

# **Anoxic selector, single stage nitrification process**

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Water Utility Services**

# Presentation

- Review of Theory
  - ◆ Nitrification
  - ◆ Denitrification
- Characteristics of bioreactors
  - ◆ Aerated or Oxidic
  - ◆ Un-aerated or Anoxic
- Nitrification Optimization
- Denitrification Optimization
  
- PRACTICAL APPLICATIONS @ WMARSS

# Nitrification

- Oxidation of ammonia to nitrite in oxic conditions by nitrosomonas group (Optimum pH 8.0):

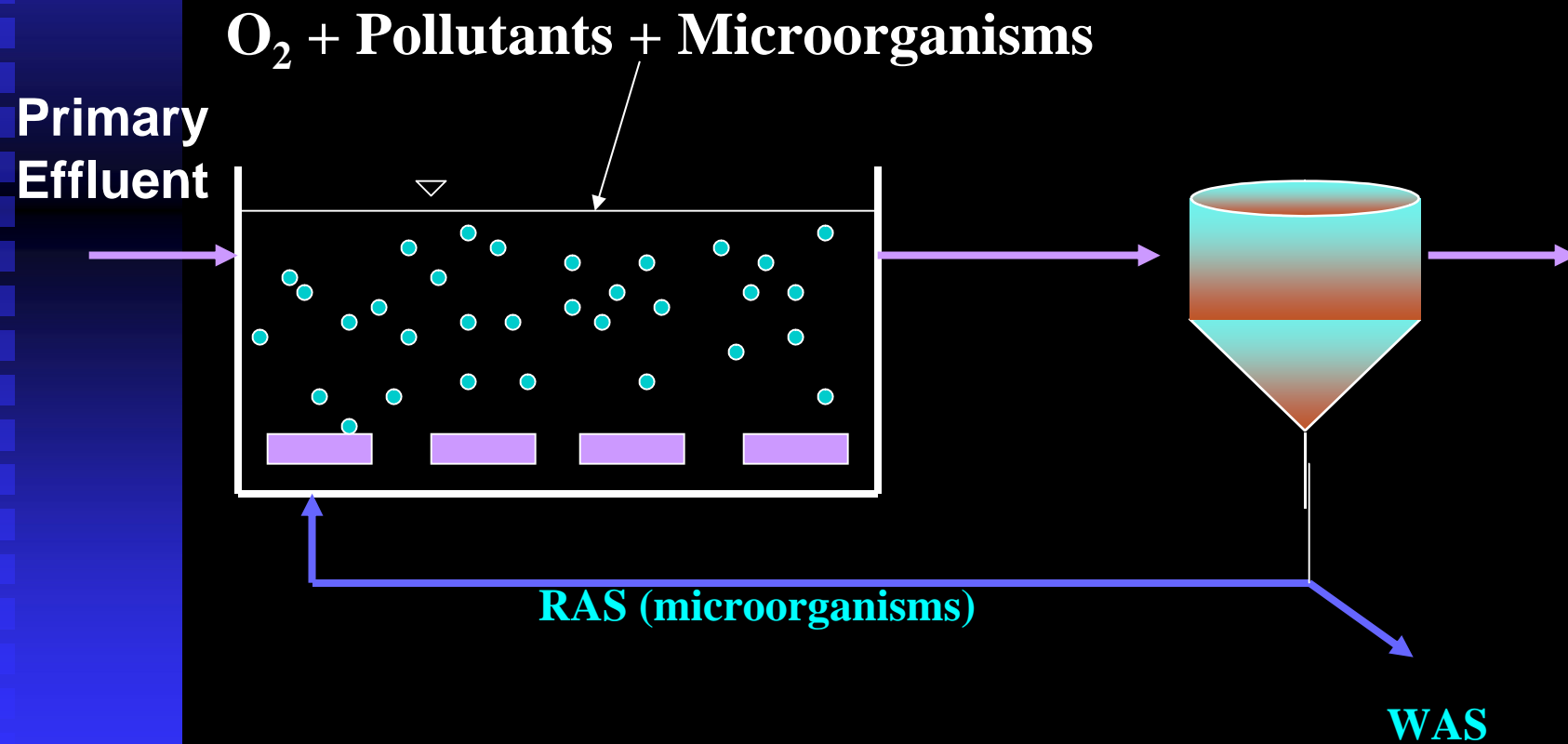


- Oxidation of nitrite by nitrobactor group:



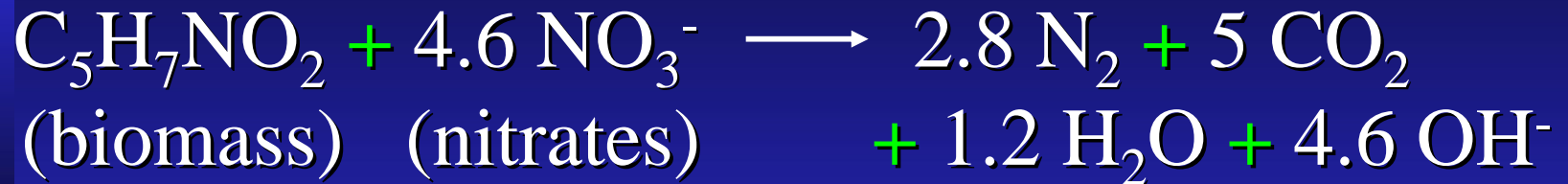
- Oxygen **mechanically** provided by blowers
- Oxygen Consumption: 4.6 lbs of oxygen per lb of ammonia oxidized to nitrates (**energy intensive!**)
- Recover Nitrification Cost: **De-nitrification**
- Nitrobes that Nitrify are facultative (oxic or anoxic). In anoxic they can use  $\text{NO}_3$  in lieu of direct  $\text{O}_2$  for cellular respiration and denitrify

# Aerated (Oxic) Bioreactor



# Denitrification

Using biomass in wastewater as carbon source for bacteria:

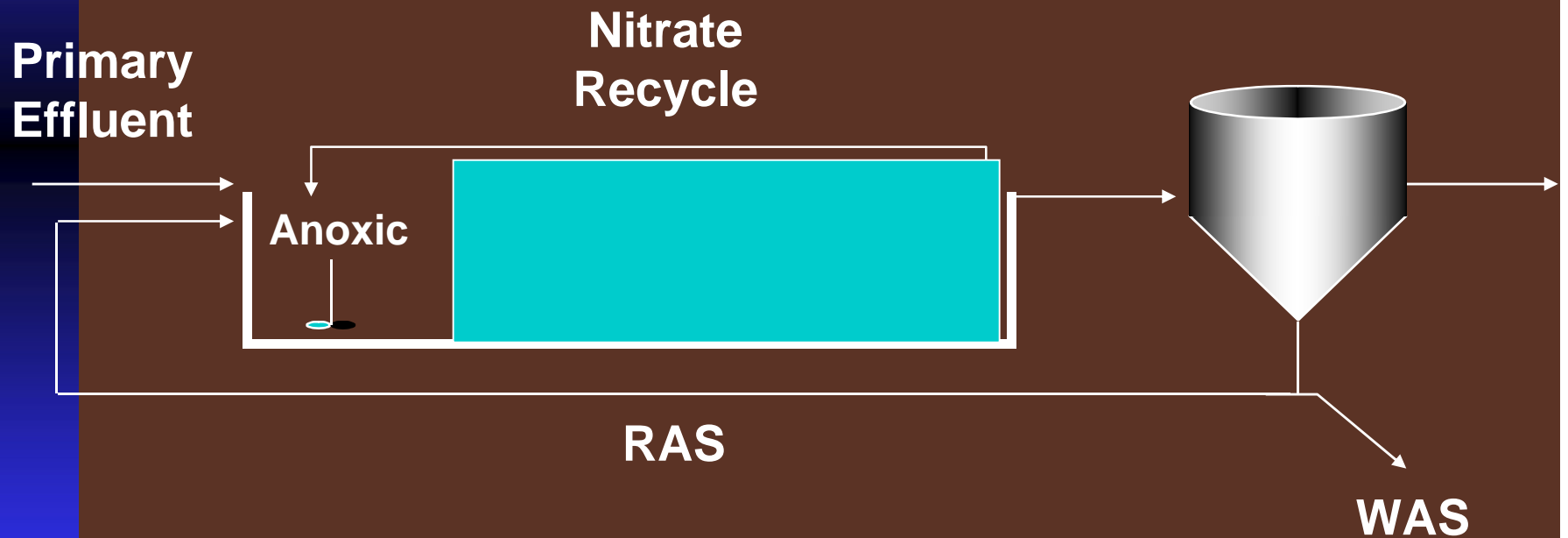


- Because within the anoxic reactor no dissolved oxygen is supplied bacteria strip the oxygen molecule from the nitrates and consume the BOD present.

## ADVANTAGES OF DENITRIFICATION

- Nitrate is reduced to nitrogen:  $\text{NO}_3 \longrightarrow \text{N}_2$
- BOD is consumed
- Alkalinity is replenished saving the buffer for subsequent pH sensitive biological reactions

# Un-aerated Bioreactor (Anoxic Zone)



# Nitrification Optimization

## Summary

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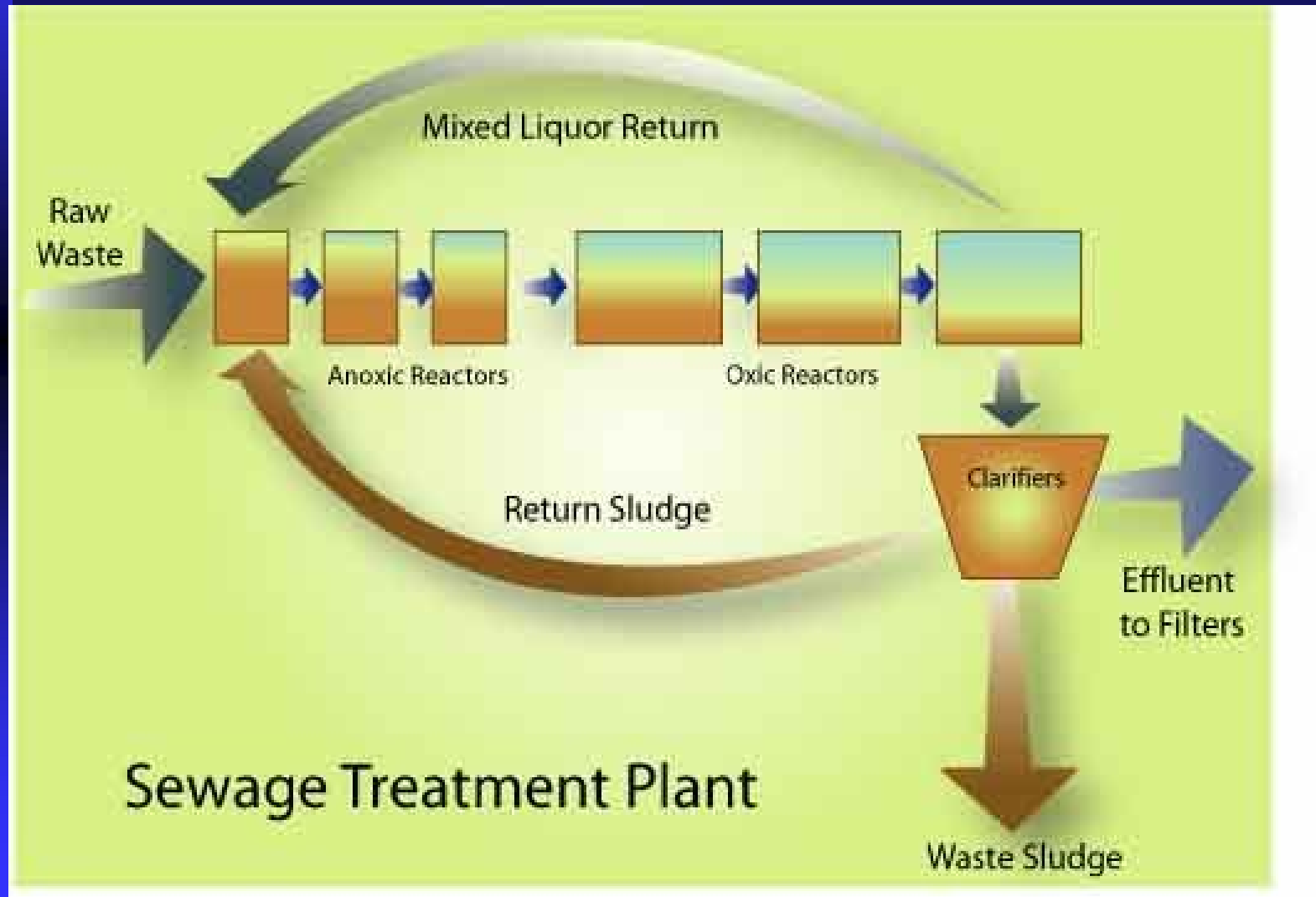
- Test nitrification rate occasionally
- Select appropriate SRT
- Keep DO at min 2 mg/l @ peak conditions
- Keep pH about neutral (optimal 7.5 to 8.5)
- Provide sufficient alkalinity
- Replenish a portion of the alkalinity consumed during the nitrification process by denitrification

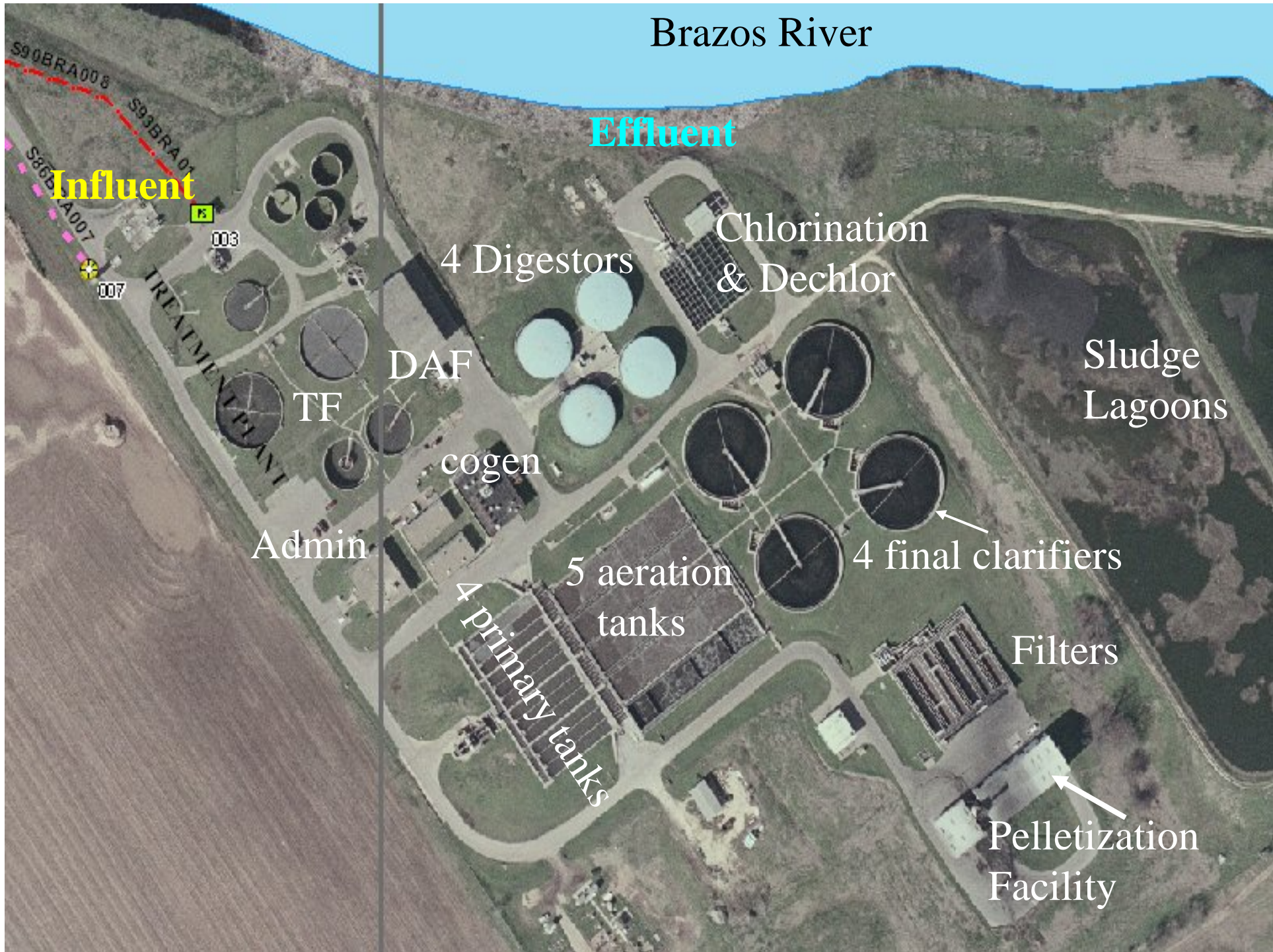
# Denitrification Optimization Summary

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- Minimize DO in anoxic zone ( $< 0.2$  mg/l)
- Maximize recycle capabilities
- Provide sufficient carbon source

# Ludzak - Ettinger Process





Brazos River

Effluent

Influent

Chlorination  
& Dechlor

4 Digestors

Sludge  
Lagoons

DAF

TF

cogen

Admin

4 final clarifiers

5 aeration  
tanks

Filters

4 primary  
tanks

Pelletization  
Facility