

# HIGH STRENGTH WASTEWATER MANAGEMENT

Addressing the challenge with  
design, installation, operation and  
permitting

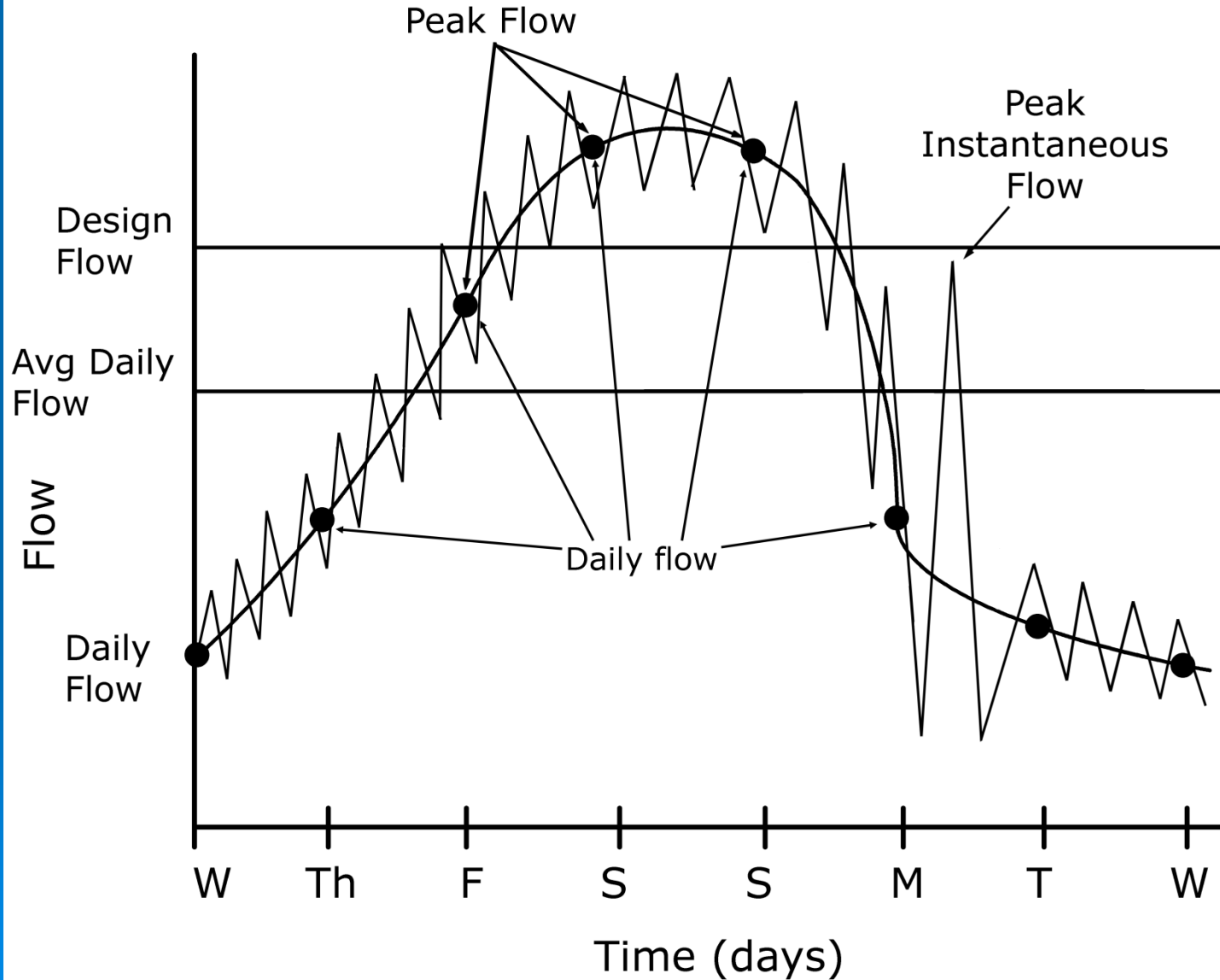
Bruce Lesikar

The background of the slide is a solid blue color. In the lower right quadrant, there are several faint, concentric circular ripples, resembling water droplets or raindrops, which are a lighter shade of blue than the background.

# What we will learn

- What is Flow management
- Evaluating flow for design
- Choosing the right size tank
- Begin thinking “out of the box” when evaluating system malfunctions due to high strength waste to derive a solution unique and specific to the system.
- Understand common causes of system malfunction so that they can be properly managed
- Performance based permitting

# Variation in flow



# Managing hydraulic loads

- Need to determine the length, timing and volume of peak flow.
  - Residential typically diurnal pattern
  - Restaurants typically about 2 hours after lunch and dinner.
    - Clean up time
  - But you need to consider that the water use habits may not be “typical”

# *Data required*

## Flow characteristics:

- Average daily flow
- Peak flow
  - Regular highs
  - Weekly
  - Monthly
- Special occasions
  - How often: annually/ bi-annual, monthly?

Cash flow and  
hydraulic flows  
are related



# Water use habits

- To permanently reduce flows and peaks, water use habits must change.
- Educate system owners
  - Constant changes
- Help system owners see the \$\$\$\$ benefit to managing water use
- Need a good working relationship with owner

# Water saving devices

- Decrease the flow rate
- No effect on the overall organic load

***Allows for OVER-use***





# Flow equalization systems

- Makes the flow introduced to the treatment system more consistent. ***Uses 24 hours***
- Flow equalization is important if:
  - The average daily flow is  $\geq 70\%$  of the design capacity
  - Water use habits or facility operations are variable-
    - Example: church only open on Sun.
  - Frequent peaks exceed system capacity
    - Wash day: cleaning service

# Other benefits of a flow equalization system

➤ Monitoring of flows from the surge tank may help detect

- major changes in flow patterns
- leaking effluent
- clogging orifices

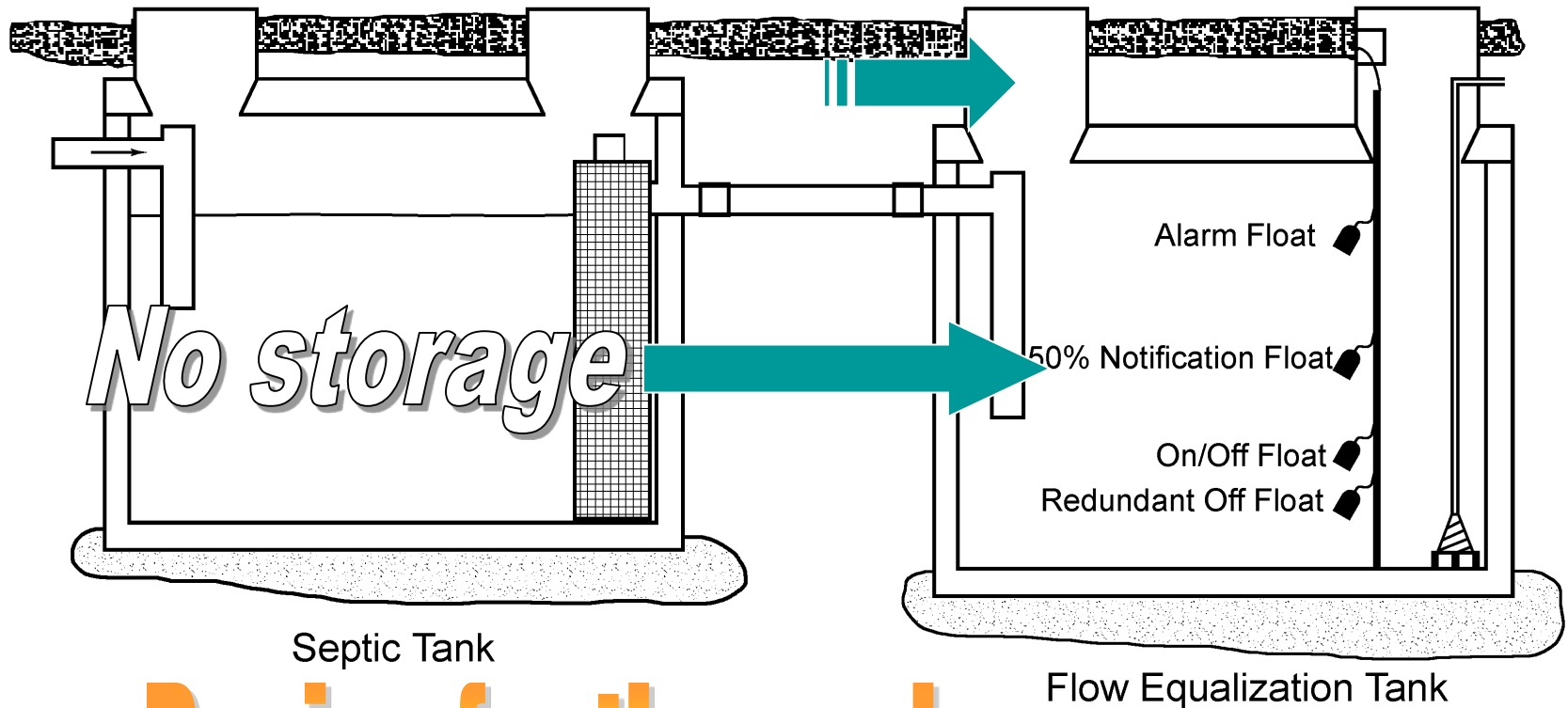
*Uses 24 hours*

➤ Provide storage and spread out water delivery after a power outage.

➤ Regular feeding the hungry population of microbes that are used for treatment.

➤ Regular resting

# Flow equalization tank

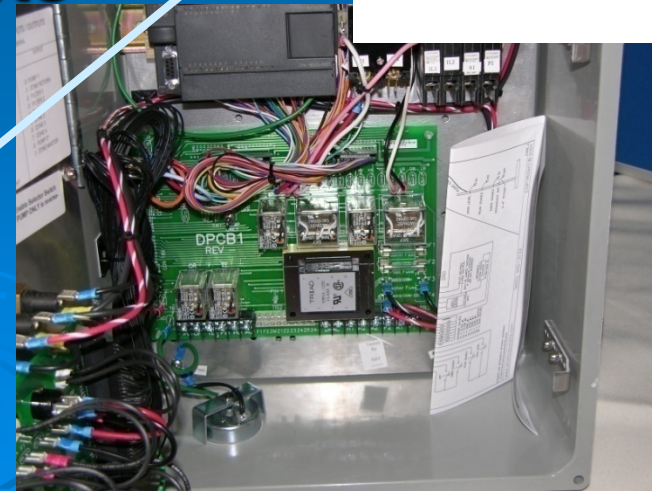
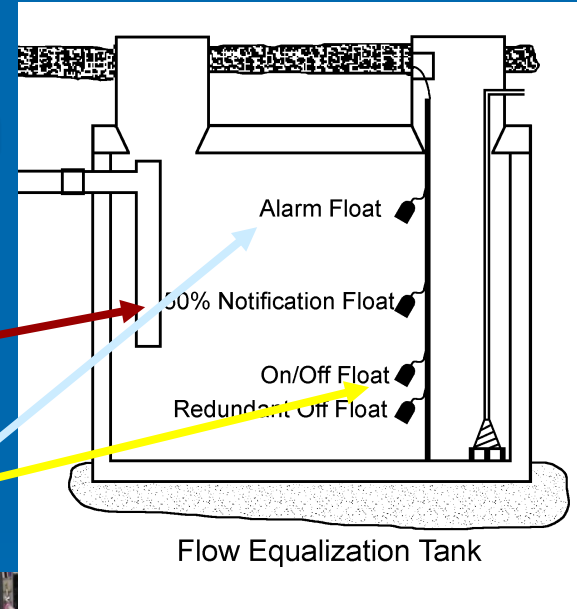


**Design for the peak**

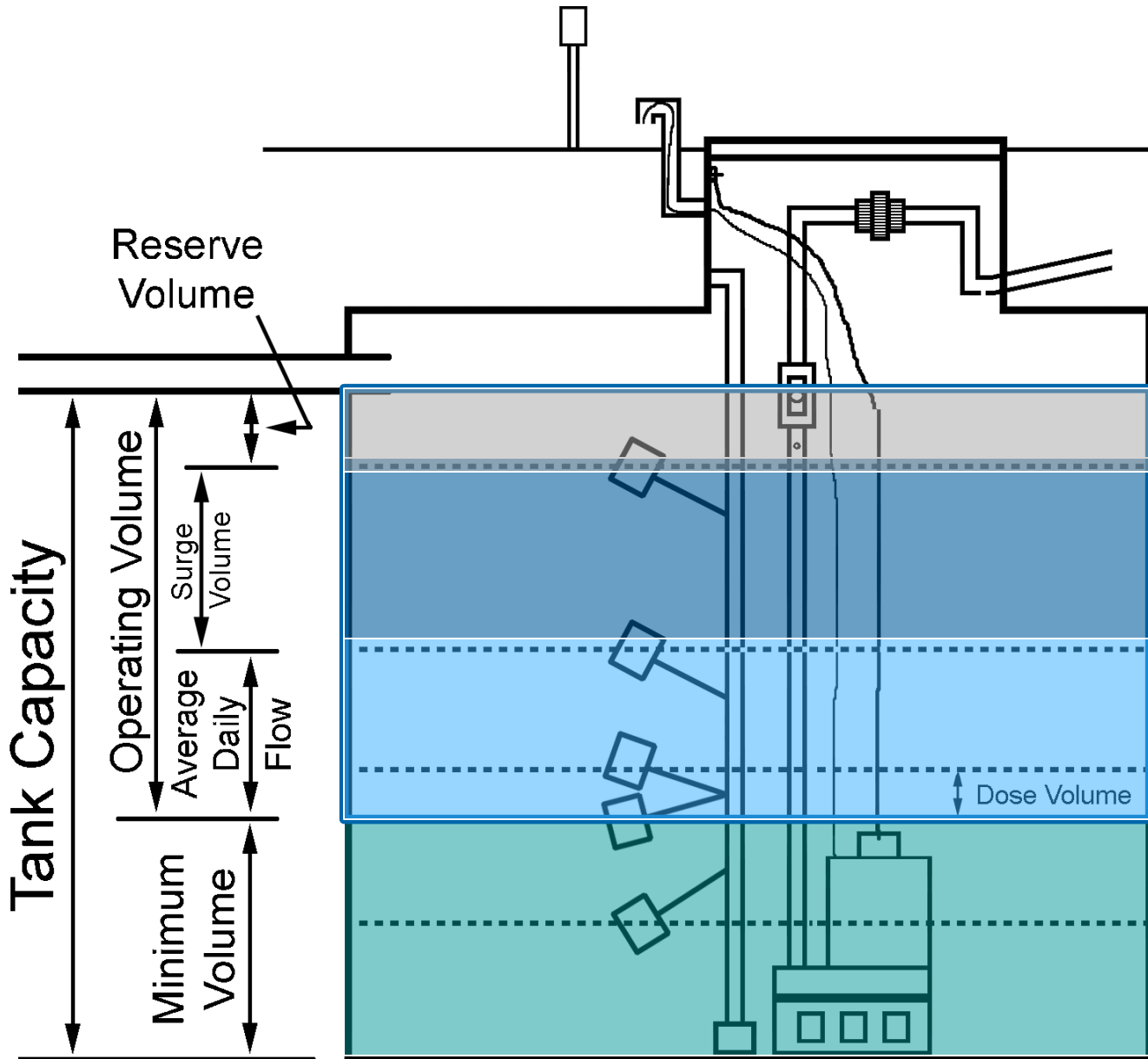
# Control panel needs

# Timer

- 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

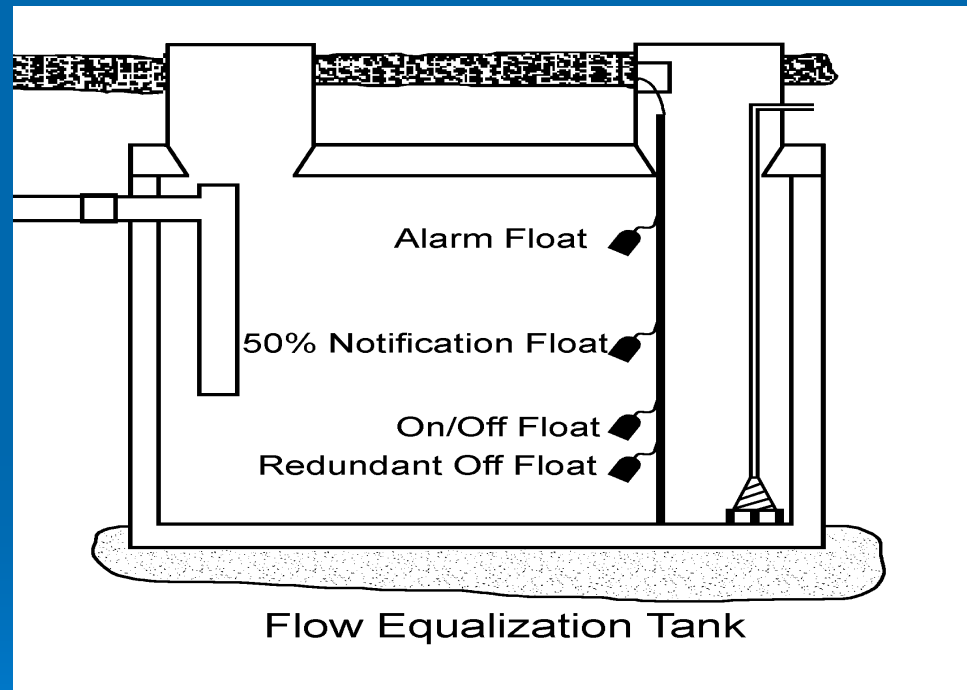


# Required volumes



# Calculating for commercial

- Measure the flow
  - Read meter
  - Calculate flow
- Calculate volume in tank
  - Daily flow - timed dose
- Necessary storage
  - Surge volume
  - Storage volume [surge volume + avg.]
- Operating volume
  - Storage volume + reserve volume
- Tank capacity
  - Sum all necessary volumes [min.+ operating]



# Flow controlled by surge tank

Day	Daily flow (gal)	Timed dose (gal)	Surge vol. (gal)
Monday	250	350	600
Tuesday	200	350	450
Wednesday	150	350	250
Thursday	200	350	100
Friday	250	350	0
Saturday	700	350	350
Sunday	700	350	700

Peaking 20%



# Storage volume

Storage volume = surge vol. + avg.  
 $700 + 350 \text{ gpd} = 1050 \text{ gallons}$

- Storage x peaking = design vol.
- $1050 \times 1.2 = 1260 \text{ gallons}$



Floats

90% tank depth

Alarm level

Peak Enabler / Amber Alarm (Optional)

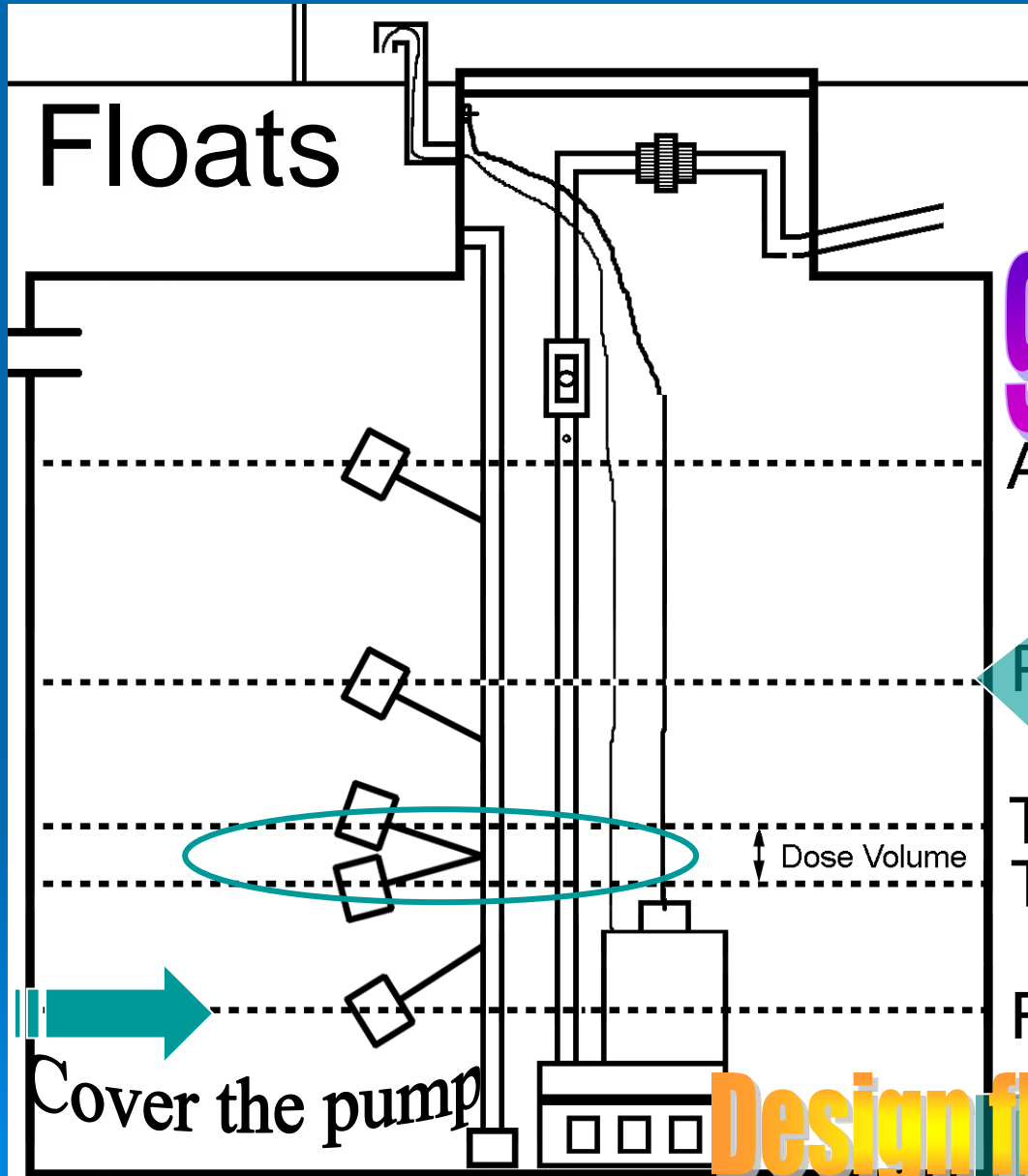
Timer Enable  
Timer OFF

Redundant OFF (Optional)

Dose Volume

Cover the pump

Design flow



# Annual event

- Single use service
- Portable toilets
- Washing schedule
- Pre cooking
- Clean up
- Pump extra capacity from tank

# Managing high organic loading

- Malfunction may be due to high organic loading
- Management considerations
  - Blackwater and graywater separation
  - Wastewater source separation
  - Holding tanks
  - Working with the owner

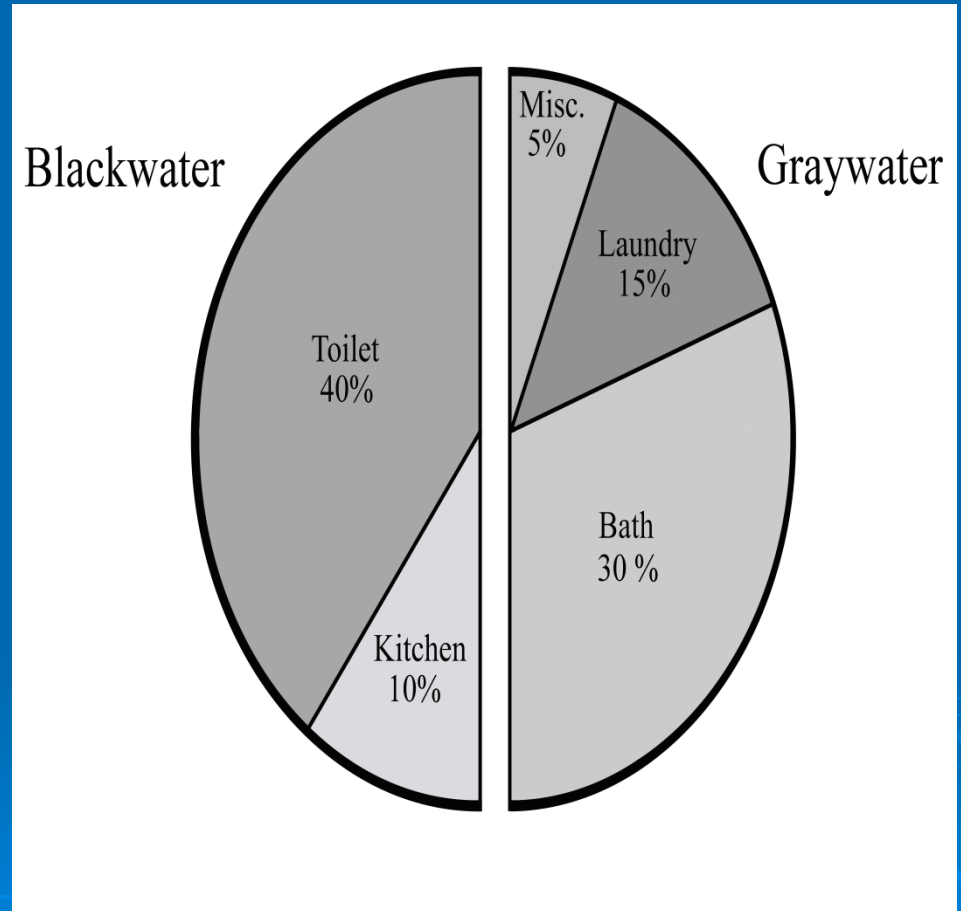
# Blackwater and graywater

## ➤ Blackwater

- Residential wastewater from toilets and food preparation areas
- Commercial - toilets
- Much higher in organic content

## ➤ Graywater

- Wastewater from all other sources
- Commercial - kitchen

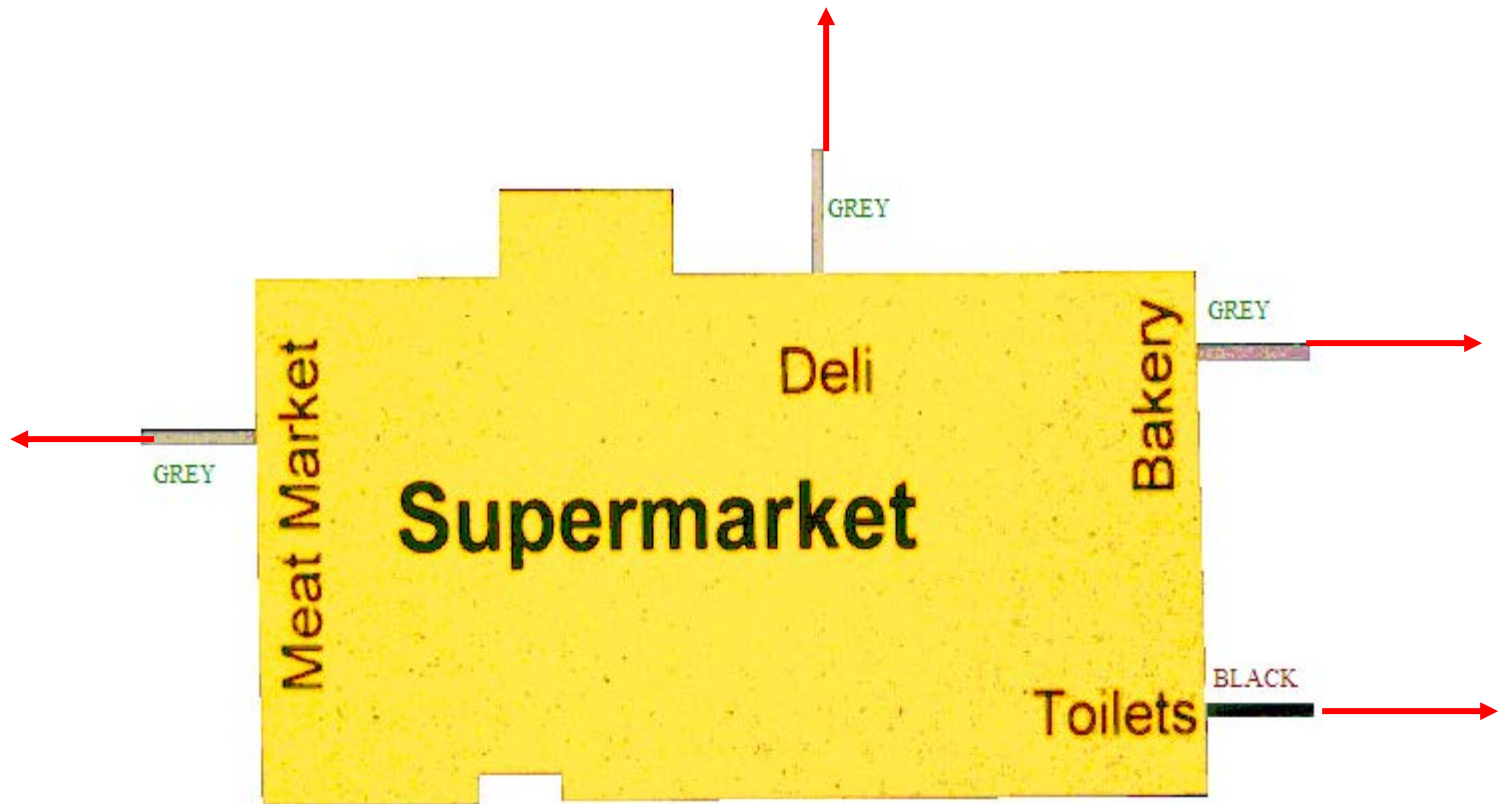


Residential breakdown – Commercial breakdown shifts

# Blackwater and graywater

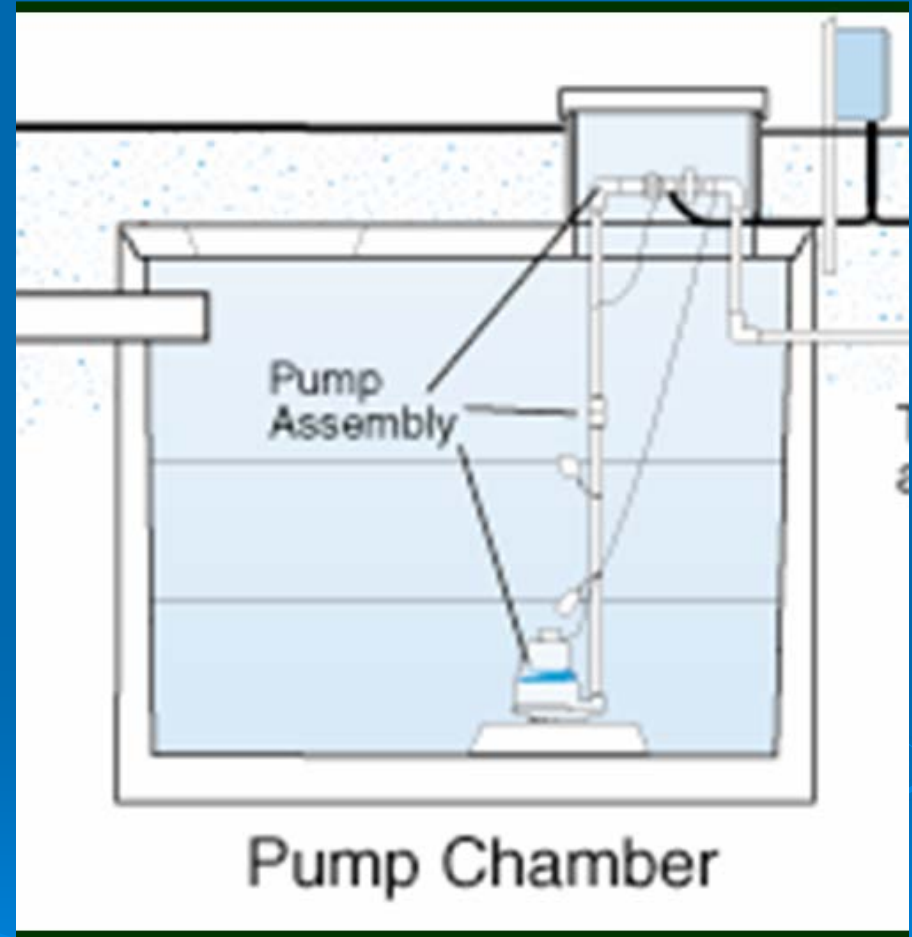
- Separation may not be a good idea:
  - Depending on the ratio of blackwater to graywater
  - If blackwater is not able to be treated without the dilution of graywater
  - If graywater contains a lot of harsh chemicals

# Diversity of flows from a supermarket



# Hold & dose

- Some chemical products must be contained in a separate tank and introduced into the system in small doses



Time dosed to treatment train

# 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 will negatively affect the treatment system.
  - Floor drains, utility sinks, laboratory drains, disinfecting basins and dishwashers
  - Streams that require a long detention time



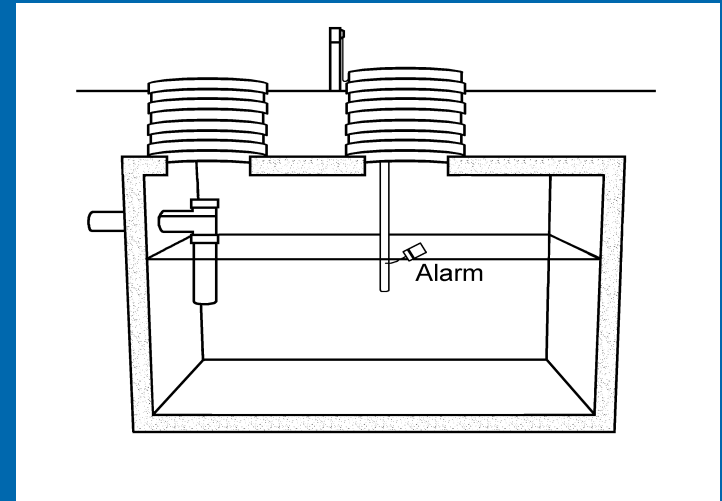
# Hold and haul

- Can wastewater treatment system tolerate the chemical?
- Option: hauled for offsite disposal



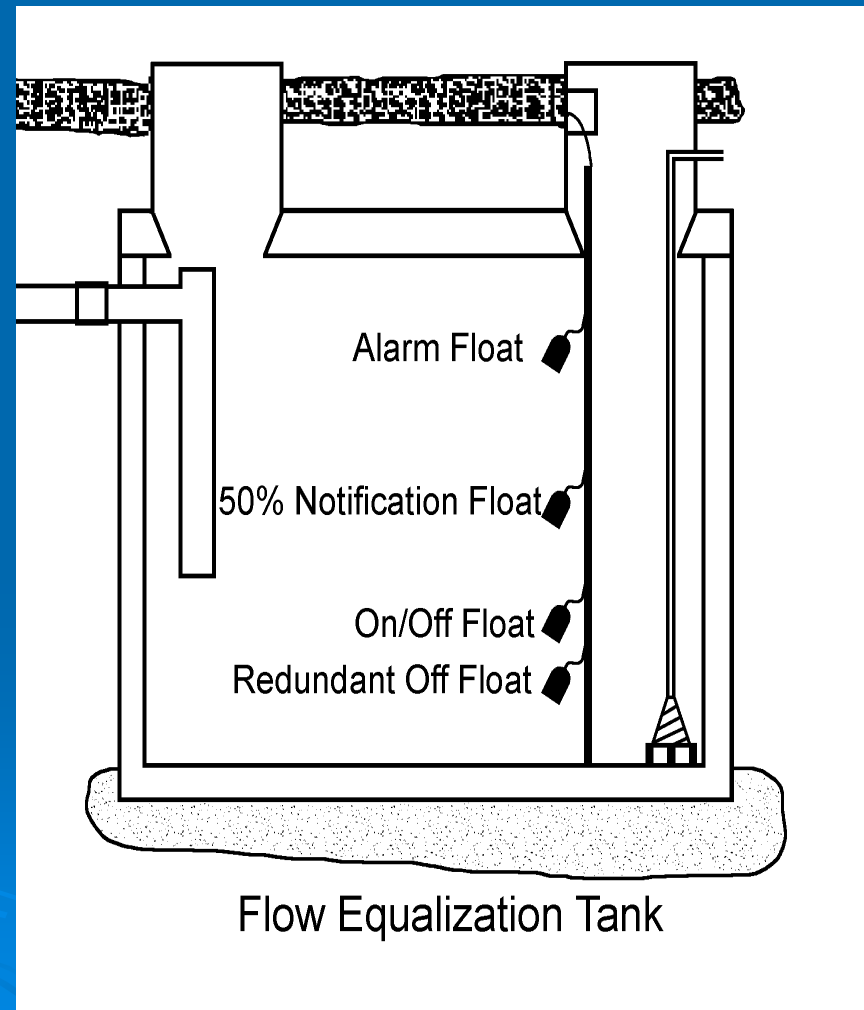
# Holding tanks & haul

- Must be pumped on a regular basis
- Sometimes a temporary fix
- Designed based on the capacity of the pump truck and their dumping requirements



# Flow equalization tank & haul

- Lower the extreme peak
  - Special events
- Too costly for infrastructure needed for special event extreme flow/strength
- If the peak flows only happen a few times a year
- Pump the extra flow from surge - 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



# Separation of Businesses

- Strip mall
  - Multiple stores
  - Different sources
- Initial tank for each facility
- Rental contract tied to wastewater quality & quantity



# Treatment options

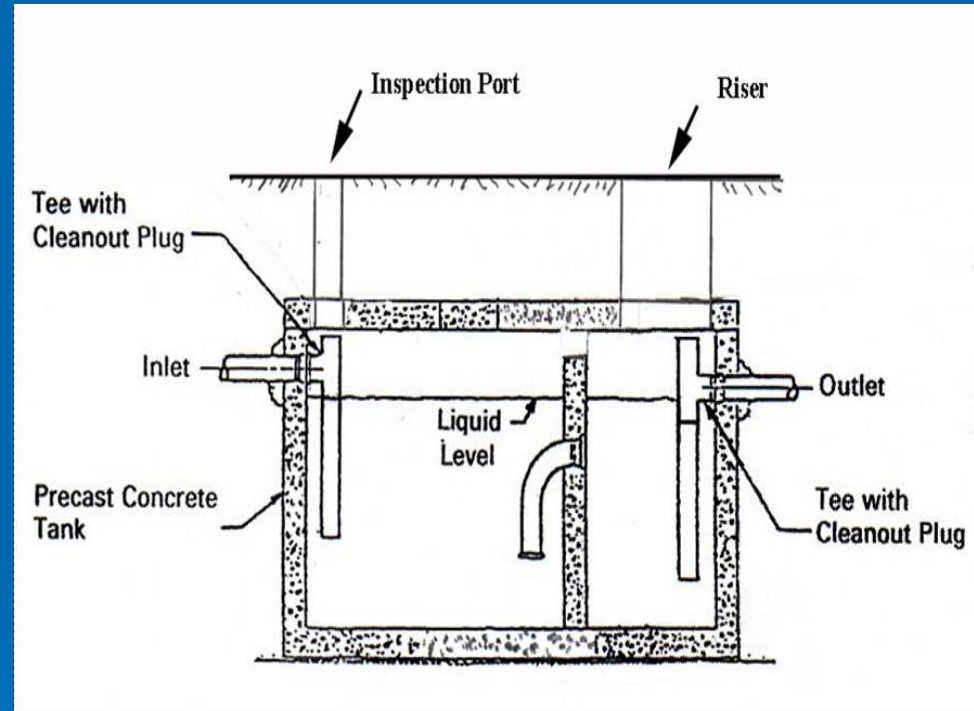
- Configuration of the system and the facility operation can be changed to influence treatment
- Start-up phase - monitor closely in first months of operation
- System is subject to the source
  - Educate users on proper procedures and how their usage is impacting the system

# Fats, oils, and grease management

- Best - minimize their source
  - Use commercial facility surveys
  - Find operations that can be changed or eliminated – salad bar?
- Separate waste streams
- Grease interceptor or trap
- Temperature moderation

# Grease trap

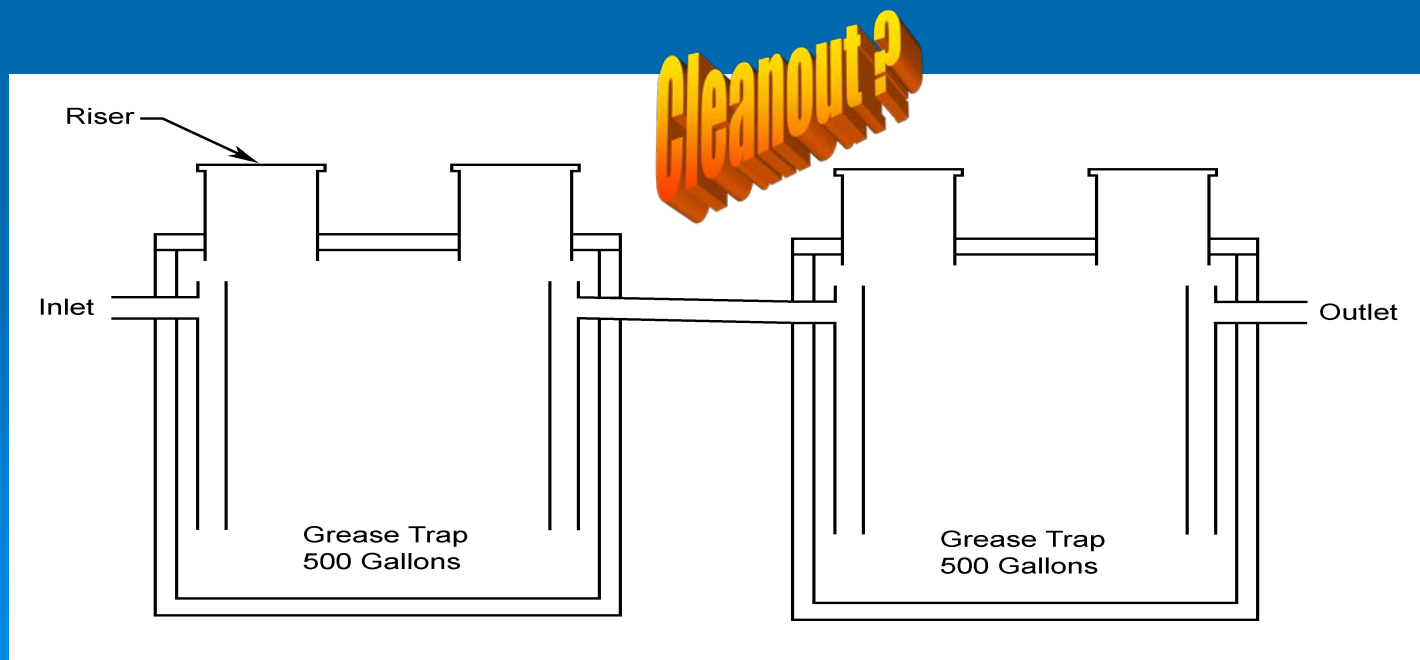
- Grease traps are often first in the treatment train
- Baffles extend lower into tank than septic tank
- Needs frequent pumping
  - Sizing dependent on pump truck capacity



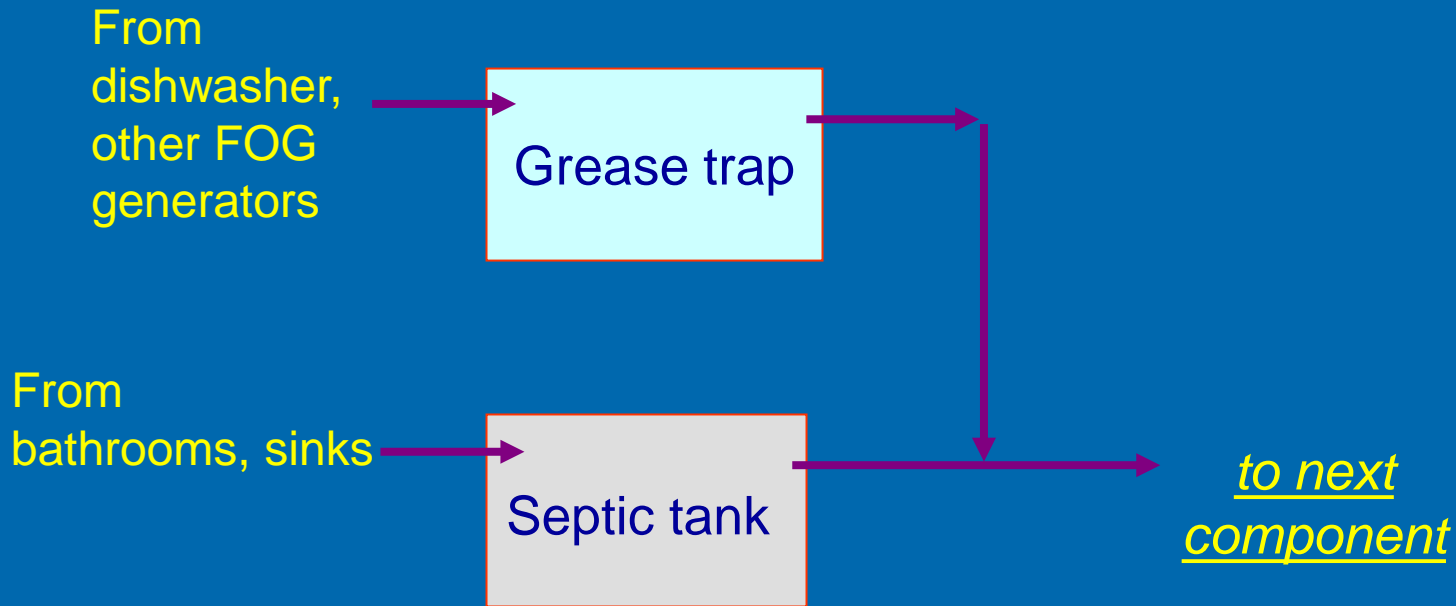


# Grease trap

- Multiple tanks in series can be used to cool water as it moves from one tank to the next
  - Must be able to remove grease in between.



# Grease temperature moderation

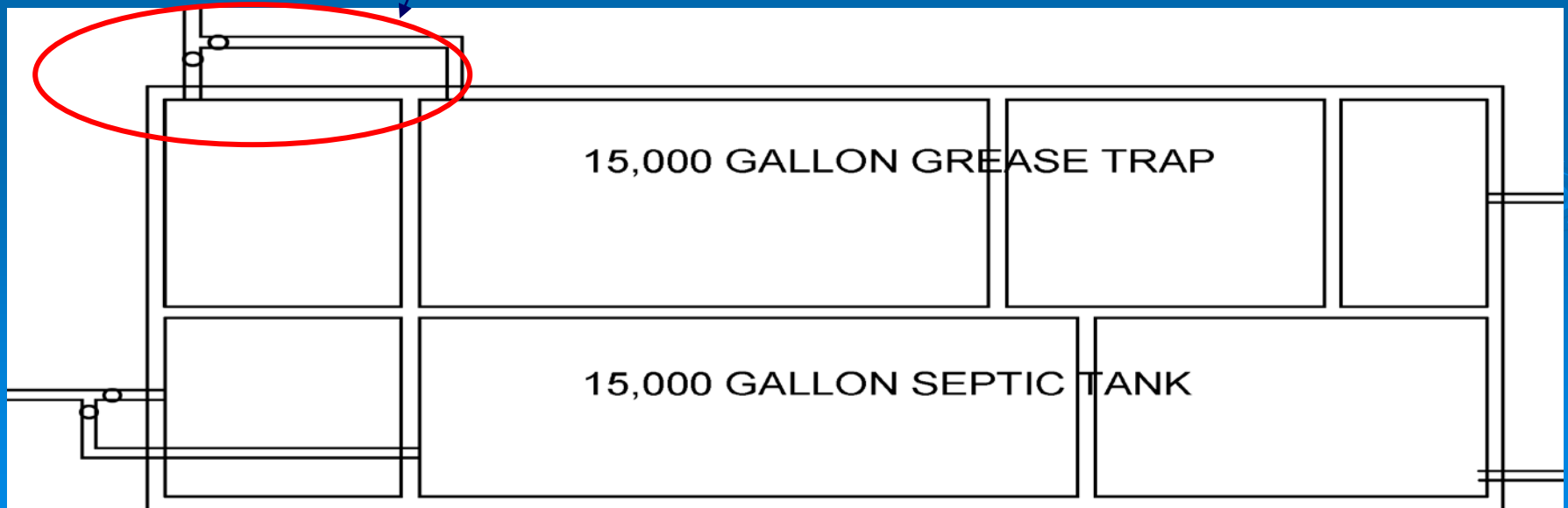


- Multiple tanks in series,
- Distance of pipes running through cool soil,
- Blending waste streams,
- Separating waste streams,

# Grease temperature moderation

- Using common walls for heat exchange
- Multiple compartments in the tanks
- Ability to direct the flow to multiple inlet points

**Flexibility**



# Temperature moderation

- Cold climates can require increased temperatures
- Insulation of components
- Adding heat to component - warm air
- Aeration systems may need warmed air



# Flexibility

- Because it is impossible to determine exact wastewater quality and quantity of a brand new system,
- Design the system for potential expansion.
  - Piping between components
  - Space between components
- Leave room for treatment component expansion



FLOW  
SPLITTING

# Stereotyping

- Remember EVERY FACILITY IS UNIQUE; what 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**

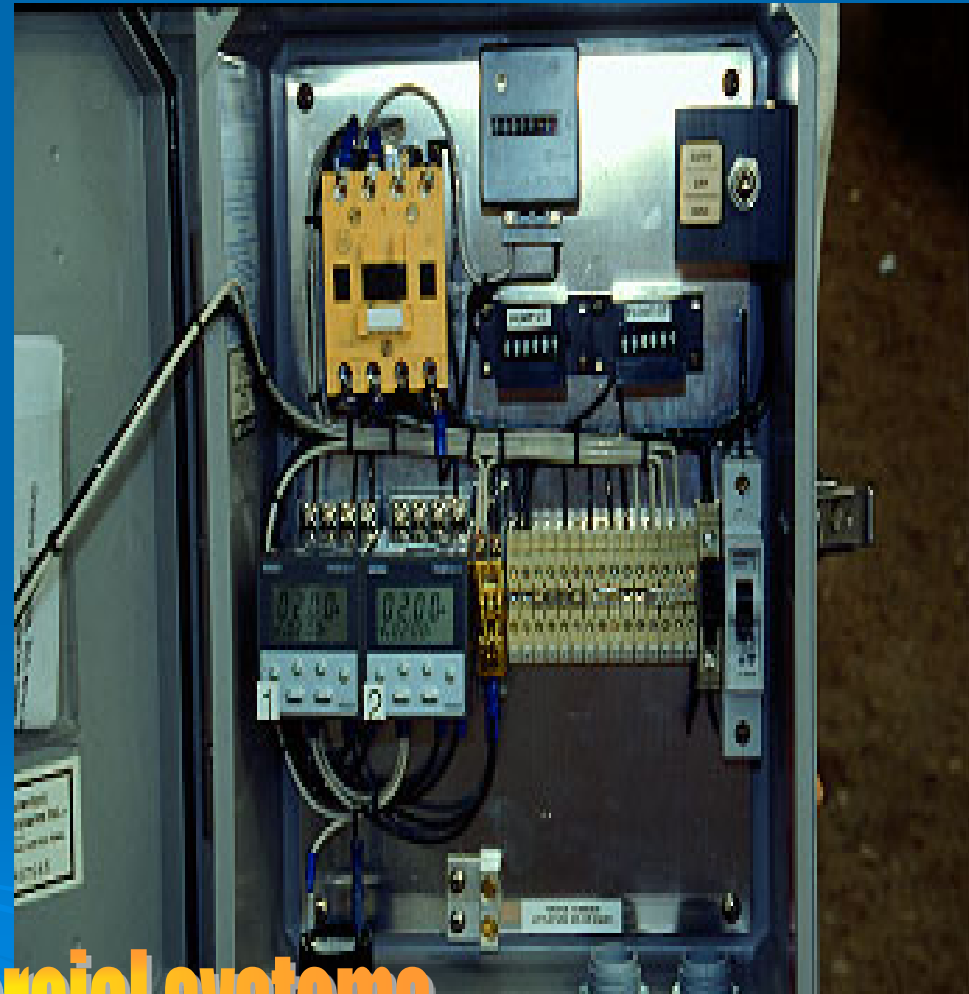
**Sampling BOD & FOG**

# Recovery features

- Recovery features need to be incorporated into the design of commercial systems that will treat HSW
  - Pretreatment components
  - Final treatment and dispersal components

# Flow metering / recording

- Eliminate the need for guessing by adding a means to collect accurate and vital flow data for troubleshooting
- Meter
- Cycle counter
- Elapsed time meter



**Critical Feature on commercial systems**

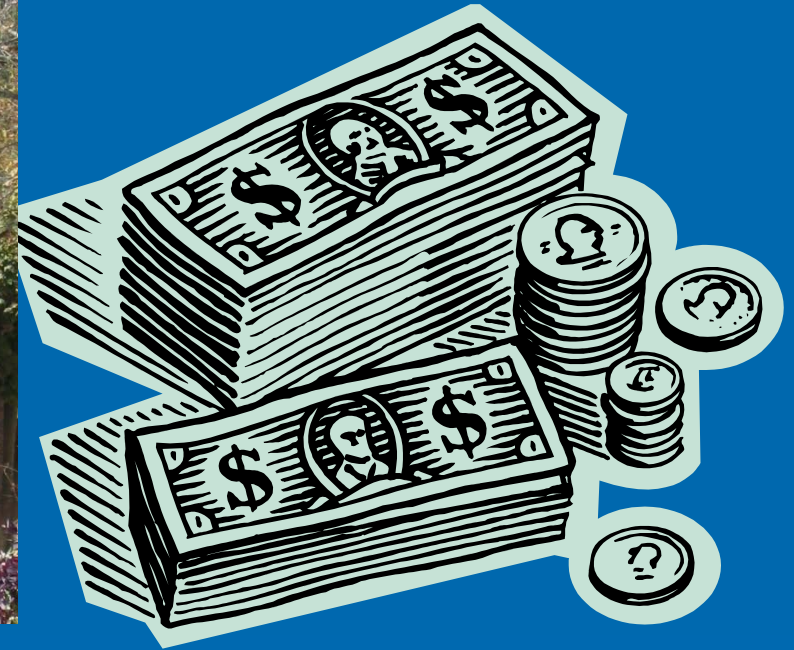


# Effluent screens

- Additional removal of solids
- Should prevent the passage of solid particle larger than a nominal 1/8 inch diameter sphere.
- Must be frequently cleaned.
- Frequent clogging of the effluent screen may indicate need for changes in the facility



# Work with system owners



- Owner education is vital
- Most effective to demonstrate the economical benefits.
- Management relates directly to waste stream

# Work with system owners



- Fix leaking plumbing fixtures
- Lower water pressure
- Use automatic shut-off faucets
- Use water-saver dishwasher cycle



# Work with system owners



- Scrape plates into garbage, not the sink
- Install drain covers and sink baskets/strainers.
- Avoid use of a garbage disposal
- Avoid using slop sinks to dispose of liquid food items.

# Work with system owners

- Kitchen layout for dish washing.
- Dish storage?
- Insufficient storage – peak usage leads to quick placement into dishwasher and with no scraping



# Performance Based Permitting

- Revokable Operating Permit
- Start-up testing
- On-going testing
- Three strikes on samples
- Discharge to soil is revoked and system is operated as pump and haul until performance demonstrated
- Great Design + Best Installation + Excellent Operation & Maintenance + Disinterested User = Malfunctioning System

# Summary

- Flow equalization
- Wastewater source separation
  - Isolate waste streams
  - Hold and dose
  - Hold and haul
- Flexibility in the wastewater treatment system
- Recoverable systems
- Flow measuring and recording
- Temperature moderation
- Effluent screen
- Work with system owner
  - MUST establish their requirements – Commercial facility survey