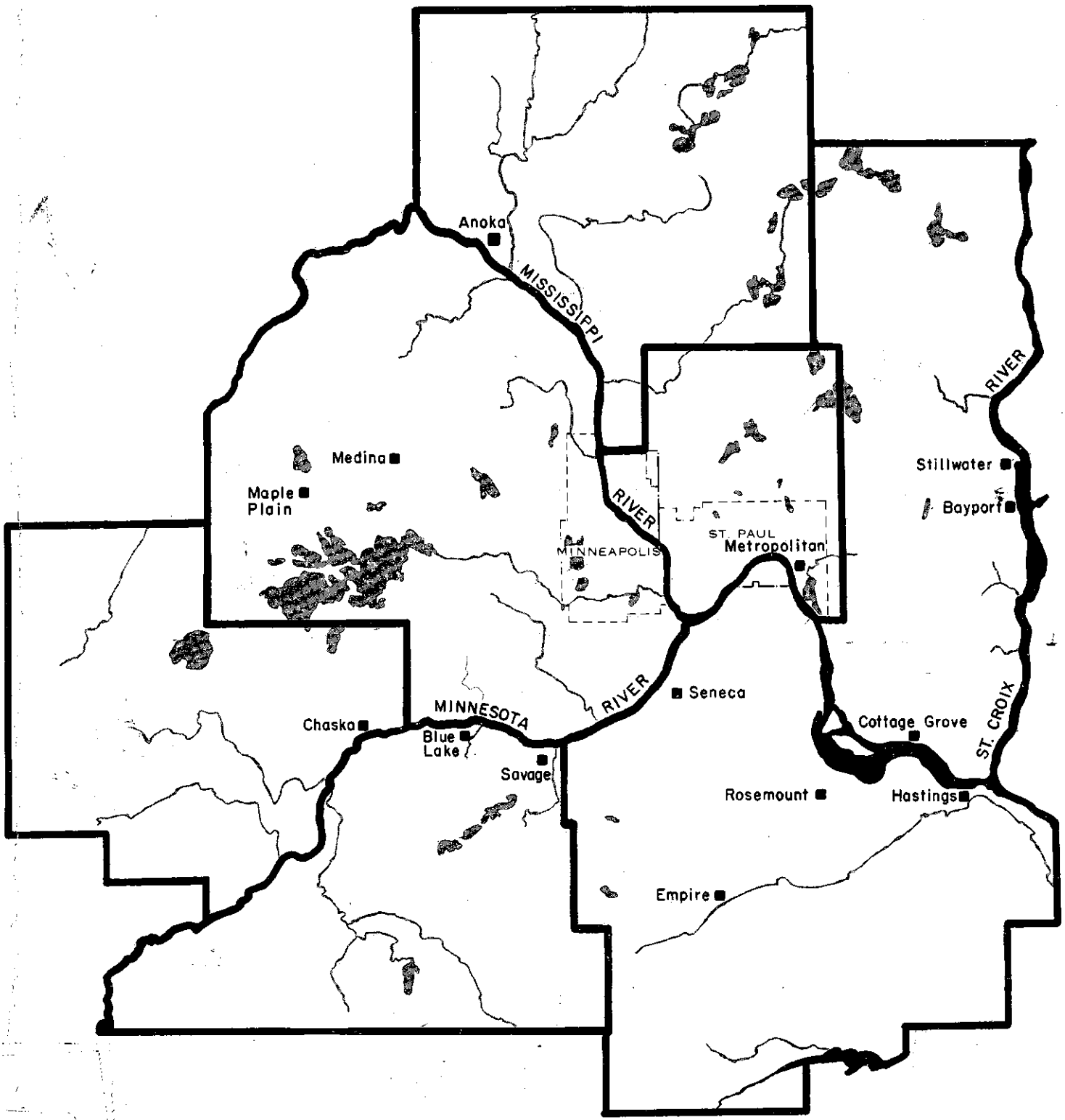
1985 Treatment Plant Report

VOLUME II



METROPOLITAN WASTE CONTROL COMMISSION

1985 ANNUAL WASTEWATER TREATMENT PLANT REPORT VOLUME II

prepared by the

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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
CL_2	Chlorine
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
Fe	Iron
$FeCl_3$	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. TBOD refers to the carbonaceous and nitrogeneous BOD, whereas CBOD is carbonaceous BOD only.

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.

Cyanide and Heavy Metals.

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

Phenol is an organic compound monitored because of its adverse taste and odor it imparts to water.

Polychlorinated Biphenyls (PCB) refers to a group of organic compounds monitored because of their toxicity in the environment if they are not removed in the treatment process.

1.0 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 around Minneapolis and St. Paul. The accomplishment of these responsibilities required that the Commission acquire, construct, operate, and maintain all interceptor sewers and treatment plants necessary for the collection, treatment, and disposal of wastewater in the area.

Throughout each year, the performance of each plant is monitored, recorded, and reported to regulatory agencies, Commission administrators, and Commission program managers to indicate the degree of compliance with regulatory discharge standards. At the end of each year, the performance of each treatment plant is summarized; this report is a summary of treatment plant performance during 1985.

This report is published in two volumes. Volume I is a summary analysis of plant performance with respect to Permit limitations. Volume II is a detailed data compilation of the performance indicators for each plant, along with descriptive information about each plant's facilities.

This document is Volume II of the 1985 report. Following this introduction, the report contains three major sections:

1. Plant sludge management
2. Individual reports on each plant's operation
3. Various data compilations relating to plant process areas

2.0 SLUDGE MANAGEMENT

Each of the Commission's treatment plants produce sludge as a result of wastewater treatment. Sludge treatment may include thickening, stabilization, conditioning, and dewatering. Final disposal of sludge is accomplished either by landspreading or incineration and ash landfilling.

2.1 Sludge Processing

Table 2-1 is a summary of sludge processing and disposal methods utilized at Commission Plants. As shown in Table 2-1, 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, Hastings 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.

Roll presses and filter presses are used for dewatering sludge at the Metropolitan Plant. The roll 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 filter presses rely on thermal conditioning, i.e. no conditioning chemicals are required. 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 1985, the Metropolitan Plant new sludge incineration facilities were in the operational optimization stage. Only a small fraction (5%) of the dewatering sludge generated during the year was landspread. Lime was added to this sludge for stabilization prior to landspreading.

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 conditioned 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 can be used at the Seneca Plant in combination with the belt press, but were not operated during 1985.

TABLE 2-1

SUMMARY OF SLUDGE PROCESSING AND DISPOSAL METHODS
1985

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	(1)(2)(3)(4)
Cottage Grove	Gravity	Anaerobic Digestion	None	None	(1) (4)
Empire	Gravity	Anaerobic Digestion	Polymer	Centrifuging	(4)
Hastings	Gravity	Anaerobic Digestion	None	None	(1) (4)
Maple Plain	In Primaries	Anaerobic Digestion	None	None	(1)
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	(1)(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.

2.2 Sludge Disposal

During 1985, 88,336 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 2-2.

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 disposal.

Digested sludge from the Chaska Plant is transported to the Blue Lake, Seneca or Metropolitan 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, Chaska, Cottage Grove, Stillwater, and Savage Plants is also landspread. Table 2-3 lists the annual volume 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.

2.3 Sludge Quality

During 1985, 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 2-4. 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.

2.4 Landspreading

As shown in Tables 2-2 and 2-3, 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 converted to a backup sludge management system in 1985.

TABLE 2-2

1985 SUMMARY OF SLUDGE GENERATED

TREATMENT PLANT	ANNUAL WASTEWATER FLOW Daily Average MGD	ANNUAL WASTEWATER FLOW Annual Total MG	ANNUAL SLUDGE PRODUCTION MG	ANNUAL SLUDGE PRODUCTION % SOLIDS	ANNUAL SLUDGE PRODUCTION DRY TONS	SLUDGE DISPOSAL METHOD
ANOKA	2.47	903	4.671	1.72	335	(1)
BAYPORT	0.53	193	1.262	2.03	107	(1)
BLUE LAKE*	19.3	7,064	36.922	4.05	6,235	(1) (2)
CHASKA	0.91	332	3.211	2.13	286	(1)(2)(3)(4)
COTTAGE GROVE	1.36	496	2.928	1.69	206	(1) (4)
EMPIRE	5.43	1,987	-----	----	771	(4)
HASTINGS	1.49	544	2.479	3.89	402	(1) (4)
MAPLE PLAIN	0.42	153	0.053	4.00	9	(1)
METROPOLITAN*	222	81,030	-----	----	66,437	(4) (5)
ROSEMOUNT	0.38	139	2.051	9.72	831	(1)
SAVAGE	0.64	234	0.673	2.86	80	(1) (2) (4)
SENECA*	17.5	6,388	-----	23.4	12,209	(5)
STILLWATER	2.74	1,000	3.960	2.59	428	(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.

TABLE 2-3

SUMMARY OF 1985 SLUDGE HAULING

Treatment Plant	Interim Disposal Location	Final Disposal Location	Amount Hauled During 1985 (MG)
Anoka	Coon Rapids Interceptor	Metropolitan Plant	2.284
	Coon Rapids Lift Station	Metropolitan Plant	2.387
Bayport	South St. Paul Interceptor	Metropolitan Plant	1.262
Blue Lake	Seneca Plant	Seneca Plant	28.447
	3rd and Commercial Interceptor	Metropolitan Plant	8.475
Chaska	Seneca Plant	Seneca Plant	1.873
	Farm Land	Landspread	0.461
	3rd & Commercial Interceptor	Metropolitan Plant	0.062
	Blue Lake Plant	Seneca Plant or Metropolitan Plant	0.815
Cottage Grove	U of M Experimental Ag. Station	Landspread	0.144
	Farm Land	Landspread	0.732
	So. St. Paul Interceptor	Metropolitan Plant	2.051
Empire	U of M Experimental Ag. Station	Landspread	1.652
	On-Site Farm Land	Landspread	630*
Hastings	U of M Experimental Ag. Station	Landspread	0.112
	Farm Land	Landspread	0.458
	South St. Paul Interceptor	Metropolitan Plant	1.327
	3rd & Commercial Interceptor	Metropolitan Plant	0.582
Maple Plain	Plymouth Interceptor	Metropolitan Plant	0.053
Rosemount	3rd and Commerical Interceptor	Metropolitan Plant	2.051
Savage	Farm Land	Landspread	0.032
	3rd and Commercial Interceptor	Metropolitan Plant	0.288
	Seneca Plant	Seneca Plant	0.353
Stillwater	South St. Paul Interceptor	Metropolitan Plant	2.973
	Farm Land	Landspread	0.987

* Dry tons of centrifuge cake or liquid landspreading at on-site farmland. Gallonage figures not available.

TABLE 2-4

1985 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 %	NO_3-N %	PCB mg/kg
Anoka	Ave.	1.81	64.3	1,910	190	589	1,571	9.0	363	8.66	7.7	5.91	10.27	0.53	2.55	0.01	0.84
	Range	1.49-	59.5-	1,363-	142-	253-	929-	5.1-	170-	5.49-	7.5-8.1	3.76-	7.52-	0.34-	2.26-	<0.01-	0.57-
Anaerobic digested		2.82	68.7	2,475	255	927	2,369	11.9	688	11.54		8.06	12.56	0.71	2.91	0.03	1.10
Bayport	Avg.	2.06	62.4	309	22	127	751	5.4	87	4.42	7.0	0.20	3.91	0.32	2.90	0.01	0.29
	Range	1.49-	58.1-	168-	15-	73-	378-	3.8-	31-	1.15-	6.8-7.2	0.10-	1.55-	0.18-	1.43-	<0.01-	0.18-
Aerobic digested		2.62	66.7	520	33	220	1,113	8.6	207	12.44		0.40	5.14	0.40	3.67	0.03	0.40
Chaska	Avg.	1.85	65.7	488	53	121	815	7.2	424	5.50	6.8	0.17	4.78	0.91	2.55	0.07	0.64
	Range	1.18-	57.4-	383-	28-	72-	492-	4.4-	194-	2.51-	6.2-7.3	0.10-	3.15-	0.60-	1.61-	<0.01-	0.48-
Aerobic digested		3.19	75.0	593	138	182	1,081	11.6	852	10.98		0.32	6.25	1.16	3.09	0.77	0.80
Cottage Grove	Avg.	1.58	66.7	505	75	148	973	7.1	36	5.66	7.6	5.68	10.25	0.59	2.58	0.02	0.91
	Range	1.02-	62.5-	295-	48-	72-	645-	4.7-	23-	3.12-	5.8-8.3	0.85-	6.02-	0.32-	1.45-	<0.01-	0.90-
Anaerobic digested		2.59	77.7	608	93	192	1,142	9.0	49	12.80		8.34	14.46	0.95	3.43	0.05	0.92
Empire																	
Centrifuge Cake	Avg.	12.3	63.5	789	29	135	990	7.8	112	2.3	7.9	1.61	5.75	0.24	2.62	0.01	1.60
Digester Sludge	Avg.	2.0	64.1	753	29	133	960	6.1	103	4.8	5.7	6.86	11.49	1.09	3.38	0.01	0.55
Hastings	Avg.	3.44	75.7	466	22	106	1,682	6.8	2,796	2.11	6.5	1.48	5.54	0.33	1.57	0.01	0.86
	Range	2.48-	61.4-	307-	12-	48-	321-	2.1-	1,360-	1.44-	5.3-7.9	0.41-	3.15-	0.26-	0.97-	<0.01-	0.83-
Anaerobic digested		5.06	82.6	769	81	267	10,120	39.8	6,257	3.90		2.91	7.75	0.45	3.07	0.01	0.90
Metropolitan																	
Roll Press Cake	Avg.	34.8	69.8	1,157	179	270	1,799	70	778	2.5	-------	0.11	3.19	0.12	1.48	----	1.2
Rosemount	Avg.	8.92	26.7	122	28	154	198	5.3	44	0.44	8.9	0.12	1.01	0.05	0.69	<0.01	0.13
	Range	6.29-	24.4-	103-	23-	93-	144-	3.8-	25-	0.28-	6.6-9.8	0.03-	0.72-	0.04-	0.59-	<0.01-	----
Chemically thickened		10.60	28.8	141	32	208	237	6.4	69	0.72		0.16	1.53	0.07	0.92	0.02	
Savage	Avg.	2.80	43.8	936	73	2,666	6,721	182.6	144	59.82	7.5	3.12	4.20	0.65	2.27	0.01	1.80
	Range	0.85-	40.5-	735-	51-	1,346-	3,757-	121.6-	118-	44.96-	7.3-7.7	1.44-	2.85-	0.05-	1.57-	<0.01-	----
Anaerobic digested		4.27	47.1	1,400	141	3,770	10,118	270.6	212	84.71		6.27	5.82	1.34	3.59	0.02	
Seneca																	
Vacuum Filter Cake	Avg.	22.5	43.8	1,197	879	203	548	11.1	569	1.4	-------	0.07	3.15	0.14	1.10	----	1.0
Belt Filter PC	Avg.	22.1	76.5	1,663	50	354	1,034	20.3	167	3.0	-------	0.63	5.96	0.26	1.88	----	1.2
Stillwater	Avg.	2.71	53.6	630	27	351	1,398	21.8	88	8.80	7.6	2.34	6.14	0.31	3.55	0.01	0.53
	Range	1.78-	49.8-	523-	19-	89-	703-	3.3-	64-	2.16-	7.2-8.0	1.34-	5.29-	0.20-	2.28-	<0.01-	0.46-
Anaerobic digested		3.60	54.9	1,028	61	2,971	6,965	191.7	202	57.51		4.15	9.16	0.61	4.94	0.01	0.60

(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 lime and ferric chloride and removing water with a vacuum filter. Dewatered press cake is produced by either thermal or polymer conditioning of the sludge followed by dewatering on filter presses or roll presses. Roll press cake is stabilized with lime. Both lime and thermal 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 2-5 presents a summary of sludge quantities disposed of by the landpreading program since 1978.

TABLE 2-5

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	11,100	195,700
1983	134,300	14,900	149,200
1984	35,700	500	36,200
1985	11,900	------	11,900

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 1985, approximately 12,000 wet tons of dewatered sludge were applied to permitted sites in four area counties. The dewatered sludge was applied to land used for crop production. It is anticipated that the dewatered sludge available for land application will continue to be a minimum quantity to maintain land application as a viable backup method for incineration.

In addition to landspreading of dewatered sludge from the Metropolitan Plant, approximately three million gallons of liquid digested sludge generated at the Chaska, Cottage Grove, Hastings, Savage, and Stillwater Plants were applied to farm lands during 1985. Approximately 1.6 million gallons of liquid digested sludge generated at the Empire Plant was applied to agricultural land at the University of Minnesota Agricultural Experiment Station. Approximately 600 dry tons of digested dewatered sludge from the Empire Plant were applied to adjacent farm land owned by the Commission.

6.0 INDIVIDUAL TREATMENT PLANT REPORTS

This section contains the individual treatment plant reports for 1985. For each plant report there is an introduction briefly describing the background of the plant, its design basis, 1985 performance and activities, and a statement regarding the future of the plant. The introduction is followed by a listing of 1983 through 1985 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 1985 and annual average flows for 1971-1985 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 1985 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 1985 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 1971-1985 annual averages (arithmetic average of monthly geometric means) shown on one graph and the 1985 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 1974-1984 are compared to data obtained during 1985.

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.

In 1985, interim improvements were implemented to provide additional raw sewage pumping and activated sludge aeration capacity.

The plant is presently operating at about 100 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 the Champlin Lift Station expansion. The plant is subject to secondary treatment limits.

Performance

Plant flow averaged 2.47 mgd in 1985, down slightly from 2.49 mgd in 1984. Average plant effluent quality was 14 mg/L BOD and 13 mg/L TSS. Plant performance was excellent throughout the year, with one NPDES Permit violation of the weekly fecal coliform limit. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/L

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	10	10	12	12	14	14	16	17	19	17	21	23
TSS	7	9	10	11	10	12	13	16	15	16	16	21

Future

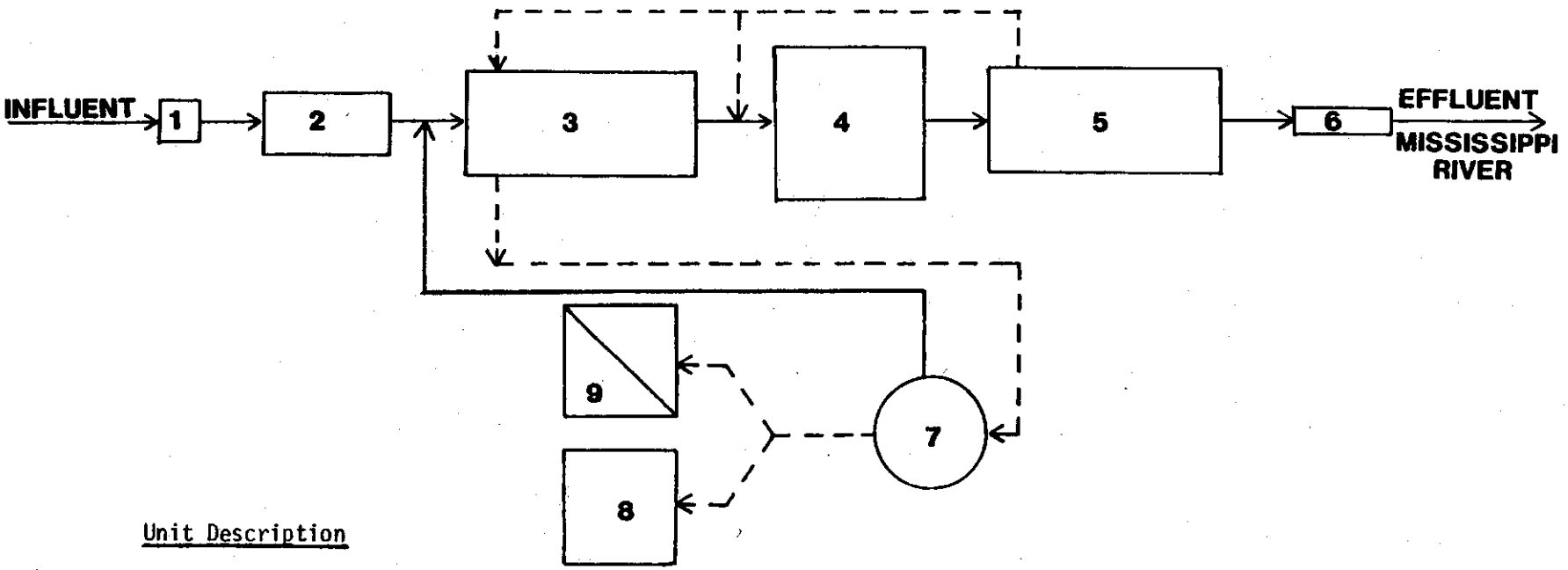
The plant will continue to serve Service Area No. 3 until about 1989, when it is scheduled for phase-out, with flow transported to the Metropolitan Plant. Plant phase-out is contingent upon completion of the Minneapolis East Interceptor to provide downstream interceptor capacity.

ANOKA PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	2.33	2.49	2.47	2.48	2.74	2.67
BOD Loading, lb/day	4,000	4,010	4,680	4,200	4,900	5,210
TSS Loading, lb/day	3,400	3,300	3,620	4,100	4,380	6,800
COD Loading, lb/day	7,800	8,350	8,700	8,700	10,170	10,100
Sludge Production, lb/day	1,800	1,970	1,840	3,000	3,130	2,340
Grit Removal						
Overflow Rate, gpd/sq. ft.	45,000	47,900	47,500	48,000	52,700	51,300
Primary Sedimentation						
Detention Time, hr.	1.9	1.8	1.8	1.8	1.6	1.6
Weir Overflow Rate, gpd/lin. ft.	8,700	9,300	9,200	9,300	10,200	10,000
Surface Overflow Rate, gpd/sq. ft.	780	830	820	830	910	890
Aeration Tanks						
Detention Time, hr.	7.2	6.7	6.8	6.8	6.1	6.3
BOD Loading, lb/day/1000 cu. ft.	43	43	40	46	52	45
Final Sedimentation						
Detention Time, hr.	3.3	3.1	3.1	3.1	2.8	2.9
Weir Overflow Rate, gpd/lin. ft.	7,100	3,640	7,580	7,600	8,400	8,200
Surface Overflow Rate, gpd/sq. ft.	550	590	580	580	650	630
Chlorination						
Contact Time, minutes	34	32	32	12	29	30
Chlorine Use, lb/day	110	113	114	130	131	129
Anaerobic Digestion (Primary Digester Only)						
Volatile Solids Loading, lb/cu. ft./day	0.06	0.06	0.06	-----	0.10	0.10
Detention Time, days	22	22	22	-----	16	16
Volatile Solids Reduction, %	55.0	50	50	-----	------	------
Sludge Transport						
Volume, gpd	9,100	11,300	12,800	12,000	15,900	17,200

ANOKA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

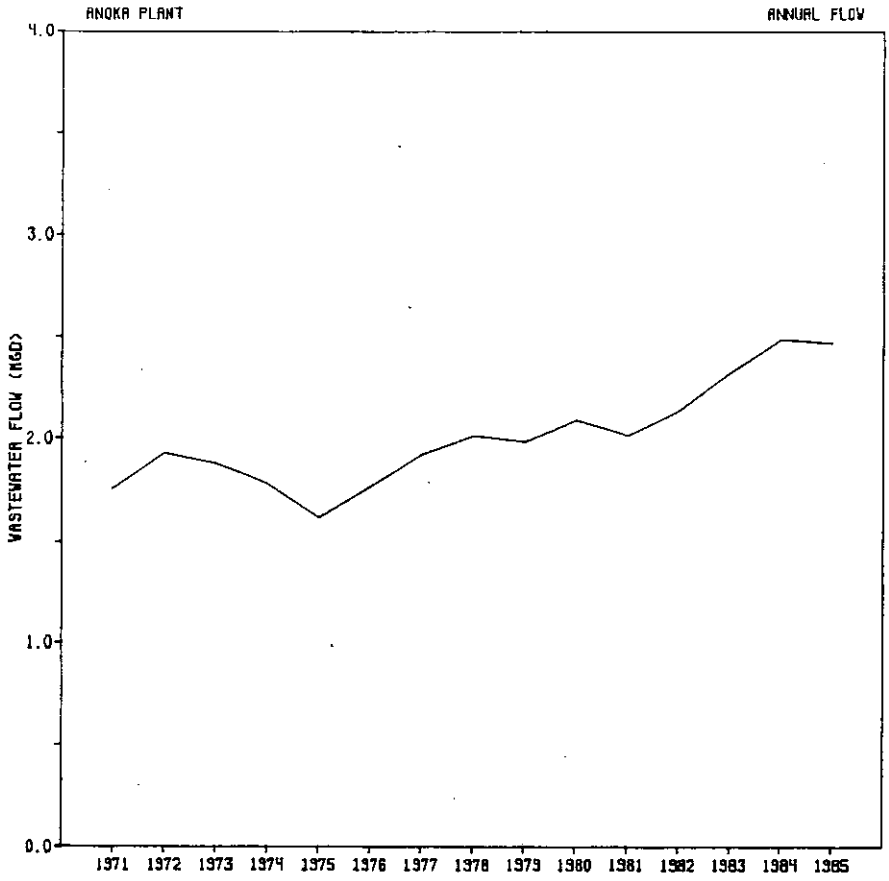
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

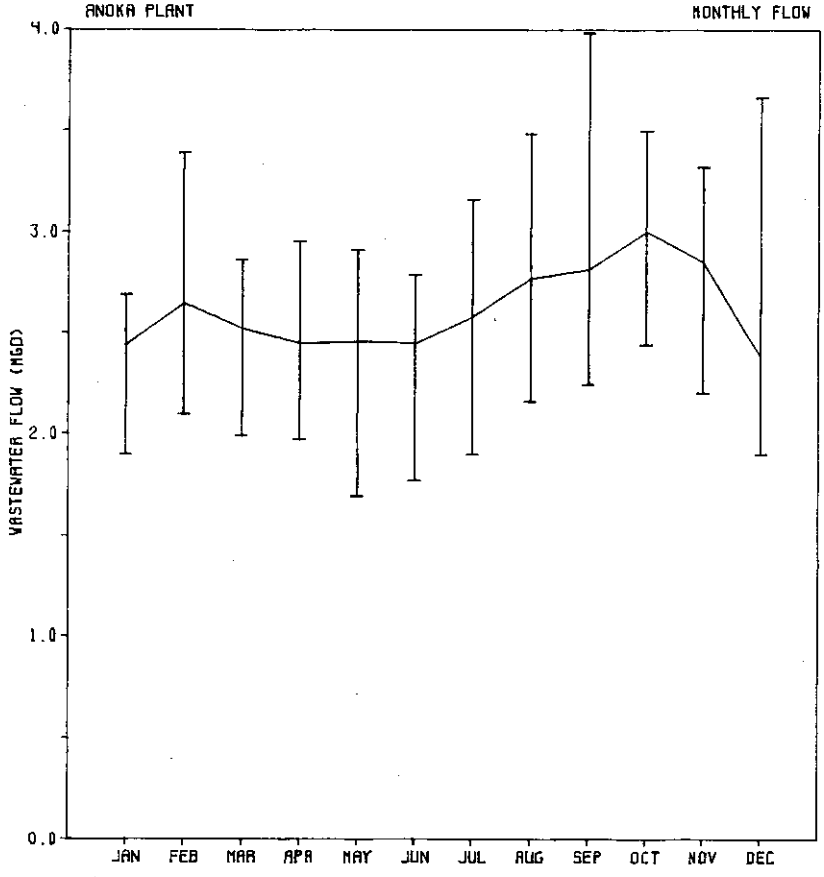
Solids Phase

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

Legend

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


ANOKA PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
4.0
3.0
2.0
1.0
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


ANOKA PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
4.0
3.0
2.0
1.0
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

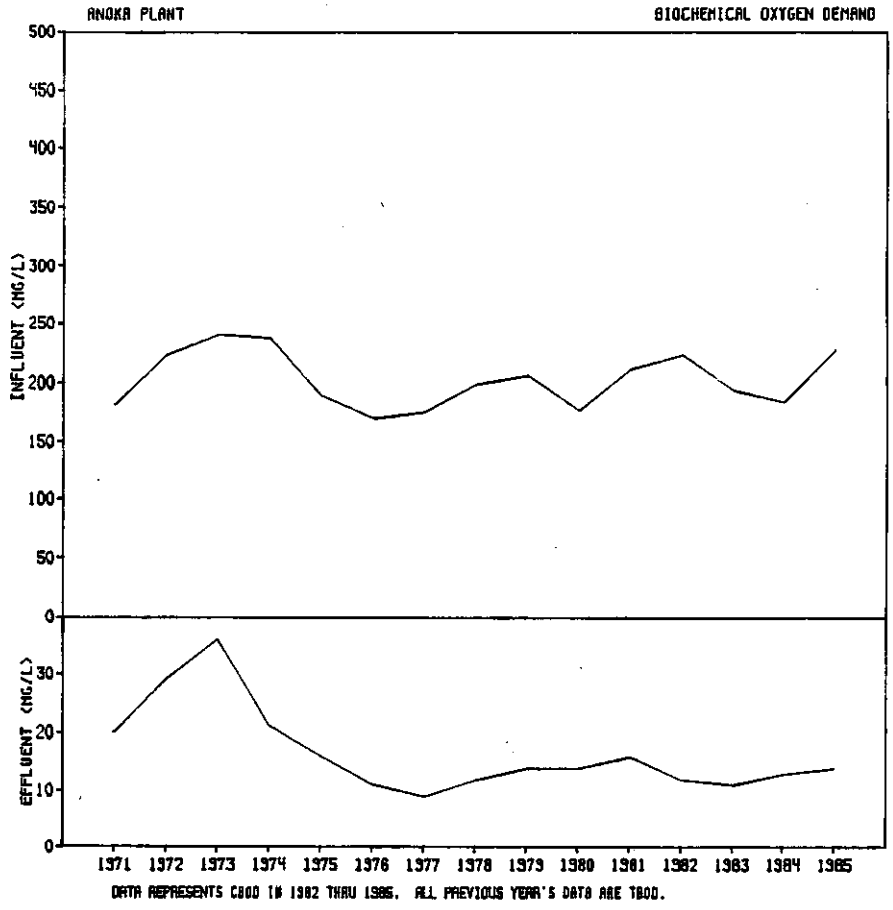
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Anoka

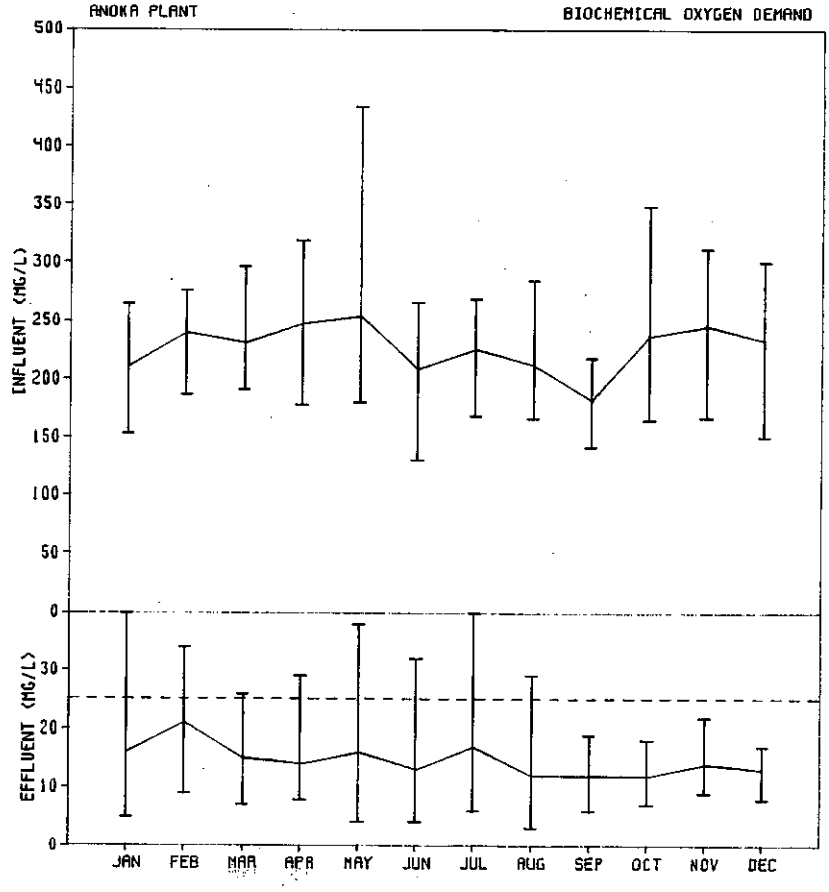
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	2.44	15	210	159	6.9-8.5	36.9	10.0	15.7	400
FEBRUARY	2.65	16	239	172	7.0-8.6	32.6	9.7	15.5	457
MARCH	2.52	18	231	155	7.3-8.6	33.8	8.5	13.1	477
APRIL	2.45	18	247	150	7.2-8.4	34.2	7.3	14.6	425
MAY	2.46	19	254	170	7.3-8.5	34.8	7.0	15.5	420
JUNE	2.45	20	208	138	7.3-8.4	33.8	6.5	16.3	387
JULY	2.33	22	225	168	7.2-8.3	35.9	6.9	14.1	451
AUGUST	2.48	23	212	159	7.1-8.2	29.3	5.9	14.4	411
SEPTEMBER	2.67	22	182	168	7.0-9.8	29.7	5.7	16.7	349
OCTOBER	2.57	20	237	317	6.0-9.0	37.1	7.8	15.8	448
NOVEMBER	2.30	18	245	184	6.5-8.5	34.5	8.3	16.4	441
DECEMBER	2.39	16	233	167	6.0-8.5	32.5	6.2	19.0	402
1985 AVERAGE	2.47	19	227	176	6.0-9.8	33.7	7.4	15.7	422
1984 AVERAGE	2.49	19	184	150	6.5-8.8	34.1	7.2	15.7	381

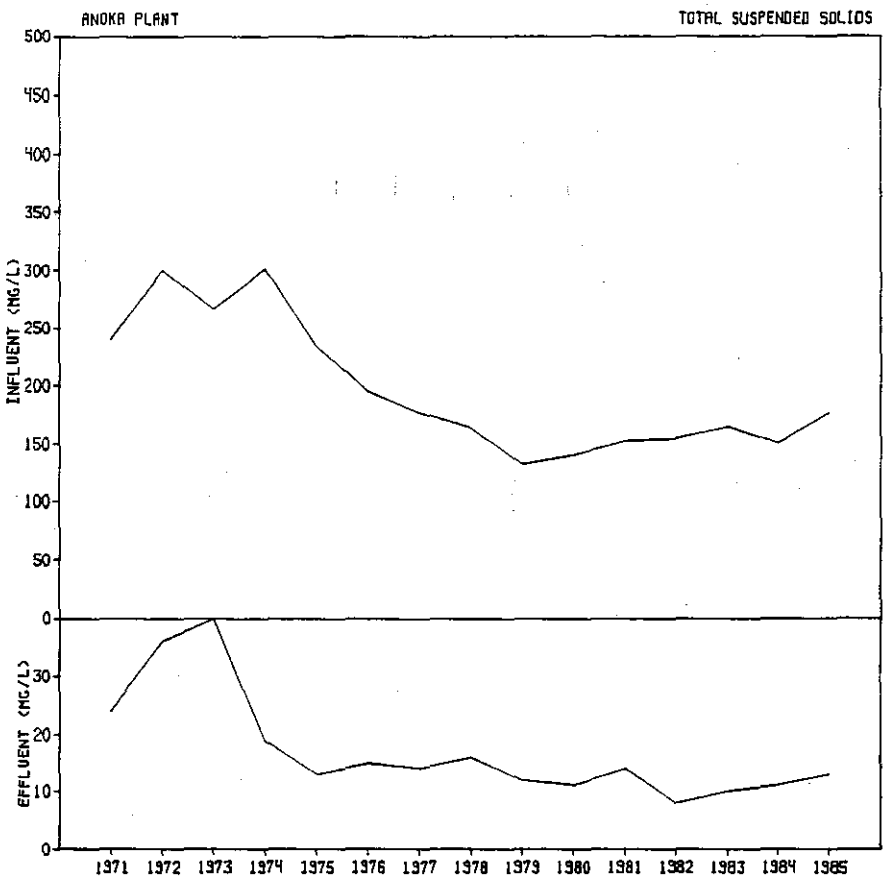
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Anoka

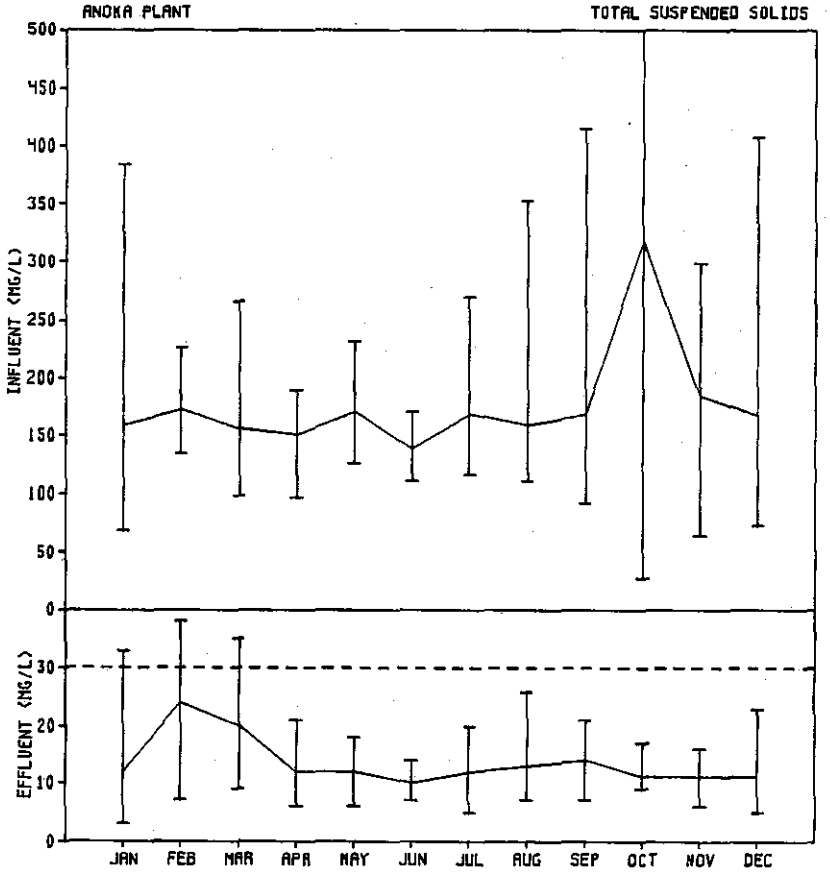
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	----	----	----	---	---	---	---	6.0-9.0	--	--
JANUARY	22	16	76	12	23	8	17.8	12.4	0.05	0.19	3.5	103	5.5	2.1	7.1-7.3	93	93
FEBRUARY	23	21	93	24	46	13	20.4	8.0	0.02	0.14	5.2	115	5.0	2.0	7.0-7.3	91	86
MARCH	19	15	77	20	12	10	18.6	10.2	0.02	0.15	3.9	112	5.4	2.1	7.1-7.4	94	87
APRIL	16	14	73	12	48	8	23.1	10.8	0.03	0.19	4.6	114	5.5	2.3	7.2-7.4	94	92
MAY	20	16	63	12	78	8	15.4	7.8	0.02	0.25	3.1	117	6.4	1.9	7.2-7.5	94	93
JUNE	16	13	65	10	23	6	15.8	11.4	0.02	0.22	2.8	129	5.6	1.7	7.1-7.4	94	93
JULY	22	17	87	12	22	8	24.4	11.5	0.18	0.16	4.2	109	6.2	1.7	7.0-7.3	92	93
AUGUST	16	12	65	13	150	6	16.6	8.3	0.56	0.31	3.4	115	6.9	1.7	7.0-7.3	94	92
SEPTEMBER	16	12	60	14	127	7	12.2	8.5	0.52	0.38	2.6	118	6.8	1.7	7.0-7.3	93	92
OCTOBER	16	12	66	11	79	6	14.6	8.1	0.02	0.24	3.2	120	6.7	2.1	7.0-7.3	95	96
NOVEMBER	21	14	67	11	18	6	21.1	15.5	0.04	0.11	4.7	119	6.9	2.2	7.0-7.3	94	94
DECEMBER	17	13	54	11	25	6	15.1	12.7	0.04	0.28	2.7	102	6.3	2.3	7.0-7.4	95	93
1985 AVG.	19	14	70	13	54	7	17.8	10.3	0.13	0.22	3.6	114	6.1	2.0	7.0-7.5	94	92
1984 AVG.	19	13	80	11	78	7	19.9	11.8	0.27	0.33	3.8	114	5.1	1.9	7.1-7.5	93	93

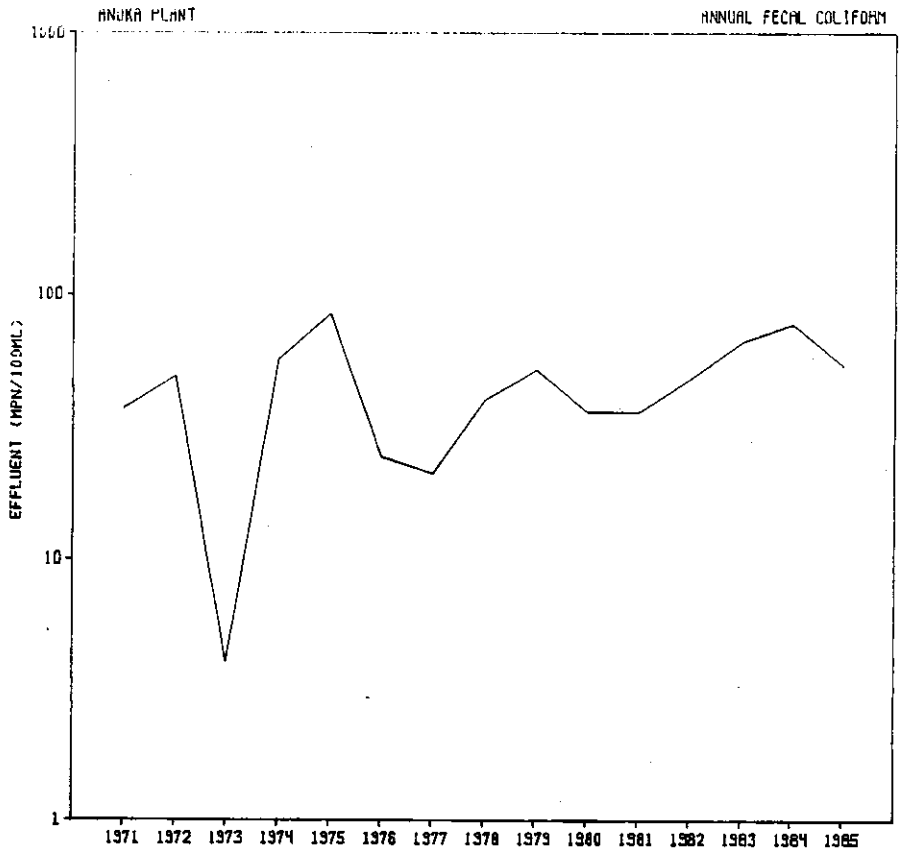
*For disinfection only.

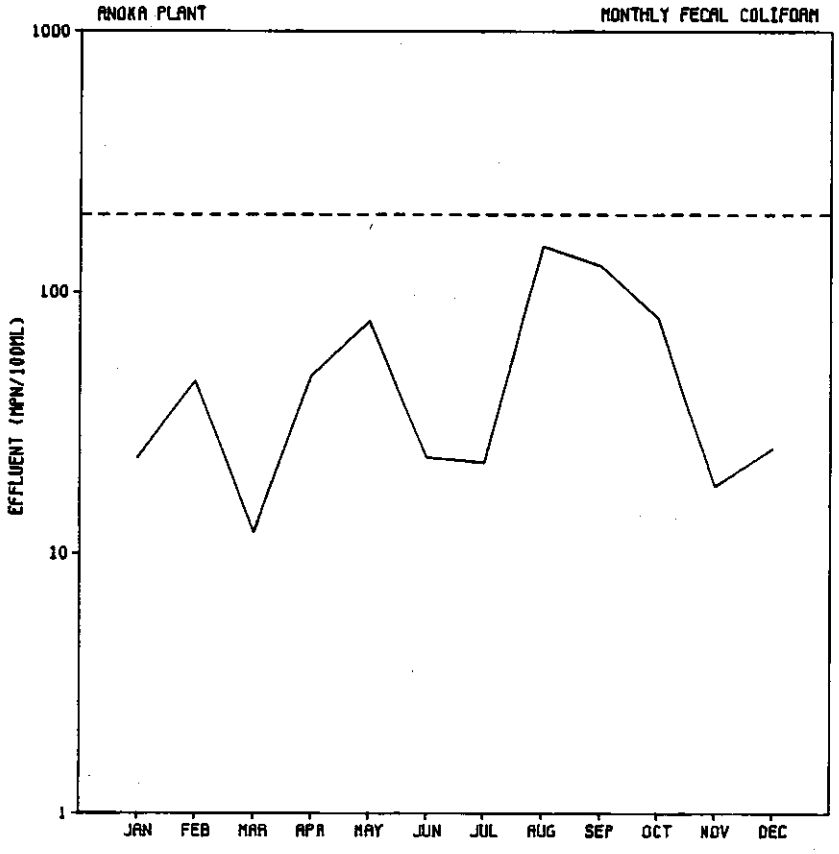

ANOKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

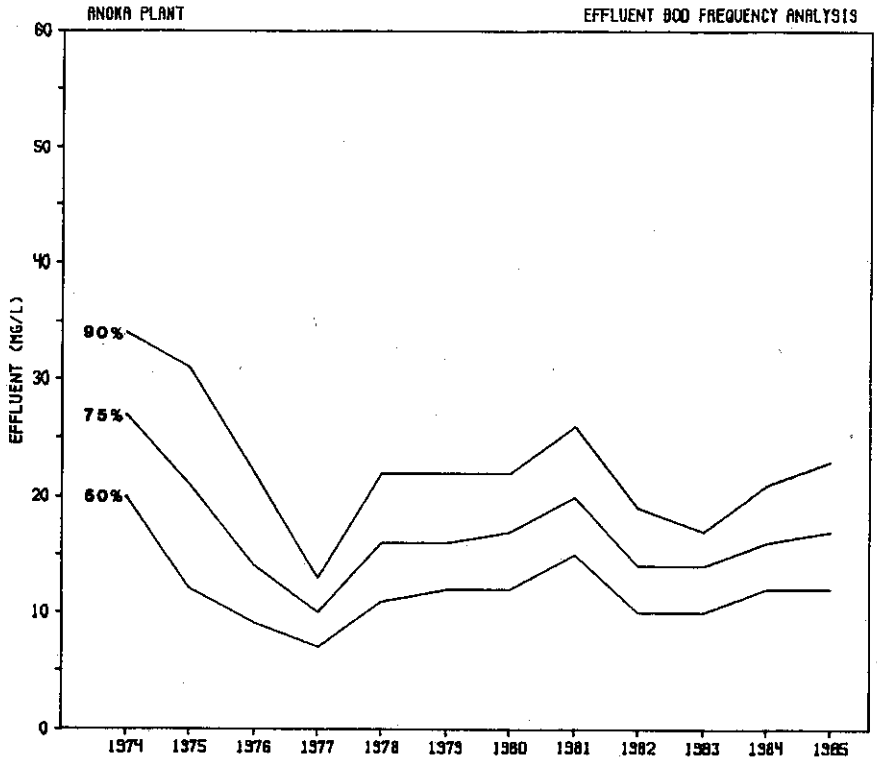

ANOKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

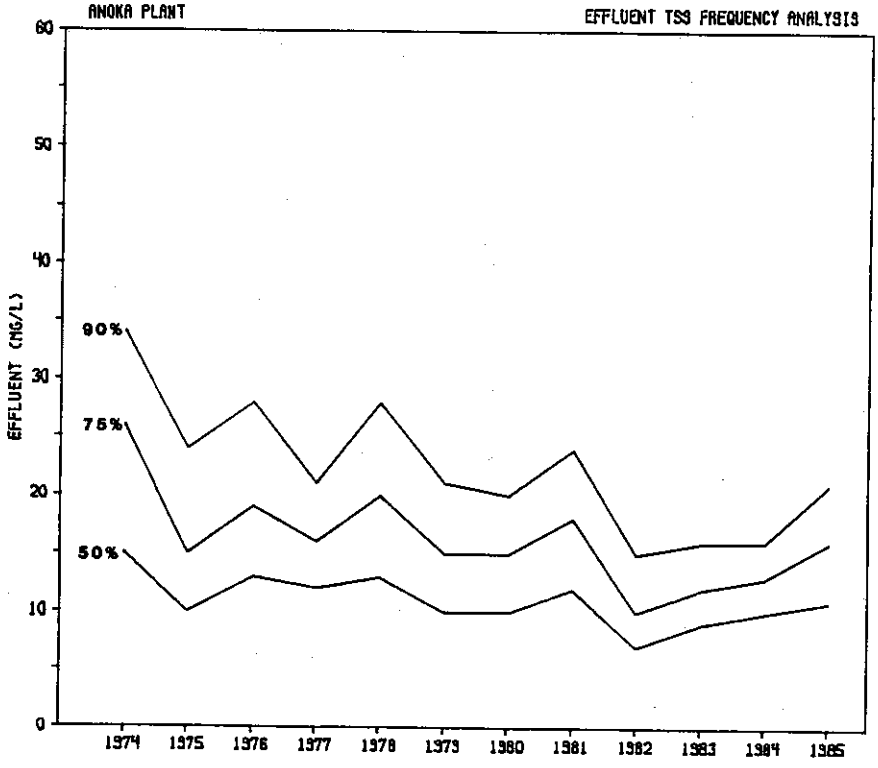

ANOKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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 1984 1985


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%
60%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985


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
1984
1985

1985 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	0.05	<0.05	0.21	<0.05			<0.030					
February	0.06	<0.05	0.12	<0.05			0.043					
March	0.05	<0.05	0.10	<0.05			<0.027					
April	0.07	<0.06	0.09	<0.05			<0.032					
May	0.08	<0.05	0.16	<0.05			<0.023					
June	0.05	<0.05	0.41	<0.05			<0.040					
July	0.04	<0.05	0.05	<0.05			0.025					
August	0.05	<0.05	0.09	<0.05			<0.045					
September	0.05	<0.05	0.06	<0.05			<0.022					
October	0.04	-----	----	-----			<0.040					
November	0.05	-----	----	-----			<0.023					
December	0.02	-----	----	-----			<0.020					
1985 Avg.	0.05	<0.05	0.15	<0.05			<0.031					
1984 Avg.	0.06	<0.05	0.15	<0.05			<0.038					

*Limits apply January 1 through August 21.

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. 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 80 percent of its design capacity, and is subject to secondary treatment limits and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 0.53 mgd in 1985, slightly higher than 0.50 mgd in 1984. Average plant effluent quality was 6 mg/L BOD, 9 mg/L TSS, and 0.5 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 CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	7	6	5	5	9	7	7	7	13	8	8	8
TSS	7	6	7	7	9	7	9	9	12	9	10	12

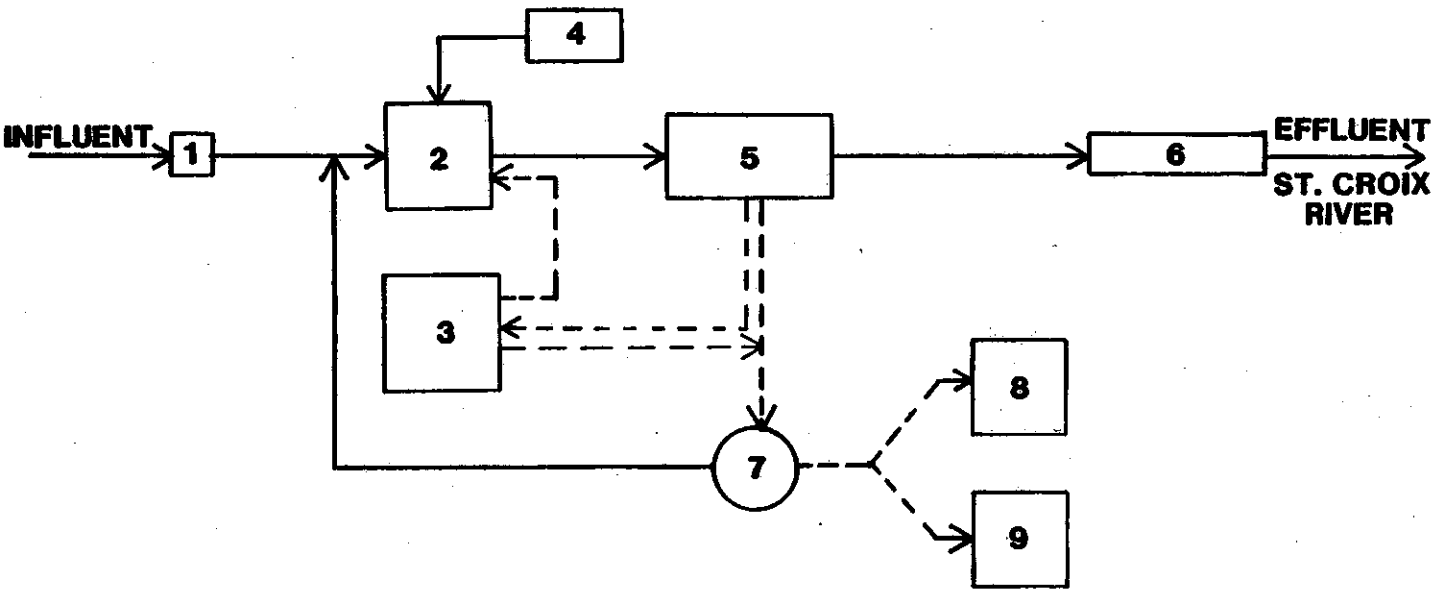
Future

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 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		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	0.54	0.50	0.52	0.66	0.76	0.61
BOD Loading, lb/day	720	717	790	1,060	914	1,020
TSS Loading, lb/day	800	877	830	1,380	1,378	1,350
COD Loading, lb/day	1,330	1,432	1,490	2,020	1,799	1,670
Aeration Basin						
BOD Loading, lb/day/1000 cu. ft.	22	22	24	32	28	31
Alum Feed Rate, gal/day	140	110	108	165	145	129
Final Sedimentation						
Weir Overflow Rate, gpd/lin. ft.	4,430	4,100	4,260	5,410	6,230	5,000
Surface Overflow Rate, gpd/sq. ft.	450	420	433	550	630	508
Chlorination						
Chlorine Use, lb/day	34	27	27	35	30	40
Sludge Transport						
Volume, gpd	4,000	3,540	3,460	4,700	4,170	4,390
Mass, lb/day	660	650	582	820	790	743

BAYPORT WASTEWATER TREATMENT PLANT
FLOW DIAGRAM



Unit Description

Liquid Phase

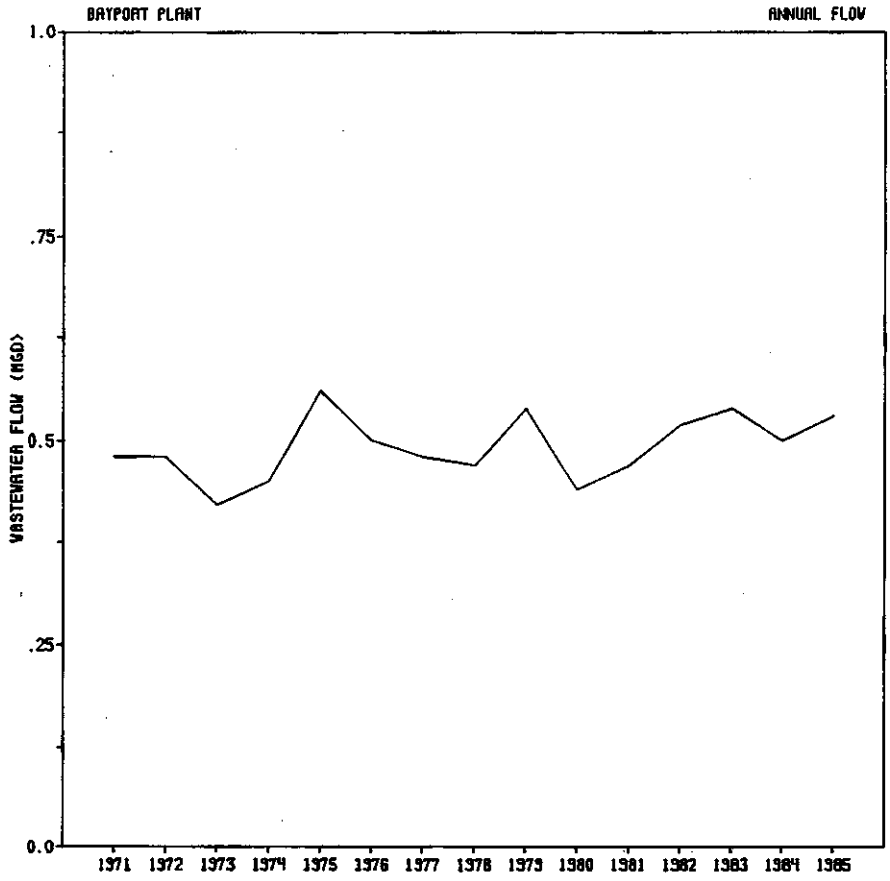
1. Screening (Coarse + Fine)
2. Contact Aeration
3. Sludge Reaeration
4. Chemical Addition
5. Sedimentation
6. Chlorination

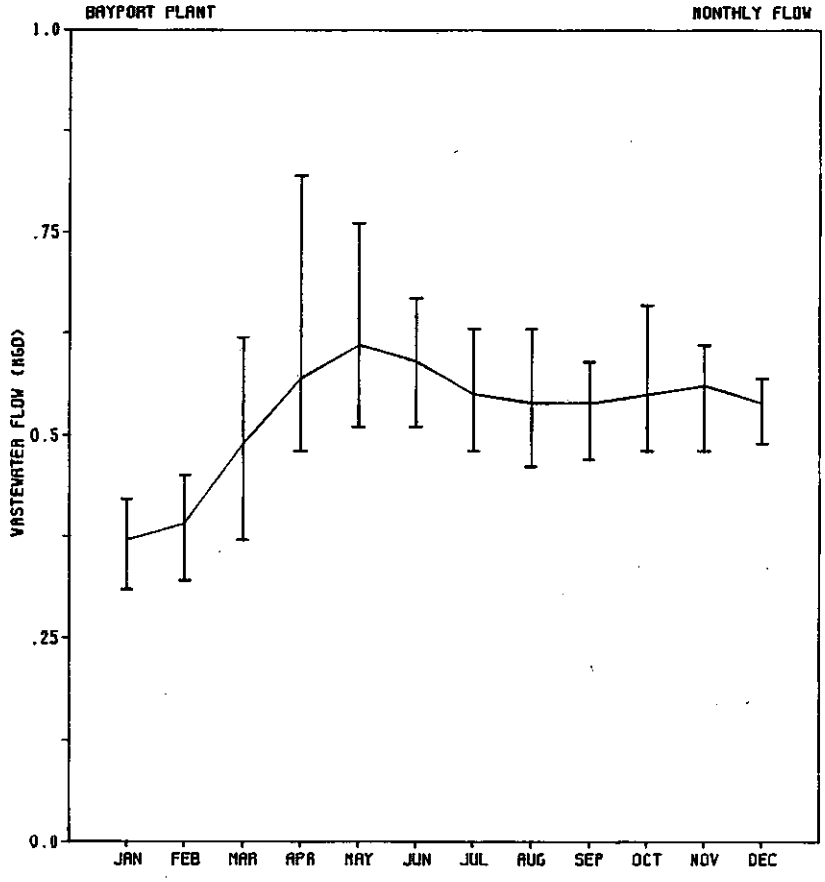
Solids Phase

7. Aerobic Digestion
8. Disposal at Metro Plant
9. Land Spread

Legend

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


BAYPORT PLANT
ANNUAL FLOW
1.0
.75
.5
.25
0.0
WASTEWATER FLOW (MGD)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


BAYPORT PLANT
MONTHLY FLOW
1.0
.75
.5
.25
0.0
WASTEWATER FLOW (MGD)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

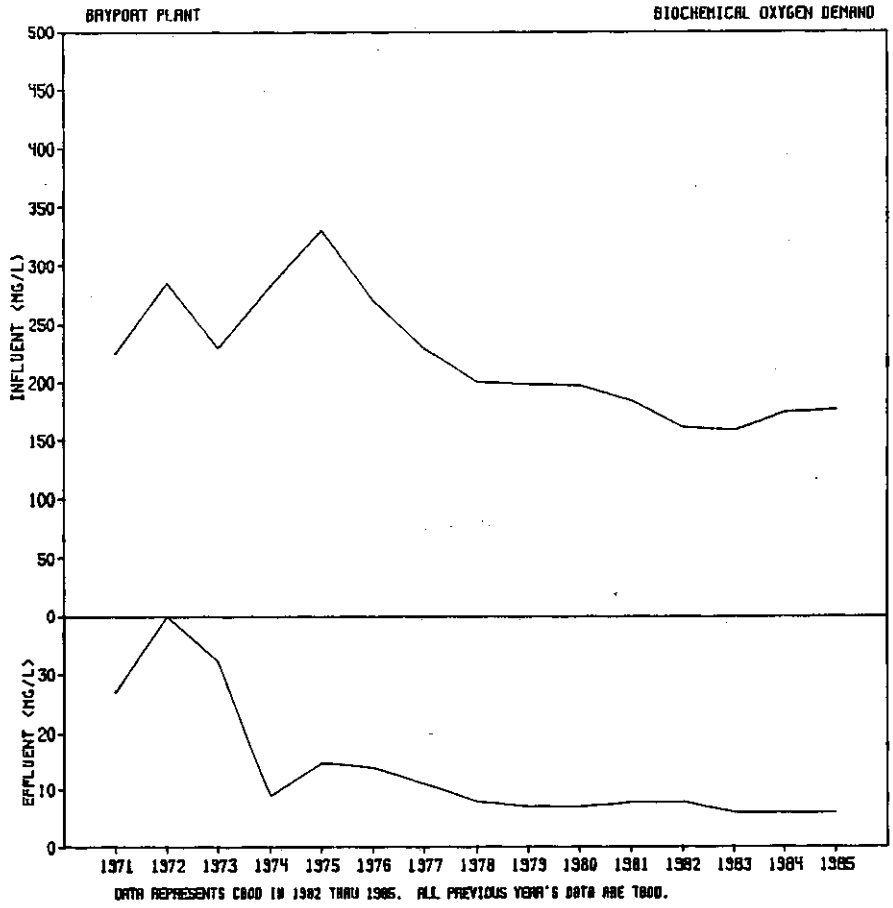
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Bayport

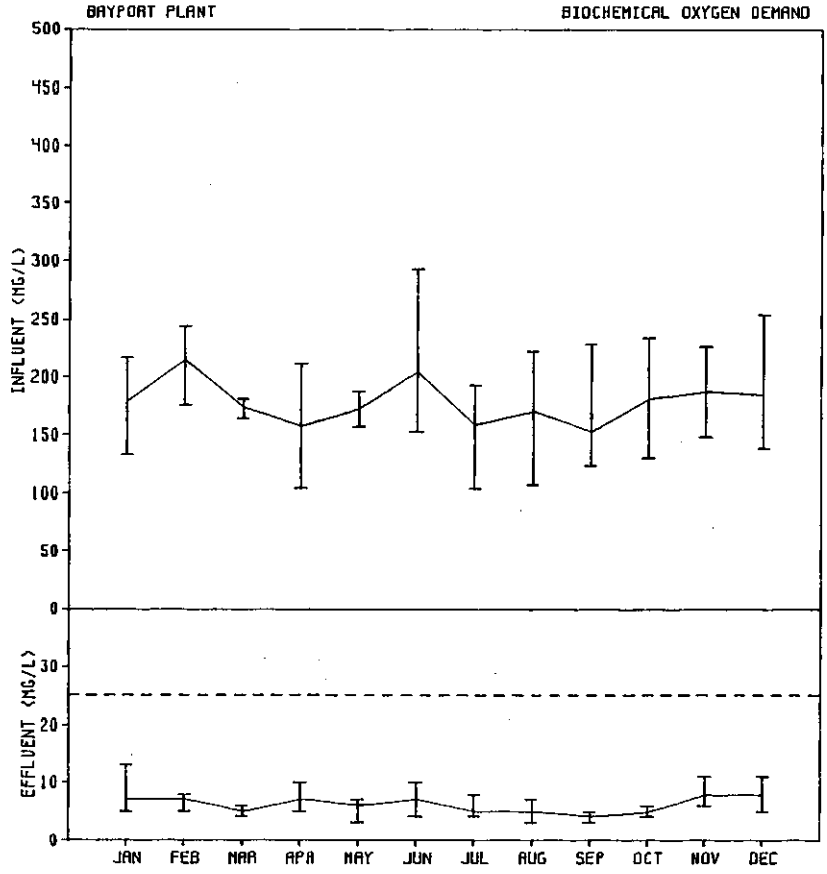
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.37	15	179	150	6.4-9.0	32.5	6.8	17.3	399
FEBRUARY	0.39	14	215	169	6.2-9.0	31.4	5.8	17.8	353
MARCH	0.49	15	173	153	6.6-9.0	28.3	5.5	14.1	392
APRIL	0.57	16	157	145	6.8-9.2	28.7	5.3	13.0	298
MAY	0.61	17	172	161	6.0-9.4	27.6	5.0	13.8	298
JUNE	0.59	19	204	270	4.0-9.4	33.2	6.3	15.9	316
JULY	0.55	22	158	184	7.0-9.2	28.9	5.8	13.3	343
AUGUST	0.54	21	170	283	7.2-8.0	29.3	6.4	15.8	357
SEPTEMBER	0.54	21	152	166	6.8-7.8	26.2	6.6	15.3	302
OCTOBER	0.55	18	181	199	7.2-8.2	29.0	6.5	14.6	351
NOVEMBER	0.56	17	187	171	7.2-8.0	28.4	5.5	15.6	318
DECEMBER	0.54	15	184	161	7.0-7.9	29.9	5.5	17.4	332
1985 AVERAGE	0.53	18	176	188	4.0-9.4	29.2	5.9	15.3	337
1984 AVERAGE	0.50	18	174	210	5.8-9.4	29.6	6.2	14.6	339

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	--	30	200	25	---	---	----	-----	1.0	--	---	---	6.0-9.0	--	--
JANUARY	13	7	31	7	---	4	5.9	4.0	0.65	13.87	0.4	--	---	4.9	6.6-7.1	96	95
FEBRUARY	12	7	34	8	---	4	5.3	4.1	0.62	11.88	0.4	29	2.5	3.8	6.7-7.2	97	95
MARCH	7	5	27	8	4	4	6.4	3.6	0.27	11.73	0.3	28	3.0	3.7	6.6-7.6	97	95
APRIL	9	7	41	11	3	6	7.4	4.0	0.27	10.12	0.5	40	3.4	3.3	6.9-8.0	95	93
MAY	6	6	30	10	3	5	6.1	4.1	0.28	11.11	0.5	40	2.9	3.5	6.8-7.5	97	94
JUNE	6	7	29	10	3	4	6.9	4.6	0.26	11.75	0.5	29	4.1	3.4	6.9-7.9	97	96
JULY	6	5	29	8	3	4	7.2	3.9	0.27	11.36	0.4	21	3.9	3.2	6.9-7.8	97	96
AUGUST	6	5	23	7	5	3	6.4	4.8	0.60	12.09	0.4	20	3.2	3.2	6.9-7.6	97	97
SEPTEMBER	5	4	25	6	4	3	5.9	4.6	0.48	11.03	0.7	21	2.7	3.2	6.9-7.9	97	96
OCTOBER	6	5	29	8	2	4	7.1	5.0	0.39	11.11	0.5	20	2.7	3.2	7.1-8.2	97	96
NOVEMBER	13	8	31	9	---	3	6.0	4.4	0.56	11.62	0.4	--	---	3.7	6.7-7.8	96	95
DECEMBER	14	8	28	12	---	4	6.4	4.6	0.51	11.87	0.6	--	---	3.9	6.9-7.5	96	93
1985 AVG.	9	6	30	9	3	4	6.5	4.4	0.44	11.60	0.5	27	3.2	3.6	6.6-8.2	97	95
1984 AVG.	10	6	33	8	8	3	5.8	3.5	0.58	10.25	0.4	26	3.0	3.8	6.6-7.8	97	96

*For disinfection only.


BAYPORT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.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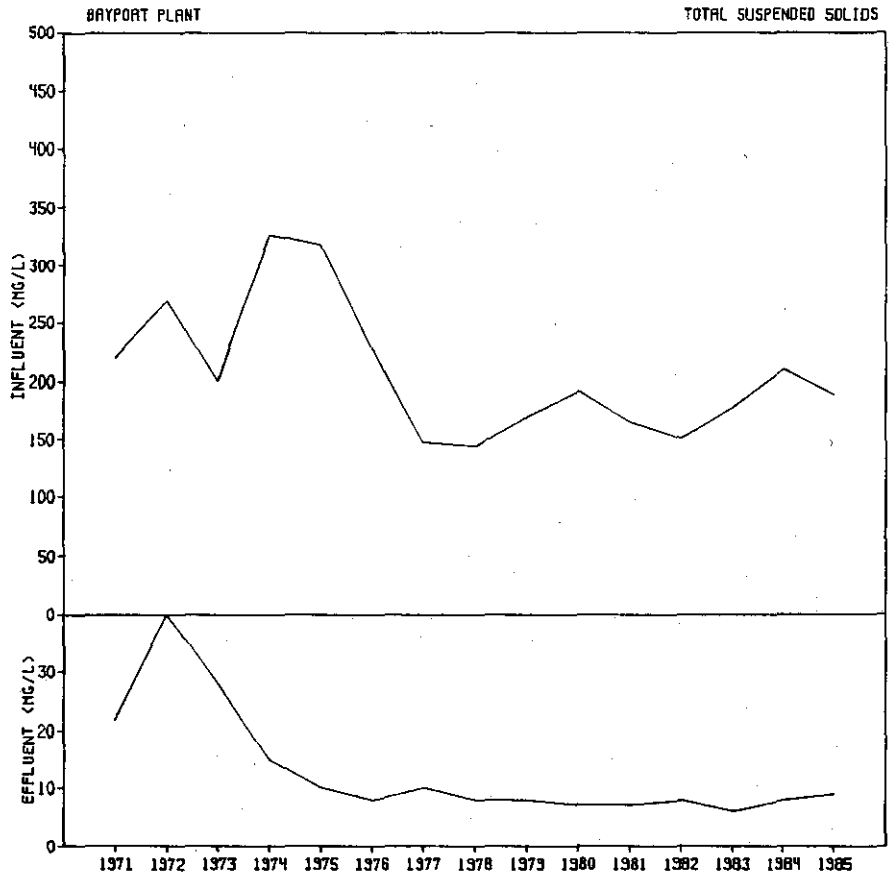
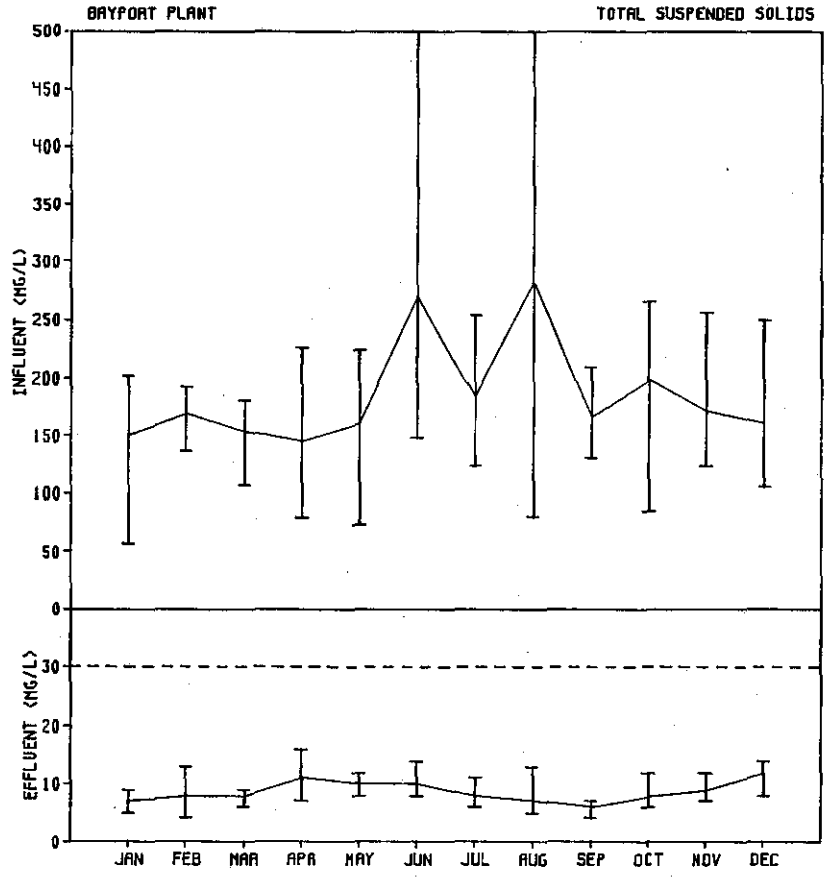
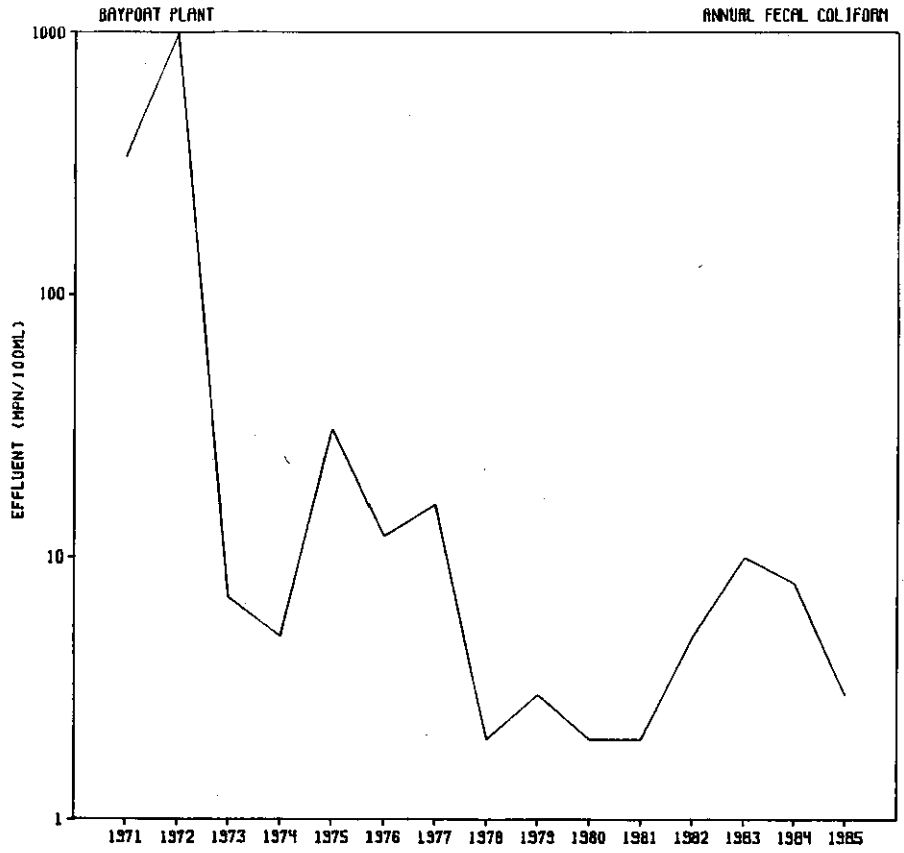
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


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 1984 1985


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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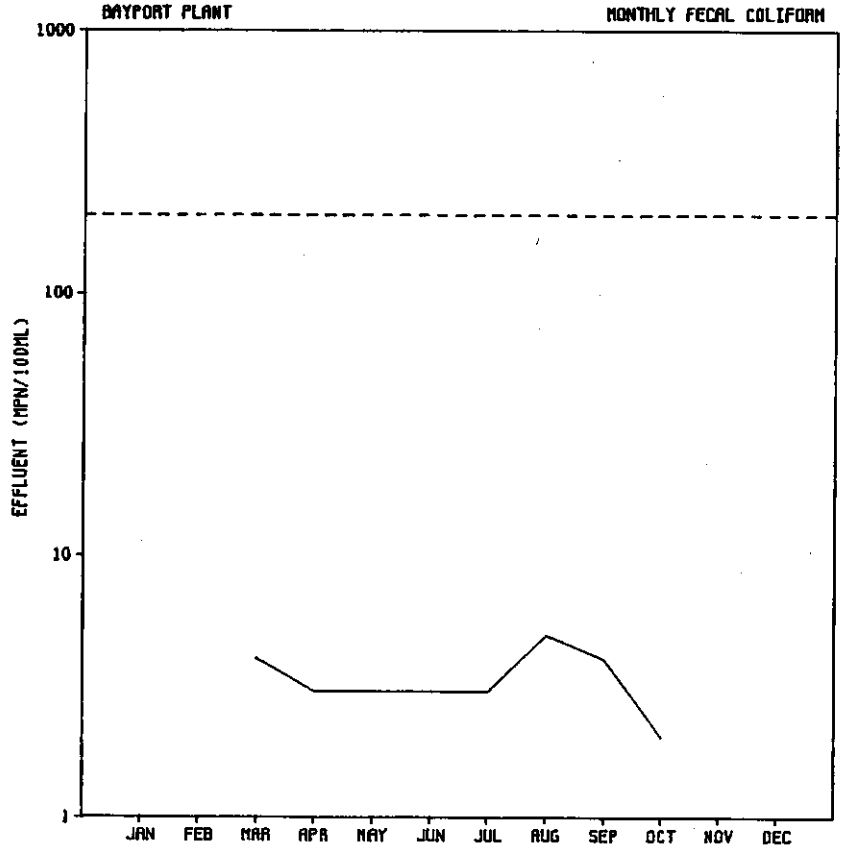
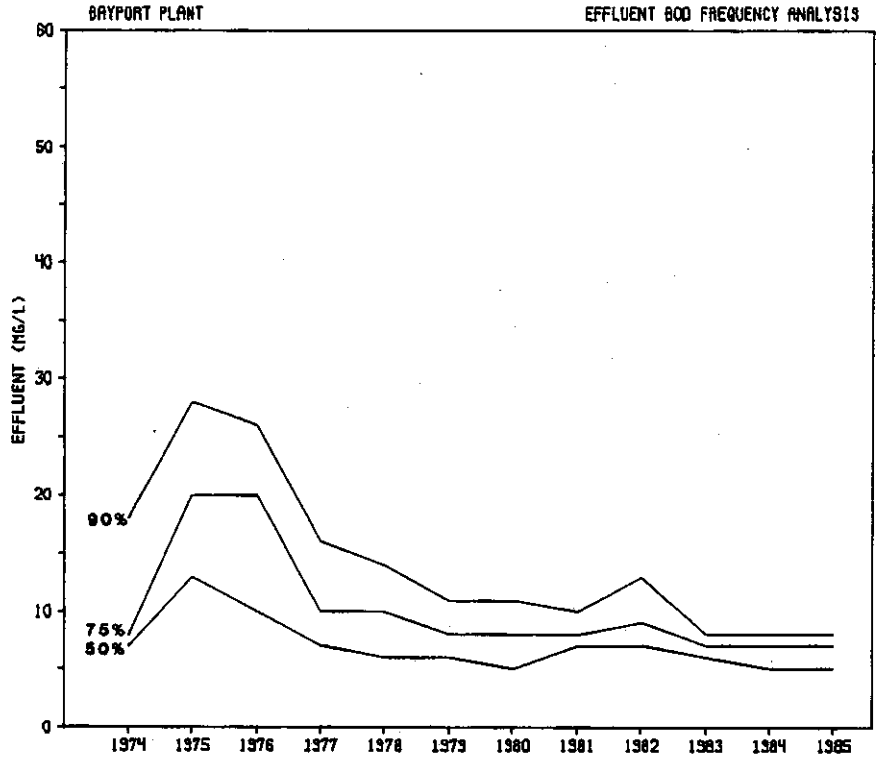
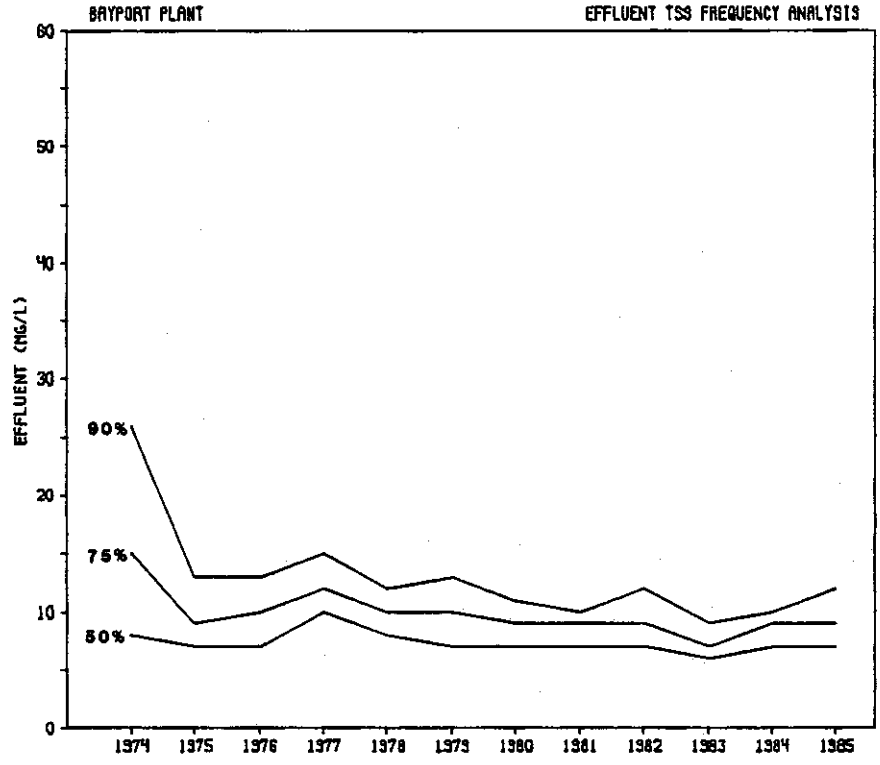
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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
1984
1985


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
1984
1985

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 primary clarifiers and sludge hauling to either the Seneca or Metropolitan Plant.

The Blue Lake Plant is operating at approximately 95 percent of its rated capacity and is subject to secondary treatment limits. Actual plant capacity is higher than rated capacity and is estimated to be 24 mgd.

Performance

Plant flow averaged 19.3 mgd in 1985, slightly lower than 19.5 mgd in 1984. Average plant effluent quality was 11 mg/L BOD and 6 mg/L TSS. Plant performance was good throughout the year with no NPDES permit violations. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	10	8	9	10	13	11	11	12	16	13	14	15
TSS	6	7	5	5	8	9	7	7	10	11	10	9

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 scheduled for construction in 1986-1987. The remainder of Stage III is planned to include anaerobic digestion, dewatering and land application. The timing of implementing these facilities is uncertain. A liquid treatment plant expansion and upgrade to meet water quality based effluent limits is planned for the late 1980's.

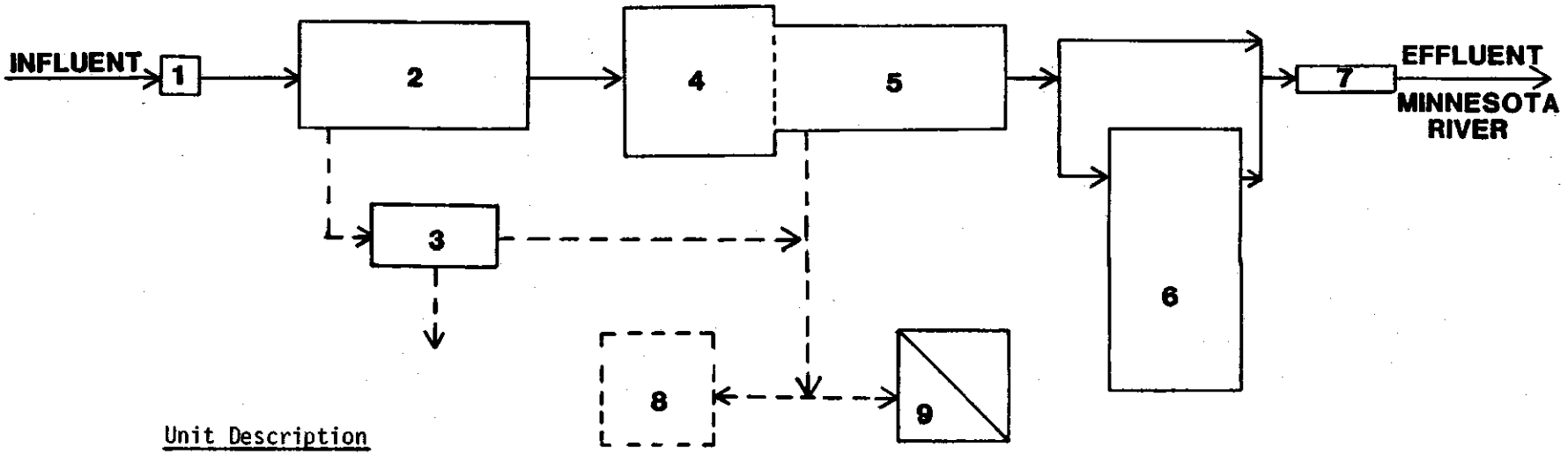
BLUE LAKE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	18.1	19.5	19.3	24.2	23.9	22.6
BOD Loading, lb/day	29,300	28,800	29,600	35,000	31,600	34,400
TSS Loading, lb/day	33,800	33,200	27,900	48,400	37,000	31,200
Primary Sedimentation[1]						
Surface Overflow Rate, gpd/sq. ft.	905	975	965	1,210	1,190	1,130
Weir Overflow Rate, gpd/lin. ft.	18,100	19,500	19,300	24,200	23,900	22,600
Aeration Tanks						
BOD Loading, lb/day/1000 cu. ft.	56	57	60	75	62	70
Detention Time, hr.	3.3	3.7	3.7	2.9	2.8	3.2
Final Sedimentation						
Surface Overflow Rate, sq. ft.	530	570	570	710	700	660
Weir Overflow Rate, gpd/lin. ft.	10,900	11,700	5,700	14,500	14,300	6,600
Aerated Pond						
BOD Loading, lb/day	2,300	2,200	3,700	3,600	2,500	5,900
Detention Time, days	2.8	2.5	2.7	2.1	2.1	2.3
Average Air Flow, cfm	-------	-------	2,700	-------	-------	3,000
Chlorine Use, lb/day	250	190	210	274	225	290
Thickened Sludge						
Production, lb/day	47,500	42,600	34,200	53,600	47,000	38,500
Volume, gpd	116,000	111,000	101,200	125,600	130,000	120,500
Concentration, %TSS	4.9	4.6	4.05	5.7	5.6	4.64
Volatile Solids, %	71	71	75.6	74	76	79.2

[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

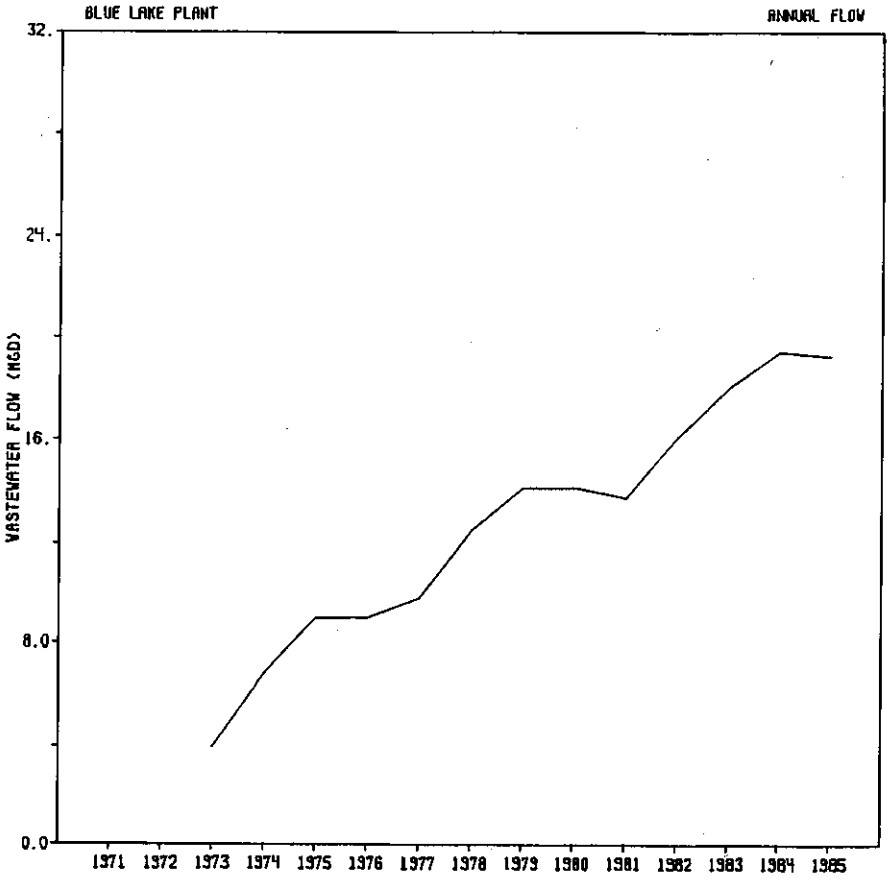
1. Screening
2. Primary Sedimentation
3. Grit Removal
4. Activated Sludge
5. Final Sedimentation (Upflow Clarifier)
6. Aerated Effluent Pond
7. Chlorination

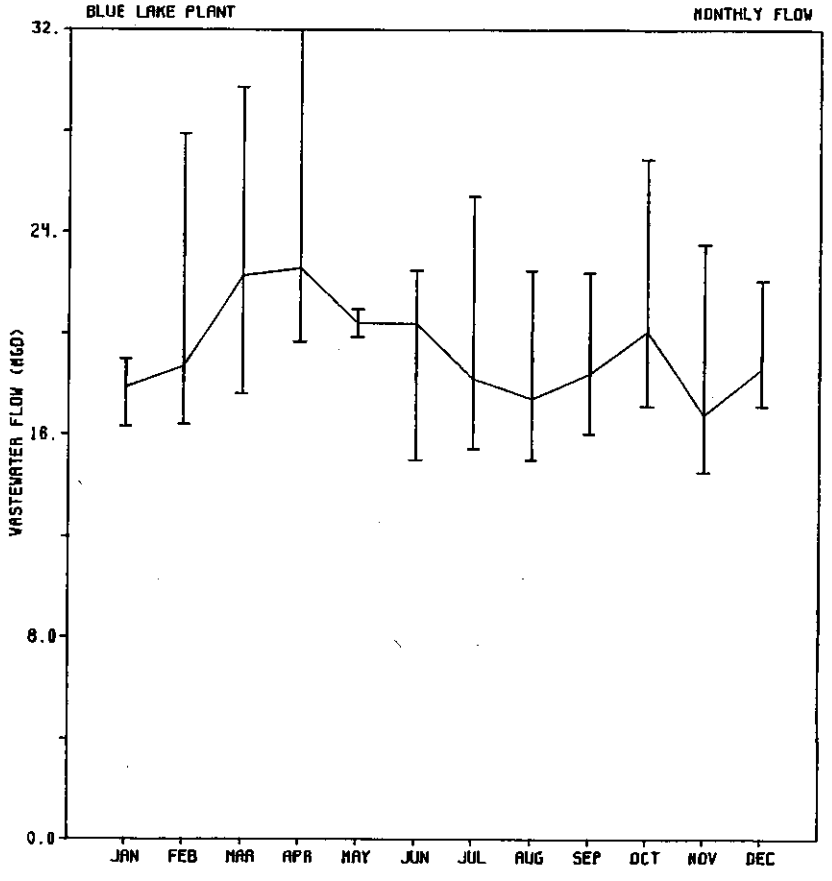
Solids Phase

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

Legend

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


BLUE LAKE PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
32.
24.
16.
8.0
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


BLUE LAKE PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
32.
24.
16.
8.0
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

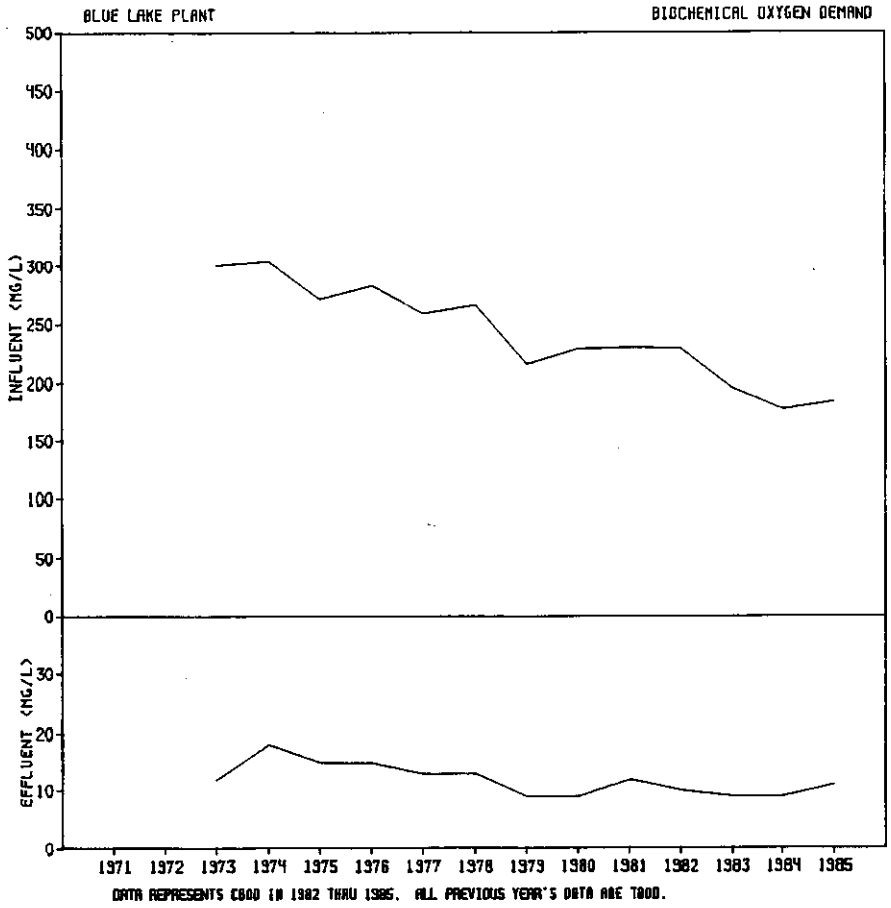
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Blue Lake

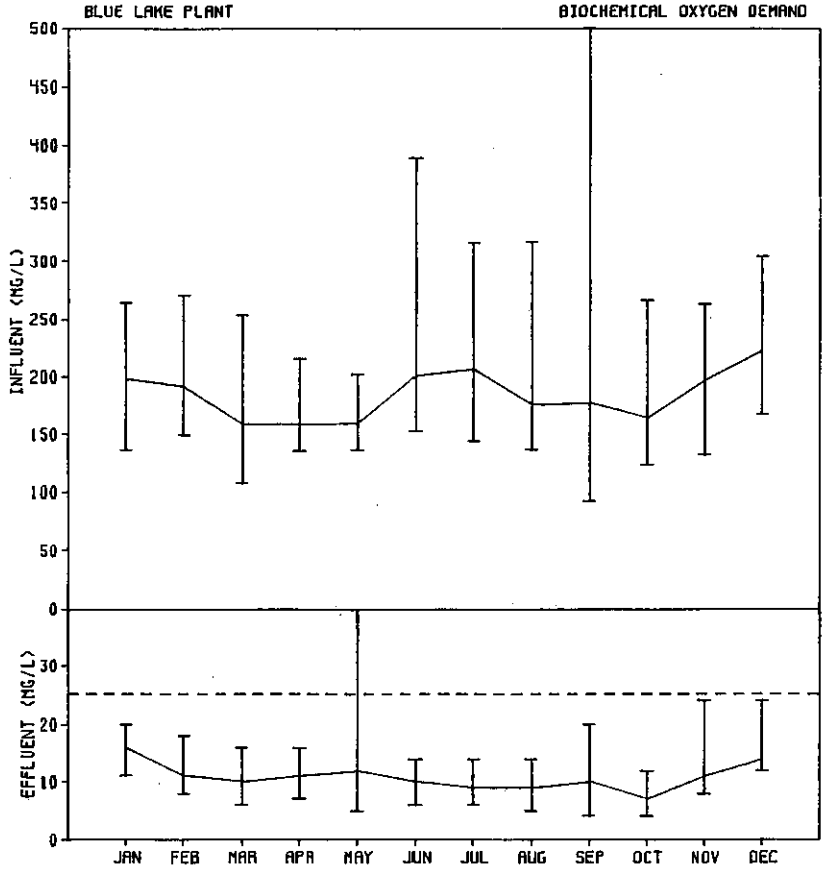
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	17.9	12	198	184	6.6-8.3	31.1	6.5	11.6	451
FEBRUARY	18.7	11	191	194	6.3-8.1	30.6	7.1	12.5	444
MARCH	22.3	9	158	142	5.9-8.7	26.9	5.7	11.0	366
APRIL	22.6	10	159	154	6.5-8.0	27.7	5.7	9.4	387
MAY	20.4	12	160	156	6.5-8.6	29.8	6.0	10.8	366
JUNE	20.4	14	201	164	6.3-8.1	30.3	6.2	12.9	402
JULY	18.2	15	206	206	5.6-8.7	33.3	7.2	10.9	464
AUGUST	17.4	16	175	215	6.6-8.1	28.6	6.3	11.9	401
SEPTEMBER	18.4	17	176	179	6.0-8.6	62.6	5.2	11.8	474
OCTOBER	20.1	16	164	155	5.9-8.9	23.3	4.9	9.4	343
NOVEMBER	16.8	14	197	163	5.8-9.5	28.6	5.9	12.0	397
DECEMBER	18.6	12	222	161	6.1-8.3	31.2	6.0	15.0	404
1985 AVERAGE	19.3	13	184	173	5.6-9.5	32.4	6.1	11.6	409
1984 AVERAGE	19.5	14	177	204	4.3-9.4	27.8	6.1	10.7	434

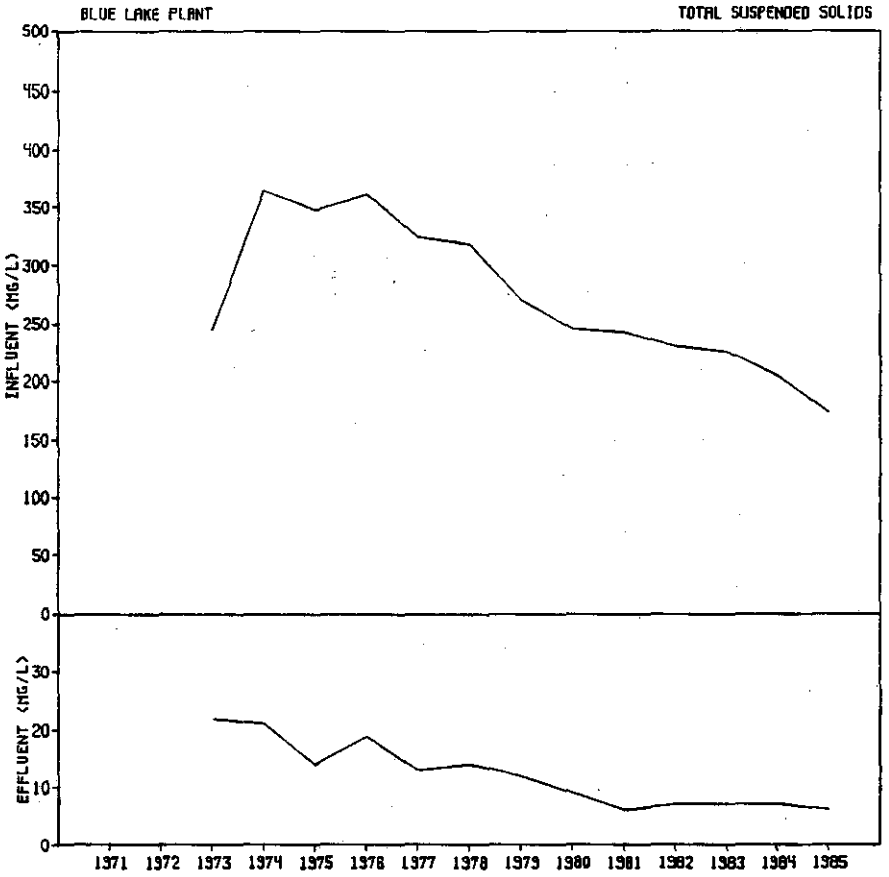
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Blue Lake

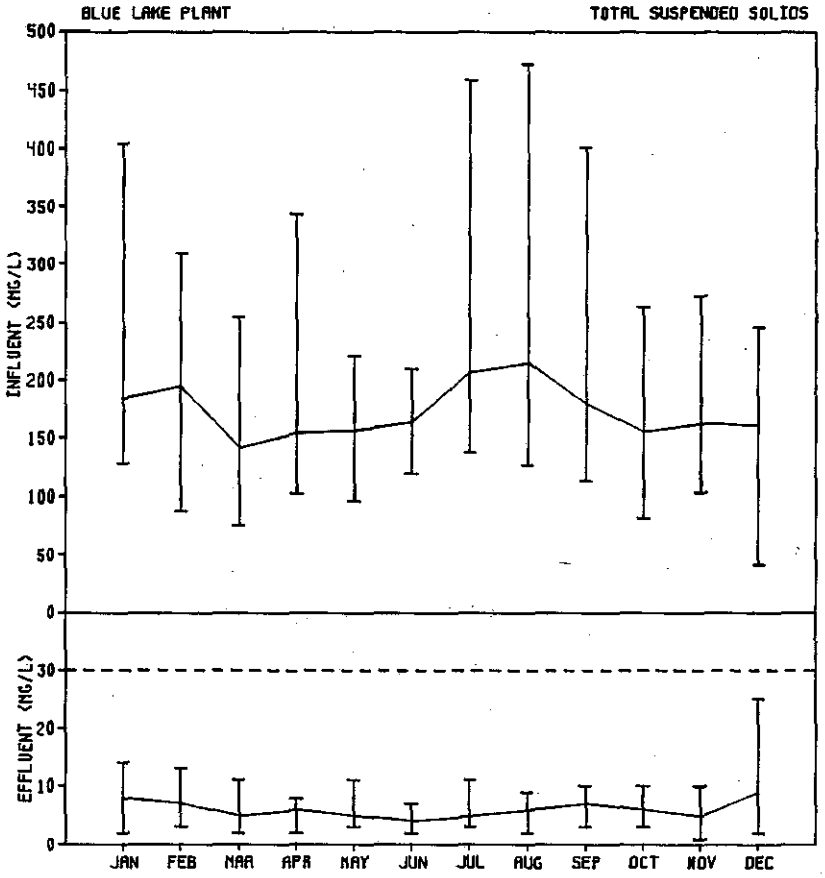
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	----	----	----	---	---	---	----	6.5-8.5	--	--
JANUARY	24	16	92	8	---	7	18.4	11.6	0.11	2.39	3.6	---	---	10.9	7.0-7.7	92	96
FEBRUARY	27	11	83	7	---	6	16.1	11.0	0.14	2.51	3.4	250	1.1	11.1	7.0-7.4	94	97
MARCH	20	10	77	5	11	5	13.8	8.7	0.40	1.01	2.5	216	0.7	10.7	6.9-7.3	94	96
APRIL	36	11	73	6	10	6	13.7	7.6	1.11	1.88	2.6	200	0.7	9.1	7.0-8.0	93	96
MAY	37	12	77	5	22	4	13.5	9.1	1.45	3.22	2.9	200	0.5	6.4	6.9-7.8	93	97
JUNE	32	10	77	4	14	4	16.2	10.7	1.60	2.32	3.1	200	0.4	5.6	6.9-7.3	95	97
JULY	36	9	79	5	9	6	15.0	9.9	1.75	3.38	3.1	200	0.4	5.3	7.0-7.5	96	97
AUGUST	34	9	71	6	53	5	15.1	11.1	2.00	2.74	3.4	205	0.4	4.9	7.0-7.4	95	97
SEPTEMBER	33	10	71	7	67	5	15.1	10.9	1.62	2.14	3.0	200	0.4	5.0	7.0-7.3	94	96
OCTOBER	29	7	61	6	32	5	13.1	9.3	1.41	1.73	2.7	290	0.6	7.3	7.0-7.4	96	96
NOVEMBER	28	11	62	5	---	4	16.0	11.6	1.05	2.51	3.0	---	---	9.3	7.0-8.0	94	97
DECEMBER	23	14	70	9	---	6	18.8	13.7	0.27	2.51	3.6	---	---	10.2	7.1-7.4	94	94
1985 AVG.	30	11	75	6	27	5	15.5	10.4	1.06	2.35	3.1	214	0.5	8.0	6.9-8.0	94	96
1984 AVG.	26	9	76	7	24	8	14.1	9.0	0.97	1.92	3.1	190	0.5	9.5	6.5-7.9	95	97

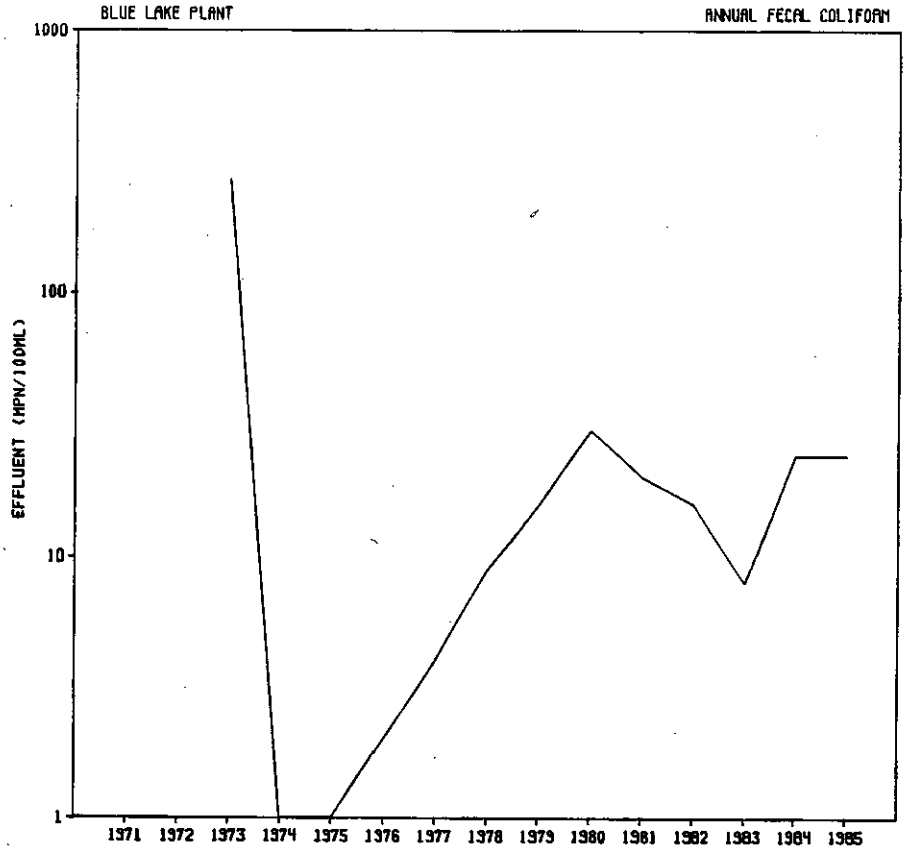
* For disinfection only unless otherwise noted.

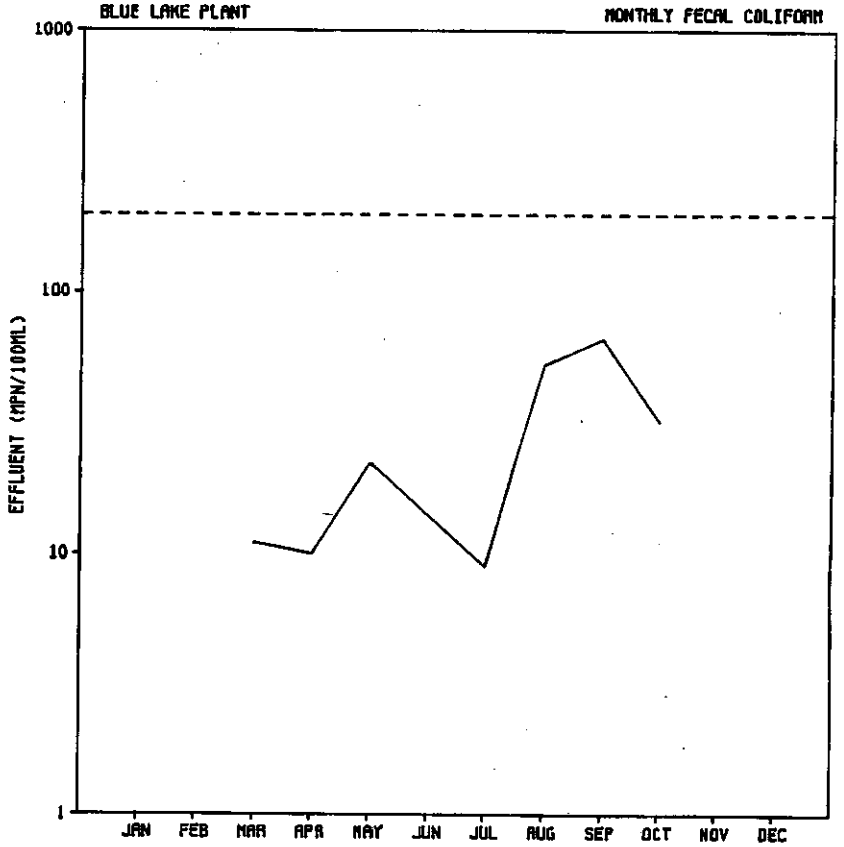

BLUE LAKE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

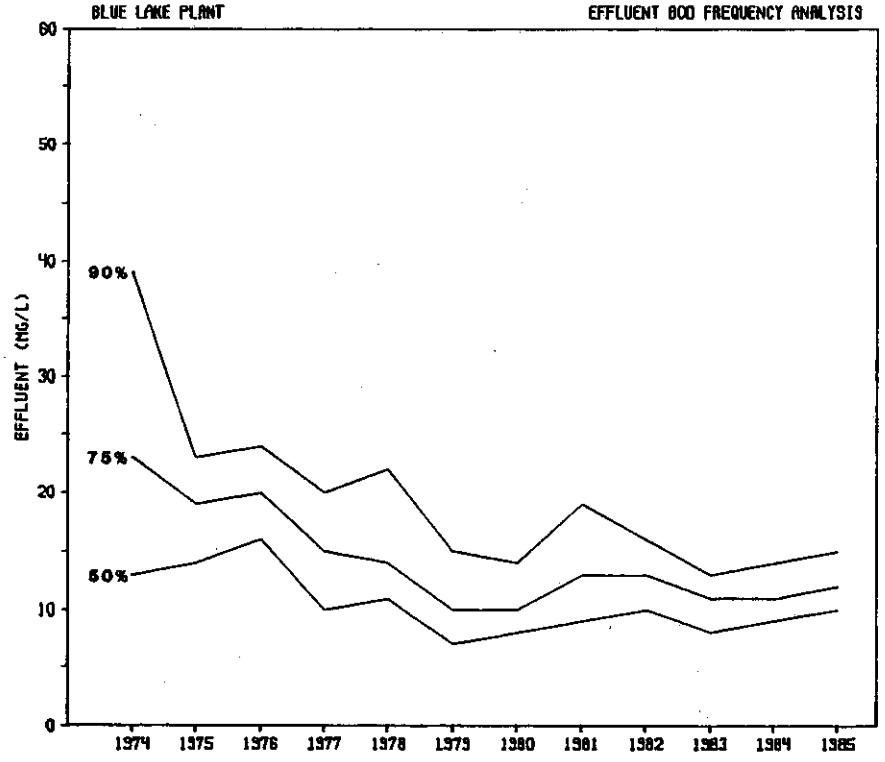

BLUE LAKE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
EFFLUENT (MG/L)
30
20
10
0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

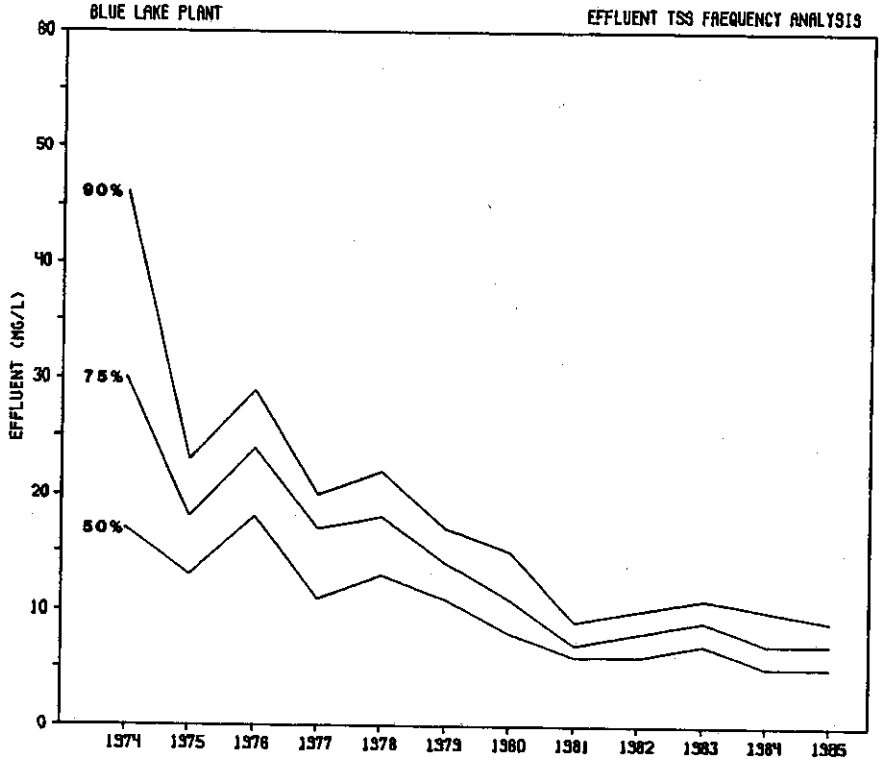

BLUE LAKE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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


BLUE LAKE 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
1984
1985


BLUE LAKE 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
1984
1985

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 0.91 mgd in 1985, slightly lower than 1.09 mgd in 1984. Average plant effluent quality was 13 mg/L BOD and 14 mg/L TSS. Plant performance was good throughout the year, with one NPDES Permit violation of the weekly TSS limit. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	12	9	6	10	16	13	10	14	22	17	14	19
TSS	10	8	5	11	14	14	9	16	19	22	18	19

Future

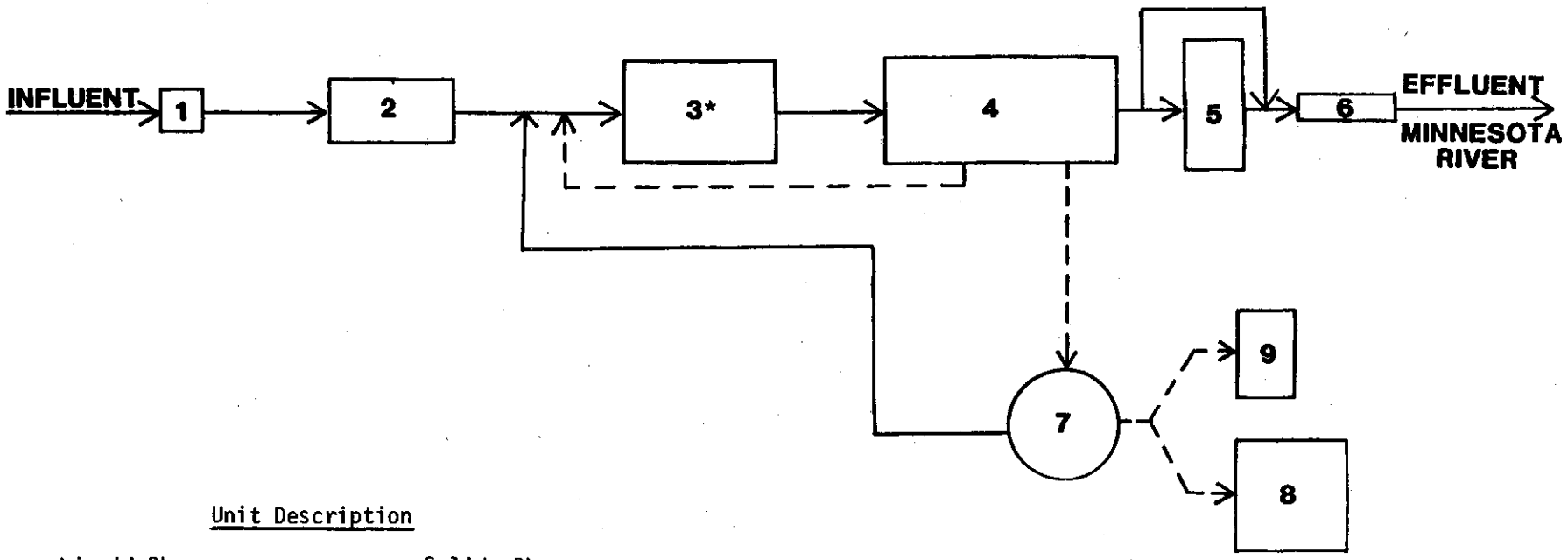
This plant is one of the Commission's permanent treatment plants. A plant expansion is scheduled for the 1986-1988 period.

CHASKA PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1983	Annual Average 1984	Annual Average 1985	Maximum Month 1983	Maximum Month 1984	Maximum Month 1985
Wastewater Flow, mgd	1.02	1.09	0.91	1.78	1.38	1.19
BOD Loading, lb/day	1,200	1,010	1,135	1,500	1,190	1,421
TSS Loading, lb/day	1,100	1,440	1,121	1,300	5,150	1,441
COD Loading, lb/day	2,500	2,330	2,358	2,900	3,450	2,905
Sludge Production, lb/day	800	1,500	1,300	1,110	2,100	1,900
Grit Removal						
Overflow Rate, gpd/sq. ft.	23,000	24,000	20,200	30,000	30,700	26,400
Aeration Tanks						
Detention Time, hr.	2.4	2.2	2.7	1.4	1.8	2.0
BOD Loading, lb/day/1000 cu. ft.	90	70	85	110	90	105
Oxygen Utilization, lb/day as O_2	------	1,900	1,950	------	------	------
Final Sedimentation						
Detention Time, hr.	5.5	5.1	6.1	3.1	4.0	4.7
Weir Overflow Rate, gpd/lin. ft.	5,400	5,800	4,800	9,500	7,300	6,300
Surface Overflow Rate, gpd/sq. ft.	360	390	320	640	490	420
Chlorination						
Contact Time, minutes	110	108	130	60	85	100
Chlorine Use, lb/day	70	48	41	130	84	48
Aerobic Digestion						
Volatile Solids Loading, lb/cu. ft./day	0.01	0.025	0.005	------	------	------
Detention Time, days	60	43	120	------	------	------
Sludge Transport						
Volume, gpd	6,000	8,600	8,800	8,600	10,700	10,900

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

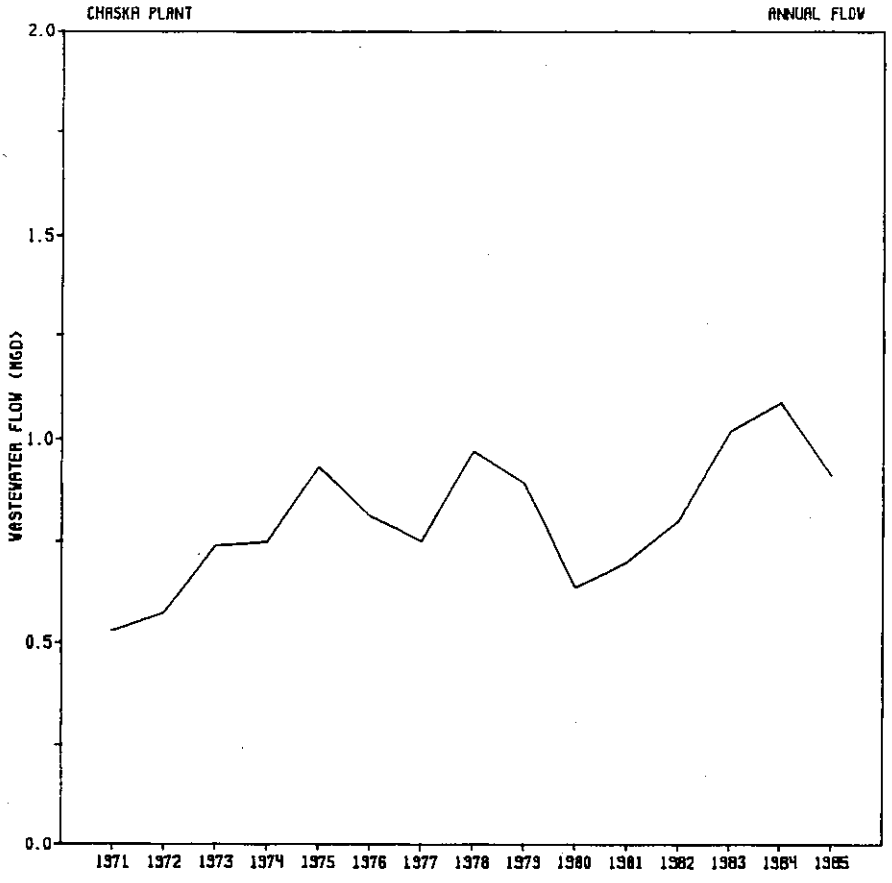
Solids Phase

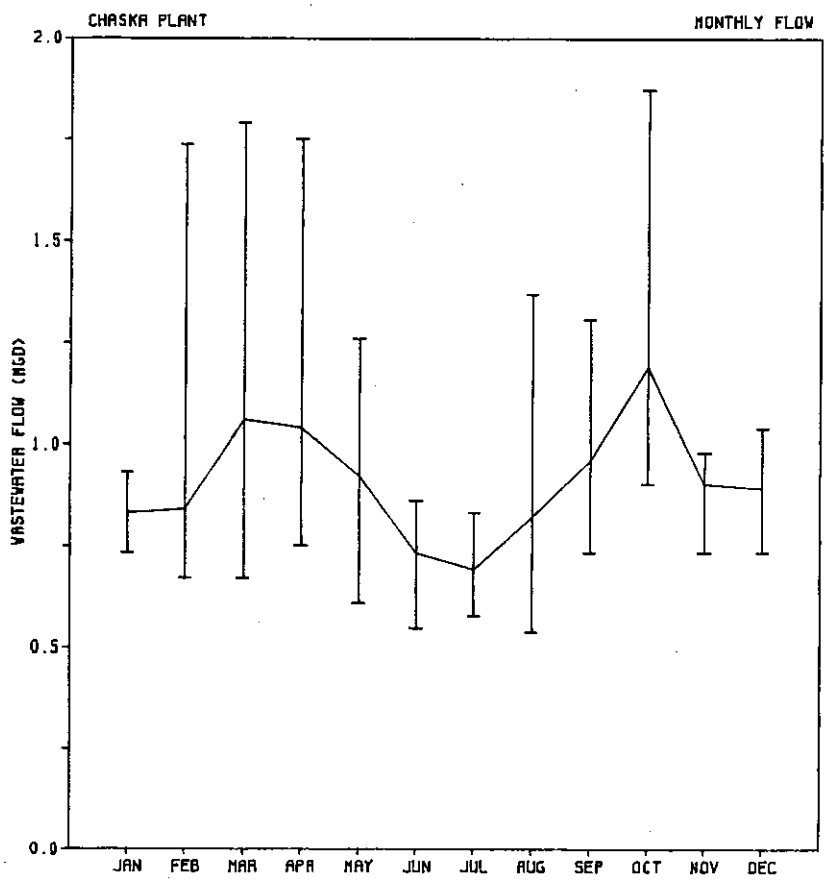
7. Two Stage Aerobic Digestion
8. Land Spread
9. Haul to Blue Lake, Seneca, or Metro System

* Pure Oxygen

Legend

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


CHASKA PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
2.0
1.5
1.0
0.5
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


CHASKA PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
2.0
1.5
1.0
0.5
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

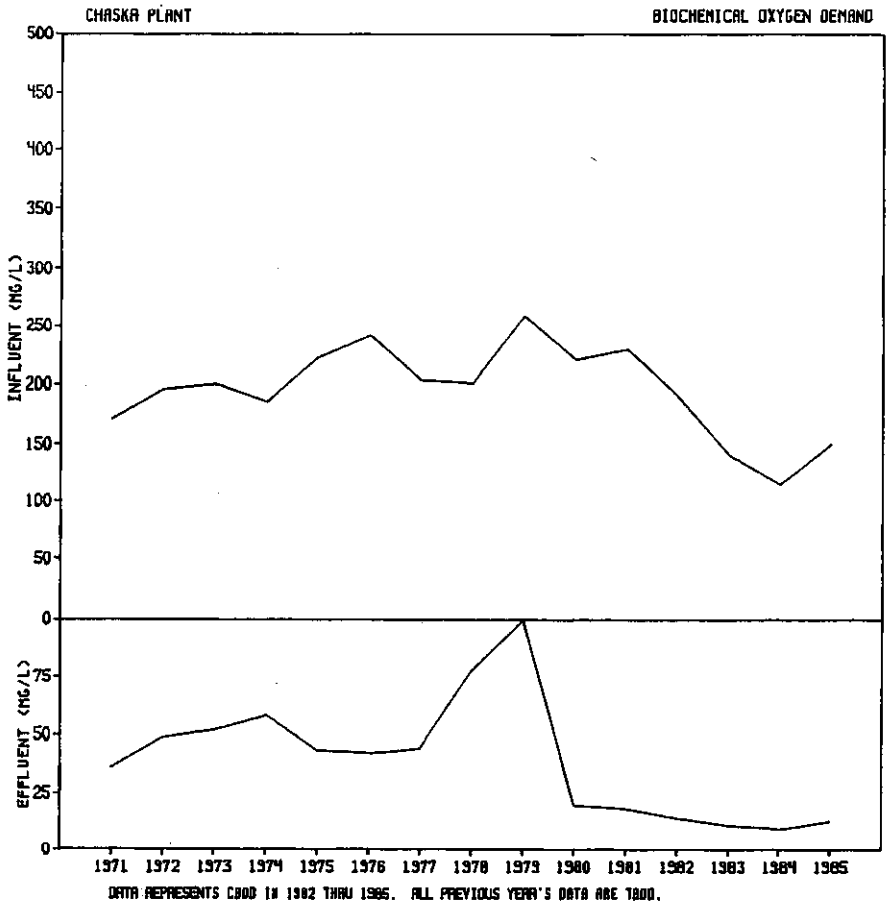
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Chaska

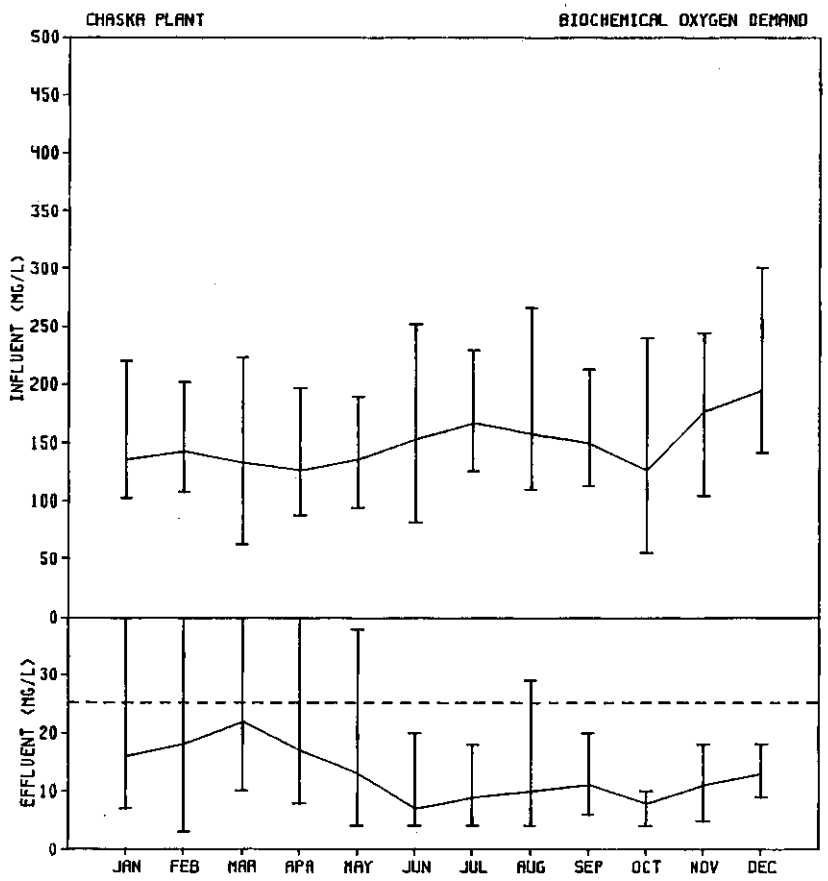
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.83	12	136	125	7.0-9.0	27.4	4.3	15.1	284
FEBRUARY	0.84	10	143	118	6.7-10.0	36.6	4.3	23.5	301
MARCH	1.06	9	133	121	6.6-9.8	39.8	6.2	19.0	320
APRIL	1.04	10	127	124	5.4-9.0	22.3	3.5	9.4	259
MAY	0.92	13	136	123	4.5-9.4	24.3	4.1	11.6	275
JUNE	0.73	14	153	141	6.4-9.8	28.0	4.8	14.6	319
JULY	0.69	17	167	161	6.4-10.2	29.6	5.0	11.9	353
AUGUST	0.82	18	157	188	6.8-9.0	38.5	5.1	22.4	343
SEPTEMBER	0.96	18	149	170	6.6-9.0	24.0	4.0	14.4	322
OCTOBER	1.19	16	127	131	6.8-8.8	21.5	3.6	11.4	259
NOVEMBER	0.90	15	177	173	0.6-8.7	31.0	4.8	15.8	333
DECEMBER	0.89	13	194	169	6.0-8.7	29.6	4.7	16.7	350
1985 AVERAGE	0.91	14	150	145	0.6-10.2	29.1	4.5	15.3	309
1984 AVERAGE	1.09	14	115	148	3.0-10.0	31.2	4.2	16.1	263

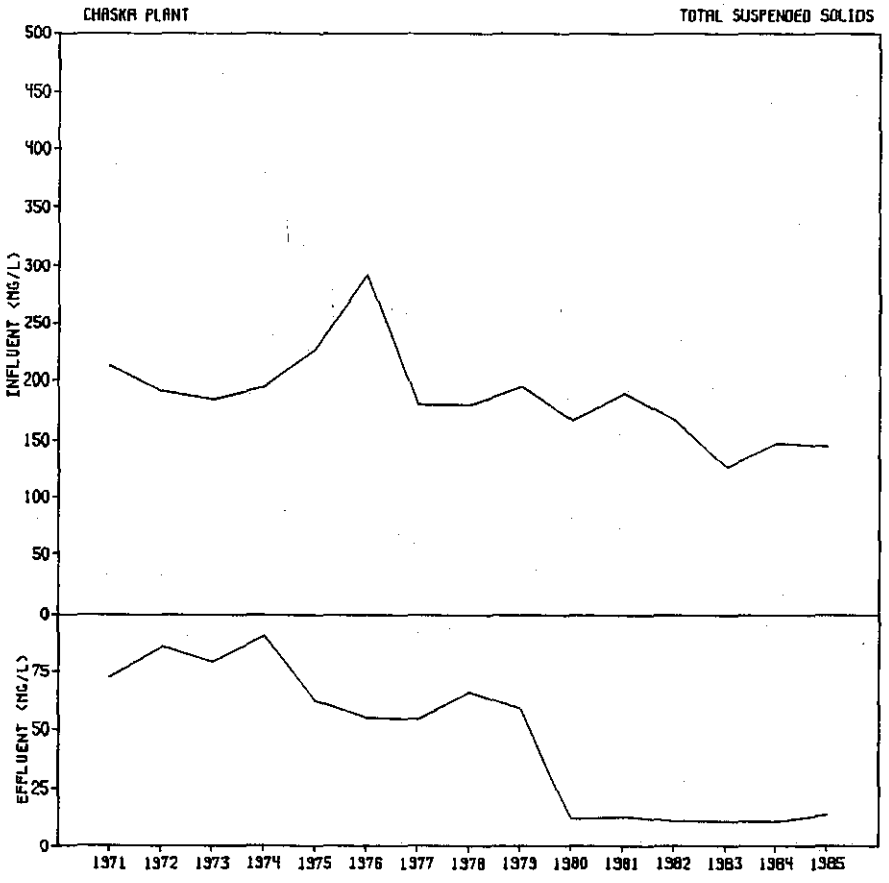
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Chaska

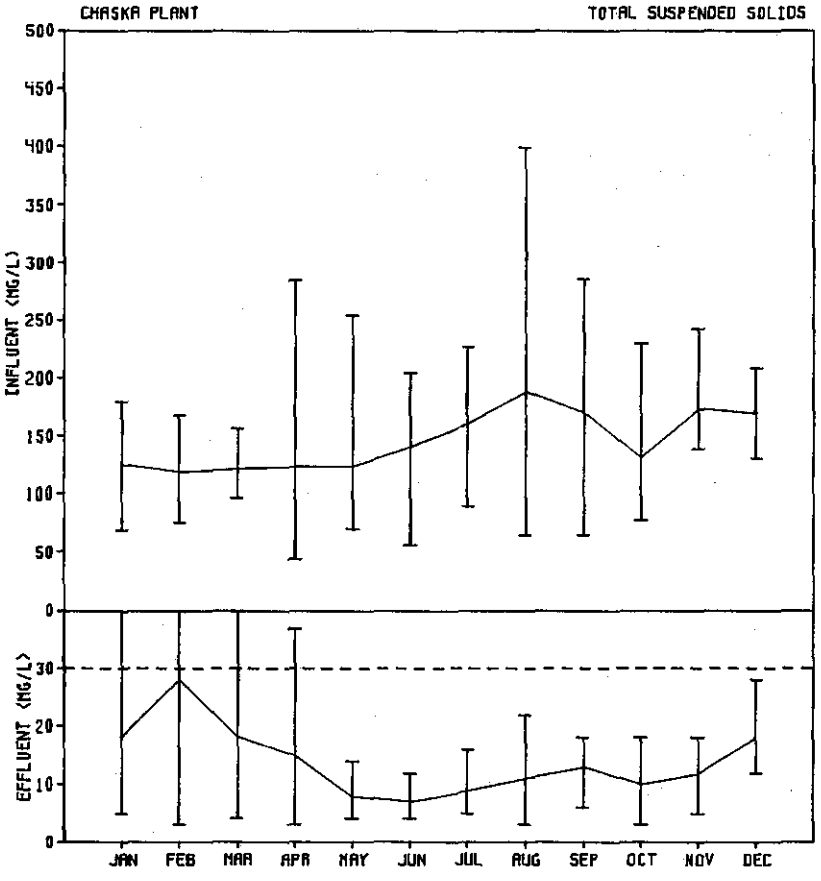
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	-----	---	-----	---	---	--	---	-----	6.0-9.0	--	--
JANUARY	36	16	69	18	---	6	17.2	10.3	0.25	3.77	2.4	--	---	9.5	7.2-7.6	88	86
FEBRUARY	34	18	89	28	---	8	15.4	11.5	0.16	2.10	0.7	--	---	8.6	7.2-7.7	87	77
MARCH	25	22	92	18	8	10	16.0	9.4	0.67	1.13	2.3	48	3.5	10.3	7.2-7.7	84	85
APRIL	20	17	71	15	5	8	14.2	7.4	0.19	0.81	1.2	44	2.0	9.8	7.2-7.9	87	88
MAY	15	13	57	8	4	5	16.5	10.6	0.13	0.65	0.6	36	1.8	9.1	7.4-8.0	91	94
JUNE	11	7	56	7	7	4	18.4	13.1	0.33	0.78	1.5	34	1.6	9.3	6.7-7.9	95	95
JULY	14	9	62	9	5	4	16.3	9.9	1.04	0.99	0.6	31	1.5	8.5	7.3-7.7	95	94
AUGUST	13	10	58	11	5	5	15.5	12.5	0.64	1.39	1.4	40	1.6	9.0	7.1-7.9	94	94
SEPTEMBER	22	11	60	13	7	6	12.9	9.1	1.38	2.47	0.9	46	1.7	8.8	7.2-7.7	92	92
OCTOBER	15	8	55	10	7	5	12.1	8.3	0.62	2.06	0.5	47	1.7	8.8	7.1-7.8	94	93
NOVEMBER	24	11	59	12	---	5	15.9	11.3	0.95	1.63	0.9	--	---	9.4	7.0-7.7	94	93
DECEMBER	37	13	63	18	---	6	17.7	13.9	0.47	3.21	1.3	--	---	9.3	6.8-7.5	93	89
1985 AVG.	22	13	66	14	6	6	15.8	10.7	0.56	1.77	1.2	41	1.9	9.2	6.7-8.0	91	90
1984 AVG.	15	9	60	11	18	5	12.3	7.7	0.45	1.32	0.9	48	2.5	9.2	6.6-7.9	92	93

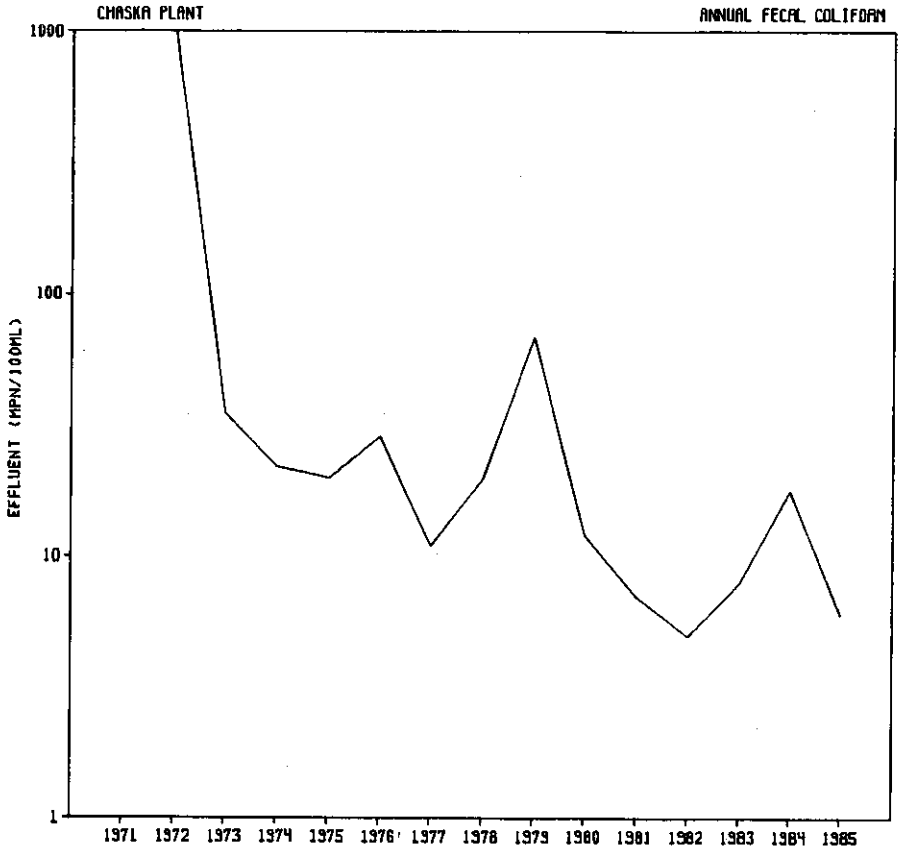
*For disinfection only.

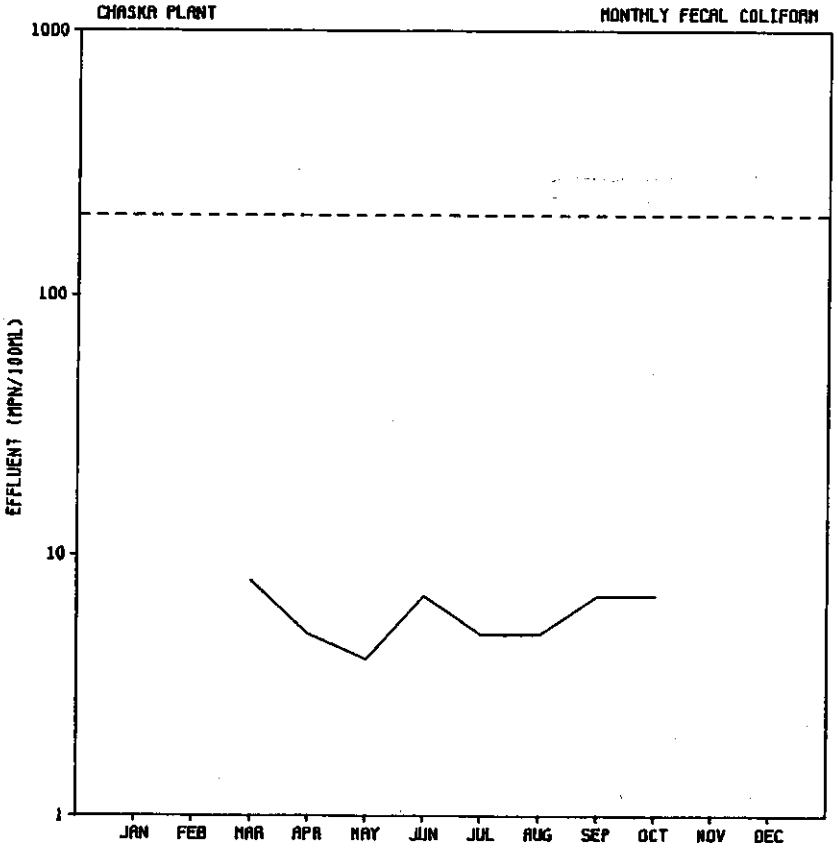

CHASKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

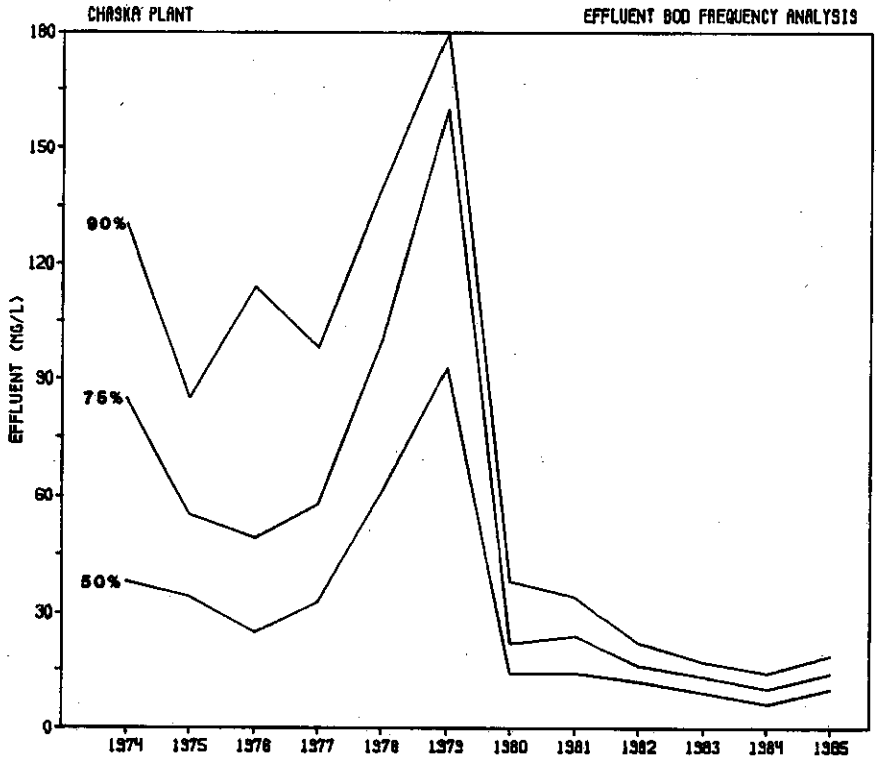

CHASKA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

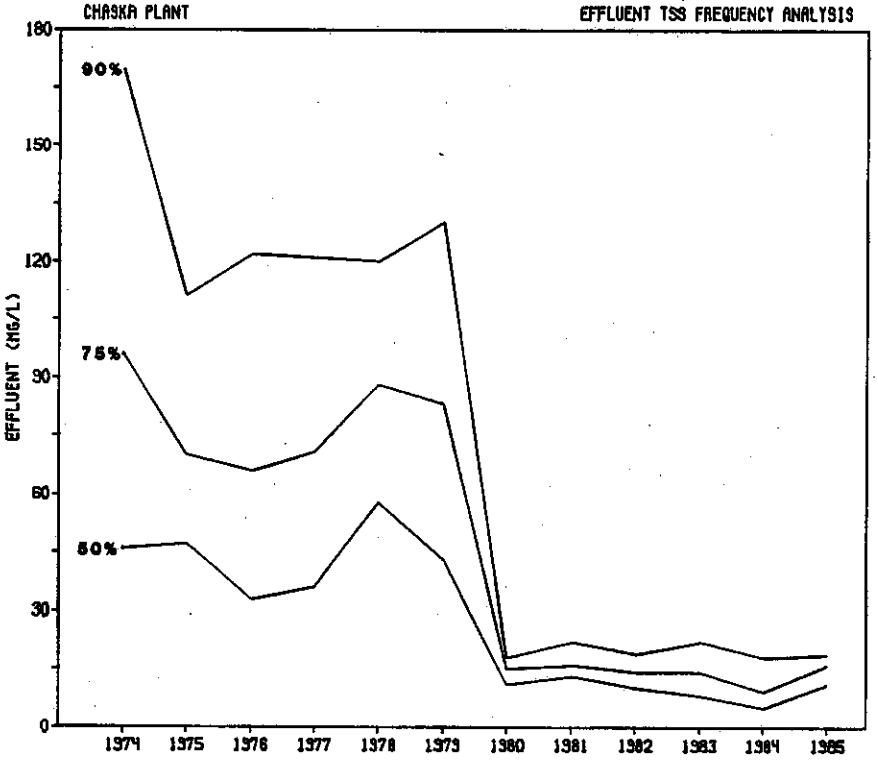

CHASKA PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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
0
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 1984 1985


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
1984
1985


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
1984
1985

COTTAGE GROVE WASTEWATER TREATMENT PLANT

Plant History and Description

The Cottage Grove Plant, designed by Bonestroo, Rosene, Anderlik, and Associates, was 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, chlorination, and discharge to the Mississippi River.

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

The plant is presently operating at about 75 percent of its design capacity and is subject to secondary treatment limits.

Performance

The plant flow averaged 1.35 mgd in 1985, slightly higher than 1.30 in 1984. Average plant effluent quality was 11 mg/L BOD and 12 mg/L TSS. Plant performance was good throughout the year with three NPDES Permit violations related to fecal coliform limitations. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	8	8	8	9	13	11	11	13	18	14	14	17
TSS	6	10	7	11	10	14	11	15	14	18	14	20

Future

The Cottage Grove facility is considered a permanent plant. The plant is expected to be expanded in the early 1990's.

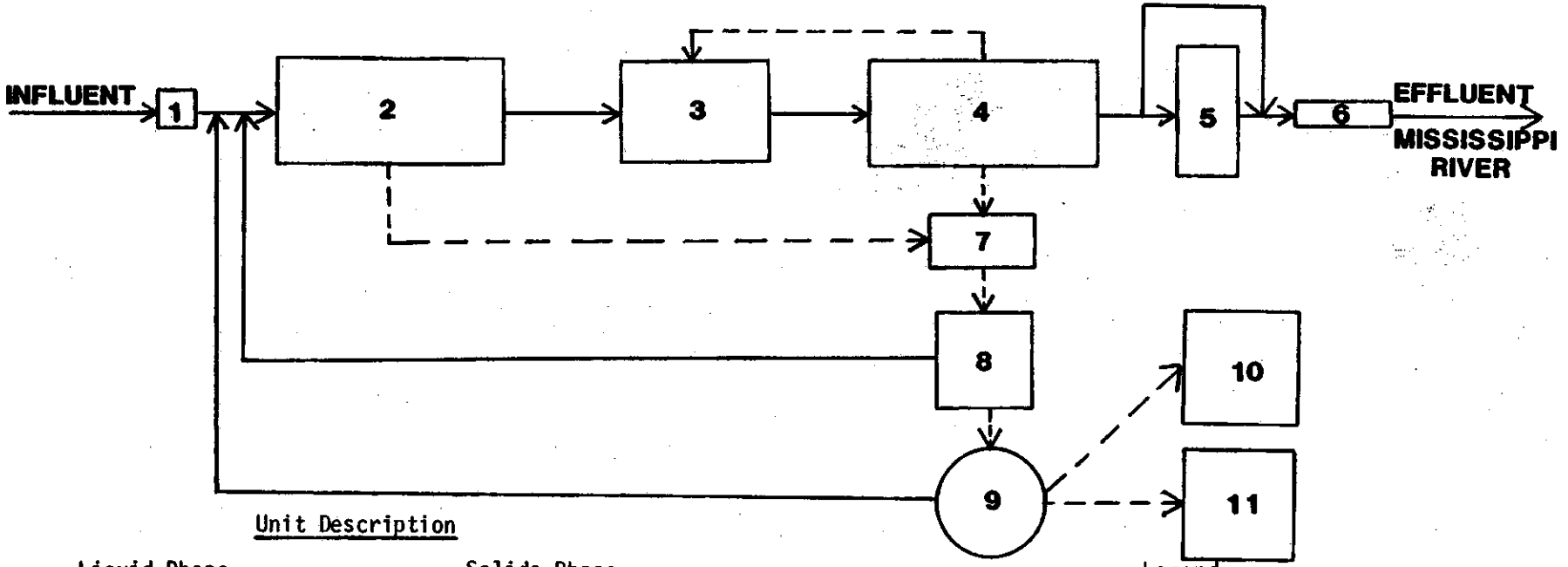
COTTAGE GROVE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	1.30	1.30	1.35	1.37	1.37	1.46
BOD Loading, lb/day	1,900	1,900	2,350	2,380	2,190	3,030
TSS Loading, lb/day	1,680	1,670	2,050	2,520	1,980	2,520
COD Loading, lb/day	3,960	4,110	4,770	4,700	4,900	5,310
Primary Sedimentation						
Surface Overflow Rate, gpd/sq. ft.	550	550	567	575	575	613
Aeration Basin						
BOD Loading, lb/day/1000 cu. ft.[1]	37	30	37	47	34	47
Final Sedimentation						
Weir Overflow Rate, gpd/lin. ft.	4,600	4,600	4,790	4,860	4,860	5,180
Surface Overflow Rate, gpd/sq. ft.	410	410	424	430	430	459
Chlorination						
Chlorine Use, lb/day	69	86	91	80	77	121
Gravity Thickener						
Surface Loading Rate, gpd/sq. ft.	725	725	680	------	------	890
Mass Loading Rate, lb/sq. ft./day	3	3	3	------	------	5
Anaerobic Digestion						
Solid Retention Time, day	62	62	49	41	41	41
Sludge Transport						
Volume, gpd	6,260	8,960	8,020	9,500	15,110	9,490
Mass, lb/day	960	1,300	1,130	1,000	1,600	1,720

[1]Assumes 20% BOD removal in primary sedimentation.

COTTAGE GROVE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

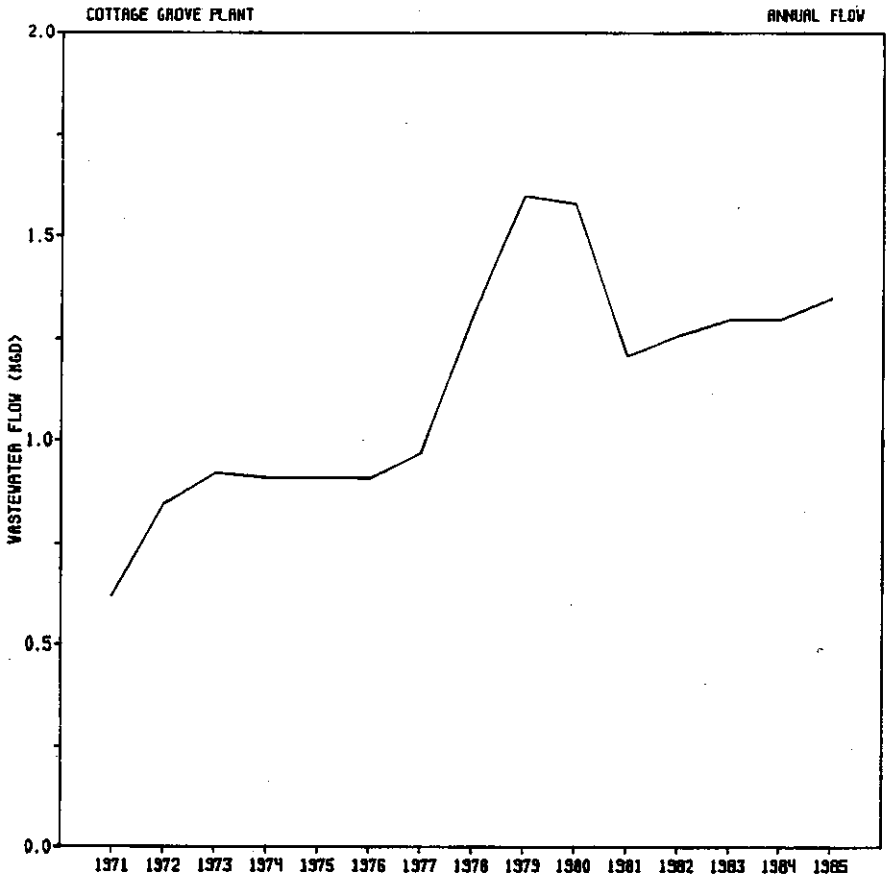
1. Screening
2. Primary Sedimentation
3. Activated Sludge
4. Final Sedimentation
5. Effluent Filtration
6. Chlorination

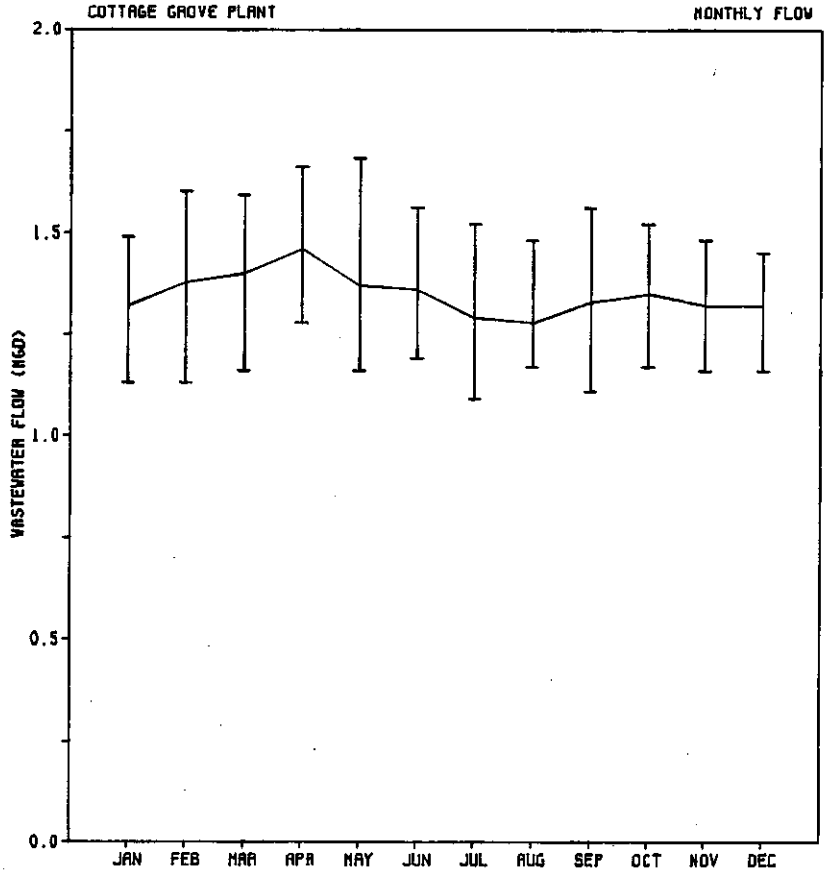
Solids Phase

7. Sludge Blend Tank
8. Sludge Thickener
9. Anaerobic Digestion
10. Haul to Land Spreading
11. Disposal at Metro Plant

Legend

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


COTTAGE GROVE PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
2.0
1.5
1.0
0.5
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


COTTAGE GROVE PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
2.0
1.5
1.0
0.5
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

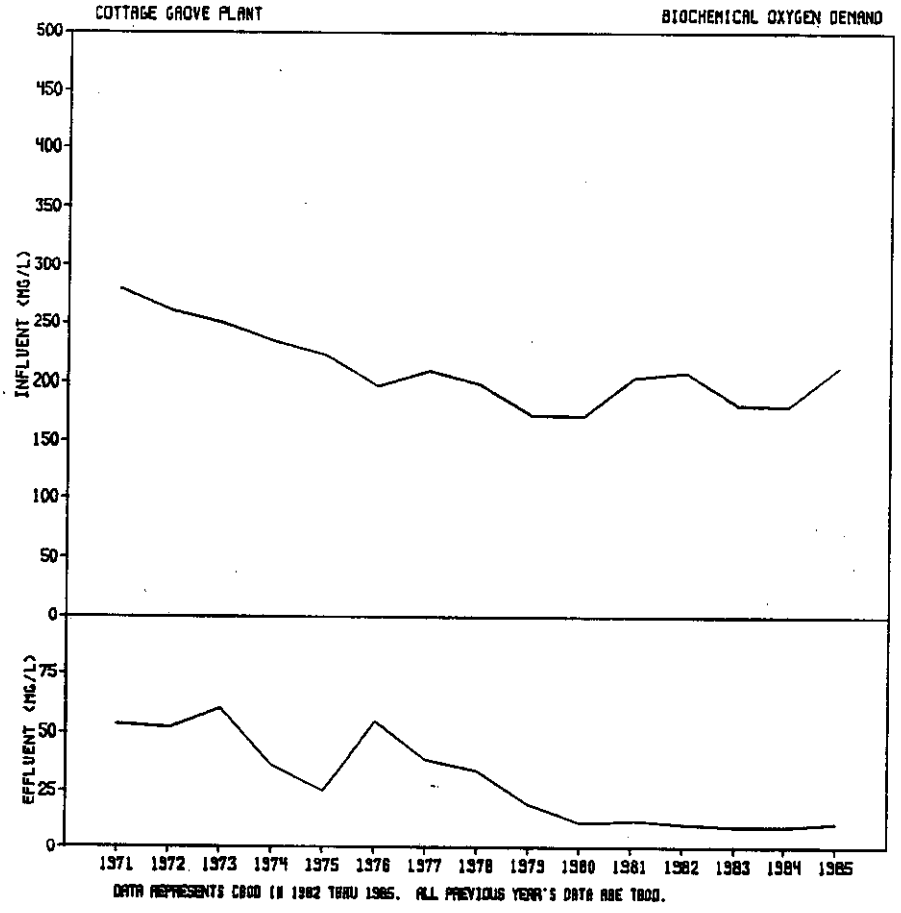
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Cottage Grove

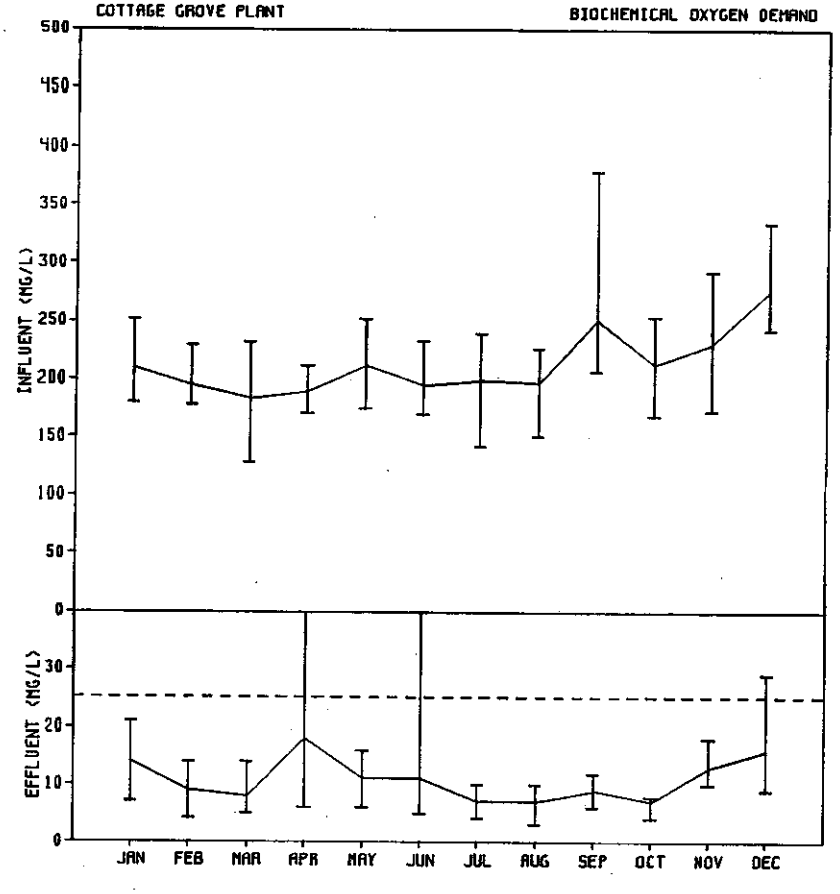
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	1.32	11	209	188	7.7-8.5	44.2	7.7	23.9	458
FEBRUARY	1.38	10	195	161	7.5-8.4	42.0	7.1	25.4	432
MARCH	1.40	10	183	150	7.6-8.6	37.8	6.2	18.9	423
APRIL	1.46	11	189	172	7.7-8.3	40.1	6.7	19.5	385
MAY	1.37	15	211	195	7.6-8.5	42.3	7.1	21.1	413
JUNE	1.36	17	195	162	7.5-8.1	41.8	7.0	22.6	395
JULY	1.29	19	199	184	7.3-7.9	41.7	7.0	22.0	427
AUGUST	1.28	20	197	236	7.2-7.8	39.9	6.7	21.9	404
SEPTEMBER	1.33	20	251	209	7.2-8.1	43.9	7.7	23.8	465
OCTOBER	1.35	18	213	186	7.4-8.1	41.9	7.2	22.5	438
NOVEMBER	1.32	15	231	178	7.3-8.2	44.6	6.6	25.0	441
DECEMBER	1.32	12	276	204	7.3-8.2	43.4	7.8	26.4	485
1985 AVERAGE	1.35	15	213	186	7.2-8.6	42.0	7.1	22.8	431
1984 AVERAGE	1.30	15	180	158	7.2-8.5	40.6	6.8	22.8	389

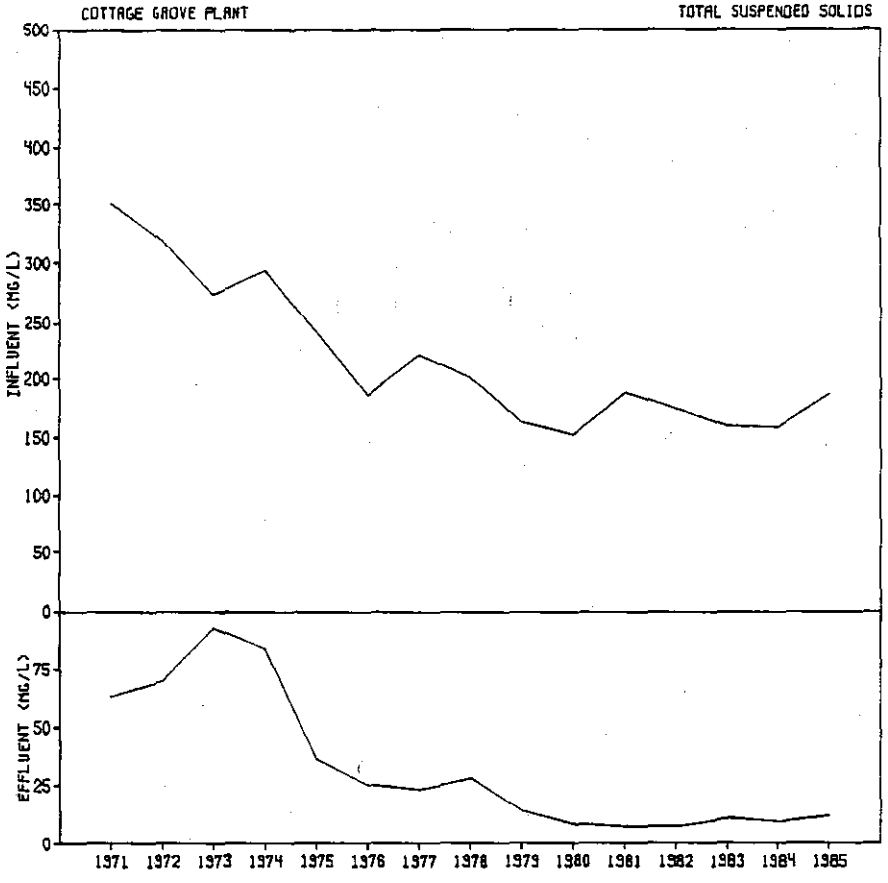
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Cottage Grove

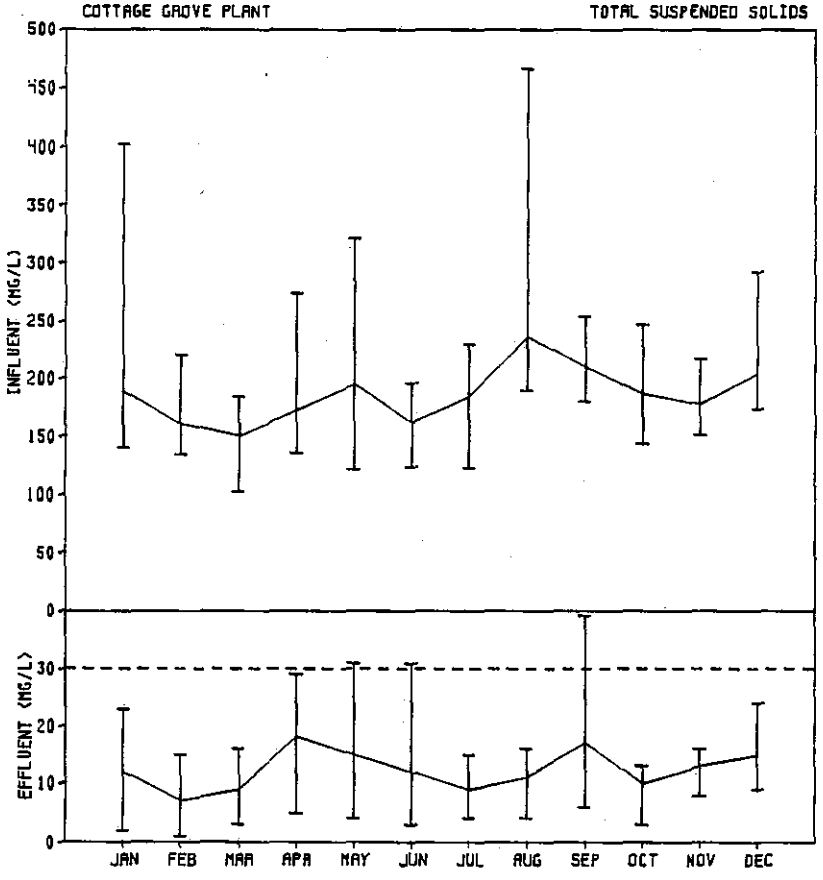
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	----	----	-----	---	---	---	---	6.5-8.5	--	--
JANUARY	24	14	70	12	---	6	29.3	21.7	0.14	3.18	4.5	---	---	4.8	7.4-7.7	93	94
FEBRUARY	21	9	56	7	---	4	25.3	21.1	0.10	3.55	4.3	30	---	5.8	7.3-7.7	96	96
MARCH	20	8	59	9	7	5	23.2	15.9	0.32	3.10	3.7	65	5.1	5.8	7.0-7.6	96	94
APRIL	35	18	87	18	20	10	29.7	17.6	0.46	3.31	4.6	52	5.0	5.3	7.3-7.6	91	89
MAY	26	11	67	15	122	8	26.8	16.9	1.15	2.80	4.6	62	3.8	5.2	7.3-7.6	95	92
JUNE	24	11	59	12	125	6	18.2	12.0	2.26	6.54	4.6	105	4.2	4.4	7.1-7.4	94	93
JULY	14	7	53	9	58	5	13.0	7.4	1.06	10.93	4.7	109	4.2	4.3	7.0-7.3	96	95
AUGUST	15	7	51	11	60	6	10.7	5.4	1.57	12.72	4.7	121	3.4	4.6	6.9-7.2	97	95
SEPTEMBER	15	9	62	17	32	9	19.4	11.6	1.04	8.36	4.9	117	4.2	4.7	6.8-7.4	97	92
OCTOBER	19	7	52	10	212	5	11.8	7.0	1.49	9.13	4.6	105	4.4	4.7	6.9-7.3	97	95
NOVEMBER	41	13	54	13	---	5	19.9	13.6	1.54	3.99	4.4	---	---	5.0	7.0-7.5	94	93
DECEMBER	30	16	65	15	---	6	28.3	20.6	0.44	3.82	4.9	---	---	4.8	7.3-7.5	94	93
1985 AVG.	24	11	61	12	79	6	21.6	14.3	0.95	5.85	4.5	91	4.3	5.0	6.8-7.7	95	93
1984 AVG.	22	9	69	9	101	5	25.5	18.6	1.13	2.56	4.7	85	4.4	5.5	7.0-7.9	95	94

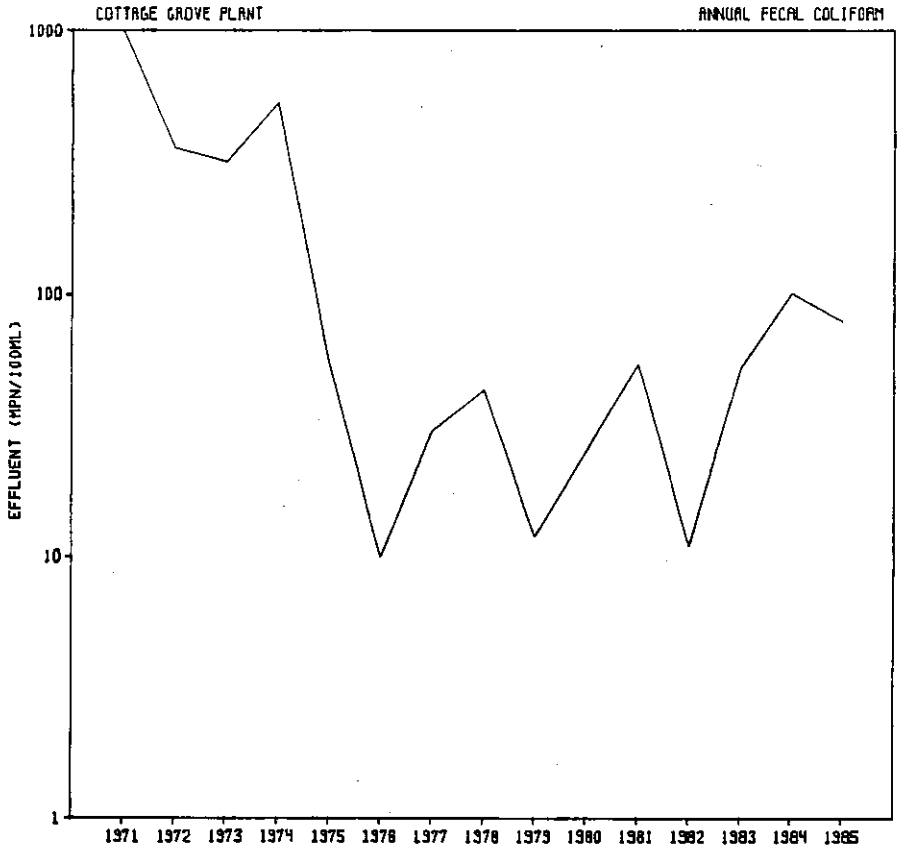
*For disinfection only.

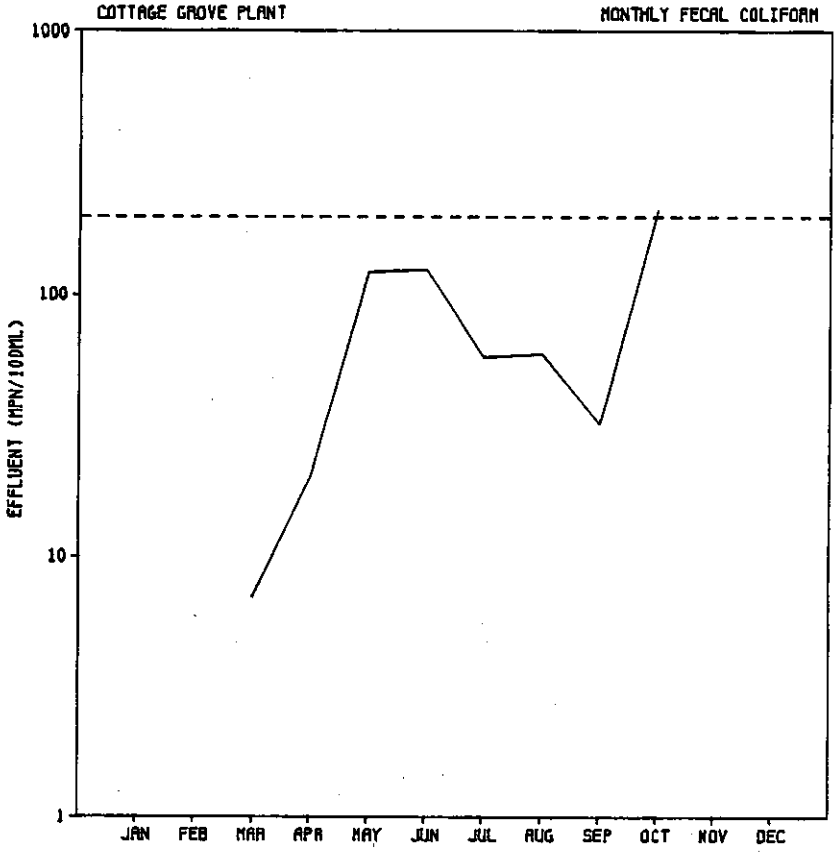

COTTAGE GROVE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

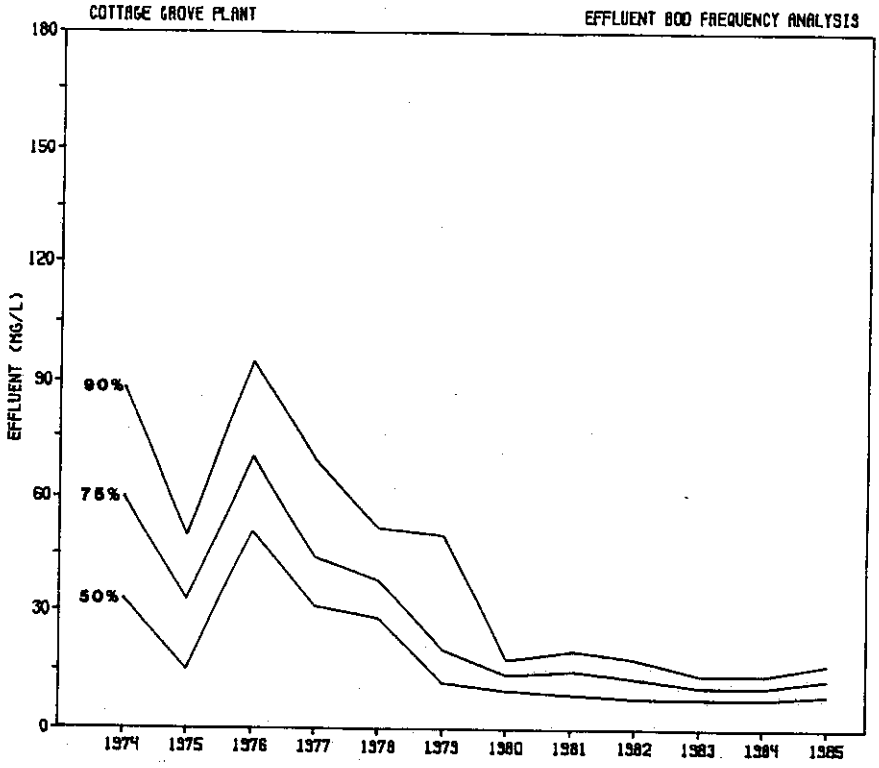

COTTAGE GROVE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

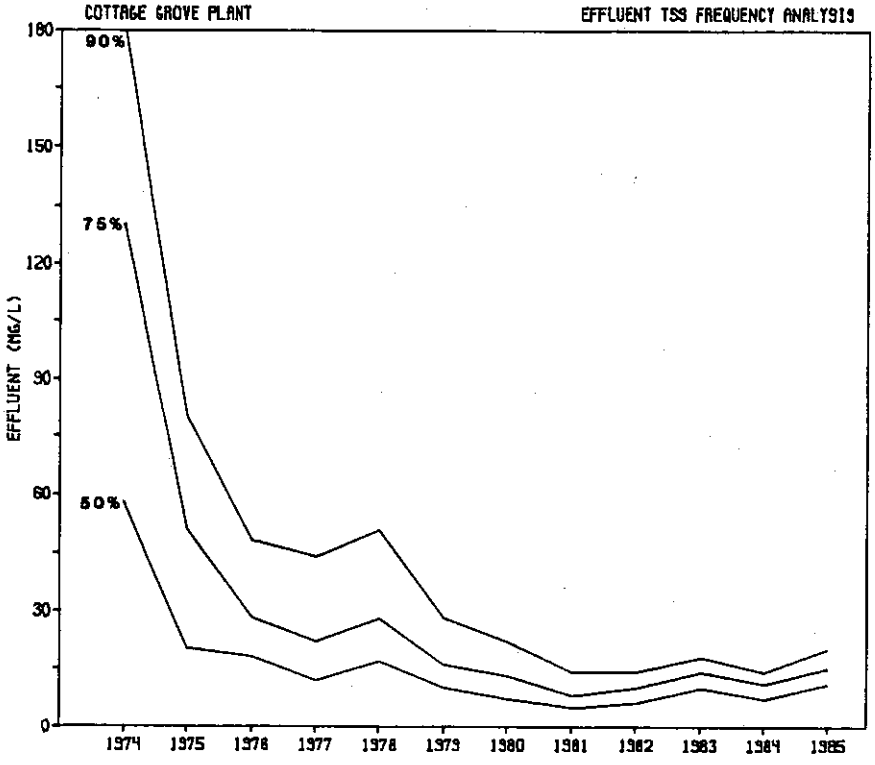

COTTAGE GROVE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
75
50
25
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


COTTAGE GROVE 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


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 1984 1985


COTTAGE GROVE PLANT
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
1984
1985


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
1984
1985

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 90 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 5.43 mgd in 1985, somewhat higher than 5.19 mgd in 1984. Average plant effluent quality was 3 mg/L BOD, 2 mg/L TSS and 0.3 mg/L ammonia. Plant performance was excellent throughout the year with one NPDES permit violation of the ammonia limit. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	2	2	1	2	3	3	2	2	4	4	3	4
TSS	1	1	1	1	1	1	2	2	2	2	3	3

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. A plant expansion is planned for the late 1980's.

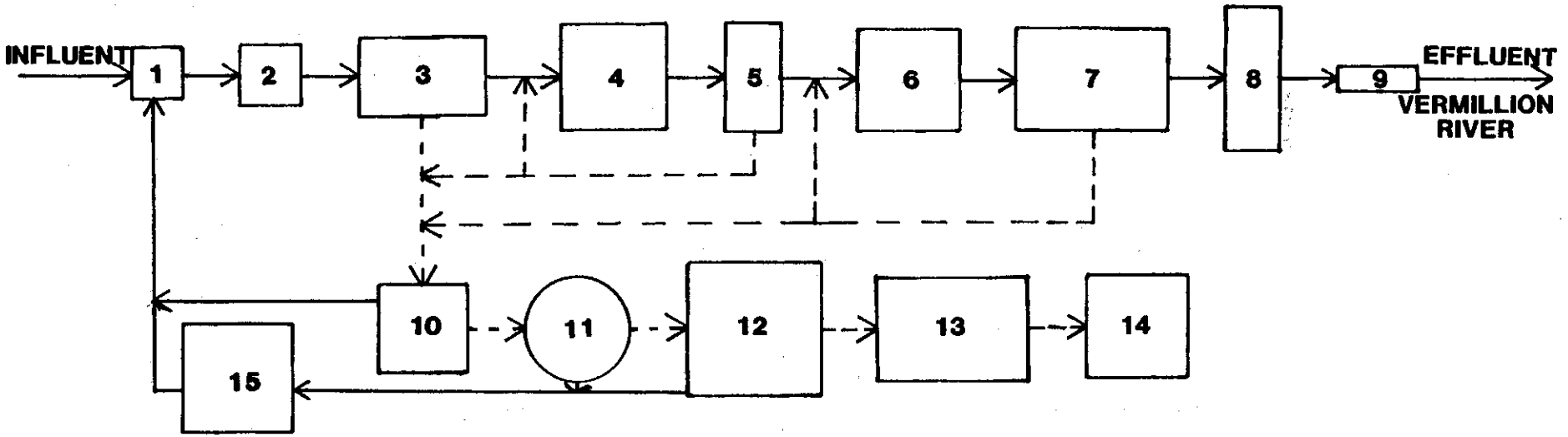
EMPIRE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	4.81	5.19	5.43	6.57	6.36	6.31
BOD Loading, lb/day[1]	8,500	11,200	10,300	13,300	20,900	13,600
TSS Loading, lb/day[1]	9,900	11,100	9,400	13,200	16,000	14,600
Ammonia Loading, lb/day[1]	650	810	800	800	1,100	940
COD Loading, lb/day[1]	17,900	------	19,200	23,800	------	25,500
Kj-N Loading lb/day[1]	------	1,870	1,700	------	2,700	2,400
Aerated Grit Chamber						
Flow Through Velocity, ft./sec.	0.03	0.046	0.048	0.04	0.054	0.054
Detention Time, minutes	20	14	13	15	12	12
Primary Clarifiers						
Surface Overflow Rate, gpd/sq. ft.	480	685	710	650	800	800
Weir Overflow Rate, gpd/lin. ft.	9,600	13,700	14,200	13,100	16,000	16,000
Aeration						
High Rate BOD Loading lb/day/ 1000 cu. ft.	25	62	73	39	76	88
Nitrification BOD Loading lb/day/ 1000 cu. ft.	------	16	6.5	------	29	11
Nitrification Kj-N Loading lb/day/ 1000 cu. ft.	------	------	5.5	------	------	8.3
Nitrification NH_3-N Loading lb/day/ 1000 cu. ft.	3.6	3.1	3.6	3.9	4.4	4.5
Clarification						
High Rate Surface Overflow Rate, gpd/sq. ft.	480	685	710	650	800	800
Nitrification Surface Overflow Rate, gpd/sq. ft.	380	485	470	520	580	535
Dual Media Filters						
Filtration Rate, gpm/sq. ft.	2.2	2.8	2.5	2.9	3.3	2.8
Chlorination						
Chlorine Use, lb./day	125	105	124	145	150	151
Sludge Production						
Sludge Production, lb/day	------	------	4,200	------	------	5,500

[1]Includes loading from plant return flow.

EMPIRE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Liquid Phase

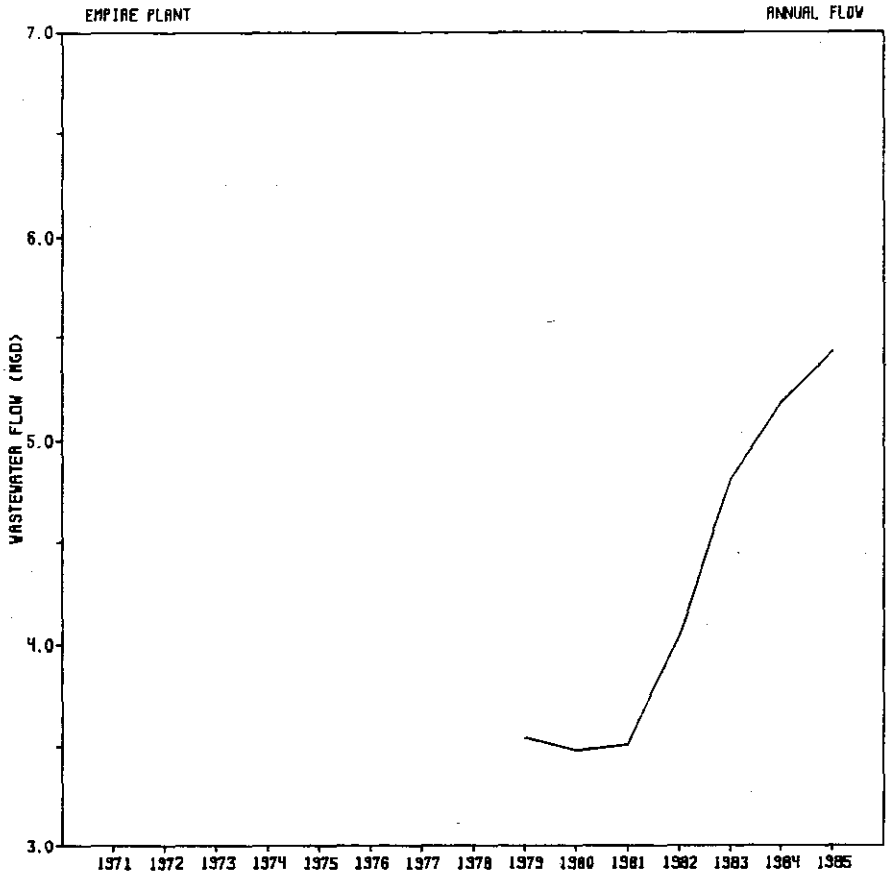
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Hi-Rate Activated Sludge Aeration
5. Intermediate Clarification
6. Nitrification Activated Sludge Aeration
7. Final Clarification
8. Effluent Filtration
9. Chlorination

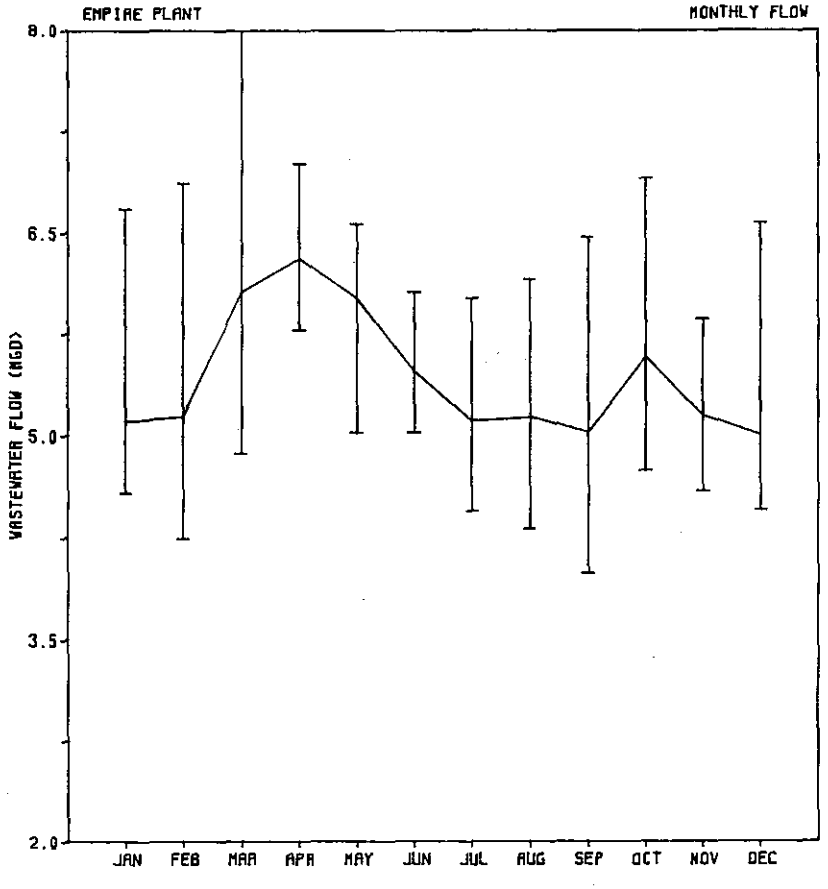
Solids Phase

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

Legend

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


EMPIRE PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
7.0
6.0
5.0
4.0
3.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985

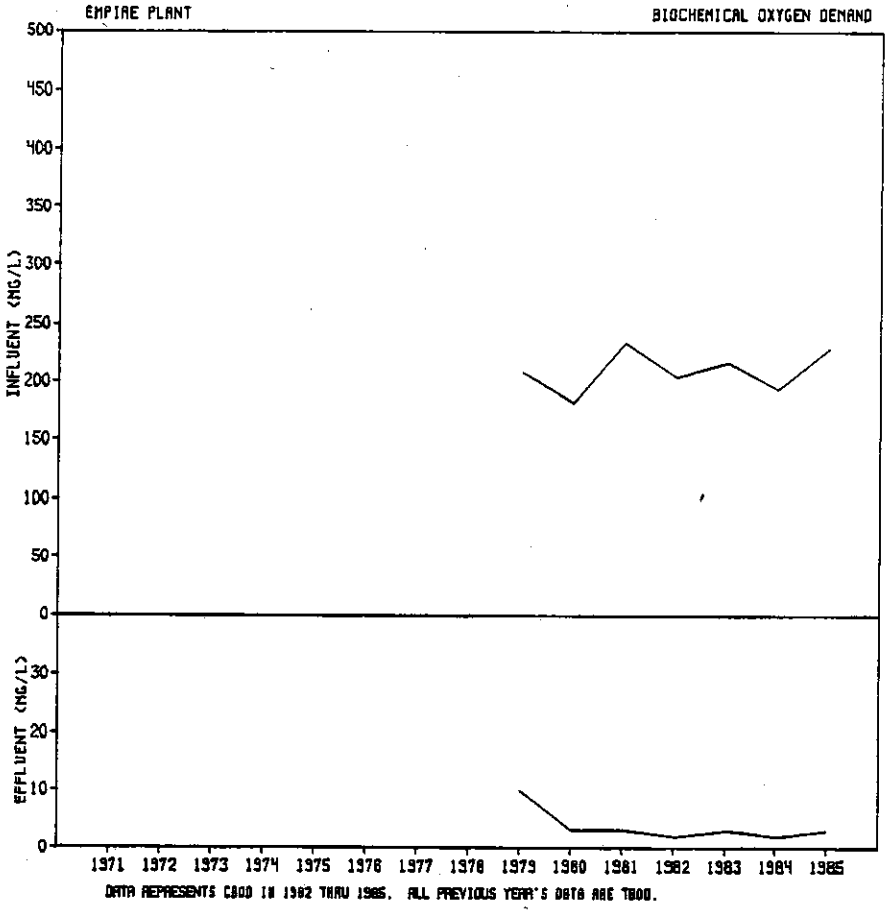

EMPIRE PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
8.0
6.5
5.0
3.5
2.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

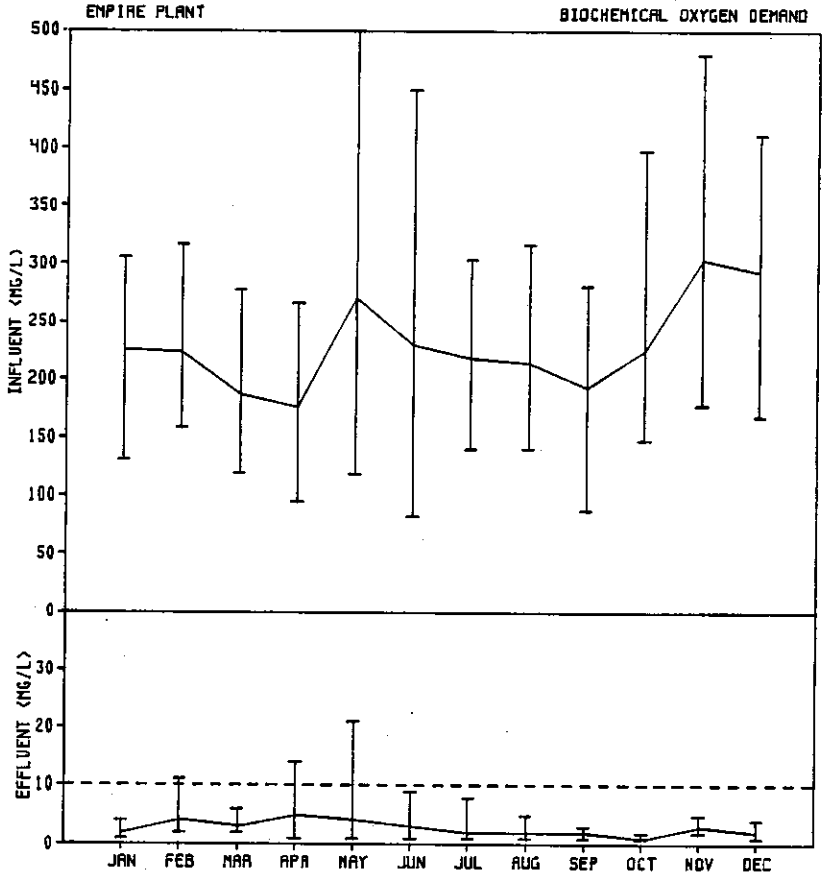
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Empire

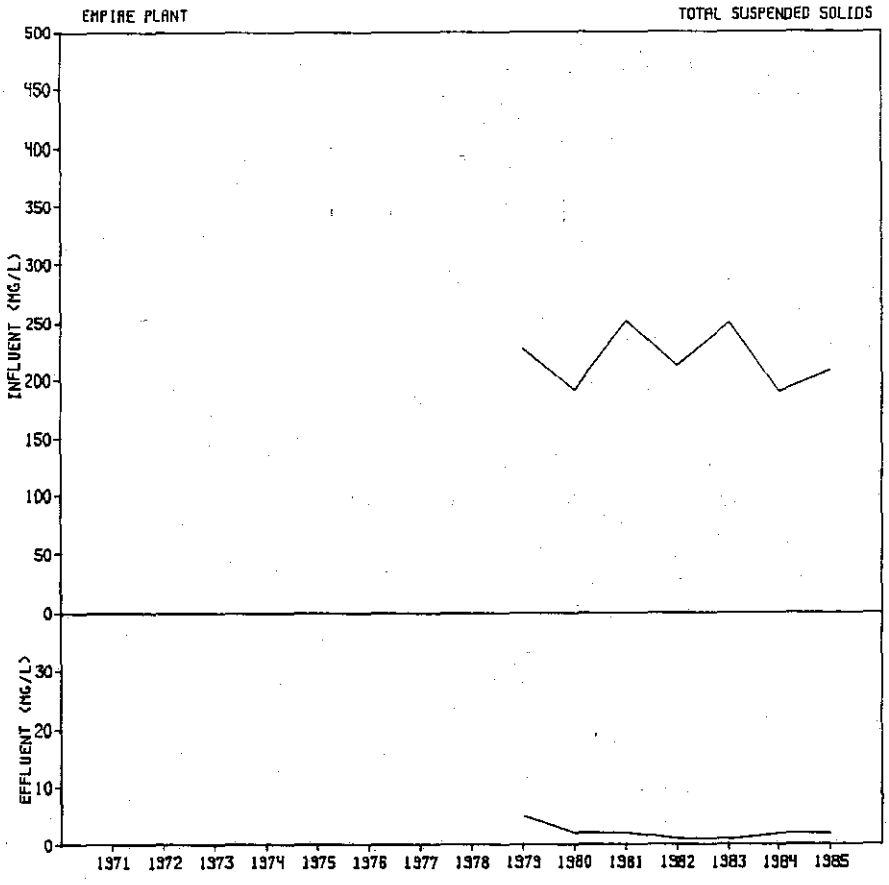
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	5.11	12	225	175	5.7-9.4	35.7	6.8	19.4	392
FEBRUARY	5.15	12	223	164	6.4-9.0	33.0	8.7	16.9	435
MARCH	6.06	11	186	180	6.9-9.4	38.5	6.7	18.0	384
APRIL	6.31	12	175	143	6.4-9.5	31.2	6.2	13.7	322
MAY	6.02	14	271	291	7.0-8.6	47.6	10.7	17.5	504
JUNE	5.47	16	230	230	6.7-8.8	40.2	9.1	17.7	414
JULY	5.11	18	218	228	6.3-8.7	42.3	9.2	18.4	421
AUGUST	5.14	19	214	235	6.3-8.6	42.2	8.1	20.5	457
SEPTEMBER	5.02	19	192	182	6.0-9.3	31.8	7.3	15.4	367
OCTOBER	5.58	17	225	164	6.7-8.6	28.5	7.3	13.3	371
NOVEMBER	5.15	16	304	307	6.6-8.9	45.9	9.5	21.7	585
DECEMBER	5.00	14	293	219	6.3-8.1	42.4	9.6	20.6	499
1985 AVERAGE	5.43	15	229	207	5.7-9.5	38.1	8.2	17.7	425
1984 AVERAGE	5.19	15	193	189	5.9-10.5	32.9	9.1	14.3	387

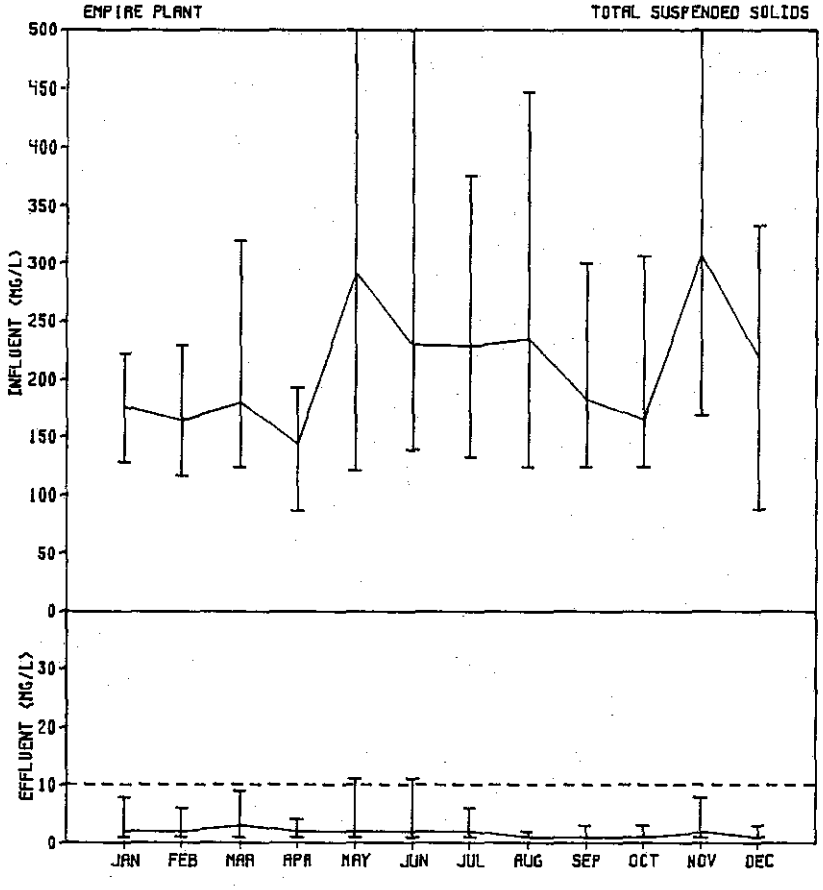
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Empire

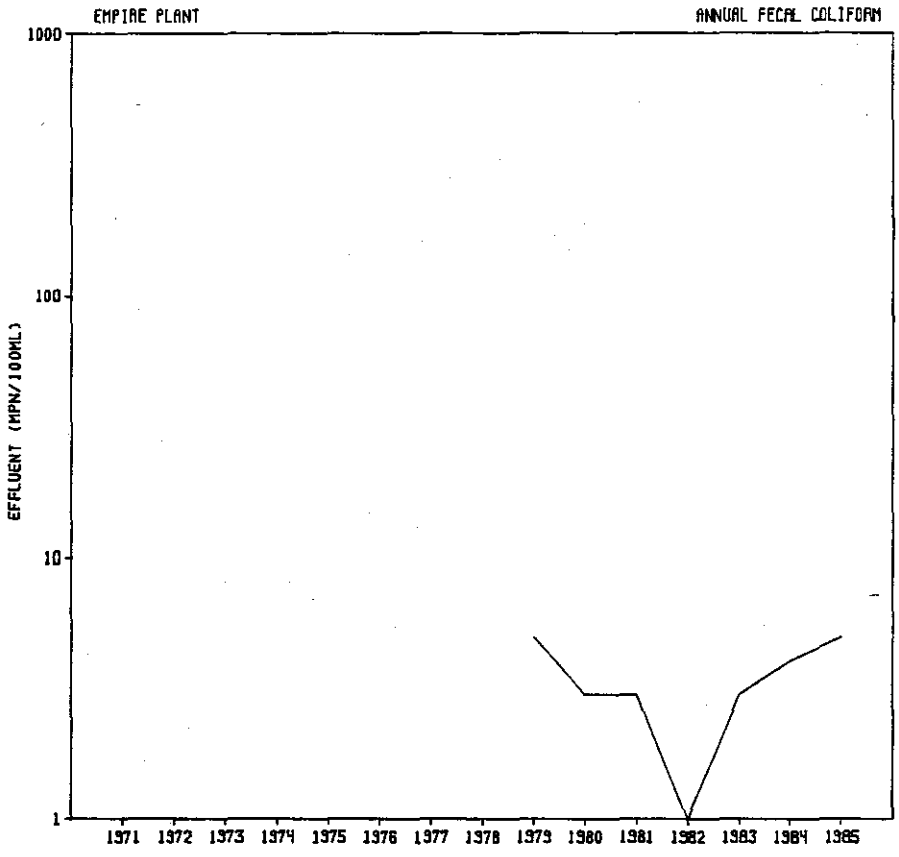
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	10	--	10	200	25	---	1.0	----	-----	---	---	---	>4.0	6.0-9.0	--	--
JANUARY	3	2	30	2	---	1	1.8	0.2	0.06	17.07	5.0	---	---	11.7	6.7-7.1	99	99
FEBRUARY	5	4	31	2	---	1	2.5	0.6	0.12	15.71	5.1	---	---	12.1	6.9-7.2	98	99
MARCH	3	3	26	3	2	1	2.2	0.1	0.03	18.78	4.7	133	0.8	12.1	6.8-7.1	99	99
APRIL	5	5	26	2	2	1	1.8	0.3	0.12	14.62	5.0	129	0.8	12.0	6.8-7.2	97	98
MAY	5	4	26	2	2	1	1.7	0.4	0.15	19.46	5.3	137	0.7	11.5	6.8-7.3	99	99
JUNE	3	3	24	2	4	1	1.8	0.3	0.11	18.40	2.9	98	0.6	11.7	6.9-7.3	99	99
JULY	3	2	25	2	3	1	1.8	0.3	0.10	23.45	5.2	102	0.6	10.6	6.9-7.3	99	99
AUGUST	2	2	22	1	7	1	1.5	0.1	0.01	22.96	3.5	151	0.8	9.8	6.7-7.3	99	99
SEPTEMBER	2	2	25	1	13	1	1.8	0.1	0.02	16.19	3.3	113	0.7	9.9	6.8-7.5	99	99
OCTOBER	1	1	21	1	4	1	1.5	0.1	0.01	13.54	2.9	127	1.1	10.2	7.0-7.5	99	99
NOVEMBER	4	3	26	2	---	1	2.8	1.1	0.06	22.07	3.5	136	1.0	10.8	7.0-7.4	99	99
DECEMBER	3	2	27	1	---	1	2.2	0.2	0.03	21.02	4.2	---	---	12.0	7.0-7.5	99	99
1985 AVG.	3	3	26	2	5	1	1.9	0.3	0.07	18.54	4.1	124	0.8	11.2	6.7-7.5	99	99
1984 AVG.	3	2	32	2	4	1	1.9	0.3	0.09	13.83	4.3	120	0.9	8.0	6.5-8.3	99	99

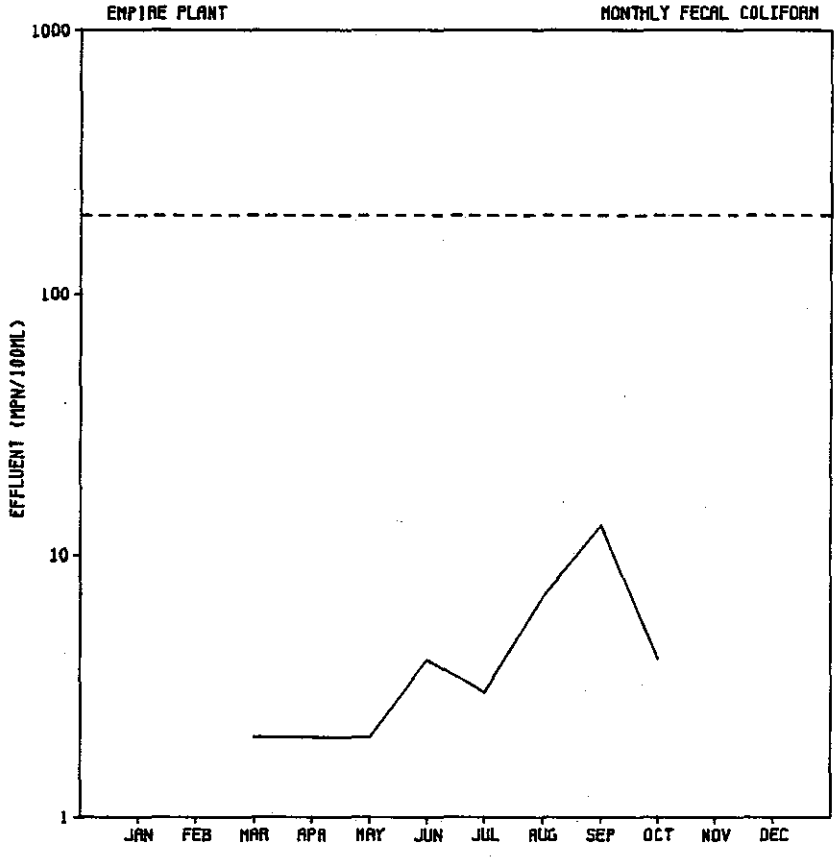

EMPIRE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

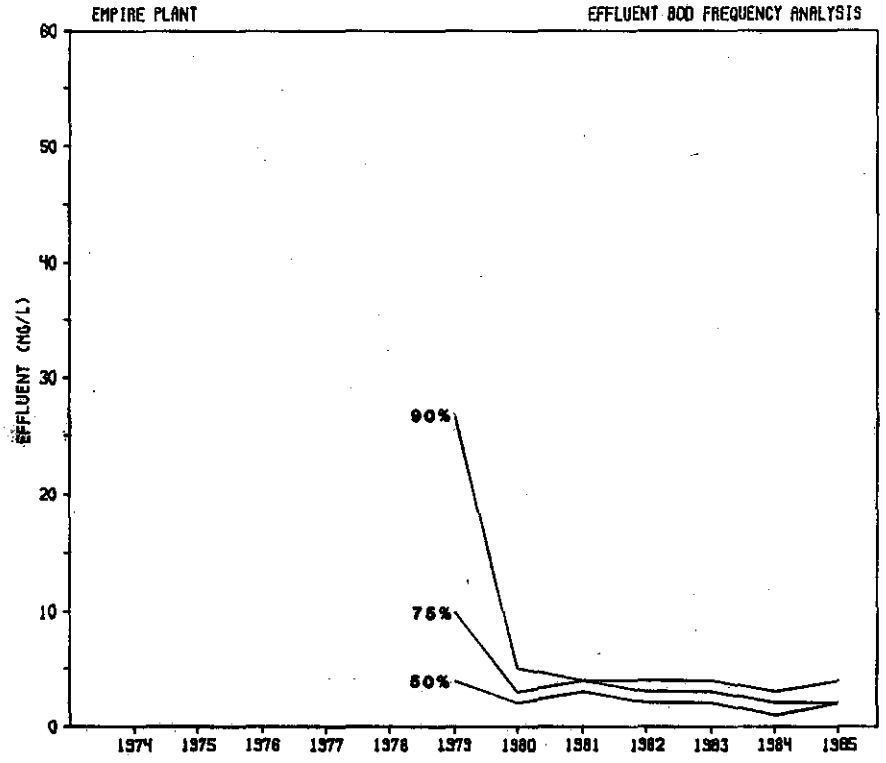

EMPIRE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

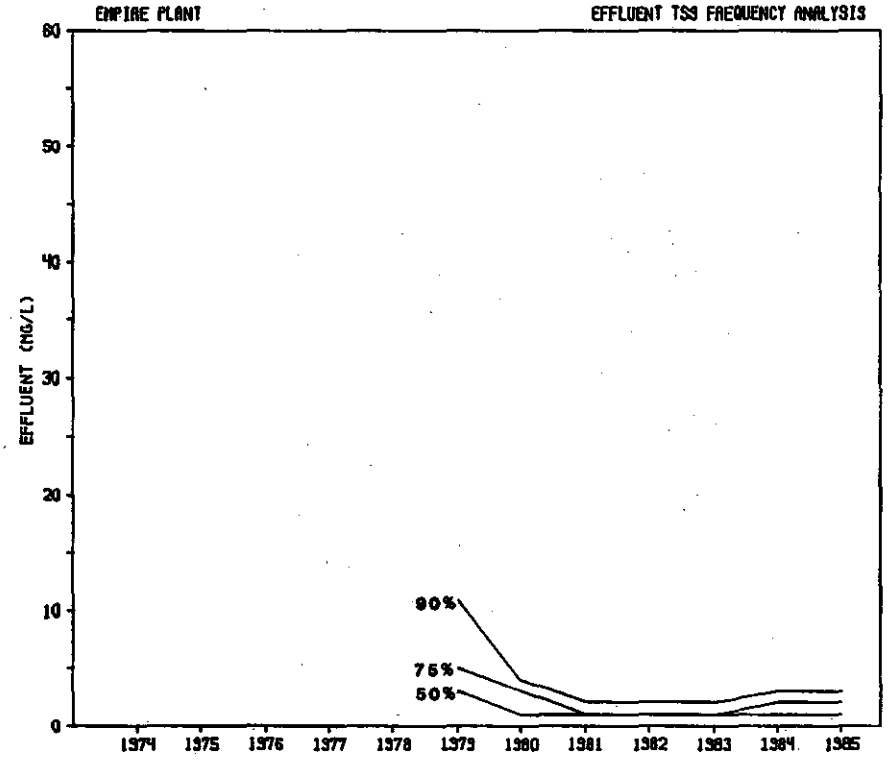

EMPIRE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


EMPIRE 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


EMPIRE PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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
1984
1985


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
1984
1985

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 prior to the current plant expansion was estimated to be about 1.44 mgd.

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

Solids processing consists of gravity thickening of combined sludge, anaerobic digestion, and ultimate disposal by landspreading or through the Metropolitan Plant Interceptor System. The Hastings Plant was operating beyond its effective capacity until June, 1985, when completion of Phase I of the plant expansion provided additional capacity. The plant is subject to secondary treatment limits.

Performance

Plant flow averaged 1.66 mgd in 1985, similar to 1.64 mgd in 1984. Average plant effluent quality was 18 mg/L BOD and 21 mg/L TSS. Plant performance was fair due to operation near plant capacity. A total of 10 NPDES violations occurred throughout the year with 9 of them occurring in January through April, before the completion of Phase I expansion. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	17	14	16	14	27	20	23	23	37	26	35	36
TSS	28	22	24	15	38	32	32	28	48	41	59	40

Future

The Hastings Plant is being expanded to a capacity of 2.34 mgd. The first phase of the plant expansion was completed in June, 1985. Completion of the remainder of the plant expansion is scheduled for early 1986.

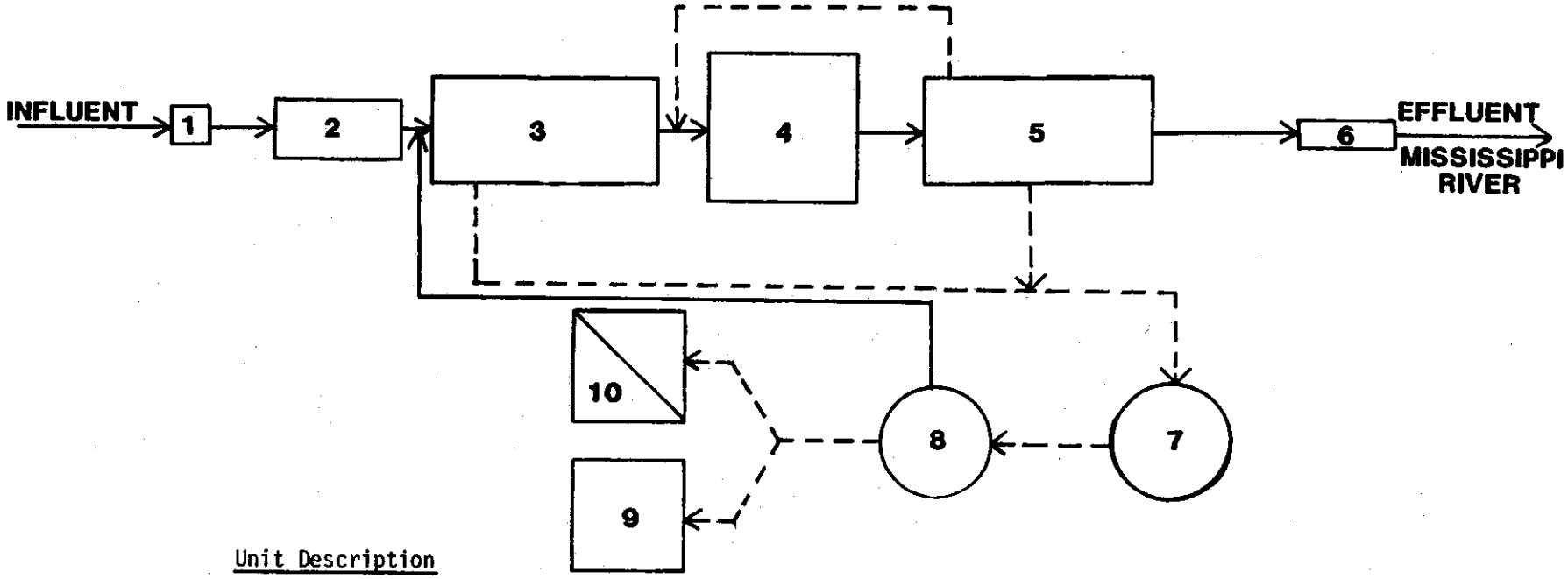
HASTINGS PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1983	Annual Average 1984	Annual Average 1985[1]	Maximum Month 1983	Maximum Month 1984	Maximum Month 1985[1]
Wastewater Flow, mgd	1.65	1.64	1.48	1.75	1.72	1.63
BOD Loading, lb/day	3,260	2,770	3,490	4,150	3,900	4,930
TSS Loading, lb/day	2,620	2,780	2,700	3,670	4,200	4,580
COD Loading, lb/day	7,430	6,670	6,700	8,750	9,500	7,660
Aerated Grit Chamber						
Detention Time, minutes	------	------	17	------	------	15
Primary Sedimentation						
Surface Overflow Rate, gpd/sq. ft.	2,500	2,500	260	2,600	2,600	290
Aeration Tanks						
BOD Loading, lb/day/1000 cu. ft.[2]	47	40	38	60	56	54
Final Sedimentation						
Weir Overflow Rate, gpd/lin. ft.	10,100	10,000	3,900	10,700	10,500	4,300
Surface Overflow Rate, gpd/sq. ft.	690	680	260	730	720	290
Chlorination						
Chlorine Use, lb/day	116	93	114	130	165	156
Sludge Transport						
Volume, gpd	8,100	5,700	6,800	11,800	12,600	11,300
Mass, lb/day	1,900	1,400	2,060	2,100	2,400	3,140

[1]Values represent operation since new facilities have been on-line.
[2]Assumes 25% BOD removal in primary sedimentation.

HASTINGS WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

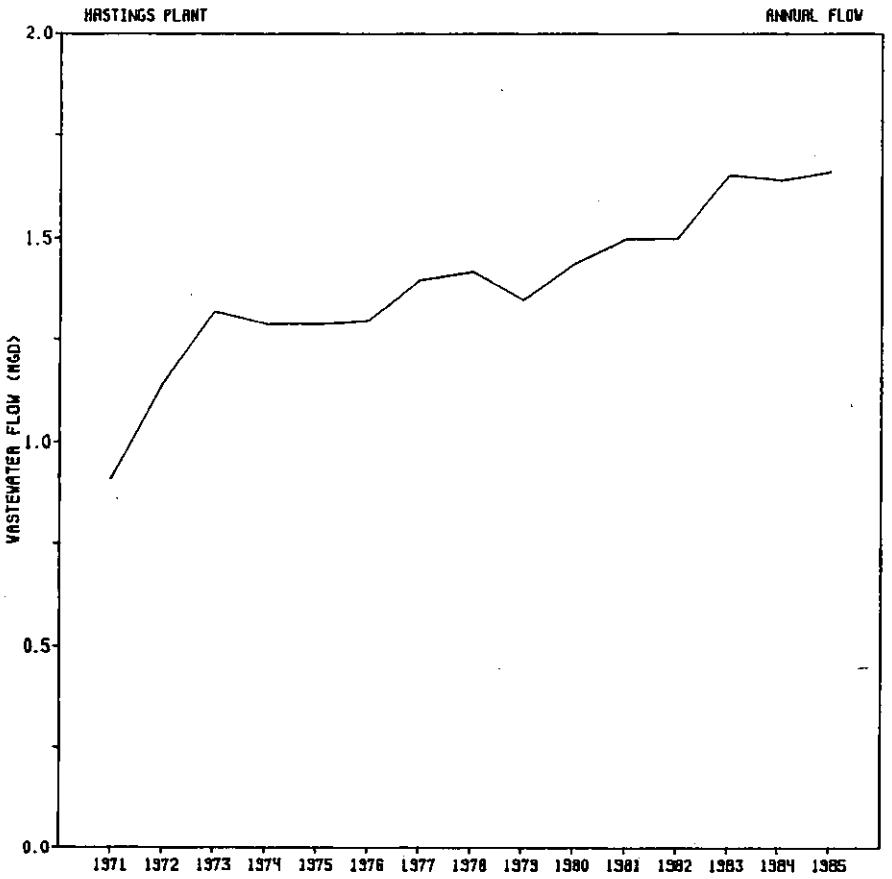
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge Aeration
5. Final Sedimentation
6. Chlorination

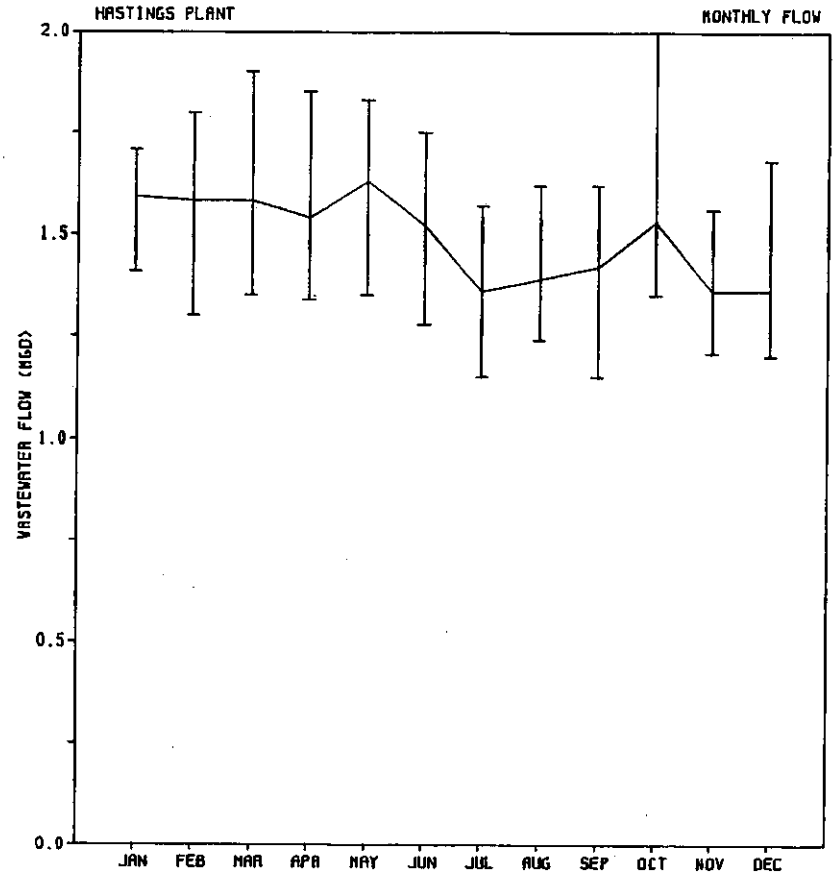
Solid Phase

7. Sludge Gravity Thickening
8. Anaerobic Digestion
9. Solids Disposal at Metro Plant
10. Land Spreading

Legend

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


HASTINGS PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
2.0
1.5
1.0
0.5
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


HASTINGS PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
2.0
1.5
1.0
0.5
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

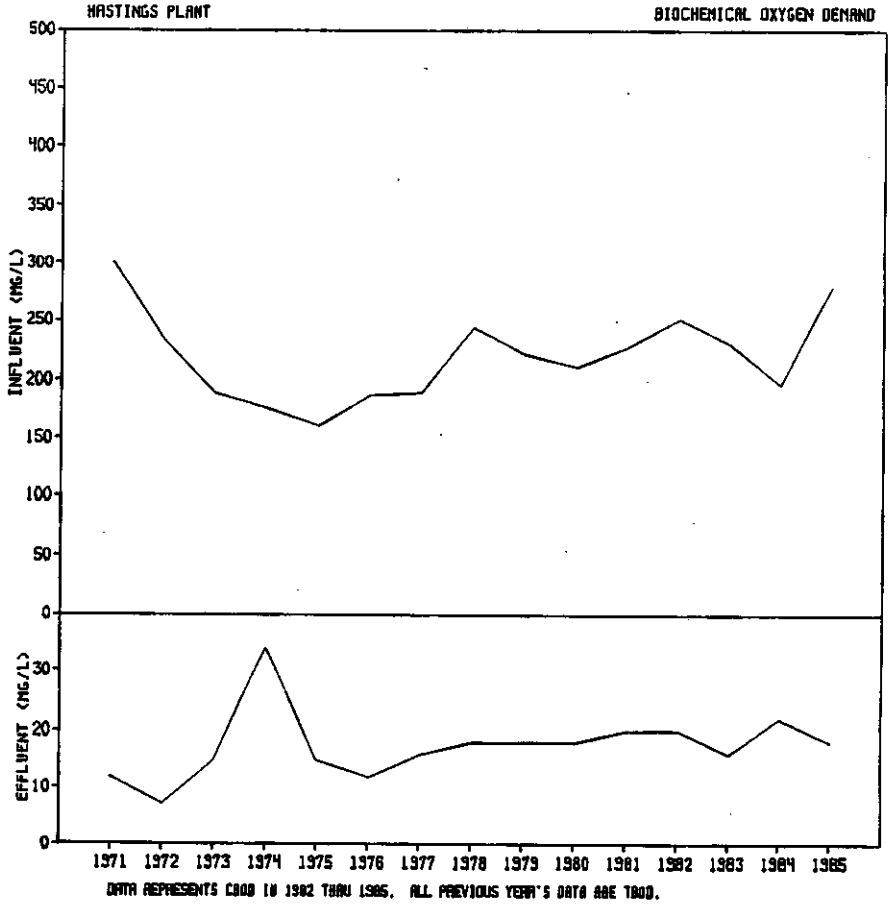
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Hastings

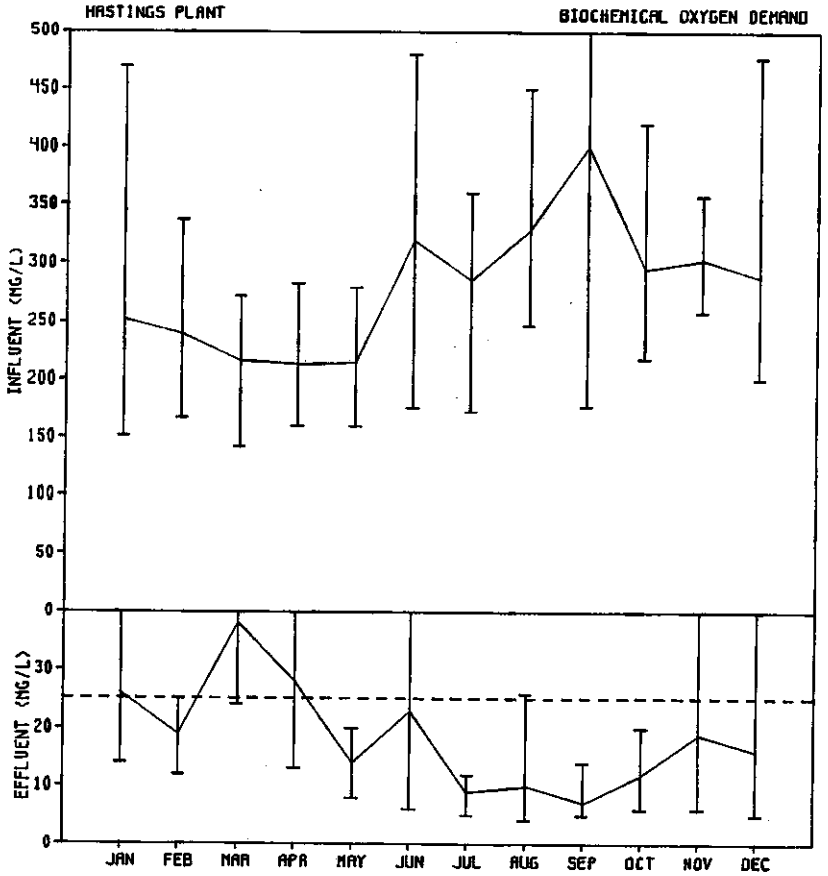
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	1.59	14	252	196	5.6-13.0	49.4	11.5	27.0	552
FEBRUARY	1.58	13	239	157	5.8-12.0	66.6	12.7	49.0	509
MARCH	1.58	13	216	137	6.4-12.2	40.5	8.0	22.3	506
APRIL	1.74	13	213	131	6.2-11.4	39.5	6.7	17.7	437
MAY	1.75	16	215	156	5.8-12.0	38.1	7.0	17.6	451
JUNE	1.71	17	319	253	6.6-10.5	45.7	7.7	22.2	607
JULY	1.61	17	286	265	5.7-10.6	40.9	7.7	19.8	499
AUGUST	1.70	17	328	263	6.0-10.2	39.9	10.2	18.3	610
SEPTEMBER	1.71	17	401	371	5.8-12.0	44.8	7.7	20.2	546
OCTOBER	1.65	17	295	246	5.9-12.0	39.1	7.2	17.4	558
NOVEMBER	1.62	17	303	224	4.8-11.8	39.1	6.5	20.5	607
DECEMBER	1.65	15	288	199	5.6-13.4	41.5	6.6	22.7	517
1985 AVERAGE	1.66	15	279	217	4.8-13.4	43.8	8.3	22.7	533
1984 AVERAGE	1.64	17	196	196	4.4-11.2	45.7	10.6	23.1	472

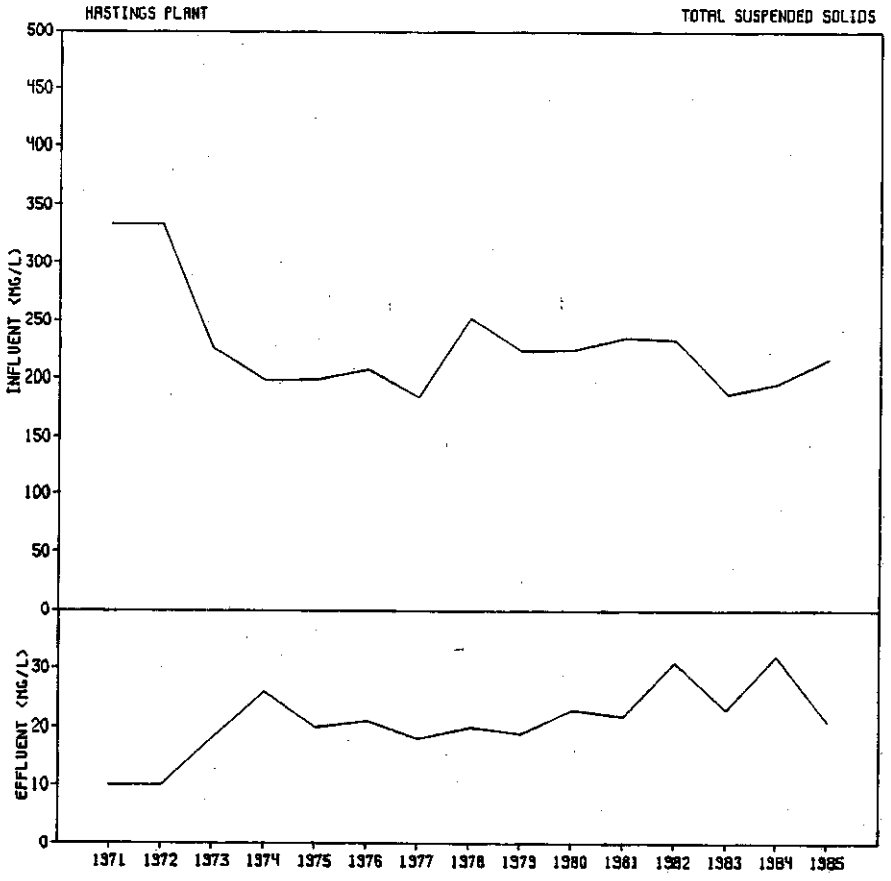
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Hastings

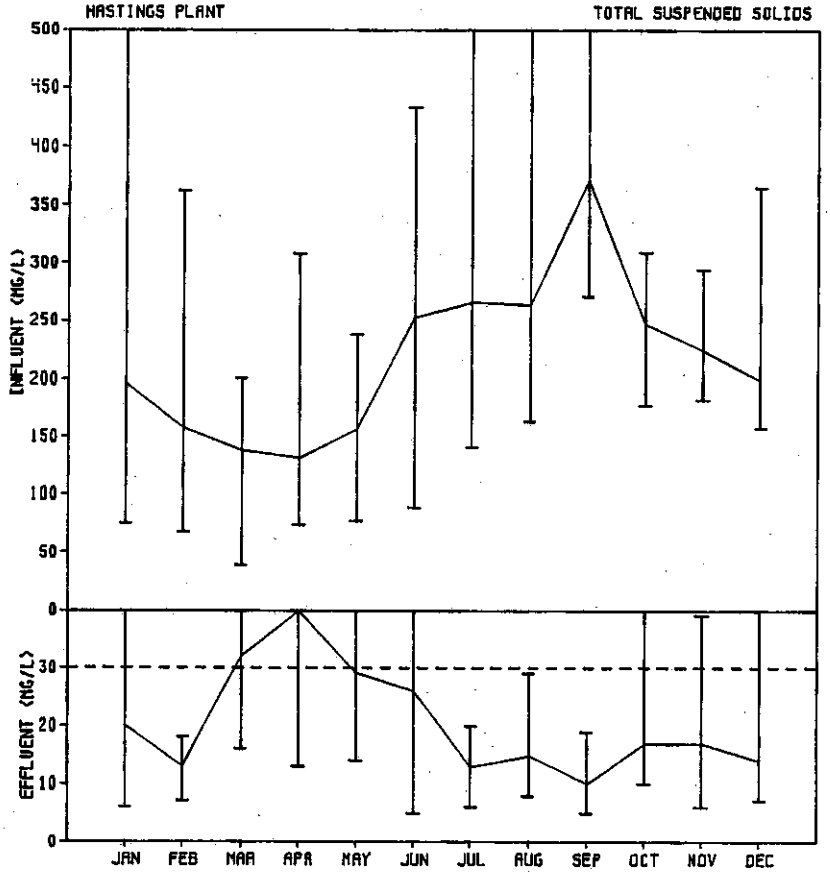
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	---	30	200	25	----	----	----	----	---	---	---	---	6.0-9.0	--	--
JANUARY	44	26	106	20	---	8	30.1	21.3	0.63	2.14	7.0	---	---	6.7	7.0-7.5	90	90
FEBRUARY	61	19	89	13	---	6	33.3	34.6	0.49	2.40	8.7	30	1.0	6.6	6.8-7.3	92	92
MARCH	69	38	146	32	134	16	31.8	19.6	0.81	1.29	6.4	95	5.3	6.6	6.8-7.3	82	77
APRIL	42	28	130	41	22	18	33.5	17.4	0.63	0.80	4.7	100	7.2	5.4	6.8-7.5	87	69
MAY	35	14	91	29	80	11	26.1	14.6	5.25	1.83	2.9	101	5.2	4.7	6.9-7.2	93	81
JUNE	39	23	109	26	150	9	27.0	18.5	3.30	1.71	4.2	111	4.9	4.7	6.9-7.3	93	90
JULY	27	9	55	13	38	5	5.5	3.9	1.39	16.61	4.6	156	4.5	4.4	6.9-7.2	97	95
AUGUST	25	10	54	15	48	5	3.3	0.7	0.44	19.08	4.2	121	4.3	4.4	6.9-7.4	97	94
SEPTEMBER	24	7	47	10	57	4	4.6	1.8	0.45	16.65	3.8	117	3.5	4.6	7.0-7.4	98	97
OCTOBER	30	12	74	17	50	6	9.5	5.6	4.65	9.23	4.0	118	3.2	5.1	6.7-7.3	96	93
NOVEMBER	37	19	84	17	---	8	20.1	13.6	2.22	3.67	4.2	---	---	5.2	6.9-7.2	94	92
DECEMBER	25	16	72	14	---	6	28.0	22.1	0.94	0.29	4.2	---	---	4.5	6.8-7.8	95	93
1985 AVG.	38	18	88	21	72	9	21.4	14.4	1.71	6.12	4.9	114	4.7	5.2	6.7-7.8	93	89
1984 AVG.	43	22	123	32	33	12	25.8	16.8	1.88	4.37	6.7	92	5.4	5.8	6.6-7.7	89	83

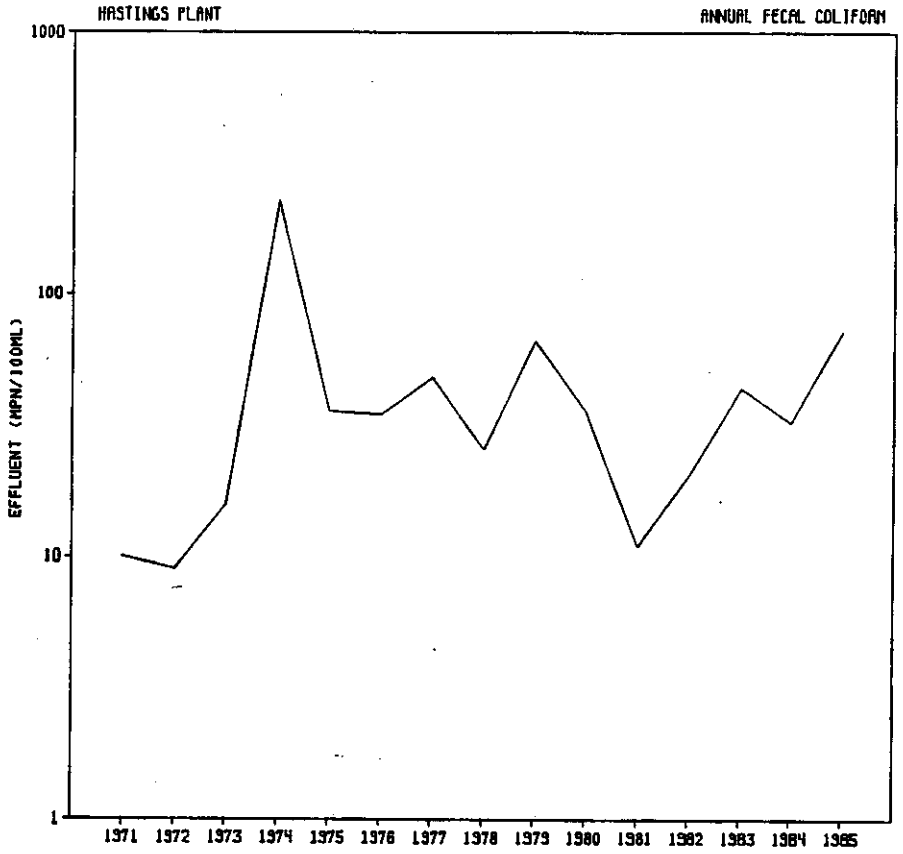
*For disinfection only.

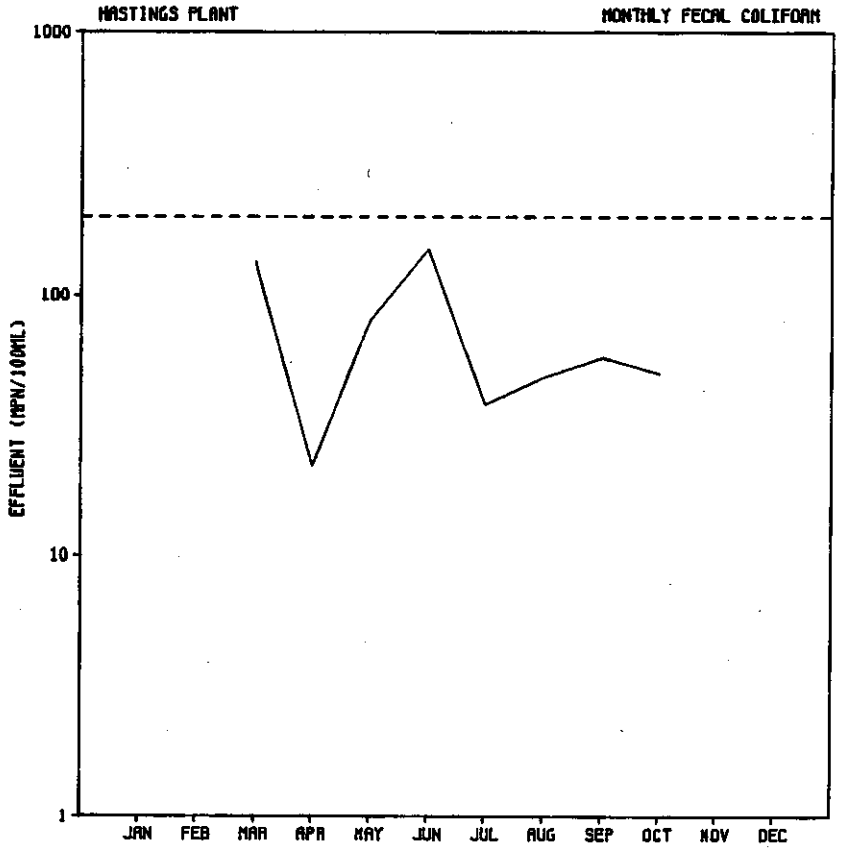

HASTINGS PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS COOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TOOD.

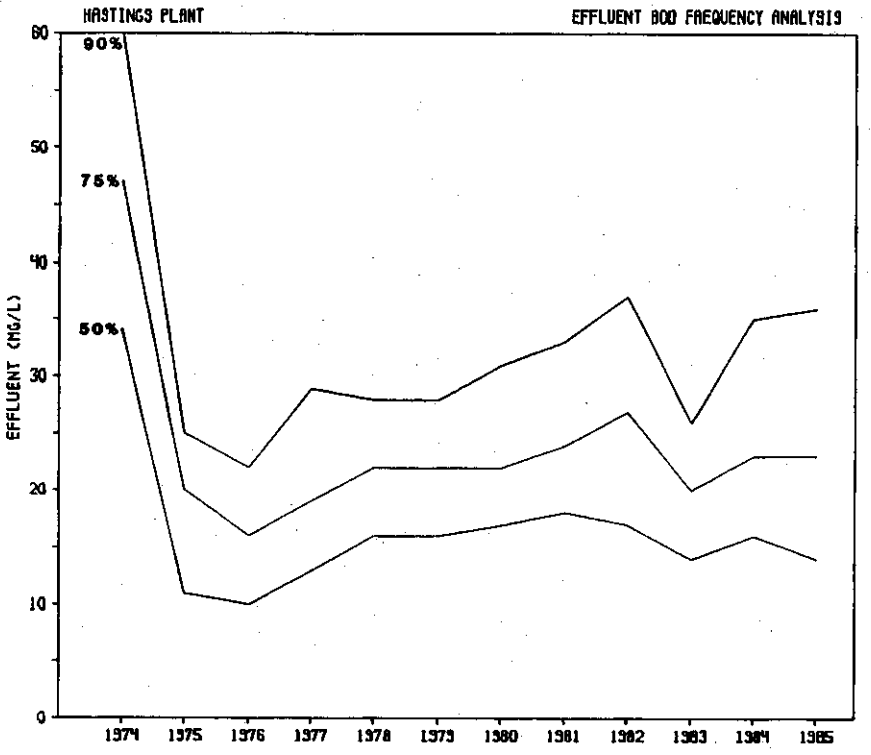

HASTINGS PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

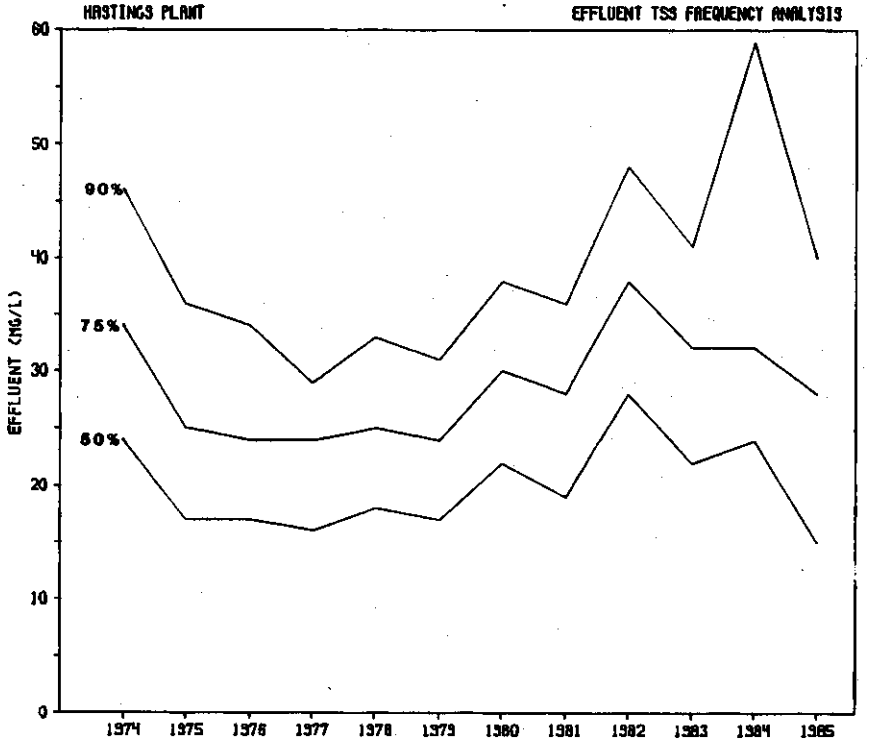

HASTINGS PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


HASTINGS 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


HASTINGS PLANT
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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


HASTINGS PLANT
EFFLUENT BOD FREQUENCY ANALYSIS
90%
75%
50%
EFFLUENT (MG/L)
0
10
20
30
40
50
60
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985


HASTINGS PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
90%
75%
50%
EFFLUENT (MG/L)
0
10
20
30
40
50
60
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985

1985 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	0.03	0.30	0.08			<0.20	<0.020				16.2	
February	0.01	0.14	0.06			<0.30	<0.020				13.6	
March	0.03	0.16	0.08	<0.05	<0.008	<0.20	<0.020			<0.04	15.2	1.00
April	0.04	<0.19					<0.020					
May	0.02	0.10					<0.020					
June	0.02	0.07					<0.020					
July	0.01	<0.05					<0.020					
August	0.03	<0.05					<0.020					
September	0.04	<0.05					<0.020					
October	0.01	<0.05					<0.020					
November	0.02	<0.05					<0.020					
December	<0.01	<0.05					<0.020					
1985 Avg.	<0.02	<0.11	0.08	<0.05	<0.008	<0.23	<0.020			<0.04	15.1	1.00
1984 Avg.	0.04	<0.12	0.10	<0.05	<0.008	<0.22	<0.020			<0.04	10.1	0.76

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 0.42 mgd in 1985, slightly higher than 0.40 mgd in 1984. Average plant effluent quality was 12 mg/L BOD and 14 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 CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	11	8	6	9	18	12	12	14	26	17	22	21
TSS	6	6	8	10	10	12	15	18	16	16	19	29

Future

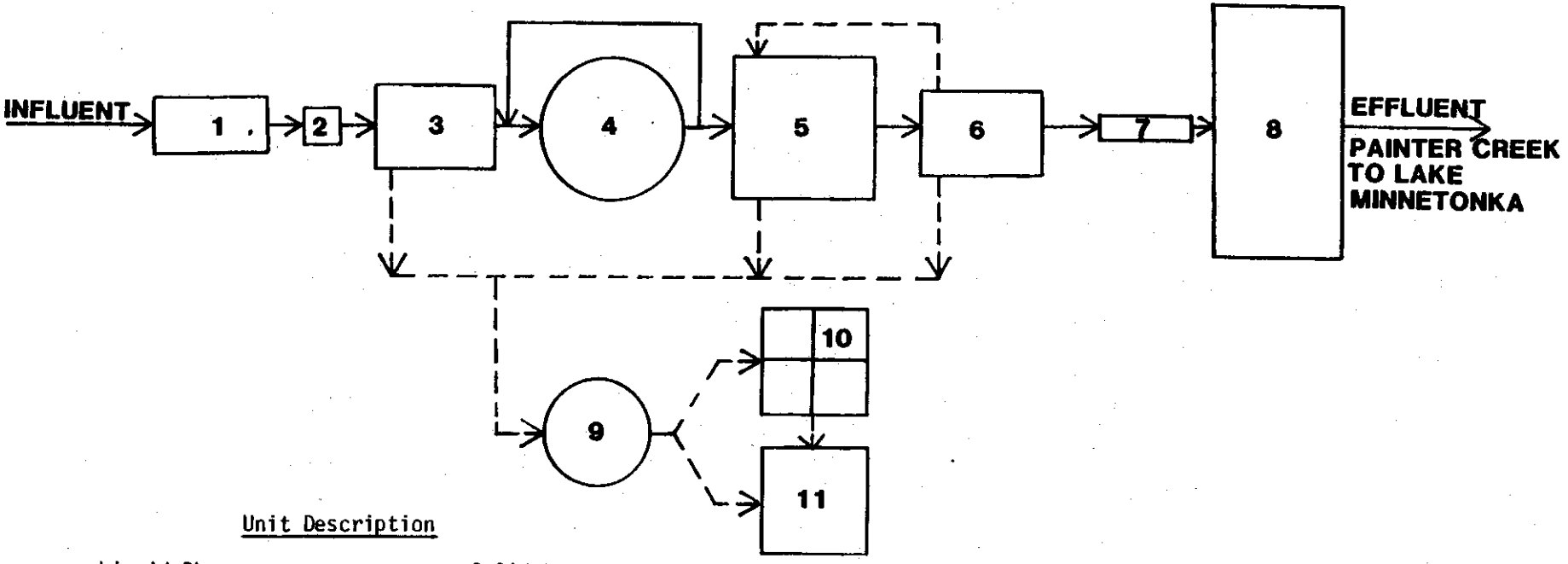
The long-term plan is to phase out the Maple Plain Plant by constructing an interceptor to Long Lake. The existing plant flow will then be conveyed to the Blue Lake Plant for treatment. Completion of interceptor construction is scheduled for mid-1986.

MAPLE PLAIN PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, MGD	0.35	0.40	0.42	0.75	0.60	0.70
BOD Loading, lb/day	7,360	350	440	460	500	510
TSS Loading, lb/day	500	600	450	700	1,300	700
COD Loading, lb/day	800	870	960	1,100	1,400	1,660
Sludge Production, lb/day	60	45	50	------	------	------
Grit Removal						
Overflow Rate, gpd/sq. ft.	22,000	25,000	26,250	47,000	37,500	43,750
Primary Sedimentation						
Detention Time, hr.	0.75	0.7	0.6	0.35	0.4	0.4
Weir Overflow Rate, gpd/lin. ft.	9,700	11,100	11,700	21,000	16,700	19,400
Surface Overflow, gpd/sq. ft.	1,400	1,600	1,700	3,100	2,500	2,900
Trickling Filters						
Hydraulic Loading, gpd/sq. ft.	220	250	260	470	380	440
BOD Loading, lb/day/1000 cu. ft.	35	34	43	45	48	49
Aeration Tanks						
Detention Time, hr.	7.1	6.2	5.9	3.3	4.2	3.6
BOD Loading, lb/day/1000 cu. ft. (Assume 50% trickling filter reduction)	13	13	16	17	18	18
Final Sedimentation						
Detention Time, hr.	2.0	1.8	1.7	1.0	1.2	1.0
Weir Overflow Rate, gpd/lin. ft.	9,000	10,300	10,800	19,000	15,400	18,000
Surface Overflow Rate, gpd/sq. ft.	1,000	1,200	1,200	2,200	1,800	2,000
Chlorination						
Contact Time, minutes	15	13	13	7	9	8
Chlorine Use, lb/day	31	24	32	43	30	40
Polishing Pond						
Detention Time, days	2.9	2.5	2.4	1.3	1.4	1.4
BOD, lb/acre/day	40	50	65	210	130	180
Anaerobic Digestion (Prim. Dig. Only)						
Solids Loading, lb/cu. ft./day	0.08	0.08	0.08	------	------	------
Detention Time, days	30	30	30	------	------	------
Sludge Transport						
Volume, gpd	160	180	150	------	------	------

MAPLE PLAIN WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

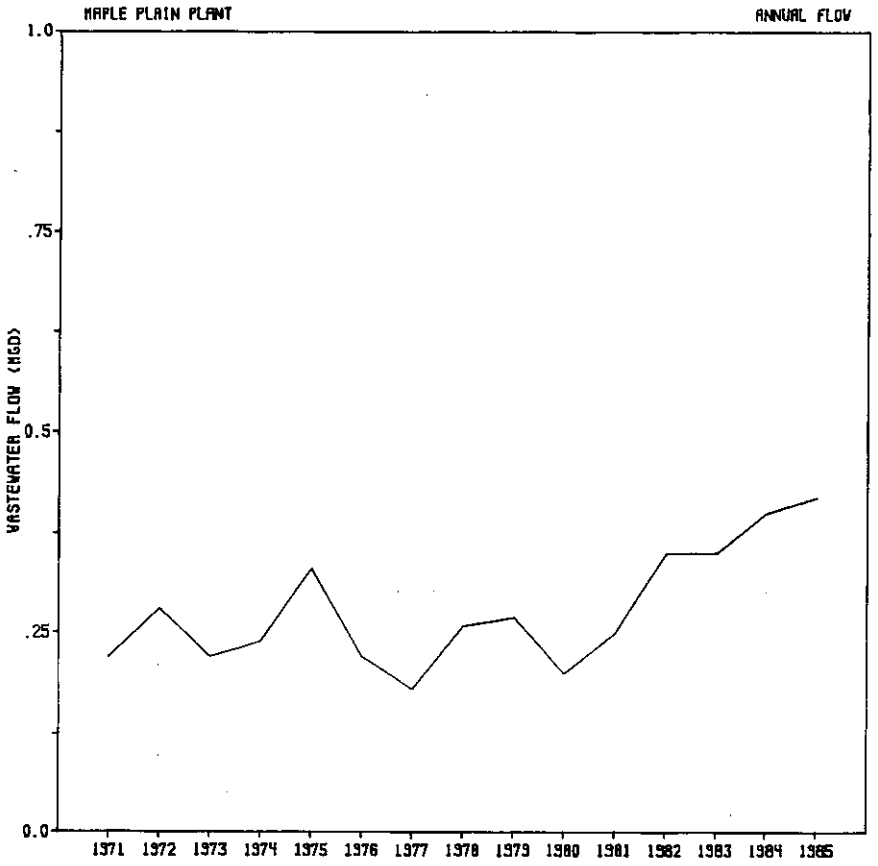
1. Grit Removal
2. Screening
3. Primary Sedimentation
4. Trickling Filter
5. Activated Sludge
6. Final Sedimentation
7. Chlorination
8. Effluent Pond

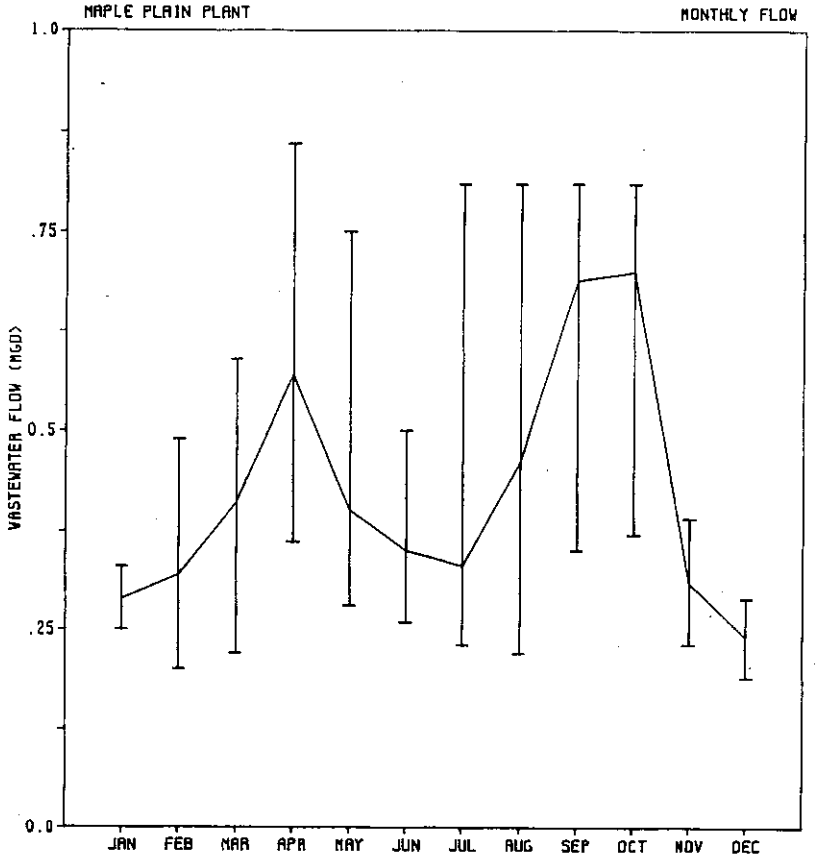
Solid Phase

9. Anaerobic Digestion
10. Sand Drying Beds
11. Disposal at Metro Plant

Legend

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


MAPLE PLAIN PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


MAPLE PLAIN PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

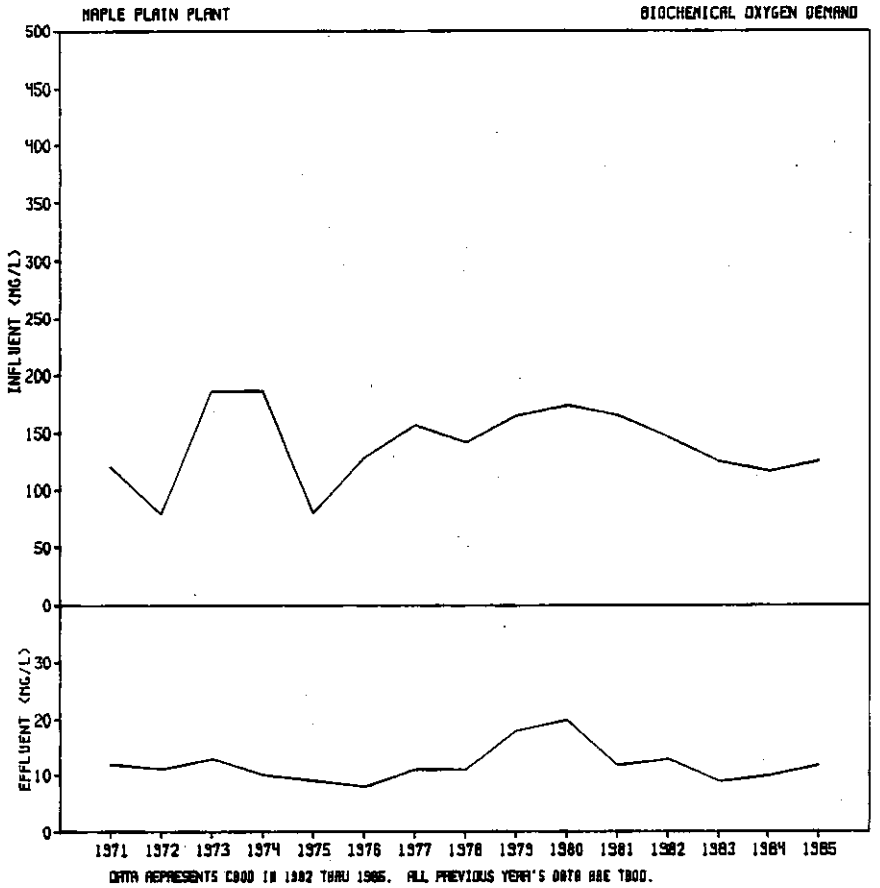
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Maple Plain

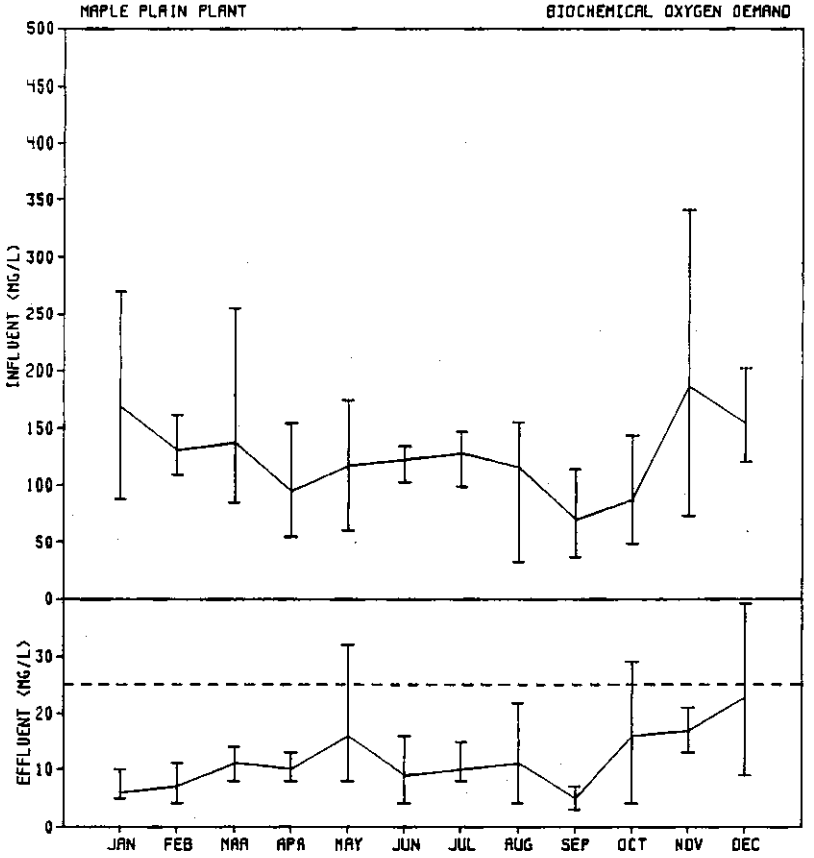
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.29	13	169	147	7.5-7.6	36.2	6.7	17.4	335
FEBRUARY	0.32	13	131	99	7.5-7.7	30.8	4.2	15.9	248
MARCH	0.41	14	137	102	7.4-7.6	23.6	3.3	10.3	306
APRIL	0.57	14	95	93	7.5-7.7	24.5	3.6	6.1	191
MAY	0.40	15	117	131	7.5-7.7	23.5	3.5	9.0	273
JUNE	0.35	15	122	177	7.0-7.6	32.8	4.3	15.6	253
JULY	0.33	17	128	197	7.0-7.6	35.7	6.5	19.2	288
AUGUST	0.46	17	115	105	7.1-7.6	18.7	3.5	14.6	233
SEPTEMBER	0.69	17	69	85	7.2-7.5	20.8	3.8	8.1	145
OCTOBER	0.70	15	87	113	7.2-7.5	18.2	3.2	5.9	273
NOVEMBER	0.31	13	186	140	7.0-7.6	30.0	4.6	16.6	411
DECEMBER	0.24	10	154	137	6.8-7.3	36.4	5.0	18.9	310
1985 AVERAGE	0.42	14	126	128	6.8-7.7	27.8	4.4	13.2	273
1984 AVERAGE	0.40	13	116	195	7.2-7.8	25.8	4.2	10.6	279

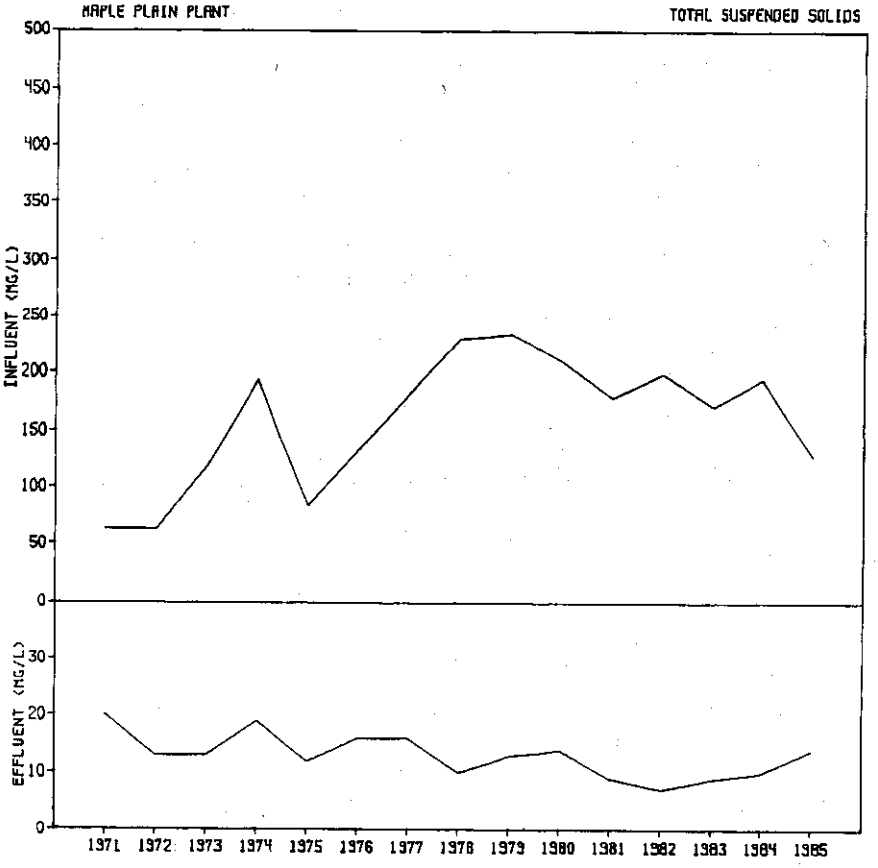
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Maple Plain

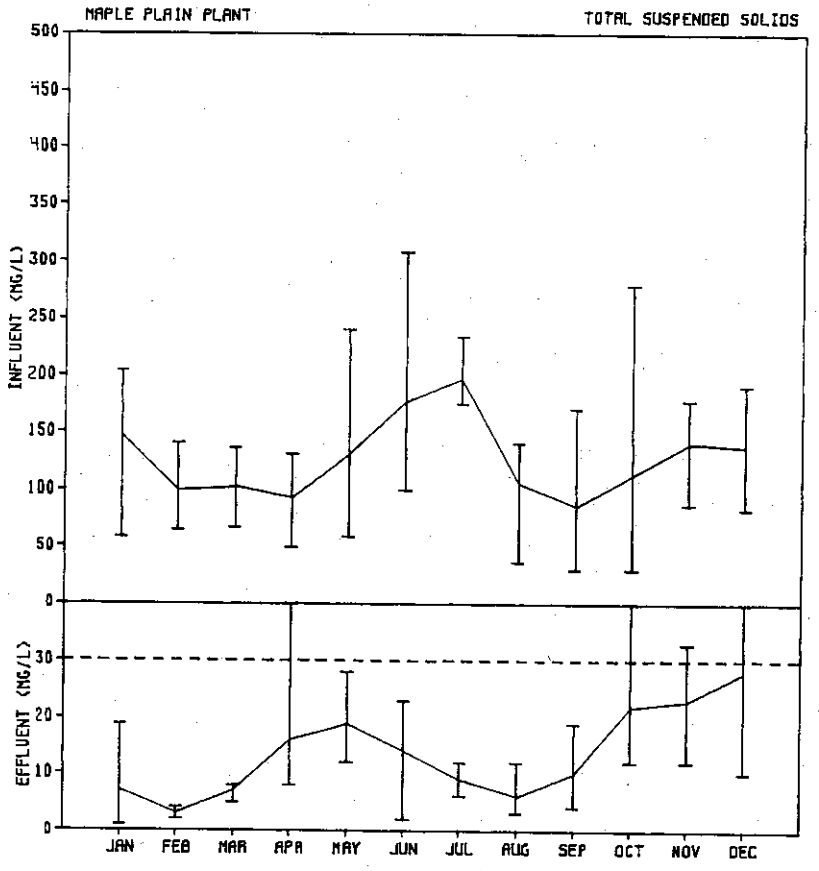
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	----	----	----	---	--	---	---	6.5-8.5	--	--
JANUARY	11	6	31	7	---	4	11.2	8.8	0.24	1.31	2.2	--	---	7.8	7.6-7.8	96	96
FEBRUARY	12	7	31	3	---	4	11.8	9.8	0.28	2.26	2.4	--	---	7.7	7.6-7.8	94	97
MARCH	12	11	48	7	4	6	11.8	7.0	0.08	0.95	1.9	26	---	7.5	7.5-7.8	92	93
APRIL	13	10	47	16	4	11	7.2	2.9	0.09	0.87	1.3	30	0.1	7.7	7.6-7.9	89	82
MAY	22	16	50	19	4	11	9.5	6.2	0.01	0.30	1.5	30	0.0	7.6	7.5-7.9	86	86
JUNE	11	9	41	14	19	10	9.4	6.8	0.05	0.38	1.8	29	---	7.6	7.5-8.0	93	92
JULY	12	10	48	9	14	9	17.2	11.4	0.11	1.23	2.6	20	0.0	7.2	7.0-7.8	92	96
AUGUST	11	11	43	6	24	5	12.4	10.0	0.01	0.28	1.9	34	0.0	7.3	7.0-7.6	91	94
SEPTEMBER	13	5	32	10	7	7	4.8	3.0	0.26	1.24	1.4	40	0.0	7.6	7.2-7.6	93	88
OCTOBER	27	16	61	22	4	14	6.4	2.7	0.09	1.16	0.9	40	0.0	7.6	7.2-7.8	81	81
NOVEMBER	22	17	58	23	---	12	9.3	5.5	0.04	0.28	1.1	40	0.0	7.6	7.0-7.8	91	84
DECEMBER	27	23	66	28	---	15	8.7	5.4	0.03	0.41	1.4	--	---	7.4	7.2-7.5	85	80
1985 AVG.	16	12	47	14	10	9	10.0	6.6	0.11	0.89	1.7	32	0.0	7.6	7.0-8.0	90	89
1984 AVG.	13	10	47	10	7	9	10.2	5.9	0.13	1.84	1.9	24	0.0	7.1	7.1-7.9	91	93

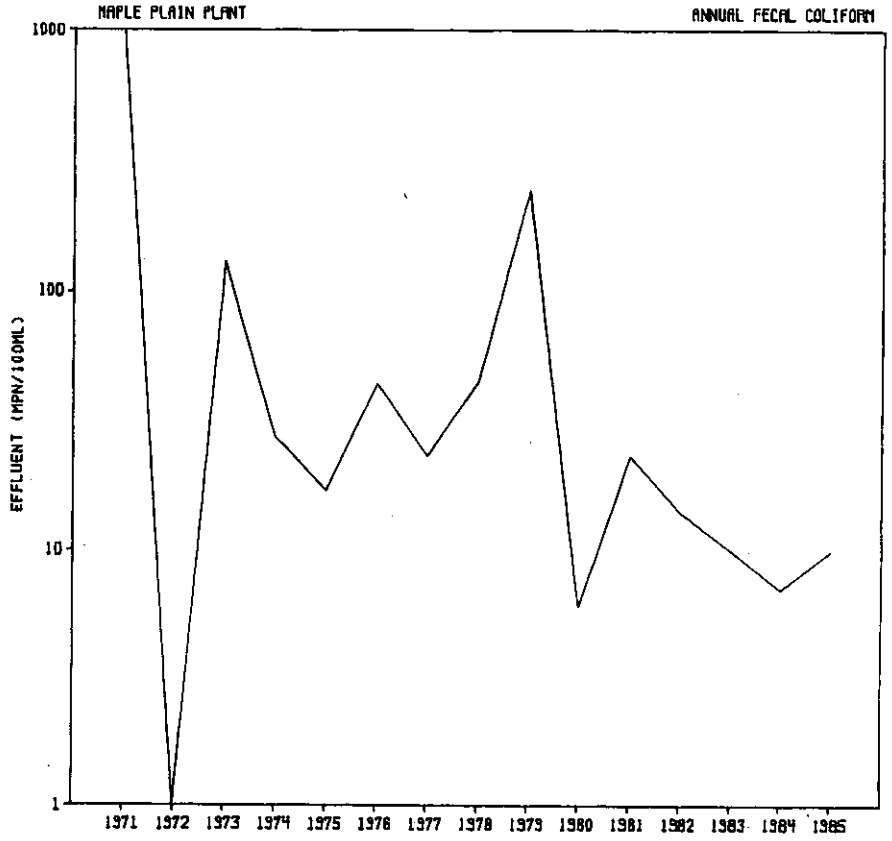
*For disinfection only.

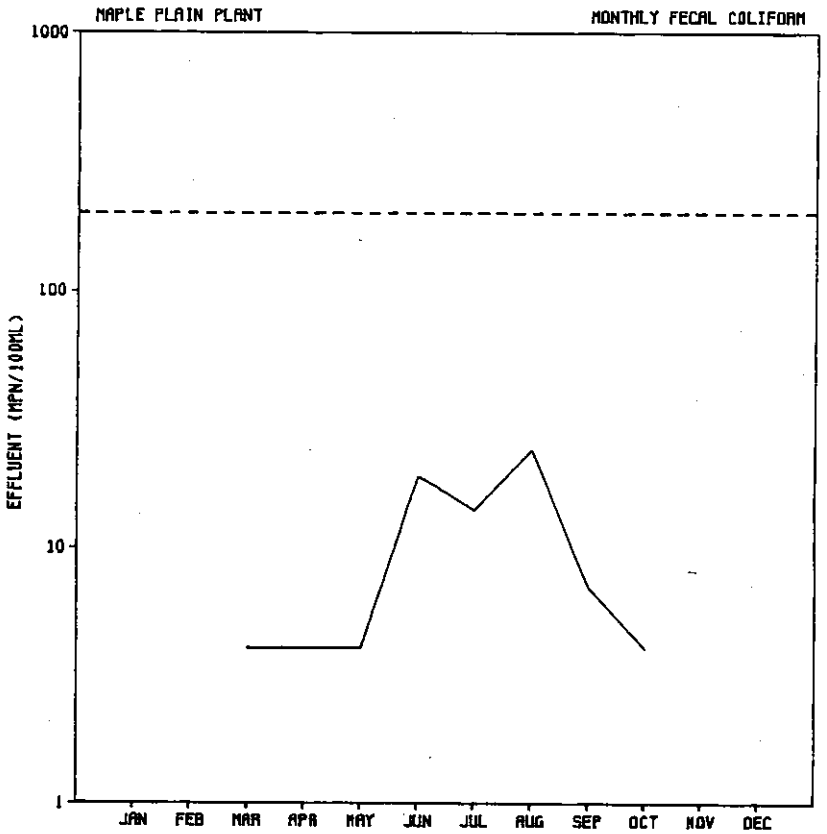

MAPLE PLAIN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

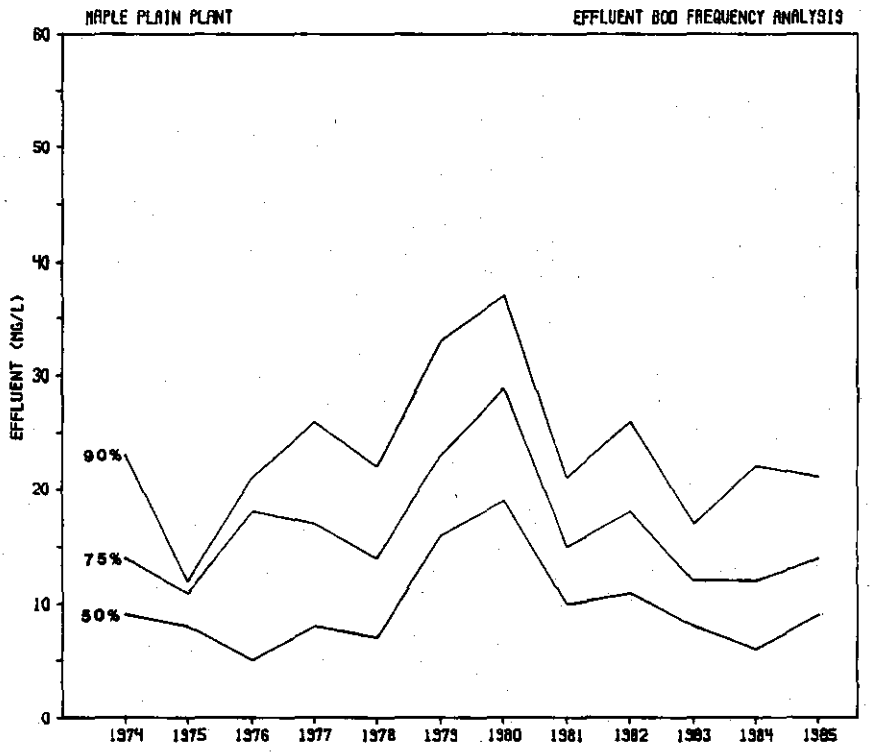

MAPLE PLAIN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

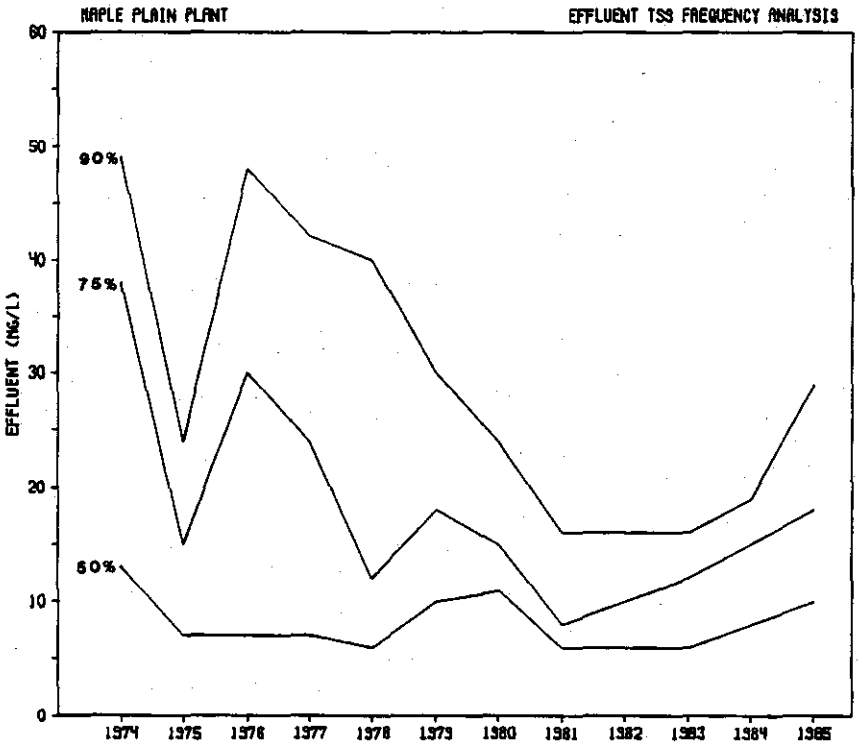

MAPLE PLAIN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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


MAPLE PLAIN 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
1984
1985

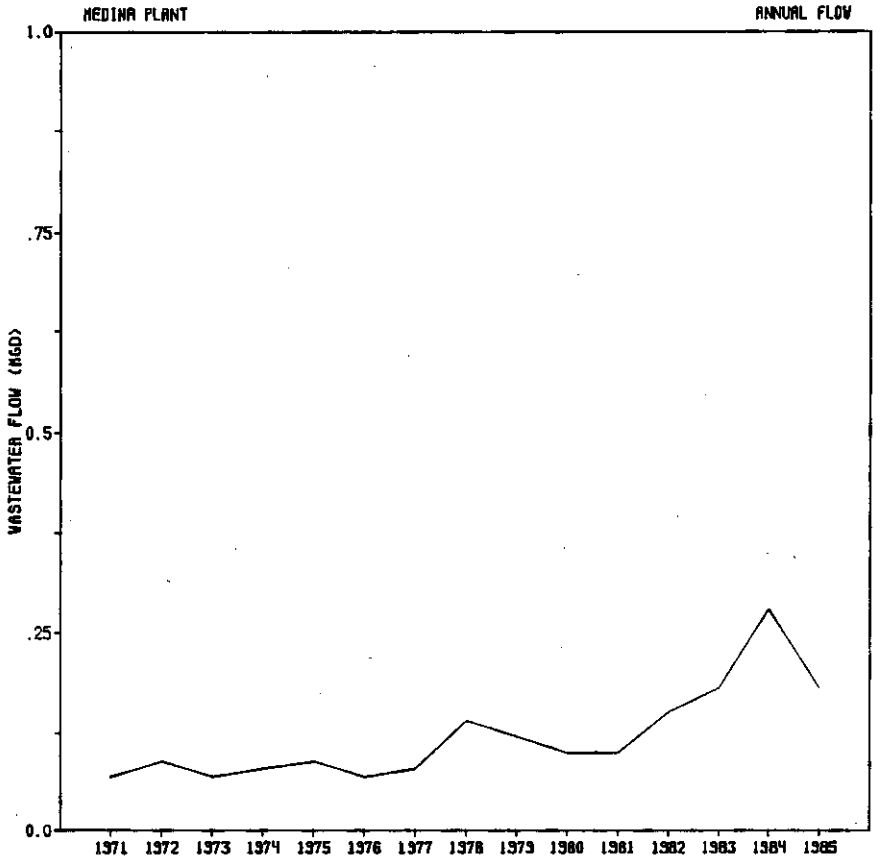

MAPLE PLAIN PLANT
EFFLUENT TSS FREQUENCY ANALYSIS
EFFLUENT (MG/L)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985

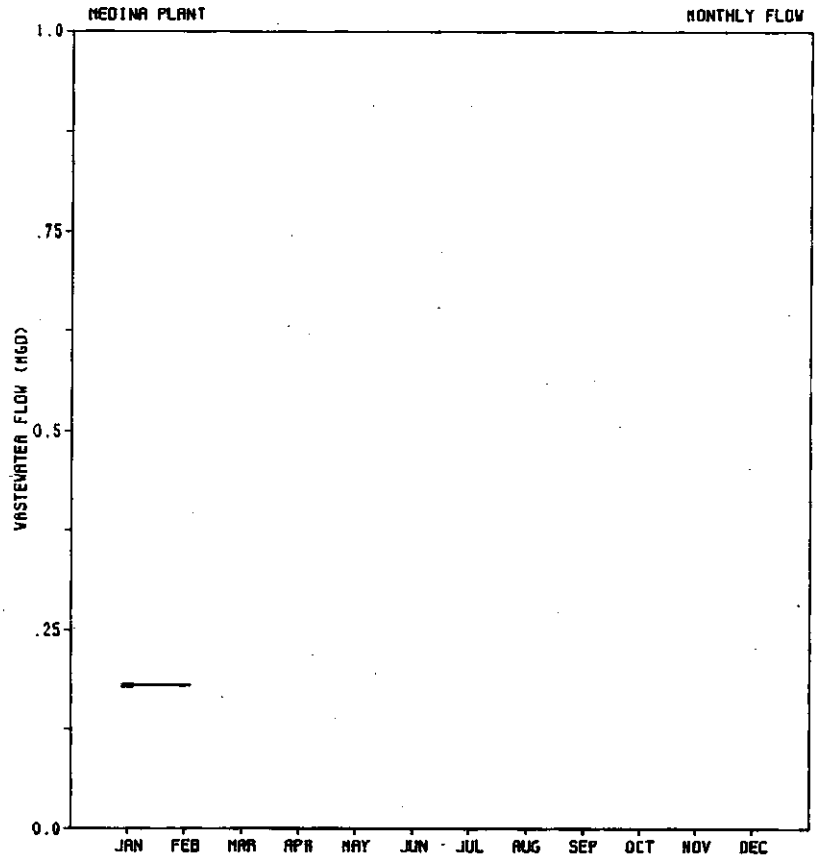
MEDINA WASTEWATER TREATMENT PLANT

Plant History and Description

The Medina Plant was constructed in 1969.

The plant was phased out of operation in February, 1985, by construction of an interceptor sewer through the City of Plymouth and into the Metropolitan Plant interceptor system.


MEDINA PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


MEDINA PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Medina

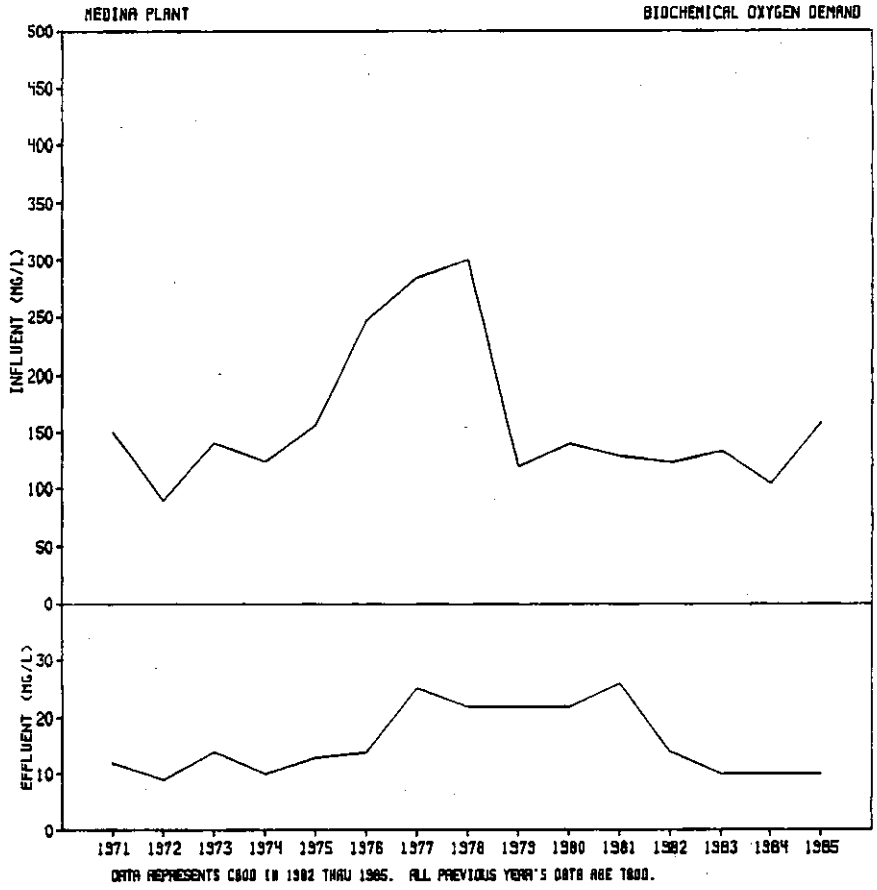
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.179	12	161	255	7.4-7.6	33.8	7.0	15.6	366
FEBRUARY	0.179	--	148	122	-------	47.0	4.8	20.5	281
MARCH									
APRIL									
MAY									
JUNE									
JULY									
AUGUST									
SEPTEMBER									
OCTOBER									
NOVEMBER									
DECEMBER									
1985 AVERAGE	0.179	12	159	233	7.4-7.6	36.0	6.6	16.4	352
1984 AVERAGE	0.278	14	103	131	7.3-7.7	26.2	3.8	10.0	241

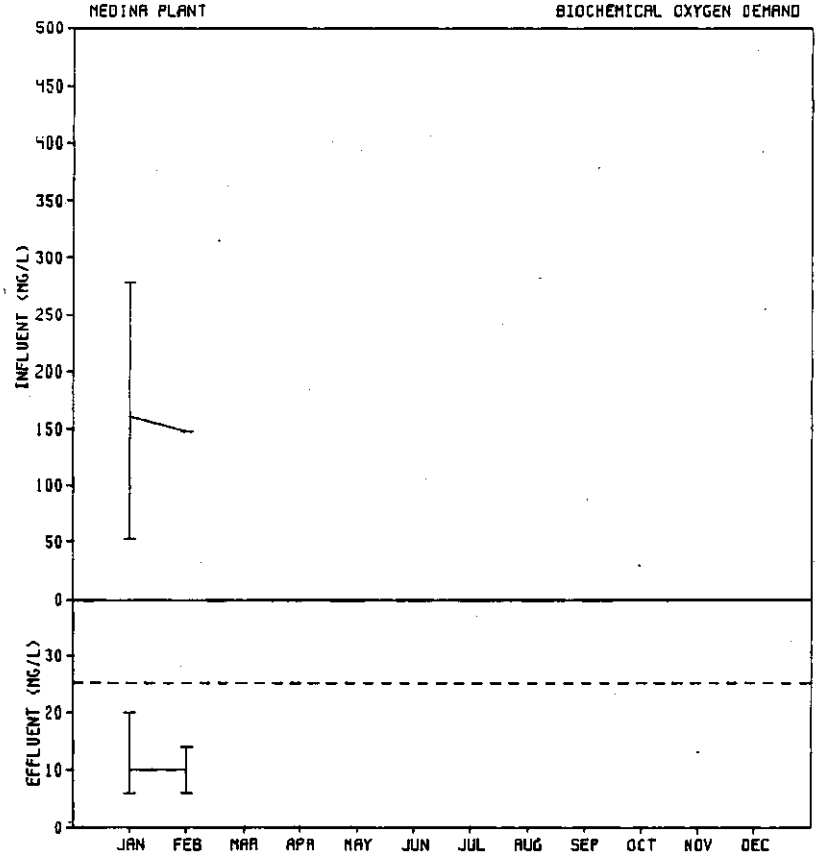
Plant flow diverted to lift station 2/14/85.

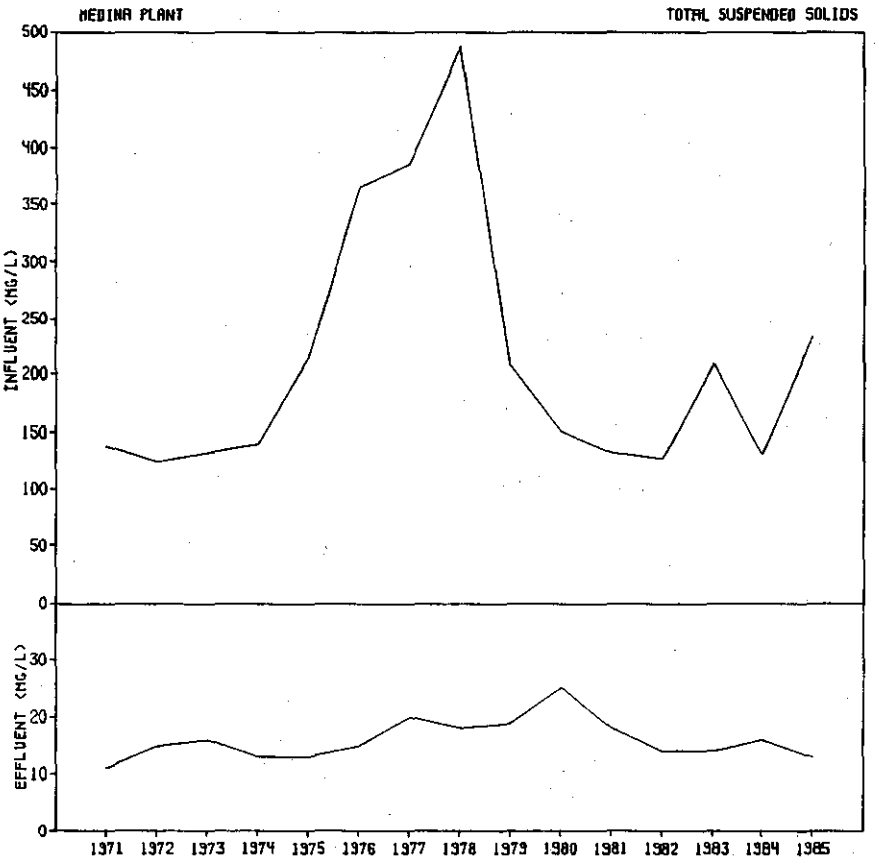
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Medina

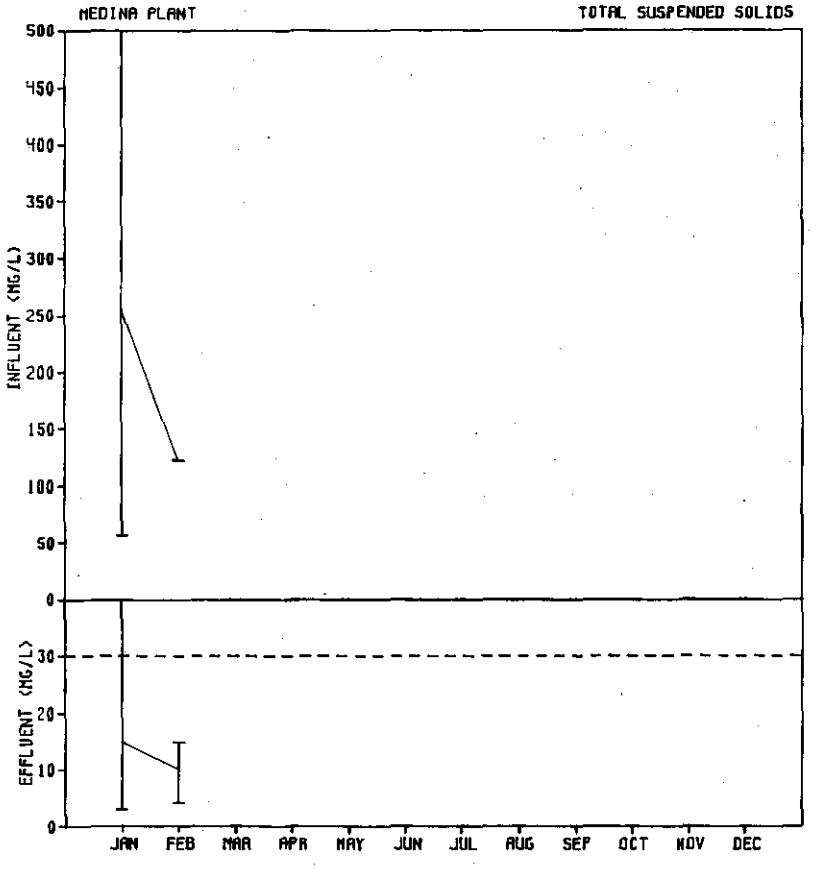
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2 Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
JANUARY	27	10	48	15	--	14	15.8	10.9	0.33	1.75	3.1	---	---	2.4	7.4-7.6	94	94
FEBRUARY	30	10	45	10	--	--	14.8	12.8	0.33	3.90	3.1	---	---	2.6	7.4-7.4	93	92
MARCH																	
APRIL																	
MAY																	
JUNE																	
JULY																	
AUGUST																	
SEPTEMBER																	
OCTOBER																	
NOVEMBER																	
DECEMBER																	
1985 AVG.	28	10	47	13	--	14	15.5	11.4	0.33	2.36	3.1	---	---	2.4	7.4-7.6	94	93
1984 AVG.	15	10	53	16	--	10	10.2	6.0	0.13	1.70	1.8	---	---	2.6	7.4-7.8	89	86

Plant flow diverted to lift station 2/14/85.


MEDINA PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.


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


MEDINA 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 1984 1985


MEDINA 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 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.

Sludge incineration and energy recovery was the primary method of sludge management during 1984 and 1985. The land application program was converted to the backup sludge management method, after several years of heavy use, while the new sludge processing facilities were being constructed.

In 1985, the Commission received a Special Recognition National Award for Energy Innovation from the Department of Energy. This award was presented in recognition of the new sludge processing facilities' enery savings at the Metropolitan Plant. The plant produced $1.25 million of usuable steam during 1984, while reducing sludge incineration auxiliary fuel costs from $3 million in 1980 to $125,000 in 1984.

Compliance with particulate and opacity air emission limitations was maintained during 1984 and 1985. Emissions averaged about 70% of allowable discharge limits. A new air operating permit was issued on April 30, 1985. To comply with one of the new permit provisions, a comprehensive odor control program was initiated during 1985 to minimize odorous air emissions from the plant. The program has been successful so far, enabling the Metropolitan Plant to be a good neighbor and minimizing odor complaints.

Operation of the South St. Paul pretreatment facility was ceased in June, 1984. Wastewater is now screened and pumped directly to the Metro Plant. Expansion of the east battery secondary treatment facilitieis was substantially completed in January, 1985.

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 by the new system of incineration with heat recovery.

During the summer of 1985, the Metropolitan Plant was operated to meet new effluent limits on ammonia (8 mg/L) and more stringent limits on BOD (18 mg/L). Performance was excellent, and effluent quality was much better than the effluent limits. Special studies were conducted during the summer of 1985 to determine optimum process performance. These studies supported the Plant Performance Evaluation, which assessed treatment capabilities of the Metropolitan Plant, considering the impact of the recently completed secondary treatment expansion.

Performance

Plant flow averaged 222 mgd in 1985, the same as 1984. Effluent quality during 1985 was excellent, with no NPDES permit violations. Average effluent BOD and TSS concentrations during 1985 were 11 mg/L and 13 mg/L as compared to 1984 average effluent BOD and TSS values of 10 mg/L and 11 mg/L. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	10	8	8	9	15	13	12	13	22	19	17	19
TSS	7	7	8	9	12	11	12	15	21	17	19	24

Future

The Metropolitan Plant will continue to be the largest treatment facility in the Metropolitan Disposal System. Disinfection improvements and dechlorination to meet a chlorine residual standard are scheduled for completion by spring of 1986. Retrofit of existing facilities to be compatible with the distributed digital acquisition and control system, and rehabilitation of older plant systems, such as west pretreatment, west primary, and west secondary, are scheduled for construction during 1985-1988.

METROPOLITAN PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average 1983	Annual Average 1984	Annual Average 1985	Maximum Month 1983	Maximum Month 1984	Maximum Month 1985
Wastewater Flow, mgd	225	222	222	285	285	261
Flow-East, mgd (1)	194	179	193	238	234	229
Flow-West, mgd (2)	31	43	29	47	65	32
BOD Loading, lb/day	330,000	330,000	380,000	390,000	370,000	410,000
TSS Loading, lb/day	360,000	370,000	360,000	460,000	490,000	420,000
Primary Sludge, dtpd	197	227	200	235	240	300
Secondary Sludge, dtpd	103	96	100	118	160	150
Total Sludge (with recycle), dtpd	300	323	300	353	400	450
Bar Screens						
East Battery						
No. of Units	5.9	5.2	5.7	6.7	6.3	6.5
Unit Flow, mgd	33	34	34	36	37	35
West Battery						
No. of Units	0.5	0.7	0.4	0.7	1.3	0.8
Unit Flow, mgd	69	61	72	72	40	107
Grit Tanks						
East Battery						
No. of Units	5.9	5.2	5.7	6.7	6.3	6.5
Hor. Velocity, fps	0.3	0.3	0.3	0.3	0.3	0.3
Unit Flow, mgd	33	34	34	36	38	35
West Battery						
No. of Units	0.9	1.4	0.8	1.3	2.5	1.6
Hor. Velocity, fps(3)	1.0	1.0	1.0	1.0	1.0	1.0
Unit Flow, mgd	35	31	36	36	20	53
Primary Sedimentation						
East Battery						
No. of Units	7.9	7.7	7.6	8.0	8.0	8.0
Detention Time, hr.	2.7	2.9	2.6	2.3	2.3	2.2
Overflow Rate, gpd/sq. ft.	1,020	980	1,050	1,240	1,220	1,250
West Battery						
No. of Units	4.9	5.8	5.6	5.9	5.6	6.0
Detention Time, hr.	7.1	6.5	8.4	5.7	5.0	5.3
Overflow Rate, gpd/sq. ft.	390	470	320	490	560	510
Activated Sludge-Aeration			Jun-Sep/ Oct-May			Jun-Sep/ Oct-May
East Battery						
Flow, mgd	98	102	94/101	116	123	108/144
No. of Units	3.6	3.2	6.9/4.3	3.9	3.5	7.0/5.7
F:M Ratio, day^{-1}	0.20	0.24	0.08/0.19	0.21	0.20	0.10/0.21

METROPOLITAN PLANT PROCESS UNIT LOADINGS (cont.)

Parameter	Annual Average 1983	Annual Average 1984	1985	Maximum Month 1983	Maximum Month 1984	1985
Activated Sludge-Aeration (Cont.)			Jun-Sep/ Oct-May			Jun-Sep/ Oct-May
BOD Load, lb/day/1000 cu. ft.	40	52	17/34	41	39	22/42
Air Use, cu. ft./lb. BOD removed	2,590	1,830	5000/2400	1,820	2,320	6200/4000
Detention Time, hr.	4.6	3.5	8.6/5.1	3.7	3.3	8.4/3.3
West Battery						
Flow, mgd	127	120	123/123	169	162	127/148
No. of Units	4.2	4.4	5.0/4.0	5.0	6.0	5.0/4.9
F:M Ratio, day^{-1}	0.35	0.39	.25/.32	0.33	0.32	.27/.35
BOD Load, lb/day/1000 cu. ft.	46	49	39/61	38	34	46/74
Air Use, cu. ft./lb. BOD removed	2,120	1,870	2200/1500	1,580	2,420	2500/2000
Detention Time, hr.	3.0	2.9	3.4/2.8	3.2	3.5	3.2/2.5
Final Sedimentation						
East Battery						
No. of Units	8.3	9.0	11.7	7.0	8.7	12.0
Detention Time, hr.	3.5	3.1	4.6	2.8	2.6	2.9
Overflow Rate, gpd/sq. ft.	630	690	490	720	800	700
Solids Load, lb./sq. ft./day	10	11.5	9.0	11	12.3	11.8
West Battery						
No. of Units	11.4	11.5	11.0	11.3	11.6	12.0
Detention Time, hr.	3.4	3.2	3.1	2.9	2.7	2.7
Overflow Rate, gpd/sq. ft.	590	640	640	680	740	730
Solids Load, lb./sq. ft./day	10	10.6	11.6	10	12.2	13.7
Chlorination						
Chlorine Use, lb/day(4)	12,200	10,400	8,000	13,600	15,300	9,200
Chlorine Dose, mg/L	6.1	4.7	4.0	6.8	6.6	5.3
Contact Time, minutes	25	25	25	21	20	23
Gravity Thickening						
Solids Loading, lb./sq. ft./day	19	19	22	23	22	31
Overflow Rate, gpd/sq. ft.	450	505	500	530	600	580
Sludge Concentration, % TS(5)	7.4	7.0	6.4	8.8	7.8	6.8
Flotation Thickening						
No. of Units	9.5	11.5	10.9	13.1	11.6	14.5
Solids Loading, lb./sq. ft./day	15.2	9.2	9.0	20.8	13.0	12.1
Air:Solids Ratio	0.04	0.04	0.05	0.05	0.02	0.06
Sludge Concentration, % TS(6)	3.6	3.5	3.3	3.8	3.3	4.0

METROPOLITAN PLANT PROCESS UNIT LOADINGS (cont.)

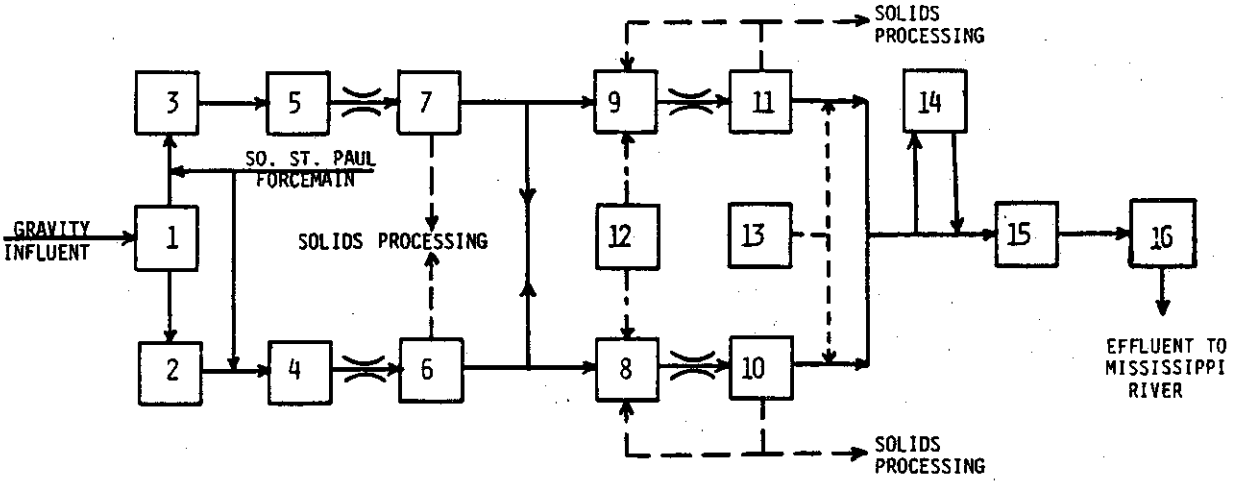
Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Thermal Conditioning						
No. of Units	3.3	3.7	3.2	3.6	4.8	5.0
Feed Concentration, % TSS	4.5	4.1	3.5	6.8	3.7	4.2
TSS Solubilization, %	39	36	37	38	38	40
Decant Tank Underflow, % TS	14	14	13	15	14	15
Roll Presses						
No. of Units	1.6	2.4	2.6	2.5	2.8	3.0
Dry Sludge, tpd	108	150	180	145	190	220
Cake Solids, % TS	32.1	34.2	34	31.2	37.8	35
Dry Polymer, lb/day	1,400	2,200	2,600	2,200	2,600	3,100
Dry Polymer, lb/tds	13	15	16	18	17	18
Filter Presses						
No. of Units	3.4	4.0	0.2	4.2	4.8	2.1
Dry Sludge, tpd	75	69	2	110	82	20
Incineration						
No. of Units per day	1.2	2.6	2.8	-------	3.3	3.2
Auxiliary Fuel Use, MMBtu/tds	1.6	0.7	0.5	-------	1.1	0.9
Dry Sludge, tpd	89	157	170	158	208	220
Wet Loading, lb./sq. ft./hour	8.7	6.9	7.5	-------	7.0	8.3

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.

METROPOLITAN WASTEWATER TREATMENT PLANT

LIQUID PROCESSING FLOW DIAGRAM

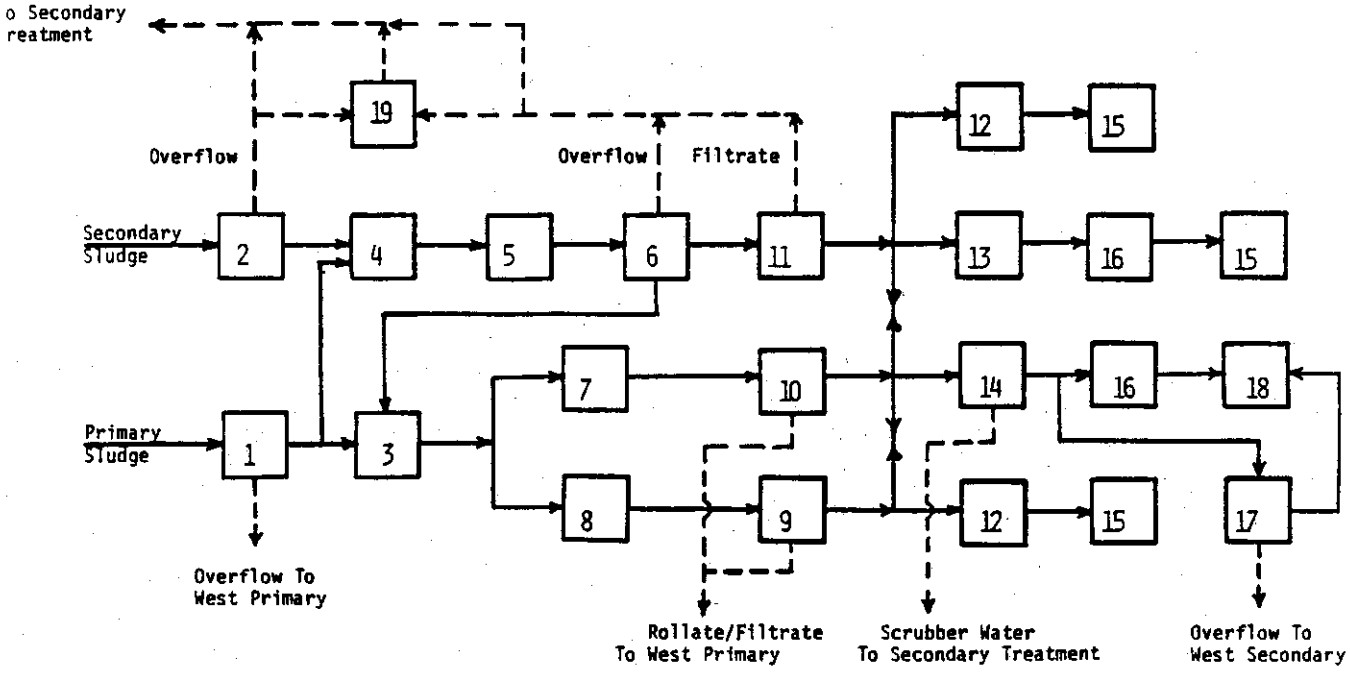


1. Flow Diversion Structure
2. Screening - West
3. Screening - East
4. Grit Removal - West
5. Grit Removal - East
6. Primary Sedimentation - West
7. Primary Sedimentation - East
8. Aeration Tanks - West
9. Aeration Tanks - East
10. Final Sedimentation - West
11. Final Sedimentation - East
12. Air Compressors
13. Chlorination Facilities
14. Effluent Pumping
15. Chlorine Contact Channel
16. Dechlorination Facilities (SO_2)

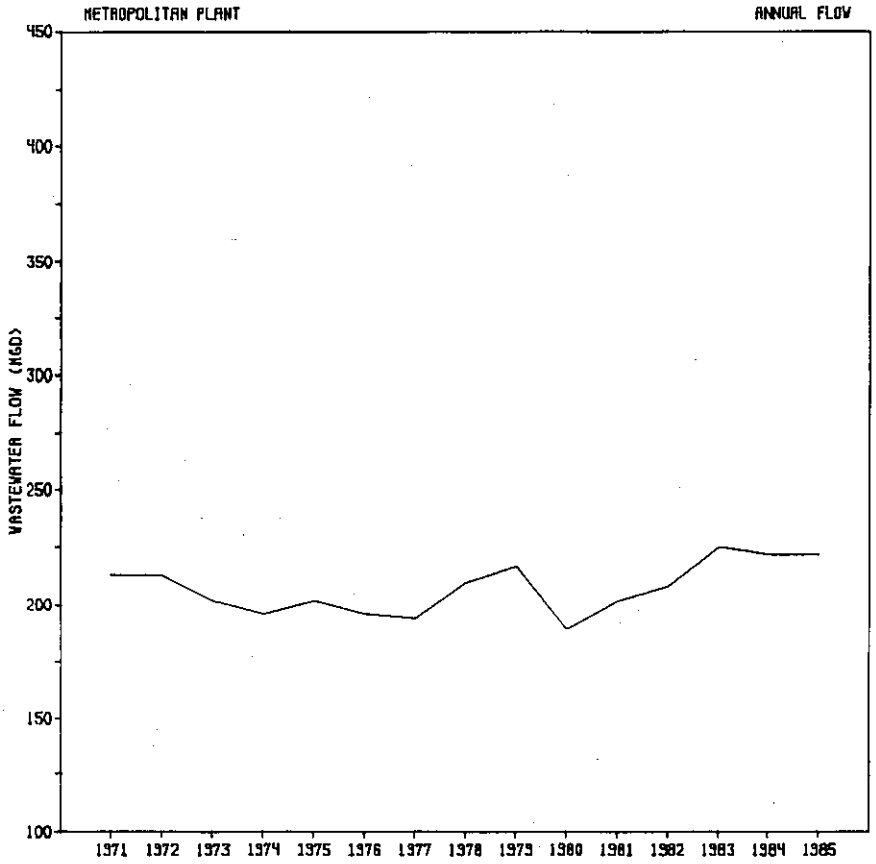
Legend

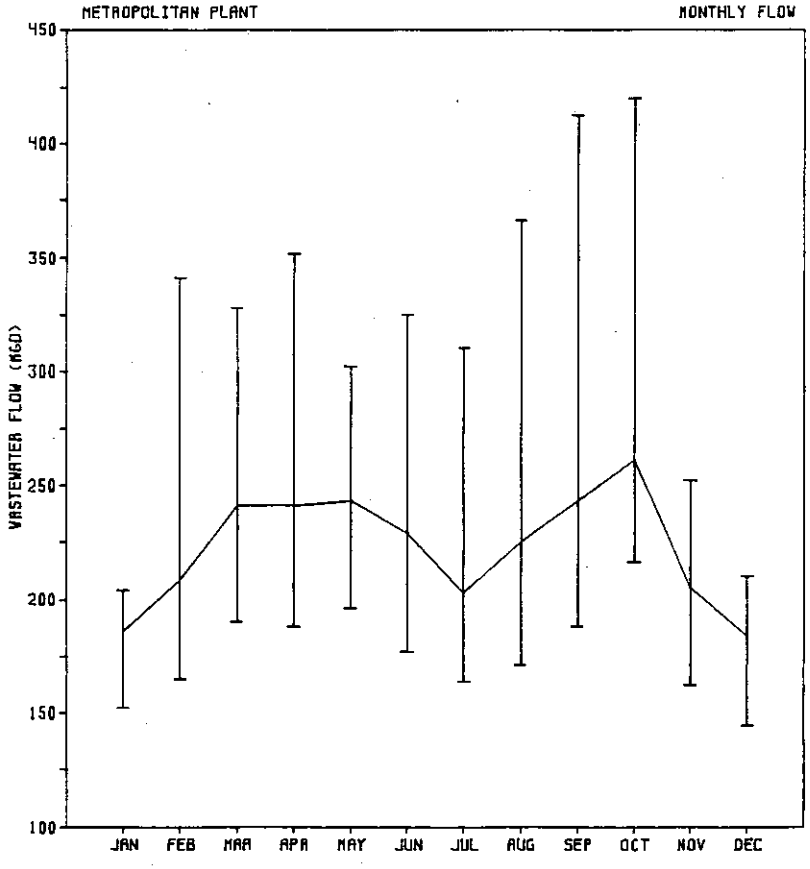
- Liquid Flow
- Air Flow
- Chemical Flow
- Solids Flow
- Flow Metering

SOLIDS PROCESSING FLOW DIAGRAM



1. Gravity Thickening
2. Flotation Thickening
3. Sludge Holding Tanks
4. Sludge Storage Tanks
5. Thermal Conditioning
6. Decant Tanks
7. Polymer Conditioning
8. Lime and $FeCl_3$
9. Vacuum Filter Dewatering
10. Roll Press Dewatering
11. Filter Press Dewatering
12. Dewatered Sludge Storage
13. Rotary Drying
14. Incineration/Energy Recovery
15. Land Application
16. Storage Silos
17. Ash Storage Ponds
18. Recycling or Landfilling
19. Recycle Liquor Treatment (Rotating Biological Surface)


METROPOLITAN PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
450
400
350
300
250
200
150
100
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


METROPOLITAN PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
450
400
350
300
250
200
150
100
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

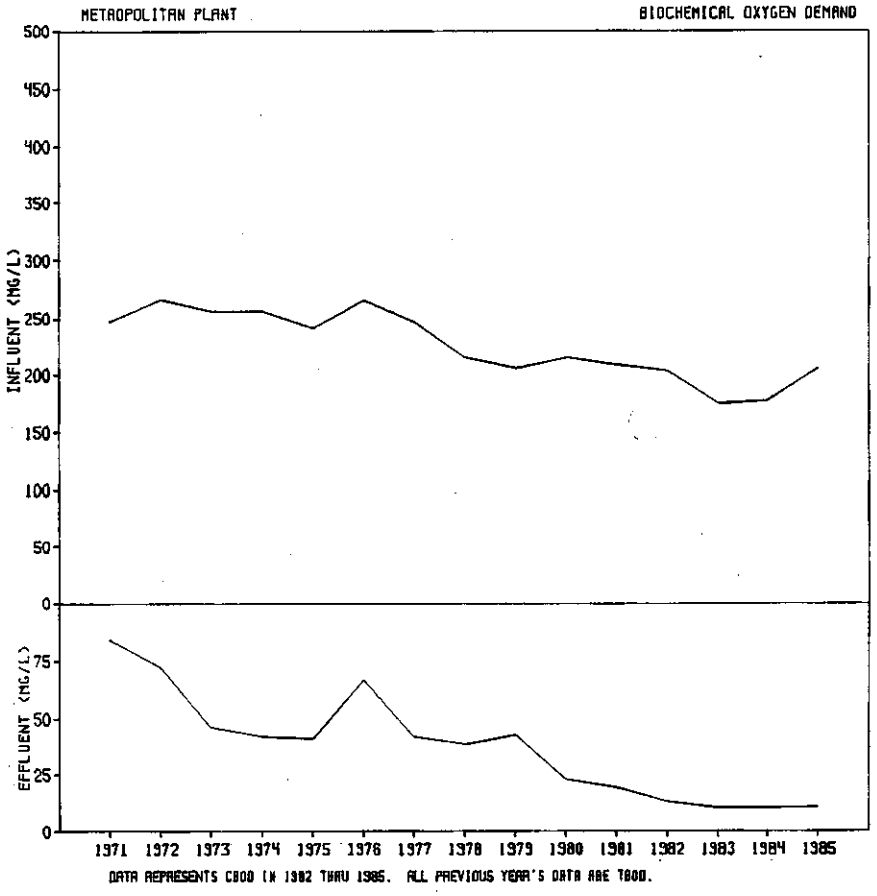
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Metropolitan

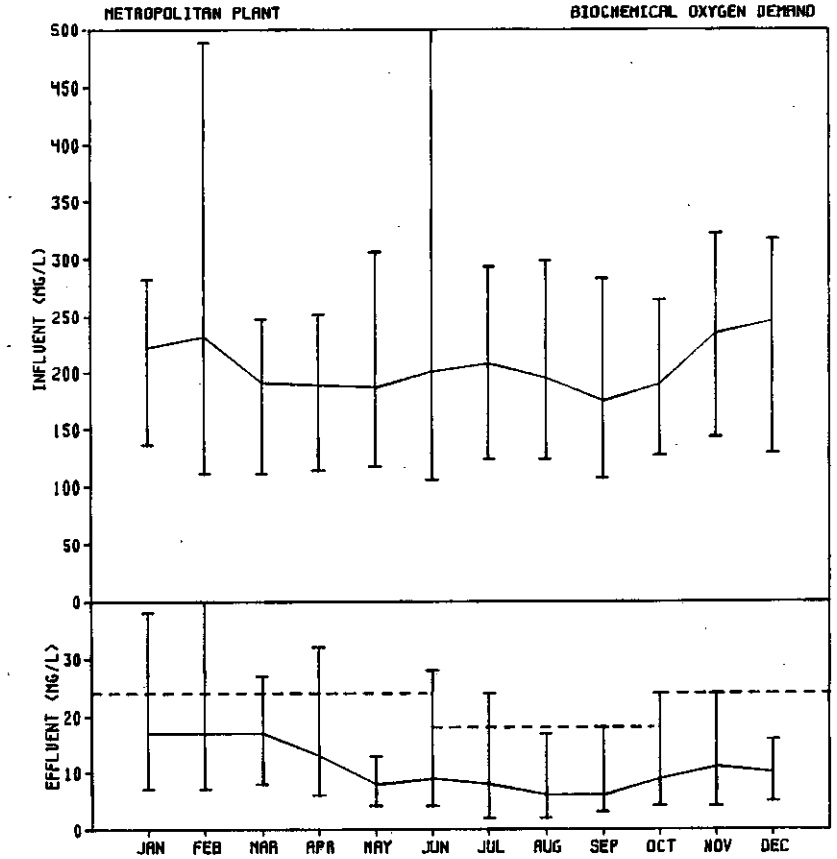
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	186	12	222	192	6.4-9.7	29.1	4.8	14.4	439
FEBRUARY	208	12	232	206	6.3-9.9	26.6	4.6	12.8	461
MARCH	241	11	190	177	6.3-9.7	24.2	4.0	9.5	413
APRIL	241	12	188	180	6.2-9.9	23.1	4.0	9.4	367
MAY	243	15	186	212	6.3-9.0	23.9	4.1	10.4	371
JUNE	229	16	201	183	6.6-8.7	24.3	4.1	10.8	418
JULY	203	19	207	209	6.5-10.5	21.1	4.1	9.9	387
AUGUST	225	20	195	214	6.4-9.3	24.3	4.0	10.2	392
SEPTEMBER	243	18	174	189	6.0-9.5	20.4	3.5	10.0	337
OCTOBER	261	17	189	194	6.6-9.7	22.6	3.9	9.1	382
NOVEMBER	205	15	235	198	5.9-10.6	26.9	4.1	12.9	411
DECEMBER	184	13	245	180	6.5-11.7	29.6	4.5	15.2	442
1985 AVERAGE	222	15	205	195	5.9-11.7	24.7	4.1	11.2	401
1984 AVERAGE	222	16	176	198	5.6-9.7	22.8	4.0	10.3	379

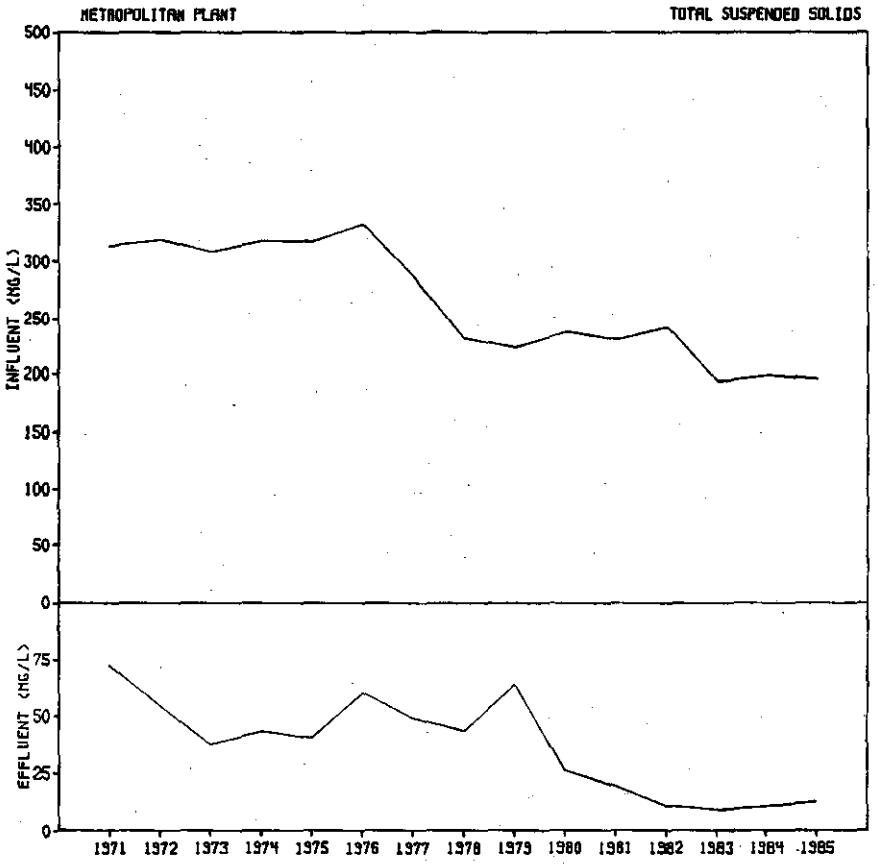
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Metropolitan

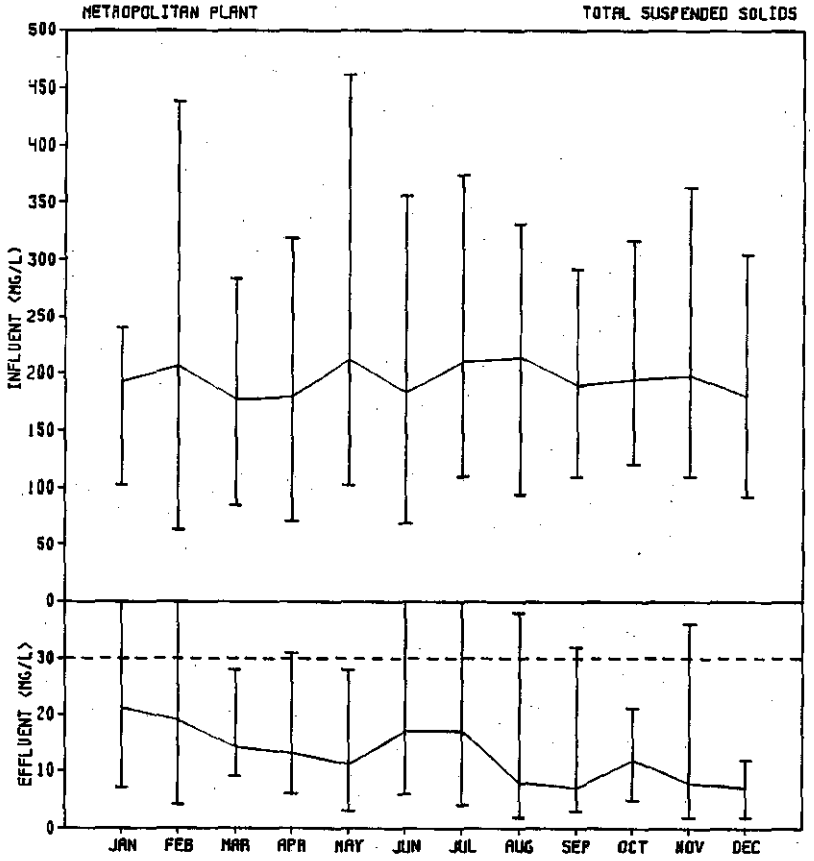
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	24/18[2]	---	30	200	25	-----	8.0[3]	----	-----	---	-----	---	[1]	6.5-8.5	--	--
JANUARY	28	17	91	21	---	8	20.0	12.2	0.52	4.25	2.5	-----	---	4.3	7.1-7.6	92	89
FEBRUARY	26	17	92	19	---	8	18.9	11.2	0.36	3.96	2.2	4366	0.6	3.5	7.2-7.8	93	91
MARCH	28	17	92	14	5	8	18.3	9.0	0.58	2.64	1.9	7882	2.0	7.4	7.2-7.6	91	92
APRIL	30	13	77	13	4	8	18.6	10.1	0.76	2.19	1.9	7094	1.8	4.2	7.3-7.8	93	93
MAY	23	8	66	11	30	6	14.9	7.4	1.54	5.13	2.5	9438	1.7	5.1	7.3-7.7	96	95
JUNE	19	9	61	17	15	7	4.7	1.4	0.36	9.83	2.7	8575	1.8	4.6	7.1-7.7	96	91
JULY	18	8	62	17	51	7	4.6	1.2	0.30	11.90	2.7	7580	1.5	4.9	7.1-7.5	96	92
AUGUST	10	6	49	8	36	4	4.0	1.3	0.20	11.84	2.5	7424	1.9	4.8	7.1-7.6	97	96
SEPTEMBER	11	6	46	7	5	4	3.8	1.1	0.15	12.06	2.2	6920	1.7	4.9	7.1-7.5	97	96
OCTOBER	17	9	62	12	49	8	8.3	4.4	0.60	7.37	2.2	8423	1.4	5.2	6.9-8.0	95	94
NOVEMBER	22	11	75	8	---	5	17.8	11.5	1.92	2.04	2.4	-----	---	---	7.1-7.8	96	96
DECEMBER	20	10	69	7	---	3	21.7	15.3	1.89	2.33	2.6	-----	---	---	7.2-7.6	96	96
1985 AVG.	21	11	70	13	24	6	12.9	7.2	0.75	6.37	2.3	7887	1.7	4.9	6.9-8.0	95	93
1984 AVG.	20	10	78	11	43	6	16.3	9.9	0.79	3.42	2.0	10297	2.2	4.4	6.8-8.1	94	95

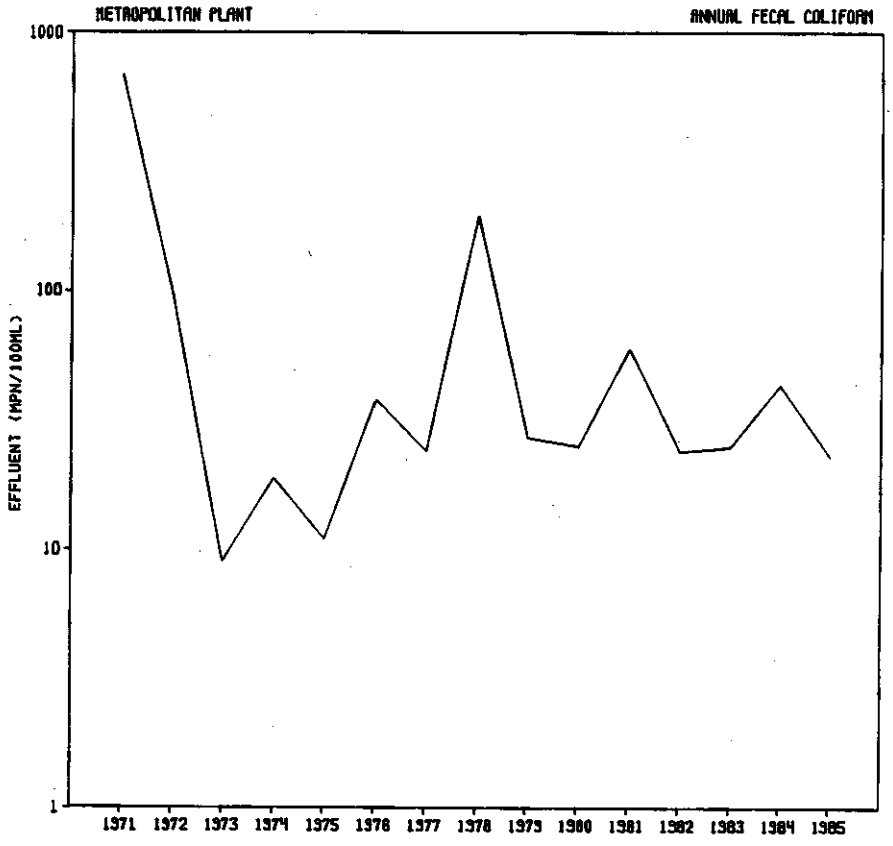
* For disinfection only.
[1]Dissolved oxygen limitation of 7 mg/l for river flows less than 7,000 cfs and river D.O. values less than 6 mg/l upstream or less than 5.5 mg/l downstream for two consecutive sample days, during the period of June-September.
[2]Oct.-May/June-Sept.
[3]June-Sept. only.

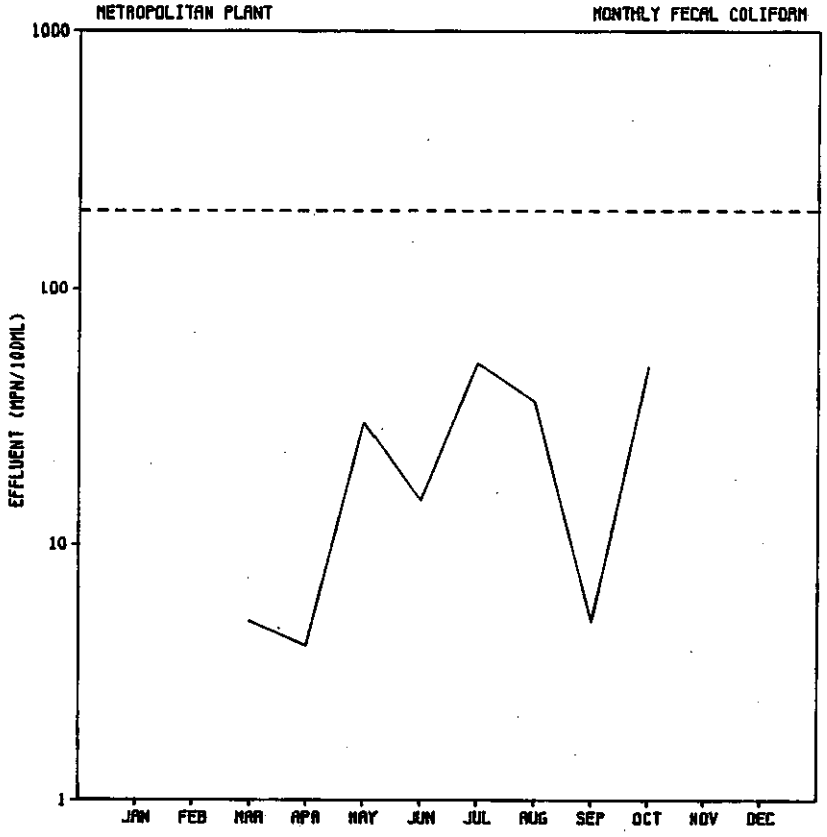

METROPOLITAN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

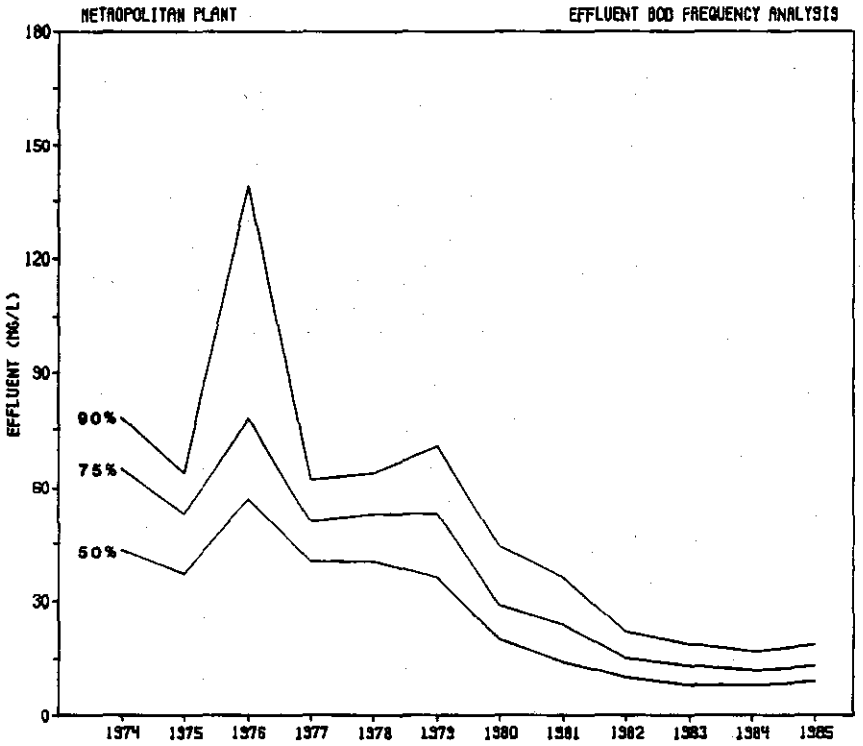

METROPOLITAN PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

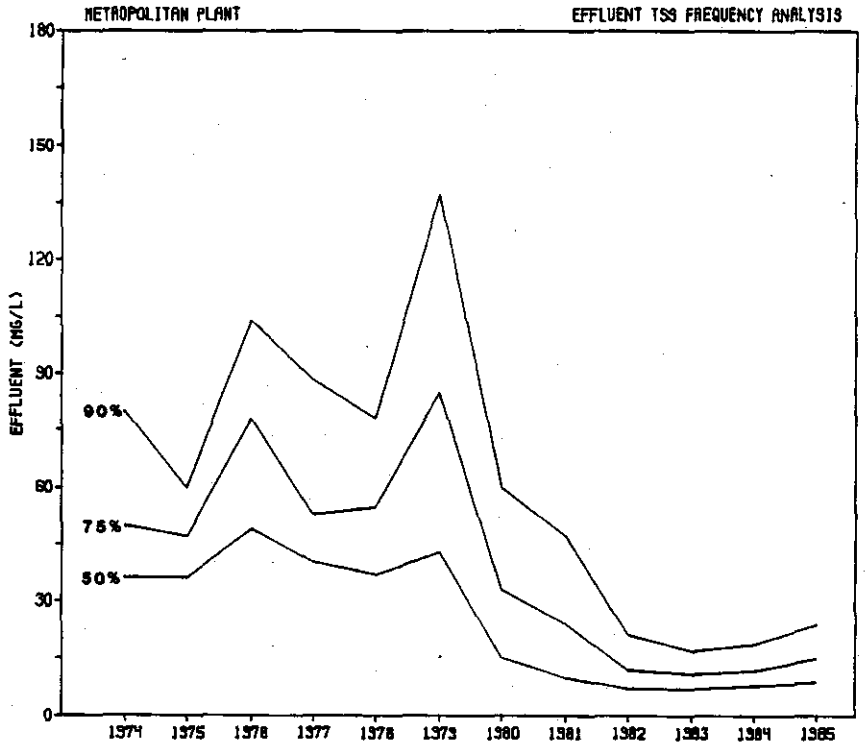

METROPOLITAN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
0
25
50
75
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


METROPOLITAN PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
0
10
20
30
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 1978 1977 1978 1979 1980 1981 1982 1983 1984 1985


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
1984
1985


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
1984
1985

1985 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	0.21	<0.161	0.39	<0.053	0.012	<0.5	<0.076	1.3	0.04	<0.11	42.2	1.39
February	0.24	<0.185	0.42	<0.065	0.012	<0.3	0.082	<1.2	0.06	<0.14	81.8	1.57
March	0.18	<0.117	0.33	<0.060	0.008	<0.3	<0.045	1.9	0.08	<0.09	38.0	2.35
April	0.18	<0.117	0.37	<0.059	0.011	<0.3	<0.069	1.6	0.08	<0.11	110.0	1.42
May	0.17	<0.121	0.33	<0.065	0.014	<0.4	<0.038	4.4	0.09	<0.08	87.0	1.70
June	0.16	<0.124	0.34	<0.055	0.009	<0.3	<0.037	2.9	0.12	<0.09	36.0	1.06
July	0.16	<0.148	0.40	<0.056	0.010	<0.6	<0.044	1.7	0.15	<0.10	30.0	1.50
August	0.18	<0.129	0.32	<0.055	0.010	<0.3	<0.055	1.3	0.09	<0.10	27.0	1.70
September	0.19	<0.111	0.35	<0.052	0.008	<0.3	<0.068	1.4	0.09	<0.09	23.8	1.98
October	0.18	<0.138	0.37	<0.054	0.013	<0.3	<0.091	<1.5	0.06	<0.14	39.6	1.37
November	0.23	<0.144	0.29	<0.051	0.011	<0.2	<0.059	2.6	0.07	<0.19	31.2	1.25
December	0.20	<0.111	0.29	<0.051	0.010	<0.3	<0.067	2.0	0.07	<0.11	23.6	1.45
1985 Avg.	0.19	<0.133	0.35	<0.056	0.011	<0.4	<0.061	<2.0	0.08	<0.11	47.5	1.56
1984 Avg.	0.22	<0.17	0.40	<0.06	0.014	<0.7	<0.056	<1.6	0.05	<0.12	38.6	1.86

1985 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	4.0	0.193					
January	0.03	<0.053	0.12	<0.050	0.003	<0.2	<0.020	1.6	<0.01	0.08	9.8	0.19
February	0.03	<0.068	0.13	<0.050	0.002	<0.2	<0.020	1.1	0.01	0.10	9.8	0.15
March	0.04	<0.051	0.12	<0.050	0.003	<0.2	<0.020	<1.1	0.01	0.07	8.9	0.32
April	0.03	<0.050	0.11	<0.050	0.003	<0.2	<0.020	<1.0	0.01	0.07	5.7	0.22
May	0.02	0.018	0.09	0.004	0.003	<0.2	<0.020	2.3	0.02	0.06	9.5	0.16
June	0.04	0.024	0.12	0.006	0.004	<0.2	<0.020	1.7	0.08	0.06	3.8	0.15
July	0.03	0.027	0.12	0.006	0.004	<0.2	<0.020	1.6	0.10	0.08	2.1	0.56
August	0.03	0.024	0.09	0.007	0.004	<0.2	<0.020	1.3	0.02	<0.07	4.0	0.15
September	0.02	0.024	0.10	0.004	0.004	<0.2	<0.020	<1.1	0.04	0.07	4.7	0.14
October	0.03	0.026	0.12	0.004	0.005	<0.2	<0.020	1.3	0.02	0.10	3.8	0.22
November	0.02	0.025	0.09	0.003	0.002	<0.2	<0.020	<1.0	0.02	0.10	7.1	0.14
December	0.02	0.027	0.07	<0.002	0.001	<0.2	<0.020	1.6	<0.02	<0.07	7.0	0.14
1985 Avg.	0.03	<0.035	0.11	<0.020	0.003	<0.2	<0.024	<1.4	<0.03	<0.08	6.4	0.21
1985 Medium	0.03	------	----	------	0.003	<0.2	<0.020	----	-----	-----	---	----
1984 Avg.	0.03	<0.05	0.11	<0.05	0.003	<0.2	<0.026	<1.6	<0.02	<0.09	14.5	0.23

*Monthly 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 solids-contact clarification, 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 70 percent of capacity and is subject to secondary treatment limits, and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 0.38 mgd in 1985, slightly higher than 0.37 mgd in 1984. Average plant effluent quality was 18 mg/L BOD, 3 mg/L TSS and 0.2 mg/L P. Plant performance was fair throughout the year with five NPDES Permit violations; one daily pH and four related to BOD limitations. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	15	13	16	15	18	18	21	21	24	29	30	30
TSS	1	1	2	2	2	2	3	3	4	4	5	4

Future

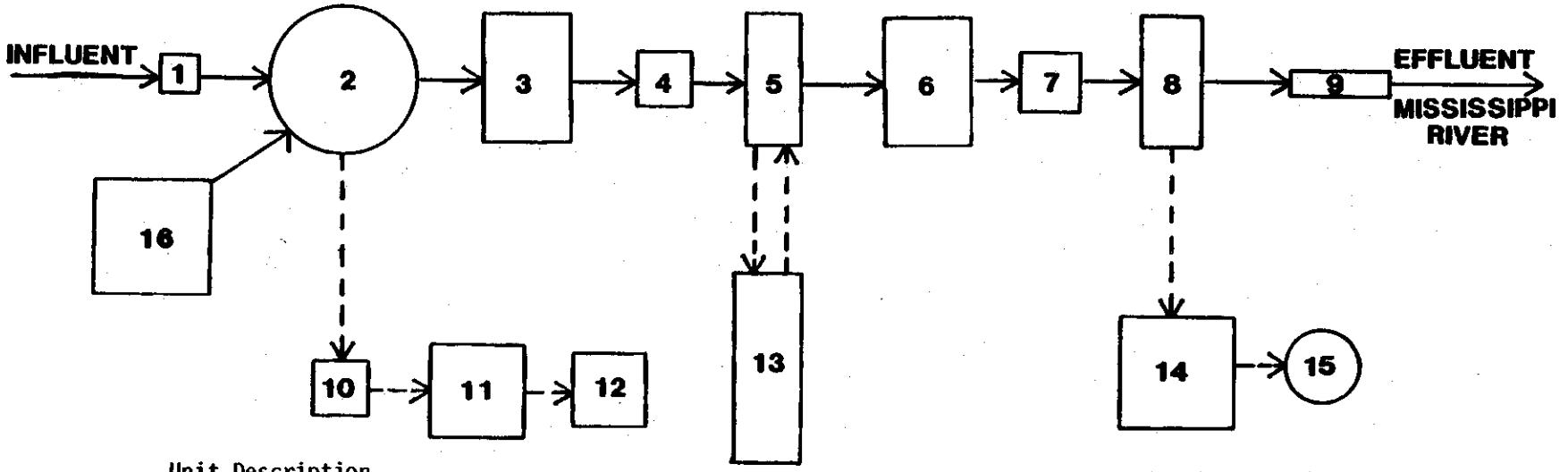
The plant was designed as a demonstration project and uses equipment intensive unit processes. As a result, the plant's useful life could be expected to be on the order of 10 to 15 years. For this reason, the plant is nearing the end of its useful life. The 201 Facility Plan recommended replacement of 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			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	0.34	0.37	0.38	0.38	0.40	0.46
BOD Loading, lb/day	460	390	437	520	510	594
TSS Loading, lb/day	680	400	390	1,300	470	536
Phosphorus Loading, lb/day	21	20	21	29	26	27
COD Loading, lb/day	1,200	990	953	1,400	1,160	1,364
Solids Contact Clarifier						
Number in Use	1	1	2	1	1	2
Surface Loading Rate, gpd/sq. ft.	700	750	390	770	810	470
Phosphorus Removal, %	96	94	92	98	88	85
Dual Media Filters (Four in Use)						
Surface Loading Rate, gpm/sq. ft.	1.1	1.2	1.3	1.3	1.4	1.6
Activated Carbon Columns						
Number of Trains in Service	1	1	2	1	1	2
Surface Loading Rate, gpm/sq. ft.	4.7	5.1	2.6	5.2	5.5	3.2
COD Loading Rate, lb/day/sq. ft.	220	190	3.1	280	380	8.9
Sludge Production						
Volume, gpd	5,000	5,100	5,620	6,300	6,600	6,540
Mass, lb/day	4,000	4,100	4,120	4,600	5,800	5,340

ROSEMOUNT WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

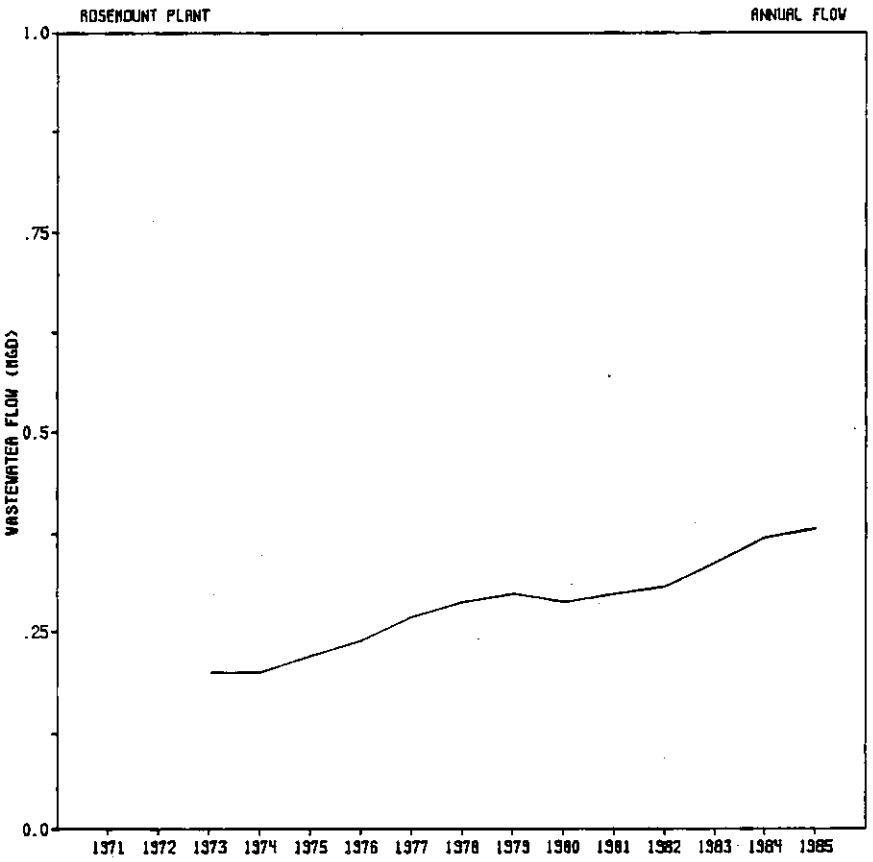
1. Screening
2. Solids Contact Clarifier
3. Dual Media Filters
4. Filtered Water Storage
5. Granular Carbon Columns
6. Dual Media Filters
7. Filtered Water Storage
8. Ion Exchange Columns
9. Chlorination

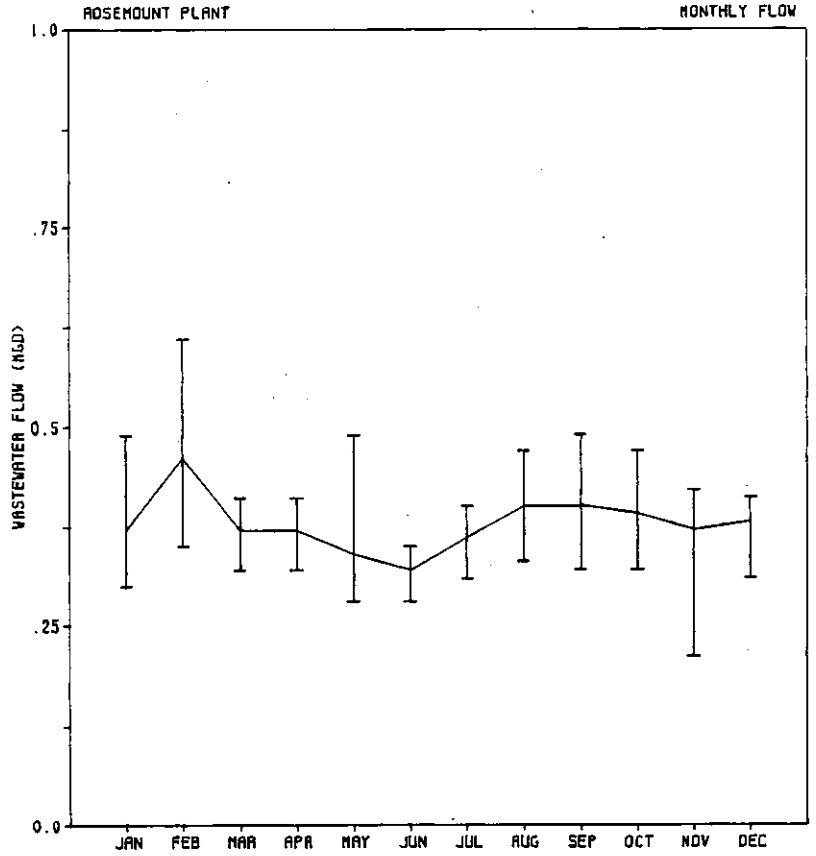
Solid Phase

10. Sludge Holding Tank
11. Sludge Dewatering
12. Disposal at Metro Plant
13. Carbon Regeneration System
14. Ion Exchange Regeneration System
15. Ammonia Recovery
16. Chemical Feed

Legend

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


ROSEMOUNT PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


ROSEMOUNT PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

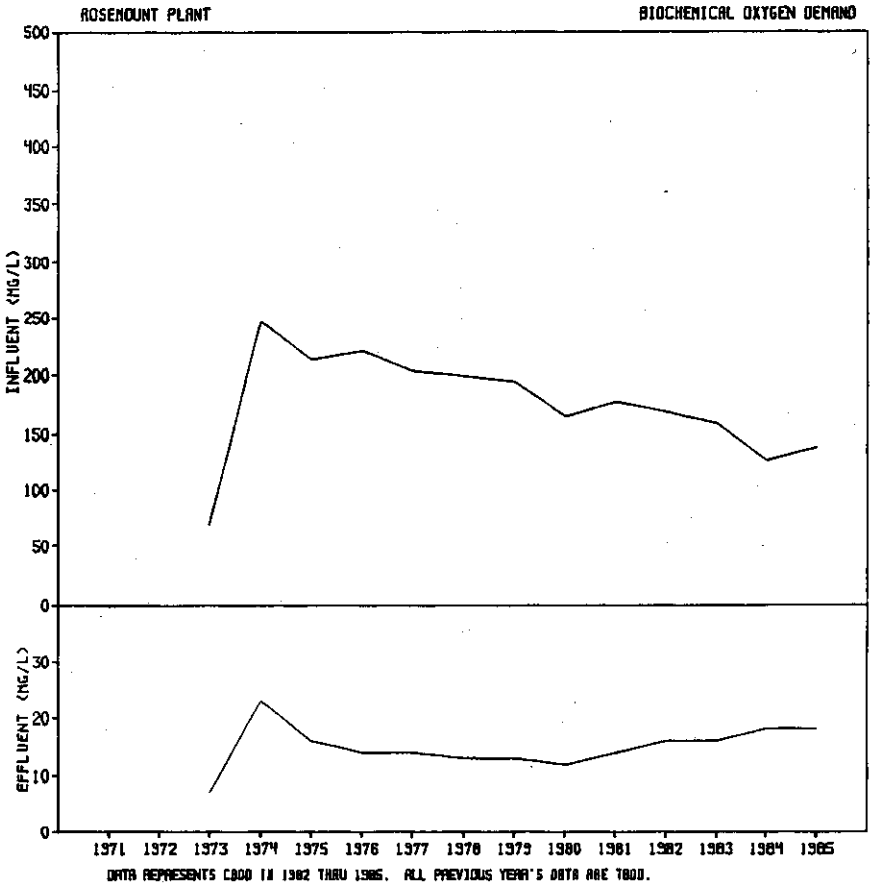
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Rosemount

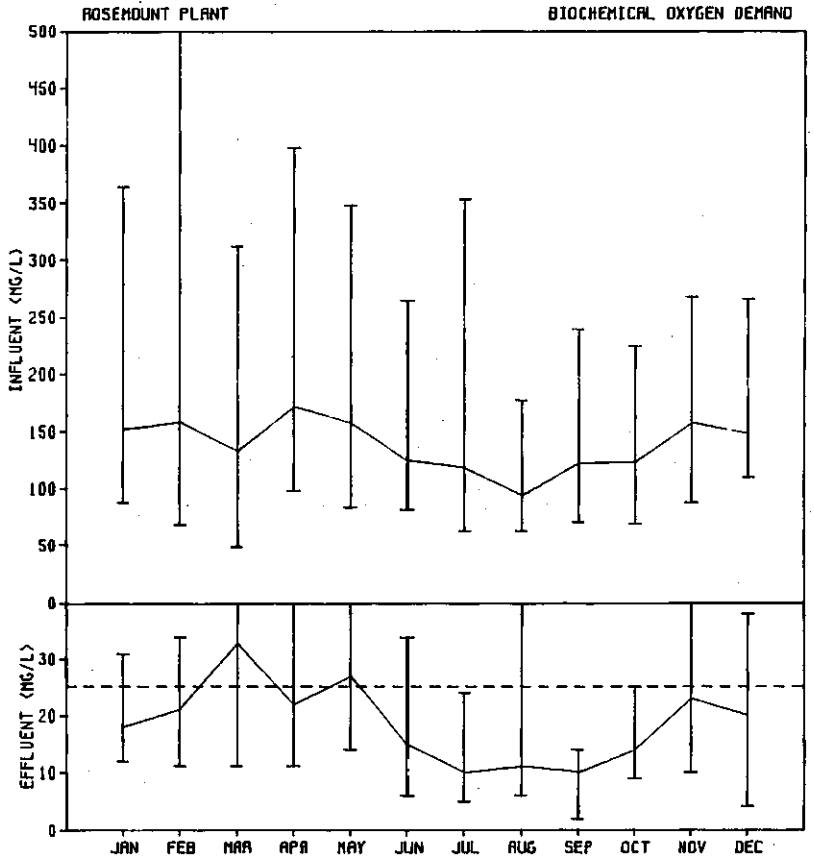
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.37	13	152	147	6.9-8.1	38.5	7.3	27.5	344
FEBRUARY	0.46	11	159	145	7.0-7.9	33.3	7.0	21.7	365
MARCH	0.37	10	133	170	7.4-8.1	35.6	6.3	19.0	365
APRIL	0.37	11	171	150	6.0-9.0	46.3	7.6	21.9	338
MAY	0.34	13	157	116	7.4-8.0	38.5	6.8	20.9	300
JUNE	0.32	15	125	150	5.0-11.3	41.9	6.4	22.5	308
JULY	0.36	16	118	126	4.8-11.0	40.4	6.4	20.8	270
AUGUST	0.40	17	94	69	4.0-12.0	35.1	5.8	21.9	209
SEPTEMBER	0.40	18	122	98	5.5-11.5	40.3	6.4	24.3	248
OCTOBER	0.39	17	124	101	3.6-10.3	39.0	6.7	25.0	283
NOVEMBER	0.37	16	157	106	6.8-9.0	40.8	6.8	25.1	285
DECEMBER	0.38	14	148	123	6.9-8.5	40.4	6.2	25.5	320
1985 AVERAGE	0.38	14	138	124	3.6-12.0	39.2	6.6	23.1	302
1984 AVERAGE	0.37	14	127	129	6.7-9.0	40.6	6.4	22.9	322

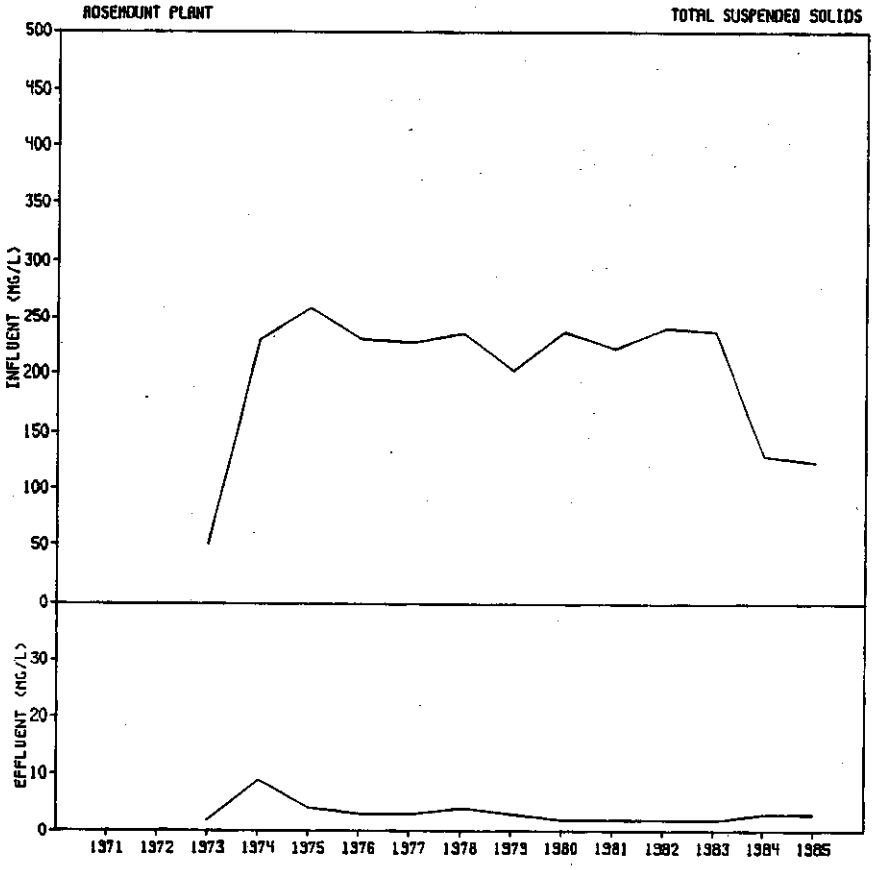
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Rosemount

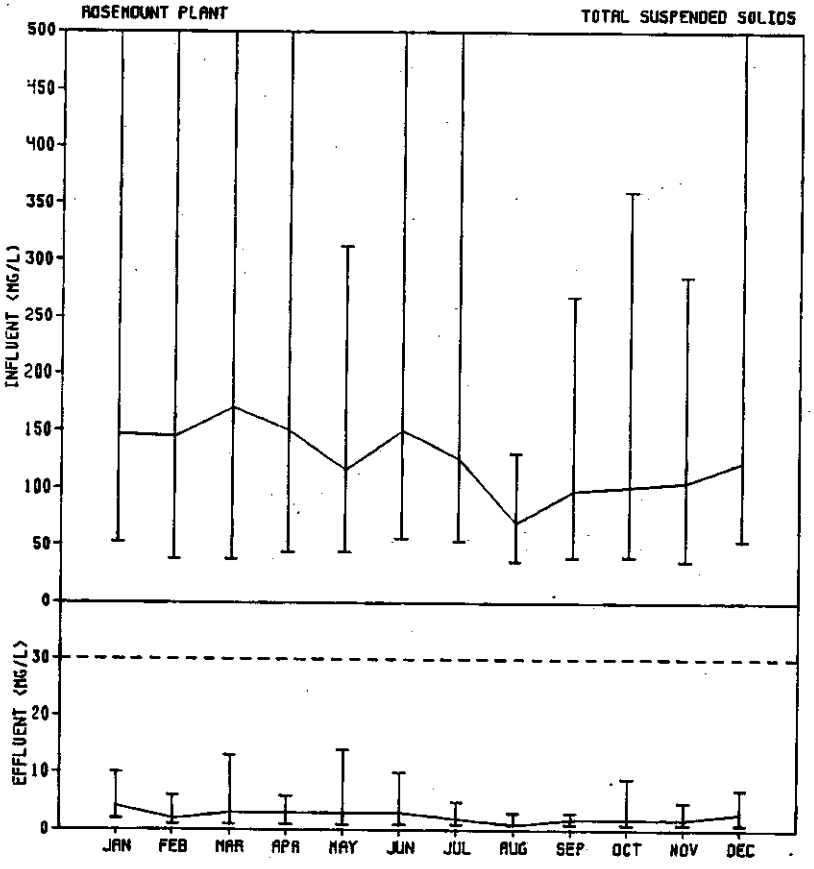
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	----	----	----	1.0	--	---	---	6.5-8.5	--	--
JANUARY	20	18	64	4	---	8	32.2	28.3	0.87	0.81	0.2	--	---	7.7	6.7-8.4	88	97
FEBRUARY	23	21	63	2	---	4	26.9	22.3	0.58	1.68	0.1	--	---	9.0	6.8-8.4	87	99
MARCH	35	33	76	3	2	6	28.6	19.7	0.63	1.59	0.4	26	2.0	8.6	6.2-8.2	75	98
APRIL	24	22	50	3	3	5	34.2	23.0	0.39	0.50	0.2	12	1.4	5.9	6.6-8.4	87	98
MAY	28	27	61	3	2	5	30.1	22.7	0.85	2.56	0.1	8	2.0	7.2	6.8-8.1	83	97
JUNE	17	15	55	3	2	4	32.2	24.2	0.33	1.68	0.3	6	2.7	8.8	6.8-8.4	88	98
JULY	12	10	36	2	2	3	27.3	22.1	0.37	1.45	0.1	5	1.8	9.4	6.8-8.4	92	98
AUGUST	12	11	37	1	2	3	29.6	23.3	0.53	2.00	0.1	5	1.6	6.9	6.8-8.4	88	98
SEPTEMBER	11	10	44	2	4	3	30.3	26.7	0.43	1.27	0.2	5	1.9	6.3	6.9-8.4	92	98
OCTOBER	16	14	50	2	2	3	32.0	28.1	0.65	0.81	0.1	5	2.6	6.6	6.7-8.4	89	98
NOVEMBER	27	23	59	2	---	5	33.1	29.0	1.43	0.95	0.2	--	---	7.3	7.0-7.9	85	98
DECEMBER	22	20	57	3	---	5	32.5	27.0	0.71	0.60	0.2	--	---	8.0	6.8-8.0	87	98
1985 AVG.	20	18	54	3	2	4	30.7	24.8	0.64	1.34	0.2	9	2.0	7.7	6.2-8.4	87	98
1984 AVG.	20	18	64	3	5	6	33.0	25.7	0.26	0.47	0.2	25	1.8	6.6	6.6-9.0	86	98

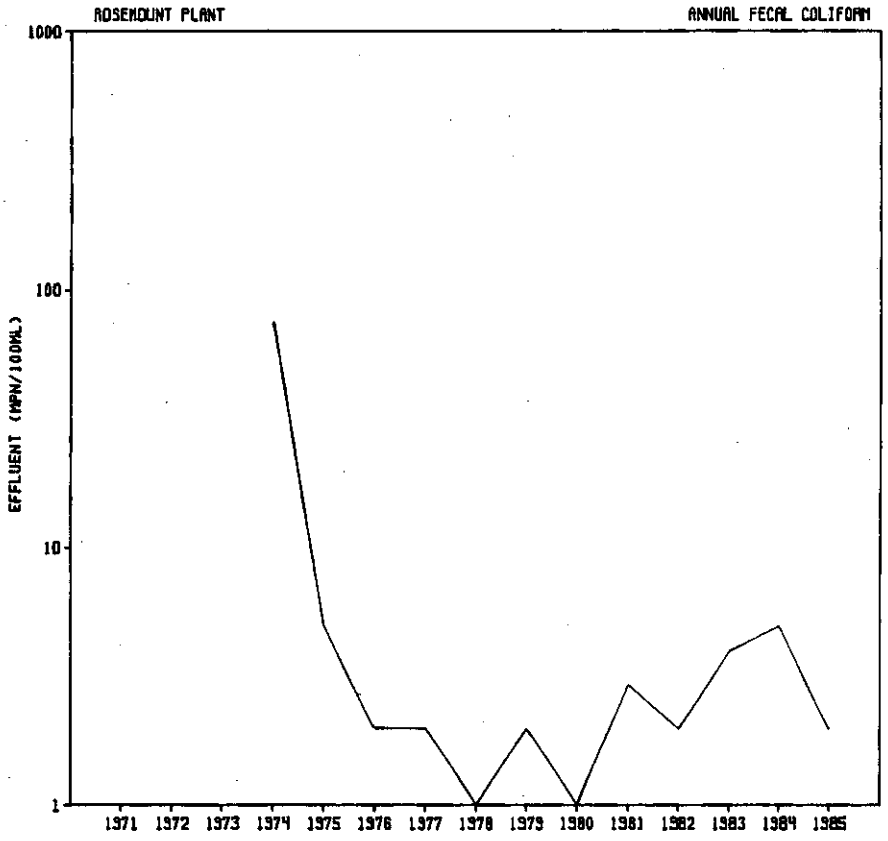
*For disinfection only.

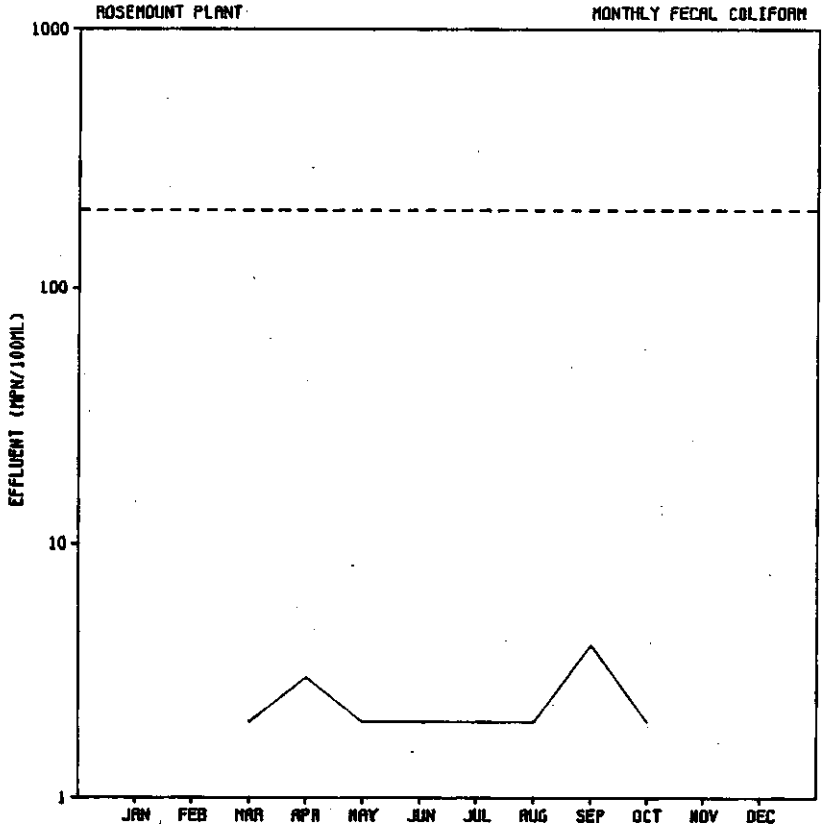

ROSEMOUNT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

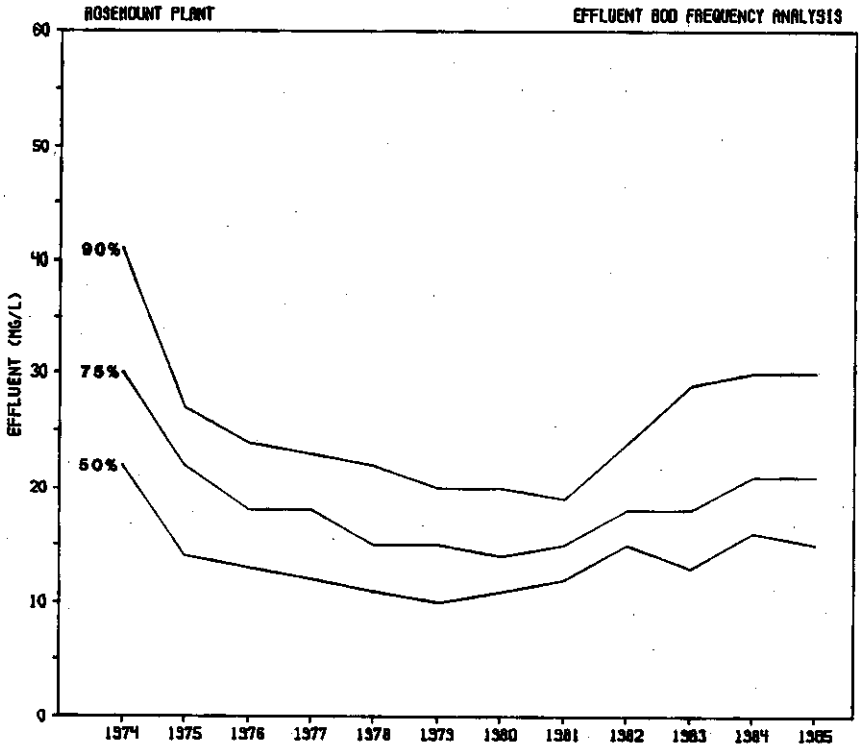

ROSEMOUNT PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

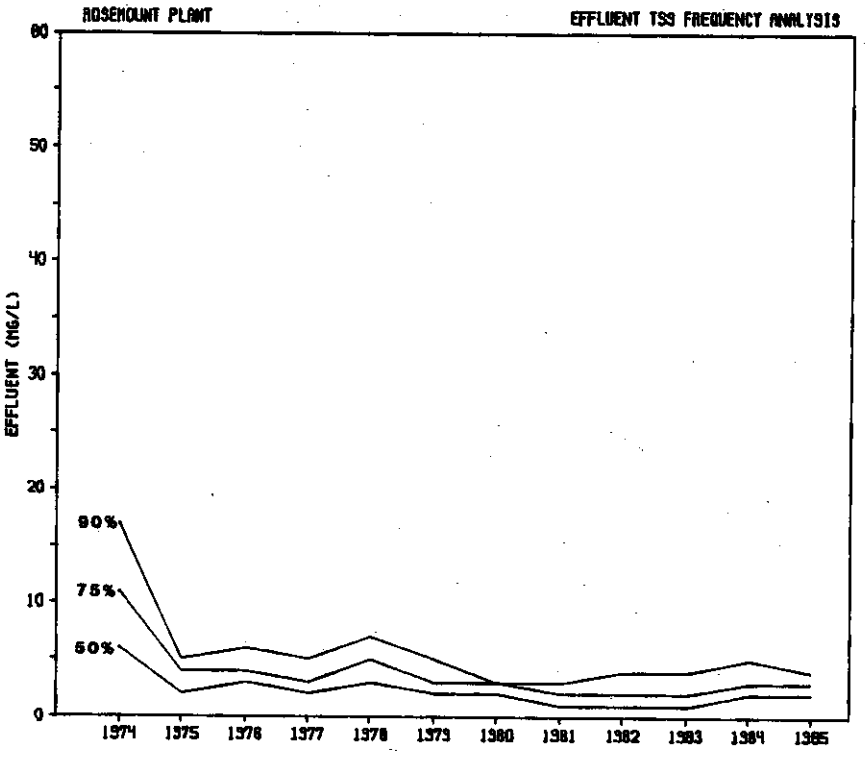

ROSEMOUNT PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
500
450
400
350
300
250
200
150
100
50
0
30
20
10
0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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 1984 1985


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)
90%
75%
50%
0
10
20
30
40
50
60
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985


ROSEMOUNT 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
1984
1985

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 80 percent of its design capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 0.64 mgd during 1985, slightly higher than 0.62 mgd in 1984. Average plant effluent quality was 9 mg/L BOD and 4 mg/L TSS. Plant performance was good throughout the year with two NPDES Permit violations; one of the weekly BOD limit, and one of the weekly fecal coliform limit. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	6	7	6	7	9	9	7	9	20	10	10	11
TSS	2	2	2	3	5	3	4	4	11	4	6	6

Future

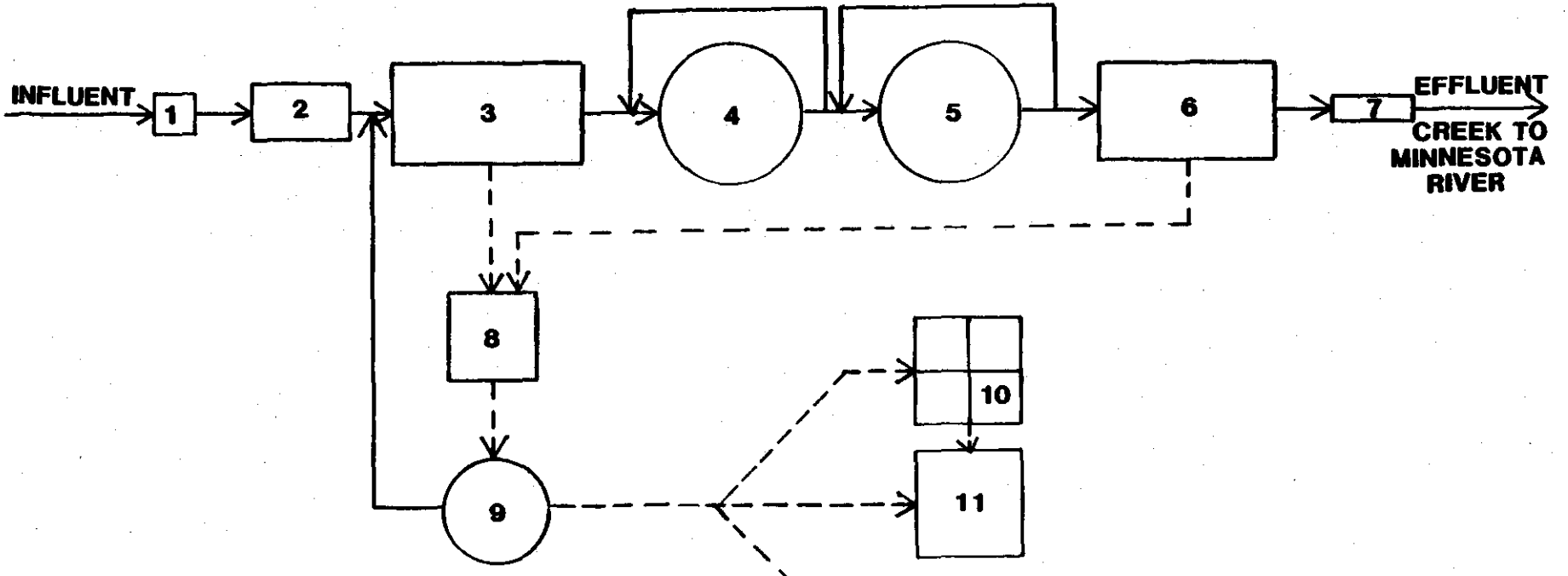
The long-term plan for the Savage Plant is to phase it out of service and divert the flow to the Seneca Plant. This is projected to occur in the late 1980's as the plant reaches its capacity.

SAVAGE PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	0.59	0.62	0.64	0.87	0.89	0.86
BOD Loading, lb/day	590	540	740	690	710	880
TSS Loading, lb/day	960	860	1,000	2,100	1,790	2,240
COD Loading, lb/day	1,200	1,300	1,520	1,500	1,570	1,840
Sludge Production, lb/day	500	520	440	------	------	1,840
Grit Removal						
Overflow Rate, gpd/sq. ft.	33,000	34,000	35,600	48,000	49,000	47,800
Primary Sedimentation						
Detention Time, hr.	1.2	1.2	1.1	0.8	0.8	0.8
Weir Overflow Rate, gpd/lin. ft.	8,600	9,000	9,300	13,000	12,900	12,500
Surface Overflow, gpd/sq. ft.	1,600	1,600	1,700	2,300	2,300	2,300
Trickling Filter No. 1						
Hydraulic Loading, gpd/sq. ft. (inc. recir.)	±400	600	600	------	------	------
Organic Loading, lb. BOD/day/1000 cu. ft.	±45	60	70	------	------	------
Trickling Filter No. 2						
Hydrualic Loading, gpd/sq. ft. (inc. recir)	±3,000	2,500	2,500	------	------	------
Organic Loading, lb. BOD/day/1000 cu. ft.	±10	18	18	------	------	------
Final Sedimentation						
Detention Time, hr.	1.9	1.8	1.8	1.3	1.3	1.3
Weir Overflow Rate, gpd/lin. ft.	6,200	6,500	6,700	9,100	9,300	9,000
Surface Overflow Rate, gpd/sq. ft.	650	690	710	970	990	960
Chlorination						
Contact Time, minutes	59	56	55	40	39	41
Chlorine Use, lb/day	25	39	51	34	51	70
Sludge Holding Tank						
Detention Time, days	±13	11	11	------	------	------
Anaerobic Digester						
Detention Time, days	±57	48	48	------	------	------
Solids Loading, lb/cu. ft./day	±0.04	0.04	0.04	------	------	------
Sludge Transport						
Volume, gpd	1,500	1,800	1,840	3,100	3,900	3,900

SAVAGE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

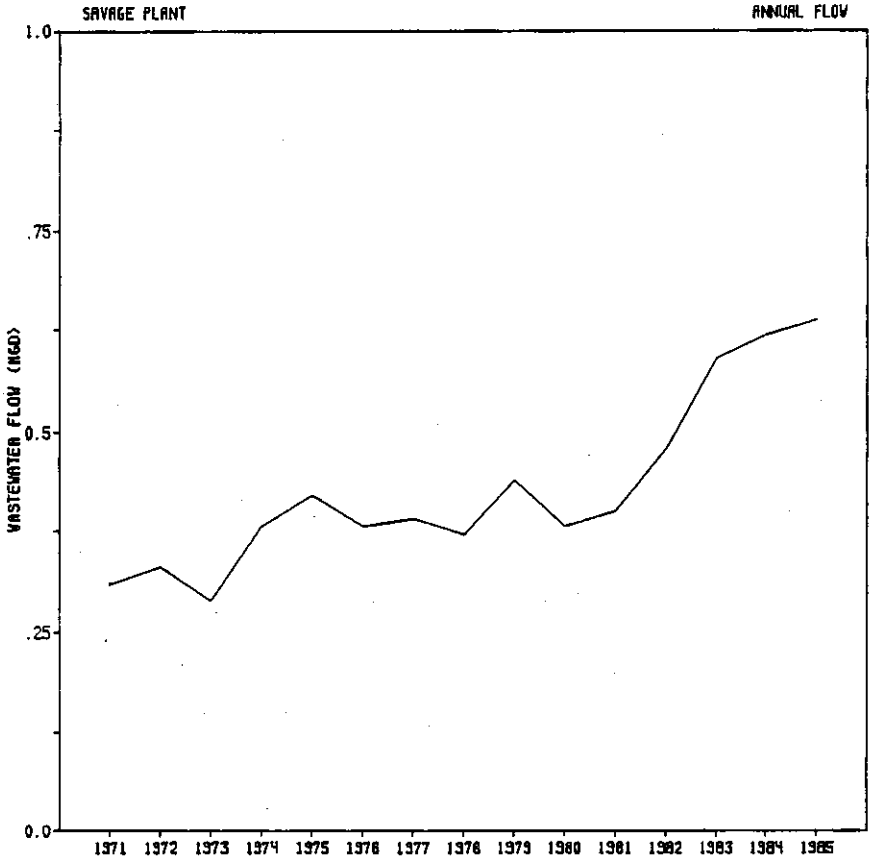
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Roughing Trickling Filter
5. Trickling Filter
6. Final Clarification
7. Chlorination

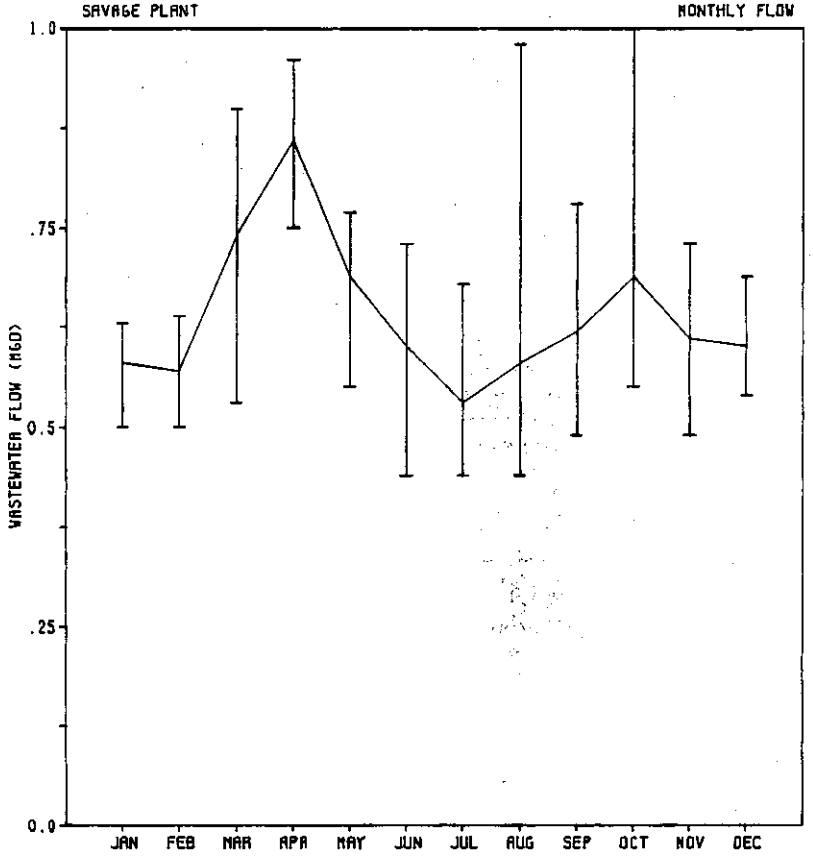
Solids Phase

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

Legend

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


SAVAGE PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


SAVAGE PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
1.0
.75
0.5
.25
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

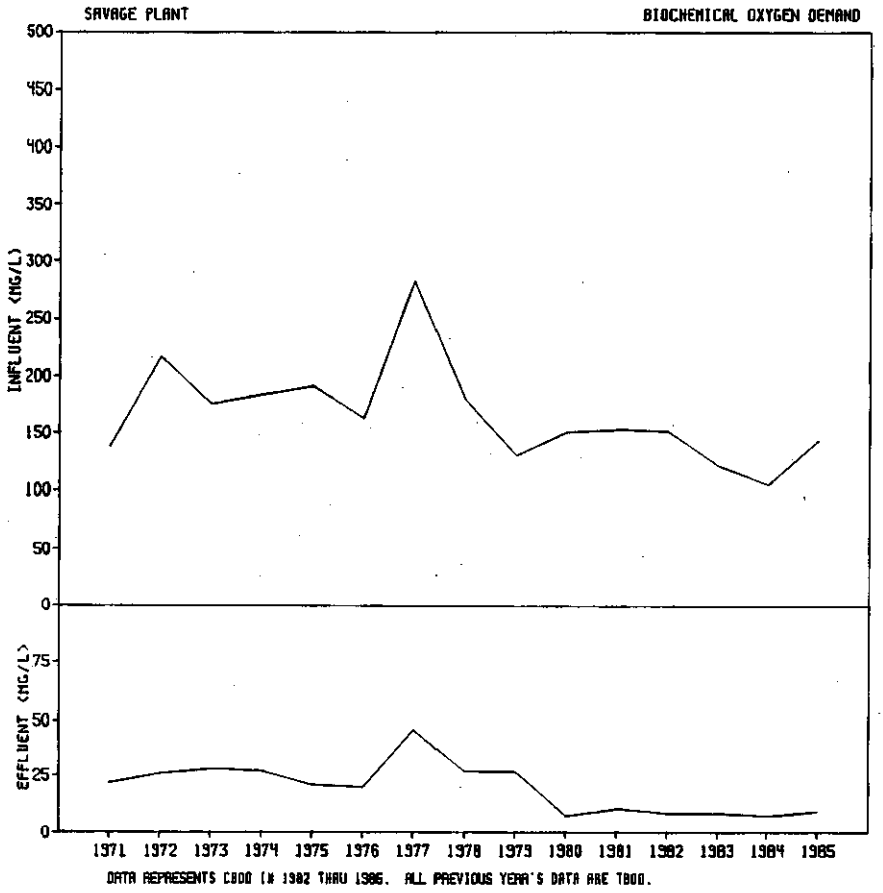
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Savage

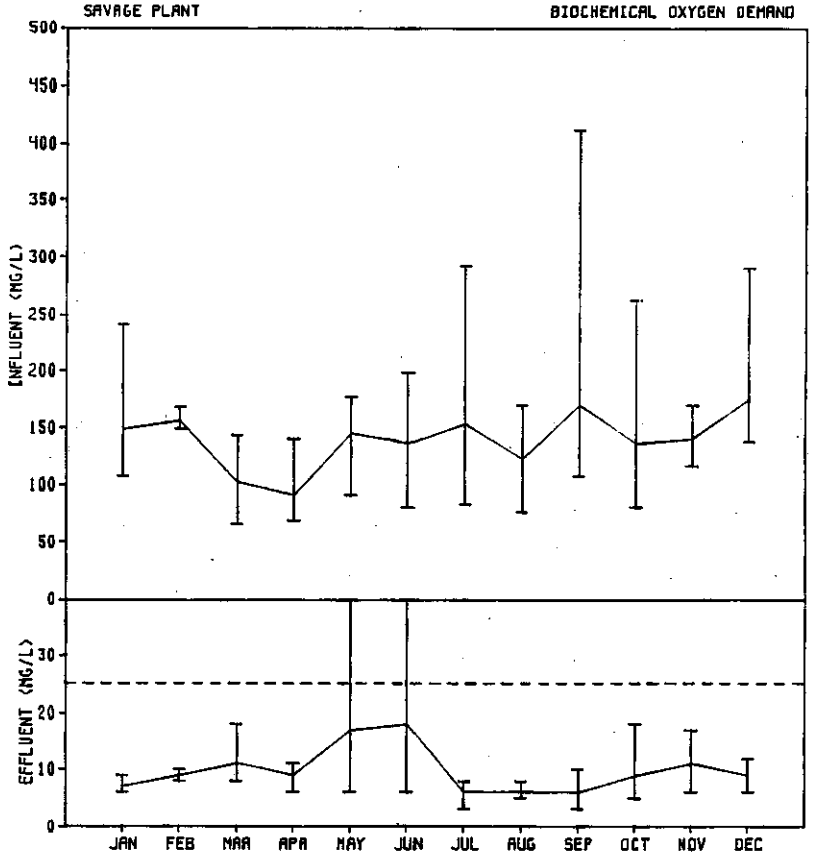
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	0.58	12	149	187	6.8-10.4	26.6	9.4	14.5	295
FEBRUARY	0.57	12	156	159	6.7-10.6	26.3	4.5	15.3	317
MARCH	0.74	9	102	115	7.0-10.6	22.5	6.3	11.9	247
APRIL	0.86	10	91	132	7.0-11.6	19.6	3.0	10.1	185
MAY	0.69	14	145	182	6.4-9.6	27.3	5.5	13.4	300
JUNE	0.60	16	136	139	6.2-9.4	25.9	8.8	15.4	346
JULY	0.53	19	153	251	6.4-9.8	30.1	29.6	15.7	355
AUGUST	0.58	20	122	161	6.8-10.0	23.0	4.1	13.1	250
SEPTEMBER	0.62	20	169	417	6.9-9.4	29.9	8.4	18.1	247
OCTOBER	0.69	17	136	164	6.8-11.6	22.2	8.5	12.7	316
NOVEMBER	0.61	15	141	152	6.8-11.2	24.6	4.3	13.9	261
DECEMBER	0.60	13	174	179	5.8-11.8	27.8	9.7	16.3	329
1985 AVERAGE	0.64	15	144	203	5.8-11.8	25.5	8.8	14.2	290
1984 AVERAGE	0.62	14	104	165	0.0-13.4	22.6	9.1	12.5	249

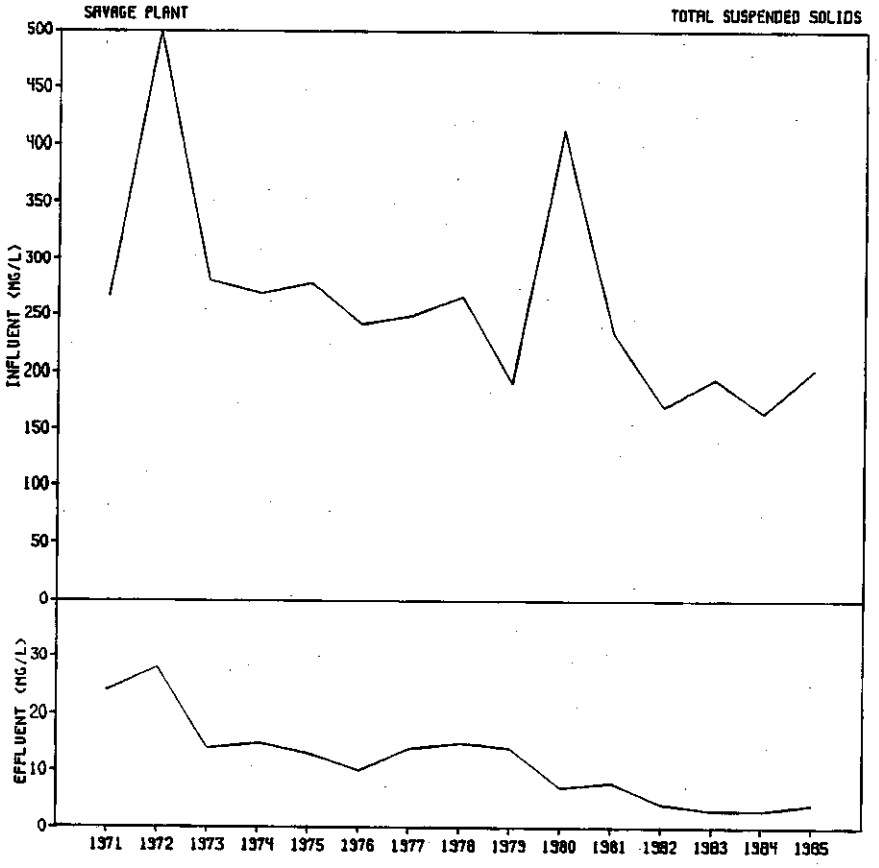
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Savage

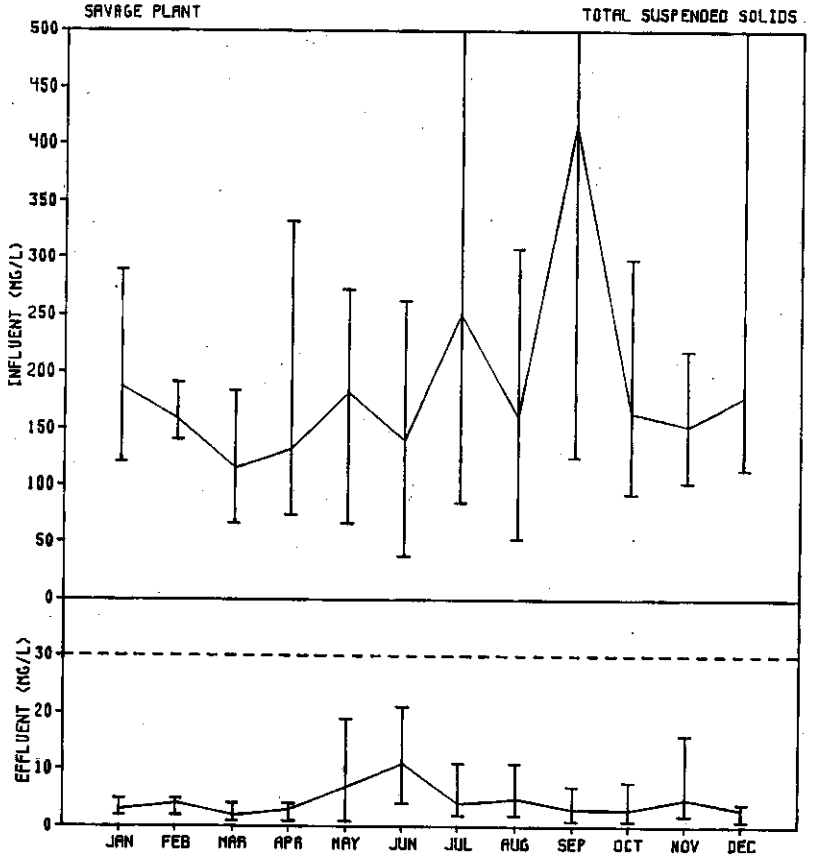
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	---	----	-----	---	--	---	----	6.0-9.0	--	--
JANUARY	10	7	43	3	---	4	5.2	2.6	0.39	7.55	7.5	--	---	8.6	7.5-7.8	95	98
FEBRUARY	15	9	43	4	---	4	5.8	3.9	0.30	3.84	3.4	--	---	8.1	7.6-7.8	94	98
MARCH	11	11	50	2	6	4	8.0	4.0	0.08	3.47	5.0	59	2.6	9.3	7.4-7.6	89	98
APRIL	11	9	45	3	7	5	8.6	5.0	0.13	2.58	2.6	70	2.6	9.0	7.2-7.6	90	98
MAY	28	17	91	7	37	10	5.3	2.0	0.12	9.28	6.5	57	2.6	8.6	7.3-7.7	89	96
JUNE	18	18	83	11	99	11	4.0	0.8	0.04	12.35	9.5	44	3.0	8.3	7.3-7.7	87	92
JULY	7	6	41	4	73	9	2.6	0.6	0.04	12.36	22.7	36	3.4	7.8	7.2-7.6	96	98
AUGUST	6	6	38	5	55	4	2.0	0.3	0.03	11.23	3.4	40	2.8	7.8	7.5-7.8	95	97
SEPTEMBER	6	6	30	3	34	3	1.9	0.3	0.03	9.24	3.1	46	2.8	7.9	7.4-7.8	97	99
OCTOBER	11	9	43	3	20	7	3.6	1.7	0.10	5.64	6.4	55	5.2	8.5	7.4-7.8	93	98
NOVEMBER	13	11	42	5	---	3	4.5	2.2	0.39	9.98	2.9	53	---	8.1	7.4-7.7	92	97
DECEMBER	13	9	43	3	---	3	5.3	3.1	0.46	6.87	5.9	--	--	8.2	7.5-7.7	95	99
1985 AVG.	12	9	48	4	41	6	4.8	2.3	0.18	7.75	6.8	51	3.1	8.3	7.2-7.8	93	97
1984 AVG.	8	7	50	3	53	4	3.1	1.2	0.13	8.92	7.3	38	1.9	8.9	7.4-8.3	93	98

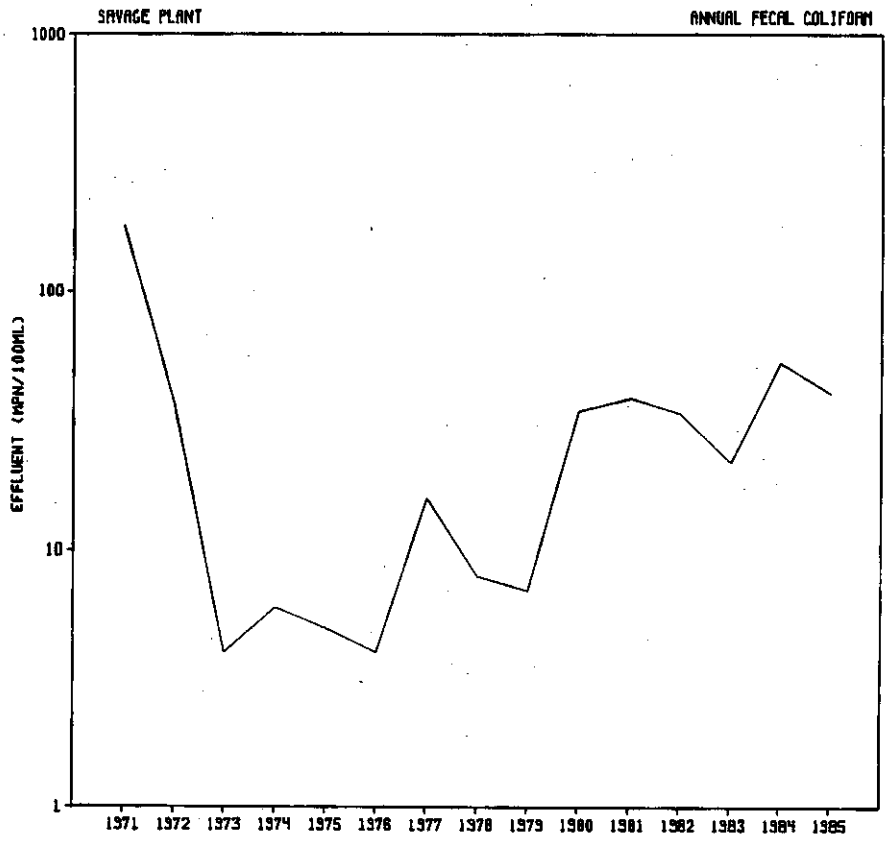
*For disinfection only.

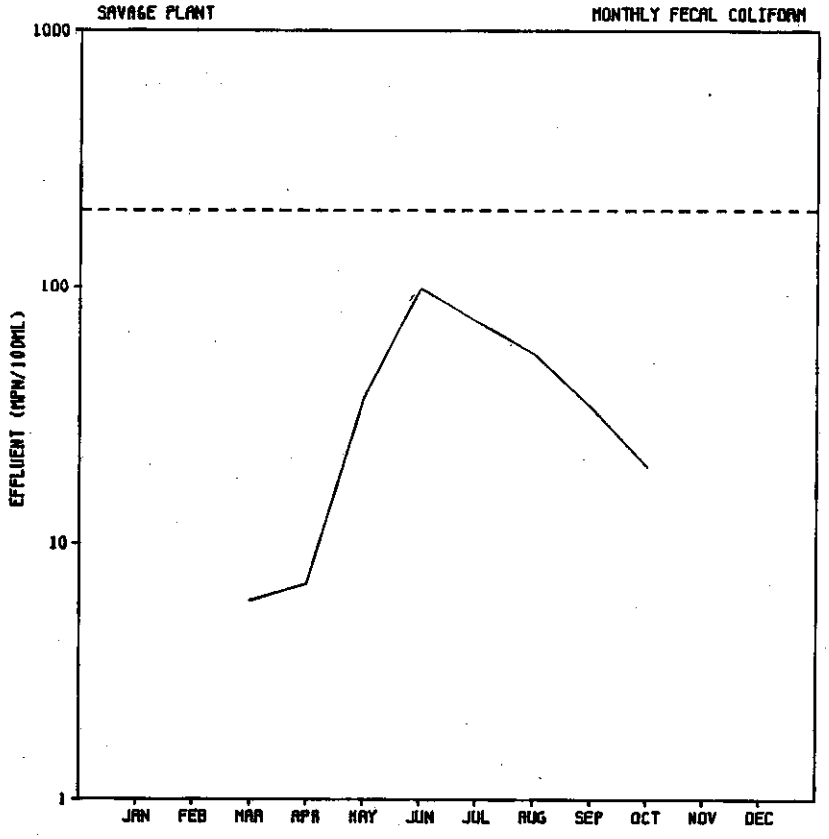

SAVAGE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1986. ALL PREVIOUS YEAR'S DATA ARE TBOD.

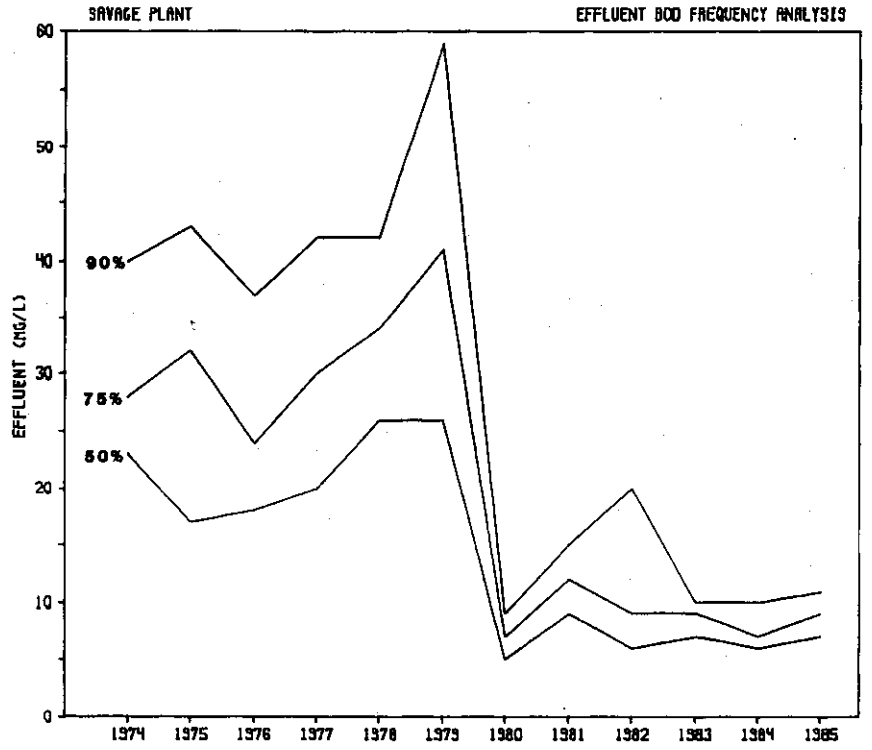

SAVAGE PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

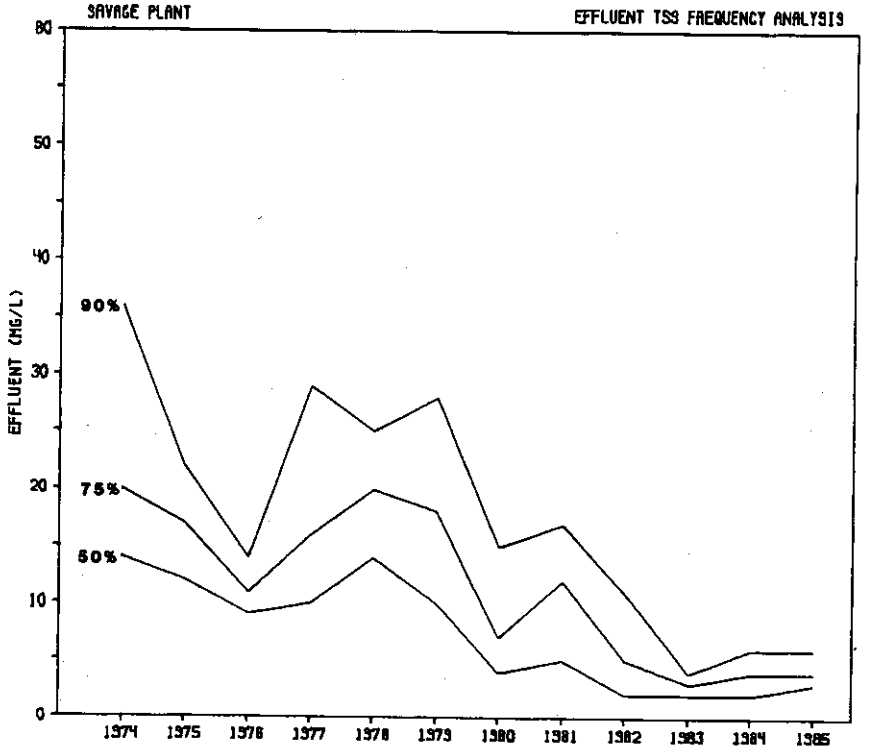

SAVAGE PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
10
20
30
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


SAVAGE 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


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 1984 1985


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)
90%
75%
50%
0
10
20
30
40
50
60
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985


SAVAGE 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
1984
1985

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. Operation of the belt filter press for sludge dewatering allowed the Seneca Plant to process more sludge during 1985. An odor nuisance problem from the belt filter press operation was solved in 1984 by installing a system to feed potasium permanganate to the liquid sludge as it is fed to the belt filter press. An ash landfill project was implemented during 1985. Several operational improvements and small capital improvements were recommended and implemented during 1985 to address odor problems. The plant is presently operating at about 75 percent of its design capacity and is subject to secondary treatment limits.

Performance

Plant flow averaged 17.5 mgd during 1985, nearly equal to the 17.6 mgd in 1984. Average plant effluent quality was 16 mg/L BOD and 17 mg/L TSS. Plant performance was good throughout the year with one NPDES Permit violation of the weekly fecal coliform limit. Statistical analysis of data show the following trend in effluent CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	17	13	15	15	21	17	19	20	25	24	24	24
TSS	19	15	19	15	23	23	26	20	26	29	34	26

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 for construction by the late 1980's.

SENECA PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	15.8	18.0	17.5	17.2	23.2	18.5
BOD Loading, lb/day	29,000	31,200	39,400	32,400	38,700	46,900
TSS Loading, lb/day	27,500	30,900	44,700	40,000	47,645	65,900
Grit Chambers						
Detention Time, minutes	23	20	21	22	16	20
Primary Clarifiers						
Surface Overflow Rate, gpd/sq. ft.	340	390	370	370	500	390
Weir Overflow Rate, gpd/lin. ft.	7,200	8,200	8,000	7,800	10,500	8,400
Detention Time, hr.	6.4	5.6	7.4	5.9	4.4	7.0
Removal Efficiency, % BOD	37	35	28	46	45	41
Removal Efficiency, % TSS	71	70	81	83	80	90
Aeration Tanks						
Number in Service	2	2	3	2	2	3
BOD Loading, lb/day/1000 cu. ft.	94	104	125	112	110	150
F:M Ratio, lb/day/lb. MLSS	0.59	0.66	0.55	0.76	0.70	0.74
Detention Time, hr.	2.2	1.9	3.0	2.1	1.7	2.8
Final Clarifiers						
Number in Service	2	2	3	2	2	3
Surface Overflow Rate, gpd/sq. ft.	640	730	480	700	940	500
Weir Overflow Rate, gpd/lin. ft.	10,600	12,100	7,800	11,500	15,500	8,200
Detention Time, hr.	4.2	3.9	5.8	3.8	2.8	5.4
Chlorination						
Chlorine Dose, mg/L	4.3	3.7	4.6	5.0	5.1	5.9
Chlorine Feed Rate, lb/day	550	580	674	650	742	881
Contact Time, minutes	40[1]	38[1]	31	39[1]	32[1]	29
Flotation Thickeners						
Solids Loading, lb./sq. ft./day	12	12	10	15	15	12
Vacuum Filters[2]						
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, %	22	22	------	23	23	------

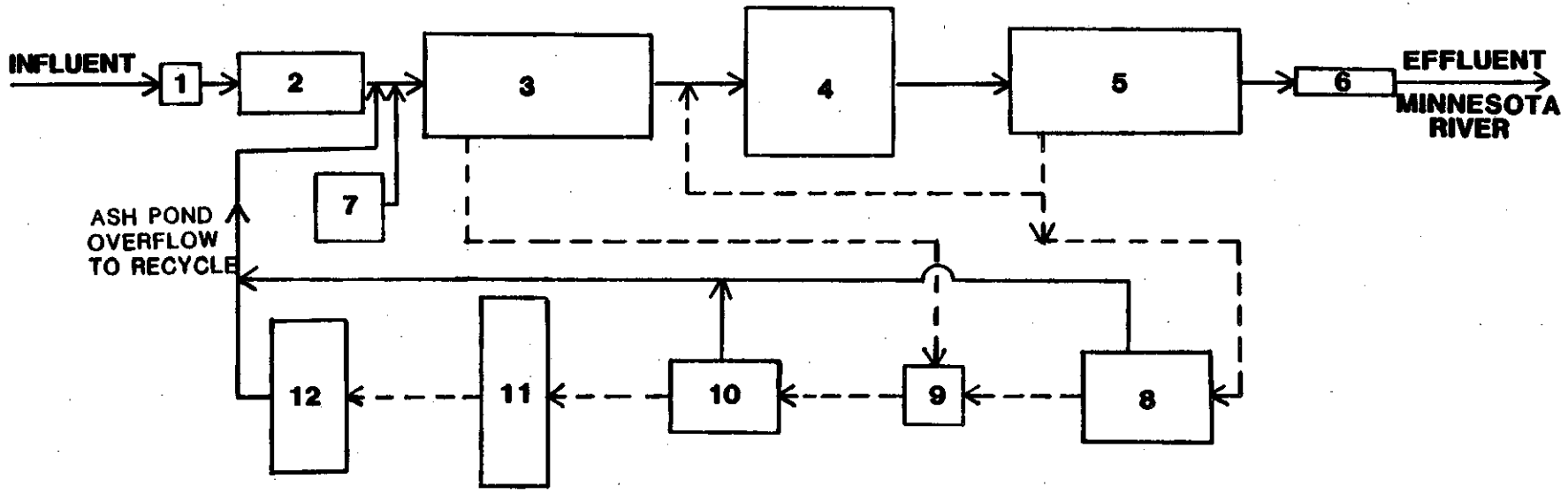
SENECA PLANT PROCESS UNIT LOADINGS (cont.)

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Belt Filter Press[2]						
Polymer Dosage, lbs/tds[3]	8.5	150	145	10	180	160
Throughput of Dry Solids, lb/hr.	1,700	2,100	2,900	2,000	3,000	3,600
Cake Solids, %	24	25	23.4	26	27	24.3
Incinerators[2]						
Auxiliary Fuel Use, MMBtu/tds	10	10	6.0	14	14	7.5

[1]Based on field measurements at the contact tanks and outfall flow characteristics.
[2]Solids processed includes sludge from Blue Lake, Chaska and Savage Plants. Vacuum filters used for limited periods during 1985.
[3]Dry polymer used in 1983. Liquid polymer used in 1984 and 1985.

SENECA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

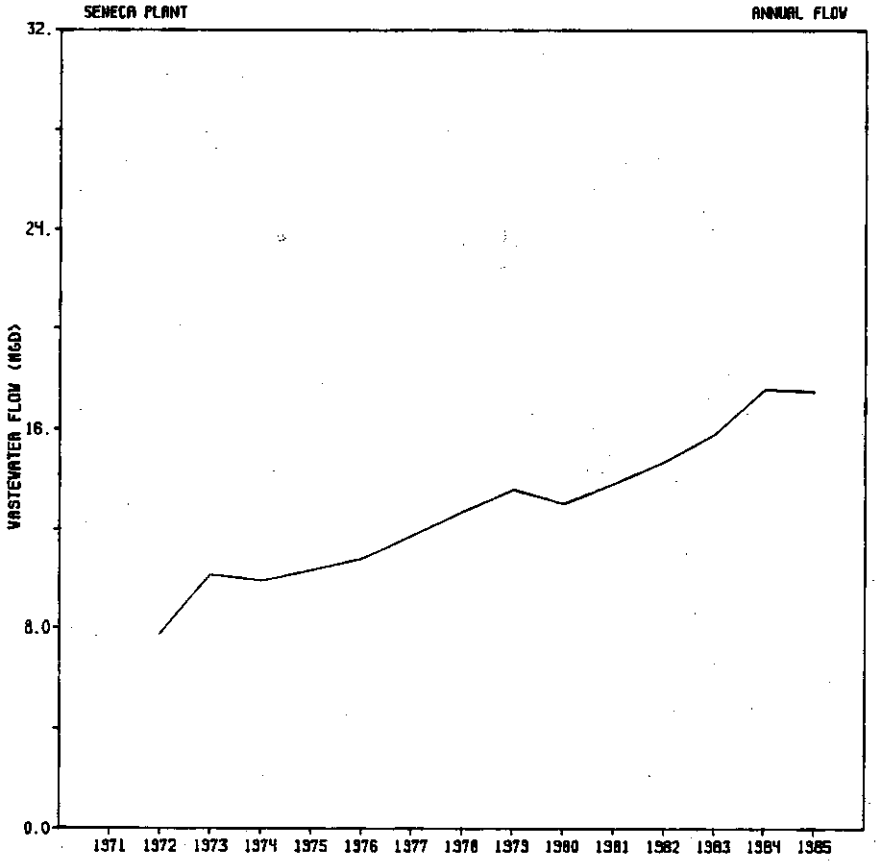
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination
7. Chemical Addition and/or Pre-Chlorination

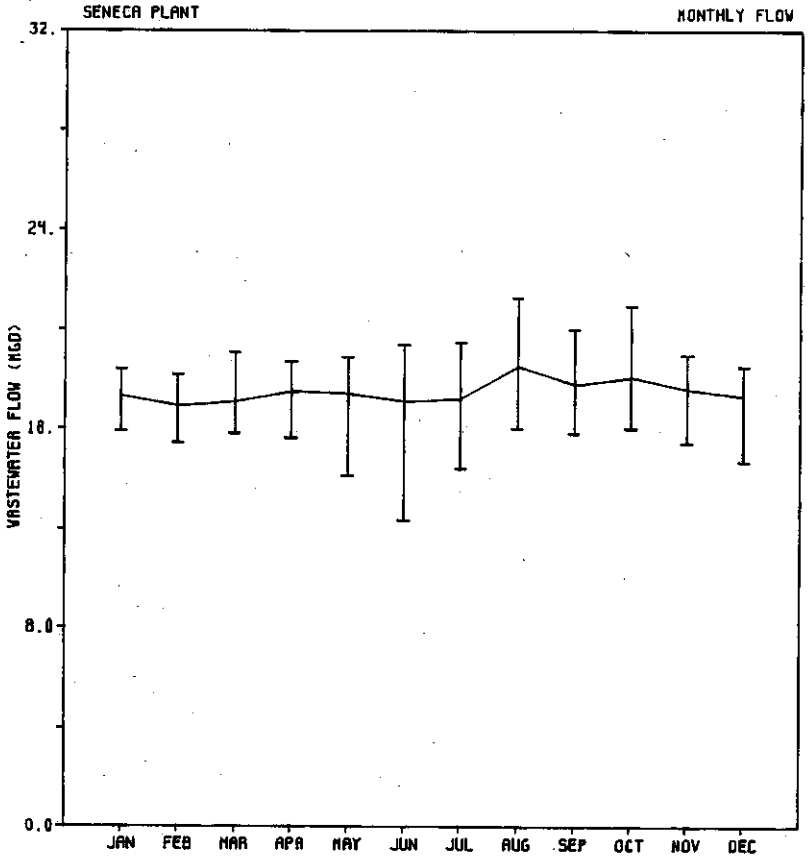
Solid Phase

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

Legend

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


SENECA PLANT
ANNUAL FLOW
32.
24.
16.
8.0
0.0
WASTEWATER FLOW (MGD)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


SENECA PLANT
MONTHLY FLOW
32.
24.
16.
8.0
0.0
WASTEWATER FLOW (MGD)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

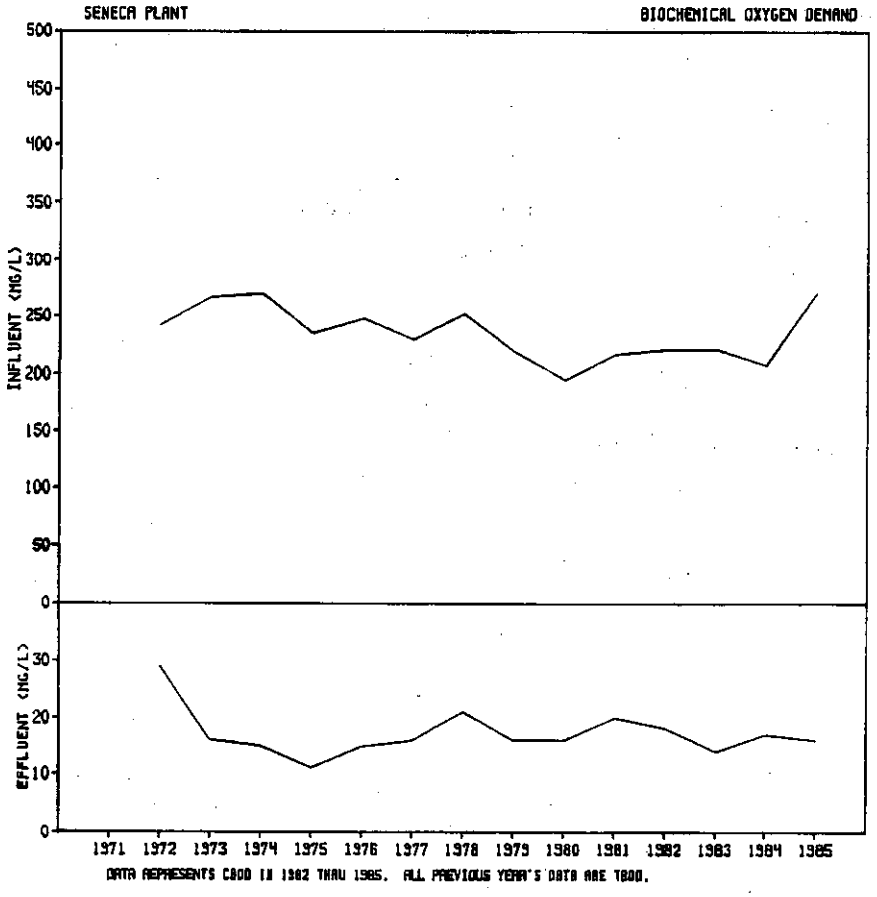
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Seneca

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	17.3	17	221	196	6.0-7.2	37.2	7.1	19.5	467
FEBRUARY	16.9	16	154	146	6.6-7.2	33.5	7.4	20.4	329
MARCH	17.1	14	261	262	6.6-7.1	38.9	7.3	18.5	554
APRIL	17.5	15	275	283	6.8-7.8	40.0	7.5	21.1	563
MAY	17.4	16	265	326	6.6-7.2	42.8	9.8	20.6	496
JUNE	17.1	18	232	234	6.7-7.3	39.6	7.0	19.9	464
JULY	17.2	20	300	315	6.3-7.8	39.8	7.5	18.2	494
AUGUST	18.5	23	304	427	6.6-7.1	41.1	7.9	19.8	693
SEPTEMBER	17.8	20	305	402	6.7-7.1	38.4	7.6	20.9	674
OCTOBER	18.1	19	265	292	6.6-7.4	39.4	8.7	20.5	531
NOVEMBER	17.6	18	305	357	6.6-7.2	40.6	7.2	20.3	653
DECEMBER	17.3	17	331	369	6.6-7.1	45.6	9.0	21.5	955
1985 AVERAGE	17.5	18	270	306	6.0-7.8	39.7	7.8	20.1	583
1984 AVERAGE	17.6	17	207	205	4.9-8.6	34.8	7.2	17.8	449

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	--	30	200	25	----	----	----	----	---	---	---	---	6.5-8.5	--	--
JANUARY	38	18	81	21	---	8	25.5	19.4	0.55	1.15	5.1	---	---	8.7	6.7-7.2	92	90
FEBRUARY	40	17	78	20	---	11	23.5	17.2	0.95	1.76	4.6	488	0.5	8.8	6.7-7.4	89	87
MARCH	29	19	94	15	57	9	27.6	17.7	0.59	0.70	4.4	435	1.6	8.8	6.8-7.7	93	94
APRIL	35	19	90	22	5	11	26.5	15.4	0.81	0.81	4.1	526	2.9	8.6	7.0-7.4	93	92
MAY	33	16	78	17	48	10	24.7	15.6	1.10	1.35	3.3	524	2.7	8.6	6.9-7.6	94	95
JUNE	30	13	80	16	8	8	23.4	15.8	2.12	1.83	3.2	657	3.6	8.1	7.0-7.5	94	93
JULY	32	16	77	14	14	8	19.7	12.9	2.87	2.15	2.9	735	3.6	8.1	6.8-7.4	95	96
AUGUST	35	19	86	17	16	12	20.0	14.0	2.36	2.09	3.5	778	3.5	8.2	6.9-7.4	94	96
SEPTEMBER	30	10	58	13	34	7	18.5	14.3	2.59	2.39	2.9	872	3.5	8.4	7.0-7.4	97	97
OCTOBER	34	10	71	14	9	7	18.5	12.9	3.36	2.75	4.2	881	3.1	8.5	6.7-7.5	96	95
NOVEMBER	48	20	74	20	---	8	17.5	12.9	3.59	3.36	3.0	---	---	8.9	7.0-7.5	93	95
DECEMBER	49	20	64	15	---	7	20.8	14.8	2.64	3.43	4.8	---	---	8.7	6.8-7.4	94	96
1985 AVG.	36	16	77	17	24	9	22.1	15.2	1.99	2.01	3.8	674	3.1	8.5	6.7-7.7	94	94
1984 AVG.	23	17	82	21	18	9	23.8	16.6	0.35	0.74	4.2	580	2.7	9.0	6.6-8.4	92	90

*For disinfection only.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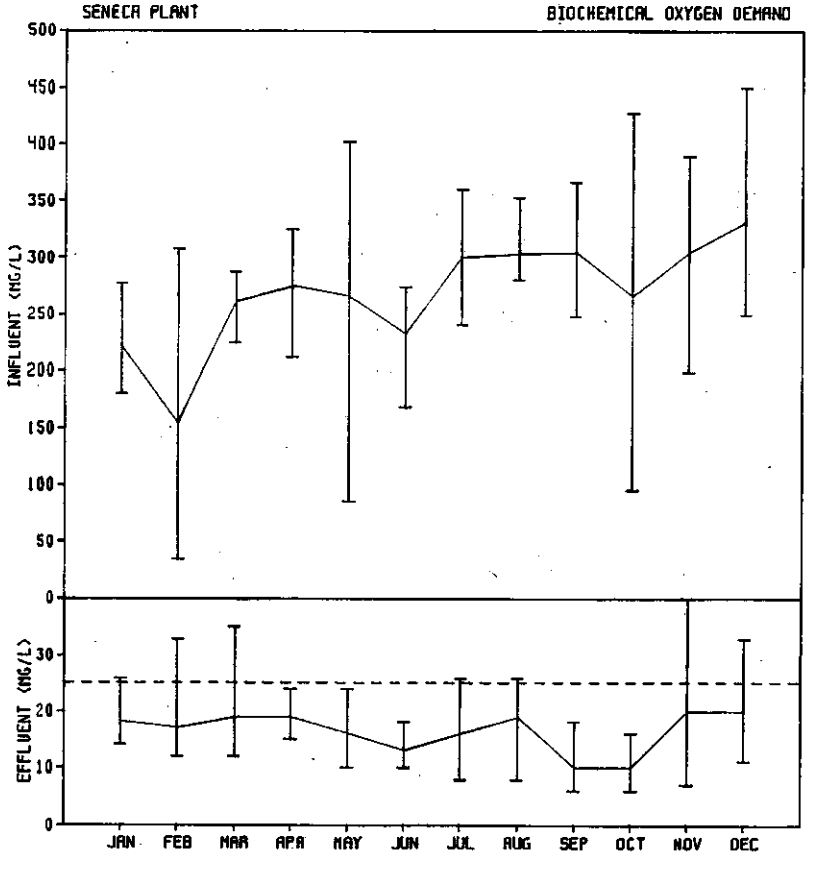
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.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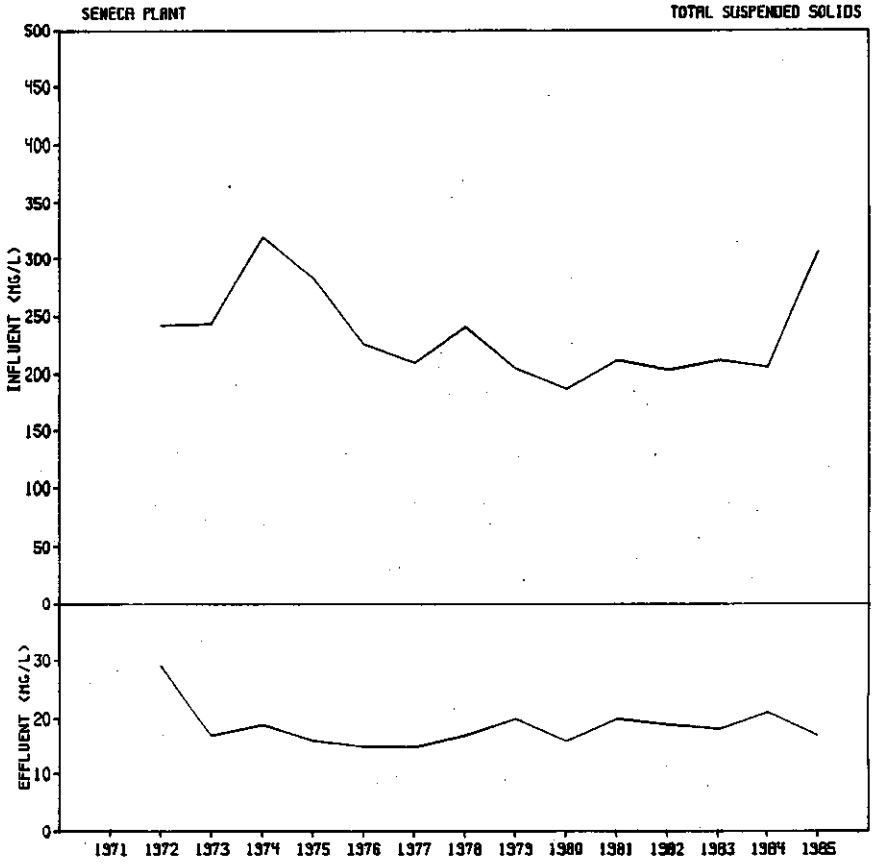
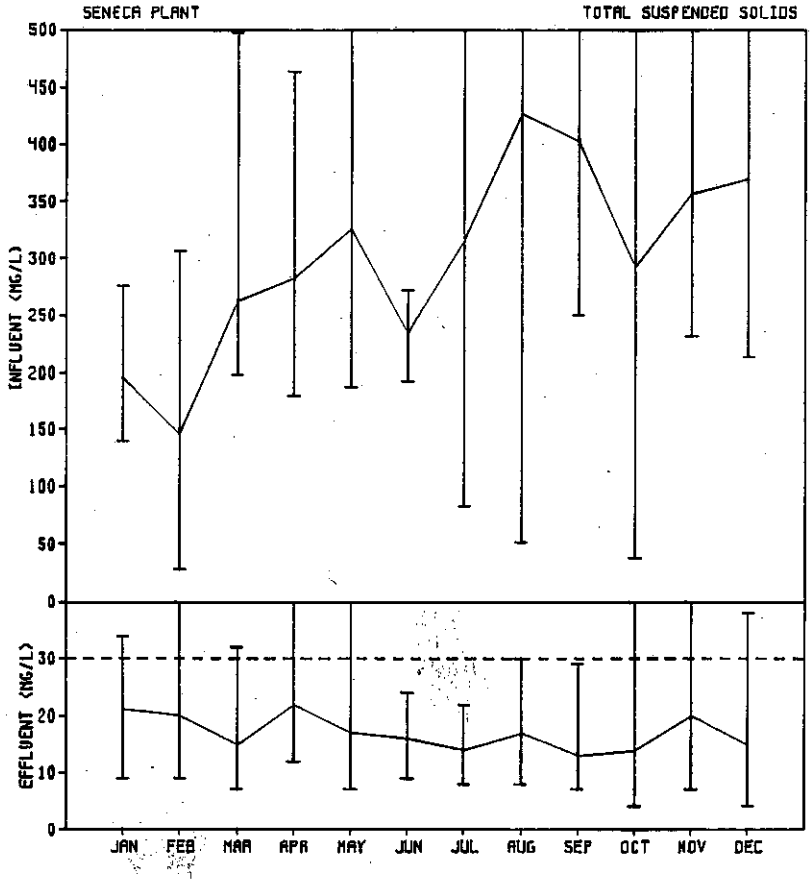
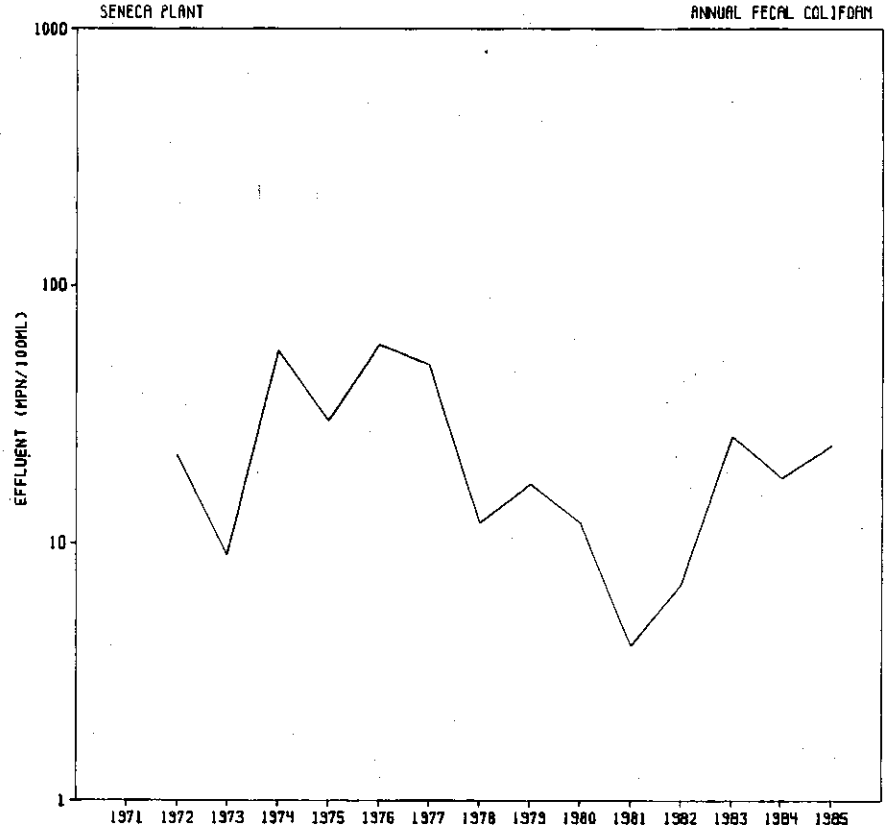
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


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 1984 1985


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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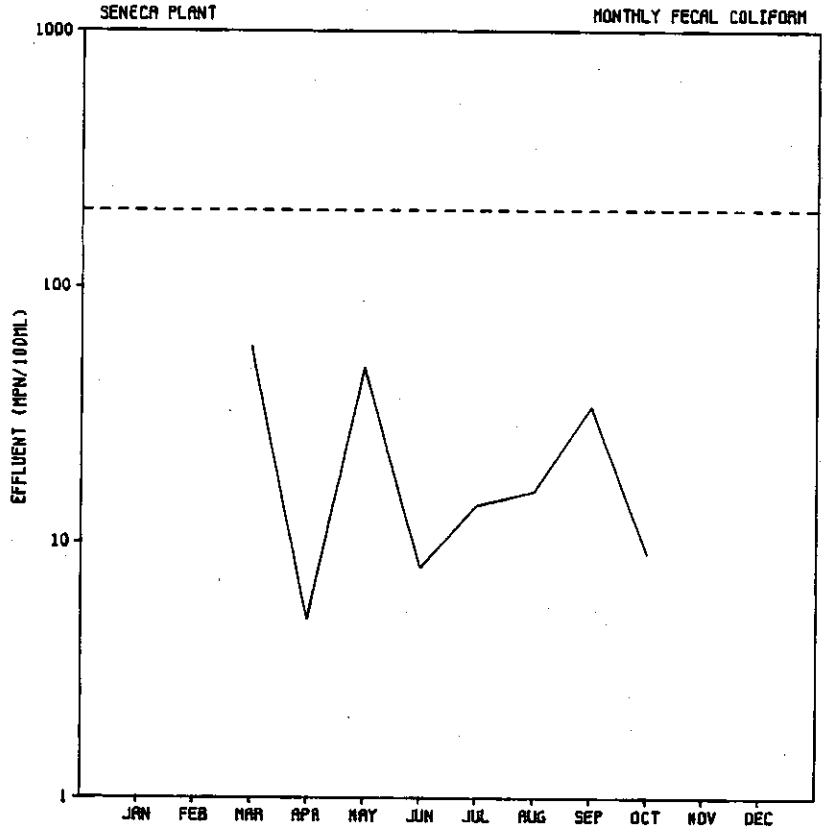
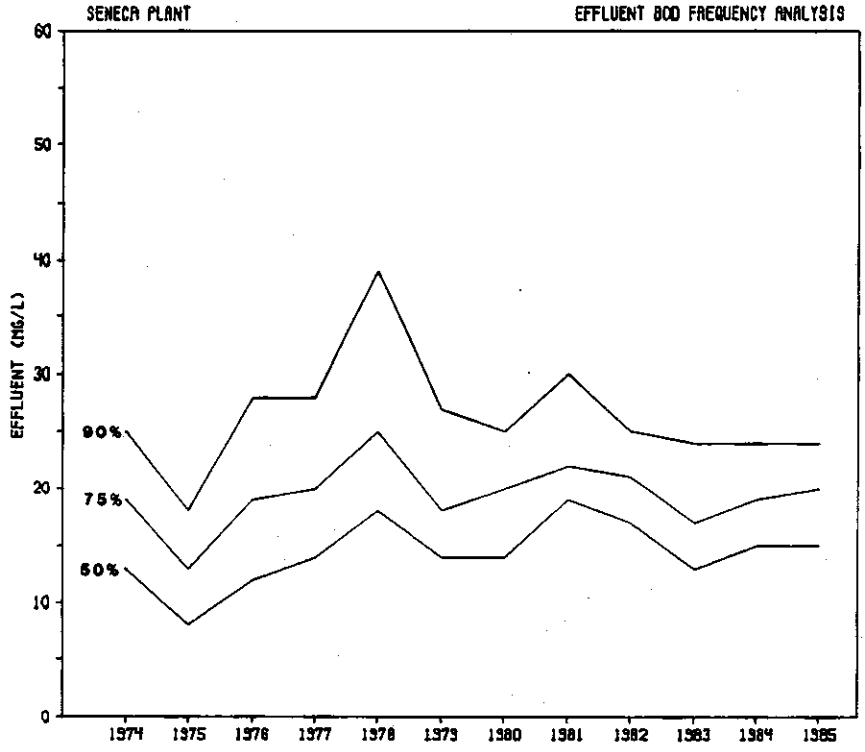
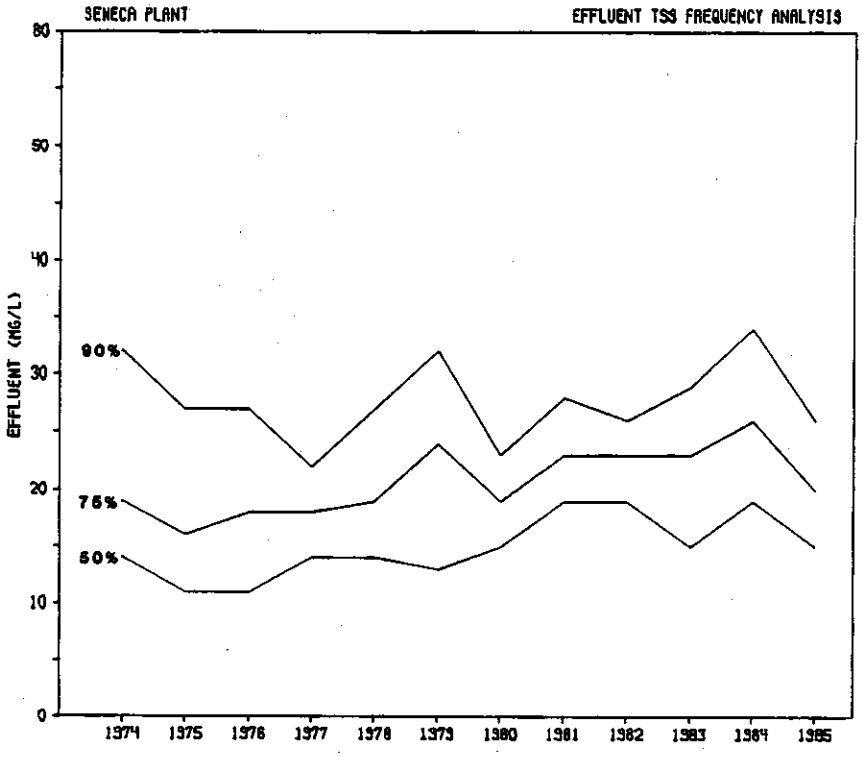
ANNUAL FECAL COLIFORM
1000
100
10
1
EFFLUENT (MPN/100ML)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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)
60
50
40
30
20
10
0
90%
75%
50%
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985


SENECA 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
1984
1985

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 90 percent of its design capacity and is subject to secondary treatment limits and a phosphorus limit of 1 mg/L.

Performance

Plant flow averaged 2.74 mgd during 1985, slightly lower than 2.95 mgd in 1984. Average plant effluent quality was 9 mg/L BOD, 11 mg/L TSS and 0.4 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 CBOD and TSS from 1982 through 1985.

Effluent Concentration, mg/l

	50% of Time				75% of Time				90% of Time			
	1982	1983	1984	1985	1982	1983	1984	1985	1982	1983	1984	1985
CBOD	10	9	7	8	12	12	10	11	14	18	13	14
TSS	8	10	8	10	10	14	10	12	12	20	13	15

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.

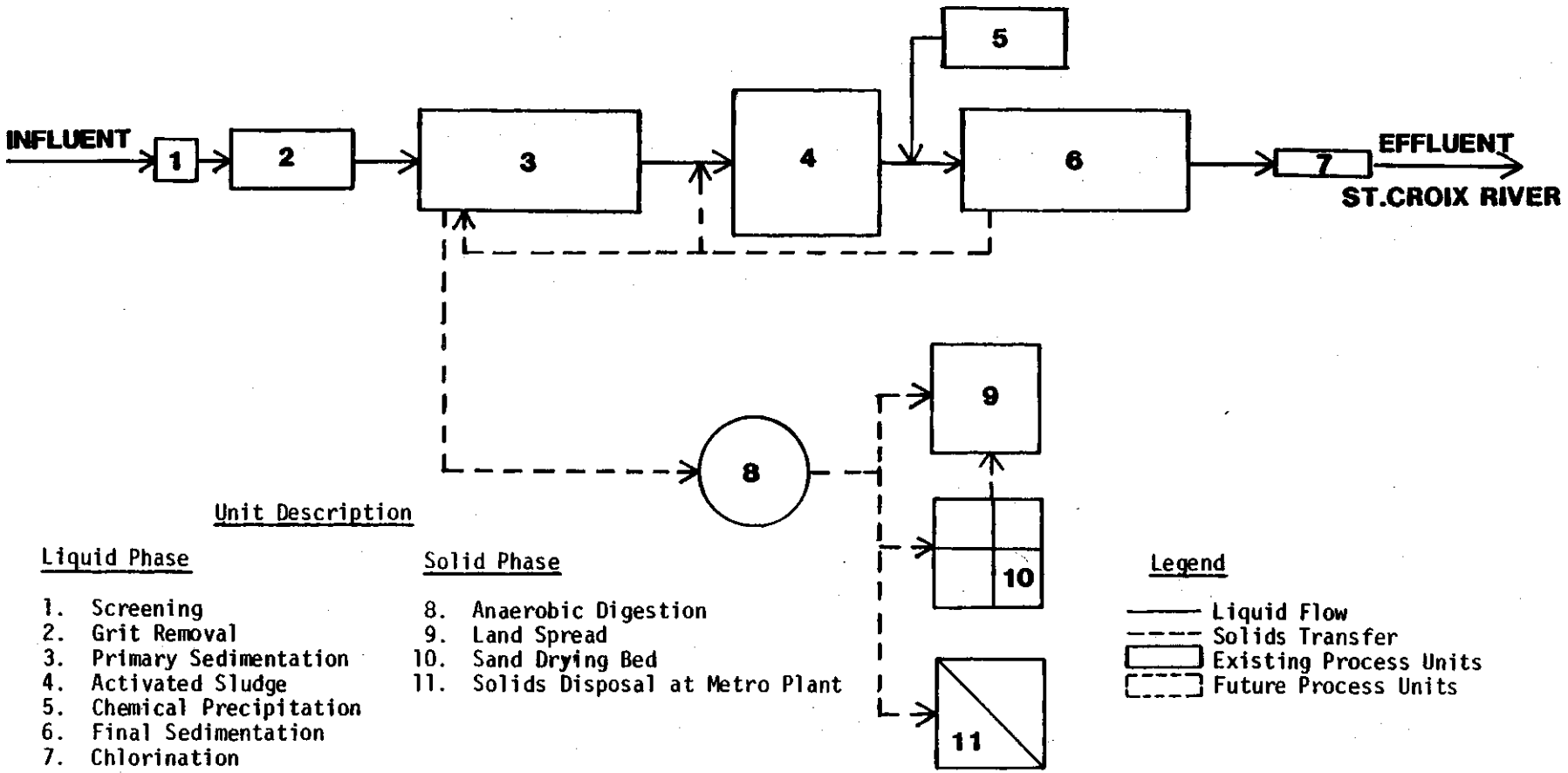
STILLWATER PLANT PROCESS UNIT LOADINGS

Parameter	Annual Average			Maximum Month		
	1983	1984	1985	1983	1984	1985
Wastewater Flow, mgd	2.84	2.95	2.74	3.45	3.41	3.05
BOD Loading, lb/day	2,940	3,054	2,760	4,080	4,077	3,430
TSS Loading, lb/day	3,220	3,713	2,200	4,980	6,771	2,900
COD Loading, lb/day	5,720	6,454	5,170	7,280	9,272	6,560
Phosphorus Loading, lb/day	------	------	94	------	------	116
Primary Sedimentation						
Weir Overflow Rate, gpd/lin. ft.	11,600	12,100	11,200	14,100	14,000	12,500
Surface Overflow Rate, gpd/sq. ft.	650	670	620	790	780	690
Aerated Basins						
BOD Loading, lb/day/1000 cu. ft.[1]	43	45	46	61	60	57
Alum Feed Rate, gal/day	410	410	397	470	433	423
Final Sedimentation						
Weir Overflow Rate, gpd/lin. ft.	9,000	9,400	8,700	11,000	10,900	9,700
Surface Overflow Rate, gpd/sq. ft.	720	750	700	880	870	780
Chlorination						
Chlorine Use, lb/day	62	54	51	70	60	54
Sludge Transport						
Volume, gpd	11,100	14,600	10,800	15,000	18,800	13,700
Mass, lb/day dry solids	2,600	3,400	2,300	4,000	4,300	2,960

[1]Assumes 10% BOD removal in primaries.

STILLWATER WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

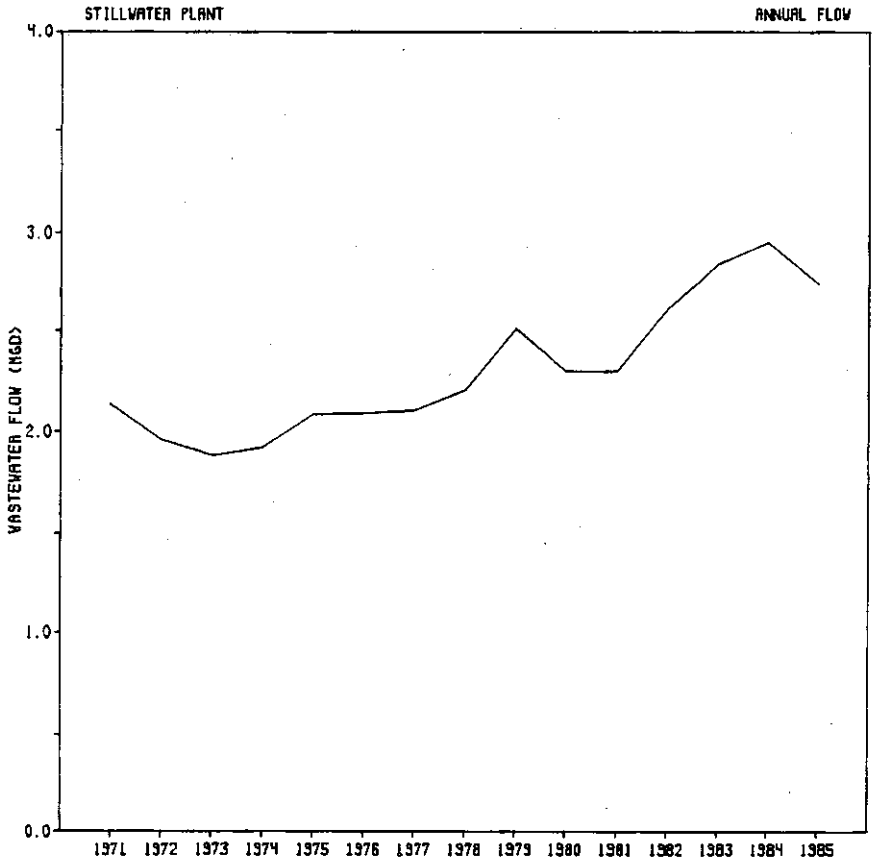
1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Chemical Precipitation
6. Final Sedimentation
7. Chlorination

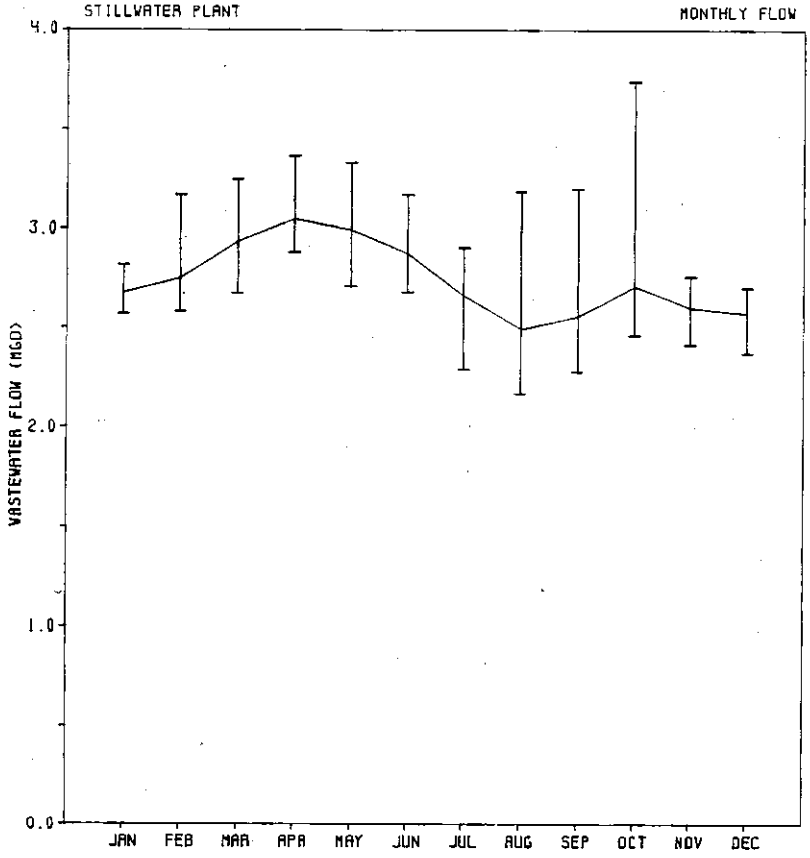
Solid Phase

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


STILLWATER PLANT
ANNUAL FLOW
WASTEWATER FLOW (MGD)
4.0
3.0
2.0
1.0
0.0
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


STILLWATER PLANT
MONTHLY FLOW
WASTEWATER FLOW (MGD)
4.0
3.0
2.0
1.0
0.0
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

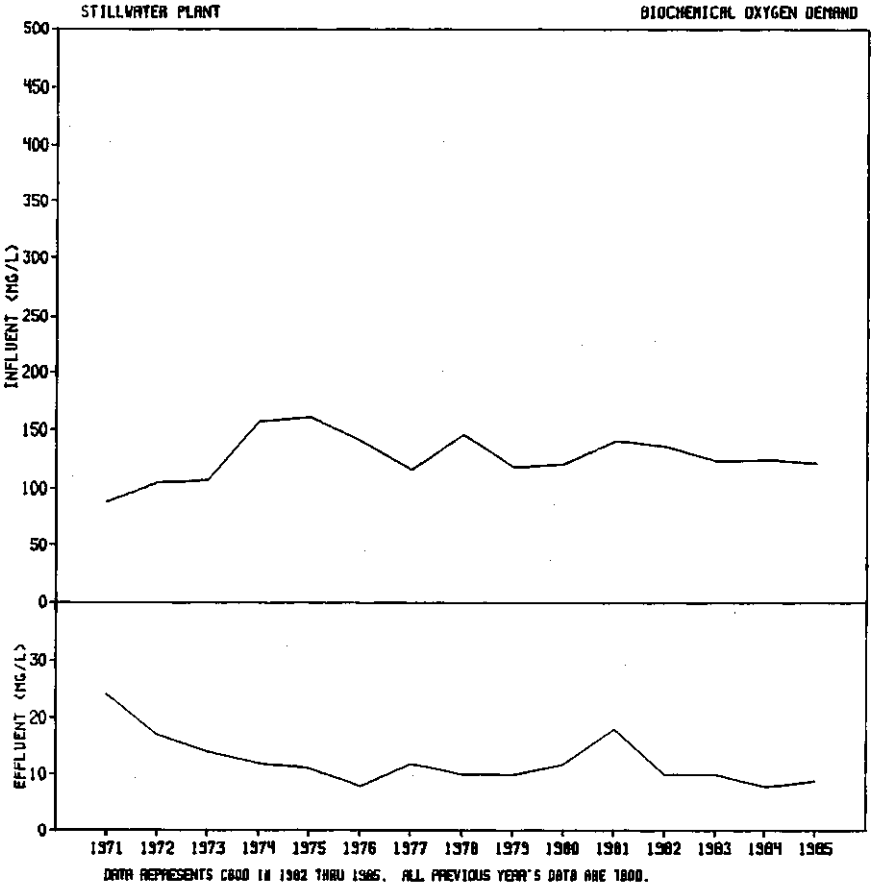
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: Stillwater

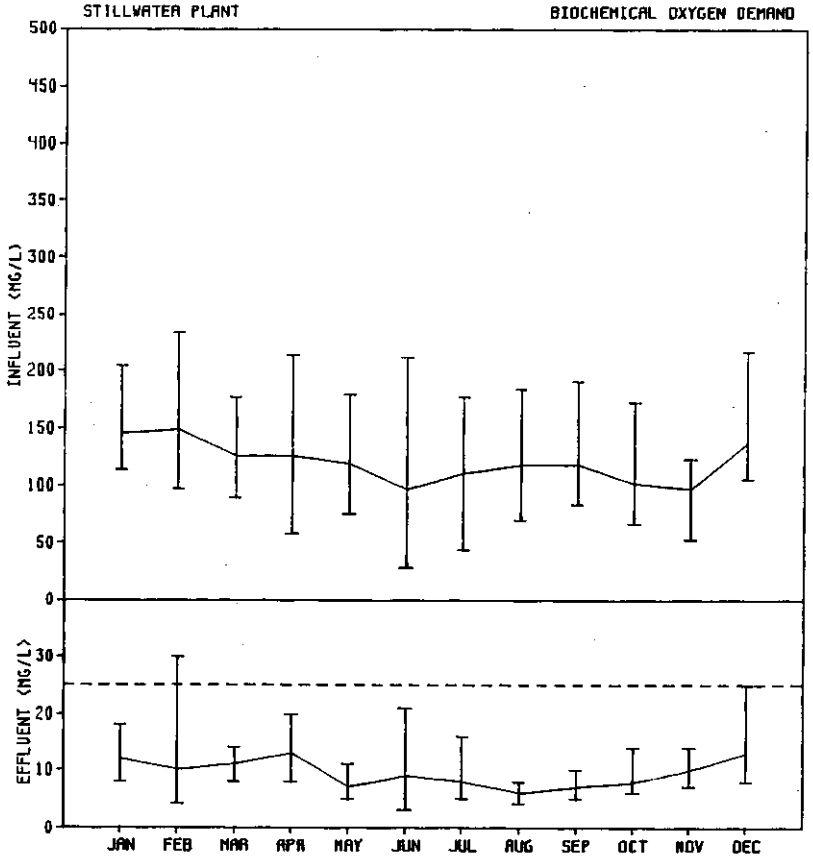
Month	Wastewater Flow, MGD	Temperature °C	TBOD mg/l	TSS mg/l	pH Range	KJN mg/l	Total-P mg/l	NH_3 mg/l	COD mg/l
JANUARY	2.68	11	146	130	6.8-9.0	26.1	4.8	13.1	267
FEBRUARY	2.75	10	149	110	6.8-9.0	24.3	4.6	12.4	278
MARCH	2.93	10	126	89	6.6-9.2	22.4	4.1	12.4	269
APRIL	3.05	10	126	93	6.8-9.1	22.0	4.5	9.7	226
MAY	2.99	11	119	106	6.6-8.6	22.6	4.2	10.5	219
JUNE	2.87	14	97	72	6.2-9.0	21.0	3.8	11.4	176
JULY	2.66	15	111	89	6.8-9.4	25.6	4.0	12.1	225
AUGUST	2.49	16	118	99	6.0-8.6	21.9	3.8	11.5	223
SEPTEMBER	2.56	15	118	100	5.8-7.8	19.8	3.8	10.7	197
OCTOBER	2.71	15	101	88	6.9-7.8	21.1	3.6	11.1	196
NOVEMBER	2.60	13	97	70	7.2-8.1	21.3	3.5	11.8	190
DECEMBER	2.57	11	137	104	6.6-7.8	23.5	4.5	14.1	243
1985 AVERAGE	2.74	13	121	97	5.8-9.4	22.6	4.1	11.7	226
1984 AVERAGE	2.95	13	125	150	4.0-9.6	22.6	4.6	11.2	262

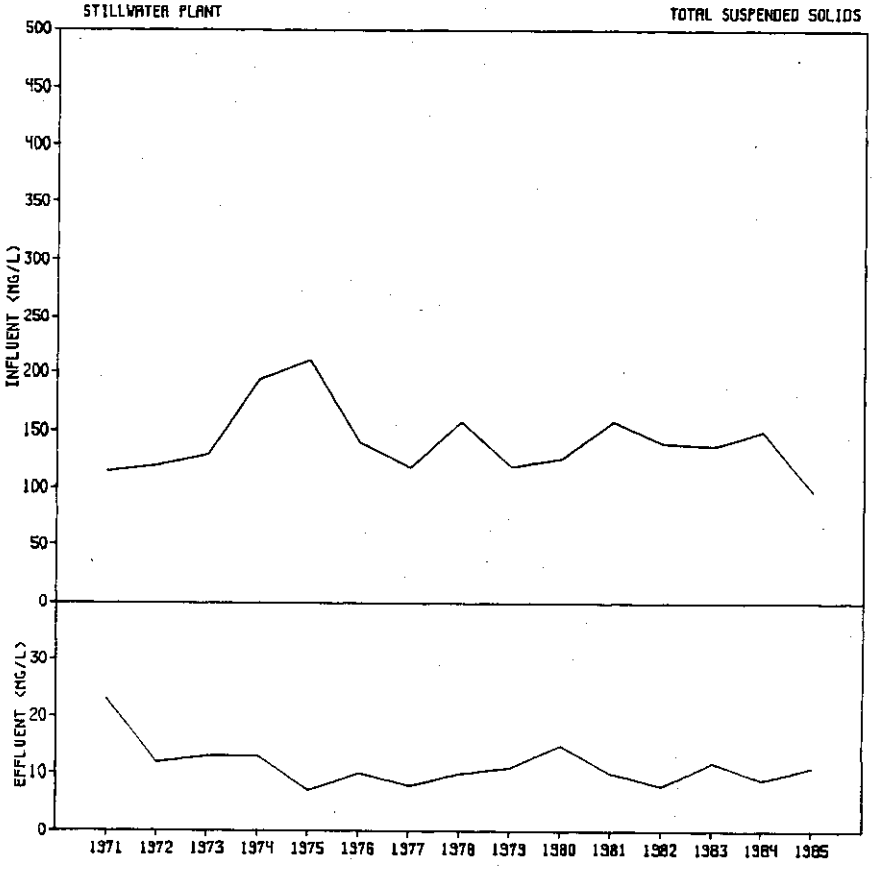
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: Stillwater

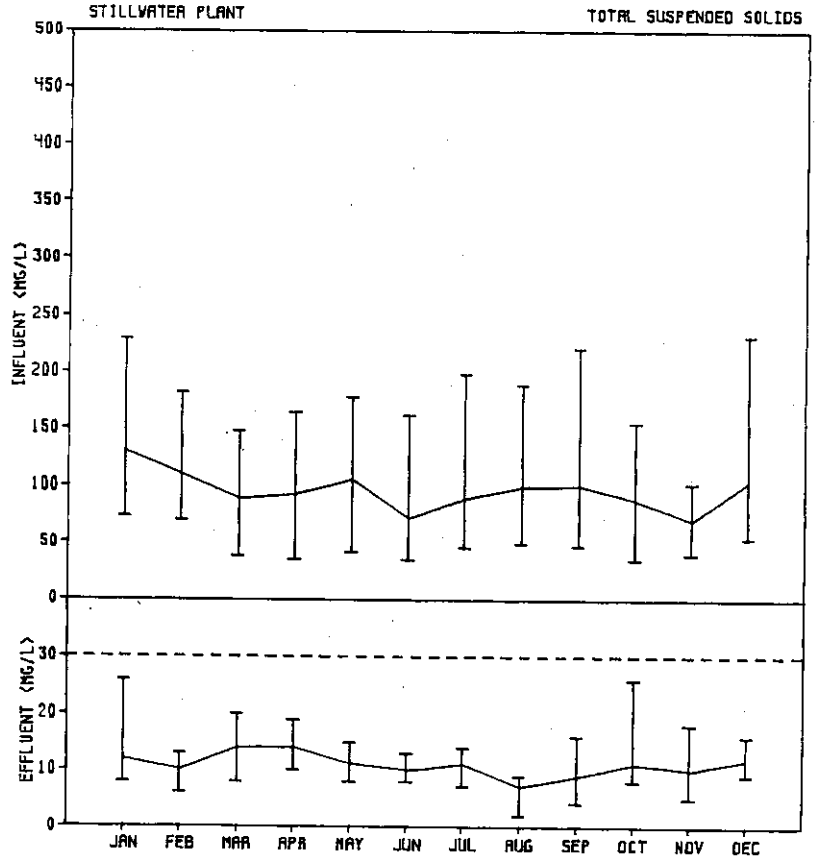
Month	TBOD mg/l	CBOD mg/l	COD mg/l	TSS mg/l	FECAL COLI Geo Mean no/100 ml	TURB NTU	KJN mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l	Total P mg/l	Cl2* Used lbs	Cl2 Res mg/l	DO mg/l	pH Range	% Removal BOD	% Removal TSS
NPDES LIMIT	--	25	--	30	200	25	----	----	----	----	1.0	--	---	---	6.0-9.0	--	--
JANUARY	17	12	44	12	---	5	16.1	11.5	0.23	2.92	0.4	--	---	5.0	6.9-7.1	92	90
FEBRUARY	12	10	48	10	---	5	16.0	12.3	0.25	1.36	0.4	40	1.4	5.3	6.9-7.1	93	91
MARCH	12	11	47	14	5	7	20.0	12.5	0.17	0.79	0.5	51	2.3	4.6	7.0-7.1	92	85
APRIL	14	13	51	14	3	8	17.0	10.2	0.14	0.53	0.5	50	2.4	4.6	7.0-7.1	90	85
MAY	10	7	40	11	3	6	16.6	11.4	0.30	0.39	0.4	50	2.5	4.3	6.9-7.1	94	90
JUNE	12	9	39	10	4	5	17.3	12.5	0.66	0.45	0.4	50	2.4	4.4	6.9-7.1	91	86
JULY	10	8	43	11	9	5	20.3	14.1	0.43	0.48	0.4	54	3.3	4.2	6.9-7.1	93	88
AUGUST	10	6	33	7	4	4	12.5	10.1	1.48	2.66	0.2	50	3.1	4.3	7.0-7.1	95	93
SEPTEMBER	12	7	48	9	14	5	12.8	9.5	0.92	3.41	0.4	50	2.7	4.1	6.9-7.2	94	91
OCTOBER	13	8	38	11	5	5	12.1	9.0	0.82	4.06	0.4	50	2.0	4.4	7.0-7.2	92	88
NOVEMBER	18	10	36	10	---	4	12.3	9.4	0.57	6.25	0.4	--	---	4.3	6.8-7.1	90	86
DECEMBER	20	13	39	12	---	4	13.6	10.5	0.23	5.54	0.5	--	---	4.5	6.9-7.1	90	88
1985 AVG.	13	9	42	11	6	5	15.5	11.1	0.51	2.42	0.4	51	2.6	4.5	6.8-7.2	92	88
1984 AVG.	14	8	41	9	7	4	12.0	8.0	0.56	2.86	0.4	54	1.8	4.8	6.8-7.3	93	93

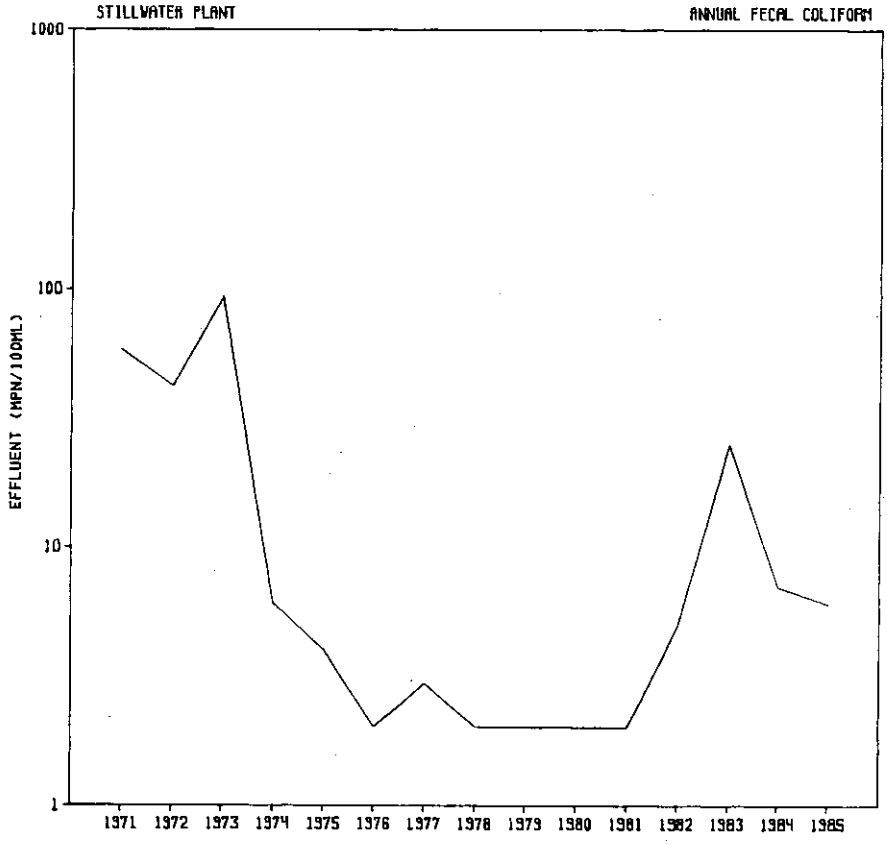
*For disinfection only.

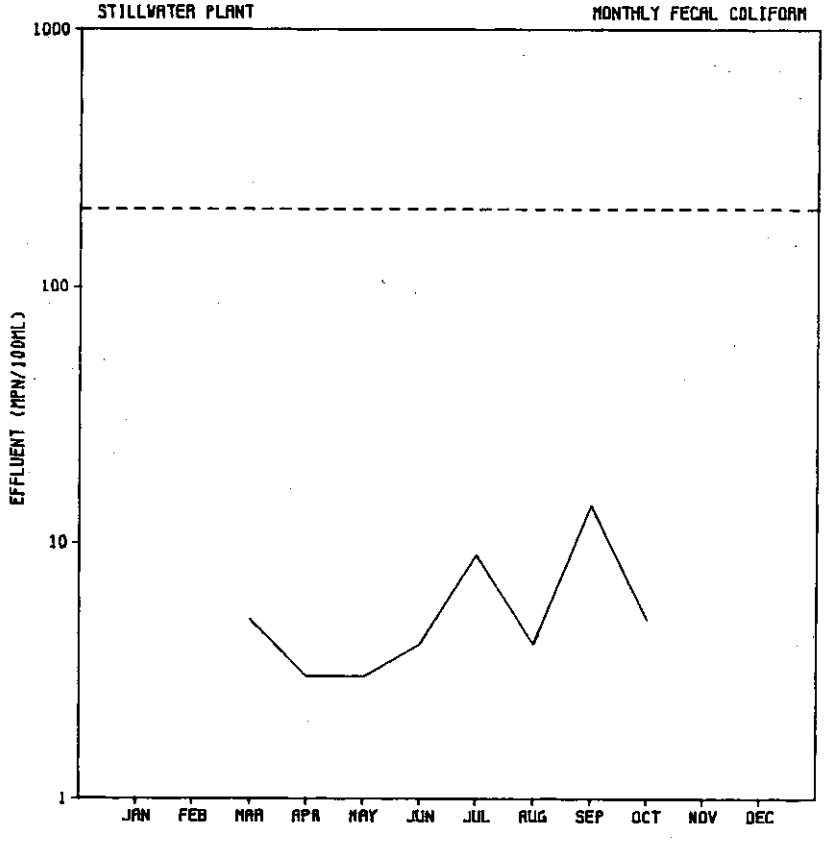

STILLWATER PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
DATA REPRESENTS CBOD IN 1982 THRU 1985. ALL PREVIOUS YEAR'S DATA ARE TBOD.

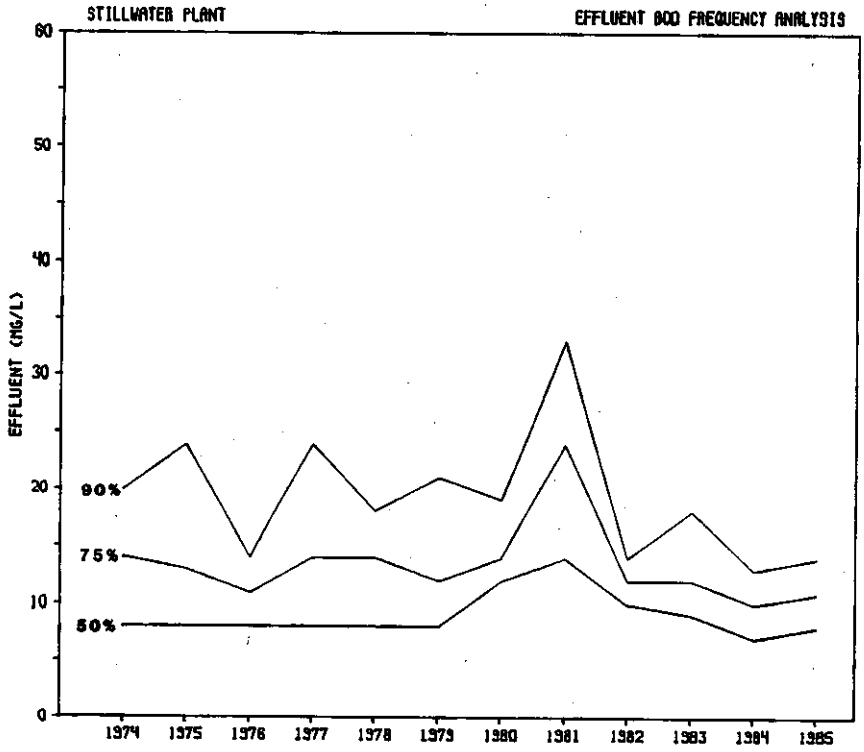

STILLWATER PLANT
BIOCHEMICAL OXYGEN DEMAND
INFLUENT (MG/L)
EFFLUENT (MG/L)
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

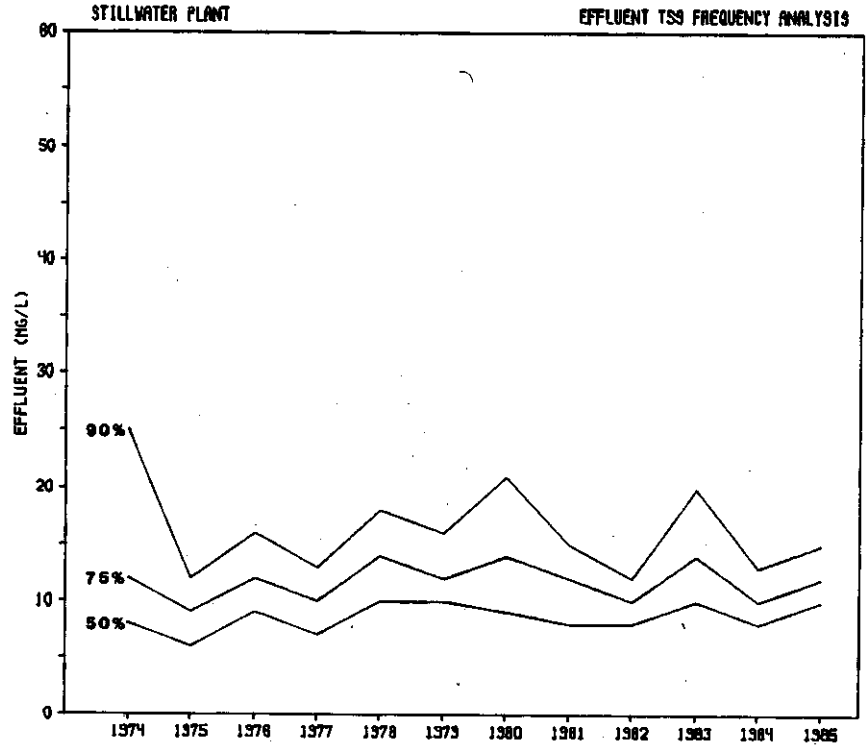

STILLWATER PLANT
TOTAL SUSPENDED SOLIDS
INFLUENT (MG/L)
EFFLUENT (MG/L)
0
50
100
150
200
250
300
350
400
450
500
0
10
20
30
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


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


STILLWATER PLANT
ANNUAL FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985


STILLWATER PLANT
MONTHLY FECAL COLIFORM
EFFLUENT (MPN/100ML)
1000
100
10
1
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
1984
1985


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
1984
1985

1985 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						<0.2						
February						<0.2						
March						<0.2						
April						0.3						
May						<0.2						
June						<0.2						
July						<0.2						
August						----						
September						----						
October						----						
November						----						
December						----						
1985 Avg.						<0.2						
1984 Avg.						<0.2						

APPENDIX

TABLE A-1

1985 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	2.47	19	227	422	176	6.0-9.8	7.4	33.7	15.7
Bayport	0.53	18	176	337	188	4.0-9.4	5.9	29.2	15.3
Blue Lake	19.3	13	184	409	173	5.6-9.5	6.1	32.4	11.6
Chaska	0.91	14	150	309	145	0.6-10.2	4.5	29.1	15.3
Cottage Grove	1.35	15	213	431	186	7.2-8.6	7.1	42.0	22.8
Empire	5.43	15	229	425	207	5.7-9.5	8.2	38.1	17.7
Hastings	1.66	15	279	533	217	4.8-13.4	8.3	43.8	22.7
Maple Plain	0.42	14	126	273	128	6.8-7.7	4.4	27.8	13.2
Medina	0.179	12	159	352	233	7.4-7.6	6.6	36.0	16.4
Metropolitan	222	15	205	401	195	5.9-11.7	4.1	24.7	11.2
Rosemount	0.38	14	138	302	124	3.6-12.0	6.6	39.2	23.1
Savage	0.64	15	144	290	203	5.8-11.8	8.8	25.5	14.2
Seneca	17.5	18	270	583	306	6.0-7.8	7.8	39.7	20.1
Stillwater	2.74	13	121	226	97	5.8-9.4	4.1	22.6	11.7

TABLE A-2

ANNUAL AVERAGE FLOW DATA
FOR THE PERIOD 1971-1985

Treatment Plant	ANNUAL AVERAGE FLOW (MGD)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
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	2.49	2.47
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	0.50	0.53
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	19.5	19.3
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	1.09	0.91
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	1.30	1.35
**EAGAN TOWNSHIP	----	----	*----	----	----	----	----	----	----	----	----	----	----	----	----
EMPIRE	----	----	----	----	----	----	----	----	3.54	3.48	3.51	4.05	4.81	5.19	5.43
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	1.64	1.66
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	0.40	0.42
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	0.28	0.179
METROPOLITAN	213	213	202	196	202	196	194	210	217	206	202	208	225	222	222
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	0.37	0.38
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	0.62	0.64
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	17.6	17.5
SHAKOPEE	1.24	*---	----	----	----	----	----	----	----	----	----	----	----	----	----
SOUTH ST. PAUL	0.10	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	2.95	2.74
**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	54	54
ALL PLANTS	239	244	238	235	234	228	227	249	262	247	242	253	275	276	276

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

TABLE A-3

ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
FOR THE PERIOD 1971-1985

Treatment Plant	ANNUAL AVERAGE BOD (MG/L)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982**	1983**	1984**	1985**
ANOKA	20	29	36	21	16	11	9	12	14	14	16	12	11	13	14
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	6	6
BLUE LAKE (POND)	31	31	39	---	---	---	---	---	---	---	---	---	---	---	---
BLUE LAKE	---	---	12	18	15	15	13	13	9	9	12	10	9	9	11
BURNSVILLE	40	55	*--	---	---	---	---	---	---	---	---	---	---	---	---
CHASKA	36	49	52	58	43	42	44	78	112	20	18	14	11	9	13
CHANHASSEN	84	*--	---	---	---	---	---	---	---	---	---	---	---	---	---
COTTAGE GROVE	53	52	60	36	25	55	39	34	19	11	12	10	9	9	11
EAGAN TOWNSHIP	50	52	*--	---	---	---	---	---	---	---	---	---	---	---	---
EMPIRE	---	---	---	---	---	---	---	---	10	3	3	2	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	22	18
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	10	12
MEDINA	12	9	14	10	13	14	25	22	22	22	26	14	10	10	10
METROPOLITAN	84	72	46	42	41	67	42	39	43	23	19	13	10	10	11
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	18	18
ST. PAUL PARK	66	93	52	51	63	*--	---	---	---	---	---	---	---	---	---
SAVAGE	22	26	28	27	21	20	46	27	27	7	10	8	8	7	9
SENECA	---	29	16	15	11	15	16	21	16	16	20	18	14	17	16
SHAKOPEE	355	*--	---	---	---	---	---	---	---	---	---	---	---	---	---
SOUTH ST. PAUL	60	42	31	46	*--	---	---	---	---	---	---	---	---	---	---
STILLWATER	24	17	14	12	11	8	12	10	10	12	18	10	10	8	9
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	11	12
ALL PLANTS (weighted average)	81	67	43	40	38	60	38	36	39	21	18	12	10	10	11
ALL PLANTS EXCEPT METRO (actual average)	50	45	34	32	24	23	27	26	28	17	15	12	10	11	12
ALL PLANTS (actual average)	51	46	34	33	25	26	28	27	28	18	15	12	10	11	12

* Plant phased out during previous year.
**$CBOD_5$ values listed for 1982, 1983, 1984, and 1985.

TABLE A-4

ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
FOR THE PERIOD 1971-1985

Treatment Plant	ANNUAL AVERAGE TSS (MG/L)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ANOKA	24	36	40	19	13	15	14	16	12	11	14	8	10	11	13
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	8	9
BLUE LAKE (POND)	34	58	45	---	---	---	---	---	---	---	---	---	---	---	---
BLUE LAKE	---	---	22	21	14	19	13	14	12	9	6	7	7	7	6
BURNSVILLE	60	86	*--	---	---	---	---	---	---	---	---	---	---	---	---
CHASKA	72	86	79	91	62	55	54	66	59	12	13	11	11	11	14
CHANHASSEN	71	*--	---	---	---	---	---	---	---	---	---	---	---	---	---
COTTAGE GROVE	63	70	93	84	36	25	23	28	14	8	7	7	11	9	12
EAGAN TOWNSHIP	60	69	*--	---	---	---	---	---	---	---	---	---	---	---	---
EMPIRE	---	---	---	---	---	---	---	---	5	2	2	1	1	2	2
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	32	21
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	10	14
MEDINA	11	15	16	13	13	15	20	18	19	25	18	14	14	16	13
METROPOLITAN	72	54	37	43	40	60	49	43	64	26	19	11	9	11	13
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	3	3
ST. PAUL PARK	69	77	47	48	47	*--	---	---	---	---	---	---	---	---	---
SAVAGE	24	28	14	15	13	10	14	15	14	7	8	4	3	3	4
SENECA	---	29	17	19	16	15	15	17	20	16	20	19	18	21	17
SHAKOPEE	146	*--	---	---	---	---	---	---	---	---	---	---	---	---	---
SOUTH ST. PAUL	38	22	22	31	*--	---	---	---	---	---	---	---	---	---	---
STILLWATER	23	12	13	13	7	10	8	10	11	15	10	8	12	9	11
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	12	11
ALL PLANTS (weighted average)	69	52	36	40	37	54	44	38	56	24	18	11	9	11	13
ALL PLANTS EXCEPT METRO (actual average)	50	57	37	35	25	22	22	24	21	16	11	10	10	11	11
ALL PLANTS (actual average)	51	57	37	36	26	24	23	25	23	16	12	10	10	11	11

* Plant phased out during previous year.

TABLE A-5

ANNUAL AVERAGE EFFLUENT PERCENT REMOVAL
EFFICIENCY FOR THE PERIOD 1971-1985

Treatment Plant	ANNUAL AVERAGE BOD REMOVAL (%)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ANOKA	89	87	85	91	92	94	95	94	93	92	92	95	94	93	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	97	97
BLUE LAKE (POND)	87	92	88	--	--	--	--	--	--	--	--	--	--	--	--
BLUE LAKE	--	--	96	94	94	95	95	95	96	96	95	95	96	95	94
BURNSVILLE	74	69	*--	--	--	--	--	--	--	--	--	--	--	--	--
CHASKA	79	75	74	69	81	83	78	61	57	91	92	93	92	92	91
CHANHASSEN	70	*--	--	--	--	--	--	--	--	--	--	--	--	--	--
COTTAGE GROVE	81	80	76	85	89	72	81	83	89	94	94	95	95	95	95
EAGAN TOWNSHIP	75	69	*--	--	--	--	--	--	--	--	--	--	--	--	--
EMPIRE	--	--	--	--	--	--	--	--	95	98	99	99	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	89	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	91	90
MEDINA	92	90	90	92	92	94	86	93	82	84	80	87	91	89	94
METROPOLITAN	66	73	82	84	83	75	83	82	79	89	91	95	94	94	95
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	86	87
ST. PAUL PARK	88	66	79	78	72	*--	--	--	--	--	--	--	--	--	--
SAVAGE	84	88	84	85	88	88	84	85	79	95	93	94	93	93	93
SENECA	--	88	94	94	95	94	93	92	93	92	91	92	94	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	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	94	94
ALL PLANTS (weighted average)	68	75	83	85	84	77	84	84	81	90	91	94	94	94	95
ALL PLANTS EXCEPT METRO (actual average)	77	78	84	86	88	89	88	87	86	89	92	94	94	93	93
ALL PLANTS (actual average)	77	78	84	86	88	89	88	87	86	89	92	94	94	93	93

* Plant phased out during previous year.

TABLE A-6

ANNUAL AVERAGE EFFLUENT PERCENT REMOVAL
EFFICIENCY FOR THE PERIOD 1971-1985

Treatment Plant	ANNUAL AVERAGE TSS REMOVAL (%)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ANOKA	90	88	85	94	94	92	92	90	91	92	91	95	94	93	92
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	96	95
BLUE LAKE (POND)	78	66	75	--	--	--	--	--	--	--	--	--	--	--	--
BLUE LAKE	--	--	91	94	96	95	96	96	96	96	98	97	97	97	96
BURNSVILLE	75	72	*--	--	--	--	--	--	--	--	--	--	--	--	--
CHASKA	66	54	57	53	73	81	70	63	70	93	93	93	91	93	90
CHANHASSEN	75	*--	--	--	--	--	--	--	--	--	--	--	--	--	--
COTTAGE GROVE	82	78	66	71	85	86	90	86	91	95	96	96	93	94	93
EAGAN TOWNSHIP	72	61	*--	--	--	--	--	--	--	--	--	--	--	--	--
EMPIRE	--	--	--	--	--	--	--	--	98	99	99	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	83	89
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	93	89
MEDINA	92	88	88	91	91	96	88	96	91	83	86	88	89	86	93
METROPOLITAN	77	83	88	86	87	82	83	81	71	89	92	95	95	95	93
MOUND	80	82	74	80	*--	--	--	--	--	--	--	--	--	--	--
NEWPORT	66	50	56	56	51	*--	--	--	--	--	--	--	--	--	--
OAK PARK HEIGHTS	85	81	71	*--	--	--	--	--	--	--	--	--	--	--	--
OROND	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	98	98
ST. PAUL PARK	78	75	83	82	80	*--	--	--	--	--	--	--	--	--	--
SAVAGE	91	96	95	94	95	95	94	94	93	99	97	97	98	98	97
SENECA	--	88	93	94	94	93	93	93	90	91	91	90	91	90	94
SHAKOPEE	38	*--	--	--	--	--	--	--	--	--	--	--	--	--	--
SOUTH ST. PAUL	93	94	93	92	*--	--	--	--	--	--	--	--	--	--	--
STILLWATER	80	90	90	93	97	93	93	94	91	88	94	94	91	93	88
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	94	95
ALL PLANTS (weighted average)	78	83	88	87	88	83	84	84	75	90	92	95	95	95	93
ALL PLANTS EXCEPT METRO (actual average)	76	76	83	86	88	91	90	89	90	91	94	95	94	93	93
ALL PLANTS (actual average)	76	76	84	86	88	90	89	89	89	91	94	95	94	93	93

* Plant phased out during previous year.

TABLE A-7

INFLUENT BOD DATA 1971-1985

Treatment Plant	ANNUAL AVERAGE VALUES, BOD (MG/L)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ANOKA	182	223	240	237	189	170	175	199	206	176	211	223	193	184	227
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	174	176
BLUE LAKE	---	---	300	304	271	282	258	266	216	228	230	228	194	177	184
CHASKA	171	196	200	185	222	241	203	200	258	220	229	189	141	115	150
COTTAGE GROVE	279	260	250	234	222	197	209	198	172	171	204	208	181	180	213
EMPIRE	---	---	---	---	---	---	---	---	208	181	234	204	217	193	229
FARMINGTON	279	400	329	957	453	452	447	338	293	*--	---	---	---	---	---
HASTINGS	300	233	188	175	161	187	189	243	221	210	227	251	230	196	279
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	116	126
MEDINA	150	90	140	124	156	246	285	300	119	139	128	122	133	103	159
METROPOLITAN	247	267	256	256	241	266	246	215	205	215	208	203	174	176	205
NEWPORT	229	244	207	217	170	*--	---	---	---	---	---	---	---	---	---
ORONO	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	127	138
ST. PAUL PARK	550	274	248	227	224	*--	---	---	---	---	---	---	---	---	---
SAVAGE	138	217	175	184	191	163	283	179	130	151	153	151	120	104	144
SENECA	---	242	267	270	235	247	230	252	219	194	217	221	221	207	270
STILLWATER	89	106	108	157	161	140	116	146	118	121	141	135	124	125	121
WACONIA	---	---	---	---	169	676	341	*--	---	---	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)					234	243	229	239	207	197	217	214	198	183	217
ALL PLANTS (weighted average)					240	263	243	219	205	212	209	205	178	177	207
ALL PLANTS EXCEPT METRO (actual average)					209	252	232	208	191	171	192	185	169	154	186
ALL PLANTS (actual average)					210	252	232	209	191	174	193	186	169	156	187

*Plant phased out during previous year.

TABLE A-8

INFLUENT TSS DATA 1971-1985

Treatment Plant	ANNUAL AVERAGE VALUES, TSS (mg/l)														
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ANOKA	240	300	267	302	234	195	176	164	132	141	152	154	165	150	176
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	210	188
BLUE LAKE	---	---	244	364	347	361	324	317	270	244	241	230	224	204	173
CAHSKA	212	190	184	194	226	292	180	180	195	167	189	167	127	148	145
COTTAGE GROVE	350	318	274	294	241	185	220	200	163	152	187	173	160	158	186
EMPIRE	---	---	---	---	---	---	---	---	226	190	251	212	250	189	207
FARMINGTON	259	296	225	361	250	223	235	189	147	*--	---	---	---	---	---
HASTINGS	333	333	225	198	199	207	184	252	223	224	235	233	187	196	217
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	195	128
MEDINA	138	125	133	141	214	365	385	487	205	151	132	127	208	131	233
METROPOLITAN	313	318	308	317	316	332	288	231	222	237	230	241	192	198	195
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	129	124
ST. PAUL PARK	318	308	276	270	241	*--	---	---	---	---	---	---	---	---	---
SAVAGE	267	700	280	269	278	241	249	265	190	565	234	170	195	165	203
SENECA	---	242	243	319	282	225	209	240	204	186	211	203	211	205	306
STILLWATER	115	120	130	193	210	140	118	158	119	127	159	139	137	150	97
WACONIA	---	---	---	---	187	381	270	*--	---	---	---	---	---	---	---
ALL PLANTS EXCEPT METRO (weighted avg.)					292	264	243	255	219	204	218	206	209	194	217
ALL PLANTS (weighted average)					313	323	281	235	221	232	228	235	195	197	199
ALL PLANTS EXCEPT METRO (actual average)					266	266	246	235	202	209	197	184	188	172	183
ALL PLANTS (actual average)					268	269	248	235	203	211	199	188	189	173	184

*Plant phased out during previous year.

TABLE A-9

STATISTICAL ANALYSES OF BIOCHEMICAL OXYGEN DEMAND DATA
FOR PLANTS IN OPERATION DURING 1985

TREATMENT PLANT EFFLUENT STATISTICAL DATA

BIOCHEMICAL OXYGEN DEMAND, mg/l*

Treatment Plant	50% of Time							75% of Time							90% of Time						
	1979	1980	1981	1982**	1983**	1984**	1985**	1979	1980	1981	1982**	1983**	1984**	1985**	1979	1980	1981	1982**	1983**	1984**	1985**
ANOKA	12	12	15	10	10	12	12	16	17	20	14	14	16	17	22	22	26	19	17	21	23
BAYPORT	6	5	7	7	6	5	5	8	8	8	9	7	7	7	11	11	10	13	8	8	8
BLUE LAKE	7	8	9	10	8	9	10	10	10	13	13	11	11	12	15	14	19	16	13	14	15
CHASKA	93	14	14	12	9	6	10	160	22	24	16	13	10	14	210	38	34	22	17	14	19
COTTAGE GROVE	12	10	9	8	8	8	9	20	14	15	13	11	11	13	50	18	20	18	14	14	17
EMPIRE	4	2	3	2	2	1	2	10	2	4	3	3	2	2	28	5	4	4	4	3	4
HASTINGS	16	17	18	17	14	16	14	22	22	24	27	20	23	23	28	31	33	37	26	35	36
MAPLE PLAIN	16	19	10	11	8	6	9	23	29	15	18	12	12	14	33	37	21	26	17	22	21
METROPOLITAN	36	20	14	10	8	8	9	53	29	24	15	13	12	13	71	44	36	22	19	17	19
ROSEMOUNT	10	11	12	15	13	16	15	15	14	15	18	18	21	21	20	20	19	24	29	30	30
SAVAGE	26	5	9	6	7	6	7	41	7	12	9	9	7	9	59	9	15	20	10	10	11
SENECA	14	14	19	17	13	15	15	18	20	22	21	17	19	20	27	25	30	25	24	24	24
STILLWATER	8	12	14	10	9	7	8	12	14	24	12	12	10	11	21	19	33	14	18	13	14

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

**1982 through 1985 data represents CBOD values.

TABLE A-10

STATISTICAL ANALYSES OF TOTAL SUSPENDED SOLIDS EFFLUENT DATA
FOR PLANTS IN OPERATION DURING 1985

TREATMENT PLANT EFFLUENT STATISTICAL DATA

TOTAL SUSPENDED SOLIDS, mg/l*

Treatment Plant	50% of Time							75% of Time							90% of Time						
	1979	1980	1981	1982	1983	1984	1985	1979	1980	1981	1982	1983	1984	1985	1979	1980	1981	1982	1983	1984	1985
ANOKA	10	10	12	7	9	10	11	15	15	18	10	12	13	16	21	20	24	15	16	16	21
BAYPORT	7	7	7	7	6	7	7	10	9	9	9	7	9	9	13	11	10	12	9	10	12
BLUE LAKE	11	8	6	6	7	5	5	14	11	7	8	9	7	7	17	15	9	10	11	10	9
CHASKA	43	11	13	10	8	5	11	83	15	16	14	14	9	16	130	18	22	19	22	18	19
COTTAGE GROVE	10	7	5	6	10	7	11	16	13	8	10	14	11	15	28	22	14	14	18	14	20
EMPIRE	3	1	1	1	1	1	1	5	3	1	1	1	2	2	11	4	2	2	2	3	3
HASTINGS	17	22	19	28	22	24	15	24	30	28	38	32	32	28	31	38	36	48	41	59	40
MAPLE PLAIN	10	11	6	6	6	8	10	18	15	8	10	12	15	18	30	24	16	16	16	19	29
METROPOLITAN	43	15	10	7	7	8	9	85	33	24	12	11	12	15	137	60	47	21	17	19	24
ROSEMOUNT	2	2	1	1	1	2	2	3	3	2	2	2	3	3	5	3	3	4	4	5	4
SAVAGE	10	4	5	2	2	2	3	18	7	12	5	3	4	4	28	15	17	11	4	6	6
SENECA	13	15	19	19	15	19	15	24	19	23	23	23	26	20	32	23	28	26	29	34	26
STILLWATER	10	9	8	8	10	8	10	12	14	12	10	14	10	12	16	21	15	12	20	13	15

*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

1985 METROPOLITAN PLANT

SLUDGE PROCESSING DATA

PARAMETER	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL	DAILY AVG.
A. SLUDGE PRODUCTION														
1. WET TONS:														
Roll Press Cake	13,598	13,993	19,740	15,388	17,138	14,322	15,475	15,508	16,101	17,746	18,263	16,599	193,871	531
Filter Press Cake	111	2,445	0	0	0	0	234	0	0	0	0	0	2,790	8
Total	13,708	16,438	19,740	15,388	17,138	14,322	15,709	15,508	16,101	17,746	18,263	16,599	196,661	539
2. DRY TONS:														
Roll Press Cake	4,497	4,860	6,706	5,318	5,950	4,929	5,150	5,425	5,250	5,757	6,190	5,285	65,317	179
Filter Press Cake	45	980	0	0	0	0	95	0	0	0	0	0	1,120	3
Total	4,542	5,840	6,706	5,318	5,950	4,929	5,245	5,425	5,250	5,757	6,190	5,285	66,437	182
B. SLUDGE INCINERATED														
1. WET TONS:														
Roll Press Cake	13,577	12,916	19,735	15,356	17,114	14,289	15,405	15,488	16,101	10,304	18,264	16,599	185,148	507
Filter Press Cake	111	37	0	0	0	0	206	0	0	0	0	0	354	1
Total	13,688	12,954	19,735	15,356	17,114	14,289	15,611	15,488	16,101	10,304	18,264	16,599	185,502	508
2. DRY TONS:														
Roll Press Cake	4,490	4,486	6,704	5,307	5,942	4,917	5,126	5,417	5,250	3,343	6,190	5,285	62,457	171
Filter Press Cake	45	14	0	0	0	0	84	0	0	0	0	0	143	1
Total	4,535	4,500	6,704	5,307	5,942	4,917	5,210	5,417	5,250	3,343	6,190	5,285	62,600	172
C. SLUDGE TO LAND														
1. WET TONS:														
Roll Press Cake	21	1,076	5	32	25	35	71	22	0	7,442	0	0	8,729	24
Filter Press Cake	0	2,408	0	0	0	0	28	0	0	0	0	0	2,436	7
Total	21	3,484	5	32	25	35	99	22	0	7,442	0	0	11,165	31
2. DRY TONS:														
Roll Press Cake	7	374	2	11	8	12	24	8	0	2,414	0	0	2,860	8
Filter Press Cake	0	966	0	0	0	0	11	0	0	0	0	0	977	2
Total	7	1,340	2	11	8	12	35	8	0	2,414	0	0	3,837	10

TABLE A-12

1985 METRO PLANT SLUDGE QUALITY

						mg/kg (dry weight basis)								
	TS %	TVS %	KJN %	NH3-N %	P %	Cd	Cu	Ni	Pb	Zn	Cr	K	Hg	PCB
Roll Press Cake														
January	34.6	75.8	3.58	0.16	1.82	108	1670	233	321	2454	867	728	---	----
February	33.1	75.5	2.99	0.09	1.09	113	1510	204	289	2453	1039	1196	1.2	1.1
March	----	----	----	----	----	---	----	---	---	----	----	----	---	----
April	39.5	66.1	2.78	0.08	0.99	53	777	138	311	1380	532	1380	1.0	----
May	34.3	70.6	4.11	0.16	1.75	58	950	126	239	1565	615	1227	2.1	1.4
June	33.2	64.4	3.40	0.09	1.51	64	1030	157	301	1690	708	1446	1.1	----
July	32.9	72.5	2.92	0.10	1.46	49	1106	193	221	1781	830	1319	2.2	----
August	36.2	59.5	2.54	0.11	1.19	54	961	181	304	1597	704	1326	3.3	1.6
September	34.9	66.2	2.75	0.12	1.55	59	1063	209	295	1880	817	1440	3.3	---
October	----	----	----	----	----	---	----	---	---	----	----	----	---	----
November	36.5	73.0	3.16	0.07	1.81	64	1197	182	210	1874	937	1066	4.2	----
December	32.8	75.2	3.66	0.12	1.65	78	1305	164	205	1320	732	793	4.4	0.53
Average	34.8	69.8	3.19	0.11	1.48	70	1157	179	270	1799	778	1192	2.5	1.2

TABLE A-13

METRO WASTE CONTROL COMMISSION
1985 SLUDGE DISPOSAL
GALLONS HAULED (X 1000)

Plant / Disposal Location	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Sub Total	Total
Anoka														
Coon Rapids Int.	405.2	300.8	355.2	396.8	396.8	428.8	0.0	0.0	0.0	0.0	0.0	0.0	2284	4671
Coon Rapids L.S.	0.0	0.0	0.0	0.0	0.0	0.0	336.0	534.4	473.6	412.8	281.6	348.8	2387	
Bayport														
South St. Paul Int.	106.6	92.8	114.8	131.6	71.8	98.8	107.6	108.4	111.8	128.0	95.4	94.8	--	1262
Blue Lake														
3rd and Comm.	337.7	188.4	529.1	771.2	421.5	5.3	104.5	102.3	1335.5	1600.6	1523.0	1556.2	8475	36922
Seneca	2890.2	2790.1	2595.3	2803.1	3314.1	2735.3	2990.4	3238.3	1781.7	1340.2	908.1	1060.2	28447	
Chaska														
Blue Lake	0.0	20.8	72.8	109.2	109.2	98.8	98.8	5.2	20.8	57.2	62.4	160.0	815	3211
3rd & Comm.	0.0	5.2	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	46.8	0.0	62	
Seneca	0.0	46.8	228.8	202.8	218.4	187.2	156.0	213.2	166.4	213.2	104.6	135.2	1873	
Landspreading	313.6	147.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	461	
Cottage Grove														
U of M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.0	38.4	22.4	19.2	0.0	144	2928
Landspreading	185.2	224.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	64.0	249.6	0.0	732	
South St. Paul Int.	16.0	19.2	265.6	246.4	358.4	262.4	201.6	147.2	137.6	156.8	16.0	224.0	2051	
Drying Beds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
Hastings														
U of M	0.0	0.0	0.0	0.0	99.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	112	2479
Landspreading	211.2	89.6	0.0	156.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	458	
South St. Paul Int.	0.0	0.0	150.4	3.2	0.0	128.0	224.0	287.2	307.2	60.8	80.0	86.4	1327	
3rd & Comm.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	291.2	198.4	80.0	582	
Maple Plain														
Drying Beds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	53
Landspreading	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
Plymouth Int.	0.0	0.0	0.0	0.0	0.0	40.0	13.2	0.0	0.0	0.0	0.0	0.0	53	
Rosemount														
3rd & Comm.	139.6	185.3	186.8	196.3	168.4	157.1	140.1	181.5	178.2	189.2	178.8	149.3	--	2051
Savage														
Drying Beds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	673
Landspreading	0.0	0.0	0.0	0.0	0.0	9.6	22.4	0.0	0.0	0.0	0.0	0.0	32	
3rd & Comm.	10.0	5.0	0.0	30.0	30.0	0.0	0.0	30.0	40.0	0.0	104.5	38.5	288	
Seneca	25.0	35.0	30.0	0.0	85.0	56.0	40.0	27.0	0.0	27.5	27.5	0.0	353	
Stillwater														
South St. Paul Int.	12.8	208.6	220.2	393.1	395.8	300.8	87.6	126.4	270.6	284.6	347.2	325.2	2973	3960
Landspreading	371.6	0.0	0.0	0.0	0.0	0.0	345.8	243.8	0.0	0.0	25.4	0.0	987	
Empire														
U of M	1,652,000 gallons													

TABLE A-14

1985 SENECA PLANT SLUDGE QUALITY

	TS %	TVS %	KJN %	NH3-N %	P %	mg/kg (dry weight basis) Cd	Cu	Ni	Pb	Zn	Cr	K	Hg	PCB
Vacuum Filter Cake														
January	----	----	----	----	----	----	----	----	----	----	----	----	----	----
February	25.2	37.6	2.22	0.07	0.79	6.0	1036	917	147	351	607	655	1.1	----
March	21.0	54.3	3.38	0.06	1.19	11.0	1448	1086	238	619	619	1348	2.6	1.1
April	22.2	43.9	3.27	0.07	1.10	11.8	1093	582	210	567	726	1750	1.0	----
May	22.1	39.3	3.60	0.07	1.33	15.1	1316	1227	208	636	168	1316	1.5	1.0
June	----	----	----	----	----	----	----	----	----	----	----	----	----	----
July	----	----	----	----	----	----	----	----	----	----	----	----	----	----
August	----	----	----	----	----	----	----	----	----	----	----	----	----	----
September	----	----	----	----	----	----	----	----	----	----	----	----	----	----
October	----	----	----	----	----	----	----	----	---	----	----	----	---	----
November	----	----	----	----	----	----	----	----	----	----	----	----	----	----
December	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Average	22.5	43.8	3.15	0.07	1.10	11.1	1197	879	203	548	569	1363	1.4	1.0
Roll Press Cake														
January	19.6	74.6	5.76	0.88	1.71	10.2	1170	33	215	716	118	2150	2.0	1.9
February	23.2	75.8	4.19	0.35	1.28	13.5	1401	62	244	624	144	1604	1.6	----
March	24.3	76.0	5.19	0.42	1.56	14.9	1369	63	286	729	176	2079	1.7	1.0
April	23.5	76.6	4.72	0.47	1.51	14.1	1505	48	288	887	134	2013	2.5	1.2
May	22.4	74.0	4.91	0.72	1.76	18.6	1592	74	293	942	179	2241	2.0	1.3
June	23.6	75.8	4.87	0.71	1.52	17.4	1754	43	309	784	142	1910	2.0	----
July	22.4	69.9	5.14	0.57	1.66	16.6	1662	27	248	1027	107	2598	2.8	1.3
August	22.1	75.6	4.72	0.52	1.32	14.5	1674	39	246	923	140	1986	3.0	1.2
September	23.1	77.3	4.68	0.37	1.34	12.5	1291	31	231	841	137	1973	2.6	----
October	21.9	79.5	4.65	0.60	1.42	11.3	890	29	238	680	141	1968	1.7	----
November	21.5	78.8	5.03	0.42	1.74	19.0	1089	29	336	760	151	2231	3.4	0.44
December	21.2	85.0	5.31	0.48	1.57	13.0	883	26	174	602	167	2101	1.8	1.0
Average	22.6	76.5	4.90	0.53	1.52	14.6	1383	43	261	797	145	2051	2.3	1.2

TD 525 .T9 M42c 1985 v.2
Metropolitan Waste Control
Commission
Annual wastewater treatment

DATE	ISSUED TO
[redacted]	