FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

INTRO TO PANEL PRESENTATIONS ON WWRF OPTIMIZATION

CASE STUDIES OF WHAT WORKS AND WHAT DOESN'T

Allen Gelderloos, PE | MWEA Process Seminar | November 10, 2016

Overview of Panel Discussions

- Goal of presentations
- Mix of small and large systems
- Presented by municipal staff
- Focused on activated sludge

	Capacity, mgd	Optimizations/Investigations
Dexter	0.5	Blower and diffuser replacement
Grand Haven	6.5	Bio-P; ORP monitoring; Auto-DO control
Wyoming	24	Bio-P; ORP monitoring; Auto-DO control
Grand Rapids	61	Bio-P; Auto-ammonia control; Auto-UV Control

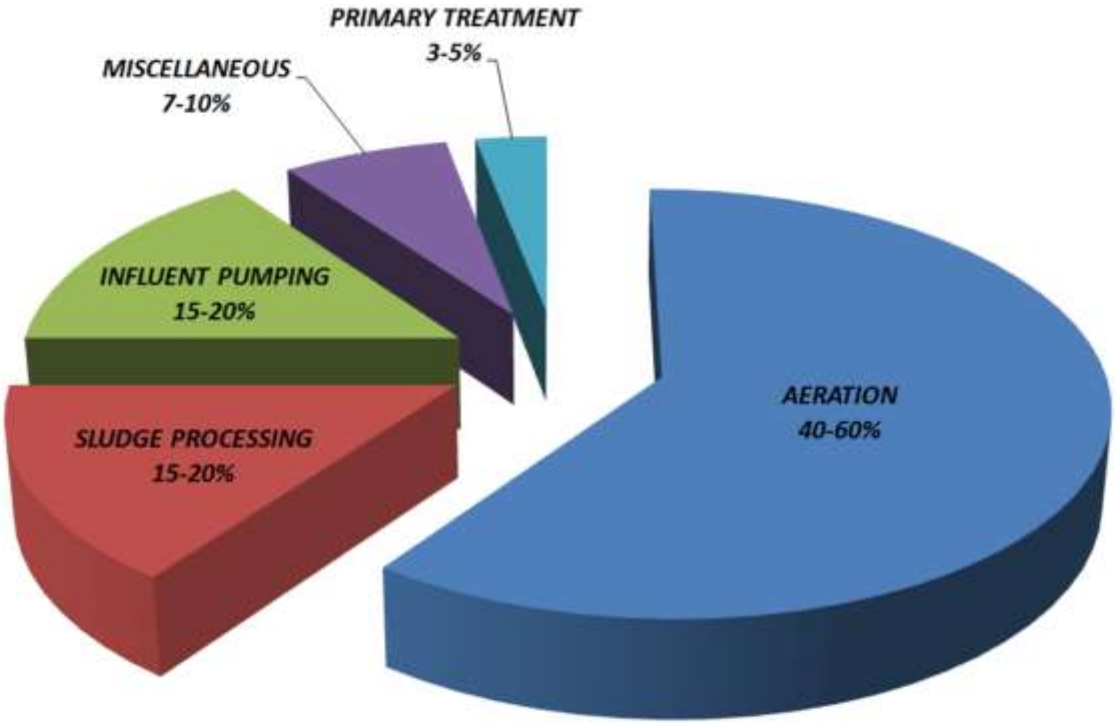
What is the Goal of Optimization?

- Minimize $$$
  - Life cycle costs and operating costs
- Improve process reliability
  - Minimize permit violations
- Reduce stress for superintendents & operators

Overview Topics

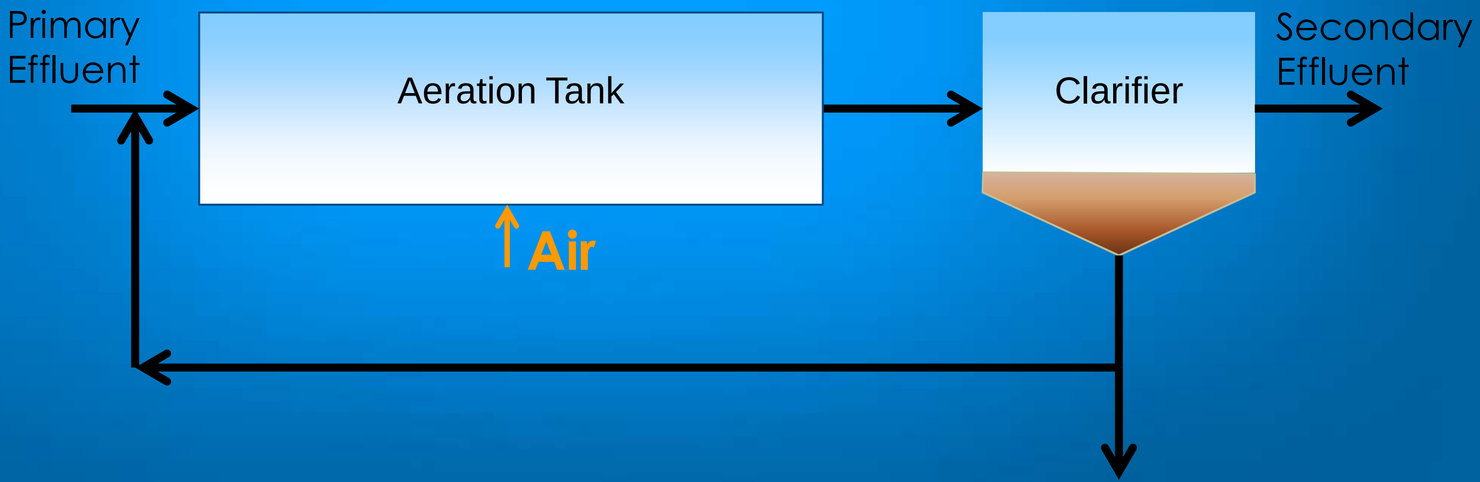
- Aeration System Energy Optimization
- Enhanced Biological Phosphorus Removal
- Probes for Automation

Typical Energy Usage in WRRFs



Aeration System Energy Optimization

- Starts with blower efficiency
- Fine bubble and clean diffusers
- Automatic DO and/or ammonia control



Newer, Energy Efficient Blowers Reduce Power Usage

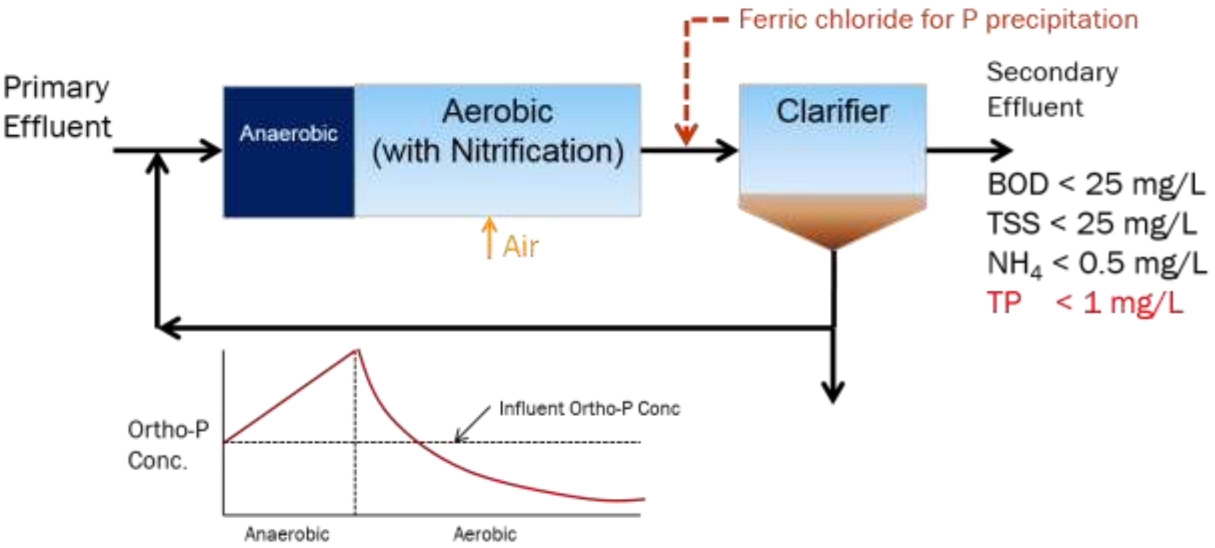
- Rotary Screw (PD)
- Centrifugal – Single Stage
- High Speed Turbo

Typical Secondary Treatment in Michigan WRRFs

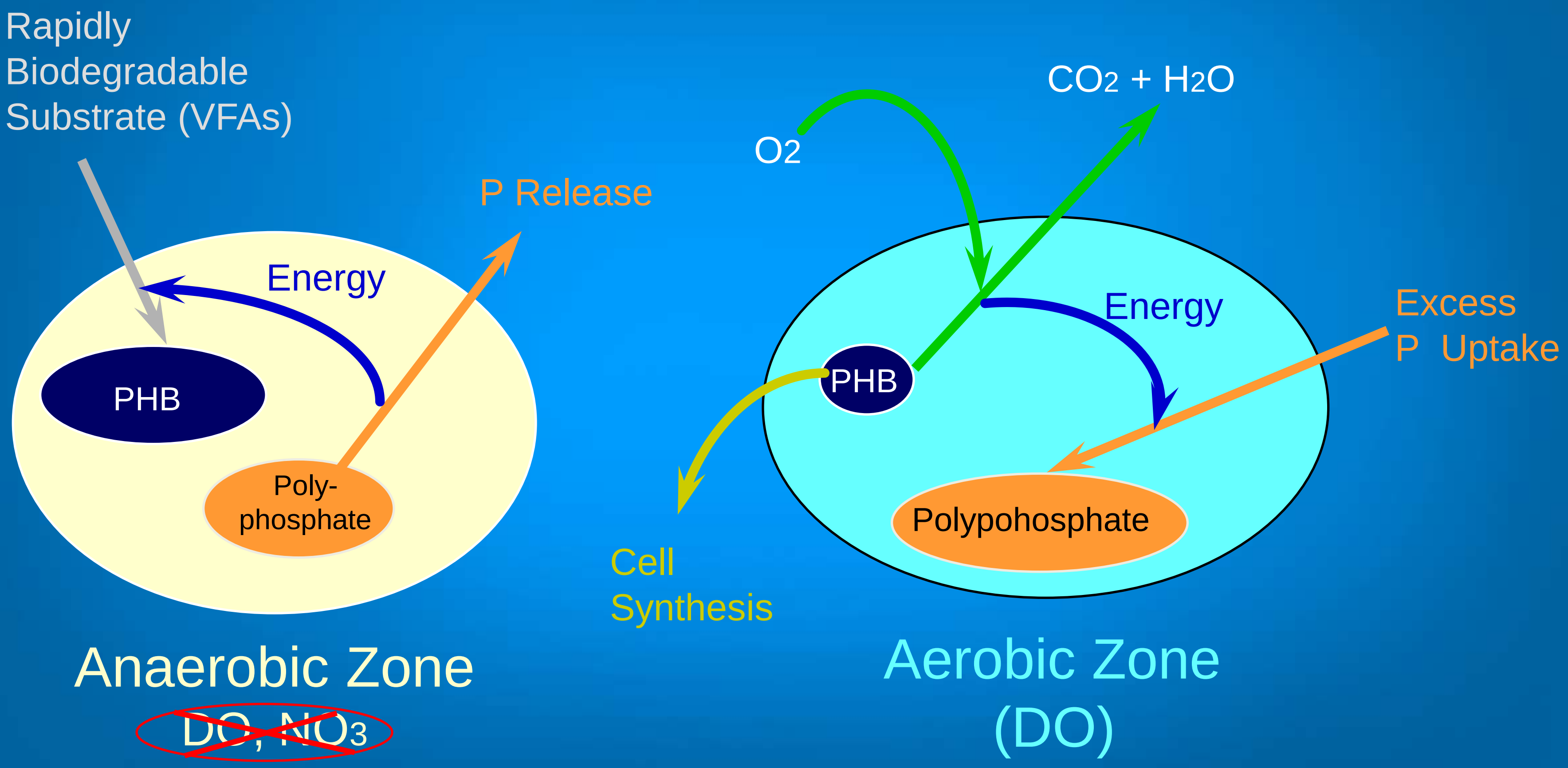
Activated Sludge Processes with:

- Nitrification
- **Enhanced Bio-P Removal (EBPR)**
- Chemical P Removal

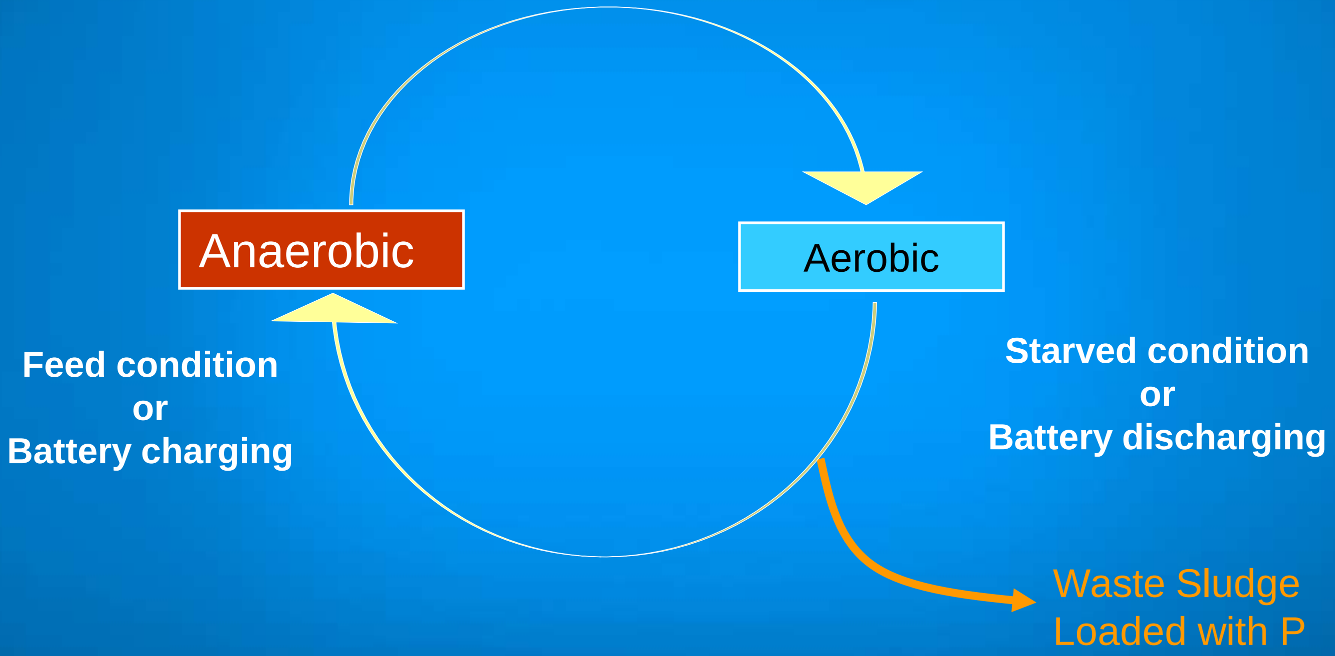
Enhanced Biological Phosphorus Removal



Enhanced Biological P Removal (EBPR) Mechanism



EBPR Mechanism



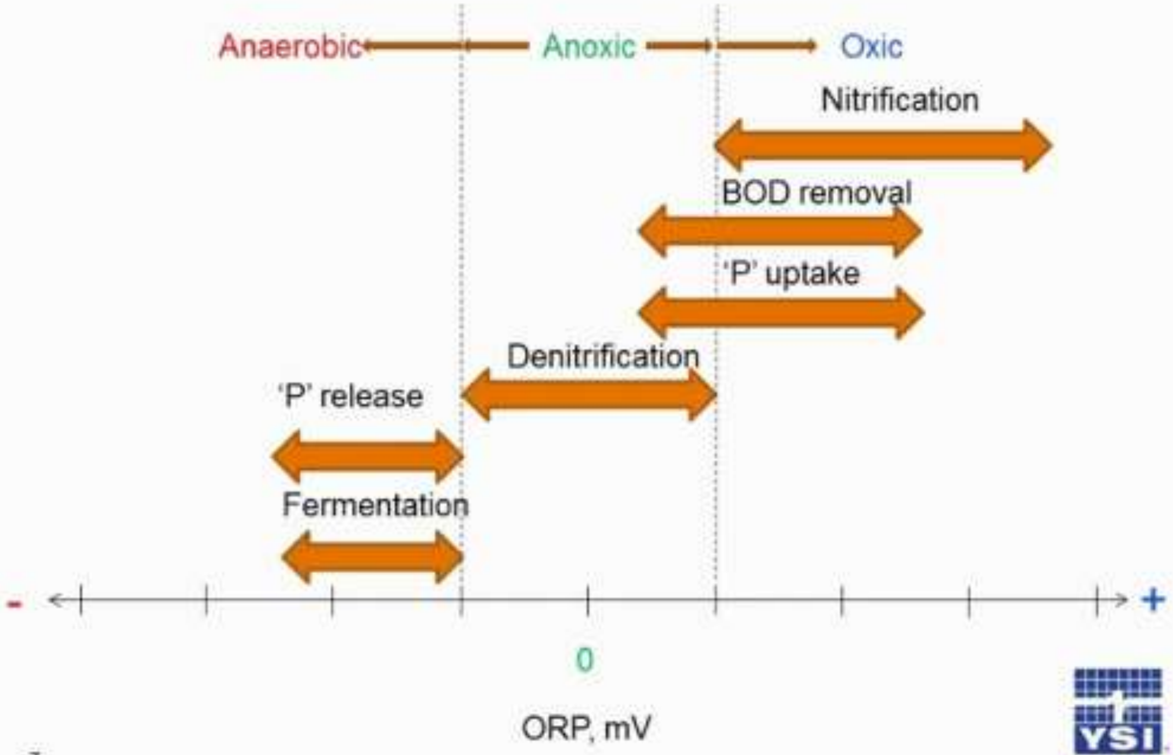
VFAs Play a Central Role in EBPR

- VFA = Food for PAOs
  - VFA:P removed = 4:1 to 16:1
- Rapidly biodegradable COD is another estimate of VFA formation potential
  - rbCOD:P removed = 15:1 (minimum)
- Potential sources VFAs
  - Fermentation in sewer system
  - Fermentation in anaerobic zone of the bioreactor
  - Primary sludge fermentation

Requirements for Reliable EBPR

1. Consistent and adequate supply of VFAs
   - Variable supply of VFAs appear to stress the PAOs
   - Wet weather flows & high infiltration cause low VFAs
   - Recycle loads can impact VFA:TP ratio
2. Preserve integrity of the anaerobic zone
   - Critical for P release – No P release, no PAO selection
3. Maximize solids capture
   - Solids = Particulate P
     - Optimize clarifier & filter operation
     - Maximize thickening & dewatering solids capture

Aeration and the (bio-chemical) environment



Probes for Process Control

Types of Probes:

- Dissolved Oxygen
- Oxidation Reduction Potential
- Ammonia

Key O&M Issues:

- Instrument reliability
- Maintenance requirements (calibration, cleaning)
- Frequency of replacement
- Cost (per analyzer, SCADA)
- What happens to process if instrument fails?

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