Report on Water Pollution

in the

LAKE HURON BASIN

SOUTHEASTERN MICHIGAN AREA

HURON RIVER

UNITED STATES DEPARTMENT OF THE INTERIOR

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

GREAT LAKES REGION

APRIL 1967

REPORT ON

WATER POLLUTION IN THE LAKE ERIE BASIN SOUTHEASTERN MICHIGAN AREA HURON RIVER

APRIL 1967

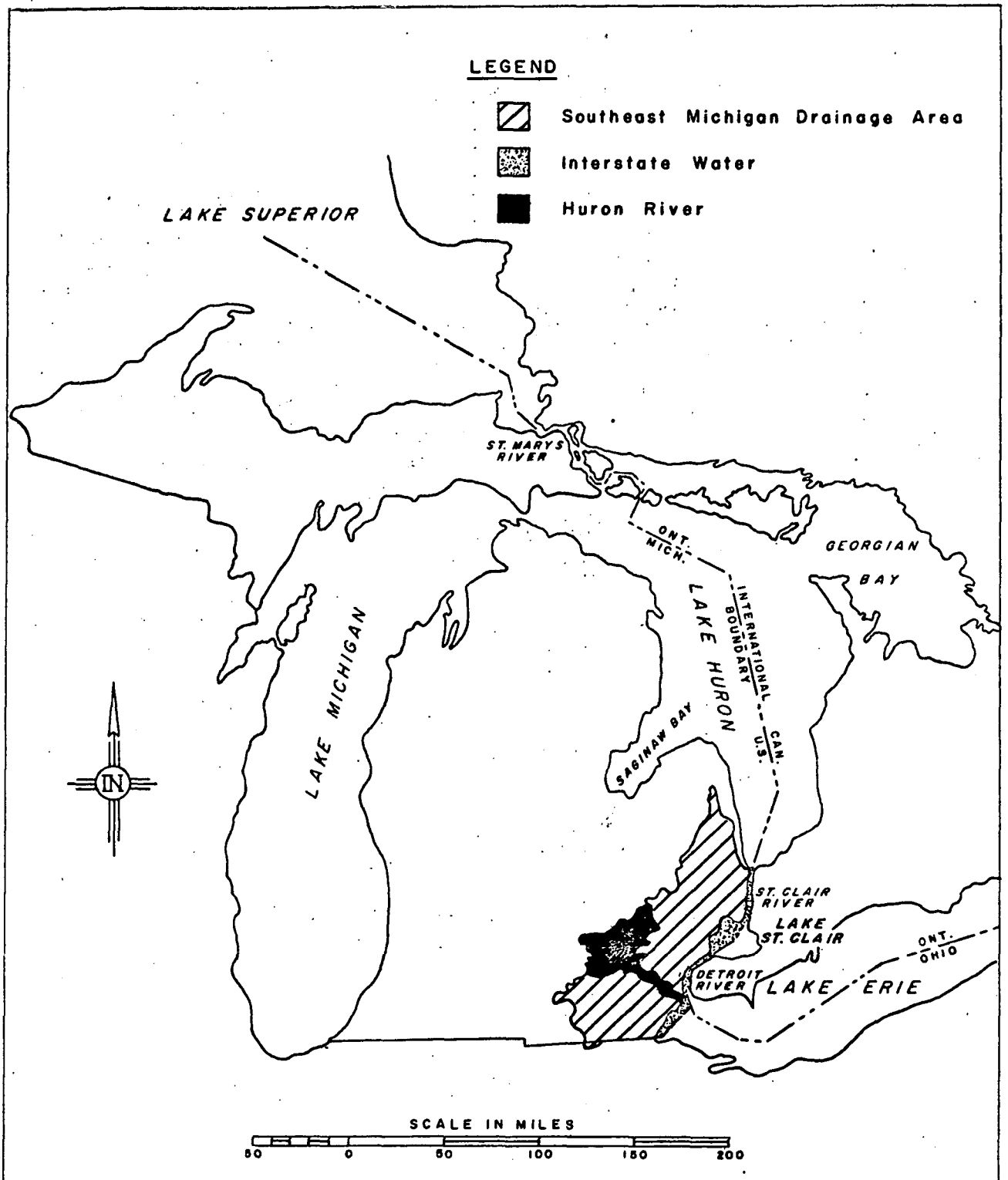
U.S. DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
Great Lakes Region
Detroit Program Office
U.S. Naval Air Station
Grosse Ile, Michigan

PREFACE

The southeastern Michigan area draining into Lake Erie has been recognized as one of the major water pollution areas of the Lake Erie system. Extending across the natural watershed boundaries of southeastern Michigan's tributaries is the metropolitan area of Detroit and its suburbs. The water quality problems of Lake Erie, Detroit River, Lake St. Clair, St. Clair River, and the individual tributaries are interrelated and compounded by the urbanization and industrialization of the area.

The complexity of the problem requires a comprehensive plan for "CLEAN WATER" that takes into account the cause and effect relationships of water resource utilization from the headwaters of the smallest tributary to the large water reservoirs that constitute the Great Lakes.

This document was assembled by the Detroit Program Office, Federal Water Pollution Control Administration, with the intention that it be used together with information from other sources to develop a comprehensive plan for water pollution control in the southeast Michigan tributaries of the Lake Erie Basin. The intended purpose of the plan would be to restore the usefulness of these waters for recreational purposes, provide a more suitable environment for fish and aquatic life, and enhance the value of this resource. It would improve the quality of the area's waters for municipal and industrial purposes, aesthetic enjoyment, and other beneficial uses.



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LOCATION MAP
LAKE ERIE BASIN
HURON RIVER

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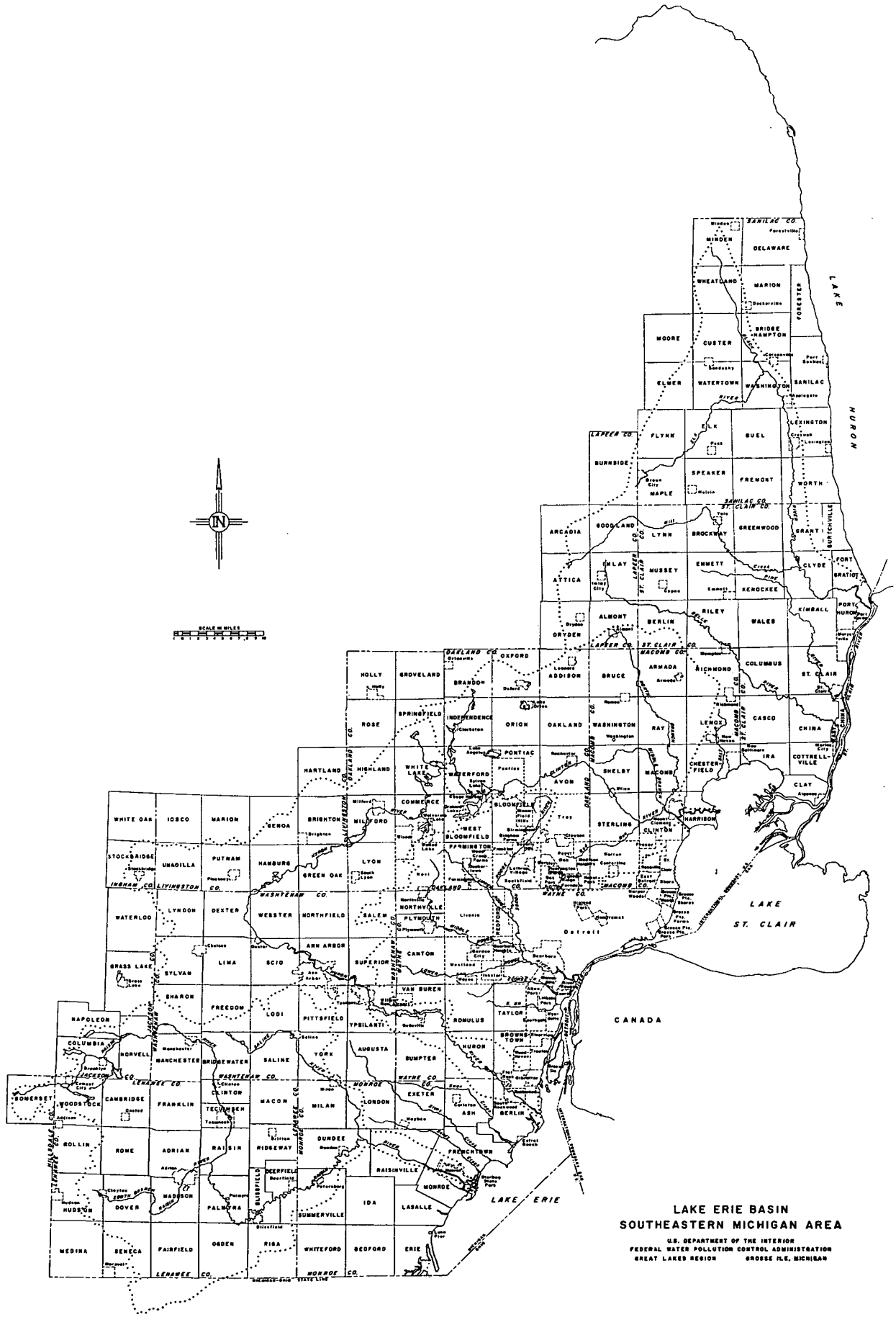

LAKE ERIE BASIN
SOUTHEASTERN MICHIGAN AREA

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN

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INTRODUCTION

AUTHORITY

Comprehensive water pollution control studies were authorized by The Federal Water Pollution Control Act of 1956, as amended (33 USC 466 et seq.).

> Sec. 3.(a) "The Secretary shall, after careful investigation, and in cooperation with other Federal agencies, with State water pollution control agencies and interstate agencies, and with the municipalities and industries involved, prepare or develop comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary condition of surface and underground waters. In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for public water supplies, propagation of fish and aquatic life and wildlife, recreational purposes, and agricultural, industrial, and other legitimate uses. For the purpose of this section, the Secretary is authorized to make joint investigations with any such agencies of the condition of any waters in any State or States, and of the discharges of any sewage, industrial wastes, or substance which may adversely affect such waters."

> Sec. 5.(f) "The Secretary shall conduct research and technical development work, and make studies, with respect to the quality of the waters of the Great Lakes, including an analysis of the present and projected future water quality of the Great Lakes under varying conditions of waste treatment and disposal, an evaluation of the water quality needs of those to be served by such waters, an evaluation of municipal, industrial, and vessel waste treatment and disposal practices with respect to such waters, and a study of alternate means of solving water pollution problems (including additional waste treatment measures with respect to such waters."

Initiation of the Great Lakes-Illinois River Comprehensive Program Activity followed an appropriation of funds by the 86th Congress late in 1960. In accordance with the provisions of the Act, the Secretary of Health, Education, and Welfare delegated the responsibility for the study

to the Division of Water Supply and Pollution Control of the Public Health Service. Passage of the "Water Quality Act of 1965" gave the responsibility for these studies to the Federal Water Pollution Control Administration (FWPCA). As a result of Reorganization Plan No. 2 of 1966, the FWPCA was transferred from the Department of Health, Education, and Welfare to the Department of the Interior effective May 10, 1966.

PURPOSE

This report presents the water quality of the Huron River, Michigan as it exists today, and includes predictions of population, water use, and waste load trends for future years. Its purpose is to present information that can be used as a basis for developing a basin wide water pollution control program. The objectives of the Federal Water Pollution Control Administration are to enhance the quality and value of the Nation's water resources, and to prevent, control, and abate water pollution through cooperative municipal, State, and Federal pollution control programs.

SCOPE

The area covered by this report is the Huron River Drainage Basin, Michigan, which is part of the Southeastern Michigan area tributary to Lake Erie. While some data from the entire Huron River Basin are presented herein, most of the water quality data collected by FWPCA are in the main river between Ann Arbor and the mouth of the Huron River at Lake Erie.

ORGANIZATION

The Detroit Program Office, located at the Naval Air Station, Grosse Ile, Michigan, began collecting water quality data on the Huron River in 1966. Its staff includes specialists in several professional skills, such as sanitary engineers, hydrologists, chemists, biologists, and bacteriologists. The resources of the Robert A. Taft Sanitary Engineering Center at Cincinnati, Ohio have been utilized, and assistance and guidance have been obtained from the Great Lakes-Illinois River Basins Project, Chicago.

ACKNOWLEDGMENTS

The Detroit Program Office has received the cooperation and assistance of local, State, and Federal agencies, as well as interested individuals. The principal agencies taking an active part in providing assistance in the preparation of the report are as follows:

State Agencies -

Michigan Water Resources Commission
Michigan Department of Public Health

Federal Agencies -

U.S. Department of Commerce
Weather Bureau
Office of Business Economics
Bureau of Census

U.S. Department of the Interior
Bureau of Commercial Fisheries
Bureau of Sports Fisheries and Wildlife
Bureau of Outdoor Recreation
Geological Survey

U.S. Department of Defense
Detroit District, Corps of Engineers
Lake Survey, Corps of Engineers

GENERAL DESCRIPTION

Area Description

The Huron River, located in the southeastern portion of Michigan, discharges to the western end of Lake Erie near the mouth of the Detroit River. The Huron River has its source at Big Lake in Oakland County and flows in a southwesterly direction for 55 miles through an inland lake region. The river then flows southeasterly approximately 65 miles to its mouth at Pointe Mouillee on Lake Erie. Pointe Mouillee is a large marshy area extending into Lake Erie at the mouth of the Detroit River area. The Huron River enters Lake Erie through a distributary system in the Mouillee Marsh.

The Huron River falls about 440 feet from its headwaters to its mouth. The main stem of the Huron River below Base Line Lake has a series of hydroelectric dams, some of which are not producing power. Two of the major impoundments are Ford and Belleville Lakes below Ypsilanti.

The Huron River Basin has a drainage area of 890 square miles comprising parts of Oakland, Livingston, Washtenaw, Wayne, and Monroe Counties. The major population center is the Ann Arbor-Ypsilanti area. (See Figure 1.)

The two major tributaries to the Huron River are the Portage River in the northwestern portion of the basin and Mill Creek in the southwestern portion of the basin near Dexter, Michigan. The Portage River has a drainage area of approximately 80 square miles and Mill Creek has a drainage area of approximately 135 square miles.

The Huron River Basin is shaped like a mallet with the upper basin comprising the head. For approximately 50 miles from the mouth of the Huron River to Ann Arbor, the basin is narrow and averages 5 miles in width.

Above Ann Arobr, the basin widens and contains some 340 lakes and impoundments.

The upper basin topography consists of rolling hills, flatlands, and lakes, and contains extensive deposits of sand and gravel. The topography below Ann Arbor is relatively flat, containing primarily clay and silt deposits of an ancient lake bed.

Climate

The Huron River Basin, lying in the southeast corner of Michigan, has a climate that is greatly affected by the Great Lakes. These large masses of water tend to raise the temperature of the air in winter and lower it during the summer. This action results in a climate that is more moderate than is experienced in the areas to the west and southwest of Michigan. This climate can be described as one having a wide seasonal temperature variation, many storms, and a relatively constant yearly precipitation distribution. In the winter, this precipitation is usually in the form of snow.

At Ann Arbor, the average yearly temperature is 49, with average summer and winter temperatures of 69° and 28°, respectively. The normal yearly precipitation at Ann Arbor is 31 inches, with roughly 50% falling during the months of May through September, inclusive. The growing season averages 163 days.

Hydrology

Location of U.S. Geological Survey Gages

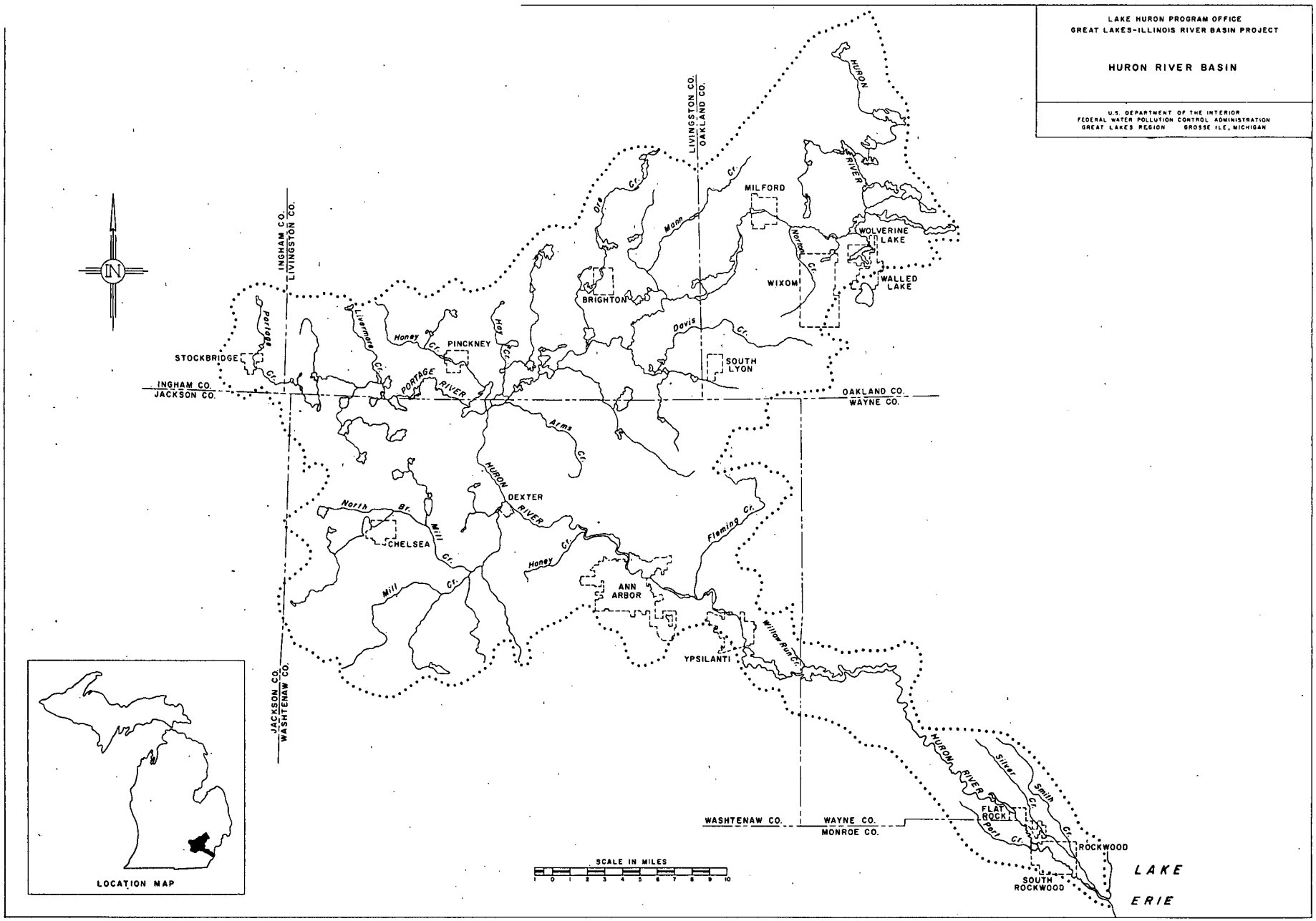
There are nine U.S. Geological Survey gaging stations in the Huron River Basin. One of these, Huron River at Ann Arbor, was utilized by the Federal Water Pollution Control Administration in this report. It has a

drainage area of 711 square miles and is located 100 feet upstream from the Wall Street bridge in Ann Arbor. It has been in operation since February 1904. At this station, the maximum and minimum discharges are 5840 and 4 cubic feet per second (cfs), respectively. For the period of record, the discharge has averaged 434 cfs.

Drought Flow

The flow of the Huron River is regulated by the many dams along its length. This regulation tends to make meaningless any value of short-term drought flow calculated. It is believed, however, that the thirty-day drought flow is a reliable value. The one and seven-day values are included below to show the wide variance between the three flows. These flows were calculated for the U.S. Geological Survey gage at Ann Arbor for the 1948-1964 period. They are as follows:

One-day (once-in-ten-years)	-	35 cfs
Seven-day (once-in-ten-years)	-	70 cfs
Thirty-day (once-in-ten-years)	-	97 cfs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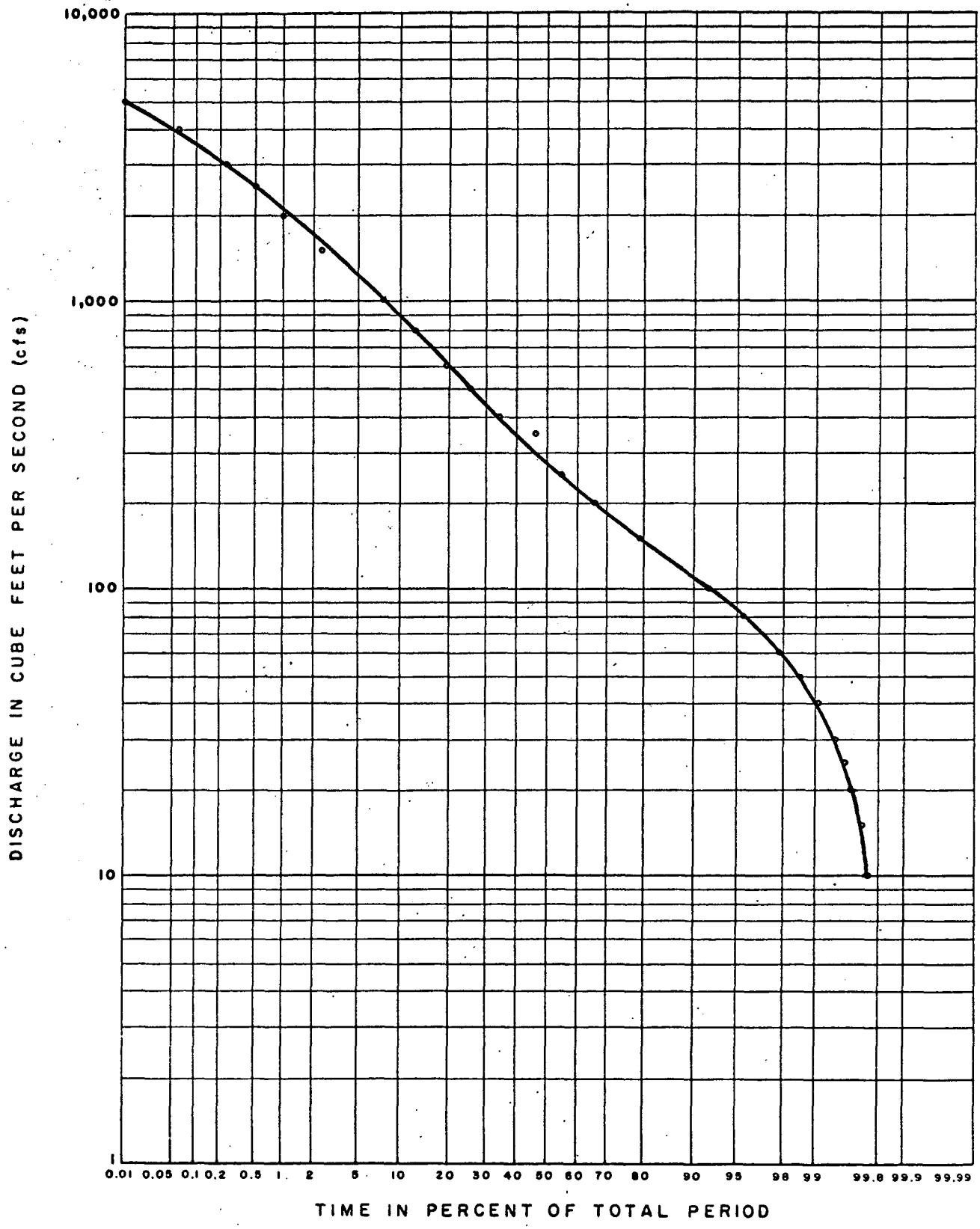
N
INGHAM CO.
LIVINGSTON CO.
LIVINGSTON CO.
OAKLAND CO.
JACKSON CO.
WASHTENAW CO.
INGHAM CO.
JACKSON CO.
OAKLAND CO.
WAYNE CO.
WASHTENAW CO.
WAYNE CO.
MONROE CO.
HURON RIVER
Portage Cr.
Livermore Cr.
Honey Cr.
PINCKNEY
Hall Cr.
STOCKBRIDGE
PORTAGE RIVER
Arms Cr.
HURON RIVER
DEXTER
North Br. Mill Cr.
CHELSEA
Mill Cr.
Honey Cr.
Fleming Cr.
ANN ARBOR
YPSILANTI
Willow Run Cr.
Old Cr.
Mason Cr.
LIVINGSTON CO.
OAKLAND CO.
MILFORD
HURON RIVER
Norton Cr.
WOLVERINE LAKE
WIXOM
WALLED LAKE
BRIGHTON
Davis Cr.
SOUTH LYON
HURON RIVER
Silver Smith Cr.
FLAT ROCK
Pearl Cr.
ROCKWOOD
SOUTH ROCKWOOD
LAKE ERIE
SCALE IN MILES
1 0 1 2 3 4 5 6 7 8 9 10
LOCATION MAP

FIGURE 1

FIGURE 2

FLOW DURATION CURVE
HURON RIVER AT ANN ARBOR
1915-1947, 1949-1964



WATER USE

Municipal Water Supply

The Huron River Basin has a 1965 population served by public water supplies of about 150,000 people. This number is expected to increase to 360,000 by 1990 and to 510,000 by 2020. Municipal water use in 1965 was estimated to be approximately 20 million gallons per day (MGD) and projected to be 48 and 73 MGD in 1990 and 2020, respectively. Approximately one-half of the present water supply comes from the Huron River. The remainder is from ground water supplies.

Table 1 lists the present water supplies and the source. In Table 2 the projected municipal water uses for 1990 and 2020 are shown.

Industrial Water Supply

Many of the small industries in the basin obtain their water from the municipal supply. The industrial water use shown in Table 2 is the quantity of water obtained directly from other sources. This table also shows projected industrial water use.

Water-related Recreation

The Huron River Basin is dotted with lakes and parks that offer outdoor facilities of all types. One of the major recreational areas in the basin is the Lower Huron Metropolitan Park. Fishing, boating, swimming, and skiing, are popular water uses in the basin. Recreation inventory and analyses are contained in the Bureau of Outdoor Recreation report. "Water Oriented-Outdoor Recreation Lake Erie Basins." August 1966.

TABLE 1. MUNICIPAL WATER SUPPLIES*
Huron River Basin

Town	1960 Pop.	Owner**	Source	Treatment**
Brighton	2,300	M	Wells in drift 94' to 97' deep	4, 5 & 6
Brighton Twp.	450	T	Wells in drift 105' deep	-
Green Oak Twp.	1,000	T	Wells in drift 116' to 126' deep	-
Boys Vocational School	100	S	Wells in drift 81' to 90' deep	4 & 5
Commerce Twp.	3,100	C	Wells in drift 112' to 140' deep	-
Milford	4,300	M	Wells in drift 118' deep	-
South Lyon	1,800	M	Wells in drift 104' to 118' deep	-
Walled Lake	700	M	Wells in drift 160' to 206' deep	-
Wixom	350	C	Wells in drift 64' deep	-
Wolverine Lake	300	M	Wells in drift 254' to 257' deep	-
Belleville	1,900	M	Detroit	-
Flat Rock	4,700	M	Intake Huron River	1
Rockwood	2,000	M	Water from Flat Rock	-
Ann Arbor	67,300	M	Wells in drift 30' to 56' deep and 178' deep plus Huron River water	2 & 6

* Taken from "Data on Public Water Supplies in Michigan," Engineering Bulletin No. 4 by the Michigan Department of Public Health.
** See Owner and Treatment Code, page 13.

TABLE 1 . MUNICIPAL WATER SUPPLIES*
Huron River Basin

Town	1960 Pop.	Owner**	Source	Treatment**
Ann Arbor Twp.	500	P	Wells in drift 58' to 142' deep	-
Chelsea	3,400	M	Wells in drift 34' to 40' deep	4 & 6
Dexter	1,700	M	Wells in rock 280' deep	5
Lyndon Twp.	250	S	Wells in drift 74' deep	-
Brookside Sub.	200	T	Wells in drift 75' deep	-
Walden Woods	200	P	Wells in drift 101' deep	-
Scio & Webster Twp.	200	D	Wells in drift 51' deep	-
Superior Twp.	400	T	Wells in drift 113' to 120' deep	5
Ypsilanti	21,000	M	Wells in drift 87' to 102' deep	2 & 6
Ypsilanti Twp.	20,000	T	Wells in drift 81' to 87' deep	2 & 6
Ypsilanti State Hospital	5,000	S	Wells in drift 217' to 226' deep	-

* Taken from "Data on Public Water Supplies in Michigan," Engineering Bulletin No. 4 by the Michigan Department of Public Health.
** See Owner and Treatment Code, page 13.

OWNER AND TREATMENT CODES

Owner Code:

M = City or Village
T = Township
P = Private
D = District
C = County
S = State
U.S. = Federal

Treatment Code:

1. Std. Filtration*
2. Lime softening**
3. Zeolite softening
4. Iron removal
5. Chlorination
6. Fluoridation

* Implies at least chlorination, chemical coagulation, and rapid sand filtration.

**Lime softening includes filtration.

TABLE 2. PROJECTED WATER USE (MGD)

	1965	1990	2020
Municipal*	20	48	73
Industrial	6	10	14
Total	26	58	87

*Includes water for small industries.

SOURCES AND CHARACTERISTICS OF WASTE

Municipal

Eleven communities discharge treated wastes to watercourses in the Huron River Basin. Secondary treatment is provided for an estimated 132,550 people, primary treatment for an estimated 86,000 people, and private septic tank or no treatment at all for an estimated 16,000 people. All of the municipal sewage treatment plants chlorinate the final effluent.

Municipal sewage treatment plants discharge about 19 million gallons per day (MGD). The Ann Arbor-Ypsilanti area contributes 87% of the municipal waste to the Huron River. Table 3 lists the 1965 population served, the flow, and the waste constituents. Figure 3 gives the location of the municipal sewage treatment plants in the Huron River Basin.

Ann Arbor - 1965

The Ann Arbor sewage treatment plant serves a population of 74,000 and discharges 10.3 MGD to the Huron River. Ninety-five percent of the occupied properties in Ann Arbor are served with a separate sewer system. Utilizing the activated sludge process, the plant removes an average of 95% of the biochemical oxygen demand (BOD_5) from the incoming sewage. BOD_5 in the effluent varied from 7 to 30 milligrams/liter (mg/l), with an average of 12 mg/l during 1965.

Brighton - 1965

The community of Brighton has 98% of the population connected to a separate sewer system. A trickling filter plant with an average flow of 0.5 MGD serves a population of 2300. The average BOD_5 removal was 88%

during 1965. The BOD_5 in the effluent varied from 15 to 30 mg/l with an average of 21 mg/l. The Brighton sewage treatment plant discharges to Ore Creek, a tributary of the Huron River.

Chelsea - 1965

The Chelsea sewage treatment plant serves a population of 3500. Virtually all occupied properties are connected to a separate sewer system. Treatment consists of an activated sludge plant with an average removal of 93% of the BOD_5. The concentration of BOD_5 in the effluent varied from 6 to 27 mg/l with an average of 13 mg/l. The average discharge for 1965 was 0.3 MGD.

Dexter - 1965

The Village of Dexter provides primary treatment for a population of 2000. Approximately 95% of the community is served with a separate sewer system. The average discharge to Mill Creek was 0.12 MGD with an effluent BOD_5 range of 123 to 305 mg/l. The average BOD_5 in the effluent was 207 mg/l.

Flat Rock - 1965

The Flat Rock primary sewage treatment plant serves a population of 4600. Ninety-five percent of the community is sewered. Approximately 30% of the occupied properties are connected to a combined sewer and the remainder to a separate sewer system. The BOD_5 in the effluent ranged from 68 to 173 mg/l with an average of 135 mg/l, a removal of 50%. The average flow was 0.34 MGD.

Milford - 1965

The City of Milford has virtually all occupied properties connected to

a separate sewer system. Treatment consists of a trickling filter with 66% removal of BOD_5. The average BOD_5 discharged was 73 mg/l during 1965. The total population served by the Milford plant was 5000. Average flow was 0.53 MGD.

Rockwood - 1965

The Rockwood primary sewage treatment plant serves a population of 8000. The average discharge during 1965 was 0.32 MGD. The BOD_5 removal averaged about 40% with a concentration range of 49 to 139 mg/l and an average of 96 mg/l. Virtually all occupied properties are connected to a combined sewer system.

City of Ypsilanti - 1965

The City of Ypsilanti with a population served of 22,000 has an activated sludge type sewage treatment plant. Virtually all occupied properties are connected to a separate sewer system. BOD_5 removals average about 86% with an average concentration in the effluent of 21 mg/l. average flow was 2.28 MGD.

Ypsilanti Township - 1965

Ypsilanti Township has approximately 80% of its occupied properties connected to a separate sanitary sewer system. Treatment consists of an activated sludge-type plant with an average flow of 3.65 MGD. The effluent has an average concentration of 25 mg/l. The population served was 23,000.

Ypsilanti State Hospital - 1965

Ypsilanti State Hospital sewage treatment plant has an average flow of approximately 0.5 MGD. This is a trickling filter plant. The effluent

BOD_5 for the 1965 records available averaged 33 mg/1. The BOD_5 removal efficiency of this plant is about 87%.

South Lyon - 1965

South Lyon has 98% of the occupied properties connected to a separate sewer system. Treatment consists of an activated sludge type plant. This plant serves a population of 1,900 and has an average flow of 0.18 MGD. BOD_5 removal of 95% provides an effluent with an average concentration of 12 mg/1.

Industrial - 1966

Thirteen industries discharge wastes to the Huron River or the tributaries. Waste originating from plating operations, automotive parts, and assembly plants, steel plants, a paper company, and manufacturing plants total approximately 6 MGD. Waste constituents include toxic metals, oil, grease, solids, BOD_5, iron, chrome, fiber, dye, and cooling water, shown on Table 4. Figure 3 shows the location of the industrial waste outfalls in the Huron River Basin.

Nine industries provide adequate treatment or control of their industrial wastes as determined by the Michigan Water Resources Commission. Two industries provide inadequate treatment and are under order by the State. Surveys to determine the adequacy of treatment for the two remaining industries are being conducted by the State.

Belleville Plating Company in Belleville discharges 0.02 MGD to the Huron River from electroplating operations. Waste constituents include copper, cyanide, nickel, cadmium, zinc, acids, and alkali. Treatment consists of CN oxidation with chlorine, precipitation of metals with a lime

equalizing lagoon, and two sedimentation tanks. Treatment is rated as adequate by the State of Michigan. Sanitary wastes are discharged to a septic tank and the tile field.

Detroit, Toledo, and Ironton Railroad Company operates a railroad repair yard and repair shops in Flat Rock. Wastes originate during the repair and fueling of diesel engines, and are discharged to Silver Creek, a tributary of the Huron River. The principal waste constituents contained in a flow of 0.003 MGD are oils. Treatment consists of oil skimming and is rated as adequate by the State. Sanitary wastes are discharged to a septic tank and tile field.

Federal Screw Products Corporation is located in the City of Chelsea. The products are metal-threaded parts and bolts. A waste discharge of 0.02 MGD consists of soluble oils, wastewater, and cooling water. The oils are collected and disposed of by commercial waste oil contractors. Wastewaters are discharged to a 10,000-gallon holding tank for washer water. Cooling waters are discharged to a city-owned storm drain connected to Letts Creek, a tributary to the Huron River. Control of wastes are rated as adequate by the State. Sanitary wastes are treated by the City of Chelsea.

Ford Motor Company-Lincoln Division, located in the City of Wixom, discharges wastes originating from automobile assembly operations, and are discharged to Norton Creek, a tributary to the Huron River. The flow from this plant is 1.2 MGD, and the main waste constituents are paint, sludge, solids, and chromate. Waste treatment consists of the breaking up of sludges by chemical agents, bisulfite for chromate, and 3 settling lagoons. Treatment is considered adequate by the State. Sanitary wastes are treated in a company plant with a biofilter and chlorination.

Ford Motor Company-Ypsilanti Plant discharges 0.03 MGD of wastes to the Huron River. Cooling water and cyanides are the main waste constituents produced in the manufacture of automotive parts and accessories. The cooling water is discharged to the Huron River and the cyanide is taken to Monroe for treatment. Treatment is considered as adequate by the State. Sanitary wastes are discharged to Ypsilanti for treatment.

General Motors Corporation-Fisher Body Division, Ypsilanti Township, discharges 0.66 MGD of wastes originating from automobile body assembly operations. The major waste constituents are chromate, paint, sludge, BOD_5, and solids. Industrial waste treatment or control consists of removal with coagulants in clarifier-equalizing lagoons. Additional treatment has been provided to remove excess BOD_5. Adequacy has not been determined. Sanitary sewage is discharged to the Ypsilanti Township.

Hoover Ball & Bearing Company-Reynolds Chemical Products Division, Northfield Township, discharges wastes from the manufacture of plastic products to Horseshoe Lake outlet drain, a tributary of the Huron River. The waste discharge is 0.07 MGD of cooling water. Control is rated as adequate by the State. Sanitary wastes are discharged to a septic tank and tile field.

Huron Valley Steel Corporation in Belleville discharges wastes from the production of pig iron to the Huron River. The flow from the plant is 1.1 MGD, and the wastes constituents are iron and solids. Waste treatment or control consists of a lagoon. Present treatment is inadequate. Plans and construction are underway to provide additional treatment facilities. Sanitary wastes are discharged to a septic tank and tile field.

King-Seeley Corporation - Scio Plant in Ann Arbor discharges 0.276 MGD

of wastes originating from electroplating operations to the Huron River. Waste constituents include alkali, acids, chromate, copper, nickel, and cyanide. Waste treatment is considered adequate by the State. Sanitary wastes are treated in a plant biofilter and Imhoff tank with chlorination.

Longworth Plating Company is located in the City of Chelsea. Wastes in amounts of 0.04 MGD originate from electroplating operations, and are discharged to a city-owned storm sewer tributary to Letts Creek and the Huron River. The principal waste constituents consist of cyanide and metalic ions. New waste treatment facilities have been added. Adequacy has not been determined. Sanitary wastes are discharged to the City of Chelsea for treatment.

Michigan Seamless Tube Company is located in the City of South Lyons. The waste discharge is 0.91 MGD. The cooling water is discharged to the Huron River, and is insignificant. The pickling liquor is lagooned and discharged to the ground. Treatment or control is rated as adequate by the State. Sanitary wastes are discharged to the City of South Lyons for treatment.

Peninsular Paper Company in Ypsilanti discharges wastes from the manufacture of paper, using purchased pulp as raw material to the Huron River. Principal waste constituents are paper fiber and dyes. No industrial waste treatment is provided. Control is rated as inadequate by the State. Sanitary wastes are treated by the City of Ypsilanti.

Rockwell-Standard Corporation - Chelsea Spring Division, located in Chelsea, discharges 0.1 MGD of uncontaminated cooling water to Letts Creek, a tributary to the Huron River. Sanitary wastes are discharged to the City of Chelsea for treatment. Treatment or control is rated as adequate by the State.

TABLE 3. HURON RIVER MUNICIPAL WASTES
Yearly Averages for 1965

Community	Population Served	Flow (MGD)	Temp. °F	pH	5-Day BOD (mg/l)	5-Day BOD (#/d)	Suspended Solids (mg/l)	Suspended Solids (#/d)
Ann Arbor	74,000	10.31	62	7.5	12	1030	18	1550
Brighton	2,300	0.49	58	-	21	86	38	155
Chelsea	3,500	0.27	60	7.4	13	29	17	38
Dexter	2,000	0.12	57	7.9	207	207	127	127
Flat Rock	4,600	0.34	58	7.5	135	383	63	179
Milford	5,000	0.53	59	7.4	73	323	45	200
Rockwood	2,000	0.32	66	7.7	96	256	60	160
South Lyon	1,900	0.18	59	7.8	12	18	14	21
Stockbridge	850	0.13	No information available					
Ypsilanti	22,000	2.28	-	7.7	21	400	52	990
Ypsilanti Twp.	23,000	3.65	65	7.6	25	760	33	1000
Ypsilanti State Hospital	-	.54	81	-	33	149	30	135

TABLE 4, HURON RIVER INDUSTRIAL WASTE INVENTORY

Industry	Location	Receiving Stream	Waste Constituents	Waste Flow (MGD)	Treatment Provided	MWRC Rati 1966
Belleville Plating Co.	Belleville	Huron River	Acids, toxic metals, alkali	0.02	CN_6 oxid.w/chlorine, Cr red w/bisulfite, ppt. of metals w/lime equalizing, lagoons	A
DT&IRR Yards	Flat Rock	Silver Creek	Oil	0.003	Oil skimmer	A
Federal Screw Products	Chelsea	Letts Creek	Cooling water	0.02	Holding tank	A
Ford Motor Co.	Ypsilanti	Huron River	Cooling water	0.03	None	A
Ford Motor Co. - Lincoln Div.	Wixom	Norton Drain	Paint sludge, solids, chromate	1.2	Precipitation, lagoons	A
General Motors Corp. - Fisher Body Div.	Willow Run	Willow Run Creek	Paint sludge, BOD solids, chromate	0.66	Coagulation, lagoon	B
Hoover Ball & Bearing Co. Chemical Prod. Div.	Whitmore Lake	Horseshoe Lake outlet drain	Cooling water	0.07	None	A
Huron Valley Steel Corp.	Belleville	Huron River	Solids	1.1	Lagoon	E
King-Seeley Thermos Corp.	Scio	Huron River	Acids, alkali, toxic metals	0.276	Cr^6 red w/bisulfite, CN oxid.w/chlorine, ppt.of Cr^3 w/lime, settling lagoon	A

Note: * A - Control adequate.
B - Control provided - adequacy not established.
E - Control inadequate.

TABLE 4. HURON RIVER INDUSTRIAL WASTE INVENTORY (cont.)

Industry	Location	Receiving Stream	Waste Constituents	Waste Flow (MGD)	Treatment Provided	MWRC Rating 1966
Longworth Plating Co.	Chelsea	Letts Creek	Acids, alkali, toxic metals, oil	0.04	CN oxid.w/hypochlorite, 2 settling lagoons	B
Michigan Seamless Tube Co.	South Lyon	Huron River	Cooling water, pickling liquor	0.91	Pickling liquor lagooned, cooling water to river	A
Peninsular Paper Co.	Ypsilanti	Huron River	Fiber, dye	1.6	Save-alls	E
Rockwell-Standard Corp. Spring Div.	Chelsea	Letts Creek	Cooling water	0.1	None	A

Note: * A - Control adequate.
B - Control provided - adequacy not established.
E - Control inadequate.

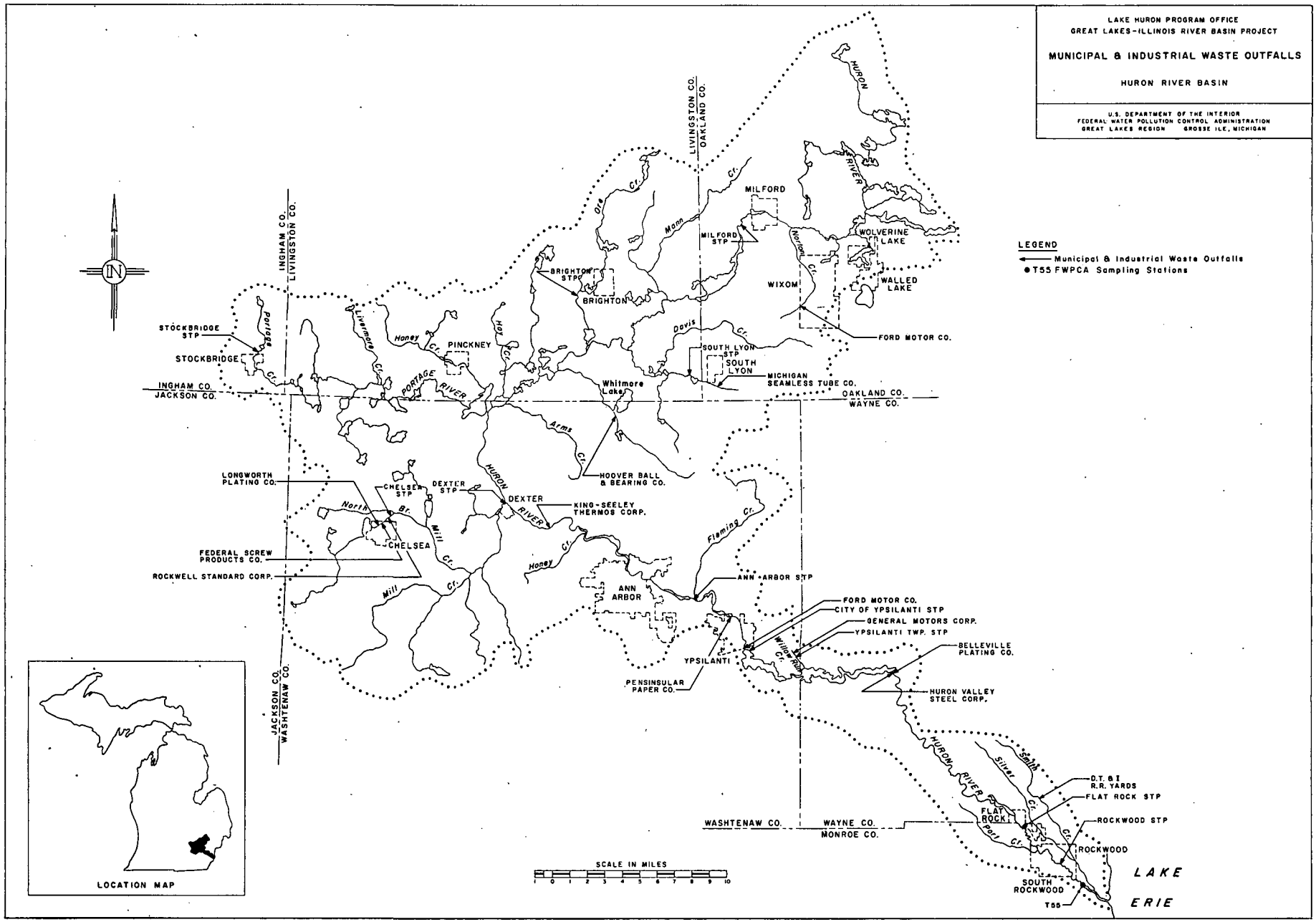

LAKE HURON PROGRAM OFFICE
GREAT LAKES-ILLINOIS RIVER BASIN PROJECT
MUNICIPAL & INDUSTRIAL WASTE OUTFALLS
HURON RIVER BASIN
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
LEGEND
Municipal & Industrial Waste Outfalls
T55 FWPCA Sampling Stations
LOCATION MAP
SCALE IN MILES
LAKE ERIE
INGHAM CO.
LIVINGSTON CO.
OAKLAND CO.
WAYNE CO.
JACKSON CO.
WASHTENAW CO.
MONROE CO.
STOCKBRIDGE STP
STOCKBRIDGE
PINCKNEY
BRIGHTON STP
BRIGHTON
MILFORD
MILFORD STP
WOLVERINE LAKE
WALLED LAKE
WIXOM
FORD MOTOR CO.
SOUTH LYON STP
SOUTH LYON
MICHIGAN SEAMLESS TUBE CO.
Whitmore Lake
HOOVER BALL & BEARING CO.
LONGWORTH PLATING CO.
CHELSEA STP
CHELSEA
DEXTER STP
DEXTER
KING-SEELEY THERMOS CORP.
FEDERAL SCREW PRODUCTS CO.
ROCKWELL STANDARD CORP.
ANN ARBOR
ANN ARBOR STP
FORD MOTOR CO.
CITY OF YPSILANTI STP
GENERAL MOTORS CORP.
YPSILANTI TWP. STP
YPSILANTI
BELLEVILLE PLATING CO.
PENSINSULAR PAPER CO.
HURON VALLEY STEEL CORP.
D.T. & I R.R. YARDS
FLAT ROCK STP
FLAT ROCK
ROCKWOOD STP
ROCKWOOD
SOUTH ROCKWOOD
T55
Portage River
Honey Cr.
Mill Cr.
Arms Cr.
Davis Cr.
Flaming Cr.
Norton Cr.
Silver Cr.
Smith Cr.
Pearl Cr.
Willow Run
Huron River

FIGURE 3

POPULATION AND WASTE LOAD PROJECTIONS

Demographic studies were conducted by the Great Lakes-Illinois River Basins Project, Chicago, for the southeastern Michigan portion of the Lake Erie drainage basin, of which the Huron River is a part. Population trends, on a national, regional, and county basis were analyzed and population projections were developed for the Huron River Basin.

The population centers in the Huron River Basin are Ann Arbor (67,340), Ypsilanti (20,957), Ypsilanti Township (25,950), Flat Rock (4,696), and Milford (4,323), according to the 1960 census figures.

The total 1960 population in the Huron River Basin, including the population of incorporated and unincorporated areas, was estimated to be 218,000. By the year 1990, the total population was estimated to increase to 380,000, of which 360,000 would be municipal and served by sewerage systems. In 2020, the total population was estimated to be 590,000, of which 510,000 would be municipal population. In the Huron River Basin, each area was analyzed and it was determined that these areas would be urbanized by 1990 and 2020, and served by sewerage systems.

Table 5 shows the estimated populations and waste flow projections for the Huron River Basin in 1990 and 2020. (See Figure 4.)

For the Huron River Basin, the 1965 population served by municipal sewage systems was 142,000. This population served was used to determine the 1965 BOD_5 loading to the Huron River. BOD_5 projections were based on present day inventory information obtained from the Michigan Water Resources Commission, the Michigan Department of Public Health, and the U.S. Public Health Service.

The results of the BOD_5 projections are shown in Table 6. Total BOD_5 to the Huron River, with removal of 90% for municipal wastes, and an assumed removal of 50% for industrial wastes, was determined to be 5500 pounds per day. In 1990 and 2020, this is projected to increase to 11,600 and 17,400 pounds per day, respectively.

TABLE 5. POPULATION AND WASTE FLOW PROJECTIONS

	1965	1990	2020
Population Served	142,000	360,000	510,000
Water Usage (GPCD)	100	110	120
Waste Flows (MGD)			
Municipal			
Residential	14.2	40	61
Industrial	5.0	8	12
Subtotal	19.2	48	73
Industrial (direct to river)	6.0	10	14
Total to Huron River (MGD)	25.2	58	87

FIGURE 4

POPULATION AND MUNICIPAL WASTE FLOW PROJECTIONS FOR THE HURON RIVER BASIN

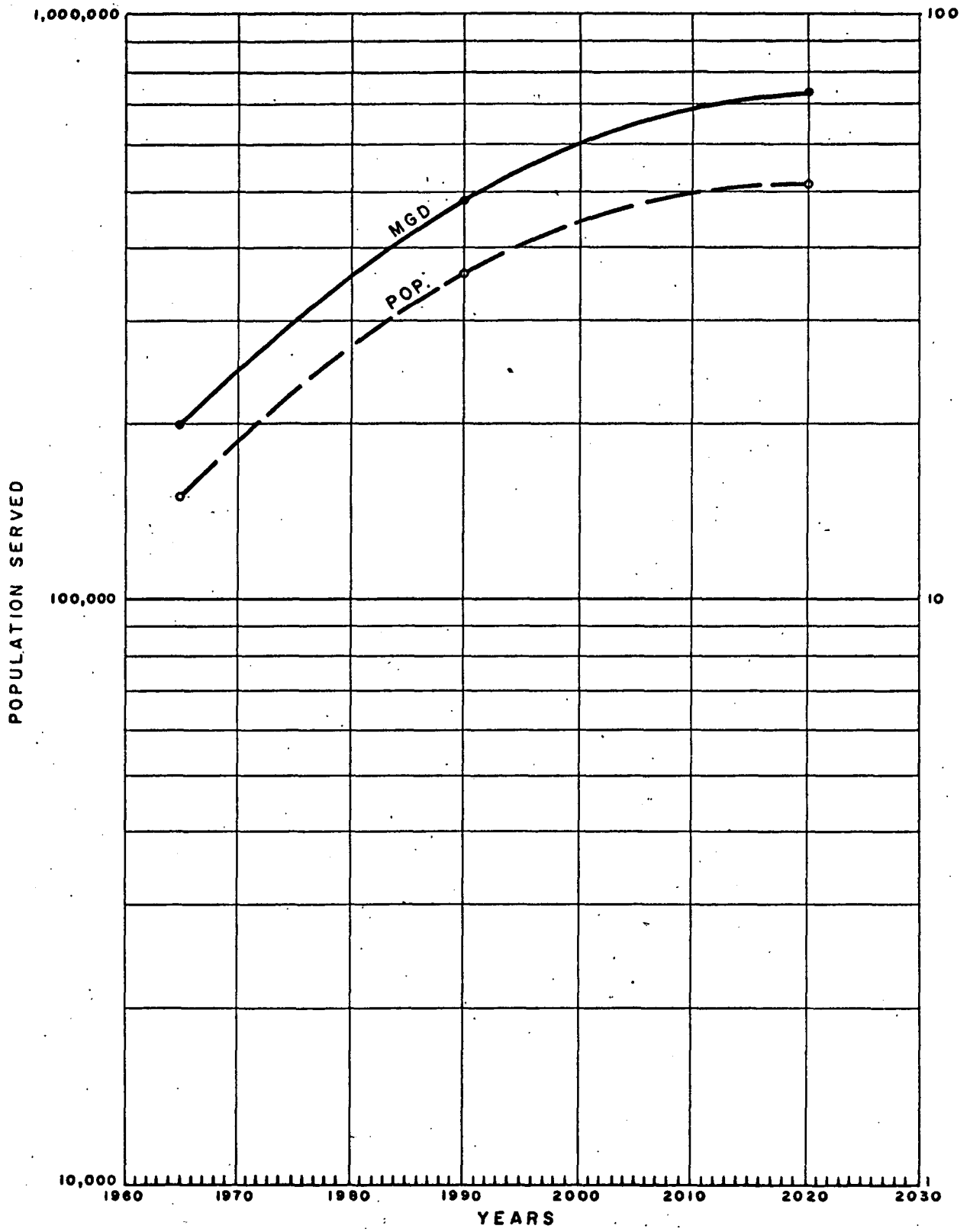


TABLE 6. BOD_5 PROJECTIONS (#/day)

	1965	1990	2020
Untreated BOD			
Municipal			
Residential	25,000	65,000	102,000
Industrial	10,000	17,000	24,000
Subtotal	35,000	82,000	126,000
Industrial (direct to river)	4,000	6,800	9,600
Total Untreated BOD	39,000	88,800	135,600

Treated BOD to Huron River	1965	1990	2020
Municipal			
With present 90% removal	3,500	8,200	12,600
With 95% removal	1,750	4,100	6,300
With 99% removal	350	820	1,260
Industrial (direct to river)			
With present 50% removal	2,000	3,400	4,800
With 90% removal	400	680	960
With 95% removal	200	340	480
With 99% removal	40	68	96
Total BOD to Huron River			
With present removal	5,500	11,600	17,400
With 90% removal	3,900	8,880	13,560
With 95% removal	1,950	4,440	6,780
With 99% removal	390	888	1,356

WATER QUALITY

The water quality data of the Huron River Basin is divided into two sections: 1) the Huron River, and 2) tributaries of the Huron River which include Mill Creek and Willow Run Creek, shown on Figure 1. The station locations for the Huron River and its tributaries are shown on Table 7 and were sampled on a biweekly basis in 1966 and January 4, 1967. These sampling stations included the following parameters and are shown on Table 8: coliform, dissolved oxygen (DO), 5-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), phosphate (total and total soluble), nitrogen (nitrate, nitrite, ammonia, and organic nitrogen), solids (total, dissolved and suspended), phenol, chloride, conductivity, pH, iron, calcium, and total hardness.

Chemical

DO, as shown on Figure 5, averaged 9.5 to 12.9 mg/l, and BOD_5 as shown on Figure 6, averaged 2 to 11 mg/l, from Station T270 to T055. The range of BOD_5 values was from 3 to 52 mg/l (average 11 mg/l) at T230, below the Ann Arbor sewage treatment plant (STP). However, at Station T235, which is also below the STP, the range was from 2 to 11 mg/l, and the average was 6 mg/l.

COD data at Station T230 showed an average value of 65 mg/l and maximum value of 665 mg/l. The COD values shown on Figure 7 for the rest of the river stations averaged from 23 to 36 mg/l.

Total phosphate average values, Figure 8, ranged from .10 to 3.12 mg/l between T270 and T055. Stations T270 to T240 showed averages were .10 to

.26 mg/1, and Station T210 had an average of 3.12 mg/1. From T235, below the Ann Arbor STP to Station T055, the averages were at or above 1.00 mg/1. The greatest concentrations were found below the Ann Arbor and Ypsilanti STP's. Total soluble phosphate values, Figure 9, follow the pattern set by the total phosphates with the averages between T270 and T240 ranging from .06 to .21 mg/1. Between T235 and T055, averages ranged from .83 and 2.51 mg/1, with Station T210 average value being 2.51 mg/1.

Nitrate concentration averages, Figure 10, ranged from .2 to .8 mg/1 on the river. Nitrate concentrations were greater than .5 mg/1 below the Ann Arbor STP (T235 to T055). At T220, T056, and T055, averages were at .8 mg/1. All maximum values, except for T270 (.5 mg/1) were above 1.0 mg/1.

Nitrite concentrations, Figure 11, averaged .01 mg/1 above the Ann Arbor STP, while below the STP, concentrations increased to .07 mg/1 and then decreased below T215 with the range being .02 to .03 mg/1.

Ammonia nitrogen concentrations, Figure 12, above the Ann Arbor STP, Stations T270 to T245 averaged from .22 to .34 mg/1, then increased dramatically at T235 below the STP to 1.68 mg/1. Between Stations T220 and T055, the averages ranged from .88 to .56 mg/1. An increase was noted from T056 to T055. (Rockwood STP is located between these sampling points.)

Organic nitrogen concentration averages, Figure 13, ranged from .11 to .19 mg/1 over all sampling points. The only noticeable concentration increases were found from T215 to T055 below where Willow Run Creek enters the Huron River.

Solids concentrations, Figures 14, 15 and 16, were generally high in the Huron River. Total solid averages increased steadily from T270 to T056,

348 to 452 mg/l, and then increased dramatically at T055 to 536 mg/l. Suspended solids averaged from 12 to 36 mg/l, with the greatest concentrations being found at T056 and T055, 36 and 35 mg/l, respectively. These sampling points were influenced by the Flat Rock and Rockwood areas.

Chloride concentrations, Figure 17, showed a general increase from T270 to T055 (23 to 45 mg/l). A similar trend was noticed by conductivity between T270 and T056 (481 to 595 micromhos); however, below the Rockwood STP at T055, conductivity, Figure 18, increased to 675 micromhos.

Phenolic concentrations, Figure 19, averaged from 3 to 12 µg/l between Stations T270 and T055. The highest average values, 11 and 12 µg/l, are found at Stations T230 and T205, with maximum values of 48 and 59 µg/l, respectively.

Iron concentration averages, Figure 20, ranged from .36 to 1.77 mg/l between T270 and T055, with averages over 1.00 mg/l being found at T240 (1.77 mg/l), T056 (1.25 mg/l), and T055 (1.41 mg/l). These 3 sampling points, T240, T056, and T055, showed a dramatic increase over preceding sampling points. T240 is located above the Ann Arbor STP and below the City of Ann Arbor, while T056 and T055 are influenced by the cities and STP's of Flat Rock and Rockwood.

From Stations T270 to T055, average calcium values ranged from 61 to 84 mg/l (see Figure 21). Average values for total hardness ranged from 239 to 315 mg/l, Figure 22.

pH values, shown on Figure 23, were from 8.1 to 8.6 mg/l for all sampling points.

Microbiology

Five sampling points - T240, T235, T230, T056, and T055 had coliform densities above 2400 organisms/100ml. At Station T240, the coliform densities did reduce to below 1000 organisms/100ml during the chlorinating season. At Stations T235 and T230, both below the Ann Arbor STP and Station T056 below the Flat Rock STP, and Station T055 below the Rockwood STP, coliform medians during chlorination ranged from 2000 to 3700 organisms/100ml, while during non-chlorination seasons, the range was from 34,000 to 620,000 organisms/100ml (Table 9).

Coliform data, Figure 24, is divided into three seasons - January 1 to May 14, 1966 (non-chlorination period), May 15 to September 15, 1966 (chlorination period), and September 16 to January 4, 1967 (non-chlorination).

Tributaries

Mill Creek

Station T266 is located on the Mill Creek above Dexter STP. Water quality measurements are found in Table 8. Except for higher values for nitrates - 1.00 mg/l, total solids - 518 mg/l, conductivity - 657 micromhos/cm, iron - .71 mg/l, hardness - 345 mg/l, and calcium - 100 mg/l, the water quality measurements for Mill Creek are in the same range as water quality measurements in the Huron River for sampling points T270 to T255.

At Station T266 coliform medians, Table 10, ranged from 530 organisms/100ml (chlorination season) to 8900 organisms/100ml (post-chlorination season). Average values show: DO - 10.3 mg/l, BOD_5 - 2 mg/l, COD - 25 mg/l, total phosphate - .34 mg/l, total soluble phosphate - .21 mg/l, nitrogen -

nitrate - 1.0 mg/l, nitrite - .02 mg/l, ammonia - .37 mg/l, and organic - .11 mg/l, suspended solids - 18 mg/l, phenol - 8 µg/l, and chloride - 29 mg/l. Mill Creek does not have a great effect on the Huron River though phosphates and phenols do show relatively high averages as shown on Table 8.

Willow Run Creek

Willow Run Creek receives the Ypsilanti Township STP and General Motors Corporation wastes above Station T216, the sampling point on Willow Run Creek. Except for nitrates - .8 mg/l average value which is consistent with the Huron River data, all of the other water quality measurements are extremely high.

Coliform medians ranged from 38,000 to 1,270,000 organisms/100ml for the 3 seasons - pre-chlorination, chlorination, and post-chlorination - at Station T216. The average values for the following parameters indicate that the water of Willow Run Creek is of extremely poor quality and grossly polluted: DO - 7.4 mg/l, BOD_5 - 20 mg/l, COD - 142 mg/l, phosphate - (total - 15.41 mg/l and total soluble - 8.59 mg/l), nitrogen - (nitrite - .30 mg/l, ammonia - 8.8 mg/l, and organic - .65 mg/l), solids - (total - 640 mg/l and suspended - 57 mg/l), phenol - 16 µg/l, chloride - 110 mg/l, conductivity - 868 micromhos, and iron - 2.31 mg/l (Tables 8 and 10).

Summary of Water Quality

Except for a few isolated instances, water quality measurements show that the main pollution problems are located below the Ann Arbor sewage treatment (STP), Station T235. Coliform medians were 3300 to 620,000 organisms/100ml for the chlorination and non-chlorination seasons; total phosphate concentrations - average 2.1 mg/l and total soluble - 1.75 mg/l, nitrate - average .7 mg/l, ammonia nitrogen - 1.68 mg/l, organic nitrogen - .16 mg/l, and total solids - 510 mg/l are increases which occur at Station T235. At T056, below the Flat Rock STP, and T055, below the Rockwood STP, show increases in coliform densities, nitrates, total solids, conductivity, and iron concentrations, which are serious enough to influence the water quality of the Huron River. Various parameters such as total phosphate - .10 to 3.12 mg/l, total soluble - .06 - 2.5 mg/l, nitrate nitrogen - .2 - .8 mg/l, ammonia .22 - 1.68 mg/l, total solids - 348 - 536 mg/l, and suspended solids - 12 - 36 mg/l, and iron - .36 - .77 mg/l are present in concentrations which effect the overall quality of the Huron River.

The Huron River is divided, generally, into two water quality sections; one above the Ann Arbor STP where parameter concentrations are low; and the section below the Ann Arbor STP where parameter concentrations are high.

Tributaries

Mill Creek and Willow Run Creek are two tributaries to the Huron River which were sampled.

Mill Creek water quality measures on a level comparable with the Huron River area above the Ann Arbor STP, except for higher nitrate, total solids, conductivity, iron, hardness, and calcium concentrations.

Willow Run Creek, except for nitrate concentrations which are consistent with the Huron River data, contains extremely high levels of pollutants. Coliform densities range from 38,000 organisms/100ml during the chlorination period, to 1,270,000 organisms/100ml during the post-chlorination period; total phosphate - 15.41 mg/l, and total soluble phosphate 8.59 mg/l; nitrogen - ammonia 8.8 mg/l, and organic .65 mg/l; total solids - 640 mg/l and suspended - 57 mg/l; phenol - 16 ug/l, chloride - 110 mg/l, conductivity - 860 micromhos, and iron - 2.31 mg/l are averages which indicate the extremely poor quality of the Willow Run Creek water.

TABLE 7. HURON RIVER SAMPLING STATIONS

MAINSTREAM STATIONS

Station	Mile Point	Location
T055	1.65	River Rd. bridge near Pointe Mouillee (MWRC station)
T056	4.60	Fort St. bridge in Rockwood
T200	9.00	Telegraph Rd bridge in Flat Rock
T205	19.75	Waltz Rd. bridge in New Boston
T210	25.30	Huron Rd. bridge below Belleville Lake dam
T215	28.80	Belleville Rd. crossing of Belleville Lake
T220	32.00	Rawsonville Rd. crossing at the head of Belleville Lake
T225	37.50	Michigan Ave. bridge in Ypsilanti
T230	38.90	LeForge Rd. bridge below Peninsular Dam
T235	39.80	Superior Rd. bridge downstream from the Ann Arbor sewage treatment plant
T240	42.60	Dixboro Rd. bridge
T245	46.80	Wall St. bridge in Ann Arbor (USGS gage)
T255	54.10	Delhi Rd. bridge
T265	58.50	Mast Rd. bridge near Dexter
T270	62.60	No. Territorial Rd. bridge (USGS gage)

TRIBUTARY STATIONS

Station	Mile Point	On Tributary	Confluence Mile Point	Location
T216	1.90	Willow Run Cr.	30.80	Downstream from Ypsilanti Twp. STP below Spillway
T266	0.50	Mill Creek	58.80	Island Lake bridge at Dexter

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		pH	Cond.	Cl	Phenol	DO	BOD_5	COD	Tot. PO_4	Sol. PO_4	NO_3-N	NO_2-N	NH_3-N	Org-N
T055	Avg	8.2	680	45	5	10.6	6	34	1.15	0.90	0.8	0.03	0.76	0.17
	Max	8.8	820	57	10	13.8	11	48	1.70	1.40	2.4	0.06	4.64	0.39
	Min	7.7	570	34	0	6.0	2	23	0.40	0.3	0.1	0.00	0.03	0.02
	NS	25	24	25	25	25	24	24	25	25	25	25	24	24
T056	Avg	8.4	600	46	9	10.4	6	32	1.00	0.83	0.8	0.02	0.56	0.18
	Max	8.9	690	62	43	14.2	12	50	1.80	1.50	2.2	0.07	1.18	0.44
	Min	8.0	500	34	1	7.3	3	19	0.40	0.20	0.1	0.00	0.06	0.02
	NS	25	25	25	25	25	24	24	25	25	25	25	25	24
T200*	Avg	8.2	630	43	7	12.8	6	25	0.80	0.64	1.5	0.03	0.77	0.31
	Max	8.3	670	48	15	14.1	10	28	1.30	1.10	2.6	0.04	1.09	0.60
	Min	8.0	580	38	1	10.6	3	20	0.40	0.20	0.6	0.03	0.47	0.14
	NS	5	5	5	4	5	5	4	5	5	5	5	5	5
T205	Avg	8.5	580	43	12	10.9	5	36	1.02	0.91	0.6	0.03	0.74	0.16
	Max	9.0	660	52	59	14.4	25	141	1.60	1.30	1.7	0.06	1.73	0.56
	Min	8.0	510	34	2	7.7	2	22	0.50	0.40	0.1	0.00	0.22	0.04
	NS	21	21	21	21	21	20	21	21	21	21	21	21	21
T210	Avg	8.4	580	41	8	10.7	4	31	3.12	2.51	0.5	0.02	0.82	0.19
	Max	9.0	660	56	15	14.3	6	42	52.00	41.00	2.0	0.05	1.79	0.67
	Min	7.8	510	32	0	7.6	1	16	0.50	0.50	0.0	0.00	0.30	0.04
	NS	25	25	25	25	25	24	24	25	25	25	25	23	22

*Limited sampling - 2/2 - 4/13/66.
Note: Phosphates reported as PO_4.

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		Total Solids	Dissolved Solids	Suspended Solids	Sodium	Potassium	Iron	Calcium	Hardness	CN	SO_4	Mg
T055	Avg	536	489	35	25	8	1.41	84	315	.000	138	27
	Max	658	614	61	33	11	2.30	103	364	.000	170	38
	Min	431	410	7	21	6	0.51	61	248	.000	100	20
	NS	25	25	25	10	10	11	10	10	5	10	10
T056	Avg	452	415	36	28	8	1.25	75	276	-	98	24
	Max	497	480	72	33	10	2.90	90	328	-	130	32
	Min	400	370	8	23	6	0.50	62	230	-	80	18
	NS	25	25	25	10	10	11	10	10		10	10
T200*	Avg	466	434	32	26	8	0.80	-82	294	-	100	26
	Max	505	481	62	28	9	1.60	-86	308	-	110	31
	Min	440	380	6	23	6	0.40	-76	278	-	90	24
	NS	5	5	5	4	4	4	4	4		4	4
T205	Avg	436	413	24	28	9	0.73	68	260	-	90	23
	Max	746	570	181	34	12	1.40	83	304	-	100	24
	Min	372	359	0	25	7	0.20	58	226	-	80	20
	NS	21	21	21	8	8	9	8	8	-	8	8
T210	Avg	422	397	26	27	8	0.55	71	258	.003	84	24
	Max	543	470	196	36	10	1.3	89	292	.01	100	30
	Min	371	350	2	21	6	0.10	56	224	.00	70	19
	NS	25	25	25	10	10	11	10	10	4	10	10

*Limited sampling - 2/2 - 4/13/66

TABLE 8. HURON RIVER WATER QUALITY
1966 Values

Station		pH	Cond.	Cl	Phenol	DO	BOD_5	COD	Tot. PO_4	Sol. PO_4	NO_3-N	NO_2-N	NH_3-N	Org-N
T215	Avg	8.6	570	43	8	11.2	5	34	1.16	1.05	0.5	0.02	0.82	0.18
	Max	9.3	640	49	15	15.7	8	45	1.80	1.50	1.9	0.06	1.62	0.49
	Min	8.0	500	33	1	5.5	3	24	0.50	0.50	0.1	0.00	0.26	0.09
	NS	21	21	21	20	21	20	21	21	21	21	21	20	20
T216	Avg	7.6	870	110	16	7.5	20	142	15.41	8.59	0.7	0.30	8.80	0.64
	Max	8.6	1070	208	29	9.0	135	> 488	20.00	14.60	1.6	0.70	12.96	2.08
	Min	7.2	720	78	5	4.1	6	51	9.00	6.30	0.3	0.09	6.40	0.03
	NS	12	12	12	12	11	9	11	12	12	12	12	10	9
T220	Avg	8.4	580	40	9	9.7	4	29	1.22	1.07	0.8	0.05	0.88	0.15
	Max	8.8	650	48	16	12.8	8	39	1.70	1.40	1.9	0.30	1.86	0.26
	Min	8.0	520	29	0	4.3	2	19	0.60	0.50	0.1	0.01	0.28	0.02
	NS	18	18	18	18	18	17	18	18	18	18	18	16	17
T225*	Avg	8.0	590	32	5	12.2	5	25	1.50	1.30	0.7	0.01	1.60	0.14
	Max	8.0	590	32	5	12.2	5	25	1.50	1.30	0.7	0.01	1.60	0.14
	Min	8.0	590	32	5	12.2	5	25	1.50	1.30	0.7	0.01	1.60	0.14
	NS	1	1	1	1	1	1	1	1	1	1	1	1	1
T230	Avg	8.1	590	41	11	10.1	11	65	1.66	1.28	0.7	0.07	1.27	0.16
	Max	8.7	700	92	48	14.3	52	655	3.40	2.80	1.4	0.26	2.96	0.32
	Min	7.6	500	24	4	5.0	3	20	0.50	0.30	0.2	0.01	0.46	0.02
	NS	25	25	25	25	25	23	25	25	24	25	25	25	25

*Limited sampling - 2/2/66
Phosphates reported as PO_4.

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		Total Solids	Dissolved Solids	Suspended Solids	Sodium	Potassium	Iron	Calcium	Hardness	CN	SO_4	Mg
T215	Avg	408	389	16	28	8	0.45	69	260	-	84	23
	Max	455	450	30	35	10	0.80	87	306	-	110	27
	Min	350	299	5	22	7	0.24	52	226	-	70	20
	NS	21	21	21	9	9	9	9	9		9	9
T216	Avg	640	587	57	96	20	2.31	57	216	0.093	133	18
	Max	918	800	236	140	25	4.91	72	270	0.400	240	26
	Min	451	432	19	59	10	0.50	44	170	0.000	80	10
	NS	12	12	12	10	10	11	9	9	5	10	10
T220	Avg	406	389	18	26	8	0.59	68	263	-	79	24
	Max	460	421	43	34	9	1.70	84	308	-	100	27
	Min	370	357	5	20	7	0.16	54	226	-	60	20
	NS	18	18	18	8	8	8	8	8		8	8
T225*	Avg	420	410	8	26	8	0.80	82	296	-	90	28
	Max	420	410	8	26	8	0.80	82	296	-	90	28
	Min	420	410	8	26	8	0.80	82	296	-	90	28
	NS	1	1	1	1	1	1	1	1		1	1
T230	Avg	432	404	29	29	8	0.96	72	260	-	95	24
	Max	510	490	90	50	12	4.03	89	292	-	170	32
	Min	371	351	6	18	6	0.39	60	228	-	60	19
	NS	25	25	25	10	10	11	10	10		10	10

*Limited sampling - 2/2/66

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		pH	Cond.	Cl	Phenol	DO	BOD_5	COD	Tot. PO_4	Sol. PO_4	NO_3-N	NO_2-N	NH_3-N	Org-N
T235	Avg	8.1	580	40	9	9.5	6	28	2.10	1.75	0.6	0.07	1.68	0.13
	Max	8.7	680	86	15	14.0	11	38	4.10	3.20	1.4	0.21	3.44	0.34
	Min	7.7	500	23	2	4.7	2	19	0.60	0.50	0.2	0.01	0.29	0.02
	NS	21	21	21	20	21	19	21	21	21	21	21	21	21
T240	Avg	8.2	540	36	8	10.3	3	28	0.26	0.21	0.4	0.01	0.34	0.11
	Max	8.7	650	63	15	14.6	6	44	0.60	0.60	1.4	0.03	1.15	0.26
	Min	8.0	440	22	3	7.3	1	18	< 0.02	< 0.02	0.1	0.00	0.01	0.02
	NS	20	20	20	19	20	18	20	20	18	20	20	20	20
T245	Avg	8.3	520	29	8	10.8	3	27	0.15	0.11	0.5	0.01	0.22	0.13
	Max	8.7	580	39	25	15.0	6	49	0.40	0.20	1.2	0.03	0.48	0.36
	Min	7.9	410	21	0	6.9	1	16	< 0.02	< 0.02	0.0	0.00	0.03	< 0.01
	NS	25	25	25	24	25	22	24	24	21	25	25	24	22
T250*	Avg	8.1	540	24	4	13.1	1	18	< 0.03	< 0.03	0.5	0.01	0.4	> 0.10
	Max	8.1	540	24	4	13.1	1	18	< 0.03	< 0.03	0.5	0.01	0.4	> 0.10
	Min	8.1	540	24	4	13.1	1	18	< 0.03	< 0.03	0.5	0.01	0.4	> 0.10
	NS	1	1	1	1	1	1	1	1	1	1	1	1	1
T255	Avg	8.3	520	25	7	9.8	3	23	0.20	0.15	0.4	0.01	0.28	0.11
	Max	8.7	560	31	20	14.4	5	36	0.50	0.40	1.1	0.03	0.92	0.29
	Min	8.0	430	19	0	5.0	0	13	0.08	< 0.02	0.0	0.00	< 0.03	< 0.01
	NS	25	24	25	24	25	20	24	25	24	25	25	24	23

*Limited sampling - 2/2/66.
Phosphates reported as PO_4.

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		Total Solids	Dissolved Solids	Suspended Solids	Sodium	Potassium	Iron	Calcium	Hardness	CN	SO_4	Mg
T235	Avg	413	393	17	28	8	0.79	69	259	-	73	23
	Max	500	487	37	43	12	1.40	81	286	-	90	27
	Min	376	294	5	21	6	0.29	58	224	-	60	20
	NS	21	21	21	8	8	8	8	8		8	8
T240	Avg	414	386	29	22	66	1.77	61	250	-	64	23
	Max	459	450	73	32	9	2.78	82	300	-	90	30
	Min	370	370	3	17	5	0.30	39	200	-	50	17
	NS	20	20	20	7	7	7	7	7		7	7
T245	Avg	387	371	17	19	6	0.76	66	262	-	68	25
	Max	455	430	53	24	8	1.60	81	290	-	90	30
	Min	349	338	3	15	4	0.11	31	224	-	50	19
	NS	25	25	25	10	10	11	10	10		10	10
T250*	Avg	394	390	7	19	6	0.40	81	294	-	90	30
	Max	394	390	7	19	6	0.40	81	294	-	90	30
	Min	394	390	7	19	6	0.40	81	294	-	90	30
	NS	1	1	1	1	1	1	1	1		1	1
T255	Avg	385	373	14	16	5	0.55	63	262	.001	71	25
	Max	450	430	63	18	6	1.70	78	288	.004	90	30
	Min	332	320	0	14	4	0.16	18	242	.000	50	20
	NS	25	25	25	10	10	11	10	10	4	10	10

*Limited sampling - 2/2/66

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		pH	Cond.	Cl	Phenol	DO	BOD_5	COD	Tot. PO4	Sol. PO4	NO_3-N	NO_2-N	NH_3-N	Org-N
T260*	Avg	8.1	520	23	3	12.5	3	17	< 0.03	< 0.03	0.5	0.01	0.33	0.13
	Max	8.1	520	23	3	12.5	3	17	< 0.03	< 0.03	0.5	0.01	0.33	0.13
	Min	8.1	520	23	3	12.5	3	17	< 0.03	< 0.03	0.5	0.01	0.33	0.13
	NS	1	1	1	1	1	1	1	1	1	1	1	1	1
T265**	Avg	8.2	520	22	3	12.9	2	22	0.15	0.09	0.6	0.01	0.29	0.12
	Max	8.4	550	24	10	14.5	3	27	0.30	0.10	1.3	0.01	0.52	0.20
	Min	8.0	480	20	0	8.6	2	18	0.02	0.02	0.3	0.01	0.10	0.06
	NS	5	5	5	5	5	5	5	4	3	5	5	5	5
T266	Avg	8.3	660	29	8	10.3	2	25	0.34	0.21	1.0	0.02	0.37	0.11
	Max	8.6	770	39	26	13.2	4	43	0.60	0.40	2.2	0.05	0.71	0.34
	Min	8.0	460	24	0	7.8	0	11	0.04	< 0.02	0.1	0.00	< 0.01	0.01
	NS	24	24	24	24	24	20	22	24	23	24	24	22	23
T270	Avg	8.3	480	23	8	10.5	2	23	0.10	0.06	0.2	0.01	0.30	0.12
	Max	8.7	690	26	21	14.4	5	34	0.30	0.10	0.5	0.01	0.80	0.26
	Min	8.1	410	17	0	7.0	1	15	< 0.02	0.02	0.1	0.01	0.01	< 0.01
	NS	24	23	24	24	24	19	23	23	20	24	24	22	23
	Avg													
	Max													
	Min													
	NS													

**Limited sampling - 2/2/ - 5/26/66 *One (1) sample only - 2/2/66.
Note: Phosphates reported as PO4.
All results in mg/l, except phenol - ug/l.

TABLE 8 HURON RIVER WATER QUALITY
1966 Values

Station		Total Solids	Dissolved Solids	Suspended Solids	Sodium	Potassium	Iron	Calcium	Hardness	CN	SO_4	Mg
T260*	Avg	368	360	10	17	6	0.40	74	274	.001	70	30
	Max	368	360	10	17	6	0.40	74	274	.001	70	30
	Min	368	360	10	17	6	0.40	74	274	.001	70	30
	NS	1	1	1	1	1	1	1	1	1	1	1
T265**	Avg	366	354	12	15	6	0.36	71	268	.000	70	25
	Max	401	388	23	17	6	0.50	75	276	.000	80	29
	Min	345	330	5	14	5	0.20	64	260	.000	60	33
	NS	5	5	5	5	5	5	5	5	2	5	5
T266	Avg	518	500	18	18	6	0.71	100	345	-	137	29
	Max	656	650	117	22	7	1.50	125	408	-	300	40
	Min	386	380	0	14	5	0.40	63	240	-	70	18
	NS	24	24	24	9	9	10	9	9		9	9
T270	Avg	348	326	22	15	5	0.39	63	239	.000	63	25
	Max	429	380	90	17	6	0.90	71	254	.001	80	31
	Min	307	290	7	12	3	0.10	53	221	.000	50	20
	NS	24	24	24	9	9	9	9	9	5	9	9
	Avg											
	Max											
	Min											
	NS											

*One sample only - 2/2/66
**Limited sampling - 2/2 - 5/26/66

TABLE 9 HURON RIVER - WATER QUALITY
ANNUAL BACTERIOLOGICAL DENSITIES*

STATION		Pre-chlorination (Jan 1-May 14)			Chlorination (May 15-Sept 14)			Post-chlorination (Sept 15-Jan 11		
		Total Coliform	Fecal Coliform	Fecal Strep	Total Coliform	Fecal Coliform	Fecal Strep	Total Coliform	Fecal Coliform	Fecal Strep
T055	Med	54,000	3,900	730	2,500	280	300	46,000	2,700	490
	Max	95,000	17,000	1,300	36,000	960	2,500	81,000	8,300	2,200
	Min	5,800	190	120	700	84	30	3,400	210	100
	NS	8	8	8	9	8	9	8	8	6
T056	Med	35,000	2,600	410	3,700	430	330	38,000	2,200	350
	Max	60,000	15,000	1,100	18,000	910	1,200	80,000	9,100	7,300
	Min	12,000	1,600	200	320	220	16	7,600	410	90
	NS	8	8	8	9	8	9	8	8	6
T200	Med	1,140	225	-	-	-	-	-	-	-
	Max	3,200	250	25	-	-	-	-	-	-
	Min	220	30	< 5	-	-	-	-	-	-
	NS	4	4	4						
T205	Med	540	200	60	290	54	280	340	64	90
	Max	600	200	100	660	260	1,100	2,200	210	1,600
	Min	500	30	10	160	35	50	130	10	20
	NS	3	3	3	9	8	8	8	8	6
T210	Med	190	10	15	250	70	140	220	30	20
	Max	730	330	150	730	370	260	2,000	800	1,800
	Min	80	4	< 4	40	1	12	24	10	6
	NS	7	7	7	9	7	8	8	7	6

*1966 values - Membrane Filter Technique (MF/100ml)

TABLE 9 HURON RIVER - WATER QUALITY
ANNUAL BACTERIOLOGICAL DENSITIES*

STATION		Pre-chlorination (Jan 1-May 14)			Chlorination (May 15-Sept 14)			Post-chlorination (Sept 15-Jan 11		
		Total Coliform	Fecal Coliform	Fecal Strep	Total Coliform	Fecal Coliform	Fecal Strep	Total Coliform	Fecal Coliform	Fecal Strep
T215	Med	600	100	-	230	13	100	180	18	15
	Max	870	210	4	1,100	80	300	1,200	48	1,400
	Min	420	10	< 10	5	2	18	12	2	6
	NS	3	3	3	9	6	6	8	8	6
T220	Med	1,000	600	20	200	25	150	120	38	43
	Max	2,600	1,200	30	460	66	1,300	1,000	130	260
	Min	820	10	10	22	14	10	20	8	22
	NS	3	3	2	7	6	6	8	8	6
T230	Med	460,000	49,000	7,400	2,000	220	400	40,000	5,900	44
	Max	960,000	83,000	9,900	36,000	1,100	2,100	340,000	84,000	8,100
	Min	47,000	5,700	600	550	32	10	3,500	210	10
	NS	8	8	8	9	9	8	7	7	5
T235	Med	620,000	180,000	17,000	3,300	300	90	54,000	20,000	1,100
	Max	1,500,000	240,000	33,000	76,000	1,200	1,800	420,000	60,000	6,600
	Min	460,000	110,000	3,000	370	48	10	22,000	6,200	120
	NS	4	4	4	9	8	8	8	8	6
T240	Med	6,000	300	100	600	98	70	3,300	840	140
	Max	9,000	750	110	4,800	800	3,800	190,000	3,400	2,200
	Min	3.300	170	100	200	18	10	1,700	10	2
	NS	3	3	2	9	9	8	8	8	6

*1966 values - Membrane Filter Technique (MF/100ml)

TABLE 9 HURON RIVER - WATER QUALITY
ANNUAL BACTERIOLOGICAL DENSITIES*

STATION		Pre-chlorination (Jan 1-May 14) Total Coliform	Fecal Coliform	Fecal Strep	Chlorination (May 15-Sept 14) Total Coliform	Fecal Coliform	Fecal Strep	Post-chlorination (Sept 15-Jan 11) Total Coliform	Fecal Coliform	Fecal Strep
T245	Med	660	100	10	740	92	120	420	55	30
	Max	3,000	210	140	4,400	470	850	2,800	150	350
	Min	140	10	< 5	200	58	62	160	14	20
	NS	7	7	7	9	7	8	8	8	6
T255	Med	680	110	10	370	64	160	670	75	39
	Max	3,400	570	500	3,600	870	1,300	17,000	3,000	1,900
	Min	130	10	5	95	44	48	320	14	18
	NS	8	7	7	9	8	8	8	8	6
T265	Med	2,000	440	200	90	50	10	-	-	-
	Max	3,900	660	400	90	50	10	-	-	-
	Min	400	150	30	90	50	10	-	-	-
	NS	4	4	4	1	1	1	-	-	-
T270	Med	23	7	5	300	41	210	34	5	30
	Max	200	10	40	1,400	70	2,500	630	250	86
	Min	10	< 5	5	26	14	28	14	2	10
	NS	6	6	3	9	8	7	7	7	5
	Med									
	Max									
	Min									
	NS									

*1966 values - Membrane Filter Technique (MF/100ml)

TABLE 10. TRIBUTARIES TO HURON RIVER - WATER QUALITY
ANNUAL BACTERIOLOGICAL DENSITIES*

Station		Pre-chlorination (Jan 1-May 14)			Chlorination (May 15-Sept 14)			Post-chlorination (Sept 15-Jan 4		
		Total Coliform	Fecal Coliform	Fecal Strep	Total Coliform	Fecal Coliform	Fecal Strep	Total Coliform	Fecal Coliform	Fecal Strep
T216 Willow Run Creek	Med	360,000	37,000	4,800	38,000	1,200	120	1,300,000	114,000	12,000
	Max	1,800,000	120,000	20,000	450,000	150,000	2,500	2,400,000	186,000	22,000
	Min	190,000	7,800	1,000	3,000	90	50	140,000	42,000	1,400
	NS	6	6	6	4	4	4	2	2	2
T266 Mill Creek	Med	7,300	2,200	230	530	160	340	8,900	1,900	700
	Max	28,000	2,700	1,200	17,000	3,300	4,600	37,000	8,000	13,000
	Min	500	70	30	230	54	130	630	58	100
	NS	8	8	8	9	7	8	7	7	5

*1966 Values - Membrane Filter Technique (MF/100ml)

HURON RIVER
DISSOLVED OXYGEN ANNUAL VALUES
1966

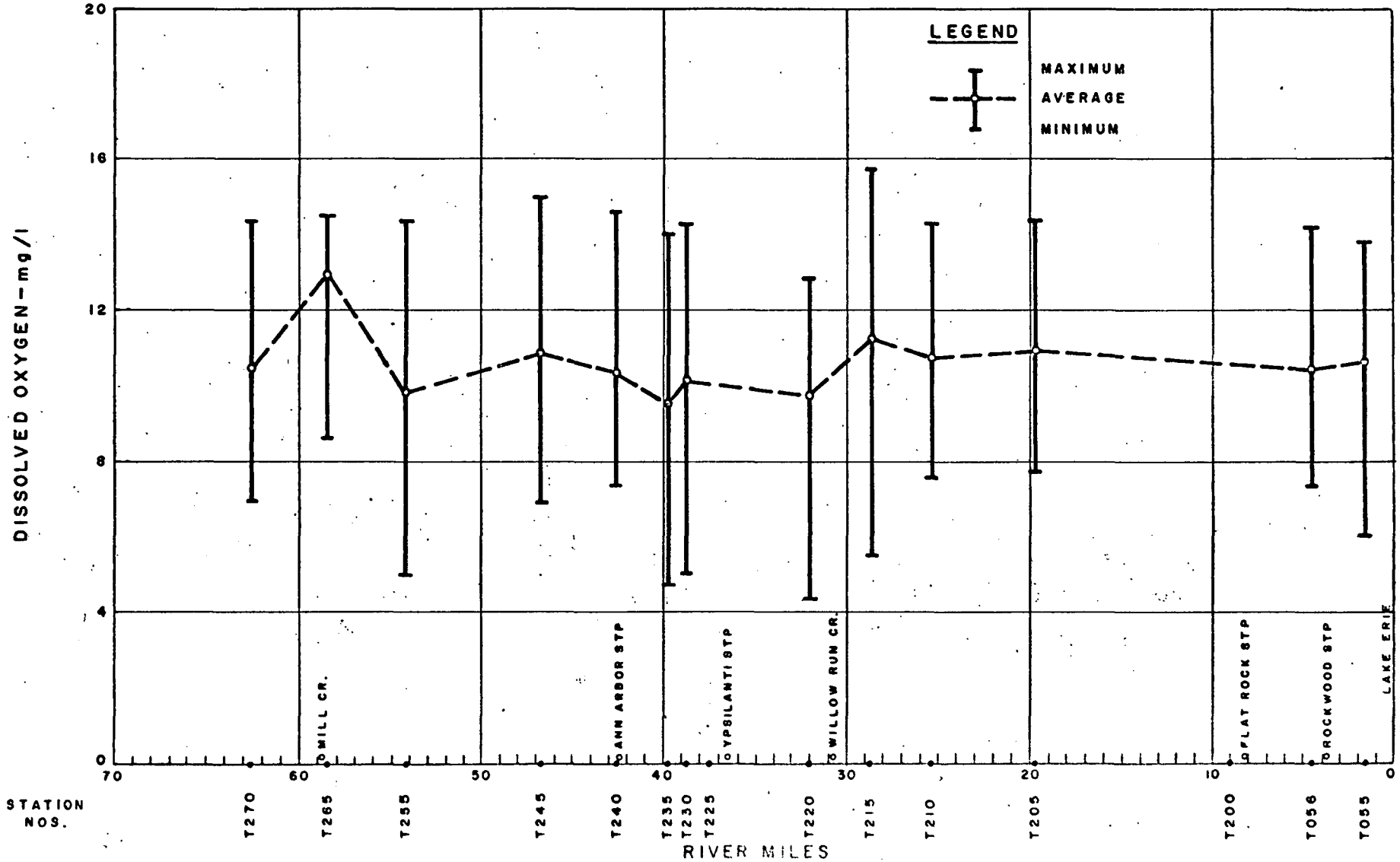


FIGURE 5

HURON RIVER
BOD_5 ANNUAL VALUES
1966

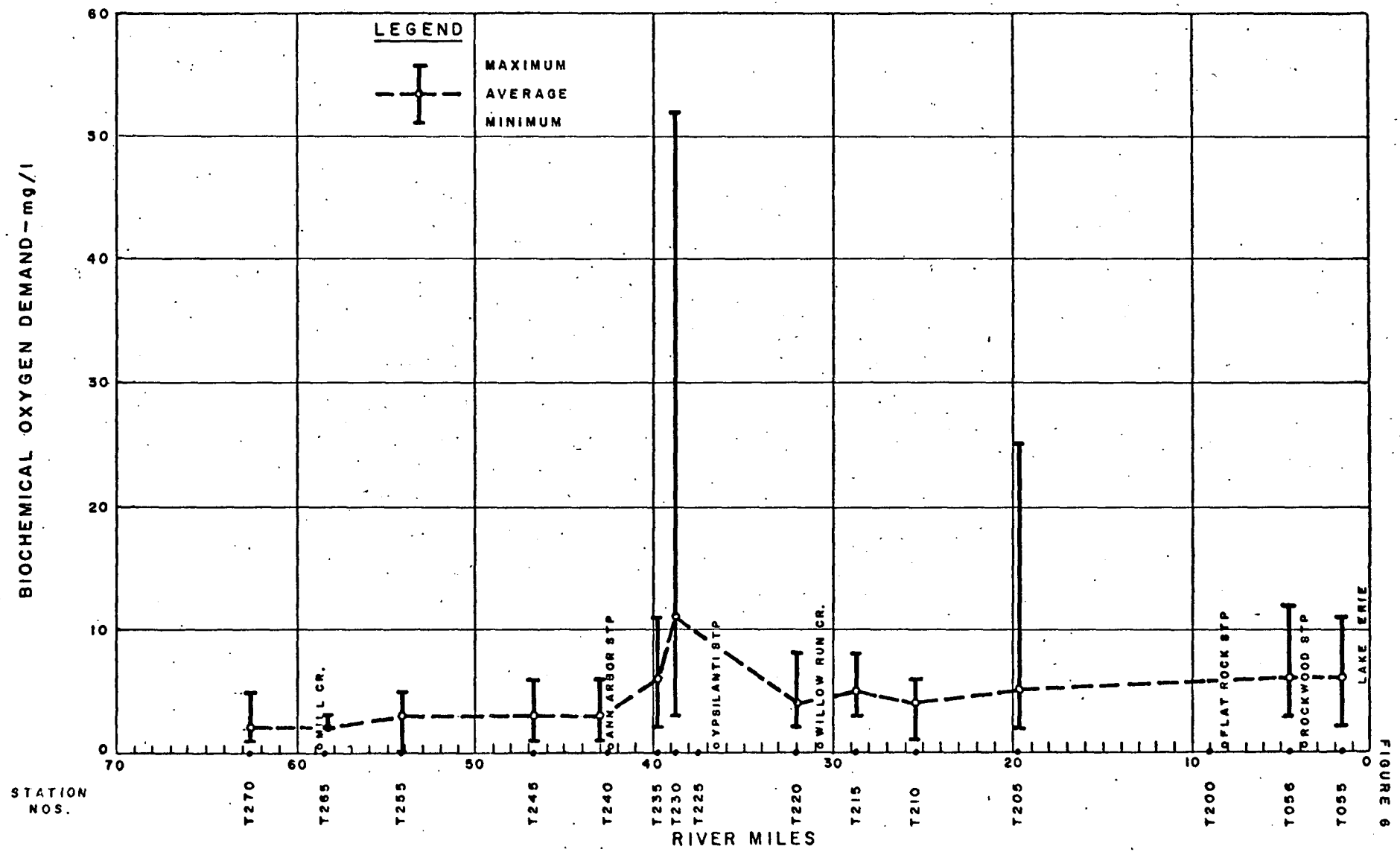


FIGURE 6

HURON RIVER
COD ANNUAL VALUES
1966

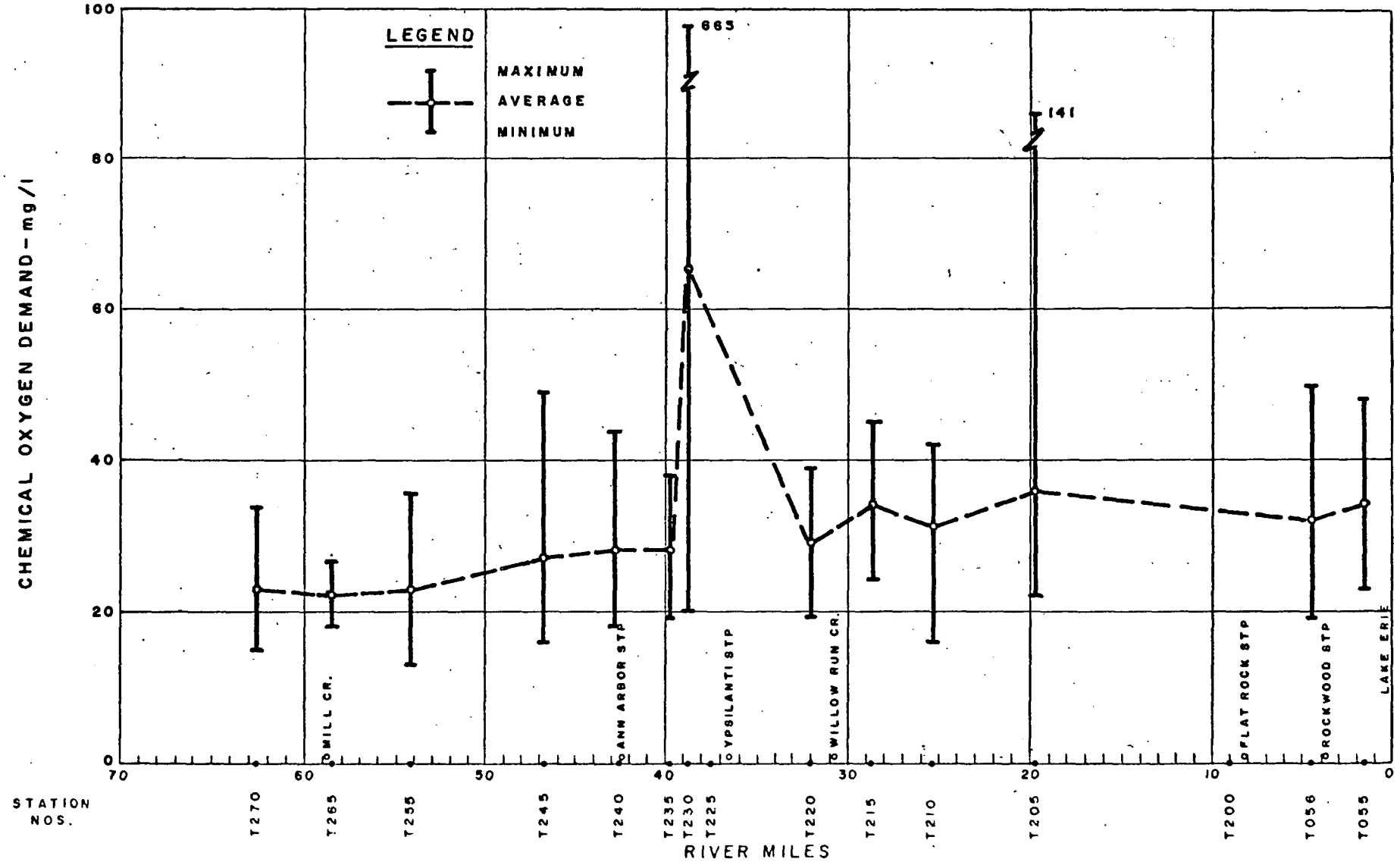


FIGURE 7

HURON RIVER
TOTAL PHOSPHATE ANNUAL VALUES
1966

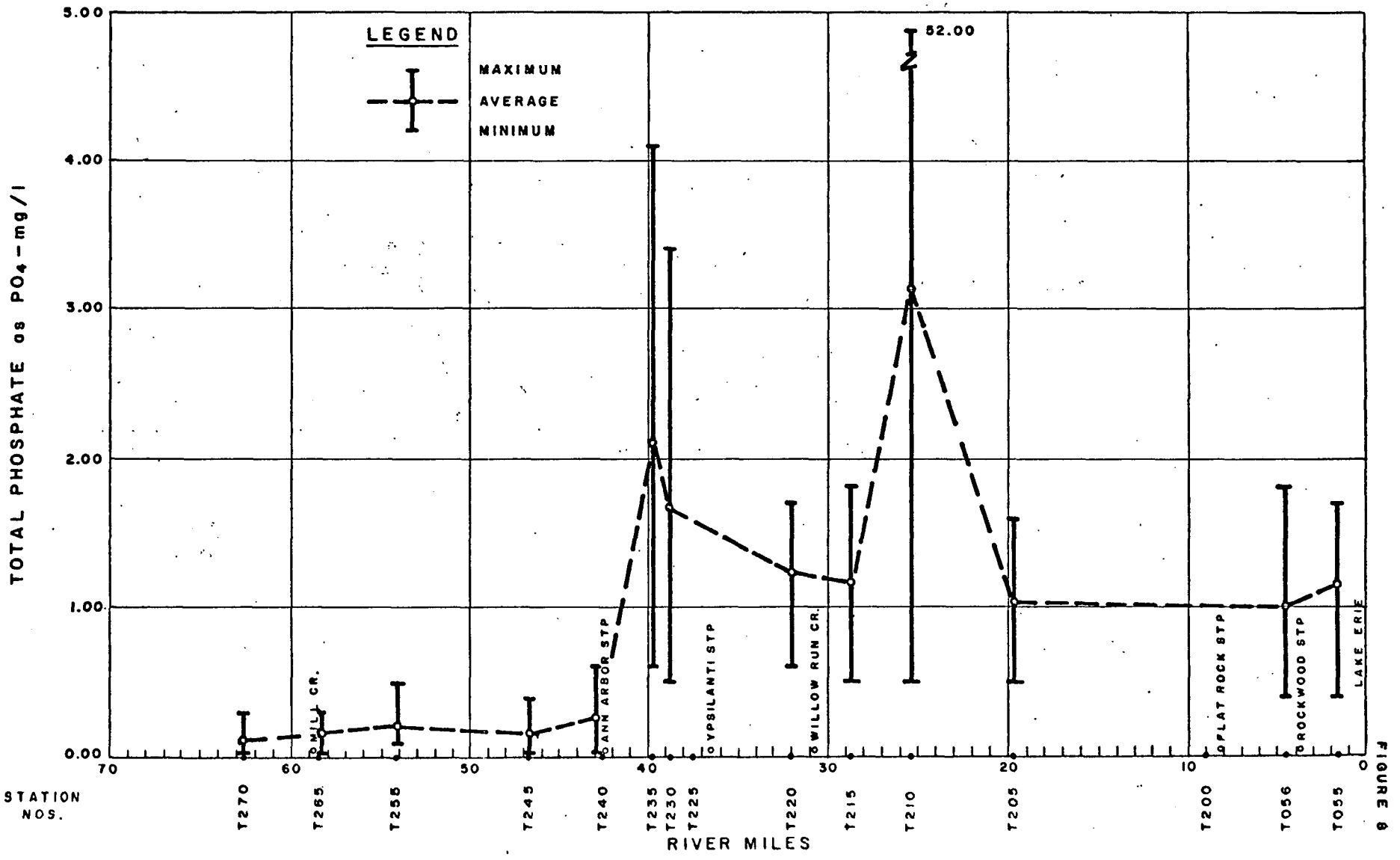


FIGURE 8

HURON RIVER
TOTAL SOLUBLE PHOSPHATE ANNUAL VALUES
1966

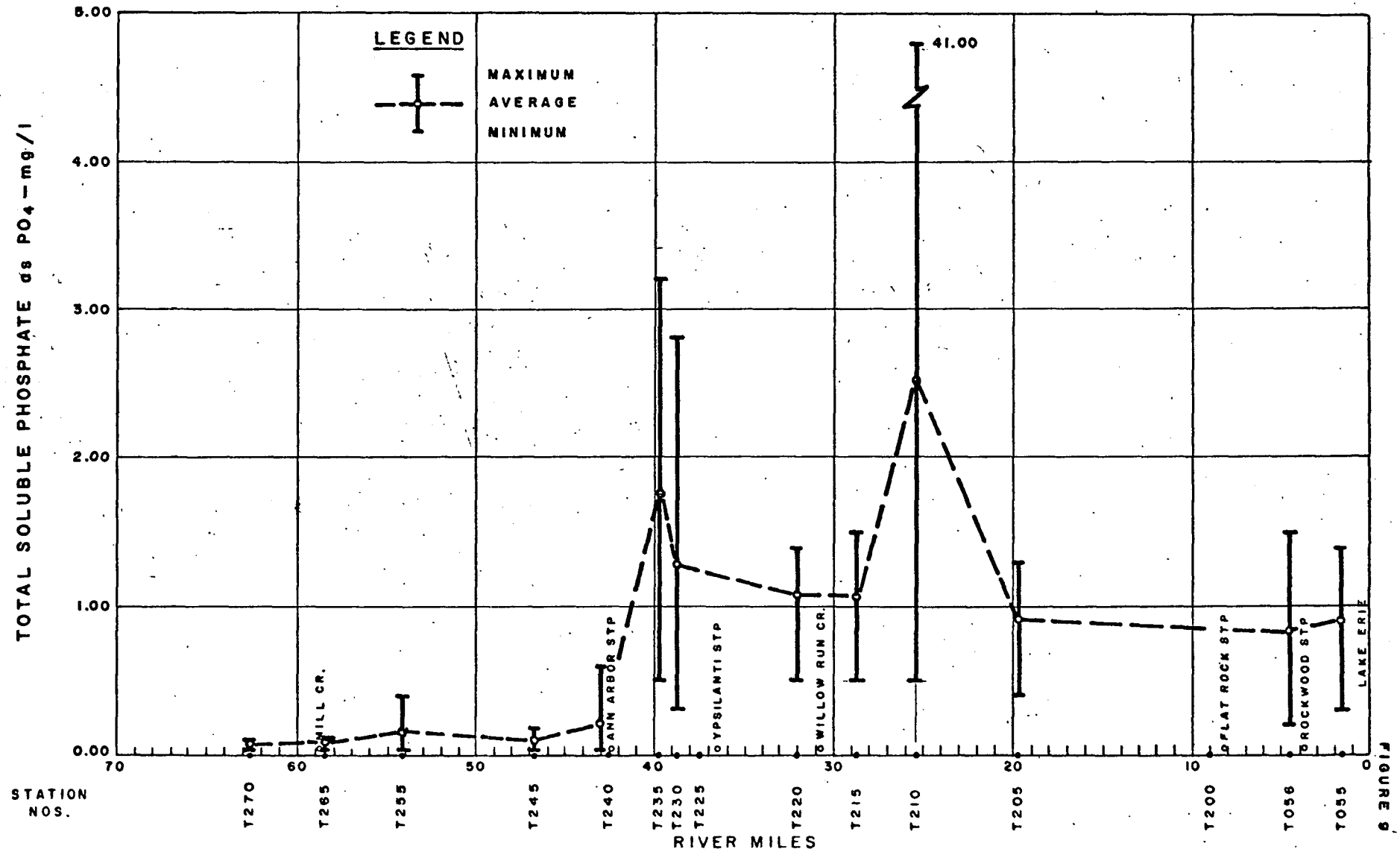


FIGURE 9

HURON RIVER
NITRATE ANNUAL VALUES
1966

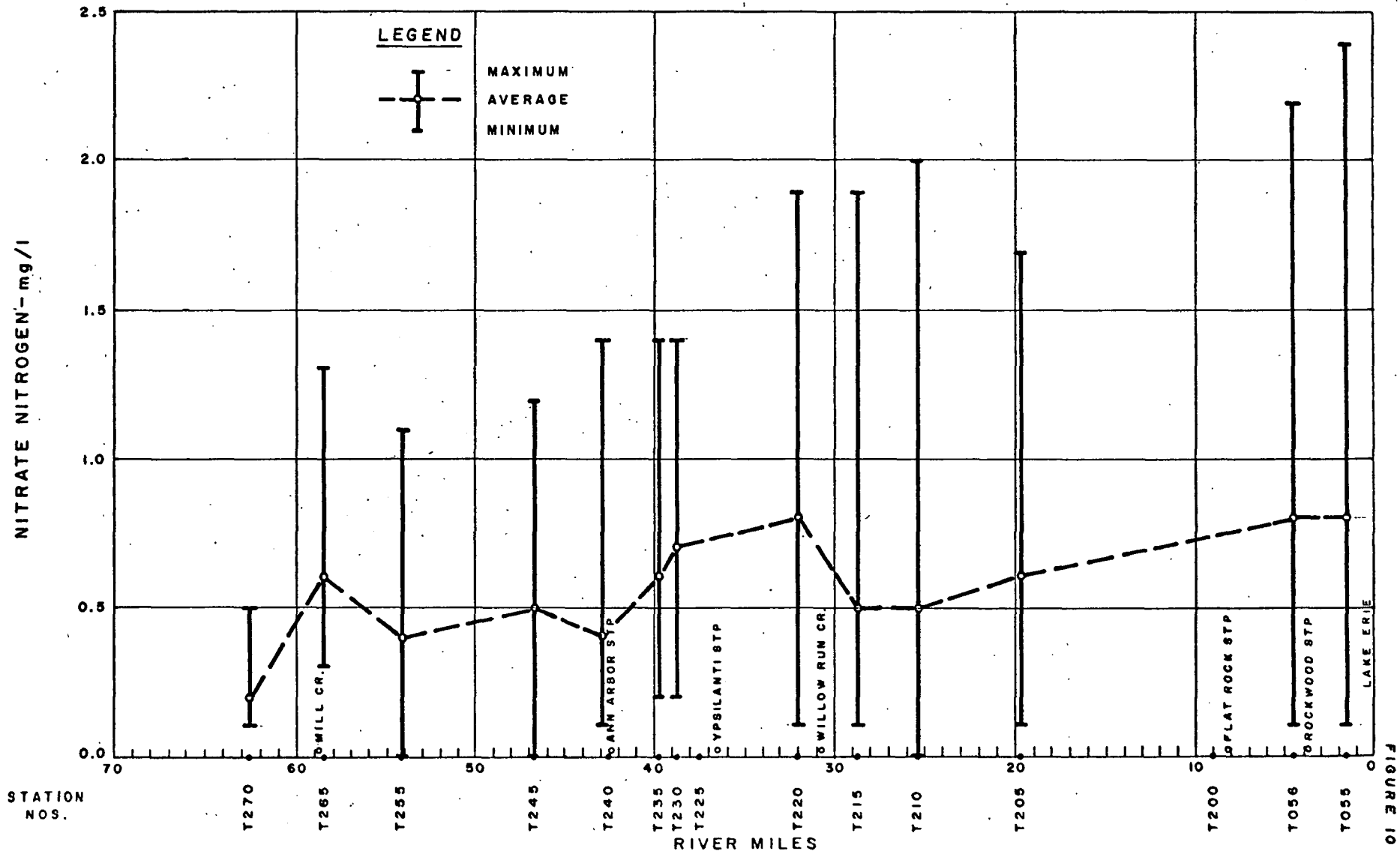


FIGURE 10

HURON RIVER
NITRITE ANNUAL VALUES
1966

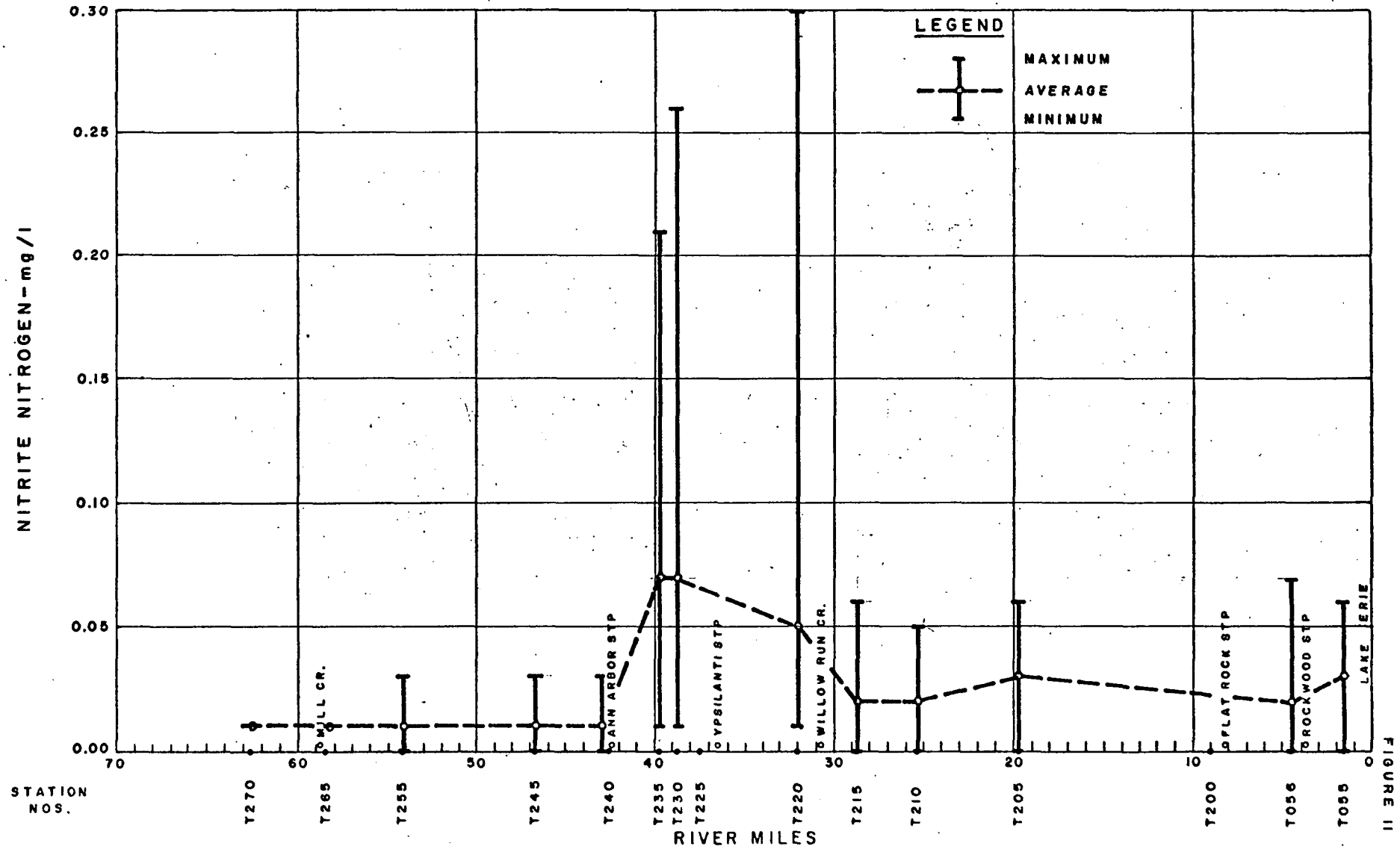


FIGURE 11

HURON RIVER
AMMONIA NITROGEN ANNUAL VALUES
1966

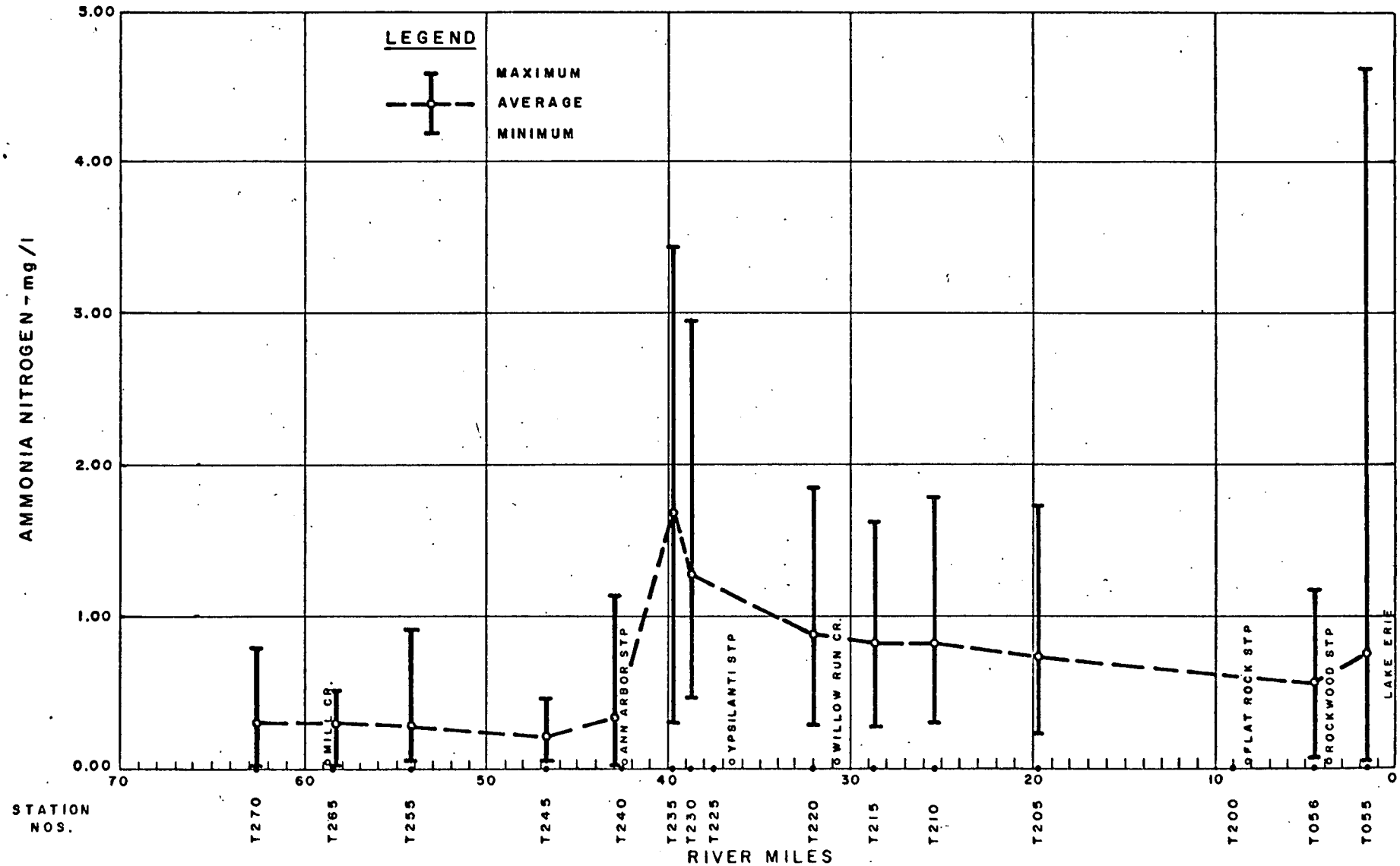


FIGURE 12

HURON RIVER
ORGANIC NITROGEN ANNUAL VALUES
1966

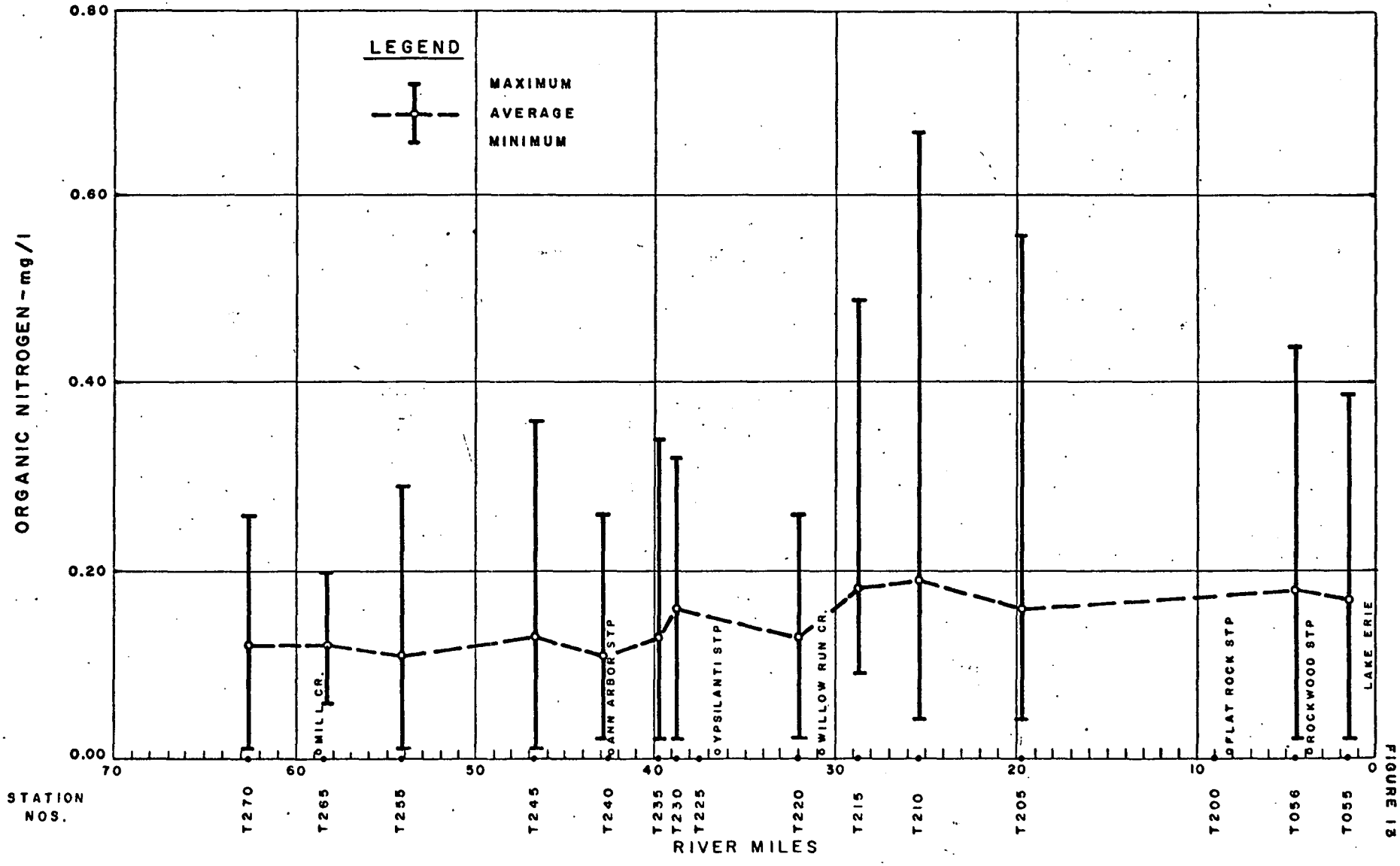


FIGURE 13

HURON RIVER
TOTAL SOLIDS ANNUAL VALUES
1966

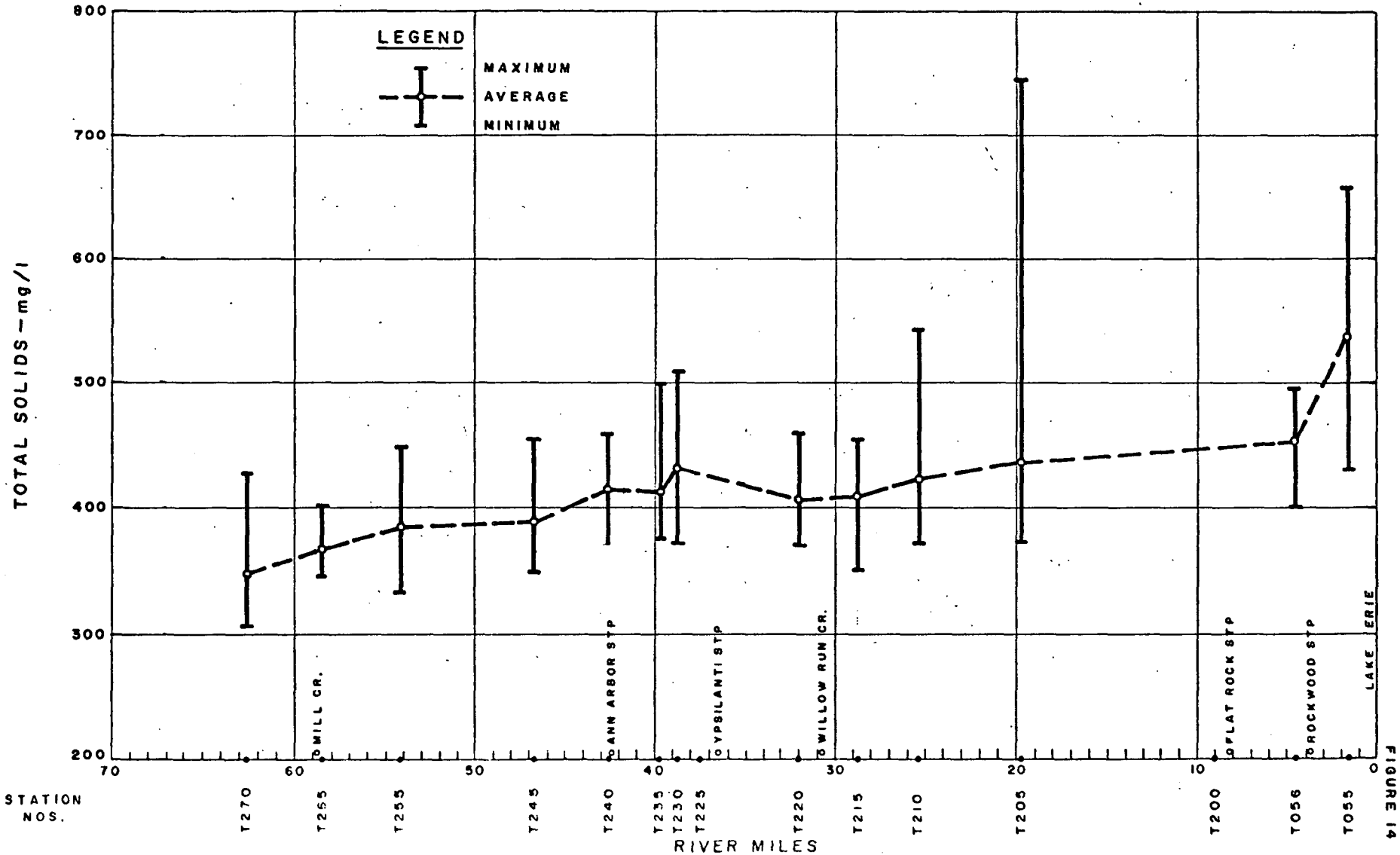


FIGURE 14

HURON RIVER
DISSOLVED SOLIDS ANNUAL VALUES
1966

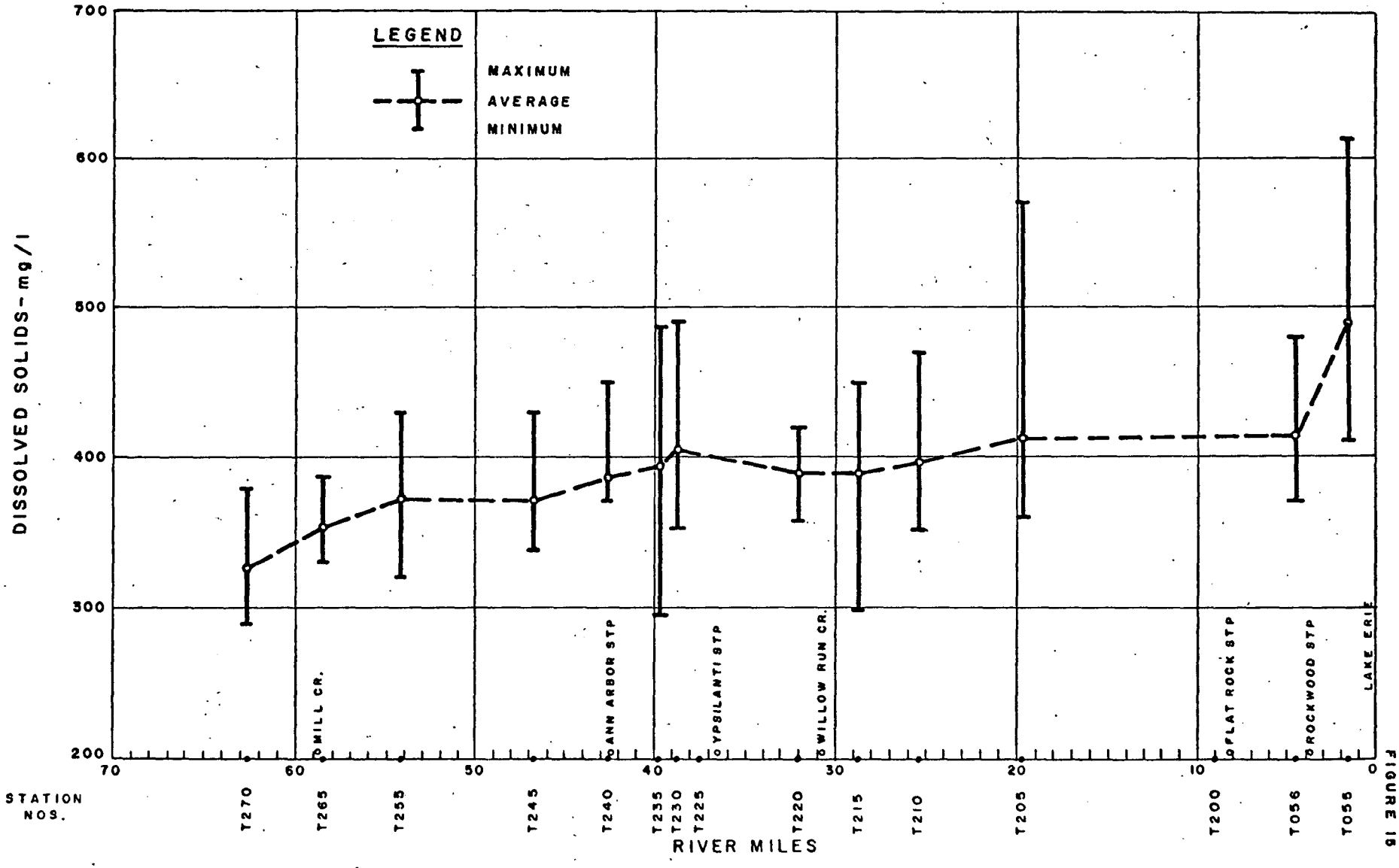


FIGURE 18

HURON RIVER
SUSPENDED SOLIDS ANNUAL VALUES
1966

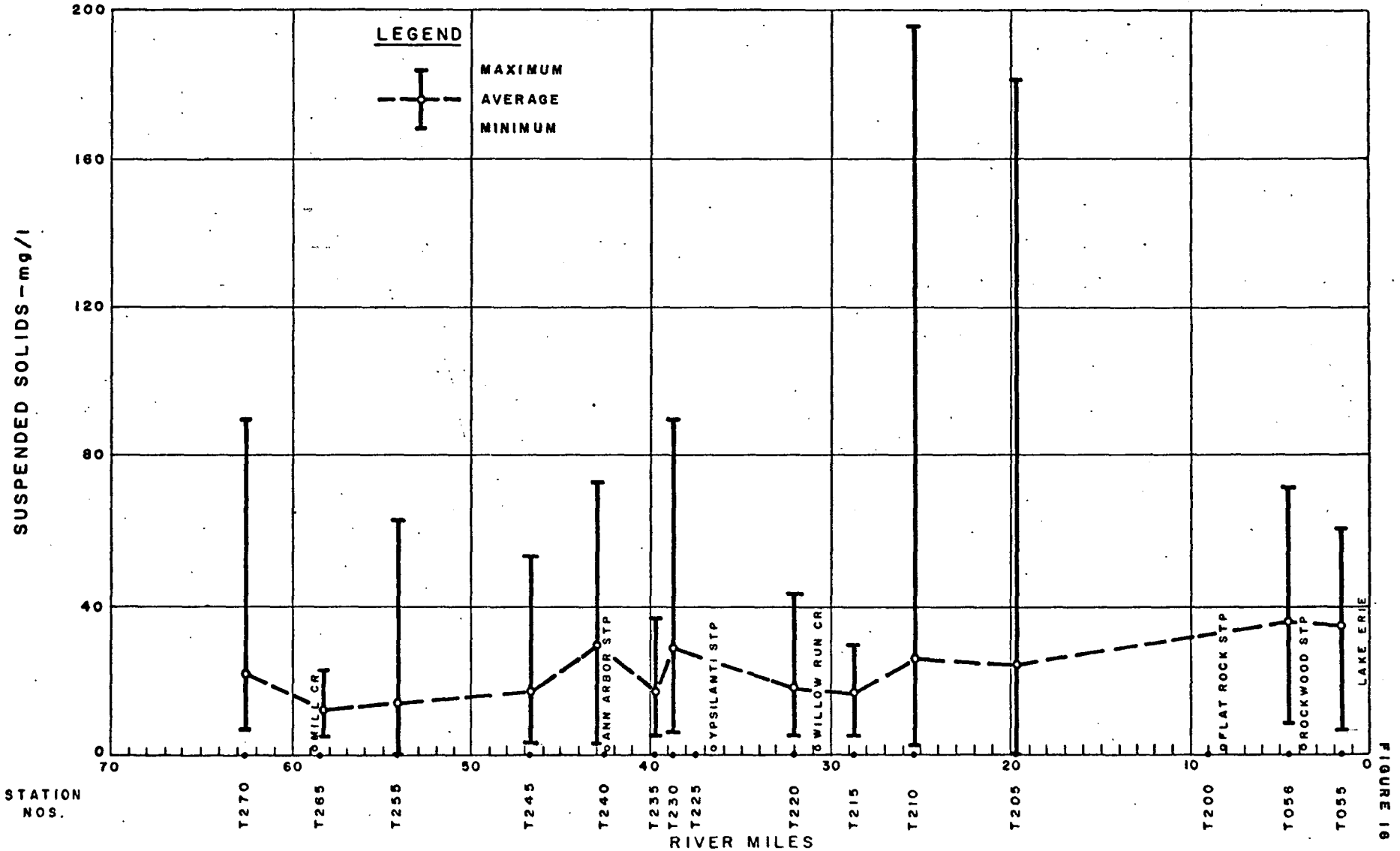


FIGURE 16

HURON RIVER
CHLORIDE ANNUAL VALUES
1966

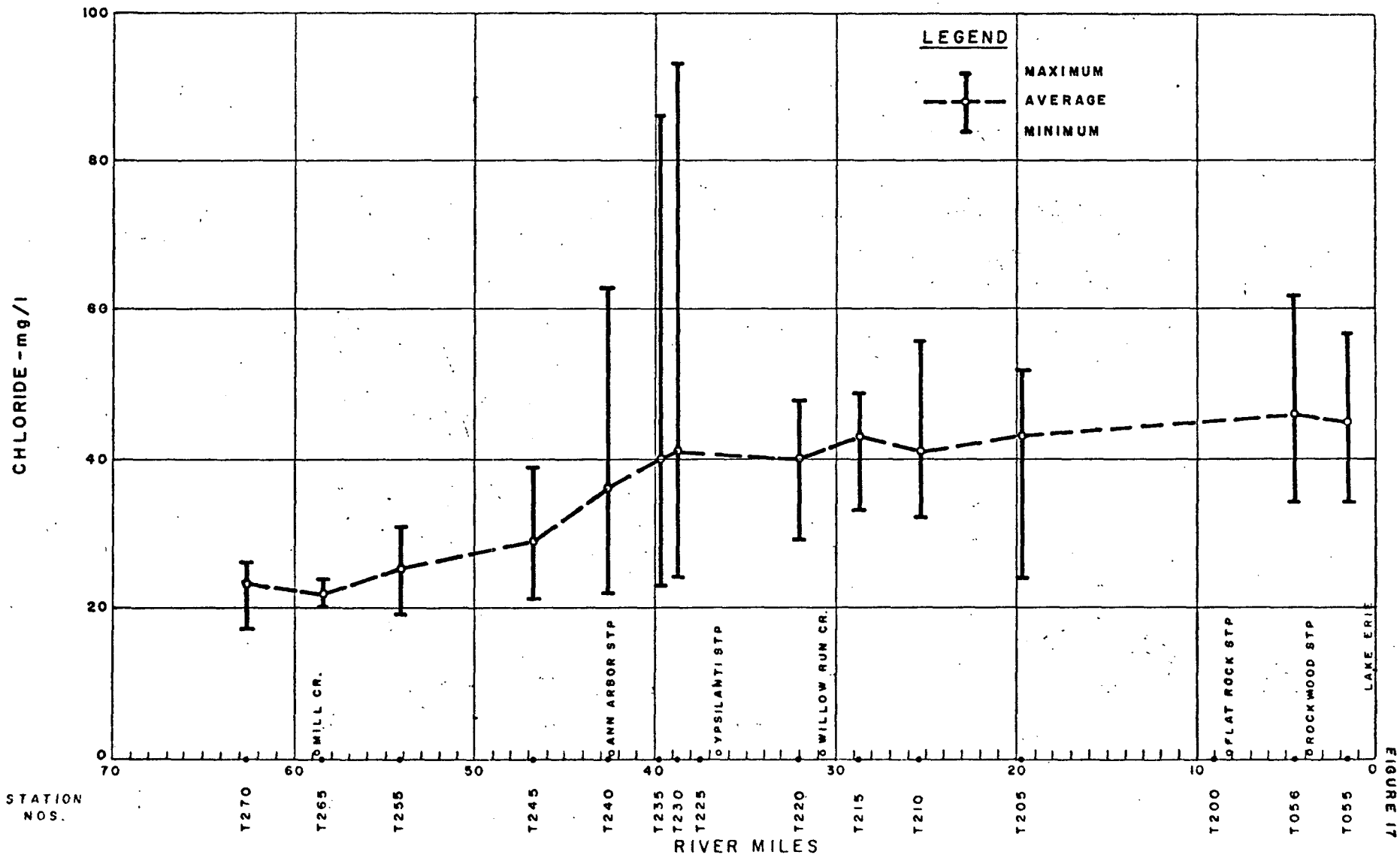


FIGURE 17

HURON RIVER
CONDUCTIVITY ANNUAL VALUES
1966

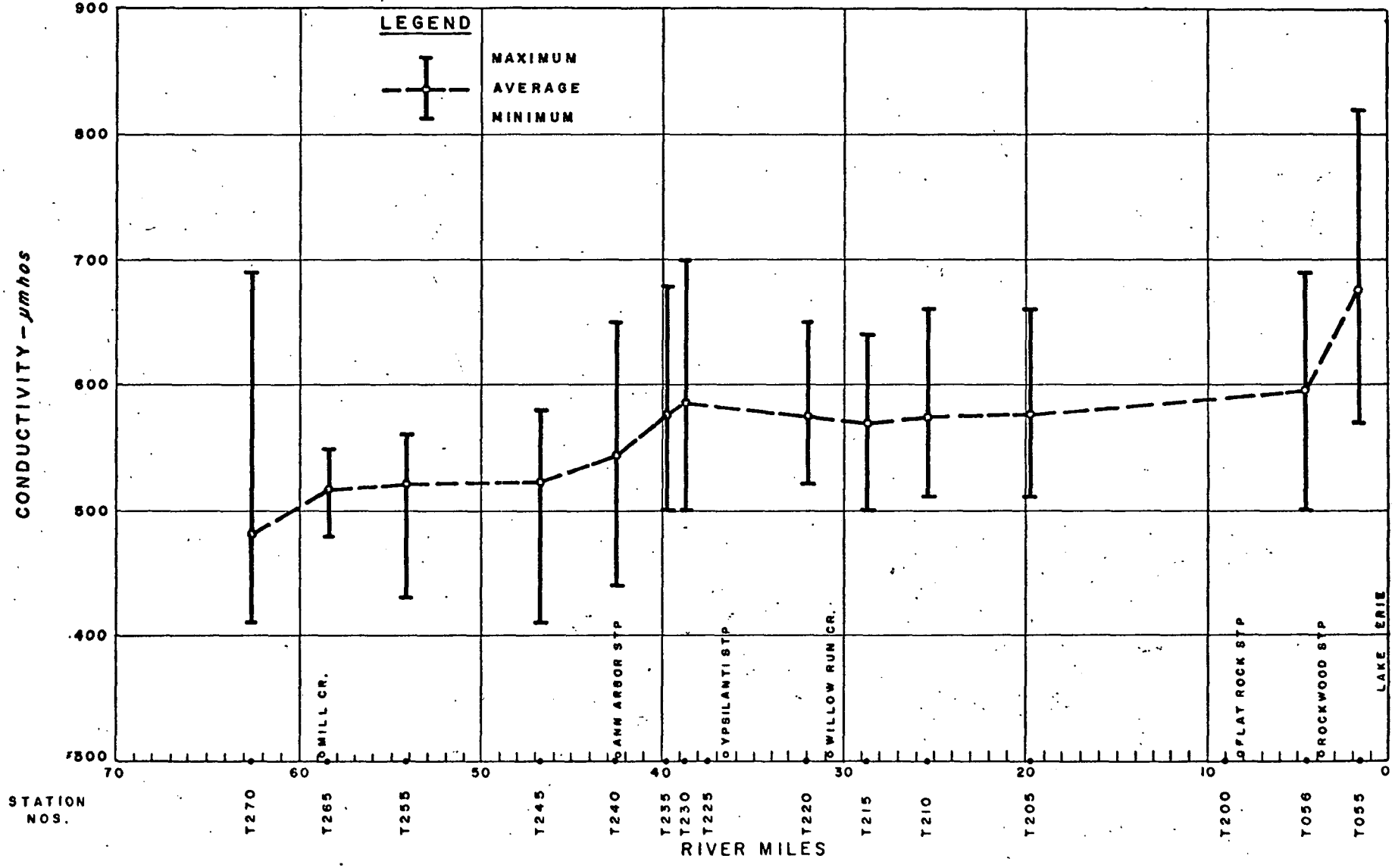


FIGURE 18

HURON RIVER
PHENOL ANNUAL VALUES
1966

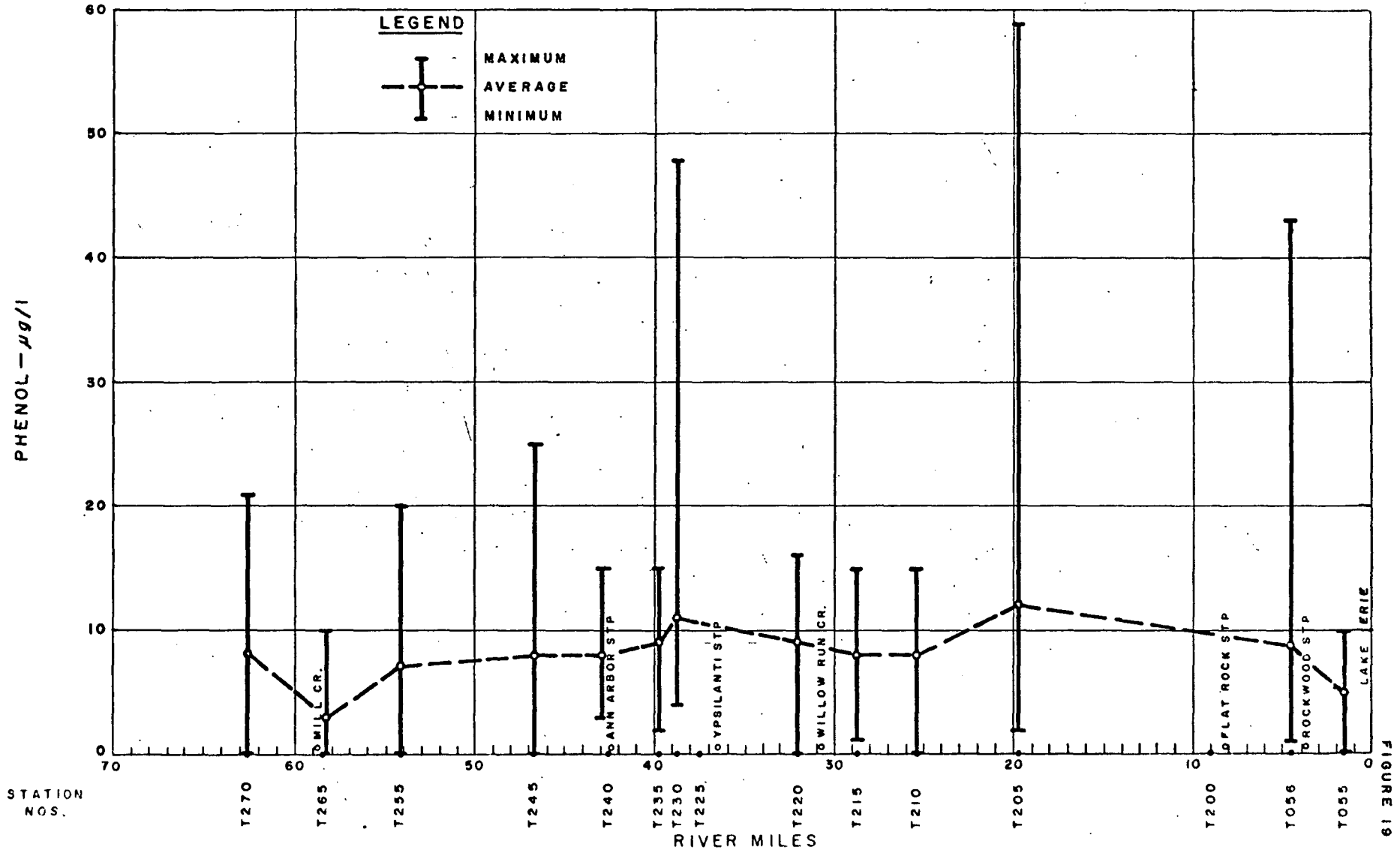


FIGURE 19

HURON RIVER
IRON ANNUAL VALUES
1966

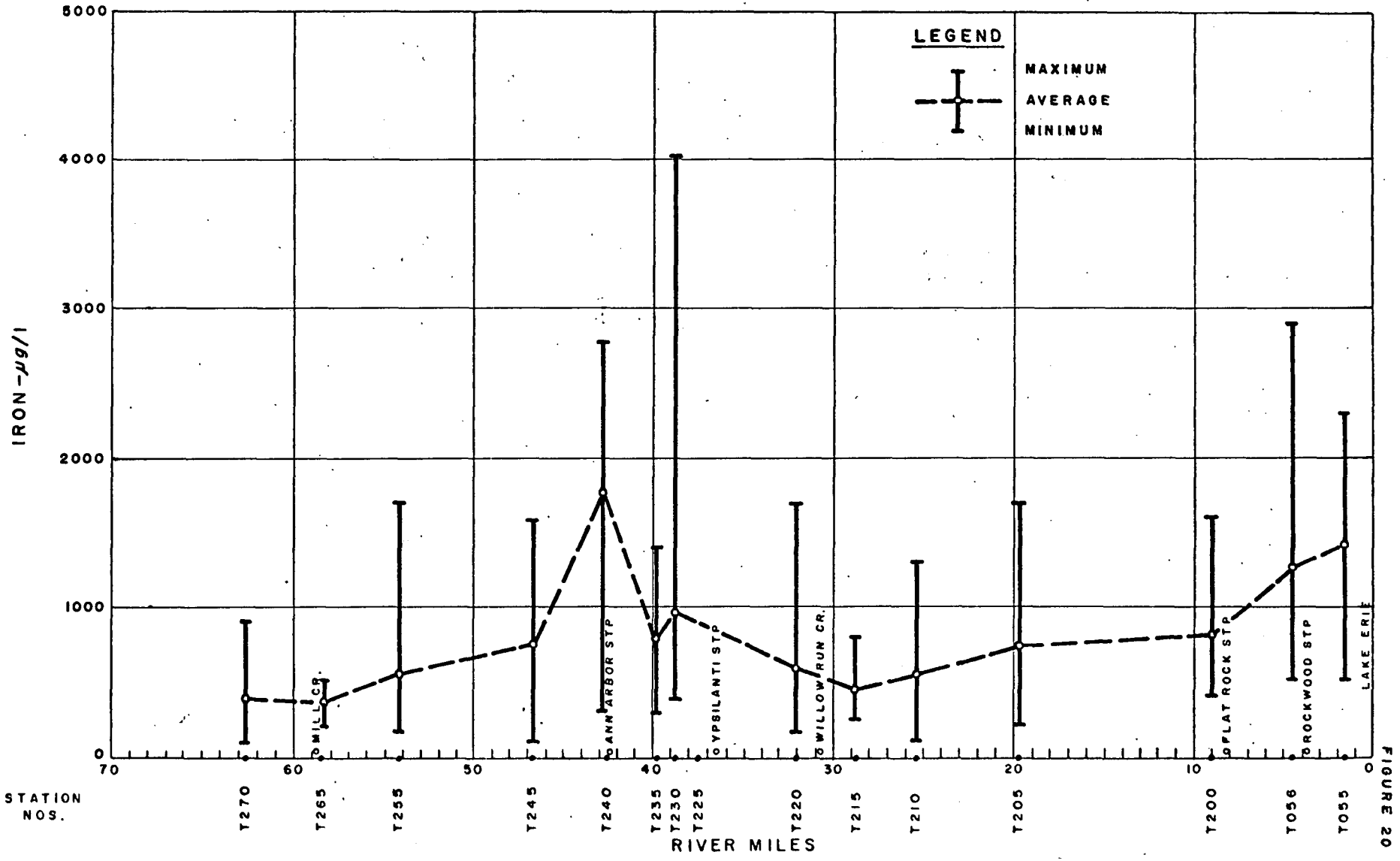


FIGURE 20

HURON RIVER
CALCIUM ANNUAL VALUES
1966

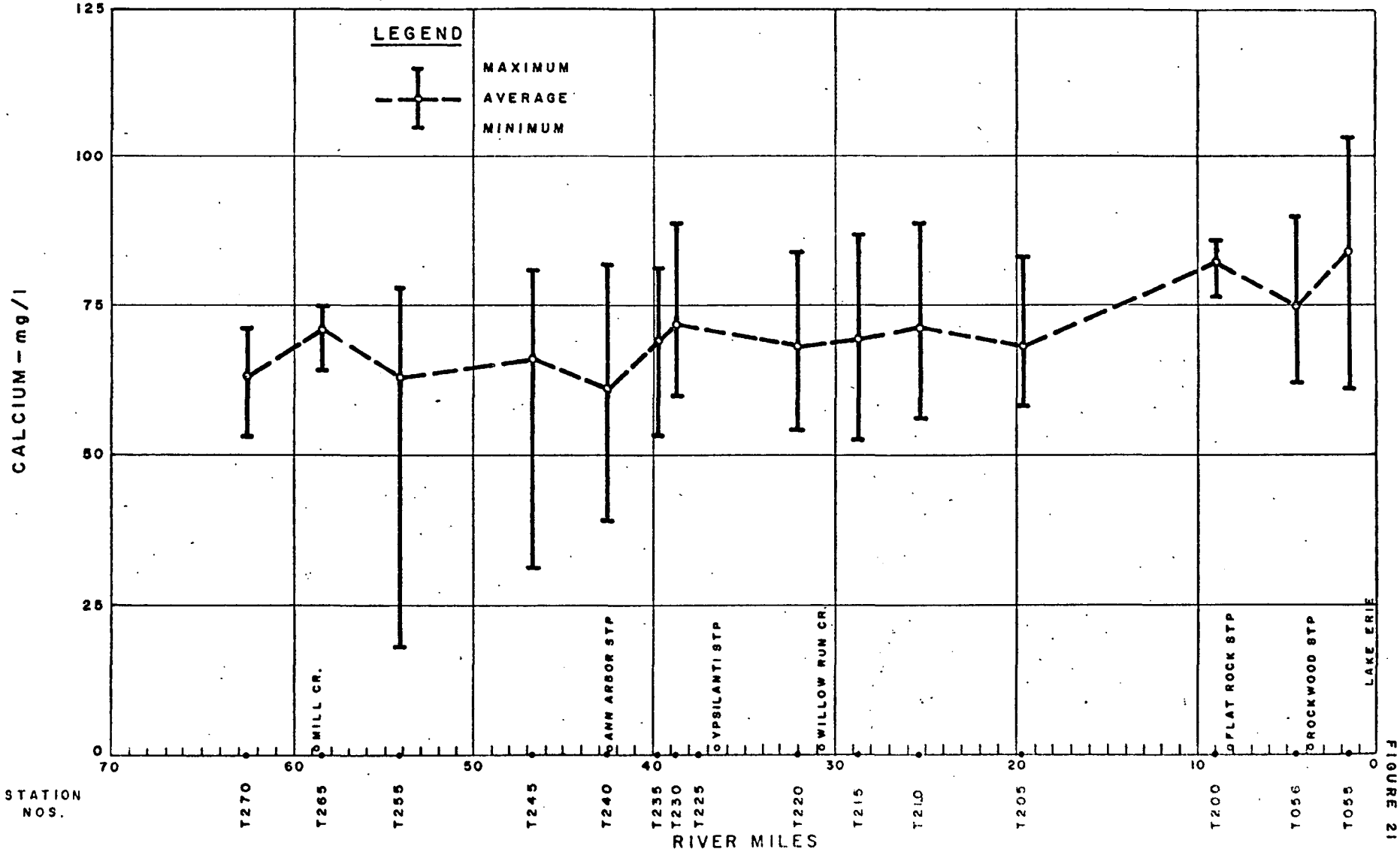


FIGURE 21

HURON RIVER
TOTAL HARDNESS ANNUAL VALUES
1966

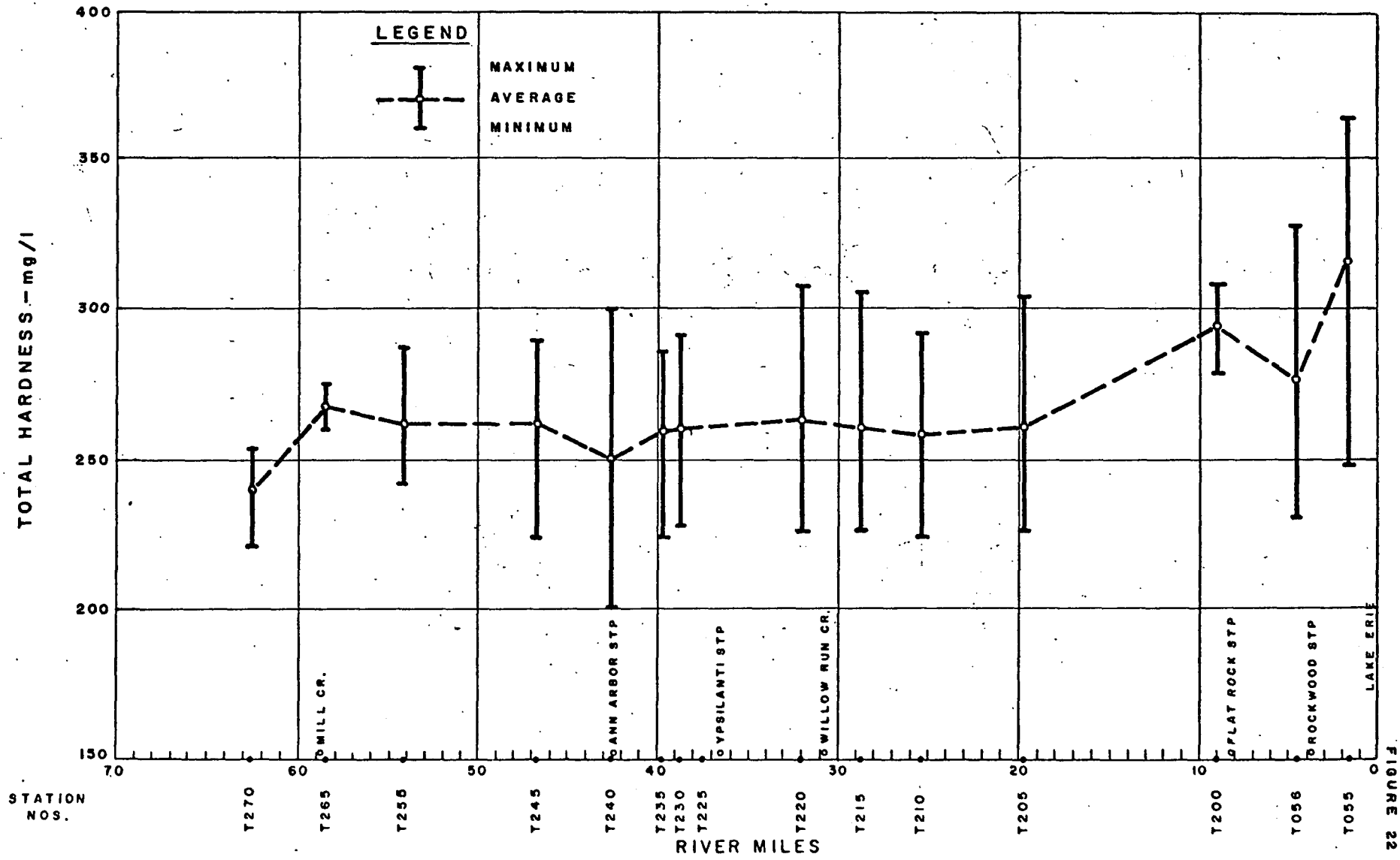


FIGURE 22

HURON RIVER
pH ANNUAL VALUES
1966

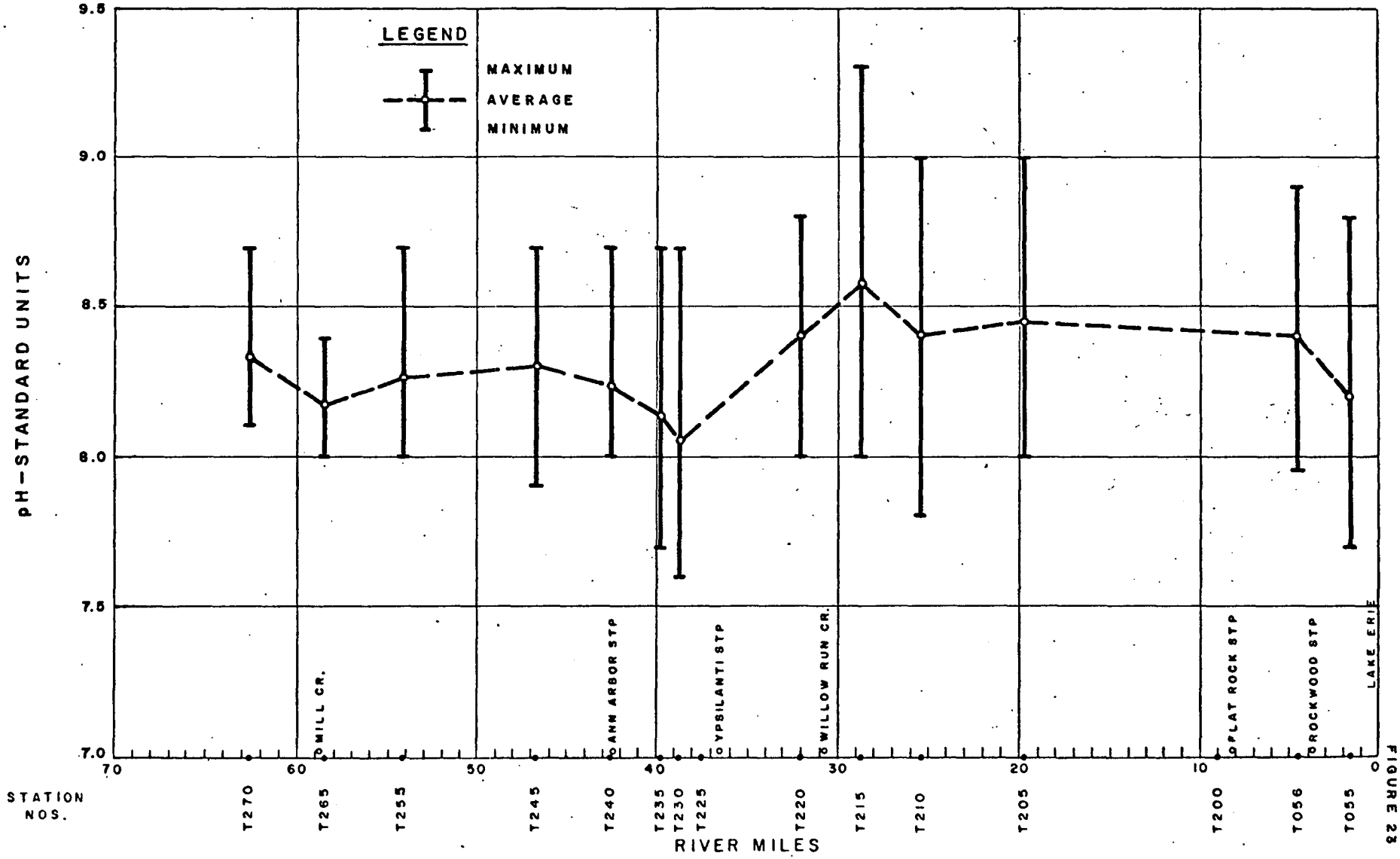


FIGURE 23

HURON RIVER
TOTAL COLIFORM SEASONAL VALUES
1966

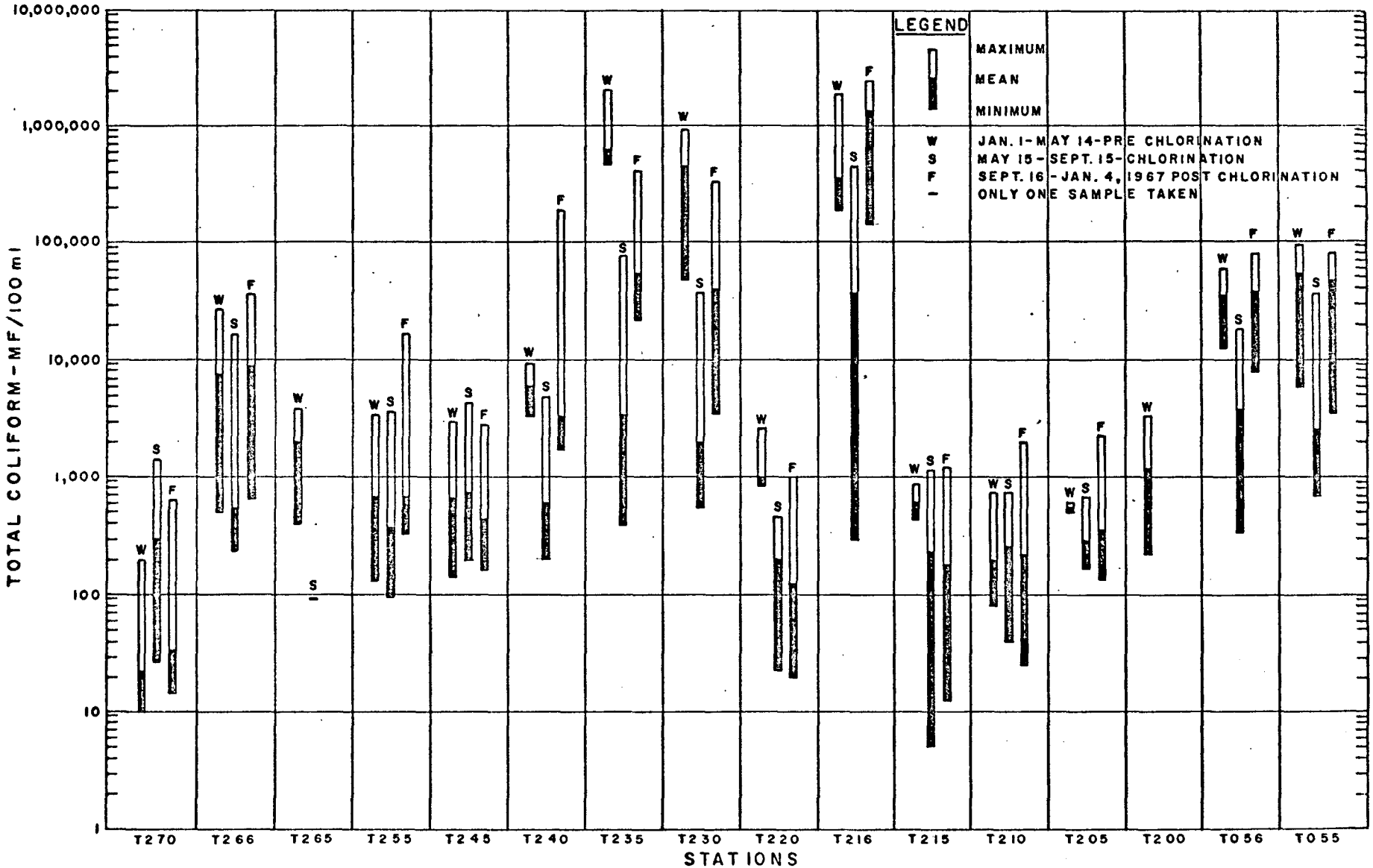


FIGURE 24

HURON RIVER
TOTAL COLIFORM SEASONAL MEDIAN VALUES
1966

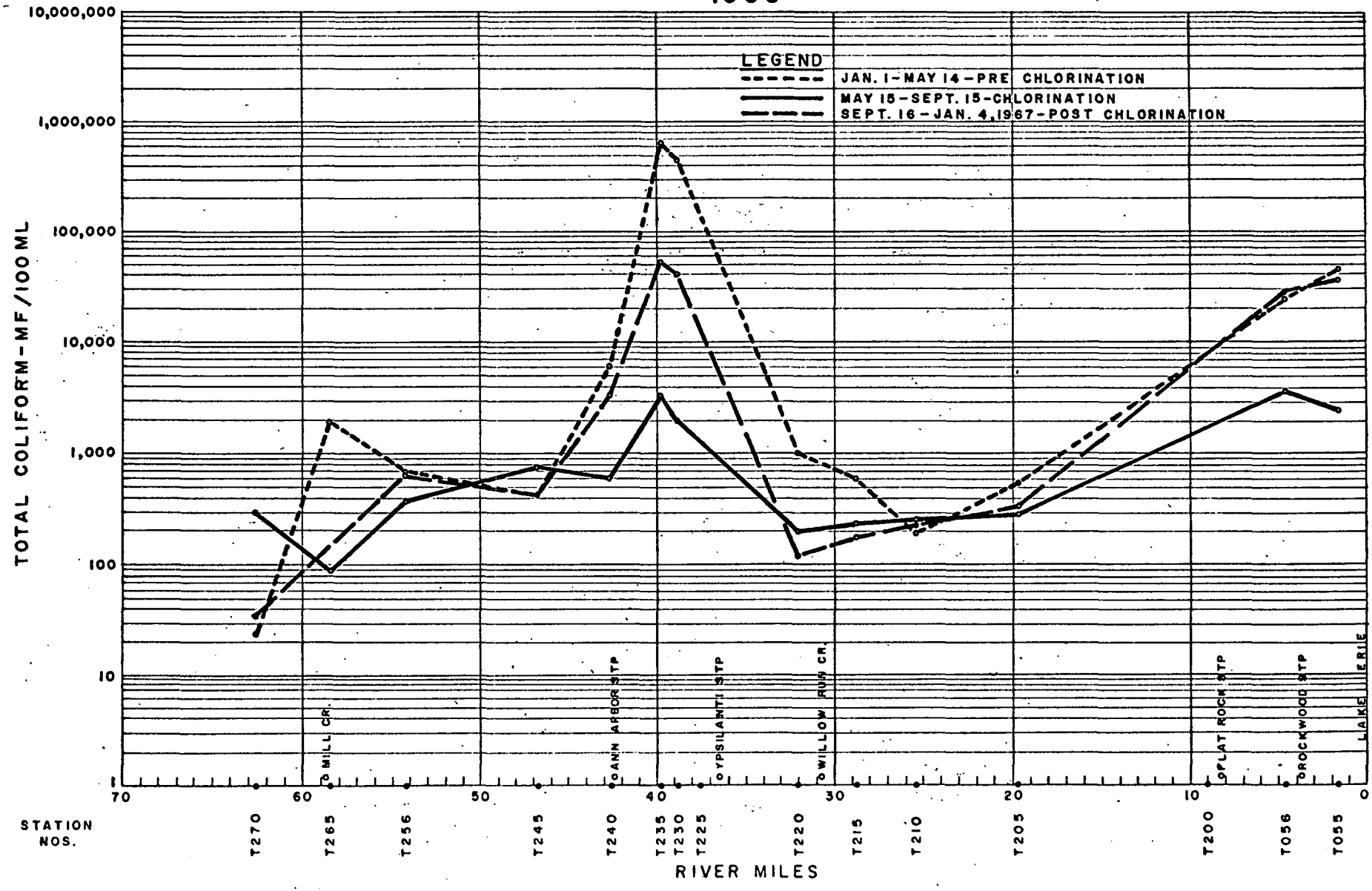


FIGURE 25

EXAMINATION OF STREAM EFFLUENTS OF TWO SEWAGE TREATMENT PLANTS LOCATED ON THE LOWER HURON RIVER

During the early phase of a salmonella survey that was being conducted on the Raisin River early in 1966, a number of salmonella serotypes were isolated from the stream effluent of the Monroe sewage treatment plant. These isolations raised the question whether salmonellae could be isolated from other sewage treatment plants in the general area. The two plants on the lower Huron River were selected. These two plants were at Flat Rock and Rockwood.

Sampling for salmonella was carried out via a modified Moore gauze swab over a 3-day period in both instances. The Flat Rock sewage treatment plant effluent (Figure 26) was sampled about 5 feet downstream of the submerged waste outlet from February 11 to February 14, 1966. No attempt was made to determine bacterial parameters at this time, other than salmonella. Two salmonella serotypes, S. minnesota and S. heidelberg were isolated.

On February 18, 1966, a modified Moore gauze swab was positioned in the Huron River for a 3-day period, approximately 25 feet downstream of the submerged waste effluent outlet (Figure 25) of the sewage treatment plant at Rockwood. One salmonella serotype, S. minnesota was isolated. The two samplings were carried out prior to the chlorination season, May 15-September 15, 1966.

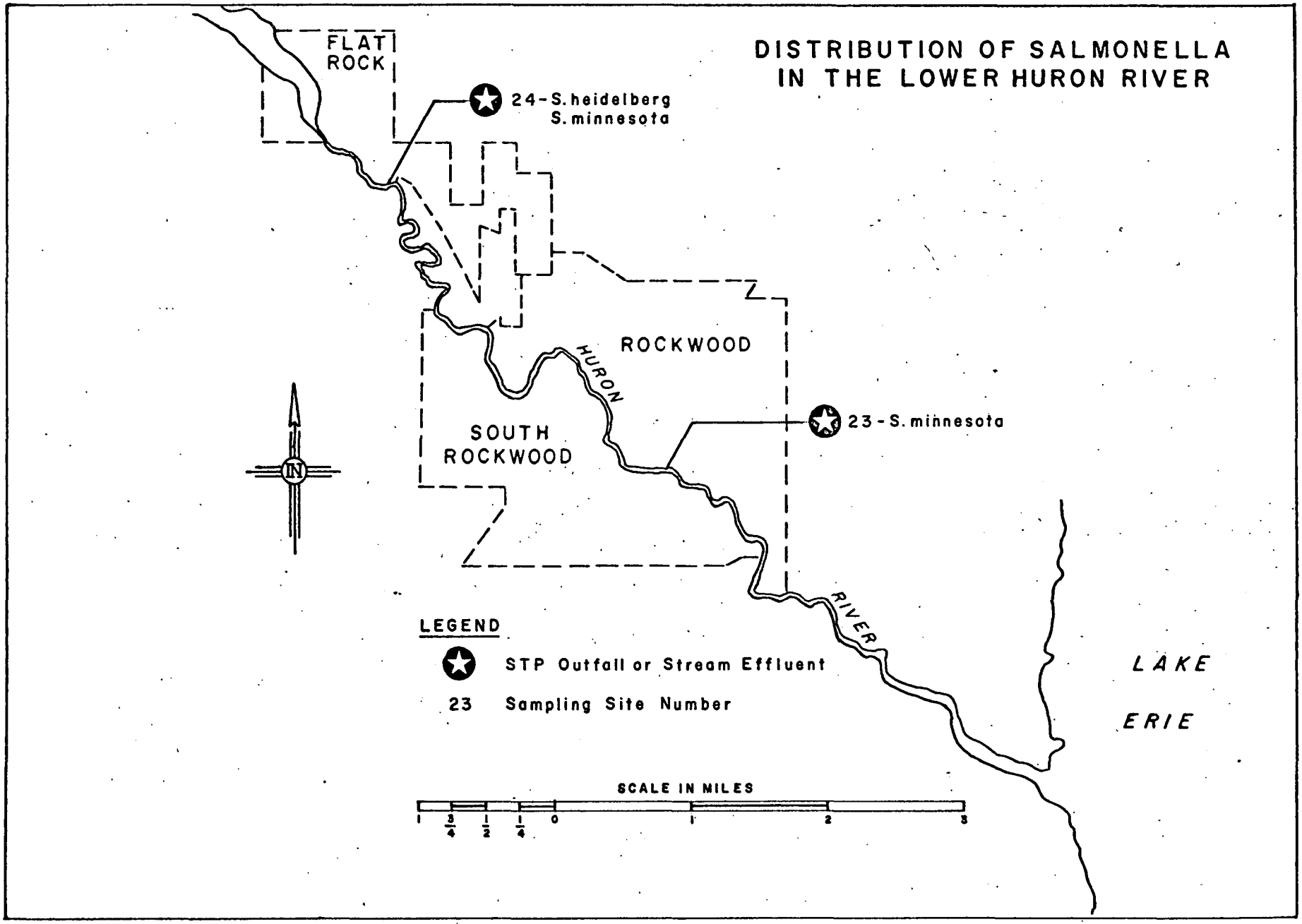

DISTRIBUTION OF SALMONELLA
IN THE LOWER HURON RIVER
FLAT
ROCK
24-S.heidelberg
S.minnesota
ROCKWOOD
HURON
23-S.minnesota
SOUTH
ROCKWOOD
IN
RIVER
LAKE
ERIE
LEGEND
STP Outfall or Stream Effluent
23 Sampling Site Number
SCALE IN MILES
3/4
1/2
1/4
0
1
2
3

FIGURE 26

SUMMARY AND WATER QUALITY PROBLEMS

The population centers in the Huron River Basin are Ann Arbor (67,340), Ypsilanti (20,957), Ypsilanti Township (25,950), Flat Rock (4,696), and Milford (4,323) according to the 1960 census figures. The Huron River Basin has a 1965 population served by public water supplies of about 150,000 people. This number is expected to increase to 360,000 by 1990, and 510,000 by 2020. Municipal water use in 1965 was estimated to be approximately 20 million gallons per day and projected to be 48 and 73 million gallons per day in 1990 and 2020, respectively. Approximately one-half of the present water supply comes from the Huron River; the remainder is from groundwater supplies. Many of the small industries in the basin obtain their water from the municipal supply.

Eleven communities discharge treated wastes to watercourses in the Huron River Basin. Secondary treatment is provided for an estimated 132,550 people, primary treatment for an estimated 86,000 people, and private septic tanks or no treatment at all for an estimated 16,000 people. All of the municipal sewage treatment plants chlorinate the final effluent. Municipal sewage treatment plants discharge about 19 million gallons per day. The Ann Arbor-Ypsilanti area contributes 87 percent of the municipal waste to the Huron River.

Thirteen industries discharge wastes to the Huron River or the tributaries. Wastes originating from plating operations, automotive parts and assembly plants, steel plants, a paper company, and manufacturing plants total approximately 6 million gallons per day. Waste constituents include toxic metals, oil, grease, solids, BOD_5, iron, chrome, fiber, dye, and cooling water.

The Huron River rises in the lake country of Oakland and Livingstone Counties. There are numerous park and parkway areas in the upper reaches of both the main stem and the tributaries. These include State, regional, and local areas. State areas include Pontiac Lake, Highland, Island Lake, Brighton, and Pinckney State Recreation Areas, and Gregory and Chelsea State Game Areas. Huron-Clinton Metropolitan Authority (HCMA) areas include Marshbank, Kensington, Hudson Mills, Dexter-Huron, and Delhi Metropolitan Parks, all above Ann Arbor. Lower Huron Metropolitan Park of HCMA begins at the outlet of Belleville Lake and extends to New Boston. Willow-Bell Metropolitan Park, which extends from New Boston to Flat Rock, is presently being developed. Many of the cities and villages which are on the Huron River have also developed smaller parks. Pointe Mouillee marsh is a State game area and important stopping point for migratory waterfowl.

The 4,300 acre Kensington Park includes Kent Lake, a 1,200 acre artificial lake with numerous oriented and water related activites. This includes swimming at two beaches, facilities for launching and dockage of private boats, boat rental, a sixty-passenger excursion boat, canoeing (part of the Huron River canoe route), fishing, camping, and picnicking. Similar, though not as extensive, facilities are provided at the other parks.

Dissolved oxygen concentration averages in the Huron River ranged from 9.5 mg/l at MP 62.6, the most upstream station (above Dexter) to 12.9 mg/l at MP 1.7, the most downstream station (below South Rockwood). Low DO values of 5.0, 4.7, 5.0, 4.3, and 5.5 mg/l were recorded 4.5 miles downstream from Dexter, 2.5 and 3.5 miles below Ann Arbor sewage treatment plant, 4.5 miles below Ypsilanti sewage treatment plant, and 2 miles below the confluence of Willow Run Creek which receives the effluent from Ypsilanti Township sewage treatment plant.

BOD_5 concentrations averaged 2 to 11 mg/l from above Dexter to below South Rockwood, with a maximum BOD_5 value of 52 mg/l below Peninsular Paper Company. A maximum BOD_5 value of 135 mg/l was recorded below Ypsilanti Township sewage treatment plant on Willow Run Creek.

Total phosphate, as phosphate, average values ranged from .10 to 3.12 mg/l from upstream to downstream terminal stations. The greatest concentrations of phosphate were found below the Ann Arbor and Ypsilanti sewage treatment plants. Total soluble phosphates followed the pattern of total phosphate with average concentration values of .06 to .21 mg/l above Ann Arbor, and .83 and 2.51 mg/l below Ann Arbor to South Rockwood. The maximum phosphate concentration in the Huron River was recorded below Willow Run Creek (Ypsilanti Township sewage treatment plant effluent) with a value of 52 mg/l total phosphate, and 41 mg/l soluble phosphate.

Nitrate concentration averages ranged from .2 to .8 mg/l on the river. Nitrate concentrations were greatest below Ann Arbor.

Nitrite Concentrations in the river above Ann Arbor averaged .01 mg/l, while below Ann Arbor concentrations increased to .07 mg/l. Ammonia nitrogen average values above Ann Arbor ranged from .22 to .34 mg/l, and below Ann Arbor at a station 2.5 miles downstream - 1.68 mg/l.

Organic nitrogen values ranged from .11 to .19 mg/l over all sampling points. The only noticeable concentration increases were found below Willow Run Creek.

Concentrations of solid materials carried by the river were generally high. Total solids averages increased steadily from above Dexter, downstream to Rockwood, 348 to 452 mg/l, then increased sharply to 536 mg/l below South Rockwood. Suspended solids averages in the Huron River ranged from 12

to 36 mg/l, with the greatest concentrations being found below Flat Rock and Rockwood sewage treatment plants. These average concentrations were 36 and 35 mg/l, respectively. Maximum suspended solids concentrations of 196 and 181 mg/l were found below Willow Run Creek.

Chloride average concentrations increased from 23 to 45 mg/l in the Huron River from Dexter to the mouth. A maximum chloride value of 86 mg/l was recorded just below the Ann Arbor sewage treatment plant.

Median total coliform densities for the survey period exceeded 2,400 organisms/100 ml at five stations on the main stem of the Huron River and at the two tributary stations. Two were downstream of the Ann Arbor sewage treatment plant, one below the Flat Rock sewage treatment plant, and one below the Rockwood sewage treatment plant. The tributary stations were on Willow Run Creek below the Ypsilanti Township sewage treatment plant, and on Mill Creek near Dexter.

The following table is based on the formerly required disinfection season (May 15-September 15) and indicates seasonal differences at the above mentioned stations.

Seasonal Medians - Total Coliform
(organisms/100 ml)

Station (miles downstream)	Predisinfection	Disinfection	Post-Disinfection	Survey
Ann Arbor (0)	6,000	600	3,300	2,650
Ann Arbor (2.5)	620,000	3,300	54,000	41,000
Ann Arbor (3.5)	460,000	2,000	40,000	38,000
Flat Rock (3.5)	35,000	3,700	38,000	19,000
Rockwood (2)	54,000	2,500	46,000	36,000
Willow Run Creek	360,000	38,000	1,300,000	280,000
Mill Creek	7,300	530	8,900	5,150

These seasonal differences in coliform density will be affected by the State requirement for continuous year-round disinfection as of January 1967.

A salmonella survey was conducted at two sampling sites on the Huron River during 1966. The Flat Rock sewage treatment plant outfall was sampled about five feet downstream of the submerged waste outlet via a modified Moore gauze pad technique. Two salmonella serotypes were isolated: S. minnesota and S. heidelberg.

A gauze pad was planted similarly in the Rockwood sewage treatment plant outfall, and one salmonella serotype was isolated - S. minnesota. These samples were taken in February 1966 prior to the chlorination season. Health hazards are indicated in this section of the Huron River.

Previous studies in the Ann Arbor area have indicated the bacteriological degradation possible from stormwater overflows of even separate sewer systems. An analysis of the survey data collected for this report was made, and correlation between rainfall immediately prior to sampling and increased coliform densities was established. In view of the use of surface waters for recreation, it is desirable to maintain suitable bacteriological quality in the waters at all times by treatment of stormwater overflows.

Studies (by others) have shown a diurnal fluctuation and also a stratification in the deeper impoundments. Levels of dissolved oxygen were extremely low in the waters below the thermocline.

Fluctuations of both carbonaceous and nitrogenous oxygen demand were noted on certain main stem stations below major sources of pollution. In particular, the organic loading of Willow Run Creek was extremely high. A significant increase in nitriet-nitrogen concentration occurred at two points

below the Ann Arbor sewage treatment plant during the summer months. Ammonia nitrogen concentration also increased substantially below Ann Arbor. At one station below Peninsular Paper Company, the BOD_5, COD, and suspended solids varied erratically. The ratio of the maximum value to the average value was greater than at any other station. No corresponding pattern was found at the station above the Peninsular Paper Company. The occurrence of these peaks was not observed at the next downstream station.

Nutrient concentrations at all stations were sufficient for the formation of nuisance algal blooms. Phosphate levels increased eightfold below the Ann Arbor sewage treatment plant. A gradual reduction in level occurred to a relatively constant 1 mg/l average for the remainder of the stream. Nitrate levels did change, although not as dramatically, in the Ann Arbor area. Seasonal fluctuation was evident throughout, with a much higher concentration of nitrate observed in the cooler months.

A number of industries discharge cooling water to the surface waters of the basin. A significant factor in the heat balance in the river is the number of impoundments which present a large surface area to solar radiation. Studies have shown that thermal stratification exists in the deeper parts of the impoundments. Destratification of the impoundment or withdrawal of flow from the cooler layers of water would maintain a lower river temperature.

Suspended materials of an inorganic nature also affect the water quality, but in secondary effects. Silt and sand, when settled, destroys the bottom habitat. The food chain and life cycle of organisms dependent on the bottom habitat is broken. Suspended materials, particularly in the impoundments, will settle out, decreasing the volume of the reservoir.

Esthetic values of the stream are also lessened by the presence of turbidity.

A significant factor affecting the water quality of the main stem of the Huron River is the series of impoundments in the Ann Arbor-Ypsilanti area, and also in the Flat Rock-Rockwood area. These impoundments act in effect as a settling pond or final oxidation pond, especially during the periods of summer drought flow when the water flows very slowly through the backwaters.

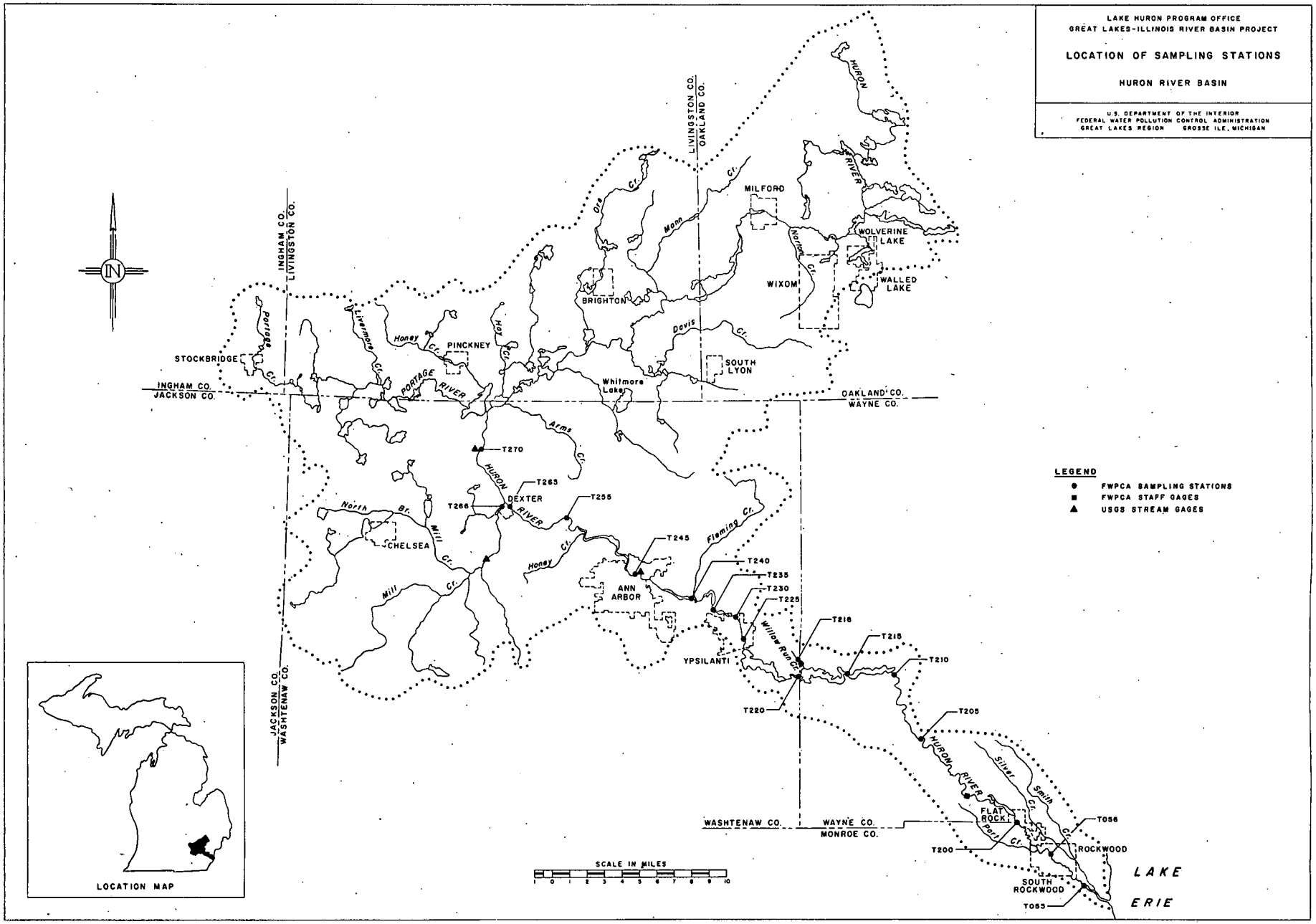

LAKE HURON PROGRAM OFFICE
GREAT LAKES-ILLINOIS RIVER BASIN PROJECT
LOCATION OF SAMPLING STATIONS
HURON RIVER BASIN
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
GREAT LAKES REGION GROSSE ILE, MICHIGAN
LEGEND
FWPCA SAMPLING STATIONS
FWPCA STAFF GAGES
USGS STREAM GAGES
LOCATION MAP
SCALE IN MILES
INGHAM CO.
LIVINGSTON CO.
OAKLAND CO.
WAYNE CO.
JACKSON CO.
WASHTENAW CO.
MONROE CO.
STOCKBRIDGE
PINCKNEY
BRIGHTON
MILFORD
WIXOM
WOLVERINE LAKE
WALLED LAKE
SOUTH LYON
CHELSEA
DEXTER
ANN ARBOR
YPSILANTI
FLAT ROCK
ROCKWOOD
SOUTH ROCKWOOD
LAKE ERIE
HURON RIVER
PORTAGE RIVER
Whitmore Lake
Honey Cr.
Mill Cr.
Fleming Cr.
Willow Run Cr.
Silver Smith Cr.
Davis Cr.
Mann Cr.
Norvell Cr.
Arms Cr.
North Br.
T270
T263
T266
T255
T245
T240
T235
T230
T225
T220
T218
T215
T210
T205
T200
T056
T055

FIGURE 27