A Complex Wetland Delineation Case Study in Minnesota, USA

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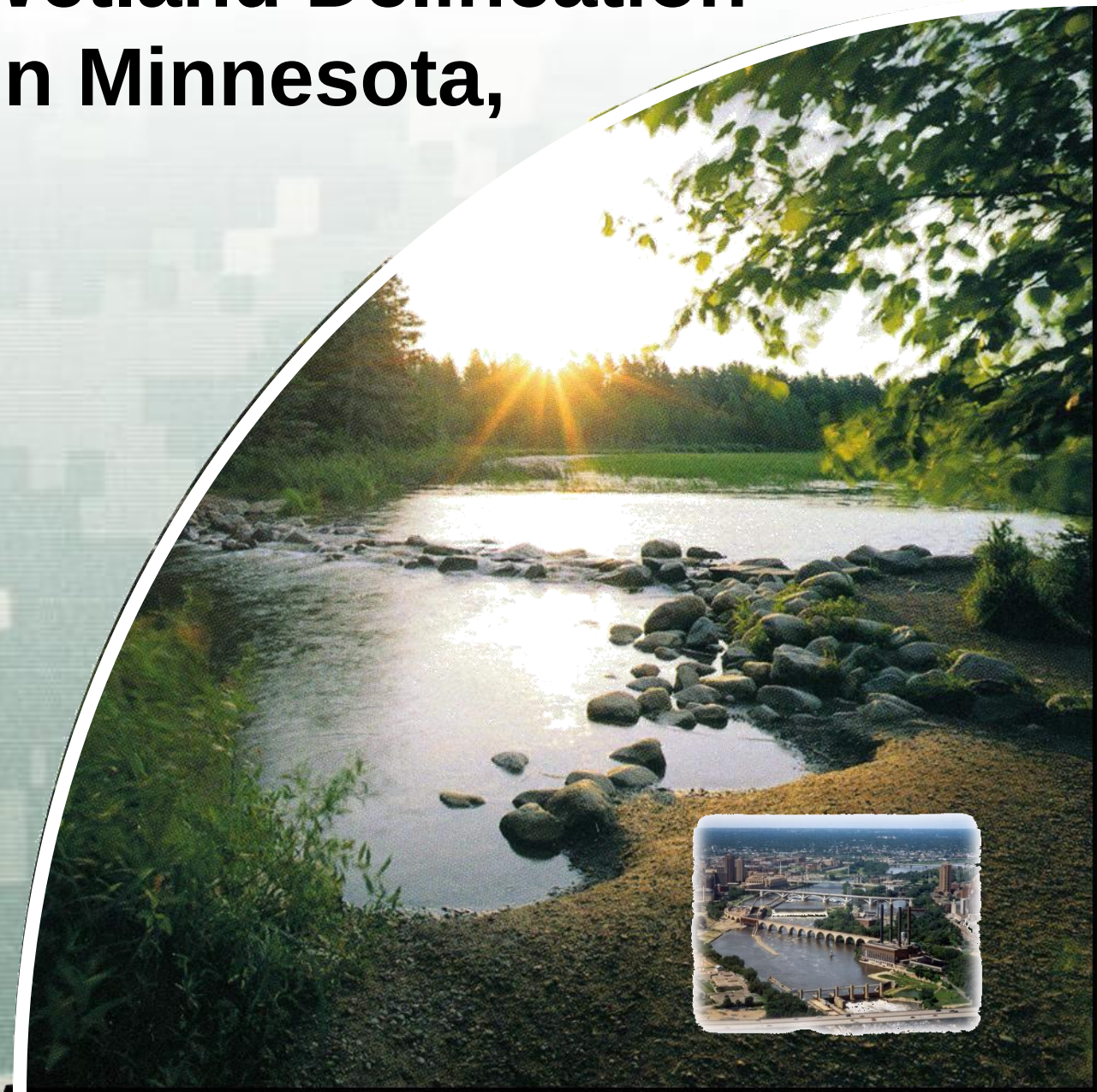

US Army Corps of Engineers
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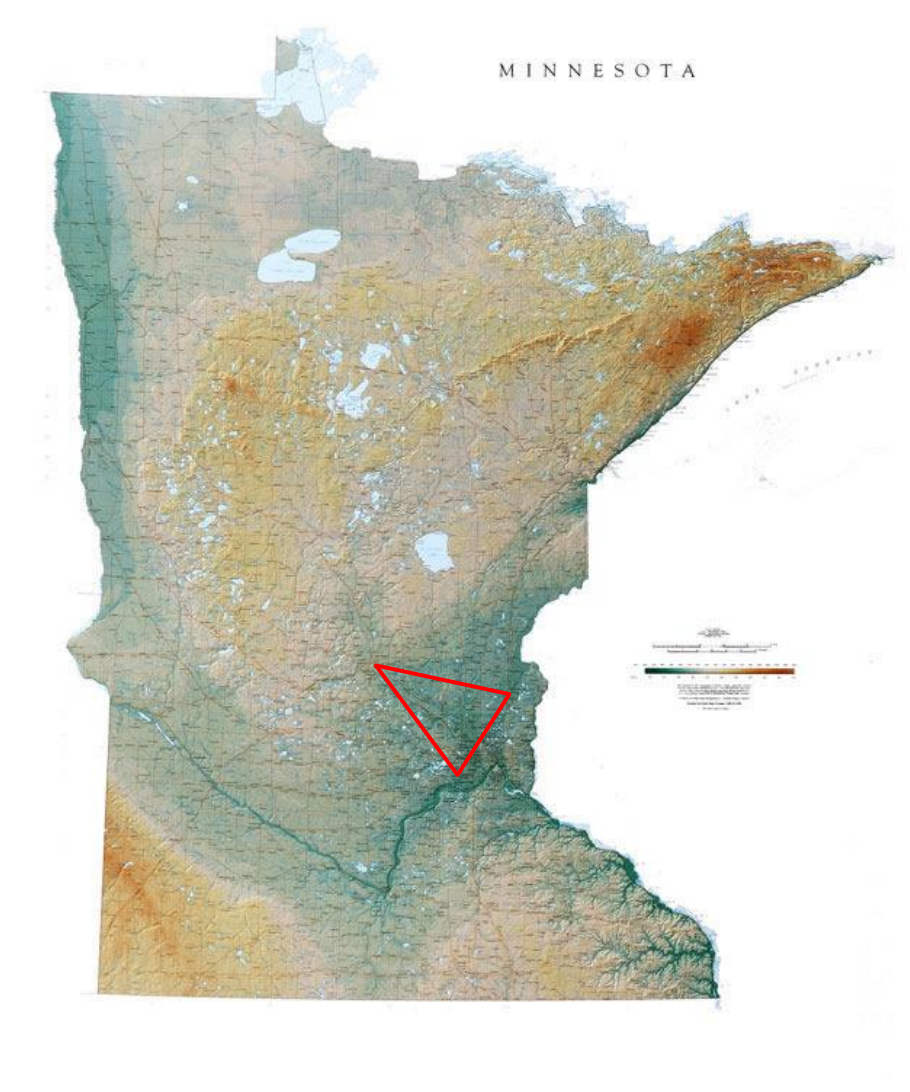
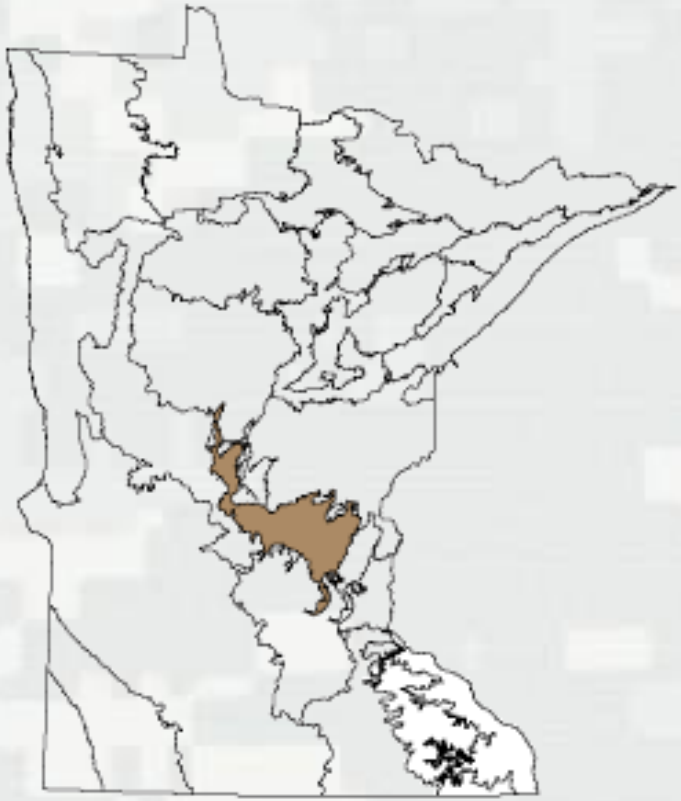
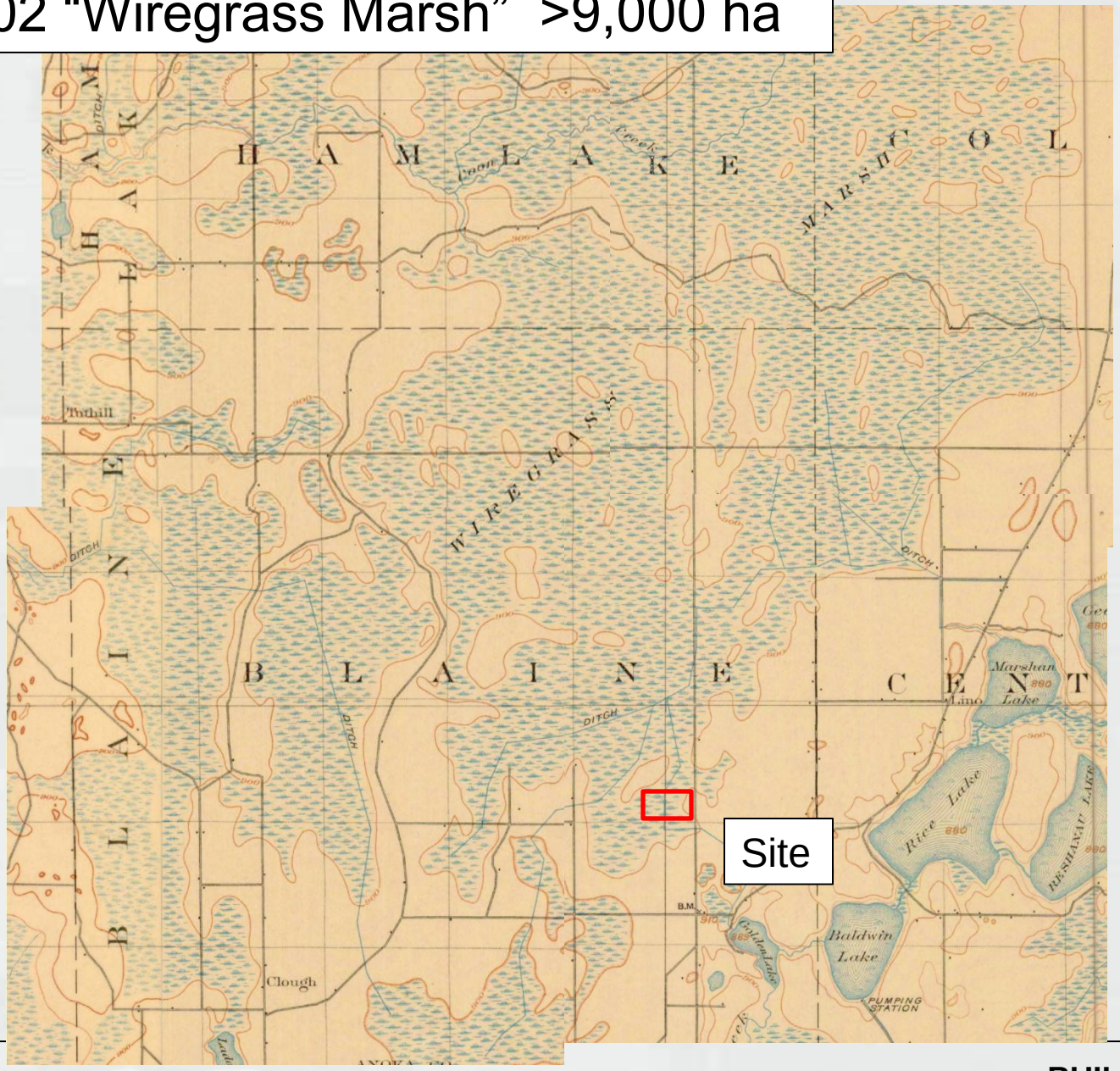
Anoka Sand Plain





Sandy, Glacial Lake Plain

1902 “Wiregrass Marsh” >9,000 ha



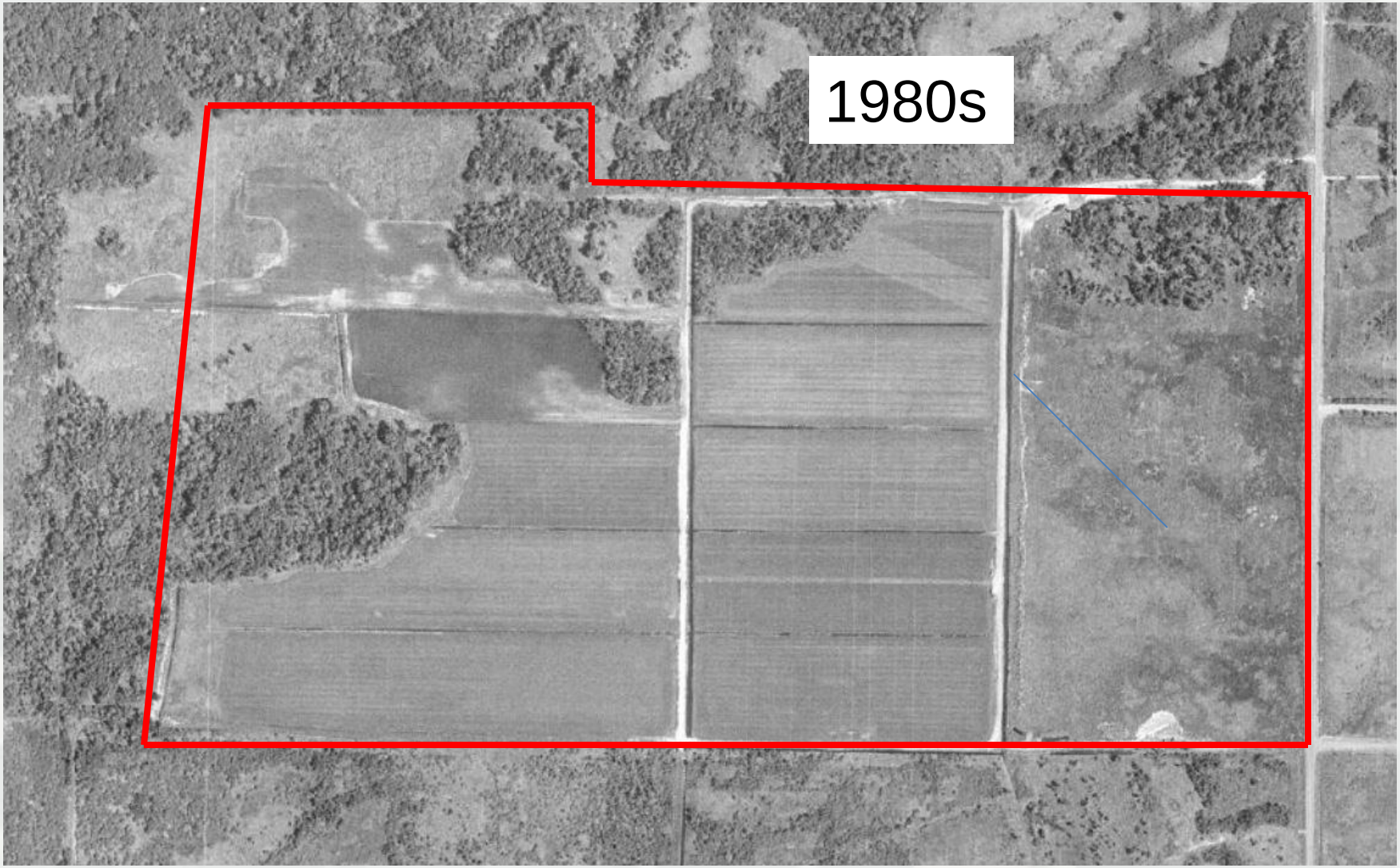
Pre-Disturbance Condition

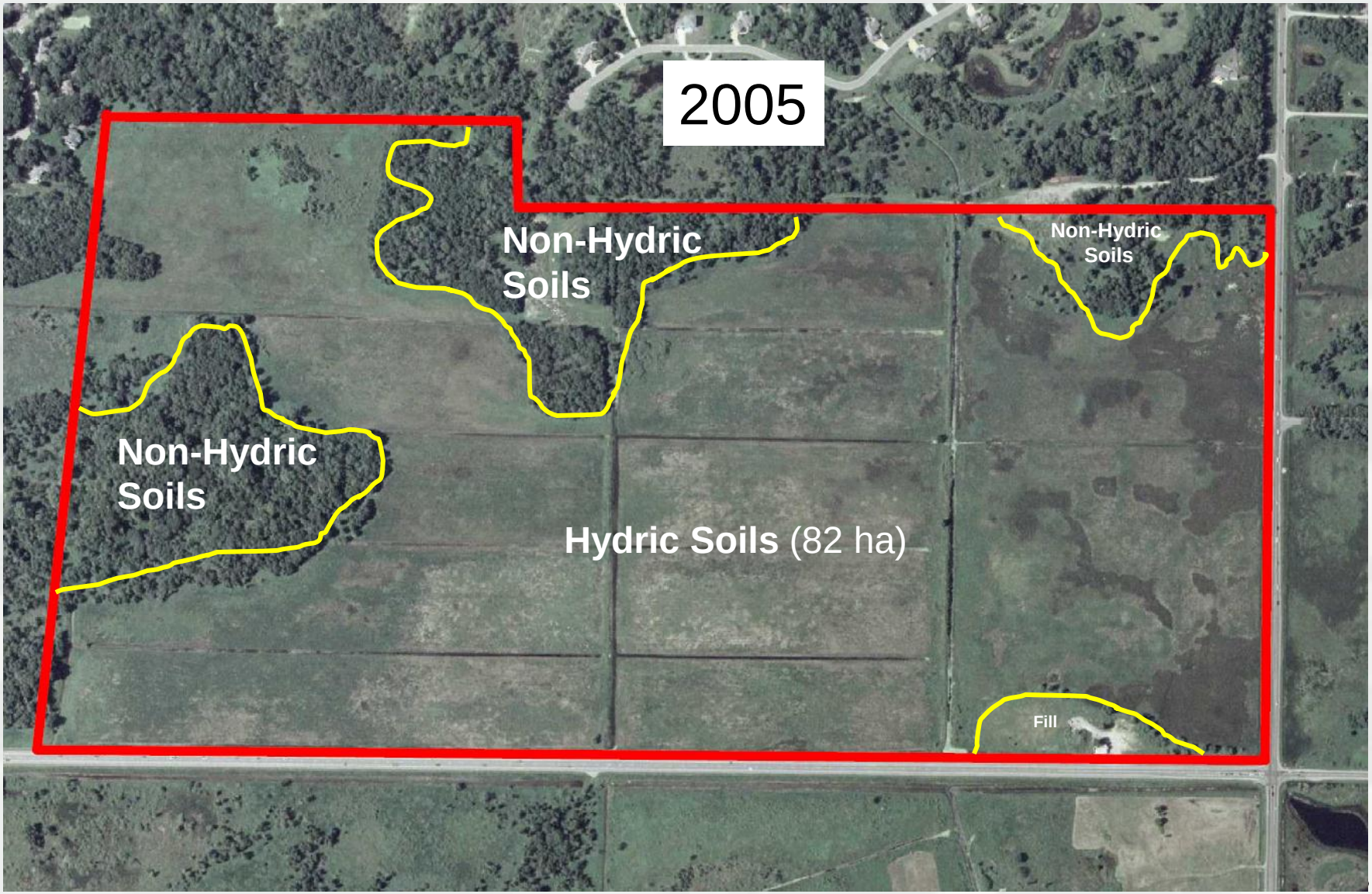
Carex lasiocarpa

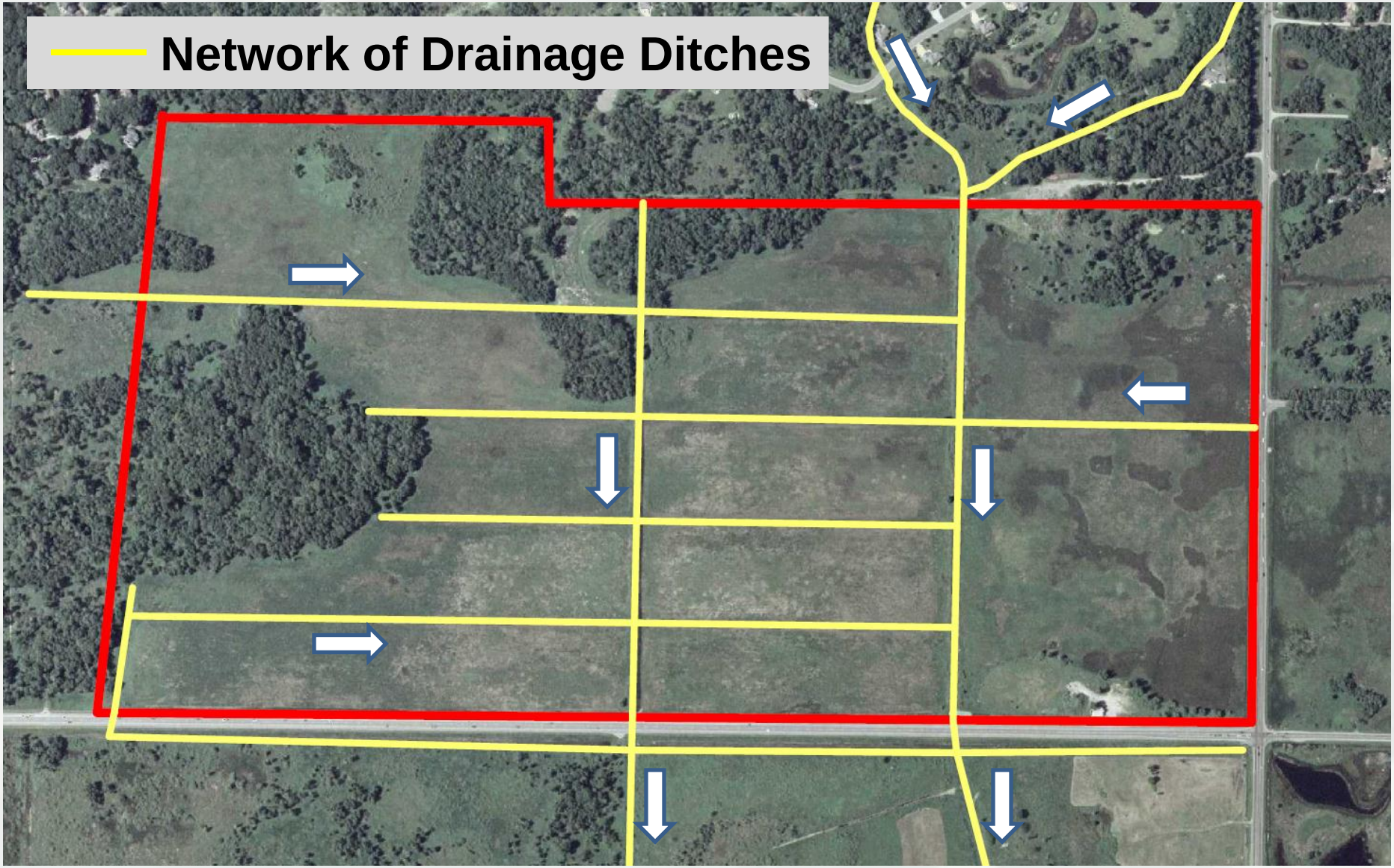
Wire-Grass Marsh

- Original land survey (mid-1800s) described delineation site as a “floating marsh”
- Ditching began in late 1800s
- Ditches effective in removing ponding – no more “floating marsh”


1960s
Approx. 125 ha
Public Ditch


1980s


2005
Non-Hydric Soils
Non-Hydric Soils
Non-Hydric Soils
Hydric Soils (82 ha)
Fill


Network of Drainage Ditches

Phalaris arundinacea (FACW)
Phragmites australis (FACW)
Typha spp. (OBL)

Site Conditions 2005

Regulatory Purposes

- Delineation involved Federal, state and local regulators as well as several private consulting firms representing landowners
- Determine which areas of the site, if any, meet wetland criteria
- Consensus was that site had hydric soils and was dominated by hydrophytes
- Question was hydrology

Evaluating Disturbed Hydrology

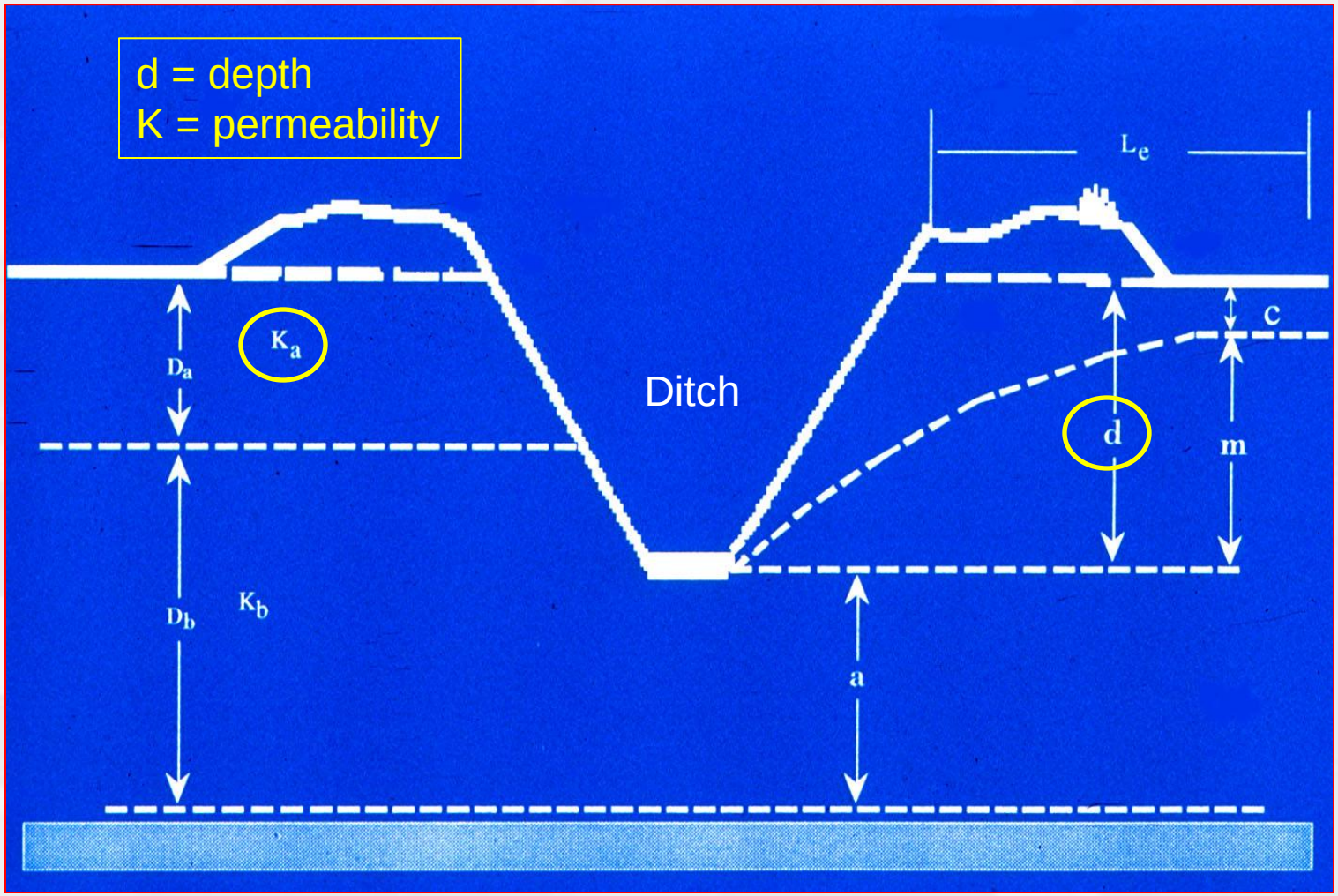
- Drainage equations
- Monitoring well study
- Modeling (e.g., MODFLOW, DRAINMOD)

See USDA Natural Resources Conservation Service. 1997. *Hydrology Tools for Wetland Determination*. Chapter 19, Engineering Field Handbook.

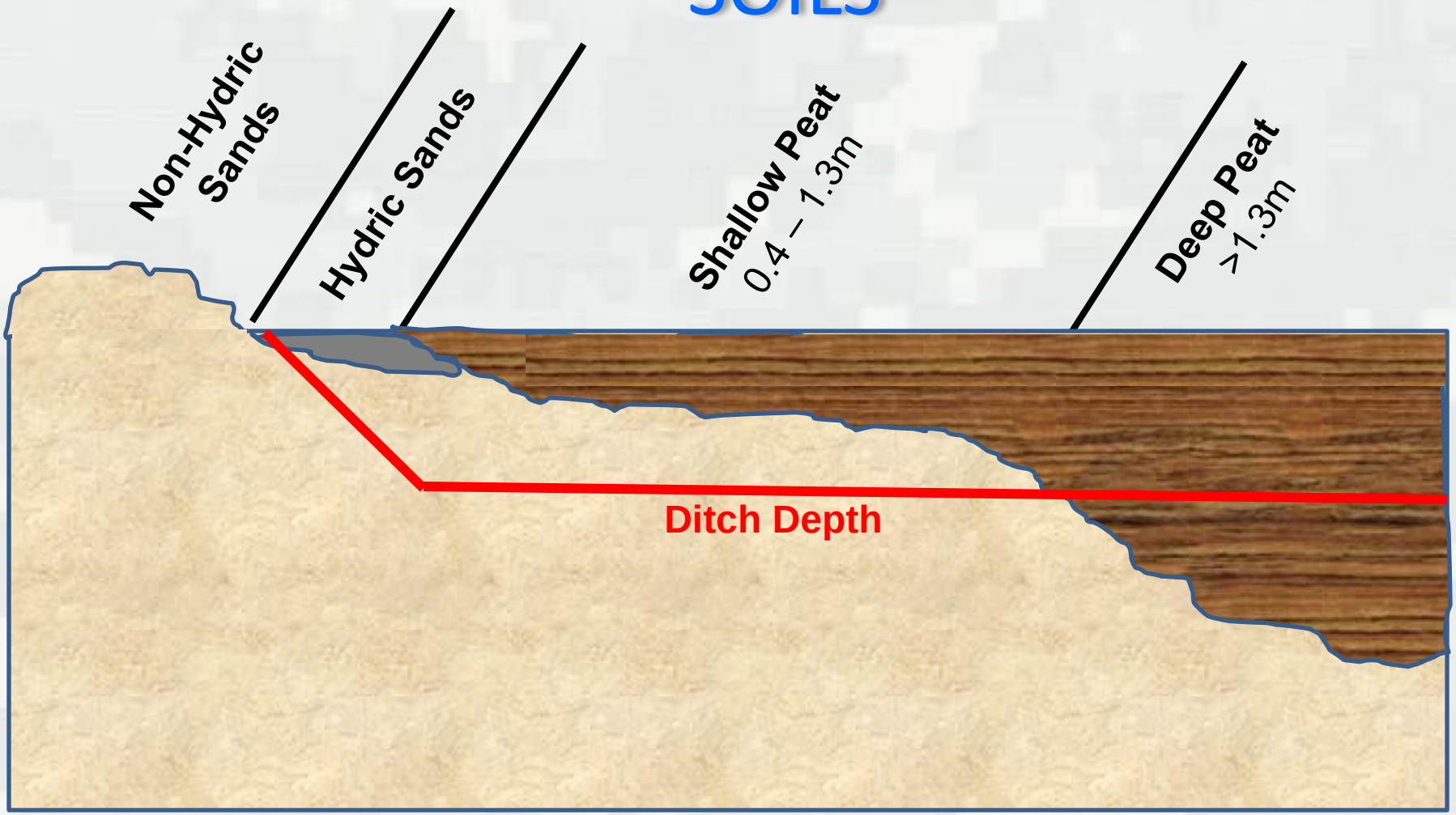
Partially vs. Effectively Drained

Effectively drained means that the wetland hydrology criterion is no longer met: inundation or a water table 30 cm or less below the soil surface for at least 14 consecutive days during the growing season in most years

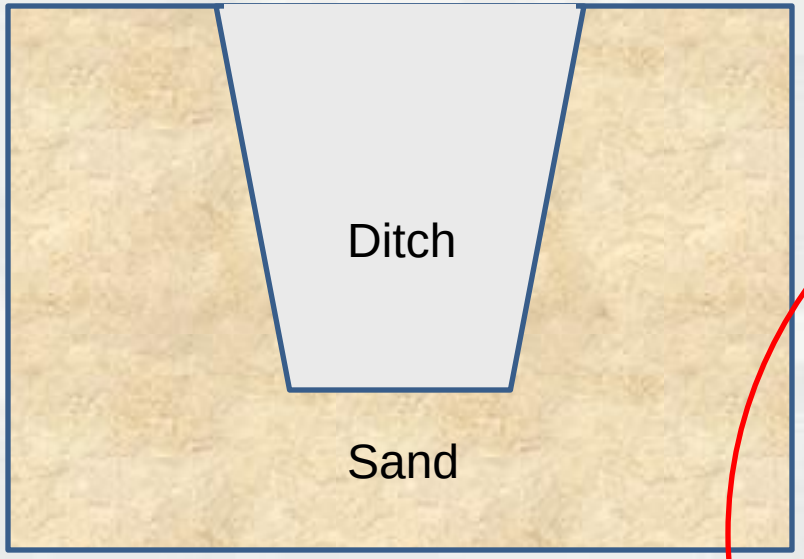
van Schilfgaarde Equation

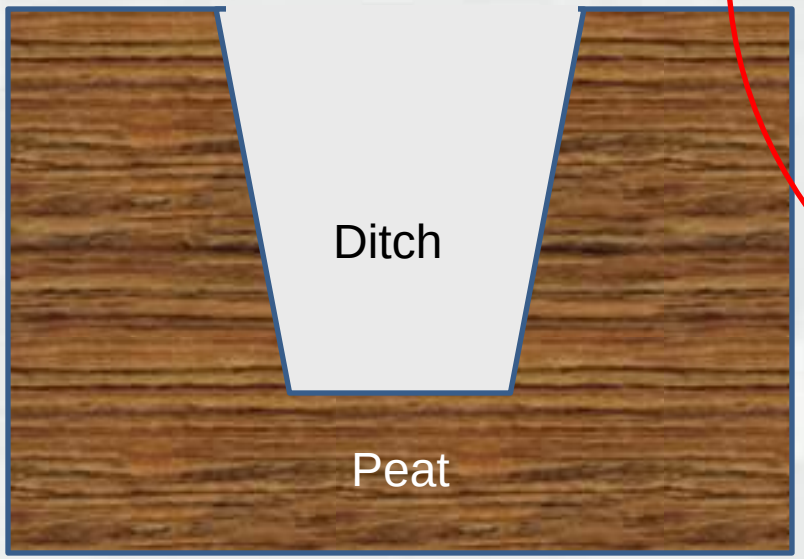


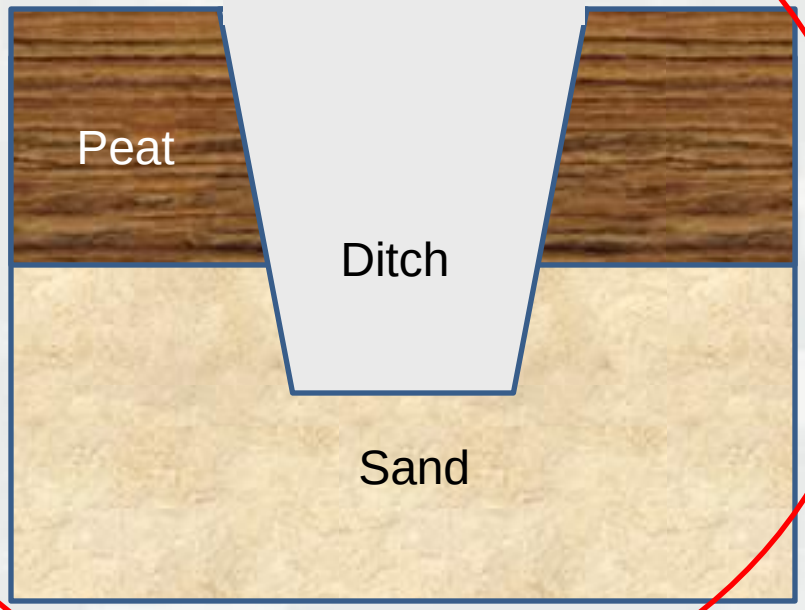
SOILS


Non-Hydric Sands
Hydric Sands
Shallow Peat
0.4 – 1.3m
Deep Peat
>1.3m
Ditch Depth

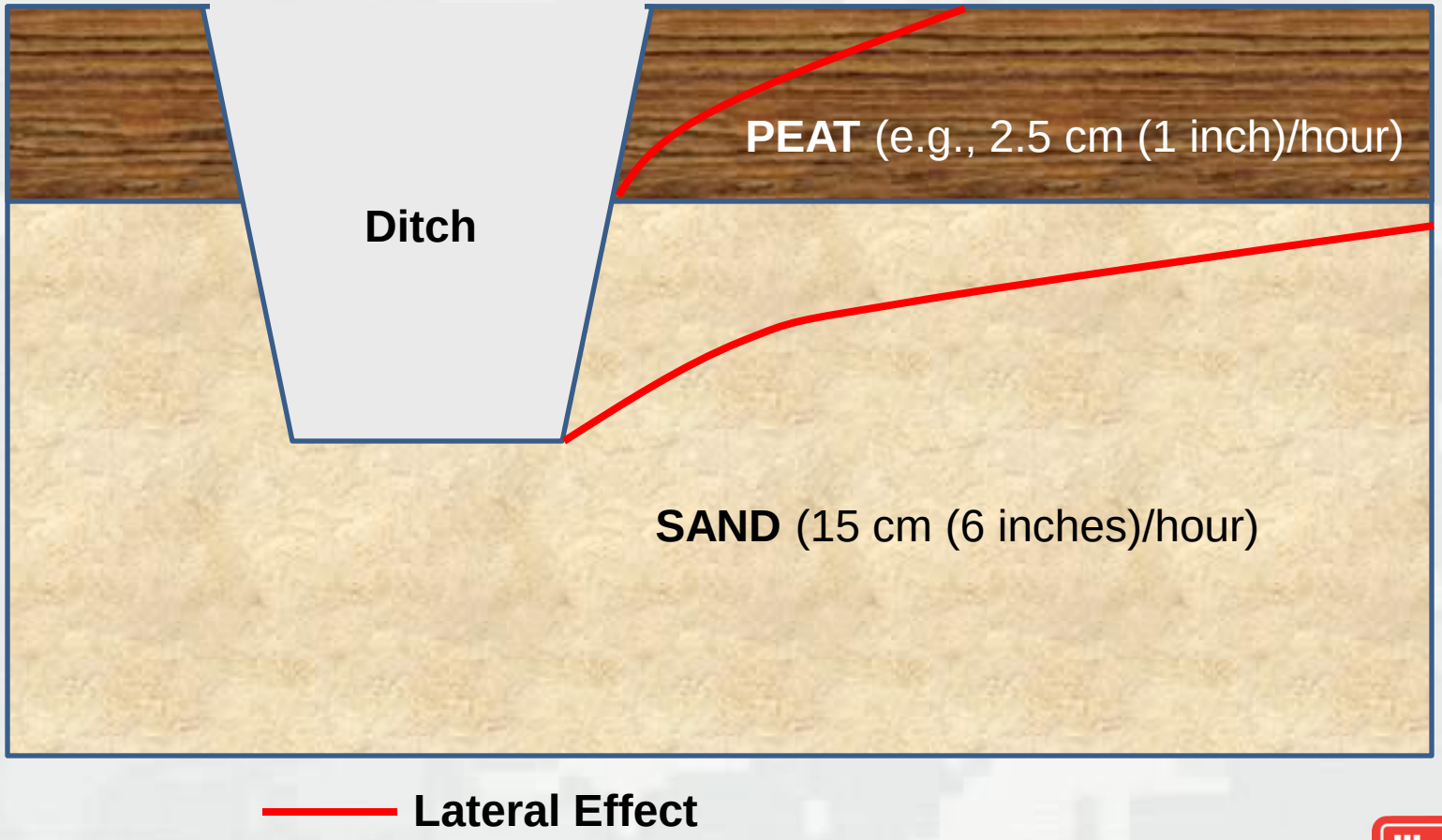
Ditch Cross Sections



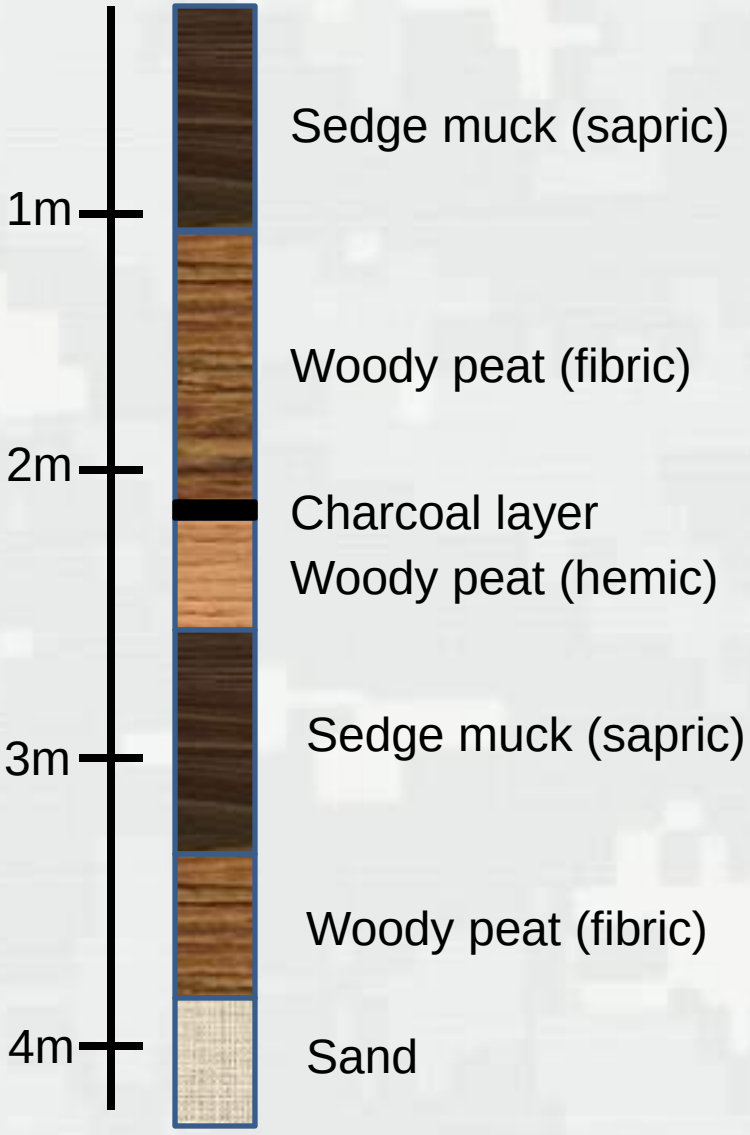




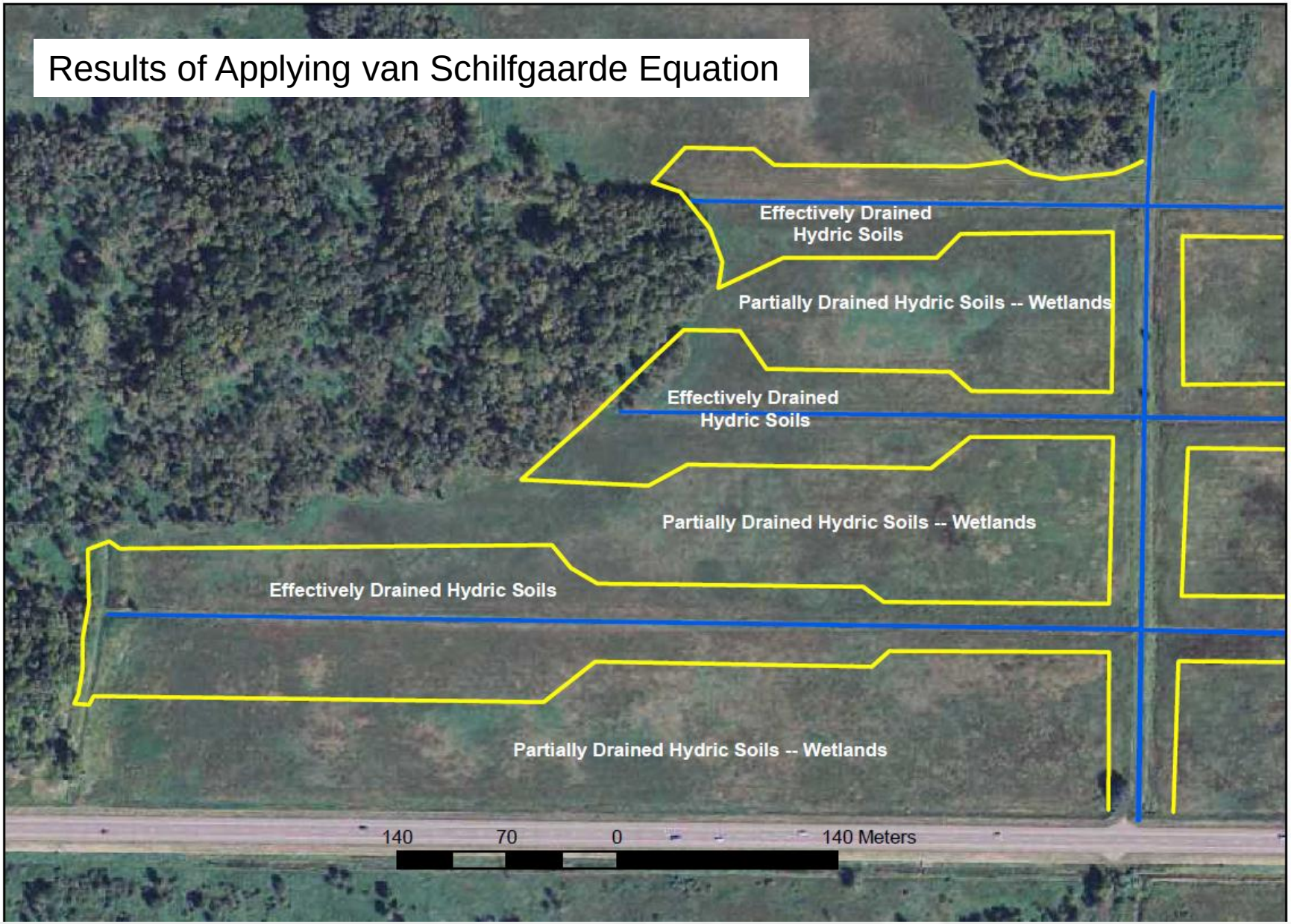
Differential Drainage Effect



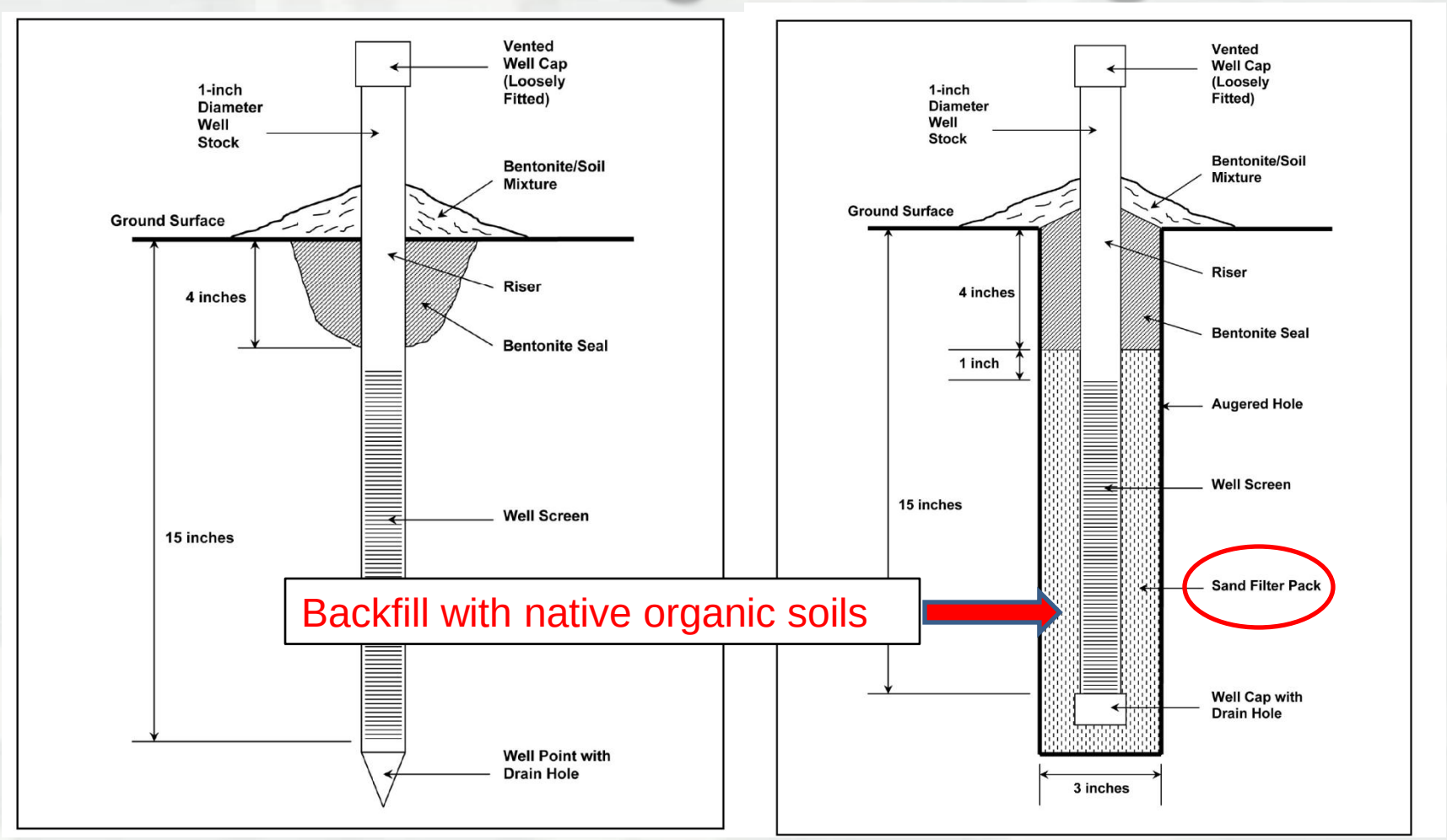
Heterogeneity of Organic Soil Deposits



Results of Applying van Schilfgaarde Equation



Monitoring Well Designs

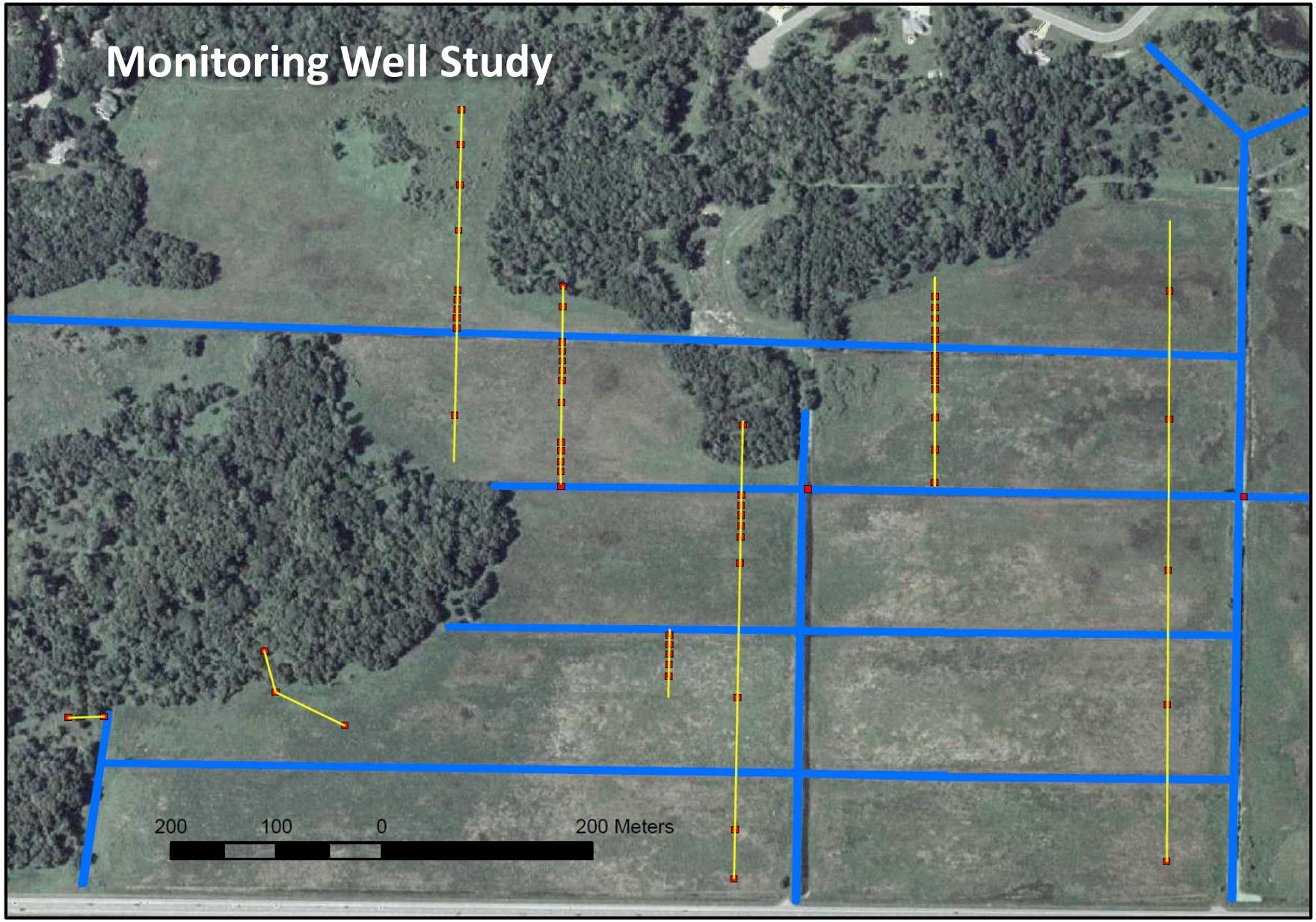


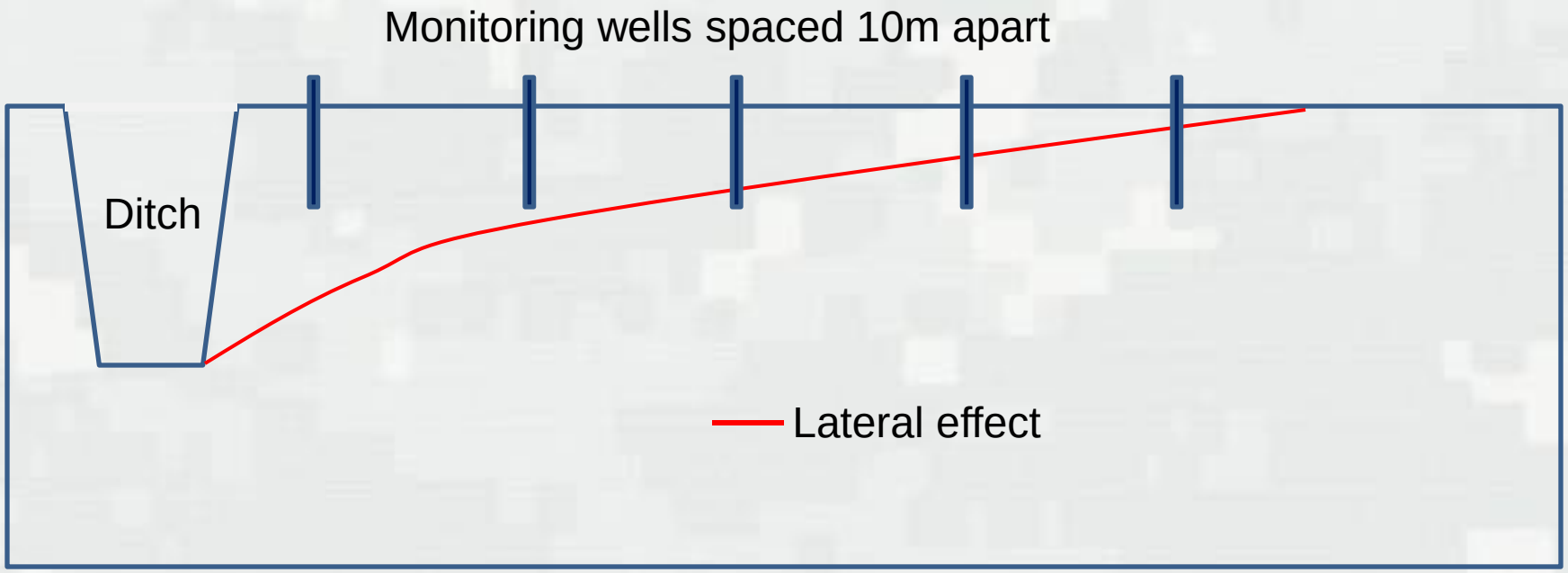
Driven Well

Augered Well

US Army Corps of Engineers. 2005. *Technical Standard for Water-Table Monitoring of Potential Wetland Sites*.

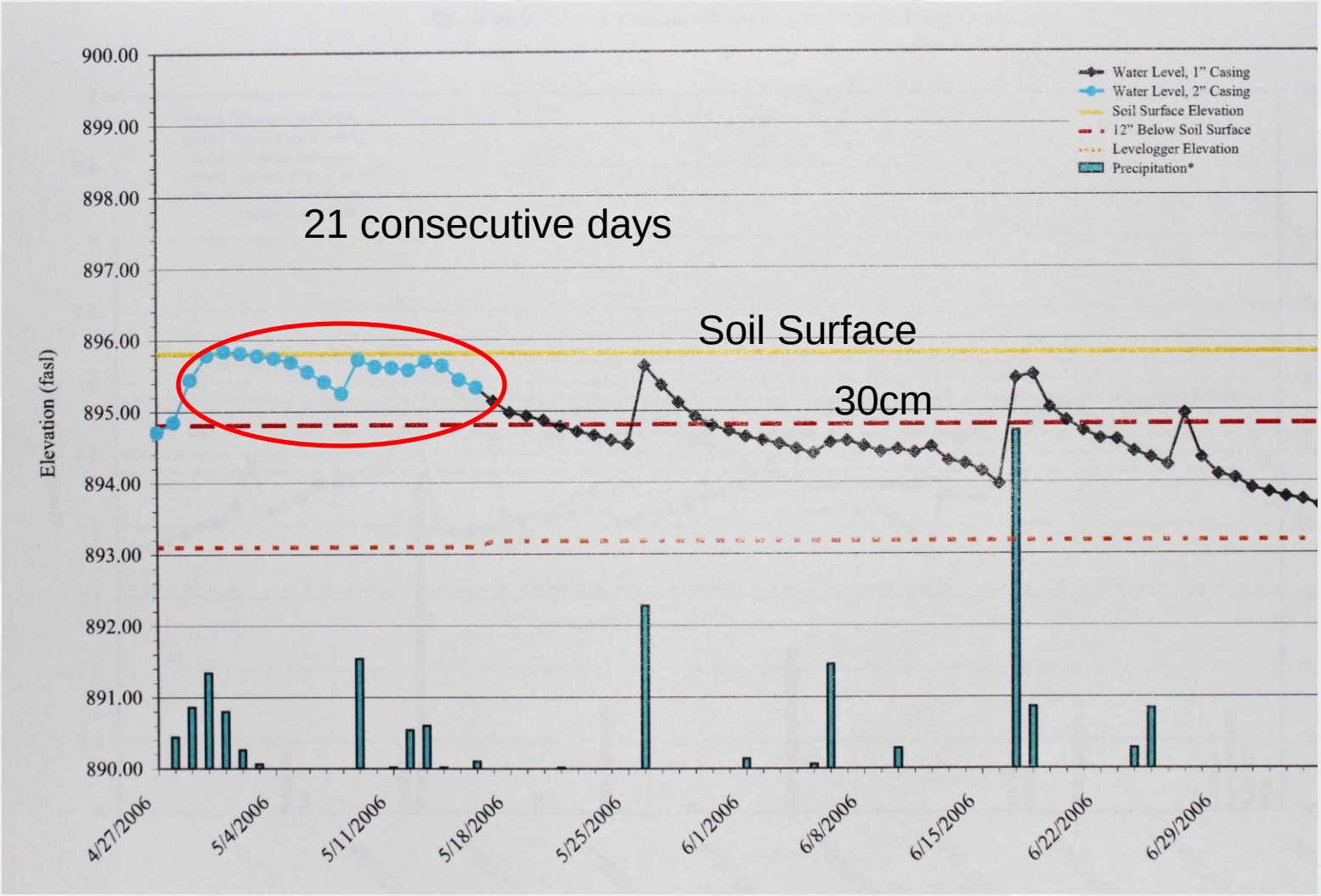
Monitoring Well Study





Transects of closely spaced monitoring wells perpendicular to a ditch can measure actual lateral effect. Data can be used to calibrate drainage equations and/or groundwater models.

Monitoring Well Data



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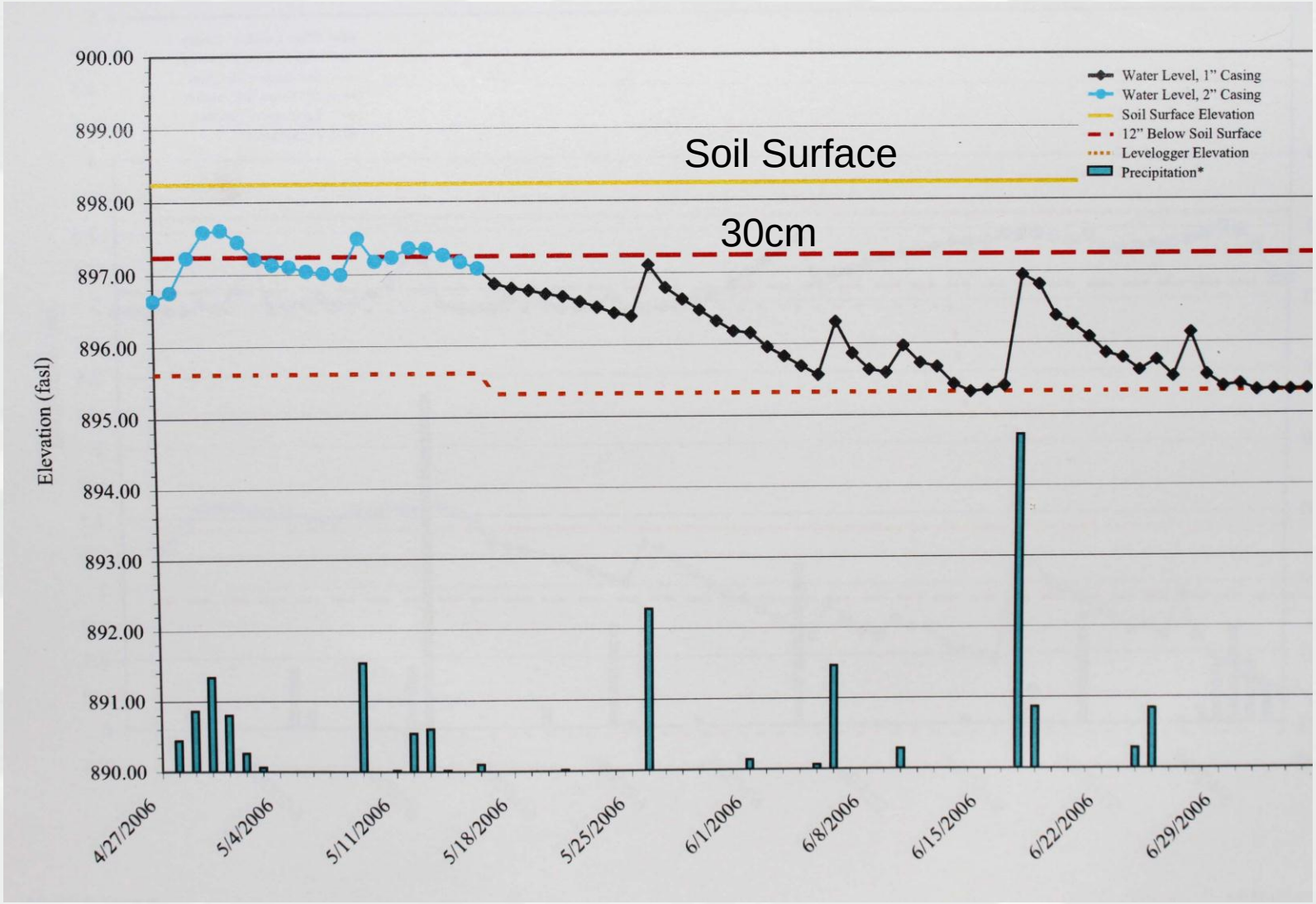

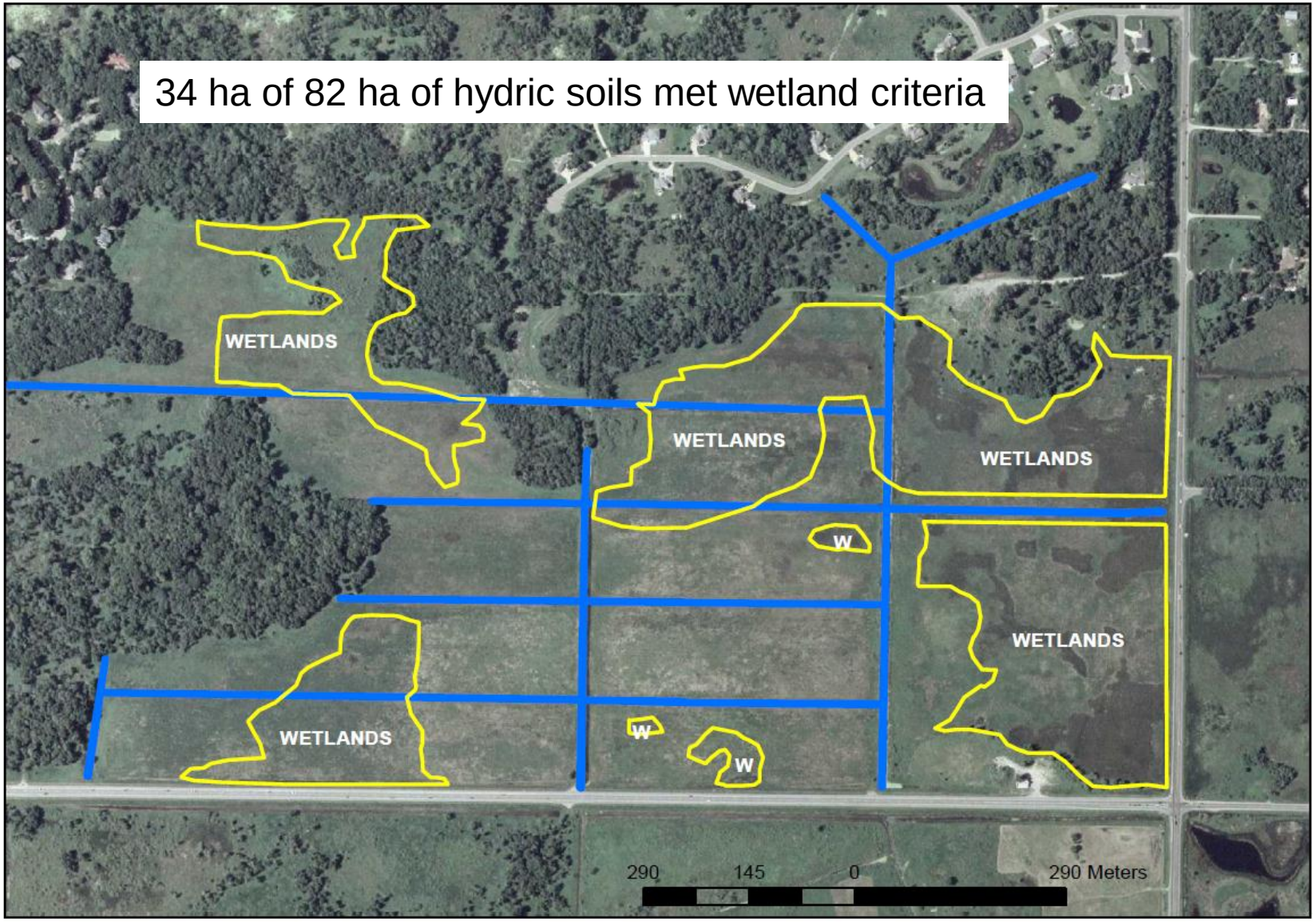

Final Wetland Delineation

Conclusion

- In this case of organic soils, the van Schilfgaarde equation did not work well for estimating scope and effect of ditches
- The monitoring well study provided the most reliable data although very short-term data was collected (<3 years)
- Regulators , consultants and landowners reached concurrence on the delineation