

Best Management Practices to keep nutrients in the field and out of the tile

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Drain tile Water quality is not a new issue

- **Manure in tile (96/97), Kewaunee/Manitowoc**
- **Manure storage and drain tile problems**
 - **Small leaks to 300,000+ gallons**
- **Elevated P in Drain Tile**
(1993) (McIntosh



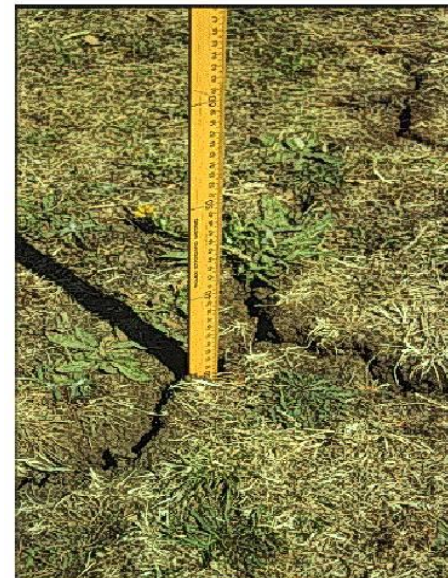
Manure in Tile Lines

- **Problem documented in Ohio / Michigan / Indiana in late 1990's.**
- **21% of manure runoff tile-related in Ohio (Hoorman)**
- **> 50% of Indiana fish kills are tile-related (Smith)**
- **Greater Realization that what happens on the surface is directly linked to the drainage tile outfall**



How does Manure end up in Tile Lines

- **Preferential Flow Pathways**
 - Root Channels
 - Earthworm burrows
 - Cracks
 - Soil porosity
- **Type of injection equipment / rate**
 - Injection points and sweeps



Earthworm Macropores Intersect Tile Lines



**Smoke blower
attached to tile
line, immediately
up from surface
water outlet.**

**Manitowoc
County, WI,
2005**

Soil Crack Preferential Flow



Smoke
being forced
through
drain tile,
(3 ft deep).

Escaping
from cracks
in the soil.

Earthworm Macropores Intersect Tile Lines



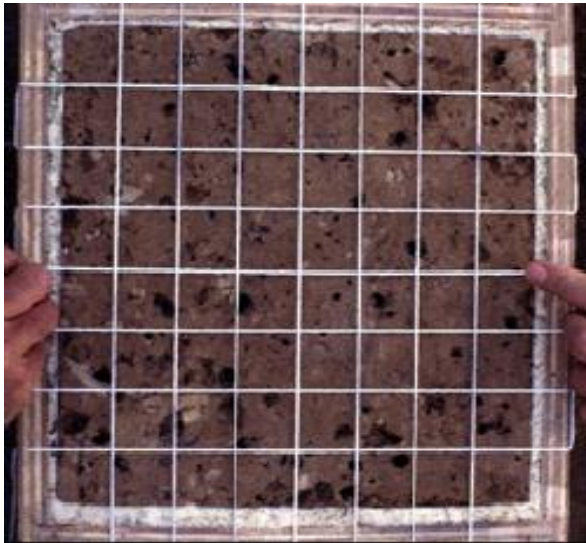
Smoke
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Escaping
from
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burrow.

Crop:
alfalfa, 3rd
crop
regrowth.

Earthworm Burrows

- 727,000 per acre
(long term no till)
- Higher velocity of water
and solute movement
- Less contact time



(Shipitalo and Gibbs, 2000)



Not just earthworms...

- **Wisconsin clay soils crack when dry**
- **Smoke seen 10 feet either side of drain tile from soil cracks**
- **Manure movement down 15 ft.+ in cracks**



What is in drain tile water?

- **Sediment**
 - Fine particles from normal operation
 - Larger particles from blowouts/partial collapses
- **Nutrients (N, P)**
- **Pathogens**



Preventing losses to tiles

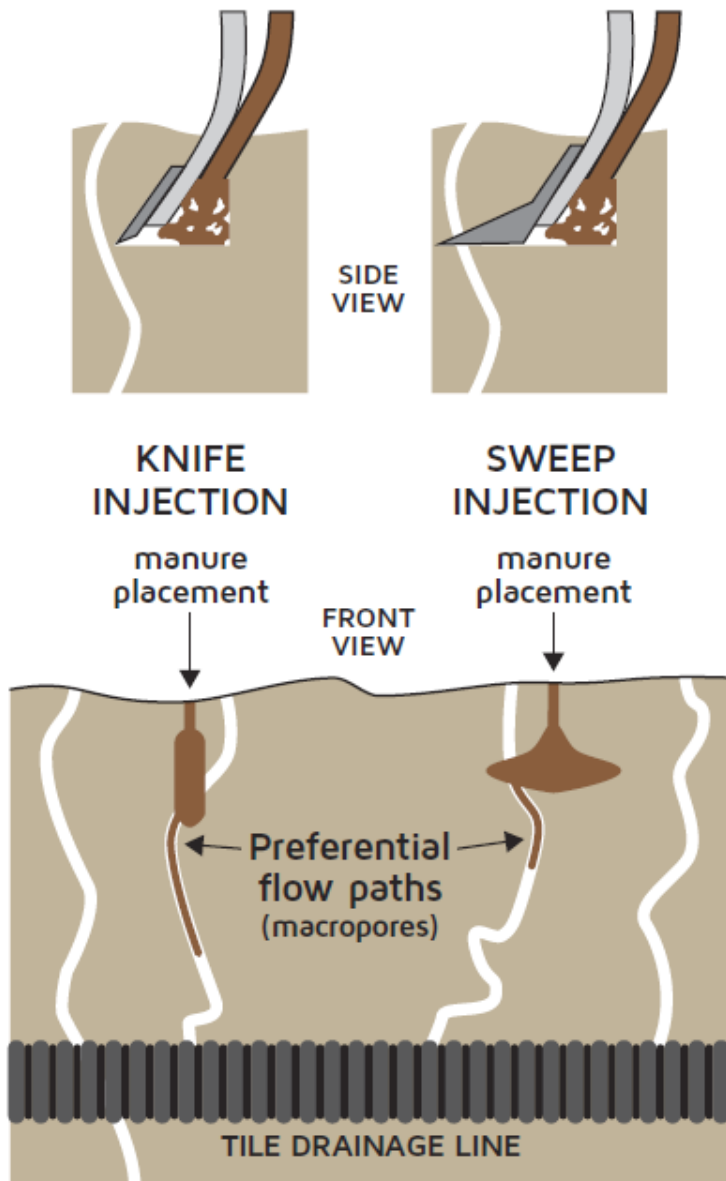
Not always Simple

- Target application to uptake/lower rates
- Fall applications greatest risk for loss
- Late season applications when soils are cooler (<50) to reduce nitrates
- Low Disturbance Manure Application
- Cover Crops
- Take precautions when surface applying liquid manure to land under no-till or perennial crops...

Tillage to reduce macropores

- Evaluate type of injection equipment / rate

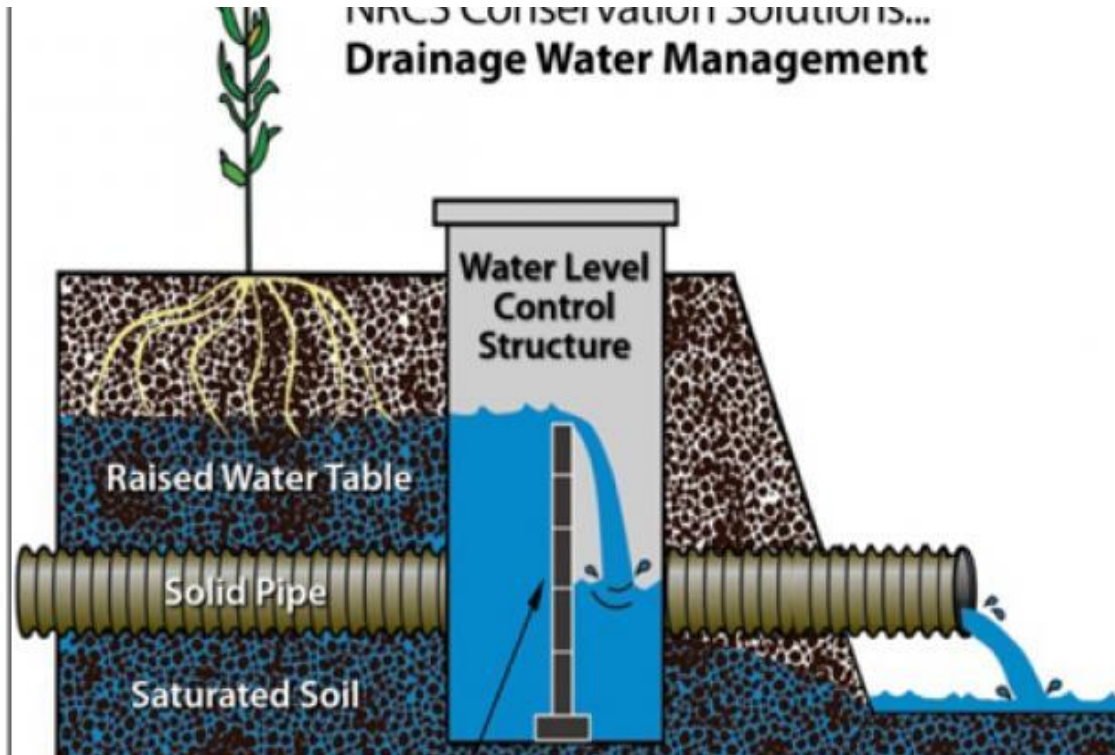
Use tillage to break up preferential flow paths prior to or concurrent with application



If performed improperly, knife injection or horizontal sweep injection can force manure through macropores



Control water levels and N in tile systems – NRCS

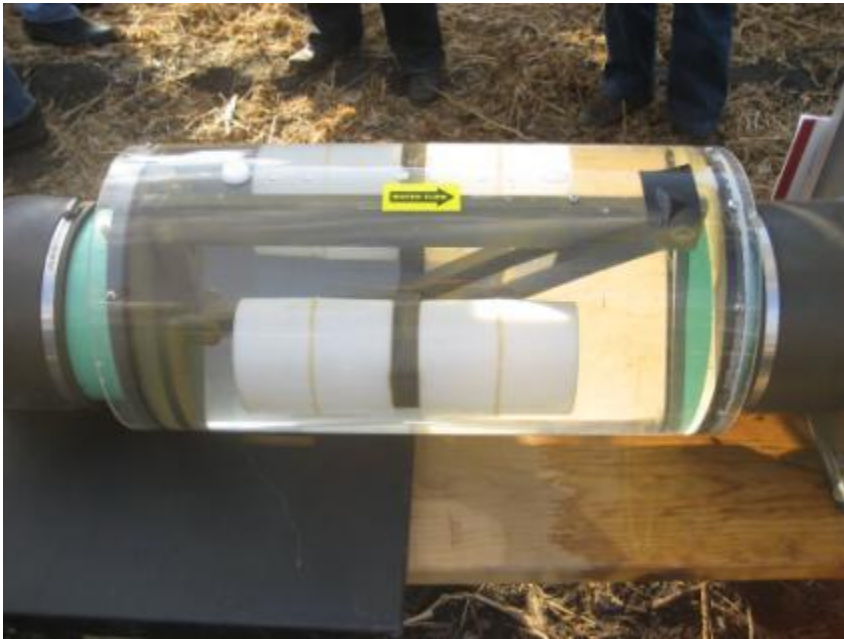


Manage water levels

- shut valve in fall, open in spring
- Doesn't work on fields w/ $> 0.5\%$ slopes

Stair- Step Drainage

Better Option for Wisconsin



Manure in Tile lines

- Clay soils that crack when drying
- Manure solids less than 5%,
- $< 2\frac{1}{2}$ % solids are greatest risk (Shipitalo – ARS)



Assess soil conditions prior and review forecasted weather prior to liquid manure applications

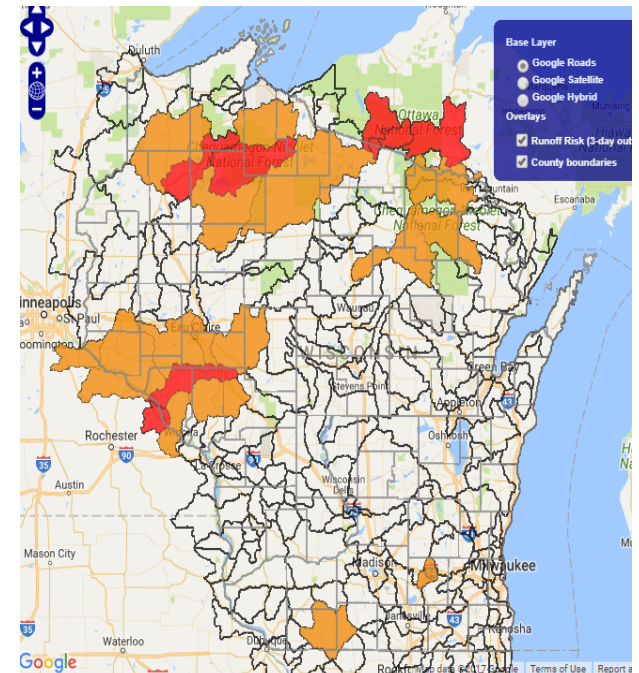
1. Both high and low soil moisture contents can be problematic for liquid manure applications to tile-drained land

- High –tiles flowing
- Low –soil cracking

2. Avoid applications when rainfall is predicted to occur after application

- Soil moisture levels are increased by liquid manure applications

- 7,000 gal = $\frac{1}{4}$ inch
- Can the soil take it?



Consider Low Disturbance Manure Applications

- Lower applications rates
- Use of Cover Crops
- Flip the sequence ...cover crops first then manure applications



Understand and Locate Tile Features



Ensure precautions are taken for manure applications in fields with tile surface inlets

- Surface inlets are commonly used in fields with closed depressions -areas without an outlet for surface water
- Extra precautions need to be taken in proximity of surface tile inlets because they are a direct conduit to tile drainage systems



Manure flowed under road, reached tile inlet



Situation:

- Manure injected according to WPDES permit at 20,000 gal/acre.
- Solids content <3%
- 2 days after application first started, manure flowing in tile.





Guiding Principles for Improved Tile Water Quality

- Till or fracture the soil before manure application
 - If cracks/pathway exists
- Consider low disturbance application
- Application made into cover crops
- Be aware of tile locations, inlets and outlets
- Tile line control structures
- Monitor tile line outfalls
- Have manure response team & equipment ready

Thank you!

Questions

