Reducing Hydrological Connectivity of Depressions to Streams in Glacial Till Landscapes

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Sediment Loading from Maumee River Basin to Western Lake Erie

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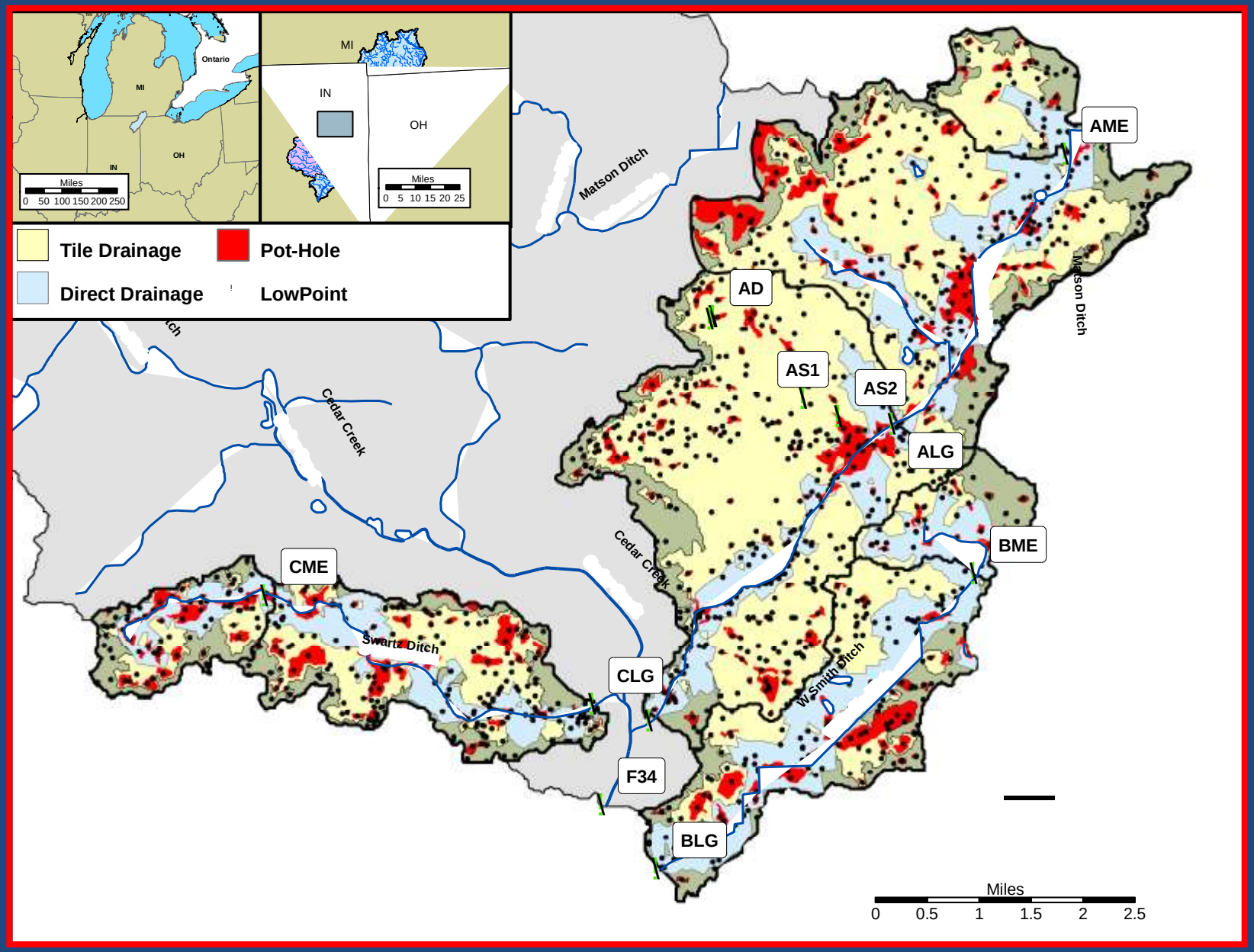
Extent of Glaciation



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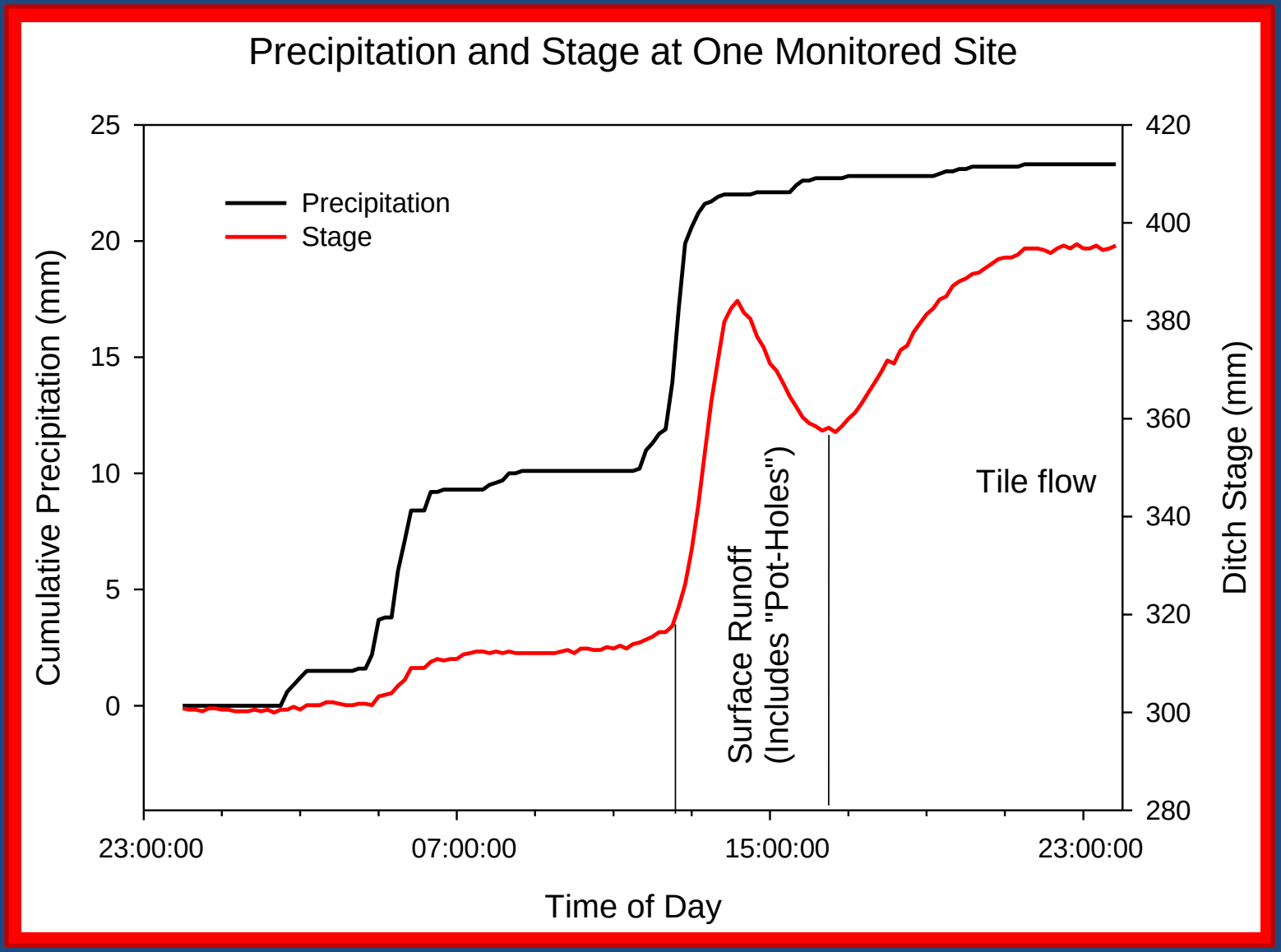
Influence of Drainage Class on Nutrient Losses

- Nutrient losses were higher from watersheds with more:
  - Direct Drainage
  - Pothole Drainage

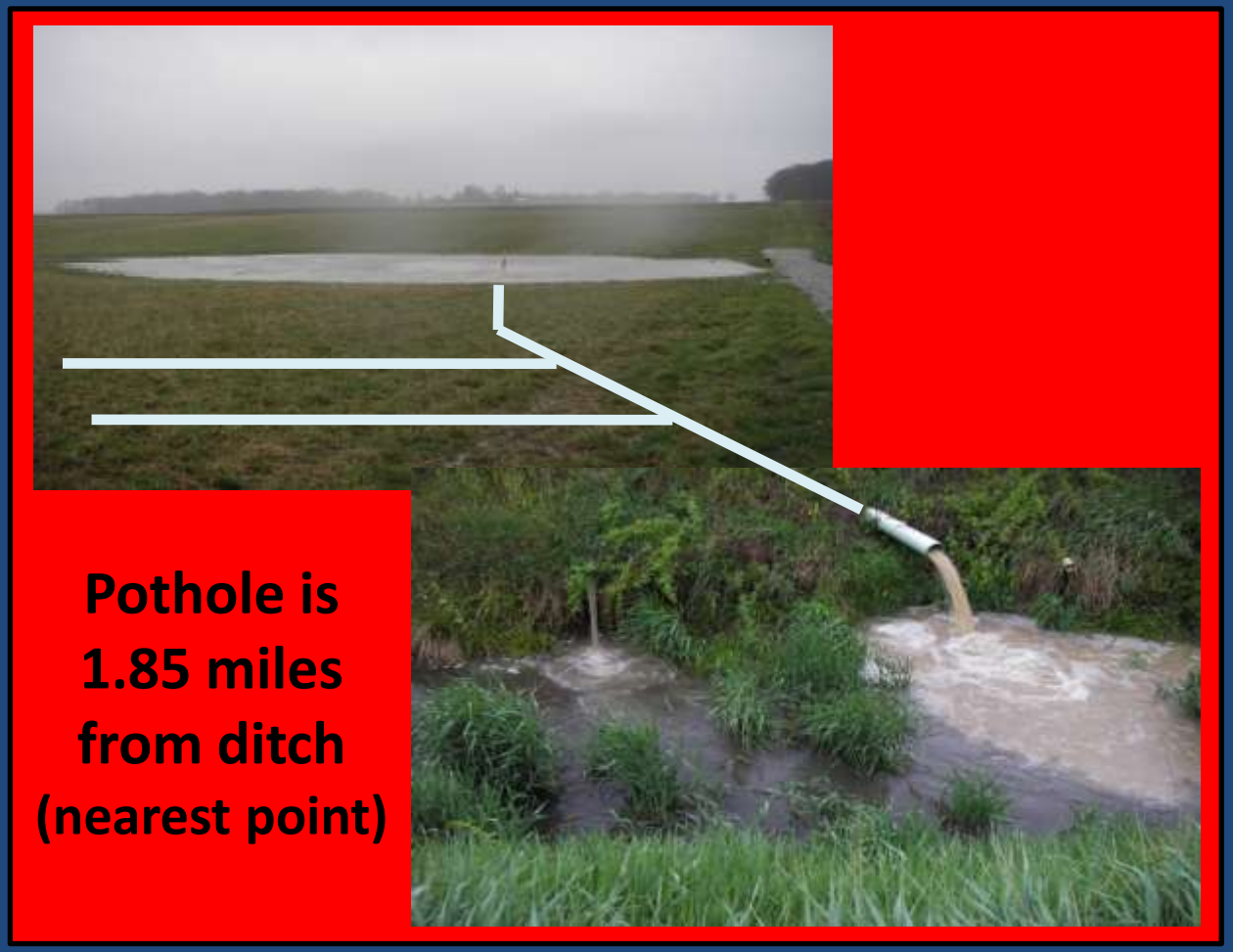
Traditional Tile Risers


Precipitation and Stage at One Monitored Site
Precipitation
Stage
Cumulative Precipitation (mm)
Ditch Stage (mm)
Surface Runoff
(Includes "Pot-Holes")
Tile flow
25
20
15
10
5
0
420
400
380
360
340
320
300
280
23:00:00
07:00:00
15:00:00
23:00:00
Time of Day

Ditch Spoil Blocks Flow to Drainage Ditch

Subsurface Tile & Tile Riser Flow

In our landscape, the hydrology has been short circuited. Dating back to the mid-1800's, settlers had to drain the land to break the sod.



Pothole is 1.85 miles from ditch (nearest point)

Alternatives to Tile Risers

- Protect Lake Erie's water quality
  - Reduce Sediment & Phosphorus loads
- Must be a practice farmers will implement
  - Minimize loss of productive land
  - Allow farm traffic (don't like risers)
  - Minimal/easy maintenance
  - Approved for cost share
  - Effectively drain landscape

Rock Inlets

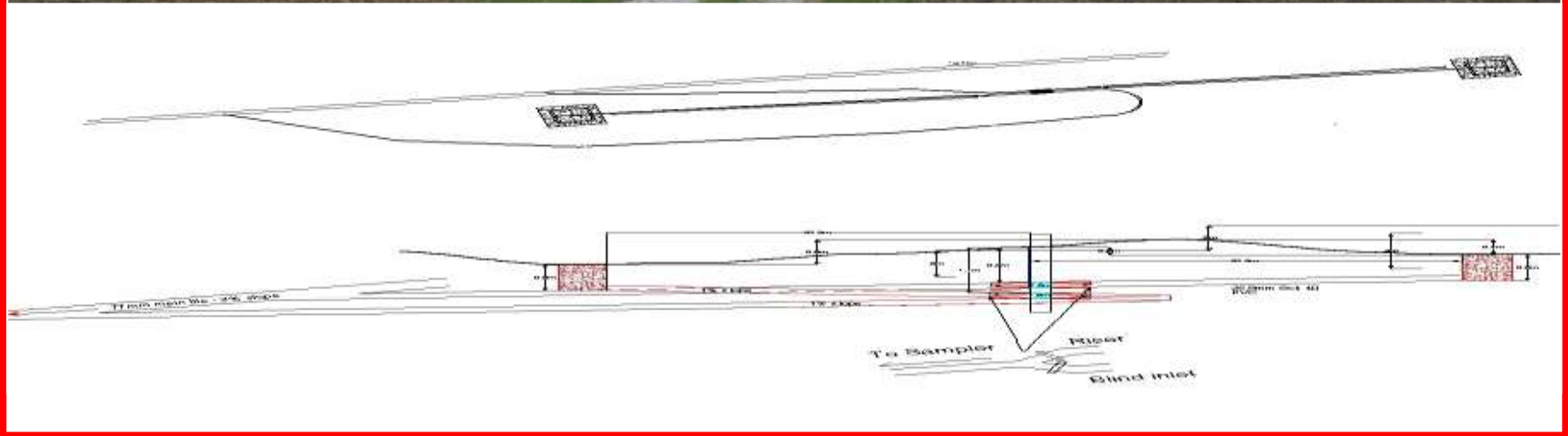
Rock inlets have been tested in other locales as an alternative to tile risers:

- **Not very effective at decreasing contaminant loads**
- **Silt in with time**
- **Farm over them???**

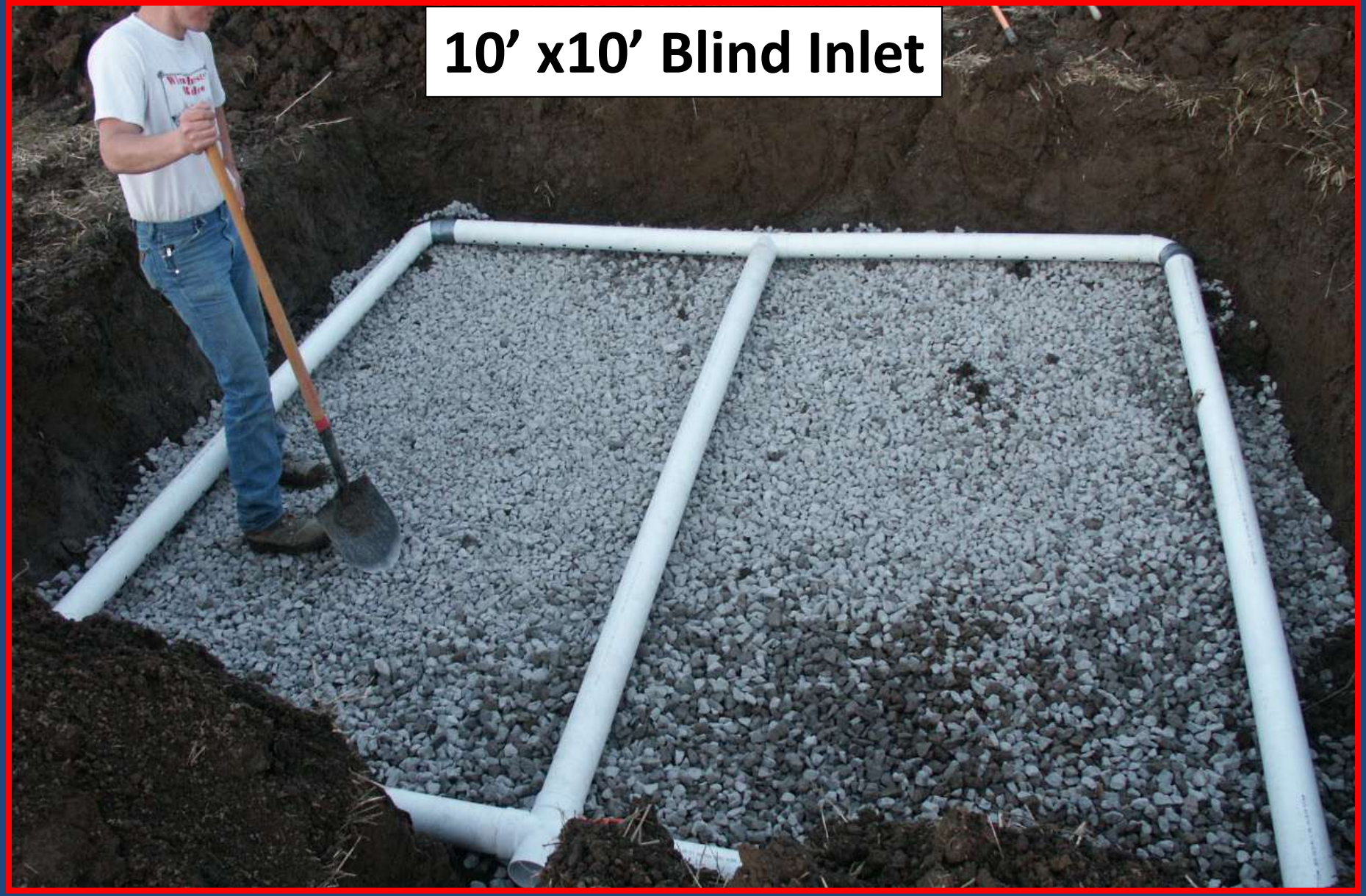
Rock Inlets

- Rock inlets have been tested in other scales as an alternative to tile risers:
  - Not very effective at decreasing contaminant load
  - Silt will fill in time
  - Flush over system???

Pothole Study Site



10’ x10’ Blind Inlet



Blind Inlet with riser alternate

Blind Inlet with pit-run cover (coarse sand and gravel)

Blind Inlet after 1 growing season

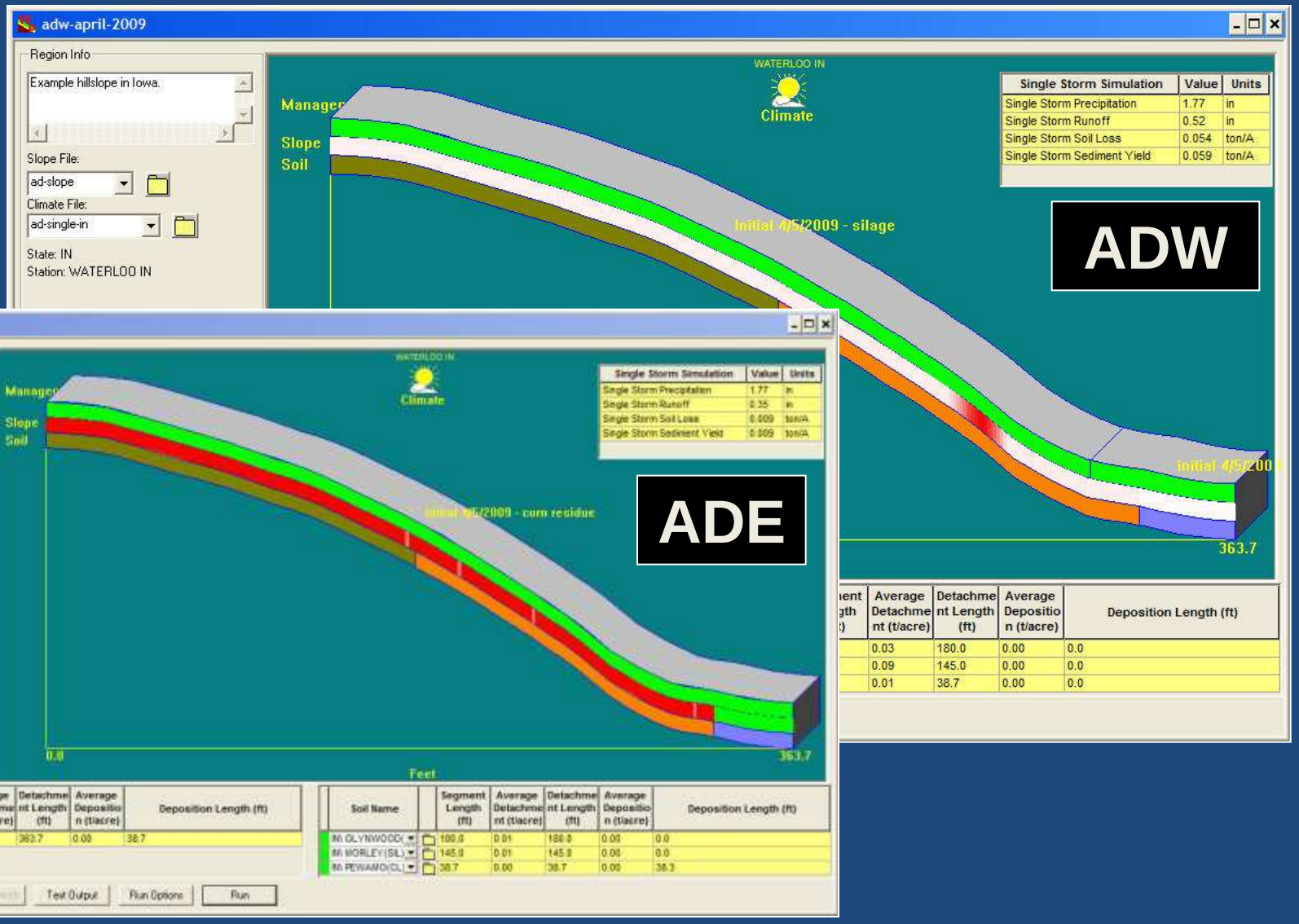
Conditions prior to runoff event of April 5, 2009

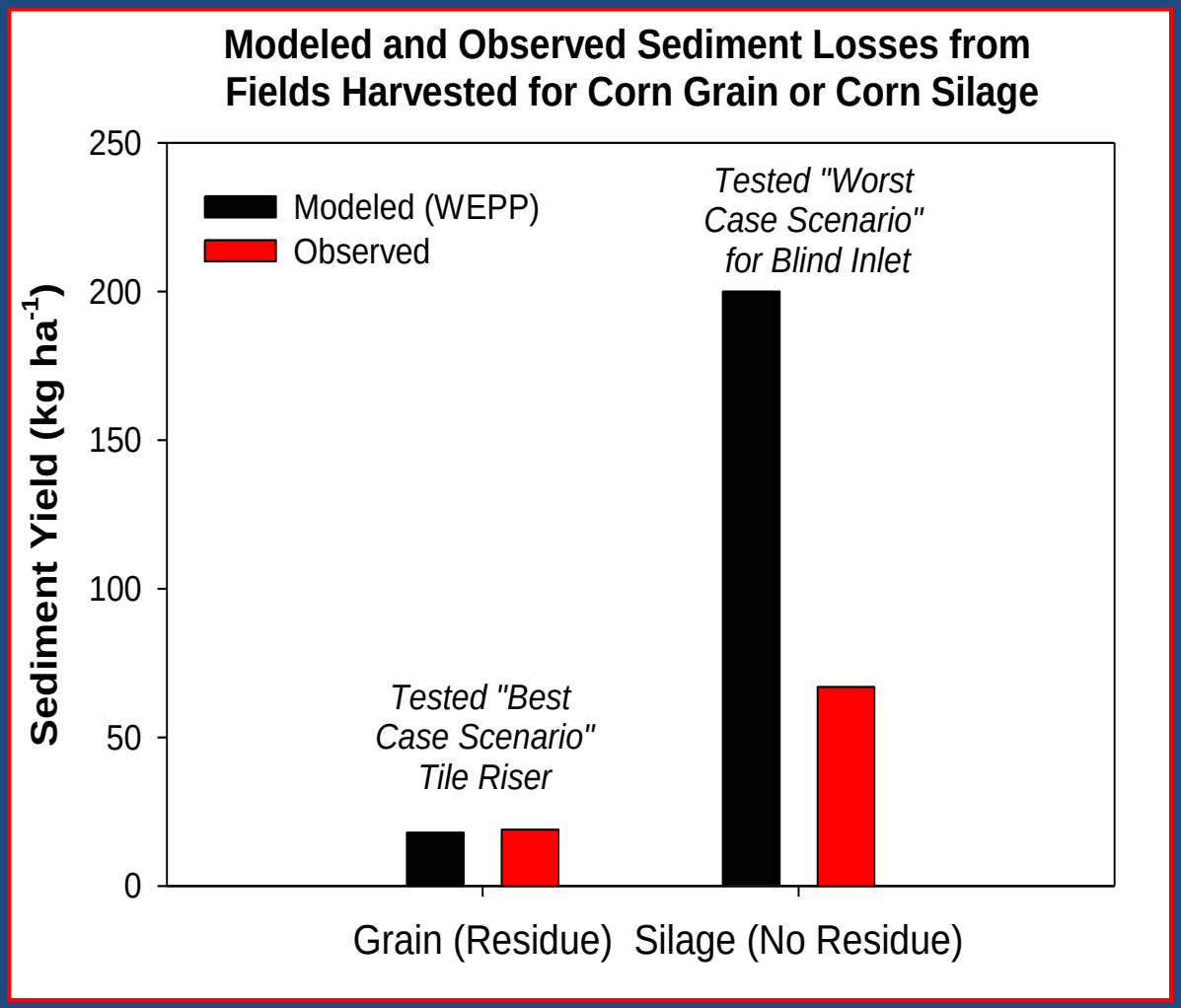
- ADE (riser)
  - No cultivation since spring 2008,
  - 100% residue cover, no disturbance
- ADW (blind Inlet)
  - No cultivation after spring 2008
  - Silage harvest, late summer 2008 (10% residue cover)
  - Disturbance on lower portion late fall (10% disturbed)

ADW Residue estimate 10%

ADW disturbed estimate 10% of lower section

Computer simulations of April 5, 2009 event

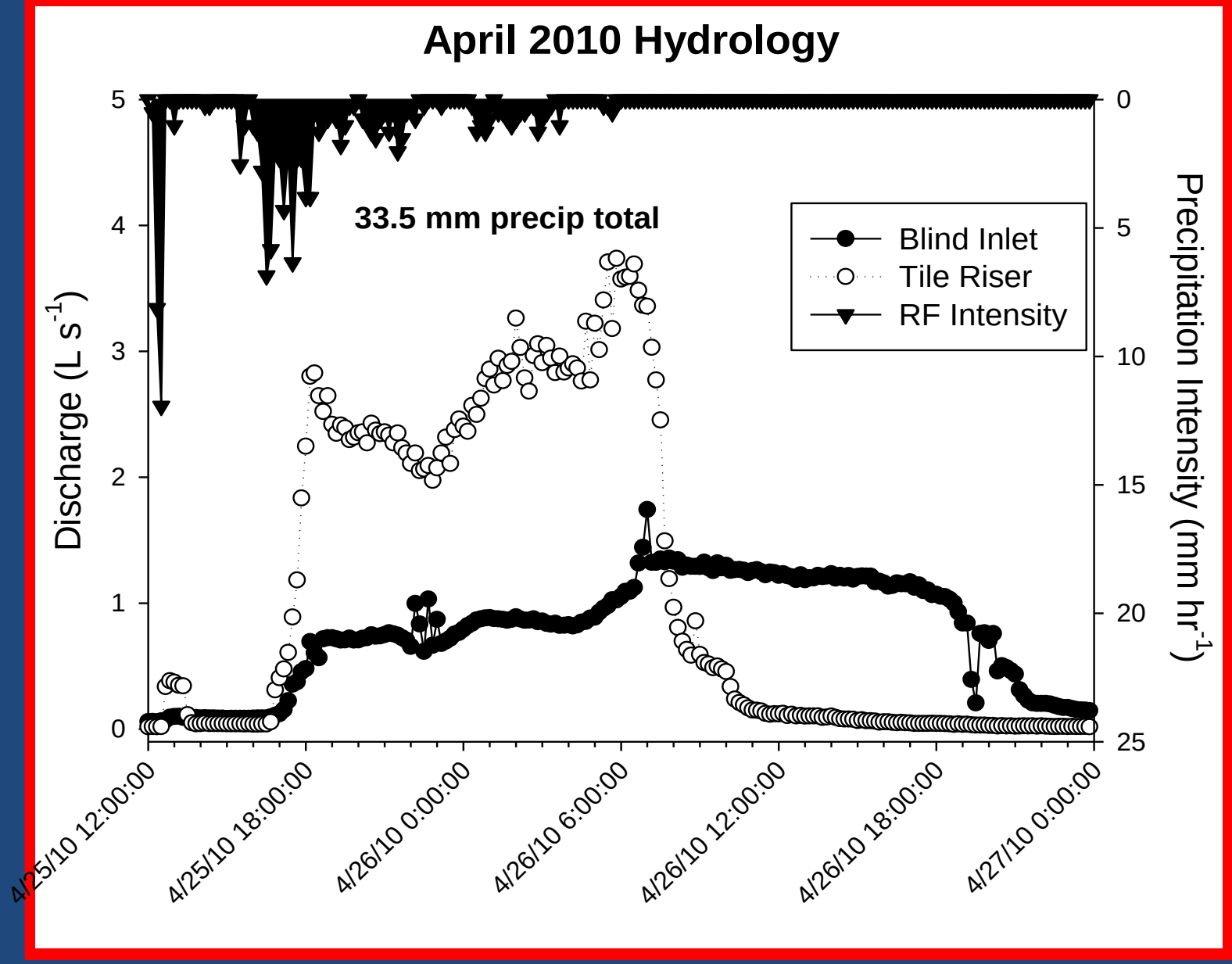




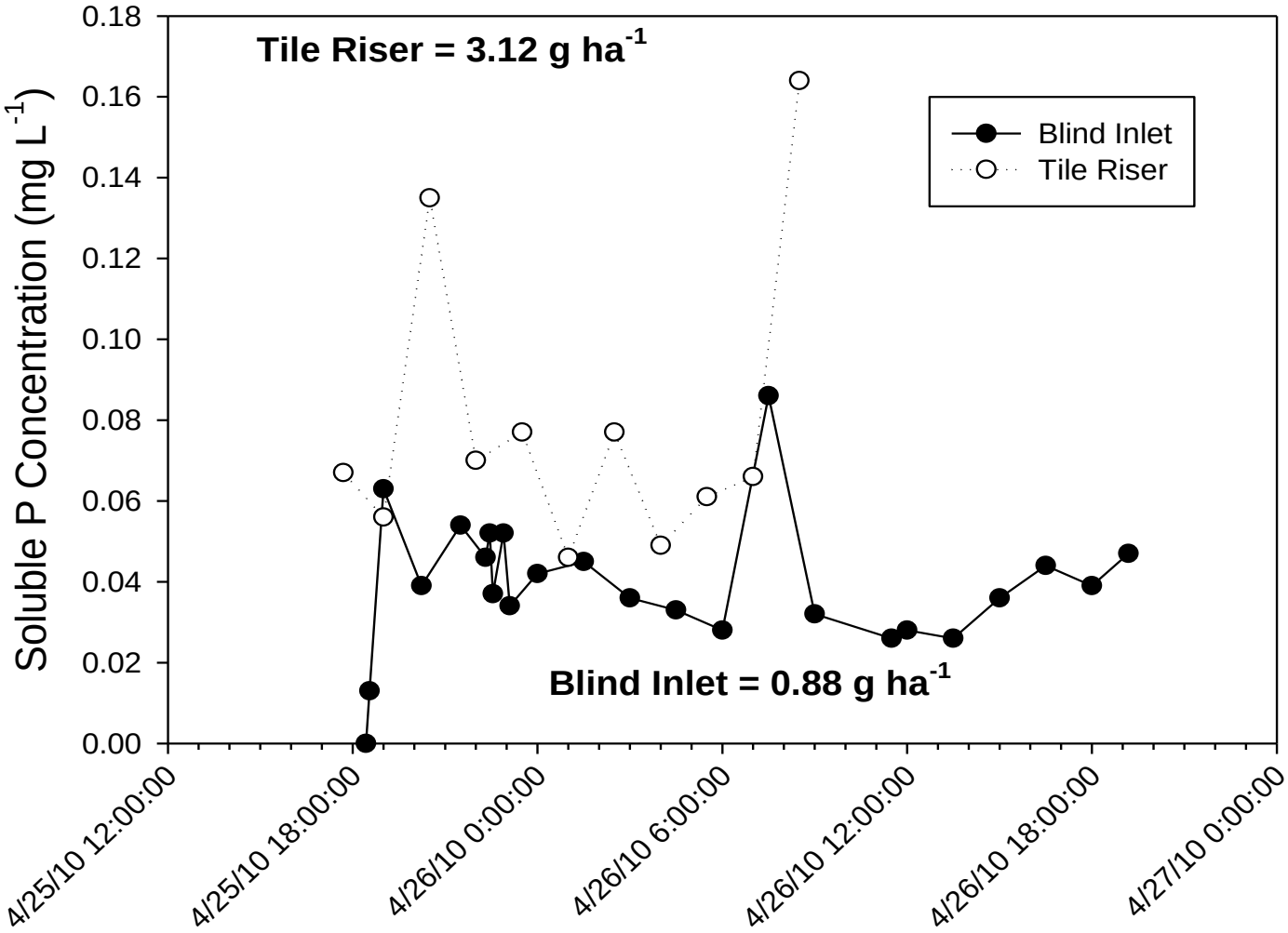
- WEPP model runs predicted 60% more sediment loss than was collected from ADW
- Difference is probably due to the blind inlets filtering sediments prior to entering the tile system
- We are confident in this number because the model predicted same amount as was measured through the ADE tile riser with 100% corn residue

April 2010 Field Events

- ADW and ADE cropped in Oat
- Tilled early April 2010
- 33.5 mm precipitation April 25-26, 2010


April 2010 Hydrology
33.5 mm precip total
Blind Inlet
Tile Riser
RF Intensity
Discharge (L s-1)
Precipitation Intensity (mm hr-1)
0
1
2
3
4
5
0
5
10
15
20
25
4/25/10 12:00:00
4/25/10 18:00:00
4/26/10 0:00:00
4/26/10 6:00:00
4/26/10 12:00:00
4/26/10 18:00:00
4/27/10 0:00:00

Soluble P Concentrations During April 2010 Storm

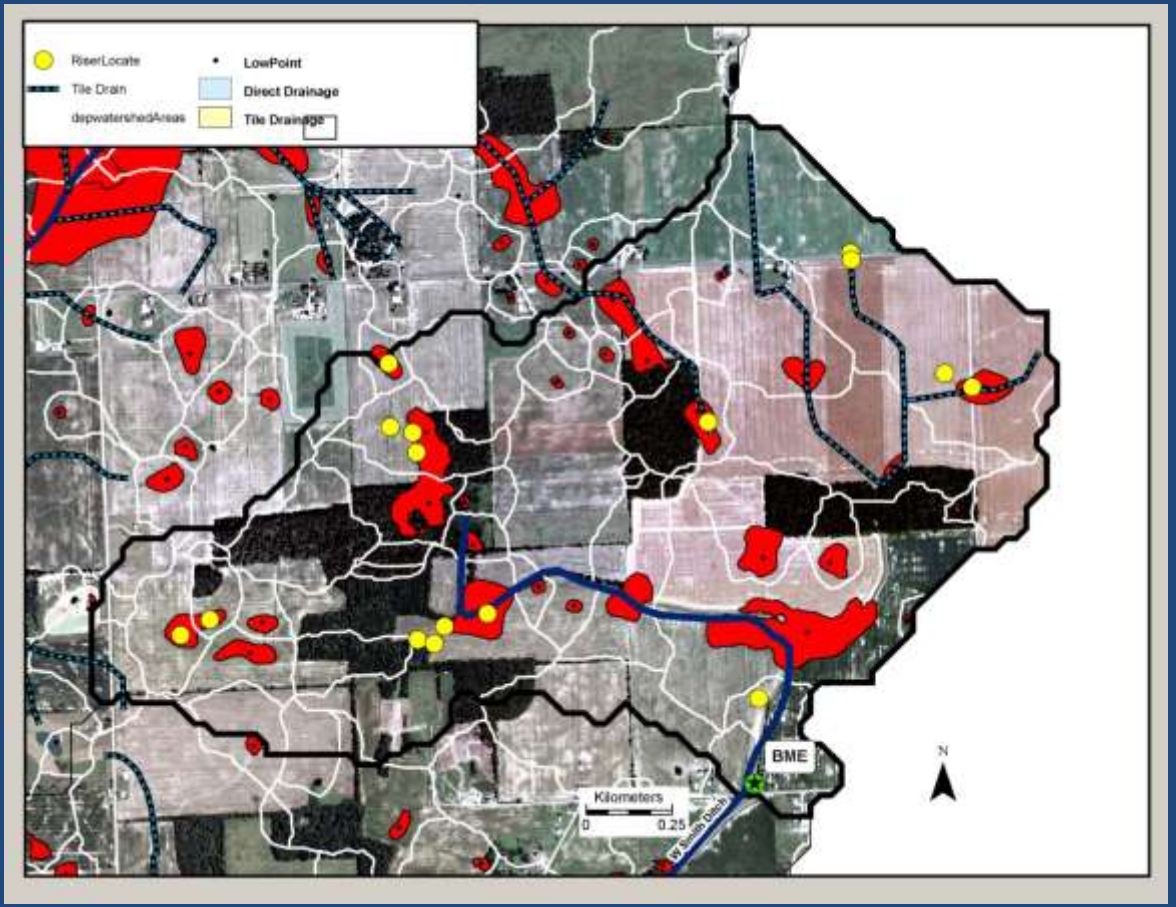


Percent Reductions in Sediment and Nutrient Loads: blind inlet vs tile risers

Nutrient	2009 % Reduction	2010 % Reduction
Sediment	11*	79
Ammonium-N	30	59
Nitrate-N	34% increase	24
Total Kjehldahl N	66	48
Soluble P	64	72
Total P	52	78

Watershed Scale Assessment

- Blanketed a 300 ha monitored watershed with blind inlets
- Work with Indiana NRCS for consideration as an approved conservation practice



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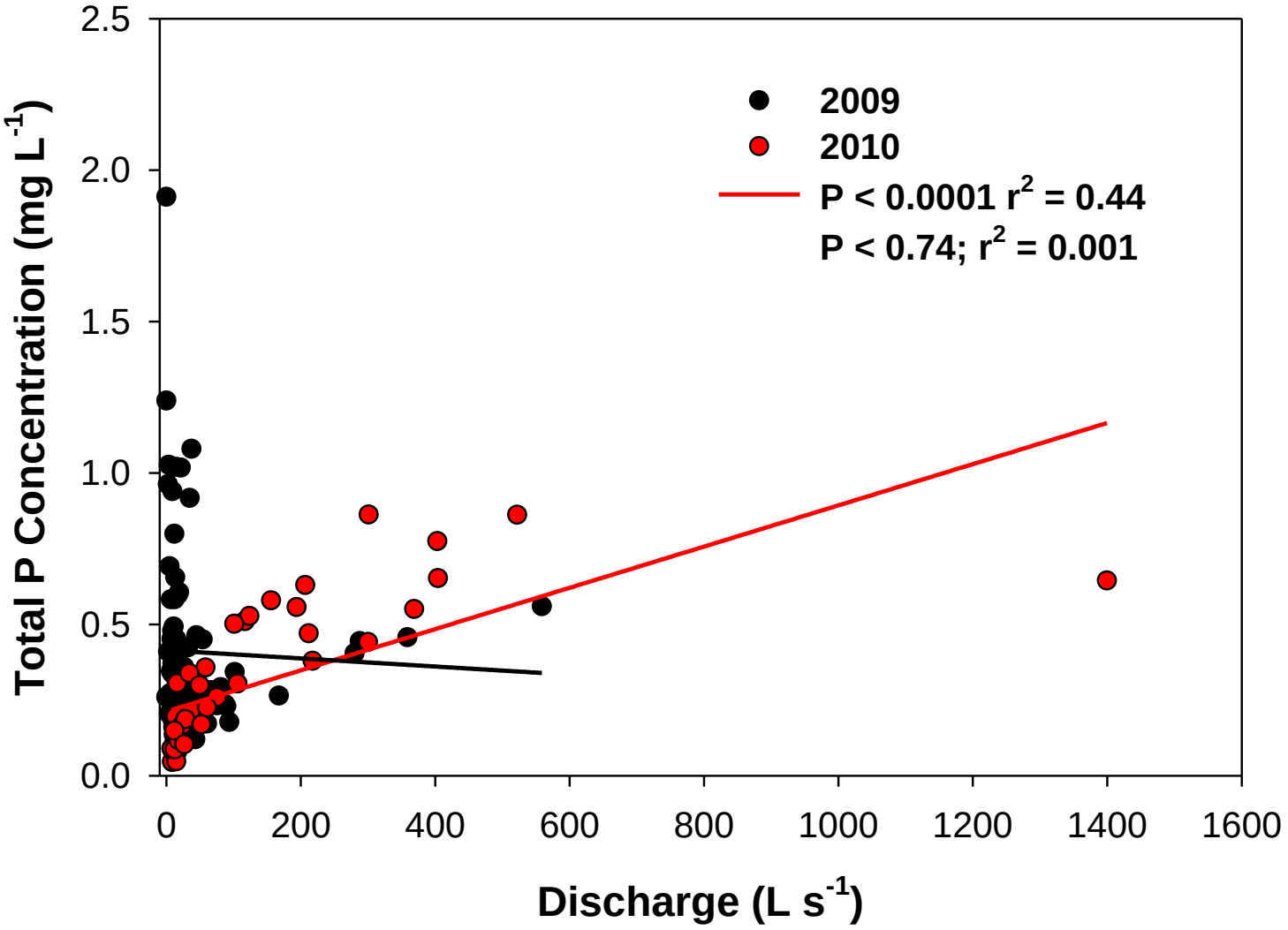
Total Phosphorus as a Function of Discharge Before (2009) and After (2010) Watershed Installation of Blind Inlets



Conclusions

- Distant fields with risers are directly connected to streams.
- Blind inlets reduce connectivity of contaminants
- Breaking connectivity appears to decrease TP loading to streams during runoff events


Questions?