

Evaluating hydrogeologic impacts of frac sand mining and irrigated agriculture in western Chippewa County, WI

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3. Chippewa County Dept. of Land Conservation & Forest Management



Study overview

- **Started fall 2012**

Project team

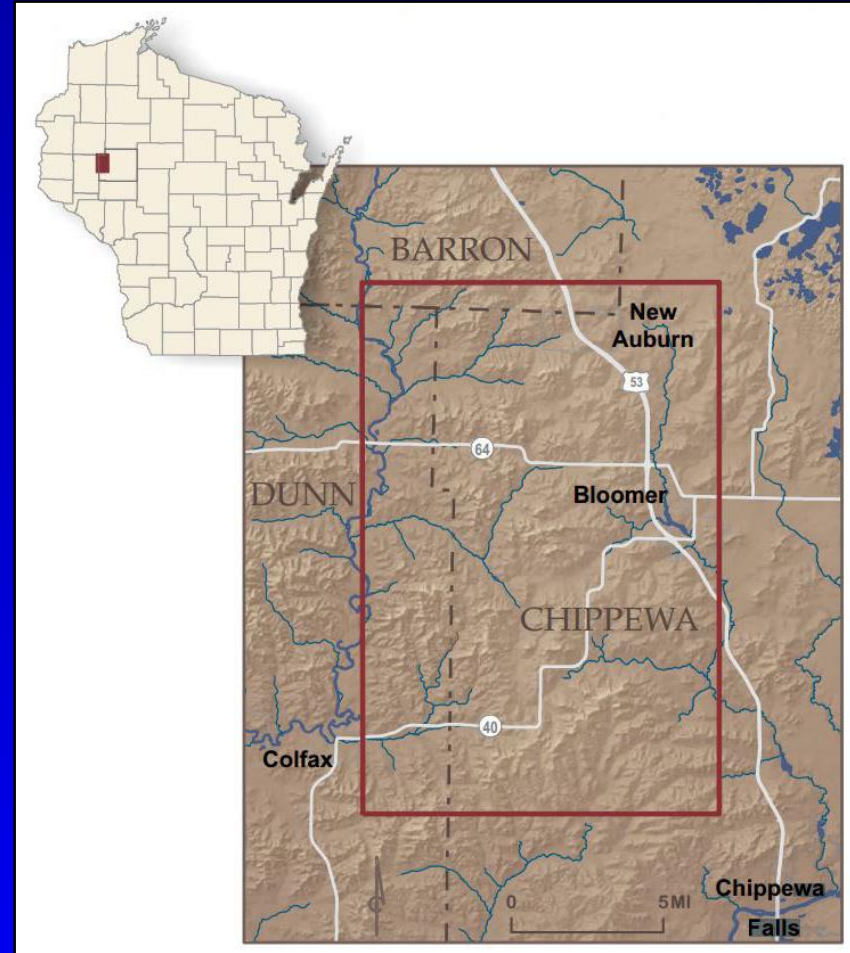
- WGNHS
- USGS
- Chippewa Co. LCFM

Stakeholders group

- All active sand mining companies
- WI Farmers Union
- WI DNR
- Trout Unlimited
- Local farmers and citizens

- **5-year study effort**

- Technical investigation and modeling
- Outreach and reporting



Study overview

Frac sand mining

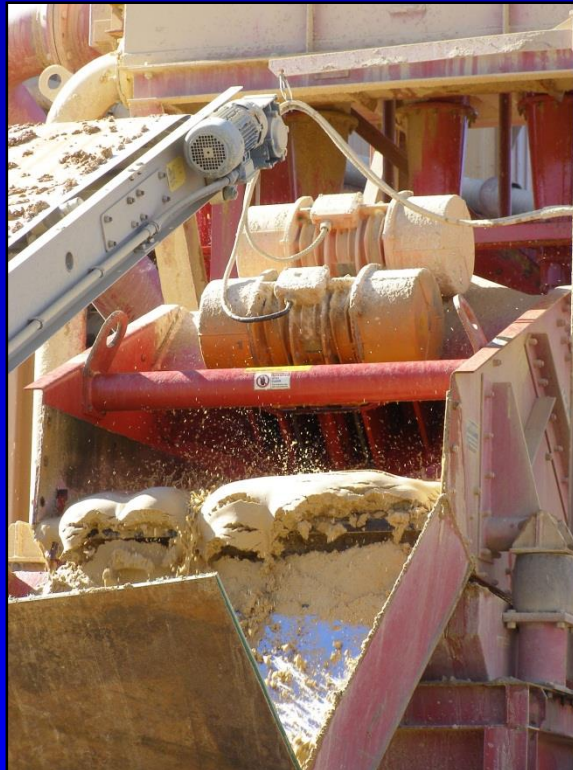


Photo: Chippewa Co.

Water used to wash sand (remove fines), transport sand on site, and control dust

Study overview

Irrigated agriculture



Municipal supply

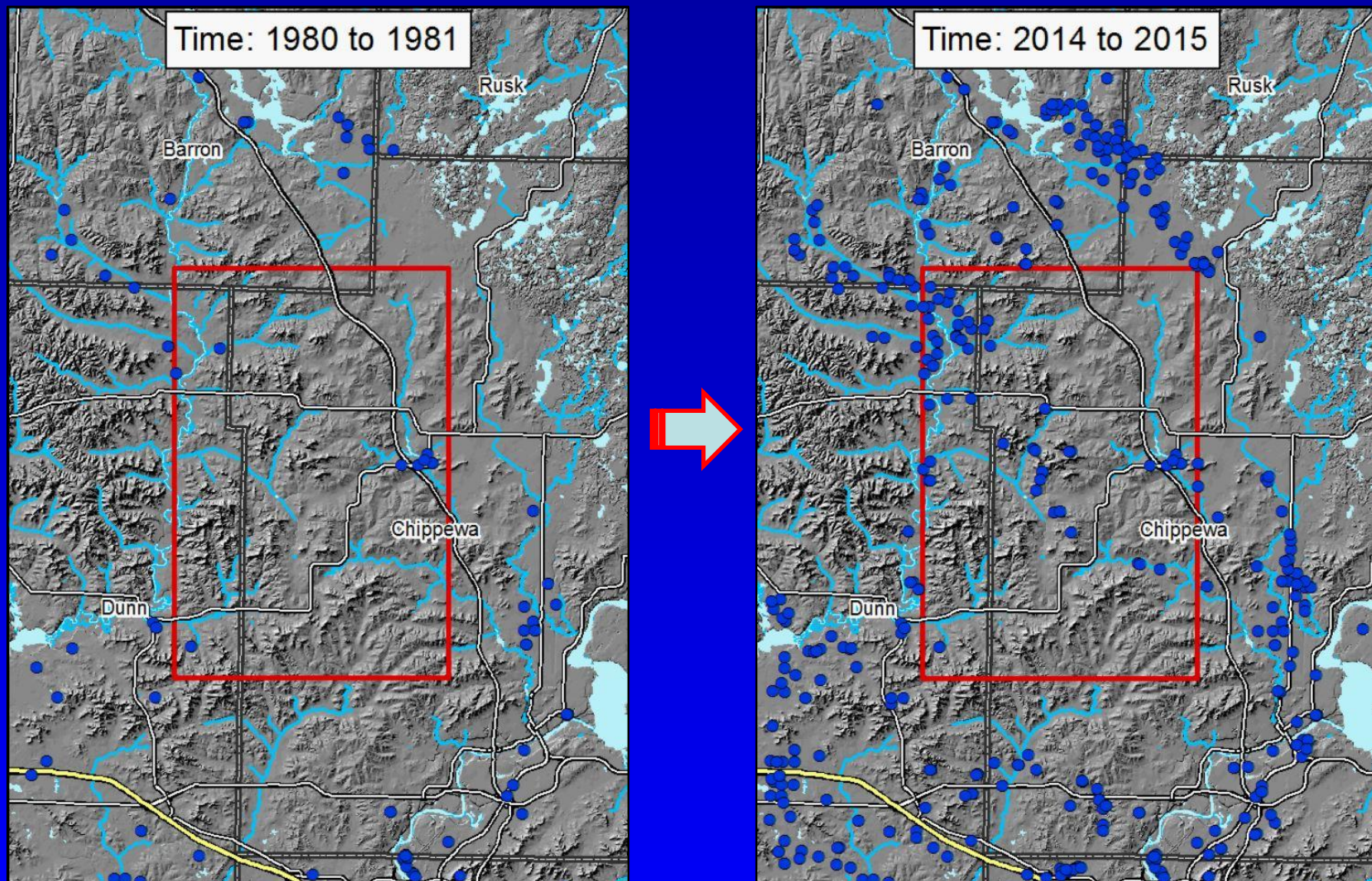


Study overview

- Why do we care?
 - Pumping in upland areas near headwaters of streams
 - Intensifying water-use practices
 - Changes to landscape and implications for recharge
 - Long-term water resource management and sustainability

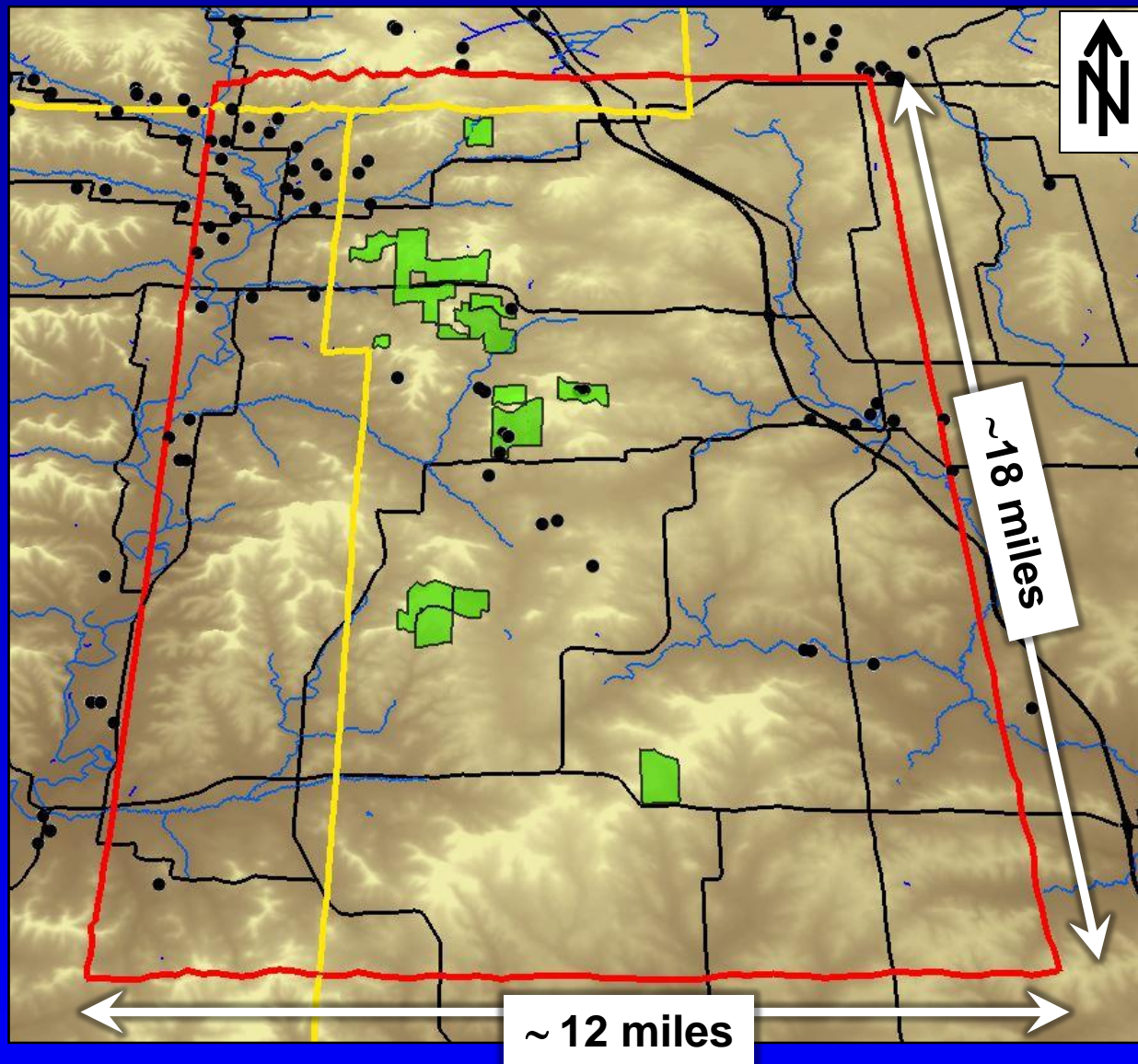


Study overview



Recent intensification of water use in upland areas

Study overview



- Permitted mine parcels as of Feb 2013
- Hi-cap wells as of Feb 2014
 - Source: Bob Smail DNR



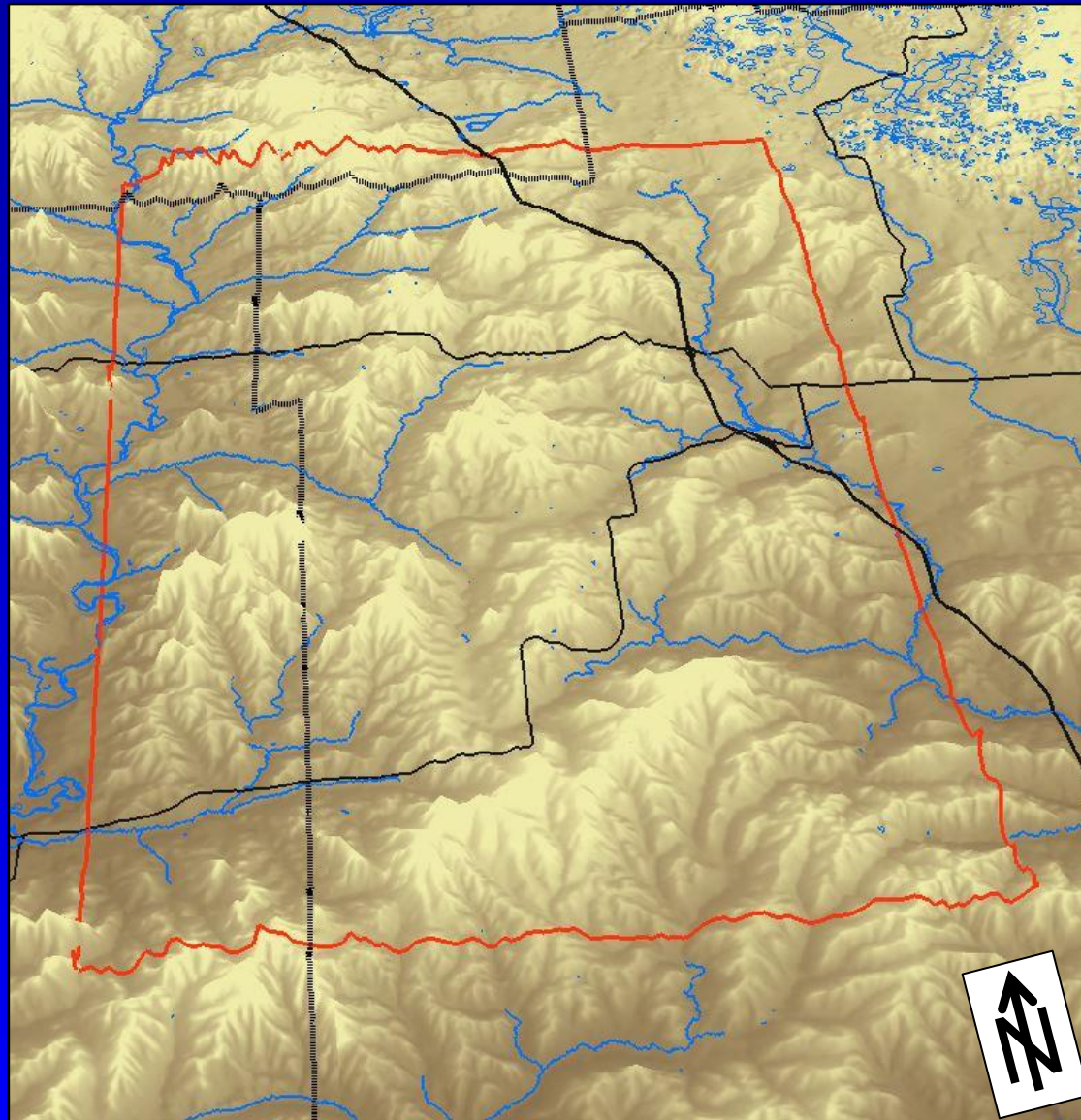
Oblique view looking north over study area with shaded relief DEM

Study overview

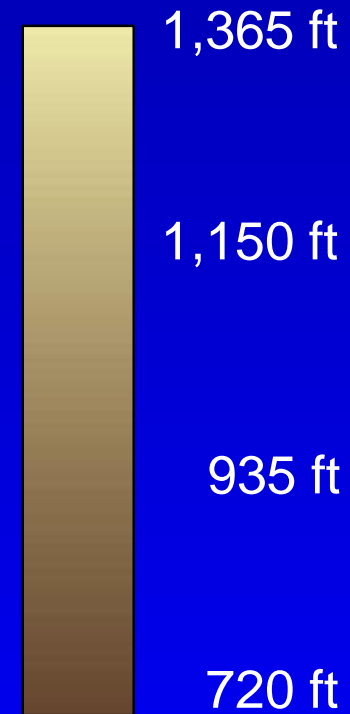
Objectives

- **Modeling** - develop soil water balance (recharge) and groundwater flow models to evaluate current and future water use and landscape changes on the hydrologic system
 - Calibrate MODFLOW model to pre-mine recharge and pumping rates
 - Test future scenarios (*e.g., peak mine, post mine reclamation*) which incorporate changes in recharge (*e.g., soil types, vegetative cover, hill slope geometry*) and pumping rates
 - Evaluate potential impacts to water levels and base flow to streams
- **Outreach** - disseminate the study results to stakeholders and the general public
- **Transferability**- transfer the study results to similar geologic and hydrologic settings as appropriate

Hydrostratigraphic modeling

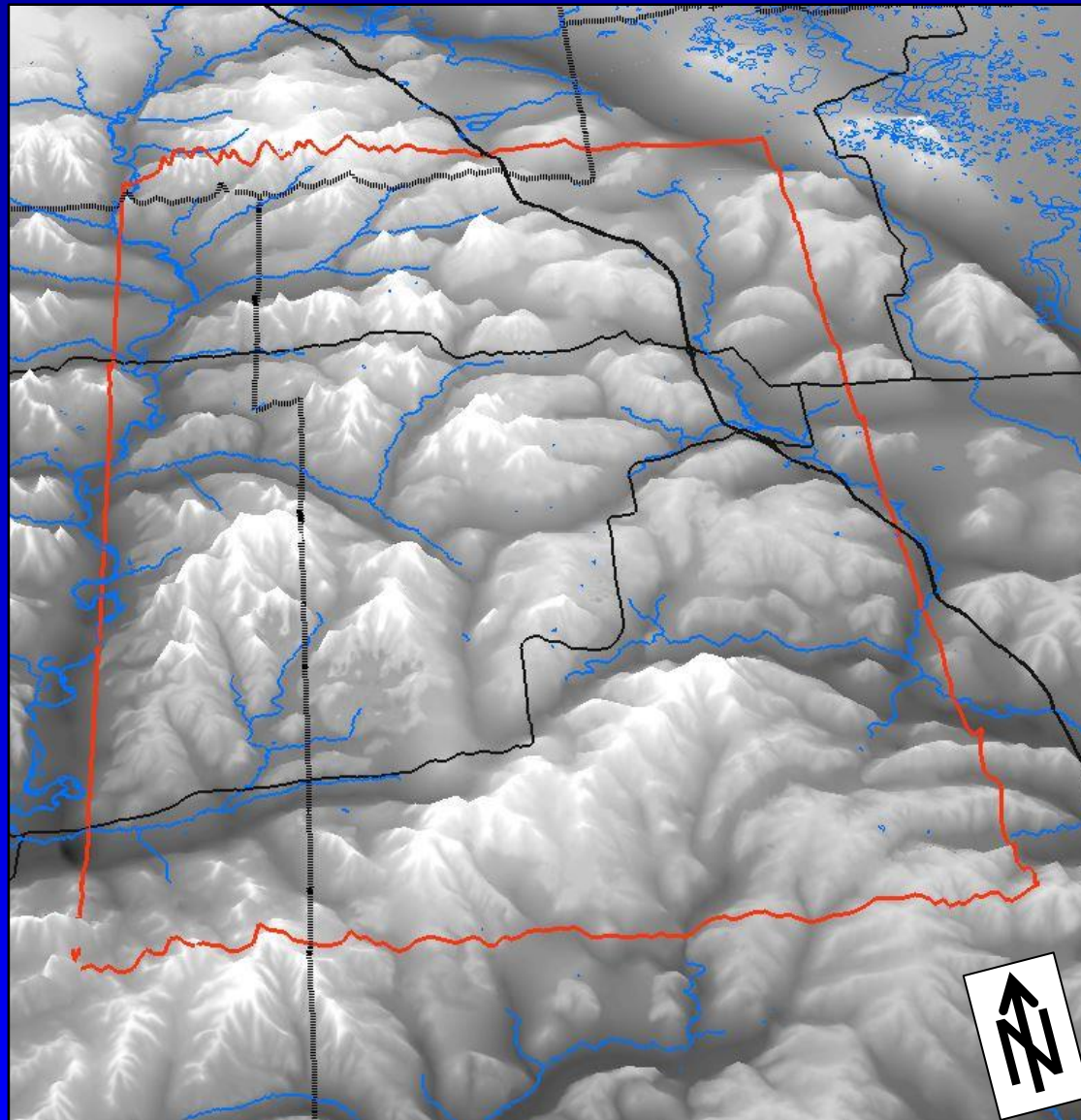


Land surface
elevation (*ft-msl*)

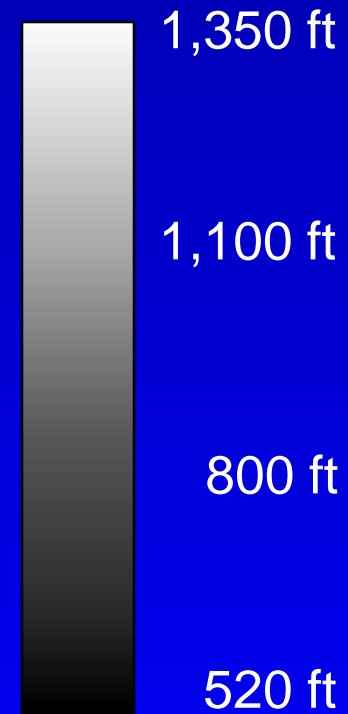


msl = mean sea level

Hydrostratigraphic modeling

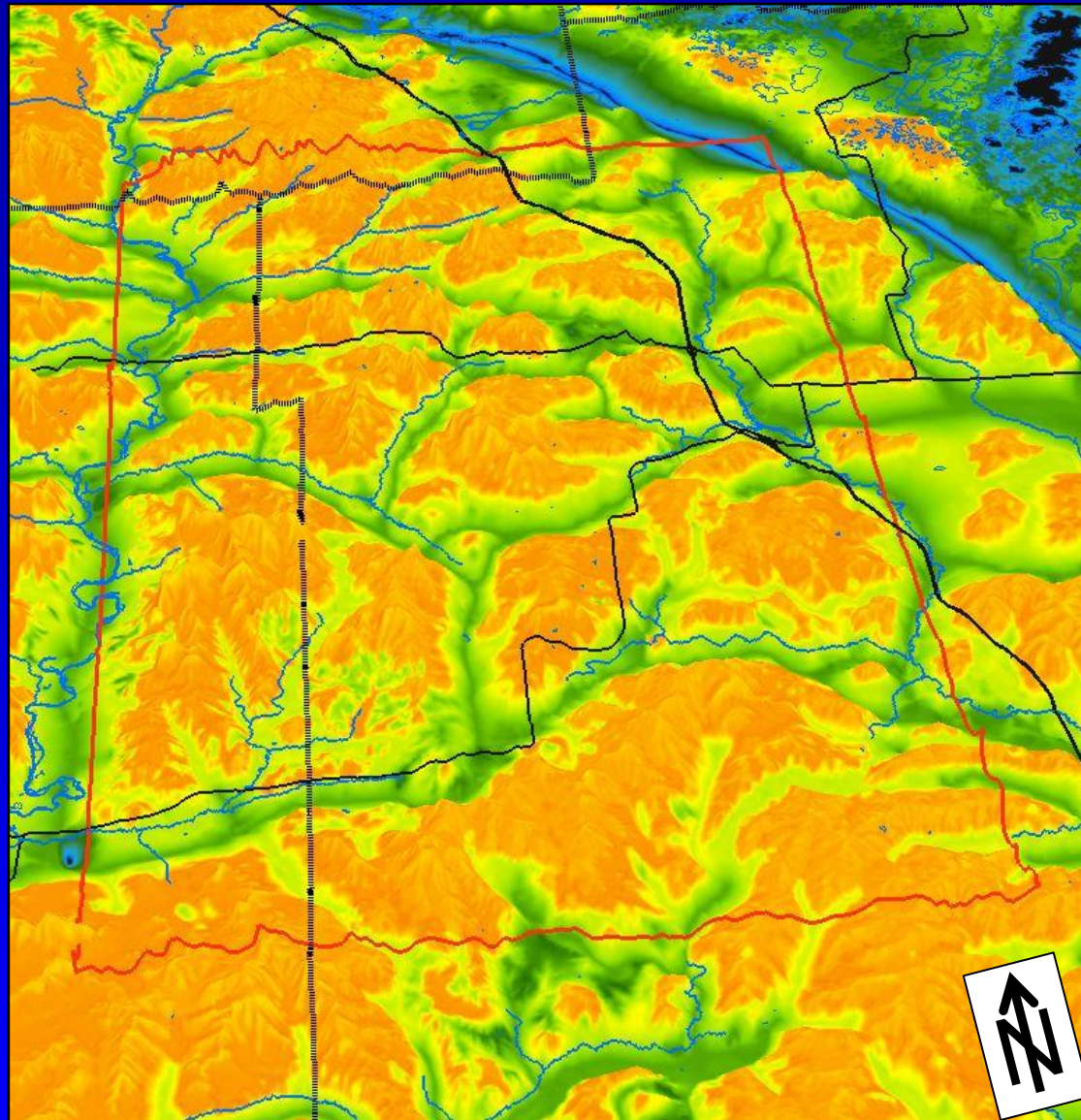


Top of bedrock
elevation (*ft-msl*)

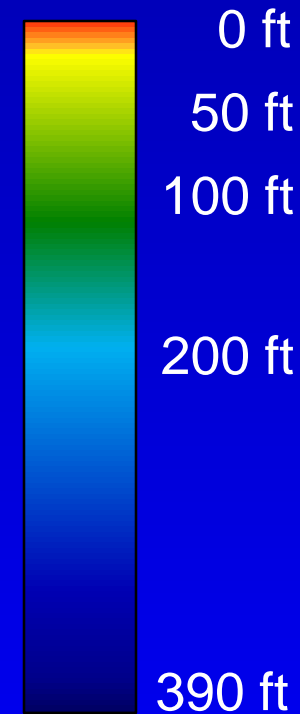


msl = mean sea level

Hydrostratigraphic modeling



Depth to bedrock
(below land surface)

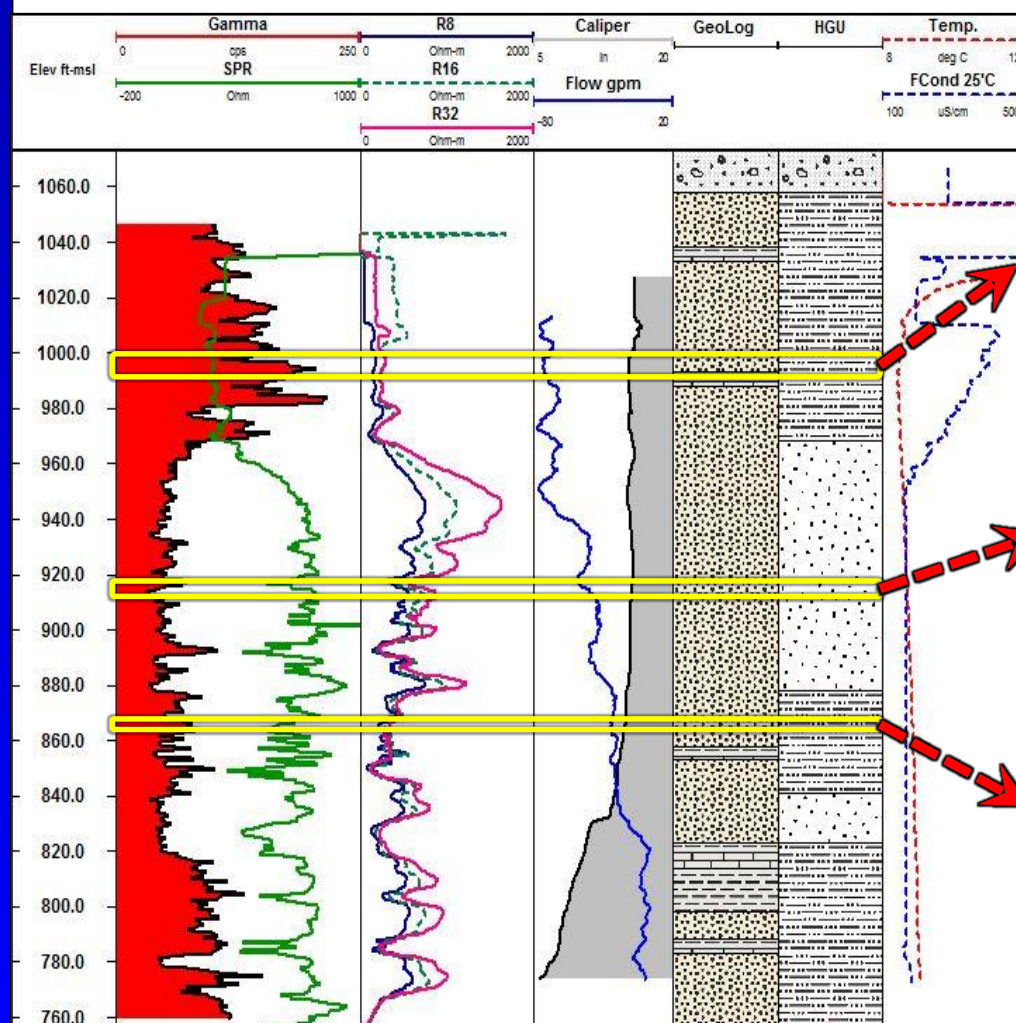


~ Unconsolidated
aquifer thickness

Hydrostratigraphic modeling

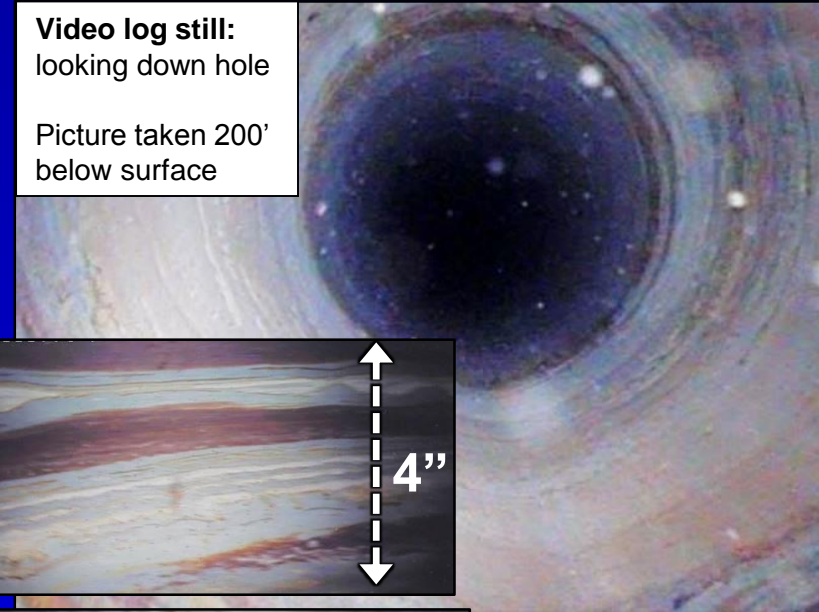
Geophysical log of a 320' irrigation well

High-capacity well - western Chippewa County



Video log still:
looking down hole

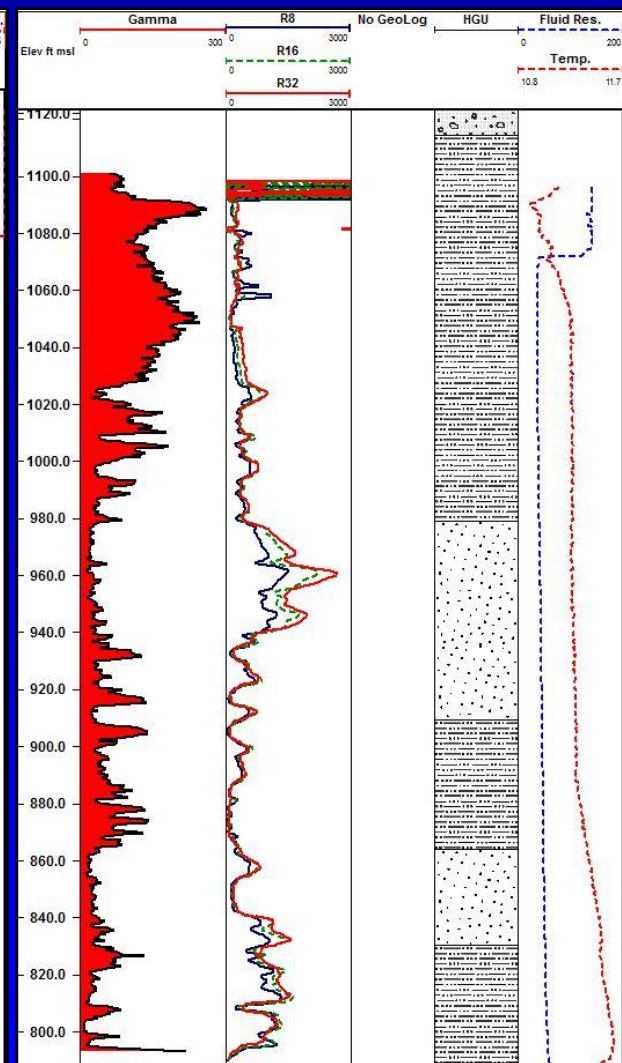
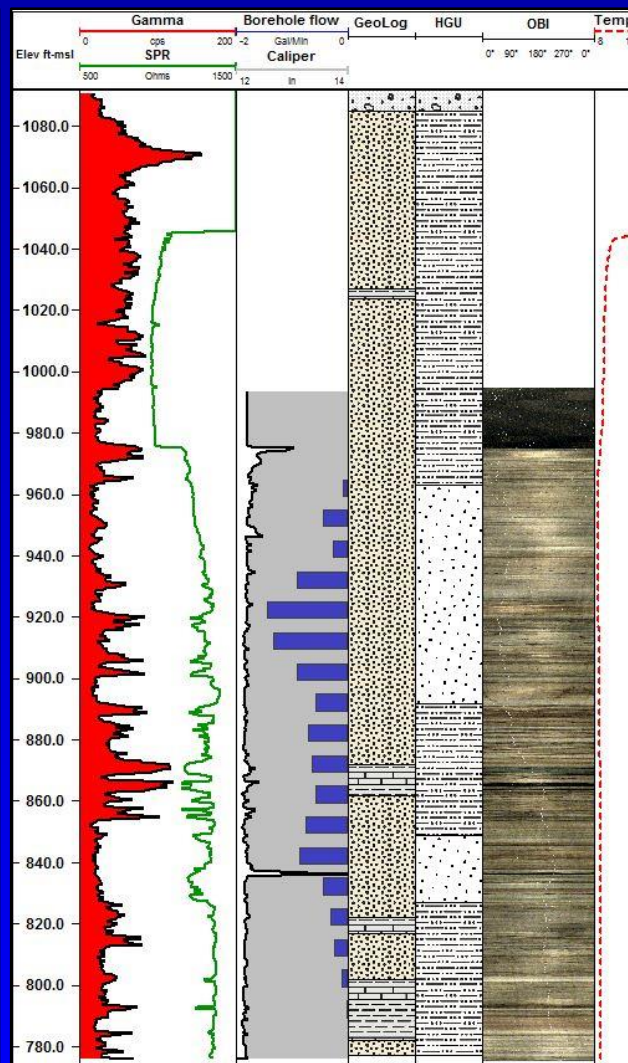
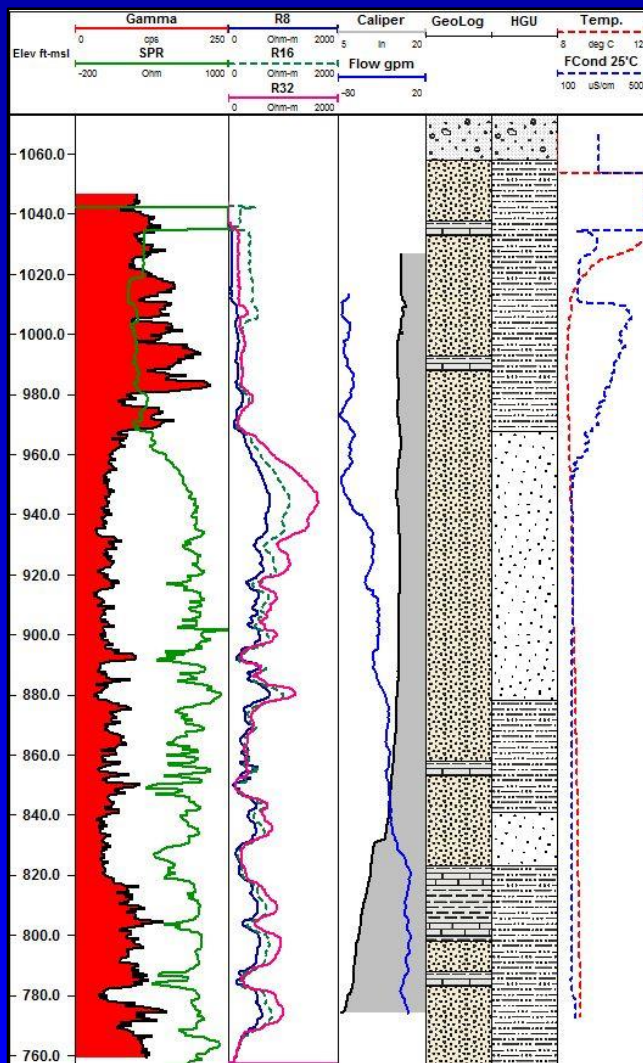
Picture taken 200'
below surface



Video log stills:
looking at wall of hole



Hydrostratigraphic modeling



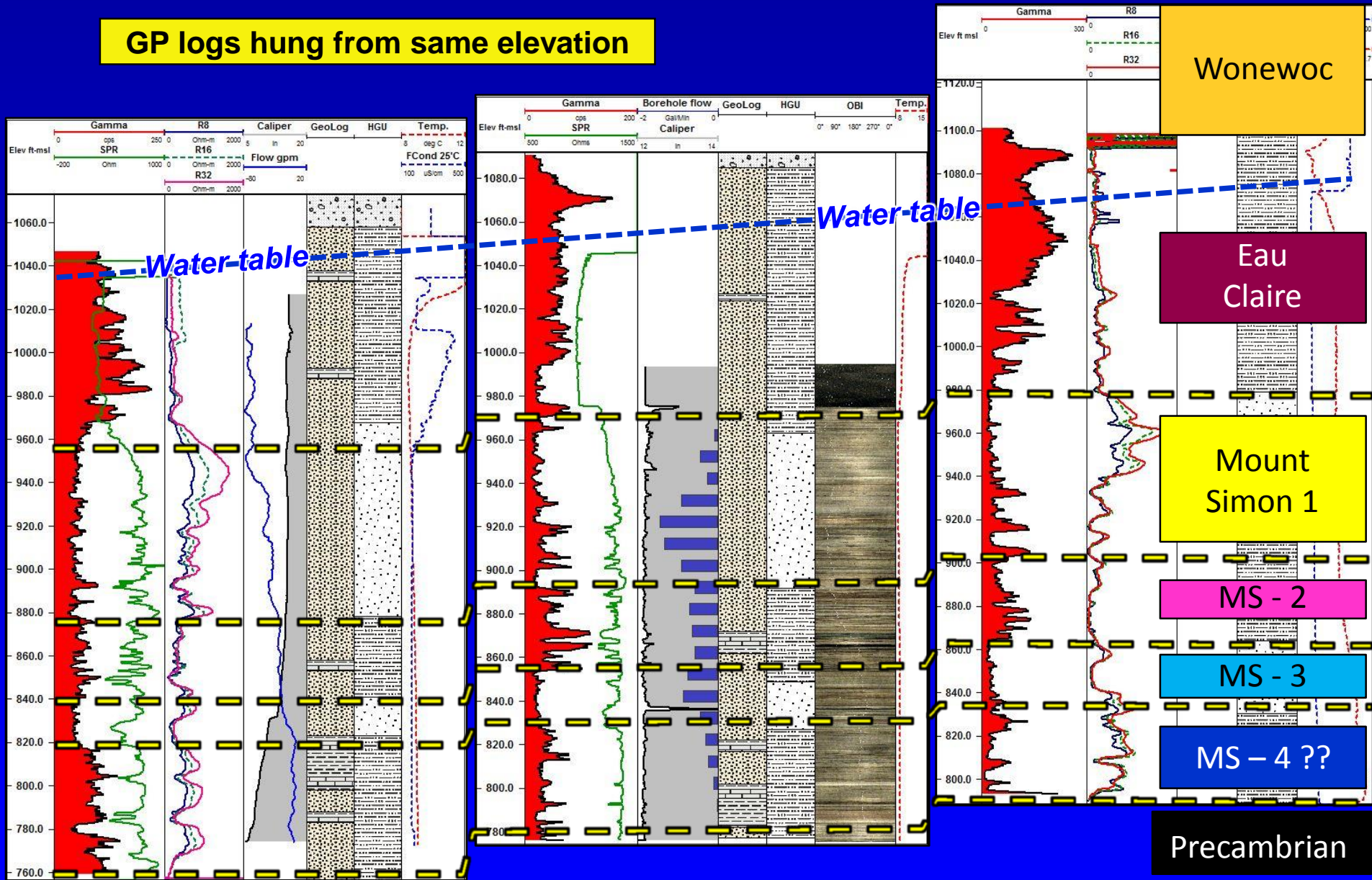
Dan Stiehl Farm

Superior Silica

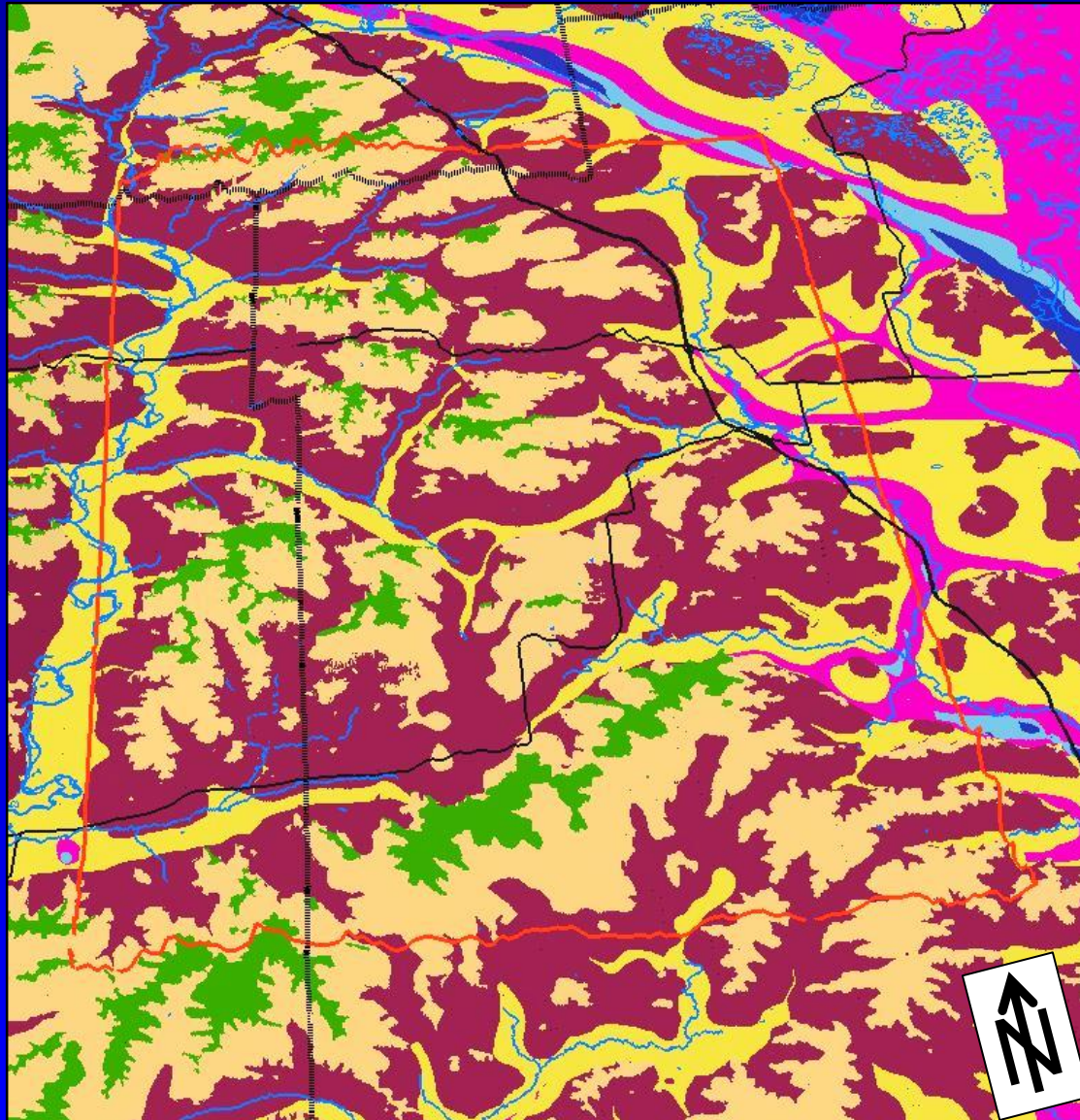
Preferred Sands

Hydrostratigraphic modeling

GP logs hung from same elevation



Hydrostratigraphic modeling



Stratigraphic framework	Hydro-stratigraphic framework	
Tunnel City	Tunnel City	Quaternary Sand & gravel
Wonewoc	Wonewoc	
Water-table		
Eau Claire	Eau Claire	
Mount Simon	Mount Simon 1	
	MS - 2	MS - 4 ??
	MS - 3	
Precambrian	Precambrian (No-flow boundary)	

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To find out more visit the
WGNHS website:

www.wisconsingeologicalsurvey.org

Or,

Chippewa County website:

co.chippewa.wi.us/lcfm and

click on the link *“Chippewa County Groundwater Study”*

