

# Future Opportunities, Policy Directions, and General Discussion

**Wisconsin Lakes Convention 2008**



# LAKE LEVELS

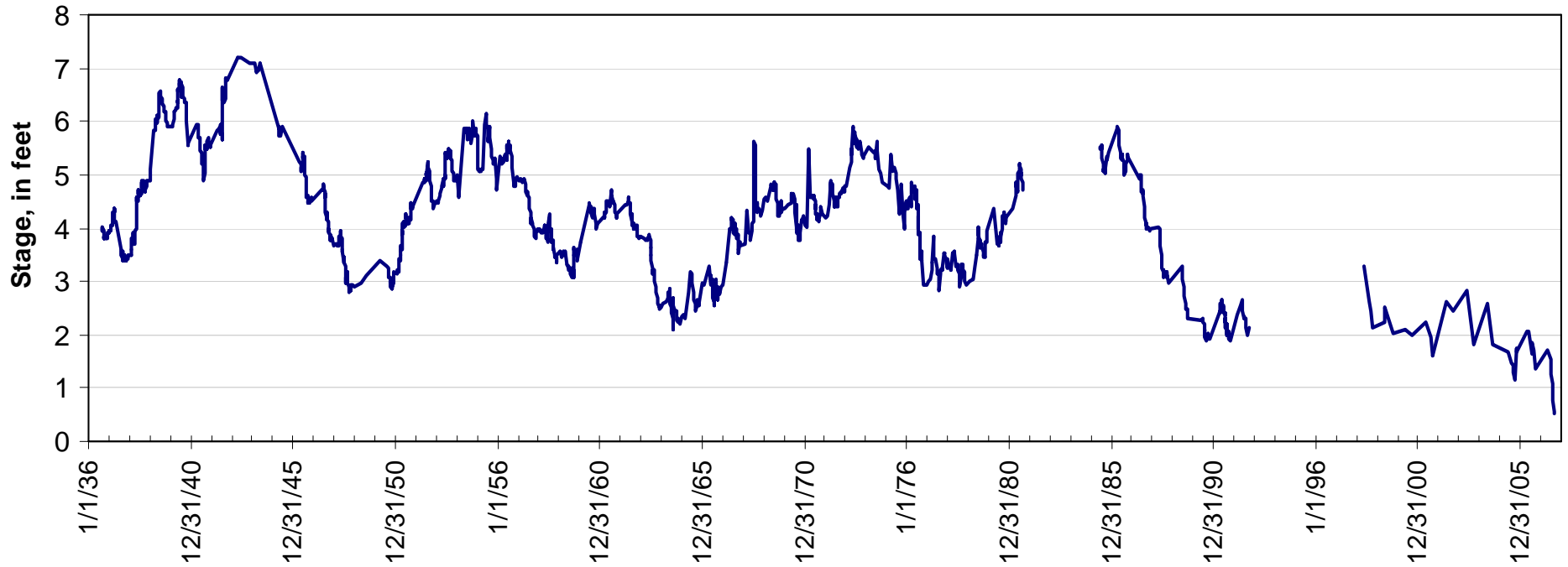
PROPOSED LAKE-LEVEL  
MONITORING NETWORK

# Problem

There is no consistent long-term lake-level monitoring network in the State. Seepage lakes are most problematic and have large fluctuations in water level caused by the cumulative effect of climatic factors over years or tens of years.

# Anvil Lake, Vilas County, lake levels 1936-2007

Anvil Lake Stages, 1936-2007



# Objectives

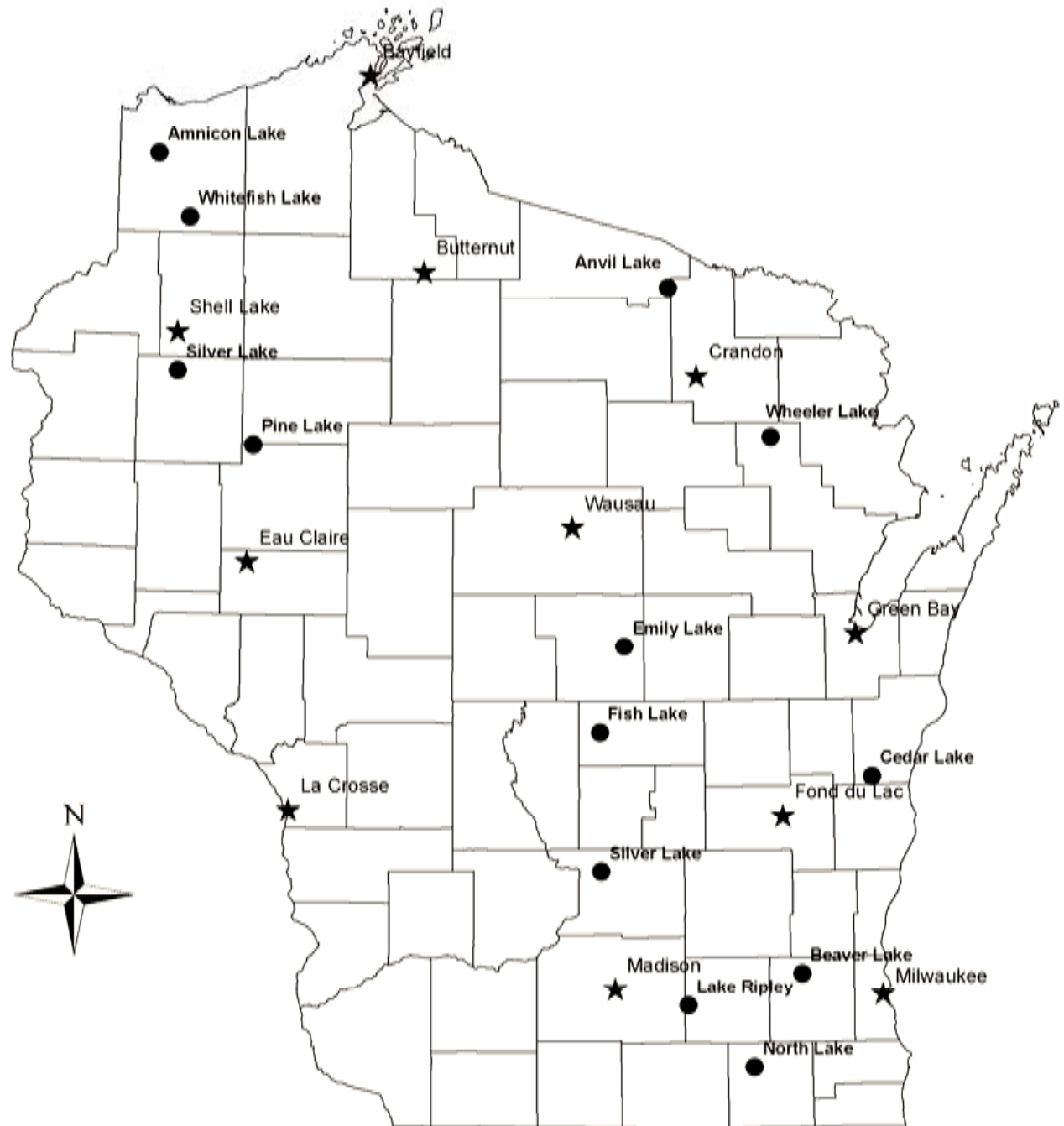
- Establish a lake-level monitoring network to evaluate trends in various regions of the state. Emphasis will be on relatively natural seepage lakes, which are most responsive and can give indications of climatic/hydrologic change following a regional pattern.
- Establish baseline conditions for environmental studies and comparison with short-term results.
- Increase the understanding of different lake hydrologic systems and how they affect lake water levels

Water level  
read from  
staff gage  
by observer



About  
10-13  
index  
lakes

Mostly  
natural  
seepage  
lakes



Basic network may be used to add more lakes to increase coverage of geographic areas or to include lakes having specific problems

- **Cost**

Install: \$1860 per Site

Operate: \$1630 per Site





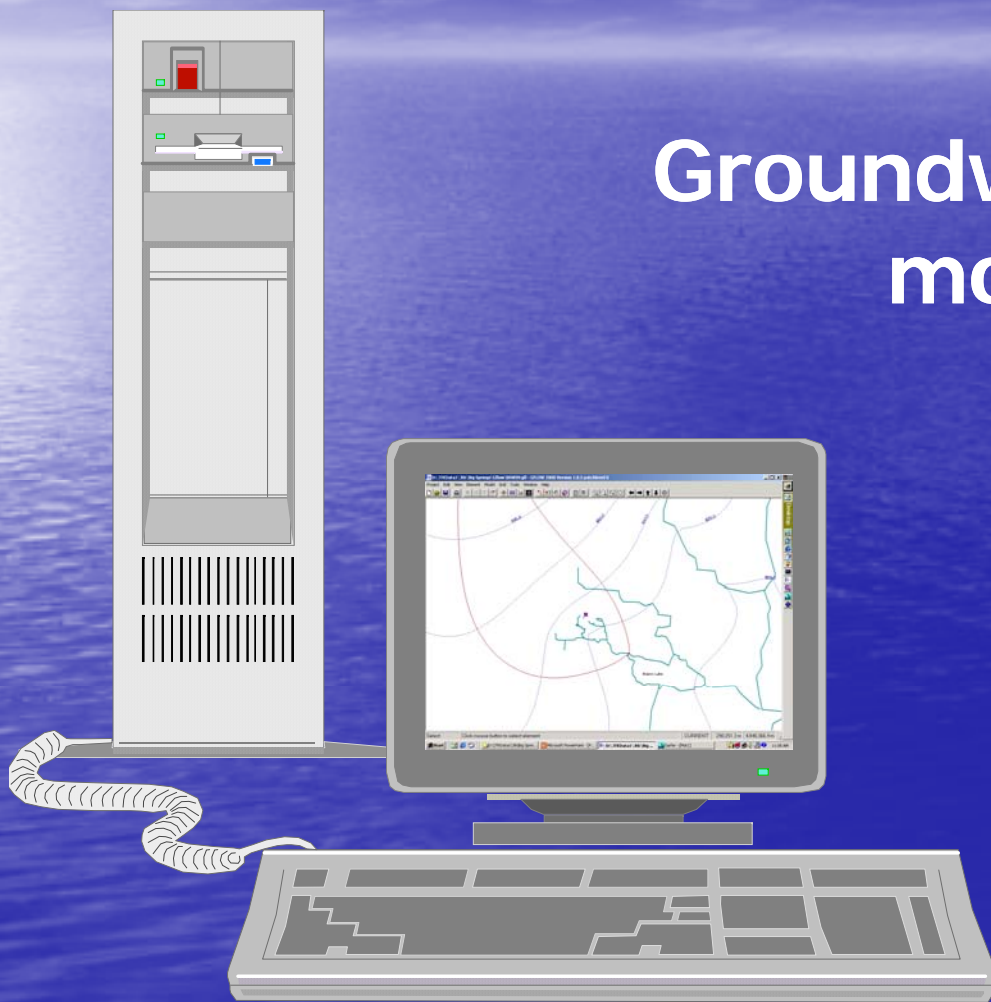
Should this part go in tools?

# **Groundwater Monitoring and Modeling**

**The Value of Long-Term Monitoring in the Development of Ground-Water-Flow Models**

By Daniel T. Feinstein, David J. Hart, and James T. Krohelski

# Groundwater flow models



Jim Krohelski  
Randy Hunt  
Chuck Dunning  
Paul Juckem  
Daniel Feinstein  
*wi.water.usgs.gov*

# Groundwater Flow Models

- Darcy's Law - Water flows downhill
- Continuity – Mass Balance;  $IN=OUT$
- Numerical equations representing streams, wetlands, wells, etc.
- Extensive data requirements - "GI/GO"
- Quantifies system / Predictions
- Highlights areas where more and what type of data are needed

# Model Development

- “Take your best guess” - Interpretation of hydrologic data
- “Draw a picture” - Conceptual model development
- “Keep it as simple as possible” - one layer?, multiple layers?
- “Build the machine” - Model development
- “Constrain the arm waving” - Calibration and sensitivity analysis

# Simulating groundwater-lake interactions with models: MODFLOW and Analytic Element Approaches

R.J. Hunt, H.M. Haitjema, J.T. Krohelski, and  
D.T. Feinstein

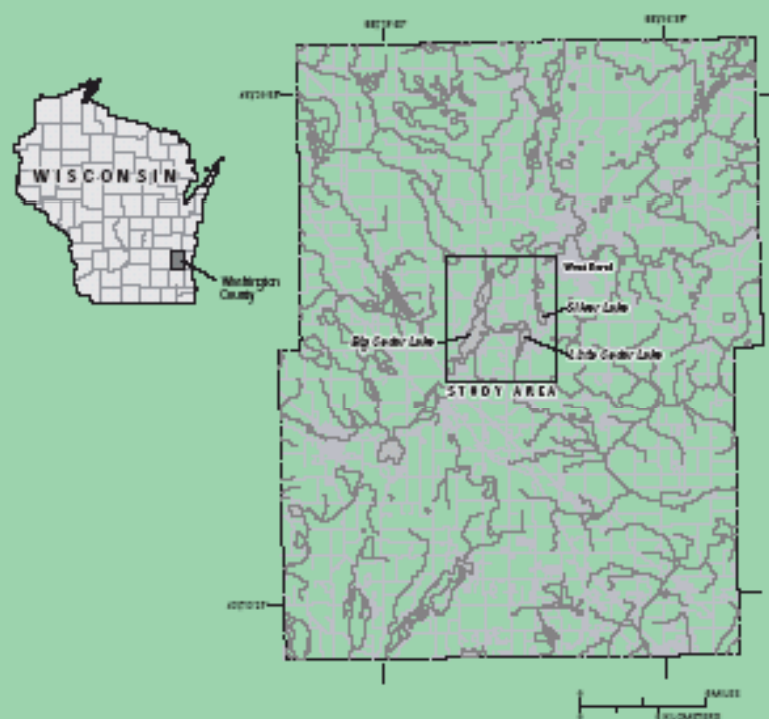


The Indiana University School of  
**Public and Environmental Affairs**

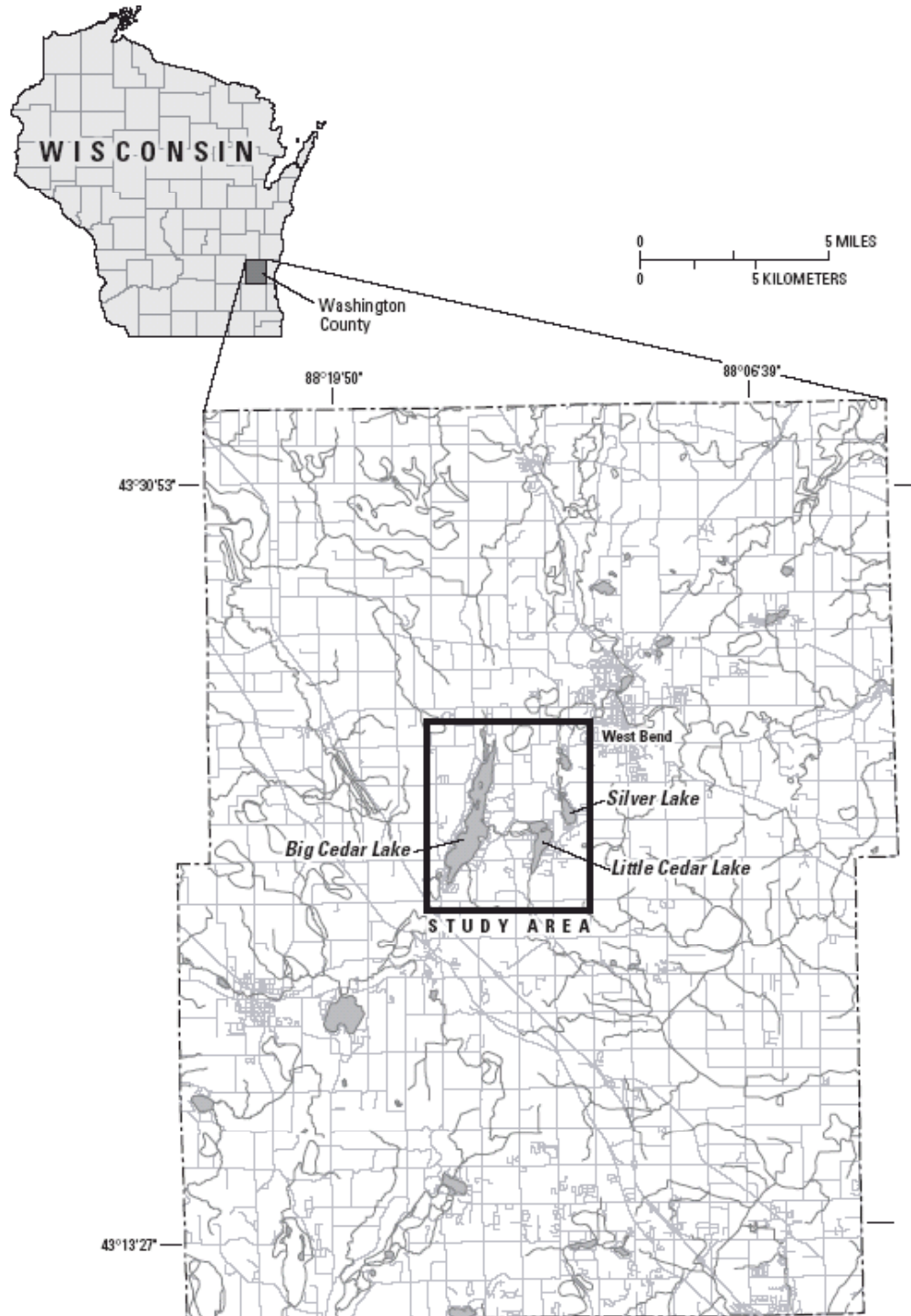
U.S. Department of the Interior  
U.S. Geological Survey

## Simulation of the Shallow Aquifer in the Vicinity of Silver Lake, Washington County, Wisconsin, Using Analytic Elements

Water-Resources Investigations Report 02-4204

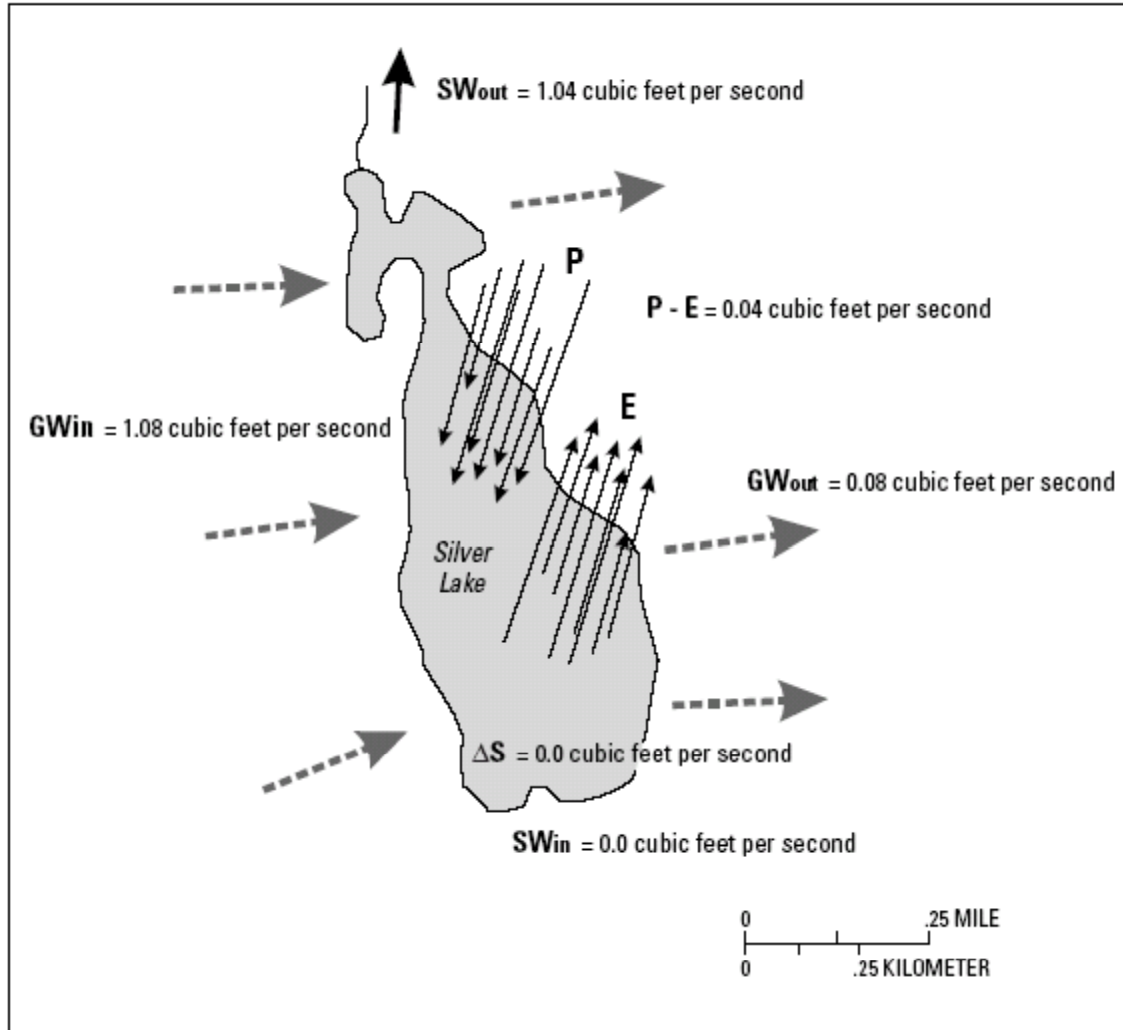


Prepared in cooperation with the  
Silver Lake Protection and Rehabilitation District





# Silver Lake Study, Washington County



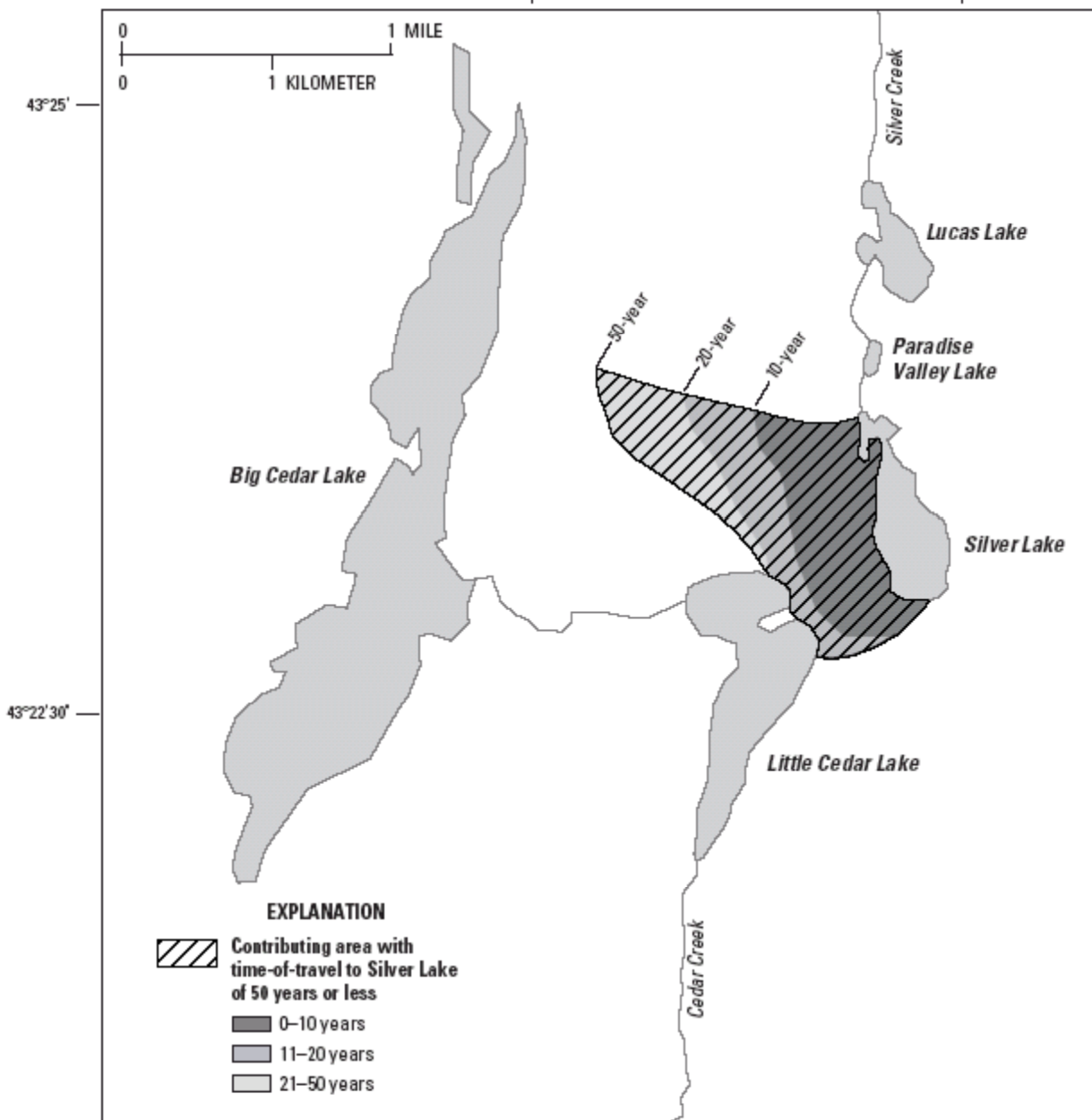
## EXPLANATION

- Precipitation
- Evaporation
- Direction of ground-water flow
- Direction of surface-water flow

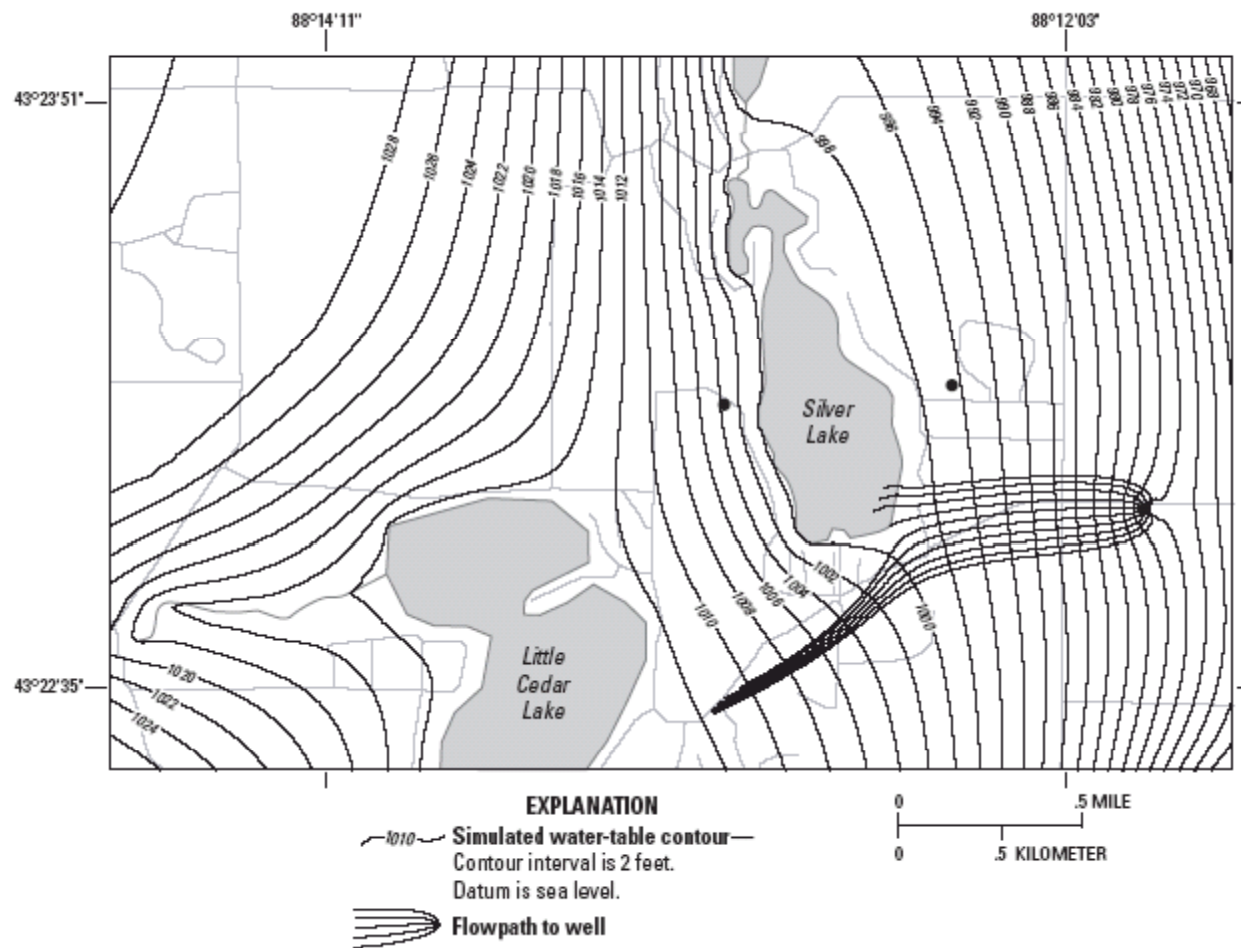
## Equation definitions

- GW<sub>in</sub>** Ground-water flow into Silver Lake
- GW<sub>out</sub>** Ground-water flow out of Silver Lake
- SW<sub>in</sub>** Surface-water flow into Silver Lake
- SW<sub>out</sub>** Surface-water flow out of Silver Lake into Silver Creek
- P** Precipitation falling on the surface of Silver Lake
- E** Evaporation from the surface of Silver Lake

*Silver Lake Study,  
Washington County*



*Silver Lake Study,  
Washington County*



**Figure 11d.** Simulated fully-penetrating well pumping 75 gallons per minute from southeast side of Silver Lake, Washington County, Wisconsin.



Southeast Wisconsin  
Regional Planning  
Commission

*UW*  
Extension

WISCONSIN GEOLOGICAL  
AND NATURAL HISTORY SURVEY



science for a changing world

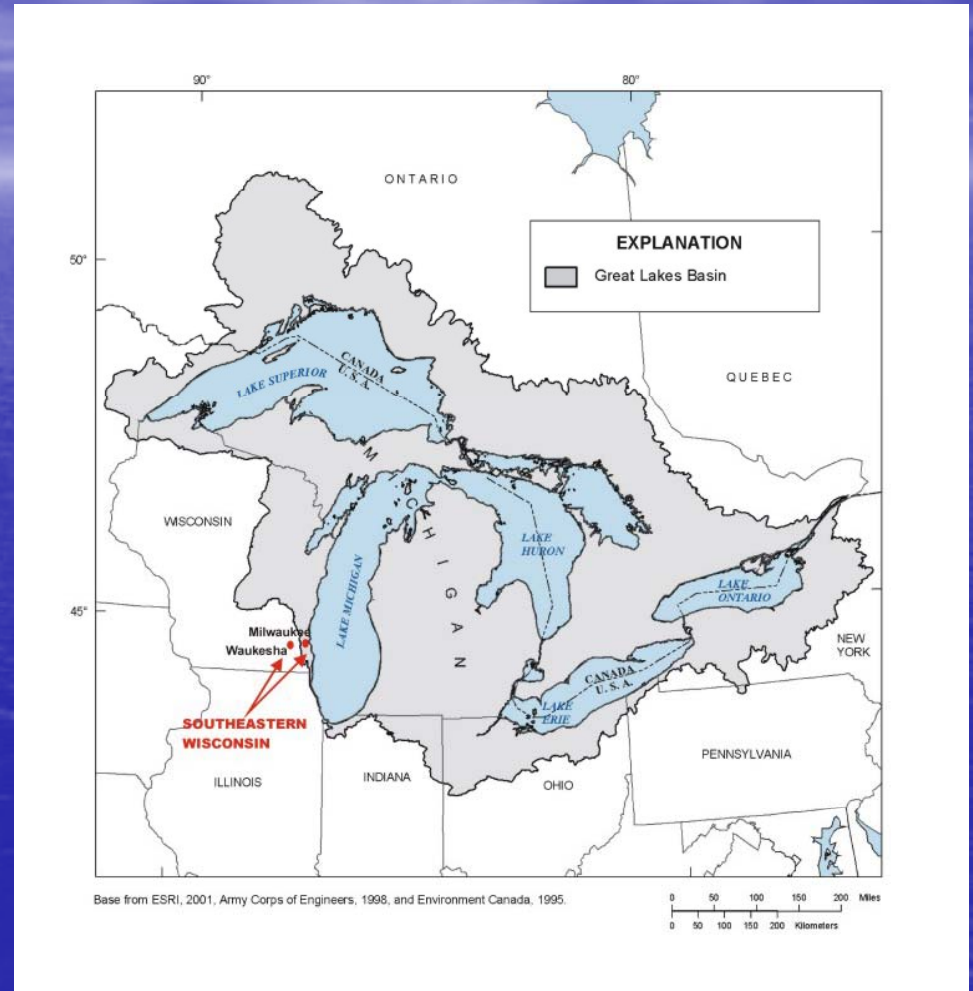


Great Lakes  
Protection Fund



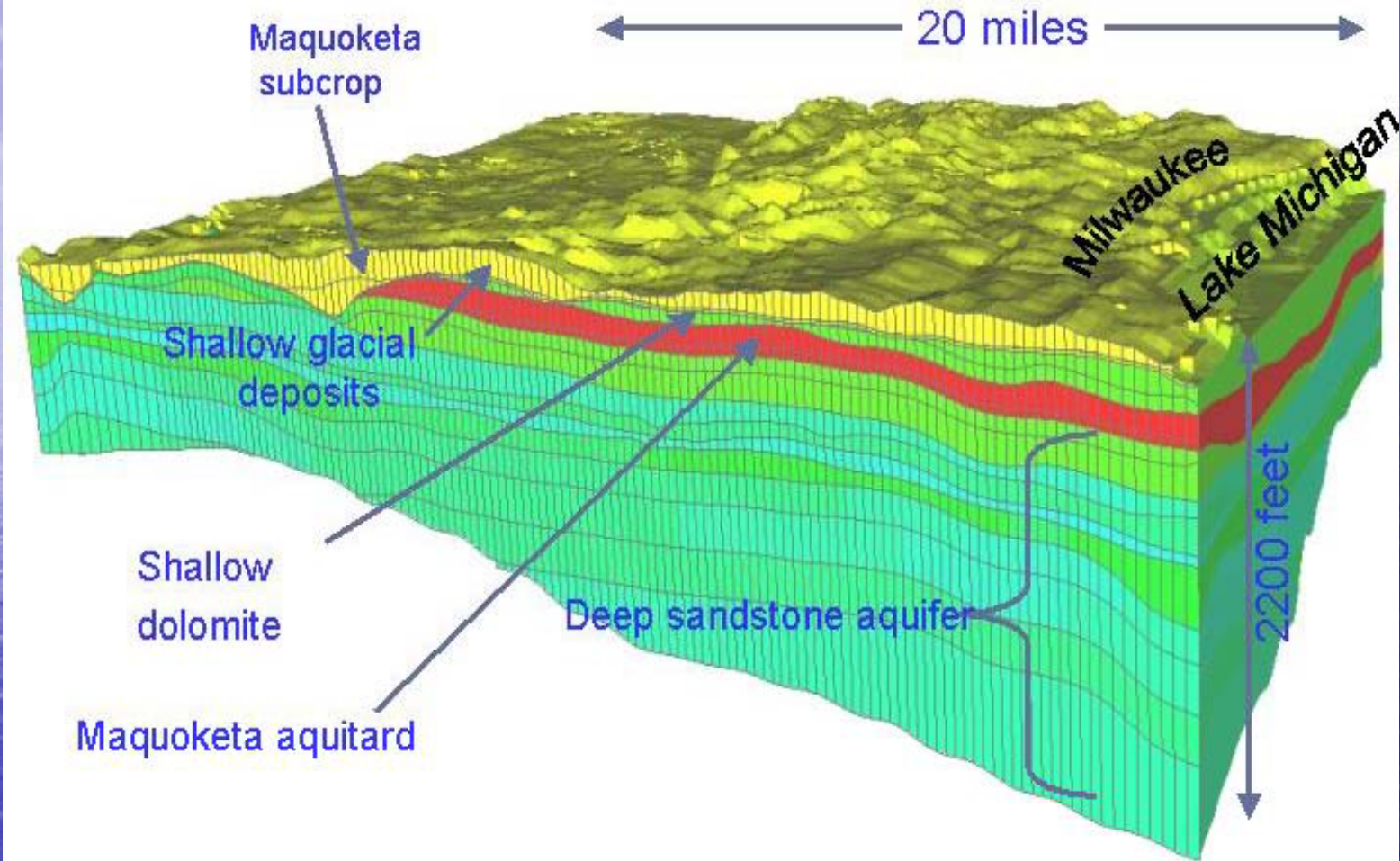
Water Resources of Wisconsin

## Ground water in the Great Lakes Basin: The case of southeastern Wisconsin



<http://wi.water.usgs.gov/glpf/>

## General hydrogeology of southeast Wisconsin

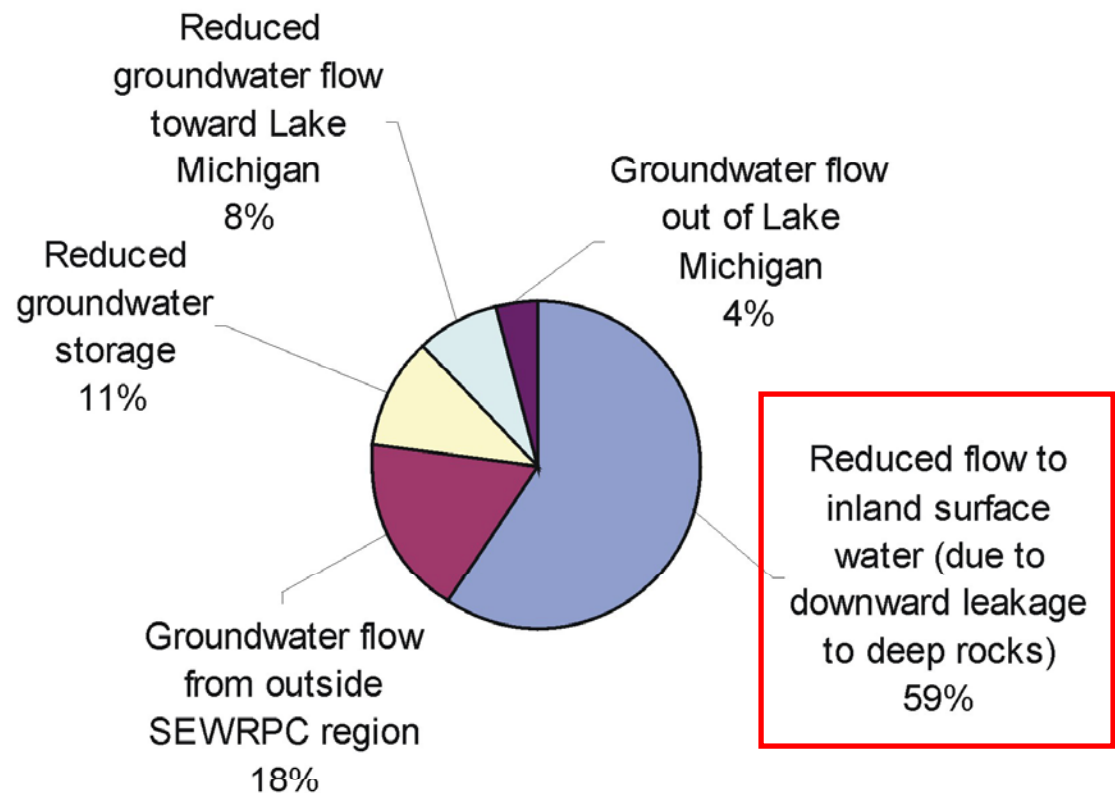


Hydrostratigraphy.....

*Ken Bradbury, WGNHS*

# Groundwater Budget for Deep Part of Flow System in SE Wisconsin

**Deep pumping in 7-counties of SE Wisconsin = 33.33 mgd**





***STATEWIDE AND REGIONAL  
POLICY DIRECTIONS***

# *STATEWIDE AND REGIONAL POLICY DIRECTIONS*

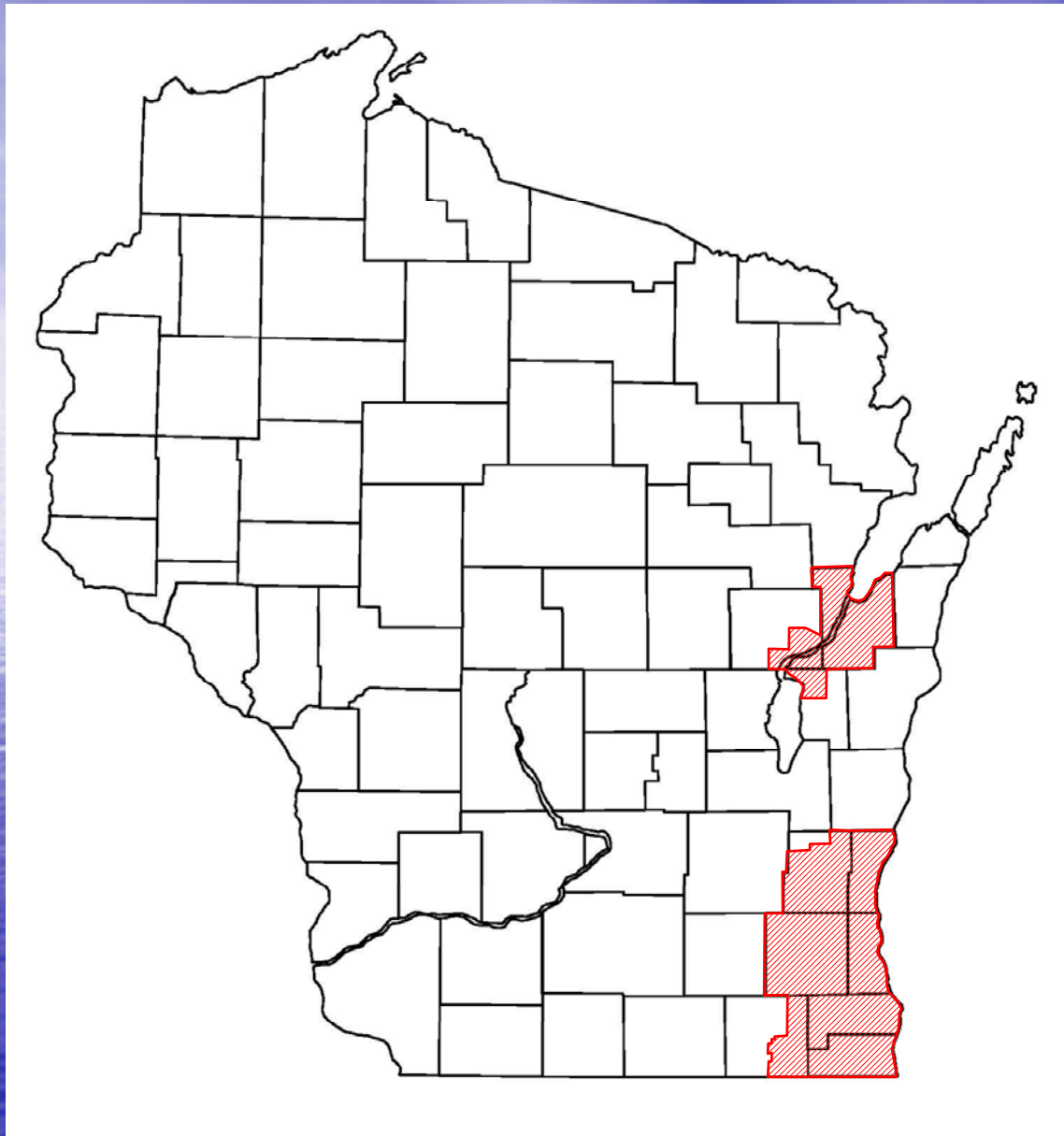
- ~~Cannot adversely impact a lake~~
- ~~Cannot adversely impact a stream~~
- ~~Cannot adversely impact a wetland~~
- ~~Cannot adversely impact a private water supply~~
- Cannot adversely impact a municipal water supply
- Approval – not a permit
- Properties – not wells



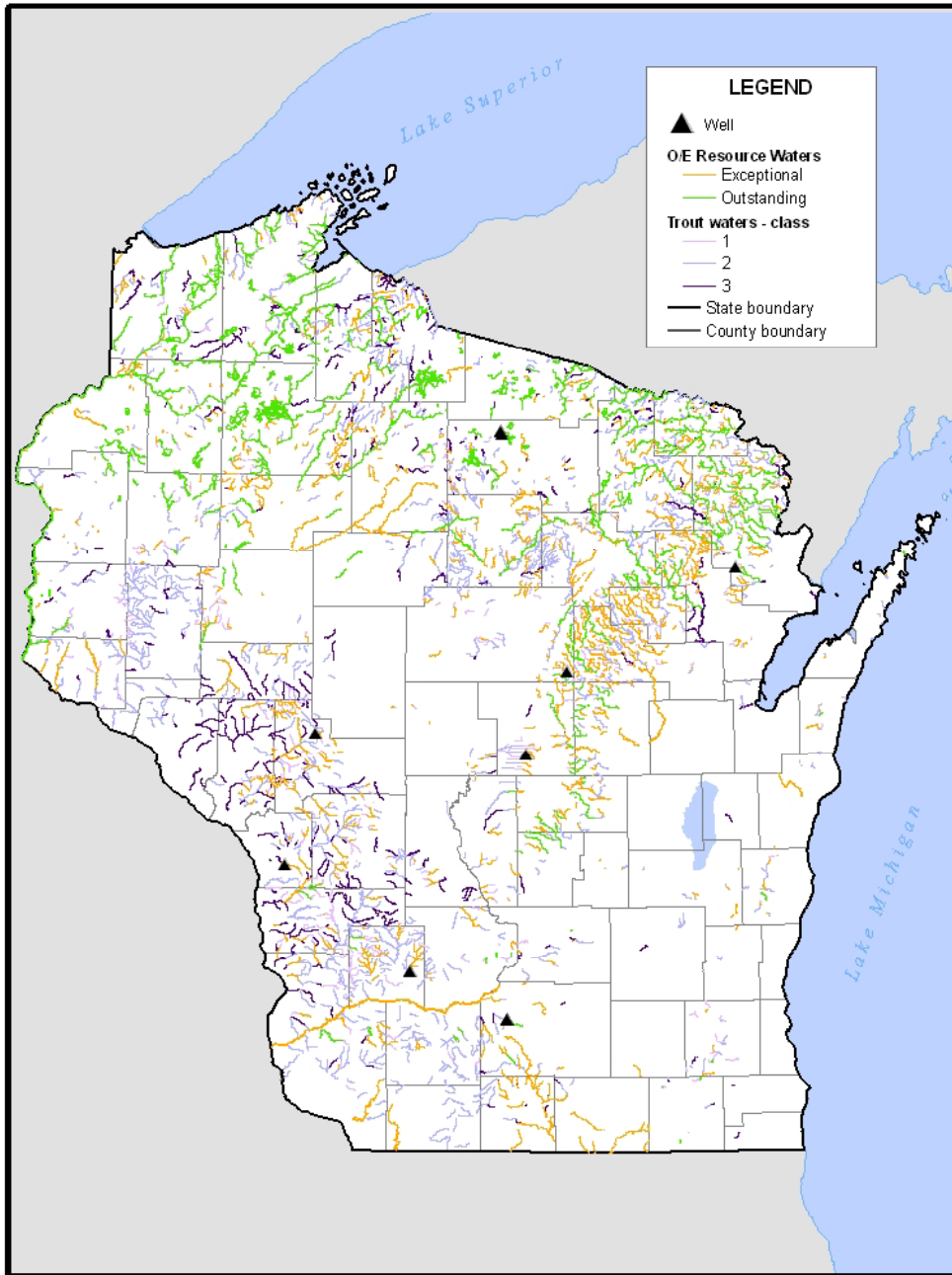
# *2003 ACT 310*

**Act 310 provided minimal protections**

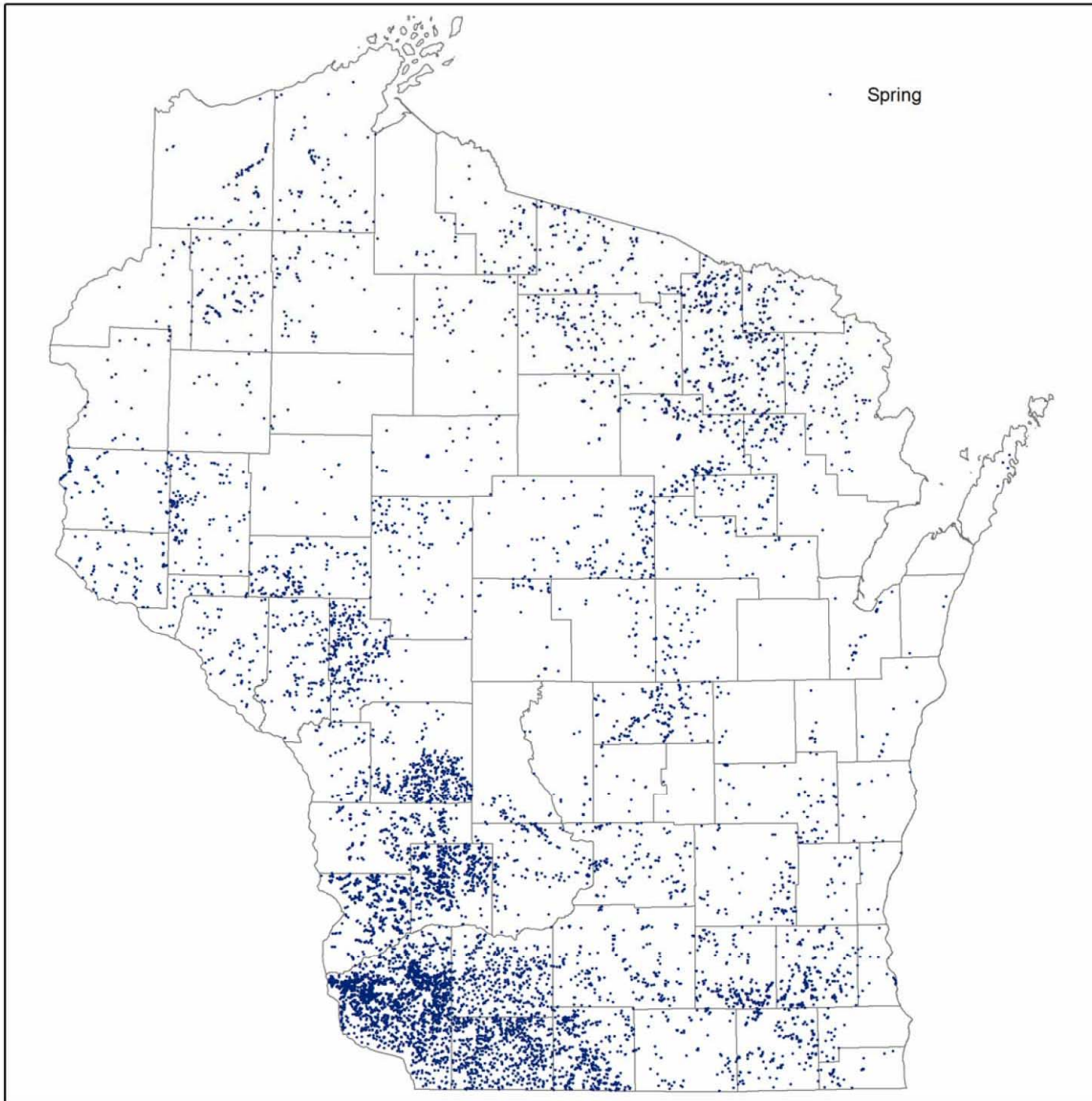
- **Created Groundwater Management Areas (GMAs)**
- **Created and “protected” Groundwater Protection Areas (GPAs) GPAs**
- **“Protected” springs**
- **Municipalities are exempted (mostly)**
- **Created the Groundwater Advisory Committee (GAC)**



***GROUNDWATER  
MANAGEMENT  
AREAS***



# ***GROUNDWATER PROTECTION AREAS***




## All Known Springs



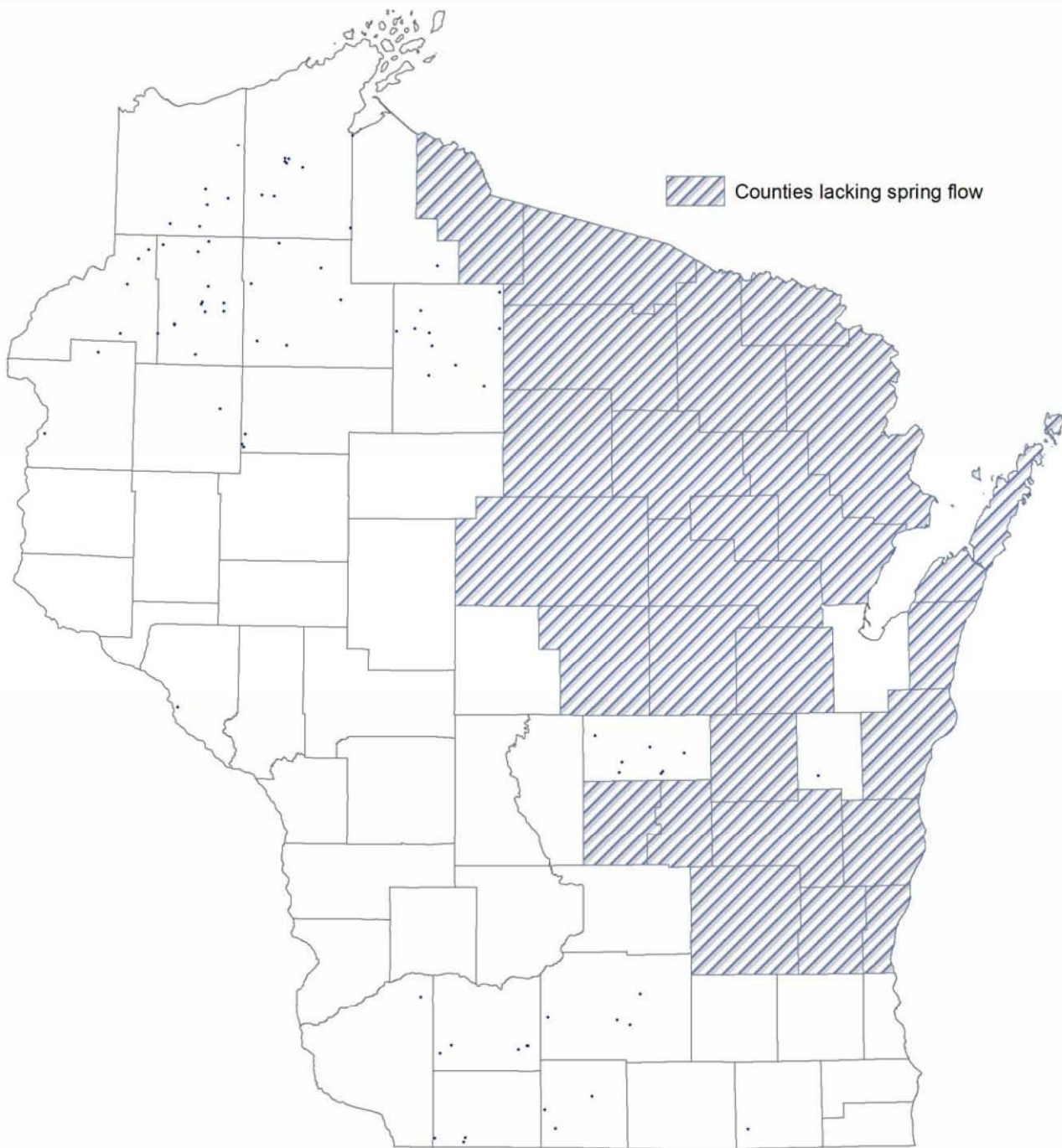
Number of springs: 10851

## Springs 1 CFS and Greater

 Counties lacking spring flow



Number of springs: 81



# ***GROUNDWATER ADVISORY COMMITTEE***

**14 MEMBERS – SELECTED BY THE  
GOVERNOR, SPEAKER OF THE ASSEMBLY &  
PRESIDENT OF THE STATE SENATE**

- 3 – Industry**
- 3 – Municipalities**
- 3 – Agriculture**
- 3 – Environmental**
- 1 – Driller**
- 1 – DNR**

# ***GROUNDWATER ADVISORY COMMITTEE***

***April 2005 – December 2006***

## **BIGGEST ISSUES:**

- **ADDITION OF NEW GMAs**
- **MODIFYING CRITERIA**

# ***GROUNDWATER ADVISORY COMMITTEE***

***April 2005 – December 2006***

**REPORT SUBMITTED TO THE LEGISLATURE  
ON DECEMBER 31, 2007:**

- RECOMMENDATIONS FOR FUNDING**
- RECOMMENDATIONS FOR GOALS AND OBJECTIVES**
- RECOMMENDATIONS FOR PROCESS TO BE RELIEVED OF GMA STATUS**



# ***GROUNDWATER ADVISORY COMMITTEE***

***2007***

- **GPAs**
- **SPRINGS**
- **WELL APPROVALS**
- **SIGNIFICANT  
ENVIRONMENTAL IMPACT**
- **FUNDING**

# ***GROUNDWATER ADVISORY COMMITTEE***

***2007***

## **GPA's**

- **SHOULD THE 1200-FOOT RULE BE CHANGED?**
- **SHOULD ANY OTHER FEATURES BE ADDED?**

# ***GROUNDWATER ADVISORY COMMITTEE***

***2007***

## **SPRINGS**

- **WHAT DOES "NEAR" MEAN?**
- **SHOULD THE 1 CFS CRITERION BE CHANGED?**

# ***GROUNDWATER ADVISORY COMMITTEE***

***2007***

## **WELL APPROVALS**

- **REPORTING REQUIREMENTS**
- **GROUNDWATER MONITORING REQUIREMENTS**
- **REVIEW/RENEW PROCESS FOR WELLS IN A GPA**

# ***GROUNDWATER ADVISORY COMMITTEE***

***2007***

**REPORT SUBMITTED DECEMBER 31, 2007:**

- **CONSENSUS ITEMS**
- **A SERIES OF POSITION PAPERS**
- **THE RULES ARE WORKING?**

# ***GROUNDWATER ADVISORY COMMITTEE***

## ***ACCOMPLISHMENTS***

### **GROUNDWATER PROTECTION AREAS:**

- Retains an arbitrary setback, not based in hydrogeologic logic
- Springs still 1 cfs or greater
- Very rudimentary evaluations of well applications at the DNR
- Still grant approvals
- No new GPAs

# Future Directions

- Better science and understanding
  - Lake and groundwater level monitoring
  - Quantify impacts of pumping on regional scale
  - Identify lakes vulnerable to pumping
- Pursue lake-specific management options
  - Physical/engineering approaches
  - Cooperative arrangements among water users
  - Mitigation/contingency plans in dry periods
- Regional/Statewide regulations and incentives
  - Better oversight of individual water extractions
  - Coordinated water management

# Questions?

