Conservation Practices to Manage Nutrients for Crop Production and WQ

Nutrient, Soil and Water Mgmt. Conference

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Bigwood Event Center, Fergus Falls, MN

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Why Nut. Mgmt. for Crop Production and Water Quality is a Hot Topic

- High grain demand and commodity prices mean high profit potential for high production
- Soil erosion is a key transporter of Phosphorus
- Tile drainage is a key transporter of water soluble Nitrate nitrogen
- About 40% of Minnesota surface waters assessed to date are impaired (only about 15 have been delisted)
- Hypoxia in the Gulf of Mexico
- Rapid eutrophication and frequent algae blooms in Lake Winnipeg

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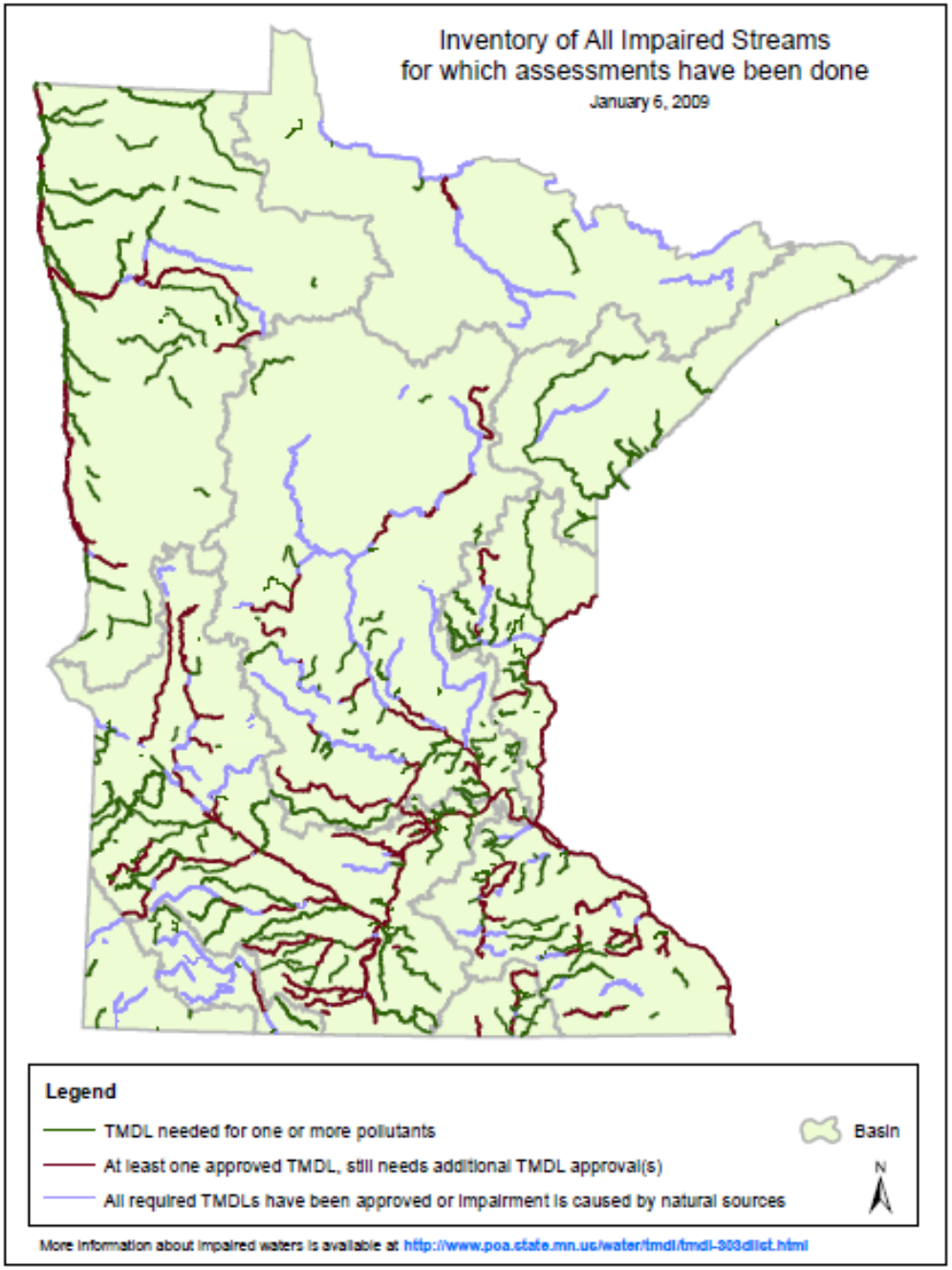
Impaired Rivers and Streams in Minnesota

3,643 River and Stream reaches and Lakes as of September 2012



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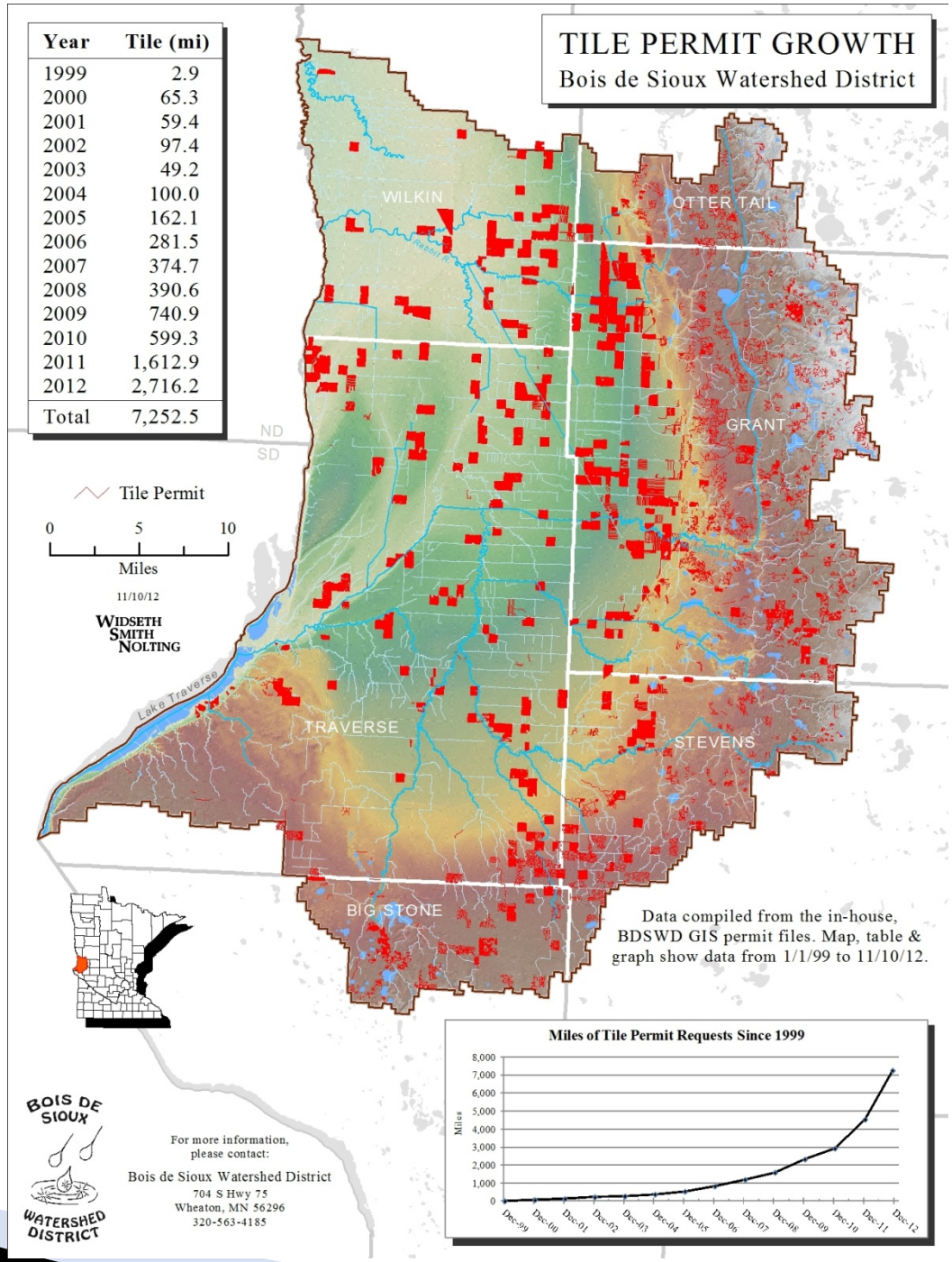
Pattern Tile Drainage Permits 1999 - 2012 Bois de Sioux Watershed District

Year	Tile (mi)
1999	2.9
2000	65.3
2001	59.4
2002	97.4
2003	49.2
2004	100.0
2005	162.1
2006	281.5
2007	374.7
2008	390.6
2009	740.9
2010	599.3
2011	1,612.9
2012	2,716.2
Total	7,252.5



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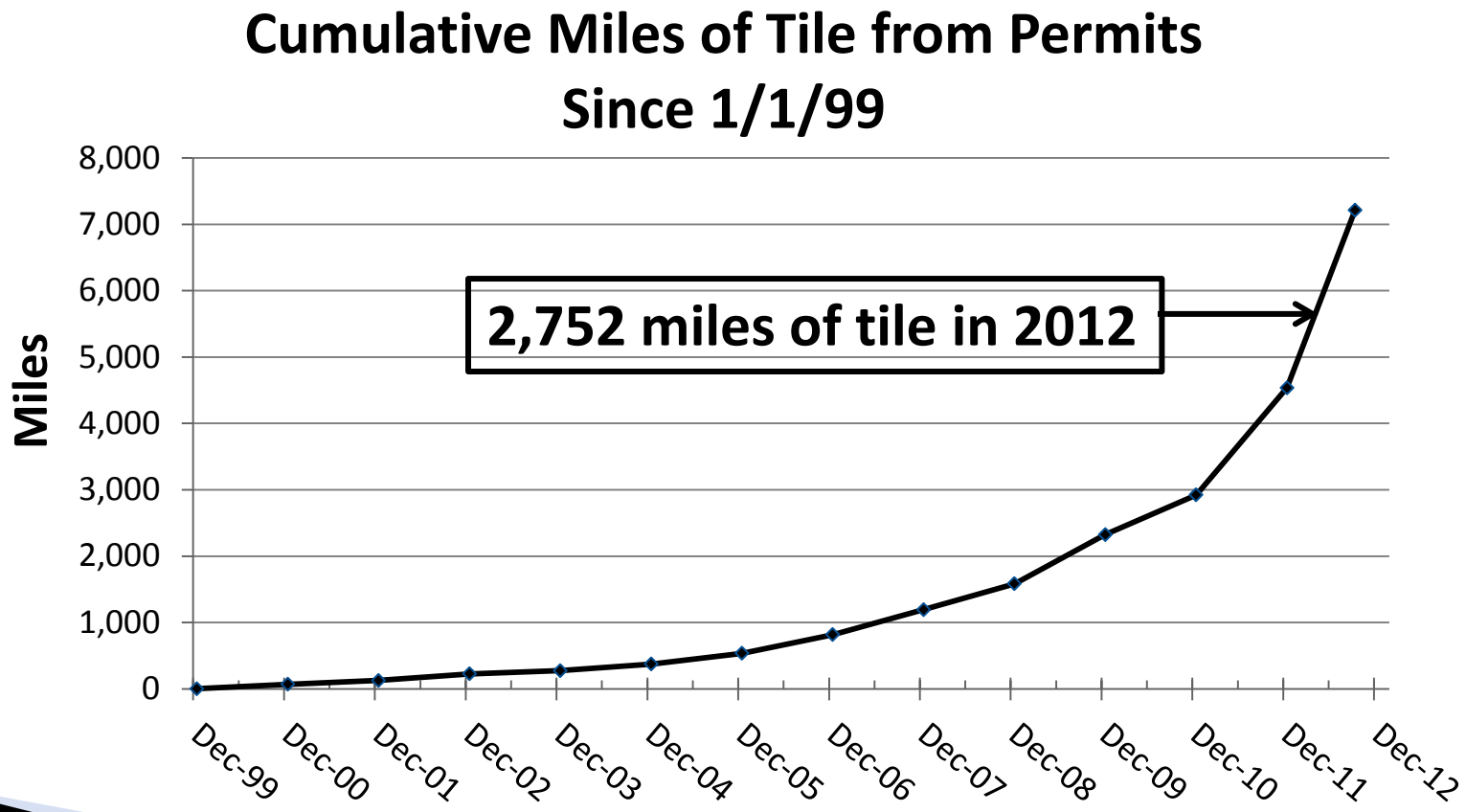
Miles of Ag Drainage Tile Permitted
1/1/99 - 11/10/12
Bois de Sioux Watershed District



Source: Bois de Sioux WD and WSN, Inc.

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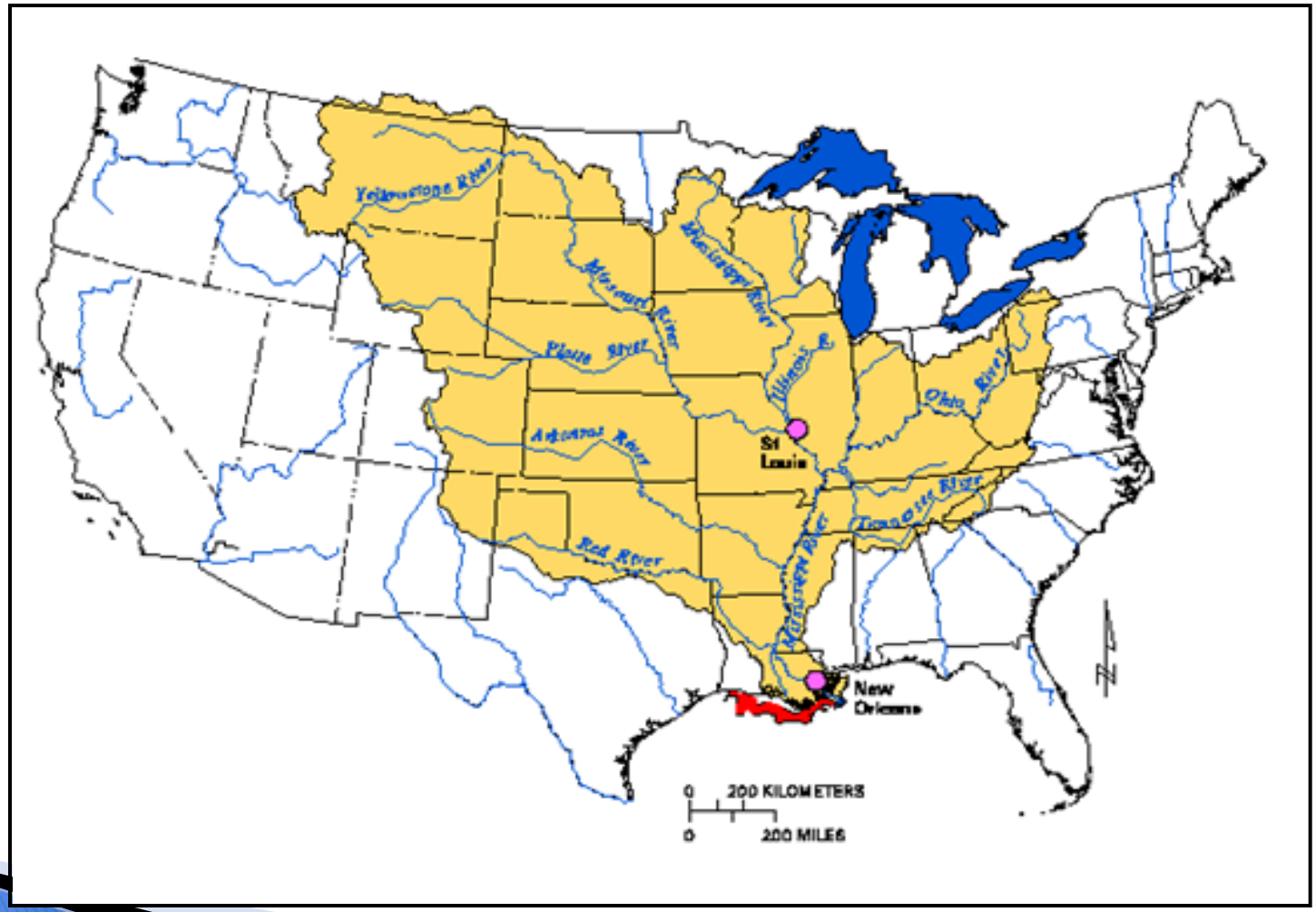
Gulf of Mexico Hypoxia



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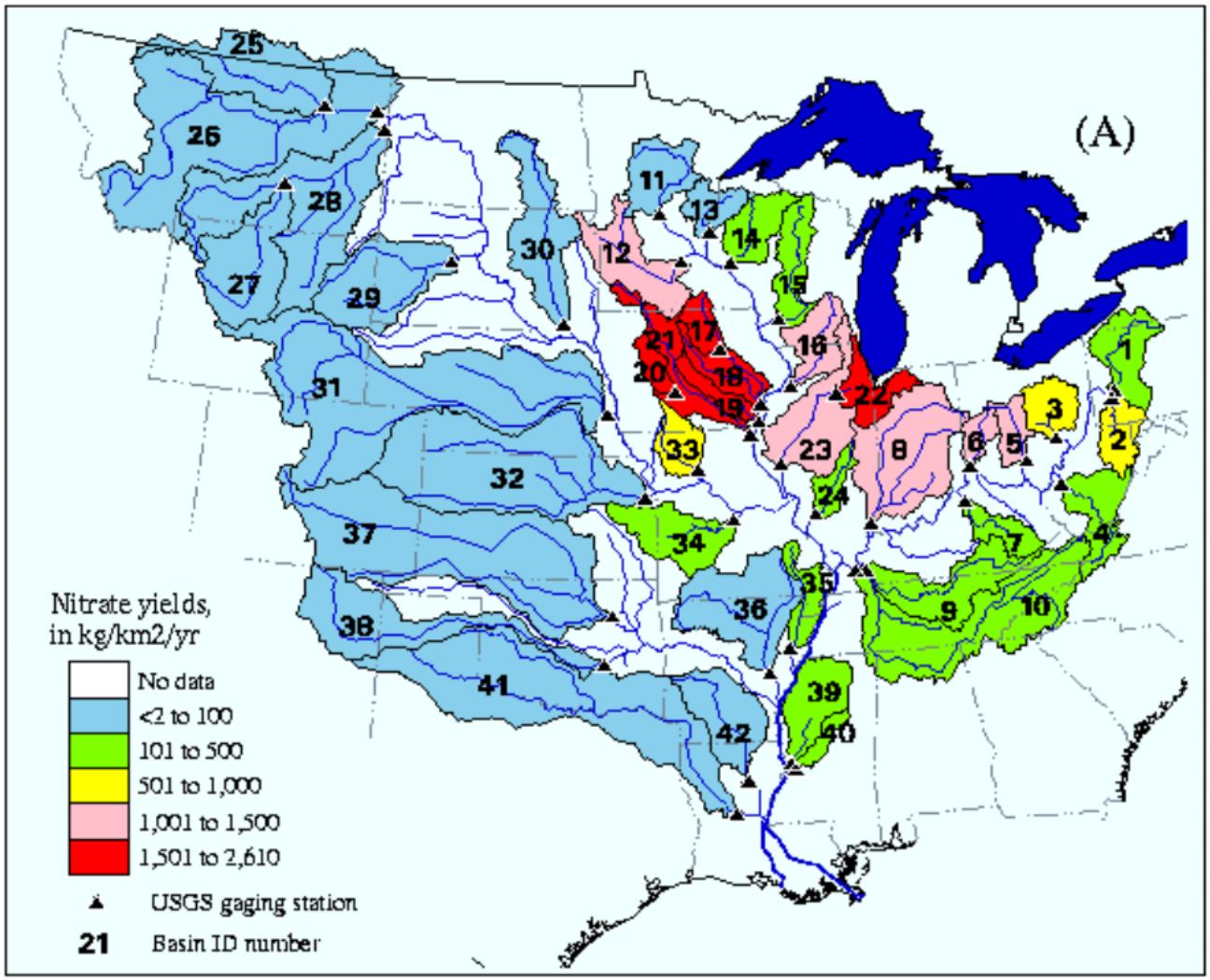
Gulf of Mexico Hypoxia – Nitrate Sources by Watershed



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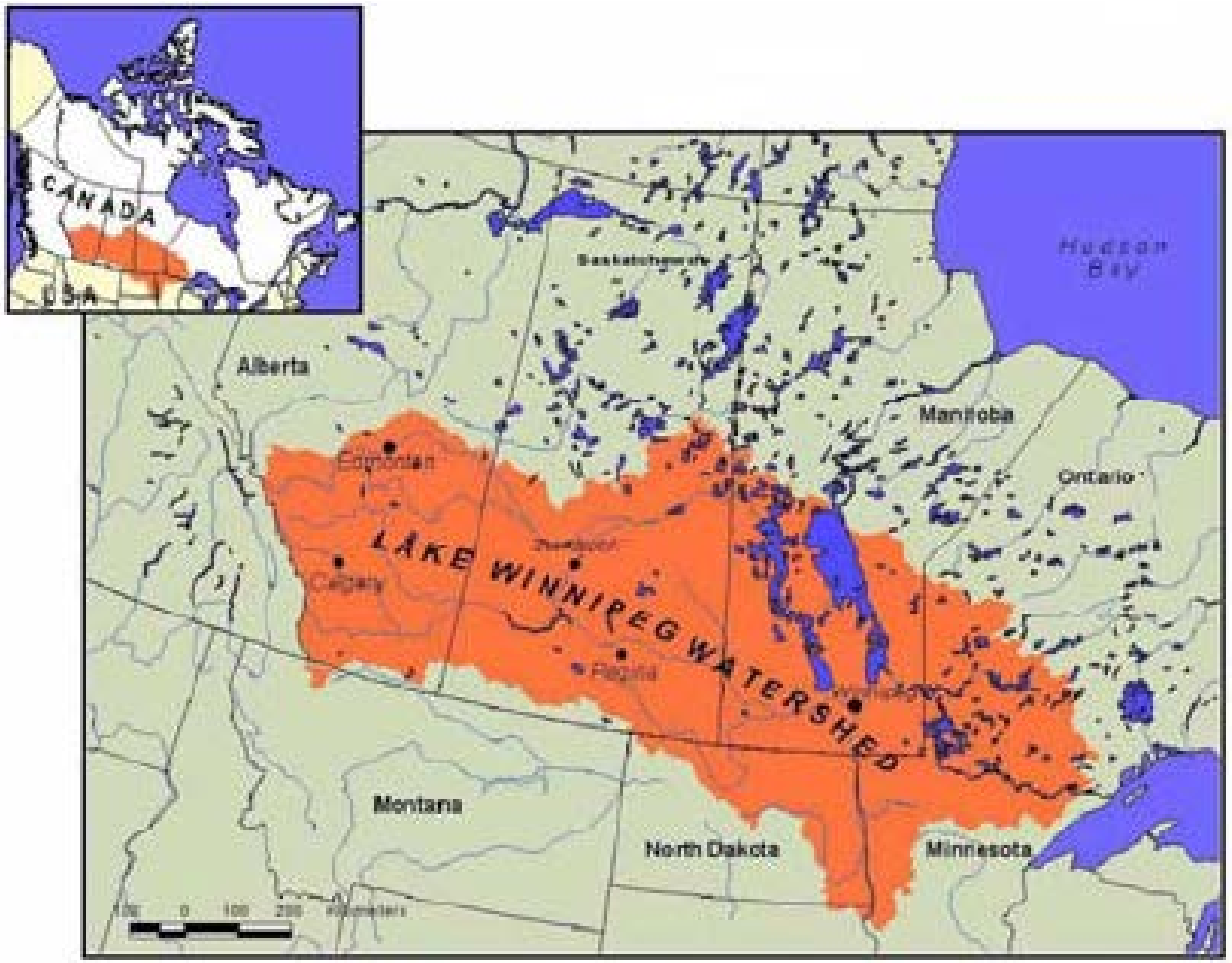
Eutrophication in Lake Winnipeg



Red River Basin contributes much of the excess Phosphorus and Nitrogen

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Algae in Lake Winnipeg Increasing Problem Since 1990s

In 2006, algae bloom over nearly the entire lake, which is the 10th largest in the world (9,500 mi.^{2})

Goal: Multipurpose, Science-Based Nutrient Management

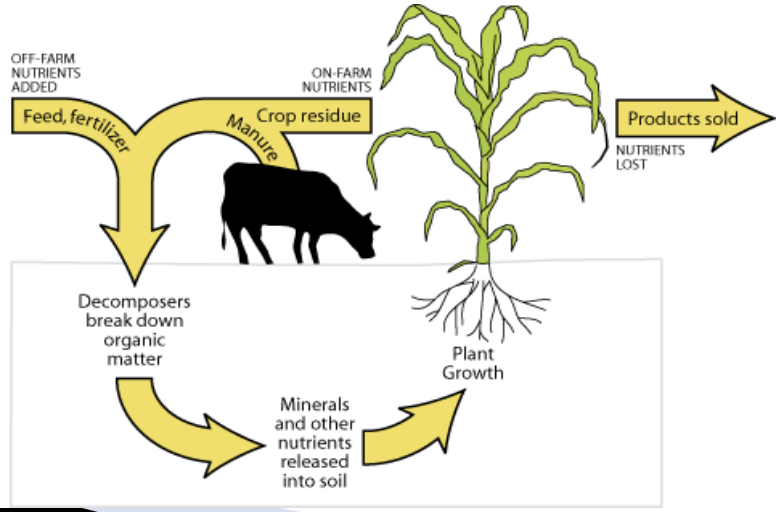
- **Traditional conservation practices** focus on surface runoff, soil erosion and water quality
- **Newer conservation practices** have increased focus on subsurface drainage water quality (Drainage Water Management, DWM)
- **Soil Health practices** to reduce runoff and erosion, and sequester nutrients

Key Players in Multipurpose Nutrient Management

- Farmers and livestock producers
- Key advisors to farmers/producers
  - Certified Crop Advisors / Agronomists / Nutrient Management Specialists
  - Tax advisors and bankers
  - Tiling contractors
  - NRCS and SWCD technical specialists (erosion control, nutrient management)
  - Universities
  - State and federal agencies and programs

Traditional and Evolving Cons. Practice – Nutrient Mgmt.

- NRCS Conservation Activity Plan **(CAP) 104 – Nutrient Mgmt. Plan** (EQIP – Flat rates: <100 ac.; 101-300 ac.; >300 ac.)
- NRCS **CAP 102 – Comprehensive Nutrient Mgmt. Plan (CNMP)** (EQIP – Flat rates for different types of livestock operations)
- NRCS Conservation Practice **590 – Nutrient Mgmt.** (EQIP – Per acre rate for 3 yrs. Basic NM; With manure; Enhanced NM, Precision NM, and Advanced NM Precision System)



Nutrient Management Actions and Conservation Practices

- **Phosphorus Management**
  - Banding and immediate incorporation of fertilizer and manure
  - Soil testing, University guidelines, and P Index, as applicable
  - Soil erosion reduction practices (e.g. Residue & Tillage Mgmt., Contour Farming, Grassed Waterways, Grade Stabilization, Terraces, WASCOBs)
- **Nitrogen Management**
  - Soil testing and soil texture considerations for N application
  - University guidelines
  - Type and timing of fertilizer application
  - Manure application guidelines and crediting
  - Immediate incorporation of fertilizer and manure
  - Cover crops

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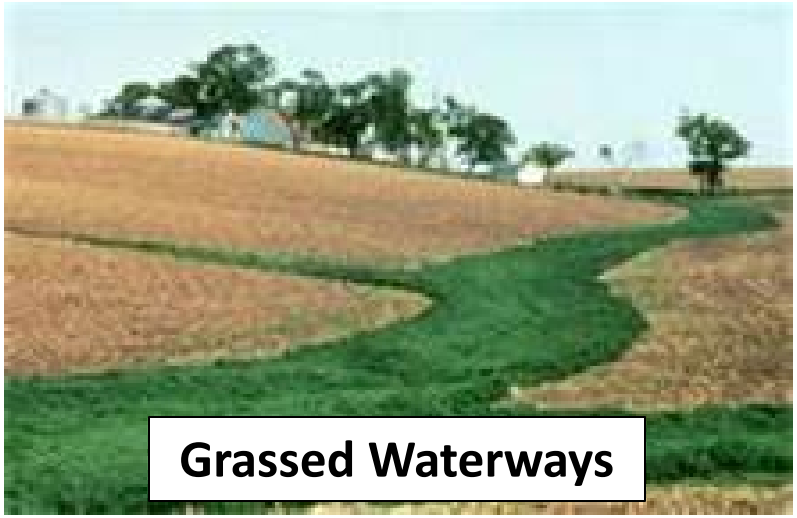
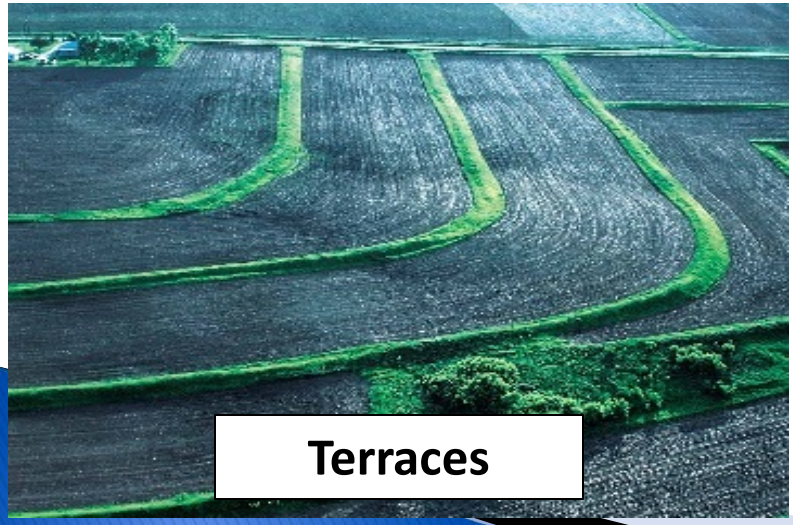
Traditional Practices for Erosion Control and Phosphorus Mgmt.



Grassed Waterways

WASCOBs



Terraces

Grade Stabilization - Side Inlets

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Traditional Practices for Erosion Control and Phosphorus Mgmt.

Contour Strip Cropping

Contour Buffer / Filter Strip

Buffer / Filter Strip

Residue Management

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Newer Tillage Practices for Erosion and Nutrient Mgmt.

Federal and State Drainage Water Management (DWM) Initiatives

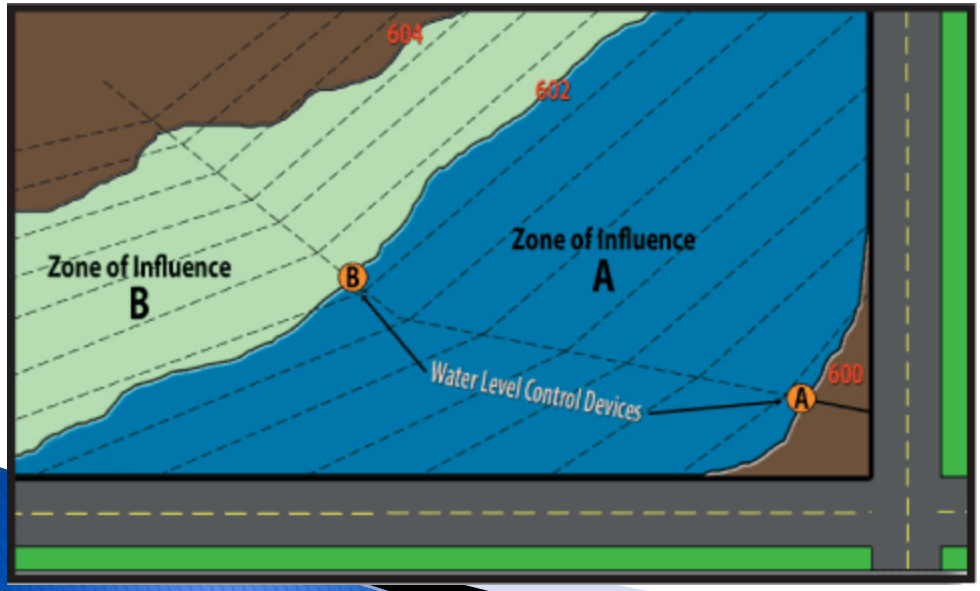
- **USDA-NRCS** Environmental Quality Incentives Program (**EQIP**) began a DWM initiative in 2012 (flat rates)
- **BWSR CWF** Conservation Drainage Management Program (**CDMP**) received additional $700,000 for FY 13 DWM initiative (25% non-state share required)
- Coordinated to use NRCS conservation practice stds.
- Both federal and state can now provide financial assistance for control structures on **new** pattern tile
- Federal and state programs do not pay for pattern tile, except state will help replace existing open tile inlets

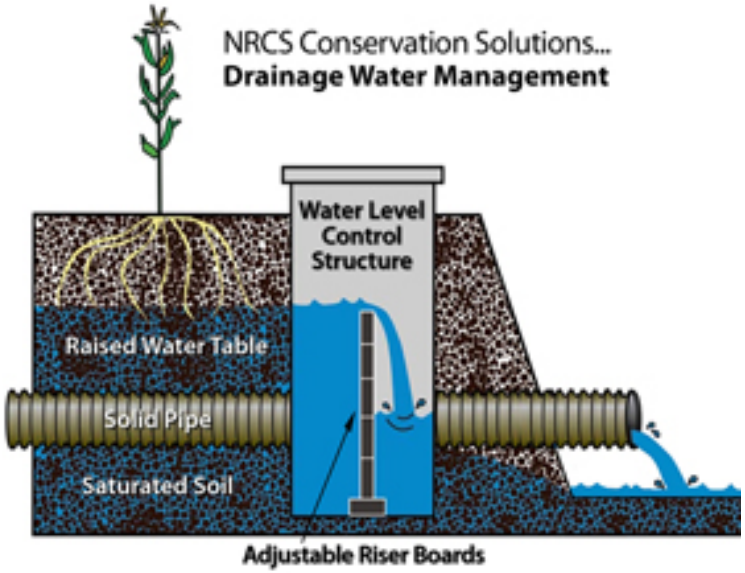
DWM Practice
Controlled Subsurface Drainage

NRCS Conservation Activity Plan (CAP) 130 – Drainage Water Mgmt.
Plan – must be prepared by TechReg Technical Service Provider (TSP)

NRCS Practice 587 Structure for Water Control

NRCS Practice 554 Drainage Water Management (Operation) – CAP 130 is required.





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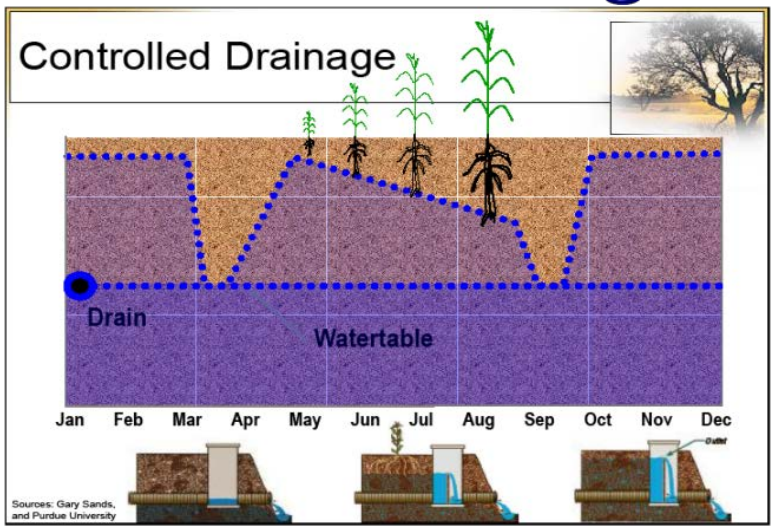
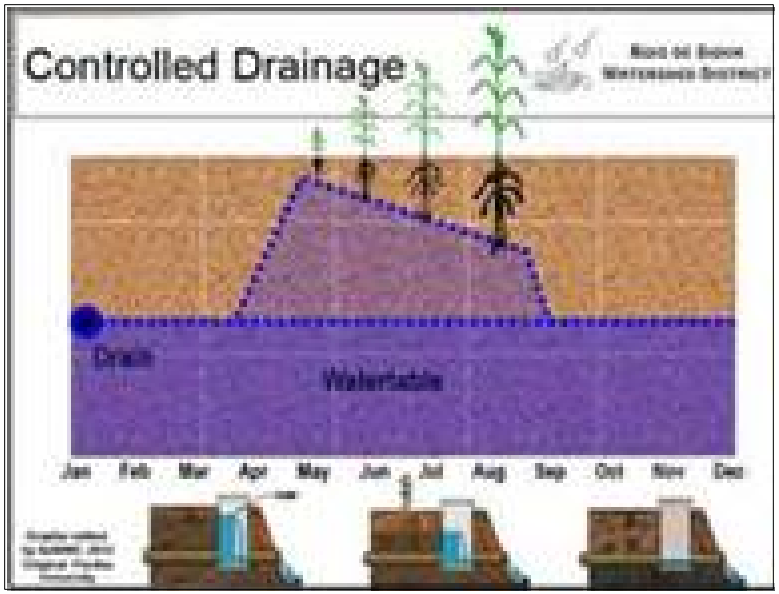
DWM Practice
Controlled Subsurface Drainage

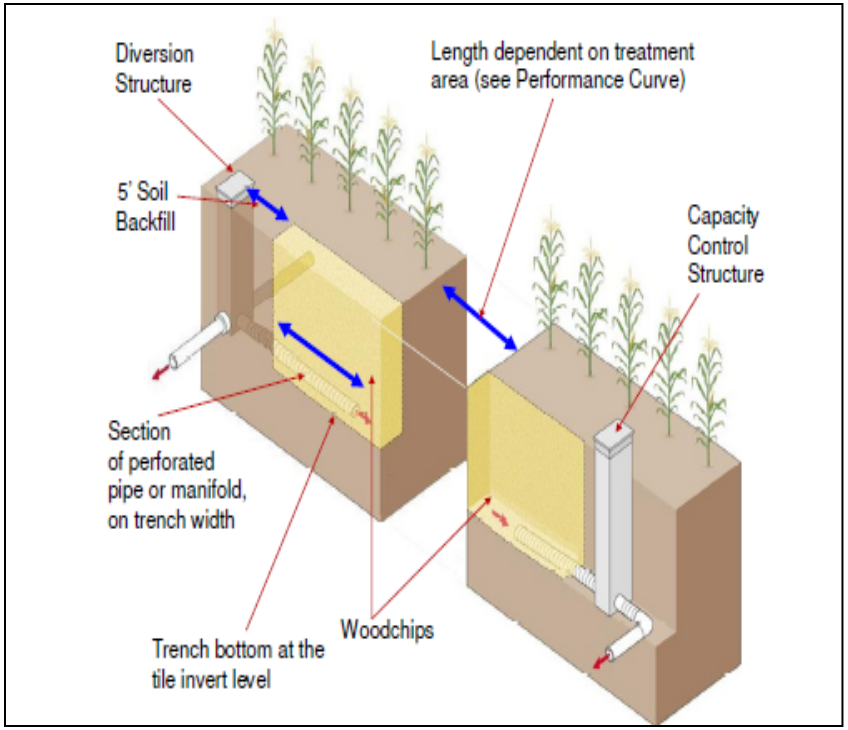
Stop log Structure

AgriDrain Water Gate





DWM Practice
Denitrifying Bioreactor



NRCS Interim Practice 747 Denitrifying Bioreactor

- Wood chips are typical carbon source for bacteria and microbes that do the denitrification
- Need 4+ hour water residence time, so can only treat a portion of the tile flow
- University of Illinois and Iowa State University have developed spreadsheets to help design

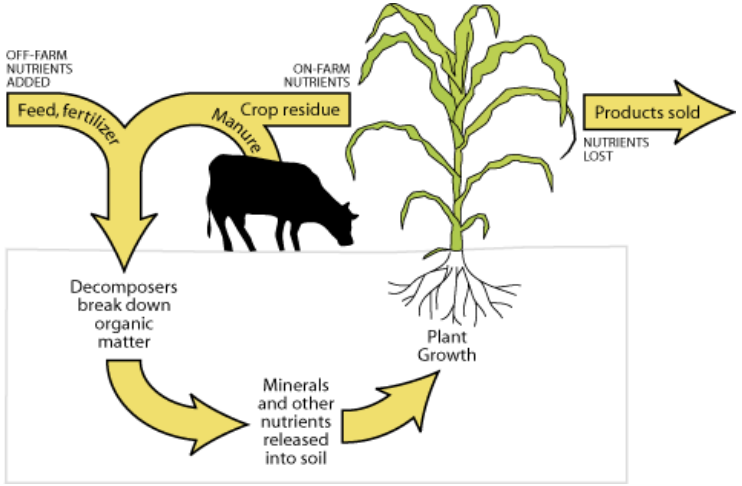
DWM Practice
Nutrient Management

Conservation Activity Plan (CAP) 104 Nutrient Management Plan

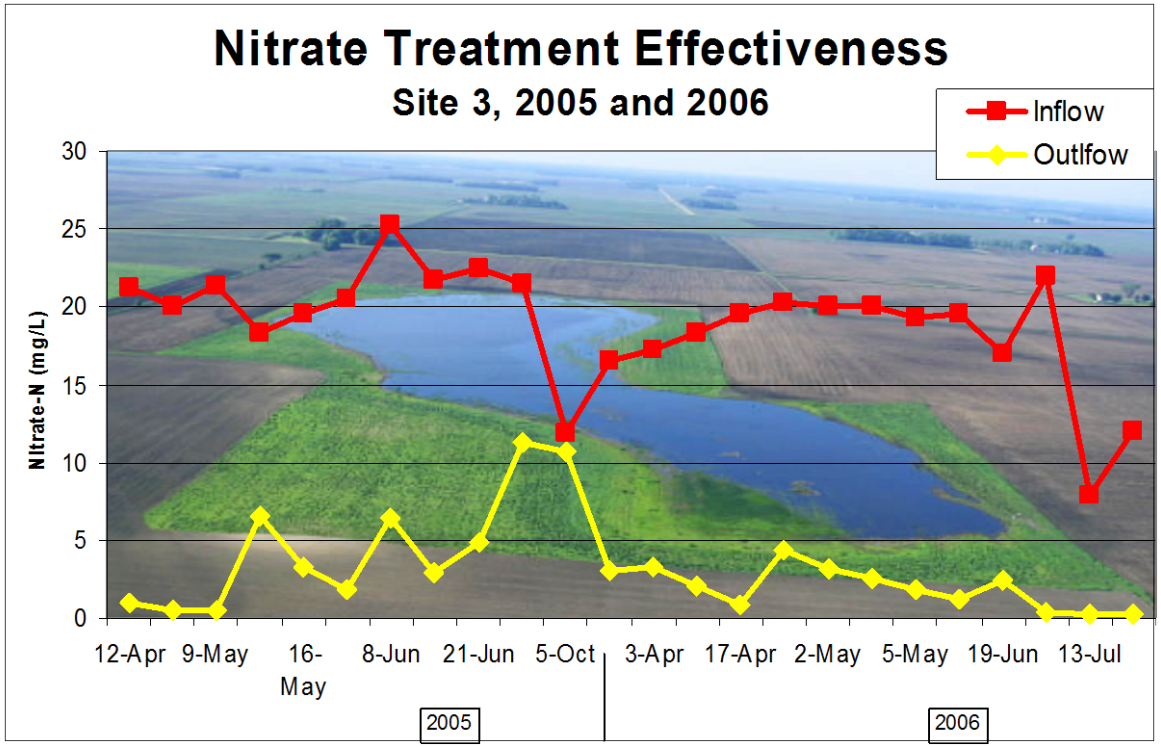
- Plan must be developed by a NRCS TechReg certified Technical Service Provider (TSP)

Conservation Practice 590 Nutrient Management

- CAP 104 is required
- Operation incentive for the first 3 years



DWM Practice – Wetland Restoration / Treatment Wetland



RIM / CREP Nicollet County, MN
Public and Private Tile Inflow
Public Tile Outflow
Ave. 80% Nitrate Reduction

Farm Service Agency (FSA) CRP Cons. Practice **CP-39 Constructed Wetland** for agricultural runoff treatment.

- Based on Iowa denitrifying wetlands CREP.
- Only 2 or 3 in MN to date.

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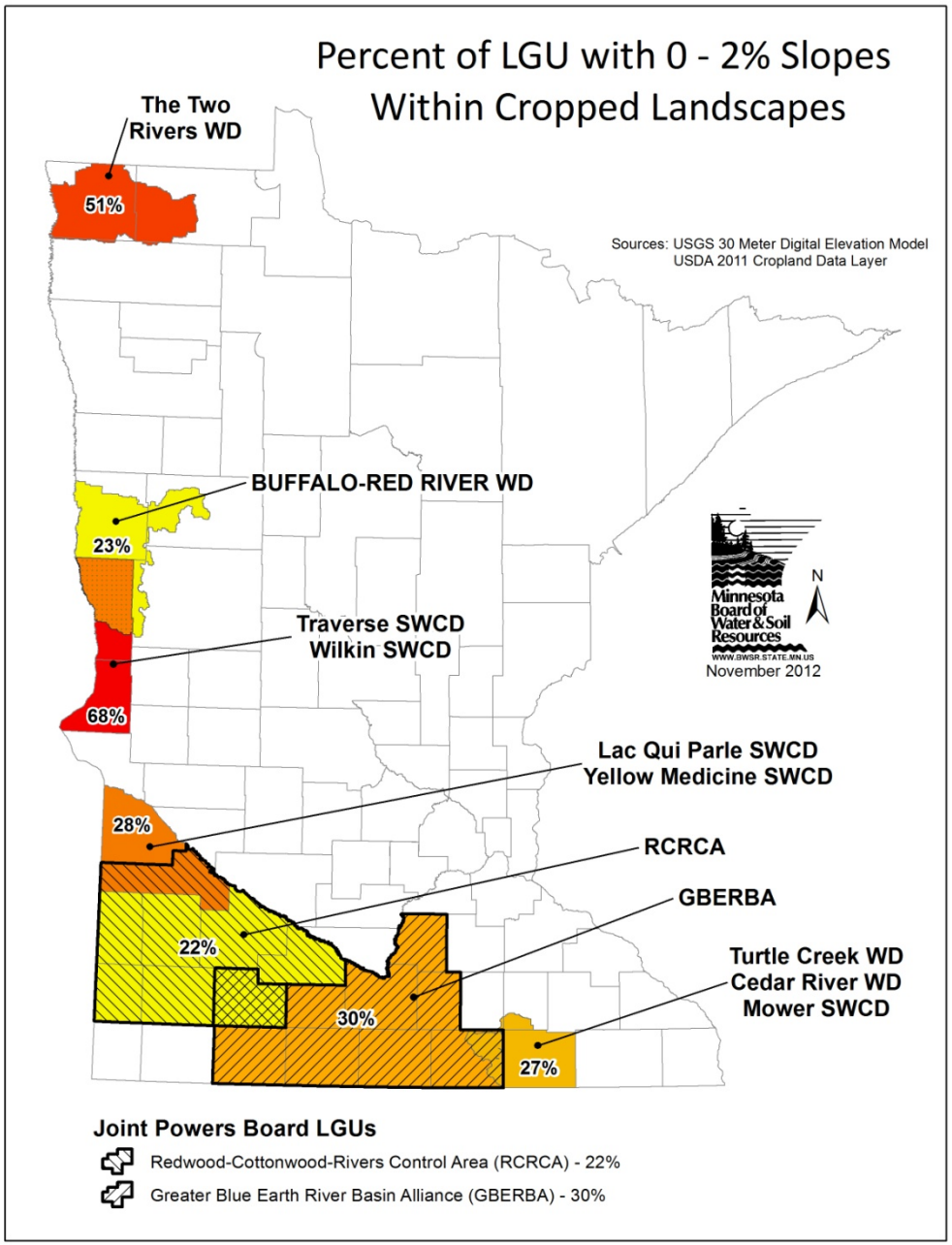
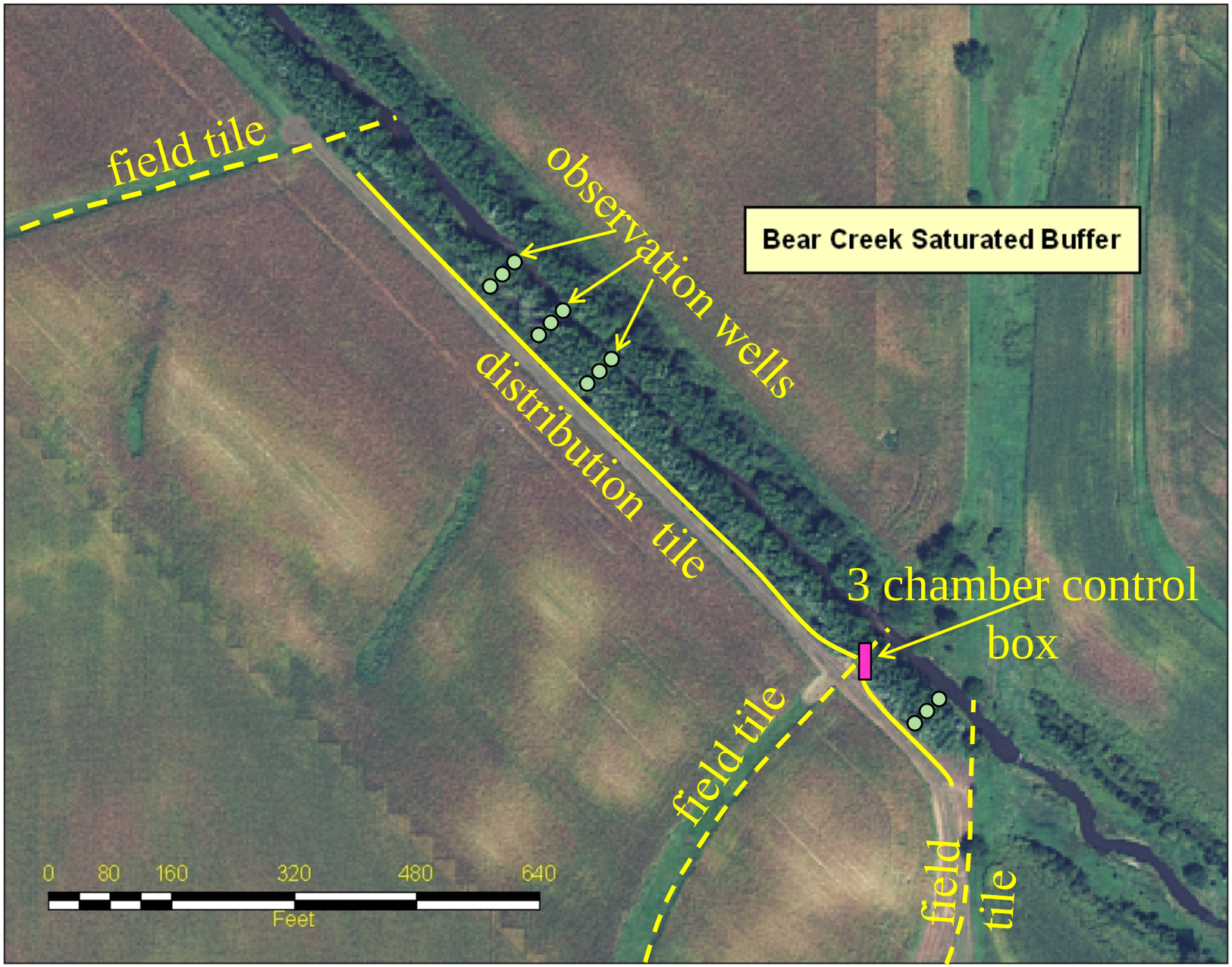
BWSR FY 2013 Targeted Drainage Water Management Grants



New DWM Practice – Vegetated Subsurface Drain Outlet

- aka "**Saturated Buffer**" for denitrification of tile flow
- Interim Conservation Practice Standard 739
- First demonstration by Iowa State University starting in 2011
- First demonstration in MN installed near Granite Falls on Doug Albin farm – fall 2012
- ADMC has a Conservation Innovation Grant for 3 demo sites each in IA, IL and IN


field tile
observation wells
Bear Creek Saturated Buffer
distribution tile
3 chamber control box
field tile
field tile
0 80 160 320 480 640
Feet

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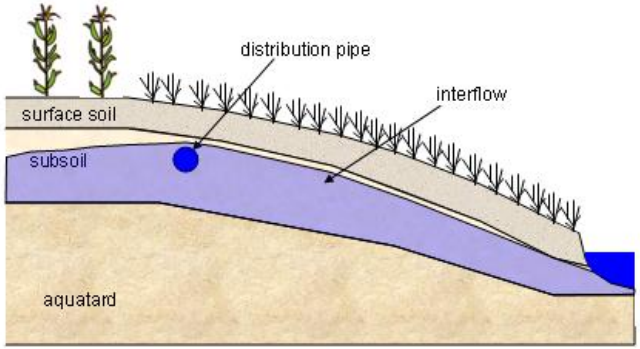
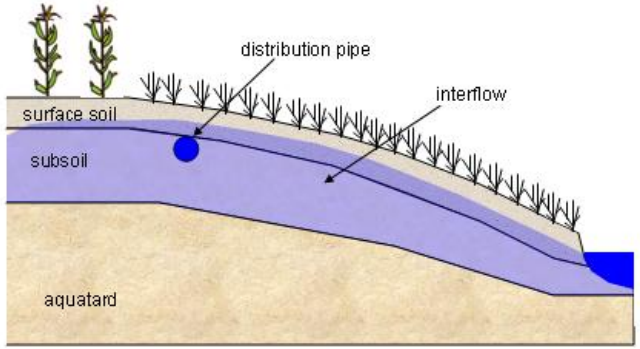
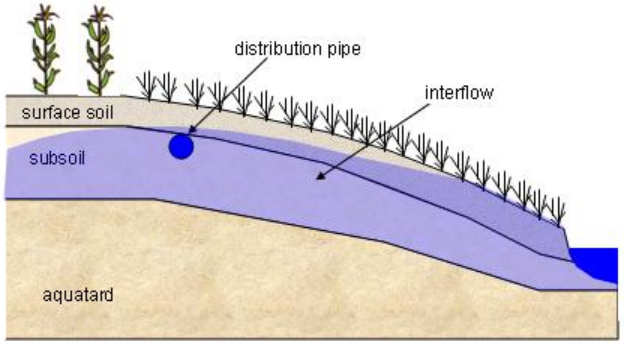
Induced Seepage Flow



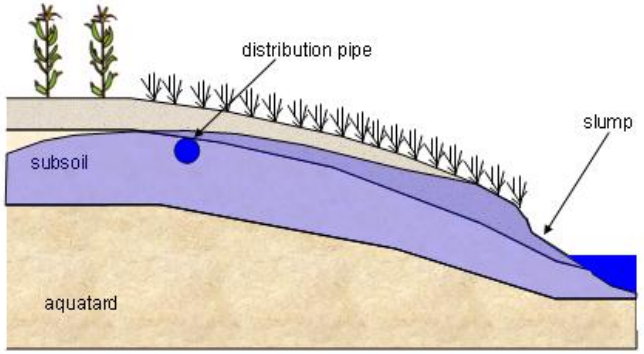
a) Enhanced nut. uptake



b) Enhanced denitrification

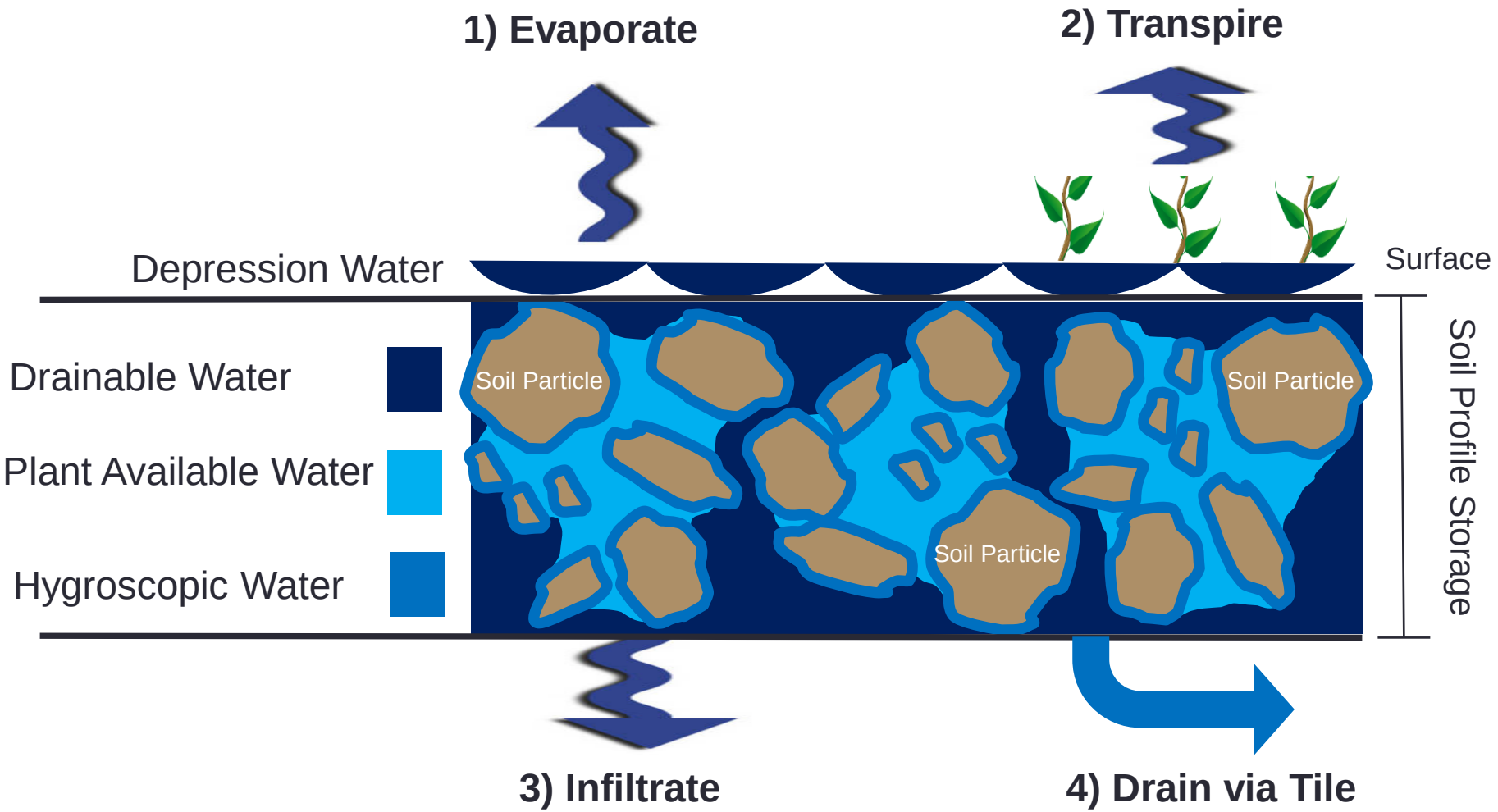


c) Surface discharge



d) Channel slumping?

Fate of Soil Profile and Surface Depression Water



Soil Organic Matter and Cover Crops for Nut. Mgmt. and Profit

- Soil Health / Soil Quality
  - Soil organic matter loss since plowed the prairie = 20% - 60%
  - For typical MN soils: 1% increase in soil organic matter in the top 30 inches of soil = **approximately ¾ in. to 1 in. increase in water holding capacity**, or about 7 - 14 days plant available water increase
- Cover Crops
  - Sequester N & P, reduce inputs
  - More feasible due to pattern tile drainage, shorter growing season hybrids, new cover crops, and experience

No-Till and Cover Crops

Multipurpose Nutrient Management

Questions?

If there is time.