Chapter 5 Review – Point Sources

Rick Manner

Urbana & Champaign Sanitary District

Illinois Association of Wastewater Agencies

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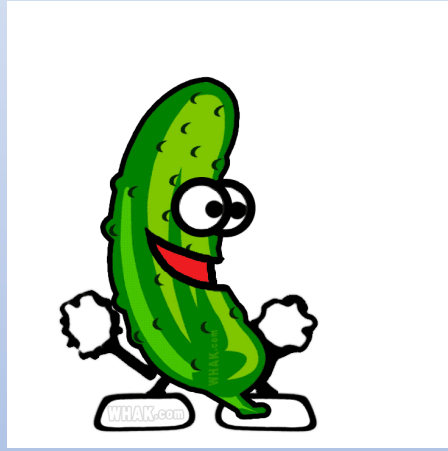

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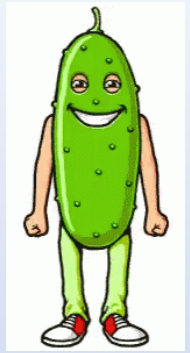
Point Source Details - Phosphorous Discharges

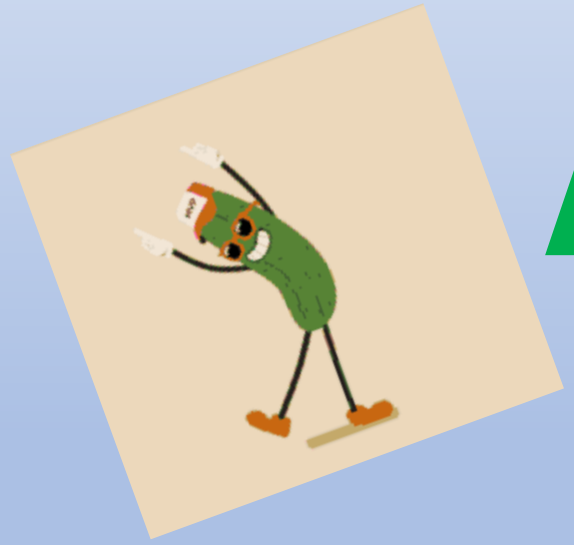
- 2011 = **18.1** million pounds from all point sources (BASELINE)

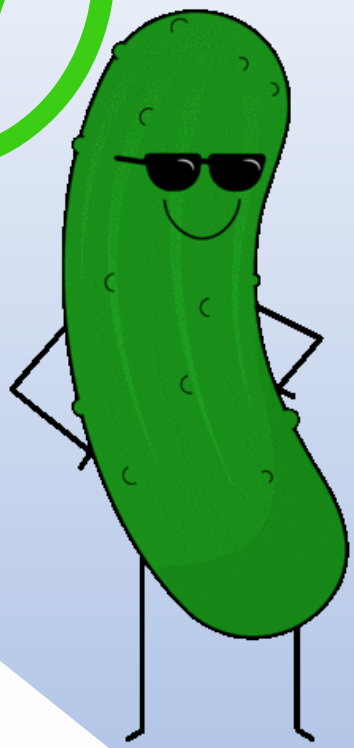
- 2019 = **14.9** million pounds from all point sources
- 2020 = **15.2** million pounds from all point sources
- 2021 = **12.5** million pounds from all point sources
- 2022 = **11.9** million pounds from all point sources

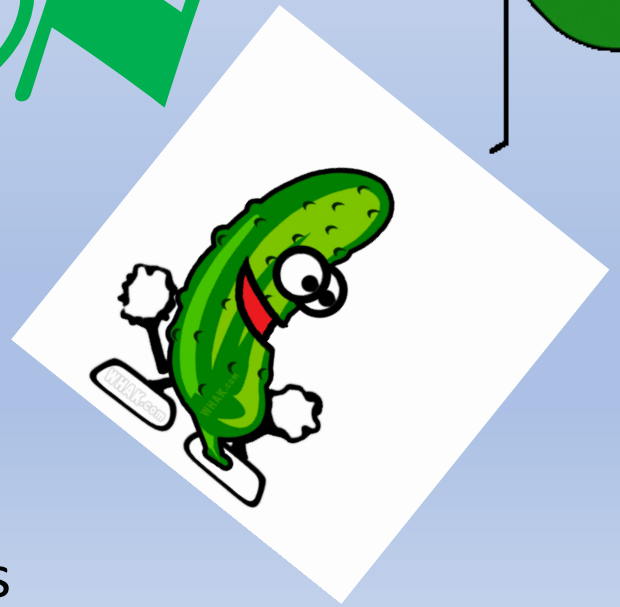
- ***Now at 6.2 million pound reduction ! ! !***



6,200,000 POUND REDUCTION TALK







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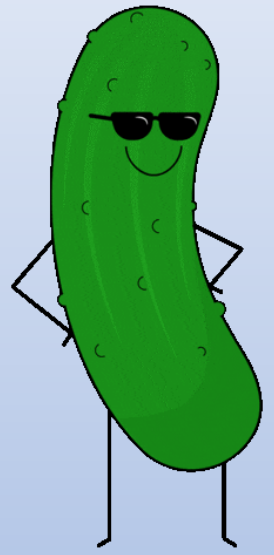
Why Have 6 Million Pound Reductions Occurred?

- ✓Required all expanding plants to remove to 1.0 mg/L
- ✓Each large MWRDGC facility is a huge step
- ✓Required all plants to study removal options
- ✓Required all plants to optimize with what they have



- ✓Provided permit certainty over time, to facilitate upgrades
- ✓Stopped arguing over state-wide water quality standard
- ✓Established Bio-P as the preferred solution
  (Bio-P is not right for all, or required in all plants.)
- ✓Limited focus to P, where we can
- ✓Emphasizing watershed issues

6,200,000
Pounds Reduction !!!

Where Have Reductions Already Occurred

Greater than 1 million pounds reduced or change

Stickney – MWRDGC (1.3 million)

Correction to estimated discharges from plants unsampled in 2011 (1.1 million)

Still exceed 25% goal without including correction

From 100,000 to 999,999 pounds reduced

Fox Metro WRD

Kankakee MWRA

Peoria SD

Kirie - MWRDGC

From 50,000 to 99,999 pounds reduced

O'Brien – MWRDGC

Fox River WRD

North Shore WRD

Sangamon County WRD

From 10,000 to 49,999 pounds reduced

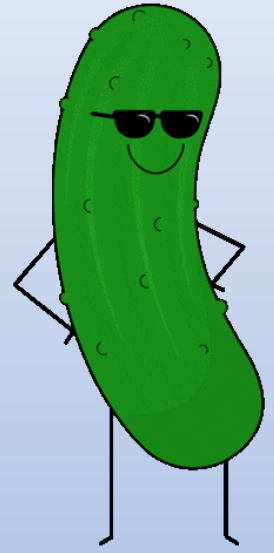
Expanded facilities across IL – Interim P rule

Numerous watershed-specific reductions in NE Illinois

Egan, Hanover Park – MWRDGC

Naperville

Bloomington Normal WRD



6,200,000

Pounds Reduction !!!

Where Have Reductions Already Occurred

Greater than 1 million pounds reduced or change **~2,400,000**

Stickney – MWRDGC (1.3 million)

Correction to estimated discharges from plants unsampled in 2011 (1.1 million)

Still exceed 25% goal without including correction

From 100,000 to 999,999 pounds reduced **~600,000**

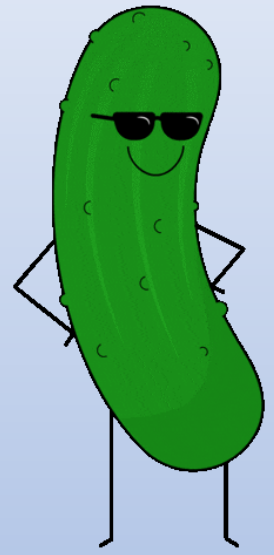
Fox Metro WRD
Kankakee MWRA
Peoria SD
Kirie - MWRDGC

From 50,000 to 99,999 pounds reduced **~300,000**

O'Brien – MWRDGC
Fox River WRD
North Shore WRD
Sangamon County WRD

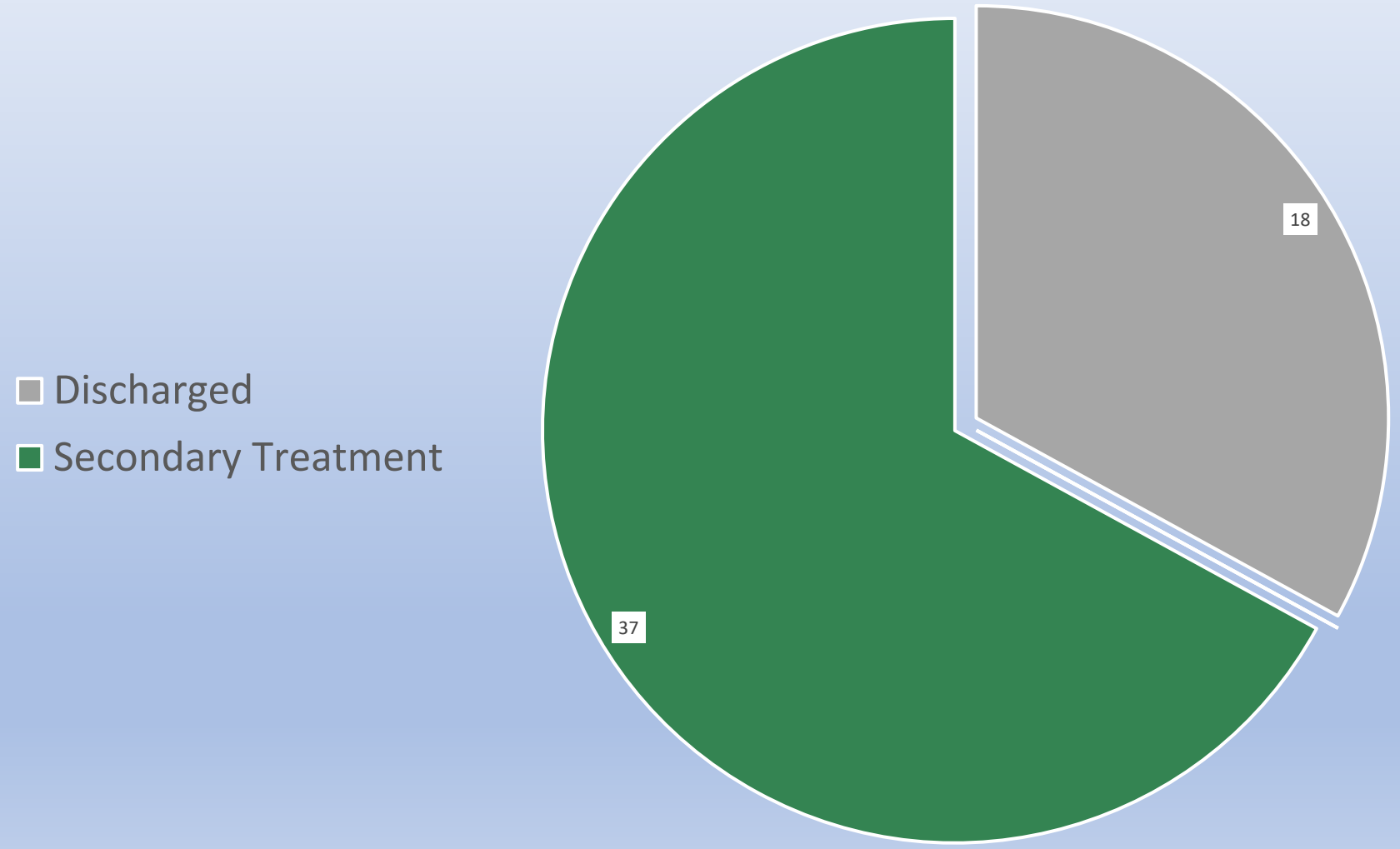
From 10,000 to 49,999 pounds reduced **> 2,500,000 !**

Expanded facilities across IL – Interim P rule
Numerous watershed-specific reductions in NE Illinois
Egan, Hanover Park – MWRDGC
Naperville
Bloomington Normal WRD



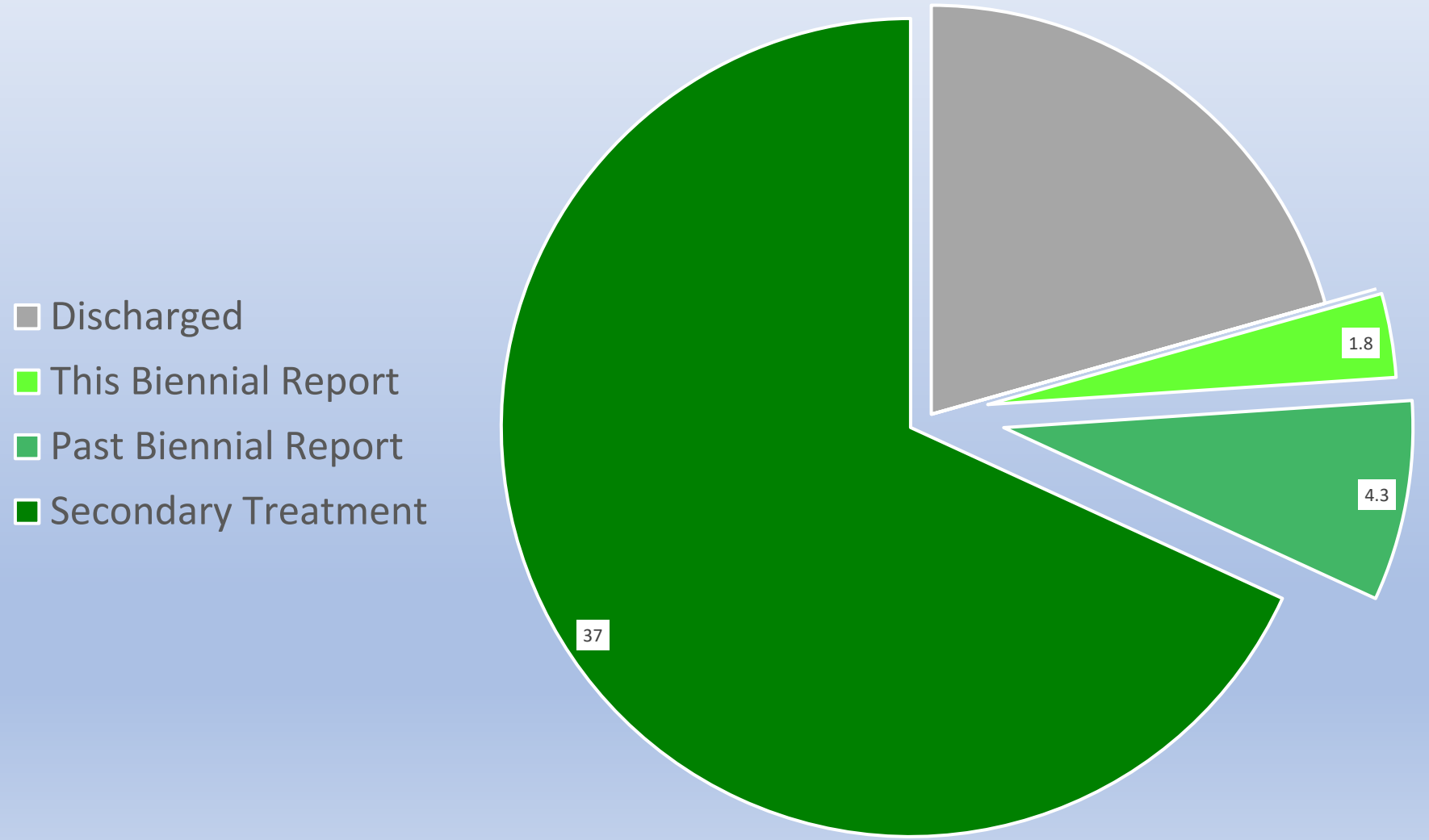
6,200,000
Pounds Reduction ! ! !

Point Source Details - 2011 Pounds P Removed



Roughly 67% P Removal Via Secondary Treatment's Cell Growth and Solids Removal

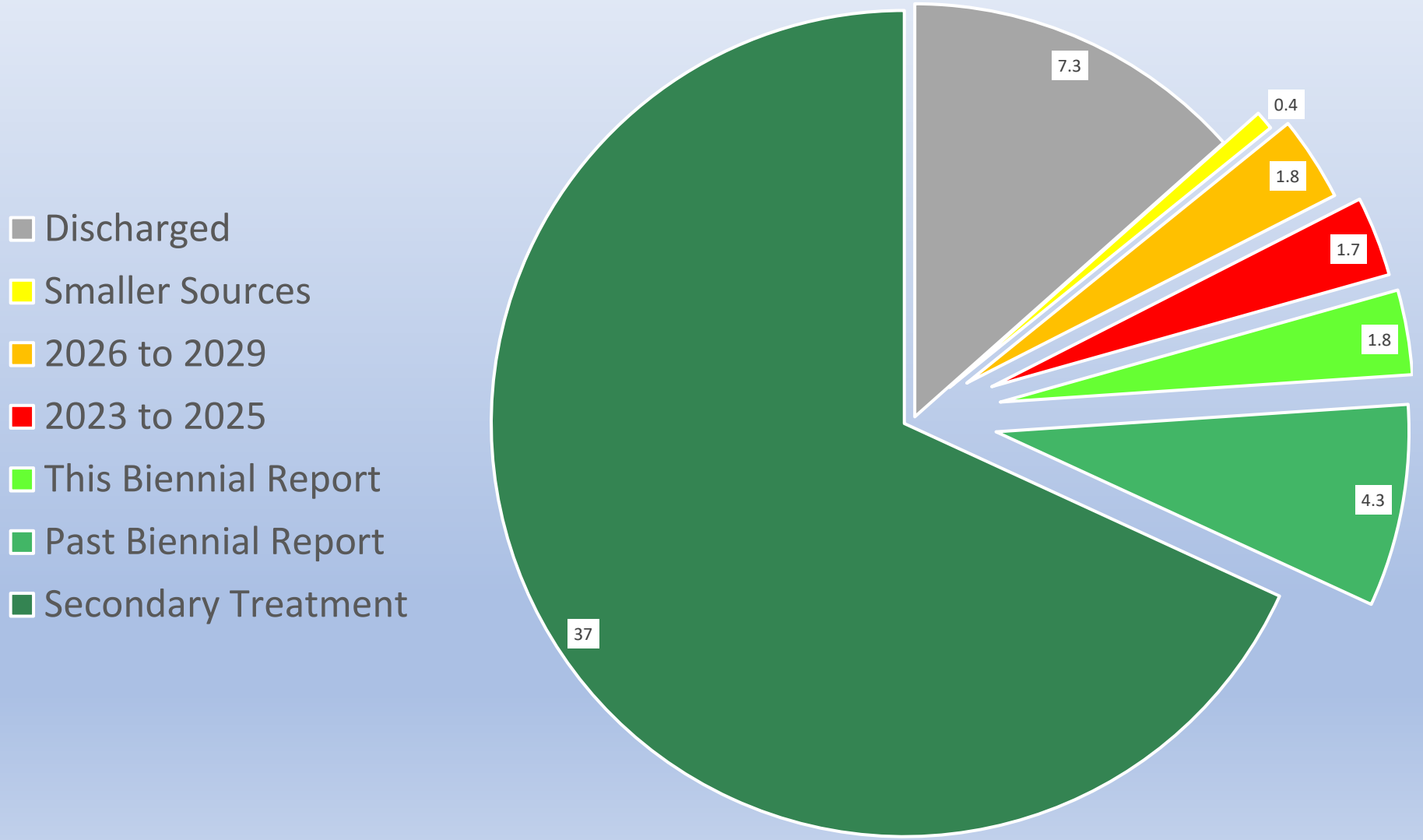
Point Source Details - 2022 Pounds P Removed



Current 34% Reduced vs Baseline

~80% Removal From Influent

Point Source Details - 2030 Pounds P Removed



Possibly 50% Reduced vs Baseline

~85% Removal From Influent

Further Reductions Coming

- 4 of Baseline Year Top 10 in 2011 now have < 1.0 mg/L.
  - 1.9 million reduction from these 4 (Stickney, FMWRD, FRWRD, KRMA)
  - All but Stickney have now dropped from Top 10 list.

- **ONLY** considering Current Top 10 we know future reductions are coming
  - 2 million more pounds within 5 years
  - 3+ million more pounds within 10 years

- 45% statewide goal will be met soon
- Exceeding 50+% statewide is within reach
- Exceeding 10,000,000 pounds reduction is possible

Is more than 10,000,000 Pounds Possible ? ? ?

Top 10 Dischargers Planned Compliance with 1.0 mg/L – Table 5.6

NPDES ID	Facility Name	TP 1 mg/L Compliance Date	
IL0028061	Calumet Water Reclamation Plant (MWRDGC)	Jan. 1, 2024	2024
IL0028321	Sanitary District of Decatur – Main Sewage Treatment Plant	Oct. 1, 2029	2029
IL0028053	Stickney Water Reclamation Facility (MWRDGC)	Aug. 1, 2021	done
IL0028088	Terrence J. O'Brien WRP (MWRDGC)	Aug. 1, 2027	2027
IL0027201	Four Rivers Sanitation Authority Sewage Treatment Plant	TBD	
IL0036340	John E. Egan WRP (MWRDGC)	Jan. 1, 2031, or Jan. 1, 2032	2032
IL0027723	Thorn Creek Basin Sanitary District Sewage Treatment Plant	TBD	
IL0034061	N Springbrook Water Reclamation Center – Naperville	Jan. 1, 2029, or Jan. 1, 2030	2032
IL0027731	Bloomington-Normal Water Reclamation District west-side plant	TBD	
IL0028380	Downers Grove Sanitary District Wastewater Treatment Center	Aug. 1, 2025, or Aug. 1, 2026	2028

Future reductions planned at Top 10 dischargers.

These total more than 3 million more pounds in reductions that will occur.

The 3 largest will in the next 1, 3, and 5 years.

Numerous smaller dischargers will also continue their progress.

Is more than 10,000,000 Pounds Possible ? ? ?

Executive Summary and Key Points

- Mother Nature and History Are Powerful Drivers
  - Rain volume matters – wetter years will discharge more, may not be linear
  - Soil erosion matters – storm intensity causes erosion, almost certainly not linear
  - Prior discharges matter – legacy load is tens of millions of pounds
  - Sediment conditions matter – P is released in anaerobic layers, N is destroyed in anoxic layers

  - What else is hidden in complexity of the problem ? ? ?

- But still…
  - 6.2 million fewer pounds discharged!
  - 34% reduction by 2022!
  - More coming!

  - 38% < 1 mg/L ***limit***
  - 48% < 1 mg/L ***discharge***
  - 22% < 0.5 mg/L ***discharge***

6,200,000
Pounds
Reduction
! ! !

Executive Summary and Key Points

- 210 Phosphorous reduction studies*

- 18 nutrient events
- 4,300 people attending as reported by IAWA

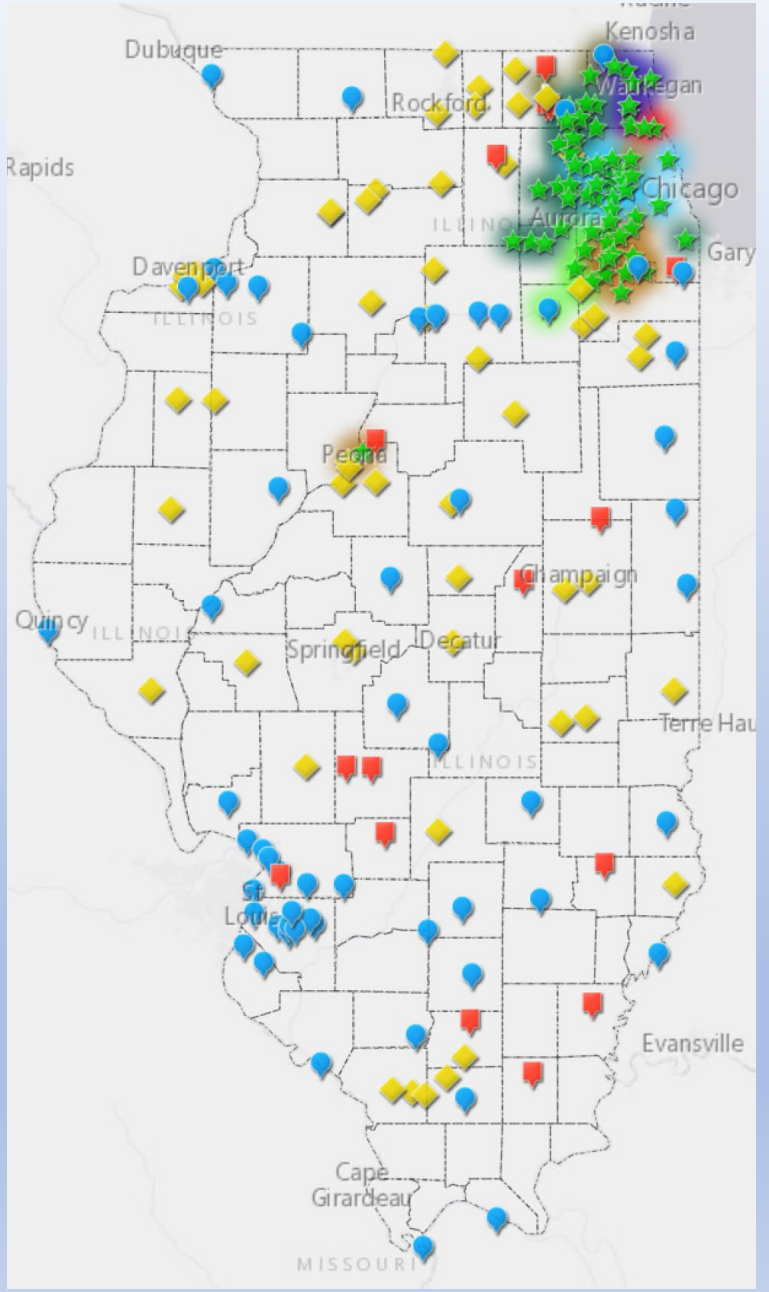
6,200,000
Pounds Reduction !!!

NARPs and Watershed Groups

- 156 Majors involved with NARPs/Watershed Groups

- Problems have slowed NARP development
  - Lack of explanation of NARPs at permit writing.
  - Complexity of the issues.
  - Trying to identify and get active stakeholders.
  - Lack of guidance.
  - COVID (couldn’t have been timed worse).
  - Lack of partners or funds in less-populace regions.

  - First batch have been submitted by end of 2023.



Money Spent on Nutrients by Point Sources

- Estimating funding attributable to nutrients is extremely difficult

- ~$100 million/yr identified via SRF application review – ***this is likely too low***
  - $400+ million/yr SRF is loaned out
  - SRF previously had excess available – ***recall talk about expanding access***
    - Now there is more demand from just point sources projects than funds available
      - Nutrient projects **<u>are</u>** being delayed – ***so funding diversions are a problem for progress on nutrients***
      - Insufficient SRF funding situation will assuredly extend until 2030, or 2035, or longer

- If not funded via SRF, costs go up by 25%
  - Progress will be slower
  - Less will get done
  - 'Non-essentials' will be cut

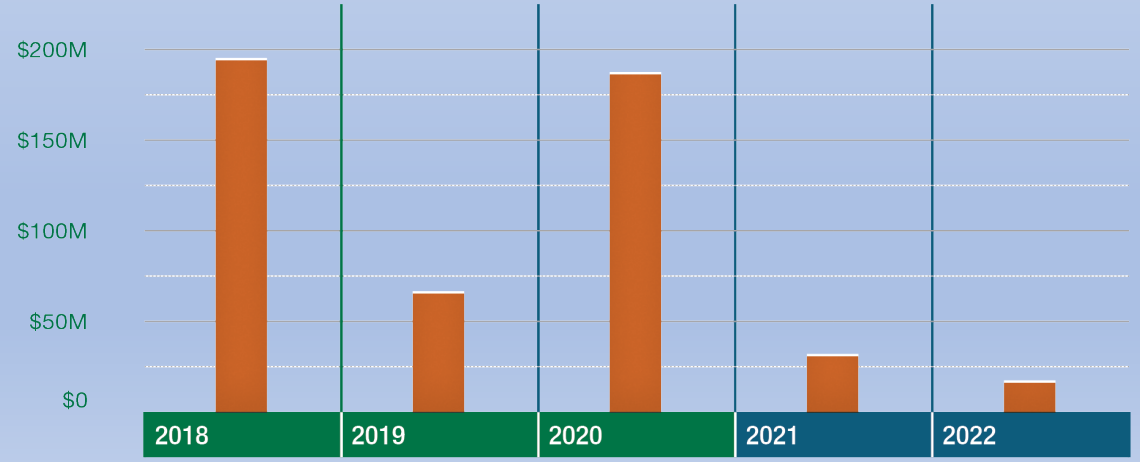


Figure 5.2. *Reported point source spending from 2018-22 submitted from facilities*

Total Nitrogen (TN) Removal at Point Sources

- Total Nitrogen removal of 11.6% more than baseline year.
  - Possible due to permitting time to build Bio-P.
    - Chem-P does not have conditions that generate ‘free’ TN reductions.
    - Bio P includes anaerobic conditions.
    - TN removal wants anoxic conditions (in between oxic and anaerobic).
      - Some amount of free TN removal happens in transition zones.
      - If TN limits appear, TP removal will suffer due to complication of dual priorities.
      - Maintaining TN optimization requirements seems effective and smart.

Final thoughts

- **If sediment is a real source that took 20 years to accumulate, it will take decades to bleed out on its own. To reduce discharges faster, we must remove legacy loads**
  - **What sort of $/lb removed can we get from the following ideas?**
  - ***Biological removal***
    - Some Asian Carp harvesting is occurring already
    - Could IL subsidize market for improved fisheries and faster nutrient improvement
      - Create a consumer market and fishermen will supply P removal labor
  - ***Sidestream treatment of IL River***
    - Idaho already doing this as the majority of their P sources are diffuse – old mine leakage
    - Proposed wetland by MWRDGC
    - Other engineered wetlands as treatment and habitat
    - Habitat recreation should have spin off benefits that may provide economic value – recreation, hunting.
  - ***Clean sediment trap in IL River basin - recreate the sink for P that existed in 1990s***
    - Some dredging occurs for navigation – characterize that for NP removal.
    - Target additional selective dredging to remove NP in hot spots.

- **Florida received extensive federal assistance to address Everglades and P**
  - Propose grand solution and lobby for bringing federal aid to MS River basin
  - Illinois River seems like the ideal test area – extensively monitored, large source in one basin

Final thoughts

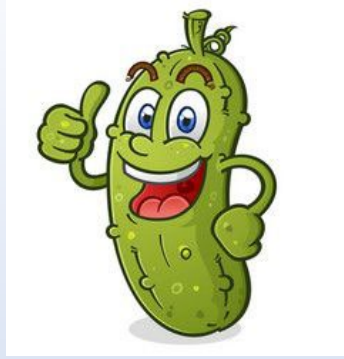
- **I'd appreciate the scientists and modelers to discuss if it would be useful to attempt to update the fractional contributions of nitrogen and phosphorous into IL Waters and into MS River from IL**
  - Sediment should be its own source/sink
  - Soil erosion should be its own source/sink

  - Result would be:

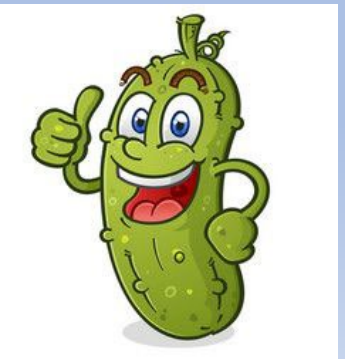
    Net Leaving IL = Point + NonPointAg + NonPointUrban + Sediment + SoilErosion

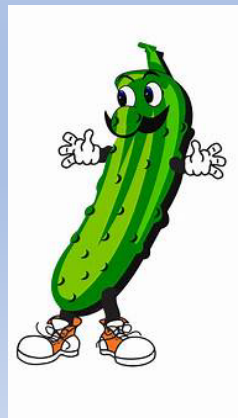
  - Unfortunately only 2 of the inputs into this formula can be measured with any accuracy.

  - It might be possible to start off modeling smaller rivers where some of the sources would be near zero – such as:
    - An Urban stream that may have limited soil erosion (i.e. no NonPointAg or SoilErosion)
    - An Ag stream with limited ability to store significant amounts of sediment (i.e. only NonPointAg and Soil Erosion)
    - With this we could model P inputs per acre of difficult to measure drivers



QUESTIONS ?





Rick Manner
rmanner@u-csd.com
(217) 367-3409

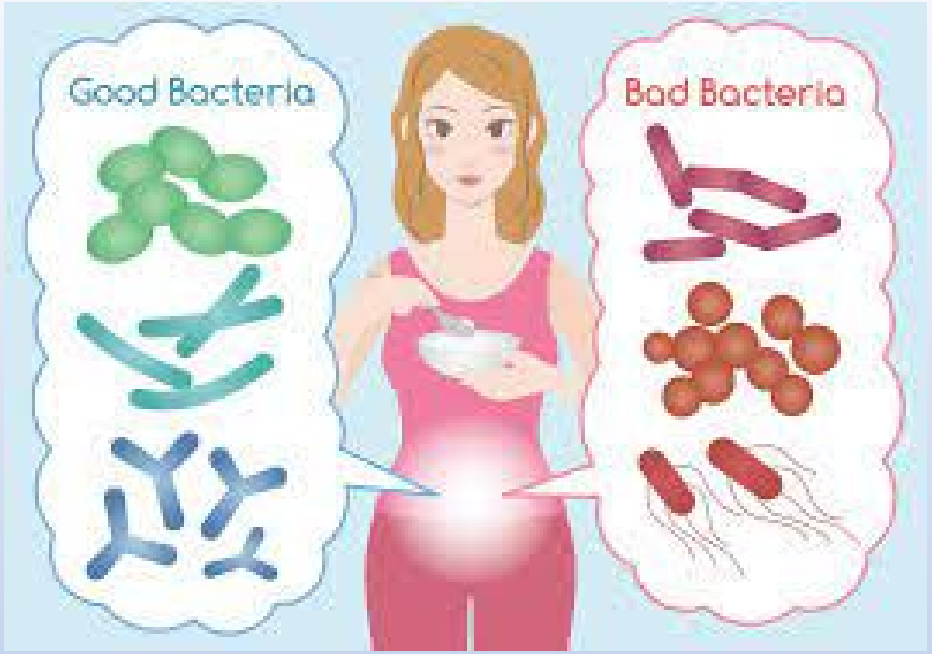
Sewage Treatment 101

- Primary treatment is gravity separation. This reduces some pollutants.
  - 50% solids removal
  - 35% removal of solid BOD-Carbon settles
  - This removes some P via adsorption of P onto solids that are removed
    - This same mechanism is how many heavy metals are removed.
  - Gravity separation does nothing for dissolved pollutants or solids that are colloids.

Sewage Treatment 101

- Secondary Treatment – Attached growth
  - Trickling filter lets microbes grow on surface
  - CHONPS – Growth consumes the 6 most common elements
  - Temperature sensitive – not so effective in winter in northern climes

Sewage Treatment 101



- Secondary Treatment – Activated Sludge
  - Grows up ‘good microbes’ – intensive CHONPS
  - Good settling – so solids are removed to 99+%
  - Good conversion of ammonia to nitrate by 95+%
  - Good at converting nitrate to N2 gas (Modified Ludzack-Ettinger process - MLE)
  - P removed in excess of what is needed by ‘luxury uptake of P’ now up to 90+%

Sewage Treatment 101

- Enhanced Biological Phosphorous Treatment – ‘Luxury Uptake of P’
  - Grow microbes that choose to take up excess P, more than they need for cell growth, and are compatible with all of the other microbes in the treatment plant.

- We are reliant upon a mixture of desirable microbes to out-compete others
  - We do not control the source microbes.
  - We do not control the food input rate.
  - We do not control the weather.

  - But we are expecting 95% compliance… forever.