

Drainage Practices for Water Quality Remediation

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Legislative Water Commission

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Tile Drainage

- Essential for profitable crop production on poorly drained soils in southern, west central, and north western MN
- Increases rooting zone and reduces surface runoff
 - Less phosphorus and sediment in surface waters
- Increases nitrate-N in drainage water, which enters ditches, streams, and rivers
 - Contributor to hypoxia in the Gulf of Mexico and alters fresh water ecosystems in Minnesota



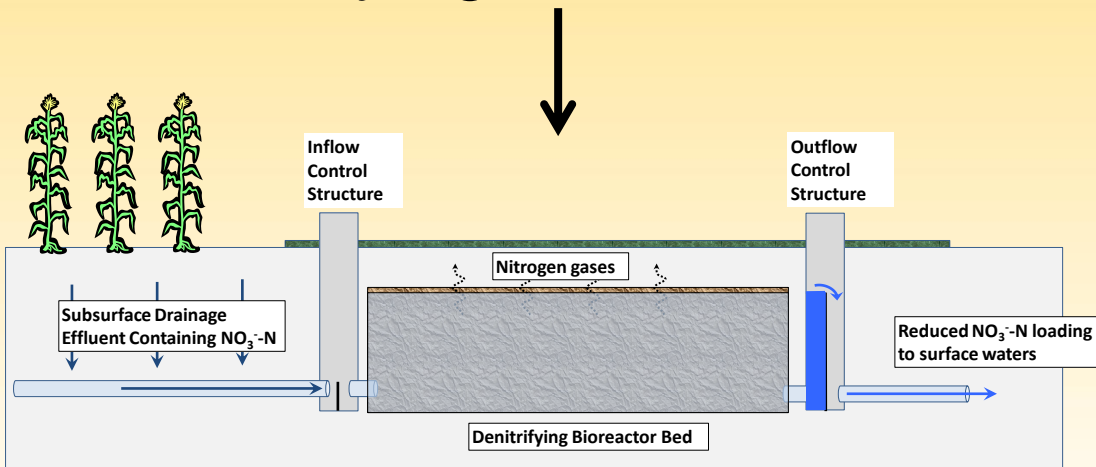
Tile Drainage Nitrate Reduction Strategies

- Water table management (controlled drainage)
 - Load reduction; Limited to flat ground
- Saturated buffers
- Denitrifying bioreactors



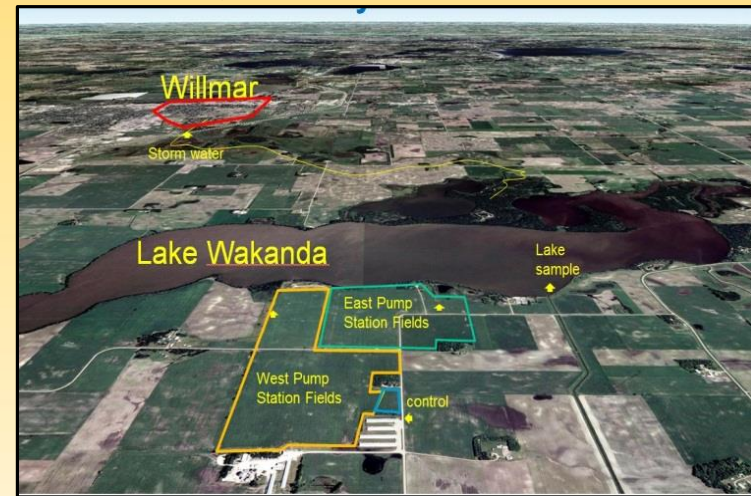
Dan Jaynes, Soil Scientist;
USDA-ARS, National
Laboratory for Agriculture
and the Environment)

<http://www.epa.gov/region5/agriculture/pdfs/nutrientworkshop/18reetz.pdf>



Current Research

- Objective: To optimize woodchip bioreactors to reduce nitrogen in subsurface drainage water
- Willmar field site is part of a Discovery Farms Project
 - 2007 to present
- 350 ft bioreactor built in 2010
 - Bioreactor was ineffective
 - Poor hydraulics
- Bioreactors work poorly when water temperatures are cold (<40 F)



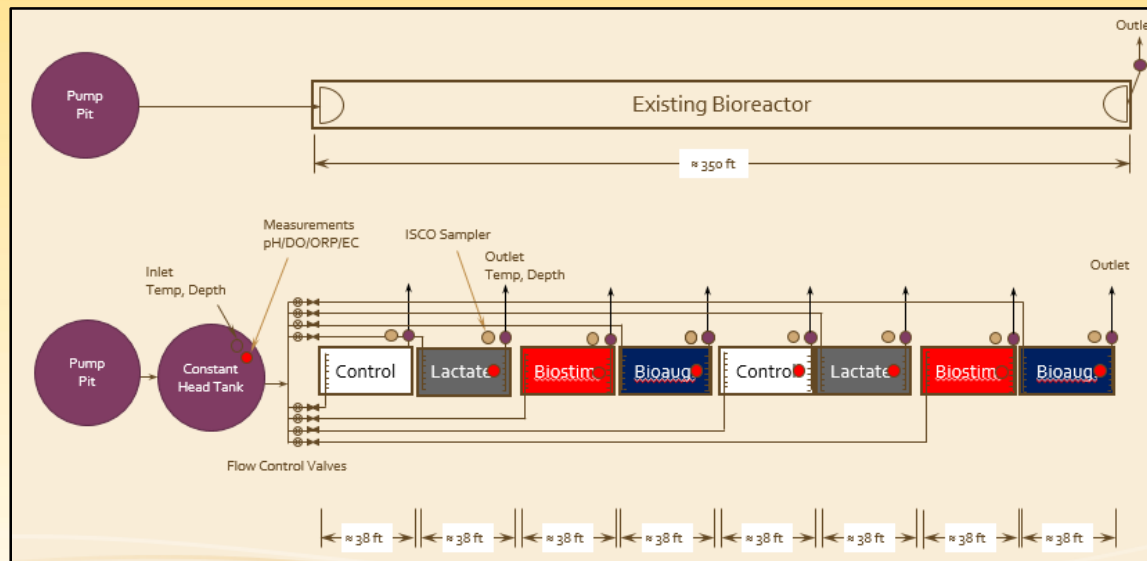
MnDRIVE Funding

- MnDRIVE funds were used to redesign the bioreactor to create a replicated experiment
- 350-ft long by 6.5-ft wide by 6-ft deep bed was retrofitted to include 8 individual woodchip beds in October 2014
- Segmented into eight 38-ft long independent bioreactors supplied with the same tile water

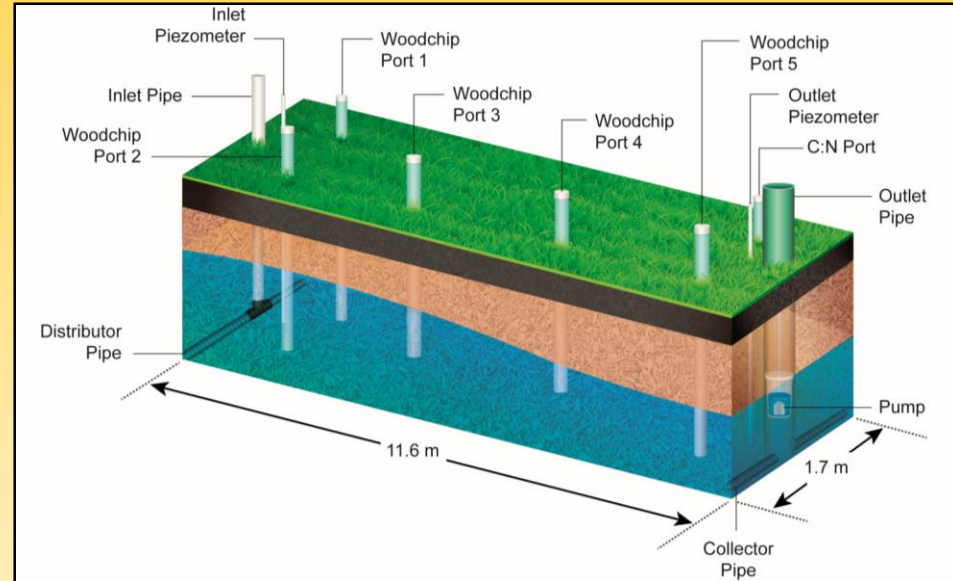


Four Treatments

- Control
- Biostimulation - C addition
- Bioaugmentation – Microbes
 - (collaboration with Mike Sadowsky and Satoshi Ishii)
- Biostimulation + Bioaugmentation



Current Setup



Next Phase

- Currently supported by MDA Clean Water funds, MnDRIVE, and Discovery Farms for 2 years
 - Treatments will be implemented in fall of 2016
- Operational funds from other sources are needed to conduct the study for at least 4-5 years
- Annual Cost ~ 180K
- Partnership among
 - MnDRIVE
 - Biotechnology Institute
 - MDA
 - Discovery Farms
 - USDA-ARS
 - MN Legislature

