ANNUAL REPORT 1964

PORT ARTHUR

water pollution control plant

DIVISION OF PLANT OPERATIONS
Ontario Water Resources Commission

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Port Arthur Local Advisory Committee,
City of Port Arthur.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Port Arthur Water Pollution Control Plant, OWRC Project No. 58-S-13.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D. S. Caverly, P. Eng.,
General Manager

General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Port Arthur Water Pollution Control Plant, OWRC Project No. 58-S-13 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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PORT ARTHUR
water pollution control plant

operated for

THE CITY OF PORT ARTHUR

by the

ONTARIO WATER RESOURCES COMMISSION

CHAIRMAN: Dr. James A. Vance

VICE-CHAIRMAN: J. H. H. Root, M.P.P.

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W. S. MacDonnell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: D. A. McTavish
Operations Engineer: M. B. Fielding

801 Bay Street **Toronto 5**

'64 REVIEW

The flow of sewage to the Port Arthur Water Pollution Control Plant averaged 4.4 mgd (million gallons per day) in 1964 as compared to 3.0 mgd in 1963. The flow exceeded the design capacity of 4.0 mgd 67% of the time.

The strength of the influent sewage during 1964 was consistent with that of domestic sewage having an average BOD of 147 ppm and an average suspended solids content of 198 ppm. The plant efficiency as measured by removal of BOD and suspended solids exceeded design expectations achieving 47.5% removal of BOD and 56.0% removal of suspended solids.

The cost of operation during 1964 was $45,374.87 representing a per capita cost of $1.01 or a cost of $27.52 per million gallons of sewage treated. This compares favourably with the costs incurred at other such plants in the province.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1956 - 1964

INCEPTION

In 1956, the City Council of Port Arthur in conjunction with R. V. Anderson and Associates initiated plans for a new primary sewage disposal plant and extension to existing sewers.

APPROVAL

Ontario Municipal Board approval was received for the above project in April of 1958 and the final agreement between the City of Port Arthur and the OWRC was signed during the same month.

CONSTRUCTION

In May, 1958, a contract for the construction of storm relief and sanitary trunk sewers was awarded to Hacquoil's Construction. The cost of the 0.76 miles of storm relief sewers was estimated at $152,909.20 and the cost of the 2.22 miles of sanitary trunk sewers was estimated at $1,078,652.32 for a total of $1,265,057.17.

The Foundation Company was awarded the contract for the construction of the primary treatment plant in June, 1958, at an estimated cost of $699,544.00.

Construction, which was supervised by the Commission's Division of Construction, officially began in August, 1958. Construction was substantially completed, and the systems put into operation, early in 1960.

The plant was officially opened on June 15, 1961.

During 1962, construction work was carried out to increase the plant capacity from 2.0 MGD to 4.0 MGD and was completed during 1963. The new equipment and additions included an extension to the trunk interceptor sewer; two new settling tanks; a new 20,000 gpm storm pump, and a new 48 inch barminutor.

TOTAL COSTS

58-S-13 - $2,157,062

62-S-101 - $ 241,909

R. ROMANICK
CHIEF OPERATOR

Project Staff

S. Hrymnak	Operator
E. J. Hughes	Operator
R. W. Johnstone	Operator

COMMENTS

The plant was under a 16 hour daily supervision, 7 days a week by a staff consisting of a Chief Operator and three operators.

During 1964, R. Romanick was promoted to Chief Operator, a position left vacant because of illness. An operator was also hired to bring the staff up to the required number.

It was also necessary to hire part-time help during vacation periods and statutory holidays.

The duties of the plant staff are to maintain a high quality effluent. In order to do so, tests were carried out daily by the staff at the plant. Samples were also taken every two weeks and sent to the OWRC Laboratory for analysis. The operators were also responsible for maintaining all the equipment, grounds and buildings.

The operation of the project is under the supervision of engineers of the Division of Plant Operations. The project is visited periodically by the head office Operations Engineer.

Description of Project

GENERAL

At present, the plant is designed to give primary treatment with heated sludge digestion to 4,000,000 gallons of sewage per day. The plant is now capable of serving 40,000 persons and can be ultimately enlarged to a secondary treatment plant with a capacity of 16,000,000 gallons per day and serving 80,000 people.

The facilities presently include a combined lift station and control building, two grit channels, four primary sedimentation tanks, a heated sludge digester, four sludge drying beds, a chlorine contact chamber and one chlorine feeder.

CONTROL BUILDING

This building houses the raw sewage pumps, motors, storm pump, electrical controls, heat exchanger, sludge pumps, office, laboratory and limited storage space. There is also room for the installation of future equipment necessary for expansion.

LIFT STATION

The raw sewage enters the wet well through a 60" diameter gravity sewer at sub-basement level. It is coarse screened before passing through two barminutors which cut and shred any solid material in the sewage. Before the sewage enters the wet well, it passes through an influent manhole which houses a control gate and a by-pass line Due to the hydraulics of the sewer and wet well, this control gate has to be

kept partially closed to avoid flooding the wet well. It is also impossible to use the by-pass without flooding basements upstream in Port Arthur.
Sewage is lifted by two 5,000 gallons per minute pumps approximately 40' to the grit channels. Each pump is equipped with a 75 H. P. electric motor, and one is also equipped with a 90 H. P. diesel motor which acts as a standby power source in case of electrical power failures.

GRIT CHANNELS

Sand and grit is allowed to settle in two parallel grit channels, each 35' x 3' x 5' deep and having a detention time of 4.7 minutes at design flow. After leaving the grit channels, the sewage flows through the flow meter.

PRIMARY SEDIMENTATION

From the grit channels, the sewage flows into four rectangular primary settling tanks. These tanks each measure 100' x 18' x 8' deep and have travelling combination scum skimmers and sludge collectors. The retention time is 2.14 hours at design flow, however, their combined maximum hydraulic capacity is 8 MGD, but at a reduced efficiency.

The sludge and scum collected in the primary tanks flows by gravity to an 11' x 11' x 10' deep raw sludge hopper, from which it is pumped by a 150 GPM, raw sludge pump to the digester.

In the event of a failure of the regular sludge and recirculation pumps, a 150 GPM standby pump powered by a 6 H. P. motor is provided.

CHLORINATION

The primary tank effluent flows into the chlorine contact chamber where its bacterial content is reduced by the addition of chlorine. The chlorine contact chamber measures 45' x 20' x 10' deep and has a retention time of 20 minutes at design flow. The gas chlorinator has a capacity of 400 pounds per day.

The chlorine tank effluent is discharged to the McIntyre River through an effluent sewer equipped with a flap gate to prevent back-flow from the river.

DIGESTION

The sludge collected in the two primary tanks is pumped from the raw sludge hopper to the digester. The sludge is heated to an average temperature of 93° Fahrenheit and is broken down by bacterial action into:

1. A thick, black, odourless sludge.
2. A relatively clear supernatant liquor which is returned to the wet well.
3. A digester gas which is utilized to heat the digester.

Natural gas is used as a standby fuel. The digested sludge is drained out onto the sand drying beds periodically throughout the warm season. The sludge is allowed to dry on the beds into a manageable sludge cake, and is then disposed of as a soil conditioner. Facilities are also available for disposal of this digested sludge in liquid form by tank trucks.

The digester measures 50 feet in diameter by 20 feet side wall depth. It has a capacity of 50,000 cubic feet or 312,000 gallons. This capacity allows for 1.25 cubic feet per capita at design flow.

The four drying beds have a total area of 10,000 square feet which represents 0.25 square feet per capita per year at design flow.

PROJECT COSTS

LONG TERM DEBT:	58-S-13	$2,157,063.00
(Total Capital Cost)	62-S-101	241,909.00

The total cost to the municipality during 1964 was as follows:

Net Operating			$ 45,374.87
Debt Retirement -	S-13	$43,533.00	
	S-101	6,197.27	49,730.27
Reserve -	S-13	$14,960.00	
	S-101	4,997.00	19.957.00
Interest Charged -	S-13	$121,358.49	
	S-101	19,020.33	140,378.82
TOTAL			$ 255,440.96

RESERVE ACCOUNT

Balance at Jan. 1, 1964	S-13	$63,870.10	
	S-101	1,666.00	$ 65,536.10
Deposited by municipality			19,957.00
Interest Earned	S-13	$ 3,839.99	
	S-101	195,71	4,035.76
			$ 89,528.86
Less Expenditures	S-13	$ 566.17	
	S-101	-	566.17
Balance at Dec. 31, 1964			$ 88,962.69

DEBT OUTSTANDING:	58-S-13	$1,908,602.00

MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	*SUNDRY	WATER
JAN	2798.33	1330.16	247.36		416.75		122.65	52.87	225.00		403.54
FEB	3240.72	1330.16	244.02	53.32	412.21		57.40	1.62		1141.99	
MARCH	3231.35	1683.86	80.40	113.02	548.99		134.46		521.54	149.08	
APRIL	2680.74	1452.14	200.76	60.00	298.39		54.64	98.07	176.46	83.51	256.77
MAY	4560.69	2186.25	372.29	45.28	495.43	1233.60	97.73	1.79	55.22	73.10	
JUNE	3862.97	1571.43	452.63	36.00	494.87	1148.05	90.94		43.81	25.24	
JULY	3824.41	359.75	701.06	158.38	478.31	371.10	143.80	49.00	223.04	786.63	553.34
AUG	4961.51	1153.10	521.40	36.00	440.33	448.05	71.65		510.43	1780.55	
SEPT	4937.34	689.29	548.08	36.00	417.69	448.05	141.71	66.76	179.93	2409.83	
OCT	5258.46	1121.89	534.78	192.16	429.81	483.05	129.50		209.56	1893.81	263.90
NOV	2878.35	1072.98	521.40	162.57	449.14	448.05	60.12	33.50	102.93	27.66	
DEC	3140.00	1609.47	598.84	324.21	407.64	(1260.00)	115.60	65.75	278.88	195.88	804.33
TOTAL	45,374.87	15,560.48	5,023.02	1216.94	5289.56	3319.95	1220.20	369.36	2526.80	8566.80	2281.88

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE $5836.60
BRACKETS INDICATE CREDIT

YEARLY COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	840.41	29,861.94	* 2.77	35.52	3 CENTS
1962	885.49	31,781.54	2.85	35.89	4 CENTS
1963	1063.67	32,700.58	2.89	34.74	3 CENTS
1964	1648.94	45,374.87	3.94	27.52	4 CENTS

* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

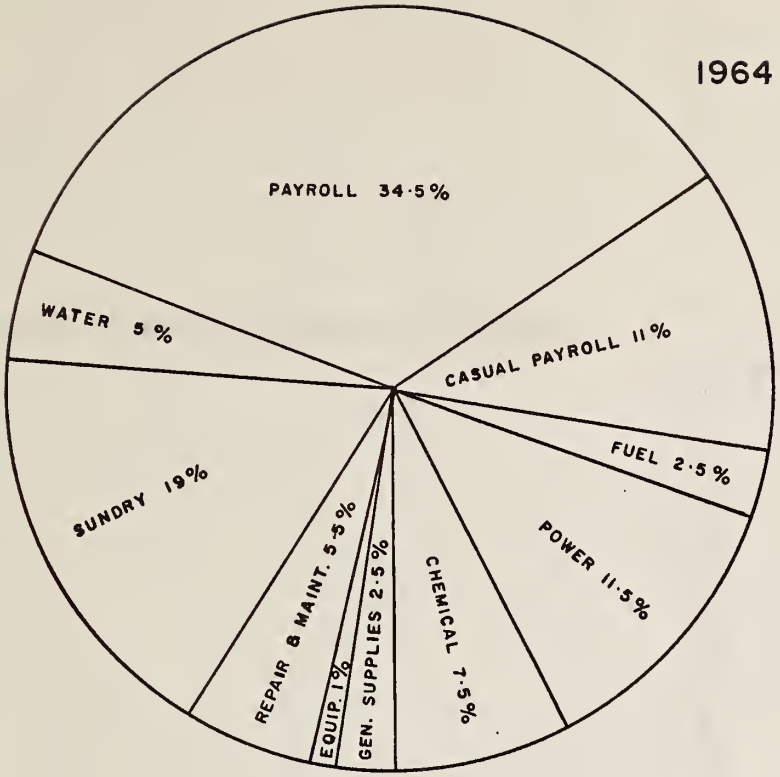
SUMMARY OF OPERATING EXPENSES

ITEM	COSTS 1960	COSTS 1961	COSTS 1962	COSTS 1963	COSTS 1964	BUDGET 1965
Payroll	$12,330.24	$13,868.30	$16,580.38	$17,537.98	$15,560.48	$19,900
Casual Payroll	4,311.52	2,189.03	1,091.42	2,168.62	5,023.02	1,000
Superannuation	*	*	*	*	*	*
Fuel	1,524.00	677.17	914.32	593.17	1,216.94	800
Power	5,117.44	3,942.55	3,854.41	4,481.84	5,289.56	6,000
Water	-	498.69	598.05	859.59	2,281.88	1,500
Chemicals	2,730.43	973.03	1,344.18	2,261.05	3,319.95	4,500
General Supplies	2,760.70	1,167.54	1,729.72	1,297.08	1,220.20	1,200
Equipment	1,930.64	5,129.24	3,888.70	182.83	369.36	500
Maint. & Repairs	114.64	205.45	519.45	1,241.29	2,526.80	1,000
Sludge Haulage	-	-	-	-	5,836.60	2,500
Sundry	2,546.60	1,210.92	1,260.91	677.45	1,452.28	2,000
Ins. & Taxes	-	-	-	707.28	917.08	1,000
Travel	-	-	-	692.40	360.72	400
Contingency	-	-	-	-	-	2,700
TOTAL	33,366.21	29,861.94	31,781.54	32,700.58	45,374.87	45,000

* Included in Payroll

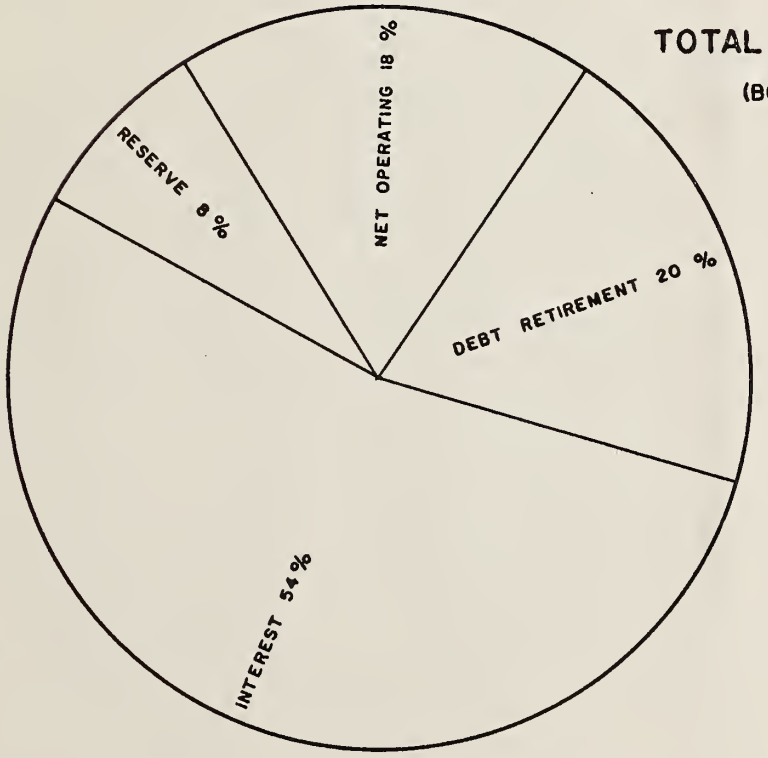
Note - The plant was expanded in 1963, thus increasing the cost of operation in 1964 and 1965.

1964 OPERATING COSTS

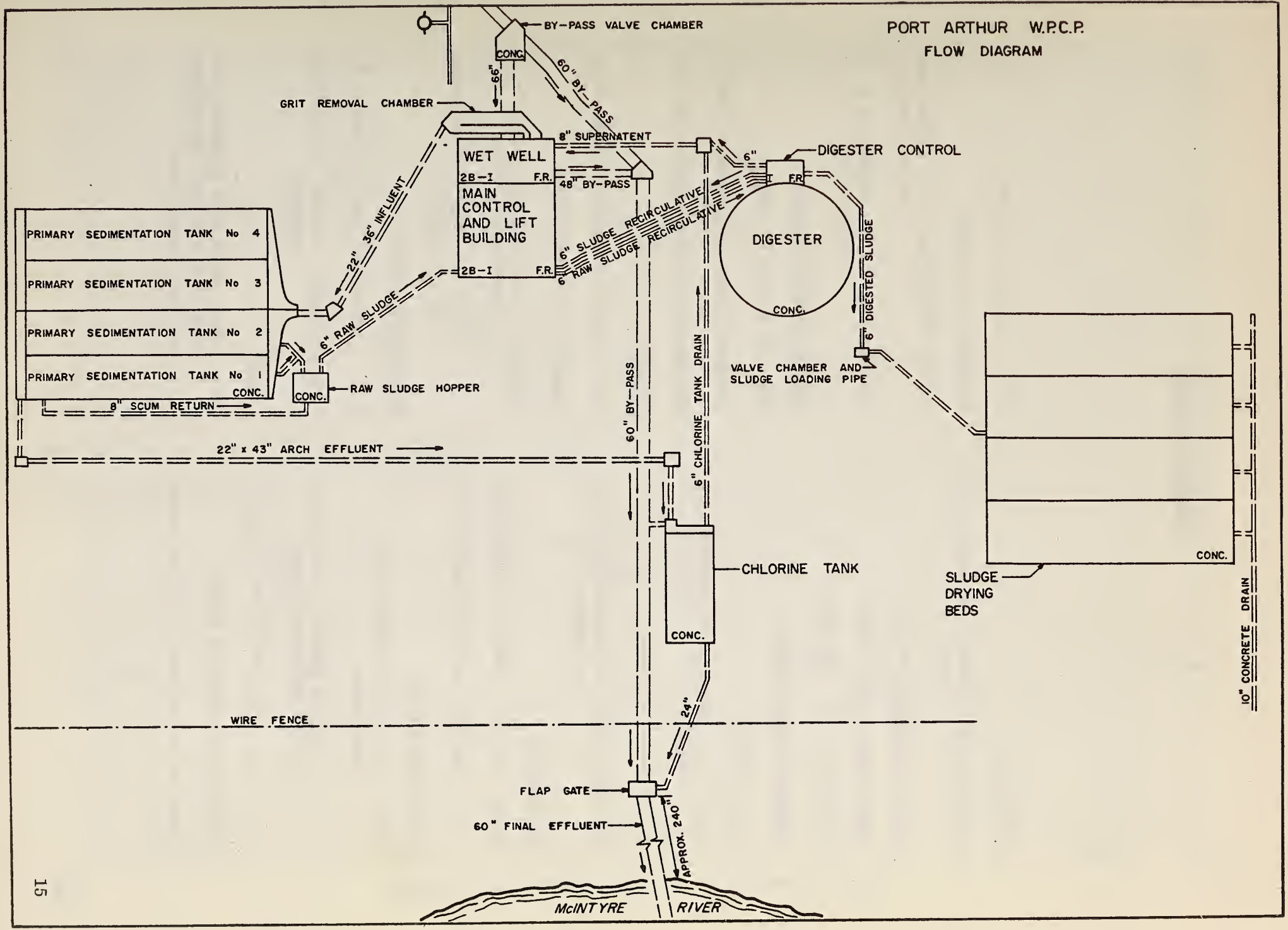


TOTAL ANNUAL COST

(BOTH PROJECTS)



Technical Section


PORT ARTHUR W.P.C.P.
FLOW DIAGRAM
BY-PASS VALVE CHAMBER
CONC.
66"
60" BY-PASS
GRIT REMOVAL CHAMBER
8" SUPERNATENT
WET WELL
2B-I
F.R.
48" BY-PASS
MAIN CONTROL AND LIFT BUILDING
2B-I
F.R.
DIGESTER CONTROL
6"
I
F.R.
DIGESTER
CONC.
22" x 36" INFLUENT
6" SLUDGE RECIRCULATIVE
6" RAW SLUDGE RECIRCULATIVE
6" DIGESTED SLUDGE
PRIMARY SEDIMENTATION TANK No 4
PRIMARY SEDIMENTATION TANK No 3
PRIMARY SEDIMENTATION TANK No 2
PRIMARY SEDIMENTATION TANK No 1
CONC.
6" RAW SLUDGE
CONC.
RAW SLUDGE HOPPER
8" SCUM RETURN
VALVE CHAMBER AND SLUDGE LOADING PIPE
22" x 43" ARCH EFFLUENT
60" BY-PASS
6" CHLORINE TANK DRAIN
CHLORINE TANK
CONC.
SLUDGE DRYING BEDS
CONC.
10" CONCRETE DRAIN
WIRE FENCE
24"
FLAP GATE
60" FINAL EFFLUENT
APPROX. 240"
McINTYRE
RIVER

Design–Data

GENERAL

Type of Plant - Primary treatment with digester.

Design Population - 40,000.

Design Plant Flow - 4 MGD.

Per Capita Flow - 100 GPD.

PRIMARY TREATMENT

Grit Removal

Type - two rectangular parallel grit channels.

Size - 35' x 3' x 5' deep.

Detention Time - 4.7 minutes at 2 MGD per channel.

Barminutors

Sizes - one 35" model B Barminutor.

- one 48" model A1 Barminutor.

Sewage Lift Pumps

Sizes - one 35,000 USGPM driven by a diesel engine.

- two 4,000 USGPM - each driven by a 75 HP electric motor.

- one with a 90 HP diesel engine.

Primary Sedimentation Tanks

Type - 4 rectangular parallel units.

Size - 18' x 100' x 8' deep.

Retention - 2.14 hours.

Surface Settling Rate - 560 gallons per sq. ft. per day.

Overflow Rate - 6,000 gallons per ft. of weir per day.

Chlorine Contact Chamber

Size - 45' x 20' x 10' deep.

Retention Time - 20 minutes at 4 MGD.

Chlorinator Capacity - 400 lbs. per day.

Digester

Size - 50 ft. in diameter by 20 ft. deep.

Capacity - 312,000 gallons.

Loading - 1.25 cubic ft. per capita (population 40,000).

- 2.0 lbs. of solids per cubic ft. per month.

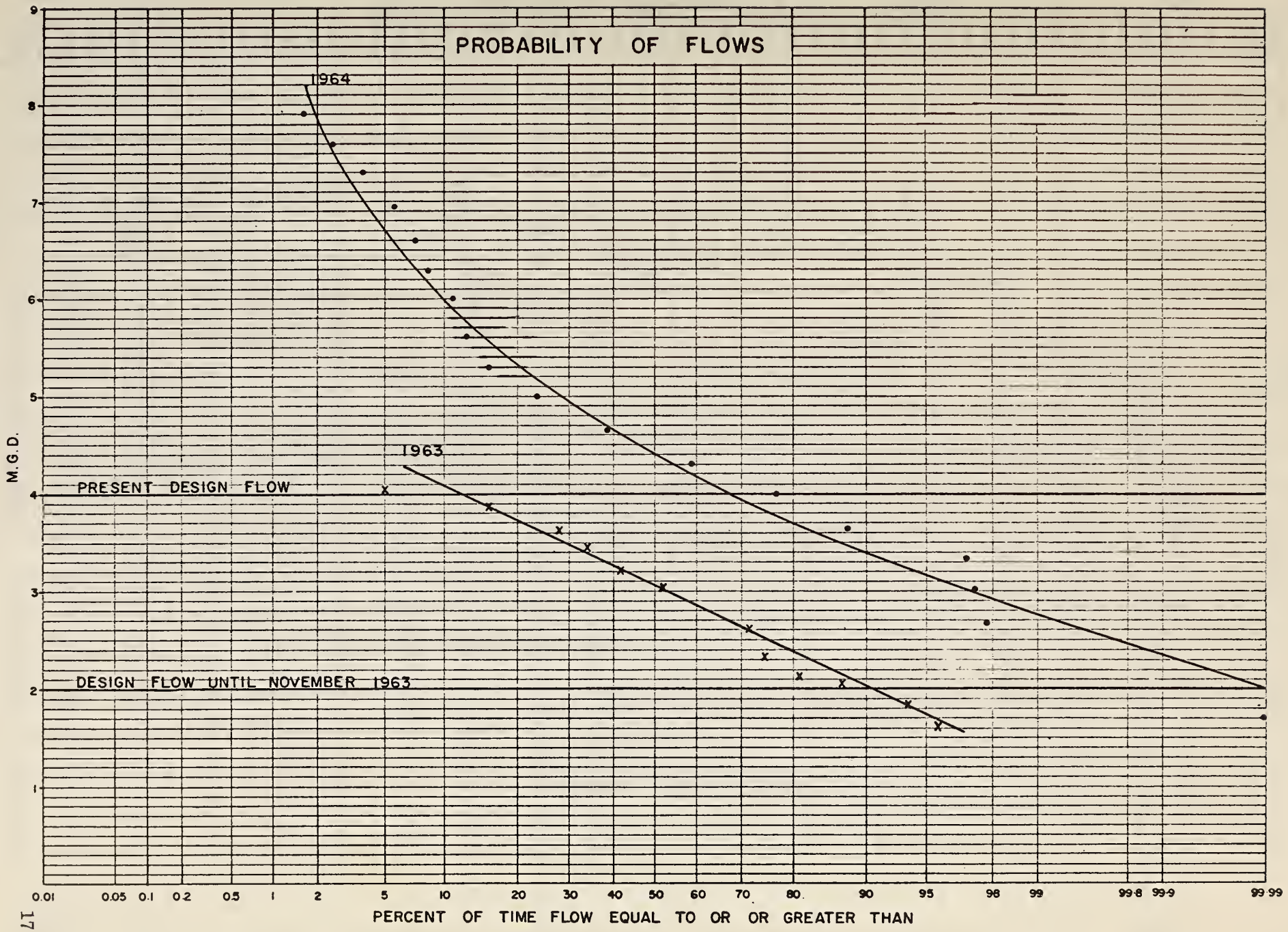
Sludge Drying Beds

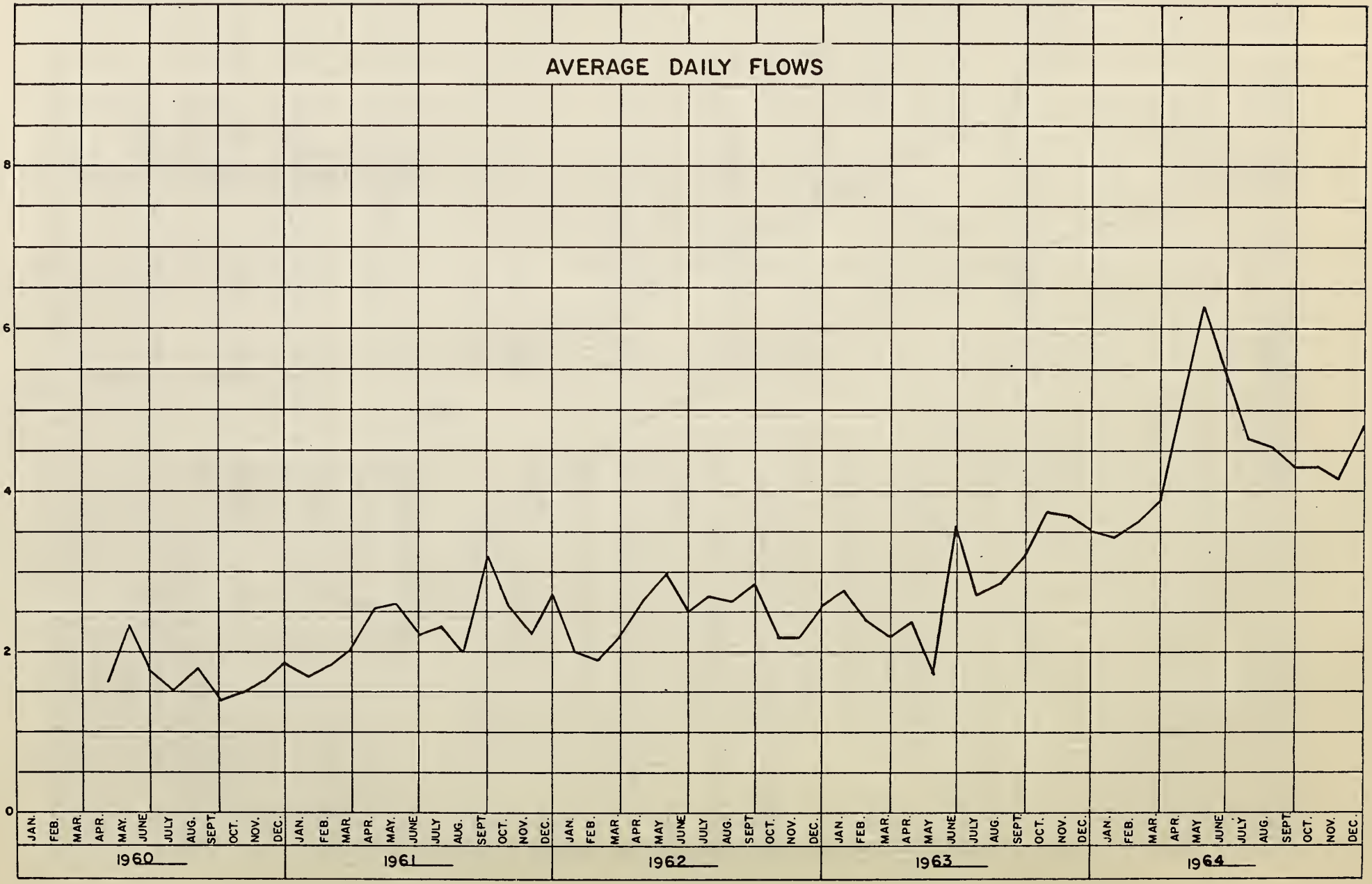
Size - 4 for a total area of 10,000 sq. ft.

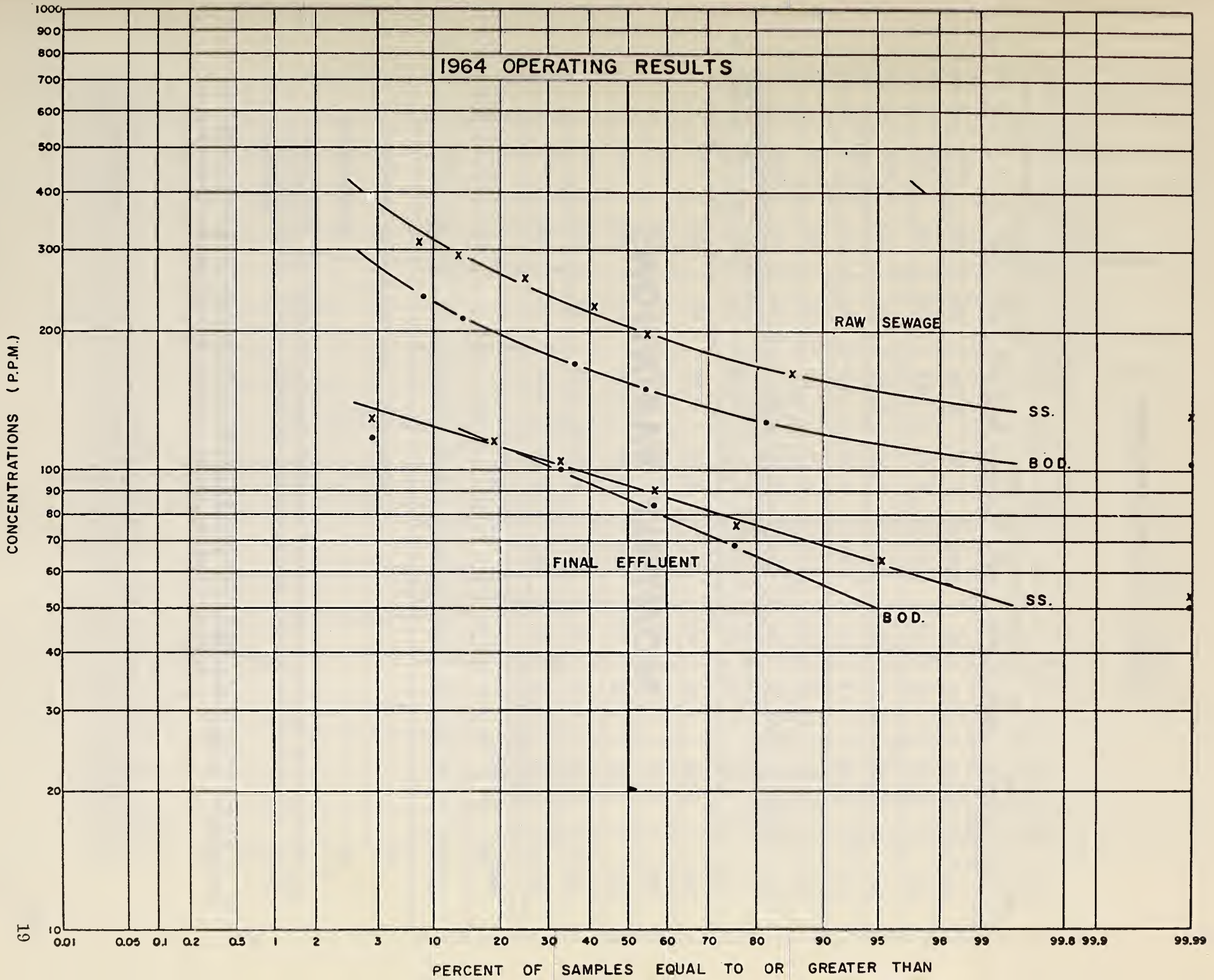
Area per capita - 225 sq. ft. @ 40,000 persons.

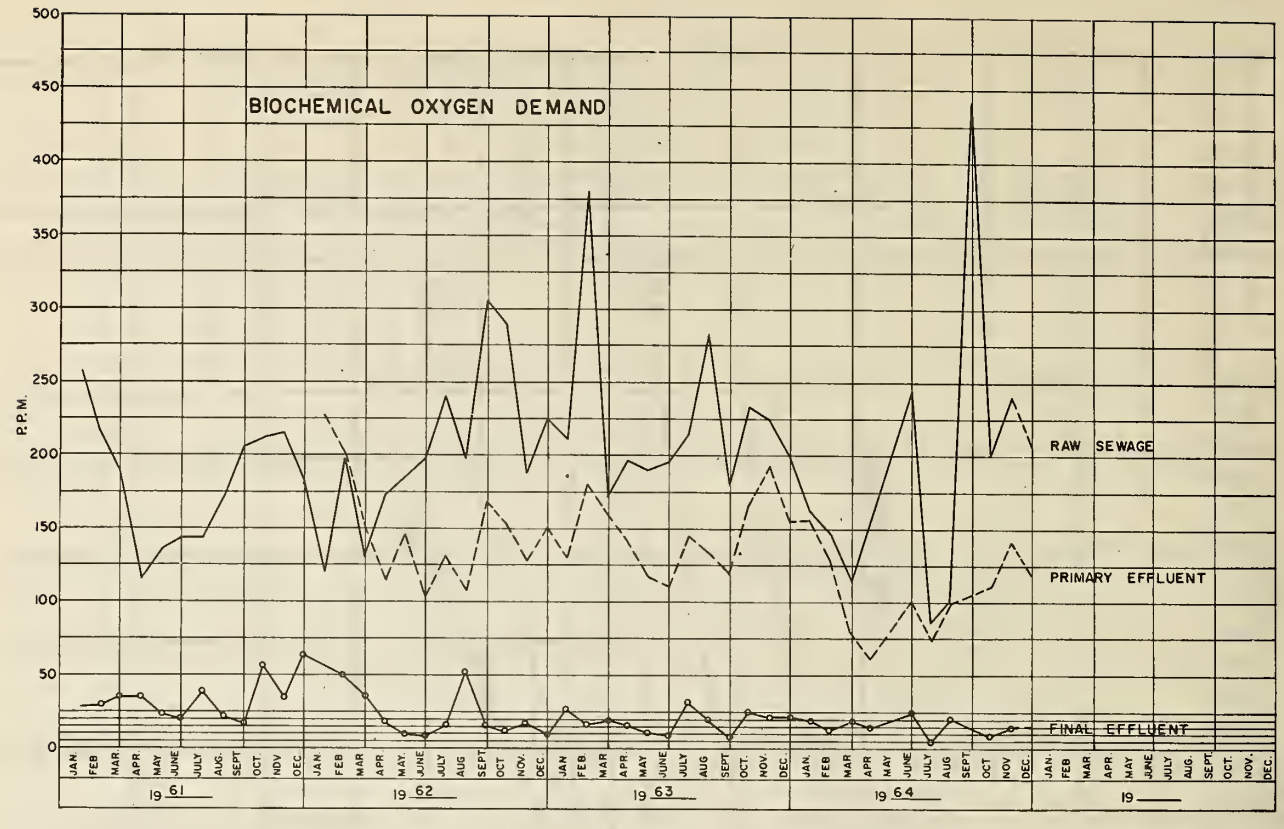
Outfall

Size - 240 ft. of 60 inch diameter corrugated metal pipe discharging into the McIntyre River.

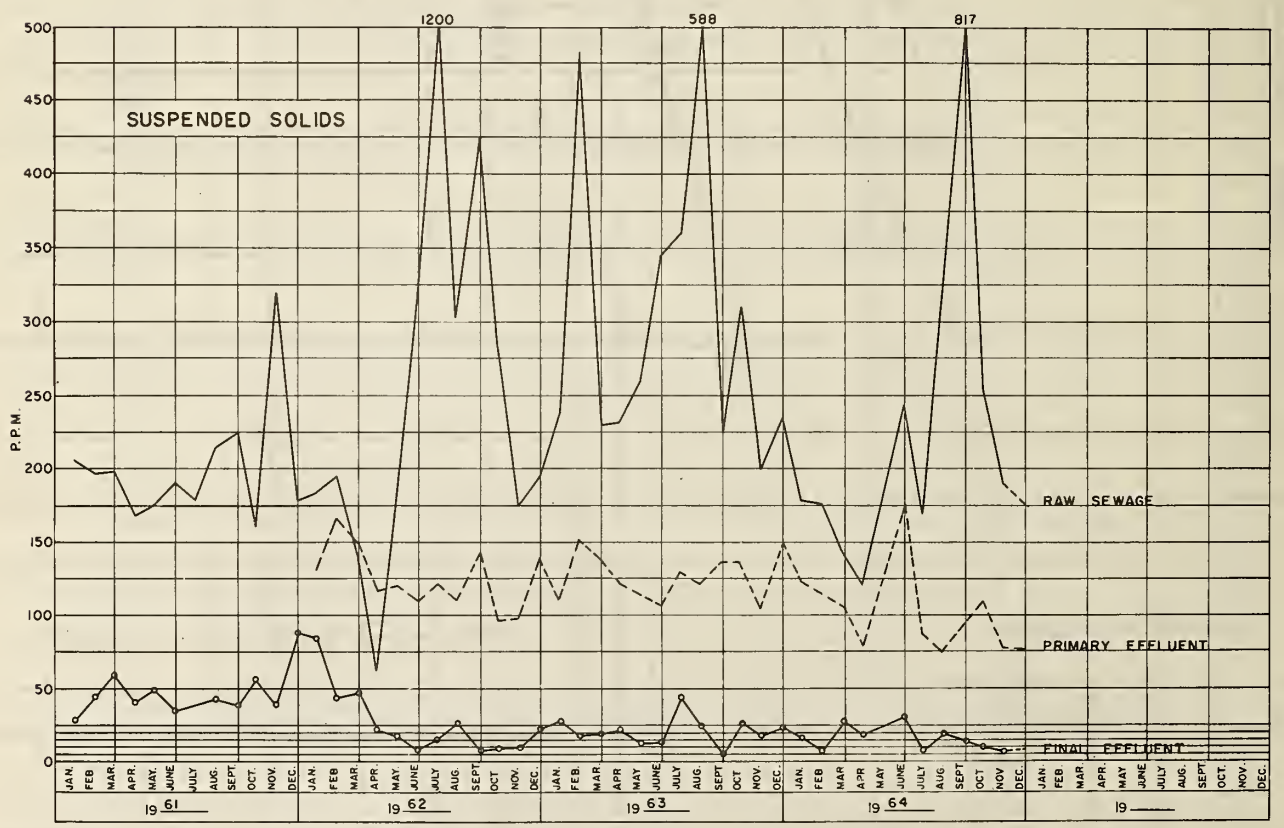

PROBABILITY OF FLOWS
1964
1963
PRESENT DESIGN FLOW
DESIGN FLOW UNTIL NOVEMBER 1963
M.G.D.
9
8
7
6
5
4
3
2
1
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PERCENT OF TIME FLOW EQUAL TO OR OR GREATER THAN


AVERAGE DAILY FLOWS
M.G.D.
0
2
4
6
8
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
1960
1961
1962
1963
1964


1964 OPERATING RESULTS
CONCENTRATIONS (P.P.M.)
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
RAW SEWAGE
SS.
BOD.
FINAL EFFLUENT
SS.
BOD.
0.01
0.05
0.1
0.2
0.5
1
2
3
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PERCENT OF SAMPLES EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

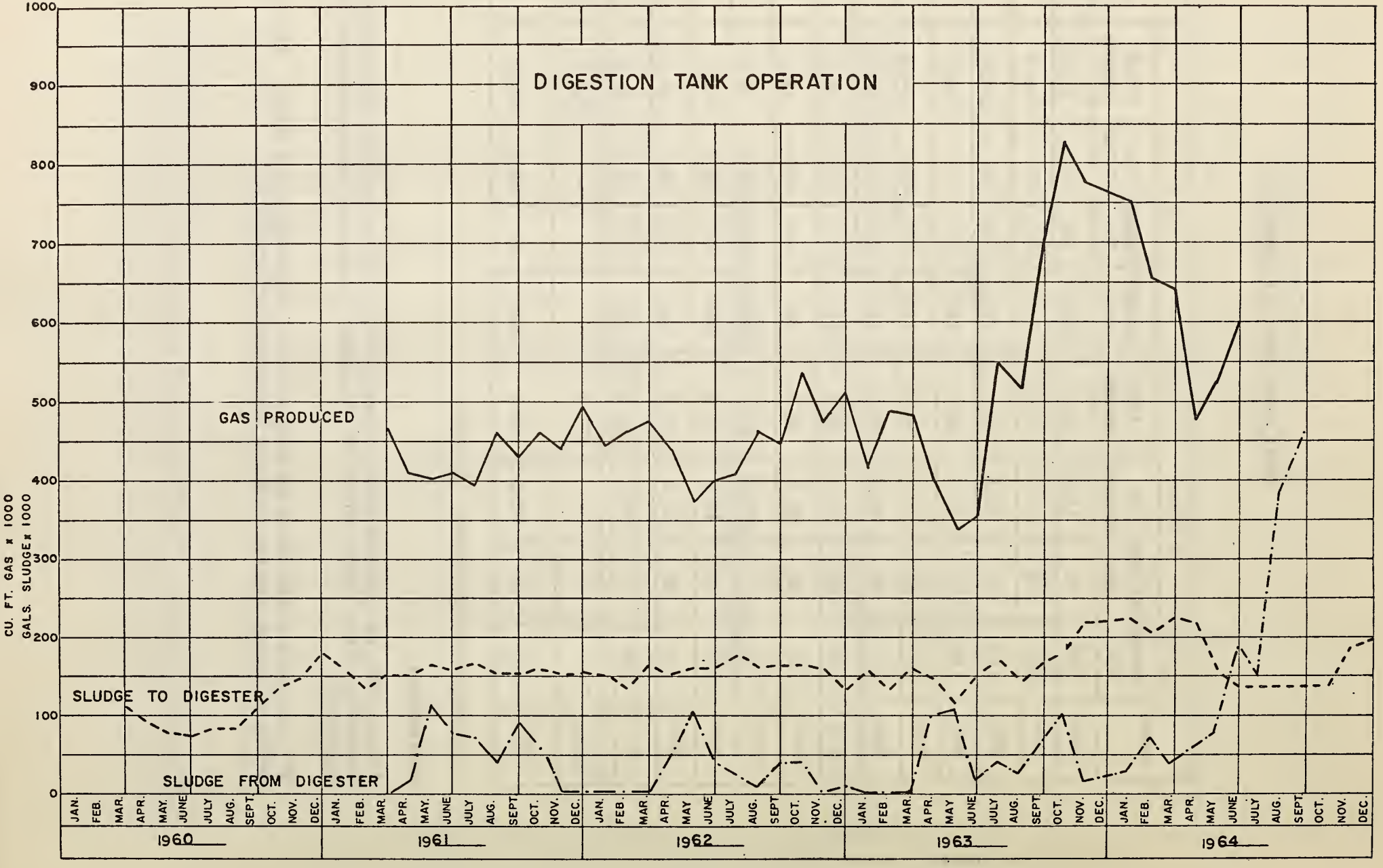
MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	158	83	47.5	39.7	222	66	70	82.5	254
FEB.	208	108	48	52.2	247	101	59	76.2	194
MAR.	188	95	49.5	56.1	298	97	67.5	121.2	194
APR.	170	80	53	69.9	253	99	61	119.6	275
MAY	120	47	61	71.3	172	108	37	62.5	250
JUNE	127	69	45.5	47.7	147	93	36.5	73.2	410
JULY	95	46	51.5	35.3	144	51	64.5	67.0	148
AUG.	142	86	39.5	38.3	195	104	46.5	62.2	291
SEPT.	*147	77	47.5	45.2	198	87	56.0	71.6	285
OCT.	138	76	45.0	41.3	165	100	39.5	43.3	163
NOV.	150	80	46.5	43.6	138	58	58.0	49.8	161
DEC.	119	74	38.0	30.5	196	76	61.0	81.3	189
TOTAL	–	–	–	577.1	–	–	–	915.2	2814
AVG.	147	77	47.5	48.1	198	87	56.0	76.3	234

* average value substituted. No sample.

COMMENTS

During 1964, the incoming sewage contained an average of 147 ppm BOD and 198 ppm suspended solids. These values are consistent with average domestic sewage characteristics.

The plant removed 47.5% of the BOD and 56.0% of the suspended solids. These percentages indicate that the plant was being operated efficiently.


DIGESTION TANK OPERATION
GAS PRODUCED
SLUDGE TO DIGESTER
SLUDGE FROM DIGESTER
CU. FT. GAS x 1000
GALS. SLUDGE x 1000
1000
900
800
700
600
500
400
300
200
100
0
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
1960
1961
1962
1963
1964

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU. FT.	% SOLIDS	% VOL. MAT.	1000'S CU. FT.	% SOLIDS	% VOL. MAT	
JAN.	36.02	–	–	4.54	7.64	3.25	751.25
FEB.	33.46	4.11	2.94	11.28	–	–	653.31
MAR.	36.41	2.46	1.88	5.91	6.59	2.82	645.81
APR.	35.26	1.01	0.10	–	–	–	476.98
MAY	24.87	–	–	11.88	12.20	3.04	529.66
JUNE	23.18	4.02	2.12	27.70	39.60	33.04	600.15
JULY	* –	–	–	+ 16.90	–	–	–
AUG.	* –	–	–	+ 60.96	–	–	–
SEPT.	3.23	–	–	+ 72.47	–	–	–
OCT.	22.31	3.56	2.12	#–	–	–	–
NOV.	30.77	4.45	3.64	#–	–	–	–
DEC.	31.79	3.98	2.69	#–	–	–	–
TOTAL	277.30	–	–	211.64	–	–	(a) 3657.16
AVG.	30.81	3.37	2.21	26.46	16.51	10.54	609.53

* Digester down; tank truck haulage

(a) Six months' data only

\+ Digester was pumped clean to remove indigestible matter

\# No sludge was pumped from digester, as digester was being filled

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	105.81	-	-
FEBRUARY	104.32	-	-
MARCH	120.60	-	-
APRIL	155.34	-	-
MAY	195.40	3848	1.97
JUNE	164.59	3889	2.36
JULY	144.01	3941	2.74
AUGUST	136.66	3477	2.54
SEPTEMBER	128.99	3532	2.74
OCTOBER	133.27	3903	2.93
NOVEMBER	124.52	-	-
DECEMBER	135.43	-	-
TOTAL	1648.94	22590	-
AVERAGE	137.41	3765	2.50

COMMENTS

Chlorination, for purposes of effluent disinfection, is carried on from break-up to freeze-up in the receiving stream. Chlorine application is effected by automatic proportioning equipment supplied from 150 pound cylinders.


ONTARIO WATER RESOURCES COMMISSION