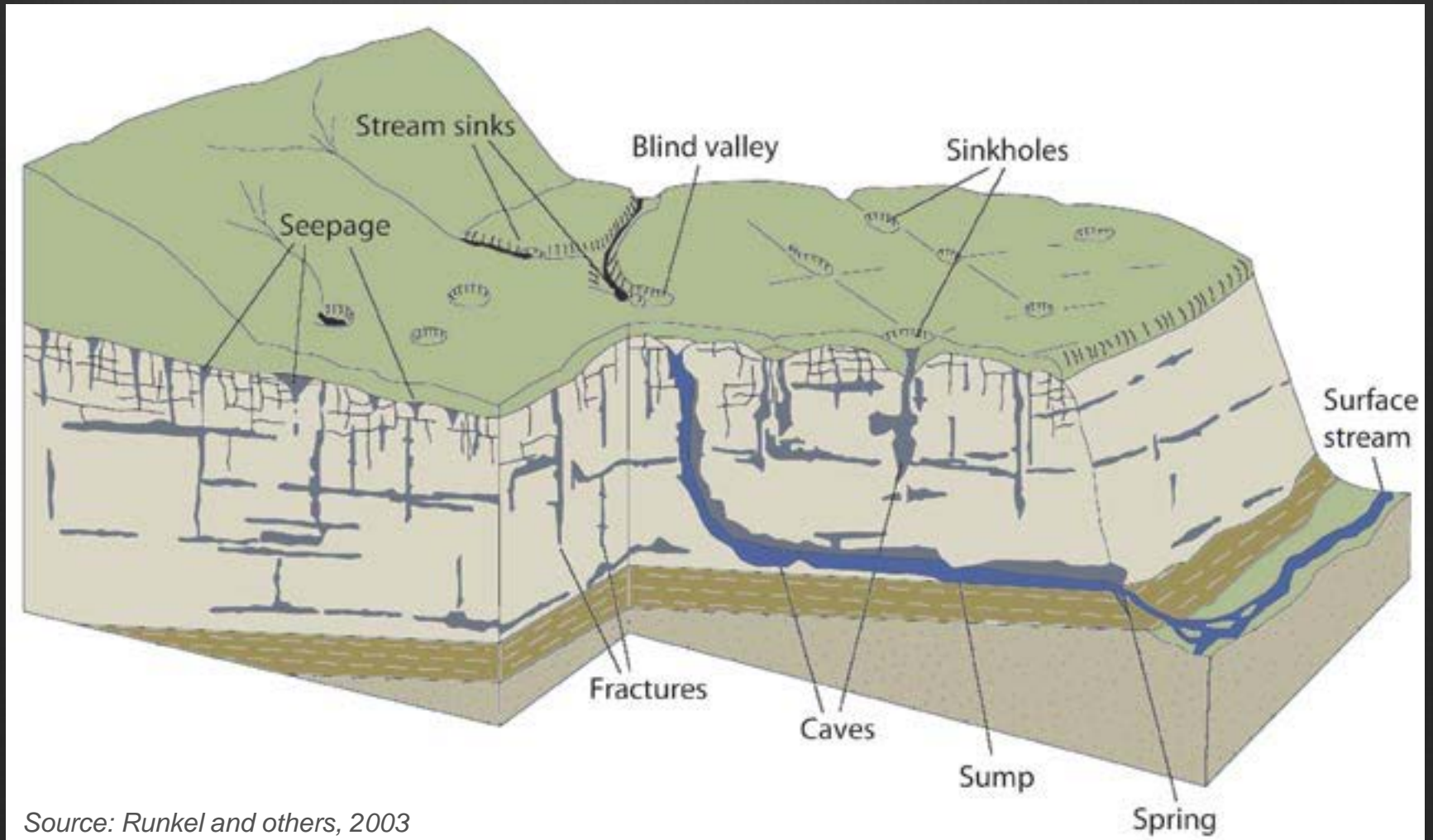


Lafayette County

Karst and other groundwater considerations



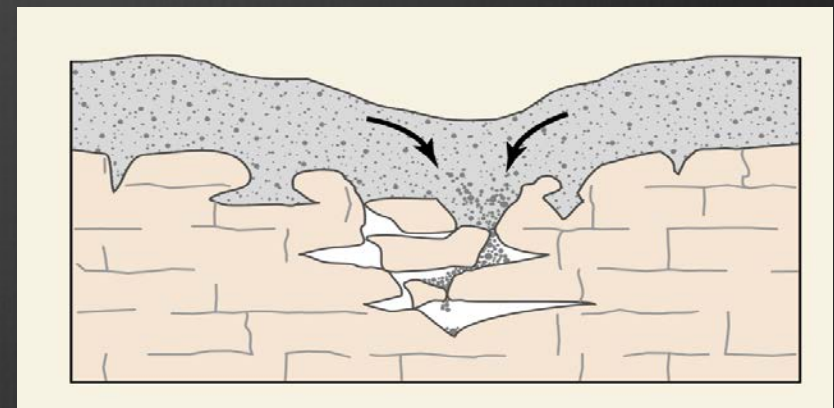
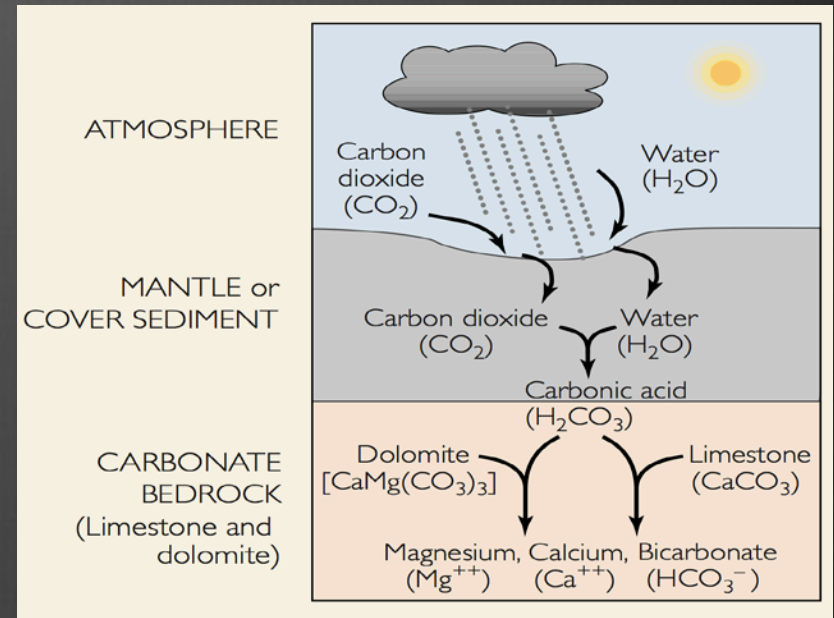
What is karst?



- “Karst” is a landscape created when water dissolves rocks.
- In Wisconsin, dolomite and some limestone are typical soluble rocks.

Sinkholes and caves indicate karst

- ◆ Karst develops by dissolution in carbonate bedrock.
- ◆ Water washes overlying material into the underlying conduits and fractures



Overlying material affects sinkhole type

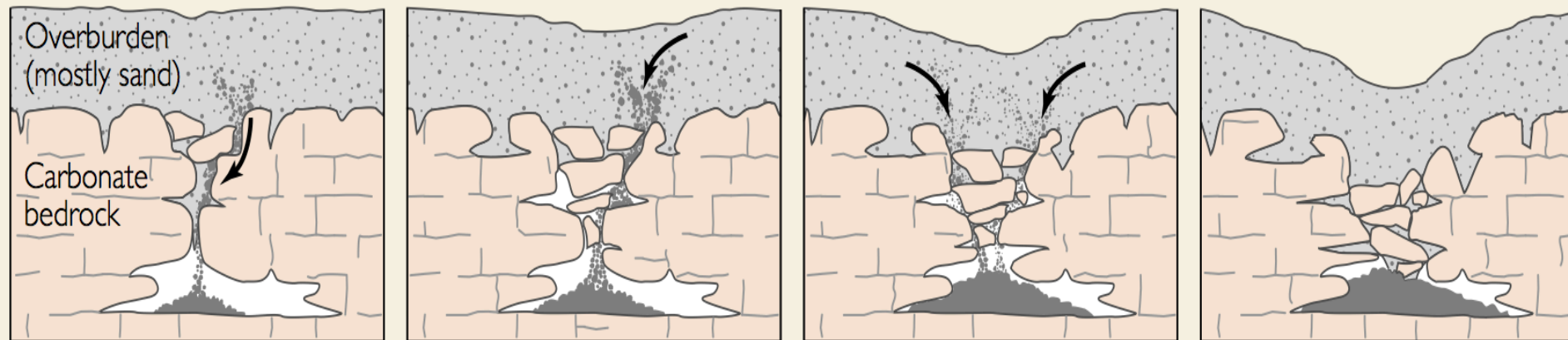
Tihansky, 1999

Granular sediments spall into secondary openings in the underlying carbonate rocks.

A column of overlying sediments settles into the vacated spaces (a process termed "piping").

Dissolution and infilling continue, forming a noticeable depression in the land surface.

The slow downward erosion eventually forms small surface depressions 1 inch to several feet in depth and diameter.



Cover-subsidence - Less cohesive overlying sediment (sand and gravel)

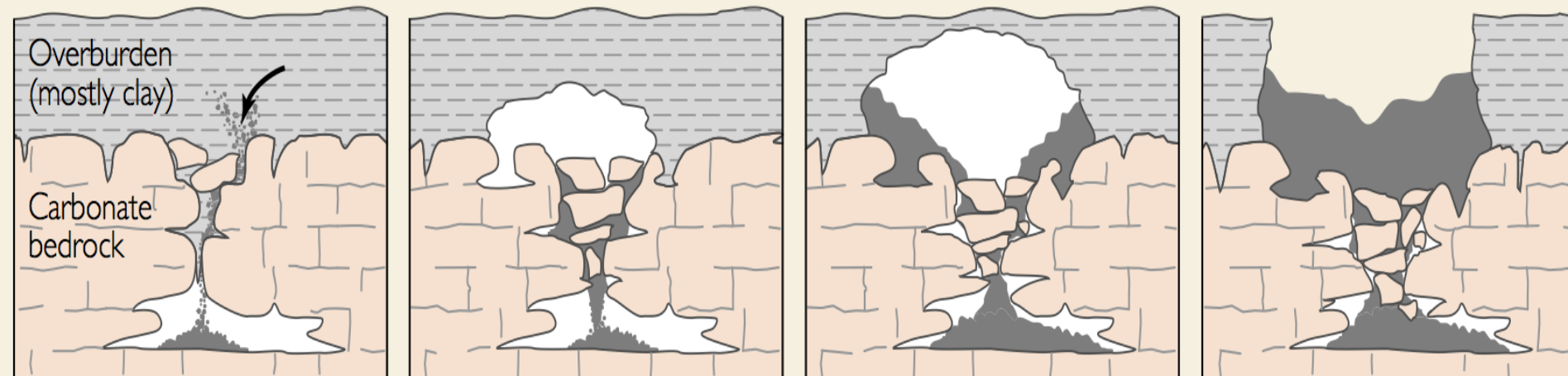
Overlying material affects sinkhole type

Tihansky, 1999

Sediments spall into a cavity. As spalling continues, the cohesive covering sediments form a structural arch.

The cavity migrates upward by progressive roof collapse.

The cavity eventually breaches the ground surface, creating sudden and dramatic sinkholes.



Cover-collapse - Overlying sediments are cohesive (clays, silts, and concrete)

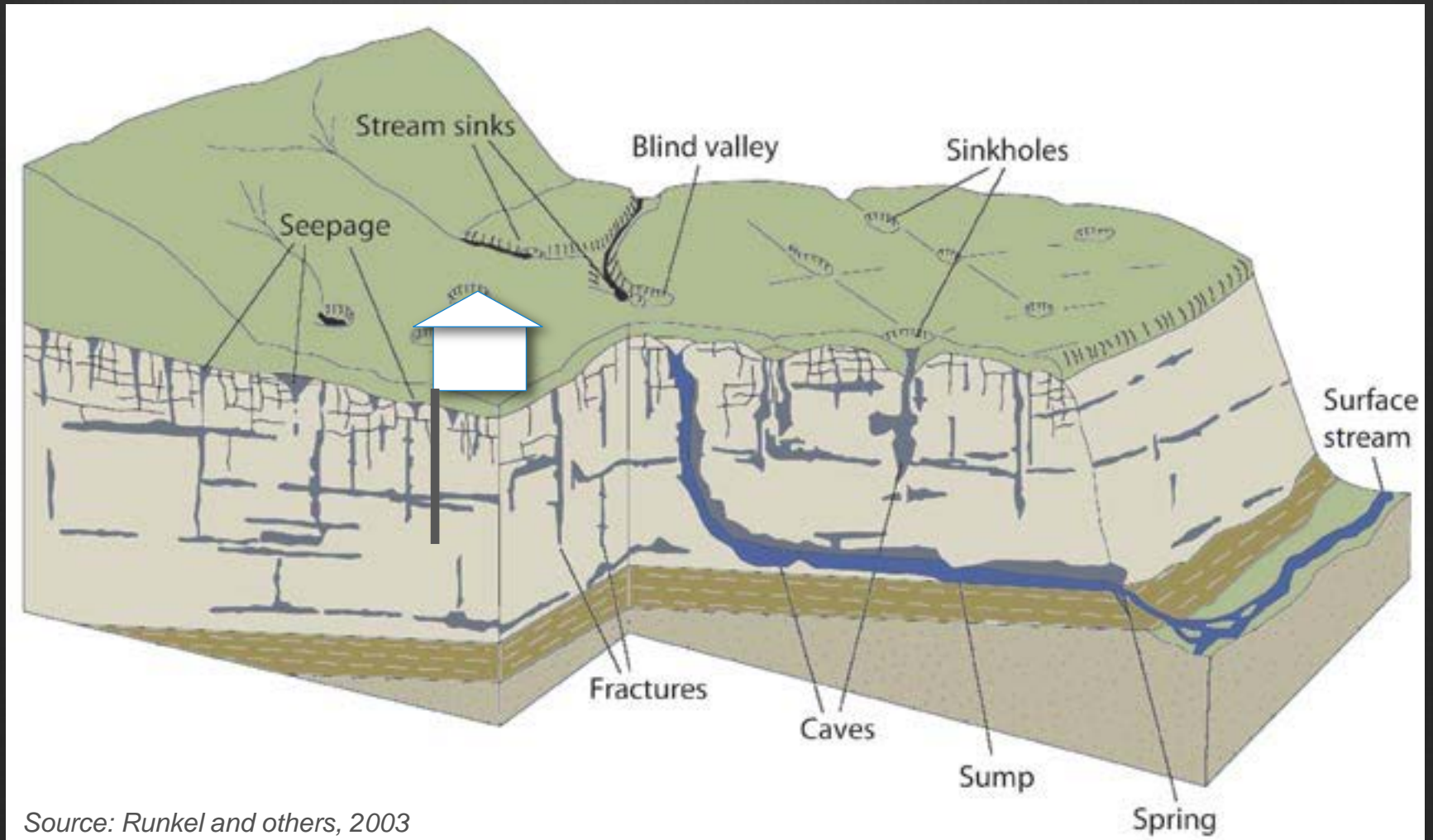
Fractures and swallets indicate karst



Sometimes fractures fill with soil.

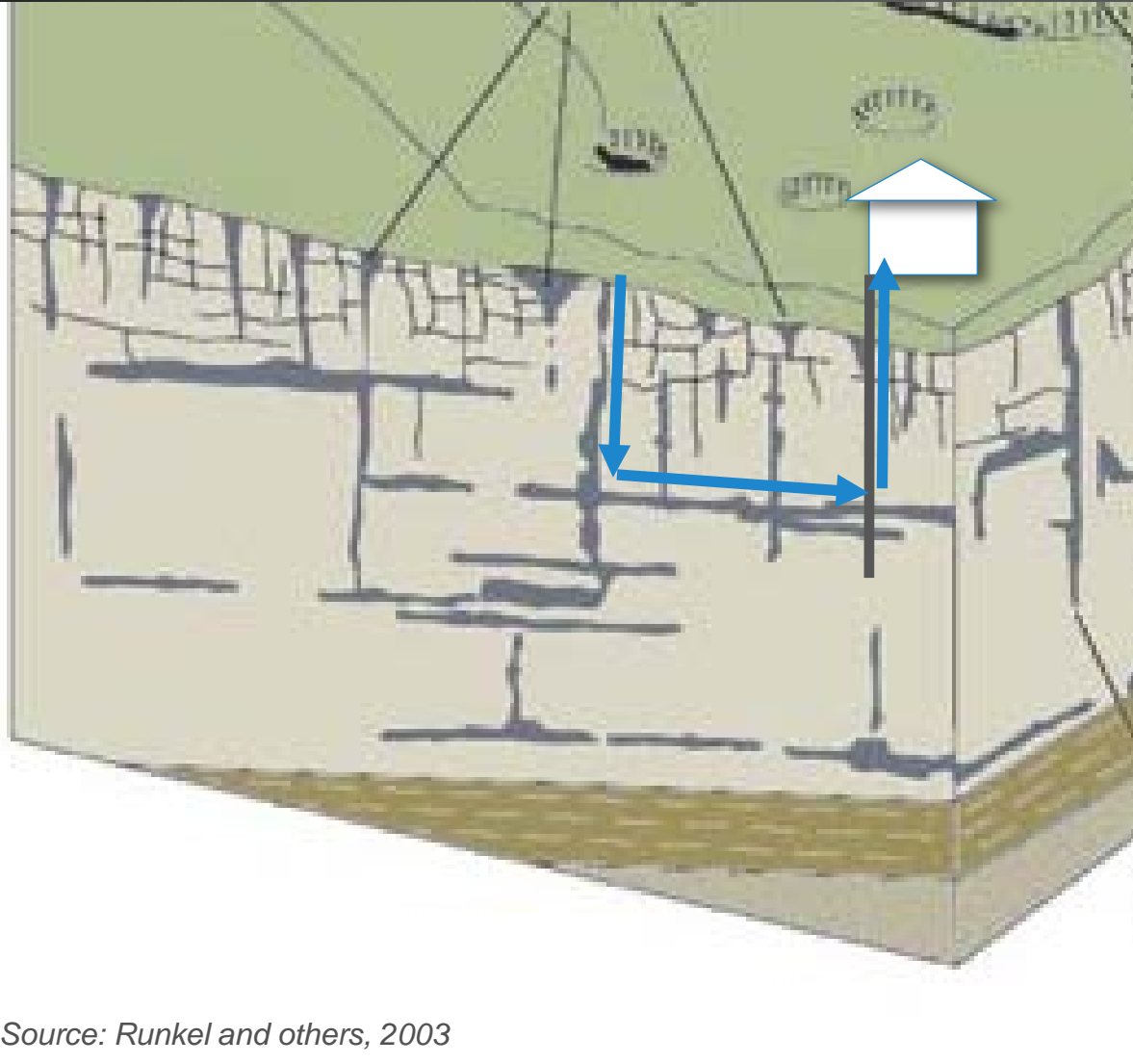
Plants like increased soil thickness

Groundwater flow in karst



Karst → well connected conduits and fractures in the rock.

Groundwater flow in karst



Source: Runkel and others, 2003

Surface contaminants are quickly transported through the conduits and fractures

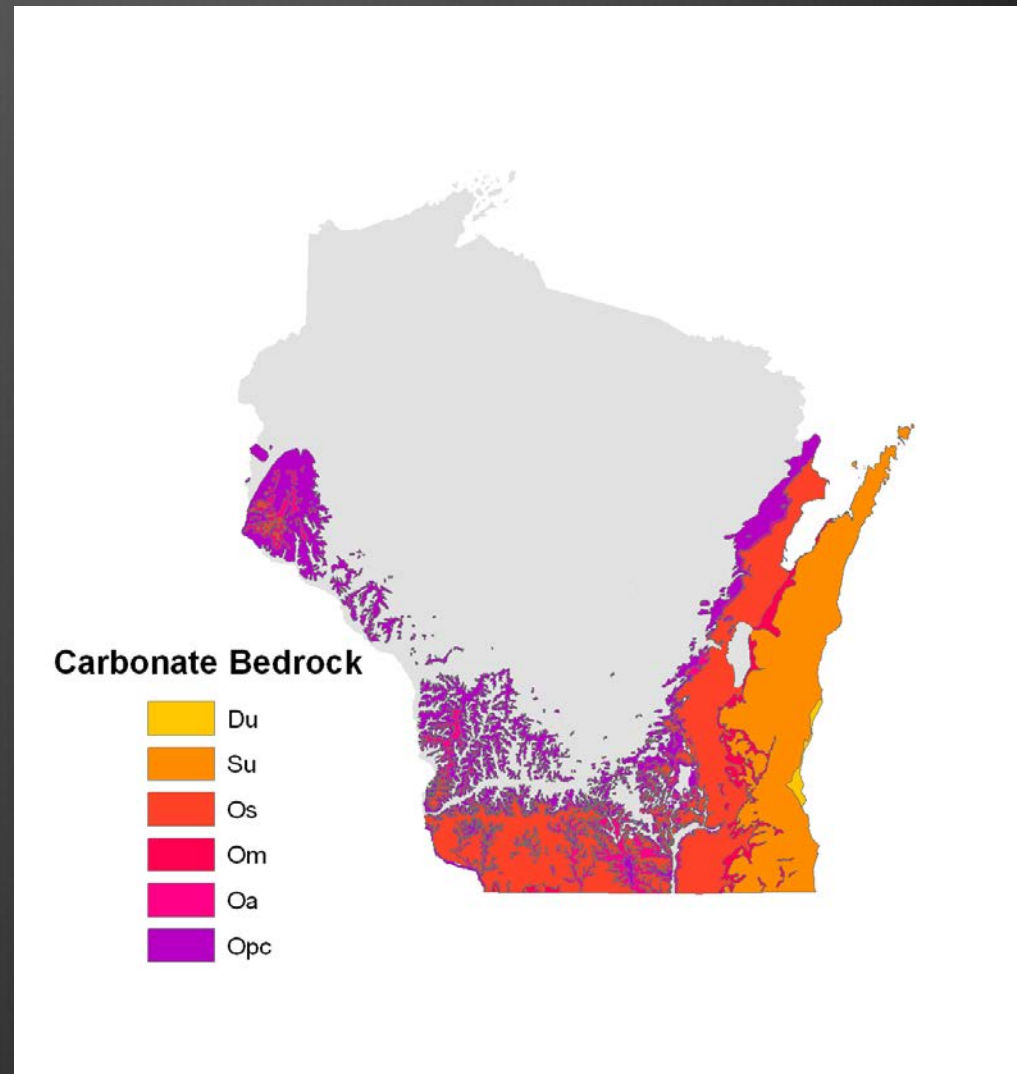
Little filtering or removal of contaminants during transport through the carbonate rocks.



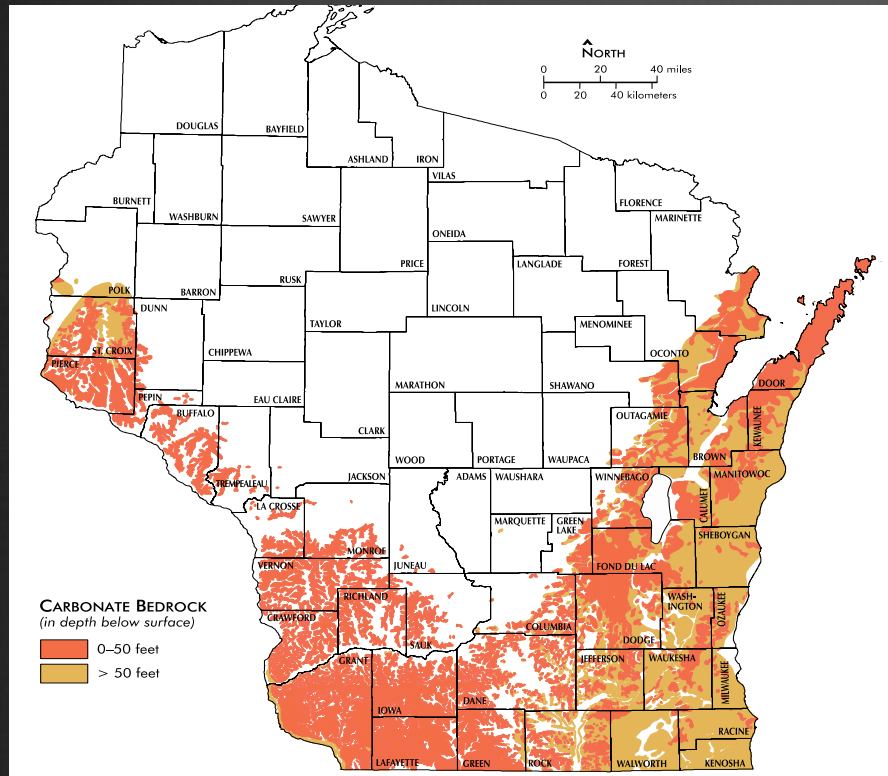
Residue from manure spreading

Karst and Wisconsin Bedrock

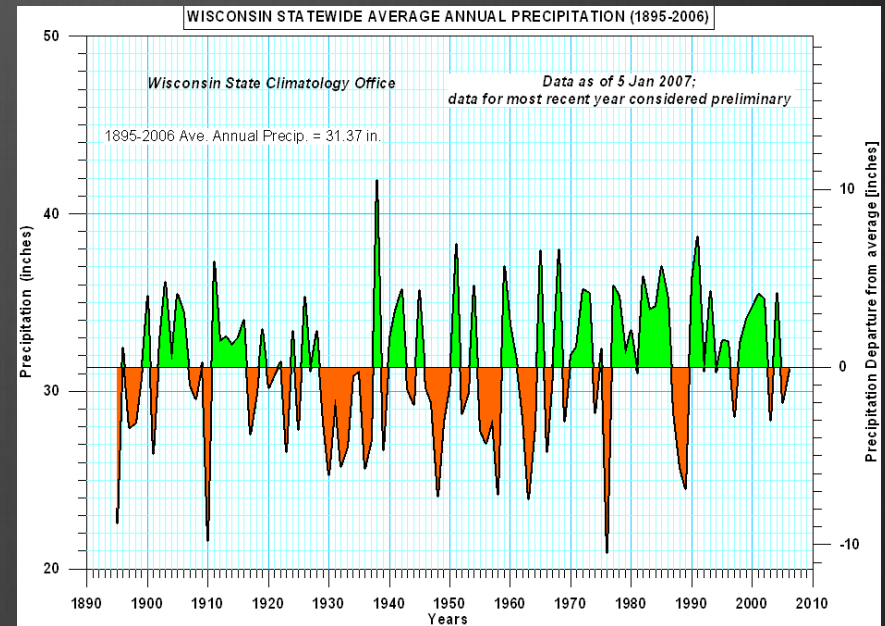
- ◆ Bedrock Units associated with karst
 - ◆ Devonian and Silurian Dolomites
 - ◆ Sinnipee Group (Galena-Platteville)
 - ◆ Prairie du Chien



Just need carbonate rock and water



Depth and presence
of carbonate rock in Wisconsin

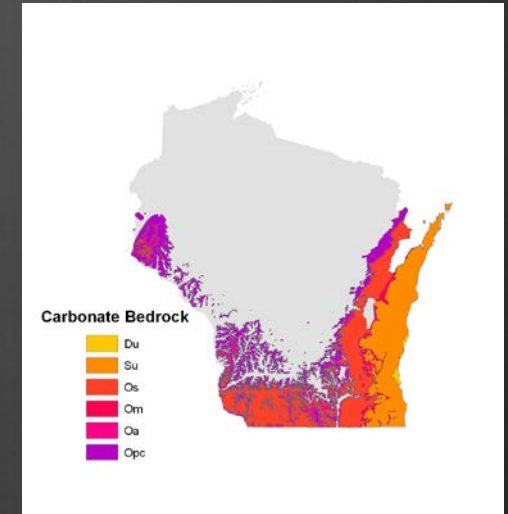
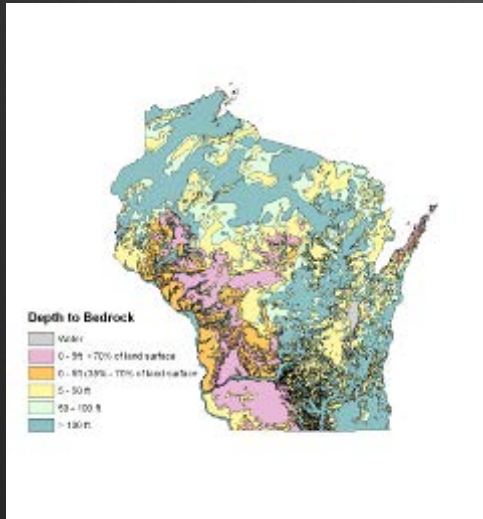


Average precipitation 31 inch/year

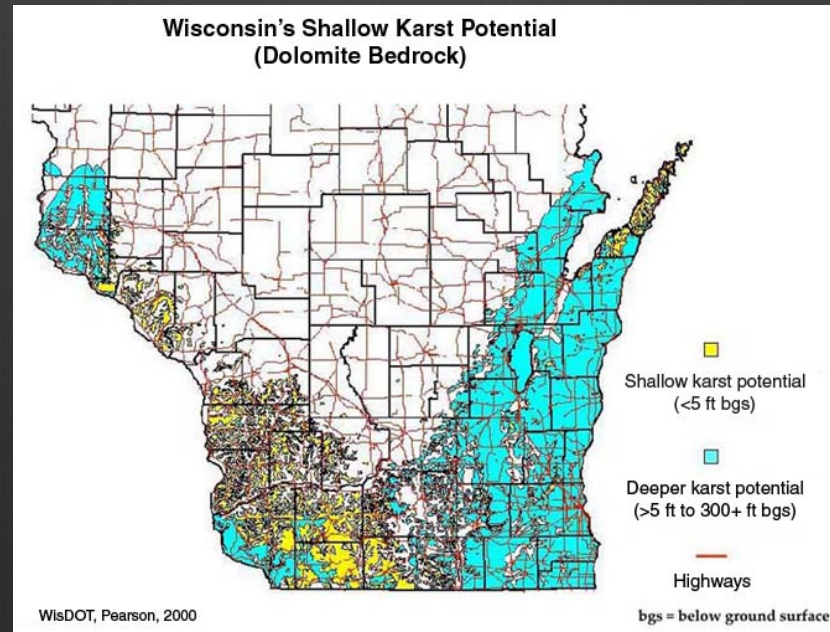
Wisconsin has both

Karst Potential Map

combines geology and depth to bedrock



Depth to bedrock



Carbonate Bedrock

Lafayette County

Has high karst potential

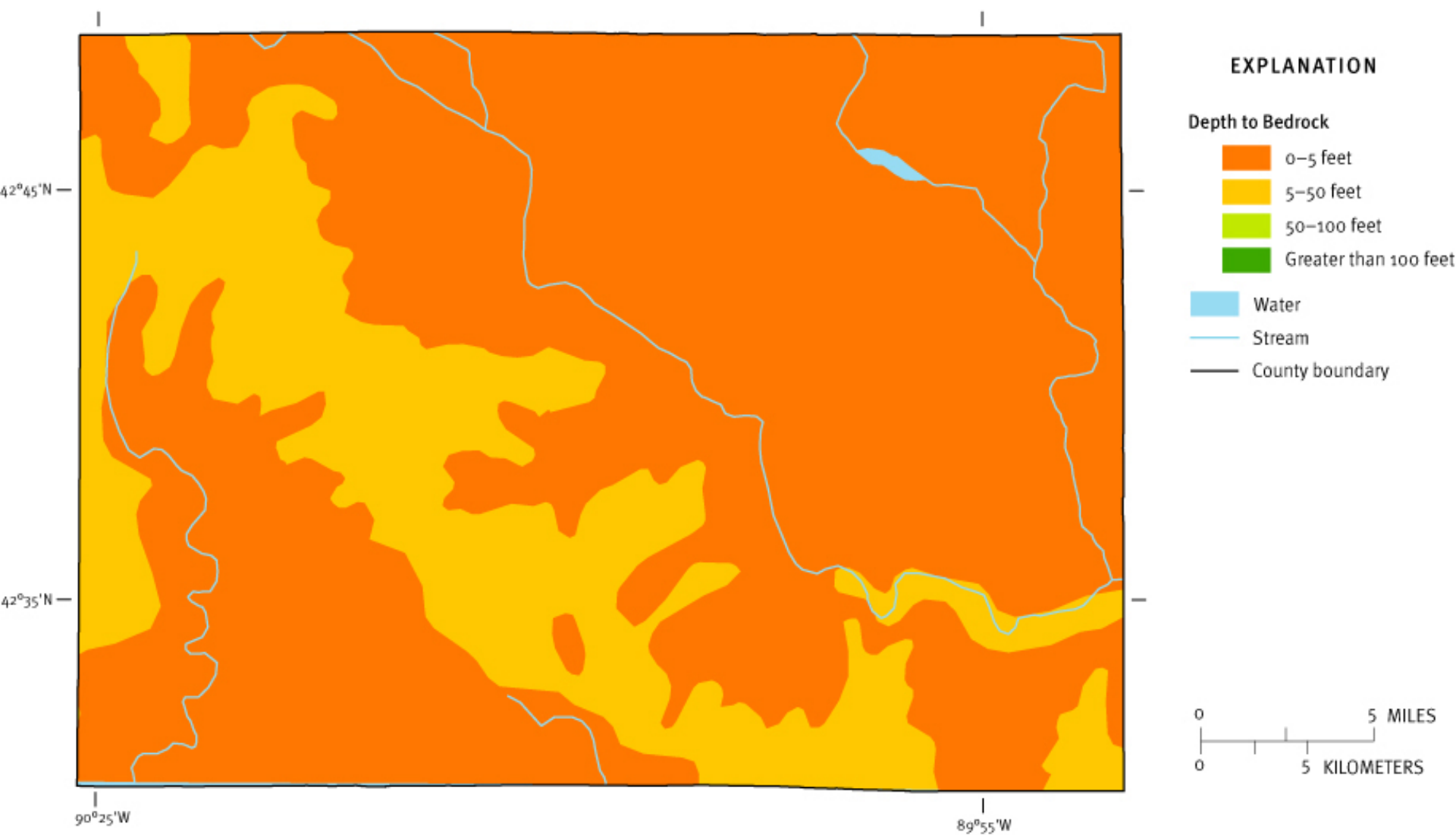
- Shallow depth to bedrock
- Much of the county has carbonate bedrock as the uppermost unit
- Combine to also have relatively high susceptibility to groundwater contamination.

Lafayette Topography

Part of Driftless Area – Many ridges and valleys



Lafayette County – Depth to Bedrock

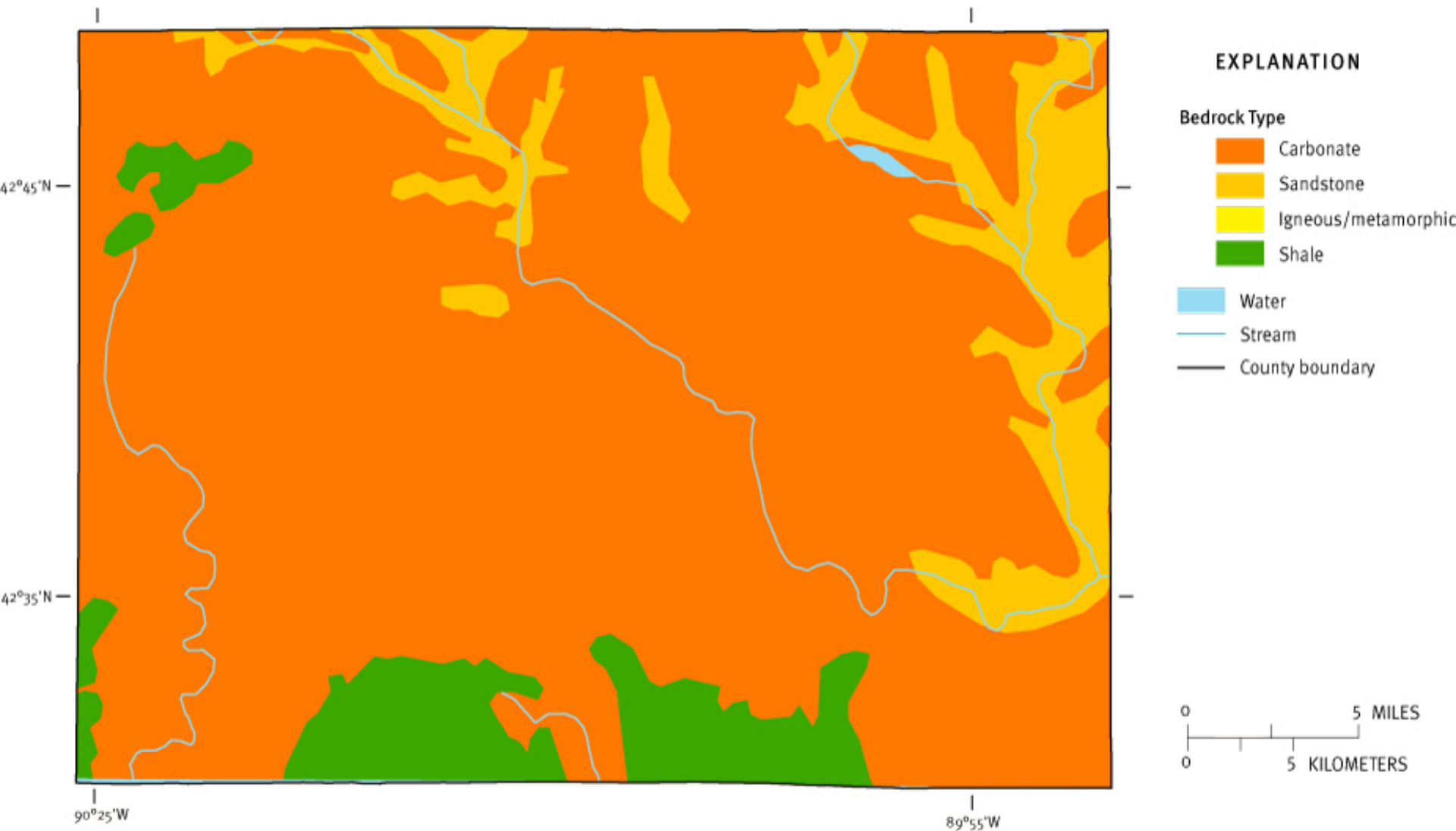


This resource characteristic map was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map source: Schmidt, R.R., 1987, Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, <http://wi.water.usgs.gov/gwcomp/>

Lafayette County – Bedrock Type

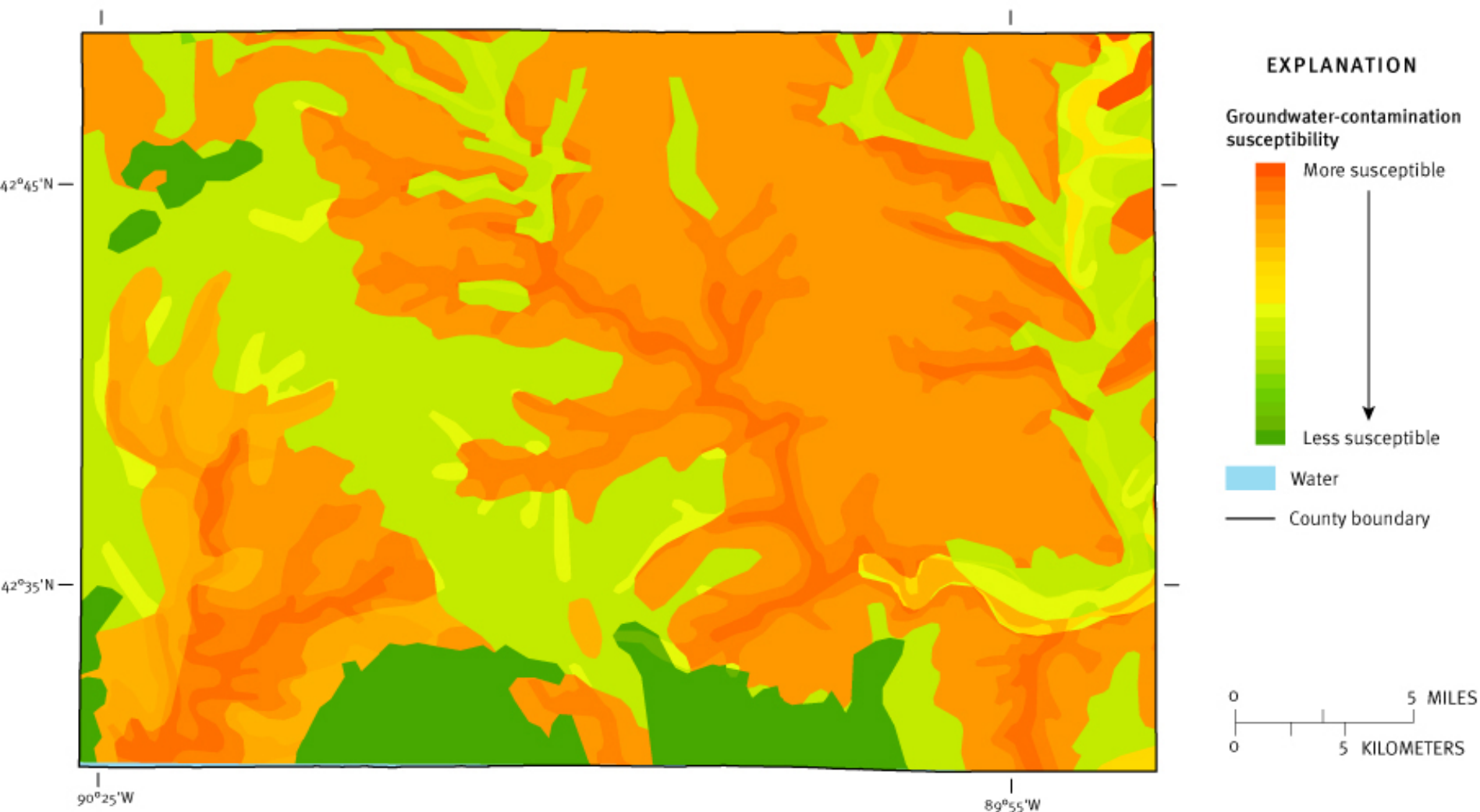


This resource characteristic map was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map source: Schmidt, R.R., 1987, Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, <http://wi.water.usgs.gov/gwcomp/>

Lafayette County – Groundwater-Contamination Susceptibility Analysis



This groundwater-contamination susceptibility map is a composite of five resource characteristic maps, each of which was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map source: Schmidt, R.R., 1987, Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, <http://wi.water.usgs.gov/gwcomp/>

Example of fractures in Lafayette County Platteville Dolomite on Highway 151



Example of fractures in Lafayette County Platteville Dolomite on Highway 151

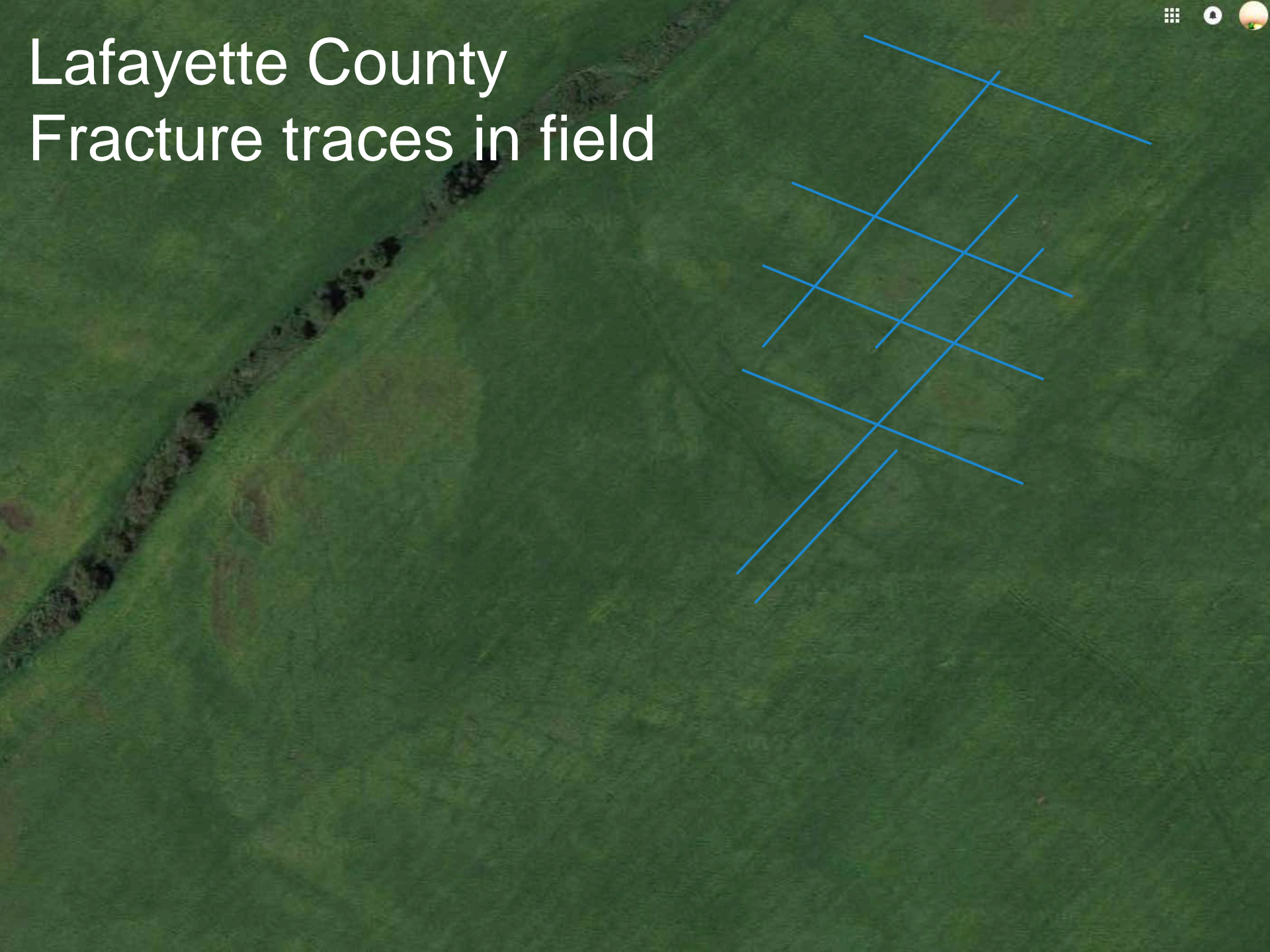
Sinkholes

These formed easily because sediment
had room to move into.



Lafayette County

Fracture traces in field



Cave in Lafayette County

Madison Youths in Grant Jail

4 Teen Cave Dwellers Held for Armed Thefts

LANCASTER — Four hippie-like teen-aged cave dwellers, arrested Sunday as suspects in two armed robberies in Grant County are still being held by Grant County authorities awaiting further court action.

The four, three of them juveniles, had set up housekeeping in a Lafayette County cave near Hazel Green. They were taken into custody by a posse of law officers from Grant and Lafayette counties, plus volunteers from the area.

Being held in Grant County jail under a \$50,000 bond is Richard Hammill, 19, a native of the Patch Grove area recently residing in Madison. He is charged with two counts of armed robbery and one count of theft.

Still in detention here are a 16-year-old youth, a 16-year-old girl and a 15-year-old girl, all of Madison.

Grant County Sheriff Roy Graney said the county is holding the girls for Dane County juvenile authorities, and authorities will seek a waiver so they can try the youth in County Court instead of juvenile court.

The four allegedly threatened and robbed Sylvester Rogers, 86, Hazel Green, after entering his home last Wednesday night, taking \$26 and clothing.

On Friday night, authorities said, they allegedly entered the home of Mr. and Mrs. Floyd (Pat) Temperly, Hazel Green, threatened them with a knife, bound them, and then took food, clothing, dishes, and other household items valued at \$400.

They also reportedly took the car which they abandoned near a vacant farmhouse about a half mile from the cave.

The posse first surrounded the farmhouse, but found it vacant. They combed the area, and on advice of three Hazel Green teenagers who saw the suspects washing clothes in an area creek, surrounded the mouth of the cave.

The four refused to come out, but fled from the cave after one shot was fired.

Nearly two pick-up truck loads of housekeeping items were taken from the cave including a rug, chest of drawers, food, cuckoo clock, and bed clothing.

Value of stolen items was estimated at between \$400 and \$500, exclusive of the car.

Sheriff Graney said Grant County authorities took custody of the four since the thefts occurred there, although the cave was in Lafayette County.

WISCONSIN MINERAL DEVELOPMENT ATLAS

LAFAYETTE COUNTY

INDEX MAP

ATLAS LEGEND

INDEX MAP

Numbers assigned to each section refer to individual section maps prepared at a scale of 1 inch = 200 feet. Section reference numbers are also indexed in separate Record Volumes wherein individual logs and records pertaining to any single section have been assembled.

SECTION MAPS

PS. Etc. Numbers identify the location of a mapped section by direct reference to the Index Map.

Filed. Date to which all available records have been assembled on any single section.

20-WC 105 Etc. Drill hole locations.

Number to the left is the Atlas Serial Number.

Number to the right is the Original Identification Number.

Serial Numbers are assigned consecutively, starting with number 1 in each section. They are entered in numeric order as the records of holes or mine workings are posted on section maps and included in the Record Volumes.

MINERALIZATION IDENTIFICATION

- Drill holes penetrating least and zinc totality or least 3 percent of metal, singly or combined, through a minimum distance of 2 feet.
- Drill holes penetrating from a trace to 3 percent and zinc, singly or combined, through a minimum distance of 2 feet.
- Drill holes barren of mineralization as evidenced by records or analyses.
- Drill hole location is known but no dependable records exist.

P05 (Serial Number) Etc. Identified Mine Work.

Serial number refers to details of one or mine workings as described in Record Volumes. Numbers are of this same series assigned to drill hole sections.

- Surveyed mine workings — Outline of excavation.
- Unsurveyed mine workings — Outline of excavation.
- Confirmed presence of ore in mine traces.

Lead dips error.

RECORD VOLUMES

20-WC 105 Etc. Index Tab Numbers are Section Reference Numbers and are identified directly with some numbers on Index Map and individual Section Map.

Lafayette County Sec. Ref. 105 Etc. Individual record sheet numbers are identified for direct reference to the Section Reference Numbers and County.

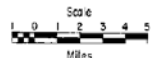
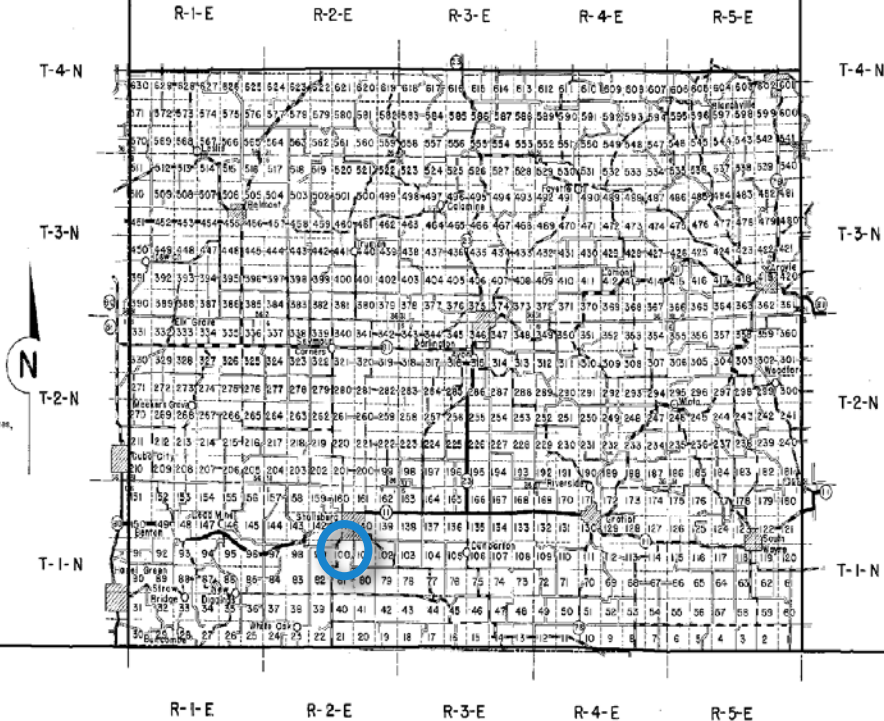
Serial Numbers are assigned to logs and records in the consecutive order of their posting and assembly behind proper index tab in the Record Volumes.

Lead furnace site. Approximate location - 2.

Controlled by U.S. Department of the Interior
Geological Survey
Bureau of Mines

Compiled from Studies and Records of exploration and development work, compiled by:
Local Mining Companies and operators
Geological Survey
Bureau of Mines
State of Wisconsin

Atlas assembled under the direction of the Bureau of Mines,
Minneapolis Branch, Mining Division.



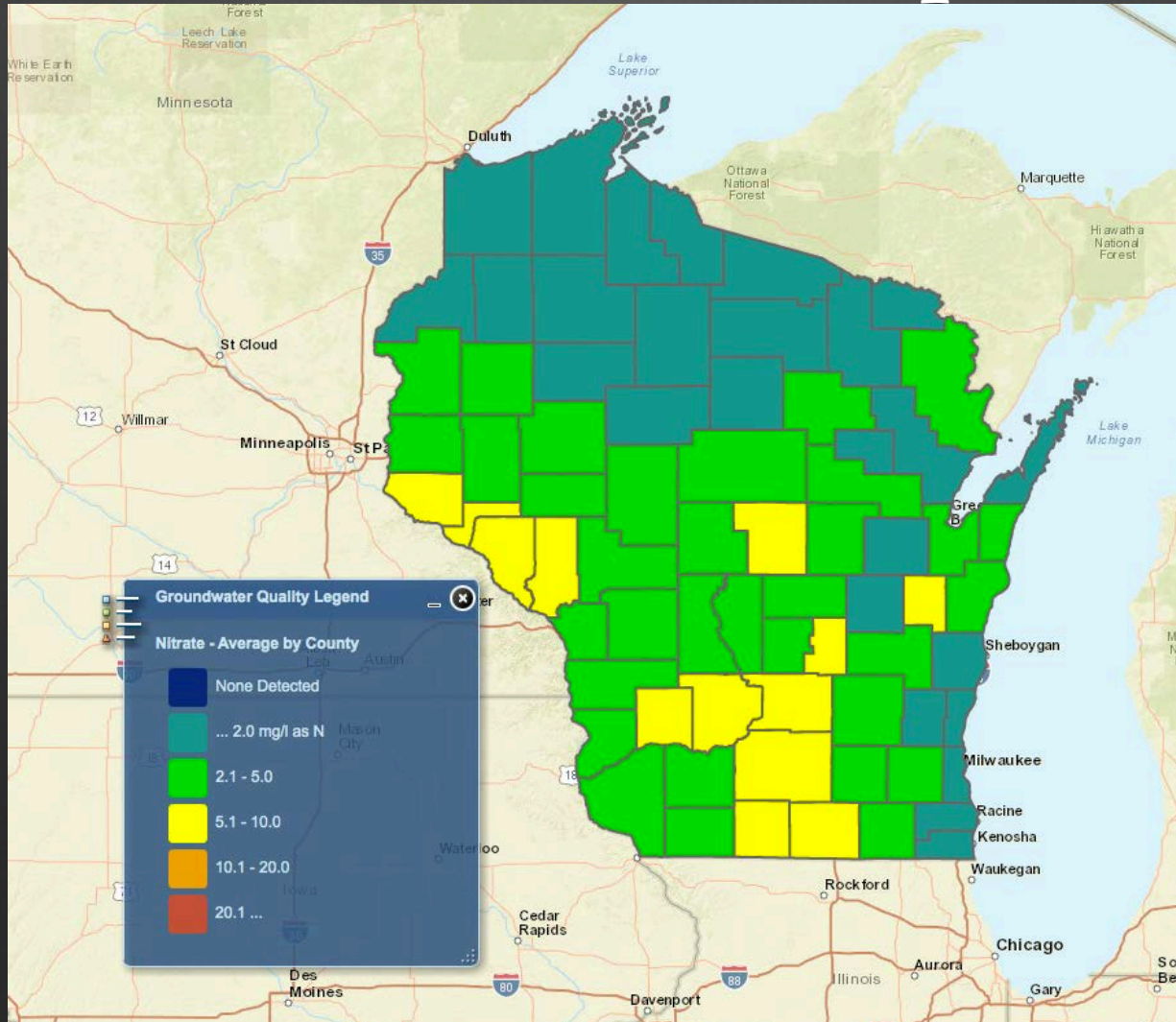
Compilation Started September 4, 1947

Lafayette County had many lead zinc mines.
Old mines can act like karst



Indicators and Concerns

Ground Water Susceptibility



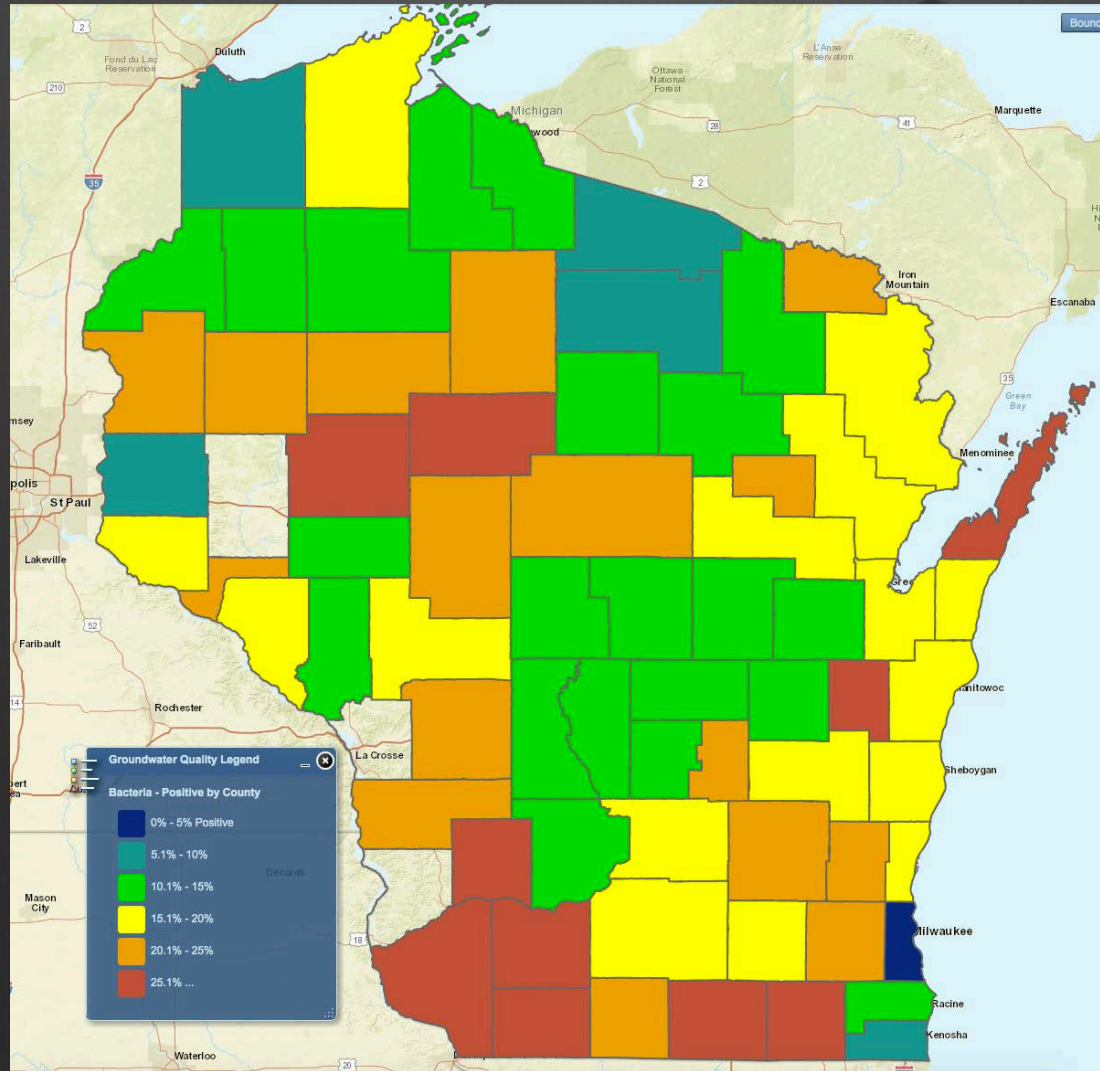
Indicators and Concerns

Ground Water Susceptibility



Indicators and Concerns

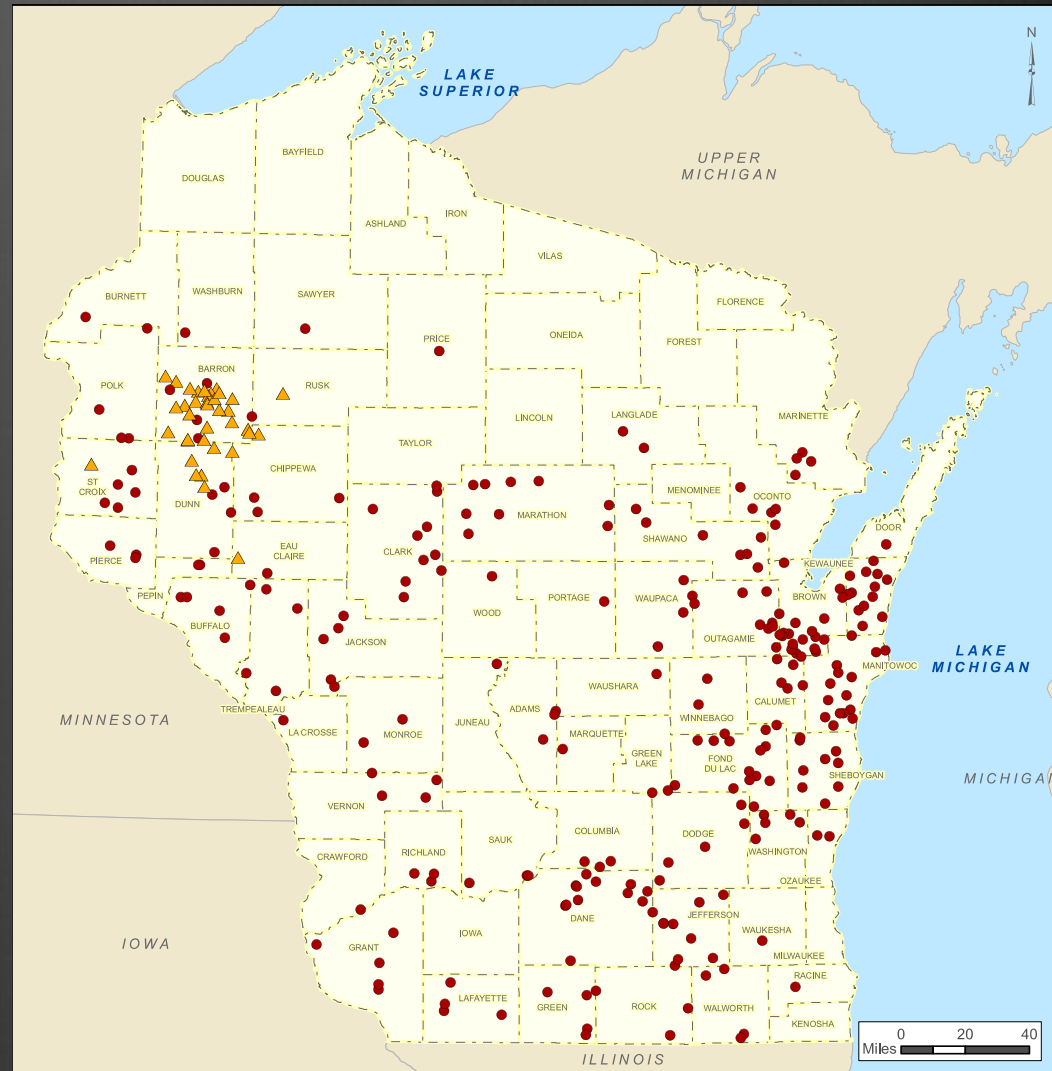
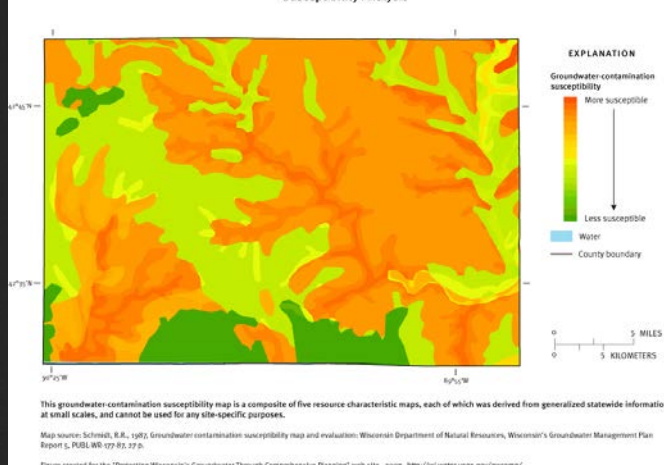
Ground Water Susceptibility



Concentrated Animal Feeding Operations (CAFO)

- Similar number and density as neighboring counties.
- Fewer than northeast
 - 6 in Lafayette Co
 - 16 in Kewaunee Co
- Siting of facility and land spreading important to reduce impacts

Lafayette County – Groundwater-Contamination Susceptibility Analysis

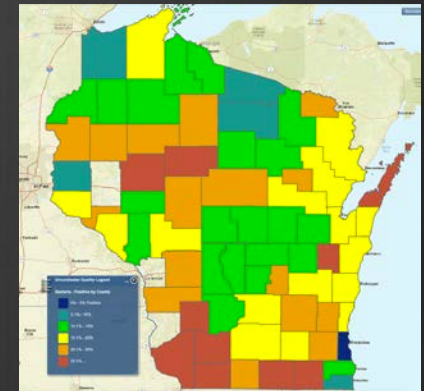
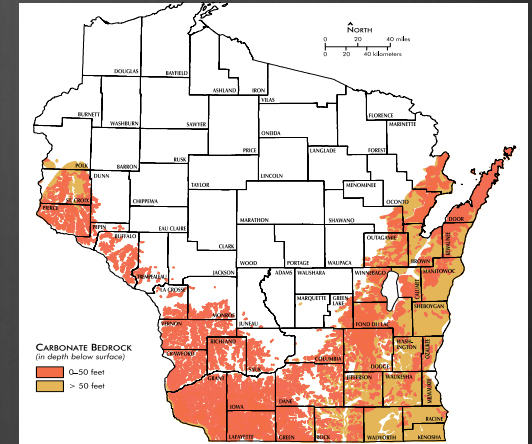


mitted jointly under a single WPDES permit.
All other CAFOs are permitted individually

Conclusions

Like much of Wisconsin,

- Lafayette County has carbonate rocks that have some karst features.
- Lafayette County has some groundwater contamination issues.



Some Resources

- Final Report of the Northeast Wisconsin Karst Task Force
 - <http://learningstore.uwex.edu/Final-Report-of-the-Northeast-Wisconsin-Karst-Task-Force-P1394.aspx>
- Recommendations of the Technical Workgroup Liquid Manure Storage in the Karst Region
 - <https://www.pca.state.mn.us/sites/default/files/karst.pdf>
- Well Water Quality Viewer: Private Well Data for Wisconsin
 - <http://www.uwsp.edu/cnr-ap/watershed/Pages/WellWaterViewer.aspx>
- Wisconsin Manure Management Advisory System
 - <http://www.manureadvisorysystem.wi.gov>
- Wisconsin Department of Natural Resources Agribusiness
 - <http://dnr.wi.gov/topic/AgBusiness/CAFO/>
- Wisconsin Karst and Sinkholes
 - <http://wgnhs.uwex.edu/water-environment/karst-sinkholes/>
- Neighboring counties
 - Iowa and Green County Karst workshop (UW Extension) – August 25th.