# Fermentation Enhanced Nutrient Removal at Janesville WWTF

WWOA – 46th Annual Conference

October 11, 2012

**Presented by:**
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**Joe Zakovec, Janesville Wastewater Utility**

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# Presentation Outline

- Project background
- BNR design
- Startup and operation
- Supplemental carbon pilot
- What's next?

# Project Background

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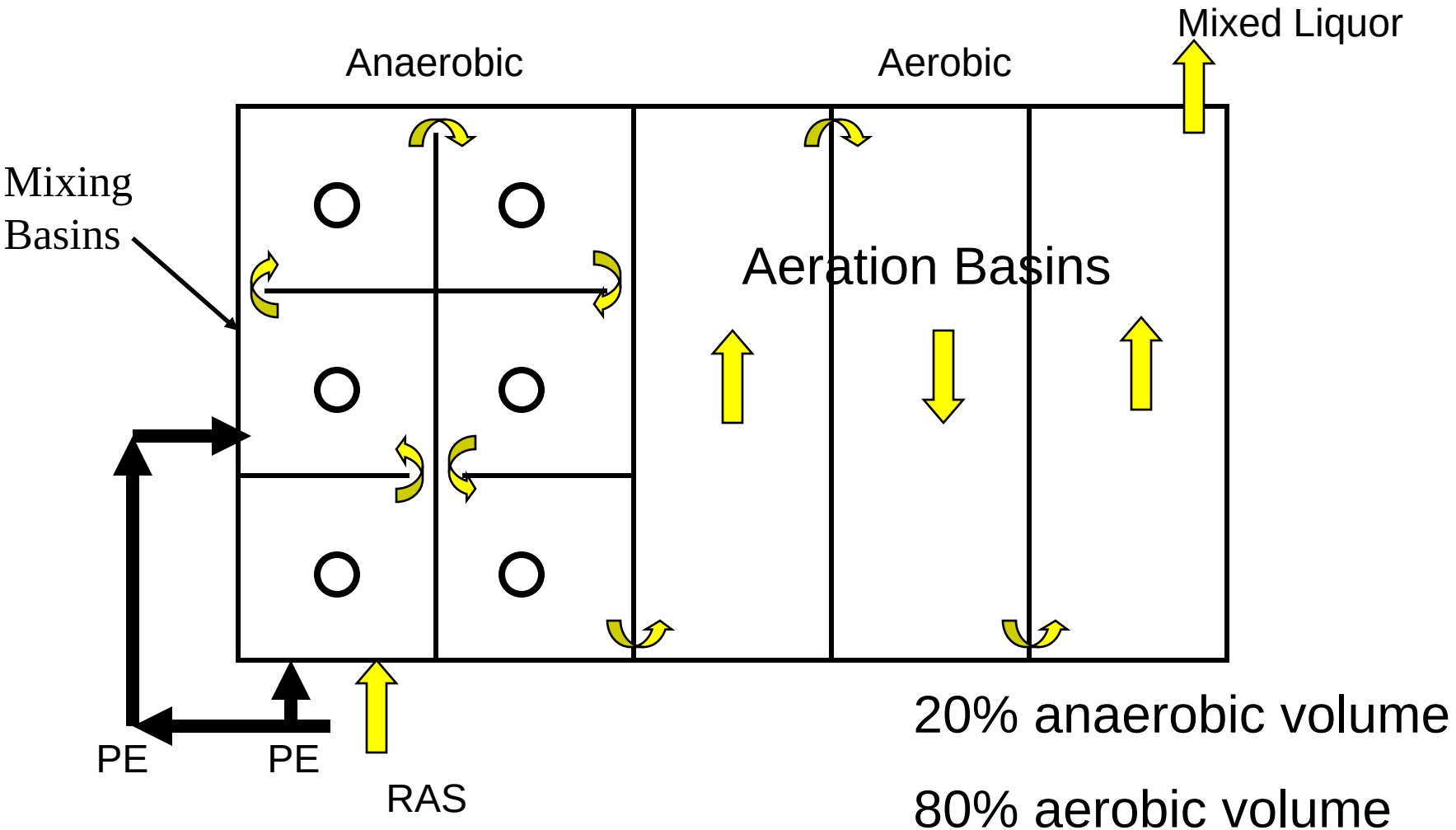
# Project Background

- Current flow of 14 MGD
- Serves population of 60,000
- Biological phosphorus removal (BPR) first incorporated 2001 to 2003
  - Anaerobic / Oxic (A/O) configuration
  - Included backup chemical P removal facilities
  - Influent lacked sufficient VFAs
  - Chemical polishing used off and on

# Project Background

## 2003 A/O Process Configuration




20% anaerobic volume

80% aerobic volume

# Project Background

## 2003 A/O Process Configuration

# Project Background

- 2010 – 2011 upgrade project
  - $32 million upgrade
  - Capacity increase to 20 MGD
  - Incorporated biological nutrient removal (BNR)
  - New cogeneration facilities
  - Renovation of several 30+ year-old facilities

# Biological Nutrient Removal Design

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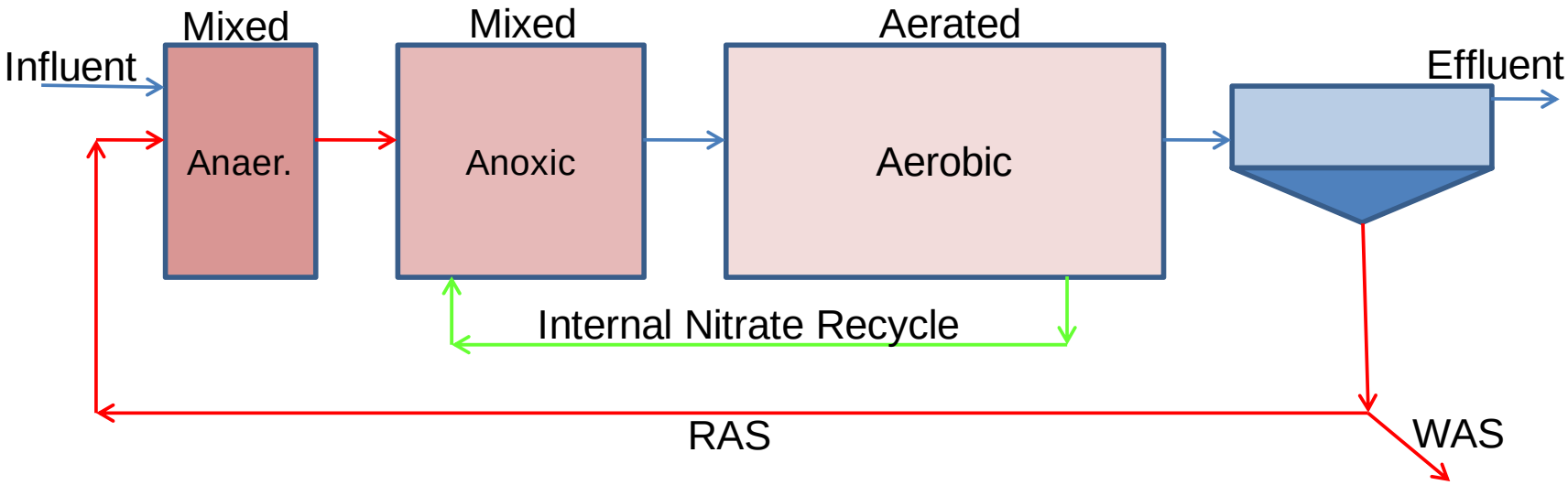
# Biological Nutrient Removal Design

- Project goals:
  - Enhance biological phosphorus removal to eliminate chemical polishing
    - Effluent phosphorus goal between 0.3 mg/L and 0.5 mg/L
  - Incorporate biological nitrogen removal
    - Effluent nitrogen goal between 6 mg/L and 8 mg/L
- Resources utilized
  - BioWin computer simulations
  - AECOM Canada experts

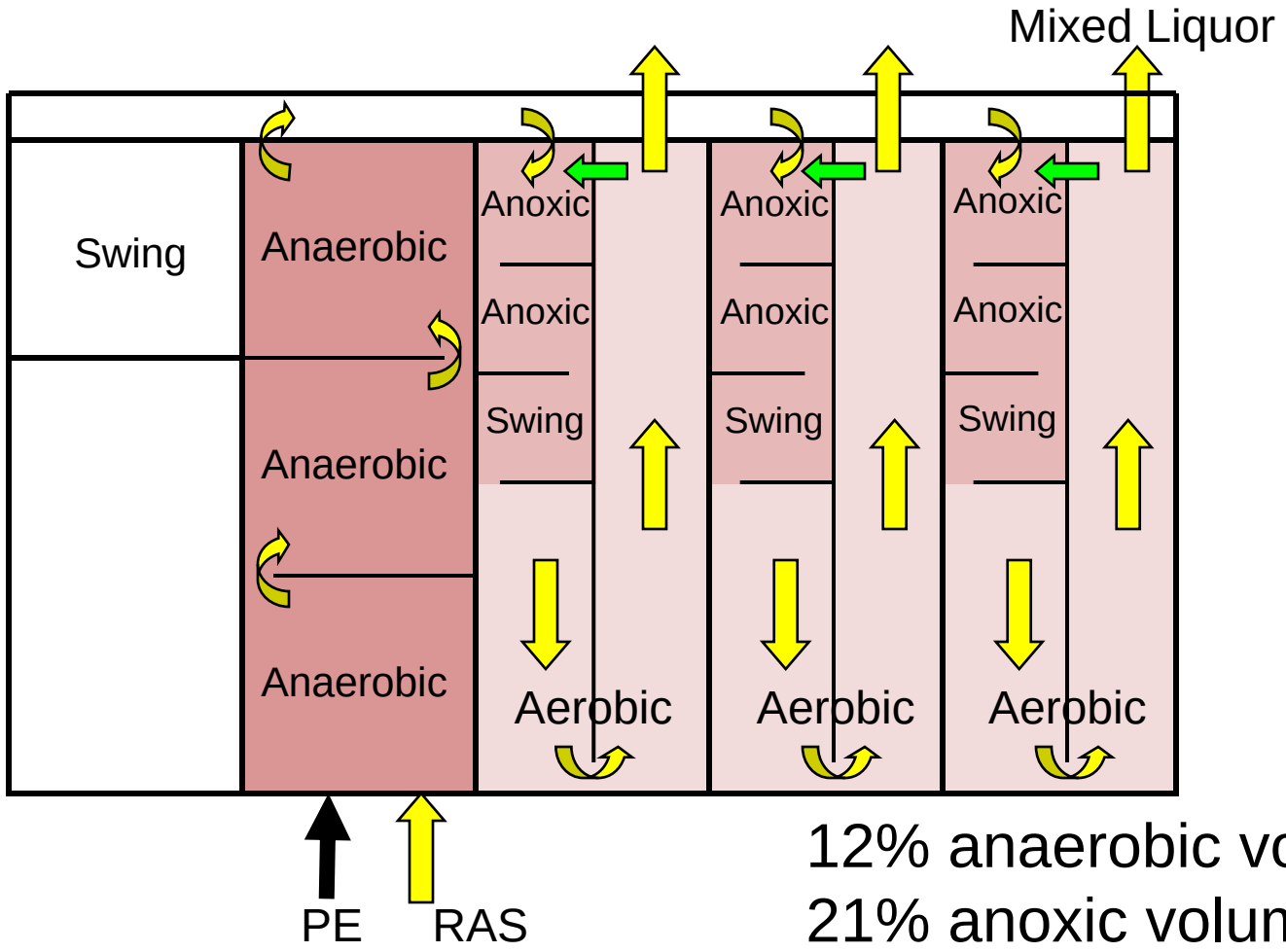
# Biological Nutrient Removal Design

- Process configuration
  - Anaerobic / Anoxic / Oxic ($A^2O$)



# Biological Nutrient Removal Design

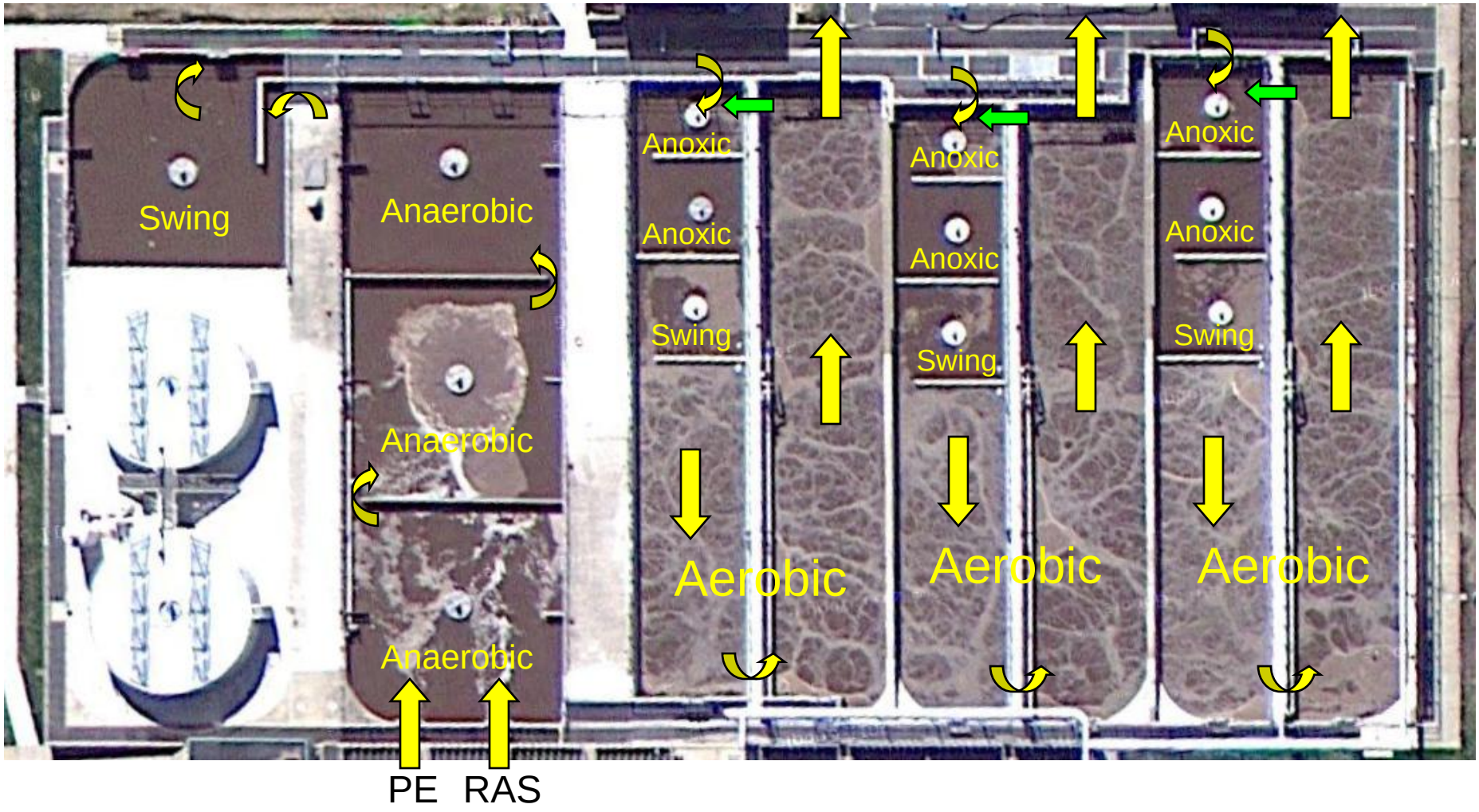
## 2011 $A^2O$ Process Configuration




12% anaerobic volume
21% anoxic volume
67% aerobic volume

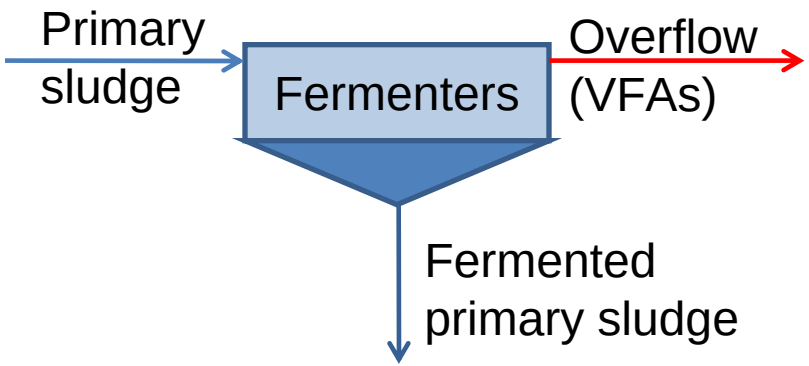
# Biological Nutrient Removal Design

## 2011 $A^2O$ Process Configuration

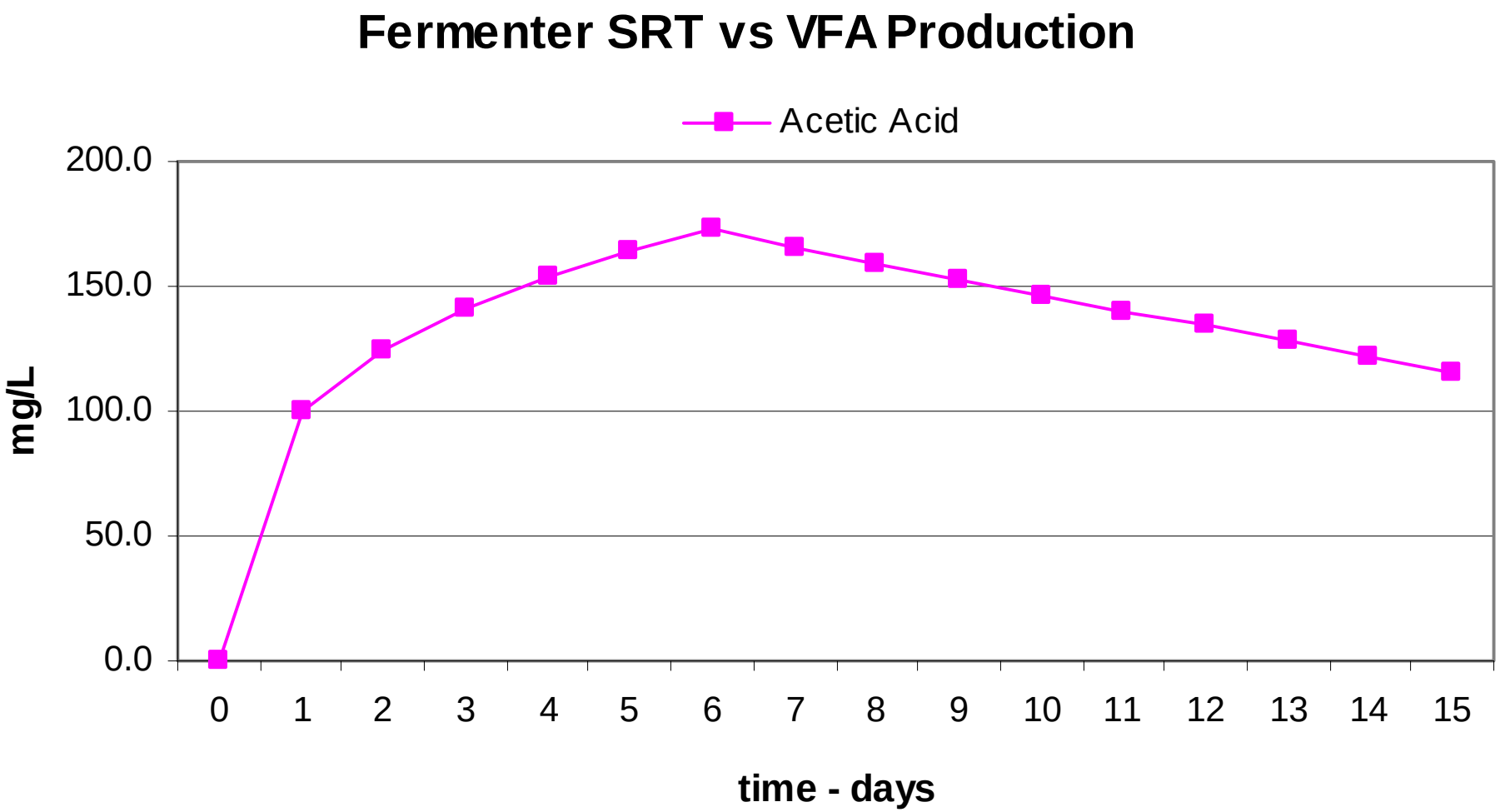


# Biological Nutrient Removal Design

- Fermentation incorporated into design due to low wastewater strength
  - Primary sludge is pumped to the fermenters
  - Fermenters store and thicken the sludge
  - VFA production is based on time and temperature
  - Operation based on target SRT

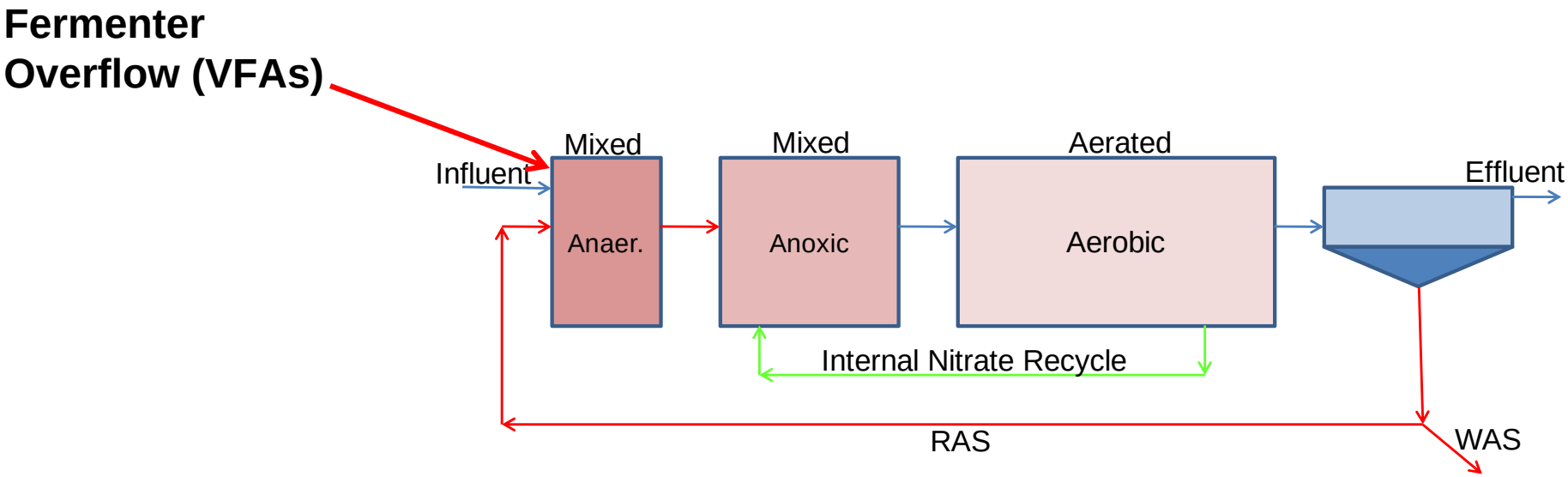



# Biological Nutrient Removal Design

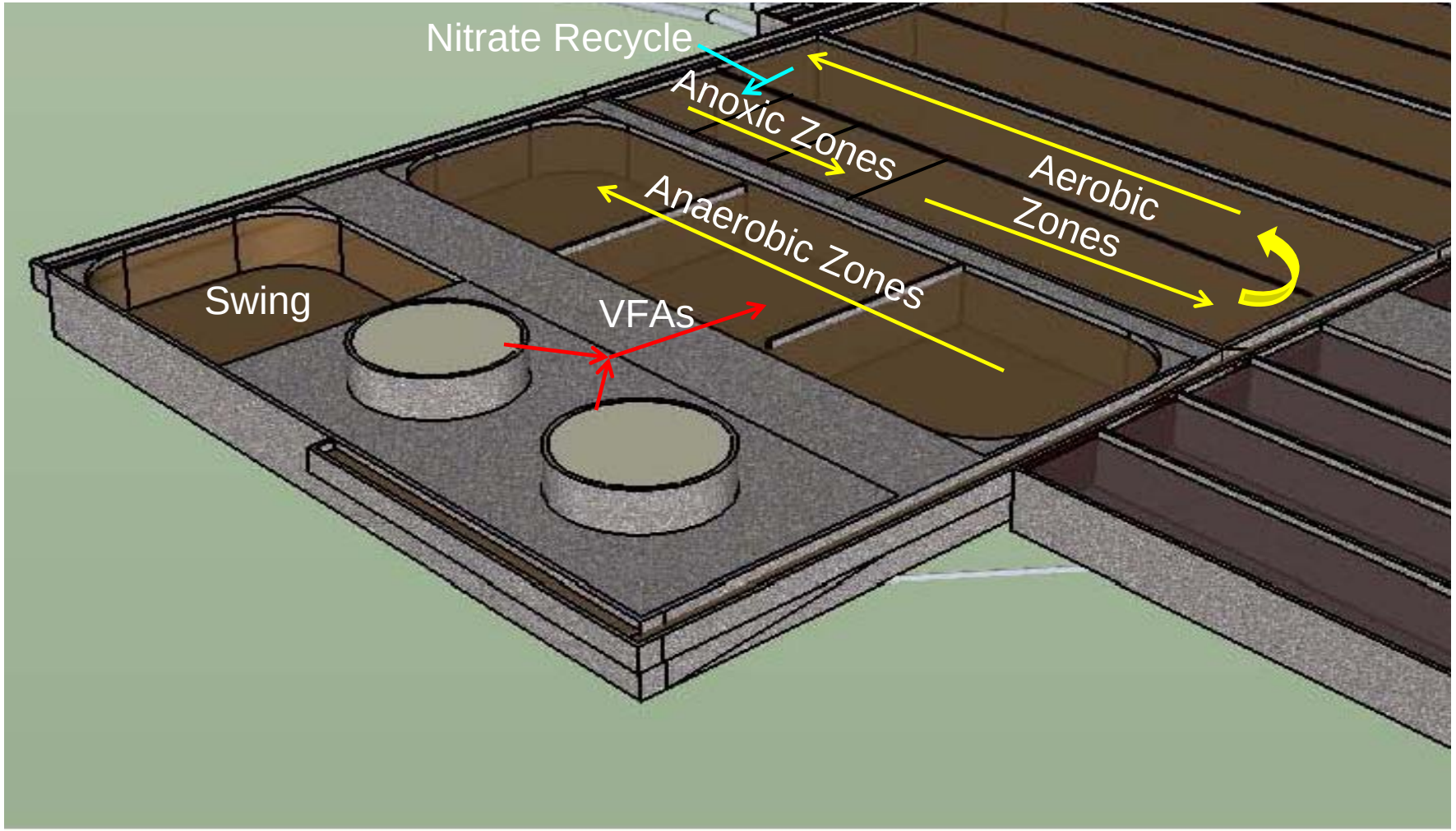


# Biological Nutrient Removal Design

- Overflow from fermenters provides the necessary VFA for biological phosphorus removal
- The remaining VFA flows into the anoxic zone for biological nitrogen removal



# Biological Nutrient Removal Design



# Biological Nutrient Removal Design

- System components
  - Baffle walls
    - Create boundaries for the environments
    - Minimize short-circuiting

# Biological Nutrient Removal Design

- System components
  - Mixers
    - Keep tankage completely mixed without aeration

# Biological Nutrient Removal Design

- System components
  - Nitrate recycle pumps
    - High flow, low head pumping between tankage


# Biological Nutrient Removal Design

- System components
  - Swing zones – aeration can be turned on or off

# Startup and Operation

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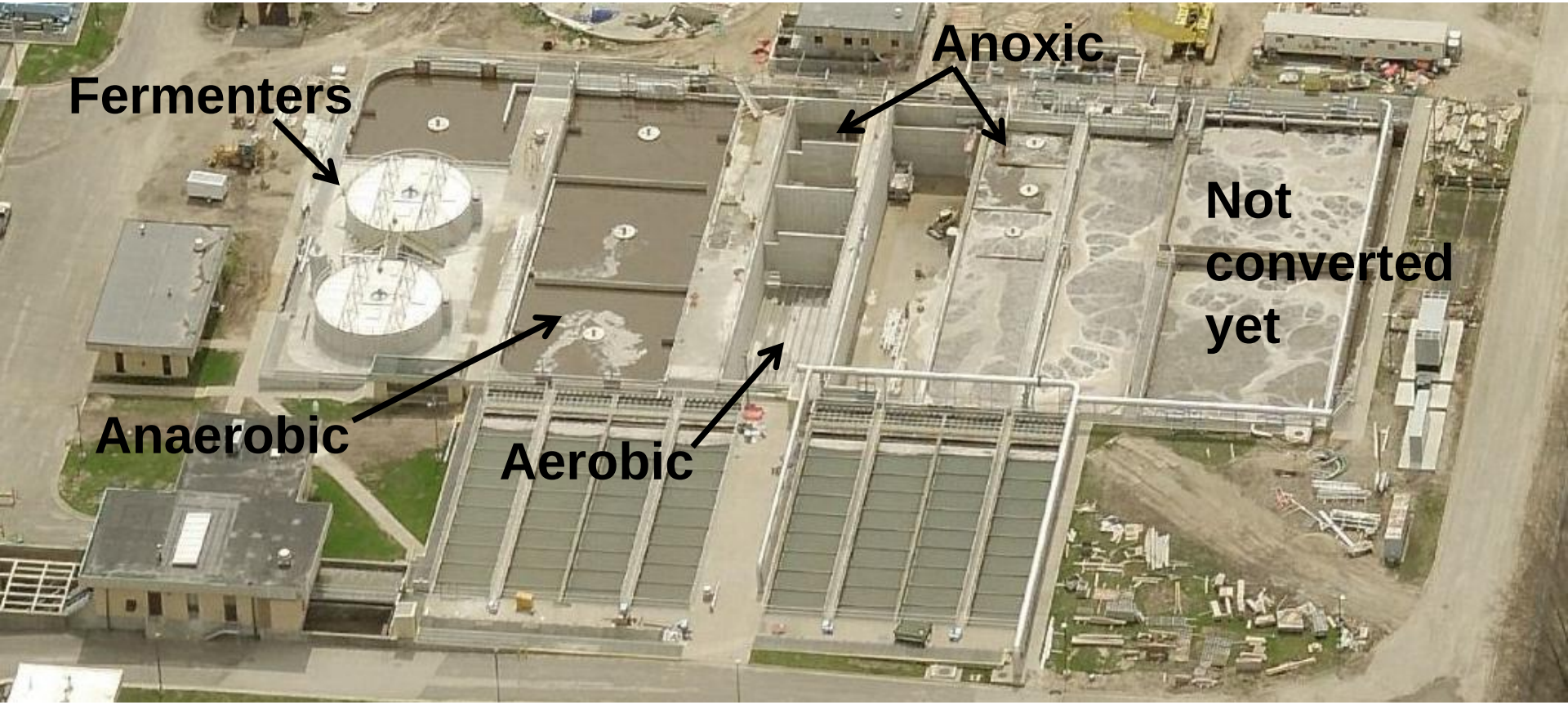
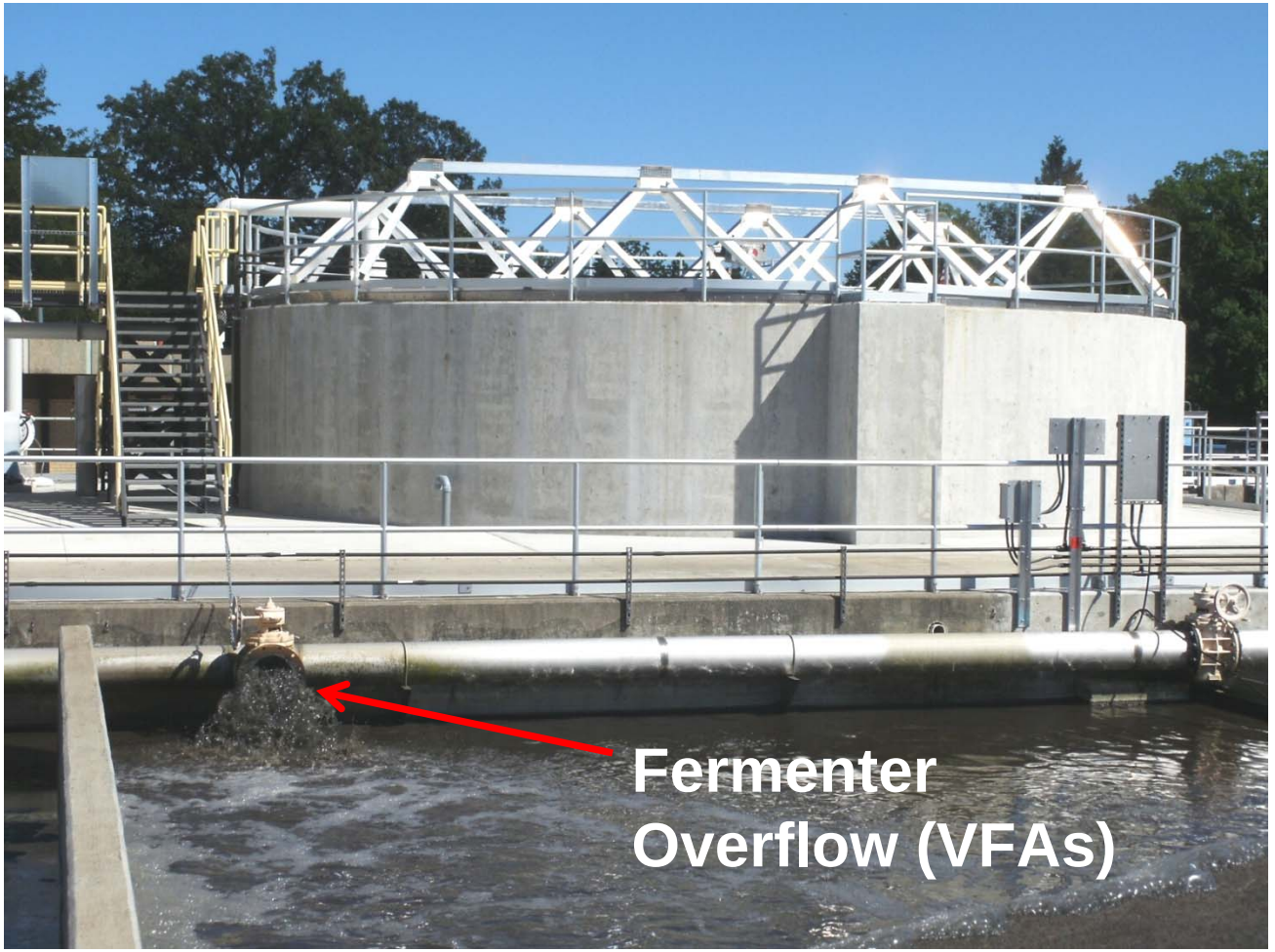
# Startup and Operation

- BNR system overview



# Startup and Operation

- Fermenters and anaerobic zones

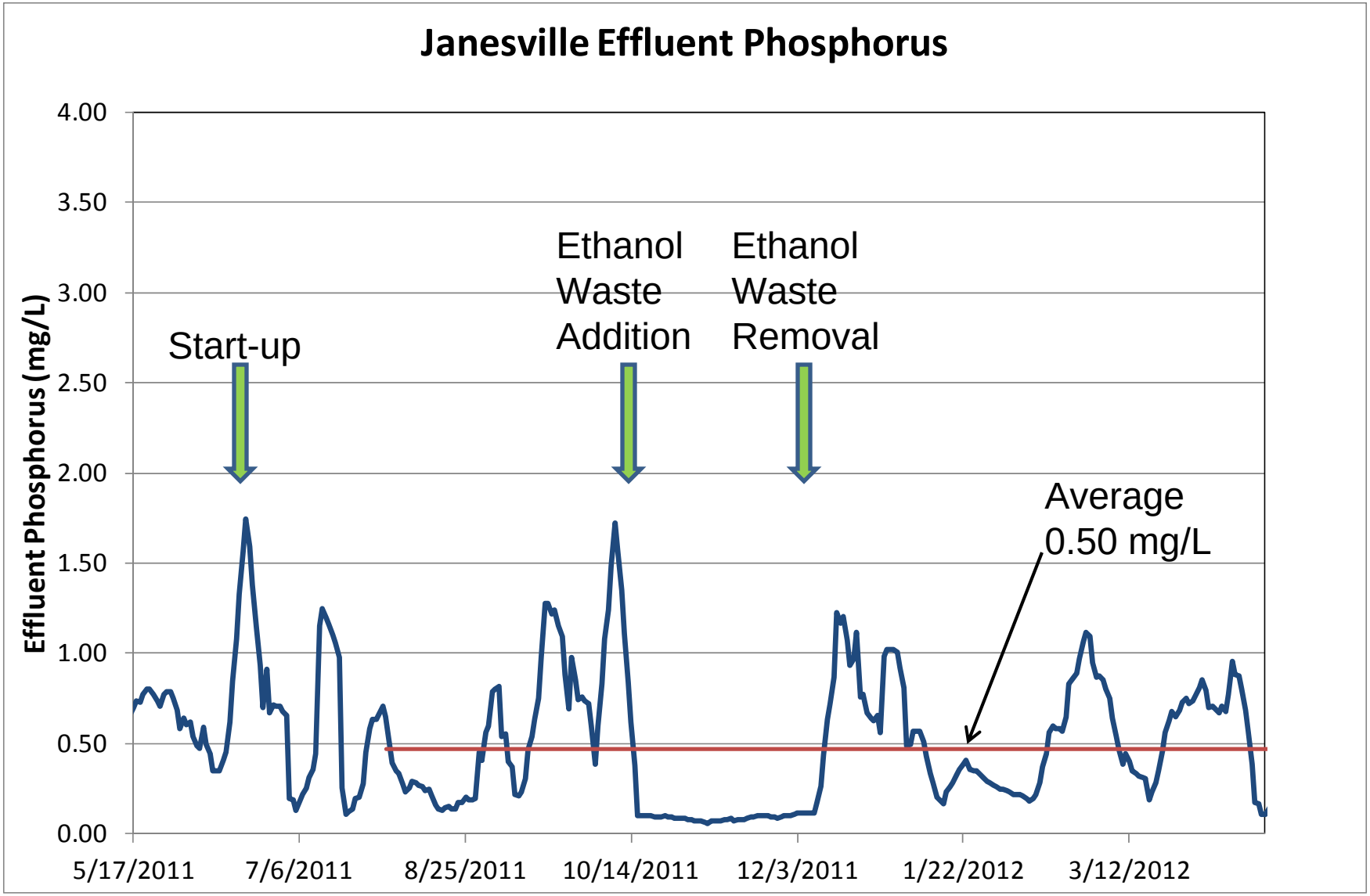


# Startup and Operation

- Fermenter overflow
  - Flow of 0.9 MGD
  - 7% of forward flow
  - Currently generating 1000 lbs/day VFA

| Date | Volatile Acids (mg/L) |
|---|---|
| 01/03/12 | 100 |
| 01/24/12 | 87 |
| 02/14/12 | 125 |
| 02/22/12 | 115 |
| 02/28/12 | 216 |
| 03/07/12 | 218 |
| 03/14/12 | 183 |
| 03/14/12 | 163 |
| 03/21/12 | 60 |
| 03/27/12 | 118 |
| 04/04/12 | 72 |
| 04/09/12 | 150 |
| 04/18/12 | 121 |
| 04/24/12 | 105 |
| 05/04/12 | 139 |
| **Average** | **132** |

# Startup and Operation



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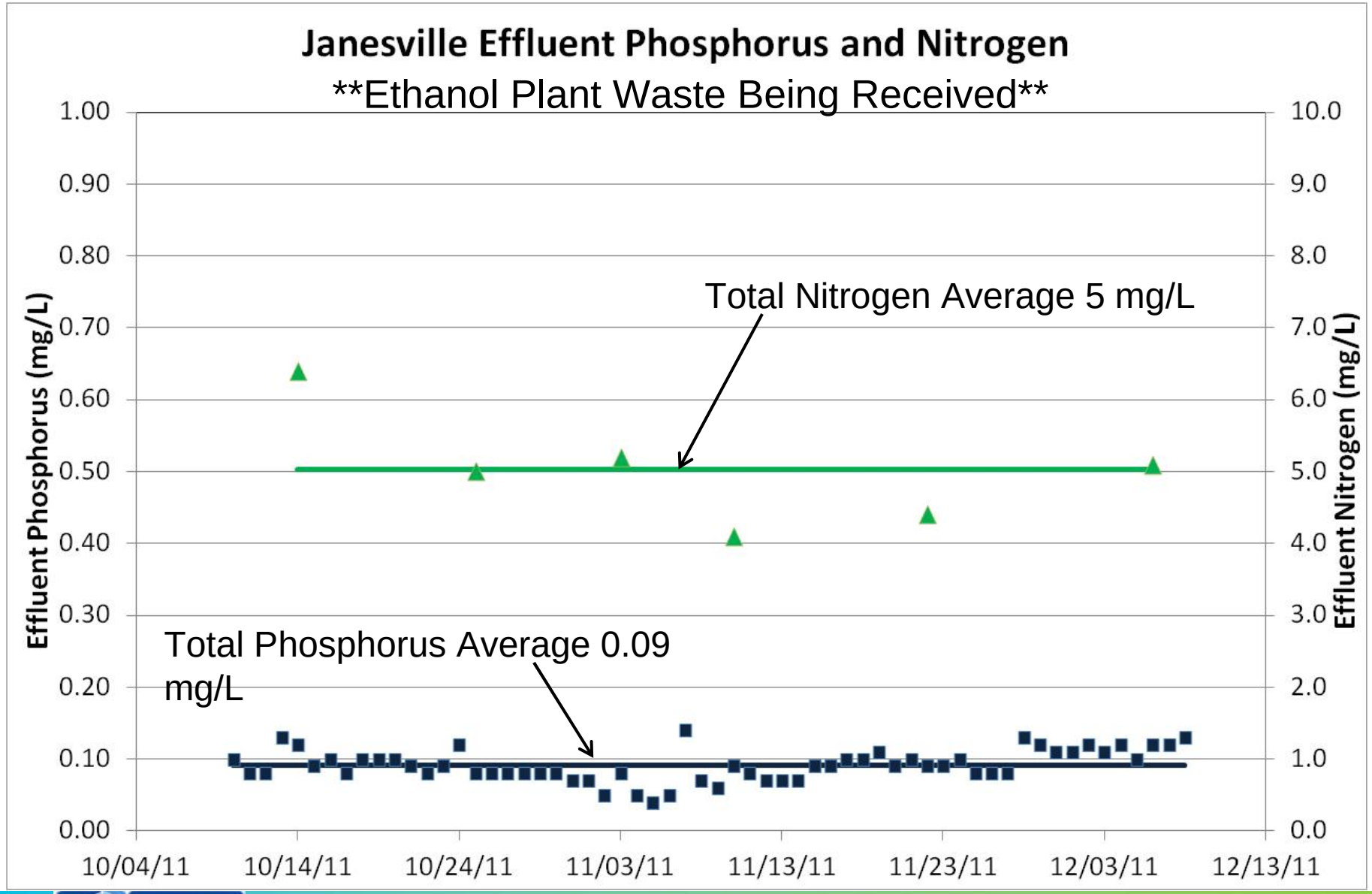

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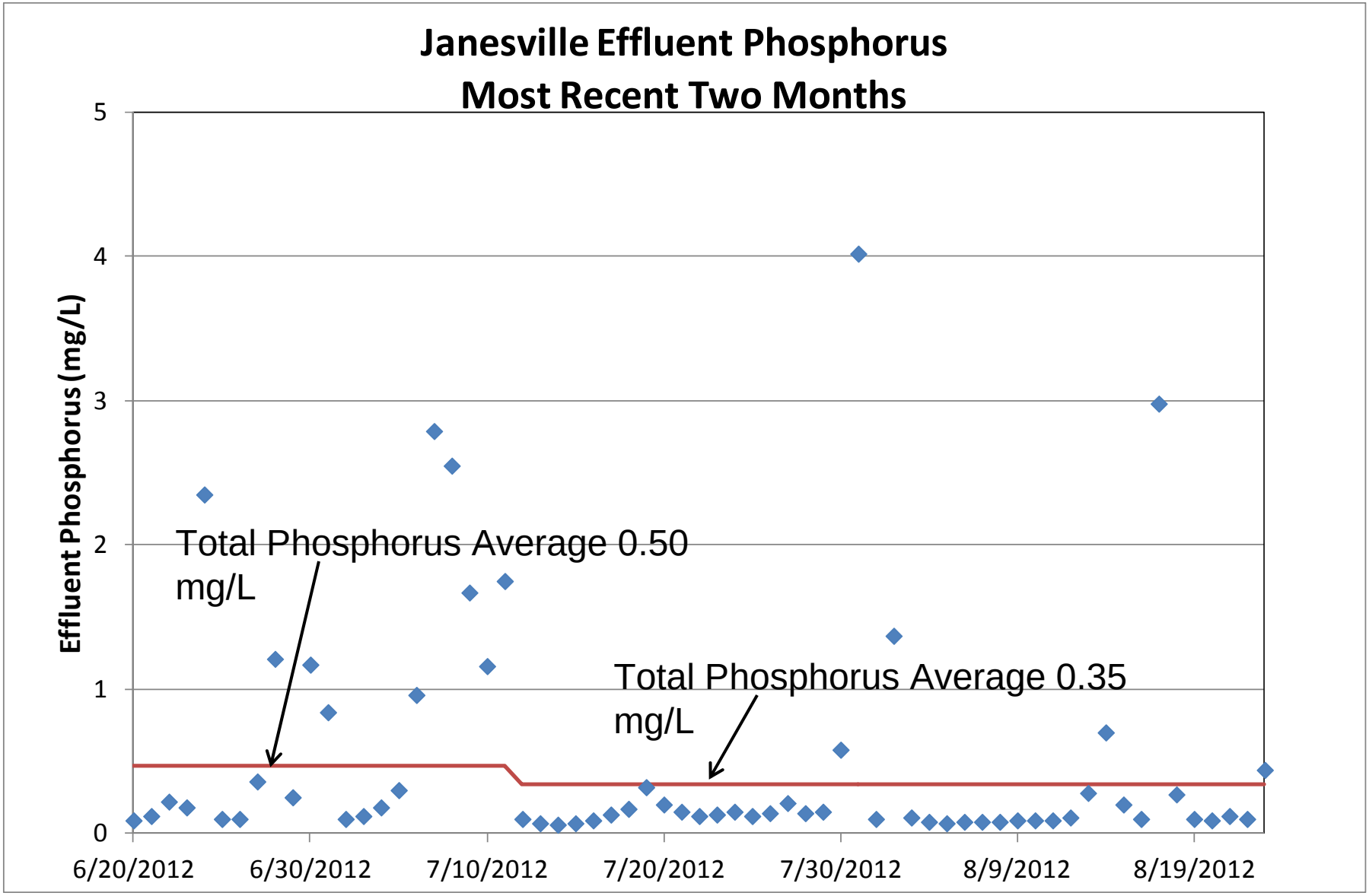
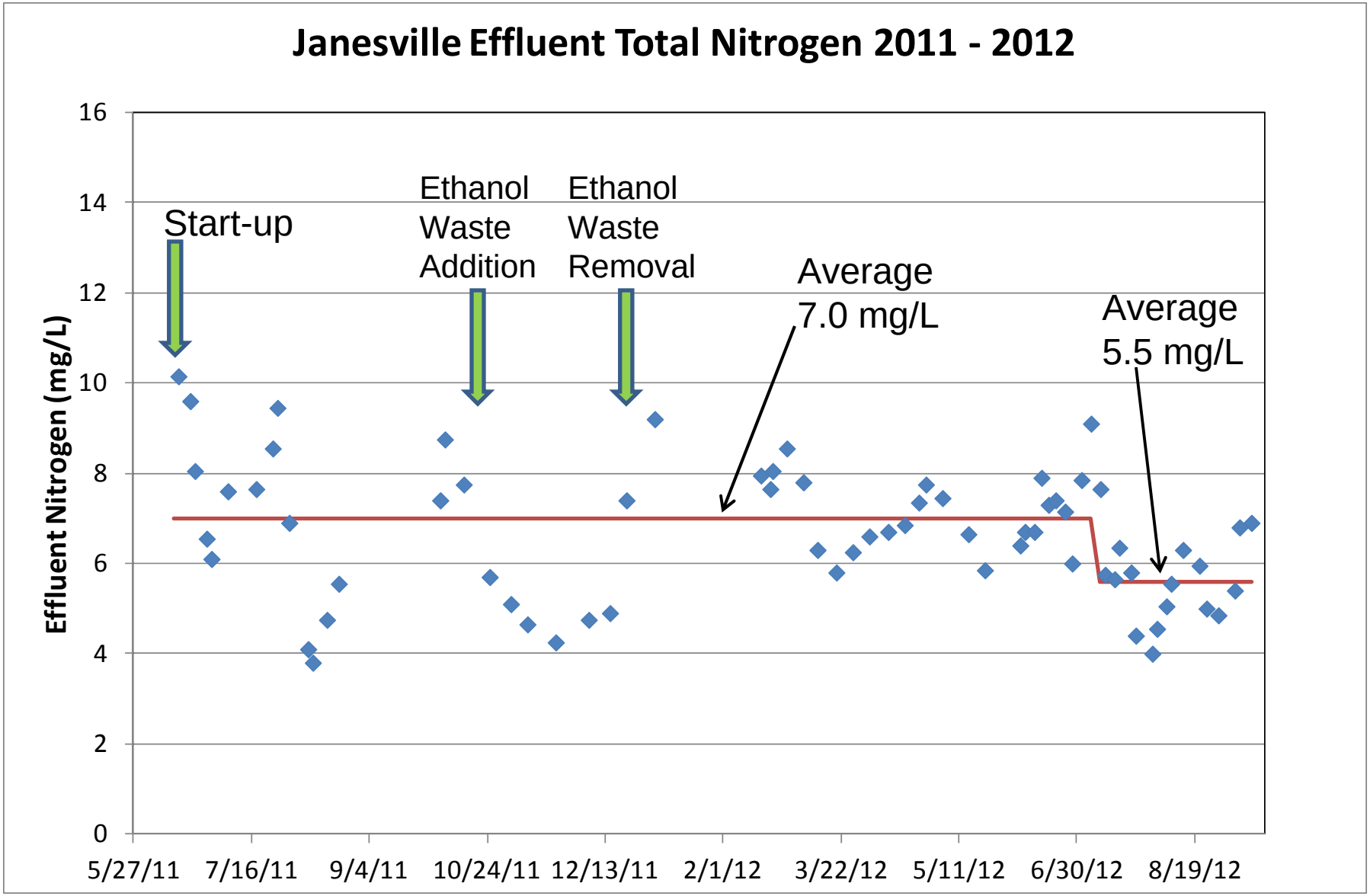


# Startup and Operation

- Anoxic and aeration zones

# Startup and Operation



# Supplemental Carbon Pilot

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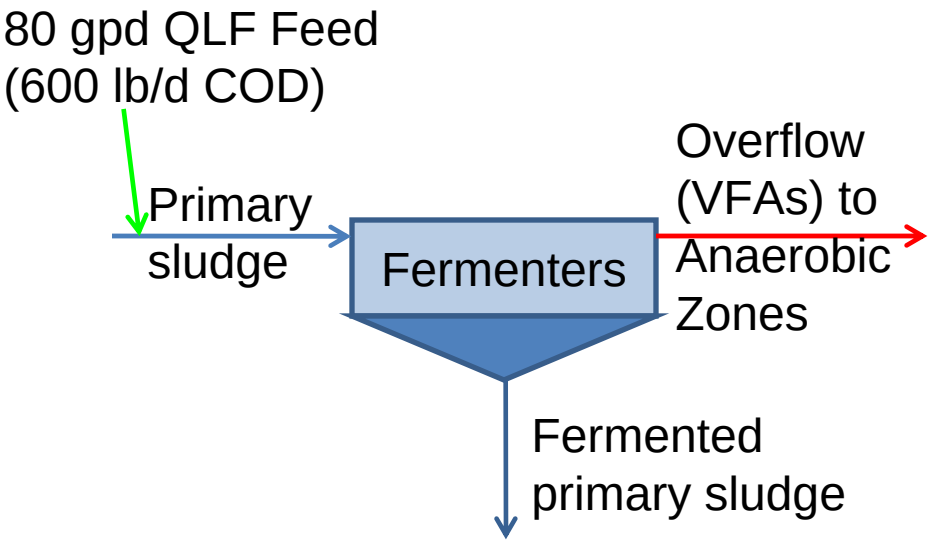
# Supplemental Carbon Pilot

- Pilot Project
  - Evaluate feeding supplemental carbon from QLF Specialty Products
    - Liquid molasses blend product
    - 7.3 lbs COD per gallon (875,000 mg/L)
- Pilot Goal
  - Stabilize BPR performance near 0.10 mg/L effluent total-P **(no filters and no ferric chloride)**

# Supplemental Carbon Pilot

- QLF product fed into fermenters
  - Fermenters convert product to VFA's
  - VFA loading in fermenter overflow increased



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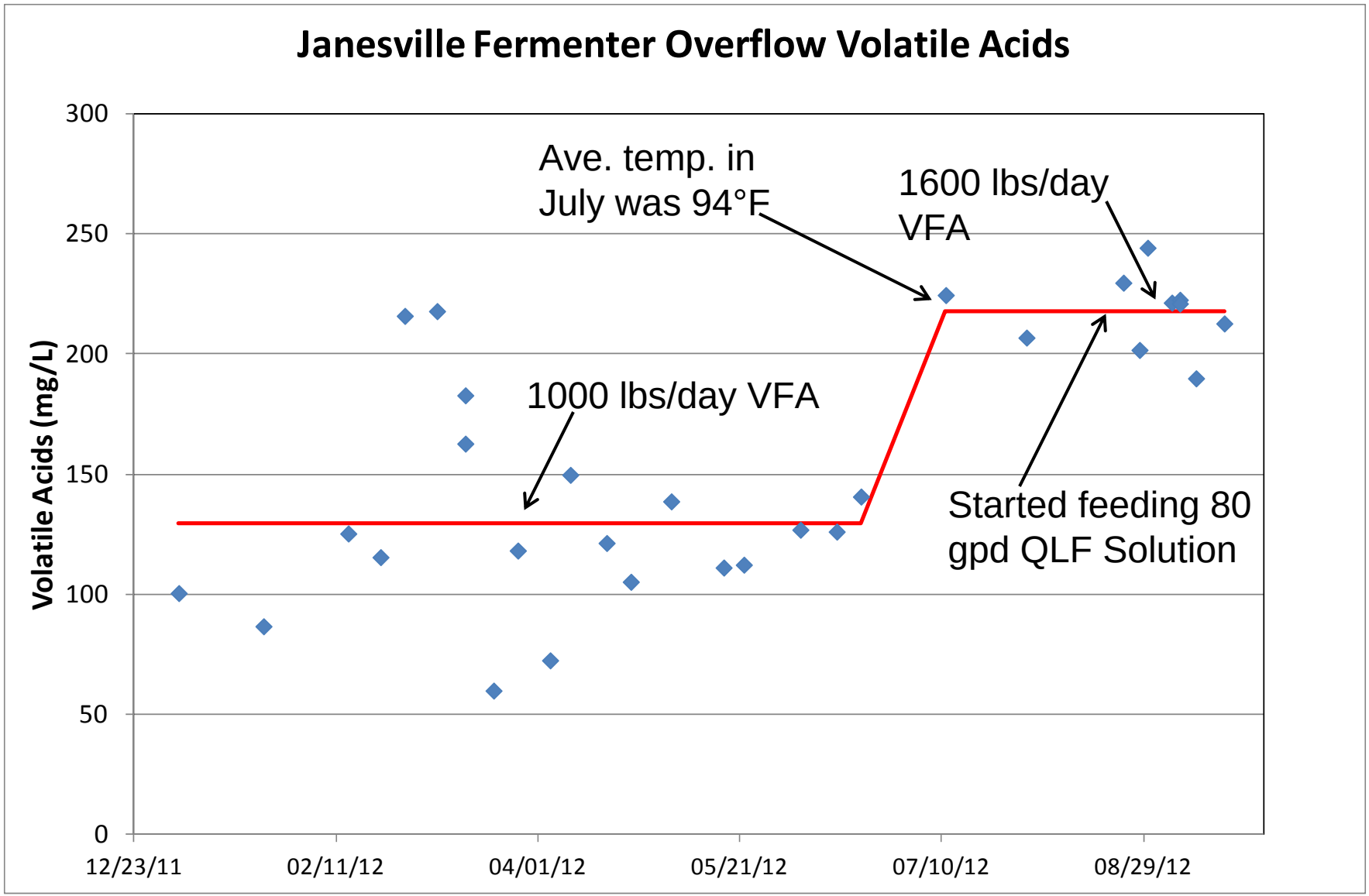
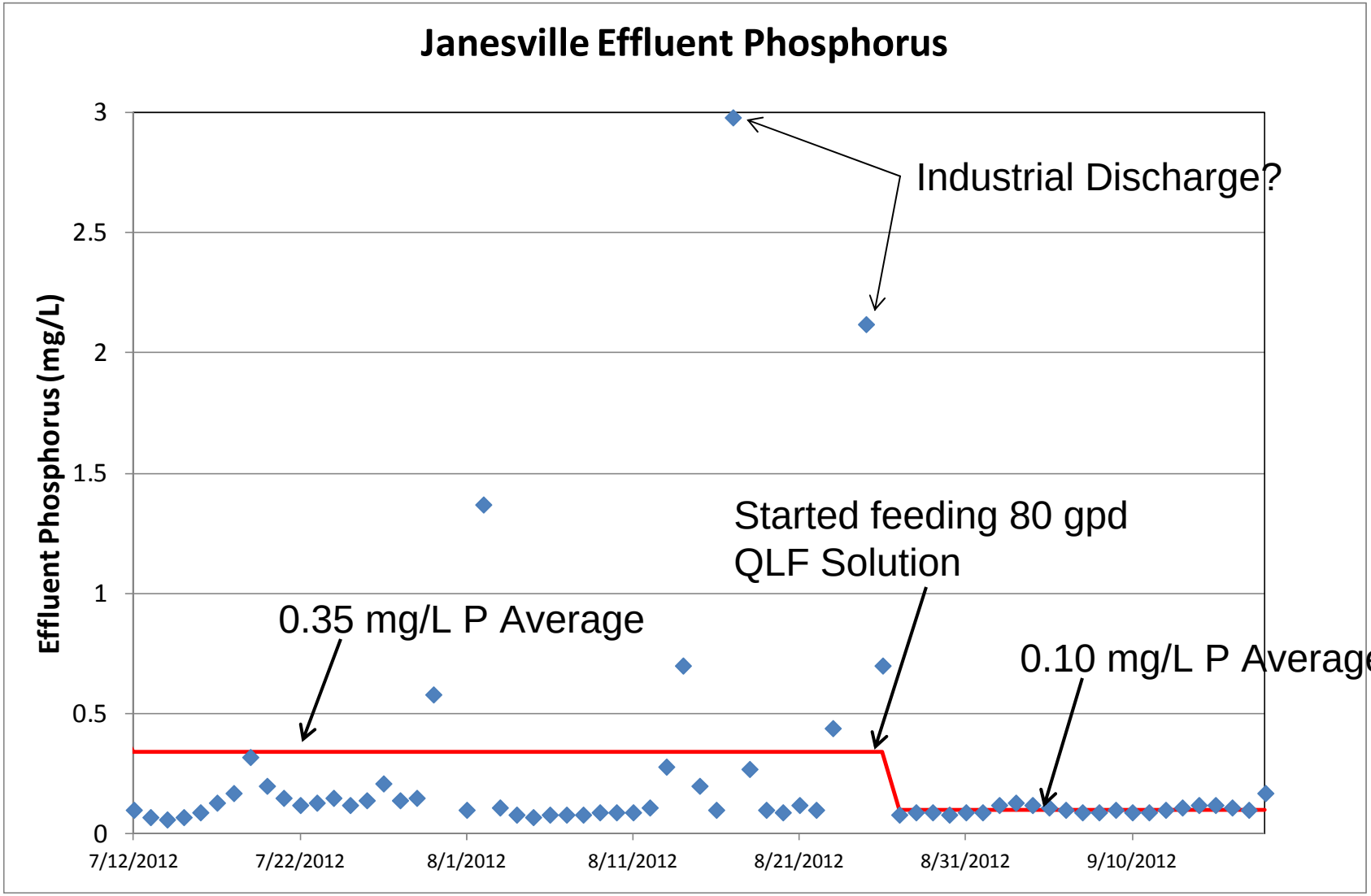


# Supplemental Carbon Pilot



# What's Next?

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# What's Next?

- 2012 Fall / Winter Activities
  - Continue supplemental carbon feed pilot
  - Continue BNR optimization study
    - Analysis and adjustment of operating parameters
    - Stabilization of biological phosphorus removal
  - Evaluate (based on above results) if TMDL P limits can be achieved without upgrades.

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