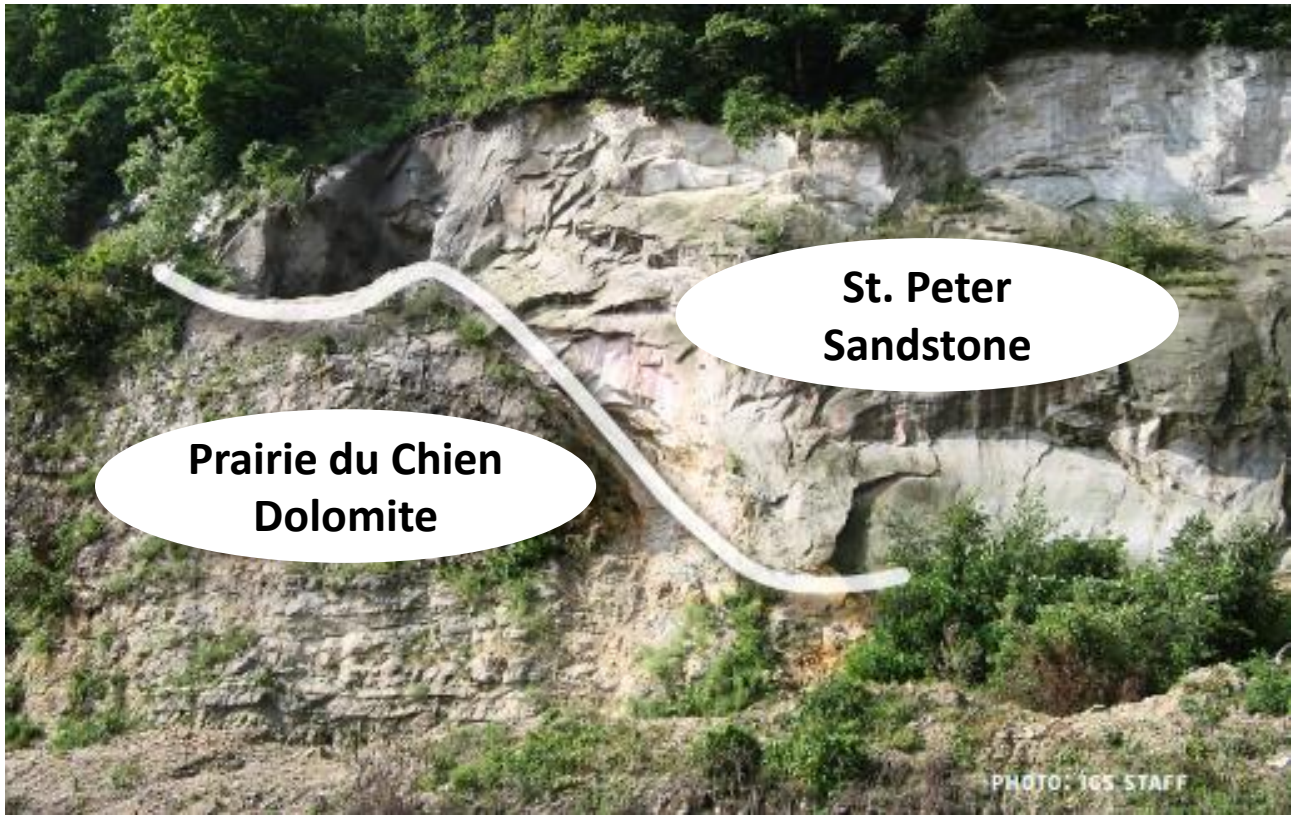
Groundwater Sustainability Modeling in the Cambrian-Ordovician Aquifer

DRUMMOND CARPENTER
engineering + research
Service-Disabled Veteran-Owned Small Business

Nathan Holt, PE, Drummond Carpenter

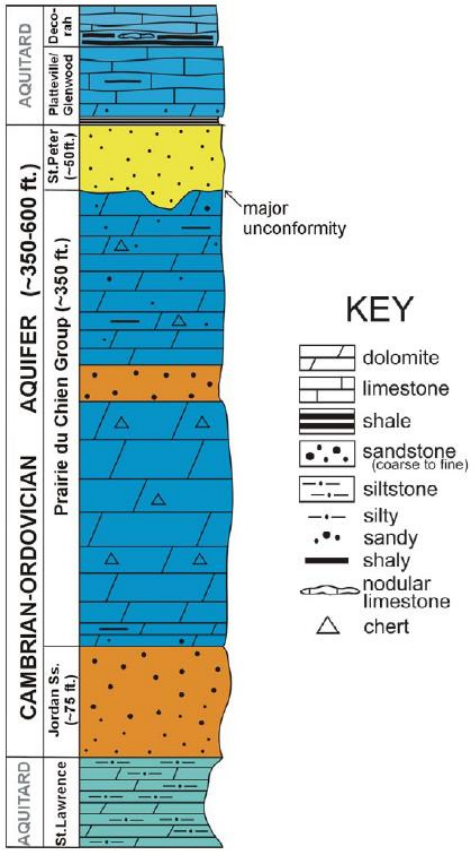
Mike Gannon, Iowa Geological Survey

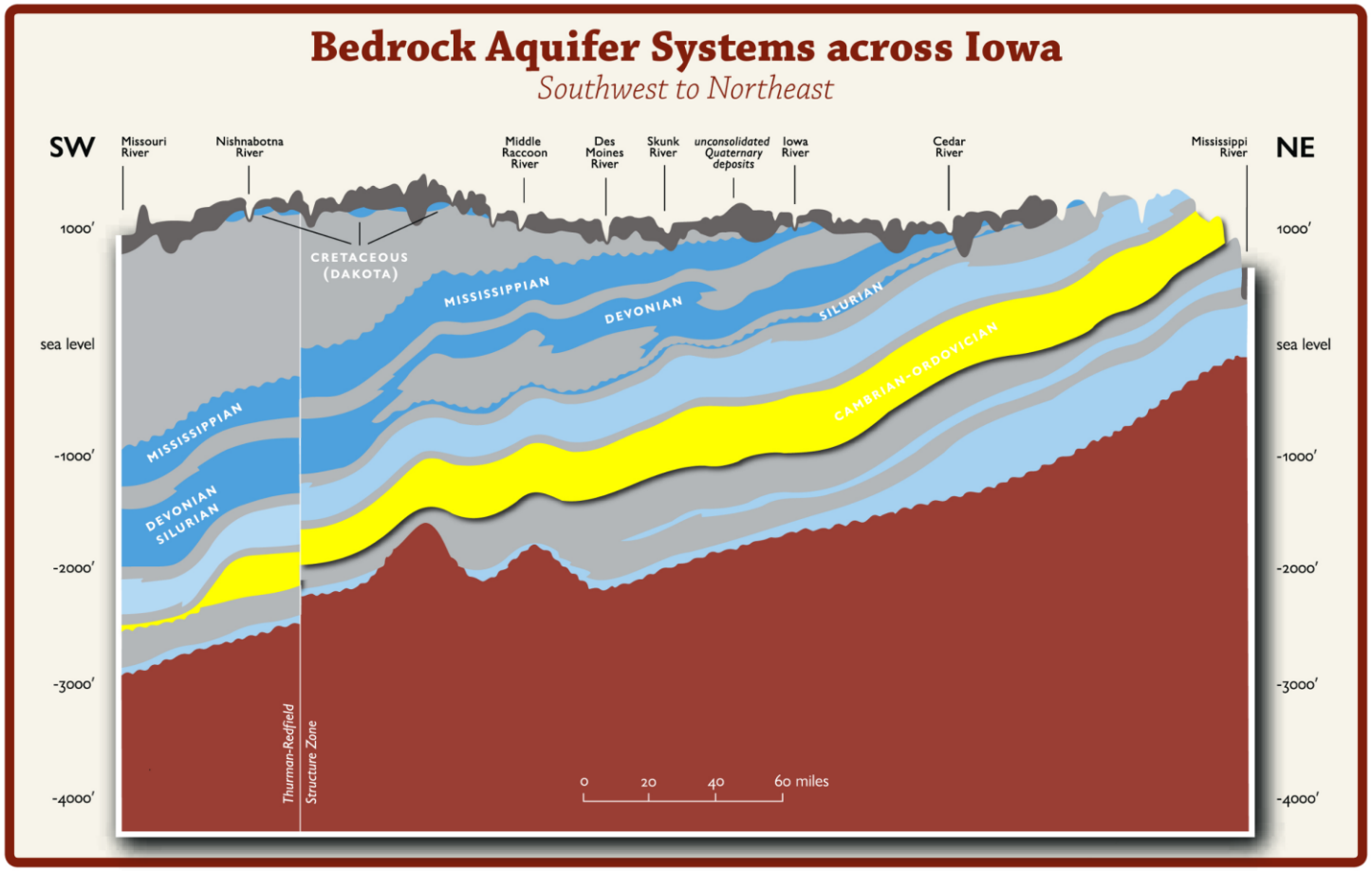
"The Cambrian and Ordovician sandstones…are hundreds of feet thick in the aggregate and underlie thousands of square miles: There are…vast volumes of water stored in the Prairie du Chien and other limestones belonging to the same artesian system. *It is assumed that this reservoir…is* ***practically inexhaustible***."



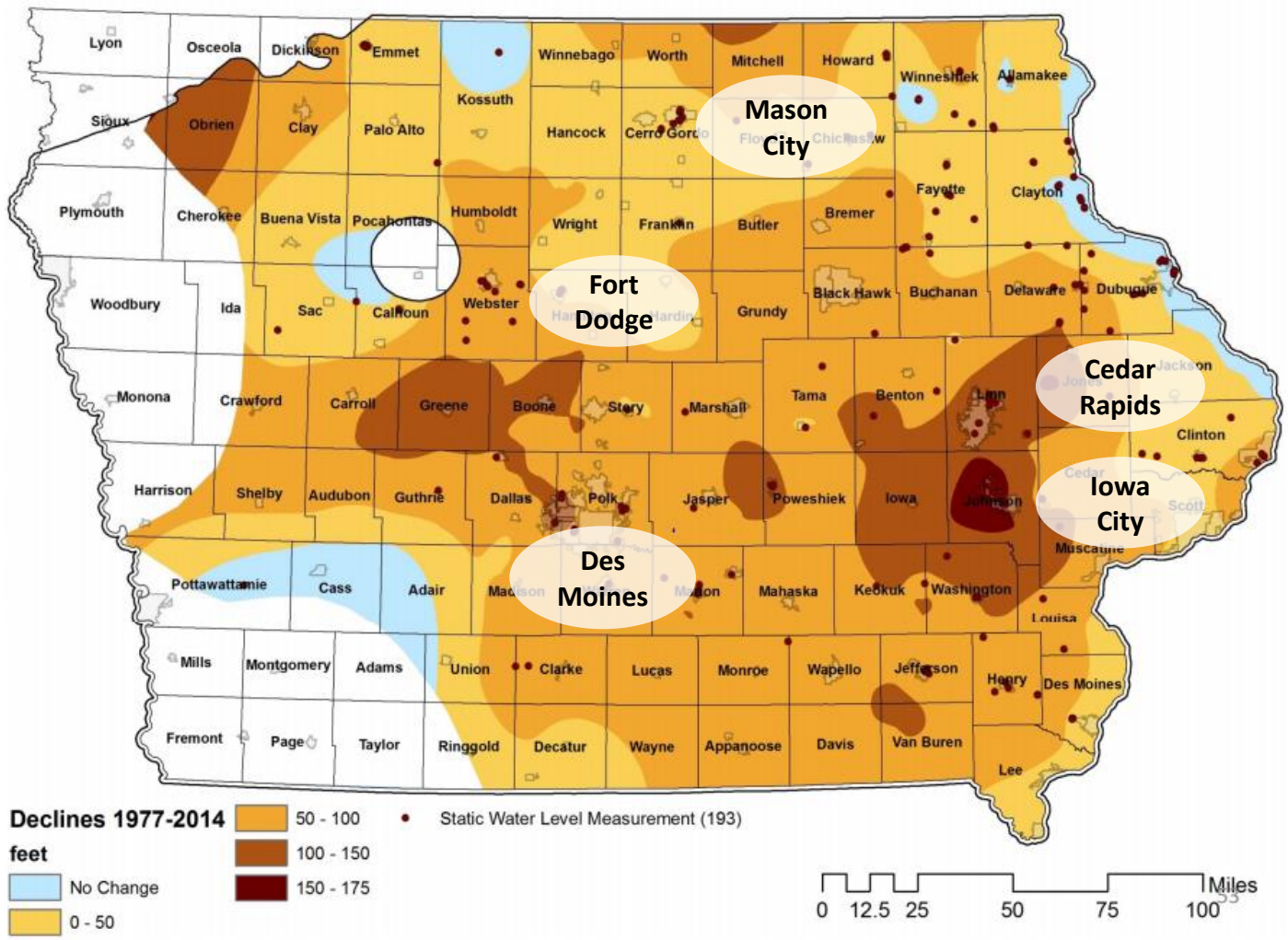
- 1927 Iowa Geological Survey Annual Report (p.72)

The Cambrian-Ordovician (Jordan) aquifer is one of Iowa's most productive and relied upon aquifers.





Water levels in the aquifer have been declining in certain areas over the past several decades.

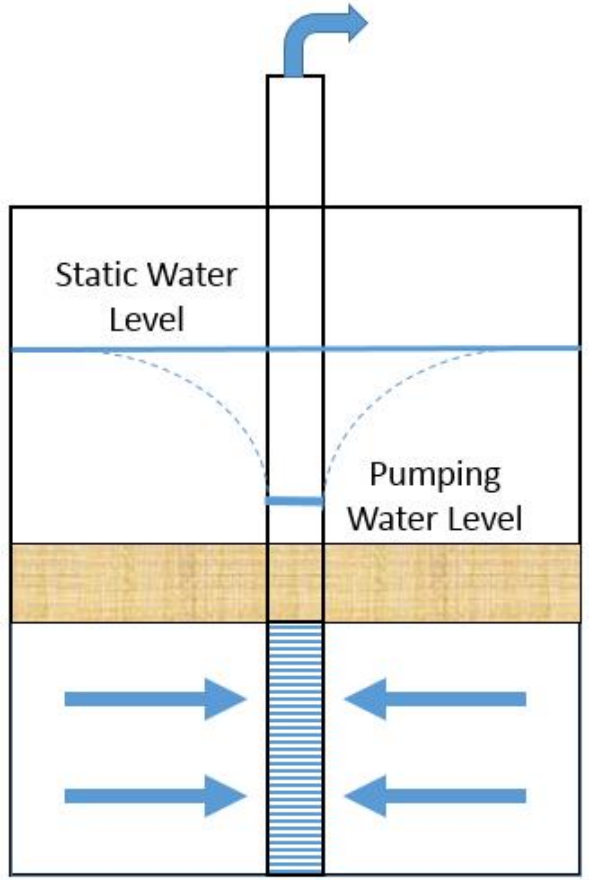


New regulations were introduced in 2014 to reflect improved science and better manage the aquifer.

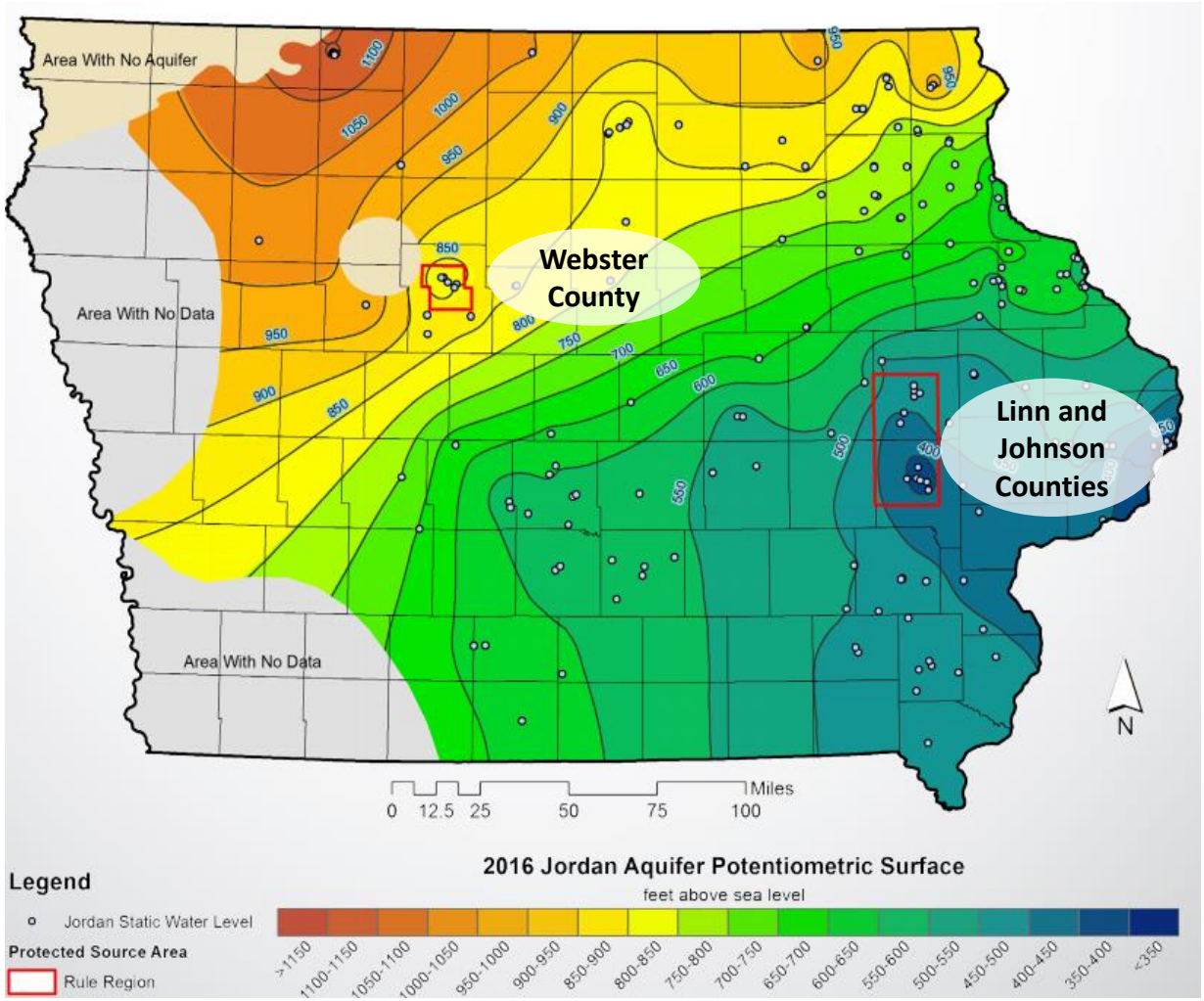
	Declines from 1978 Potentiometric Surface	
Tier 1	< 300 feet	<50%
Tier 2	300 – 400 feet	50-75%
Tier 3	> 400 feet	>75%

*Dependent on whether top of aquifer is greater or less than 600 feet from 1978 surface (Horick and Steinhilber, 1978)

Tier criteria based on pumping water levels.

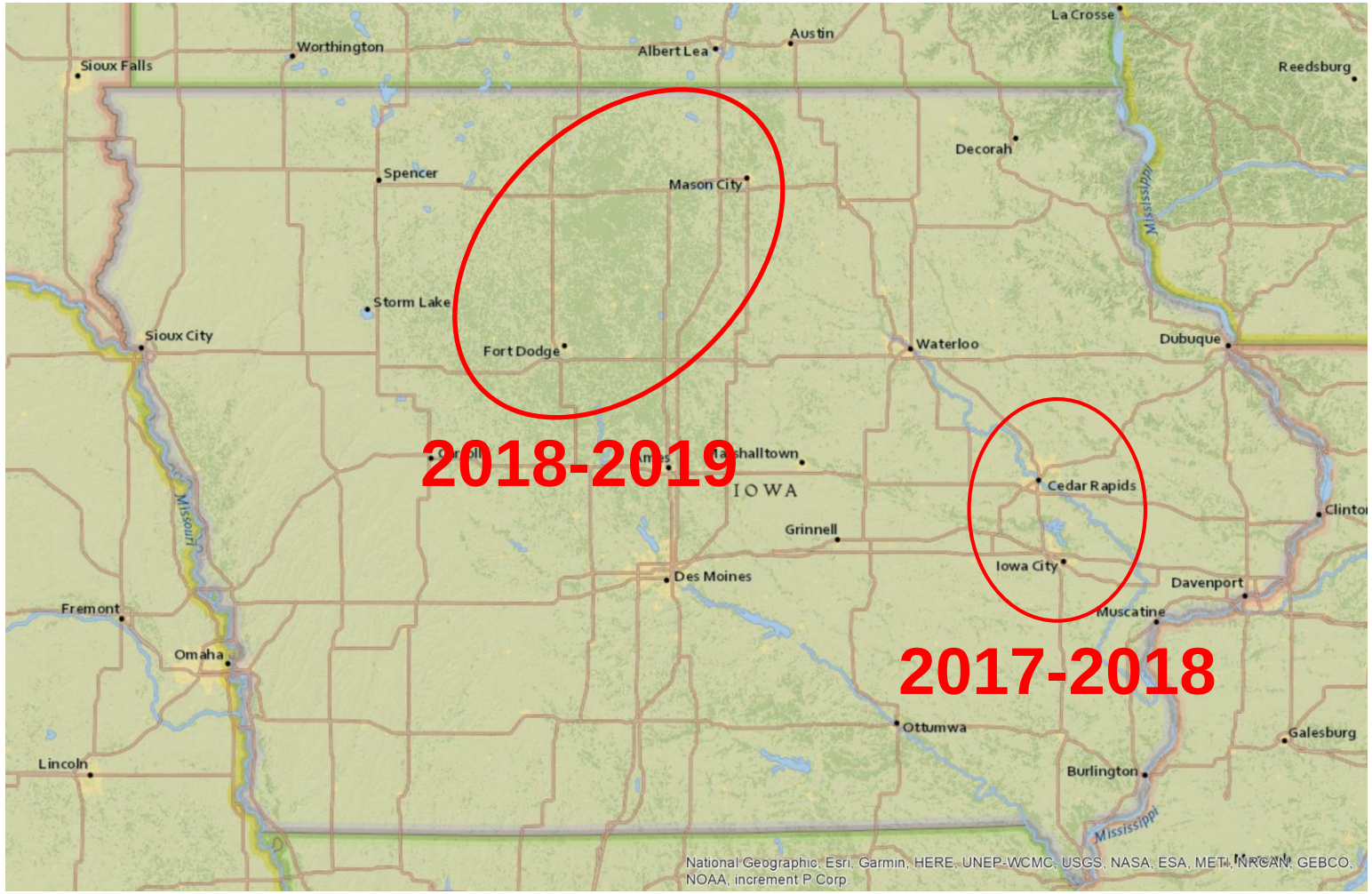


New regulations also identified two protected water source areas.



Chad Fields, INDR

The IGS began a multi-year groundwater modeling project to develop a tool for long-term aquifer management.



The project was a *collaborative* effort between individual water users, the DNR, and the IGS.

Individual Users

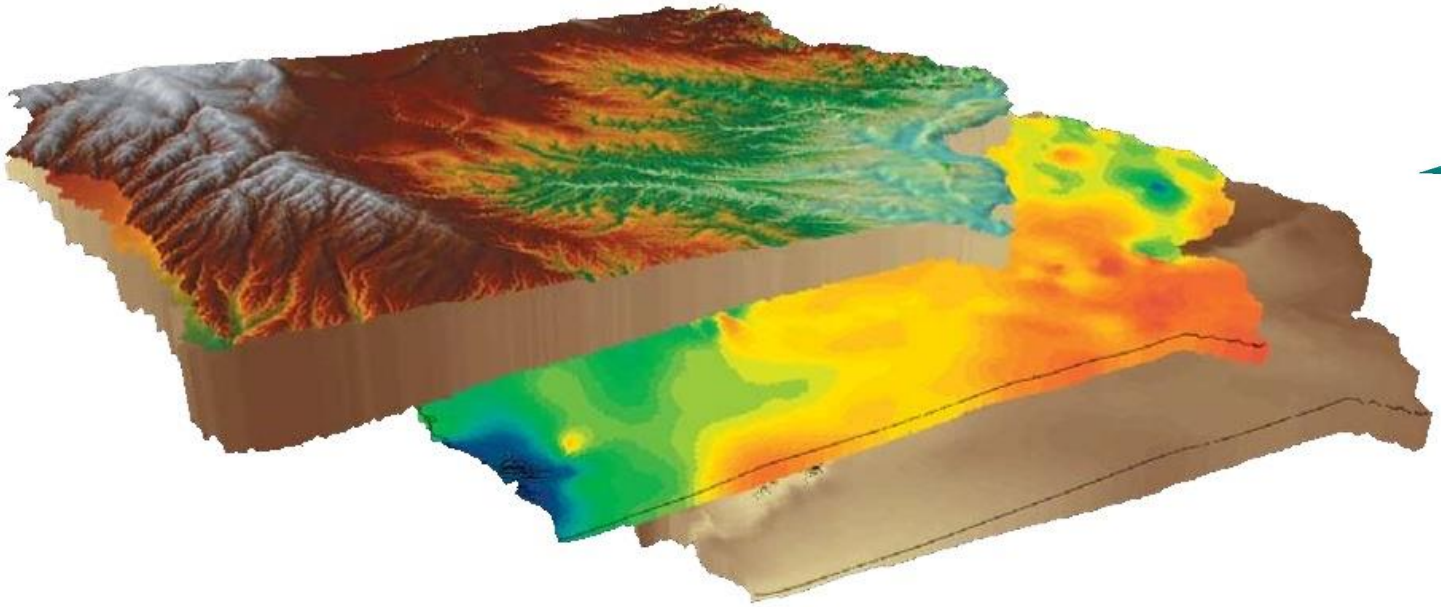
ADM
City of Fort Dodge
City of Marion Iowa
Koch Fertilizer
The University of Iowa
Tiffin Crossroads of the Heartland
City of Iowa City
Coralville
North Liberty
Ingredion
Prestage Farms
City of Mason City Iowa

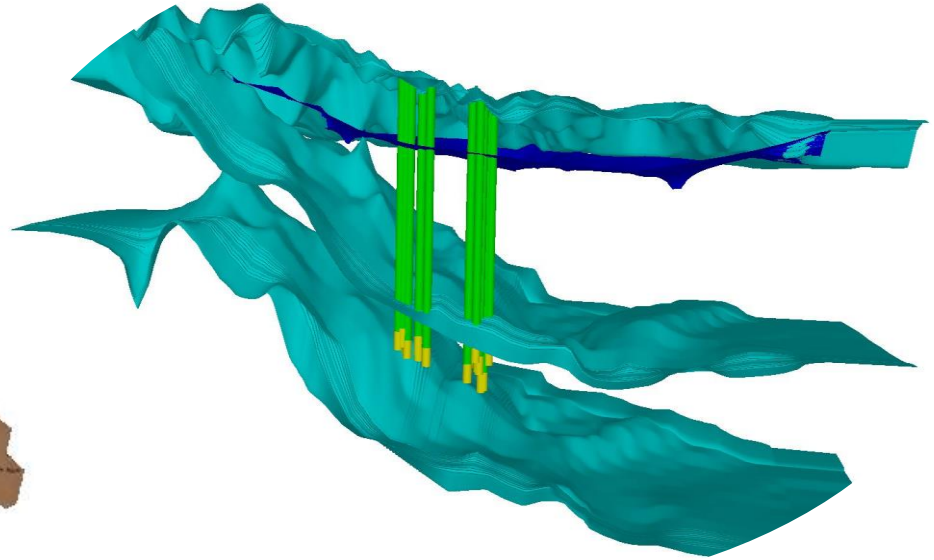
Regulatory Agency

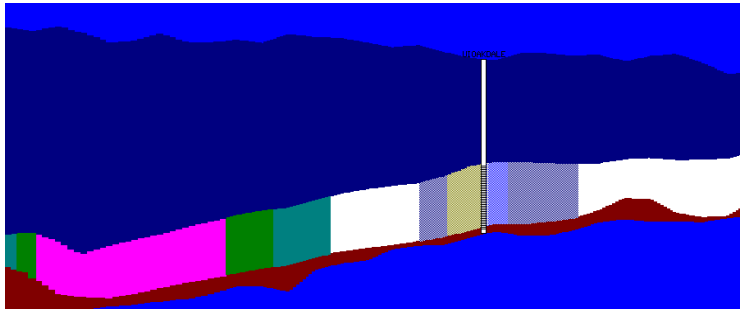
DNR Iowa Department of Natural Resources

A statewide CO aquifer model was adapted to evaluate areas of interest and local wellfields.

Geological Surfaces, Well Information, and Usage

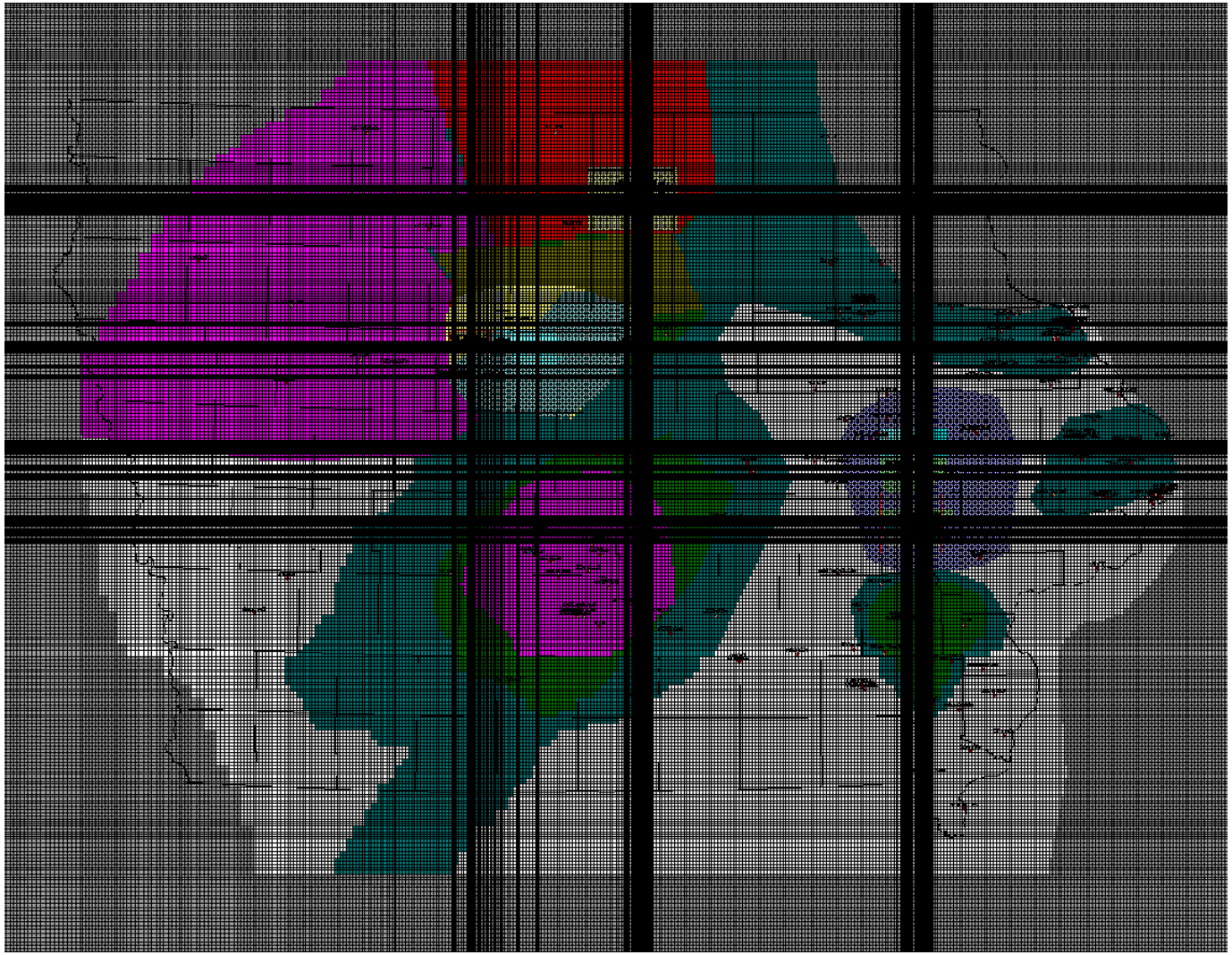






A statewide CO aquifer model was adapted to evaluate areas of interest and local wellfields.

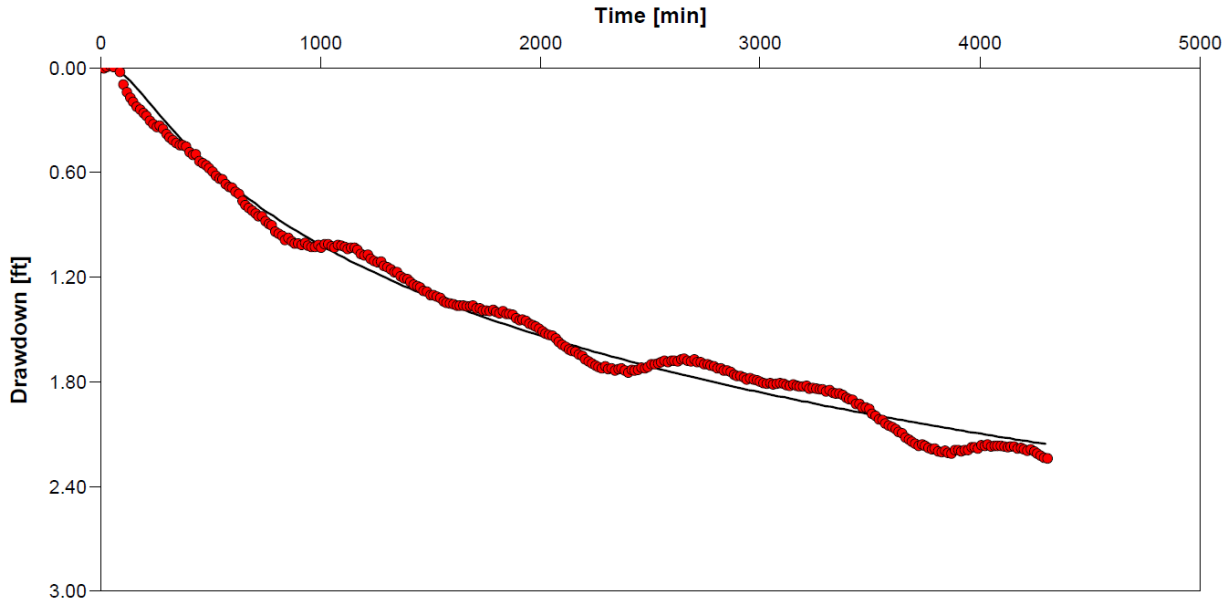
Grid Refinement



A statewide CO aquifer model was adapted to evaluate areas of interest and local wellfields.

Collect Local Aquifer Information

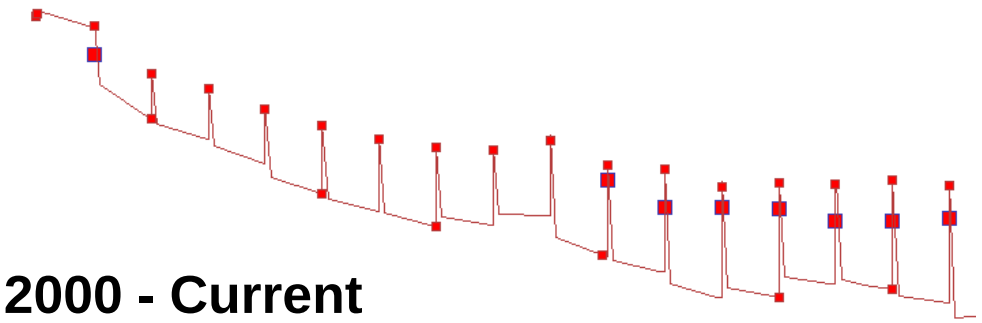
- **Historic Water Levels**
- **Pump Tests**



Calculation using Theis					
Observation Well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Storage coefficient	Radial Distance to PW [ft]	
OB1 (84022)	8.75×10^{3}	2.82×10^{1}	7.35×10^{-4}	2670.0	

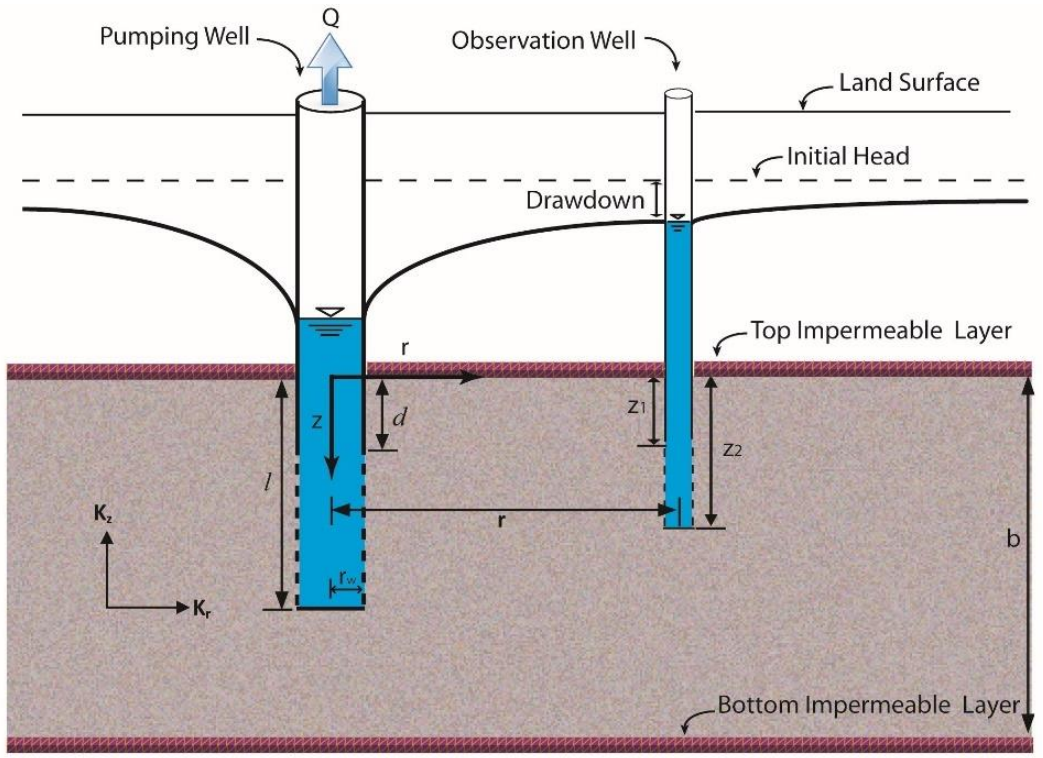
The model was calibrated to (1) static water level time series and (2) pump test drawdowns.

Static Water Levels



2000 - Current

Drawdown

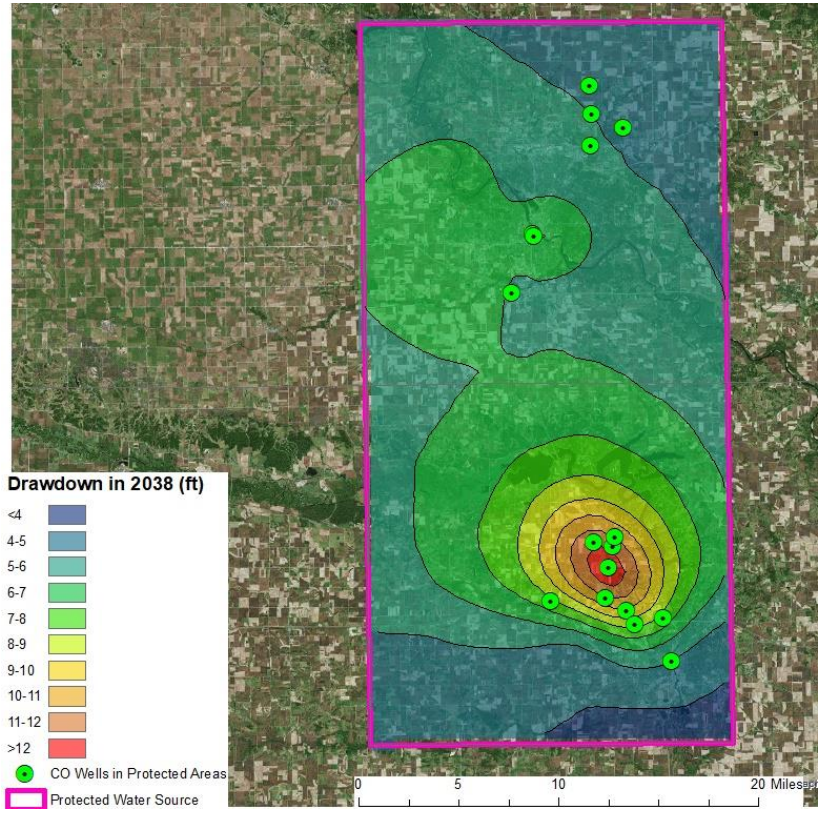


Los Alamos National Security LLC

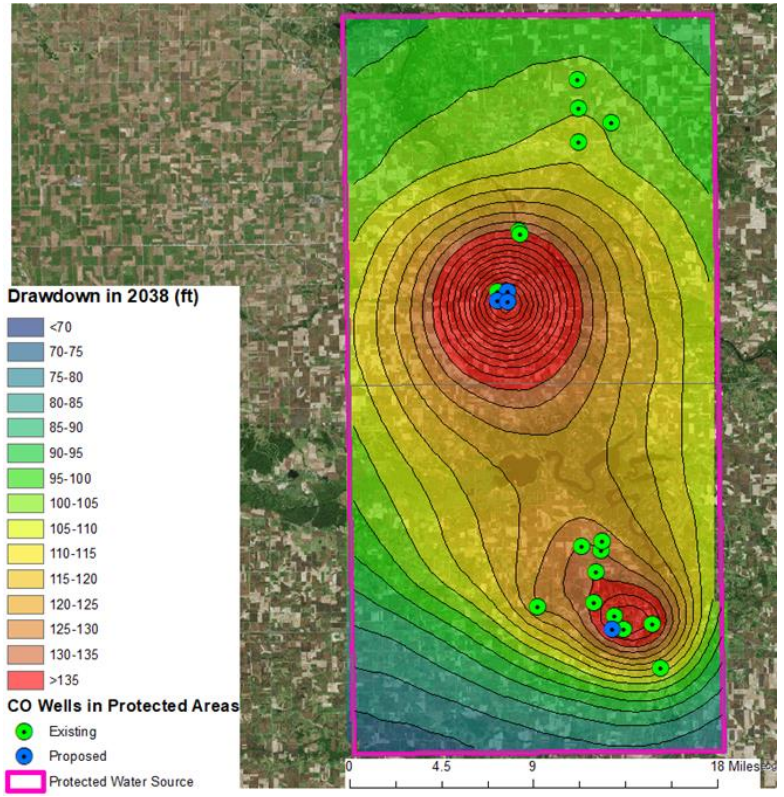
Regionally, the model provides regulators with a tool for long-term management.

Linn and Johnson Counties

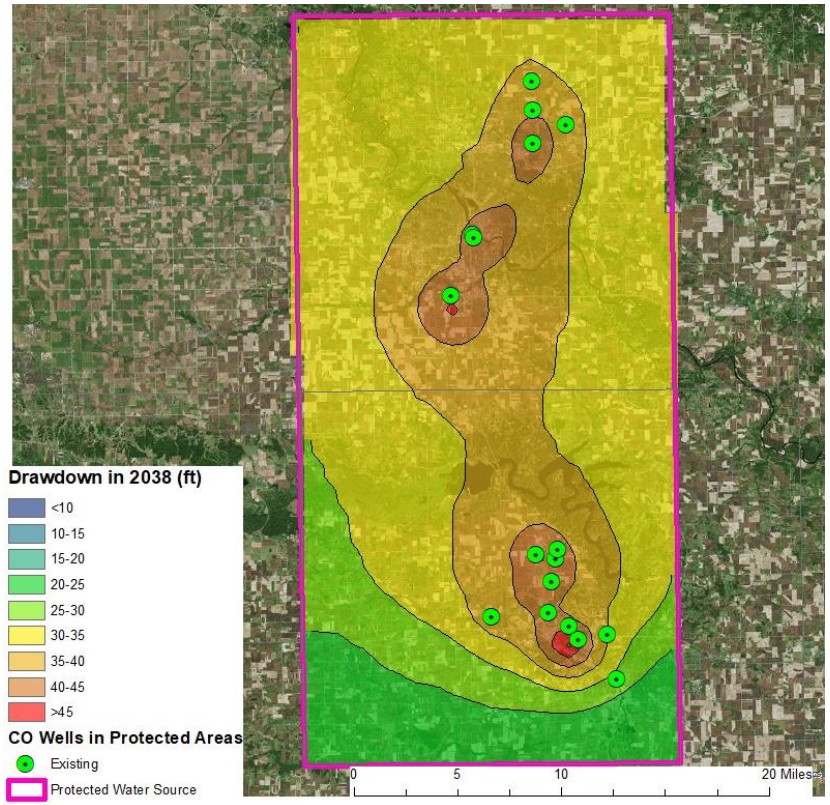
Current



Allocated



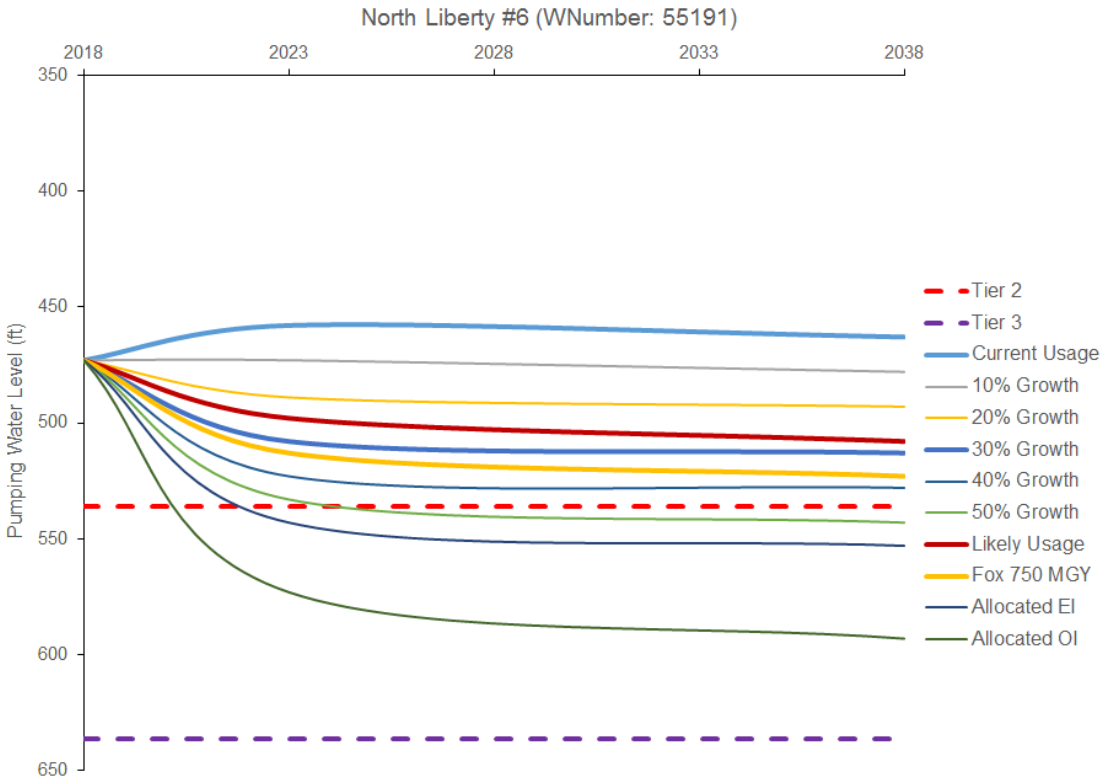
Most Likely



City of North Liberty

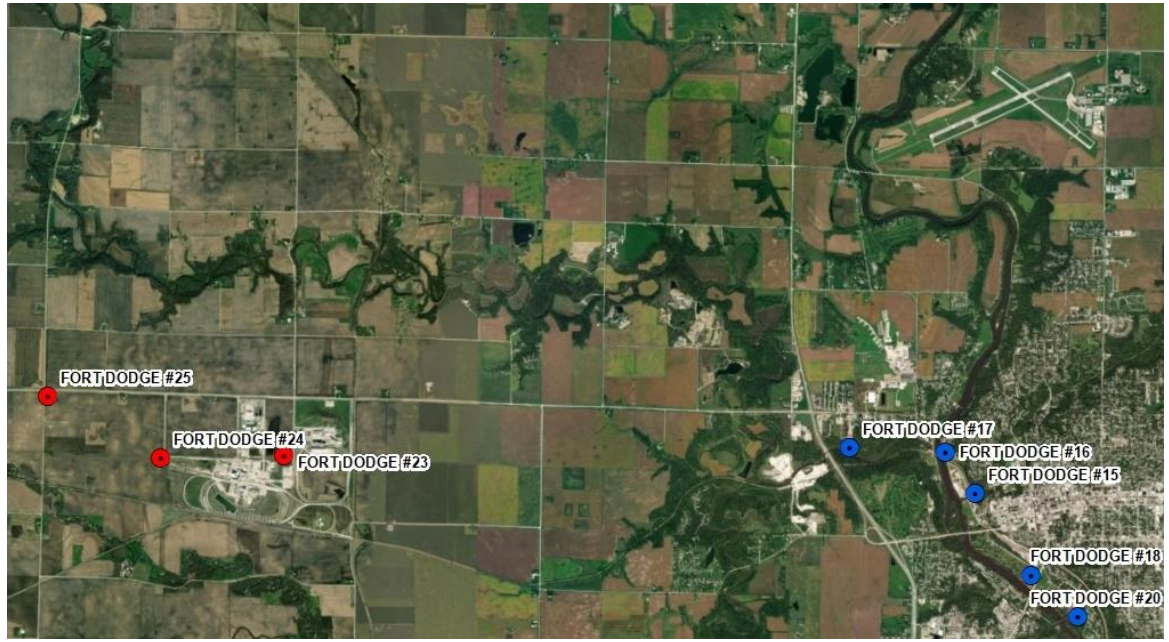
"The model has allowed the city to maximize water production while minimizing the impact on the aquifer. It's been a win-win for the city and the other area water users." - *Greg Metternich, North Liberty Water Manager*

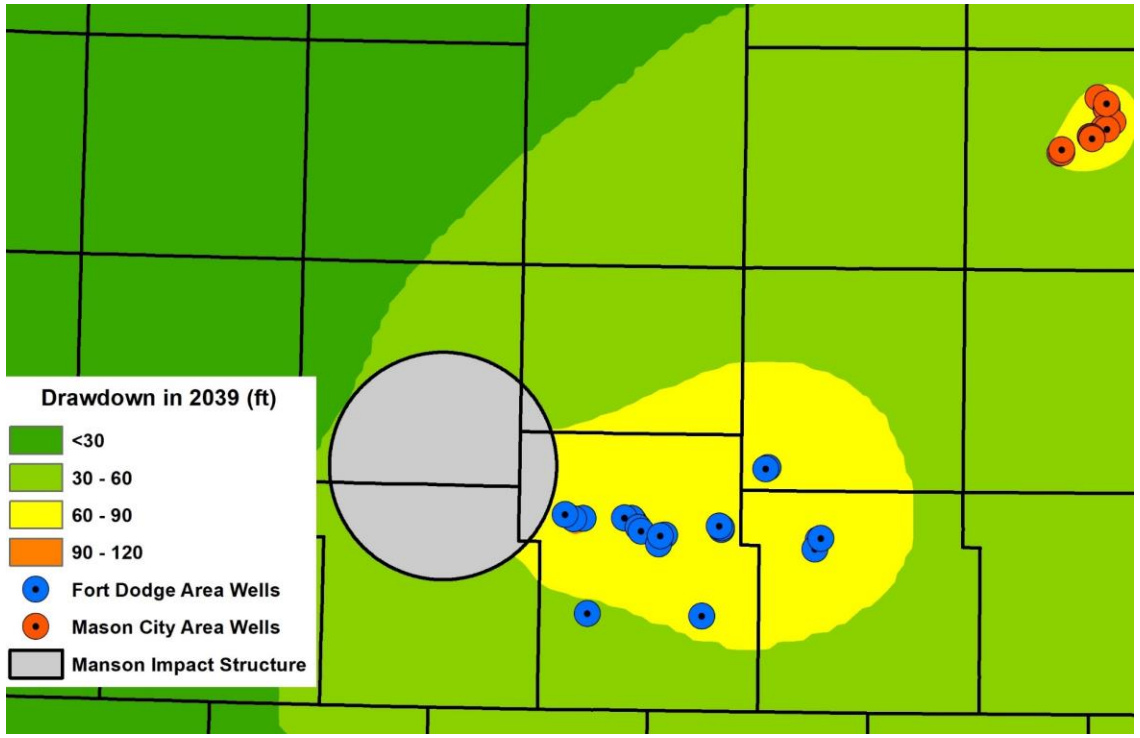
Mike Gannon (left, IGS) meeting with North Liberty's Greg Metternich (right) and Shannon Kopecky (center).



City of Fort Dodge

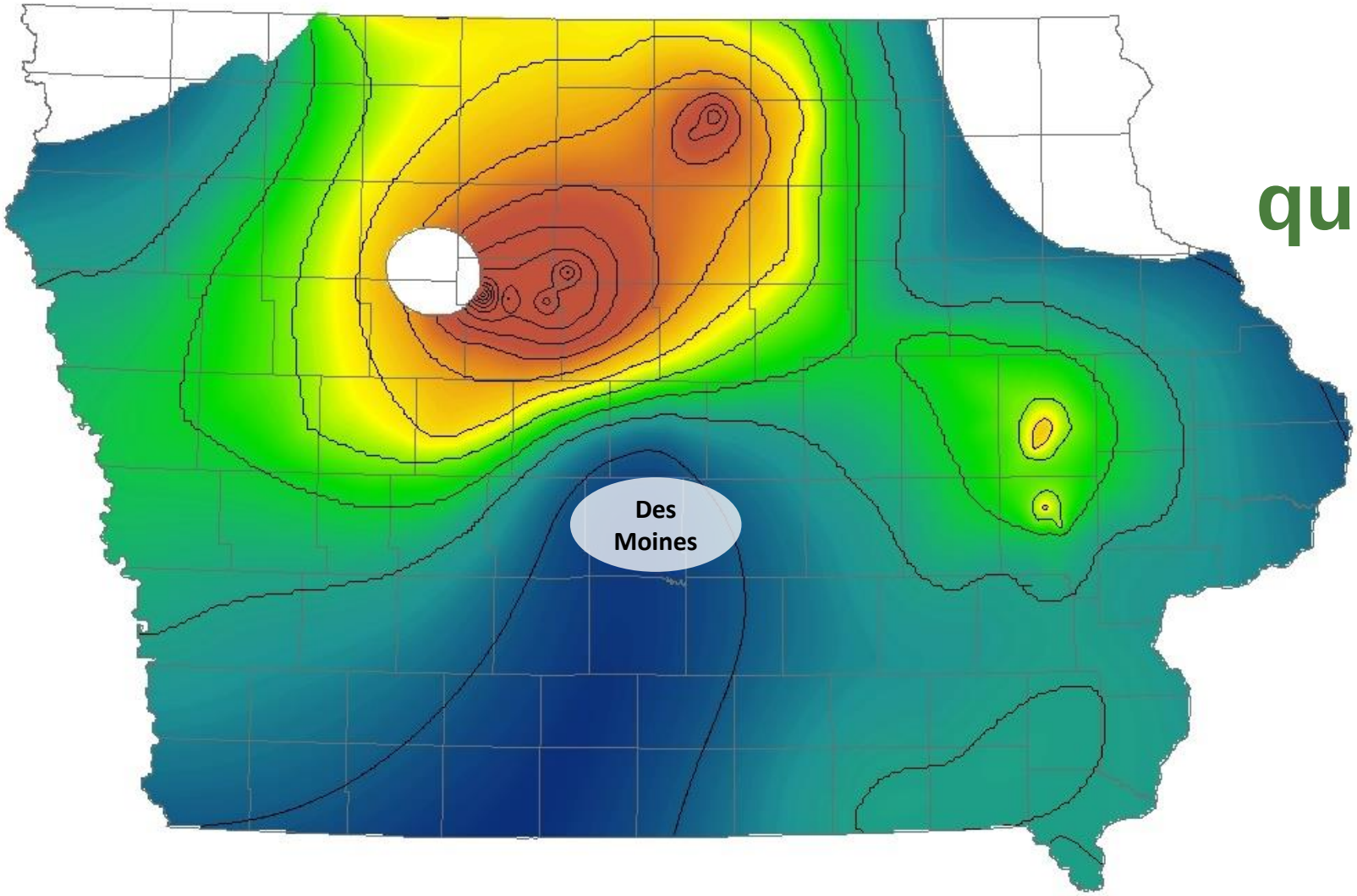
- **Additional wells and a significant increase in water usage for the new industrial park.**





The regional groundwater model is being successfully applied to local water use and management evaluations.

Thanks for listening!



Any questions?