

SECTION 7 - EXISTING TREATMENT FACILITY

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7.1 INTRODUCTION

The purpose of the section is to describe the existing treatment facility (Des Moines Creek Wastewater Treatment Plant) and provide information on its historical performance. All flows are treated at the Treatment Plant located north of S. 216th Street near Des Moines Creek. The District also has a current NPDES permit. Recommended improvements to the treatment facility are discussed in Section 8.

In a letter dated August 8, 1995 from Department of Ecology (Ecology) to the Midway Sewer District, it was indicated that certain parameters had exceeded 85% of design capacity as rated in the August 1985 Engineering Report, *"Addition of Secondary Treatment Facilities Des Moines Creek Wastewater Treatment Plant."* In particular, an influent design for total suspended solids (TSS) of 10,000 pounds per day was the indicated capacity. Average influent TSS for 1995 is 9462 pounds per day or approximately 95% of plant influent capacity. As a result, Midway Sewer District initiated an engineering study, *"Evaluation of Wastewater Facilities Capacity-Engineering Report, URS, 1996"* to determine those actions necessary to upgrade the treatment plant, and provide the necessary reserve treatment capacity as required by Ecology. Recommendations resulting from the engineering study were expansion of the primary digestion process and expansion of the disinfection system. At the same time Ecology imposed a residual chlorine standard as part of the proposed NPDES permit. The District then commissioned the design of an additional primary anaerobic digester and conversion of the chlorine disinfection system to ultra-violet irradiation (UV). These upgrades were completed in 1999. Subsequent to these upgrades the District petitioned Ecology to re-rate the treatment facilities to 9 million gallons per day (MGD). This has occurred and is reflected in the current NPDES permit.

7.2 TREATMENT PLANT SUMMARY

This section of the report describes the existing wastewater treatment plant (as of 2000). A two page summary spread sheet is developed, summarizing both the sizing of the unit processes, the specific loading conditions for each unit process and the historical performance for each unit process as well as the overall treatment plant performance. The summary is shown in Table 7-1.

**Table 7-1
Midway Sewer District
Summary of Unit Sizing And Treatment Performance**

Parameter or Unit	Design Criteria (average condition)	Design Criteria (peak instantaneous condition)	WDOE Design Criteria	Actual Loading/Performance (as of year = 1999)	Projected Loading (as of year = 2020) (Avg. Wet Weather Conditions)
Treatment Plant Influent (Average for 1994 & 1995)					
Plant Influent Flow (MGD)	9.00 (proposed)*	27.00 (proposed)		5.5	10.0
Plant Influent BOD (mg/l)	250			280	242
Plant Influent BOD (lb/d)	18765 (proposed)			12800	19,000
Plant Influent TSS (mg/l)	200			230	230
Plant Influent TSS (lb/d)	15,000 (proposed)			10400	16,800
Headworks					
Bar Screens (2@4'x0.75")		25 MGD		5.50	10.0
Grit Chamber (1@576" ³)		31250 gpd/sq. ft.		9550 gpd/sq.ft.	17360 gpd/sq.ft.
Grit Cyclone		205 gpm		29 gpm	
Classifier comminutor	18 MGD	900 lbs/hr		43 lbs/hr	
Primary Clarifiers Overflow Conditions					
Clarifiers 1 & 2	2 @ 86.5'L x 16'W x 7.6'D				
Clarifiers 3 & 4	2 @ 156'L x 16'W x 9'D				
Surface Overflow Rate - All Operating	847 gpd/sq. ft.	2540 gpd/sq.ft.	800 to 1200/peak to 3000 gpd/sq	709 gpd/sq.ft.	1290 gpd/sq.ft.
Surface Overflow Rate - No.s 3 & 4 only	847 gpd/sq. ft.	2540 gpd/sq.ft.	800 to 1200/peak to 3000 gpd/sq	1100 gpd/sq.ft.	2000 gpd/sq.ft.
Clarifier Performance (Data Averages in mg/l)					
Clarifiers Influent TSS				227	
Clarifiers Effluent TSS				77	
Percent TSS Reduction				66.1%	
All Clarifiers Operational - Influent BOD			50% to 60%	282	
All Clarifiers Operational - Effluent BOD				170	
Percent BOD Reduction			30% to 35%	39.7%	
Trickling Filter Loading Conditions					
Feed Pumps	3 @ 6250 gpm = 9 MGD each	18 MGD (firm rating)			
Filter Blowers - 10 Hp. each	2 @ 9000 SCFM each	2.0 ft./min. rise rate			
Filter Diameter	75 ft. = 4418 sq. ft. each				
Filter Depth	22 ft. @ 30 sq.ft./cubic ft.		15 to 20 ft.		
Surface Loading Rate (without recycle-high flow only)	0.51 gpm/sq.ft.	1.41 gpm/sq.ft.	0.7 to 2.1 gpm/sq.ft.	0.41 gpm/sq.ft. (calculated)	0.78 gpm/sq.ft.
Surface Loading Rate (with recycle-night time operat	0.7 gpm/sq.ft.	1.41 gpm/sq.ft.	0.7 to 2.1 gpm/sq.ft.	0.5 gpm/sq.ft. (controlled minimum)	0.78 gpm/sq.ft.
Trickling Filter Performance					
Filter Influent BOD - (total 5 day)				170	
Filter Influent BOD - (soluble 5 day)				96	
Filter Effluent BOD - (soluble 5 day)				9	
BOD ₅ Loading	50.9 lbs/day per 1000 cu.ft.		30 to 80 lbs/day/1000 cu.ft.	40.1 lbs/day/1000 cu.ft.	59.9 lbs/day/1000 cu.ft.
BOD ₅ Loading	30.9 lbs/day per 1000 cu.ft.			22.7 lbs/day/1000 cu.ft.	28.5 lbs/day/1000 cu.ft.
BOD ₅ Removal				90.6%	
Solids Contact System					
Contact Tank Detention Time (202500 gallons)	45 minutes detention	15 minutes detention		53.0 minutes detention	29.2 minutes detention
Oxygen Requirement		63 lbs/hr.			
Blower No. 1	20 Hp. - 200 SCFM				
Blower No.s 2 & 3	30 Hp. - 350 SCFM ea.				
Tank Mixed Liquor Suspended Solids				2504 mg/l.	
Sludge Volume Index				89	
Secondary Clarifiers Size and Overflow Conditions					
Clarifier Number and Size	2 @ 85' dia. x 16' SWD		16' SWD (suggested)		
Hydraulic Surface Overflow Rate	577 gpd/sq.ft.	1586 gpd/sq.ft.	800 with peaks to 1200 gpd/sq.ft.	485 gpd/sq.ft.	852 gpd/sq.ft.
Solids Surface Loading Rate			25 with peaks to 40 lbs/day/sq.ft.	10.1 lbs/day/sq.ft.	18.4 lbs/day/sq.ft.
Weir Loading Rates	7725 gpd/lin.ft.	23175 gpd/lin.ft.	3000 with peaks to 30000 gpd/lin.	5149 gpd/lin.ft.	9362 gpd/lin.ft.

**Table 7-1
Midway Sewer District
Summary of Unit Sizing And Treatment Performance**

Clarifier Performance (Data Averages in mg/l)					2504 8 99.7%	
Influent TSS (mg/l)						
Effluent TSS (mg/l)						
Percent Solids Reduction						
Sludge Thickener Size and Loadings						
Thickener Number and Size	1 @ 40' x 10' SWD					
Thickener Pumps	2 @ 55 gpm each					
Flow to Thickener					33.3 gpm (daily average)	53.9 gpm (daily avg.)
Hydraulic Surface Overflow Rate	777 gpd/sq. ft.		500 to 800 gpd/sq. ft.		38.1 gpd/sq. ft. (daily average)	99.9 gpd/sq. ft.
Solids Surface Loading Rate	13.6 lbs/day/sq. ft.		10 to 12 lbs/day/sq. ft.		6.6 lbs/day/sq. ft.	12.1 lbs/day/sq. ft.
Thickener Performance						
Feed Concentration					1.69% solids	
Underflow Concentration					3.41% solids	
Percent Increase in Solids Concentration					50.4%	
Percent Volatile Solids in Total Solids Underflow					87%	
Primary Digester						
Digester Size	2 @ 60' dia x 30' SWD	165,600 cu. ft.	ND = 0.5 x diameter (60' and under)			
Detention Time	34 days		15 to 20 days		35.2 days	19.6 days
Volatile Solids Loading	0.08 lbs/day/cu. ft.		0.15 to 0.40 lbs VS/cu. ft./day		0.06 lbs VS/cu. ft./day	0.11 lbs VS/cu. ft./day
Gas Production	103,470 cu. ft./day				69,417 cu. ft./day	
Percent Volatile Solids Reduction			40% to 50%		82.6%	
Total Gas Production per Pound of Volatile Solids					17.4 cu. ft. per pound of volatile solids	
Secondary Digesters						
Number and Size	2 @ 153000 gallons each					
Detention Time					18.3 days	
Sludge Dewatering System						
Belt Filter Press	1 @ 6.56 ft. wide					
Flow to Filter	4,287.7 gallons per day				11,210 gallons per day	30,436 gallons per day
Dry Solids Throughput	9286 lbs/day				2400 lbs/day	4364 lbs/day
Filter Solids Surface Area Loading Rate	50.31 lbs/sq. ft./hour				21.0 lbs/sq. ft./hour	38.2 lbs/sq. ft./hour
Filter Hydraulic Surface Area Loading Rate	3.86 gpm/sq. ft.				1.07 gpm/sq. ft.	1.95 gpm/sq. ft.
Cake Solids	20% to 25%				16.0%	
Treatment Plant Effluent (Average for 1994 & 1995)						
Discharge Biochemical Oxygen Demand (BOD)					16 mg/l	
Discharge Total Suspended Solids (TSS)					8 mg/l	
Discharge pH					6.6 (pH units)	
Discharge Temperature					65°F (18.4°C)	
UV Disinfection System ⁽¹⁾						
Type	medium pressure-high intensity					
Number and Size	2@ 9MGD each(1 + 3rd channel)					
Minimum Dose rate	26 mw-sec./sq. cm.	26 mw-sec./sq. cm.	26 mw-sec./sq. cm.			26 mw-sec./sq. cm.
Projected Actual Dose Rate					42.6 mw-sec./sq. cm.	46.8 mw-sec./sq. cm.
Number of Units Operating					1 normally	2

Notes:

*recommended NPDES

(1) actual dose rates may be less than shown due to power "turn-down"

BOD - Biochemical Oxygen Demand

TSS - Total Suspended Solids

SCFM - Standard Cubic Feet Per Minute

SWD - Side Water Depth

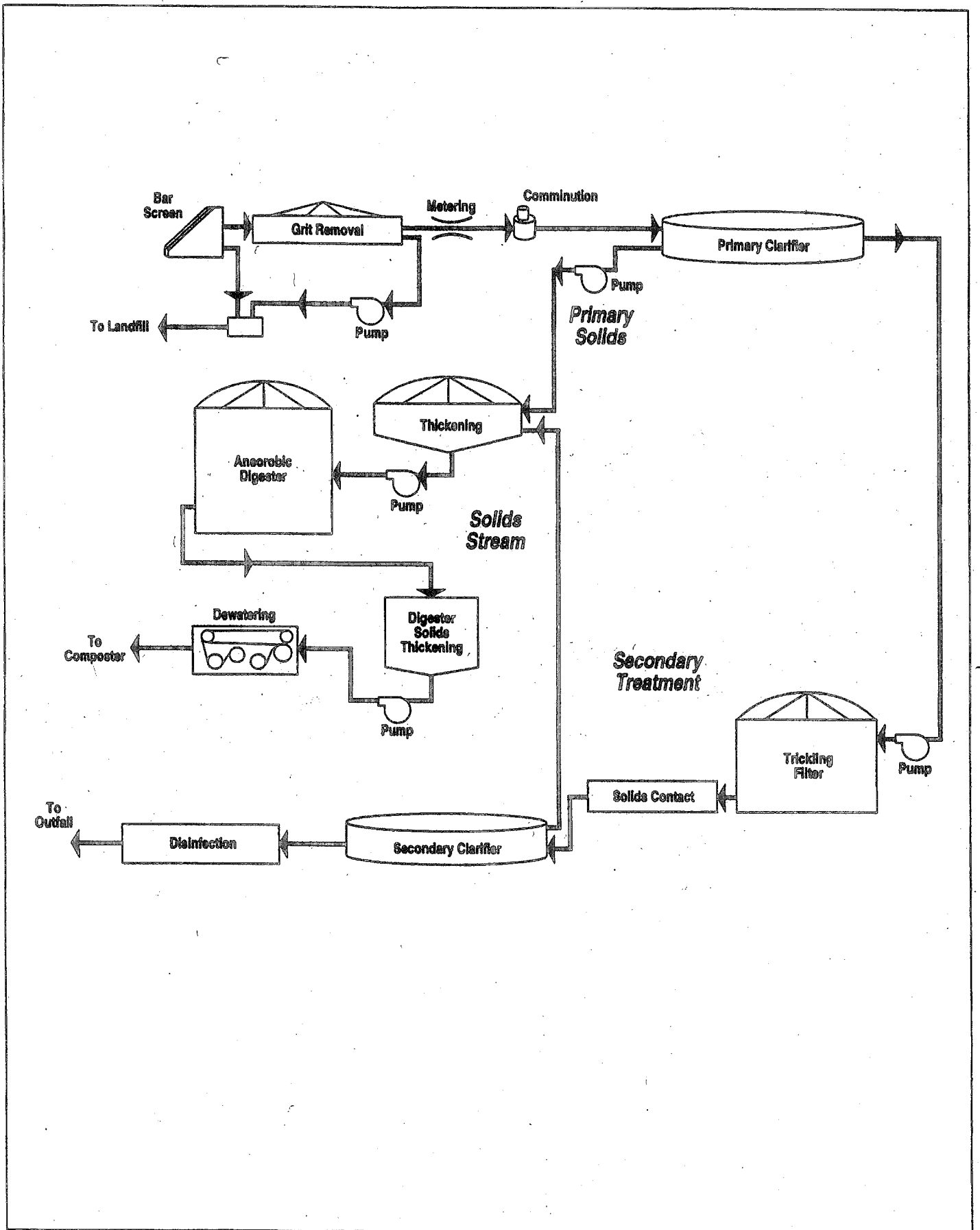


Figure 7-1,
Treatment Plant Process Schematic
Midway Sewer District

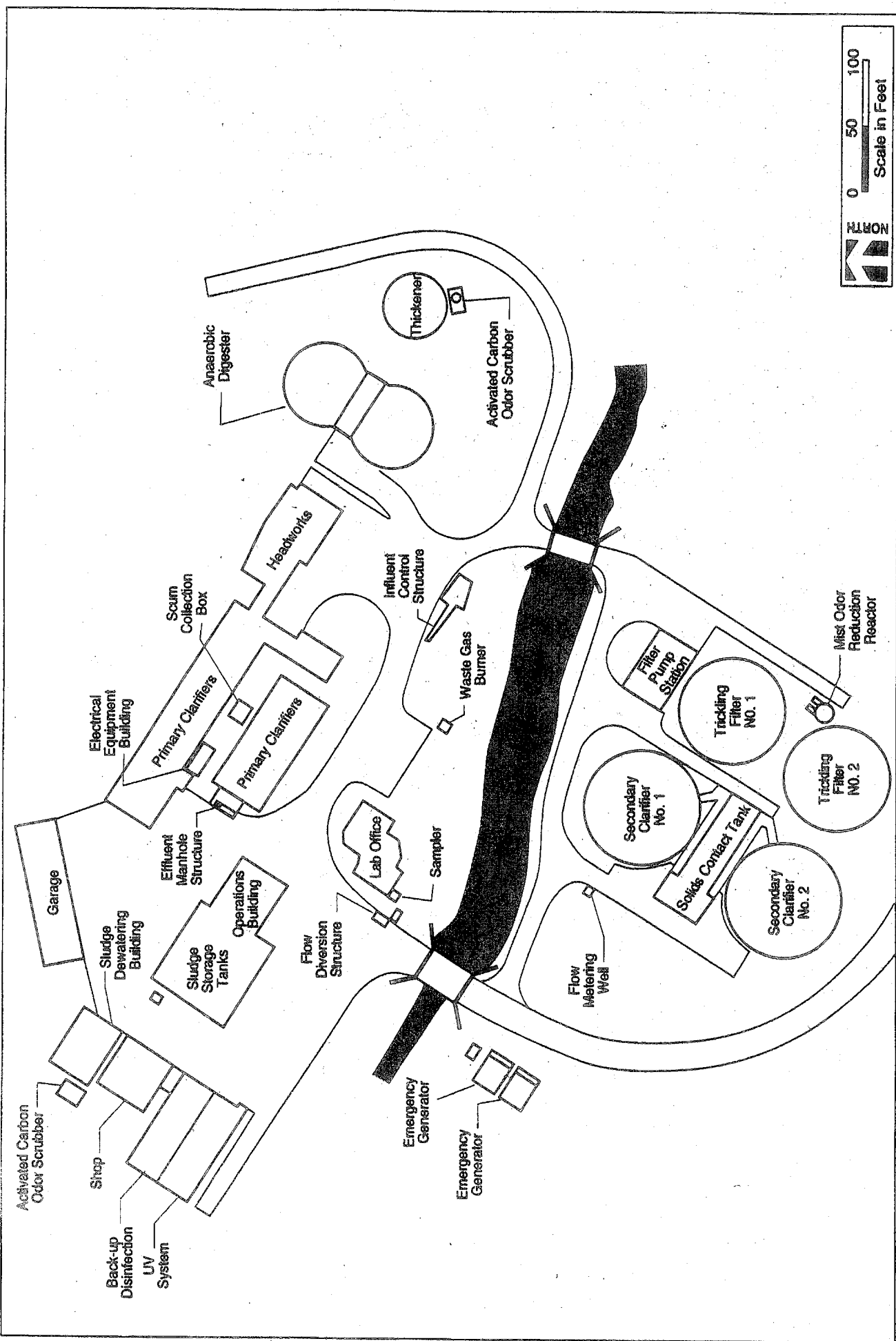


Figure 7-2
Treatment Plant Site Layout
Midway Sewer District

MIDWAY SEWER DISTRICT



7.2.1 Unit Process

The treatment plant consists of headworks, primary treatment, secondary treatment, and UV disinfection with discharge via an outfall to Puget Sound. Figure 7-1 shows the treatment plant site layout, and Figure 7-2 is a schematic of the treatment process. Table 7-2 is a description of each of the unit processes in the treatment system.

**Table 7-2
Midway Sewer District
Present Treatment Plant Configuration**

Unit Process Description	Number	Size/Capacity
Bar Screens	2	4' X 0.75" space
Grit Chambers	1	576 square feet area
Grit Cyclone	1	205 gpm rating
Classifier	1	900 pounds per hour
Communtor	1	18 MGD
Primary Clarifiers (No.s 1 & 2)	2	86.5' L x 16' W x 7.8' D
Primary Clarifiers (No.s 3 & 4)	2	156' L x 16' W x 9' D
Trickling Filters Feed Pumps	3	9 MGD each
Trickling Filters	2	4418 square feet each 22' D @ 30 sq. ft. per cu. ft.
Trickling Filter Blowers	2	9000 SCFM each
Solids Contact Chamber	1	202,500 gallons
Air Delivery System Blowers	1	200 SCFM
	2	350 SCFM
Secondary Clarifiers	2	85' Dia. X 16' SWD
Sludge Thickener	1	40' Dia. X 10' SWD
Thickener Pumps	2	55 gpm each
Primary Digesters	2	60' Dia. X 30' SWD
Secondary Digesters	2	153,000 gallons each
Sludge Filter Press	1	6.56' W x 6.56 fpm
Ultra-violet System	2	9 MGD each
Standby Channel	1	for third 9 MGD unit
Standby Chlorine Contact Chamber	1	125,000 gallons

7.2.2 Historical Performance

Discharge monitoring reports (DMRs) data for the period from 1992 through 1999 inclusive were used in the evaluation of the treatment plant performance. In addition, a program of grab sampling was performed to provide data not normally included on the DMR. The results of the analysis are provided in Table 7-3.

**Table 7-3
Midway Sewer District
Evaluation of Treatment Plant and Unit Process Performance**

Unit Process	Loading	Performance
Treatment Plant BOD	280 mg/l. influent 8 mg/l. effluent	94.3% reduction
Treatment Plant TSS	230 mg/l. influent 8 mg/l. effluent	96.5% reduction
Primary Clarifiers TSS	709 gpd/sq.ft.	66.1% reduction
Primary Clarifiers BOD		39.7% reduction
Trickling Filters BOD (total)	0.5 gpm/sq.	52.8% reduction
Trickling Filters BOD (soluble)		90.6% reduction
Solids Contact Chamber	53.0 min. detention	SVI = 87 80.2% BOD reduction
Secondary Clarifiers TSS	9.1 lbs/day/sq.ft.	99.7% reduction
Sludge Thickener Solids	6.6 lbs/day/sq.ft.	50.4% increase
Primary Digester Volatile Solids	0.06 lbs/day/cu.ft.	50.4% increase
Primary Digester Gas	17.4 cu.ft./lb. of VS	69,417 cu.ft./day
Secondary Digesters	9.0 days detention	0.88% TSS return
Sludge Filter Press	27.5 lbs/hour/sq.ft.	15% solids cake
UV Disinfection	-	less than 10/100 ml

As can be seen from the data in Table 7-3, many of the unit processes are not loaded to capacity. The result of the "underloading" is that most of the unit processes perform well above expectation. Overall performance for the treatment plant for the period of data analysis is an average of around 95% BOD and TSS reduction.