Groundwater Science Meets Public Policy in Wisconsin

Ken Bradbury
Wisconsin Geological and Natural History Survey,
University of Wisconsin-Extension

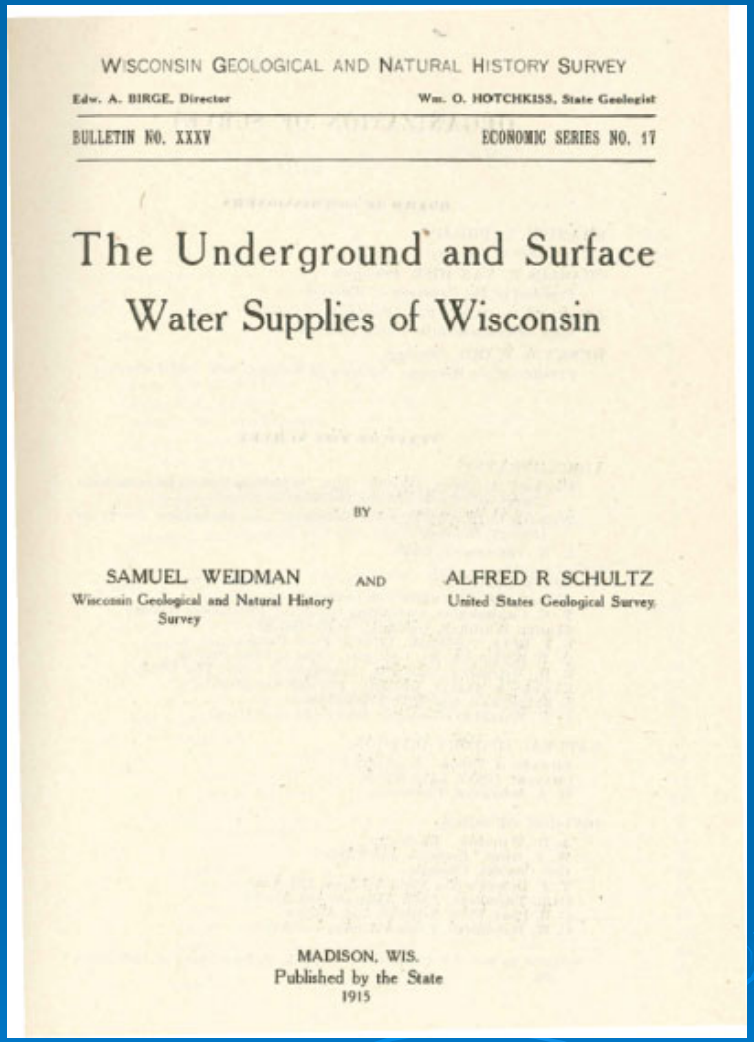
UW Extension
Wisconsin Geological and Natural History Survey

57th Annual
Midwest Ground Water Conference
October 1-3, 2012 ♦ Minneapolis, Minnesota

Wisconsin has a rich history of hydrogeologic studies and widespread availability of both data and technical expertise for water resources management.

Citizens and scientists usually expect informed management of water resources to be based on sound science and careful technical evaluations.

However, several recent events in Wisconsin demonstrate continuing disconnects between groundwater science and public policy decision-making.



WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

Edw. A. BIRGE, Director — Wm. O. HOTCHKISS, State Geologist

BULLETIN NO. XXXV — ECONOMIC SERIES NO. 17

The Underground and Surface Water Supplies of Wisconsin

BY

SAMUEL WEIDMAN, Wisconsin Geological and Natural History Survey — AND — ALFRED R SCHULTZ, United States Geological Survey

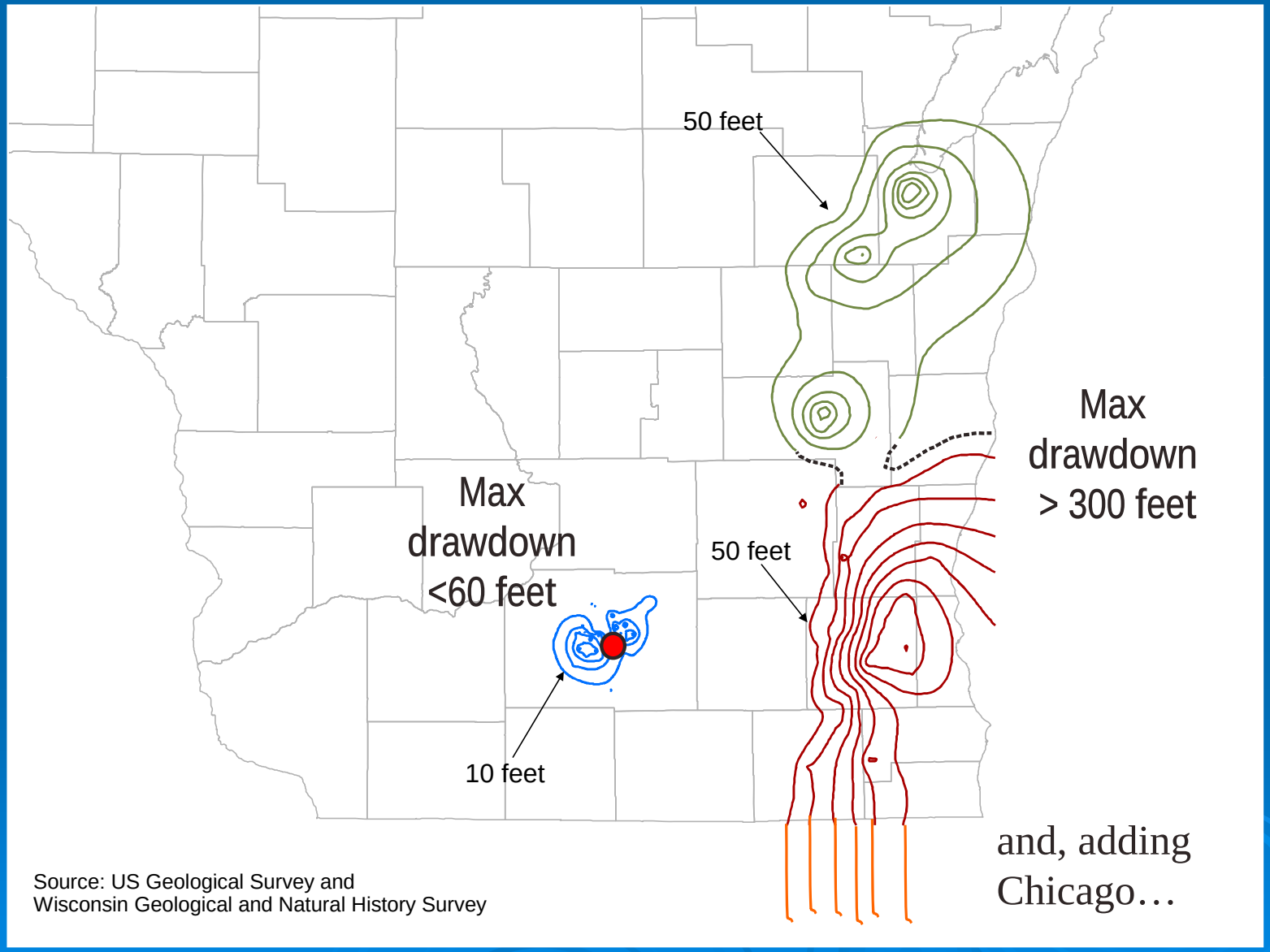
MADISON, WIS.
Published by the State
1915

Weidman and Schultz, 1915

- Inability of a legislatively mandated advisory committee to reach consensus on groundwater quantity management issues
- Failure of proposed 2010 legislation to revise high-capacity well approval policy
- Ongoing arguments over the relationships between irrigation pumping, climate, and surface water impacts
- Groundwater contamination issues in areas of karst and shallow fractured rock
- Legislative reversal of disinfection requirements from municipal water systems

academic.evergreen.edu

Regional declines in water levels:



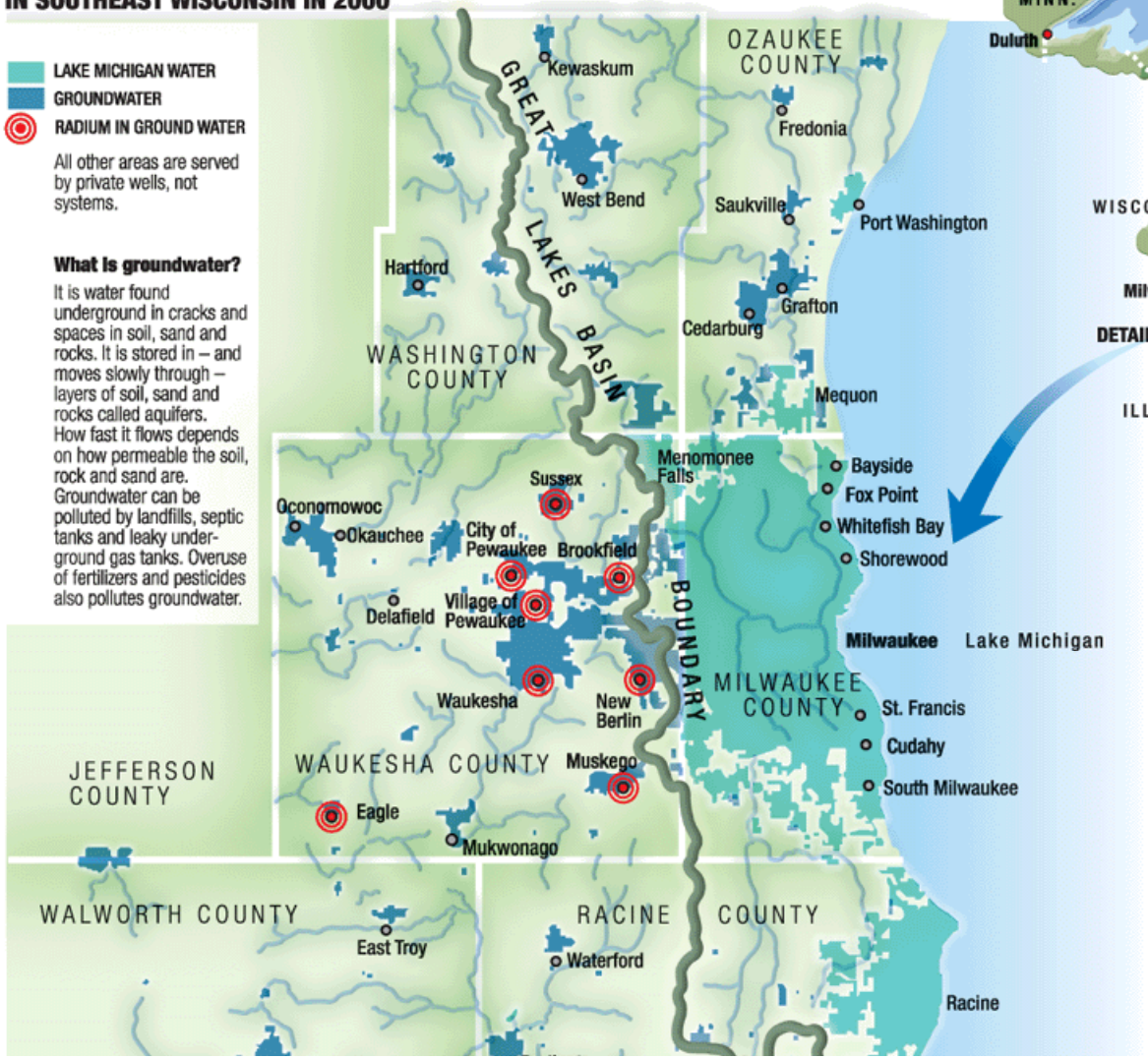
Source: US Geological Survey and
Wisconsin Geological and Natural History Survey

DIVIDED OVER WATER

A GROWING DEMAND, A LIMITED RESOURCE

The eyes of the region are on the subcontinental divide, the line that runs through southeastern Wisconsin and around the Great Lakes, separating those who are entitled to Great Lakes water from those forced to suck from a shrinking and increasingly contaminated groundwater supply. Emerging water shortages in Milwaukee's western suburbs could become particularly acute in the next decade. That could force politicians to rethink how they will balance protection of one of the nation's great natural resources with basic needs of their constituents. "The experience in Milwaukee and its suburbs is going to be a test case for the entire Great Lakes region," says Michael Donahue, president of the Great Lakes Commission.

SOURCES OF PUBLIC AND PRIVATE WATER SUPPLY SYSTEMS IN SOUTHEAST WISCONSIN IN 2000



THE GREAT LAKES

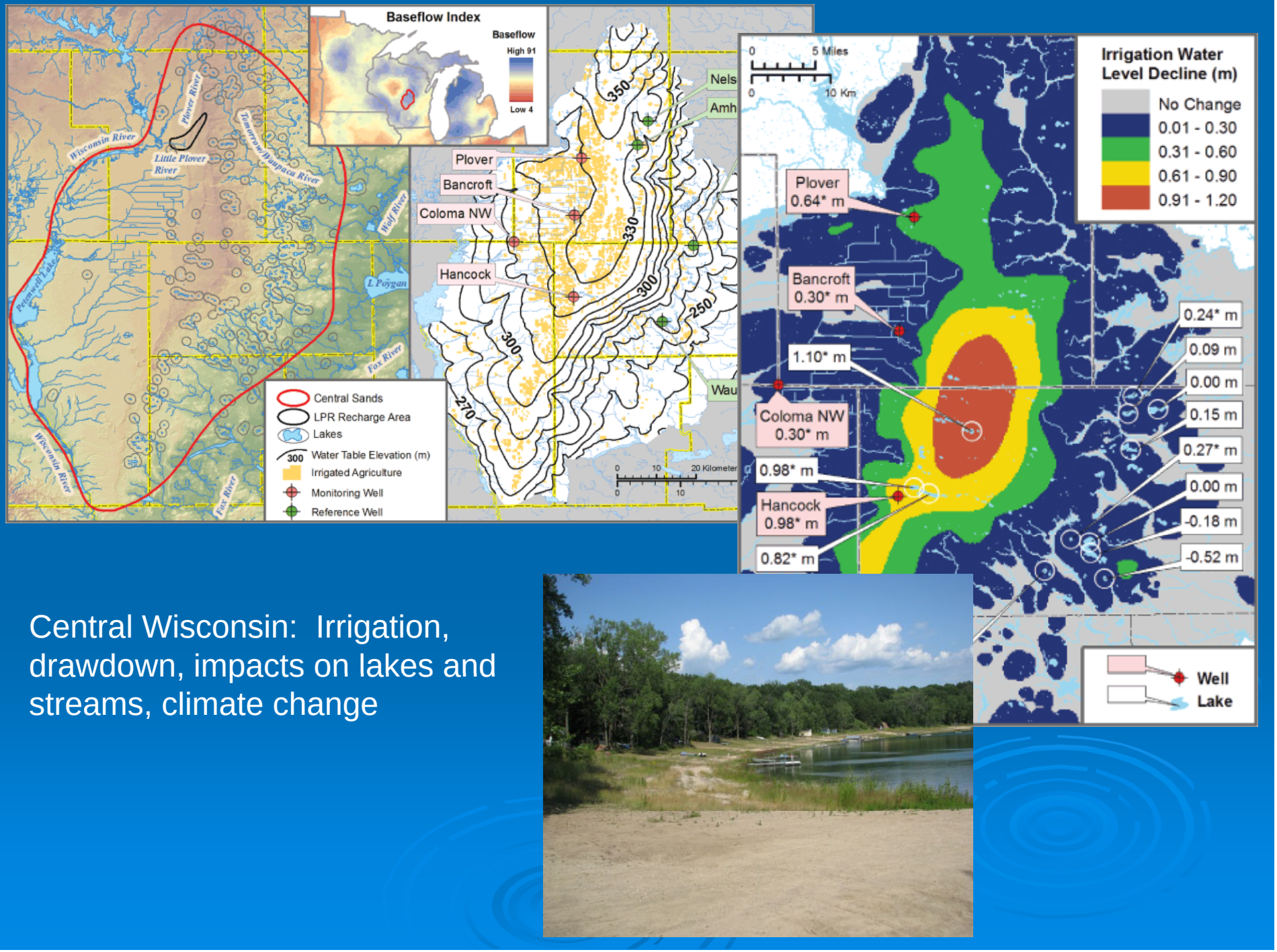
The five lakes that span more than 740 miles from west to east – Superior, Michigan, Huron, Erie and Ontario – have shaped the development of the United States and Canada. To the early European explorers and the millions today who call the region home – one-tenth of the U.S. population and one-fourth of the Canadian population – the Great Lakes have been the key source of a single most important commodity: water.

As the earth's largest system of fresh water, with roughly 18% of the world supply, the lakes hold about 5,500 cubic miles of water, enough to cover a 94,000 square-mile area or sink the continental U.S. under 10 feet of water.

WISCONSIN AS A GREAT LAKES STATE

Wisconsin is one of the eight American Great Lakes states. It enjoys a vast reservoir of fresh water and resources for commercial shipping and recreational activities, owing primarily to its 1,017-mile shoreline on its two bordering lakes, Superior and Michigan. Milwaukee County draws water from Lake Michigan, but surrounding local communities outside the Great Lakes Basin do not have the same access.

Milwaukee Journal, Nov, 2003



Central Wisconsin: Irrigation, drawdown, impacts on lakes and streams, climate change

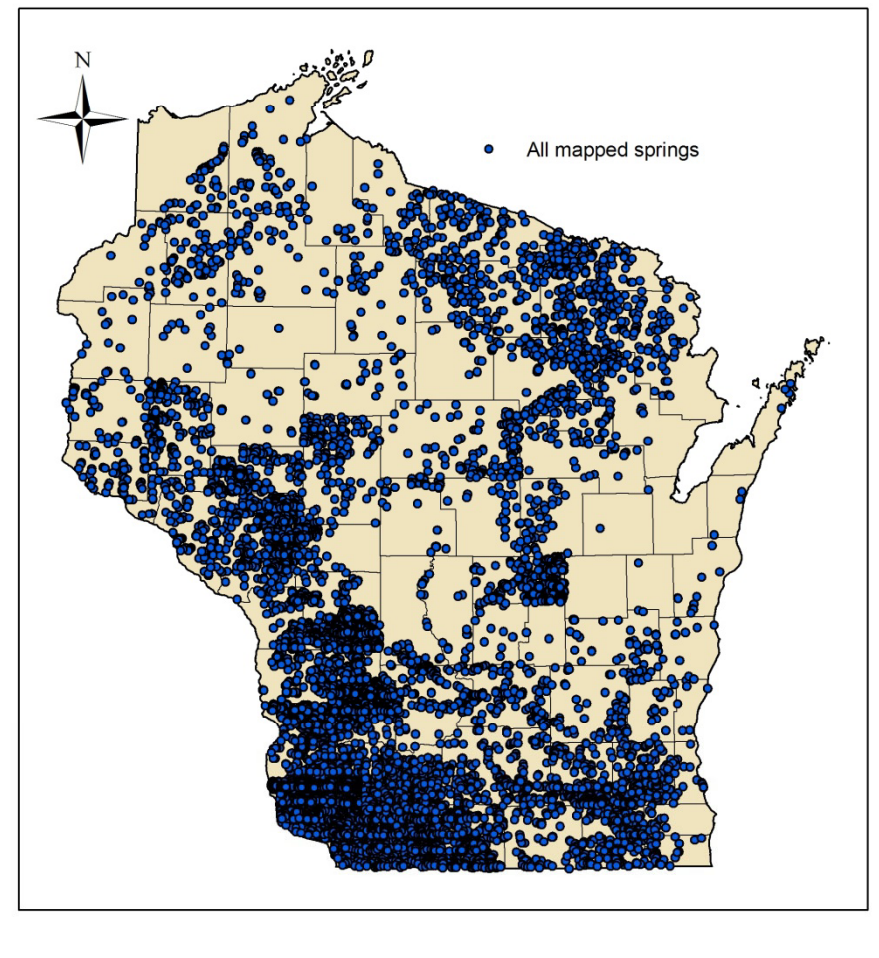
Springs in Wisconsin

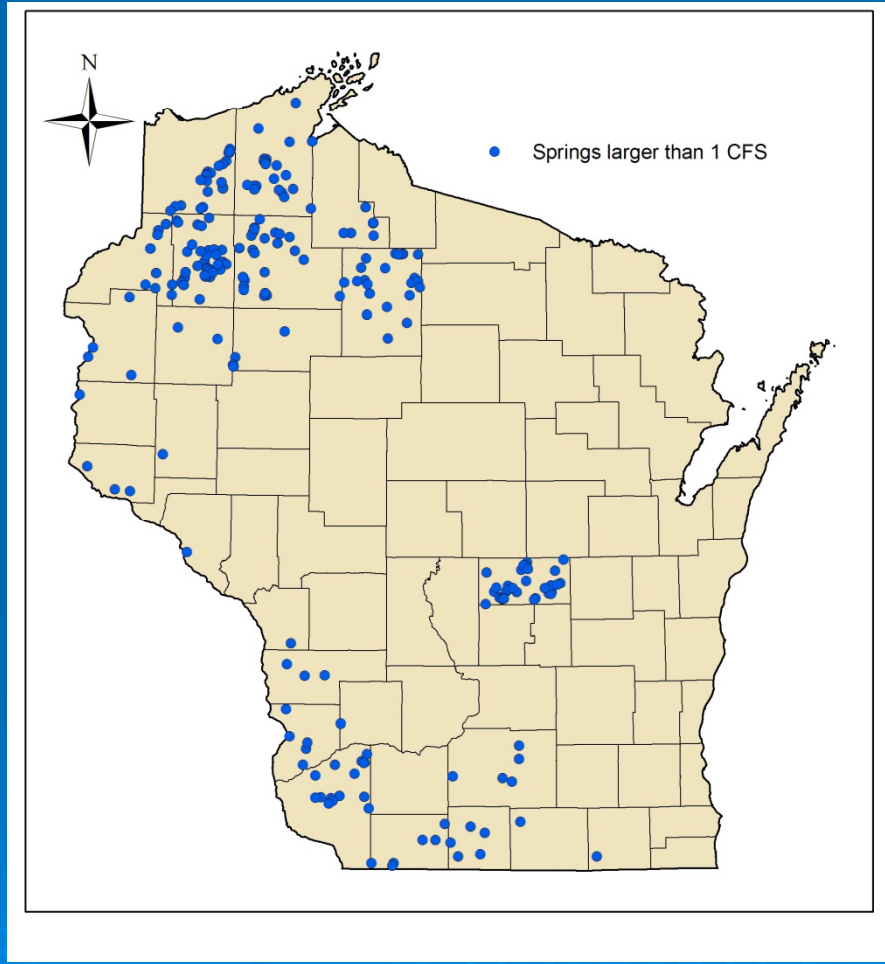
-over 10,800 springs identified

-most have flow less than 1 CFS

-almost no springs have enough data for flow duration analysis

Technical consensus on 0.25 CFS as a reasonable flow criterion.





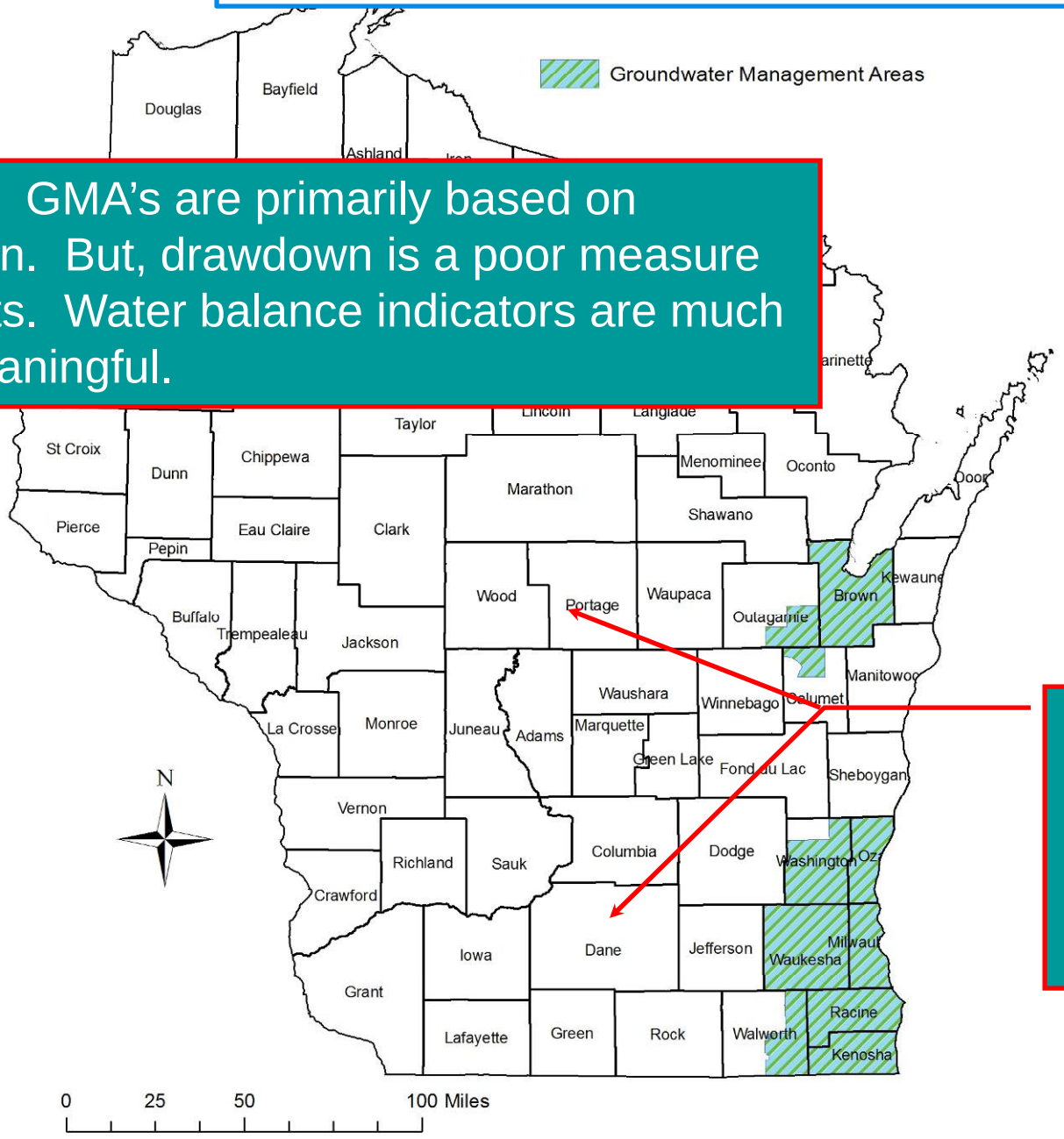
235 springs = 2% of total

Background: Wisconsin Act 310

- The “Groundwater Quantity Law”
- Passed State legislature in 2003
- Enhanced the State’s authority to regulate groundwater quantity
- Created two groundwater management areas
- Lacked details
- Directed formation of a Groundwater Advisory Committee (GAC)

Groundwater Management Areas

Problem: GMA's are primarily based on drawdown. But, drawdown is a poor measure of impacts. Water balance indicators are much more meaningful.



Dane County and Little Plover River are Groundwater Attention Areas

Groundwater Advisory Committee (GAC)

- Charged with evaluating Act 310
- Representatives from
  - Environmental groups
  - Agricultural groups
  - Municipalities
  - Well drilling
  - Industry
  - DNR
- Technical Advisory Committees

GAC visits a Fitchburg spring

GAC actions – 2006-2007

Consensus: Need for coordinated statewide water policy

- -balance competing uses
- -rely on sound science
- -encourage efficiency; discourage waste
- -provide for coordination among agencies
- -seek to insure future supply

No Consensus:

- -Statewide water conservation program
- -Existing regulatory framework
- -Need for hydrogeologic analysis of all high-capacity wells
- -Expanding groundwater protection around springs
- -Definition of a spring

Why this lack of consensus?…

- There was no way to determine whether Act 310 was working because there had been little true monitoring
- A desire for the “status quo”; no change
- Concern that more rigorous protection of springs would harm economic development
- Belief that rigorous analysis of the impacts of new wells was not practical or necessary, or that sufficient data was not available.
- A fear or mistrust of models

State of Wisconsin
2009 - 2010 LEGISLATURE

LRB-4094/1
RCT/RNK/MDK:kjf&nwn:md

2009 ASSEMBLY BILL 844

- set out criteria for *Groundwater Management Areas (GMAs)*. Within these areas local stakeholders would develop goals and a groundwater management strategy.
- set out criteria for *Groundwater Attention Areas (GAAs)*. GAAs are areas having common geology and groundwater issues where groundwater problems are “on the horizon” but are not yet severe.
- defined a “qualifying spring” as having a discharge of 0.25 cfs or more.
- allowed people to petition the DNR for environmental review of proposed high-capacity wells

State of Wisconsin
2009 - 2010 LEGISLATURE

LRB-4094/1
RCT/RNK/MDK:kjf&nwn:md

2009 ASSEMBLY BILL 844

- opposed by some major agricultural and industry groups
- arguments over local vs state management of groundwater management areas
- concerns about fairness – new users vs existing users
- died in committee

Politics

POLITICS MAIN

Wisconsin legislators scuttle updates to groundwater law

POLITICS | MAY 2, 2010 | BY: CLAYTON MONTEZ, M.A. | + Subscribe

The 2011 Lake Beulah decision

Village officials aim to locate a high capacity well in this proposed densely packed 149-lot subdivision.

Source: www.lakebeulah.org

Wisconsin Supreme Court finds that WDNR has the authority and a general duty to consider whether a proposed high capacity well may harm waters of the state

2011 WI 55

SUPREME COURT OF WISCONSIN

CASE NO.: 2009AP2021

COMPLETE TITLE:

Lake Beulah Management District,
Plaintiff-Appellant-Petitioner,

v.

Village of East Troy,
Defendant-Respondent.

Wisconsin Supreme Court Upholds Village of East Troy's High Capacity Well Permit; Finds WDNR Has a General Duty under Statute and the Public Trust Doctrine to Consider Impact to Waters of the State

Client Alert

July 11, 2011

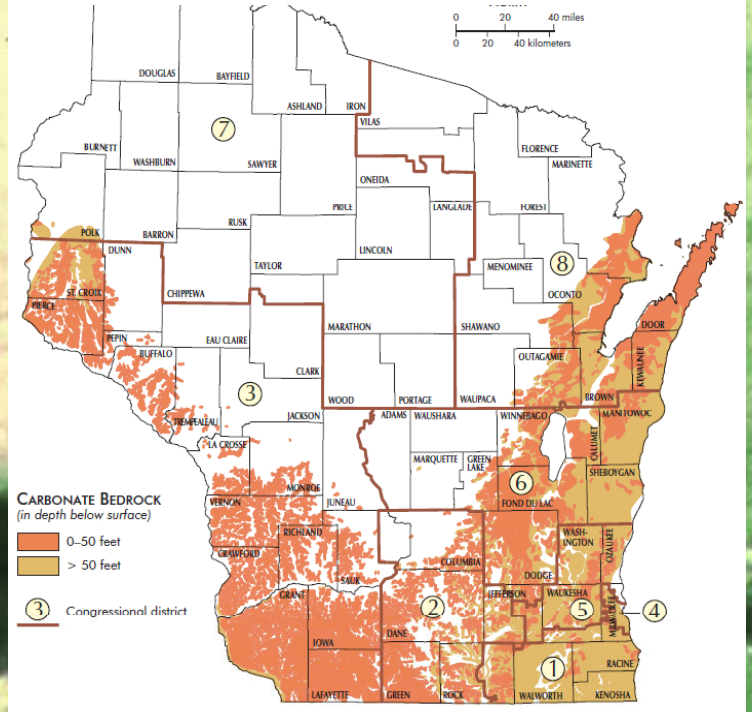
On July 6, 2011, the Wisconsin Supreme Court issued two decisions - *Lake Beulah Management District v. Dep't of Natural Res.*, 2011 WI 54 (July 6, 2011) and *Lake Beulah Management District v. Village of East Troy*, 2011 WI 55 (July 6, 2011).

In *Lake Beulah Management District v. Dep't of Natural Res.*, the Wisconsin Supreme Court ended an eight-year battle over the Wisconsin Department of Natural Resources ("WDNR") issuance of a high capacity well permit to the Village of East Troy near Lake Beulah. WDNR issued the Village a permit in 2005 for a well with a capacity of 1,440,000 gallons per day ("GPD"). The issue arose because Wisconsin's statutory scheme for permitting high capacity wells specifically requires WDNR to determine that proposed wells with the greatest pumping capacity (in excess of 2,000,000 GPD) will not adversely affect public water rights in navigable waters but no corollary requirement exists for high capacity wells below the 2,000,000 GPD threshold. In this decision, the Supreme Court extended the obligation to consider impacts to navigable waters when WDNR reviews applications for wells below the statutory 2,000,000 GPD threshold.

Fractured rock and karst issues

How should we make decisions about living and working in very susceptible environments?

Near-surface carbonate rock



2007 **contamination incident** at a restaurant near Egg Harbor.

Over 200 people were sickened with flu-like symptoms.

Viruses were found in the restaurant's well.

greenbay pressgazette.com

February 13, 2008

Residents still seeking answers

Concerns with Log Den septic system expressed at county meeting

By Deb Fitzgerald
deb@doorcountyadvocate.com.

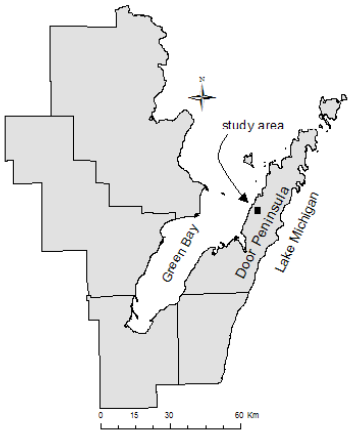
A group of frustrated homeowners asked the Door County Board of Health Committee Monday to stop the wastewater from flowing into the groundwater from the private septic system at the Log Den restaurant in Egg Harbor.

The Log Den system was deemed failing by the Door County Sanitarian's Office in late December for releasing wastewater into the groundwater.

The office issued an order to the Log Den owners, requiring them to repair or replace the system by June 30.

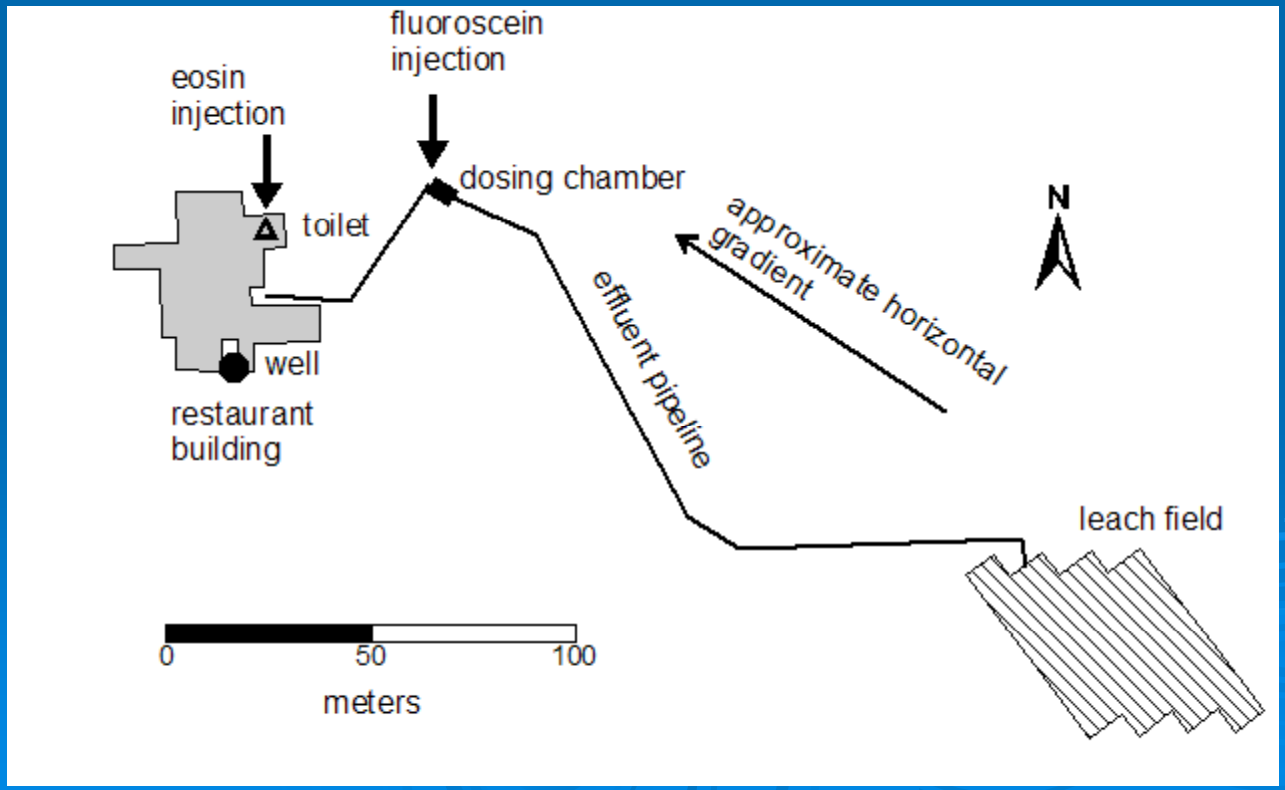
The homeowners who live in the area surrounding the Log Den said Monday they were not satisfied with the remedy.

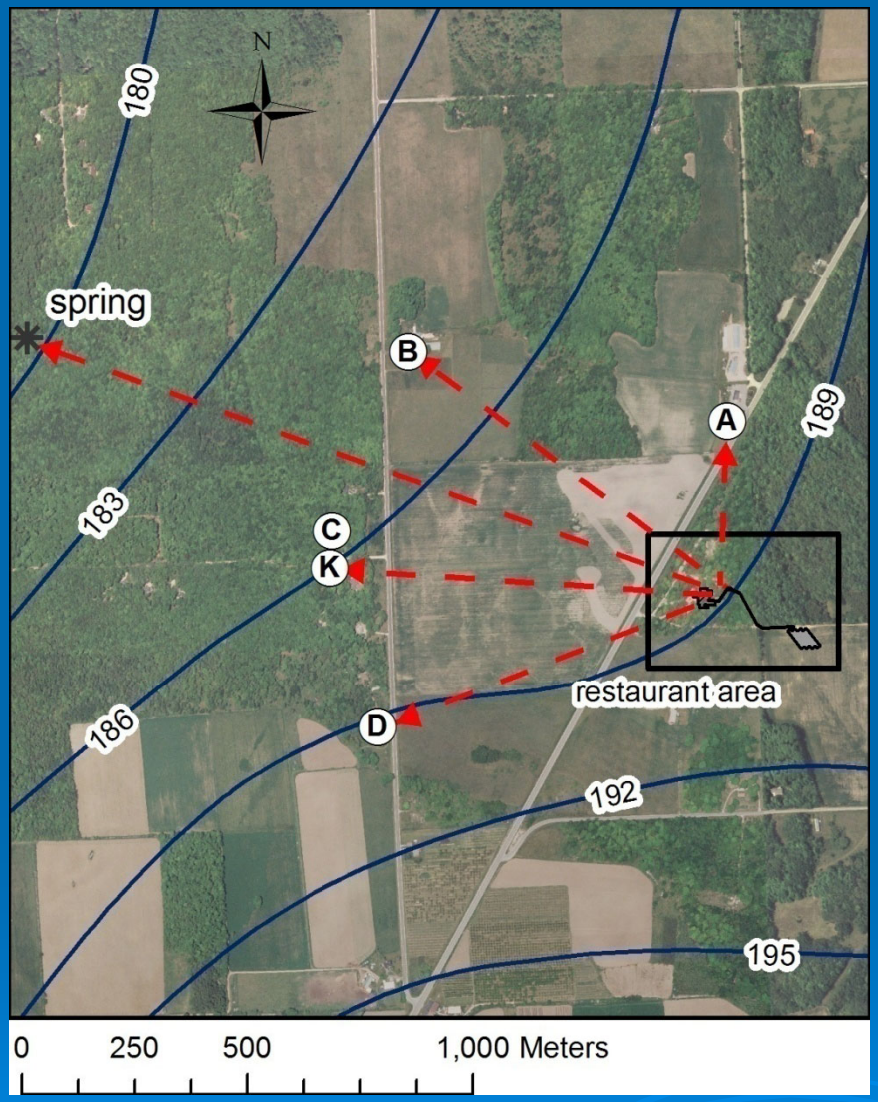
"That's totally unacceptable to allow a public healthcare problem to go unattended," for six months, said Al Goeppinger, who lives with his wife, Lynn, east of the Log Den on County Highway G in Egg Harbor.



Location of and well configuration at the Restaurant

Well downgradient of septic field





Dye tracer detections at offsite wells.

Calculated dye velocities ranged from 3 to 41 feet/day.

Septic experts concluded that this system, after repairs, meets codes and is operating correctly.

Publication: Borchardt and others, 2011. Norovirus outbreak caused by a new septic system in a dolomite aquifer. *Ground Water*, v 49, no 1, pp 85-97.

Significance of the restaurant incident

- Human illness (virus infection) was unequivocally linked to viruses in well water
- The local septic system contributed the viruses to groundwater
- The travel time from the septic system to the well was about 10 days
- Even if the septic system had functioned properly, the viruses would likely not have been removed.

Implication: Current septic codes are inadequate to protect groundwater from virus contamination

NE WI Karst Task Force

- Recommendations
  - primarily intended to minimize groundwater contam… from pathogens and … water”
  - secondarily intended… minimize groundwat… contamination from …

Final Report of the

Comments

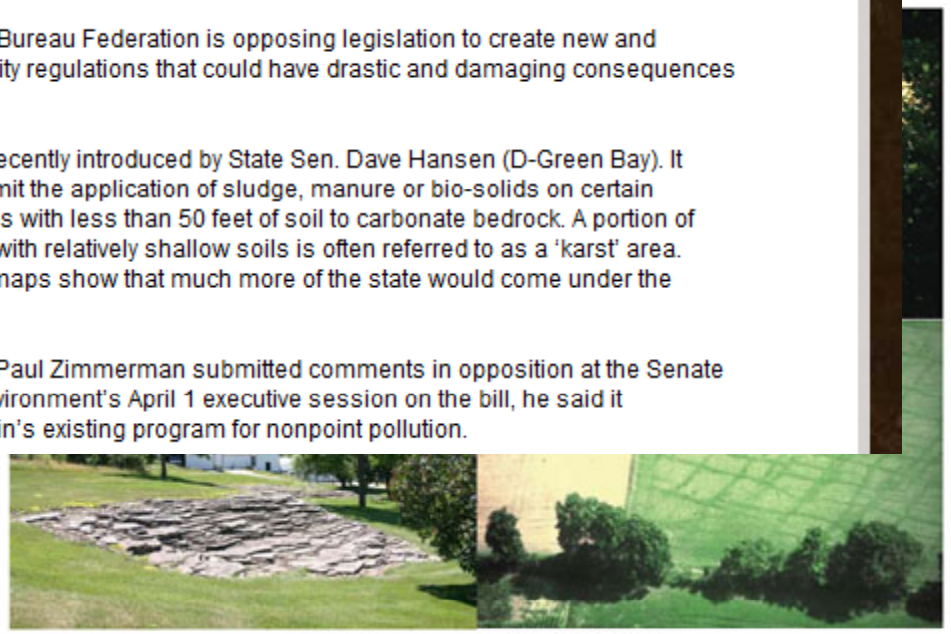
Farm News: Farm Bureau Opposes Karst Legislation

Posted: 04.05.2010

The Wisconsin Farm Bureau Federation is opposing legislation to create new and duplicative water quality regulations that could have drastic and damaging consequences for agriculture.

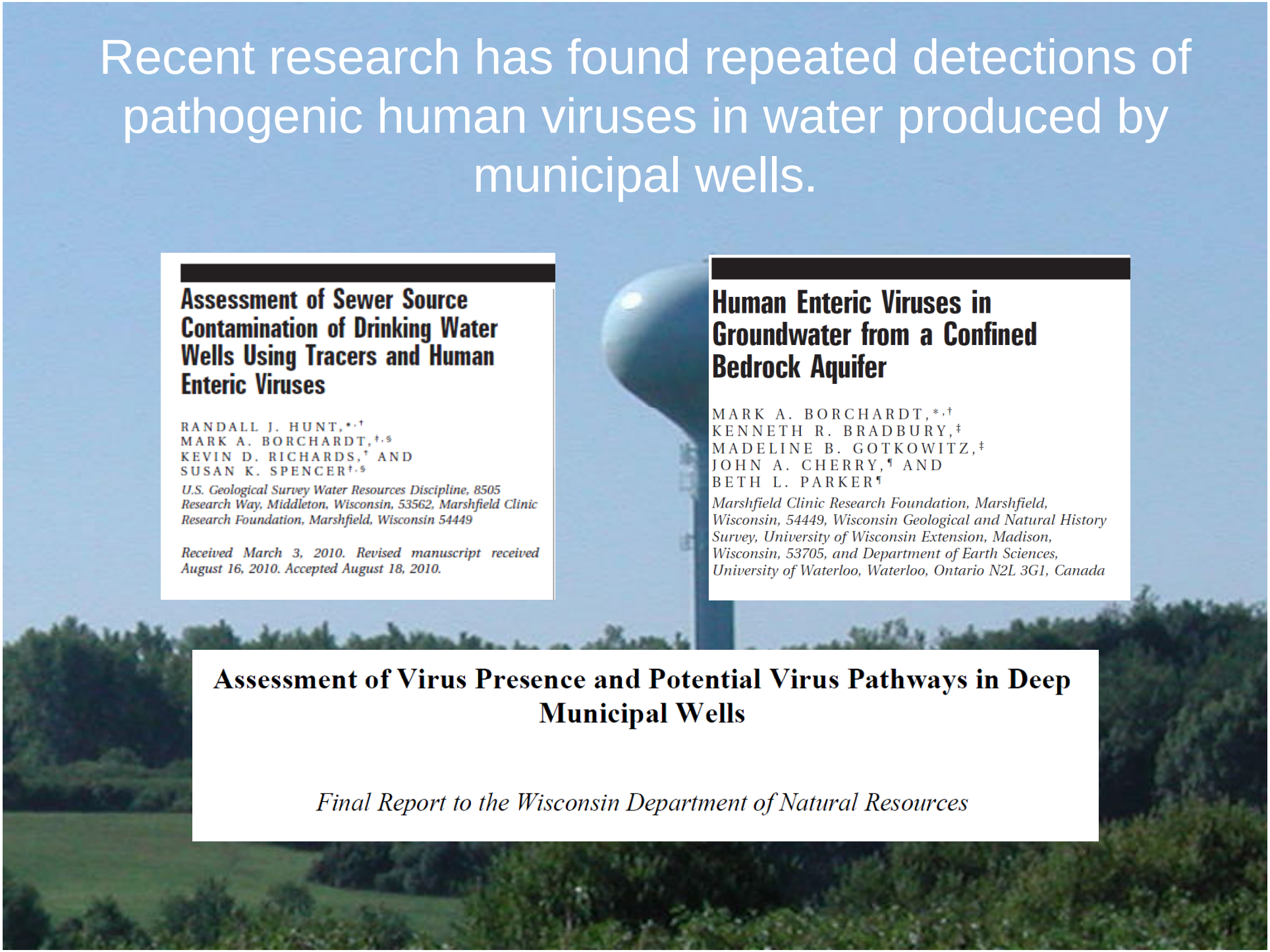
Senate Bill 632 was recently introduced by State Sen. Dave Hansen (D-Green Bay). It seeks to prohibit or limit the application of sludge, manure or bio-solids on certain Wisconsin landscapes with less than 50 feet of soil to carbonate bedrock. A portion of northeast Wisconsin with relatively shallow soils is often referred to as a ‘karst’ area. However, geological maps show that much more of the state would come under the jurisdiction of this bill.

When WFBF lobbyist Paul Zimmerman submitted comments in opposition at the Senate Committee on the Environment’s April 1 executive session on the bill, he said it circumvents Wisconsin’s existing program for nonpoint pollution.



February 9, 2007

Recent research has found repeated detections of pathogenic human viruses in water produced by municipal wells.



Assessment of Sewer Source Contamination of Drinking Water Wells Using Tracers and Human Enteric Viruses

RANDALL J. HUNT,*,† MARK A. BORCHARDT,†,§ KEVIN D. RICHARDS,† AND SUSAN K. SPENCER†,§

U.S. Geological Survey Water Resources Discipline, 8505 Research Way, Middleton, Wisconsin, 53562, Marshfield Clinic Research Foundation, Marshfield, Wisconsin 54449

Received March 3, 2010. Revised manuscript received August 16, 2010. Accepted August 18, 2010.

Human Enteric Viruses in Groundwater from a Confined Bedrock Aquifer

MARK A. BORCHARDT,*,† KENNETH R. BRADBURY,‡ MADELINE B. GOTKOWITZ,‡ JOHN A. CHERRY,¶ AND BETH L. PARKER¶

Marshfield Clinic Research Foundation, Marshfield, Wisconsin, 54449, Wisconsin Geological and Natural History Survey, University of Wisconsin Extension, Madison, Wisconsin, 53705, and Department of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

Assessment of Virus Presence and Potential Virus Pathways in Deep Municipal Wells

Final Report to the Wisconsin Department of Natural Resources

Should communities be required to disinfect public water?

- Following several virus studies, the WDNR decided to require all communities to disinfect public water supplies.

- In 2011 the Legislature voted to make it illegal to require disinfection.
  - Reasons given included cost, taste, and a desire for local decision-making
  - Cost of illness was not considered
  - Vote was exactly along party lines

Why these disconnects?

- Widespread misunderstanding of groundwater principles
- Desire for one-size-fits-all policies
- Poor communication of uncertainty
- Lack of awareness of available data and past studies
- Misunderstanding and mistrust of models
- Interest groups and politics

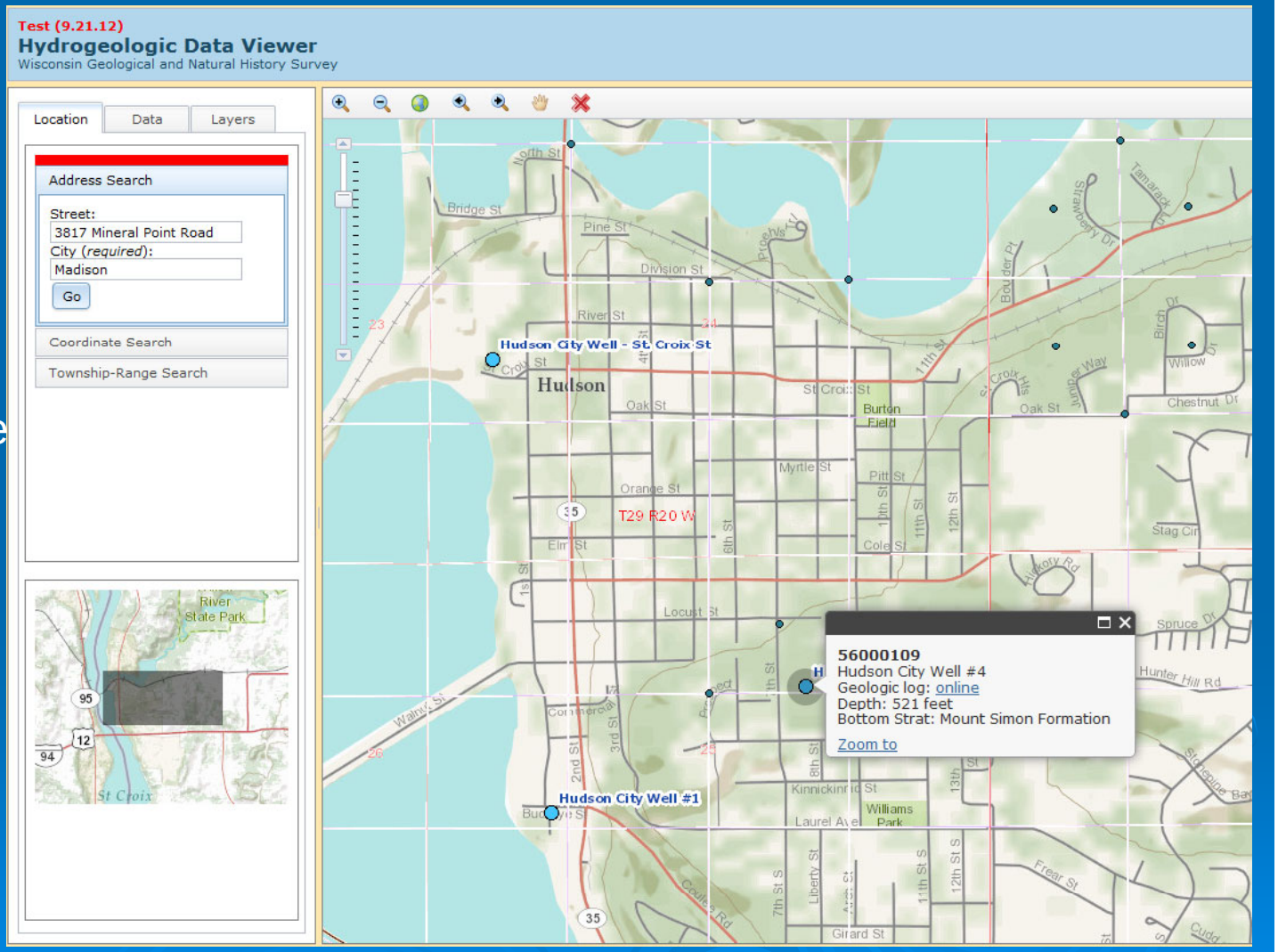
How to move forward?

- Good, timely communication, and repetition, repetition, repetition…
- Make data widely available
- Communicate uncertainty; uncertainty is different than lack of knowledge
- Build bridges to interest groups

Make data available

WDNR-funded data viewer project:

Goal is to make hydrogeologic data more easily available to everyone



Extension
Wisconsin Geological and Natural History Survey

Make people comfortable with models

- Models are the *current standard of professional practice* in hydrogeology
- based on mathematical and physical principles; give objective solutions
- Integrate impacts from multiple stresses (wells)
- Produce a complete water balance
- Contain a database of hydrogeologic information

"Hydrologists are occupied in studying aquifer dynamics. The principal tool for these investigations is the ground water model." John Bredehoeft, 2002

Education

- decision-makers, the public, industry, interest groups, ourselves…
- There are still many misunderstandings about “the hidden resource”
- Scientists need to understand the legislative and regulatory process

Ending up…

- As water scientists, we have an obligation to be sure that legislators, regulators, and the public have the best possible technical information to inform their decisions
- Modeling and quantitative analysis is now a standard of our profession; we need to communicate this to decision makers
- Good data collection and hydrogeologic interpretation is essential for meaningful decision making
- In the final analysis, science may contribute to the debate, but it almost never controls the final choice. Scientists must come to terms with this reality.