



Wastewater treatment in Minnesota: History, pollutant limits, permits and challenges



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What we'll cover

1. Wastewater treatment
2. Standards to pollutant limits
3. Permits
4. Legal challenges
5. Summary

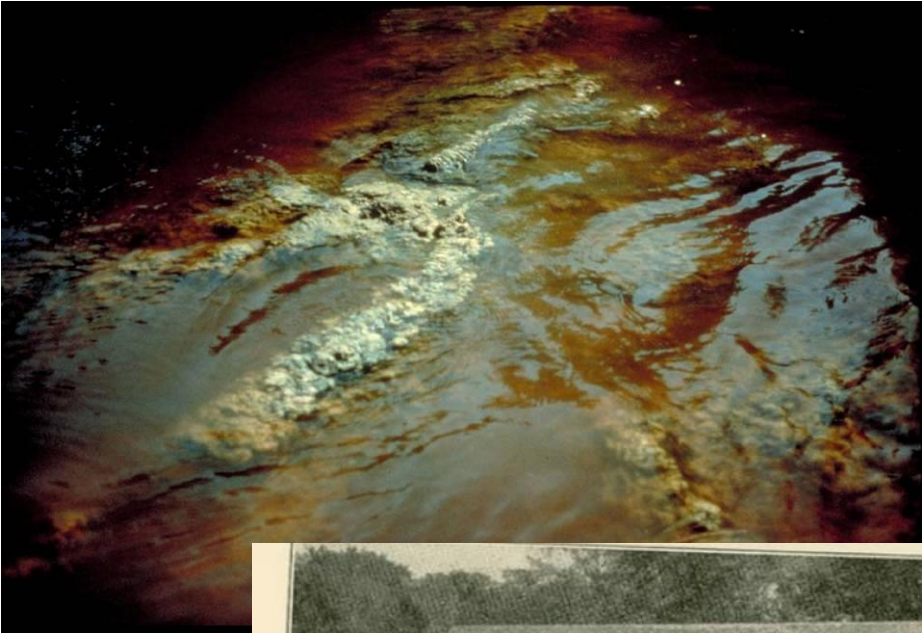


History of wastewater treatment in Minnesota

Wendy Turri

Manager of Municipal Wastewater

Why we treat wastewater



*Weir, Fourth Street South, Outlet, Minneapolis
Average discharge, 1,570,000 gallons per 24 hours*

Protect human and environmental health

- 1920s: Twin Cities dumping more than 1.5 million gallons of raw sewage into Mississippi River EVERY DAY
- 1930s: Mississippi River “dead” in Twin Cities – failed to support fish and other aquatic life
- 1950s: Half of metro area’s drinking water contaminated by sewage

Milestones in wastewater treatment



1960s

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- 1st MN water quality rules
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- Water quality standards nationwide
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- Technology based Limits
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- Pre-treatment program
- Biosolids program
- Change from Federal grants to state loans

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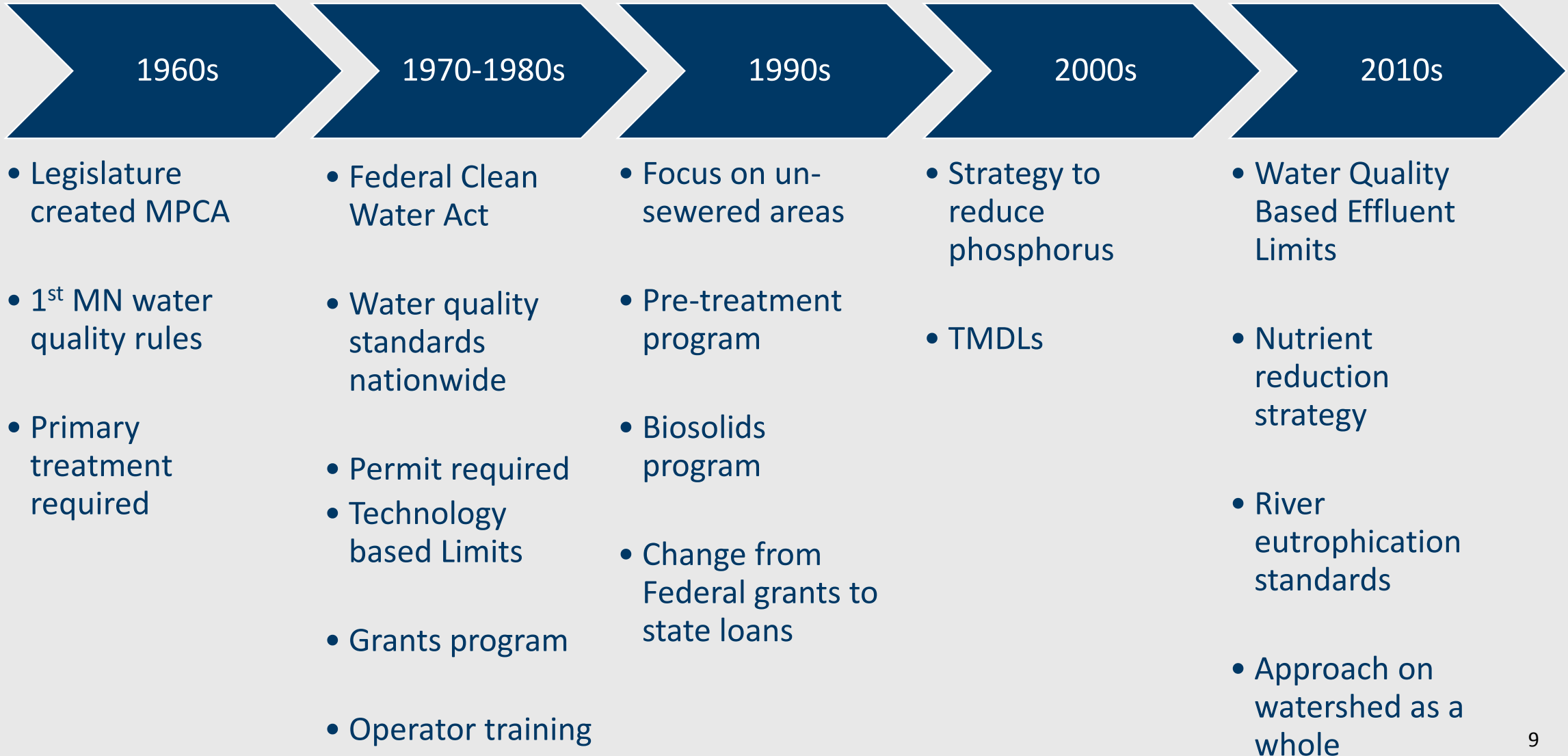
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2000s

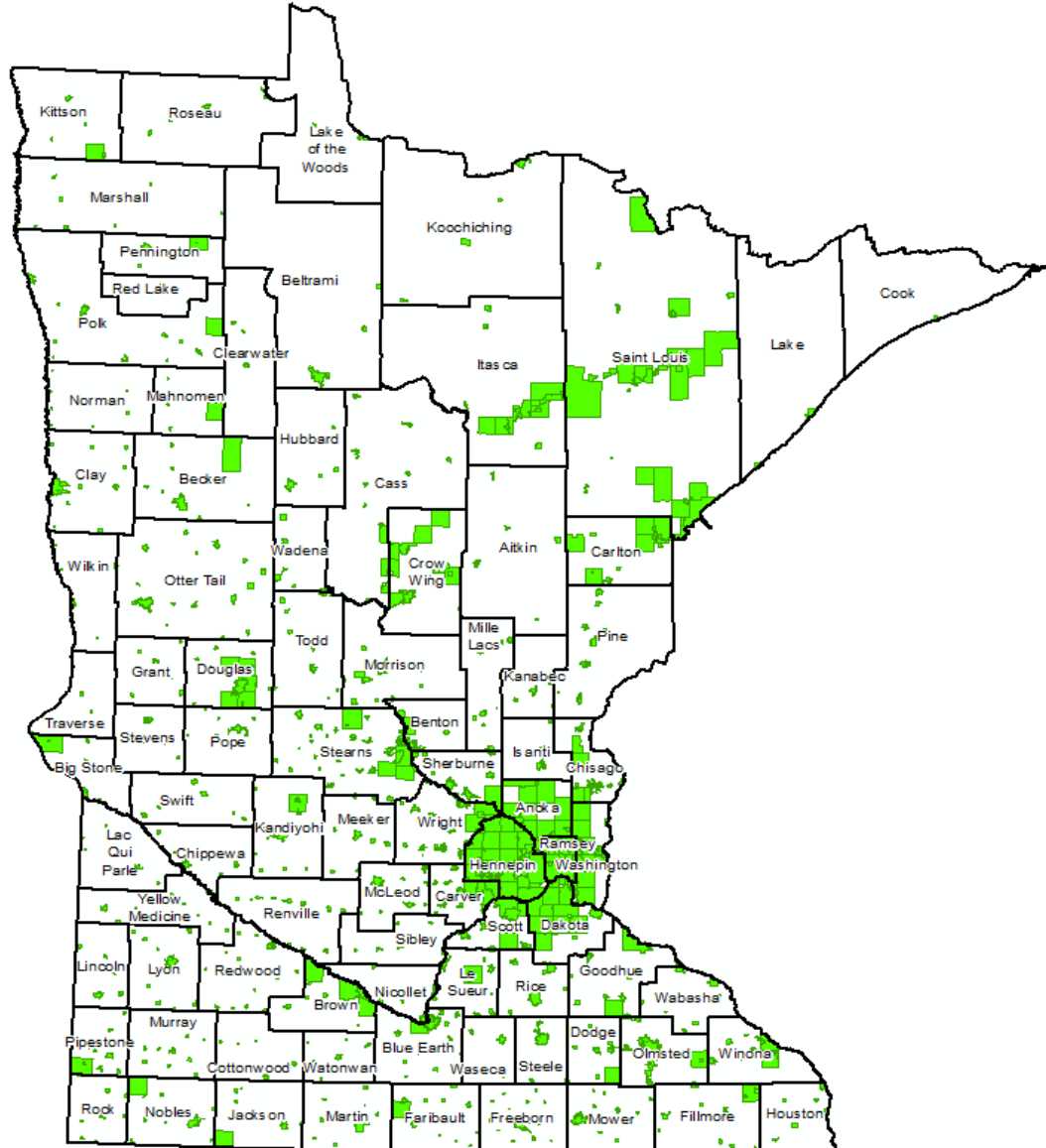
- Strategy to reduce phosphorus
- TMDLs

2010s

Milestones in wastewater treatment



Who's on a wastewater treatment system?



Municipalities – today's focus

- 736 municipal wastewater treatment plants in Minnesota
- Map: 4.4 million of state's 5.5 million population on a municipal system

Industries

- About 700 plants in state

Rural homes and businesses

- 534,000 on-site septic systems

Who regulates wastewater treatment?

Federal Clean Water Act Section 402

Title 40 Code of Federal Regulations

Regulations to implement and
administer NPDES Program

Delegation of NPDES program
authority to states
CWA section 402(b) & CFR Part 123

MPCA runs program in Minnesota

NPDES:
National
Pollutant
Discharge
Elimination
System

Original goal:
Eliminate discharges
to lakes and streams

Who regulates wastewater treatment?

Minnesota Statute Ch. 115 and 116 charges MPCA:

- “to adopt, issue, reissue, modify, deny, or revoke, enter into or enforce reasonable orders, permits, variances, standards, rules, schedules of compliance...in order to prevent, control or abate water pollution, or for the installation or operation of disposal systems...”

Permitting regulations are found in Minnesota Rule chapters:

- 7001 – Permit required & procedural requirements
- 7041 - Biosolids
- 7049 – Pre-treatment
- 7053 –Effluent limits
- 9400 – Certification

How is wastewater treated?



Plant Influent

Preliminary Treatment

Primary Treatment

Secondary Treatment

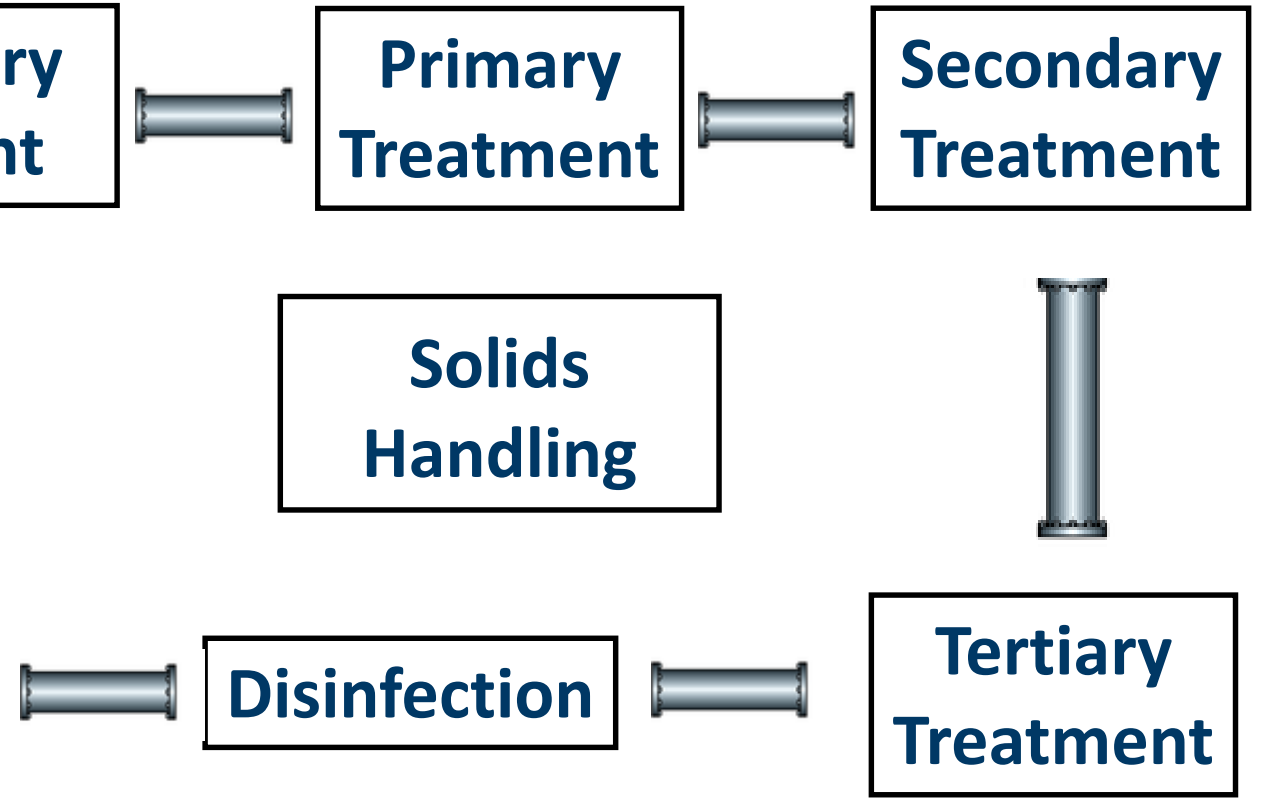
Solids Handling



Plant Effluent

Disinfection

Tertiary Treatment



What are preliminary and primary treatments?



**Plant
Influent**

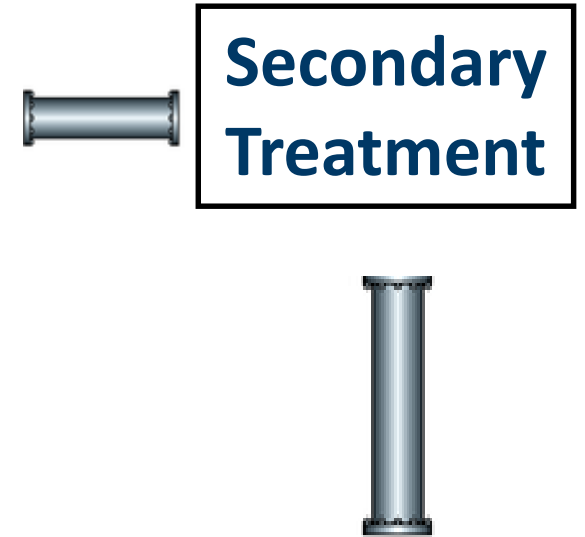
**Preliminary
Treatment**



**Primary
Treatment**



What is secondary treatment?



What is tertiary treatment?

Biological nutrient removal

- Removes phosphorus and nitrogen:
 - 0.5-2.0 mg/l total phosphorus
 - 5-10 mg/l total nitrogen



**Tertiary
Treatment**



**Solids
handling**

How is wastewater treated?



Plant Influent

Preliminary Treatment

Primary Treatment

Secondary Treatment

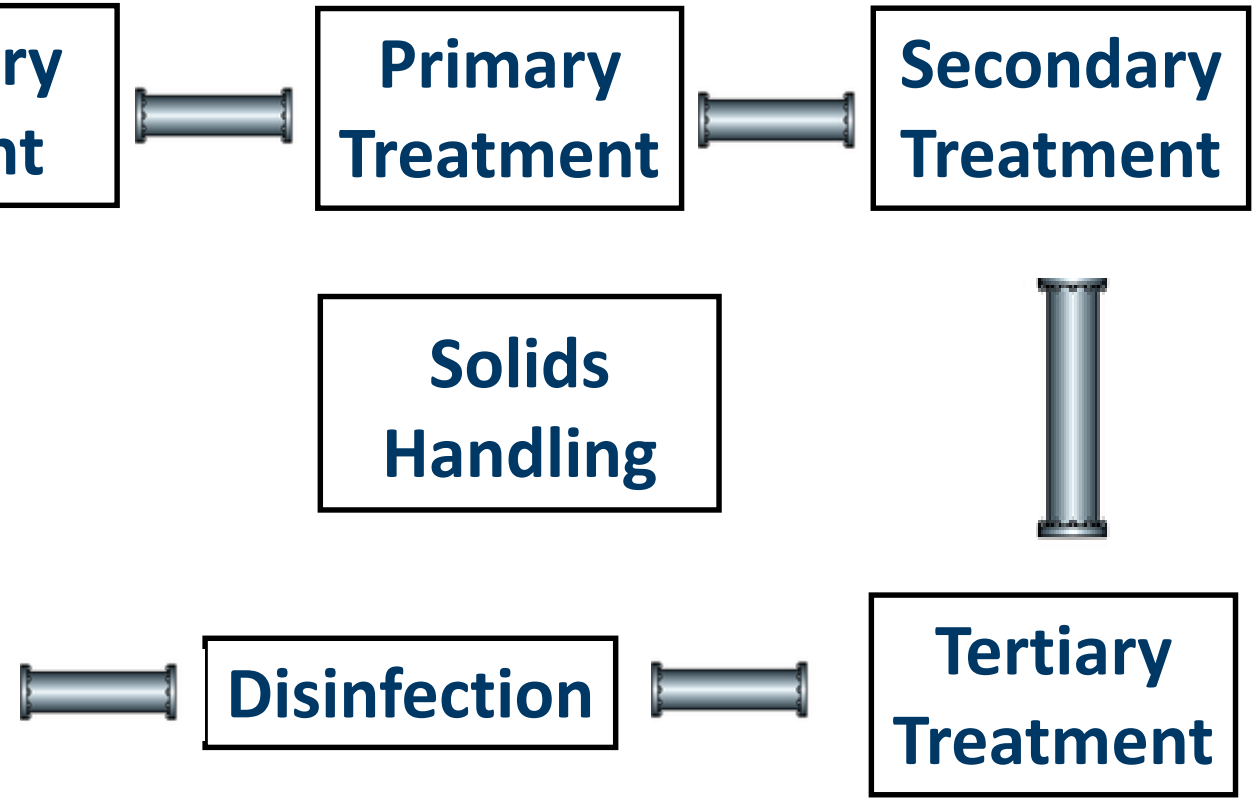
Solids Handling



Plant Effluent

Disinfection

Tertiary Treatment



What are the types of treatment plants?



50% use pond system

- Stabilization or aerated ponds



25% use aeration



15% use soil-based system

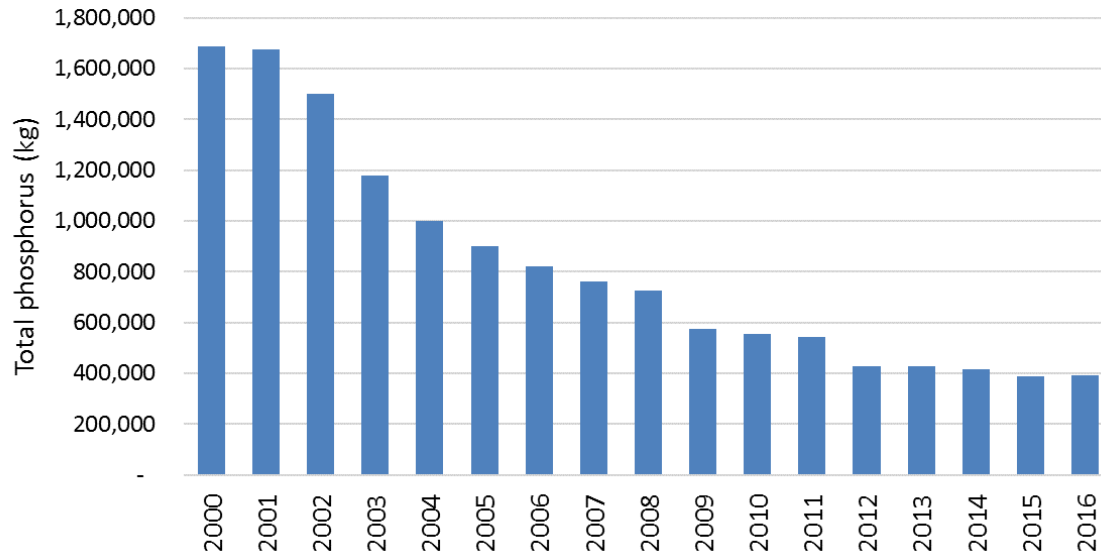


10% use trickling filters

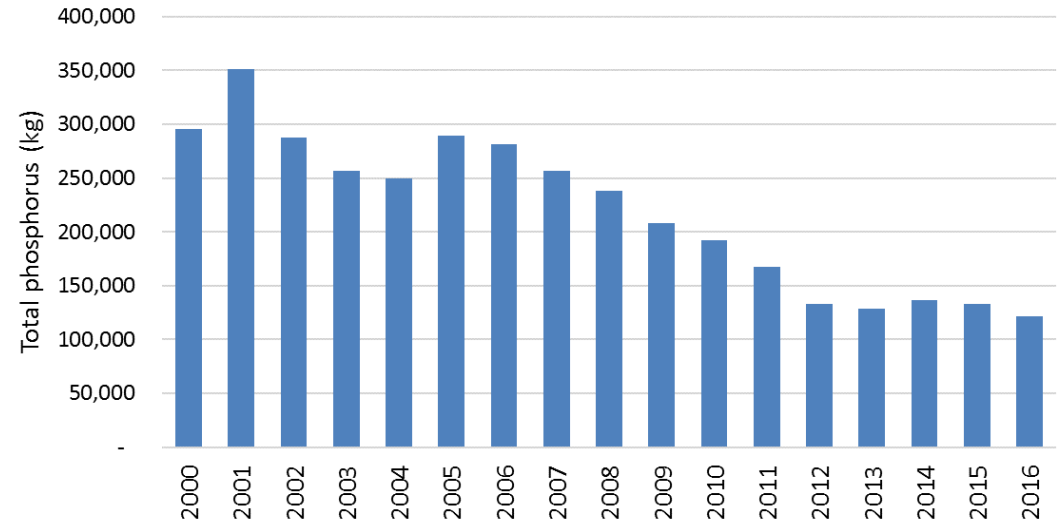
How well are municipalities doing?

Two examples of success: Mississippi and Minnesota rivers

Total phosphorus from NPDES Wastewater Facilities in the Mississippi River Basin (includes MN and St. Croix)



Total phosphorus from NPDES Wastewater Facilities in the Minnesota River Basin



How well are municipalities doing?

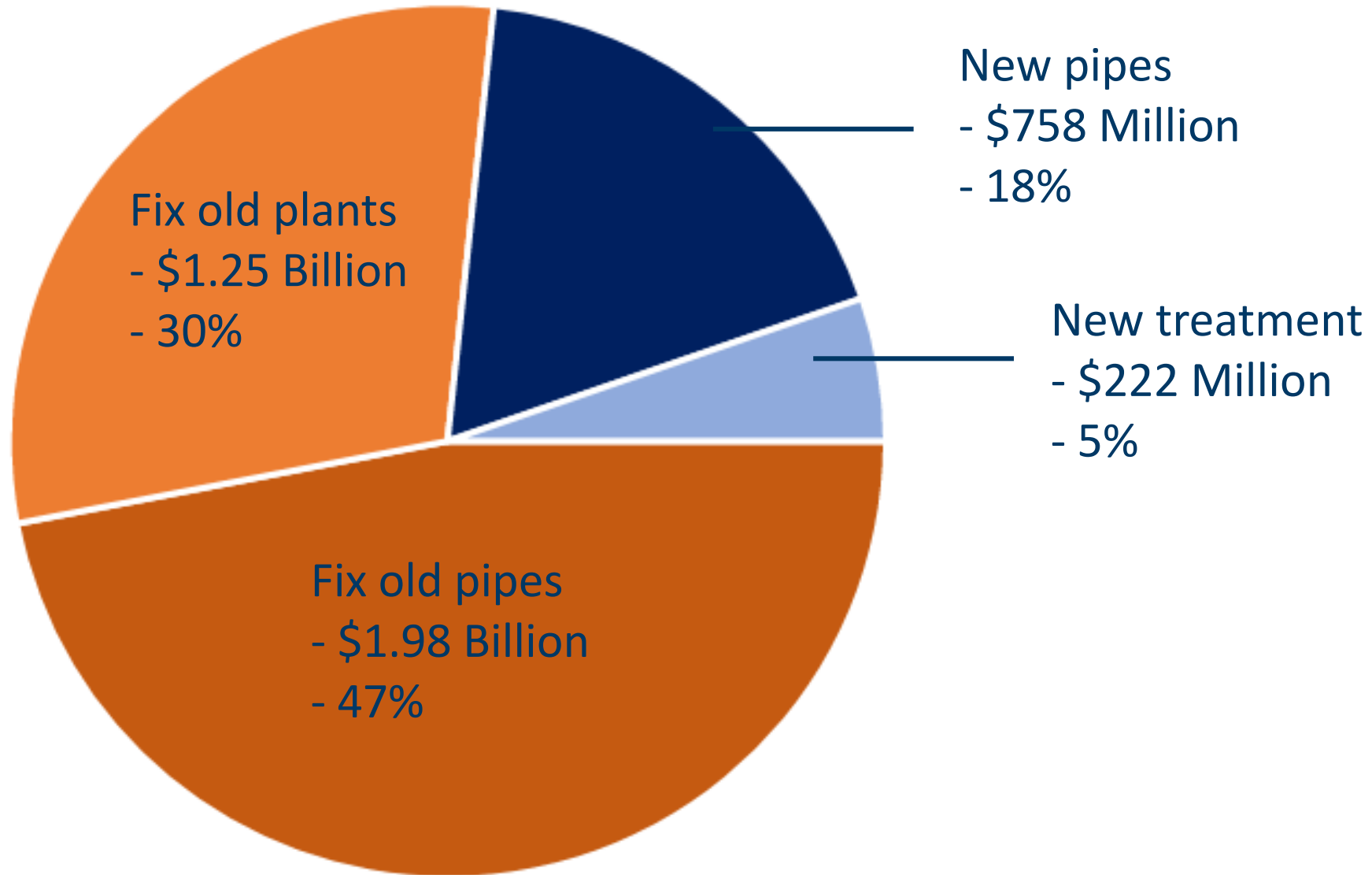
- Inspections find 82% in compliance with their permits
- 18% non-compliant
 - Effluent violations
 - Releases of untreated wastewater
 - Serious operational or maintenance issues



How much are communities paying?

Monthly Sewer Bills for Greater Minnesota Communities (\$)				
Population	Average	Low	High	Range
Under 500	30.67	1.67	102.05	100.38
500 to 999	35.79	8.17	116.00	108.87
1,000 to 2,499	37.56	12.50	96.90	84.40
2,500 to 4,999	36.25	13.50	83.00	69.70
5,000 to 9,999	40.67	10.25	88.33	78.09
10,000 to 24,999	33.09	15.37	46.50	31.13
25,000 and up	26.91	16.42	42.69	26.27
Monthly Sewer Bills for Met Council Enviro Services (\$)				
All metro service areas	Average	Low	High	Range
	23.23	10.23	56.00	45.77

What about the future?



Questions so far?





From standards to pollutant limits

Steve Weiss

Supervisor of Effluent Limits Section

Standard

- Ambient water quality goal
- Lake or river water quality target



Limit

- Effluent goal
- Legal requirement in permit to meet water quality standard







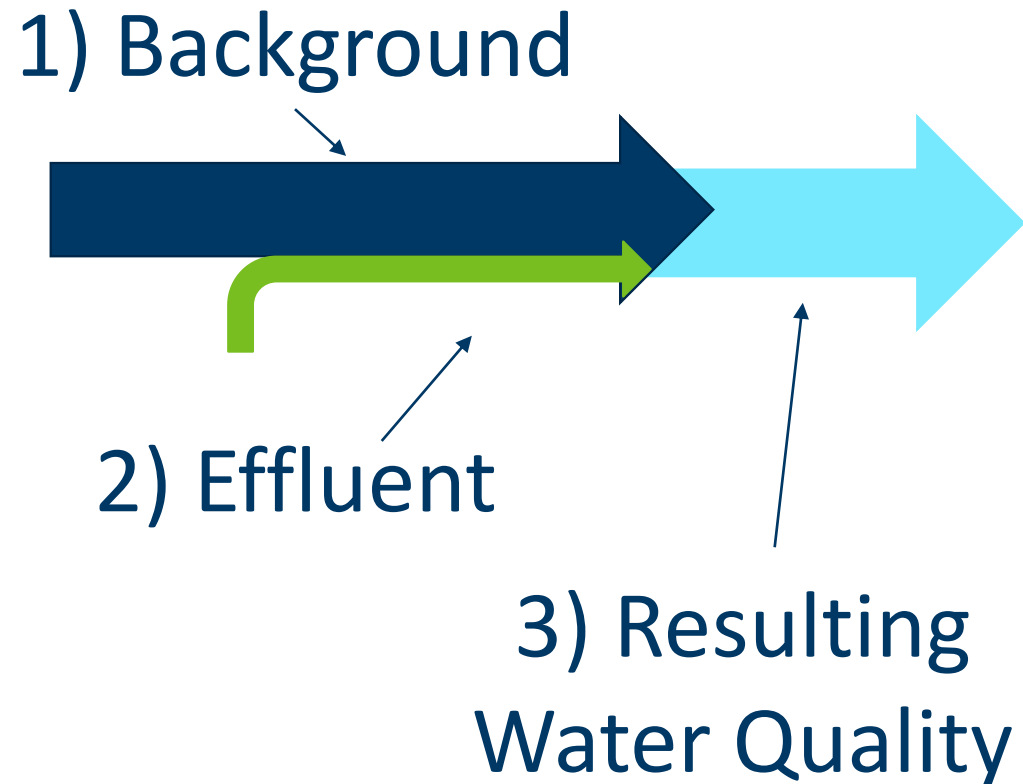








Basic example - toxics



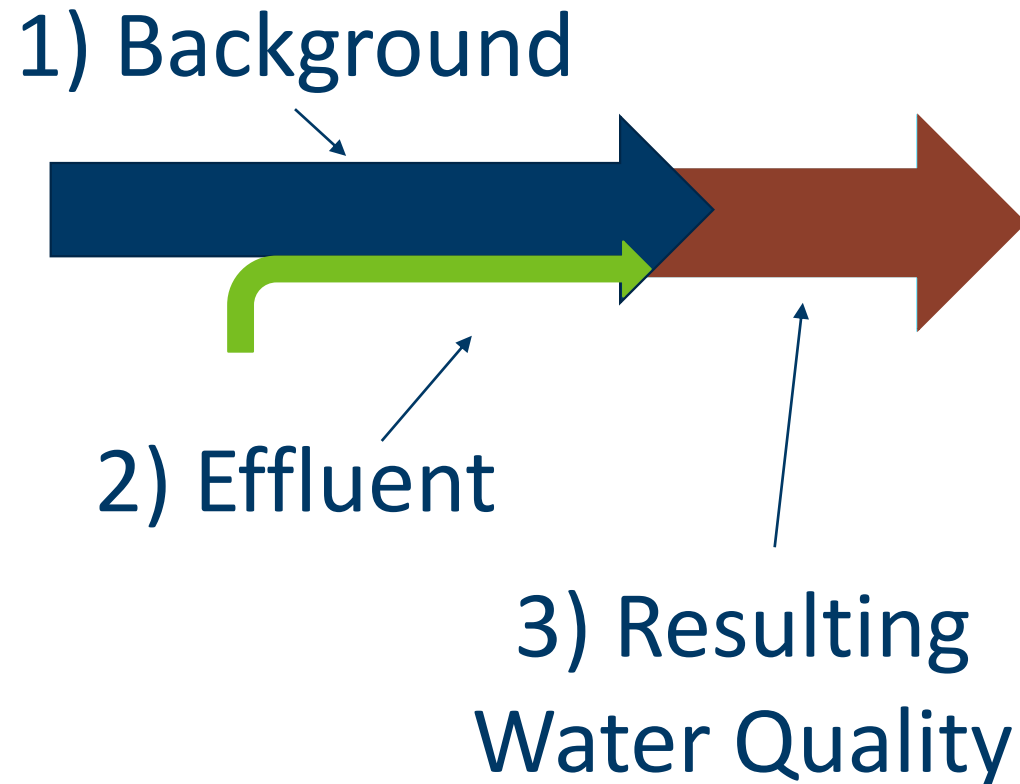
Critical details

- Concentration (background, effluent, resulting)
- Flow (critical river flow, facility design flow)

Other details (statistics)

- Effluent variability
- Exceedance frequency – never, 1x every 3 years, other
- Timing/Seasonality

Basic example - toxics

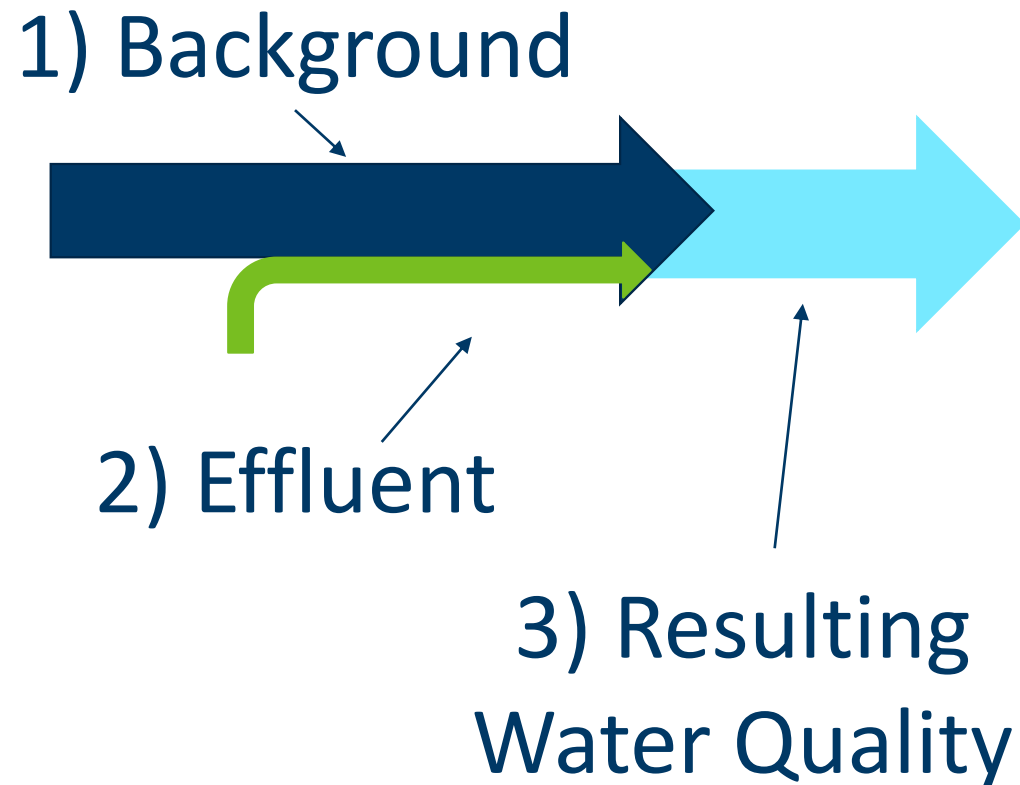


If resulting water quality

- 1) at or below concentration of water quality standard – **no limit**
- 2) Exceeds concentration of water quality standard – **must include limit** in new permit

- 40 CFR 122.44(d)(1)(i)

Basic example - toxics



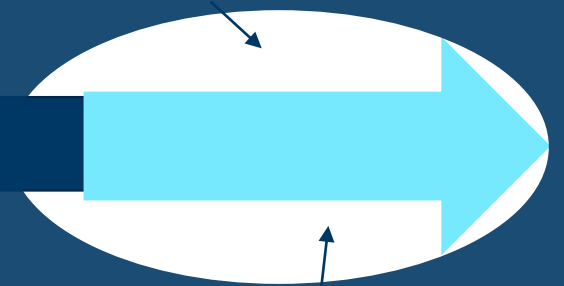
Details *not* typically required for toxics limit analysis

- Geography, downstream waters
- Other sources
- Changes in river flow and background concentrations through time

The river isn't constant!

- Flow changes
- Phosphorus concentration changes
- Algae growth changes

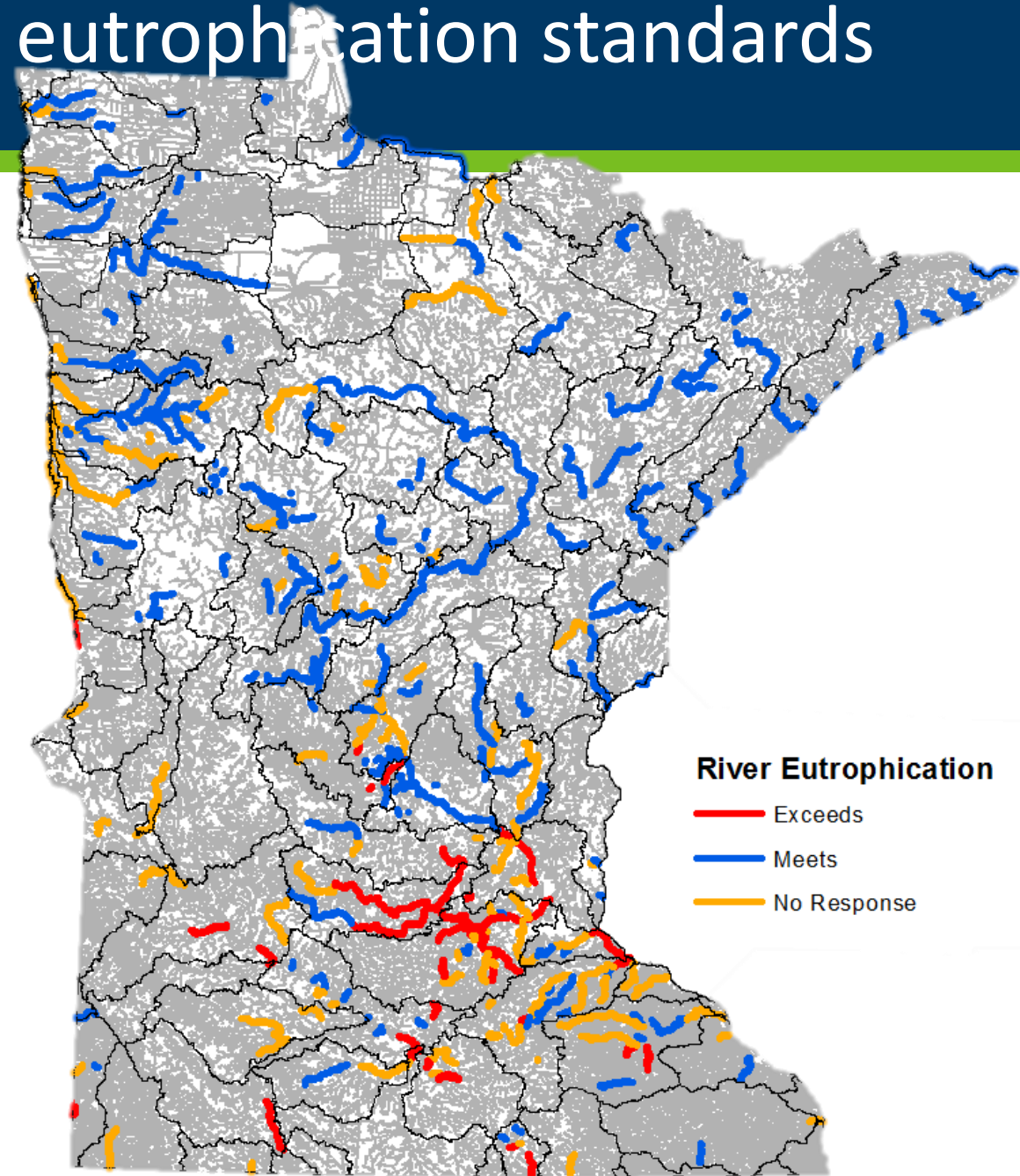
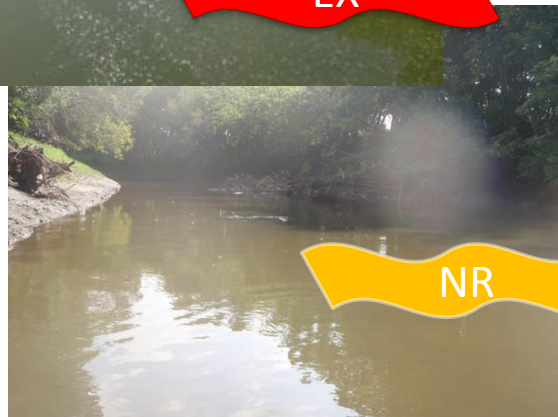
1) Background



2) Effluent

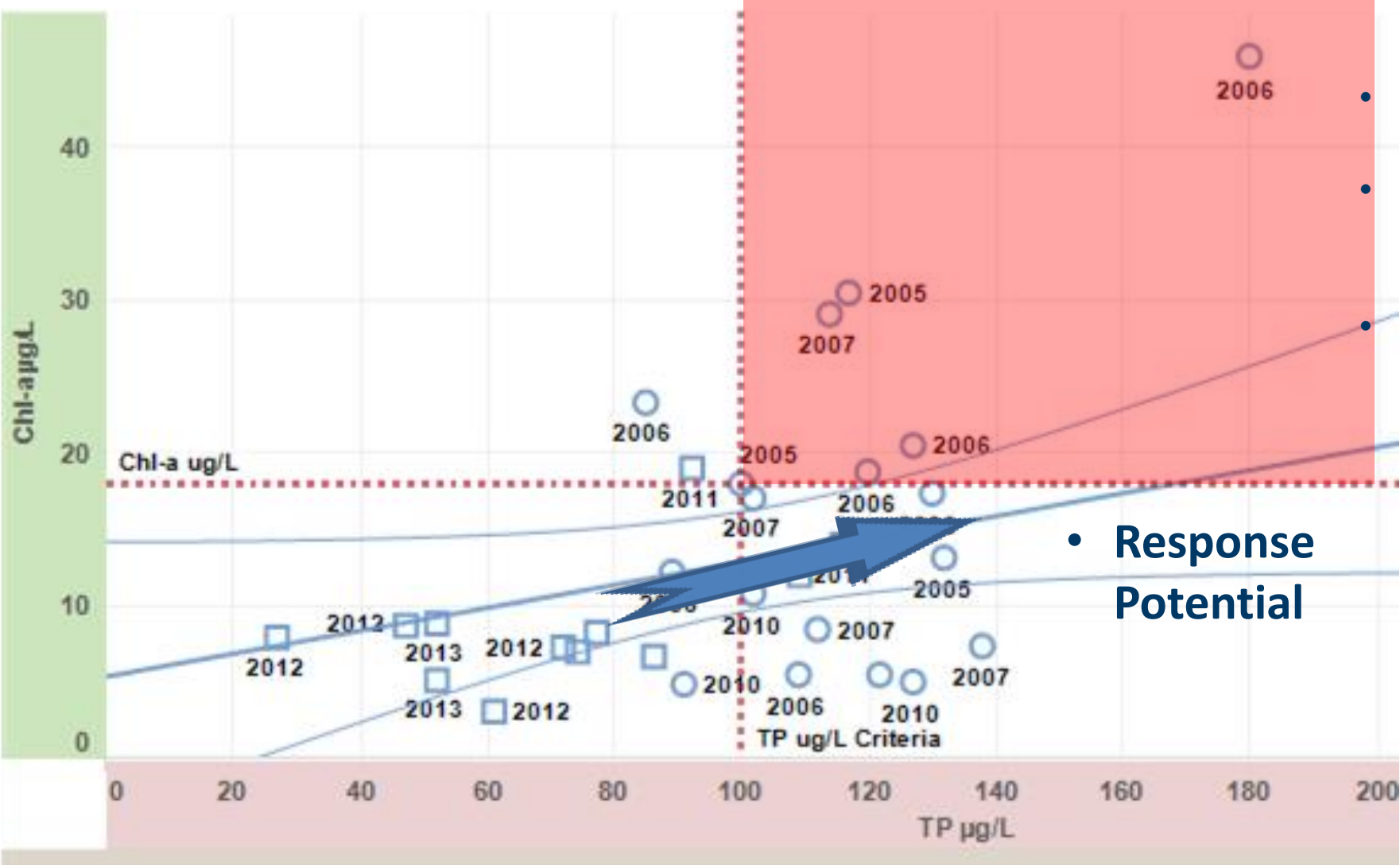
3) Resulting Water Quality

Statewide look at river eutrophication standards





Response potential

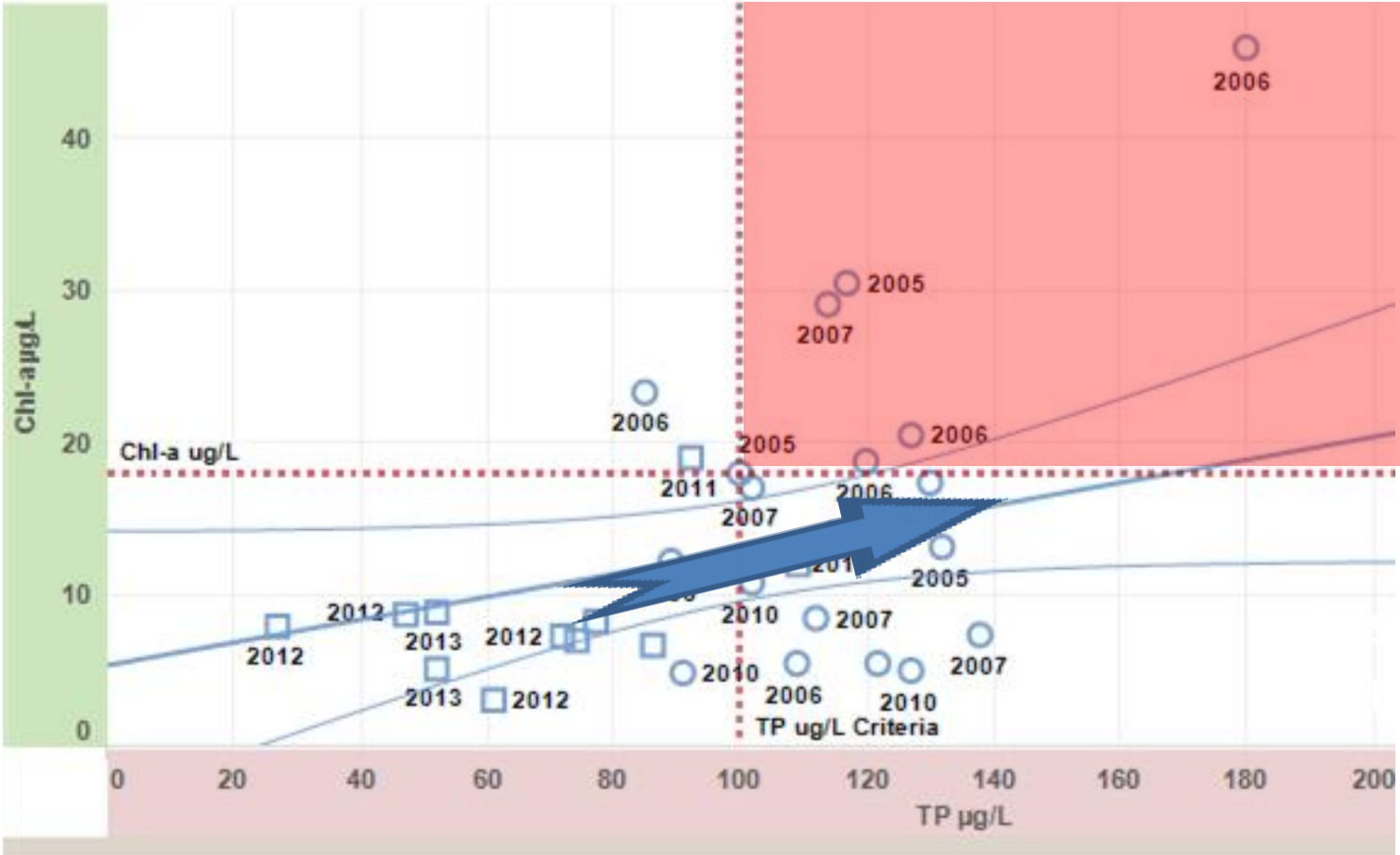


- Low dilution
- WWTF well below capacity
- System responds to TP

• Response Potential

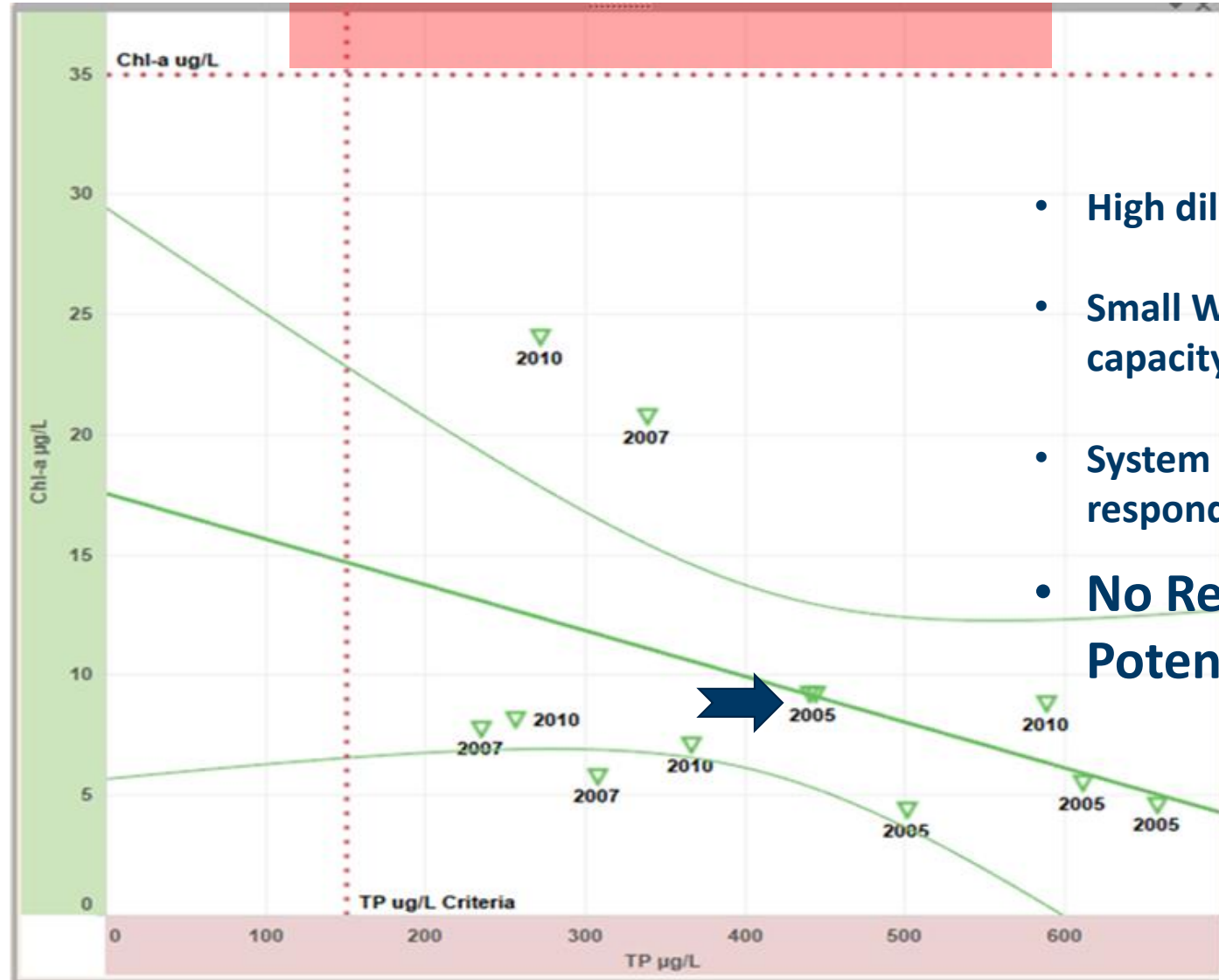


Response potential





Response potential

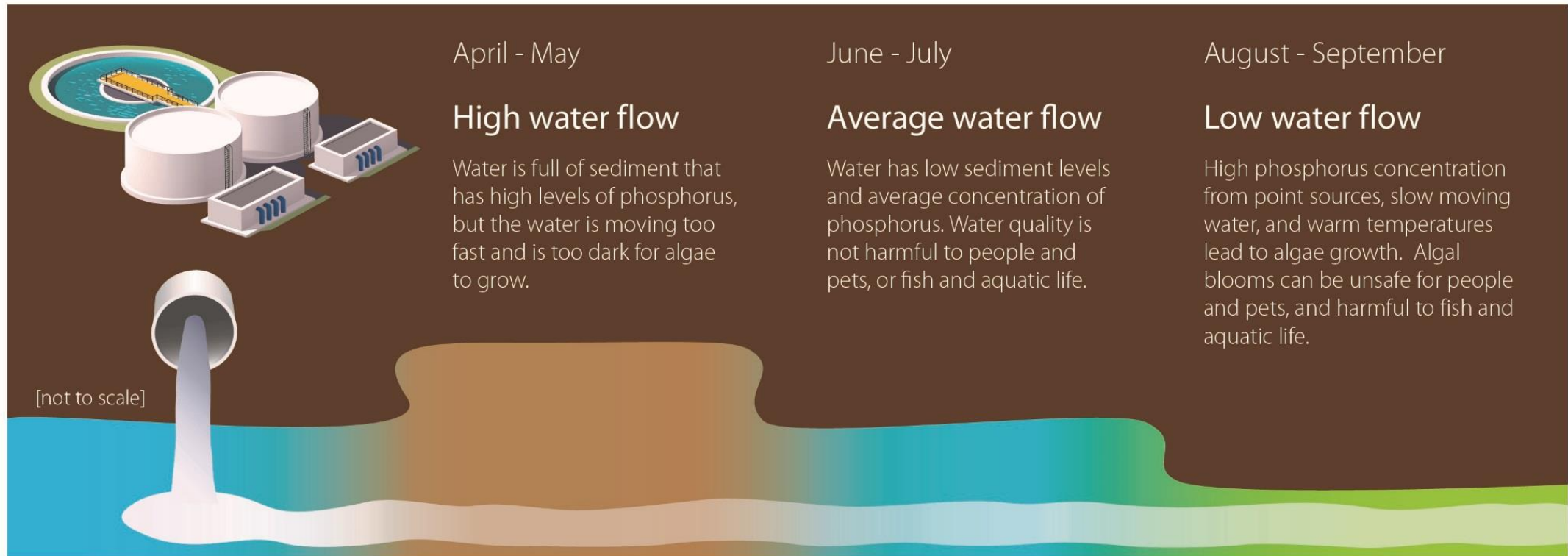


- High dilution
- Small WWTF near capacity
- System does not respond to TP
- **No Response Potential**

Flow, phosphorus, and algae

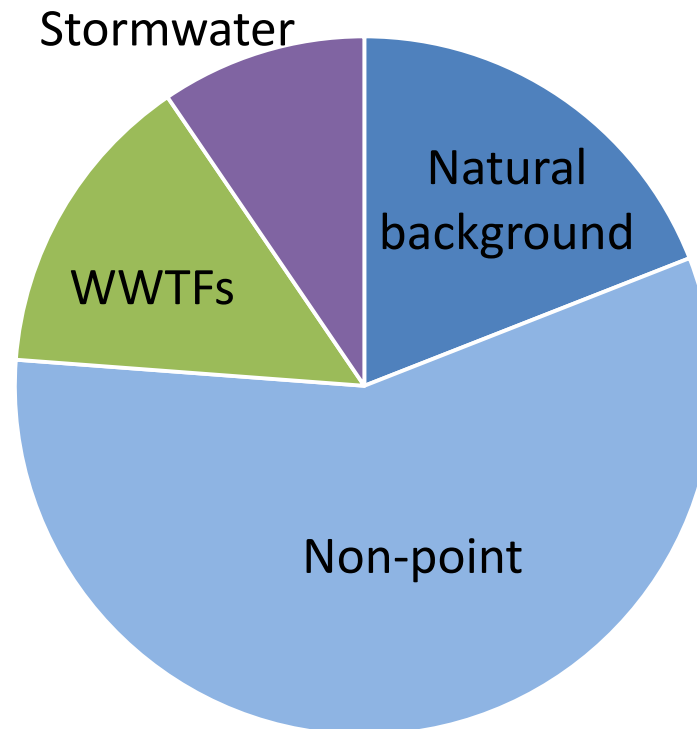
Same phosphorus, changing concentration

Waste water treatment plants discharge the same amount of phosphorus year round, but the concentration of phosphorus in our lakes, streams, and rivers depends on how high water levels are and how fast that water is flowing.

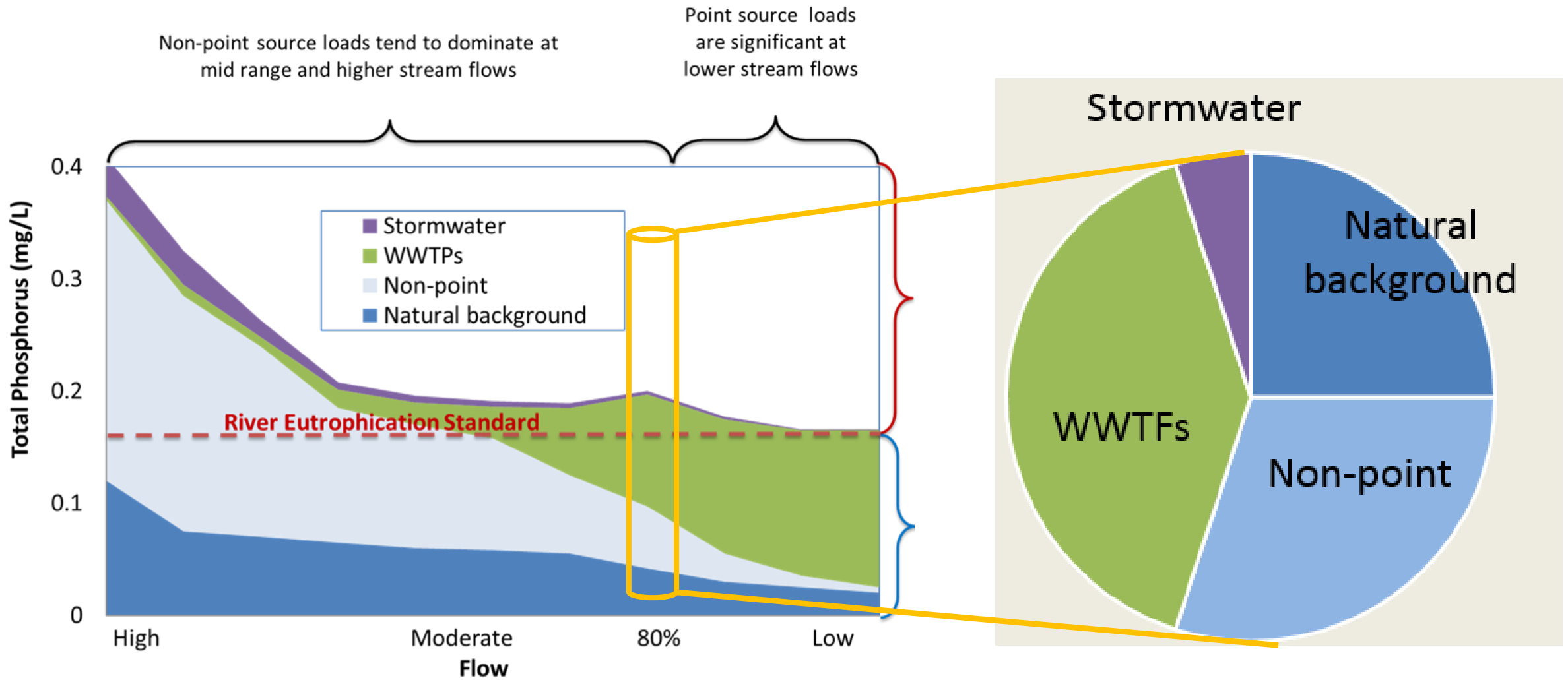


Annual phosphorus loads

Annual load



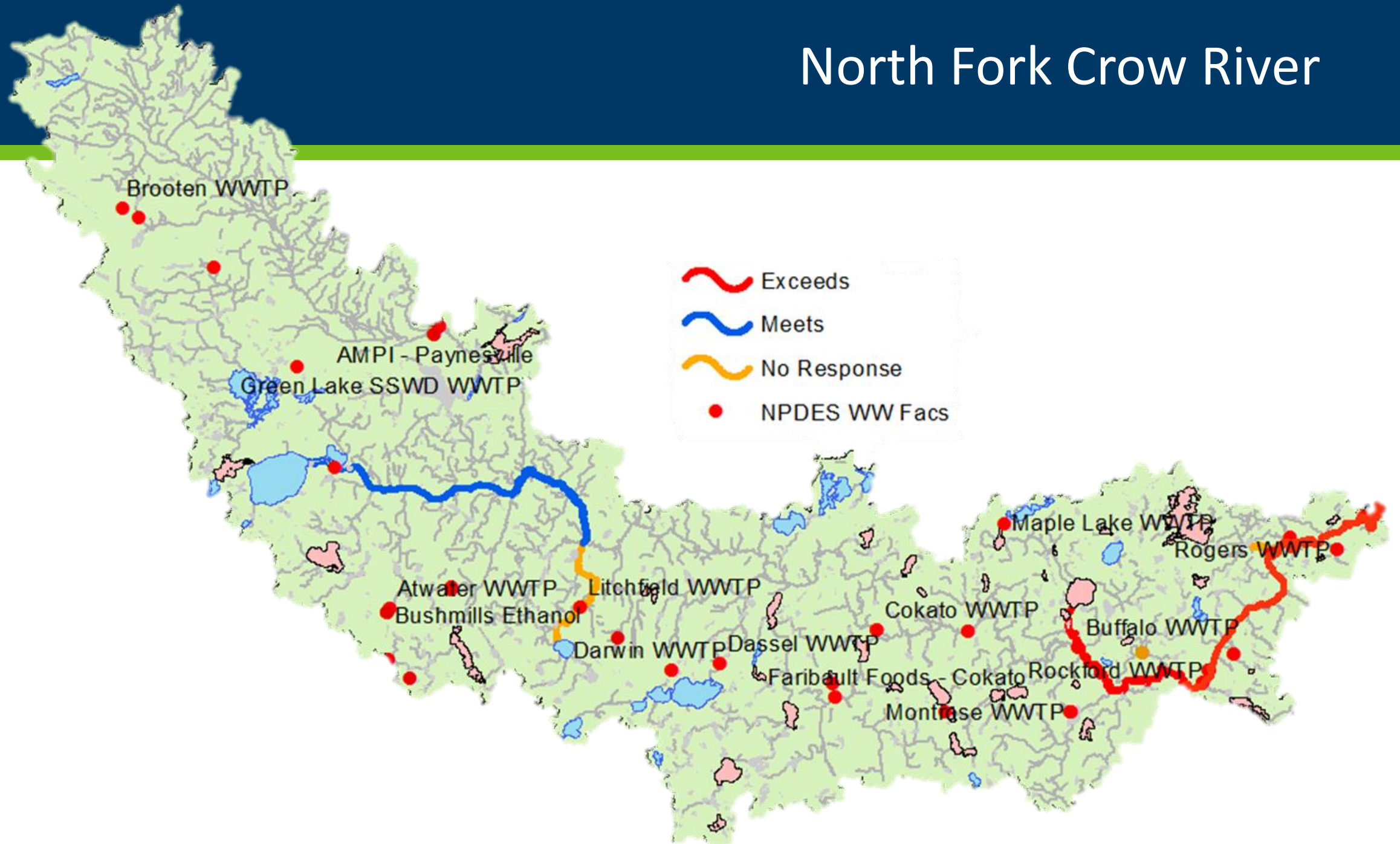
Contributions when algae flourish



Minnesota Rule 7053.0205, Subp. 7.C cont.

- ...When setting the effluent limit for total phosphorus, the commissioner shall consider the discharger's efforts to control phosphorus *as well as reductions from other sources, including nonpoint and runoff from permitted municipal storm water discharges.*

North Fork Crow River



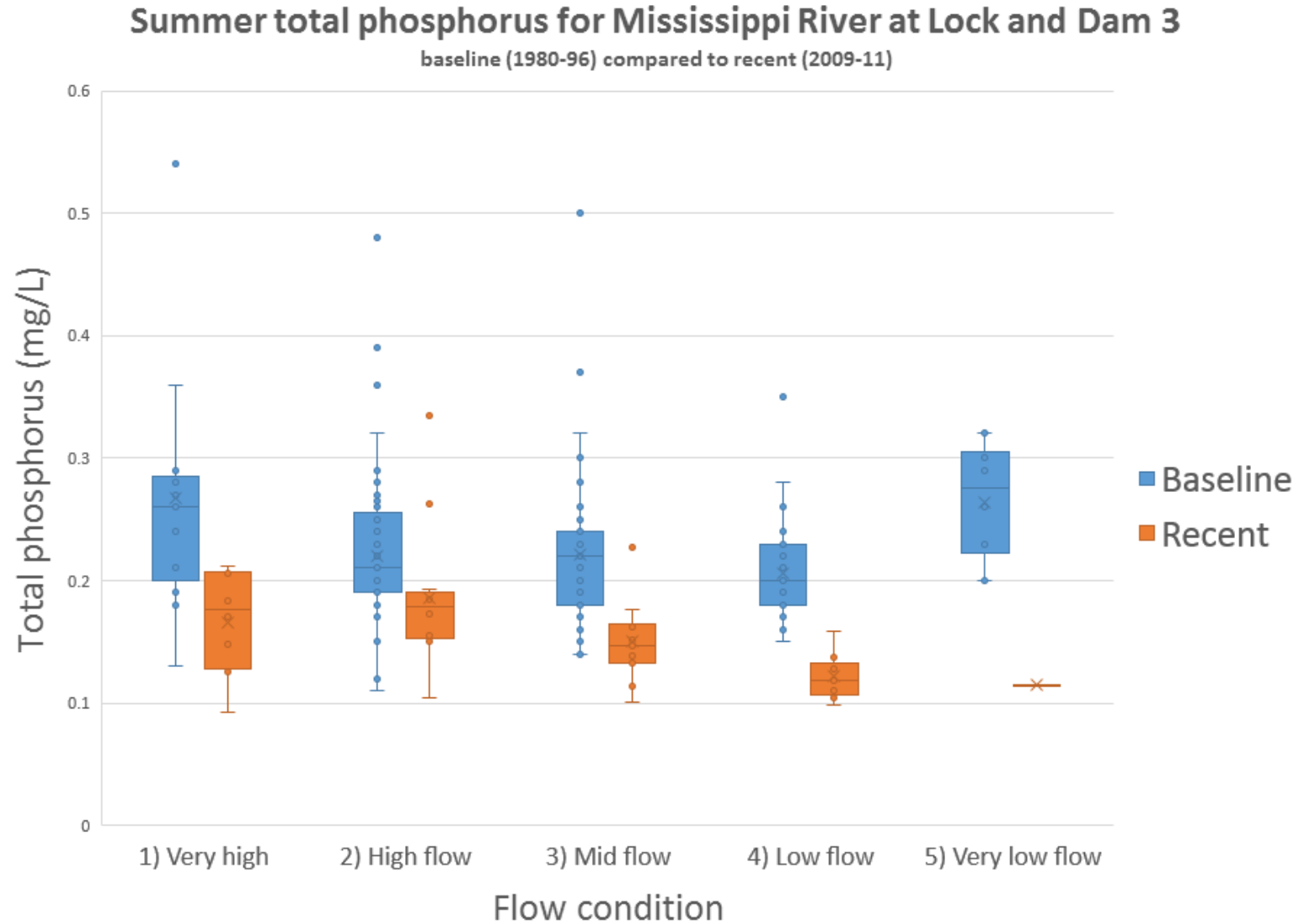
Improvements due to limits

Excerpt from staff email (July 26, 2017)

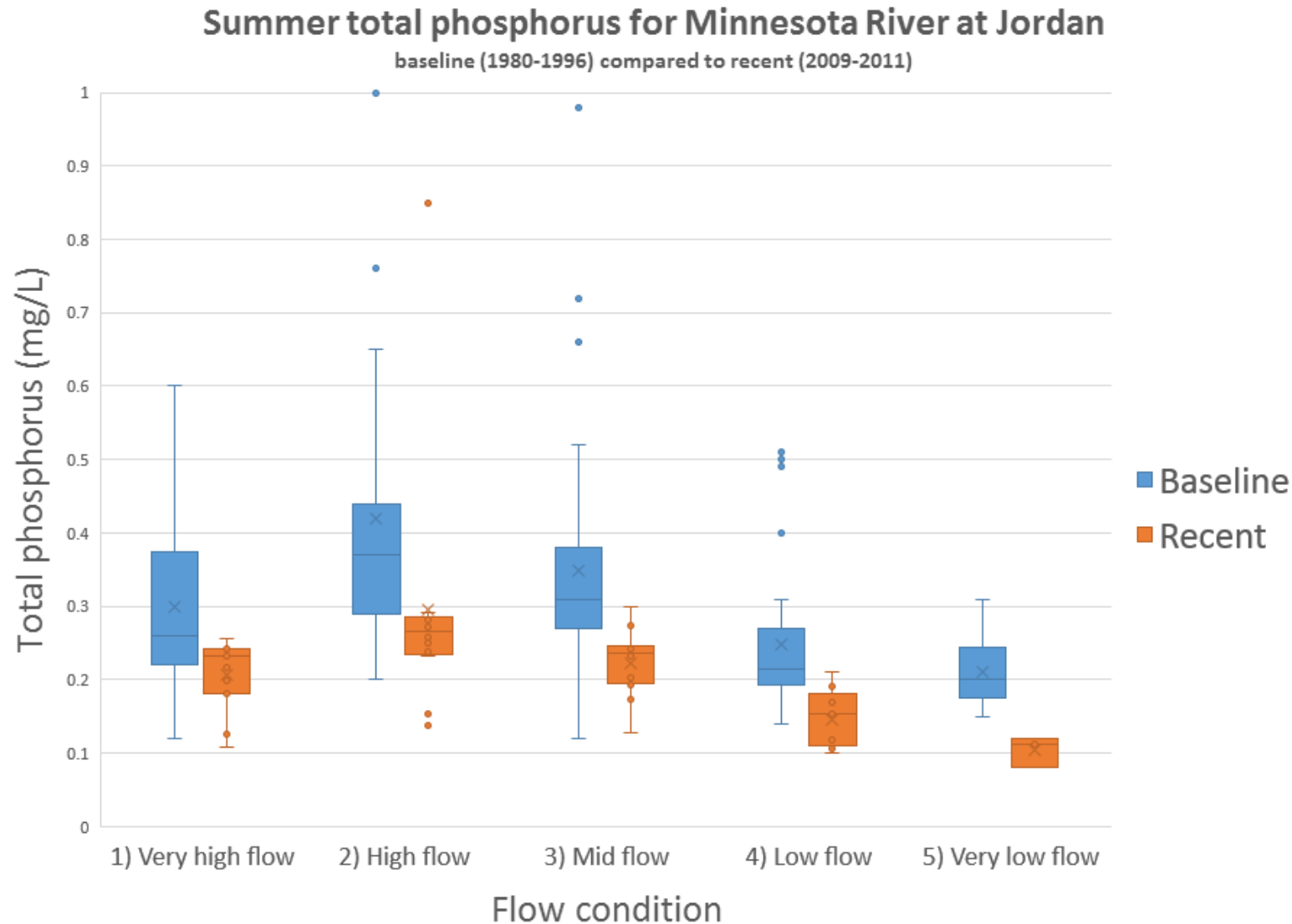
At Cannon meeting last night one of the Byllesby locals was praising our driving of “dramatic water quality improvement.” He noted that the water is as clear as he’s ever seen it; he’s lived there 30-40 years.

We talked about the WWTP reductions and the carp removal efforts. Certainly other variables in play e.g. residence time. But overall good to hear.

Improvements due to limits



Improvements due to limits



Summary of how MPCA translates standards into limits

1. We use data
2. May consider other pollutant sources
3. Our final target is defined by limiting nuisance algae, not a pre-settlement condition

Minnesota has made some big
improvements,
but we still have work to do on point sources

Questions so far?

