Southeastern Wisconsin Regional Water Supply Planning Program — Background, Findings to Date, and Next Steps – Focus on Waukesha County

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Wisconsin Town's Association
Waukesha County Unit

January 23, 2008

#134378

Presentation Overview

- Regional Water Supply Planning Program – Background and Status Report
- What Have We Learned So Far
- Next Steps

Background

A Cooperative Program…

SE Wisconsin Water Utilities

USGS science for a changing world

Seven Southeastern Wisconsin Counties

Southeastern Wisconsin Regional Planning Commission

Wisconsin Dept. of Natural Resources

University of Wisconsin UWMilwaukee

UW Extension Wisconsin Geological and Natural History Survey

Background

Objective – To assure that the water supply for this Region can sustain existing and planned population and development.

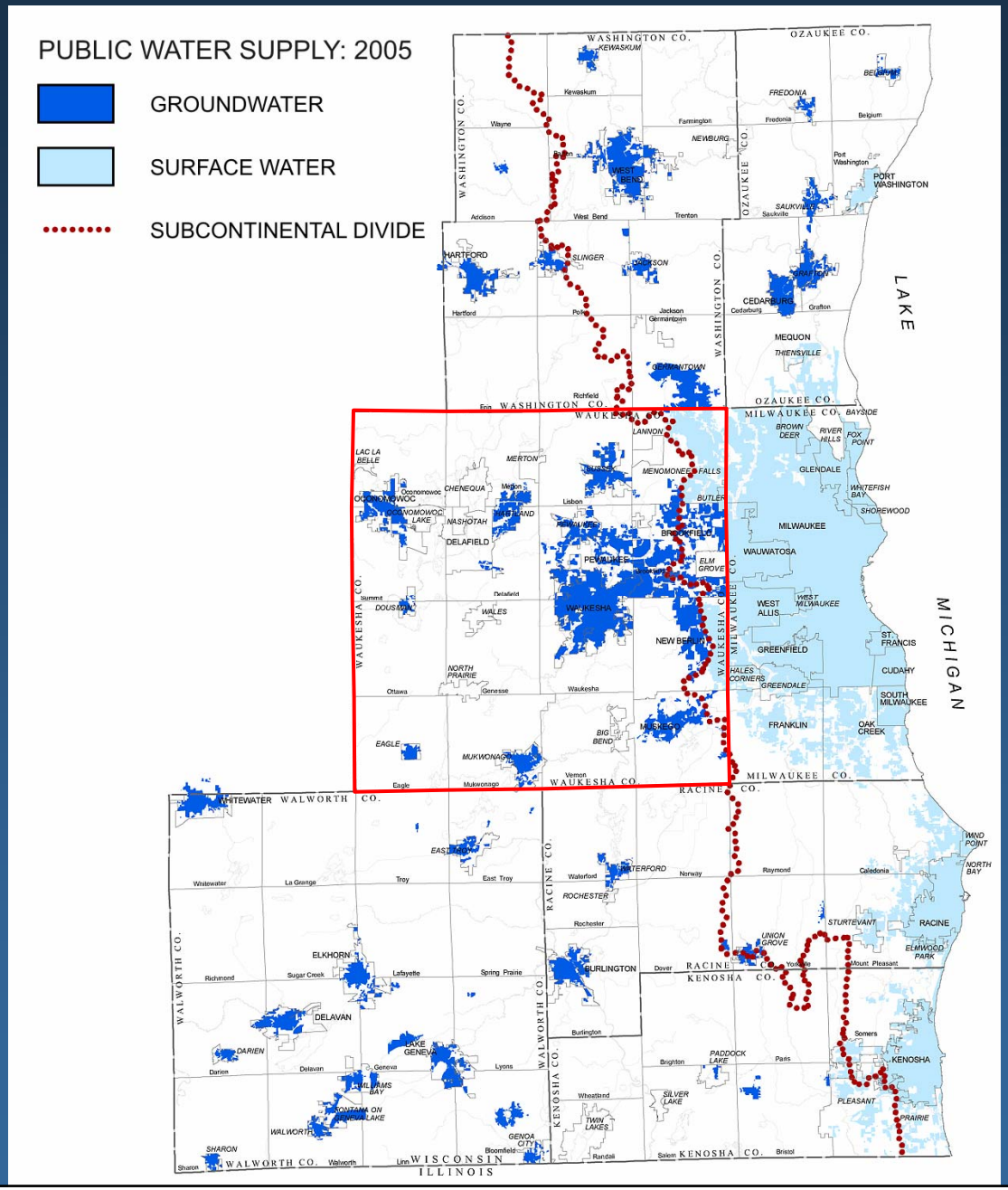
Experience to Date

- **Current water supply**
  - **Lake Michigan – 9 plants (28 systems) serving 1.2 million people (211 mgd)**
  - **Groundwater – 50 systems serving 400,000 people (50 mgd)**
  - **Groundwater – individual wells serving 400,000 people (24 mgd)**

- **Groundwater deep aquifer – historic 4 to 5 feet annual drawdown and some radium and dissolved solids problems.**

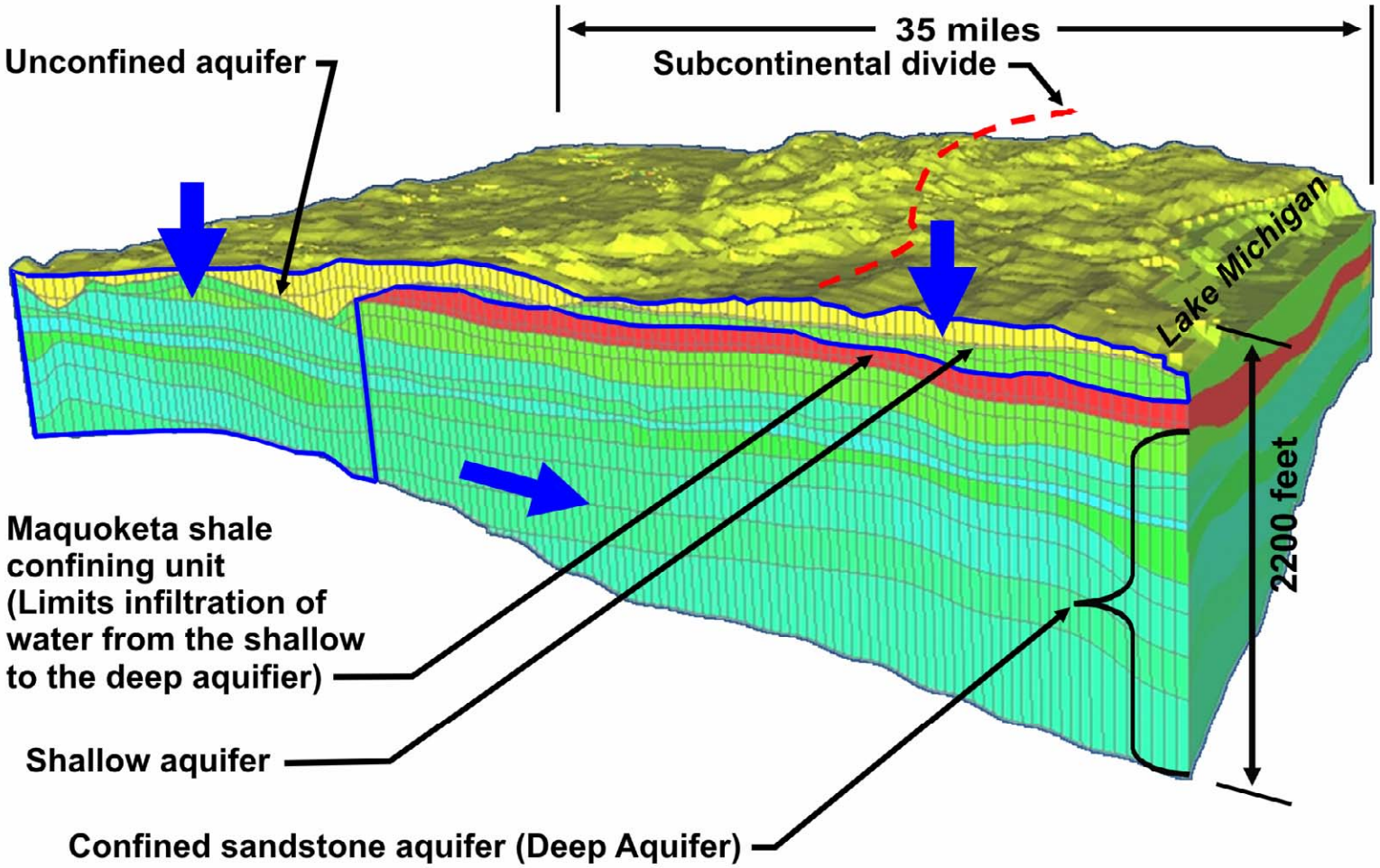
- **Groundwater shallow aquifer – some isolated seasonal supply problems.**

- **Lake Michigan water – existing treatment plants operating at less than 50 percent of capacity.**



Background

General Hydrogeology of Southeast Wisconsin



Private residential wells are generally in the shallow aquifer and 100 to 300 feet deep. Most municipal wells are 200 to 800 feet deep with some up to 2,200 feet deep, and are in both the shallow and deep aquifer.

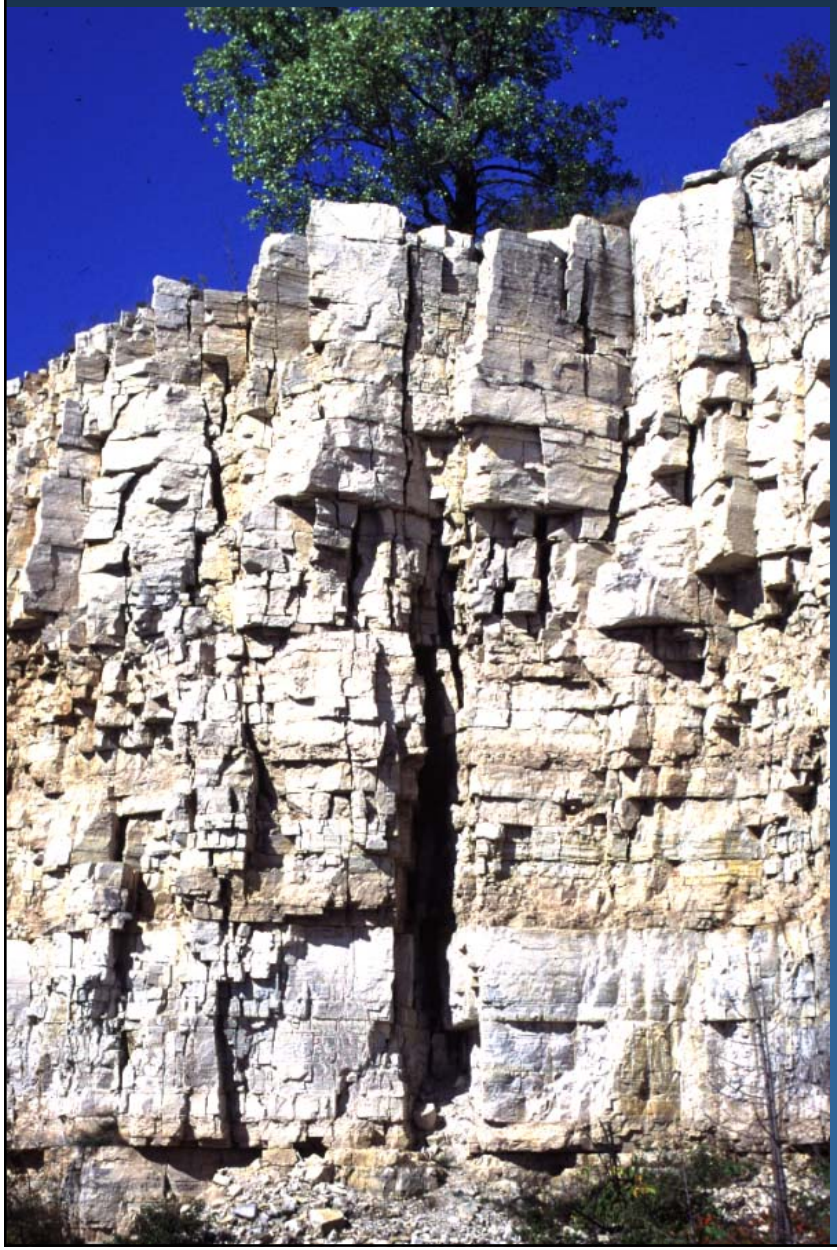
Source: USGS.

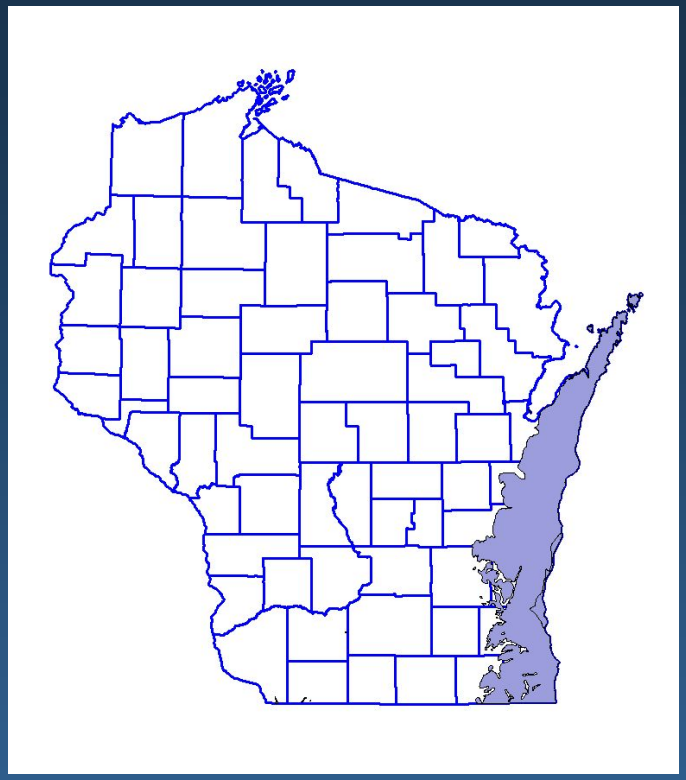
Background

Sand and Gravel Aquifer Present as Lenses or Channel Deposits

- Sand not present as uniform layer
- Thickness and permeability of sand changes with location

Background





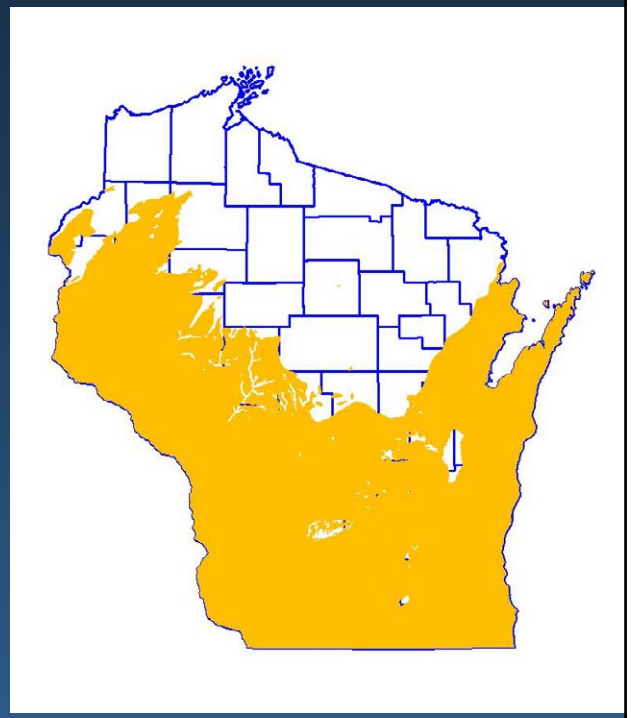
“Dolomite” Aquifer:

- Silurian dolomite
- Fracture-dominated flow
- Only present in east
- Important for municipal and domestic wells

Background

“Sandstone” Aquifer:

- Sandstone, dolomite
- Regionally extensive
- Excellent aquifer
- Porous flow
- Most high-capacity wells
- Occurs beneath shale in east



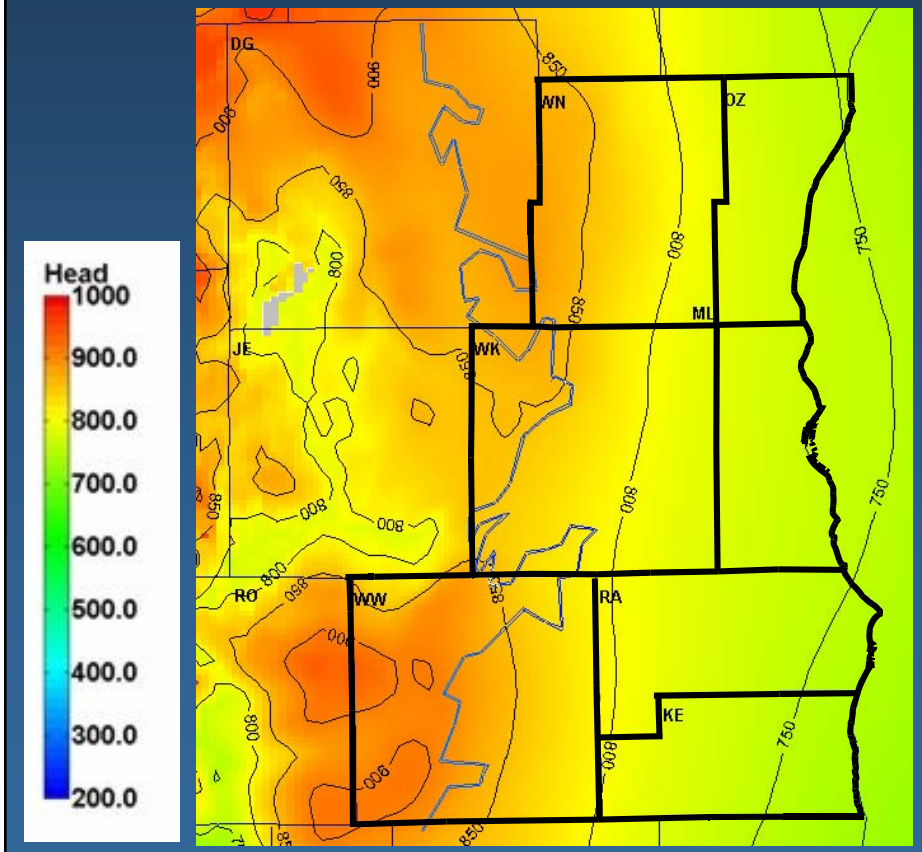
Exposure of Sandstone in the Wisconsin Dells

Background

State of Wisconsin 2003 Wisconsin Act 310 Groundwater Management Area (Area including and surrounding Brown and Waukesha Counties consisting of the entire City, Village, and Town where the groundwater level has been reduced by 150' or more)

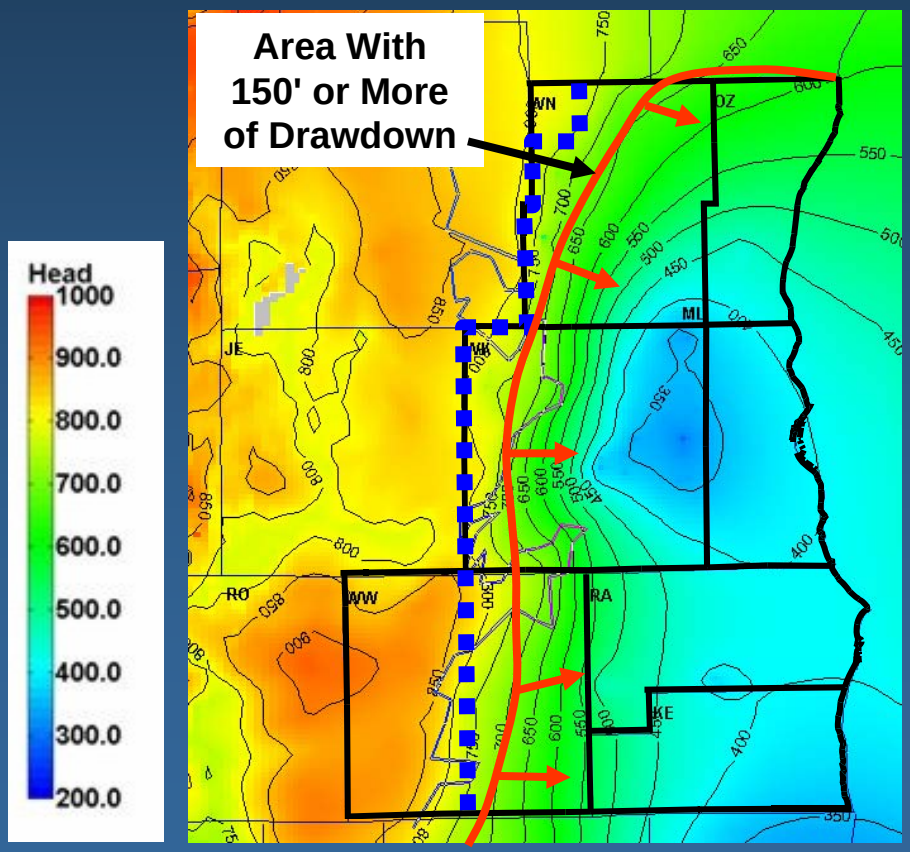
Deep Sandstone Aquifer Drawdown

Pre-1864



Water Levels in the Sandstone Aquifer (feet above sea level)

2000



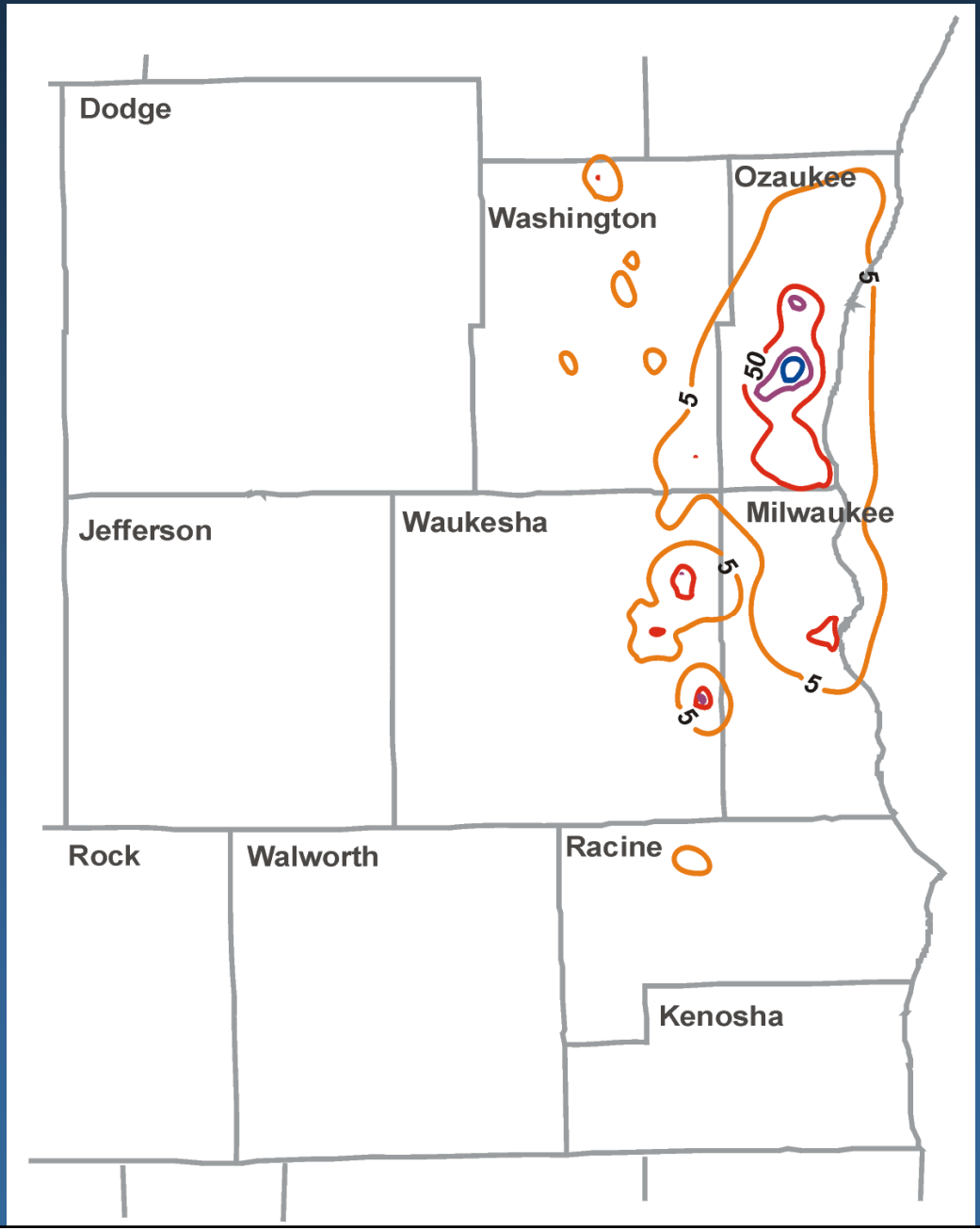
Water Levels in the Sandstone Aquifer (feet above sea level)

Background

Simulated Shallow Drawdown Relative to Predevelopment Conditions: Silurian Dolomite in 2000

Drawdown in Feet

- 5
- 50
- 100
- 150



Background

Regional Water Supply Planning Program

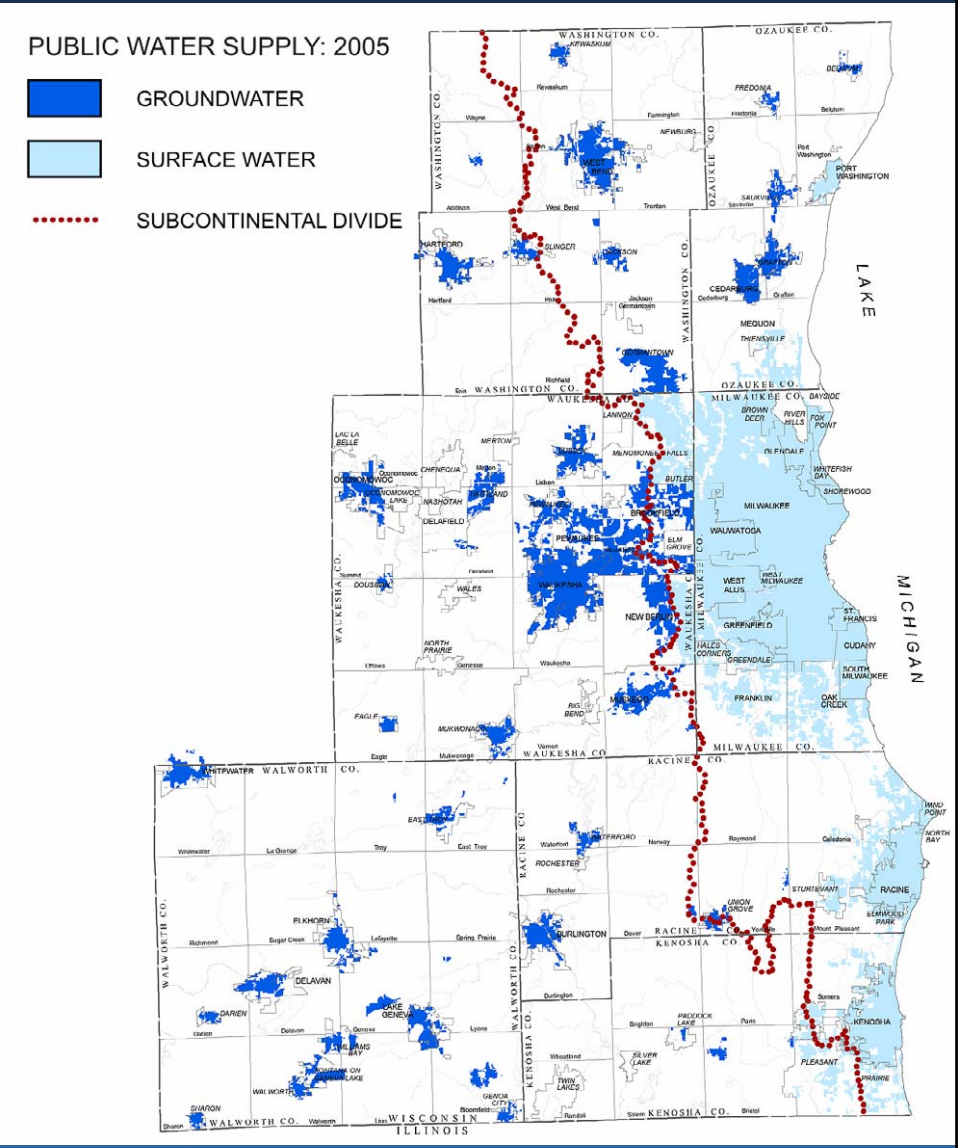
Three Elements (Coordinated With And Designed To Complement Local Actions)

1. Conduct Basic Groundwater Inventories (Completed in 2001 With Partners—WGNHS and WDNR)
2. Collect Additional Inventory Data and Develop Regional Aquifer Simulation Model (Completed with Partners—USGS, WGNHS, UW-Milwaukee, WDNR, and SE Wisconsin Water Utilities)
3. Prepare Regional Water Supply System Plan (Planning is Underway With Support from Seven Counties in Southeastern Wisconsin; Partners Include USGS, WGNHS, UW-Milwaukee, and WDNR)

Background

Scope of Study

- Forecast future water use demand in the Region.
- Consider potential of water conservation to reduce future demand.
- Identify groundwater recharge areas which should be protected from development.
- Assess potential for shallow groundwater recharge through infiltration of stormwater runoff and treatment plant effluent.
- Consider potential alternative sources of supply
  - Shallow groundwater
  - Lake Michigan water replacing groundwater east of the subcontinental divide.
  - Lake Michigan water replacing groundwater in "straddling communities" which already have "return flow"
  - Lake Michigan water replacing groundwater in "straddling communities" and "communities in straddling counties" and providing for "return flow".
- Estimate costs and impacts of alternatives
  - Groundwater-Surface Water Interdependence and Impacts
- Identify any development constraints necessary to assure water supply sustainability



What Have We Learned So Far

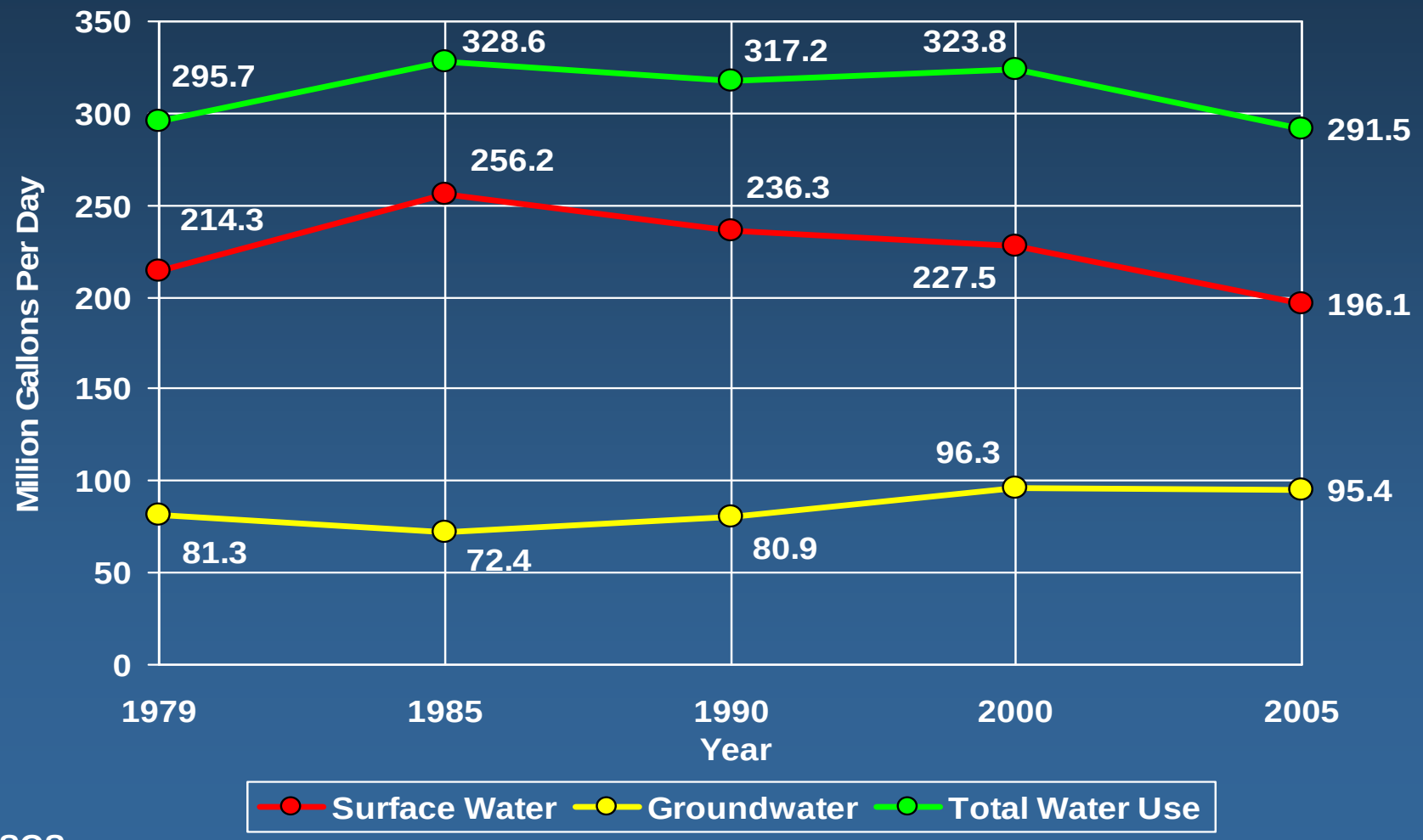
Water Use Data

Summary of Municipal Water Use in the Southeastern Wisconsin Region: 2000, and 2005

Year	Average Annual Water Uses					Percent Unaccounted-for Water
	Residential Water Use		Industrial Water Use	Commercial, Institutional, and Multi-Family Residential	Total Municipal Water Use	
	Per Person (gallons per capita per day)	Per Acre (gallons per acre per day)	Per Acre (gallons per acre per day)	Per Acre (gallons per acre per day)	Per Person (gallons per capita per day)	
2000	68	910	4,010	1,054	128	10
2005	70	916	3,003	964	120	11
Waukesha County						
2005	72	565	904	689	134	8

Background

Trends in Water Use for the Region: 1979-2000 (in Million Gallons Per Day)*

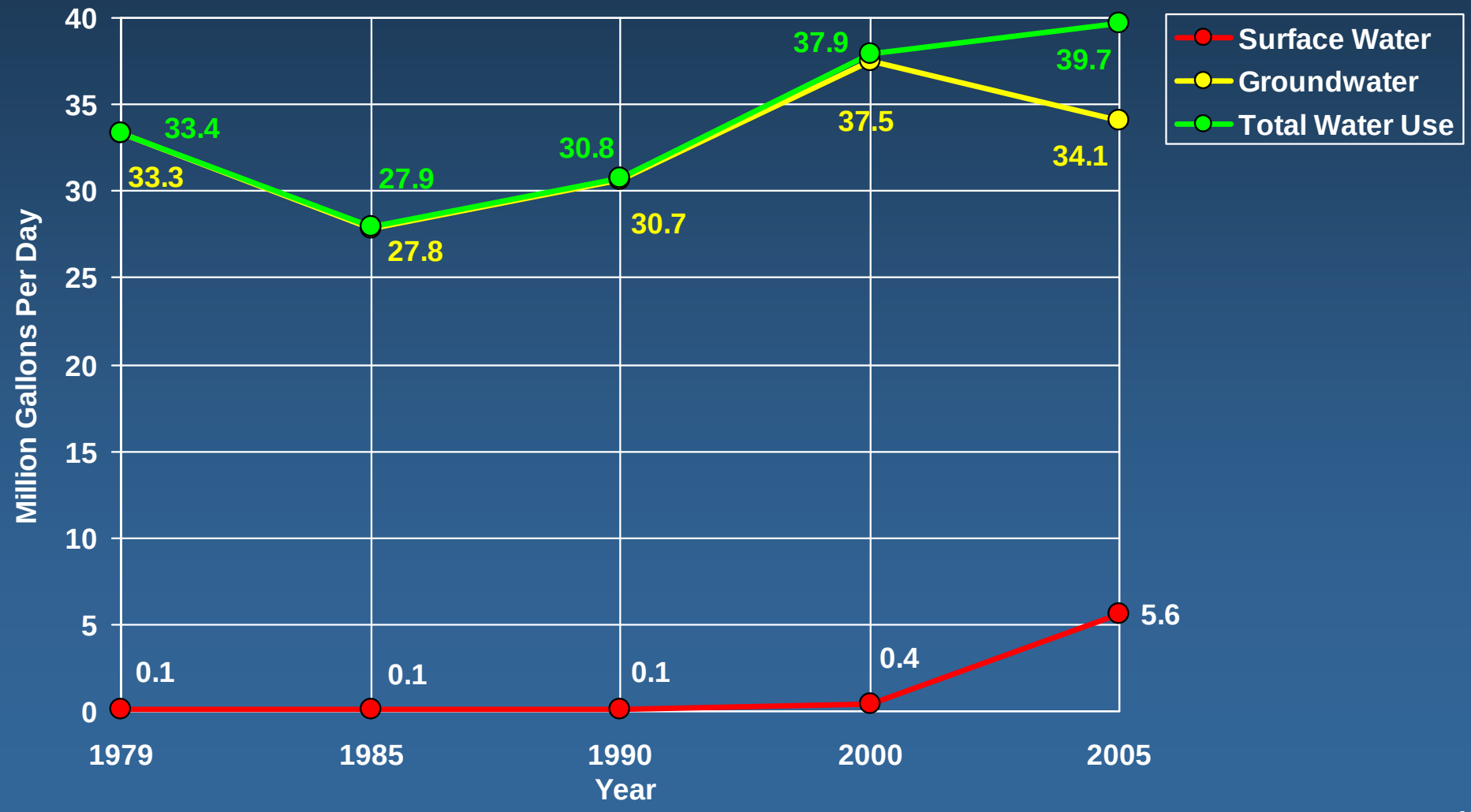


Source: USGS

* Excludes thermoelectric power generation uses

What Have We Learned So Far

Trends in Water Use for Waukesha County: 1979-2000 (in Million Gallons Per Day)*



What Have We Learned So Far

Average Daily Residential Municipal Water Use Per Capita: 1997 - 2005

What Have We Learned So Far

Projected Areas Served by Municipal and Other Than Municipal, Community Water Supply Systems in Waukesha County: 2035

GROUNDWATER-SUPPLIED SYSTEMS IN 2005

2005 2035

- CITY OF BROOKFIELD MUNICIPAL WATER UTILITY
- DELAFIELD MUNICIPAL WATER UTILITY
- CITY OF MUSKEGO PUBLIC WATER UTILITY
- CITY OF NEW BERLIN WATER UTILITY
- CITY OF OCONOMOWOC UTILITIES
- CITY OF PEWAUKEE WATER UTILITY
- CITY OF WAUKESHA WATER UTILITY (PORTION OF NEW AREA IN TOWN OF GENESSEE COULD BE A NEW TOWN UTILITY DISTRICT)
- VILLAGE OF EAGLE MUNICIPAL WATER UTILITY
- DOUSMAN WATER UTILITY
- HARTLAND MUNICIPAL WATER UTILITY
- VILLAGE OF MENOMONEE FALLS WATER UTILITY
- MUKWONAGO MUNICIPAL WATER UTILITY
- PRAIRIE VILLAGE WATER TRUST
- VILLAGE OF PEWAUKEE WATER UTILITY
- SUSSEX VILLAGE HALL AND WATER UTILITY
- BROOKFIELD SANITARY DISTRICT NO. 4

NEW GROUNDWATER-SUPPLIED SYSTEMS

2035

- VILLAGE OF BIG BEND
- VILLAGE OF LANNON AREA
- VILLAGE OF WALES AREA
- TOWN OF EAGLE-EAGLE SPRING LAKE AREA
- TOWN OF MUKWONAGO-RAINBOW SPRINGS AREA
- TOWN OF NORWAY-WIND LAKE AREA
- TOWN OF OCONOMOWOC-OKAUCHEE LAKE AREA
- TOWN OF OTTOWA-PRETTY LAKE AREA
- TOWN OF SUMMIT-GOLDEN LAKE AREA

SURFACE WATER-SUPPLIED SYSTEMS IN 2005

2005 2035

- VILLAGE OF BUTLER PUBLIC WATER UTILITY
- VILLAGE OF MENOMONEE FALLS WATER UTILITY
- CITY OF NEW BERLIN WATER UTILITY

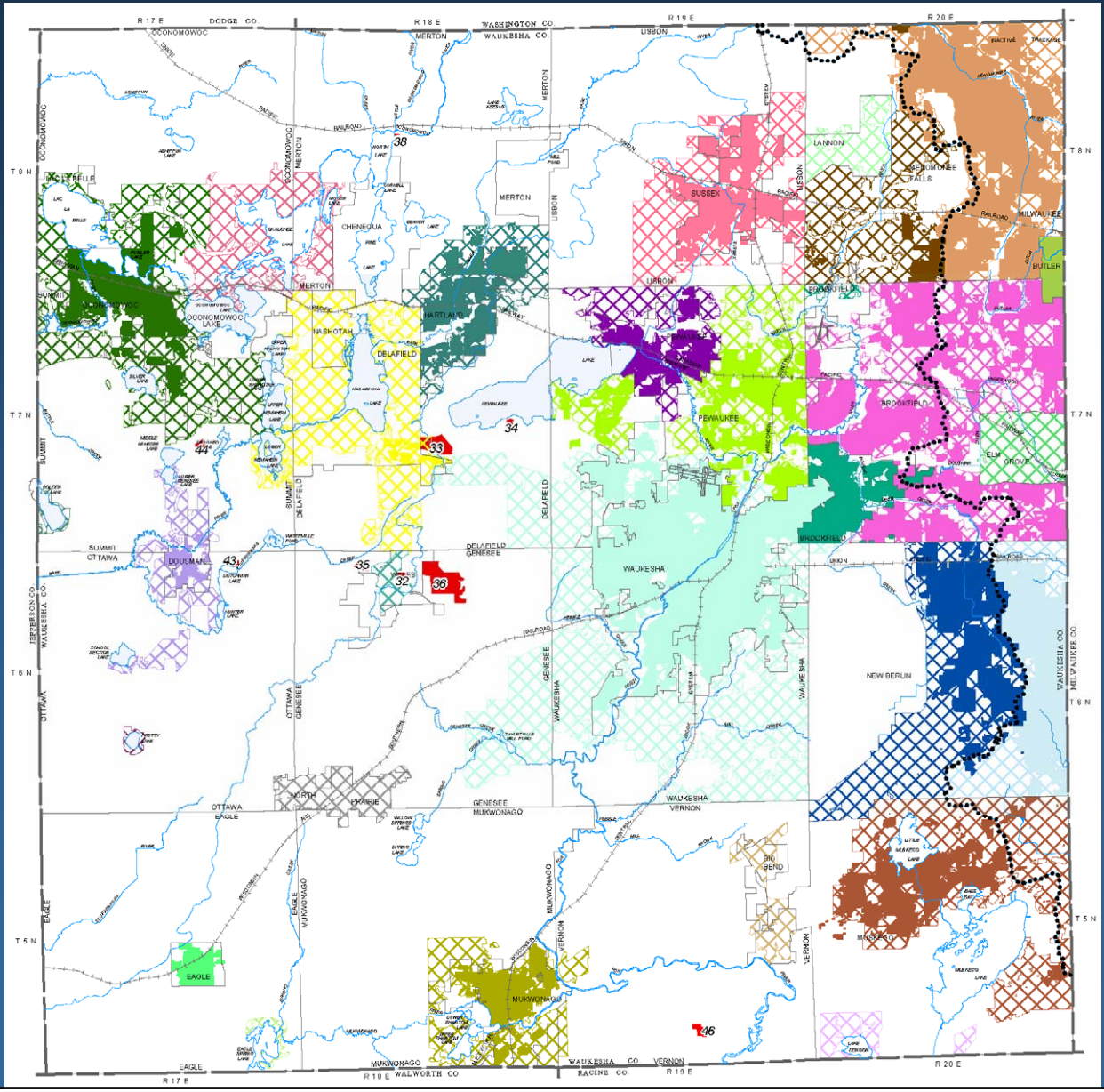
NEW SURFACE WATER-SUPPLIED SYSTEMS

- VILLAGE OF ELM GROVE

SUBCONTINENTAL DIVIDE

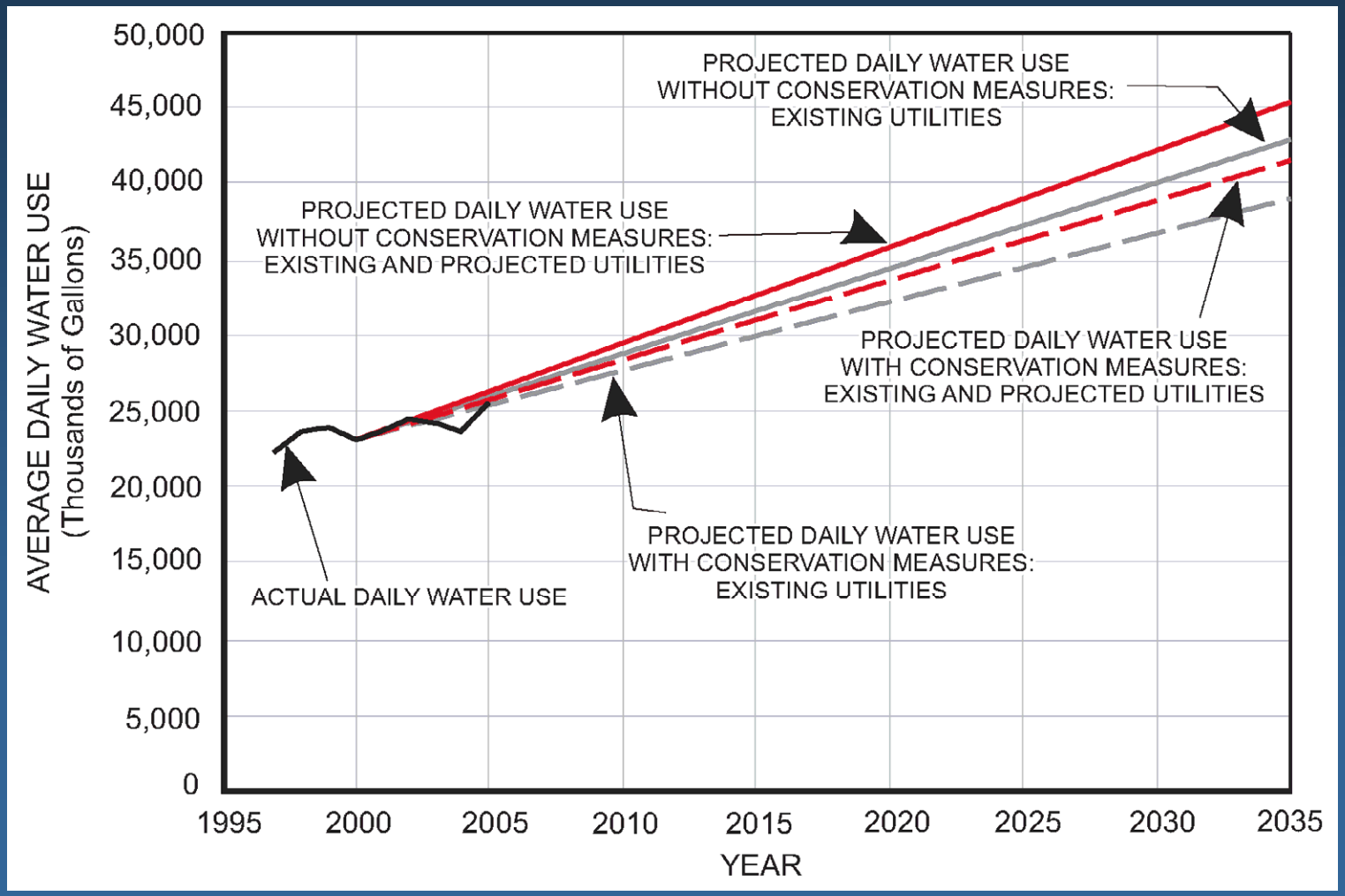
28 AREA SERVED BY OTHER THAN MUNICIPAL, COMMUNITY SYSTEMS USING GROUNDWATER. IDENTIFICATION NUMBER CORRESPONDS WITH APPENDIX G.

NOTE: RECOMMENDED SOURCES OF SUPPLY FOR AREAS ADDED TO EXISTING MUNICIPAL WATER SUPPLY SERVICE AREAS ARE NOT YET ESTABLISHED .



What Have We Learned So Far

Actual Projected, and Forecast Average Daily Water Use: Waukesha County



What Have We Learned So Far

Water Supply Law Report Findings

Straddling Communities and Communities within Straddling Counties in the Southeastern Wisconsin Region

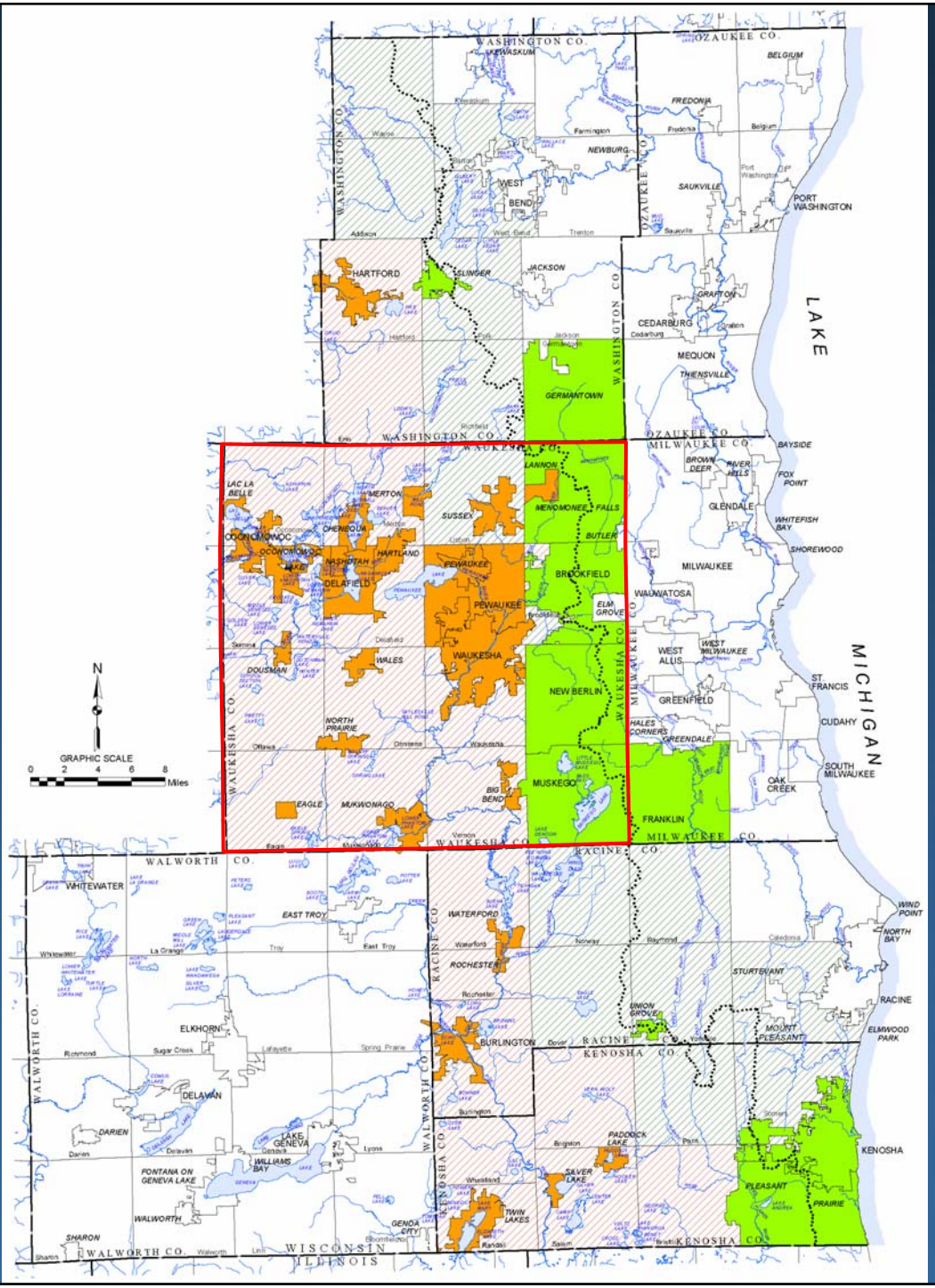
COMMUNITY STRADDLING THE SUBCONTINENTAL DIVIDE

- CITY OR VILLAGE (264.9 sq. mi.)
- TOWN (454.9 sq. mi.)

COMMUNITY WITH A COUNTY WHICH STRADDLES THE SUBCONTINENTAL DIVIDE AND WHICH IS NOT A STRADDLING COMMUNITY

- CITY OR VILLAGE (139.7 sq. mi.)
- TOWN (598.5 sq. mi.)
- SUBCONTINENTAL DIVIDE

Return flow component required for all Waukesha County communities.



What Have We Learned So Far

State of the Art of Water Supply Practices Findings

Water Conservation – General Conclusions

Water Conservation Program Components

- Water Supply System Efficiency or Supply Side Conservation. Water utility programs designed to minimize water produced to meet customer demands.
  - Some program level is typically ongoing (metering, related billing, leak detection and repair, operational refinements)
- Water Use Demand Reduction or Demand Side Conservation. Includes practices such as rate modification, water saving, plumbing fixtures, water recycling, and public education
  - Limited programs in place – largely to preserve infrastructure capacity in peak outdoor water use periods
- Level of Water Conservation Should be Utility Specific
  - Comparison of users
  - Source of supply and its sustainability
  - Infrastructure capacity and condition

What Have We Learned So Far

State of the Art of Water Supply Practices Findings

Water Conservation – Applicable Example Program (Waterloo, Ontario)

- Service Area – 530 square miles & 500,000 persons: 75 percent groundwater supplied
- Current Program 1998-2005
  - Components
    - Public awareness & education (school curriculum)
    - Toilet replacement rebate program
    - Rain barrel distribution
    - Outdoor water use restrictions
    - Municipal building water conservation
    - Other miscellaneous activities
  - Effectiveness
    - Reduced water usage by 1.5 mgd or 4% of total usage
  - Cost
    - $900,000 per year
- Future Program and Long Term Objective
    - Refinement of current program
    - Reduction of 6.6% on average day and 10.3% maximum week demand by 2041

What Have We Learned So Far

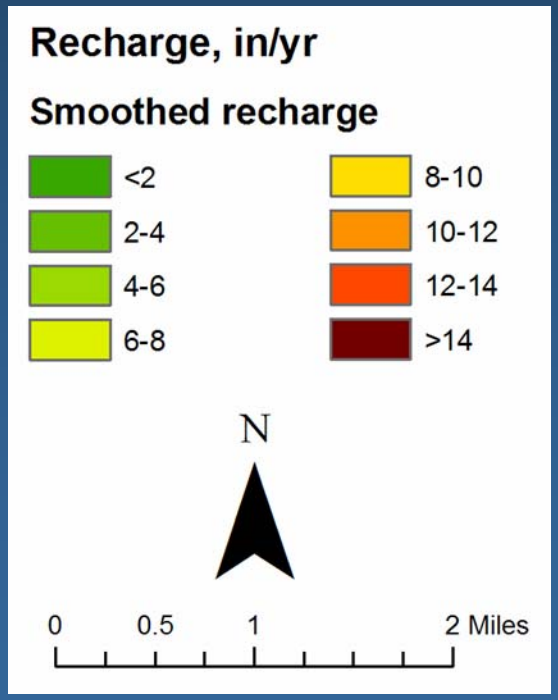
State of the Art of Water Supply Practices Findings

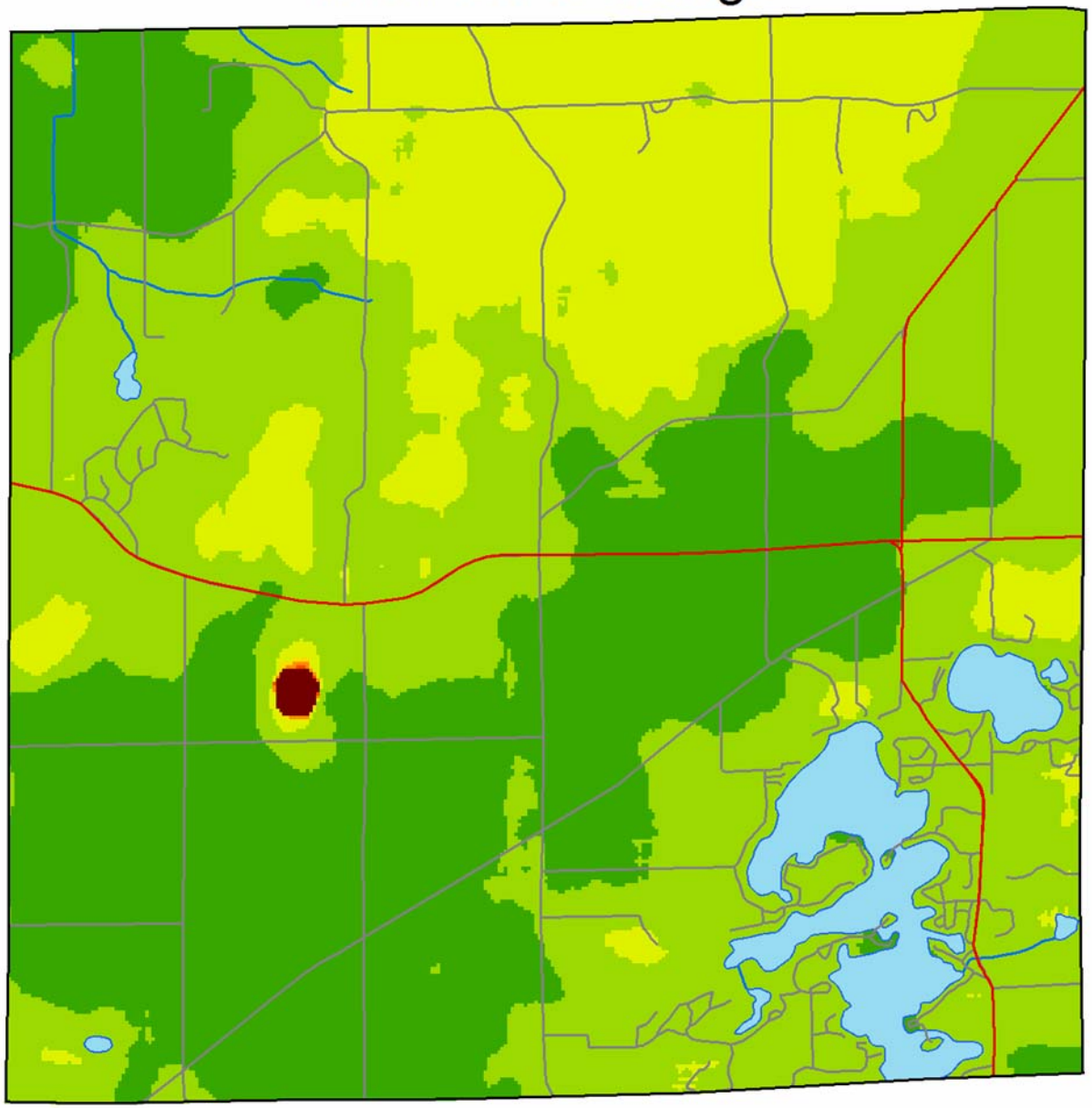
Planned Initial Assumptions Concerning Effectiveness of Water Conservation Program Levels for Use in Alternative Plan Development for the Regional Water Supply System Planning Program for Southeastern Wisconsin

	Future Water Conservation Assumption Over and Above the Current Level	
Water Utility Category	Average Day Demand Reduction (percent)	Maximum Day Demand Reduction (percent)
• Lake Michigan Supply with Return of Spent Water • Adequate Water Supply Infrastructure in Place for 10 or More Years	4	6
• Lake Michigan Supply with Return of Spent Water • Some Water Supply Infrastructure Needs Expected During the Next 10 Years	4	10
• Groundwater Supply • Adequate Water Supply Infrastructure for 10 or More Years • No Major Aquifer Quality or Quantity Issues	6	12
• Groundwater Supply • Major Infrastructure Needs Expected During the Next 10 Years • No Major Aquifer Quantity or Quality Problems	8	16
• Groundwater Supply • Major Infrastructure Needs Expected During the Next 10 Years • Aquifer Quantity or Quality Problems	10	18

What Have We Learned So Far

Regional groundwater recharge area analysis using soil water balance approach (methodology was initially developed by USGS staff and others)

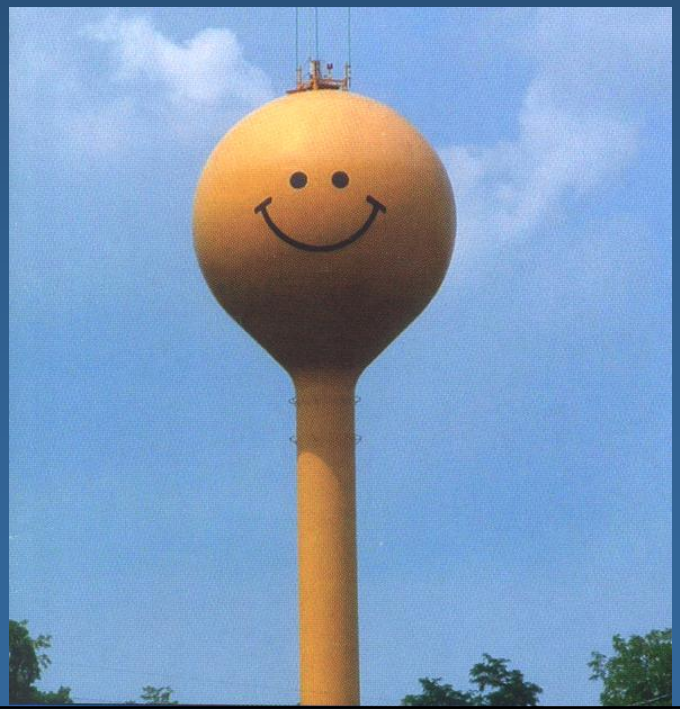




Note: Intent is to combine recharge areas with surface water and deep sandstone aquifer recharge area considerations.

What Have We Learned So Far

- All Groundwater Use Has Consequences – Most (80%) well pumpage is water transferred from the local surface water system
- Balancing Groundwater Water Supply Needs With Surface Water Impacts (Reasonableness) is an Important Part of Alternative Plan Development and Evaluation



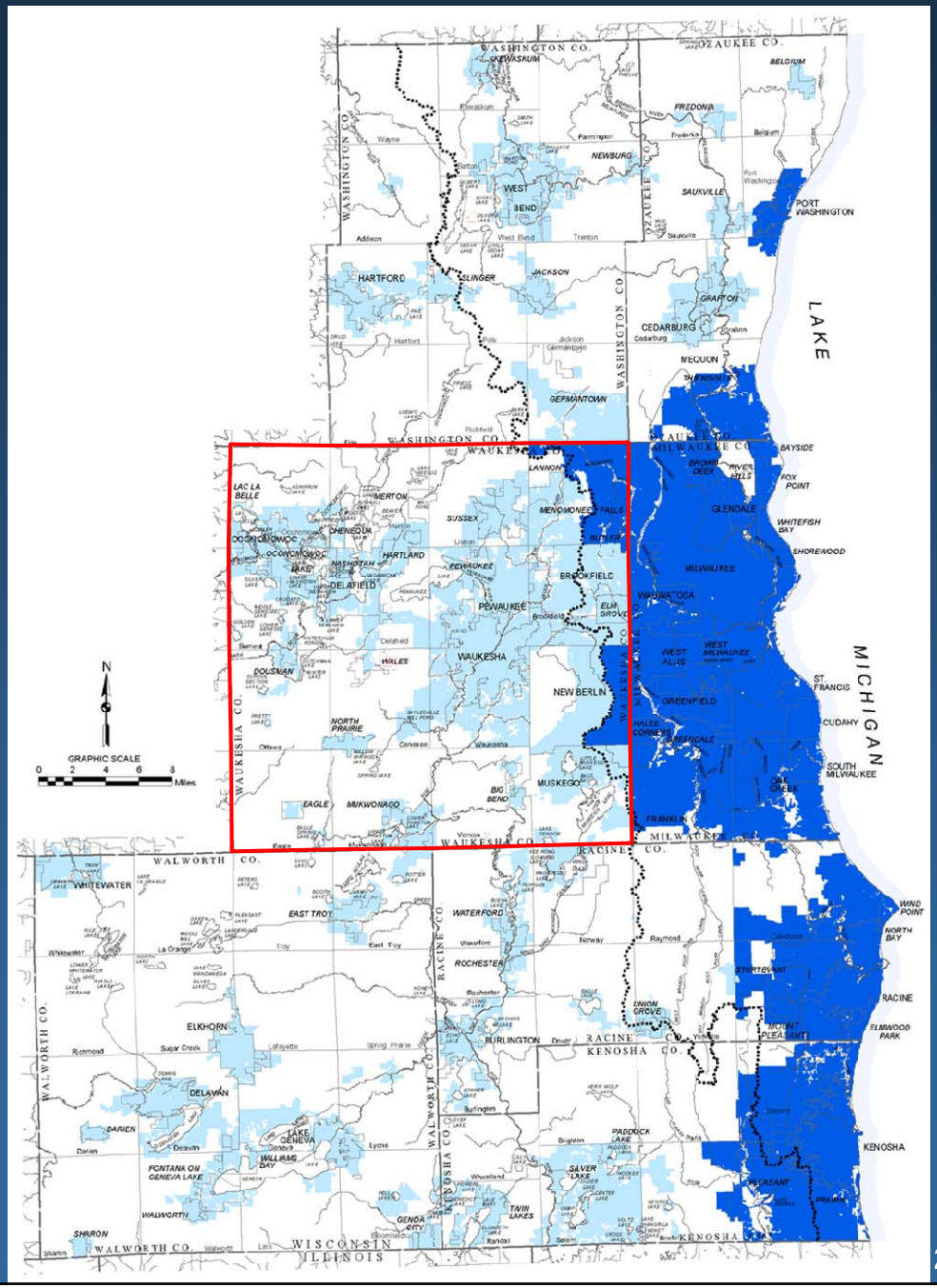
Regional Water Supply Plan

Alternative Plan 1 – Design Year 2035 Forecast Conditions Under Existing Trends and Committed Actions

LEGEND

- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING WATER FROM LAKE MICHIGAN: 2035
- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING GROUNDWATER: 2035
- SUBCONTINENTAL DIVIDE

- Existing 2007 water supply facilities
- Enhanced local water conservation programs
- Continued reliance on groundwater sources to meet 2035 demand (light blue)
- Continued reliance on Lake Michigan water sources for all areas now served, meeting 2035 demand (dark blue)
- Recharge of groundwater at new construction sites to the extent required by State law
- Continued reliance on private wells for residential areas (about 180,000 residences) plus selected agricultural, irrigation, and industrial uses

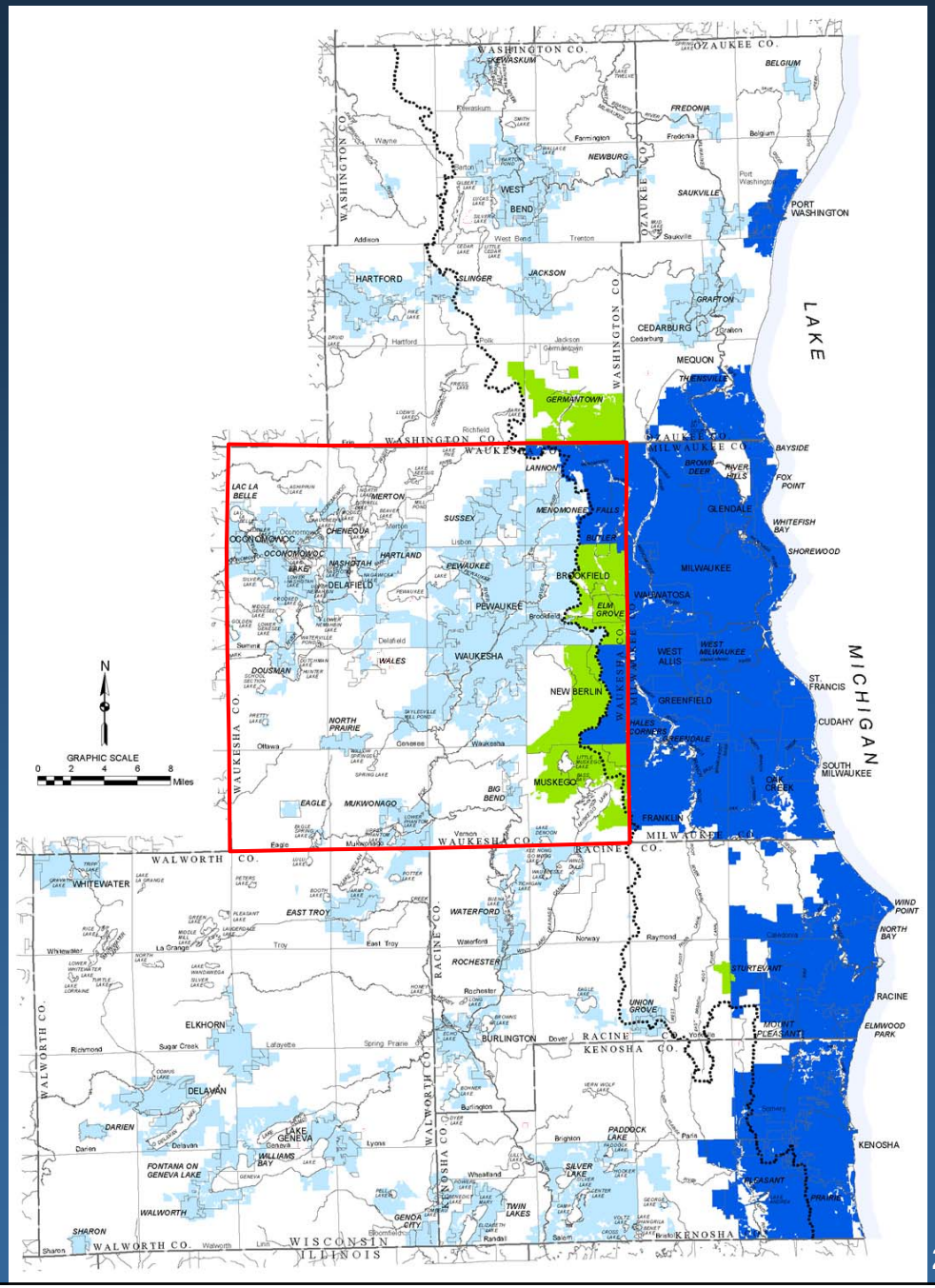


Regional Water Supply Plan

Alternative Plan 2 – Limited Expansion of Lake Michigan Supply

LEGEND

- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING WATER FROM LAKE MICHIGAN UNDER ALTERNATIVE PLAN 1: 2035
- AREAS CONVERTED FROM GROUNDWATER TO SURFACE WATER UNDER ALTERNATIVE PLANS 2 AND 3 COMPARED TO ALTERNATIVE PLAN 1: 2035
- SUBCONTINENTAL DIVIDE



- Includes all aspects of Alternative Plan 1, but converts certain areas to Lake Michigan supply
  - 4 areas east of the subcontinental divide (Germantown, Elm Grove, Brookfield-east, and Yorkville) all with existing return flow (green)
  - 2 areas west of the divide (New Berlin-central, Muskego) both with existing return flow (green)

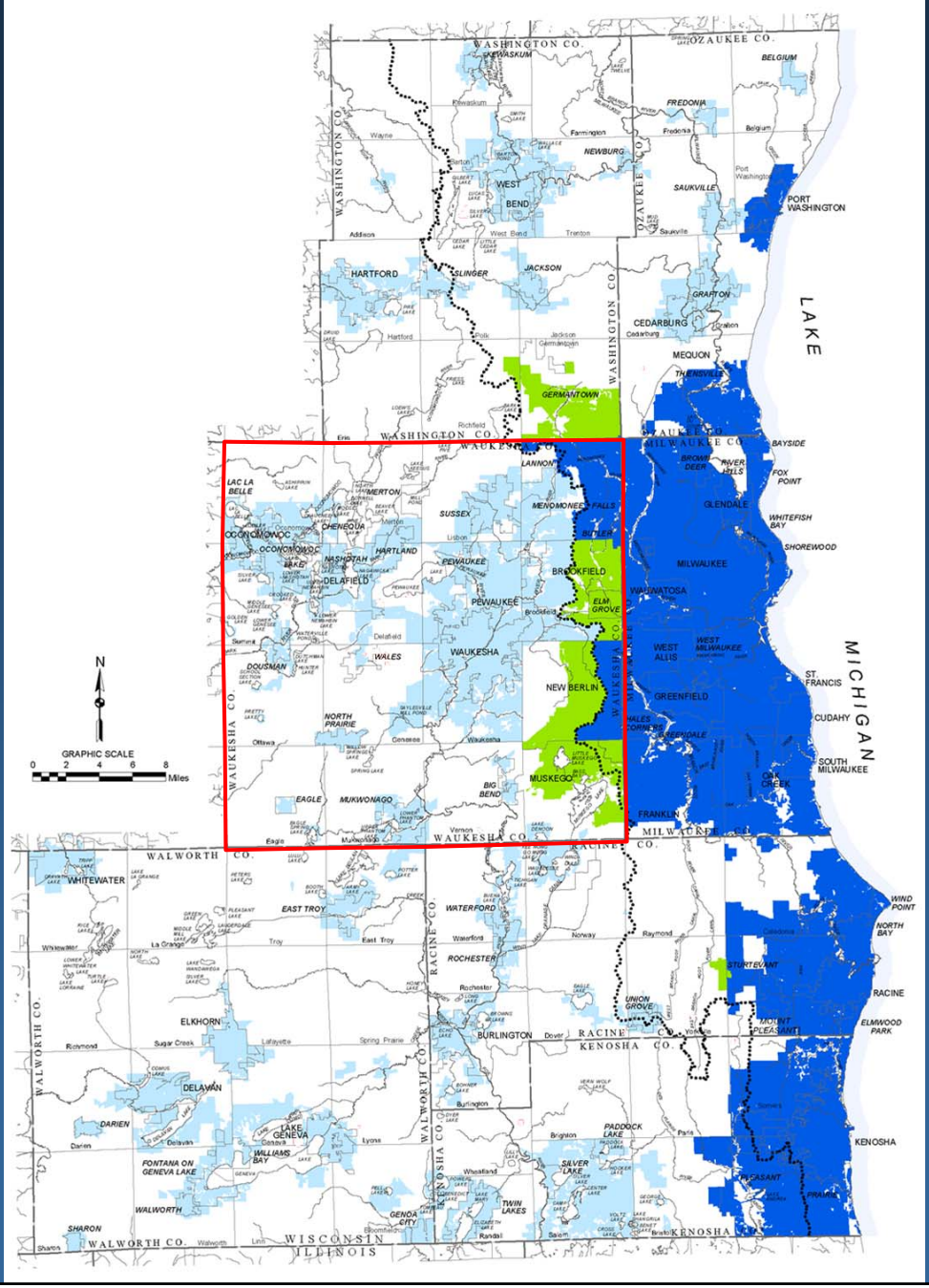
Regional Water Supply Plan

Alternative Plan 3 – Groundwater Recharge

LEGEND

- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING WATER FROM LAKE MICHIGAN UNDER ALTERNATIVE PLAN 1: 2035
- AREAS CONVERTED FROM GROUNDWATER TO SURFACE WATER UNDER ALTERNATIVE PLANS 2 AND 3 COMPARED TO ALTERNATIVE PLAN 1: 2035
- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING GROUNDWATER: 2035
- SUBCONTINENTAL DIVIDE

- Includes all aspects of Alternative Plan 2
- Enhancement of rainfall infiltration over 4.0 square miles of open space through bioengineering; sites to be selected
- Protection of most significant groundwater recharge areas through public purchase if necessary
- Recharge of groundwater at new construction sites beyond the extent required in State law
- Redirection of wastewater treatment plant effluent to shallow aquifer after enhanced treatment at 3-4 demonstration locations
- Recharge deep aquifer with treated Lake Michigan water

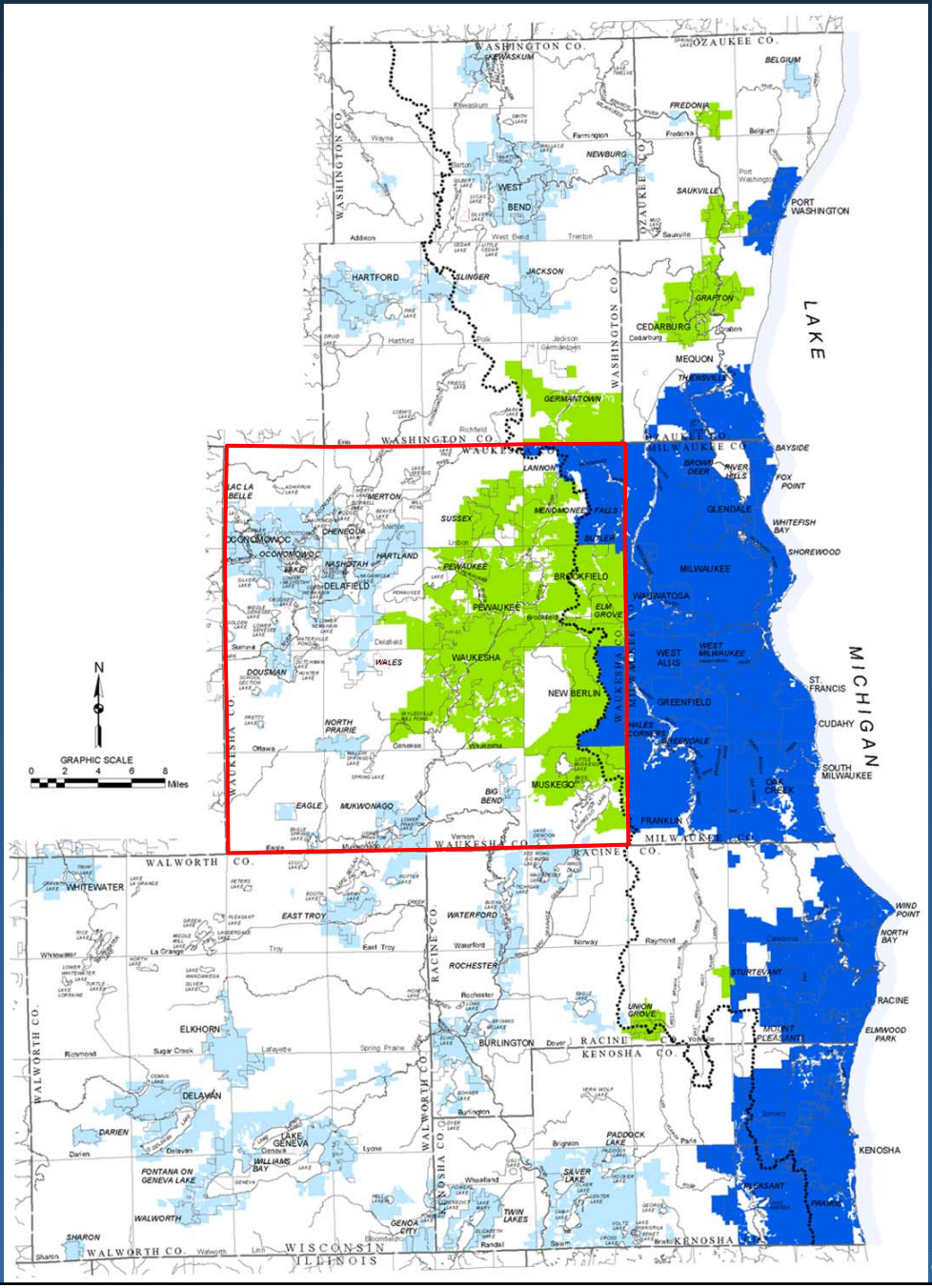


Regional Water Supply Plan

Alternative Plan 4 – Further Expansion of Lake Michigan Supply

- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING WATER FROM LAKE MICHIGAN UNDER ALTERNATIVE PLAN 1: 2035
- AREAS CONVERTED FROM GROUNDWATER TO SURFACE WATER UNDER ALTERNATIVE PLAN 4 COMPARED TO ALTERNATIVE PLAN 1: 2035
- AREAS SERVED BY PUBLIC WATER UTILITIES PROVIDING GROUNDWATER: 2035
- SUBCONTINENTAL DIVIDE

- **Includes all aspects of Alternative Plan 2 but with conversion of selected additional areas to Lake Michigan supply all with return flow components**
  - **4 areas east of the subcontinental divide (Cedarburg, Grafton, Fredonia, Saukville) (green)**
  - **4 areas in communities which straddle the divide (Brookfield-west, Menomonee Falls-west, Brookfield-town, Union Grove) (green)**
  - **5 areas which are in communities west of the divide within a straddling county (Pewaukee-city, Pewaukee-village, Sussex, Lannon, Waukesha) (green)**



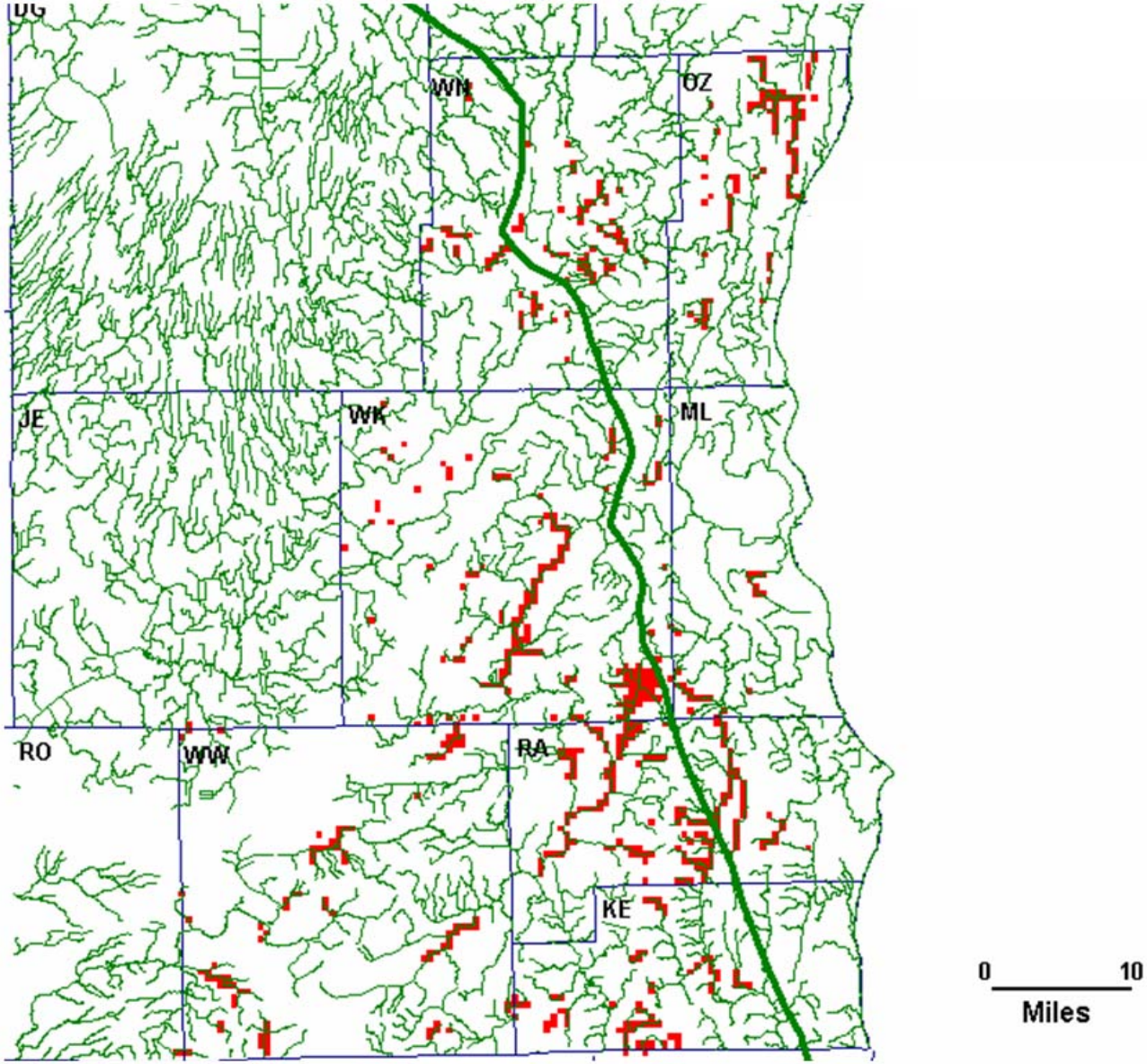
Regional Water Supply Plan

Alternative Plan Evaluation Criteria

- Cost Effectiveness
- Impacts on Groundwater System
- Impacts on Surface Water System
- Environmental Justice Considerations
- Implementability
- Consistency with State and Federal Regulations and Policies
- Flexibility and Adaptability

Next Steps
Modeling Groundwater-Surface-Water Impacts

Model Results: Nodes with more than 10% stream depletion between 2000 and 2035



Your Turn

Questions? – Comments?

Also see SEWRPC web site: www.sewrpc.org

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