

Agricultural Longwall Subsidence Mitigation Utilizing Subsurface Drainage Systems:

Why Can't We Make It Better

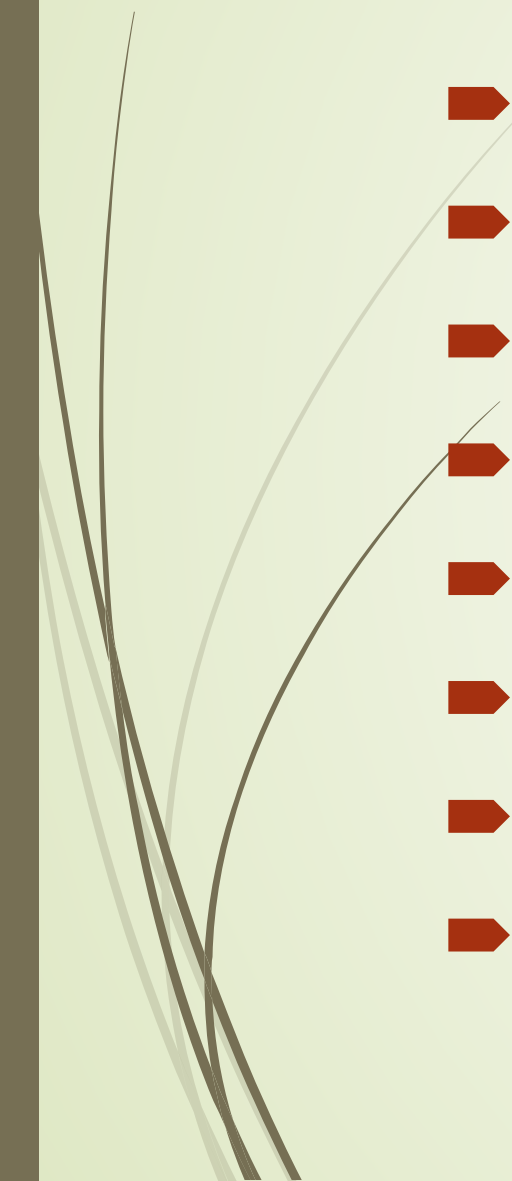


Gerry Spinner: E&G Construction

Dan Barkley: Illinois Dept. of Natural Resources, Office of Mines and Minerals



Illinois Longwall Experience

- Cropland
 - Perennial streams
 - Homes and buildings
 - Public highways
 - Railroads
 - Major Pipelines
 - Methane gas plant
 - Capped slurry impoundment
- 

Regulatory Oversight

- ▶ **SMCRA** and counterpart state law has very generic language regarding subsidence mitigation of land.
- ▶ 62 Ill. Adm. Code 1817.121(c)(1)
*"Repair of damage to surface land. The permittee must correct any material damage resulting from subsidence caused to surface lands, to the extent technologically and economically feasible, **by restoring the land to a condition capable of maintaining the value and reasonably foreseeable uses which it was capable of supporting before subsidence damage.**"*
- ▶ There is no productivity or yield performance requirement



Illinois Subsidence Control Plan Requirements for Land

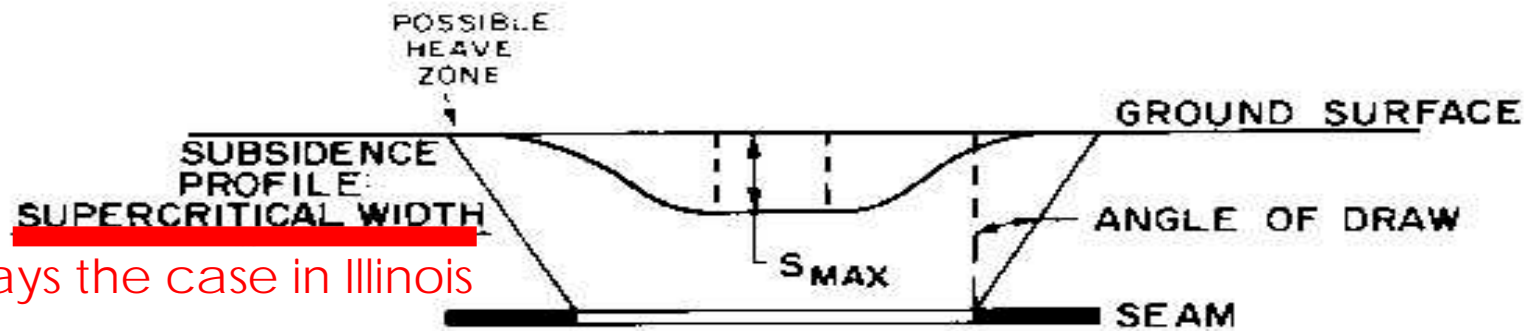
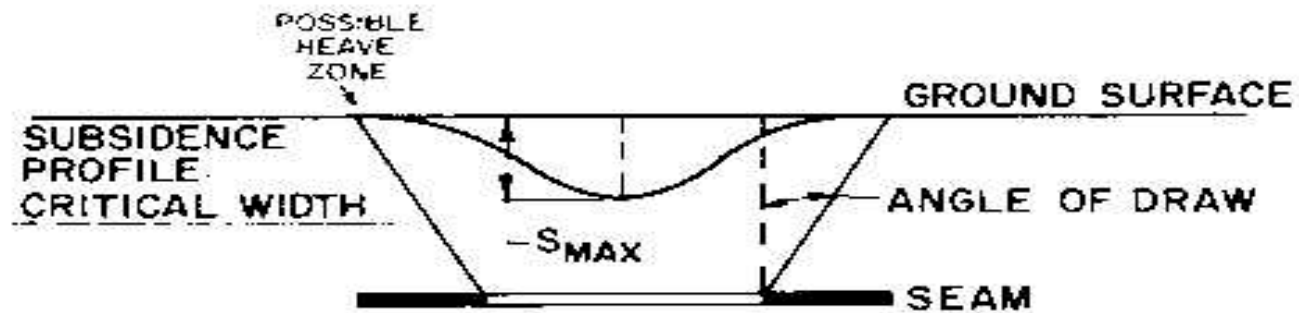
- Existing and projected contours required to define potential drainage problems (This requirement is unique to Illinois)
- Drainage interruptions must be corrected
- Addition of drainage tile may be needed to supplement surface drainage
- Temporary crop damage compensation \$\$ is required until repair is complete (Not a SMCRA or state regulation...we work it into each individual longwall permit)



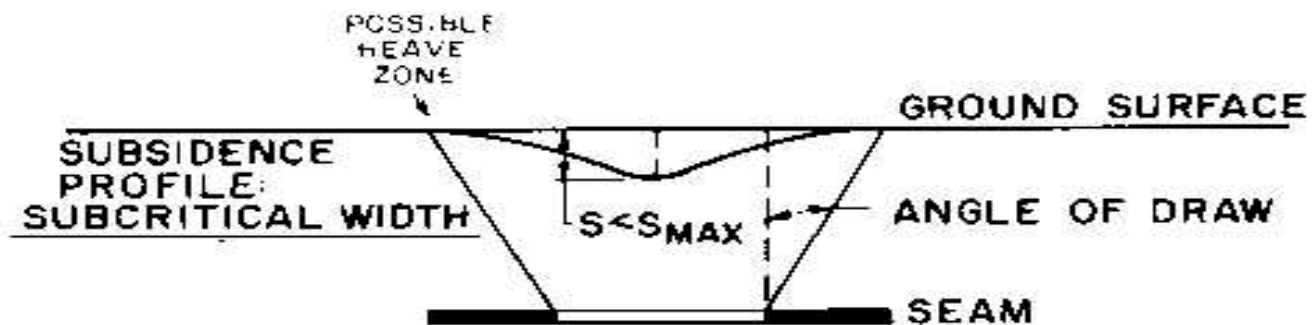
Mechanics of Longwall Subsidence

- Maximum subsidence is typically **70 percent** (+or-) the extraction height. (10 ft seam extracted = 7 ft of subsidence)
- A uniform profile develops over the longwall trough
- “Angle of Draw” creates a larger surface impact area beyond full extraction panel

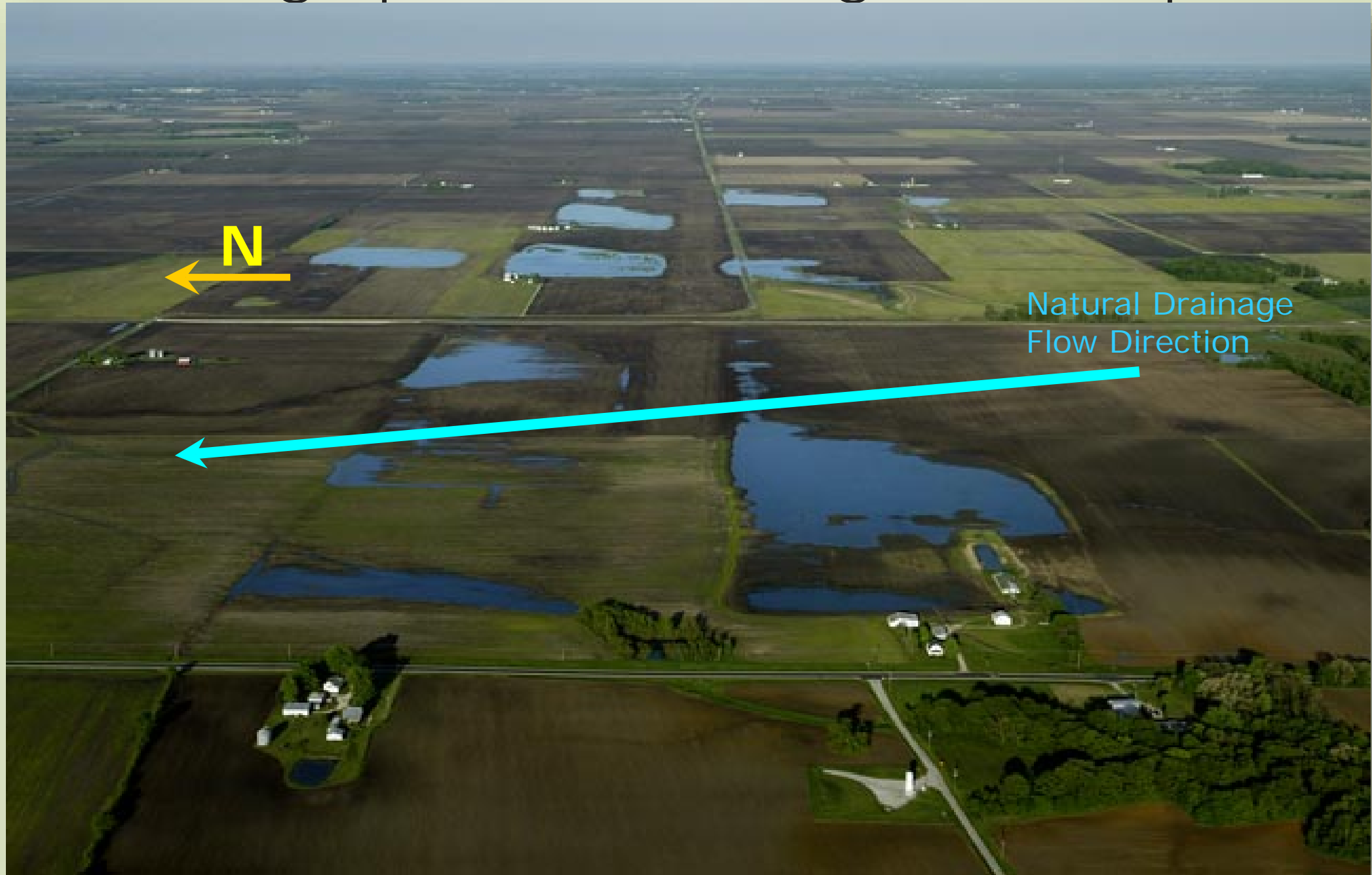
Subsidence Profiles



Always the case in Illinois



Drainage problems from gate road pillars





Enhanced Drainage Through Effective Use of Subsurface Tile Systems

Planning an effective drainage system
starts
before the longwall subsidence occurs



The Problem

Which is longwall
subsidence?





Design Planning Preparation

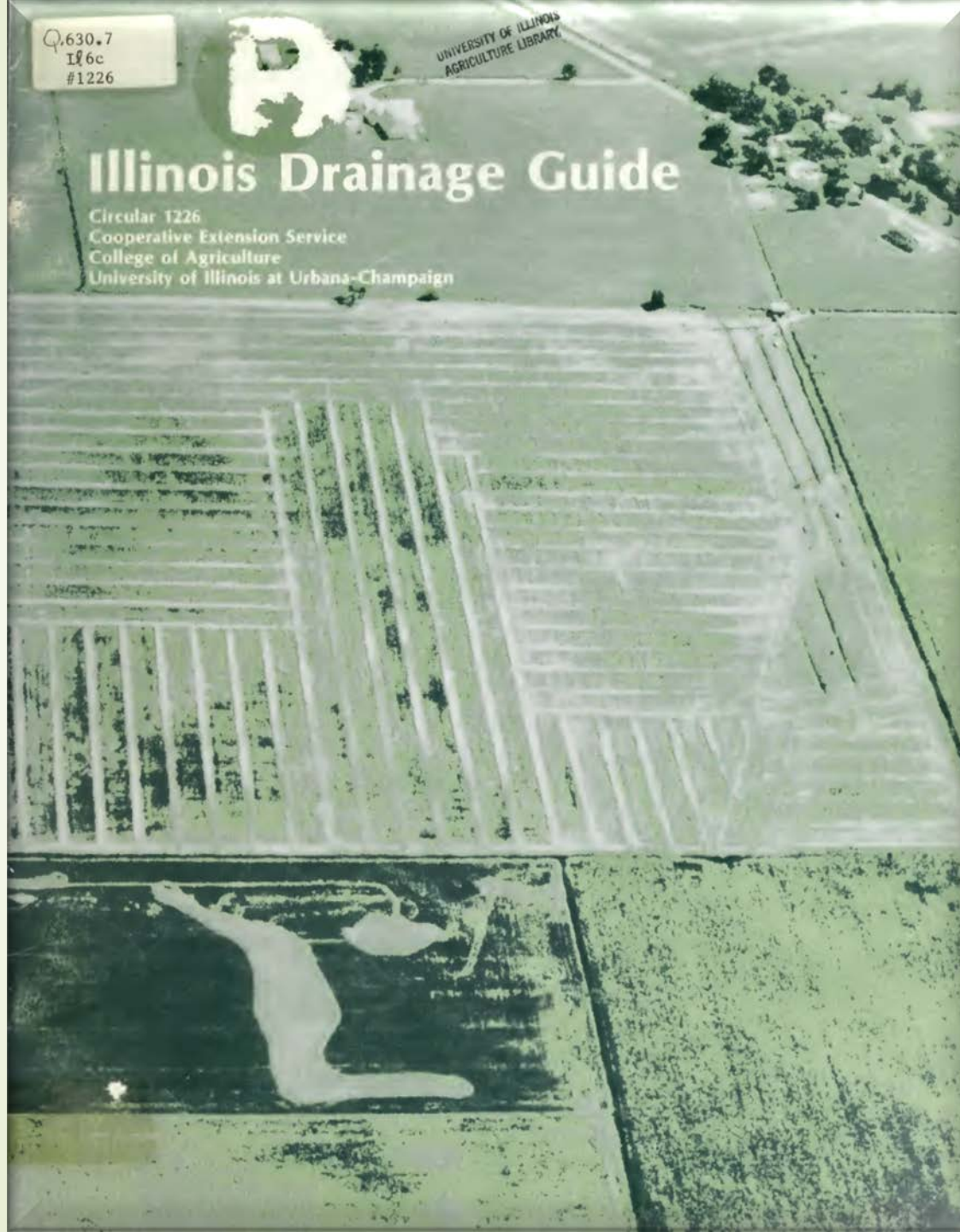
1. Secure post subsidence land contour maps generated by the company (subsidence modeling techniques).
2. Assess the initial tile system design based on land slope & soil type.
 - Rough out tile spacing & size with the Illinois Drainage Guide.
 - Then work with tile supply company on the specific design.

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Illinois Drainage Guide

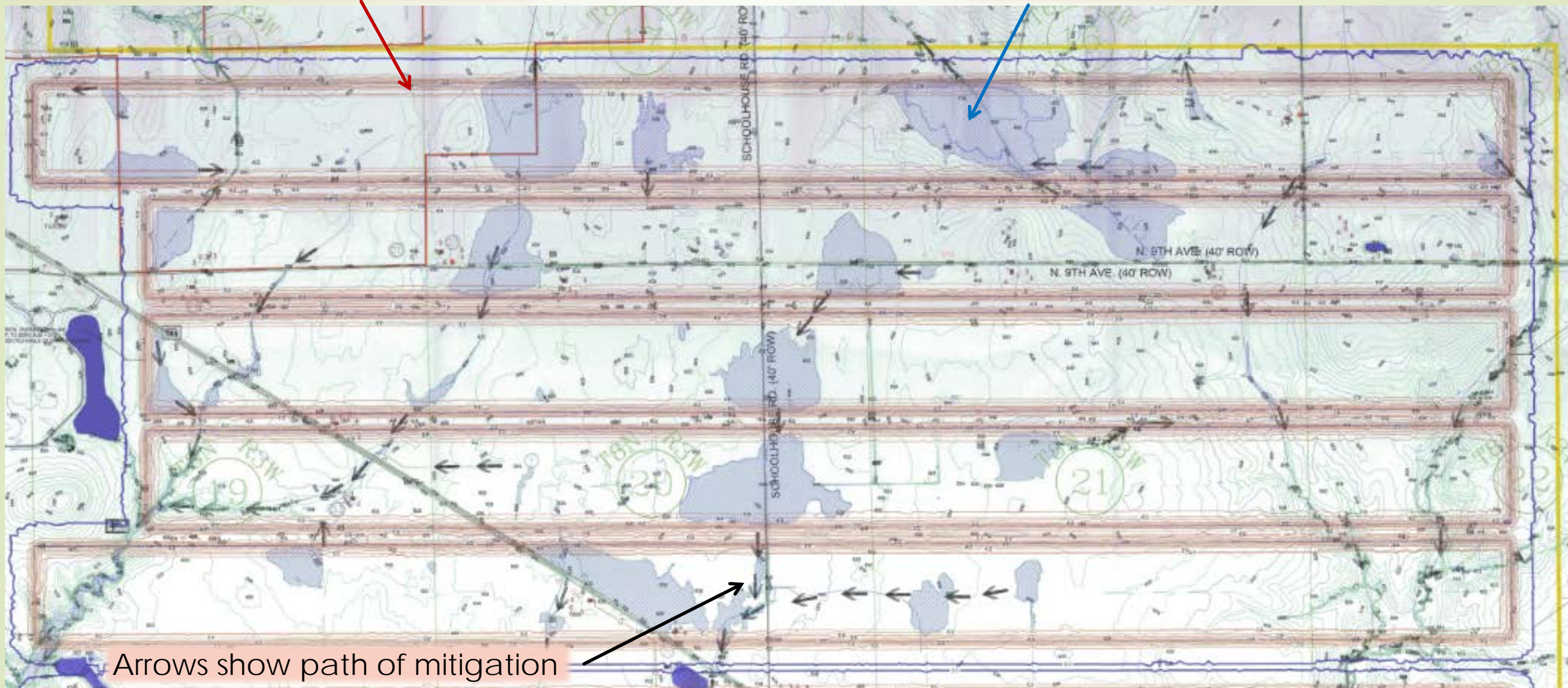
Circular 1226
Cooperative Extension Service
College of Agriculture
University of Illinois at Urbana-Champaign



Post Subsidence Projections 2 Ft Contours (from permit)


Isopleth lines for subsidence trough

Projected Ponding

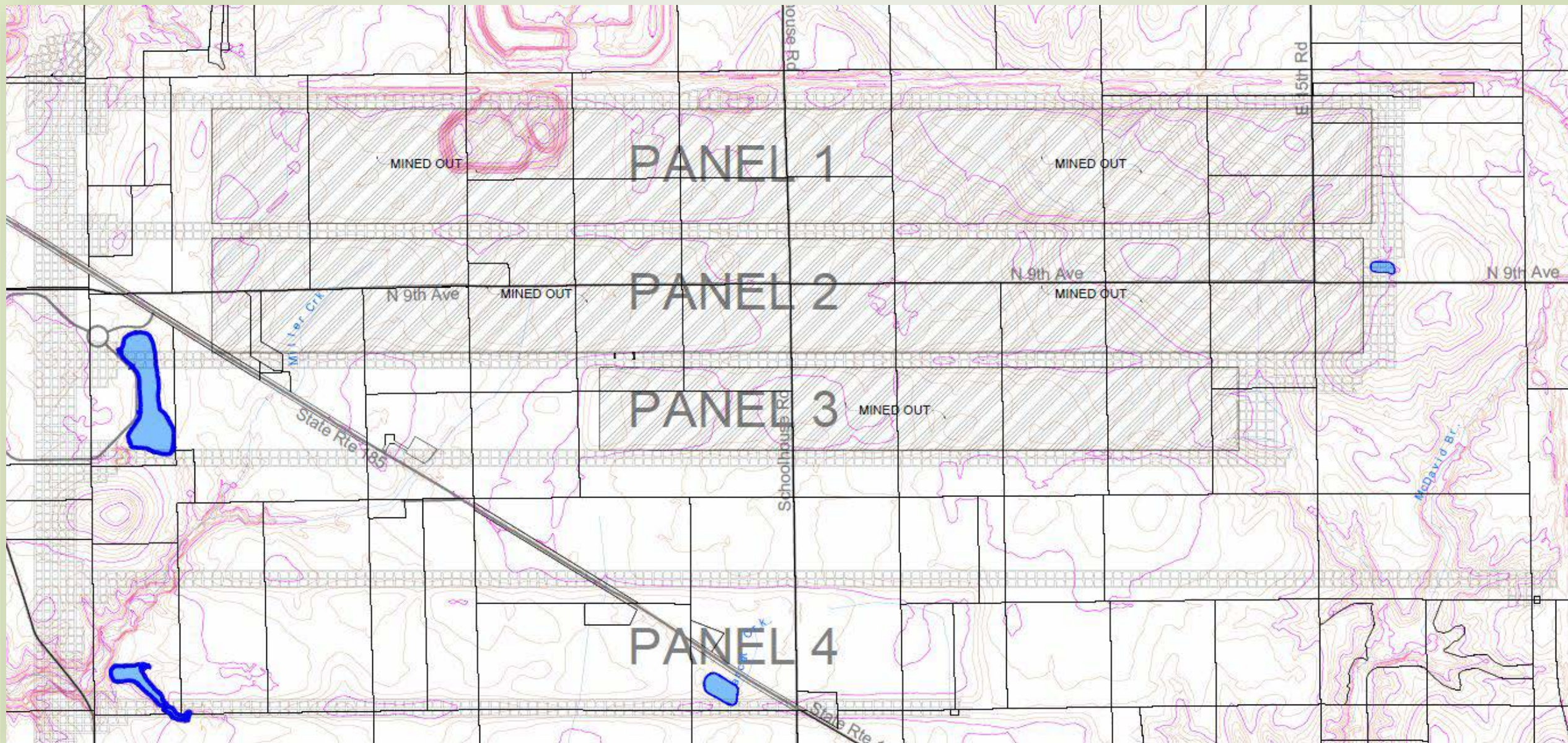




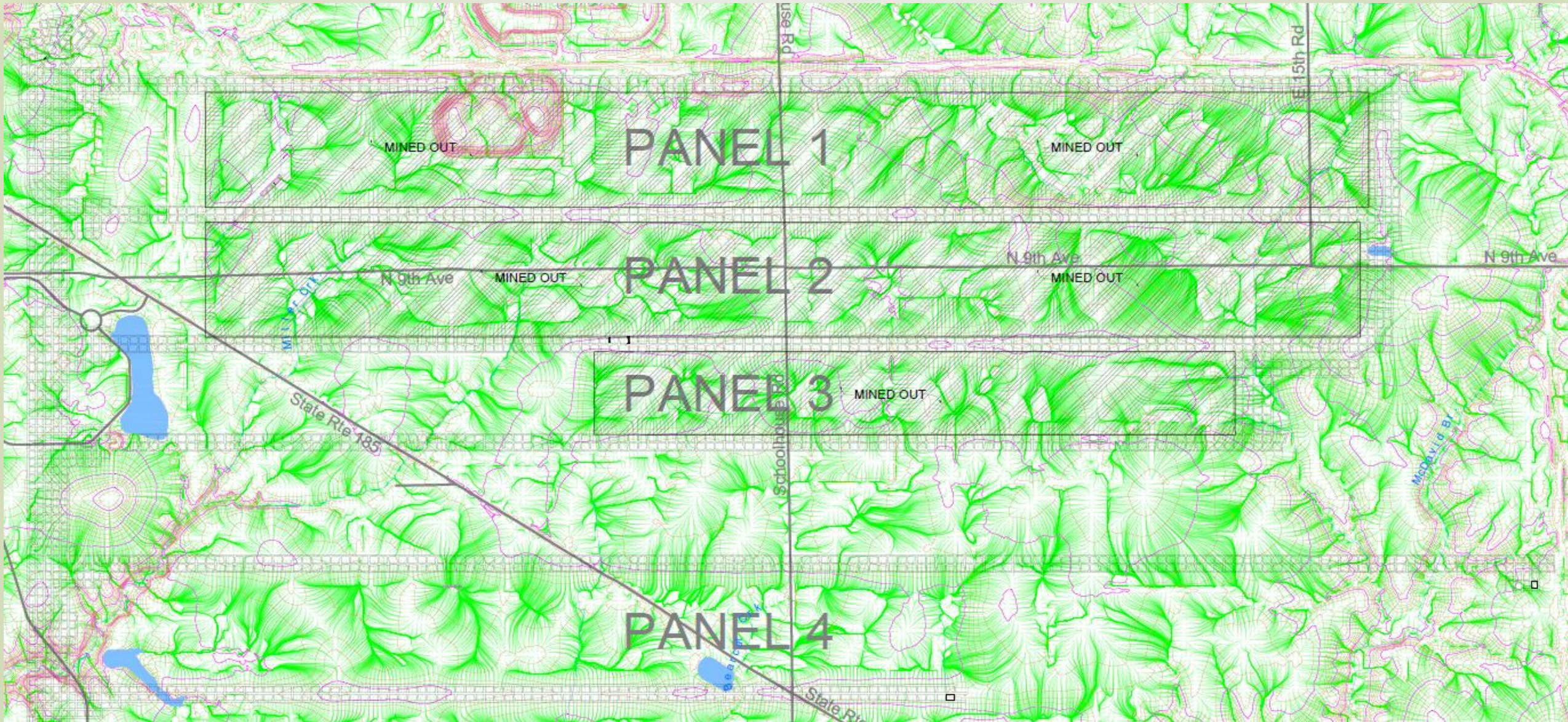
A comprehensive drainage plan spans multiple land owners

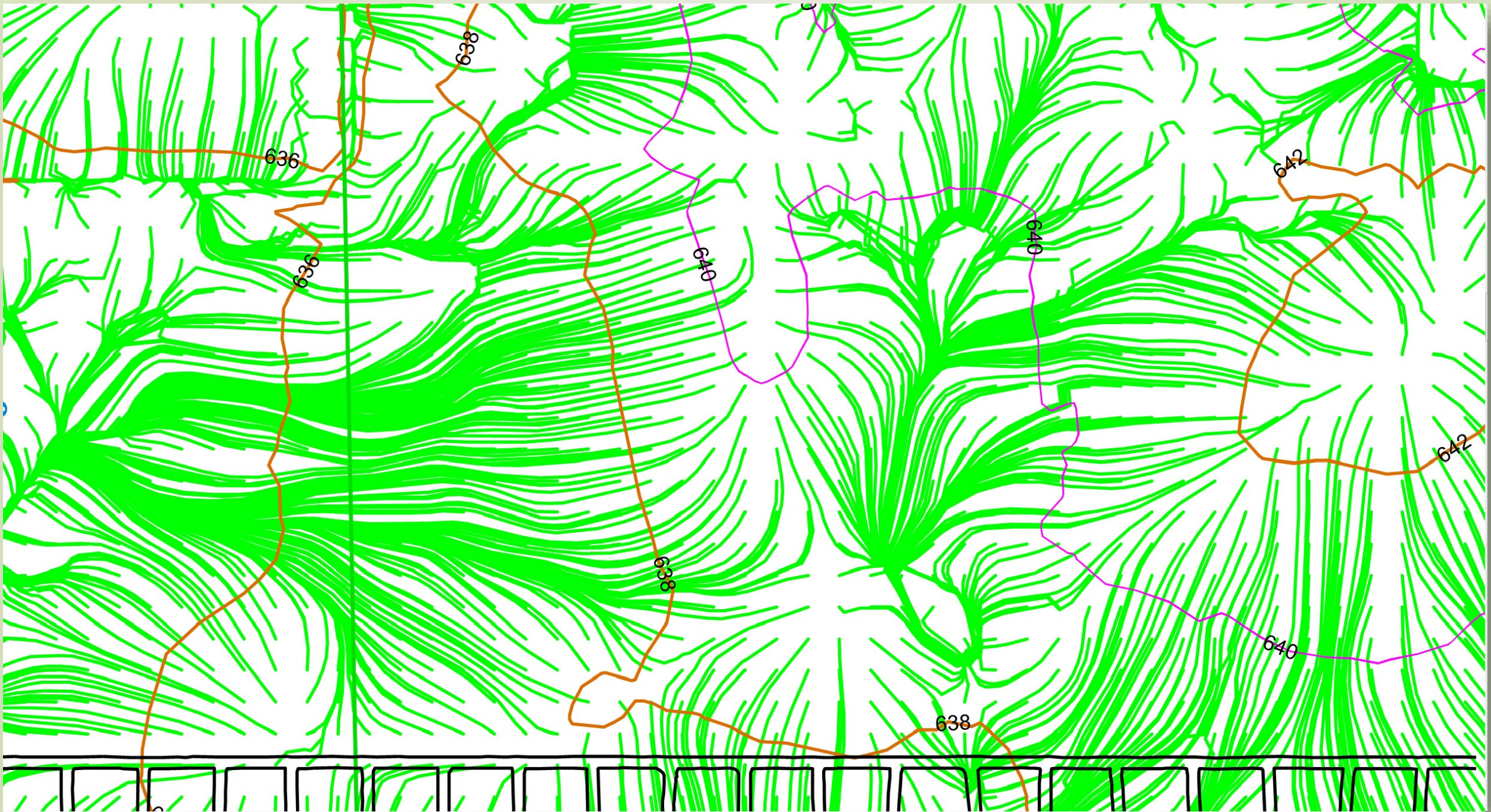
- This can be problematic.
 - Must work with upstream and downstream land owners and convince all that the system will work for all.
- 

Multiple landowners sharing the same watershed areas.




Projected Post Subsidence Contour With Drainage Lines

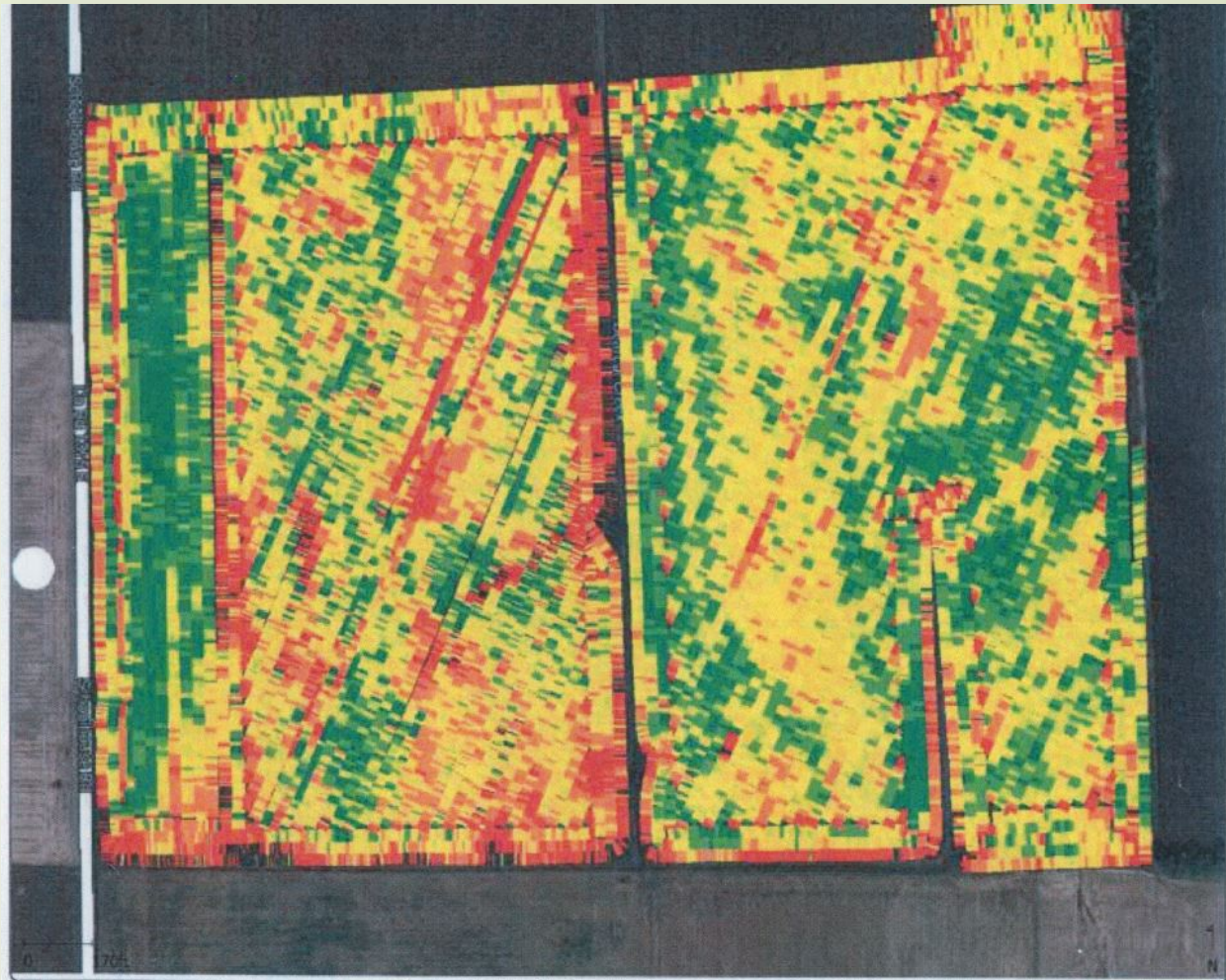






Obtain Pre-Subsidence Yield Maps

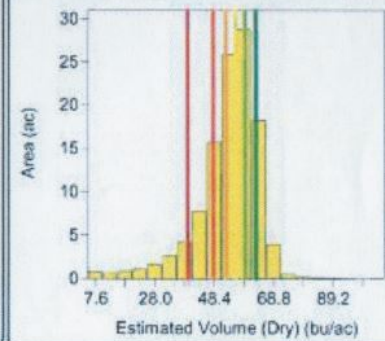
- Farmers can supply if they have this technology.
 - Used to assist in the overall tile design.
 - Pre existing problematic yield areas in a field will be problematic post mining and need special attention.
- 

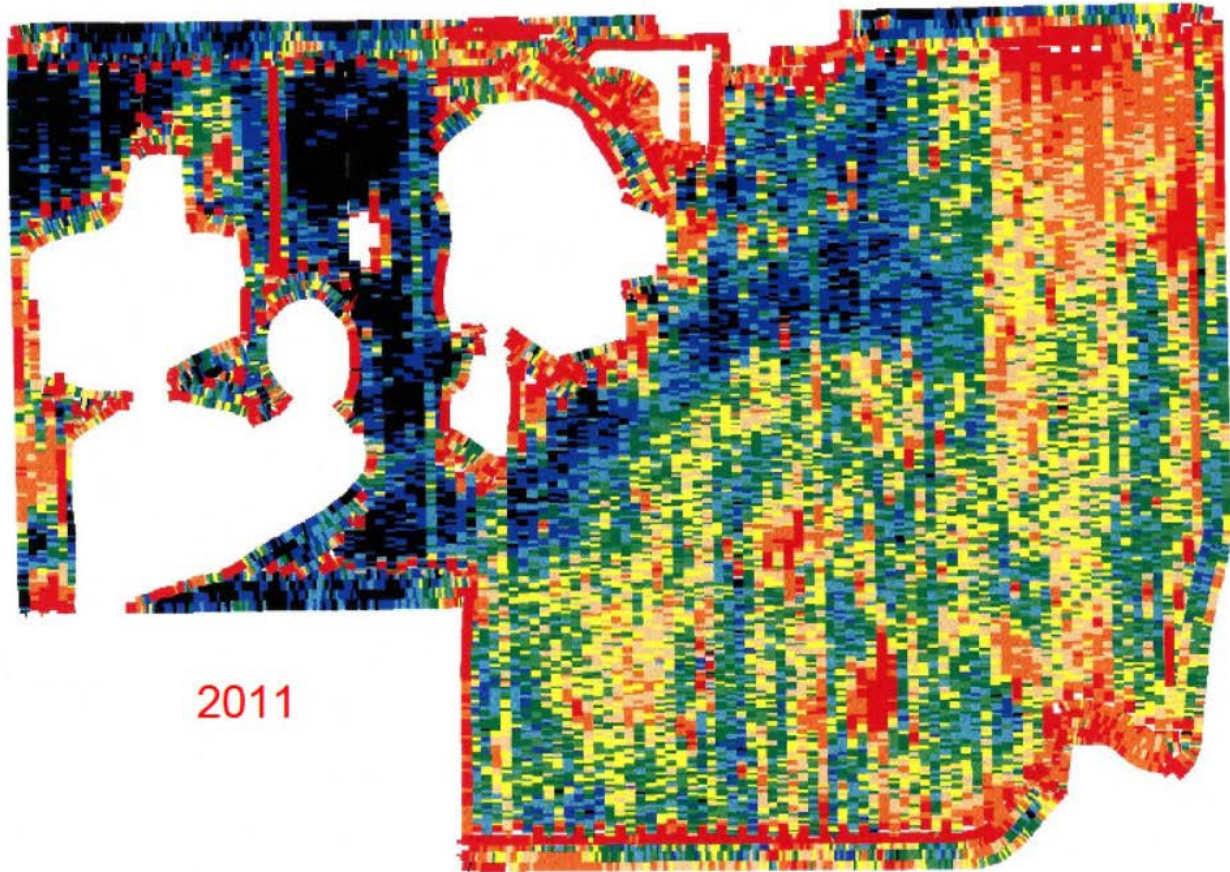


Grower : 4 Seasons
 Farm : Spinner
 Field : Middle 80
 Year : 2014
 Operation : Grain Harvest
 Crop / Product : SOYBEANS
 Instance : Harvest - 1
 Area : 113.44 ac
 Avg. Yield : 52.27 bu/ac
 Avg. Moisture : 12.25 %

Estimated Volume (Dry)

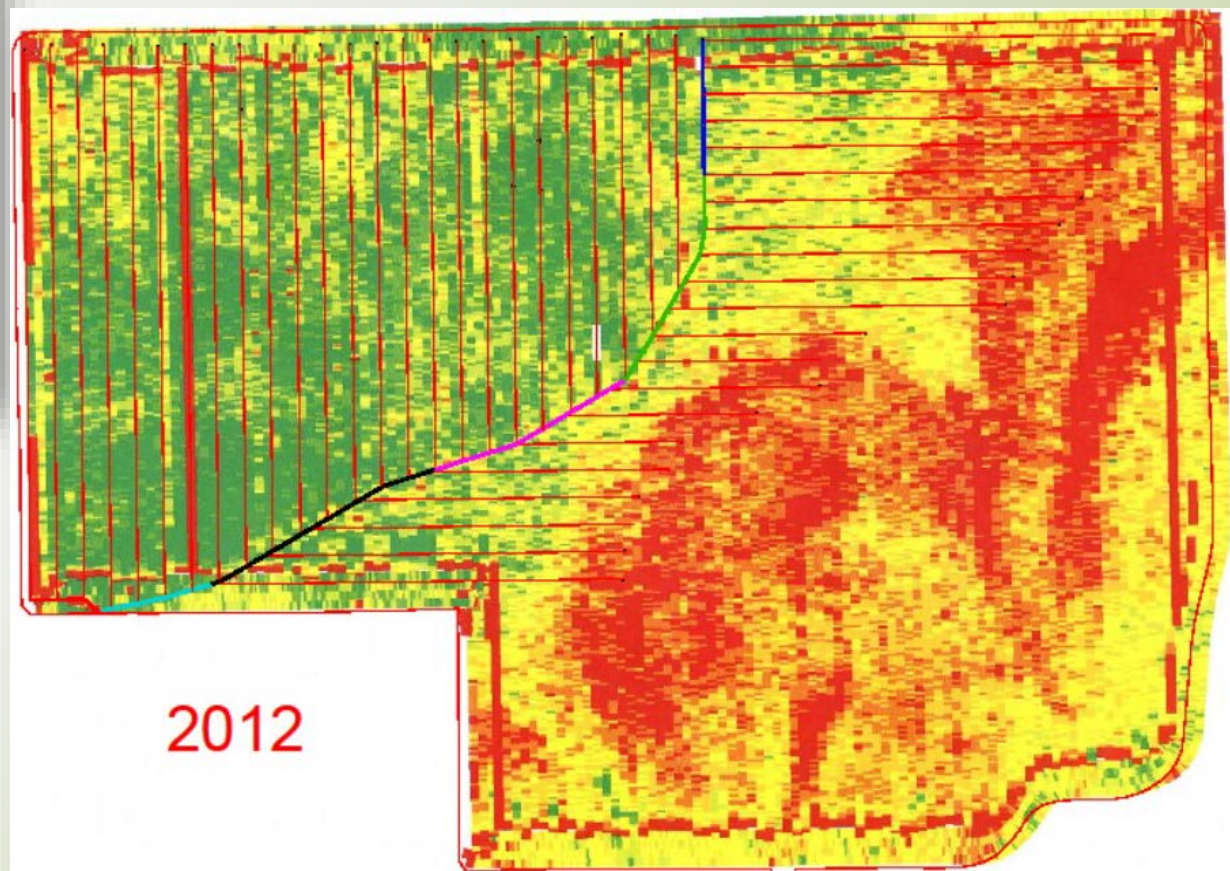
	(bu/ac)	
62.59	-	369.02 (16.44 ac)
58.88	-	62.59 (18.77 ac)
55.79	-	58.88 (18.29 ac)
52.45	-	55.79 (17.95 ac)
48.00	-	52.45 (16.79 ac)
39.26	-	48.00 (14.77 ac)
5.01	-	39.26 (10.42 ac)





2011

Yield mapping
before and
after tile
installation

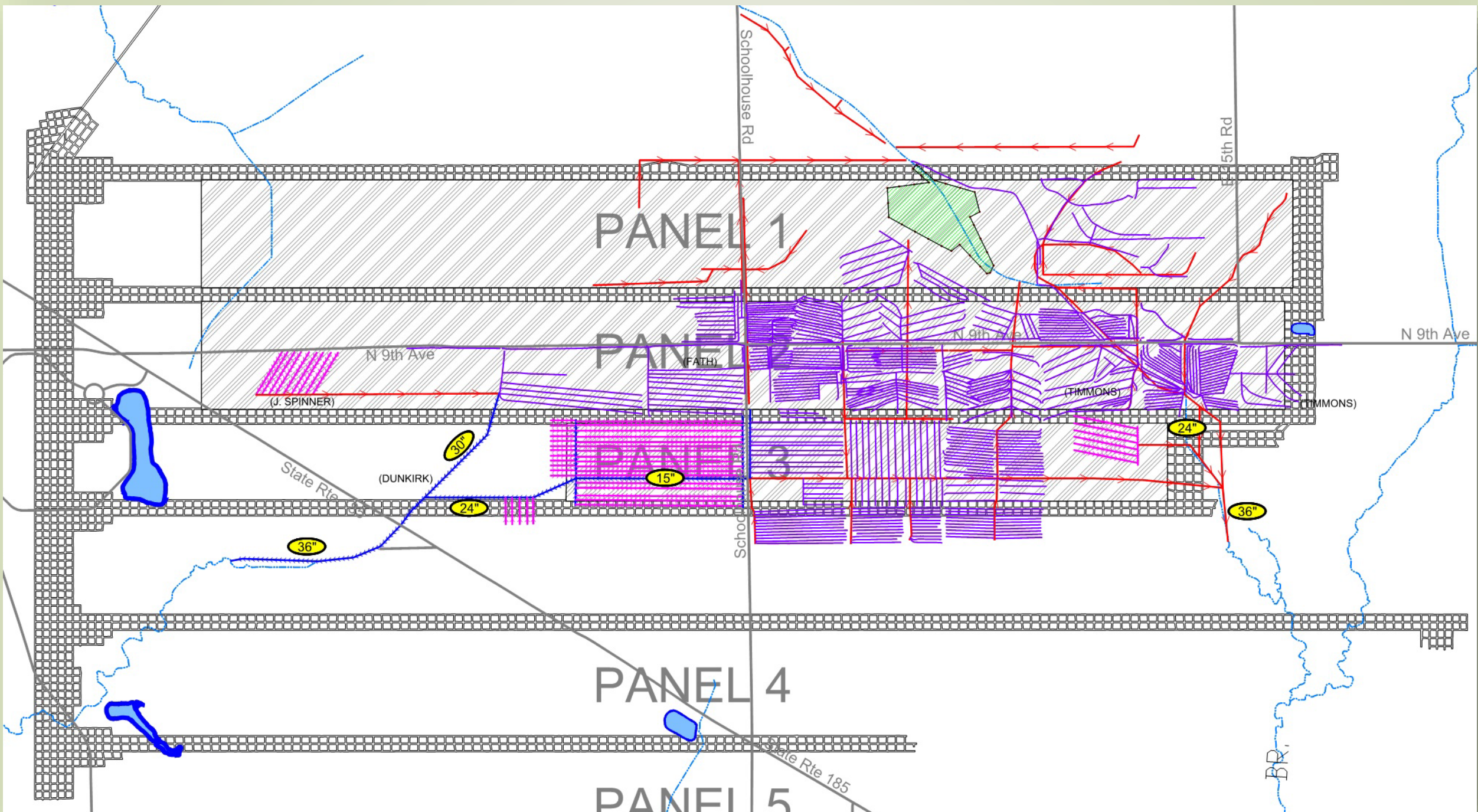


2012




Complete the design and generate a map of the comprehensive tile system.

- Present to the company first and sell the value of the expense.
- Present to all affected landowners and sell the value of the result.





Installing a comprehensive drainage system in longwall subsided flat prime farmland soils.

1. Rough in the mains
 2. Install the mains
 3. Incorporate drainage control structures
 4. Install lateral system
- 

Roughing in the initial tile mains



Installing Tile Main





Replacing Old Drainage Tile



Old
Clay
Tile



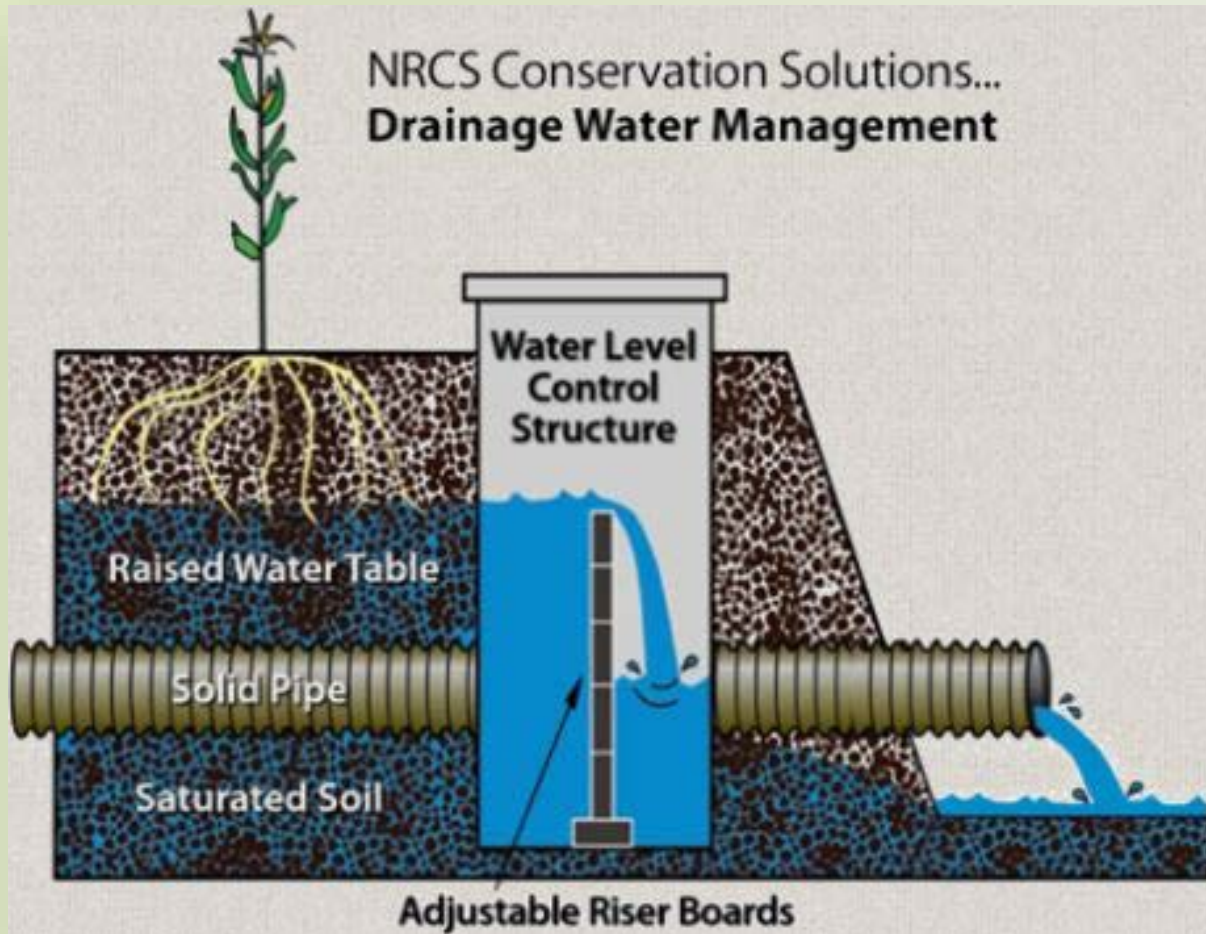


Laterals Installation

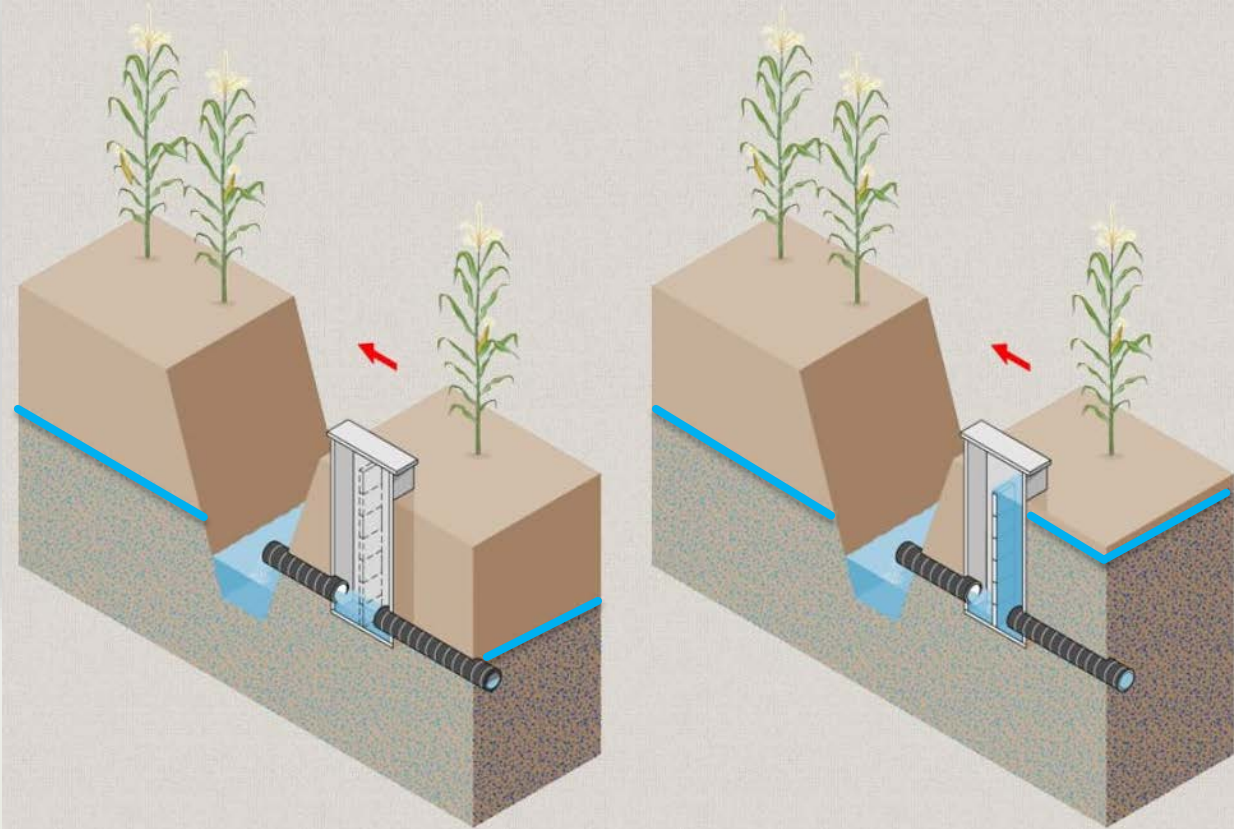




NRCS Conservation Solutions...
Drainage Water Management



Water Drainage Management



Outlet at drain level

Outlet near soil surface



NOV 3 2005



Inspection Port





Importance of Cover Crops











Main drain tile beneath a waterway



Broad waterway with subsurface tile inlet





May 19, 2017 7:00 am



May 19. 2017 12:00 pm



May 19, 2017 7:00 pm



Conclusion:

Effective use of a combination of:

1. Designed Surface Waterways
2. Subsurface Drainage Tile Systems
3. Drainage Control Structures

Can result in improved crop management through the retention of soil nutrients & control of water table levels to benefit the rooting system as conditions warrant in longwall subsidence areas.