# Annual Activity Summary

# 1976

# Technical Operations Section

Scientific Support Division
Inland Waters Directorate

# 1976
# CSS LIMNOS

| | SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|---|
| JAN | | | | | 1 | 2 | 3 |
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| FEB | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| MAR | 29 | 1 | 2 | 3 | 4 | 5 | 6 |
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| | 28 | 29 | 30 | 31 | 1 | 2 | 3 |
| APR | 4 | 5 Depart CCIW 0945 | 6 Lake Ontario | 7 Surveillance | 8 Lake Ontario | 9 Transit Welland Canal | 10 Lake Erie |
| | 11 Surveillance | 12 Lake Erie | 13 Arrive Pt. Colborne 1045 | 14 CCIW | 15 CCIW | 16 CCIW | 17 CCIW |
| | 18 CCIW | 19 CCIW | 20 CCIW | 21 CCIW | 22 CCIW | 23 CCIW | 24 CCIW |
| | 25 CCIW | 26 Depart CCIW 0912 | 27 Lake Ontario | 28 Surveillance | 29 Lake Ontario | 30 Arrive CCIW 1310 | 1 CCIW |
| MAY | 2 Depart CCIW 0900 | 3 Transit | 4 Transit | 5 North Channel | 6 Moorings | 7 Current | 8 Meters |
| | 9 Moorings | 10 Current | 11 Meters | 12 Georgian Bay | 13 Transit | 14 Transit | 15 Arrive CCIW 0340 |
| | 16 CCIW | 17 Depart CCIW 1605 | 18 St. Lawrence | 19 River | 20 Sediment | 21 Water | 22 Interrelation |
| | 23 St. Lawrence | 24 River | 25 Sediment | 26 Water | 27 Interrelation | 28 Arrive CCIW 0810 | 29 CCIW |
| JUN | 30 CCIW | 31 Depart CCIW 1031 | 1 Lake Ontario | 2 Lake Metabolism | 3 Study | 4 Arrive CCIW 1330 | 5 CCIW |
| | 6 CCIW | 7 Depart CCIW 0942 | 8 Lake Ontario | 9 Surveillance | 10 Lake Ontario | 11 Arrive CCIW 1226 | 12 CCIW |
| | 13 CCIW | 14 CCIW | 15 CCIW | 16 CCIW | 17 Engineering | 18 Trials | 19 CCIW |
| | 20 CCIW | 21 Engineering | 22 Trials | 23 Towing System | 24 CCIW | 25 CCIW | 26 CCIW |
| | 27 CCIW | 28 Depart CCIW 0900 | 29 Lake Ontario | 30 Surveillance | 1 Lake Ontario | 2 Arrive CCIW 0205 | 3 CCIW |
| JUL | 4 CCIW | 5 Depart CCIW 0915 | 6 Transit | 7 Transit | 8 Moorings | 9 Current | 10 Meters |
| | 11 North Channel | 12 Georgian Bay | 13 Drogue Tracking | 14 Drogue Tracking | 15 Transit | 16 Transit | 17 Arrive CCIW 0708 |
| | 18 CCIW | 19 Depart CCIW 1027 | 20 Lake Ontario Optics Study | 21 Arrive CCIW 2241 | 22 CCIW | 23 CCIW | 24 CCIW |
| | 25 CCIW | 26 Lake Ontario Met. Buoy | 27 Depart CCIW 0905 | 28 Lake Ontario | 29 Surveillance | 30 Lake Ontario | 31 Arrive CCIW 0403 |
| AUG | 1 Depart CCIW 0856 | 2 Lake Erie Coring | 3 Lake Huron | 4 Near-shore | 5 Sediment | 6 Survey | 7 Lake Huron |
| | 8 Arrive Kingsville 1725 | 9 Depart Kingsville 1426 | 10 Lake Erie | 11 Organic | 12 Floc | 13 Investigation | 14 Transit Welland Canal |
| | 15 Lake Ontario Organic Floc Inv | 16 Arrive CCIW 0956 | 17 Depart CCIW 0947 | 18 Lake Ontario | 19 Surveillance | 20 Arrive CCIW 2235 | 21 CCIW |
| | 22 CCIW | 23 Depart CCIW 1042 | 24 Arrive Pt. Colborne 0130 | 25 Lake Erie | 26 Metabolism | 27 Study | 28 Erieau 1805 - 1915 |
| SEP | 29 Lake Erie | 30 Metabolism | 31 Study | 1 Arrive Pt. Colborne 0730 | 2 Transit | 3 Transit | 4 CCIW |
| | 5 CCIW | 6 CCIW | 7 Depart CCIW 1111 | 8 Lake Ontario | 9 Surveillance | 10 Lake Ontario | 11 Arrive CCIW 0525 |
| | 12 CCIW | 13 Depart CCIW 1102 | 14 Lake Erie | 15 Organic | 16 Floc | 17 Investigation | 18 Arrive Sarnia 0610 |
| | 19 Depart Sarnia 0746 | 20 Moorings | 21 Current | 22 Meters | 23 North Channel | 24 Georgian Bay | 25 EBT Survey |
| | 26 EBT Survey | 27 Transit | 28 Transit | 29 Arrive CCIW 0105 | 30 CCIW | 1 CCIW | 2 CCIW |
| OCT | 3 CCIW | 4 Depart CCIW 0907 | 5 Lake Ontario | 6 Surveillance | 7 Lake Ontario | 8 Arrive CCIW 0056 | 9 CCIW |
| | 10 CCIW | 11 CCIW | 12 CCIW | 13 CCIW | 14 CCIW | 15 CCIW | 16 CCIW |
| | 17 CCIW | 18 Depart CCIW 0915 | 19 Lake Erie | 20 Meteorological | 21 Survey | 22 Arrive CCIW 1125 | 23 CCIW |
| | 24 CCIW | 25 CCIW | 26 CCIW | 27 CCIW | 28 CCIW | 29 CCIW | 30 CCIW |
| | 31 CCIW | 1 Depart CCIW 1008 | 2 Transit | 3 North Channel | 4 Moorings | 5 Georgian Bay | 6 Britt |
| NOV | 7 Georgian Bay | 8 Moorings | 9 Georgian Bay and Transit | 10 Transit | 11 Arrive CCIW 2318 | 12 CCIW | 13 CCIW |
| | 14 CCIW | 15 Depart CCIW 0931 | 16 Lake Ontario | 17 Surveillance | 18 Lake Ontario | 19 Arrive CCIW 1732 | 20 CCIW |
| | 21 CCIW | 22 Mooring Service 0829 - 2045 | 23 CCIW | 24 CCIW | 25 CCIW | 26 CCIW | 27 CCIW |
| | 28 CCIW | 29 Depart CCIW 0845 | 30 Pt. Colborne | 1 Port Colborne 0716 - 1635 | 2 Transit Welland Canal | 3 CCIW 0240 - 0935 | 4 Lake |
| DEC | 5 Ontario | 6 Surveillance | 7 Arrice CCIW 0621 | 8 Lake Ontario 1145 - 1515 | 9 CCIW | 10 CCIW | 11 CCIW |
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| | 26 | 27 | 28 | 29 | 30 | 31 | |

TABLE OF CONTENTS



(.....ii)

Page

# TECHNICAL OPERATIONS SECTION, 1976: OVERVIEW

The Technical Operations Section has the responsibility for the multidisciplinary field support to scientific projects conducted at Canada Centre for Inland Waters, Central, Western and Northern Regions. Field support and measurements are carried out from major and minor vessels and shore bases at a variety of sites, primarily in the Great Lakes Basin, but in other areas across Canada as well.

Support is provided to those projects and programs that are identified and approved by CCIW management. These not only include specific CCIW projects, but also projects from other Departments, Agencies, Directorates, Regions, Universities, and the private sector. It is the intention of the Section to provide, as requested, the expertise required to support all scientific field research undertaken by departmental and interservice groups from CCIW.

Personnel are assigned to the major vessels and large shorebased projects on a continuing basis in support of all surveillance, limnological, and research projects, as well as small craft involved with regional shore based parties, conducted in support of CCIW approved goals and objectives. Field operations are mainly undertaken by Technical Operations staff; where more specialized field analyses are required, the Technical Operations staff form the back-up group assisting the appropriate scientist performing the more specialized tasks.

In addition to the versatility required in all phases of sampling procedures, the section provides expertise through several committees: the Assignment of Vessels Committee in the planning of ship, launch, and support programs in the design of operational facilities aboard new vessels; the Surveillance Working Committee in providing field operational and logistical input into the planning and execution of the

Surveillance Program; and the CCIW Buoy Committee to provide field operational input to development of a Great Lakes data buoy system. The Technical Operations Section is responsible for insuring that the various programs and projects proposed by the scientific community and outside agencies are coordinated and logically arranged to suit the availability of research vessels and other resources.

The Technical Operations Section has developed a dive unit to respond to the special needs of research projects proposed by CCIW and other interservice groups to conduct underwater tasks. Expertise has been developed and responds to the need for offshore scientific tower erection, deployment of various underwater services, inspection and maintenance and other special underwater tasks and studies.

Similarly, the Technical Operations Section has the expertise to provide continuous meteorological and radiation data from the installation of the appropriate measuring systems to a final data summary. Technical Operations further provides installation, monitoring, and data listings from a variety of sensor instruments, including various electronic profiling temperature systems.

The Technical Operations Section has the responsibility of preparing preliminary description limnology reports based on individual surveillance cruises on the Great Lakes. These reports, although not very detailed in format, provide a cursory summary of shipboard measured lake parameters and are complementary to the responsibilities of the Water Quality Branch, Ontario Region, IWD.

## STAFF LIST - TECHNICAL OPERATIONS SECTION

| | | |
|---|---|---|
| H.B. Macdonald | - | Head |
| Mrs. A. Stern | - | Secretary |
| D.H. Hanington | - | Senior Operations Officer, Shore Unit |
| W.B. Taylor | - | A/Operations Officer, Ship Unit |
| J.T. Roe | - | Senior Diving Officer |

| | | |
|---|---|---|
| L.E. Benner | - | Shore Unit - Kootenay Lake Project, Pacific Region |
| T.J. Carew | - | Ship Unit - WAVES '76 and REX |
| R.G. Chapil | - | Shore Unit - Instrument Systems and Data |
| J.R. Compton-Smith | - | Shore Unit - Georgian Bay Physical Studies |
| F.J. de Vree | - | Dive Unit |
| F.H. Don | - | Dive Unit |
| H.E. Greencorn | - | Rigging Shop |
| P.M. Healey | - | Ship Unit - Surveillance |
| B.L. Killins | - | Ship Unit - Surveillance |
| G.J. Koteles | - | Shore Unit - Waste Heat Studies, GLBL |
| L.J. Lomas | - | Rigging Shop, Foreman |
| M.R. Mawhinney | - | Shore Unit - National Lakes Survey |
| B.H. Moore | - | Ship Unit - Limnos |
| H.K. Nickolson | - | Shore Unit - Microbiological Studies and Others |
| G.M. Perigo | - | Rigging Shop |
| S.B. Smith | - | Ship Unit - Limnos |
| M.R. Thompson | - | Shore Unit - Erosion Studies, HRD |
| E.H. Walker | - | Shore Unit - Persistent Contaminants, GLBL |
| P.R. Youakim | - | Shore Unit - Lake St. George studies |

### Term employees

| | | |
|---|---|---|
| G.D. Bruce | - | Surveillance, on strength April - November |
| J. Ellard | - | Lake St. George, on strength June - August |
| V.I. Golini | - | Surveillance, on strength June - November |
| D.F. Moore | - | Surveillance, on strength April - December |
| J. Scott | - | Lake St. George, on strength May - November |

### Contract employees

| | | |
|---|---|---|
| E. Cameron | - | Surveillance, on strength May - August |
| G. Laing | - | Paleoenvironmental Studies, on strength May - July |
| G. Logan | - | Paleoenvironmental Studies, on strength May - July |
| W. Mason | - | Erosion Studies, on strength May - August |

## SHORE UNIT

Administratively, the Technical Operations is divided into three units: the Shore Unit, the Ship Unit and the Dive Unit. The Shore Unit was responsible for those projects identified specifically as shore and/or launch based, involving general operational multidisciplinary support. Also included in the Shore Unit was the responsibility of coordinating, deploying and monitoring of the various electronic instrument systems.

In addition, the rigging shop and the coordination of Technical Operations vehicles were included within the responsibilities of the Shore Unit.

There were approximately 50 individual projects supported by personnel from the Shore Unit. They varied from locations as far west as Kootenay Lake, B.C., to the eastern end of Lake Ontario, and such agencies as the Pacific and Yukon Region of CCIW, the Ontario Ministry of the Environment, and the University of California. In complexity, they varied from year round projects involving multidisciplinary studies and various scientists, to as little as simple water collection from one nearshore area.

Technical Operations personnel were selected to support the various shore projects, some as required, on a continuous basis. These people acted as liaison between the scientist and various support sections and agencies within CCIW, coordinated and expedited the projects by: planning the necessary logistics; arranging transportation and accomodation of equipment and personnel; conducting the sampling program; installing, monitoring and recovering various field instrument systems; correcting and compiling the collected data; assisting the scientists in special analytical tasks; and reporting by both monthly and final field reports.

In the performance of this support, very close liaison was maintained between the Technical Operations Section; Engineering Services Section; and Ocean and Aquatic Sciences, Ship Division. A more comprehensive description of the various projects supported by the Shore Unit, Technical Operations Section, follows in this summary.

## RIGGING SHOP

The resources of the Technical Operations Section to support the various scientific projects include a rigging shop, an enclosed working area, indoor and outdoor storage areas, a 10 ton crane truck, a 3 ton truck, and a fork lift truck. These facilities are maintained and operated by the rigging foreman and a staff of two riggers.

Considerable support is provided to both Ship Unit and Shore Unit projects by maintaining a stock of specific mooring and marine hardware, rope, wire, various generators, and assorted tools which are drawn from the rigging shop stores as required. Similarly, maintenance and repair of buoys, generators and other equipment is effected. In order to accomplish these tasks, the enclosed working area includes space for fiberglassing and some machining and mechanical work.

Expertise is also provided in the design, assembly and erection of towers for marine application. The trucks are used for the transportation of heavy equipment to various locations in the Great Lakes Basin in support of both the ships and shore projects. Scheduled vehicle repair and maintenance of all Technical Operation vehicles is carried out through the rigging shop, as well as the maintenance of the Technical Operations trailers.

In addition to the above support which the riggers provide directly to the Technical Operations Section, support has been provided to: Ocean and Aquatic Sciences in transporting equipment to and from Halifax; transporting positioning systems to Lake Superior; the Lands

Directorate in transporting equipment to and from Cochrane; universities by assembling and anchoring special purpose barges in Hamilton Harbour; and other support to Divisions within CCIW.

TECHNICAL OPERATIONS VEHICLES

| | | | |
|---|---|---|---|
| 70-236 | Crane Truck | - | Rigging Shop |
| 73-187 | Ford Van | - | Dive Unit |
| 73-254 | 3 Ton Truck | - | Rigging Shop |
| 73-47 | Dodge Van | - | Shore Unit - Lake St. George |
| 74-434 | 1 Ton Truck | - | Shore Unit - Waste Heat Project |
| 75-176 | Chev Van | - | Shore Unit - Physical Studies |
| 76-13 | Station Wagon | - | CCIW - Various Projects |
| 76-14 | Crew Cab | - | Shore Unit - Various Projects |
| Fork Lift Truck | | - | Rigging Shop |

| | | | | | |
|---|---|---|---|---|---|
| 1968 | Glendale | 10 x 23 | Office | - | CCIW Slip |
| 1969 | Pyramid | 8 x 30 | Accomodation | - | Lake St. George |
| 1972 | Pyramid | 10 x 30 | Laboratory | - | Lake St. George |
| 1972 | Pyramid | 10 x 30 | Laboratory | - | Lake St. George |
| 1973 | Atco | 10 x 38 | Laboratory | - | Hamilton Beach |
| 1974 | Glendale | 10 x 38 | Laboratory | - | Sault Ste. Marie |

## DIVE UNIT

In 1976, the Dive Unit was able to provide support for fourteen scientific field projects and four Operations-Engineering projects. The support provided covered major contribution to engineering design, project coordination, equipment and instrument installation and service evaluation inspection and recovery.

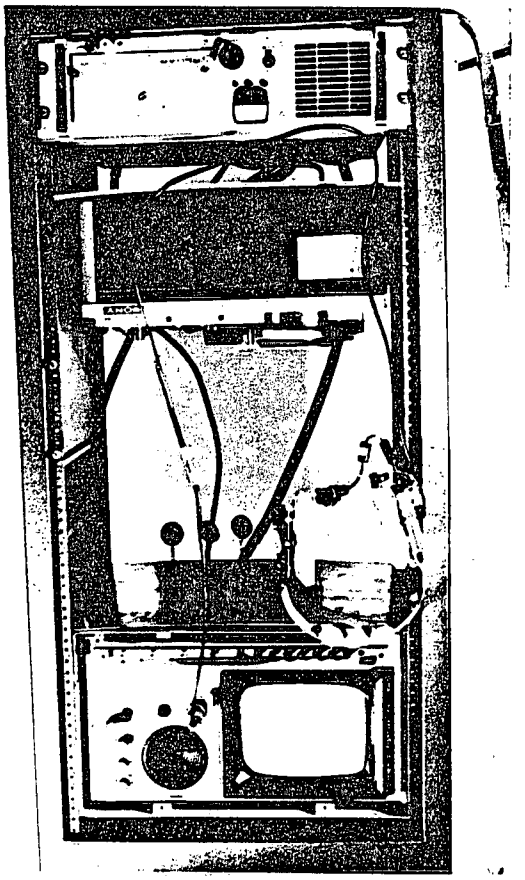
The Unit logged eight hundred and fifty underwater hours in support of these projects, in addition to the surface and operation support provided. The Dive Unit also provided sixty-two man-days of support to agencies outside CCIW.

The MV LAC ERIE was used in support of all diving operations in the Great Lakes area. A twenty-one foot Monark-type boat was towed by the dive van to support contingency diving, and diving in inland lakes. The "Monark" was also used in support of the MV LAS ERIE on some projects.

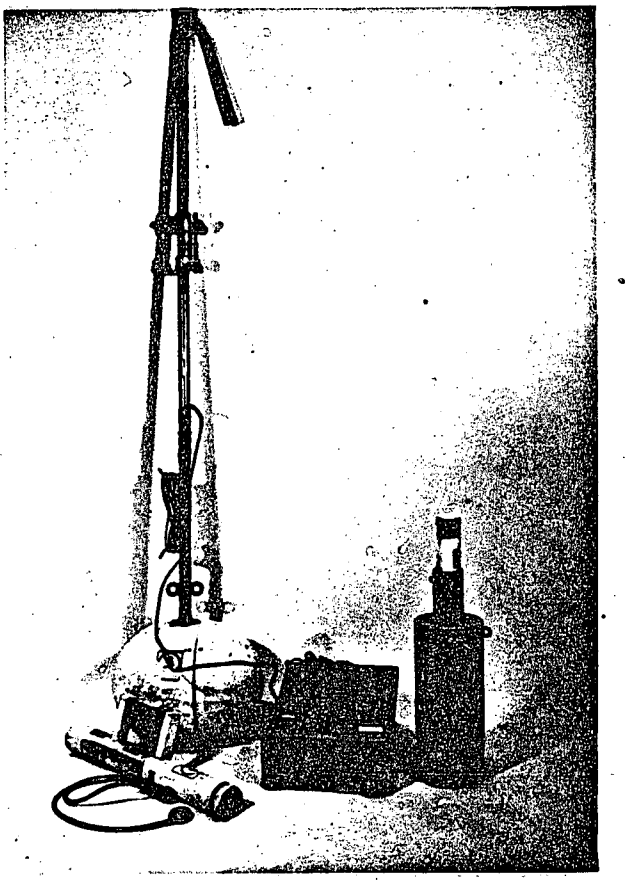
The Dive Unit for 1976 consisted of the Senior Diving Officer and two divers. An additional diver and back-up diver were permanently assigned to a field project involving extensive diving maintenance on a continuing basis.

The Dive Unit conducted a CCIW Dive Course in January and February, 1976, and five new divers were certified. These divers were not available to the Dive Unit during 1976, although they were able to provide some support to the Fisheries and Marine Service for whom they worked.

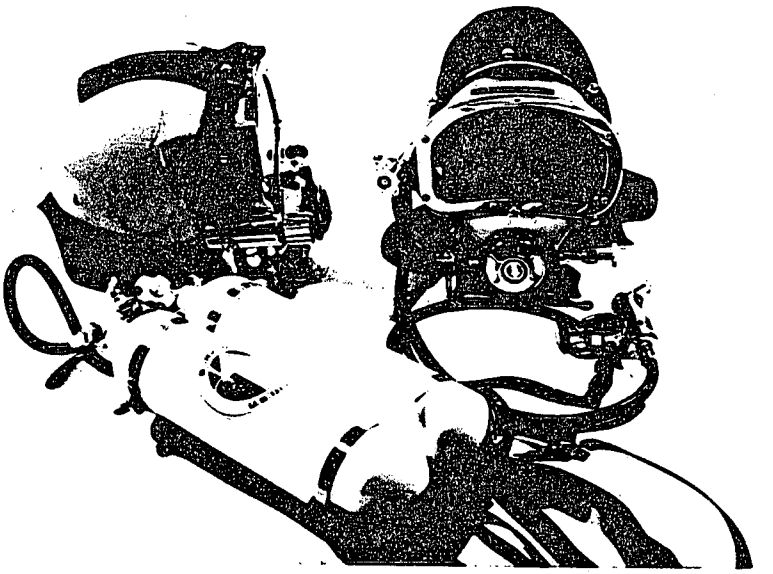
The following pages are a photographic summary of some of the Dive Unit's work in 1976.



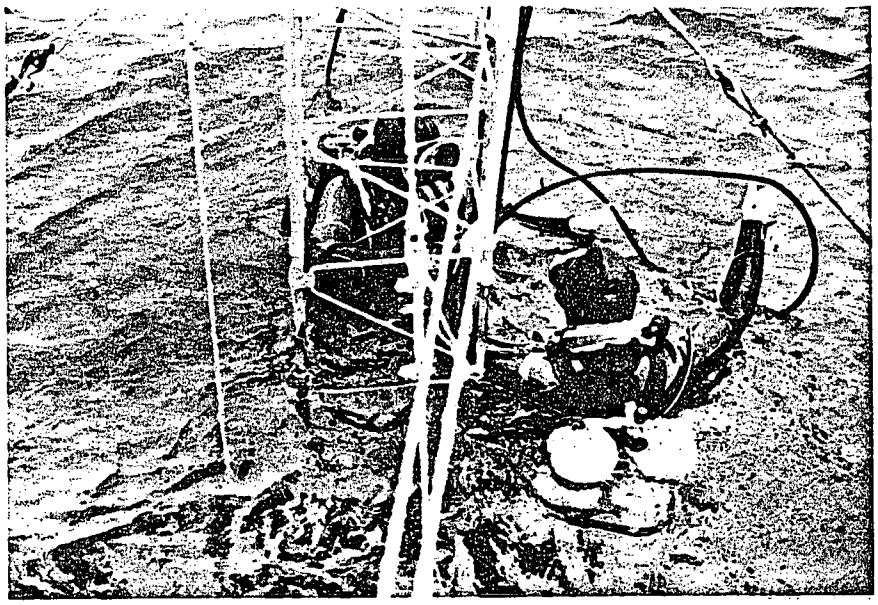
Surface Control Panel
For U/W Television System



U/W Acoustic Locating
Equipment (Pinger)



KBM-8 and Emergency Bail Out Tanks
DIVING EQUIPMENT & HARDWARE



Millard Tower Installation - Glenora

WAVES Tower Inspection

Installation of Current Meters At The WAVES Tower

## SPECIAL PROJECTS

Many diverse projects are supported and coordinated by the Special Projects Officer, Technical Operations Section. Instrumentation, project liaison, and full time field duties are involved.

In addition, the scheduling was done for field use, maintenance and logistics of the various instrument systems ( Meteorological, Radiation, Temperature Recording Systems, Fixed Temperature Profilers, CATSS, Rain Gauges and Geological Sediment Sampling Equipment).

### METEOROLOGICAL SYSTEMS

Ten meteorological buoys or tower systems (Figure 1) were maintained which produced about 66 months of meteorological data (Figure 2).

Two meteorological buoys were installed on Kootenay Lake, Project 76-IW-AR-100, in addition to refurbishing the meteorological systems at Pickering, Project 6-IW-AR-056, Lake Ontario, Project 76-IW-HR-038, and Lake St. George, Project 76-IW-PR-024, throughout the research collection period.

## Tipping Bucket Rain Gauge System

Three projects were supported in the collection of precipitation on land or from the vessel MV PETREL V.

One electric tipping bucket rain gauge was installed at CCIW (Figure 3) in support of Projects 6-IW-AR-067 and 6-IW-PR-038. The rain samples were in support of Mr. F. C. Elder and Mr. W. Schertzer's program (BIMS, ARD), in conjunction with PCB loading from atmospheric sources.

A mast mounted rain collector (Figure 4) was installed on the research vessel MV PETREL V to collect rainfall on Hudson Bay for the R & D Division, Ocean and Aquatic Sciences, and Dr. J. R. Kramer of McMaster University.

The third station was installed at the Pickering nuclear reactor site.

Temperature System

A portable YSI temperature system (Figure 5) was used at CCIW to measure the variance in water temperature in the canal near CCIW for use with the building's air-conditioning.

Radiation Systems

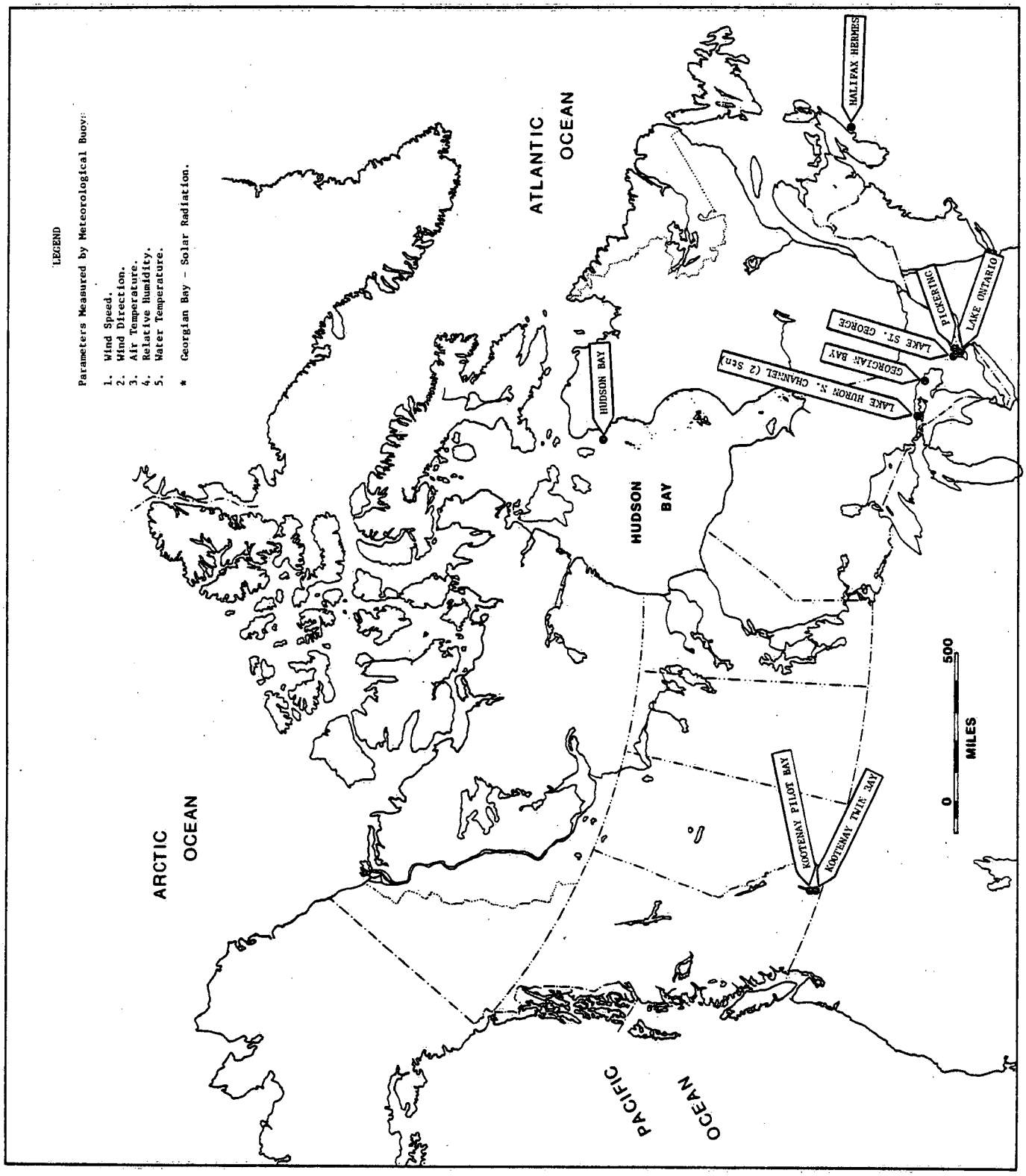
A total of seventeen radiation stations were maintained throughout Canada (Figure 6), with about 138 months of data collected (Figure 7).

Thirteen solar radiation, two Net (total), one reflected and one Incident Radiometer were used in support of programs from CCIW and Regional Detachments.

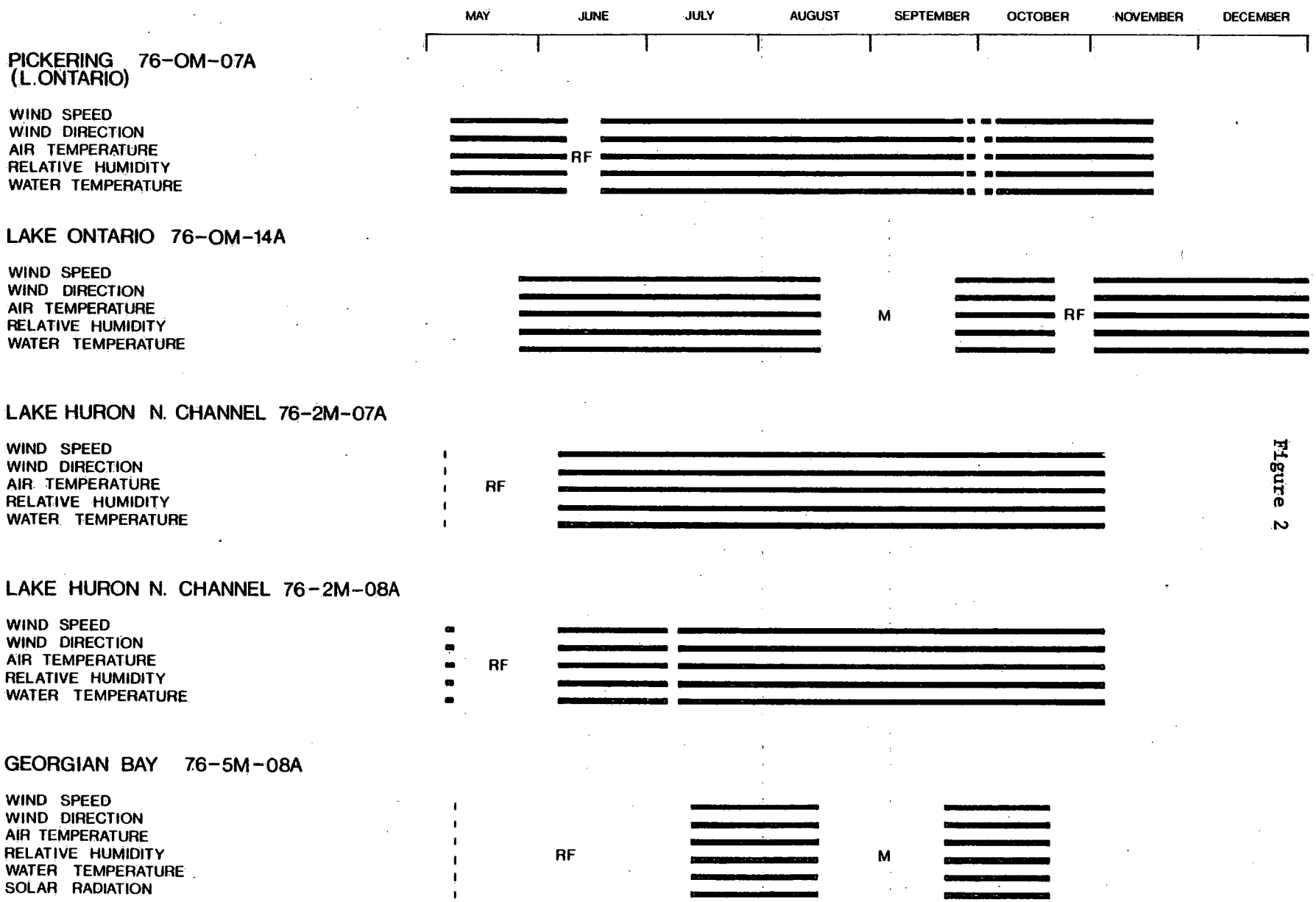
A special Radiation Study was implemented over Lake Erie to measure the albedo over an ice covered lake from a Cherokee aircraft (Figures 8 & 9). This study was undertaken by the Water Planning and Management Branch in support of the International Niagara Working Committee and the Niagara River Ice Boom Study.

An incident Radiometer (Figure 10) was developed for use at Lake St. George to measure the light penetration to depths of one metre. Continuous underwater measurements were taken from June to December, 1976. Intensive measurements were made through the ice (Figure 11) with both clear ice and snow covered conditions.

Figure 1


1976 METEOROLOGICAL BUOY STATIONS
LEGEND
Parameters Measured by Meteorological Buoys:
1. Wind Speed.
2. Wind Direction.
3. Air Temperature.
4. Relative Humidity.
5. Water Temperature.
* Georgian Bay - Solar Radiation.
ARCTIC OCEAN
ATLANTIC OCEAN
PACIFIC OCEAN
HUDSON BAY
HUDSON BAY
HALIFAX HERMES
LAKE ONTARIO
PICKERING
LAKE ST. GEORGE
GEORGIAN BAY
LAKE HURON N. CHANNEL (2 Stn)
KOOTENAY PILOT BAY
KOOTENAY TWIN BAY
0
500
MILES

# METEOROLOGICAL BUOY DATA 1976

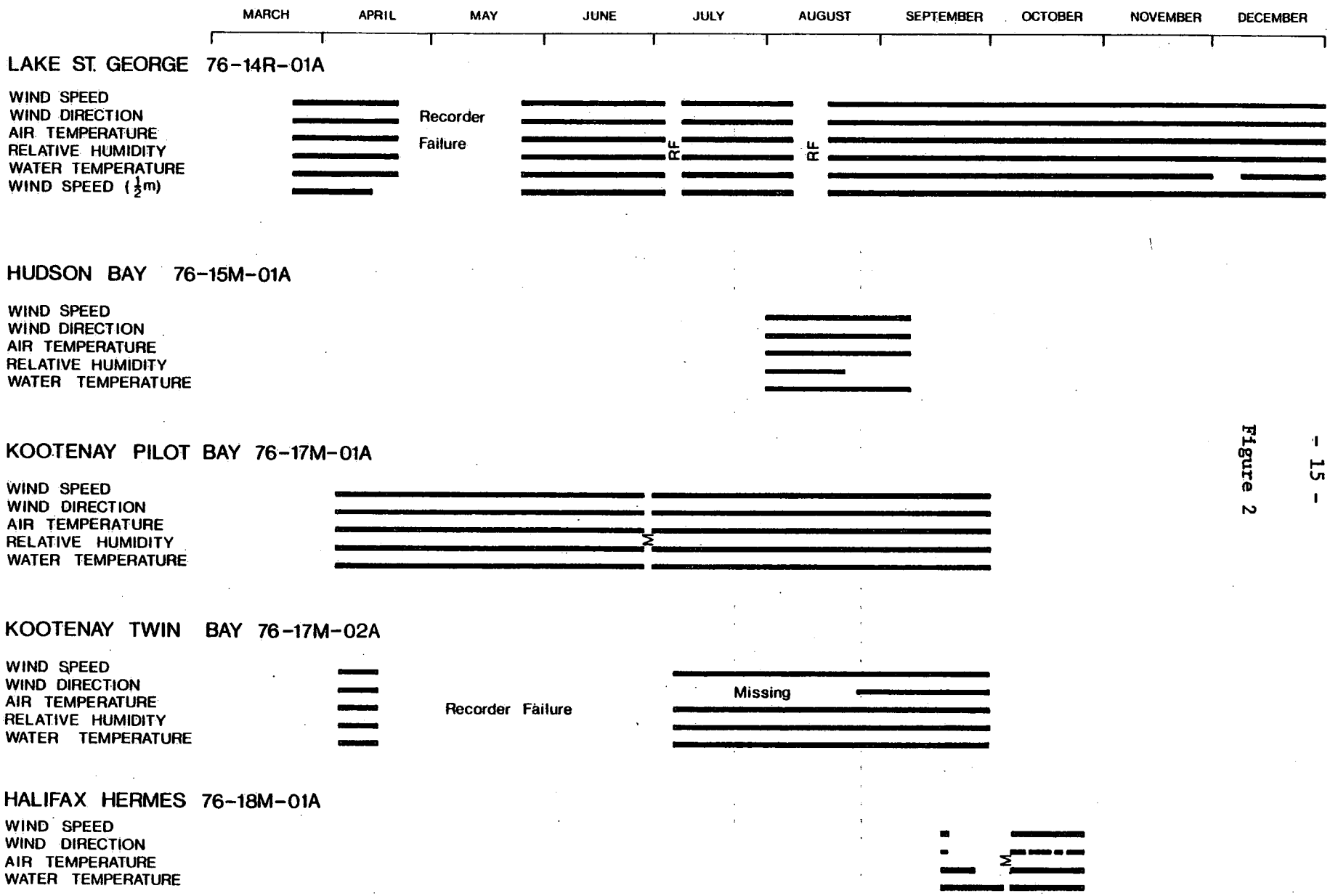



RF- RECORDER FAILURE

M- MISSING

Figure 2

# METEOROLOGICAL BUOY DATA 1976




RF - RECORDER FAILURE

M - MISSING

Figure 2

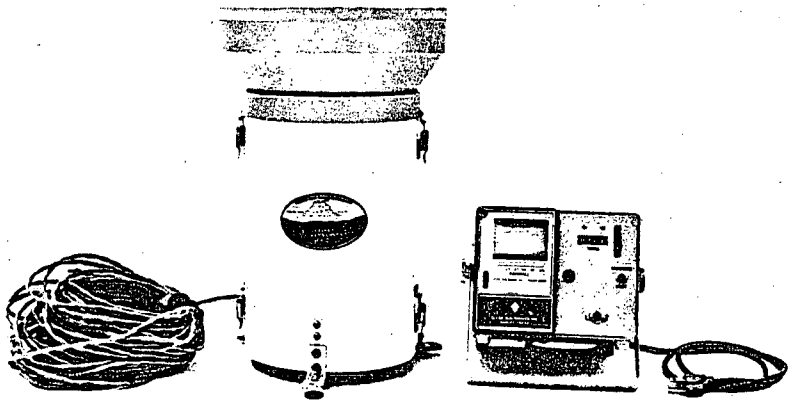


Figure 3

Electric Tipping Bucket Rain Gauge

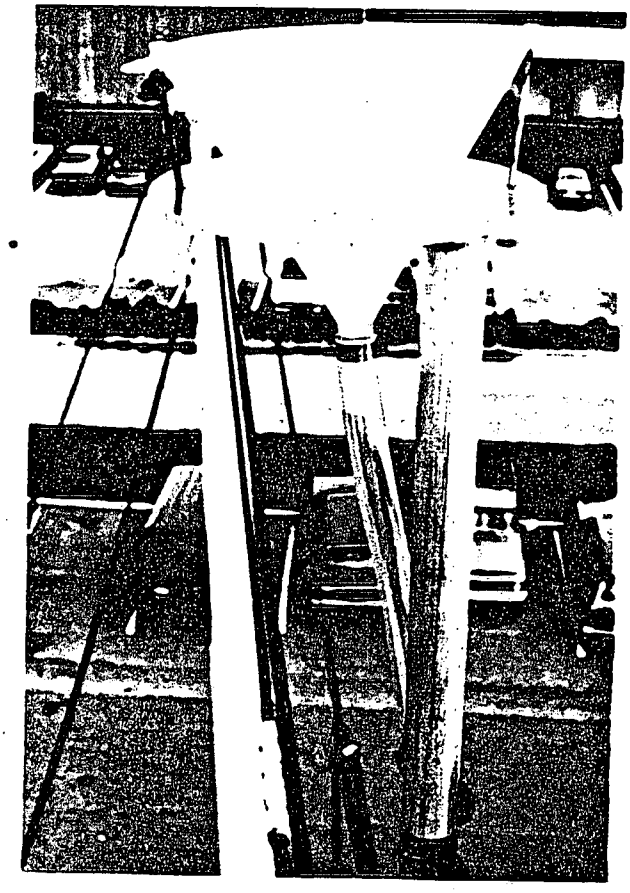
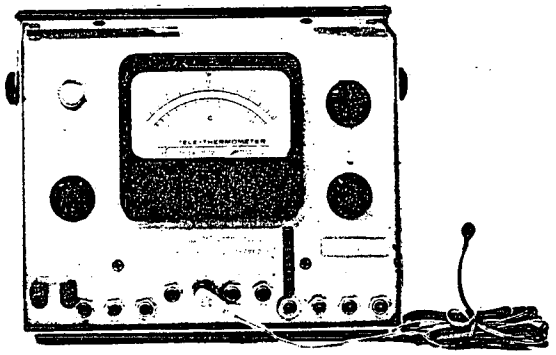


Figure 4

Mast Mounted Rain Collector



YSI Scanning Tele-thermometer

Figure 6

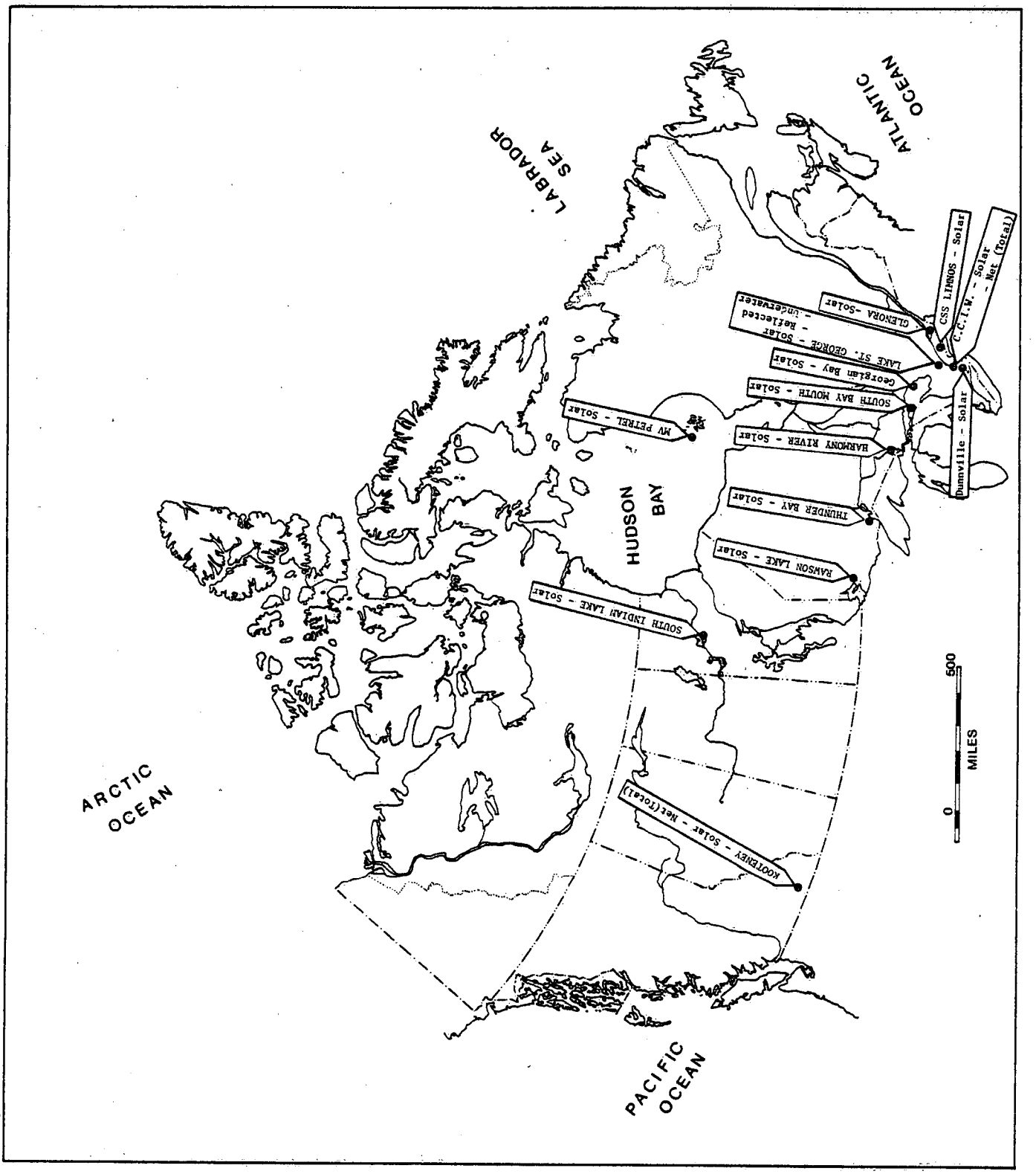
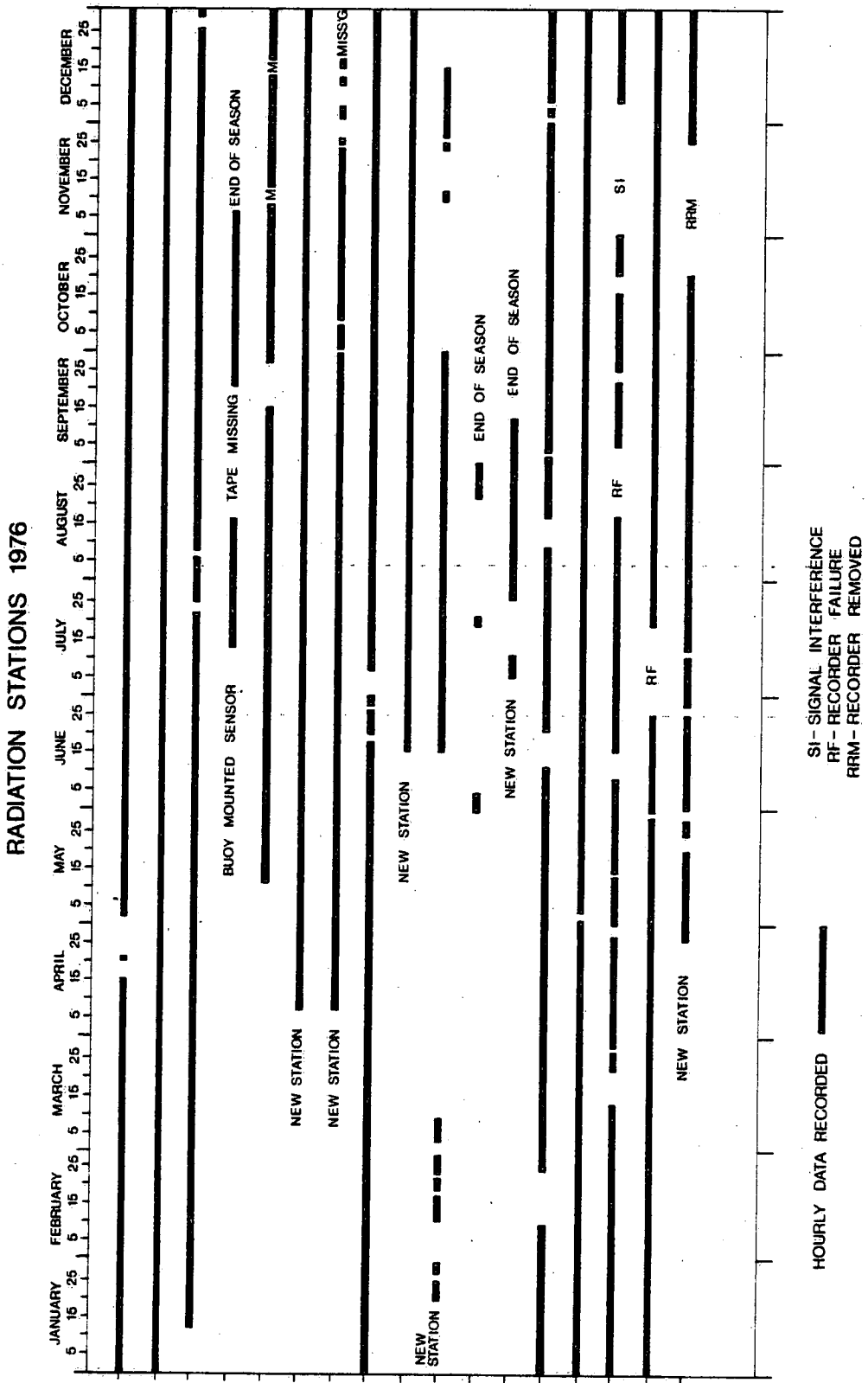
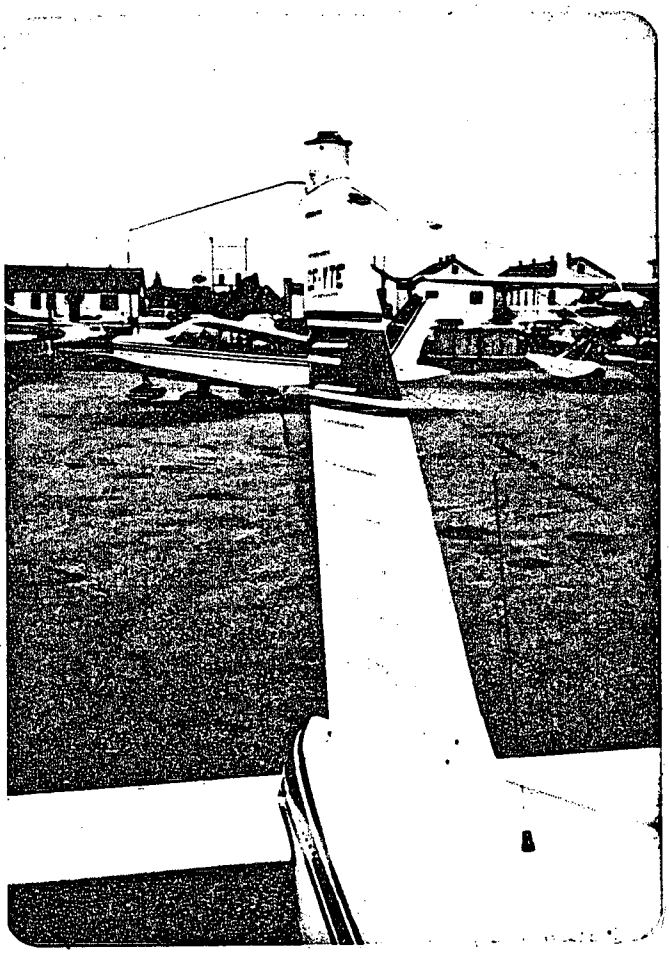

RADIATION STATIONS 1976
LABRADOR SEA
ATLANTIC OCEAN
HUDSON BAY
ARCTIC OCEAN
PACIFIC OCEAN
CSS LIMNOS - Solar
C.C.I.W. - Solar - Net (Total)
GLENORA - Solar
LAKE ST. GEORGE - Solar - Reflected - Underwater
Georgian Bay - Solar
SOUTH BAY MOUTH - Solar
MV PETREL - Solar
HARMONY RIVER - Solar
Dunnville - Solar
THUNDER BAY - Solar
RAWSON LAKE - Solar
SOUTH INDIAN LAKE - Solar
KOOTENEY - Solar - Net (Total)
500
0
MILES

Figure 7


RADIATION STATIONS 1976
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
CCIW SOLAR
CCIW NET (TOTAL)
DUNNVILLE SOLAR
GEORGIAN BAY SOLAR
HARMONY RIVER SOLAR
KOOTENAY SOLAR
KOOTENAY NET (TOTAL)
LAKE ST. GEORGE SOLAR
REFLECTED
UNDERWATER
CSS LIMNOS SOLAR
PETREL SOLAR
RAWSON LAKE SOLAR
SOUTH BAYMOUTH SOLAR
SOUTH INDIAN LAKE SOLAR
THUNDERBAY SOLAR
GLENORA SOLAR
NEW STATION
BUOY MOUNTED SENSOR
TAPE MISSING
END OF SEASON
RF
SI
RRM
HOURLY DATA RECORDED
SI - SIGNAL INTERFERENCE
RF - RECORDER FAILURE
RRM - RECORDER REMOVED



Solarimeter

Figure 8

(on top of tail-piece)

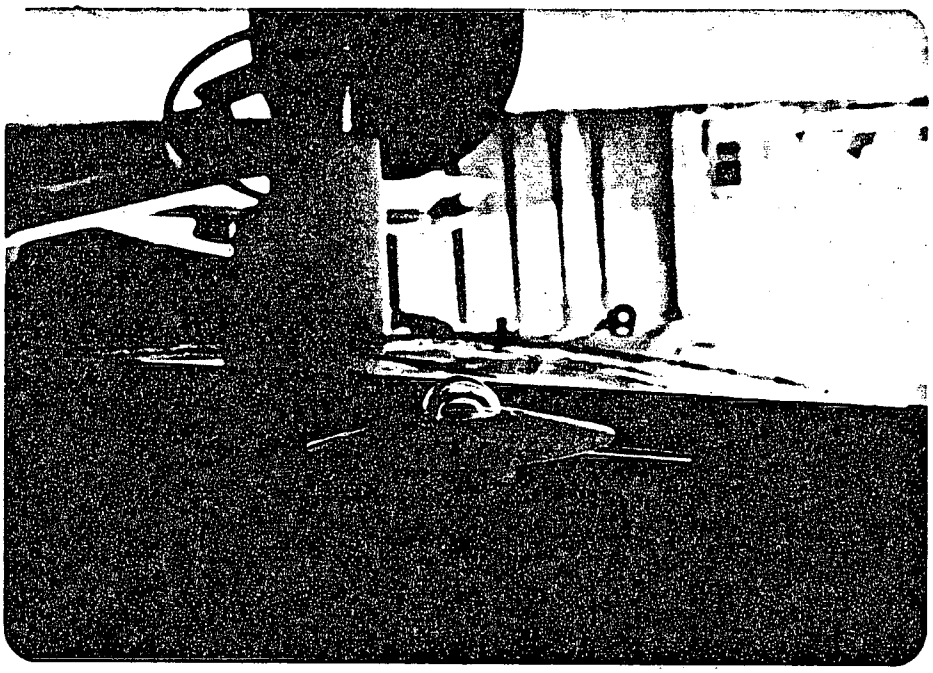


Figure 9

Solarimeter on undercarriage

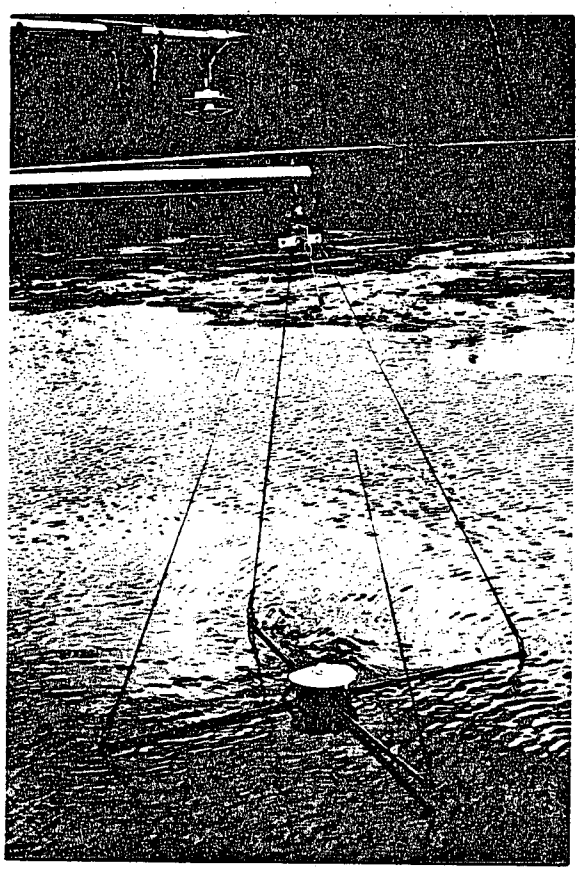


Figure 10
Incident Radiometer
Lake St. George

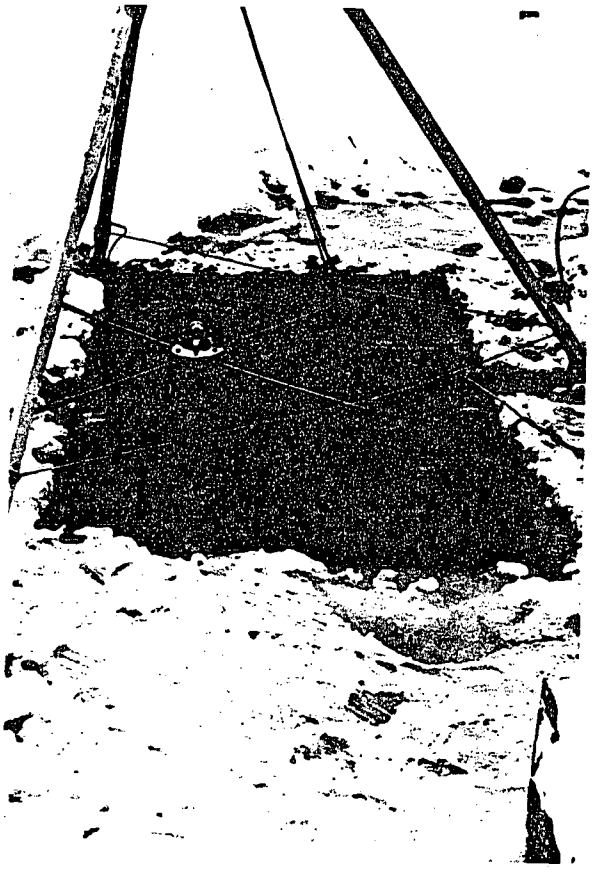


Figure 11
Incident Radiometer
Lake St. George
winter operations

## CORING AND SEDIMENT

With the increase of scientific research being done in small lakes or nearshore studies on the Great Lakes, more emphasis was placed on the use of smaller sediment dredges.

The three most popular pieces of equipment were the Mini-Shipek (Figure 1), Mini-Ponar (Figure 2), and the Ekman Dredge (Figure 3). The demand for this equipment exceeded the inventory of Technical Operations and on numerous occasions we were required to borrow the above equipment from other Divisions at CCIW.

The Impact Corer (Figure 4) was modified to obtain favourable cores in till and light sediments. Experimental work will be continued in Lake Huron during 1977, in developing an Impact Corer which will be capable of obtaining cores in fine sand.

CCIW experimental Lightweight Corer (Figure 5) was used extensively by Technical Operations staff, in Ontario and Manitoba. The results of these samples are obtainable from Dr. J. D. H. Williams (Geology Section, PRD).

The future predicts greater use of the CCIW Lightweight Corer, and grab samplers for winter through-ice coring in Manitoba, Saskatchewan and Northern Ontario. The long range forecast may see additional sampling in the Hudson Bay area, plus studies in the Arctic.

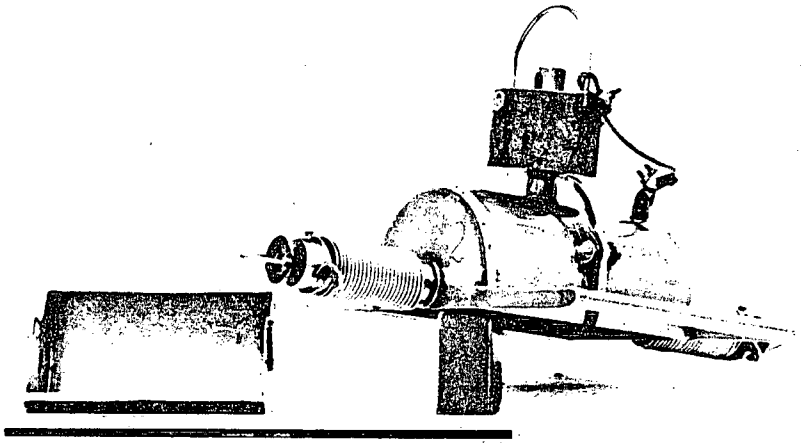


Figure 1

Mini-Shipek

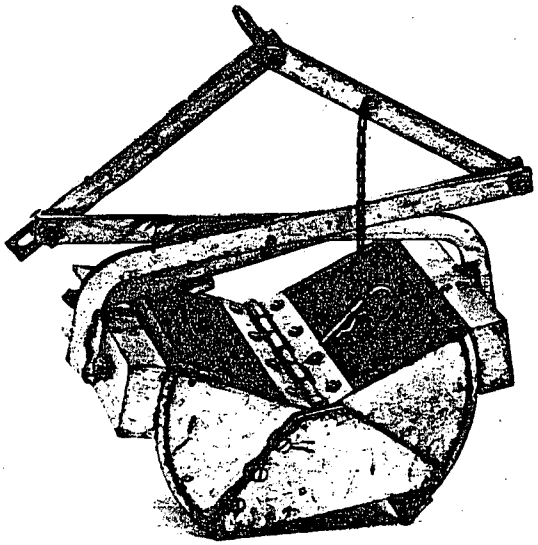


Figure 2

Mini-Ponar

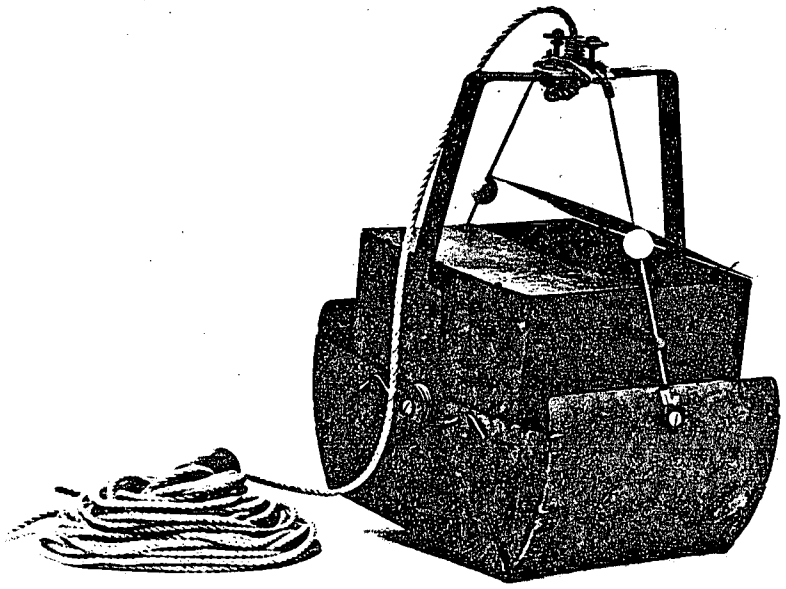


Figure 3

Ekman Dredge

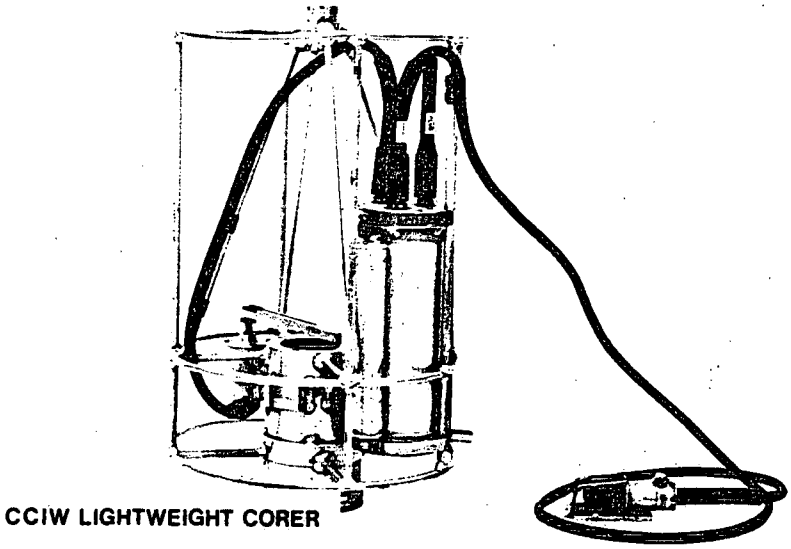



Figure 5

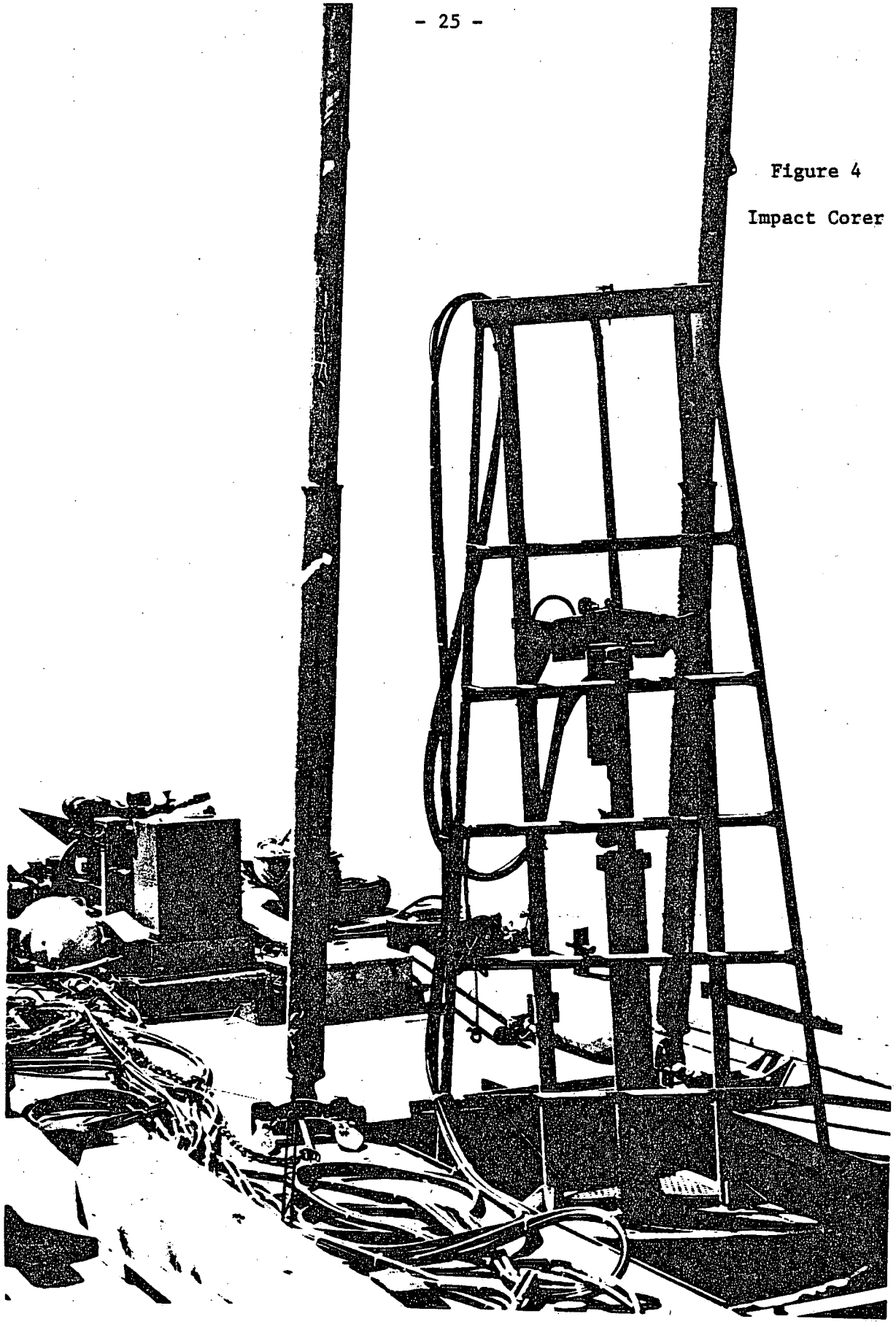


Figure 4

Impact Corer

## MAJOR SHIP OPERATIONS

During the 1976 field season on the Great Lakes, the CSS LIMNOS completed thirteen major ship cruises in addition to the Surveillance Program. Beginning in early May, instrument moorings were placed in Georgian Bay and the North Channel of Lake Huron. These moorings were refurbished twice (July & September) and retrieved in early November. The cruises were generally of a 2-week duration and included EBT surveys.

In support of input required for PLUARG, IJC, under Project 6-IW-PR-010, a St. Lawrence River cruise, May 17 - 28, 1976, was conducted to obtain water and bottom samples between Kingston and Point-au-Pic. This inter-agency study involved CCIW, Centreau Laval University (Quebec City, P.Q.) and the Bedford Institute of Oceanography (Dartmouth, N.S.).

Two Lake Metabolism Studies were conducted in Lake Erie May 31 - June 4, and August 23 - September 1, 1976, under the direction of Dr. D.R.S. Lean (Nutrient Dynamics Section, PRD) in support of Project 6-IW-PR-024, to determine the relationship of primary production and total carbon balance.

Two cruises were conducted in Lake Erie August 9 - 16, and September 13 - 18, 1976, under the direction of Dr. N.M. Burns (Nutrient Dynamics Section, PRD). The object was to carry out preliminary investigations of the physical and chemical nature of the organic floc lying on the sediment water interface in Lake Erie, Project 6-IW-PR-003.

A Nearshore Sediment Survey was conducted August 1 - 8, 1976, on Lake Huron in support of Project 6-IW-HR-035. The surficial geology of the nearshore zone of southern Lake Huron was mapped. In addition, a number of stations were occupied for bottom sampling and underwater photography.

A Meteorological Survey was conducted on Lake Erie October 18 - 22, 1976. A number of staff from the Atmospheric Environment Service (Toronto) were aboard the CSS LIMNOS to monitor and review existing meteorological facilities on Lake Erie as input to the planning of future forecasting and observing services on the Great Lakes by AES. The cruise also familiarized AES personnel involved with marine meteorology with the various weather parameters affecting vessel operations.

Proposed new MARS II sites at Port Stanley and Erieau were investigated for seaward exposure.

## DATA TASK FORCE

In September, 1976, the Technical Operations Data Task Force was formed to process, over the winter months, the large quantity of data collected by instrument systems installed and maintained by Technical Operations personnel throughout the field season. Eight staff were assigned to the Data Task Force, each with data responsibilities for specific instrument systems. In addition, each with data responsibilities for specific instrument systems. In addition, a member of the Data Management Section as well as a scientific representative were in attendance at meetings to assist and advise in establishing policy and priority. By April, 1978, the Data Task Force will have processed over 3,300,000 field collected data measurements.

## PROJECT 6-IW-AR-006

## MICROBIOLOGICAL POINT SOURCE EFFLUENT STUDY

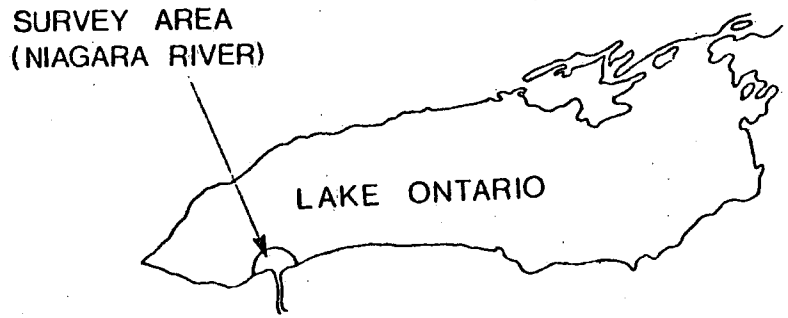
This program is a continuation of Project 5-IW-AR-071.

The purpose of this current investigation was to extend the "Zonal Grid" sampling concept (See Following Diagrams) to a bacteriological study of the effluent plume associated with the discharge of Niagara River Water into Lake Ontario and also the effect of thermal heat discharge at Nanticoke, on bacteriological conditions in Lake Erie.

On each of the four cruises at Niagara, weather permitting, five sampling days were completed. During each sampling day seventeen stations were occupied and at all stations: an electronic bathythermograph trace and bucket temperature were taken, at depths of one metre and one metre off the bottom or ten metres whichever was less, and one litre Microbiology sample, one litre Water Quality sample and a dissolved oxygen sample were collected. The Microbiology samples were placed in coolers with ice and with the Water Quality sample were returned to CCIW for analysis the following day. The dissolved oxygen samples were pickled and analysed at CCIW by Technical Operations personnel using the Winkler Method.

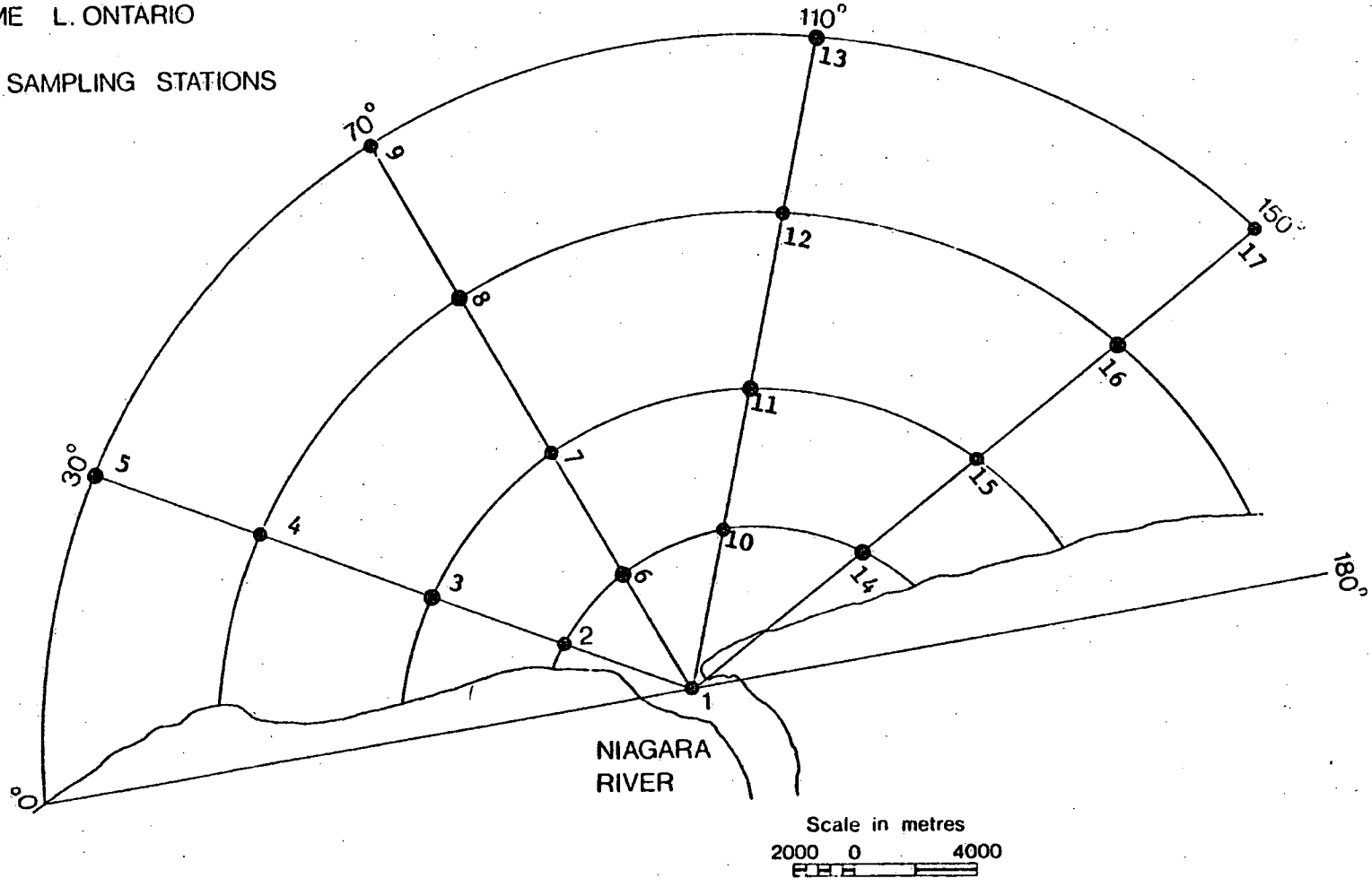
On both cruises at Nanticoke, similar sampling methods were used except no dissolved oxygen samples were required.

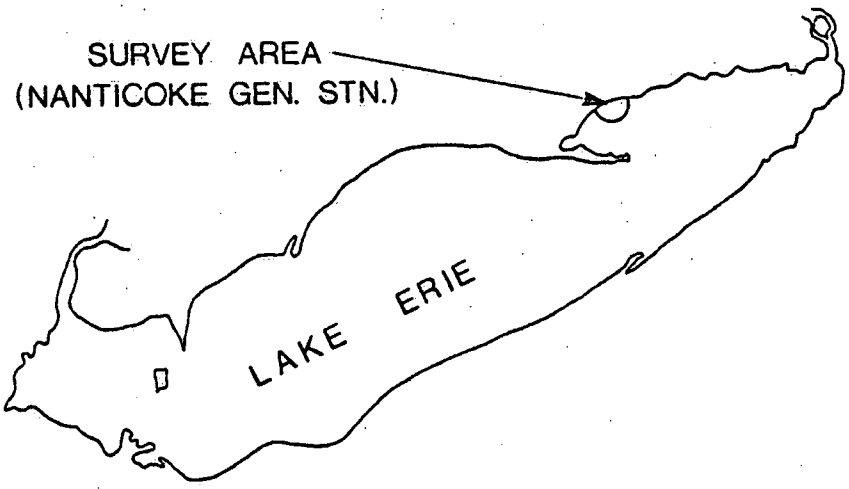
These surveys were timed to coincide with the open lake surveillance cruises, in order to compare the Point Source values with the open lake. The results at Niagara obtained over two years have been published in, "The Delineation of a Point Source Plume by the Study of Bacterial Populations", by Dr. S.S. Rao and Dr. R.P. Bukata.




POINT SOURCE MICROBIOLOGICAL STUDY – 1975 & 1976
NIAGARA R. PLUME L. ONTARIO

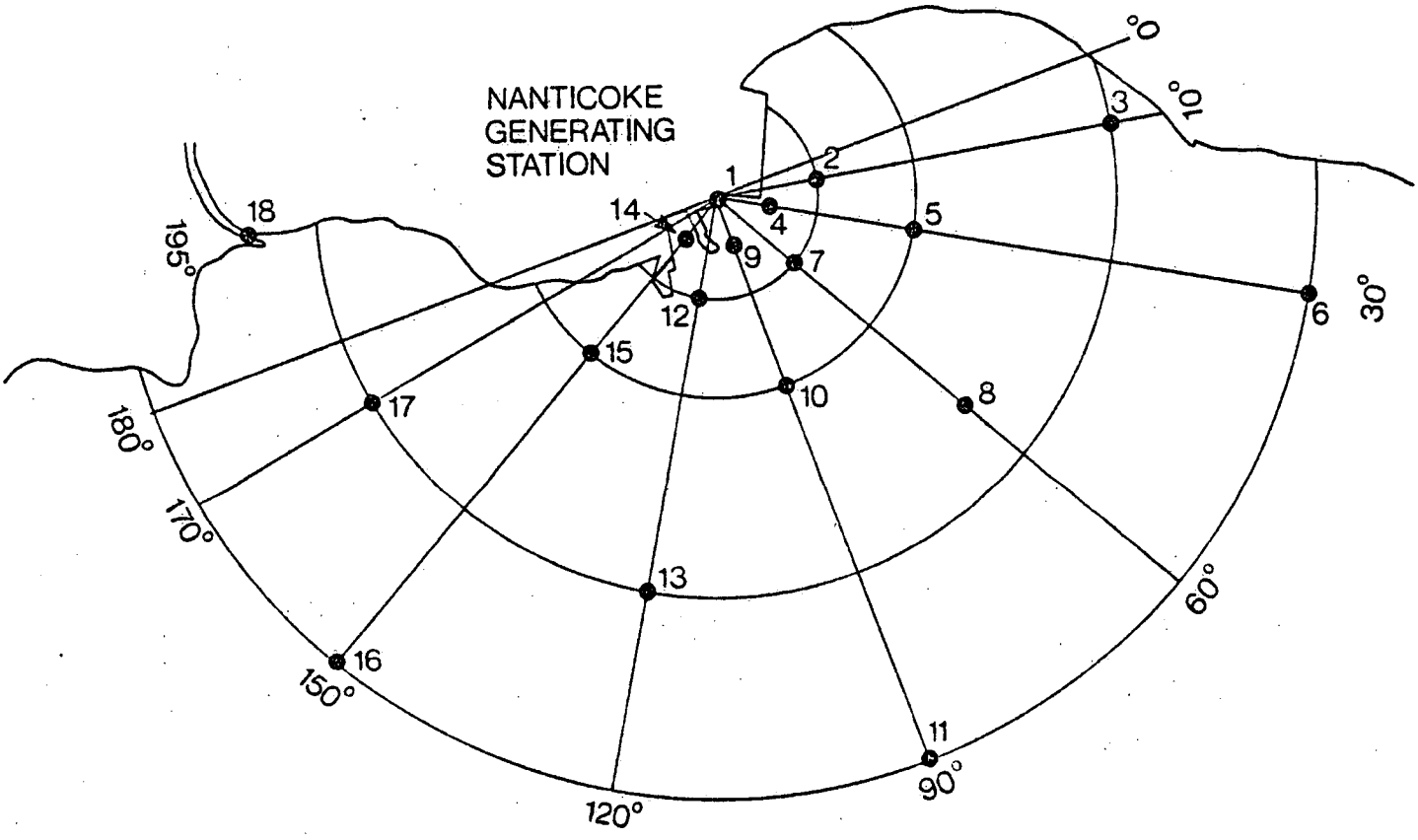
● LOCATION OF SAMPLING STATIONS



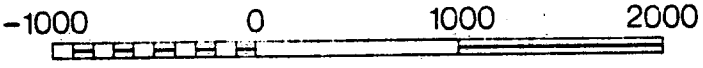



POINT SOURCE MICROBIOLOGICAL STUDY – 1975 & 1976
NANTICOKE – LAKE ERIE

● LOCATION OF SAMPLING STATIONS




scale in metres



The CSL LEMOYNE was used as the survey launch throughout the survey. Its use was coordinated and the vessel was manned by Technical Operations personnel for this project.

## PROJECT 6-IW-AR-056

## TRITIUM TRANSFER FROM NUCLEAR POWER STATION PICKERING

Lake Ontario, Pickering area was used as a study of pathways of radionuclides released by nuclear generating stations through the aquatic environment.

Technical Operations supplied and maintained six Geodyne toridal buoys (Figure 1) specially equipped for collecting precipitation samples at selected locations within 3 miles of the Pickering nuclear generating station.

One of the above buoys (Figure 2) was equipped with meteorological sensors which measured wind speed and direction, air temperature, relative humidity and water temperature in addition to a rain sampler.

To establish time correlation and intensity of specific rain storms, a shore-based tipping bucket raingauge and recorder (Figures 3, 4) were installed.

Servicing and refurbishment of the equipment was done from CCIW by Technical Operations and Analytical Methods Research Section staff, on a 2 week schedule from May 6 to November 18.

Data processing of the meteorological parameters was done by Technical Operations, while water analysis for tritium was processed by the Analytical Methods Research Section.

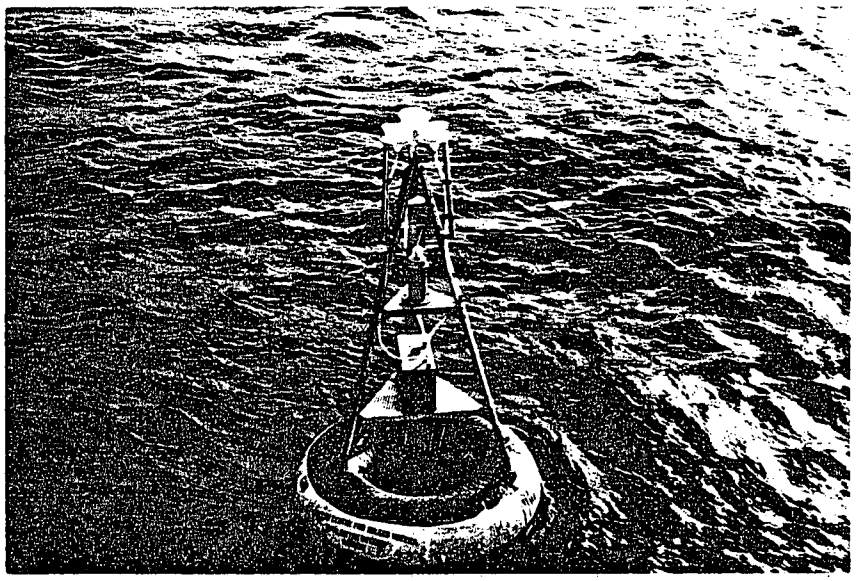


Figure 1
Geodyne Toridal Buoy

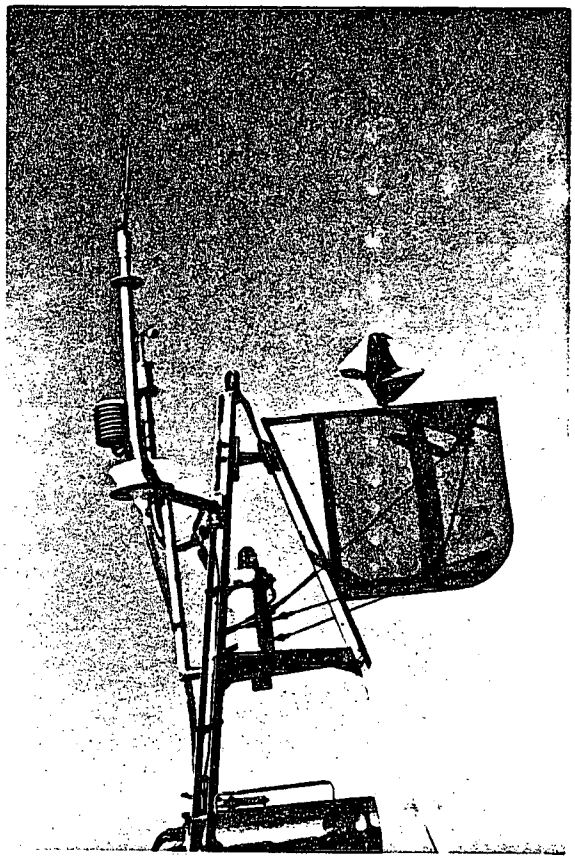


Figure 2
Meteorological Sensors
on Geodyne Buoy

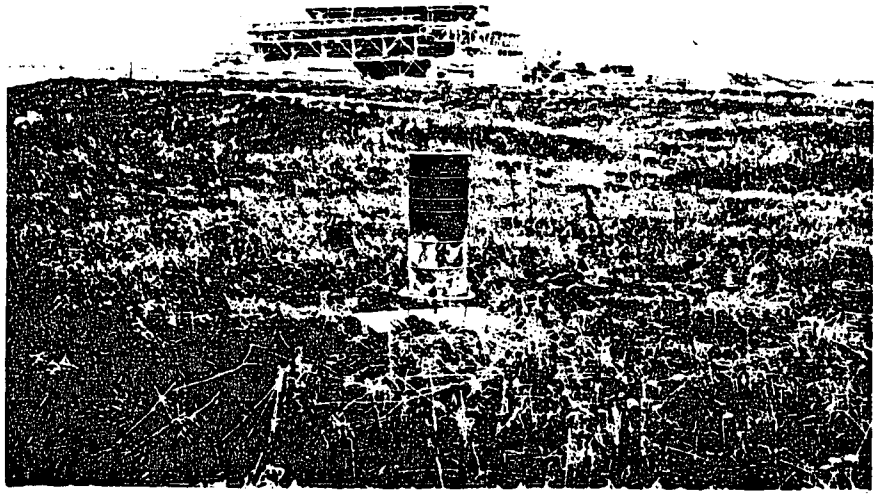


Figure 3
Tipping Rain Gauge

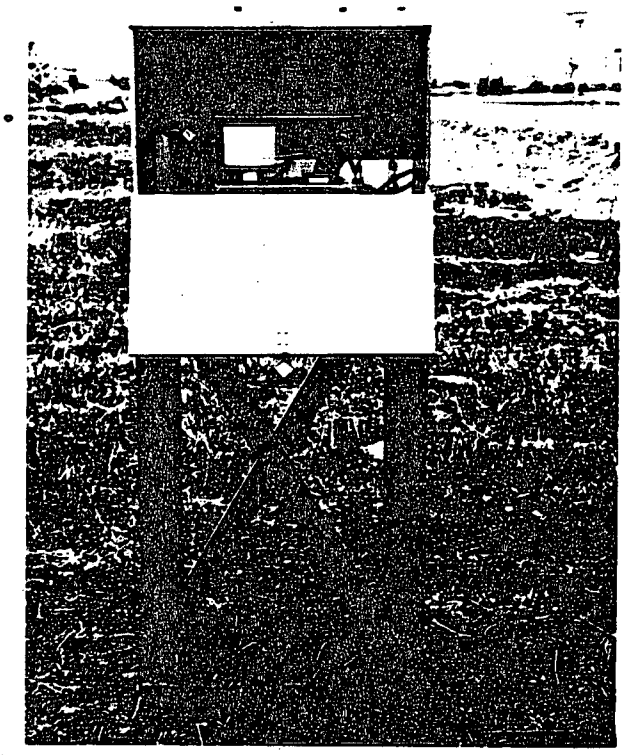


Figure 4
Rain Gauge Recorder

## PROJECT 6-IW-AR-096

## LAKE WINNIPEG

Regional program support was provided to the CCIW, Winnipeg detachment, by Technical Operations with program coordination and equipment installation. The Lake Winnipeg Program was part of a commissioned study on Lake Winnipeg.

Two strings of current meters were moored in the narrows off Little Bullhead Point (Figure 1), from May 14 to September 24, to study the exchange of water masses between north and south Lake Winnipeg.

These measurements will be used in conjunction with existing federal and provincial collected data to assess the water quality and movements in Lake Winnipeg.

Installation and retrieval of the current meter mooring was implemented by the Ministry of Transport's new vessel, "Namao".

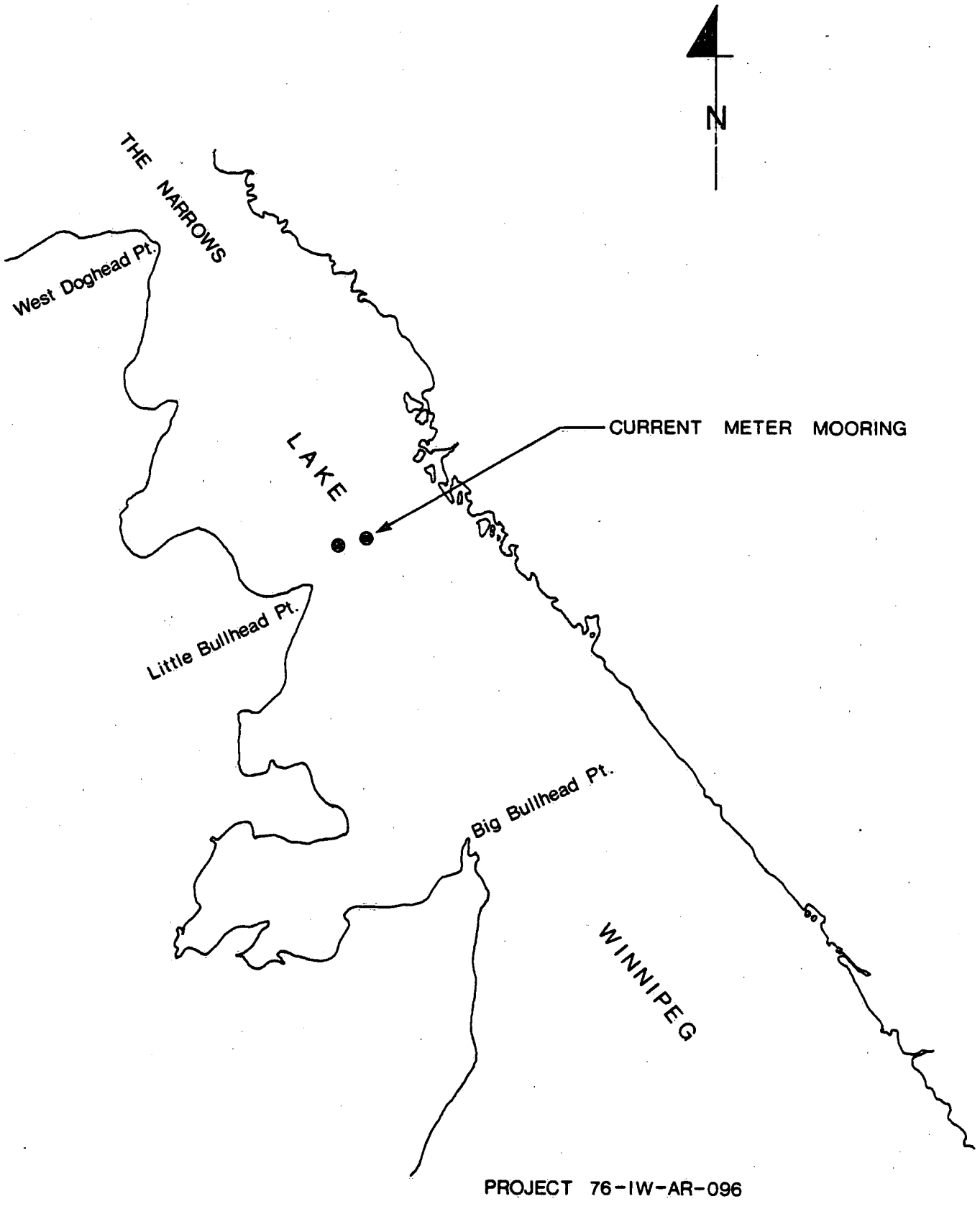

N
THE NARROWS
West Doghead Pt.
LAKE
CURRENT METER MOORING
Little Bullhead Pt.
Big Bullhead Pt.
WINNIPEG
PROJECT 76-IW-AR-096

Figure 1

## LOWER LAKES SURVEILLANCE

The purpose of the Surveillance Program is to provide data for compilation of a continuing report and long term trend information on water quality and eutrophication parameters in the Lower Great Lakes. Data collected are to be used as input to Tasi 12, Canada-United States Agreement on Great Lakes Water Quality and the Annual Report to the International Joint Commission.

During the 1976 field season a total of 15 surveillance cruises were supported by Technical Operations Section on Lakes Ontario and Erie. Twelve cruises were carried out on Lake Ontario of which eleven were completed and one partially completed, due to ship breakdown. Three cruises were attempted on Lake Erie, two were completed successfully and the remaining cruise after partially being completed was cancelled due to adverse weather conditions and tight ship scheduling.

The basic surveillance parameters measured on Lake Ontario cruises were; dissolved oxygen, conductivity, temperature, particulate organic carbon, chlorophyll a, total phosphorus (unfilitered), chloride and percent transmission. The sampling depths were based on the lake temperature structure which was obtained from an electronic bathythermograph trace taken at each station.

A total of four chemistry and six microbiology cruises were piggy-backed onto the basic Surveillance Program. On these cruises additional samples were collected for:

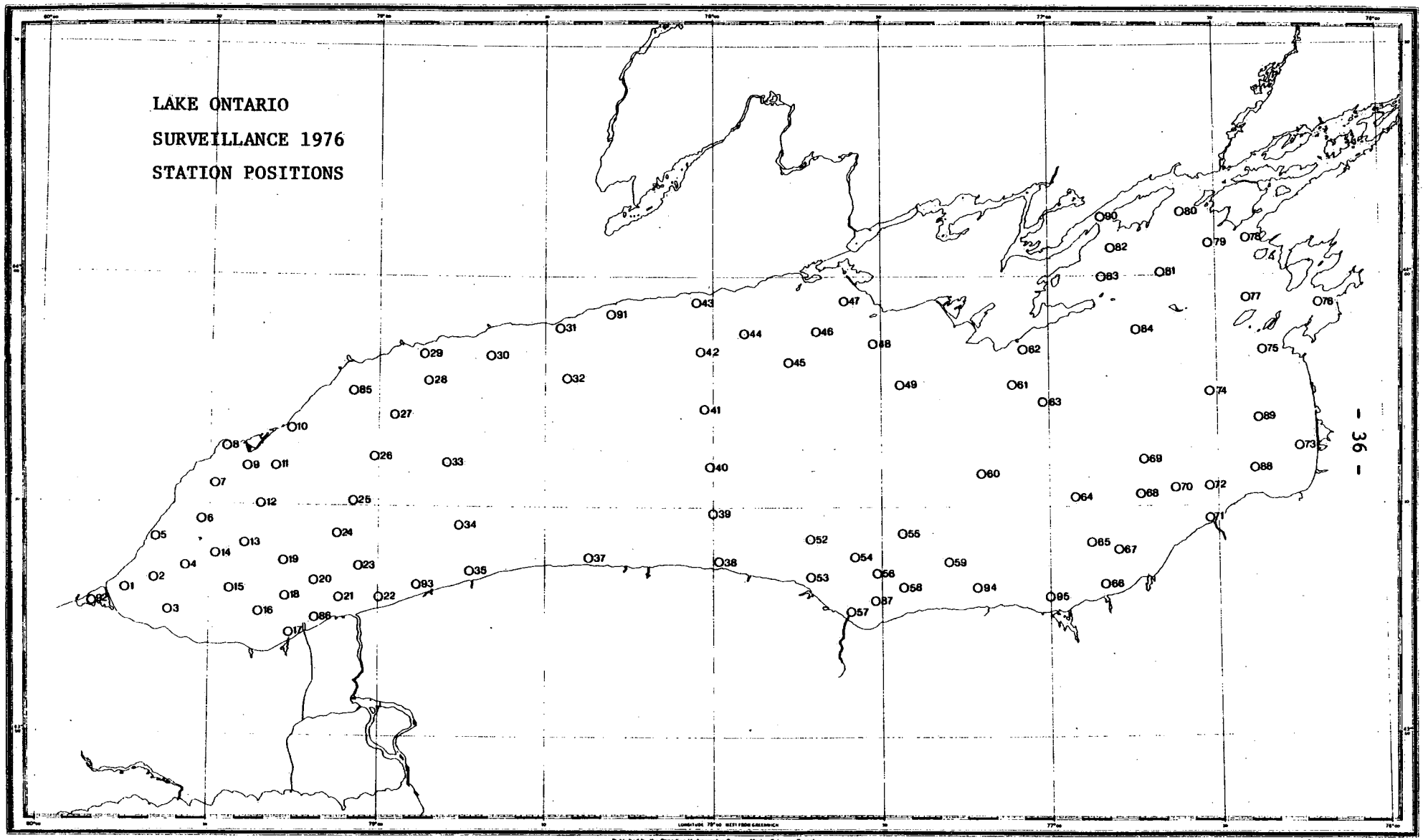
1) Chemistry cruise: total phosphorus (filitered), soluble reactive phosphorus, total filtered nitrogen, nitrate and nitrite, ammonia, reactive silicate, dissolved organic carbon, major ions, pH and alkalinity.
2) Microbiology cruise: total coliforms, fecal coliforms, fecal streptococci, aerobic heterotrophs, pseudomonas aeruginosa, total

counts, total filtered nitrogen, total phosphorus filtered and fecal sterols.

The surveillance parameters measured on Lake Erie varied for each cruise. On the first cruise the parameters measured were; dissolved oxygen, conductivity, chlorophyll a, total phosphorus, chloride and temperature. On the second cruise only temperature, dissolved oxygen and chlorophyll a parameters were measured. The third cruise parameters for temperature, dissolved oxygen, chlorophyll a, total phosphorus and chlorides were again measured.

More specialized studies in support of specific research projects were carried out in conjunction with the 1976 Lake Ontario surveillance cruises. These projects included: the ATP Program for GLBL, Lake Optics Program for Remote Sensing Section, current meter installation and retrieval for Ocean and Aquatic Sciences, Radioactivity Sampling Program, total dissolved solids study, trace metal study, particulate material and particulate suspended material study.

The support provided by Technical Operations Section to the Surveillance Program included: coordinating the scheduling of a sampling platform to enable all cruises to be carried out at the specified times requested; coordinating all vessel's activities for the collection of surveillance data; collection of all water samples and physical limnological parameters aboard the vessel; operation of a manual laboratory chemistry aboard ship; maintaining data quality control checks on all sampling and data which was compiled aboard the ship; providing a cruise and preliminary description report upon the completion of all surveillance cruises. This support was carried out by six members of Technical Operations staff who were assigned to the Surveillance Program.


LAKE ONTARIO
SURVEILLANCE 1976
STATION POSITIONS
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Published by the Canadian Hydrographic Service, Marine Sciences Branch,
DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA
LAKE ONTARIO
10501

# STATISTICS SUMMARY

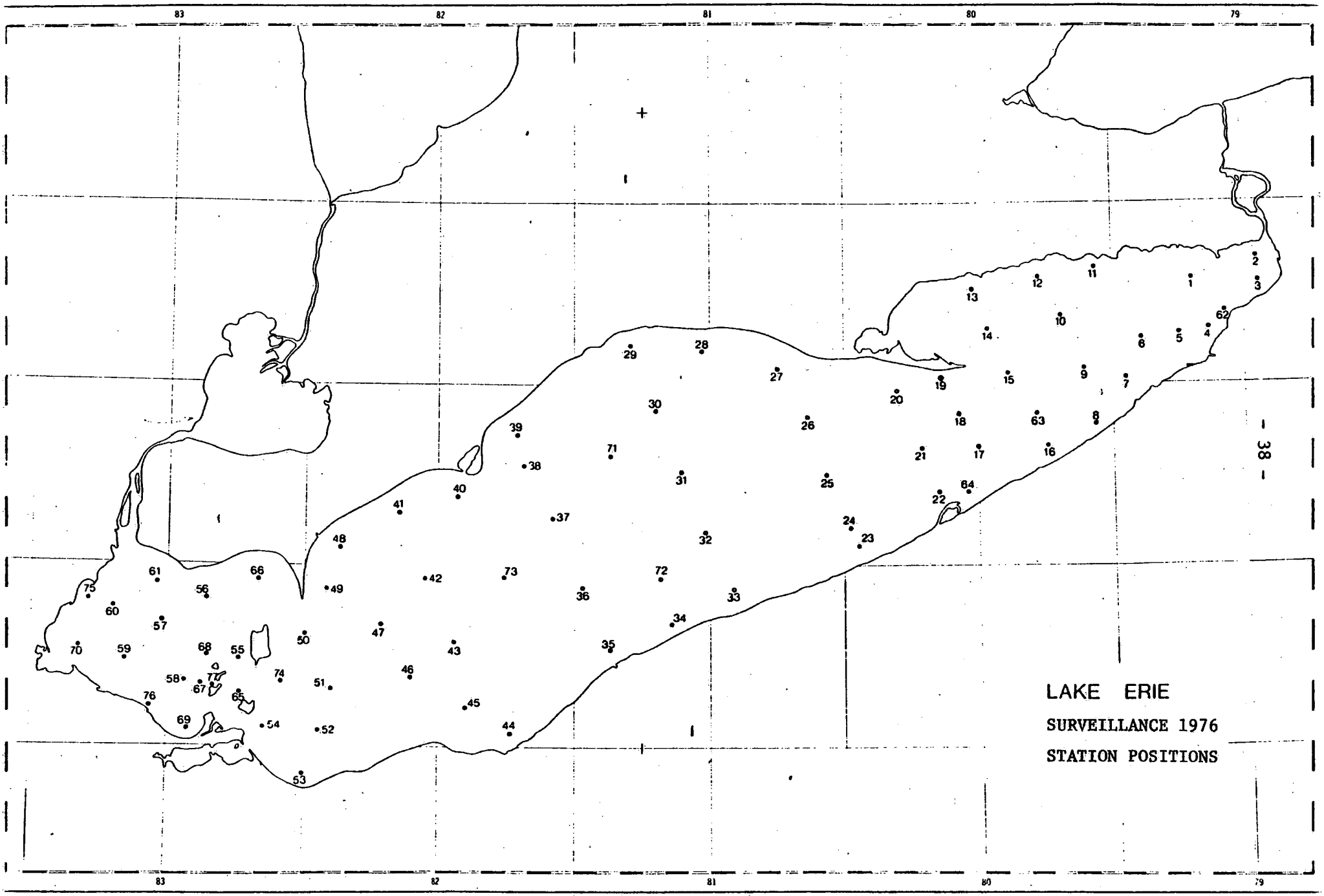
Cruise No. SURVEILLANCE '76 Consec. No. _____ Ship CSS LIMNOS

Dates From April 5, 1976 to December 7, 1976 Lake ONTARIO

Cruise Type SURVEILLANCE Miles Steamed 7414.50

| Description | Total | Description | Total |
|---|---|---|---|
| Secchi | 511 | Moorings Established (CM) | |
| Stations Occupied | 1028 | Moorings Retrieved (CM) | 3 |
| Bathythermograph Casts | 0 | Moorings Established (Met.) | |
| E.B.T. Casts | 1028 | Moorings Retrieved (Met.) | |
| Transmissometer Casts | 1022 | Moorings Established ( ) | |
| Reversing Thermometer Obs. | 135 | Moorings Retrieved ( ) | |
| Water Samples Collected (Chemistry) | 6883 | Moorings Serviced (CM) | |
| Water Samples Collected (Microbiology) | 648 | Moorings Serviced (Met.) | |
| Water Samples Collected (Biolimnology) | 1643 | Moorings Serviced ( ) | |
| Water Samples Collected ( GLBL - ATP ) | 192 | Cores Taken (Gravity) | |
| Water Samples Collected ( POC/TPN, CI, TP, TN, T.D.S., ) | 3427 | Cores Taken (Piston) | |
| Water Samples Collected ( Toxicity WQB ) | 750 | Grab Samples Taken | 4 |
| Water Samples Collected ( Remote Sensing & Guppy ) | 124 | Drogues Tracked | |
| Water Samples Filtered (Chlorophyll) | 1510 | Dye Releases | |
| Water Samples Treated (Phytoplankton) | 132 | | |
| Zooplankton Hauls | | Observations (Weather) | 338 |
| Zooplankton Hauls (Mysis) | | Observations ( ) | |
| Primary Productivity Moorings | | | |
| Bottom Samples (Fauna) | | Continuous Observations (Days) | |
| Integrator (10m) | | Air Temperature | |
| Integrator (20m) | 36 | Relative Humidity | |
| Total Number of Depths Sampled | 1027 | Water Temperature (In-Hull) | 8.5 |
| Total Number of Water Samples Collected | 3711 | Water Temperature (Towed) | |
| | 14210 | Integrated Printout | |
| ONBOARD ANALYSIS | | Solar Radiation | 9 |
| Geolimnology | 0 | Long Wave (IR) Radiation | |
| Manual Chemistry (Tech. Ops.) | 8135 | | |
| Nutrients (W.Q.D.) | 670 | | |
| Microbiology | 2527 | | |

REMARKS


83
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LAKE ERIE
SURVEILLANCE 1976
STATION POSITIONS

# STATISTICS SUMMARY



Cruise No. SURVEILLANCE '76 Consec. No. _____ Ship CSS LIMNOS

Dates From April 9, 1976 to December 3, 1976 Lake ERIE

Cruise Type SURVEILLANCE Miles Steamed 1698.10

| Description | Total | Description | Total |
|---|---|---|---|
| Secchi | 69 | Moorings Established (CM) | |
| Stations Occupied | 154 | Moorings Retrieved (CM) | |
| Bathythermograph Casts | 0 | Moorings Established (Met.) | |
| E.B.T. Casts | 154 | Moorings Retrieved (Met.) | |
| Transmissometer Casts | 0 | Moorings Established ( ) | |
| Reversing Thermometer Obs. | 26 | Moorings Retrieved ( ) | |
| Water Samples Collected (Chemistry) | 1060 | Moorings Serviced (CM) | |
| Water Samples Collected (Microbiology) | 0 | Moorings Serviced (Met.) | |
| Water Samples Collected (Biolimnology) | 501 | Moorings Serviced ( ) | |
| Water Samples Collected ( TP, TN ) | 20 | Cores Taken (Gravity) | |
| Water Samples Collected ( WQB ) | 243 | Cores Taken (Piston) | |
| Water Samples Collected ( ) | | Grab Samples Taken | |
| Water Samples Collected ( ) | | Drogues Tracked | |
| ter Samples Filtered (Chlorophyll) | 501 | Dye Releases | |
| Water Samples Treated (Phytoplankton) | 0 | | |
| Zooplankton Hauls | | Observations (Weather) | 60 |
| Zooplankton Hauls (Mysis) | | Observations ( ) | |
| Primary Productivity Moorings | | | |
| Bottom Samples (Fauna) | | Continuous Observations (Days) | |
| Integrator (10m) | 0 | Air Temperature | |
| Integrator (20m) | 0 | Relative Humidity | |
| Total Number of Depths Sampled | 511 | Water Temperature (In-Hull) | |
| Total Number of Water Samples Collected | 1877 | Water Temperature (Towed) | |
| | | Integrated Printout | |
| ONBOARD ANALYSIS | | Solar Radiation | |
| Geolimnology | 0 | Long Wave (IR) Radiation | |
| Manual Chemistry (Tech. Ops.) | 1060 | | |
| Nutrients (W.Q.D.) | 243 | | |
| Microbiology | 0 | | |

REMARKS

## WAVES

### Project No. 6-IW-HR-038

The WAVES (Water/Air Vertical Exchange Studies) project was one of the largest cooperative exercises mounted by CCIW in 1976. Principally, the objectives were to investigate the breaking of wind-generated waves in relation to: wind variability and atmospheric stability; local and distant currents; and the transfer of momentum, heat and moisture. The project was highly successful in meeting these objectives, reflecting the great degree of cooperation, skill and industry of both management and staff of Hydraulics Research Division and Scientific Support Division, with Technical Operations Section having the major support responsibility.

Three distinct and equally challenging phases of the project were necessary for its successful conclusion. The first was the construction and installation of a 35 ton steel tower or platform, 22 metres high and 12 metres square at its base. The completed structure was transported to a predetermined site in the extreme western end of Lake Ontario, one kilometre from shore and in 12 metres of water.

The second phase was the fitting out of hardware and instruments. The hardware for the instrumentation included booms, guys, brackets and cranes. Some 25 instruments and associated electronic packages were installed for measuring wind, waves, humidity, temperature and currents; strain gauging equipment was also installed. All measurements were recorded in the shore facility.

Phase three was the data analysis and programming portion of the project. Considerable effort from all three Divisions of CCIW was required for this task.

It is anticipated that the research platform and its shore office will contribute to scientific programs for at least the next decade, with a continuing major input from Technical Operations Section.

## Robot Experimenter (REX)

## Project No. 6-IW-SSD-001

The Robot Experimenter is an instrument which can perform *in situ* unattended analysis of dissolved oxygen, temperature, pH, specific conductance, chlorides, turbidity, Eh and total alkalinity. Data can be telemetered to CCIW for direct storage on computer files.

After intensive testing at CCIW throughout the summer, successful field trials were conducted in October.

In support of the project Technical Operations staff moved the REX system to various test locations, performed water quality analyses for comparison purposes, and assisted in editing the raw data on the PDP-15 computer.

## PORT HOPE RADIATION SURVEY

Technical Operations Section provided assistance to the Atomic Energy Control Board for a period of six weeks in July and August at Port Hope. The town was surveyed by the AECB to determine the extent and magnitude of radioactive contamination. The contamination originated in the Eldorado Nuclear Ltd. refining operation which has been located there for many years. Geiger counters, measuring beta and gamma radiation, were used to inspect virtually the whole town, both inside and around buildings, as well as the ravines and lakeshore.

Air-carried radioactivity was found near the plant while radioactive material from the refining process that was used as landfill was evident in areas where construction took place, at the time when there were no controls. Contaminated building materials and equipment which originated in the plant were found in various places.

At the same time, the Ontario Ministry of Health was monitoring the inside of buildings for radon gas which is produced as radioactive materials decay. The AECB is co-ordinating the removal of radioactive materials and landfill and the installation of ventilation systems where radon gas is present at unsafe levels.

## PROJECT 6-IW-AR-067

## SURVEILLANCE OF UPPER GREAT LAKES

### Objective

To provide verification or clarification of several important points of the Upper Lakes Reference which remain unestablished.

The reference study of the Upper Lakes established a baseline condition through extensive surveys during 1973-1974. Several areas of uncertainty remained which must be resolved to make the reference more certain. Areas in which these surveys failed to establish a baseline are:

a) mean phosphorus concentration in open lake waters,
b) mean concentration of silica in open lake waters,
c) mean value of conductance or specific ion concentration in the open lake waters,
d) water budget and residence time of the North Channel of Georgian Bay.

The project comprised one survey cruise of Lake Superior and Lake Huron, including the North Channel on which very precise measurements were carried out to verify the measurements of 1973-74. Current meters were established to determine the North Channel, Lake Huron and St. Mary's interchange rates. Meteorological buoys were placed in the North Channel and monthly temperature surveys were conducted in the North Channel.

### Technical Operations - Shore Unit

This unit was responsible for conducting the field maintenance of the meteorological buoys and for performing the monthly temperature surveys. Deployment and recovery of the instrumentation as well as the chemical surveys were conducted by Technical Operations' Ships Unit, CSS LIMNOS and MV PETREL respectively.

Meteorological Buoys

Two standard Hymet systems were placed in a central position in the North Channel. They were located about 1 km apart. These buoys were serviced monthly from CSL SHARK. Positions of the two buoys (6-2M-07 and 6-2M-08) as well as the positions of the 6 current meter arrays is shown in Figure 1.

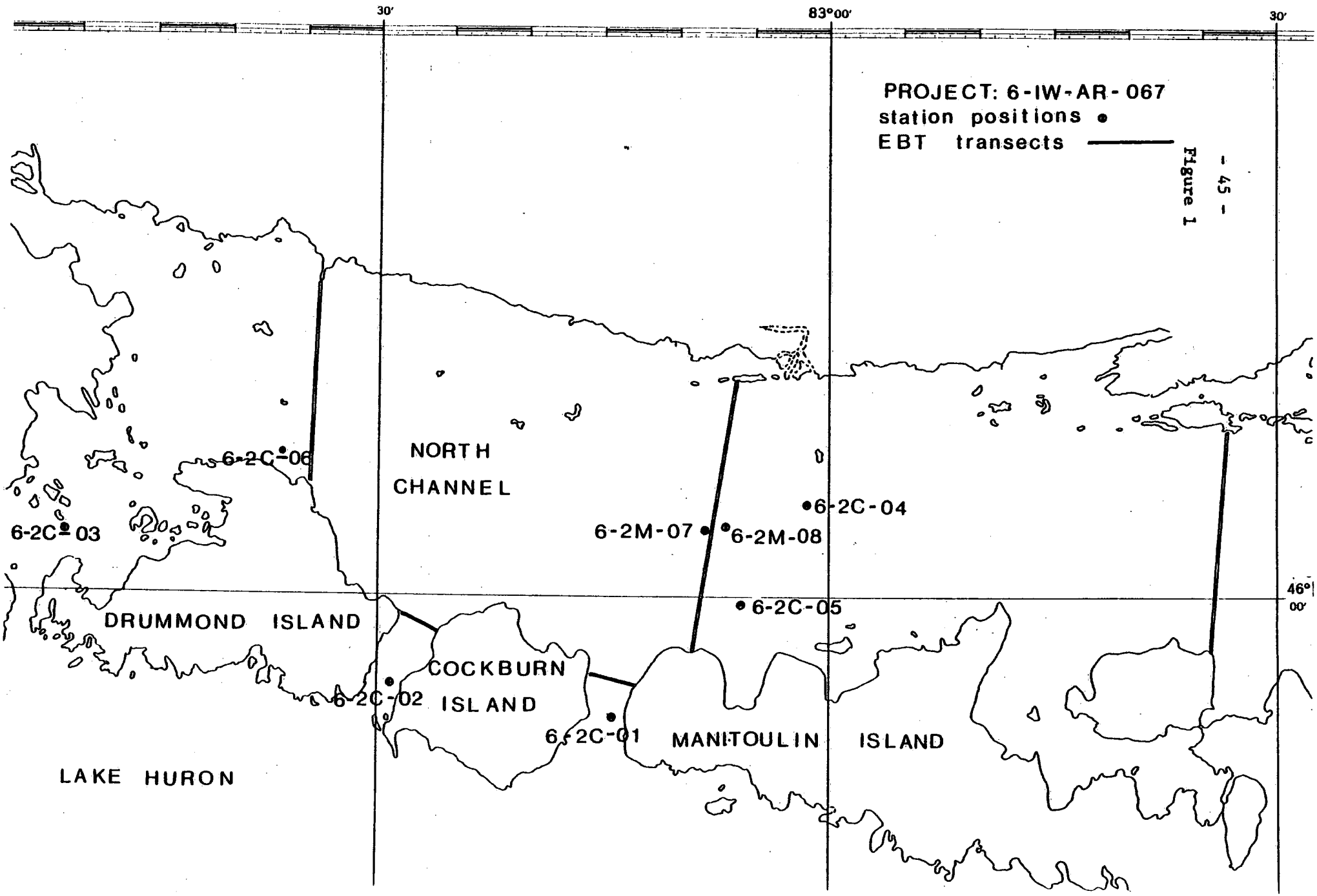
No major difficulties were encountered in maintaining these buoys. Heavy weather on occasion necessitated a change in the schedule of maintenance due to the danger in boarding the buoys. In these cases EBT stations were completed while awaiting fair weather. The longest delay was two days.

All sensors remained operational for the entire season. Wind speed and direction, air temperature, relative humidity and water temperature were monitored.

EBT Surveys

Five transects of the North Channel were selected. Three lines of 8 stations each ran north and south across the main channel and two lines of 3 stations connected Manitoulin, Cockburn and Drummond Islands. Surveys were conducted from June to October by CSL SHARK and a final survey by CSS LIMNOS was made in November. Figure 1 shows the location of the transects. Traces were digitized in the field and returned to CCIW for analysis.

Figure 1


30'
83°00'
30'
PROJECT: 6-IW-AR-067
station positions •
EBT transects
6-2C-06
NORTH
CHANNEL
6-2C-03
6-2C-04
6-2M-07
6-2M-08
46°
00'
6-2C-05
DRUMMOND ISLAND
COCKBURN
ISLAND
6-2C-02
6-2C-01
MANITOULIN ISLAND
LAKE HURON

## PROJECT 6-IW-AR-69

## DISTRIBUTION AND ACTIVITY OF MICROORGANISMS LAKE ONTARIO

Project Leaders

Dr. E. Halfon - Basin Investigation & Modeling Section, ARD

Dr. M.L. MacKinnon - Great Lakes Biological Laboratory

Two Technical Operations personnel using the CSL LEMOYNE collected data and samples at three stations, at specified depths, at the western end of Lake Ontario.

Trials were made in Hamilton Harbour prior to actual collection in Lake Ontario.

The sample and collection data were:

- Integrator 0-20 metres
- Dissolved oxygen
- Carbon$^{14}$ in situ primary production
- In situ BOD oxygen
- Specific conductance and pH

A maximum of ten depths were taken at three stations (see map). Stations were occupied at the west end of Lake Ontario.

## PROJECT 6-IW-AR-076

## COASTAL ZONE MANAGEMENT

Objective

To collect a year round time series (physical) data base for a high energy, shallow, island shrouded coastline in the Great Lakes. Studies of this nature are relevant with regard to waste heat dispersion, coastal process studies and the compilation of data bases for coastal zone modelling.

In order to fulfill these objectives, a current meter, Fixed Temperature Profiler and Meteorological measuring network was established and maintained. The network was installed on a line running offshore from a point 8 miles south of Byng Inlet, Georgian Bay. The region under study is from the very nearshore to mid-lake conditions in essentially the same mooring sites as were measured during the 1975-76 Winter Program.

Operational Support

The operational support to this project consisted of the installation, monitoring and maintenance of the 7 current meter moorings, 3 FTP moorings, 1 meteorological buoy and 3 CATSS systems.

The current meters were installed, maintained and recovered by CSS LIMNOS. Launching and retrieval of the meteorological buoy and two of the three FTPs was also conducted by CSS LIMNOS.

The three CATSS stations were installed by the Dive Unit. Two of the stations had towers to support the thermistor arrays. These towers were also installed by the Dive Unit. The Dive Unit recovered one FTP which required diver assistance for retrieval.

The remaining FTP launching and the wiring of all CATSS stations were performed by the on-site personnel from the Technical Operations Shore Unit. The following tasks were identified and performed by this Unit:

1. Locate and mark appropriate sites for 3 CATSS systems.
2. Supervise the installation of CATSS stations and towers by the Dive Unit.
3. Complete such tasks as necessary to make each CATSS system fully operational.
4. Monitor each CATSS at installation, 15 and 30 days after installation.
5. Replace and field refurbish digitizers and power supplies every 45 days.

6. Monitor and refurbish 3 FTP stations on the same schedule as 4 and 5 above.
7. Monitor 1 meteorological station in Georgian Bay every 15 days and refurbish it every 30 days.
8. Perform, as required, ongoing maintenance to CATSS, FTP and meteorological systems.

Additional Tasks

Concurrent with this project, Project 6-IW-AR-067, "Surveillance of the Upper Great Lakes", (see attached report) was conducted. The time division was planned at one week/month to be devoted to AR-067. Aside from interference by weather, this objective was met.

One current meter mooring, 5-5C-02A, from the previous Winter Program was not recovered by CSS LIMNOS during the initial cruise in Georgian Bay. This Unit was directed to carry out a limited search for this equipment. Two components of this mooring were recovered with the assistance of the Canadian Coast Guard Base, Parry Sound. Of the two meters, acoustic release device and mooring hardware, one meter and the subsurface float was recovered. These units were recovered some 40 miles away from the mooring site. When these units were recovered, the search was terminated.

It was intended that CSS LIMNOS and CSL SHARK, which were assigned to this project, would conduct drogue tracking experiments. Inclement weather and the pressure of other tasks caused this operation to be deleted. CSS LIMNOS did complete (64 hour) one drogue experiment in June.

CATSS

The CATSS system used on this project was identical to that used previously in Sinking Plume Studies, except for the method of placing the thermistor array. One station, CATSS 1 (3 m water depth) had a staff with a sprung ball socket joint and the other two had Millard towers. The bottom terrain was exposed bed rock and rock bolts were used to secure the tower guys and the CATSS frames to the bottom.

## PROJECTS 6-IW-PR-003/024/014

## LAKE ST. GEORGE

Three major projects were underway at Lake St. George this summer, as follows:

1) Project 6-IW-PR-024 (Dr. D.R.S. Lean)
2) Project 6-IW-PR-003 (Dr. N.M. Burns)
3) Project 6-IW-PR-041 (Dr. R.R. Weiler)

### Major Project Objectives

To interrelate the flux of nutrients in lakes to the response of the lake community.

### Relevance

Lake St. George study is designed to relate nutrient kinetics to chemical and biological responses in ecosystems that can be carefully monitored. In this way, it is hoped that more meaningful variable can be identified and that much of the existing Water Quality Testing can be eliminated

Dr. D. Lean coordinated the whole project, and the entire staff of the Nutrient Dynamics Section, PRD, CCIW was involved in this project. Dr. Lean also coordinated limnological work with outside agencies, mainly through cooperation with postgraduate students and their supervisors at various universities (from Toronto, Waterloo, Brock, McMaster, Guelph and McGill). Also, contract personnel, e.g., Electron Microscopy and phytoplankton identification and enumeration. Up to 15 people in any one day were participating in projects at the site.

Good use was made of the rented area, including the house, the cottage, the shed and the boat house. During the summer months, the boat house, for instance, was converted into a lab and its upper floor into a storage area.

Some other interesting aspects of the study were measurements of atmospheric contribution, i.e., nitrogen fixation, carbon dioxide invasion and nutrients in precipitation.

The movement of the sediments was calculated using both mass balances of radioisotopes and sediment traps.

The determination of adenosine triphosphate (ATP) content of the planktonic organisms within the limnocorrals was continued. This provided an estimate of total living biomass and, when combined with total particulate carbon and chlorophyll, can be used to categorize a community into autotrophic and heterotrophic organisms (or the relative combination of both type organisms), plus the abundance of dead particulate material.

Occasional Technical Operations support was also given to personnel from other agencies. Dr. W. Adams headed the team from Ottawa's Ice Properties section and visited the site frequently in the winter. During the fall, assistance to his project was liaisoned through personnel from the Atmospheric Environment Service at Toronto. A postgraduate student (Toronto University) worked most of the summer at the lake and Miss R. Janus, a contract biologist, commenced work on site by mid-summer. A summer student from McMaster University, a research team from Scarborough College (University of Toronto), a research student from Brock University and a postgraduate student from Trent University took part in the scientific investigations.

Throughout the year, field work was confined to a 5-day per week operation for the summer months and to a 4-day per week operation in the fall, winter and spring. Half a day or more was usually spent at headquarters to deliver and pick up supplies.

Other Technical Operations personnel came to the site occasionally and provided the required assistance.

Eleven limnocorrals were installed before mid-summer: five new limnocorrals at a deep location (Station A); and another five limnocorrals at a shallow nearshore location (Station B). One limnocorral was launched in an appropriate location inbetween the 2 stations mentioned, A and B, for testing and future use. (See Figure 1).

Work by support staff involved sampling from the limnocorrals and the lake, processing and analysing the samples, operating, procuring and maintaining scientific electronic equipment and the launching and retrieval of specific scientific moorings and limnocorrals.

Water Quality Branch samples were delivered once a week to CCIW - ships support laboratories, for further chemical analyses. Work also extended to include examining the data obtained after the chemical analyses were performed.

The job also included the provision of supplies, e.g., fuel to the buildings and the trailers on site, paying for various bills and negotiating work requirements through outside agencies, mainly from the private sector.

In addition to the above mentioned support given to this project, meteorological data were monitored on a regular basis and assistance in installing new sensors and maintaining the electronic equipment used was given.

Four trailers were in use during the season. One for chemical analyses, one for scintillation counting and chlorophyll analysis, one microbiology trailer, and a live-in trailer, part of which was set up for zooplankton studies.

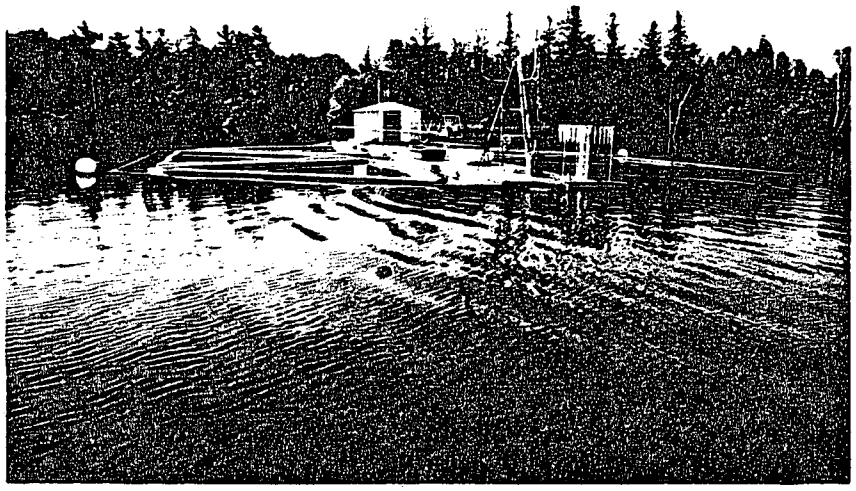


Figure 1

Lake St. George

Project Leaders

1) Dr. D.R.S. Lean
2) Dr. B.G. Brownlee
3) Mr. M.N. Charlton
4) Dr. N.M. Burns
5) Dr. R. R. Weiler
6) Mr. T. Murphy
7) Dr. K. Burnison

Many other investigators could be named, but the above mentioned are the scientists from CCIW who frequently participated in field and lab activities at Lake St. George.

Vehicle

Dodge Van 73-47, Licence BVK 498.

Over 12,000 miles were driven between Lake St. George and headquarters.

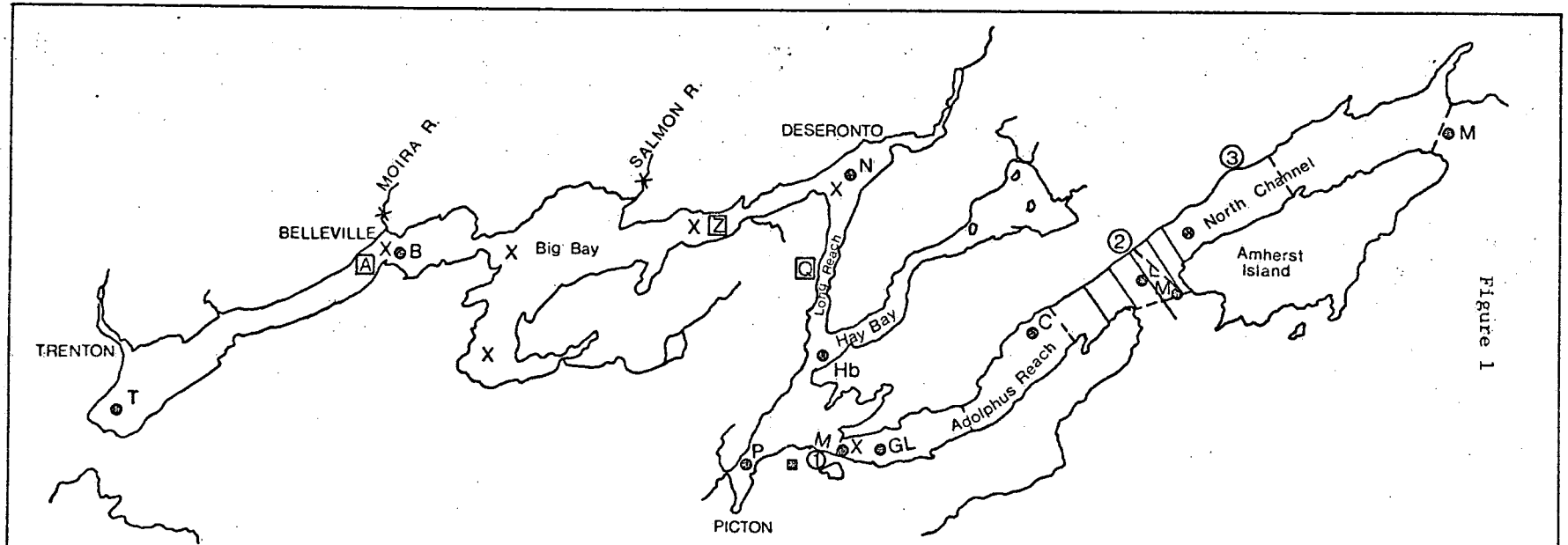
Boats

Six boats were on the site to carry out the scientific program.

1) 2-Joe Boats: used mainly in sampling from the limnocorrals and the lake.
2) 2-Aluminum Boats (12 ft.): used for transportation to the platform, launching and retrieving the sediment traps and in light operations.
3) 2-Fiberglass Boats (5 ft.): used specifically in sampling from inside the limnocorrals.

Support Staff

P.R. Youakim, J.D. Scott, J.E. Ellard, E.H. Walker (who provided assistance during the last few weeks of this year).




1976 PRIMARY PRODUCTIVITY and PERSISTENT CONTAMINANTS PROJECT 1977

PRIMARY PRODUCTIVITY STNS.

- T - TRENTON
- B - BELLEVILLE
- N - NAPANEE
- Hb - HAY BAY
- P - PICTON
- GL - GLENORA
- C - CONWAY
- L - LENNOX

BACK-UP DATA STATIONS

- X - 8 METAL and P.C.B. LOCATIONS
- ------ 7 TEMPERATURE/DEPTH TRANSECTS
- ——— 26 TEMPERATURE-OXYGEN/DEPTH STATIONS PROFILES
- M - 3 CURRENT METER MOORINGS
- ■ SOLAR and RAIN GUAGE STATION

DIP STATIONS

- A - BELLEVILLE BAY BRIDGE
- L - TELEGRAPH NARROWS LIGHT STATION
- Q - QUICKS QUINTES COTTAGES

- ① - GLENORA M.N.R. LABORATORY
- ② - LENNOX HYDRO GENERATING PLANT
- ③ - HYDRO LAB. TRAILER

## BAY OF QUINTE

## PROJECTS 6-FR-BL-017 and 6-FR-BL-020

### Purpose

The above two projects were carried out to measure persistant contaminants and primary productivity.

### Narrative

The primary productivity part of this study was a continuing program of which 1976 became the fourth successive year of investigation for the Bay of Quinte Basin.

Introduction of effluent from the Quinte and area drainage basin has caused considerable degradation of the recreational value of the natural waters ever since the early 1920's. Therefore, in reference to this, it is hoped one can understand the purpose and usefulness of a primary productivity and contaminants study in this region.

### Technical Operations Role and Field Support

Technical Operations support involved 6 man-months full-time support, beginning in April and ending in October. A support vehicle was used for towing boat trailers and for commuting between various sampling sites.

Operations personnel were directly involved in handling a variety of field samplers including: an Ekman dredge; Shindler Petalas 30 litre Trap; Grazing Chamber; 100 litre closing Net; Photometer; YSI dissolved oxygen and temperature meter; portable Electronic Bathythermograph; Alpha bottle; and Van Dorn bottles.

Sampling stations were located on the Bay of Quinte and visited in consecutive order from one to eight, West to East. Chart #1 shows the Primary Productivity stations. Eight of these stations were selected at or very near river outlets and at more dense population sites and sampling was executed at each of these stations, primarily for respiration and zooplankton measurements.

Several back-up parameters were also obtained, such as photometry; temperature readings; solar radiation; and algae and chlorophyll samples. Stations A, Z and Q were additional sites that were sampled weekly. The Moira and Salmon Rivers were sampled by Technical Operations personnel every second week of the month. The remaining six were sampled four times during the season. Also, four times per season, six duplicate closing-net hauls were executed using the Dell Quay Dory and required three people to handle the large 1 metre round net.

Every two weeks, 26 oxygen/temperature/depth profiles were obtained at the Lennox Hydro Plant.

This site is indicated by the circled #2.

Continuous recording solar radiation and rain gauge stations were installed at Taylor's field near Glenora. Solar radiation readings were used in conjunction with primary productivity and the rain gauge installation was for measuring PCB levels in the atmospheric rain.

Site one was the main laboratory for all equipment and various filtering and primary productivity studies. This work area was included with the Ministry of Natural Resources Station, at Glenora. The work area was set up by Technical Operations and encompassed one half of the 2nd floor. One boat was docked here and the other one at the Glenora Marina, where a launching ramp was located.

In order to get an idea of the value of flows and volumes involved in the Quinte area, several temperature/depth transects were carried out along the Adoulphus Reach to Kingston. This involved 29 stations with 3 transects selected at 3-current meter positions that had been established by the LIMNOS and Technical Operations staff. These current meters were equipped with 30 min. cams, which monitored the temperature as well as the velocity of the waters.

Fish Species

Twice during the summer varying sizes and ages of fish were caught from the Quinte area. The net sites were chosen at random to get a general idea of the fish which frequented the Quinte waters.

During one such haul, Technical Operations coded, gutted and separated the gonads and stomachs of 65 fish. These fish were White Perch, Yellow Perch, Bass, Alewife, Chad, Suckers and Catfish.

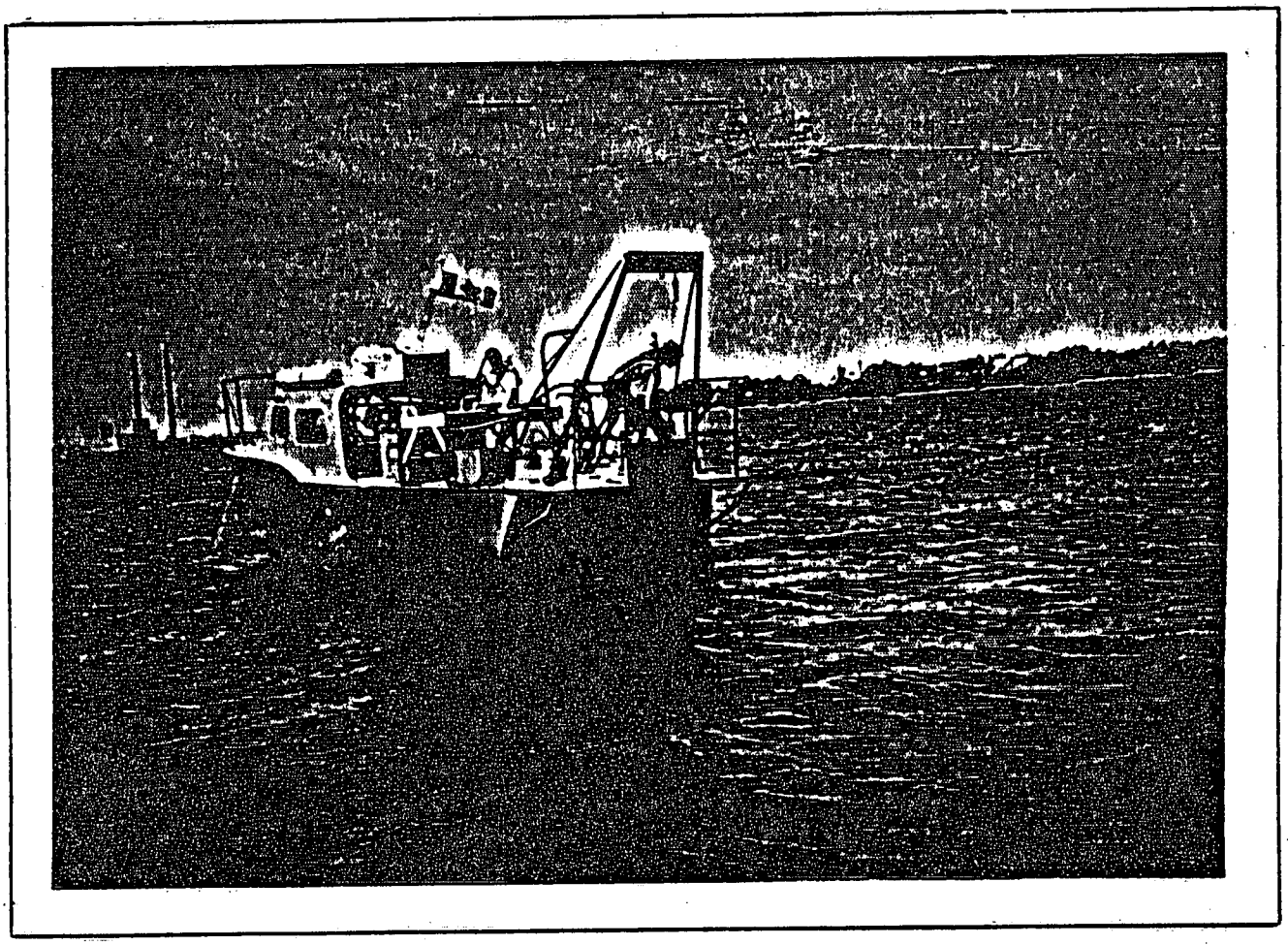
Conclusion

With Technical Operations invaluable assistance, the field year 1976 was successful. Twenty-six weekly cruises were completed for Primary Productivity, involving the collection of 182 major chemical samples, 1,664 zooplankton samples and many more equally important back up data.

Addendum

Pictures are included showing the launch Sandpiper and a few of the regularly used sampling devices on the program.

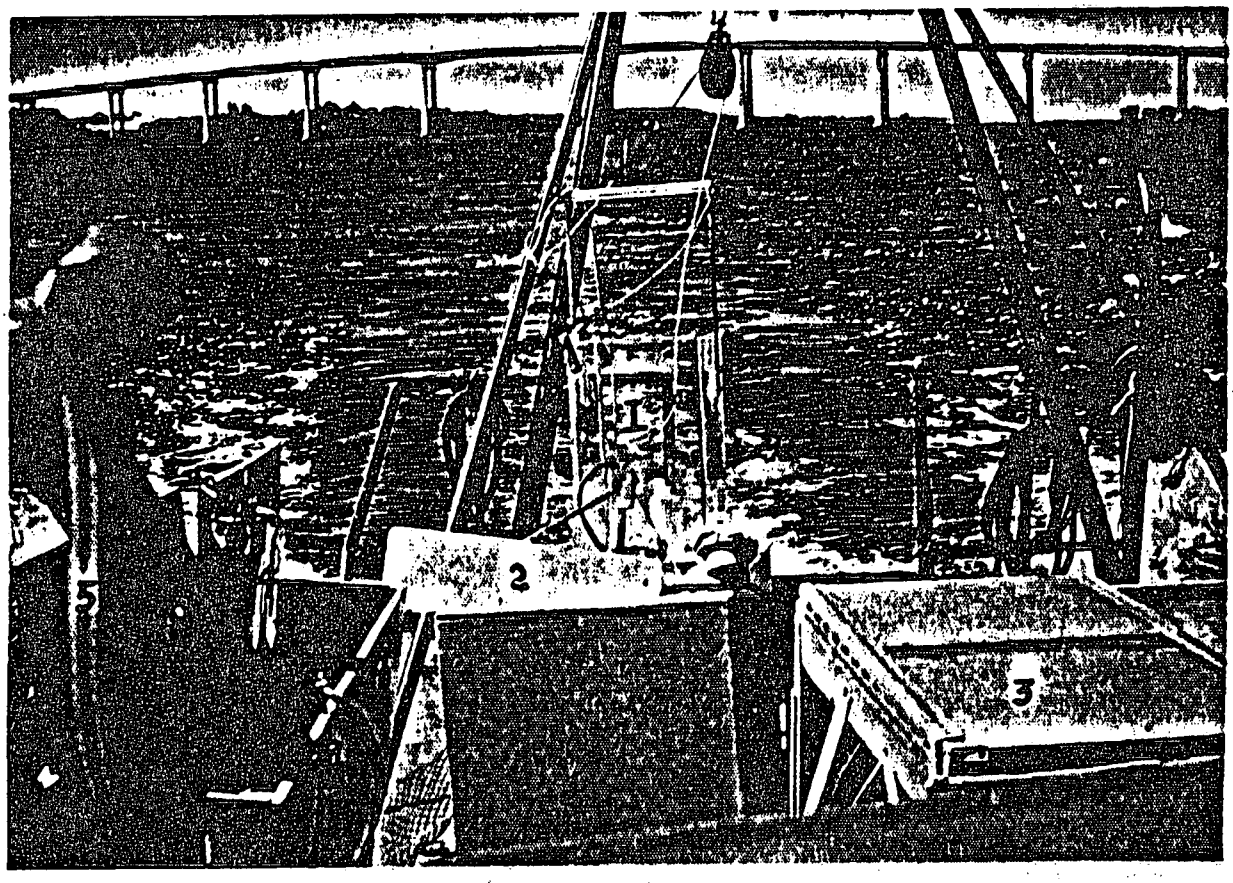
CSL SANDPIPER



Ekman dredge bottom fauna cruise

Lennox hydro plant in background.

CSL SANDPIPER




1) Shindler Petalas 30 litre trap for collection of zooplankton.

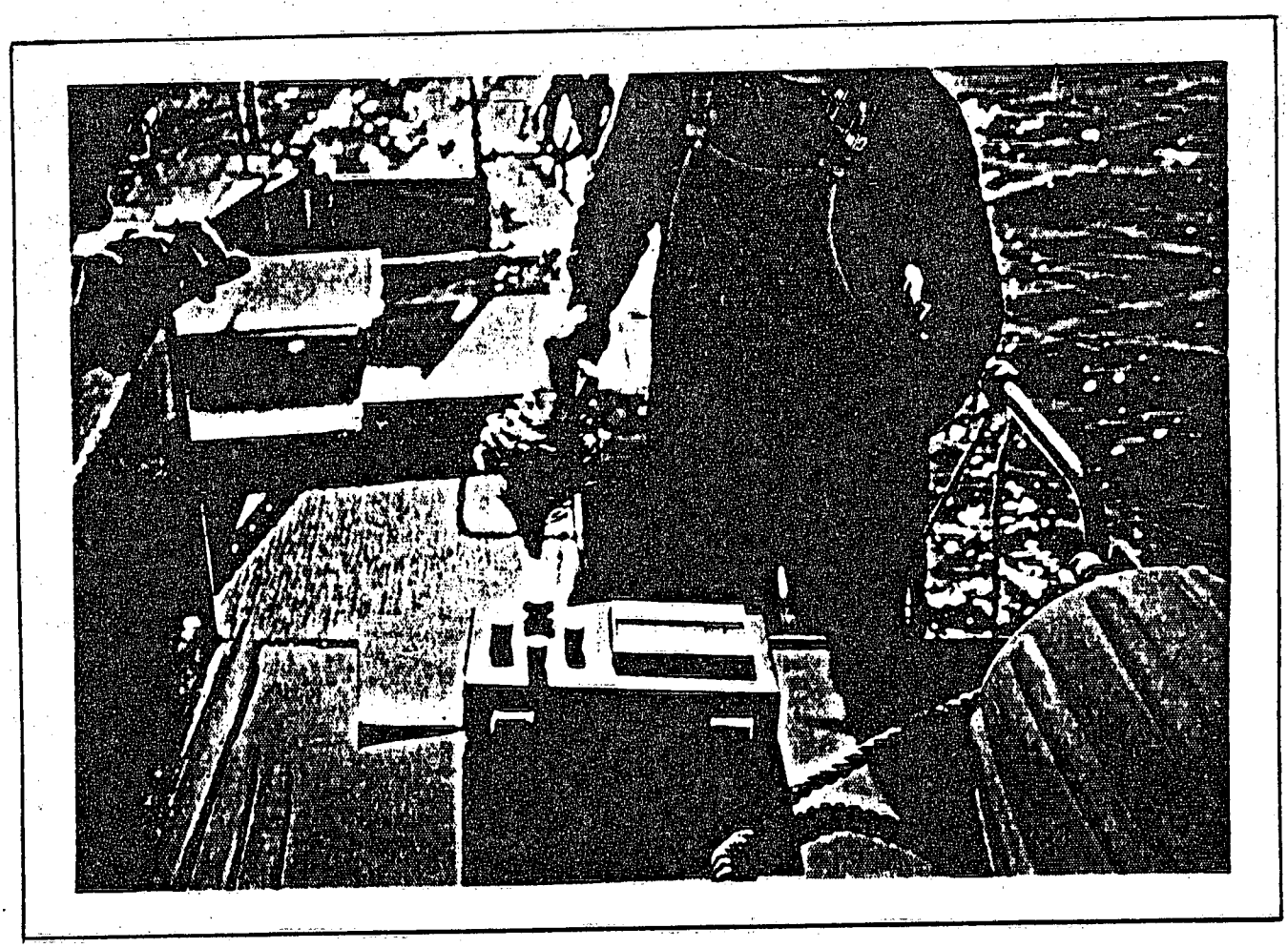
2) Photometer used for light extinction measurements.

3) Light table used for oxygen respiration studies.

4) Integrator 1 litre used for water samples. Secchi disc is beside it.

5) Nitrogen bubbling cylinder and hose used for controlling $O_2$ level.

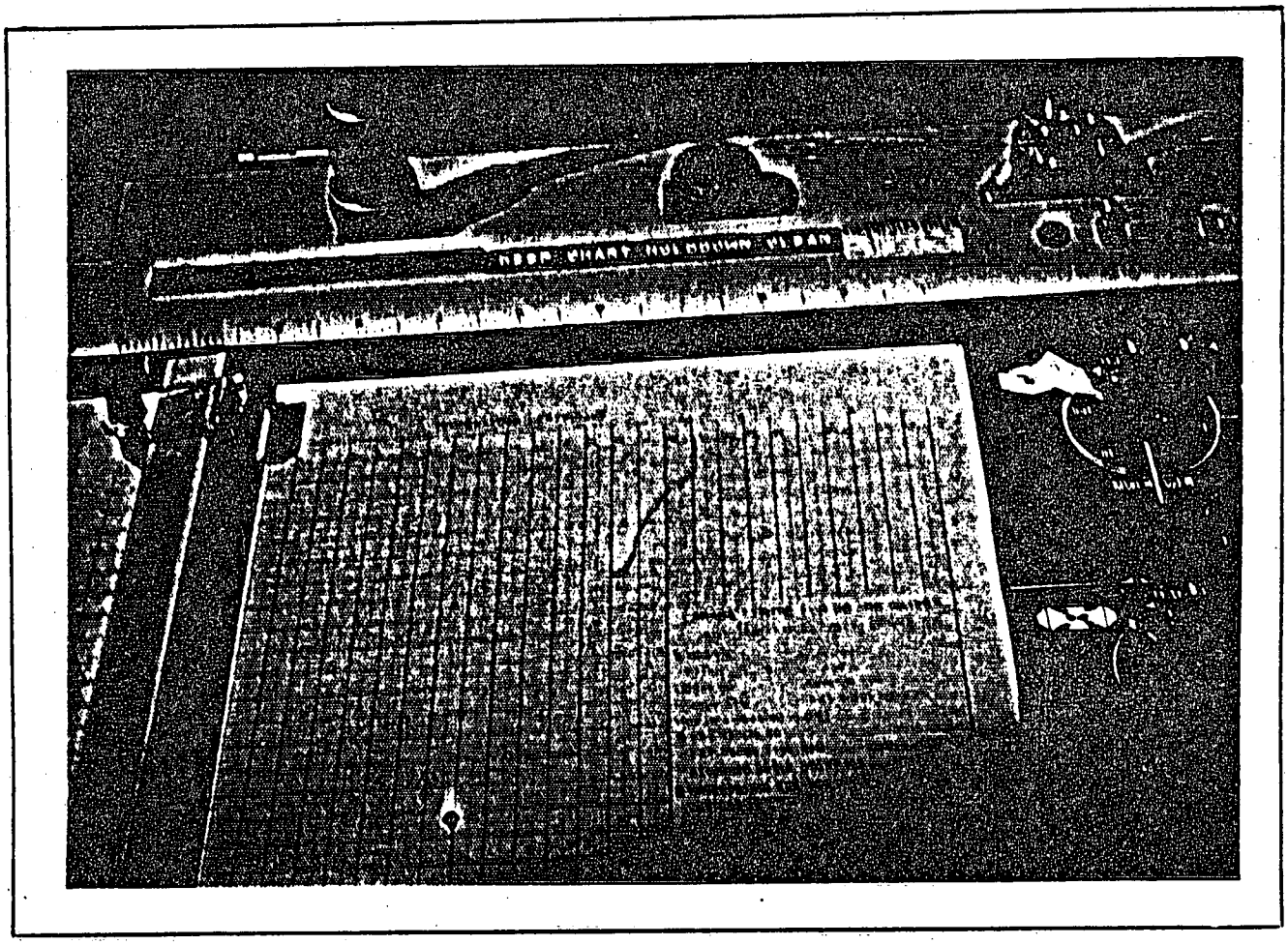
This photograph is taken just before the Napanee Station and shows the Deseronto Bridge in background.



YSI oxygen and temperature measurements.

Napanee Station.

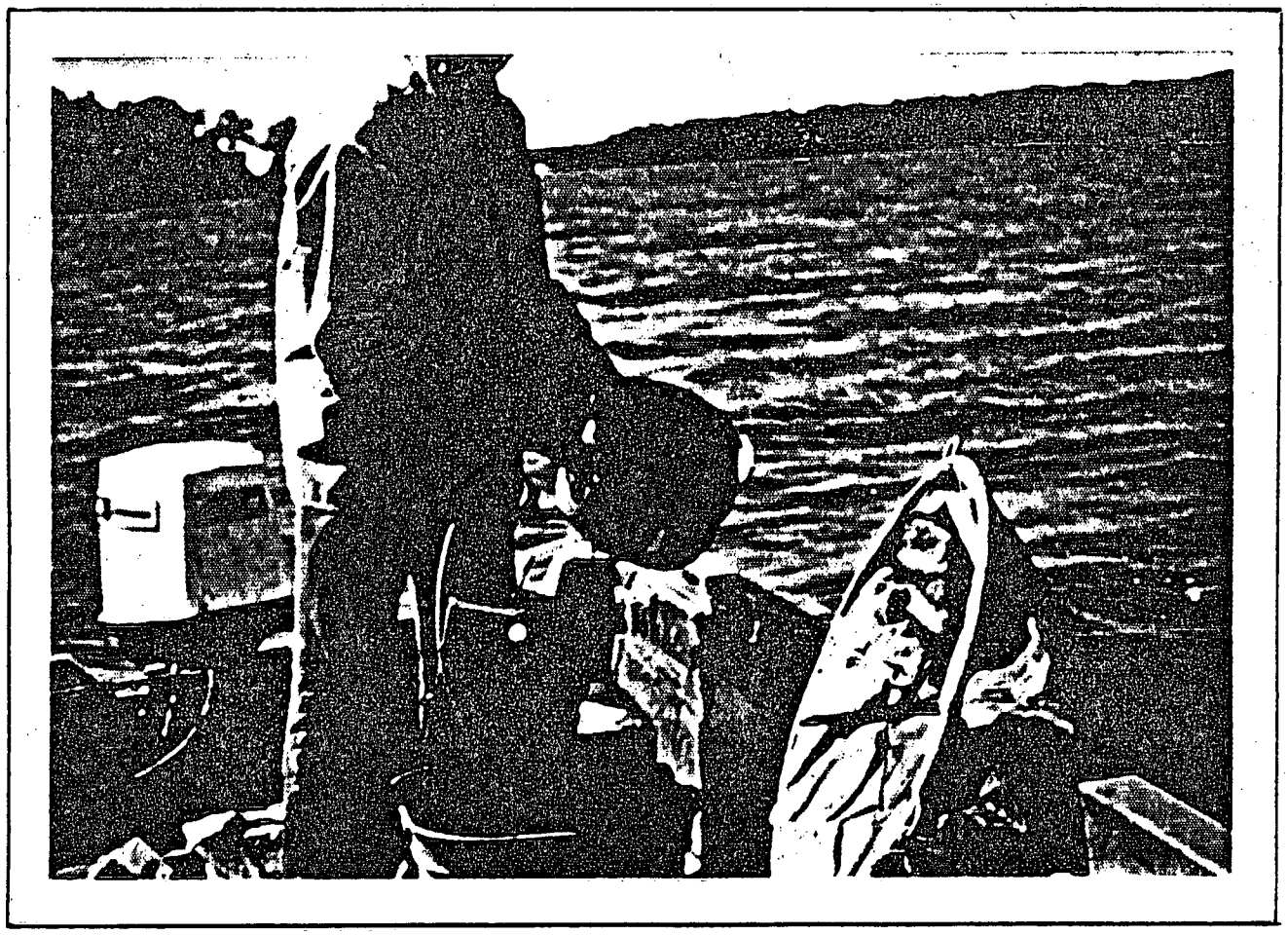
ON BOARD WHALER



Portable EBT used for temperature profiles.

Adoulphus Reach to east end Amherst Island.

DELL QUAY DORY HAYWARD LONG REACH



Ekman dredge, net and seive for collecting chronomids.

## PERSISTENT CONTAMINANTS

The purpose of the 1976 field year at Batchawana Bay was to conduct a preliminary study of contamination of the oligotrophic environment which exists there. Studies would provide a description of contaminant loadings with respect to their source, behaviour and transfer in the natural aquatic system. A cursory examination of the biotic community was also carried out.

The project leader was Dr. J. Kelso. Also present during the field season was GLBL technician, Bob Collins, a summer student and M.S.D. personnel Doug Greenway and a seaman assigned to the launch Aqua. Technical Operations personnel were present from May 1 until November 20.

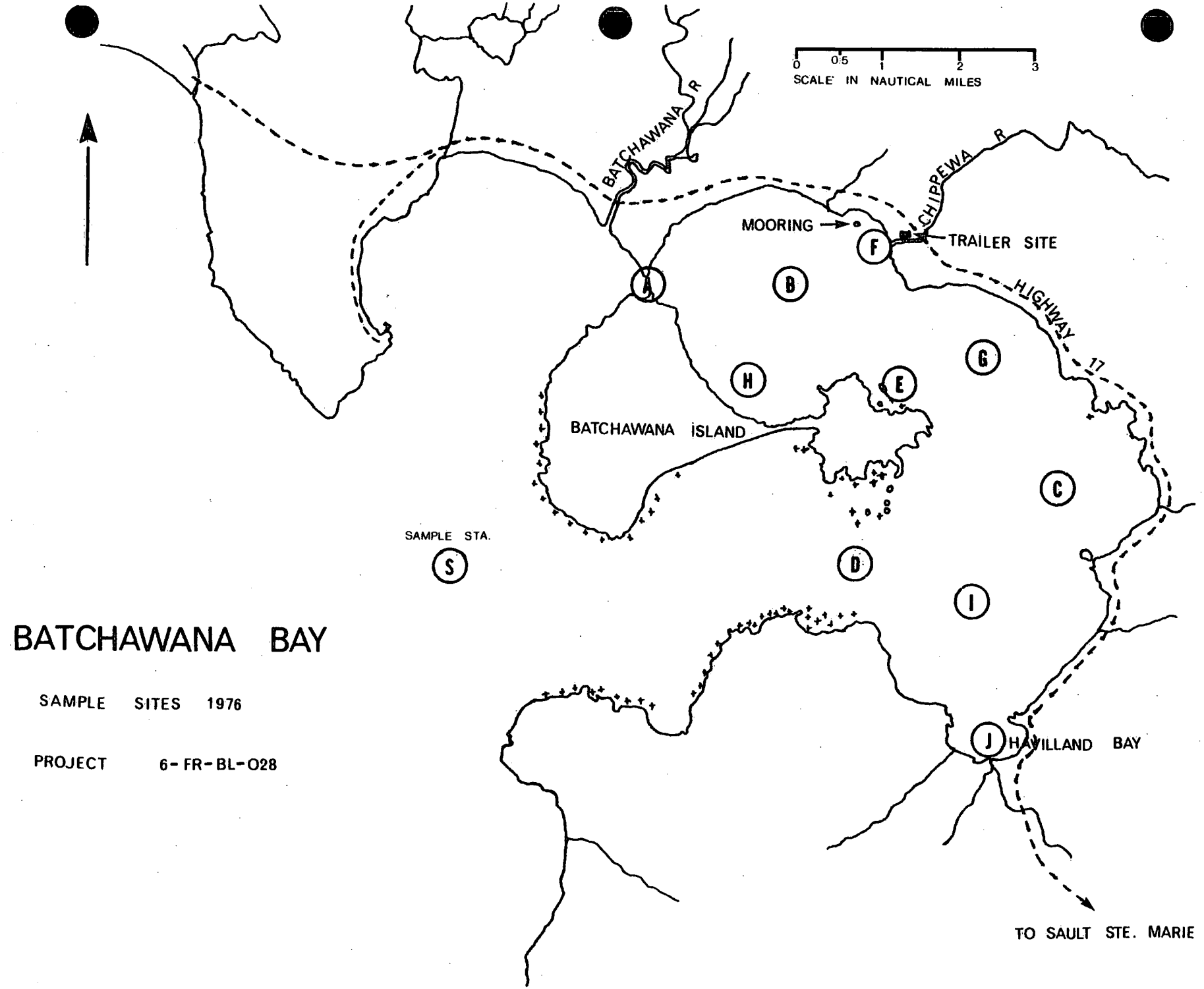
A field camp consisting of three mobile trailers was set up at the Chippewa River, on Batchawana Bay, from which the field work was done. These were used as a laboratory, storage, workshop and short-term living quarters. Sampling work was done from the CSL Aqua, two "Joe" boats and a 14 foot "cartopper".

Technical Operations staff were involved with such activities as:

- installation and maintenance of a solarimeter.
- collection of rainfall and dryfall matter.
- coring for both geological structure and benthic study.
- collection and preparation of macrophyte samples.
- zooplankton and phytoplankton were collected by both Shindler trap and by net hauls for various analyses.
- bottom fauna samples, including clams and crayfish, were collected using an Ekman Dredge.
- fish were captured using gill nets, and trawling from the Aqua using mid-water and bottom trawl nets.
- lines were run using acoustic sounding equipment to estimate number and distribution of fish in conjunction with trawling.
- during the field season a physical survey of the bay was done on a bi-weekly schedule.

- monthly a C-14 experiment was done to determine primary productivity in the bay.
- water samples were taken from stations in the bay for shipment to CCIW and analysis for PCB and water quality parameters.
- a complete survey of Batchawana Bay was done by Shipek for the Geolimnology Section of CCIW.
- one week was spent working with Ontario Ministry of Natural Resources on Black Bay, near Nipigon, using acoustic gear, to try and determine fish populations and distribution during the fall fishing season.

Taking all factors in account, the field season produced much useful information.




# BATCHAWANA BAY

SAMPLE SITES 1976

PROJECT 6-FR-BL-028

## PROJECT 6-IW-PR-004 - WETLANDS STUDY

(Dr. E. Murdoch)

The Wetlands of Lake St. Clair were studied during the 1976 field season and were to be supported monthly by Technical Operations personnel. The samples were collected for phosphate, mercury, trace metals and pesticides.

The four areas to be sampled were: Dover, Balmoral, St. Luke's and Walpole Island marshes. During the April collection period, samples were collected on the Dover, Balmoral and St. Luke's marshes. The Walpole Island marsh was sampled at a later date without Technical Operations support as an Indian guide was necessary since Walpole Island marsh is on an Indian reservation and the Band Council requested that a guide be used.

As it happened, the April sampling period was the only time Technical Operations support was required, as the Indian guide was used for support the rest of the year.

## PROJECT 6-IW-PR-041

## NATIONAL SEDIMENT SURVEY

6-IW-PR-041 (National Sediment Survey) was initiated to study, in depth, areas of Canada that had abnormally high concentration of various trace metals. The areas to be studied were chosen by using Geological Surveys of Canada's results from their National Grid Sampling Program.

Various areas of Ontario and Manitoba were sampled and the sediments collected were shared by CCIW with several other agencies. The areas sampled were Chalk River, Sudbury-Timagami, North Bay, Ontario and Flin Flon, Manitoba.

The first field trip had twofold purpose:

1) to test the CCIW Lightweight Corer (See Pg. 24-5) in gyttja and,
2) to core Perch Lake on the Atomic Energy Canada Limited property at Chalk River, for their Geological and Biological Departments.

The second field trip was a joint effort with the Geology Department of McMaster University, when 5 lakes were sampled in the Sudbury-Timagami area. This field trip was also a trial of the light-weight corer in different types of bottom sediments.

Having completed two field sampling programs and trials, several modifications to the corer were found necessary. The changes were made upon return to CCIW. The corer was then taken to North Bay, Ontario, for more sampling and trials. This time sampling was conducted off the floats of a DHC-2 Dehavilland Beaver aircraft.

Sampling from a float plane proved very successful. Three lakes were sampled in an hour, where it would have taken at least a day and a half by boat and land transport, due to distance and inaccessability of the lakes.

After very successful trials at North Bay, Ontario, a major sampling program was initiated in the Flin Flon, Manitoba area. The

program suffered a setback when the lightweight corer was lost in Kississing Lake, 60 miles northeast of Flin Flon. Due to the efforts of a contract diver from Flin Flon, with support by CCIW divers, the corer was recovered and 11 lakes in the area were sampled by plane (See Figure 2).

Technical Operations did all the collection, subdividing, freeze-drying, grinding to 100 mesh size and took the samples to Ottawa for contracted analysis. This was done as Dr. J.H.D. Williams, the project scientist, moved to Switzerland and requested that the work be completed by Technical Operations in his absence, under the direction of Dr. R.L. Thomas.

## PROJECT 6-IW-HR-034

## BLUFF EROSION STUDY

This project is a continuation of Project 5-IW-HR-034 and is scheduled to terminate in 1977.

The survey of the Lake Erie shoreline near Port Burwell studies the problem of steep, unstable fluffs and high erosion rates. Two types of slope failure are being examined in detail - deep rotational landslips, in which chunks of a bluff break free because of undercutting by waves, and rapidly receding gullies by surface water flow and ground water seepage.

### Personnel

| | | | |
|---|---|---|---|
| Mr. A. Zeman | - | Physical Scientist | - Physical Sedimentology Section, HRD |
| Mrs. L. Oelze | - | Technician | - Physical Sedimentology Section, HRD |
| Mr. M. R. Thompson | - | Officer-in-Charge | - Technical Operations Section, SSD |
| Mr. B. Mason | - | Summer Student | - Technical Operations Section, SSD |

Other personnel from Technical Operations Section, Hydraulics Research Division and Engineering Services supported the program on a intermittent basis.

### The Survey

In April, Canadian Hydrographic Service positioned two stakes within the 1975 survey for control points and chart orientation and alignment. Detailed contour maps covering approximately 850 m of shoreline were completed for publication by November (the 1975 map was adjusted for orientation). Two of the gullies surveyed and section of shore had eroded 50 m between surveys, while other areas were unaltered. Three moderately sized rotational landslips occured in August, September and November, after the surveying. After the August slide, a slight change in the slope of Borehole 2 was recorded by the slope indicator. All data is being analysed by Mr. A. Zeman.

Piezometers

From 19 December, 1975, to 23 July, 1976, piezometer data was recorded on punch tape. Due to a severe lightening storm and improper connections, on 23 July, five of the six piezometers were destroyed by an electrical charge and the recorder in the trailer was damaged. The piezometers were replaced in November and recording again in December.

Photologger

In September the Photologger was installed with Engineering assisting on the bluffs in Lot 22. Wind speed and direction recorders were installed by Technical Operations personnel for comparison to Photologger pictures. When the Photologger film was developed it was blurred and it was discovered the focus had not been changed to infinity. The Photologger is scheduled to be installed at the site in March, 1977, after winter trials at CCIW.

Shipek and Block Sampling Trials (includes Project 6-IW-HR-036)

Several undisturbed 3 $cm^3$ clay block samples were required for comparison of methods at CCIW. The two methods to be employed were sampling by hand digging and by using a hydraulic jack. The compressor for the hydraulic jack weighed approximately 200 kilograms and was water cooled. The Sea Truck was used to transport the equipment from Port Burwell to the sampling site, but unfavourable weather conditions prevented the Sea Truck from approaching the shore. Only one block sample was obtained by the hand digging method. Weather conditions also prevented the safe operating conditions required for Shipek sampling.

Sounding Lines

Sixteen sounding lines 50 m apart were scheduled to be run perpendicular to the shore with every fourth line to be sounded to 1 kilometre from shore and all other lines 500 m from shore. In July, one person from Shore Property Studies and Technical Operations personnel ran six sounding lines before electronic failure prevented the completion

of the soundings. In August, Shore Property Studies personnel ran all sixteen lines, but the data were misplaced during their move at CCIW in November

This study is helping scientists gain an understanding of the mechanisms which cause the collapse of some bluffs. Its conclusion will describe some causes of erosion and recession, recommend further work and discuss possible remedial measures.

## PROJECT 6-IW-SS-054

## BURLINGTON PIER

The Burlington Pier meteorological station was installed to collect wind speed and direction from May 15, 1969. Periodically maximum and minimum temperatures, and relative humidity, were obtained on an as-required basis. During IFYGL, two levels of water temperature were recorded at one and 9 metres.

### Data

Wind speed and direction are available in both printout and magnetic tape, from May 15, 1969 to January 12, 1977. Water temperature was intermittently recorded from 1971 to 1973.

## PROJECT 6-IW-HR-026

## LITTORAL DRIFT

### Personnel

| | | | |
|---|---|---|---|
| Dr. M. G. Skafel | - Project Leader | - Hydraulics Section, HRD |
| Mr. J. P. Coakley | - Co-researcher | - Physical Sedimentology Section HRD |
| M. B. F. White | - Electronic System Engineer | - Electronic Engineering Unit, ESS |
| Mr. M. R. Thompson | - Field Officer | - Technical Operations Section, SSD |
| Mr. J. T. Roe | - Head, Dive Unit | - Technical Operations Section, SSD |

The Littoral Drift Program includes Project 6-IW-HR-028 and is retrospective to the 1972-73 Beach Stability Program. The results were published in, "Beach Stability Investigations at Van Wagner's Beach, Western Lake Ontario", by J. P. Coakley (HRD) and H. K. Cho (Technical Operations).

### Purpose

The relationship between nearshore sediment transport rates and wave parameters is poorly defined, particularly in lakes where the process is complicated by seasonal water level changes. This project contributes to basic research on the wave-sediment interaction and provides information useful to shore erosion control and design of shore structures.

### Field Operations

In September, Technical Operations personnel surveyed a grid system and seventeen sounding lines were run perpendicular to Van Wagner's Beach. Two of the lines coincided with Mr. H. K. Cho's bathymetry work in 1972-73. A chart of the survey area was drawn for future comparison. The Canadian Hydrographic Service positioned two horizontal control points in the concrete support bases of two hydro towers near the survey, for current meter orientation and chart alignment.

By December, the Dive Unit had installed five towers; the three inside towers, one on sounding run seven 71.5 m from the base line, one 71.5 m from base line and 8 m 15 southeast of run 7 and the third 118.5 m from base line on line 7 contained current meter sensors and the last two 250 m from the base line, one on sounding run 7 and the other 15 southeast of run 7 contained wave probes. Cables were layed and buried from the instruments to the CCIW WAVES program trailer.

Engineering Service connected the cables to recorders located in the trailer and are responsible for subsequent system-design work during the winter 1976-77.

The towers and probes are scheduled to be removed in January, 1977, or when ice conditions are considered hazardous to instrument operations. At this time, a bathymetry survey will again be performed by Technical Operations personnel.

Summary

Development and testing of instruments and techniques for measuring currents and sediment transport in the surf zone took place in 1976 in preparation for field measurements at the nearshore experimental site, Van Wagner's Beach in 1977 (scheduled duration of three years).

## PROJECT 6-IW-AR-001

## KOOTENAY LAKE PROGRAM

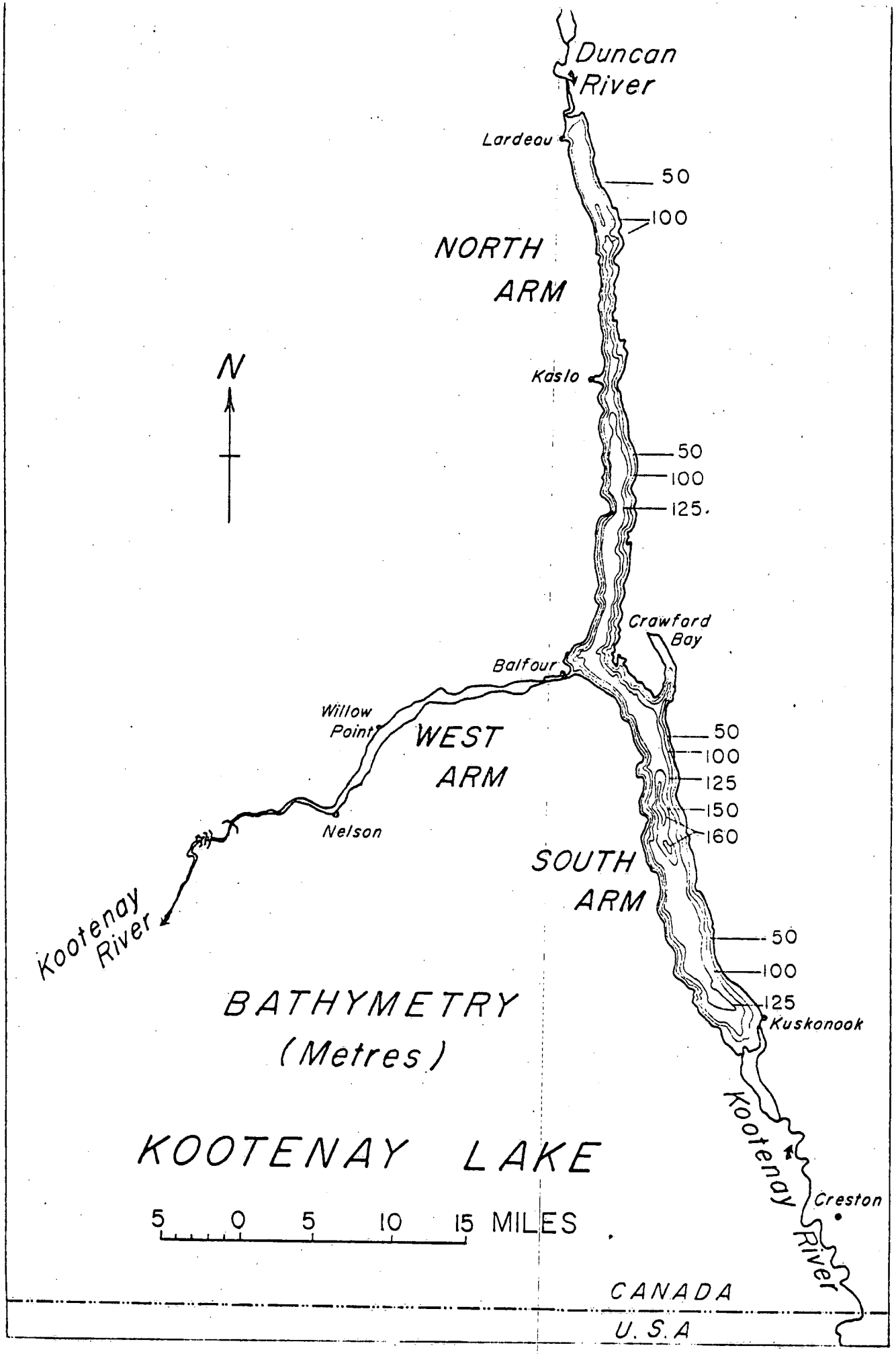
In the spring of 1976, Technical Operations Section, CCIW Central Region lent support to CCIW Western and Northern Region for their limnology program at Kootenay Lake, British Columbia. This support was given by way of technicians and equipment.

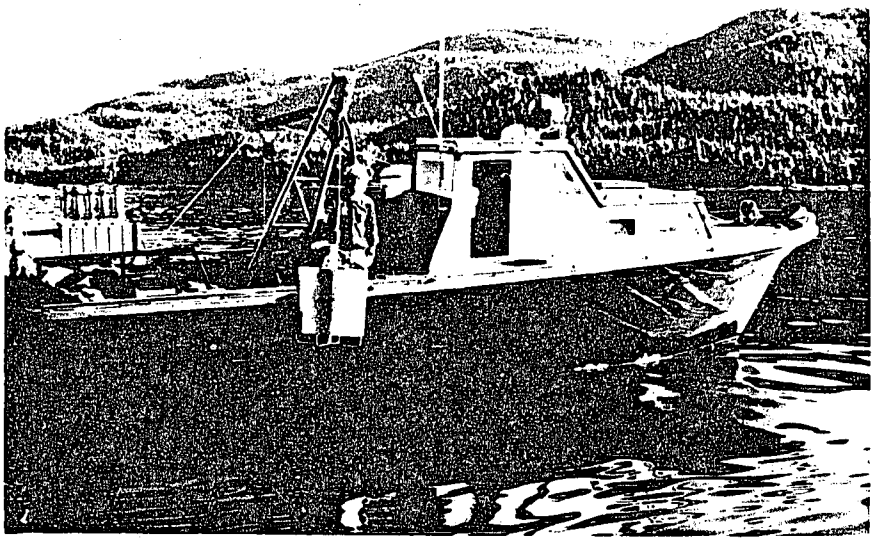
Two technicians were assigned to the Kootenay Program. Mr. L.E. Benner was seconded to that Region and remained in the field at the Kootenay site to coordinate and operate most field activities until termination of the support at the end of August. Mr. R.G. Chapil acted as liaison officer between the Regions. He coordinated all data, as well as the shipping and receiving of equipment required to support the automated sensor network systems that covered the lake.

Kootenay Lake is operated under an order of the International Joint Commission which controls the operating levels of the lake. Both the lake and Kootenay River are subject to the Boundary Water Treaty. Completion of the Libby Dam on the river in Montana, and to a lesser extent the Duncan Dam on the Duncan River in British Columbia, has substantially altered the natural pattern of flows in Kootenay Lake. The decrease in freshet flows will have definite effects on the limnology of the lake, including physical circulation, thermal characteristics, turbidity, chemistry and microbiology.

The two to three year study undertaken by CCIW Western and Northern Region will assess these factors, as well as the input of pollutants. It will also attempt to obtain the basic information and understanding necessary to assess future water management including the potential for future diversion under the Columbia River Treaty and a possible change in the method of lake operation.

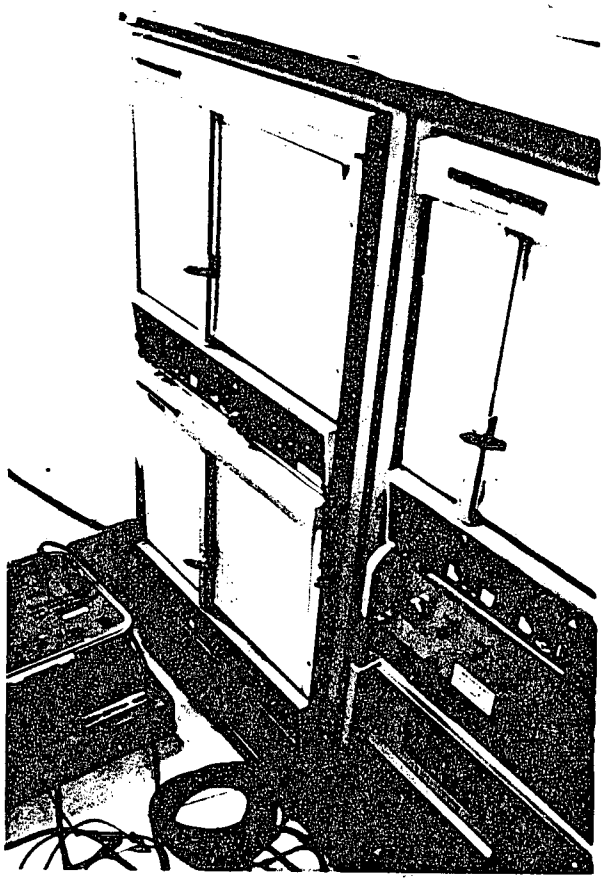
See following chart and photographs, taken from "Kootenay Lake Field Report, 1976" by L.E. Benner.


Duncan River
Lardeau
50
100
NORTH ARM
N
Kaslo
50
100
125
Crawford Bay
Balfour
Willow Point
WEST ARM
50
100
125
150
160
Nelson
SOUTH ARM
Kootenay River
50
100
125
Kuskonook
BATHYMETRY
(Metres)
KOOTENAY LAKE
Kootenay River
Creston
5 0 5 10 15 MILES
CANADA
U.S.A



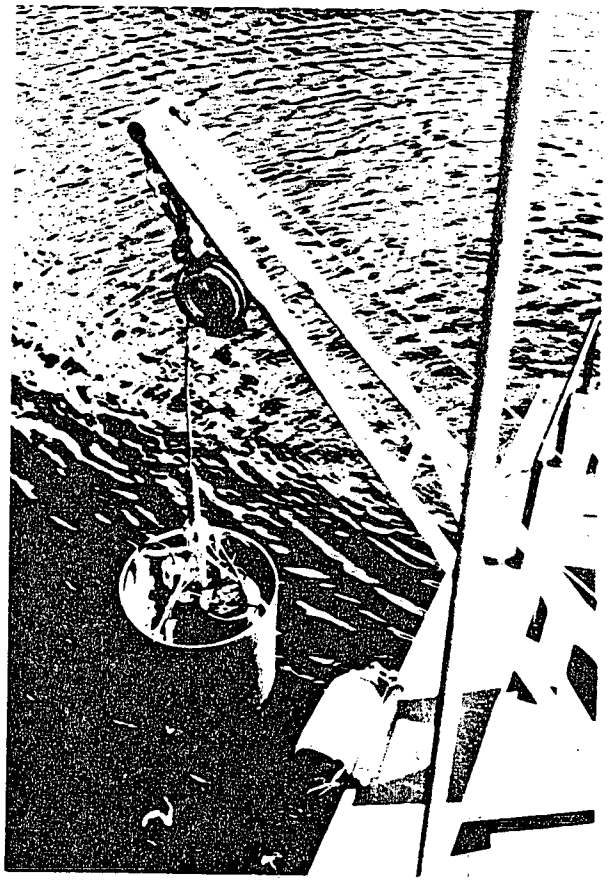
Temperature, Depth, Turbidity, Conductivity ( T.T.C. ) System

(17)



T.T.C. Recorders

(18)



T.T.C. System Sensors

(19)