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PORT ARTHUR

SEWAGE TREATMENT PLANT

ANNUAL REPORT

1960

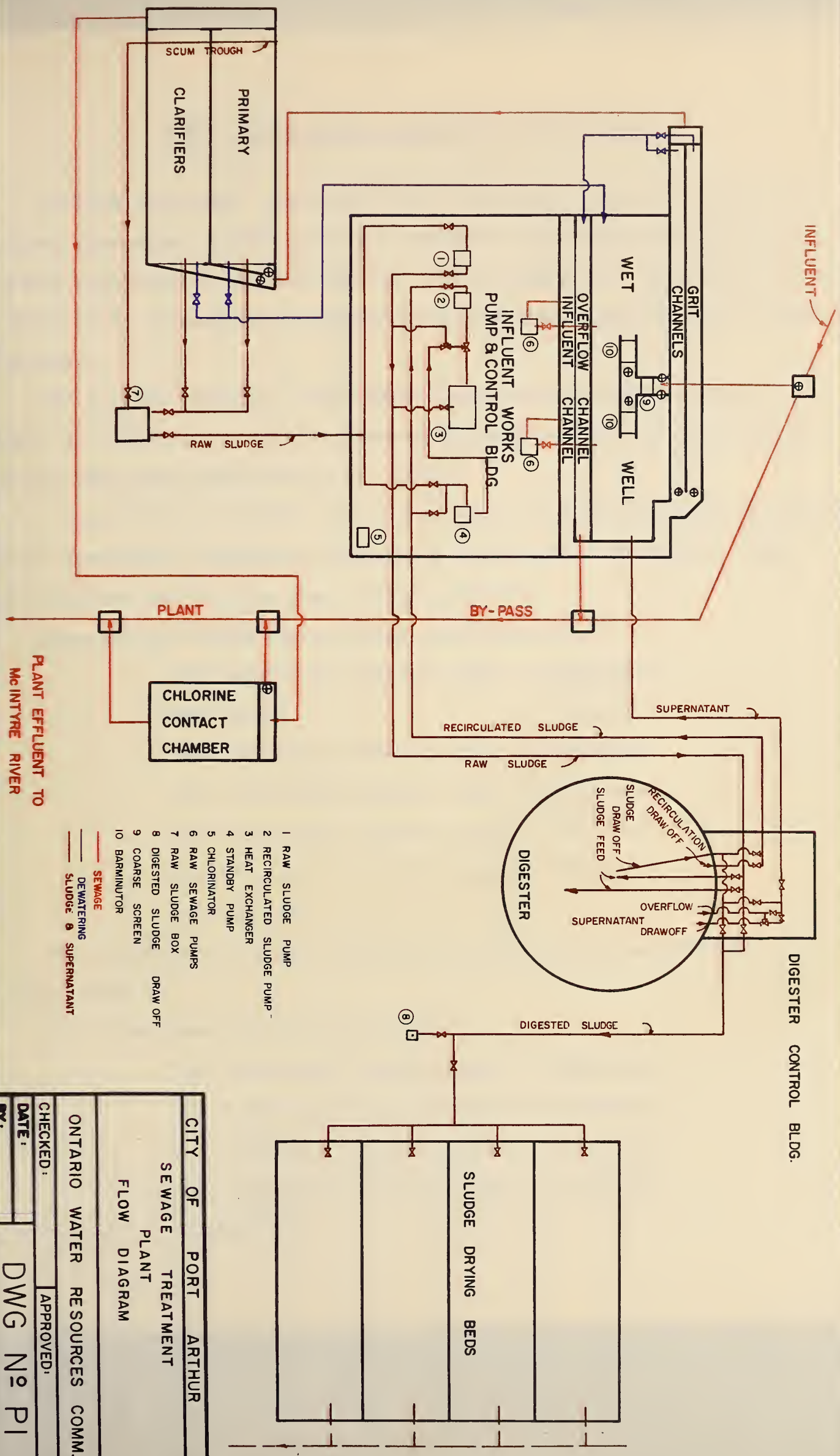
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Port Arthur : sewage treatment
plant.

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- 1 RAW SLUDGE PUMP
- 2 RECIRCULATED SLUDGE PUMP
- 3 HEAT EXCHANGER
- 4 STANDBY PUMP
- 5 CHLORINATOR
- 6 RAW SEWAGE PUMPS
- 7 RAW SLUDGE BOX
- 8 DIGESTED SLUDGE DRAW OFF
- 9 COARSE SCREEN
- 10 BARMINUTOR

— SEWAGE
 — DEWATERING
 — SLUDGE ⑨ SUPERNATANT

CITY OF PORT ARTHUR	
SEWAGE TREATMENT	
FLOW DIAGRAM	
ONTARIO WATER RESOURCES COMM.	
CHECKED:	APPROVED:
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PORT ARTHUR ANNUAL REPORT FOR THE YEAR 1961

In 1956 plans were initiated for a new sewage treatment plant and further extensions to the storm and sanitary trunk sewer systems to meet present requirements and provide for future expansion. These plans were drafted by R. V. Anderson & Associates consulting engineers for the municipality.

The Ontario Municipal Board gave final approval to the scheme on (April 17, 1958) and a final agreement between the City of Port Arthur and the OWRC was signed (April 30, 1958).

A construction contract for construction of sanitary trunk and storm relief sewers was awarded to Hacquoil's Construction on May 23, 1958. This contract was for the sum of \$1,265,057.17.

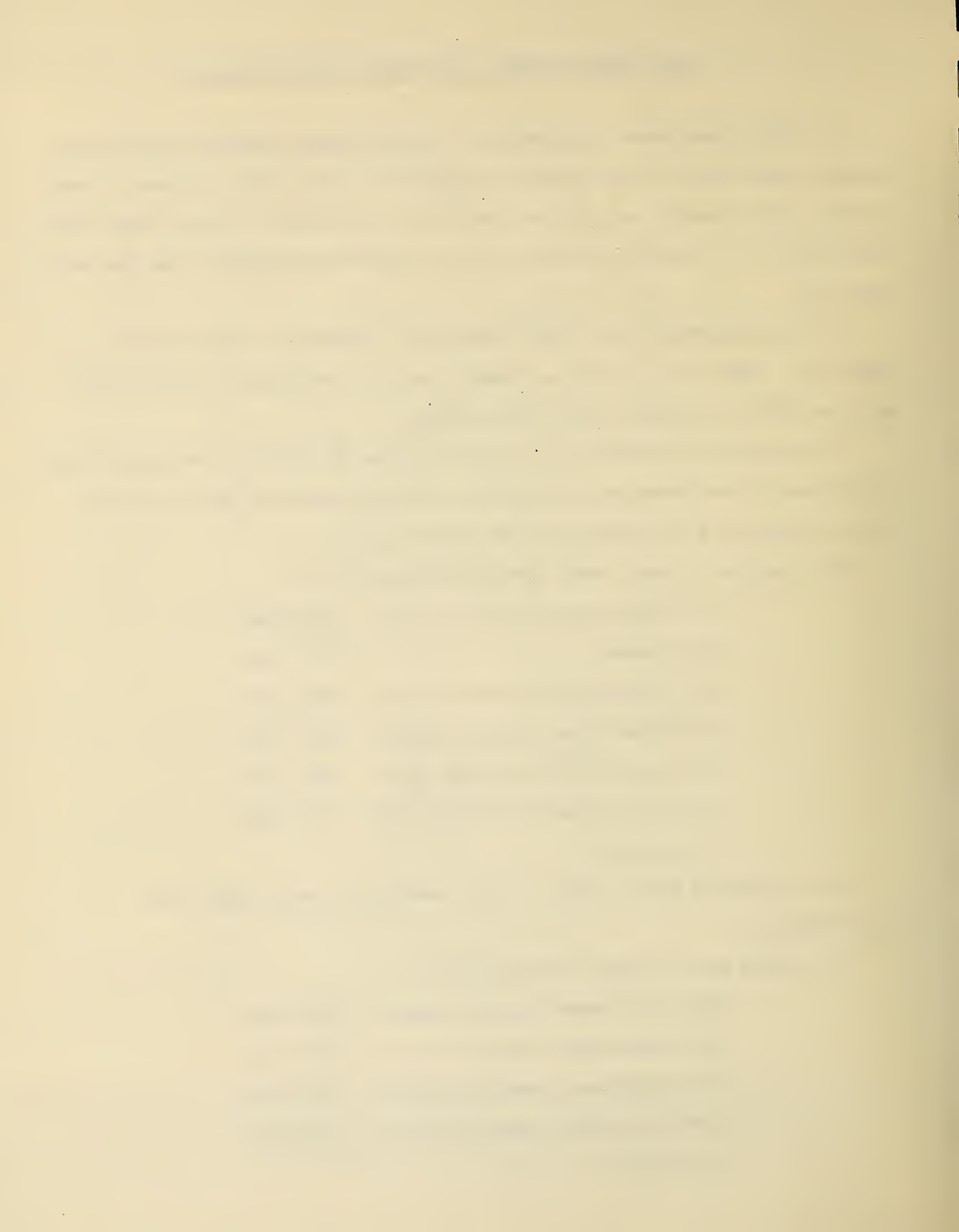
The sanitary trunk sewer system consisted of: -

60" reinforced concrete pipe - 4388 feet
60" tunnel - 152 feet
54" reinforced concrete pipe - 5403 feet
48" reinforced concrete pipe - 2588 feet
24" reinforced concrete pipe - 180 feet
18" reinforced concrete pipe - 119 feet
34 manholes

The estimated price for the above sanitary trunk sewers was \$1,078,652.32.

The storm sewer system consisted of:

36" reinforced concrete pipe - 1299 feet
30" reinforced concrete pipe - 1464 feet
21" reinforced concrete pipe - 788 feet
18" reinforced concrete pipe - 437 feet
21 manholes



The estimated price for the above storm relief sewers was \$152,909.20.

A contract for construction of a primary treatment plant and all appurtenances was awarded to Foundation Company on June 11, 1958.

This contract was broken down in the following form:


Piling	\$ 65,433.00
Lift station & control bldg.	269,760.00
Digester	91,322.00
Primary tank	44,072.00
Other structures	61,849.00
Yard piping	54,905.00
Trades	59,126.00
Site work	48,077.00
Contingencies	<u>5,000.00</u>

Sod turning ceremonies were performed by Mayor Eunice M. Wishart and OWRC Chairman A. M. Snider on August 18, 1958.

In 1958 and 1959 and 1960, under the direction of the OWRC and in co-operation with the city, these new facilities were constructed.

The plant was designed for primary treatment with heated sludge digestion. The initial capacity was 2,000,000 Imp. G.P.D. serving a population of 20,000 persons but can be ultimately enlarged to a secondary treatment plant for 80,000 persons with a capacity of 16 M.G.D.

The treatment plant consists of a combined lift station and control building, two grit channels, two primary sedimentation tanks, a digester, four sludge drying beds and a chlorine contact chamber. The control building houses the raw sewage pumps, motors, controls and electrical equipment necessary for the operation of the plant and also provides room for future



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additional equipment. It also contains the office and laboratory.

LIFT STATION

The raw sewage enters the plant through a 60" gravity flow sewer at sub-basement level. The sewage is coarse screened before passing through a 36" Barminutor which cuts and shreds the solid material in the sewage.

The sewage is then lifted by two 2,500 G.P.M. pumps to the grit removal tanks. Each raw sewage pump is equipped with a 75 H.P. electric motor and in the event of a power failure, a 90 H.P. diesel motor is provided as an alternative source of power.

GRIT CHANNELS

Removal of sand and grit is accomplished in two parallel chambers each 35' x 3' x 5' deep having a detention time of 3½ minutes.

PRIMARY SEDIMENTATION

From the grit removal facilities the sewage flows into two rectangular primary sedimentation tanks. These two tanks are each 100' x 18' x 8' with travelling scrapers. The retention time is 2.2 hr @ 2 M.G.D. but they have a maximum hydraulic capacity of 4 M.G.D. The function of these tanks is to separate the solids from the incoming sewage by allowing them to settle to the bottom of the tank, with the settled sewage passing over the effluent weirs.

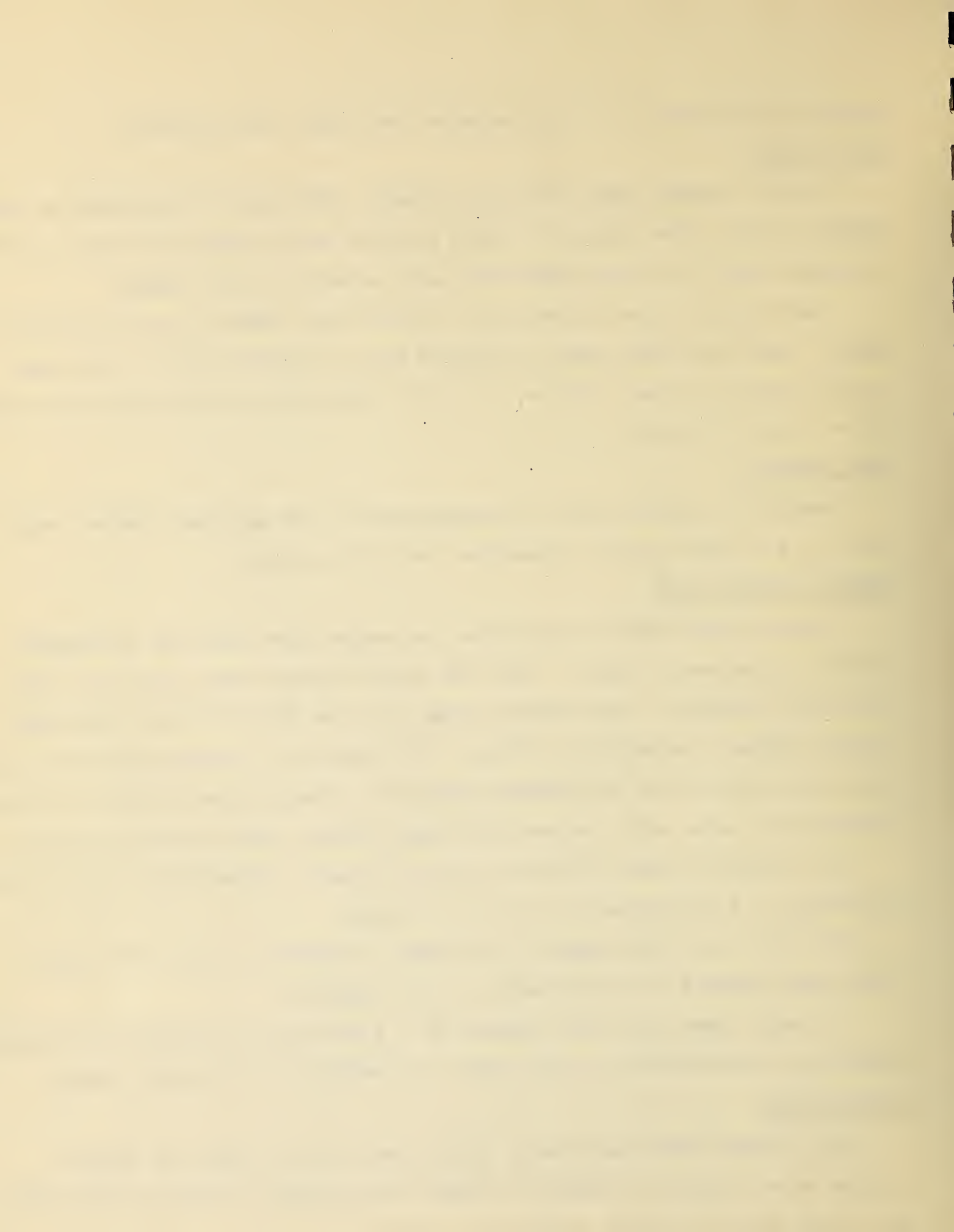
The sludge and scum collected from the primary sedimentation tanks flows by gravity to a raw hopper 11' x 11' x 10' deep.

From the raw sludge hopper, the sludge is pumped by a 150 G.P.M. raw sludge pump powered by a 10 HP motor to the digester.

A standby pump 150 G.P.M. powered by a 6 HP motor is provided for sludge pumping and recirculation in the event of a failure of the regular pumps.

CHLORINATION

The effluent from the primary tanks flows into the chlorine contact chamber where chlorine is added to reduce the bacterial content of the effluent. The chlorine contact chamber 45' x 20' x 10' has a retention time of



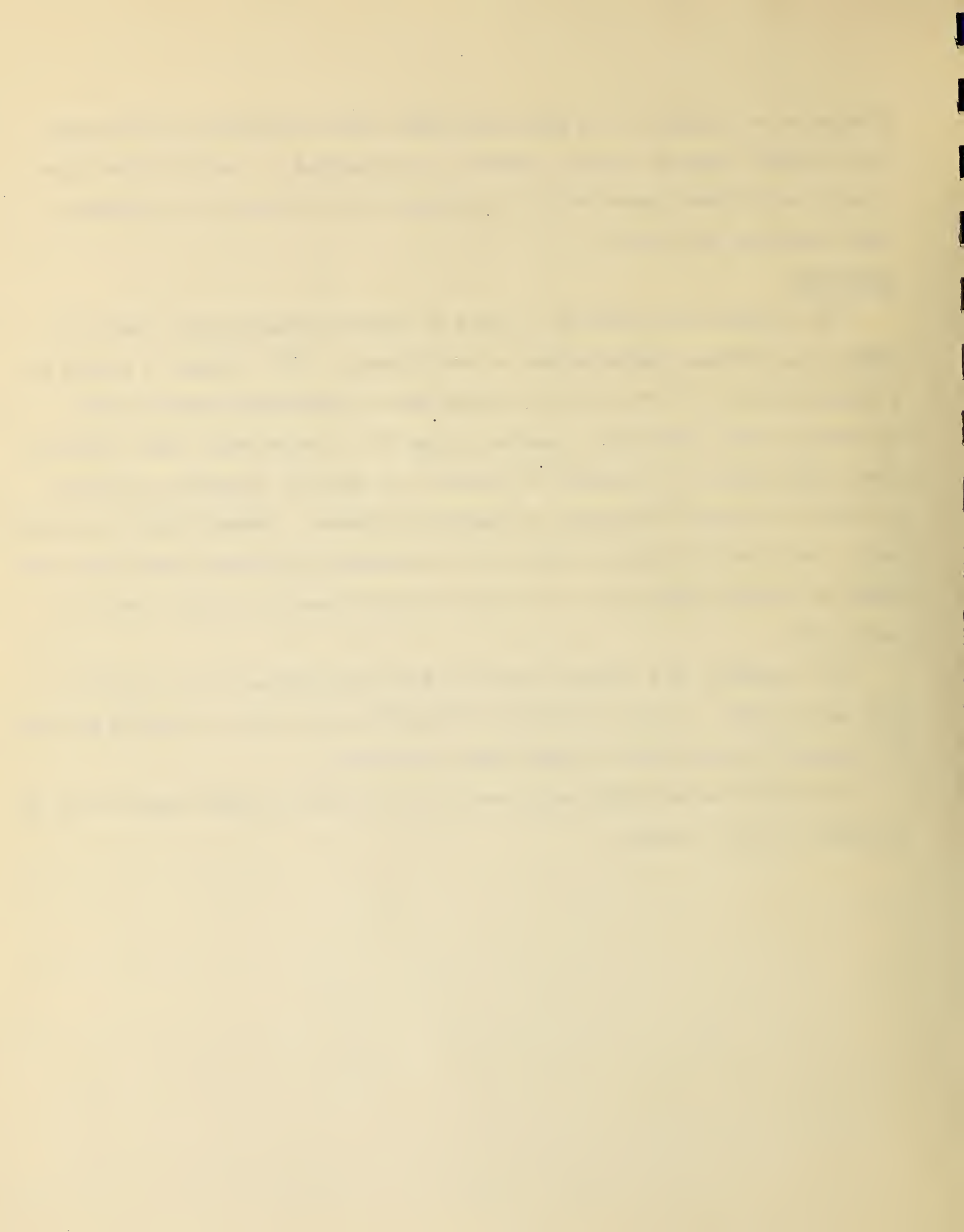
40 minutes at 2 M.G.D. The gas chlorinator has a capacity of 400 lb/day. The effluent from the contact chamber is discharged to the McIntyre River through an effluent sewer which is equipped with a flap gate to prevent back-flow from the river.

DIGESTION

The sludge which settles in the two primary sedimentation tanks is pumped via the raw sludge hopper to the digester. The sludge is heated to a temperature of 90° F and it is broken down by bacterial action into: (1) thick, black, odorless digested sludge (2) a relatively clear supernatant liquor which is returned to the wet well and (3) digester gas which is used in the heat exchanger to heat the digester. Standby fuel is natural gas. The digested sludge is run out on sand beds for drying and later disposal as a soil conditioner or it can be hauled away in liquid form by a tank truck.

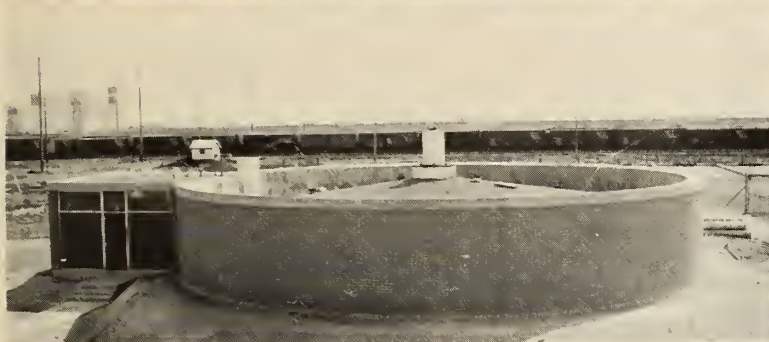
The digester is a circular tank 55 feet in diameter with a 20 foot side wall depth. It has a capacity of 50,000 cubic feet or 312,000 gallons. The capacity allows for 2.5 cubic feet per capita.

The four sludge drying beds have a total area of 10,000 square feet or $\frac{1}{2}$ square foot per capita.





PRIMARY SEDIMENTATION
TANKS



DIGESTER



SLUDGE DRYING BEDS



ADMINISTRATION - CONTROL
BUILDING

OPERATING RESULTS

The following is a summary of the operating results for the 9 months from April 1, 1960 to December 31, 1960:

<u>MONTH</u>	<u>TOTAL FLOW M.G.</u>	<u>AVG. DAILY PEAK FLOW</u>	<u>MAX. RECORDED PEAK FLOW</u>	<u>AVG. DAILY MIN. FLOW</u>	<u>MIN. RECORDED FLOW</u>	<u>AVG. DAILY FLOW</u>
APRIL	47.7	2.54	6.2	1.0	0.8	1.59
MAY	69.9	3.57	6.2	1.22	0.9	2.32
JUNE	52.5	2.52	6.1	0.96	0.8	1.75
JULY	45.0	2.80	6.2	0.89	0.8	1.50
AUG.	55.1	2.74	6.2	1.17	0.8	1.83
SEPT.	43.1	2.04	2.9	0.46	0.1	1.43
OCT.	44.7	2.39	2.95	1.26	0.1	1.48
NOV.	48.7	2.42	4.8	0.78	0.2	1.62
DEC.	56.8	2.96	4.7	0.99	0.8	1.88

Total flow for 9 recorded months was 463.4 million gallons.

Cost of treatment - 7.2 cents per 1,000 gallons treated.

OPERATING RESULTS

MONTHLY SLUDGE REMOVAL

	<u>GALS.</u>	<u>GALS/M.G.D.</u> <u>SEWAGE</u>
APRIL	111,286	2,340
MAY	94,080	1,350
JUNE	79,200	1,510
JULY	75,500	1,680
AUG.	82,400	1,500
SEPT.	109,120	2,540
OCTOBER	136,160	3,060
NOVEMBER	148,310	3,040
DECEMBER	181,920	3,200

Total gallons of sludge removed in the 9 months was 1,065,096 gallons.

With an average of 4% solids in the sludge, the total weight of organic material removed was 213 tons.

OPERATING RESULTS

MONTHLY GRIT REMOVAL

	<u>CU. FT.</u>	<u>CU. FT./MG SEWAGE</u>
APRIL	-	
MAY	-	
JUNE	495	9.5
JULY	338	7.5
AUG.	410	7.5
SEPT.	259	6.0
OCT.	418	9.5
NOV.	326	6.7
DEC.	311	5.5

Total cubic yards of grit removed in 7 months 2557.

Some results from various communities with combined sewers are quoted below for comparison

	<u>CU. FT./MG SEWAGE</u>
Blackstone Valley R.I.	1.56
Detroit Michigan	4.0
Duluth Minn.	0.8
Fort Wayne, Inc.	2.8
Hartford, Conn.	1.6

OPERATING RESULTS

It can be seen from the figures above that the Port Arthur Sewage Treatment Plant receives a large quantity of grit. The figures given for grit removal at Port Arthur are approximated only, because roughly 1/3 of the amount of grit removed is swept into the bypass channel when the grit chambers are drained. The installation of a mechanical grit removal mechanism is recommended to reduce the manpower requirements in the plant and to prevent the escape of grit to the river.

OPERATING RESULTS

MONTHLY POWER CONSUMPTION

<u>MONTH</u>	<u>KWH</u>	<u>KWH/M.G. SEWAGE</u>
APRIL	32500	680
MAY	39000	560
JUNE	33500	640
JULY	33000	735
AUG.	36000	655
SEPT.	31000	720
OCT.	30500	685
NOV.	33000	680
DEC.	36000	635

Total KWH used for the 9 month period was 304,2000

It is pointed out that the poor power factor at this plant has increased the power consumption. This condition will improve itself when higher average flows are encountered.

OPERATING RESULTS

MONTHLY CHLORINE USAGE

<u>MONTH</u>	<u>LBS. CHLORINE</u>	<u>LBS. CHLORINE M.G. SEWAGE</u>	<u>PPM DOSAGE</u>
APRIL			
MAY			
JUNE			
JULY	1981-started July 9th		
AUG.	3392	61.7	6.2
SEPT.	2369	55.1	5.5
OCT.	2308	51.8	5.2
NOV.			
DEC.			

From the FSIWA Manual of Practice No. 4, it is estimated that settled sewage requires 5 to 10 ppm dosage to maintain the required residual. From the three months of chlorination it is seen that the Port Arthur Plant maintained a very close control on the chlorine usage.

PORT ARTHUR PLANT PERFORMANCE

<u>DATE</u>	<u>INFLUENT</u>		<u>EFFLUENT</u>		<u>% REMOVAL</u>	
	<u>BOD</u>	<u>S.S.</u>	<u>BOD</u>	<u>S.S.</u>	<u>BOD</u>	<u>S.S.</u>
July 8	360	102	125	90	65.2	11.7
July 15	170	116	60	64	64.7	44.8
July 22	265	192	116	88	56.2	54.2
July 29	380	172	116	64	69.5	62.9
Aug. 5	195	156	90	40	54.0	74.5
Aug. 12	200	378	82	68	59.0	82.0
Aug. 19	250	166	105	78	58.0	53.0
Aug. 26	240	118	100	40	58.4	66.1
Sept. 2	310	68	185	48	40.4	29.4
Sept. 9	620	234	105	52	83.0	78.0
Sept. 19	235	204	100	42	57.5	79.5
Oct. 3	250	200	120	82	52.0	59.0
Oct. 17	255	328	100	94	60.8	71.5
Oct. 31	255	270	160	108	28.9	60.0
Nov. 14	205	248	110	86	46.4	65.4
Nov. 28	305	484	120	100	60.6	79.5
Dec. 12	225	200	95	78	60.0	61.8
Dec. 26	275	204	110	78	60.0	61.0
Average	270	213	111	72	57.3%	60.7%

The operation of the Port Arthur S.T.P. entailed the overcoming of numerous small problems due to the extreme climate and the fact that a newly constructed sewage plant does normally have a lot of "bugs" to be ironed out.

During January the ice buildup on the primary clarifier mechanism caused the chains to jump off their sprockets. These chains were replaced and the unit put back into operation.

During February the icing problems continued which forced the plant into 24 hour operation with a subsequent increase of staff.

In the month of March, there were minor equipment difficulties which were overcome. Gas production in the digester started and because of its poor quality was burned off in the waste gas burner.

During April, the settling conditions caused the sludge recirculation pipe to shear off beside the lift station. The plant was bypassed for 5 days while repairs were made by the contractor.

On May 9th, it became necessary to lower the main gate into the plant to protect the plant from flooding. The recorded rainfall at the plant was 1.3 inches.

In the month of June, the chlorine contact chamber was thoroughly cleaned out and put back into operation.

On July 25th, it again became necessary to lower the main gate into the plant due to a 9.71" rain.

On August 1st, the heat exchanger was switched on to digester gas. The heating of the plant has now become much more economical due to the utilization of the sludge gas. On August 6th and 7th, the main gate to the plant was lowered due to 1.59" and 0.77" rains.

During September, October, November and December, minor difficulties were experienced and the plant operated very well.

PERSONNEL

On November 16th and 17th, 1959, Messrs. Uren, Perry and Caverly of the OWRC and Alderman Laskin and Mr. Fell, City Engineer of Port Arthur interviewed 35 applicants for the job of chief operator and operator.

Mr. S. Antonik was hired as chief operator at a salary of \$4050 per year going to \$4200 in six months. Mr. S. Hrymnak was hired as operator at \$3480 per year going to \$3600 in six months. These men started employment on December 1st, 1959.

Mr. Bernard Jensen was hired as a nightwatchman to cover the 12 midnight to 8 AM shift starting midnight December 19th, 1959.

On March 8, 1960, 6 applicants were interviewed for the position of operator and Mr. R. Romanick was hired.

In order to reduce the amount of overtime it became necessary to hire another casual laborer in September 1960.

The operators at the Port Arthur S.T.P. have been very capable in the performance of their duties and the plant has been maintained to the highest possible standards.

The Chief Operator has in our opinion performed his duties in an extremely capable manner which has and will ensure that the Port Arthur Sewage Treatment Plant will be operated to the highest standards and in the most economical manner.

ANALYSIS OF OPERATING COSTS

PAYROLL

Total permanent staff payroll	-	\$ 12,330.24
Total casual staff payroll	-	<u>4,311.52</u>
Total payroll	-	\$ 16,641.76

During the past year, the Port Arthur Sewage Treatment Plant has been under 24 hour supervision. The 24 hour supervision has been accomplished throughout most of the year by using 3 operators plus a night watchman who worked 12 hours a night, 7 nights a week.

In the fall, an attempt was made to go to 16 hour supervision but this was discontinued because of an inherent fault in the automatic controls. At that time, it was decided to hire an additional casual laborer to adequately cover all shifts without overtime and to remain within the requirements of the regulations of the Department of Labor.

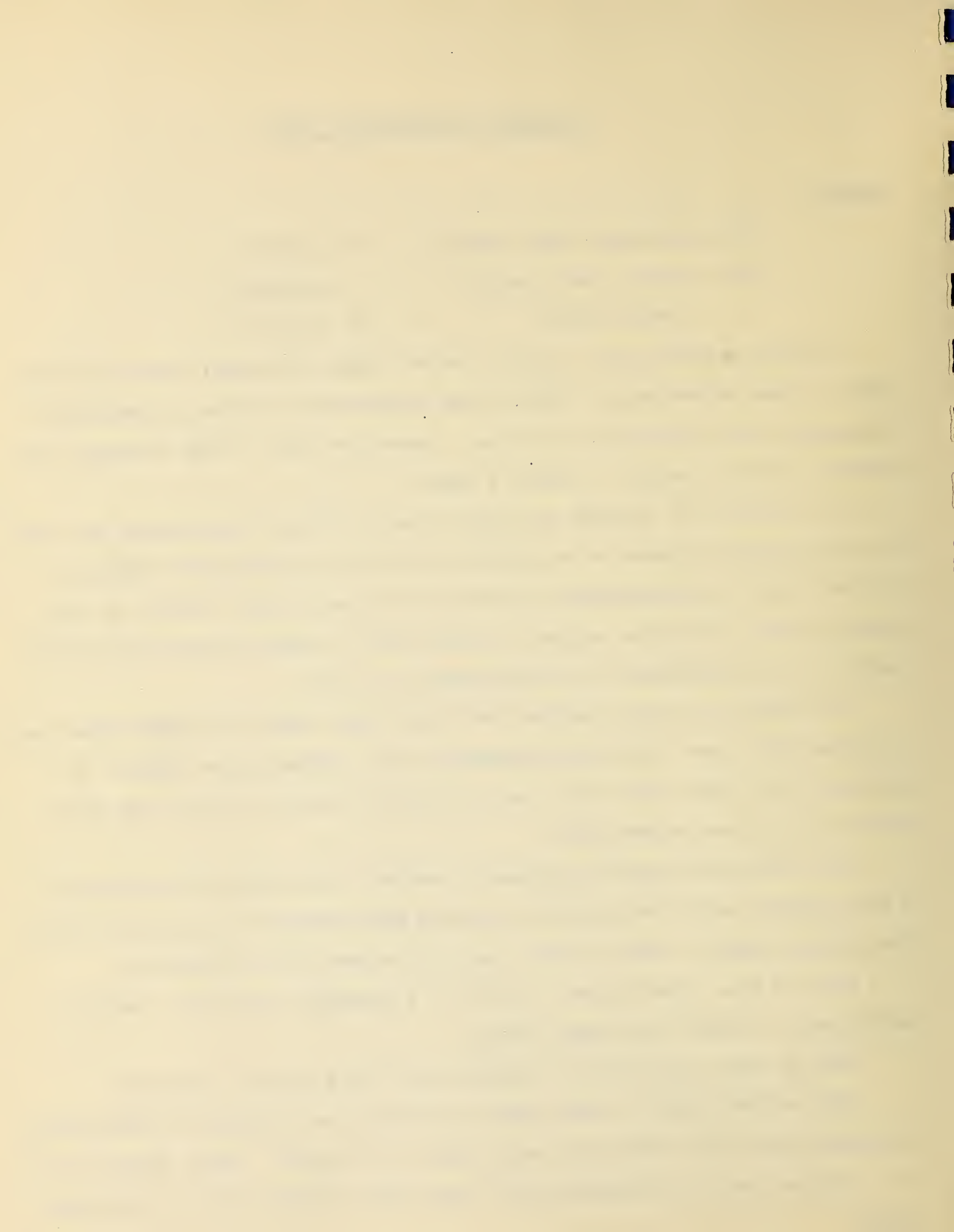
In January of 1961, a wooden cover was built over the sludge hopper and a wooden shack over the chain mechanism of the sedimentation tanks. On February 1st, 1961, one of the casual laborers was laid off and the plant went on to 16 hour supervision.

The difficulty with the automatic controls has still to be overcome. A replacement control sub-assembly costing \$324.00 must be installed before the spring runoff or else 24 hour supervision must be reintroduced.

With 16 hour supervision, a staff of 4 permanent operators should be sufficient to handle the normal duties.

With 24 hour supervision a minimum staff of 5 men are required.

The required staff at the plant can be kept to a minimum by purchasing equipment which will reduce the work load on the staff. These items such as (a) lawnmower and (b) mechanical grit and sludge removal will be discussed later.

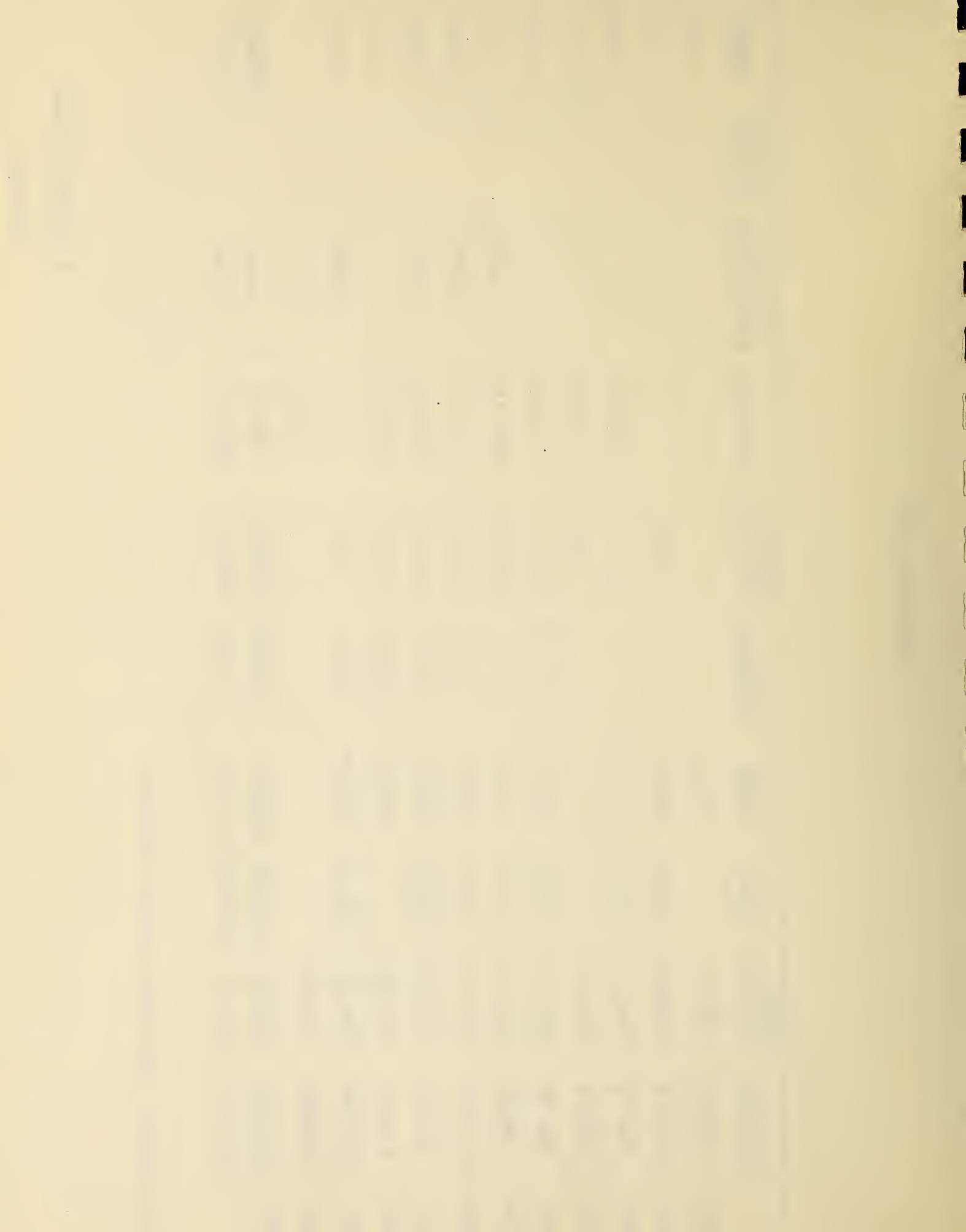


OPERATING COST

	<u>PAYROLL</u>	<u>CASUAL PAYROLL</u>	<u>FUEL</u>	<u>POWER</u>	<u>CHEMICAL</u>	<u>GENERAL SUPPLIES</u>	<u>EQUIPMENT</u>	<u>REPAIR & MAINTENANCE</u>	<u>SLUDGE HAULAGE</u>	<u>SUN DRY</u>
JAN.	782.36	186.00		275.44						36.21
FEB.	1219.58	336.00	427.45	262.61		15.73				7.50
MAR.	744.75	240.00	189.20	227.44		217.50	136.80			17.86
APR.	985.32	224.00				33.04	70.47			122.01
MAY	864.86	303.60	307.90	720.48	11.50	336.47	250.24			55.90
JUNE	988.88	302.40	136.99	371.13		303.27	507.14	4.25		18.40
JULY	1417.59	583.28	112.70	324.37	315.63	616.59	69.50	14.70		44.40
AUG.	941.16	302.40	87.00	788.22	623.00	141.35	500.07	60.00		26.23
SEPT.	449.00	151.20		350.56	1246.00	80.46	281.00			69.75
OCT.	1492.98	594.00	169.00	1187.38	1246.00	68.80		35.69		42.73
NOV.	1068.60	432.00					11.21			
DEC.	<u>1374.96</u>	<u>656.64</u>	<u>93.76</u>	<u>609.81</u>	<u>(711.70)</u>	<u>947.49</u>	<u>84.21</u>			<u>2105.59 *</u>
	12330.24	4311.52	1524.00	5117.44	4153.83	2760.70	1930.64	114.64		2546.60

Total annual operating cost was \$33366.18

* Includes plant insurance



1961 BUDGET ESTIMATES

Assuming 1 chief operator
3 permanent operators

Chief Operator - 4200	
Increase - 200 x 1/2 year	Total \$4300
2 operators - 2 x 3600 = 7200	
Increase - 2 x 150 x 1/2 year	Total 7350
1 operator (new) - 3600	Total <u>3600</u>
Total Estimated 1961 Payroll	\$ 15,250

FUEL

The total fuel bill for 1960 was \$1,524.00. During the first year of operation, the fuel bill is high because very little gas is produced and the digester must be brought up to its operating temperature.

In the year 1961, the use of digester gas will provide all the required heat for the digester, but since the building heat is on a separate system it is estimated that the total fuel bill will be \$800.00.

POWER

The total power bill for 1960 was \$5117.44. Since the flow of sewage into the plant is expected to increase slightly over the next year, it is anticipated that the power bill will increase to \$6,000.00.

CHEMICAL

The total cost of chemicals for 1960 was \$4,153.83. Due to the expected increased flow and the longer chlorination period, it is anticipated that the total chemical costs will increase to \$5,500.00.

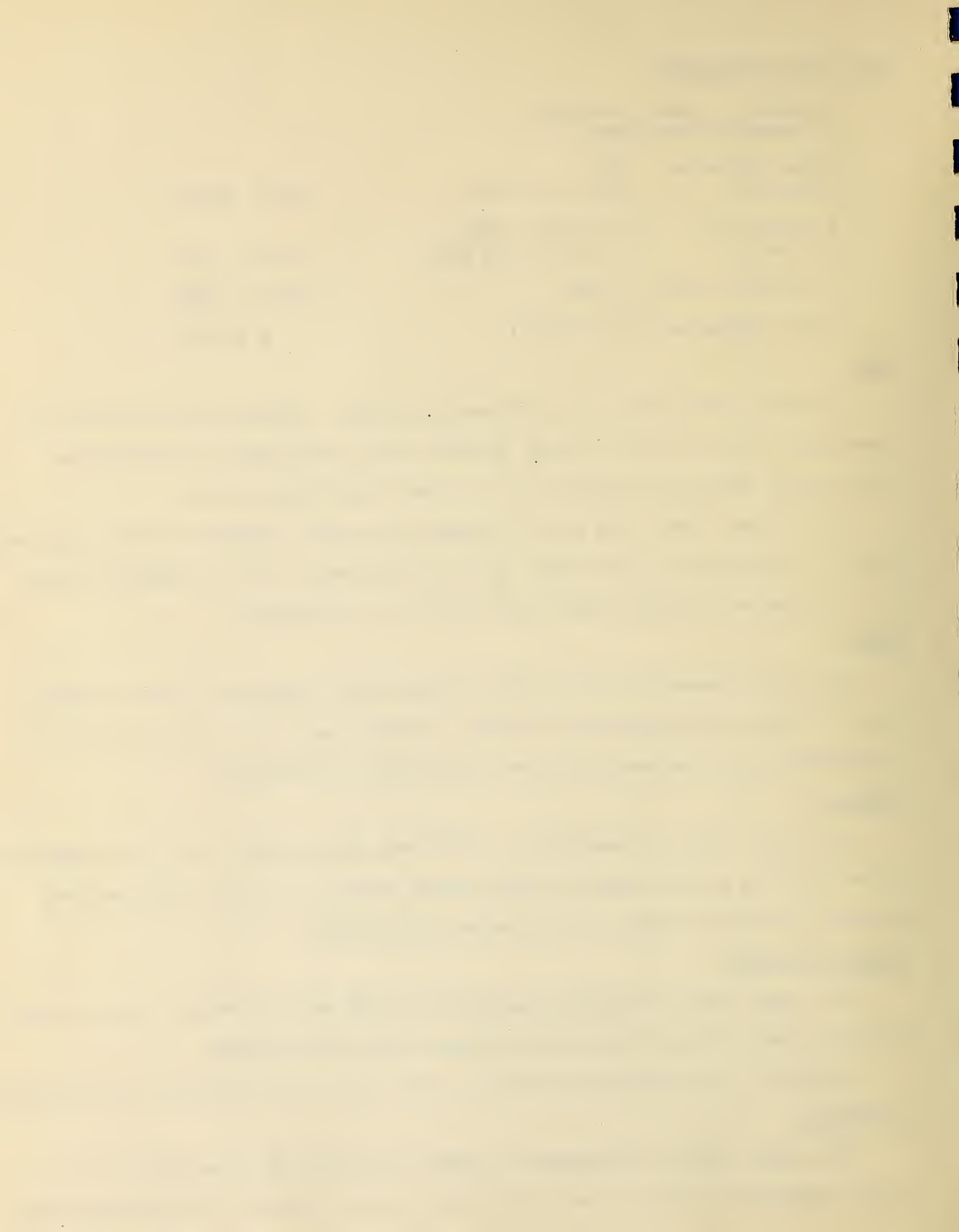
GENERAL SUPPLIES

The total cost for general supplies in 1960 was \$2,760.70. As this was the first year of operation, the cost was higher than normal.

In 1961, it is estimated that the total cost will decrease to \$2,000.00.

EQUIPMENT

The total cost for equipment in 1960 was \$1,930.64. Because of the future expansion plans at the plant which are not clear at the present time,



the normal equipment costs will be estimated at \$1,000.00.

REPAIR & MAINTENANCE

The total cost for repairs and maintenance in 1960 was \$114.64. Due to the fact that the equipment is a year older and not covered by the one year maintenance period, it is estimated that the repair and maintenance bill will be \$1,800.00.

SLUDGE HAULAGE

In the year 1960, 8 beds of digested sludge were dried. The Chief Operator contacted various market gardeners who removed the sludge at no cost. The removal of sludge by outside firms and individuals should be encouraged so that the cost of removing sludge is kept to a minimum.

The operators at the plant helped the market gardeners remove sludge by hand. This was a hard and time consuming task. Some of the contractors hired trucks and men to remove the sludge at considerable cost to themselves.

To decrease the time and labor required by both contractors and plant operators and to encourage outsiders to remove sludge free of charge, it is recommended that some thought be given to the purchase or rental of a small front end loader.

It is estimated that approximated 40 beds of sludge will have to be dried in the summer of 1961 i.e. 5 times that of 1960, and that if some assistance is not given to persons removing the sludge the practice will become unpopular and a contractor will have to be hired.

SUNDRY

The total cost of sundry and miscellaneous materials required at the plant totaled \$2,546.60. Included in this total is a sum of \$2,032.80, which is a 3 year insurance premium which covers up to January 1, 1963 and which will not be a cost in 1961. The remaining portion of \$514.00 is expected to increase to \$550.00 in 1961.

SUMMARY OF ESTIMATED 1961 COSTS

PAYROLL.....	\$ 15,250	
FUEL.....	800	
POWER.....	6,000	
CHEMICAL.....	5,500	
GENERAL SUPPLIES.....	2,000	
EQUIPMENT.....	1,000	
REPAIRS & MAINTENANCE.....	1,800	
SLUDGE HAULAGE.....	-----	
SUNDRY.....	550	
		Approx.
	\$ 32,900	= \$33,000
CONTINGENCIES 5%.....		<u>1,600</u>
TOTAL ESTIMATED COST		\$34,600

ADDITIONAL PROPOSALS

The future expansion of the Port Arthur plant has complicated the problem of additional equipment at the plant. The following is a discussion of equipment and costs which should be purchased in the very near future.

1. (a) A Gravely riding lawnmower with sickle bar, rotary mower, and snowblower attachment at a cost of \$550 alternatively:
- (b) A small front end loader with a set of gang mowers at the back. This unit would replace the above lawnmower and in addition to be used to remove dried sludge and carry grit.

ADDITIONAL PROPOSALS - Continued

2. A mechanical grit collector at a cost of \$5,000.00
3. A third raw sewage pump with a diesel standby. The cost of this pump is difficult to estimate without calling tenders but would be in the neighborhood of \$50,000.00.

The installation of the above mentioned equipment is required now at the plant and should precede the actual addition to the plant which appears to be one or two years in the future.



