# MELTWATER CHANNELS IN THE KARST BELLEVUE-CASTALIA PLAIN, SENECA COUNTY


**Prince Atiti,**

**Olawale Quadri Ogunsola,**

**Obinna Urom,**

**Kennedy Doro,**

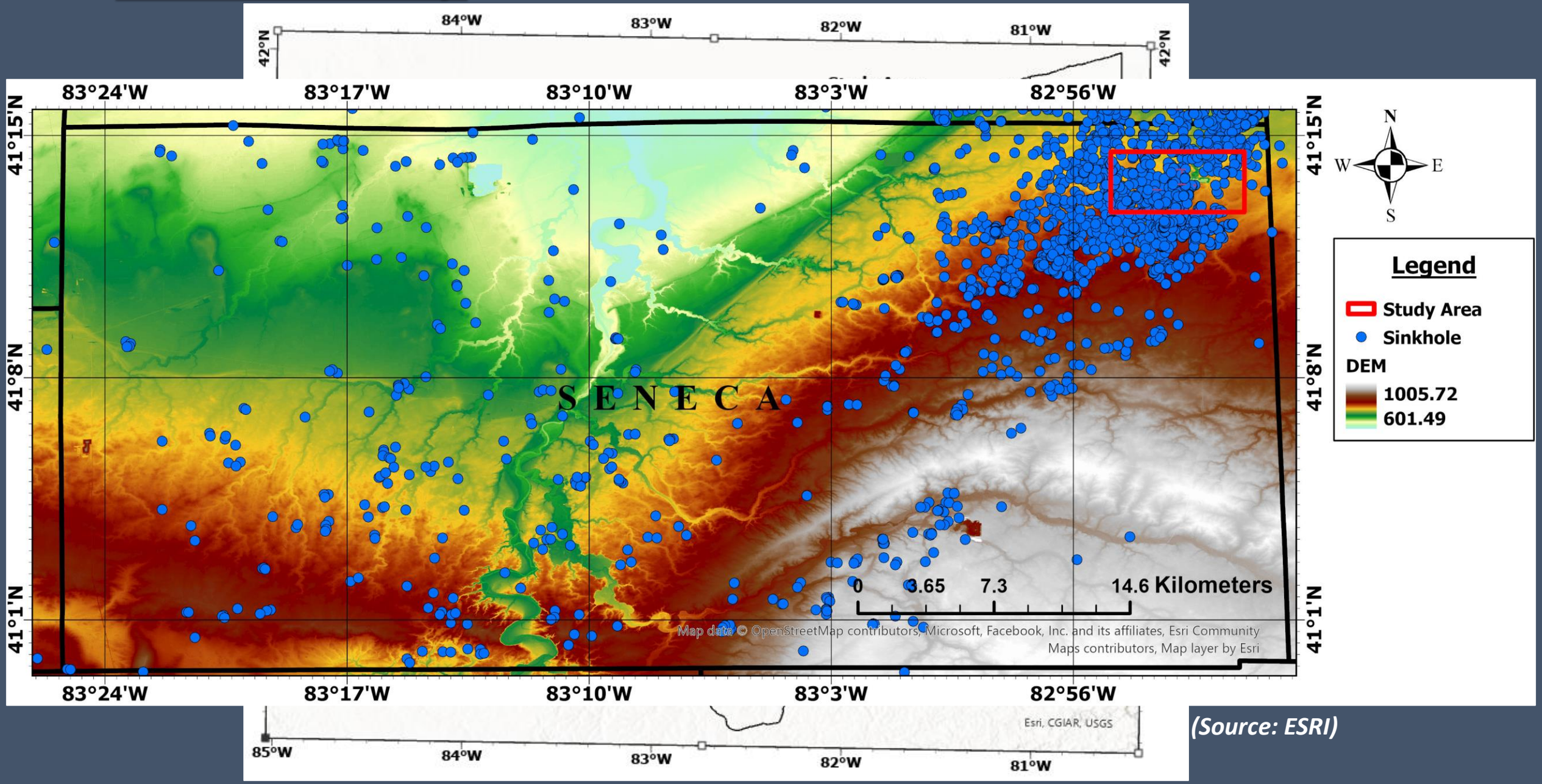
**Timothy Fisher.**

***Department of Environmental Sciences***



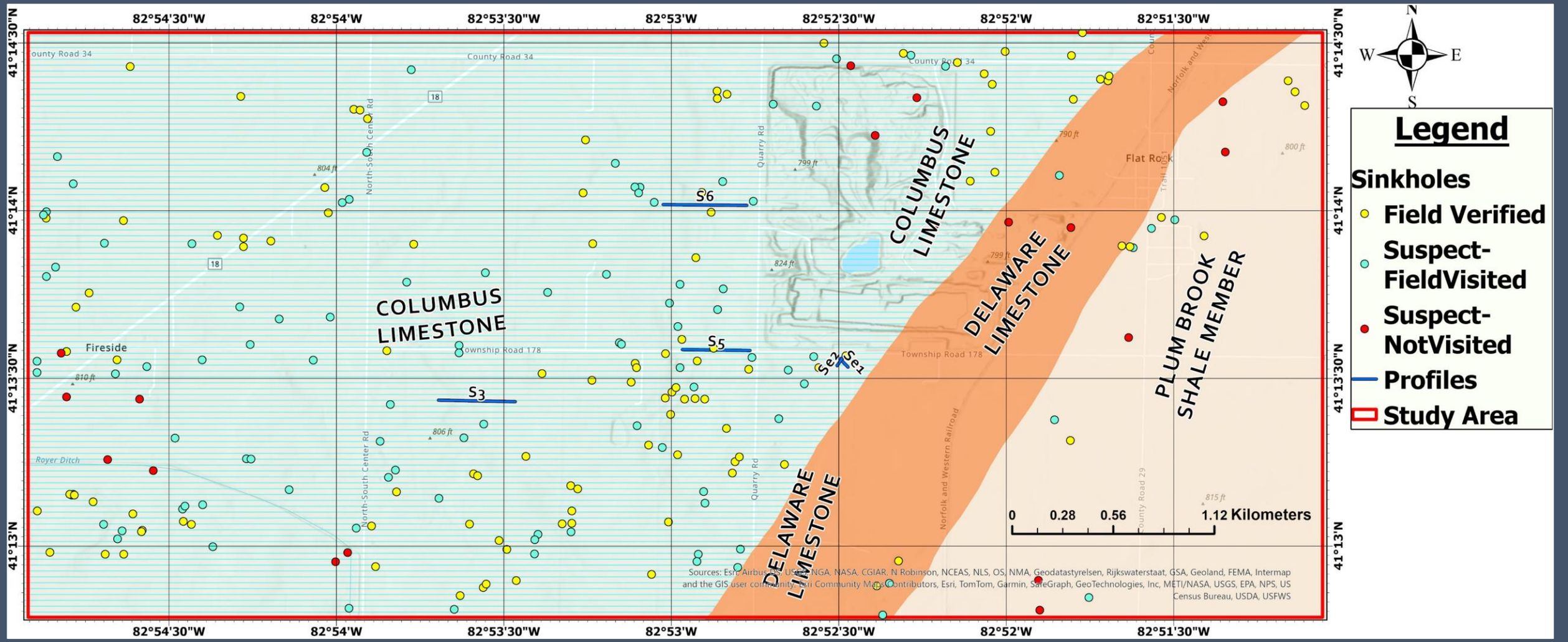
**GSA Joint North South-Central Section Annual Meeting, April 21-23, Springfield, MO**

# Seneca County



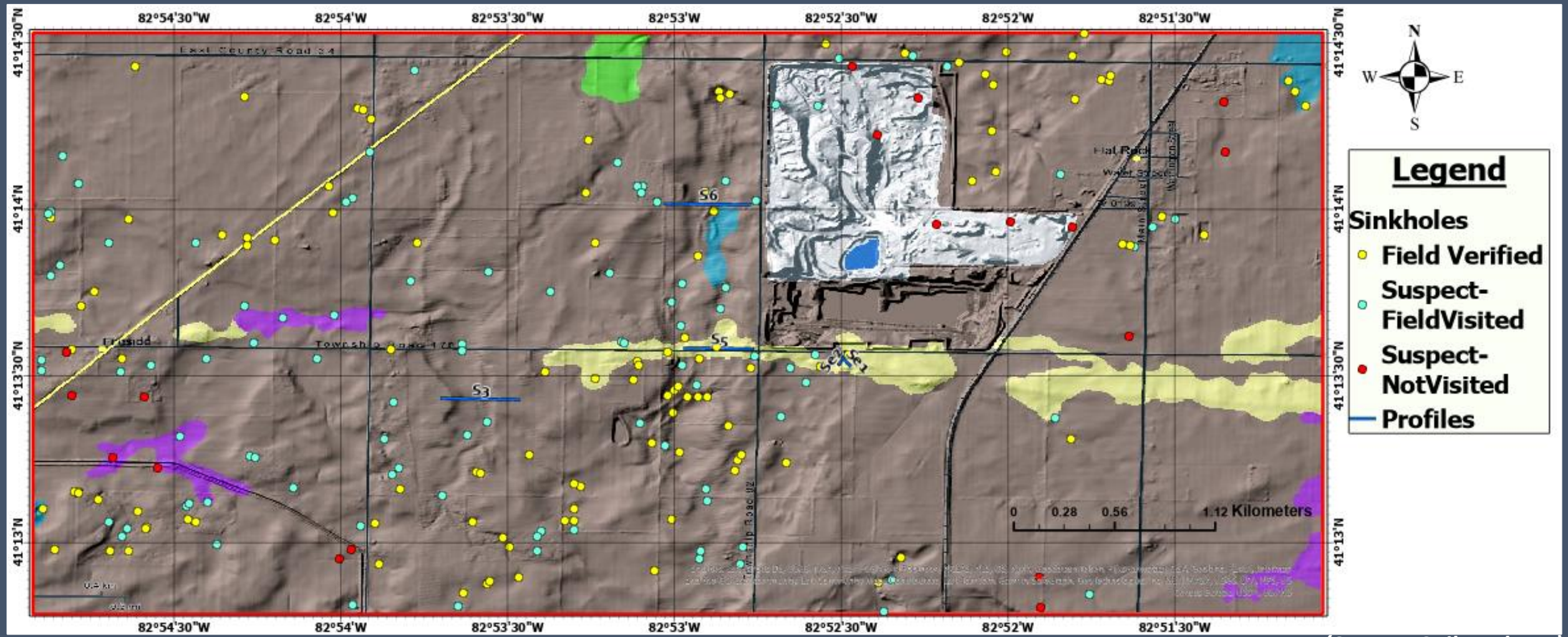

*(Source: ESRI)*

# Bellevue-Castalia Karst System




- 94% calcium-carbonate limestone composition
- Bedrock Solution weathering
- Extensive *subaerial erosion* that preceded glaciation formed the *Columbus Cuesta* (Forsyth and Kahle, 1983)

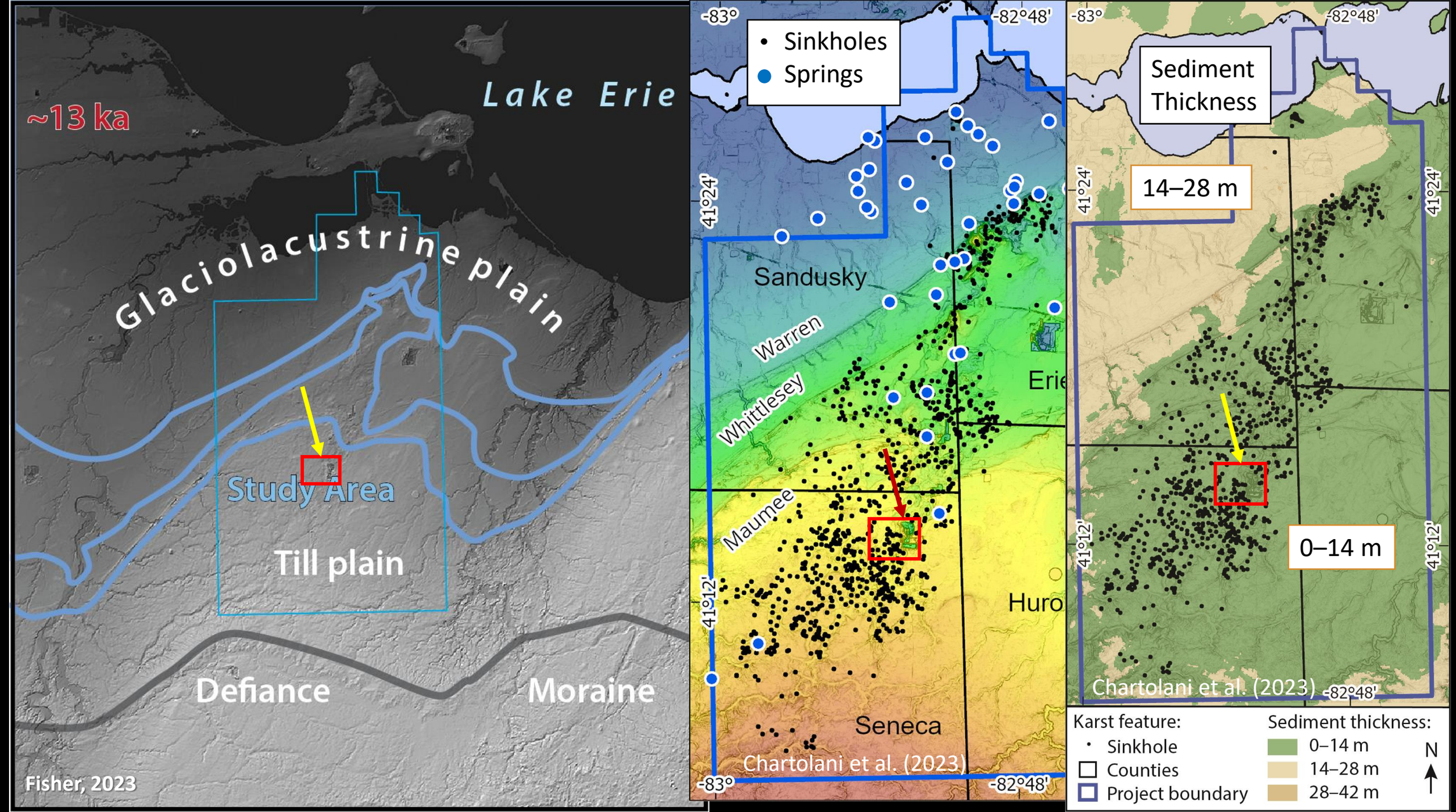
# Surficial Deposit

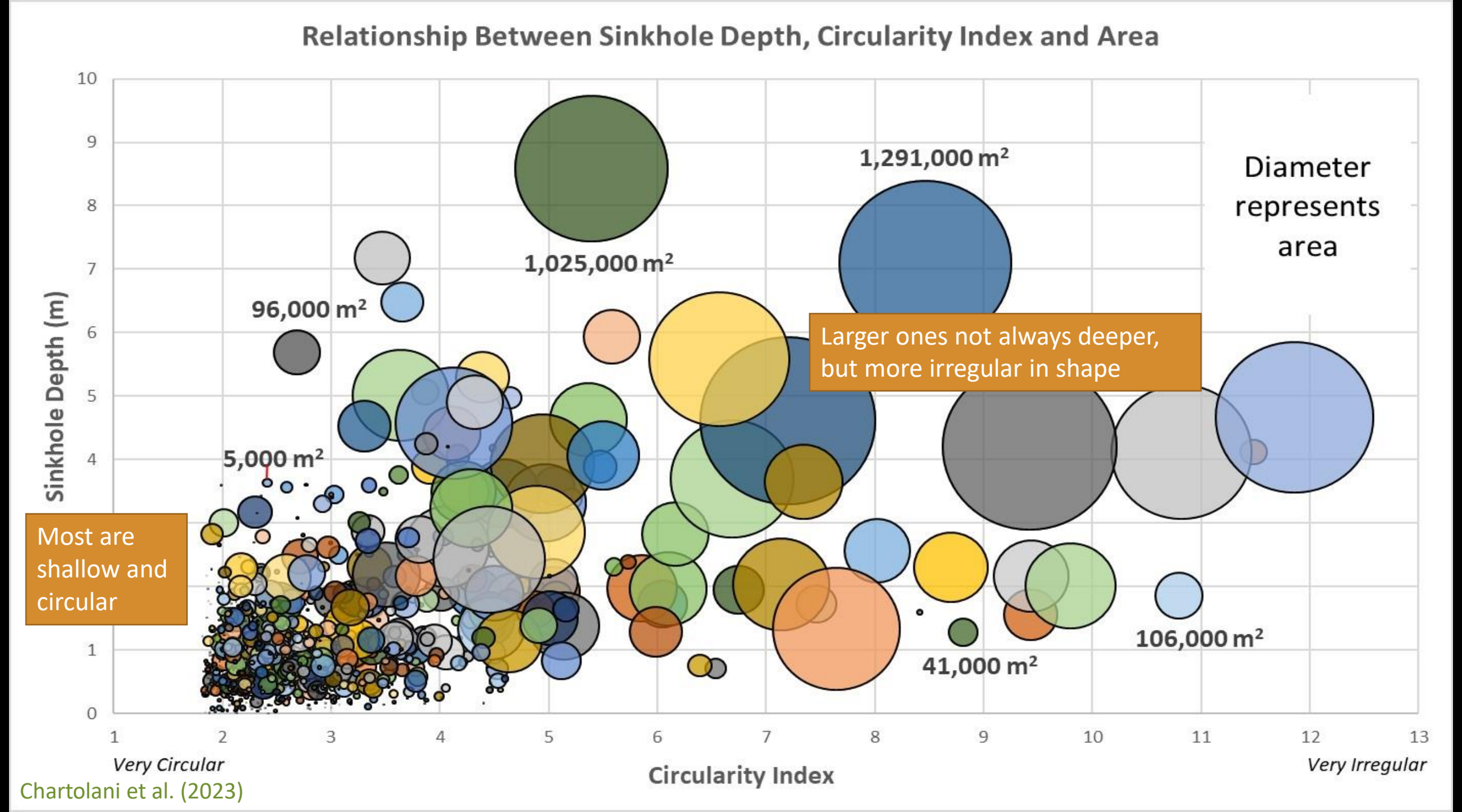



*(Source: Soil Explorer)*

Clayey Wisconsin Till | Eolian Sands | Old Alluvium | Fine-Textured Lacustrine Deposits | Outwash (Wisconsin Age)

- Plane-off of landscape by Ice-sheets of Pleistocene Epoch (Kihn, 1988)

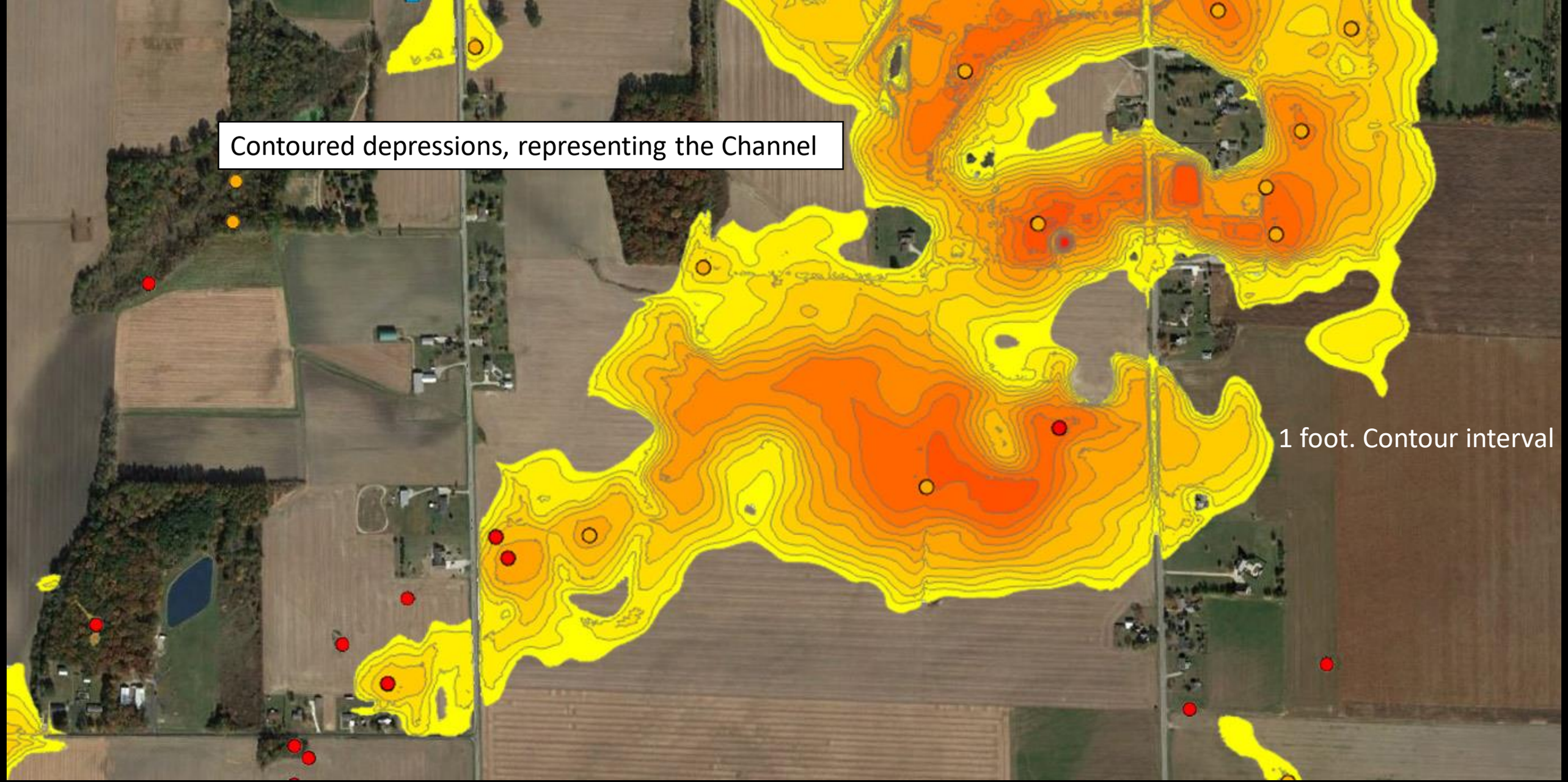

~13 ka
Lake Erie
Glaciolacustrine plain
Study Area
Till plain
Defiance
Moraine
Fisher, 2023
Sinkholes
Springs
-83°
-82°48'
41°24'
41°12'
Sandusky
Warren
Whittlesey
Maumee
Erie
Huron
Seneca
Chartolani et al. (2023)
Sediment Thickness
14–28 m
0–14 m
Karst feature:
Sinkhole
Counties
Project boundary
Sediment thickness:
0–14 m
14–28 m
28–42 m
N




Chartolani et al. (2023)

Fisher, 2023

Fisher, 2023

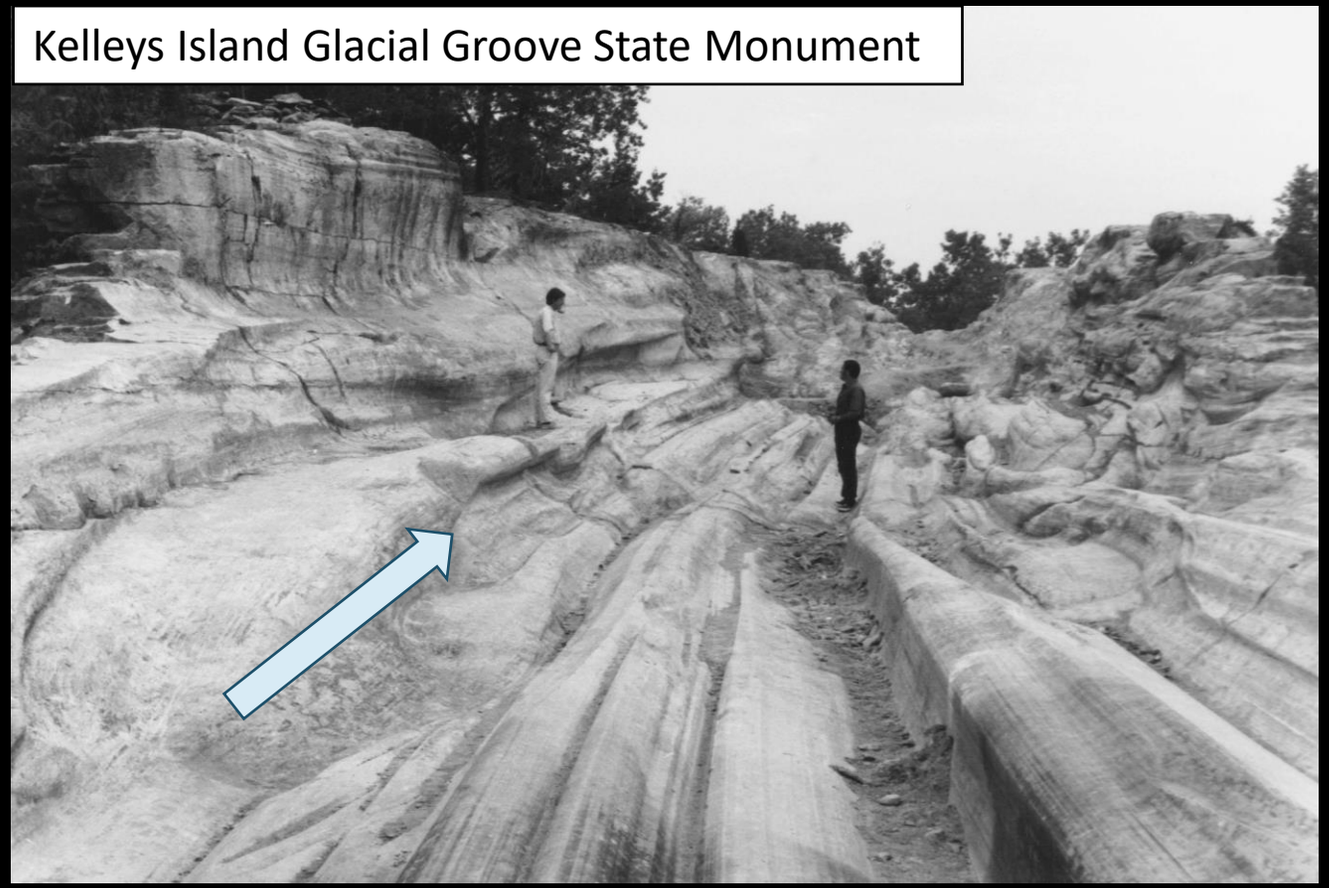



Red dot, verified active sinkhole
Orange dot, suspected sinkhole

Karst Interactive Map, ODNR Division of Geological Survey

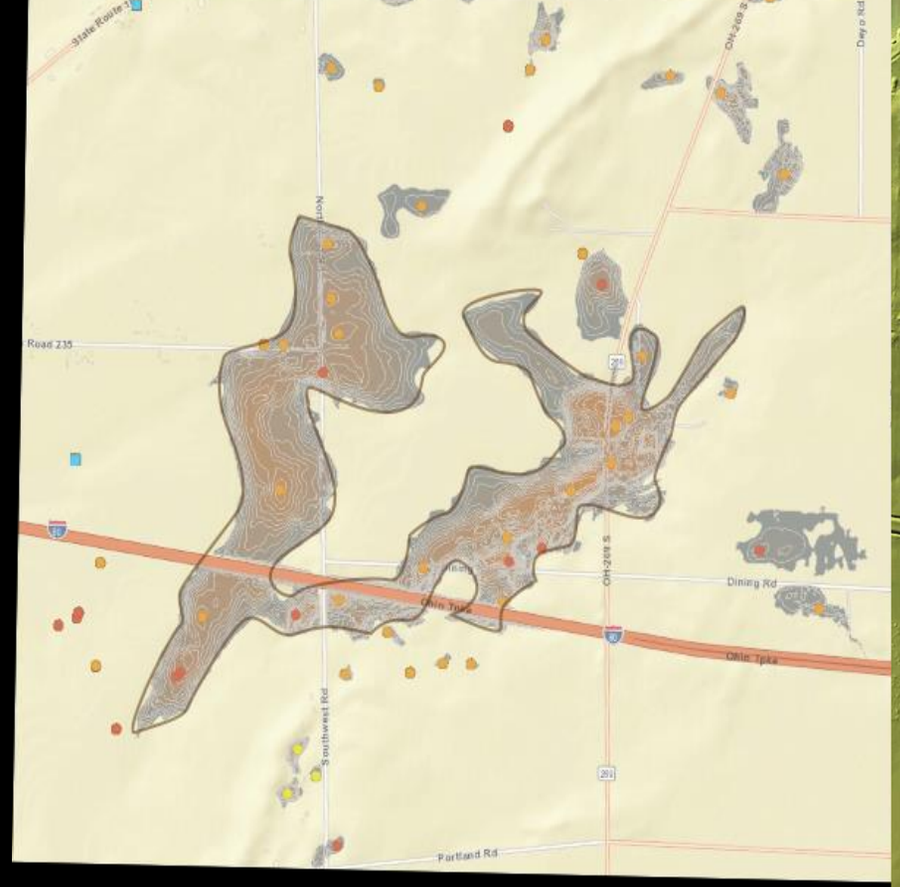

Fisher, 2023

Kelleys Island Glacial Groove State Monument

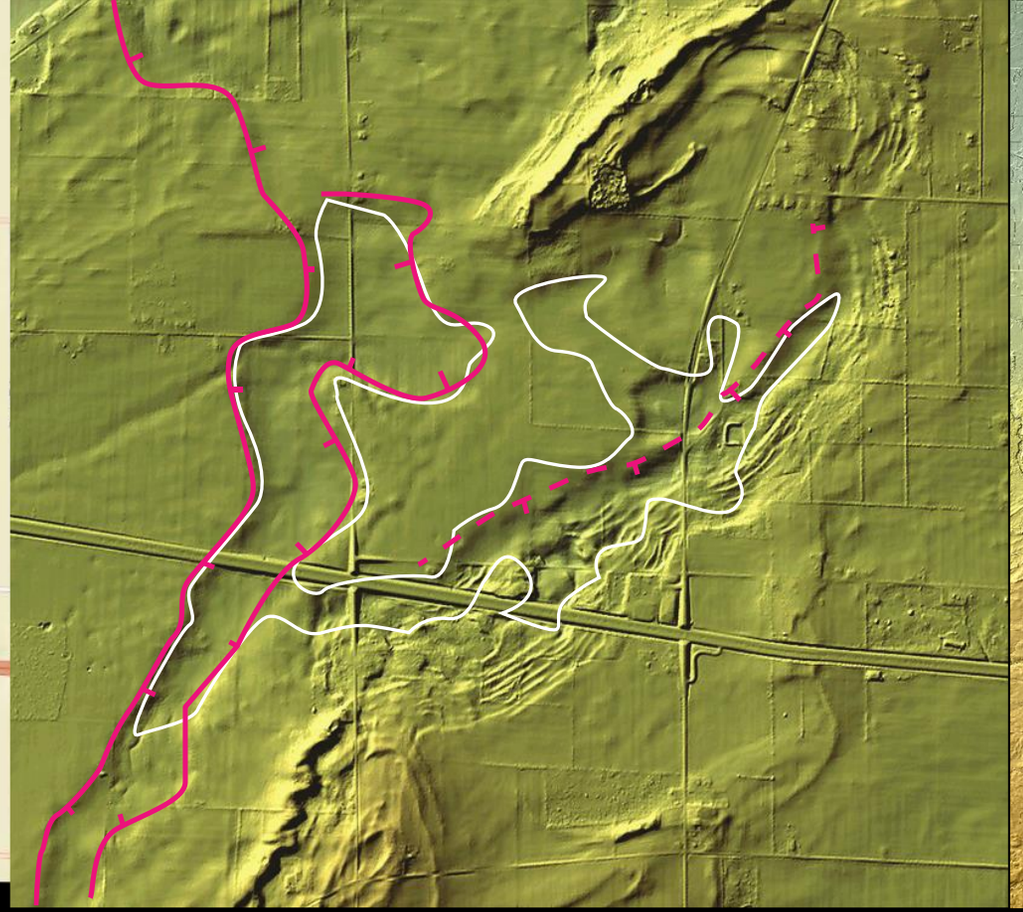


Evidence for subglacial meltwater erosion:
Sichelwannen forms are fluvial erosional marks that form from sediment charged turbulent fluids.

**Fisher, 2023**

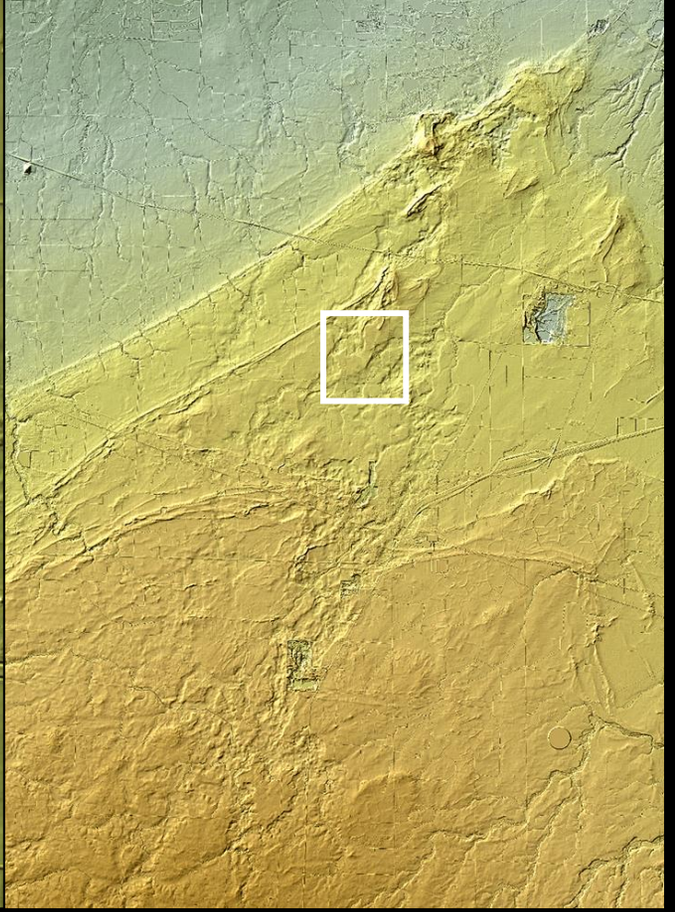



Contoured channels

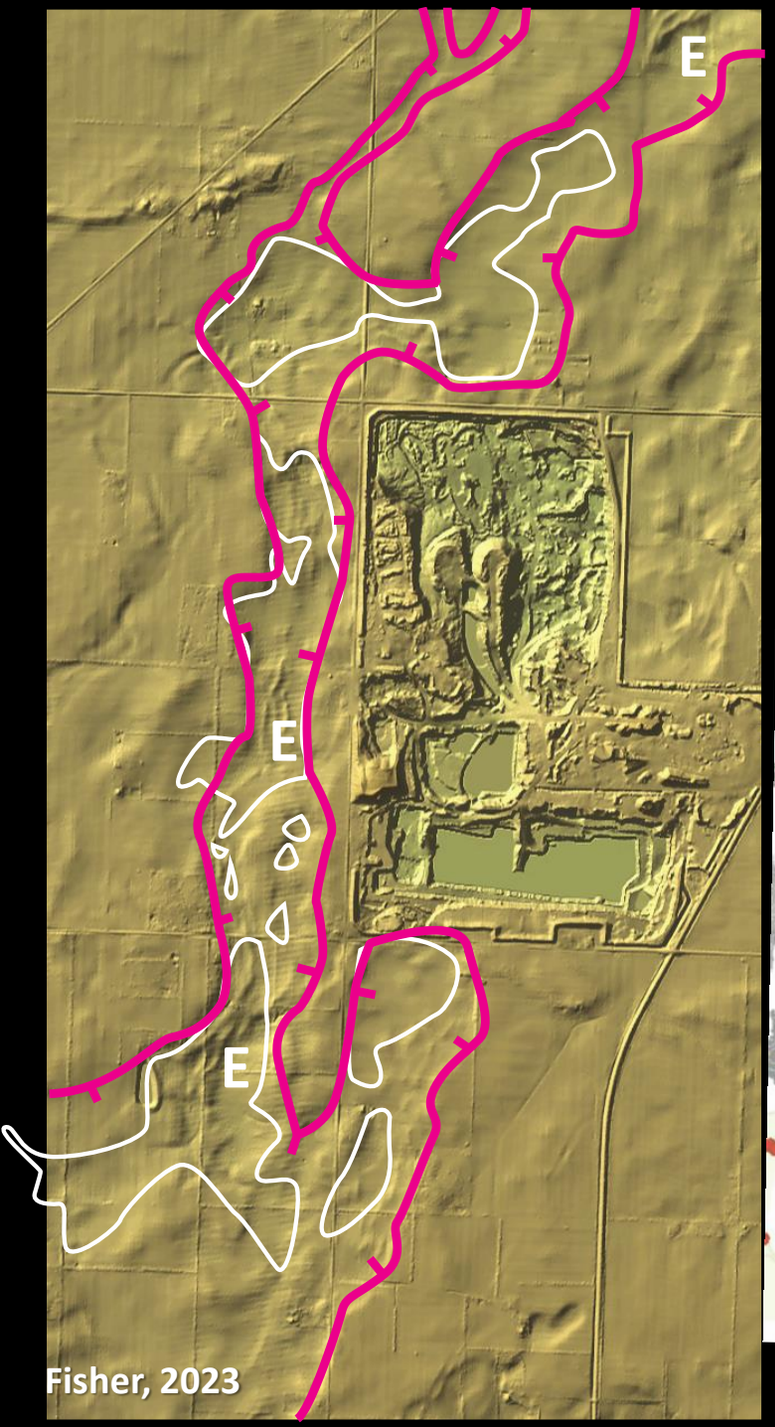


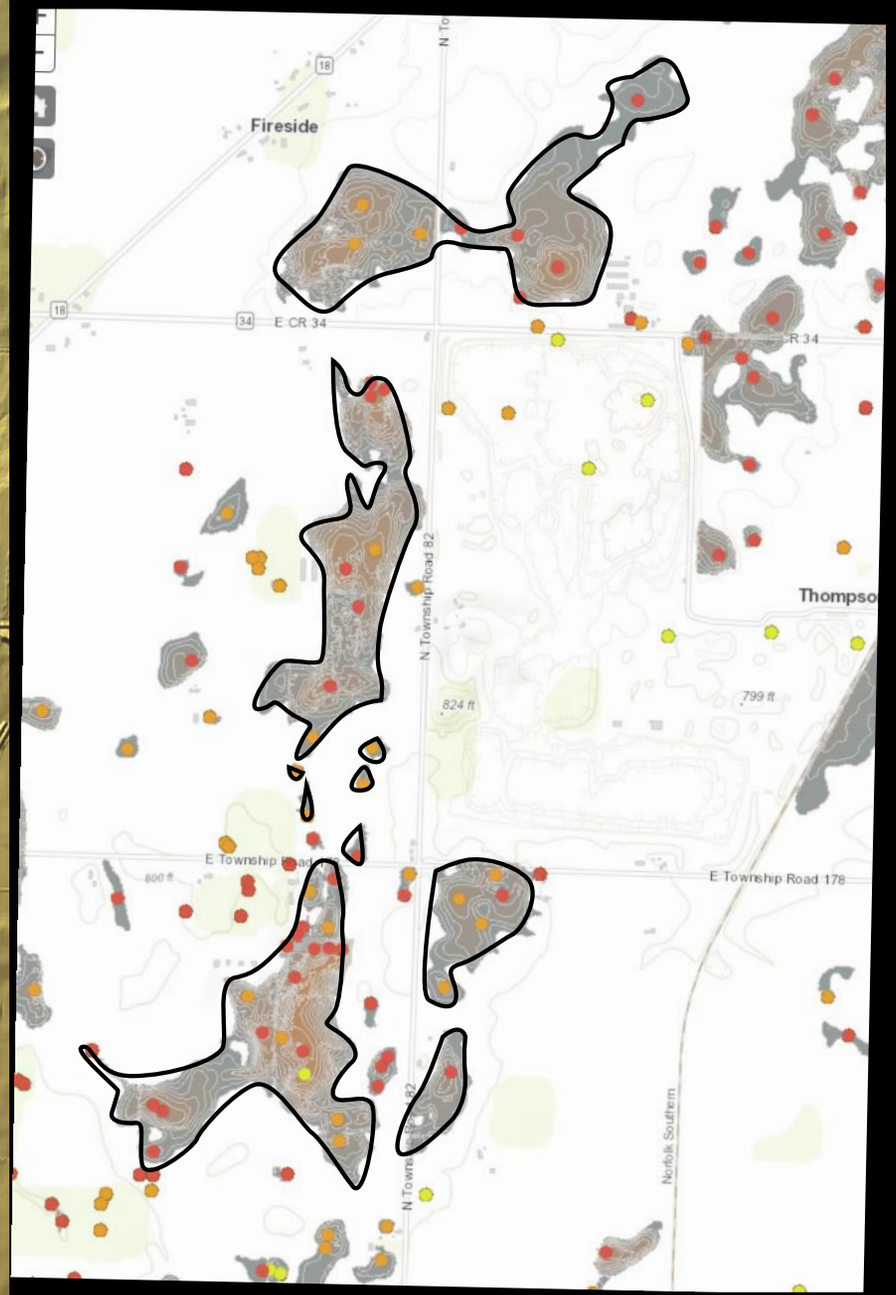
Outline of contoured sink holes

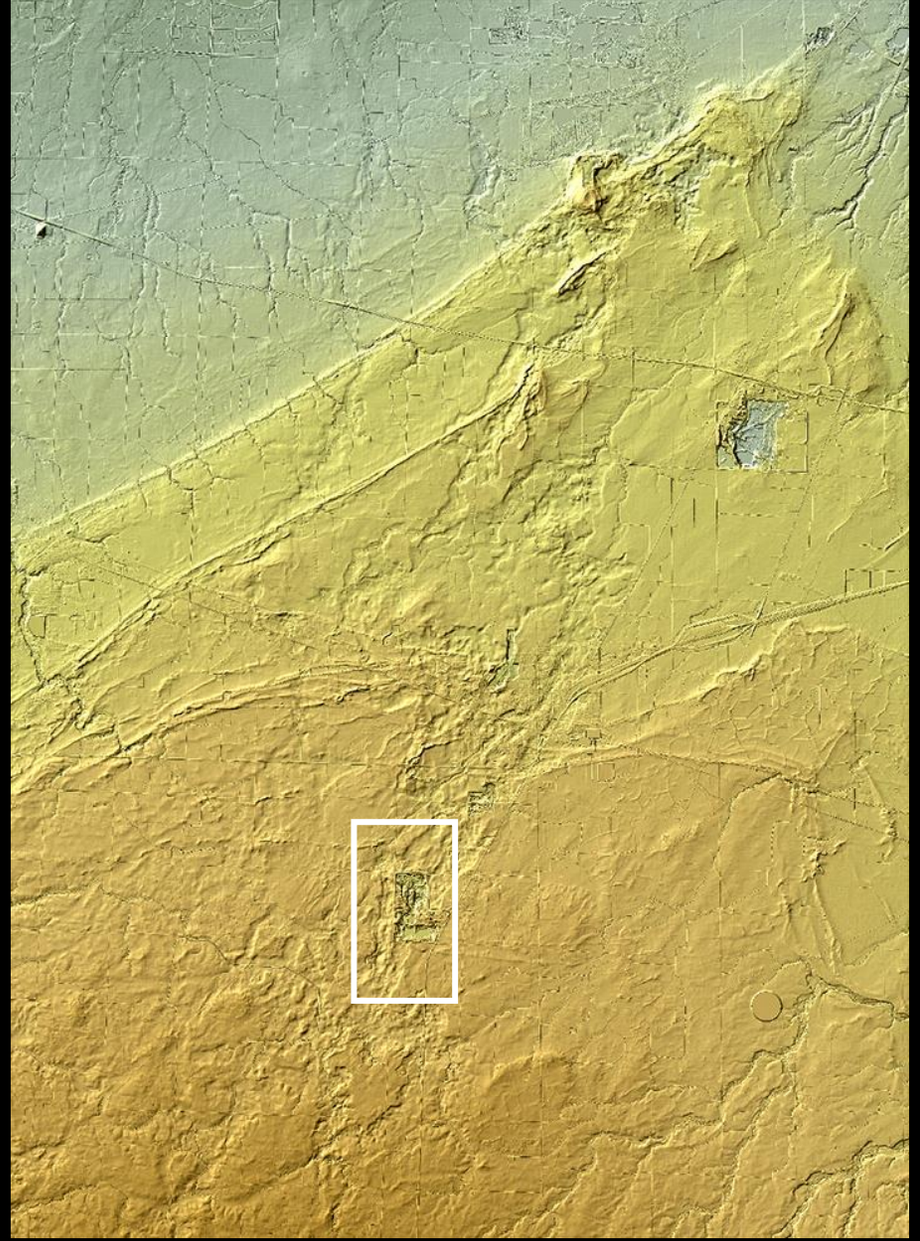
Outline of channels

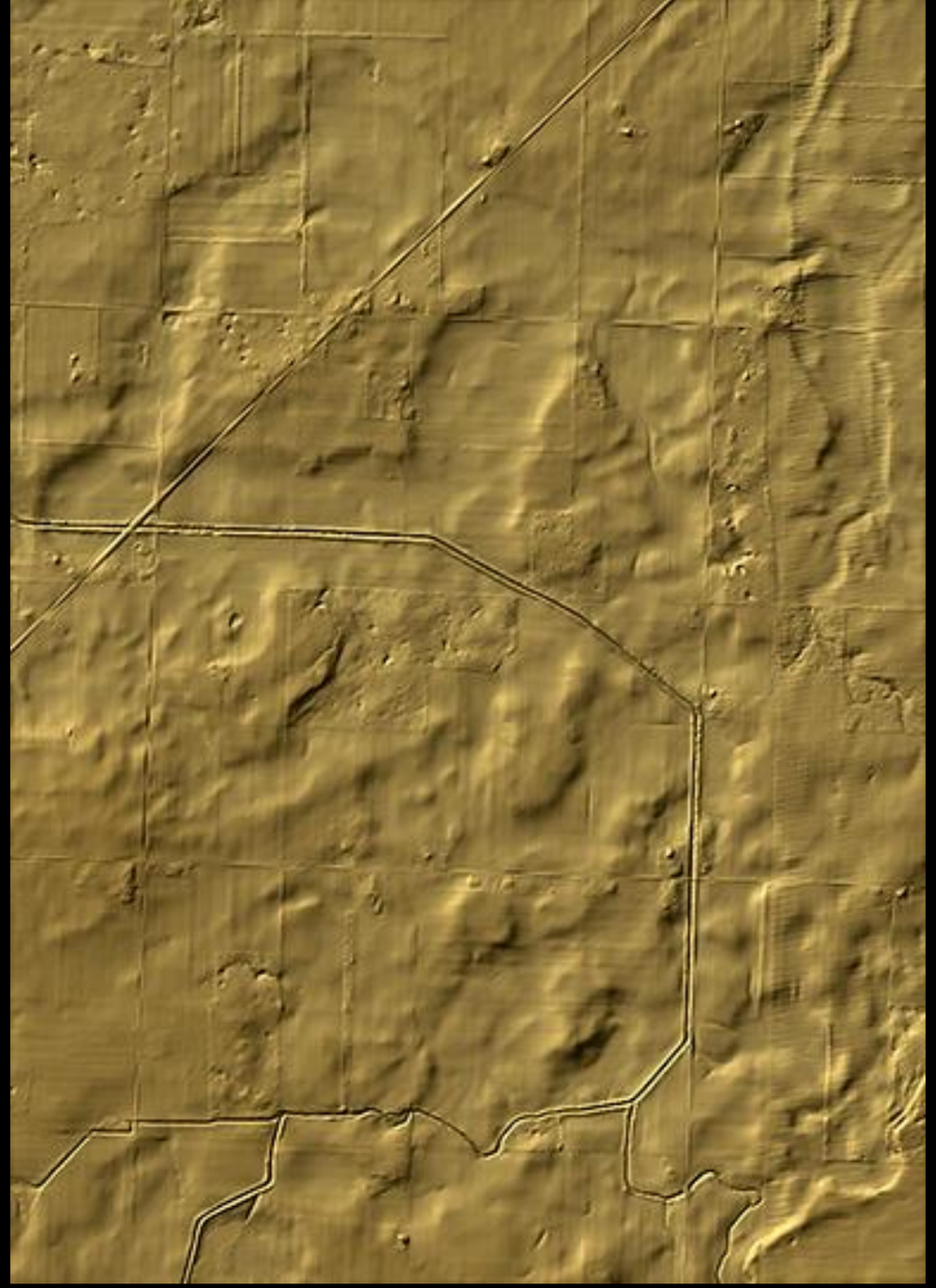


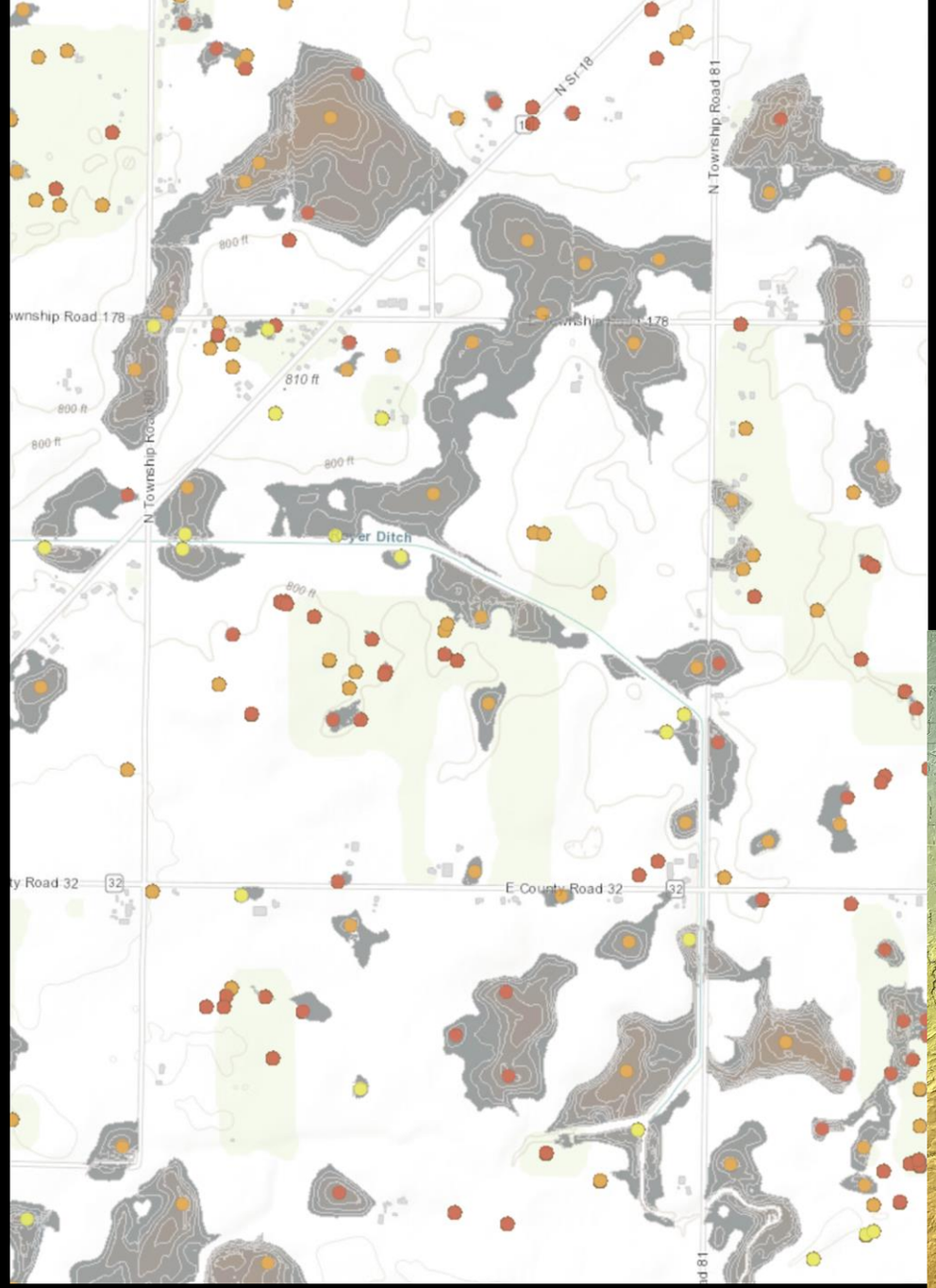
**Fisher, 2023**


E
E
E
Fisher, 2023


Fireside
E CR 34
N Township Road 82
E Township Road 178
824 ft
799 ft
Norfolk Southern

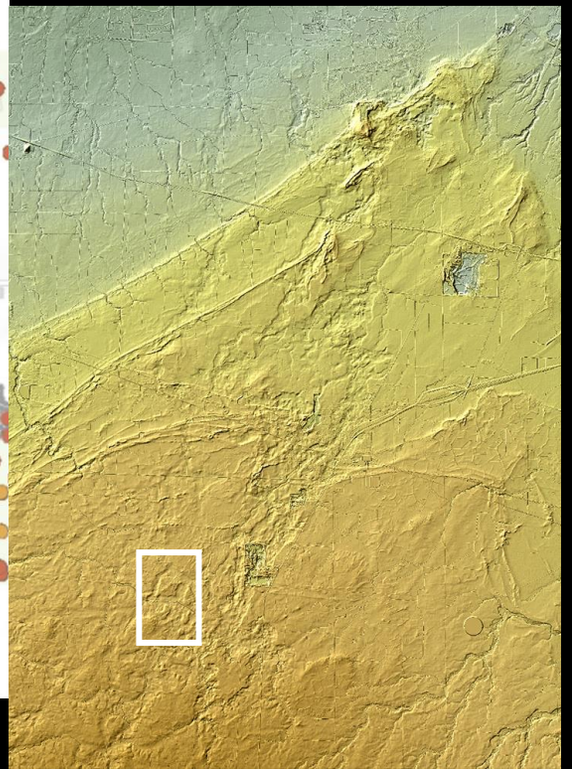







All depressions suspected to be connected channel

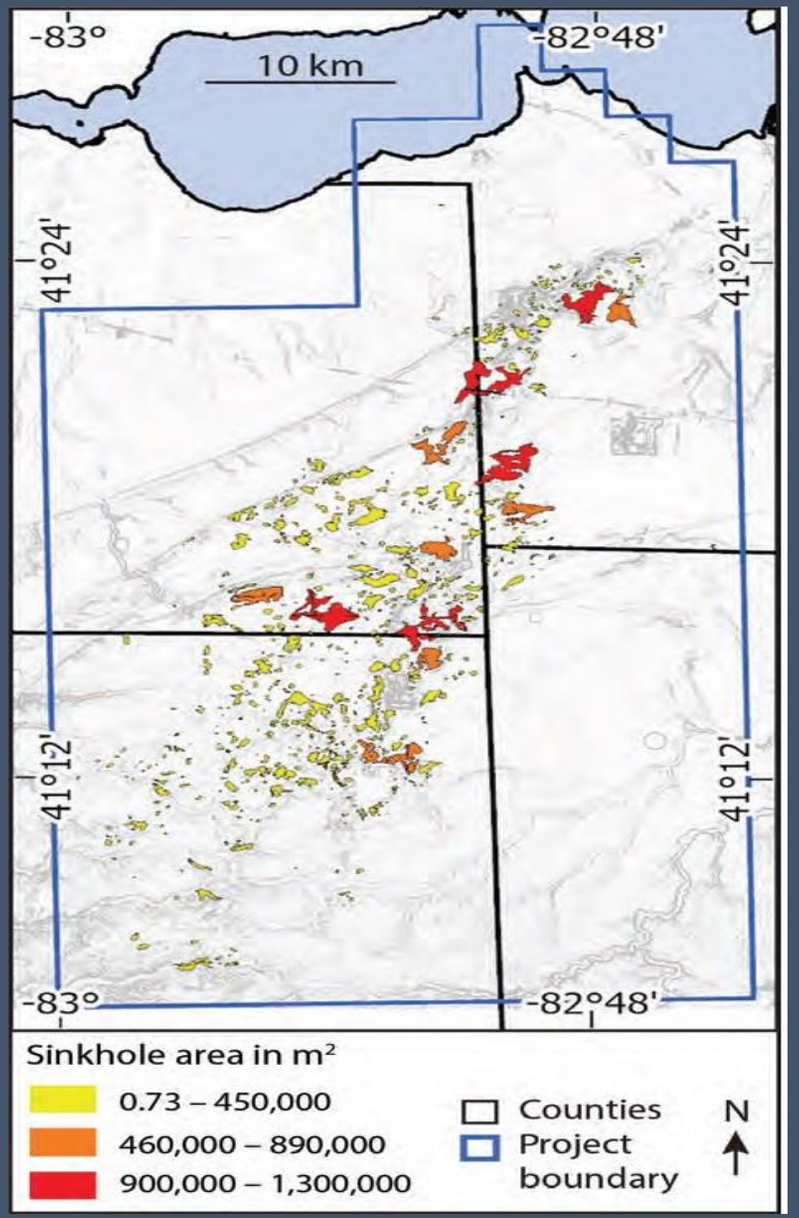
Active sinkholes in channels and uplands.



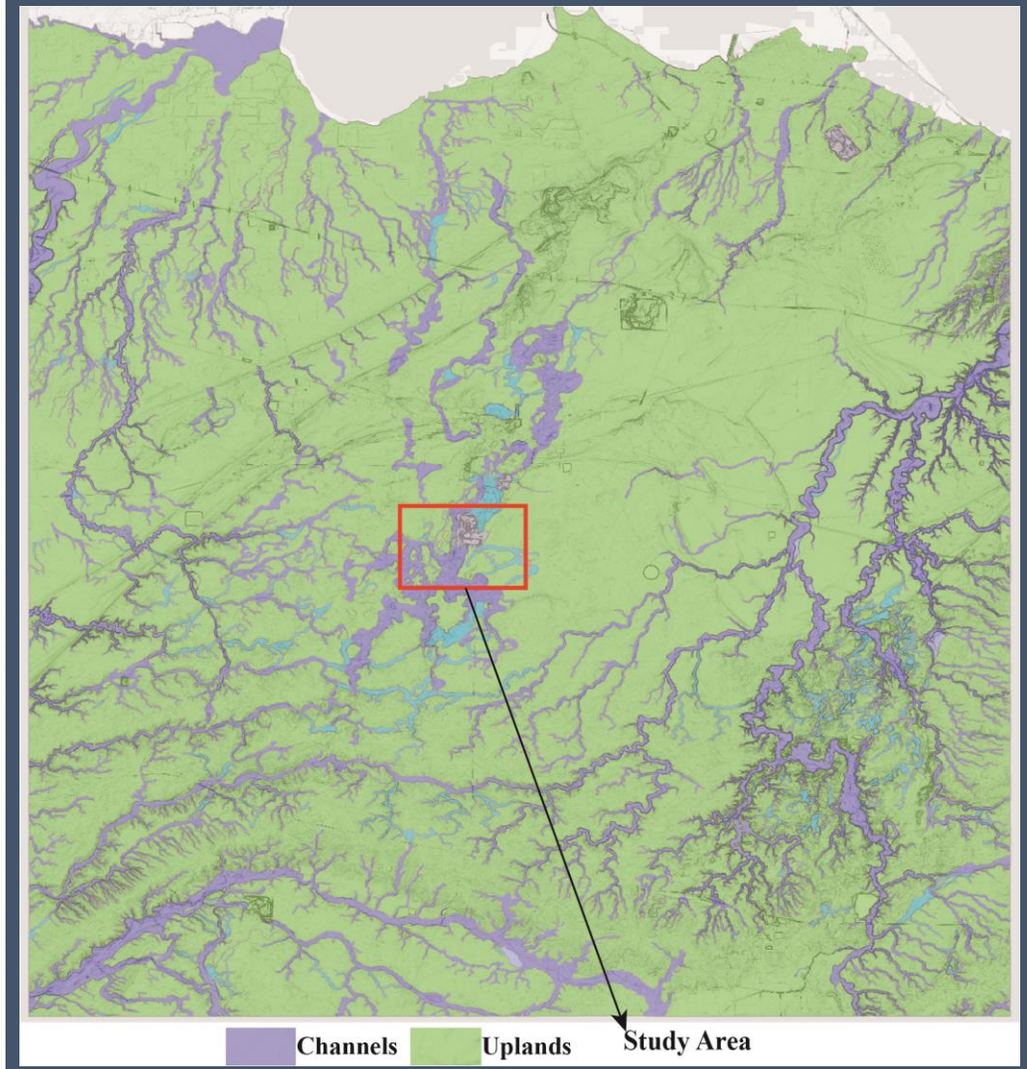
Fisher, 2023

# Channels or Sinkholes?

- Depressions previously inferred as sinkholes.
- Are they sinkholes or channels?




*Inferred sinkholes (Chartolani et al. 2023)*




*Mapped channels in Northeastern Ohio (Source: ODNR-Mr. Douglas Aden)*

# Research Questions and Hypothesis

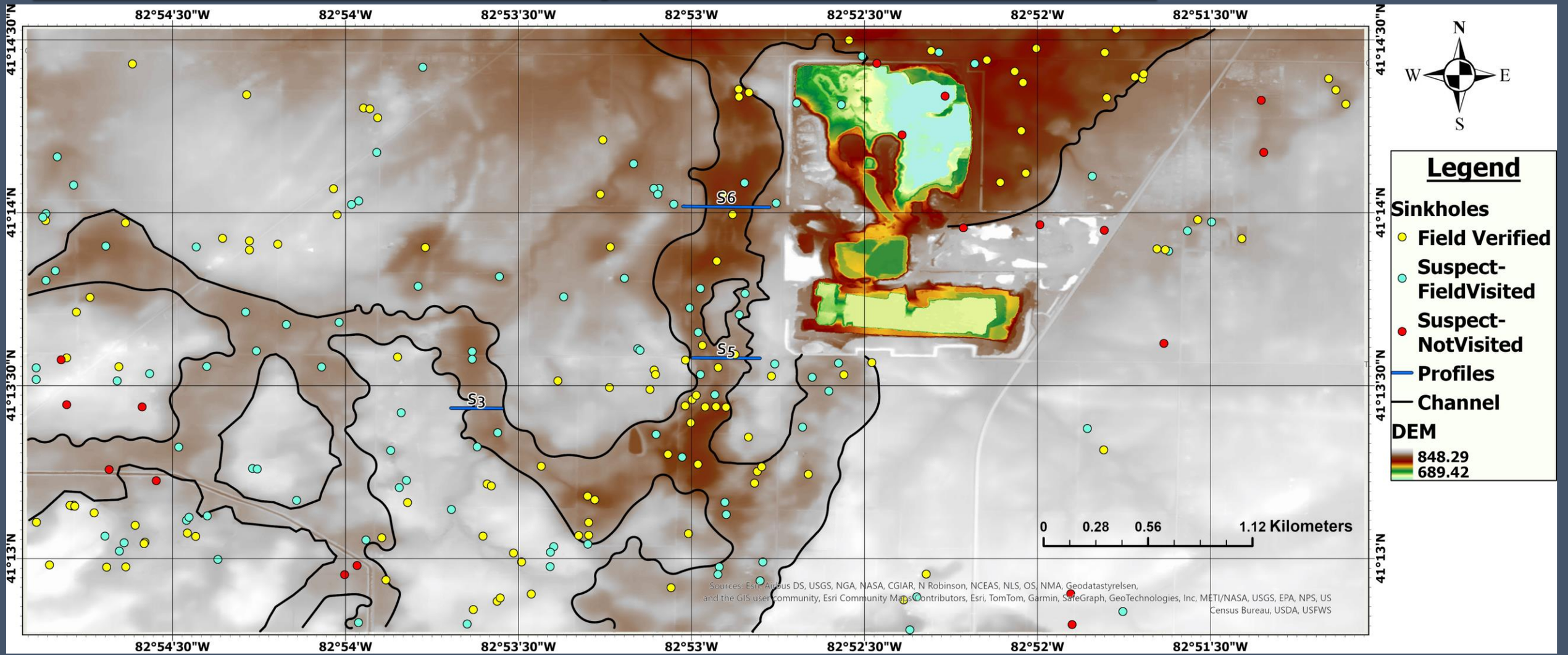
## Hypothesis

***The depressions are channels formed by subglacial meltwater erosion of Pleistocene ice-sheets.***

## Questions

- What are the depressions: meltwater channels or large sinkholes? How were they formed?

# Could the connected depressions be channels?




- *Northeast slope topography*

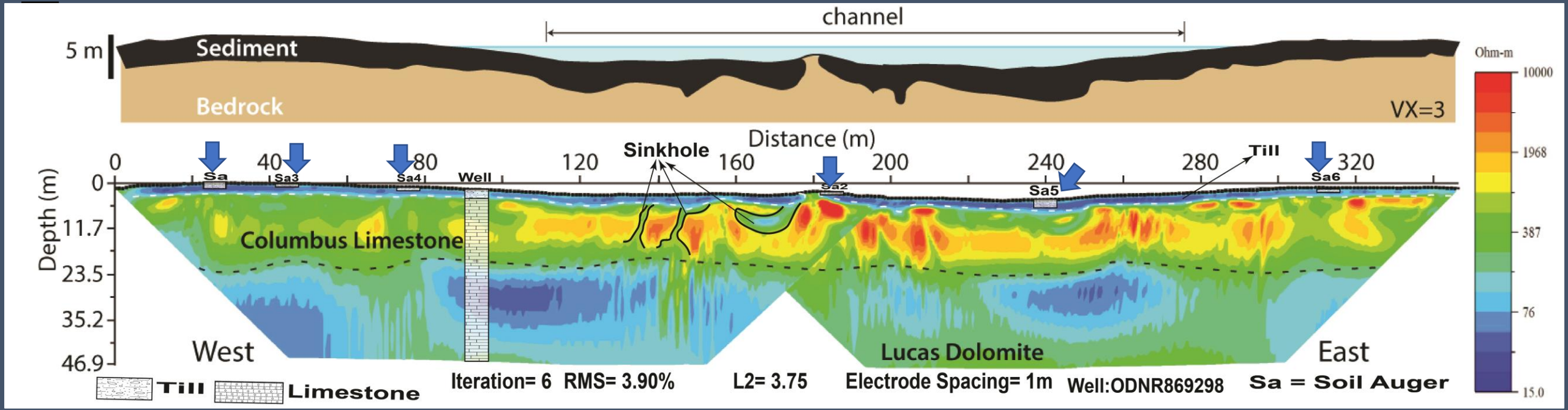
# Method

- Electrical Resistivity Tomography
  - Dipole-Dipole Array
  - Instrument: Lippmann
  - Frequency: 5Hz
  - 200m transects with 1m electrode separation.
  - Inversion: Earth Imager

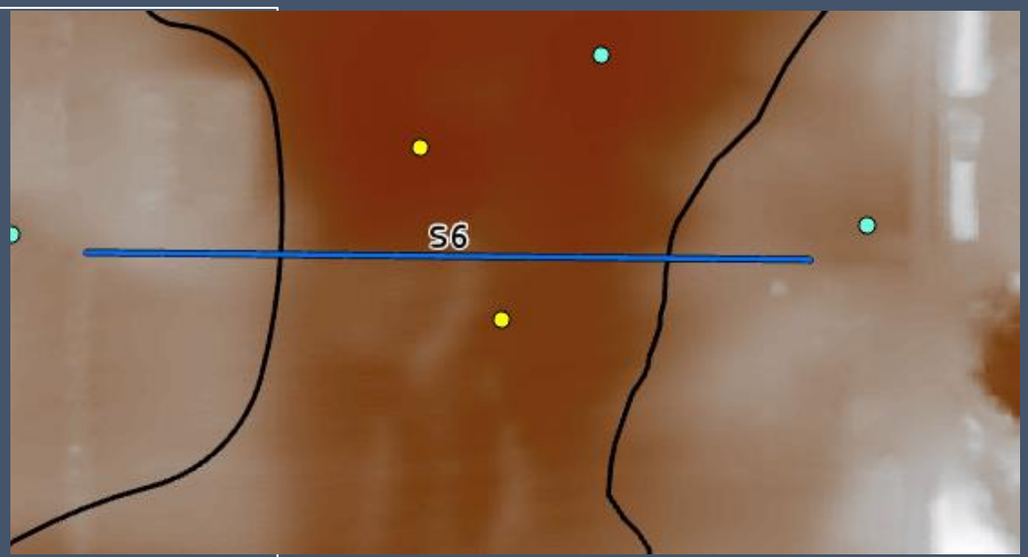
- Well Logs and Soil Augers

# Results: Site 6

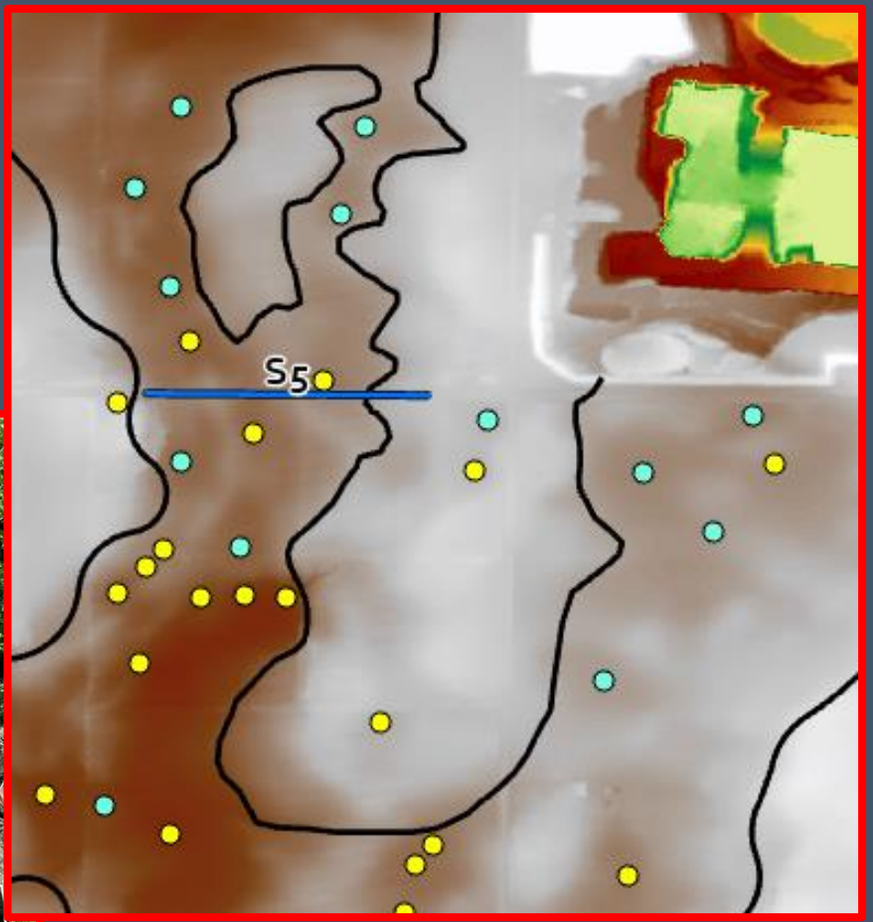
*ERT at site 6 (1-200m transect)*




- The channel
- Stratigraphy
- Variable till thickness
- Two bedrock units –Limestone and Dolomite
- Well log and soil augers
- Limestone-till boundary and surface topography
- Sinkholes



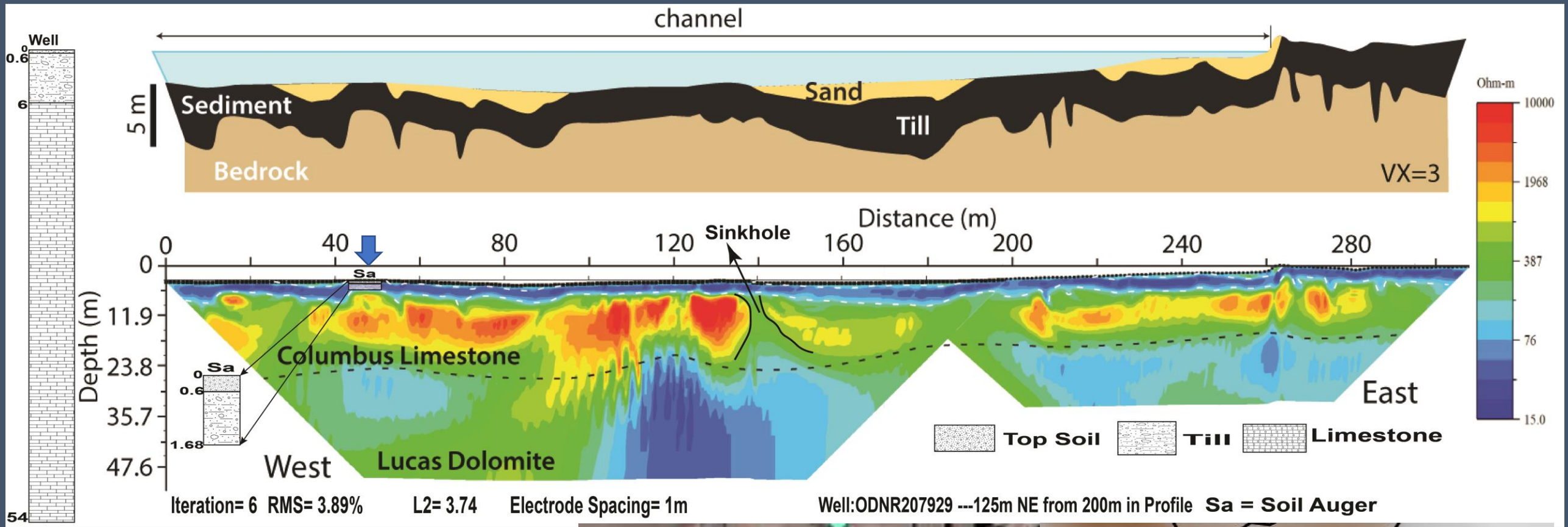
# *Sinkhole at Site 5*



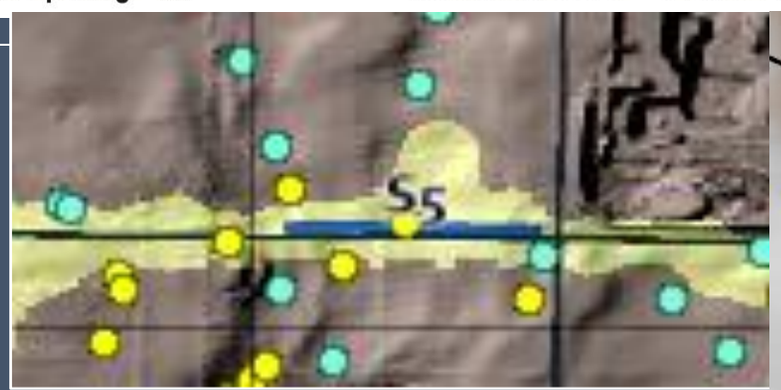

Influence extend across the road and observed at 140m along profile

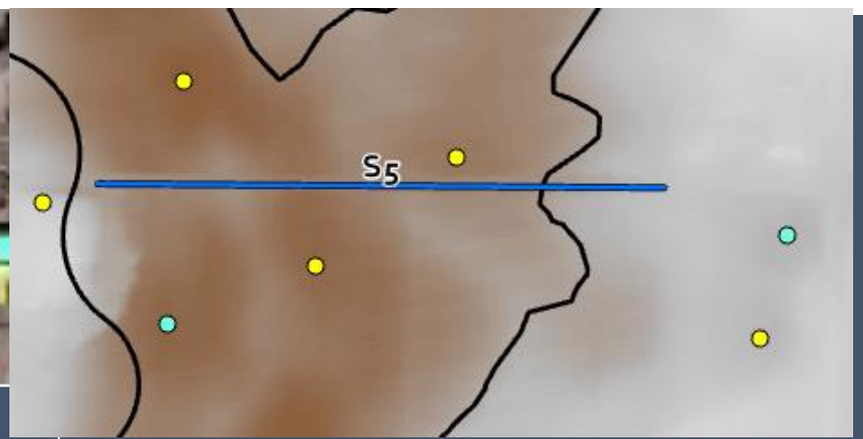
# Results: Site 5

**ERT at site 5**



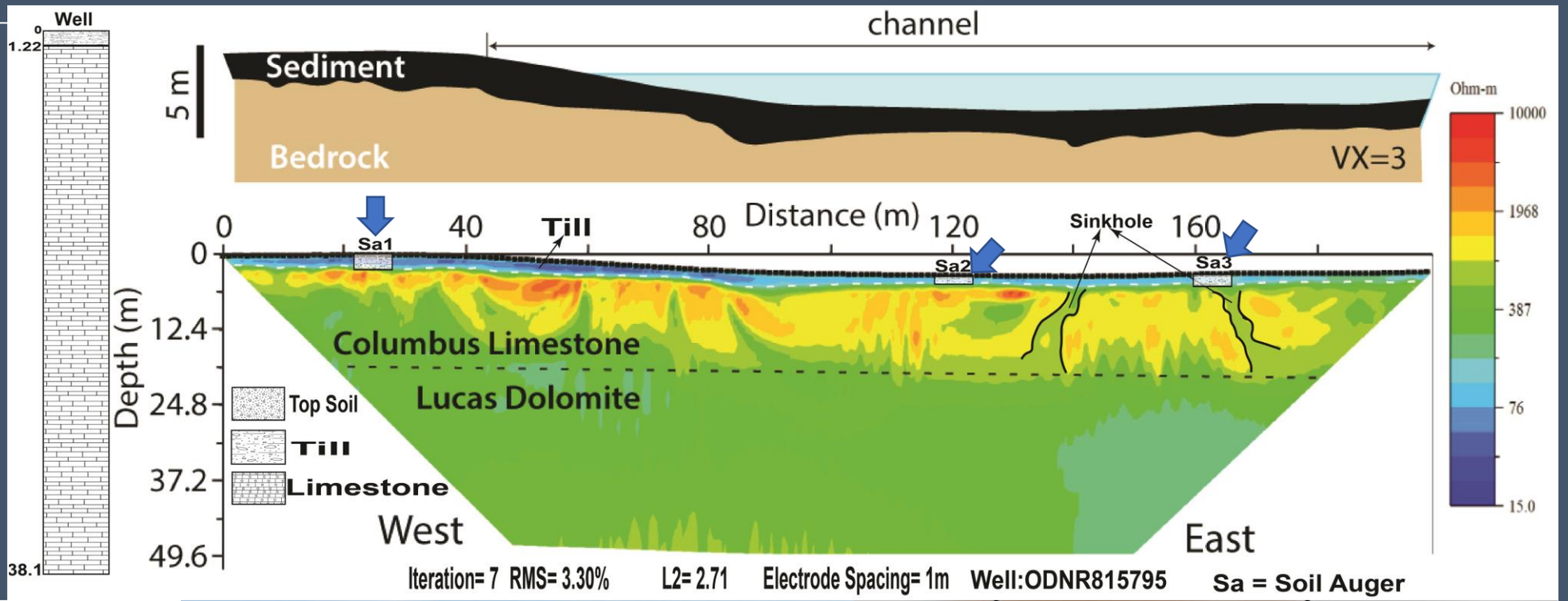

- The channel
- Sand?
- Till thickness
- Bedrock-till boundary
- Sinkhole *(Verified)*



# Results: Site 3

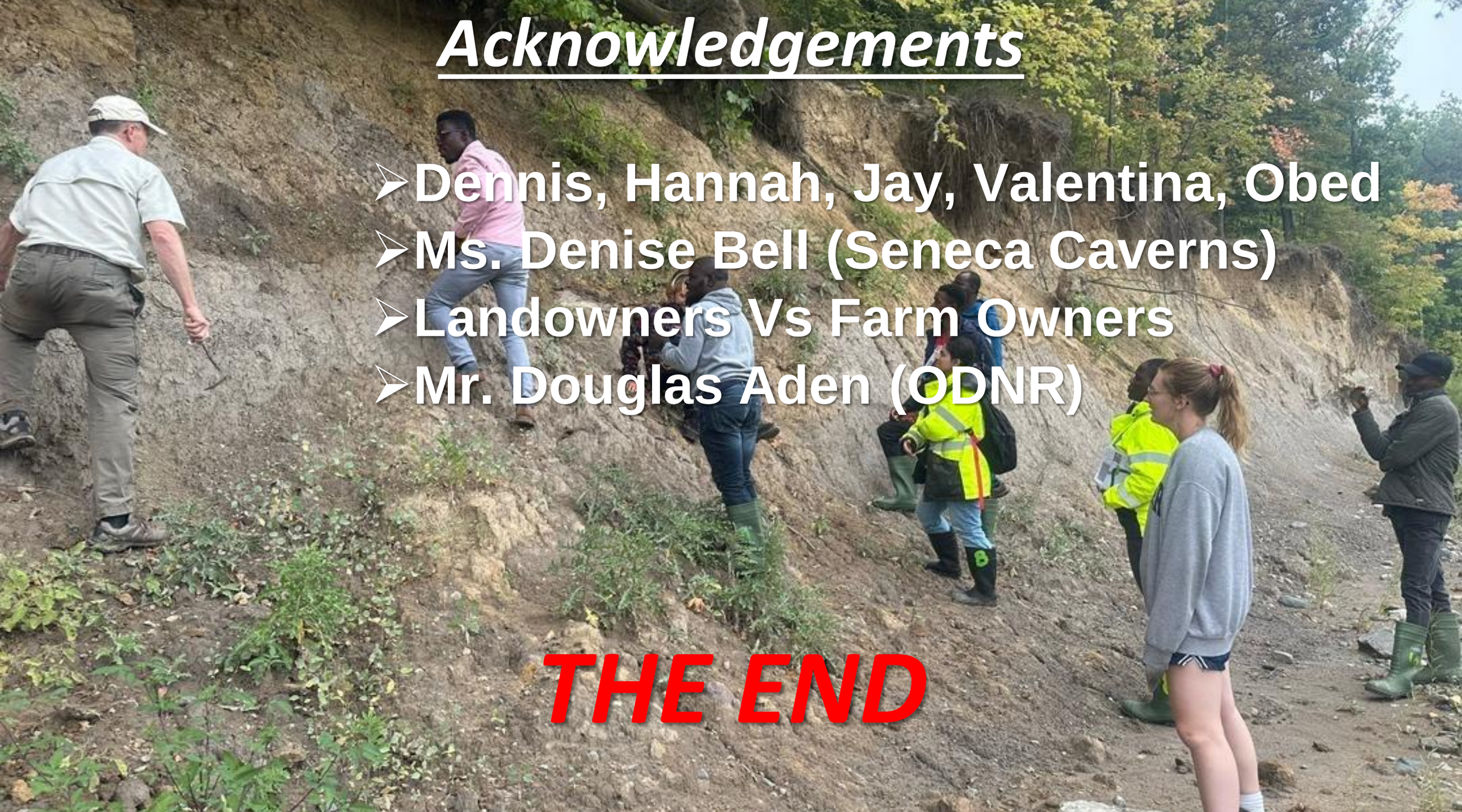
- The channel
- Till thickness
- Sinkholes
- Bedrock-till boundary




*ERT at site 3*

# Summary

- **The depressions are connected channels formed by Subglacial meltwater erosion**
  - ***Lateral till thickness across channels and upland***
  - ***undulating till-bedrock boundary***
- **Channels are cut into the bedrock.**
  - ***Surface topography Vs irregular bedrock surface***
- **Small suspected sinkholes at the bedrock surface do not account for the larger channel-shaped depressions observed.**



# Acknowledgements


- Dennis, Hannah, Jay, Valentina, Obed
- Ms. Denise Bell (Seneca Caverns)
- Landowners Vs Farm Owners
- Mr. Douglas Aden (ODNR)


**THE END**