

METERED DOSING AND EQUALIZATION

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Training Goals

- Review The Need for Metered Dosing and Flow Equalization
- Examine Flow Metering Techniques
- Examine Flow Equalization Techniques
- Appreciate How Flow Metering and Equalization Enhance Performance

Benefits

- Minimize Component Sizing
- Maximize Treatment Efficiency
- Address Transient Conditions That Otherwise Affect Operation
- Reduce Operation and Maintenance Issues and Resulting Costs
- Provide Environmental Protection (and meet applicable codes!)

DEFINITIONS

FLOW METERING

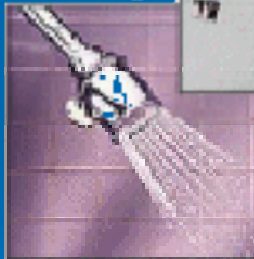
Techniques, practices, and devices to limit the **rate** at which wastewater enters or leaves treatment tanks.

Flow Metering

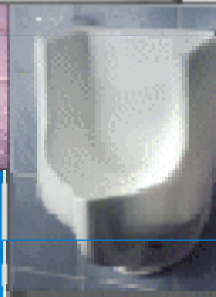
- Within Dwelling
 - Flow Restrictor
 - Reduced Flow Fixtures
 - Spacing Laundry or Bathing
- Within Treatment Tank
 - Dosing Pump
 - Orifice Plate or V-Notch Weir
 - Effluent Filters

Flow Metering

Low-flow
fixtures



Waterless
fixtures



Flow Metering



V-Notch Weir



V-Notch Weir



V-Notch Weir



FLOW EQUALIZATION

Techniques, practices, and devices to limit the **time** when wastewater enters or leaves treatment tanks.

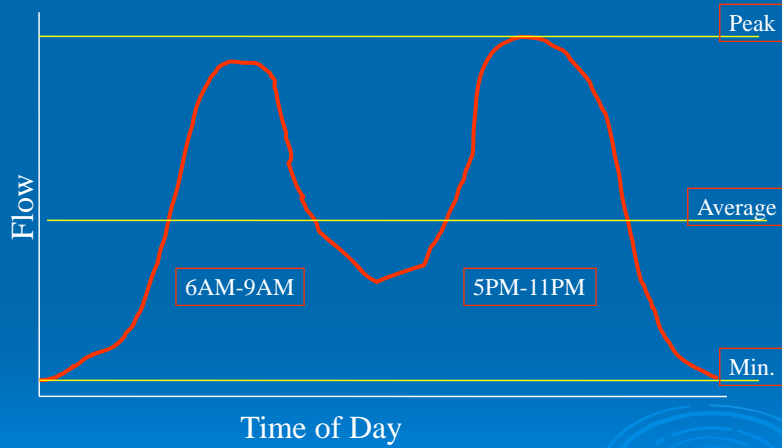
Flow Equalization

- Spacing Laundry or Bathing
- Capturing Wastewater for Release at Later Time
 - Tank, Pump, and Timer
 - Tank and Flow Restrictor

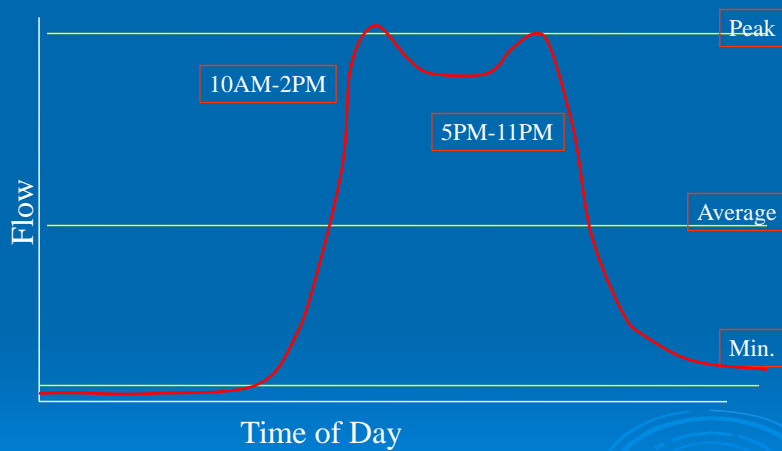
Definitions

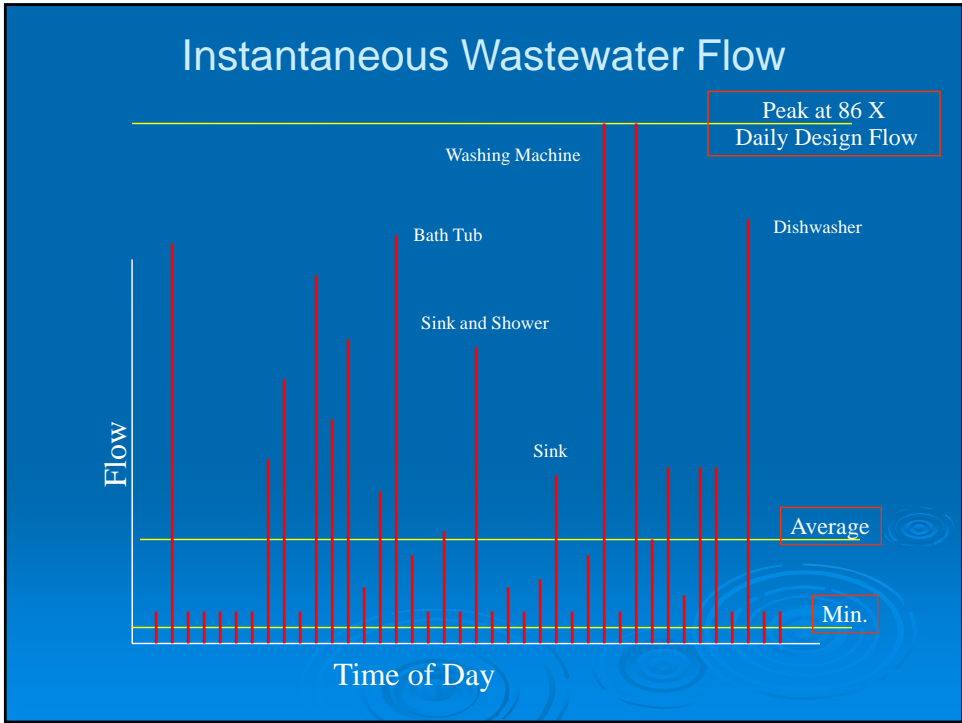
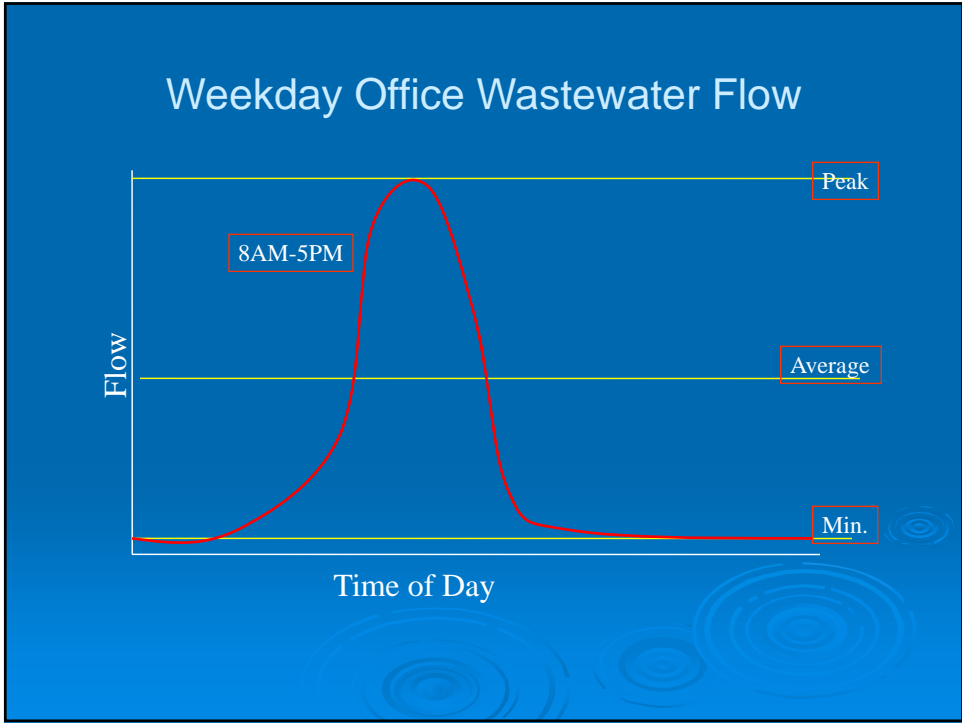
Flow Metering and Flow Equalization are *related but independent* processes. Both must be addressed independently to provide proper design.

Weekday Residential Wastewater Flow



Weekend Residential Wastewater Flow

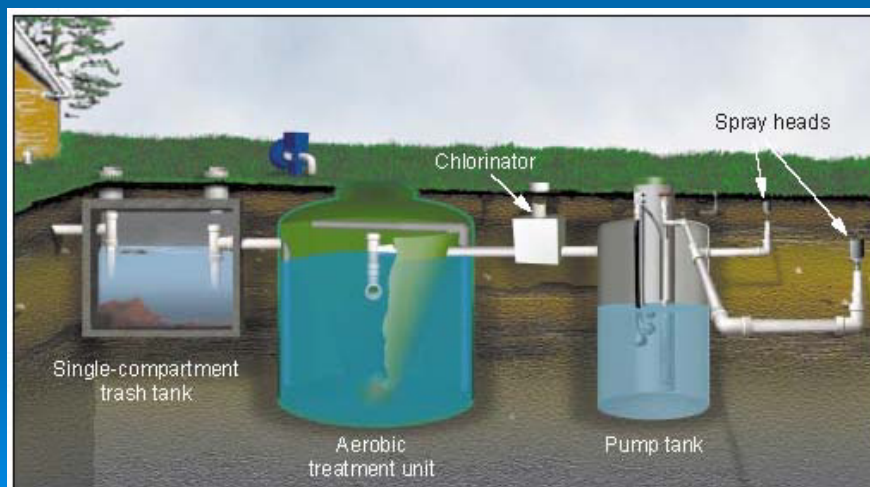




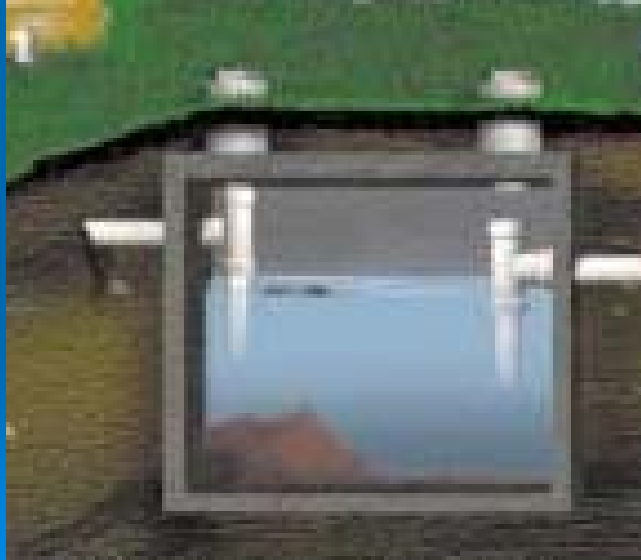
Residential Activity and Flow

Activity	Instantaneous Flow	Equivalent Daily Flow
Washing Machine	30 gpm	43,200 gpd
Draining Bath Tub	10 gpm	14,400 gpd
Shower and Sink	6 gpm	8,640 gpd
Low Flow Shower	2.5 gpm	3,600 gpd

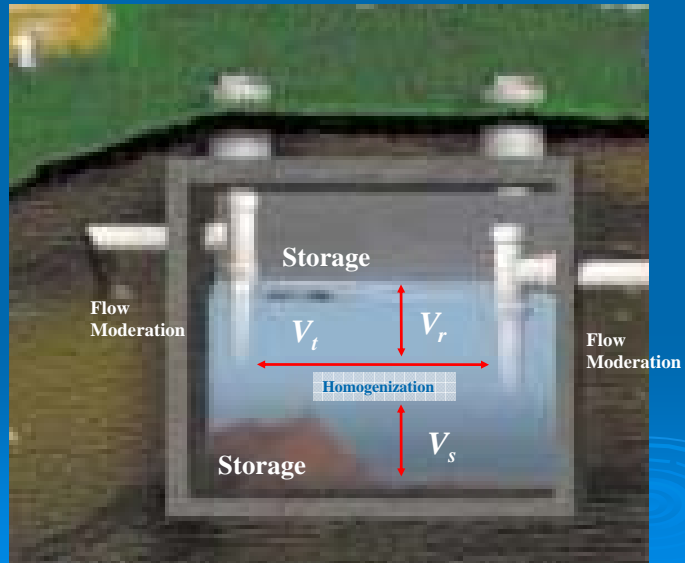
ATU and Trash Tank



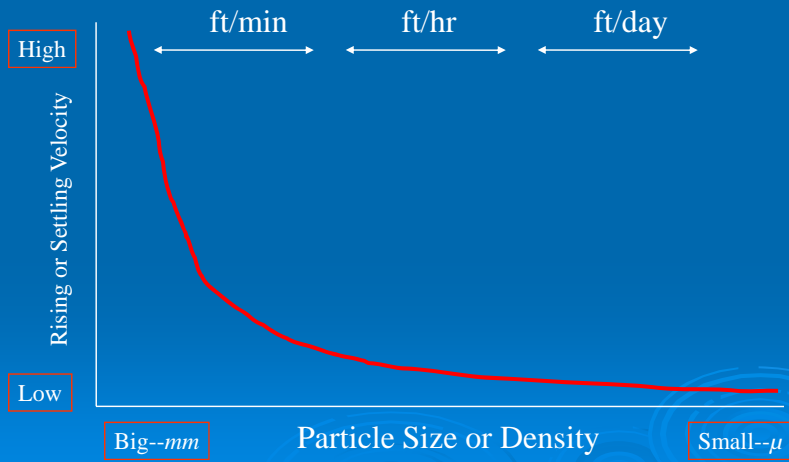
Trash Tank



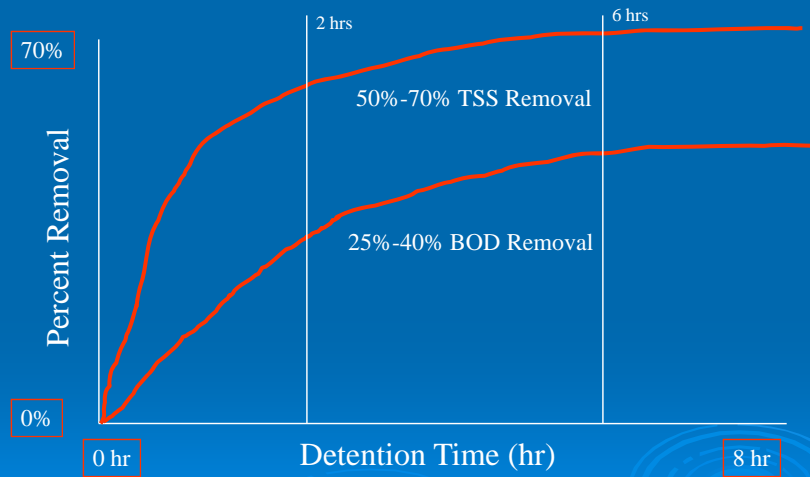
Trash Tank



Trash Tank



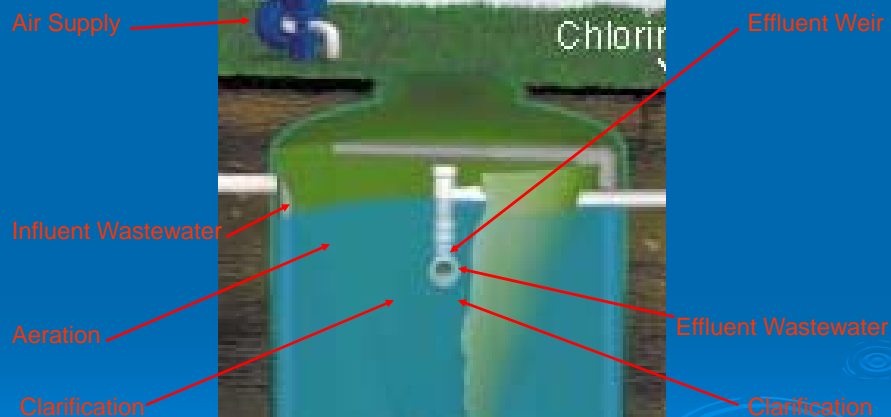
Trash Tank



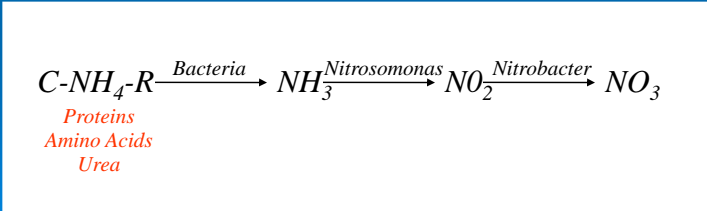
Trash Tank

High Flows
Allow Solids to be Carried Out of the
Trash Tank
And
Prevent BOD Removal from Reaching Its
Highest Efficiency

Treatment Tank

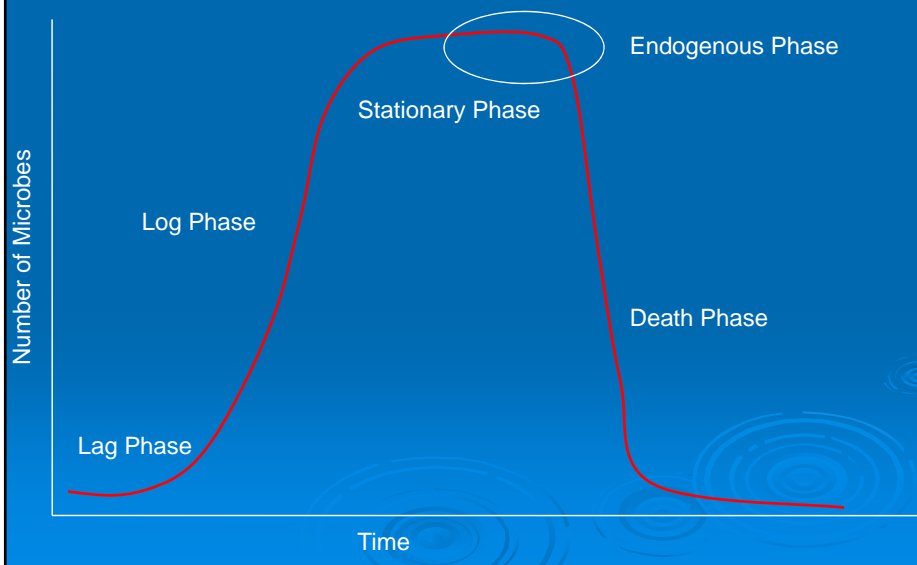


Treatment Tank



Nitrification

Treatment Tank



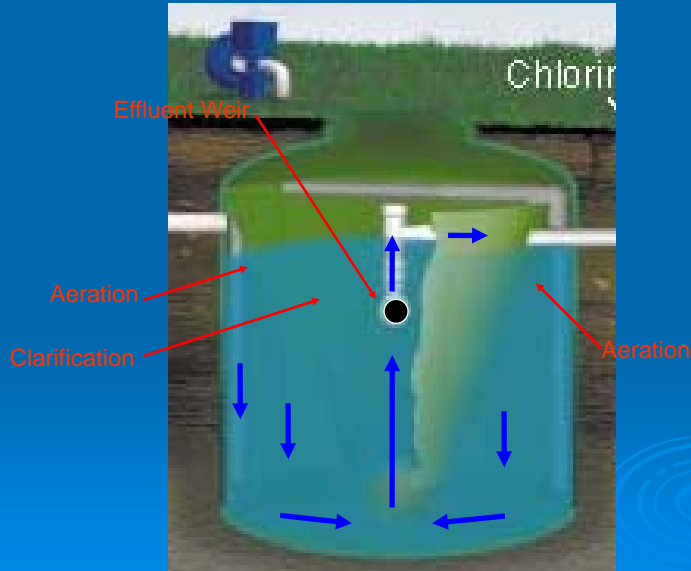
Treatment Tank

Parameter	Municipal Design	Observed in ATU's
Hydraulic Retention Time	3-to-5 Hours	10-to-24 Hours
Solids Retention Time	3-to-15 days	40-to-250 days
Mixed Liquor Suspended Solids	1500-4000 mg/L	2000-5000 mg/L
Oxygen Supply	1.2 lb/lb BOD 4.57 lb/lb TKN .04 lb/lb MLSS	.5-1.2+ lb/lb BOD 0-4.57+ lb/lb TKN 0-.04+ lb/lb MLSS

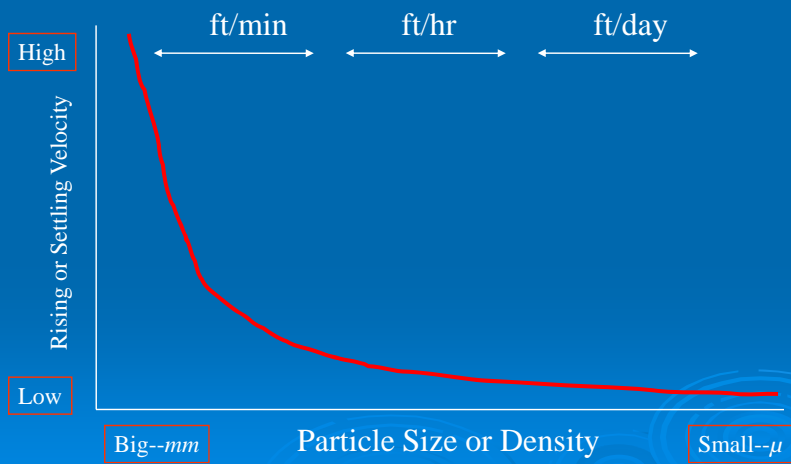
Treatment Tank High Flow

- Overwhelm Aerator
 - Incomplete BOD Removal
 - Exceed Effluent Limits
 - Odors!
- High Effluent BOD and TSS
 - Incomplete BOD Removal
 - Incomplete Settling of Sludge

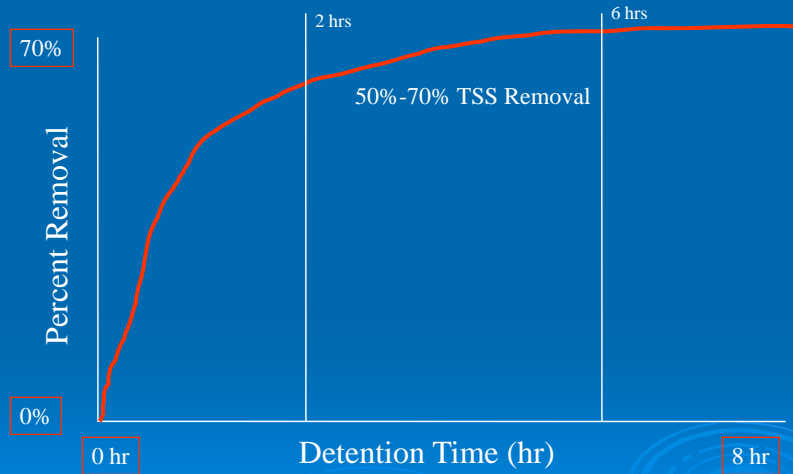
Treatment Tank Clarifier



Treatment Tank Clarifier



Treatment Tank Clarifier



Treatment Tank Clarifier

Parameter	Municipal Design	Observed in ATU's
Overflow Rate	200-to-400 gpd/ft ²	25-to-50 gpd/ft ²
Weir Loading	10,000 gpd/LF	30-to-1500 gpd/LF
Upflow Velocity	12-24 ft/hr	<u>8-100 ft/hr*</u>

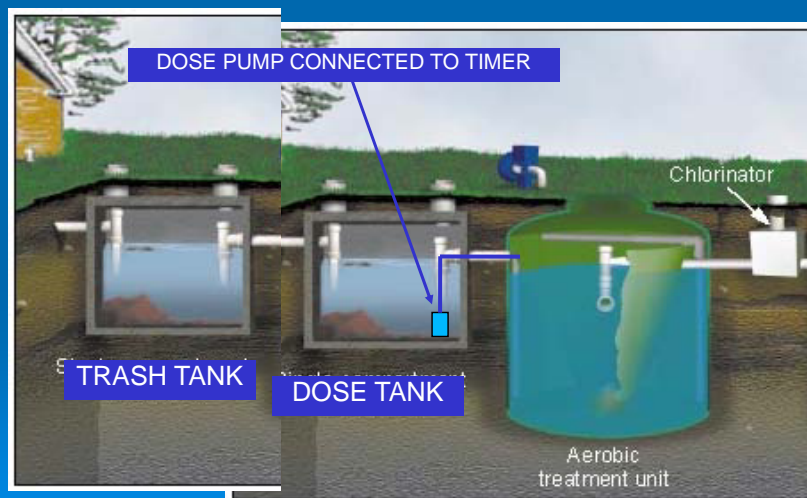
*Critical Design Factor

Treatment Tank Clarifier

High Flows
Allow Solids to be Carried Out of the
Trash Tank



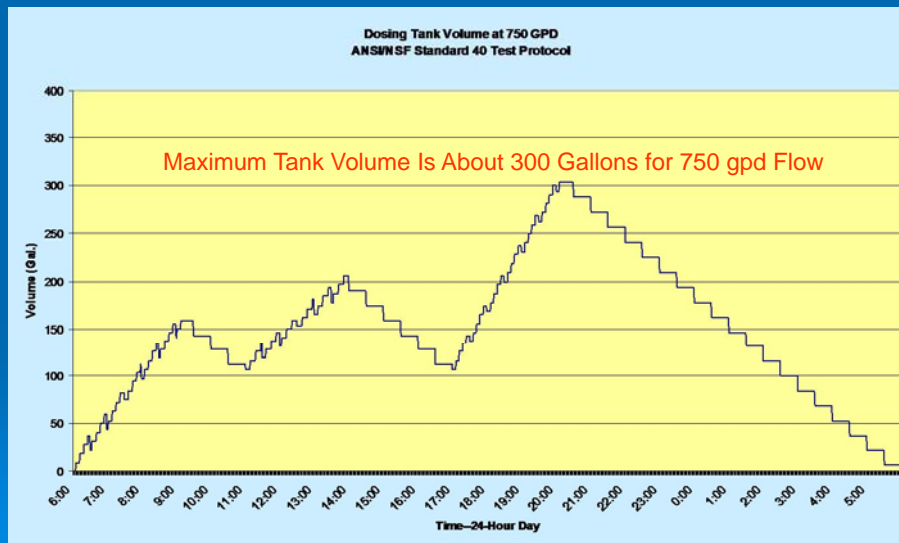
Flow Metering and Flow Equalization



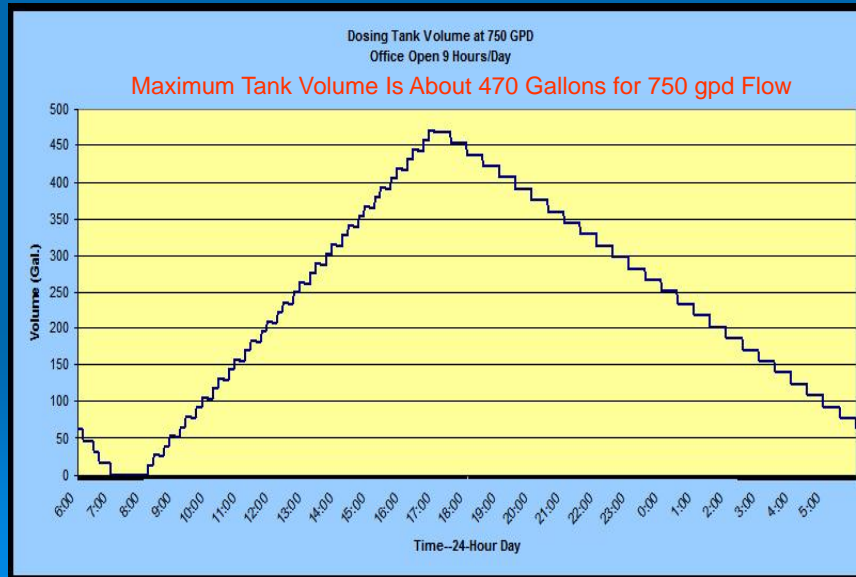
Control Strategy to Provide Flow Metering and Flow Equalization

- Distribute Dosing Over Longest Time Period—24 Hours
- Match Flow to “Assimilative Capacity” of the Treatment Tank—About 5 gpm
- Make Sure to Provide Adequate Storage for Highest Flows
 - Seasonal
 - Daily
 - Hourly

Provide Adequate Storage Residential Installation



Match Flow to Occupancy



Distribute Flow Over 24 Hours

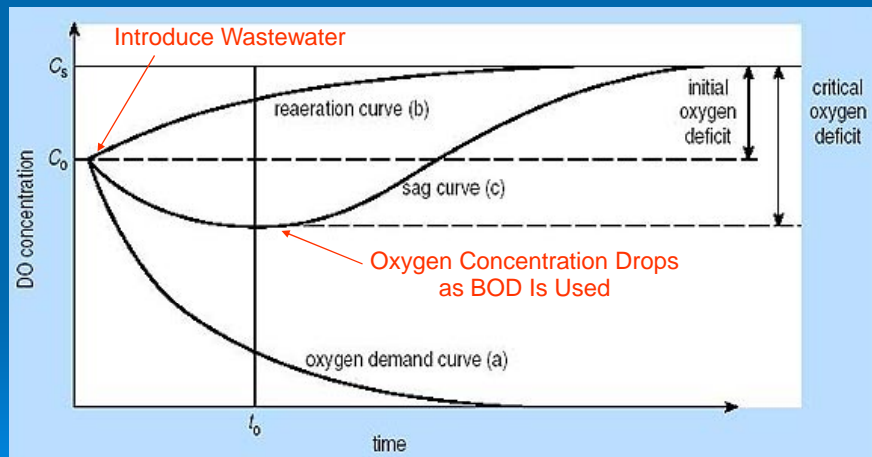
- Match Treatment Capacity of ATU
- Minimize Dose Volume
- Maximize Dilution/Homogenization of Wastewater
- Minimize Change in Treatment Tank

Flow Metering

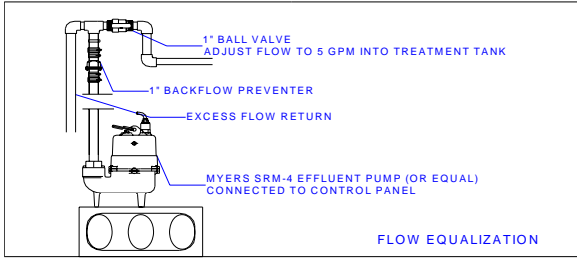
➤ Match Flow to “Assimilative Capacity” of Treatment Tank and Clarifier

- Match Wastewater Inflow with Oxygen Availability
- Do Not Exceed Critical Upflow Velocity

Match Wastewater Inflow with Oxygen Availability



Flow Metering and Flow Equalization



Flow Metering and Flow Equalization



Flow Metering and Flow Equalization



Flow Metering and Flow Equalization



Flow Metering

- Maintain Dissolved Oxygen at a Minimum 1 mg/L-to-2 mg/L
- Avoid Rapid Changes in Salinity or pH
- Avoid Lethal Concentrations of Toxic Substances

Potential Performance

	BOD	TSS	TN	TP
Influent	224	219	46	12
Effluent	≤ 10	≤ 10	23	8
% Removal	98	98	50	33

ATU Performance After Two-Months of Inactivity

- $\text{CBOD}_5 \leq 10 \text{ mg/L}$ after one day
- $\text{TSS} \leq 10 \text{ mg/L}$ after two days

Summary

- Flow Metering Manages *Rate* Wastewater Enters or Leaves a Tank
- Flow Equalizations Manages *Time* Wastewater Enters or Leaves a Tank
- Flow Metering and Flow Equalization Are Related But Independent Activities

Summary

- Meter Flow to Match the Assimilative Capacity of the Treatment Tanks
 - Oxygen Concentration
 - Particle Velocity
 - Salinity—pH—Toxicity—Concentration
 - **Maximize Treatment Performance**

Summary

- Equalize Flow to Match Tank Volume with Occupancy Flow
 - Identify Minimum, Average, and Peak Flows
 - Identify Diurnal Flow Variation