

Operational Challenges for Groundwater Discharge

West-Central Ottawa WWTP

Joe Hebert, Plant Operator

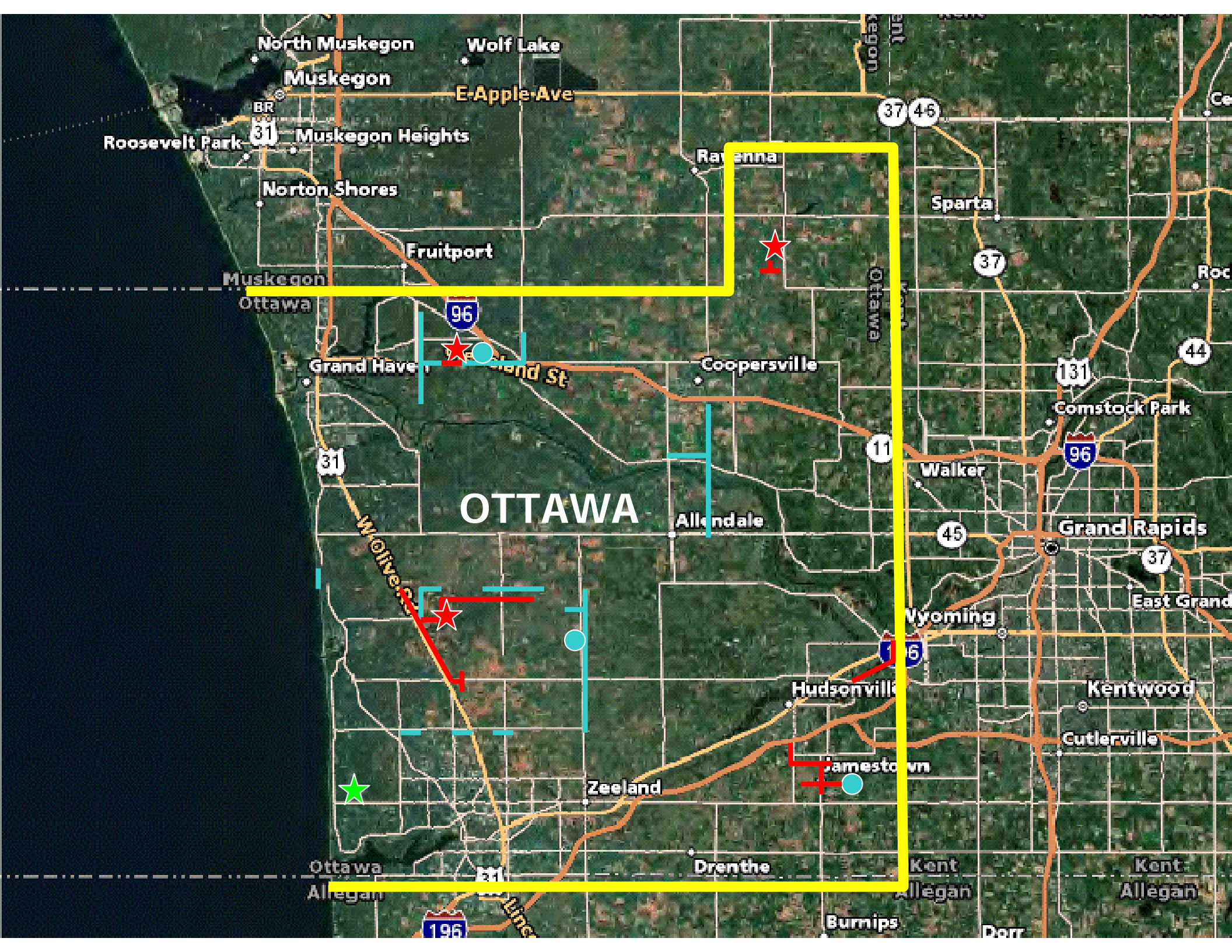
MDEQ Licensed: C, L1, L2-R, S-3, A-2b, B2a, B3b

Ottawa County Road Commission, Department of Public Utilities

John Barszewski, Plant Operator

MDEQ Licensed: B, S-4, D-4, *(plus other numerous letters and numbers)*

Fishbeck, Thompson, Carr & Huber, Inc.



OTTAWA

North Muskegon
Muskegon
E-Apple Ave
Wolf Lake

Roosevelt Park
Muskegon Heights
Norton Shores

Fruitport
Muskegon
Ottawa

Grand Haven
Coopersville

31

96

Allendale

11

Walker

131

96

Grand Rapids

45

37

Wolverine

31

Wyoming

196

Hudsonville

Kentwood

Cutlerville

Ottawa

Zeeland

Drenthe

Burnips

Kent

Dorr

Kent

Allegan

196

31

196

Background

- **Ottawa County expanding for Sheriff's Department, administrative offices, probate court, juvenile detention, and medium-security jail**
- **July 1993 – Purchased existing WWTP from nearby trailer park**
- **County proposed OCRC Department of Public Utilities (DPU) operate the facility**
- **Retained FTC&H to help with plant operations**

What is an Orbal?



Original Design

- **Headworks: Muffin Monster grinder and flow meter**
- **0.16-MGD, Envirex 3-ring orbal provides extended air treatment with two rotating disk aerators**
- **One 24-foot-diameter secondary clarifier**
- **Two 0.93-acre, 1.57-MG holding ponds**
- **Two 0.75-acre groundwater discharge seepage basins**
- **One 0.19-MG open sludge storage tank**
- **Pumps: two RAS, two WAS, one sludge, two sludge decant, two clarifier scum**

Recent WWTP Upgrade History

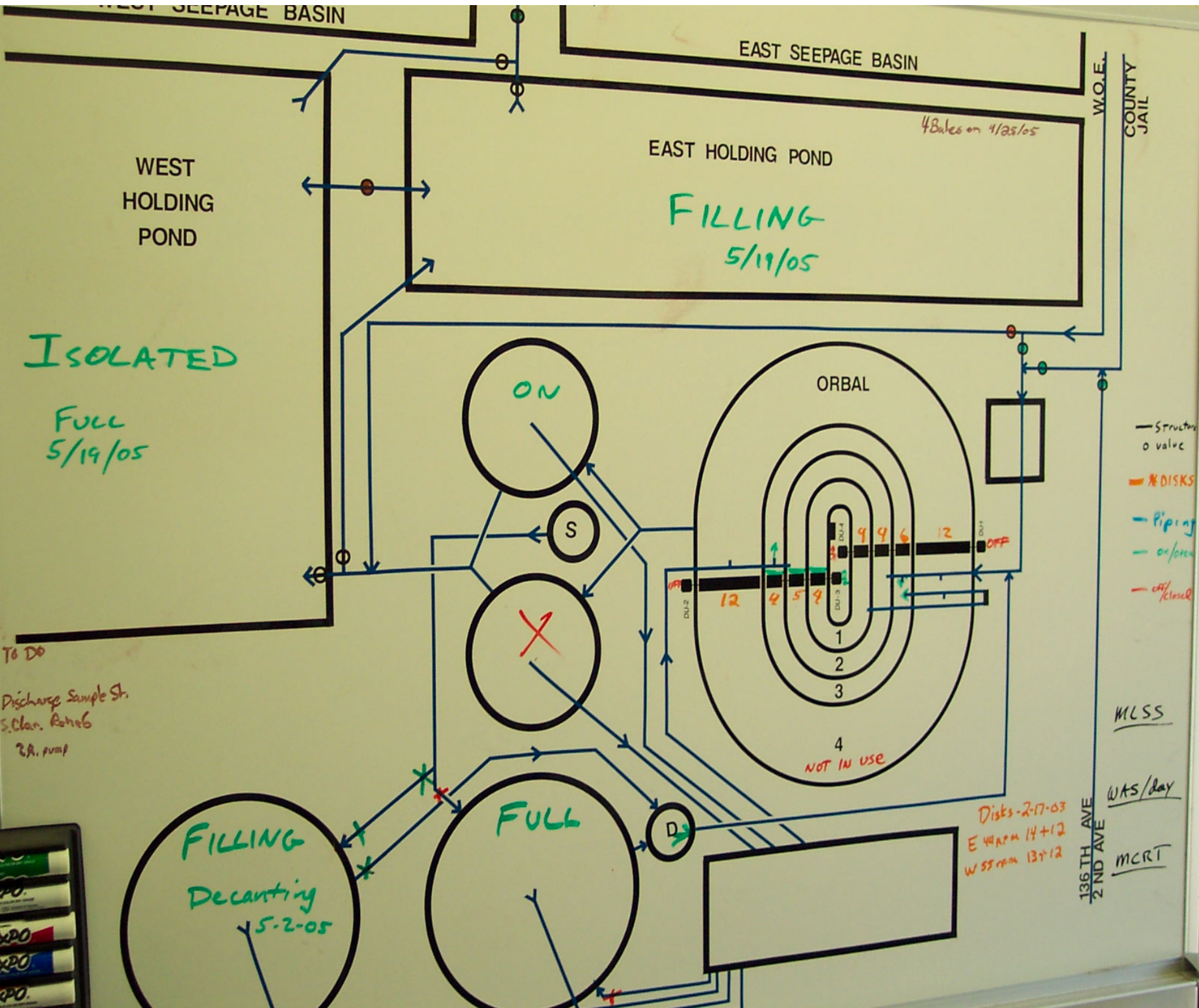
- **Struggled through low flows, cold temperatures, no redundancy, and difficulty achieving total inorganic nitrogen (TIN) removal from 1993 to 2003**
- **Added internal recycle pump to improve TIN removal in 2001**
- **Underwent plant expansion to 0.300 MGD from 2002 to 2003**

Plant Expansion



Plant Expansion





ISOLATED

FULL
5/19/05

To DO

Discharge Sample Str.
S. Clar. Rehab
2A. pump

FILLING
Decanting
5-2-05

FULL

EAST HOLDING POND

FILLING
5/19/05

ORBAL

NOT IN USE

- Structure
- o valve
- *DISKS
- Piping
- on/open
- off/closed

MLSS

WAS/day

MCR

136 TH AVE
2 ND AVE

Disks - 2-17-03
E 44 rpm 14+12
W 55 rpm 13+12

4 Bales on 4/25/05

W.O.E.
COUNTY
JAIL

WEST
HOLDING
POND

EAST SEEPAGE BASIN

WEST SEEPAGE BASIN

Challenges

- Plug flows directly from five lift stations (observed instantaneous flows of 1 MGD)
- No solids removal at headworks
- No onsite lab to provide same-day results
- Achieving TIN removal to meet the permitted limit of 5 milligrams per liter (mg/l) ($\text{NH}_3 + \text{NO}_2 + \text{NO}_3 = \text{TIN}$)
Ammonia + Nitrite + Nitrate
- Winter (cold weather) operation

Removing TIN

(starts with nitrification and BOD removal)

- Typical Influent: 0.130 MGD
BOD 230 mg/l -- 249 lbs/day
NH₃ 57 mg/l -- 62 lbs/day
- Removal of BOD+NH₃ = 634 lbs O₂ required
@ 0.160 MGD = 780 lbs O₂ required
- 13 disks x 60 lbs/O₂/day = 780 lbs O₂ delivered
(provides a small amount of DO residual)
- Result of NH₃ conversion is 10 to 20 mg/l NO₃



Removing Nitrate

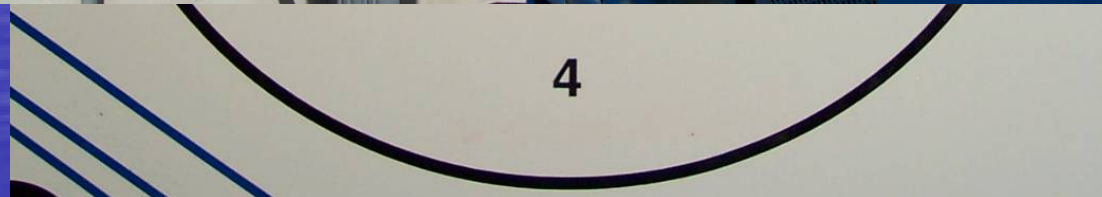
(The next step)

- Provide carbon source (residual BOD within channel or split-feed influent)
- Creating anoxic zones < 0.5 mg/l DO (conversion of nitrate to nitrogen gas through denitrification)
- Internal recycle rate of 400% (provides multiple passes through oxic and anoxic zones)

Orbal Operation



g/l



The DO Balancing Act

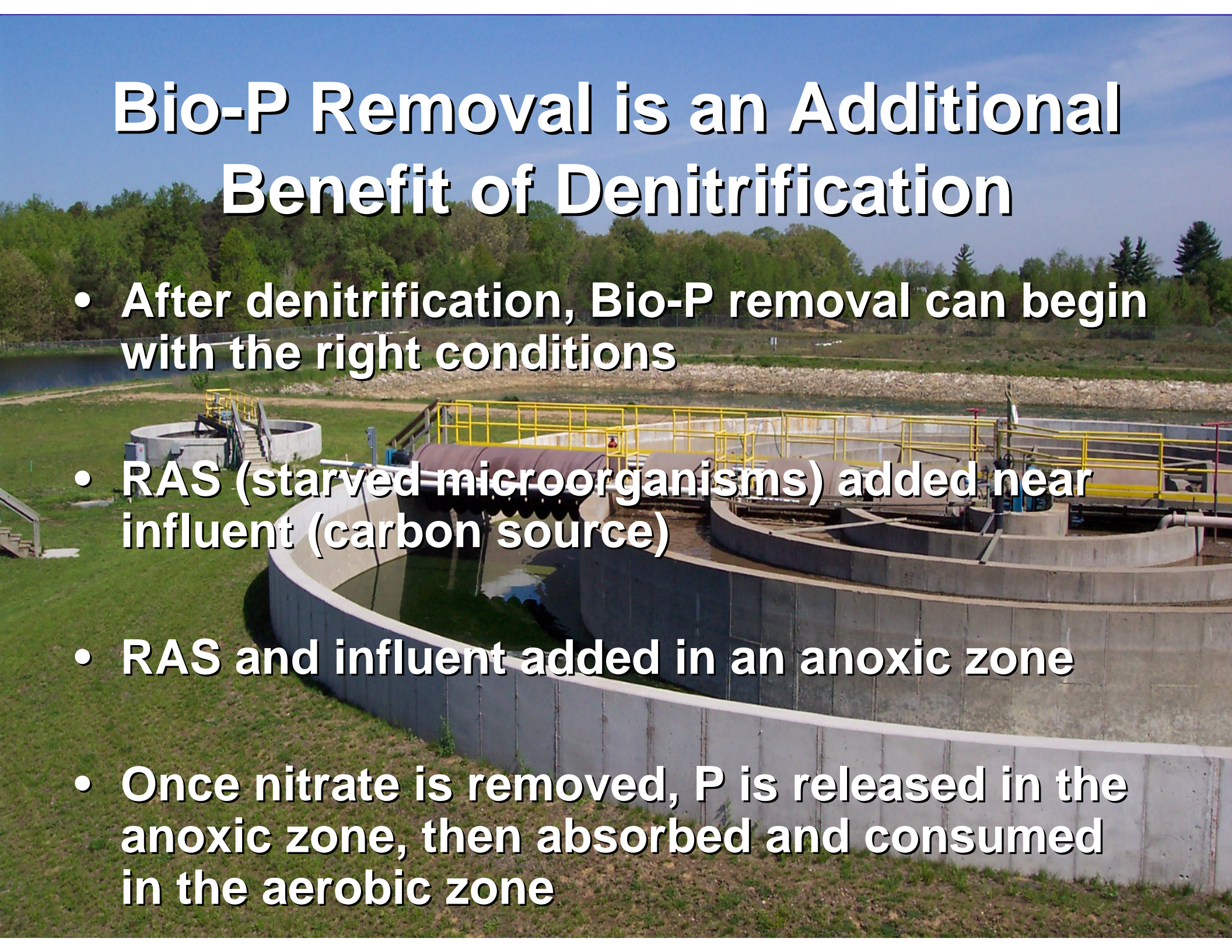
- If the DO $>$ 3 to 4 mg/l in ring 1 (innermost ring), OR

If the DO in rings 2 and 3 does not drop $<$ 0.5 mg/l before the aerators, NO_3 will quickly rise above 5 mg/l in effluent

- If the DO $<$ 1.5 mg/l in ring 1, NH_3 and BOD will rise in effluent

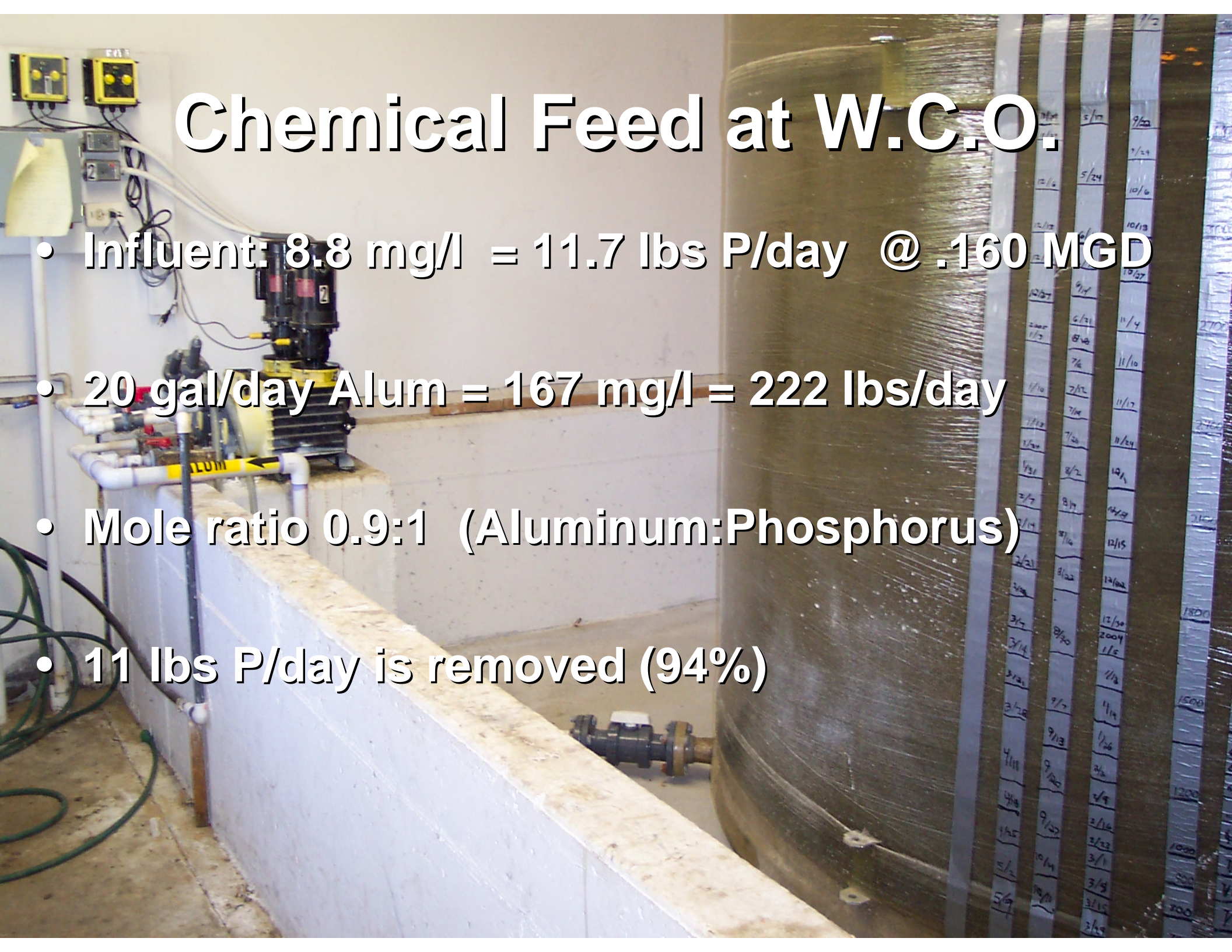
Bio-P Removal is an Additional Benefit of Denitrification

- After denitrification, Bio-P removal can begin with the right conditions
- RAS (starved microorganisms) added near influent (carbon source)
- RAS and influent added in an anoxic zone
- Once nitrate is removed, P is released in the anoxic zone, then absorbed and consumed in the aerobic zone



Chemical Feed at W.C.O.

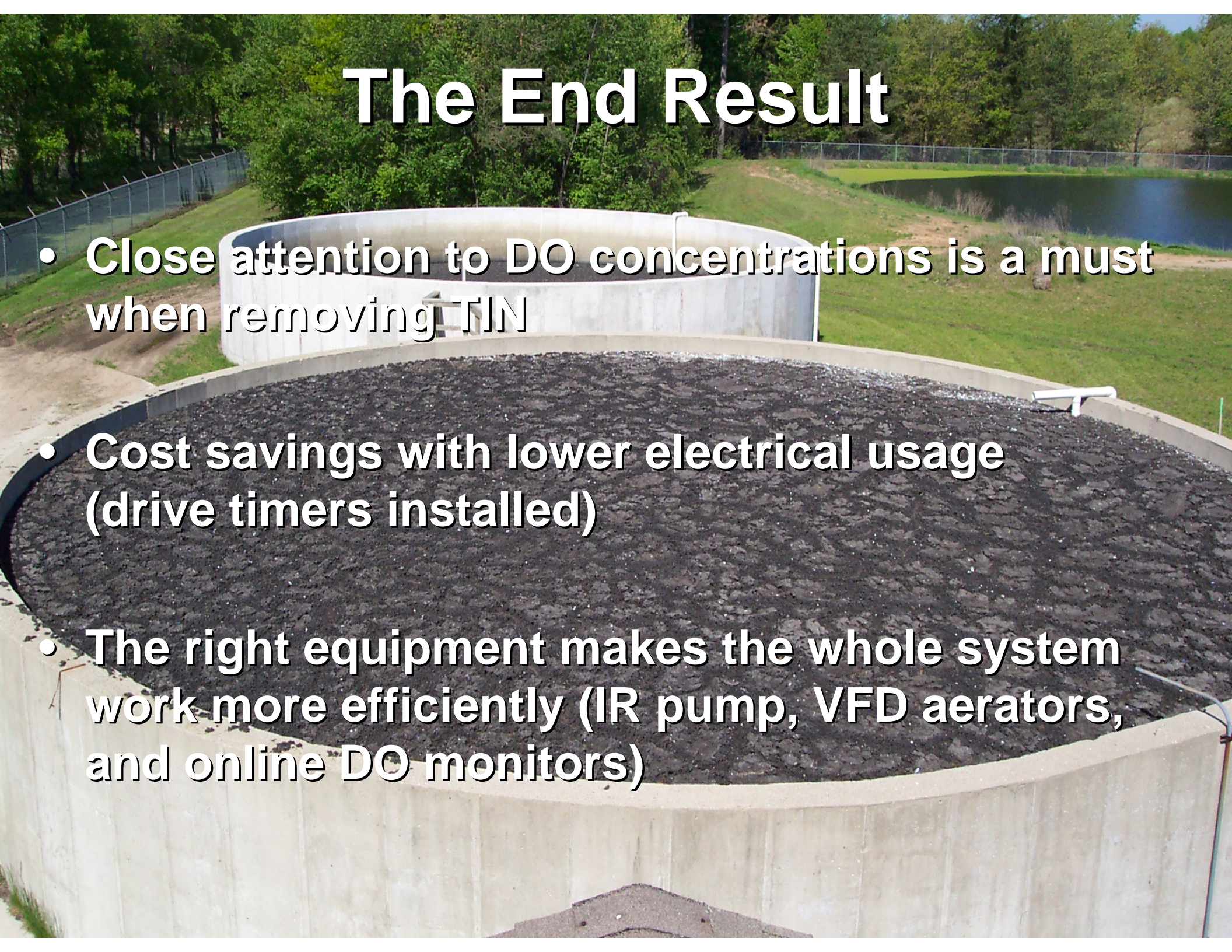
- Influent: 8.8 mg/l = 11.7 lbs P/day @ .160 MGD
- 20 gal/day Alum = 167 mg/l = 222 lbs/day
- Mole ratio 0.9:1 (Aluminum:Phosphorus)
- 11 lbs P/day is removed (94%)





**Groundwater Discharge
0.75-acre Seepage Bed**

The End Result

- **Close attention to DO concentrations is a must when removing TIN**
 - **Cost savings with lower electrical usage (drive timers installed)**
 - **The right equipment makes the whole system work more efficiently (IR pump, VFD aerators, and online DO monitors)**
- 
- A large circular concrete aeration tank is shown from an elevated perspective. The tank is filled with a dark, textured sludge, likely activated sludge, which is being aerated. The concrete walls of the tank are visible, and a white pipe protrudes from the side. In the background, there is a chain-link fence, a grassy area, and a body of water surrounded by trees under a clear sky.

Don't Forget an Operator's Attention to Detail!



The #1 Work-Related Injury:



Cranial-Rectal Inversion



Folks take their football seriously in Ohio

Thank you!

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