

Wisconsin Groundwater Coordinating Council

Fiscal Year 2011

REPORT TO THE LEGISLATURE



August, 2011

GROUNDWATER COORDINATING COUNCIL MEMBERS

Department of Natural Resources – **Ken Johnson (Chair)**
Department of Agriculture, Trade, and Consumer Protection – **John Petty**
Department of Safety and Professional Services – **Eric Scott**
Department of Health Services - **Henry Anderson, MD**
Department of Transportation - **Dan Scudder**
Geological and Natural History Survey (State Geologist) - **James Robertson**
Governor's Representative – **George Kraft**
University of Wisconsin System – **Anders Andren**

2011 SUBCOMMITTEE MEMBERS

Research & Monitoring

Geological and Natural History Survey - **Ken Bradbury (Co-Chair) ***, **Madeline Gotkowitz*** and **Bill Bristoll**
Department of Natural Resources – **Jeff Helmuth*(Co-Chair)**, **Bill Phelps*** and **Larry Lynch***
Department of Agriculture, Trade and Consumer Protection - **Jeff Postle*** and **Rick Graham***
Department of Safety and Professional Services – **Ross Fugill*** and **Jon Heberer***
Department of Health Services - **Robert Thiboldeaux*** and **Bruce Rheineck***
University of Wisconsin System - **Paul McGinley***, **Maureen Muldoon***, **Tim Grundl***, and **Trina McMahon***
U. S. Geological Survey - **Randy Hunt***, **Mike Fienen***, and **Cheryl Buchwald**
Center for Watershed Science and Education - **George Kraft*** and **Dave Mechenich**
Natural Resources Conservation Service - **Tim Weissbrod**
* Member of Standing Joint Solicitation Work Group

Outreach & Partnership

Center for Watershed Science and Education - **Kevin Masarik (Co-Chair)**
Department of Natural Resources – **Mary Ellen Vollbrecht (Co-Chair)**
University of Wisconsin System – **Carolyn Betz**, **Ken Genskow** and **Steve Born**
Department of Agriculture, Trade and Consumer Protection – **Jason Lowery** and **Trevor Bannister**
Department of Safety and Professional Services - **Thomas Braun** and **Roman Kaminski**
Department of Health Services - **Jessica Maloney** and **Bruce Rheineck**
Geological and Natural History Survey - **Dave Hart**, **Carol McCartney**, and **Fred Madison**
Department of Transportation - **Bob Pearson**
State Laboratory of Hygiene –**Jeremy Olstad**
UW Center for Land Use Education - **Lynn Markham**
U. S. Geological Survey – **Marie Peppler**
Natural Resources Conservation Service - **Tim Weissbrod**
Association of Wisconsin Regional Planning Commissions – **Eric Fowle**
Wisconsin Alliance of Cities – vacant
Wisconsin County Code Administrators - **Ray Schmidt**
Capitol Area Regional Planning Commission – **Mike Kakuska**
Wisconsin Rural Water Association – vacant
Wisconsin Water Association - **Nancy Quirk**



State of Wisconsin \ GROUNDWATER COORDINATING COUNCIL

Scott Walker, Governor

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August, 2011

To: The Citizens of Wisconsin

The Honorable Governor Scott Walker
Senate Committee on Environment and Natural Resources
Assembly Committee on Natural Resources
Secretary Mark Gottlieb - Department of Transportation
Secretary Dave Ross - Department of Safety and Professional Services
Secretary Ben Brancel - Department of Agriculture, Trade & Consumer Protection
Secretary Dennis Smith - Department of Health Services
Secretary Cathy Stepp - Department of Natural Resources
President Kevin P. Reilly - University of Wisconsin System
State Geologist James Robertson - Geological and Natural History Survey

Ken Johnson,
Council Chair
DNR

James Robertson
WGNHS

John Petty
DATCP

Henry Anderson, MD
DHS

Anders Andren
UWS

Eric Scott
DSPS

Dan Scudder
DOT

George Kraft
GOVERNOR'S REP.

The Groundwater Coordinating Council (GCC) is pleased to release its 2011 Report to the Legislature. The GCC was formed in 1984 to help state agencies coordinate non-regulatory activities and exchange information on groundwater. For the past 27 years, the GCC has served as a model for interagency coordination and cooperation among state agencies, the Governor, local and federal government, and the university. It is one of the few groups in the nation to effectively coordinate groundwater activities in its state from an advisory position.

This report summarizes and provides links to information on GCC and agency activities related to groundwater protection and management in FY 11 (July 1, 2010 to June 30, 2011). The links also provide information on the condition of the groundwater resource. At the end of this report are the GCC's recommendations titled *Directions for Future Groundwater Protection*.

(<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/Report/Recommendations.doc>). The report and supporting materials will be made available online at <http://dnr.wi.gov/org/water/dwg/gcc/rtl/gccreport2011.htm>.

Highlights of the State's groundwater protection activities this past year include:

- Research and monitoring contributing to our understanding of many groundwater issues including: nitrate, mercury methylation, biofuel cropping, antibiotics, climate change, water use, and fecal contamination.
- Implementation of the Great Lakes Compact (2008 Wisconsin Act 227).
- The Water Resources Library made considerable progress in providing full-text reports of UWS and DNR groundwater monitoring and research projects through the UW Ecology and Natural Resources Digital Collection at <http://digital.library.wisc.edu/1711.dl/EcoNatRes.Groundwater>.

We hope you will find this report to be a useful reference in protecting Wisconsin's valuable groundwater resource.

Sincerely,

Ken Johnson, Chair
Groundwater Coordinating Council

PURPOSE OF THE GCC AND THIS REPORT

1984, the Legislature enacted 1983 Wisconsin Act 410, Wisconsin's Comprehensive Groundwater Protection Act, to improve the management of the state's groundwater. The Groundwater Coordinating Council (GCC) was created and is directed by s. 160.50, Wis. Stats., to "serve as a means of increasing the efficiency and facilitating the effective functioning of state agencies in activities related to groundwater management. The Groundwater Coordinating Council shall advise and assist state agencies in the coordination of non-regulatory programs and the exchange of information related to groundwater, including, but not limited to, agency budgets for groundwater programs, groundwater monitoring, data management, public information and education, laboratory analysis and facilities, research activities and the appropriation and allocation of state funds for research." For a summary of statutory language relating to the GCC see: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/StatLanguage.pdf>

The GCC is required by s. 15.347, Wis. Stats., to prepare a report which "summarizes the operations and activities of the council..., describes the state of the groundwater resource and its management and sets forth the recommendations of the council. The annual report shall include a description of the current groundwater quality of the state, an assessment of groundwater management programs, information on the implementation of ch. 160, Wis. Stats., and a list and description of current and anticipated groundwater problems." This report is due each August. The purpose of this report is to fulfill this requirement for fiscal year 2011 (FY 11). Please note that this report has been prepared in the style of an executive summary with supporting information referenced by numerous Internet links.

Membership of the GCC includes the Secretaries of the Departments of Natural Resources (DNR); Commerce; Agriculture, Trade & Consumer Protection (DATCP); Health Services (DHS); Transportation (DOT); the President of the University of Wisconsin System (UWS); the State Geologist; and a representative of the Governor. Agency designees and members of the two GCC subcommittees are listed on the inside of the front cover and at <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/Report/Members.doc>). More information about the GCC and its activities can be found on the GCC web pages: <http://dnr.wi.gov/org/water/dwg/gcc/index.htm>.

The GCC's role in facilitating inter-agency coordination includes the exchange of information regarding 1983 Wisconsin Act 410, Wisconsin's Comprehensive Groundwater Protection Act, Wisconsin's Groundwater Protection Act - 2003 Wisconsin Act 310, the Great Lakes Compact, 2007 Wisconsin Act 227, the federal Safe Drinking Water Act's Wellhead Protection and Source Water Protection provisions and many other regulations. For a summary of Wisconsin's groundwater law see <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/Report/WIgroundwaterLaw.pdf>

GROUNDWATER COORDINATION ACTIVITIES

To complete coordination activities, the GCC is authorized to create subcommittees on "the subjects within the scope of its general duties...and other subjects deemed appropriate by the Council." See a list of GCC subcommittee members on the inside cover of this report.

The GCC and its subcommittees regularly bring together staff from over 15 different agencies, institutions and organizations to communicate and work together on a variety of research, monitoring and data management, educational, local government and planning issues. In addition, numerous contacts and informal conversations are generated both at meetings and through email communications among GCC and subcommittee members, leading to better communication across agency lines on a variety of groundwater-related issues. These activities regularly create efficiencies and provide numerous benefits to Wisconsin's taxpayers.

Coordination of Groundwater Research and Monitoring Program

The GCC is directed to "advise the Secretary of Administration on the allocation of funds appropriated to the Board of Regents of the University of Wisconsin under s. 20.285(1)(a) for groundwater research." In 1990 this directive led to the collaborative formation of a joint solicitation process by the UWS, DNR, DATCP, and Commerce and to the Wisconsin Groundwater Research and Monitoring Program (WGRMP). The joint solicitation was first carried out for projects funded in FY 92.

In FY 11 the GCC, the UWS, DNR and the Groundwater Research Advisory Council (GRAC) again collaborated on the annual solicitation for groundwater research and monitoring proposals as specified in a November 2002 Memorandum of Understanding <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/MonitoringResearch/MOU2002.pdf>. After a multi-agency effort spear-headed by the UW Water Resources Institute, the GCC approved the FY 12 Joint Solicitation for Proposals in August of 2010:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/MonitoringResearch/FY12JointSolicitation.pdf>. A total of 12 project proposals were received. A comprehensive review process including the GRAC, the GCC's Monitoring & Data Management and Research Subcommittees and outside technical experts resulted in recommendations that were used by the UWS and DNR in deciding which groundwater-related proposals to fund in FY 12. The process resulted in the selection of six new projects for funding for FY 12, four by UWS and two by DNR. The GCC approved the proposed UWS groundwater research plan as required by s. 160.50(1m), Wis. Stats., and a letter to this effect was sent to the UWS President and the Department of Administration.

Links to WGRMP project lists

Projects funded in FY 11:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/MonitoringResearch/FY11projects.pdf>

Projects to be funded in FY 12:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/MonitoringResearch/FY12projects.pdf>

All Wisconsin state-funded groundwater research and monitoring projects:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/MonitoringResearch/AllProjects.pdf>

The UW Water Resources Institute (WRI) provides access to summaries and reports of GCC-facilitated groundwater research (<http://wri.wisc.edu/Default.aspx?tabid=69>) as well as cataloging all WRI research reports into WorldCat and MadCat, two library indexing tools that provide both worldwide and statewide access to this research. The Water Resources Library has partnered with UW Libraries' Digital Collections Center to digitize and post UWS and DNR final project reports. As a result of this partnership, full-text reports are also available through the UW Ecology and Natural Resources Digital Collection at <http://digital.library.wisc.edu/1711.dl/EcoNatRes.Groundwater>. In 2011 considerable progress was made by WRI and DNR in locating older final reports and summaries for digitization and availability on the Internet.

Information and Outreach Activities

For the eleventh year in a row, three groundwater workshops for teachers were taught jointly by GCC Education Subcommittee members from the DNR, WGNHS and the Center for Watershed Science and Education (CWSE) at UW Stevens Point. In January and February, educators from 26 schools and nature centers took part in the workshops held at Mount Horeb, Chilton, and Fall Creek. The workshop leaders instructed teachers on using a groundwater sand-tank model and provided additional resources to incorporate groundwater concepts into their classroom. Educators who attended the workshops received a

free model. With funding from a U.S. Environmental Protection Agency (EPA) wellhead protection grant, over 250 groundwater models have been given to schools and nature centers since 2001 and about 500 educators have received hands-on training in using the model effectively.

Education Subcommittee members representing The UW-Stevens Point Center for Watershed Science and Education and the WRI again contributed to four news releases for the annual “Groundwater Awareness Week” in March 2011 that were distributed via the UW media mailing lists.

Other Coordination Activities

The GCC continued to promote communication, coordination and cooperation between the state agencies through its quarterly meetings. In FY 11, the GCC received briefings, heard presentations, and discussed:

- Groundwater, streams, lakes and pumping in the Central Sands
- Human viruses as tracers of wastewater pathways into deep municipal wells
- The FY 12 Joint Solicitation
- Mapping infiltration rates in Dane County
- US Dept of Interior’s WaterSMART Program
- Impacts of State budget cuts on groundwater programs
- GCC member agency leadership changes
- Transport and survival of pathogenic bacteria associated with dairy manure in soil and groundwater
- Climate variability and groundwater recharge in southwest Wisconsin
- Improving inter-agency collaboration on groundwater issues through GCC new Priorities and Operations Plan
- Many small informational items presented by the agencies.

More information on the coordinating efforts of the GCC can be found in the FY 11 GCC meeting minutes at: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/Minutes/FY11Minutes.htm>. Through these activities, the GCC continues to play an important role in ensuring agency coordination, increasing efficiency, and facilitating the effective functioning of state agencies in activities related to groundwater protection and management. Ultimately groundwater is better protected, which benefits public health and preserves Wisconsin’s natural resources for future generations.

SUMMARY OF AGENCY GROUNDWATER ACTIVITIES

State agencies and the University of Wisconsin System addressed numerous issues related to groundwater protection and management in FY 11. Detailed discussions of the groundwater activities of each agency can be found on the following GCC web pages:

Department of Natural Resources groundwater activities:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/DNRactivities.pdf>.

Department of Agriculture, Trade, and Consumer Protection groundwater activities

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/DATCPactivities.pdf>.

Department of Commerce groundwater activities:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/CommerceActivities.pdf>

Department of Transportation groundwater activities

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/DOTactivities.pdf>.

Department of Health Services groundwater activities

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/DHSactivities.pdf>.

Wisconsin Geological and Natural History Survey groundwater activities:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/WGNHSactivities.pdf>

University of Wisconsin System groundwater activities

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/UWSactivities.pdf>.

United States Geological Survey – Wisconsin Division Groundwater Activities

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/USGactivities.pdf>.

United States Department of Agriculture – Natural Resources Conservation Service groundwater Activities: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AgencyActivities/NRCSactivities.pdf>.

CONDITION OF THE RESOURCE: Groundwater Quality

Major groundwater quality and quantity concerns in Wisconsin include:

Volatile Organic Compounds (VOCs): Sources of VOCs in Wisconsin's groundwater include landfills, underground storage tanks, and hazardous substance spills. Thousands of wells have been sampled for VOCs and about 60 different VOCs have been found in Wisconsin groundwater. Trichloroethylene is the VOC found most often in Wisconsin's groundwater. More information on VOCs in Wisconsin groundwater can be found here: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuality/VOCs.pdf>.

Pesticides: Pesticide contamination in groundwater results from field applications, pesticide spills, misuse, or improper storage and disposal. Pesticide metabolites are related chemical compounds that form when the parent pesticide compounds break down in the soil and groundwater. The most commonly detected pesticide compounds in Wisconsin groundwater are: metabolites of alachlor (Lasso) and metolachlor (Dual), and atrazine and its metabolites. A 2007 DATCP private well survey estimated that the proportion of wells in Wisconsin that contained a pesticide or pesticide metabolite was 33.5%. Areas of the state with a higher intensity of agriculture generally had higher frequencies of detections of pesticides. The two most commonly-detected pesticide compounds were the herbicide metabolites metolachlor ESA and alachlor ESA which each had a proportion estimate of 21.6%. More information on pesticides in Wisconsin groundwater can be found here: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuality/Pesticides.pdf>.

Nitrate: Nitrate is Wisconsin's most widespread groundwater contaminant and is increasing in extent and severity. Nitrate levels (as nitrate-N) in groundwater are below 1 milligram per liter (mg/L) where pollution sources are absent. Higher levels indicate a source of contamination such as agricultural or turf fertilizers, animal waste, septic systems, and wastewater. At least 90% of nitrate inputs into our groundwater originate from manure spreading, agricultural fertilizers, and legume cropping systems. Concentrations of nitrate in private water supplies frequently exceed the state drinking water standard of 10 mg/L. In 2005 and 2007, DNR aggregated and analyzed data from three extensive statewide groundwater databases. Most recent samples from 48,818 private wells showed 5,686 (11.6 %) equaled

or exceeded the 10 mg/L standard. A 2007 DATCP survey estimated the proportion of private wells that exceeded the 10 mg/l enforcement standard for nitrate-nitrogen at 9.0%. More information on nitrate in Wisconsin groundwater can be found here:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuality/Nitrate.pdf>

Microbial agents: Microbiological contamination often occurs in areas where the depth to groundwater is shallow, in areas where soils are thin, or in areas of fractured bedrock. Microbial agents include bacteria, viruses, and parasites. These agents can cause acute illness and result in life-threatening conditions for young children, the elderly and those with chronic illnesses. In one assessment (Warzecha et.al., 1994), approximately 23% of private well water samples statewide tested positive for total coliform bacteria, an indicator species of other biological agents. Approximately 3% tested positive for *E. coli*, an indicator of water borne disease that originates in the mammalian intestinal tract. The DNR has recently begun tracking total coliform detects in the raw water samples through its Drinking Water System database.

Viruses in groundwater are increasingly a concern as new analytical techniques have detected viral material in private wells and public water supplies. Research conducted at the Marshfield Clinic indicates that 4-12% of private wells contain detectible viruses. Other studies showed virus presence in four La Crosse municipal wells, in the municipal wells and wastewater system in Madison, and in five shallow municipal wells serving smaller communities.

Public and private water samples are not regularly analyzed for viruses due to the high cost of the tests. The presence of coliform bacteria has historically been used to indicate the water supply is not safe for human consumption. However, recent findings show that coliform bacteria do not always correlate with the presence of enteric viruses. More information on microbial agents in Wisconsin groundwater can be found here: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuality/MicrobialAgents.pdf>

Radionuclides: Naturally-occurring radionuclides, including uranium, radium, and radon are an increasing concern for groundwater quality, particularly in the Cambro-Ordovician aquifer system in eastern Wisconsin. The water produced from this aquifer often contains combined radium activities in excess of 5 pCi/L and in some cases in excess of 30 pCi/L. Approximately 35 public water systems exceed the drinking water standard of 15 pCi/L for gross alpha activity. Federal standards are causing many communities to search for alternative water supplies or treatment options. More information on radionuclides in Wisconsin groundwater can be found here:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuality/Radionuclides.pdf>

Arsenic: Naturally occurring arsenic has been detected in wells throughout Wisconsin. DNR historical data show that 3,830 public wells and 3,013 private wells have detectable levels of arsenic. About 10% of these wells exceed the federal drinking water standard of 10 µg/L. Although arsenic has been detected in well water samples in every county in Wisconsin, the problem is especially prevalent in northeastern Wisconsin where increased water use has likely released arsenic from rocks and unconsolidated material into the groundwater. The State continues to proactively address arsenic concerns through well drilling advisories, health studies, well testing campaigns, and studies aimed at improving geological understanding and developing practical treatment technologies. More information on arsenic in Wisconsin groundwater can be found here:

<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuality/Arsenic.pdf>

CONDITION OF THE RESOURCE: Groundwater Quantity

Despite a general abundance of groundwater in Wisconsin, there is a concern about the overall availability of good quality groundwater for municipal, industrial, agricultural, and domestic use and for adequate baseflow to our lakes, streams, and wetlands. Groundwater use grew from 570 to 804 million gallons per day (Mgal/d) from 1985 to 2000. Groundwater use was estimated to be 983 Mgal/d in 2005, but much of the increase between 2000 and 2005 was due to a shift in how irrigation water use was estimated.

Groundwater quantity problems have occurred both naturally and from human activities, and often affect groundwater quality. Regional effects of groundwater withdrawals are well documented in the Lower Fox River Valley, southeastern Wisconsin, and Dane County. Localized effects of groundwater pumping on trout streams, springs, and wetlands have been noted throughout the state. Groundwater quantity legislation enacted in 2004 was the first step towards managing groundwater quantity on a comprehensive basis. The DNR began implementing a new rule, NR 820, regulating high-capacity wells in FY 08. The Great Lakes Compact, signed by Governor Doyle in 2008, requires Wisconsin to have water conservation goals within the Great Lakes Basin. Implementing legislation (2007 Wisconsin Act 227) is currently being implemented. More information on groundwater quantity issues in Wisconsin can be found at the following links:

Issues and Problems

- Water Use: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/WaterUse.pdf>
- Surface Water Impacts: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/SurfaceWaterImpacts.pdf>
- Regional Drawdowns: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/RegionalDrawdowns.pdf>
- Impact of Reduced Quantity on Groundwater Quality <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/QuantityQuality.pdf>
- Land use and high groundwater conflicts: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/LandUseHighGW.pdf>
- Alternative Sources – Aquifer Storage and Recovery: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/AlternativeSources.pdf>

Management Solutions

- Groundwater Quantity Law (2003 Act 310): <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/GWquantityLaw.pdf>
- Statewide Groundwater Level Network: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/GroundwaterLevelNetwork.pdf>
- Great Lakes Compact (2007 Wisconsin Act 227): <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/GreatLakesCompact.pdf>
- Wisconsin Stream Model: <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/GwQuantity/WIStreamModel.pdf>

BENEFITS OF MONITORING AND RESEARCH PROJECTS

The GCC provides consistency and coordination among state agencies in funding Wisconsin's Groundwater Research and Monitoring Program to meet state agency needs. Approximately \$15.5 million has been spent by DNR, UWS, DATCP, and Commerce through FY 11 on 376 different projects dealing with groundwater or related topics. A list of all these projects is available on the GCC webpage (<http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/AllProjects.pdf>). Projects funded have provided valuable

information regarding the Wisconsin's groundwater resources, helped evaluate existing regulatory programs, increased the knowledge of the movement of contaminants in the subsurface, and developed new methods for groundwater evaluation and protection. While the application of the results is broad, some areas where the results of state-funded groundwater research and monitoring projects have been successfully applied to groundwater problems in Wisconsin include:

- Pharmaceuticals, personal care products, and endocrine disrupting compounds
- The Atrazine Rule
- Groundwater monitoring at solid waste disposal sites
- Arsenic monitoring and research in Northeastern Wisconsin
- Groundwater movement in shallow carbonate rocks
- Developing new tools for groundwater protection
- Prevention and remediation of groundwater contamination
- Detection and monitoring of microbiological contaminants
- Groundwater drawdowns
- Comprehensive planning
- Rain garden design and evaluation
- Methylmercury formed in groundwater

See the GCC webpage <http://dnr.wi.gov/org/water/dwg/gcc/rtl/gccreport2011.htm> under the "Benefits from Projects" tab for more information on some of these projects and how agencies have used the project results to improve the management of the state's groundwater resources.

RECOMMENDATIONS: DIRECTIONS FOR FUTURE GROUNDWATER PROTECTION

The GCC is directed by statute to include in its annual report a "list and description of current and anticipated groundwater problems" and to "set forth the recommendations of the Council" (s. 15.347(13)(g), Wis. Stats.). In this section the GCC identifies its 2011-13 statewide groundwater protection priorities: pathogens, nitrates, private wells and groundwater quantity.. In addition, the following list sets forth the GCC's recommendations for future groundwater protection and management needs to state agencies, the Governor, the Legislature, and the citizens of Wisconsin.

2011-13 Priorities

Evaluate occurrence of recently discovered groundwater contaminants: Studies have found evidence of viruses and other microbial agents in both municipal water supplies and domestic wells. More research is needed to refine our understanding of the scope of occurrence of this human health threat and demonstrate how these contaminants reach and move through the groundwater.

Find solutions to groundwater nonpoint pollution problems: On average, 9% of all wells in the state exceed the nitrate standard. These rates are substantially higher in agricultural areas and have been greater than 60% in some townships. A 2008 DATCP report indicated that 33.5% of wells contain a detectable level of at least one pesticide or pesticide metabolite and 11.7% of Wisconsin's wells still contain detectable atrazine residues. More work is needed to determine what practices will sustain both agriculture and groundwater quality. The GCC will support the agencies and the UWS in obtaining information on the measures needed to avoid the human health implications of consuming nitrate and pesticide contaminated groundwater and the effect of discharge of this groundwater on surface waters and their ecosystems.

Meet funding needs to develop nitrogen management practices that avoid significant health impacts. From 2005 to 2007, nitrogen fertilizer sales increased 25% resulting in the application of approximately 400 million pounds of N in excess of UW recommendations. A recent DATCP survey of private well water quality shows increasing probability of nitrogen contamination of drinking water as the percentage of nearby agricultural land use increases. A USGS study further finds that nitrate contamination of groundwater is increasing (Saad, 1997). The implementation of nutrient management plans by farmers should reduce nitrogen loading to groundwater. Nutrient management planning has increased dramatically in recent years. With a tight agricultural economy, farmers are embracing nutrient management because it is beneficial economically as well as environmentally. While nutrient management planning is a necessary first step, the plans must be implemented and maintained over time. Additionally, the individual practices that make up nutrient management plans need to be evaluated to ensure both practicality for farmers and effectiveness for groundwater and surface water protection.

Evaluate the scope of manure pollution of groundwater: Groundwater contamination associated with manure handling and disposal is an ongoing problem in many parts of Wisconsin. Rural home owners sometimes report brown, discolored, or smelly well water, and some of these cases have been directly linked to manure contamination. Concern about this problem is increasing as Wisconsin farming methods have evolved toward larger farms with thousands of animal units and proportionally higher waste loads. Manure handling has also evolved toward producing material with higher liquid content, which is easier to transport and store but has a higher probability of moving to groundwater than the higher-solid manure produced by traditional Wisconsin farms. A statewide assessment of manure-groundwater issues is needed to understand the scope and magnitude of the problem. Mechanisms, pathways, and timing of movement into groundwater, the influence of landscape settings and climatic factors, the applicability of new analytical tools and methods of vulnerability assessment and best management practices (BMPs) and the threat of associated contaminants (bacteria, nitrate, pharmaceuticals, viruses, other pathogens, etc) all need to be better understood. Several manure management research and monitoring projects started in FY 08. The GCC and its subcommittees need to help evaluate the findings and guide follow-up projects on this topic.

Support Implementation of the Great Lakes Compact: The Great Lakes Compact establishes a consistent framework for oversight of groundwater and surface water in the Great Lakes basin. Implementing legislation (2007 Wisconsin Act 227) includes a water use permitting system for review and approval of water withdrawals and diversion applications, direction to develop a statewide water conservation and efficiency program, and a statewide requirement for water supply service area planning. Effective implementation will require sound data and research and development of innovative approaches to balance competing demands and make sustainable water use decisions. Wisconsin should continue its leadership in the Great Lakes basin on Compact implementation. The GCC will play an important role in supporting essential research and management initiatives

Define the impacts of groundwater withdrawals: Recent headlines about lakes, streams and springs drying up in various parts of the state, and severe groundwater level drawdowns in southeastern Wisconsin have generated many questions about the effects of groundwater withdrawals on surface waters and long-term groundwater availability. Wisconsin will undoubtedly face hard choices among competing water uses in areas of shortage. Aside from a few cases, the state-wide scope of groundwater withdrawals and associated impacts on surface water is not clear. State actions should ensure that scientific information is available for decision-making related to the availability of groundwater and on promoting recognition of the relationship between groundwater quantity and quality. The GCC will continue to encourage research and management efforts that will address this issue.

Address groundwater quantity management issues at both statewide and regional levels:

Groundwater quantity issues came to the forefront of public discussion in FY 04, with the development and passage of landmark groundwater quantity legislation, 2003 Wisconsin Act 310. Since its passage, the DNR has been implementing the law and the Groundwater Advisory Committee has been addressing specific policy issues related to groundwater management planning and the overall effectiveness of the law. There is a need for proactive regional groundwater planning in certain areas of the state where development/population growth pressures are intersecting with limited groundwater resources and leading to water availability and sustainability issues. The GCC will continue to serve as a resource for addressing scientific and technical questions related to groundwater quantity – this includes facilitating dialogue among all parties on potential approaches to existing problems and measures to identify areas with developing or potential groundwater quantity problems.

Ongoing Recommendations

Develop methods to assess and protect against health hazards posed by exposure to ‘orphan’ contaminants as well as multiple contaminants in a water supply. Data collected by DNR and DATCP indicate that many groundwater aquifers are contaminated with ‘orphan’ chemicals, such as pesticide degradates, chlorinated organics and petroleum derivatives, for which toxicity information is inadequate to support risk assessment. When drinking water wells have one or more pesticide degradates present, perhaps in combination with a parent compound or other unrelated compounds, solutions are needed to effectively address these scenarios. The GCC will support the agencies in their attempt to develop uniform methods that can be used to establish contaminant-specific advisories for owners of impacted water supplies.

Support implementation of a Statewide Groundwater Monitoring Strategy: Chapter 160 of the Wisconsin Statutes requires the DNR to work with other agencies and the GCC to develop and operate a system for monitoring and sampling groundwater to determine whether harmful substances are present (s. 160.27, Wis. Stats.). In FY 04, several agencies worked together to develop and refine a Statewide Groundwater Monitoring Strategy to guide agency monitoring efforts for the next eight to ten years. The strategy has been incorporated into the DNR Water Monitoring Strategy (<http://dnr.wi.gov/org/water/monitoring/strategy.htm>). In FY 07 a multiagency groundwater monitoring workgroup developed a process and priorities for implementing the first goal: enhancing the Wisconsin Observation Well Network. The GAC, in its 2006 and 2007 reports, stressed the value of an enhanced monitoring network and included recommendations that urged sufficient funding. To date, no significant improvements of the monitoring well network have been made. However DNR and WGNHS are currently planning network enhancements to be made in the near future.. The GCC encourages agencies, the university, and federal and local partners to further implement this and other components of the strategy and to seek funding to support its implementation.

Investigate extent and origins of naturally occurring substances in groundwater: Continued problems of elevated arsenic, low pH, and other water quality problems in domestic wells exist over large areas of northeast Wisconsin. In addition, elevated sulfate, total dissolved solids (TDS), and radium have been found in some new deep municipal wells in the Lower Fox River Valley. In some other existing deep wells as far south as Milwaukee, TDS has been steadily increasing over several years. Elevated levels of radium, sulfate and TDS pose a problem for local water managers, and the origin of these constituents is not well-understood. The State needs more information about the extent and naturally occurring contaminants in order to give advice to homeowners, municipalities, and well drilling contractors. The GCC should continue to encourage research efforts that will provide information useful in addressing these issues.

Understand the links between land use and groundwater quantity and quality: Intelligent decision-making requires an understanding of how land use change (such as developing rural lands into urban uses) impacts groundwater. For example, Juckem and others (2008) show that land management mitigates or magnifies stresses such as climate change. Also, agricultural nonpoint source rules require nutrient management plans that are intended to reduce nutrient inputs. The effects of land and nutrient management practices on surface water and groundwater quality need to be better understood. Another example is the impact of storm water infiltration on groundwater. Storm water infiltration rules require storm water infiltration trenches in many commercial and multi-family residential settings in Wisconsin. This will help reduce runoff in urban areas, but the impacts of trenches on groundwater quality and quantity are not fully understood. Research is needed to determine the impact of infiltration devices on local groundwater, and to assess the need for signage or abandonment criteria to protect the groundwater resource.

Continue to evaluate and catalog Wisconsin's groundwater resources. Although we have ample amounts of groundwater in our state, we can still experience local water shortages when our ability to extract water exceeds the natural replenishment rate. To meet growing demand, Wisconsin's groundwater resources need to be further defined in terms of its quality, quantity, and availability.

Continue to fund groundwater monitoring and research: Numerous years of state budget cuts and increased costs have reduced the number of groundwater research and monitoring projects that are funded each year (see <http://dnr.wi.gov/org/water/dwg/gcc/rtl/2011/MonitoringResearch/AllProjects.doc>). Continued cuts will hamper the State's ability to address critical groundwater monitoring and research needs in the future. Research and monitoring are necessary to identify and test cost-effective groundwater protection strategies that can prevent groundwater problems before they need to be remediated at a much greater cost. The GCC encourages its member agencies and the Legislature to restore adequate resources for groundwater monitoring and research and to seek partnerships to leverage additional funds.

Evaluate potential impacts of climate change on Wisconsin's groundwater: Climate change will likely increase the frequency and severity of weather patterns that may produce unprecedented flooding or drought conditions. As a result, land and water use patterns may also change and affect the groundwater supply. These may include biological or chemical contamination issues or increased demand for groundwater by agricultural, municipal, and commercial users. Additionally, recent groundwater/surface-water modeling by USGS suggests that climate change will affect timing of groundwater recharge, amount of baseflow in streams, the relative contribution of groundwater to lakes, the distribution of wetlands on our landscape and affect soil moisture content. More work is needed on the range of possible climates in Wisconsin's future. Work is also needed on feedback mechanisms between climate and groundwater to fully characterize possible changes to Wisconsin's groundwater resource. This research will help identify management strategies for Wisconsin's groundwater supply.

References:

- Juckem, P.F., Hunt, R.J., Anderson, M.P., and Robertson, D.M., 2008, Effects of Climate and Land Management Change on Streamflow in the Driftless Area of Wisconsin, *Journal of Hydrology*, Vol. 355, p 123–130, doi:10.1016/j.jhydrol.2008.03.010
- Saad, D.A., 1997, Effects of land use and geohydrology on the quality of shallow ground water in two agricultural areas in the Western Lake Michigan Drainages, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 96–4292, 69 p.