A Presentation of the 2012 Drainage Research Forum

November 20, 2012
Farmamerica, Waseca MN

IOWA STATE UNIVERSITY
University Extension

SDSU
Extension

Developing Minnesota's Nutrient Reduction Strategy

Dave Wall
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November, 2012

Scientific Assessment

MPCA – Steve Weiss, Dennis Wasley, Tom Pearson, David Christopherson, Pat Baskfield

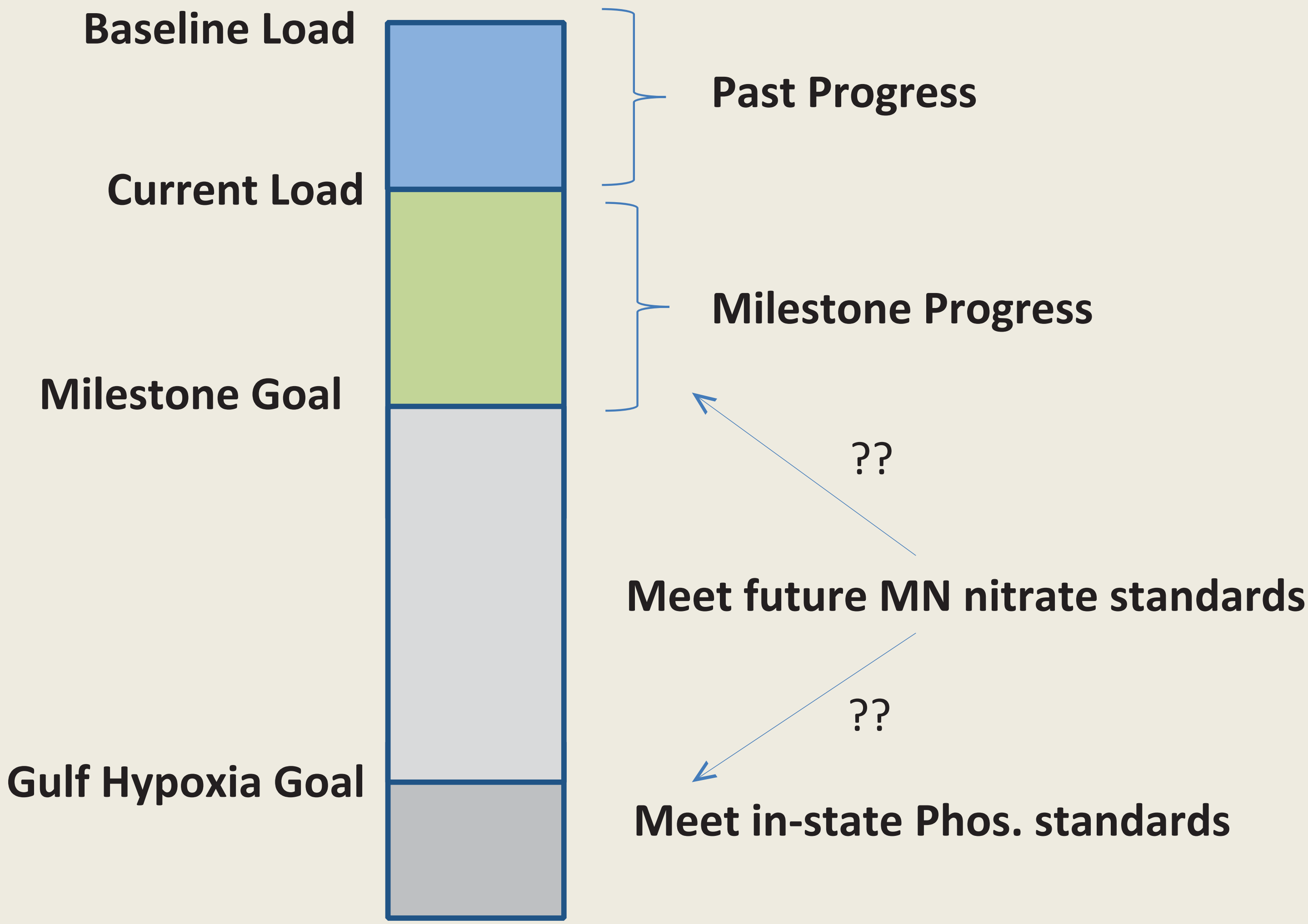
University of Minnesota – David Mulla, Jake Galzki, Karina Fabrizi, William Lazarus, Ki-In Kim, Carl Rosen, Geoffrie Kramer

USGS – Dave Lorenz, Dale Robertson, David Saad, Gary Martin

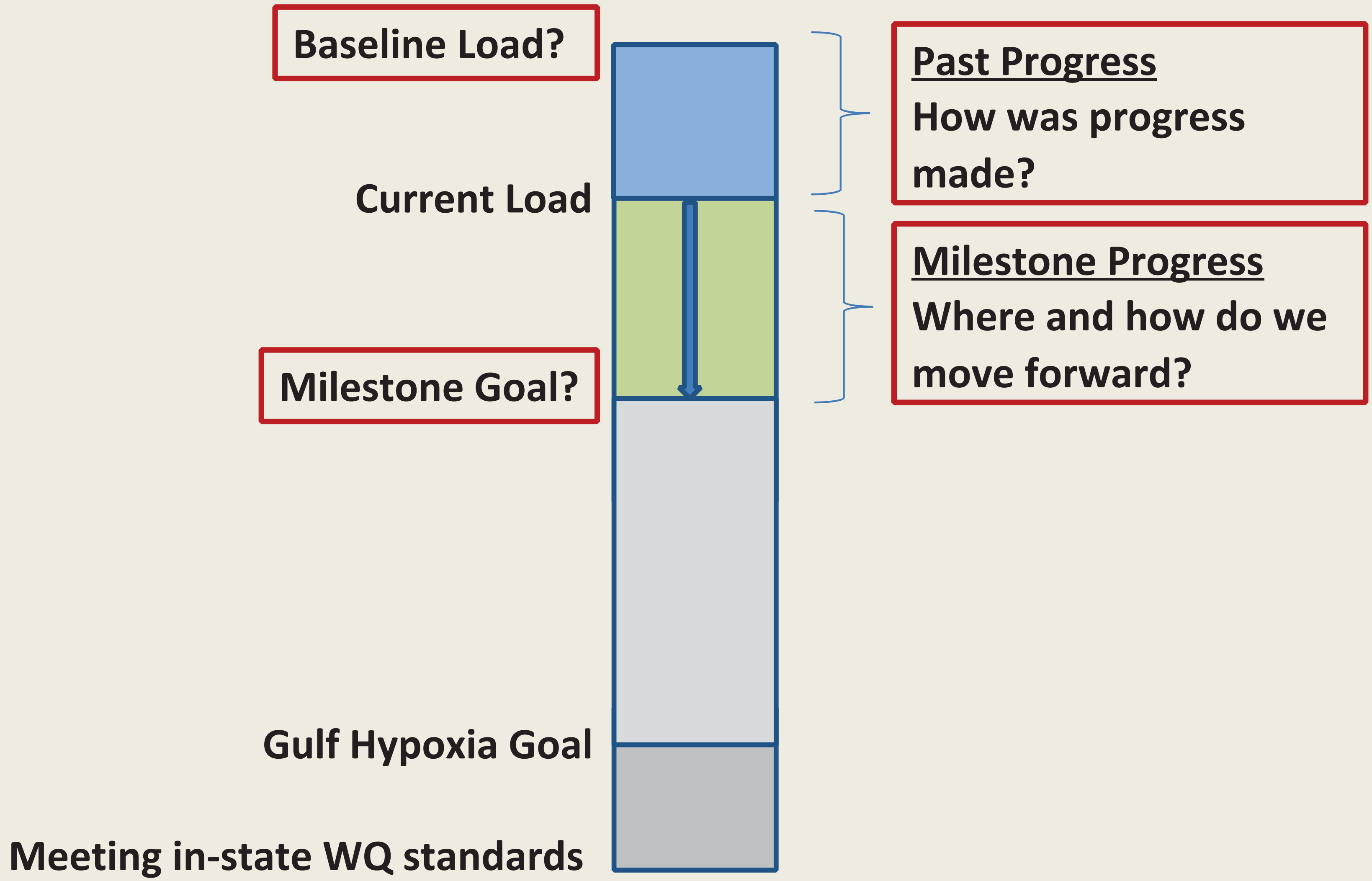
Metropolitan Council – Karen Jensen, et al.

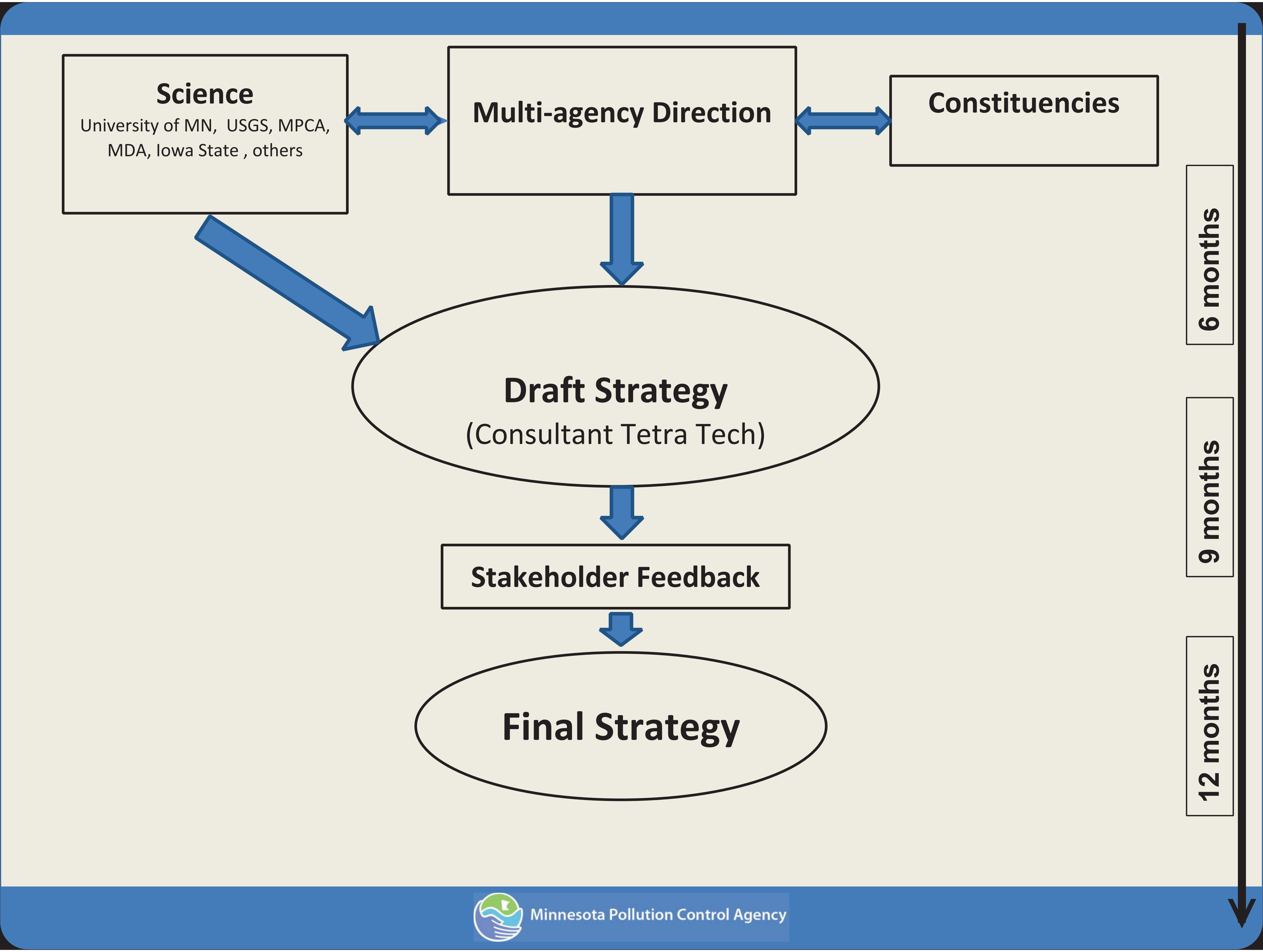
MDA – Joshua Stamper, et al.

Nutrient Load Reductions



MN Nutrient Load Reduction Strategy




Science
University of MN, USGS, MPCA, MDA, Iowa State , others
Multi-agency Direction
Constituencies
Draft Strategy
(Consultant Tetra Tech)
Stakeholder Feedback
Final Strategy
6 months
9 months
12 months
Minnesota Pollution Control Agency

Why make progress?

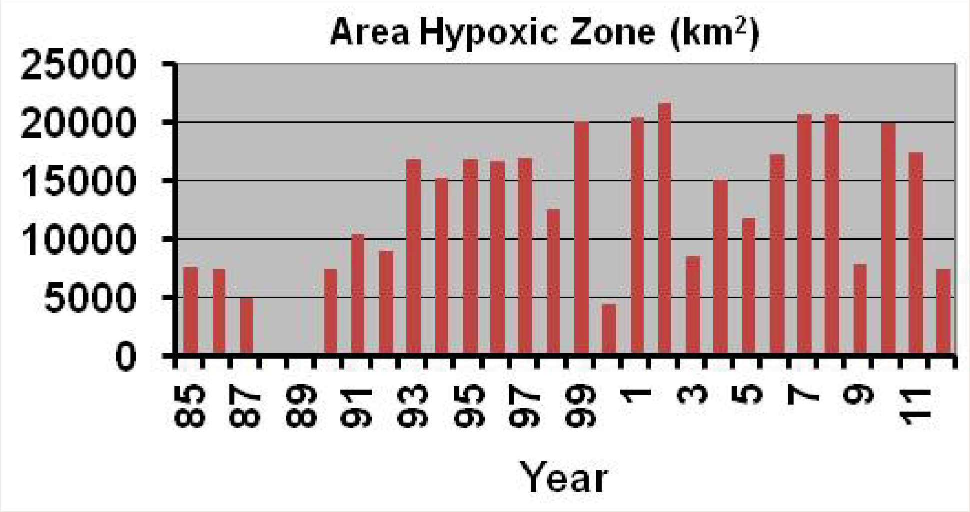
Downstream Loads

- Gulf of Mexico Hypoxia
- Lake Winnipeg
- Lake Pepin

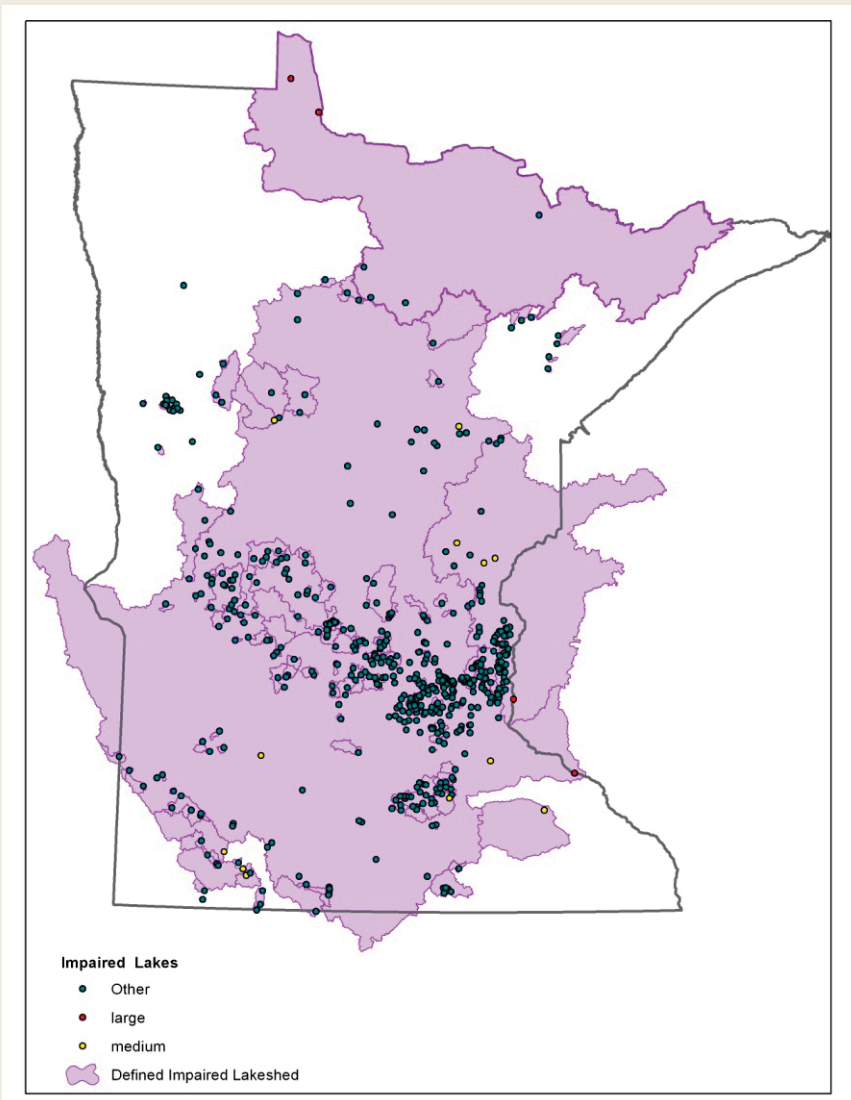
Local Nutrient Concentrations

- Aquatic life toxicity (nitrate)
- River and Lake Eutrophication (P)
- Drinking water (nitrate)

Transport to Gulf of Mexico



520 Phosphorus-impaired Lakes/Bays



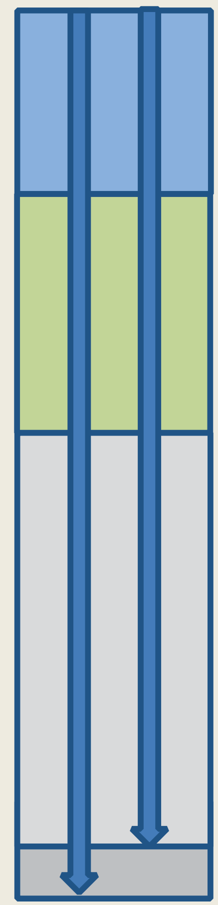
Baseline Load

Current Load

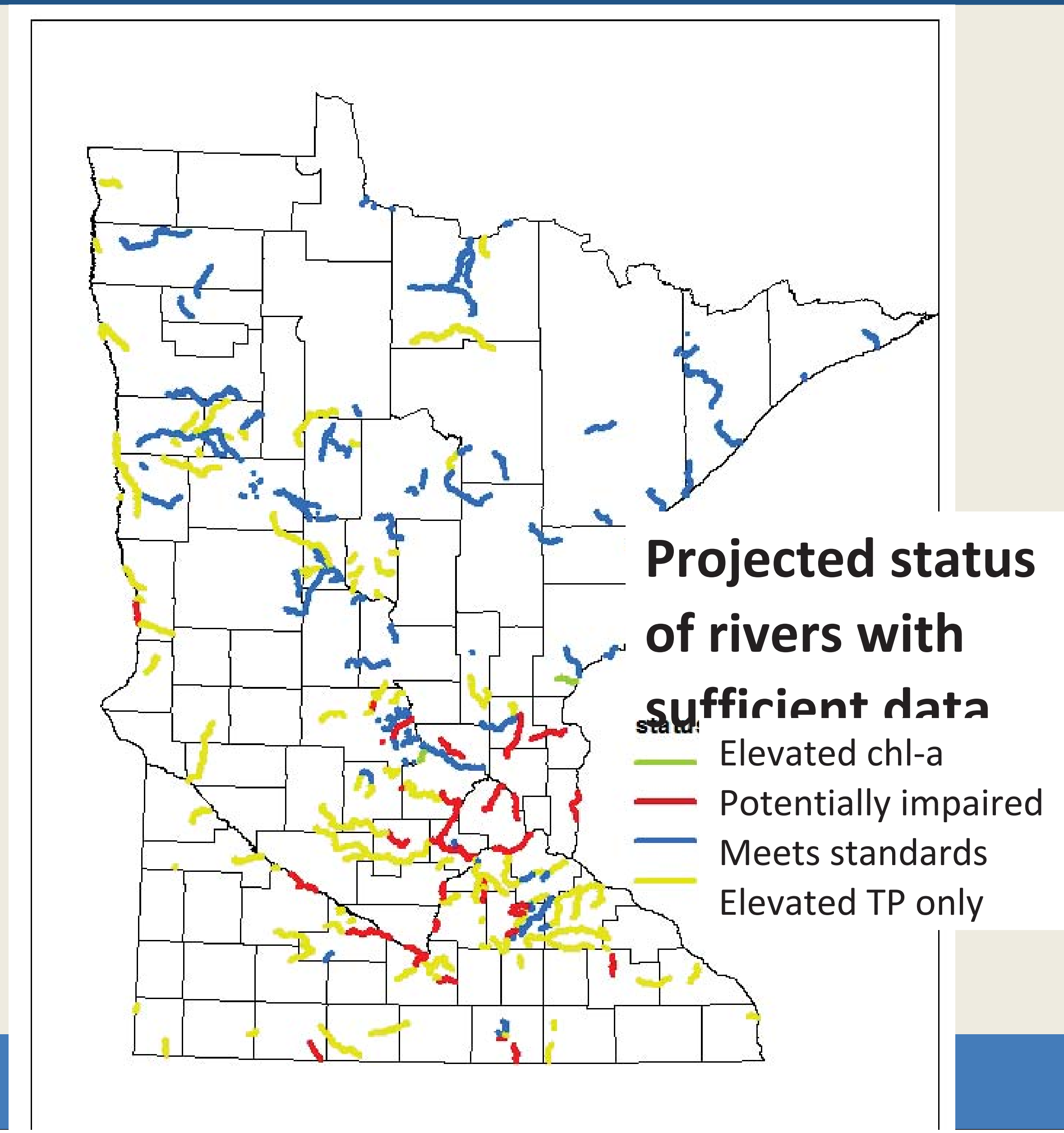
Milestone Goal

Gulf Hypoxia Goal

Meet P standards

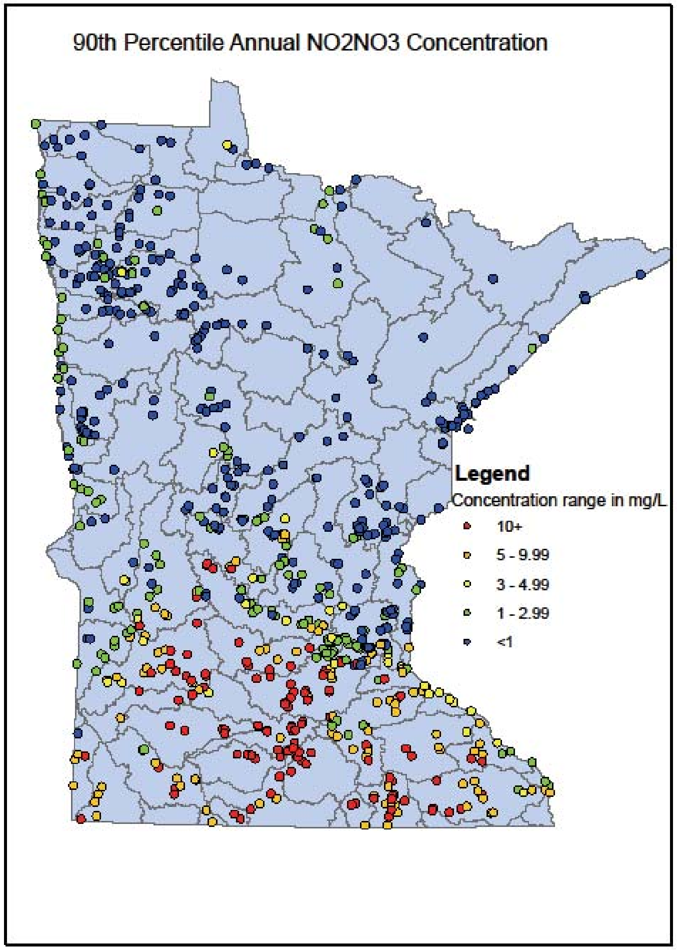


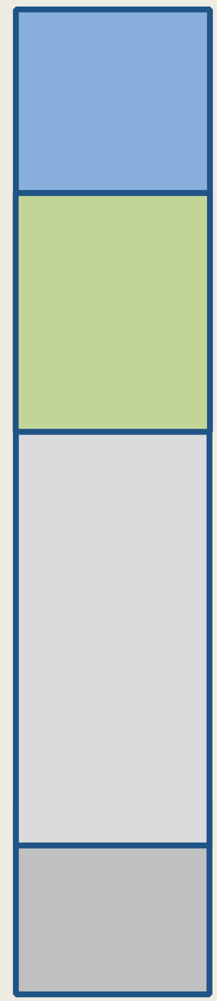
Draft River Eutrophication Standards



Stream Nitrate Concentrations

90th percentiles 2000-2010





Baseline Load

Current Load

Nitrate standard?

Milestone Goal

Nitrate standard?

Nitrate standard?

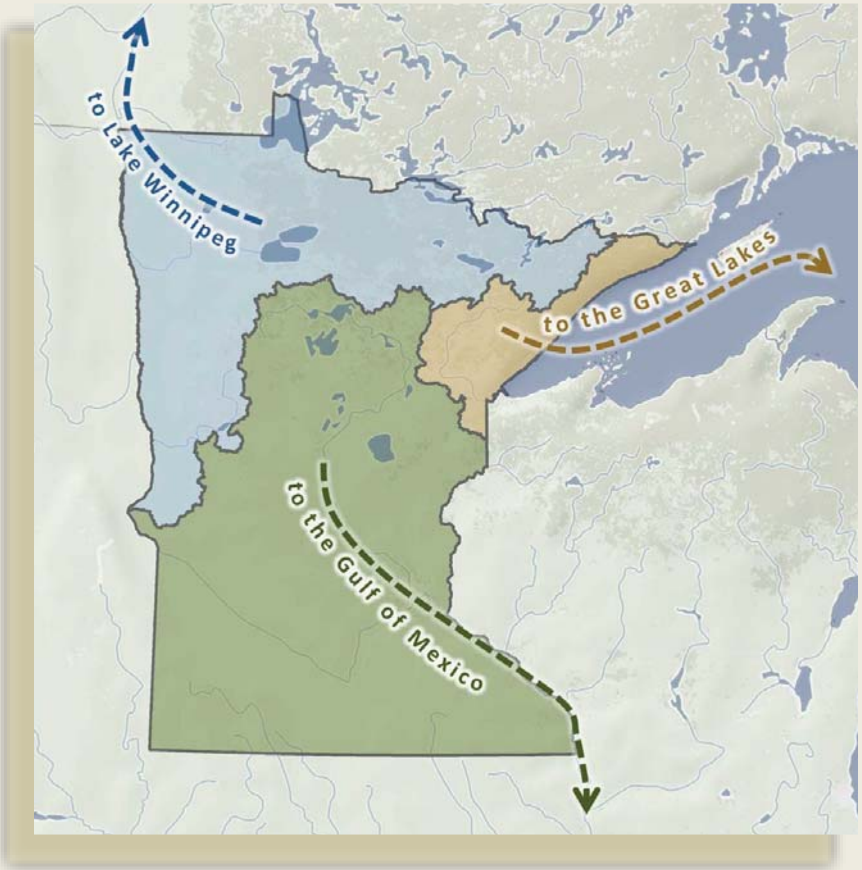
Gulf Hypoxia Goal

Nitrate standard?

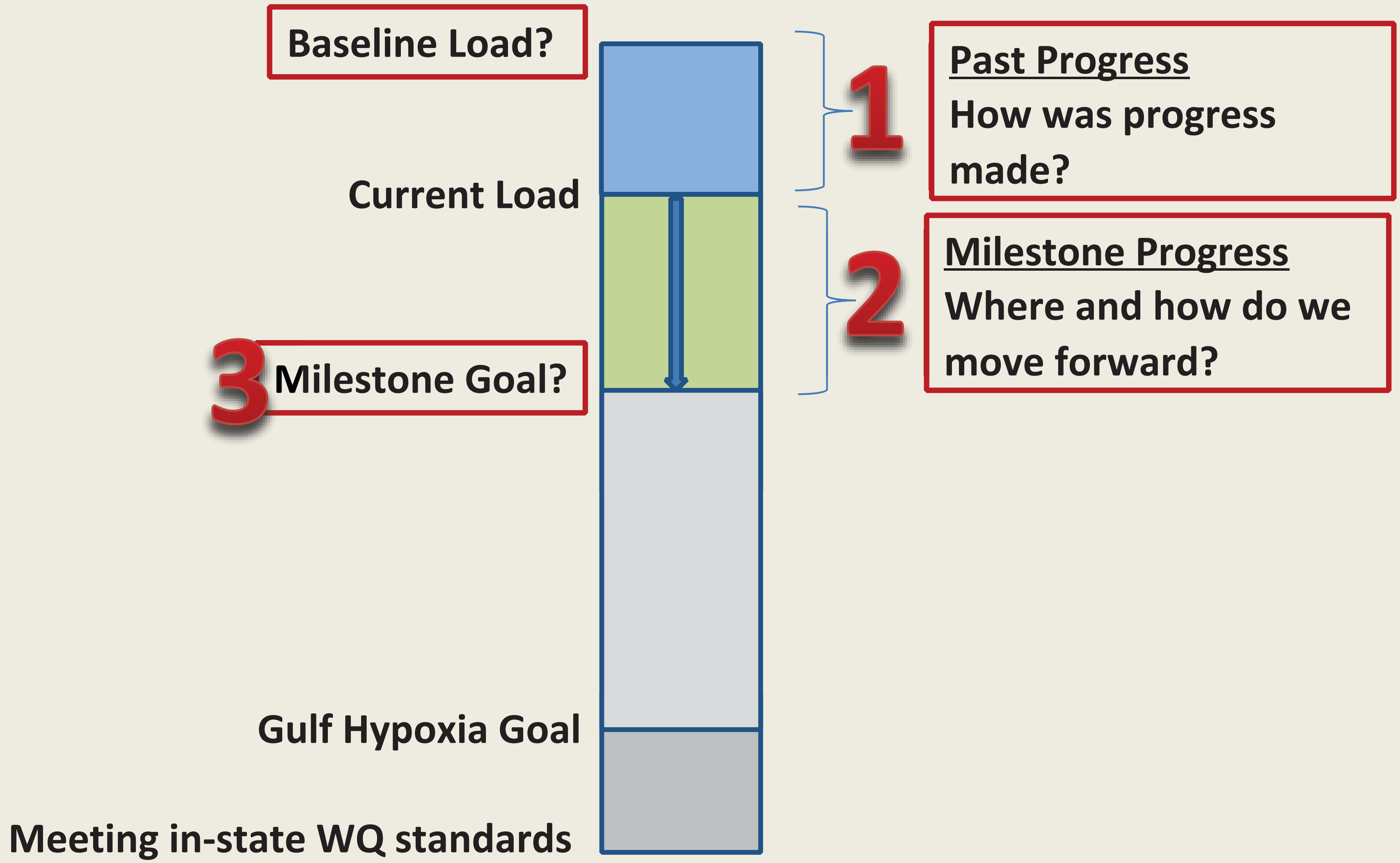
Minnesota Goals

Other Considerations

- Lake Winnipeg needs
- Lake Superior needs

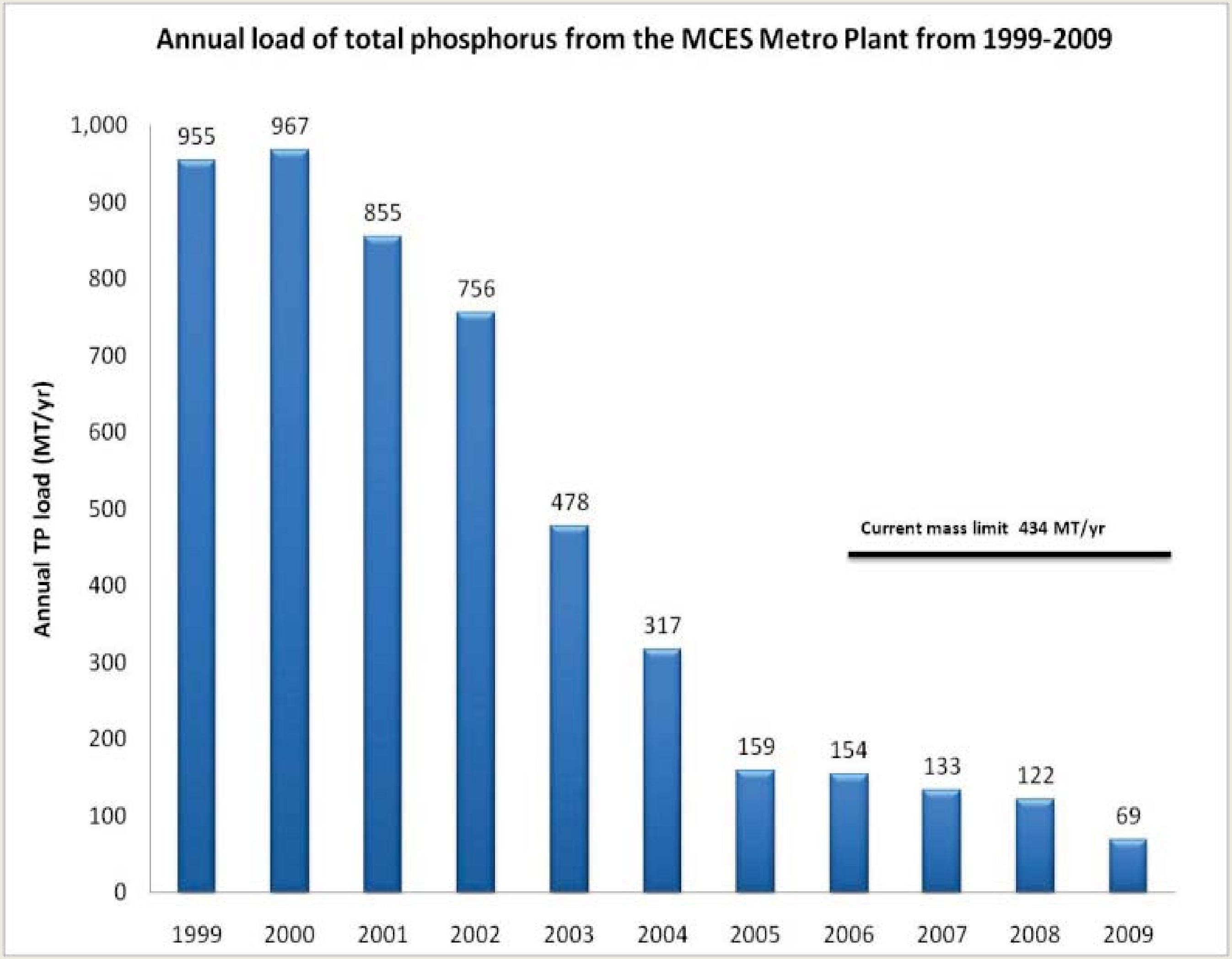


Outline



Baseline Load?
Current Load
3 Milestone Goal?
Gulf Hypoxia Goal
Meeting in-state WQ standards
1
Past Progress
How was progress made?
2
Milestone Progress
Where and how do we move forward?

Metro Point Source Phosphorus



Other Phosphorus Reductions

Lawn P fertilizer ban

Lower cropland soil P test results

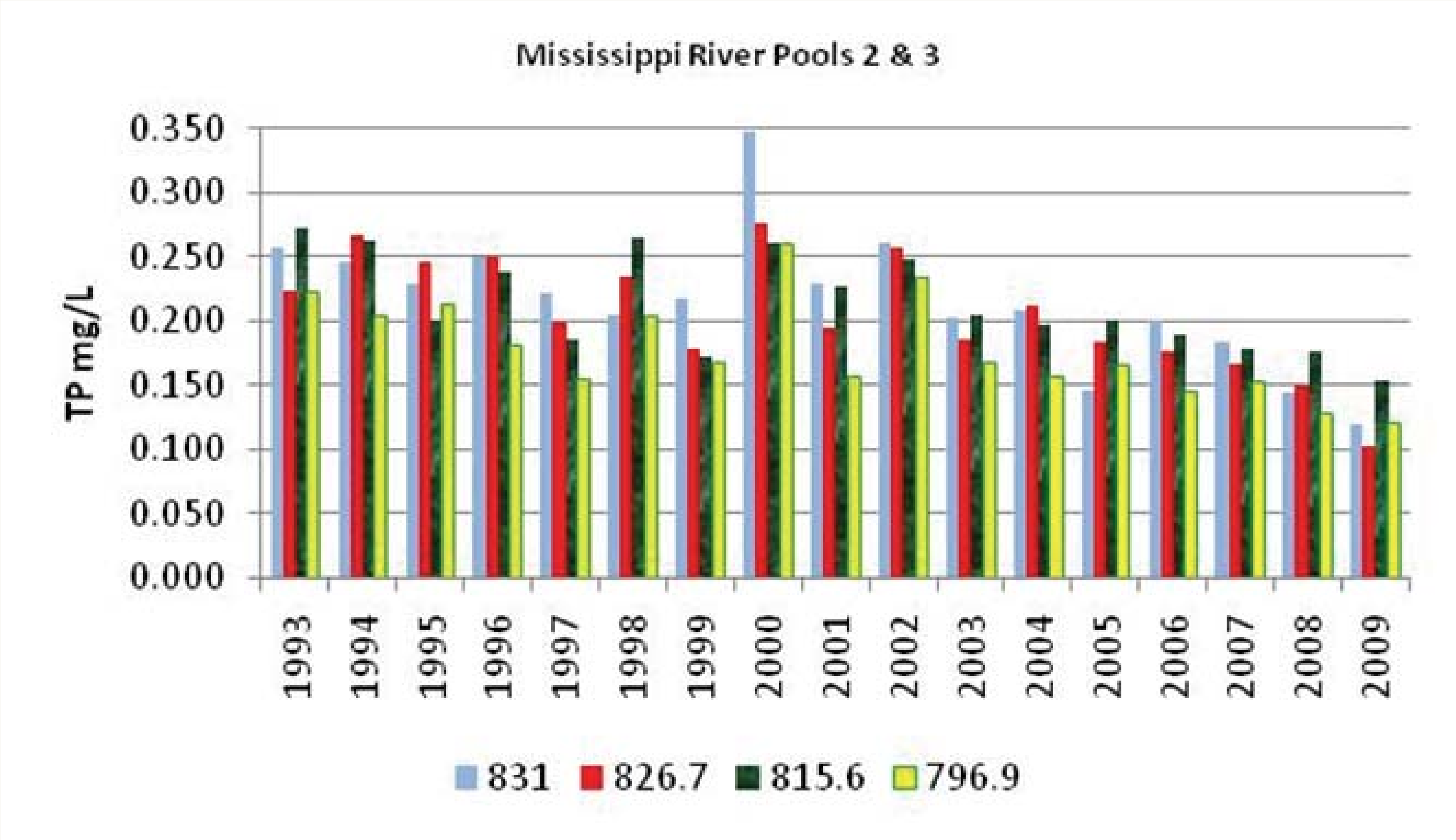
Increased manure injection/incorporation

Livestock feed/supplements changes

Feedlot runoff reductions

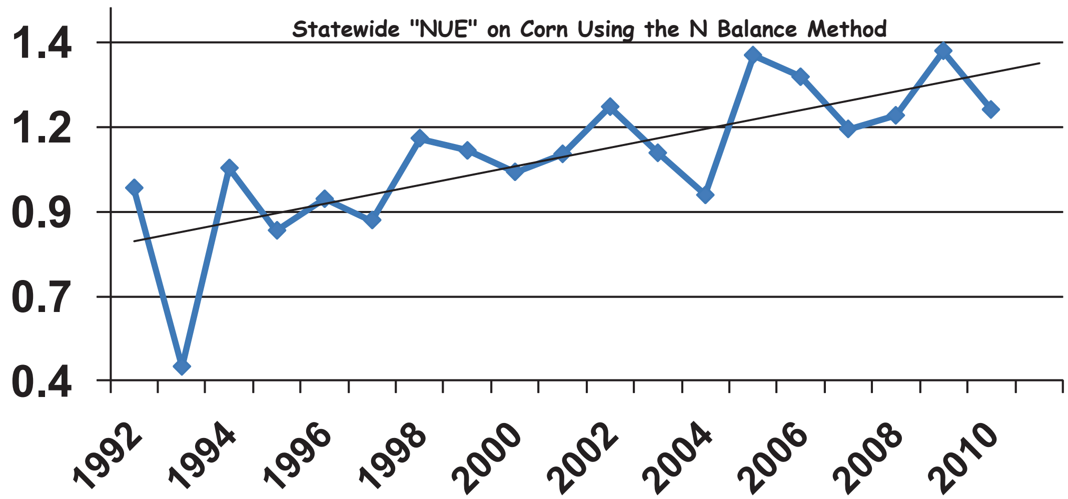
Improved cropland P management

Mississippi River Phosphorus Trends



Nitrogen Changes

Cropland Nitrogen Use Efficiency Increases



Source: MDA

Precipitation increasing trends

Land use changes

Nitrogen Trends

Depend on

- Nitrate or Total Nitrogen
- Load or concentration
- Time period being evaluated
- Location on the river
- Influence of groundwater
- Statistical methods

Trends

Flow Adjusted Nitrate Concentration

	Since 1976 (overall change)	Recent Period (Avg. annual change)
Mississippi River – Sauk Rapids	+192%	+8%
Mississippi River – Anoka	+210%	+3%
Mississippi River – St. Paul	+238%	+3%
Mississippi River - Red Wing	+134%	+0.3%
Mississippi River – Minneiska	+109%	+3%
Mississippi River - LaCrosse	+182%	+11%

Trends

Flow Adjusted Nitrate Concentration

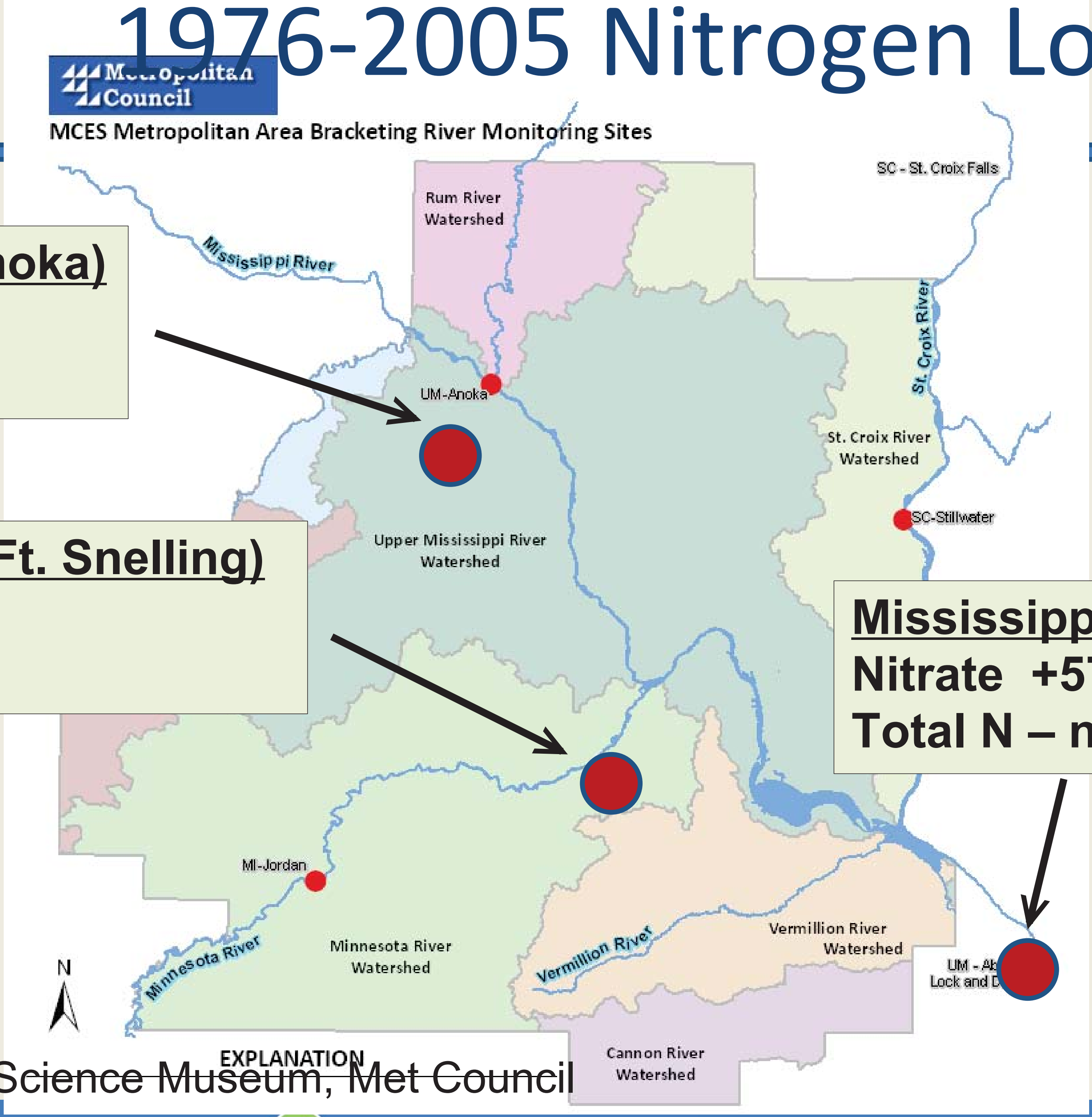
	Since 1976 (overall change)	Recent Period (Avg. annual change)
Minnesota River – Courtland	-76%	-5%
Minnesota River - St. Peter		
Minnesota River - Henderson		
Minnesota River – Jordan	-38%	-3%
Minnesota River - Fort Snelling	-8%	-3%

1976-2005 Nitrogen Loads

Mississippi (Anoka)
Nitrate +62%
Total N +22%

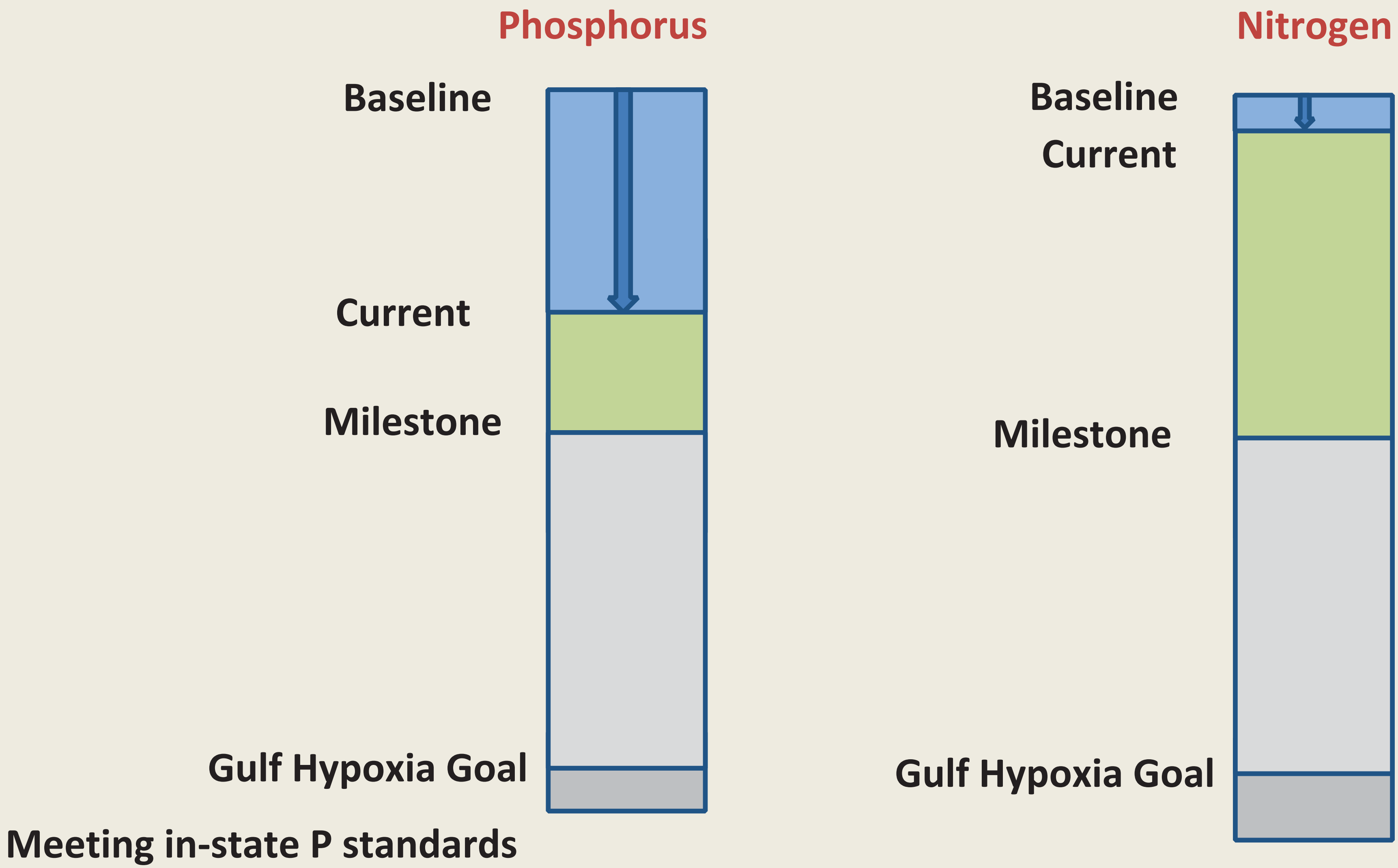
Minnesota R. (Ft. Snelling)
Nitrate +27%
Total N +18%

Mississippi (L&D 3)
Nitrate +57%
Total N – not signif.

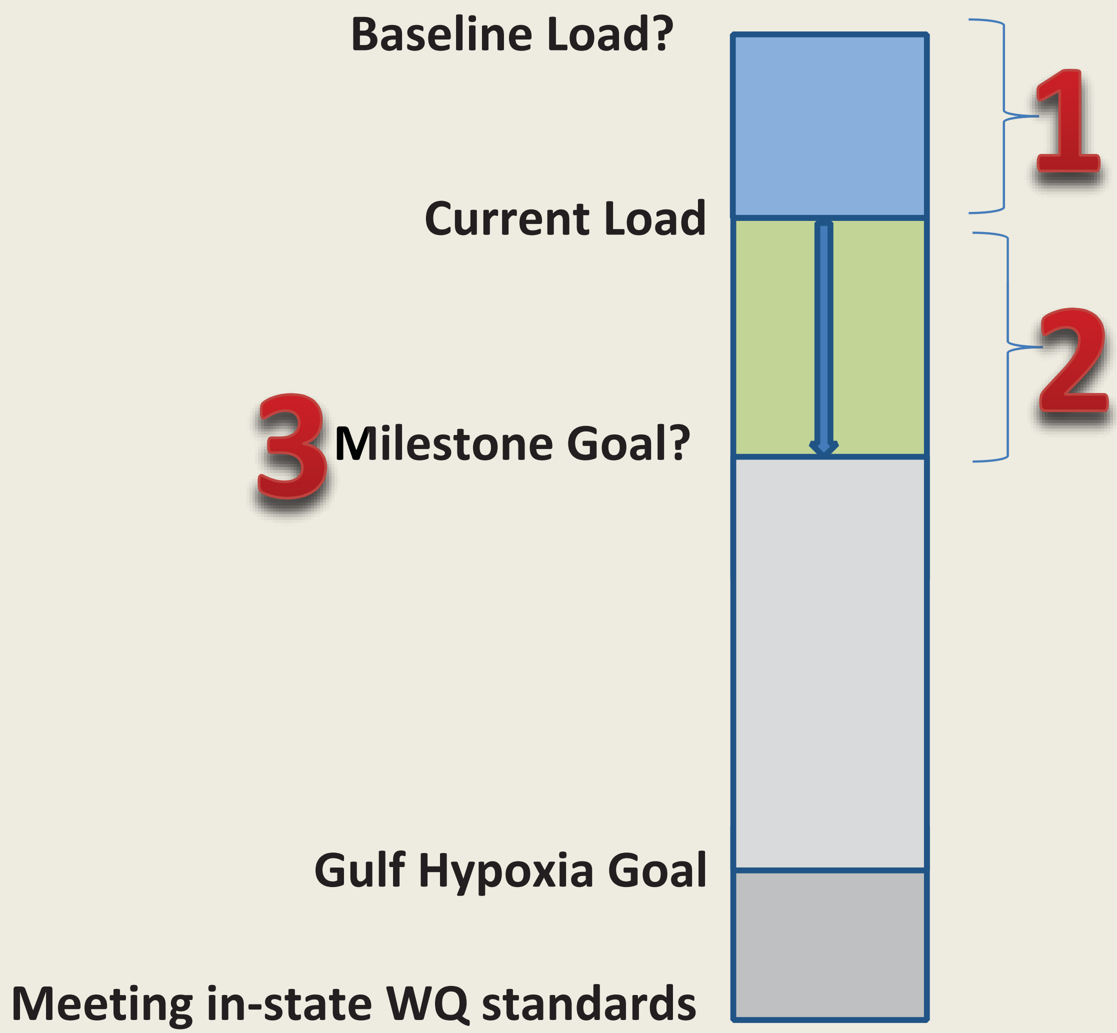


From: Natl Parks, Science Museum, Met Council

Recent Progress Summary



Outline



Past Progress

How was progress made?

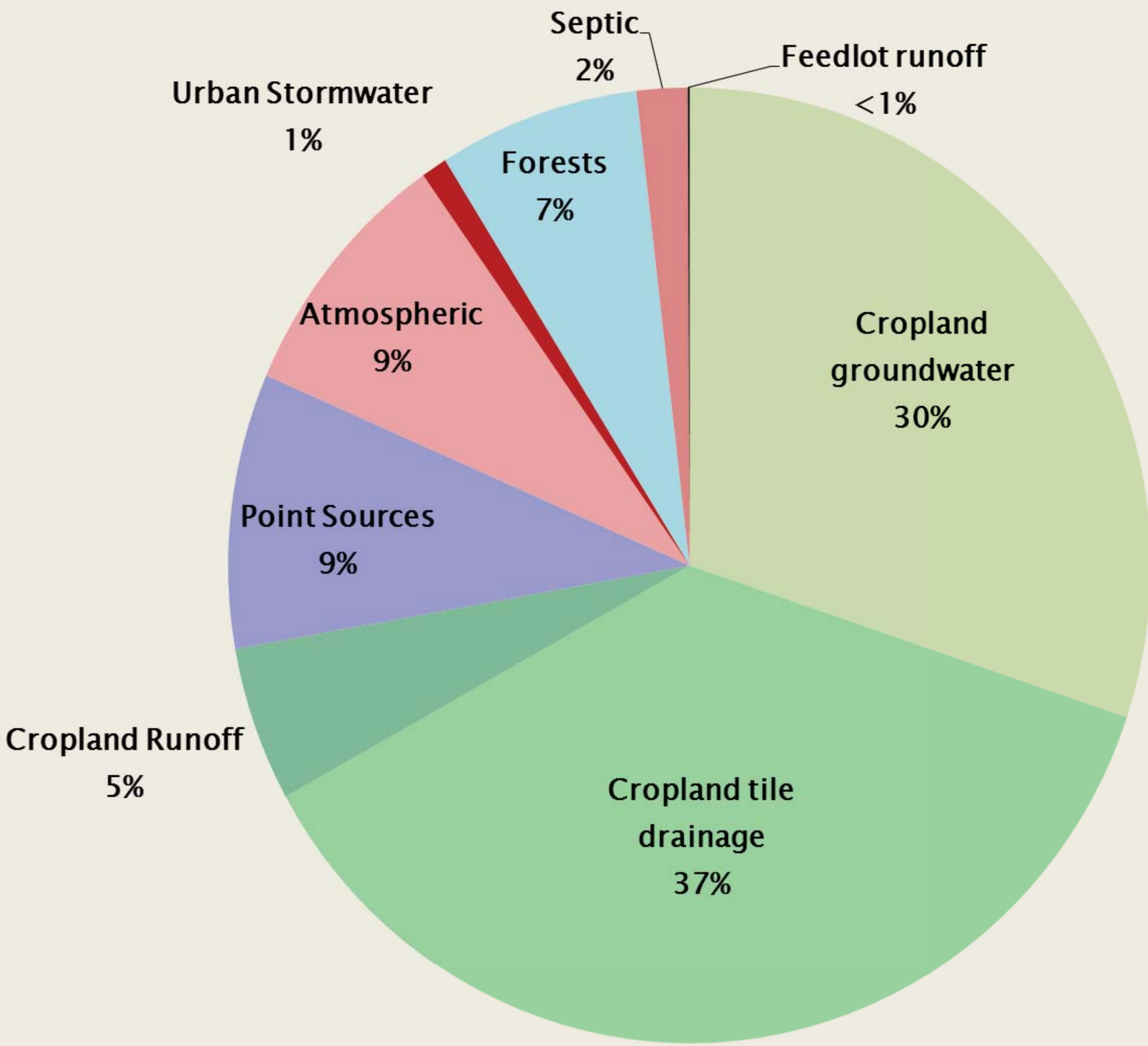
Milestone Progress

Where and how do we move forward?

Statewide P Sources to Surface Waters

Statewide N Sources to Surface Waters

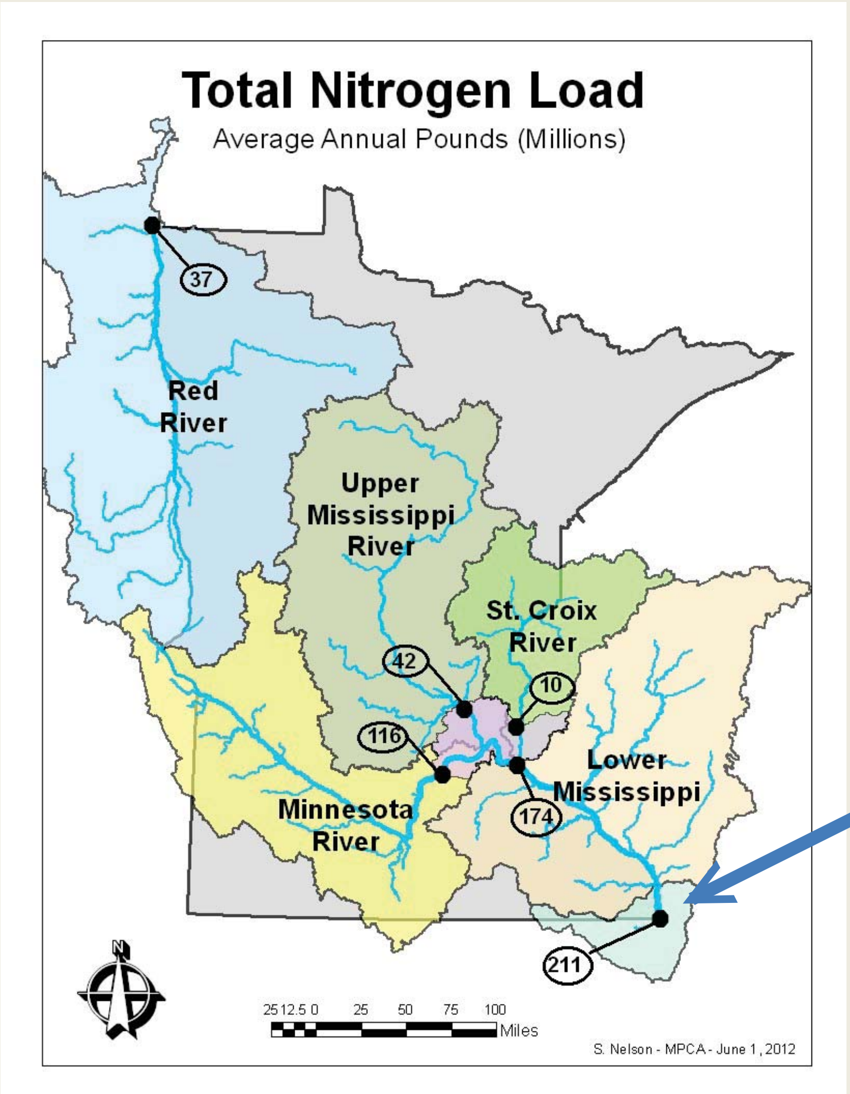
(average year)



Average Year: N Sources to Surface Waters
(Minnesota parts of basins)

Wet Year – N Sources to Surface Waters

Mississippi River at Iowa



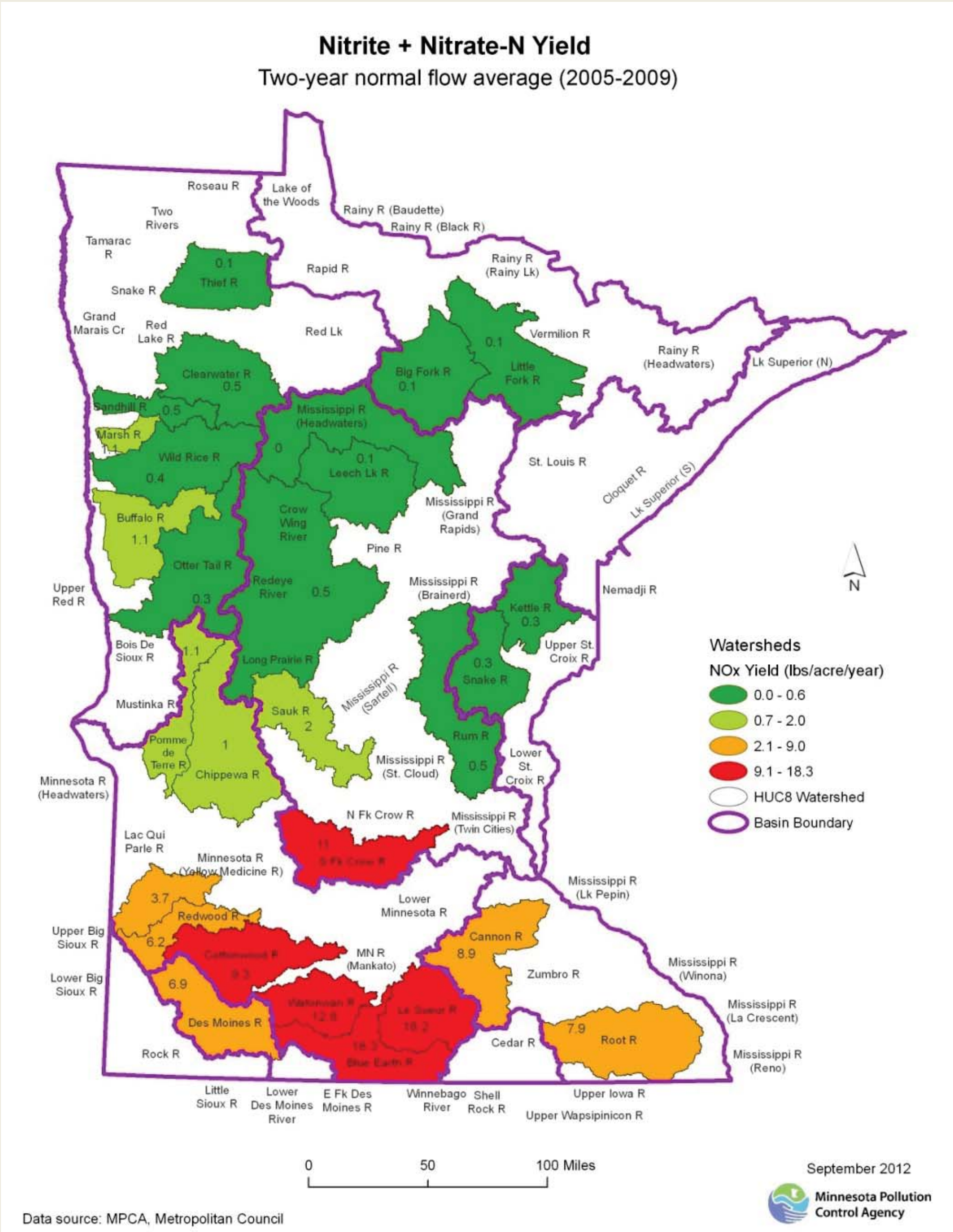
211 million lbs/yr TN (avg)

77% from Minn. watersheds

75% in Nitrate form

Nearly half from Minnesota River Basin

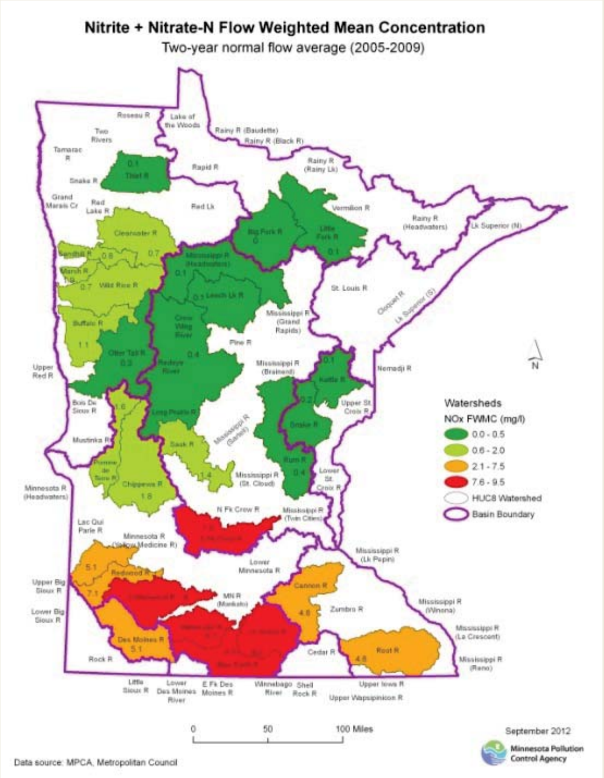
Peaks April-June



Monitoring

	Nitrite+Nitrate-N Yield (lbs/ac)
S. Central	11-19
Southeast	8-9
Southwest	4-9
Central	1-2
Northwest	0.1-1
Northeast	0.1-2

Row crops over tile, sand & bedrock



SPARROW Modeling

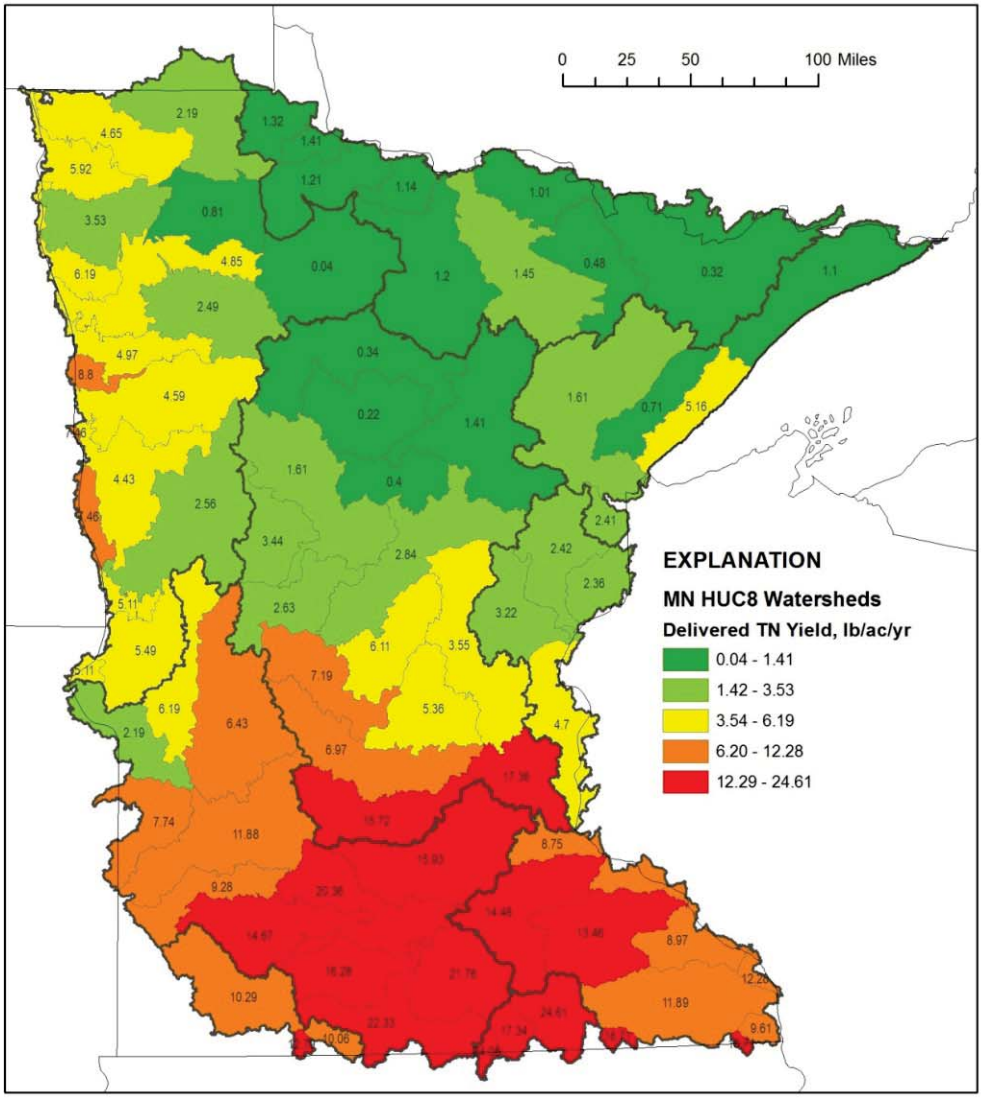
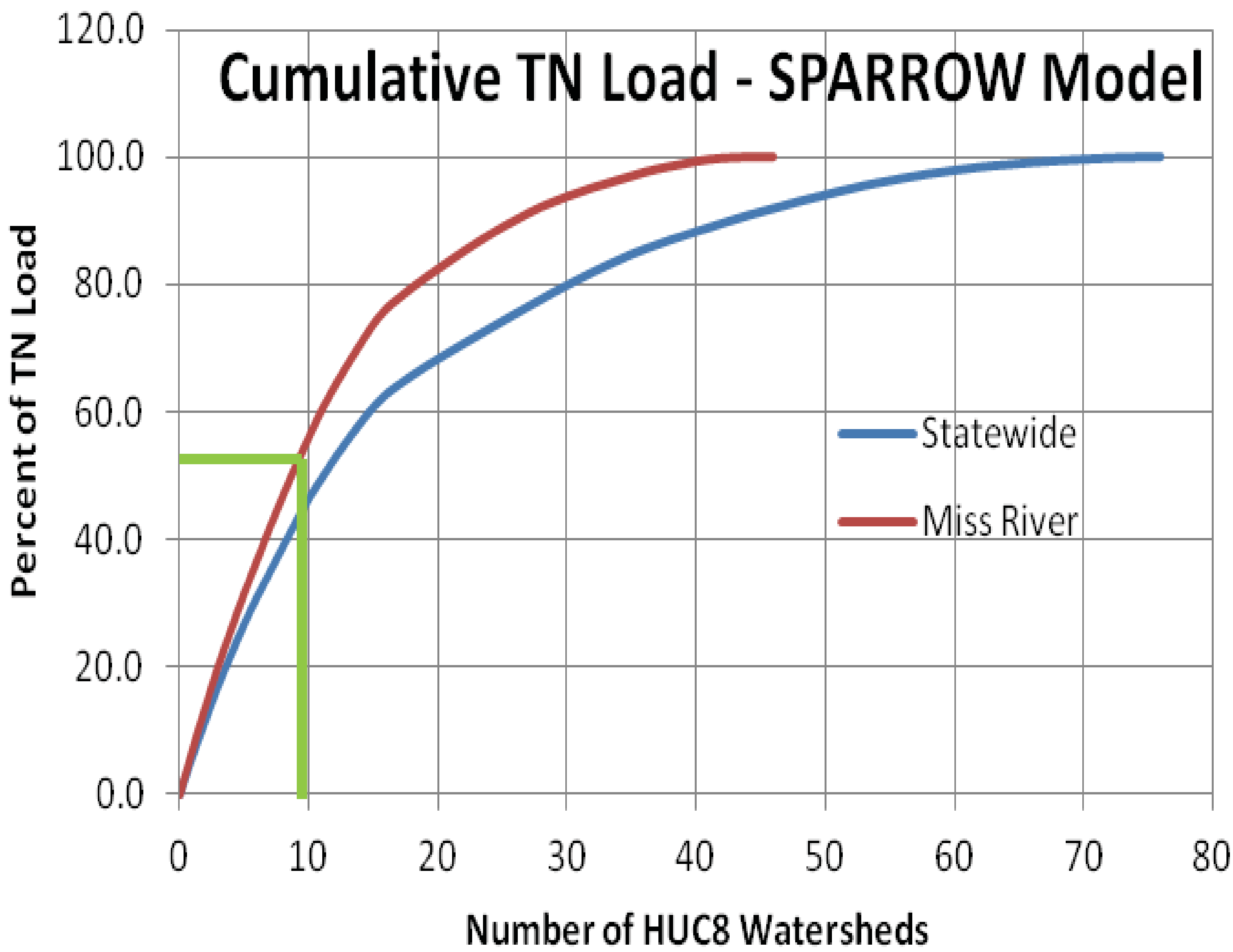


Figure 1BY. Delivered TN Yields for Minnesota catchments of the MRB3 2002 Nutrient SPARROW model, by HUC8 Watersheds. Delivery targets are HUC8 outlets.

	Total Nitrogen Yield (lbs/ac)
S. Central	16-22
Metro	17
Southeast	9-15
Southwest	8-15
Central	3-6
Northwest	3-6
Northeast	0-2



Cumulative TN Load - SPARROW Model
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Percent of TN Load
0
10
20
30
40
50
60
70
80
Number of HUC8 Watersheds
Statewide
Miss River

How to reduce N?

- Practices

BMPs
Point source nitrate removal
Optimal N fertilization rates
Fall to Spring N
Sidedressing N
Nitrification inhibitors
Wetland Treatment
Bioreactors
Controlled drainage
Cover crops
Perennial vegetation on marginal lands & riparian

- Programs

Programs
What pilots should move into programs?
What programs can help get widespread adoption of key BMPs?
Which programs lead to multiple benefits? E.g. soil health, economics
Are there new opportunities for private/public sector partnerships?
Are there new program innovations to consider?
Where can efficiencies be gained?

Watershed N Reduction Estimator

Developed in 2012 by Univ. of MN

- W. Lazarus, D. Mulla, et al.

For HUC8 watershed scale use, or statewide

BMP adoption scenarios

- Costs
- N reductions in waters

BMP options in spreadsheet
N rates
Fall to Spring N
Sidedressing N
Wetland Treatment
Bioreactors
Controlled drainage
Cover crops
Perennial vegetation on marginal lands & riparian

N Reduction Estimator Tool

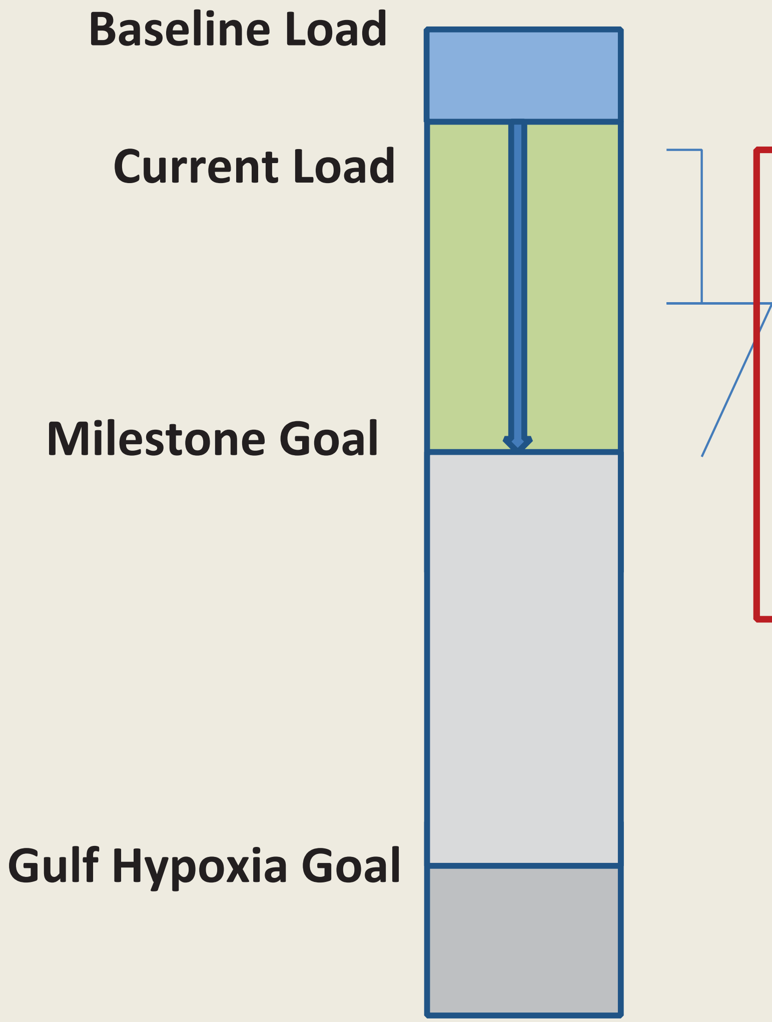
Watershed: Le Sueur River

	Adoption %	% watershed	% suitable
Corn grain & silage acres receiving the target N rate	50%	24.7%	49.3%
Fall N applications switched to spring, % of fall-app. acres	10%	3.2%	32.2%
Fall N applications switched to sidedressing, % of fall acres	25%	8.0%	32.2%
Riparian buffers % of suitable acres	10%	0.7%	6.5%
Restored wetlands % of suitable acres	25%	4.5%	17.9%
Tile line bioreactors % of suitable acres	25%	4.5%	18.1%
Controlled drainage % of suitable acres	5%	0.9%	18.1%
Corn &soybean acres planted w/cereal rye cover crop	10%	8.8%	87.7%
Perennial crop % of corn & soybean area	25%	0.8%	3.3%

Weather scenario: Average weather - all of preplant N is available 1

For wet spring scenario 2, fertilizer & manure N lost 25%

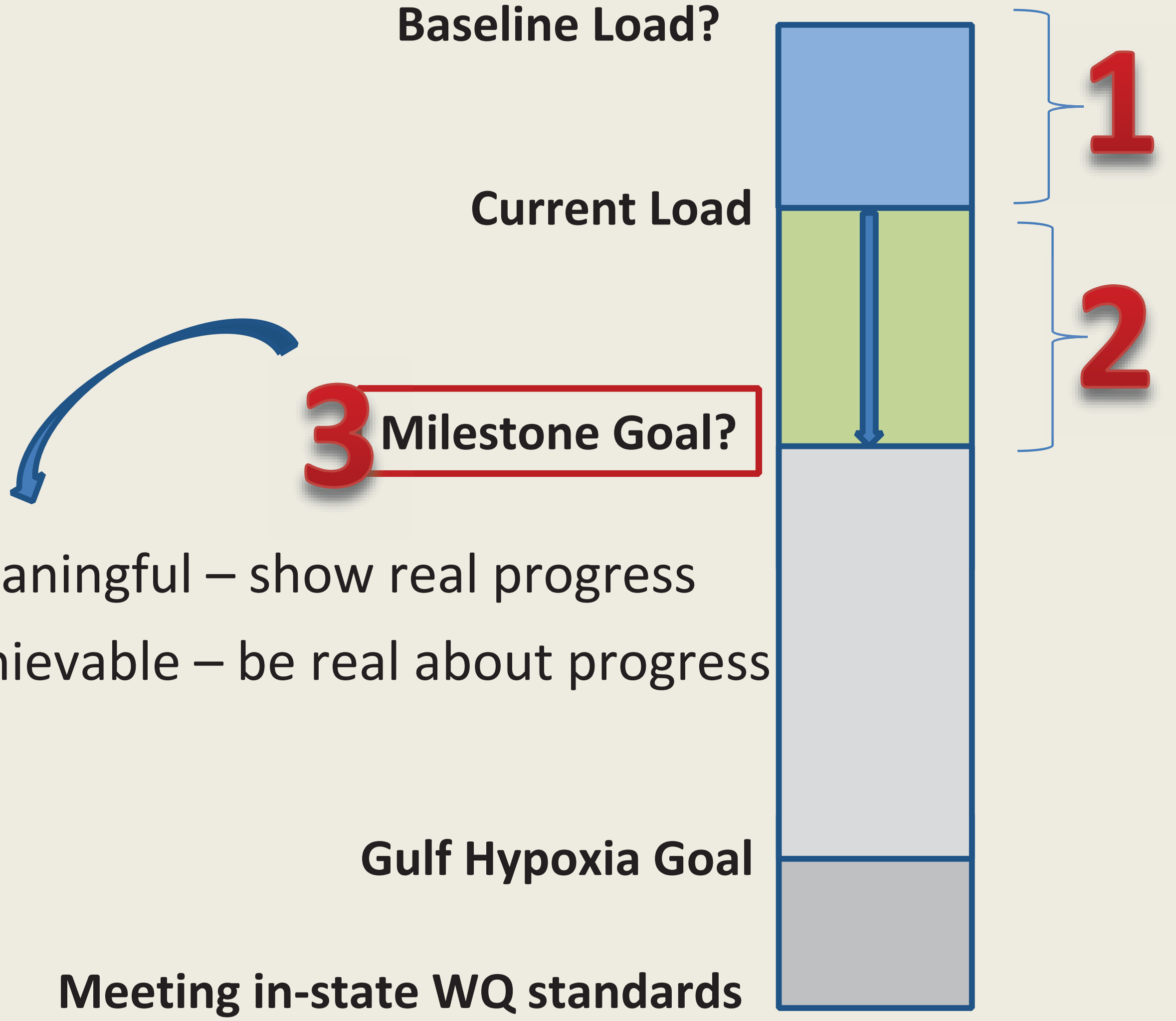
Summary of where to make progress



<u>Making Further Progress with N</u>

- **Widespread adoption of multiple BMP types**
- **Tiled lands in south-central MN are key areas**
- **What state-level efforts can help us move forward?**

Outline



Past Progress

How was progress made?

Milestone Progress

Where and how do we move forward?

Meaningful – show real progress

Achievable – be real about progress

LeSueur BMP Scenarios

LeSueur BMP Scenarios

Chippewa BMP Scenarios

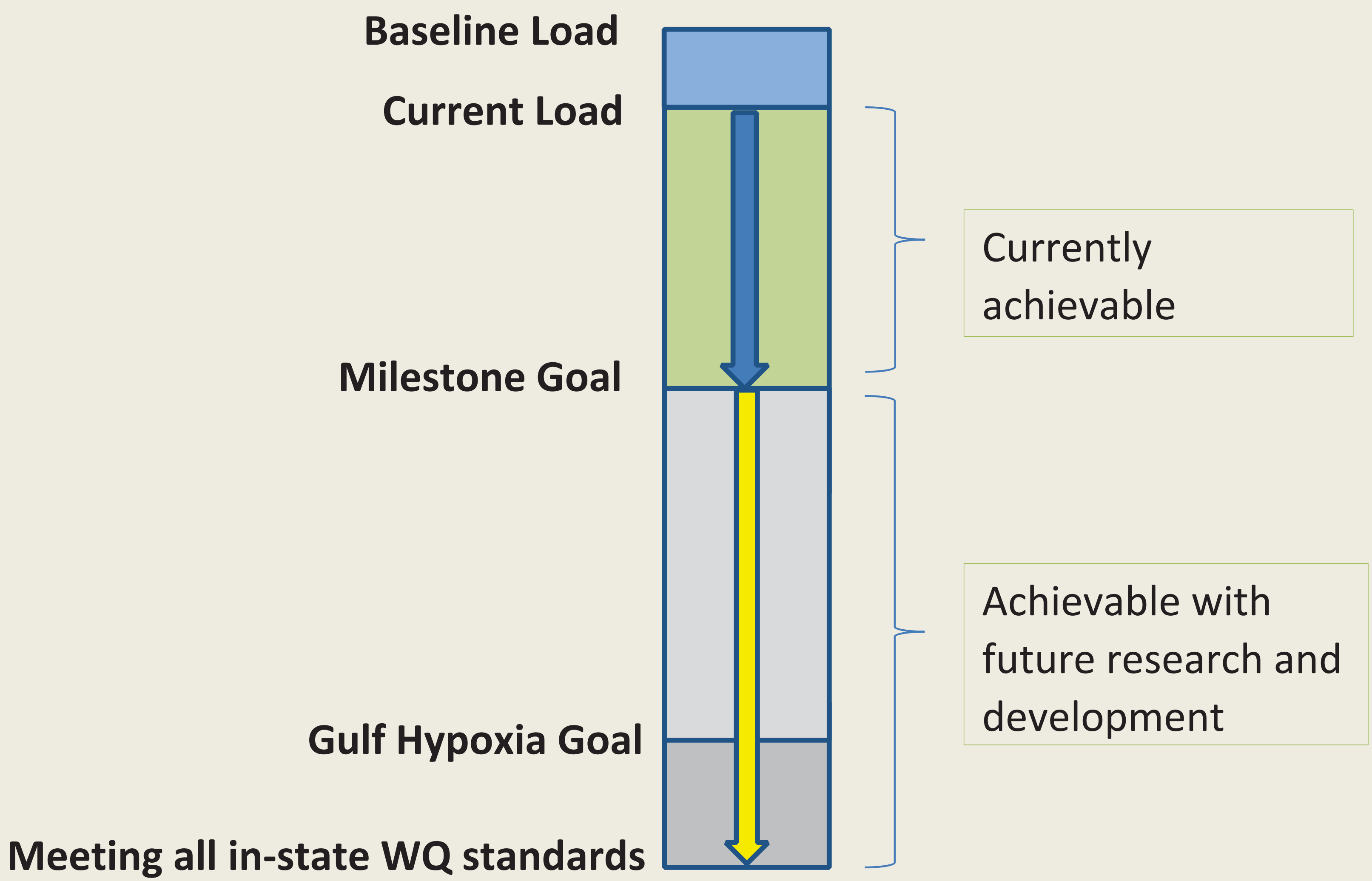
Root River BMP Scenarios

Watershed N Reduction Estimator

N reductions to streams with broad adoption of BMPs

- ~ 15-20% Statewide
- ~ 20-30% Heavily tiled watersheds
- ~ 10-15% Non-tiled watersheds

Long-term Adaptive Management



Summary

- Top 12 nutrient loading states committed to develop a strategy by 2013
- Address in-state and downstream needs
- Nitrogen and phosphorus
- Multi-agency effort
- Science informing recommendations
- Meaningful and achievable progress
- Some progress already made – phosphorus
- Your ideas for better state-level nutrient programs needed

For More Information

Watershed Nitrogen Reduction Estimator

http://z.umn.edu/nbmp

Nutrient Reduction Strategy Website

www.pca.state.mn.us/iryp1138

Ask questions or share thoughts through the Strategy email address:

nutrientreduction.pca@state.mn.us

Thank You

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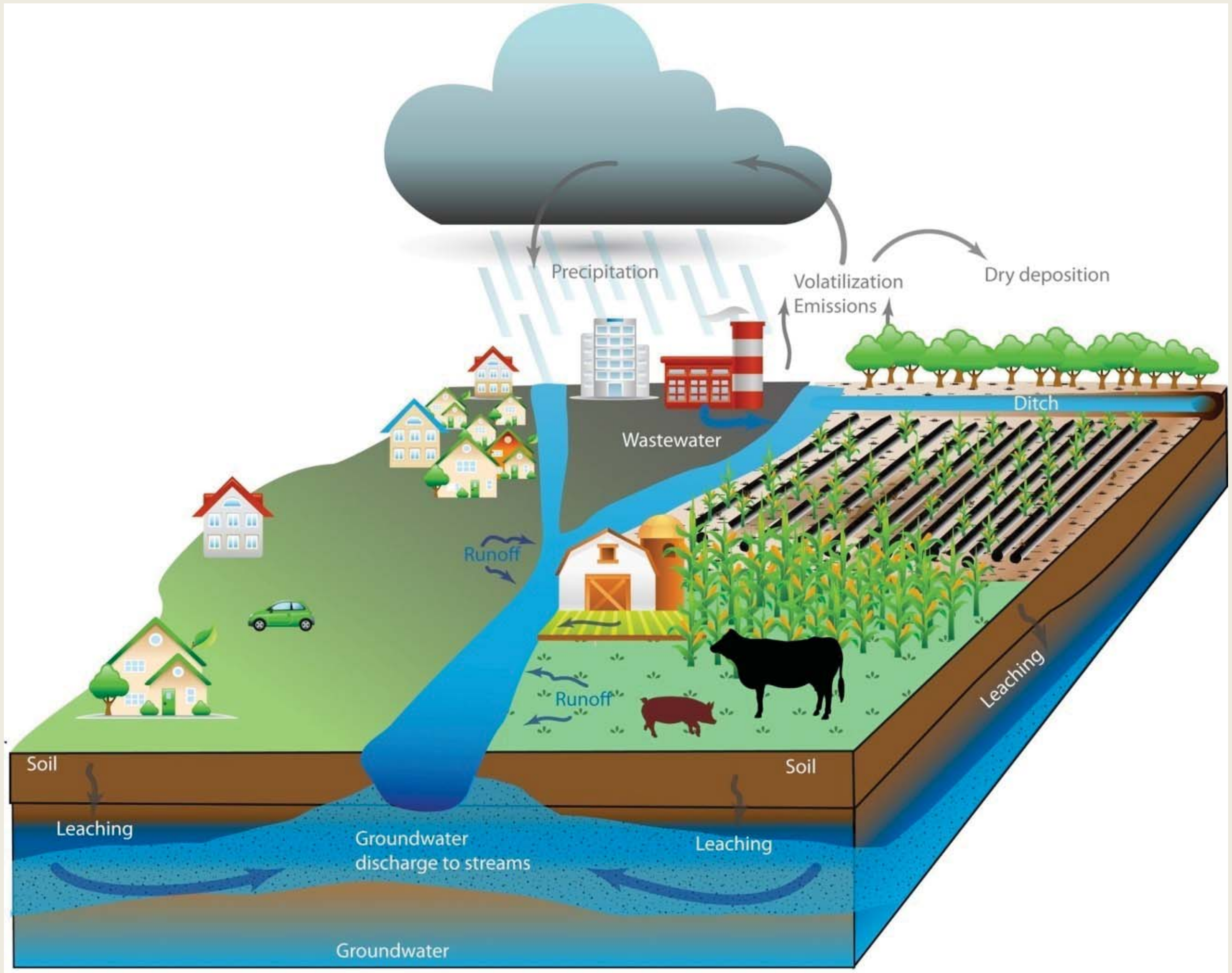
Questions



Precipitation
Volatilization
Emissions
Dry deposition
Ditch
Wastewater
Runoff
Runoff
Leaching
Soil
Soil
Leaching
Groundwater
discharge to streams
Leaching
Groundwater