Protecting Lake Michigan & Our Waterways.

North Shore Water Reclamation District

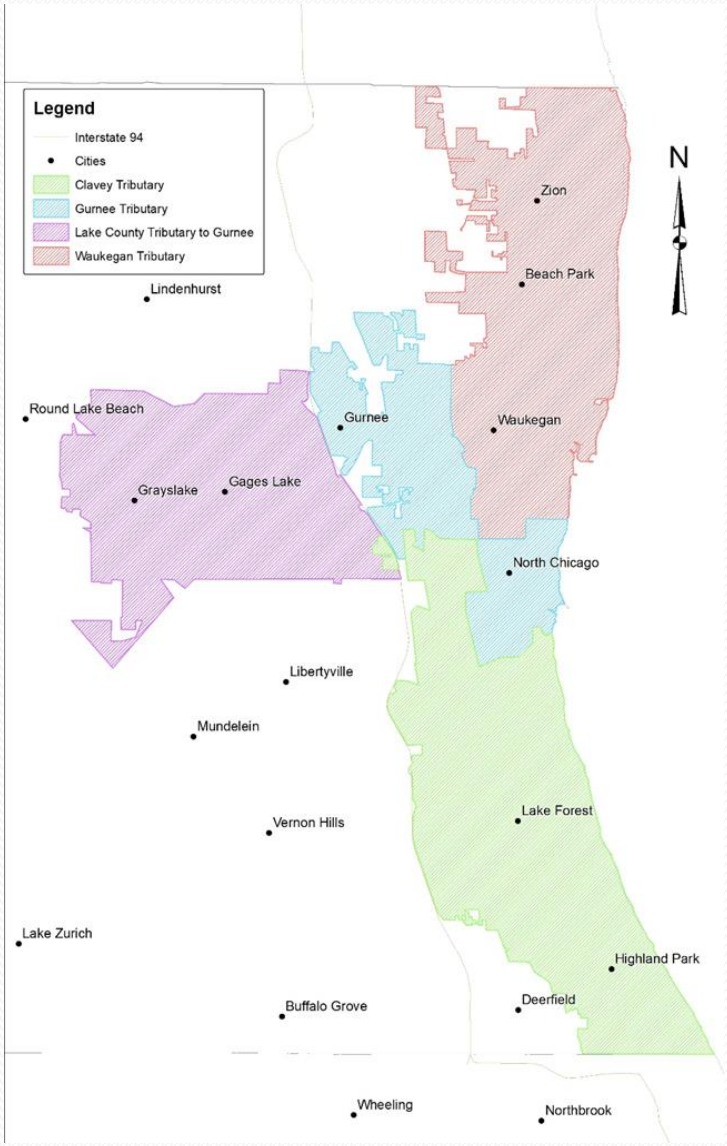
North Shore WRD – Phosphorus Reduction Projects

North Shore WRD

- “The North Shore Water Reclamation District is dedicated to the beneficial reuse of our water resources while protecting Lake Michigan, local waterways, and our environment through sustainable and fiscally responsible wastewater reclamation practices at our state-of-the-art treatment facilities.”

Who We Are

- Formed in 1914
- 3 Water Reclamation Facilities
  - Gurnee, Waukegan, Clavey Rd
- Biosolids Recycling Facility
- Collection System



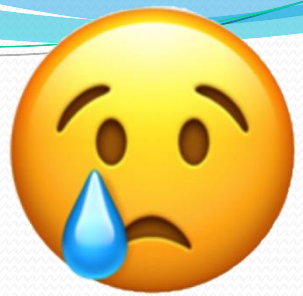
Overview

- Illinois Nutrient Loss Reduction Strategy
  - Biennial Update
- Point Source Reductions
- Nutrient Assessment Reduction Plan
  - Key Takeaways
- North Shore Phosphorus Reduction Efforts

Illinois Nutrient Loss Reduction Strategy

- State-wide, collaborative effort working to reduce the amount of nutrients entering Illinois waterways
- Strategy Goals
  - In-stream Phosphorus
    - 25% reduction by 2025
    - 45% long-term
  - In-stream Nitrogen
    - 15% reduction by 2025
    - 45% long-term

2023 Biennial Report



- “The NLRS partnership anticipates the strategy will fall short of its goals”
- “Nutrient levels in Illinois waterways continued to increase in 2021 and 2022 compared to baseline measurements”
- “Statewide nutrient levels are still higher than interim targets, with phosphorus being a significant concern”

Point Source Sector - P

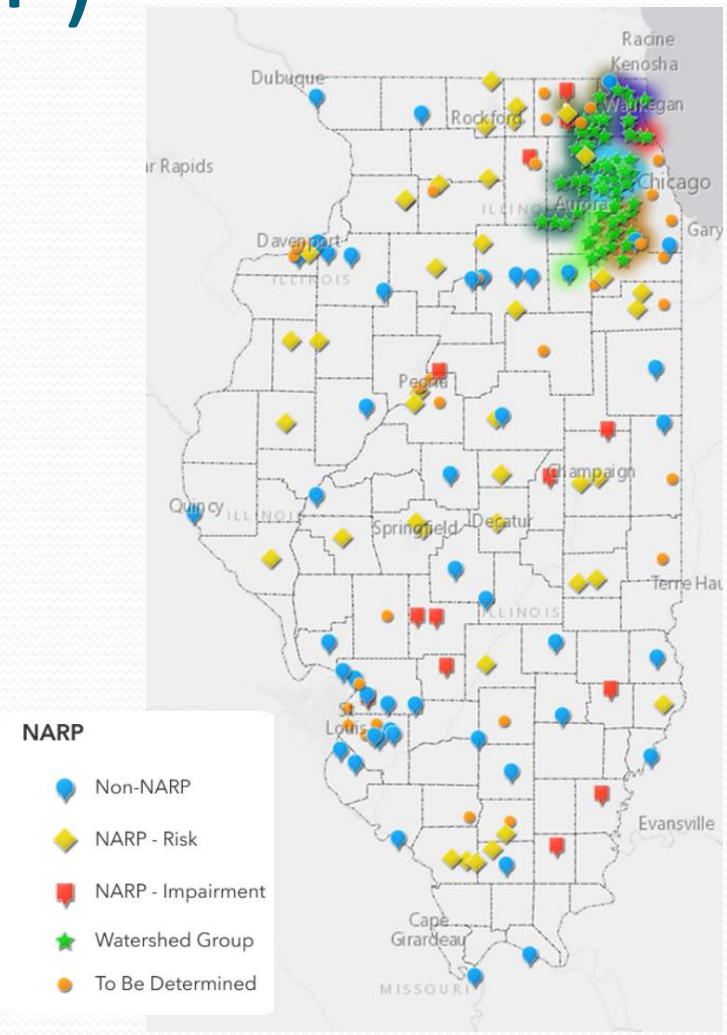
- "By 2022, the point source sector exceeded the strategy's 25% interim total phosphorus reduction goal for 2025, by reducing phosphorus discharges by **6.2 million pounds**, a **34% decline** since 2011."
- "45% statewide goal will be met soon"
- "Exceeding 50+% statewide is within reach"
- "Exceeding 10,000,000 pounds reduction is possible"

NSWRD Discharge(s)

- Waukegan & Gurnee WRF's – Des Plaines River
- Clavey Road – East Fork of the North Branch of the Chicago River (Skokie River)

Nutrient Assessment Reduction Plans (NARP)

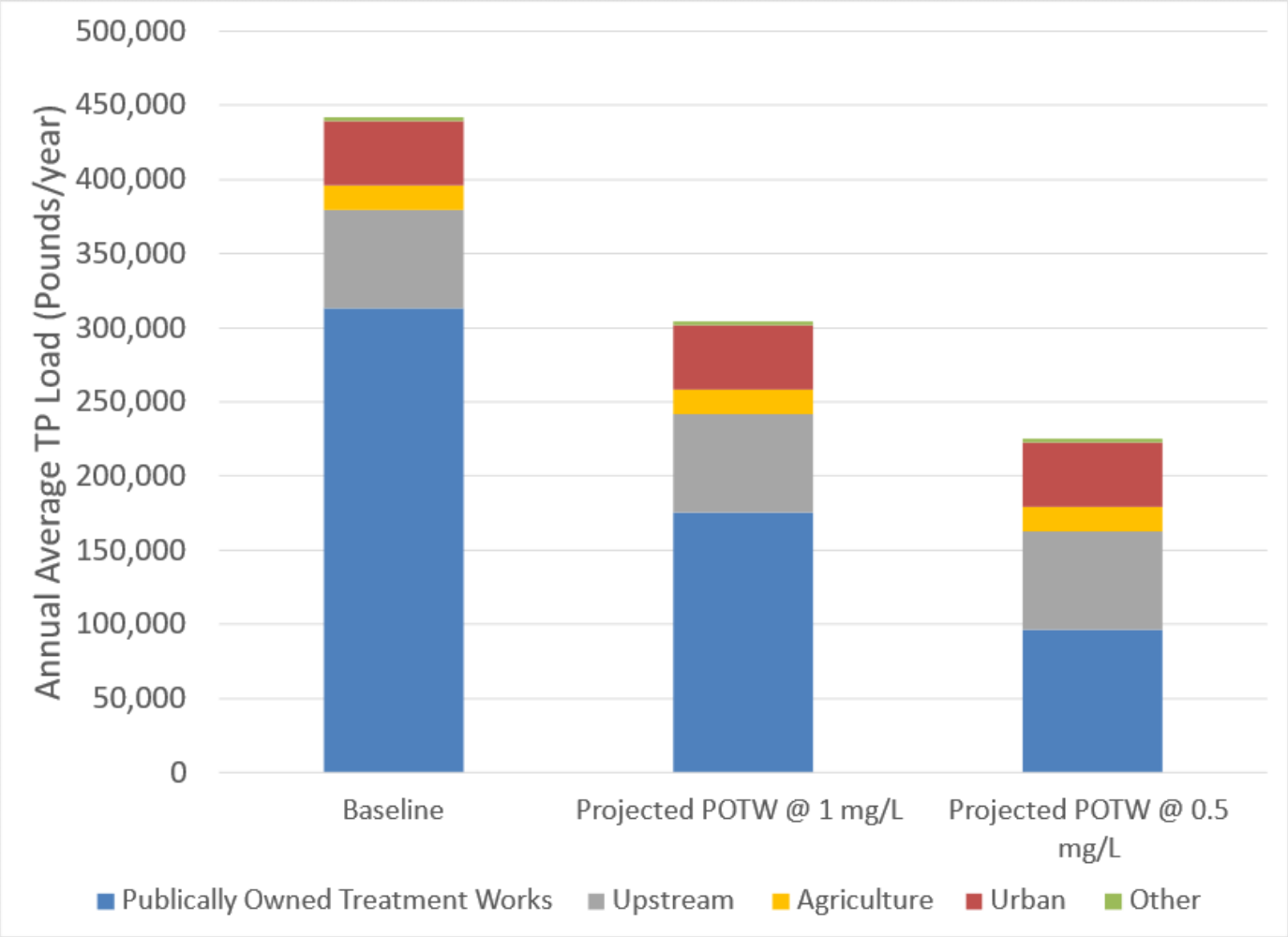
- Watershed based approach in lieu of state-wide WQS/TMDL's
- Identify phosphorus input reductions by point source and non-point source discharges
  - Point Sources
    - POTW's
    - MS4's & Other NPDES Permit Holders
  - Non-Point Sources
    - Agricultural
    - Urban Runoff
  - Other – Upstream, Streambank Erosion, Others



NARP KEY TAKEAWAYS (DRWW)

1. POTW total phosphorus reductions beyond 0.5 mg/L have minimal impact on water quality.
2. Upstream total phosphorus reductions reduce sestonic chlorophyll and improve dissolved oxygen during high flow periods.
3. Tributary total phosphorus reductions reduce sestonic chlorophyll in the mainstem river, but have minimal impact on dissolved oxygen.
4. A combined reduction in the load from POTWs, nonpoint sources, and upstream improves the water quality in the Des Plaines River.
5. Improving upstream dissolved oxygen addresses the impairment in the upper reaches of the Des Plaines River.

Total Phosphorus Loading (DRWW)



NSWRD Total Phosphorus Effluent Limitations

- Monthly average - 1.0 mg/l
  - Clavey Road – February 1, 2022
    Gurnee – June 1, 2022
    Waukegan – March 1, 2023
- 12-Month Rolling Geometric Mean – 0.5 mg/l
  - January 1, 2030
  - Exceptions

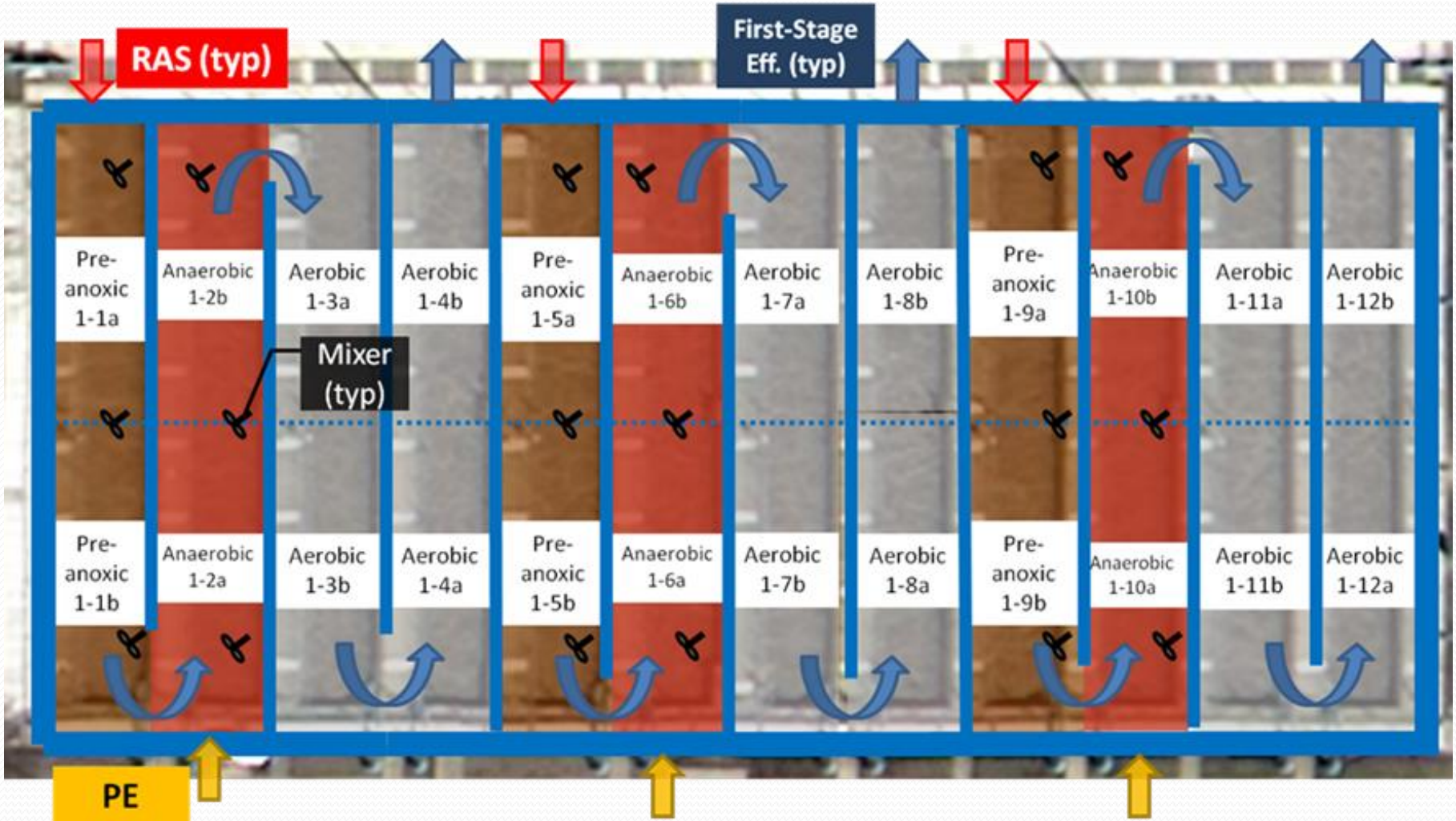
Phosphorus Reduction Efforts

- Nutrient Removal Study - 2010
- Phosphorus Removal Feasibility Study 2016, 2021
- Phosphorus Discharge Optimization Study 2016, 2021
- Nutrient Monitoring Program – 2016 - Present
- Aeration Improvements Project – Biological Phosphorus Removal (All 3 facilities) – 2017-2018
- Advanced Optimization & Modeling - 2021
- Chemical Phosphorus Removal Project – 2023
- Automatic Sludge Retention Time (SRT) controls, Return Channel Aeration Controls, Mixer On/Off Cycling, Additional Carbon Recovery and Fermentation, Online Instrumentation, and Many More - Ongoing

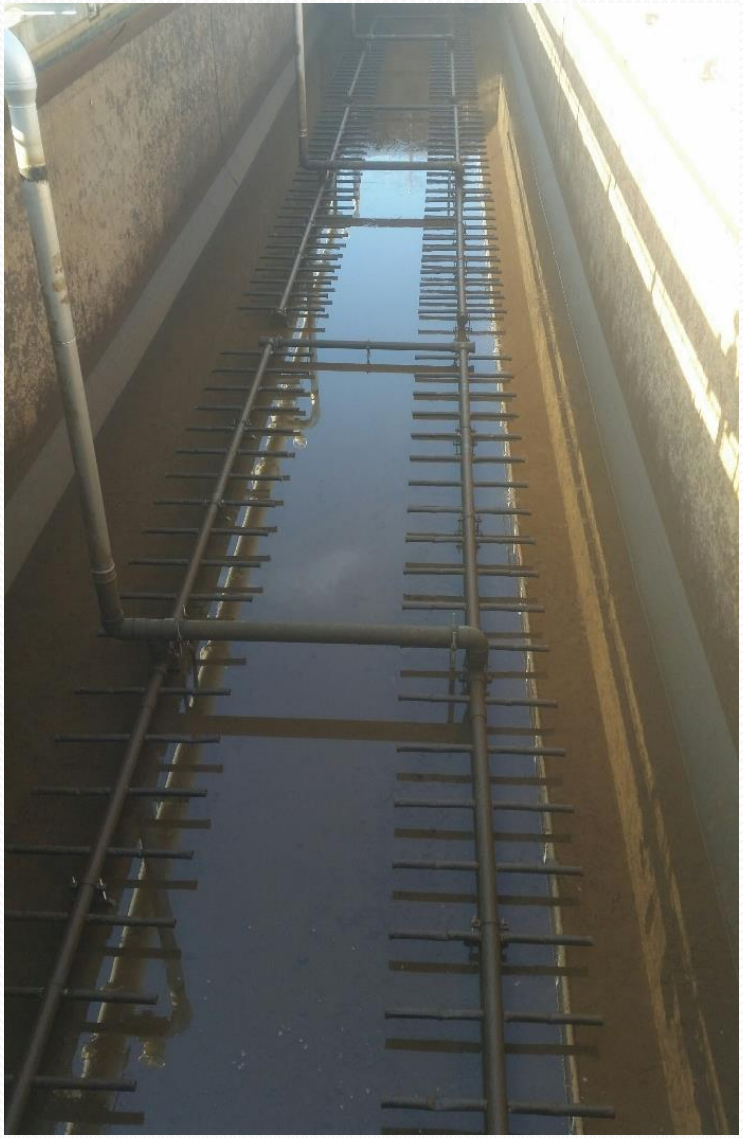
Aeration Improvements Project

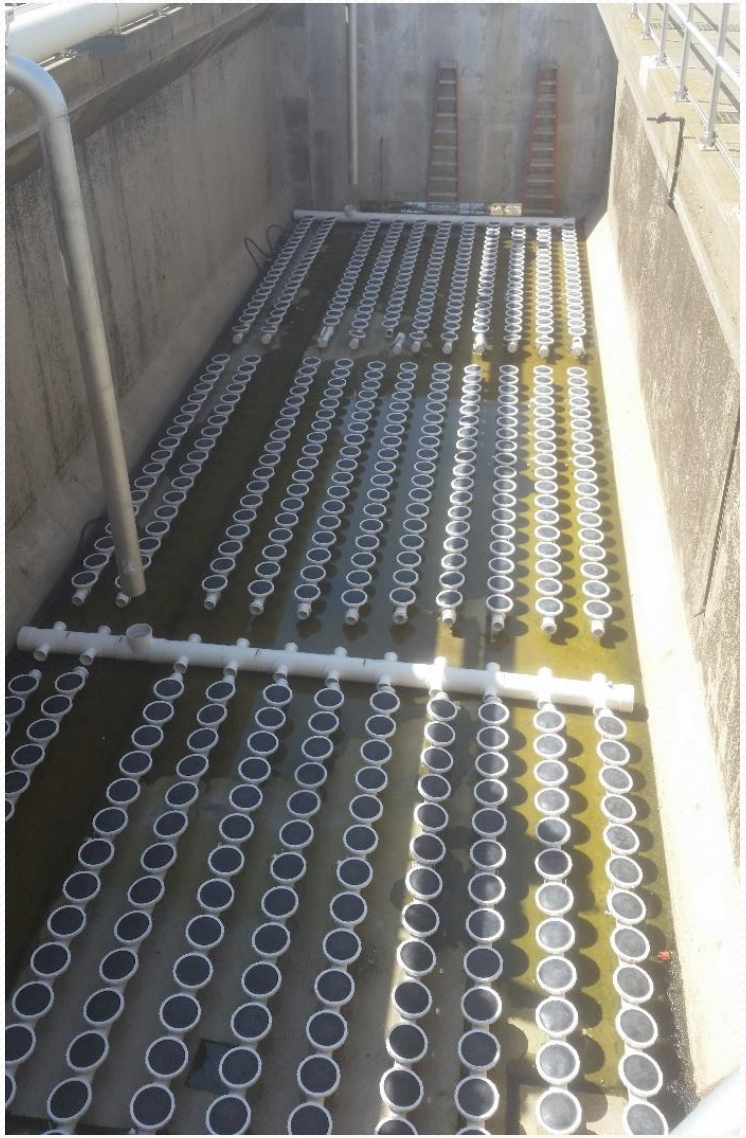
- Approximately $14 Million
- Concurrent construction at all 3 facilities
- Enhanced Biological Phosphorus Removal (EBPR)
  - Anaerobic/Oxic process with RAS denitrification using the modified Johannesburg (JHB) process

EBPR Configuration

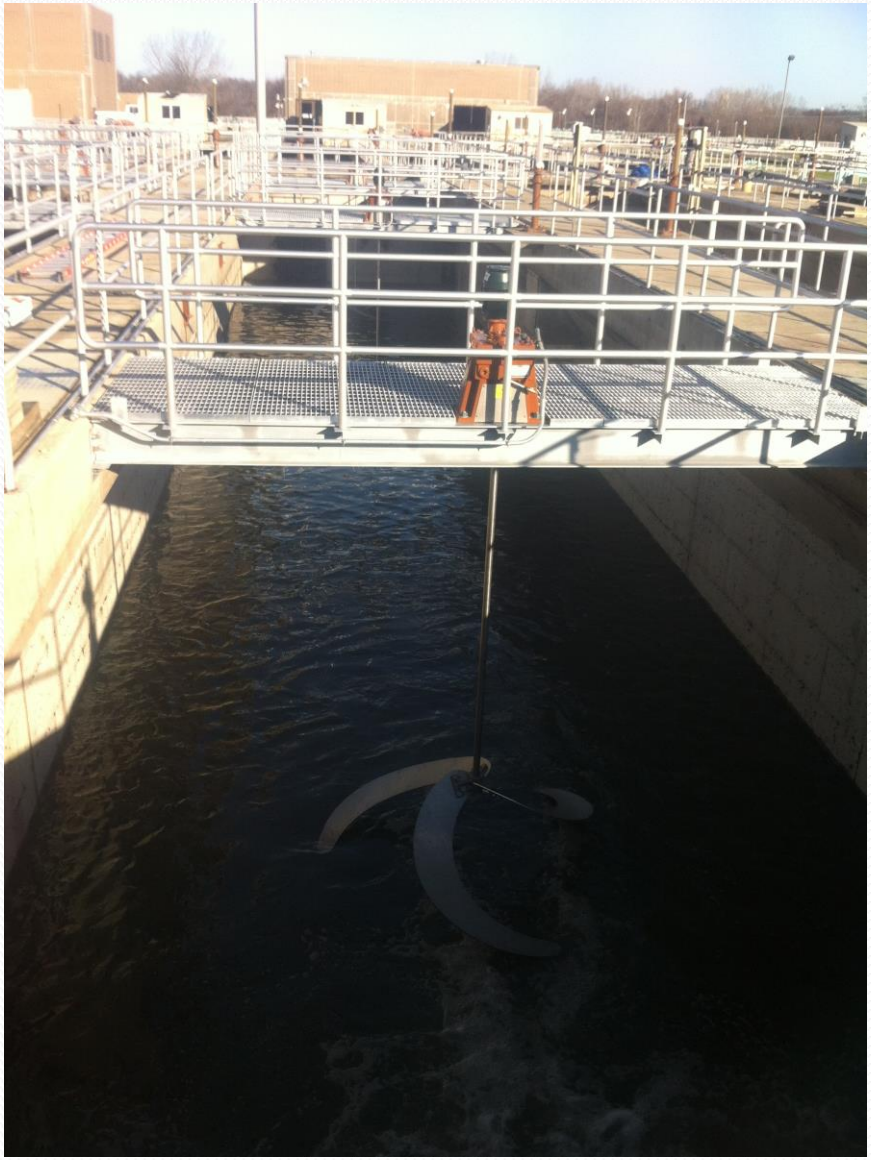


Air Diffuser Replacement





Mixers & Baffles

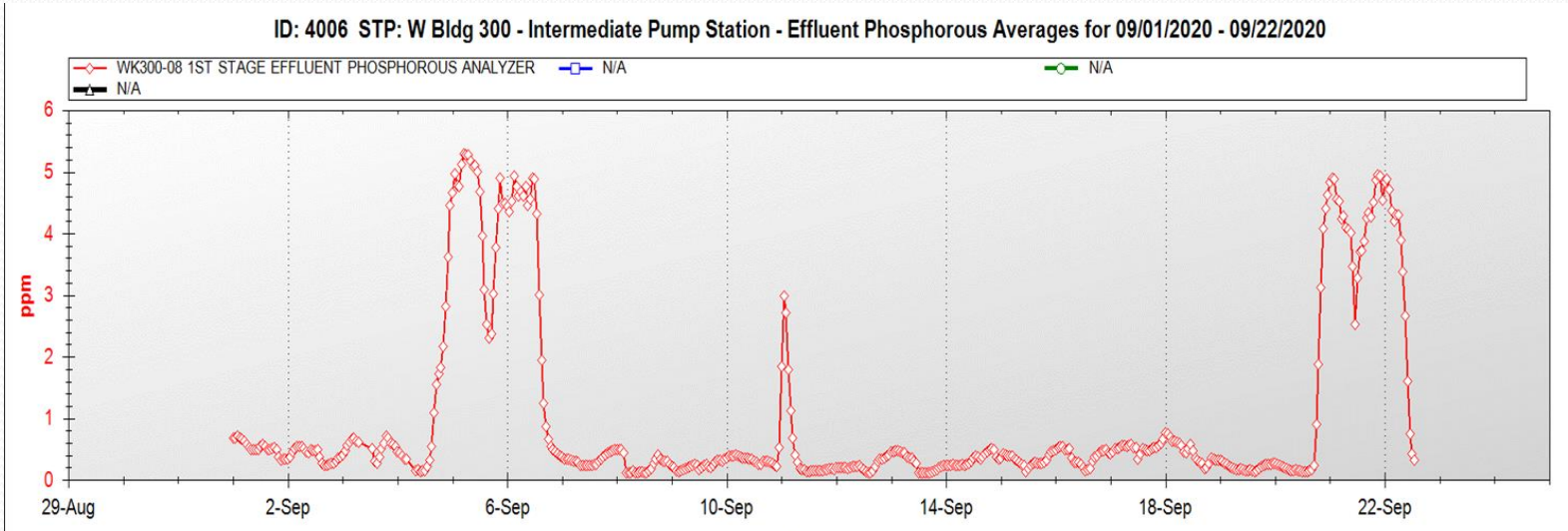


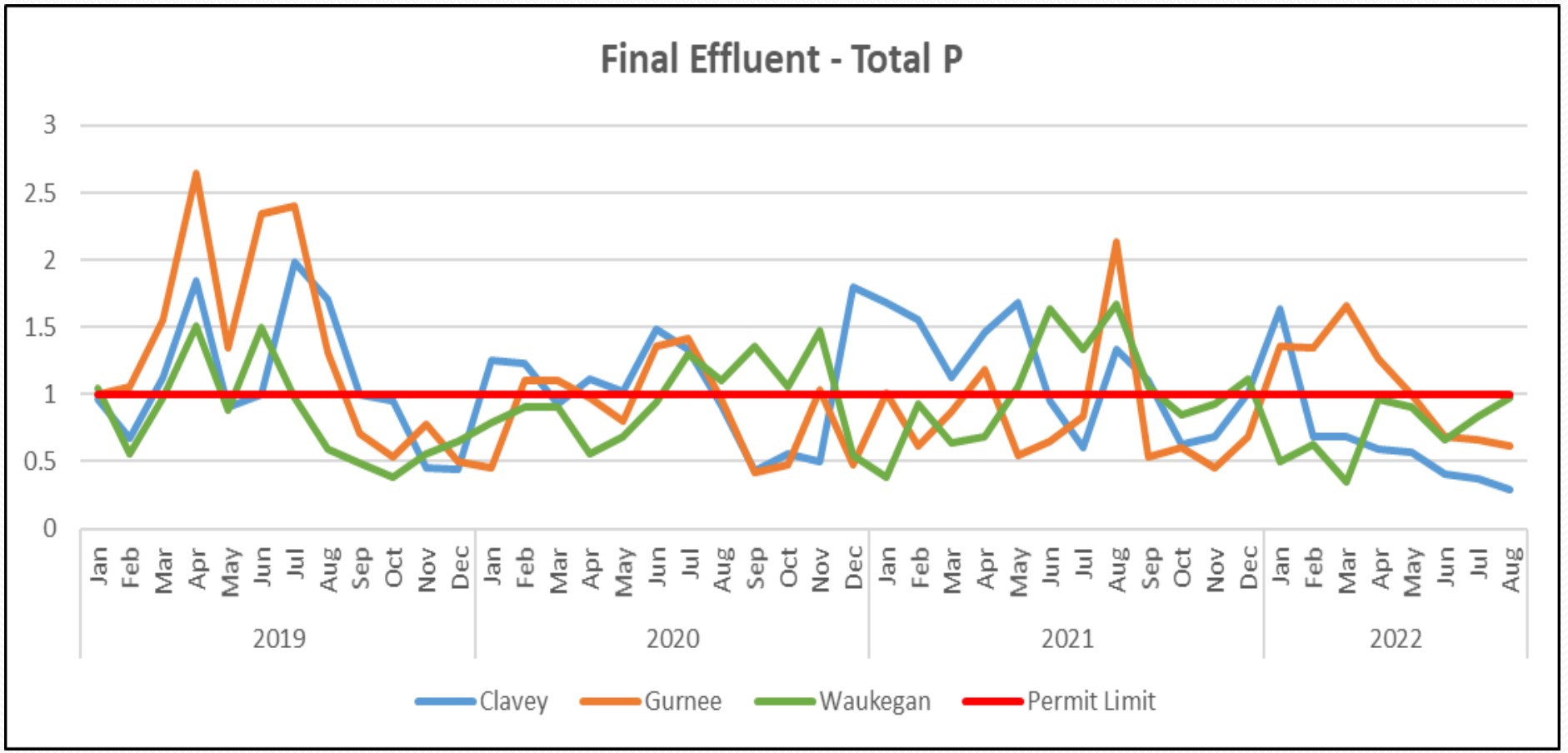
High-Efficiency Blowers

Project Completion

EBPR Process Control

- Biological Phosphorus Removal systems have been subject to upsets
  - Wet Weather Events
  - Variable Influent Characteristics
  - Mechanical Failures
  - Other Factors
- Still not reliably meeting 1.0 mg/l future limit with regularity
  - Potent yet Brief Effluent Phosphorus Discharges




Final Effluent - Total P
3
2.5
2
1.5
1
0.5
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2019
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2020
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2021
Jan Feb Mar Apr May Jun Jul Aug
2022
Clavey
Gurnee
Waukegan
Permit Limit

Chemical Phosphorus Removal

- $3.8 Million
- Secondary Back-Up System
  - Bio-P still Primary
- Ferric Chloride
- Multiple Dose Points
- Designed to Meet Future Limits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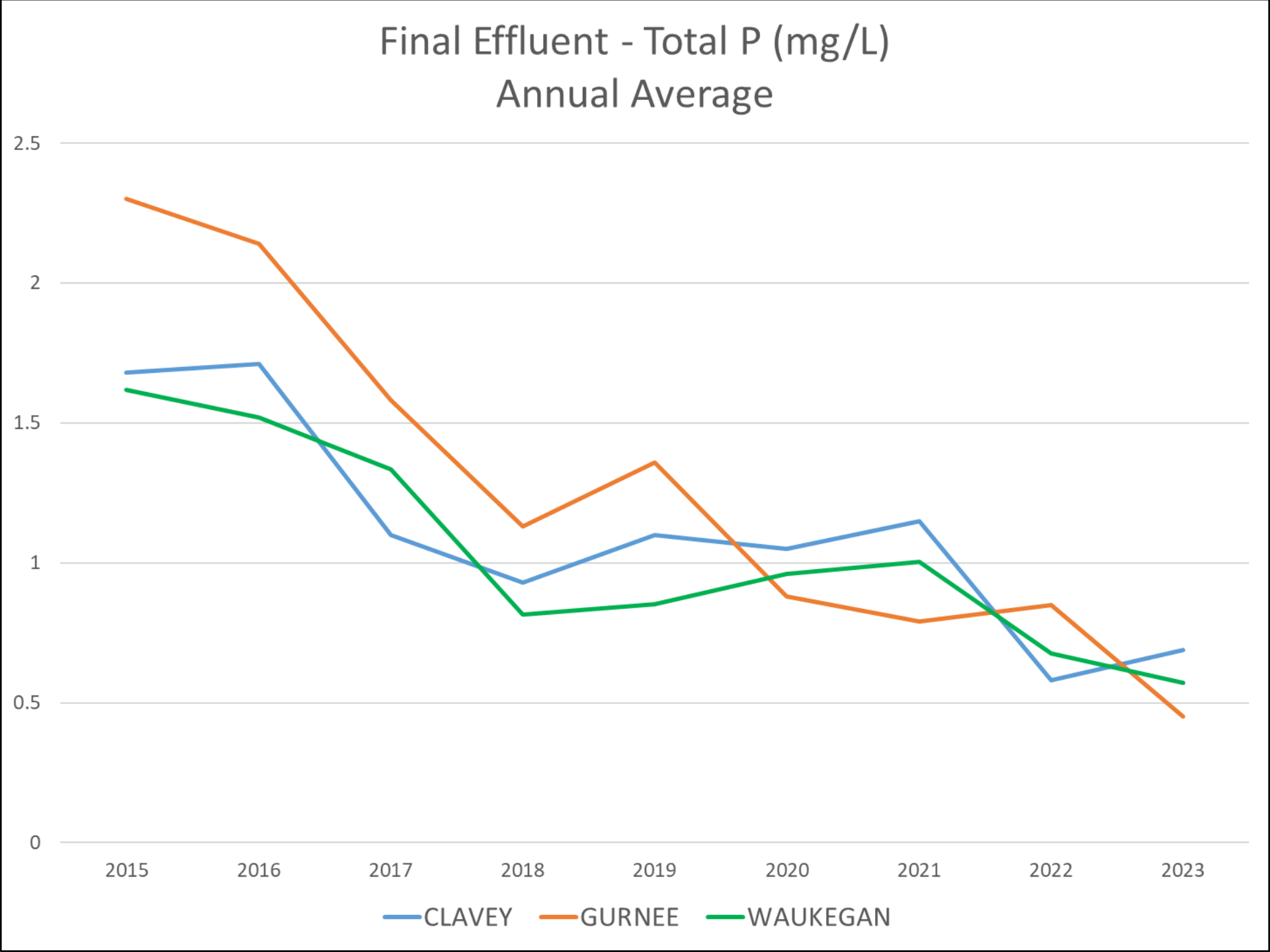
NUCOR


Final Effluent - Total P (mg/L)
Annual Average
2.5
2
1.5
1
0.5
0
2015
2016
2017
2018
2019
2020
2021
2022
2023
CLAVEY
GURNEE
WAUKEGAN

2023 Phosphorus Removal

	Influent		Effluent		% Removal
	Average Conc. (mg/L)	Pounds Received	Average Conc. (mg/L)	Pounds Discharged	
Clavey	4.63	207,854	0.69	31,036	85.1%
Gurnee	3.77	161,242	0.45	18,461	88.6%
Waukegan	3.28	183,877	0.57	34,940	81.0%
District-Wide	3.90	552,973	0.57	84,436	84.9%

468,537 lbs of Phosphorus removed and beneficially reused in 2023!

Summary

- Illinois Nutrient Loss Reduction Strategy Goals
  - In-stream Phosphorus
    - 25% reduction by 2025
    - 45% long-term
- District Phosphorus Reduction Projects
  - Biological Phosphorus Removal
  - Chemical Phosphorus Removal Back-Up Systems
  - $18M + Capital Spending to meet ILNLRS P Reduction Goals
- District 2023 P removal of 85%


QUESTIONS?