of the IFYGL program to determine ground-water inflow to the lake in the eastern porton of the basin, compilation of hydrogeologic data from records of water wells completed near the shore of Lake Ontario was initiated in the townships of Escott and Yonge.

Remote Sensing

Under the IFYGL program, the Branch participated in meetings initiated by CARED, an agency of McMaster University, to co-ordinate Canadian participation in the NASA overflights of Lake Ontario. Proposals were put forth by CARED for a CARED–USGS–NASA contract for future NASA overflights of Lake Ontario. The final remote sensing overflight, prior to the advent of the Field Year, was undertaken by NASA over the western portion of the Lake Ontario drainage basin.

The University of Michigan conducted a remote sensing overflight, obtaining multispectral data for the Oakville Creek and Bowmanville, Soper and Wilmot creeks basins.

Technical discussions were held with the University of Michigan and the University of Guelph as to requirements of ground truth for multi-spectral and radar mapping in certain portions of the Lake Ontario drainage basin. Other discussions with the University of Guelph dealt with the feasibility of establishing remote sensing platforms at one or two main meteorological stations in the IHD representative basins for data relay to the proposed ERTS satellite, and with evaluation and interpretation of infra-red photographs obtained during past NASA overflights.

Consultations were held with the federal Inland Waters Branch with regard to the interpretation of the imagery from the July 6, 1970, NASA overflight, obtained for detailed study to determine ground-water discharges on land and water surfaces. To assist in this interpretation, densitometric measurements of selected points on the imagery were attempted by the University of Guelph.

Delineation of areas of apparent ground-water discharge, using high-altitude imagery flown by NASA over the western portion of the Lake Ontario drainage basin, was commenced.

To obtain further exposure to and education in remote sensing areas, the branch staff attended the Seventh International Symposium on Remote Sensing of the Environment, the First Canadian Symposium on Remote Sensing, meetings concerning the newly-established Canada Centre for Remote Sensing (CCRS) and a short course "Fundamentals of Infra-red Imagery" at the University of Michigan. Enrollment was also made in the Canadian inter-university graduate course "Integrated Aerial Surveys" and in a graduate course "Geohydrologic Response Systems" at the University of Waterloo.

General

The preparation of the overburden-well yields map for the Lake Ontario drainage basin was completed and submitted to the United States Geological Survey for approval prior to publication. To provide material for the preparation of the IFYGL Technical Plan and the planning of the IFYGL data storage bank, descriptions of the OWRC data acquisition systems were submitted to the Canada Centre for Inland Waters for compilation. In addition, the third US–Canadian IFYGL workshop was attended in Washington, D.C., to review the necessary information for the completion of the draft IFYGL Technical Plan, describing data acquisition systems, field operations and data management for the upcoming Field Year, April 1, 1972 to March 31, 1973.

Appendix

TECHNICAL PAPERS AND ADDRESSES BY OWRC PERSONNEL – 1971

INDUSTRIAL WASTES

Caplice, D.P.
"Our Environment and the Dairy Industry", 35th Annual Meeting International Association of Milk Control Agencies, April 1971.

Clarke, H.A.
"Water Management in an Urban Area", Urban Environment Seminar, 1971.

Clarke, H.A.
"Water Quality Requirements for Municipal and Industrial Uses", Professional Development Course on Water: Quality and Control, June 1971, Halifax, Nova Scotia.

Armstrong, T.D.
"Water Pollution and the Ready Mixed Concrete Producer", Twelfth Annual Meeting of the Ready Mixed Concrete Association of Ontario, Muskoka, September 1971.

Gotts, R.M.
"The Role of the Plant Engineer in Pollution Control", American Institute of Plant Engineers, Sarnia Plant Engineers Chapter No. 113, May 1971.

Gotts, R.M.
Panel: "Industrial Pollution Control Municipalities", City Engineers Association Workshop, Sault Ste. Marie, November 1971.

Gotts, R.M.
"Safe Disposal of Hazardous Wastes", Industrial Accident Prevention Association 1971 Safety Conference, April 1971, Toronto.

Hawley, J.R.
"Aspects of the Problem of Acid Mine Drainage in the Province of Ontario", 18th Ontario Industrial Waste Conference, Niagara Falls, June 1971.

Hawley, J.R.
"The Problem of Acid Mine Drainage in Ontario", Third Annual Meeting of the Canadian Mineral Processors, January 1971, Ottawa.

LABORATORIES

Veal, D.M., Michalski, M.F.P.
A Case of Nutrient Enrichment in an Inshore Area of Georgian Bay. Proc. 14 Conf. Great Lakes Res., Internat. Assoc. Great Lakes Res. 277-292. 1971.

Michalski, M.F.P., Hopkins, G.J.
Biological and Limnological Aspects of Water Supply. Sixth Waterworks Seminar on the Topic of Biological Problems in Water Supply, Ontario Section, American Waterworks Association, 1971.

Johnson, M.G., Owen, G.E.
Nutrients & Nutrient Budgets in the Bay of Quinte, Lake Ontario. W.P.C.F. Journal May 1971.

McCombie, A.M., Wile, I.
Ecology of Aquatic Vascular plants in Southern Ontario Impoundments. Weed Science, Vol. 19, No. 3, May 1971.

Schenk, C.F.
The Cottage Country Fight to Save our Recreational Lakes. Water and Pollution Control Journal, March 1971.

Brydges, T.G.
Chlorophyll a – Total Phosphorus Relationships in Lake Erie. Proc. 14th Conf. Great Lakes Res., Internat. Assoc. Great Lakes Res. 185-190, 1971.

Brydges, T.G.
An Intensive Survey in Western Lake Erie. Proc. 14th Conf. Great Lakes Res., Internat. Assoc. Great Lakes Res., 191-197, 1971.

Rees, G.A.V.
Notes on Column Chromatographic Separation of PCB'S from Chlorinated Hydrocarbon Pesticides, and Subsequent Gas Chromatographic Quantitation of PCB's in Terms of Decachlorobiphenyl, with E.C. Detector. Seminar on Pesticides Residue Analysis, Quebec. April 1971.

Bishop, J.N.
O.W.R.C.: Its Relation to the Industrial Community and its Chemical Laboratory Procedures. 3rd Annual Meeting of Canadian Mineral Analysts, Haileybury, October 1971.

Berg, O.W., Diosady, P.L., Rees, G.A.V.
Column Chromatographic Separation of Polychlorinated Biphenyls from Chlorinated Hydrocarbon Pesticides, and Subsequent Gas Chromatographic Quantitation in Terms of Derivatives. Bulletin of Environmental Contamination on Toxicology, Vol. VII, No. 3, 1971.

RESEARCH

Black, S.A.
Agriculture & Water Pollution in Ontario – Perth County Crop Improvement Association, Stratford, Dec. 1971.

Black, S.A.
Provincial Standards for Water Pollution in Relation to Agriculture Operation and Food Conference, University of Guelph, Jan. 1971.

Black, S.A.
Phosphorus Removal By Chemical Addition to an Extended Aeration Activated Sludge Plant – Research Publication No. 39, Mar. 1971.

Black, S.A.
Lake Eutrophication, A Laboratory Investigation, Research Paper No. 2026.

Boyko, B.I.
Aerated Lagoons in Industrial Waste Treatment, 18th Ontario Industrial Waste Conference, June 1971.

Boyko, B.I.
Application of Aerated Lagoons in Ontario, Association Quebecoise des Techniques de l'Eau. Annual Convention, Quebec City, April 1971.

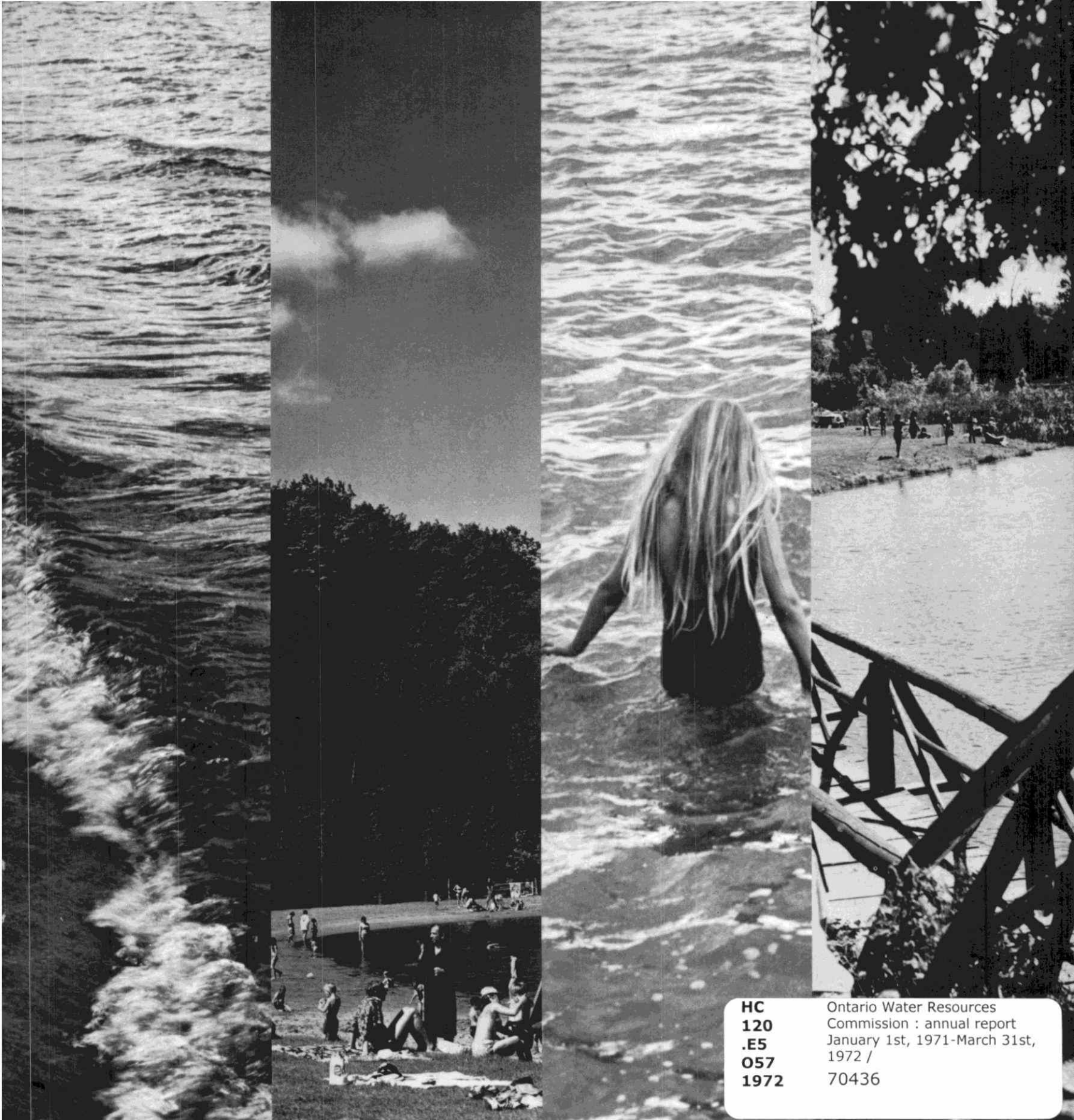
Vajdic, Ann H.
Gamma-Ray Treatment of Tastes and Odours, J.A.W.W.A. 63, 459-461, 1971.

Vajdic, Ann H.
Treatment of Actinomycetes Tastes and Odours with Gamma Irradiation, 91st Conference, A.W.W.A., June 1971, Denver, Colorado.

Vajdic, Ann H.
Gamma Irradiation of Wastes and Waste Waters for Disinfection Purposes – Isotopes and Radiation Technology 8, 451, 1971.

Harris, A.J., Roberts, K.J., Christie, A.E.
Effects of Detergents on Water Supplies, J.A.W.W.A. 63, 795, 1971.

Vajdic, Ann H.
Gamma Irradiation of Sewage and Sewage Sludges, Research Publication No. 38.



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