

# **MULTI-FLO**

**WASTE TREATMENT SYSTEMS**

## **DESIGN GUIDELINES FOR FOODSERVICE APPLICATIONS**

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## GENERAL GUIDELINES FOR *MULTI-FLO* USE WITH FOOD SERVICE

The *MULTI-FLO* has been used successfully to provide an extremely high degree of treatment of wastewater generated by various types of food service establishments. The following guidelines describe and illustrate the total design and maintenance requirements for these *MULTI-FLO* systems.

It is important to note that these designs incorporate supplemental pre-treatment facilities, in addition to the basic *MULTI-FLO* treatment plant. These pre-treatment facilities, which are discussed below, are necessary to prevent "shock loading" due to both hydraulic surges during peak operating periods, as well as the presence of grease, food scraps, cleaning agents and sanitizers in the raw wastewater. **Failure to provide these pre-treatment facilities will result in poor treatment efficiency and/or increased maintenance demands.**

Each *MULTI-FLO* system has a designated treatment capacity based upon a minimum plant retention time of 24 hours. This criteria also assumes that the oxygen requirements of the raw wastewater to be that of normal domestic sewage, i.e., Biochemical Oxygen Demand ( $BOD_5$ ) = 100 – 300 mg/l. However, due to the presence of grease, food scraps, detergents, etc., the strength of the typical wastewater generated by any food service will be greater than normal domestic sewage. Typical restaurant waste will exhibit a  $BOD_5$  of 600 – 800 mg/l or greater. This is more than twice the strength of normal domestic sewage, and as a result will require additional treatment capacity (retention time) in order to treat the same volume of sewage. The pre-treatment facilities described in these guidelines help to provide this additional treatment capacity.

These guidelines also describe the recommended maintenance schedule for *MULTI-FLO* systems which are used on restaurant facilities. Although the maintenance requirements for the *MULTI-FLO* are less demanding than those of larger package plants, regular inspections and service must be provided to insure continuous, trouble-free operation. Because of the heavier organic loading and the inconsistent nature of typical restaurant activities, more frequent plant inspections must be performed than would be required for the normal residential system. Also, sludge wasting (pumping) and filter maintenance must be provided on more frequent intervals in order to maintain proper plant operating conditions.

## DETERMINING THE *MULTI-FLO* SIZING REQUIREMENTS BASED UPON AVERAGE AND PEAK WATER CONSUMPTION FIGURES

Table I, Restaurant Sizing Chart, establishes the minimum capacity of each component of the treatment system based upon the average daily flow shown in column 1, as well as the design peak flow, which is listed in column 2.

In most situations, the "average daily flow" (column 1) is determined for existing facilities by reviewing their monthly water consumption records. To avoid oversizing the system, the highest 30-day average (in a 12-month period) should be used. This is especially important when designing a seasonal facility.

The determination of the treatment capacity of the *MULTI-FLO* is based upon the "design peak flow" (column 2). For new facilities, this value is usually determined by State or local code requirements. On existing facilities, this value can be estimated to be at least 150% of the average daily flow (column 1). If neither of these sources is available, use Table V of the guidelines.

### PRE-TREATMENT COMPONENTS

**Grease Traps:** Each food service establishment must be provided with one or more grease traps in order to prevent grease and cooking oil from entering the *MULTI-FLO*. The capacity of the grease trap(s) can be determined from local code requirements or Table I, column 3, whichever is greater.

**Pre-Aeration Tank:** As mentioned earlier, typical restaurant waste is several times stronger (i.e., BOD<sub>5</sub>) than normal domestic or household wastewater. Additional treatment capacity must be provided in order to achieve complete treatment, as well as preventing anaerobic conditions from developing during peak operating periods.

The additional treatment capacity can be achieved by increasing the number of *MULTI-FLO* units to provide a retention time of 48 hours or more. However, a more effective means is to provide a pre-aeration tank prior to the *MULTI-FLO* units in order to reduce the organic loading to the *MULTI-FLO*. This will also reduce the anaerobic or septic condition of the sewage, thereby reducing the potential "shock" loading to the *MULTI-FLO*. Pre-aeration will also allow mixing of the sewage prior to the *MULTI-FLO*, providing a more consistent and homogenous influent.

Aeration is provided by installing one or more *MULTI-FLO* aerators in the inlet end of a standard septic tank (see Table I, column 4 for tank capacity and number of aerators required). As the sewage flows through the tank, quiescent conditions will occur near the outlet, allowing settling of the solids to occur. Although a baffle is not provided on the inlet, it is necessary to baffle the outlet.

**Flow Equalization:** In order to maintain a steady, even flow of sewage to the *MULTI-FLO* and eliminate any extreme hydraulic surges during meal periods, flow equalization **must** be provided. This is accomplished by installing a surge tank with a capacity equal to the peak flow. (see Table II, column 5)

**TABLE I RESTAURANT SIZING GUIDE**

Column 1 Avg Daily Flow (GPD)	Column 2 Design Peak Flow (GPD)	Column 3 Grease Trap (Gal.)	Column 4 Pre-Aeration (Gal.)	Column 5 Surge Tank (Gal.)	Column 6 MULTI-FLO Model	GPD
1 – 350	1 – 500	1 – 750	1 – 750 with no aerator	500	1 – FTB 0.5	500
351 – 500	501 – 750	1 – 750	1 – 750 with 1 aerator	750	1 – FTB 0.75	750
501 – 650	751 – 1000	1 – 750	1 – 750 with 1 aerator	1000	1 – FTB 1.0	1000
651 – 800	1001 – 1250	1 – 750	1 – 750 with 1 aerator	1250	1 – FTB 1.5	1500
801 – 1000	1251 – 1500	1 – 1000	1 – 1000 with 1 aerator	1500	1 – FTB 1.5	1500
1001 – 1150	1501 – 1750	1 – 1250	1 – 1250 with 1 aerator	1750	2 – FTB 1.0	2000
1151 – 1300	1751 – 2000	1 – 1250	1 – 1250 with 1 aerator	2000	2 – FTB 1.0	2000
1301 – 1500	2001 – 2250	2 – 750	1 – 1500 with 1 aerator	2250	3 – FTB 0.75	2250
1501 – 1650	2251 – 2500	2 – 1000	1 – 1750 with 2 aerators	2500	3 – FTB 1.0	3000
1651 – 1850	2501 – 2750	2 – 1000	1 – 2000 with 2 aerators	2750	3 – FTB 1.0	3000
1851 – 2000	2751 – 3000	2 – 1000	1 – 2000 with 2 aerators	3000	2 – FTB 1.5 or 3 – FTB 1.0	3000
2001 – 2200	3001 – 3250	2 – 1250 1 – aerator	1 – 2500 with 2 aerators	3250	4 – FTB 1.0	4000
2201 – 2350	3251 – 3500	2 – 1250 1 – aerator	1 – 2500 with 2 aerators	3500	4 – FTB 1.0	4000
2351 – 2500	3501 – 3750	2 – 1250 1 – aerator	1 – 2500 with 2 aerators	3750	4 – FTB 1.0	4000
2501 – 2700	3751 – 4000	2 – 1500 1 – aerator	1 – 3000 with 2 aerators	4000	4 – FTB 1.0	4000
2701 – 2850	4001 – 4250	2 – 1500 1 – aerator	1 – 3000 with 2 aerators	4250	3 – FTB 1.5	4500
2581 - 3000	4251 - 4500	2 – 1500 1 - aerator	1 – 3000 with 2 aerators	4500	3 – FTB 1.5	4500

Column 1: (For existing facilities) = Based upon the highest 30 day average  
 Column 2: (For existing facilities) – 150% of average daily flow  
 (For new facilities) – Maximum daily flow as determined by state and local does or Table V  
 Column 3: Minimum 750 gallon or 100% of average daily flow  
 Column 4: Minimum 750 gallon or 100% of average daily flow  
 Column 5: For flow equalization: 100% of peak design flow  
 Column 6: Plant capacity equal to or greater than peak design flow.

A dosing pump (preferably a duplex system) is provided in the surge tank to pump a pre-determined volume of sewage to the *MULTI-FLO* units. The pump is activated by a timer so that a small quantity of sewage is pumped to the *MULTI-FLO* units at specific intervals. A low level float must be provided to shut off the pump when the tank is emptied. Table II (below) gives the recommended dosing rates for different flow rates:

**Table II Flow Equalization: Dosing Schedule**

Plant Capacity	Dosing Interval	Quantity/Dose	Rate (Max.)
500	30 min.	10 gal.	10 gal/min
600	30 min.	12 gal.	10 gal/min
750	20 min.	10 gal.	10 gal/min
1000	15 min.	10 gal.	10 gal/min
1500	20 min.	20 gal.	10 gal/min

Note: The length of time for each dose will need to be calculated based upon the pumping capacity of the individual pump being used. (See manufacturer's pump curve.)

Also, when more than a single *MULTI-FLO* unit is being dosed simultaneously, the values listed in columns 3 and 4 can be multiplied by the total number of *MULTI-FLO* units. (For example, if 3 – 1500 gallon *MULTI-FLO* units are installed in parallel and dosed simultaneously, the quantity/dose would be 60 gallons at a maximum rate of 30 gallons/minute.)

In order to prevent hydraulic overloading of the filters, no more than 2 – 3 percent of the plant capacity should be dosed at one time. The flow rate to each *MULTI-FLO* unit should not exceed 10 gallons per minute. If the pump capacity exceeds this rate, it may be necessary to install a valve on the discharge line with a return line back to the surge tank so that a portion of the discharge is recycled back to the tank. (refer to diagram C)

***MULTI-FLO* Units:** The minimum number of *MULTI-FLO* units and their capacity is given in Table I, column 6. The total treatment capacity of the *MULTI-FLO* units should be equal to, or greater than the peak flow value shown in column 2.

It is important to note that the design capacity of the *MULTI-FLO* units is dependent upon the influent BOD<sub>5</sub> to the *MULTI-FLO* not exceeding 300 mg/l. **Should the influent to the *MULTI-FLO* exceed 300 mg/l., additional treatment capacity may be required.**

Whenever multiple *MULTI-FLO* units are installed, it is necessary to split the flow evenly between the parallel units. If the dosing pump is provided with gate valves to restrict flow to the *MULTI-FLO* units (see diagrams A & B), these valves will insure equal flow. If a distribution box is installed to split the flow equally between each unit, **the capacity of the distribution box should be at least 50 gallons with a minimum of 6" freeboard.** This is to insure that the influent enters the *MULTI-FLO* by gravity and not under pressure. **The invert of the distribution box outlet should be a minimum of 3" higher than the invert of the inlet(s) of the *MULTI-FLO* unit(s).**

## PLANT START-UP

As mentioned previously, restaurant waste contains large quantities of detergents, cleaning agents, and sanitizers. These chemicals will inhibit or prevent the normal growth of bacteria, especially during plant start-up. Furthermore, typical restaurant waste contains oils, greases, and fats which are more difficult for the bacteria to digest. Unless adequate numbers of bacteria can be established quickly, the treatment system will likely exhibit poor effluent quality, as well as rapid filter clogging due to accumulations of untreated grease and soap residue. Excessive foaming or sudsing may also be observed.

To facilitate plant start-up and prevent the above described problems from occurring, it is necessary to "seed" the *MULTI-FLO* with a good quality, activated sludge taken from a well-operating treatment plant. The seed material (sludge) should be well-aerated, free of grease and grit, and exhibit good settling characteristics. In addition, the vessel which is used to haul the sludge (usually a pump truck) should be clean and free of any grease or oil residue.

Although it is important to seed the *MULTI-FLO* with a sufficient volume of activated sludge to insure rapid plant start up, adding too large a quantity of sludge may result in excessive foaming for several days. Although each plant is different, a rule-of-thumb recommendation is to add a quantity of activated sludge (seed) equal to 20 percent of the *MULTI-FLO* treatment capacity. The following table gives the recommended quantities of "seed" material to be used:

Table III

<i>MULTI-FLO</i> Treatment Capacity	Quantity of "Seed" Activated Sludge
500 gal	100 gal
600 gal	120 gal
750 gal	150 gal
1000 gal	200 gal
1500 gal	300 gal
2000 gal	400 gal
3000 gal	600 gal

**For best results, the "seed" material should be added when the wastewater from restaurant first enters the plant.** Without a food source, the bacteria will quickly starve and die off. On the other hand, waiting until the plant has been operating for several weeks will make it more difficult for the "seed" resulting in an unnecessary service call.

It is important to monitor plant operation more closely during the first 2 – 3 months operation. During this period the plant is establishing a "biological equilibrium" and some adjustment may be required. These adjustments include setting of the dosing pump after true average daily flow is determined, as well as the addition or removal of aerators in either the *MULTI-FLO* or the pre-aeration facilities. After BOD strength is established, air supply may need to be increased where estimates of water usage and BOD were made.

## MAINTENANCE SCHEDULE

When sized and designed properly, the *MULTI-FLO* system which is used for a restaurant should not require constant (daily or weekly) maintenance. However, even with pre-treatment the flow generated by a restaurant is usually stronger than normal household wastewater. This will result in faster sludge build-up in the plant, increasing the frequency of sludge wasting (pumping) and filter necessary to conduct routine inspections more often than is required for non-food service facilities which utilize the *MULTI-FLO*.

Table IV lists the minimum maintenance schedule for any *MULTI-FLO* system serving a food service establishment.

Table IV

Activity	Frequency
Routine Inspection (monitor sludge build-up, filter condition, odors, foaming, air supply, alarm, etc.)	1 month
Pump waste sludge from <i>MULTI-FLO</i>	1 – 6 months
Pump grease trap	1 – 3 months (as needed)
Pump pre-tank	1 – 6 months
Filter maintenance (clean or exchange)	1 – 3 months

Note: Each plant will have a different maintenance schedule based upon its actual hydraulic and organic loadings, as well as the in-house operating procedures by the restaurant personnel. Accurate maintenance records by the service entity during the first 6 months will help establish a more specific maintenance schedule that will be economical and help prevent unnecessary emergency calls.

Flow Meter: All food service establishments which utilize a *MULTI-FLO* for the waste treatment system must be provided with an accurate means of monitoring the daily sewage flow. For most facilities this can be provided by a water meter on the incoming potable water supply. Outside sprinkler systems should not be connected to this water meter. Meter readings should be taken during monthly inspection visits and recorded on the maintenance record forms.

Plant Upsets: Occasionally, the food service may discharge an unusually large volume of toxic or excessively high strength wastewater. This can be due to accidental spillage of food products or to seasonal cleaning activities. Although pre-aeration and flow equalization will minimize the harmful effects of such discharges to the *MULTI-FLO* system, operational problems may still be observed.

Excessive foaming in the aeration chamber may result if the "shock load" consists of either unusually large volumes of cleaning agents or high BOD wastes such as coke syrup or flour. Large quantities of sanitizers or other chemicals may result in a complete die-off of all the micro-organisms in the plant. This will usually cause the aeration chamber to become dark grey or black, or in some instances, to become totally clear (no visible solids).

If the plant exhibits excessive foaming but no other unusual conditions (color, effluent quality, etc.) normal operation should re-occur within 2 – 3 days, as the “shock load” is completely assimilated by the *MULTI-FLO* system. It may be advisable to pump the grease traps and the pre-aeration chamber in order to eliminate any residue from the system. Also, an inspection of the food service should be conducted to identify the source. The manager should be advised of the findings so that a reoccurrence can be prevented.

In the event of a plant die-off due to a toxic discharge, the entire treatment system (grease traps, pre-aeration, surge tank and *MULTI-FLO*) should be pumped completely and the plant re-started. This will require “seeding” the plant according to the previous directions for a new facility.

**Note:** As the treatment plant operates for a continuous period of time, specific organisms will develop that are suited to the wastewater discharged by the facility being served. These organisms will increase in number and will be better able to assimilate (treat) shock loads. For this reason, a new facility may be more likely to experience “plant upsets” than a facility that has been operating for 6 months or more.

## CONCLUSION

Satisfactory use of the *MULTI-FLO* to serve restaurant facilities requires the following:

1. Proper Design
2. Proper Start-Up
3. Adequate Routine Maintenance

Failure to provide one or more of the above will most likely result in poor operation or excessive maintenance. *MULTI-FLO* Waste Treatment Systems, a division of Consolidated Treatment Systems, Inc., has provided this manual to help insure the above mentioned requirements are met. *MULTI-FLO* does not authorize the use of its treatment plant to serve food service establishments unless designed in accordance with these minimum requirements or with the written approval of Consolidated Treatment Systems, Inc.

These guidelines are proprietary to *MULTI-FLO* and shall be used only with *MULTI-FLO* products. *CONSOLIDATED TREATMENT SYSTEMS, INC.*, its representatives and distributors take no responsibility for use of these guidelines with any other aeration systems or engineering drawings using other products or methods of incorporating these guidelines.



TABLE V Guide for Estimated Sewage Flows\*

TYPE OF FACILITY	ESTIMATED SEWAGE FLOW IN GAL/UNIT/DAY	BOD <sub>5</sub> /PPM	BOD <sub>5</sub> (LB/DAY/UNIT)
Apartment	150 gal. per bedroom	240	.30 lb/bedroom
Assembly Hall (no kitchen)	5 gal. per seat	240	.01 lb/seat
Bowling Alley (no kitchen)	75 gal. per lane	240	.15 lb/lane
Church (no kitchen)	3 gal. per sanctuary seat	240	.01 lb/seat
Country Club	50 gal. per member	400	.17 lb/member
Country Club	20 gal. per employee	240	.04 lb/employee
Drive-In Theaters	5 gal. per car space	240	.01 lb/car space
Factory (no showers)	20 gal. per employee	240	.04 lb/employee
Factory (showers)	35 gal. per employee	240	.07 lb/employee
<b>Food Service (Water Meters should always be provided for food service)</b>			
Ordinary Restaurant	50 gal. per seat	6-800	.35 lb/seat
24-Hour Restaurant	75 gal. per seat	6-800	.50 lb/seat
Freeway Restaurant	100 gal. per seat	6-800	.70 lb/seat
Tavern (limited food)	30 gal. per seat	400	.10 lb/seat
Carry-out (single-service)	50 gal. per 100 sq.ft./floor sp.	6-800	.70 lb/100 sq.ft./fl. sp.
Carry-out	20 gal. per employee (add'l)	240	.04 lb/employee
Fast Food Chain	100 gal. per seat	1000	.80 lb/seat
Hospital (not incl. Personnel)	200 gal. per bed	400	.70 lb/bed
Hospital personnel (additional)	20 gal. per employee	240	.04 lb/employee
Laundry (coin-operated)	400 gal. per machine	600	2.00 lb/machine
<b>NOTE: The MULTI-FLO is not appropriate when the total flow is laundry waste.</b>			
Mobile Home Park	200 gal. per space	240	.40 lb/space
Motel and Hotel, regular	150 gal. per room	240	.30 lb/room
Resort hotel, cottage	75 gal. per room	240	.15 lb/room
Add for self-service laundry	400 gal. per machine	600	2.00 lb/machine
Nursing Home (not incl. Kitchen or laundry)	100 gal. per bed	400	.30 lb/bed
Nursing Home personnel (add'l)	20 gal. per employee	240	.04 lb/employee
Office Building (per 8-hr shift)	20 gal. per employee	240	.04 lb/employee
Service Station	250 gal. per urinal/water closet	240	.50 lb/fixture
<b>Schools</b>			
Day/type	15 gal. per student	240	.03 lb/student
Add for showers	5 gal. per student	240	.01 lb/student
Add for cafeteria	5 gal. per meal	600	.03 lb/meal
Add for school employees	15 gal. per employee	240	.03 lb/employee
Boarding school	75 gal. per student	240	.15 lb/student
Shopping Center (no food service or laundry)	100 gal. per 1000 sq.ft./floor sp	400	.30 lb/1000 sq.ft.fl.sp.
<b>Travel Trailer or RV Park</b>			
W/out water/sewer hook-up	75 gal. per space	400	.25 lb/space
With water/sewer	100 gal. per space	400	.30 lb/space

\* This table appears in the *MULTI-FLO* Design Manual, page DM 005-0799

# PRE-AERATION AND FLOW EQUALIZATION

Diagram A: Top View

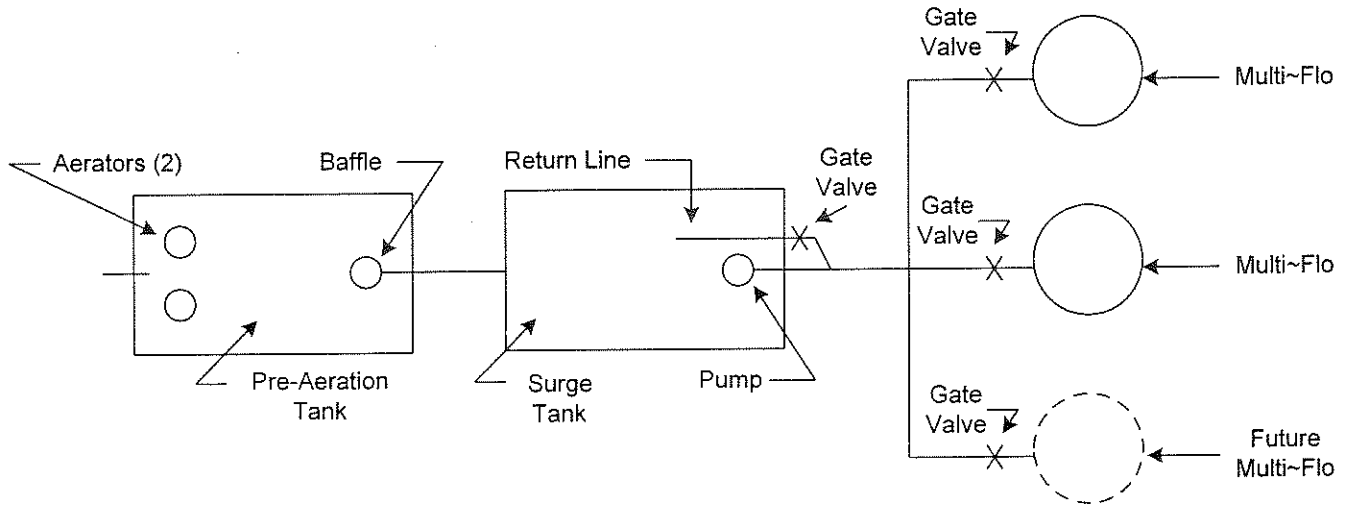


Diagram B: Side View

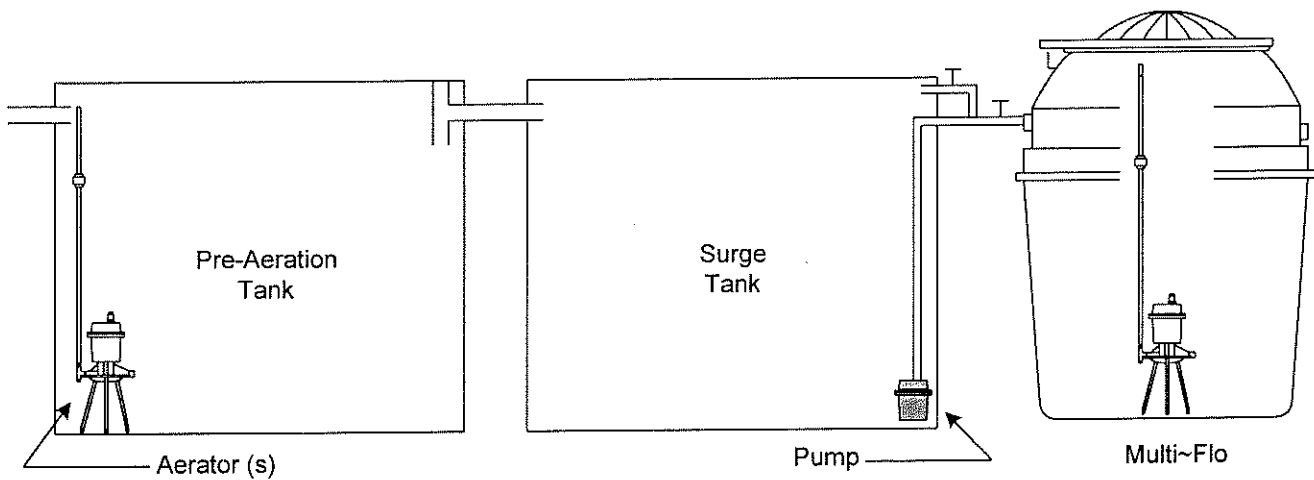


Diagram C: Close-up of piping between surge tank and *MULTI-FLO*

