Vella Pit: Aquifer Assessment

Ann Arbor Township, August 21, 2023

HALEY ALDRICH

JP Brandenburg – Hydrogeologist

- BS Geology, Michigan State University
- MS Environmental Engineering and Science, Johns Hopkins University
- PhD Geology, University of Michigan
- Licensed professional geologist (Texas and California)
- Community member: Chelsea resident and owner of a domestic water well

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Vella Pit - Operations

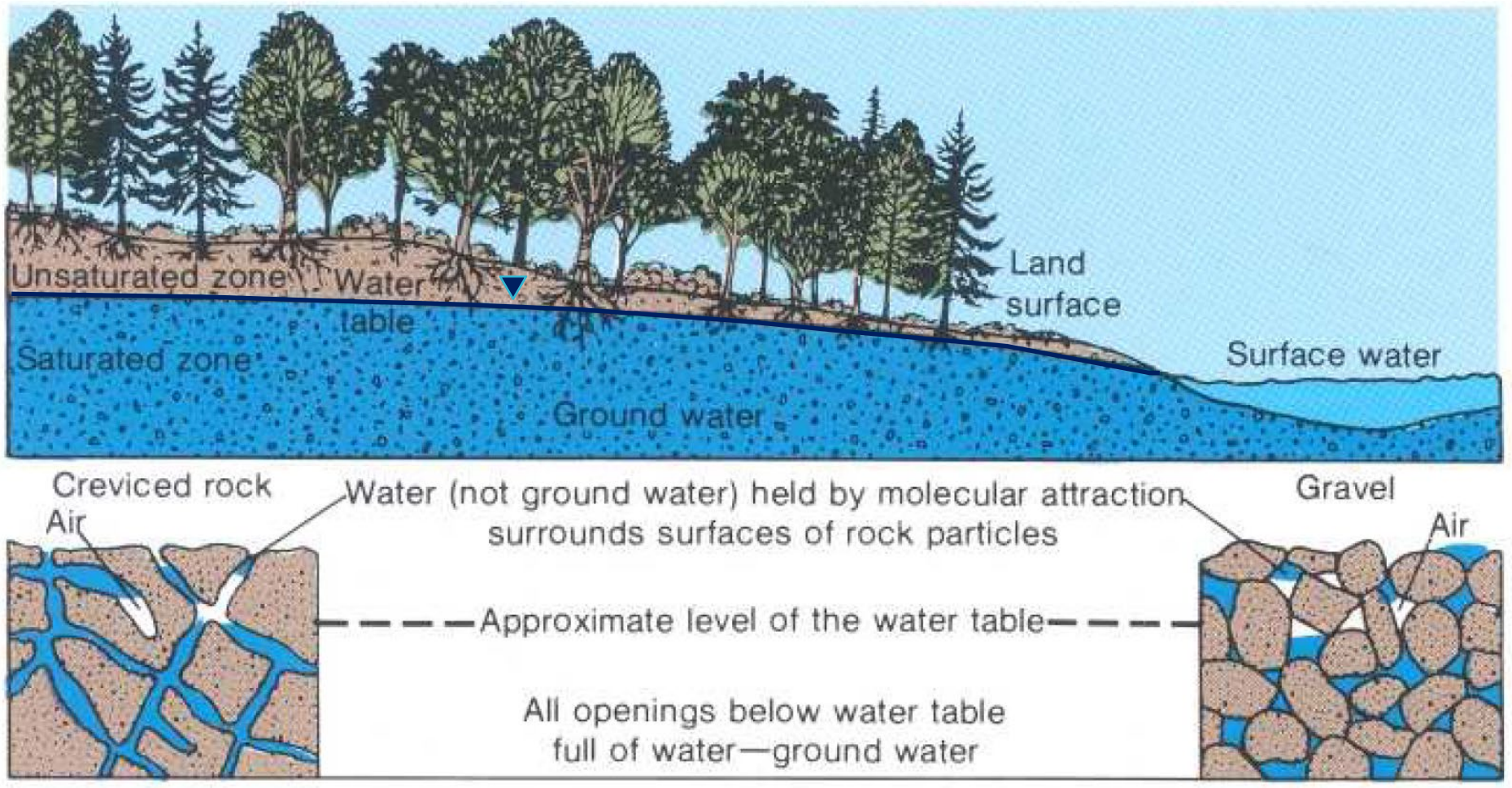


1. Active mining area
2. Reservoir of water for wash plant
3. Settling pond
4. NPDES outfall to wetlands
5. Settling pond for wash plant return water

Water flow direction



Groundwater and the Water Table

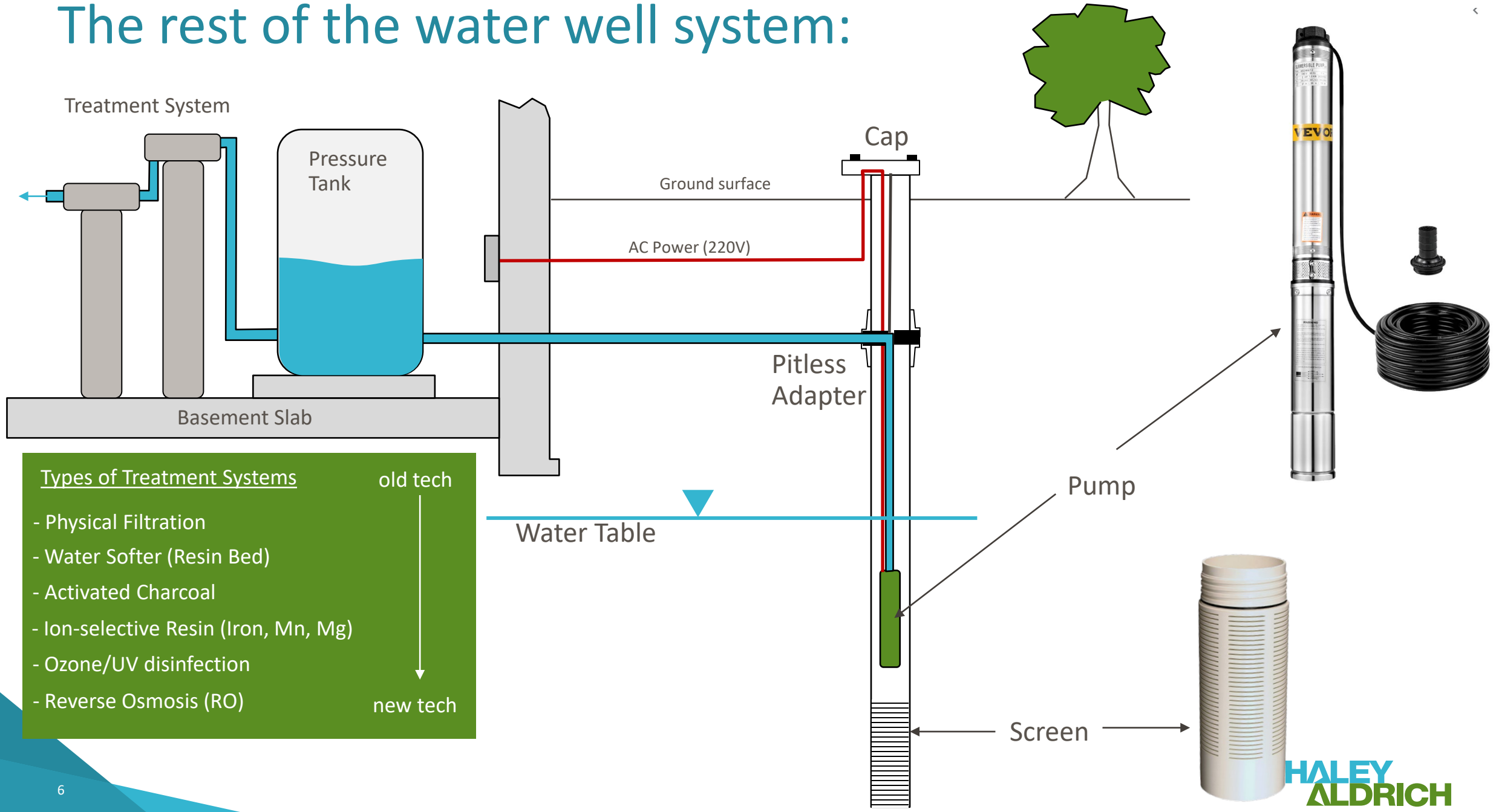


Typical residential water well in Southeast Michigan





The rest of the water well system:



Types of Treatment Systems

old tech

- Physical Filtration
- Water Softer (Resin Bed)
- Activated Charcoal
- Ion-selective Resin (Iron, Mn, Mg)
- Ozone/UV disinfection
- Reverse Osmosis (RO)

new tech

Designing durable domestic wells

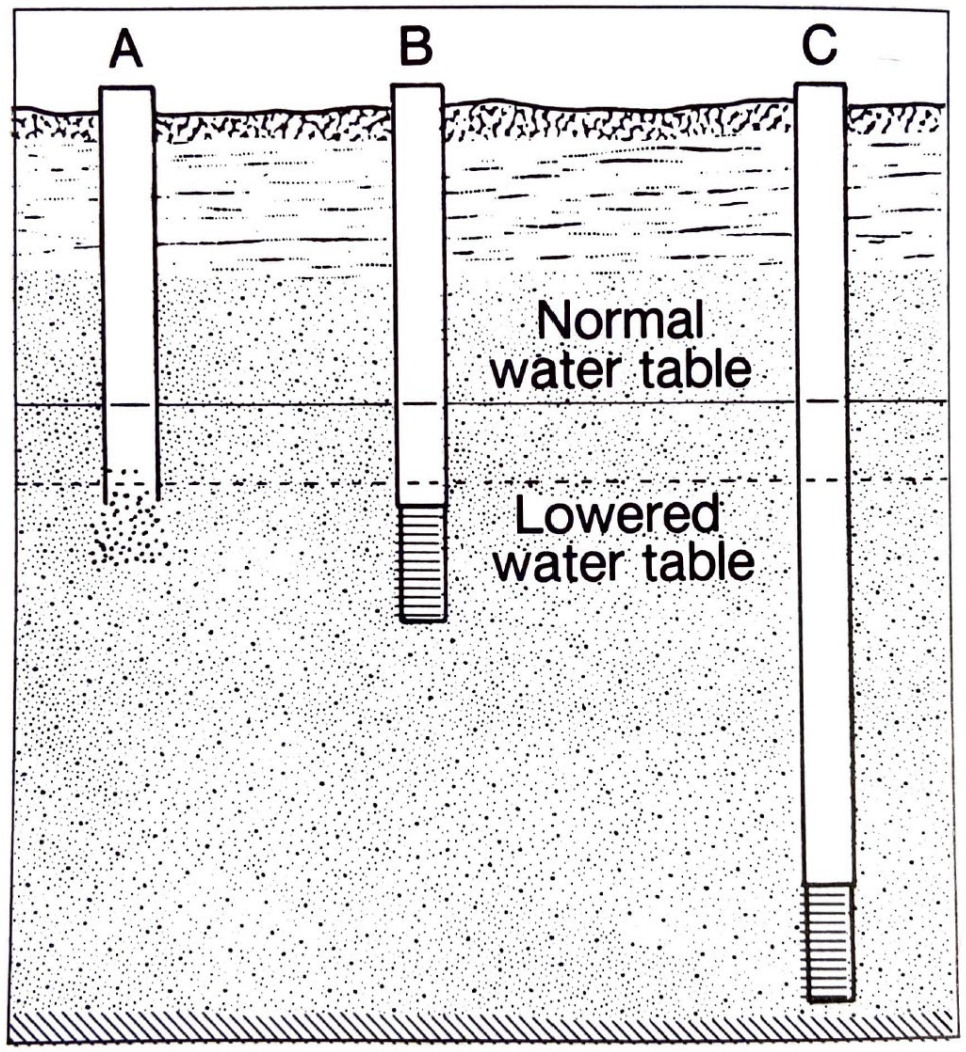
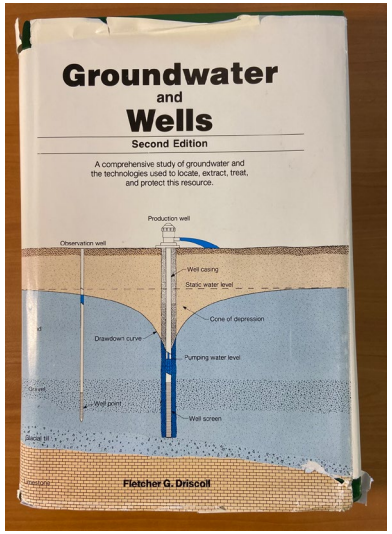
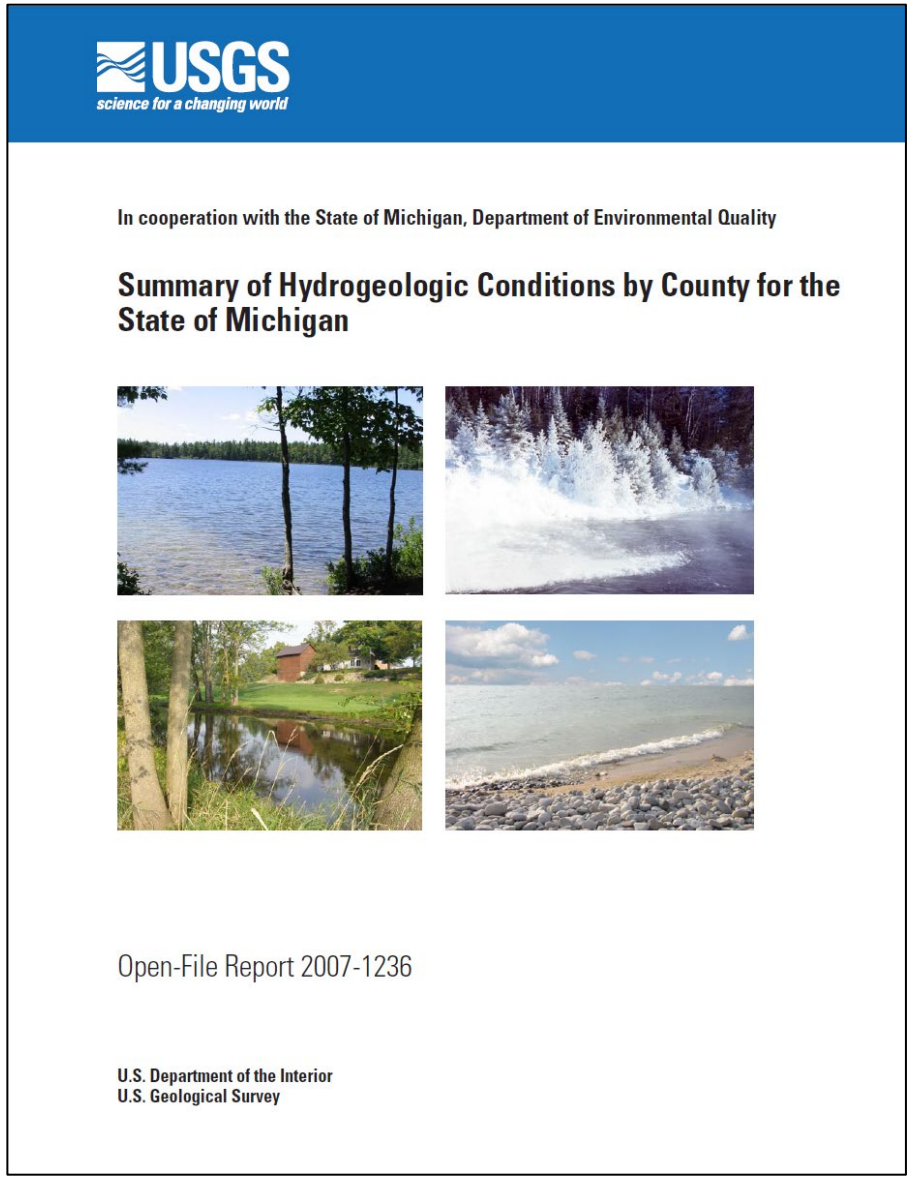


Figure 13.17 from Peter Driscoll "Groundwater and Wells"

"Adequate long-term yields are obtained by installing a well screen of adequate length at the proper depth.



Enough potential drawdown must be available to meet future yield demands"



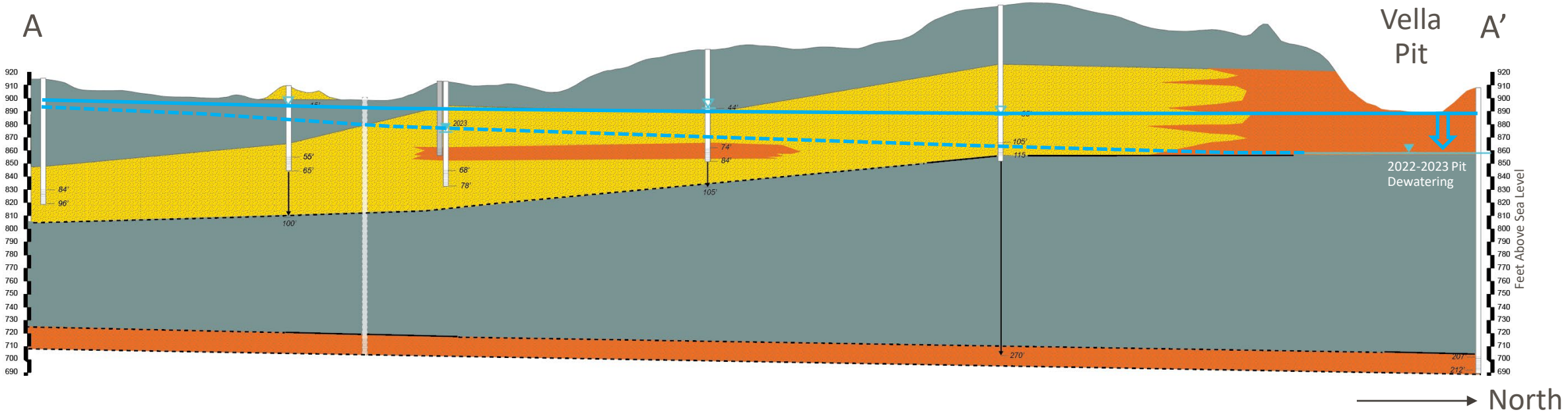
Washtenaw County

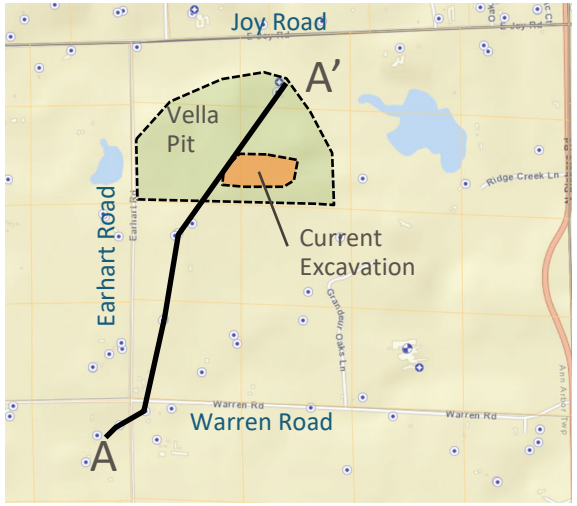
"Aquifers in the glacial deposits consist largely of sands and gravels and vary regionally in thickness and permeability. The ability to obtain water from the glacial deposits varies with location within the county."

"In the eastern portion of the county*, aquifer materials occur in **small lenses**, and are probably sufficient for domestic supplies."

*Northfield, Salem, Superior and Saline Townships in this discussion.

Geological Cross Section – To Scale





- Gravel/Coarse Gravel
- Sand/Sand with Gravel
- Clay Till*

*May contain isolated gravel lenses up to 2' thick, not aquifer quality

- Observed geologic contact
- Inferred geologic contact
- Historical static water level
- New static water level (conceptual)

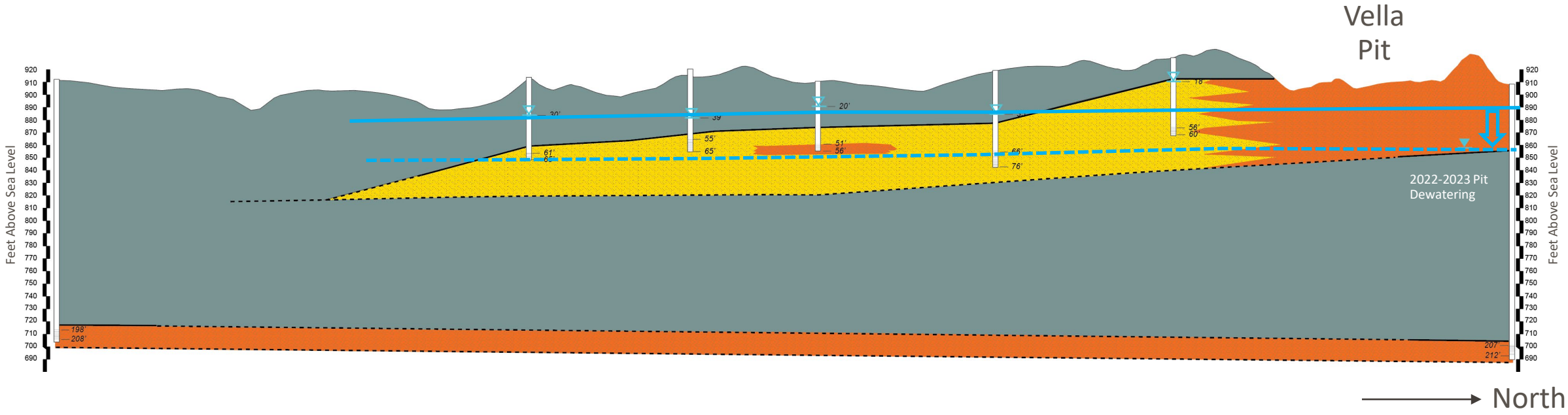
Water supply well

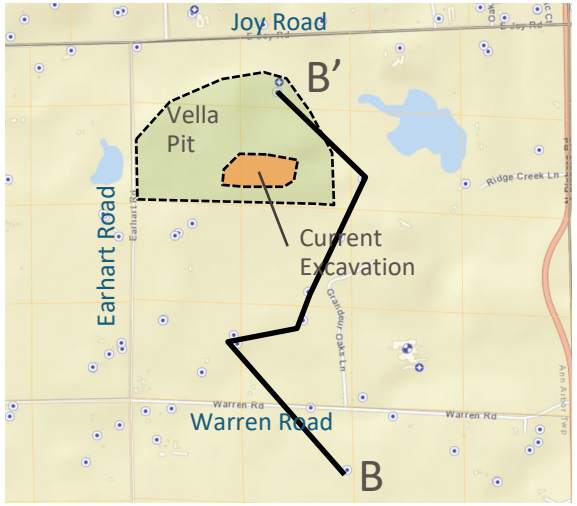
Screened interval (depth noted)

Topography from USGS 3DEP Digital Elevation Model, 2020 (pre-dates current pit excavation)

All dimensions are approximate

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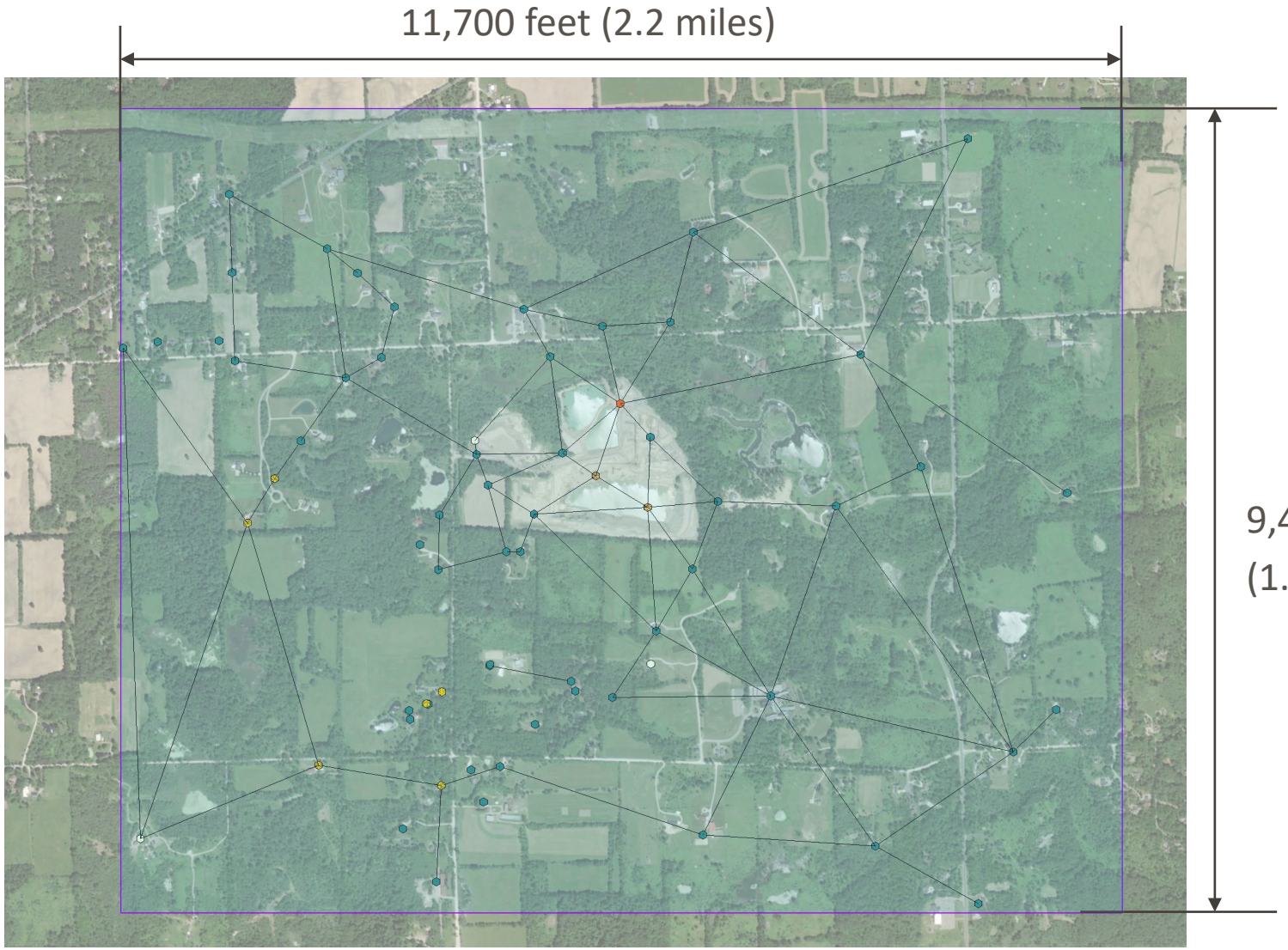
Water supply well

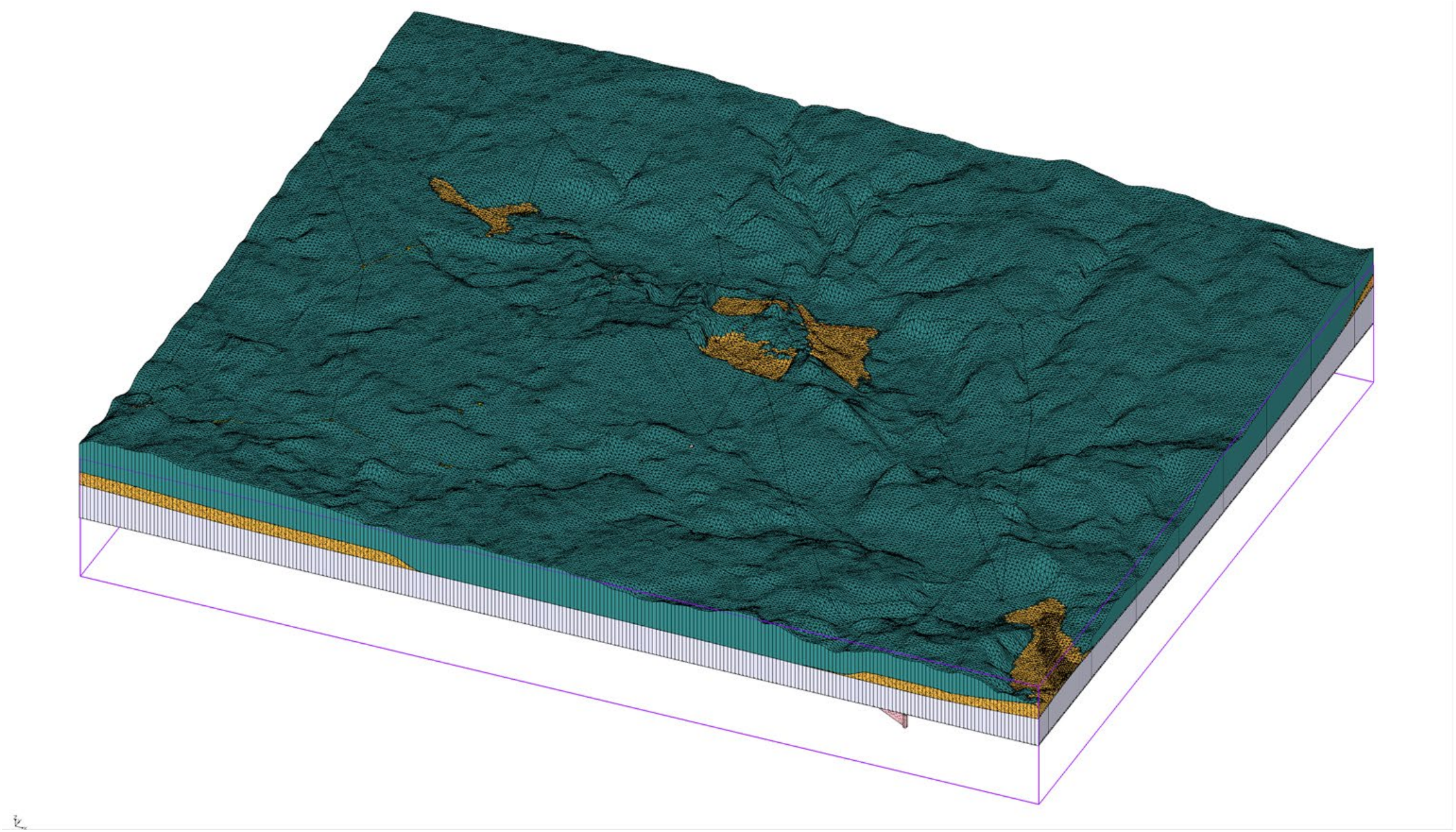
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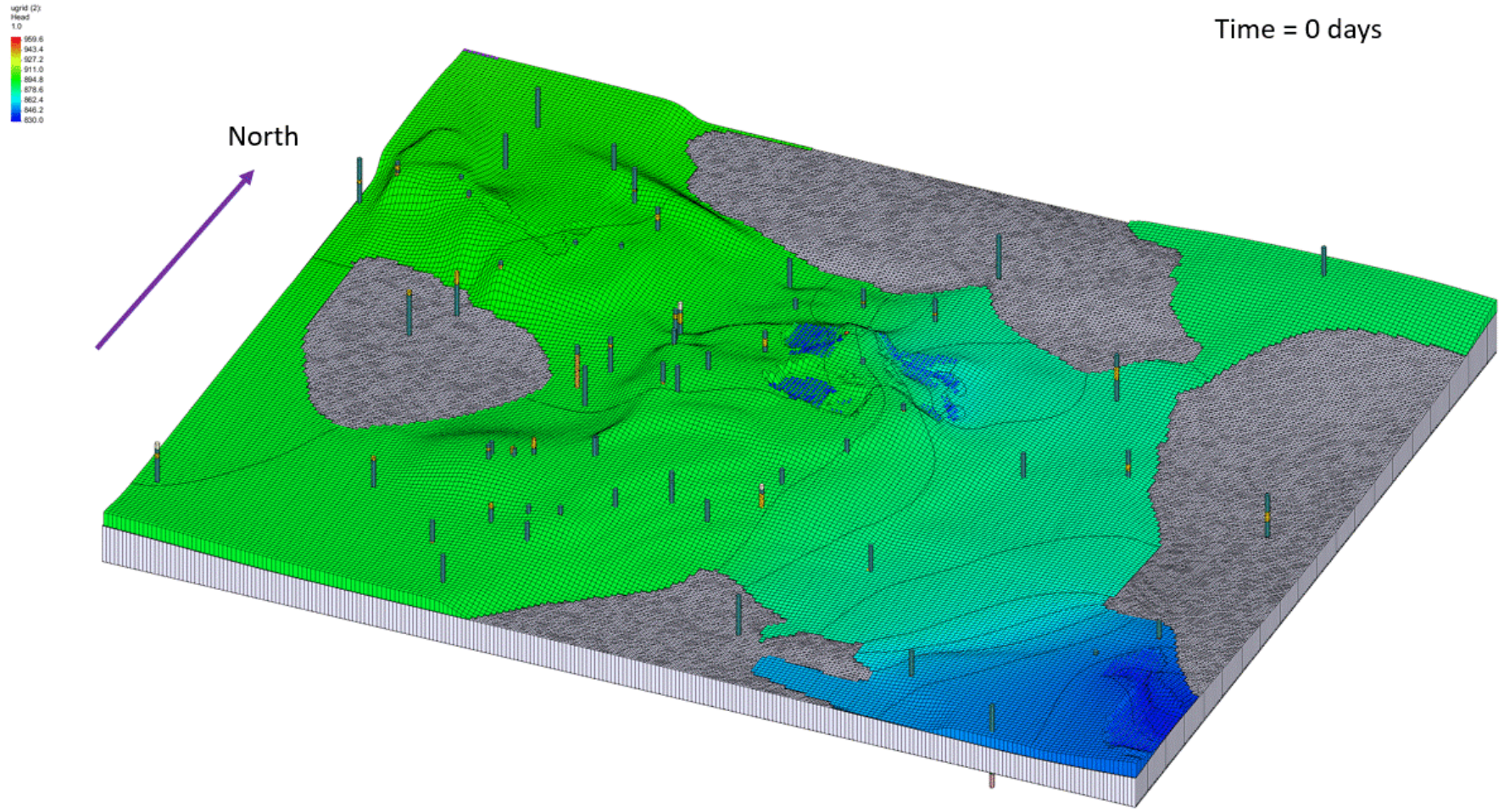
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Groundwater Flow Model




Lower Clay
Upper Aquifer
Upper Clay Till

Numerical Groundwater Model

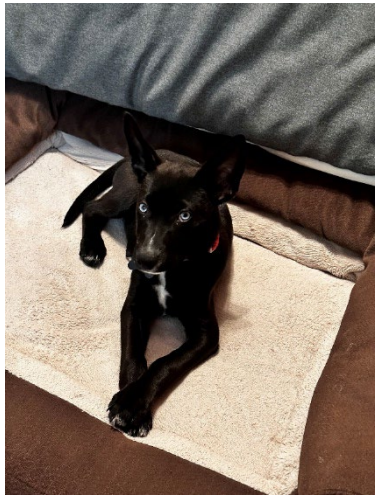


Leslie M. Nelson, P.E.

- B.S. in Environmental Engineering from Michigan Tech
- Professional Environmental Engineer (MI, IL, TX)
- Over 25 years of environmental experience in Michigan
- Mom to two amazing kids and two sweet dogs







Continued Hydrogeological study

- Monitoring well installation on and off property
- Install recording transducers in monitoring wells for continuous water level data
- Use monitoring well data to further refine and calibrate numerical model
- Continue to refine model to forecast future aquifer conditions
- Perform well health checks where model forecast indicates a future problem is possible
- Act by adjusting pump position or drilling new well **before** resident experiences an outage (this is how the most recent well replacement was performed)

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Residential well steps

- Lower pump
- Drill new well deeper in upper aquifer
- Drill new well in lower aquifer
  - Naturally-occurring arsenic

Lower Aquifer

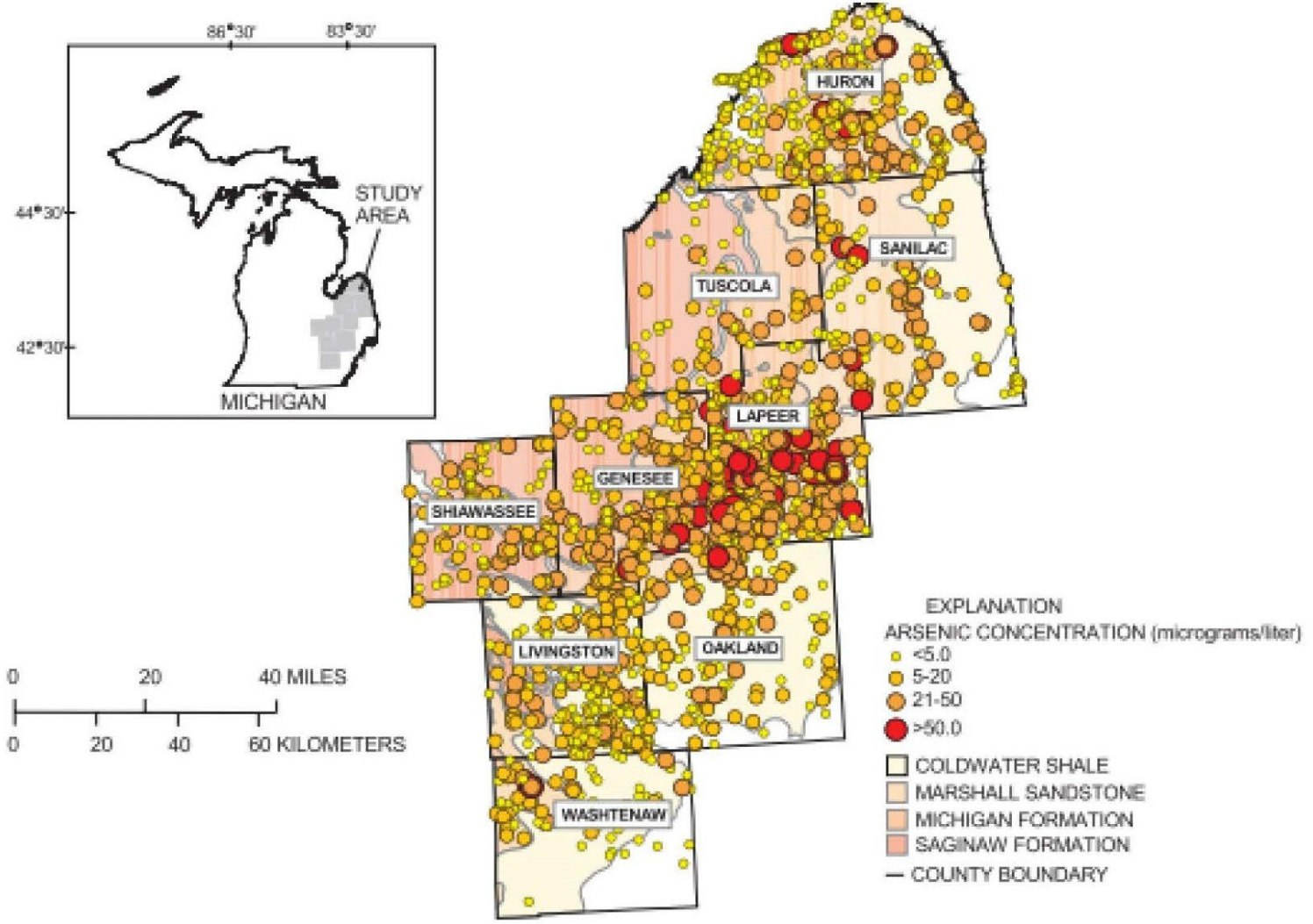


Figure 1. Locations of selected wells in southeastern Michigan and their concentrations of arsenic.

Source: USGS

Lower Aquifer

- According to EGLE, “treating drinking water with point-of-use reverse osmosis (RO) or arsenic adsorption media cartridge filters is the most effective and practical treatment method for residential use.”



- WHO: “arsenic water can be used for other purposes such as bathing and washing clothes.”
- WHO: “Technologies for arsenic removal include oxidation, coagulation-precipitation, absorption, ion exchange and membrane techniques.”

Lower Aquifer



- Federal Arsenic drinking water standard: 10 PPB
- In Michigan, no other arsenic water quality standards
- According to EGLE: “Arsenic is not readily absorbed by the skin; contact with water (showering, laundering, washing dishes, etc.) is not a risk.”

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