

# CEE 370

# Environmental Engineering Principles

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## Lecture #31

### Wastewater Treatment II:

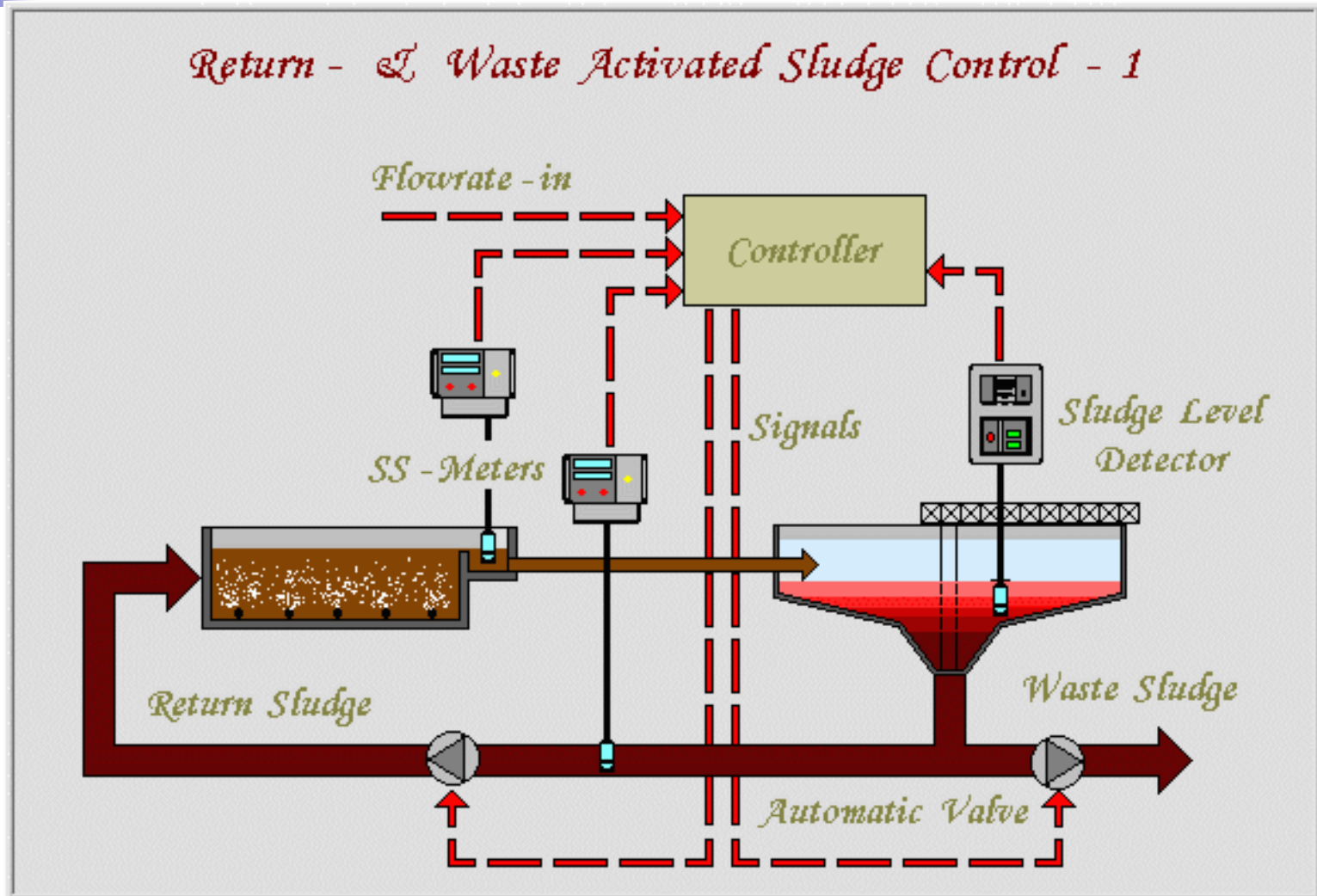
### Characteristics, Growth & Process Modeling

#### [Reading M&Z: Chapter 9](#)

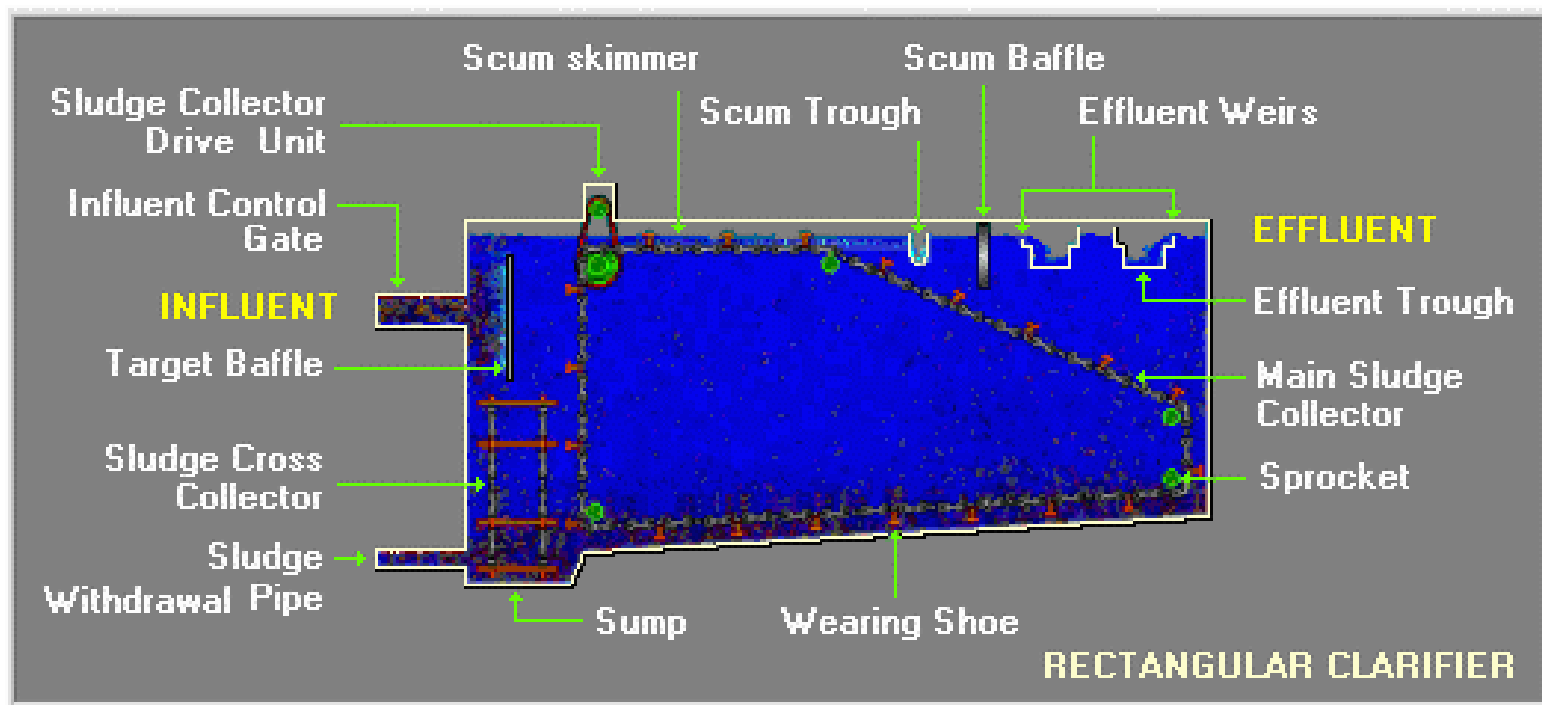
[Reading: Davis & Cornwall, Chapt 6-2 to 6-8](#)

[Reading: Davis & Masten, Chapter 11-2 to 11-7](#)

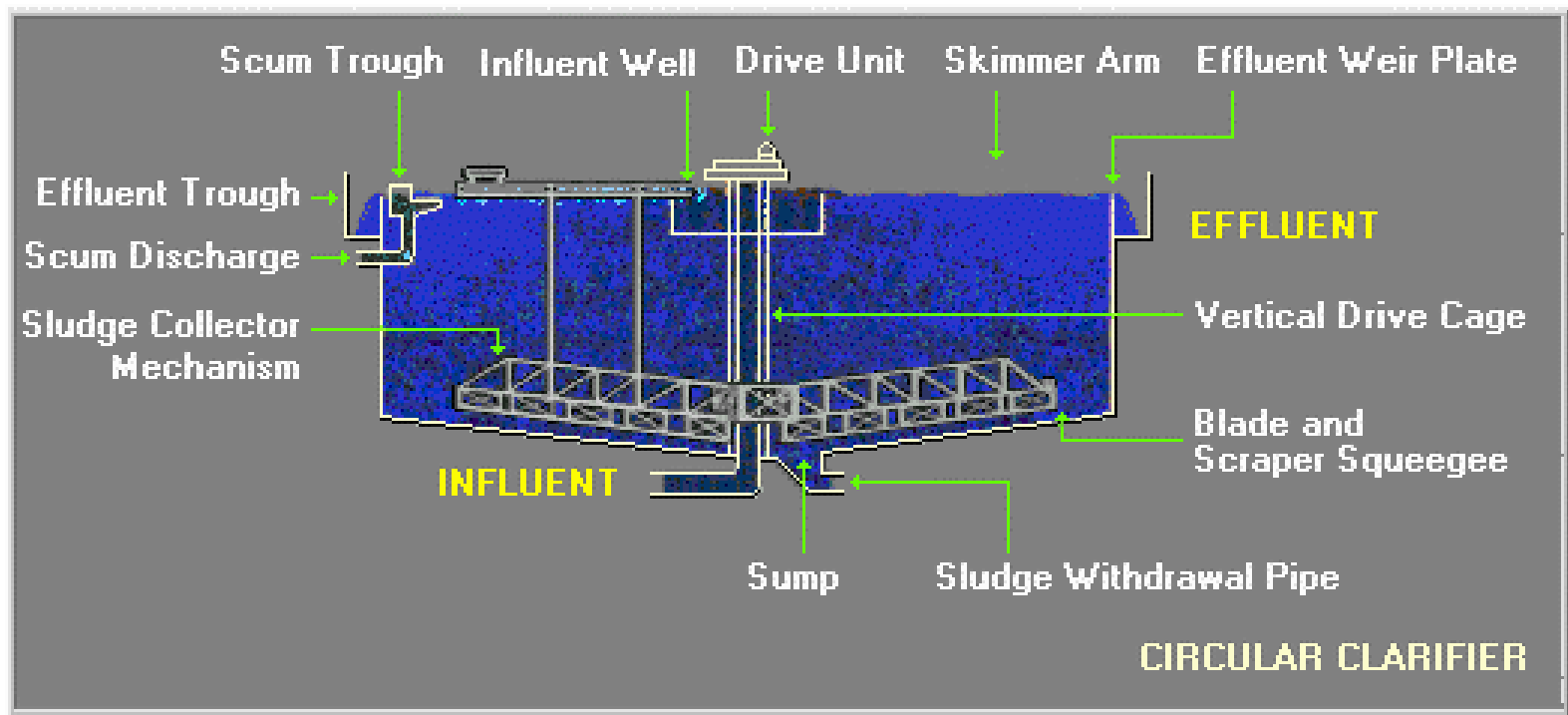
# Residuals & biomass control



# Clarifiers: Rectangular



# Clarifiers: circular

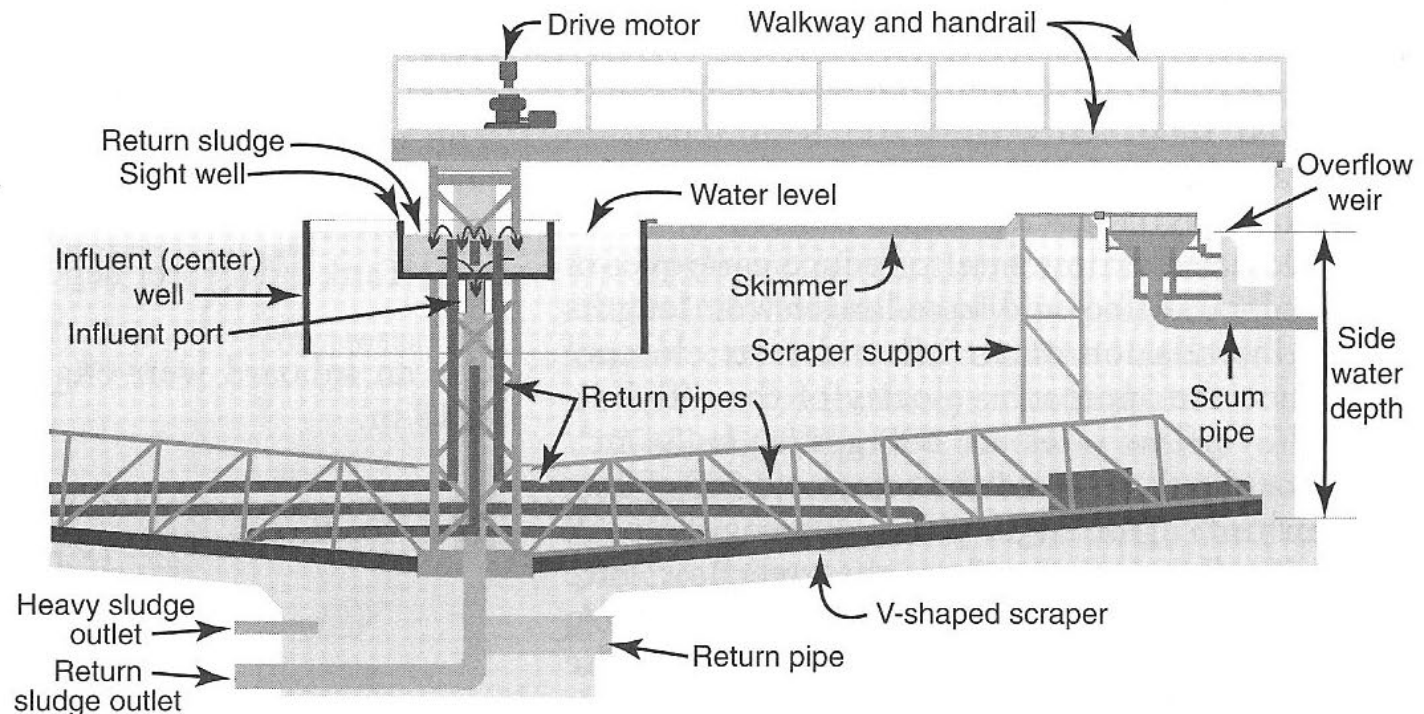


# 2° Settling

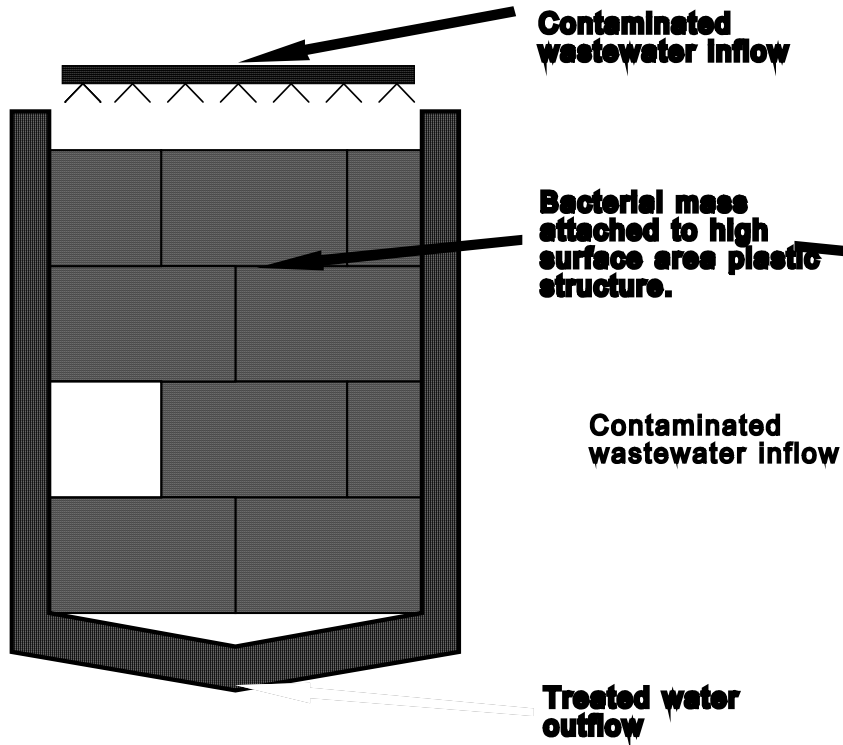
- Typical secondary settling tank with suction sludge withdrawal

**Figure 11-17**

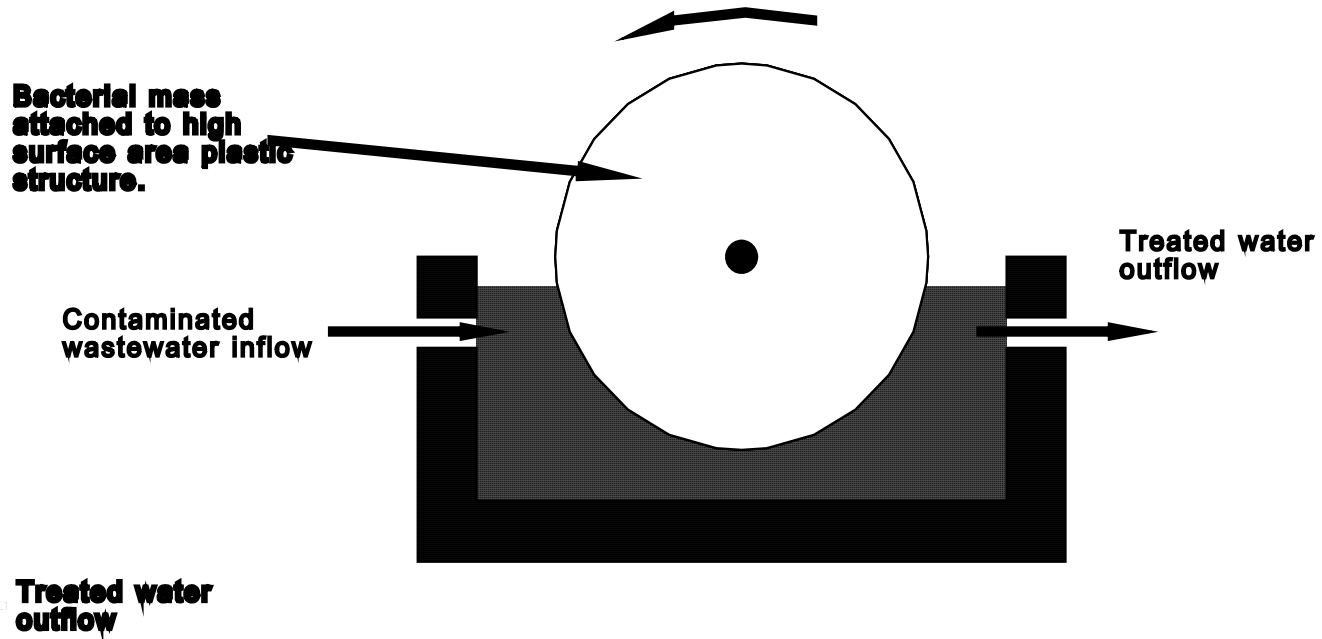
Secondary clarifier designed for use with biological aeration. Activated sludge is withdrawn through suction pipes located along the collector arm for rapid return to the aeration basin.



# Attached Growth Processes



a) Trickling filter



b) Rotating biological contactor

# Biofilms

**Engineered  
support  
surface**

**Biofilm**

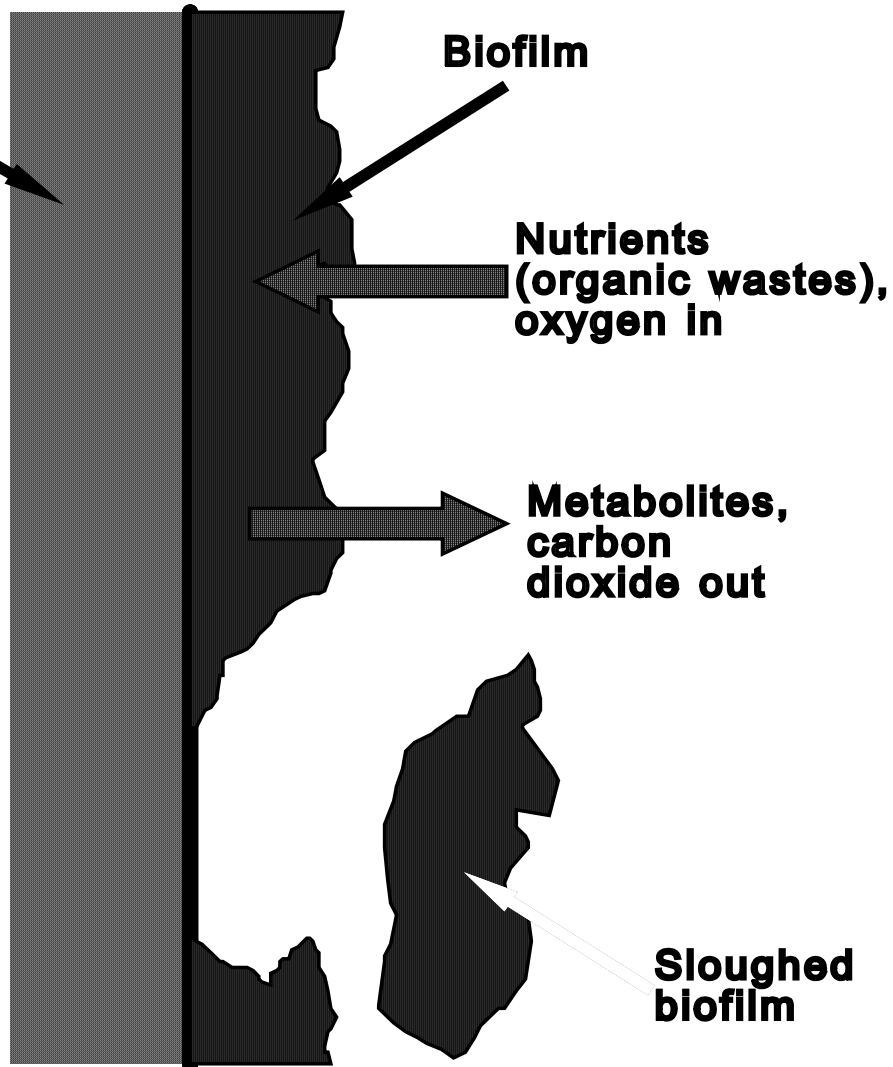
**Nutrients  
(organic wastes),  
oxygen in**

**Metabolites,  
carbon  
dioxide out**

**Sloughed  
biofilm**

**Glycocalyx**

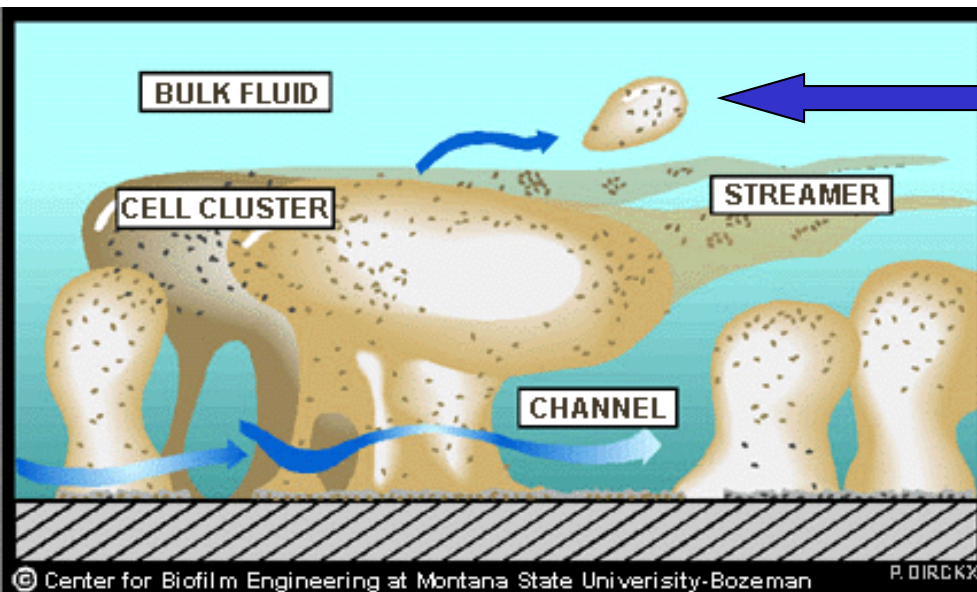
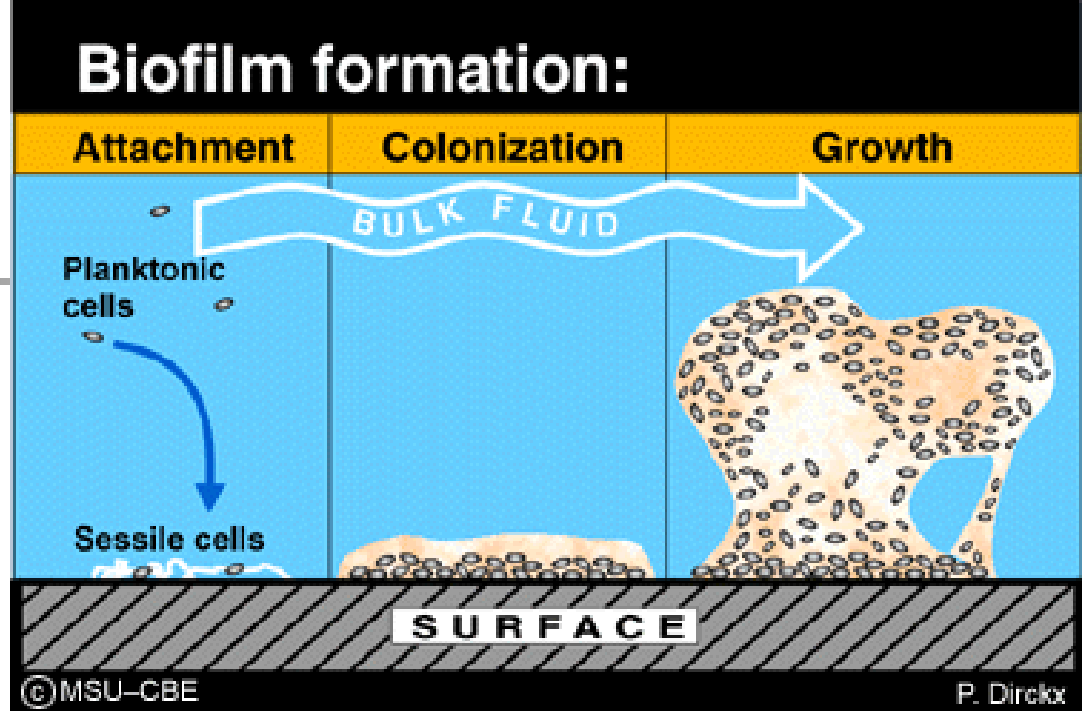
Mostly  
polysaccharides



# Biofilms

## Formation

- Biofilm →
- Engineered support →



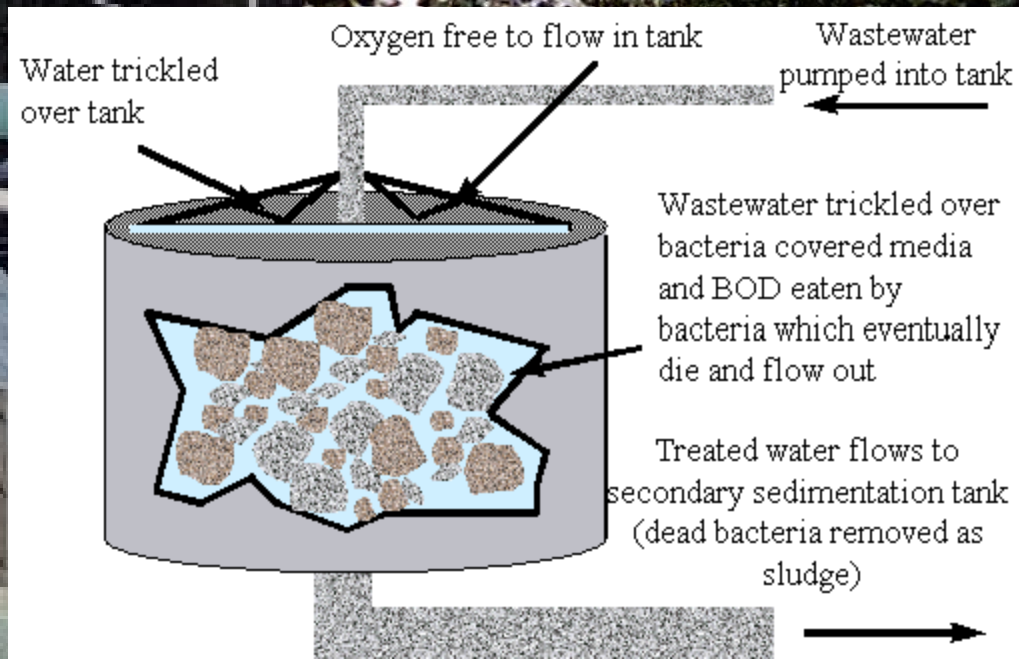
**Sloughed biomass**

Glycocalyx

Mostly polysaccharides



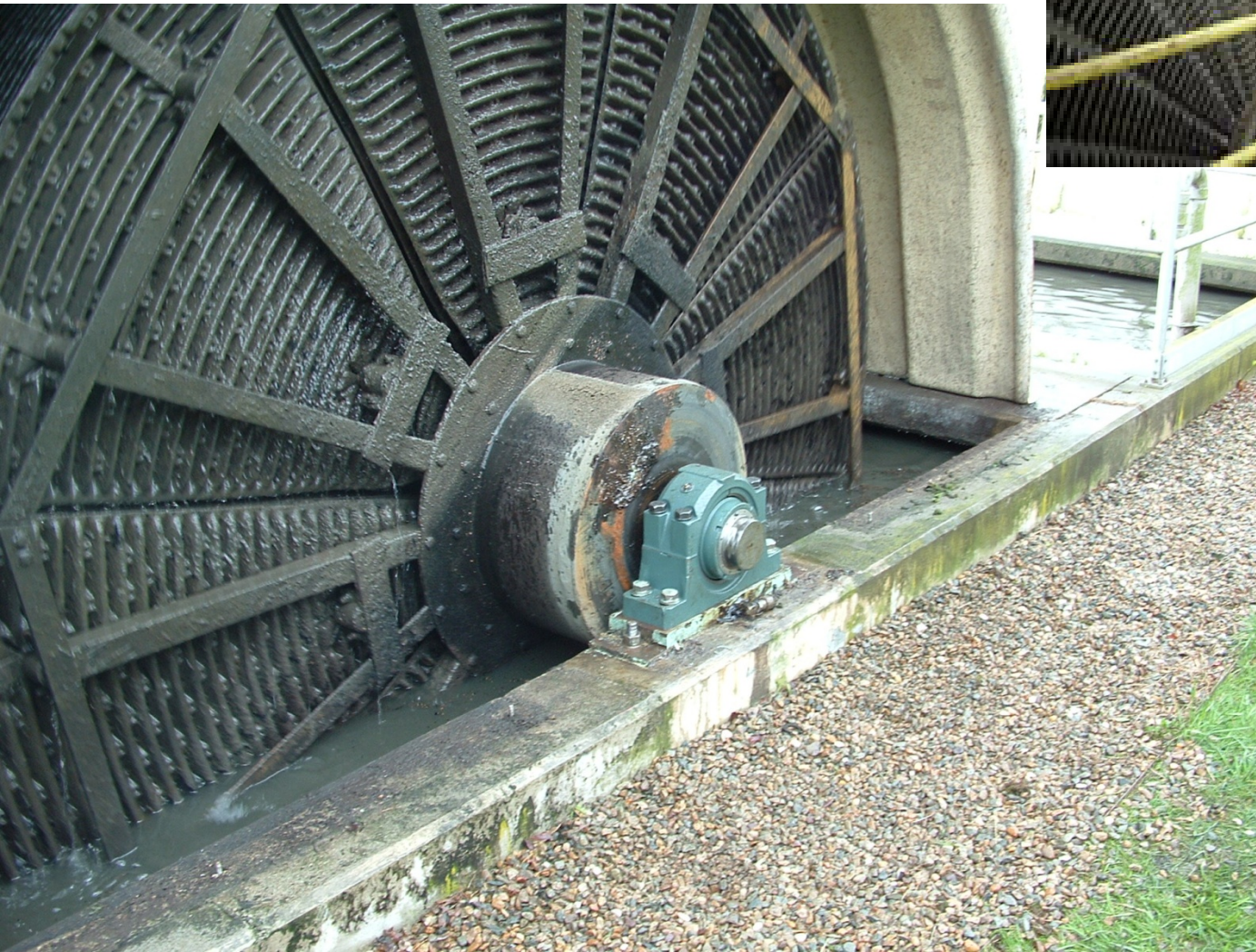
# Trickling Filters





# RBCs

- Marquette, MI



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- To next lecture