The Significance of an Observation Well Network in McHenry County

McHenry County Groundwater Protection Task Force
April 16, 2008
Woodstock, Illinois

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Center for Groundwater Science, ISWS

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Geologic Mapping & Hydrogeology Center, ISGS

Illinois State WATER SURVEY

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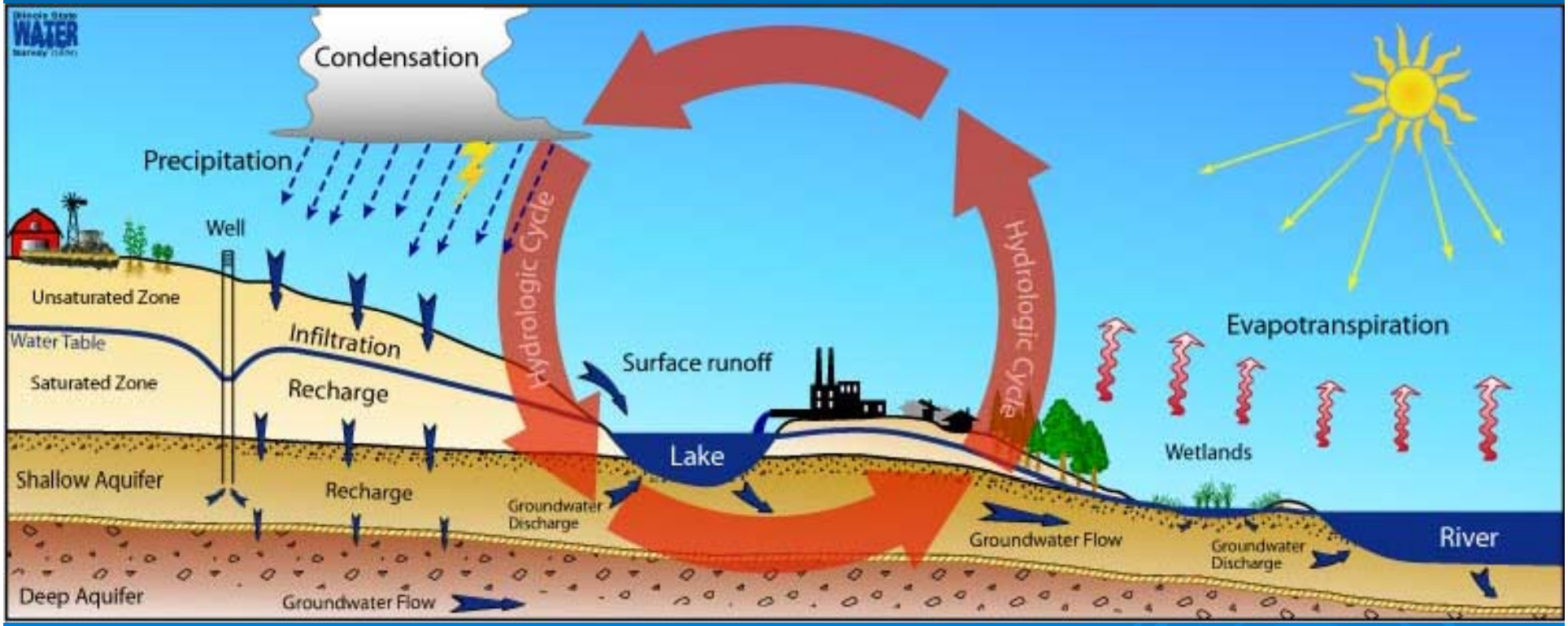
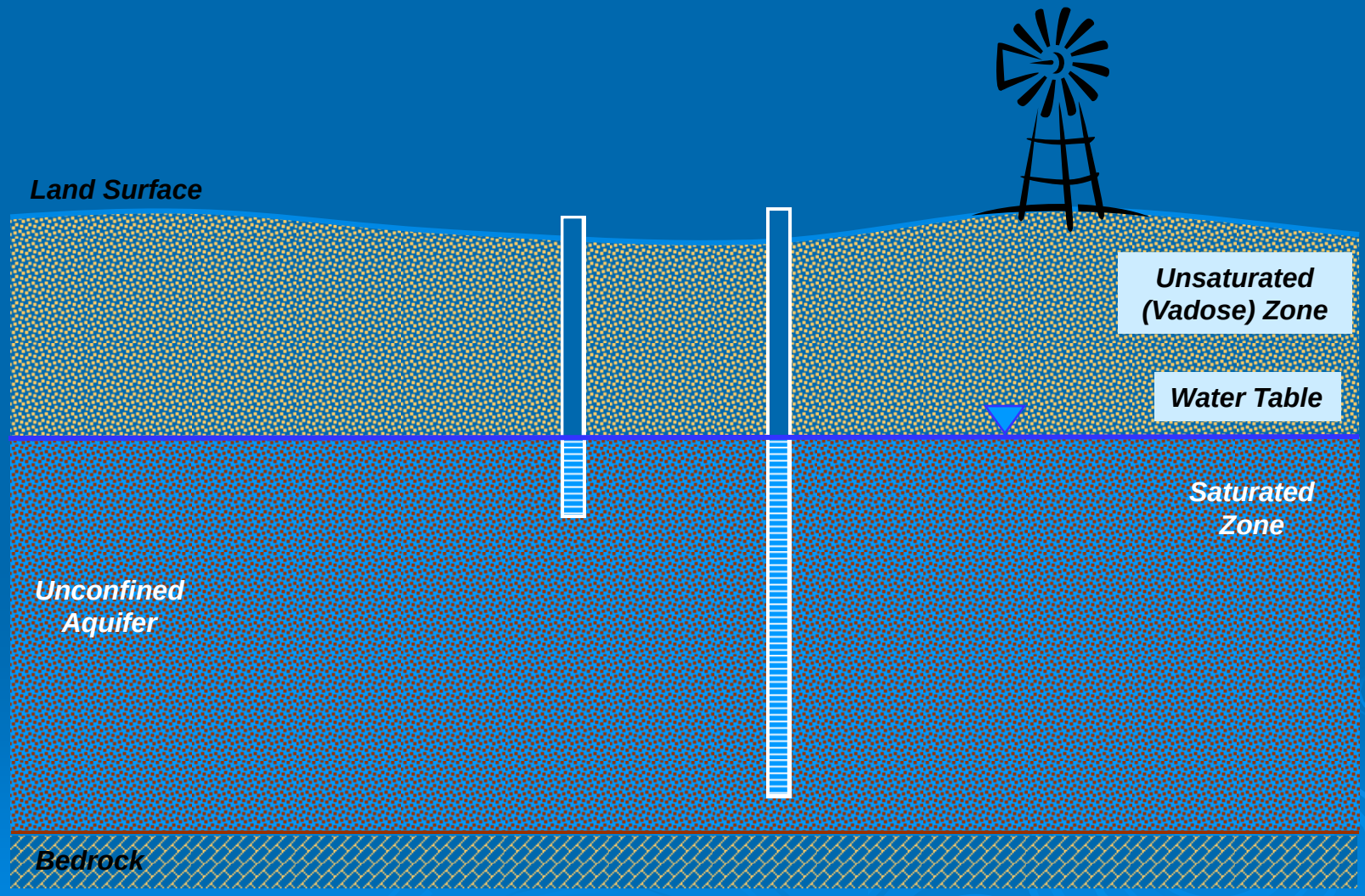
ISGS Illinois State Geological Survey

The Water Cycle

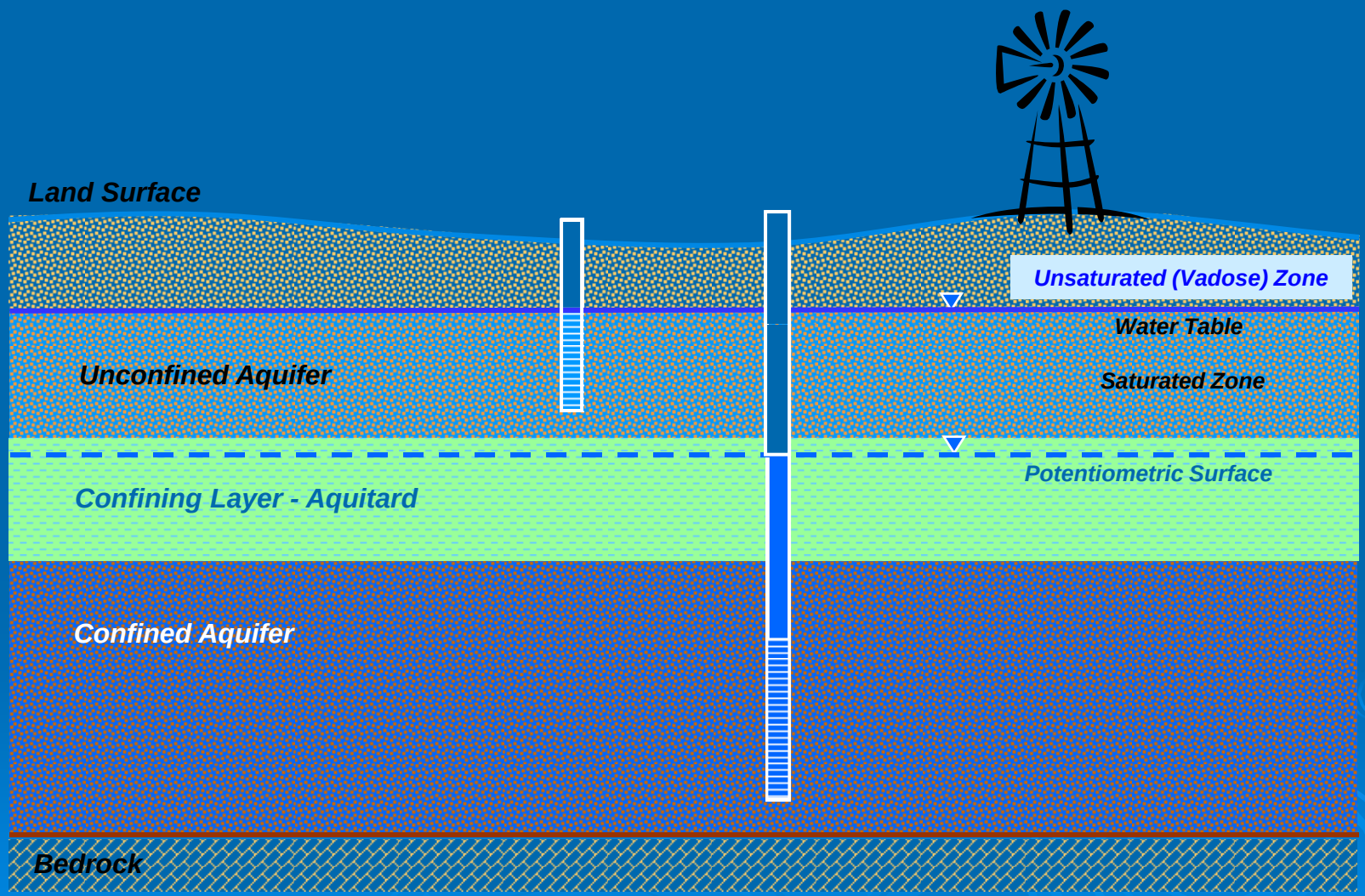
Climate, surface water, and groundwater are linked



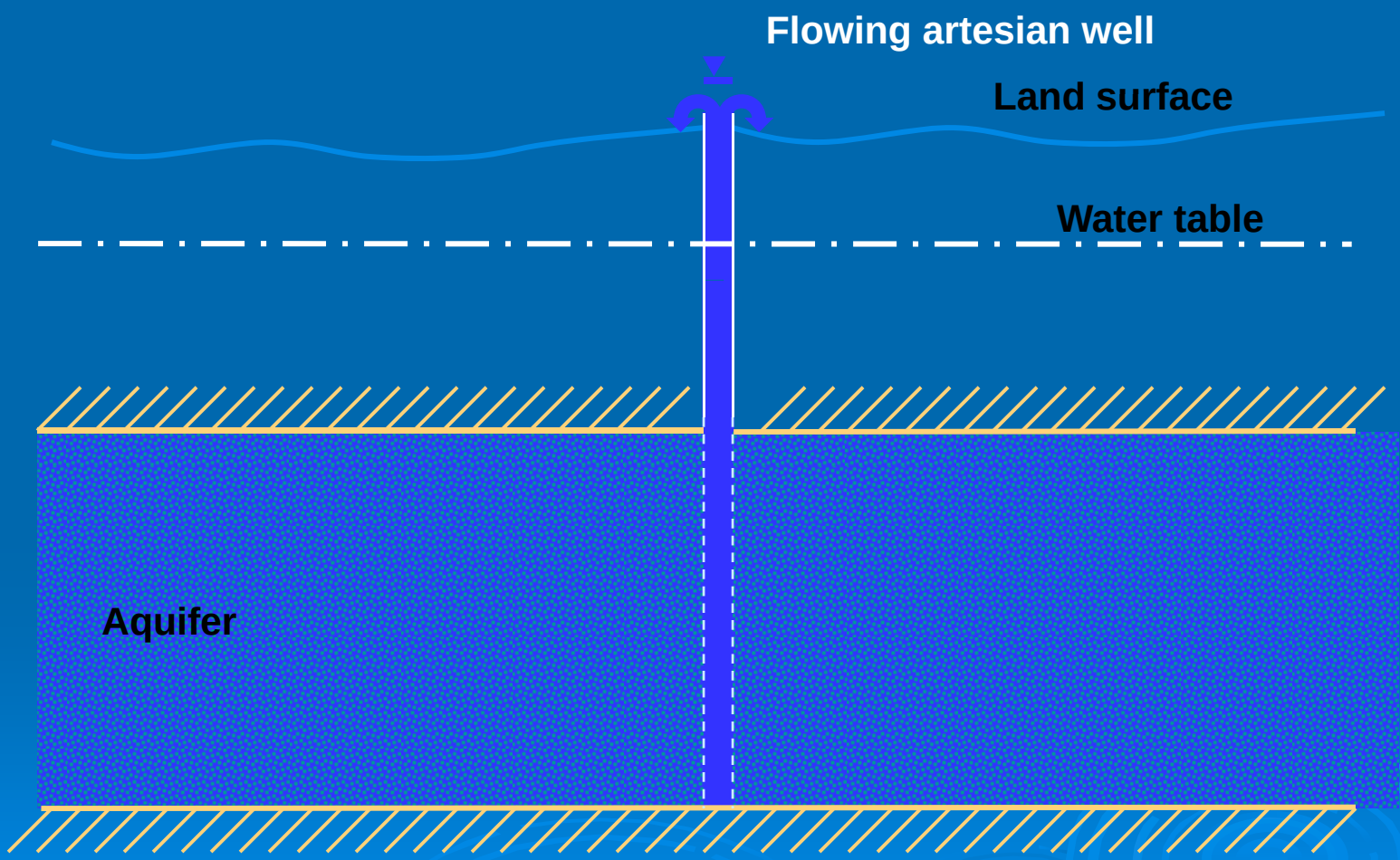
Unconfined Aquifers



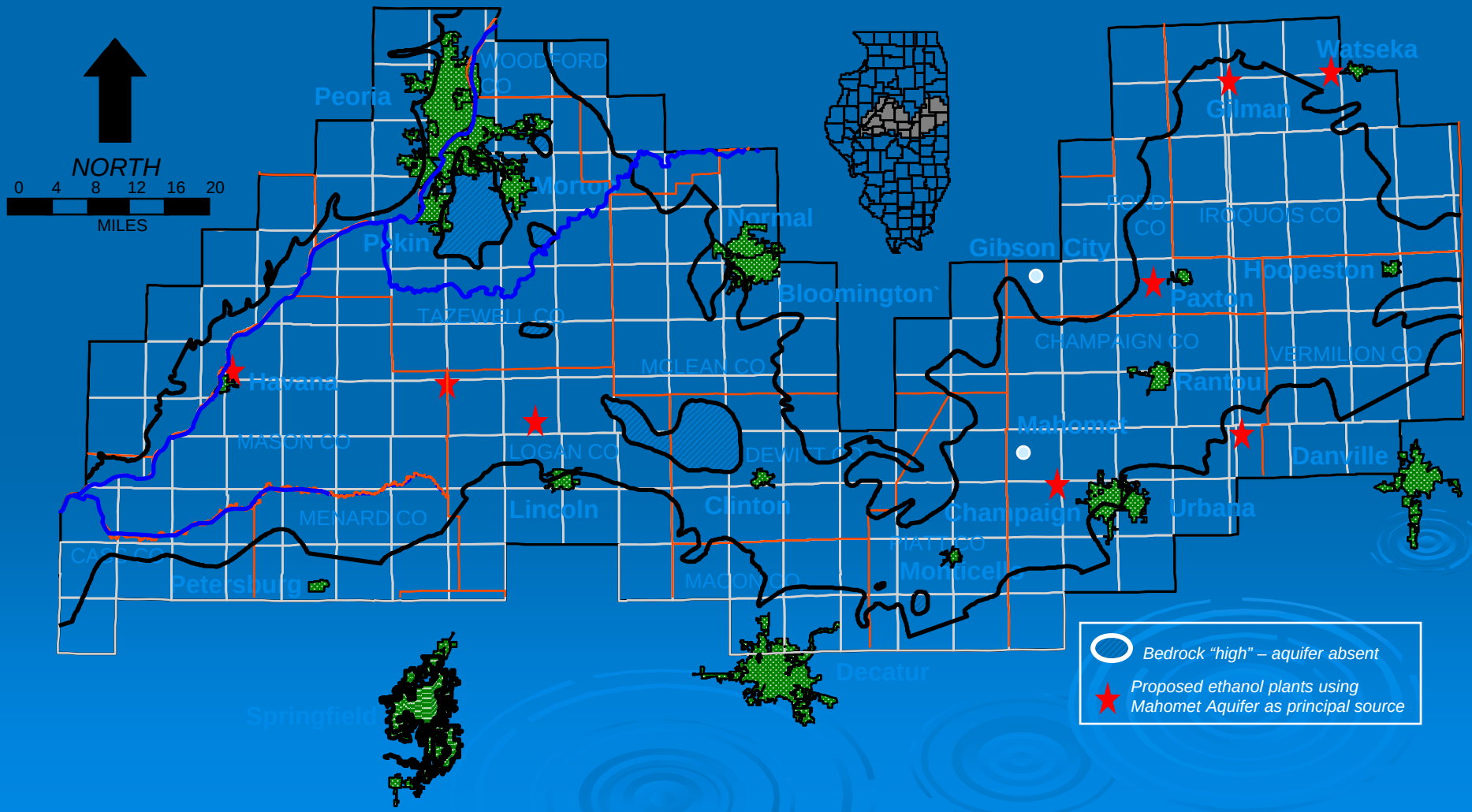
Confined Aquifers



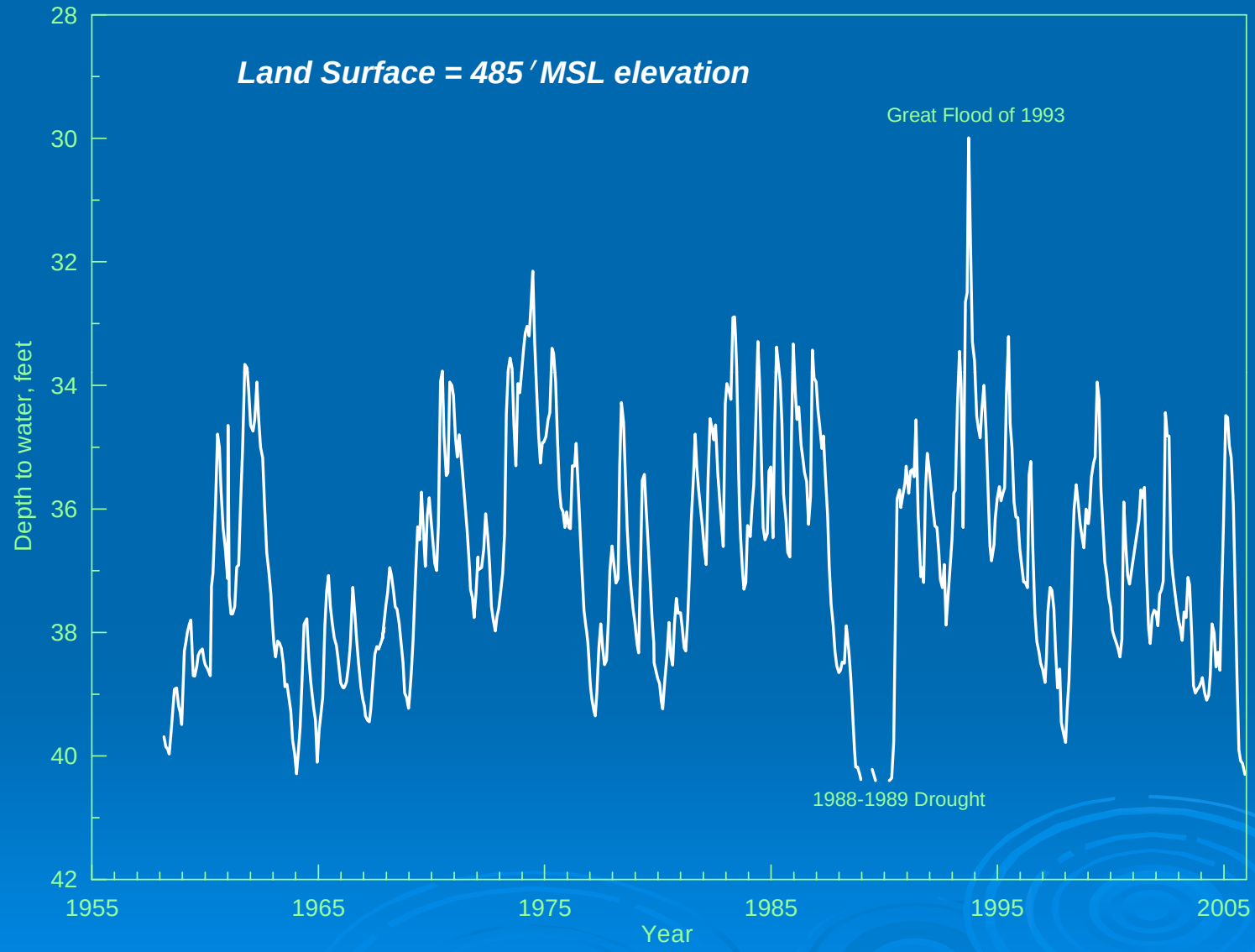
Confined Aquifers & Artesian Wells



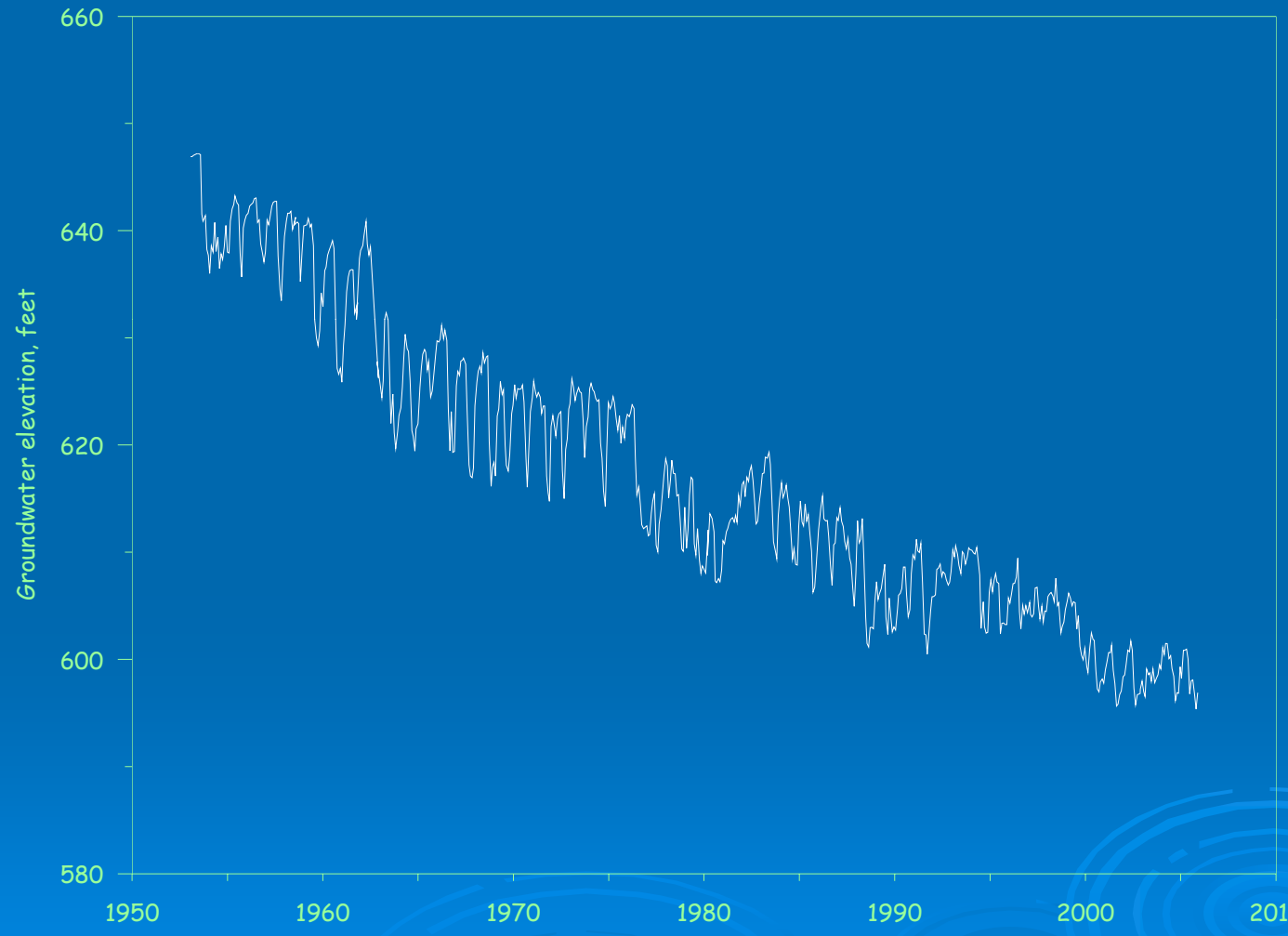
The Mahomet Aquifer Region



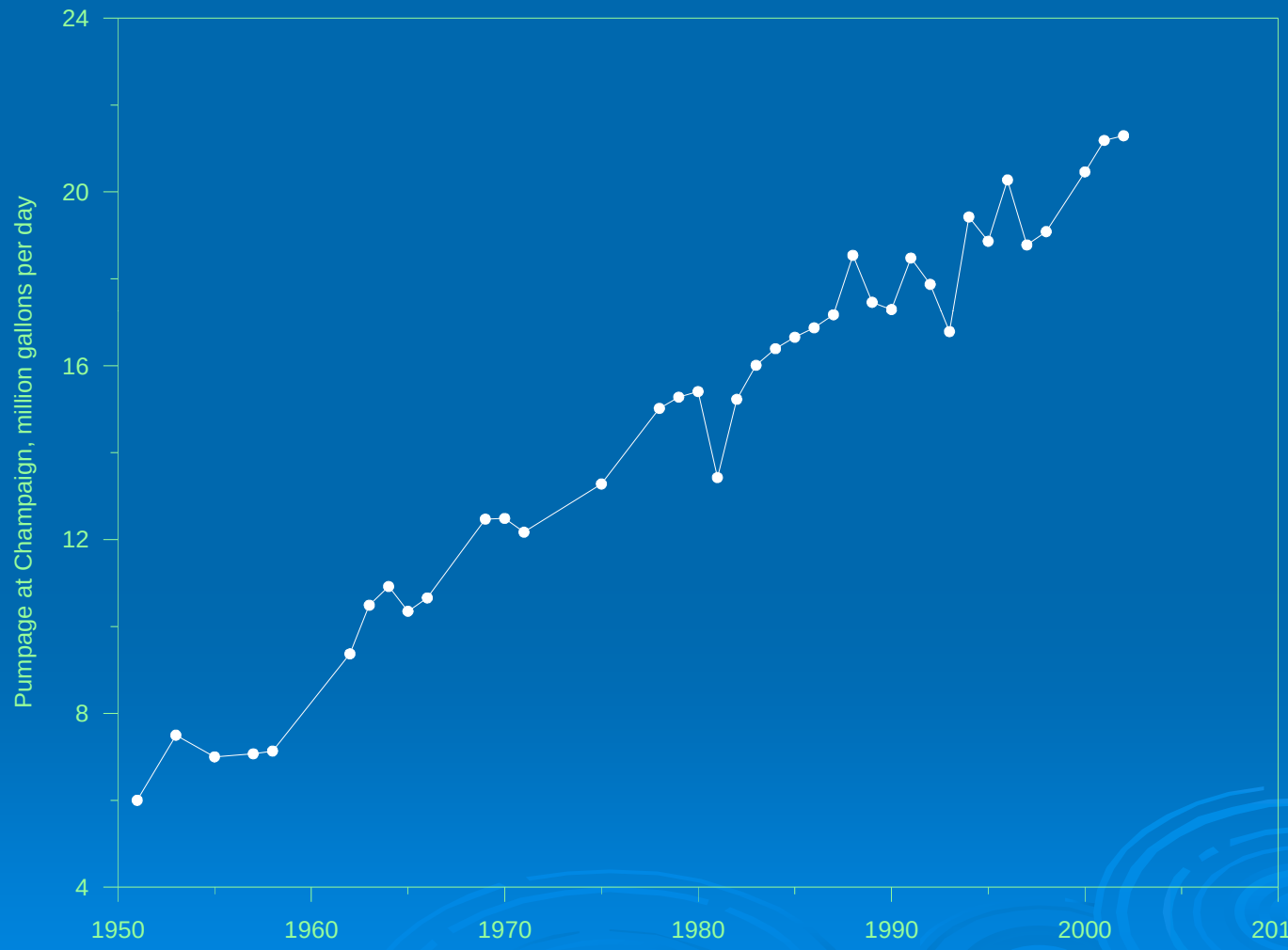
Mahomet Aquifer Water Levels by the Illinois River



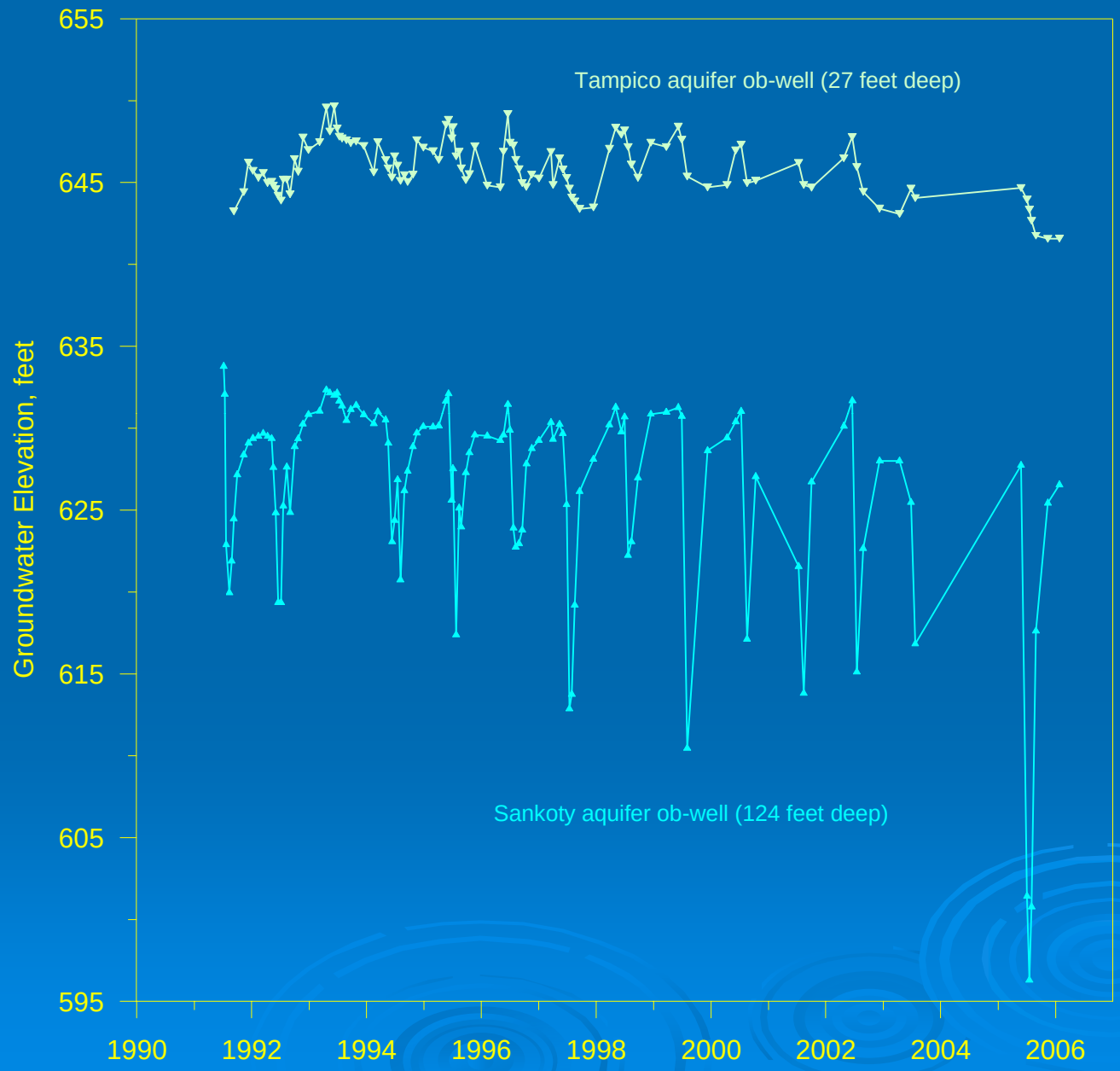
Mahomet Aquifer Potentiometric Heads near Champaign



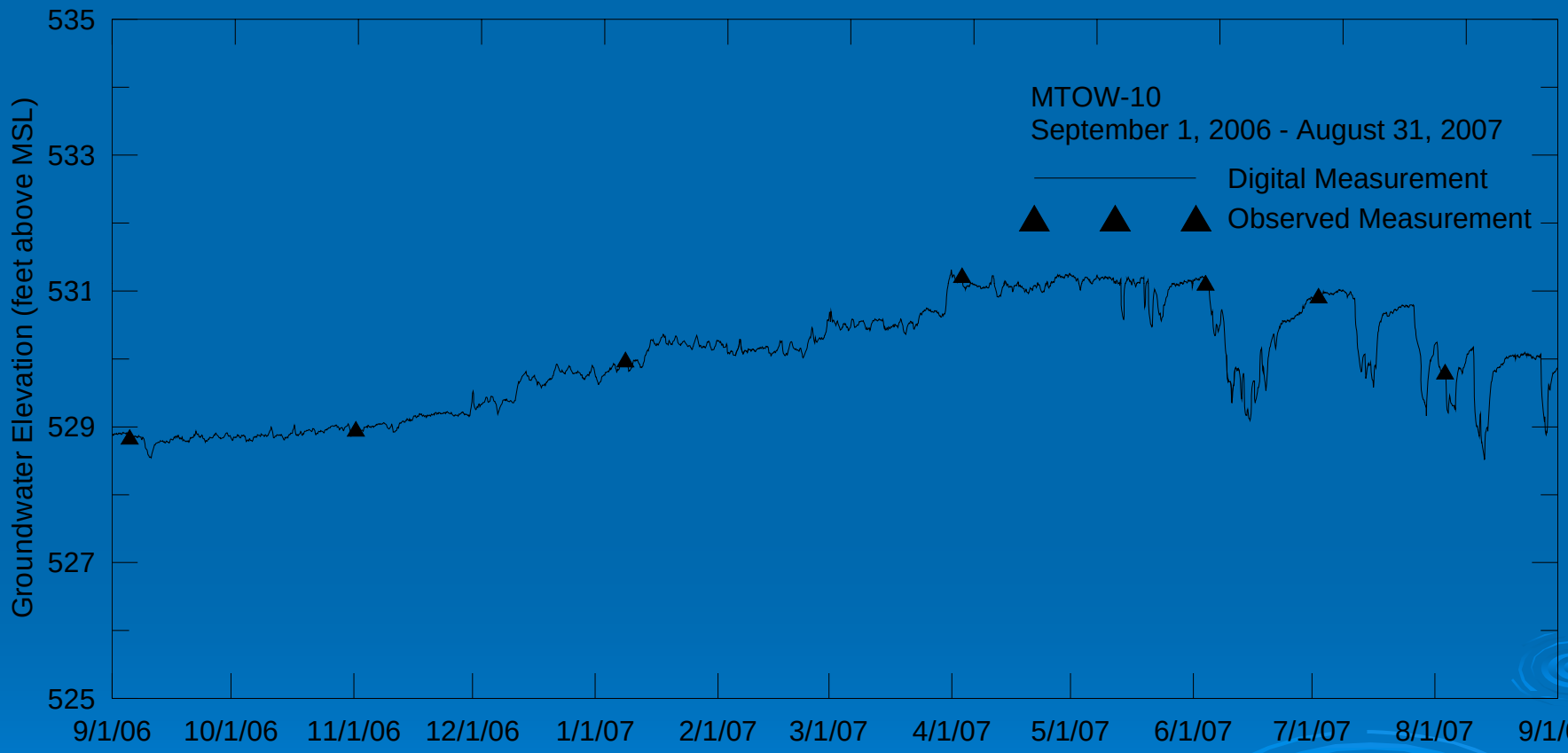
Water Use Trend at Champaign



Comparison of water levels in shallow and deep aquifers in Lee County, IL

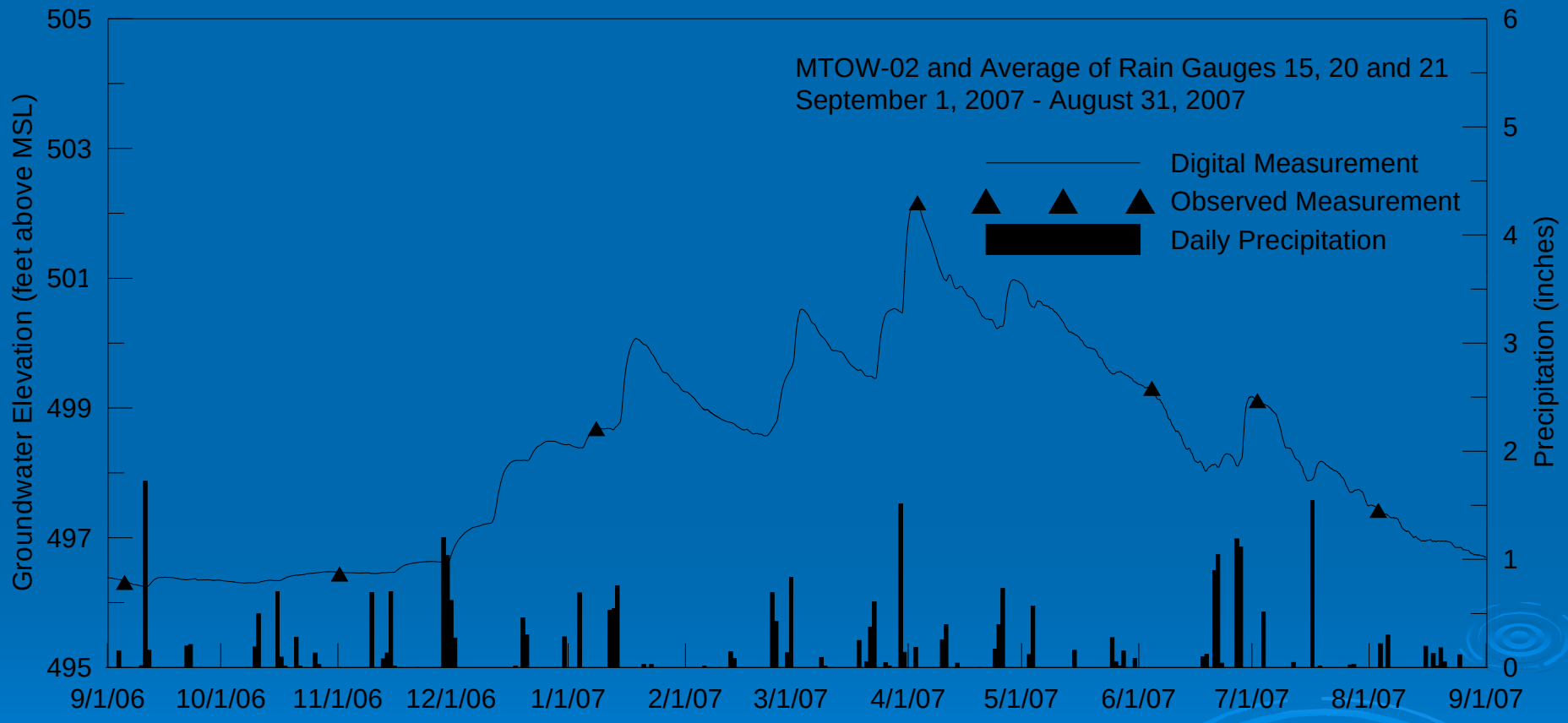


Digital Data Logging vs. Hand Measurements



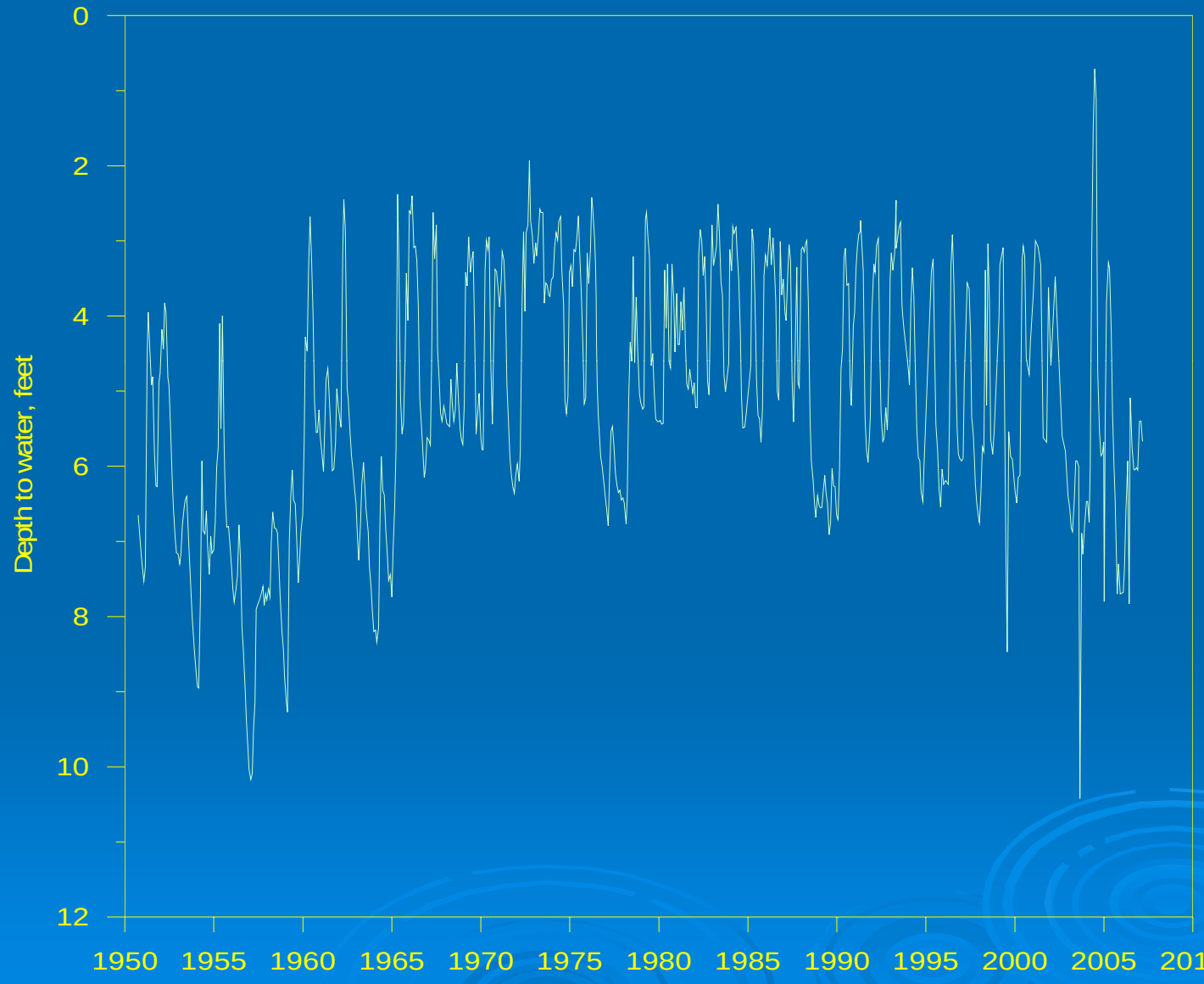
Imperial Valley Water Authority Ob-Well near San Jose

Digital Data Logging vs. Hand Measurements



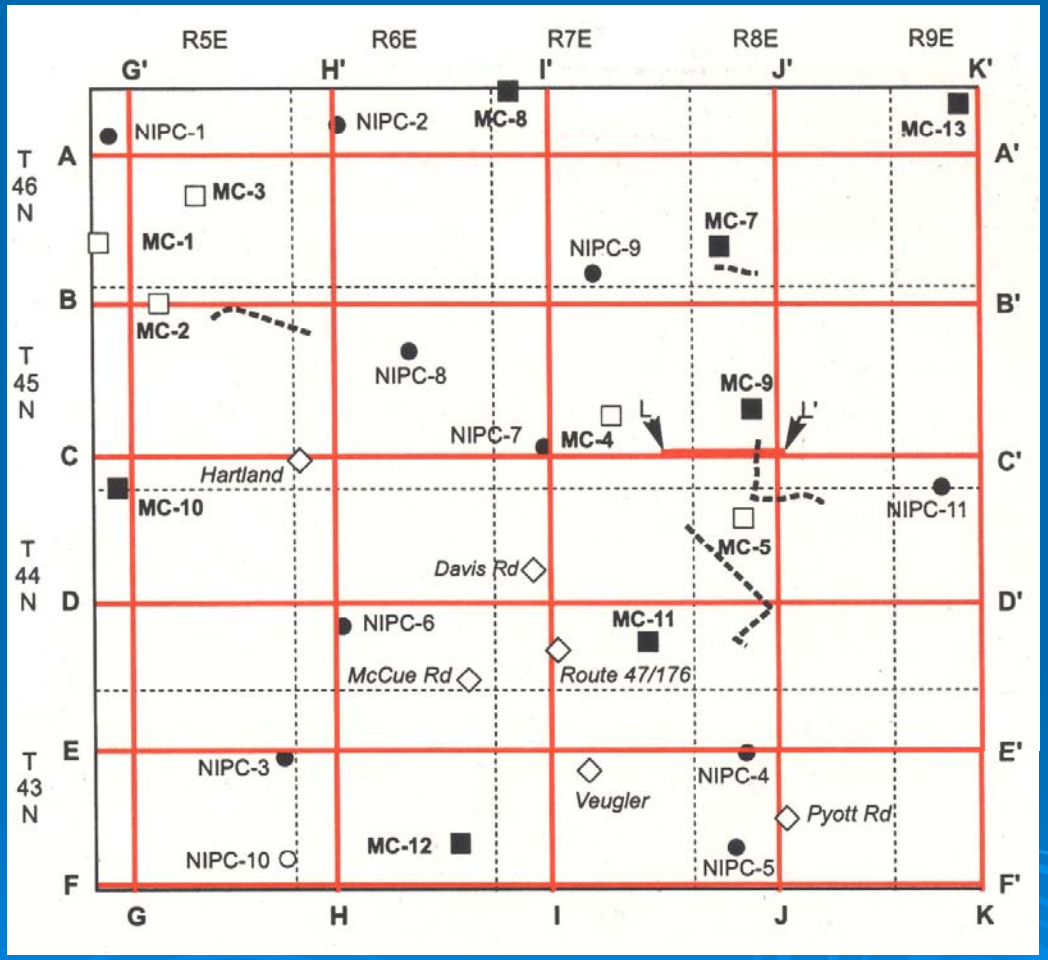
Imperial Valley Water Authority Ob-Well near Easton

ISWS Shallow Observation Well Hydrograph, Crystal Lake

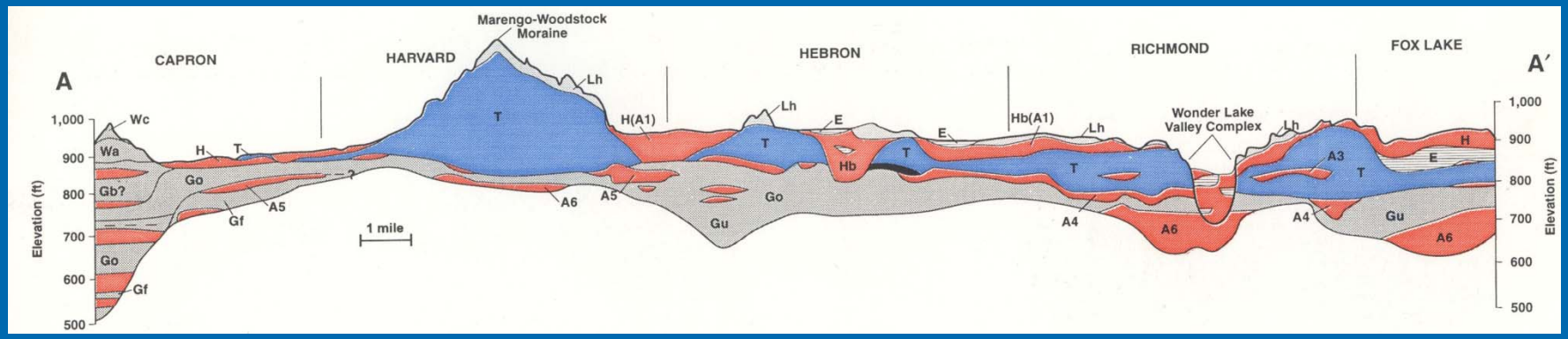


McHenry County Geologic Mapping 1997

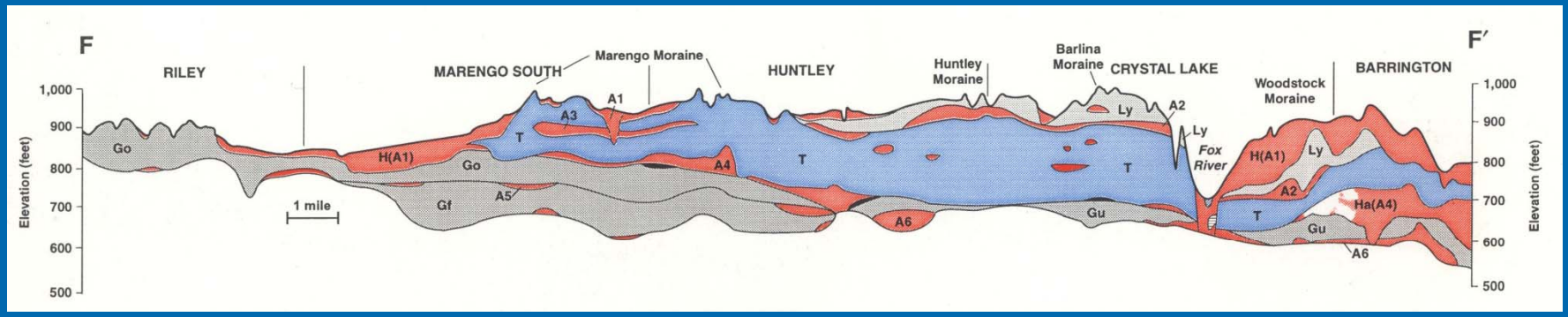
11 Geologic Cross Sections



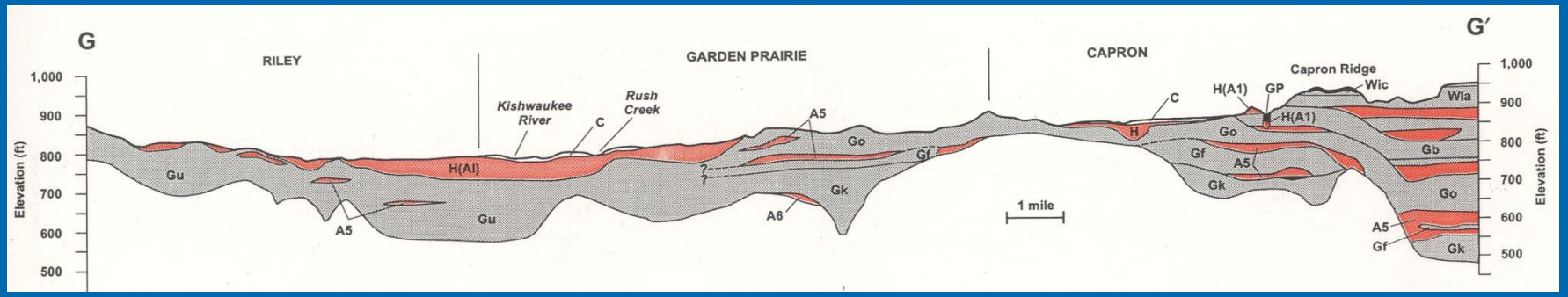
Cross Section A-A'



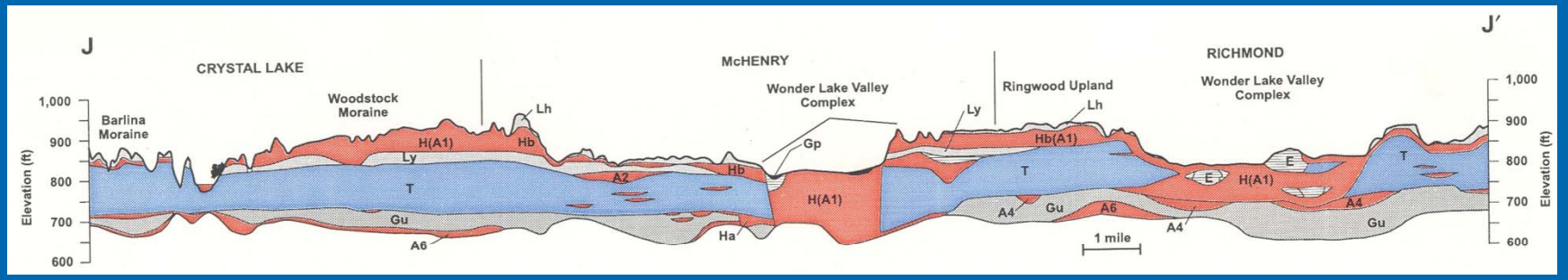
Cross Section F-F'



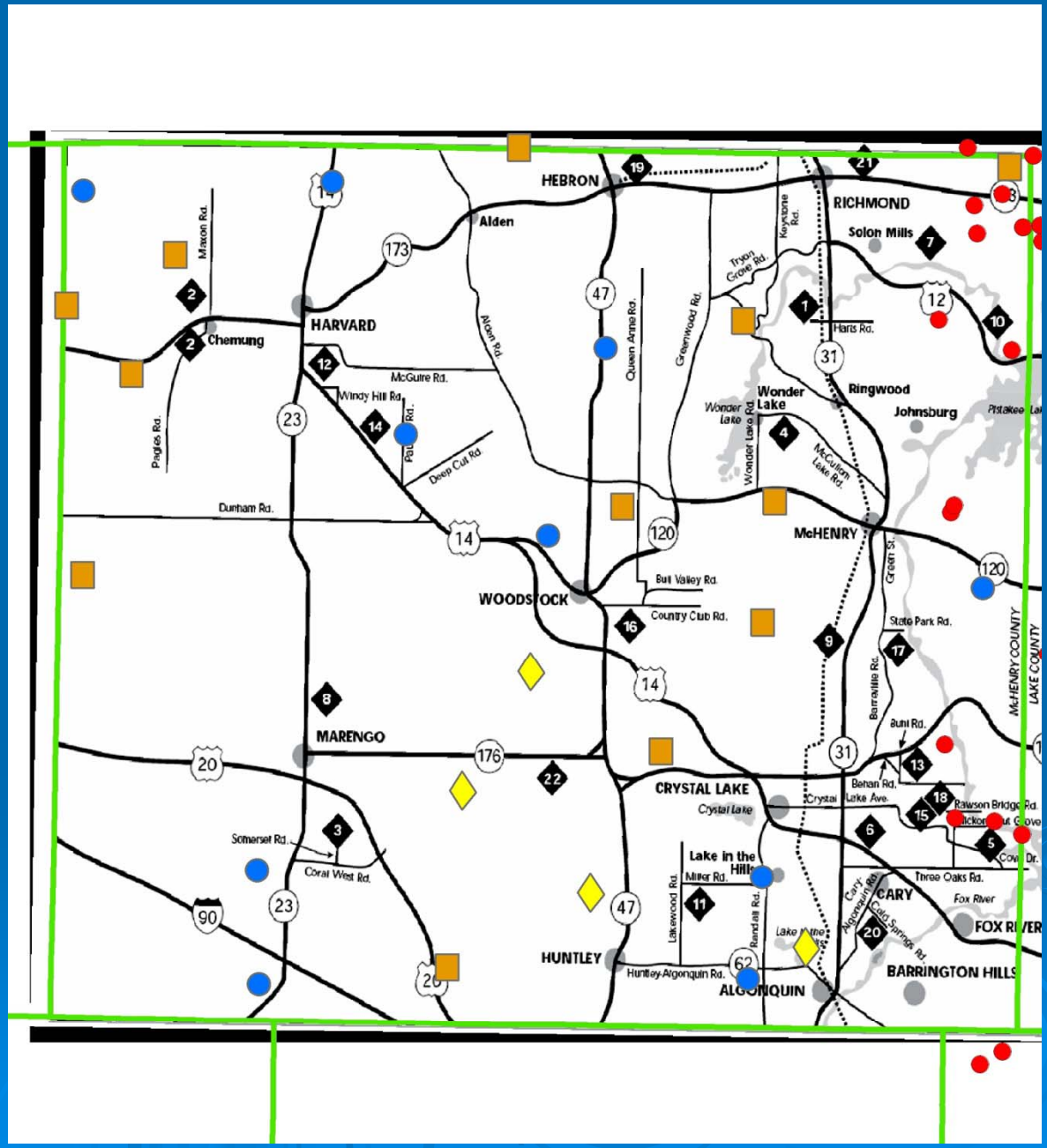
Cross Section G-G'



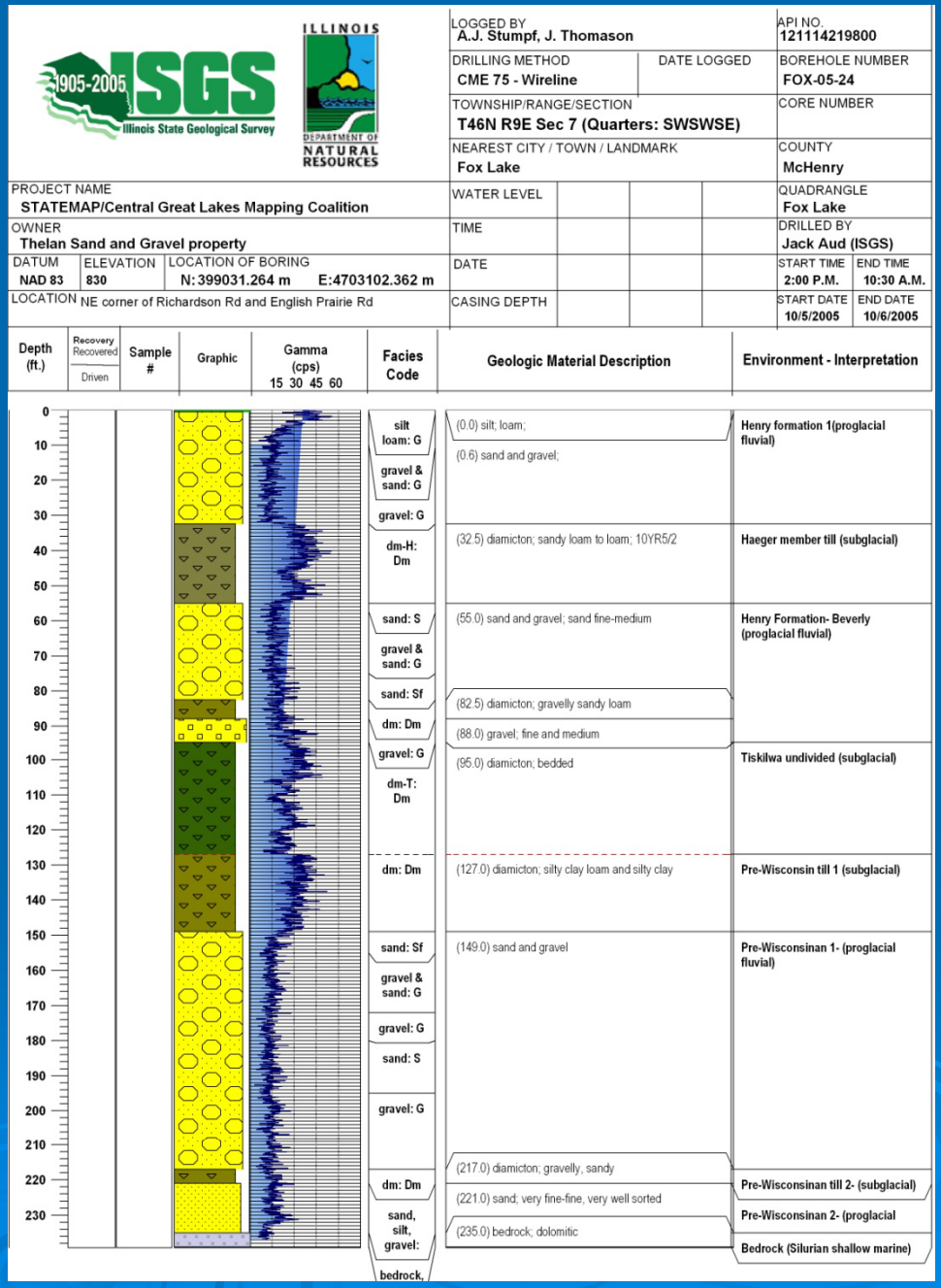
Cross Section J-J’



ISGS Borings
(1997)
and
Observation Wells
(2005-2007)



Geophysical logs and detailed geologic descriptions



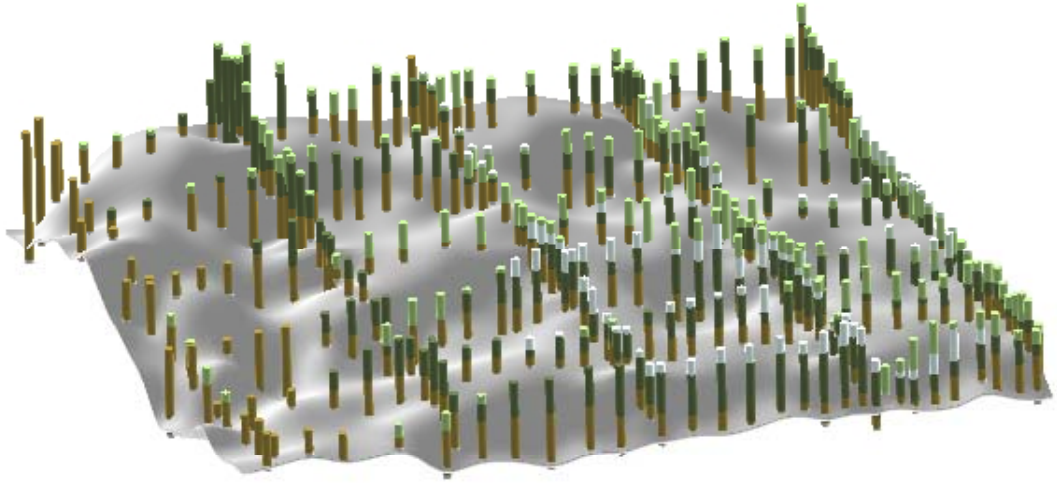
1905-2005 ISGS Illinois State Geological Survey

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

LOGGED BY: A.J. Stumpf, J. Thomason			API NO.: 121114219800
DRILLING METHOD: CME 75 - Wireline	DATE LOGGED		BOREHOLE NUMBER: FOX-05-24
TOWNSHIP/RANGE/SECTION: T46N R9E Sec 7 (Quarters: SWSWSE)			CORE NUMBER
NEAREST CITY / TOWN / LANDMARK: Fox Lake			COUNTY: McHenry
PROJECT NAME: STATEMAP/Central Great Lakes Mapping Coalition	WATER LEVEL		QUADRANGLE: Fox Lake
OWNER: Thelan Sand and Gravel property	TIME		DRILLED BY: Jack Aud (ISGS)
DATUM: NAD 83 / ELEVATION: 830 / LOCATION OF BORING: N: 399031.264 m E:4703102.362 m	DATE		START TIME: 2:00 P.M. / END TIME: 10:30 A.M.
LOCATION: NE corner of Richardson Rd and English Prairie Rd	CASING DEPTH		START DATE: 10/5/2005 / END DATE: 10/6/2005

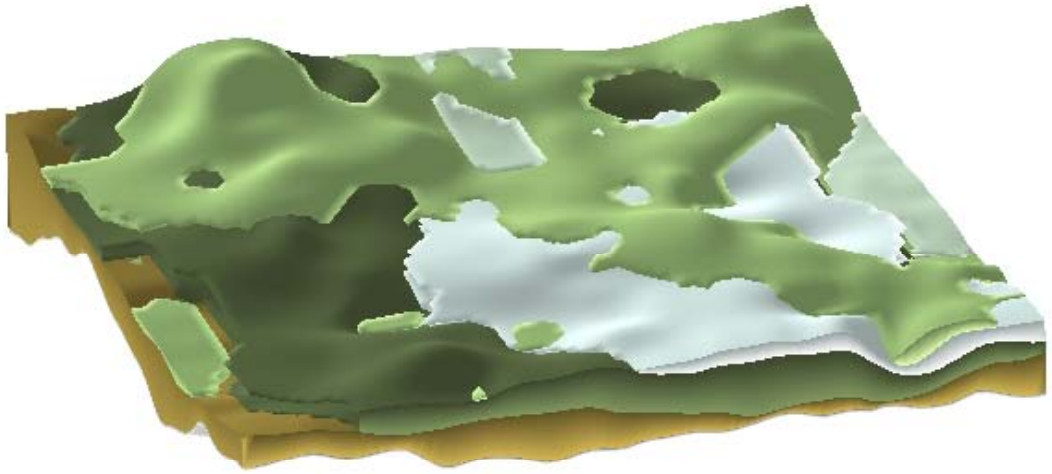
Depth (ft.)	Recovery Recovered / Driven	Sample #	Graphic	Gamma (cps) 15 30 45 60	Facies Code	Geologic Material Description	Environment - Interpretation
0–230					silt loam: G	(0.0) silt; loam;	Henry formation 1(proglacial fluvial)
					gravel & sand: G	(0.6) sand and gravel;	
					gravel: G		
					dm-H: Dm	(32.5) diamicton; sandy loam to loam; 10YR5/2	Haeger member till (subglacial)
					sand: S	(55.0) sand and gravel; sand fine-medium	Henry Formation- Beverly (proglacial fluvial)
					gravel & sand: G		
					sand: Sf	(82.5) diamicton; gravelly sandy loam	
					dm: Dm	(88.0) gravel; fine and medium	
					gravel: G	(95.0) diamicton; bedded	Tiskilwa undivided (subglacial)
					dm-T: Dm		
					dm: Dm	(127.0) diamicton; silty clay loam and silty clay	Pre-Wisconsin till 1 (subglacial)
					sand: Sf	(149.0) sand and gravel	Pre-Wisconsinan 1- (proglacial fluvial)
					gravel & sand: G		
					gravel: G		
					sand: S		
					gravel: G		
					dm: Dm	(217.0) diamicton; gravelly, sandy	Pre-Wisconsinan till 2- (subglacial)
					sand, silt, gravel:	(221.0) sand; very fine-fine, very well sorted	Pre-Wisconsinan 2- (proglacial
					bedrock,	(235.0) bedrock; dolomitic	Bedrock (Silurian shallow marine)

Generalized 3-D Geologic Map
McHenry County
Water Supply Planning and Management Initiative



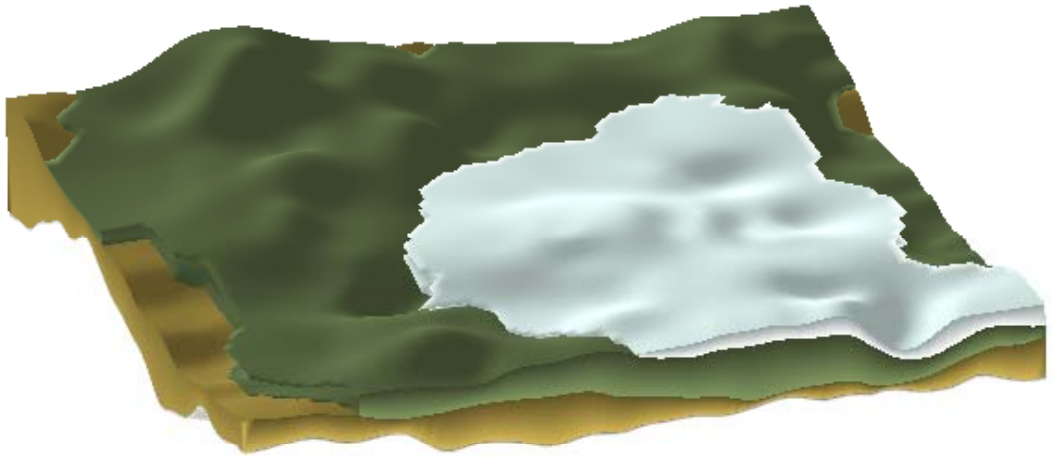
Data and Bedrock Surface

Generalized 3-D Geologic Map
McHenry County
Water Supply Planning and Management Initiative



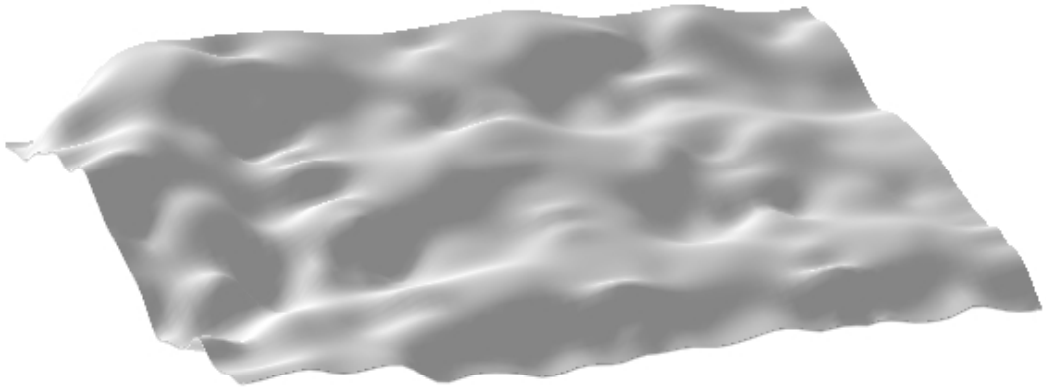
Full 6-layer map

Generalized 3-D Geologic Map
McHenry County
Water Supply Planning and Management Initiative



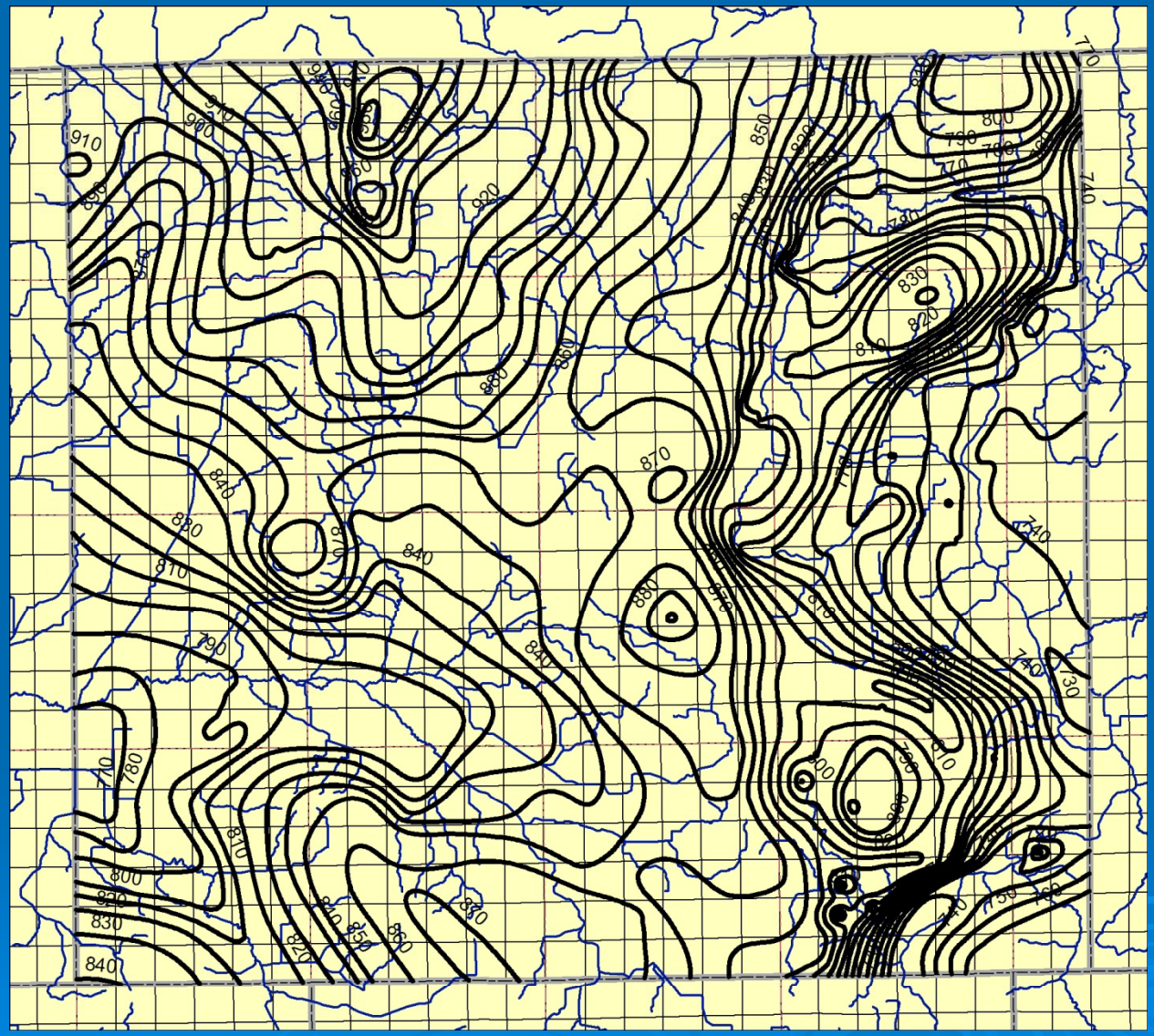
Layers 3-6 and bedrock

Generalized 3-D Geologic Map
McHenry County
Water Supply Planning and Management Initiative



Bedrock Surface

Potentiometric Surface of "Aquifer 5", McHenry County



Water Supply Planning Toolbox - *Groundwater Models*

Hydrogeology:
- Piezometric mapping
- Aquifer testing (Conductivity, etc)

→Hydrogeologic Model

Surface Water:
- Location, Width, Depth
- Diversions/Discharge
- Stream Gauge

→Flow Accounting Model
→Streamflow Probability

Groundwater Flow Model

Assimilate / Understand

Quantify

Predict

Physics:
- Mass/Energy
- Flow in Porous Media

→Governing Equations

Other:
- Soil Type
- Land Cover
- Tile/Storm Drains

→ Supporting Data

Geology:
- Boring logs
- Geophysical Surveys
- Interpolation

→ Stratigraphic Model

Well Data:
- Depth
- Water Levels
- Pumping Rates

→ History/Projection

Questions the Models Can Answer

Where does the water (recharge) come from?

Does pumping affect streamflow?

Are additional measurements needed, and where?

What are the long-term effects of current pumping?

For Kane County, 2 Flow Models Were Developed:

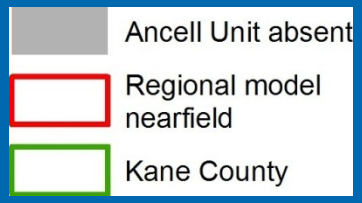
Regional (Deep) Model
Approx. 800,000 nodes
Max grid spacing 16 mi.
Min grid spacing 2,500 ft.
All aquifers

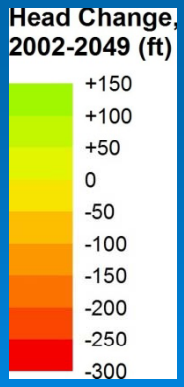
Local (Shallow) Model
Approx. 1.5 million nodes
Grid spacing 660 ft.
Shallow aquifers only

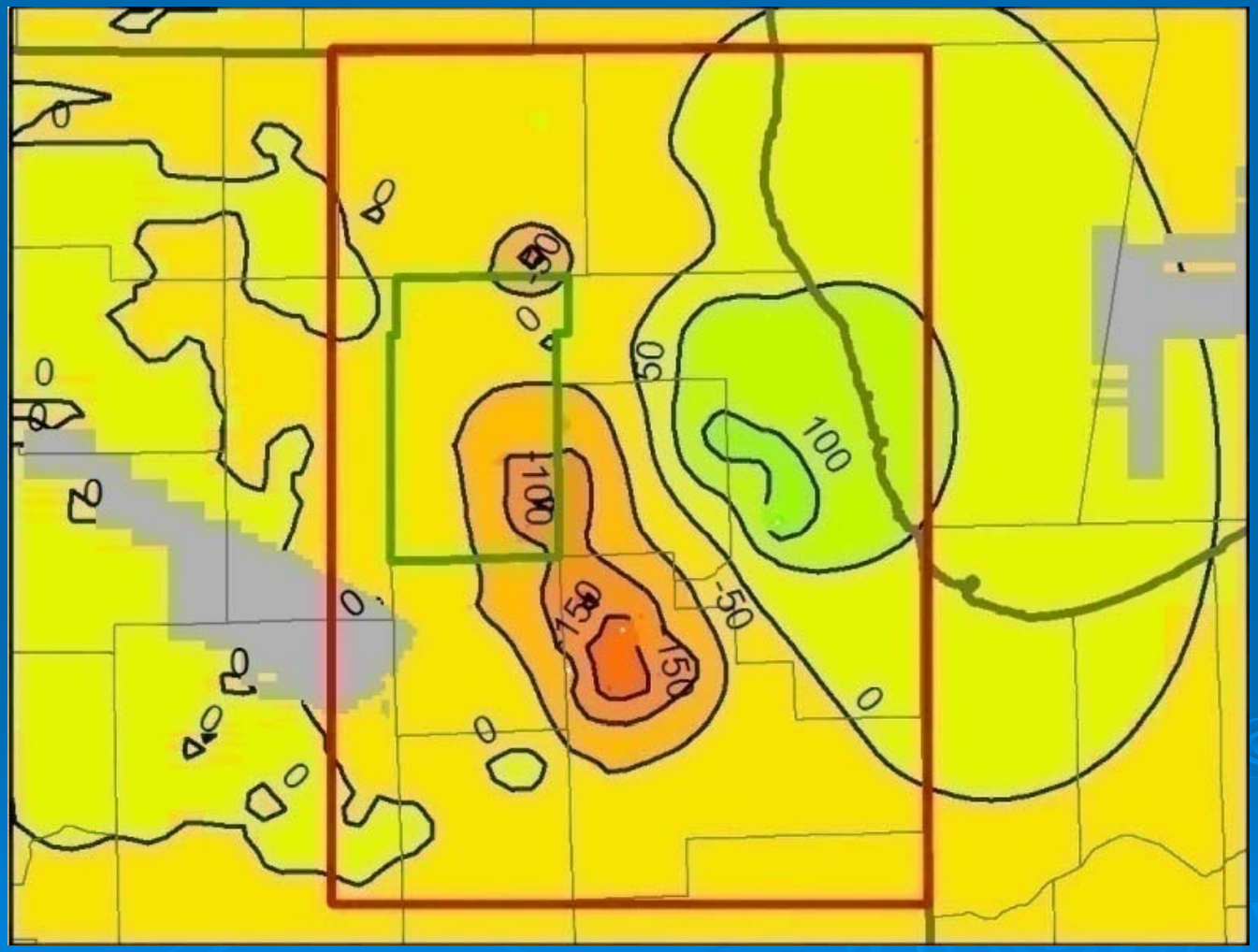
For consistency and realism, the local model takes its boundary conditions from the regional model

Estimated Head Change from 2002 to 2049 in Ancell Unit under Low and High Pumping Scenarios

Low Pumping Scenario

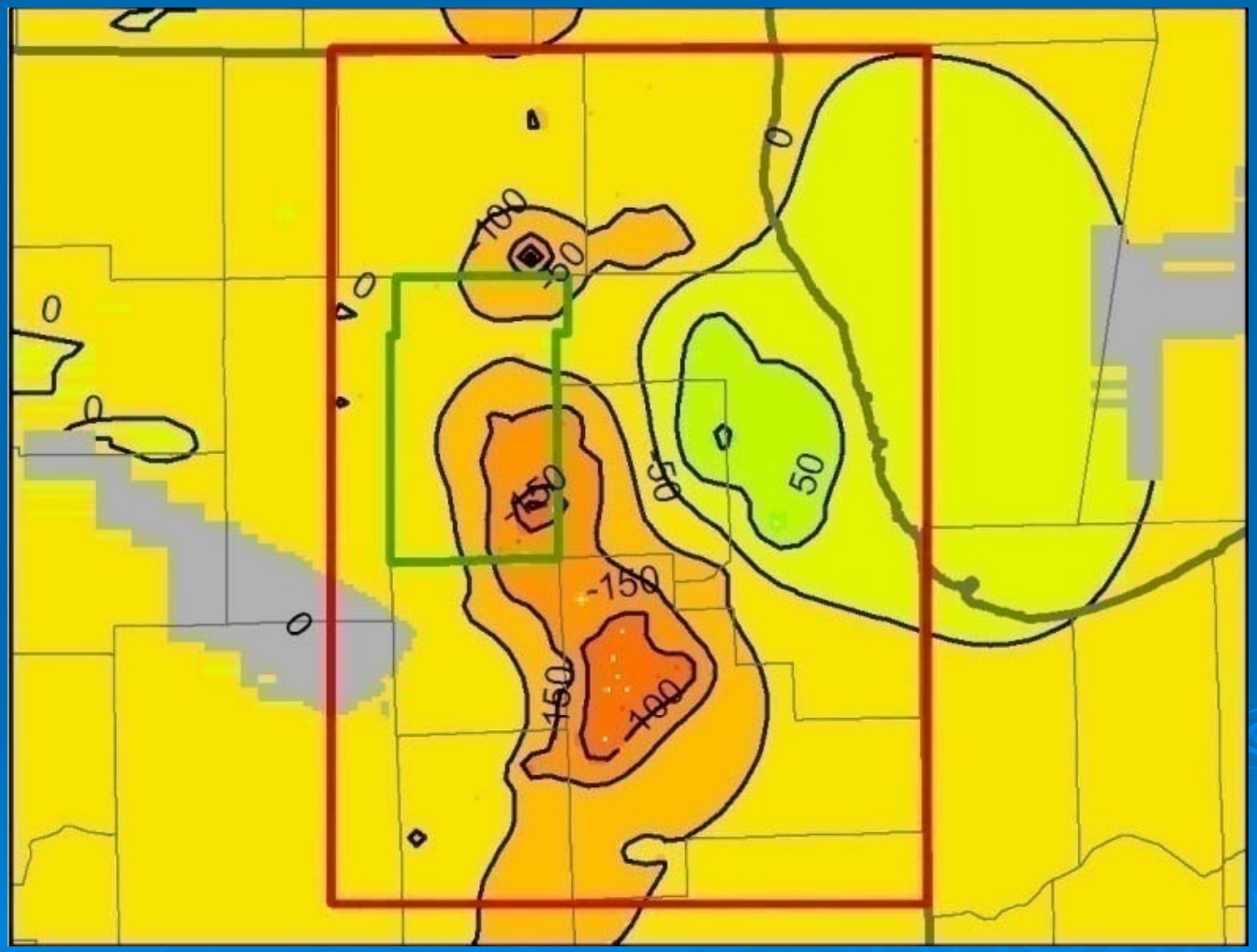




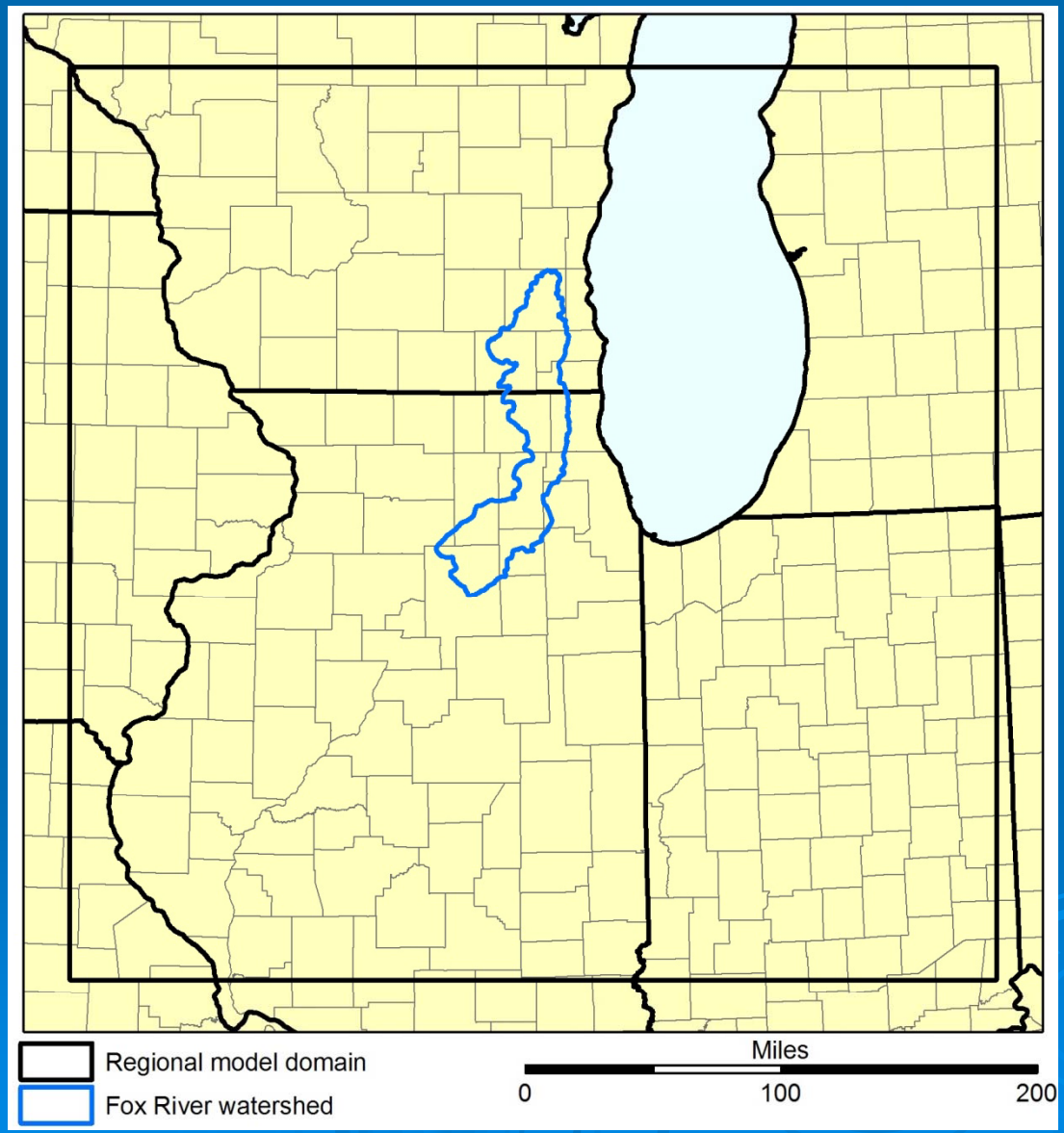


Estimated Head Change from 2002 to 2049 in Ancell Unit under Low and High Pumping Scenarios

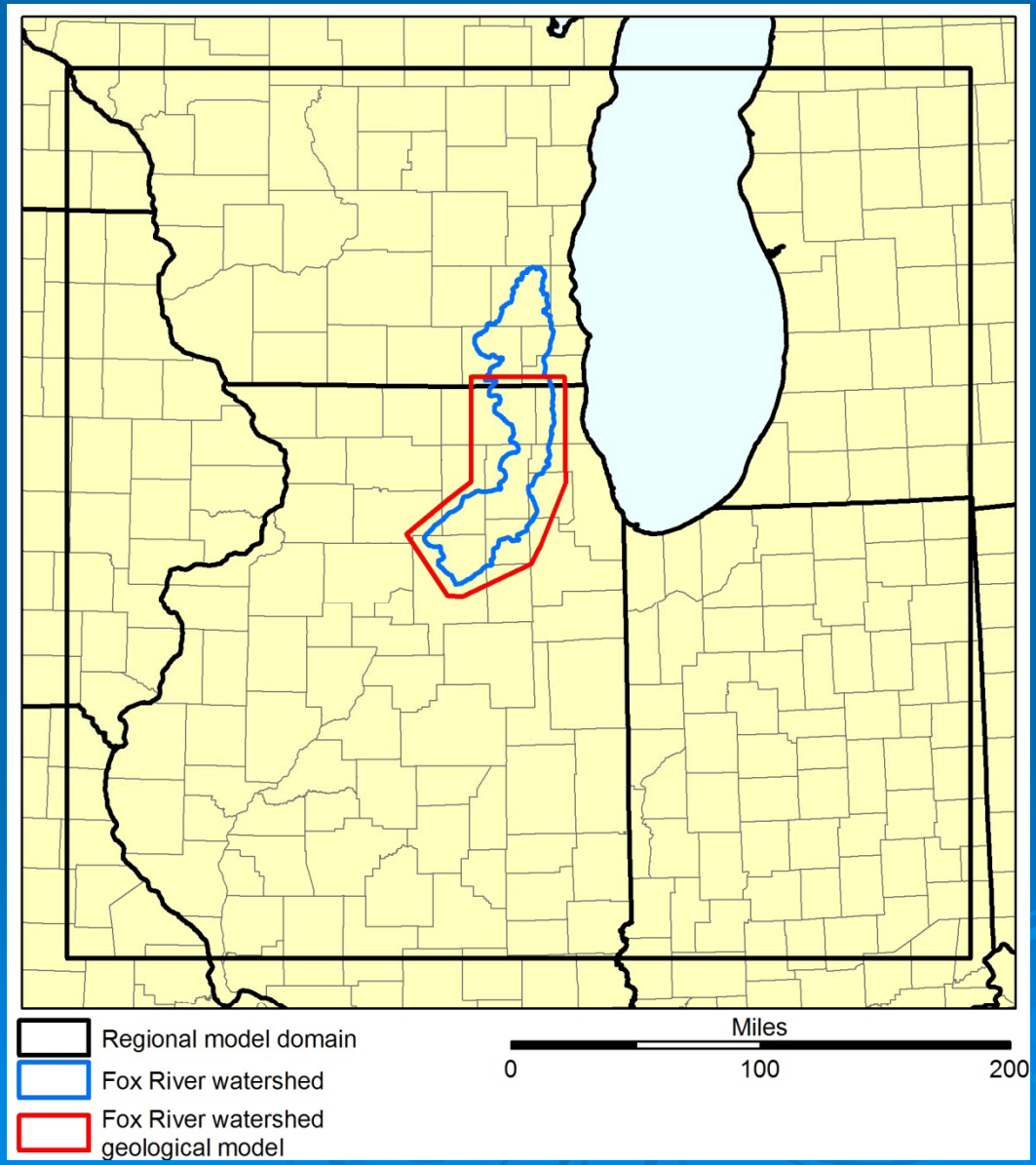
High Pumping Scenario



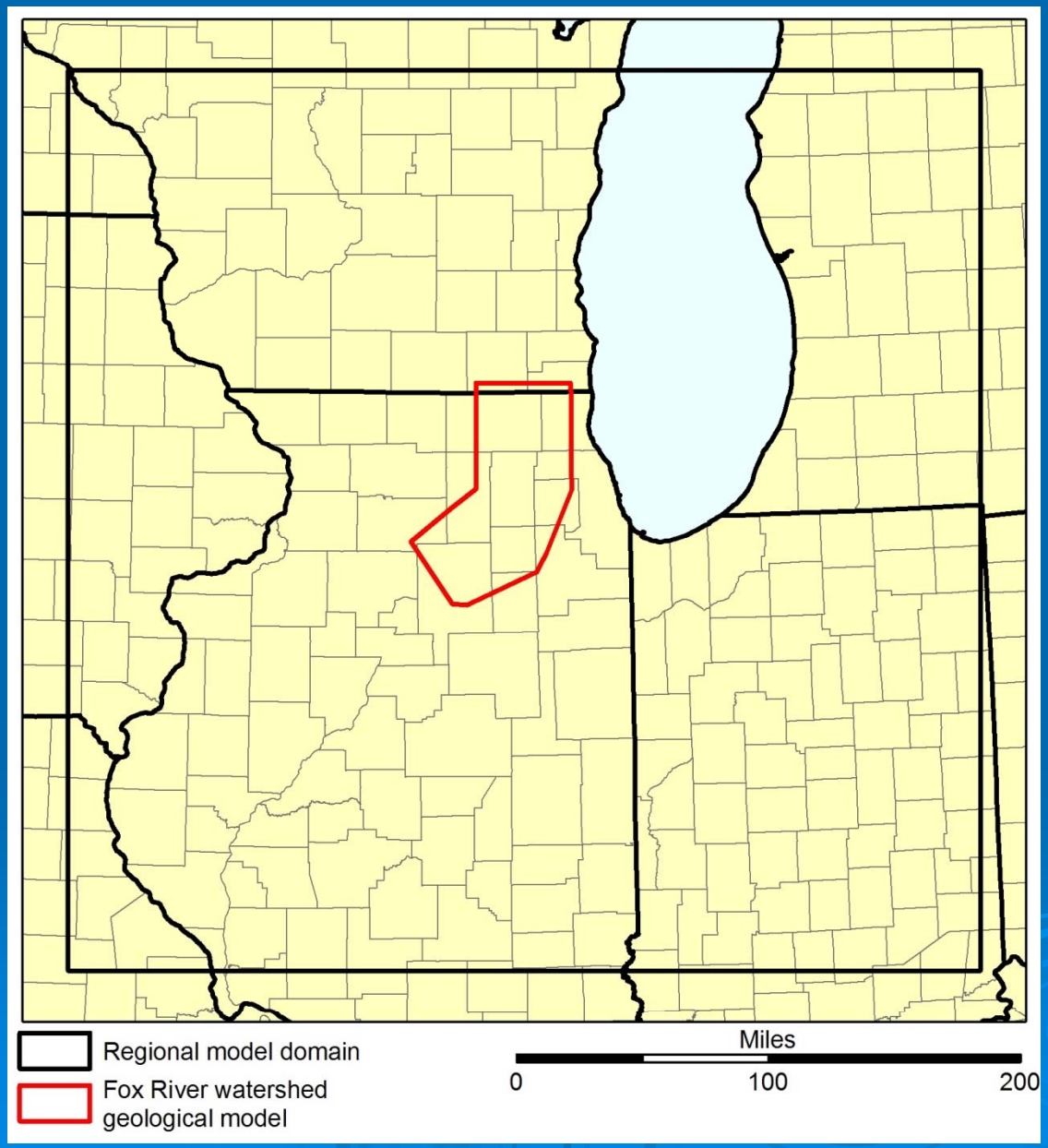
NE Illinois Regional Model with Fox River Basin



NE Illinois Regional Model with Fox River Basin and Fox River Basin Geologic Model



NE Illinois Regional Model with Fox River Basin Geologic Model



Thanks!

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