



SOUTHWEST
ENVIRONMENTAL
FINANCE CENTER

US Territories Wastewater Operator Training Series

Session 2: Treatment Overview: Regulation History and Treatment Overview

7/8/25

Your trainers for today:



A.J. Barney
Research Engineer



Valeria Cortes-Mora
Professional Intern



SOUTHWEST
ENVIRONMENTAL
FINANCE CENTER



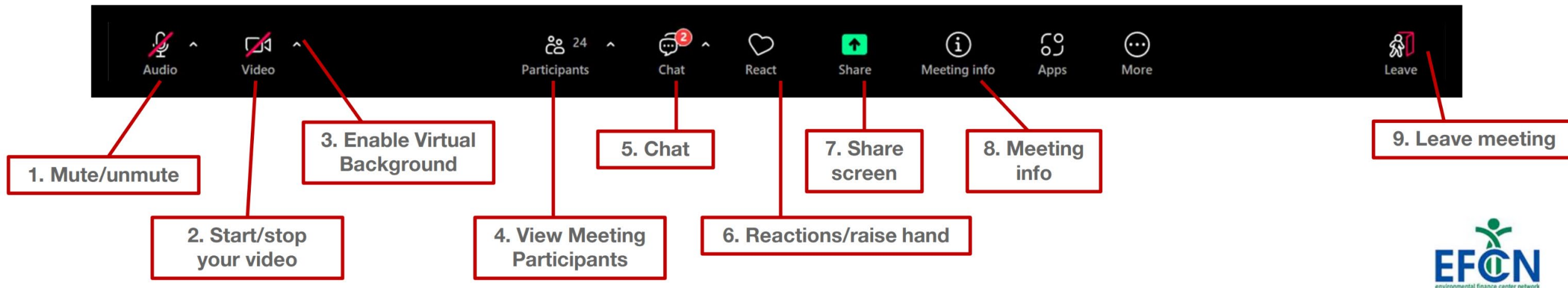
SCHOOL OF
ENGINEERING



This training series is funded by the EPA

Attendee Meeting Controls

- Locate your control bar
- All attendees will see a black horizontal bar on their screen
- If your control bar is not visible, it may be hidden
 - Move your cursor to the screen's bottom (or top) to reveal this control bar.





WPI/ABC Operator Certification

Get the latest water industry news, insights, and resources from our new blog IMMERSE. [Check it out!](#)



Superior Water Starts Here™



Ask WooPI!

Make A Payment

TESTING SERVICES ▾ CERTIFICATION ▾ MEMBERSHIP ▾ ABOUT US ▾ EVENTS ▾

Search ...

Standardized Wastewater Treatment Operator Exams

Wastewater Treatment Operator Need-to-Know Criteria

Need-to-Know Criteria outline the content that will be covered on WPI's standardized examinations provided through [ABC Testing](#), a WPI service.

- [Wastewater Treatment Operator Class I](#)
- [Wastewater Treatment Operator Class II](#)
- [Wastewater Treatment Operator Class III](#)
- [Wastewater Treatment Operator Class IV](#)

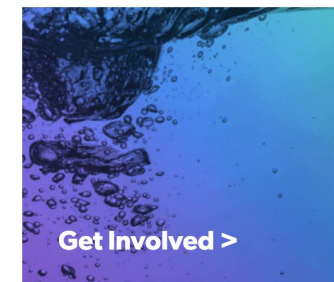
Wastewater Treatment Operator Formula/Conversion Table

WPI standardized exams are administered with a Formula/Conversion Table containing mathematical formulas and common abbreviations that may be present on the exam.

- [Wastewater Treatment Operator Formula/Conversion Table](#)



**WPI Voluntary
Certification Process >**



Get Involved >



Schedule for 2025:

Date	Topic
6/24/25	Program Overview, Test Format, Study & Test Tips
7/8/25	Treatment Overview - Reg history, overview
7/22/25	WW Math Part 1 (Areas & Volumes)
8/5/25	WW Math Part 2 (Flow Rates & Detention Times)
8/19/25	Collection Systems - Gravity systems
9/2/25	Collection Systems - Pumping & force mains
9/16/25	Collection System Maintenance
9/30/25	Operator Safety/OSHA/Chemical Safety & Inventory
10/14/25	Preliminary Treatment
10/28/25	Primary Treatment: Sedimentation
11/11/25	Fixed-Film Media
12/2/25	Activated Sludge Part 1
12/16/25	Activated Sludge Part 2



<https://swefc.unm.edu/home/op-cert-trainings/>



[Home](#) [Our Work](#) [About](#) [Resources](#) [Blog](#) [Events](#) [Infohub](#) [EFLA](#) [Search](#)



This page is a repository of Wastewater and Drinking Water Operator Certification (Op Cert) Training Webinars offered by the SW EFC for systems in the Pacific Territories. Below you will find the **training webinar schedules (wastewater, then drinking water)** followed by a **training webinar recordings library**.

[Jump to Wastewater Trainings](#) [↓](#)

[Jump to Drinking Water Trainings](#) [↓](#)

Wastewater Training Schedule

Please note all times are local to CNMI and Guam. The times in American Samoa are one day earlier at 11 am.

Session	Date	Training Topic & Link to Recording (click to view)	Supporting Materials (click to download)
1	6/25/2025	Program Overview, Test Format, Study & Test Tips	PPT slides
2	7/9/2025	Treatment Overview	
3	7/23/2025	WW Math Part 1 (Areas & Volumes)	
4	8/6/2025	WW Math Part 2 (Flow Rates & Detention Times)	
5	8/20/2025	Collection Systems – Gravity systems	
6	9/3/2025	Collection Systems – Pumping & Force Mains	
7	9/17/2025	Collection System Maintenance	
8	10/1/2025	Operator Safety/OSHA/Chemical Safety & Inventory	



Sign in for every session to ensure you get credit for attending



US Territories Water & Wastewater Operator Certification
Virtual Training Series Group Attendance Sheet

Session Title: _____
Session Date: _____
Training Location: _____

Attendee Name	Attendee Signature	Arrival Time	Departure Time

I hereby certify that the individuals listed above attended the referenced training session.

Name: _____
Signature: _____
Title: _____
Date: _____

Wastewater Regulation History

Why do we treat wastewater?

- Protect fresh water supplies
- Public health
- Environmental health
- Required by EPA regulations



What do we treat wastewater for?

- Excess nutrients (BOD, nitrogen and phosphorus)
- Pathogens
- Solids/ debris
- Others (pH, metals, emerging contaminants)



History of Wastewater Regulations

In 1850,
pump

- Cont

US
The P

- First

- Crea

The Fe
in 197



?

re
er Act

Clean Water Act (CWA) of 1972

Before 1972 most of the US relied on septic tanks

The CWA of 1972:

- Established the National Pollutant Discharge Elimination System (NPDES) permit program
- Set Wastewater Standards and Water Quality Standards
- Funds Wastewater Infrastructure
- Provides the EPA authority to enforce water and wastewater regulations

National Pollutant Discharge Elimination System (NPDES) permit program

NPDES permits are required for facilities that discharge to surface waters

NPDES permits intended to make the nation's waters suitable for fishing, swimming, and other uses

Industries that discharge to Municipal systems must meet pretreatment requirements

NPDES permits specify the effluent limits of the wastewater treatment plant (WWTP)

Regulates sewer overflows, stormwater, the National Pretreatment Program and biosolids



Effluent Discharge Limits

Monitored by the WWTP operator

NPDES permit specify parameters, schedule, frequency, methods, etc.

Determined by available technology and ability of receiving water to withstand contaminant loading

- Technology-Based Effluent Limits (TBELs)
- Water Quality-Based Effluent Limits (WQBELs)

Typical Influent Pollutant Concentrations

Parameter	Influent Concentration	Effluent Goal
BOD5	200 mg/L	< 30 mg/L
TSS	200 mg/L	< 30 mg/L
TDS	800 mg/L	< 1000 mg/L
Settleable Solids	10 mL/L	< 0.1 mg/L
pH	6- 9	6- 9
Fecal Coliform	Too numerous to count	< 500 cfu/ 100mL
TKN (Ammonia + Organic Nitrogen)	30 mg/L	< 10 mg/L Total Nitrogrn
Nitrate/ Nitrate (Inorganic Nitrogen)	< 1.0 mg/L	
Phosphorus	2.0 mg/L	< 1.0 mg/L
Fats, Oils, and Grease	Varies greatly	None Visible
30/45 Effluent Rule		
Parameter	30-day average	7-day averge
BOD5	30 mg/L	45 mg/L
TSS	30 mg/L	45 mg/L



NPDES Non-Compliance

Permitting agency responsible
for NPDES enforcement

NPDES enforcement includes:

- Notices of Violations (NOVs)
- Administrative Orders
- Fines
- Criminal Prosecution

Wastewater Treatment Overview



General treatment processes

- Collection
- Preliminary treatment
- Primary treatment
- Secondary treatment
- Tertiary treatment
- Disinfection
- Sludge handling

LIQUID TRAIN

Wastewater

From residences and industry enters treatment facility

Fine Screens

Screens remove floating debris from incoming wastewater

Grit Removal

Grit particles sink and are removed

Primary Clarifiers

Grease floats
Heavy sludge sinks
Other wastewater passes through

SOLIDS TRAIN

Dissolved Air Flotation Thickeners

Air bubbles are added
Skimmers remove thickened sludge from surface and bottom

Anaerobic Digesters

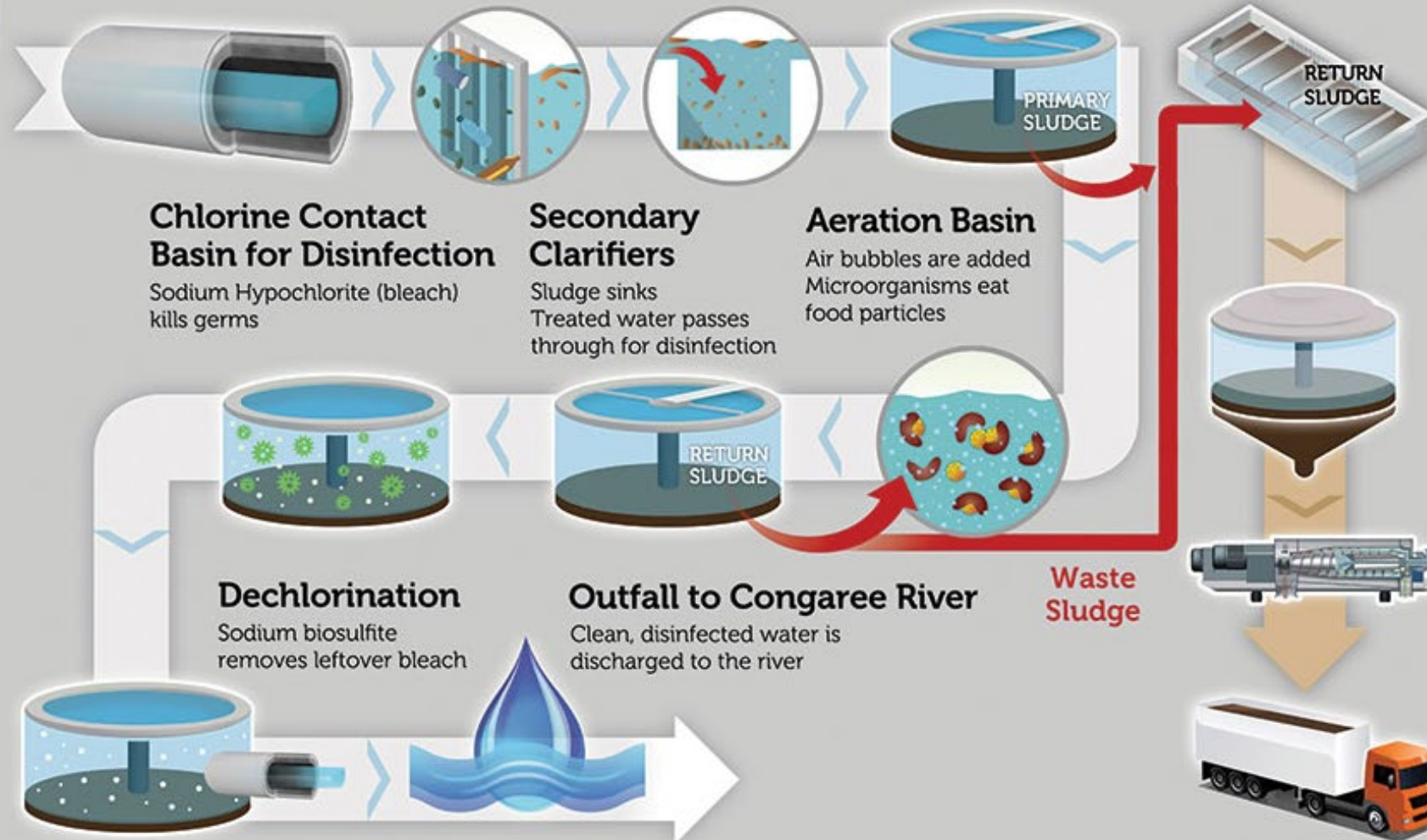
Sludge is processed and methane gas is captured under a dome cover

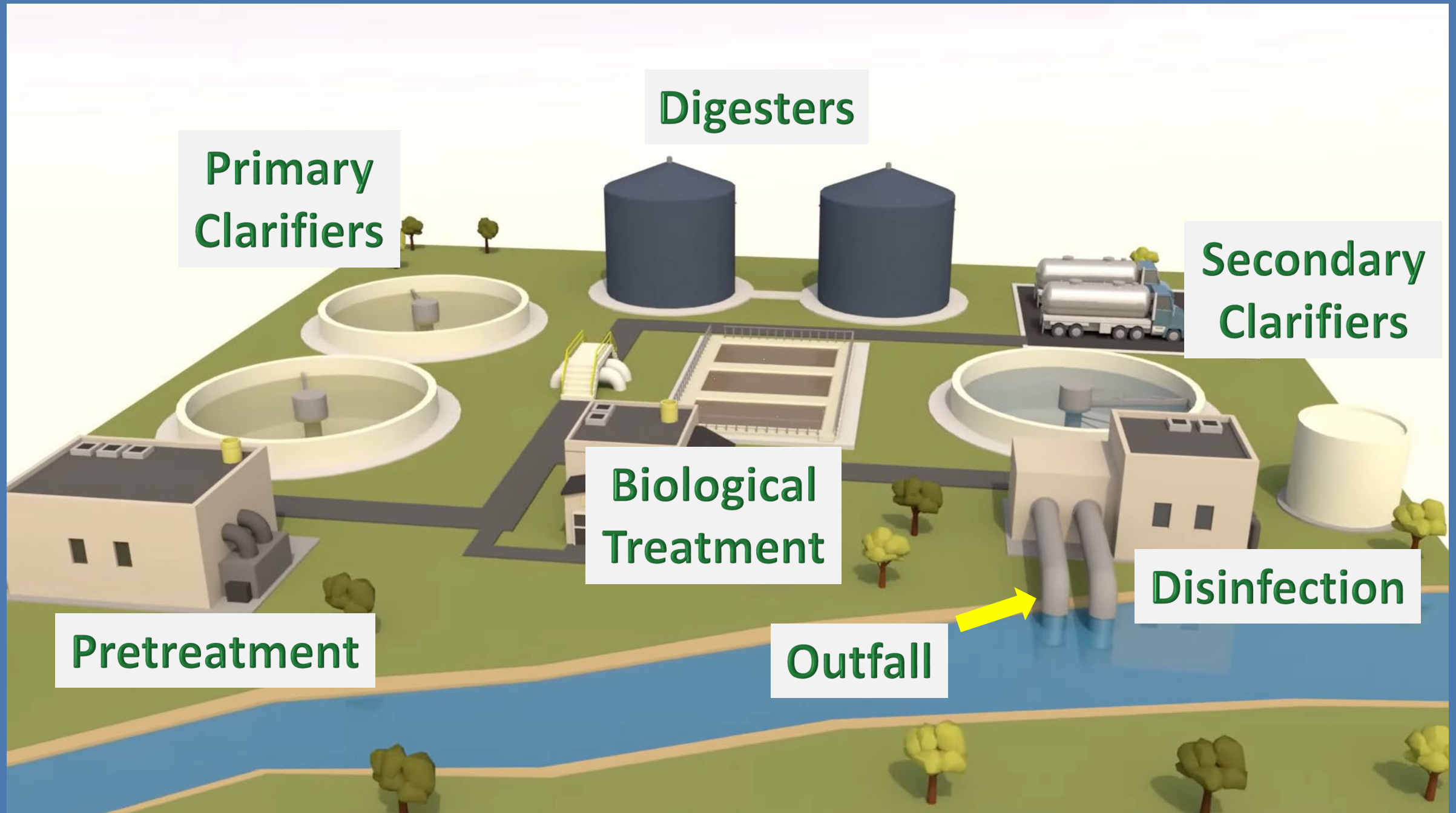
Centrifuges

Water is separated from digested sludge ("dewatered")

Biosolids Disposal

Dewatered sludge is trucked to landfill





Important Wastewater Terms

BOD- Amount of oxygen consumed at 20°C

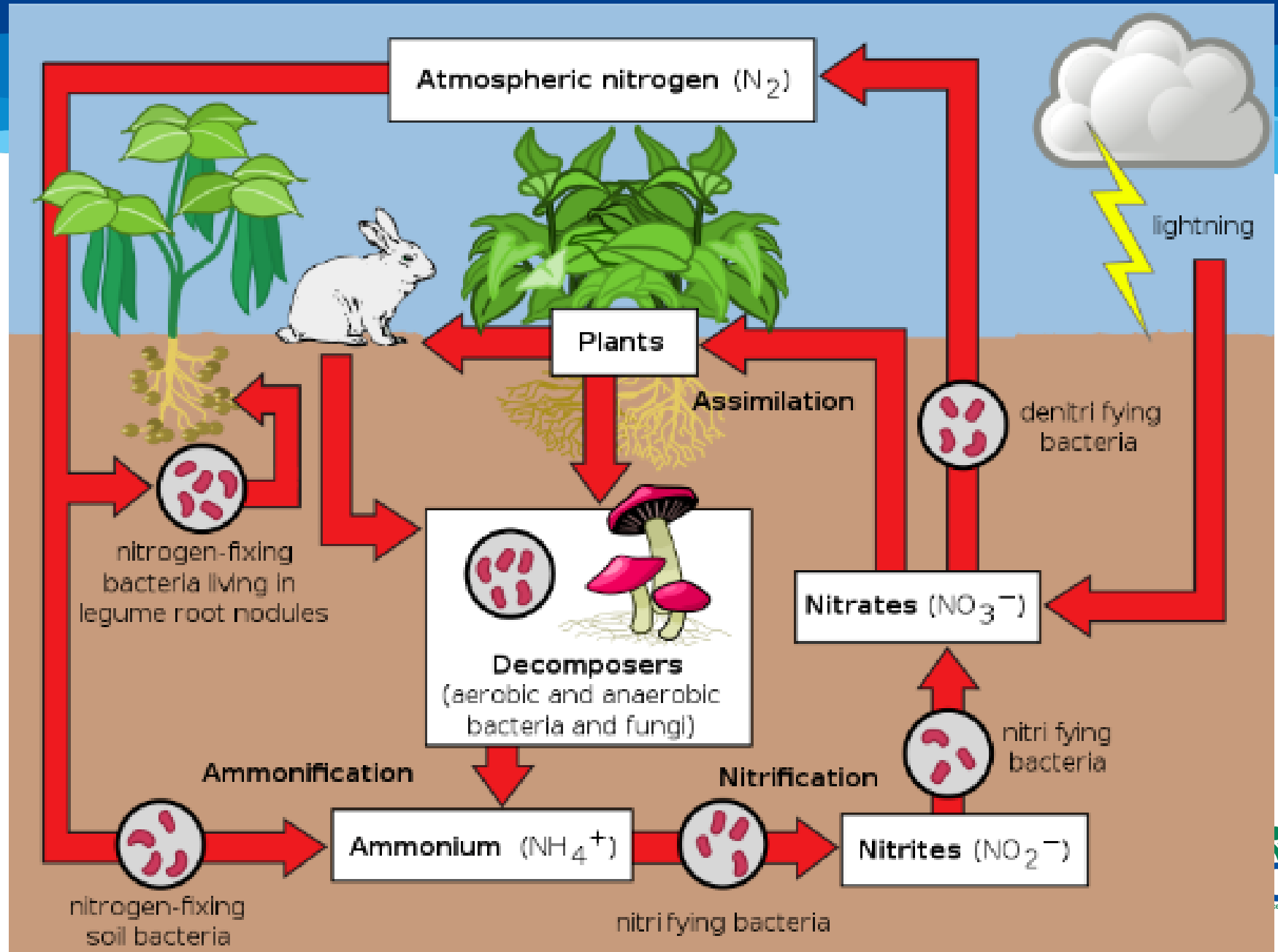
Carbon Cycle- Aerobic and anaerobic respiration

Nitrogen Cycle- Manipulated to removes ammonia (NH_3) and nitrate (NO_3)

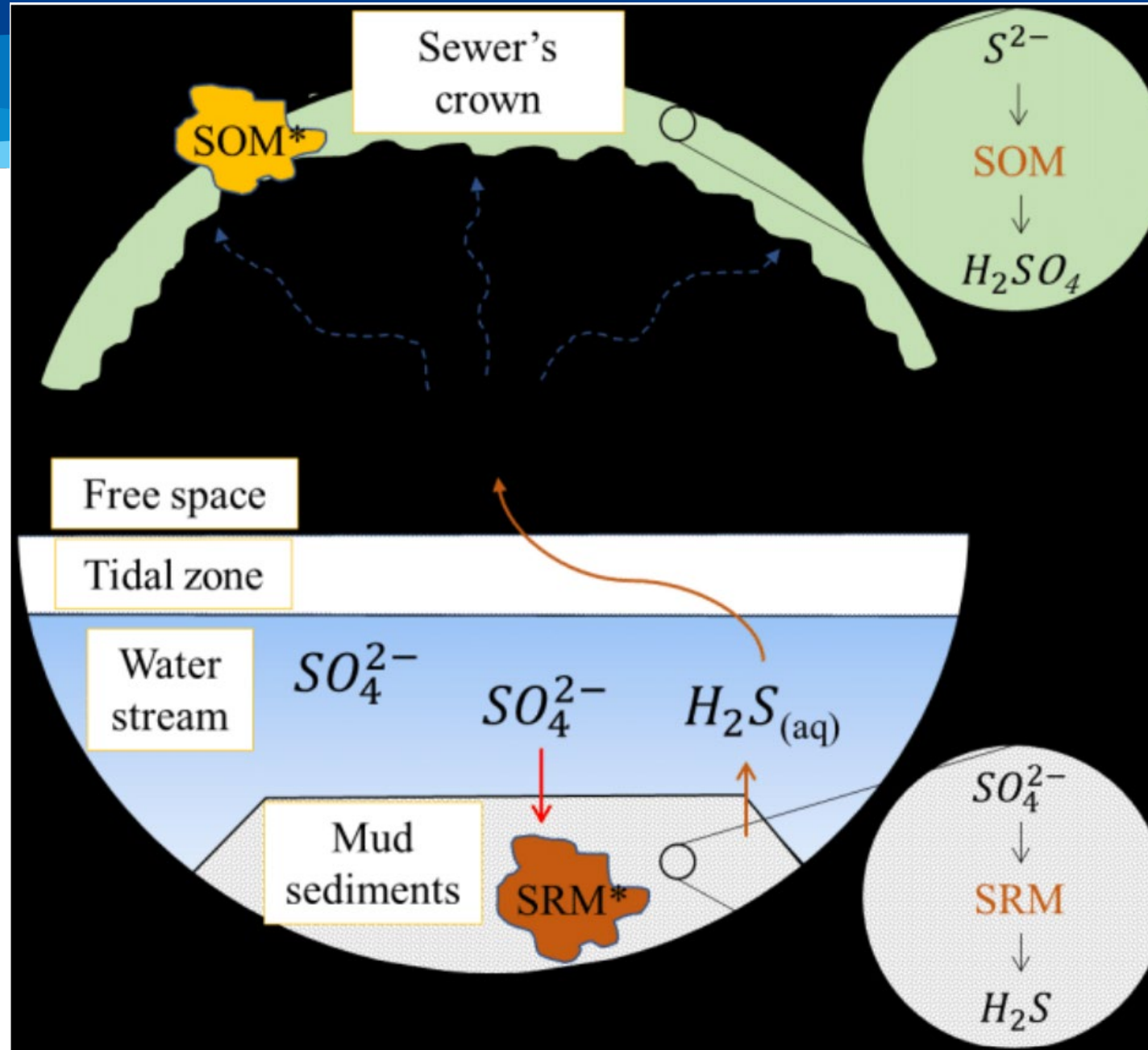
Sulfur Cycle- Results in sulfuric acid and hydrogen sulfide (H_2S) gas

Specific Gravity- Density of a substance compared to water. Used to create physical separation of solids from wastewater

Nitrogen



Sulfur





Collection System

Conveys wastewater from homes and businesses to the WWTP

Consists of pipes and pumps

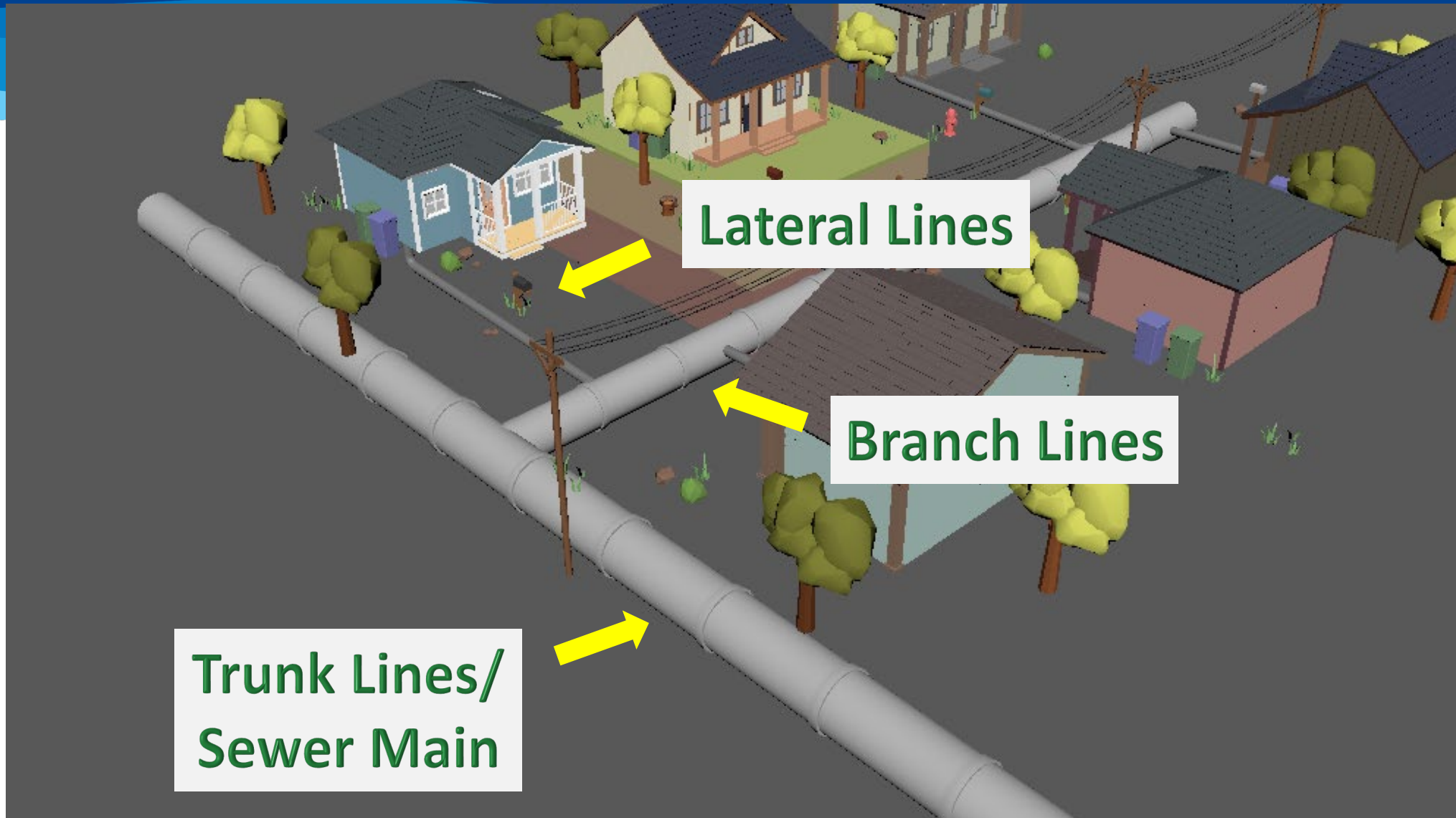
Pipe location and size determines hierarchy

Collection systems are typically gravity fed or pressurized

Wastewater collection may be combined with stormwater

Collection system concerns include infiltration and inflow, roots, corrosion, and FOG

Sewer Pipes





Odor Control

Odors occur naturally due to biological activity

Odor concerns increase with increased wastewater travel times

H₂S and Ammonia (NH₃) are the primary concern

- Other notable sewer gases are CO₂, CH₄, and odorous organics

Sewer gases can be toxic, explosive, and corrosive (crown rot)

Sewer gas mitigation includes proper collection system design, maintenance, aeration, and chemical treatment (hydrogen peroxide)

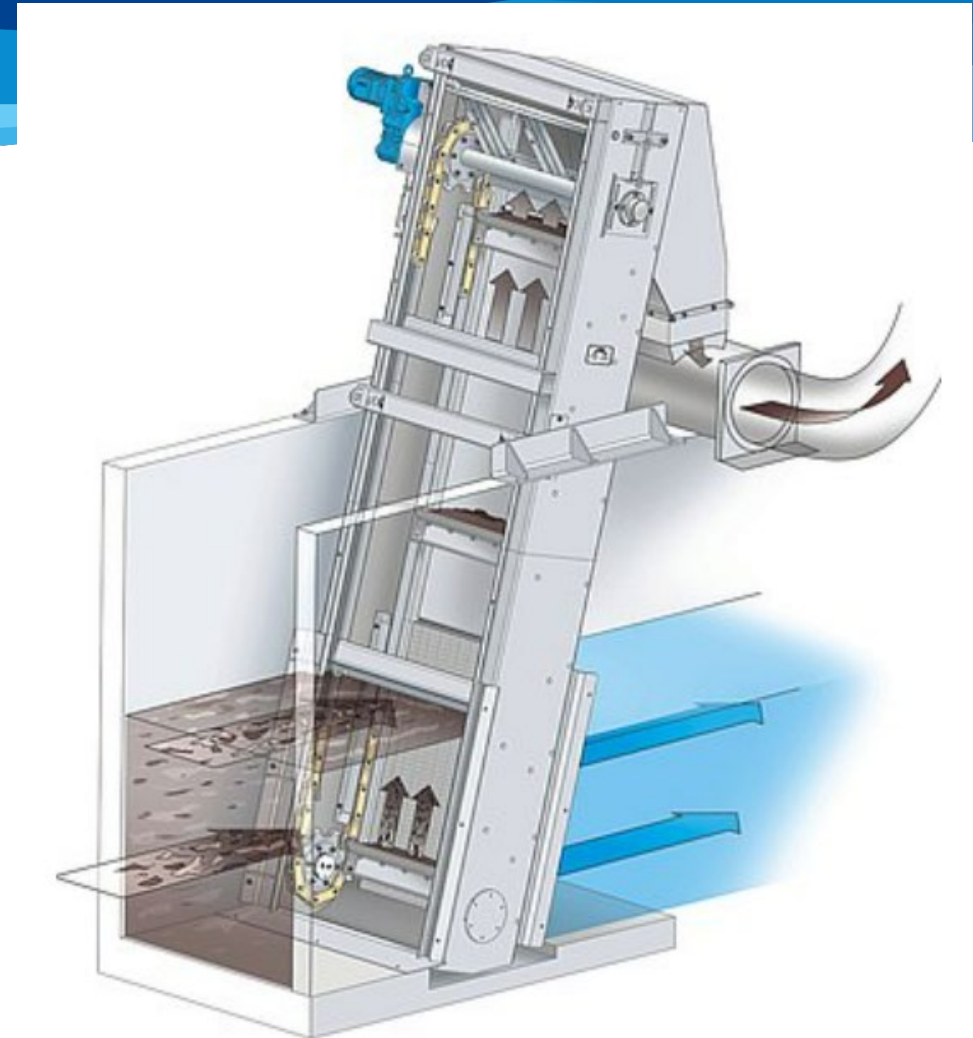
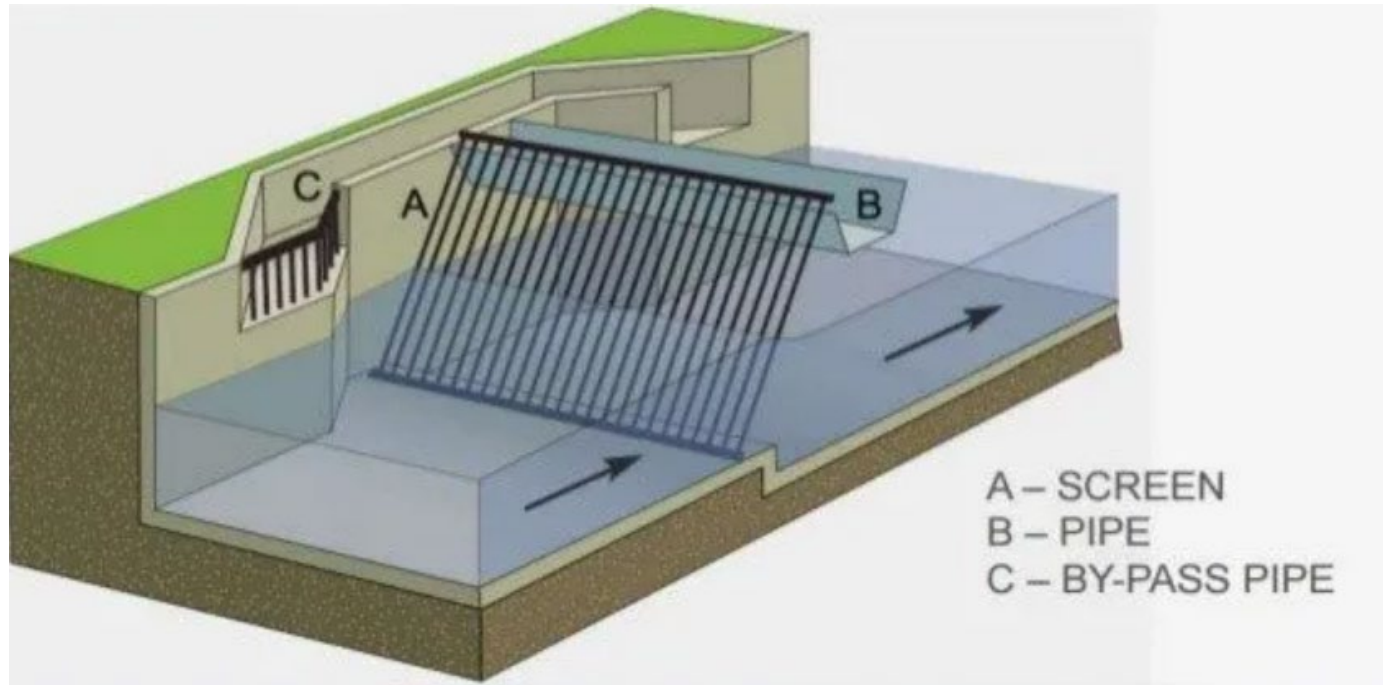


Pretreatment

- Larger solids and rags
- Grit removal
- Flow measurement
- Flow equalization



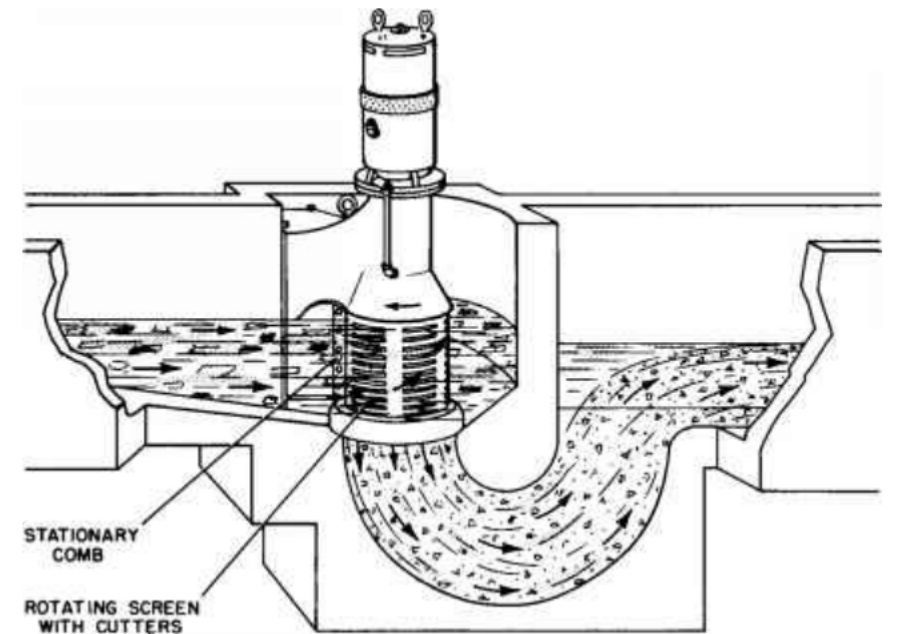
Bar Screens



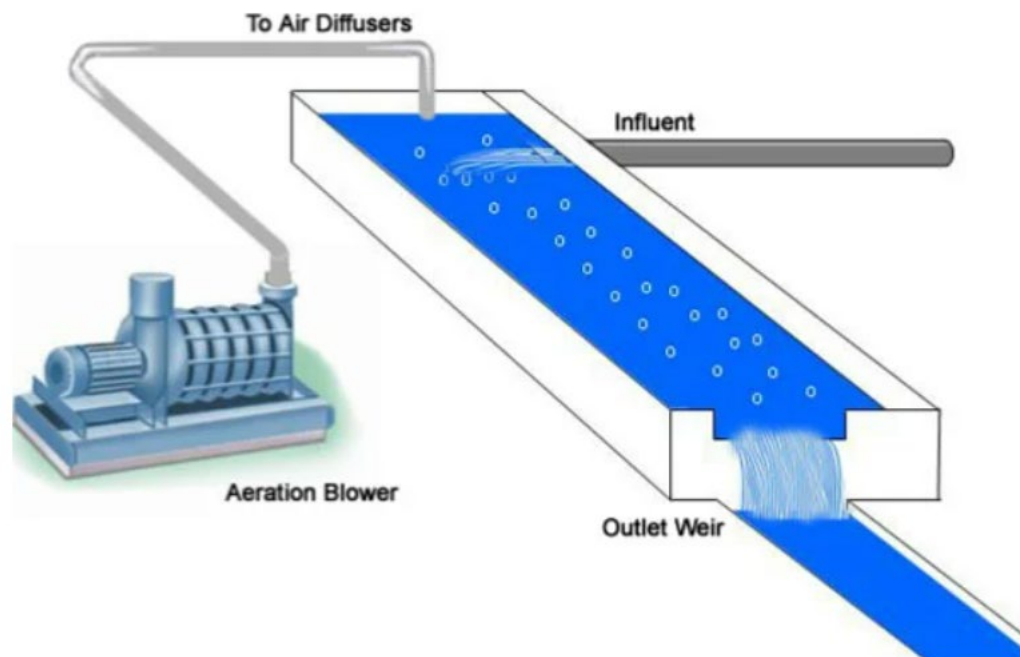


Comminutors

- Rags and debris are shredded and left in the water
- Can clog equipment and be labor intensive
- Require electricity unlike manual bar screens



Grit Removal





Flow Measurement

MGD, gpm, and cfs

Ultrasonic meter

Flume

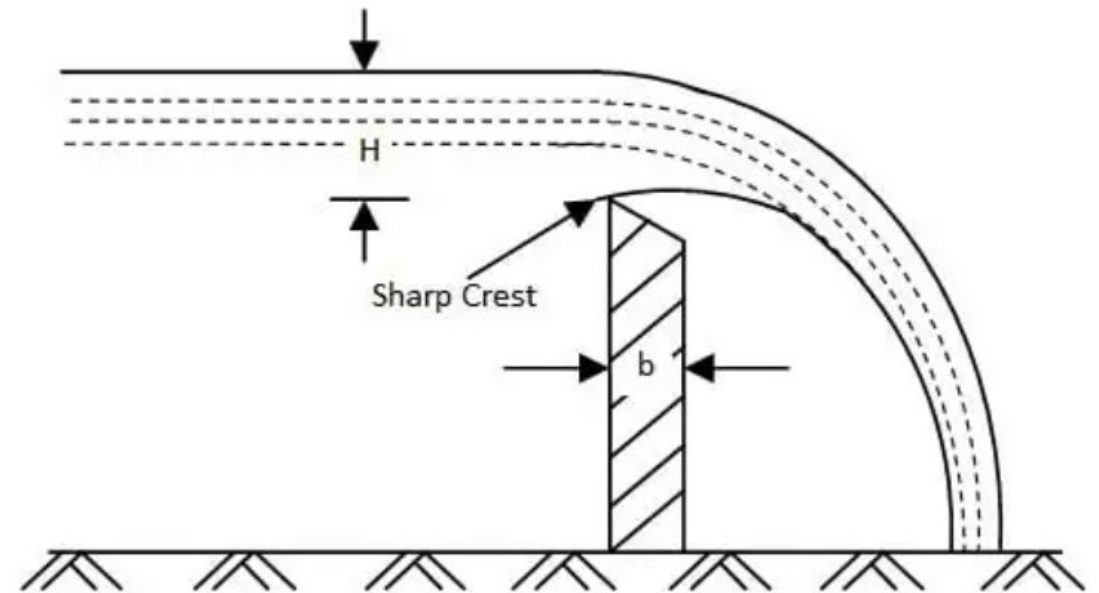
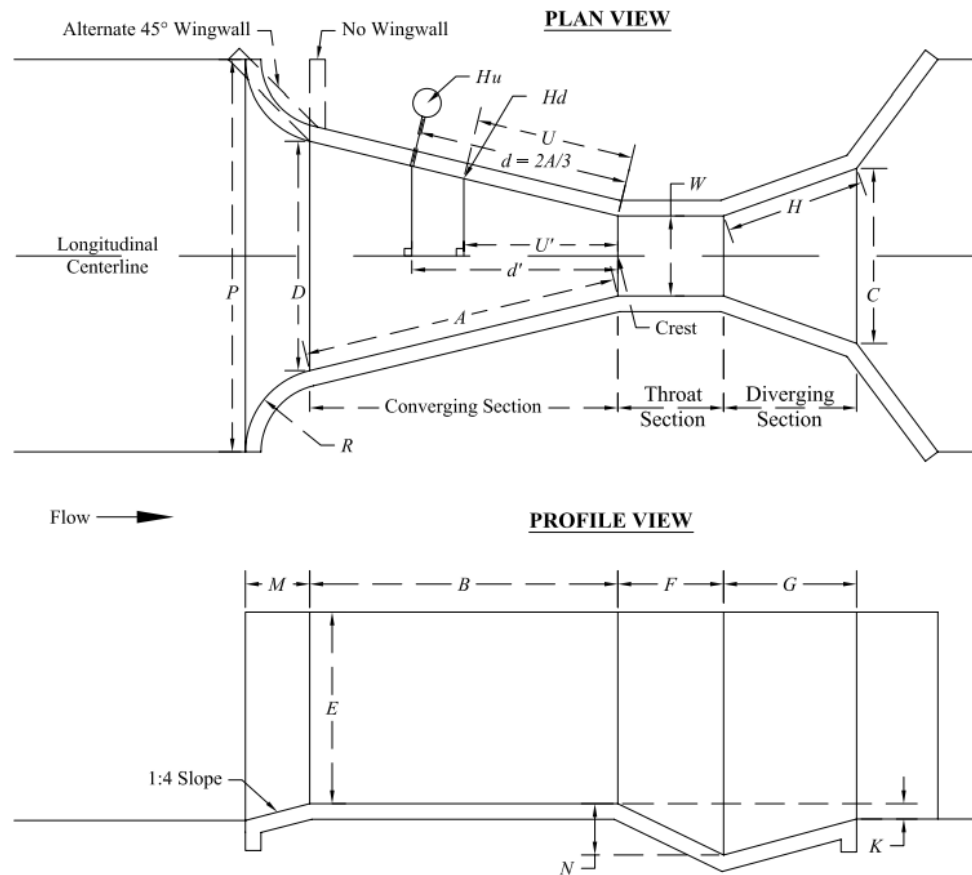
Weir with staff gage

Bubbler

Venturi Meters or Magnetic
for inline pipe



Flow Measurement Devices



Primary Treatment

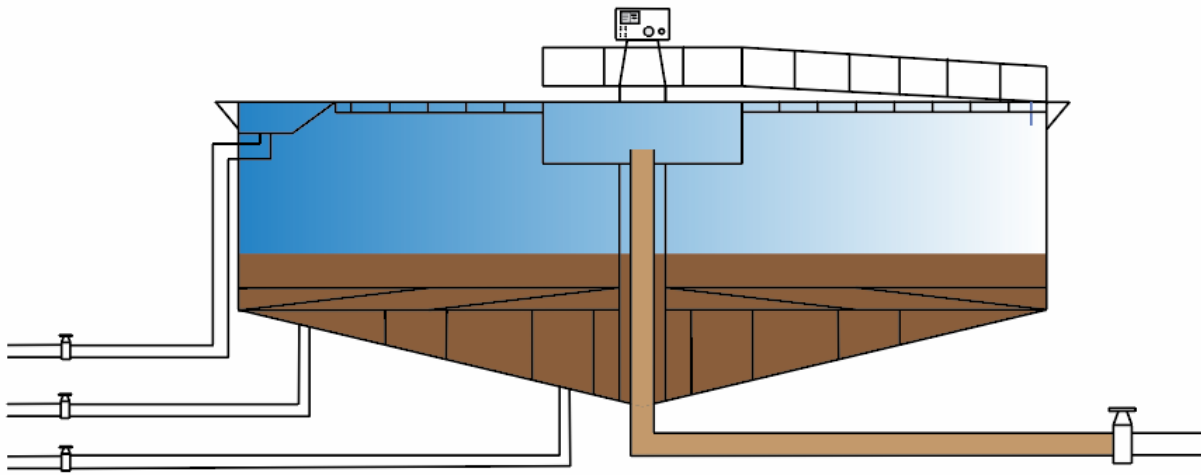
Primary clarification

- Removes 90-95% of settleable solids
- 40-60% of suspended solids
- 30-40% of BOD

Sludge removal



Primary Clarifier



Consists of a tank, scraper, drive unit, influent baffle, weir, and scum tray/trough

Primary sludge: 4-8% dry solids

Detention Time: 2-3 hours

Weir Overflow Rate: 10,000-20,000 gpd

Surface Loading Rate: 300-1,200 gpd/sq. ft

Secondary Treatment

Designed to remove BOD, NH₃ and NO₃

Comes in many shapes and sizes

Derived from naturally occurring microorganisms found in wastewater

Can be fixed film or suspended growth

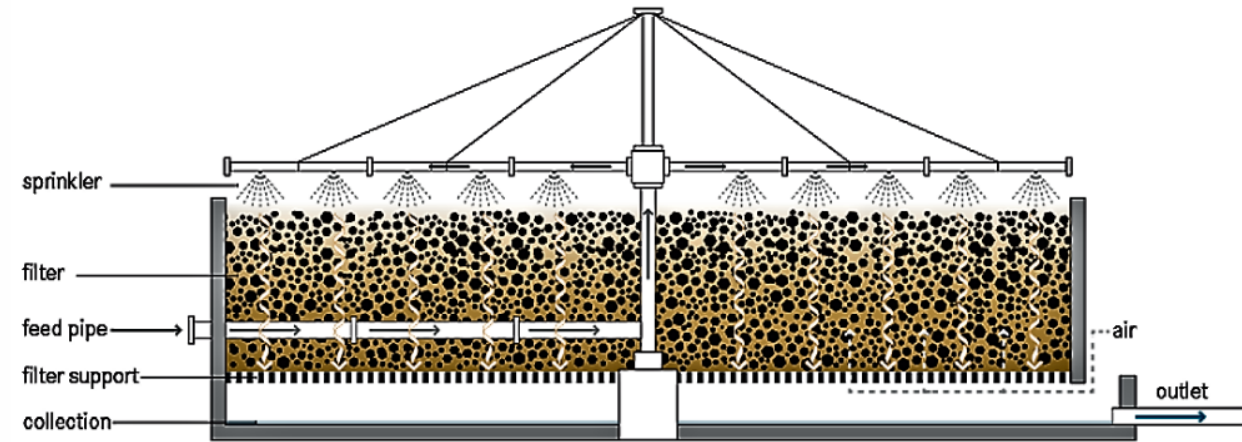
Can require secondary clarification

Trickling Filters

Similar structure to a clarifier filled with rocks.

Rocks covered in zoogeleal film

Typical plant efficiency is 90% removal of BOD and suspended solids



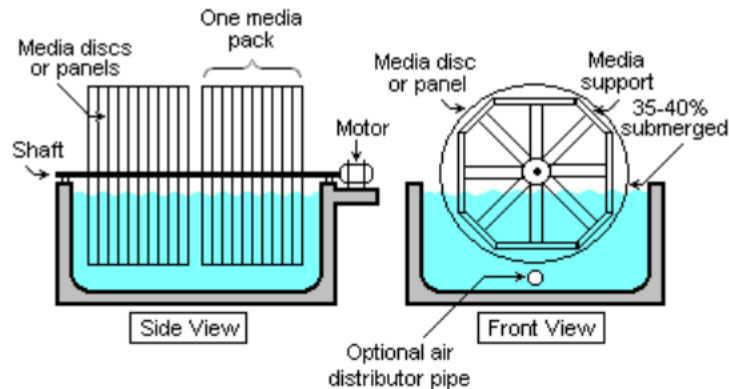


Rotating Biological Contactors (RBCs)

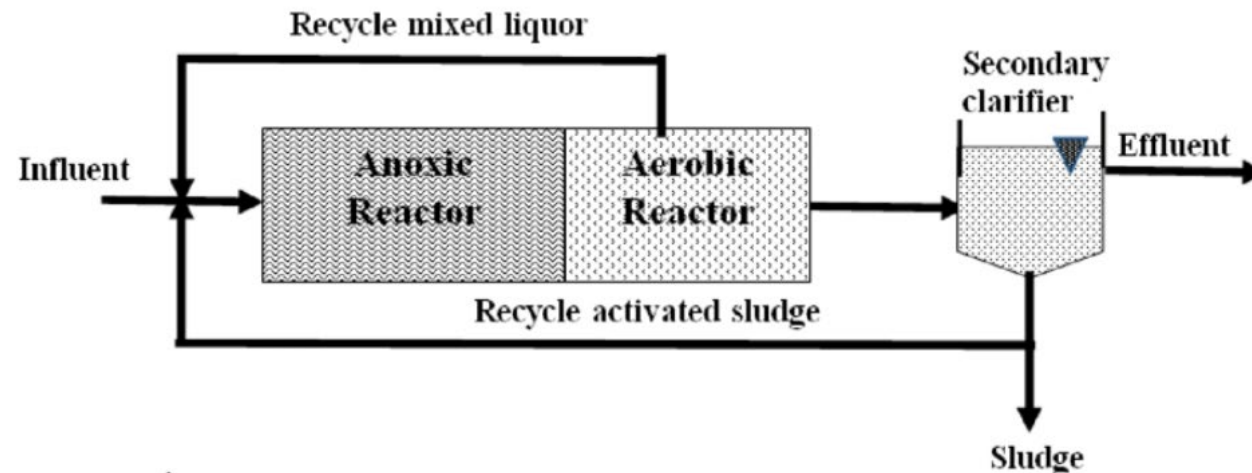
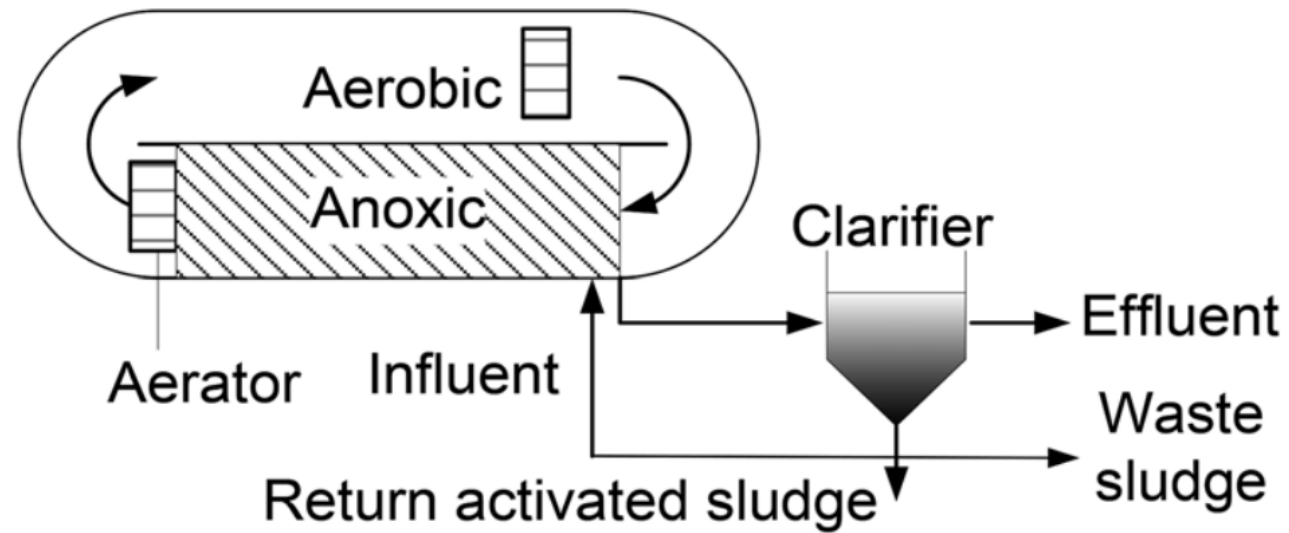
Same fixed-media concept as
Trickling Filters

Cylinders made of plastic
sheets that allow for media
growth and air distribution

Rotates at 1.5 rpm and 40% of
contactor is submerged



Activated Sludge



Wastewater Treatment Ponds

Combine sedimentation and biological treatment

Can be aerobic, anaerobic, or facultative

Can be mechanically aerated

Oxygen and pH should be monitored

Sludge, vegetation, liner and berms need to be maintained

Odors, nuisance animals, and land should be considered



Package Plants

Combine WW treatment process into compact system

Useful for small applications

Can be premanufactured

Includes Sequencing Batch Reactors (SBRs) and other modified processes



Tertiary Treatment

Required for plants that have a higher effluent quality requirement

Disinfection for removal of pathogens

Specialized treatment to removal special contaminants such as mercury, microplastics, PPCPs, excess chlorine etc.

Includes polishing ponds, constructed wetlands, advanced filtration, etc.



Disinfection

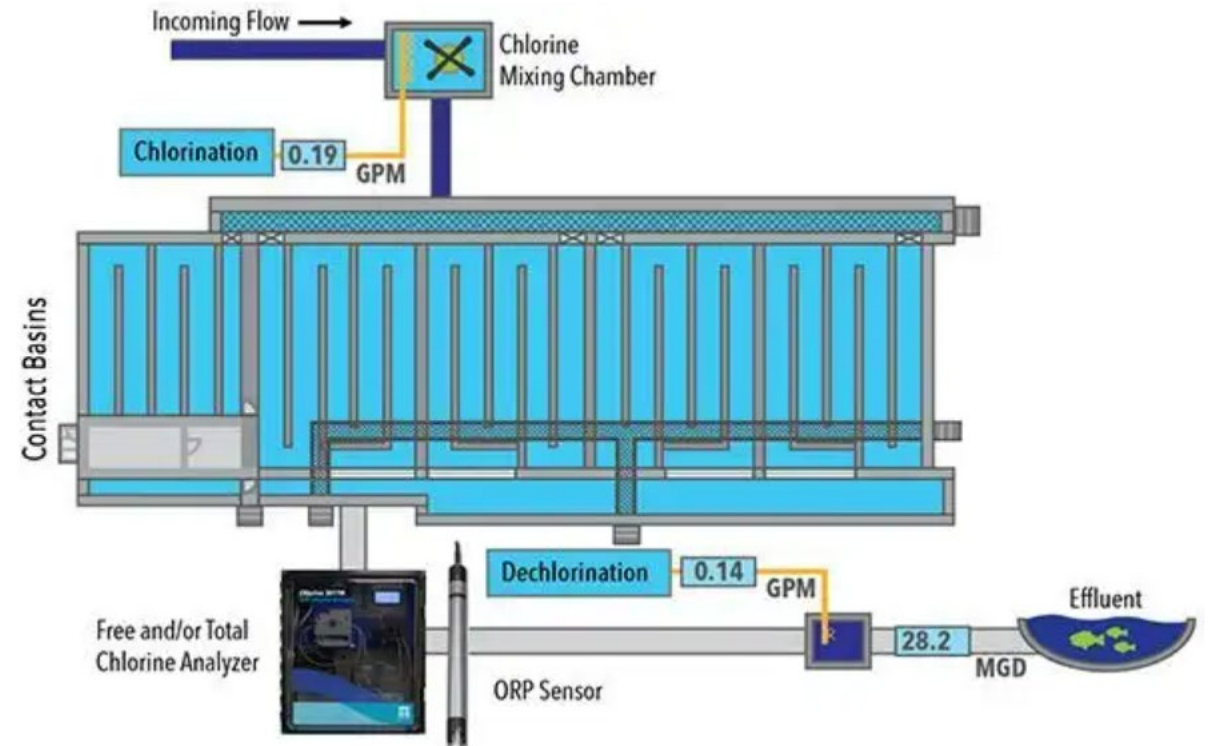
Through chlorination, ozone or UV

Prevents spread of water borne diseases

Industry has been shifting from chlorination to UV to mitigate safety hazards

Chlorination

- Liquid, solid, and gas forms
- Requires chlorine residual and occurrence of breakpoint chlorination
- Dechlorination must occur to prevent fish kills



UV disinfection

- Safer than chlorination
- No residual required
- Less space intensive
- UV wavelength of 253nm disinfects bacteria





Solids Handling

Pumped primary and secondary sludge must be disposed of properly

Sludge disposal is regulated due to the presence of pathogens, heavy metals, etc.

Water must be removed from sludge for transport

Digestion used to stabilize solids

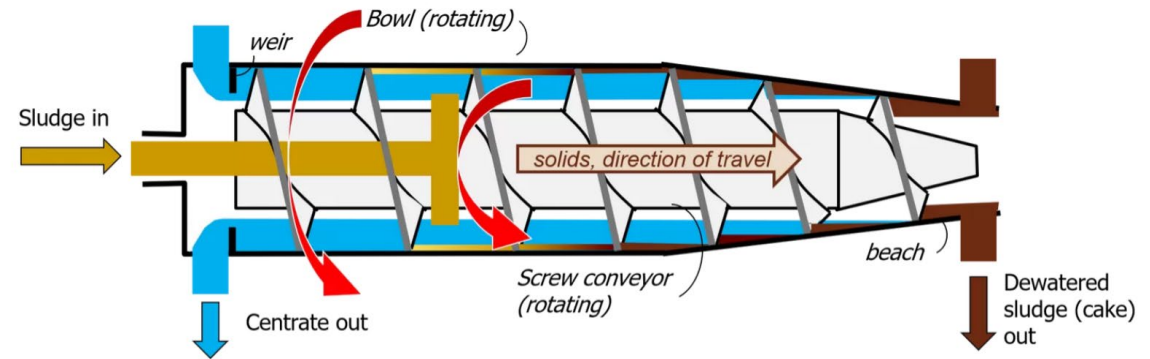




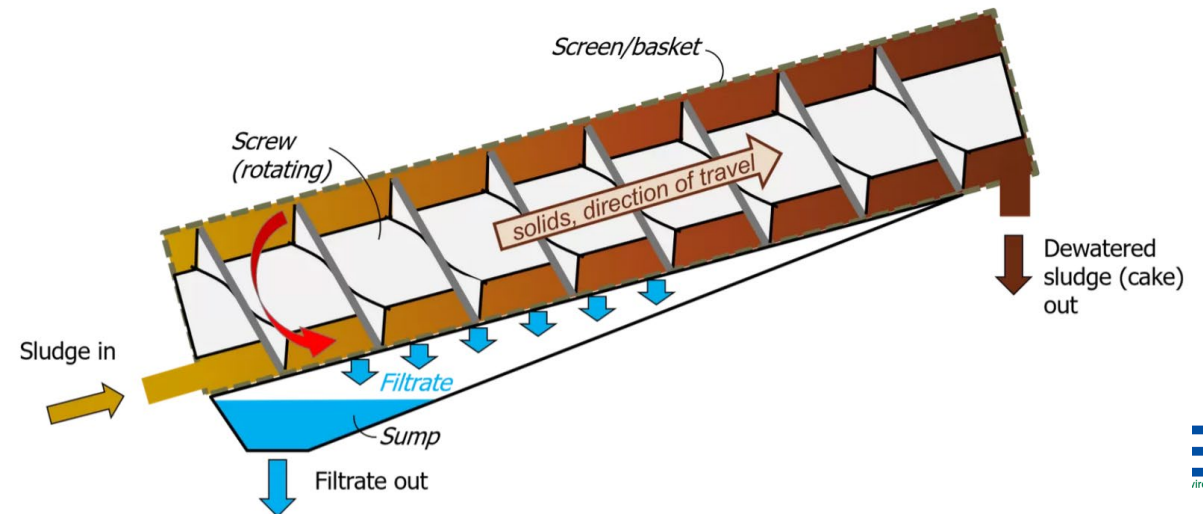
Solids Handling Technology



Solid bowl dewatering centrifuge, counter-current operation



Screw press



Digestion



Questions?

CONTACT INFORMATION



SOUTHWEST ENVIRONMENTAL FINANCE CENTER

swefc@unm.edu

Department of Civil Engineering MSCo1 1070
1 University of New Mexico
Albuquerque, NM 87131
505-277-0644
swefc@unm.edu
<http://swefc.unm.edu>