

Using Drainage Water Management to Mitigate Flood Potential

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Fargo-Moorhead Diversion Conference

August 19, 2024

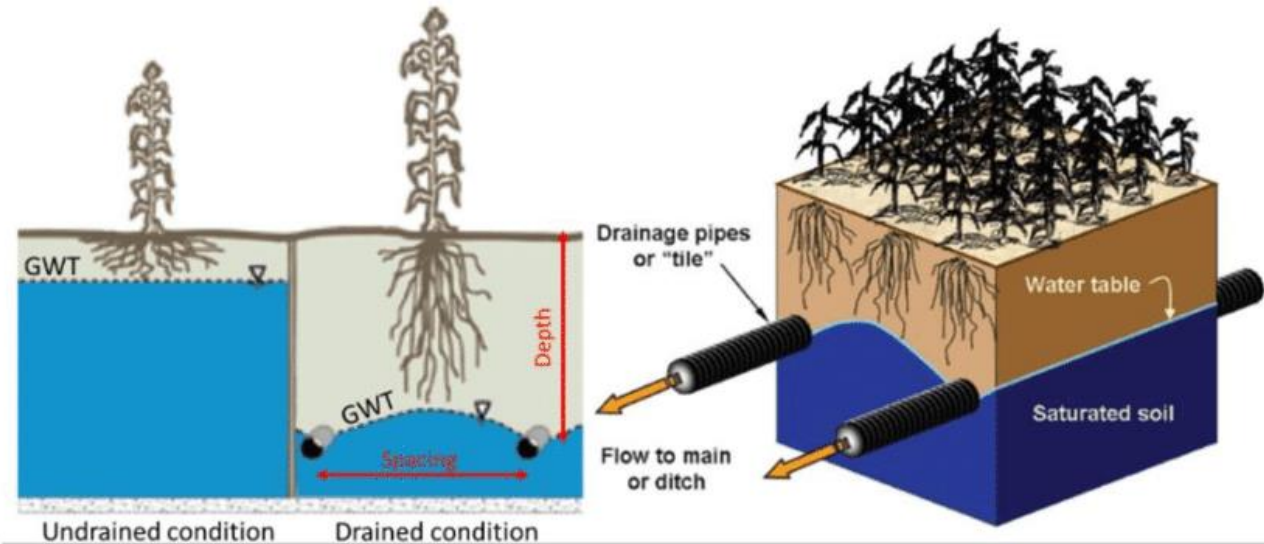
Drainage

Drainage: Process of removing surface or subsurface water from a soil profile or area (ASABE, 2019).

Subsurface drainage (tile drainage): Subsurface conduits used primarily to remove subsurface water from soil.



(Source: <http://www.vantage-ssa.com/>)



Drainage Water Management

Drainage water management (DWM) is the process of managing the timing and the amount of water discharged from agricultural drainage systems.

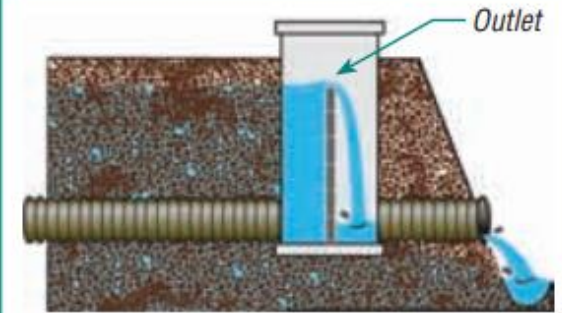


Figure 1. The outlet is raised after harvest to reduce nitrate delivery.

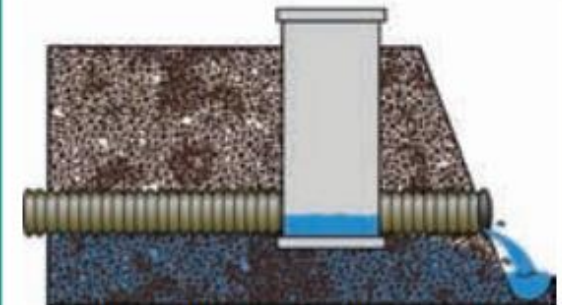


Figure 2. The outlet is lowered a few weeks before planting and harvest to allow the field to drain more fully.

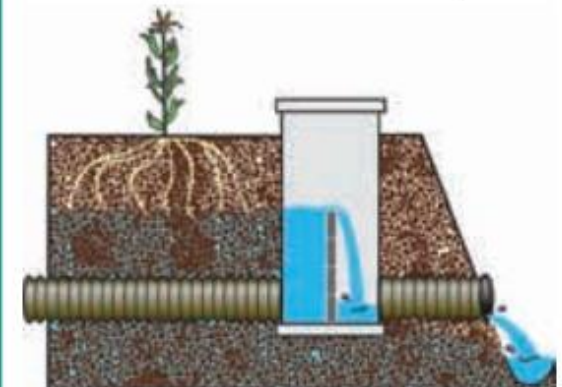
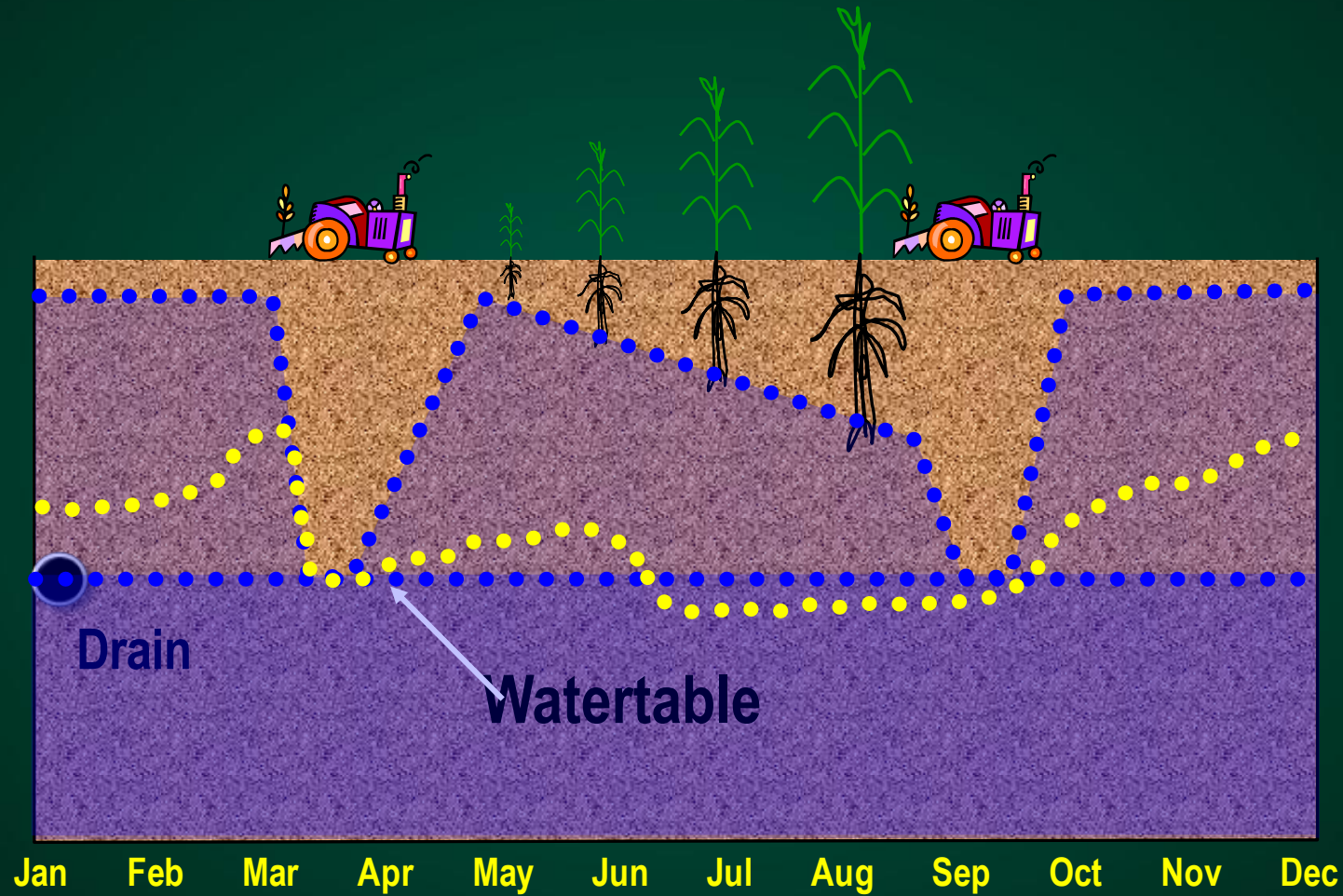


Figure 3. The outlet is raised after planting to potentially store water for crops.

Seasonal Drainage Management



Drainage Water Management – CPS 554

DEFINITION -

The process of managing the drainage volume and water table elevation by regulating the flow from a surface or subsurface agricultural drainage system.

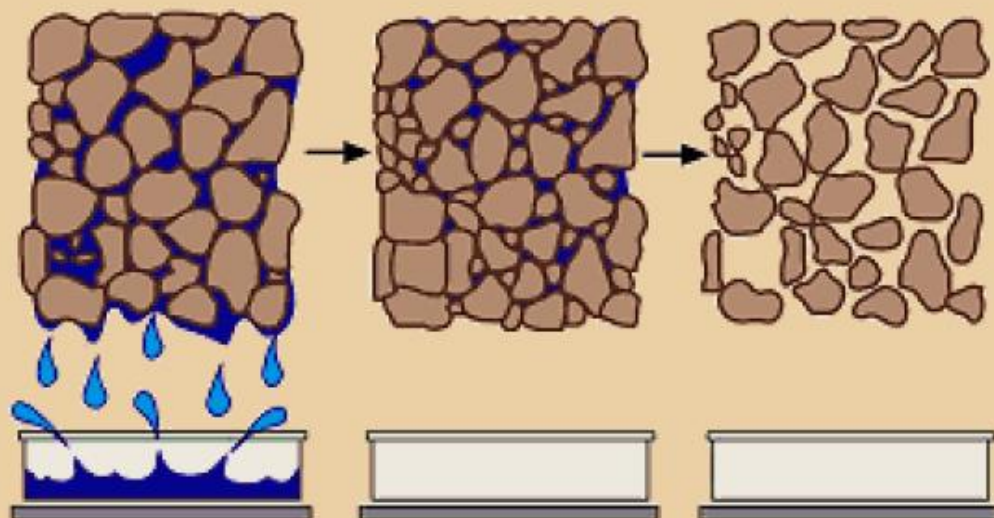
PURPOSE -

- Reduce nutrient, pathogen, and pesticide loading from drainage systems into downstream receiving waters.
- Improve productivity, health, and vigor of plants.
- Reduce oxidation of organic matter in soils.

Does NOT apply to snowmelt runoff whether it is Gravity outlet or sump pumped outlet



Soil Water Concepts



Saturation

All pores are full of water. Gravitational water is lost

Field Capacity

Available water for plant growth

Wilting Point

No more water is available to plants

- Agronomic concepts:
 - Field Capacity (FC)
 - Permanent Wilting Point (PWP)
 - Available water holding capacity (AWHC)
 - $AWHC = FC - PWP$
- Not important for drainage!
- Saturation (Sat.)
 - All void space full of water
- Drainable porosity (DP)
 - $DP = Sat. - FC$
- Tile drainage does not remove “agronomic” water

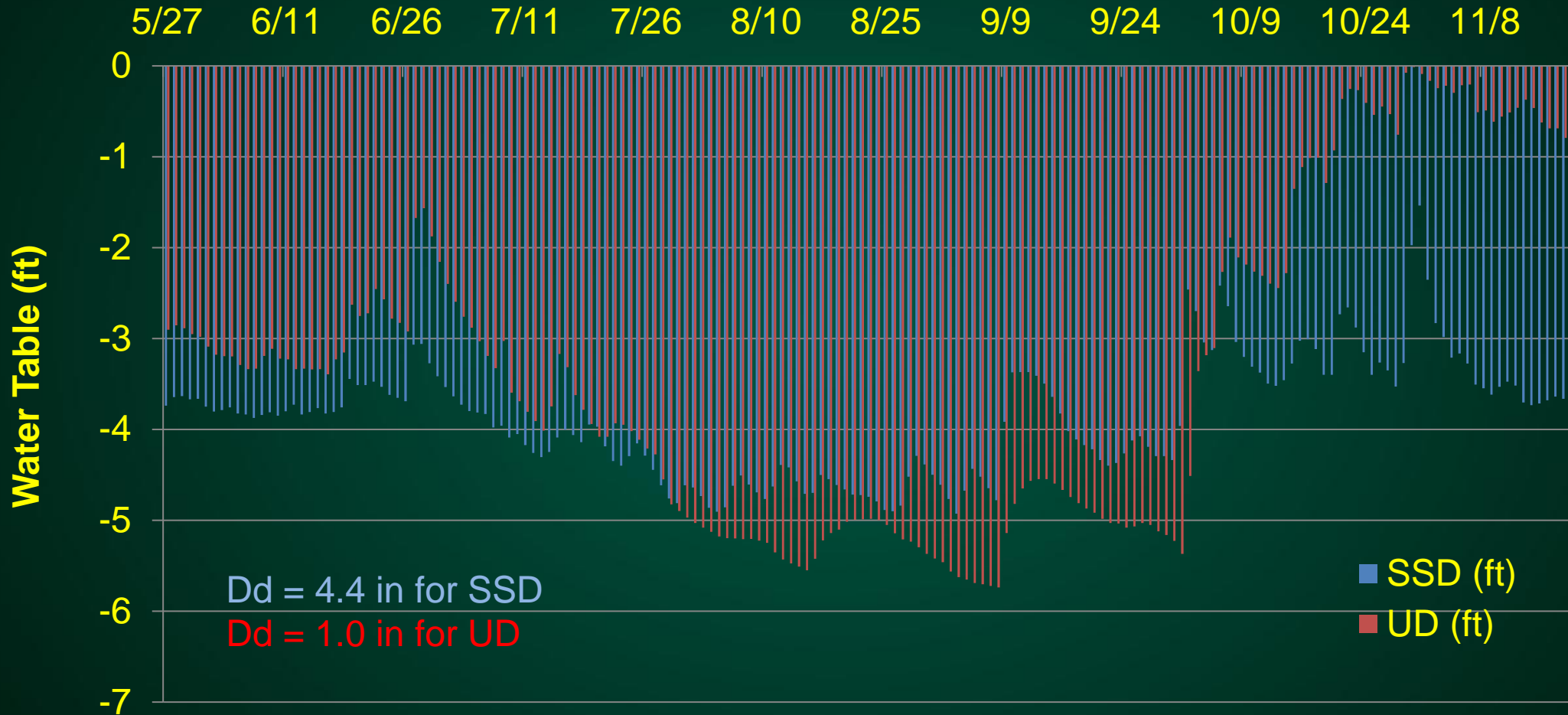


Corn field with and without subsurface drainage



Field status in November 2009, Richland County, ND

Water Table Changes in 2009



FM Area Diversion Project

Four components:

Stormwater diversion channel

Southern embankment

Mitigation projects

In-town features

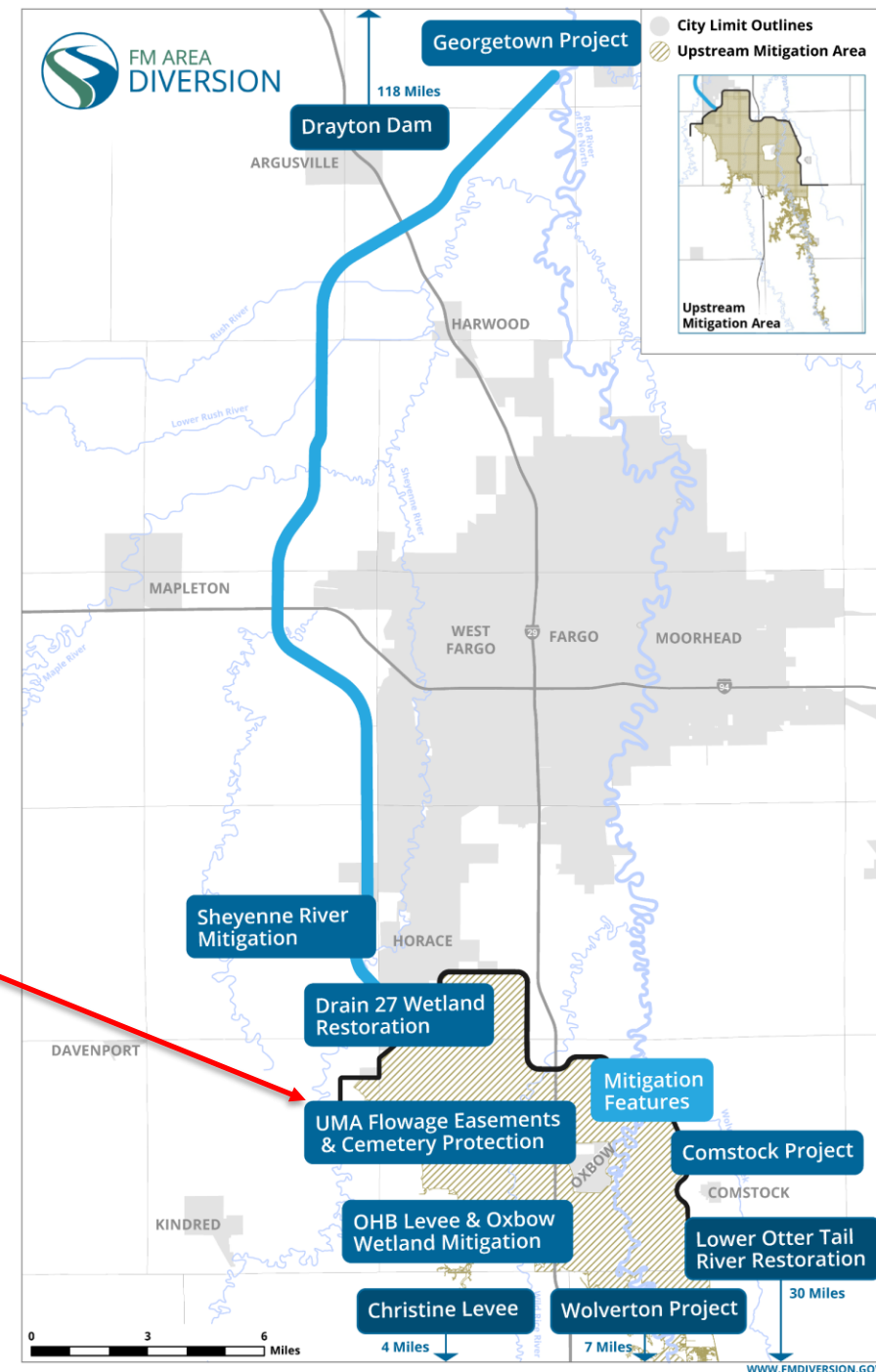
Mitigation Area

29,000 acres of land will be used as temporary flood water storage area.

1 in drainage water equals to 787 M Gallons of flood water storage.

Drainage porosity is 18.3% for top 1 ft infiltration zone → 2.2 in drainable water → 1.73 B Gallons of flood water storage.

[Project Components | Metro Flood Diversion Authority \(fmdiversion.gov\)](http://www.fmdiversion.gov)



Future Research

- Water balance for the impoundment area
- Infiltration into frozen soil
- Soil property changes due to inundated ponding
- Soil moisture mapping in the fall before soil freezing
- Improve the Red River Stream Forecast with and without the FM Area Diversion Project

Questions?

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Or

Call me at 231-6453

Or

See me at Ladd Hall 101C

NDS