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Treatment Plant Report

METROPOLITAN WASTE CONTROL COMMISSION
Twin Cities Area

1983 ANNUAL WASTEWATER TREATMENT PLANT REPORT

prepared by the

Quality Control & Operations Department
Metropolitan Waste Control Commission
350 Metro Square Building
Saint Paul, Minnesota 55101

Report No. QC 83-73

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ABBREVIATIONS AND SYMBOLS

As	Arsenic
Avg.	Average
BOD	Biochemical oxygen demand (generally means BOD_5, or five day biochemical oxygen demand)
CBOD	Carbonaceous biochemical oxygen demand
Cd	Cadmium
cfs	Cubic feet per second
Cn	Cyanide
COD	Chemical oxygen demand
Cr	Chromium
Cu	Copper
cu. ft.	Cubic feet
DO	Dissolved oxygen
dss	Dry sludge solids
DTPH	dry ton/hour
EFF	Effluent
°F	Degrees Fahreneit
F:M	Food to microorganism ratio
$FeCl_3$	Ferric chloride
fps	Feet per second
g	Grams
gpd	Gallons per day
gpm	Gallons per minute
gr/dscf	Grains/dry standard cubic foot
Hg	Mercury
hor.	Horizontal
hr.	Hour
ID	Identification
INF	Influent
KJN	Kjeldahl nitrogen
lb.	Pound
lin. ft.	Lineal feet
mg/kg	Milligram per kilogram
mg/l	Milligrams per liter
MGD or mgd	Million gallons per day
MLSS	Mixed liquor suspended solids
mmbtu	Million british thermal units
NH_3 (NH_3-N)	Ammonia (nitrogen)
Ni	Nickel
No.	Number
NO_2	Nitrite (nitrogen)
NO_3	Nitrate (nitrogen)
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric turbidity units

ABBREVIATIONS AND SYMBOLS CONT.

ocu	Odor concentration unit
P	Phosphorus
Pb	Lead
PCB	Polychlorinated biphenyl
pH	Indicates acidity/alkalinity
SCFM	Standard cubic feet per minute
Sn	Tin
sq. ft.	Square feet
Std.	Standard
TBOD	Total biochemical oxygen demand
tds	Tons dry solids
tpd	Tons per day
TS	Total solids
TSS	Total suspended solids
Turb.	Turbidity
ug/l	Micrograms per liter
VS	Volatile solids
Zn	Zinc
>	Greater than
<	Less than

DEFINITION OF PARAMETERS

Biochemical Oxygen Demand (BOD) is a measure of the dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in wastewater. A low BOD in the plant discharge is desirable because this would cause the least amount of oxygen depletion in the receiving body of water. This test normally takes five days before results are available.

Chemical Oxygen Demand (COD) is a measure of the oxygen equivalent required to chemically oxidize the organic matter present in wastewater. A low COD is desirable in plant effluent discharges. This test takes approximately three hours to complete and the results can be used to estimate BOD values. It is, therefore, extremely useful as a process control tool.

Total Suspended Solids (TSS) is a measure of the amount of particulate matter found suspended in a given amount of wastewater. Suspended solids adversely affect receiving waters by exerting an oxygen demand during decomposition or filtering out available sunlight needed by aquatic organisms for photosynthesis.

pH is a measure of the hydrogen ion concentration in a given sample of water. It is used as an indication of acidity or alkalinity. A pH of 7 is neutral - neither acid or alkaline. pH values below 6 or above 9 are usually harmful to aquatic life.

Dissolved Oxygen (DO) is a measure of the concentration of oxygen dissolved in a given sample of water. A sufficient DO level in plant effluent discharges is important because dissolved oxygen is required for the life processes of aquatic organisms.

Fecal Coliform organisms are a group of bacteria present in wastewater and are used as indicators of the possible presence of pathogenic or disease producing bacteria. Monitoring of fecal coliform organisms is also done to determine the efficiency of effluent disinfection processes.

Ammonia (NH_3), Nitrate (NO_3), and Nitrite (NO_2) are nitrogenous compounds found in wastewater. Excessive discharges of these compounds can adversely affect the receiving body of water. Degradation of NH_3 to NO_3 is an oxygen demanding reaction. Monitoring of nitrogenous compounds is also useful for controlling secondary treatment processes.

Phosphorus (P) is monitored because it also can have adverse effects on the receiving body of water. When discharged in sufficient quantities it aids in stimulating excessive and undesirable algal growth.

DEFINITION OF PARAMETERS CONT.

Heavy Metals covered in this report include the following: copper (Cu), chromium (Cr), zinc (Zn), lead (Pb), cadmium (Cd), mercury (Hg), nickel (Ni), arsenic (As), and tin (Sn). Close monitoring of heavy metals is necessary due to their possible toxicity to aquatic organisms present in the receiving waters.

1.0 SUMMARY

During 1983, the Commission operated fourteen wastewater treatment plants. The performance of these facilities is related to: (1) the effluent quality of each plant and the record of compliance with NPDES permit conditions; (2) the quality of air emissions from sludge incineration at two regional plants; and (3) management of sludge generated at each plant as a result of wastewater treatment. The purpose of this report is to summarize the performance of Commission treatment plants during 1983 by presenting and analyzing data generated to monitor these major areas.

Table 1-1 is a summary of average annual effluent quality at each plant. Annual average effluent CBOD and TSS were below permitted discharge limitations at all plants. At Bayport, Rosemount, and Stillwater, annual average effluent phosphorus was below the limit of 1 mg/L. At Empire, annual average effluent ammonia was below the limit of 1 mg/L.

One of the most important indicators of performance of individual treatment plants, and performance of the Commission in the operation of all plants, is compliance with NPDES permit limitations. Table 1-2 summarizes the trend in NPDES permit compliance for the period of NPDES administration, 1974-1983. During this period, the number of plants operated by the Commission was reduced from 21 in 1974 to its present number of 14. The total number of violations was reduced from 163 in 1974 to 20 in 1983. Overall percent compliance with NPDES permit limitations improved from 86.4% in 1974 to 99% in 1983.

Individual NPDES compliance records of the fourteen plants currently in operation are given for the period 1978-1983 in Table 1-3. In general, performance at each plant improved significantly through the period 1978-1980, and remained relatively constant from 1980-1982. The number of permit violations decreased from 30 in 1982 to 20 in 1983.

Trends in plant performance can also be evaluated by examining the two major effluent parameters, BOD and TSS, in the form of a single performance indicator (BOD + TSS). Figure 1 shows these trends for the Metropolitan Plant alone, and for all other plants combined. Performance at the Metropolitan Plant has been somewhat erratic in the past, with particularly poor performance in 1976 and 1979. NPDES permit limitation levels were eased in 1977 and in 1978 in recognition of reduced plant performance capabilities. During the period of 1980-1983, NPDES permit limitations for the Metropolitan Plant approached and equaled secondary treatment levels (BOD = 25 mg/L and TSS = 30 mg/L or BOD + TSS = 55 mg/l) while performance was consistently better than secondary treatment.

Other plants show a trend of improved performance throughout 1971-1981, with marked improvement in 1971-1975, and 1979-1981. NPDES permit limitations became more stringent between 1975-1980. In 1983, NPDES permit limits were at the secondary treatment level (BOD = 25 mg/L and TSS = 30 mg/L) or better at all plants while performance was consistently better than secondary treatment.

TABLE 1-1

1983 ANNUAL SUMMARY OF TREATMENT PLANT EFFLUENT QUALITY

Treatment Plant	Wastewater Flow mgd		1983 Percent Removal		BOD mg/l			TSS mg/l		Fecal Coli. Geometric Mean Number/ 100 ml		Nutrients, mg/l Phosphorus		Ammonia		Turbidity NTU		Dissolved Oxygen mg/l	
	Design*	1983 Avg.	BOD	TSS	NPDES Limit	1983 CBOD Avg.	1983 TBOD Avg.	NPDES Limit	1983 Avg.	NPDES Limit	1983 Avg.	NPDES Limit	1983 Avg.	NPDES Limit	1983 Avg.	NPDES Limit	1983 Avg.	NPDES Limit	1983 Avg.
Anoka	2.46	2.33	94	94	25	11	15	30	10	200	67	---	4.2	---	15.6	25	6	----	1.8
Bayport	0.65	0.54	96	96	25	6	9	30	6	200	10	1.0	0.4	---	3.0	25	2	----	3.8
Blue Lake	20.00	18.1	96	97	25	9	25	30	7	200	8	---	3.1	---	9.2	25	8	----	10.2
Chaska	1.40	1.02	92	91	25	11	17	30	11	200	8	---	1.8	---	7.3	25	5	----	9.2
Cottage Grove	1.80	1.30	95	93	25	9	19	30	11	200	53	---	5.0	---	13.5	25	5	----	5.1
Empire	6.00	4.81	99	99	10	3	3	10	1	200	3	---	4.6	1.0	0.4	25	1	>4.0	10.0
Hastings	1.83	1.65	93	87	25	16	27	30	23	200	44	---	6.9	---	16.0	25	10	----	6.0
Maple Plain	0.22	0.35	92	93	25	9	12	30	9	200	10	---	2.5	---	9.1	--	6	----	6.4
Medina	0.10	0.18	91	89	--	10	14	--	14	---	--	---	2.7	---	9.6	--	7	----	3.0
Metropolitan	250	225	94	95	24	10	19	30	9	200	25	---	2.2	---	11.7	--	5	7**	3.4
Rosemount	0.60	0.34	90	99	25	16	17	30	2	200	4	1.0	0.2	---	28.0	25	3	----	7.2
Savage	0.86	0.59	93	98	25	8	8	30	3	200	22	---	4.6	---	1.4	25	3	----	8.9
Seneca	24.00	15.8	94	91	25	14	22	30	18	200	26	---	3.7	---	15.9	25	7	----	9.1
Stillwater	3.02	2.84	92	91	25	10	16	30	12	200	25	1.0	0.6	---	10.9	25	5	----	4.8

* Represents NPDES permitted flow. See text of report for discussion of design flow capacity.

**Dissolved oxygen limitation of 7 mg/L for river flows less than 7,000 cfs and river D.O. values less than 6.0 mg/L upstream or less than 5.5 mg/L downstream for two consecutive sample-days, during the period June-September.

TABLE 1-2

TRENDS IN NPDES PERMIT COMPLIANCE

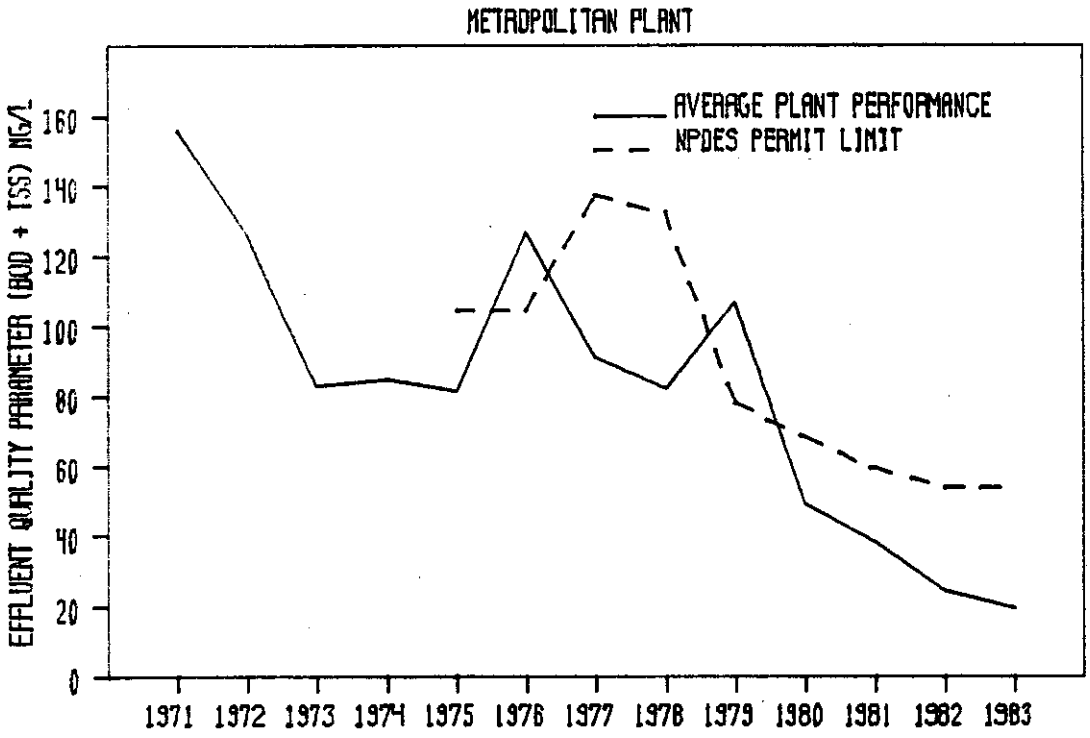
Year	Number of Plants In Operation (at Year-End)	Number of Violations	Percent Compliance
1974	21	163	86.4
1975	20	81	94.5
1976	20	109	92.7
1977	20	101	93.6
1978	18	94	94.5
1979	16	109	93.8
1980	14	36	98.0
1981	14	35	98.0
1982	14	30	98.3
1983	14	20	99.0

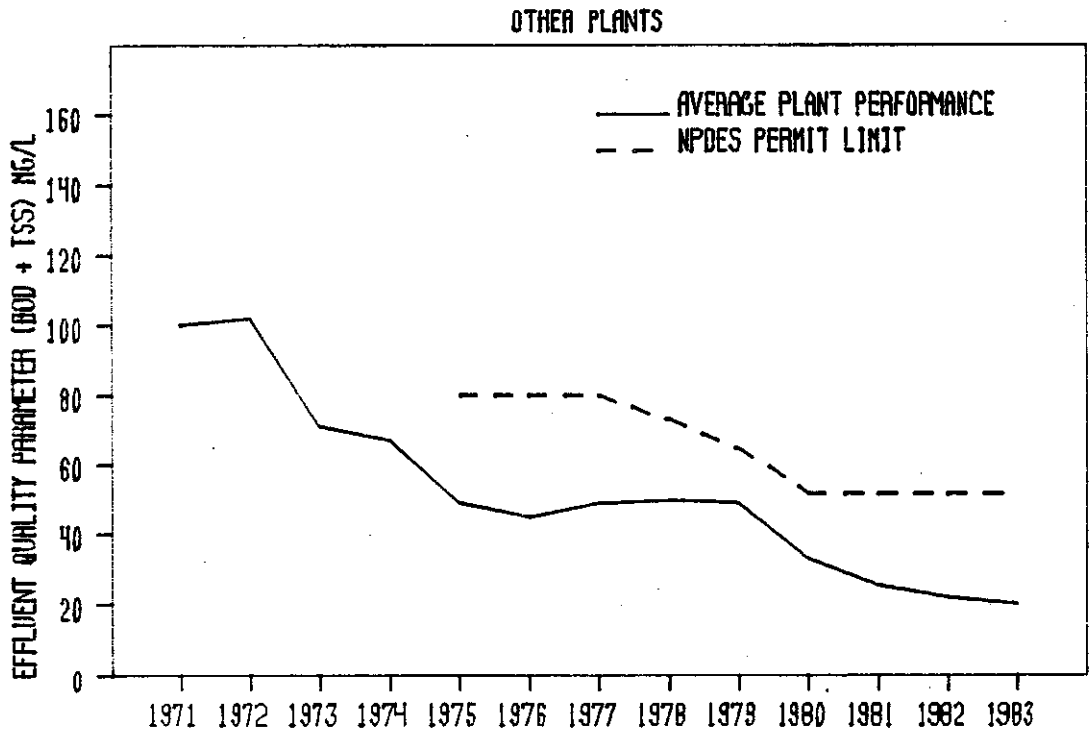
TABLE 1-3

NPDES PERMIT COMPLIANCE AT EXISTING PLANTS

TREATMENT PLANT	ANNUAL NUMBER OF VIOLATIONS (V) AND PERCENT COMPLIANCE (C)											
	1978		1979		1980		1981		1982		1983	
	V	C	V	C	V	C	V	C	V	C	V	C
ANOKA	27	90	3	97	3	99	8	97	2	99	2	99
BAYPORT	0	100	0	100	0	100	0	100	0	100	0	100
BLUE LAKE	1	99	0	100	0	100	0	100	0	100	1	99
CHASKA	15	69	25	58	4	96	3	98	1	99	1	99
COTTAGE GROVE	3	94	4	95	1	99	4	96	1	99	1	99
EMPIRE	--	---	1	90	1	99	0	100	3	98	0	100
HASTINGS	2	98	2	99	5	97	8	94	18	87	7	95
MAPLE PLAIN	2	97	--	95	3	95	1	99	2	96	0	100
MEDINA	0	100	1	92	0	100	2	83	0	100	4	92
METROPOLITAN	6	88	15	69	2	96	5	89	0	100	0	100
ROSEMOUNT	1	99	1	99	1	99	0	100	1	99	3	98
SAVAGE	2	96	6	92	0	100	0	100	1	99	0	100
SENECA	5	97	8	94	0	100	2	99	1	99	1	99
STILLWATER	0	100	0	100	2	99	2	99	0	100	0	100
TOTALS	64	94	74	95	22	99	35	98	30	98	20	99

FIGURE 1
TRENDS IN PLANT PERFORMANCE
1971 - 1983





1.2 Air Emissions

There are four major sources of air emissions at the Metropolitan and Seneca Plants: Metropolitan F & I No. 1 sludge incinerators, Metropolitan Solids Processing Building sludge incinerators, Metropolitan scum incinerator, and Seneca sludge incinerators.

During 1983, the newly constructed incinerators in the Metropolitan Solids Processing Building were in a startup and adjustment stage while Metropolitan F & I No. 1 sludge incinerators were shutdown. As such, limited testing was conducted at the Metropolitan Plant during 1983.

Table 1-4 is a summary of sludge and scum incinerator emission quality measured during 1983. The Metropolitan and Seneca Solids Processing Buidlings demonstrated compliance with particulate, opacity, and mercury emission standards. The Metropolitan Scum Incinerator slightly exceeded particulate emission standards due to gas scrubber problems occurring when the incinerator was operated at or near rated capacity.

1.3 Sludge Management

Each of the fourteen plants operated by the Commission produces sludge as a result of wastewater treatment, and with the exception of Medina, each plant provides some form of sludge processing. Ultimate disposal of sludge generated at Commission plants involves either landspreading or incineration. The Metropolitan Plant and the Seneca Plant represent major points of final sludge disposal. At the Metropolitan Plant, sludge is either landspread or incinerated; at Seneca, sludge is incinerated. The Empire Plant has on-site sludge landspreading facilities; all other plants transport sludge to the Metropolitan or Seneca Plant, or directly to landspreading sites. Table 1-5 is a summary of sludge generated at Commission plants.

TABLE 1-4

SUMMARY OF 1983 INCINERATOR EMISSION QUALITY

Source	Mercury				Particulate				Opacity			
	Emission std. g/24 hr.	Annual Avg. g/24 hr.	No. of Tests	Percent of Tests Mtg. Stds.	Emission std.	Annual Avg.	No. of Tests	Percent of Tests Mtg. Stds.	Opacity Std., %	Annual Avg. Opacity, %	No. of Tests	Percent of Tests Mtg. Stds.
Metro, Solids Processing Bulding	3200	827	2	100	1.3(1)	0.74(1)	10	90	20	13	11	91
Metro Scum Incinerator	----	---	-	---	0.2(2)	0.25(2)	2	50	20	--	0	--
Seneca Solids Processing Building	3200	74	2	100	0.2(2)(3)	0.033(2)	4	100	20	13	40	85

(1)Metro Solids Processing Bulding particulate standard and testing results expressed in lbs particulate/ton dry solids.

(2)Grains/dry standard cubic foot corrected to 12% CO_2.

(3)Seneca incinerators were derated from 1.4 DTPH to 1.0 DTPH on November 1, 1981, resulting in an increase in the particulate emission standard to 0.2 gr/dscf at 12% CO_2.

TABLE 1-5

1983 SUMMARY OF SLUDGE GENERATED

TREATMENT PLANT	ANNUAL WASTEWATER FLOW Daily Average MGD	Annual Total MG	ANNUAL SLUDGE PRODUCTION MG	% SOLIDS	DRY TONS	SLUDGE DISPOSAL METHOD
ANOKA	2.33	850	3.33	2.43	320	(1)
BAYPORT	0.54	197	1.46	1.99	121	(1)
BLUE LAKE*	18.1	6,606	42.29	4.73	8,320	(1) (2)
CHASKA	1.02	372	2.19	1.61	146	(1) (2) (3)
COTTAGE GROVE	1.30	474	2.28	1.84	176	(1) (4)
EMPIRE	4.81	1,756	-----	13.7	593	(4)
HASTINGS	1.65	602	2.95	2.77	338	(1) (4)
MAPLE PLAIN	0.35	128	0.07	4.29	11	(1) (3) (4)
MEDINA	0.18	66	0	-----	0	-------
METROPOLITAN*	225	82,125	-----	32.6	74,016	(4) (5)
ROSEMOUNT	0.34	124	1.84	9.54	731	(1)
SAVAGE	0.59	215	0.56	3.95	91	(1) (2) (4)
SENECA*	15.8	5,767	-----	22.3	11,810	(5)
STILLWATER	2.84	1,037	4.04	2.84	480	(1) (4)

SLUDGE DISPOSAL METHODS:

(1) Transported to Metropolitan Plant for further proccessing

(2) Transported to Seneca Plant for futher processing

(3) Transported to Blue Lake Plant for further processing

(4) Landspreading

(5) Incineration

NOTES:

*Annual Sludge Production includes sludge transported from other plants for further processing. Chemicals added for sludge conditioning are included for only the Seneca Plant.

2.0 INTRODUCTION

The Metropolitan Waste Control Commission was established as the areawide operational water pollution control agency by the Minnesota State Legislature, through the Metropolitan Sewer Act in 1969. This Act gives the Commission formal charge to prevent, abate, and control water pollution in lakes, rivers, and streams of the seven county Metropolitan area. The accomplishment of these responsibilities required that the Commission acquire, construct, operate, and maintain all interceptors and treatment works necessary for the collection, treatment, and disposal of wastewater in the area.

The Commission originally acquired 33 existing wastewater treatment plants in 1970. Through a ten year regionalization program, the Commission eliminated 22 old and outdated plants which could not comply with recent and more stringent effluent limitations. Three new and modern plants were designed and constructed to economically meet required effluent limitations, and provide for expansion to accomodate future growth in the area. Completion of this regionalization program left the Commission with the existing 14 treatment plants. The number of plants in operation at the end of each year is shown graphically in Figure 2-1. A history of each plant is summarized in Table 2-1.

The 14 plants currently operated by the Commission include the Metropolitan Plant. This is the largest plant in the system and serves the greater Minneapolis-St. Paul area. Three other regional plants, Blue Lake, Empire, and Seneca, each serve several suburban communities. The remaining ten smaller plants generally serve communities in the each of their immediate areas.

Throughout each year, the performance of each plant is monitored, recorded, and reported to regulatory agencies, Commission administrators, and Commission program managers, in order to insure consistently good performance and indicate areas where additional effort is necessary to improve performance. At the end of each year, the performance of each treatment plant is summarized. This report is a summary of treatment plant performance during 1983.

The purposes of this report are as follows:

(1) To provide a summary of 1983 treatment plant performance data for future reference;

(2) To compare plant effluent quality to NPDES permit effluent limitations;

(3) To compare effluent quality to plant program performance goals;

(4) To compare major air emissions to emission standards;

(5) To summarize quantity and quality of sludge production, and methods of sludge treatment and disposal at each plant;

FIGURE 2-1

NUMBER OF TREATMENT PLANTS IN OPERATION

1970 - 1983

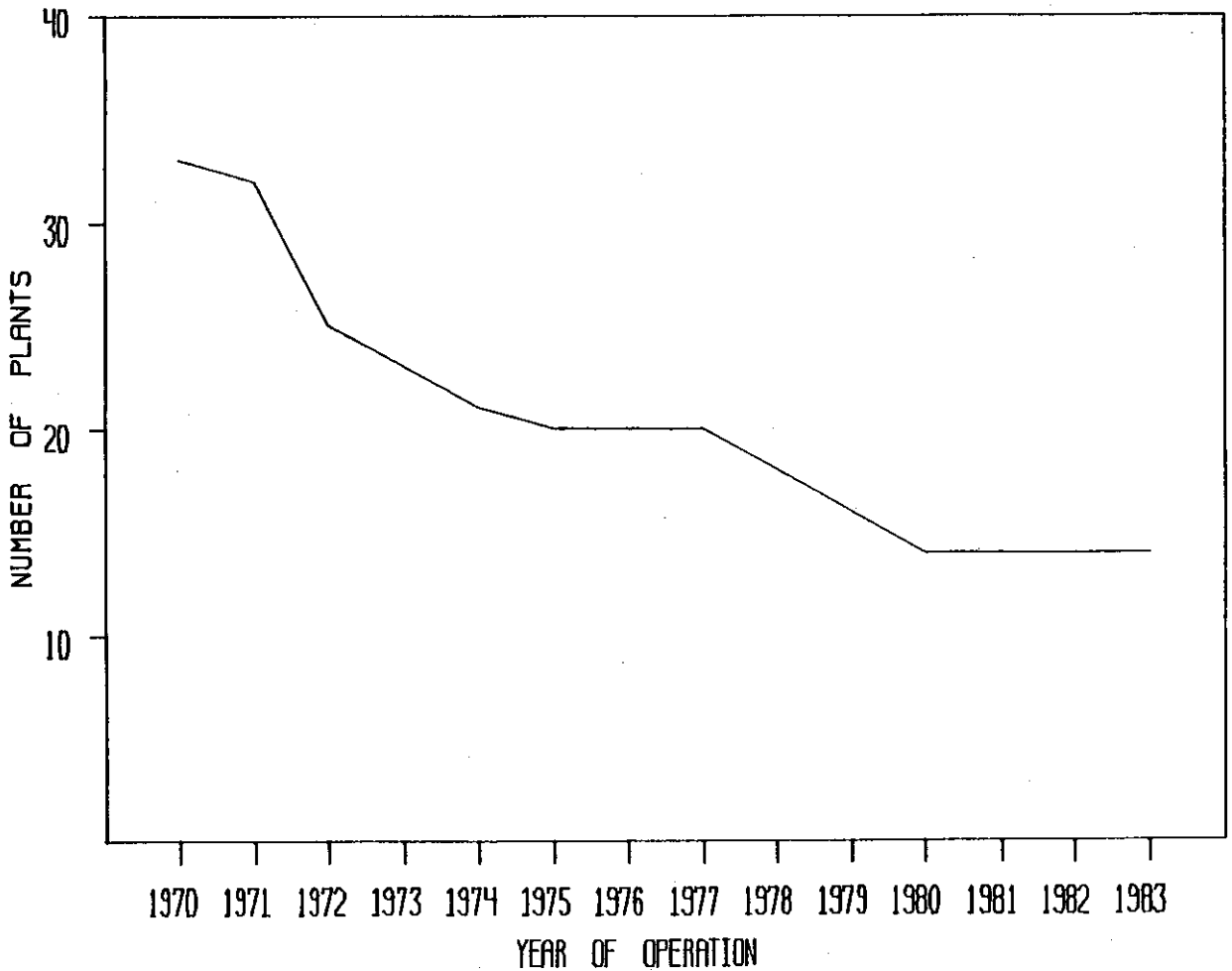


TABLE 2-1

TREATMENT PLANTS IN OPERATION DURING THE PERIOD IN 1970-1983

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
APPLE VALLEY	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXX (Flow diverted to Empire Plant 9/79)				
BAYPORT	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
BLUE LAKE	(Plant Start-up 8/71)XXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
BURNSVILLE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXX (Flow diverted to Blue Lake 9/22/72)											
CHASKA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
CHANHASSEN	XXXXXXXXXXX	XXXXXXXXXXX	X (Flow diverted to Blue Lake Plant 1/10/72)											
COTTAGE GROVE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
EAGAN TOWNSHIP I	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXX (Flow diverted to Seneca Plant, 7/21/72)											
EAGAN TOWNSHIP II	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXX (Flow diverted to Seneca Plant, 7/21/72)											
EMPIRE									(Plant Start up 9/79) XXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
EXCELSIOR	XXXXXXXXXXX	XXXXXXXXXXX	XX (Flow diverted to Blue Lake Plant 2/28/72)											
FARMINGTON	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXX (Flow diverted to Empire Plant 9/79)				
FOREST LAKE TOWNSHIP	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Metropolitan Plant 9/28/72)											
FOREST LAKE VILLAGE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Metropolitan Plant 9/28/72)											
HASTINGS	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
INVER GROVE HEIGHTS	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX (Flow diverted to Metropolitan Plant 11/8/72)											
LAKEVILLE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXX (Flow diverted to Empire Plant 9/79)				
LONG LAKE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Blue Lake Plant 6/80)			
MAPLE PLAIN	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
MEDINA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
METROPOLITAN	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
MOUND	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXX (Flow diverted to Blue Lake Plant 5/74)									
NEWPORT	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Metropolitan Plant 6/11/75)								
OAK PARK HEIGHTS	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXX (Flow diverted to Stillwater Plant 7/11/73)										
ORONO	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Blue Lake Plant 6/80)			
PRIOR LAKE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXX (Flow diverted to Blue Lake Plant 5/78)					
ROSEMOUNT I	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXX (Flow diverted to Rosemount II 11/20/73)										
ROSEMOUNT II			(Plant Start-up 11/73) XX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
ST. PAUL PARK	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXX (Flow diverted to Metropolitan Plant 6/18/75)								
SAVAGE	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
SENECA		(Plant Start-up 7/72) XXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
SHAKOPEE	XXXXXXXXXXX	XXXXXXX (Flow diverted to Blue Lake Plant 7/71)												
SOUTH ST. PAUL	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXX (Flow diverted to Metropolitan Plant 6/24/74)									
STILLWATER	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX
VICTORIA	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXXX	XXXXXXXXXX (Flow diverted to Blue Lake Plant 11/7/73)										
WACONIA							(Plant acquired 11/75) XX	XXXXXXXXXXX	XXXXXXXXXXX	X (Flow diverted to Blue Lake Plant 1/78)				
WAYZATA	XXXXXXXXXXX	XXXXXXXXX (Flow diverted to Blue Lake Plant 10/71)												

(6) To summarize activities related to plant performance at each plant; and

(7) To compare 1983 plant performance data to historical performance data.

This report is divided into seven major sections. Sections 1 and 2 are a summary and introduction, respectively. Section 3 discusses plant effluent quality relative to NPDES effluent limitations and performance goals. Section 4 discusses air emissions from the four major sources at the Metropolitan and Seneca Plants. Section 5 summarizes plant sludge production and sludge quality. Section 6 consists of individual treatment plant reports giving details of plant treatment processes, plant efficiencies, plant loadings, and 1983 activities at each plant. Section 7 is an appendix which presents additional data and data analyses in several forms.

3.0 EFFLUENT QUALITY

3.1 Water Pollution Control Regulations

Current federal regulations on water pollution control are based primarily on the Water Pollution Control Act Ammendments of 1972 (Public Law 92-500), which was passed by Congress in October, 1972. The purpose of the Act was to enhance the quality and value of water resources and to establish a national policy for the prevention, control, and abatement of water pollution. The national goal established by this Act is to make all surface waters, i.e. lakes and rivers, fishable and swimmable.

The federal law has taken an approach to water pollution control regulation that follows two complementary strategies. First, all publicly owned treatment works have been required to comply with technology-based limits on effluent quality, or what is commonly known as secondary treatment. Second, all states are required to establish use classifications for its surface waters, to adopt water quality standards necessary to assure attainment of the designated use, and to require more stringent treatment than secondary treatment when necessary to insure compliance with water quality standards.

As a result, secondary treatment is required as a minimum for all Commission wastewater treatment plants. Certain treatment plants (basically the larger, regional plants) are currently, will be, or may be subject to more stringent effluent limits as water quality standards are revised in the future.

Congress has amended the 1972 Act twice, by the Clean Water Act of 1977, and the Municipal Wastewater Treatment Construction Grant Amendments of 1981. These amendments have recognized the magnitude of the federal water pollution control program and have set a compliance date of July 1, 1988, for publicly owned treatment works to meet secondary treatment limits and, where applicable, water quality related effluent limits. The federal agency which administers the law and regulates dischargers is the U.S. Environmental Protection Agency (EPA).

The corresponding state regulatory agency, the Minnesota Pollution Control Agency (MPCA), has established rules regarding water use classifications and water quality standards, as required by federal law. These rules include the definition of secondary treatment, as presented in Table 3-1.

TABLE 3-1

DEFINITION OF SECONDARY TREATMENT EFFLUENT - 6 MCAR 4.8014-4.8015

Substance or Characteristic	Limiting Concentration or Range	
	30 Day Mean	7 Consecutive Day Mean
5-Day Biochemical Oxygen Demand, mg/L(1)	25	45
Fecal Coliform Group Organisms, Number/100 mL(2)	200	400
Total Suspended Solids, mg/L(1)	30	45
Phosphorus, mg/L(3)	1	---
Turbidity, mg/L(1)	25	---
pH Range(4)	6.5-8.5	---
Unspecified Toxic or Corrosive Substances(5)	---	---

(1) Arithmetic Mean
(2) Geometric Mean; Disinfection required from March 1 through October 31.
(3) In effect where discharge is directly to lake or reservoir.
(4) Not subject to averaging.
(5) None allowed at levels acutely toxic to humans or other animals or plant life.

Where it is evident that the concentration levels specified in Table 3-1 are not effective in preventing pollution, or the specified stream flow is inadequate to protect the applicable water quality standards, effluent standards more stringent than those specified in Table 3-1 may be adopted. As such, specific water quality based effluent limitations have been adopted for the Vermillion River, and are applied to the Empire Plant. These limitations are listed in Table 3-2.

TABLE 3-2

WATER QUALITY BASED EFFLUENT STANDARDS (WPC-41)

Substance or Characteristic	Limiting Concentration or Range
5-Day Biochemical Oxygen Demand, mg/L(1)	10
Fecal Coliform Group Organisms, Number/100 mL(2)	200
Total Suspended Solids, mg/L(1)	10
Phosphorus, mg/L(3)	1
Turbidity, mg/L(1)	25
pH Range(4)	6.5-8.5
Ammonia as Nitrogen, mg/L(1)	1
Dissolved Oxygen, mg/L(1)	4
Unspecified Toxic or Corrosive Substances(5)	---

(1) Arithmetic Mean
(2) Geometric Mean; Disinfection required from March 1 through October 31.
(3) In effect where discharge is directly to lake or reservoir.
(4) Not subject to averaging.
(5) None allowed at levels acutely toxic to humans or other animals or plant life.

During 1974, the National Pollutant Discharge Elimination System (NPDES) was established as the major regulatory tool to be used in implementing the requirements of Public Law 92-500. Under this system, each individual wastewater discharged to state or federal waters is required to have an NPDES permit. The NPDES permit places limitations on the quantity and quality of the wastewater discharge. After establishment of initial policies and procedures, the EPA transferred the responsibility for issuing permits to individual state governments.

3.2 Effluent Limitations

In 1974, all Commission Plants were issued discharge permits by the MPCA. The permits stipulated interim effluent quality standards to be achieved for compliance with permit conditions. Effluent quality standards were determined using water quality standards of the receiving waters and the practicability of a facility to attain certain levels of treatment under existing operating conditions. The interim effluent quality standards established for each plant were the same as, more stringent than, or less stringent than those of secondary treatment. These standards have been revised in the past and will be revised in the future as receiving water quality standards change, and as facilities are upgraded or constructed capable of achieving higher levels of treatment.

The Metropolitan Plant for example, will be required to meet effluent limits more stringent than secondary treatment beginning in 1985, consistent with completion of the secondary treatment expansion at the plant. The current NPDES permit for the Metropolitan Plant expires in 1987, reflecting the five-year duration of most NPDES permits. The next NPDES permit is expected to contain final water quality related effluent limits for the Metropolitan Plant.

Several plants' NPDES permits have expired and need to be reissued by MPCA in the near future. As such, the conditions of these expired permits have been assumed to remain in effect until new NPDES permits are issued by MPCA. Table 3-3 summarizes the NPDES permit effluent limitations for the Commission's 14 treatment plants.

3.3 Plant Performance

During 1983, the Commission's network of treatment plants had available capacity to treat 114 billion gallons of wastewater (312 mgd). The actual volume of wastewater treated during 1983 was approximately 100 billion gallons (275 mgd). Wastewater treated during 1983 represented 88 percent of the Commission's total treatment capacity on an average basis. There was an increase in wastewater volume of 8 billion gallons, or 9 percent, in 1983 over 1982. Much of this increase was caused by extraneous flow, i.e. infiltration and inflow.

Of the 100 billion gallons of wastewater received during 1983, 82 percent was treated at the Commission's largest facility, the Metropolitan Wastewater Treatment Plant. Approximately 14 percent of the total flow was treated by the other three regional treatment plants, Blue Lake, Empire, and Seneca.

During 1983, the Commission's laboratories continued to measure and report both carbonaceous BOD (CBOD) and total BOD (TBOD). Measurement of the CBOD

TABLE 3-3

NPDES EFFLUENT LIMITATIONS - 1983

TREATMENT PLANT (a)	Standards Applicable	5-Day BOD mg/l 7-Day Avg.	5-Day BOD mg/l 30-Day Avg.	TSS, mg/l 7-Day Avg.	TSS, mg/l 30-Day Avg.	Fecal Coliform number/100 ml Geometric Mean(f) 7-Day Mean	Fecal Coliform number/100 ml Geometric Mean(f) 30-Day Mean	Turbidity NTU 7-Day Mean	Phosphorus mg/l 30-Day Mean	Ammonia mg/l 30-Day Mean	Dissolved Oxygen mg/l 30-Day Mean
ANOKA (b)	At All Times	45	25	45	30	400	200	25	---	---	---
BAYPORT	At All Times	45	25	45	30	400	200	25	1.0	---	---
BLUE LAKE	At All Times	45	25	45	30	400	200	25	---	---	---
CHASKA	At All Times	45	25	45	30	400	200	25	---	---	---
COTTAGE GROVE	At All Times	45	25	45	30	400	200	25	---	---	---
EMPIRE	At All Times	--	10	--	10	400	200	25	---	1.0	>4.0
HASTINGS	At All Times	45	25	45	30	400	200	25	---	---	---
MAPLE PLAIN	At All Times	--	25	--	30	---	200	--	---	---	---
MEDINA(c)	At All Times	45	25	45	30	400	200	--	---	---	---
METROPOLITAN(d)	At All Times	44	24	45	30	400	200	--	---	---	7.0(e)
ROSEMOUNT	At All Times	45	25	45	30	400	200	25	1.0	---	---
SAVAGE	At All Times	45	25	45	30	400	200	25	---	---	---
SENECA	At All Times	45	25	45	30	400	200	25	---	---	
STILLWATER	At All Times	45	25	45	30	400	200	25	1.0	---	---

(a) General Requirements for Essentially All Plants:
1) The pH shall not be less than 6.5 nor greater than 8.5. These upper and lower limitations are not subject to averaging and shall be met at all times.
2) There shall be no discharging of floating solids or visible foam in other than trace amounts.
3) The discharge shall not contain oil or other substances in amounts sufficient to create a visible color or film.

(b) Additional 30-day mean permit standards for Anoka: chromium - 0.4 mg/l; copper - 0.3 mg/l; lead - 0.5 mg/l; zinc - 0.5 mg/l; cyanide - 0.5 mg/l.

(c) Applies only when Medina Plant discharges from absorption ponds - Must be authorized by MPCA.

(d) Additional 30-day median permit standards for the Metropolitan Plant: copper - 0.14 mg/l; cadmium - 0.03 mg/l; mercury - 4.0 ug/l; cyanide - 0.193 mg/l.

(e) Dissolved oxygen limitation of 7 mg/L for river flows less than 7,000 cfs and river D.O. values less than 6.0 mg/l upstream or less than 5.5 mg/L downstream for two consecutive sample-days, during the period June through September.

(f) Disinfection required from March 1 through October 31 except for the Anoka Plant where disinfection is required year round.

eliminates misleading test results which are sometimes affected by nitrification occurring in the TBOD test. Nitrification is an oxygen consuming process and, therefore, tends to increase the BOD value. Comments made regarding 1983 treatment plant performance, for the most part, draw upon CBOD data and should be viewed with consideration for the fact that there are differences between the test procedures. TBOD and CBOD effluent data are tabulated for each plant in Section 6 of this report. The EPA and MPCA are presently in the process of revising their regulations to effectively replace TBOD with CBOD as the official measurement for organic strength of effluents.

Figure 1-1, located in the first section of the report, illustrates the trend in NPDES compliance for the years 1971 through 1983, for both the Metropolitan Plant and other plants. It can be seen from Figure 1-1, that excellent plant performance continued during 1983 and that effluent CBOD and TSS have been significantly reduced in 1983 for the Metropolitan Plant and the other plants. The annual average effluent concentration (CBOD and TSS) has been below permissible NPDES discharge limits for the Metropolitan Plant during the past four years, while the annual average effluent concentration (CBOD and TSS) for all other plants has been consistently below permissible NPDES discharge limits since 1975.

During 1983, the Metropolitan Plant, effluent quality showed a slight improvement over the already good performance during 1982. Average effluent CBOD and TSS concentrations during 1983 were 10 mg/l and 9 mg/l, respectively as compared to 1982 average effluent CBOD and TSS values of 13 mg/l and 11 mg/l, respectively. Removal efficiencies for CBOD and TSS were 94 percent and 95 percent, respectively. This is approximately the same removal efficiency as that achieved during 1982. The Metropolitan Plant effluent quality, as expressed in CBOD and TSS, has reached a level that is difficult to surpass with a conventional secondary treatment facility.

Effluent quality for plants other than the Metropolitan Plant also improved slightly during 1983. Annual average effluent CBOD and TSS concentrations during 1983 were 10 mg/l and 10 mg/l respectively, as compared to 1982 annual average CBOD and TSS values of 12 mg/l and 10 mg/l, respectively. The annual average CBOD removal efficiency for all plants increased from 93 percent in 1982 to 94 percent in 1983, and the TSS removal efficiency remained constant at 95 percent in 1982 and 1983.

Annual performance and monthly variations in performance, at each treatment plant, are summarized in Table 3-4. Plant flow and major effluent quality parameters are included in the summary.

Nominal design flow for each plant is included in each NPDES permit, and is listed in Table 3-4. When relating current plant operation to plant capacity, it is normal practice to compare average annual flow to nominal design flow. However, this practice is often deceiving. To obtain an accurate indicator of plant capacity, nominal design flow must be adjusted to reflect unique flow variation factors, organic loading, organic load variation, and individual process capacities. These flow and loading variations can vary from year to year, depending on changes in infiltration/inflow and activities of local industries.

TABLE 3-4

SUMMARY OF PLANT PERFORMANCE
1983

Treatment Plant	Permit Limitation		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Avg.
	Flow	2.46	2.07	2.20	2.38	2.48	2.33	2.43	2.41	2.44	2.34	2.28	2.29	2.26	2.33
	CBOD	25	7	8	10	12	10	12	17	11	11	14	11	10	11
Anoka	TSS	30	7	8	11	11	7	11	12	11	13	10	10	10	10
	Flow	0.65	0.51	0.51	0.63	0.66	0.62	0.64	0.58	0.54	0.51	0.50	0.29	0.48	0.54
	CBOD	25	8	5	5	6	7	5	6	7	4	5	4	5	6
Bayport	TSS	30	9	7	7	6	6	4	4	7	5	5	7	5	6
	Flow	20.0	15.7	16.2	23.1	24.2	19.5	18.7	15.9	17.7	16.5	16.6	16.4	16.8	18.1
	CBOD	25	11	13	11	8	11	7	8	8	7	6	7	7	9
Blue Lake	TSS	30	8	5	7	10	6	7	10	7	7	9	7	8	7
	Flow	1.40	0.72	0.82	1.38	1.78	1.40	1.06	1.17	0.81	0.82	0.72	0.79	0.80	1.02
	CBOD	25	10	23	12	16	12	10	11	7	6	8	10	16	11
Chaska	TSS	30	10	17	18	14	5	10	6	5	6	9	16	16	11
	Flow	1.80	1.31	1.30	1.32	1.30	1.35	1.37	1.32	1.28	1.27	1.27	1.30	1.19	1.30
	CBOD	25	9	11	9	11	12	9	10	7	5	6	7	11	9
Cottage Grove	TSS	30	9	8	11	16	12	11	15	7	8	7	11	14	11
	Flow	6.00	3.36	4.04	4.96	6.19	6.57	5.84	5.09	4.45	4.31	4.17	4.27	4.50	4.81
	CBOD	10	6	2	2	2	3	3	3	3	2	2	1	2	3
Empire	TSS	10	2	1	1	1	1	2	1	1	1	1	1	1	1
	Flow	1.83	1.46	1.59	1.64	1.74	1.75	1.67	1.58	1.73	1.75	1.71	1.62	1.62	1.65
	CBOD	25	16	24	19	21	22	15	18	11	11	12	12	14	16
Hastings	TSS	30	34	32	32	36	27	18	14	10	12	20	22	26	23
	Flow	0.22	0.28	0.32	0.59	0.75	0.38	0.32	0.32	0.23	0.22	0.27	0.26	0.25	0.35
	CBOD	25	17	8	13	16	12	10	8	6	5	7	5	3	9
Maple Plain	TSS	30	11	5	8	8	10	15	10	5	7	9	11	9	9
	Flow	0.10	0.087	0.107	0.247	0.249	0.200	0.175	0.189	0.172	0.193	0.198	0.164	0.182	0.181
	CBOD	25*	16	10	9	14	13	13	12	8	5	7	7	7	10
Medina	TSS	30*	12	11	12	23	10	17	36	10	6	6	13	18	14
	Flow	250	175	184	246	285	246	251	252	242	233	201	195	192	225
	CBOD	24	10	10	10	18	15	11	8	9	8	7	9	7	10
Metropolitan	TSS	30	8	9	13	18	16	9	6	7	5	7	6	5	9
	Flow	0.60	0.32	0.36	0.38	0.32	0.33	0.33	0.31	0.32	0.38	0.37	0.34	0.35	0.34
	CBOD	25	20	15	17	20	30	14	8	11	14	13	17	16	16
Rosemount	TSS	30	2	2	2	2	3	1	2	1	1	1	3	2	2
	Flow	0.86	0.50	0.51	0.71	0.86	0.87	0.73	0.60	0.49	0.48	0.44	0.45	0.48	0.59
	CBOD	25	7	6	7	10	12	10	9	9	6	4	5	6	8
Savage	TSS	30	1	1	3	2	2	6	3	6	1	2	1	2	3
	Flow	24.0	15.5	15.2	13.7	12.8	16.9	17.2	16.9	16.8	16.7	16.2	16.9	15.4	15.8
	CBOD	25	18	17	18	10	21	10	11	12	11	10	15	18	14
Seneca	TSS	30	24	22	22	11	22	10	8	14	12	13	24	30	18
	Flow	3.02	2.57	2.63	3.25	3.45	3.14	2.90	2.97	2.70	2.64	2.65	2.58	2.60	2.84
	CBOD	25	9	7	7	10	14	12	16	13	11	7	7	9	10
Stillwater	TSS	30	9	7	9	12	15	10	10	14	19	20	9	10	12

*Only at time of discharge.

It is not within the scope of this report to analyze and define, in detail, realistic current plant capacities. Treatment plant capacities will be evaluated on an ongoing basis and periodically summarized in separate reports. However, the following summary of realistic capacity versus nominal design capacity of several plants is necessary in order to understand subsequent discussions of plant performance in 1983.

Anoka: Current plant capacity has been determined to be slightly less than design (2.46 mgd), due to existing activated sludge aeration and raw sewage pumping limitations.

Bayport: Plant capacity is somewhat less than design capacity (0.65 mgd), due to chemical feed which was added for phosphorus removal subsequent to the original plant construction. This addition has reduced activated sludge aeration and sludge processing capabilities.

Chaska: Plant capacity is somewhat less than design capacity (1.4 mgd) due to high inflow/infiltration, and high and variable organic loadings, which stress the activated sludge oxygenation capacity.

Hastings: Current plant capacity has been determined to be approximately 1.44 mgd (instead of 1.83 mgd), due to final clarification and sludge processing limitations.

Rosemount: Plant capacity is somewhat less than design capacity (0.60 mgd), due to increasing maintenance requirements. As the plant ages, one process train cannot handle peak flow at the rated design capacity.

Stillwater: Plant capacity is somewhat less than design capacity (3.02 mgd), due to the addition of a phosphorus removal system. This addition has reduced activated sludge aeration and sludge processing capabilities.

Annual average flow data included in Table 3-4 indicates that Maple Plain and Medina are currently operating beyond their design capacity. Based on realistic plant capacities discussed above, Anoka, Bayport, Chaska, Hastings, Rosemount, and Stillwater are also currently operating at or near plant capacity.

Table 3-5 is a complete summary of NPDES permit violations which occurred in 1983. Violations of weekly and monthly mass limitations on CBOD and TSS, not shown in Table 3-3, are included in Table 3-5. Also shown are pH, ammonia, cyanide, metals, and fecal coliform violations. A total of 20 violations occurred in 1983, ranging from seven at Hastings to none at Bayport, Empire, Maple Plain, Metropolitan, Savage, and Stillwater. A maximum of six violations occurred in April, while no violations occurred in June or December.

The distribution of violations among effluent parameters and major problem areas are presented in Table 3-6. As shown in Table 3-6, most of the violations occurred in the first part of the year, which generally reflects the seasonally oriented capacity problems at the Hastings and Medina treatment plants.

TABLE 3-5

SUMMARY OF NPDES PERMIT NON-COMPLIANCE IN 1983

TREATMENT PLANT	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL NUMBER
ANOKA								DCn			WFC		2
BAYPORT													0
BLUE LAKE							WFC						1
CHASKA		WB											1
COTTAGE GROVE									WFC				1
EMPIRE													0
HASTINGS	MS	MS	MS, WS	MS,WFC							pH		7
MAPLE PLAIN													0
MEDINA				WS, $\overline{MS}$ WFC,$\overline{WS}$									4
METROPOLITAN													0
ROSEMOUNT	pH				MB, WB								3
SAVAGE													0
SENECA										WFC			1
STILLWATER													0
TOTALS	2	2	2	6	2	0	1	1	1	1	2	0	20

Symbols: MB,WB= Monthly and Weekly CBOD Conc; MS,WS= Monthly and Weekly TSS Conc; $\overline{MB}$,$\overline{WB}$,$\overline{MS}$,$\overline{WS}$= Mass Limits; MFC,WFC= Monthly and Weekly Fecal Coliform; pH; MP= Monthly Phosphorus Conc; $\overline{MP}$= Mass Limit; T-Turbidity; MAm= Monthly NH_3-N; MDO= Monthly Dissolved Oxygen; MCN,DCN= Monthly and Daily Cyanide; MCu,DCu= Monthly and Daily Copper; MCr,DCr= Monthly and Daily Chromium; MPb, DPb= Monthly and Daily Lead; MZn,DZn= Monthly and Daily Zinc.

TABLE 3-6

NPDES PERMIT VIOLATION DISTRIBUTION
1983

Distribution of Violations Among Effluent Parameters

EFFLUENT PARAMETER	NUMBER OF VIOLATIONS 1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	TOTAL
CBOD	1	2	0	0	3
TSS	4	4	0	0	8
FECAL COLIFORM	0	2	2	2	6
pH	1	0	0	1	2
AMMONIA	0	0	0	0	0
CYANIDE	0	0	1	0	1
HEAVY METALS	0	0	0	0	0
TOTAL	6	8	3	3	20

Distribution of Violations Among Problem Areas

PROBLEM AREA	NUMBER OF VIOLATIONS 1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	TOTAL
PROCESS CONTROL	1	1	1	2	5
MAINTENANCE	0	1	1	1	3
INDUSTRIAL WASTES	1	1	1	0	3
PLANT CAPACITY	4	5	0	0	9
TOTAL	6	8	3	3	20

Plant capacity problems accounted for five TSS violations at Hastings and three TSS violations and one fecal coliform violation at Medina. The weekly CBOD violations at Chaska and Rosemount and the daily cyanide violation at Anoka are directly attributable to process overloading from industrial wastes. Maintenance problems contributed to the monthly CBOD violation at Rosemount and the weekly fecal coliform violations at Anoka and Cottage Grove. The pH violations at Hastings and Rosemount and the weekly fecal coliform violation at Hastings, Seneca, and Blue Lake were due to process control problems.

The decrease in violations from 1982 to 1983 can be attributed to decreased number of problems related to plant capacity. This improvement was achieved primarily by a combination of improved industrial pretreatment and improved process control at the Hastings Plant. The Hastings Plant is currently being expanded, so that plant capacity limitations should be eliminated sometime during 1985. The other current plant capacity problem will be eliminated by the scheduled phase out of the Medina Plant in 1985.

The effluent limitation violations caused by process control, maintenance, and industrial waste problems have remained fairly stable during 1982 and 1983. These problems account for an average of one violation per month, or one violation per treatment plant per year as an average for Commission treatment facilities.

The following is a plant-by-plant summary of non-compliance problems during 1983.

Anoka: The Anoka Plant had one daily cyanide violation and one weekly fecal coliform violation. The daily cyanide violation was caused by temporary industrial waste overloading from one local industry. The weekly fecal coliform violation was caused by reduced chlorination efficiency during a short period when the chlorine mixer was out of service for maintenance. Chlorine dosage was being minimized at the time in an attempt to minimize effluent residual chlorine concentrations. The problem is being resolved by adding an alarm and checking the mixer more frequently.

Blue Lake: The Blue Lake Plant had one weekly fecal coliform violation. The apparent cause of the violation was effluent quality variation that resulted in an increased chlorine demand, for which normal process control procedures proved to be inadequate.

Chaska: The Chaska Plant had one weekly CBOD violation. The cause was industrial waste overloading of the activated sludge oxygenation capacity.

Cottage Grove: The Cottage Grove Plant had one weekly fecal coliform violation. The cause was a partially plugged chlorine gas line that reduced the effective disinfection capacity. Additional preventive maintenance procedures have been initiated to prevent recurrence of this problem.

Hastings: The Hastings Plant had four monthly TSS violations, one weekly TSS violation, one weekly fecal coliform violation, and one daily pH violation. The TSS violations were caused by the plant having to operate at flows and loads beyond its effective capacity. A plant expansion is under construction which should prevent recurrence of this problem. The pH violation may have been related to an improperly calibrated pH meter.

Medina: The Medina Plant had a weekly TSS, monthly TSS, weekly TSS mass, and weekly fecal coliform violation. All four violations related to the spring discharge, which was necessary because the plant is operating beyonds its seepage capacity. The plant will be phased out in 1985.

Rosemount: The Rosemount Plant had one weekly CBOD, one monthly CBOD, and one daily pH violation. The weekly CBOD violation was due to high industrial waste organic loadings to the plant. This occurrence coincided with the end of an activated carbon cycle, i.e. the carbon needed regeneration. The pH violation may have been related to an improperly calibrated pH meter.

Seneca: The Seneca Plant had one weekly fecal coliform violation. This violation was caused by incorrect valve adjustments on the chlorine solution line. Closer checks on valve positions are now being made.

The following comments of 1983 treatment plant performance are also significant:

1. The Metropolitan Plant has met secondary treatment limitations during the past four years. Effluent quality during 1983 was consistently below the limitations of 24 mg/L CBOD and 30 mg/L TSS.

2. The Metropolitan Plant had no significant bypasses during 1983. Only 0.004% of wastewater which received primary treatment and no chlorination was bypassed. Improved effluent quality has been achieved despite the burden posed by the larger volume of combined sewage treated. This has been made possible by the near completion of the plant expansion program, which has effectively reduced the volume of combined sewer overflows to the Mississippi River.

3. Commission treatment facilities are performing as well as can be expected for the type of facilities available. Plant performance has stabilized at an excellent level during 1982 and 1983, and should continue at approximately the same level during 1984. However, performance at some plants may deteriorate as plant capacity is approached or exceeded, or as equipment reaches the end of its useful life and becomes subject to more frequent equipment failures.

4. Treatment plants which currently are operating beyond design or realistic plant capacity include Hastings, Maple Plain, and Medina. Hastings is currently being expanded with completion scheduled for late 1985. Maple Plain has been tentatively scheduled for phaseout by interceptor construction to the Blue Lake Plant interceptor system. Completion of the interceptor should occur in 1987. Medina is scheduled for phaseout in 1985 by construction of an interceptor to the Metropolitan Plant interceptor system.

3.4 Program Goals

Initially developed in 1976, the Commission continues to utilize a criteria which rapidly assesses plant performance. The assessment is made in terms of four parameters: Compliance (C) Frequency (F), Severity, (S), and Noncompliance Index (NCI).

Compliance (C) is the percentage compliance with NPDES effluent limitations as listed in each plant's NPDES permit. The nearer the compliance number is to 100 percent, the better the plant performance.

Frequency (F) is the frequency of compliance with NPDES effluent limitations. It is calculated by dividing the total number of CBOD and TSS analyses complying with effluent standards by the total number of CBOD and TSS analyses performed and expressing the result as a percentage. The nearer the frequency number is to 100 percent, the better the plant performance as related to effluent quality standards.

Severity (S) is the deviation from the standard for those CBOD and TSS analyses which exceed NPDES effluent limitations. It is determined by locating the median value of those values exceeding the standards and expressing the deviation as a percentage of the NPDES limit. The larger the severity number, the greater the magnitude of violation of effluent standards.

In judging the performance of plants, both frequency and severity must be considered; therefore, noncompliance index was developed to allow a rapid, single-number assessment of plant performance. The noncompliance index is determined by multiplying the percent severity by the noncompliance (100-frequency) and by dividing by 100. A low noncompliance index indicates better overall compliance with effluent quality standards.

Performance objectives in terms of compliance, frequency, and severity were defined for each individual treatment plant at the beginning of 1983. A summary of 1983 goals and actual performance at each plant is provided in Table 3-7. All 14 plants met their compliance goals, 13 plants met their frequency goals and 11 plants met their severity goals. Individual goal attainment is summarized as follows:

All Goals	Two Goals
Anoka	Chaska (C, F)*
Bayport**	Empire (C, F)*
Blue Lake	Rosemount (C, F)*
Cottage Grove	Seneca (C, F)*
Hastings	
Maple Plain	
Medina	
Metropolitan	
Savage**	
Stillwater	

* Letter in parenthesis indicates goals met.
**These plants had a perfect record of 100% compliance, 100% frequency, and no severity.

TABLE 3-7

SUMMARY OF TREATMENT PLANT PERFORMANCE PARAMETERS

Compliance, Frequency, Severity, and Noncompliance Index Values for 1980-1983

Treatment Plant	Compliance					Frequency					Severity					Noncompliance Index				
	Actual 1980	Actual 1981	Actual 1982	Goal 1983	Actual 1983	Actual 1980	Actual 1981	Actual 1982	Goal 1983	Actual 1983	Actual 1980	Actual 1981	Actual 1982	Goal 1983	Actual 1983	Actual 1980	Actual 1981	Actual 1982	Goal 1983	Actual 1983
Anoka	97	97	99	97	99	97	94	98	93	99	10	16	4	33	8	0.3	1.0	0.1	2.3	0.1
Bayport	100	100	100	98	100	99	100	100	93	100	13	0	0	33	0	0.1	0.0	0.0	2.3	0.0
Blue Lake	100	100	100	99	99	99	97	100	95	99	36	40	0	33	4	0.4	1.2	0.0	1.6	0.1
Chaska	96	98	99	98	99	90	89	96	93	95	52	32	24	33	60	5.2	3.5	0.9	2.3	2.7
Cottage Grove	99	96	99	97	99	99	97	99	93	100	75	32	36	35	0	0.8	1.0	0.4	2.4	0.0
Empire	99	100	98	97	100	99	99	99	95	99	30	30	80	25	40	0.3	0.3	0.3	1.2	0.2
Hastings	97	94	87	95	95	79	80	64	80	81	24	24	37	33	23	5.0	4.8	13.1	6.6	4.4
Maple Plain	95	99	96	95	100	80	94	93	85	99	20	37	12	45	16	4.0	2.2	0.8	6.8	0.2
Medina	100	83	100	92	92	72	74	90	70	96	20	60	32	50	42	5.6	15.6	3.3	15.0	11.7
Metropolitan	96	89	100	97	100	81	81	93	90	97	40	40	36	40	13	7.6	7.6	2.5	4.0	0.4
Rosemount	99	100	99	98	98	98	97	97	95	96	56	48	36	25	28	1.1	1.4	1.0	1.2	1.2
Savage	100	100	99	98	100	99	98	97	93	100	13	36	43	33	0	0.1	0.7	1.1	2.3	0.0
Seneca	100	99	90	97	99	95	91	94	93	92	16	27	16	33	17	0.8	2.4	0.9	2.3	1.3
Stillwater	99	99	100	98	100	96	90	99	93	98	42	32	37	33	24	1.7	3.2	0.2	1.6	0.4
Average	98	98	98	97	99	92	92	94	90	96	32	32	28	35	19	2.4	2.8	1.6	3.4	0.7

4.0 INCINERATOR EMISSION QUALITY

Sludge generated at Commission Treatment Plants is handled either by land application or incineration and ash disposal. Most of the sludge generated by Commission treatment plants receives final processing and disposal at the Metropolitan or Seneca Plant. These two plants primarily use incineration and ash landfilling for sludge management. During 1983, the Metropolitan Plant was in the startup and adjustment stage on Incinerator Nos. 5-10 in the new Solids Processing Building.

The incineration process produces exhaust gas, which discharges to the atmosphere through stacks and is subject to air emissions limitations. The purpose of these limitations is to prevent deterioration of existing ambient air quality. Incinerator emission limitations or standards are contained in MPCA's Air Quality Rules and Regulations.

4.1 Emission Standards

APC-9 of MPCA's Air Quality Rules and Regulations deals with the control of odors by limiting odor emission rates from defined odor sources and by establishing odor standards for ambient air based upon local zoning.

Odor standards are expressed as odor concentration units. The odor concentration unit is defined as the number of standard cubic feet of odor free air needed to dilute each cubic foot of contaminated air to a point where at least 50 percent of the individuals comprising the odor test panel do not detect an odor in the diluted mixture.

An odor source, as defined in APC-9 includes but is not limited to, any stack, chimney, vent, window, opening, lagoon, basin, pond, open tank, or any organic or inorganic discharge and/or application which emits odorous gas, gases, or particulates.

The odor emission rate is the product of the number of standard cubic feet per minute of air or other gases emitted from a suspected odor pollution source, and the number of odor concentration units determined for that source.

The following odor limitations are contained in APC-9:

1. Sources emitting odors from well defined stacks, 50 feet or more above grade elevation, with adequate dispersion characteristics, as determined by the MPCA, shall not emit odors greater than 150 odor concentration units.

2. Sources, emitting odors, of less than 50 feet elevation above grade or otherwise failing to create good dispersion conditions, as determined by the MPCA, shall not emit more than 25 odor concentration units.

3. No odor source shall have an odor emission rate in excess of 1,000,000 odor concentration units per minute.

Air emissions standards on particulate matter and opacity (visual emissions) for new and exisiting sewage sludge incinerators are set in APC 28 of the MPCA Rules. The Metropolitan Plant Incinerator Nos. 1-4 (F & I No. 1) are classified as existing sludge incinerators, as are Seneca Plant Incinerator Nos. 1 and 2. The Metropolitan Plant Incinerator Nos. 5-10 (Solids Processing Building) are classified as new sludge incinerators. The Metropolitan Plant scum incinerator has air emission standards set in APC 7 of the MPCA Rules, which covers air emissions from various types of solid waste incinerators. These standards are the same standards as those set for existing sludge incinerators in APC 28. These standards are summarized in Table 4-1.

TABLE 4-1

EMISSION STANDARDS FOR EXISTING SEWAGE SLUDGE INCINERATOR, APC-28 AND FOR SOLID WASTE INCINERATORS, APC-7

Incinerator Burning Capacity (lb/hour)[2]	Particulate Emission Standard grain/dscf corrected to 12% CO2	Percent Opacity	
		Average	Maximum[1]
<200	0.3	20	40
200-2000	0.2	20	40
>2000	0.1	20	40

[1] A maximum of 40 percent is permissible for four minutes in any 60 minute period.

[2] Burning capacity is defined as the manufacturer's or designer's maximum rate, or such other rate that is considered good engineering practice.

The particulate emission limitations for new sludge incinerators is 1.3 lb. particulate per ton of dry sludge solids fed to the incinerator. The opacity limitation is 20% or less at all times.

APC 31, of MPCA's Air Quality Rules and Regulations, sets standards for mercury emissions. This regulation states that no owner or operator of a sludge incineration and drying plant shall cause to be discharged into the atmosphere from such plant more than 3,200 grams of mercury per 24 hour period.

Table 4-2 summarizes the applicable air emissions standards for the Commission's incineration facilities.

TABLE 4-2

SUMMARY OF AIR EMISSION STANDARDS FOR COMMISSION INCINERATORS

Air Emission Standard	Metropolitan Plant** F & I No. 1 Sludge Incin. Nos. 1-4	Metropolitan Plant** Solids Processing Building Sludge Inc. Nos. 5-10	Metropolitan Plant** Scum Incin.	Seneca Sludge Incin.
Particulate Matter				
grain/dscf @ 12% CO_2	0.1	---	0.2	0.2
lb./ton sludge solids	---	1.3	---	---
Opacity, percent	20*	20	20*	20*
Odors, Odor Concentration Units (O.C.U.)	25	150	25	150
Odor Emission rate, odor concentration units/min. (O.C.U./min.)	1,000,000	1,000,000	1,000,000	1,000,000
Mercury Emissions grams/24 hr. period	3,200	3,200	---	3,200

* A maximum of 40 percent opacity is permissible for four minutes in any 60 minute period.
**Figure 4-1 illustrates the stack identification number for each corresponding incinerator.

4.2 Summary of 1983 Air Emissions Monitoring

During 1983, stack gases from incinerators at the Metropolitan and Seneca Plants were sampled and analyzed for particulate matter, opacity, and mercury. During this time, the new sludge incineration facilities (incinerators Nos. 5-10) at the Metropolitan Plant were in the startup and adjustment stage while existing incineration facilities (incinerator Nos. 1-4) were shutdown. As such, limited testing was conducted at the Metropolitan Plant during 1983.

Opacity testing conducted at the Metropolitan Plant during 1983, is summarized in Table 4-3. Table 4-4 presents a summary of opacity testing conducted at the Seneca Plant during 1983. At the Seneca Plant, the percentage of opacity tests which have met standards has increased from 40 percent in 1978 to 85 percent in 1983.

TABLE 4-3

SUMMARY OF OPACITY MEASUREMENTS
METROPOLITAN PLANT

	Incinerator No.									
	1	2	3	4	5	6	7	8	9	10
Total Test Measurements	*	*	*	*	2	2	2	2	2	1
Number of Tests Meeting Stds.	*	*	*	*	1	2	2	2	2	1
Number of Tests Exceeding Stds.	*	*	*	*	1	0	0	0	0	0
Percent of Tests Meeting Stds.	*	*	*	*	50	100	100	100	100	100
Average Opacity, %	*	*	*	*	45	12	<5	5	<5	<5

*Incinerator taken out of operation, October 1982.

METROPOLITAN WASTEWATER TREATMENT PLANT
LOCATION OF EMISSION SOURCES

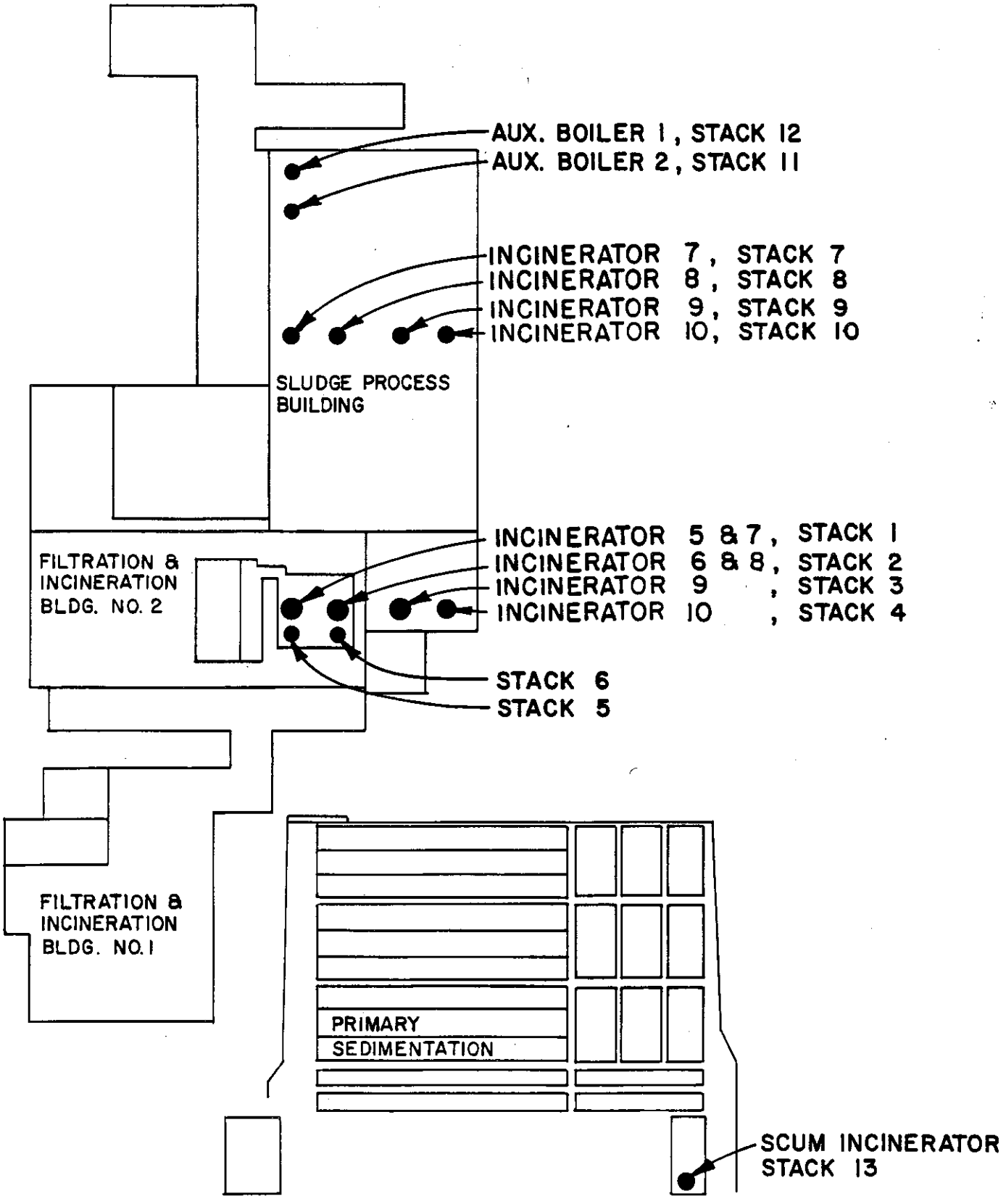


TABLE 4-4

SUMMARY OF OPACITY MEASUREMENTS
SENECA PLANT
1983

Month	Date	Percent Opacity
January	14	5
February	15	6
March	3	29
	10	9
	14	13
	24	7
	29	7
April	--	--
May	2	5
	9	5
	20	8
	26	4
	31	14
June	6	7
	17	14
	22	16
July	1	34
	6	14
	12	9
	22	12
	26	9
August	8	13(a)
	11	14
	16	18
	24	11
	30	6
September	9	10
	16	6
	23	6
	28	16
October	7	17
	13	14
	18	30
	27	5
November	17	7
	20	9
	21	57
December	2	7
	6	10
	15	6
	28	23
Total Test Measurements		40
Number of Tests Passing Std.		34
Number of Tests Failing Std.		6
Percent of Tests Passing Std.		85

(a)Exceed 40 percent opacity longer than 4 minutes in 60 minute period - Fails to meet APC 28 Limits.

Table 4-5 summarizes results of particulate testing conducted at the Metropolitan and Seneca Plants during 1983. Annual average particulate emission from the Scum Incinerator at the Metropolitan Plant was 0.248 grain/dscf. Annual average particulate emissions from the Solids Processing Building (incinerators No. 5-10) was 0.74 lbs/dry ton of sludge solids. Annual average particulate emission at the Seneca Plant was 0.033 grain/dscf.

Test results from odor monitoring of incinerator stack discharge at the Metropolitan Plant are presented in Table 4-6. Odor monitoring of incinerator stack discharge was not conducted at the Seneca Plant during 1983. Table 4-6 shows that, in most cases, the Metropolitan Plant was in compliance with MPCA's odor unit concentration standard for stack discharge, but failed to meet MPCA's standard for odor unit emission rate.

Mercury emission testing conducted during 1983 show that both the Metropolitan and Seneca Plants met standards set forth in APC 31. Annual average mercury emissions were 74 g/24 hr. at the Seneca Plant and 827 g/24 hr. at the Metropolitan Plant.

TABLE 4-5

SUMMARY OF 1983 PARTICULATE TESTING
METROPOLITAN AND SENECA PLANTS

A. Metropolitan Plant, Scum Incineration

Date	Stack ID	Burning Rate % of Design Capacity	Stack Gas Flow Rate, SCFM	Particulate[1] grain/dscf at 12% CO2
1/16	Scrubber Stack	--	2,750	0.179
1/21	Scrubber Stack	--	5,394	0.316
	Average	--	4,072	0.248

B. Metropolitan Plant, Solids Processing Building

Date	Stack ID	Burning Rate % of Design Capacity	Stack Gas Flow Rate, SCFM	Particulate[2] lbs/dry ton solids
3/22	8	100	22,680	0.58
3/28	8	100	20,700	0.30
4/20	1	81	16,464	1.90
5/23	9	100	20,500	0.56
6/6	10	100	18,900	0.48
6/16	7	100	24,200	0.80
7/11	2	100	17,900	0.85
7/14	1	100	16,900	0.68
10/28	9	77	18,800	0.79
11/9	10	78	15,000	0.48
	Average	94	19,204	0.74

C. Seneca Plant, Solids Processing Building

Date	Stack ID	Burning Rate % of Design Capacity	Stack Gas Flow Rate, SCFM	Particulate[3] grain/dscf at 12% CO2
10/14	Common	62	11,525	0.0435
11/15	Common	50	12,266	0.0255
12/1	Common	79	12,269	0.0288
12/6	Common	87	13,000	0.0343
	Average	70	12,265	0.0330

(1)MPCA Standard for Scum Incinerator = 0.2 g/dscf
(2)MPCA Standard for Metro Plant New Incinerators = 1.3 lbs particulate/ton dry solids
(3)MPCA Standard for Seneca Plant Incinerators = 0.2 g/dscf

TABLE 4-6

ODOR MONITORING RESULTS OF INCINERATOR STACK DISCHARGE
1983

Plant	Date	Stack ID	Stack Gas Odor[1] Concentration, O.C.U.	Stack Odor Emission[2] Rate, O.C.U./Min.
Metropolitan	3/28	8	91	1,900,000
	5/23	9	113	2,300,000
	6/6	10	150	2,800,000
	6/16	7	65	1,600,000
	7/11	2	59	1,000,000
	7/14	1	70	1,200,000
	10/19	8	200	4,536,000
	10/19	9	223	4,200,000
	10/19	8	123	2,790,000

[1]MPCA Standard for Metropolitan Plant = 150 O.C.U.

[2]MPCA Standard = 1,000,000 O.C.U./Min.

5.0 SLUDGE MANAGEMENT

Each of the Commission's treatment plants produce sludge as a result of wastewater treatment. At Medina, sludge settles and decomposes in treatment ponds, and removal of this sludge has not been required. At all other plants, sludge treatment may include thickening, stabilization, conditioning, and dewatering. Final disposal of sludge is accomplished either by landspreading or incineration and ash landfilling.

5.1 Sludge Processing

Table 5-1 is a summary of sludge processing and disposal methods utilized at Commission Plants. As shown in Table 5-1, most plants provide sludge thickening in either primary tanks or independent thickener units. At the Metropolitan and Seneca Plants, gravity thickening is provided for primary sludge, while air flotation thickening is provided for secondary (waste activated) sludge. At the Empire and Cottage Grove Plants, gravity thickening is provided for combined primary and secondary sludge.

Most of the smaller outlying plants provide sludge digestion to reduce and stabilize sludge solids. One exception is the Rosemount Plant, where sludge produced by physical-chemical treatment of wastewater is concentrated and transported to the Metropolitan Plant for disposal.

Changes in sludge conditioning and dewatering at the Metropolitan and Seneca Plants are noted in Table 5-1. Roll and filter presses are now used for dewatering sludge at the Metropolitan Plant, replacing the aging vacuum filters in F & I No. 1. The presses rely on polymer conditioning, rather than lime and ferric chloride, as was used for the vacuum filters. It is also possible to dewater a blend of primary and thermally conditioned sludge with the new roll presses. The presses produce a drier sludge cake than vacuum filters, which reduces and nearly eliminates auxiliary fuel use in the sludge incineration process. This sludge processing approach is part of the overall concept of energy recovery and energy conservation at the Metropolitan Plant.

During 1983, the new sludge incineration facilities were in the startup and adjustment stage. Therefore, much of the dewatered sludge generated at the Metropolitan Plant during 1983 was landspread. Since polymer conditioned primary sludge is unstabilized, lime was added to the roll press cake to accomplish stabilization (pathogen destruction).

In mid-1983, a new belt filter press for sludge dewatering at the Seneca Plant was installed. Like the roll presses at the Metropolitan Plant, the belt press uses polymer conditioning of the sludge. The belt press produces a drier sludge cake than the vacuum filters, reducing the fuel requirements for the sludge incineration process. The vacuum filters continued to be used at the Seneca Plant, in combination with the belt press.

TABLE 5-1

SUMMARY OF SLUDGE PROCESSING AND DISPOSAL METHODS
1983

TREATMENT PLANT	THICKENING	STABILIZATION	CONDITIONING	DEWATERING	SLUDGE DISPOSAL METHOD
Anoka	In Primaries	Anaerobic Digestion	None	None	(1)
Bayport	None	Aerobic Digestion	None	None	(1)
Blue Lake	In Primaries	None	None	None	(1) (2)
Chaska	None	Aerobic Digestion	None	None	(3)
Cottage Grove	Gravity	Anaerobic Digestion	None	None	(1) (4)
Empire	Gravity	Anaerobic Digestion	Polymer	Centrifuging	(4)
Hastings	In Primaries	Anaerobic Digestion	None	None	(1) (4)
Maple Plain	In Primaries	Anaerobic Digestion	None	None	(1) (4)
Medina	None	None	None	None	-------
Metropolitan*	Gravity (Primary) Air Flotation (Secondary)	Lime Lime Thermal	Polymer Lime/$FeCl_3$ Thermal	Roll Press Vacuum Filters Filter Presses	(4) (5) (4) (5) (4) (5)
Rosemount	In Holding Tank	None	None	None	(1)
Savage	In Holding Tank	Anaerobic Digestion	None	None	(2) (4)
Seneca	Air Flotation (Secondary)	None	Lime/$FeCl_3$ Polymer	Vacuum Filters Belt Press	(5) (5)
Stillwater	In Primaries	Anaerobic Digestion	None	None	(1) (4)

SLUDGE DISPOSAL METHODS:

(1) Transported to Metropolitan Plant for further processing
(2) Transported to Seneca Plant for further processing
(3) Transported to Blue Lake Plant for further processing
(4) Landspreading
(5) Incineration

*Various combinations of stabilization, conditioning, dewatering, incineration, and landspreading are used. The listing shows the conditioning method associated with each dewatering method. Thermal conditioning also accomplishes stabilization, as does lime addition for conditioning prior to vacuum filtration. If polymer conditioned, roll press cake is to be landspread, lime is added to the cake for stabilization.

5.2 Sludge Disposal

During 1983, 97,153 dry tons of sludge were processed at Commission plants. A summary of sludge quantities produced at each of the Commission plants is shown in Table 5-2.

Sludge disposal methods presently utilized by the Commission include: (1) transporting of sludge to the Blue Lake, Seneca, or Metropolitan Plants for further processing; (2) landspreading; and (3) incineration with ash landfilling.

Digested sludge from the Chaska Plant is transported to the Blue Lake Plant. Sludge from the Blue Lake Plant is transported by tanker truck to either the Seneca or Metropolitan Plant. Digested sludges from the Anoka, Bayport, Cottage Grove, Hastings, Maple Plain, and Stillwater Plants and undigested sludge from the Rosemount Plant are transported through the interceptors to the Metropolitan Plant for further processing. Digested sludge from the Hastings, Cottage Grove, Stillwater, Maple Plain and Savage Plants is also landspread. Table 5-3 lists the annual quantities of sludge transported from each of the outlying plants, the interim disposal location, and the final disposal location.

At the Empire, Metropolitan, and Seneca Plants, sludge conditioning and dewatering are provided. At the Empire Plant, dewatered sludge is landspread; at the Metropolitan Plant, dewatered sludge is either incinerated or landspread; at the Seneca Plant, dewatered sludge is incinerated.

5.3 Sludge Quality

During 1983, digested sludge from the outlying plants and dewatered sludge or sludge cake from the Metropolitan and Seneca Plants were analyzed routinely for solids, nutrients, and metals. Results of analyses are summarized in Table 5-4. Total solids are shown as percent; volatile solids are shown as percent of total solids; nutrients (KJN, NH3-N, P) are shown as percent (dry weight basis); and metals and PCB are shown as mg/kg (dry weight basis). A more extensive summary of the quantity and quality of sludges from the various plants is listed in the Appendix of this report.

5.4 Landspreading

As shown in Tables 5-2 and 5-3, a portion of sludge generated at Commission treatment plants is landspread as a fertilizer supplement and soil conditioner. Prior to 1978, landspreading was limited to utilizing sludges generated at the smaller treatment plants for application to adjacent farm land. All other sludges were ultimately dewatered and disposed of by incineration.

In 1978, a sludge application program was initiated at the Metropolitan Plant. Because solids processing facilities at the plant were limiting the removal of solids from the sewage, the plant could not consistently meet NPDES discharge limitations. The land application program was developed as a means of disposing sludge solids generated in excess of the existing capacity of sludge handling facilities. This land application program was continued throughout 1983. However, as the new incinerators were gradually put into service, the portion of the dewatered sludge disposed of on land decreased accordingly.

TABLE 5-2

SUMMARY OF SLUDGE PRODUCTION AND DISPOSAL METHODS
1983

Treatment Plant	Annual Sludge Production MG	Annual Sludge Production Dry Tons	Sludge Disposal Method
Anoka	3.33	320	(1)
Bayport	1.46	121	(1)
Blue Lake	42.29	8,320	(1) (2)
Chaska	2.19	146	(1) (2) (3)
Cottage Grove	2.28	176	(1) (4)
Empire	-----	593	(4)
Hastings	2.95	338	(1) (4)
Maple Plain	0.07	11	(1) (3) (4)
Medina	-----	----	-------
Metropolitan			
a) Vacuum Filters	-----	4,714	(4) (5)
b) Filter Presses	-----	27,422	(4) (5)
c) Roll Presses	-----	41,880	(4) (5)
Rosemount	1.84	731	(1)
Savage	0.56	91	(1) (2) (4)
Seneca	-----	11,810	(5)
Stillwater	4.04	480	(1) (4)

(1) Transported to Metropolitan Plant for further processing.
(2) Transported to Seneca Plant for further processing.
(3) Transported to Blue Lake Plant for further processing.
(4) Landspreading
(5) Incineration

NOTE: Annual sludge production includes sludge transported from other plants for further processing. Chemicals added for sludge conditioning are included for only the Seneca Plant.

TABLE 5-3

SUMMARY OF 1983 SLUDGE HAULING

Treatment Plant	Interim Disposal Location	Final Disposal Location	Amount Hauled During 1983 (MG)
Anoka	Coon Rapids Interceptor	Metropolitan Plant	3.33
Bayport	Oakdale Interceptor	Metropolitan Plant	1.46
Blue Lake	Seneca Plant	Seneca Plant	19.06
	3rd and Commercial Interceptor	Metropolitan Plant	23.23
Chaska	Blue Lake Plant	Seneca Plant Metropolitan Plant	2.19
Cottage Grove	U of M Experimental Ag. Station	Landspread	0
	Farm Land	Landspread	0.78
	Sludge Drying Beds	Landspread	0.05
	So. St. Paul Interceptor	Metropolitan Plant	1.46
Hastings	U of M Experimental Ag. Station	Landspread	0
	Farm Land	Landspread	1.38
	South St. Paul Interceptor	Metropolitan Plant	1.57
Maple Plain	Sludge Drying Beds	Landspread	0.018
	Plymouth Interceptor	Blue Lake/Metropolitan	0.004
	Farm Land	Landspread	0.044
Rosemount	3rd and Commerical Interceptor	Metropolitan Plant	1.84
Savage	Farm Land	Landspread	0.07
	Sludge Drying Beds	Landspread	0.04
	Seneca Plant	Seneca Plant	0.23
	3rd and Commercial Interceptor	Metropolitan Plant	0.22
Stillwater	Oakdale Interceptor	Metropolitan Plant	3.50
	Farm Land	Landspreading	0.54

TABLE 5-4

1983 SLUDGE QUALITY SUMMARY

Treatment Plant Type of Sludge		Total Solids %	Volatile Solids %	Cu mg/kg	Ni mg/kg	Pb mg/kg	Zn mg/kg	Cd mg/kg	Cr mg/kg	Hg mg/kg	pH	NH3-N %	KJN %	K %	P %	PCB mg/kg
Anoka	Avg.	2.43	65.7	1,411	280	648	1,576	17.1	1,640	12.68	7.2	4.01	10.74	0.43	3.03	1.2
	Range	----	----	751-	127-	320-	1,109-	4.7-	989-	3.7-	5.8-7.9	0.4-	4.3-	0.2-	1.4-	----
Anaerobic digested				1,843	716	955	2,308	64.1	1,955	27.3		6.3	21.3	0.6	5.9	
Bayport	Avg.	1.99	59.1	257	24	155	643	9.1	70	3.68	7.0	0.05	4.95	0.24	3.49	0.24
	Range	----	----	207-	16-	102-	518-	5.1-	36-	1.6-	6.6-7.3	0.03-	1.6-	0.15-	2.5-	----
Aerobic digested				314	31	319	843	22.2	269	6.3		0.15	10.8	0.31	7.5	
Chaska	Avg.	1.61	62.9	702	57	207	916	21.7	518	6.26	6.9	0.12	5.18	0.97	3.61	0.60
	Range	----	----	336-	37-	132-	637-	5.8-	60-	3.9-	6.6-7.5	0.02-	2.9-	0.5-	2.9-	----
Aerobic digested				974	107	427	1,275	98.0	1,029	14.8		0.35	9.2	1.3	6.5	
Cottage Grove	Avg.	1.84	66.1	465	97	172	1,092	13.2	37	5.46	7.8	4.86	10.63	0.54	2.88	0.60
	Range	----	----	121-	22-	32-	302-	2.0-	12-	1.5-	7.4-8.4	2.0-	2.7-	0.2-	0.7-	----
Anaerobic digested				592	128	224	1,320	31.4	68	11.3		7.5	24.4	1.0	5.8	
Empire	Avg.	13.7	61.8	1,020	43	184	2,354	15.0	263	5.26	7.8	1.23	6.55	0.19	3.42	1.0
	Range	----	----	915-	31-	144-	1,610-	7-	155-	0.4-	7.3-8.2	1.0-	3.7-	0.16-	2.3-	----
Anaerobic digested				1,156	62	208	2,788	25	401	10.0		1.4	12.7	0.24	6.5	
Hastings	Avg.	2.77	63.6	1,171	34	178	747	9.8	5,782	2.51	7.4	2.53	8.15	0.39	2.73	0.80
	Range	----	----	868-	24-	27-	570-	3.1-	3,827-	0.9-	7.0-8.1	1.9-	6.0-	0.3-	1.9-	----
Anaerobic digested				1,762	59	511	897	34.8	8,199	7.7		4.0	13.5	0.6	5.5	
Maple Plain	Avg.	4.29	68.2	1,274	38	356	892	12.1	72	5.58	5.8	0.43	5.12	0.16	1.76	1.4
	Range	----	----	1,138-	37-	272-	885-	6-	51-	5.5-	5.1-6.5	0.3-	2.7-	0.16-	1.0-	----
Anaerobic digested				1,411	40	441	899	18	92	5.7		0.6	7.6	0.17	2.5	
Metropolitan																
Vacuum Filer Cake	Avg.	27.4	44.1	929	271	204	1,050	41	840	1.4	--------	0.05	2.7	885	1.4	0.8
Roll Press Cake	Avg.	32.0	70.3	993	159	266	1,546	40	927	2.2	--------	0.16	3.1	1,176	1.3	0.9
Filter Press Cake	Avg.	43.5	64.5	1,737	247	376	2,561	112	1,609	2.4	--------	0.08	3.5	1,091	2.9	1.7
Load Out Cake	Avg.	27.5	57.1	875	167	219	1,220	41	898	1.6	--------	0.06	3.1	1,024	1.2	0.6
Savage	Avg.	3.95	42.8	1,899	48	458	1,364	23.1	108	55	7.5	1.37	4.41	0.28	1.80	0.8
	Range	----	----	799-	44-	265-	751-	10-	95-	15.2-	7.2-7.8	0.8-	2.3-	0.24-	1.2-	----
Anaerobic digested				4,299	52	762	2,345	52	125	88.2		2.0	6.8	0.34	2.2	
Seneca	Avg.	22.3	46.3	1,185	253	190	482	12.3	417	1.9	--------	0.08	3.40	920	1.45	0.83
	Range	----	----	-----	---	---	-----	----	-----	----	--------	----	-----	----	----	----
Dewatered sludge cake																
Stillwater	Avg.	2.84	50.1	627	32	174	1,154	9.4	131	2.37	7.5	2.37	6.51	0.25	3.85	0.24
	Range	----	----	515-	28-	136-	896-	6.2-	109-	0.8-	7.2-8.2	1.9-	3.9-	0.2-	2.9-	----
Anaerobic digested				808	39	367	1,402	18.1	168	3.9		3.6	15.3	0.4	7.7	

(1)Metals, nutrient, and PCB analysis listed as dry weight.

At the Metropolitan Plant, sludges are conditioned and dewatered to produce sludge cake. Two types of sludge cake are produced: filter cake and press cake. The filter cake is produced by treating sludge with chemicals and removing water with a vacuum filter. Dewatered press cake is produced by either thermally or chemically conditioning the sludge followed by dewatering. Both chemical addition of lime and heat treatment conditioning have been shown to reduce pathogenic organisms to an acceptable level.

Since the initiation of landspreading as a disposal method at the Metropolitan Plant, portions of the dewatered sludge that is suitable for soil incorporation has been landspread. Table 5-5 presents a summary of sludge quantities disposed of by the landspreading program since 1978.

TABLE 5-5

SUMMARY OF QUANTITIES OF METROPOLITAN PLANT
DEWATERED SLUDGE DISPOSED OF BY LANDSPREADING PROGRAM

Year	Agricultural Land (wet tons)	Other (wet tons)	Total wet tons disposed by landspreading
1978	13,700	------	13,700
1979	18,700	15,500	34,200
1980	75,600	29,600	105,200
1981	189,600	9,900	199,500
1982	184,600	11,145	195,745
1983	134,350	14,880	149,230

In addition to disposing of sludge cake directly on land, portions of cake are composted prior to land application. Composting provides for additional destruction of pathogenic organisms and organic matter.

All land application of sludge is done under permits from MPCA. Each permit is granted for an individual parcel of land and specifies the maximum sludge application rate per acre. These application rates are based upon maximum allowable application rates of the various chemical constituents of the sludge (NH_3, Cd, etc.). All sludge is analyzed before applications to insure meeting conditions of each permit.

During 1983, approximately 134,000 wet tons of dewatered sludge were applied to 150 permitted sites in seven area counties. The dewatered sludge was applied to land used for crop production. In addition, 15,000 wet tons of dewatered sludge were composted. The compost was used primarily to establish turf grasses on parks, cemetaries, and landfills. At the end of 1983, the Metropolitan Plant had sufficient incinerator capacity to incinerate all dewatered sludge produced. As such, it is anticipated that the dewatered sludge available for land application will decrease substantially during 1984.

In addition to landspreading of dewatered sludge from the Metropolitan Plant, approximately three million gallons of liquid sludge generated at the Cottage Grove, Hastings, Savage, and Stillwater Plants were applied to farm lands during 1983. Approximately 590 dry tons of digested dewatered sludge from the Empire Plant were applied to adjacent farm land owned by the Commission. Because of the demand for sludge application to agricultural land and the close proximity of the land to the above treatment plants, it is anticipated that the use of liquid sludge generated at the smaller treatment facilities will gradually increase.

6.0 INDIVIDUAL TREATMENT PLANT REPORTS

This section contains the individual treatment plant reports for 1983. For each plant report there is an introduction briefly describing the background of the plant, its design basis, 1983 performance and activities, and a statement regarding the future of the plant. The introduction is followed by a listing of 1982 and 1983 unit process loadings and a liquids and solids flow diagram of the treatment process. In addition, a graphical presentation of flows for individual months of 1983 and annual average flows for 1971-1983 is included. Monthly flow data are shown as a vertical bar corresponding to the range of flow for that month with the top cross bar representing the maximum flow and the bottom cross bar the minimum flow. A solid line connects the vertical bars and is drawn to the average wastewater flow for that month. Flow data are followed by 1983 monthly influent and effluent summaries. These tables contain monthly and annual average data on virtually all of the parameters for which the influent and effluent of that plant are analyzed.

Graphs of BOD and TSS for 1983 show a vertical bar which encompasses the maximum and minimum parameter range for that month. The solid line connects the monthly averages. Fecal coliform data are also presented graphically with the 1971-1983 annual averages (arithmetic average of monthly geometric means) shown on one graph and the 1983 monthly geometric means shown on another graph. Finally, plots of effluent BOD and TSS are shown illustrating the percent of the time the effluent concentrations were less than or equal to a given value. On these graphs, data from 1974-1982 are compared to data obtained during 1983.

ANOKA WASTEWATER TREATMENT PLANT

Plant History and Description

The Anoka Plant was designed by Toltz, King, Duvall, Anderson and Associates and built in two stages. The original plant was constructed in 1954-55, with a design capacity of 1.4 mgd. The plant was expanded in 1969 to its present design capacity of 2.46 mgd. The Anoka Plant serves the communities of Anoka, Champlin, and Ramsey in Service Area No. 3.

Liquid treatment consists of screening, grit removal, influent pumping, primary sedimentation, primary effluent pumping, conventional activated sludge aeration, final clarification, chlorination, and discharge to the Mississippi River.

Solids processing consists of combined thickening in primary tanks, anaerobic digestion, and sludge hauling for disposal in the Metropolitan Plant Interceptor System.

The plant is presently operating at about 95 percent of its rated capacity and provides good BOD and TSS removal. Significant flow increases are anticipated in the next two years which may exceed the capacity of certain process units. These additional flow sources are from the construction of the Anoka Interceptor and a Champlin Station expansion. The plant is subject to secondary treatment limits and additional limits on heavy metals and cyanide.

Performance

Plant flow averaged 2.33 mgd in 1983, up slightly from 2.14 mgd in 1982. Average plant effluent quality was 11 mg/L BOD and 10 mg/L TSS. Plant performance was good throughout the year, although two NPDES Permit violations occurred due to one daily cyanide violation and one weekly fecal coliform failure. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/L

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	12	15	10	10	17	20	14	14	22	26	19	17
TSS	10	12	7	9	15	18	10	12	20	24	15	16

*1982 and 1983 values represent CBOD.

Future

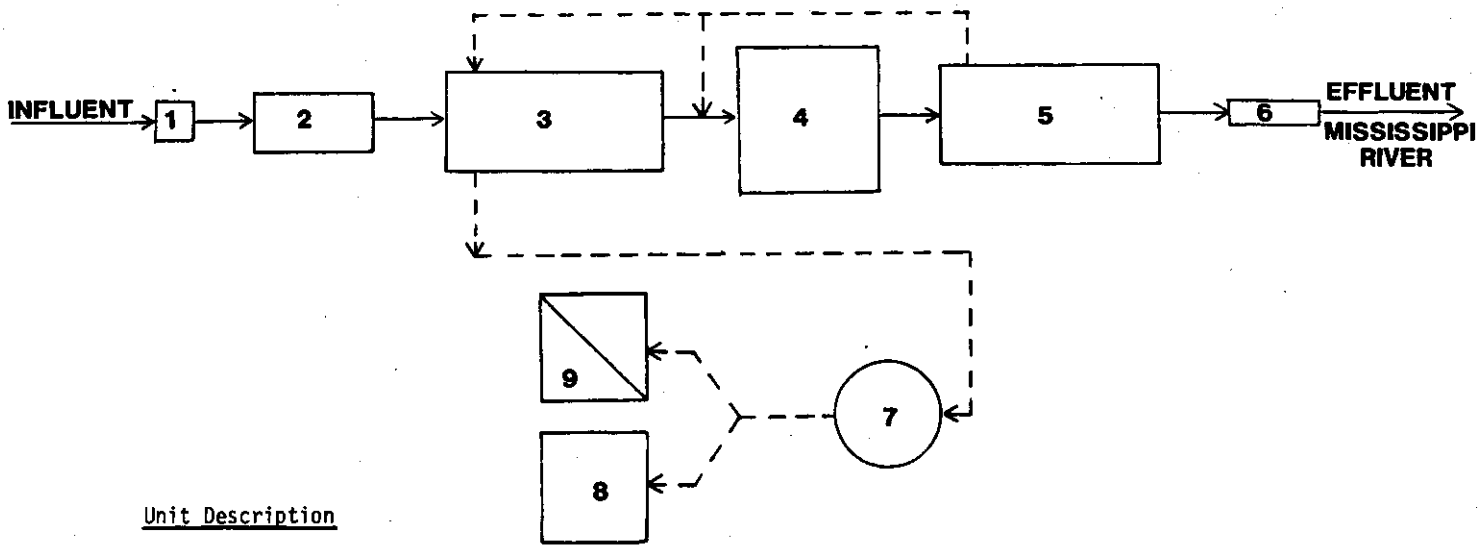
The plant will continue to serve Service Area No. 3 until the late 1980's, when it is scheduled for phase-out, with flow transported to the Metropolitan Plant. Plant phase-out is contingent upon completion of the Champlin-Anoka-Brooklyn Park (CAB) Interceptor. In the interim period prior to phase-out limited capital improvements will be necessary to insure adequate capacity.

ANOKA PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	2.14	2.33	2.34	2.48
BOD Loading, lb/day	3,980	4,000	4,500	4,200
TSS Loading, lb/day	2,770	3,400	3,160	4,100
COD Loading, lb/day	6,350	7,800	7,120	8,700
Sludge Production, lb/day	1,500	1,800	1,970	3,000
Grit Removal				
Overflow Rate, gpd/sq. ft.	41,150	45,000	45,000	48,000
Primary Sedimentation				
Detention Time, hr.	2.0	1.9	1.9	1.8
Weir Overflow Rate, gpd/lin. ft.	7,980	8,700	8,730	9,300
Surface Overflow Rate, gpd/sq. ft.	715	780	780	830
Aeration Tanks				
Detention Time, hr.	7.9	7.2	7.2	6.8
BOD Loading, lb/day/1000 cu. ft.	43	43	48	46
Final Sedimentation				
Detention Time, hr.	3.6	3.3	3.3	3.1
Weir Overflow Rate, gpd/lin. ft.	6,560	7,100	7,180	7,600
Surface Overflow Rate, gpd/sq. ft.	500	550	550	580
Chlorination				
Contact Time, minutes	37	34	34	12
Chlorine Use, lb/day	123	110	146	130
Anaerobic Digestion (Primary Digester Only)				
Solids Loading, lb/cu. ft./day	0.08	0.06	0.10	----
Detention Time, days	20.0	22.0	15.8	----
Volatile Solids Reduction, %	----	55.0	----	----
Sludge Transport				
Volume, gpd	10,930	9,100	14,040	12,000

ANOKA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

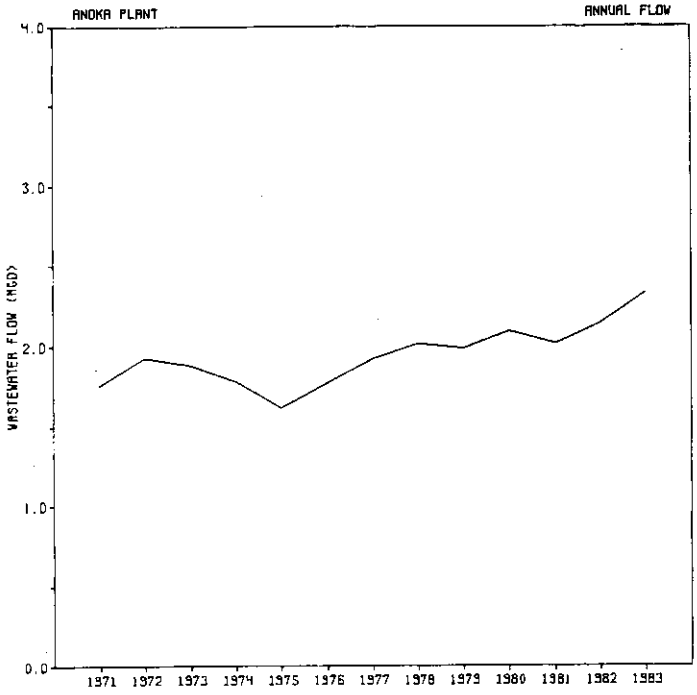
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

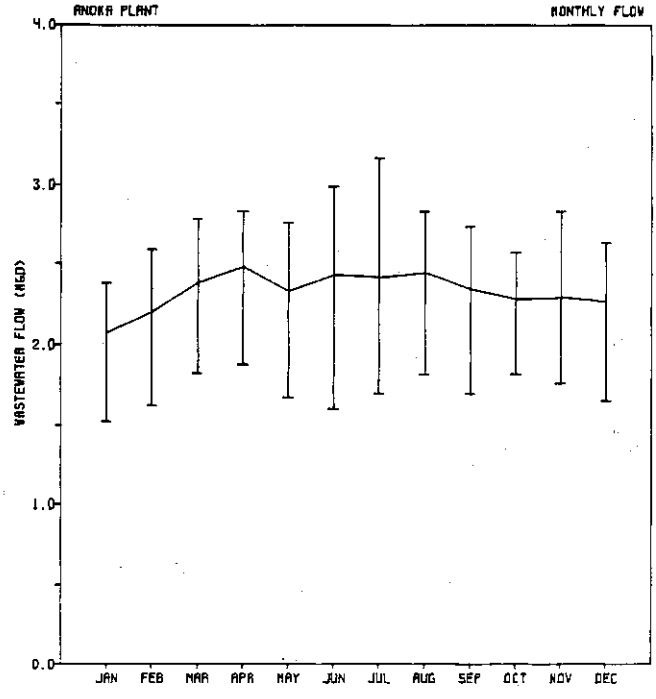
Solids Phase

7. Anaerobic Digestion
8. Landspreading
9. Disposal at Metro Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Processing Units
- Future Process Units





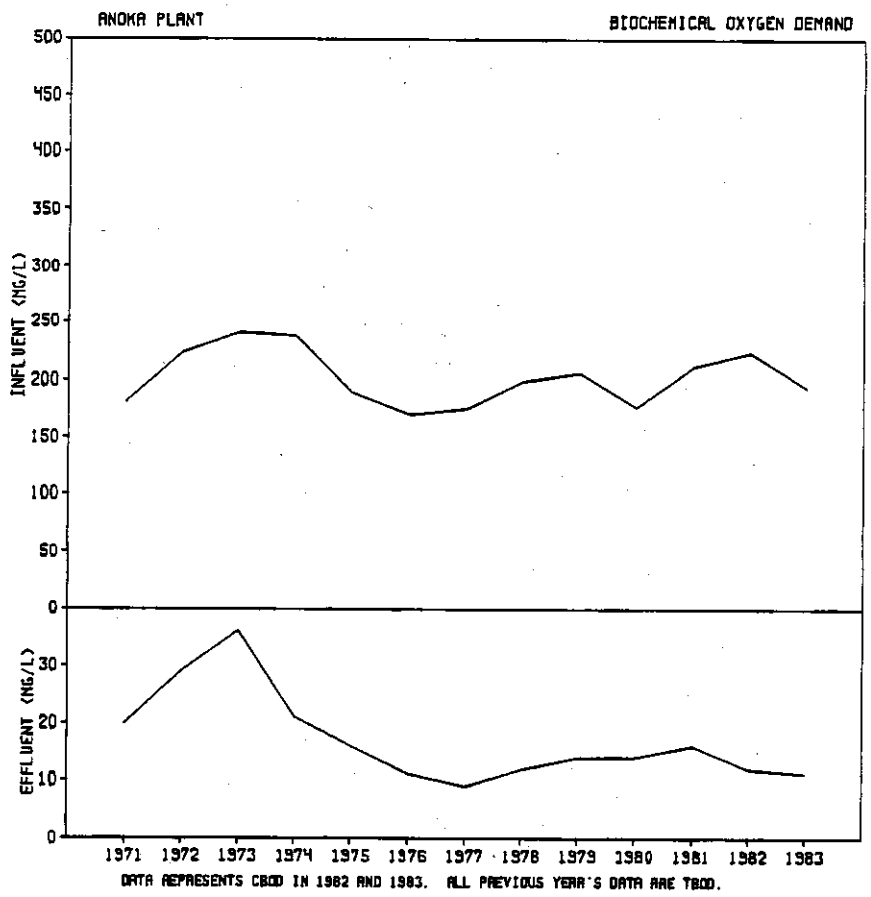
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Anoka

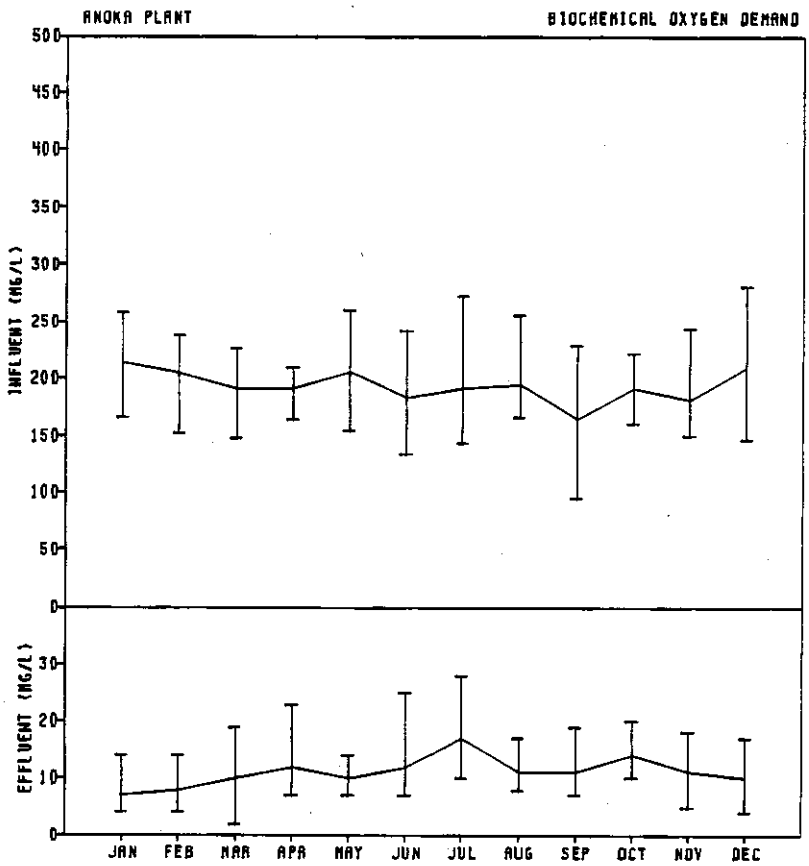
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	2.07	14	214	147	6.8-8.5	40.3	6.1	22.3	317
FEBRUARY	2.20	15	204	181	7.2-8.4	----	8.9	21.6	367
MARCH	2.38	15	190	143	7.5-8.3	32.3	5.6	18.5	373
APRIL	2.48	15	191	147	7.2-8.3	34.5	6.3	17.9	367
MAY	2.33	16	205	149	7.3-8.3	34.3	6.3	16.6	336
JUNE	2.43	17	183	168	7.3-8.3	40.1	7.9	23.1	390
JULY	2.41	19	191	156	6.8-8.2	31.9	5.8	18.1	393
AUGUST	2.44	20	194	185	6.7-7.8	39.0	7.2	21.3	403
SEPTEMBER	2.34	20	165	131	6.5-8.2	33.9	6.5	16.4	359
OCTOBER	2.28	20	191	181	6.0-8.2	38.8	7.3	22.0	428
NOVEMBER	2.29	19	181	182	7.0-9.2	40.3	7.4	17.0	394
DECEMBER	2.26	17	209	203	7.0-8.7	43.6	10.0	19.9	415
1983 AVERAGE	2.33	17	193	165	6.0-9.2	37.4	7.2	19.5	379
1982 AVERAGE	2.14	17	223	154	7.0-8.4	37.9	6.8	20.3	356

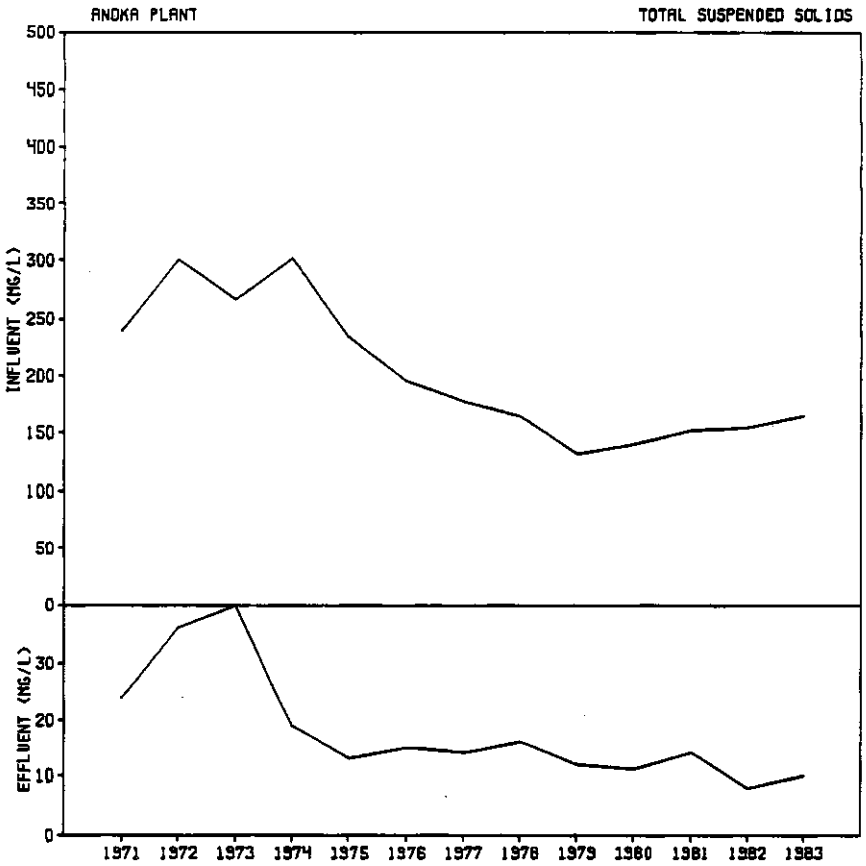
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Anoka

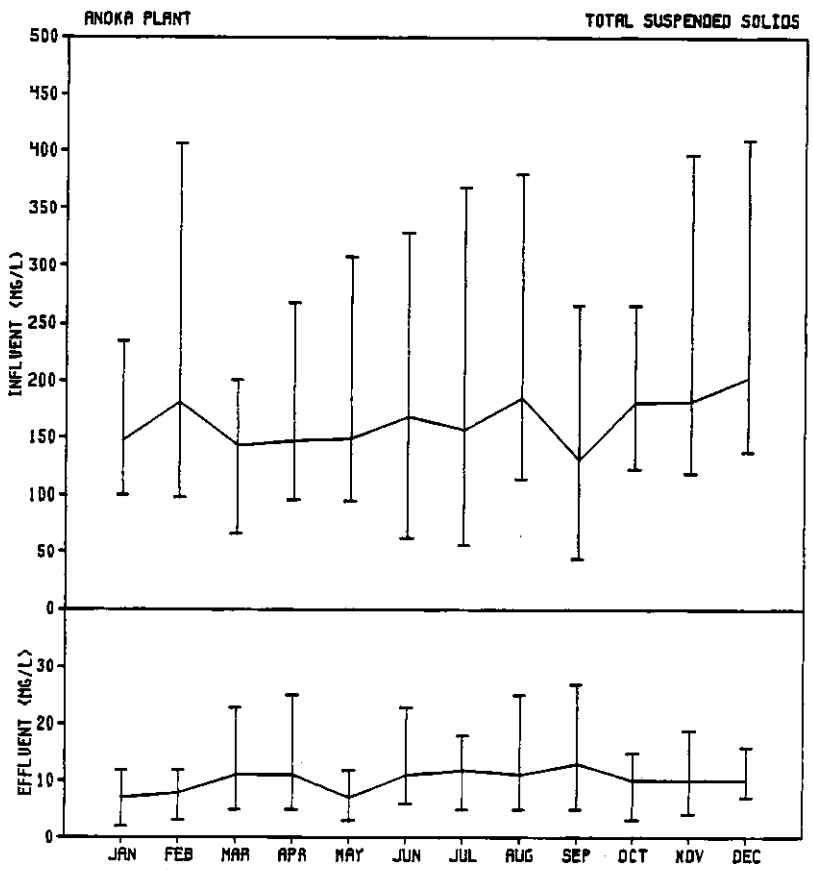
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	---	---	---	---	6.5-8.5	--	--
JANUARY	9	7	54	7	18	4	22.4	15.1	0.88	0.45	3.4	122	5.2	1.2	7.3-7.5	97	95
FEBRUARY	8	8	64	8	30	4	----	16.3	0.17	0.18	4.2	109	4.1	1.7	7.2-7.4	96	96
MARCH	12	10	95	11	67	6	22.8	17.2	0.24	0.12	3.3	109	5.6	2.2	7.2-7.4	95	92
APRIL	14	12	75	11	29	5	21.6	16.1	0.34	0.23	3.6	122	5.6	2.0	7.3-7.4	94	92
MAY	11	10	62	7	26	3	21.1	14.8	0.16	0.20	3.6	112	4.9	1.9	7.3-7.4	95	95
JUNE	15	12	84	11	54	6	22.4	16.9	0.47	0.26	7.0	114	4.2	1.7	7.2-7.4	93	93
JULY	20	17	99	12	81	7	20.6	14.5	0.37	0.14	3.5	109	4.1	1.6	7.1-7.3	91	92
AUGUST	18	11	79	11	125	6	17.8	11.3	1.00	0.39	3.9	111	3.7	1.9	7.0-7.3	94	94
SEPTEMBER	17	11	80	13	58	7	18.6	12.1	1.33	0.32	3.7	134	4.5	1.6	7.0-7.3	93	90
OCTOBER	17	14	94	10	79	6	26.9	20.8	1.03	0.24	4.4	130	4.0	1.7	7.1-7.4	93	95
NOVEMBER	16	11	91	10	151	7	24.2	14.4	0.54	0.20	4.8	108	5.3	1.8	7.0-7.4	94	94
DECEMBER	16	10	76	10	86	6	23.8	17.7	0.55	0.23	5.2	102	5.1	1.9	7.0-7.3	95	95
1983 AVG.	15	11	80	10	67	6	21.9	15.6	0.58	0.24	4.2	115	4.7	1.8	7.0-7.5	94	94
1982 AVG.	14	12	69	8	48	5	23.0	15.8	0.58	0.30	3.7	123	5.5	1.1	7.2-7.7	95	95

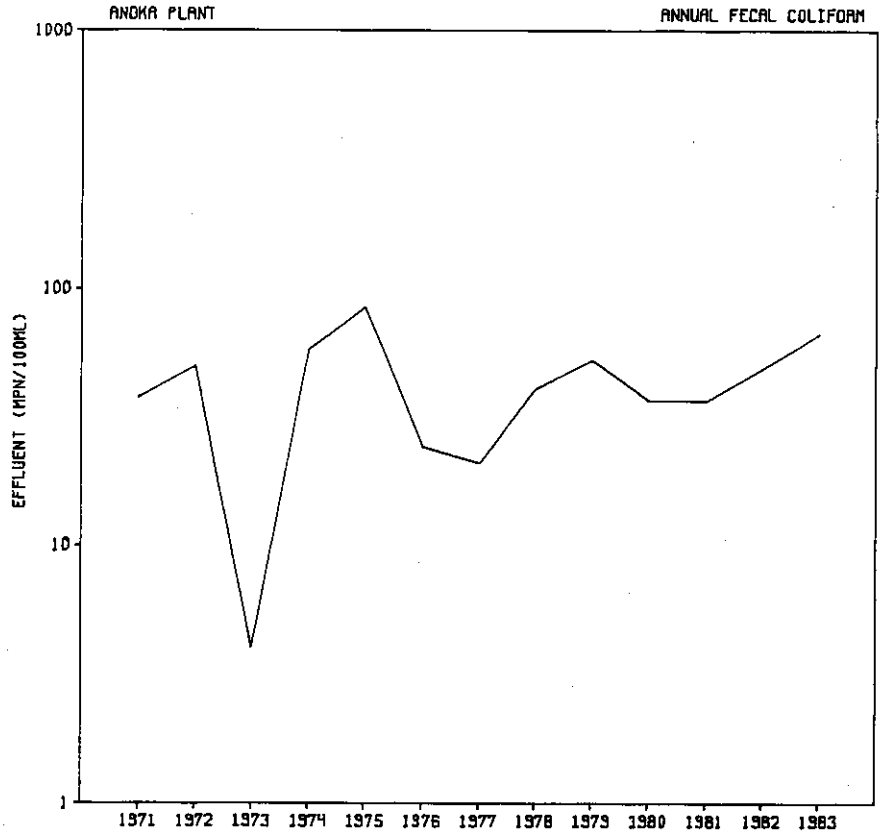
*For disinfection only.

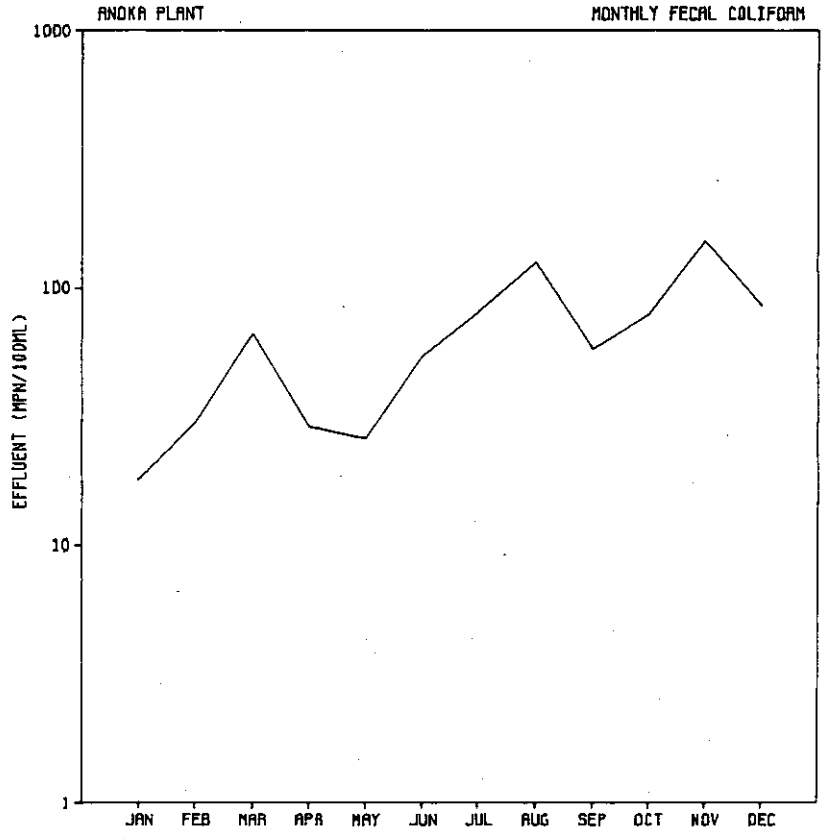

ANOKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

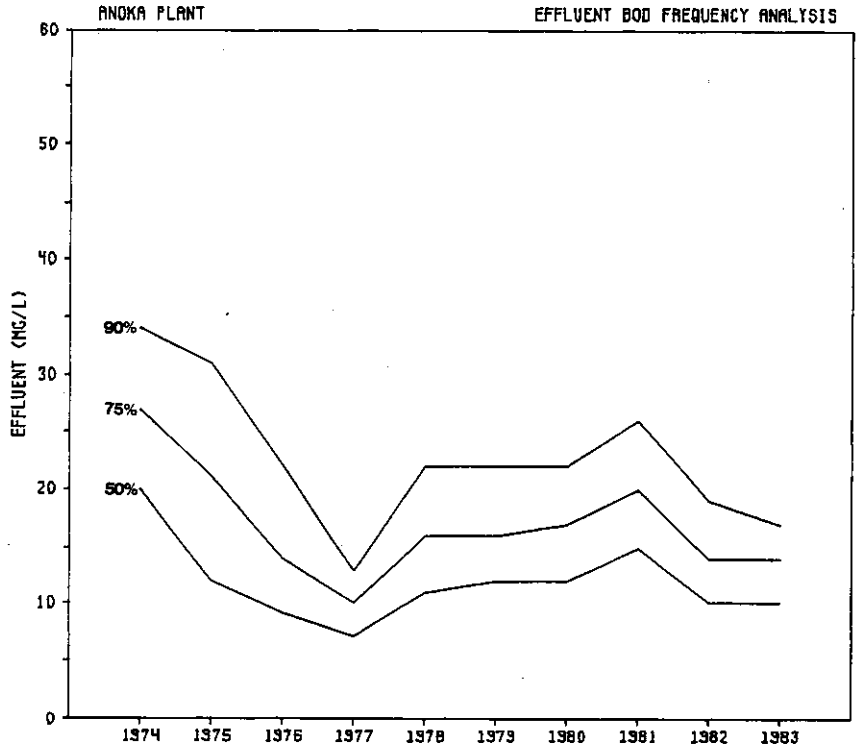

ANOKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

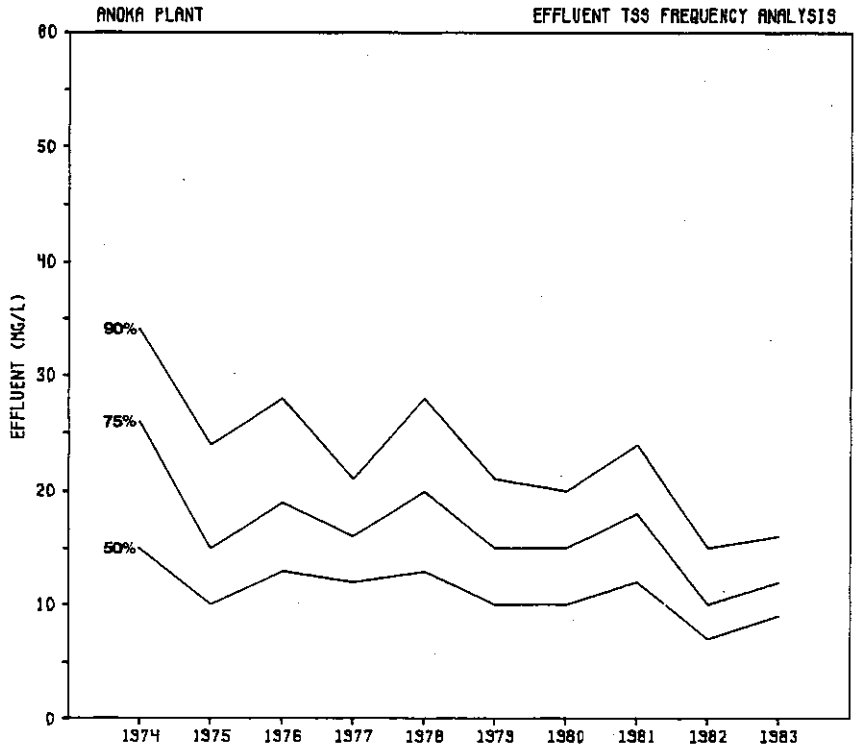

ANOKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


ANOKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ANOKA PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


ANOKA PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ANOKA PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


ANOKA PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

1983 EFFLUENT DATA
TREATMENT PLANT Anoka

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	PCB mg/l	Ni mg/l	Phenol ug/l	Fe mg/l
NPDES Limit	0.30	0.40	0.50	0.50			0.500					
January	0.04	<0.05	0.12	<0.05			0.203					
February	0.05	<0.05	0.07	<0.05			0.433					
March	0.04	<0.05	0.07	<0.05			0.251					
April	0.03	<0.05	0.09	<0.05			0.070					
May	0.02	<0.05	0.09	<0.05			0.247					
June	0.04	<0.05	0.09	<0.05			0.196					
July	0.04	<0.05	0.06	<0.05			0.193					
August	0.04	<0.05	0.05	<0.05			0.383					
September	0.03	<0.05	0.07	<0.05			0.237					
October	0.03	<0.05	0.07	<0.05			0.315					
November	0.02	<0.05	0.10	<0.05			0.056					
December	0.03	<0.05	0.15	<0.05			<0.045					
1983 Avg.	0.03	<0.05	0.09	<0.05			<0.219					

BAYPORT WASTEWATER TREATMENT PLANT

Plant History and Description

The original Bayport Wastewater Treatment Plant was built in 1939, consisting of a primary clarifier, two mechanical aeration tanks, final clarifier, chlorine contact tank, heated anaerobic digester, drying beds, and a control and pumping building. In 1956, the digester was converted to external heating, and a sludge recirculating pump added. In 1958, the plant was expanded by addition of a chlorine contact tank, an aeration tank, a final settling tank, an anaerobic digester, a barminutor, and a drying bed.

In 1964, extensive plant remodeling and additions, designed by Banister, Short, Elliot, Hendrickson, and Associates were completed. In 1973, chemical feed for phosphorus removal was provided and in 1982, mechanical screening was replaced by a stationary hydrasieve fine screening mechanism.

Liquid treatment consists of screening, influent pumping, contact stabilization, activated sludge aeration, alum addition for phosphorus removal, final clarification, chlorination, and discharge to Lake St. Croix (the St. Croix River).

Solids processing consists of aerobic digestion and sludge hauling to the Metropolitan Plant Interceptor System.

The Bayport Plant is presently operating at about 85 percent of its design capacity, and is subject to secondary treatment limits and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 0.54 mgd in 1983, slightly higher than 0.52 mgd in 1982. Average plant effluent quality was 6 mg/L BOD, 6 mg/L TSS, and 0.4 mg/l P. Plant performance was excellent throughout the year, with no NPDES Permit violations. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	5	7	7	6	8	8	9	7	11	10	13	8
TSS	7	7	7	6	9	9	9	7	11	10	12	9

*1982 and 1983 values represent CBOD.

Future

The long-term plan for this plant is to phase it out of service and divert flows to the Stillwater Plant. This is projected to occur in the late 1980's or early 1990's, when the plant is expected to reach its capacity, and also will be nearing the end of its useful life.

BAYPORT PLANT PROCESS LOADINGS

Parameter	Annual Average		Maximum Month	
	1982	1983	1982	1983
Wastewater Flow, MGD	0.52	0.54	0.65	0.66
BOD Loading, lb/day	698	720	968	1,060
TSS Loading, lb/day	664	800	999	1,380
COD Loading, lb/day	1,227	1,330	1,453	2,020
Aeration Basin				
BOD Loading, lb/day/1000 cu. ft.	21	22	29	32
Alum Feed Rate, lb/day	100	140	133	165
Final Sedimentation				
Weir Overflow Rate, gpd/lin. ft.	4,260	4,430	5,330	5,410
Surface Overflow Rate, gpd/sq. ft.	430	450	540	550
Chlorination				
Contact Time, minutes	60	--	48	--
Chlorine Use, lb/day	29	34	34	35
Aerobic Digestion				
Solid Retention Time, day	31	31	26	26
Sludge Transport				
Volume, gpd	3,400	4,000	4,040	4,800
Mass, lb/day	610	600	749	770

MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Bayport

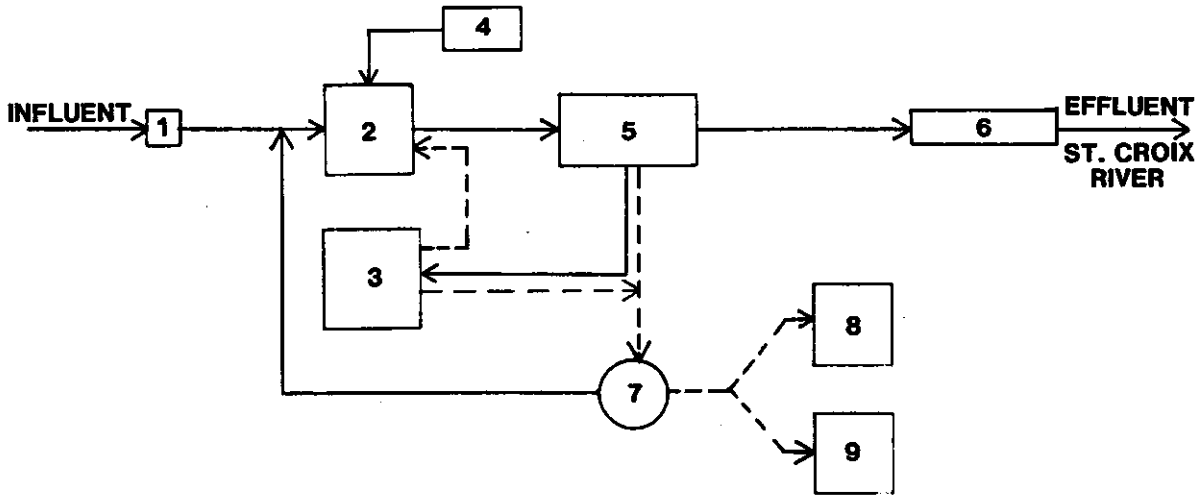
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.51	17	185	162	6.6-9.7	31.1	7.6	16.5	256
FEBRUARY	0.51	18	166	166	6.8-8.8	----	7.5	17.4	283
MARCH	0.63	18	121	108	6.2-8.8	26.0	4.7	14.9	210
APRIL	0.66	17	144	163	6.8-8.9	27.5	4.9	13.4	221
MAY	0.62	20	198	217	6.6-8.8	29.6	5.3	13.7	318
JUNE	0.64	21	114	105	6.8-8.8	23.4	6.5	15.4	351
JULY	0.58	23	111	102	6.8-8.8	22.6	4.2	14.6	247
AUGUST	0.54	24	154	235	6.4-9.4	27.1	4.9	14.4	278
SEPTEMBER	0.51	23	179	234	6.4-8.4	30.4	5.5	16.0	338
OCTOBER	0.50	22	132	102	6.4-8.6	28.3	4.9	18.7	240
NOVEMBER	0.29	17	166	189	5.2-8.4	40.7	6.8	24.4	389
DECEMBER	0.48	18	221	345	6.4-8.2	32.9	5.7	17.1	369
1983 AVERAGE	0.54	20	158	178	5.2-9.7	29.4	5.7	16.4	293
1982 AVERAGE	0.52	20	161	150	5.0-10.0	28.4	5.5	15.9	283

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Bayport

Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	---	---	----	-----	1.0	--	---	---	6.5-8.5	--	--
JANUARY	17	8	21	9	---	2	5.6	3.0	0.66	8.74	0.7	--	---	3.7	7.0-7.1	96	95
FEBRUARY	13	5	26	7	---	2	---	2.6	0.49	12.27	0.6	24	1.6	3.7	6.8-7.0	97	96
MARCH	5	5	32	7	3	3	4.8	2.6	0.43	13.75	0.4	30	2.2	3.8	6.8-7.1	96	93
APRIL	6	6	25	6	6	2	5.1	1.5	0.49	10.51	0.4	32	2.1	4.3	6.8-7.1	96	96
MAY	8	7	26	6	6	2	5.5	2.0	0.42	9.68	0.3	35	2.9	3.5	6.8-7.1	96	97
JUNE	6	5	29	4	8	2	4.6	3.7	0.25	10.61	0.4	35	2.4	3.5	6.9-7.0	96	96
JULY	15	6	33	4	48	2	4.5	3.3	0.33	9.05	0.2	35	2.1	3.2	6.9-7.1	95	96
AUGUST	8	7	34	7	3	2	6.5	3.2	0.47	9.32	0.5	35	2.5	3.0	6.8-7.1	95	97
SEPTEMBER	8	4	25	5	4	2	6.0	3.0	0.41	11.10	0.4	35	2.4	3.5	6.8-7.1	98	98
OCTOBER	7	5	26	5	2	2	4.9	3.6	0.26	9.61	0.5	35	3.3	3.6	6.8-7.0	96	95
NOVEMBER	9	4	37	7	---	2	4.7	2.7	0.34	15.15	0.4	--	---	5.8	6.8-7.4	97	96
DECEMBER	9	5	28	5	---	2	7.0	5.8	0.37	7.40	0.3	--	---	4.7	6.8-7.1	98	99
1983 AVG.	9	6	29	6	10	2	5.4	3.0	0.41	10.71	0.4	34	2.5	3.8	6.8-7.4	96	96
1982 AVG.	10	8	29	8	5	4	5.4	3.4	0.38	10.88	0.5	30	2.6	3.7	6.8-7.3	95	94

*For disinfection only.

BAYPORT WASTEWATER TREATMENT PLANT
FLOW DIAGRAM



Unit Description

Liquid Phase

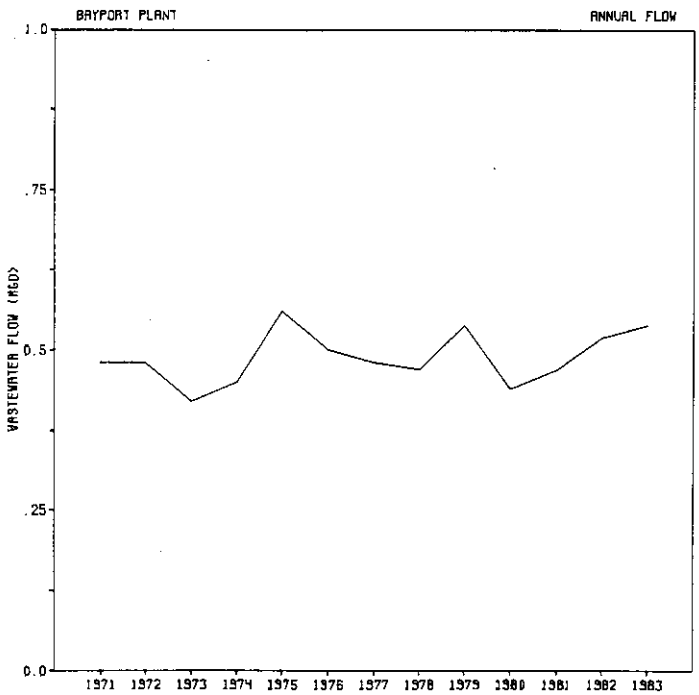
1. Screening
2. Activated Sludge
3. Sludge Reaeration
4. Chemical Addition
5. Final Sedimentation
6. Chlorination

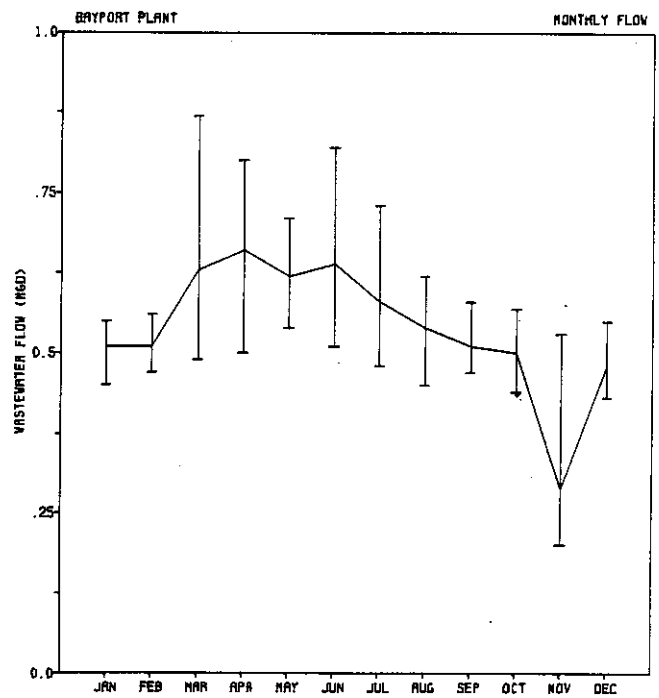
Solids Phase

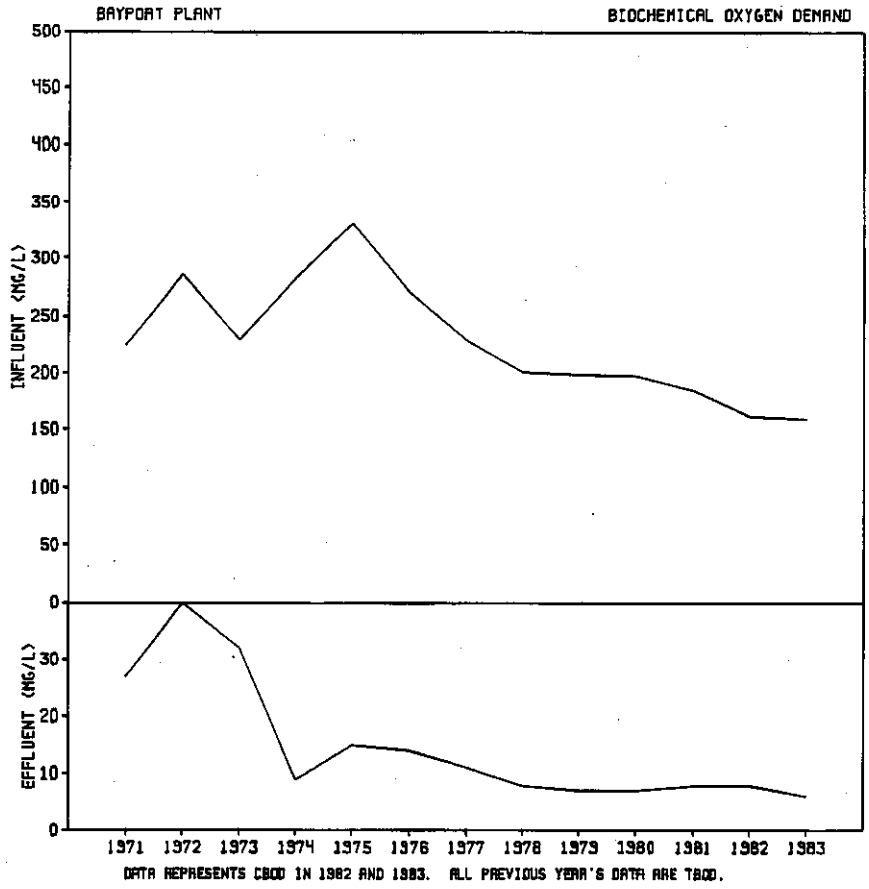
7. Aerobic Digestion
8. Sand Drying Beds
9. Land Spread

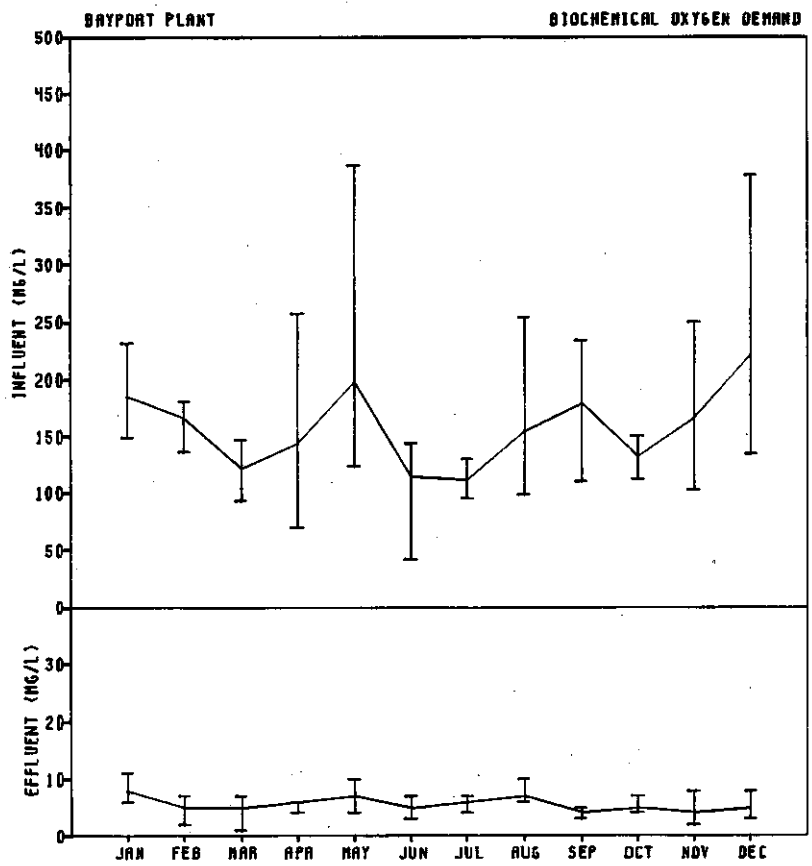
Legend

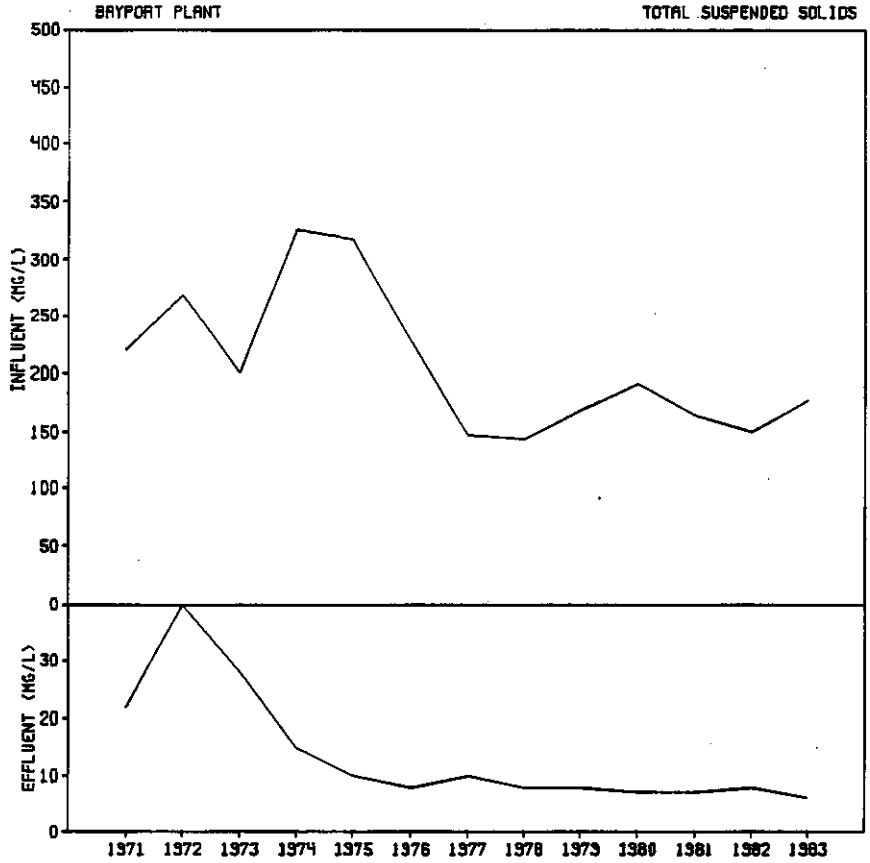
- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units

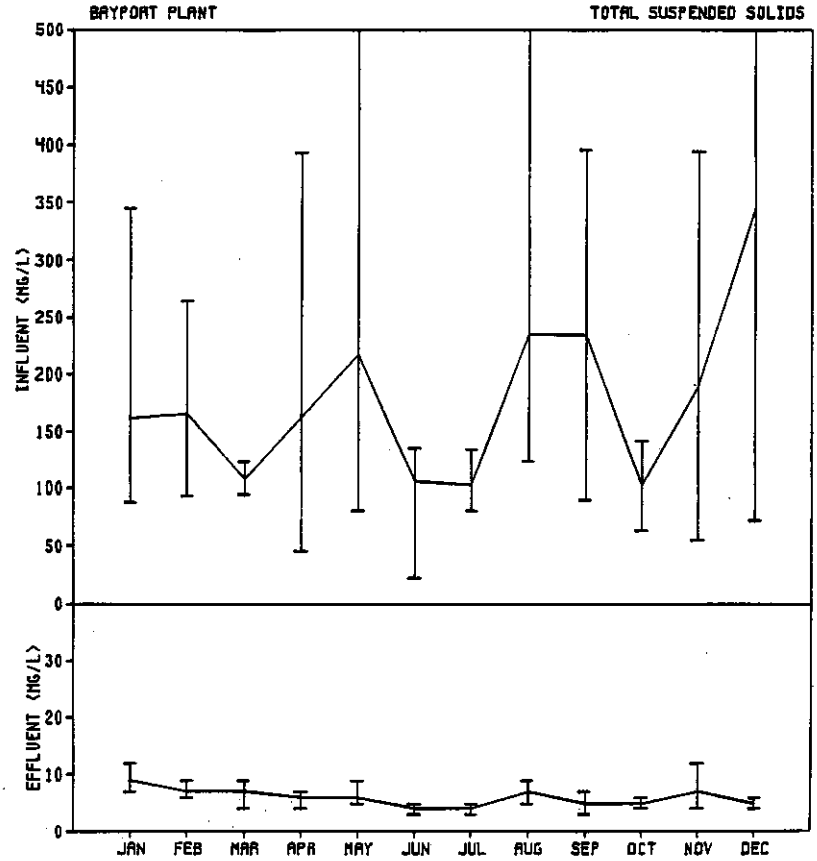


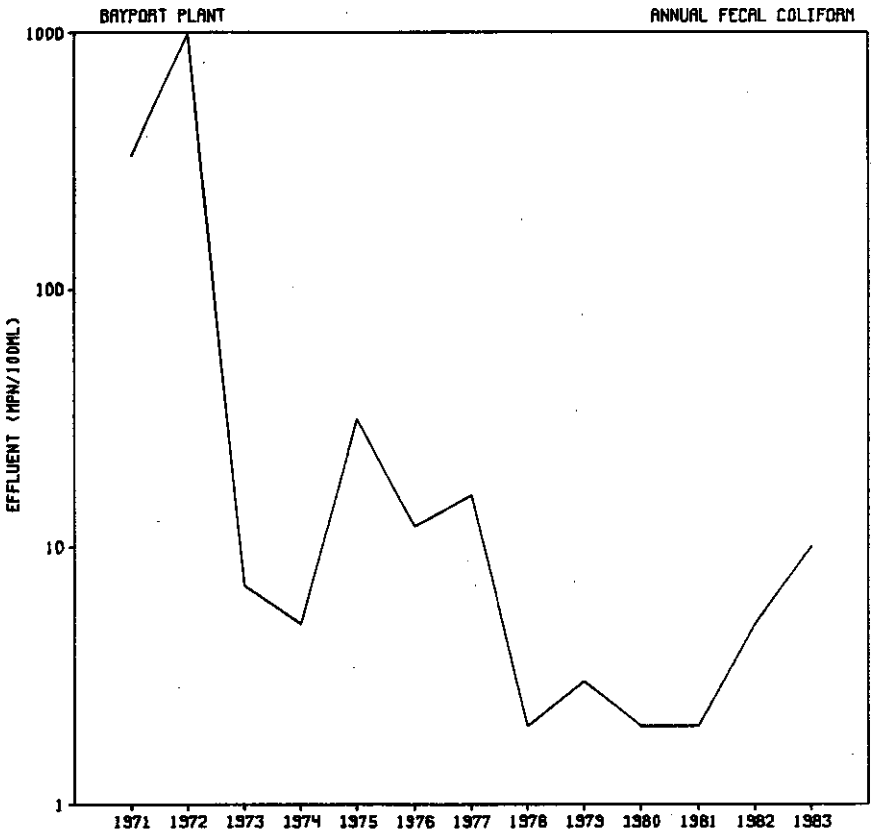


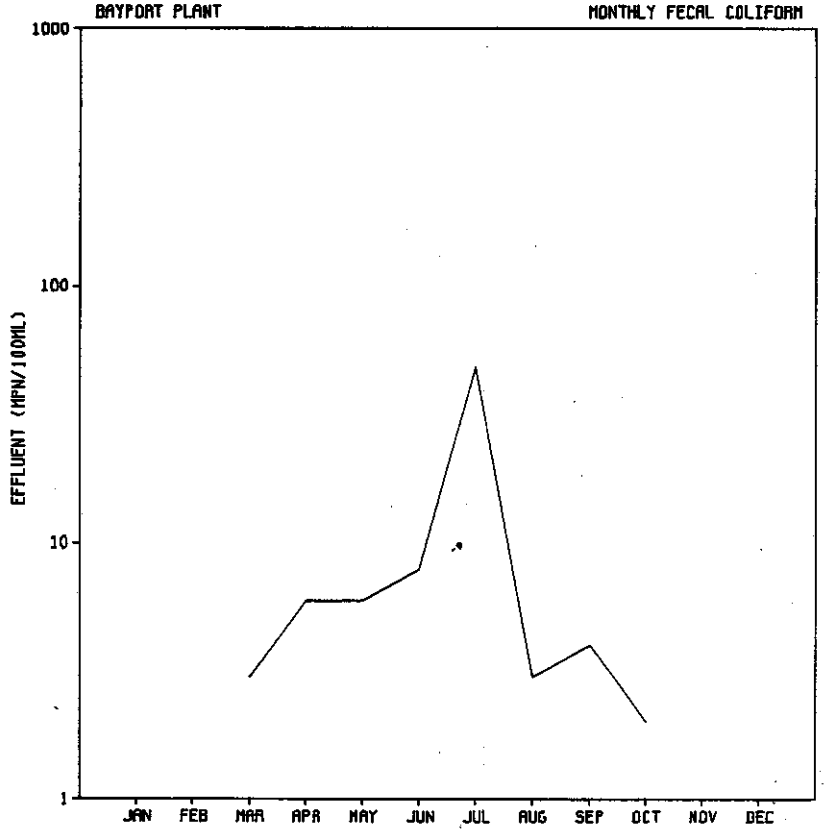

BAYPORT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

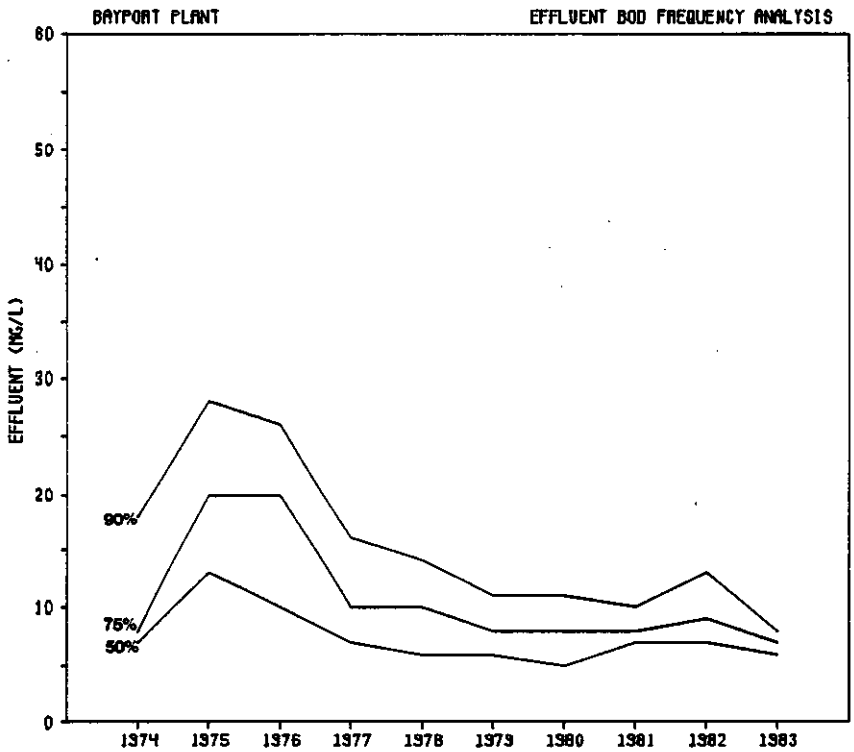

BAYPORT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

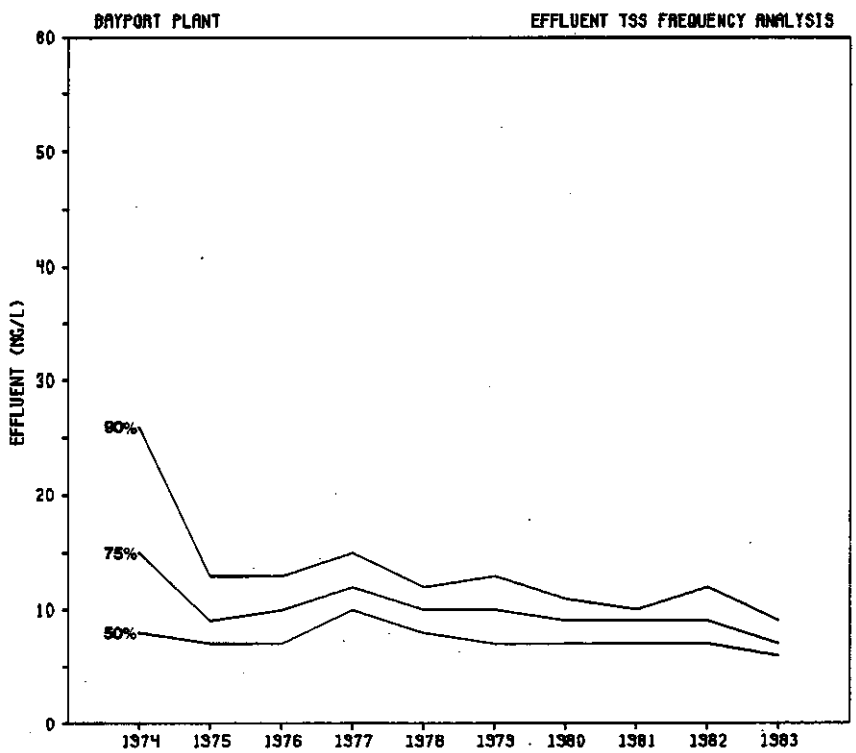

BAYPORT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


BAYPORT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BAYPORT PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


BAYPORT PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BAYPORT PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


BAYPORT PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

BLUE LAKE WASTEWATER TREATMENT PLANT

Plant History and Description

The Blue Lake Wastewater Treatment Plant was designed by Rieke-Carroll-Muller and Associates to be built in several stages and treat wastewater contributed by Sewer Service Area No. 4. Stage I, placed in operation in July, 1971, consisted of an aerated pond and chlorination facilities to provide temporary wastewater treatment. Stage II, consisting of the liquid treatment portion of a secondary treatment activated sludge plant, utilizing the existing aerated pond as an effluent polishing pond was constructed in 1973. Stage III, consisting of sludge processing facilities has not yet been constructed.

Liquid treatment consists of screening, primary sedimentation, complete mix activated sludge aeration with integral final clarification, an effluent polishing pond, chlorination, and discharge to the Minnesota River.

Solids processing consists of sludge thickening in spare primary clarifiers and sludge hauling to either the Seneca or Metropolitan Plant.

The Blue Lake Plant is operating at approximately 90 percent of its capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 18.1 mgd in 1983, considerably higher than 16.1 mgd in 1982. Average plant effluent quality was 9 mg/L BOD and 7 mg/L TSS. Plant performance was good throughout the year with one NPDES permit violation due to a weekly average fecal coliform failure. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	8	9	10	8	10	13	13	11	14	19	16	13
TSS	8	6	6	7	11	7	8	9	15	19	10	11

*1982 and 1983 values represent CBOD.

Future

The Blue Lake Plant is one of the Commission's permanent regional treatment plants. Space is available for future expansions to serve Sewer Service Area No. 4. The first phase of Stage III, gravity thickeners and sludge loadout facilities, has been designed and is awaiting construction funding. The remainder of Stage III is planned to include anaerobic digestion, dewatering and land application. The timing of implementing these facilities is uncertain.

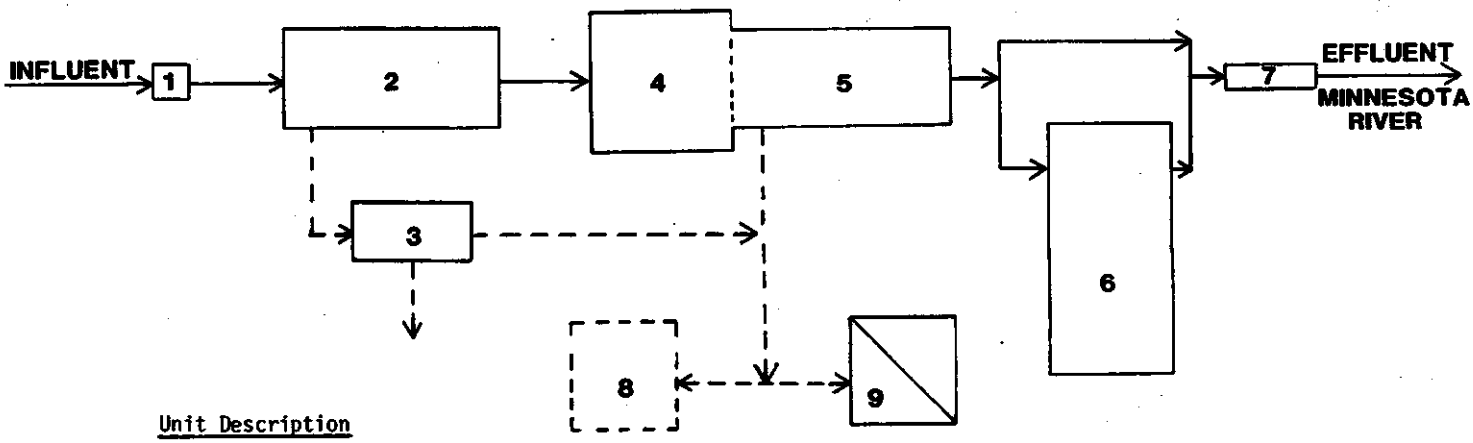
BLUE LAKE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	16.1	18.1	18.2	24.2
BOD Loading, lb/day	30,600	29,300	36,100	35,000
TSS Loading, lb/day	30,800	33,800	44,500	48,400
Primary Sedimentation[1]				
Surface Overflow Rate, gpd/sq. ft.	800	905	910	1,210
Weir Overflow Rate, gpd/lin. ft.	16,100	18,100	18,200	24,200
Aeration Tanks				
BOD Loading, lb/day/1000 cu. ft.	82	56	91	75
Detention Time, hr.	3.3	3.2	2.9	2.9
Final Sedimentation				
Surface Overflow Rate, sq. ft.	620	530	710	710
Weir Overflow Rate, gpd/lin. ft.	12,000	10,900	14,000	14,500
Aerated Pond				
BOD Loading, lb/day	3,800	2,300	5,600	3,600
Detention Time, days	3.2	2.8	2.9	2.1
Total Air Flow, cfm	12,400	13,100	14,700	14,400
Chlorine Use, lb/day	210	250	260	274
Thickened Sludge				
Production, lb/day	42,000	47,500	48,000	53,600
Volume, gpd	99,000	116,000	114,000	125,600
Concentration, %TSS	4.9	4.9	5.6	5.7
Volatile Solids, %	72	71	71	74

[1]Two clarifiers are used for combined settling and gravity sludge thickening. These clarifiers normally receive less flow than the other two clarifiers, but flow to each pair of clarifiers is not measured. Overflow rates shown are based on equal flow to all clarifiers.

BLUE LAKE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

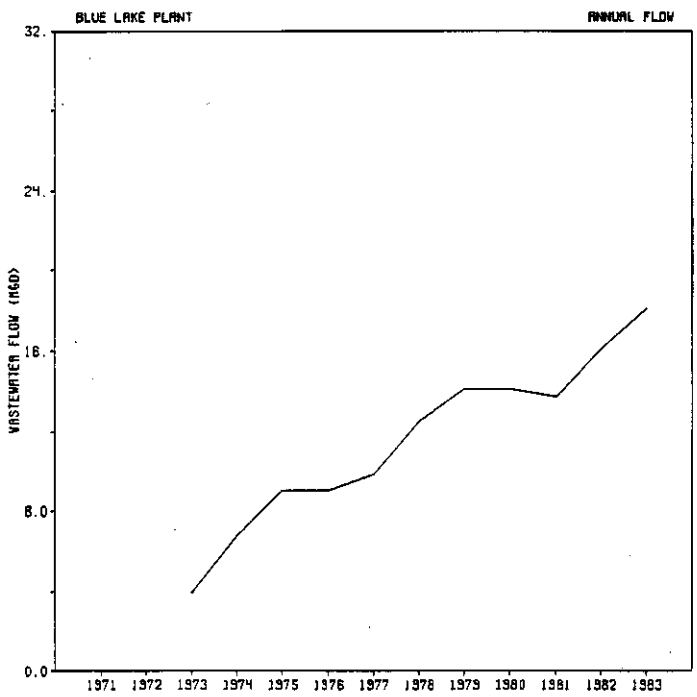
1. Screening
2. Primary Sedimentation
3. Grit Removal
4. Activated Sludge
5. Final Sedimentation
6. Aerated Effluent Pond
7. Chlorination

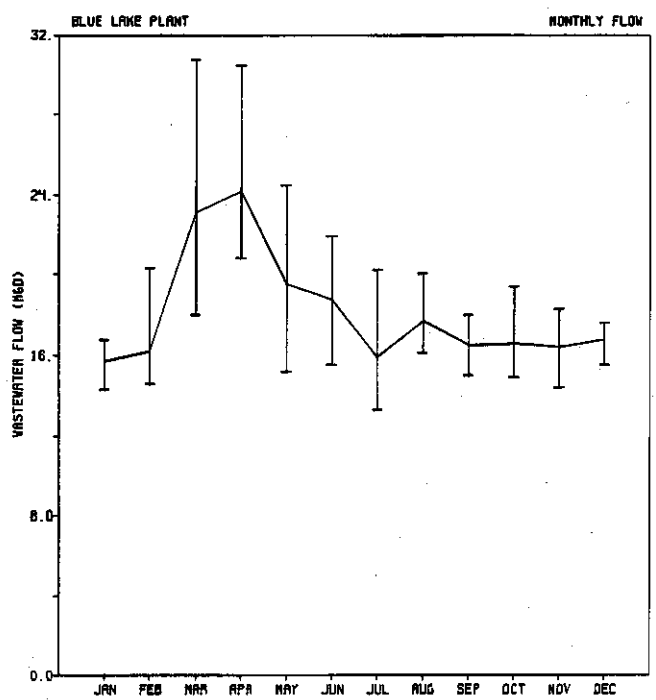
Solids Phase

8. Stage III (Future)
9. Disposal at Metro or Seneca Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





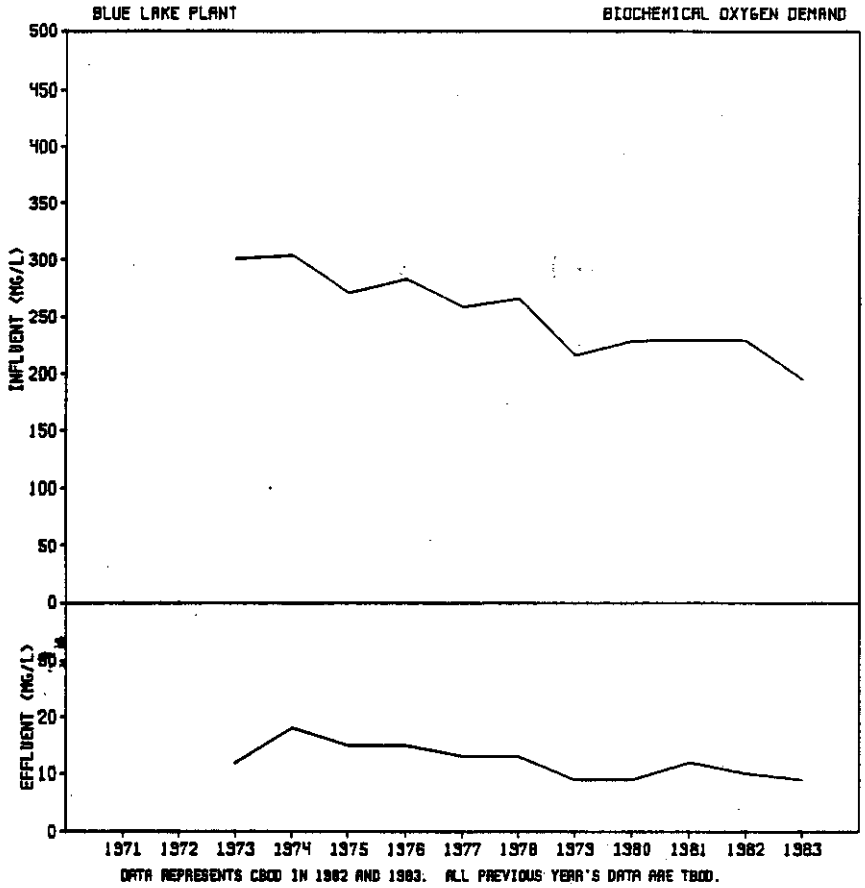
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Blue Lake

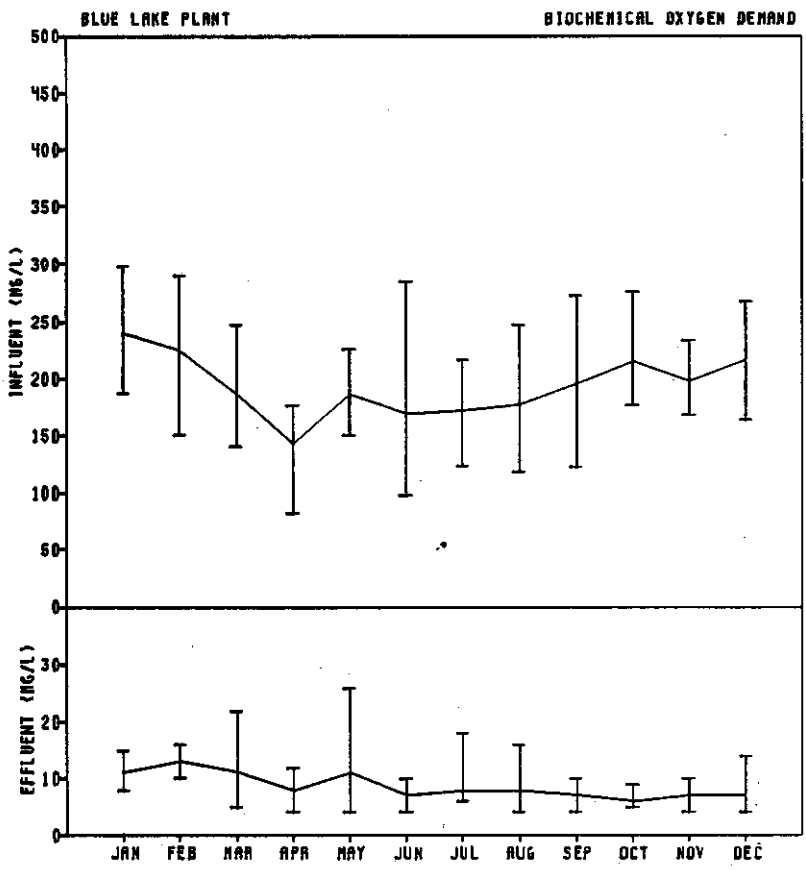
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	15.7	13	240	278	6.9-7.4	38.0	7.5	17.0	563
FEBRUARY	16.2	12	225	267	6.9-7.5	----	8.6	15.3	571
MARCH	23.1	10	186	251	6.9-7.3	27.3	5.9	11.6	487
APRIL	24.2	10	143	153	6.9-7.4	24.1	4.8	10.3	323
MAY	19.5	12	186	189	6.5-7.4	26.5	5.3	9.3	408
JUNE	18.7	13	169	197	6.9-7.5	24.6	5.1	11.9	400
JULY	15.9	15	172	217	6.9-7.4	24.3	5.2	11.4	400
AUGUST	17.7	17	178	232	6.9-7.4	28.4	6.1	11.4	449
SEPTEMBER	16.5	17	196	222	7.0-7.6	30.0	6.7	11.4	456
OCTOBER	16.6	16	216	229	6.8-7.8	29.8	6.1	14.6	505
NOVEMBER	16.4	14	198	222	6.9-7.5	32.0	6.5	11.1	476
DECEMBER	16.8	13	217	227	6.9-7.3	32.6	6.8	14.6	500
1983 AVERAGE	18.1	14	194	224	6.5-7.8	28.9	6.2	12.4	461
1982 AVERAGE	16.1	14	228	230	6.3-8.1	33.1	7.0	14.6	500

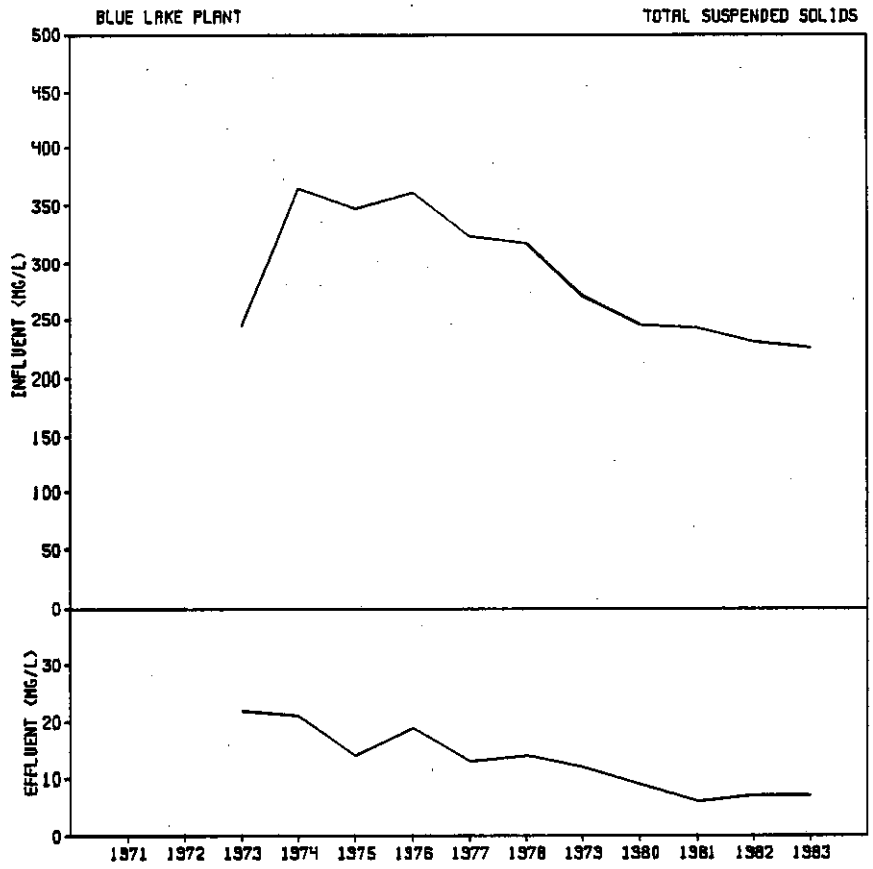
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Blue Lake

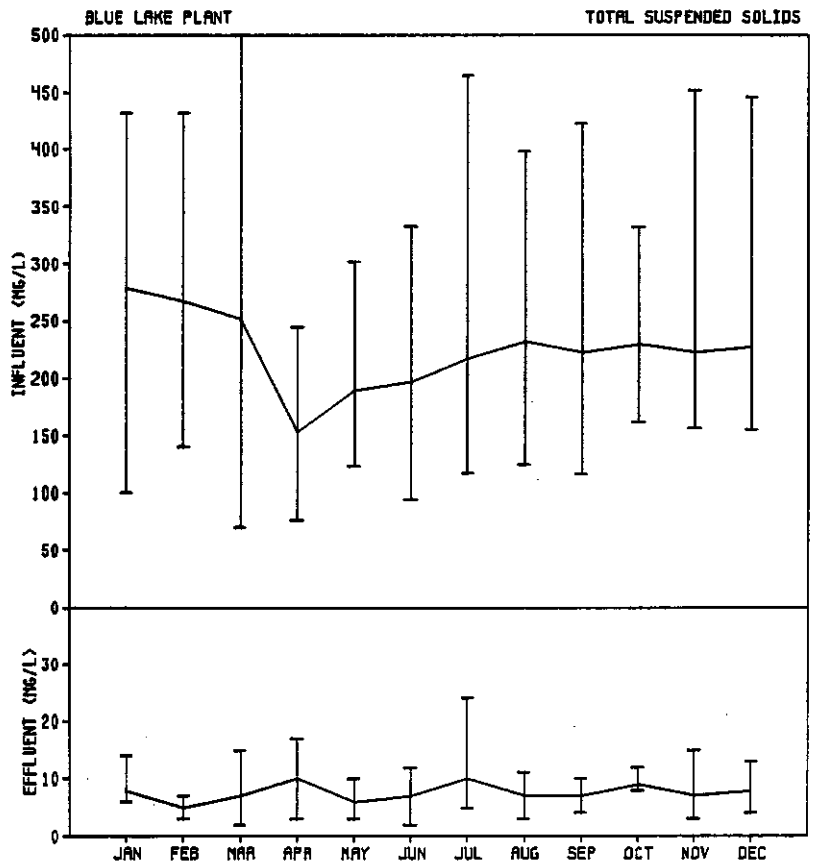
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	---	---	---	----	6.5-8.5	--	--
JANUARY	27	11	75	8	---	8	21.3	14.0	0.14	2.94	3.8	187**	0.0	12.6	7.1-7.7	95	97
FEBRUARY	25	13	80	5	---	6	----	10.6	0.17	2.85	3.8	175**	0.1	12.6	7.2-7.7	94	98
MARCH	36	11	68	7	6	8	12.3	8.1	0.47	2.80	2.6	202	0.6	12.9	7.0-7.7	94	97
APRIL	22	8	61	10	2	11	12.1	5.6	0.51	2.59	2.2	274	0.7	11.2	7.1-7.5	95	94
MAY	22	11	59	6	2	7	13.4	6.9	0.80	1.30	2.3	250	0.7	10.9	7.2-8.0	94	97
JUNE	17	7	60	7	4	9	14.1	10.3	0.87	1.41	2.6	250	0.7	9.5	7.1-7.7	96	96
JULY	25	8	64	10	8	10	12.4	10.1	0.98	1.38	2.5	269	0.8	8.6	7.0-7.6	95	96
AUGUST	32	8	53	7	6	8	14.5	10.0	1.82	2.32	3.1	250	0.7	6.2	7.0-7.5	95	97
SEPTEMBER	28	7	53	7	27	8	13.1	8.1	2.55	2.28	3.5	250	0.7	6.7	7.1-7.9	97	97
OCTOBER	30	6	59	9	11	10	12.1	9.1	1.70	2.26	3.5	250	0.7	8.5	7.1-7.9	97	96
NOVEMBER	20	7	47	7	---	7	12.1	7.1	1.03	2.70	3.4	---	---	10.2	7.1-8.0	97	97
DECEMBER	15	7	53	8	---	8	15.0	11.1	0.22	2.54	3.6	---	---	12.9	7.0-7.6	97	97
1983 AVG.	25	9	61	7	8	8	13.9	9.2	0.94	2.28	3.1	236	0.6	10.2	7.0-8.0	96	97
1982 AVG.	24	10	73	7	16	7	21.1	13.9	1.14	1.07	3.8	209	0.6	11.3	6.8-8.4	95	97

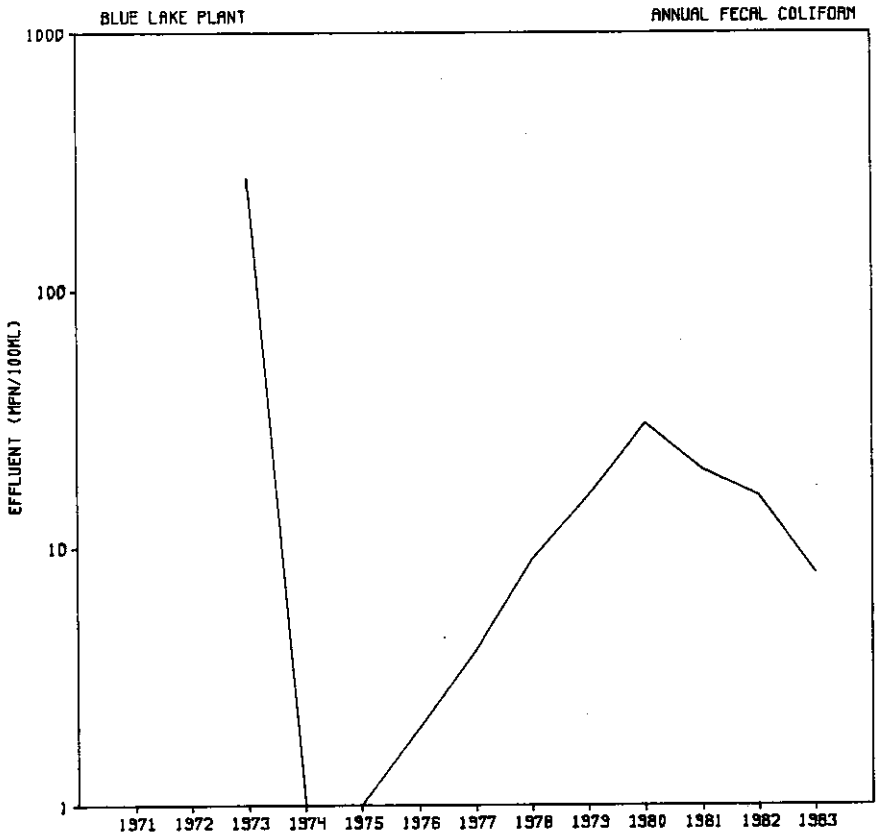
* For disinfection only unless otherwise noted.
**Includes process control.

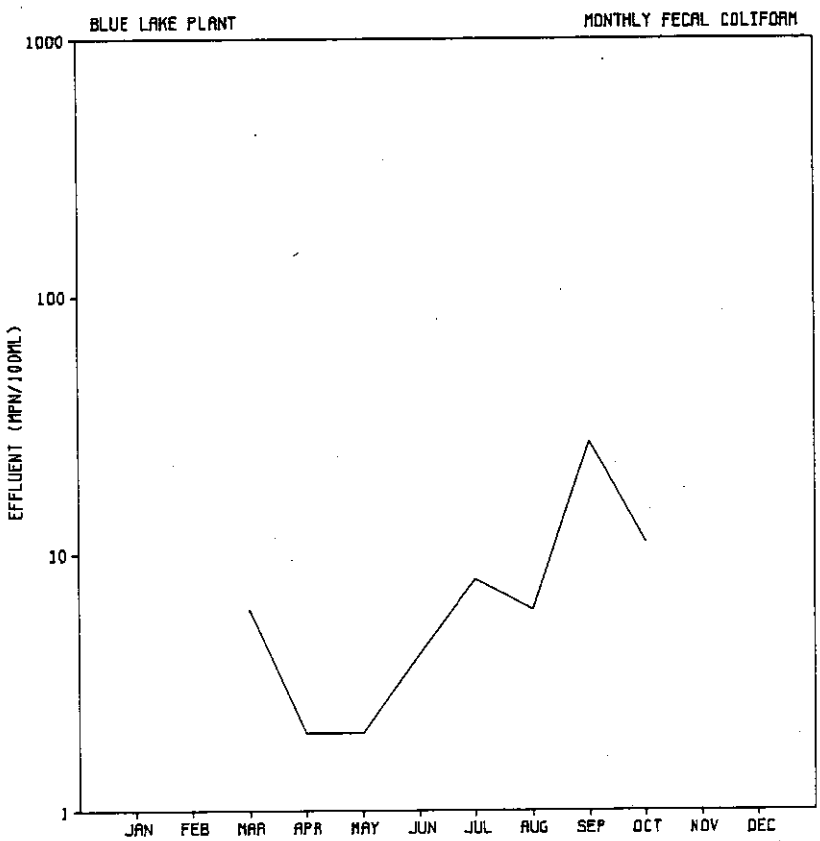

BLUE LAKE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

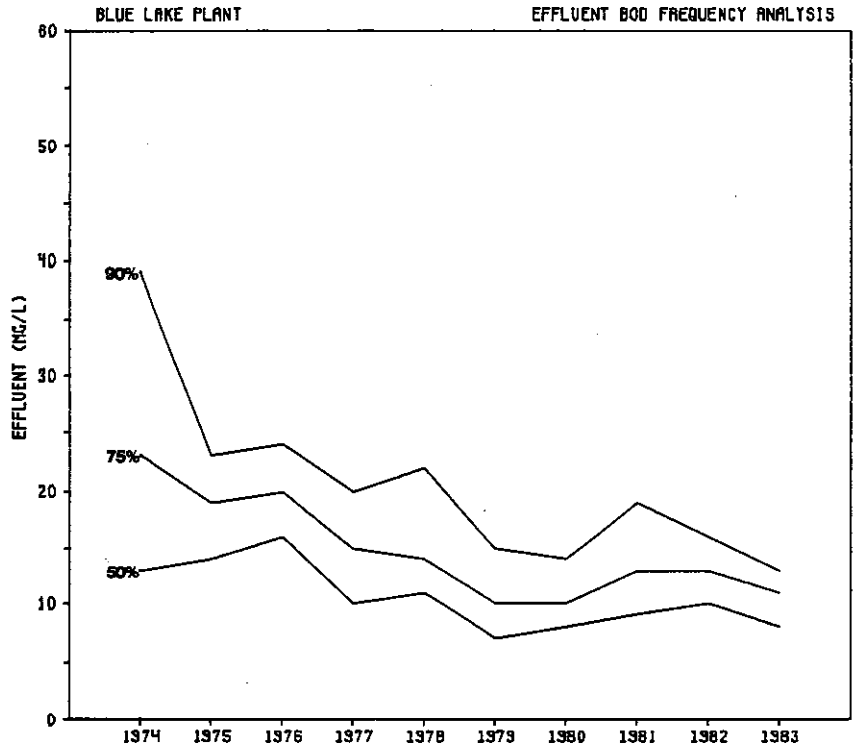

BLUE LAKE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

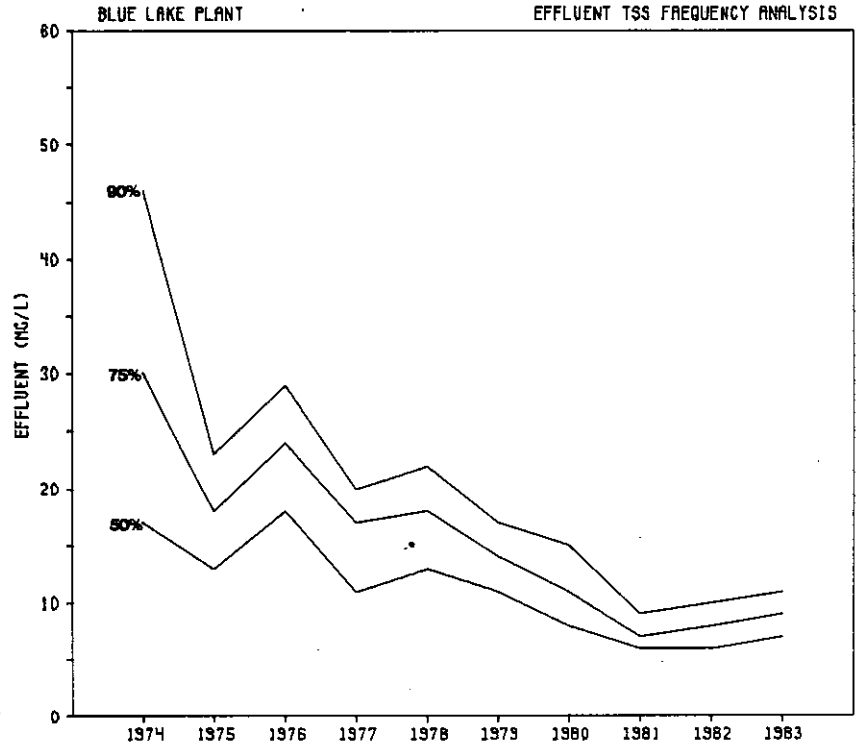

BLUE LAKE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


BLUE LAKE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BLUE LAKE PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


BLUE LAKE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


BLUE LAKE PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


BLUE LAKE PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

CHASKA WASTEWATER TREATMENT PLANT

Plant History and Description

The original Chaska Plant was designed by Lindsey Engineering Co. and constructed in 1963, with a design capacity of 0.75 mgd. The plant was converted to a pure oxygen activated sludge process in 1973, and final effluent filters were added in 1974. A plant expansion designed by McCombs-Knutson was constructed in 1980, increasing plant design capacity to 1.4 mgd. Actual operating capacity is somewhat less, due to high and widely variable organic loadings.

Liquid treatment consists of screening, grit removal, influent pumping, pure oxygen activated sludge aeration, final clarification, final effluent pumping, chlorination, and discharge to the Minnesota River.

Solids processing consists of aerobic digestion, and hauling to the Blue Lake Plant for further treatment and disposal.

The Chaska Plant is presently operating at about 80 percent of its rated hydraulic capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 1.02 mgd in 1983, up significantly from 0.80 mgd in 1982. Average plant effluent quality was 11 mg/L BOD and 11 mg/L TSS. Plant performance was affected by one NPDES weekly average effluent BOD violation, related to an excessively high influent organic loading. The probable source of the high organic loading was an industrial discharge. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	14	14	12	9	22	24	16	13	38	34	22	17
TSS	11	13	10	8	15	16	14	14	18	22	19	22

*1982 and 1983 values represent CBOD.

Future

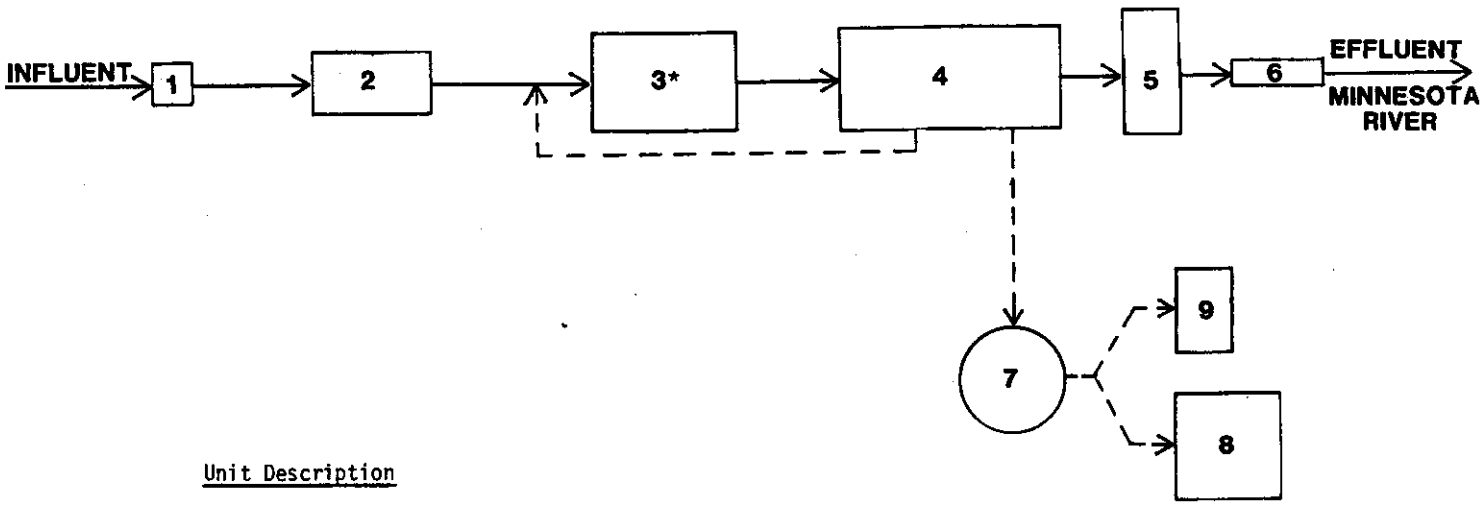
This plant is one of the Commission's permanent treatment plants. A plant expansion is scheduled for the mid-1980's.

CHASKA PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	0.80	1.02	1.06	1.78
BOD Loading, lb/day	1,260	1,200	1,490	1,500
TSS Loading, lb/day	1,120	1,100	1,520	1,300
COD Loading, lb/day	2,380	2,500	2,940	2,900
Sludge Production, lb/day	960	800	1,510	1,110
Grit Removal				
Overflow Rate, gpd/sq. ft.	17,780	23,000	23,560	30,000
Aeration Tanks				
Detention Time, hr.	3.0	2.4	2.3	1.4
BOD Loading, lb/day/1000 cu. ft.	93	90	110	110
Oxygen Utilization, lb/day as O_2	1,870	---	-----	---
Final Sedimentation				
Detention Time, hr.	7.0	5.5	5.3	3.1
Weir Overflow Rate, gpd/lin. ft.	4,260	5,400	5,640	9,500
Surface Overflow Rate, gpd/sq. ft.	280	360	380	640
Chlorination				
Contact Time, minutes	147	110	111	60
Chlorine Use, lb/day	29	70	33	130
Aerobic Digestion				
Volatile Solids Loading, lb/cu. ft./day	0.025	0.01	-----	---
Detention Time, days	53	60	36	---
Sludge Transport				
Volume, gpd	7,220	6,000	10,650	8,600

CHASKA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Grit Removal
3. Activated Sludge
4. Final Sedimentation
5. Effluent Filtration
6. Chlorination

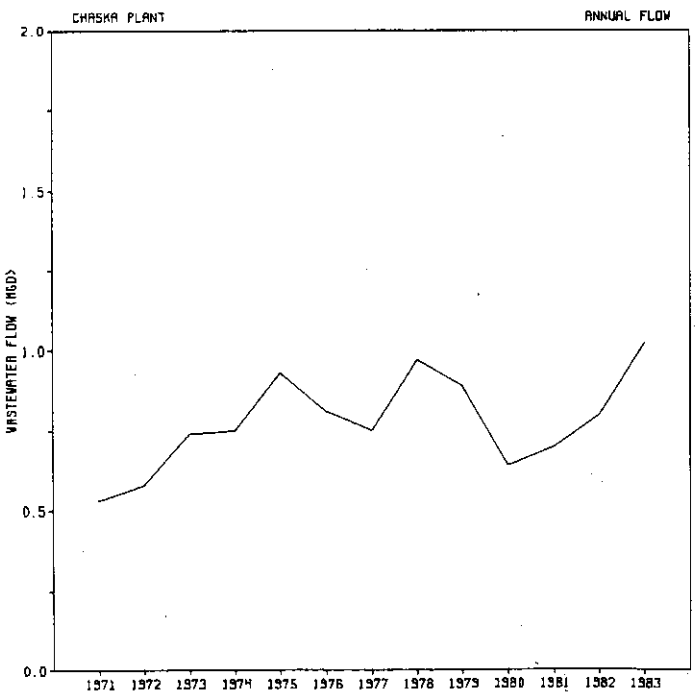
Solids Phase

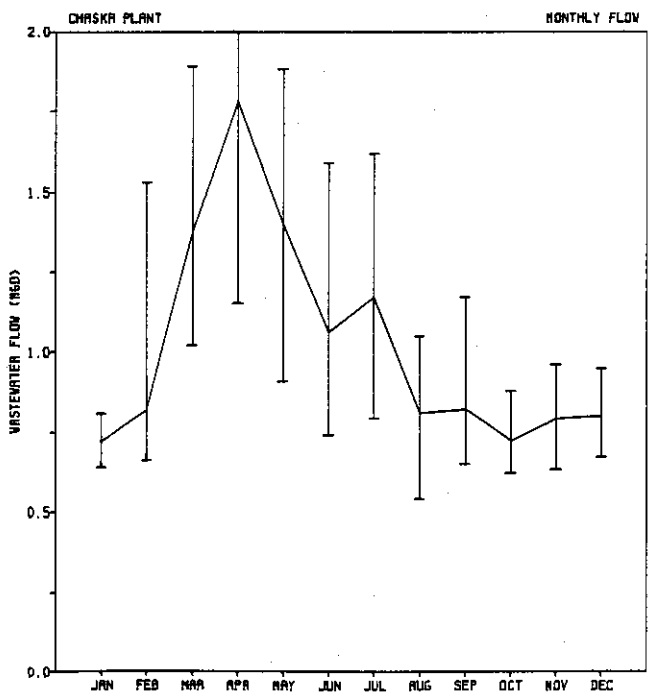
7. Two Stage Aerobic Digestion
8. Land Spread
9. Haul to Blue Lake System

* Pure Oxygen

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





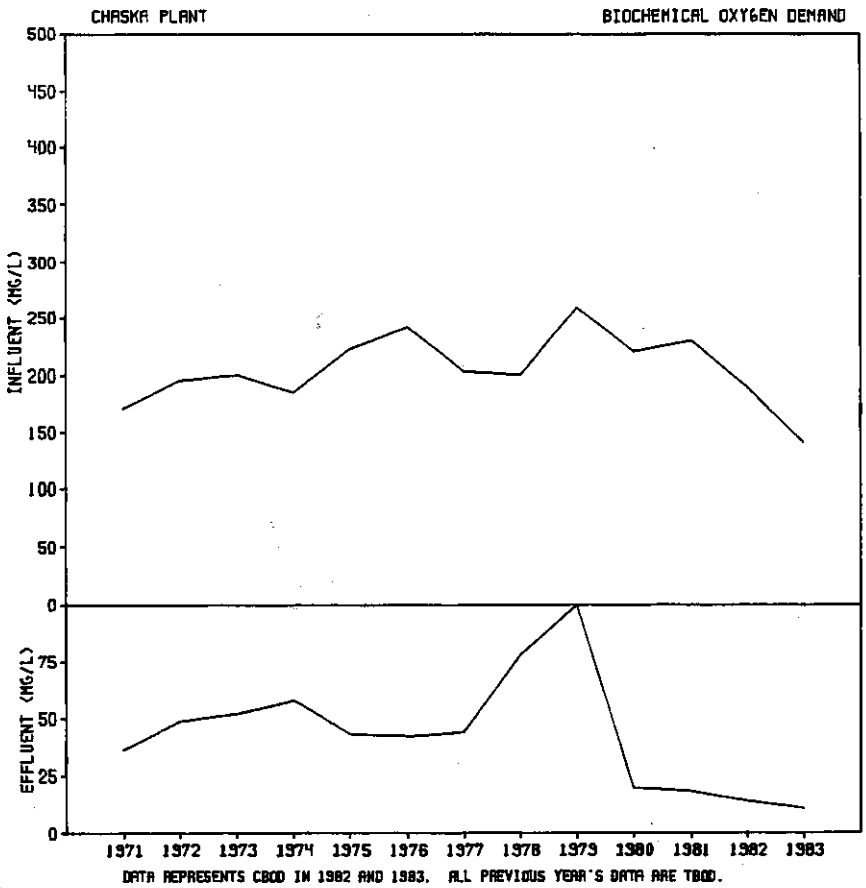
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Chaska

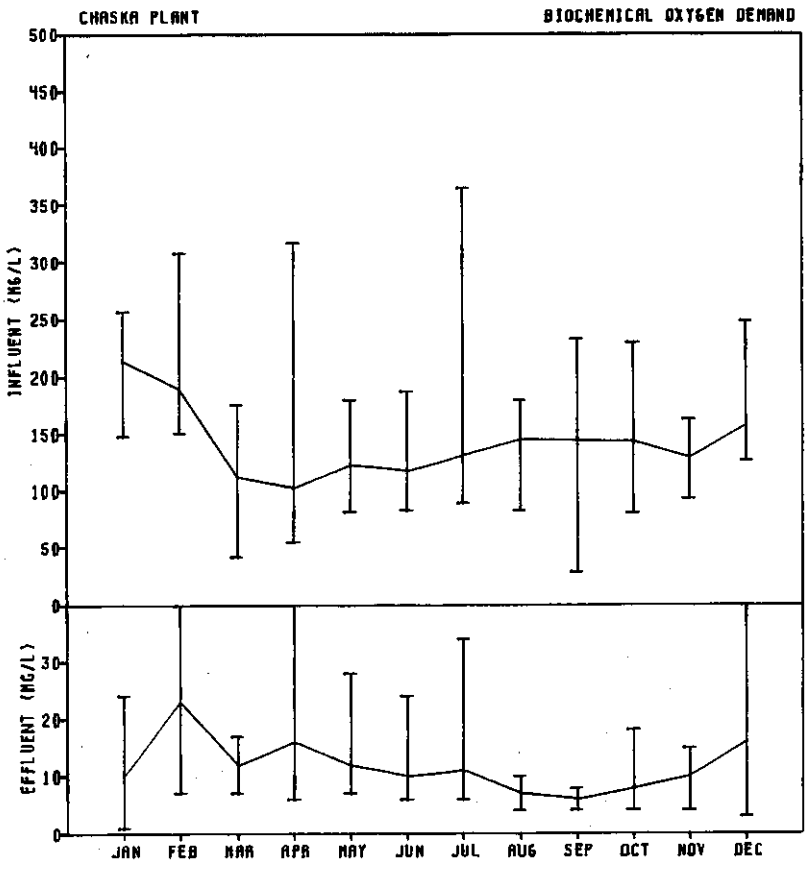
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.72	12	214	165	4.2-12.0	33.0	5.6	18.5	399
FEBRUARY	0.82	11	189	130	6.9-9.2	----	6.3	17.1	359
MARCH	1.38	10	112	85	6.8-8.6	19.0	3.2	25.1	240
APRIL	1.78	10	102	77	6.4-8.4	29.9	3.4	19.1	179
MAY	1.40	11	122	96	6.1-8.6	18.0	4.0	8.1	204
JUNE	1.06	14	117	115	7.0-9.0	22.5	3.9	12.4	254
JULY	1.17	16	131	133	6.9-8.8	84.1	6.3	41.5	297
AUGUST	0.81	18	145	139	6.8-9.4	26.3	5.1	13.2	310
SEPTEMBER	0.82	19	144	132	6.9-8.8	28.1	9.8	14.9	317
OCTOBER	0.72	17	143	166	5.6-9.4	62.0	12.2	39.8	308
NOVEMBER	0.79	15	129	157	6.4-9.2	31.3	5.3	12.8	318
DECEMBER	0.80	13	157	132	4.4-9.4	30.4	4.9	16.0	311
1983 AVERAGE	1.02	14	141	127	4.2-12.0	35.1	5.9	19.5	291
1982 AVERAGE	0.80	14	189	167	5.6-11.2	32.7	5.6	16.0	356

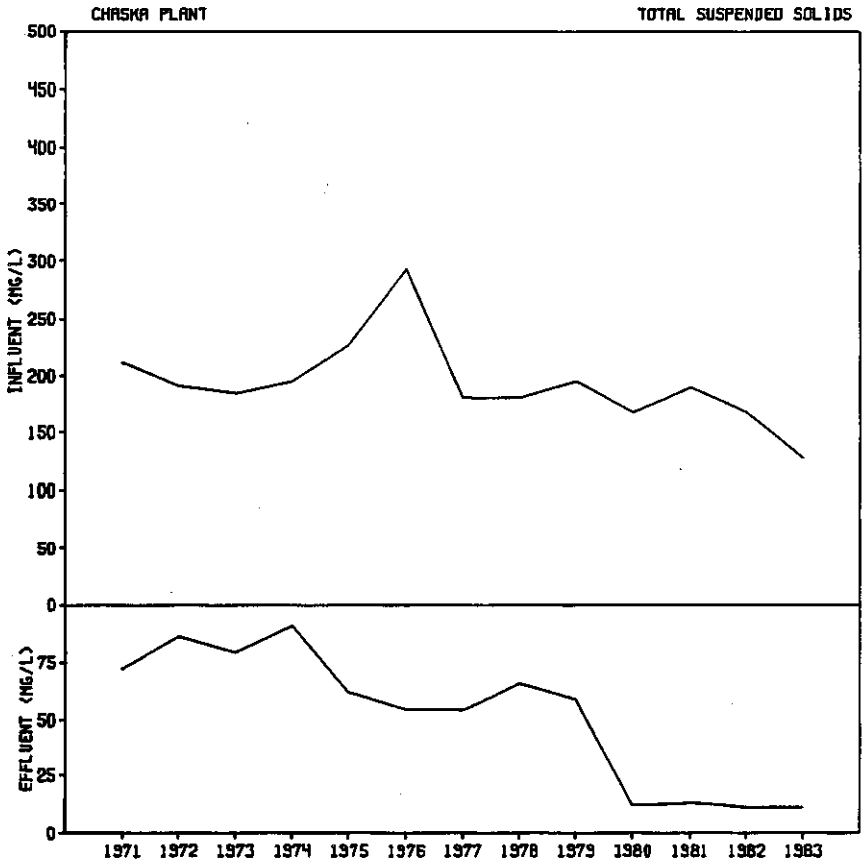
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Chaska

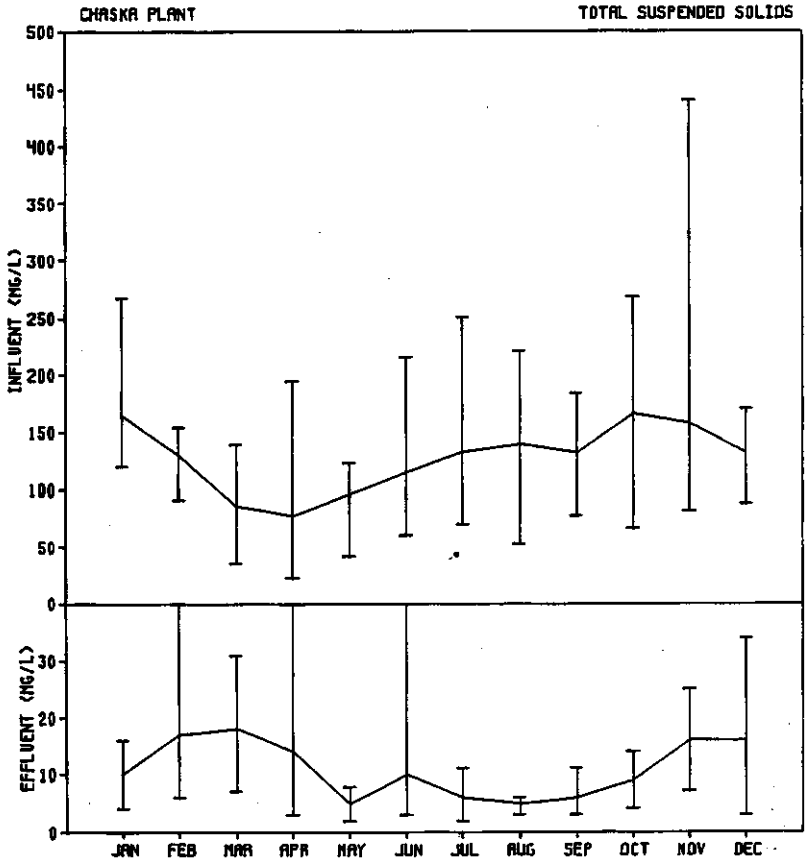
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	---	----	---	---	--	---	----	6.5-8.5	--	--
JANUARY	17	10	62	10	---	3	18.6	11.9	1.25	1.30	2.0	--	---	10.0	7.0-7.8	95	94
FEBRUARY	29	23	102	17	---	7	----	11.8	0.65	1.00	2.9	20	1.2	9.5	6.8-7.8	88	87
MARCH	14	12	75	18	10	6	11.8	6.4	0.32	1.65	1.5	128	6.8	10.0	6.9-7.8	90	79
APRIL	18	16	85	14	6	6	11.4	5.6	0.07	2.49	1.5	199	9.1	10.4	7.1-7.7	84	81
MAY	12	12	50	5	11	3	10.3	4.2	0.13	1.17	1.1	42	3.4	10.8	7.1-7.8	90	95
JUNE	12	10	61	10	5	5	12.1	8.1	0.19	1.14	1.3	41	2.7	9.3	7.1-7.9	92	91
JULY	12	11	63	6	7	3	10.1	7.0	0.31	1.00	0.5	40	2.5	9.1	7.1-7.7	92	96
AUGUST	8	7	55	5	6	3	12.1	7.8	0.52	0.77	1.3	44	2.7	8.4	7.2-7.7	95	96
SEPTEMBER	9	6	51	6	10	3	12.3	7.4	1.03	1.35	1.1	35	2.7	7.9	7.0-7.6	96	96
OCTOBER	13	8	68	9	8	5	9.6	6.2	2.58	3.10	3.3	46	1.6	8.4	7.0-7.7	95	94
NOVEMBER	24	10	76	16	---	6	9.8	4.9	2.70	4.16	2.4	--	---	8.3	7.0-7.8	93	90
DECEMBER	39	16	77	16	---	6	12.4	8.1	1.31	4.54	2.3	--	---	8.7	7.1-7.7	90	88
1983 AVG.	17	11	68	11	8	5	11.8	7.3	0.92	1.97	1.8	70	3.8	9.2	6.8-7.9	92	91
1982 AVG.	20	14	75	11	5	5	15.6	9.6	1.27	1.10	1.7	29	2.0	9.0	6.6-8.2	93	93

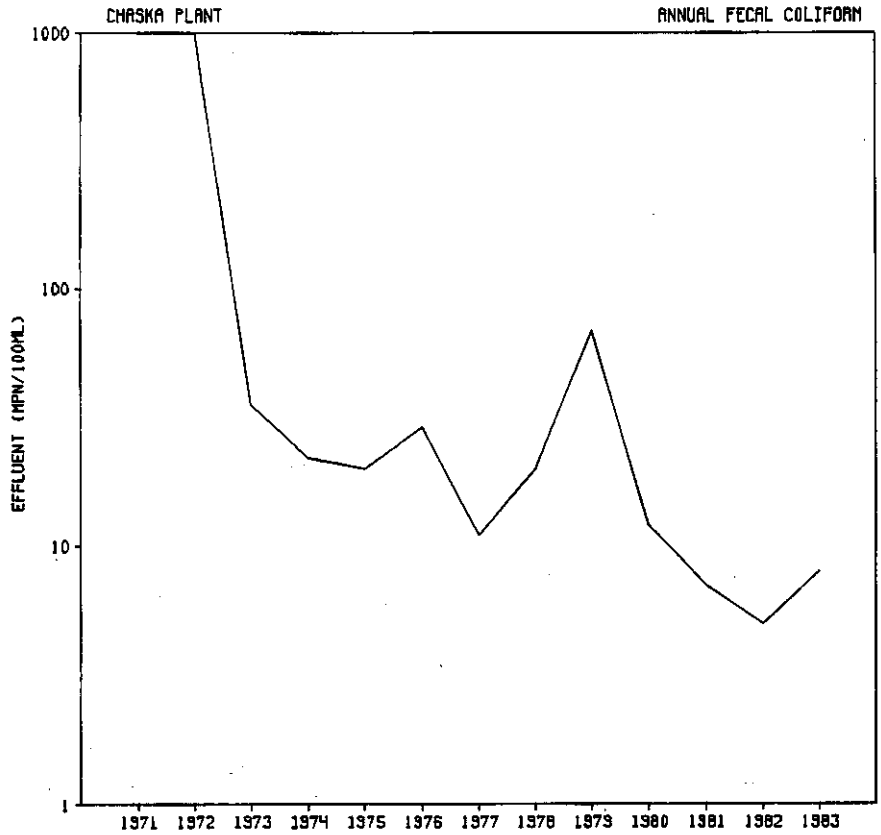
*For disinfection only.

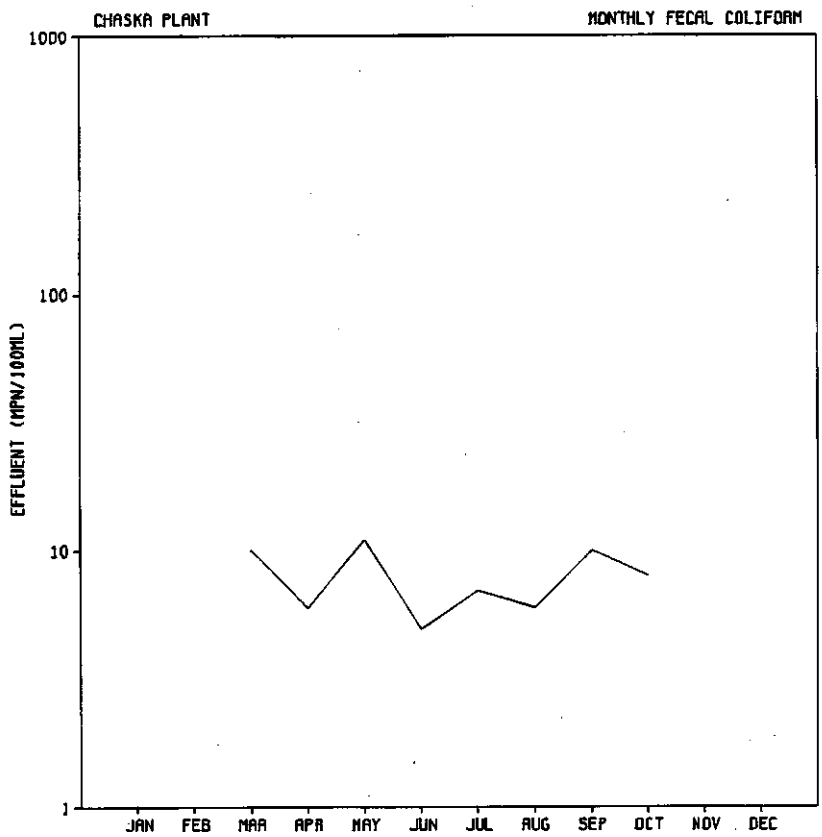

CHASKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

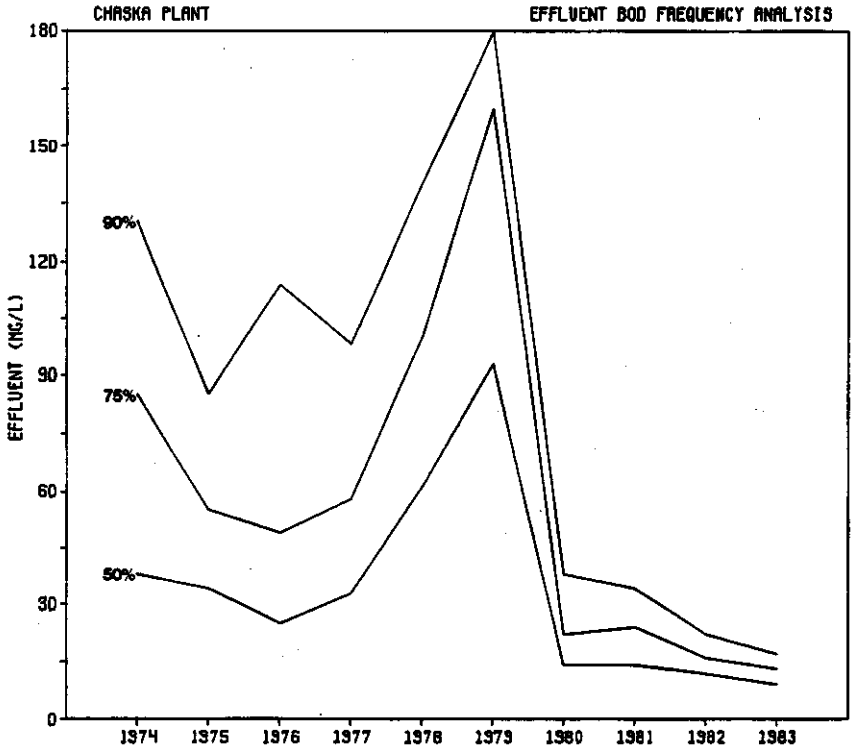

CHASKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

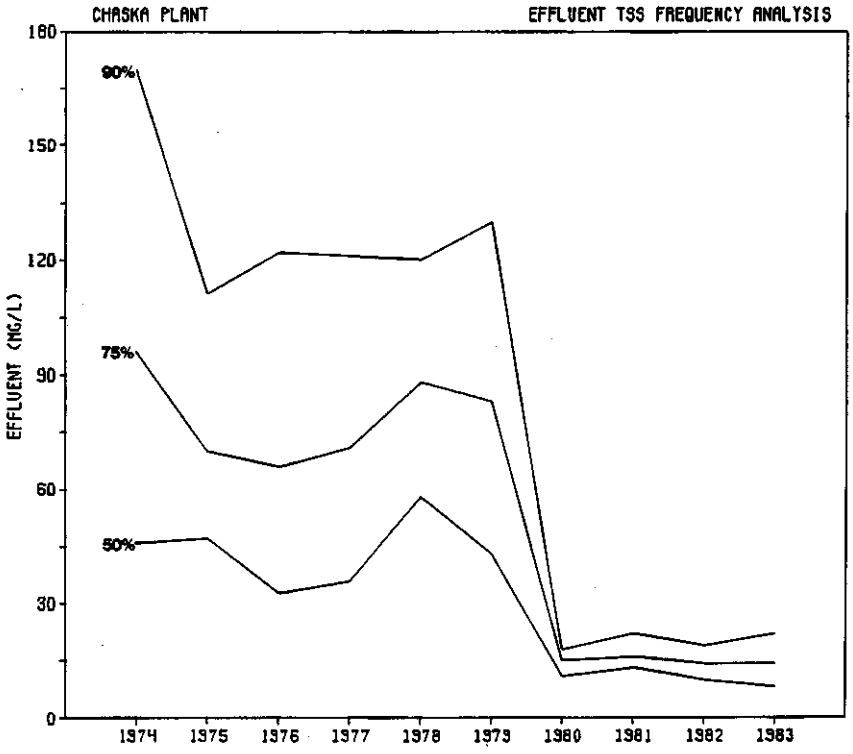

CHASKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
75
25
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


CHASKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


CHASKA PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


CHASKA PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


CHASKA PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


CHASKA PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

COTTAGE GROVE WASTEWATER TREATMENT PLANT

Plant History and Description

The Cottage Grove Plant was designed by Bonestroo, Rosene, Anderlik, and Associates, originally constructed in 1962 and expanded in 1963 and 1968. In 1975, effluent polishing filters were added to the plant. In 1976, primary anaerobic digester volume was increased and a new cover was installed. In 1979, the plant was expanded to its current design capacity of 1.8 mgd.

Liquid treatment consists of screening, primary sedimentation, activated sludge aeration, final clarification, effluent polishing filters, chlorination, and discharge to the Mississippi River.

Solids processing consists of combined sludge gravity thickening, anaerobic digestion with ultimate disposal by landspreading or the Metropolitan Plant Interceptor System.

The plant is presently operating at about 70 percent of its design capacity and is subject to secondary treatment limits.

Performance

The plant flow averaged 1.30 mgd in 1983, up slightly from 1.26 mgd in 1983. Average plant effluent quality was 9 mg/L BOD and 11 mg/L TSS. Plant performance was good throughout the year although one NPDES Permit violation occurred. The violation, exceeding the weekly effluent fecal coliform limit, was the result of a maintenance problem with the chlorine equipment. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	10	9	8	8	14	15	13	11	18	20	18	14
TSS	7	5	6	10	13	8	10	14	22	14	14	18

*1982 and 1983 values represent CBOD.

Future

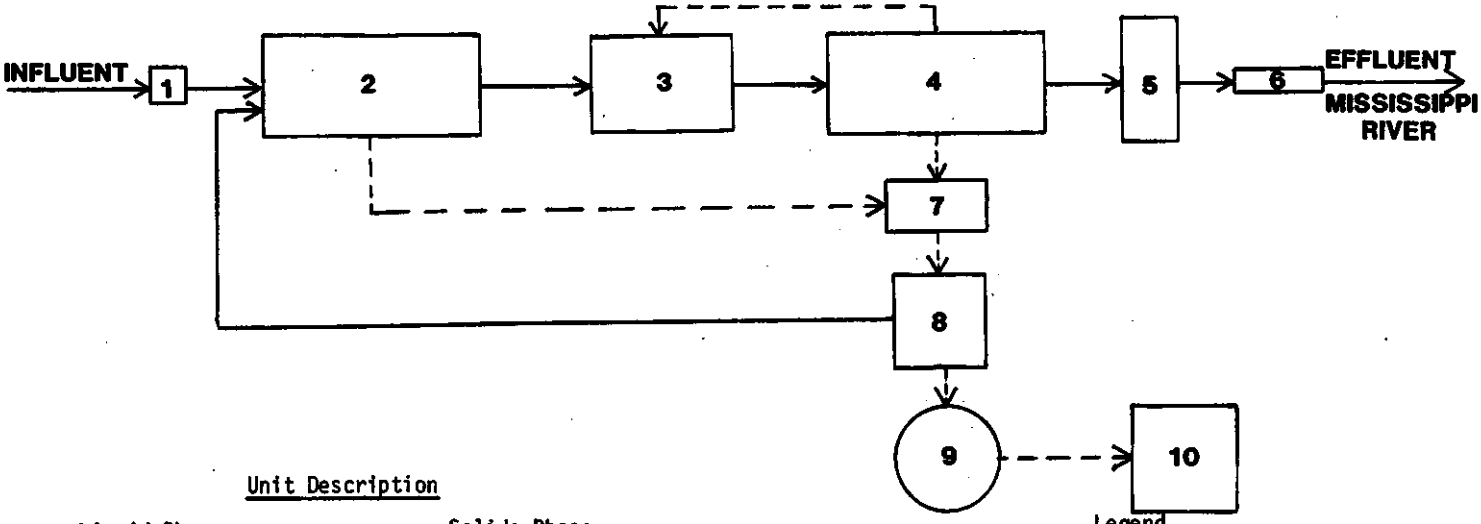
The Cottage Grove facility is considered a permanent plant. The plant is expected to be expanded in the late 1980's.

COTTAGE GROVE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	1.26	1.30	1.32	1.37
BOD Loading, lb/day	2,186	1,900	2,528	2,380
TSS Loading, lb/day	1,829	1,680	2,245	2,520
COD Loading, lb/day	4,174	3,960	-----	4,700
Primary Sedimentation				
Detention Time, hr.-north	2.5	2.5	2.4	2.4
Detention Time, hr.-south	3.8	3.7	3.6	3.5
Weir Overflow Rate, gpd/lin. ft.-north	6,680	6,900	7,000	7,260
Weir Overflow Rate, gpd/lin. ft.-south	4,320	4,460	4,520	4,700
Surface Overflow Rate, gpd/sq. ft.-north	530	550	550	575
Surface Overflow Rate, gpd/sq. ft.-south	530	550	550	575
Aeration Basin				
BOD Loading, lb/day/1000 cu. ft.	43	37	50	47
Final Sedimentation				
Detention Time, hr.	2.7	5.3	2.6	5.0
Weir Overflow Rate, gpd/lin. ft.	4,470	4,600	4,680	4,860
Surface Overflow Rate, gpd/sq. ft.	396	410	415	430
Polishing Filtration				
Average Filtration Rate, gpm/sq. ft.	2.9	---	3.1	---
Chlorination				
Contact Time, minutes	34	--	32	--
Chlorine Use, lb/day	86	69	108	80
Gravity Thickener				
Surface Loading Rate, gpd/sq. ft.	730	725	---	---
Mass Loading Rate, lb/sq. ft./day	6	3	---	---
Anaerobic Digestion				
Solid Retention Time, day	48	62	39	41
Sludge Transport				
Volume, gpd	9,528	6,260	13,000	9,500
Mass, lb/day	1,295	960	1,890	1,000

COTTAGE GROVE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

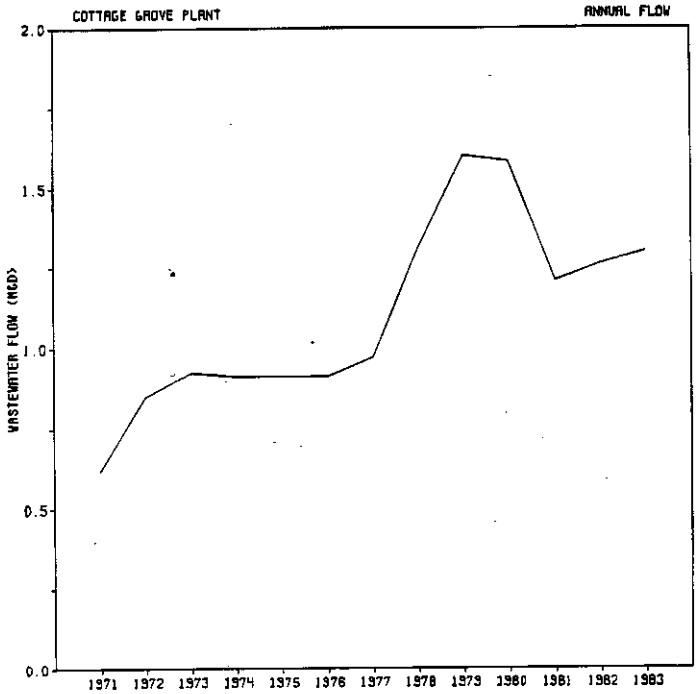
1. Screening
2. Primary Sedimentation
3. Activated Sludge
4. Final Sedimentation
5. Effluent Filtration
6. Chlorination

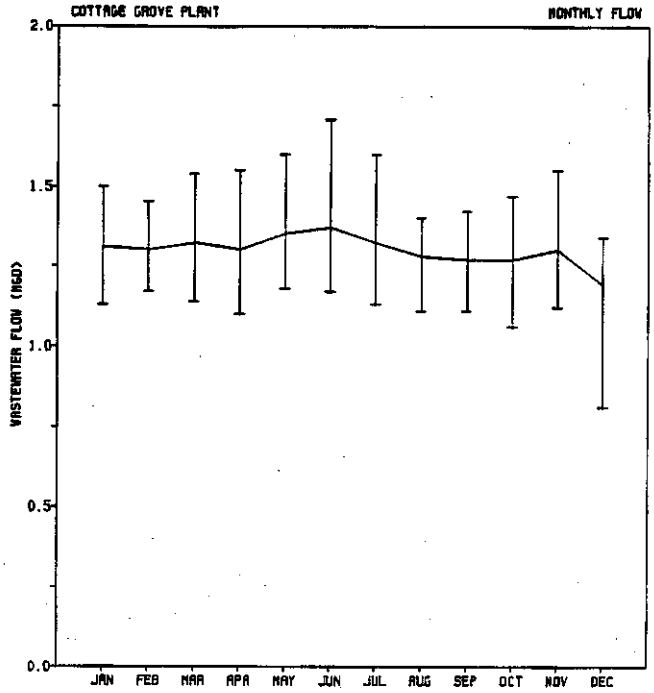
Solids Phase

7. Sludge Blend Tank
8. Sludge Thickener
9. Anaerobic Digestion
10. Haul to Land Spreading

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





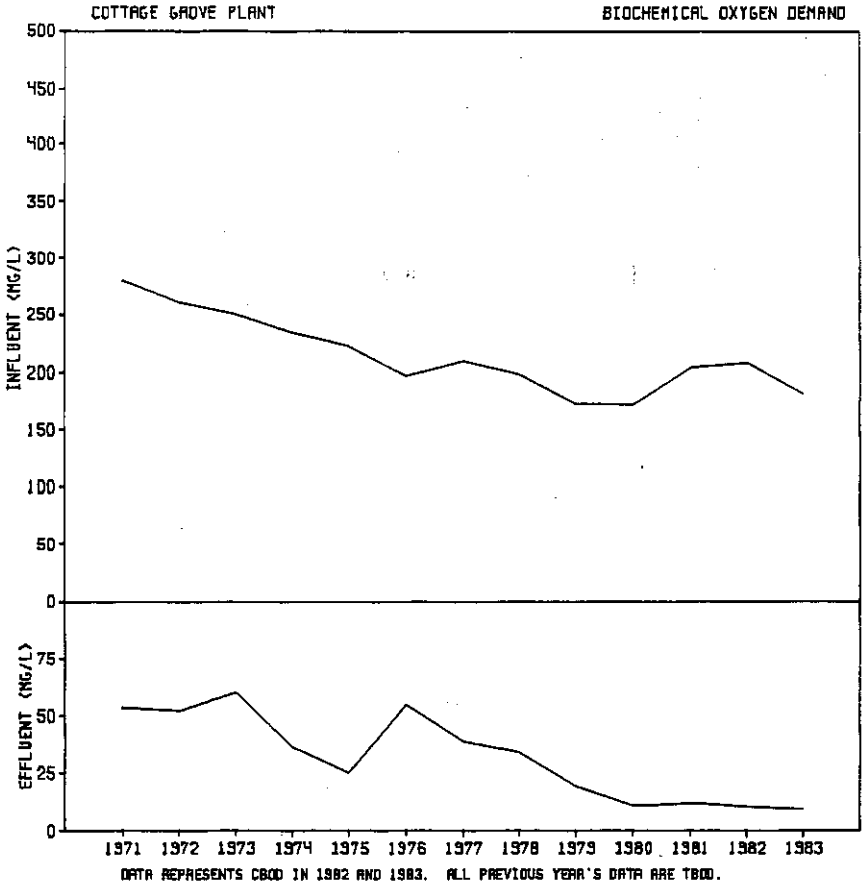
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Cottage Grove

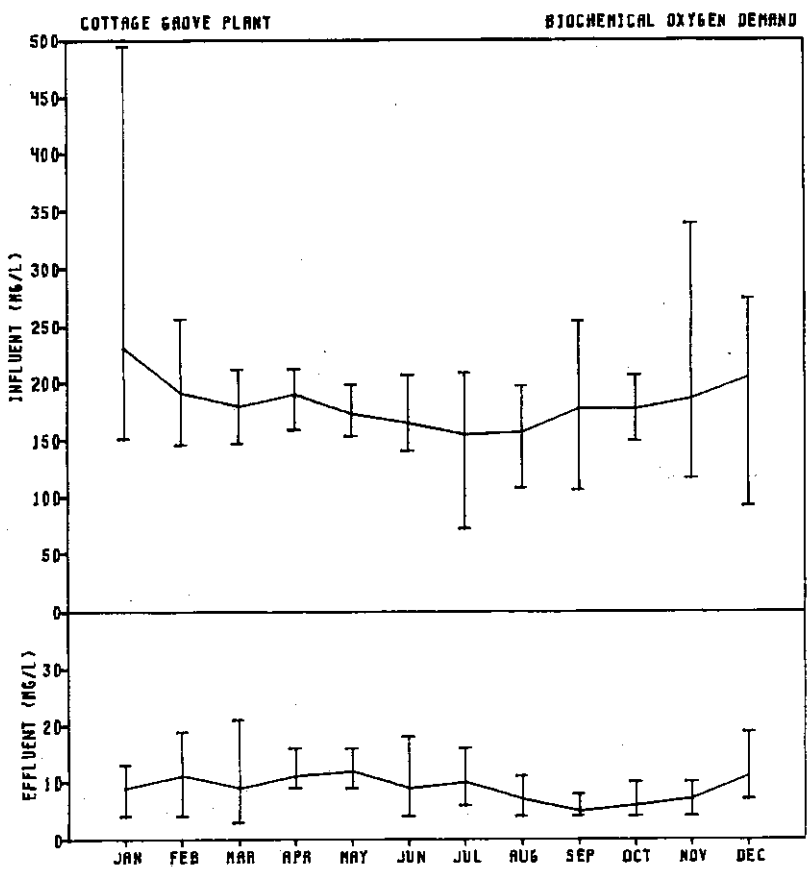
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	1.31	12	231	242	7.6-8.5	55.4	10.3	29.3	453
FEBRUARY	1.30	11	190	137	7.5-8.5	----	14.0	29.1	360
MARCH	1.32	11	179	149	7.2-8.3	40.0	8.0	29.5	376
APRIL	1.30	12	189	152	7.5-8.2	47.1	7.4	31.5	371
MAY	1.35	13	172	119	7.0-8.3	39.7	6.3	24.9	307
JUNE	1.37	16	164	148	7.4-8.1	38.4	6.4	26.3	349
JULY	1.32	19	154	137	7.4-8.0	34.6	5.7	23.0	339
AUGUST	1.28	20	156	153	7.4-8.0	38.9	6.7	23.1	373
SEPTEMBER	1.27	21	177	207	7.2-8.1	39.1	7.2	24.4	414
OCTOBER	1.27	19	176	139	7.4-8.0	41.4	7.7	28.0	370
NOVEMBER	1.30	16	185	163	7.3-8.0	42.4	7.1	20.9	410
DECEMBER	1.19	13	204	175	7.4-8.2	43.1	6.9	23.0	414
1983 AVERAGE	1.30	15	181	160	7.0-8.5	41.9	7.7	25.9	378
1982 AVERAGE	1.26	15	208	173	7.2-8.7	46.1	7.6	26.5	397

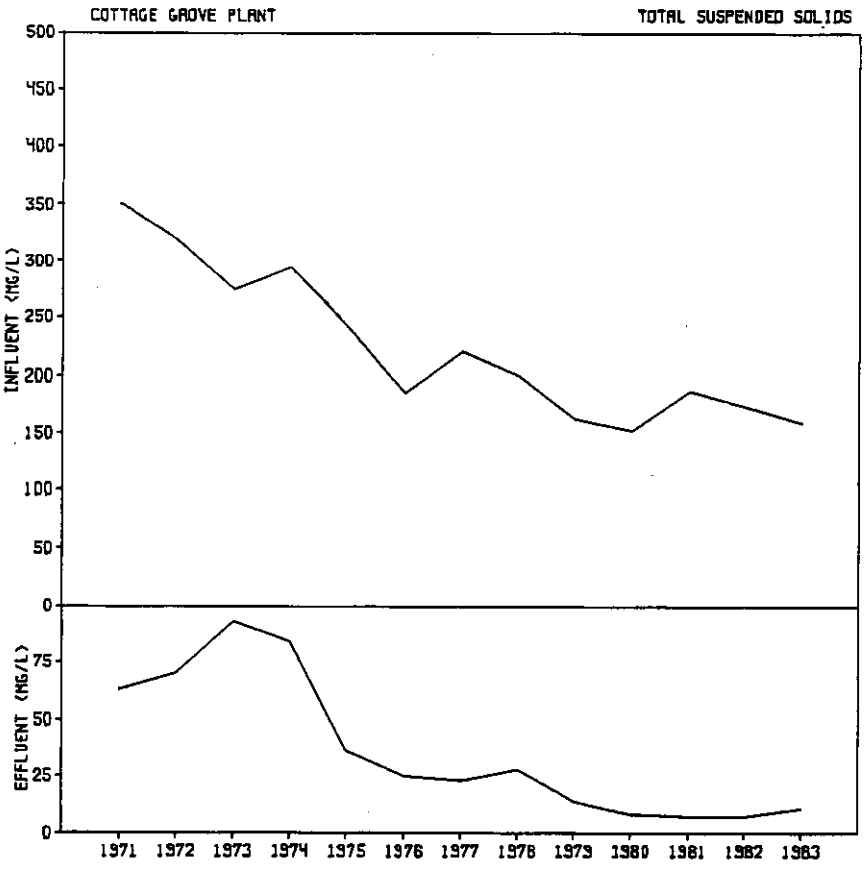
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Cottage Grove

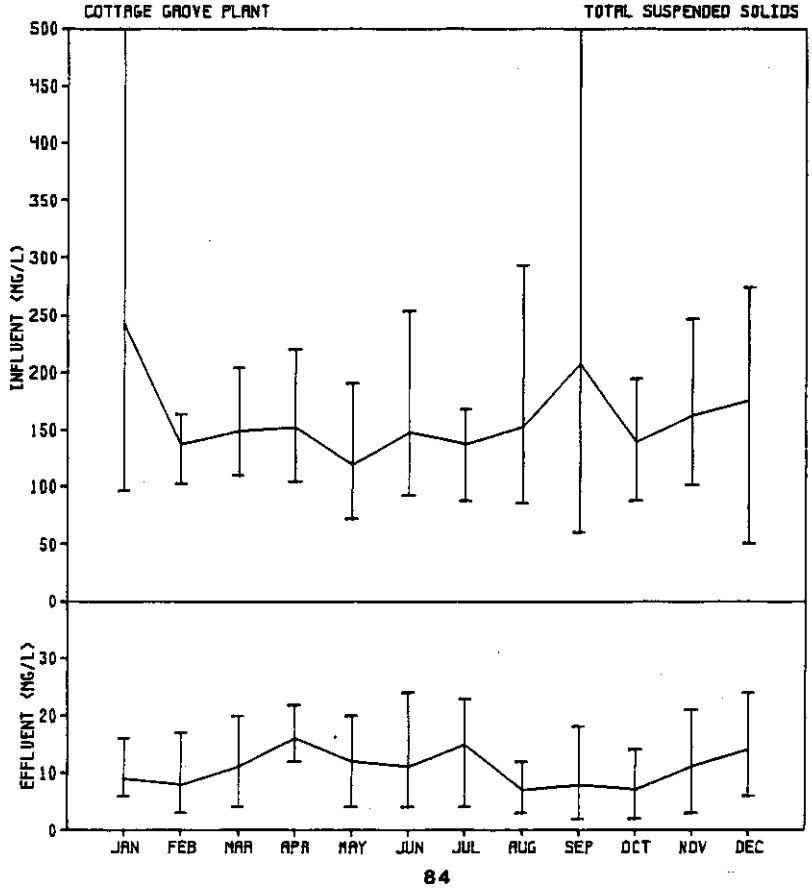
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	------	---	--	---	---	6.5-8.5	--	--
JANUARY	21	9	56	9	---	4	37.5	24.8	1.04	1.77	5.9	--	---	5.2	7.2-7.7	96	96
FEBRUARY	31	11	60	8	---	3	----	18.6	1.49	11.40	6.4	43	2.0	5.6	7.2-7.7	94	94
MARCH	11	9	78	11	24	6	39.0	28.3	0.72	2.16	5.4	60	4.3	5.5	7.1-7.5	95	93
APRIL	13	11	74	16	27	8	31.9	30.4	0.85	1.01	4.8	64	3.2	5.3	7.3-7.6	94	90
MAY	26	12	67	12	101	5	27.5	21.3	2.39	1.49	4.7	59	2.3	4.9	7.0-7.6	93	90
JUNE	21	9	62	11	47	5	17.5	10.9	1.98	8.52	4.9	69	5.0	4.9	7.1-7.6	95	92
JULY	17	10	72	15	17	6	7.9	2.3	0.79	19.08	4.9	69	2.7	5.1	6.8-7.5	93	89
AUGUST	13	7	45	7	71	3	5.8	3.9	1.02	11.38	4.3	73	3.5	4.6	7.2-7.5	96	95
SEPTEMBER	11	5	49	8	44	4	6.8	5.3	1.12	12.25	4.6	78	4.6	4.6	6.8-7.7	97	96
OCTOBER	11	6	49	7	95	4	5.6	4.2	0.92	13.83	4.9	80	2.9	4.8	6.8-7.4	97	95
NOVEMBER	25	7	66	11	---	4	10.2	4.4	1.20	12.99	4.9	--	---	4.9	7.0-7.4	96	93
DECEMBER	29	11	65	14	---	5	17.5	13.0	0.75	12.44	5.1	--	---	5.7	7.0-7.5	95	92
1983 AVG.	19	9	62	11	53	5	16.7	13.5	1.21	9.15	5.0	68	3.5	5.1	6.8-7.7	95	93
1982 AVG.	14	10	57	7	11	4	16.6	11.3	2.00	12.44	5.3	93	7.2	6.1	6.7-7.9	95	96

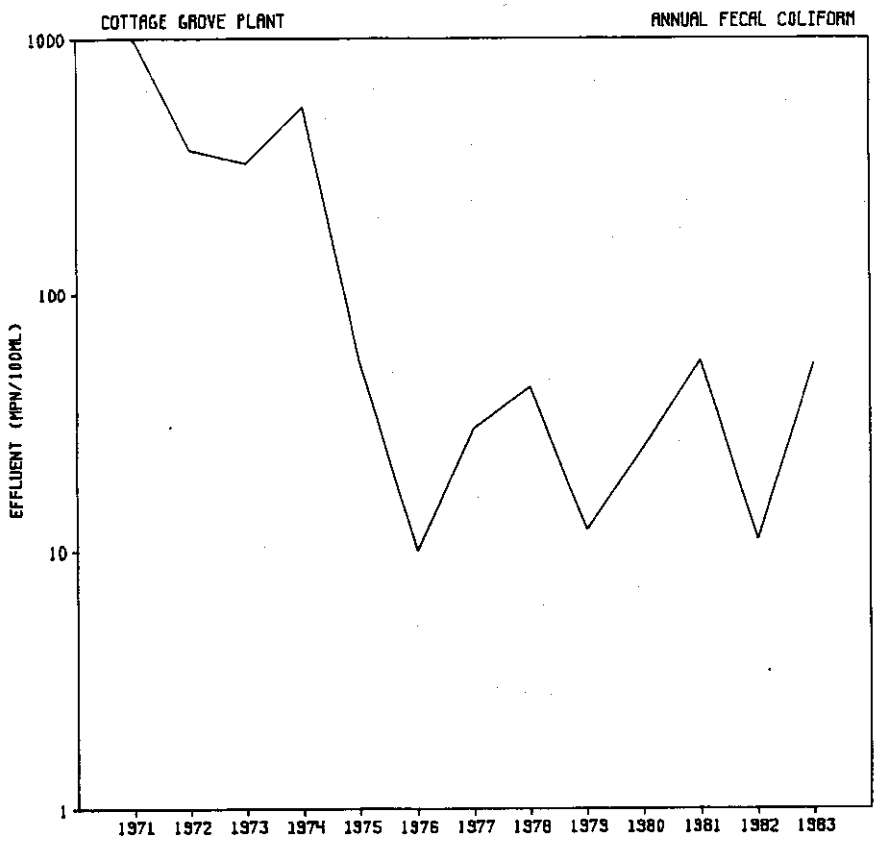
*For disinfection only.

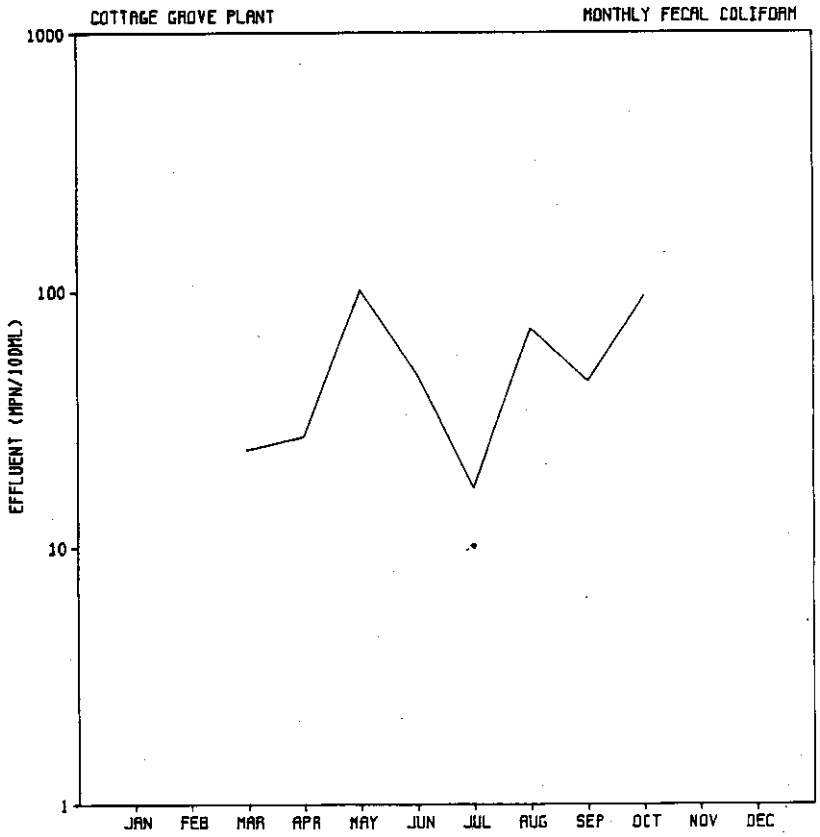

COTTAGE GROVE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.


COTTAGE GROVE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


COTTAGE GROVE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


COTTAGE GROVE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


COTTAGE GROVE PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983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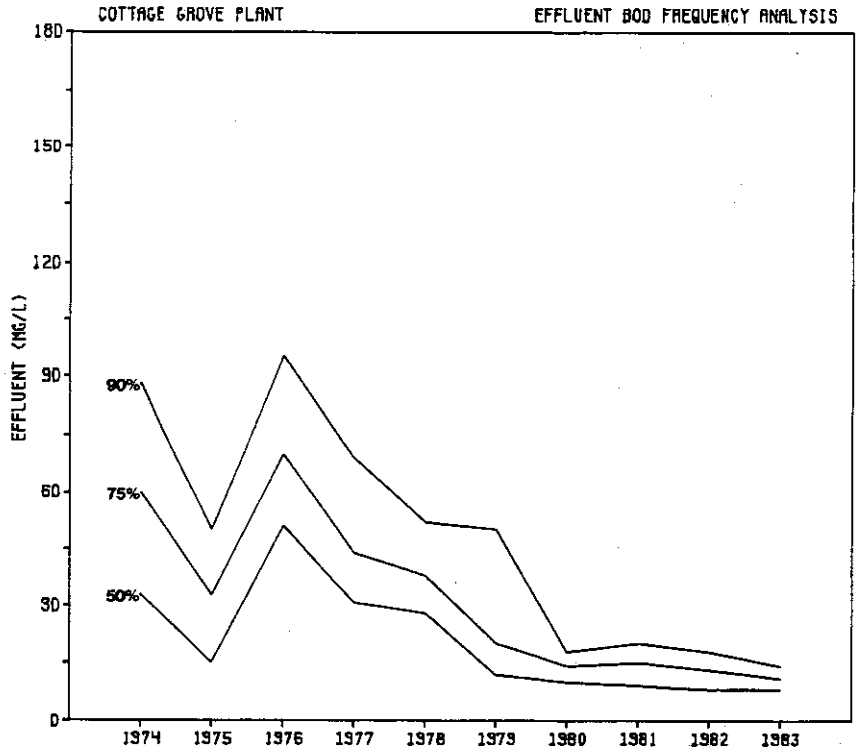
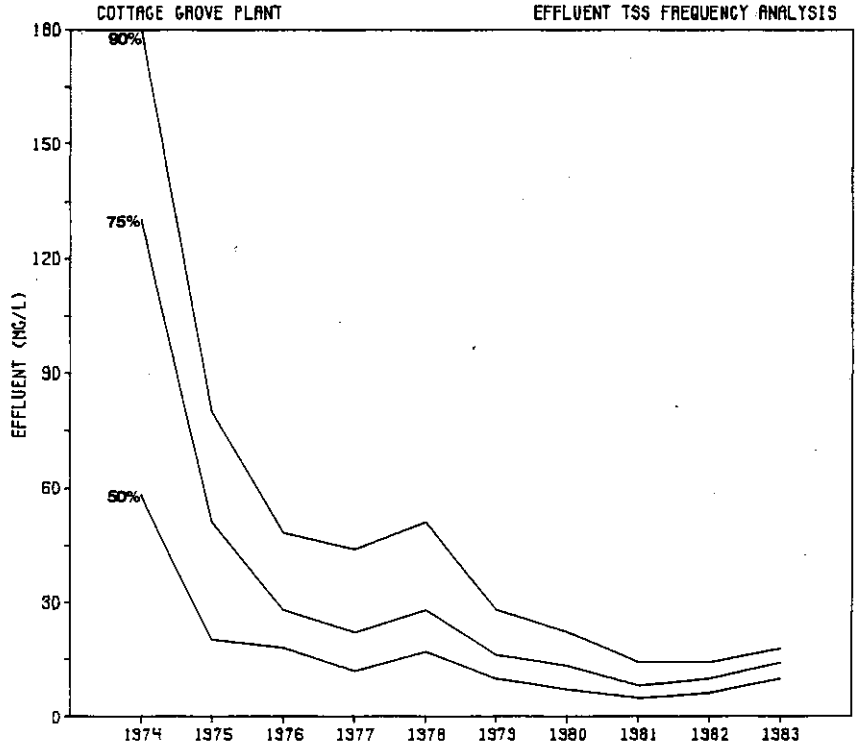
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


COTTAGE GROVE PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


COTTAGE GROVE PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

EMPIRE WASTEWATER TREATMENT PLANT

Plant History and Description

The Empire Plant was designed by Short, Elliot, Hendrickson and Associates and was constructed in 1977-1979. The Empire Plant began operation in the fall of 1979. The plant replaced three treatment plants (Lakeville, Farmington, and Apple Valley) which were overloaded and required upgrading to meet water quality based effluent standards. The Empire Plant serves Apple Valley, Empire Township, Farmington, and Lakeville in Service Area No. 6 and has a design capacity of 6.0 mgd.

Liquid treatment consists of screening, influent pumping, grit removal, primary sedimentation, high rate activated sludge aeration, intermediate sedimentation, nitrification activated sludge aeration, final clarification, effluent filtration, chlorination, and discharge to the Vermillion River.

Solids processing consists of combined sludge gravity thickening, anaerobic digestion, centrifuge dewatering, sludge storage and sludge landspreading. The plant is operating at about 80 percent of design capacity and is subject to effluent limits of 10 mg/L BOD and TSS, and 1 mg/L ammonia.

Performance

Plant flow averaged 4.81 mgd, slightly higher than 4.05 mgd in 1982. Average plant effluent quality was 3 mg/L BOD, 1 mg/L TSS and 0.4 mg/L ammonia. Plant performance was excellent throughout the year with no NPDES permit violations. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	2	3	2	2	2	4	3	3	5	4	4	4
TSS	1	1	1	1	3	1	1	1	4	2	2	2

*1982 and 1983 values represent CBOD.

Future

The Empire Plant is one of the Commission's permanent regional plants. Provisions have been made for doubling the plant's capacity when the area's growth requires plant expansion.

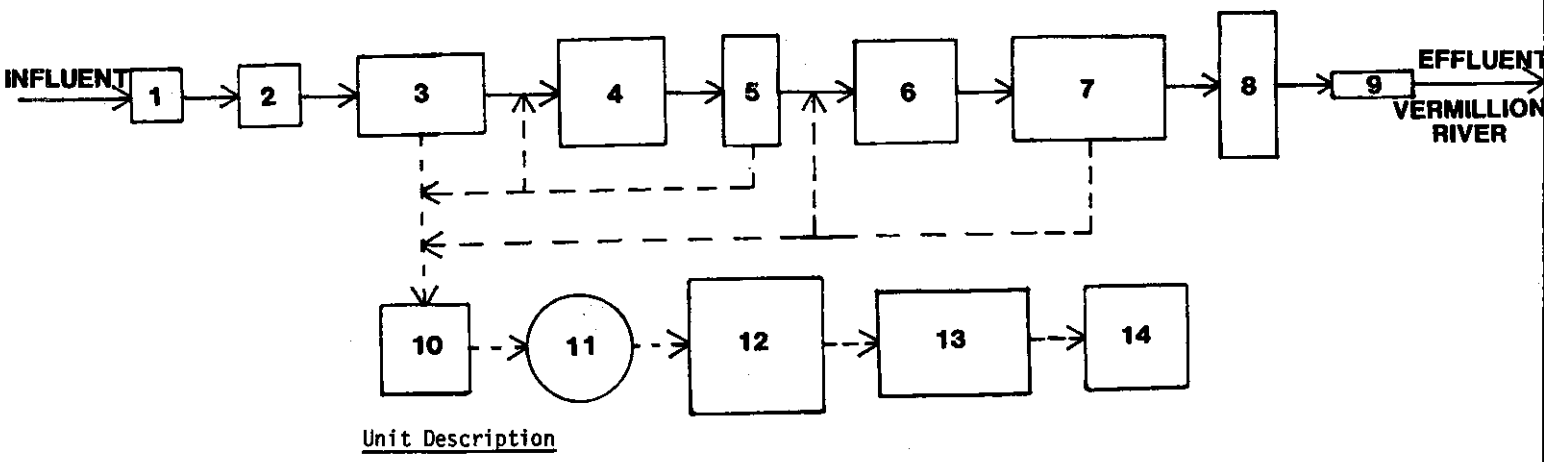
EMPIRE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	4.05	4.81	4.89	6.57
BOD Loading, lb/day	6,900	8,500	7,600	13,300
TSS Loading, lb/day	7,200	9,900	9,500	13,200
Ammonia Loading, lb/day	740	650	1,000	800
	-----	17,900	-----	23,800
Aerated Grit Chamber (All in Use)				
Flow Through Velocity, fps	0.05	0.03	0.06	0.04
Detention Time, minutes	12	20	10	15
Primary Clarifiers				
Surface Overflow Rate, gpd/sq. ft.	400	480	490	650
Weir Overflow Rate, gpd/lin. ft.	8,000	9,600	9,800	13,100
Detention Time, hr.	5.3	4.5	4.4	3.3
Removal Efficiency, %BOD	31	-----	32	------
Removal Efficiency, %TSS	58	-----	70	------
High Rate Aeration				
Mixed Liquor Suspended Solids, mg/L	1,600	1,900	1,900	2,000
F:M Ratio, lb. BOD/day/lb. MLSS	0.72	0.21	0.87	0.40
BOD Loading, lb./day/1000 cu. ft.	66	25	79	39
Detention Time, hr.	3.0	3.8	2.5	2.7
High Rate Clarifiers				
Surface Overflow Rate, gpd/sq. ft.	400	480	490	650
Weir Overflow Rate, gpd/lin. ft.	8,000	9,600	9,800	13,100
Detention Time, hr.	5.3	4.5	4.4	3.3
Nitrification Aeration				
Mixed Liquor Suspended Solids, mg/L	2,400	2,700	2,100	3,200
Ammonia: Mass Ratio, lb. NH_3/day/lb. MLSS	0.024	0.021	0.04	0.038
Ammonia Loading, lb. NH_3/day/1000 cu. ft.	3.8	3.6	5.8	3.9
Detention Time, hr.	6.8	6.3	4.9	4.6
Nitrification Final Clarifiers				
Surface Overflow Rate, gpd/sq. ft.	320	380	390	520
Weir Overflow Rate, gpd/lin. ft.	7,200	8,500	8,700	11,600
Detention Time, hr.	6.5	5.7	5.4	4.2
Dual Media Filters				
Filtration Rate, gpd/sq. ft.	1.9	2.2	2.3	2.9

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Chlorination				
Chlorine Dose, mg/L	3.6	2.9	3.9	3.3
Chlorine Use, lb./day	130	125	140	145
Contact Time, minutes	38	32	32	23
Cascade Aeration				
Effluent Dissolved Oxygen, mg/L	8.9	10.0	9.8	11.6
Gravity Thickener				
Solids Loading, lb/sq. ft./day	4	----	5	----
Surface Overflow Rate, gpd/sq. ft.	600	----	600	----
Sludge Concentration, % TS	3.8	----	4.9	----
Anaerobic Digesters (Primary)				
Solids Loading, lb. VS/cu. ft./day	0.04	----	0.05	----
Detention Time, days	40	----	30	----
Dewatered Sludge				
Quantity, lb/day	3,000	----	5,600	----
Cake Solids, % TS	13	----	14	----

EMPIRE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

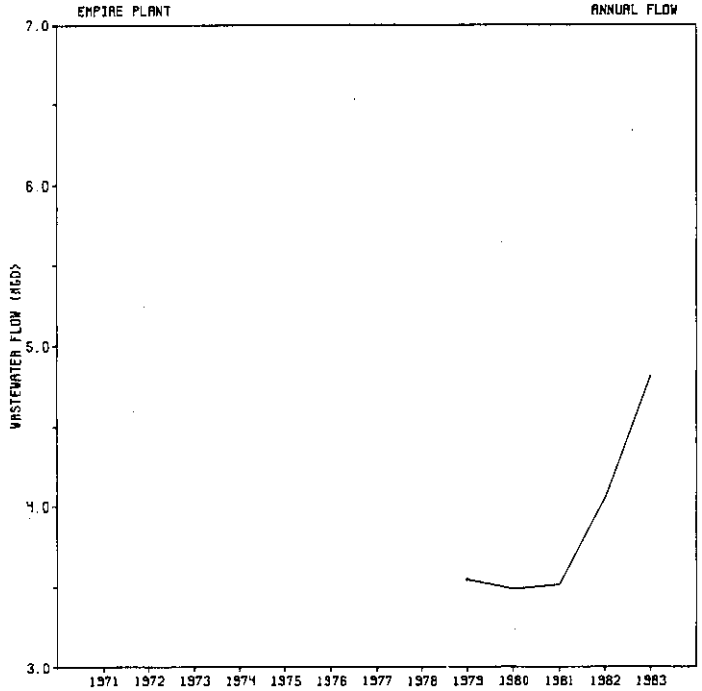
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Hi-Rate Activated Sludge Aeration
5. Intermediate Clarification
6. Nitrification Activated Sludge Aeration
7. Final Clarification
8. Effluent Filtration
9. Chlorination

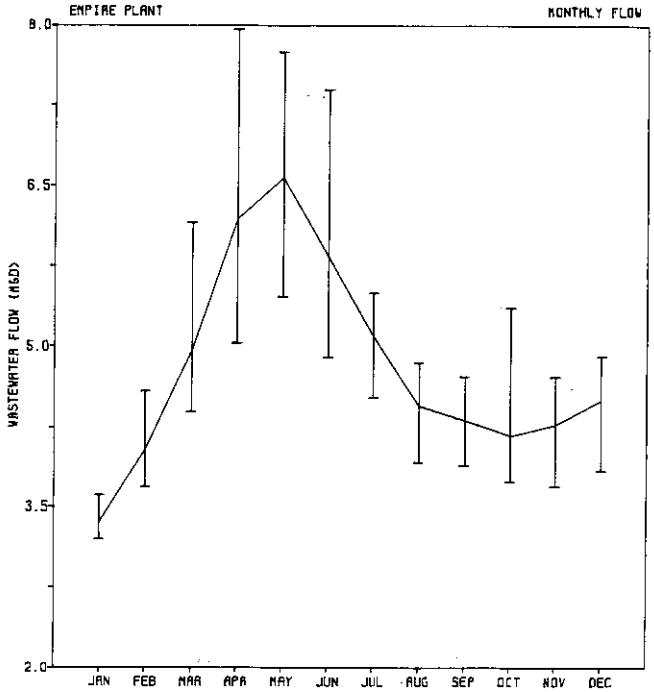
Solids Phase

10. Gravity Thickening
11. Anaerobic Digestion
12. Centrifuge Dewatering
13. Cake Storage
14. Sludge Landspreading

Legend

——— Liquid Flow
– – – – Solids Transfer
▭ Existing Process Units
▭ Future Process Units



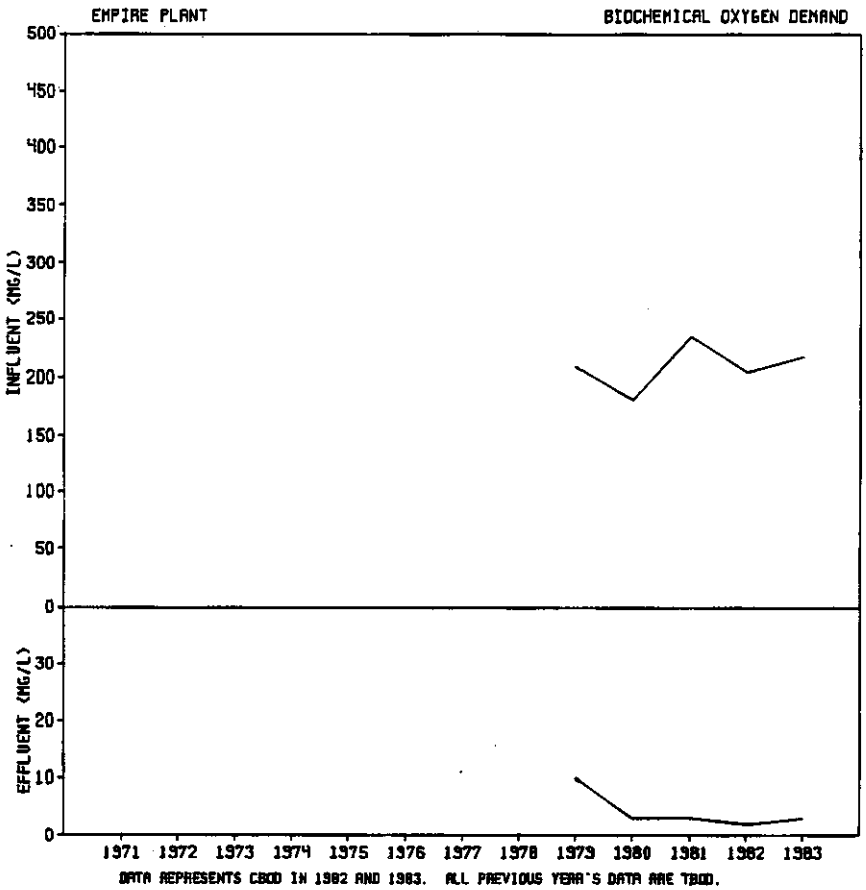


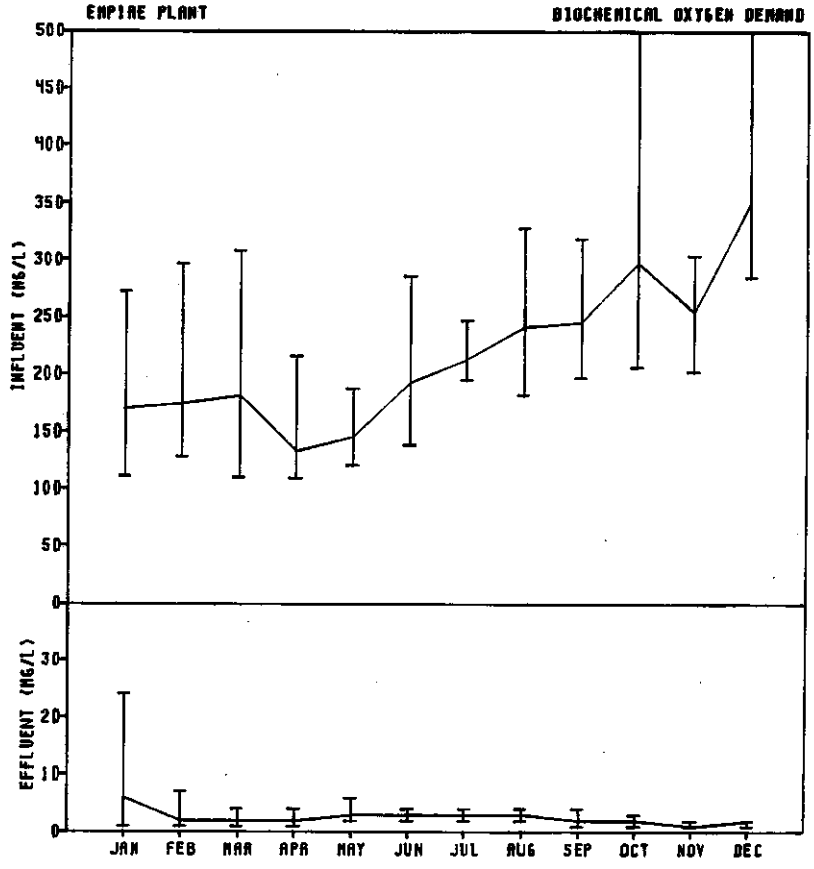
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Empire

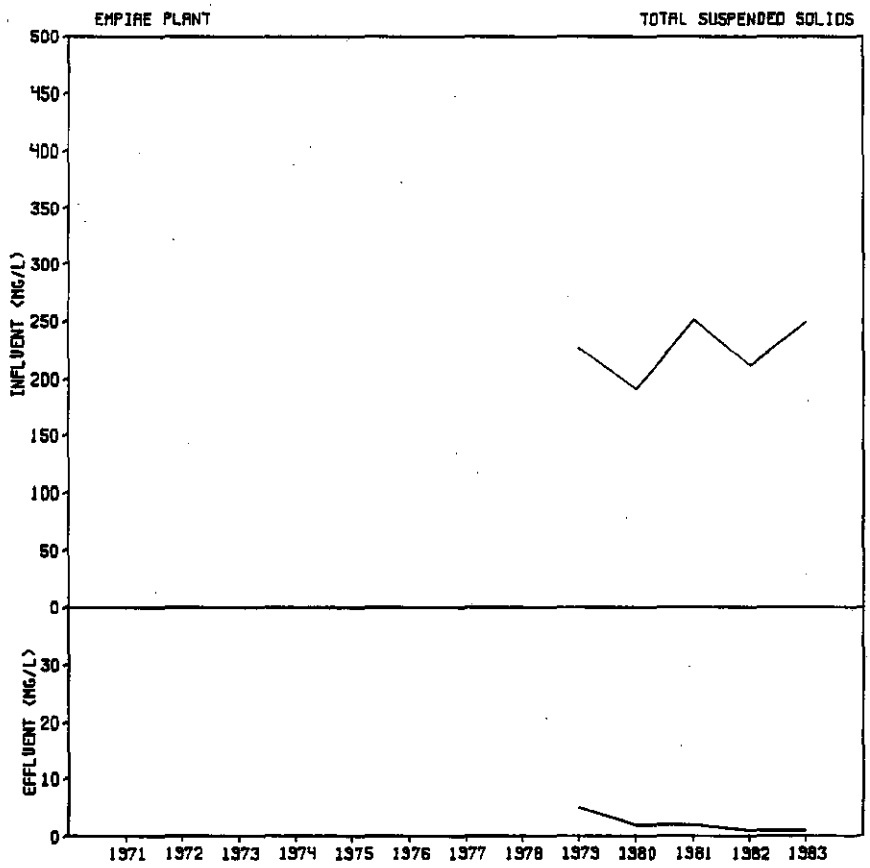
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	3.36	12	170	161	6.0-8.5	34.3	13.3	18.7	353
FEBRUARY	4.04	12	174	200	6.6-8.7	----	17.5	21.3	365
MARCH	4.96	11	181	164	6.8-8.8	28.8	8.6	14.2	311
APRIL	6.19	11	133	174	6.3-8.1	21.5	6.0	11.5	314
MAY	6.57	13	146	160	6.0-8.8	22.0	7.1	9.5	277
JUNE	5.84	15	192	240	6.3-8.7	32.5	8.3	16.1	493
JULY	5.09	17	213	311	6.4-8.4	36.6	11.9	17.0	553
AUGUST	4.45	18	241	310	6.4-8.9	39.2	10.4	15.9	527
SEPTEMBER	4.31	18	245	309	6.4-8.8	39.5	12.8	19.6	532
OCTOBER	4.17	17	297	338	6.0-9.0	42.7	13.8	20.2	592
NOVEMBER	4.27	15	254	310	6.4-8.3	40.1	11.5	15.6	540
DECEMBER	4.50	13	350	322	6.2-8.4	46.9	11.5	21.4	613
1983 AVERAGE	4.81	14	217	250	6.0-9.0	35.3	11.1	17.0	457
1982 AVERAGE	4.05	14	204	212	5.7-10.2	39.0	13.3	21.8	401

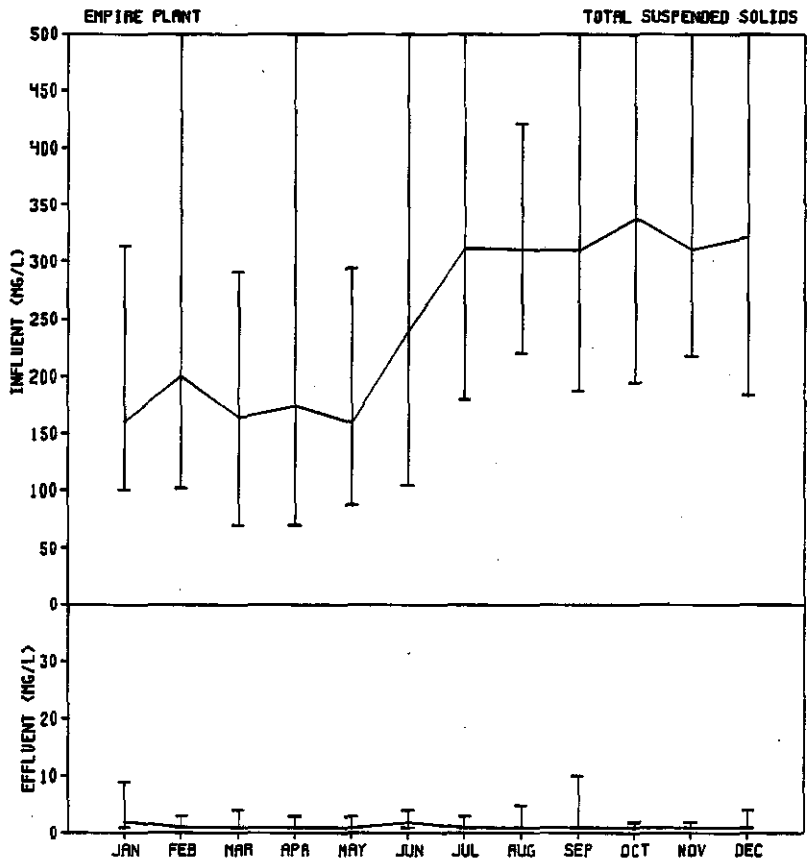
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Empire

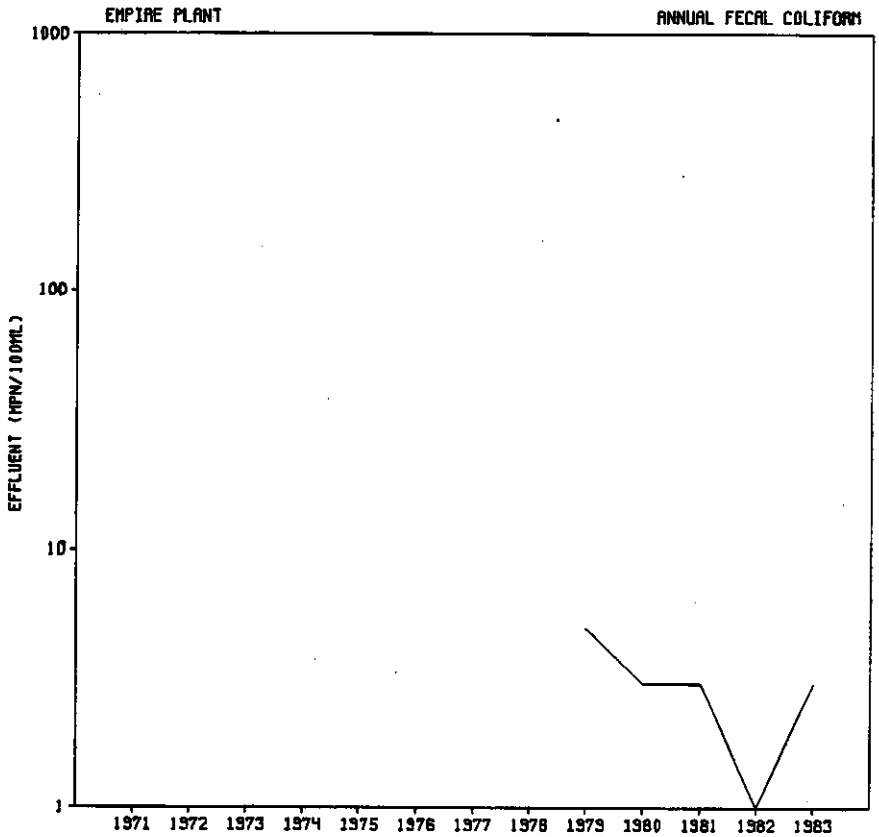
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	10	10	--	10	200	25	---	1.0	-----	-----	---	---	---	>4.0	6.5-8.5	--	--
JANUARY	11	6	30	2	---	2	3.5	0.8	0.27	19.77	6.8	---	---	10.4	6.5-7.3	96	99
FEBRUARY	3	2	27	1	---	1	---	0.8	0.46	26.71	7.2	100	2.3	10.1	6.7-7.8	99	99
MARCH	3	2	24	1	3	1	1.2	0.3	0.29	18.02	4.6	127	1.1	10.9	6.8-7.7	99	99
APRIL	2	2	22	1	6	1	1.4	0.5	0.26	12.37	3.7	145	1.2	10.6	6.7-7.6	98	99
MAY	3	3	25	1	2	0.5	1.0	0.2	0.15	10.12	3.1	138	1.2	9.3	6.8-8.4	98	99
JUNE	3	3	29	2	5	1	1.7	0.6	0.14	12.64	4.1	128	1.2	10.5	6.8-7.3	99	99
JULY	3	3	30	1	2	1	2.3	0.9	0.11	14.97	3.7	115	1.3	11.2	6.5-7.3	99	99
AUGUST	3	3	31	1	4	1	1.7	0.5	0.10	13.40	3.8	109	1.5	11.6	7.0-7.3	99	99
SEPTEMBER	2	2	28	1	2	1	1.3	0.1	0.11	16.13	3.4	114	1.3	9.8	6.8-7.3	99	99
OCTOBER	2	2	27	1	2	0.4	1.2	0.1	0.01	16.67	4.8	115	2.1	7.9	6.6-8.0	99	99
NOVEMBER	1	1	34	1	---	1	1.1	0.1	0.01	19.28	4.4	100	0.9	8.0	6.9-7.3	99	99
DECEMBER	2	2	34	1	---	1	1.3	0.1	0.01	17.19	6.2	---	---	8.7	6.5-7.7	99	99
1983 AVG.	3	3	28	1	3	1	1.6	0.4	0.16	16.41	4.6	123	1.4	10.0	6.5-8.4	99	99
1982 AVG.	3	2	27	1	1	1	2.1	0.7	0.12	25.35	7.1	128	1.8	8.9	6.5-7.9	99	99


EMPIRE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.


EMPIRE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


EMPIRE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


EMPIRE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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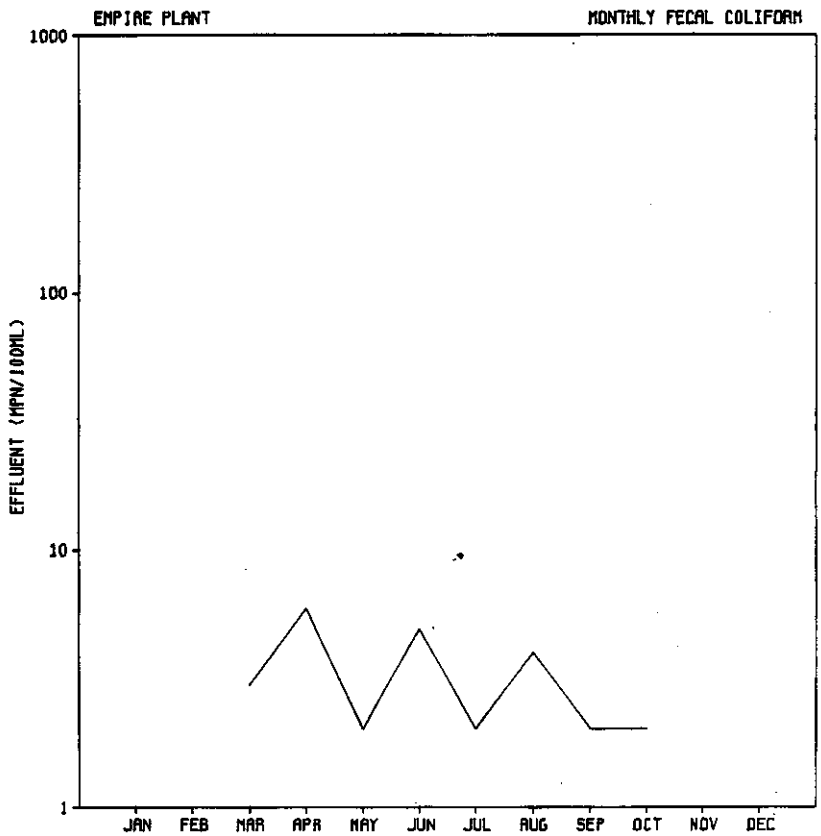
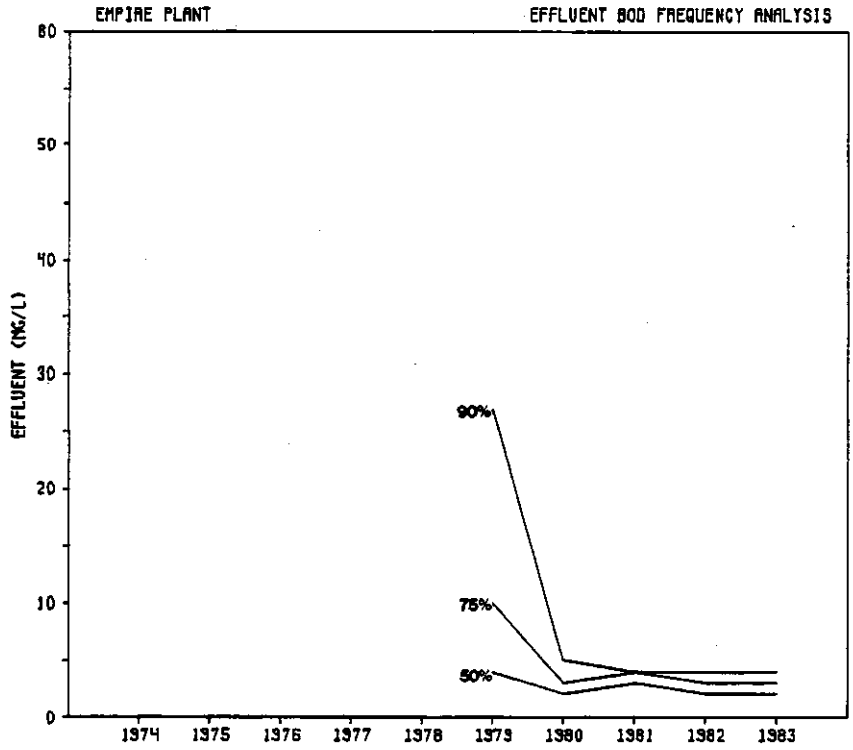
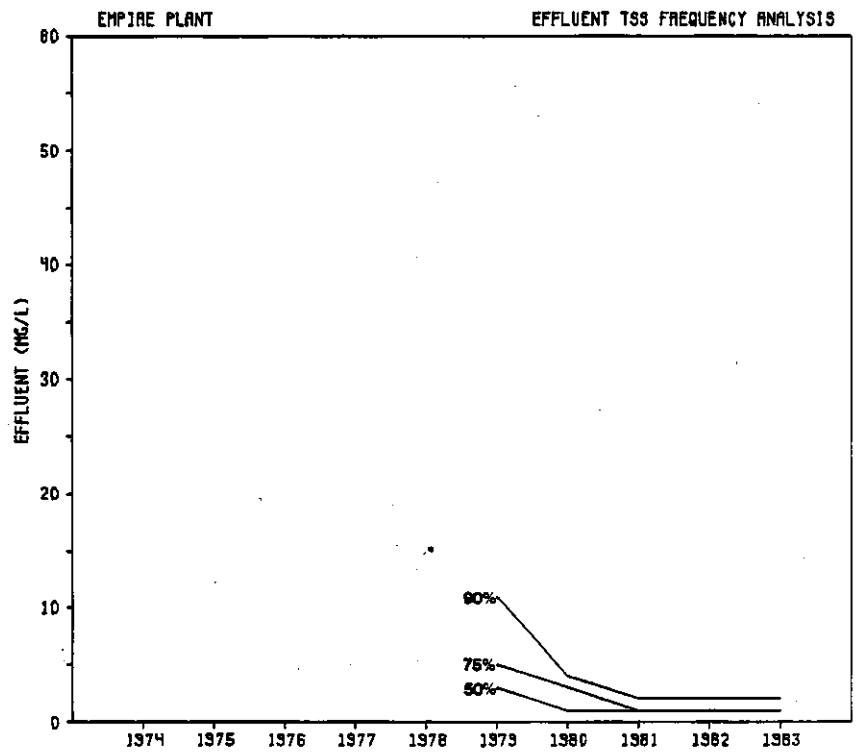
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


EMPIRE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


EMPIRE PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


EMPIRE PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

HASTINGS WASTEWATER TREATMENT PLANT

Plant History and Description

The Hastings Plant was designed by Toltz, King, Duvall, Anderson, and Associates and built in 1955 as a "primary treatment" plant. Principal items included a primary control building, primary settling and chlorination tanks, anaerobic digester, and sludge drying beds. In 1967, the plant was modified to include secondary treatment facilities. Major additions included one four-pass aeration tank, two final settling tanks, a chlorine contact tank and a secondary sludge digester. After 1967 modifications, the plant's design capacity was 1.83 mgd. Actual operating capacity is somewhat less, estimated to be about 1.44 mgd.

Liquid treatment consists of screening, grit removal, primary sedimentation, primary effluent pumping, activated sludge aeration, final clarification, chlorination, and discharge to the Mississippi River.

Solids processing consists of combined thickening in primary tanks, anaerobic digestion with ultimate disposal by landspreading or through the Metropolitan Plant Interceptor System. The Hastings Plant is operating beyond its effective capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 1.65 mgd in 1983, slightly higher than 1.50 in 1982. Average plant effluent quality was 16 mg/L BOD and 23 mg/L TSS. Plant performance was marginal due to operation near plant capacity. A total of 7 NPDES violations occurred throughout the year. Statistical analysis of data show the following trend in effluent quality from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	17	18	17	14	22	24	27	20	31	33	37	26
TSS	22	19	28	22	30	28	38	32	38	36	48	41

*1982 and 1983 values represent CBOD.

Future

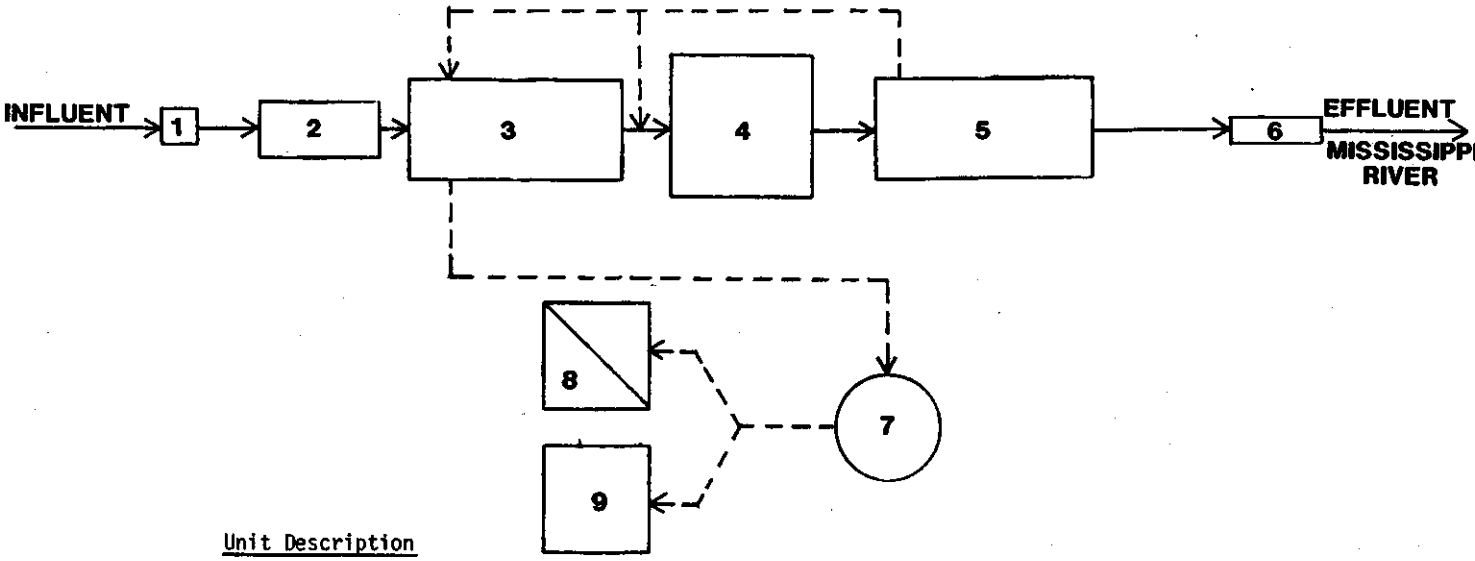
The Hastings Plant is being expanded to a capacity of 2.34 mgd. Construction grants for a plant expansion were received and construction began in late 1983. The first phase of the plant expansion is scheduled for completion in early 1985.

HASTINGS PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	1.50	1.65	1.63	1.75
BOD Loading, lb/day	3,140	3,260	3,550	4,150
TSS Loading, lb/day	2,930	2,620	3,820	3,670
COD Loading, lb/day	6,770	7,430	8,120	8,750
Primary Sedimentation				
Surface Overflow Rate, gpd/sq. ft.	1,330	2,500	1,390	2,600
Aeration Tanks				
BOD Loading, lb/day/1,000 cu. ft.	45	47	51	60
Final Sedimentation				
Weir Overflow Rate, gpd/lin. ft.	9,100	10,100	9,900	10,700
Surface Overflow Rate, gpd/sq. ft.	625	690	680	730
Chlorination				
Contact Time - Primary, minutes	37	---	34	---
Contact Time - Secondary, minutes	10	---	10	---
Chlorine Use, lb/day	126	116	185	130
Sludge Transport				
Volume, gpd	7,560	8,100	9,810	11,800
Mass, lb/day	2,000	1,900	2,550	2,100

HASTINGS WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

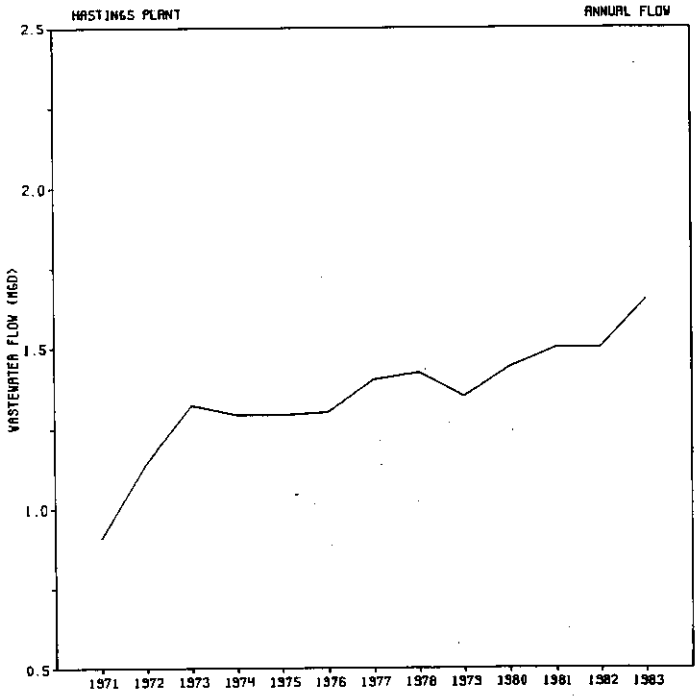
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

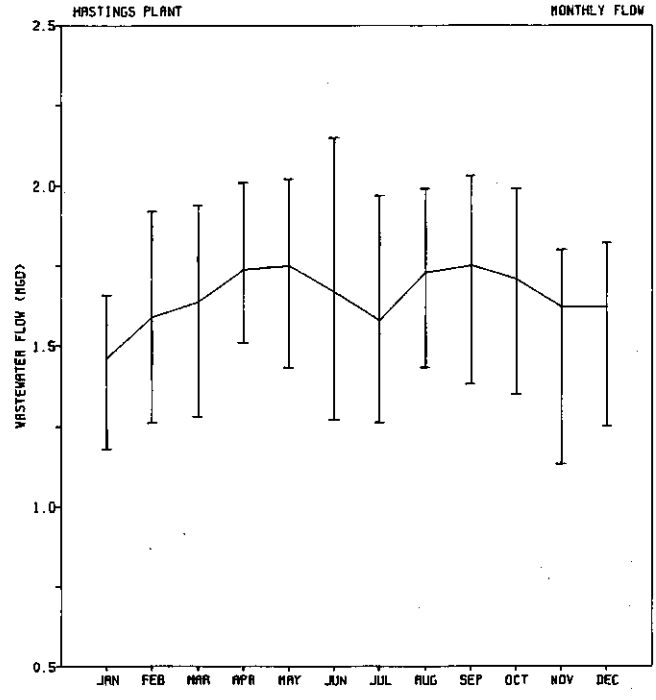
Solid Phase

7. Anaerobic Digestion
8. Solids Disposal at Metro Plant
9. Land Spreading

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





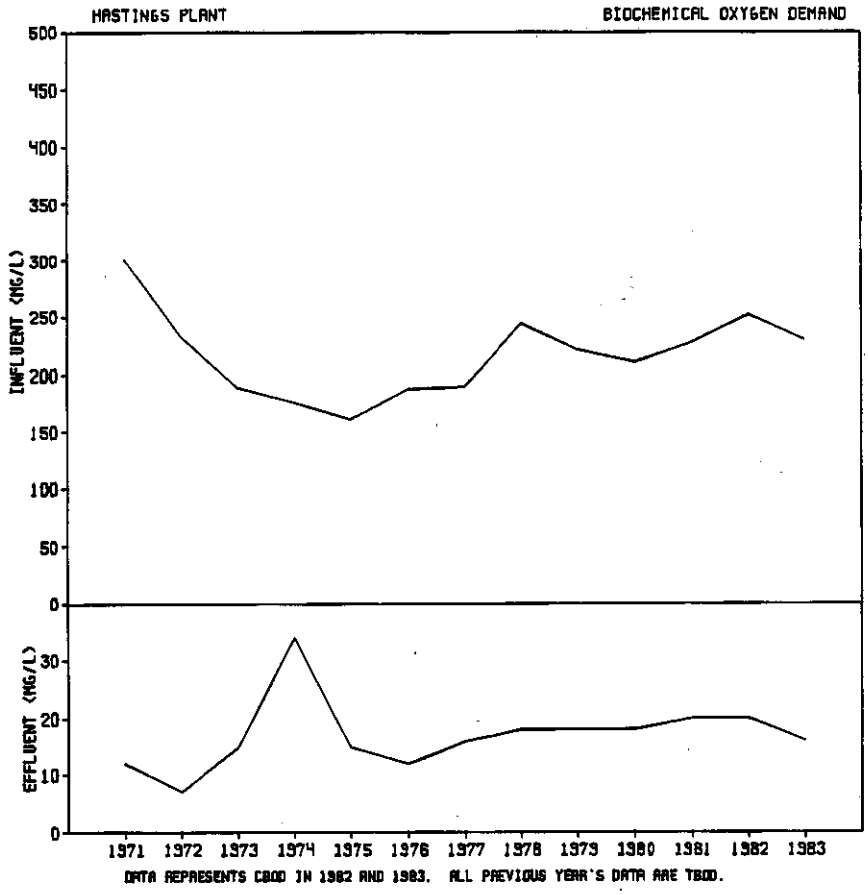
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Hastings

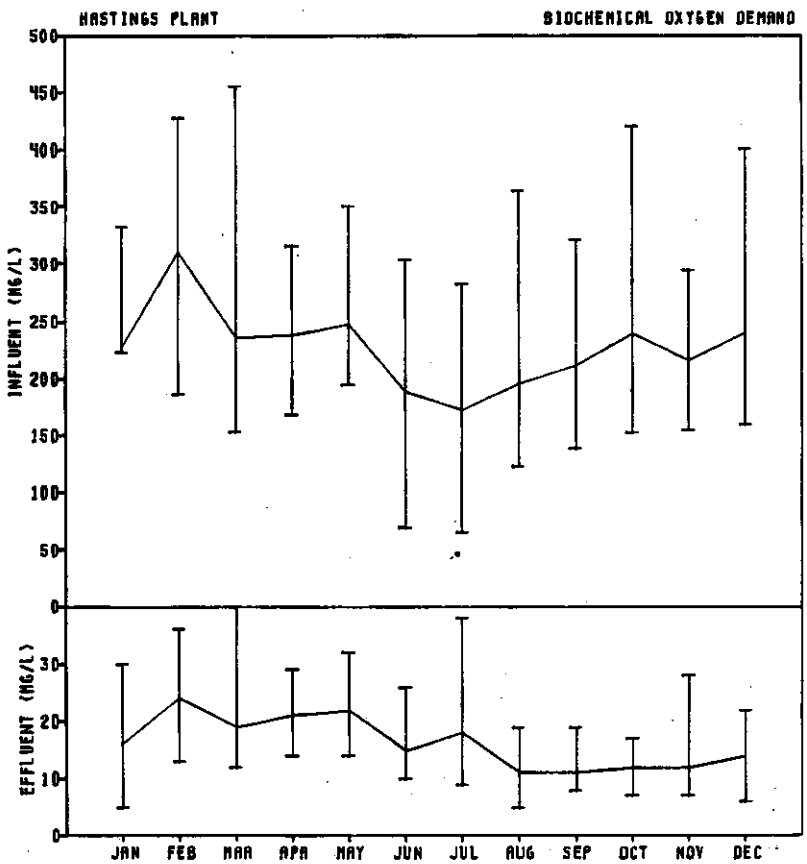
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	1.46	14	277	206	6.0-10.3	66.3	19.8	27.8	587
FEBRUARY	1.59	13	310	273	6.2-9.9	----	22.8	26.8	653
MARCH	1.64	13	236	173	6.0-9.9	42.5	9.5	26.8	490
APRIL	1.74	13	238	151	5.8-9.9	45.3	10.6	30.1	512
MAY	1.75	15	248	177	5.8-12.0	45.0	10.1	26.7	523
JUNE	1.67	17	188	184	5.7-10.9	37.6	8.0	21.9	460
JULY	1.58	19	172	165	6.2-10.6	41.3	8.7	25.3	467
AUGUST	1.73	21	196	160	6.2-10.3	45.4	10.0	22.2	445
SEPTEMBER	1.75	20	211	173	4.5-12.0	41.9	10.5	20.4	508
OCTOBER	1.71	19	239	228	6.0-10.6	48.0	12.9	28.6	590
NOVEMBER	1.62	19	216	177	6.3-11.4	46.3	12.2	21.0	538
DECEMBER	1.62	16	240	186	4.9-10.2	44.1	11.0	22.0	539
1983 AVERAGE	1.65	17	230	187	4.5-12.0	45.9	12.2	25.0	523
1982 AVERAGE	1.50	16	251	233	3.0-12.0	46.9	11.1	26.0	541

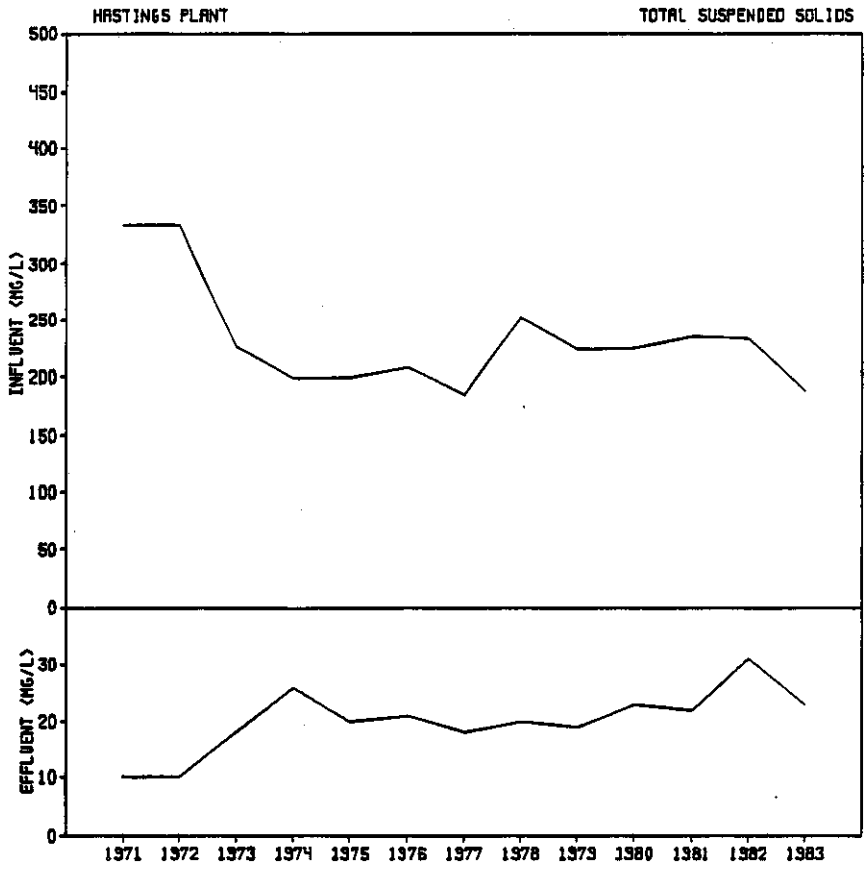
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Hastings

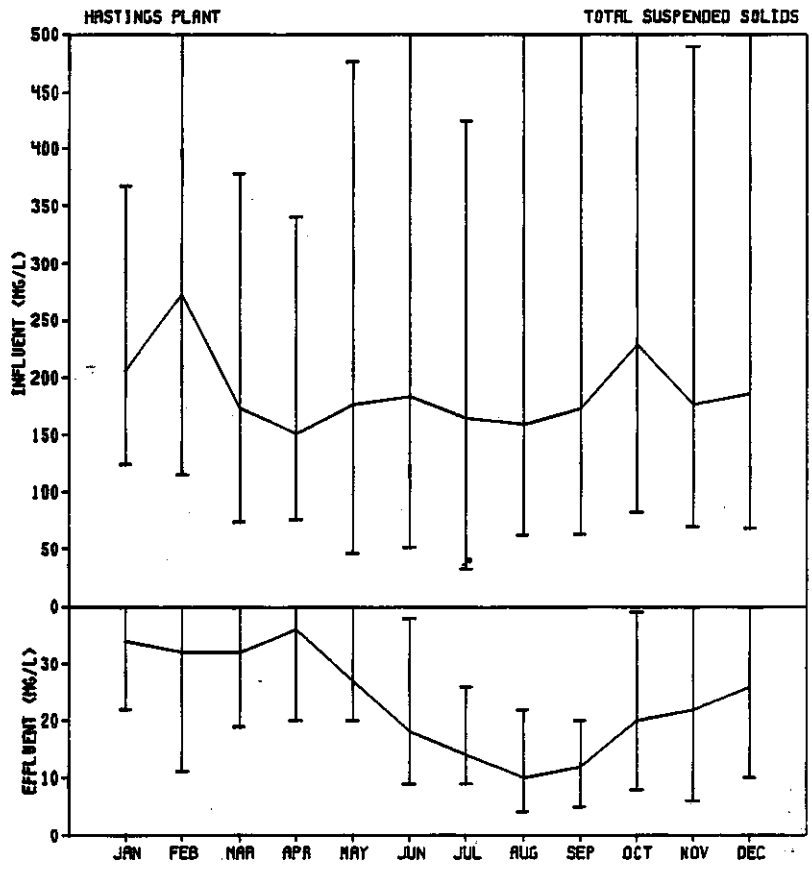
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	---	30	200	25	----	----	----	----	---	---	---	---	6.5-8.5	--	--
JANUARY	34	16	103	34	---	9	34.8	22.0	1.07	2.13	3.9	---	---	6.3	7.0-7.8	94	84
FEBRUARY	44	24	145	32	---	10	----	20.4	1.75	2.73	9.2	53	1.3	6.4	6.8-7.7	92	88
MARCH	27	19	154	32	148	14	22.3	16.0	2.84	1.88	6.4	104	3.1	6.3	6.8-7.7	92	81
APRIL	23	21	145	36	70	15	23.9	15.0	0.94	2.58	5.8	122	5.3	6.1	6.8-7.4	91	76
MAY	24	22	127	27	65	12	27.5	18.4	1.08	1.13	7.2	130	6.9	6.1	6.8-7.7	91	85
JUNE	21	15	105	18	19	9	20.3	14.1	1.46	1.94	5.6	128	6.9	5.6	6.9-7.3	92	90
JULY	24	18	107	14	14	7	27.3	20.4	1.33	3.26	5.8	122	8.9	5.1	7.0-7.5	90	91
AUGUST	14	11	94	10	7	5	24.4	16.6	0.48	0.22	6.9	120	7.2	5.3	7.0-7.4	94	94
SEPTEMBER	17	11	106	12	14	7	20.3	12.1	0.90	0.81	7.7	105	6.2	5.8	6.6-7.4	95	93
OCTOBER	20	12	115	20	20	11	24.3	16.0	0.31	0.65	8.2	100	8.1	6.1	6.5-7.3	95	91
NOVEMBER	32	12	120	22	---	9	20.0	10.9	1.56	4.52	7.0	---	---	6.3	6.4-7.2	94	88
DECEMBER	44	14	114	26	---	8	18.6	11.3	0.73	6.34	8.8	---	---	6.3	6.8-7.4	94	86
1983 AVG.	27	16	120	23	44	10	24.0	16.0	1.23	2.32	6.9	115	6.4	6.0	6.4-7.8	93	87
1982 AVG.	31	20	120	31	21	12	27.7	17.6	1.27	3.59	4.5	133	5.0	6.0	6.5-7.8	92	87

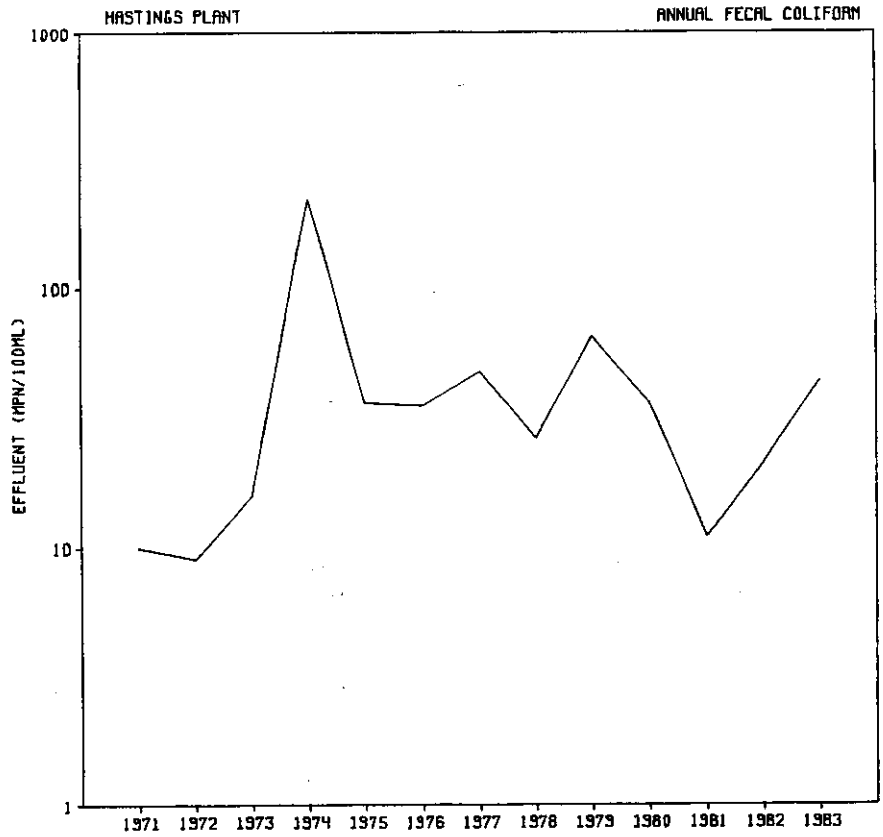
*For disinfection only.

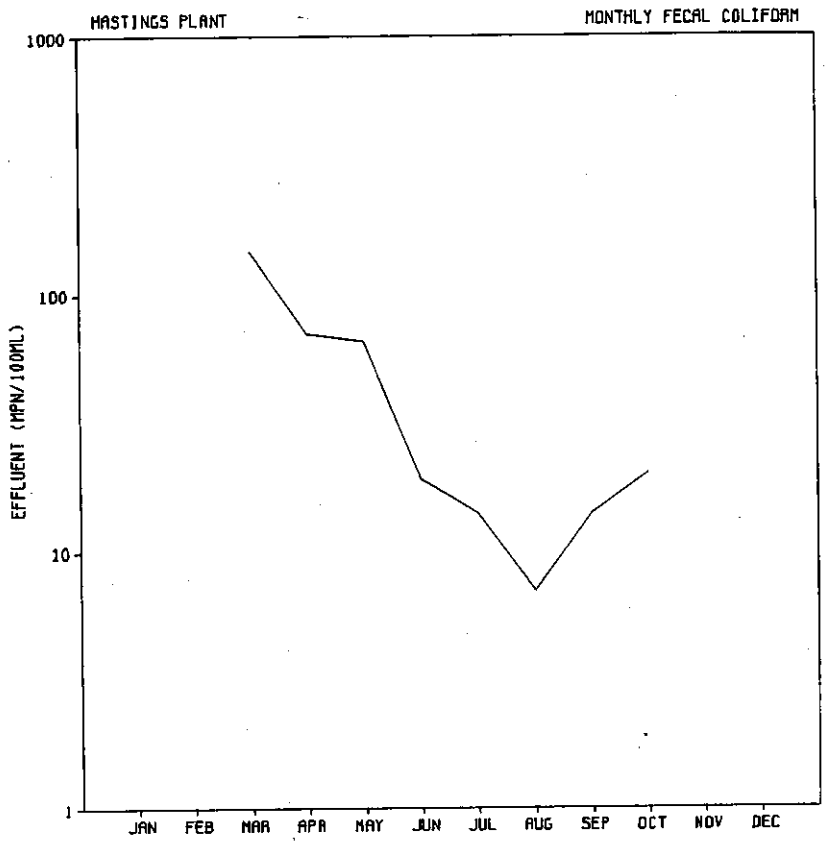

HASTINGS PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

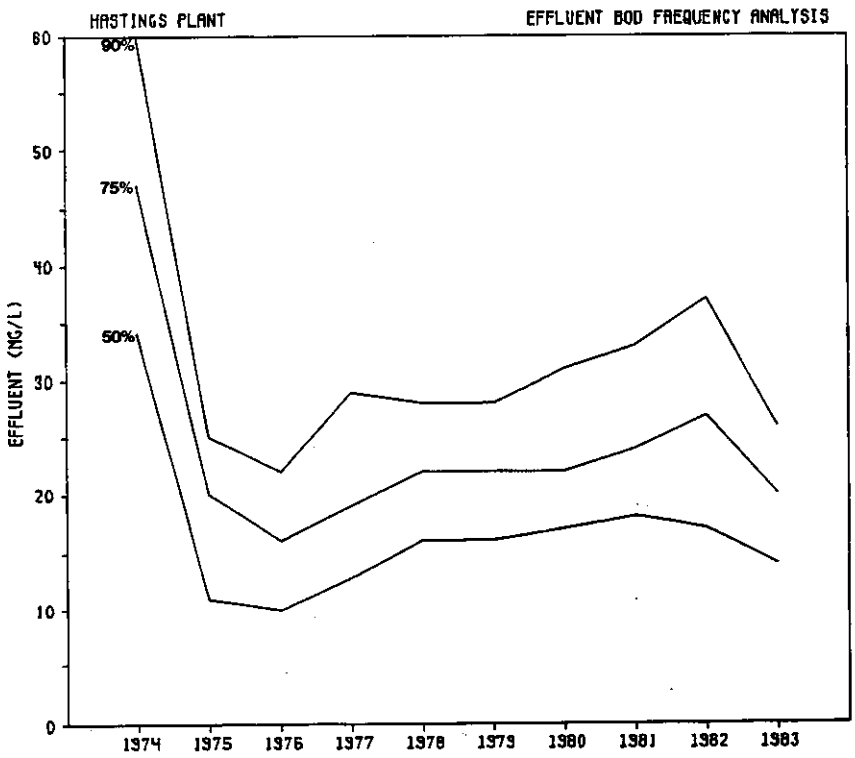

HASTINGS PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

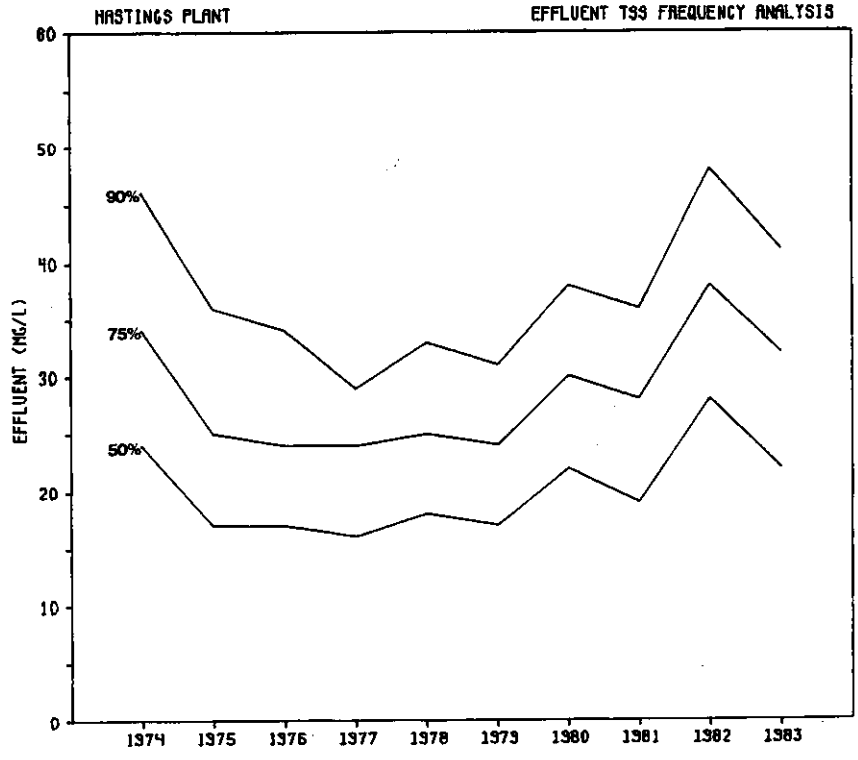

HASTINGS PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
10
20
30
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


HASTINGS PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
10
20
30
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


HASTINGS PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


HASTINGS PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


HASTINGS PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
90%
75%
50%
0
10
20
30
40
50
60
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


HASTINGS PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
90%
75%
50%
0
10
20
30
40
50
60
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

1983 EFFLUENT DATA
TREATMENT PLANT Hastings

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	PCB mg/l	Ni mg/l	Phenol ug/l	Fe mg/l
January	0.04	0.16	0.09			<0.20	0.083				6.3	
February	0.05	0.25	0.12			<0.20	0.095				7.0	
March	0.05	0.27	0.11	<0.05	<0.008	<0.20	0.130			<0.04	7.6	0.34
April	0.11	0.27	0.12			<0.20	0.058				9.7	
May	0.13	0.22	0.14			<0.20	0.045				11.9	
June	0.03	0.14	0.10	<0.05	<0.008	<0.20	0.060			0.04	7.7	0.26
July	0.03	<0.08	0.11			<0.20	<0.052				7.8	
August	<0.02	0.14	0.10			<0.34	<0.024				7.6	
September	0.01	0.27	0.10			<0.45	<0.062				10.8	
October	0.07	0.23	0.13			<0.20	<0.035				7.5	
November	0.08	0.16	0.11			<0.20	<0.060				17.0	
December	0.03	0.17	0.11	<0.05	0.008	<0.20	<0.035			<0.04	17.3	0.37
1983 Avg.	<0.05	<0.20	0.11	<0.05	<0.008	<0.23	<0.062			<0.04	9.9	0.32

MAPLE PLAIN WASTEWATER TREATMENT PLANT

Plant History and Description

The original Maple Plain Plant was designed by Toltz, King, Duvall, Anderson and Associates and constructed in 1952. A plant expansion was designed by W.T. Mills, and constructed in 1965. Current plant design capacity is 0.22 mgd.

Liquid treatment consists of grit removal, screening, influent pumping, primary sedimentation, roughing trickling filter, complete mix activated sludge aeration, final clarification, chlorination, effluent polishing pond, and discharge through a swamp to Lake Minnetonka.

Solids processing consists of combined thickening in primary tanks, anaerobic digestion, and sludge hauling to other plants for processing or to landspreading sites.

The plant is presently operated well beyond its rated hydraulic capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 0.35 mgd in 1983, unchanged from that of 1982. Average plant effluent quality was 9 mg/L BOD and 9 mg/L TSS. Although the flow was in excess of plant capacity, plant performance was excellent throughout the year with no violations of its NPDES Permit. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	19	10	11	8	29	15	18	12	37	21	26	17
TSS	11	6	6	6	15	8	10	12	24	16	16	16

*1982 and 1983 values represent CBOD.

Future

Facility planning revisions have resulted in a plan to phase out the Maple Plain Plant by constructing an interceptor to Long Lake. The existing plant flow will then be conveyed to the Blue Lake Plant for treatment. Final approval has not been received from MPCA and, therefore, the schedule is uncertain at this time.

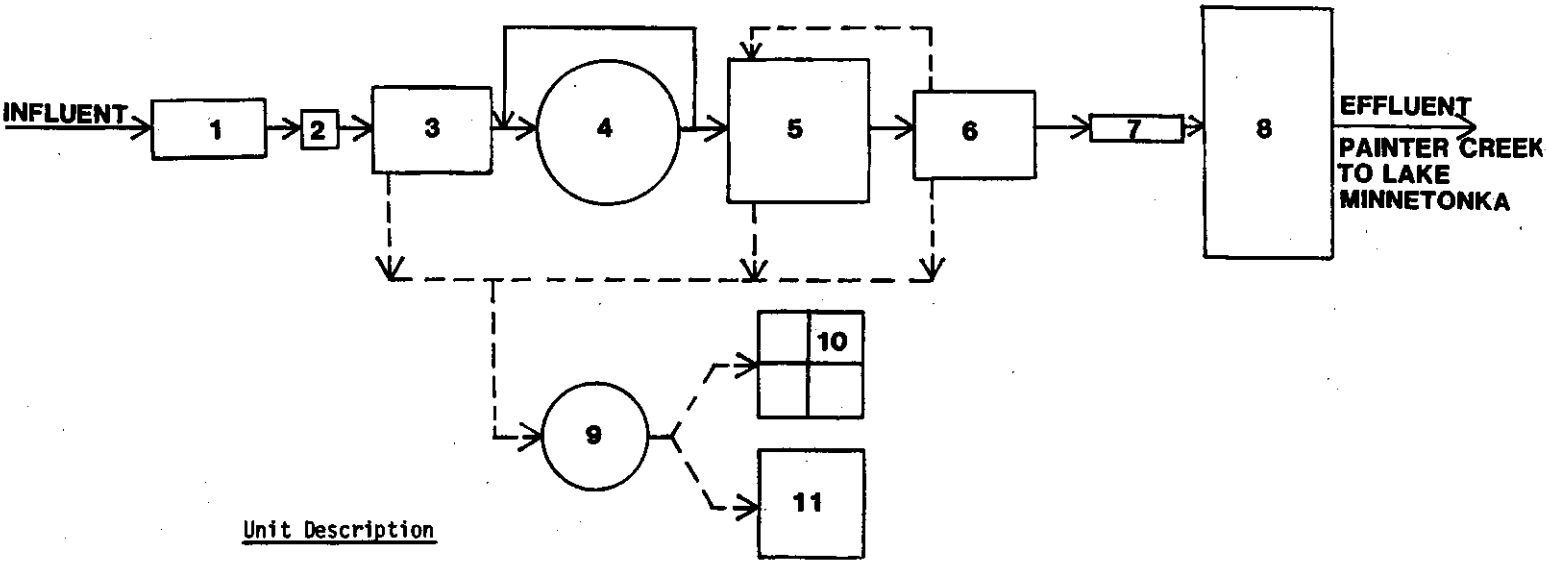
MAPLE PLAIN PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	0.35	0.35	0.59	0.75
BOD Loading, lb/day	425	360	490	460
TSS Loading, lb/day	580	500	1,080	700
COD Loading, lb/day	860	800	1,090	1,100
Sludge Production, lb/day	80	60	-----	-----
Grit Removal				
Overflow Rate, gpd/sq. ft.	21,880	22,000	36,880	47,000
Primary Sedimentation				
Detention Time, hr.	0.7	0.75	0.4	0.35
Weir Overflow Rate, gpd/lin. ft.	9,720	9,700	16,390	21,000
Surface Overflow Rate, gpd/sq. ft.	1,440	1,400	2,430	3,100
Trickling Filters				
Hyraulic Loading, gpd/sq. ft.	220	220	370	470
BOD_5 Loading, lb/day/1000 cu. ft.	41	35	47	45
Aeration Tanks				
Detention Time, hr.	7.1	7.1	4.2	3.3
BOD_5 Loading, lb/day/1000 cu. ft. (Assume 50% trickling filter reduction)	±15	13	±18	17
Final Sedimentation				
Detention Time, hr.	2.0	2.0	1.2	1.0
Weir Overflow Rate, gpd/lin. ft.	8,970	9,000	15,130	19,000
Surface Overflow Rate, gpd/sq. ft.	1,030	1,000	1,730	2,200
Chlorination				
Contact Time, minutes	15	15	9	7
Chlorine Use, lb/day	36	31	50	43
Polishing Pond				
Detention Time, days	2.9	2.9	1.7	1.3
BOD_5, lb/acre/day	59	40	150	210

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Anaerobic Digestion (Prim. Dig. Only)				
Solids Loading, lb/cu. ft./day	0.08	0.08	-----	-----
Detention Time, days	29	30	-----	-----
Sludge Transport				
Volume, gpd	160	180	-----	-----

MAPLE PLAIN WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

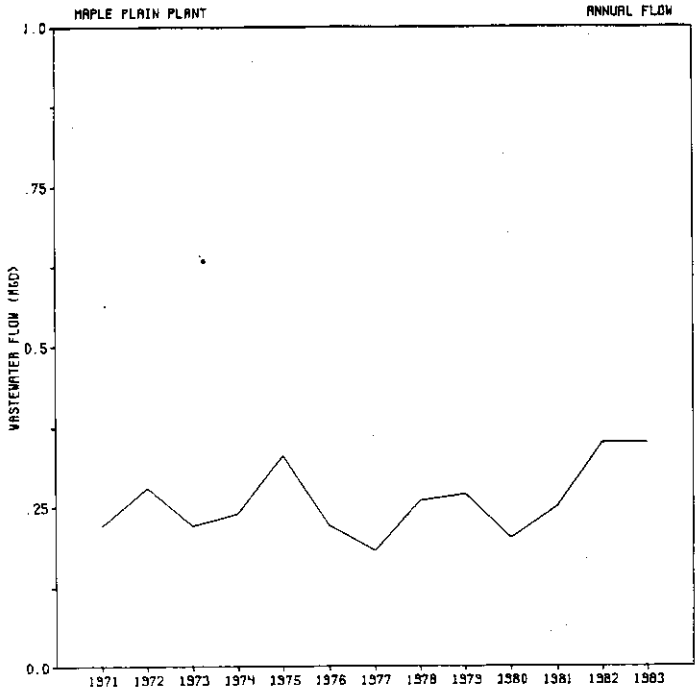
1. Grit Removal
2. Screening
3. Primary Sedimentation
4. Trickling Filter
5. Activated Sludge
6. Final Sedimentation
7. Chlorination
8. Effluent Pond

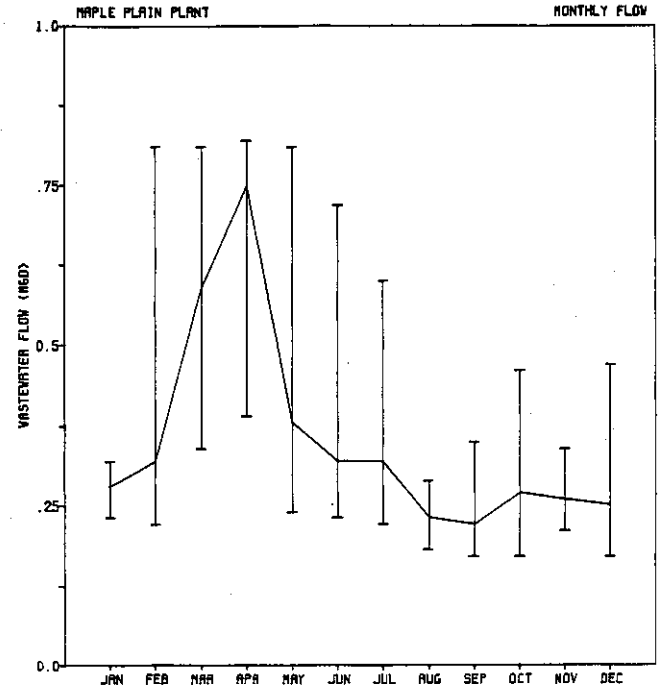
Solid Phase

9. Anaerobic Digestion
10. Sand Drying Beds
11. Land Spread

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





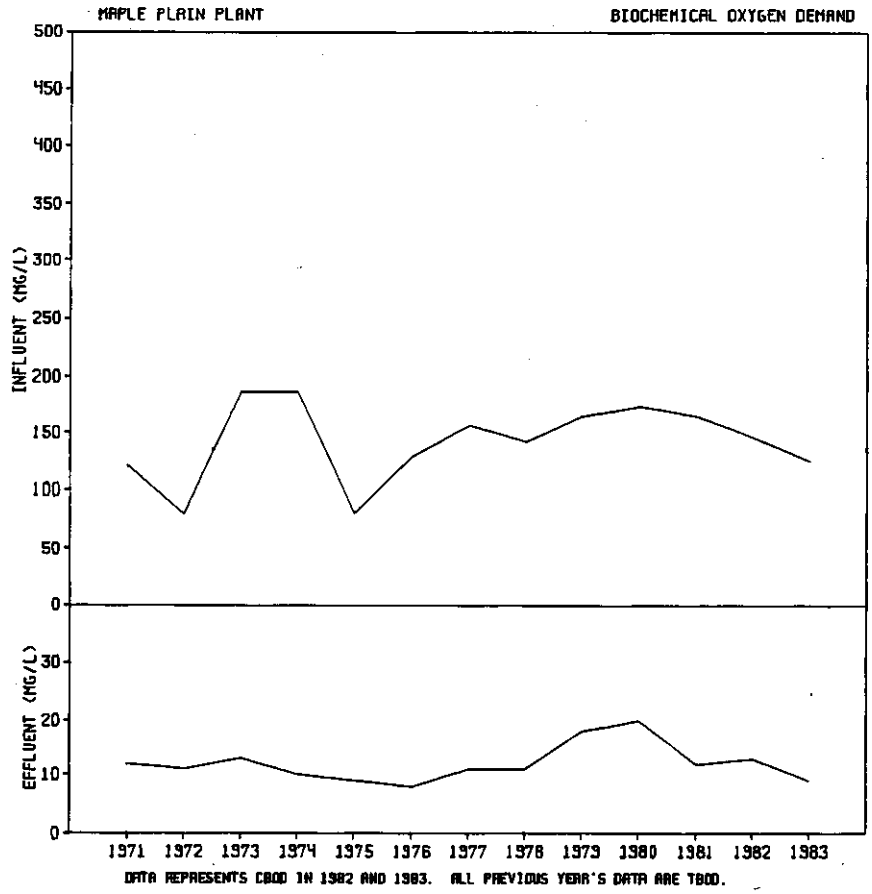
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Maple Plain

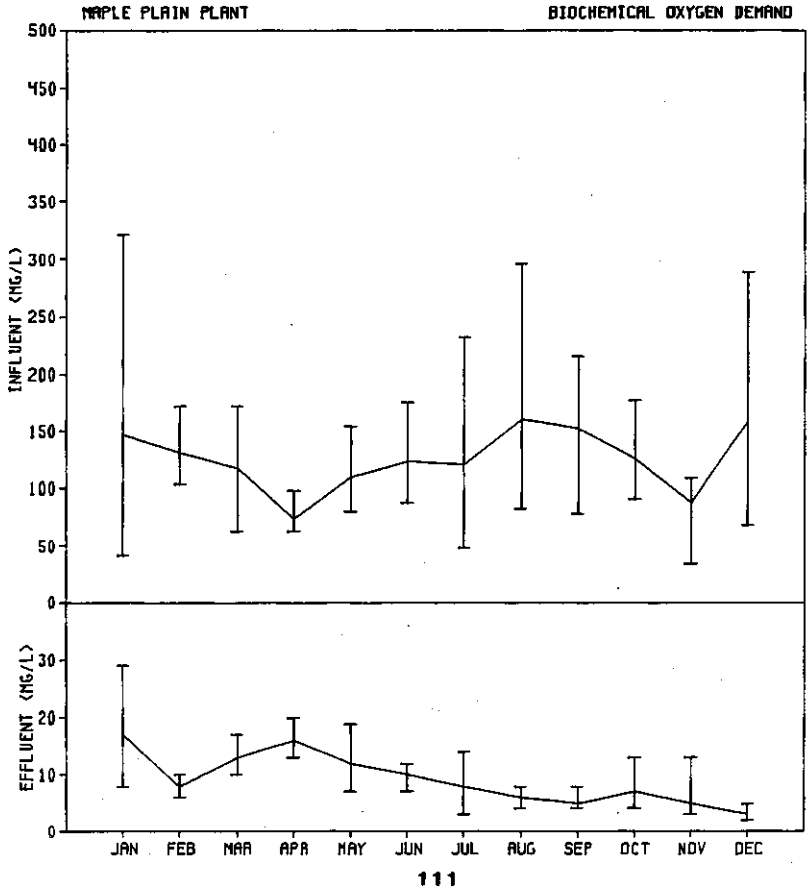
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.28	10	147	171	7.4-7.6	38.1	5.2	19.8	278
FEBRUARY	0.32	10	131	105	7.4-7.6	----	10.1	20.8	250
MARCH	0.59	10	117	111	7.4-7.7	16.8	3.2	6.6	220
APRIL	0.75	11	74	61	7.3-7.8	19.9	2.6	4.1	156
MAY	0.38	11	110	88	7.3-7.8	20.6	3.6	6.5	205
JUNE	0.32	13	123	101	7.2-7.5	21.0	4.9	13.9	294
JULY	0.32	15	120	267	7.3-7.6	27.5	4.0	13.4	334
AUGUST	0.23	17	161	258	7.3-7.9	34.8	5.3	17.2	287
SEPTEMBER	0.22	16	152	254	7.3-7.5	33.5	5.4	16.5	377
OCTOBER	0.27	16	126	153	7.4-7.6	33.5	5.2	14.3	301
NOVEMBER	0.26	15	87	255	7.4-7.6	29.2	4.5	12.7	228
DECEMBER	0.25	14	158	230	-------	30.8	7.2	15.4	388
1983 AVERAGE	0.35	13	125	171	7.2-7.9	28.1	5.1	13.4	275
1982 AVERAGE	0.35	13	146	199	6.9-7.9	37.9	5.5	18.1	299

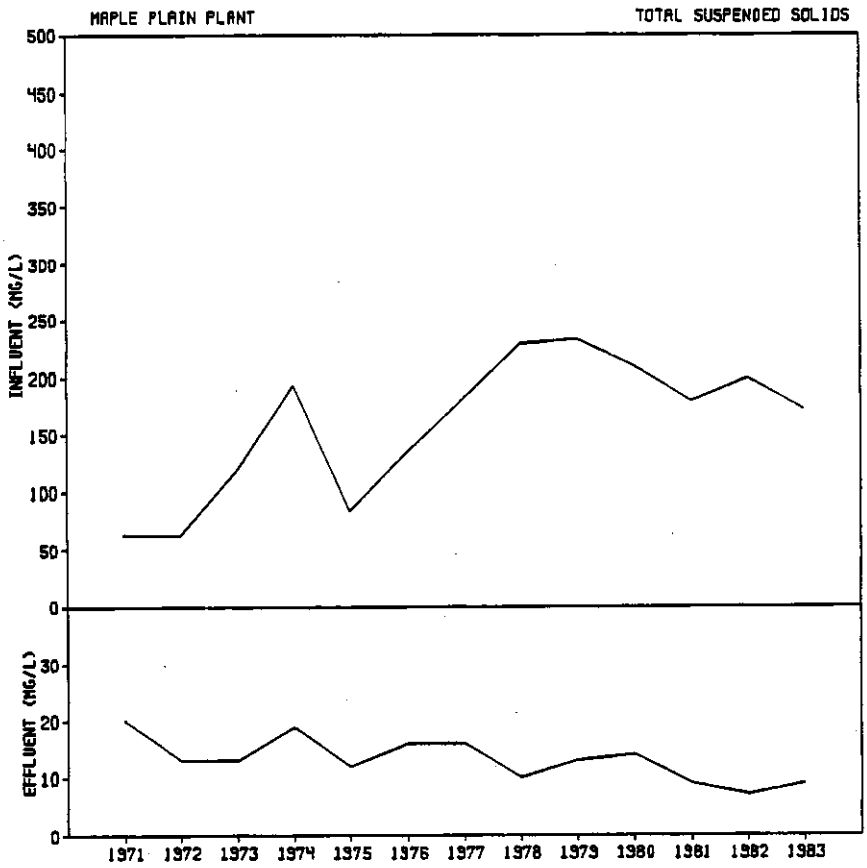
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Maple Plain

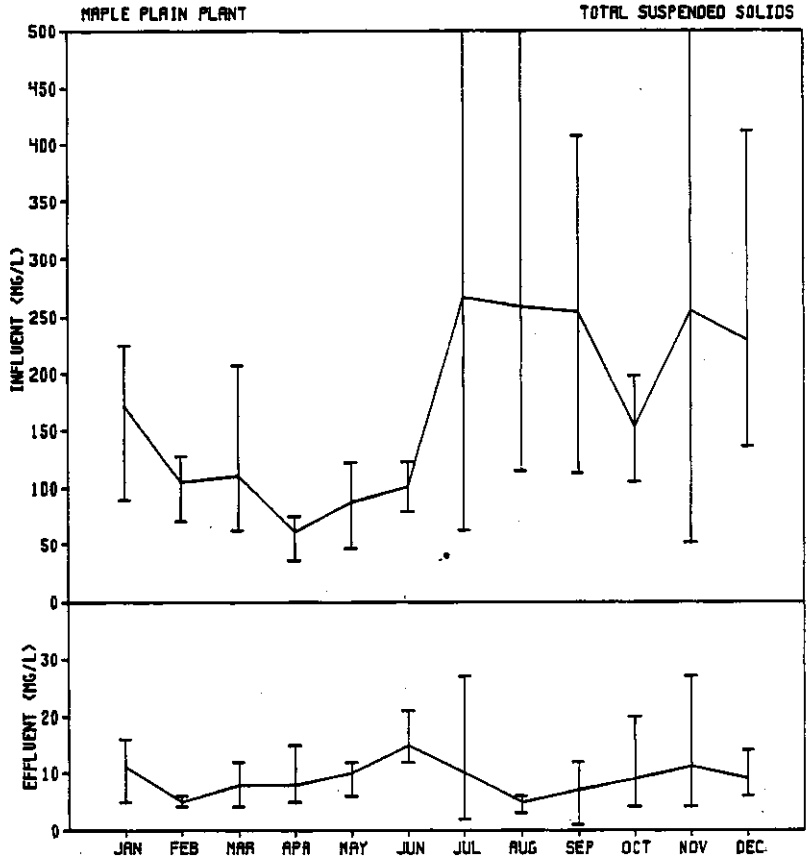
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	--	----	----	----	----	---	--	---	---	6.5-8.5	--	--
JANUARY	20	17	68	11	--	6	25.9	19.0	0.01	0.05	2.9	--	---	6.5	7.4	89	94
FEBRUARY	9	8	45	5	--	3	----	15.6	0.14	0.41	3.7	50	0.0	6.8	7.6	94	96
MARCH	13	13	68	8	14	7	12.0	6.8	0.21	1.83	1.7	40	0.3	6.3	7.3-7.8	89	93
APRIL	17	16	56	8	19	6	8.7	3.5	0.17	1.65	1.5	43	2.9	5.7	7.4-7.7	78	86
MAY	13	12	42	10	4	6	15.9	10.0	0.05	0.14	2.7	29	0.3	6.0	7.6-7.8	89	89
JUNE	12	10	63	15	4	10	19.4	16.1	0.09	0.35	2.7	30	0.1	6.2	7.6-7.8	92	85
JULY	10	8	83	10	4	4	9.6	7.0	0.30	3.36	2.0	29	0.1	6.3	7.5-7.6	93	96
AUGUST	7	6	42	5	4	4	10.1	6.3	0.42	5.08	2.9	25	0.1	6.3	7.5-7.7	96	98
SEPTEMBER	8	5	51	7	4	4	10.3	5.4	0.54	5.74	3.0	25	0.1	5.7	7.5-7.8	97	97
OCTOBER	15	7	36	9	31	6	8.3	6.8	0.20	2.75	2.7	25	0.0	6.5	7.4-7.6	94	94
NOVEMBER	14	5	47	11	--	5	11.5	7.1	0.23	1.94	2.3	--	---	6.9	7.5-7.6	94	96
DECEMBER	6	3	23	9	--	6	7.3	5.9	0.06	0.62	1.4	--	---	7.7	-------	98	96
1983 AVG.	12	9	52	9	10	6	12.7	9.1	0.21	2.02	2.5	31	0.4	6.4	7.3-7.8	92	93
1982 AVG.	15	13	55	7	14	9	19.3	13.6	0.08	0.63	2.8	36	0.2	5.8	7.4-7.9	90	94

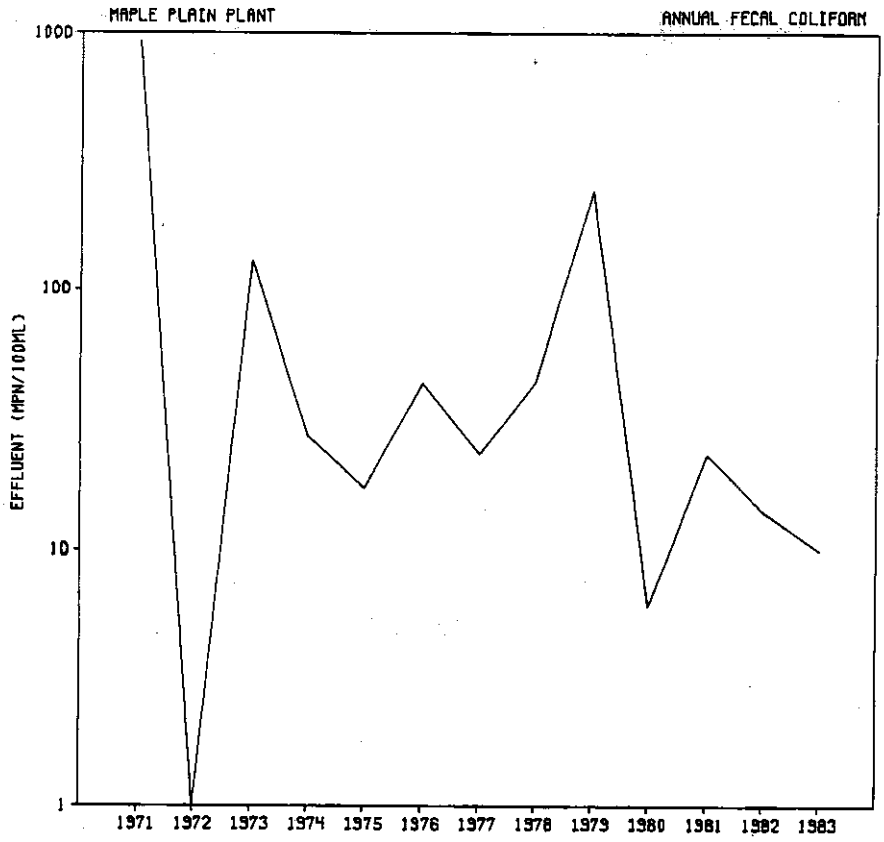
*For disinfection only.

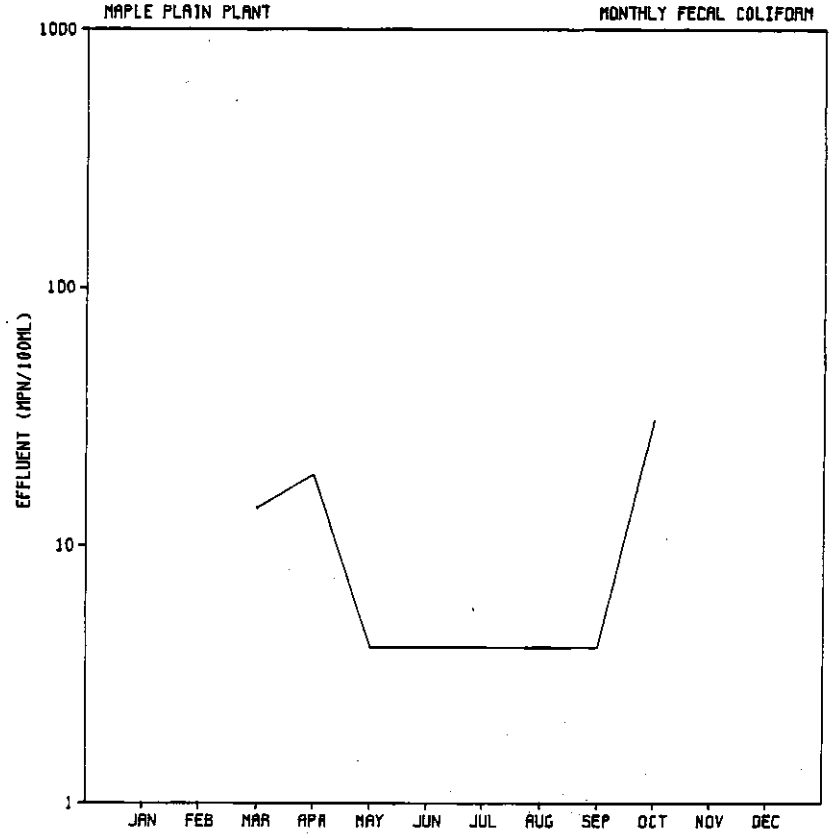

MAPLE PLAIN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

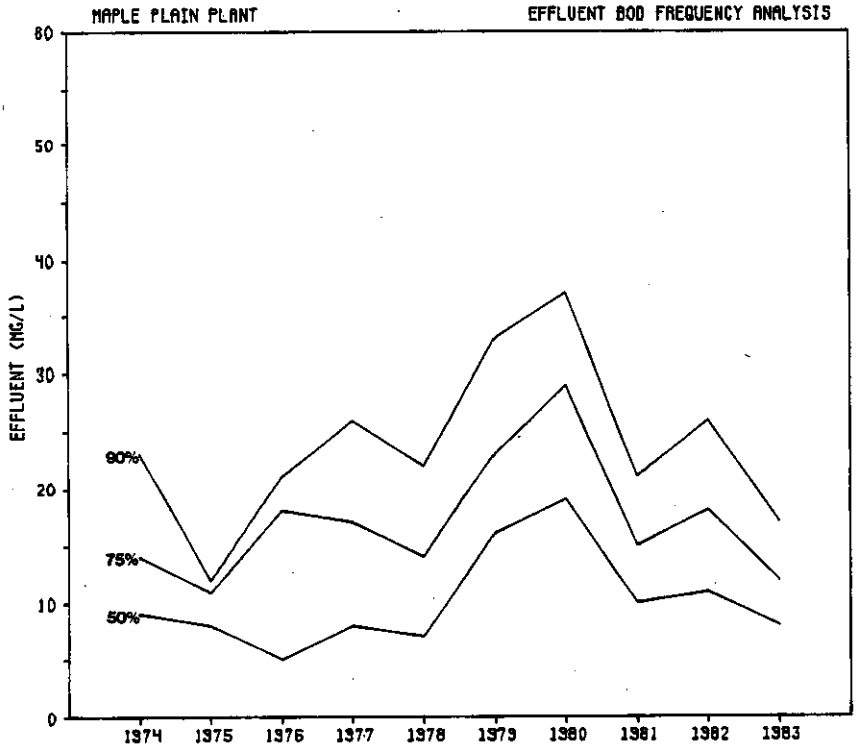

MAPLE PLAIN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

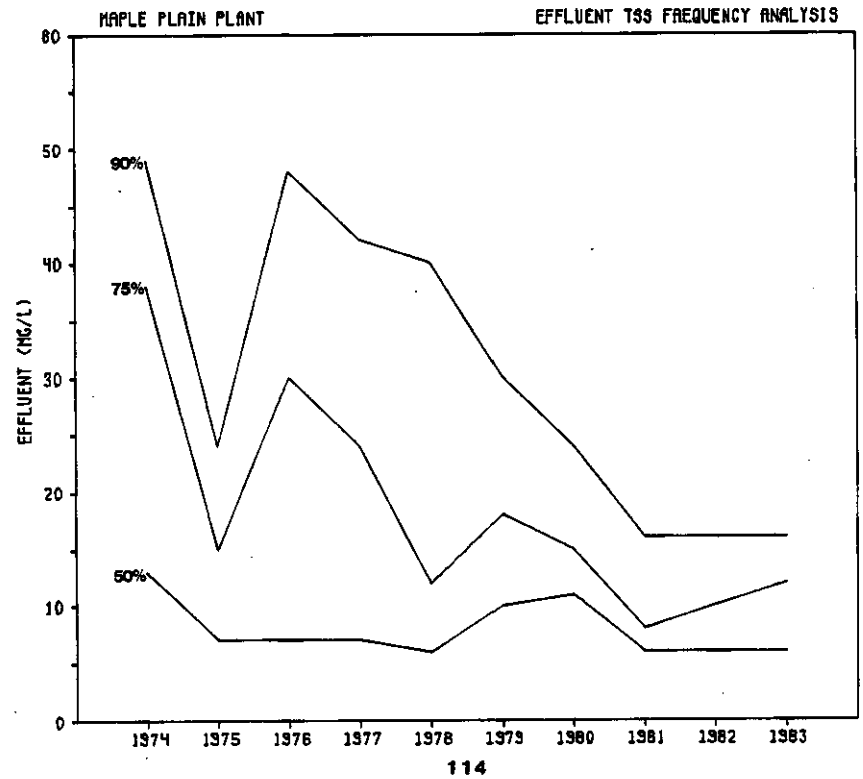

MAPLE PLAIN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


MAPLE PLAIN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


MAPLE PLAIN PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


MAPLE PLAIN PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


MAPLE PLAIN PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
0
10
20
30
40
50
60
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


MAPLE PLAIN PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
0
10
20
30
40
50
60
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

MEDINA WASTEWATER TREATMENT PLANT

Plant History and Description

The Medina Plant was designed by W.T. Mills, and constructed in 1969. The plant serves the Hamel area and the City of Medina and has a design capacity of 0.10 mgd. The plant consists of a two-staged aerated lagoon system followed by two seepage ponds. The seepage pond contents are emptied by evaporation, percolation, and controlled discharge to nearby Elm Creek, when necessary.

Performance

Plant flow averaged 0.182 mgd in 1983, significantly higher than 0.149 mgd in 1982. Average aeration pond effluent quality was 10 mg/L BOD and 14 mg/L TSS, representing removal rates of 97 percent for BOD and 89 percent for TSS. The plant is presently operating at about 180 percent of its rated design capacity. Major problems with the seepage pond operation have been experienced since the fall of 1981 when the ponds overflowed their dikes. The Commission applied for, and received on November 1, 1982, a revised NPDES Permit which allows for controlled discharge directly to Elm Creek. The plant is subject to inflow/infiltration. The Medina Plant had a weekly TSS, monthly TSS, weekly TSS mass, and weekly fecal coliform violation. All four violations related to spring discharge which was necessitated due to the plant operating beyond its seepage capacity.

Future

The Medina Plant is scheduled to be phased out of operation in 1985, by construction of an interceptor sewer through the City of Plymouth and into the Metropolitan Plant collection system. The newly issued NPDES Permit requires plant phaseout by the end of 1984.

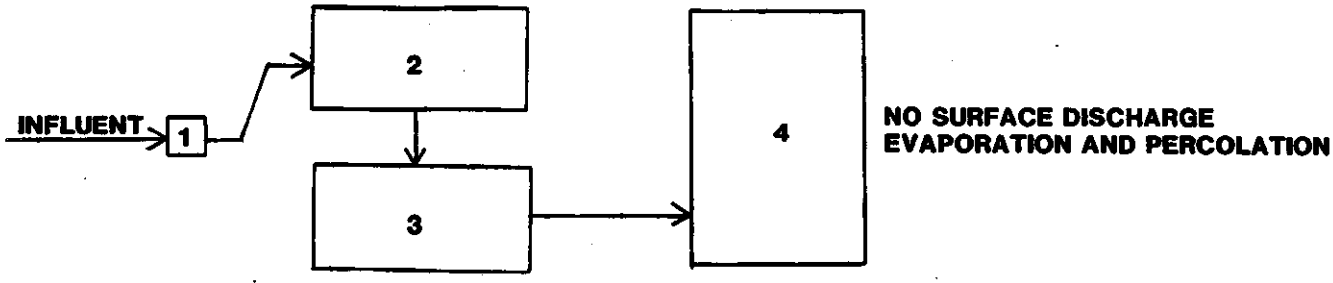
MEDINA PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	0.132	0.180	0.224	0.250
BOD_5 Loading, lb/day	135	200	360	390
TSS Loading, lb/day	140	310	490	1,100
COD Loading, lb/day	255	420	300	760
Primary Aeration Pond				
Detention Time, days	12.5	9	7.4	7
BOD_5, lb/day/1000 cu. ft.	0.6	0.9	1.6	1.8
Final Aeration Pond				
Detention Time, days	12.5	9	7.4	7
Seepage Ponds				
Detention Time, days	72*	86**	42*	53**
BOD_5 Loading, lb/acre/day	1.8	1.7	3.7	3.4

* Calculated assuming zero percolation and evaporation.
**Calculated assuming an annual average percolation rate of 70,000 gpd.

MEDINA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



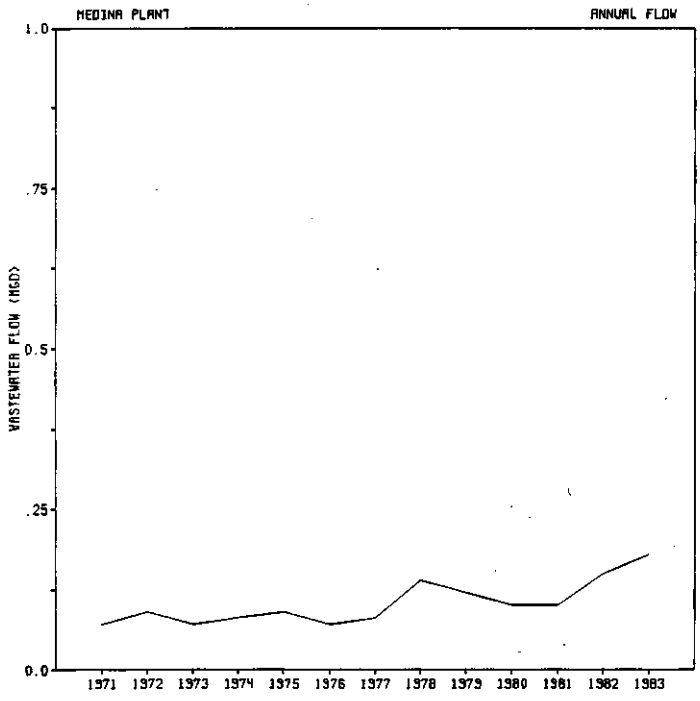
Unit Description

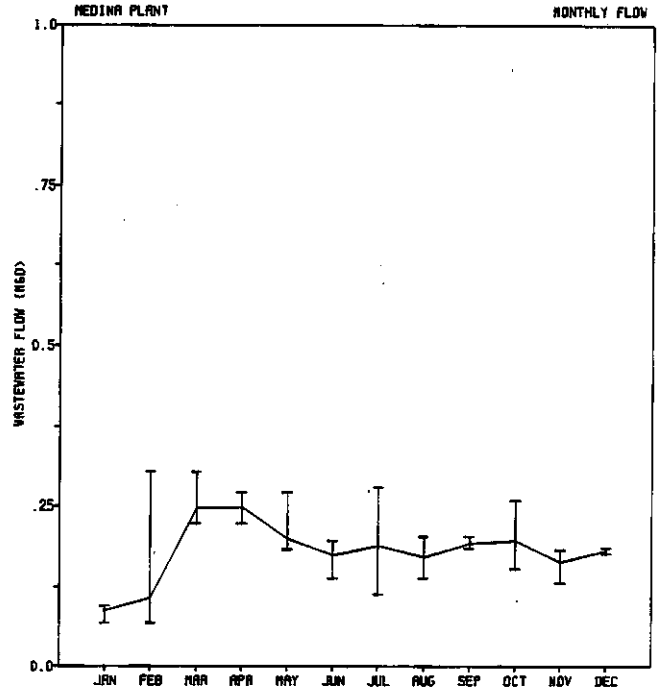
Liquid Phase

1. Screening
2. Primary Aerated Pond
3. Final Aerated Pond
4. Absorption Pond

Legend

Liquid Flow
Solids Transfer
Existing Process Units
Future Process Units



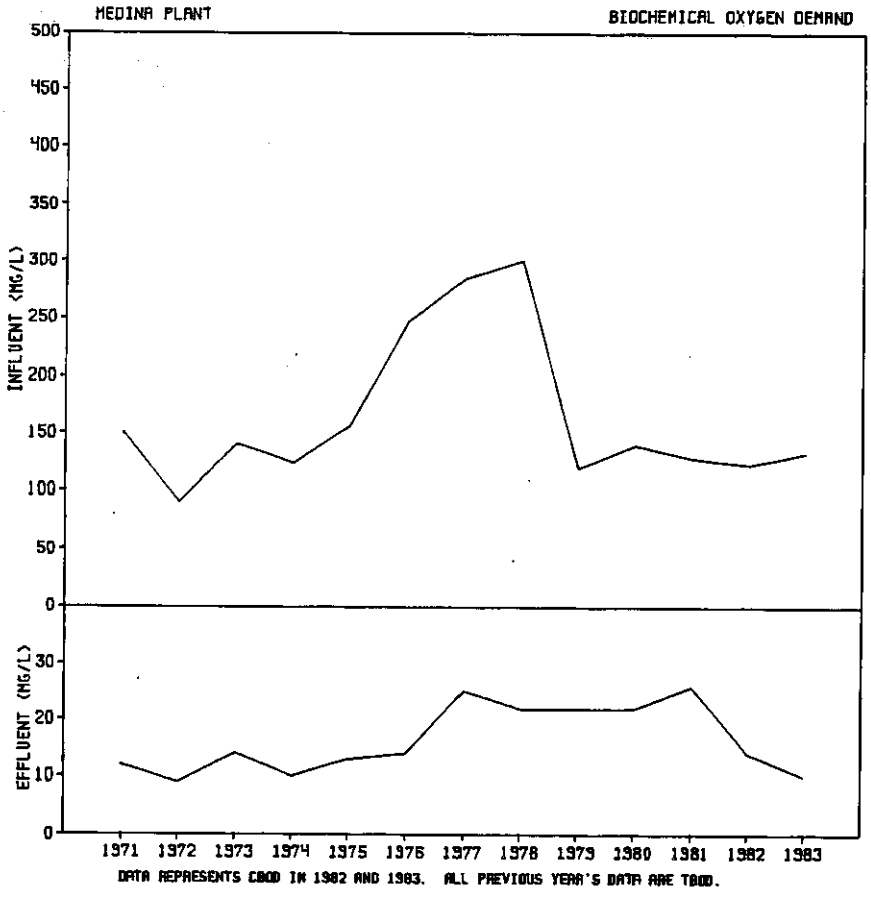


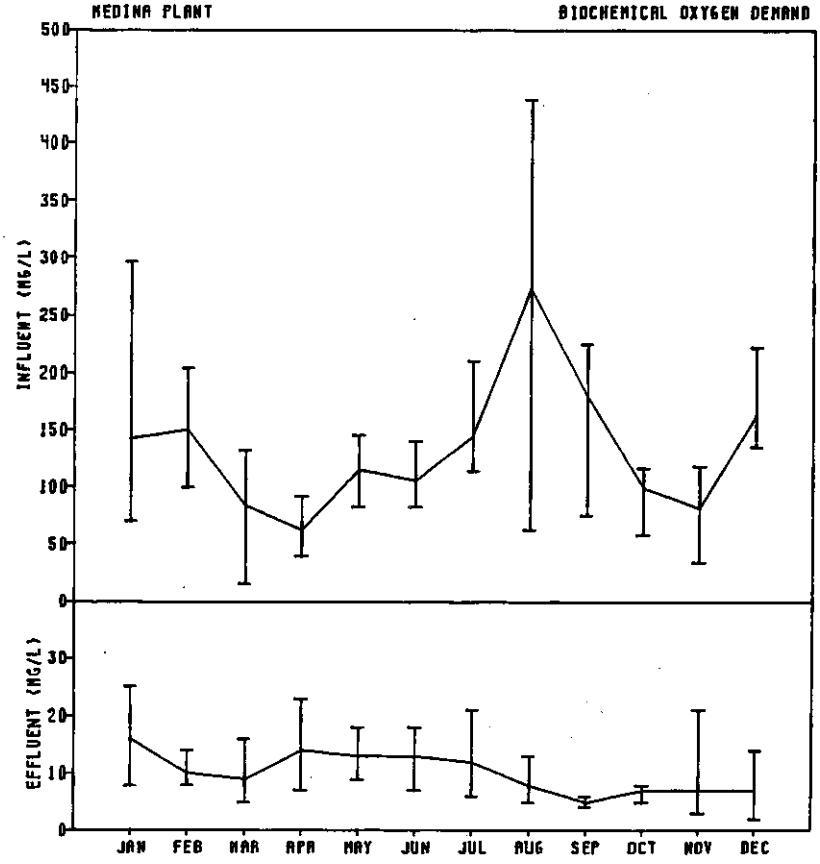
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Medina

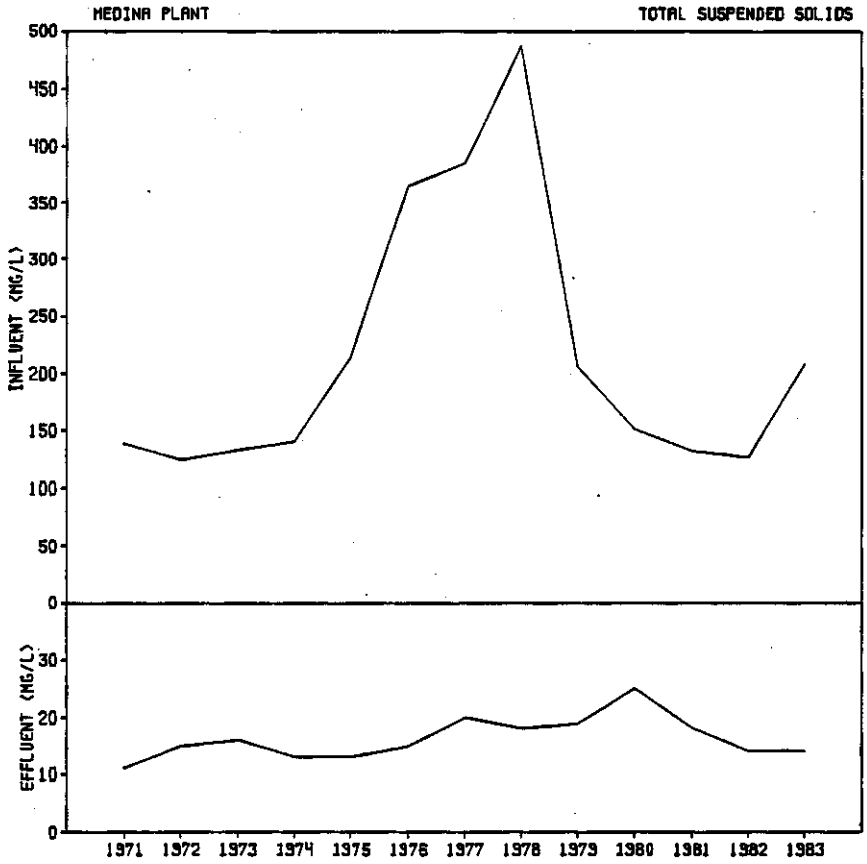
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.087	--	143	148	-------	37.9	5.4	19.8	299
FEBRUARY	0.107	--	150	122	-------	----	7.7	20.0	226
MARCH	0.247	--	83	110	7.6	13.8	2.4	5.3	217
APRIL	0.249	11	62	65	7.5-7.7	21.9	2.6	4.4	148
MAY	0.200	11	115	119	7.5-7.7	20.8	3.9	6.5	213
JUNE	0.175	13	105	95	7.4-7.6	21.6	3.5	13.6	291
JULY	0.189	15	145	228	7.5-7.7	33.3	4.5	16.0	341
AUGUST	0.172	17	273	752	7.3-7.6	39.4	8.4	15.1	538
SEPTEMBER	0.193	16	180	333	7.5	33.6	5.1	16.6	396
OCTOBER	0.198	15	99	114	7.5-7.6	29.4	4.2	13.5	225
NOVEMBER	0.164	15	81	97	7.4-7.6	29.9	4.1	10.7	210
DECEMBER	0.182	13	163	255	7.6	29.8	6.3	13.1	347
1983 AVERAGE	0.181	14	133	208	7.3-7.7	28.7	4.9	12.8	289
1982 AVERAGE	0.149	13	122	127	7.5-7.9	31.7	4.2	14.3	231

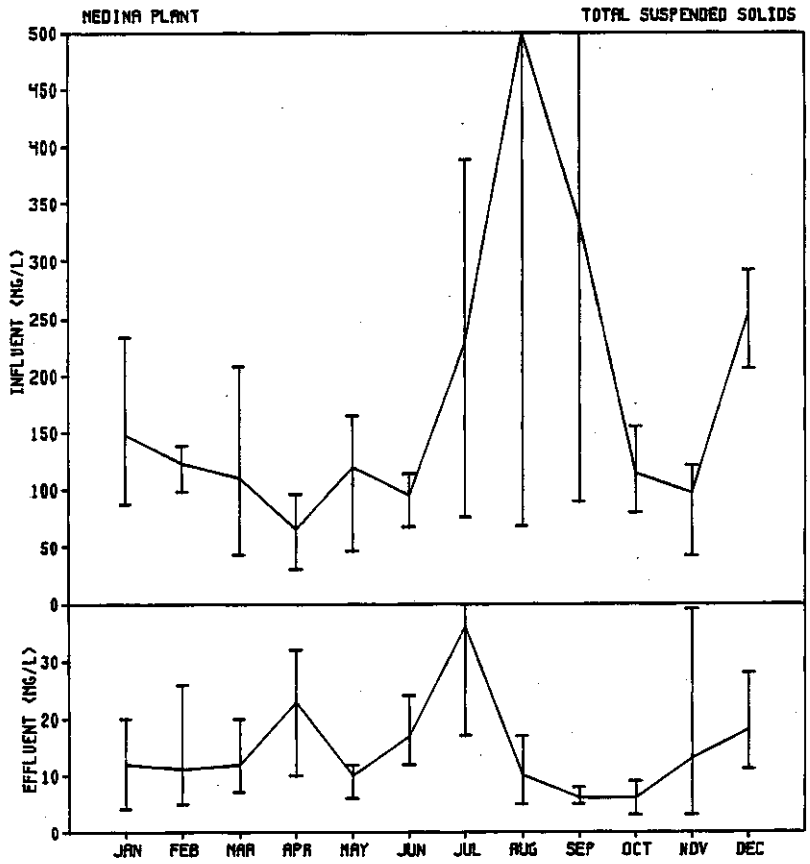
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Medina

Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
JANUARY	20	16	73	12	--	6	26.1	18.9	0.01	0.05	3.1	---	---	2.8	7.4-7.5	89	92
FEBRUARY	12	10	59	11	--	8	----	16.8	0.01	0.05	4.1	---	---	2.8	7.3-7.5	93	91
MARCH	17	9	63	12	--	8	9.5	5.2	0.19	1.31	1.4	---	---	3.2	7.5-7.5	89	89
APRIL	15	14	66	23	--	10	9.0	2.5	0.10	1.67	1.4	---	---	3.5	7.5-7.6	78	65
MAY	13	13	57	10	--	6	16.0	9.9	0.05	0.12	2.8	---	---	3.3	7.6-7.7	89	92
JUNE	15	13	70	17	--	8	22.8	17.6	0.11	0.42	3.7	---	---	3.1	7.5-7.6	88	82
JULY	15	12	79	36	--	6	8.5	3.4	0.19	3.51	1.9	---	---	2.9	7.5-7.6	92	84
AUGUST	9	8	47	10	--	5	10.9	6.4	0.32	2.34	3.0	---	---	2.9	7.3-7.6	97	99
SEPTEMBER	6	5	42	6	--	4	11.5	6.8	0.24	2.96	2.9	---	---	3.3	7.3-7.5	98	98
OCTOBER	7	7	37	6	--	5	13.3	11.0	0.02	0.07	3.5	---	---	3.0	7.4-7.5	93	95
NOVEMBER	20	7	64	13	--	7	12.5	8.3	0.18	1.94	2.5	---	---	2.5	7.5-7.6	91	86
DECEMBER	22	7	43	18	--	13	11.3	8.5	0.05	0.67	2.1	---	---	2.9	7.5-7.5	96	93
1983 AVG.	14	10	59	14	--	7	14.0	9.6	0.13	1.30	2.7	---	---	3.0	7.3-7.7	91	89
1982 AVG.	17	14	61	14	--	8	17.7	11.4	0.12	0.48	2.7	---	---	3.4	7.3-7.8	87	88


MEDINA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.


MEDINA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


MEDINA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
10
20
30
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


MEDINA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
10
20
30
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

METROPOLITAN WASTEWATER TREATMENT PLANT

Plant History and Description

The existing Metropolitan Plant has been constructed in several stages. The original 1938 primary treatment was designed on the basis of an average annual wastewater flow of 134 mgd. It included pretreatment by screening and grit removal, primary treatment by sedimentation, intermediate treatment by chemical precipitation, effluent filtration and chlorination. The sludge disposal system included chemical conditioning (lime and ferric chloride), vacuum filtration, incineration, and land disposal of ash.

In the early 1960's, construction was initiated on the second stage of the plant. In 1966, the secondary treatment portion of the plant was placed into operation. This expansion was based on an annual average flow of 218 mgd and was designed to operate as a high rate activated sludge process. It consisted of four aeration tanks, three aeration compressors, twelve final sedimentation tanks, additional chlorination facilities, and a new chlorine contact effluent channel. The original sludge disposal system was expanded by construction of new gravity sludge thickeners, sludge holding tanks, and additional chemical conditioning, vacuum filtration and incineration facilities.

Stage Three was placed into operation in 1972. This phase added four more aeration tanks and two more air compressors to provide enough capacity to operate the step aeration activated sludge process. Incremental feed pipes were required as modification to the original aeration tanks. This completed the West Battery activated sludge system. One new incinerator was also constructed during this time to allow additional sludge disposal capacity.

By the mid 1970's, the fourth stage of construction was initiated to meet the following objectives: (1) to protect the plant from flood damage; (2) to maintain secondary treatment during flood periods; (3) to provide a minimum of primary treatment and disinfection for all dry and wet weather flows that reached the plant; (4) to provide secondary treatment capacity based on secondary treatment standards as defined by the 1972 Water Pollution Control Act Ammendments (PL92-500); (5) to provide solids processing capacity to handle the increased sludge generated by the liquid treatment expansion; and (6) to minimize energy consumption for solids processing at the plant.

By 1978, the bulk of the liquid treatment construction program had been completed. Completed projects included the flood protection facility, effluent pumping station, east battery pretreatment (screening and grit removal), east battery primary settling tanks and east battery aeration and final settling tanks.

By 1980, the first portion of the solids processing facilities was completed. These projects included floatation thickening for secondary sludge, sludge storage, thermal conditioning, return liquor treatment facilities and filter press dewatering. The sludge incineration and energy recovery

facilities were behind schedule at that time. To meet air pollution control requirements, scrubbers were installed on the F & I No. 1 incinerators. Further, to allow temporary shutdown of F & I No. 2 incinerators, an interim land disposal program was implemented. This required construction of sludge loadout facilities and asphalt sludge storage pads and composting area.

By late 1982, the startup phase had begun for the roll presses and the distributed digital acquisition and control system (computer system). Also during 1982, a new warehouse and maintenance facility was completed, providing the maintenance staff with the necessary facilities to properly and efficiently maintain this extensive and complex treatment facility. Computer-assisted inventory and maintenance systems now optimize storage and retrieval of materials and response time and reporting of maintenance work.

During 1983, the remaining solids processing facilities began operation. These include two new sludge incinerators, four modified F & I No. 2 sludge incinerators, energy recovery facilities, air pollution control equipment, dry ash handling and storage facilities, auxiliary boilers, and sludge dryers. As a result of successful incinerator startup and air compliance testing, a consent decree with the EPA, regarding plant air pollution control problems, was successfully concluded in December, 1983. In addition, the sludge energy recovery facilities began producing steam for plant process and heating uses, significantly reducing the plant's fuel costs.

The new facilities at the Metropolitan Plant have enabled the transition from an inefficient, energy-intensive operation, unable to consistently meet the federal-mandated minimum requirements of secondary treatment standards, to a modern, efficient, flood-protected, energy-conserving operation, projected to meet the minimum standards for the metropolitan area to the year 2000. The massive program for land spreading of sludge, required to satisfactorily dispose of sludge when incineration capacity was inadequate, has now been transformed to a back-up role in the new system of incineration with heat recovery.

Following an extended public hearing, the Minnesota Pollution Control Agency issued a new NPDES permit for the Metropolitan Plant on December 14, 1982. The new permit requires progressively more stringent effluent quality to be achieved. In the summer months of 1985, the monthly dishcarge BOD standard drops to 18 mg/L and may decrease to as low as 10 mg/L in 1988. Ammonia standards, set to prevent toxic effects to fish, become applicable in the summer months of 1985 (8 mg/L) and may be further reduced to 5 mg/L in 1988. Final limitations for heavy metals (mercury, copper, and cadmium) and cyanide begin in 1986. In June, 1986, residual chlorine in the plant effluent must be removed to satisfactorily protect aquatic life in the Mississippi River.

Effluent BOD and ammonia limits scheduled for 1985 were met during the summer months of 1983 when biological ammonia removal was provided in the east secondary treatment facilities. Completion of the East Battery Expansion should provide greater treatment reliability and the industrial pretreatment program will assist in providing compliance with cyanide and metals limitaitons. Addition of effluent dechlorination facilities must be constructed to achieve compliance with future chlorine residual limitations.

Performance

Plant flow averaged 225 mgd in 1983, much higher than 208 mgd in 1982. Effluent quality during 1983 improved from that of 1982. Average effluent BOD and TSS concentrations during 1983 were 10 mg/L and 9 mg/L as compared to 1982 average effluent BOD and TSS values of 13 mg/L and 11 mg/L. This is the fourth consecutive year that the Metropolitan Plant performance has shown improvement. This improvement is significant because 82 percent of all wastewater generated in the Metropolitan Area is treated at this facility. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	20	14	10	8	29	24	15	13	44	36	22	19
TSS	15	10	7	7	33	24	12	11	60	47	21	17

*1982 and 1983 values represent CBOD.

Future

The Metropolitan Plant will continue to be the largest treatment facility in the Metropolitan Disposal System. Construction of additional aeration and final sedimentation tanks for the East Battery activated sludge system is underway and is expected to be completed in early 1985. Future projects include: (1) disinfection improvements and dechlorination to meet a chlorine residual standard by 1986; (2) retrofit of existing facilities to be compatible with the distributed digital acquisition and control system; and (3) rehabilitation of older plant systems such as west pretreatment, west primary, west secondary.

METROPOLITAN PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	208	225	239	285
Flow-East, MGD (1)	176	194	204	238
Flow-West, MGD (2)	32	31	35	47
BOD Loading, lb/day	350,000	330,000	440,000	390,000
TSS Loading, lb/day	420,000	360,000	600,000	460,000
Primary Sludge, dtpd	184	197	220	235
Secondary Sludge, dtpd	114	103	140	118
Total Sludge (with recycle), dtpd	298	300	360	351
Bar Screens				
East Battery				
No. of Units	4.2	5.9	4.8	6.7
Unit Flow, MGD	42	33	42	36
West Battery				
No. of Units	0.6	0.5	0.7	0.7
Unit Flow, MGD	50	69	50	72
Grit Tanks				
East Battery				
No. of Units	4.2	5.9	4.8	6.7
Hor. Velocity, fps	0.4	0.3	0.4	0.3
Unit Flow, MGD	42	33	42	36
West Battery				
No. of Units	1.2	0.9	1.4	1.3
Hor. Velocity, fps(3)	1.0	1.0	1.0	1.0
Unit Flow, MGD	25	35	25	36
Primary Sedimentation				
East Battery				
No. of Units	7.9	7.9	8.0	7.9
Detention Time, hr.	3.0	2.7	2.6	2.2
Overflow Rate, gpd/sq. ft.	930	1,020	1,060	1,860
West Battery				
No. of Units	5.6	4.9	4.9	---
Detention Time, hr.	8.0	7.1	6.4	5.7
Overflow Rate, gpd/sq. ft.	350	390	440	490
Activated Sludge-Aeration				
East Battery				
Flow, MGD	97	96	112	98
No. of Units	3.8	3.6	4.0	---
F:M Ratio, day^{-1}	0.22	0.20	0.27	0.21

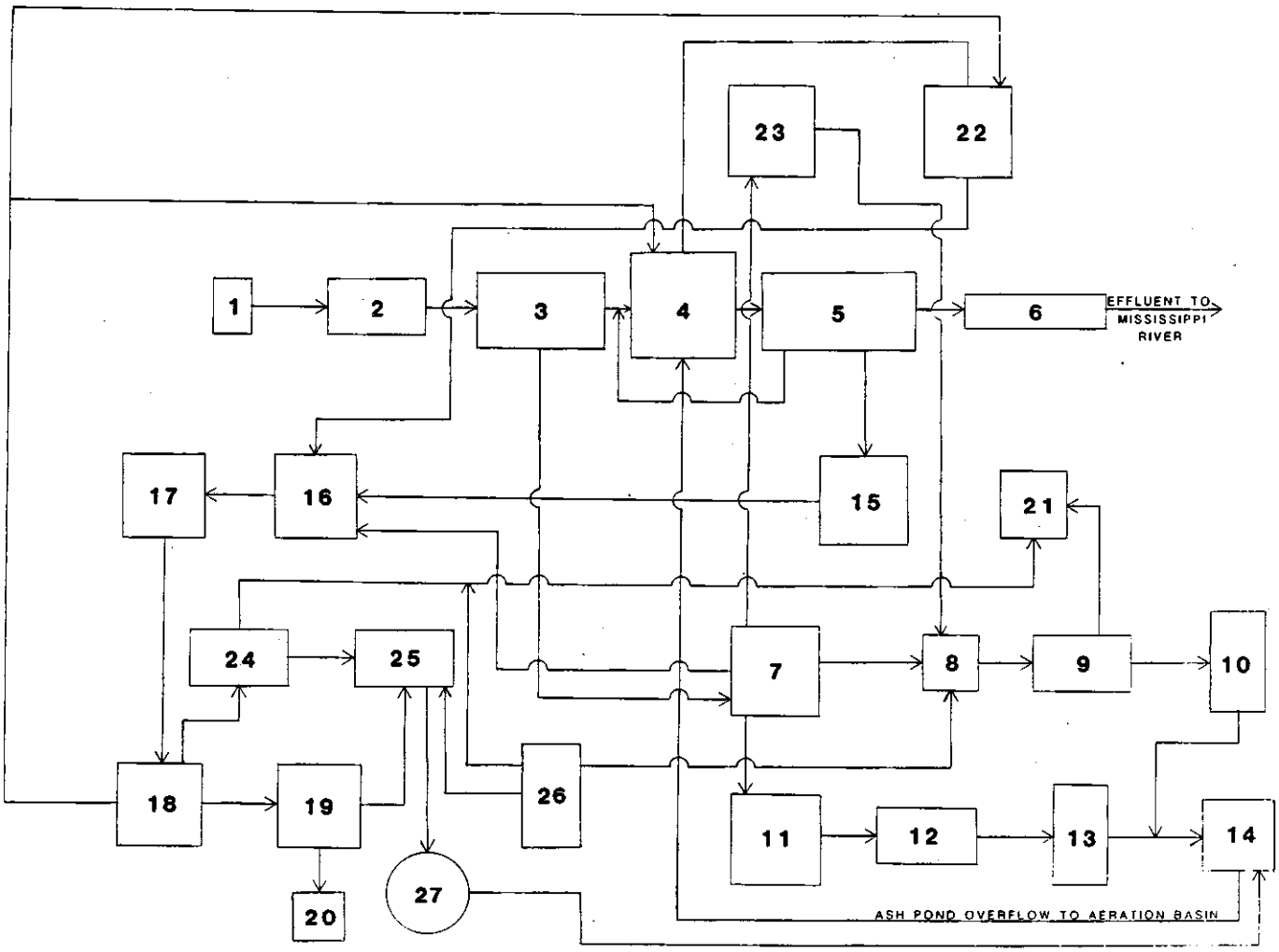
Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Activated Sludge-Aeration (Cont.)				
BOD Load, lb/day/1000 cu. ft.	47	40	62	41
Air Use, cu. ft./lb. BOD	1,700	---	2,600	---
Detention Time, hr.	4.7	4.6	4.3	3.7
West Battery				
Flow, MGD	111	124	127	143
No. of Units	4.0	4.2	4.3	5.0
F:M Ratio, day^{-1}	0.23	0.35	0.30	0.33
BOD Load, lb/day/1000 cu. ft.	49	46	59	38
Air Use, cu. ft./lb. BOD	1,800	----	2,100	----
Detention Time, hr.	4.3	3.0	4.0	3.2
Final Sedimentation				
East Battery				
No. of Units	8.8	8.3	9.0	7.0
Detention Time, hr.	3.5	3.5	3.1	2.8
Overflow Rate, gpd/sq. ft.	560	630	630	720
Solids Load, lb./sq. ft./day	10	10	14	11
West Battery				
No. of Units	11.6	11.4	12.0	11.3
Detention Time, hr.	4.0	3.4	3.6	2.9
Overflow Rate, gpd/sq. ft.	490	590	540	680
Solids Load, lb./sq. ft./day	9	10	11	10
Chlorination				
Chlorine Use, lb/day(4)	8,500	12,200	14,000	13,600
Chlorine Dose, mg/L	4.6	6.1	7.3	6.8
Contact Time, minutes	28	25	24	21
Gravity Thickening				
Solids Loading, lb./sq. ft./day	20	19	26	23
Overflow Rate, gpd/sq. ft.	430	450	470	530
Sludge Concentration, % TS(5)	6.5	7.4	6.4	8.8
Flotation Thickening				
No. of Units	10.9	9.5	12.7	13.1
Solids Loading, lb./sq. ft./day	9.4	15.2	11	20.8
Air:Solids Ratio	0.03	0.04	0.03	0.05
Sludge Concentration, % TS(6)	3.3	3.6	3.0	3.8
Thermal Conditioning				
No. of Units	3.0	3.3	3.6	3.6
Feed Concentration, % TSS	3.9	4.5	4.1	6.8
TSS Solubilization, %	42	39	46	38
Decant Tank Underflow, % TSS	14	14	14	15

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Chemical Conditioning				
Vacuum Filters (F & I No. 1)				
Lime Dose, % of dss	9	---	10	---
$FeCL_3$ Dose, % of dss	2.6	---	3.1	---
Vacuum Filters (F & I No. 2)				
Lime Dose, % of dss	27	29	38	---
$FeCL_3$ Dose, % of dss	11	13	15	---
Roll Press				
Dry Polymer, lb/day	---	1,430	---	2,220
Lbs. Polymer, per tds	---	13.1	---	17.7
Vacuum Filters				
F & I No. 1				
No. of Units	4.4	---	5.0	---
Filter Rate, lb./sq. ft./day	3.3	---	3.6	---
Cake Solids, % TS	28	---	30	---
Dry Sludge, tpd	87	---	108	---
F & I No. 2				
No. of Uuits	5.6	1.1	6.9	3.9
Filter Rate, lb./sq. ft./day	2.0	1.1	1.9	---
Cake Solids, % TS	25	24.4	26	28.7
Dry Sludge, tpd	90	11	110	53
Filter Presses				
No. of Units	2.6	3.4	3.1	4.2
Dry Sludge, tpd(8)	41	75	87	110
Cake Solids, % TS(9)	48	42	45	---
Incineration				
No. of Units(10)	2.0	1.2	1.7	---
Auxiliary Fuel Use, MMBtu/tds	6.5	1.6	5.8	---
Dry Sludge, tpd	73	89	108	158
Wet Loading, lb./sq. ft./day	6.0	9.2	6.5	---

NOTES:

(1) Flow to East Pretreatment and East Primary.
(2) Flow to West Pretreatment and West Primary.
(3) Velocity in West Battery Grit Tank is gate controlled.
(4) Average for months when disinfection is required (i.e., March - October).
(5) Sludge concentration in Gravity Thickener underflow.
(6) Sludge concentration in Flotation Thickener Sludge.
(7) Vacuum filter ran only 8 months in 1983.
(8) Maximum month when most dry cake was produced.
(9) Maximum month cake solids production as % TS.
(10) F & I No. 1 not put back into service in 1983.

METROPOLITAN WASTEWATER TREATMENT PLANT
FLOW DIAGRAM

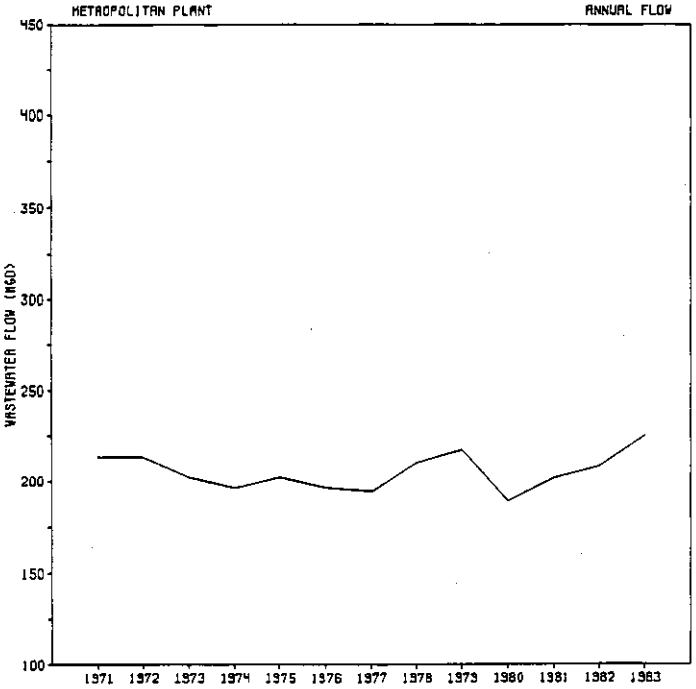


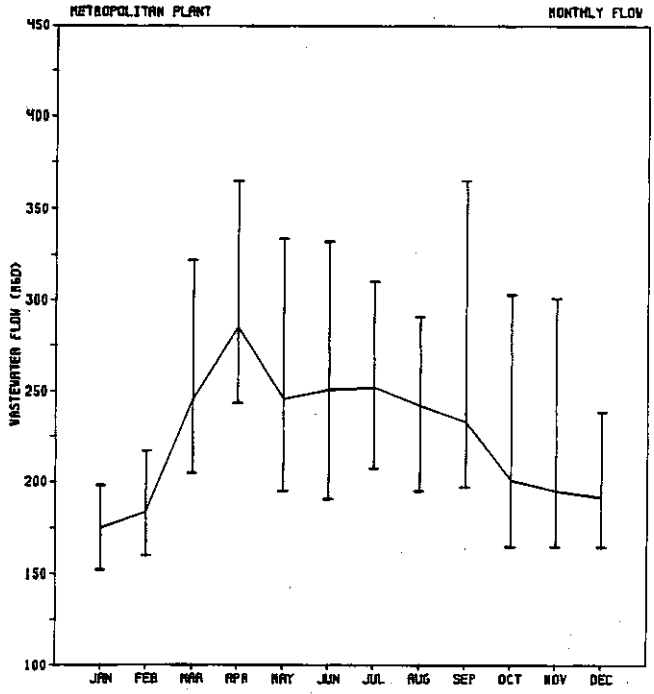
Liquid Phase

1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

Solid Phase

7. Gravity Thickening
8. Holding Tank
9. Vacuum Filtration
10. Incineration
11. Concentration
12. Vacuum Filtration
13. Incineration
14. Ash Pond
15. Flotation Thickening
16. Sludge Storage
17. Thermal Conditioning
18. Decant Thickening
19. Plate & Frame Press
20. North Loadout
21. South Loadout
22. Return Liquors Bio.
23. Return Liquors P-Chem.
24. Vacuum Filter
25. Incinerator
26. Roll Press
27. Silos





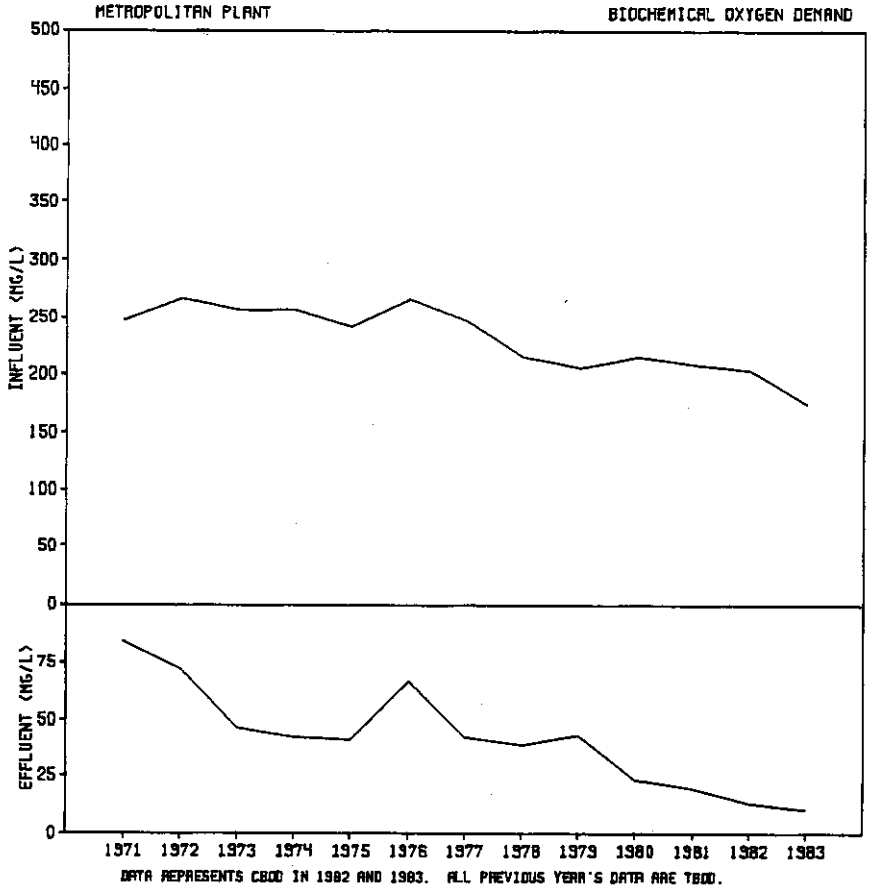
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Metropolitan

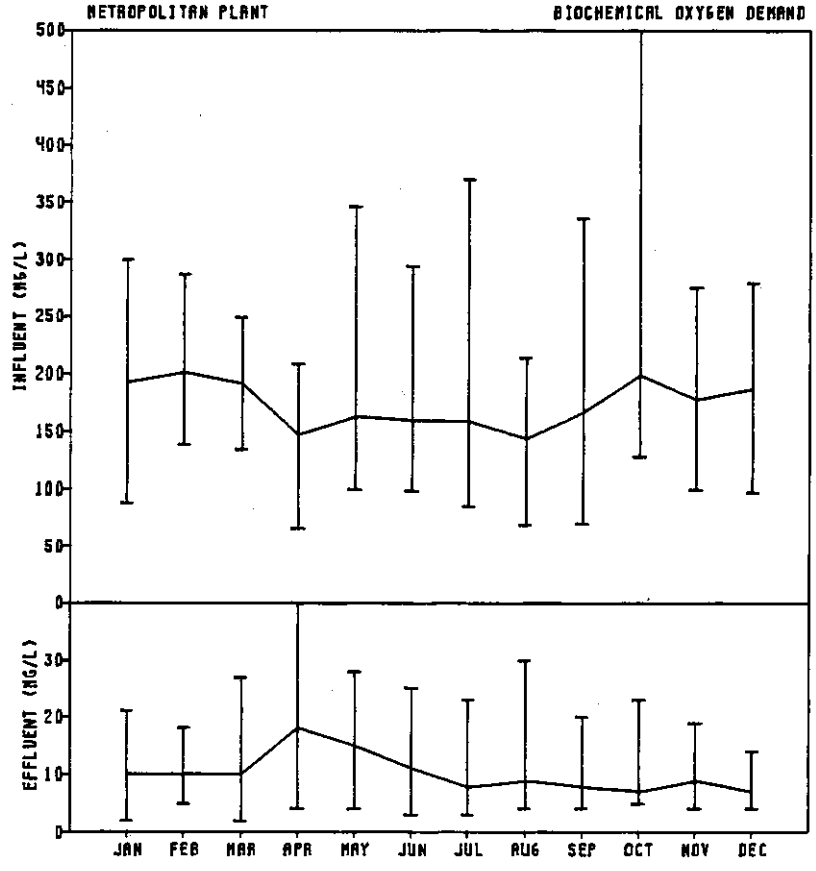
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	175	13	192	162	6.6-10.4	33.4	5.5	20.1	379
FEBRUARY	184	13	201	182	6.6-9.3	----	5.5	17.9	396
MARCH	246	13	191	208	6.6-9.5	26.5	4.6	14.4	416
APRIL	285	13	147	133	6.7-10.4	22.3	3.7	11.6	289
MAY	246	16	163	178	5.3-9.2	19.4	3.6	11.1	320
JUNE	251	20	160	190	6.2-11.1	20.6	3.7	12.4	353
JULY	252	22	159	199	5.6-8.8	20.7	3.9	11.3	346
AUGUST	242	22	144	158	5.6-8.4	23.4	4.0	10.8	317
SEPTEMBER	233	21	167	227	5.4-8.3	21.8	4.4	10.2	385
OCTOBER	201	19	199	268	6.5-8.9	26.7	4.9	13.5	463
NOVEMBER	195	17	178	196	6.2-8.8	24.9	4.9	11.3	406
DECEMBER	192	14	187	198	6.5-10.0	28.0	4.8	14.7	428
1983 AVERAGE	225	17	174	192	5.3-11.1	24.3	4.4	13.2	375
1982 AVERAGE	208	16	203	241	5.7-9.4	30.6	4.9	16.4	415

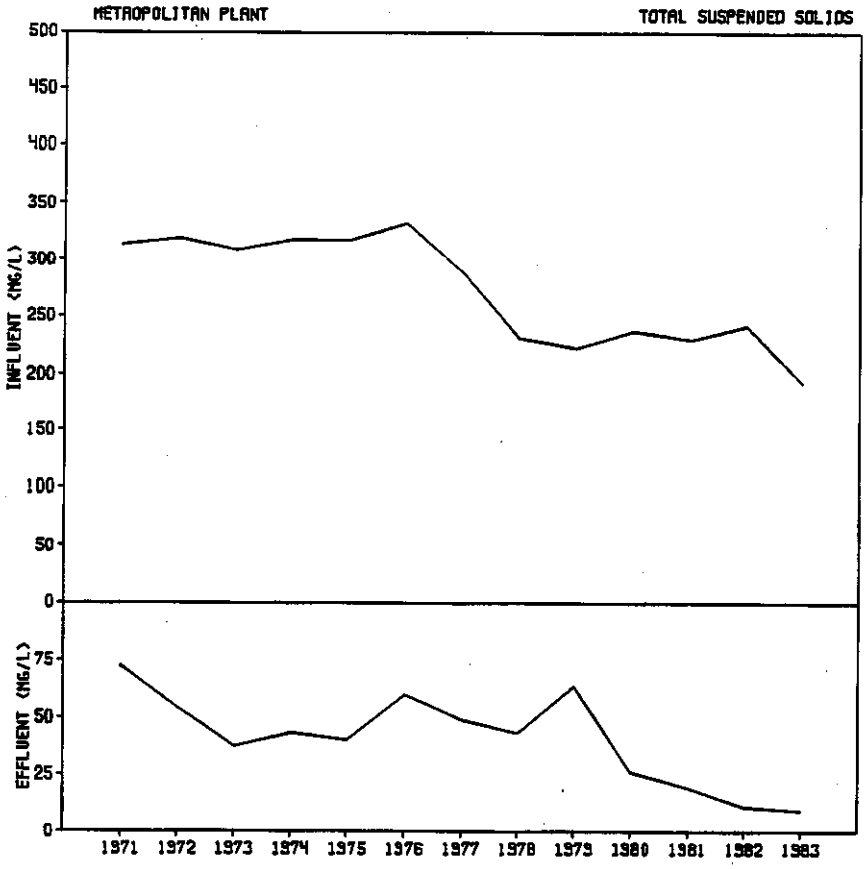
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Metropolitan

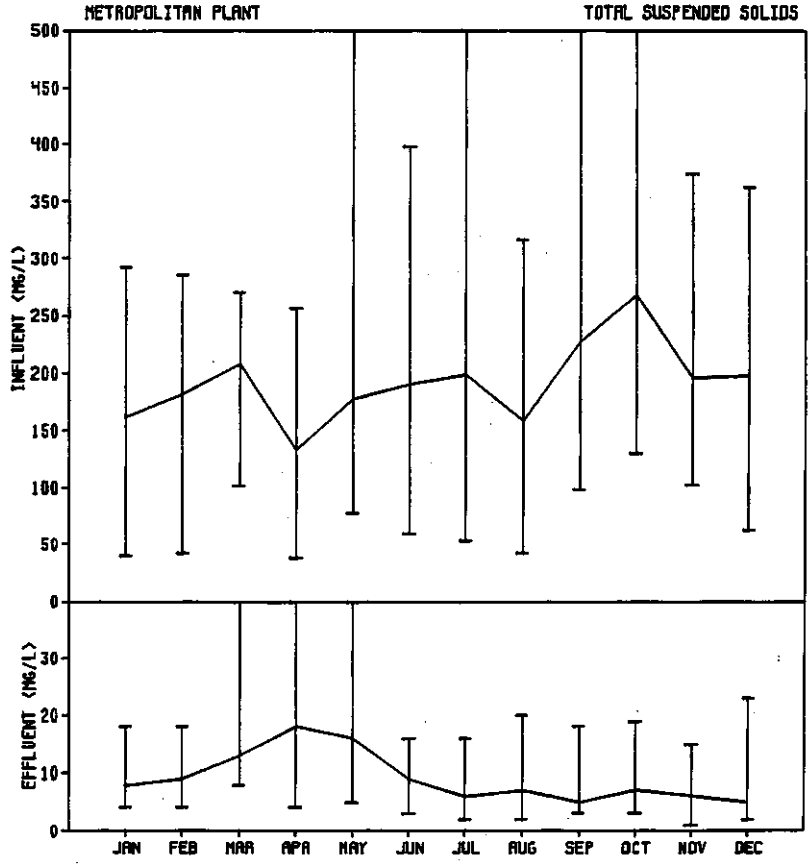
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	24	24	---	30	200	--	-----	----	----	----	---	------	---	**	6.5-8.5	--	--
JANUARY	21	10	73	8	---	4	25.6	18.4	0.31	2.55	2.5	------	---	1.1	7.0-7.8	95	95
FEBRUARY	19	10	75	9	---	4	-----	17.9	0.57	2.22	3.1	3800	0.0	1.4	7.1.7.8	95	95
MARCH	13	10	82	13	5	7	22.6	15.3	0.40	1.01	1.6	11981	3.1	2.9	7.2-7.8	95	94
APRIL	20	18	88	18	4	10	19.3	13.4	0.26	0.91	2.8	10840	2.9	3.2	7.1-8.2	88	86
MAY	24	15	76	16	9	9	18.6	12.7	0.70	0.78	1.7	9355	2.6	2.8	7.2-7.9	91	91
JUNE	20	11	77	9	11	6	12.0	8.1	1.05	3.86	1.7	13867	3.0	4.6	7.1-7.7	93	95
JULY	17	8	66	6	14	4	10.3	6.8	0.86	4.87	1.7	13690	2.9	5.6	7.2-8.0	95	97
AUGUST	22	9	70	7	101	4	11.1	6.6	1.48	5.19	1.9	13458	2.9	5.1	7.1-8.0	94	96
SEPTEMBER	15	8	62	5	23	4	9.1	5.1	1.20	5.69	2.2	13467	3.5	5.3	7.0-7.8	95	98
OCTOBER	18	7	72	7	33	4	13.7	10.2	1.67	3.83	2.7	11432	3.0	5.8	7.1-7.8	96	97
NOVEMBER	21	9	77	6	---	3	18.3	11.7	1.42	1.88	2.2	------	---	2.0	7.1-8.0	95	97
DECEMBER	22	7	72	5	---	3	20.3	14.6	0.39	4.04	2.2	------	---	1.0	7.0-7.7	96	97
1983 AVG.	19	10	74	9	25	5	16.3	11.7	0.87	3.08	2.2	12120	2.9	3.4	7.0-8.2	94	95
1982 AVG.	22	13	77	11	24	6	21.3	14.9	0.99	1.58	2.0	8458	2.1	3.1	6.9-8.4	95	95

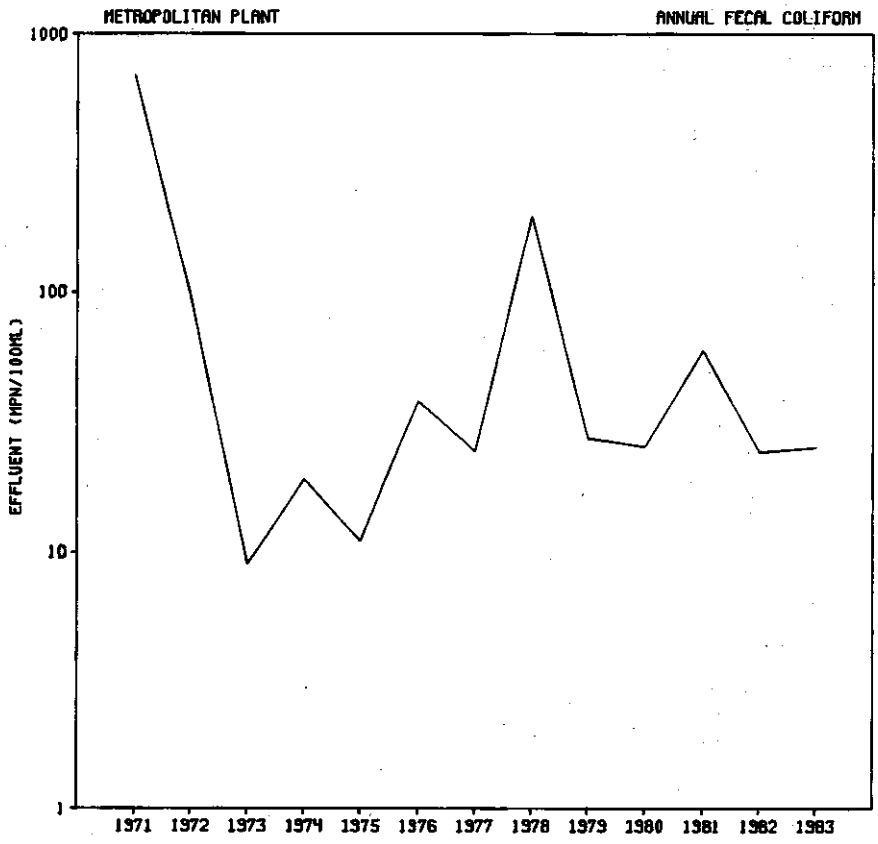
* For disinfection only.
**Dissolved oxygen limitation of 7 mg/l for river flows less than 7,000 cfs and river D.O. values less than 6 mg/l upstream or less than 5.5 mg/l downstream for two consecutive sample days, during the period of June-September.

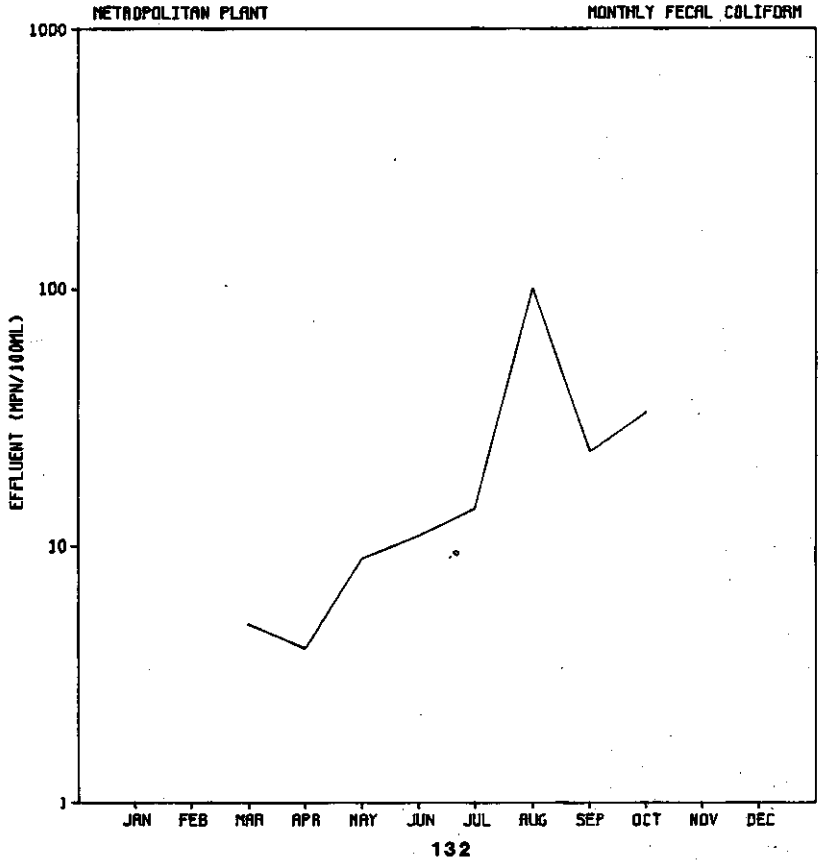

METROPOLITAN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

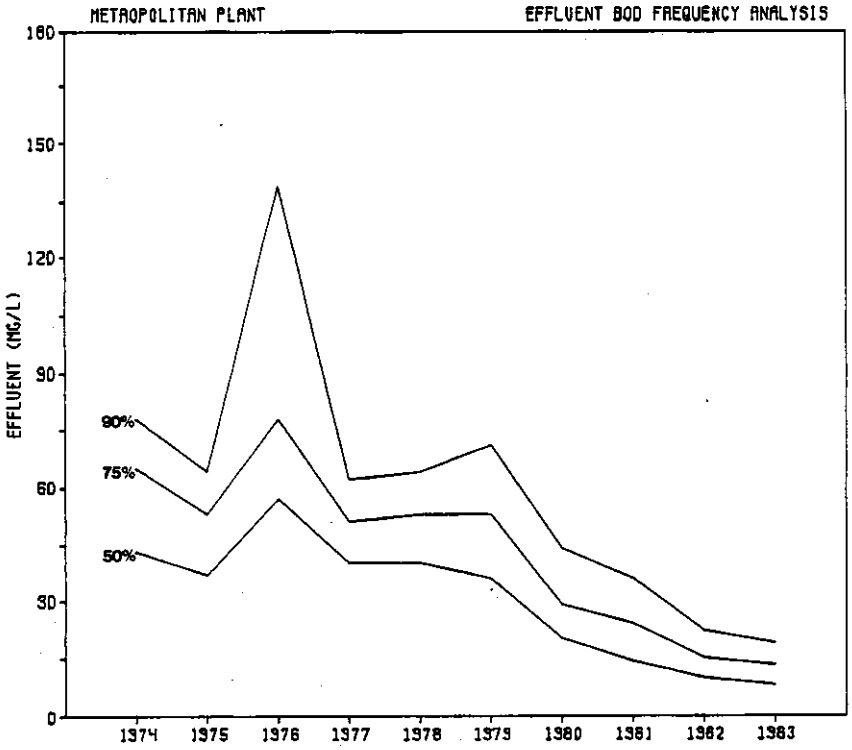

METROPOLITAN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

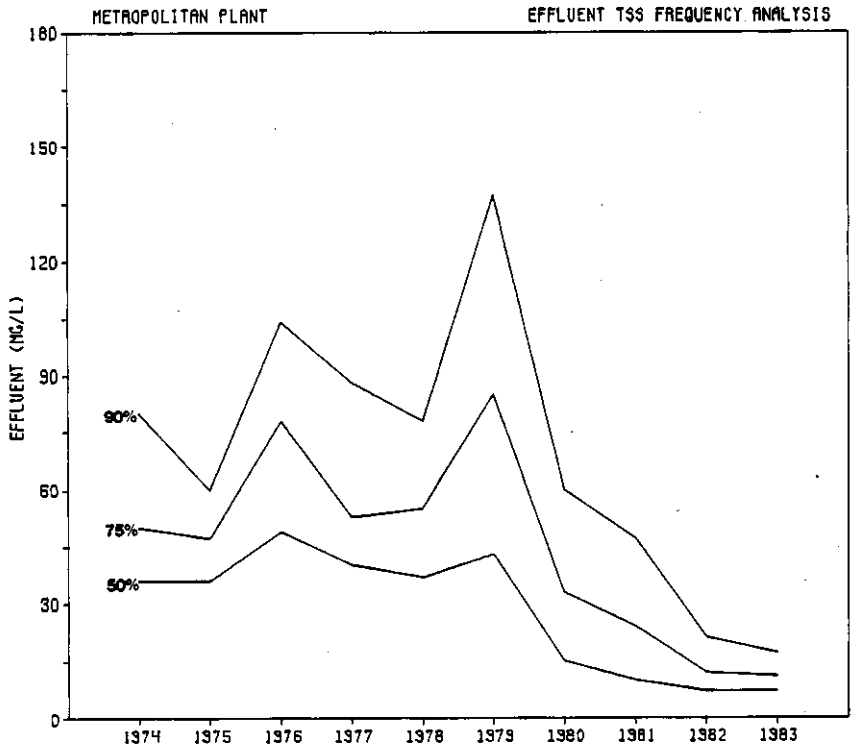

METROPOLITAN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


METROPOLITAN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


METROPOLITAN PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


METROPOLITAN PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


METROPOLITAN PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


METROPOLITAN PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
180
150
120
90
60
30
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

1983 INFLUENT DATA
TREATMENT PLANT Metropolitan

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	PCB mg/l	Ni mg/l	Phenol ug/l	Fe mg/l
January	0.24	<0.20	0.32	<0.06	0.013	<0.42	<0.095	<1.1	0.75	0.13	37.8	1.87
February	0.19	<0.18	0.35	<0.07	0.021	<0.36	<0.105	<1.3	0.39	0.14	44.4	2.40
March	0.23	0.22	0.41	<0.09	0.019	0.34	0.087	2.3	0.31	0.12	24.4	1.83
April	0.14	<0.19	0.30	<0.06	0.014	<0.44	0.068	1.6	0.23	<0.09	34.8	1.93
May	0.20	<0.15	<0.41	<0.08	0.017	<0.39	<0.056	1.6	0.32	<0.11	37.0	1.77
June	0.17	<0.14	0.29	<0.06	0.018	<0.51	<0.046	<1.3	0.65	<0.11	26.4	1.13
July	0.16	0.12	0.36	<0.05	0.011	1.08	<0.042	<1.2	0.03	0.10	46.0	1.23
August	0.17	0.15	0.32	<0.06	0.010	<0.41	0.057	2.0	0.03	0.11	28.4	1.00
September	0.24	0.22	0.44	<0.06	0.013	<0.73	0.083	<1.1	0.06	0.15	32.8	1.87
October	0.22	0.22	0.37	<0.07	0.012	<0.46	0.055	1.6	1.00	0.11	22.6	1.70
November	0.22	0.18	0.37	<0.06	0.010	<0.60	0.070	<1.6	0.09	<0.09	37.0	2.00
December	0.19	<0.16	0.32	<0.06	0.023	<0.80	<0.087	<1.4	1.00	<0.14	----	1.66
1983 Avg.	0.20	<0.18	<0.36	<0.07	0.015	<0.55	<0.071	<1.5	0.40	<0.12	33.8	1.70

1983 EFFLUENT DATA
TREATMENT PLANT Metropolitan

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	PCB mg/l	Ni mg/l	Phenol ug/l	Fe mg/l
NPDES Limit**	0.14				0.030	4.00	0.193					
January	0.03	<0.06	0.10	<0.05	0.001	<0.84	0.035	<1.0	0.40	<0.09	5.4	0.15
February	0.03	<0.06	0.12	<0.05	0.001	<1.27	0.056	<1.0	0.25	0.11	11.0	0.17
March*	0.04	<0.06	0.13	<0.05	0.002	<0.20	0.040	<1.0	0.06	0.09	4.4	0.33
April*	0.04	<0.08	0.14	<0.05	0.004	<0.20	0.030	1.5	0.17	0.08	4.2	0.15
May*	0.04	<0.06	0.14	<0.05	0.003	<0.20	<0.048	<1.0	0.21	<0.07	6.2	0.27
June*	0.04	<0.06	0.12	<0.05	0.004	<0.20	0.120	<1.0	0.31	0.10	4.7	0.24
July*	0.03	<0.05	0.11	<0.05	0.002	<0.20	0.100	<1.0	0.01	0.08	5.9	0.14
August*	0.03	<0.05	0.11	<0.05	0.003	<0.20	0.120	<1.1	0.01	0.10	8.2	0.29
September*	0.03	<0.05	0.14	<0.05	0.003	<0.20	0.120	1.2	0.04	0.11	----	0.17
October*	0.02	<0.07	0.12	<0.05	0.002	<0.20	0.110	<1.6	0.05	<0.10	7.9	0.18
November*	0.01	<0.05	0.10	<0.05	0.001	<0.20	<0.020	<1.5	0.04	<0.08	16.0	0.24
December*	0.02	<0.05	0.08	<0.05	0.002	<0.20	<0.020	<1.0	0.02	0.11	6.8	0.13
1983 Avg.	0.03	<0.06	0.12	<0.05	0.002	<0.34	<0.068	<1.2	0.13	<0.09	7.3	0.21

*Average reported values are monthly medians for Copper, Cadmium, Mercury, and Cyanide. The remaining parameters are monthly arithmetic averages.
** Limits are median values.

ROSEMOUNT WASTEWATER TREATMENT PLANT

Plant History and Description

The Rosemount Plant was designed by Banister, Short, Elliot, Hendrickson, and Associates and constructed in 1973. The plant has a design capacity of 0.6 mgd.

Liquid treatment consists of physical-chemical processes, dual media filtration, activated carbon column absorption and chlorination. Plant effluent is discharged to the Spring Lake area of the Mississippi River.

Solids processing facilities consist of sludge storage and sludge hauling to the Metropolitan Plant Interceptor System. The plant is presently operating at about 55 percent of capacity and subject to secondary treatment limits, and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 0.34 mgd in 1983, nearly equal to 0.31 mgd in 1982. Average plant effluent quality was 16 mg/L BOD, 2 mg/L TSS and 0.2 mg/L P. Plant performance was good throughout the year with three NPDES Permit violations; one daily pH, one weekly BOD, and one monthly BOD. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	11	12	15	13	14	15	18	18	20	19	24	29
TSS	2	1	1	1	3	2	2	2	3	3	4	4

*1982 and 1983 values represent CBOD.

Future

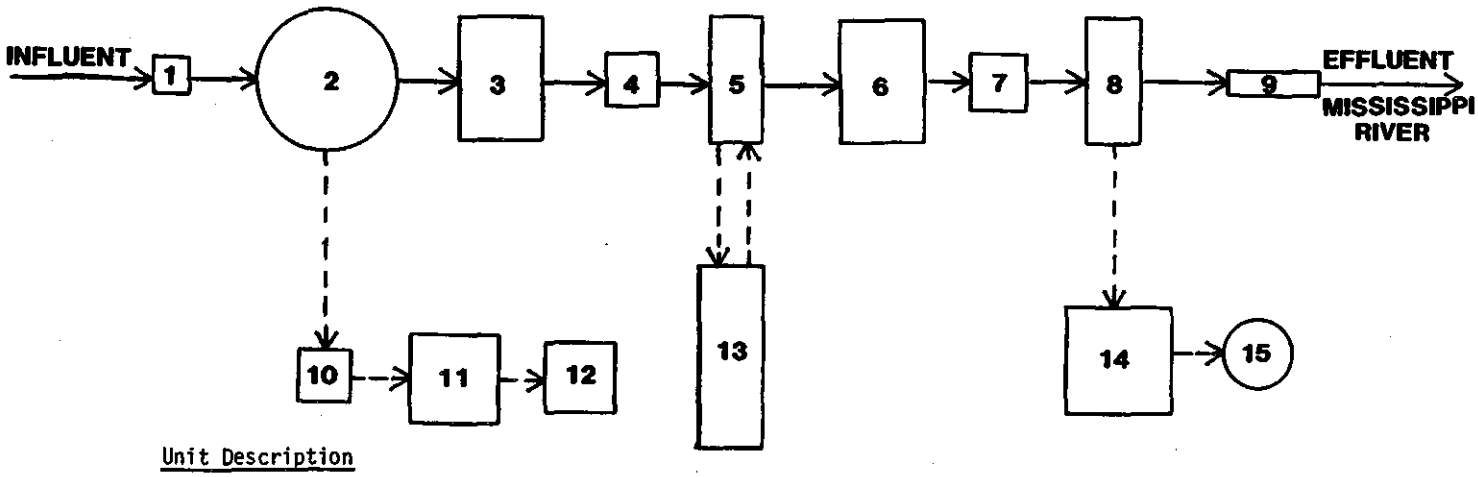
The plant was designed as a demonstration project and uses equipment intensive unit processes. As a result, the plant's useful life could be expected to be on the order of 10 to 15 years. For this reason, the plant is nearing the end of its useful life. The 201 Facility Plan recommended replacement of the physical-chemical facility with a biological treatment plant sometime during the 1980's. It is expected that a replacement plant will be constructed in the late 1980's.

ROSEMOUNT PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	0.31	0.34	0.40	0.38
BOD Loading, lb/day	440	460	490	520
TSS Loading, lb/day	620	680	700	1,300
Phosphorus Loading, lb/day	19	21	21	29
COD Loading, lb/day	1,100	1,200	1,200	1,400
Solids Contact Clarifier (One in Use)				
Surface Loading Rate, gpd/sq. ft.	700	700	900	770
TSS Removal, %	89	---	92	---
Phosphorus Removal, %	93	96	95	98
COD Removal, %	77	---	80	---
Dual Media Filters (Four in Use)				
Surface Loading Rate, gpm/sq. ft.	1.1	1.1	1.4	1.3
TSS Removal, %	59	---	80	---
Activated Carbon Columns (One Train)				
Surface Loading Rate, gpd/sq. ft.	4.3	4.7	5.6	5.2
COD Loading Rate, lb/day	190	220	290	280
COD Removal, %	28	---	60	---
TSS Removal, %	82	---	85	---
Sludge Production				
Volume, gpd	4,000	5,000	4,800	6,300
Quantity, lb/day	3,400	4,000	4,000	4,600
Concentration, % TS	10	-----	12	-----

ROSEMOUNT WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

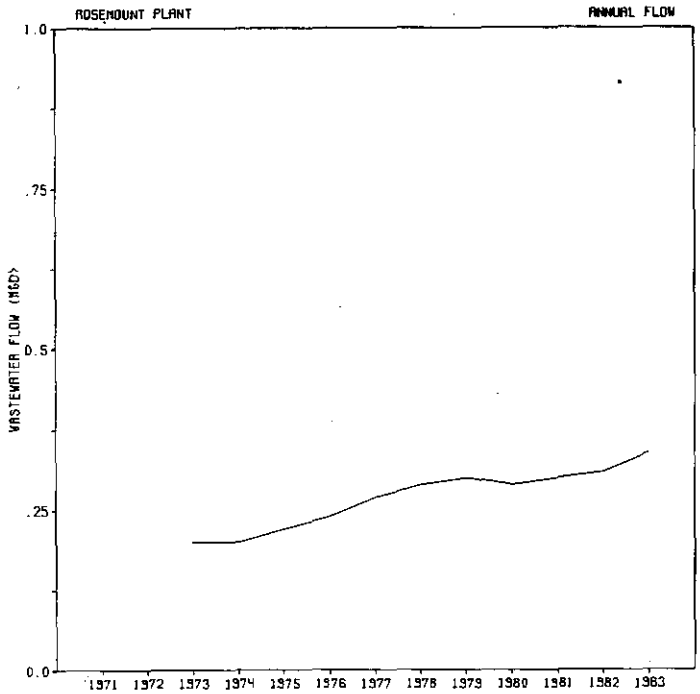
1. Screening
2. Solids Contact Clarifier
3. Dual Media Filters
4. Filtered Water Storage
5. Granular Carbon Columns
6. Dual Media Filters
7. Filtered Water Storage
8. Ion Exchange Columns
9. Chlorination

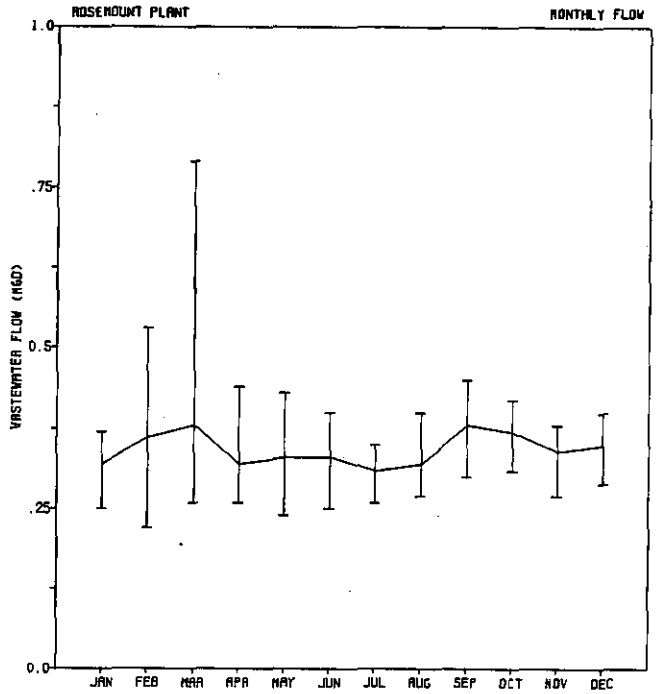
Solid Phase

10. Sludge Holding Tank
11. Sludge Dewatering
12. Land Spread
13. Carbon Regeneration System
14. Ion Exchange Regeneration System
15. Ammonia Recovery

Legend

——— Liquid Flow
– – – – Solids Transfer
▭ Existing Process Units
▭ Future Process Units





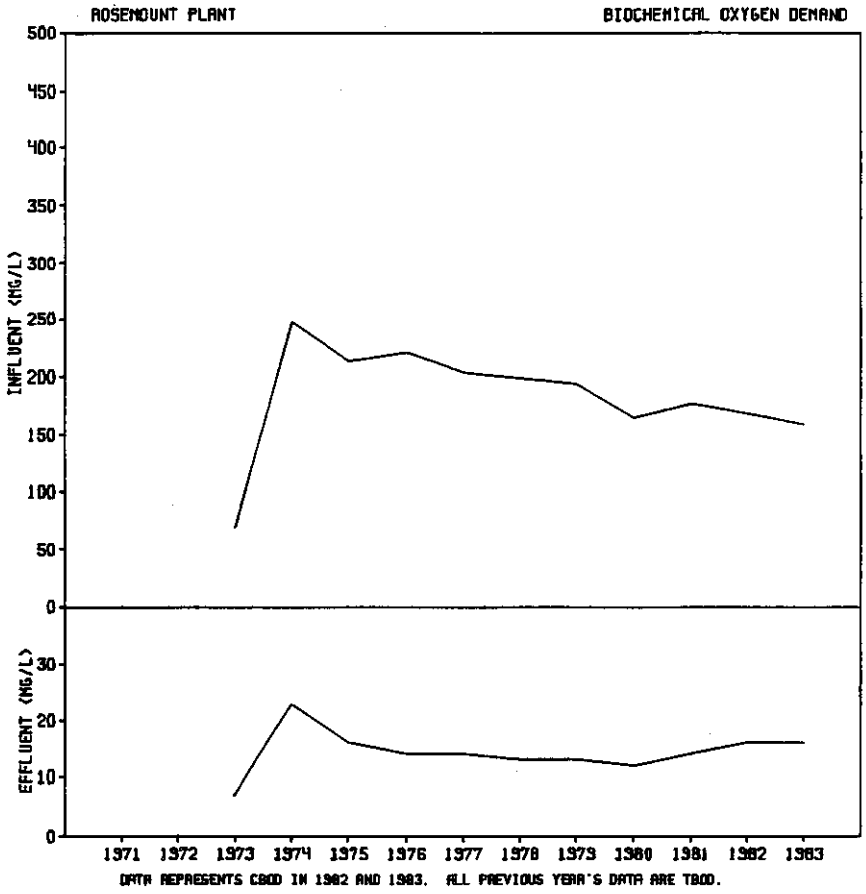
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Rosemount

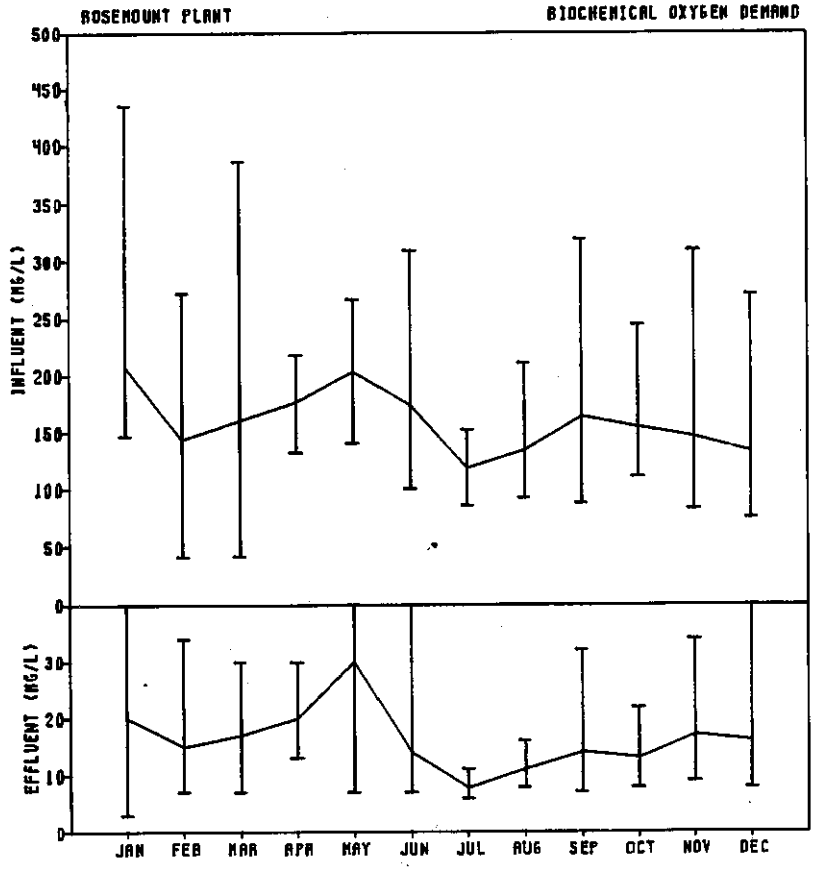
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.32	12	207	254	6.7-10.0	68.7	10.0	28.9	459
FEBRUARY	0.36	11	144	177	6.5-7.7	----	9.8	27.3	367
MARCH	0.38	10	161	414	6.6-8.4	37.5	6.7	24.3	461
APRIL	0.32	11	176	246	6.8-7.6	45.4	6.9	31.0	456
MAY	0.33	12	203	238	6.2-10.4	46.6	7.2	27.7	455
JUNE	0.33	13	173	236	6.8-7.7	41.9	6.9	24.4	406
JULY	0.31	16	118	223	6.9-7.5	37.8	5.4	24.6	427
AUGUST	0.32	17	134	220	6.9-7.5	39.4	6.3	23.3	394
SEPTEMBER	0.38	18	164	230	6.8-11.3	37.6	7.0	24.3	403
OCTOBER	0.37	17	154	245	7.0-7.7	40.1	7.4	26.3	379
NOVEMBER	0.34	16	146	187	7.0-7.6	46.4	7.0	23.6	370
DECEMBER	0.35	14	133	148	6.7-7.5	43.9	6.0	26.4	376
1983 AVERAGE	0.34	14	159	236	6.2-11.3	44.4	7.2	26.1	413
1982 AVERAGE	0.31	14	168	239	6.0-11.0	49.0	7.4	27.1	421

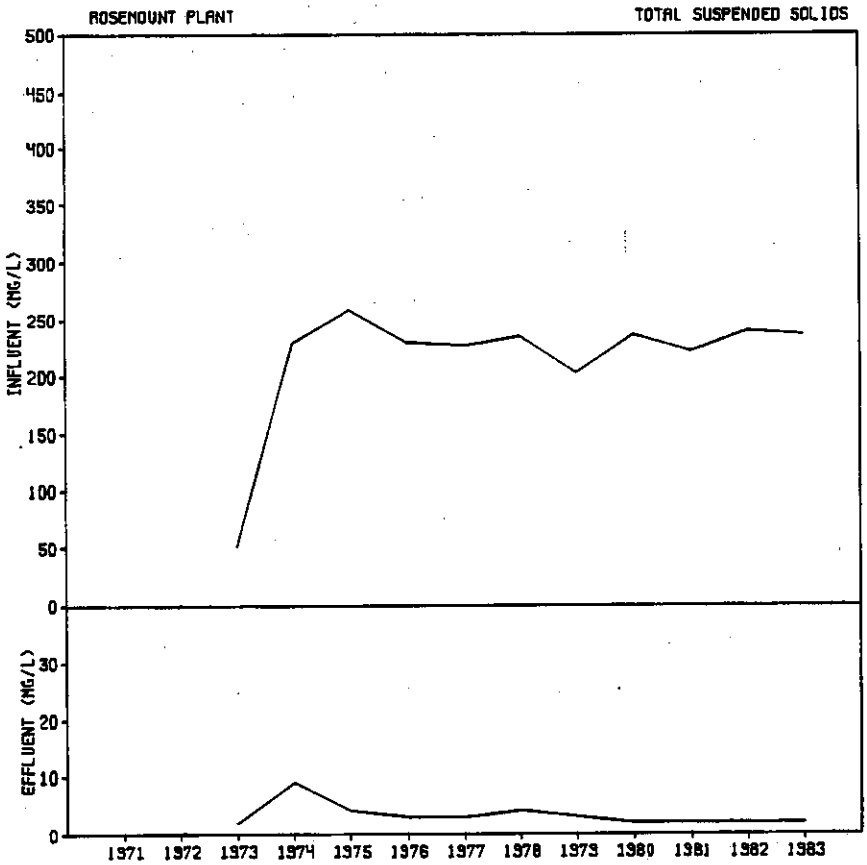
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Rosemount

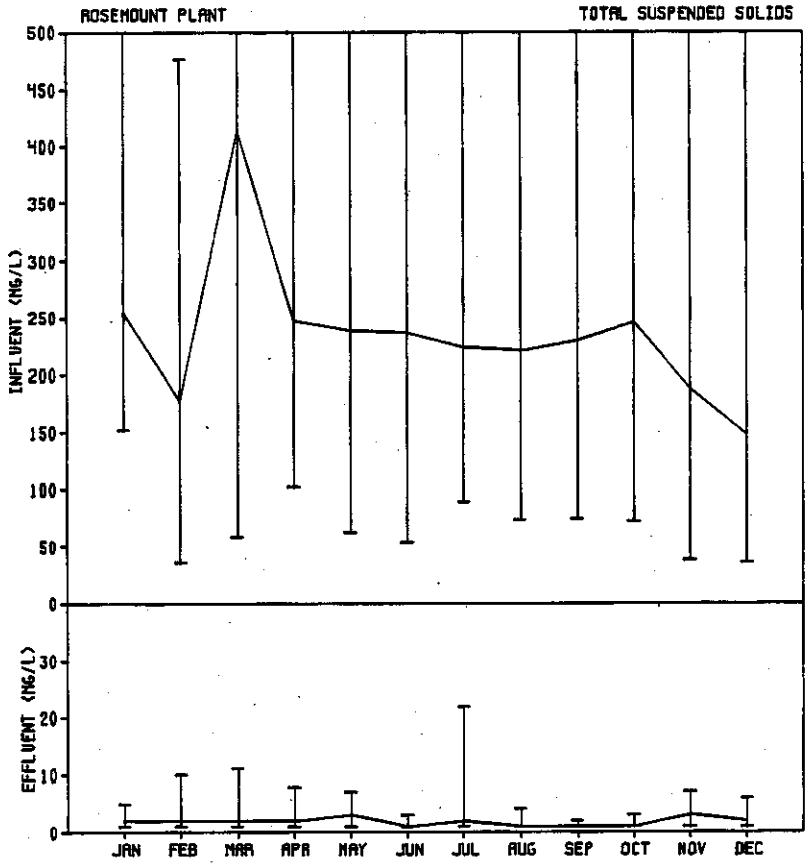
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	1.0	--	---	---	6.5-8.5	--	--
JANUARY	23	20	43	2	---	4	45.4	32.1	0.56	1.51	0.2	--	---	6.1	6.2-7.5	90	99
FEBRUARY	17	15	51	2	---	4	----	27.9	1.44	1.46	0.3	33	1.1	6.1	6.6-7.4	90	99
MARCH	19	17	52	2	2	3	33.0	28.5	0.63	3.37	0.2	35	1.6	5.8	6.5-7.8	89	99
APRIL	21	20	59	2	2	3	35.1	32.0	0.81	2.14	0.2	36	1.9	5.8	6.5-8.0	89	99
MAY	29	30	60	3	2	4	34.6	29.2	0.31	3.64	0.2	26	1.6	7.4	6.5-7.7	85	99
JUNE	14	14	34	1	5	3	30.8	27.4	0.79	0.89	0.2	24	2.0	7.9	6.5-8.2	92	99
JULY	9	8	37	2	2	2	28.8	24.6	0.66	1.61	0.1	15	1.7	8.0	6.7-8.0	93	99
AUGUST	12	11	41	1	7	2	29.0	24.6	0.59	3.14	0.2	24	1.4	8.0	6.9-8.1	92	99
SEPTEMBER	15	14	53	1	2	3	28.3	26.1	0.63	2.14	0.2	37	1.6	7.8	6.6-8.1	91	99
OCTOBER	15	13	52	1	11	3	32.9	28.4	0.32	0.80	0.3	40	1.8	7.7	7.0-8.4	92	99
NOVEMBER	18	17	68	3	---	2	36.4	27.3	0.19	0.31	0.2	20	---	8.0	7.1-8.2	89	99
DECEMBER	17	16	64	2	---	3	34.3	28.7	0.44	0.43	0.2	--	---	8.1	6.8-8.3	88	98
1983 AVG.	17	16	51	2	4	3	33.5	28.0	0.60	1.85	0.2	30	1.7	7.2	6.2-8.4	90	99
1982 AVG.	18	16	43	2	2	5	35.6	29.0	0.53	2.06	0.3	39	1.6	6.2	6.3-8.2	90	99

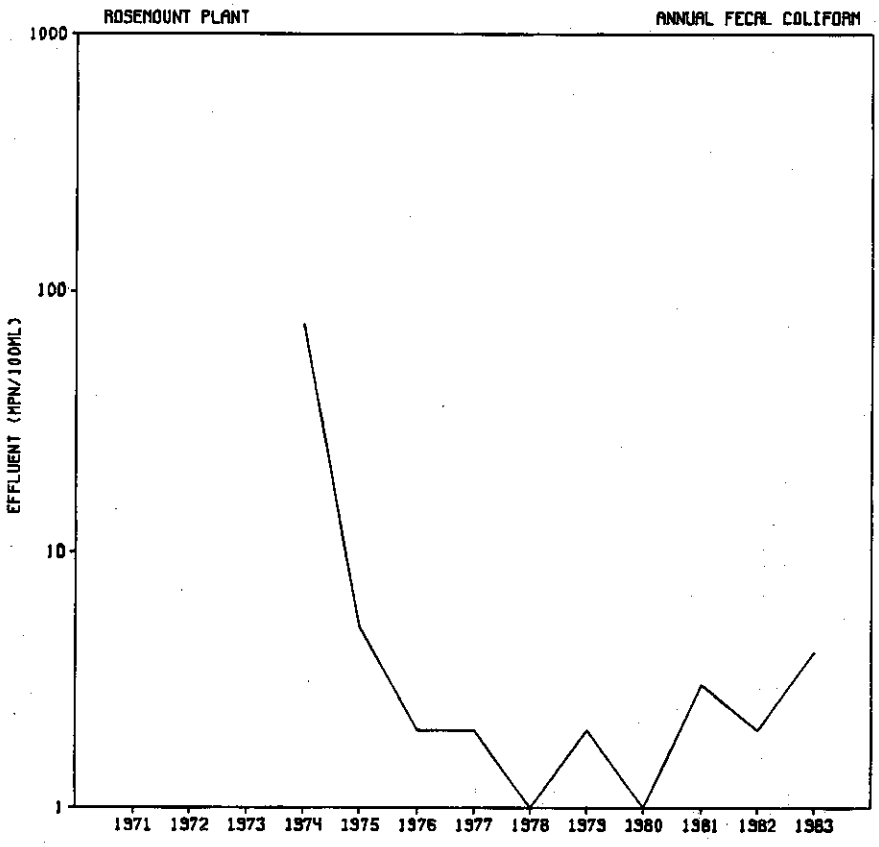
*For disinfection only.

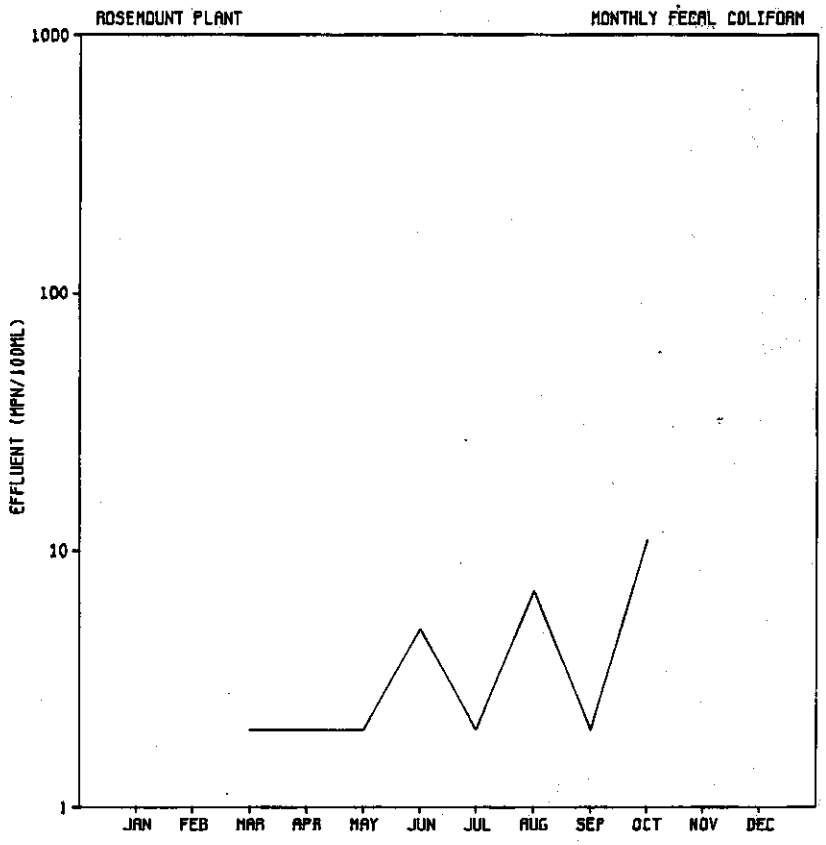

ROSEMOUNT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

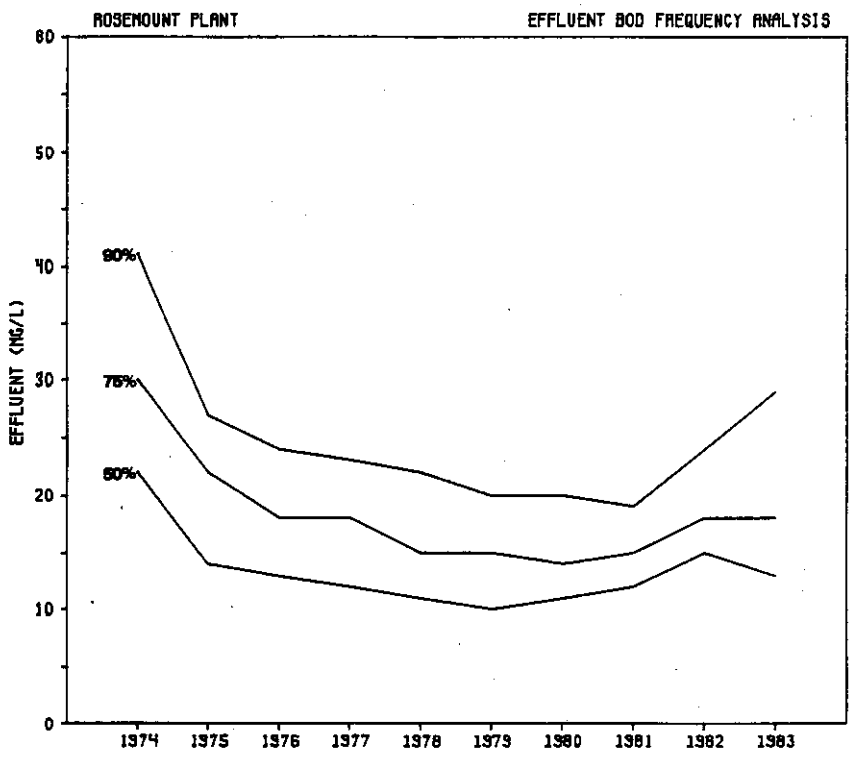

ROSEMOUNT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

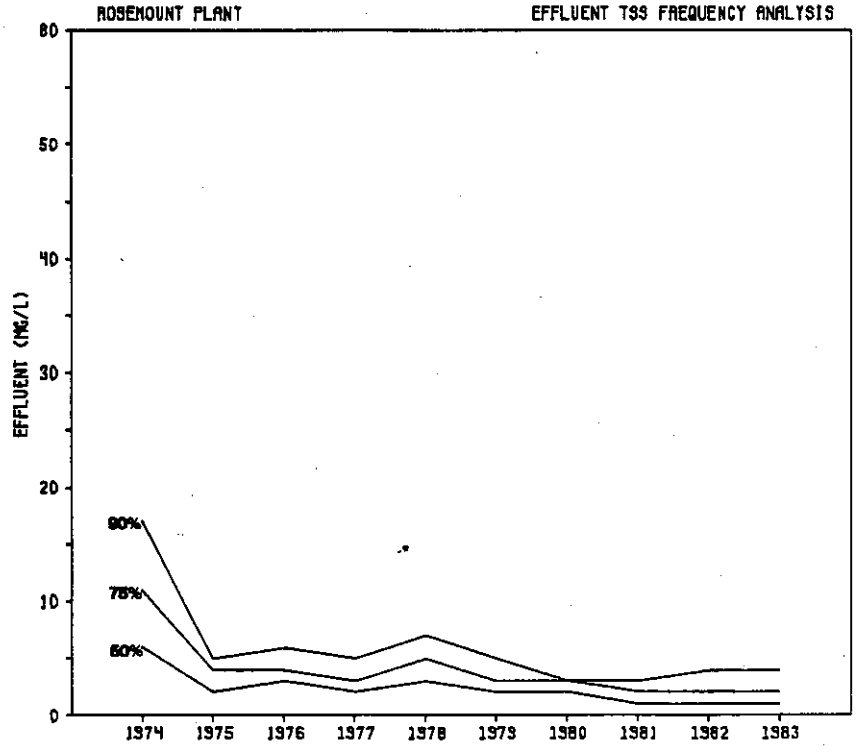

ROSEMOUNT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


ROSEMOUNT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ROSEMOUNT PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


ROSEMOUNT PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


ROSEMOUNT PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
80
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


ROSEMOUNT PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
80
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

SAVAGE WASTEWATER TREATMENT PLANT

Plant History and Description

The original Savage Treatment Plant was designed by Ellison-Philstrom, Inc. and constructed in 1963 with a capacity of 0.36 mgd. Interim improvements to the plant were designed by RCM and construction was completed in 1979. These plant modifications included the addition of a new synthetic media trickling filter, a new chlorine contact tank and a new sludge holding/decant tank. The current plant design capacity is 0.86 mgd. The plant serves the community of Savage in Service Area No. 4.

Liquid treatment consists of screening, influent pumping, primary clarification , a roughing filter, a synthetic media high-rate trickling filter, final clarification, chlorination and discharge to the Minnesota River.

Solids processing consists of a sludge holding and decant tank, anaerobic digestion, and sludge hauling to another plant for further treatment or sludge landspreading. The plant is presently operating at about 70 percent of its design capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 0.59 mgd during 1983, higher than 0.48 mgd in 1982. Average plant effluent quality was 8 mg/L BOD and 3 mg/L TSS. Plant performance was excellent throughout the year with no NPDES Permit violations. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	5	9	6	7	7	12	9	9	9	15	20	10
TSS	4	5	2	2	7	12	5	3	15	17	11	4

*1982 and 1983 values represent CBOD.

Future

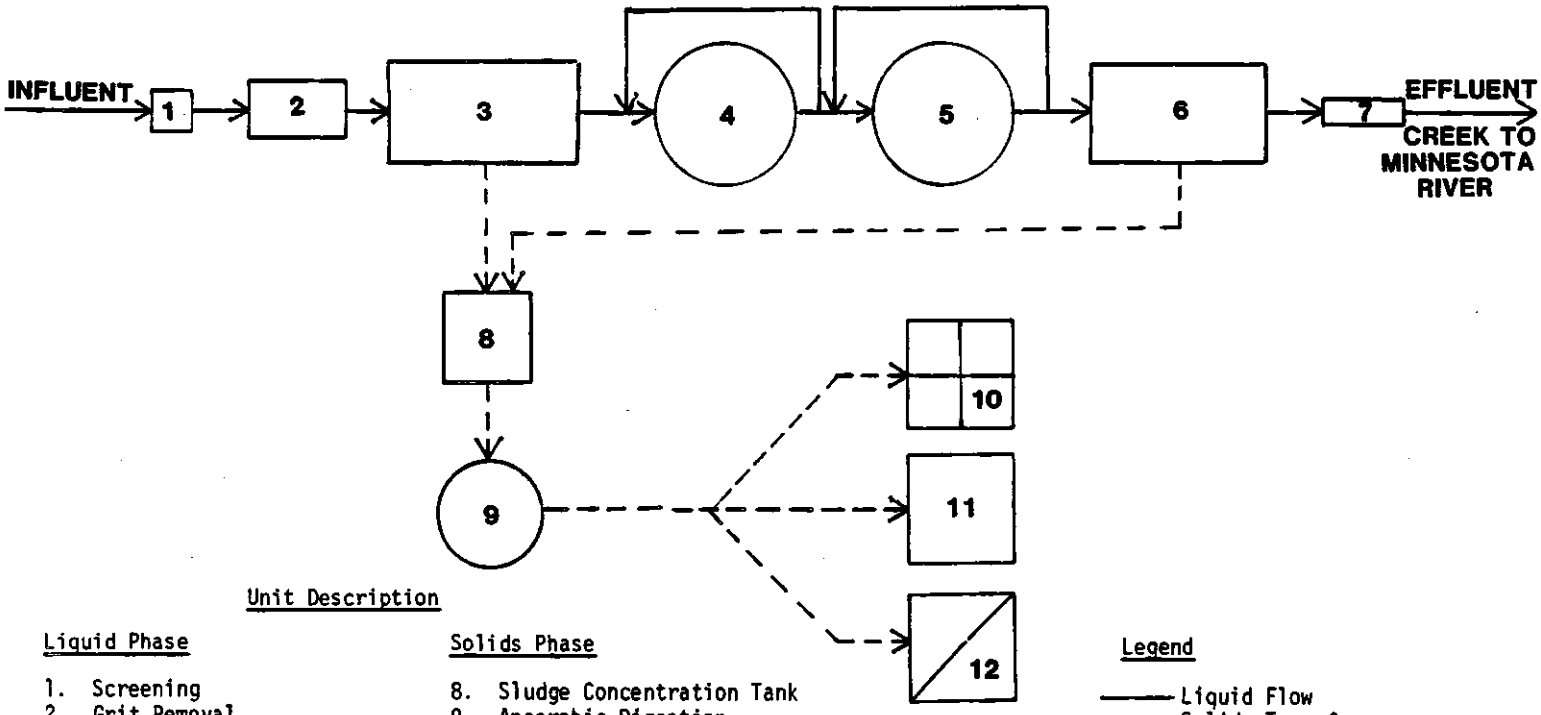
The long-term plan for the Savage Plant is to phase it out of service and divert the flow to the Seneca Plant. This is projected to occur in the late 1980's as the plant reaches its capacity.

SAVAGE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	0.48	0.59	0.62	0.87
BOD Loading, lb/day	610	590	910	690
TSS Loading, lb/day	700	960	1,010	2,100
COD Loading, lb/day	1,120	1,200	1,400	1,500
Sludge Production, lb/day	280	500	---	-----
Grit Removal				
Overflow Rate, gpd/sq. ft.	26,700	33,000	34,400	48,000
Primary Sedimentation				
Detention Time, hr.	1.5	1.2	1.2	0.8
Weir Overflow Rate, gpd/lin. ft.	6,960	8,600	8,990	13,000
Surface Overflow, gpd/sq. ft.	1,260	1,600	1,630	2,300
Trickling Filter No. 1				
Hydraulic Loading, gpd/sq. ft. (inc. recir.)	±400	±400	---	---
Organic Loading, lb. BOD_5/day/1000 cu. ft. (Assume 20% Primary BOD Removal)	±45	±45	---	---
Trickling Filter No. 2				
Hydrualic Loading, gpd/sq. ft. (inc. recir)	±3,000	±3,000	-----	-----
Organic Loading, lb. BOD_5/day/1000 cu. ft. (Assume 50% Filter No. 1 BOD Removal)	±10	±10	-----	-----
Final Sedimentation				
Detention Time, hr.	2.4	1.9	1.8	1.3
Weir Overflow Rate, gpd/lin. ft.	5,000	6,200	6,460	9,100
Surface Overflow Rate, gpd/sq. ft.	530	650	680	970
Chlorination				
Contact Time, minutes	73	59	56	40
Chlorine Use, lb/day	19	25	30	34
Sludge Holding Tank				
Detention Time, days	±11	±13	---	---
Anaerobic Digester				
Detention Time, days	±50	±57	---	---
Solids Loading, lb/cu. ft./day	±0.05	±0.04	---	---
Sludge Transport				
Volume, gpd	690	1,500	---	3,100

SAVAGE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

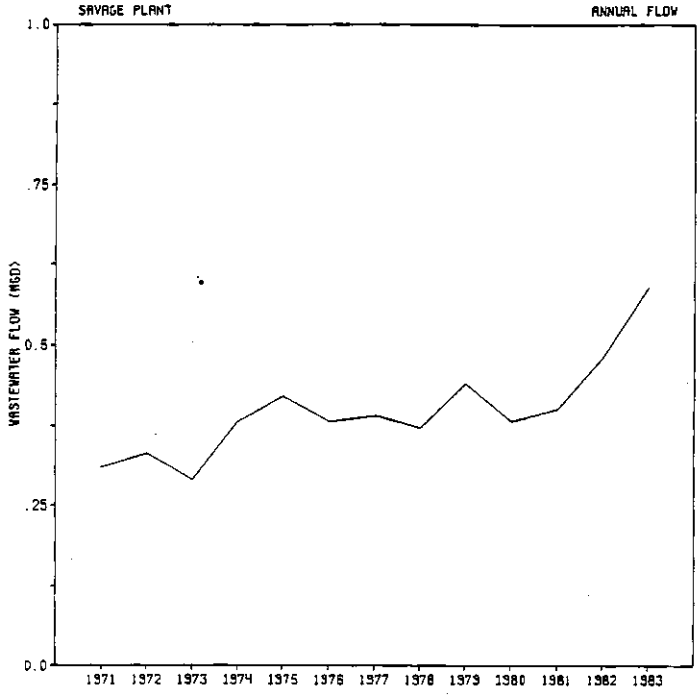
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Roughing Trickling Filter
5. Trickling Filter
6. Final Clarification
7. Chlorination

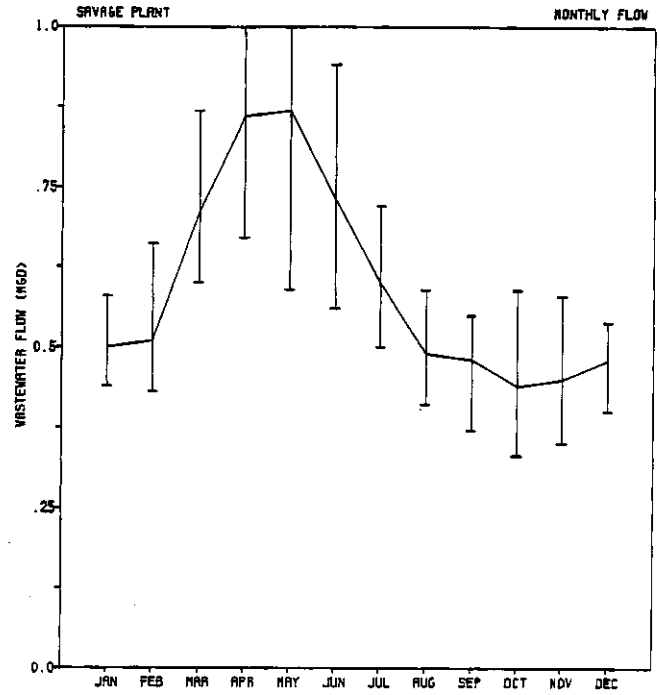
Solids Phase

8. Sludge Concentration Tank
9. Anaerobic Digestion
10. Drying Beds
11. Landspreading
12. Solids Disposal at Seneca Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





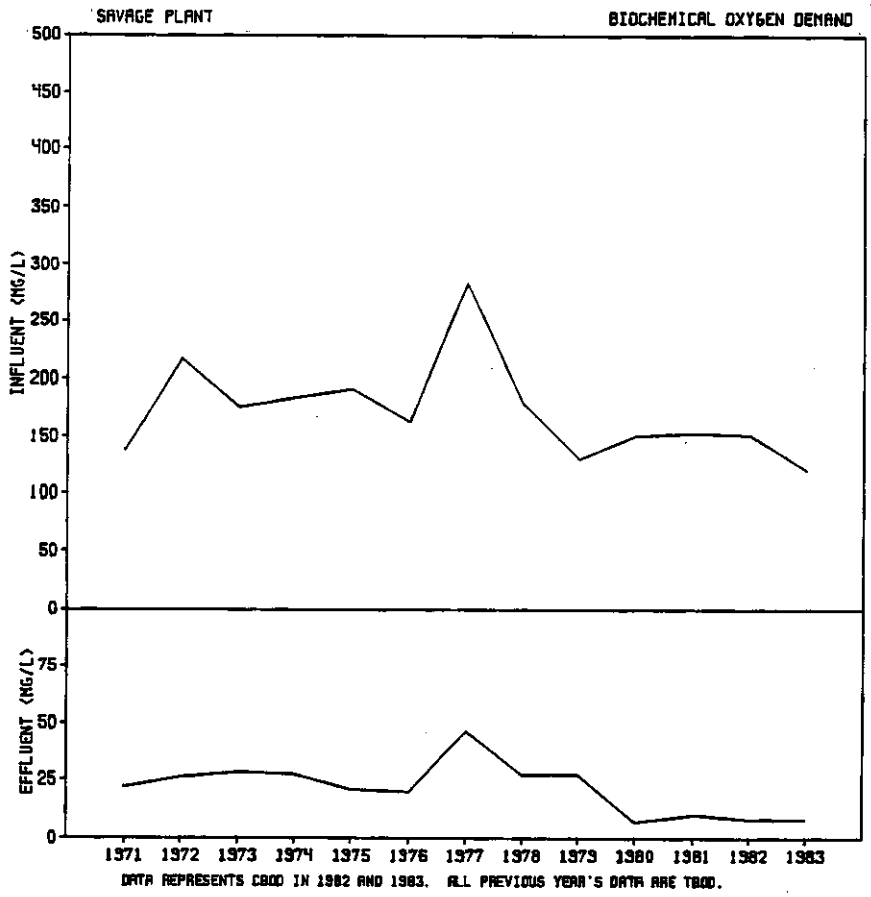
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Savage

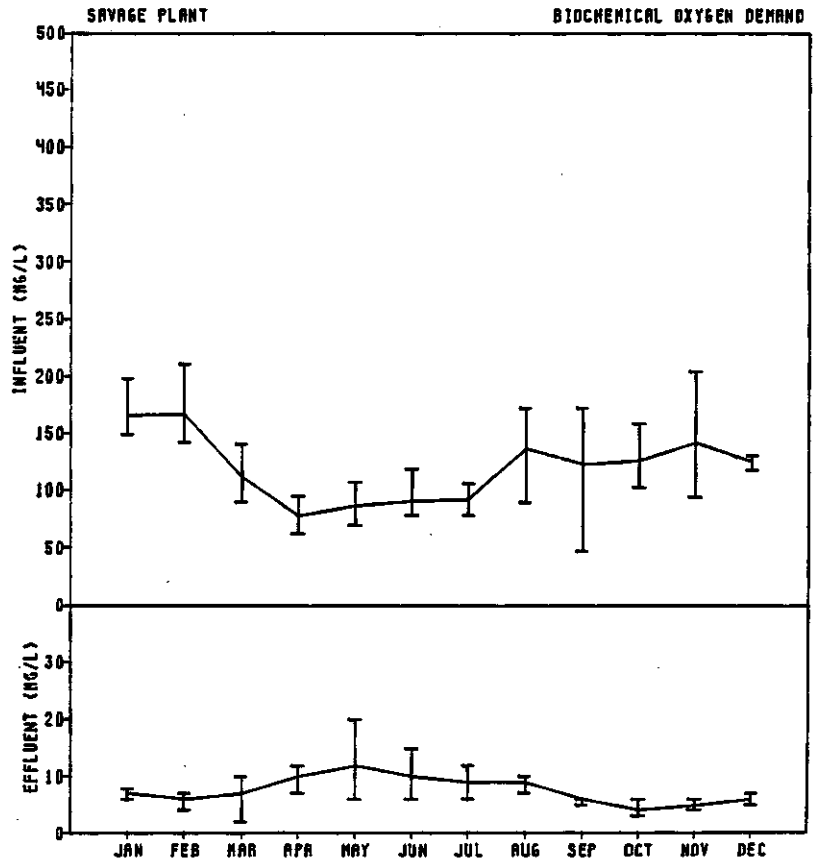
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.50	10	166	167	7.0-9.1	34.0	6.1	17.5	286
FEBRUARY	0.51	9	167	274	1.2-12.0	----	140.0	18.7	344
MARCH	0.71	8	111	179	4.6-10.4	20.3	3.8	11.2	255
APRIL	0.86	9	78	100	6.4-12.4	15.8	4.1	8.1	164
MAY	0.87	10	86	93	3.6-11.8	16.1	5.1	7.0	179
JUNE	0.73	14	91	219	6.6-12.0	17.5	6.4	8.7	235
JULY	0.60	16	92	121	3.0-10.6	18.1	4.9	11.1	193
AUGUST	0.49	19	136	168	1.6-10.1	25.3	9.6	14.3	281
SEPTEMBER	0.48	17	122	140	6.2-9.4	27.9	4.4	17.3	246
OCTOBER	0.44	16	126	221	5.9-9.2	33.9	5.8	20.0	275
NOVEMBER	0.45	15	142	184	1.5-9.8	29.0	5.6	14.6	321
DECEMBER	0.48	13	125	520	4.2-9.6	27.8	5.2	15.3	249
1983 AVERAGE	0.59	13	120	195	1.2-12.4	24.3	16.7	13.5	253
1982 AVERAGE	0.48	13	151	170	0.2-13.6	27.0	6.4	15.1	281

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Savage

Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	---	----	-----	---	--	---	----	6.5-8.5	--	--
JANUARY	9	7	26	1	---	2	4.1	1.6	0.31	6.15	3.8	--	---	9.2	7.4-7.8	96	99
FEBRUARY	8	6	28	1	---	3	---	1.8	0.25	7.50	14.1	19	1.8	9.2	7.4-7.8	96	99
MARCH	8	7	60	3	7	4	5.3	2.1	0.12	3.81	3.4	25	2.0	10.1	7.4-7.8	94	99
APRIL	9	10	42	2	14	3	6.0	1.9	0.18	3.27	3.0	34	2.0	10.2	7.4-7.7	88	98
MAY	12	12	51	2	12	4	7.0	2.4	0.20	2.16	3.1	34	2.0	9.4	7.5-7.8	86	97
JUNE	10	10	53	6	12	6	4.4	1.7	0.19	3.26	3.7	27	2.0	8.7	7.5-7.9	89	97
JULY	9	9	53	3	54	3	2.1	0.5	0.30	10.94	3.3	22	2.0	8.2	7.4-7.8	91	98
AUGUST	10	9	56	6	45	4	3.5	0.2	0.08	11.12	6.4	17	2.0	7.9	7.4-7.8	94	96
SEPTEMBER	6	6	40	1	14	2	1.8	0.5	0.07	9.91	3.0	20	2.0	7.9	7.3-7.8	95	99
OCTOBER	6	4	33	2	21	3	1.4	0.5	0.04	9.96	3.8	24	2.0	8.4	7.4-7.7	97	99
NOVEMBER	7	5	42	1	---	2	2.6	1.0	0.19	12.59	3.6	25	2.0	9.1	7.4-7.8	96	99
DECEMBER	8	6	37	2	---	2	2.8	2.4	0.19	12.93	3.4	--	--	9.2	7.4-7.8	95	99
1983 AVG.	8	8	44	3	22	3	3.7	1.4	0.17	7.77	4.6	25	2.0	8.9	7.3-7.9	93	98
1982 AVG.	9	8	44	4	34	5	4.1	1.5	0.19	8.67	3.8	19	2.0	9.0	7.4-7.9	94	97

*For disinfection only.


SAVAGE PLANT
BIOCHEMICAL OXY&EN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.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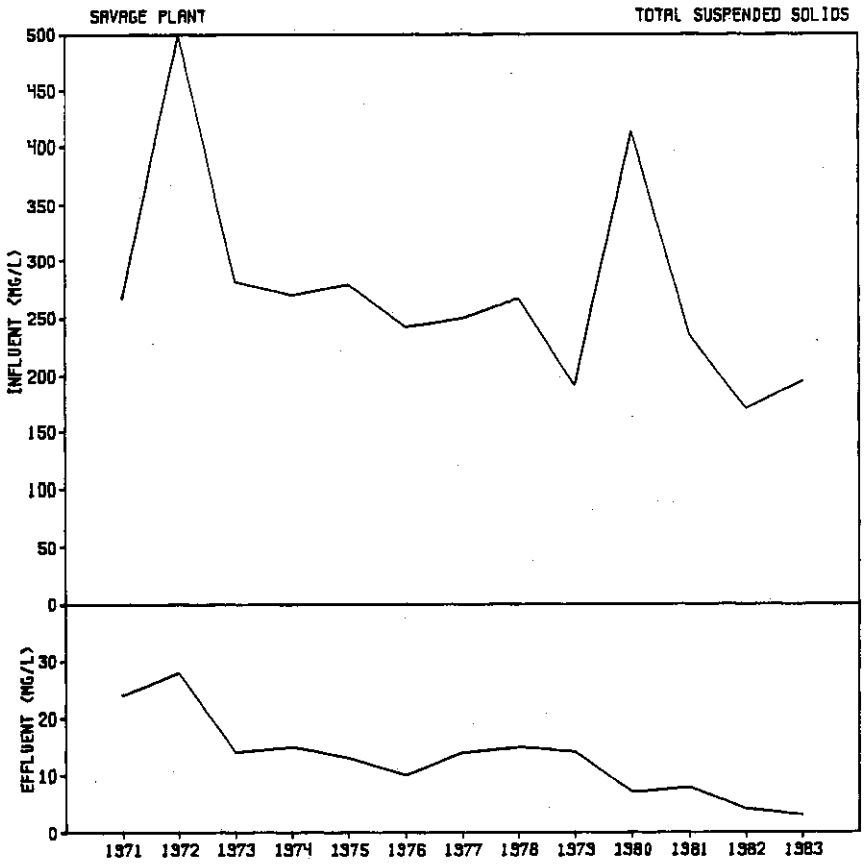
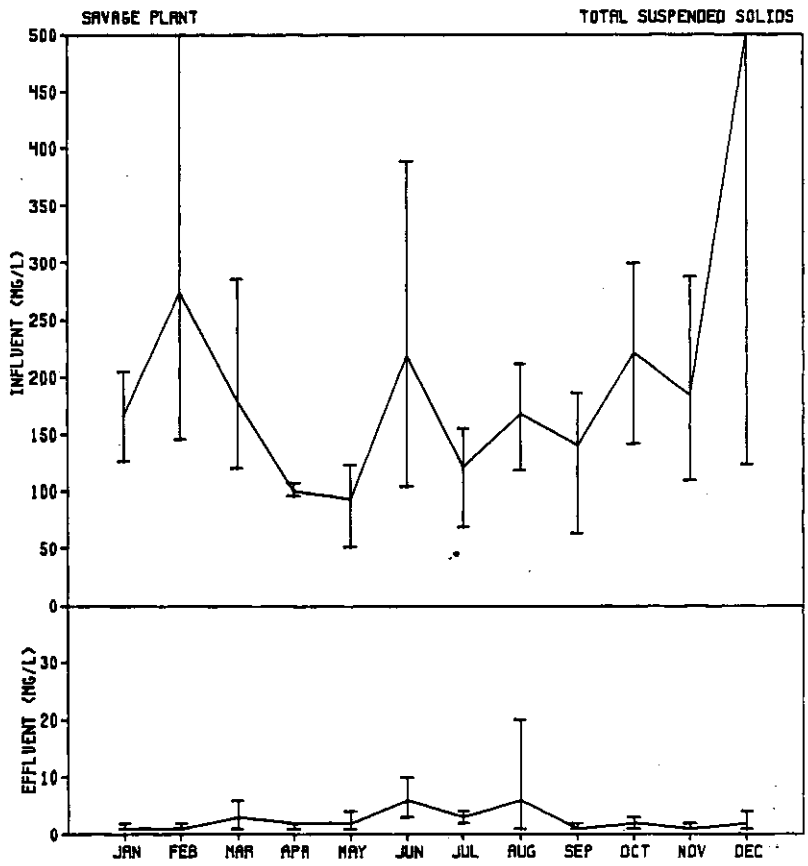
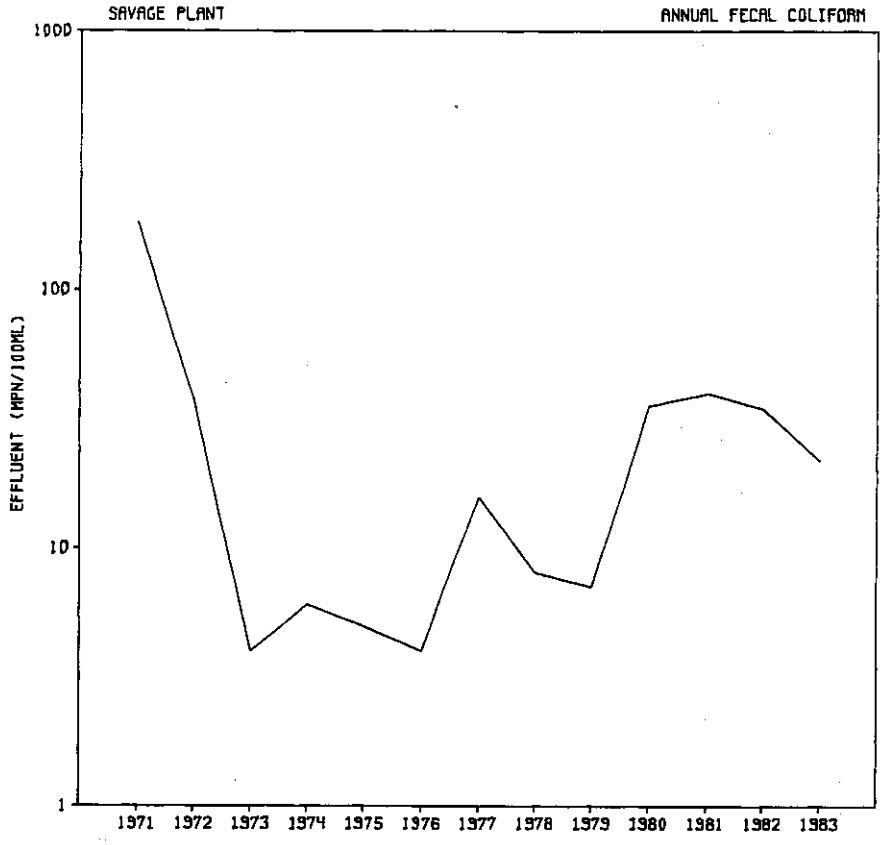
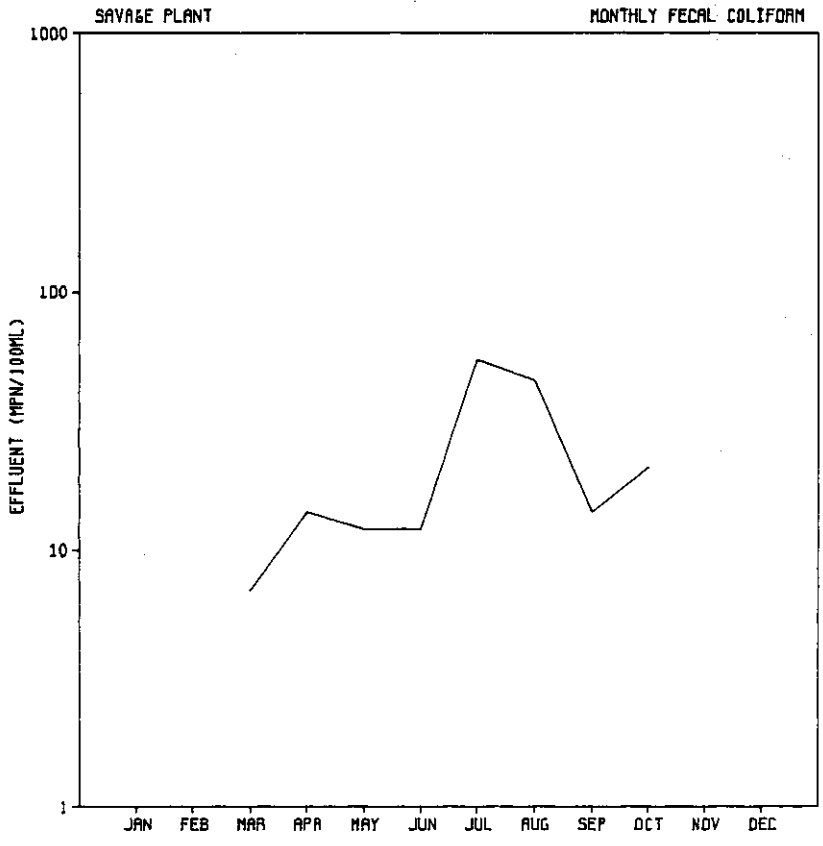
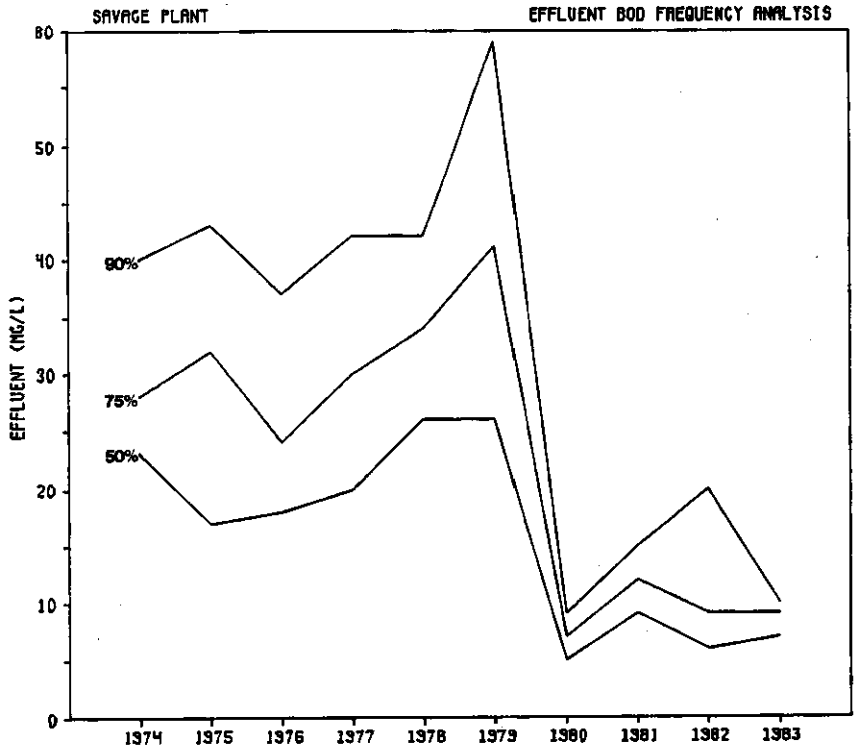
BIOCHEMICAL OXY&EN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

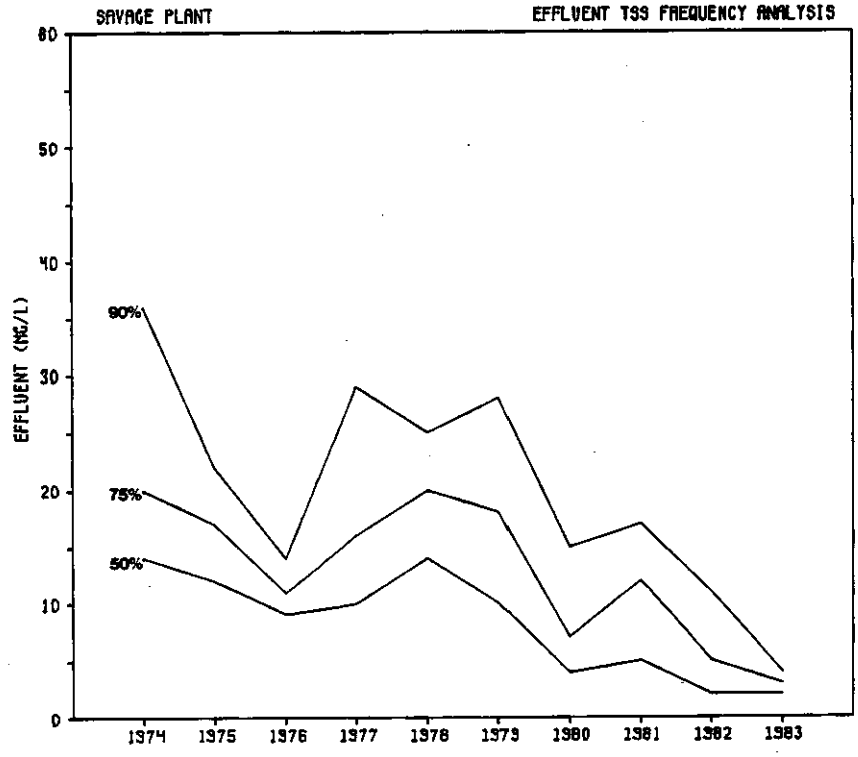

SAVAGE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


SAVAGE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


SAVAGE PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


SAVAGE PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


SAVAGE PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


SAVAGE PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

SENECA WASTEWATER TREATMENT PLANT

Plant History and Description

The Seneca Plant was designed by Black and Veatch Consulting Engineers, and was placed into operation in 1972, with a design capacity of 24 mgd.

Liquid treatment consists of screening, grit removal, primary sedimentation, complete mix activated sludge aeration, final clarification, chlorination, and discharge to the Minnesota River.

Solids processing consists of waste activated sludge air floatation thickening, combined sludge storage, chemical conditioning, vacuum filtration or belt filter press dewatering, and incineration. A polymer conditioning system and belt filter press dewatering system has been added and began operation in mid-1983. The plant is presently operating at about 70 percent of its design capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 15.8 mgd during 1983, considerably higher than 14.7 mgd in 1982. Average plant effluent quality was 14 mg/L BOD and 18 mg/L TSS. Plant performance was good throughout the year with one NPDES Permit violation of the effluent weekly fecal coliform limit. This violation was caused by incorrect valve adjustments on the chlorine solution line valves. Statistical analysis of data show the following trend in effluent BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	14	19	17	13	20	22	21	17	25	30	25	24
TSS	15	19	19	15	19	23	23	23	23	28	26	29

*1982 and 1983 values represent CBOD.

Future

The Seneca Plant is one of the Commission's permanent regional plants. Space is available for future plant expansion and advanced treatment as needed. Additional sludge processing improvements are planned, particularly thickening and dewatering.

SENECA PLANT PROCESS UNIT LOADINGS

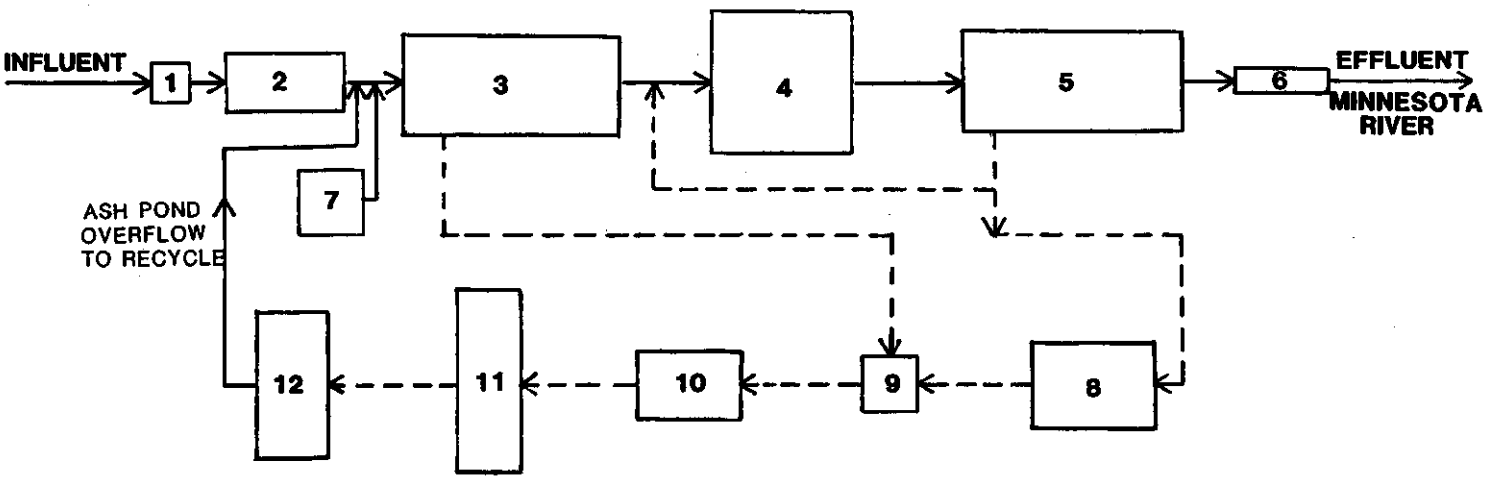
Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	14.8	15.8	15.9	17.2
BOD Loading, lb/day	27,200	29,000	32,500	32,400
TSS Loading, lb/day	25,000	27,500	34,600	40,000
Grit Chambers				
Detention Time, minutes	25	23	23	22
Primary Clarifiers				
Surface Overflow Rate, gpd/sq. ft.	320	340	340	370
Weir Overflow Rate, gpd/lin. ft.	6,700	7,200	7,200	7,800
Detention Time, hr.	6.8	6.4	6.3	5.9
Removal Efficiency, % BOD	28	37	39	46
Removal Efficiency, % TSS	72	71	74	83
Aeration Tanks (Two)				
BOD Loading, lb/day/1000 cu. ft.	92	94	102	112
F:M Ratio, lb/day/lb. MLSS	0.58	0.59	0.69	0.76
Detention Time, hr.	2.4	2.2	2.2	2.1
Final Clarifiers (Two)				
Surface Overflow Rate, gpd/sq. ft.	600	640	650	700
Weir Overflow Rate, gpd/lin. ft.	9,900	10,600	10,600	11,500
Detention Time, hr.	4.5	4.2	4.2	3.8
Chlorination				
Chlorine Dose, mg/L	4.3	4.3	5.0	5.0
Chlorine Feed Rate, lb/day	520	550	610	650
Contact Time, minutes	36	34	34	31
Flotation Thickeners				
Solids Loading, lb./sq. ft./day	12	12	15	15
Vacuum Filters*				
Lime Dose, %	30	30	40	40
Ferric Chloride Dose, %	8	8	10	10
Filtration Rate, lb./sq. ft./day	3.2	3.2	3.5	3.5
Cake Solids, %	23.5	22	24.7	23

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Belt Filter Press				
Dry Polymer Dosage, lbs/tds	----	8.5	----	10
Throughput of Dry Solids, lb/hr.	----	1,700	----	2,000
Cake Solids, %	----	24	----	26
Incinerators*				
Wet Sludge Loading Rate, lbs./sq. ft./hr.	4.0	4.0	4.3	4.3
Dry Solids Loading, lb/hr.	1,700	1,700	1,800	1,800
Auxiliary Fuel Use, MMBtu/tds	10	10	14	14

*Solids processed includes sludge from Blue Lake Plant.

SENECA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

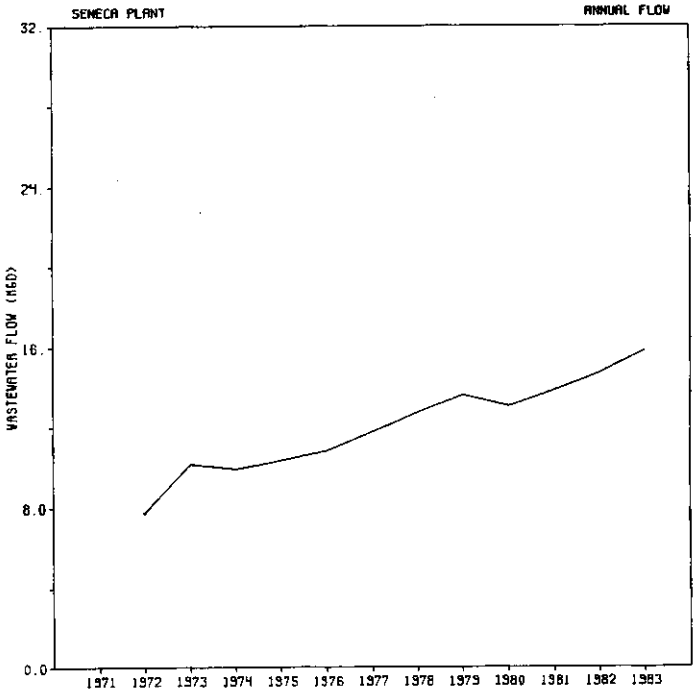
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination
7. Chemical Addition and/or Pre-Chlorination

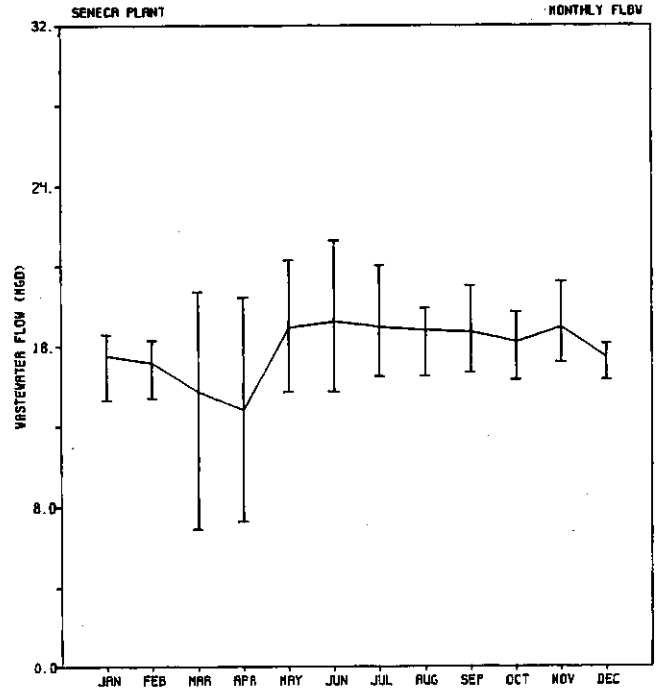
Solid Phase

8. Flotation Thickener
9. Holding Tank
10. Vacuum Filtration
11. Incineration
12. Ash Pond

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





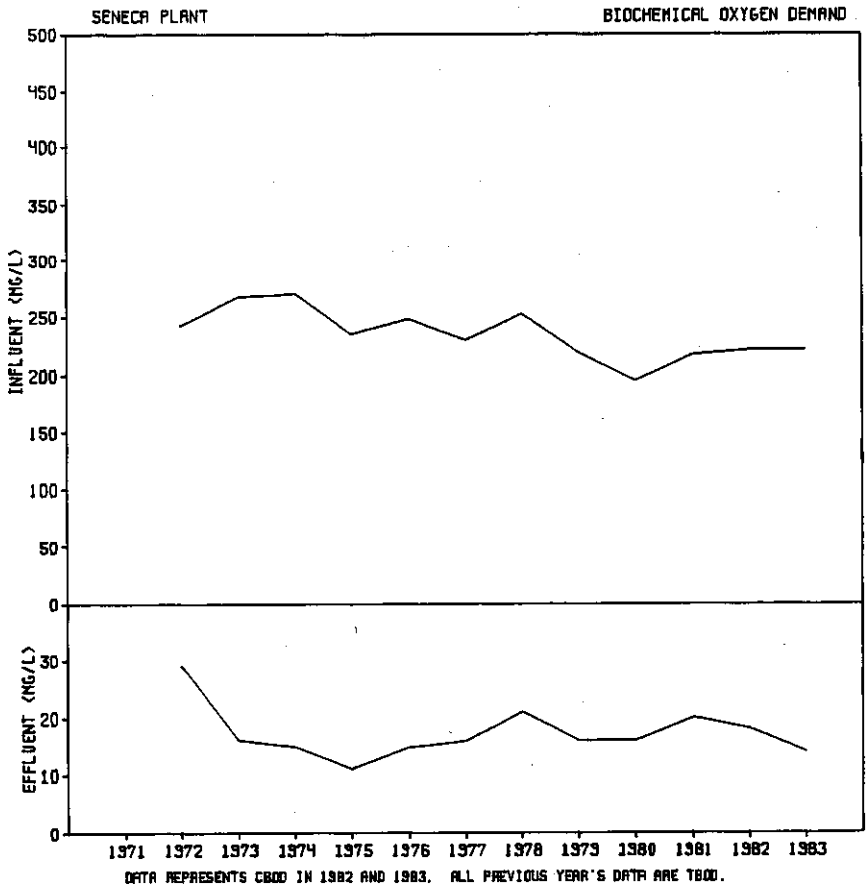
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Seneca

Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	15.5	13	244	185	6.8-8.7	43.0	10.6	22.6	516
FEBRUARY	15.2	13	225	168	6.7-7.8	----	11.9	21.8	460
MARCH	13.7	12	198	150	6.9-8.0	27.3	5.6	20.2	482
APRIL	12.8	12	213	180	6.8-8.2	32.3	6.3	15.3	456
MAY	16.9	14	214	195	6.7-7.8	32.9	6.8	18.8	426
JUNE	17.2	16	180	177	6.6-7.6	31.6	6.4	19.4	414
JULY	16.9	19	214	184	6.4-7.8	32.5	6.7	17.8	439
AUGUST	16.8	20	234	211	6.2-7.8	31.6	6.3	17.1	451
SEPTEMBER	16.7	20	233	223	6.4-7.6	32.4	7.4	18.0	512
OCTOBER	16.2	19	228	256	6.3-7.2	38.8	8.0	23.1	473
NOVEMBER	16.9	18	230	284	6.4-7.4	39.8	8.2	17.7	509
DECEMBER	15.4	16	242	261	6.4-7.4	37.9	7.5	18.7	494
1983 AVERAGE	15.8	16	221	211	6.2-8.7	34.9	7.7	19.1	469
1982 AVERAGE	14.7	16	221	203	6.3-8.5	39.4	7.8	21.3	445

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Seneca

Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	---	---	---	---	6.5-8.5	--	--
JANUARY	23	18	83	24	---	8	28.3	19.9	0.07	0.47	3.9	---	---	9.3	7.0-7.3	93	87
FEBRUARY	20	17	84	22	---	5	----	20.1	0.06	0.52	5.1	508	0.4	9.4	7.0-7.8	93	87
MARCH	25	18	95	22	1	10	20.4	17.8	0.47	0.37	2.5	457	0.8	10.0	7.0-7.7	91	85
APRIL	13	10	62	11	2	4	18.0	14.5	0.54	0.41	2.2	384	0.8	10.3	7.1-7.7	95	94
MAY	23	21	86	22	6	8	21.9	15.4	0.51	0.41	3.0	556	0.8	9.3	7.0-7.5	90	89
JUNE	16	10	58	10	3	6	17.2	14.4	1.24	1.17	3.4	526	0.6	9.2	6.9-7.6	94	94
JULY	18	11	62	8	9	5	16.5	12.8	0.88	1.61	3.4	578	0.6	8.9	7.0-7.5	95	96
AUGUST	18	12	66	14	7	6	18.5	12.6	0.76	0.80	3.8	606	0.4	8.8	7.1-7.4	95	93
SEPTEMBER	20	11	63	12	92	6	18.5	14.4	0.85	0.63	4.2	560	0.7	9.2	7.0-7.4	95	95
OCTOBER	17	10	64	13	88	6	22.8	19.0	0.42	0.70	3.7	561	0.7	8.4	6.7-7.4	96	95
NOVEMBER	37	15	66	24	---	8	23.6	15.4	0.77	1.01	4.8	---	---	8.6	6.9-7.4	94	91
DECEMBER	27	18	79	30	---	8	20.5	15.2	0.14	0.57	3.7	---	---	8.0	6.8-7.4	93	89
1983 AVG.	22	14	72	18	26	7	20.6	15.9	0.57	0.73	3.7	528	0.7	9.1	6.7-7.8	94	91
1982 AVG.	24	18	81	19	7	8	25.7	18.9	0.63	0.20	3.4	518	0.7	8.0	6.4-7.7	92	90

*For disinfection only.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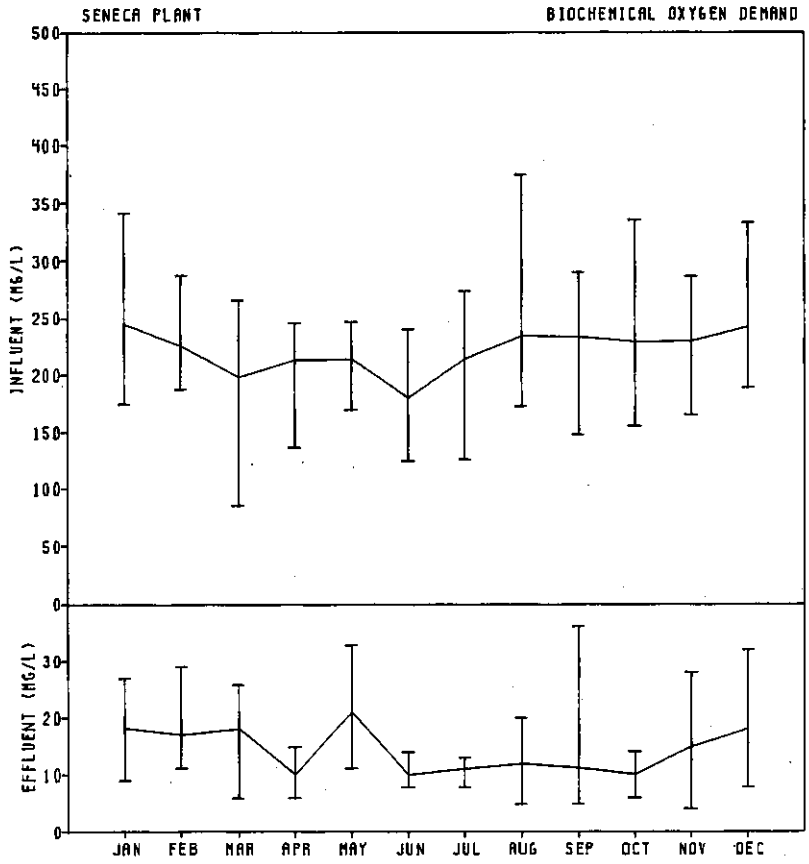
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.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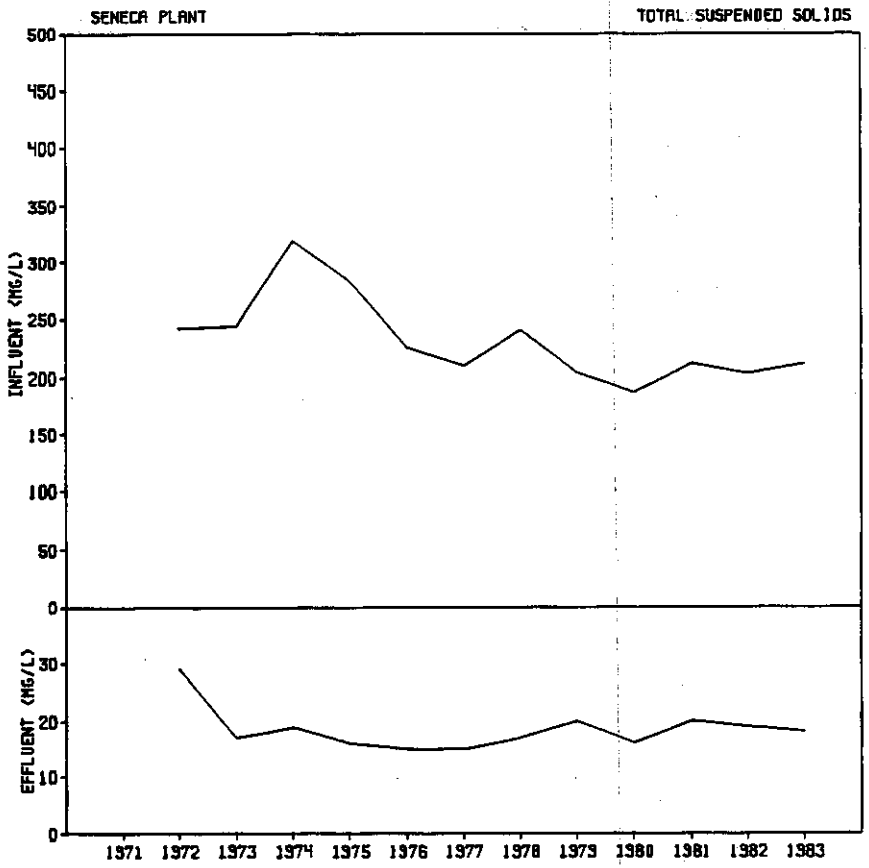
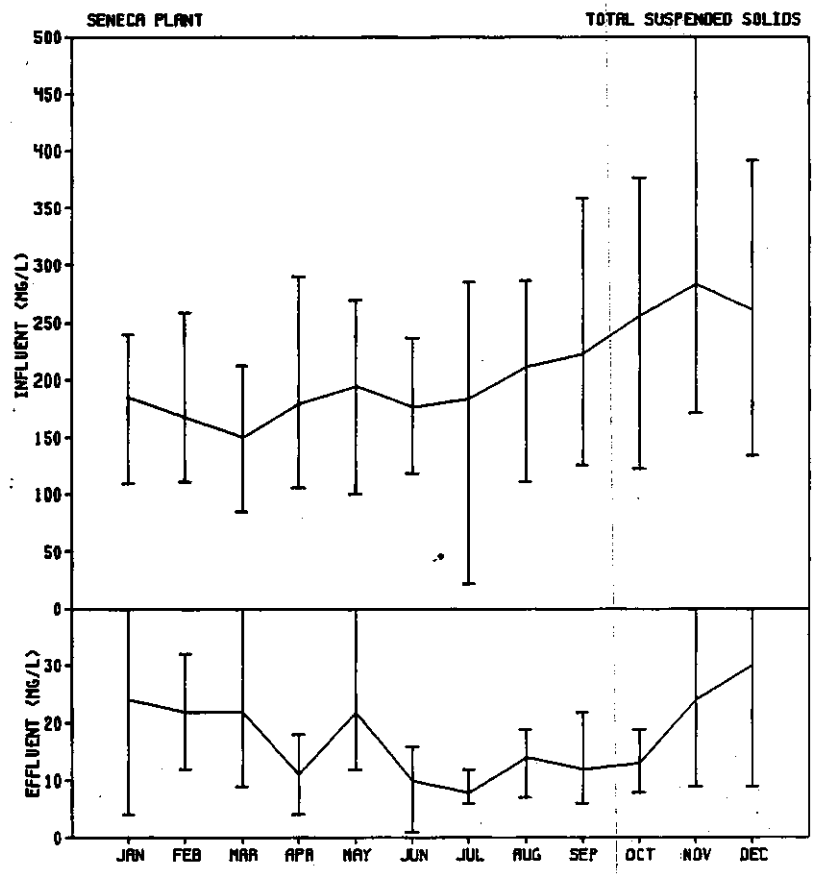
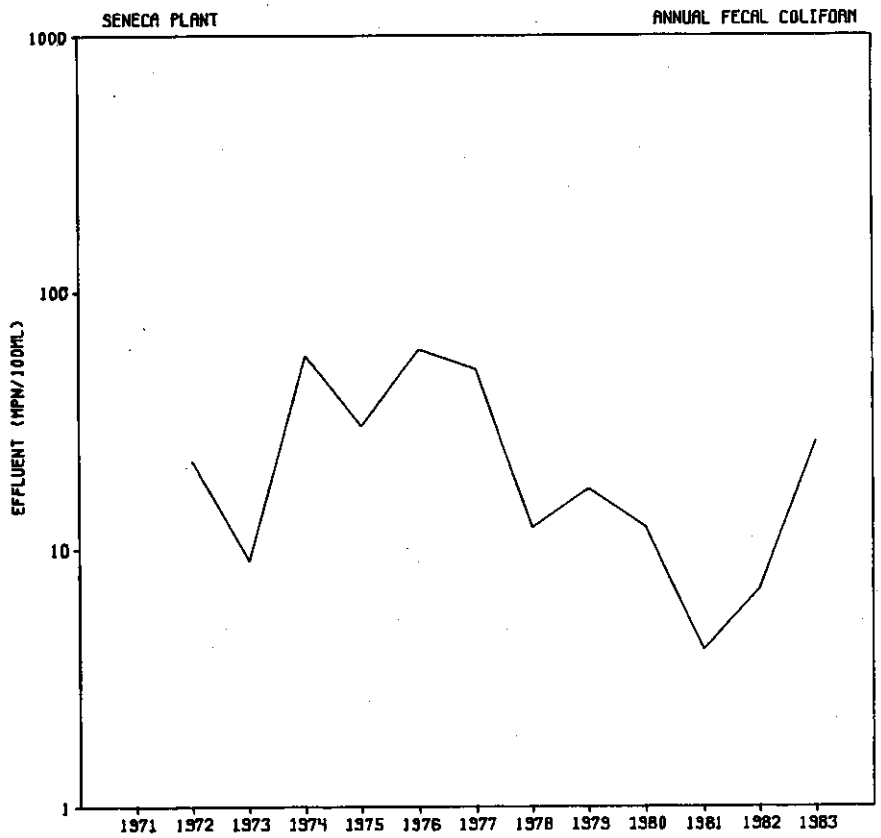
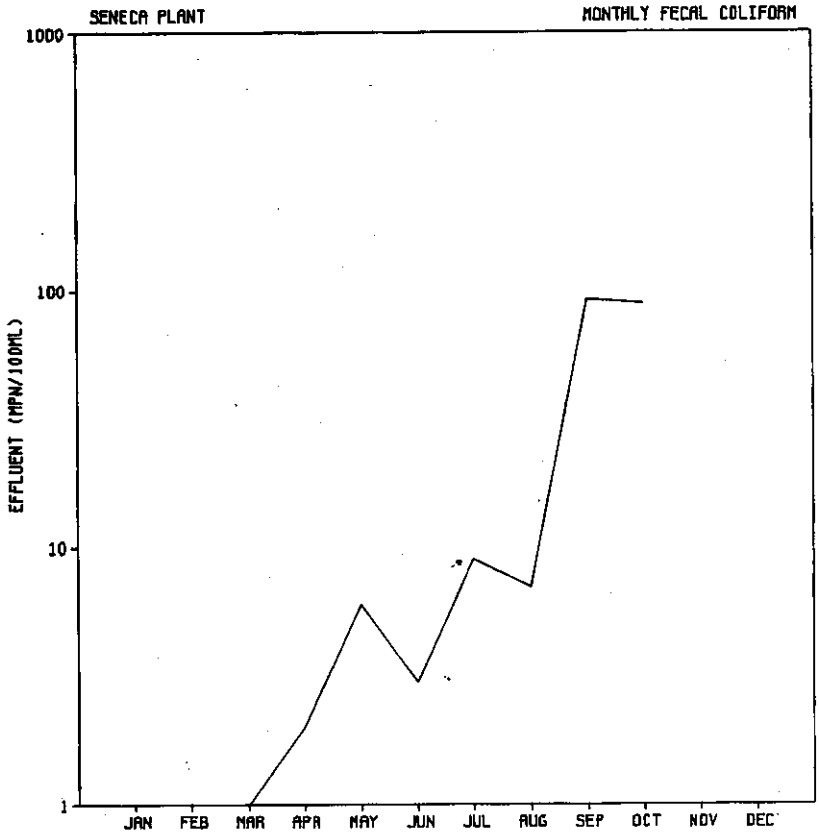
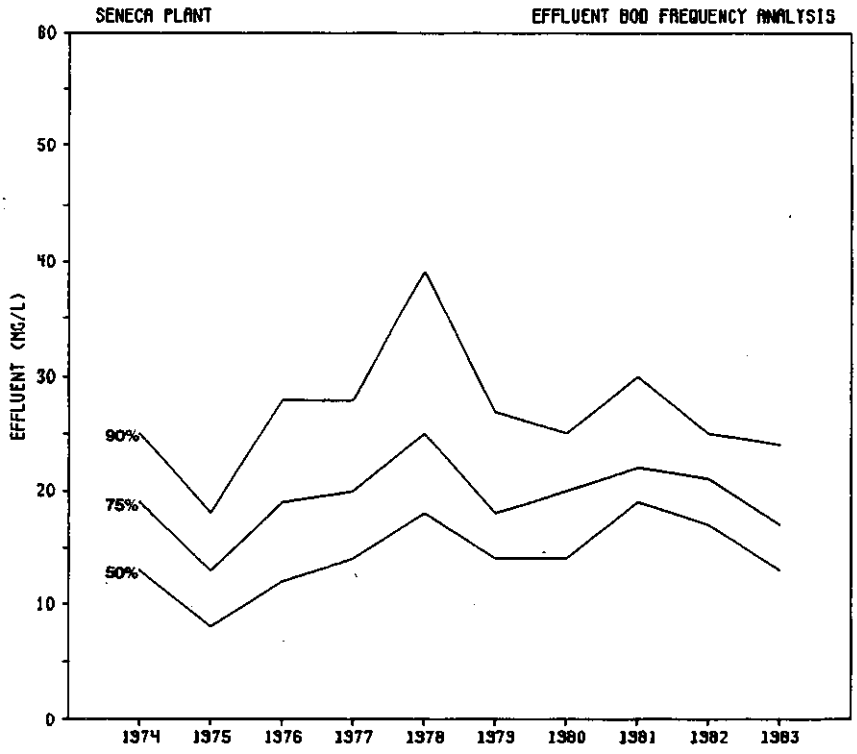
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

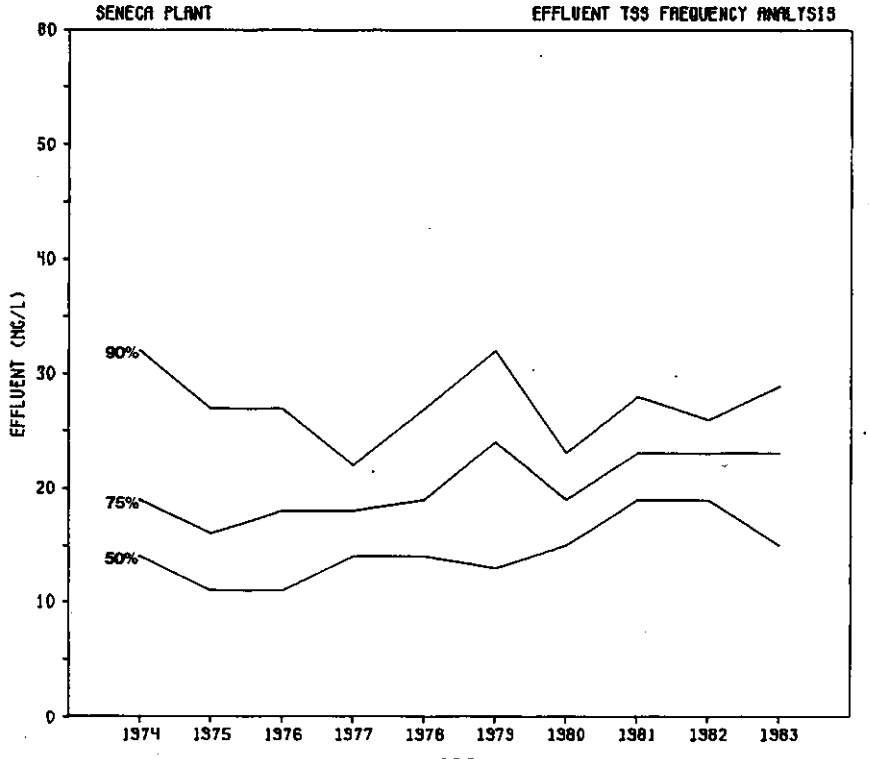

SENECA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


SENECA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


SENECA PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


SENECA PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


SENECA PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
0
10
20
30
40
50
60
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


SENECA PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
0
10
20
30
40
50
60
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

STILLWATER WASTEWATER TREATMENT PLANT

Plant History and Description

The Stillwater Plant was originally constructed in 1959 as a primary treatment plant. In 1970, the plant was upgraded to include secondary treatment and phosphorus removal facilities were added to the plant in 1973. The design capacity of the plant is 3.0 mgd. Actual operating capacity is somewhat less, due to the additional phosphorus removal facilities.

Liquid treatment consists of screening, grit removal, primary sedimentation, activated sludge aeration, alum addition for phosphorus removal, final clarification, chlorination, and discharge to Lake St. Croix (St. Croix River).

Solids processing consists of combined thickening in primary tanks, anaerobic digestion, and sludge hauling to either the Metropolitan Plant Interceptor System or sludge landspreading sites. The plant is presently operating at about 95 percent of its design capacity and is subject to secondary treatment limits and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 2.84 mgd during 1983, up significantly from 2.61 mgd in 1982. Average plant effluent quality was 10 mg/L BOD, 12 mg/L TSS and 0.6 mg/L P. Plant performance was excellent throughout the year, as no NPDES Permit violations were experienced. Statistical analysis of data show the following trend in BOD and TSS from 1980 through 1983.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1980	1981	1982	1983	1980	1981	1982	1983	1980	1981	1982	1983
*BOD	12	14	10	9	14	24	12	12	19	33	14	18
TSS	9	8	8	10	14	12	10	14	21	15	12	20

*1982 and 1983 values represent CBOD.

Future

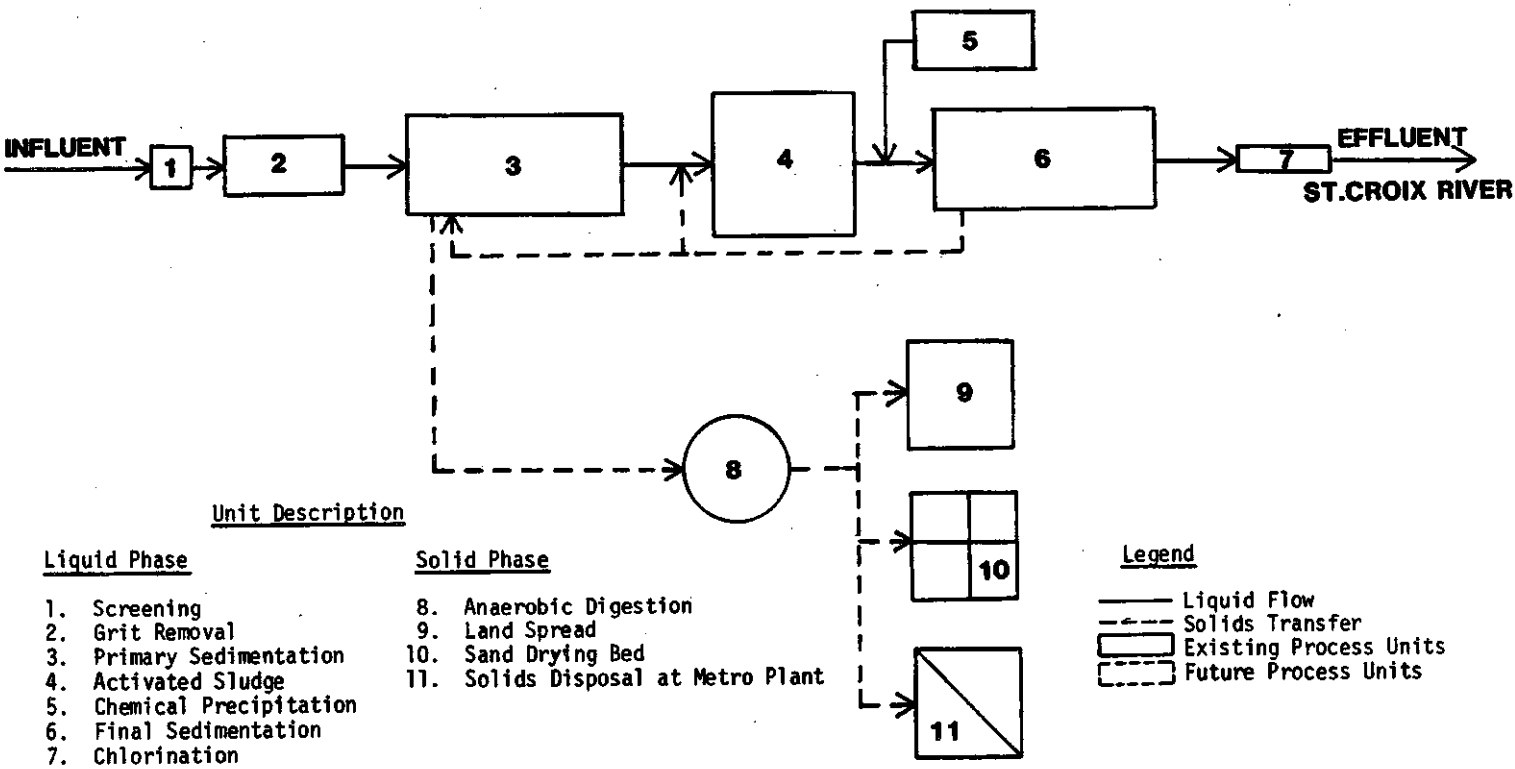
The Stillwater Plant is considered a permanent plant. The plant is expected to be expanded in the late 1980's to allow for the inclusion of flow from the City of Bayport and increased flow from the present service area.

STILLWATER PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1982	Annual Average 1983	Maximum Month 1982	Maximum Month 1983
Wastewater Flow, MGD	2.61	2.84	3.16	3.45
BOD Loading, lb/day	2,940	2,940	3,290	4,080
TSS Loading, lb/day	3,050	3,220	3,940	4,980
COD Loading, lb/day	5,350	5,720	5,920	7,280
Primary Sedimentation				
Detention Times, hr.	2.3	2.1	1.9	1.7
Weir Overflow Rate, gpd/lin. ft.	10,700	11,600	13,000	14,100
Surface Overflow Rate, gpd/sq. ft.	594	650	719	790
Aeration Basin				
BOD Loading, lb/day/1000 cu. ft.	54	43	61	60
Alum Feed Rate, lb/day	399	410	416	470
Final Sedimentation				
Detention Time, hr.	2.7	2.5	2.2	2.0
Weir Overflow Rate, gpd/lin. ft.	8,310	9,000	10,100	11,000
Surface Overflow Rate, gpd/sq. ft.	665	720	805	880
Chlorination				
Contact Time, minutes	36	33	30	27
Chlorine Use, lb/day	48	62	56	70
Anaerobic Digesters				
Solid Detention Time, days	27	36	24	27
Sludge Transport				
Volume, gpd	13,800	11,100	19,500	15,000
Mass, lb/day	3,090	2,600	4,220	4,000

STILLWATER WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

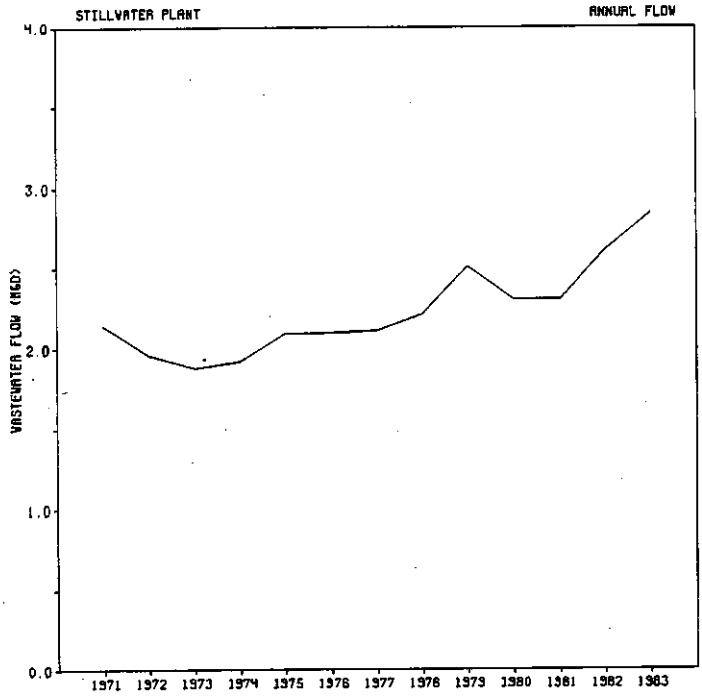
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Chemical Precipitation
6. Final Sedimentation
7. Chlorination

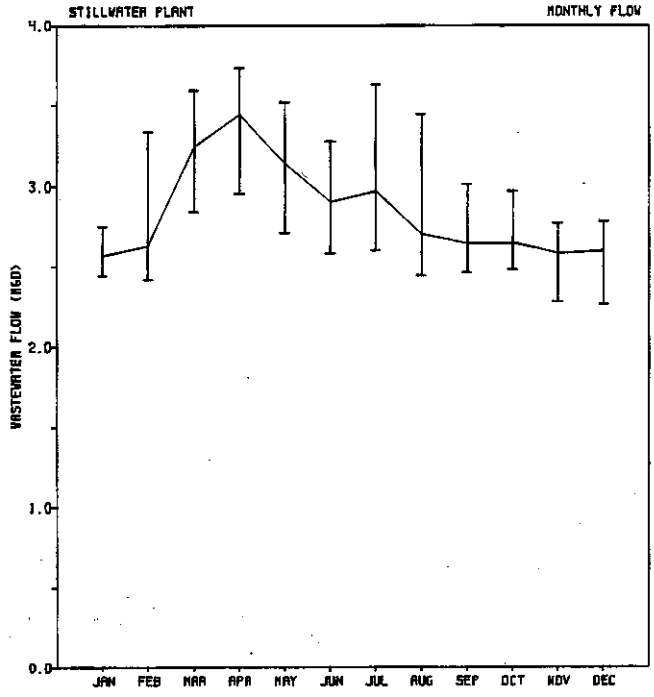
Solid Phase

8. Anaerobic Digestion
9. Land Spread
10. Sand Drying Bed
11. Solids Disposal at Metro Plant

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- Future Process Units





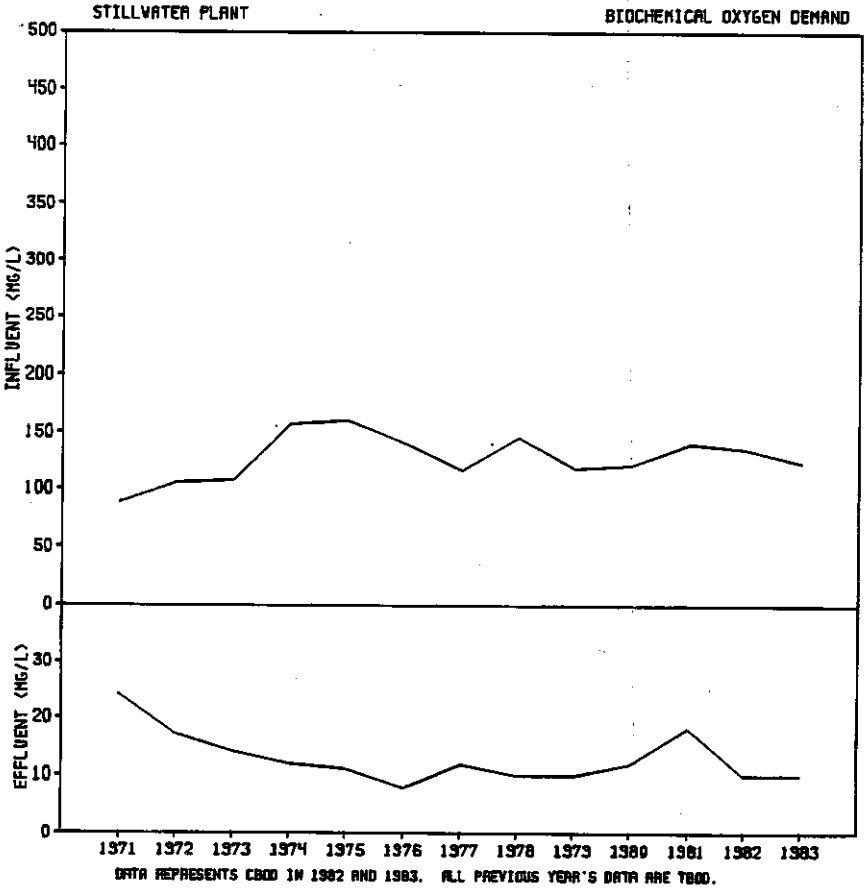
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Stillwater

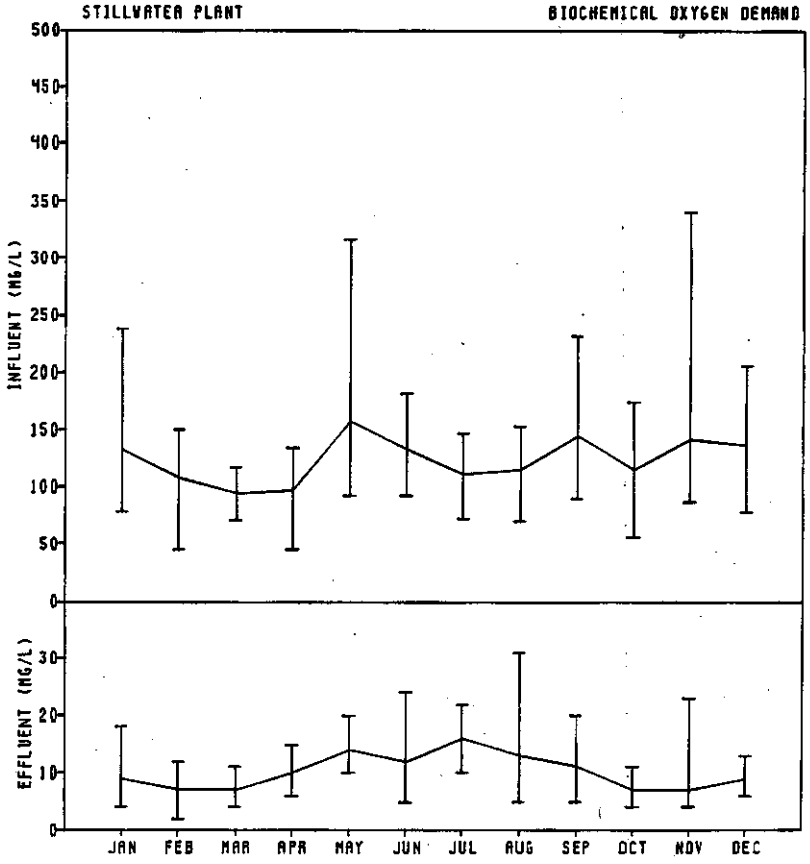
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	2.57	11	133	106	6.2-8.0	31.4	5.6	16.3	221
FEBRUARY	2.63	10	108	97	6.6-8.4	----	5.9	13.6	203
MARCH	3.25	9	94	86	6.4-8.0	18.5	3.4	11.4	181
APRIL	3.45	10	97	104	6.8-7.8	16.0	3.1	8.5	169
MAY	3.14	11	157	159	6.8-8.4	23.0	4.5	11.2	238
JUNE	2.90	13	133	131	6.6-8.4	22.1	4.6	13.8	297
JULY	2.97	15	111	136	6.6-8.4	20.8	4.5	11.3	269
AUGUST	2.70	17	115	118	6.8-8.4	22.1	4.7	10.3	242
SEPTEMBER	2.64	17	145	161	6.8-8.4	20.4	5.1	10.3	300
OCTOBER	2.65	15	115	157	6.6-8.4	20.5	4.5	11.5	235
NOVEMBER	2.58	14	142	235	6.4-8.2	28.9	4.5	11.3	303
DECEMBER	2.60	13	136	148	6.6-8.0	24.1	5.3	14.4	249
1983 AVERAGE	2.84	13	124	137	6.2-8.4	22.8	4.7	11.9	243
1982 AVERAGE	2.61	13	135	139	3.8-9.6	23.6	5.0	12.6	246

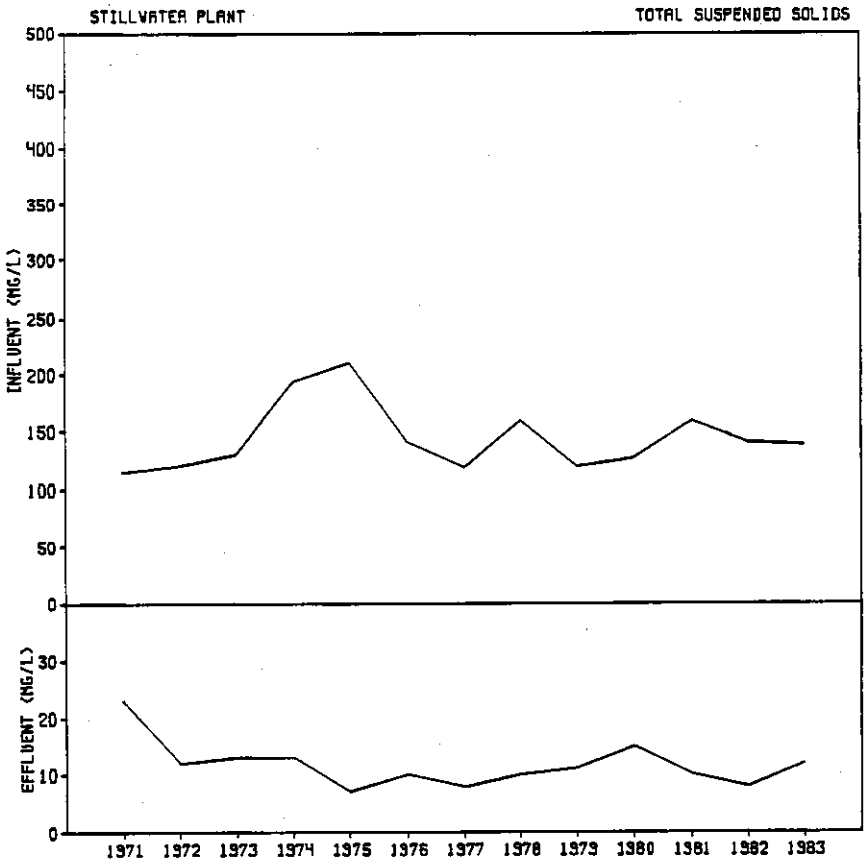
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Stillwater

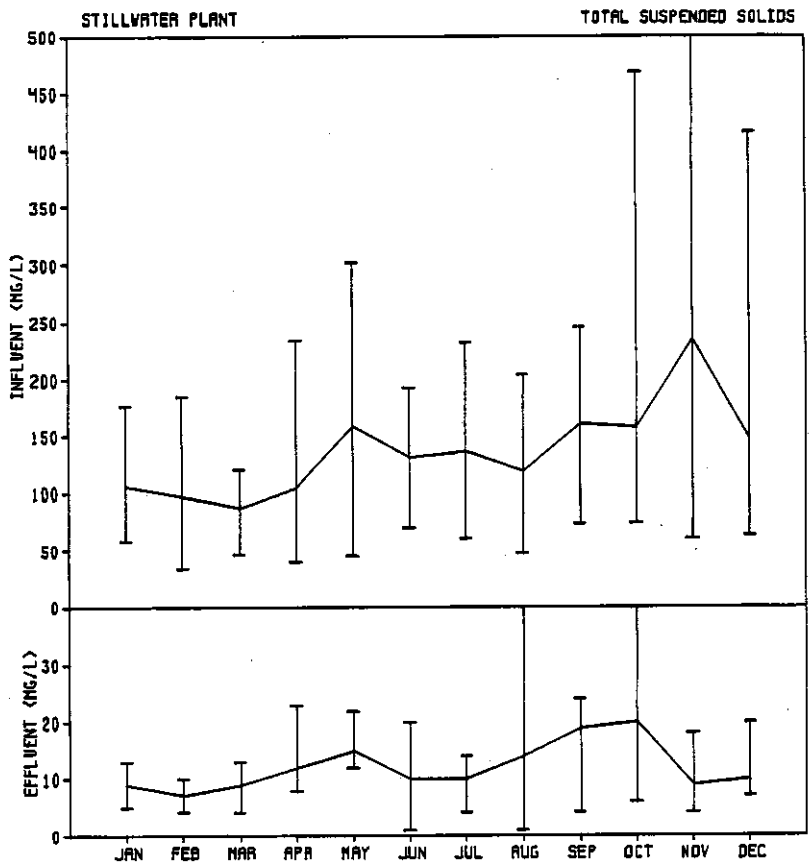
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	25	25	--	30	200	25	----	----	----	----	1.0	--	---	---	6.5-8.5	--	--
JANUARY	10	9	34	9	---	3	17.3	13.3	0.16	0.90	0.5	--	---	5.1	7.0-7.2	93	92
FEBRUARY	13	7	28	7	---	3	----	12.9	1.87	1.88	0.6	40	1.4	5.0	6.9-7.1	93	92
MARCH	10	7	38	9	7	4	12.5	10.8	0.90	0.91	0.4	50	1.8	4.9	6.9-7.2	93	90
APRIL	21	10	44	12	21	5	11.1	7.1	1.71	0.93	0.4	54	1.7	5.1	6.9-7.2	90	88
MAY	26	14	51	15	34	7	13.3	7.9	1.84	0.73	0.6	60	1.9	5.1	6.9-7.1	91	90
JUNE	16	12	51	10	26	5	15.8	14.3	0.15	0.48	0.5	60	2.2	5.1	6.9-7.2	91	93
JULY	28	16	58	10	34	6	13.3	11.0	1.41	1.11	0.5	61	2.0	4.5	7.0-7.1	86	92
AUGUST	19	13	52	14	50	7	14.5	11.9	1.07	2.62	0.7	69	1.9	4.2	7.0-7.1	88	88
SEPTEMBER	15	11	49	19	12	8	13.0	9.4	0.68	3.51	0.8	70	2.1	4.3	6.8-7.1	93	88
OCTOBER	12	7	48	20	17	10	13.5	10.9	0.45	3.10	0.9	70	2.3	4.6	6.9-7.1	94	87
NOVEMBER	13	7	43	9	---	4	14.7	10.0	0.32	1.75	0.7	--	---	4.9	6.9-7.1	95	96
DECEMBER	13	9	34	10	---	4	15.6	12.8	0.54	2.26	0.4	--	---	5.1	6.9-7.1	93	93
1983 AVG.	16	10	44	12	25	5	14.1	10.9	0.93	1.67	0.6	61	2.0	4.8	6.8-7.2	92	91
1982 AVG.	17	10	36	8	5	5	14.7	10.6	1.10	1.32	0.4	51	2.0	5.1	6.5-7.2	93	94

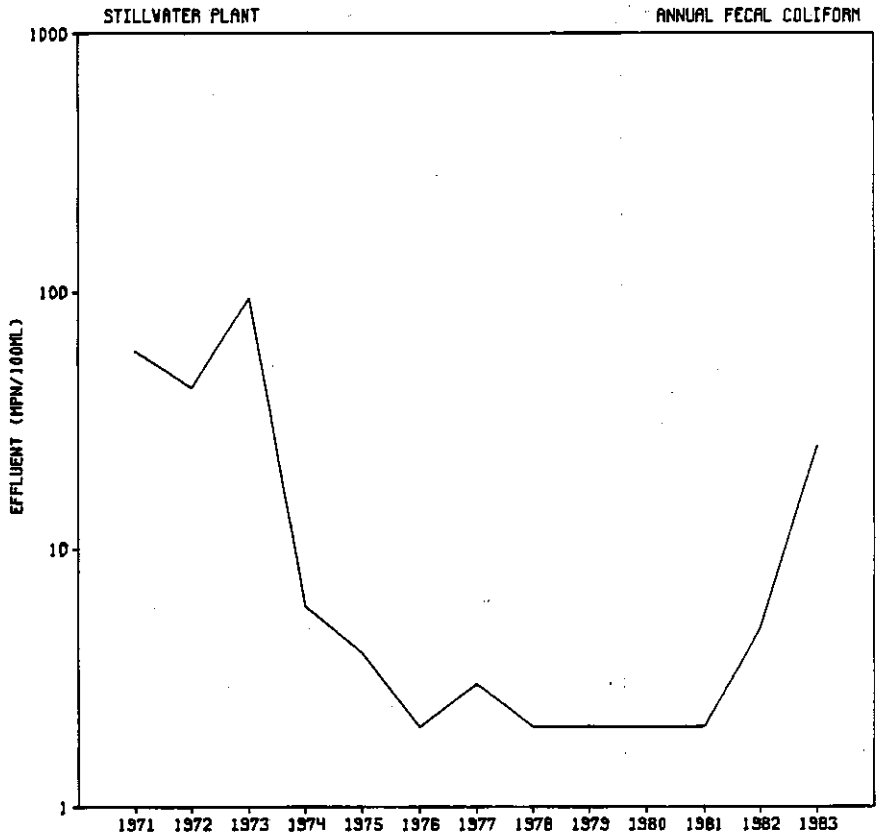
*For disinfection only.

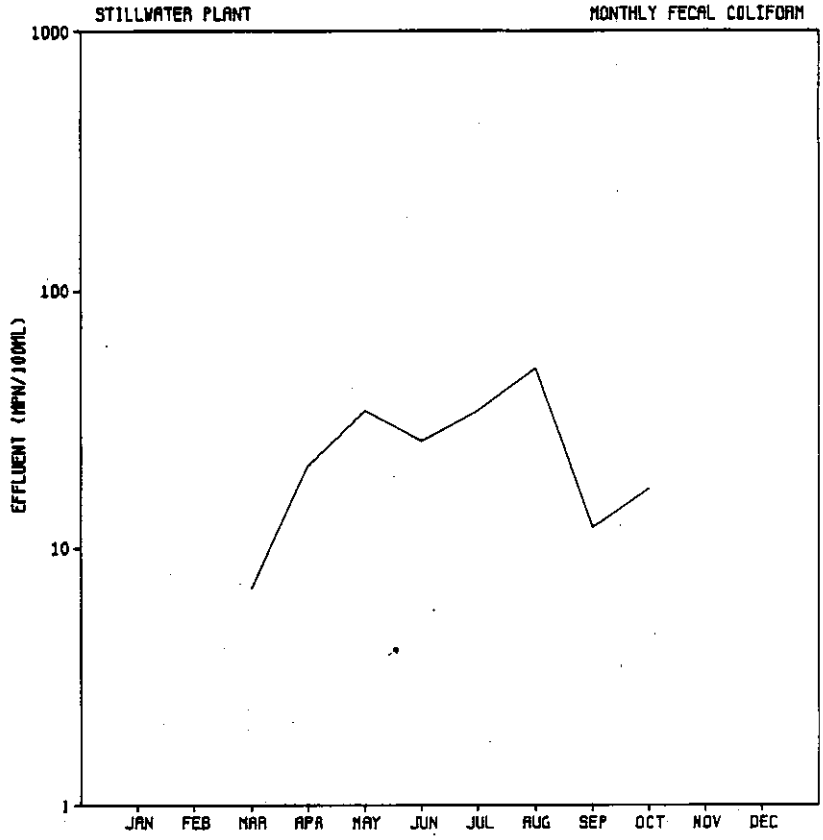

STILLWATER PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983
DATA REPRESENTS CBOD IN 1982 AND 1983. ALL PREVIOUS YEAR'S DATA ARE TBOD.

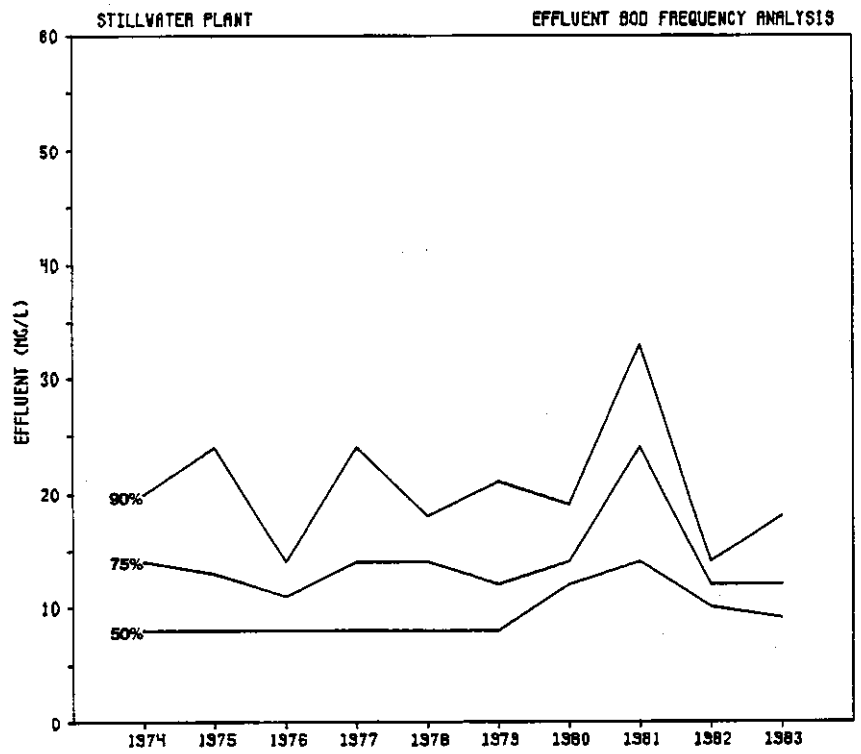

STILLWATER PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

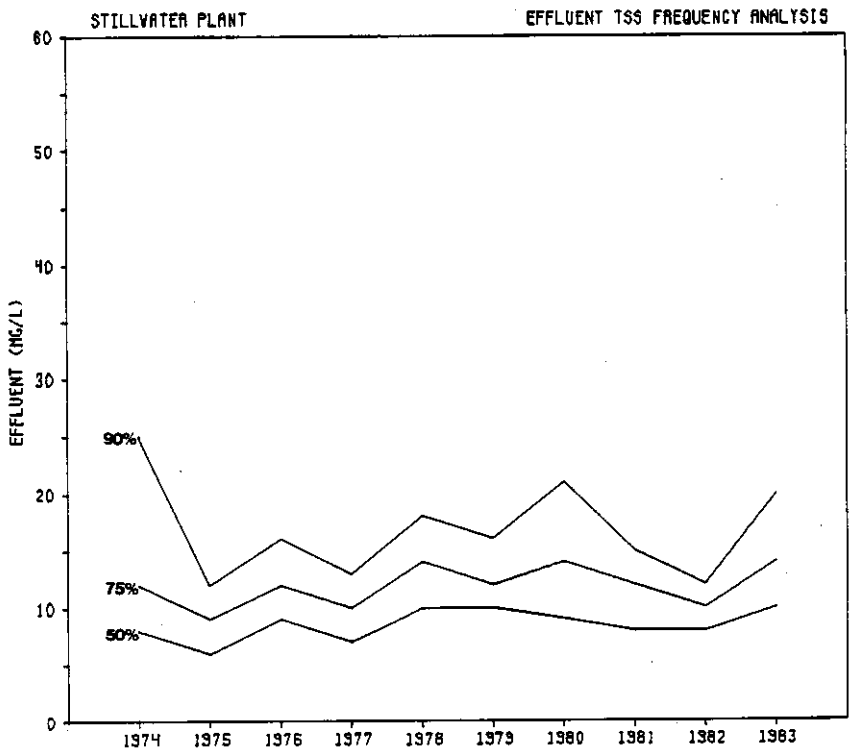

STILLWATER PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


STILLWATER PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


STILLWATER PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983


STILLWATER PLANT
MONTHLY FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


STILLWATER PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983


STILLWATER PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983

1983 EFFLUENT DATA
TREATMENT PLANT _Stillwater_

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	Cd mg/l	Hg ug/l	CN mg/l	As ug/l	PCB mg/l	Ni mg/l	Phenol ug/l	Fe mg/l
January						<0.20						
February						<0.20						
March						<0.20						
April						<0.20						
May						<0.20						
June						<0.20						
July						<0.20						
August						<0.20						
September						----						
October						<0.20						
November						<0.20						
December						<0.20						
1983 Avg.						<0.20						

APPENDIX

TABLE A-1

1983 ANNUAL AVERAGE
TREATMENT PLANT INFLUENT DATA

Treatment Plant	Flow mgd	Temp °C	TBOD mg/l	COD mg/l	TSS mg/l	pH Range	Nutrients Total P mg/l	Nutrients KJN mg/l	Nutrients NH3 mg/l
Anoka	2.33	17	193	379	165	6.0-9.2	7.2	37.4	19.5
Bayport	0.54	20	158	293	178	5.2-9.7	5.7	29.4	16.4
Blue Lake	18.1	14	194	461	224	6.5-7.8	6.2	28.9	12.4
Chaska	1.02	14	141	291	127	4.2-12.0	5.9	35.1	19.5
Cottage Grove	1.30	15	181	378	160	7.0-8.5	7.7	41.9	25.9
Empire	4.81	14	217	457	250	6.0-9.0	11.1	35.3	17.0
Hastings	1.65	17	230	523	187	4.5-12.0	12.2	45.9	25.0
Maple Plain	0.35	13	125	275	171	7.2-7.9	5.1	28.1	13.4
Medina	0.181	14	133	289	208	7.3-7.7	4.9	28.7	12.8
Metropolitan	225	17	174	375	192	5.3-11.1	4.4	24.3	13.2
Rosemount	0.34	14	159	413	236	6.2-11.3	7.2	44.4	26.1
Savage	0.59	13	120	253	195	1.2-12.4	16.7	24.3	13.5
Seneca	15.8	16	221	469	211	6.2-8.7	7.7	34.9	19.1
Stillwater	2.84	13	124	243	137	6.2-8.4	4.7	22.8	11.9

TABLE A-2

ANNUAL AVERAGE FLOW DATA
FOR THE PERIOD 1971-1983

Treatment Plant	ANNUAL AVERAGE FLOW (MGD) 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	1.76	1.93	1.88	1.78	1.62	1.77	1.92	2.01	1.98	2.09	2.01	2.14	2.33
APPLE VALLEY	0.57	0.71	1.16	1.26	1.48	1.46	1.67	1.94	2.03	*---	----	----	----
BAYPORT	0.48	0.48	0.42	0.45	0.56	0.50	0.48	0.47	0.54	0.44	0.47	0.52	0.54
BLUE LAKE (POND)	1.43	2.96	3.74	----	-----	-----	-----	-----	----	----	----	----	----
BLUE LAKE	----	----	3.94	6.78	9.05	9.03	9.86	12.49	14.1	14.1	13.7	16.1	18.1
BURNSVILLE	1.76	2.10	*----	----	-----	-----	-----	-----	----	----	----	----	----
CHASKA	0.53	0.58	0.74	0.75	0.91	0.81	0.75	0.97	0.89	0.64	0.70	0.80	1.02
CHANHASSEN	0.07	*---	-----	----	-----	-----	-----	-----	----	----	----	----	----
COTTAGE GROVE	0.62	0.85	0.92	0.91	0.91	0.91	0.97	1.31	1.60	1.58	1.21	1.26	1.30
**EAGAN TOWNSHIP	-----	----	*----	----	-----	-----	-----	-----	----	----	----	----	----
EMPIRE	-----	----	-----	----	-----	-----	-----	-----	3.54	3.48	3.51	4.05	4.81
EXCELSIOR	0.56	0.50	*----	----	-----	-----	-----	-----	----	----	----	----	----
FARMINGTON	0.35	0.30	0.40	0.35	0.59	0.37	0.35	0.52	0.78	*---	----	----	----
FOREST LAKE TOWNSHIP	0.16	0.17	*----	----	-----	-----	-----	-----	----	----	----	----	----
FOREST LAKE VILLAGE	0.23	0.25	*----	----	-----	-----	-----	-----	----	----	----	----	----
HASTINGS	0.91	1.14	1.32	1.29	1.29	1.30	1.40	1.42	1.35	1.44	1.50	1.50	1.65
INVER GROVE HEIGHTS	0.59	0.64	*----	----	-----	-----	-----	-----	----	----	----	----	----
LAKEVILLE	0.45	0.36	0.33	0.37	0.50	0.38	0.36	0.48	0.60	*---	----	----	----
LONG LAKE	0.18	0.17	0.15	0.20	0.23	0.19	0.21	0.30	0.32	0.28	*---	----	----
MAPLE PLAIN	0.22	0.28	0.22	0.24	0.33	0.22	0.18	0.26	0.27	0.20	0.25	0.35	0.35
MEDINA	0.07	0.09	0.07	0.08	0.09	0.07	0.08	0.14	0.12	0.10	0.10	0.15	0.18
METROPOLITAN	213	213	202	196	202	196	194	210	217	206	202	208	225
MOUND	1.09	1.23	1.26	1.48	*----	-----	-----	-----	----	----	----	----	----
NEWPORT	0.18	0.17	0.18	0.17	0.21	*----	-----	-----	----	----	----	----	----
OAK PARK HEIGHTS	0.07	0.10	0.12	*---	-----	-----	-----	-----	----	----	----	----	----
ORONO	0.20	0.25	0.27	0.34	0.32	0.31	0.34	0.46	0.49	0.62	*---	----	----
PRIOR LAKE	0.10	0.12	0.13	0.17	0.31	0.44	0.10	0.01	*---	----	----	----	----
ROSEMOUNT (trickling filter)	0.10	0.11	0.12	*---	-----	-----	-----	-----	----	----	----	----	----
ROSEMOUNT AWTP	-----	----	0.20	0.20	0.22	0.24	0.27	0.29	0.30	0.29	0.30	0.31	0.34
ST. PAUL PARK	0.30	0.31	0.30	0.28	0.36	*----	----	-----	----	----	----	----	----
SAVAGE	0.31	0.33	0.29	0.38	0.42	0.38	0.39	0.37	0.44	0.38	0.40	0.48	0.59
SENECA	-----	7.76	10.12	9.89	10.34	10.81	11.72	12.71	13.6	13.0	13.8	14.7	15.8
SHAKOPEE	1.24	*---	-----	----	-----	-----	-----	-----	----	----	----	----	----
SOUTH ST. PAUL	10.10	9.38	9.66	9.72	*----	-----	-----	-----	----	----	----	----	----
STILLWATER	2.14	1.96	1.88	1.92	2.09	2.10	2.11	2.21	2.51	2.30	2.31	2.61	2.84
**VICTORIA	-----	----	-----	*---	-----	-----	-----	-----	----	----	----	----	----
WACONIA	-----	----	-----	----	0.23	0.26	0.25	*----	----	----	----	----	----
WAYZATA	0.53	*---	-----	----	-----	-----	-----	-----	----	----	----	----	----
ALL PLANTS EXCEPT METRO	26	31	36	39	32	32	33	39	45	41	40	45	50
ALL PLANTS	239	244	238	235	234	228	227	249	262	247	242	253	275

* Plant phased out during previous year.
**Flow data not available.

TABLE A-3

ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
FOR THE PERIOD 1971-1983

Treatment Plant	ANNUAL AVERAGE BOD (MG/L)												
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982**	1983**
ANOKA	20	29	36	21	16	11	9	12	14	14	16	12	11
APPLE VALLEY	74	113	22	24	7	7	6	12	23	*--	---	---	---
BAYPORT	27	40	32	9	15	14	11	8	7	7	8	8	6
BLUE LAKE (POND)	31	31	39	---	---	---	---	---	---	---	---	---	---
BLUE LAKE	---	---	12	18	15	15	13	13	9	9	12	10	9
BURNSVILLE	40	55	*--	---	---	---	---	---	---	---	---	---	---
CHASKA	36	49	52	58	43	42	44	78	112	20	18	14	11
CHANHASSEN	84	*--	---	---	---	---	---	---	---	---	---	---	---
COTTAGE GROVE	53	52	60	36	25	55	39	34	19	11	12	10	9
EAGAN TOWNSHIP	50	52	*--	---	---	---	---	---	---	---	---	---	---
EMPIRE	---	---	---	---	---	---	---	---	10	3	3	2	3
EXCELSIOR	13	26	*--	---	---	---	---	---	---	---	---	---	---
FARMINGTON	39	52	46	85	64	29	76	31	52	*--	---	---	---
FOREST LAKE TOWNSHIP	8	35	*--	---	---	---	---	---	---	---	---	---	---
FOREST LAKE VILLAGE	77	114	*--	---	---	---	---	---	---	---	---	---	---
HASTINGS	12	7	15	34	15	12	16	18	18	18	20	20	16
INVER GROVE HEIGHTS	76	110	*--	---	---	---	---	---	---	---	---	---	---
LAKEVILLE	36	33	34	25	28	34	51	67	65	*--	---	---	---
LONG LAKE	53	24	18	35	40	41	43	42	43	58	*--	---	---
MAPLE PLAIN	12	11	13	10	9	8	11	11	18	20	12	13	9
MEDINA	12	9	14	10	13	14	25	22	22	22	26	14	10
METROPOLITAN	84	72	46	42	41	67	42	39	43	23	19	13	10
MOUND	24	35	53	98	*--	---	---	---	---	---	---	---	---
NEWPORT	48	88	58	47	49	*--	---	---	---	---	---	---	---
OAK PARK HEIGHTS	39	32	48	*--	---	---	---	---	---	---	---	---	---
ORONO	15	10	10	6	6	8	12	24	18	31	*--	---	---
PRIOR LAKE	34	26	28	22	24	35	22	24	*--	---	---	---	---
ROSEMOUNT (trickling filter)	36	68	76	*--	---	---	---	---	---	---	---	---	---
ROSEMOUNT AWTP	---	---	7	23	16	14	14	13	13	12	14	16	16
ST. PAUL PARK	66	93	52	51	63	*--	---	---	---	---	---	---	---
SAVAGE	22	26	28	27	21	20	46	27	27	7	10	8	8
SENECA	---	29	16	15	11	15	16	21	16	16	20	18	14
SHAKOPEE	355	*--	---	---	---	---	---	---	---	---	---	---	---
SOUTH ST. PAUL	60	42	31	46	*--	---	---	---	---	---	---	---	---
STILLWATER	24	17	14	12	11	8	12	10	10	12	18	10	10
VICTORIA	73	52	70	*--	---	---	---	---	---	---	---	---	---
WACONIA	---	---	---	---	17	62	52	31	*--	---	---	---	---
WAYZATA	41	*--	---	---	---	---	---	---	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)	52	38	27	26	16	17	17	19	17	12	15	13	10
ALL PLANTS (weighted average)	81	67	43	40	38	60	38	36	39	21	18	12	10
ALL PLANTS EXCEPT METRO (actual average)	50	45	34	32	24	23	27	26	28	17	15	12	10
ALL PLANTS (actual average)	51	46	34	33	25	26	28	27	28	18	15	12	10

* Plant phased out during previous year.
**$CBOD_5$ values listed for 1982 and 1983.

TABLE A-4

ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
FOR THE PERIOD 1971-1983

Treatment Plant	ANNUAL AVERAGE TSS (MG/L)												
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	24	36	40	19	13	15	14	16	12	11	14	8	10
APPLE VALLEY	93	148	16	14	5	5	3	6	10	*--	---	---	---
BAYPORT	22	43	28	15	10	8	10	8	8	7	7	8	6
BLUE LAKE (POND)	34	58	45	---	---	---	---	---	---	---	---	---	---
BLUE LAKE	---	---	22	21	14	19	13	14	12	9	6	7	7
BURNSVILLE	60	86	*--	---	---	---	---	---	---	---	---	---	---
CHASKA	72	86	79	91	62	55	54	66	59	12	13	11	11
CHANHASSEN	71	*--	---	---	---	---	---	---	---	---	---	---	---
COTTAGE GROVE	63	70	93	84	36	25	23	28	14	8	7	7	11
EAGAN TOWNSHIP	60	69	*--	---	---	---	---	---	---	---	---	---	---
EMPIRE	---	---	---	---	---	---	---	---	5	2	2	1	1
EXCELSIOR	13	36	*--	---	---	---	---	---	---	---	---	---	---
FARMINGTON	70	77	54	75	29	23	34	34	37	*--	---	---	---
FOREST LAKE TOWNSHIP	11	24	*--	---	---	---	---	---	---	---	---	---	---
FOREST LAKE VILLAGE	105	163	*--	---	---	---	---	---	---	---	---	---	---
HASTINGS	10	10	18	26	20	21	18	20	19	23	22	31	23
INVER GROVE HEIGHTS	139	174	*--	---	---	---	---	---	---	---	---	---	---
LAKEVILLE	47	36	36	30	33	39	53	68	71	*--	---	---	---
LONG LAKE	35	47	23	50	39	48	37	30	26	43	*--	---	---
MAPLE PLAIN	20	13	13	19	12	16	16	10	13	14	9	7	9
MEDINA	11	15	16	13	13	15	20	18	19	25	18	14	14
METROPOLITAN	72	54	37	43	40	60	49	43	64	26	19	11	9
MOUND	37	36	47	38	*--	---	---	---	---	---	---	---	---
NEWPORT	85	120	96	110	89	*--	---	---	---	---	---	---	---
OAK PARK HEIGHTS	36	47	85	*--	---	---	---	---	---	---	---	---	---
ORONO	19	15	10	10	11	17	21	32	23	43	*--	---	---
PRIOR LAKE	28	33	27	25	25	28	17	17	*--	---	---	---	---
ROSEMOUNT (trickling filter)	51	63	58	*--	---	---	---	---	---	---	---	---	---
ROSEMOUNT AWTP	---	---	2	9	4	3	3	4	3	2	2	2	2
ST. PAUL PARK	69	77	47	48	47	*--	---	---	---	---	---	---	---
SAVAGE	24	28	14	15	13	10	14	15	14	7	8	4	3
SENECA	---	29	17	19	16	15	15	17	20	16	20	19	18
SHAKOPEE	146	*--	---	---	---	---	---	---	---	---	---	---	---
SOUTH ST. PAUL	38	22	22	31	*--	---	---	---	---	---	---	---	---
STILLWATER	23	12	13	13	7	10	8	10	11	15	10	8	12
VICTORIA	59	45	52	*--	---	---	---	---	---	---	---	---	---
WACONIA	---	---	---	---	33	53	42	40	*--	---	---	---	---
WAYZATA	34	*--	---	---	---	---	---	---	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)	44	38	27	26	17	18	15	18	16	12	14	11	11
ALL PLANTS (weighted average)	69	52	36	40	37	54	44	38	56	24	18	11	9
ALL PLANTS EXCEPT METRO (actual average)	50	57	37	35	25	22	22	24	21	16	11	10	10
ALL PLANTS (actual average)	51	57	37	36	26	24	23	25	23	16	12	10	10

* Plant phased out during previous year.

TABLE A-5

ANNUAL AVERAGE EFFLUENT PERCENT REMOVAL
EFFICIENCY FOR THE PERIOD 1971-1983

Treatment Plant	ANNUAL AVERAGE BOD REMOVAL (%)												
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	89	87	85	91	92	94	95	94	93	92	92	95	94
APPLE VALLEY	65	52	90	89	97	96	97	94	88	*--	--	--	--
BAYPORT	88	86	86	97	95	95	95	96	96	96	96	95	96
BLUE LAKE (POND)	87	92	88	--	--	--	--	--	--	--	--	--	--
BLUE LAKE	--	--	96	94	94	95	95	95	96	96	95	95	96
BURNSVILLE	74	69	*--	--	--	--	--	--	--	--	--	--	--
CHASKA	79	75	74	69	81	83	78	61	57	91	92	93	92
CHANHASSEN	70	*--	--	--	--	--	--	--	--	--	--	--	--
COTTAGE GROVE	81	80	76	85	89	72	81	83	89	94	94	95	95
EAGAN TOWNSHIP	75	69	*--	--	--	--	--	--	--	--	--	--	--
EMPIRE	--	--	--	--	--	--	--	--	95	98	99	99	99
EXCELSIOR	92	91	*--	--	--	--	--	--	--	--	--	--	--
FARMINGTON	86	87	86	91	86	94	83	91	82	*--	--	--	--
FOREST LAKE TOWNSHIP	--	--	*--	--	--	--	--	--	--	--	--	--	--
FOREST LAKE VILLAGE	51	40	*--	--	--	--	--	--	--	--	--	--	--
HASTINGS	96	97	92	81	91	94	92	93	92	91	91	92	93
INVER GROVE HEIGHTS	66	51	*--	--	--	--	--	--	--	--	--	--	--
LAKEVILLE	75	78	84	94	92	94	88	77	75	*--	--	--	--
LONG LAKE	75	86	93	86	73	78	79	74	74	61	*--	--	--
MAPLE PLAIN	90	86	93	95	89	94	93	92	89	88	93	90	92
MEDINA	92	90	90	92	92	94	86	93	82	84	80	87	91
METROPOLITAN	66	73	82	84	83	75	83	82	79	89	91	95	94
MOUND	82	79	75	52	*--	--	--	--	--	--	--	--	--
NEWPORT	79	64	72	78	71	*--	--	--	--	--	--	--	--
OAK PARK HEIGHTS	85	88	83	*--	--	--	--	--	--	--	--	--	--
ORONO	88	93	94	96	94	93	91	79	82	68	*--	--	--
PRIOR LAKE	82	78	80	80	77	68	71	78	*--	--	--	--	--
ROSEMOUNT (trickling filter)	74	72	65	*--	--	--	--	--	--	--	--	--	--
ROSEMOUNT AWTP	--	--	90	91	92	94	93	93	93	93	92	90	90
ST. PAUL PARK	88	66	79	78	72	*--	--	--	--	--	--	--	--
SAVAGE	84	88	84	85	88	88	84	85	79	95	93	94	93
SENECA	--	88	94	94	95	94	93	92	93	92	91	92	94
SHAKOPEE	11	*--	--	--	--	--	--	--	--	--	--	--	--
SOUTH ST. PAUL	88	92	90	87	*--	--	--	--	--	--	--	--	--
STILLWATER	73	84	87	92	93	94	90	93	92	90	87	93	92
VICTORIA	57	68	66	*--	--	--	--	--	--	--	--	--	--
WACONIA	--	--	--	--	90	90	85	90	*--	--	--	--	--
WAYZATA	78	*--	--	--	--	--	--	--	--	--	--	--	--
ALL PLANTS EXCEPT METRO (weighted avg.)	83	85	89	90	93	93	93	92	92	94	93	94	95
ALL PLANTS (weighted average)	68	75	83	85	84	77	84	84	81	90	91	94	94
ALL PLANTS EXCEPT METRO (actual average)	77	78	84	86	88	89	88	87	86	89	92	94	94
ALL PLANTS (actual average)	77	78	84	86	88	89	88	87	86	89	92	94	94

* Plant phased out during previous year.

TABLE A-6

ANNUAL AVERAGE EFFLUENT PERCENT REMOVAL
EFFICIENCY FOR THE PERIOD 1971-1983

Treatment Plant	ANNUAL AVERAGE TSS REMOVAL (%)												
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	90	88	85	94	94	92	92	90	91	92	91	95	94
APPLE VALLEY	64	55	95	96	98	98	99	98	96	*--	--	--	---
BAYPORT	90	84	86	95	97	96	93	94	95	96	96	94	96
BLUE LAKE (POND)	78	66	75	--	--	--	--	--	--	--	--	--	--
BLUE LAKE	--	--	91	94	96	95	96	96	96	96	98	97	97
BURNSVILLE	75	72	*--	--	--	--	--	--	--	--	--	--	--
CHASKA	66	54	57	53	73	81	70	63	70	93	93	93	91
CHANHASSEN	75	*--	--	--	--	--	--	--	--	--	--	--	--
COTTAGE GROVE	82	78	66	71	85	86	90	86	91	95	96	96	93
EAGAN TOWNSHIP	72	61	*--	--	--	--	--	--	--	--	--	--	--
EMPIRE	--	--	--	--	--	--	--	--	98	99	99	99	99
EXCELSIOR	93	80	*--	--	--	--	--	--	--	--	--	--	--
FARMINGTON	73	74	76	79	88	90	86	82	75	*--	--	--	--
FOREST LAKE TOWNSHIP	--	--	*--	--	--	--	--	--	--	--	--	--	--
FOREST LAKE VILLAGE	41	37	*--	--	--	--	--	--	--	--	--	--	--
HASTINGS	97	97	92	87	90	90	90	92	91	90	91	87	87
INVER GROVE HEIGHTS	42	31	*--	--	--	--	--	--	--	--	--	--	--
LAKEVILLE	73	83	89	96	97	96	93	82	81	*--	--	--	--
LONG LAKE	83	84	92	89	79	82	86	85	88	79	*--	--	--
MAPLE PLAIN	68	79	89	90	86	88	91	96	94	93	95	94	93
MEDINA	92	88	88	91	91	96	88	96	91	83	86	88	89
METROPOLITAN	77	83	88	86	87	82	83	81	71	89	92	95	95
MOUND	80	82	74	80	*--	--	--	--	--	--	--	--	--
NEWPORT	66	50	56	56	51	*--	--	--	--	--	--	--	--
OAK PARK HEIGHTS	85	81	71	*--	--	--	--	--	--	--	--	--	--
ORONO	86	91	94	96	93	88	88	81	84	72	*--	--	--
PRIOR LAKE	89	82	86	80	86	80	80	88	*--	--	--	--	--
ROSEMOUNT (trickling filter)	72	87	83	*--	--	--	--	--	--	--	--	--	--
ROSEMOUNT AWTP	--	--	96	96	98	99	99	98	99	99	99	99	99
ST. PAUL PARK	78	75	83	82	80	*--	--	--	--	--	--	--	--
SAVAGE	91	96	95	94	95	95	94	94	93	99	97	97	98
SENECA	--	88	93	94	94	93	93	93	90	91	91	90	91
SHAKOPEE	38	*--	--	--	--	--	--	--	--	--	--	--	--
SOUTH ST. PAUL	93	94	93	92	*--	--	--	--	--	--	--	--	--
STILLWATER	80	90	90	93	97	93	93	94	91	88	94	94	91
VICTORIA	62	69	72	*--	--	--	--	--	--	--	--	--	--
WACONIA	--	--	--	--	82	86	84	89	*--	--	--	--	--
WAYZATA	72	*--	--	--	--	--	--	--	--	--	--	--	--
ALL PLANTS EXCEPT METRO (weighted avg.)	82	83	88	93	94	93	94	93	93	94	94	95	94
ALL PLANTS (weighted average)	78	83	88	87	88	83	84	84	75	90	92	95	95
ALL PLANTS EXCEPT METRO (actual average)	76	76	83	86	88	91	90	89	90	91	94	95	94
ALL PLANTS (actual average)	76	76	84	86	88	90	89	89	89	91	94	95	94

* Plant phased out during previous year.

TABLE A-7
INFLUENT BOD DATA 1971-1983

Treatment Plant	Annual Average Values, BOD (mg/l)												
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	182	223	240	237	189	170	175	199	206	176	211	223	193
APPLE VALLEY	211	235	220	228	204	189	228	216	194	*--	---	---	---
BAYPORT	225	286	229	282	330	270	228	200	198	197	184	161	158
BLUE LAKE	---	---	300	304	271	282	258	266	216	228	230	228	194
CHASKA	171	196	200	185	222	241	203	200	258	220	229	189	141
COTTAGE GROVE	279	260	250	234	222	197	209	198	172	171	204	208	181
EMPIRE	---	---	---	---	---	---	---	---	208	181	234	204	217
FARMINGTON	279	400	329	957	453	452	447	338	293	*--	---	---	---
HASTINGS	300	233	188	175	161	187	189	243	221	210	227	251	230
LAKEVILLE	144	150	213	426	373	570	432	290	257	*--	---	---	---
LONG LAKE	212	171	257	258	150	183	201	163	164	148	*--	---	---
MAPLE PLAIN	120	79	186	186	80	129	156	142	165	173	165	146	125
MEDINA	150	90	140	124	156	246	285	300	119	139	128	122	133
METROPOLITAN	247	267	256	256	241	266	246	215	205	215	208	203	174
NEWPORT	229	244	207	217	170	*--	---	---	---	---	---	---	---
OROND	125	143	167	158	105	110	141	116	102	98	*--	---	---
PRIOR LAKE	189	118	140	111	104	110	76	103	*--	---	---	---	---
ROSEMOUNT	---	---	70	246	213	220	203	198	193	165	177	168	159
ST. PAUL PARK	550	274	248	227	224	*--	---	---	---	---	---	---	---
SAVAGE	138	217	175	184	191	163	283	179	130	151	153	151	120
SENECA	---	242	267	270	235	247	230	252	219	194	217	221	221
STILLWATER	89	106	108	157	161	140	116	146	118	121	141	135	124
WACONIA	---	---	---	---	169	676	341	*--	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)					234	243	229	239	207	197	217	214	198
ALL PLANTS (weighted average)					240	263	243	219	205	212	209	205	178
ALL PLANTS EXCEPT METRO (actual average)					209	252	232	208	191	171	192	185	169
ALL PLANTS (actual average)					210	252	232	209	191	174	193	186	169

*Plant phased out during previous year.

TABLE A-8
INFLUENT TSS DATA 1971-1983

Treatment Plant	Annual Average Values, TSS (mg/l) 1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
ANOKA	240	300	267	302	234	195	176	164	132	141	152	154	165
APPLE VALLEY	258	329	320	378	300	229	271	274	240	*--	---	---	---
BAYPORT	220	269	200	326	317	227	147	144	169	191	165	150	178
BLUE LAKE	---	---	244	364	347	361	324	317	270	244	241	230	224
CAHSKA	212	190	184	194	226	292	180	180	195	167	189	167	127
COTTAGE GROVE	350	318	274	294	241	185	220	200	163	152	187	173	160
EMPIRE	---	---	---	---	---	---	---	---	226	190	251	212	250
FARMINGTON	259	296	225	361	250	223	235	189	147	*--	---	---	---
HASTINGS	333	333	225	198	199	207	184	252	223	224	235	233	187
LAKEVILLE	174	212	327	849	997	876	759	388	365	*--	---	---	---
LONG LAKE	206	294	288	446	187	261	274	195	210	196	*--	---	---
MAPLE PLAIN	63	62	118	193	83	134	182	228	233	209	179	199	171
MEDINA	138	125	133	141	214	365	385	487	205	151	132	127	208
METROPOLITAN	313	318	308	317	316	332	288	231	222	237	230	241	192
NEWPORT	250	248	218	248	181	*--	---	---	---	---	---	---	---
ORONO	136	167	167	235	168	146	176	167	140	154	*--	---	---
PRIOR LAKE	255	183	193	123	180	139	83	149	*--	---	---	---	---
ROSEMOUNT	---	---	50	230	258	230	226	235	202	236	221	239	236
ST. PAUL PARK	318	308	276	270	241	*--	---	---	---	---	---	---	---
SAVAGE	267	700	280	269	278	241	249	265	190	565	234	170	195
SENECA	---	242	243	319	282	225	209	240	204	186	211	203	211
STILLWATER	115	120	130	193	210	140	118	158	119	127	159	139	137
WACONIA	---	---	---	---	187	381	270	*--	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)					292	264	243	255	219	204	218	206	209
ALL PLANTS (weighted average)					313	323	281	235	221	232	228	235	195
ALL PLANTS EXCEPT METRO (actual average)					266	266	246	235	202	209	197	184	188
ALL PLANTS (actual average)					268	269	248	235	203	211	199	188	189

*Plant phased out during previous year.

TABLE A-9

STATISTICAL ANALYSES OF BIOCHEMICAL OXYGEN DEMAND DATA
FOR PLANTS IN OPERATION DURING 1983

TREATMENT PLANT EFFLUENT STATISTICAL DATA

BIOCHEMICAL OXYGEN DEMAND, mg/l*

Treatment Plant	50% of Time							75% of Time							90% of Time						
	1977	1978	1979	1980	1981	1982**	1983**	1977	1978	1979	1980	1981	1982**	1983**	1977	1978	1979	1980	1981	1982**	1983**
ANOKA	7	11	12	12	15	10	10	10	16	16	17	20	14	14	13	22	22	22	26	19	17
BAYPORT	7	6	6	5	7	7	6	10	10	8	8	8	9	7	16	14	11	11	10	13	8
BLUE LAKE	10	11	7	8	9	10	8	15	14	10	10	13	13	11	20	22	15	14	19	16	13
CHASKA	33	61	93	14	14	12	9	58	100	160	22	24	16	13	98	140	210	38	34	22	17
COTTAGE GROVE	31	28	12	10	9	8	8	44	38	20	14	15	13	11	69	52	50	18	20	18	14
EMPIRE	--	--	4	2	3	2	2	--	--	10	2	4	3	3	--	--	28	5	4	4	4
HASTINGS	13	16	16	17	18	17	14	19	22	22	22	24	27	20	29	28	28	31	33	37	26
MAPLE PLAIN	8	7	16	19	10	11	8	17	14	23	29	15	18	12	26	22	33	37	21	26	17
METROPOLITAN	40	40	36	20	14	10	8	51	53	53	29	24	15	13	62	64	71	44	36	22	19
ROSEMOUNT	12	11	10	11	12	15	13	18	15	15	14	15	18	18	23	22	20	20	19	24	29
SAVAGE	20	26	26	5	9	6	7	30	34	41	7	12	9	9	42	42	59	9	15	20	10
SENECA	14	18	14	14	19	17	13	20	25	18	20	22	21	17	28	39	27	25	30	25	24
STILLWATER	8	8	8	12	14	10	9	14	14	12	14	24	12	12	24	18	21	19	33	14	18

* The data shows that for the percent of time shown, the effluent concentration was less than or equal to the tabulated values.

**1982 and 1983 data represents CBOD values.

TABLE A-10

STATISTICAL ANALYSES OF TOTAL SUSPENDED SOLIDS EFFLUENT DATA
FOR PLANTS IN OPERATION DURING 1983

TREATMENT PLANT EFFLUENT STATISTICAL DATA

TOTAL SUSPENDED SOLIDS, mg/l*

Treatment Plant	50% of Time							75% of Time							90% of Time						
	1977	1978	1979	1980	1981	1982	1983	1977	1978	1979	1980	1981	1982	1983	1977	1978	1979	1980	1981	1982	1983
ANOKA	12	13	10	10	12	7	9	16	20	15	15	18	10	12	21	28	21	20	24	15	16
BAYPORT	10	8	7	7	7	7	6	12	10	10	9	9	9	7	15	12	13	11	10	12	9
BLUE LAKE	11	13	11	8	6	6	7	17	28	14	11	7	8	9	20	22	17	15	9	10	11
CHASKA	36	58	43	11	13	10	8	71	88	83	15	16	14	14	121	120	130	18	22	19	22
COTTAGE GROVE	12	17	10	7	5	6	10	22	28	16	13	8	10	14	44	51	28	22	14	14	18
EMPIRE	--	--	3	1	1	1	1	--	--	5	3	1	1	1	--	--	11	4	2	2	2
HASTINGS	16	18	17	22	19	28	22	24	26	24	30	28	38	32	29	33	31	38	36	48	41
MAPLE PLAIN	7	6	10	11	6	6	6	24	12	18	15	8	10	12	42	40	30	24	16	16	16
METROPOLITAN	40	37	43	15	10	7	7	53	55	85	33	24	12	11	88	78	137	60	47	21	17
ROSEMOUNT	2	3	2	2	1	1	1	3	5	3	3	2	2	2	5	7	5	3	3	4	4
SAVAGE	10	14	10	4	5	2	2	16	20	18	7	12	5	3	29	25	28	15	17	11	4
SENECA	14	14	13	15	19	19	15	18	19	24	19	23	23	23	22	27	32	23	28	26	29
STILLWATER	7	10	10	9	8	8	10	10	14	12	14	12	10	14	13	18	16	21	15	12	20

*The data shows that for the percent of time shown, the effluent concentration was less than or equal to the tabulated values.

TABLE A-11

1983 METROPOLITAN PLANT SLUDGE QUANTITY

PARAMETER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL	AVERAGE
SLUDGE PRODUCTION														
Wet Tons														
Roll Press Cake	10,073	8,068	10,940	10,506	12,426	12,489	11,474	10,096	7,369	11,556	14,260	11,159	130,416	10,868
Filter Press Cake	5,586	3,850	4,804	5,462	7,634	5,137	5,006	8,111	6,288	4,640	3,518	4,341	64,377	5,365
Vacuum Filter Cake	7,802	7,836	6,066	1,792	990	659	166	0	0	0	530	0	25,841	2,153
Total	23,461	19,754	21,810	17,760	21,050	18,285	16,646	18,207	13,657	16,196	18,308	15,500	220,634	18,386
Dry Tons (Sludge Solids)														
Roll Press Cake	2,970	2,597	3,500	3,401	4,118	4,232	3,713	3,150	2,298	3,800	4,452	3,649	41,880	3,490
Filter Press Cake	2,662	1,834	2,287	2,296	3,416	2,248	2,043	3,307	2,673	2,050	1,166	1,440	27,422	2,285
Vacuum Filter Cake	1,347	1,490	1,133	322	178	119	30	0	0	0	95	0	4,714	393
Total	6,979	5,921	6,920	6,019	7,712	6,599	5,786	6,457	4,971	5,850	5,713	5,089	74,016	6,168
SLUDGE INCINERATED														
Wet Tons														
Roll Press Cake	0	0	1,943	6,226	7,655	9,547	9,937	6,347	6,665	10,690	11,495	9,273	79,778	6,648
Filter Press Cake	0	0	0	152	142	1,131	483	785	4,963	2,171	3,518	3,384	16,729	1,394
Total	0	0	1,943	6,378	7,797	10,678	10,420	7,132	11,628	12,861	15,013	12,657	96,507	8,042
Dry Tons (Sludge Solids)														
Roll Press Cake	0	0	622	2,015	2,537	3,235	3,216	1,980	2,078	3,516	3,589	3,032	25,820	2,152
Filter Press Cake	0	0	0	64	64	495	197	320	2,109	959	1,166	1,122	6,496	541
Total	0	0	622	2,079	2,601	3,730	3,413	2,300	4,187	4,475	4,755	4,154	32,316	2,693
SLUDGE TO LAND														
Wet Tons														
Roll Press Cake	10,073	8,068	8,997	4,280	4,771	2,942	1,536	3,749	704	866	2,765	1,886	50,637	4,220
Filter Press Cake	5,586	3,850	4,804	5,310	7,492	4,006	4,523	7,326	1,325	2,469	0	957	47,648	3,971
Vacuum Filter Cake	7,802	7,836	6,066	1,792	990	659	166	0	0	0	530	0	25,841	2,153
Total	23,461	19,754	19,867	11,382	13,253	7,607	6,225	11,075	2,029	3,335	3,295	2,843	124,126	10,344
Dry Tons (Sludge Solids)														
Roll Press Cake	2,970	2,597	2,878	1,386	1,581	997	497	1,170	220	284	863	617	16,060	1,338
Filter Press Cake	2,662	1,834	2,287	2,232	3,352	1,753	1,846	2,987	564	1,091	0	318	20,926	1,744
Vacuum Filter Cake	1,347	1,490	1,133	322	178	119	30	0	0	0	95	0	4,714	393
Total	6,979	5,921	6,298	3,940	5,111	2,869	2,373	4,157	784	1,375	958	935	41,700	3,475

TABLE A-12

1983 METRO PLANT SLUDGE QUALITY

	Solids %	Volatiles %	KJN %	NH3-N %	P %	mg/kg (dry weight basis) Cd	Cu	Ni	Pb	Zn	Cr	K	Hg	PCB
F & I No. 2 Vacuum Filter Cake														
January	25.1	63.3	5.1	0.08	1.8	31	1,053	373	181	1,134	710	984	1.7	0.8
February	27.7	42.2	2.6	0.02	1.7	38	800	197	187	947	689	771	1.1	0.5
March	27.3	43.5	1.5	0.06	0.8	39	891	200	227	994	943	884	1.4	0.6
April	24.7	41.4	2.8	0.05	2.0	53	824	157	209	1,220	961	1,006	1.8	0.8
May	32.4	28.6	1.9	0.01	1.0	47	961	302	215	1,047	955	926	1.4	0.6
June	31.2	30.6	2.1	0.06	1.2	56	1,110	475	213	1,063	908	751	1.6	1.2
July	----	----	---	----	---	--	-----	---	---	-----	-----	-----	---	---
August	----	----	---	----	---	--	-----	---	---	-----	-----	-----	---	---
September	----	----	---	----	---	--	-----	---	---	-----	-----	-----	---	---
October	----	----	---	----	---	--	-----	---	---	-----	-----	-----	---	---
November	----	----	---	----	---	--	-----	---	---	-----	-----	-----	---	---
December	----	----	---	----	---	--	-----	---	---	-----	-----	-----	---	---
Average	27.4	44.1	2.7	0.05	1.4	41	929	271	204	1,050	840	885	1.4	0.8
Roll Press Cake														
January	29.1	76.1	4.2	0.08	1.2	27	818	89	237	1,399	440	1,199	3.8	0.9
February	31.3	74.4	3.7	0.28	1.9	35	1,013	147	313	1,214	530	1,153	0.3	1.2
March	28.3	71.6	2.4	0.39	1.0	25	777	159	208	901	830	1,039	1.4	0.8
April	32.6	72.5	2.5	0.07	0.9	31	813	117	270	1,052	871	933	1.8	0.4
May	35.4	69.7	2.8	0.03	1.2	39	686	136	260	1,260	655	1,105	3.4	0.5
June	35.9	62.3	2.6	0.30	1.3	39	836	159	337	1,432	649	1,485	3.3	0.6
July	31.0	70.2	3.1	0.19	1.1	32	1,013	168	232	1,539	635	1,458	2.2	0.7
August	34.4	67.6	3.1	0.15	1.1	38	980	163	241	1,453	951	1,134	0.7	1.2
September	26.9	68.1	3.8	0.07	1.2	41	1,126	186	264	2,262	1,554	1,219	3.3	1.6
October	31.7	68.1	2.5	0.10	1.0	32	953	158	252	1,552	1,833	1,199	1.5	1.4
November	33.5	69.7	3.1	0.08	1.9	72	1,493	197	322	2,275	1,137	1,045	---	---
December	33.6	73.6	3.2	0.15	1.7	74	1,414	229	256	1,815	1,042	1,143	---	---
Average	32.0	70.3	3.1	0.16	1.3	40	993	159	266	1,546	927	1,176	2.2	0.9
Press Cake														
January	47.7	70.5	4.0	0.09	3.3	82	1,667	167	338	2,623	1,580	924	0.4	1.7
February	47.6	70.2	4.6	0.07	3.4	100	1,849	233	378	2,398	1,629	967	2.9	1.1
March	47.6	64.6	3.8	0.08	2.7	77	1,541	213	402	2,041	1,710	1,081	1.7	2.6
April	44.1	64.0	3.2	0.05	2.7	105	1,750	241	417	2,707	1,936	1,302	2.9	1.2
May	44.6	61.6	3.2	0.05	3.1	121	1,719	253	399	2,415	1,809	1,254	5.7	1.6
June	43.8	60.9	3.0	0.13	3.3	141	1,861	275	408	2,464	1,550	1,084	2.9	1.8
July	42.0	60.6	3.7	0.11	3.3	142	1,898	308	454	2,951	1,353	1,063	3.1	1.5
August	43.2	61.5	3.2	0.08	2.8	98	1,899	289	402	2,902	1,568	982	0.8	1.3
September	42.5	61.5	3.0	0.07	2.8	102	2,037	315	445	3,528	2,122	1,058	3.3	2.4
October	43.8	64.5	2.8	0.10	2.6	96	1,817	296	375	2,845	1,885	1,129	0.4	1.9
November	36.4	67.1	5.8	0.14	2.9	127	2,136	224	427	2,933	1,564	1,339	---	---
December	37.2	68.1	3.7	0.13	2.4	247	1,456	201	262	2,087	1,254	1,093	---	---
Average	43.5	64.5	3.5	0.08	2.9	112	1,737	247	376	2,561	1,609	1,091	2.4	1.7
Load Out Cake														
January	24.0	58.8	3.7	0.05	1.2	29	825	205	168	1,063	554	1,075	1.0	0.6
February	26.9	49.8	4.1	0.04	1.6	33	712	136	192	923	540	826	1.8	0.5
March	27.5	48.7	3.5	0.05	1.4	34	774	121	225	1,004	656	1,000	1.3	0.7
April	26.0	56.6	2.4	0.04	1.2	44	754	135	207	1,160	897	1,023	1.1	0.6
May	28.4	60.8	2.5	0.04	0.9	39	772	143	205	1,063	714	1,025	1.5	0.5
June	31.2	52.4	2.5	0.08	1.3	64	1,107	243	266	1,306	939	906	2.6	0.5
July	28.1	63.7	2.7	0.04	0.8	38	963	152	264	1,473	628	1,304	2.4	0.5
August	29.0	67.0	3.0	0.06	0.9	36	809	145	177	1,179	642	792	2.0	0.4
September	28.0	62.7	2.9	0.05	1.2	35	963	192	217	1,565	1,993	1,094	1.1	---
October	35.5	63.6	2.4	0.06	1.3	51	1,225	218	294	1,867	1,561	1,149	1.3	0.7
November	24.6	64.8	2.4	0.12	1.7	51	901	155	252	1,395	1,569	1,266	---	0.8
December	26.2	65.6	3.0	0.10	1.0	64	985	187	206	1,366	715	1,199	---	1.2
Average	27.5	57.1	3.1	0.06	1.2	41	875	167	219	1,220	898	1,024	1.6	0.6

TABLE A-13

1983 OUT-PLANT SLUDGE QUANTITY

	TREATMENT PLANT	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL GALLONS	AVERAGE GALLONS
1	Anoka														
	Gallons x 1000	293.6	336.0	339.2	298.8	334.2	358.2	316.8	220.8	195.4	124.8	310.4	201.6	3330.0	277.5
	Dry Tons	36.4	29.1	20.5	24.2	28.2	31.7	32.1	17.9	16.1	17.1	45.6	21.5	320.4	26.7
2	Bayport														
	Gallons x 1000	124.6	112.0	142.0	112.0	134.4	139.2	136.4	144.4	127.2	131.2	71.8	86.2	1461.0	121.8
	Dry Tons	10.4	9.7	12.8	9.1	10.4	10.9	10.1	11.6	10.6	10.5	6.7	8.0	120.8	10.1
3	Blue Lake														
	Gallons x 1000	3155.0	3145.0	3400.0	3500.0	3985.0	3460.0	3535.0	3698.0	3829.8	3864.5	2908.1	3901.1	42,291.0	3524.0
	Dry Tons	597.3	622.9	803.9	700.6	756.1	727.2	760.6	718.6	728.2	694.0	513.0	697.9	8320.3	693.4
4	Chaska														
	Gallons x 1000	190.0	165.0	165.0	55.0	210.0	215.0	205.0	218.0	259.6	160.4	195.8	152.4	2191.0	182.6
	Dry Tons	14.2	9.5	7.7	3.1	14.7	13.2	17.7	17.0	15.7	10.8	13.1	9.8	146.5	12.2
5	Cottage Grove														
	Gallons x 1000	179.6	227.0	264.0	161.6	233.6	92.8	58.6	163.2	140.8	262.4	313.7	188.8	2286.0	190.5
	Dry Tons	13.0	12.7	14.8	9.3	23.9	11.3	7.6	18.6	16.0	19.8	17.3	11.5	175.7	14.6
6	Hastings														
	Gallons x 1000	220.8	256.0	328.4	355.2	287.8	137.6	192.0	185.6	140.8	246.4	287.6	307.2	2946.0	245.5
	Dry Tons	26.3	29.8	31.5	31.5	37.8	17.7	26.0	26.3	17.6	32.0	33.6	28.3	338.4	28.2
7	Maple Plain														
	Gallons x 1000	3.0	15.0	-	-	16.0	20.0	-	12.0	-	-	-	-	66.0	5.5
	Dry Tons	0.5	3.4	-	-	1.4	3.3	-	2.1	-	-	-	-	10.7	0.9
8	Rosemount														
	Gallons x 1000	127.6	145.5	165.0	136.6	151.0	136.5	133.5	153.0	174.1	144.8	183.0	194.7	1845.0	153.8
	Dry Tons	55.1	57.1	63.2	56.4	59.9	58.0	54.4	57.4	66.2	58.8	72.8	71.9	731.4	61.0
9	Savage														
	Gallons x 1000	40.0	-	30.0	24.0	24.0	84.0	96.0	42.0	72.8	60.8	12.0	60.0	564.0	47.0
	Dry Tons	6.6	-	4.9	4.0	4.0	13.8	15.8	5.4	13.6	10.6	2.0	9.9	90.6	7.6
10	Stillwater														
	Gallons x 1000	406.4	288.0	331.0	180.8	267.2	432.8	354.6	395.4	448.8	400.6	266.6	265.2	4037.0	336.4
	Dry Tons	46.9	29.1	30.2	19.4	36.4	60.6	49.4	46.2	48.5	46.4	29.8	37.0	479.9	40.0

TABLE A-14

1983 SENECA PLANT SLUDGE QUANTITY

QUANTITY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL	AVERAGE
Wet Tons	3,904	3,600	4,225	2,990	5,080	5,360	4,835	5,400	4,835	4,745	3,395	4,825	53,194	4,433
Dry Tons	955	810	880	625	1,210	1,195	1,085	1,175	1,100	975	730	1,070	11,810	984

TABLE A-15

1983 SENECA PLANT SLUDGE QUALITY

						mg/kg (dry weight basis)								
	Solids %	Volatiles %	KJN %	NH3-N %	P %	Cd	Cu	Ni	Pb	Zn	Cr	K	Hg	PCB
Seneca Filter Cake														
January	24.7	46.8	4.18	0.07	1.81	13.5	834	264	168	437	442	862	0.5	0.25
February	22.1	46.3	5.73	0.06	2.80	17.7	902	206	157	661	414	966	1.1	----
March	20.9	44.8	4.12	0.07	1.78	15.5	445	66	168	403	346	1,008	1.3	0.61
April	20.3	42.6	2.92	0.07	1.35	14.6	393	153	135	320	254	1,163	1.3	0.90
May	24.0	42.6	2.58	0.07	1.11	9.0	1,052	262	160	390	341	808	1.1	1.2
June	21.4	51.8	3.20	0.14	1.31	10.0	930	103	189	453	391	950	1.9	----
July	22.3	51.9	3.33	0.09	1.25	9.5	1,286	289	218	473	445	936	4.1	----
August	22.4	51.8	2.94	0.06	1.35	11.0	1,362	292	208	620	514	785	3.4	----
September	22.3	46.3	2.83	0.06	1.13	12.4	1,955	418	202	552	417	769	2.2	1.2
October	21.8	45.7	2.68	0.07	1.21	13.8	2,282	526	277	587	739	915	2.8	----
November	22.3	42.5	3.53	0.09	1.13	12.5	1,965	371	220	504	520	928	0.6	----
December	23.6	40.5	2.78	0.09	0.99	9.0	1,648	225	219	459	349	888	1.4	----
Average	22.3	46.3	3.40	0.08	1.45	12.3	1,185	253	190	482	417	920	1.9	0.83

DATE	ISSUED TO