SECTION 8 - TREATMENT PLANT ANALYSIS

SECTION 8
TREATMENT PLANT ANALYSIS AND RECOMMENDATIONS

8.1 INTRODUCTION

The purpose of this section is to evaluate the wastewater treatment facility (or plant), and to develop recommendations for modifications to the treatment plant. The recommendations are for the purpose of assuring that the District will continue to meet their discharge requirements, or to provide for less labor intensive maintenance and operation of the treatment plant.

8.2 GOALS AND OBJECTIVES

The primary objective used in the development of the recommendations is meeting the NPDES Permit requirements established by Ecology. This includes projecting those points in time when the District will probably need to increase the treatment plant capacity. The secondary objectives used in development of the recommendations are increased ease of treatment plant operation, establishing unit treatment process redundancy or reducing operating labor and costs.

8.3 DESCRIPTION OF EXISTING SYSTEM

The present system consists of headworks, primary treatment, two-stage secondary treatment, and anaerobic digestion system with solids dewatering. At present, a Class "B" sludge is produced, shipped to an off site processor and converted to a Class "A" sludge for ultimate disposal. Details of each unit operation or unit process are included in Table 7-1 along with the design criteria, Ecology recommended loading parameters, and projections of loading to the year 2020. The criterion for determining the need to upgrade is 85%, (or greater) loading, of rated capacity for three consecutive months. Therefore, projections of average monthly wet weather flows to the wastewater treatment plant (reported as daily flow rate) are necessary to determine unit operation and unit process loading rates. Consistent with the approach used in Section 3 of this report, an analysis of base flow versus average wet weather flow was performed. For this analysis, a different approach was used to determine these two values. Historical data from the daily monitoring report (DMR) records were evaluated. For the years 1996, 1997, 1998 and 1999, the six dry months and six wet months were obvious from the data. The average dry weather flow was found to be 4.18 MGD, which is consistent with the values determined by an alternate method and reported in Section 3. The average wet weather monthly flow was found to be 6.2 MGD for the same time period. The ratio of approximately 1.5 represents the wet weather average monthly flow compared to the base flow reported in Table 3-2. This ratio is used for escalating the base flow throughout the evaluation period (to the year 2020). These values are necessary to determine both the timing and need for treatment plant upgrades. The flow projections are as follows:

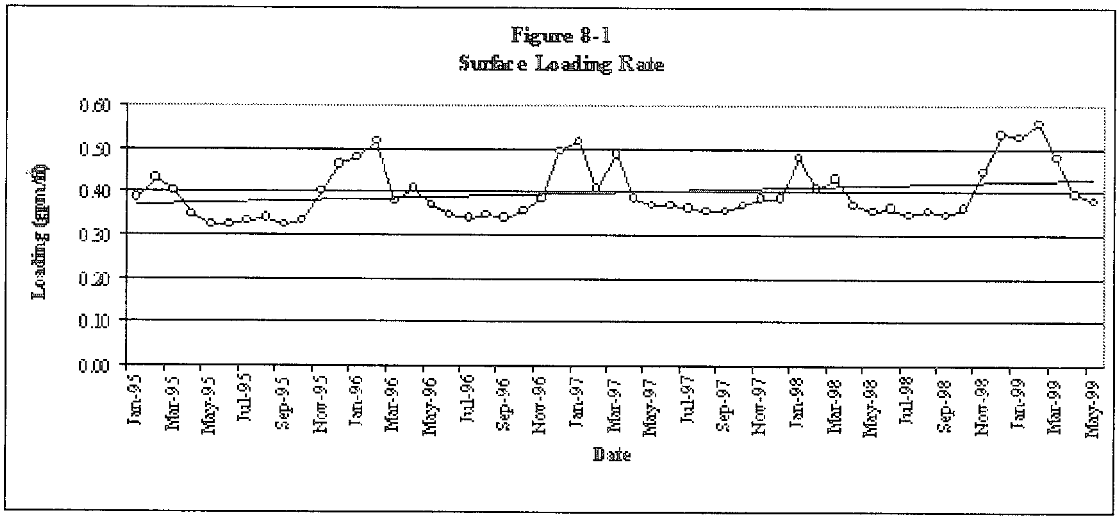
Year of Projection	Average Wet Weather Flow
2000	6.87 MGD
2006	7.08 MGD
2010	7.59 MGD
2020	9.80 MGD

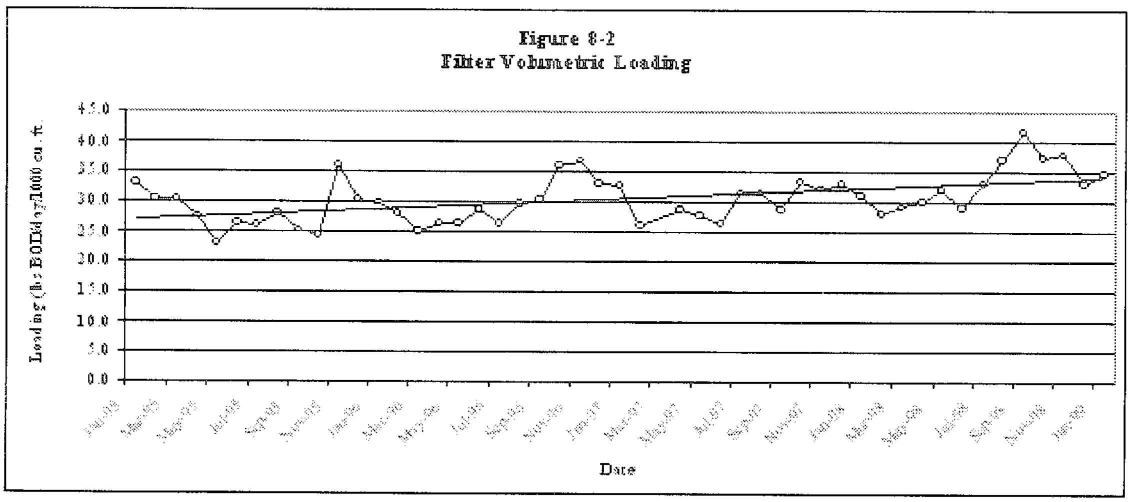
With a treatment plant rating of 9.0 MGD, 85% of this value is 7.65 MGD. When three consecutive monthly flows exceed 7.65 MGD, the treatment plant will require upgrading.

8.4 DISCUSSION OF SYSTEM PERFORMANCE

The 1999 average wet weather flow is 5.5 MGD, (1999 was drier than normal). The proposed NPDES permit application requests a rating for the WWTP of 9.0 MGD. The *"1996 Engineering Report, URS, 1996"* identified two treatment processes that limited the capacity rating of the treatment plant. The two processes that were identified were primary digestion and disinfection operations. Design and construction for upgrades to these two operations is completed. Primary digester capacity has been doubled with the construction of a second primary digester, equal in capacity to the previous primary digester. The addition of the second primary digester adds 6 MGD capacity to the treatment process, for a total of 12 MGD capacity for this unit process. Disinfection has been converted from chlorine disinfection to use of ultra-violet irradiation (UV). The UV system consists of two active channels each containing a 9 MGD UV unit. A third channel is constructed for placement of a third UV unit. Since conversion to UV disinfection, this operation (disinfection) has a capacity of 18 MGD with the potential to readily expand the system to 27 MGD. This upgrade required only half of the original chlorine contact chamber. The remaining half is used for the back-up addition of a chlorine based disinfecting chemical, when the need arises.

Other than upgrades of the two unit operations just completed, no other unit operations require change or upgrade at this time. Both primary and secondary clarifier hydraulic loading rates are well below the desired operating range, as recommended by Ecology. The principal unit operation for reduction of BOD is the trickling filters. A recent operating modification was the change from recycle to the filters for nighttime only, to continuous recycle 24 hours a day. The hydraulic loading rate is now maintained at 0.5 gpm per square foot of surface area. This operating change has resulted in lower effluent BOD concentrations. The calculated surface loading rate and volumetric loading rate for the filters, based on influent flow, are shown in Figures 8-1 and 8-2.





Ecology design criteria for hydraulic surface loading rates of trickling filters ranges from 0.7 gpm/sq. ft. to 2.1 gpm/sq. ft. None of the data shown in Figure 8-1 exceeds 0.6 gpm/sq. ft. The values shown in Figure 8-1 are based on influent flow only. Present operation is to maintain a minimum surface loading rate of approximately 0.5-gpm/sq. ft. A linear regression line is included in the Figure 8-1 to assist the reader in judging the rate of change in the surface loading rate.

The volumetric loading rate recommended by Ecology ranges from 30 pounds of BOD per day per 1000 cubic feet of filter to 80 pounds of BOD per day per 1000 cubic feet of filter volume. Present operation is approximately 35-lbs./day/1000 cu. ft. This is near the bottom of the Ecology recommended design range. Again, a linear regression line is included to assist the reader in judging the rate of increase in the volumetric loading rate. It should be noted that the volumetric loading rate is increasing faster than the hydraulic surface loading rate.

From the fall of 1996 until early 1999, the effluent BOD concentration was increasing quite rapidly. To determine if this was the result of deteriorating WWTP performance the percent BOD reduction was analyzed, also. The results are shown in Figures 8-3 and 8-4.

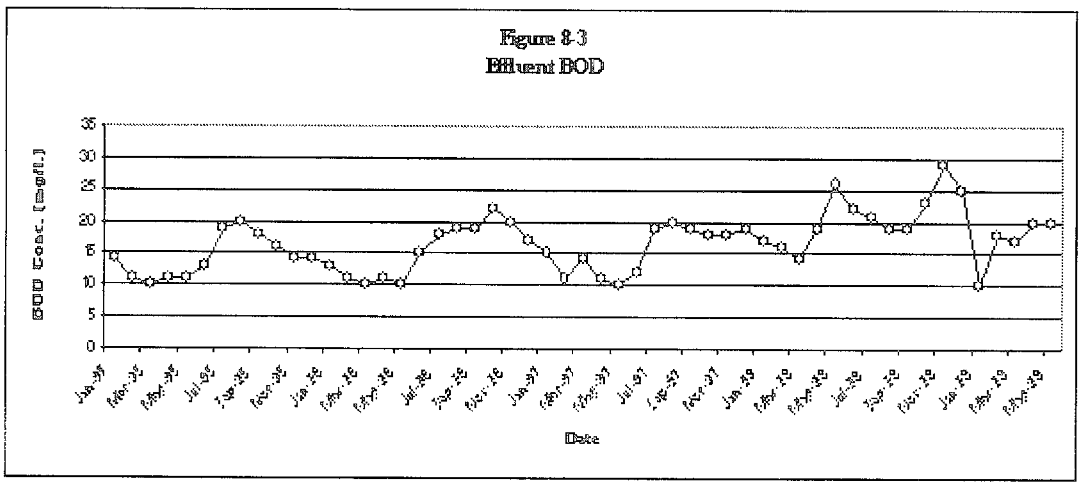
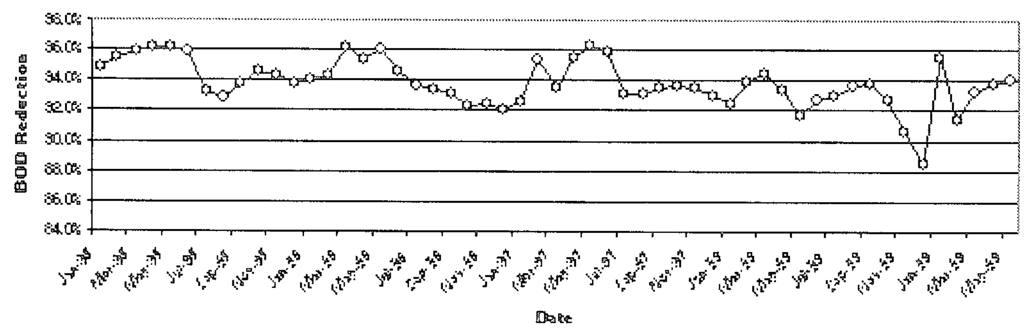


Figure 8-4
WWTP Performance



From Figure 8-3, it can be seen that the effluent BOD concentration was increasing rapidly to the point that late 1998, the concentration was approaching the Permit limit of 30 mg/l. Since that peak, it appears that the effluent BOD concentration has returned to values that have been typical of earlier operation, with an average of 17 mg/l through May 1999. The WWTP performance, as measured by percent BOD reduction, does not have quite the same obvious trend. A low performance period occurred in early 1997 and in early summer of 1998. Performance for the entire year of 1998 was in the low 90% range with only one month showing slightly higher than 94% BOD reduction. Normally there are monthly periods each year (typically April and May) when percent BOD reduction reaches or exceeds 96%. With the operational change of continuous recycle to the trickling filters, the performance has slightly improved.

The treatment plant performance change was considered to result from the presence of problems with waste characteristics in the influent. A sampling program was implemented by the District that measured the influent parameters to the treatment plant. Since the influent BOD concentration has changed more rapidly than the flow rate and the influent TSS concentration, it appears that the character of the BOD itself has changed. The District followed-up the influent sampling program with a source-sampling program. From the results of the source-sampling program, it was determined that certain areas were producing an extremely high BOD waste strength. This problem has been addressed. Problems of high strength waste will require continued monitoring on the part of the District.

Additionally, to help assure acceptable WWTP performance, with minimally loaded unit processes and operations, some method of continuous fresh "seeding" of the trickling filters should be established. Recycle of some of the mixed liquor from the solids contact tank could accomplish this objective. To determine if some benefit might accrue from this plant modification, a pilot test program was initiated on August 20, 1999. A ½ horsepower centrifugal pump connected to 2 ½ inch rubber lined fabric fire hose was used to recycle a portion of the mixed liquor from the solids contact tank. The pump was operated for a cycle of one hour on and one hour off. An estimated 250 gpm was pumped back to the trickling filter feed, when the pump was turned on. The initial results are qualitative based on observations by the chief treatment plant operator. "Clumping" of solids floating on the surface of the secondary clarifiers has disappeared, and the settled supernatant appears clearer. The additional benefit, which can only be determined after a long period of operation in this configuration, is that a viable and healthy biomass is maintained on the trickling filter surfaces even during periods of heavy sloughing. The sloughing may be due to the temporary presence of toxic compounds, fats, oils, and grease (FOG), and "slug" loadings of BOD and other compounds that might inhibit the proper functioning of the trickling filters.

8.5 RECOMMENDATIONS

Based on this analysis no major WWTP upgrades or modifications have been identified as being required at this time. One minor process modification has been identified and one change in operating procedure has been identified. These changes are recommended:

1. Mixed liquor from the effluent of the solids contact tank should be recycled to the trickling filter feed. This flow can be continuously fed at a relatively low flow rate, but sufficient to maintain 0.5 gpm per square foot of filter surface area. Alternatively, recycled flow can be done in the same manner as the pilot program. A higher flow rate can be returned with return flow for a period of time and then turned off for an equivalent period of time. It is recommended that a continuous return mixed liquor flow stream be selected. A continuous recycle stream would assist in maintaining adequate hydraulic loading rate on the filters, in addition to providing a viable microbial feed population to the filter surfaces. The continuous feed of mixed liquor to the filters would provide a slightly better margin should the WWTP be subjected to "slug" or "shock" loadings.

2. The District should continue to review its source control program. The review should include potential sources for non-typical contaminants and high waste strength (concentrations) for typical waste parameters (BOD, TSS, FOG, etc.). The District may not wish to implement a thorough pretreatment program, as the District considered earlier. However, the District may wish to re-write its source control requirements, and strengthen its sampling and inspection program. Identification of normal parameters (BOD, TSS, pH, etc.) that are out of the normal range, and or identification of atypical parameters (selected metals, etc.) will help assure that the treatment plant remains in compliance.

3. Although not required at this time, the District may wish to consider adding a second filter press along with the support appurtenances for the additional filter press. This would include better ventilation in the filter press room, additional odor control for the evacuated filter press room air, upgrade to the dewatered sludge conveyor system and other items necessary for a well operated sludge dewatering program. Justification for these modifications is based on the fact that there is no redundancy for the sludge dewatering system. If the present filter press malfunctions for any period of time, the District is forced to either store the digested sludge, (which is a large volume), or ship the un-dewatered sludge off site, which is costly. In addition, while the present filter press is not loaded to design capacity, nevertheless, the filter press is only producing a filter cake of approximately 16% solids. With a second filter press, these units could be operated at slower speed, and thus produce a filter cake of higher solids and lower disposal costs. Another area of the treatment process the District may wish to provide attention is the headworks. Much of the equipment is approaching its' useful life and will need replacement. Rather than replacement of existing equipment with the same style of equipment, the District may want to consider updating the technology applied to headworks treatment. This could include conversion of the present bar screens to rotary fine screens with solids dewatering and compaction. The grit removal system should also be reviewed and consideration of alternative methods of grit removal be provided. Upgrading the headworks will result in reduced maintenance of the entire treatment plant as well as the possibility of improved overall treatment plant operation. Other items recommended for the District are of a more cosmetic consideration, but consistent with the present treatment plant configuration. These include constructing a roof over the UV system to provide continuous protection during storm events and suppression of algae. This same consideration is also true for the secondary clarifier

system. The District should consider placing a roof over each of the secondary clarifiers, as has been constructed over the primary clarifiers.

4. Average monthly flow rates to the treatment system during the wet weather periods should be carefully monitored. When the influent flow rate reaches 7.65 MGD the District will be required to construct additional primary and secondary clarification capacity. It is expected that this condition will be experienced sometime in the years of 2010 to 2012.

In addition to primary and secondary clarification, monitoring of the trickling filter performance should be maintained. It is expected that the filters will reach the design volumetric loading rate in the years 2012 to 2014 just following the need for additional clarification. This need to upgrade will, in part, depend on the District's ability to control all sources so that treatment plant influent BOD is within the normal strength range of 260 mg/l. or less. In the event that the District accepts high strength BOD wastewater, the trickling filter process may require an upgrade at an earlier point in time.