

SURFICIAL GEOLOGIC MAPPING FOR GREEN STORMWATER INFRASTRUCTURE SITING AND SUITABILITY

Drew Phillips, Dave Grimley - Illinois State Geological Survey

Mary Pat McGuire - UIUC Dept. Landscape Architecture

Reshmina William, Ashlynn Stillwell - UIUC Dept. Civil & Env. Eng.

Piotr Szocinski, Avery Clark - Illinois State Geological Survey



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Also?

- Landscape Architecture Design Studio



Illinois Surface Topography

Donald E. Luman, Lisa R. Smith, Christopher C. Goldsmith



Explanation

The Illinois Surface Topography map is a generalization of the 1:250,000 scale topographic maps of Illinois. It is based on the 1:250,000 scale topographic maps of Illinois, which were compiled from the 1:62,500 scale topographic maps of Illinois. The map is a generalization of the 1:250,000 scale topographic maps of Illinois, which were compiled from the 1:62,500 scale topographic maps of Illinois. The map is a generalization of the 1:250,000 scale topographic maps of Illinois, which were compiled from the 1:62,500 scale topographic maps of Illinois.



SURFICIAL DEPOSITS OF ILLINOIS

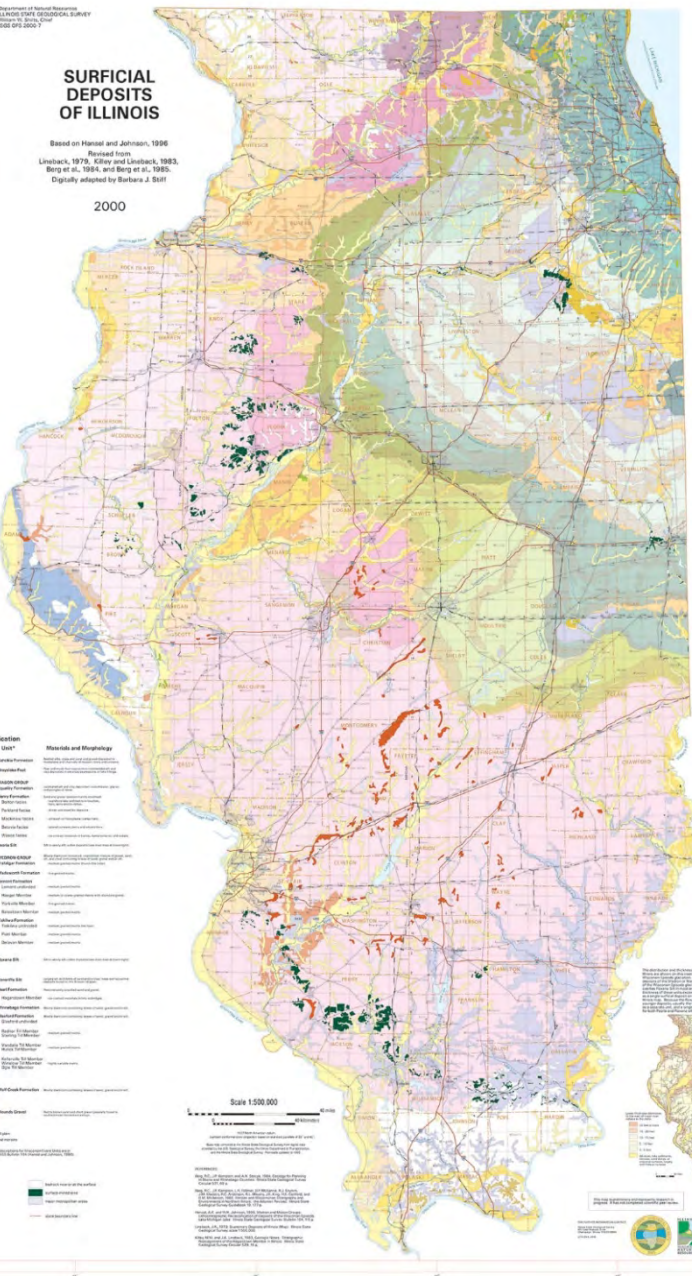
Department of Natural Resources
 1500 North First Street, Suite 100
 Springfield, Illinois 62761-1000

Based on Harrell and Johnson, 1996
 Revised from
 Linsack, 1979; Kiley and Linsack, 1983;
 Berg et al., 1984; and Berg et al., 1985.
 Digitally adapted by Barbara J. Staff

2000

Stratigraphic Classification

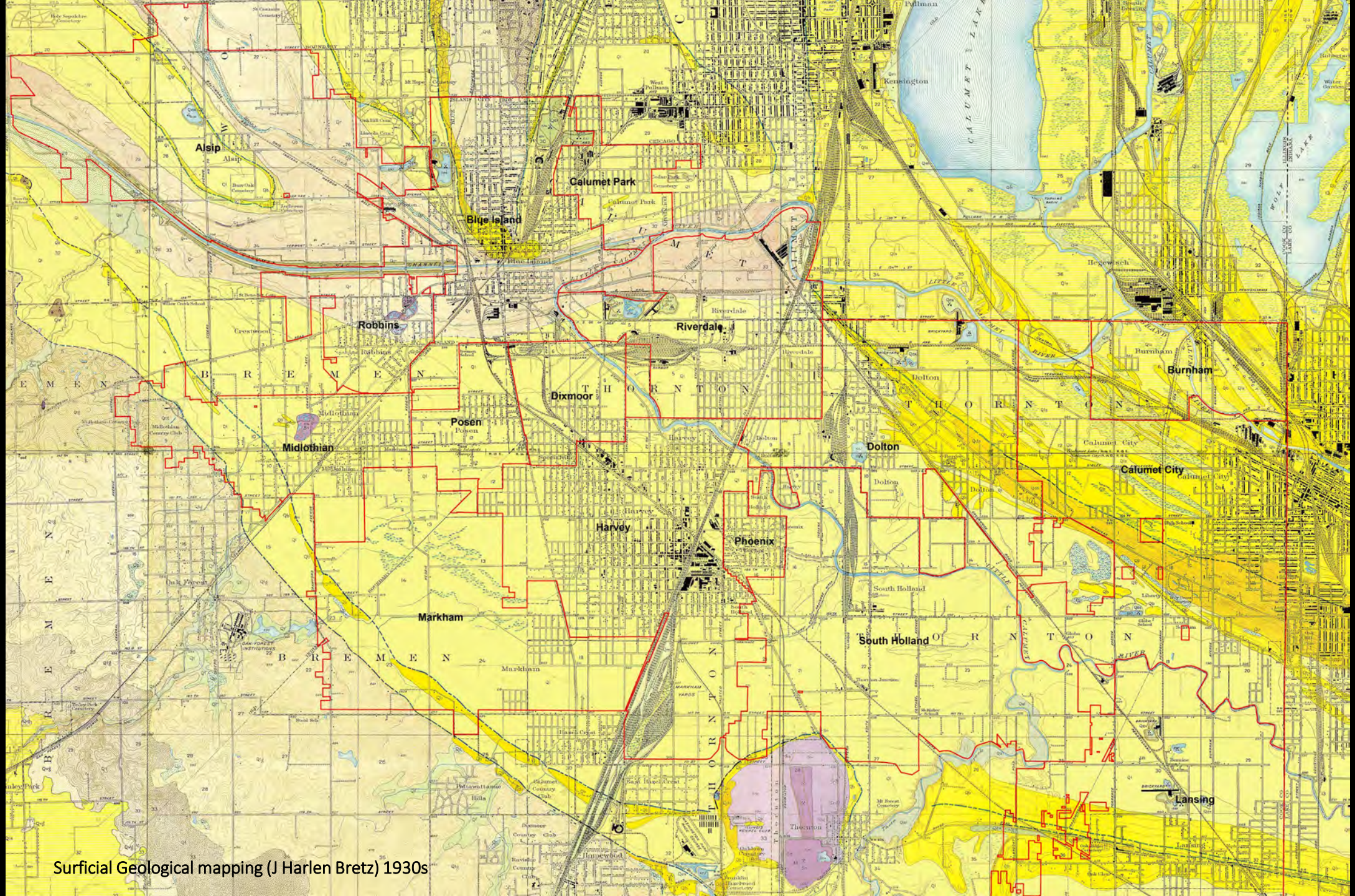
Time Period	Unit	Remarks and Morphology
Holocene	Recent Alluvium	Recent alluvium, including floodplain deposits, and recent alluvium in the Mississippi River valley.
	Recent Alluvium	Recent alluvium, including floodplain deposits, and recent alluvium in the Mississippi River valley.
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Legend

- Water
- Major River
- Minor River
- Stream
- Canal
- Road
- Railroad
- City
- Town
- Village
- Unincorporated Community
- County
- State





Surficial Geological mapping (J Harlen Bretz) 1930s

April 17-18, 2013: 5" rain in 24 hours



CALUMET CITY

meatpackers, beer brewers,
printmakers, bootleggers



NBC Chicago



1929, source: Chicago History Museum



Chicago Tribune



MIDLOTHIAN

golfers



Chicago Tribune



RainReady



RainReady

WHAT IS FLOOD RELIEF?

- A) LEAVE MIDLOTHIAN / ABANDON SHIP!
- B) HAZARD MITIGATION PROGRAM / MULTI-JURISDICTIONAL PROJECTS - HOME BUY
- C) CNT (CENTER FOR NEIGHBORHOOD TECHNOLOGY) PROJECTS "RETRO/WETROFIT" PROGRAM!
- D) MWRD (METROPOLITAN WATER RECLAMATION DISTRICT) WMO??? SHOVEL READY PROJECT \$\$\$ FUNDED
- E) RAIN BARRELS
- F) ALL OF THE ABOVE

* TUES. SEPT. 3RD. 6-8PM FLOODLOTHIAN MEETING W/ MR. ST PIERRE MWRD EXEC. DIRECTOR + HIS ENGINEERS
HE IS COMING TO LOOK AT OUR SPECIFIC PROBLEM.
BE HERE OR BE WET AND DON'T COMPLAIN ABOUT IT!

* WED. JUNE 4, 14 2PM PHASE II MIDLOTHIAN / STORMWATER PROJECT MEETING THINK CAP



RainReady

Center for Neighborhood Technologies

DEEP TUNNEL: THORTON QUARRY STORMWATER BASIN



GSI PROJECT

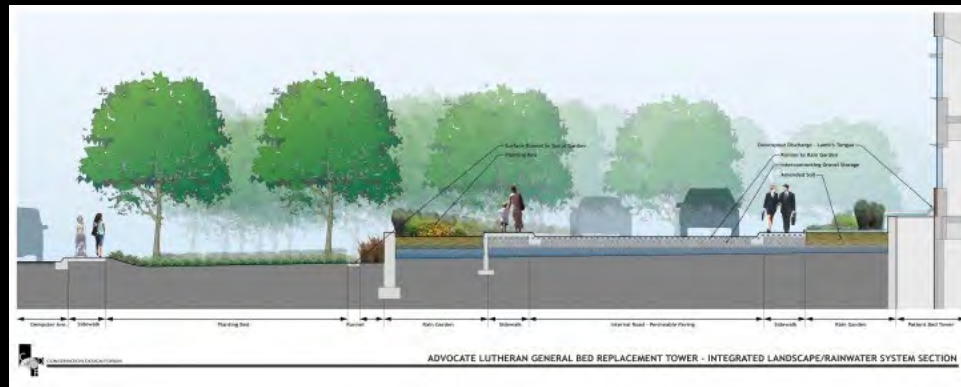
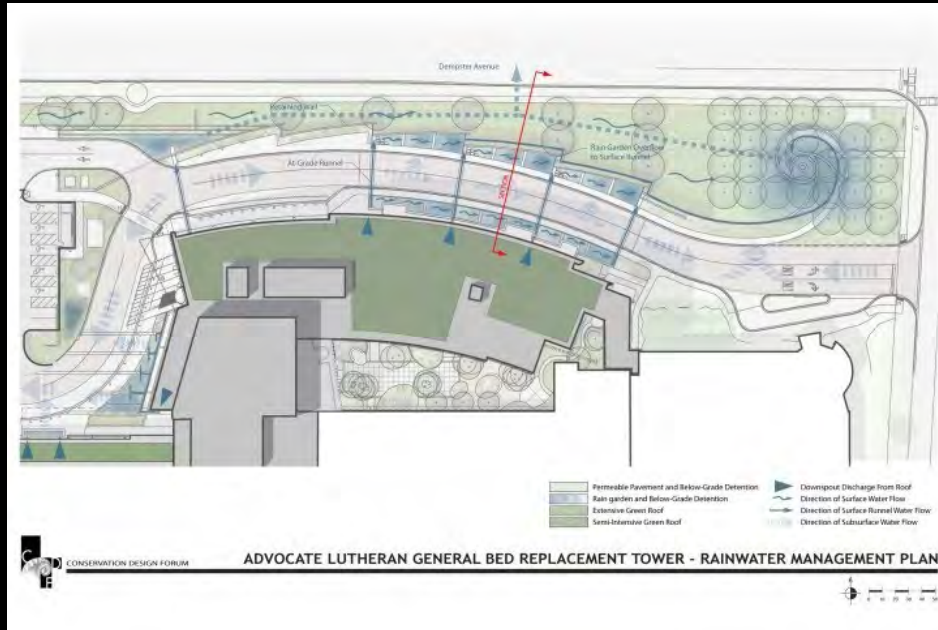
GOAL: Alleviate recurring urban flooding in the Calumet Corridor

HOW: Study the role that soils play in alleviating flooding (currently not part of GI planning or regulatory approvals)



April 17-18, 2013: 5" rain in 24 hours

Green strategy precedent: Advocate Lutheran Patient Bed Tower



Every surface converted to capture 100% of stormwater

Green Stormwater Infrastructure Design, based on underlying soils

key principles:

- intercept water directly (or, as close as possible)
- create underlying layers of material (organic and/or open-graded) to further capture water
- reduce energy and erosion (make capture very direct)
- convey water downward through soils, through gravity and/or soil properties
- use planting to uptake (everywhere possible)



GI Surfaces (e.g. parking lots)

- designed to handle water directly through the surface
- optional to receive from adjacent surfaces
- lower loading ratio

GI Features (e.g. bioswales)

- designed to receive water from adjacent surfaces
- higher loading ratio

Illinois-Indiana Sea Grant Program (NOAA) 2018-2019 #NA18OAR4170082
Hydrogeologic soil research for green stormwater infrastructure planning and design: new methods for adapting urban coastal communities
(Drawn by M.P. McGuire)

Surfaces vs Features - Concept Methodology: Loading ratio plays a key role in performance



PROJECT MOTIVATIONS

- Retrofit the land for GSI
- Test perception that the region is dominated by impervious soils
 - Limits GSI design and implementation
- Demonstrate value of considering natural soils in GSI designs.
 - Traditional GSI design practice relies only on amended soil layers
- Can high-resolution mapping of the near-surface geology, soils, and hydrologic properties improve site-specific GSI planning and design?

MY MOTIVATIONS TODAY

- Applied geology example
- Direct, early stakeholder involvement:
 - understand needs, understand deliverables
- It's nice to work with people that want the information!
- Multidisciplinary
- Collaboration with USDA-MLRA: direct use of soils data
- Feedback with StateMap-Coalition mapping

Study anticipates StateMap projects

STATEMAP/EDMAP Current Status with FY2019 Proposal

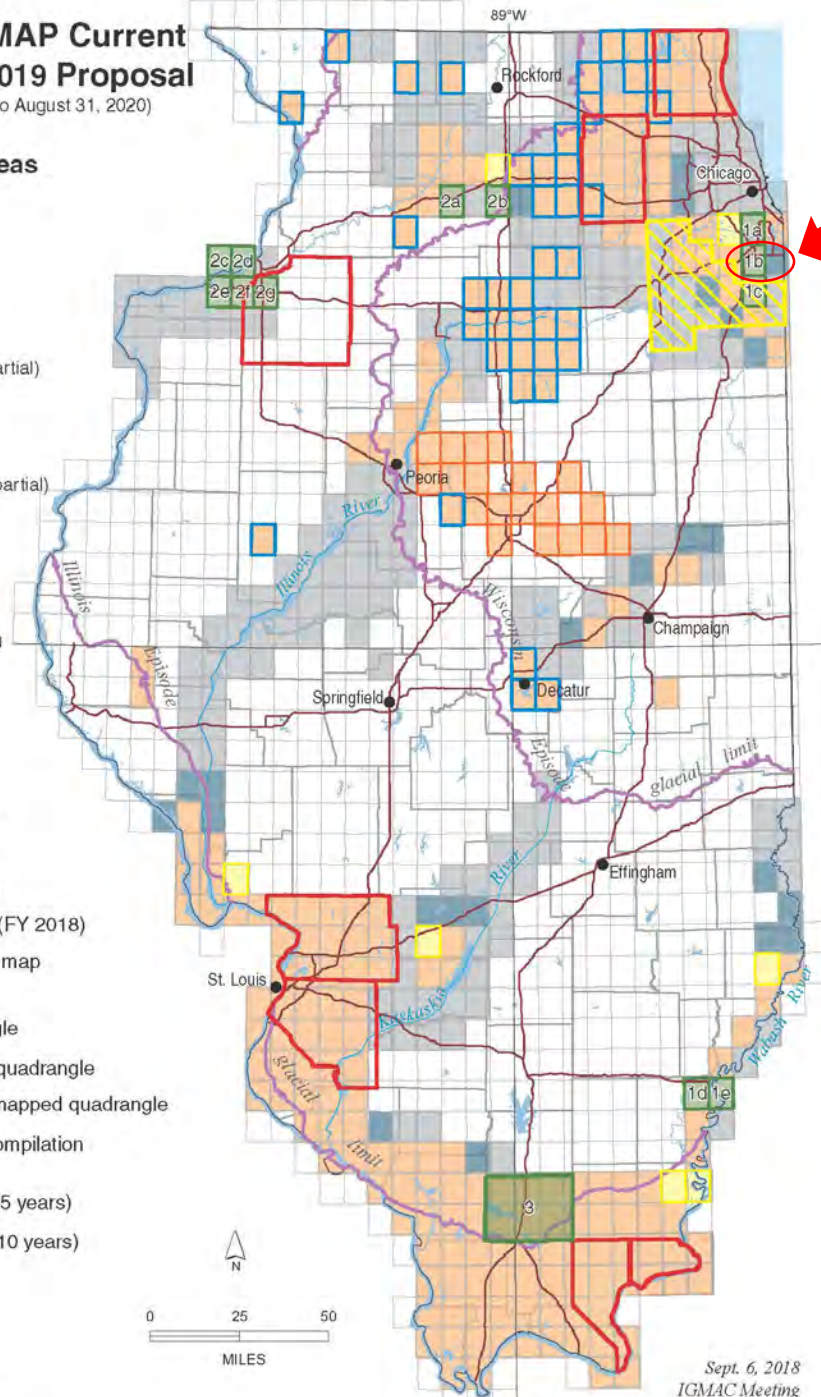
(FY2018: September 1, 2019 to August 31, 2020)

Proposed project areas (numbered on map)

1. Illinois surficial geology
 - 1a. Blue island
 - 1b. Harvey
 - 1c. Steger (partial)
 - 1d. Crossville
 - 1e. New Harmony (partial)
2. Illinois bedrock geology
 - 2a. Franklin Grove
 - 2b. Steward
 - 2c. Davenport East (partial)
 - 2d. Silvis (partial)
 - 2e. Milan
 - 2f. Coal Valley
 - 2g. Green Rock
3. Illinois geology
Williamson County

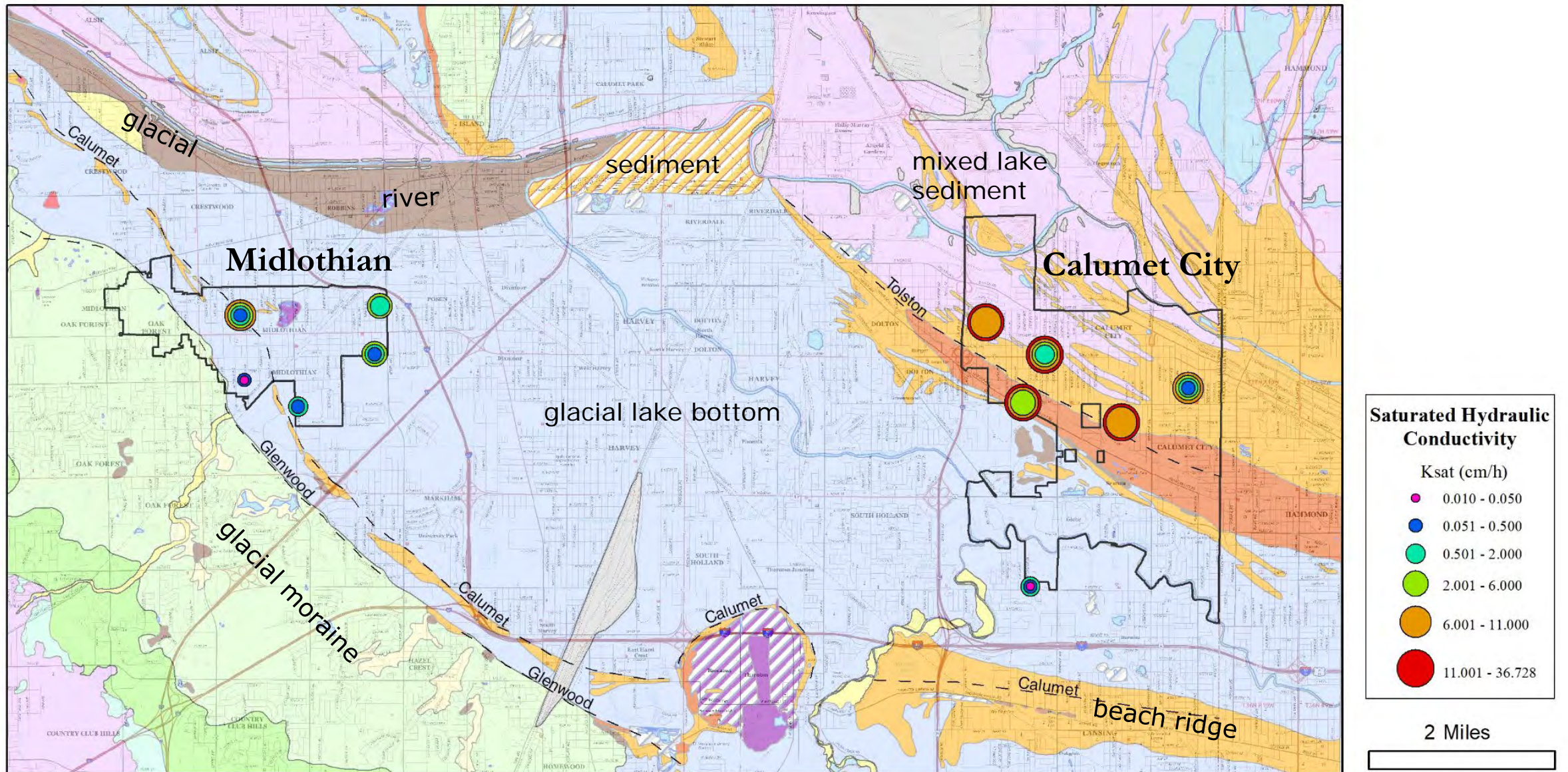
7.5-minute quadrangle and county status

- Proposed (FY 2019)
 - Current STATEMAP (FY 2018)
 - Current COALITION map
 - Completed quadrangle
 - Completed EDMAP quadrangle
 - Completed student-mapped quadrangle
 - Completed county compilation
 - Short-range plan (2–5 years)
 - Long-range plan (5–10 years)
- County boundary
— Interstate highway



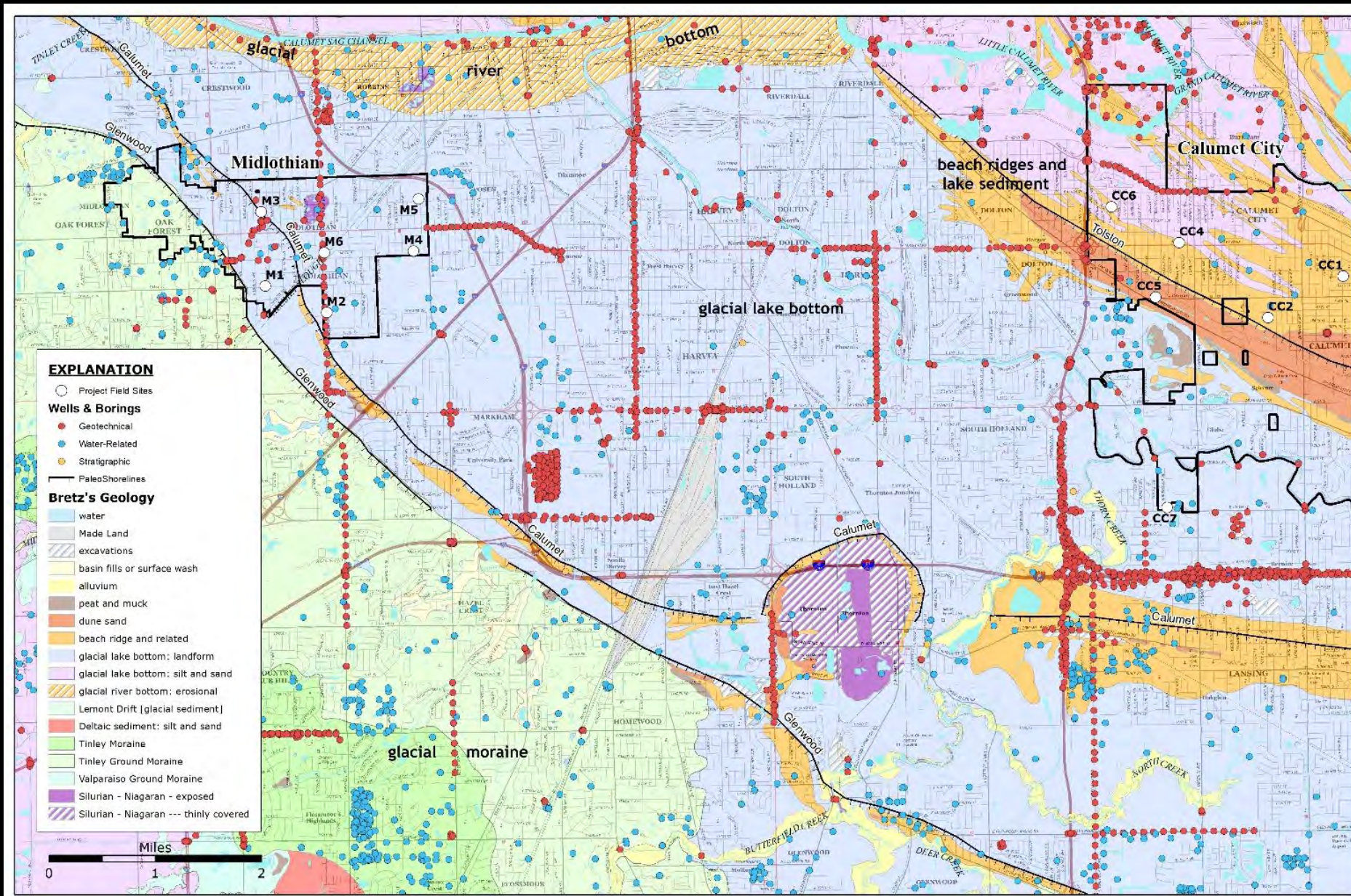
Study Area

Soil Characteristics for Green Infrastructure Planning



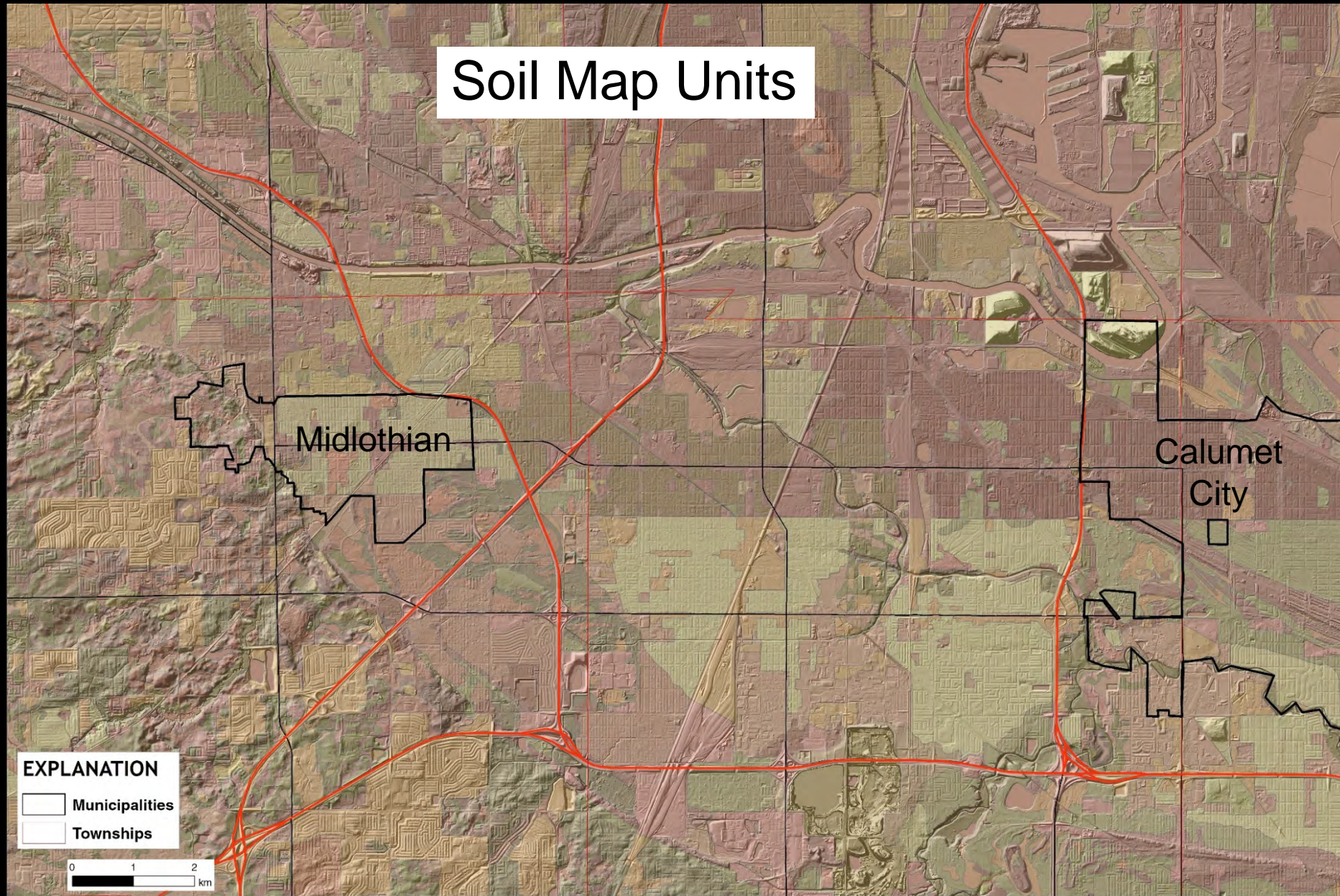
Geology after J.H. Bretz (1943)

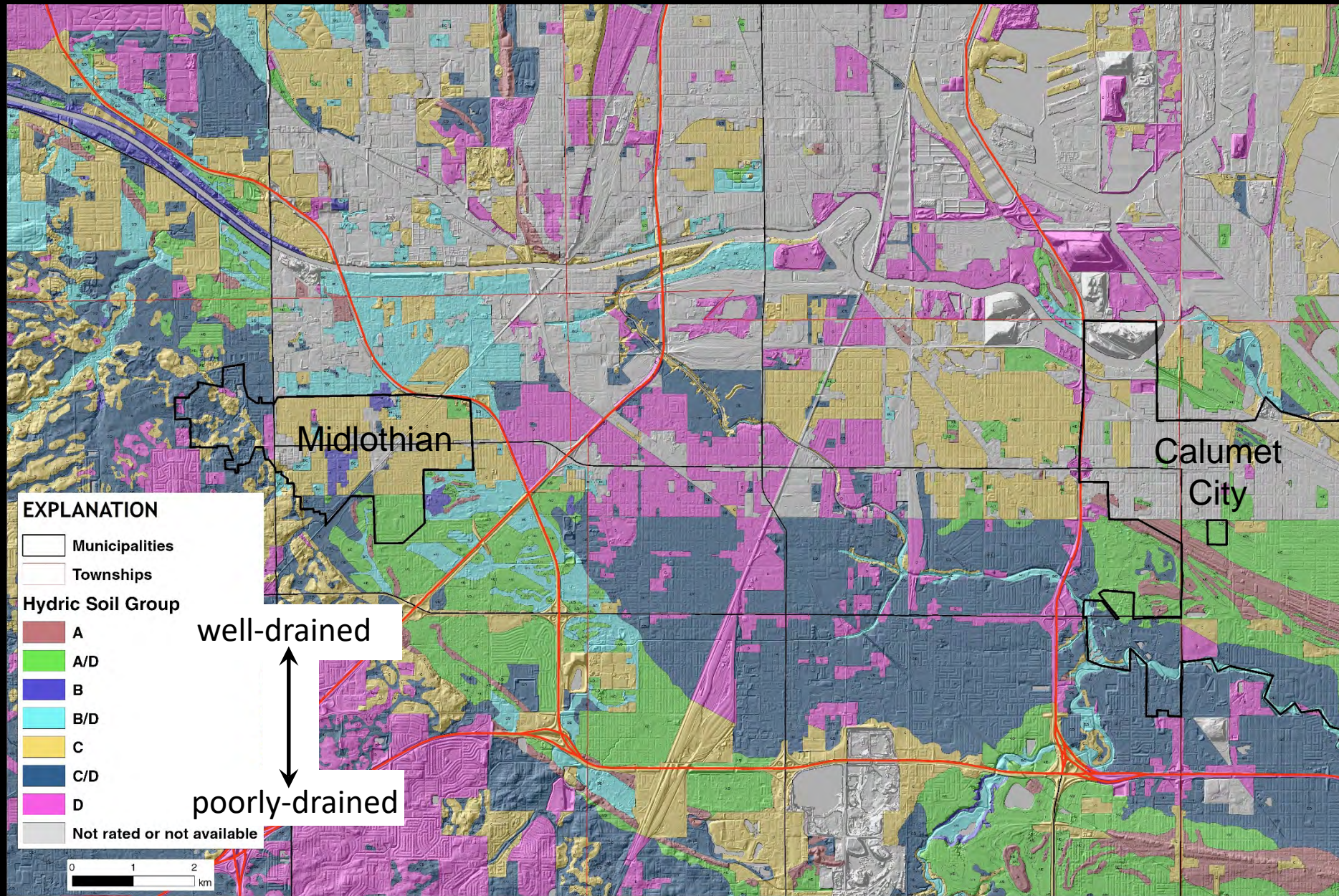
Map analysis included geotechnical, water wells



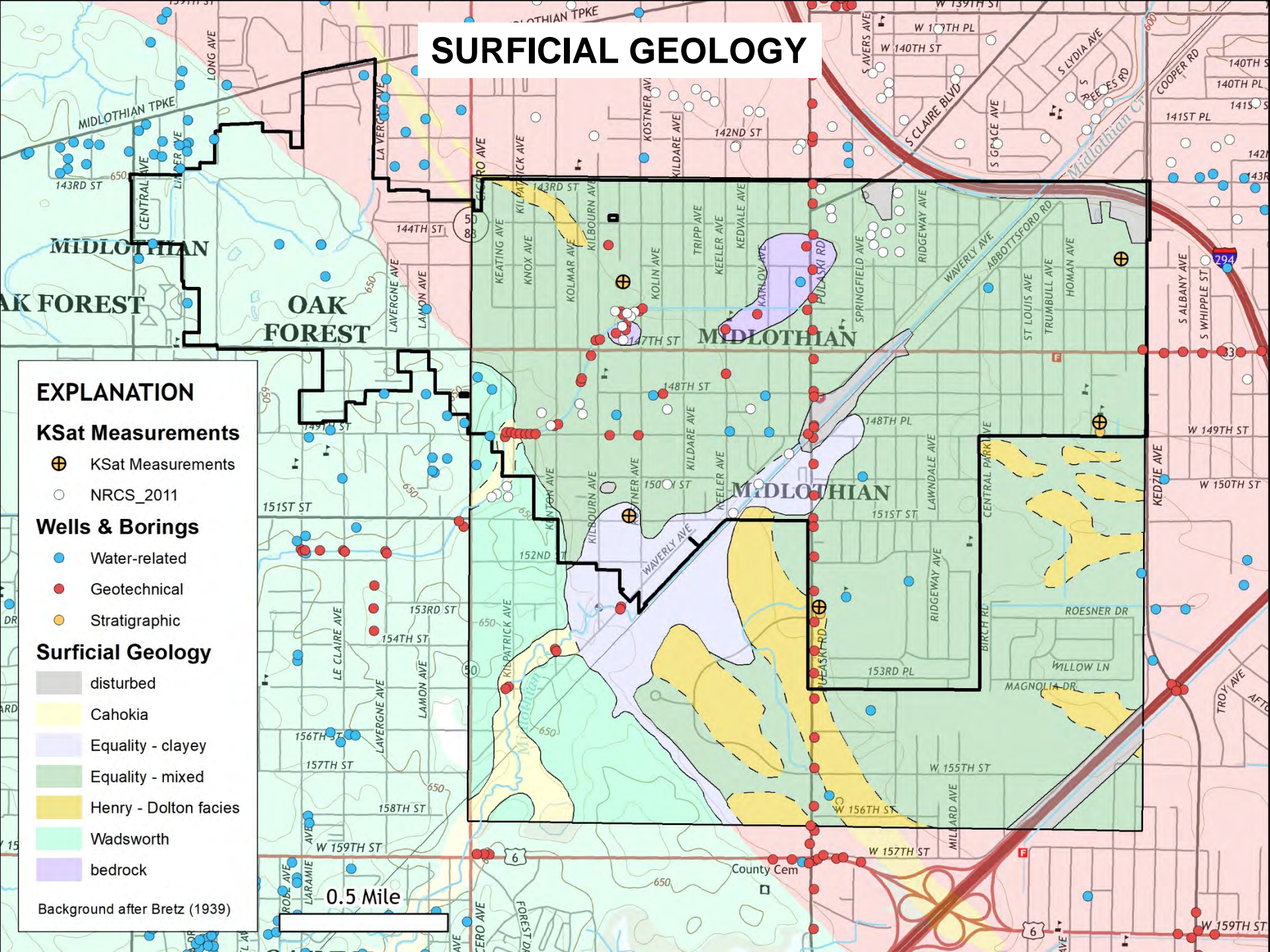
and

Soil Map Units





SURFICIAL GEOLOGY

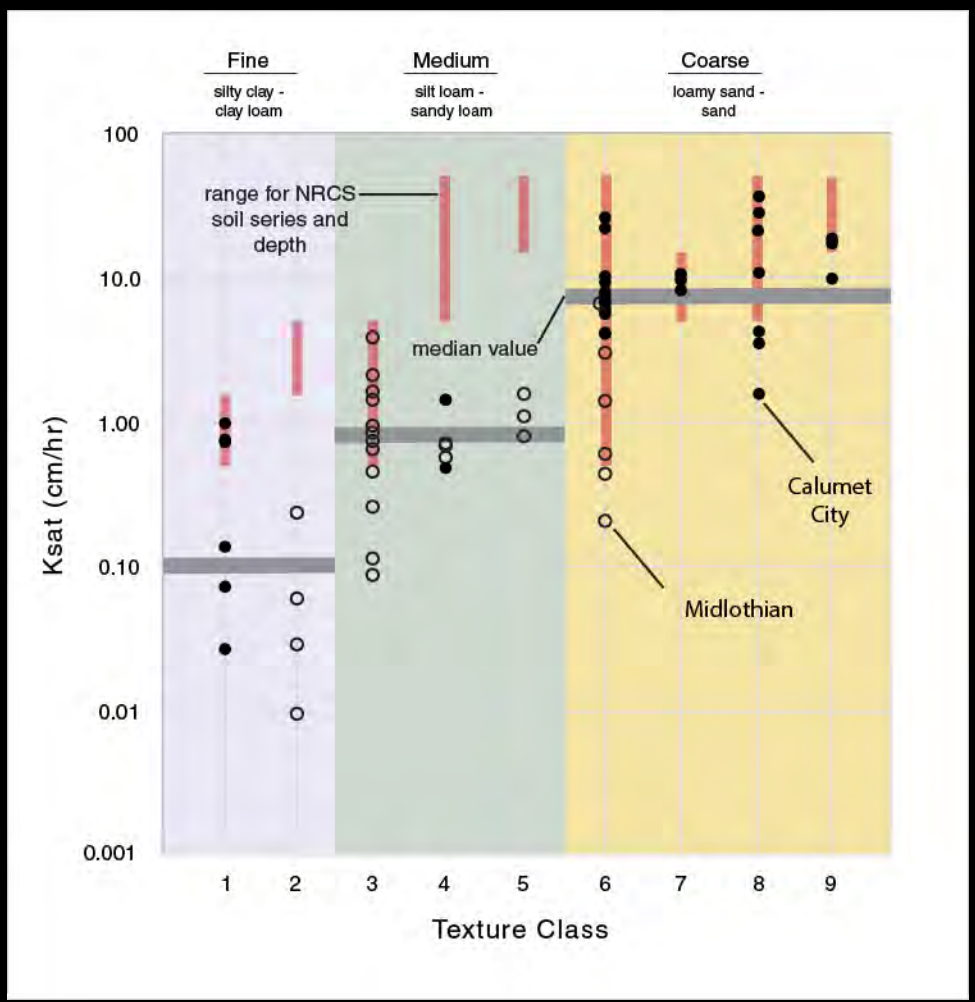




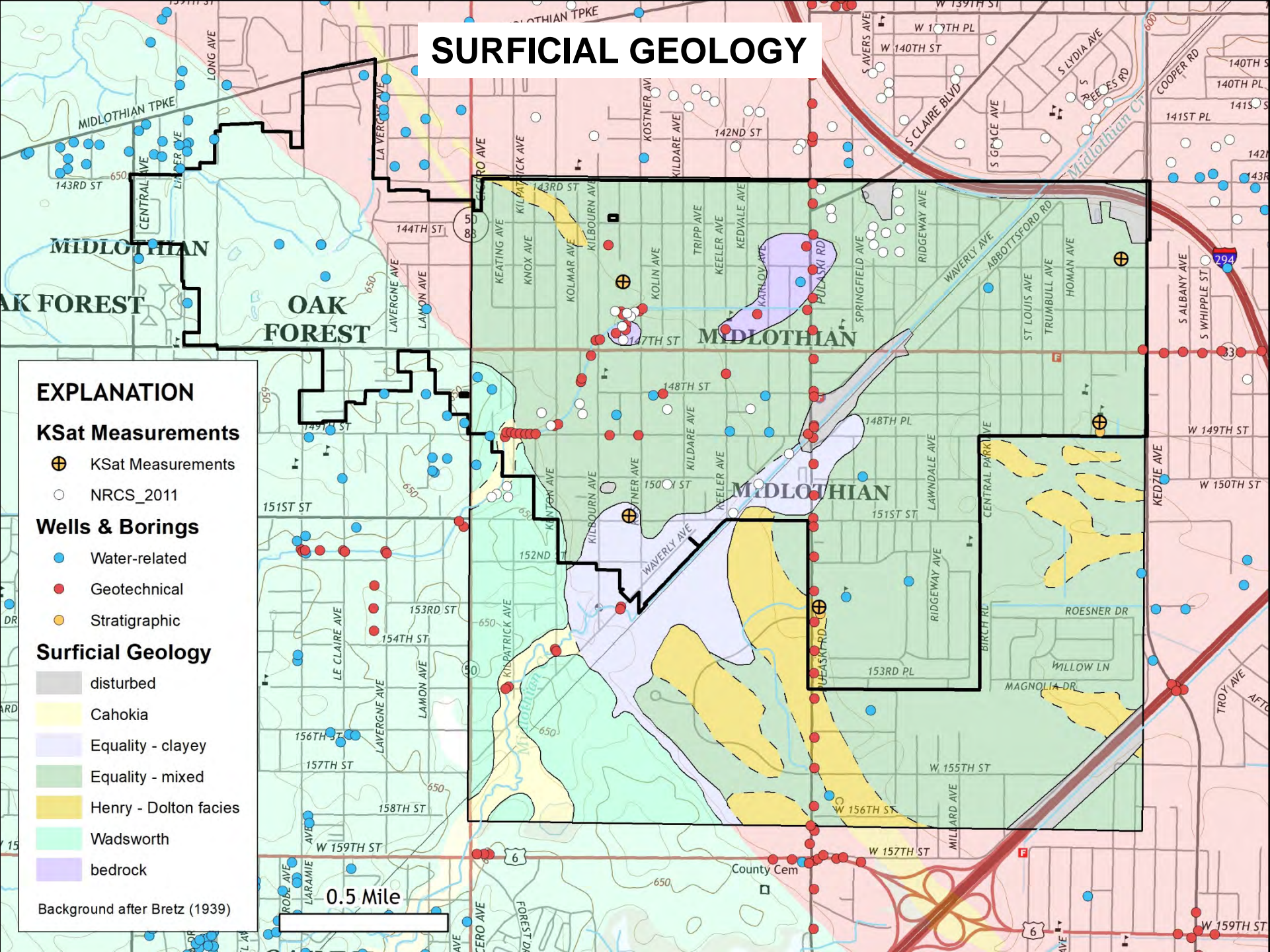
Field studies in Midlothian

Field Constant Head Test with Amoozometer (Amoozegar 1989)





SURFICIAL GEOLOGY



EXPLANATION

KSat Measurements

- ⊕ KSat Measurements
- NRCS_2011

Wells & Borings

- Water-related
- Geotechnical
- Stratigraphic

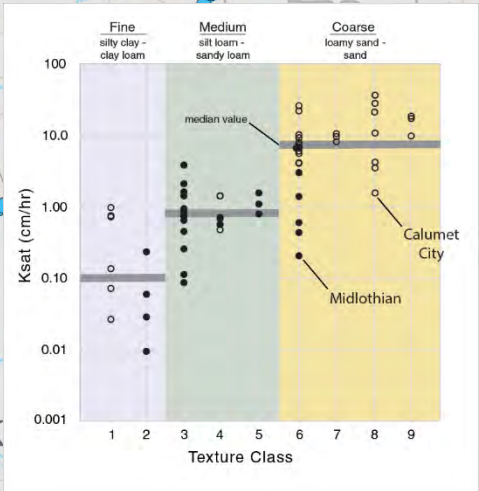
Surficial Geology

- ▒ disturbed
- Cahokia
- Equality - clayey
- Equality - mixed
- Henry - Dolton facies
- Wadsworth
- bedrock

Background after Bretz (1939)

0.5 Mile

TEXTURE CLASS



EXPLANATION

KSat Measurements

- ⊕ KSat Measurements
- NRCS_2011

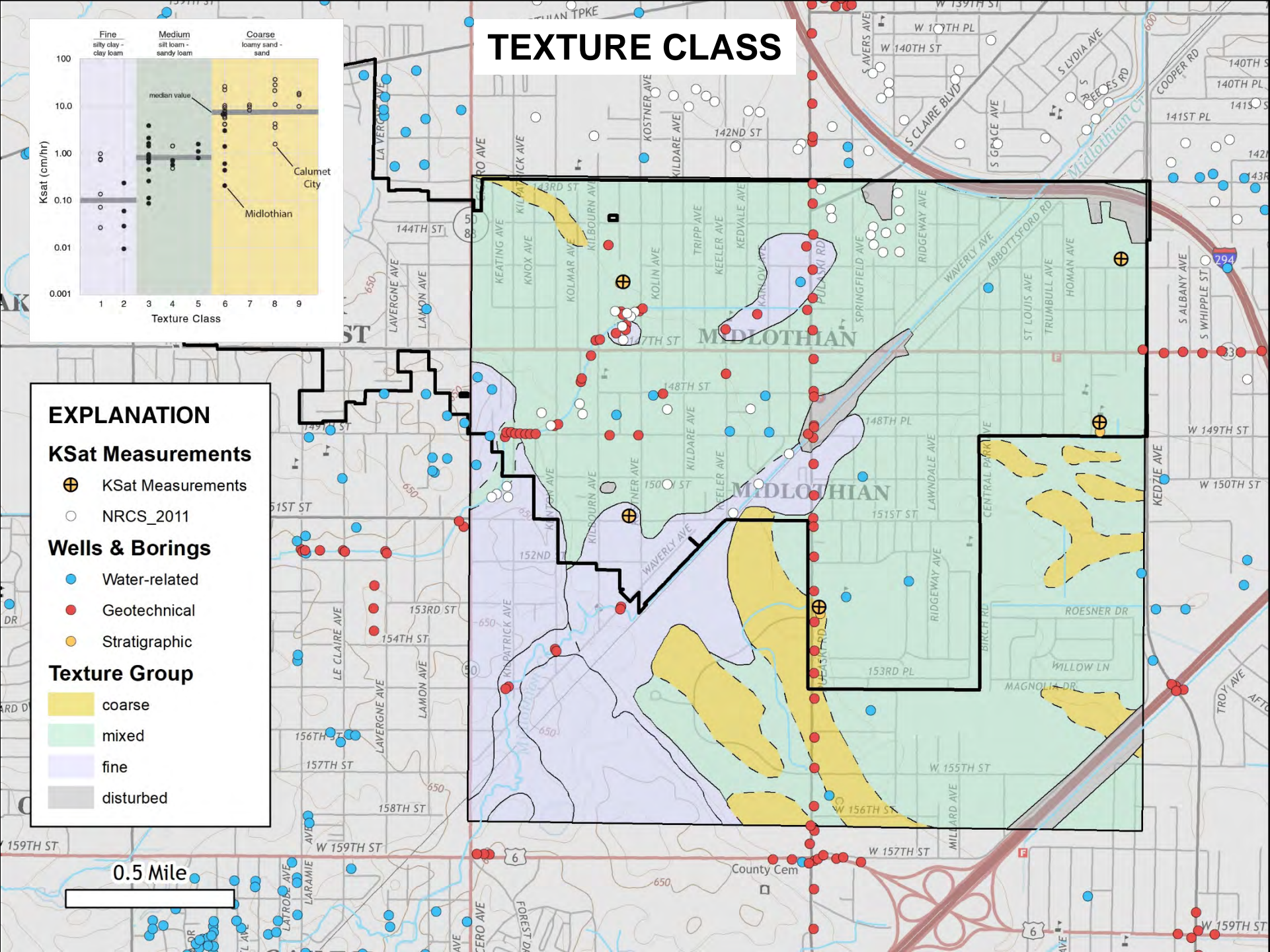
Wells & Borings

- Water-related
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Texture Group

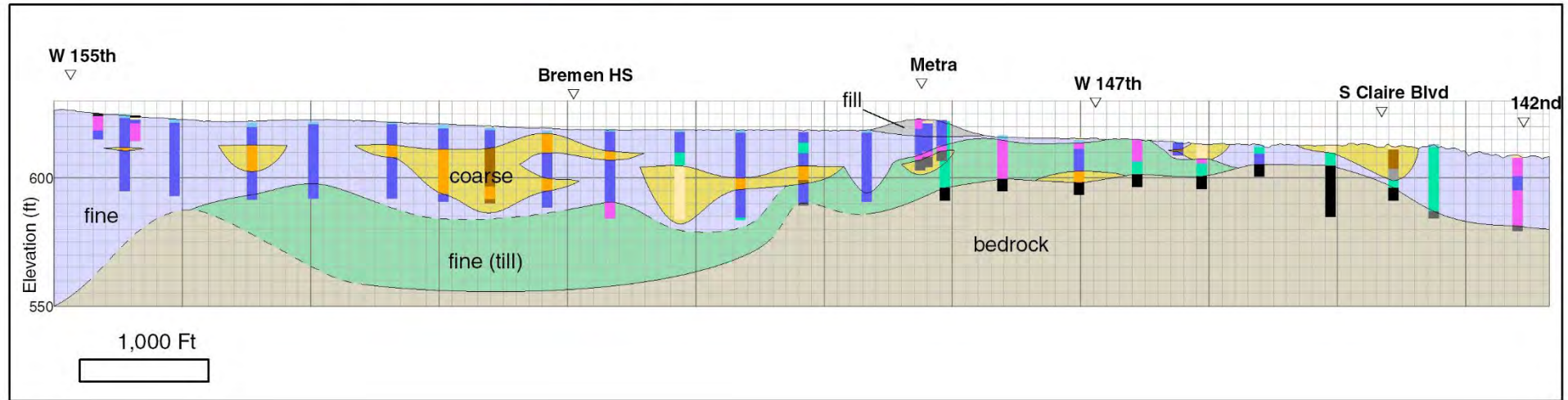
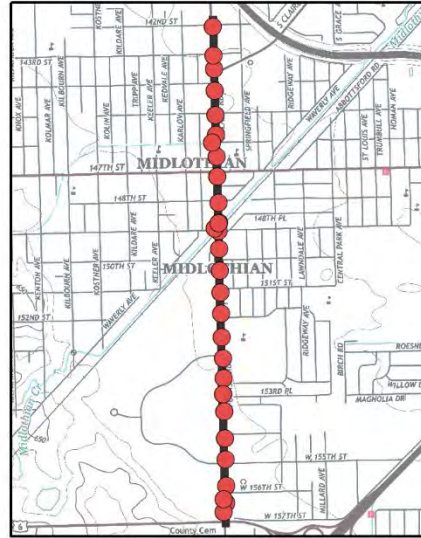
- coarse
- mixed
- fine
- disturbed

0.5 Mile



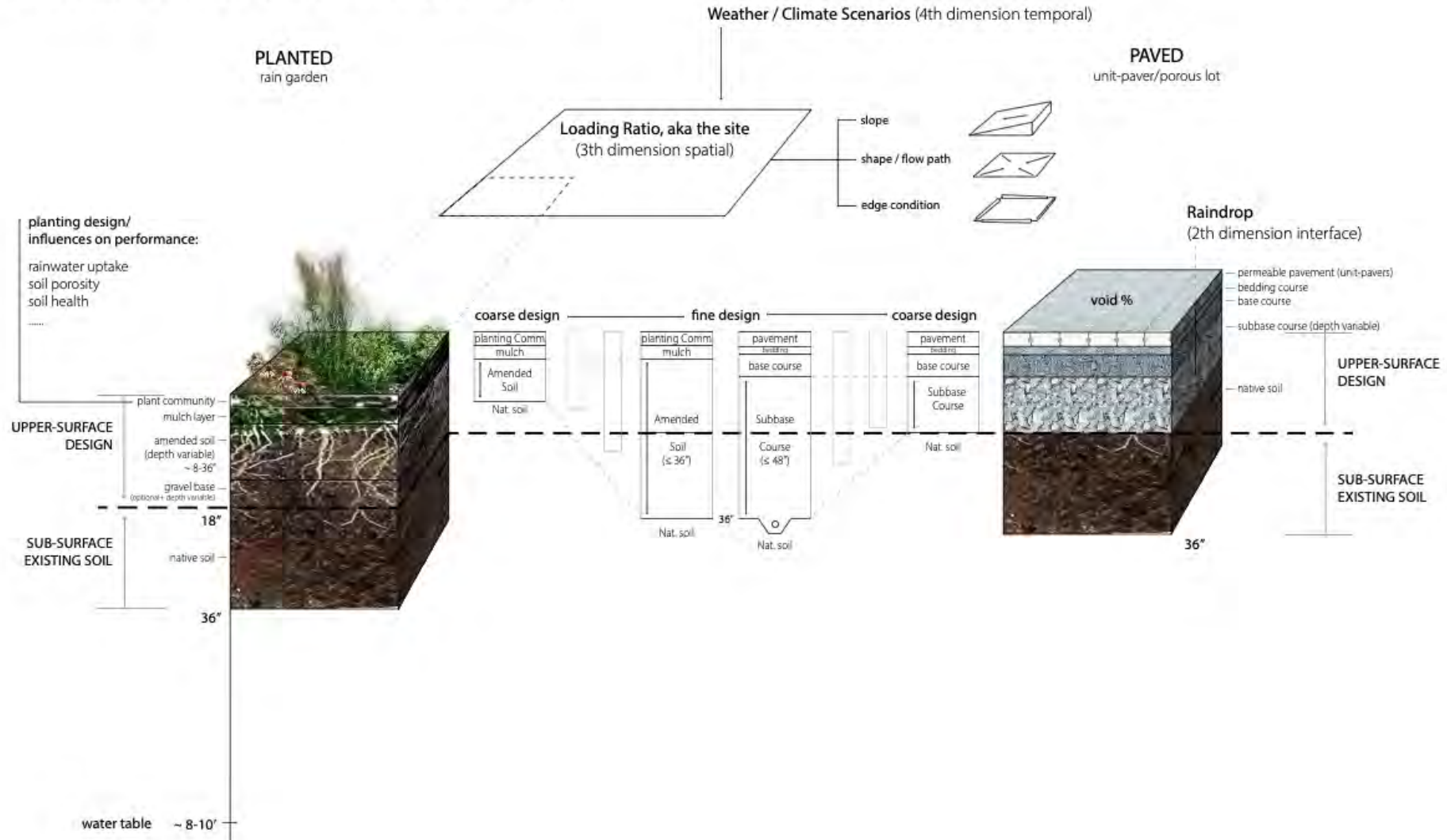
Lithologic Cross Section

- EXPLANATION**
- Unit Contacts**
- Confident
 - - - Inferred
- Texture Unit**
- fill
 - fine
 - coarse
 - diamict
 - bedrock



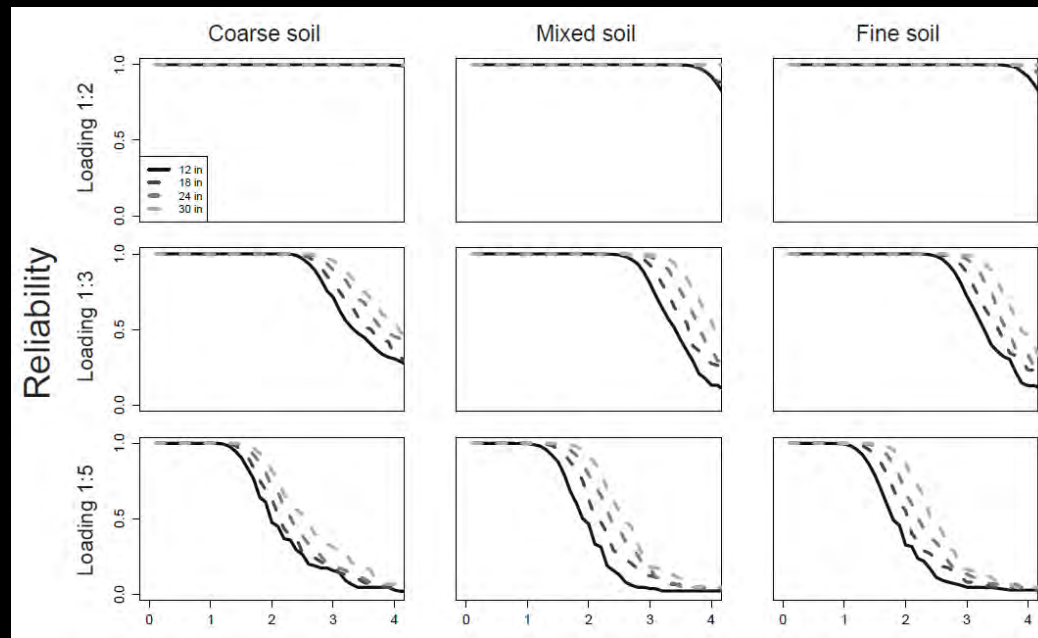
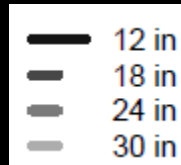
GI Design Prototype - Concept Methodology

VERTICAL INTERFACE = (Depth + Material)
 SURFACE PERFORMANCE = (site (w/context)+ weather/climate)

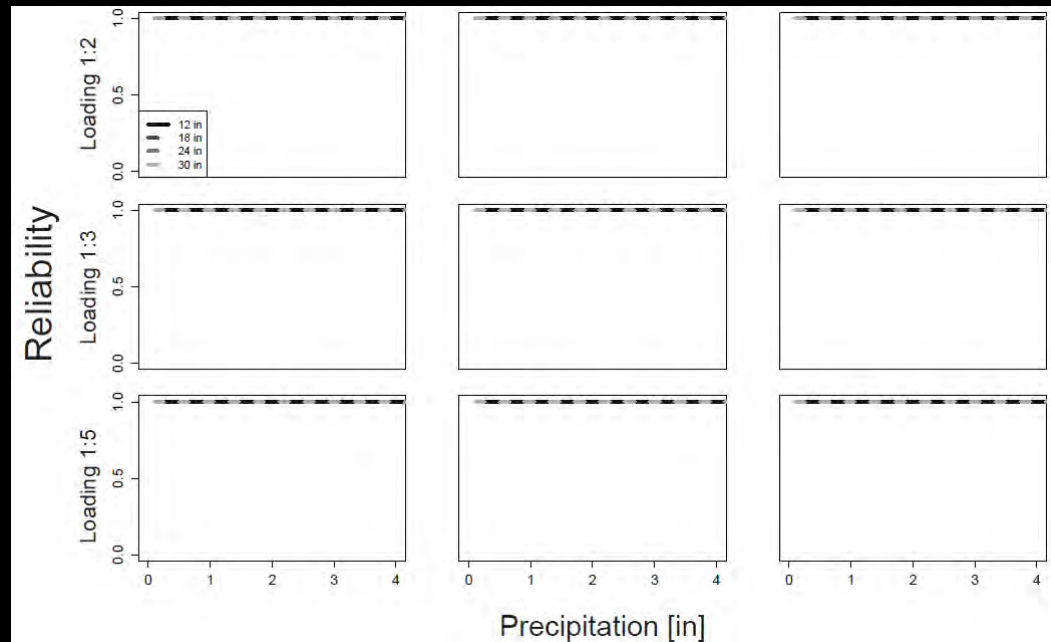


Modeling prototype reliability

2 hour



24 hour

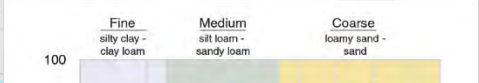
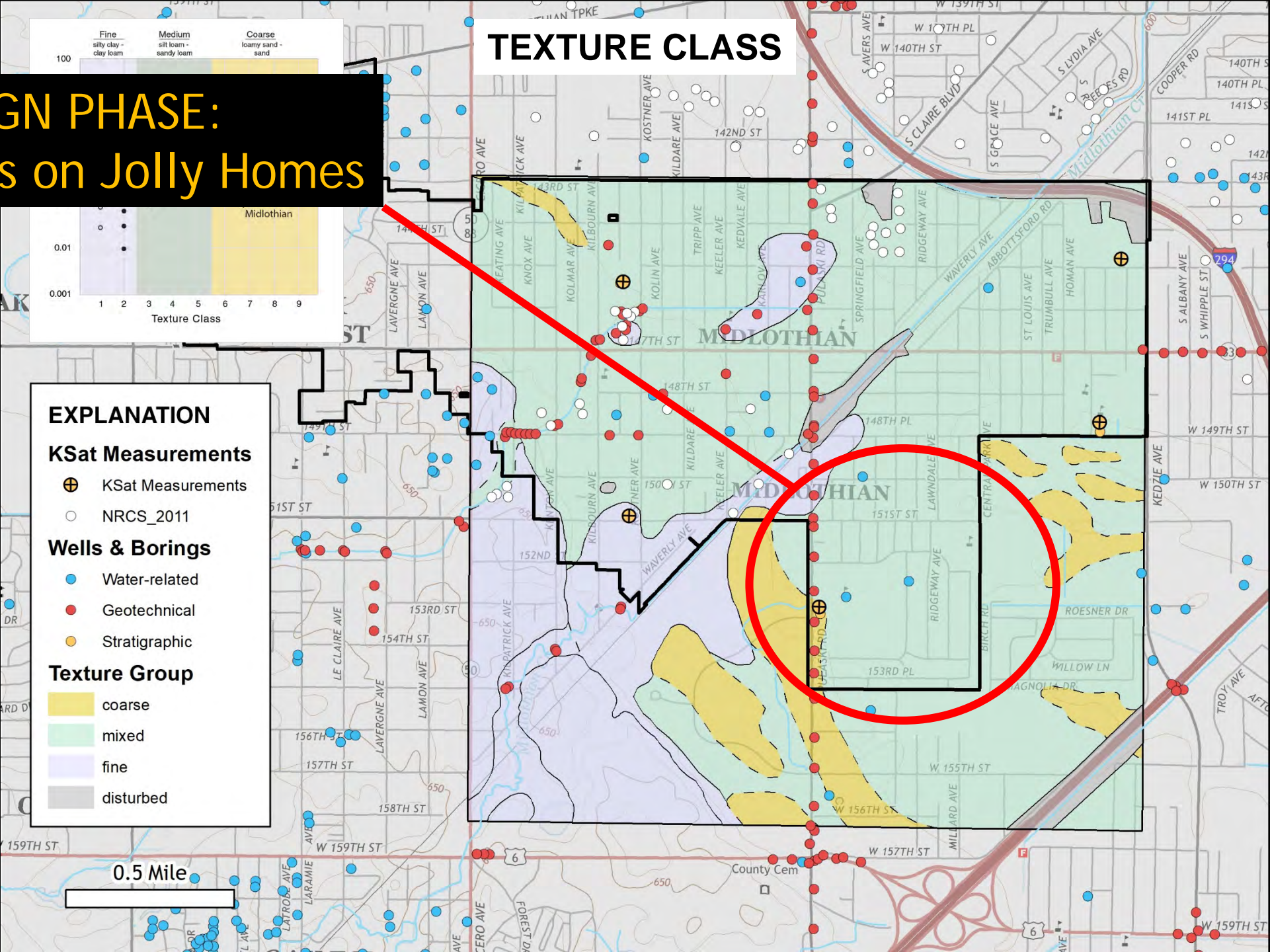


Planted

- Rain garden performance variability can be quantified.
- Rain gardens can effectively reduce runoff even with fine native soils.
- Media thickness is most important for mixed and fine native soils.
- Loading ratio is the most important design consideration for improved reliability

DESIGN PHASE: Focus on Jolly Homes

TEXTURE CLASS



EXPLANATION

KSat Measurements

- ⊕ KSat Measurements
- NRCS_2011

Wells & Borings

- Water-related
- Geotechnical
- Stratigraphic

Texture Group

- coarse
- mixed
- fine
- disturbed



STUDENT DESIGN COMPONENT



Back to The Land

151st Street



Midlothian Meadows
Nature Preserve

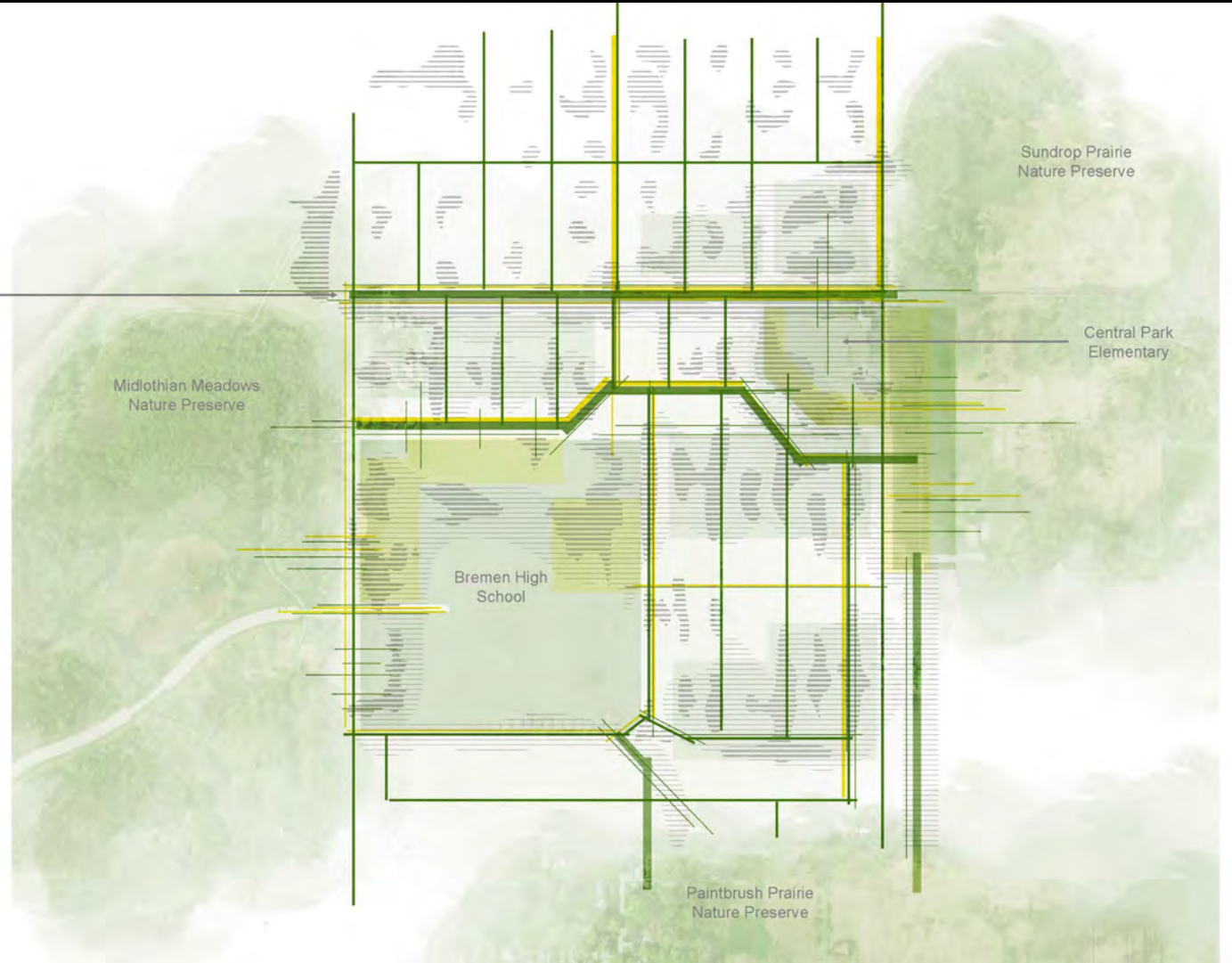
Bremen High
School

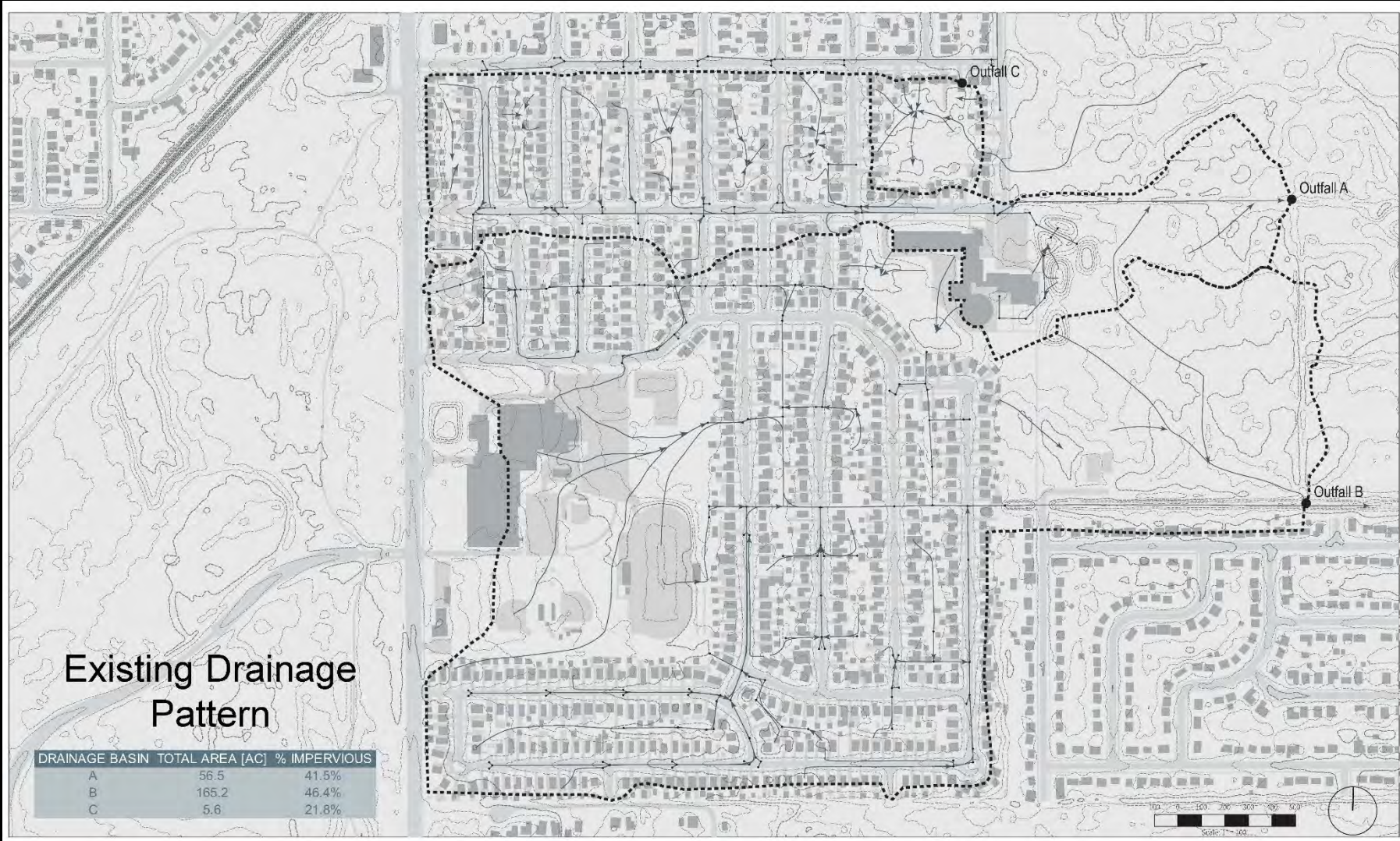
Sundrop Prairie
Nature Preserve

Central Park
Elementary

Paintbrush Prairie
Nature Preserve

-  Human connection
-  Ecological connection





Flood Susceptibility Diagram



Opportunity Surface Diagram



Proposed Site Plan



- LEGEND**
- Bio-Swale
 - Permeable Pavement
 - Green Roof
 - Shared Garden
 - Prototype Parcel
 - Edu. Green Infrastructure
 - Nature Preserve Trail
 - Bike Lane



PRESENTATION TO CITIES

