Schematic Diagram
5 Stage Biological Process

1. Anaerobic Basins
2. Anoxic Basins
3. Aerobic Basins
4. Anoxic Basins
5. Aerobic Basins

Stage Biological Process Description
Anaerobic Basin – Organisms Uptake BOD & Release Phosphorus (P)
Anoxic Basin – Organisms Uptake BOD and Convert Nitrate (NO₃) to N Gas
Aerobic Basin – Uptake BOD & P - Convert Ammonia (NH₃) to NO₃
  Internal Recycle sends NO₃ to 1st Stage Anoxic
Anoxic Basin – Converts NO₃ to N Gas
  Methanol Addition provides food for conversion
  FeCl Addition – Precipitates Remaining Phosphorus
Primary Sedimentation Tanks (Fermentation Tanks)

Four Tanks of volume 138000 gallons. Holding time is about 2.5 hours. Sludge Blankets are maintained at certain level with running of Helicoids to Produce Volatile Fatty Acids.
Anaerobic Basins
Anaerobic Basins

(Anaerobic fermentation)

Primary Effluent $Q$ with Soluble BOD

$Q + RSF$ To Anoxic Basin

Return Sludge with facultative fermentation bacteria (RSF) and Phosphate accumulating Organisms (PAOs)
Phosphorus Accumulating Organisms – Neisser Stain, 1000 X
Anaerobic Basins

Microbiology

BOD → Energy

Facultative Fermentation Bacteria

Waste Products → Volatile Fatty Acids & Alcohols

Accumulated Food

Phosphorus Accumulating Organisms (PAOs)

PO₄³⁻
Anaerobic Basins

- Four tanks of volume 266,990 gallons. Design Holding Time is about 1 hour.

- Due to anaerobic conditions (Dissolved or free Oxygen must be zero) Phosphorous Accumulating Organisms (PAOs) get stressed and release the Phosphorus from their cell structure in large quantities.

- ORP, pH, Volatile fatty Acids and mixing pattern are the important factors.

- ORP is monitored continuously by automated ORP probes and SCADA system.
Anoxic Basins Recirculation
(Denitrification tank)

Nitrogen Gas to Atmosphere

NO$_3$ from Aerobic Recycle

To Aerobic Basins

From Anaerobic Basin
Anoxic Basins

From Anaerobic basins

NO$_3$ from Aerobic Recycle

Nitrogen Gas to Atmosphere

To Aeration Basin
Anoxic basins

- Four tanks of volume 443200 gallons. Design Holding Time is 1.5 hours.

- No free or dissolved oxygen. Oxygen presents in combined state (oxygen Deficient).

- Removes Nitrogen by recycling nitrate rich mixed liquor from the aerobic zone to anoxic zone.

- Denitrification of the recycled nitrate takes place in the anoxic zone in the absence of dissolved oxygen.

- Temperature, ORP, D.O and recirculation flow is monitored continuously by automated probes and through the SCADA system.
Aerobic Basin
(Nitrification tank)
Phosphorus Accumulating Organisms

Energy for cell maintenance, reproduction and polyphosphate production

CO₂

Accumulated food

Polyphosphate

PO₄⁻³

O₂

Nitrosomonas

Nitrobacter

Nitrous Oxide

Nitric Oxide

NH₄⁺

NO₂⁻

NO₃⁻
Aerobic Basins

- Two tanks of volume 1245820 gallons. Design Holding Time is 7 hours.
- Aerobic and favorable conditions make the stressed PAOs from anaerobic conditions to take up the phosphorus, since the bacteria are lacking in phosphorus in their cell structure.
- The Phosphorus taken up by the bacteria is removed from the waste stream as waste activated sludge.
- Ammonia in the influent is converted to Nitrate (Nitrification) and then recycled to the first anoxic zone for denitrification.
- D.O and Temperature is monitored continuously by automated probe.
Second Anoxic Basins
Second Anoxic Basins

- Four tanks of volume 345520 gallons. Design Holding Time is 1.5 hours

- Further denitrification is obtained for removal of Nitrate remaining after recycling.

- ORP is monitored continuously by automated probe

- The facility has the option to add Methanol as food source as needed
Second Aeration Basins
Second Aeration Basins

- Four basins of volume 170955 gallons. Design Holding Time is 1 hour.
- Fifth in the series of BNR system.
- Further nitrification is obtained for removal of Ammonia.
- D.O is monitored continuously by automated probes.
- The facility has the option to add Ferric chloride to precipitate the remaining phosphorus.
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<th>CBOD</th>
<th>NH₃</th>
<th>Total P</th>
<th>TSS</th>
<th>Total N</th>
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Total Phosphorus – Sept. 2010 To Sept. 2011

Mg/L
Waste Water Facility's
MOST WANTED

Jason Schutz
Chief Water Operator

Jason Meyer
Water Operator

Last seen Cleaning the water filters and dumping Phosphoric acid to upset the Waste Water System