Transforming Drainage: Retaining Water to Improve Crop Yields and Water Quality

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Crops, like people, need water to thrive

Not too much, not too little.

But in some years….

Too much (June)

Then too little (July)


Midwest farmers can manage **excess** water.

Subsurface “tile” drainage

Impressive drainage infrastructure for getting rid of excess water

Side Effects of Drainage: Contaminants from drainage water…

Lead to poor water quality

Photo by Tom Bridgeman

Two problems

Sometimes too much → Sometimes too little

Crop yields are often reduced due to lack of water.


How will this situation
change in the future?

Sometimes too much; sometimes too little.

Both intensifying as **extreme weather increases**.

Spring: More runoff and nutrient loss

Summer: More drought and crop yield loss

In periods with too much water already, we expect more in the future

More water quality problems

Photo: Tom Bridgeman

More flooding

Creative Commons: http://www.flickr.com/photos/kingbob86/5341730273/

In periods with too little water already, we expect drier conditions in the future

More crop loss

More need for irrigation using potentially scarce water supplies

Solution:
Retaining more water in the landscape

The goal in agricultural drainage has been to get rid of excess water as quickly as possible.

But can we instead **retain water** in drained agricultural landscapes like this?

Storing water in the soil
Increasing soil health.

- Increasing soil organic matter can increase water holding capacity.

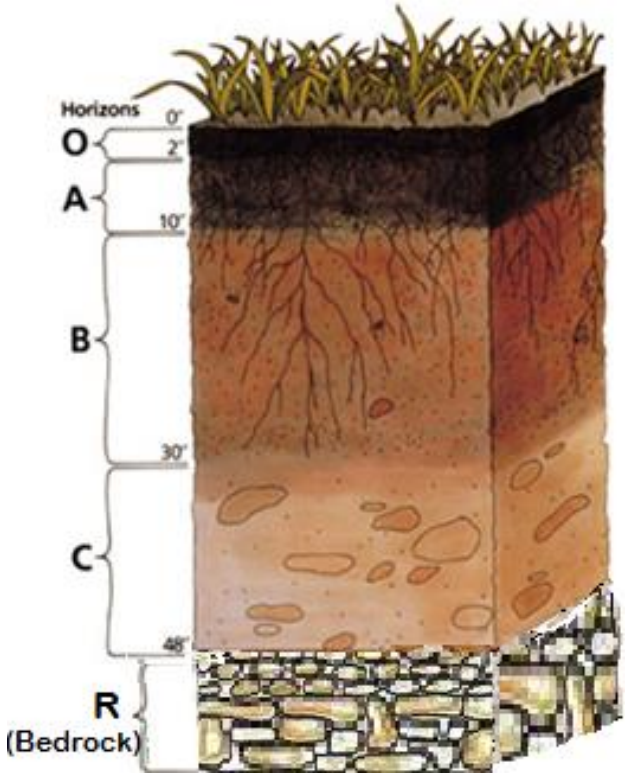
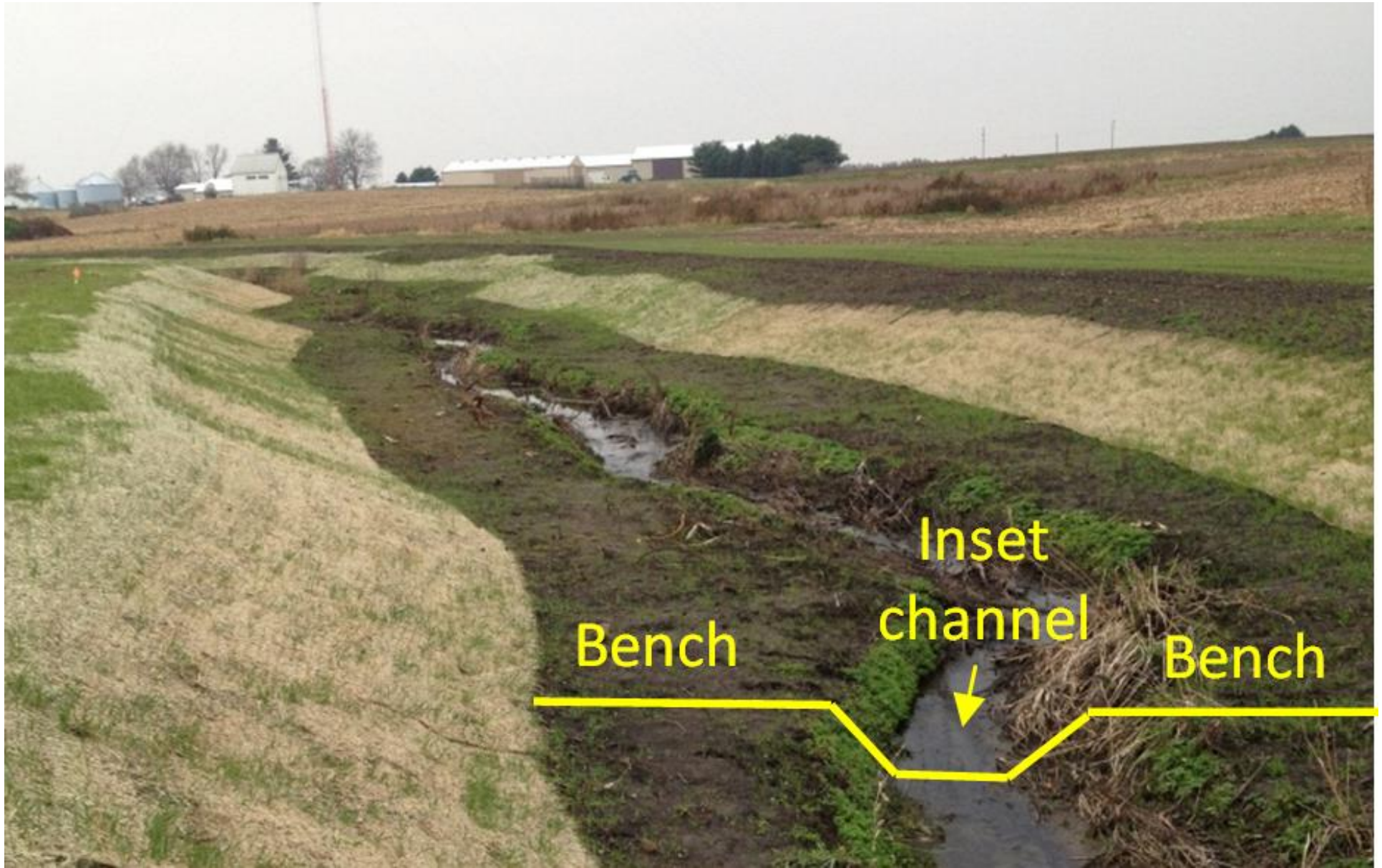


Image: Wikimedia Commons, Wilsonbriggs

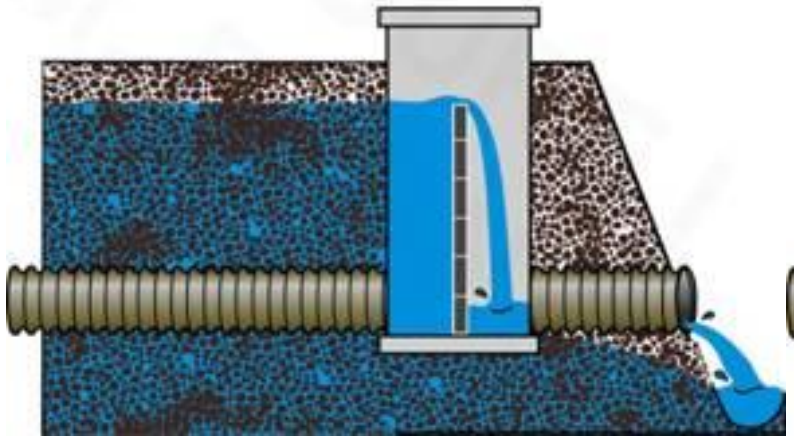
Image: NRCS

Storing water in wider ditches:
Two-Stage Ditches

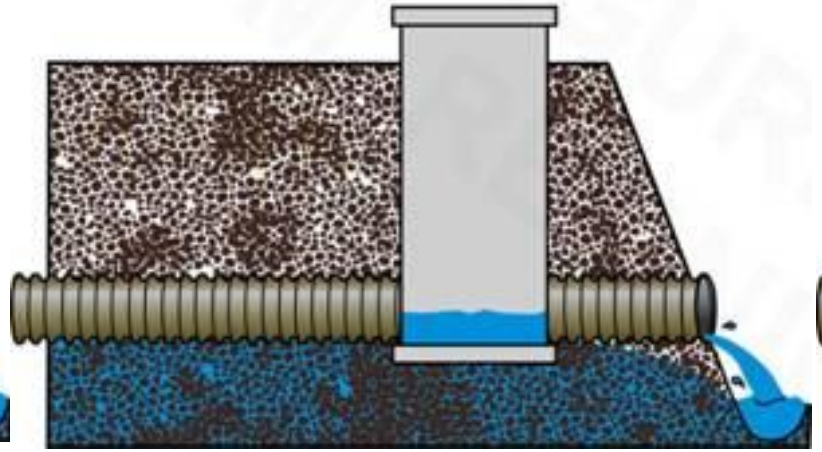


Storing water in the field:
Controlled drainage

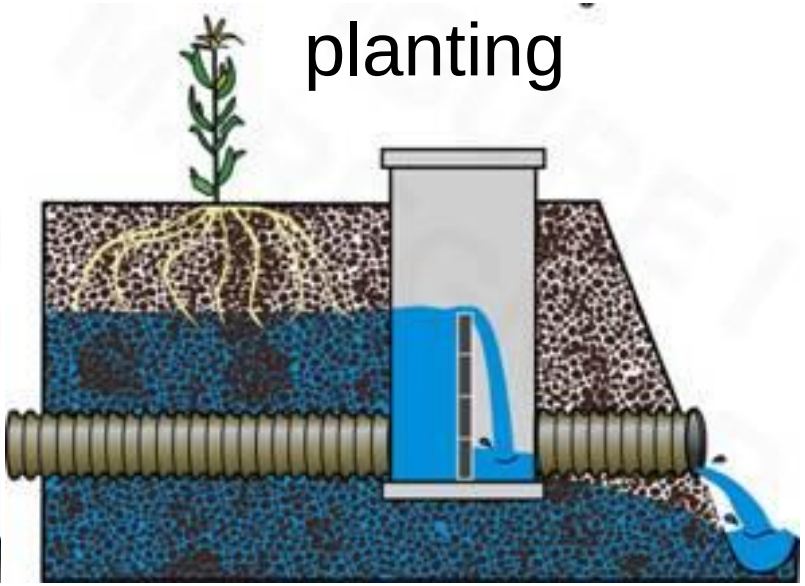
After harvest



Before planting or harvest



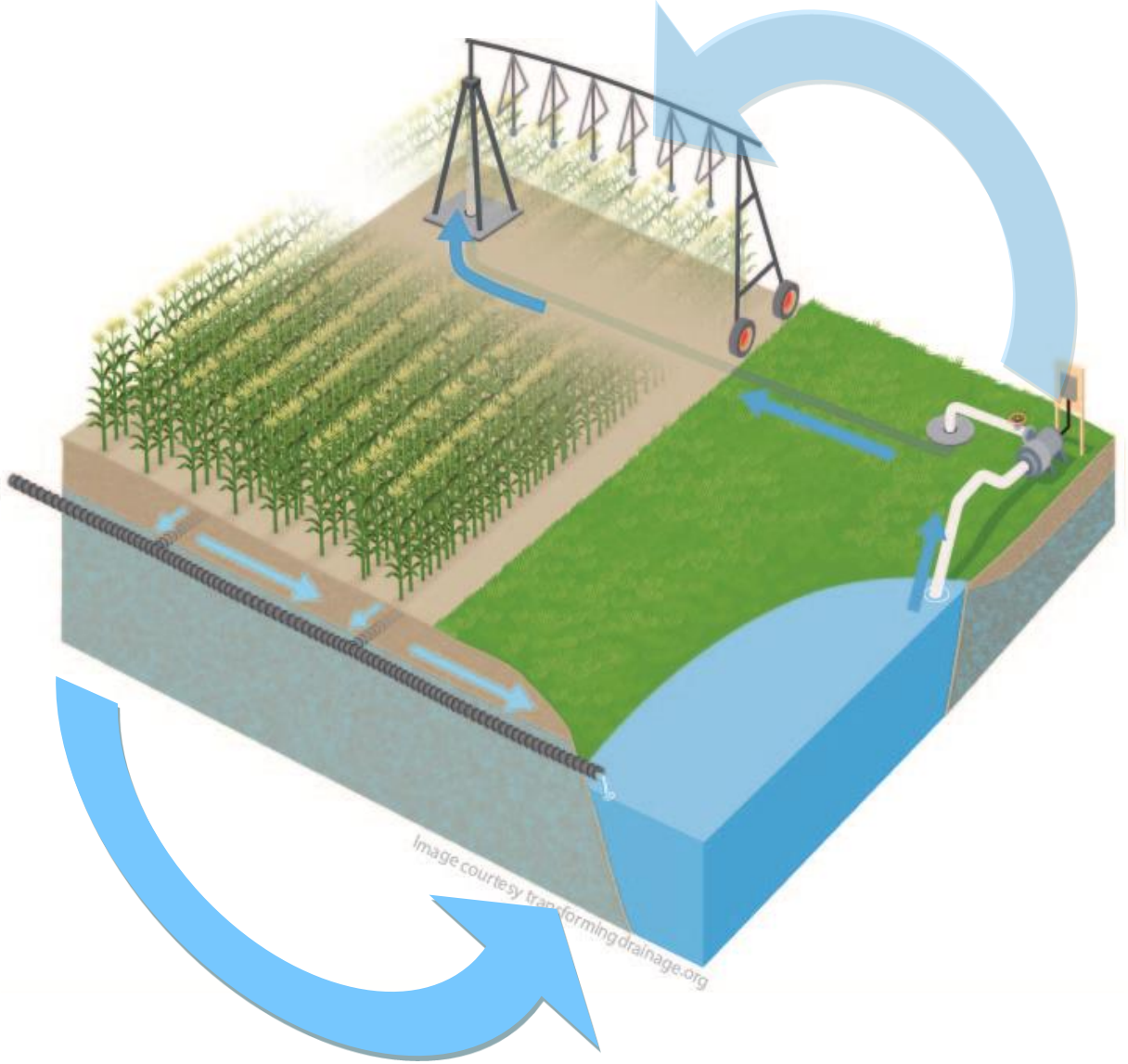
After planting



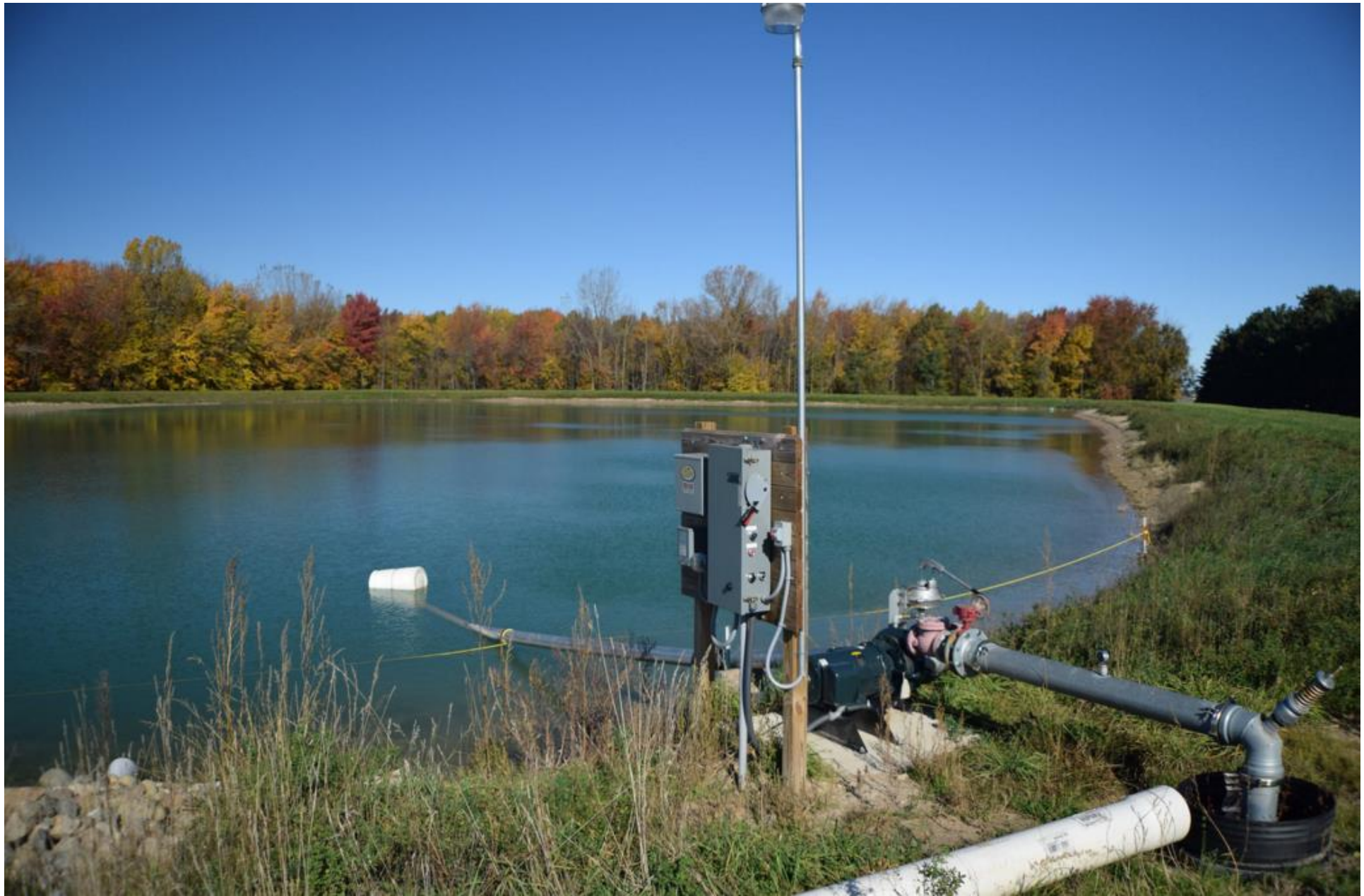
Storing water in ponds or reservoirs:
Drainage water recycling

Store drained water in a pond

and irrigate it back onto crops later in the season



An old idea being revived and made part of the conversation



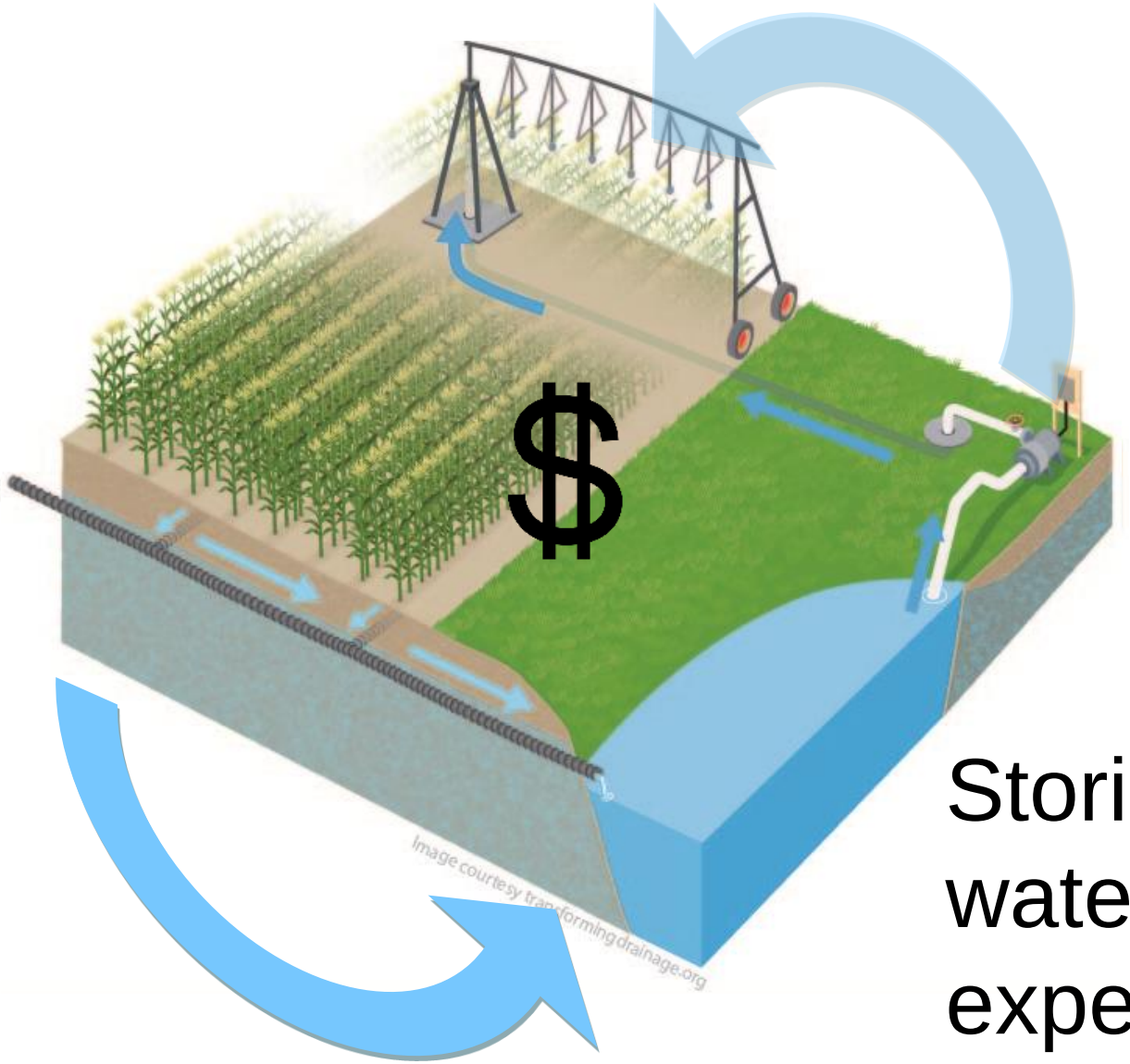
Reservoirs will need to be **large.**

Drainage water recycling

stores drained water in a pond

and irrigates it back onto crops later in the season

But there is a major challenge.



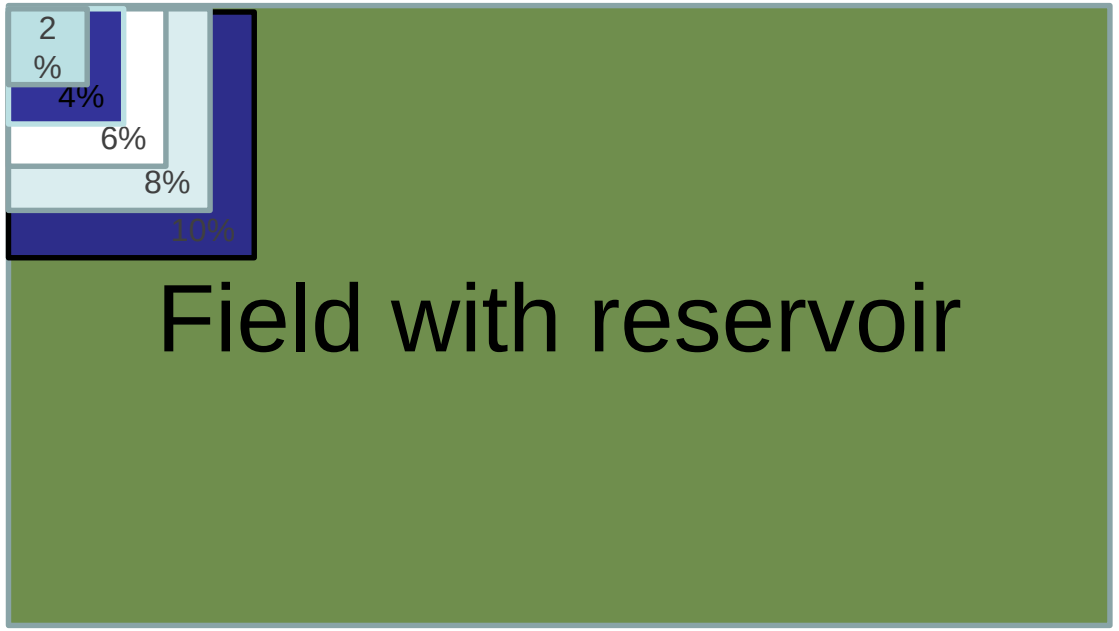
Storing water is expensive!

Drainage water recycling ponds in Michigan

Key design/research question:

How big should the water storage reservoir be?

Trying various sizes of Storage Reservoir



2% of field area

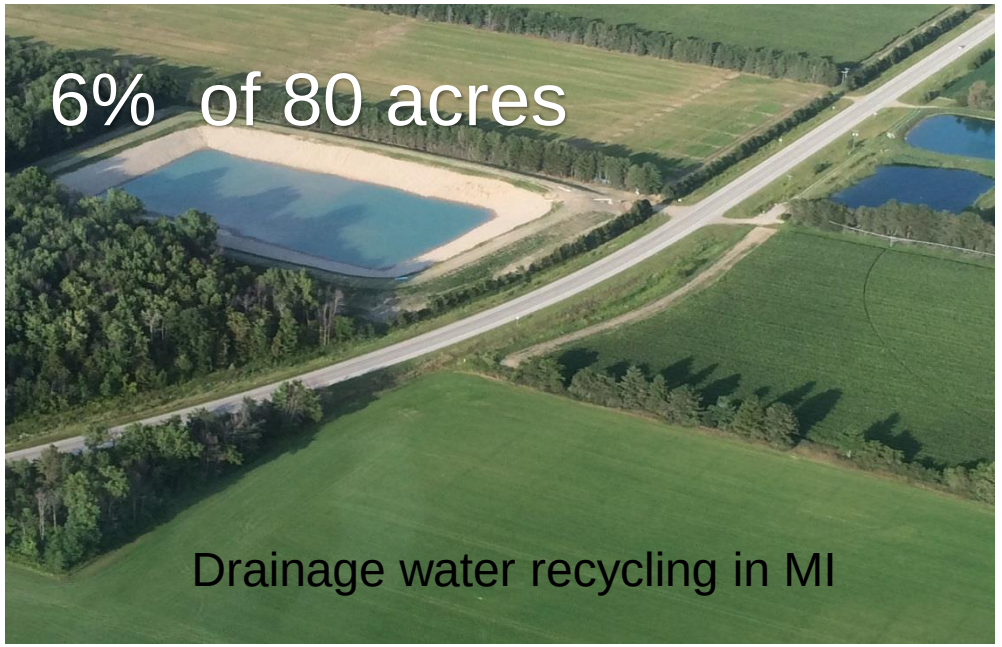
4% of field area

6% of field area

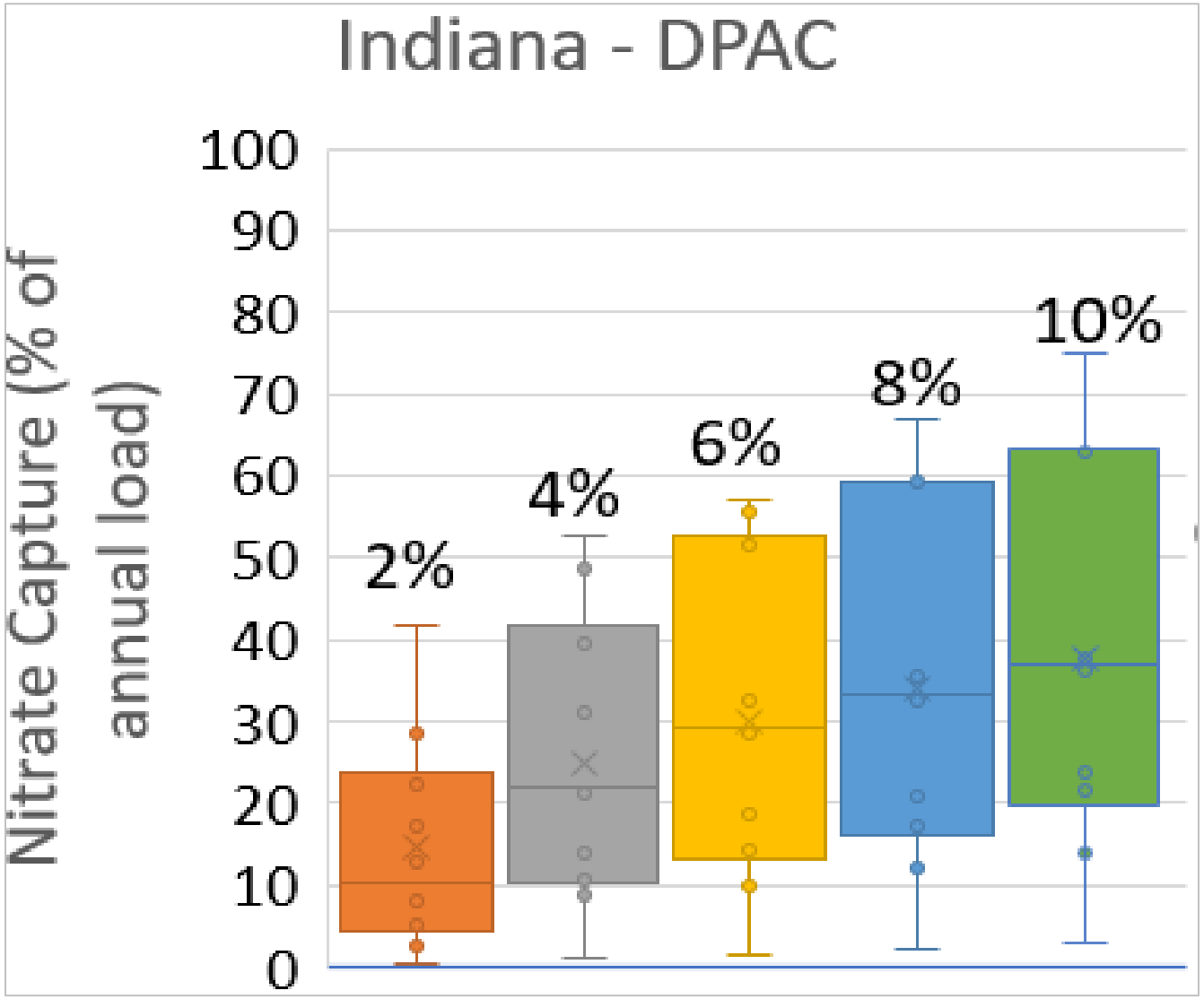
8% of field area

10% of field area

Avg. Depth: 10 feet



Percent of Annual Nitrate Loss Recycled (%)



The Evaluating Drainage Water Recycling Decisions (EDWRD) tool is available at

http://transformingdrainage.org/tools/EDWRD

Inputs and Results | Regional Results | Provide Feedback | About This Tool

Drainage Flow into the Water Storage

Drained Area: 160 acres

Include Surface Runoff

For drain flow, there are two options:

Upload .csv file with daily values of date, precipitation, drainflow, surface runoff, evaporation, and crop ET

Browse...

Select a location and use 30-year model estimates

Water Storage Size and Initial Depth

Smallest Water Storage Volume: 0 acre-feet

Largest Water Storage Volume: 100 acre-feet

Water Storage Volume Increment: 10 acre-feet

Avg. Water Storage Depth: 10 feet

Depth of Water on First Day of Simulation: 10 feet

Irrigation

Irrigation Area: 80 acres

Irrigation Depth Applied at One Time: 1 inches

Maximum Soil Moisture Content: 10 inches

Available Water Capacity: 5 inches

Submit

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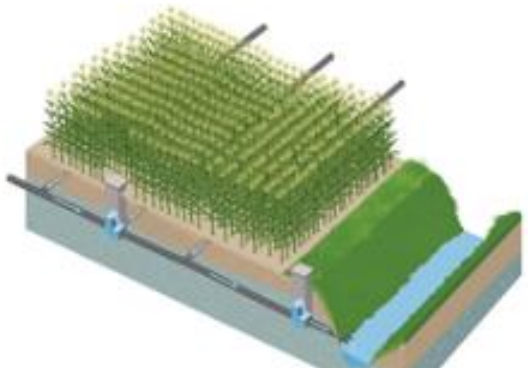
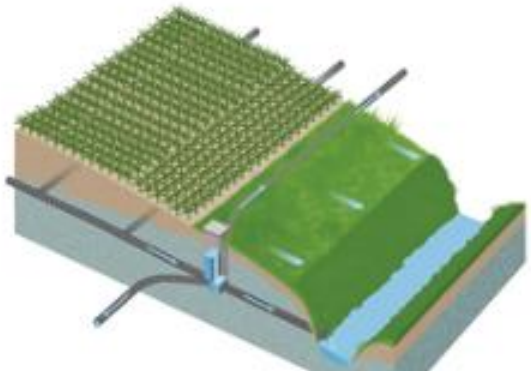
A new 8-page publication provides a broad overview of the benefits, costs and other common questions related to drainage water recycling systems. ...

Continue Reading...

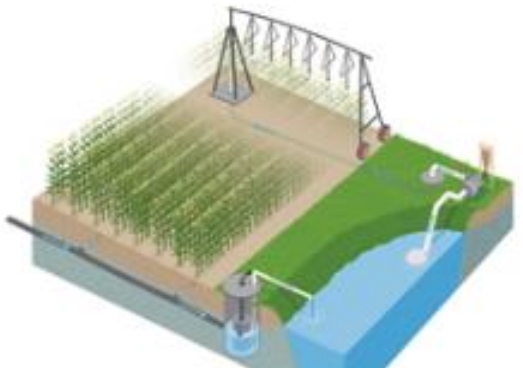
CONTROLLED DRAINAGE



SATURATED BUFFERS



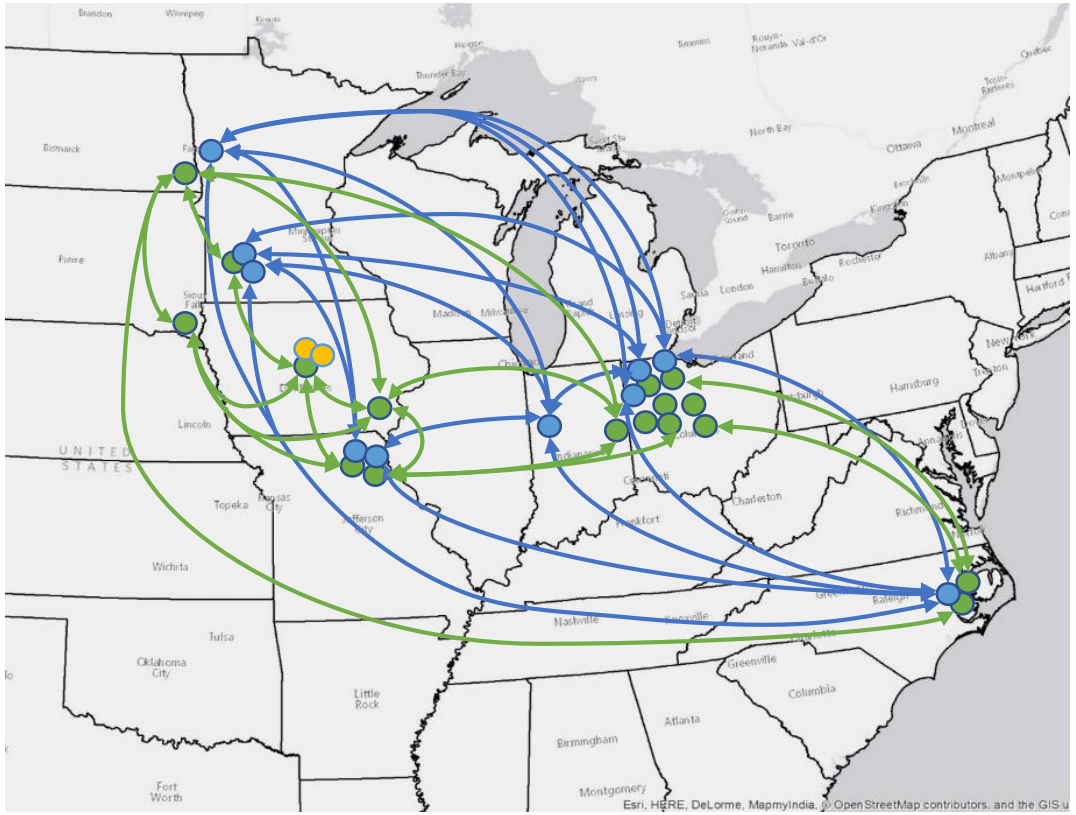
DRAINAGE WATER RECYCLING



Transforming Drainage Project

TRANSFORMING DRAINAGE.ORG

Managing Water for Tomorrow's Agriculture



Purdue University

The Ohio State University

NC State University

University of Minnesota

NDSU North Dakota State University

Iowa State University

USDA United States Department of Agriculture

South Dakota State University

University of Missouri

Iowa Soybean Association

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-68007-23193, "Managing Water for Increased Resiliency of Drained Agricultural Landscapes.

The Vision: Transforming Drainage

Long-term vision:

The process of designing and implementing agricultural drainage will be **transformed** to include water **storage** and even water **recycling**.

Photo from Dan Jaynes