INCORPORATING FLEXIBILITY AND ROBUSTNESS FEATURES INTO AN OWTS

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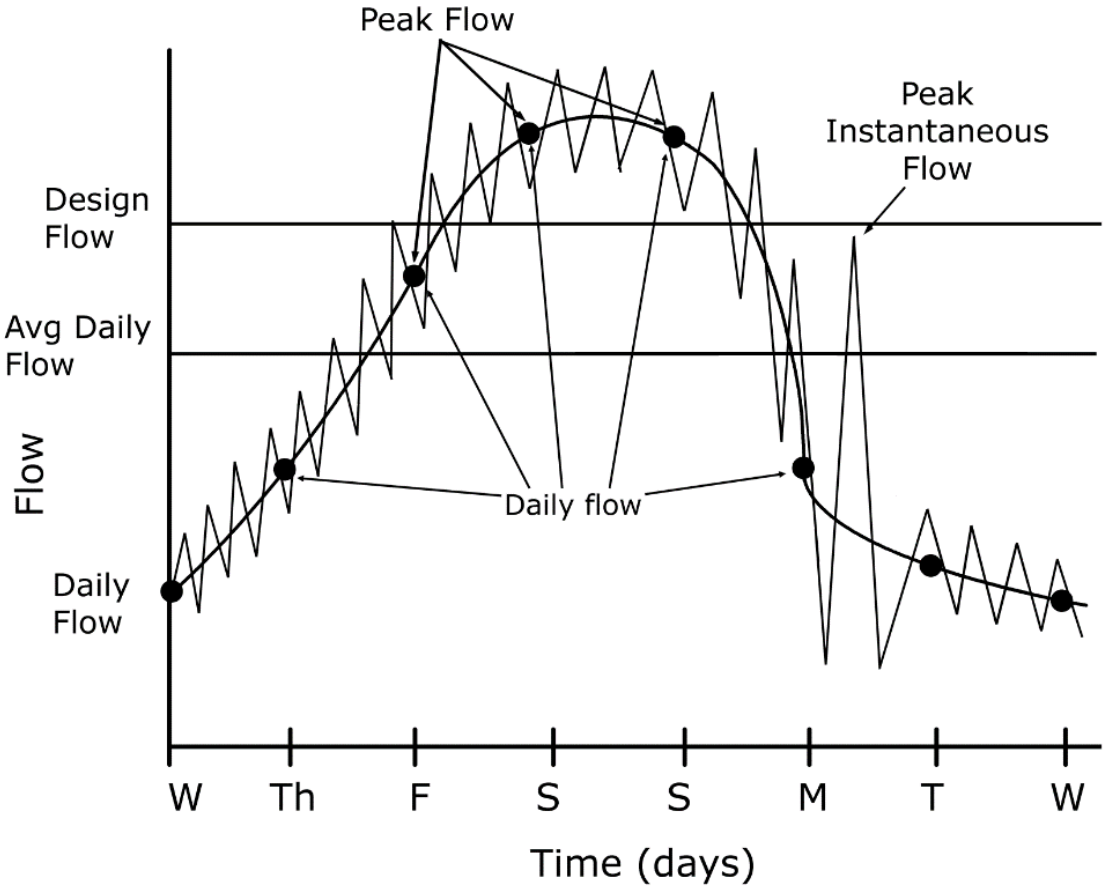
Overview

- Flow management options
  - Flow equalization
  - Flow splitting
- Waste treatment management options
  - Component arrangement
  - Anaerobic treatment tanks
  - Separation of sources
- Microbial environment management options
- Pumping management options
- Recovery features

Variable loading facilities

- Undefined retail space - rental building with multiple rental spaces
- Large warehouse facilities
- Restaurant facilities
- Convenience stores
- Travel centers
- Super markets
- RV parks
- Short-term rental facilities

Flow descriptors



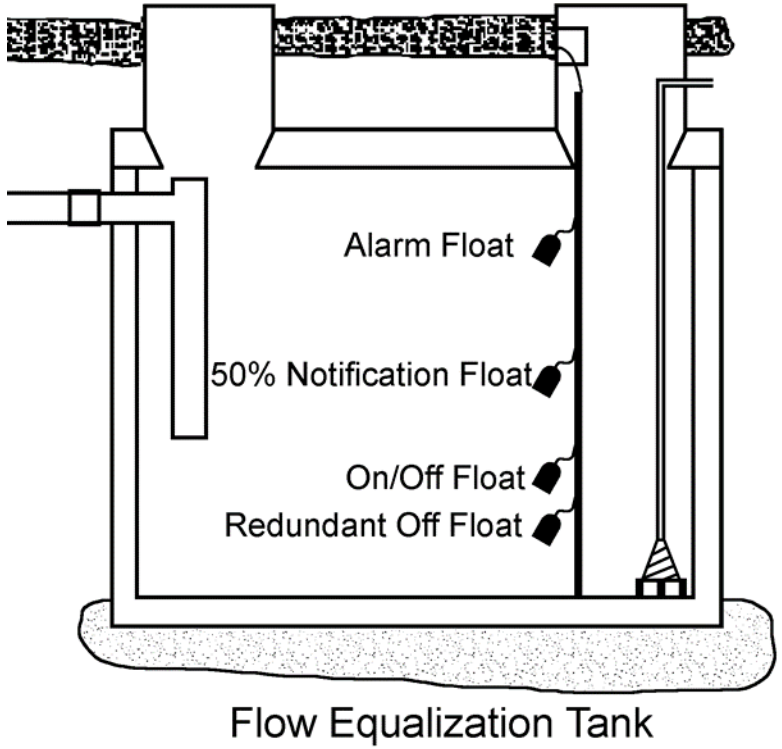
- Design flow
- Permit flow
- Average daily flow
- Peak flow
- Peak instantaneous flow
- What flow value is largest – "DESIGN"
- Design = permit divided by safety factor

Controlling flow from a facility - owner

- User controls water usage to match system capacity
  - No large water using devices
  - High water use days.
- User controls organic loading to match aeration capacity
  - Distribute organic matter
  - Slug flow from RV unit holding tank

Flow equalization/surge tank concept

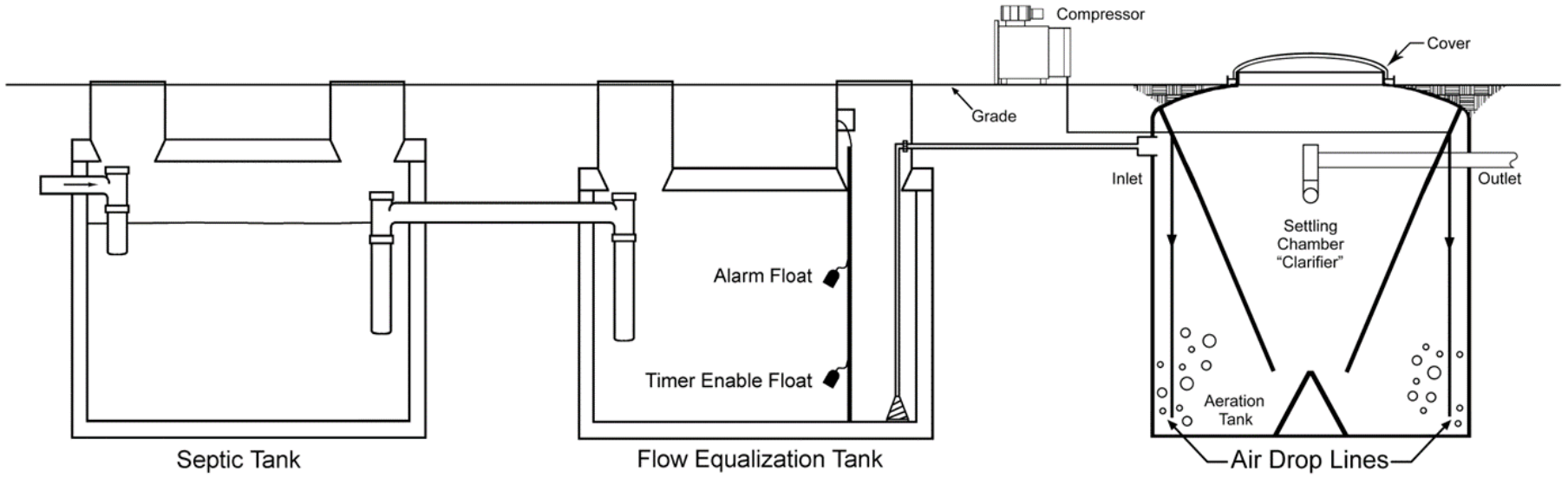
- Moderate flow through treatment train
  - Daily fluctuations
  - Weekly fluctuations
- Up stream components
  - Sized for peak flow rate
- Down stream components
  - Function more effectively
  - May allow decrease size



Flow Equalization Tank

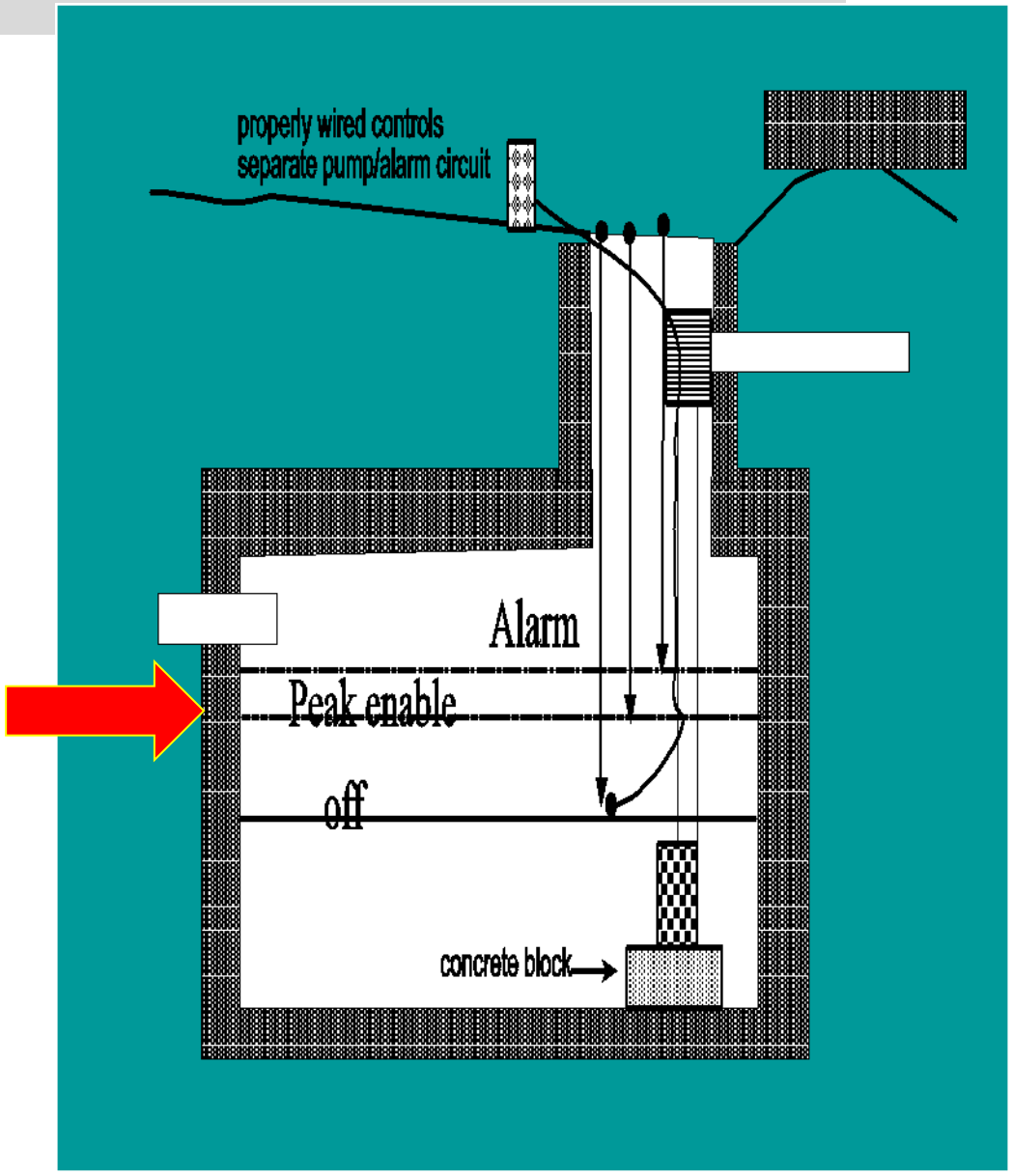
Incorporating flow equalization

- Modify the treatment train by adding components
- Add an additional tank between the trash tank and treatment components
- Upsize trash tank to meet peak flow requirement/full size septic tank, add pump with timer controls to dose treatment



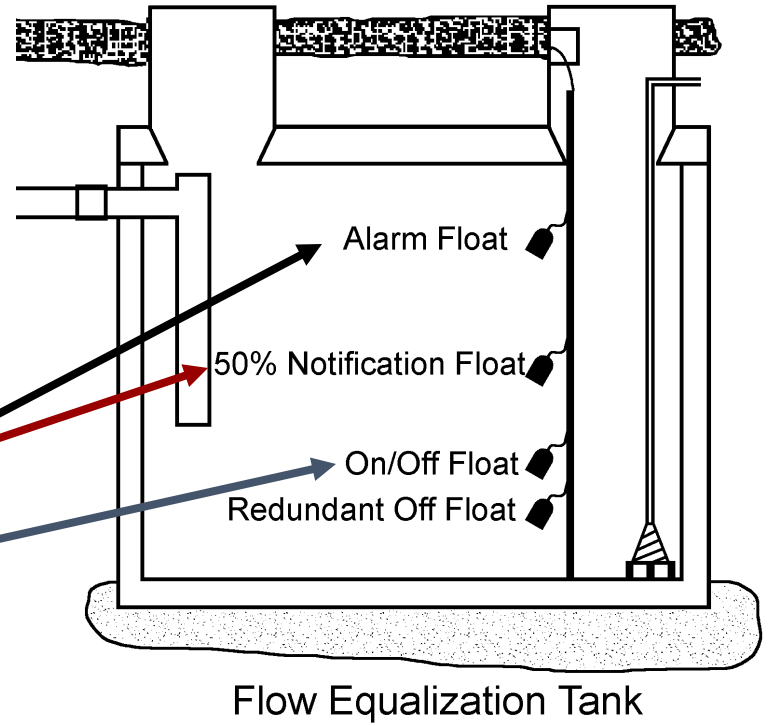
Sensor functions

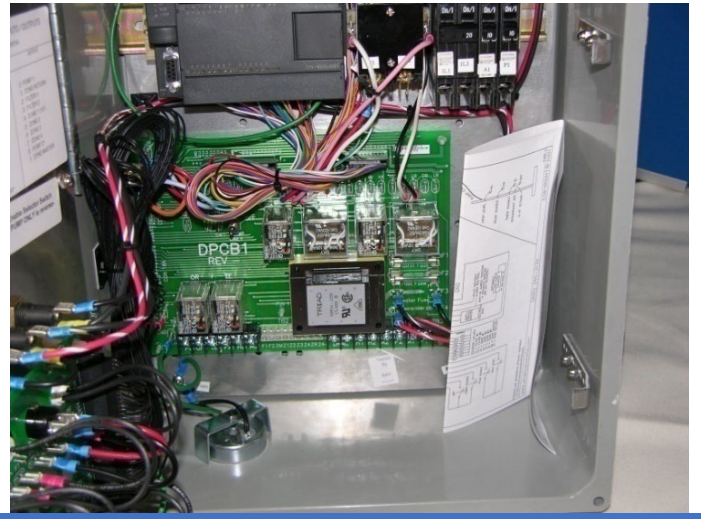
- Off
  - Turns timer off
- On
  - Timer operates the pump
- Alarm
  - Turns on the alarm
- Peak enable (override timer)
  - Changes the dosing frequency (PLC) – shortens the "off" time of dosing cycle
- Amber alarm
  - Management response to extra water



Control panel needs

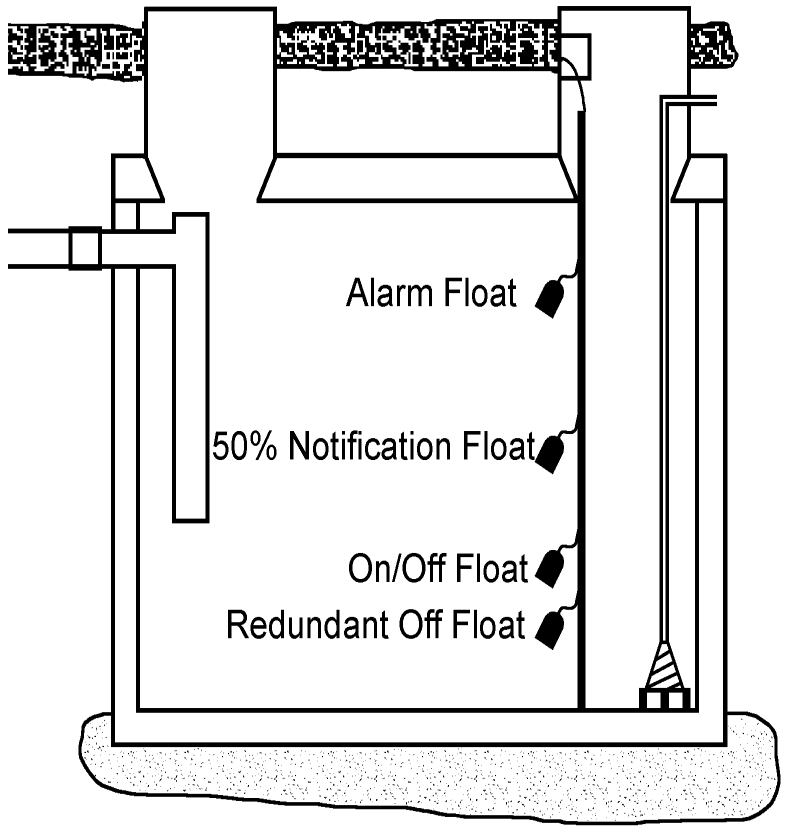
- Track doses
- Track time of pump operation
  - Flow measurement
- Track peak enable - design flow
- Track pump off events
  - Set flow too HIGH
- Track alarms
  - Set flow too LOW





Flow equalization tank & haul

- Lower the extreme peak
  - Special events
- Infrastructure too costly for treatment of liquid from special event due to extreme flow/strength
- If the peak flows only happen a few times a year
- Pump the extra flow from surge - equalization tank



Flow Equalization Tank

Portable toilet & haul

- Decrease flow
  - Facility with hydraulic issues
- Too costly for infrastructure needed for special event
- Meet a special need
  - Special events

Managing downstream flow

- Restricting flow rate leaving equalization tank
  - Recycle water to tank (change system flow)
  - Restricting valve (change system pressure)
- Distribute water to multiple treatment units
  - Flow splitting
    - Horizontal distribution box
    - Vertical distribution box
    - Orifice plate/cap

Flow splitting - multiple functions

- Split flow between components
- Uniformity of splitting – required accuracy
- Accuracy/efficiency is directly related to loading rate
- Permitted rate = design rate
  - Accuracy/efficiency = 100%
- Permitted rate = 70% of design rate
  - Accuracy/efficiency = 70%

Flow equalized loading > 70%

Flow splitting flexibility

- Change flow rate to individual components
- Isolate treatment components
  - Stop flow to individual units
  - Perform routine maintenance or remove from train while repairs are performed
- Add additional treatment units to treatment train
- Ability to determine accuracy of flow splitting system during maintenance visit: liquid level, pressure testing

Flow splitting O & M

- What is required to keep the flow splitting method operational
- Vulnerability to malfunctions
- Ability to adjust the flow rates

Distribution box

Distribution box connects to multiple treatment units

Stilling pipe inlet with flow control. Five outlets.

Vertical weir

- Single inlet
- Multiple outlet pipes to downstream components
- Adjustment vertically to have uniform distribution to downstream components
  - Visual verification of the liquid level at the overflow piping top edge
  - Brushing solids from the top edge of piping to remove accumulated biomass
- Leave room for treatment component expansion

FLOW SPLITTING

Orifice

- Plate orifice – similar to a washer
  - Stainless steel orifice
  - HDPE orifice
- Drilled orifice – threaded PVC cap
- Located in a pressure manifold system for splitting flow
- Change flow rate – change orifice
- Manifold should be at a high-point in piping system
  - Uniform pressure to multiple orifices
  - Drainage to treatment units

Pipe orifice manifold

Pipes to each treatment unit

Pipe orifice manifold with line to each unit

Stereotyping waste stream

- Remember EVERY FACILITY IS UNIQUE; an OWTS treatment train that works for one may not work for another
- What is a comparable facility?
- Heavily influenced by facility management
- Evaluate whether the facility is operating at assumed design values.

Recording flow

Sampling BOD & FOG

Relationships – ten marble example

Scenario	10 Marbles in a 2-liter bottle	10 Marbles in a 1-liter bottle
Hydraulic loading	2-liters	1-liter
Concentration	5 marbles per liter	10 marbles per liter
Organic loading	10 marbles	10 marbles
Sizing of OWTS	10 marbles	10 marbles
Controlling loading	Organic	Organic

Water conservation removes liquid, not waste

Flexibility in treatment train

- Because it is impossible to determine exact wastewater quality and quantity of a new facility
- Design the system for potential expansion
  - Piping between components
  - Space between components
  - Multiple anaerobic tanks in series
- Leave room for treatment component expansion

FLOW
SPLITTING

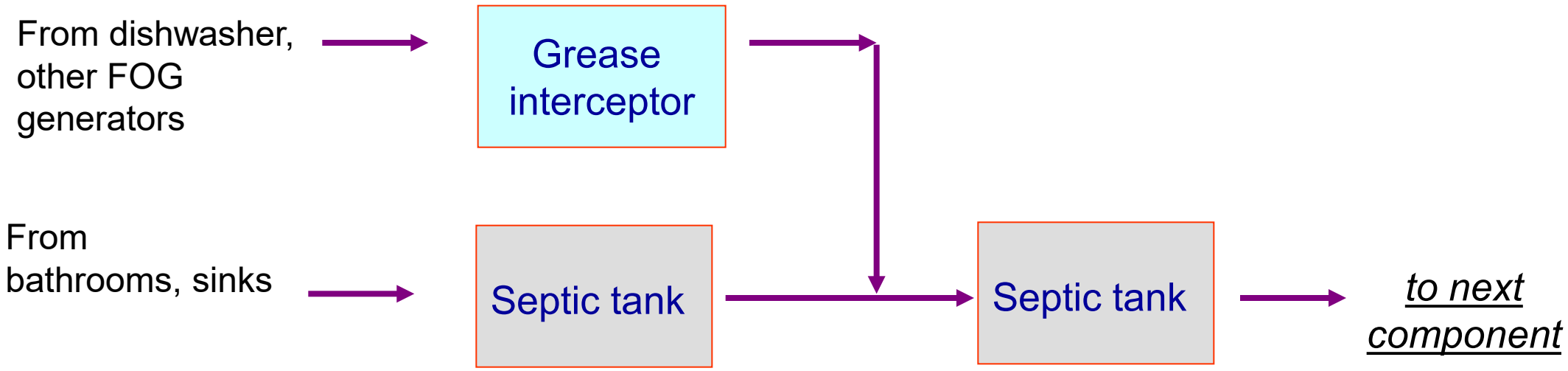
Tanks in series

- Trash tank - sized based upon pump truck capacity
  - Captures trash in waste stream
- Septic tank (first)
  - Anerobic digestion
  - Effluent screen
- Septic tank (second)
  - Flexible purpose tank: anaerobic, IFAS unit, recirculation tank
- Surge tank: aeration for mixing and dissolved oxygen in liquid

Effluent screens

- Additional removal of solids in anaerobic treatment tanks
- Should prevent the passage of solid particle larger than a nominal 1/8 - inch diameter sphere
- Lowers risk of TSS moving down stream
- Cleaned regularly
- Frequent clogging of the effluent screen may indicate need for changes in the facility water management or OWTS

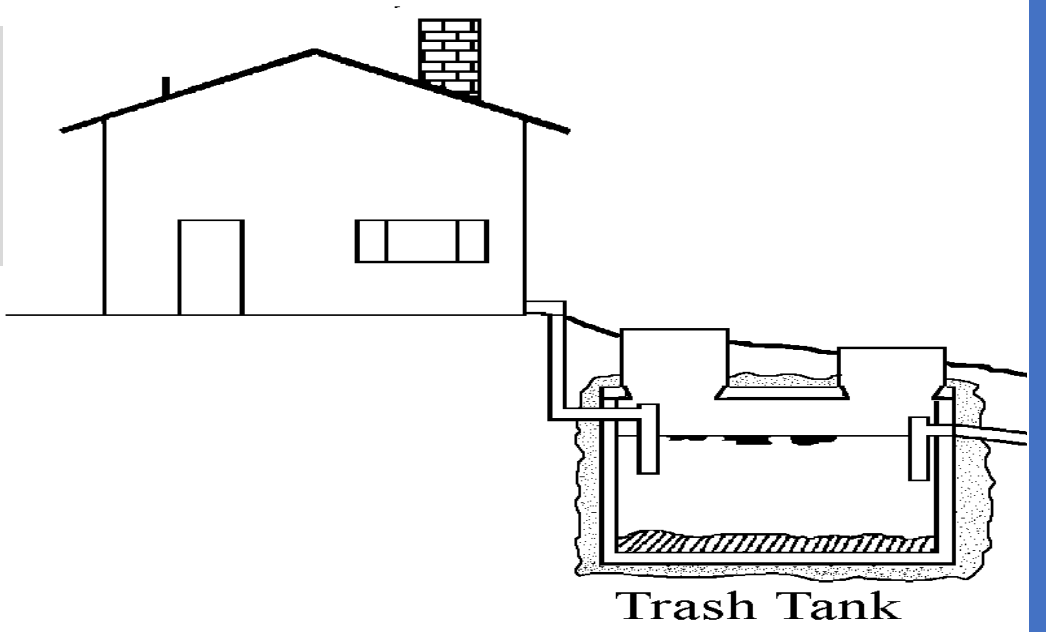
FOG temperature moderation & retention



- Multiple tanks in series
- Pipes passing through cool soil
- Separating waste streams
- Blending waste streams, always combine in anaerobic tank to minimize FOG moving downstream

Separation of businesses

- Retail space - strip mall
  - Multiple stores
  - Different sources
  - Variable types of facilities/renters
- Initial trash tank for each renter unit/facility
  - Flexibility
  - Identification of user issues
- Rental contract tied to wastewater quality & quantity

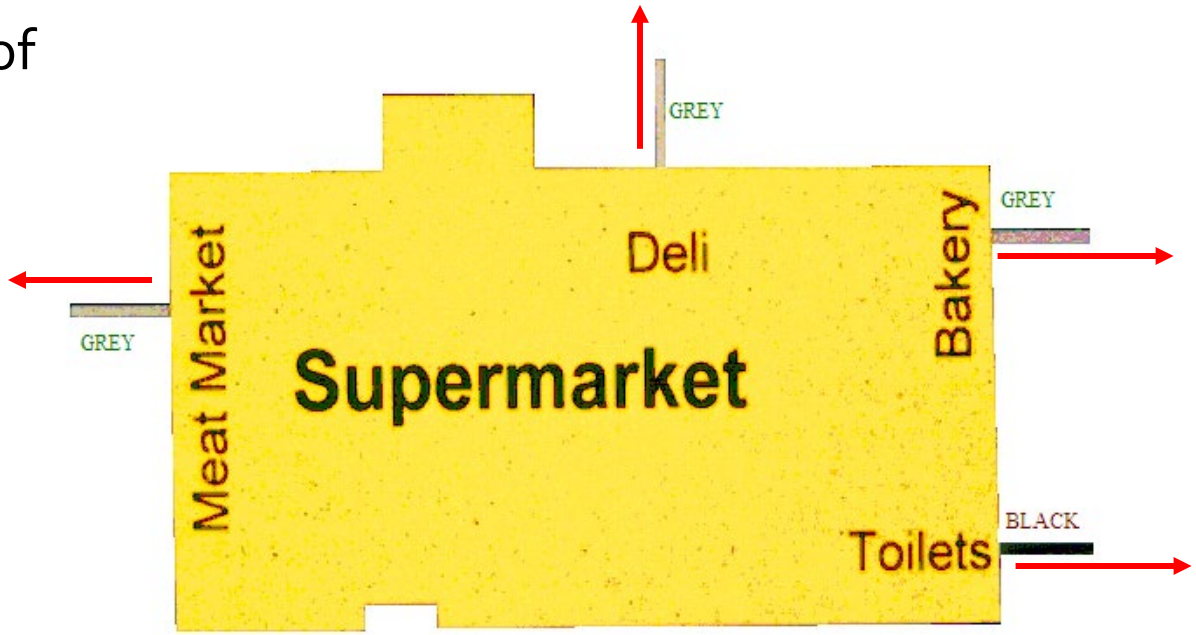


Flow equalization system – mass loading for a healthy microbial environment

- Regular feeding of the hungry population of microbes that are used for treatment, controls organic loading.
- Regular water movement maintains desired dissolved oxygen concentration in tanks/chambers
- Regular resting periods
  - Facilitate consumption of available organic matter
  - Settling of suspended solids
  - Maintains a low food to microorganism concentration
- Aeration of liquid to increase dissolved oxygen concentration of liquid, lowering risk of temporary dissolved oxygen depletion in treatment units

Diversity of flows from a supermarket

- What are the potential sources of waste in a supermarket: coffee shop, bakery, meat market, restaurant, etc.
- Multiple discharges facilitates separation of waste streams
- Evaluate treatability of each waste stream
- Identify contaminants of concern
- Management options for changing contaminant – alternative cleaning agents

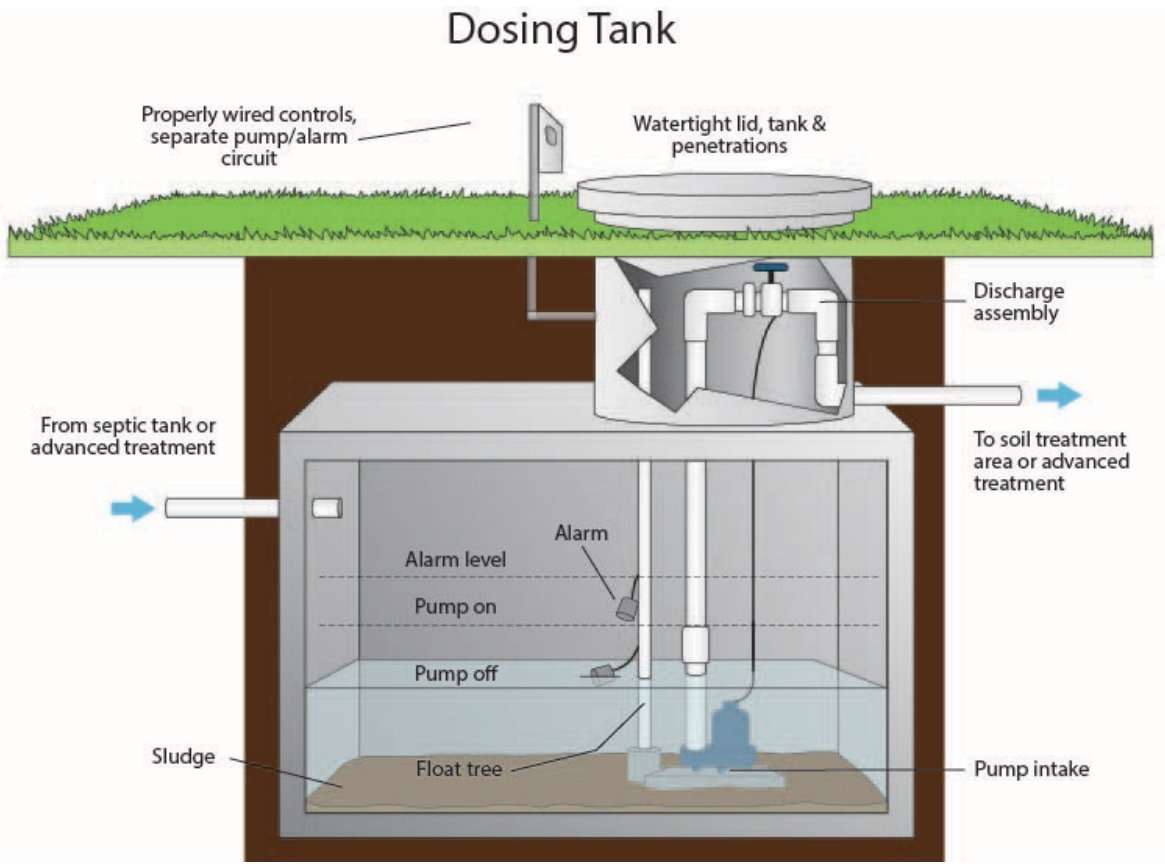


Wastewater source separation

- May be economically beneficial to treat a waste stream separately or hold and haul it away.
  - Streams with very high chemical use that negatively affect the treatment system.
  - Floor drains, utility sinks, laboratory drains, disinfecting basins and dishwashers
  - Streams that require a long detention time for digestion and/or deactivation of chemicals

Hold & dose

- Some chemical products mus be contained in a separate tank and introduced into the system in small doses
- Add deactivation chemicals fo neutralization of contaminan



Time dosed to treatment train

Hold & haul

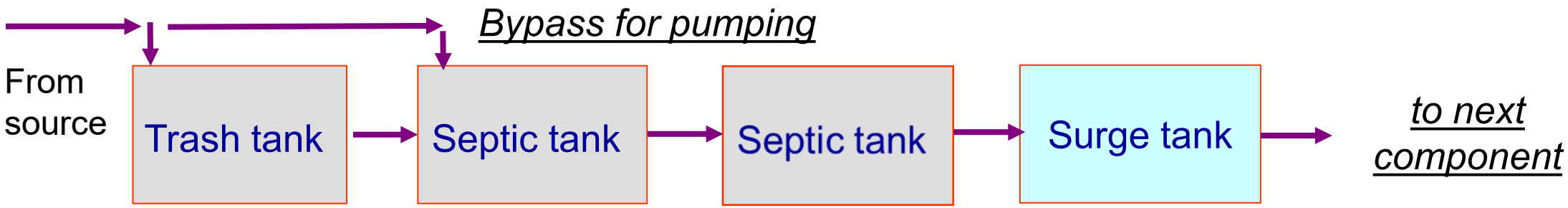
- Can wastewater treatment system tolerate the chemical?
- If contaminant cannot be treated: hauled for offsite disposal
- Enhanced nitrogen reduction systems depend on microorganisms sensitive to chemical contamination

Photo by Craig Jowett

Microbial environment management options

- Remove inhibitors of healthy growth
- Dissolved oxygen management
  - Maintenance of aeration system
  - Adjusting recirculation ratios
  - Adjusting air flow to air lift pumps
- Alkalinity management – maintaining an appropriate pH
  - Limestone in contact with aerated liquid
  - Soda ash dosing
- Enhanced denitrification through carbon management
  - MicroC® dosing
  - Methanol, ethanol, acetate, glycerol dosing
- Enhanced biological phosphorous removal processes
  - MicroC 2000® dosing

Pumping management options



- Trash tank
  - Sized based upon pump truck
  - Captures trash in waste stream
  - Must be emptied to remove the sludge collected at bottom of tank
- Pumping management
  - Frequent pumping of trash tank to limit TSS movement downstream
  - Bypass line allows temporary waste stream diversion when pumping
  - Limits the pumping frequency of downstream components
  - Potential to reduce the overall pumping costs for the treatment system

Recovery features

- Recovery features need to be incorporated into the design of commercial systems that will treat high strength wastewater
  - Treatment components
    - Aeration of media systems
  - Final treatment and dispersal components
    - Mechanical filtration of liquid entering pressurized piping networks
    - Flushing of piping networks
    - Aeration of soil systems

Summary

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  - Flow splitting
- Waste treatment management options
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- Recovery features