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INTERNATIONAL REFERENCE GROUP ON GREAT LAKES POLLUTION FROM LAND USE ACTIVITIES

INTERNATIONAL JOINT COMMISSION

INVENTORY OF LAND USE AND LAND USE PRACTICES VOLUME III - CANADIAN LAKE HURON BASIN

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INVENTORY OF LAND USE AND LAND USE PRACTICES IN THE CANADIAN GREAT LAKES BASIN

REPORT OF THE INTERNATIONAL REFERENCE GROUP ON GREAT LAKES POLLUTION FROM LAND USE ACTIVITIES

VOLUME III
CANADIAN
LAKE HURON BASIN

DECEMBER, 1977

INVENTORY OF LAND USE AND LAND USE PRACTICES IN THE CANADIAN GREAT LAKES BASIN with Emphasis on Certain Trends and Projections to 1980, and Where Appropriate, to 2020.

To be used as portion of the Canadian Task B Report on GREAT LAKES POLLUTION FROM LAND USE ACTIVITIES BY the International Joint Commission.

ACKNOWLEDGEMENTS

This report was assembled by many people working on the Canadian portion of the Task B Study planned through the Pollution From Land Use Activities Reference Group (PLUARG) of the International Joint Commission.

Canadian participants included:

Mr. John Batteke, Environment Canada
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The material for these reports was assembled from existing census and other data available in 1972 - 1975.

Five volumes were prepared, one each for Lakes Superior, Huron, Erie and Ontario, and a summary volume for the Canadian portion of the Great Lakes Basin.

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PREFACE

As its title suggests, this volume presents an Inventory of Land Use and Land Use Practices in the Canadian Great Lakes Basin, with emphasis on certain trends and projections to 1980 (and to 2020 where appropriate). The report integrates several studies by contractors and sub-contractors. These studies were part of the Canadian Task B effort for the Great Lakes Pollution from Land Use Activities Reference Group, International Joint Commission.

The Task B report for the Canadian part of the Great Lakes Basin is contained in five volumes:

Volume	I	Canadian Great Lakes Basin Summary
Volume	II	Lake Superior Basin
Volume	III	Lake Huron Basin
Volume	IV	Lake Erie Basin
Volume	V	Lake Ontario Basin

Knowledge of present and future land use and land use practices are important as background for evaluating and controlling non-point sources of water pollution. This report describes and quantifies, as appropriate, the Canadian Great Lakes Basin's geology, soils, minerals, climate, surface and ground water, vegetation, wildlife, and economic and demographic characteristics. It inventories available information on waste disposal operations, lakeshore and riverbank erosion, high-density non-sewered residential areas and recreational land uses, as well as materials application of agricultural chemicals, fertilizers, animal wastes and salts on highways. Finally, future trends and projections are shown for the above categories.

This Canadian Great Lakes Basin Summary and each of the four Canadian lake basin volumes have been reviewed by Joint Task Group B, whose comments were considered before approval for final report development. This study forms a Canadian contribution to the Task B effort of the Study on Great Lakes Pollution from Land Use Activities.

The study discussed in this report was carried out as part of the efforts of the Pollution from Land Use Activities Reference Group, an organization of the International Joint Commission, established under the Canada-U.S. Great Lakes Water Quality Agreement of 1972. Findings and conclusions are those of the author(s) and do not necessarily reflect the views of the Reference Group or its recommendations to the Commission.

SUMMARY

PHYSICAL FABRIC

The Canadian portion of the Lake Huron drainage basin has a land area of 8,592,778 ha (21.2 million acres). The northern portion of the basin lies within the Canadian Shield formation, while the southern part is underlain by the relatively flatlying sedimentary bedrock of the Paleozoic Era. Sandy till covers most of the northern part. However, south of the Canadian Shield the soil are deep fertile clays, loams and sands on varying topography. The climate is mid-continental, modified by the presence of Lake Huron. Approximately 75 percent of the Canadian Lake Huron Basin is forested, while the remainder is agricultural, mainly pasture land. Mining is particularly important in the northern sub-basins.

MAJOR LAND USES

In the Mississagi and Spanish-French Sub-Basins and the Canadian Shield portion of the Muskoka-Severn Sub-Basin, forest is the dominant land use. However, in the south, in the Saugeen-Maitland Sub-Basin, most of the land is used for agriculture. A relatively large amount of land in the Spanish-French and Muskoka-Severn Sub-Basins is used for outdoor recreation.

SPECIALIZED LAND USES

Seventy-one of the eighty-nine tailings disposal sites in the Canadian portion of the Lake Huron Basin are located in the Spanish-French Sub-Basin. There are 460 active waste disposal sites in the Canadian Lake Huron Basin which cover a land area of about 3500 ha (8650 acres) and receive 6,000 t/d waste (13.2 million lb/d). Dredge spoil disposal amounts to about 25,000 m^3 (32,700 yd^3) annually. As the northern shoreline is primarily bedrock, lakeshore erosion is confined mainly to the southern shores. About 15 percent of the intensive livestock operations in the Great Lakes Basin are located in the Canadian Lake Huron Basin. There are 440 high density, non-sewered residential areas containing a total of about 252,500 persons.

MATERIALS USAGE

Pesticide, fertilizer, salt usage and road de-icing in the Canadian portion of the Lake Huron Basin are virtually confined to the Muskoka-Severn and Saugeen-Maitland Sub-Basins. About 850 t/a (1.9 million lb/a) of pesticides are applied to agricultural lands. Annual nutrient contributions from fertilizers and manures include 70,000 t nitrogen (154 million lb); 44,200 t phosphorus (P_2O_5) (97 million lb); and 65,900

t potassium (K_2O) (145 million lb). It is estimated that approximately 274,000 t salt (603 million lb) are used on roads in the Canadian Lake Huron Basin in an average winter.

FUTURE TRENDS

Population in the Canadian portion of the Lake Huron Basin is expected to nearly double over the forecast period, from 937,769 in 1971 to 1,752,337 in 2021. Total economic output is projected to increase from 3,586.94 (millions of 1961 dollars) in 1972 to 29,041.36 in 2020. The overall land use pattern is not forecast to change drastically in the next 50 years. More urban and recreational land, and less farmland and forest, are projected. However, these net land use changes will involve only eight percent of the total land area in the Canadian Lake Huron Basin. The future pattern and extent of specialized land uses in the Canadian Lake Huron Basin will be more a function of interacting social, technological and legislative factors than of population and economics. The mass of materials applied to the land to increase its productivity or to facilitate rapid transportation, will continue to grow.

INTRODUCTION

INTRODUCTION

The Boundary Waters Treaty (1909) states, in part, that the boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health and property on the other side. In accordance with this treaty and the Water Quality Agreement of 1972, the governments of Canada and the United States requested that the International Joint Commission conduct a study on pollution of the boundary waters of the Great Lakes System by agriculture, forestry and other land use practices.

Studies completed during 1969 demonstrated that diffuse land drainage sources of pollutants were not only significant, but also were difficult to measure. As a result of those findings, the International Joint Commission called upon the International Reference Group on Great Lakes Pollution from Land Use Activities to provide a better definition of the impact of land use activities, practices and programs on water quality in the Great Lakes.

DETAILED STUDY PLAN

The February 1974 Detailed Study Plan emphasized four main tasks:

TASK A - assessment of problems, management of programs and research, and the attempt to set priorities in relation to the best information now available on the effects of land use activities on water quality in boundary waters of the Great Lakes.

TASK B - inventory of land use and land use practices, with emphasis on certain trends and projections to 1980 and, if possible, to 2020.

TASK C - intensive studies of a small number of representative watersheds, selected and conducted to permit some extrapolation of data to the entire Great Lakes Basin and to relate contamination of water quality which may be found at river mouths on the Great Lakes to specific land uses and practices.

TASK D - diagnosis of the degree of impairment of water quality in the Great Lakes, including assessment of concentrations of contaminants of concern in sediment, fish and other other aquatic resources.

PURPOSE

The objectives of TASK B were: 1) to provide information on the physical fabric of the Great Lakes Basin, including soils and their capability

hydrology, geomorphology, climate, mineral and gas resources, and broad vegetation zones; 2) to provide a general land use inventory of the Great Lakes Basin; 3) to provide specific information concerning the nature and location of defined specialized land use categories in the Great Lakes Basin; 4) to provide an inventory of various materials applied to land which may influence the quality of drainage waters; and 5) to provide a consistent and comprehensive set of forecasts for 1980 and 2020 relating to land uses and land use activities based upon socioeconomic, technological and political development.

1 PHYSICAL FABRIC

CANADIAN PORTION OF THE LAKE HURON DRAINAGE BASIN

Lake Huron is the fifth largest freshwater lake in the world, and the second largest of the Great Lakes. The Canadian portion of the Lake Huron Basin has a land area of 8,592.778 ha (21.2 million acres). For purposes of this report, the Canadian Lake Huron Basin has been divided into four major river basin groups: 1) Sub-Basin 4, the Mississagi River; 2) Sub-Basin 5, the Spanish-French Rivers; 3) Sub-Basin 6, the Severn-Muskoka Rivers; and 4) Sub-Basin 7, the Saugeen-Maitland Rivers. The boundaries of these four sub-basins are illustrated in Figure 1.

LAND RESOURCES

GEOLOGY

The Mississagi and Spanish-French Sub-Basins, and the Muskoka portion of the Severn-Muskoka Sub-Basin, lie within the geologic formation known as the Canadian or Precambrian Shield (over 500 million years old). At one stage in its development, the shield was extremely rugged and mountainous. However, through millions of years of erosion, predominantly by ice and water, it has been reduced to a relatively flat surface. Through uplifting and faulting, the original igneous and sedimentary rock has been altered to metamorphic rock.

The rest of the Canadian Lake Huron Basin is underlain by relatively flatlying sedimentary bedrock of the Paleozoic Era. This southern portion of the Basin is further divided into two parts by the Niagara Escarpment. East of the Escarpment, the bedrock strata are predominantly limestone as one progresses toward the Precambrian Shield, while they are predominantly shale toward the Escarpment. Above the Escarpment, in the Bruce Peninsula the bedrock is predominantly dolomite. Toward the south, in the Saugeen-Maitland Sub-Basin, it is mostly limestone.

SOILS AND TOPOGRAPHY

Sand-textured soils are located throughout most of the Mississagi and the Spanish-French Sub-Basins. With the exception of some clay deposits, sandy till covers most of these two sub-basins. The soils are generally quite shallow, although there are some deeper soils in the clay areas.

South of the Precambrian Shield, in the Severn portion of the Severn-Muskoka Sub-Basin, and in the Saugeen-Maitland Sub-Basin, the soils are deep fertile clays, loams and sands.

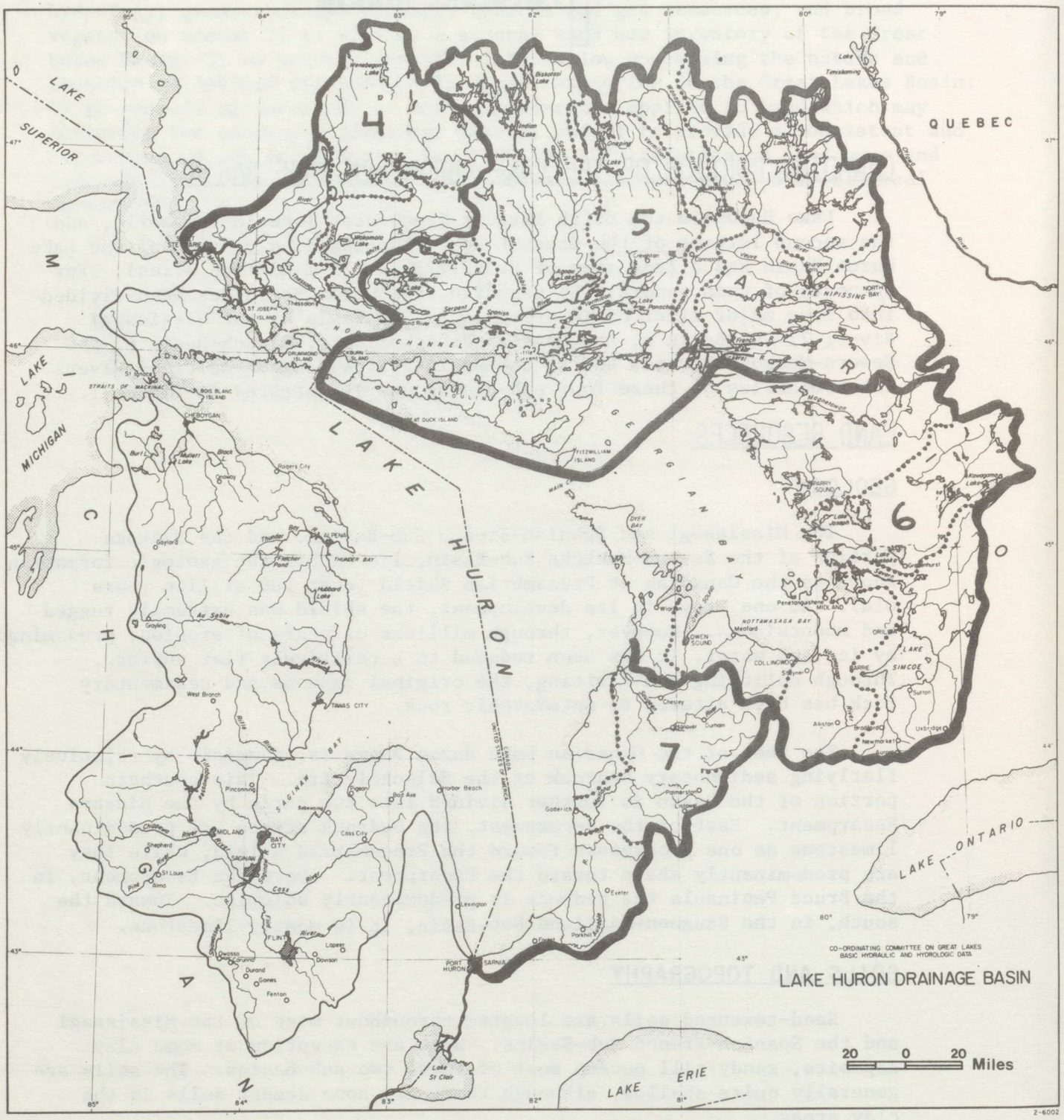

FIGURE 1: CANADIAN PORTION OF THE LAKE HURON BASIN

The topography of the Canadian Lake Huron Basin is very complex. In the southwest section, an undulating to rolling clay loam plain covers portions of Lambton, Middlesex, Huron, Perth and Bruce counties. Also present are scattered sandy areas formed by glacial lake beaches. The Bruce Peninsula and Manitoulin Island have shallow soils over limestone bedrock. Simcoe country is made up of undulating sand and sandy loams.

CLIMATE

The climate of the Canadian Lake Huron Basin varies markedly from south to north. The Basin has warm summers, with frequent periods of hot, humid, tropical air from the Gulf of Mexico. In winter, arctic air dominates the region, with mean daily temperatures below freezing for three to six months.

In addition to moderating temperatures, Lake Huron is responsible for the heavy snowfalls experienced in the area around Georgian Bay and the southern shoreline of Lake Huron. This "lake effect" occurs when cold arctic air moves southward over the open lakes in early winter. Convection produces clouds, as well as snowfall averaging more than 250 cm/a (98 in/a) in the Georgian Bay and southern Lake Huron Sub-Basins.

The growing season is sufficiently long and the soils sufficiently deep to support agriculture in the southern part of the basin and on Manitoulin Island. However, in the northern part of the basin, the soils are poorer and the growing season is shorter.

Annual precipitation ranges from 98 cm (39 in) in the Muskoka area to 68 cm (27 in) in the Dundalk Upland.

HYDROLOGY

SURFACE WATER

The watershed divisions of the Canadian portion of the Lake Huron Basin are presented in Table 1. Together with the Spanish River, the Mississagi River Sub-Basin drains the majority of the area between the Great Lakes/Hudson Bay Divide and the North Channel of Lake Huron. As with all the Canadian Shield catchments, the Mississagi River Sub-Basin contains a substantial percentage of standing water and swamp land.

The Spanish and Serpent River watersheds are also dominated by open water and swamp. The French River system drains into a complex of islands in northern Georgian Bay within which it is joined by its major tributary, the Wanapetei River. The French River itself, draining Lake Nipissing into Georgian Bay, is rather short. In turn, Lake Nipissing receives drainage primarily from the Sturgeon River, which, with its numerous tributaries, drains the entire northern area of the French River watershed.

A substantial portion of the Severn River System is attributable to the surface area of Lake Simcoe. The Severn itself is a relatively short river draining Lake Simcoe, via Lake Couchiching, through rough

Shield topography to Georgian Bay. Tributary to the Severn River are a number of small rivers draining the Precambrian area in the northeast portion of the sub-basin. The Muskoka-Moon River system drains several popular tourist lakes, including Lake Joseph, Muskoka Lake and Lake of Bays. Near its outlet, the Muskoka River also bears the name Go Home River, originating at a widening of the Muskoka River known as Go Home Lake.

The Saugeen River watershed is the largest catchment to flow directly into the Canadian portion of Lake Huron. This sub-basin drains in a westerly direction, rising on the dip slope of the Niagara Escarpment where it has a common boundary with the Nottawasaga, Beaver, Bighead and Sydenham River Systems. The Maitland River System has no unique source. The central and eastern portions of this watershed drain an area characterized as till plain. Drainage is frequently poorly defined in the southern part of this watershed due to shallow ground moraine, and in the northern part because of an abundance of abandoned spillway valleys.

TABLE 1

LAKE HURON WATERSHED DIVISIONS

	CODE
Sub-Basin 4: Mississagi River	
Garden and Thessalon Rivers	2CA
Mississagi River	2CC,2CB
Sub-Basin 5: Spanish-French Rivers	
Serpent and Blind Rivers	2CD
Spanish and Whitefish Rivers	2CD,2CF
Manitoulin Island	2CG
French River	2DA,2DB,2DC,2DD
Sub-Basin 6: Muskoka-Severn Rivers	
Magnetawan River and East Georgian Bay	2EA
Muskoka River	2EB
Severn River	2EC
Nottawasaga River	2ED
Bruce Peninsula and southwestern Georgian Bay	2FA,2FB
Sub-Basin 7: Saugeen-Maitland Rivers	
Saugeen River	2FC
Minor Lake Huron watersheds	2FD
Maitland River	2FE
Au Sable River	2FF

GROUND WATER

Ground water is present throughout most of the Lake Huron Basin. Aquifers are generally better in the southern part of the basin than in the Canadian Shield portion in the northern part of the basin.

VEGETATION ZONES AND WILDLIFE

Approximately 21 percent of the Canadian portion of the Lake Huron Basin has been cleared of its natural forest cover and is currently used for agricultural purposes. This farmland is largely confined to the southern portion of the basin.

About three-fourths of the agricultural land in the Canadian Lake Huron Basin is pasture, and one-fourth cropland.

The Great Lakes-St. Lawrence Forest Region covers 75 percent of the Canadian Lake Huron Basin. This area is characterized by a mixed forest consisting of eastern white and red pines, eastern hemlock and yellow birch. Common to this region are such species as sugar maple, red maple, red oak, basswood and white elm. Other wide-ranging species are the eastern white cedar and largetooth aspen, and to a lesser extent beech, white oak, butternut and white ash. Boreal species, such as the white and black spruces, balsam fir, jack pine, trembling aspen, balsam poplar and white birch, are intermixed.

DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

POPULATION

The Canadian portion of the Lake Huron Basin had a population of 937,769 in 1971. It was distributed among the four major sub-basins as follows: Mississagi, 101,272; Spanish-French, 267,583; Severn-Muskoka, 401,934; and Saugeen-Maitland, 166,980.

In addition, the Canadian Lake Huron Basin contains much of Ontario's resort area, attracting a large seasonal population in the summer months.

RESOURCE USE AND DEVELOPMENT

Table 2 presents economic statistics for the Canadian portion of the Lake Huron Basin. The land-based industries of agriculture, forestry and fisheries contribute relatively small amounts to the total economic output. Mining is particularly important in the Spanish-French Sub-Basin. Nearly half of the economic activity in the Canadian Lake Huron Basin is located in the Muskoka-Severn Sub-Basin.

TABLE 2

ECONOMIC ACTIVITY IN THE CANADIAN PORTION OF THE LAKE HURON BASIN, 1972

Real Domestic Product by Major Industrial Group
(millions of 1961 Canadian dollars)

Industry	Mississagi (Sub-Basin 4)	Spanish-French (Sub-Basin 5)	Muskoka-Severn (Sub-Basin 6)	Saugeen-Maitland (Sub-Basin 7)	Total Canadian Lake Huron Basin
Agriculture	0.70	0.99	20.37	13.79	35.85
Forestry	2.79	6.62	2.53	1.03	12.97
Fisheries	0.08	0.08	0.76	0.30	1.22
Mining	2.53	404.63	37.17	14.33	458.66
Manufacturing	161.98	157.46	687.75	254.02	1,261.21
Construction	15.07	53.91	97.41	47.16	213.55
Transportarion Utilities Trade and Other	133.18	362.56	848.97	304.07	1,648.78
Total Output, All Sectors	316.33	986.25	1,694.96	634.70	3,632.24

AGRICULTURE

Most of the agriculture in the Canadian portion of the Lake Huron Basin takes place in the Saugeen-Maitland Sub-Basin and the southern part of the Severn-Muskoka Sub-Basin. The agriculture is varied, and includes the growth of beef cattle, hogs and poultry, winter wheat, spring grains, grain corn, hay and pasture.

Beef cattle are produced in the Bruce Peninsula and Manitoulin Island. However, the industry is limited by drought conditions and shallow, stoney soils. Potatoes are grown near Alliston and Lafontaine in Simcoe County. Tobacco is grown in the Alliston and New Lowell area, while apples and canning crops are grown around Collingwood.

There is very little agricultural activity in the Mississagi and the Spanish-French Sub-Basins. Most of the agricultural land in the Canadian Lake Huron Basin (approximately 88 percent) is located in the Severn-Muskoka and Saugeen-Maitland Sub-Basins.

FORESTRY

The forest industry in the Canadian portion of the Lake Huron Basin is concentrated in the northern portion, where the land is unsuited for agriculture. The forest industry is comprised of pulp and paper mills, sawmills, veneer, particleboard and waferboard plants.

It appears that the total allowable acreage to be cut will soon be reached in the basin. However, the industry will still be hard pressed to meet the demand for wood-derived products. Some of the problems to be faced in attempting to meet the demand are access to the forest regions, regeneration of trees, insects and disease, and the degree of technological development in wood extraction and processing. Changes in utilization of the forest resource are closely linked with technological innovations in manufacturing processes.

MINING

The mining industry has been the major basis for economic growth in the Mississagi and Spanish-French Sub-Basins for more than a century. The mineral industry directly supports the major communities of the northern Canadian Lake Huron Basin and contributes to the support of smaller communities, through purchases of goods and services.

The single most important source of mineral products is the Sudbury Area, in the Spanish-French Sub-Basin, where nickel-copper ores also yield gold, silver, platinum-group metals, cobalt, selenium, tellurium and iron ore. By-product sulphur is used to manufacture sulphuric acid and other chemicals. Sudbury produces 70 percent of Canadian nickel as well as 43 percent of the free world's production of this element.

The Canadian Lake Huron Basin possesses about 17 percent of the free world's uranium reserves, located primarily at Elliot and Agnew Lake. These reserves are currently estimated at 216,900 t (477 million lb).

The high level of mining activity in the northern Canadian Lake Huron Basin may have a detrimental effect on the water quality in the area. Surface mining results in large areas being stripped of their natural vegetation, making them susceptible to erosion. Further, the runoff from mines and their waste disposal sites is often acidic.

RECREATION

An evaluation of recreation in the Canadian portion of the Lake Huron Basin was done on the basis of land capability. Capability for intensive recreation was derived from the Canada Land Inventory. Capability for extensive or dispersed recreation was determined by relating water patterns and topography.

The Lake Nipissing area is outstanding in terms of intensive recreation because of sand beaches, excellent angling, ski hills and excellent scenery. The Collingwood-Huronia area also has a high concentration of high capability, intensive recreation sites.

The Killarney Highlands-North Channel area has a very high capability for extensive recreational use. Other major areas with outstanding capability for extensive recreation include the Niagara Escarpment, the Georgian Bay-Parry Sound shoreline and the Muskoka Lakes.

SOURCE MATERIALS

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2 MAJOR LAND USES

INTRODUCTION

The land use classification scheme used in this report is described below, followed by presentation of results. A discussion of methodology is presented in Appendix A of Volume I in this report series.

LAND USE CLASSIFICATION SYSTEM

INTRODUCTION

The factors taken into consideration during the development of the classification system are as follows: 1) nature of the data required; 2) data collection methodologies available; 3) cost of data acquisition; 4) comparability of the data from both countries; and 5) timeliness of information.

The fact that the land use data were to be used in studies related to water quality dictated that land use categories should be different with respect to water runoff, types of pollution, degree of pollution, etc. The categories used in the inventory of the Canadian portion of the Lake Huron Basin land are defined in Table 3.

TABLE 3

LAND USE CLASSIFICATION DEFINITIONS

URBAN - Land used for residential, commercial, industrial or institutional purposes.

Residential - Land used for residential purposes. Single and multiple dwelling units in the built-up portions of cities and towns were included. Areas of urban sprawl, such as country estates and strip residential developments, were also included.

Low density residential - Land used for residential purposes which had 10 percent or less man-made surface ground cover. This category included, for example, strip residential and country estates.

Medium density residential - Land used for residential purposes which had 10 to 25 percent man-made surface ground cover. This category included, for example, urban fringe subdivision-type developments.

High density residential - Land used for residential purposes which had greater than 25 percent man-made surface ground cover. Included in this category were downtown housing and apartment buildings. Note: although some apartment buildings may have had less than 25 percent man-made surface ground cover, they were included in the high density category due to the high population density within the building.

Commercial - Industrial - Land used for commercial, industrial or institutional purposes. The entire area occupied by the establishment was included, such as surrounding grounds, storage sheds, parking lots, etc.

Low density commercial - industrial - Land used for commercial, industrial or institutional purposes which had 10 percent or less man-made surface ground cover.

Medium density commercial - industrial - Land used for commercial, industrial or institutional purposes which had 10 to 25 percent man-made surface ground cover.

High density commercial - industrial - Land used for commercial, industrial or institutional purposes which had greater than 25 percent man-made surface ground cover.

Transportation - Land used for transportation facilities such as rail yards, highway interchanges, airports and airstrips.

EXTRACTIVE - Land used for the extraction of earth materials, including open pit mines, strip coal mines, commercial mineral excavations, commercial topsoil removal operations, etc. Idle land held in reserve was included in this category.

SLAG HEAPS - Land used for commercial dumping of mine tailings, chemicals and slag. This category was of particular significance in the Sudbury area.

OUTDOOR RECREATION - Land used for private or public outdoor recreation. This category included such land use types as developed national, provincial, municipal, city and private parks, wildlife sanctuaries, historical sites, race tracks, golf courses, drive-in theatres, marinas and cemetaries.

AGRICULTURE -

Orchards, Vineyards, Horticulture, Fur and Poultry Operations - Land used for the production of tree fruits and grapes, vegetables and small fruits, and large scale fur farms and poultry operations.

Cropland - Land used for the production of annual crops such as grain, tobacco or sugar beets.

Improved Pasture - Land used for pasture or for the production of hay and other fodder crops. To qualify as improved, a pasture had to exhibit some evidence of cultivation.

Unimproved Pasture - included grasslands, such as natural range, and areas of sedges and herbaceous plants. Brush scrub and mature trees up to a maximum cover of 25 percent of the total area was included in this category.

FOREST - Land bearing forest, short trees or bushes where the tree cover exceeded 25 percent of the total area was included in this category.

MARSH & SWAMP - Open wetlands of all types were included in this category.

BARREN - Land which did not support vegetation. Examples included sand flats, barren rock, alkali flats, etc.

RESULTS

SUB-BASIN 4: MISSISSAGI RIVER

Sub-Basin 4 contains two major watersheds: the Garden and Thessalon Rivers and the Mississagi River.

The major land uses of the Mississagi Sub-Basin and the smaller watersheds are presented in Table 4. The dominant land use in this sub-basin is forest, occupying 95 percent of the sub-basin area.

In the Garden and Thessalon Rivers watershed there are about 4,000 ha (9,900 acres) of urban land. There is only about 300 ha (740 acres) in the Mississagi River watershed. Extractive uses occupy small amounts of land in both watersheds, totalling about 100 ha (250 acres).

Only 1,500 ha (3,700 acres) of land in this sub-basin are used for outdoor recreation. Agriculture is limited by the shallow soils of the Canadian Shield. However, it still occupies about 48,000 ha (119,000 acres), 99 percent of which is pasture.

SUB-BASIN 5: SPANISH-FRENCH RIVERS

Sub-Basin 5 contains four major watersheds: Serpent and Blind Rivers; Spanish and Whitefish Rivers; Manitoulin Island; and the French River. Major land uses in each of these watersheds and the total sub-basin are presented in Table 5.

Forest covers 92 percent of the sub-basin. Urban areas with populations greater than 25,000 are present in the Spanish and Whitefish Rivers watershed and in the French River watershed, occupying about 6,500 ha (16,000 acres). Urban areas with populations less than 25,000 about 13,000 ha (32,000 acres), bringing the total urban land in the sub-basin to approximately 19,500 ha (48,000 acres), 0.5 percent of the sub-basin land area.

TABLE 4

MAJOR LAND USES IN THE MISSISSAGI SUB-BASIN
(SUB-BASIN 4)

Land Use	Garden and Thessalon Rivers	Mississagi River	Total Sub-Basin
		Hectares (ha)	
Urban Areas > 25,000 pop.			
Commercial-Industrial			
Low Density	42	0	42
Medium Density	87	0	87
High Density	689	0	689
Total Com.-Indust.	818	0	818
Residential			
Low Density	392	0	392
Medium Density	1471	0	1471
High Density	154	0	154
Total Residential	2017	0	2017
Transportation	33	0	33
Total Urban > 25,000	2,868	0	2,868
Urban Areas < 25,000 pop.	1,014	293	1,307
Total Urban Areas	3,882	293	4,175
Extractive			
Extractive	85	23	108
Slag Heaps	0	0	0
Total Extractive	85	23	108
Outdoor Recreation	1,283	205	1,488
Agriculture			
Orchards, Hort., etc.	0	0	0
Cropland	236	101	337
Improved Pasture	27,700	5,317	33,017
Unimproved Pasture	10,858	3,754	14,612
Total Agriculture	38,794	9,172	47,966
Forest	288,148	876,698	1,164,846
Marsh and Swamp	1,980	684	2,664
Barren	910	0	910
Total Watershed Land Area	335,082	887,075	1,222,157

acres = hectares (ha) x 2.471
Taken from Land Management Information Systems/Lands Directorate
Environment Canada/Data Source C.L.I. and C.C.R.S. Maps

TABLE 5

MAJOR LAND USES IN THE SPANISH-FRENCH SUB-BASIN
(SUB-BASIN 5)

Land Use	Serpent and Blind Rivers	Spanish and White-fish Rivers	Manitoulin Island	French River	Total Sub-Basin
			Hectares (ha)		
Urban Areas > 25,000 pop.					
Commercial-Industrial					
Low Density	0	0	0	0	0
Medium Density	0	146	0	29	175
High Density	0	1,042	0	499	1,541
Total Com.-Indust.	0	1,188	0	528	1,716
Residential					
Low Density	0	383	0	115	498
Medium Density	0	2,606	0	560	3,166
High Density	0	774	0	249	1,023
Total Residential	0	3,763	0	924	4,687
Transportation	0	29	0	60	89
Total Urban > 25,000	0	4,980	0	1,512	6,492
Urban Areas < 25,000 pop	1,609	5,432	1,413	4,370	12,824
Total Urban Areas	1,609	10,412	1,413	5,882	19,316
Extractive					
Extractive	164	1,379	0	517	2,060
Slag Heaps	0	485	0	0	485
Total Extractive	164	1,864	0	517	2,545
Outdoor Recreation	69	34,043	544	35,796	70,452
Agriculture					
Orchards, Hort. etc.	0	0	0	0	0
Cropland	0	1,480	345	1,084	2,909
Improved Pasture	1,095	21,206	34,106	59,347	115,754
Unimproved Pasture	1,513	10,457	26,051	16,852	54,873
Total Agriculture	2,608	33,143	60,502	77,283	173,536
Forest	229,055	1,392,693	231,277	1,574,202	3,427,227
Marsh and Swamp	864	13,671	2,398	13,022	29,955
Barren	603	8,303	1,264	6,704	16,874
Total Watershed Land Area	234,972	1,494,129	297,398	1,713,406	3,739,905

acres = hectares (ha) x 2.471

Taken From Land Management Information Systems/Lands Directorate Environment Canada/Data Source C.L.I. and C.C.R.S. Maps

Although mining is the leading economic activity in this area, extractive uses comprise only about 2,500 ha (6,200 acres).

Outdoor recreation occupies 70,400 ha (174,000 acres), nearly all located in the Spanish and Whitefish Rivers and the French River watersheds.

About five percent of the land is in agricultural use, essentially all pasture. It is distributed among the watersheds as follows: Serpent and Blind Rivers - 2,600 ha (6,400 acres); Spanish and Whitefish Rivers - 33,000 ha (81,500 acres); Manitoulin Island - 60,500 ha (149,500 acres); and French River - 77,300 ha (191,000 acres).

SUB-BASIN 6: MUSKOKA-SEVERN RIVERS

The Muskoka-Severn Sub-Basin contains five major watersheds: Magnetawan River and East Georgian Bay; Muskoka River; Severn River; Nottawasaga River; and the Bruce Peninsula and southwestern Georgian Bay. Major land uses in each of these watersheds and the total sub-basin are presented in Table 6.

Forest is the dominant land use in this sub-basin, although it occupies a smaller proportion of the land area (64 percent) than was the case with the more northern Lake Huron sub-basins.

Urban uses constitute about two percent of the sub-basin area. The only watersheds with urban centres greater than 25,000 population are the Severn River and Nottawasaga River. The Nottawasaga River watershed has the most urban land, 15,000 ha (37,000 acres).

The use of land for outdoor recreation is most prevalent in the Muskoka River watershed, with 64,000 ha (158,000 acres) in this category.

Agriculture occupies a much larger proportion of the land area in this sub-basin (30 percent) than in the more northern Lake Huron sub-basins. Of the 754,400 ha (1.86 million acres) of agricultural land, 77 percent is pasture, with the remainder being cropland and orchards.

SUB-BASIN 7: SAUGEEN-MAITLAND RIVERS

There are four major watersheds in the Saugeen-Maitland Sub-Basin: Saugeen River; Minor Lake Huron Watersheds; Maitland River; and Au Sable River. Major land uses in each of these watersheds and the total sub-basin are presented in Table 7.

Three-fourths of the land in the Saugeen-Maitland Sub-Basin is used for agriculture. Of the 840,000 ha (2.08 million acres) of farmland, 2,000 ha (4,900 acres) are used for orchards and horticulture, 333,000 ha (823,000 acres) for cropland, and 505,000 ha (1.25 million acres) for pasture.

Forest land in this sub-basin covers 257,000 ha (635,000 acres), 23 percent of the total sub-basin area.

TABLE 6

MAJOR LAND USES MUSKOKA-SEVERN SUB-BASIN
(SUB-BASIN 6)

Land Use	Magnetawan River and E. Georgian Bay	Muskoka River	Severn River	Notta-wassaga River	Bruce Penin-sula and S.W. Georgian Bay	Total Sub-Basin
			Hectares (ha)			
Urban Areas > 25,000 pop.						
Commercial-Industrial						
Low Density	0	0	224	0	0	224
Medium Density	0	0	3	25	0	28
High Density	0	0	299	27	0	326
Total Com.-Indust.	0	0	526	52	0	578
Residential						
Low Density	0	0	540	18	0	558
Medium Density	0	0	724	1	0	725
High Density	0	0	248	0	0	248
Total Residential	0	0	1,512	19	0	1,531
Transportation	0	0	34	0	0	34
Total Urban > 25,000	0	0	2,072	71	0	2,143
Urban Areas < 25,000 pop.	2,733	3,287	9,153	14,961	12,421	44,555
Total Urban Areas	2,733	3,287	11,225	15,032	12,421	44,698
Extractive						
Extractive	0	209	444	752	117	1,522
Slag Heaps	0	0	0	0	0	0
Total Extractive	0	209	444	752	117	1,522
Outdoor Recreation	8,541	63,680	9,140	4,635	4,521	90,517
Agriculture						
Orchards, Hort. Etc.	0	0	3,876	607	2,247	6,730
Cropland	833	302	63,256	89,767	13,027	167,185
Improved Pasture	25,560	15,040	108,667	149,298	144,997	443,562
Unimproved Pasture	11,344	9,050	48,259	36,614	31,689	136,956
Total Agriculture	37,737	24,392	224,058	276,286	191,960	754,433
Forest	509,318	397,984	273,860	164,524	249,045	1,594,731
Marsh and Swamp	9,439	6,197	6,358	2,335	1,279	25,608
Barren	474	0	138	364	97	1,073
Total Watershed Land Area	568,242	495,749	525,223	463,928	459,440	2,512,582

acres = hectares (ha) x 2.471

TABLE 7

MAJOR LAND USES IN THE SAUGEEN-MAITLAND SUB-BASIN
(SUB-BASIN 7)

Land Use	Saugeen River	Minor Lake Huron Watersheds	Maitland River	Au Sable River	Total Sub-Basin
			Hectares (ha)		
Urban Areas > 25,000 pop.					
Commercial-Industrial					
Low Density	0	0	0	30	30
Medium Density	0	0	0	0	0
High Density	0	0	0	556	556
Total Com.-Indust.	0	0	0	586	586
Residential					
Low Density	0	0	0	614	614
Medium Density	0	0	0	852	852
High Density	0	0	0	22	22
Total Residential	0	0	0	1,488	1,488
Transportation	0	0	0	212	212
Total Urban > 25,000	0	0	0	2,286	2,286
Urban Areas < 25,000 pop.	2,688	1,199	3,153	4,775	12,815
Total Urban Areas	3,688	1,199	3,153	7,061	15,101
Extractive					
Extractive	83	0	218	1,152	1,453
Slag Heaps	0	0	0	0	0
Total Extractive	83	0	218	1,152	1,453
Outdoor Recreation	856	1,523	252	1,157	3,788
Agriculture					
Orchards, Hort. Etc.	0	0	44	1,896	1,940
Cropland	65,345	35,508	89,107	142,888	332,848
Improved Pasture	191,626	62,221	115,654	76,922	446,423
Unimproved Pasture	15,165	4,684	7,015	31,872	58,736
Total Agriculture	272,136	102,413	211,820	253,578	839,947
Forest	136,278	21,930	53,109	45,938	257,255
Marsh and Swamp	53	78	0	213	344
Barren	7	0	0	239	246
Total Watershed Land Area	413,101	127,143	268,552	309,338	1,118,134

acres = hectares (ha) x 2.471

The Au Sable River watershed contains 7,000 of the 15,000 ha (37,000 acres) of urban land, including the only urban centre with a population of 25,000 or more.

Extractive, outdoor recreation, marsh and swamp and barren land account for only 0.5 percent of the sub-basin area.

SOURCE MATERIALS

Gierman, D. and R.A. Ryerson. Land Use Information for the Great Lakes Basin, Report to Technical Committee B, Great Lakes Pollution from Land Use Activities Reference Group, International Joint Commission, Ottawa, 1974.

Thie, J., R.A. Ryerson, and T.T. Alfoldi. Mapping Land Use in the Great Lakes Basin: an Evaluation of Conventional and Remote Sensing Techniques, Report to Technical Committee B, Great Lakes Pollution from Land Use Activities Reference Group, International Joint Commission, Toronto, August 1973.

3 SPECIALIZED LAND USES

INTRODUCTION

Seven specialized land use categories are inventoried in this report. They are as follows: 1) mine tailings disposal sites; 2) waste disposal sites; 3) dredge spoil disposal; 4) shoreline erosion; 5) river bank erosion; 6) intensive livestock operations; and 7) high density, non-sewered residential areas. These specialized land uses are discussed individually below.

DISPOSAL OPERATIONS

MINE TAILINGS DISPOSAL SITES (1)

INTRODUCTION

Data on mine tailings disposal sites (Table 8) in the Canadian portion of the Lake Huron Basin were assembled for Environment Canada. The sub-basins are discussed individually below (methodology is presented in Appendix A of Volume I in this report series).

SUB-BASIN 4: MISSISSAGI RIVER

The Mississagi Sub-Basin contains nine mines which extract minerals requiring tailings disposal areas. Only two mines are active, clay being mined in one of them.

SUB-BASIN 5: SPANISH-FRENCH RIVERS

Seventy-one of the eighty-nine tailings disposal sites in the Canadian portion of the Lake Huron Basin (89 percent) are located in the Spanish-French Sub-Basin. Twenty-one mines are currently active on this sub-basin, producing tailings from uranium, thorium, yttrium, copper, nickel, platinum, cobalt, gold, silver, selenium, tellurium, iron and silica.

The remaining Canadian Lake Huron sub-basins contain no mine tailings disposal sites.

TABLE 8

MINE TAILINGS DISPOSAL SITES IN THE CANADIAN PORTION OF THE LAKE HURON BASIN

SUB-BASIN	WATER-SHED	DESCRIPTION	MINERALS
4	2CA	Bruce Mines (Copper Bay, Taylor, Wellington and Bruce Sections)	Copper
4	2CA	Dominion Mines and Quarries	Silica
4	2CA	Dominion Trap Rock Quarry	Tin (granite, trap)
4	2CA	Elliots Brickyard Clay*	Clay
4	2CA	Havilah (Ophir) Mine	Gold
4	2CA	Jardun Mine	Lead, Zinc, Silver, Gold, Copper
4	2CA	Rock Lake Mine	Copper
4	2CC	Consolidated Bi-Ore Mine	Copper
4	2CC	J.B. Allard Mg. Exploration*	
5	2CD	Rio-Algom Mines Ltd (Pronto Mine)	Uranium
5	2CD	Denison Mines Ltd	
5	2CD	Can-Met Mine	Uranium
5	2CD	Denison Mine	Uranium, Yttrium
5	2CD	Preston Mines Ltd (Stanleigh Mine)	Uranium
5	2CD	Rio-Algom Mines	
5	2CD	Buckles Mine	Uranium
5	2cd	Lacnor Mine	Uranium
5	2CD	Milliken Mine	Uranium
5	2CD	Nordic Mine*	Uranium, Thorium, Yttrium
5	2CD	Panel Mine	Uranium
5	2CD	Pater Mine (Pronto Division)*	Copper
5	2CD	Quirke No. 1 Mine	Uranium, Thorium
5	2CD	Spanish American Mine	Uranium
5	2CD	Stanrock Uranium Mines*	Uranium, Yttrium
5	2CD	New Quirke Mine (Rio-Algom)*	
5	2CE	Frechette Island Occurrence	Copper, Gold
5	2CE	Dayjon Exploration & Holdings Ltd (McMillan Mine)	Gold
5	2CE	Donalda Mines Ltd (Massey Mine)	Copper
5	2CE	Falconbridge Nickel Mines Ltd (Hermina Mine)	Copper
5	2CE	Vermont Mines Ltd (Shakespeare Mine)	Gold
5	2CF	Aer Nickel Corp Ltd (Aer & Rosen Zones)*	Nickel, Copper
5	2CF	Bousquet Mine	Gold

TABLE 8 (cont'd)

MINE TAILINGS DISPOSAL SITES IN THE CANADIAN PORTION OF THE LAKE HURON BASIN

SUB-BASIN	WATER-SHED	DESCRIPTION	MINERALS
5	2CF	Falconbridge Nickel Mines Ltd	
5	2CF	Fecunis Lake Mine*	Nickel, Copper, Platinum, Cobalt, Gold, Silver
5	2CF	Hardy Mine*	Nickel, Copper, Platinum, Cobalt, Gold, Silver
5	2CF	Longvack South Mine*	Nickel, Copper, Platinum, Cobalt, Gold, Silver
5	2CF	McKim Mine	Nickel, Copper, Platinum, Cobalt, Gold, Silver
5	2CF	Mount Nickel Mine	Nickel, Copper, Platinum, Cobalt, Gold, Silver
5	2CF	Onaping Mine*	Nickel, Copper, Platinum, Cobalt, Gold, Silver
5	2CF	Lawson Quarry	Silica
5	2CF	International Nickel Co. of Canada	Nickel, Copper, Platinum, Selenium, Tellurium, Cobalt, Silver, Gold, Iron
5	2CF	Blezard Mine	"
5	2CF	Chicago Mine	"
5	2CF	Clarabelle-Copper Cliff N. Mines*	"
5	2CF	Crean Hill Mine*	"
5	2CF	Creighton Mine*	"
5	2CF	Ellen Pit	"
5	2CF	Evans Mine	"
5	2CF	Frood Stobie Mine*	"
5	2CF	Garson Mine*	"
5	2CF	Gertrude Mine	"
5	2CF	Kirkwood Mine	"
5	2CF	Levack Mine*	"
5	2CF	Murray Mine*	"
5	2CF	No. 1 Mine	"
5	2CF	North Star Mine	"
5	2CF	Totten Mine*	"
5	2CF	Vermilion Mine	"
5	2CF	Victoria Mine	"
5	2CF	Worthington Mine	"
5	2CF	Irvington Mining Co. Ltd	Zinc, Lead, Silver
5	2CF	Long Lake Mine	Gold
5	2CF	National Steel Corp*	Iron
5	2CF	Nickel Offsets Ltd	Nickel, Copper
5	2CF	Panache Quartz Ltd*	Silica
5	2CF	Lockerby Mine (Falconbridge)	Nickel
5	2CF	Copper Cliff North Mine (INCO)	
5	2CF	Copper Cliff South Mine (INCO)	
5	2CF	Levack West Mine	

TABLE 8 (cont'd)

MINE TAILINGS DISPOSAL SITES IN THE CANADIAN PORTION OF THE LAKE HURON BASIN

SUB-BASIN	WATER-SHED	DESCRIPTION	MINERALS
5	2CF	Little Stobie Mine	
5	2CF	Canadian Industries Ltd	Sulphur
5	2DA	MacLennan (INCO)*	Nickel, Copper, Platinum, Selenium, Tellurium, Cobalt, Silver, Gold, Iron
5	2DA	Victor Mine (INCO)	"
5	2DA	Jonsmith Mines Ltd (Milnet Mine)	Copper, Nickel, Platinum
5	2DA	Nickel Rim Mines Ltd	Nickel
5	2DB	Falconbridge Nickel Mines Ltd	
5	2DB	Falconbridge Mine*	Nickel, Copper, Platinum, Cobalt, Silver, Gold
5	2DB	Norduna Mine	"
5	2DB	East Mine (Falconbridge)	Nickel
5	2DB	North Mine (Falconbridge)	Nickel
5	2DB	Allied Chemicals Canada Ltd	Sulphur
5	2DC	New Golden Rose Mine	Gold
5	2DC	Northern Granite Co. Ltd	Tin
5	2DC	River Valley Stones Mfg. Ltd	Tin
5	2DC	Stonecrest Ornamental Aggregates	Tin

* active mine

WASTE DISPOSAL SITES (1)

INTRODUCTION

The tabulated data on waste disposal sites (Tables 9 to 12) were assembled for Environment Canada. They include liquid, solid, hazardous material and deep well disposal sites which were licensed by the Waste Management Branch of the Ontario Ministry of the Environment as of January 31, 1974. The methodology used in the data collection is described in Appendix A of Volume I in this report series.

The column headings in Tables 9 to 12 are defined as follows:

No. - An arbitrary code assigned for mapping purposes.

MOE No. - Permit number in Ontario Ministry of the Environment (Waste Management Branch) records.

Municipality - Municipality in which the disposal area is situated.

Opened - Date on which the site was opened. If no figure is entered, the site was opened prior to 1971.

Closed - Date of closure.

Area - Site area (ha).

Population served - Operator's estimate of the population served.

Waste type - S - Solid, L - Liquid, H - Hazard

Volume - Listed in tons/day unless otherwise noted.

Proj. Life - Life, as estimated in 1971 when the licence was first issued, or on the opening date.

Watershed - This identifies the sub-drainage basin in which the site is located, in accordance with the Canada Water Survey classification.

SUB-BASIN 4: MISSISSAGI RIVER

The waste disposal sites in the Mississagi Sub-Basin are listed in Table 9. With one exception, all the sites handle only solid waste. The exception handles liquid as well as solid waste. There are no hazardous material disposal sites in this sub-basin.

TABLE 9

WASTE DISPOSAL SITES IN THE MISSISSAGI RIVER SUB-BASIN (SUB-BASIN 4)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		ALGOMA DISTRICT								
1407	D7305101	3 - E Twp.			0.5	500-1000	S	3	10	2CB
1408	D7307901	4 - F Twp.			1.2		S		10	2CA
1412	L7059701	Gladstone Twp.			59.2		S		50	2CC
1413	D7060901	Gould Twp.			0.2	250	S	.4	20	2CC
1395	D7166801	169 Twp.			12.8	300-500	S	3		2CC
1396	D7167601	202 Twp.			12.8	250	S	1/10	20	2CA
1397	D7200201	Aberdeen Twp.			5.2	220	S	1/10	20	2CA
1398	D7200202	Aberdeen Twp.			3.2	60	S	1/5		2CA
1399	D7200203	Aberdeen Twp.			0.02	150	S	1/5	20	2CA
1376	D7068001	Haughton Twp.			1.6	300-600	S	1/4	30	2CA
1382	D7146601	"V" Twp.			4.0	1000-2000	S	3	10	2CC
1420	D561301	MacDonald Twp.		15/9/72			S			2CA
1380	D7144901	"U" Twp.			8.0		S	5	20	2CC
1403	D7211601	5 - D Twp.			1.0	1000-2000	S	3	10	2CB
1404	D7211901	4 - D Twp.			0.8		S	1	10	2CB
1368	D561501	Plummer Twp.			2.0	533	S	2	30	2CA
1369	L561701	St. Joseph Twp.			20.0	806	S	1	30	2CA
1370	L561801	Tarbutt, etc. Twp.			2.0		S		50	2CA
1371	D561901	Thesalon Twp.			24.0	800	S		50	2CA
1384	D7154601	3 - D Twp.			3.8	500-800	S	2	15	2CB
1385	D7155001	3 - H Twp.			6.0	250 - summer	S	1/2	20	2CA
1386	D7156301	5 - E Twp.			0.5	200-500	S	2		2CB
1387	D7156302	5 - E Twp.			0.2	500-1000	S	2	2	2CB
1423	D7058301	Sault Ste. Marie Twp.			18.4	300	S	1/50	20	2CA
1355	L560101	Sault Ste. Marie			324.0		S	3,000	100	2CA
1356	L560102	Sault Ste. Marie			16.0	78000	S,L		25	2CA
1357	L560301	Bruce Mines			36.8	500	S	3/4	15	2CA
1358	D560401	Thessalon			2.0	1889	S	1-2	10	2CA
1359	D560701	Day & Bright Twp.			1.2	300	S		100	2CC
1361	D560901	Hilton Twp.			44.0	340	S			2CA
1362	D561001	Joselyn Twp.			40.0	125	S	1/8	30	2CA

TABLE 9 (cont'd)

WASTE DISPOSAL SITES IN THE MISSISSAGI RIVER SUB-BASIN (SUB-BASIN 4)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		ALGOMA DISTRICT								
1363	L561101	Johnson Twp.			9.2	400	S	1/4	20	2CA
1364	D561102	Johnson Twp.			1.2	200	S	1/2	100	2CA
1365	D561201	Laird Twp.				691	S	1/wk		2CA
1366	L561302	MacDonald, etc. Twp.			26.8	1123	S		40	2CA
		SUDBURY REGION								
1313	D7307101	Township 4			4.0	5000-10,000	S	1	15	2CB
1314	D7301902	Township 11D			0.4	200 - summer	S	1/2	10	2CB
1315	D7301901	Township 11D			0.2	75	S	50 lb/day	15	2CB
1319	D7159101	Township 11B			0.8	150	S	1/4	15	2CB

No information presented indicates data not available, unless otherwise noted.

acres = hectares (ha) x 2.471

The largest number of waste disposal sites is found in the Muskoka-Severn Sub-Basin. However, because of the population centre of Sault Ste. Marie, the largest volume of waste is in the Mississagi Sub-Basin.

SUB-BASIN 5: SPANISH-FRENCH RIVERS

Table 10 presents the waste disposal sites in the Spanish-French Sub-Basin. Fourteen of the 156 active sites handle solid and liquid wastes, while the remainder handle only solid waste. This sub-basin contains no hazardous material disposal sites.

SUB-BASIN 6: SEVERN-MUSKOKA RIVERS

Waste disposal sites in the Severn-Muskoka Sub-Basin are presented in Table 11. This sub-basin contains 181 waste disposal sites, more than the other Canadian Lake Huron sub-basins. All but one of the sites handle only solid waste. There are no hazardous material disposal sites in this sub-basin.

SUB-BASIN 7: SAUGEEN-MAITLAND RIVERS

Table 12 contains a listing of the waste disposal sites in the Saugeen-Maitland Sub-Basin. Most of the 85 active sites in this sub-basin handle exclusively solid waste. However, three sites handle hazardous materials as well. These three sites are located in Kinloss Township in Bruce County, Sarnia and Stephen Township in Huron County.

SUMMARY

A waste disposal summary for the Canadian portion of the Lake Huron Basin is presented in Table 13. There are 460 active waste disposal sites, covering a land area of about 3,500 ha (8,600 acres). The volume of waste disposed is approximately 6,000 t/d (13.2 million lb/day). In addition, there are 26 closed sites, occupying 44 ha (109 acres) of land.

DREDGE SPOIL DISPOSAL (2)

Due to the importance of maritime enterprises in Lake Huron, such as shipping and fisheries it contains many harbours. Maintenance dredging of the ship canals is often required to preserve draft requirements. In Lake Huron harbours, large volumes of sand and gravel are therefore removed from the harbour, and in most cases dumped outside the littoral zone. An estimated 25,000 m^3 (32,700 yd^3) of material are dredged from the twelve Canadian Lake Huron harbours annually.

TABLE 10

WASTE DISPOSAL SITES IN THE SPANISH-FRENCH RIVERS SUB-BASIN (SUB-BASIN 5)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		ALGOMA DISTRICT								
1411	D7302101	Long Twp.			2.0		S	1/10	20	2CD
1405	D7293901	Scarfe Twp.			2.4	1000-1500	S	4/5	5	2CD
1406	D7293902	Scarfe Twp.			2.0		S	5	10	2CD
1373	D7030301	Lewis Twp.			1.1	1000-3000	S	1		2CD
1409	D7312901	Sheddon Twp.					S			2CD
1414	D7116901	Twp. 125, Madawanson			0.4		S	200 lb/yr	5	2CE
1360	L560803	Elliot Lake Twp.			14.1	9000	S	25	10	2CD
1391	D7164901	123 Twp.			0.4		S	200 lb/yr	5	2CE
1392	D7164902	123 Twp.			0.4		S	300 lb/yr	5	2CE
1393	D7165001	124 Twp.			0.4		S	200 lb/yr	5	2CE
1394	D7165401	138 Twp.			0.4		S	400 lb/yr	5	2CD
1353	D560001	Township "G"			0.4		S	100 lb/yr	5	2CE
1379	D7138702	Striker Twp.			4.0	500-1000	S	2	15	2CD
1415	D7116902	Twp. 125, Hwy. 553			0.4		S	200 lb/yr	5	2CE
1416	D7035401	Algoma District			0.4		S	1/2	5	2CE
1417	D7035402	Algoma District			0.4		S	1	5	2CE
1418	D7035403	Algoma District			0.4		S	1/2 ton/yr		2CE
1419	D7078001	Algoma District			0.4		S	300 lb/yr	5	2CE
1388	D7159001	"I" Twp.			0.4		S	200 lb/yr	5	2CE
		SUDBURY REGION								
1320	D7131301	Scollard Twp.			4.0	200 - summer	S	1/10	25	2DD
1316	D7292701	Cherriman Twp.			4.0	200 + Camp		1/4	20	2DD
1317	L7291201	Snider Twp.			8.0		S	27	30	2CF
1318	D7205501	Gough Twp.			0.4		S	1 ton/yr	5	2CE
1282	L540610	Nickel Centre			4.0		S	46	25	2CF
1283	L540611	Nickel Centre			0.8		S	2	10	2DB
1284	L540702	Onaping Falls			7.2		S	16	25	2CF
1285	DL540705	Onaping Falls					S	15		2CF
1286	L540708	Onaping Falls			1.6	1555	S	4	20	2CF
1287	L540710	Onaping Falls			32.0	2731	S	7		2CF

TABLE 10 (cont'd)

WASTE DISPOSAL SITES IN THE SPANISH-FRENCH RIVERS SUB-BASIN (SUB-BASIN 5)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		SUDBURY DISTRICT								
1288	L540801	Rayside-Balfour			8.0	7639	S	20		2CF
1289	L540802	Rayside-Balfour			64.0	5700	S			2CF
1290	L540903	Valley East					S			2DB
1291	L540904	Valley East					S	33		2DB
1292	D541001	Waldon			4.0	200 + Camp	S	0.10	10	2CF
1293	L541002	Waldon			1.0	525	S	3		2CF
1294	L541003	Waldon			8.0	3000	S	1 1/2	50	2CF
1295	D541004	Waldon			60.0	Factory	S	5	2	2CF
1296	D541005	Waldon			2.0	2654	S	6	20	2CF
1297	D541006	Waldon			0.2	780	S	1		2CF
1298	D541202	Baldwin Twp.			0.8	600	S,L	2/wk		2CE
1299	D541302	Casimir Twp.			41.6	450	S	1/wk	25	2DD
1300	D541303	Casimir Twp.			2.0	250	S	1/4/wk	5	2DD
1301	D541505	Cosby Twp.			0.8	200	S			2DD
1302	L541506	Cosby Twp.			2.0		S	1	10	2DD
1303	D541602	Hagar Twp.			1.0	600	S	7/wk		2DD
1304	D541803	Nairn Twp.			0.8	450	S		3-4	2CE
1305	L541804	Nairn Twp.					S			2CE
1306	D541901	Ratter & Dunnet			64.0	1000	S	2	30	2DD
1307	L541902	Ratter & Dunnet		31/7/72	0.8		S		5	2DD
1308	D610902	Emo Twp.			0.8	1076	S	1 1/2	30	2CF
1309	D541503	Cosby Twp.		Fall/73	0.4	800	S		20	2DD
1310	L541504	Martland Twp.			3.2		S	10		2DD
1311	D7318301	McKinnon Twp.			0.4		S	2	5	2CE
1262	D540001	Township 115			0.4		S	200 lb/yr	5	2CE
1263	D540002	Township 115			0.4		S	500 lb/yr	5	2CE
1264	D540003	Township 119			0.4		S	1/2 ton/yr	5	2CE
1265	D540004	Township 115			0.4		S	200 lb/yr	5	2CE
1266	D540005	Township 115			0.4		S	300 lb/yr	5	2CE
1267	D540006	Township 115			0.4		S	300 lb/yr	5	2CE

TABLE 10 (cont'd)

WASTE DISPOSAL SITES IN THE SPANISH-FRENCH RIVERS SUB-BASIN (SUB-BASIN 5)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		SUDBURY DISTRICT								
1268	L540201	Sudbury			2.0	3900	S			2CF
1269	L540202	Sudbury			0.8	5900	S	6		2CF
1270	L540203	Sudbury			0.2	1045	S	1/2		2DB
1271	L540204	Sudbury			18.3	95000	S,L	230	8	2CF
1272	D540401	Espanola			4.4	5607	S	14/wk		2CE
1273	D540504	Massey			1.2	1269	S		50	2CE
1274	L540602	Nickel Centre			2.0		S	2	25	2CF
1275	L540603	Nickel Centre			0.8	1312	S	3		2CF
1276	L540604	Nickel Centre			0.2	70	S			2CF
1277	D540605	Nickel Centre			1.2	450-900	S	1	20	2CF
1278	D540606	Nickel Centre			4.0	1000	S,L	1.5	10	2DB
1279	L540607	Nickel Centre			4.0	3000	S,L	5	30	2DB
1280	L540608	Nickel Centre				5937	S		5	2CF
1281	L540609	Nickel Centre			1.8		S	600	20	2CF
1323	D7102901	Margaret Twp.			6.4	100	S	1/8	30	2CF
1324	D7065101	Haddo Twp.								2DD
1325	D7075101	Ulster Twp.			4.0	300	S	1/20	50	2CE
1326	D7059101	Gilbert Twp.			0.4		S	1/2	5	2CE
1327	D7053201	Foster Twp.			0.4		S	2	5	2CF
1328	D7053202	Foster Twp.			0.4		S	2	5	2CF
1329	D7038401	Delamere Twp.			4.0	500	S	.25	20	2DD
1330	L7033701	Creighton Twp.			0.4	2300	S	3		2CF
1331	D7021001	Burwash Twp.			4.0	400	S	1/2	20	2DB
1332	D7013901	Bigwood Twp.			4.0	150	S	1/5	20	2DD
1333	D7013902	Bigwood Twp.			4.0	50	S	1/20	50	2DD
1334	D7019901	Bigwood Twp.			2.0	250	S	1/10	15	2DD
1335	D7001201	Afton Twp.			1.2	2000	S		20	2DC
1336	L7033702	Creighton Twp.				5730	S	9		2CF
1337	D7293801	Moncrieff Twp.			4.0	500	S,L	3/4	50	2CE
1338	D7124101	Rathbun Twp.			0.4	200 - summer	S		12	2DA
1339	D7294301	Cascaden Twp.			4.0	600	S	1	30	2CF
1340	D7286401	Hoskin Twp.			4.0	100	S	1/2	20	2DD

TABLE 10 (cont'd)

WASTE DISPOSAL SITES IN THE SPANISH-FRENCH RIVERS SUB-BASIN (SUB-BASIN 5)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		SUDBURY DISTRICT								
1341	D7318501	Mongowin Twp.			0.8	140	S	1/2	25	2CF
1343	L7132401	Shakespeare Twp.			0.4	600	S	1/4	50	2CE
1344	L540902	Valley East								2CF
1345	L540701	Levack								2CF
		NIPISSING DISTRICT								
1243	D7251201	Vogt Twp.			0.4	350	S	1/6	10	2DC
1246	D7306801	Law Twp.			0.3		S	1/12	4	2DC
1247	D7309801	Olive Twp.			0.4	100	S	1/20	10	2DC
1248	D7319301	Badgerow Twp.			0.6	100	S		10	2DC
1250	D7294001	Thistle Twp.				50	S			2DC
1251	D7082201	Kirkpatrick Twp.			1.2	200	S		20	2DD
1219	L530101	North Bay			128.0	40000	S	60	25	2DD
1220	L530801	Caldwell Twp.			15.2	1740	S	45	10	2DD
1221	D530802	Caldwell Twp.			34.0	55	S			2DD
1222	L531001	Chisholm Twp.			0.6	850	S	1/4	20	2DD
1223	D531102	E. Ferris Twp.			2.0	1100	S	1 1/4	2	2DD
1224	L531103	E. Ferris Twp.			2.8	1300	S	3-1/3	10	2DD
1225	L531201	Field Twp.			2.0	750	S	3/4	10	2DC
1226	L531501	Springer Twp.			6.4	8400	S	20	5	2DC
1227	L531502	Springer Twp.			6.4		S,L	17	5	2DC
1228	L531503	Springer Twp.				730	S	1		2DC
1230	D7004502	Askin Twp.			0.6	100	S	1/4	20	2DC
1231	D7004503	Askin Twp.			0.4	400	S	1/6	10	2DC
1232	D7008201	Badgerow Twp.			0.4	100	S		10	2DC
1233	D7010201	Bastedo Twp.			0.02	10	S		5	2DC
1234	D7030101	Clement Twp.			0.4	2000	S		10	2DC
1235	D7033801	Crerar Twp.			1.2	300	S		10	2DC
1236	D7058901	Gibbons Twp.			0.2	60	S		5	2DC
1237	D7059601	Gladman Twp.			0.1	60	S		2	2DC
1238	D7061501	Grant Twp.			0.4	80	S		10	2DC
1239	D7061502	Grant Twp.			0.4	105 + Camp	S		10	2DC
1240	D7091401	Lyman Twp.			1.2	100	S		10	2DC
1241	D7094301	MacPherson Twp.			1.6	300	S		10	2DD
1242	D7101701	McLaren Twp.			0.8	500	S		10	2DC

TABLE 10 (cont'd)

WASTE DISPOSAL SITES IN THE SPANISH-FRENCH RIVERS SUB-BASIN (SUB-BASIN 5)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		MANITOULIN								
1520	L550902	Gordon Twp.			8.0	1000	S	1-2	25-30	2CG
1521	L550903	Gordon Twp.			2.0	1500	S,L	1	25	2CG
1522	L550901	Gordon Twp.				450	S	1/wk		2CG
1523	D7284202	Robinson Twp.			0.2	150	S	1/4/month	20	2CG
1524	D7073501	Humboldt Twp.			0.2		S		5	2CG
1525	L550301	Assiginack Twp.			2.0	714	S,L	1/5/wk		2CG
1526	D550501	Billings Twp.			0.8	400	S,L	1/4	40	2CG
1527	D550601	Burpee Twp.			2.0	198	S	1/2/wk		2CG
1528	D550701	Carnarvon			0.8	904	S	1/wk		2CG
1529	D550702	Carnarvon			4.0	904	S	1/wk		2CG
1530	D550801	Cockburn Is.			6.0		S	1/10	10	2CG
1531	D551002	Howland Twp.			1.6	1539	S	3.5/wk		2CG
1532	D551003	Howland Twp.			2.8	750	S	2/wk		2CG
1533	L551004	Howland Twp.					S			2CG
1534	D551101	Rutherford Twp.			0.8	600	S,L		50	2CG
1535	D551201	Sandfield Twp.			0.4	300	S,L		25	2CG
1536	L551202	Sandfield Twp.			0.2	60	S,L		25	2CG
1537	D551203	Sandfield Twp.			0.4	110	S,L		20	2CG
1538	L551301	Tehkummah Twp.			2.0	125	S,L		25	2CG
		PARRY SOUND DISTRICT								
1173	D7085901	Laurier Twp.				500	S	1/2	10-15	2DD
1196	D7121901	Pringle Twp.			1.6	200-300	S	1/4	30	2DD
1197	D7090301	Lount Twp.			0.4	800	S	12	20	2DD
1198	D7090302	Lount Twp.			0.2	130	S	5	20	2DD
1189	D7302301	Blair Twp.			4.0		S	1/10	20	2DD
1179	D7241601	Paterson Twp.			0.8	300-600	S	1/4	30	2DD
1160	D522001	Machar Twp.			1.2	1000	S	1	50	2DD
1191	D7302303	Blair Twp.			4.0		S	1/10	20	2DD
1192	D7302304	Blair Twp.			1.6	200	S	1/8	35	2DD
1155	L521601	N. Himsworth Twp.			40.0	4000 - summer	S	2		2DD
1156	L521701	S. Himsworth Twp.			30.0	2600	S	2	30	2DD
1164	L522401	Nippissing Twp.			0.8	1500 - summer 820	S	1	10	2DD
1165	L522402	Nippissing Twp.			0.8	300	S			2DD

No information presented indicates data not available unless otherwise indicated.

acres = hectares (ha) x 2.471

TABLE 11

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		MUSKEGON REGION								
1084	L510202	Bracebridge			0.8		S	2/3	10	2EB
1085	L510204	Bracebridge			200.0	6,150	S	15	25	2EB
1086	L510208	Bracebridge			0.8	1,500	S	15	3	2EC
1087	L510209	Bracebridge			0.8	1,000	S	.1	2	2EC
1088	L510210	Bracebridge			0.4	800	S	3/4	2	2EC
1089	L510301	Gravenhurst					S			2EB
1090	L510302	Gravenhurst			0.1		S			2EC
1091	L510303	Gravenhurst			0.8		S			2EC
1092	L510305	Gravenhurst			3.4		S			2EC
1093	L510306	Gravenhurst					S,L		5	2EB
1094	L510307	Gravenhurst			12.0		S		10	2EC
1095	D510401	Huntsville			0.4		S			2EB
1096	D510402	Huntsville			7.9		S		2	2EB
1097	D510403	Huntsville			1.6		S		10	2EB
1098	D510404	Huntsville			5.6		S			2EB
1099	D510405	Huntsville			6.0		S			2EB
1100	L510501	Georgian Bay Twp.			1.6	550	S	1.65	20	2ED
1101	L510502	Georgian Bay Twp.			0.2		S	1.2	5	2EB
1102	L510505	Georgian Bay Twp.			2.0		S	5	50	2EB
1103	D510601	Lake of Bays Twp.			0.4	1200 - summer 150	S			2EB
1104	D510602	Lake of Bays Twp.			0.4	3200 - summer 400	S			2EB
1105	D510603	Lake of Bays Twp.			0.4	200 - summer 50	S			2EB
1106	L510604	Lake of Bays Twp.			0.4	5400 - summer 600	S			2EB
1107	D510605	Lake of Bays Twp.			0.2	500 - summer 100	S			2EB
1108	D510606	Lake of Bays Twp.			0.1	200 - summer 5	S			2EB

TABLE 11 (cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		MUSKOKA REGION								
1109	D510701	Muskoka Lakes Twp.			2.7	240	S	1/2	50	2EB
1110	D510703	Muskoka Lakes Twp.			39.2	2,100	S	1	10	2EB
1111	D510704	Muskoka Lakes Twp.			3.2	775	S	1	10	2EB
1112	D510705	Muskoka Lakes Twp.			4.8	550	S	1	10	2EB
1113	L510706	Muskoka Lakes Twp.			2.8	530	S	1	10	2EB
1114	D510707	Muskoka Lakes Twp.			4.0	1,200	S	1		2EB
1115	D510708	Muskoka Lakes Twp.			0.4	2,100	S	1	10	2EB
1116	D510709	Muskoka Lakes Twp.			40.0	2,100	S	1	10	2EB
1117	D510710	Muskoka Lakes Twp.			24.0	775	S	1	10	2EB
1118	D510711	Muskoka Lakes Twp.			0.8	775	S	1	10	2EB
1119	D510712	Muskoka Lakes Twp.			2.0	2,100	S	1	10	2EB
1120	D510713	Muskoka Lakes Twp.			0.8	250	S	1	3	2EB
1121	D510714	Muskoka Lakes Twp.			1.6	2,100	S	1	10	2EB
1122	L510716	Muskoka Lakes Twp.			32.0		S			2EB
1123	D510724	Muskoka Lakes Twp.			28.0		S		5	2EB
1124	L510205	Draper Twp.			0.1		S	1/8	50	2EB
1125	510206	Macauley Twp.					S	1/20		2EB
1126	L510207	Macauley Twp.			0.1		S	1/8	50	2EB
1127	L510304	Muskoka Twp.			0.1		S	1/16	50	2EB
1128	L510702	Muskoka Lakes Twp.			0.1		S	1/8	50	2EB
1129	L510715	Muskoka Lakes Twp.			32.0		S			2EB
1130	L510203	Bracebridge		Dec.31/72	0.8	5,000	S	10	1	2EB
1132	L510503	Georgian Bay Twp.								2EB
		PARRY SOUND DISTRICT								
1141	L520101	Kearney			1.2	307	S	1	40	2EA
1142	L520201	Parry Sound			40.0	6,000	S		30	2EA
1143	D521003	Armour Twp.			4.6	891	S		10	2EA

TABLE 11 (cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		PARRY SOUND DISTRICT								
1144	D521101	Carling Twp.			0.4	900	S		10	2EA
1145	D521102	Carling Twp.			0.4	800	S		10	2EA
1146	D521103	Carling Twp.			0.4	900	S		20	2EA
1147	D521104	Carling Twp.			0.4	600	S		10	2EA
1148	D521105	Carling Twp.			0.4	500	S		10	2EA
1149	D521201	Chapman Twp.			0.4	326	S	1/20	10	2EA
1150	D521202	Chapman Twp.			0.4	326	S	1/20	20	2EA
1151	D521301	Christie Twp.				1000 - summer 300	S		10	2EA
1152	L521401	Foley Twp.			1.1		S	1/wk	20	2EA
1153	L521403	Foley Twp.			1.2	2000 - summer 1,000	S			2EA
1154	D521501	Hagerman Twp.			0.4	360	S	1/4	25	2EA
1193	D7303601	Cowper Twp.			4.0		S	1/4		2EA
1194	D7303602	Cowper Twp.			4.0		S	1/4	20	2EA
1195	D7303603	Cowper Twp.			4.0		S	1/2	20	2EA
1199	D7090303	Lount Twp.			0.8	110 - 120	S			2EA
1200	D7034001	Croft Twp.			0.1	250	S	110	5	2EA
1201	D522701	Strong Twp.			0.1	694	S	2		2EA
1202	D522702	Strong Twp.			30.0	500	S	1/4	35	2EA
1203	D522703	Strong Twp.			20.0	300	S		30	2EA
1204	D7034002	Croft Twp.			4.0		S	1/10	20	2EA
1190	D7302302	Blair Twp.			4.0		S	1/10	20	2EA
1161	D522002	Machar Twp.			0.2		S			2EA
1162	L522202	Machar Twp.			4.0		S	1/4	30	2EA
1163	D522301	McMurrich Twp.			1.6	200	S	1		2EA

TABLE 11 (cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		PARRY SOUND DISTRICT								
1157	D521801	Humphrey Twp.			0.4	576	S	1/4	30	2EA
1158	D521802	Humphrey Twp.			0.4	576	S	1/16		2EA
1159	D521803	Humphrey Twp.			0.5	576	S	1/8	30	2EA
1205	D7291101	Parry Sound District			4.0		S	1/2	20	2EA
1206	D522201	McKellar Twp.		15/7/73			S			2EA
1207	D522102	McDougall Twp.		23/7/73	8.0	500 - 750	S		5	2EA
1208	D522103	McDougall Twp.		Fall/73	7.6	750 -1000	S		5	2EA
1209	L522601	Ryerson Twp.		15/1/73	0.2	175	S	1/2	2	2EA
1210	D520001	Cowper Twp.			1.2		S	1/2	20	2EA
1174	D7101302	McKenzie Twp.								2EA
1175	D7101301	McKenzie Twp.			4.0		S	1/10	20	2EA
1176	D7106101	Monteith Twp.			4.0		S	1/10	20	2EA
1177	D7136101	Spence Twp.								2EA
1178	D7108301	Mowat Twp.			4.0		S	1/4	20	2EA
1180	D7252401	Wallbridge Twp.			4.0		S	1/4	20	2EA
1181	D7252402	Wallbridge Twp.			4.0		S	1/4	20	2EA
1182	D7291101	Shawanaga Twp.			4.0		S	1/2	20	2EA
1183	D7297501	Harrison Twp.			4.0		S	1/4	20	2EA
1184	D7297502	Harrison Twp.			4.0		S	1/3		2EA
1185	D7299201	Conger Twp.			4.0		S	1/10	20	2EB
1186	D7299202	Conger Twp.			4.0		S	1/10	20	2EB
1187	D7299203	Conger Twp.			4.0		S	1/4	20	2EB
1188	D7299204	Conger Twp.			4.0		S	1/10	20	2EA
1166	D522501	Perry Twp.		15/10/72	0.4	1,000	S	3		2EB
1167	D522502	Perry Twp.			10.0	1,000	S	2-3	5	2EA
1168	D522503	Perry Twp.			6.0	1,000- summer 300		1	10	2EA

TABLE 11 (cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		PARRY SOUND DISTRICT								
1169	D522504	Perry Twp.		15/10/72	0.6	1,000	S	2		2EA
1170	L522602	Ryerson Twp.			36.0	75 - 125	S			2EA
1171	D7020901	Burton Twp.			4.0		S	1/4	20	2EA
1172	D7066801	Willson Twp.			1.6	300 - 600	S	1/4	30	2EA
		ONTARIO COUNTY								
527	L241304	Reach Twp.			12.0	4,800	S	10	10	2EC
528	L241305	Reach Twp.	15/5/72		0.4	3,000	S			2EC
522	L241201	Rama Twp.	10/4/73		0.4	1,049	S	1	4	2EC
523	L241202	Rama Twp.	7/2/73		2.0	70	S	1/3	20	2EC
524	L241301	Reach Twp.					S			2EC
530	L241402	Scott Twp.			1.6	2,000	S	2	5-8	2EC
532	L241601	Thorah Twp.			1.6	2,500	S			2EC
533	L241701	Uxbridge Twp.			10.0	6,500	S	15	20	2EC
534	L241702	Uxbridge Twp.			12.0	4,000	S	8		2EC
513	L240901	Brock Twp.								2EC
514	D240902	Brock Twp.			40.0	3,151	S		50	2EC
515	L241001	Mara Twp.	10/4/73		0.8	4,000	S	15/wk	2-3	2EC
516	L241002	Mara Twp.		10/4/73	0.8	4,000	S	15/wk	2-3	2EC
		YORK REGION								
481	L230201	Aurora			35.2	75,000	S	230	10	2EC
486	L230701	Whitchurch-Stouffville			74.0		S	80	20	2EC
487	L230801	Georgina Twp.			20.0	12,250	S	30	30	2EC
489	L230802	Georgina Twp.			17.2	1,250	S	3	60	2EC
490	L230901	E. Gwillimbury			15.2	9,000	S	25	25	2EC
492	L231002	King Twp.			11.2	5,500	S			2EC

TABLE 11(cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		DUFFERIN COUNTY								
176	L180801	Mono Twp.			6.6	2,650	S	1-1/2	50	2ED
177	L180901	Mulmur Twp.			0.4	1,000	S	1/4	3	2ED
178	L180902	Mulmur Twp.			0.8	1,300	S	1/4	3	2ED
179	L180903	Mulmur Twp.	25/9/72		4.0	3,000	S	2	20	2ED
		SIMCOE COUNTY								
546	L250201	Alliston	18/12/72		4.0	3,148	S	4	15	2ED
547	L250402	Collingwood	24/7/ 73		6.0	10,000	S	6-7	3	2ED
548	L250403	Collingwood	18/12/72		10.0	10,000	S	6-7		2ED
549	L250601	Orillia			36.0	21,500	S	80	5	2EC
550	L250701	Penetanguishene		18/12/72	2.0	600	S	3	5	2ED
551	L250801	Stayner	26/4 /73		0.7	2,000	S		5	2ED
552	L251201	Creemore	16/10/72		2.0	97	S	2-3	15	2ED
553	L251401	Port McNicoll	18/4 /73		0.4		S	30		2ED
554	D251901	Adjala Twp.	16/10/72		2.2	2,271	S	2-1/2	20	2ED
555	L251901	Essa Twp.	15/11/72	27/11/72		4,000	S	4-1/2	25	2ED
556	D251902	Essa Twp.	27/11/72		4.0	3,250	S	3-1/2	1	2ED
557	D251903	Essa Twp.		27/11/72	0.8					2ED
558	L252001	Flos Twp.	22/8 /72		1.2	1,111	S	9		2ED
559	D252002	Flos Twp.	13/10/72		2.6	20,000-summer 2,000	S	2-25	20	2ED
560	L252003	Flos Twp.	7/2 /73		1.2	2,500	S			2ED
561	L252004	Flos Twp.	7/2 /73		0.8	1,500	S	2	1	2ED
562	L252101	W. Gwillimbury Twp.								2ED
563	L252201	Innisfil Twp.								2EC
564	L252202	Innisfil Twp.	16/10/72		16.0	10,000	S	25	10	2ED
565	L252203	Innisfil Twp.	27/11/72		0.6		S	20	20	2EC
566	L252204	Innisfil Twp.	27/11/72		2.0		S	50	15	2ED
567	L252301	Matchedash Twp.	10/4 /73		0.8	300 1500-summer	S			2ED
568	L252401	Medonte Twp.	18/12/72		1.6	1,500	S		10-15	2ED

TABLE 11 (cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		SIMCOE COUNTY								
569	L252402	Medonte Twp.	20/12/72		1.3	764	S		35	2ED
570	L252403	Medonte Twp.	18/9 /73		40.0		S		50	2ED
571	L252501	Nottawasaga Twp.	16/10/72		40.0	1500-3000	S	4	20	2ED
572	L252502	Nottawasaga Twp.	16/10/72		0.8	200	S	1	3	2ED
573	L252503	Nottawasaga Twp.	16/10/72		1.6	100	S	1/2	1	2ED
574	L252701	Oro Twp.	16/10/72		20.0	4,671	S	8	20	2ED
575	L252801	Sunnidale Twp.								2ED
576	L252802	Sunnidale Twp.	2/2 /72		12.0	5,948	S	5	20	2ED
577	L252901	Tay Twp.	2/2 /72		12.0	5,948	S	5	20	2ED
578	L252902	Tay Twp.	27/6 /72		4.0	4,000	S	2	10	2ED
579	L253001	Tecumseth Twp.	17/4 /72		2.0		S	3	10	2ED
580	L253101	Tiny Twp.	12/5 /72		8.0	18,000	S	60.75	10	2ED
581	L253201	Tosorontio Twp.	8/12/72		4.0	2,000	S	20	5	2ED
582	L253301	Vespra Twp.								2ED
		BRUCE COUNTY								
641	L271701	Amabel Twp.	8/12/72		8.0	10,000	S		30	2FA
654	D272301	Eastnor Twp.	21/12/72		40.0	900	S	1	50	2FA
643	L271802	Arran Twp.	12/12/72		20.0	1,250	S		50	2FA
644	L271803	Arran Twp.	8/12/72		0.3	639	S	5	30	2FA
634	L270601	Wiarton								2FA
663	D272901	Lindsay Twp.	21/12/72		0.2					2FA
664	D272902	Lindsay Twp.	20/12/73		6.2	1,400	S	1/2	20	2FA
665	D273001	St. Edmunds Twp.	19/3 /73		0.8	300	S	1	10	2FA
						1500-summer				
637	L271601	Albemarie Twp.								2FA
638	D271602	Albemarie Twp.	10/4 /73		10.0	600-700	S	2	20	2FA
639	D271603	Albemarie Twp.								2FA
640	D271604	Albemarie Twp.								2FA

TABLE 11 (cont'd)

WASTE DISPOSAL SITES IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN (SUB-BASIN 6)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		GREY COUNTY								
608	L261701	Euphrasia Twp.	27/11/72		0.2		S		5	2FB
613	L262001	Keppel Twp.		Fall/73	0.4		S			2FB
614	L262002	Keppel Twp.	14/11/72		16.8					2FA
617	L262201	Osprey Twp.								2FB
620	L262401	St. Vincent Twp.	18/8 /72		0.4	1,600	S			2FB
621	L262601	Sullivan Twp.		Fall/73	1.0		S			2FB
599	L261203	Artemesia Twp.	21/12/72		6.4	1,100	S	1	7-10	2FB
603	L261401	Collingwood Twp.	23/9 /72		22.8	3,500	S	6	30	2FB
604	L261402	Collingwood Twp.		30/6 /73	8.0	3,000	S			2FB
605	L261501	Derby	14/11/72		14.0	20,000	S	500	10	2FB
594	L260401	Meaford	18/8 /72		10.0	4,000	S		5	2FB
595	L260501	Thornbury	18/12/72							2FB
596	L260801	Flesherton		Fall/73	3.0	575	S			2FB
		HALIBURTON COUNTY								
829	L330702	Sherborne, Livingstone, McClintock			2.0	2,500 200-summer	S	1/2-1	20	2EB
830	L330703	Sherborne, Livingstone, McClintock		Fall/73	2.0	2,500 200-summer	S	1/2-1	20	2EB
831	D330704	Sherborne, Livingstone, McClintock	4/1 /72		2.0	300	S	1/2		2EB
797	D330101	Anson, Hindon, Minden			8.0	2,000	S	1	30	2EC
799	D330103	Anson, Hindon, Minden			2.0	200	S	5	30	2EC
		VICTORIA COUNTY								
763	D320801	Carden Twp.								2EC
764	D320901	Dalton Twp.								2EC
765	D321001	Eldon Twp.		15/7 71	0.8	500	S		1	2EC
767	L321004	Eldon Twp.			20.0	4,000	S		1	2EC
774	D321302	Laxton, Digby, Longford		31/7 /72						2EC
776	D321204	Laxton, Digby, Longford	9/ 7/73		10.0	500 - 1500	S	1/2	30	2EC

No information presented indicates data not available, unless otherwise noted.
acres = hectares (ha) x 2.471

TABLE 12

WASTE DISPOSAL SITES IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN (SUB-BASIN 7)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		HURON COUNTY								
134	L160501	Wingham			1.2	3,000	S	3	5	2FE
135	L160502	Wingham			4.0	4,400	S	4		2FE
136	L160503	Wingham	8/ 6/72		0.8		S	1/2		2FE
137	L160701	Blyth			2.0	774	S	.6	5	2FE
138	L160901	Hensall	16/10/72		20.0	953	S	2	10	2FF
139	L161101	Ashfield Twp.	25/ 7/72		32.0	1,600	S	1-2	20	2FD
140	L161102	Ashfield Twp.	18/ 8/72				S			2FD
141	L161201	Colborne Twp.			10.0	1,225	S	2	1	2FE
142	L161302	Goderich Twp.			2.0	12,500	S		5	2FE
143	L161401	Grey Twp.	16/10/72		2.8	3,700	S	5		2FE
144	L161501	Hay Twp.	19/ 7/72		40.0	3,300	S	6-8	25	2FF
145	L161503	Hay Twp.			2.0	2,000	S	1-2	10	2FF
146	L161504	Hay Twp.								2FF
147	L161601	Howick Twp.		30/6 /72	6.0	540	S	1.7		2FE
148	L161602	Howick Twp.	18/10/72		20.0	2,200	S	1/2		2FE
149	L161901	Morris Twp.	6/10/72		20.0	2,500	S		50	2FE
150	L162001	Stanley Twp.	4/12/72		0.8	1,500	S	1	5	2FF
151	L162101	Stephen Twp.	23/5 /72		10.0	20,000	S,L,H	12	25	2FF
152	L162102	Stephen Twp.	6/10/72		2.0	1,500	S,L	1	25	2FF
153	L162103	Stephen Twp.								2FF
154	L162201	Tuckersmith Twp.	23/5 /72		2.0	4,000	S	5		2FF
155	L162301	Turnberry Twp.	6/10/72		0.3	1,650	S	1/2	5	2FE
157	L162501	E. Wawanosh Twp.	5/10/72		1.2	1,030	S,L		5	2FE
158	L162601	W. Wawanosh Twp.	12/10/72		1.2	1,200	S		1-5	2FE

TABLE 12 (cont'd)

WASTE DISPOSAL SITES IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN (SUB-BASIN 7)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		LAMBTON COUNTY								
268	L030101	Sarnia			0.1		S,H	0.7	20	2FF
269	L030102	Sarnia	6/ 7/72		4.0		S	30	2	2FF
290	L031901	Plympton Twp.			1.6	2,250	S	4	2	2FF
291	L032002	Sarnia Twp.			40.0	70,000	S	120	20	2FF
292	L032003	Sarnia Twp.			4.4	65,000	S	110		2FF
293	L032005	Sarnia Twp.	6/ 7/72		8.0	60,000	S	10	5	2FF
294	L032006	Sarnia Twp.	6/ 7/72		44.0		S	25		2FF
271	L030105	Sarnia					S			2FF
277	L031301	Bosanquet Twp.			5.2	1,250	S		50	2FF
278	L031302	Bosanquet Twp.			0.6	3,800	S	4	5	2FF
		WELLINGTON COUNTY								
191	L170401	Mt. Forest		Closed	0.6	6,000	S,L			2FC
199	L171801	Minto Twp.			16.0	3,700	S	3	40	2FE
200	L171802	Minto Twp.		Closed	4.0	2,000	S	2.1		2FE
		PERTH COUNTY								
124	L151601	Wallace Twp.			2.8	2,000	S	4	15	2FE
112	L150301	Listowel			12.0	4,520	S	20	20	2FE
114	L150601	Blanshard Twp.	4/ 7/72		1.2	1,100	S		20	2FF
121	L151301	Hibbert Twp.	4/ 7/72		1.2	1,268	S		25	2FF
118	L151101	Elma Twp.	4/ 7/72		20.0	3,578	S,L	2	100	2FE
		GREY COUNTY								
602	L261301	Bentinck Twp.	16/10/72		20.0	1,500	S	1	25	2FC
597	L261201	Artemesia Twp.		31/5 /73	0.8		S			2FC
598	L261202	Artemesia Twp.	21/12/72		1.2					2FC
600	L261204	Artemesia Twp.	21/12/72		10.4	600-800	S	1/wk	10	2FC
601	L261205	Artemesia Twp.	21/12/72		1.2	1,158	S			2FC
609	L261801	Glenelg Twp.	18/ 4/73							2FC
610	L261802	Glenelg Twp.	6/1 /72		40.0	1,158	S	30	20	2FC
611	L261803	Glenelg Twp.	20/11/72		1.2	1,281	S	1/2	5	2FC
612	L261901	Holland Twp.	18/ 9/73		32.0	3,000	S	4	25	2FC
592	L260201	Durham	11/ 4/73		0.2		S	5/wk	2	2FC

TABLE 12 (cont'd)

WASTE DISPOSAL SITES IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN (SUB-BASIN 7)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		GREY COUNTY								
593	L260202	Durham	10/ 4/73		4.8	2,500	S	3	15	2FC
618	L262301	Proton Twp.								2FC
619	L262302	Proton Twp.	26/ 3/73		0.4	1,069	S			2FC
615	L262101	Normanby Twp.	19/ 3/73		1.0	2,000	S	1		2FC
616	L262103	Normanby Twp.								2FC
606	L261602	Twp. of Egremont			2.0	700	S		20	2FC
607	L261603	Twp. of Egremont			1.2	1,300	S		10	2FC
		MIDDLESEX COUNTY								
336	L042301	Williams West Twp.			4.0	1,410	S		20	2FF
330	L041701	McGillvray Twp.			1.6	1,400	S	2-3/wk	20	2FF
314	L040201	Parkhill			4.4	1,200	S	50-75/yr		2FF
316	L040901	Adelaide Twp.			1.0	1,800	S	1-1/2	10	2FF
317	L041001	Biddulph Twp.			2.4	3,000	S	6	5	2FF
318	L041002	Biddulph Twp.	3/ 1/72		16.0	3,500	S	30	25	2FF
		BRUCE COUNTY								
631	L270201	Kincardine			1.2	3,200	S,L	15	2	2FD
632	L270202	Kincardine			0.9	3,200	S	1/4	2	2FD
633	L270501	Walkerton	9/ 7/73		4.0	4,367	S	0 - 1	50	2FC
655	L272402	Elderslie Twp.			4.0	1,700	S		50	2FC
656	L272501	Greenock Twp.	10/10/73		40.0	2,000	S	2	50	2FC
657	L272502	Greenock Twp.	15/12/72							2FC
658	L272601	Huron Twp.	17/ 8/72		12.0	650	S	1	30	2FD
659	L272602	Huron Twp.	27/11/72		1.2	450	S	1/2	5	2FD
660	L272702	Twp. of Kincardine			12.0	1,600	S	1/wk	30	2FD

TABLE 12 (cont'd)

WASTE DISPOSAL SITES IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN (SUB-BASIN 7)

No.	MOE No.	MUNICIPALITY	OPENED	CLOSED	AREA (ha)	POPULATION SERVED	WASTE TYPE	VOLUME	1971 PROJECTED LIFE	WATERSHED
		BRUCE COUNTY								
661	L272801	Kinloss Twp.	17/ 4/72		6.0	1,200	S,H	1/4	20	2FD
662	L272802	Kinloss Twp.	19/ 4/73		0.8	1,000	S	1	5	2FD
645	L271901	Brant Twp.	15/ 5/72		3.6	9,400	S		5	2FC
646	L271902	Brant Twp.	15/ 5/72		10.0	3,080	S		15	2FC
647	L272001	Bruce Twp.			40.0	1,000 30,00-summer	S	15/wk	100	2FD
648	L272002	Bruce Twp.	28/ 7/72		4.8		S	30/yr	100	2FD
649	L272101	Carrick Twp.	28/11/72		2.4	3,000	S		2	2FC
650	L272102	Carrick Twp.	18/10/72		0.7	350	S		10	2FC
651	L272201	Culcross Twp.	17/ 6/72		40.0	936	S	2	50	2FC
652	D272202	Culcross Twp.		15/12/72	0.4	1,000	S	2	3	2FC
653	L272203	Culcross Twp.	21/12/72		0.8	500	S	1	10	2FC
635	L271101	Paisley			0.4	750	S	10/wk	20	2FC
636	L271401	Teeswater			0.8	935	S	2	2	2FC
666	L273101	Saugeen Twp.			20.0	2,000	S	5	20	2FC
667	273102	Saugeen Twp.				4,000 10,000-summer	S	12-20	30	2FC
642	L271801	Arran Twp.	21/12/72		0.2	200	S		5	2FC

No information presented indicates data not available, unless otherwise noted.
acres = hectares (ha) x 2.471

TABLE 13

WASTE DISPOSAL SUMMARY FOR THE CANADIAN PORTION OF THE LAKE HURON BASIN

SUB-BASIN	No. Active Sites	Area (ha)	Volume (t/d)	No. Closed Sites	Area (ha)
Mississagi	38	692	2,729	1	
Spanish-French	156	762	1,168	2	2
Muskoka-Severn	181	1,394	1,698	18	30
Saugeen-Maitland	85	684	479	5	12
Total Canadian Lake Huron Basin	460	3,532	6,074	26	44

acres = hectares (ha) x 2.471
pounds/day (lb/day) = tonnes/day (t/d) x 2200

EROSION (2)

LAKESHORE EROSION

Lakeshore erosion in Lake Huron is confined mainly to the southern portion of the lake, as the northern shores are primarily bedrock.

Short term rates of erosion were calculated by comparing profiles established as early as 1971 to those resurveyed in 1973. The resultant data reflect the volume of material change which occurs during a peak water level stage on the Great Lakes.

There are a total of 335 km (208 mi) of Great Lakes erodible shoreline with an erosion rate in excess of 0.5 $m^3/m/m/yr$*. Of this total, 70 km (43 mi) are located in two areas of Lake Huron. One is the coast of Huron County, from Clark Point at its northern boundary to Drysdale. The embankments are stable, as evidenced by dense vegetative cover on the slope. However, the sandy beaches along the shoreline exhibited a mean erosion rate of 1.43 $m^3/m/m/yr$ and a total eroded volume of 317,520 m^3.

Intensive erosion occurred further south between Harris Point and the City of Sarnia in Lambton County, with maximum erosion rates of 2.78 $m^3/m/m/yr$. This reach is susceptible to shore erosion, due to a combination of exposure to northwest winds yielding fetch distances as high as 350 km, and an unstable shore zone composed of sand beach and dunes.

The total volume of net erosion on the Canadian Lake Huron shore, from November 1972 to November 1973, was 663,800 m^3 (868,000 yd^3).

**Cubic meters of eroded material per linear meter of shoreline per vertical meter of bluff height per year.*

RIVERBANK EROSION

A riverbank erosion study is currently being completed as part of the Canadian PLUARG TASK C effort. The objective of this study is to gain a better understanding of bank recession mechanisms and to determine the qualities and quantities of materials eroded on a representative number of sites such that actual contributions of sediment to streams may be estimated.

The results of the riverbank erosion study were not available for inclusion in this report. However, the analysis of data collected during the preliminary phase suggested that average erosion on streambanks in southern Ontario involved relatively small quantities, probably in the neighbourhood of 1 to 2 cm (0.4-0.8 m) laterally per year.

INTENSIVE LIVESTOCK OPERATIONS

The following information on intensive livestock operations in the Canadian portion of the Lake Huron Basin was obtained from a study done by Agriculture Canada (3). Details concerning methodology appear in Appendix A of Volume I in this report series.

Intensive livestock operations were defined as follows: 75 or more dairy cattle; 150 or more beef cattle; 300 or more swine; and 30,000 or more poultry. Based on these criteria, there are 27 intensive poultry operations, 159 intensive cattle operations, and 111 intensive swine operations in the Canadian portion of the Lake Huron Basin (Table 14). These operations represent about 15 percent of the total intensive livestock operations in the Canadian Great Lakes Basin.

TABLE 14

INTENSIVE LIVESTOCK OPERATIONS IN THE CANADIAN PORTION OF THE LAKE HURON BASIN

	Poultry	Cattle	Swine
Canadian Lake Huron Basin	27	159	111
Total Canadian Great Lakes	165	1,002	834

NON-SEWERED RESIDENTIAL AREAS

INTRODUCTION

The information on non-sewered residential areas was taken from a study conducted for Environment Canada (1). Details concerning methodology are presented in Appendix A of Volume I in this report series.

Since this study was to include both permanent and seasonal residences, compact groupings of cottages or chalets were included. In the case of seasonal residences, the number of units was tabulated. This was translated to an equivalent population using a factor of 3.5 persons per unit. This same practice was followed for permanent residences in some municipalities. These estimated populations are included under the heading "total population" in the tables.

SUB-BASIN 4: MISSISSAGI RIVER

Table 15 presents the non-sewered residential areas located in the Mississagi Sub-Basin. A population of 7,429 resides in non-sewered areas in this sub-basin, nearly half located in the city of Sault Ste. Marie. The average population per non-sewered area is 571.

SUB-BASIN 5: SPANISH-FRENCH RIVERS

Table 16 presents a listing of non-sewered residential areas located in the Spanish-French Sub-Basin. There are 60 areas containing a total population of 38,502. All of the communities are quite small, the largest having a population of 3,360.

SUB-BASIN 6: SEVERN-MUSKOKA RIVERS

This sub-basin has a larger population living in non-sewered residential areas than any other Canadian Great Lakes sub-basin. Table 17 presents a listing of 244 non-sewered, residential areas in the Severn-Muskoka Sub-Basin, which contains a total population of 154,305. The average population per area is 632. Wasaga Beach is the largest non-sewered residential area, having a population of 14,886.

SUB-BASIN 7: SAUGEEN-MAITLAND RIVERS

Non-sewered, residential areas in the Saugeen-Maitland Sub-Basin are presented in Table 18. There are 123 such areas, containing a total population of 52,262. The average population per area is 425. Huron Township in Bruce County contains the largest non-sewered residential area in the sub-basin, 5,250 persons.

SUMMARY

A total population of 252,498 reside in high density, non-sewered residential areas in the Canadian Lake Huron Basin. The Severn-Muskoka Sub-Basin contains 61 percent of this non-sewered population. Another 21 percent reside in the Saugeen-Maitland Sub-Basin.

There are a total of 440 high density, non-sewered residential areas in the Canadian portion of the Lake Huron Basin, each containing an average of 574 persons.

TABLE 15

NON-SEWERED RESIDENTIAL AREAS IN THE MISSISSAGI RIVER SUB-BASIN
(SUB-BASIN 4)

TOWNSHIP	BASIN	LOCATION	KNOWN POPULATION	TOTAL POPULATION
ALGOMA COUNTY				
Gladstone	2CC	Iron Bridge	757	757
LeFroy	2CA	Nestorville	50	50
Hilton	2CA	Hilton Beach	186	186
St. Joseph	2CA	Richards Landing	250	250
Plummer -		Bruce Station	80	80
Additional	2CA	Bruce Mines	476	476
Johnson	2CA	Desharats	200	200
Laird	2CA	Bar River	60	60
MacDonald	2CA	Echo Bay	600	600
Prince	2CA		200	200
Aweres	2CA		1200	1200
Day	2CC	Sowerby	70	70
Sault. Ste. Marie	2CA	City of Sault. Ste. Marie	3300	3300
Mississagi River Sub-Basin Total				7429

TABLE 16

NON-SEWERED RESIDENTIAL AREAS IN THE SPANISH-FRENCH RIVERS SUB-BASIN
(SUB-BASIN 5)

TOWNSHIP	BASIN	LOCATION	KNOWN POPULATION	TOTAL POPULATION
ALGOMA COUNTY				
Spragge	2CD	Serpent River	500	500
Striker	2CD	Algoma Mills	200	200
Cobden	2CD	Blind River	3,200	3,200
Cobden	2CD	I.R. #8	150	150
Lewis	2CD		400	400
Shedden	2CD	Spanish	900	900
MANITOULIN COUNTY				
Rutherford	2CF	Killarney	475	475
Dawson	2CG	Meldrum Bay	60	60
Robinson	2CG	Silver Water	70	70
Burpee	2CG	Evansville	100	100
Gordon	2CG	Gore Bay	708	708
Campbell	2CG	Spring Bay	50	50
Billings	2CG	Kagawong	180	180
Carnarvon	2CG	Mindemoya	350	350
Carnarvon	2CG	Providence Bay	110	110
Tehkummah	2CG	Tehkummah	35	35
Tehkummah	2CG	South Baymounth	70	70
Assiginack	2CG	Manitowaning	380	380
Howland	2CG	Sheqniandak	120	120
Howland	2CG	Little Current	1,200	1,200
NIPISSING COUNTY				
Field	2DC	Field	600	600
Crerar	2DC	River Valley	200	200
Springer	2DC	Sturgeon Falls	1,200	1,200
Springer	2DC	Cache Bay	500	500
East Ferris	2DD	Corbeil	200	200
Caldwell	2DD	Verner	800	800
SUDBURY COUNTY				
Curtin	2CF	Willisville	70	70
Lorne	2CF	-	200	200
Louise	2CF	-	200	200
Wate Rs	2CF	-	2,900	2,900
Broder 1	2CF	South of Sudbury	3,360	3,360
Graham&Dennison	2CF	-	1,300	1,300

TABLE 16 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SPANISH-FRENCH RIVERS SUB-BASIN
(SUB-BASIN 5)

TOWNSHIP	BASIN	LOCATION	KNOWN POPULATION	TOTAL POPULATION
SUDBURY COUNTY				
Dowling	2CF	-	2,934	2,934
Capreol	2CF	Capreol	455	455
MacLennan	2DA	South Hale	700	700
Burwash	2DB	Burwash	125	125
Bryden	2DB	Wahnapitei	1,700	1,700
Neelon	2DB	Coniston	500	500
Dill	2DB	South of Sudbury	2,000	2,000
Delamere	2DD	Alban	100	100
Hagar	2DD	Markstay	350	350
Martland	2DD	Noelville	450	450
Casimir	2DD	St. Charles	800	800
Ratter	2DD	Hagar	150	150
Cartier	2CE	Cartier	500	500
Hyman & Dryry	2CE	-	1,350	1,350
Nairn	2CE	Nairn	350	350
Baldwin	2CE	McKerrow	400	400
Hallem	2CE	Webbwood	700	700
Salter	2CE	Massey	1,345	1,345
Victoria	2CE	Walford	60	60
Cavell	2CE	Ramsey	200	200
Margaret	2CE	Biscotasing	70	70
Curtin	2CF	White Fish Falls	200	200
PARRY SOUND				
Nipissing	2DD	Nipissing	75	75
South Himsworth	2DD	Trout Creek	550	550
Machar	2DD	South River	1,200	1,200
Patterson	2DD	Restoule	100	100
East Mills	2DD	Arnstein	150	150
East Mills	2DD	Port Louring	200	200
Spanish-French Sub-Basin Total				38,502

TABLE 17

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
MUSKOKA COUNTY					
Bracebridge	2EB	Lakewood		100	100
Bracebridge	2EB	Bracebridge		1,200	1,200
Bracebridge	2EC	Vankoughnet		300	300
Gravenhurst	2EB	Muskoka Falls		450	450
Gravenhurst	2EC	Severn Bridge		340	340
Lake of Bays	2EB	Dwight		110	110
Lake of Bays	2EB	Dorset		150	150
Lake of Bays	2EB	Baysvolle		95	95
Huntsville	2EB	Novar		35	35
Huntsville	2EB	Utterson		120	120
Huntsville	2EB	Port Sidney		279	279
Huntsville	2EB	Huntsville		350	350
Muskoka Lakes	2EB	Raymond		75	75
Muskoka Lakes	2EB	Milford Bay		60	60
Muskoka Lakes	2EB	Torrance		80	80
Muskoka Lakes	2EB	Minette		55	55
Muskoka Lakes	2EB	Foote Bay		40	40
Muskoka Lakes	2EB	Bala		466	466
Muskoka Lakes	2EB	Port Carling		610	610
Muskoka Lakes	2EB	Windermere		105	105
Georgian Bay	2EB	Mactier		460	460
Georgian Bay	2EC	Honey Harbour		230	230
Georgian Bay	2EC	Port Severn		110	110
GREY COUNTY					
Euphrasia	2FB	Rocklyn		35	35
Euphrasia	2FB	Talisman	20		70
Euphrasia	2FB	Kimberly		60	60
Euphrasia	2FB	Beaver Valley	60		210
Keppel	2FB	North Keppel		30	30
Keppel	2FB	Kemble		50	50
Keppel	2FA	Oxenden		35	35
Keppel	2FA	Lake Francis	12		42
Keppel	2FA	Shallow Lake		405	405
Keppel	2FA	E. of Shallow Lake		55	55
Sarawak	2FB	East Linton		65	65
Sarawak	2FB	Balmy Beach	25	750	827
Sarawak	2FB	N.W. of Owen Sound		800	800

TABLE 17 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
GREY COUNTY					
Derby	2FB	S. of Owen Sound		700	700
Derby	2FB	Kilsyth		70	70
Derby	2FB	S.E. of Derby Twp.		120	120
Sydenham	2FB	Leith		50	50
Sydenham	2FB	Annan		50	50
Sydenham	2FB	Bothwell Corners		50	50
Sydenham	2FB	Woodford		25	25
Sydenham	2FB	Bognor		125	125
St. Vincent	2FB	Sunnywise Beach	110		385
St. Vincent	2FB	N. of Meaford		120	120
St. Vincent	2FB	S. of Meaford		400	400
St. Vincent	2FB	Boucher Point	30		105
Sullivan	2FA	Keady		30	30
Sullivan	2FA	Desboro		200	200
Artemesia	2FB	L. Eugenia	185		648
Artemesia	2FB	Eugenia		100	100
Artemesia	2FB	Flesherton		580	580
Artemesia	2FB	Ceylon		30	30
Holland	2FB	Chatsworth		391	391
Holland	2FB	Walters Falls		125	125
Collingwood	2ED	E. Collingwood Twp.	100		350
Collingwood	2ED	Gibralter		20	20
Collingwood	2FB	Boucher Point	70		245
Collingwood	2FB	Laura Bay	100		350
Collingwood	2FB	Thornbury		600	600
Collingwood	2FB	Blue Mountain	100		350
Collingwood	2FB	Delphi Point	180		630
Collingwood	2FB	Craigleath Area	590		2,065
Collingwood	2FB	Clarksburg		400	400
Collingwood	2FB	Heathcote		70	70
Collingwood	2FB	Redwing		18	18
Osprey	2ED	Singhampton		30	30
Osprey	2ED	Badjeros		40	40
Osprey	2FB	Feversham		150	150
Osprey	2FB	Maxwell		60	60

TABLE 17 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
DUFFERIN COUNTY					
Melancthon	2ED	Hornings Mills		160	160
Mulmur	2ED	Honeywood		150	150
Mulmur	2ED	Terra Nova		60	60
Mulmur	2ED	East Central Point	50		175
Mulmur	2ED	Mansfield		35	35
Mulmur	2ED	Violet Hill		60	60
Mulmur	2ED	Rosemount			
Mono	2ED	Mono Centre		60	60
Mono	2ED	Hawkley		50	50
Mono	2ED	S.E. Quadrany	25		88
YORK COUNTY					
Georgina	2EC	Roches Point Area		1,170	1,170
Georgina	2EC	Crescent Beach Area		1,092	1,092
Georgina	2EC	Royal Beach Area		144	144
Georgina	2EC	Port Bolster		349	349
Georgina	2EC	Pefferlaw		432	432
Georgina	2EC	Udora		198	198
Georgina	2EC	Sutton		1,729	1,729
Georgina	2EC	Brownhill		141	141
Georgina	2EC	Baldwin		61	61
Georgina	2EC	Ravenshoe		76	76
Georgina	2EC	Bellhaven		69	69
E. Gwillimbury	2EC	Queensville		389	389
E. Gwillimbury	2EC	Sharon		603	603
E. Gwillimbury	2EC	Mt. Albert		705	705
E. Gwillimbury	2EC	River Drive Park		894	894
E. Gwillimbury	2EC	Holland Landing		1,152	1,152
Town of Newmarket	2EC	Newmarket		1,224	1,224
Town of Aurora	2EC	Aurora		1,134	1,134
Town of Richmond Hill	2HC	Richmond Hill		8,330	8,330
Town of Richmond Hill	2HC	Oak Ridges		4,469	4,469
Georgina	2EC	Keswick		6,144	6,144
King	2EC	Ananorveldt		148	148
King	2EC	Kettle		104	104
King	2EC	Pottageville		381	381
King	2EC	Schomberg-Lloydtown		877	877

TABLE 17 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
YORK COUNTY					
Stouffville	2EC	Vandorf		121	121
Stouffville	2EC	Wesley Corners		105	105
Stouffville	2EC	Ballantree		596	596
Stouffville	2EC	Mussleman's Lake		1,006	1,006
PARRY SOUND					
Strong	2EA	Sundridge		900	900
Chapman	2EA	Magnetawah		200	200
Perry	2EA	Kearney		260	260
Perry	2EA	Emsdale		300	300
Perry	2EA	Novar		150	150
McMurrich	2EA	Sprucedale		75	75
Hagerman	2EA	Dunchurch		150	150
McKellar	2EA	McKellar		200	200
Christie	2EA	Edgington		100	100
McDougall	2EA	Nobel		200	200
Harrison	2EA	Pointe Au Baril		100	100
Henvey	2EA	Britt		100	100
Humphrey	2EB	Rosseau		225	225
VICTORIA COUNTY					
Eldon	2EC	Woodville	10	490	490
Eldon	2EC	Lornerville	10		35
Eldon	2EC	Argyle	10		35
Eldon	2EC	Bolsover	10		35
Eldon	2EC	Kirkfield	50		175
BRUCE COUNTY					
Amabel	2FA	Sauble Beach Area	2,000		7,000
Amabel	2FA	Wiarton Perimeter		650	650
Amabel	2FA	Helpworth		380	380
Amabel	2FA	Sauble Beach		125	125
Amabel	2FA	Park Head		60	60
Elderslie	2FC	Paisley		890	890
Elderslie	2FA	Dobbington		75	75
Arran	2FA	Allenford		150	150
Arran	2FA	Terra		680	680
Arran	2FA	Invermay		100	100
Arran	2FA	Arkwright		45	45

TABLE 17 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
BRUCE COUNTY					
St. Edmonds	2FA	Tobermory	200	550	1,250
St. Edmonds	2FA	Eagle Point	100		350
Lindsay	2FA	Dyer Bay	150		525
Eastnor	2FA	Stokes Bay	100	80	430
Eastnor	2FA	Old Woman River	100		350
Eastnor	2FA	Isthmus Bay	100		350
Eastnor	2FA	Lionshead		510	510
Eastnor	2FA	Barrows Bay	75		262
Albemarle	2FA	Hope Bay	100		350
Albemarle	2FA	Pike Bay	200		700
Albemarle	2FA	Red Bay	200		700
Albemarle	2FA	Sky Lake	15		52
Albemarle	2FA	Burford Lake	60		210
Albemarle	2FA	Colpoys Lake	150		525
SIMCOE COUNTY					
Tay	2ED	Sturgeon Bay	451	478	1,578
Tay	2ED	S. of Waubaushane	129	345	451
Tay	2ED	Midland Area		529	529
Tay	2ED	S.E. of Midland	465	1,013	1,628
Medonte	2ED	Coldwater		774	774
Medonte	2ED	Hillsdale		345	345
Essa	2ED	Angus		1,534	1,534
Essa	2ED	Thornton		362	362
Essa	2ED	Cookstown		848	848
Tosorontio	2ED	Everett		401	401
Tiny	2ED	Allanwood Beach	391	118	1,368
Tiny	2ED	Woodland Beach	323	200	1,130
Tiny	2ED	Bluewater Beach	526	300	1,841
Tiny	2ED	Mountainview Beach	440	300	1,540
Tiny	2ED	Balm Beach	285	375	998
Tiny	2ED	Cawaja Beach	412	299	1,442
Tiny	2ED	Nottawasaga Beach	287	361	1,005
Tiny	2ED	Tiny Beach	531	1,046	1,858
Tiny	2ED	Polling Sub #13	122	136	427
Tiny	2ED	Cedar Pt. & Thunder Bay	221	93	774
Tiny	2ED	Penetang Beach		512	512
Tiny	2ED	N. of Penetang Beach	332	239	1,162
Tiny	2ED	Clearwater Beach	199	112	696
Tiny	2ED	Crescentwood Beach	220	81	770

TABLE 17 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
SIMCOE COUNTY					
Flos & Sunnidale	2ED	Wasaga Beach	4,253		14,886
Nottawasaga	2ED	Brocks Beach		523	523
Nottawasaga	2ED	W. of Collingwood		700	700
Nottawasaga	2ED	Nottawa		431	431
Nottawasaga	2ED	Creemore		977	977
Innisfill	2EC	Polling Sub #17			
		Alcona Beach	192	109	672
"	"	" #18	217	423	750
"	"	" #19	118	95	413
"	"	" #20	219	220	766
"	"	" #22	188		658
"	"	" #23	165	66	578
"	"	" #24	194	159	679
"	"	" #32			
		Minet Place		554	554
"	"	" #33	116	247	406
"	"	" #34	83	116	290
"	"	Big Bay Point			
		" #35	154	58	539
"	"	" #36	211	135	738
"	"	Painswick		2,500	2,500
"	"	Stroud		500	500
Oro	2EC	Polling Sub # 1			
		E. of Barrie		452	452
"	"	Shanty Bay			
		" #9	212	567	742
"	"	Oro Station			
		" # 7	557	702	1,949
"	"	8 mi. Point			
		" # 8	473	445	1,656
"	"	Hawkestone	179	272	626
Orillia	"	Polling Sub		549	549
"	"	" # 6			
"	"	Shoreline			
"	"	" # 7	487	877	1,704
"	"	Shoreline			
		" # 8	604	612	2,114
"	"	Severn Area			
		" # 9	430	55	1,505
"	"	N.E. of Orillia			
		" #11		760	760
"	"	" #12		572	572

TABLE 17 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SEVERN-MUSKOKA RIVERS SUB-BASIN
(SUB-BASIN 6)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
SIMCOE COUNTY					
Tay	2ED	Pt. Severn Shoreline	325	324	1,138
Tay	2ED	Victoria Harbour		1,140	1,140
Tay	2ED	Waubaushene		728	728
Tay	2ED	Penetang to Midland		809	809
Tay	2ED	E. of Penetang	242	362	847
Innisfil	2EC	Polling Sub Ballydown Beach			
"	"	" # 3	334	405	1,169
"	"	" # 4	153	241	535
"	"	" # 5	178	325	623
"	"	Bell Ewart			
"	"	" # 6	182	235	637
"	"	Little Cedar Point			
"	"	" # 7	178	126	623
"	"	Polling Sub # 8	264		984
"	"	" # 9	154	177	539
"	"	Big Cedar Point			
"	"	" #10	167		585
"	"	Polling Sub #15	211	128	738
"	"	" #16	236	139	476
ONTARIO COUNTY					
Mara	2EC	Atherly		450	450
Mara	2EC	Gamebridge		75	75
Mara	2EC	Brechin		298	298
Mara	2EC	McPhee Bay, Mulley Pt, McRae Pt.		537	537
Thoran	2EC	Beaverton		70	70
Thoran	2EC	Gamebridge		100	100
Brock	2EC	Sunderland		650	650
Brock	2EC	Wilfrid		110	110
Brock	2EC	Vallentyne		50	50
Brock	2EC	Vroomanton		60	60
Scott	2EC	Blackwater		100	100
Scott	2EC	Zyphyr		275	275
Scott	2EC	Vdora		125	125
Scott	2EC	Leaksdale		175	175
Scott	2EC	Sanford		250	250
Uxbridge	2EC	Goodwood		400	400
Uxbridge	2EC	Siloam		100	100
Rama	2EC	Washago		282	282
Rama	2EC	Longford Mills	60		210
Rama	2EC	Rama	40		140
Rama	2EC	Indian Reserve		500	500
Rama	2EC	Floral Park	50		175
Muskoka-Severn Rivers Sub-Basin Total					154,305

TABLE 18

NON-SEWERED RESIDENTIAL AREAS IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN
(SUB-BASIN 7)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
BRUCE COUNTY					
Kinloss	2FD	Lucknow		1,000	1,000
Huron	2FD	Shoreline	1,500		5,250
Huron	2FD	Ripley		486	486
Saugeen	2FC	Port Elgin	1,000		3,500
Saugeen	2FC	Burgoyne		75	75
Saugeen	2FC	S. of Port Elgin		40	40
Bruce	2FC	Glammis		30	30
Bruce	2FD	Shoreline	1,200		4,200
Bruce	2FD	Underwood		80	80
Bruce	2FD	Douglas Point		600	600
Bruce	2FD	E. of Tiverton		100	100
Greenock	2FC	Pinkerton		60	60
Greenock	2FC	Chepstow		30	30
Greenock	2FC	Riverdale		45	45
Brant	2FC	Cargill		45	45
Brant	2FC	Elmwood		200	200
Brant	2FC	Walkerton Perimeter		1,200	1,200
Carrick	2FC	Mildmay		1,100	1,100
Carrick	2FC	Formosa		75	75
Culross	2FC	Teeswater		969	969
Kincardine	2FD	Tiverton		622	622
Kincardine	2FD	Kincardine		1,200	1,200
Kincardine	2FD	Bervie		60	60
WELLINGTON COUNTY					
Minto	2FC	Clifford		596	596
PERTH COUNTY					
Hibbert	2FF	St. Columbian		30	30
Hibert	2FF	Dublin		200	200
Hibert	2FF	Staffa		100	100
Hibert	2FF	Cromarty		30	30
Wallace	2FE	Kurtzville		80	80
Wallace	2FE	Gowanstown		80	80
Elma	2FG	Trowbridge		50	50
Elma	2FG	Atwood		700	700
Elma	2FG	Newry		40	40
Elma	2FG	Donegal		30	30
Logan	2FE	Monkton		250	250

TABLE 18 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN
(SUB-BASIN 7)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
MIDDLESEX COUNTY					
Biddulph	2FF	Lucan		270	270
W. Williams	2FF	Parkhill		1,176	1,176
E. Williams	2FF	Nairn		90	90
E. Williams	2FF	Ailsa Craig		545	545
E. Williams	2FF	Felkirk		45	45
McGillivray	2FF	Greenway		40	40
McGillivray	2FF	Mount Carmel		35	35
McGillivray	2FF	Clandebove		60	60
GREY COUNTY					
Holland	2FC	Williams Ford		150	150
Holland	2FC	Dornoch		30	30
Holland	2FC	Holland Centre		125	125
Holland	2FC	Berkeley		60	60
Normenby	2FC	Neustadt		540	540
Normenby	2FC	Ayton		200	200
Egremont	2FC	Holstein		200	200
Proton	2FC	Hopeville		30	30
Proton	2FC	Cedarville		40	40
Bentinck	2FC	Rocky Saugeen		25	25
Bentick	2FC	N. of Hanover		170	170
Bentick	2FC	S.E. of Durham		33	33
Sullivan	2FC	Scong		20	20
Sullivan	2FC	McCullough	50		175
Artemesia	2FC	Proton Station		40	40
Artemesia	2FC	Priceville		100	100
Artemesia	2FC	Irish Lake	25		87
Artemesia	2FC	Markdale		400	400
LAMBTON COUNTY					
Plympton	2FF	Mandamin		367	367
Plympton	2FF	Gallimere		50	50
Bosanquet	2FF	Gustling Grove		50	50
Bosanquet	2FF	Kettle Point I.R.		600	600
Bosanquet	2FF	Ipperwash Prov. Park		120	120
Bosanquet	2FF	Ravenswood		25	25
Bosanquet	2FF	1 mile E. of Ravenswood		12	12
Bosanquet	2FF	Port Franks		261	261
Bosanquet	2FF	Thedford		660	660
Bosanquet	2FF	Beach of Pines		50	50

TABLE 18 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN
(SUB-BASIN 7)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
LAMBTON COUNTY					
Bosanquet	2FF	Southcott Pines		200	200
Bosanquet	2FF	Grand Bend		756	756
Sarnia	2FF	N. Part Lots 53 & 54		525	525
Sarnia	2FF	N. Part Lots 46 - 52		992	992
Sarnia	2FF	N. Part Lots 37 - 45		543	543
Sarnia	2FF	Blackwell		815	815
Sarnia	2FF	N. Part Lots 11 - 27		795	795
Sarnia	2FF	N. Part Lots 9 & 10		593	593
Sarnia	2FF	Brights Grove		487	487
Sarnia	2FF	Lulasville		30	30
Plympton	2FF	Errol		900	900
Plympton	2FF	Hillcrest Heights		50	50
Plympton	2FF	Invercairn		20	20
Plympton	2FF	Camlachie		225	225
Plympton	2FF	Bluepoint		30	30
Plympton	2FF	Reeces Corner		100	100
HURON COUNTY					
Morris	2FE	Belgrave		175	175
Morris	2FE	Blyth		750	750
E. Wawanogh	2FE	Auburn		150	150
E. Wawanogh	2FE	Whitechurch		100	100
Turnberry	2FE	Bluevale		100	100
Turnberry	2FE	Belmore		75	75
Howick	2FG	Lakelet		50	50
Howick	2FG	Gorrie		350	350
Howick	2FG	Wroxeter		250	250
Howick	2FG	Fordwich		250	250
Grey	2FE	Molesworth		60	60
Grey	2FE	Ethel		150	150
Grey	2FE	Brussels		800	800
Grey	2FE	Cranbrook		50	50
Grey	2FE	Moncrieff		40	40
Mckillop	2FE	Winthrop		50	50
McKillop	2FE	Walton		80	80
Hullett	2FE	Londesborough		150	150
Colborne	2FE	Benmiller		70	70
Colborne	2FE	N.E. of Goderich		75	75

TABLE 18 (cont'd)

NON-SEWERED RESIDENTIAL AREAS IN THE SAUGEEN-MAITLAND RIVERS SUB-BASIN
(SUB-BASIN 7)

TOWNSHIP	BASIN	LOCATION	UNITS	KNOWN POPULATION	TOTAL POPULATION
HURON COUNTY					
Goderich	2FE	Holmesville		60	60
Goderich	2FE	S.E. of Goderich		125	125
Stanley	2FF	Bayfield		500	500
Stanley	2FF	Varna		100	100
Stanley	2FF	Brucefield		80	80
Tuckersmith	2FF	Hensall		800	800
Tuckersmith	2FF	Kippen		30	30
Tuckersmith	2FF	Egmondville		100	100
Stephen	2FF	Dashwood		300	300
Stephen	2FF	Crediton		150	150
Stephen	2FF	Centralia		150	150
Stephen	2FD	Shoreline	950		3,325
	2FE	Shoreline	475		1,663
	2FF	Shoreline	1,075		3,762
Ashfield	2FD	Port Albert		100	100
Ashfield	2FD	Dungannon		150	150
Saugeen-Maitland Rivers Sub-Basin Total					52,262

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1. Crysler and Lathem. Land Drainage Reference Study Task B2: Mine Tailings Disposal Sites, Waste Disposal Sites, Non-Sewered Residential Areas, Land Fill Sites, prepared for Canada Department of the Environment.

2. Environment Canada and Ontario Ministry of Natural Resources. Canada-Ontario Great Lakes Shore Damage survey Technical Report, October 1975.

3. Coote, D.R., E.M. MacDonald, and M.D. Rigby. A Selective Inventory of Large Livestock Operations, Southern Ontario, Agriculture Canada, Ottawa, 1974.

4 MATERIALS USAGE

INTRODUCTION

The materials initially identified in this inventory were chosen because they may influence the quality of drainage water in the Lake Huron Basin. These materials included pesticides, fertilizers, agricultural manures and road salts. Lime was not considered because of its limited use.

The Canadian Lake Huron Basin extends north to approximately 47° N latitude. However, above 45°N latitude there is very little agricultural activity. For this reason, some of the information presented in this section extends only to 45°N latitude, encompassing only the Saugeen-Maitland Sub-Basin and part of the Muskoka-Severn Sub-Basin. The methodology used in this section is presented in Appendix A of Volume I in this report series.

AGRICULTURAL PESTICIDES

Information on the agricultural use of pesticides is presented in Table 19 in terms of kilograms of active chemical used. Pesticides were divided into five categories as follows: insecticides; fungicides; triazine herbicides; phenoxy herbicides; and herbicides other than triazine and phenoxy.

INSECTICIDES

Insecticides usage in the Canadian portion of the Lake Huron Basin amounts to about 120,000 kg (264,500 lb) annually. About 80 percent is used in the Saugeen-Maitland Sub-Basin and the remaining 20 percent in the Severn-Muskoka Sub-Basin.

Approximately 79,000 kg (174,000 lb) of insecticides are used on field crops in the Canadian Lake Huron Basin, while 41,000 kg (90,400 lb) are used on fruits and vegetables.

FUNGICIDES

Virtually all (99 percent) the fungicides used in the Canadian Lake Huron Basin are applied to fruits and vegetables.

Of the 58,600 kg (129,000 lb) of fungicides used annually in the Canadian Lake Huron Basin, 60 percent is used in the Severn-Muskoka Sub-Basin and 40 percent in the Saugeen-Maitland Sub-Basin.

HERBICIDES

A total of 679,000 kg (1.5 million lb) of herbicides are used annually in the Canadian Lake Huron Basin. Twenty-five percent of this total is

TABLE 19

USE OF PESTICIDES IN THE CANADIAN PORTION OF THE LAKE HURON BASIN
(kg of active chemicals)

SUB-BASIN	HERBICIDES							FUNGICIDES		INSECTICIDES	
	PHENOXY			TRIAZINE		OTHER TYPES					
	Field Crops	Road-Sides	Fruit & Veg	Field Crops	Fruit & Veg	Field Crops	Fruit & Veg	Field Crops	Fruit & Veg	Field Crops	Fruit & Veg
Muskoka-Severn	54,204	10,021	358	86,805	2,032	45,129	12,547	241	35,030	4,146	19,900
Saugeen-Maitland	92,627	11,619	3,244	205,865	470	153,226	877	228	23,065	74,589	20,924
Total Canadian Lake Huron Basin	146,831	21,640	3,602	292,670	2,502	198,355	13,424	469	58,095	78,735	40,824

pounds (lb) = kilograms (kg) x 2.2046

phenoxy, 43 percent triazine and 32 percent other types.

The majority of these herbicides, 94 percent, is used on field crops. About 70 percent of the herbicide usage takes place in the Saugeen-Maitland Sub-Basin, with the remainder occurring in the Severn-Muskoka Sub-Basin.

COMMERCIAL FERTILIZERS AND AGRICULTURAL MANURES

Information on the production and/or usage of agricultural manures and fertilizers in the Canadian Lake Huron Basin is reported in terms of their nutrient content. The total nutrient input from these materials and the density per unit area of improved farmland and/or all land are presented in this section.

Farmland use and livestock numbers for the Canadian portion of the Lake Huron Basin are presented in Tables 20 and 21, respectively. The Severn-Muskoka Sub-Basin has a larger total land area, but less improved farmland, than the Saugeen-Maitland Sub-Basin.

Livestock numbers are substantially higher in the Saugeen-Maitland Sub-Basin than in the Severn-Muskoka Sub-Basin.

COMMERCIAL FERTILIZERS

Table 22 presents the quantities of fertilizer nutrients applied to agricultural lands in the Canadian Lake Huron Basin. Approximately 28,000 t nitrogen (62 million lb), 23,000 t phosphorus (P_2O_5) (51 million lb), and 23,000 t potassium (K_2O) (51 million lb) are used annually, in the form of commercial fertilizers.

The heaviest use occurs in the Saugeen-Maitland Sub-Basin, where usage of fertilizer nutrients is greater than twice that of the Severn-Muskoka Sub-Basin.

TABLE 20

FARMLAND USE IN THE CANADIAN PORTION OF THE LAKE HURON BASIN
(ha)

SUB-BASIN	TOTAL LAND	TOTAL FARMLAND	IMPROVED FARMLAND	CROP-LAND	TOTAL PASTURE	WOOD-LAND
Muskoka-Severn	2,512,582	713,898	466,697	305,185	219,224	91,831
Saugeen-Maitland	1,118,134	909,394	716,553	487,815	250,776	90,469
Total Canadian Lake Huron Basin	3,630,716	1,623,292	1,183,250	793,000	470,000	182,300

acres = hectares (ha) x 2.471

TABLE 21

LIVESTOCK NUMBERS IN THE CANADIAN PORTION OF THE LAKE HURON BASIN

SUB-BASIN	TOTAL CATTLE	DAIRY CATTLE	BEEF CATTLE	SWINE	POULTRY	OTHERS
Muskoka-Severn	405,579	82,472	104,841	227,679	2,515,173	169,126
Saugeen-Maitland	610,621	105,728	195,159	539,321	6,060,827	110,874
Total Canadian Lake Huron Basin	1,016,200	188,200	300,000	767,000	8,576,000	280,000

TABLE 22

TOTAL NUTRIENTS FROM FERTILIZERS
(t/a)

Sub-Basin	N	P_2O_5	K_2O
Muskoka-Severn	8,000	7,000	7,400
Saugeen-Maitland	19,700	15,300	15,900
Total Canadian Lake Huron Basin	27,700	22,300	23,300

pounds (lb) = tonnes (t) x 2200

Table 23 presents fertilizer nutrients expressed in kg/ha of improved farmland and kg/ha of total land. The density of fertilizer nutrients on improved farmland in the Canadian Lake Huron Basin is 23.4 kg/ha nitrogen (21 lb/acre), 18.9 kg/ha phosphorus (P_2O_5) (17 lb/acre) and 19.7 kg/ha potassium (K_2O) (18 lb/acre). In terms of kg/ha of all land, the nutrient densities are much lower.

The Saugeen-Maitland Sub-Basin not only has higher levels of fertilizer nutrients than the Muskoka-Severn Sub-Basin but also a greater intensity of use, both in terms of improved farmland and all land.

TABLE 23

ESTIMATED ANNUAL USAGE OF FERTILIZER NUTRIENTS
IN THE CANADIAN PORTION OF THE LAKE HURON BASIN (1971)

Sub-Basin	(kg/improved ha)			(kg/total ha)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Muskoka-Severn	17.2	15.0	15.9	3.2	2.8	3.0
Saugeen-Maitland	27.5	21.4	22.2	17.6	13.7	14.2
Total Canadian Lake Huron Basin	23.4	18.9	19.7	7.6	6.1	6.4

pounds/acre (lb/acre) = kilograms/hectare (kg/ha) x 0.8922

AGRICULTURAL MANURES

The nutrients deposited annually from agricultural manures in the Canadian Lake Huron Basin are presented in Table 24. The quantities of nitrogen and potassium (K_2O) derived from agricultural manures are significantly higher than those from fertilizers (see Table 22); however, the quantity of phosphorus (P_2O_5) is slightly lower.

Approximately 42,000 t nitrogen (92 million lb), 22,000 t phosphorus (P_2O_5) (48 million lb), and 43,000 t potassium (K_2O) (95 million lb) are received annually from agricultural manures by the Canadian Lake Huron Basin. The majority of these nutrients, 62 percent, are located in the Saugeen-Maitland Sub-Basin, with the remainder in the Severn-Muskoka Sub-Basin.

TABLE 24

ANNUAL TOTAL NUTRIENTS FROM MANURE
(t/a)

Sub-Basin	N	P_2O_5	K_2O
Muskoka-Severn	15,900	8,200	16,700
Saugeen-Maitland	26,400	13,700	25,850
Total Canadian Lake Huron Basin	42,300	21,900	42,550

pounds (lb) = tonnes (t) x 2200

The estimated annual production of manure nutrients in the Canadian Lake Huron Basin, in terms of material applied per hectare, is 35.8 kg nitrogen (79 lb), 18.5 kg phosphorus (P_2O_5) (41 lb), and 36.0 kg potassium (K_2O) (79 lb) per ha of improved farmland (Table 25). The density of manure nutrients, in terms of hectares of improved farmland, is approximately the same in the two sub-basins. However, the Saugeen-Maitland Sub-Basin has a higher density of manure nutrients per ha of total land because of its smaller size.

Table 25

ESTIMATED ANNUAL PRODUCTION OF MANURE NUTRIENTS (1971)

Sub-Basin	(kg/improved ha/a)			(kg/total ha/a)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Muskoka-Severn	34.1	17.6	35.8	6.3	3.3	6.7
Saugeen-Maitland	36.9	19.1	36.1	23.6	12.2	23.1
Total Canadian Lake Huron Basin	35.8	18.5	36.0	11.7	6.0	11.7

pounds/acre (lb/acre) = kilograms/hectare (kg/ha) x 0.8922

COMBINED FERTILIZERS AND MANURES

Table 26 presents a summary of the nutrients from both fertilizers and agricultural manures applied to land in the Canadian portion of the Lake Huron Basin. The quantities are 70,000 t (154 million lb) nitrogen, 44,200 t phosphorus (P_2O_5) (97 million lb), and 65,900 t potassium (K_2O) (145 million lb). The majority of these nutrients are applied in the Saugeen-Maitland Sub-Basin.

TABLE 26

ESTIMATED ANNUAL TOTAL NUTRIENTS
FROM FERTILIZER USAGE AND MANURE PRODUCTION
(t/a)

Sub-Basin	N	P_2O_5	K_2O
Muskoka-Severn	24,000	15,200	24,100
Saugeen-Maitland	46,000	29,000	41,700
Total Canadian Lake Huron Basin	70,000	44,200	65,800

pounds (lb) = tonnes (t) x 2200

ROAD SALTS

It is estimated that a total of 274,000 t (603 million lb) of salt are used on roads in the Canadian portion of the Lake Huron Basin in an average winter (Table 27). The salt indicated is rock salt or sodium chloride, (composed of 94 to 97 percent pure sodium chloride), plus small quantities of chlorides, carbonates and sulphates of calcium and magnesium.

Calcium chloride is also used as a de-icing agent, although its use amounts to less than one percent of the sodium chloride used. Although, calcium chloride is used in the summer as a dust control agent on gravel surfaces, quantitative estimates were unavailable due to its relatively low usage.

Sodium chloride application rates have decreased over the last ten years. However, the number of miles of roads salted has increased, resulting in a general increase in salt use every year.

Table 27 presents a comprehensive summary of salt use in the Canadian portion of the Lake Huron Basin.

TABLE 27

USE OF ROAD SALT IN THE CANADIAN PORTION
OF THE LAKE HURON BASIN

Sub-Basin	Total Salt Use (t/a)	Total Area (ha)	Intensity of salt use (kg/ha)
Mississagi	11,780	1,222,157	10
Spanish-French	55,161	3,739,905	15
Severn-Muskoka	172,100	2,512,582	69
Saugeen-Maitland	35,142	1,118,134	31
Total Canadian Lake Huron Basin	274,183	8,592,778	32

pounds (lb) = tonnes (t) x 2200
acres = hectares (ha) x 2.471
pounds/acre (lb/acre) = kilogram/hectare (kg/ha) x 0.8922

The Severn-Muskoka Sub-Basin has the highest level of salt use, 172,000 t (379 million lb), as well as the highest intensity of salt use, 69 kg/ha (962 lb/acre). The overall intensity of salt use in the Canadian Lake Huron Basin is 32 kg/ha (28 lb/acre), which is fairly low in comparison to Lake Ontario's average of 298 kg/ha (266 lb/acre).

Most of the road salt in the Canadian portion of the Lake Huron Basin is used on provincial highways and in the cities of Owen Sound, Barrie, North Bay, Sudbury and Sault Ste. Marie.

SOURCE MATERIALS

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ADDITIONAL INFORMATION SOURCES

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Crop Science Department, University of Guelph.

Domtar Chemicals Ltd., Sifto Salt Division.

Economics Branch, Ontario Ministry of Agriculture and Food.

Iroquois Salt Products Ltd.

Maintenance Branch, Ontario Ministry of Transportation and Communications.

Soils and Crops Branch, Ontario Ministry of Agriculture and Foods.

Water Resources Branch, Ontario Ministry of the Environment.

5 FUTURE TRENDS

POPULATION

The population forecasts presented in Table 28 were compiled by the Regional Planning Branch of the Ontario Ministry of Treasury, Economics, and Intergovernmental Affairs (1). A basic assumption underlying these forecasts is that there will be no major intervention in current trends in the form of development projects or special government policies.

The total population of the Canadian portion of the Lake Huron Basin is projected to increase from 937,769 in 1971 to about 1,700,000 in 2021. The Spanish-French Sub-Basin will increase its share of the population from 29 to 33 percent. The Muskoka-Severn Sub-Basin's proportion will rise from 43 to 44 percent. The population of the Saugeen-Maitland Sub-Basin will grow at a slower rate than the rest of the Canadian Lake Huron Basin.

TABLE 28

POPULATION PROJECTIONS FOR THE CANADIAN PORTION OF THE LAKE HURON BASIN

Watershed	1971	1981	2001	2021
Mississagi Sub-Basin	101,272	116,900	149,900	188,400
Spanish-French Sub-Basin	267,583	321,700	433,900	574,000
Muskoka-Severn Sub-Basin	401,934	464,400	599,800	763,300
Saugeen-Maitland Sub-Basin	166,980	176,200	198,500	226,600
Total Canadian Lake Huron Basin	937,769	1,079,200	1,382,100	1,752,300

ECONOMIC ACTIVITY

The economic activity projections presented here were prepared by Informetrica Limited (2). Details concerning methodology were presented in Appendix A of Volume I in this report series.

Two sets of estimates were made, Series A and Series B.

Series A postulates a world economy in which basic resources are continually in short supply. This is reflected in two ways:

a) the assumption that a rapid growth in world prices of several major commodity groups, mainly associated with metals, mining and energy, will occur; and

b) the assumption that Canadian suppliers of these goods will respond by providing a rapid growth in the volume of these goods that are exported.

Over the long period under review in this study, the growth of economic output will be a function of the growth in the labour force, increases in productivity per worker, and the ability of policy makers to keep the economy continuously operating at or near "potential", with acceptable price increases. It is assumed that governments will operate the economy at close to the potential, accepting an average annual increase of about 4.1 percent in prices in the long term, as measured by the implicit deflator of Gross National Product. This rate is somewhat higher than has been experienced in the post-World War II period and reflects the general assumption of a continued world scarcity of basic resources.

Growth of the supply of labour is related to the growth of the population eligible to work and the willingness of that group to participate in the labour force. The past generation has seen a steady decline in the average hours worked per week. It is anticipated that this trend will continue, the average falling from a present 36 hours per week to about 27 in 2020. On the other hand, there has been a clear tendency for people to participate (albeit in the reduced work week) in the past. This is attributable primarily to the increased rate of women's participation. It is expected that this trend will also continue. The participation rate of women under the age of 35 is projected, for example, to rise from a present 45 percent to almost 80 percent in 2020. Overall, it is projected that the participation rate will rise from its current 58 percent to almost 65 percent in 2020.

Consequently, the labour force can be expected to grow at an average annual rate of about 1.5 percent in 1974-2020. This factor, together with a growth in output per labourer averaging about 2.7 percent annually, yields an expected average annual growth of 4.2 percent of the Gross National Product (in constant dollar terms). The pattern over time is interesting. The potential for rapid growth is almost certain to deteriorate over time, as the growth of the labour force slows. Thus, in 1974-1990, the economy can potentially grow at an average annual rate of about 4.8 percent. However, from 1991 through 2020, this potential is restricted by the slow growth of the labour force to about 3.8 percent per year.

To support the rapid growth of government services, it is assumed that taxes will be such that disposable personal income per capita will grow slightly less rapidly than Gross National Product. Nevertheless, this indicator of economic well-being will continue to increase at an average annual rate of 3.0 percent in 1974-2020. This rate is only slightly less than that which was maintained in the 1960's. In terms of 1961 prices, per capita disposable income will rise from $4,950 in 1974 to $9,410 in 2020.

The consumption of public goods and services, as measured by government current expenditures, is projected to provide an increasing share of total expenditures at the expense of private consumption. Under conditions of a slowly growing population, this is a reasonable projection if the economy is to operate at its full potential. Among private consumption items, expenditures for services and durable goods can be expected to grow most rapidly, as has been the case in the past decade.

Demand generated for investment is projected to provide 21-22 percent of total expenditures, of which the private sector is expected to provide an even greater amount. The one significant contrast between the experience of recent years and that expected in future years is in the projection for residential construction, which is projected to grow slowly and to decline as a proportion of total expenditures. This can be attributable to the projected pattern of population growth. The formation of new households, which has grown rapidly in the past decade, can be expected to increase at slower rates in the future. Domestic savings should be sufficient to finance investment throughout most of the period. Business and government can be expected to provide increasing shares of total savings, particularly after the mid-1980's. Until that time, low dependency ratios (i.e., the ratio of the number of persons not in the labour force to those employed) should cause personal savings to rise rapidly.

In Series B by the year 2020, exports (in current dollars) are about 23 percent less than in the Series A simulation. This is accomplished by assuming that:

a) world prices for uranium, coal, iron ore and automobiles grow less rapidly after 1985, and

b) the volume of exported uranium, coal and iron ore will grow more slowly, reflecting a diversion of investment interest from those sectors of the economy.

In constant dollar terms, exports in 2020 are 10 percent less than in Series A.

Such assumptions would lead to a much slower increase in economic activity and would yield a sustained high rate of unemployment. This will provide the rationale for governments to sufficiently increase transfers to persons, in order to generate domestic demand that will again lead (as in Series A) to an economy operating at "potential".

Given that policy is set to yield growth at "potential" in both simulations, the trace of economic activity in the alternative forecasts will be less broadly distinguished than would be the case if major structural differences in the economy were allowed. The changed external assumptions will have a major depressive effect, for example, on the output of the mining industry. But, because of the compensation for the slack foreign demand, this depressive effect will be partially offset. It is, of course, possible to perceive of alternative simulations that are radically differentiated. However, most of those simulations would entail the articulation of major changes to the institutional and behavioural structure of the economic system. Such an articulation would be a major task.

Given the underlying policy assumption, the results of Series B, as measured by such major aggregates as Gross National Products, the Consumer Price Index and Personal and Disposable Income, are very similar to those of Series A. In Series B, Disposable Personal Income per person amounts to $9,710 (in 1961 dollars), as compared to $9,410 in Series A. Most of the major characterizations detailed above for Series A apply to this simulation as well.

The Series A economic activity projections for the Canadian portion of the Lake Huron Basin are presented by major industrial group in Table 29. Total output is projected to increase from $3,586.94 (in millions of 1961 dollars) in 1972 to $29,041.36 in 2020. The combined contribution of agriculture, forestry and fishery to the economy is projected to continue its past decline, from 1.4 percent in 1972 to 1.1 percent in 2020. Mining, in contrast, is forecast to increase it's share of the total output over the same time period from 12.8 percent to 16.4 percent. A relative increase is also projected for manufacturing, while the proportion of total output from construction, transportation, utilities, trade and other sectors are projected to decline.

TABLE 29

ECONOMIC ACTIVITY PROJECTIONS FOR THE CANADIAN LAKE HURON BASIN, SERIES A

Real Domestic Product by Major Industrial Group
(Millions of 1961 dollars)

	1972	1980	2000	2020
Agriculture	35.85	49.40	101.11	218.53
Forestry	12.98	21.28	44.32	88.34
Fisheries	1.22	1.33	1.83	2.87
Mining	459.42	756.75	1,838.29	4,770.15
Manufacturing	1,214.94	1,997.69	4,546.69	11,445.35
Construction	213.55	325.94	629.48	1,271.48
Trans. Utilities, Trade & Other	1,648.98	2,577.49	5,502.55	11,244.64
Total Output All Sectors	3,586.94	5,729.88	12,664.27	29,041.36

MAJOR LAND USES

AGRICULTURE

The following agricultural land use forecasts are based upon trend projections, upon alternative assumptions of technological advance, and upon the assumption that political or economic factors will force agricultural output to grow in step with population (3).

The transition of traditional labour-intensive farming to its modern capital-intensive form has been an essential part of the creation of the present structure of the economy. Rapid growth in agricultural productivity has resulted in the release of labour and land to other sectors of the economy, while permitting absolute growth in the volume of agricultural commodities produced. These changes have been brought about through intensified use of intermediate inputs, especially machinery, fertilizers and pesticides.

The last few years have been somewhat different from what the economy experienced over the entire 1950 - 1975 period. In 1973, and again in 1974, real wages and salaries dropped from the previous year's levels. These were the only times that this has occurred in recent years. Furthermore, only in the seventies has the agricultural sector improved its position relative to the rest of the economy. If these are not temporary phenomena, future trends in agriculture will bear little resemblance to the past. The outflow of land and labour will cease, and perhaps even reverse. In the forecasting exercise, this is the most critical question.

In a pessimistic scenario, it is assumed that these aggregate events will signify a turning point. The area of land required to sustain the consumption standards of a fixed number of people cannot be expected to decline as dramatically as it has in the past. Therefore, through price-induced resource movements, or through government economic directives, the present decline in the land base of agriculture will be halted.

In an alternative optimistic scenario, it is assumed that the events of the recent past are a short run aberration and that agriculture will return to its typical pattern of rising yields and reduced acreages.

In both scenarios, it is assumed that either market forces or government intervention will ensure basic food production. Specifically, it is assumed that the physical volume of agricultural production will grow over any period at a constant proportion of the growth rate of Ontario population.* For a detailed discussion of methodology, see Appendix A of Volume I in this report series.

**A key omission in this study is the relationship between Ontario agriculture and the rest of the world. An implicit assumption of the present study is that Ontario will not increase its net reliance on outside agriculture at a faster rate than it has in the past.*

The agricultural land forecasts for the Canadian portion of the Lake Huron Basin are presented by river sub-basin group in Table 30. The alternative forecasts of agricultural land use indicate radically different futures for the Canadian Lake Huron Basin. In the optimistic scenario, which is based upon the assumption that agricultural yields will continue to improve over the forecast period, the total area used by agriculture is predicted to decline by about 300,000 ha (740,000 acres). The overall decline is unevenly distributed. In the Spanish-French Sub-Basin and the Saugeen-Maitland Sub-Basin, the total agricultural area will be relatively stable. Most of the decline in agriculture could occur in the Mississagi Sub-Basin and the Muskoka-Severn Sub-Basin. The reasons for the decline will vary. Toronto-centred urban expansion may be important in the Muskoka-Severn Sub-Basin. However, in most areas it is the assumed continued decline of farm incomes that may induce farmers to abandon production on marginal agricultural land.

In the pessimistic scenario, which is based upon the assumption that an upper limit to yields is being approached, the decline of the area occupied by agriculture is predicted to be halted between 1980 and 2000. Subsequently, a significant area will be absorbed by agriculture. The most apparent reversal will occur in the Muskoka-Severn Sub-Basin where a large area will be added to the agricultural estate. In the Spanish-French Sub-Basin, the decline in farm area is predicted to slow considerably.

Which scenario will best approximate the future? This depends on the nature of technological advance in agriculture. It depends also on the nature of the decision-making process in agriculture. Will broad trends in agriculture be set by the decisions of isolated producers, responding to the product prices, land prices and factor prices that are established in the world of monopolies that surrounds them -- or will the broad trends of agriculture be established by state intervention based upon a normative evaluation of the cost of resource use and of the value of alternative categories of consumption? Finally, what is becoming more scarce: farmland; energy; or the ability of the environment to absorb larger doses of biocides and fertilizer? Many forces are acting upon agriculture and the resolution of these forces is not at all clear.

URBAN

The urban land use forecasts in this report are based on a cross-sectional analysis of the relationship between urban population and urban area (4). They are basically unconstrained, assuming no more effective planning than exists now, and also that the economy will continue to be the major determinant of the urbanization process.

Two different methodologies were used in the urban land forecasts. The first approach is the constant land consumption rate method, which is based on the assumption that any increments of urban population will occupy as much space per person as the current urban population. The second approach is the allometric method, which assumes that as population increases, urban area also increases, but at a slower rate, reflecting a higher density and more intense use of land in larger cities. Finally,

TABLE 30

AGRICULTURAL LAND USE FORECASTS FOR THE CANADIAN PORTION OF THE LAKE HURON BASIN
(ha)

Scenario:	1980		2000		2020	
	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic
Mississagi Sub-Basin	22,449	22,033	12,911	18,125	7,176	16,860
Spanish-French Sub-Basin	94,316	93,419	92,676	97,828	99,358	114,130
Muskoka-Severn Sub-Basin	454,598	446,441	349,031	488,177	279,504	697,458
Saugeen-Maitland Sub-Basin	721,374	706,656	723,379	833,173	710,382	858,950
Total Canadian Lake Huron Basin	1,292,737	1,268,549	1,177,997	1,437,303	1,096,420	1,687,398

acres = hectares (ha) x 2.471

a preferred forecast (the declining land consumption rate forecast) is presented which combines the best attributes of both methods. A detailed description of methodology is presented in Appendix A of Volume I in this report series.

DEFINITIONS

Urban Population, as defined in the 1971 Census of Canada, includes the population living in: (1) incorporated cities, towns and villages with a population of 1,000 or over; (2) unincorporated places of 1,000 or over having a population density of at least 1,000 per square miles; and (3) the built-up fringes of (1) and (2) having a minimum population of 1,000 and a density of at least 1,000 per square mile.

Urban Area refers to the land actually used for residential, commercial, industrial, institutional or transportation purposes.

Land Consumption Rate is an intensity measure describing the relationship between urban population and urban area, expressed in hectares per 1,000 persons.

Urban land forecasts for the Canadian portion of the Lake Huron Basin are presented by sub-basin in Table 31. Approximately 53,000 additional ha (131,000 acres) of urban land may be required by the year 2020 to accommodate population growth. Approximately 36,000 ha (89,000 acres), or 68 percent of the total increase, is projected to occur in the Muskoka-Severn Sub-Basin. The Spanish-French Sub-Basin is forecast to experience significant urban expansion, amounting to 11,000 ha (27,000 acres). In the Mississagi and Saugeen-Maitland Sub-Basin, urban land will grow at a slower rate.

The urban expansion projected in Table 31 will necessitate the conversion of land from other uses to urban use. The Lands Directorate, Environment Canada, recently did a study on rural to urban land conversion in Ontario cities (5), recording the former use of land converted to urban over the period 1966 to 1971. The results for cities in the Canadian Lake Huron Basin are presented in Table 32. Most of the projected urban expansion around Barrie and Sarnia takes place on agricultural land. However, projected urban growth around North Bay, Sault Ste. Marie and Sudbury brought about the conversion of more forest than farmland. It is likely that future rural to urban land conversion in the Canadian portion of the Lake Huron Basin will follow these patterns.

TABLE 31

URBAN LAND FORECASTS FOR THE CANADIAN PORTION OF THE LAKE HURON BASIN
(ha)

Sub-Basin	1972	1980	2000	2020
Mississagi	4,175	4,466	5,725	7,360
Spanish-French	19,316	20,225	25,684	30,310
Muskoka-Severn	44,698	45,669	62,832	80,473
Saugeen-Maitland	15,101	15,328	16,776	18,531
Total Canadian Lake Huron Basin	83,290	85,688	111,017	136,674

acres = hectares (ha) x 2.471

TABLE 32

CONVERSION OF OTHER LAND USES TO URBAN USE IN THE CANADIAN LAKE HURON BASIN CITIES, 1966-1971

CITY*	PERCENTAGE OF TOTAL LAND CONVERTED AGRICULTURE	FOREST	OTHER
Barrie	70	29	1
North Bay	25	71	4
Sarnia	78	21	1
Sault Ste. Marie	44	50	6
Sudbury	19	66	15

*populations > 25,000

SUMMARY

The major land use projections for the Canadian portion of the Lake Huron Basin are summarized in Table 33. The Canadian Lake Huron Basin of the future is projected to contain more urban land, less farmland and forest, and more "other" land use, including recreational land. However, these net changes will involve only eight percent of the total Canadian Lake Huron Basin area; thus the overall land use pattern is not expected to change drastically in the next 50 years.

TABLE 33

MAJOR LAND USE PROJECTIONS FOR THE CANADIAN PORTION OF THE LAKE HURON BASIN, 1972-2020
(1000 ha)

Land Use	1972	1980	2000	2020
Urban	83.3	85.3	110.5	136.0
Agriculture	1404.3	1292.7	1178.0	1096.4
Forest	6855.7	6913.7	6818.7	6467.5
Other	249.5	301.1	485.6	892.9
Total Land Use	8,592.8	8,592.8	8,592.8	8,592.8

acres = hectares (ha) x 2.471

SPECIALIZED LAND USES

The five categories of specialized land uses, including waste disposal, erosion zones, intensive livestock operations, high density non-sewered residential areas and recreational lands, bear no simple relationship with the standard economic and demographic variables. The future pattern and extent of specialized land uses in the Canadian portion of the Lake Huron Basin will be more a function of interacting social, technological and legislative factors than of population and economics. The forecasts in this section extend only to 1990 because of the great uncertainties involved in forecasting changes in specialized land uses.

WASTE DISPOSAL

A major trend in waste disposal is toward fewer, but larger and better managed, waste disposal sites. The numerous open dump sites are being closed as waste is being consolidated into large sanitary landfill operations.

The Province of Ontario has adopted a waste management program, called Resource Recovery, which uses every practical means available to recover all the valuable resources from the waste produced in the Province, and at the same time to eliminate unnecessary waste (6). The programme is designed to provide, in three five-year stages, all the facilities necessary for complete resource recovery to serve at least 90 percent of the basin population, and all but eliminate the need for the landfill of waste.

If the above plan is implemented, and garbage is indeed transformed into a resource, waste disposal may not be a problem in the future.

EROSION

Lakeshore and riverbank erosion are basically natural processes caused by natural phenomena. It is likely that these processes will continue at their present long term rates in the future. However, natural erosion can be accelerated by the clearing of vegetation and construction on shorelands. In order to prevent property damage and possible loss of life, shoreline management programs will probably be implemented in the near future. Such programs would regulate development in erosion prone zones, and thereby prevent further man-caused erosion.

INTENSIVE LIVESTOCK OPERATIONS

Due to economics of scale and the escalating cost of land, the trend toward larger numbers of livestock confined to small areas will likely continue in the near future. However, if the animal waste is properly handled, it need not have a negative impact on water quality.

Beef cattle should constitute an increasing proportion of total cattle, due to a predicted relative decline in the demand for dairy products.

HIGH DENSITY, NON-SEWERED RESIDENTIAL AREAS

The urban, high density, non-sewered residential areas are gradually being connected to municipal sewage systems. The rural component of the high density, non-sewered residential areas will likely increase along with increases in the rural, non-farm population.

Advances in private waste disposal system technology may contribute to improved efficiency, resulting in less pollution of ground and surface water.

RECREATIONAL LANDS

If the supply of recreational lands keeps up with the demand for recreation, recreational lands will likely increase in the future.

Not only will there be more people wanting recreation, but shorter work weeks will give each person more time for recreational pursuits.

MATERIALS USAGE FORECASTS

PESTICIDES

There are formidable obstacles to making statements about the nature and level of pesticide use in the future. New products are continually being introduced to the market. Furthermore, the use of old products can decline, resulting in the withdrawal of some of these products from the market. In addition, legislation can radically alter the pest control choices available for use.

The projections presented are based on the following restrictive assumptions: 1) that there will be no radical changes in pest control practices or types of chemicals used; 2) that the intensity of chemical use will remain constant; and 3) that the proportion of each class of farmland subjected to pesticide use will remain constant. The only remaining variable is the area of farmland. Details of the methodology used in these forecasts are discussed in Appendix A of Volume I in this report series.

The agricultural pesticide use forecasts are presented in Table 34. The use of fungicides and insecticides is forecast to increase under both the upper and lower forecasts. The use of herbicides is projected to decline in the lower forecast and increase in the upper forecast.

These forecasts are based on very restrictive assumptions and should not be construed as balanced projections incorporating the magnitude of all factors that can affect future pesticide use.

FERTILIZERS

The volume of fertilizer that will be used by agriculture in the Canadian portion of the Lake Huron Basin in the future will depend, in a complex way, upon the area used by agriculture, prices of farm products, prices of fertilizers, environmental constraints and technical limits. Because of the uncertainty of long run projections, most of these factors have been excluded from the forecasting exercise. However, the environmental implications of a continued rapid use of fertilizers make it important to consider the magnitude of their use in the future. A detailed methodology appears in Appendix A of Volume I in this report series.

The projected chemical content of fertilizers used in the Canadian portion of the Lake Huron Basin is presented in Table 35(7).

The forecasts are very sensitive to the assumptions on which they are based. The factors behind these projections (Table 35) include the following:

1) that an increasing proportion of the area under crops will be fertilized;
2) that the total area under crops will decline; and
3) that there will be a shift to crops which require more intensive fertilization.

Based on these assumptions, there is a substantial increase projected in the fertilizer nutrients applied to the Canadian Lake Huron Basin. Table 35 indicates that total fertilizer nutrients are forecast to increase from 77,573 t (171 million lb) in 1971 to 170,156 t (374 million lb) in 2020.

ROAD SALTS

The large volume of salt applied to roads is based on the dominance of private motor vehicles. If private transportation is de-emphasized in the future, the need to keep roads free of snow and ice will be reduced. However, at the same time, emergency vehicles (e.g., fire engines, police cars,

TABLE 34

FORECAST OF AGRICULTURAL PESTICIDE USE IN THE CANADIAN PORTION OF THE LAKE HURON BASIN
(t/a)

Pesticide	1971	1980	2000	2020
Herbicides - Lower Forecast	657	609	586	553
Upper Forecast	-	622	730	897
Fungicides - Lower Forecast	59	74	104	132
Upper Forecast	-	76	134	311
Insecticides-Lower Forecast	120	124	140	155
Upper Forecast	-	127	178	318

dash (-) indicates data not available
pounds (lb) = tonnes (t) x 2200

TABLE 35

FORECAST WEIGHT OF NUTRIENTS IN COMMERCIAL FERTILIZER USED BY AGRICULTURE IN THE CANADIAN PORTION OF THE LAKE HURON BASIN
(t/a)

	1971	1980	2000	2020
Nitrogen	23,165	28,175	50,126	53,042
Phosphorus (P_2O_5)	24,363	29,373	51,106	53,293
Potassium (K_2O)	30,045	36,044	61,819	63,821
Total Nutrients	77,573	93,592	163,051	170,156

pounds (lb) = tonnes (t) x 2200

ambulances, etc.), buses and all forms of public surface transport will still be impeded by winter road conditions. Therefore, the extinction of the private vehicle would not necessarily mark the end of the environment-transportation conflict over de-icing agents.

Forecasting methodology for road salt use is presented in Appendix A of Volume I in this report series. Annual road salt use in the Canadian portion of the Lake Huron Basin is projected to increase at a steady rate, from 274,200 t (603 million lb) in 1972 to 308,000 t (678 million lb) in 1980 and to 451,000 t (1 billion lb) in 2020.

SUMMARY

The mass of materials applied to the land to increase its productivity, or to remove obstacles to rapid transportation, are forecast to continue growing. Quantitative forecasts of the use of the most important of these materials have been presented in this report.

The uncertainties of the future are emphasized in these projections. Little can be said about the preference system of society in the future. In an era characterized by rapid technological change, predictions will inevitably be clouded by the inability to deal with the development of radically new substitutes.

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