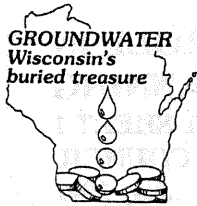


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State of Wisconsin | GROUNDWATER COORDINATING COUNCIL

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AUG 30 2002

Date: August 30, 2002

Susan L. Sylvester,
Council Chair
DNR

To: Senator James Baumgart
State Capitol
306 South
INTER-DEPARTMENTAL

Carol Cutshall
DOT

James Robertson
WGNHS

From: Tim Asplund, DNR - DG/2 *TRA*

Nicholas Neher
DATCP

Henry Anderson
DHFS

In this packet, please find the following items:

1) The 2002 Groundwater Coordinating Council *Report to the Legislature*, as required by s. 15.347 Wis. Stats.

Cathy Cliff
COMMERCE

2) A document titled, "*Sharing Our Buried Treasure: Directions for the Protection and Management of Wisconsin's Groundwater*" which is a summary of the 2001 Groundwater Summit facilitated by the Groundwater Coordinating Council.

Frances Garb
UWS

John Metcalf
GOVERNOR'S REP.

3) A set of three *Comprehensive Planning and Groundwater Fact Sheets* developed by the Groundwater Coordinating Council to assist local communities in their "Smart Growth" planning activities.

These documents are all available electronically on the GCC web site at <http://www.dnr.state.wi.us/org/water/dwg/GCC/>. If you have any questions about the Council or these materials, please contact me at 608-267-7449, or tim.asplund@dnr.state.wi.us.

GROUNDWATER
Wisconsin's
buried treasure



GROUNDWATER AND ITS ROLE IN COMPREHENSIVE PLANNING

COMPREHENSIVE PLANNING AND GROUNDWATER FACT SHEET 1 WISCONSIN GROUNDWATER COORDINATING COUNCIL

July 2002

What is this groundwater? What does it have to do with comprehensive planning? If you're like most people in Wisconsin, you use groundwater for showering, cooking, drinking, watering your lawn, washing your clothes and many other activities that we take for granted. About 75% of us Wisconsinites get our household water from groundwater, either from a private well or a municipal well. Only a small number of communities in Wisconsin, located along Lakes Michigan, Superior or Winnebago, are supplied by surface water.

In addition, groundwater is used heavily by agriculture and industry. It also supplies most of the water in Wisconsin's many lakes, streams and wetlands. Protecting this valuable resource is critical for the long-term health and well being of your community. One of the ways you can do this for your community is through the comprehensive planning process, which is commonly called "Smart Growth." This fact sheet provides some background information on groundwater and discusses its relation to comprehensive planning.

The Hydrologic Cycle

Where does the groundwater that comes out of your tap or your showerhead come from?

As the word implies, groundwater is found underground and is part of the hydrologic or water cycle, kept in motion by solar energy and gravity. (Figure 1)

Groundwater begins as precipitation. Some precipitation (rain or snow) runs off into lakes, streams, rivers and wetlands. Some evaporates back into the atmosphere. Plants take some up. Groundwater is that water that makes it past the plants down into the subsurface soil and rock.

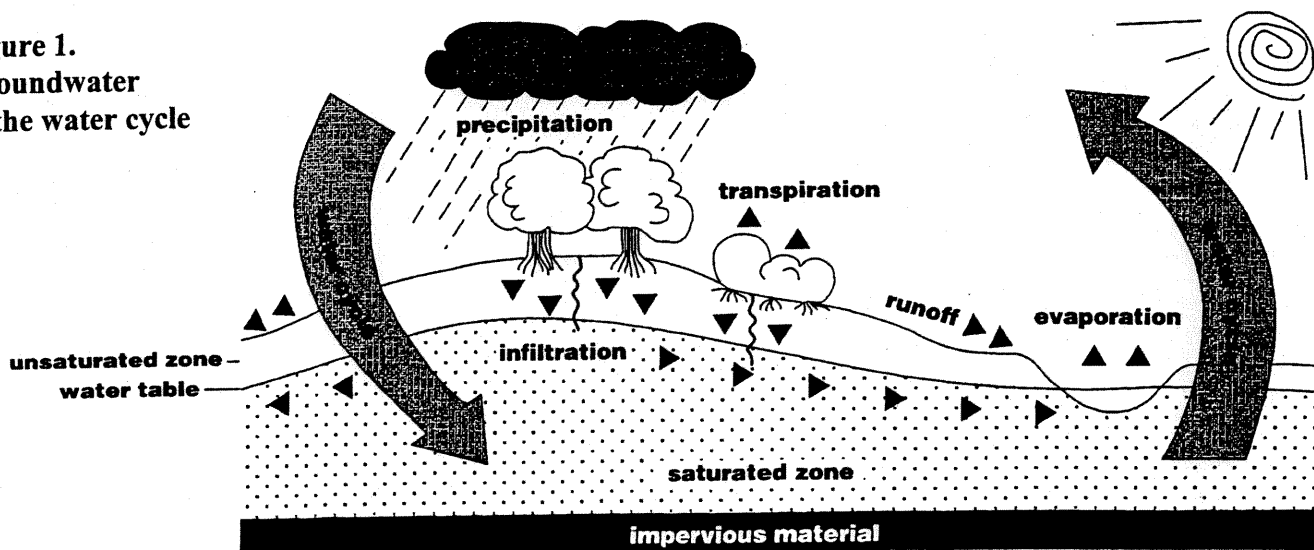
In Wisconsin, an average of 30-32 inches of precipitation fall each year. Six to ten inches of that precipitation seep into the ground to become groundwater recharge. The amount of recharge varies depending upon the topography, soil, vegetation and land use.

Groundwater moves through openings between soil or rock particles or along fractures. A layer of rock or soil that is capable of storing, transmitting and yielding water to wells is called an aquifer.

The water surface below which water fills all the openings in soil and rock is called the water table. Above the water table is the unsaturated zone and below it is the saturated zone.

Groundwater normally migrates from upland areas to lowland areas, eventually discharging in low places where the water table intersects the land surface in lakes, streams and wetlands. Most precipitation that recharges groundwater moves only a few miles from the point of recharge to the point of discharge. Wisconsin's groundwater doesn't come from Canada or Lake Superior, or flow in some mysterious underground stream.

Figure 1.
Groundwater
in the water cycle



Because groundwater naturally moves to and discharges in lowland areas, it is a significant factor in maintaining flow in our lakes, streams and wetlands. This is especially true in seasons with low precipitation. Streams, and most lakes and wetlands, are fed during the winter and dry periods by groundwater from the uplands surrounding that stream, wetland or lake. This groundwater contribution is called baseflow and is particularly critical for aquatic systems during low flow or drought conditions.

For more information on groundwater and the water cycle, check out the following resources:

- Wisconsin Department of Natural Resources (WDNR), 1999, Groundwater: Protecting Wisconsin's Buried Treasure, WDNR publication PUBL-DG-055-99, 32 p. Available for viewing at: www.wnrmag.com/supps/1999/aug99/intro.htm
- WDNR Environmental Education for Kids website: www.dnr.state.wi.us/org/caer/ce/ee/groundwater/index.htm
- Portage County groundwater website: www.uwsp.edu/water/portage
- University of Wisconsin – Stevens Point, 1998, What is this groundwater? 12 minute video produced by the College of Natural Resources and available from the Groundwater Model Project, 715-346-4613 or www.uwsp.edu/stuorg/awra/h2omodel.html.

Groundwater and Land Use

So what's the connection between groundwater and land use? Why do I need to be concerned about groundwater in planning for my community?

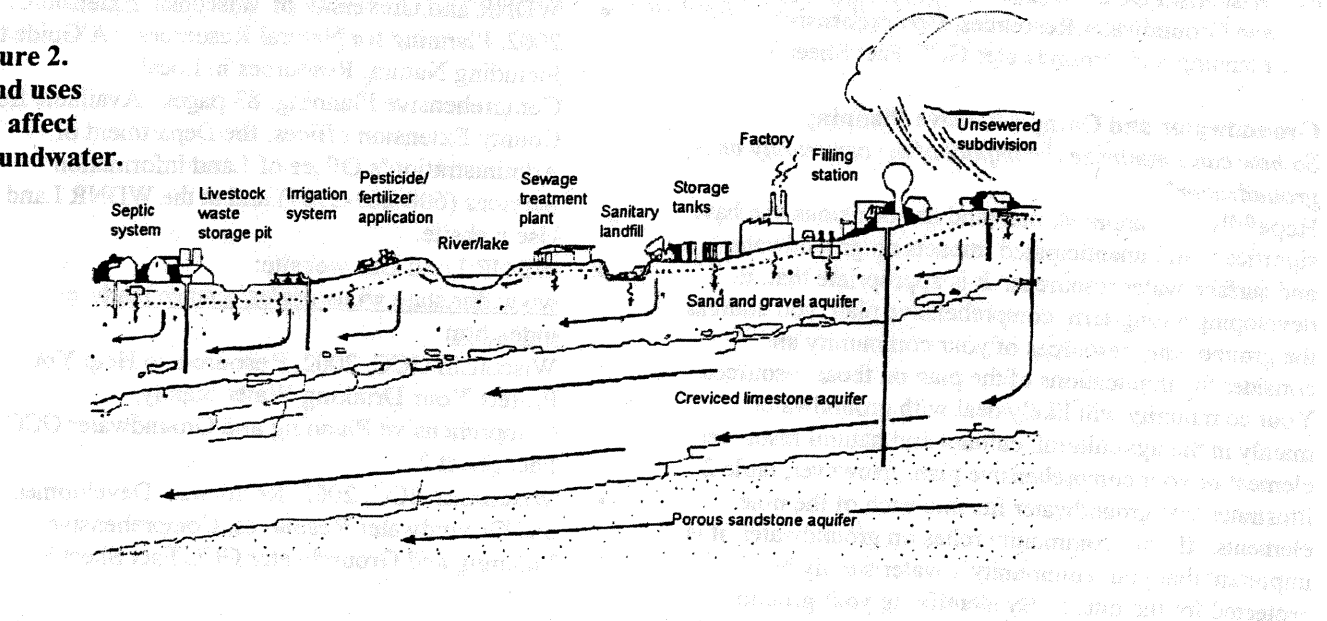
Since groundwater gets into the ground at the land surface, it makes sense that what happens on the land surface can have impact on groundwater (figure 2). In fact, it can affect both groundwater quality and quantity.

A great many land use activities have the potential to impact the natural *quality* of water, as shown in Table 1. A landfill may leach contaminants into the ground that end up contaminating groundwater. Gasoline may leak from an underground storage tank into groundwater. Fertilizers and pesticides can seep into the ground from application on farm fields, golf courses or lawns. Intentional dumping or accidental spills of paint, used motor oil, or other chemicals on the ground can result in contaminated groundwater. The list could go on and on. A fairly comprehensive list of activities that could contaminate groundwater under the right circumstances is on a WDNR contaminant source inventory form (form # 3300-215) available at www.dnr.state.wi.us/org/water/dwg/gw/CUI-Form.htm or from the WDNR. For information on potential threats from agricultural activity, visit the Department of Agriculture, Trade and Consumer Protection water quality website at <http://datcp.state.wi.us/arm/agriculture/land-water/water-quality/>.

Groundwater *quantity* can also be impacted by a number of land uses, particularly as communities grow. As the population grows, there is an increased demand for water to supply new homes, businesses and industries. When wells are installed to withdraw groundwater, the natural groundwater flow is disrupted. A portion of the water that normally would have discharged to a surface water body is pumped out of the ground to be used in a home, factory, or irrigation system. If groundwater is withdrawn from an aquifer by wells faster than it is recharged, then the amount of water in the aquifer is reduced.

There is increasing concern in the Lower Fox River Valley, southeast Wisconsin and Dane County, among other areas, where the water tables in the aquifers are dropping rapidly because of heavy groundwater use resulting from community growth.

Figure 2.
Land uses
can affect
groundwater.



As communities grow, land is paved over for roads, houses, shopping centers and parking lots. These land uses do not allow precipitation to recharge into the subsurface. Instead, the water runs off into lakes, streams and wetlands, picking up contaminants as it goes. The result is three-fold.

- First, there is less recharge to groundwater, thereby reducing the amount of groundwater that can be withdrawn from the aquifer at the same time that demand for water is increasing.
- Second, more runoff during precipitation events means more flooding than was the case before development. That water has to go somewhere. Those living near surface waters may find flooding of their properties that didn't happen before.
- Third, as precipitation runs off the land, it may pick up fertilizers or pesticides from lawns, golf courses or farm fields. It may pick up oil and other waste products from streets. This nonpoint source pollution can seriously degrade the quality of the runoff as it moves toward a stream.

The reductions in baseflow, increased flood flows and nonpoint source pollution may have significant impacts on the flora and fauna that inhabit a stream, lake or wetland. An outstanding trout stream may be adversely affected by a change in streamflow quantity or quality.

For more information on groundwater quality and quantity, check out the following resources:

- WDNR, 1997, Status of Groundwater Quantity in Wisconsin, WDNR publication PUBL-DG-043-97, 53 p.
- WDNR, 1999, Groundwater: Protecting Wisconsin's Buried Treasure, WDNR publication PUBL-DG-055-99, 32 p.
- Wisconsin Groundwater Coordinating Council (GCC), 2001, Wisconsin Groundwater Coordinating Council Report to the Legislature, 136 p.
- Wisconsin GCC, 2002, Residential Development and Groundwater Resources, Comprehensive Planning and Groundwater GCC Fact Sheet 3.

Groundwater and Comprehensive Planning

So how can I minimize the impact of my community on groundwater?

Hopefully, it is apparent that land use decisions can have significant and unanticipated impacts on groundwater and surface water resources. It is appropriate that, in developing a long-term comprehensive plan, you address the groundwater resources of your community and consider the implications of the plan on those resources. Your community will likely deal with groundwater mainly in the agricultural, cultural and natural resources element of your comprehensive plan. However, table 2 illustrates that groundwater fits into each of the nine elements. If your community relies on groundwater, it is important that your community's water supply be protected for the future. By identifying your ground-

Table 1. Activities that may contaminate groundwater.

Place of Origin	Potential Pollution Sources			
	Municipal	Industrial	Agricultural	Other
Waste-related				
At or near the land surface	Sludge and wastewater disposal		Feedlots	Septage disposal
		Wastewater irrigation & landspreading	Manure storage and spreading Whey spreading	Junkyards
Below the land surface	Landfills		Manure pits	Septic systems
	Wastewater impoundments			
	Seepage cells			
	Sanitary sewers			
Non-waste				
At or near the land surface	Salt piles	Above and on the ground storage of chemicals		Highway deicing salt
	Snow piles	Stockpiles	Irrigation	Lawn fertilizers
	Contaminated stormwater infiltration	Spills	Fertilizers	Pesticides
		Tailing piles	Pesticides	
		Silage		
Below the land surface	Underground tanks			Improperly constructed and abandoned wells
	Pipelines			
				Over-pumping (induced pollution)

water resources, you can help your community make wise development decisions that maintain and protect the integrity of your water supply for future generations.

For more information on groundwater and comprehensive planning, check out these resources:

- WDNR and University of Wisconsin Extension, 2002, Planning for Natural Resources – A Guide to Including Natural Resources in Local Comprehensive Planning, 83 pages. Available from County Extension offices, the Department of Administration's Office of Land Information Services (608-267-2707) and at the WDNR Land Use website.
- WDNR Land Use website: www.dnr.state.wi.us/org/es/science/landuse/index.htm
- Wisconsin GCC, 2002, Resources to Help You Protect Your Drinking Water Supply, Comprehensive Planning and Groundwater GCC Fact Sheet 2.
- Wisconsin GCC, 2002, Residential Development and Groundwater Resources, Comprehensive Planning and Groundwater GCC Fact Sheet 3.

Table 2. The relationship of groundwater to other elements of comprehensive planning.

Comprehensive planning element	Relationship to groundwater
Issues and Opportunities	Important issues may include • the amount of water needed for future homes, farms and businesses • whether the needed water is available, how it will be provided and at what cost • how growth will affect the future quality and quantity of available groundwater • the need for community wellhead protection planning
Housing	• Additional houses increase the demand for clean water and other services. • Paved areas may reduce the amount of groundwater recharge. • More homes may mean more fertilizer and pesticide use. • The potential for household chemicals or used oil to be dumped on the ground or into septic systems increases. • Decisions must be made on whether new houses will have public sewers or private on-site wastewater disposal systems. (See Fact Sheet 3).
Transportation	New roads needed to serve growing areas may mean: • more runoff of water off impervious surfaces that might have recharged groundwater. • more salt to keep the new streets safe in winter, which may seep into groundwater. • more chemicals leaking from automobiles and entering storm sewers or seeping into the ground.
Utilities and community facilities	• Communities must assess future water needs and the ability of existing systems to meet future needs, including the infrastructure and any environmental limitations to the siting of new wells or reservoirs. See also Economic development below.
Agricultural, natural and cultural resources	• Groundwater provides the majority of the water in many Wisconsin lakes, streams and wetlands. • Pumping municipal, industrial, agricultural or other high-capacity wells may reduce flow to surface water bodies. • Agricultural land use may increase potential for groundwater contamination from fertilizers and pesticides. • Groundwater information is important in assessing the ability of the resource to sustain growth over the long term.
Economic development	• Water demand may increase from new residences and businesses. • Water costs may increase due to pumping from deeper aquifers or adding new wells to the system to meet demand. • New high capacity wells could affect groundwater quantity and sensitive surface water resources. • New businesses may have facilities, operations or land use practices that could cause accidental spills or other groundwater contamination.
Intergovernmental cooperation	• Because groundwater impacts go beyond political boundaries, a coordinated effort is important to avoid potential problems down the road. Working together can maximize the use and protection of the available water resources.
Land use	• Many land uses (agricultural, urban, residential, commercial, industrial) have the potential to impact groundwater quality. • Impermeable areas such as buildings, roads, houses and parking lots prevent precipitation from infiltrating into the subsurface, increasing runoff and potential flooding. • Water and sewer service plans, subdivision plans, and wellhead or source water protection plans are all forms of land use planning that can mitigate groundwater impacts.
Implementation	•As communities develop a schedule to implement the comprehensive plan, communities need to make sure that protection of the groundwater resource is considered. Developing a wellhead protection plan is one way to accomplish this important step. It is important to have information on groundwater resources to make sound planning decisions.

This is one of a series of groundwater fact sheets designed to provide information to assist communities with comprehensive planning. Other fact sheets and more detailed information to assist planners can be found at the Groundwater Coordinating Council (GCC) website, www.dnr.state.wi.us/org/water/dwg/gcc/, the WDNR groundwater website, www.dnr.state.wi.us/org/water/dwg/gw/, or the WDNR Land Use Team website at www.dnr.state.wi.us/org/es/science/landuse/index.htm. To order publications listed in this fact sheet, call 608-266-9265.

Acknowledgements: Illustration, page 1 from Extension publication G3652 Do Deeper Wells Mean Better Water?; page 2, Wisconsin Geological and Natural History Survey (WGNHS) Special Report 11 Groundwater Protection through Local Land-Use Controls; table, page 3, adapted from WGNHS Special Report 9 A Guide to Groundwater Quality Planning and Management for Local Governments

Comprehensive Planning and Groundwater Fact Sheets were produced by GCC subcommittee members Dave Lindorff, WI Department of Natural Resources; Christine Mechenich, Central WI Groundwater Center, and Chuck Warzcha, WI Department of Health and Family Services, July 2002.



RESOURCES TO HELP YOU PROTECT YOUR DRINKING WATER SUPPLY COMPREHENSIVE PLANNING AND GROUNDWATER FACT SHEET 2 GROUNDWATER COORDINATING COUNCIL

July 2002

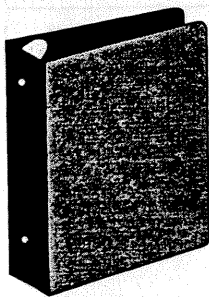
Over 95% of Wisconsin's communities and about 75% of Wisconsin residents rely on groundwater for their drinking water supply. In addition, groundwater is used widely by agriculture and industry. Groundwater also recharges Wisconsin's lakes, rivers, streams and wetlands, maintaining the vitality of the entire ecosystem. In order to plan for the future, it is important that you consider both the quantity and quality of groundwater available to your community. The future of your community depends on having a safe and dependable supply of groundwater. How do you find out about your groundwater resources? Through a series of questions, this fact sheet describes what information you'll need to address groundwater in your comprehensive ("Smart Growth") plan and where to go to find that information.

Where does your community's groundwater come from?

It is important to identify both the geologic materials or the geologic setting from which your community's groundwater comes and the recharge area which contributes water to your well(s).

What geologic materials provide water for your community's well(s)?

- Your local water utility should have engineering reports or wellhead protection plans for each of your well(s). These plans describe local geologic and groundwater conditions in the area around your community's well(s). These reports can provide information on the geologic materials in your area and which water-bearing formation or formations (aquifers) provide groundwater to your well(s).



- Another source of local geologic and groundwater information is the Wisconsin Geological and Natural History Survey (WGNHS). The WGNHS may have reports of geologic and/or groundwater conditions in your county. You can

view the WGNHS List of Publications online at:

<http://www.uwex.edu/wgnhs/maps.htm> or get a copy by calling 608-263-7839. The WGNHS also maintains records of wells drilled in the state. Find out about getting copies of well records by going online at

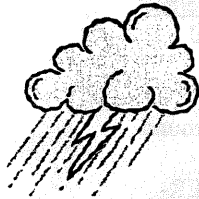
<http://www.uwex.edu/wgnhs/well.htm> or by calling Irene Lippelt at 608-262-7430.

- Well construction reports can also be obtained online at the Wisconsin Department of Natural Resources (WDNRs) Drinking Water System page at: www.dnr.state.wi.us/org/water/dwg/dws.htm.
- The WDNR is currently working to complete and make available source water assessments of the susceptibility of each public water system to contamination. These assessments will include a summary of geologic and well construction information for each system. The results of the assessments will be mailed to each water utility in 2003 and will be available through the WDNR source water assessment website at: www.dnr.state.wi.us/org/water/dwg/gw/swp.htm.
- As part of the source water assessment process, groundwater modeling was conducted to assist in source water area delineations in highly populated areas. These areas include: the Southeastern Wisconsin Regional Planning Commission counties plus Dane, Eau Claire, Fond du Lac, LaCrosse, Pierce, Rock, St. Croix and Sauk Counties. Computer models were also used for the Central Sands and the Lower Fox River Valley which incorporate parts of Adams, Juneau, Marquette, Portage, Waushara, Brown, Calumet, Outagamie and Winnebago Counties. See the WDNR wellhead protection website at www.dnr.state.wi.us.org/water/dwg/gw/whp.htm for a map and contact information for the modeling reports which will contain

detailed geologic and groundwater information.

What land area contributes recharge to your community's well(s)?

It's also important to identify the land area contributing water to your well through infiltration of precipitation into the subsurface. Rain and snow seep into the ground and migrate through the soil to groundwater, which then flows toward your well(s). This area, known as the recharge area, can also allow contaminants to enter the subsurface. If an underground storage tank or a landfill leaks contaminants into the ground within the recharge area, these contaminants could reach your community's well.



- Your water utility may have identified the recharge area for your well(s) as part of a wellhead protection plan or other report. If your community doesn't have a wellhead protection plan, you can identify the recharge area by one of several methods outlined in the WDNR publication "A Template for Preparing Wellhead Protection Plans for Municipal Wells", PUBL DG-053-00. It is available for downloading off the WDNR's wellhead protection website at www.dnr.state.wi.us/org/water/dwg/gw/WHPtplat.pdf or by calling Dave Lindorff at 608-266-9265.
- The source water assessments described above will identify each well's 5-year time of travel (TOT) capture zone for each public water supply well, that is the area which contributes recharge to the well over 5 years. These source water assessment areas will be determined by the groundwater modeling described above, a wellhead protection delineation if one has been done or a simple calculation with a default circle with a radius of 1200 feet around the well. The delineations will be included in the assessments mailed to each water utility as they are completed in 2003.

Are there sensitive areas within the recharge area that warrant protection or special consideration?

As you gather information for your community, it is important to identify any areas that may need some special consideration. For example, there may be areas that because of soil type, geologic features, shallow depth to the water

table or other reasons are sensitive to contamination. There may be critical portions of the recharge area for your wells that need to be protected to maintain adequate recharge. There may be areas where poor groundwater quality or limited groundwater availability makes it unsuitable for development of private wells.

- The 2002 publication, "Planning for Natural Resources", identifies a variety of sources for natural resource information that is available from the WDNR and other sources. It lists contact information for wetlands, floodplains, geology, soils, contaminated sites and other natural resources. The publication is available from County Extension offices, the Department of Administration's Office of Land Information Services (608-267-2707) and at www.dnr.state.wi.us/org/es/science/landuse/smart_growth/index.htm#planbook.
- The WGNHS may have geologic and groundwater maps for your area that identify particularly sensitive geologic areas.
- Your community, water utility, county or the local Regional Planning Commission may have information on sensitive areas that have been identified.
- If computer groundwater models have been developed for source water assessments or other purposes, it may be possible to use them to predict the impacts of various development scenarios. For example, groundwater models could be used to identify the impacts of additional wells or new development. Use of a groundwater model should be undertaken with the assistance of a groundwater professional who can help you understand the uses and limitations of the model.

How much groundwater do your wells currently produce?

As you plan for the future, it is important to understand the current capabilities of your water supply system so you can determine what your community will require to meet future needs.

- Your local water utility should have historical pumping records for each of your wells. Water utilities are also required to submit monthly pumping records to the WDNR's Bureau of Drinking Water and Groundwater. Using data from those months when water use is highest (typically summer), you can calculate a worst case average daily use per person.

- Your local water utility should be able to look at current use compared to well capacity to determine how close your well system is to capacity. If it is near capacity, then a new well may be needed soon. Using pump capacity data from your wells to estimate long-term well productivity can give an inaccurate assessment since most pumps aren't designed to work continuously at their maximum capacity. It is also important to remember that, if your wells are close together, increased pumping by one of the wells may cause interference with (and lower yields from) your other wells if they withdraw water from the same aquifer. This increased pumping may impact other nearby wells, e. g. industrial wells or private wells.

What are the existing and potential contaminant sources that could impact your wells?

In order to protect your water supply, it is important to know if there are any contaminant sources within the recharge area of your well that might contaminate your well. This would include any known sources of contamination as well as potential threats to your wells. Figure 1 shows some potential contaminant sources.

- Your water utility should have completed a contaminant source inventory either for a wellhead protection plan or for a vulnerability assessment to justify a waiver from water quality monitoring requirements. If a contaminant source inventory hasn't been completed for the recharge area around your wells, you can download a copy of "A Guide for Conducting Potential Contaminant Source Inventories for Wellhead Protection" from the WDNRs website at <http://www.dnr.state.wi.us/org/water/dwg/gw/ContamSI.pdf> or by calling David Lindorff at 608-266-9265.
- Another source of potential contaminant source information is the WDNR publication "Directory of Groundwater Databases". It identifies a number of databases that contain information on potential contaminant sources. It is available for downloading at <http://www.dnr.state.wi.us/org/water/dwg/gw/groundwater/Pubdwnld.HTM> or by calling Randell Clark at 608-267-7895. A summary of contaminant source inventory resources on the web is available at <http://dnr.state.wi.us/org/water/dwg/gw/Whpnews6.pdf>.

- The WDNRs Bureau of Remediation and Redevelopment's Tracking System (BRRTS) is the program's main database for tracking contaminated properties. It can be accessed on the web at <http://www.dnr.state.wi.us/org/aw/rr/brrts/index>. The Bureau also maintains the GIS Registry of Closed Remediation Sites at: <http://gomapout.dnr.state.wi.us/org/at/et/geo/gwur/index.htm>.
- The Department of Agriculture, Trade and Consumer Protection website (<http://datcp.state.wi.us/core/agriculture/pest-fert/>) contains information on potential contaminant sites due to agricultural activity.
- The Department of Commerce underground storage tank database is located at: <http://www.commerce.state.wi.us/ER/ER-EN-tanks-info.html>
- The WDNR is developing a geographic information system (GIS) database with contaminant sources identified through the vulnerability assessment and source water assessment processes, including much of the information from databases listed above. From this GIS database and other information, maps showing potential contaminant sources for all public water supply wells will be part of the source water assessment information that will be made available in 2003.

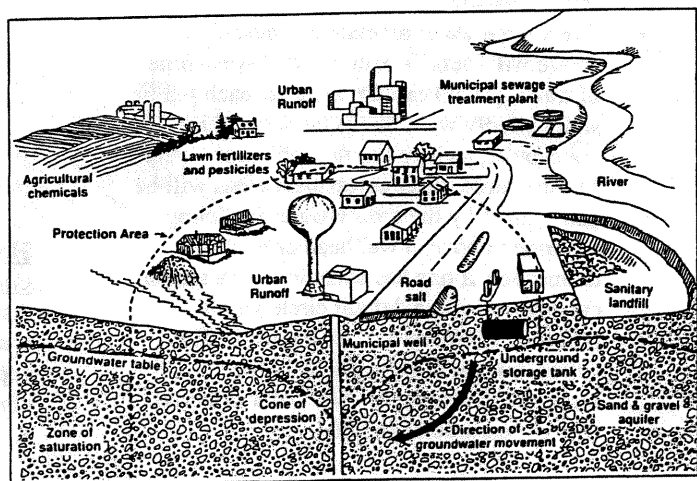


Figure 1. Some potential contaminant sources of groundwater and water supply wells.

Does the quality of the groundwater from your wells meet drinking water standards?

In order to plan for the future, you need to understand whether there are any problems with

your current water quality that need to be addressed.

- Your water utility is required to sample its wells to make sure its groundwater quality complies with drinking water standards. Checking its records can determine if there are any existing contamination problems. All public water supply systems are required to submit to their customers a Consumer Confidence Report (CCR) by July first of each year that describes the quality of the water it is providing. Your water utility should have a copy of the most recent as well as past CCRs.
- It is also important to check the historical record of sampling results for each well back to when it was installed. This information can be valuable to determine if there are any trends of increasing contaminant concentrations that might not be apparent from a cursory data evaluation. This can be an important planning consideration if a new well is needed to address a contamination problem.
- Your water utility is required to provide sampling results to the WDNRs Bureau of Drinking Water and Groundwater. This information can be found for your utility at www.dnr.state.wi.us/org/water/dwg/dws.htm.

Answering the above questions can provide a framework for planning for water supply protection. Using the above information, you can make informed decisions to make sure your water supply is protected for the future. In conjunction with other information, you can assess how much water you will need in the future and where that water will come from. Will additional wells be needed and, if so, where should they be located to minimize potential contamination problems?

Wellhead protection/source water protection

One of the ways that communities can protect their water supply is through wellhead protection planning. Through this program, a community can



identify the recharge area for its well or wells, inventory potential contaminant sources within that area and take steps to manage that area to protect its wells from contamination. For more information on Wisconsin's wellhead protection program or assistance with wellhead protection planning, visit the WDNR website at <http://www.dnr.state.wi.us/org/water/dwg/gw/whp.htm> or call Dave Lindorff at 608-266-9265.

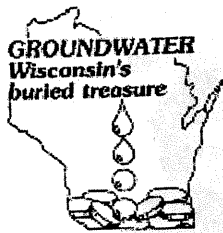
In an effort to assist communities in their wellhead protection efforts, the WDNR is currently developing source water assessments for all public water supply systems in the state. This effort is required by the 1996 Amendments to the Safe Drinking Water Act. By 2003, for every public water system, the WDNR is required to (1) delineate the source water assessment area for each public water supply well or surface water source, (2) inventory potential contaminant sources within the source water assessment area, (3) determine the susceptibility to contamination and (4) make the information public. The WDNR will work with communities to use the source water assessment information to develop a wellhead protection plan. See the WDNR source water assessment website at www.dnr.state.wi.us/org/water/dwg/gw/swp.htm or call Jeff Helmuth at 608-266-5234 for more information.

This is one of a series of groundwater factsheets designed to provide information to assist communities with comprehensive planning. Other factsheets and more detailed information to assist planners can be found at the Groundwater Coordinating Council (GCC) web site, <http://www.dnr.state.wi.us/org/water/dwg/gcc/> or the WDNR Land Use Team website at www.dnr.state.wi.us/org/es/science/landuse/index.htm.

Acknowledgments: Illustration, page 3 from WDNR publication WR 312-92 Determining Wellhead Protection Boundaries – An Introduction.

Comprehensive Planning and Groundwater Fact Sheets were produced by GCC subcommittee members Dave Lindorff, WI Department of Natural Resources; Chris Mechenich, Central WI Groundwater Center; and Chuck Warzecha, WI Department of Health and Family Services.

July 2002



RESIDENTIAL DEVELOPMENT AND GROUNDWATER RESOURCES

COMPREHENSIVE PLANNING AND GROUNDWATER FACT SHEET 3

WISCONSIN GROUNDWATER COORDINATING COUNCIL

July 2002

New residential development is one of the most common types of growth experienced by Wisconsin communities. In 2000, over 16,000 new one and two-family homes were built in Wisconsin. Wisconsin is expected to have an additional 400,000 households by 2015, so the number of new homes will continue to grow.

To understand how residential development can affect groundwater, it's important to recognize that all land has groundwater beneath it (Figure 1). Groundwater flows through underground soil and rock materials, generally from higher to lower areas on the land surface. Sometimes we plan to directly use that groundwater, as when we drill individual drinking water wells. But even when we do not plan to use it, residential development may affect both the quality and amount of local groundwater.

The choice of water supply and wastewater treatment for residential development is critical. It will affect the size of lots required, and the acceptable number and density of homes. Placement of wells and wastewater systems relative to groundwater flow direction is also important. Educating homeowners on proper lawn care or wastewater management practices later is important, but cannot always overcome poor decisions in the original design. So, good planning of residential development is the first step to protecting groundwater quality in residential areas.

This fact sheet examines the relationship between residential development, particularly development of new subdivisions, and the groundwater resource. It also discusses ways in which impacts can be minimized.

Water Supply Considerations

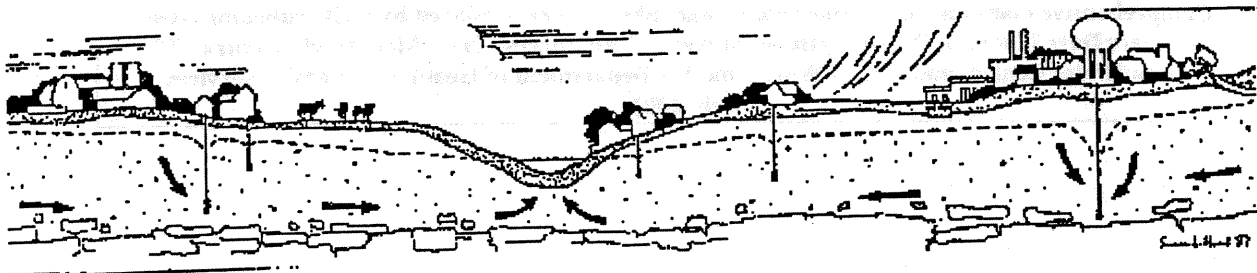
Water to serve residential developments can be provided in three ways: through connection to a community water system, a subdivision water system, or individual home wells.

- *Community water systems* may use surface water or groundwater. When groundwater is used, withdrawal of water from high capacity wells might reduce the amount of water available to local streams and lakes. Careful design and management of these wells can reduce these impacts, but Wisconsin law does not currently

require consideration of surface water effects. Changes to the community infrastructure may be needed to provide services to additional homes. The quality of community water systems is continually monitored.

- *Individual home wells* have smaller impacts on groundwater and surface water flow than high capacity wells, especially when the water is returned to the groundwater through onsite wastewater treatment. Since homeowners generally use well water without treatment, the quality of groundwater available onsite is critical. Homeowners are responsible for monitoring their own water quality.

Figure 1. Groundwater underlies Wisconsin, and supplies water for rural and urban uses.



- *Subdivision water systems* are required to monitor water quality if one well serves 25 or more residents. Typically this is assumed to be the case when 7 or more homes are interconnected to one well. Water systems serving fewer homes are otherwise similar to individual wells in their regulation and impacts on groundwater.

Wastewater Treatment Considerations

Wastewater treatment for a residential development can similarly be provided in three ways: through connection to a municipal system, development of a group onsite wastewater treatment system, or individual onsite wastewater treatment systems. Both public facilities and onsite systems vary in the degree of treatment they are designed to provide.

- Use of *municipal sewers* allows wastewater to be treated off-site, so groundwater contamination potential is minimized. However, in sewer developments with individual home wells, the local groundwater level may be lowered because the public sewer removes wastewater from the area, preventing it from naturally replenishing groundwater.
- In developments with *onsite wastewater treatment systems*, whether individual or group systems, wastewater replenishes local groundwater. However, some contaminants, such as nitrate and chloride, are not removed by conventional systems and may cause local groundwater quality problems even when systems are constructed to applicable state codes. If the development is in the recharge area for the public water source, contaminants could also affect the public water supply. Research shows that developments with individual onsite wastewater treatment systems and private wells require lot sizes of at least an acre to protect drinking water quality.
- Especially sensitive areas for onsite wastewater treatment include those with highly permeable soils, or shallow depths to groundwater or fractured bedrock. In such areas, bacteria, viruses, volatile organic compounds, or other contaminants may also affect groundwater. The community may choose to direct

development away from sensitive groundwater areas, even when onsite wastewater codes allow it, or require additional wastewater treatment, such as sand filtration, disinfection, or nitrate removal.

Conservation Subdivisions

Conservation subdivisions (sometimes called cluster development) preserve green space in a community by using less land for individual lots, and maintaining the natural features of the land as much as possible. Such developments can have many environmental benefits, including potential groundwater benefits if less land is developed into fertilized lawns and landscapes.

However, conservation subdivisions, like any development using small lots, must be carefully designed to prevent unwanted "recycling" of wastewater into private wells. This "recycling" occurs when onsite wastewater treatment system drainfields or mounds are located *upgradient* (uphill in the groundwater flow system) from private or group wells. Wastewater containing high levels of nitrate and other contaminants that re-enters the groundwater can be pumped by downgradient wells, even on neighboring properties. To minimize such problems:

- determine groundwater flow direction and avoid constructing wells downgradient from onsite wastewater treatment systems,
- use advanced onsite wastewater treatment systems,
- or connect conservation subdivisions to a community sewer and water supply.

Groundwater Issues Common to All Residential Development

Besides water supply and wastewater treatment, issues common to all residential developments include (Figure 2):

- Land covered with impervious surfaces such as homes, driveways, roads and parking lots may have more runoff and less groundwater recharge than undeveloped land. However, increased groundwater recharge may occur if the runoff water naturally infiltrates onsite or is infiltrated by raingardens or other stormwater management systems.

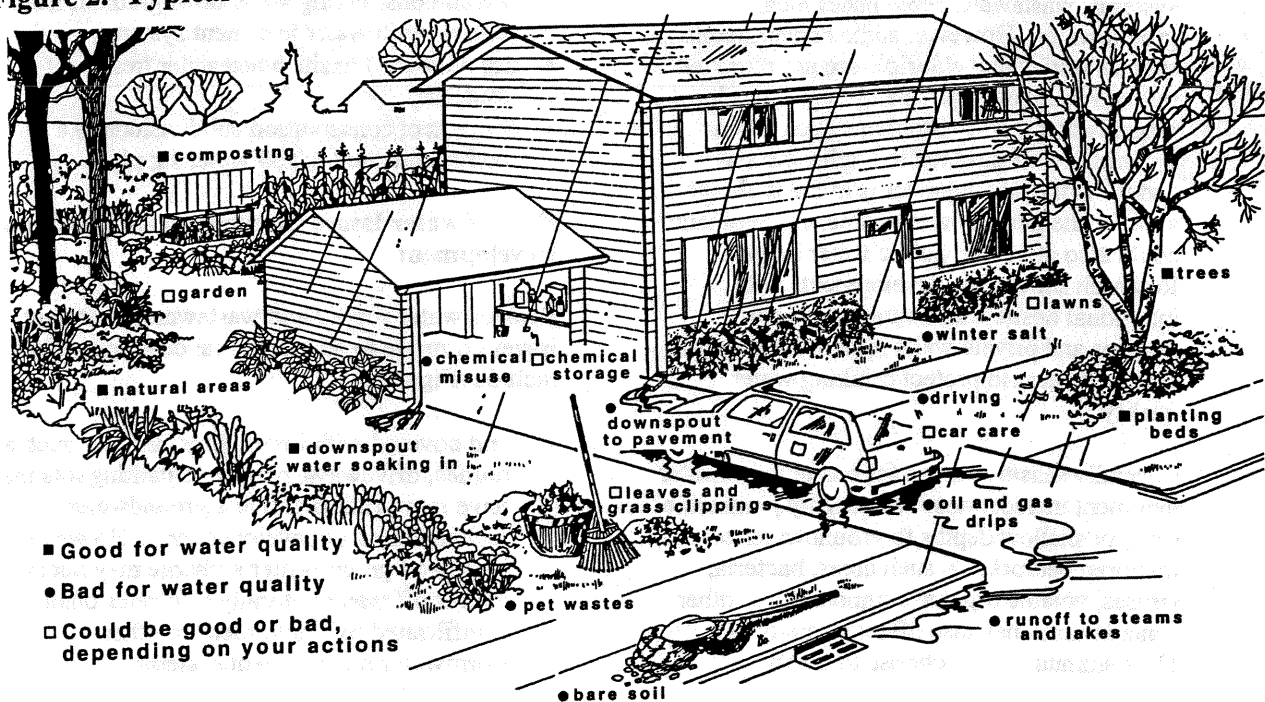
- Where storm sewers are used, they may divert water that otherwise would recharge groundwater.
- Water supplies for new homes may require an increased withdrawal of groundwater.
- Roads and parking lots serving developments mean more use of road salt and more oil, gas and other fluids from vehicles, which can end up in local streams, lakes or groundwater.
- Fertilization and irrigation of lawns increases the risk of contaminating groundwater or surface water.
- Improper waste disposal practices (dumping waste oil or antifreeze on the ground, for example) can also harm groundwater quality.

Evaluating the Quantity and Quality of Groundwater Available for Residential Development with Onsite Water and Wastewater Systems

When evaluating the potential of a piece of land for residential development using individual wells and wastewater treatment systems, the following factors should be considered:

- past uses of the land. If the land was used for a barnyard, dump, or other waste disposal site, groundwater contamination may already be present. It might be difficult to get good quality water for a private well.
- upgradient land uses. Groundwater flow direction for the subdivision should be determined. Maps are available from the Wisconsin Geological and Natural History Survey for some areas. Contamination sources in the recharge area for private wells in the new development should be identified.
- suitability of property for development of onsite wastewater treatment systems and private wells. An assessment of the local aquifer is needed to ensure that it can supply enough water to the number of private wells planned for the area. The soils on the property also need to be evaluated for their acceptability for the use of onsite wastewater systems (if proposed).
- existing groundwater quality. The developer could be required to install monitoring wells, and sample them for human-made contaminants such as nitrate and pesticides, and natural water quality problems such as

Figure 2. Typical activities around the home can affect groundwater quality.



arsenic, iron and radioactivity. Existing neighboring wells can be sampled if there are other homes in the area. Accurate information about the depth and construction details is needed for existing wells. If groundwater problems exist, local governments can consider requiring treatment systems or a notification of groundwater problems on the home's deed.

Minimizing the Impacts of Residential Development on Groundwater Resources

Fortunately, there are steps that planners, engineers, and developers can take, before, during, and after development, to minimize the effects of residential development on groundwater resources. These include:

- using raingardens to encourage infiltration of stormwater and recharge to groundwater.
- minimizing paved surfaces such as driveways, or installing brick driveways and walks instead of poured concrete or asphalt.
- requiring use of advanced wastewater treatment systems, such as nitrate removal systems, in vulnerable groundwater areas.
- providing centralized water or sewer in areas where natural conditions or housing density make onsite system use unsafe or marginal.
- educating homeowners on the need for proper maintenance of private wells and onsite wastewater treatment systems, periodic testing of private well water, and planning for eventual well, pump or drainfield replacement.
- placing private wells upgradient from onsite wastewater treatment systems on the same or neighboring property to prevent recycling of wastewater into private wells.

- encouraging or requiring water conservation and use of water saving devices, such as low-flow showerheads and toilets, within homes.
- restricting the types and amounts of pesticides and fertilizers used on lawns and gardens.
- encouraging or requiring limits on landscape watering.
- providing education on natural landscaping and other low water demand vegetation.
- providing opportunities, such as Clean Sweep programs, for residents to properly dispose of hazardous household products.
- requiring periodic maintenance of onsite wastewater treatment systems if they are used.

In summary, residential development can have many impacts on both the quality of local groundwater and the amount of water needed by a community. Good planning can balance the need for residential development with protection of both the health and well-being of residents and the quality and quantity of local water resources.

For additional information on residential development options and planning tools, see:

- Ohm, B. W., 1999, Guide to Community Planning, Department of Urban and Regional Planning, Univ. of Madison, Wisconsin /Extension, 275 p. Available from UW Extension.
- WDNR and University of Wisconsin Extension, 2002, Planning for Natural Resources – A Guide to Including Natural Resources in Local Comprehensive Planning, 83 pages. Available from County Extension offices, the Department of Administration's Office of Land Information Services (608-267-2707) and at the WDNR Land Use website.

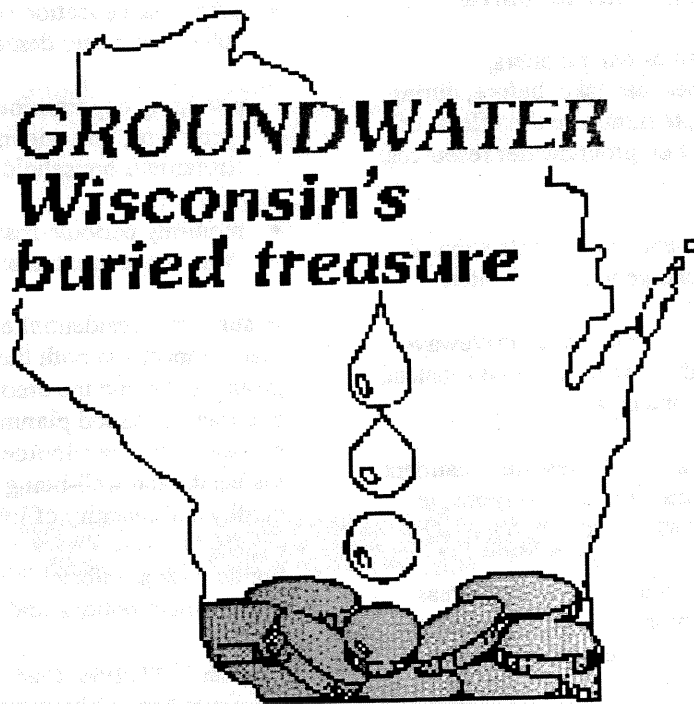
This is one of a series of groundwater factsheets designed to provide information to assist communities with comprehensive planning. Other factsheets and more detailed information to assist planners can be found at the Groundwater Coordinating Council (GCC) web site, <http://www.dnr.state.wi.us/org/water/dwg/gcc/> or the WDNR Land Use Team website at www.dnr.state.wi.us/org/es/science/landuse/index.htm.

Acknowledgements: Illustration, page 1 from WDNR publication WR-423-95 WI Groundwater Research and Monitoring Project Summaries; page 3, Extension publication GWQ009 Rethinking Yard Care.

Comprehensive Planning and Groundwater Fact Sheets were produced by GCC subcommittee members Dave Lindorff, WI Department of Natural Resources; Christine Mechenich, Central WI Groundwater Center, and Chuck Warzecha, WI Department of Health and Family Services. July 2002

Sharing Our Buried Treasure: Directions for the Protection and Management of Wisconsin's Groundwater

A Summary of the 2001 Groundwater Summit



September 2002

Wisconsin Groundwater Coordinating Council

"Sharing Our Buried Treasure" charts a course for state and local programs involved in groundwater education, protection, and management. These ideas and directions, generated by participants in a Groundwater Summit sponsored by the Groundwater Coordinating Council and held in October of 2001, will guide cooperative efforts and set priorities for working together to protect groundwater and preserve its value as an economic and natural resource for future generations.

Introduction

In the summer of 2000, the Wisconsin Groundwater Coordinating Council (GCC)¹ initiated an effort to evaluate the state's role in protecting and managing groundwater resources, and to identify educational, research, planning, and policy needs for the future. A similar effort had been undertaken in 1991, with the gathering of key state agency personnel, researchers, educators, and local government representatives at a conference titled "Working Together to Manage Wisconsin's Groundwater: Next Steps?"² The GCC, its Subcommittees and partner agencies eventually implemented many of the recommendations from this conference, which focused on groundwater quality, state and local partnerships, and data management needs. However, many issues remain unresolved. Moreover, in the decade since this conference, issues related to groundwater quantity have risen to the

¹ The Groundwater Coordinating Council was created in 1984 as part of Wisconsin's comprehensive groundwater legislation. The GCC is directed to "serve as a means of increasing the efficiency and facilitating the effective functioning of state agencies in activities related to groundwater management [and] shall advise and assist state agencies in the coordination of nonregulatory programs and the exchange of information related to groundwater..." (s. 160.50, Wis. Stats.). The GCC consists of 8 members who represent the 5 state agencies with groundwater management responsibilities (DNR, DOT, DHFS, DCOMM, and DATCP), the State Geologist, the University of Wisconsin System, and the Governor. More information can be found at the following website:

<http://www.dnr.state.wi.us/org/water/dwg/gcc/>

² Working Together to Manage Wisconsin's Groundwater - Next Steps? : Conference proceedings; March 15-16, 1991, University Center, University of Wisconsin--Stevens Point; Conference Coordinators: Stephen M. Born, Douglas A. Yanggen; Published by University of Wisconsin Extension, Geological and Natural History Survey, Madison, Wis. 113 p.

forefront of public discussion. Among them:

- an attempt by a bottled water company to locate a bottling plant in South-central Wisconsin;
- links between groundwater pumping, residential development, and arsenic contaminated wells in the Fox River Valley;
- concern about declining water tables and access to usable water supplies in southeast Wisconsin, Green Bay, and Fond du Lac areas; and
- documentation of altered hydrologic regimes due to excessive pumping in Dane County and the Central Sands.

Wisconsin's Groundwater Summit was conceived as a way to "take the pulse" of groundwater management activities, to gather input from key stakeholders, and to facilitate a dialogue among diverse viewpoints on these and other groundwater issues.

The Groundwater Summit

The Summit was held on October 30, 2001, in Waukesha, Wisconsin, and attracted 135 people representing a wide array of interests and viewpoints on future groundwater management needs. Invitations were sent to over 80 citizen and industry organizations, state agencies, tribal and local governments, and academic institutions, with a request to identify up to 2 representatives to attend the Summit. Over 50 organizations responded to the invitation (Table 1). Participants represented state, local and tribal agencies, elected officials, agricultural industry and farming groups, water utilities, environmental and conservation groups, business and industry groups, and the university research and outreach community.

Participants heard presentations on basic groundwater principles, current groundwater quality and quantity problems, the historical development of groundwater policy, and evaluations of current groundwater management activities. A group of panelists representing key groundwater user groups provided their perspectives on pressing groundwater issues and management needs.

The second half of the Summit involved dividing the large group among 8 smaller discussion groups, giving each participant a chance to express his or her views and opinions on future groundwater management needs. Each small group was led by an experienced facilitator and was composed of people representing a mix of organizations to achieve a balance of viewpoints. It was a unique opportunity for dialogue among people who do not usually discuss groundwater priorities. Individual comments, as well as topic areas and major themes, were captured for each group and organized roughly into quantity or quality issues, and educational, research, or policy needs. At the close of the Summit, organizers summarized each group's discussion and provided a synthesis of the key themes that were raised.

Most attendees to the Summit expressed that the primary issue for the next decade is managing quantity, as well as quality. Such themes as long term monitoring, water conservation, regionalization, public education, groundwater protection, the hydrological connections between surface and groundwater, and the continued management of water quality augment and support the basic issue of developing a comprehensive, science based groundwater management approach that is equitable to all users. **However, there was *not* a consensus on how to accomplish this or which approach was best suited for Wisconsin.**

Sharing Our Buried Treasure

Sharing Our Buried Treasure serves as a means of summarizing and synthesizing the key themes that were raised at the Groundwater Summit³. However, it is not intended to represent a consensus of the participants, nor the agencies and organizations that they represent. Rather it serves as a starting point for further dialogue about the future of Wisconsin's groundwater management.

This Summary was drafted by a core group of groundwater professionals affiliated with the GCC, including chairs of the GCC Subcommittees and representatives of each of the agencies and institutions that make up the GCC⁴. It was the intention of the core group to stay true to the discussion and viewpoints expressed at the Summit, while bringing some level of synthesis and common understanding into the document. Every effort was made to provide a balanced discussion of the themes and visions presented herein. Summit participants were given an opportunity to comment on the initial draft of this document and many of their comments were incorporated into the final version.

Sharing Our Buried Treasure is divided into nine Key Themes (in no particular order of importance):

³ Other products of the Summit include full conference proceedings, a complete compilation of breakout session comments, and a website with links to a number of additional resources (<http://www.dnr.state.wi.us/org/water/dwg/gcc/GCC-GWSUMMIT.HTM>)

⁴ Core group members include: Lynita Docken (Commerce); Chris Mechenich and George Kraft (CWGC); Jim Vanden Brook (DATCP); Tim Asplund, Jeff Helmuth, Mike Lemcke, and Dave Lindorff (DNR); Bob Pearson (DOT); Jim Krohelski (USGS); Steve Born (UW-Madison); Ken Bradbury and Ron Hennings (WGNHS).

- A. Clarifying "Whose Water is it?"
- B. Recognizing the Connections Between Groundwater and Surface Water
- C. Evaluating and Managing Threats to Groundwater Quality
- D. Linking Land Use Planning and Groundwater Protection
- E. Developing a Comprehensive Approach to Groundwater Quantity
- F. Addressing Water Use and Conservation Issues
- G. Exploring Options for Regionalization of Water Management
- H. Building a Groundwater Constituency through Public Education and Involvement
- I. Collecting Long-Term Groundwater Data to Address Long-term Problems

Each Theme is further developed with a corresponding Vision Statement, Narrative, and list of Potential Strategies. *Vision Statements* are brief expressions of a future desired state relative to the Theme. The *Narratives* flesh out the Theme even further and provide some structure and context for the specific strategies. The *Potential Strategies* represent specific comments or summaries of comments made by Summit participants during the breakout sessions and captured by the facilitators.

Again, the visions, narratives, and potential strategies do not reflect a consensus view of all Summit participants, nor do they necessarily represent the viewpoints of the GCC or its member agencies. Indeed, several of the strategies vary in their level of detail, may conflict with one another, and may be unworkable in the current framework of groundwater management. In addition, the list of strategies is not intended to cover all of the possible approaches to a specific problem. Rather, the strategies suggest some possible directions and set forth a

framework for future groundwater management activities (e.g., defining research priorities, guiding agency planning, finding collaborative solutions, evaluating decision-making processes, etc.).

It is the hope of the GCC that the ideas and directions presented here can serve as a common framework for ALL who have a stake in the future of Wisconsin's "Buried Treasure."

Guiding Principles

A number of overall principles or assumptions were echoed by many of the speakers and participants in their discussion at the Groundwater Summit. These Guiding Principles touch on all of the Key Themes that follow and should serve as a framework for further discussion.

Wisconsin's approach to groundwater management and protection should:

- *Ensure sustainable and safe drinking water supplies for all Wisconsinites and future generations*
- *Preserve the hydrologic cycle for proper functioning of aquatic ecosystems*
- *Recognize the economic value of a safe and adequate water supply for food production and industrial uses*
- *Recognize the intrinsic value of springs, naturally flowing wells, and groundwater-fed surface waters*
- *Recognize that Wisconsin's groundwater has limits to its abundance and must be managed and used wisely*
- *Rethink traditional distinctions between quality and quantity, surface water and groundwater, land use and water use, watershed and aquifer, in how groundwater is managed*
- *Reflect cooperative management at state, regional, local levels, as well as public/private partnerships*

Key Themes

A. Clarifying "Whose Water is it?"

The Vision

Groundwater is recognized as a vital resource of the citizens of the state, and the state must manage and regulate its use within its borders.

Narrative

The Public Trust Doctrine as interpreted through statute and case law provides that navigable waters of the state shall be held in public trust for its citizens. This view has held firm for surface waters of the state, and has been expanded to protect water quality, but has not been explicitly applied to groundwater. Indeed, groundwater is considered by the courts to be a private property right, subject only to the "reasonable use" standard - that a person is permitted to withdraw water in any amount provided it does not cause unreasonable harm to a neighboring property owner. Statutory authority is limited to denying permits for high capacity wells that negatively impact a public (municipal) water system. With the recent outcry generated by a proposal to site a bottling plant in the vicinity of a naturally flowing spring, the state's limited authority to protect surface waters or private wells from groundwater withdrawals was made apparent.

Also made apparent by the water bottling proposal was the growing demand for fresh water worldwide, which has made "water rich" states such as Wisconsin attractive as a resource for the large-scale exportation of water. Another issue is the privatization of water utilities to create economic efficiencies and better deal with failing infrastructure and increased technological

costs of treatment. These trends have caused some to question whether water should be considered a public resource or good, in which case the state should have authority to regulate its use, or a commodity or private good, in which case markets and private companies should ultimately determine its use and value. Wisconsin citizens need to engage in this discussion to ensure the long-term sustainability of its water resources.

Potential Strategies

1. Pursue statutory clarification of the Public Trust Doctrine as it pertains to groundwater.
2. Promote discussion of state's role in regulating groundwater withdrawals in a variety of forums.
3. Put safeguards into place to ensure state review of large-scale water withdrawals and exportation.
4. Investigate alternatives to the current mechanism of water rights as it pertains to groundwater use (i.e. how to balance rights of private well owners vs. public water systems).
5. Expand the ability of the state to consider impacts to non-municipal wells and aquatic ecosystems in reviewing high capacity well permits.
6. Evaluate how international agreements (e.g. NAFTA, Great Lakes Charter) may supersede or limit State and local regulation of water withdrawals.

B. Recognizing the Connections Between Groundwater and Surface Water

The Vision

Groundwater and surface water are managed in an integrated fashion, with connections between infiltration (groundwater recharge), surface runoff, groundwater withdrawals,

evapotranspiration, and stream baseflow clearly acknowledged.

Narrative

Groundwater and surface water resources (lakes, streams, springs, and wetlands) are intimately connected throughout Wisconsin. Groundwater maintains the baseflow of streams and the entire flow of springs. Groundwater resources often control surface water levels in lakes and wetlands. Groundwater inputs are critical for ecosystem functioning. Infiltration and recharge of water at the land surface replenishes groundwater supplies. Dissolved materials, including both natural constituents and contaminants, are exchanged between groundwater and surface water features.

In natural systems there are physical and chemical balances in the movement of water between groundwater and surface water resources. Our activities can alter these balances in unintended ways. Pumping from water supply wells can affect nearby lakes, streams, or wetlands by removing groundwater that would have naturally discharged there. Changing land use through urbanization, construction, or altered farming practices can affect groundwater recharge rates and groundwater quality. These changes in balance can affect changes in flora and fauna and ultimately alter biotic systems.

Currently, groundwater and surface water in Wisconsin are often thought of and treated, both legally and in the public's perception, as separate resources. However, groundwater and surface water are really parts of a whole - integral components of the water cycle. Recognition, by the legal system, by resource managers, and by the public, of this continuum is essential to the

future health of all of Wisconsin's water resources.

Potential Strategies

1. Develop ways to estimate the quantity of water that can be withdrawn without long-term adverse impacts on ecosystem functioning (streams, springs, and wetlands).
2. Encourage communication and coordination among programs that deal with different components of the hydrologic cycle, including runoff, infiltration, and recharge.
3. Add language to explicitly define the interconnectedness of surface water and groundwater in new and existing codes and statutes.
4. Use regional hydrogeologic models to predict impacts on surface waters of different pumping regimes, altered recharge rates, and growth and development scenarios.
5. Pursue ways to integrate management of surface water and groundwater within and across agency programs.
6. Strive to maintain the natural water balance (recharge, runoff, evapotranspiration) in all activities that influence the landscape.

C. Evaluating and Managing Threats to Groundwater Quality

The Vision

Wisconsin takes a proactive approach to groundwater quality protection. Standards are in place for individual contaminants and mixtures. Private well water quality is managed in accordance with public health protection.

Narrative

The Groundwater Law⁵ can comprehensively address groundwater quality concerns by triggering modification of activities that contribute a contaminating substance to groundwater, as long as those activities are regulated by a state agency and standards have been established. However, standards require adequate human health and groundwater monitoring data, and these data are not available for many potential contaminants. Moreover there is a lack of data and understanding concerning the cumulative risks or synergistic impacts of multiple contaminants.

Setting appropriate standards for contaminants, and then minimizing their occurrence in groundwater, requires coordination and priority setting by appropriate agencies and research institutions. Even if the process proceeds smoothly, responses are reactionary in nature. Contamination can be widespread before action is taken. In the case of nitrate, with responsibility divided among several agencies, very little regulatory action has been taken despite nitrate exceeding the enforcement standard more frequently than any other contaminant.

One component of the Groundwater Law that has been called into question is its approach towards aquifer classification: the practice of classifying aquifers according to use, value and vulnerability. The Wisconsin approach treats all groundwater as potential drinking water, effectively employing the "precautionary principle" and preserving future options, given the uncertainty of future water use and stressors and our limited scientific understanding of

hydrogeologic systems. However, one result of this approach has been the expenditure of millions of dollars cleaning up contaminant plumes in soils and groundwater that may not become water supply sources. Critics of the present approach argue for targeting efforts towards protecting potable water supplies, and generally favor the new standards allowing flexible closure of contaminated sites. There would be value in a public dialog reaffirming or explicitly rethinking our state policy regarding aquifer protection and classification.

Activities that manipulate the groundwater resource such as pumping and aquifer storage and recovery (ASR) may also impact water quality. Fluctuating groundwater levels may be contributing to arsenic contamination, pumping of water into aquifers may affect groundwater chemistry, and modifications of discharge rates to surface waters may affect surface water quality. Addressing groundwater quality concerns in a proactive manner will require greater efforts to evaluate risks and establish mitigation measures before potentially contaminating activities commence.

Potential Strategies

1. Reevaluate the role of Enforcement Standards (ES) and Preventive Action Limits (PAL) in preventing groundwater contamination.
2. Revisit the issue of aquifer classification for certain applications (e.g. aquifer storage and recovery, remediation, source water protection).
3. Examine and improve security for groundwater supplies to protect against acts of terror or vandalism.
4. Develop an approach for dealing with presence of multiple contaminants and

⁵ The "Groundwater Law" (1983 Wisconsin Act 410) was enacted in 1984 and is administered through Chapter 160 of the Wisconsin Statutes.

potential cumulative or synergistic health risks.

5. Find better ways to communicate risks of contaminants in private well water supplies.
6. Collect data on and develop groundwater standards for "emerging" contaminants (e.g. pharmaceuticals, pesticide metabolites, and viruses).
7. Develop a "sentinel well" monitoring system for detecting potential threats to water quality.
8. Establish inventories of chemical use (as already exists for pesticides) to determine priorities for monitoring
9. Provide incentives and alternative practices for reducing use of fertilizers.
10. Require more frequent testing of private wells for bacteria and nitrate.
11. Find innovative ways to deal with already elevated levels of nitrate in some rural areas.
12. Set effluent limitations for point source discharges to disappearing streams and karst features.
13. Seek consistency in applying regulations and standards among all entities charged with administering the Groundwater Law.
14. Explore the role of the "precautionary principle" in setting standards for "emerging" substances.
15. Seek ways to integrate water quality and quantity management within and across agency programs.

D. Linking Land Use Planning and Groundwater Protection

The Vision

Land use practices are undertaken with full consideration of the implications for groundwater quality and quantity. Strategies are developed that encourage local

governments to consider groundwater protection as a high priority in their land use and development decision-making process.

Narrative

Now is a critical time to be thinking about groundwater and its relationship to land use. Legislation enacted in 1999 provides a framework for development of comprehensive plans by Wisconsin municipalities.⁶ The new comprehensive planning legislation, sometimes referred to as the Smart Growth law, requires that any land use action taken by a municipality after January 1, 2010, must be consistent with that municipality's adopted comprehensive plan. The law further requires that each comprehensive plan address 9 elements – issues and opportunities, housing, transportation, utilities and community facilities, agricultural, natural and cultural resources, economic development, intergovernmental cooperation, land use and implementation. Most communities may think about groundwater protection in relation to the agricultural, natural and cultural resources element, but groundwater can be considered in each of the other elements as well.

At the same time that local communities are thinking about comprehensive planning, information is being generated to assist local communities through the source water assessment program. The 1996 amendments to the Safe Drinking Water Act required that each state complete the following steps for each public water supply – (1) delineate the land area that contributes water to their drinking water system – the source water area, (2) inventory potential contaminant sources within the source water area, (3)

⁶ Wisconsin's Comprehensive Planning Legislation (1999 Wisconsin Act 9) is codified in Chapter 66 of the Wisconsin Statutes.

determine the susceptibility of each public water supply system to contamination, and (4) make the assessments available to the public. The source water assessments will be completed in 2003 or 2004. Once these assessments have been completed and made available for all public systems, communities will be encouraged to use the source water assessment information to develop a management plan for protecting their water supply.⁷

These activities provide a unique opportunity to promote groundwater protection through wise land use practices and planning at the local level. These circumstances also provide an opportunity for state agencies to share information regarding our valuable groundwater resources and to develop better working relationships between state and local units of government.

Potential Strategies

1. Provide information on potential contamination sources and water supply susceptibility within source water protection areas to local planning agencies.
2. Develop tools and provide information to help local communities protect their water supplies in their comprehensive planning activities ("Smart Growth").
 - a. Promote use of "conservation" subdivisions (clustered development with greenspace between clusters) and community water supplies to ensure water quality.
 - b. Encourage protection of groundwater recharge areas through state and

⁷ One way to help communities implement these plans and protect their water supply, is through the Wisconsin DNR's wellhead protection program (see <http://www.dnr.state.wi.us/org/water/dwg/gw/whp.htm>).

- c. local public land purchases, as well as zoning ordinances.
 - c. Develop model ordinances for new developments and subdivisions that require stormwater infiltration practices.
 - d. Develop options for limiting certain land use practices within designated wellhead protection areas.
 - e. Create incentives to preserve woodlots and plant trees to promote infiltration.
 - f. Promote soil conservation practices that reduce runoff and erosion and promote infiltration.
3. Continue to fund management practice monitoring projects to identify how best to manage potential groundwater threats.
 - a. Determine and promote appropriate land application rates of fertilizers and pesticides.
 - b. Assess long-term impacts on groundwater quality of new technologies for onsite wastewater treatment.

E. Developing a Comprehensive Approach to Groundwater Quantity

The Vision

Wisconsin's groundwater quantity management provides for the sustainable development and use of this renewable resource and the equitable treatment of all users. As such, it mitigates and prevents well interference among competing users, deterioration of groundwater quality, and deterioration to aquatic systems (springs, streams, wetlands, and their associated plant and animal communities).

Narrative

Groundwater is an intimate part of Wisconsin's economic and environmental

vitality. Three-fourths of Wisconsin citizens use groundwater daily for their domestic needs and 95% of municipalities use groundwater for their public water supplies. Almost all the water for agriculture - livestock, crop irrigation, milkhouse operation, and others - comes from groundwater, as does one third of industrial water and over half of commercial-use water. Our lakes, streams, and wetlands are also fed by groundwater, as are the fish, fowl, and other creatures that live in or near them.

Awareness is building that our groundwater resource, while abundant, is not infinite: water pumped in one location deprives another location of that same water. In places, the unmanaged pumping of groundwater has caused dramatic dropping of water tables, a decrease in water quality (arsenic, radioactive materials, increased salinity), and reduced flows to streams, springs, and wetlands.

One might think that an asset as valuable as groundwater would be carefully managed, much as a family trust or retirement portfolio. Such is not the case. Laws governing groundwater withdrawals are limited. Weak management may have been less of a problem in the past when demands on the resource were smaller, but increasing demands from a growing population and a successful economy now make good management a necessity. Good management is consistent with both a healthy environment and a healthy economy.

Potential Strategies

1. Encourage legislature to evaluate and potentially reform existing high capacity well laws in the state.
2. Develop a Statewide Groundwater Quantity Plan that addresses long-term

groundwater management needs tailored to specific regional aquifer systems.

3. Set benchmarks for groundwater withdrawals, similar to the Preventive Action Limit (PAL) process, to trigger conservation measures.
4. Promote optimization of well siting and withdrawals to reduce drawdown, preserve water quality, and protect highly valued resources.
5. Build on and link local and regional groundwater flow models to get a picture of statewide groundwater quantity trends.
6. Foster cooperative efforts and voluntary actions between various parties to solve groundwater resource problems (e.g. cooperative effort by the River Alliance and Potato and Vegetable Growers).
7. Seek ways to integrate water quality and quantity management within and across agency programs.
8. Collect detailed pumping records from public and high capacity wells to better manage the resource.
9. Promote infiltration of stormwater in new development and protect recharge areas.

F. Addressing Water Use and Conservation Issues

The Vision

Water is recognized as a finite resource. Users consider and react appropriately to the water they consume and return to the environment. State and local agencies and organizations work together to promote sustainable water use practices at the individual, household, industry, and community level and provide the data needed to assist in making informed decisions.

Narrative

Water conservation (meaning both more efficient use and demand reduction) has long been a mainstay of water resources management, not only in much of the arid West, but in states like Florida with its wet-dry cycles and seasonal demands. With more people and increased competing demands -- including the needs of a healthy aquatic environment -- the time has come for water-rich Wisconsinites to evaluate and possibly modify our appetites for water. Many options exist at both at the individual and community level for effective and efficient water conservation practices.

One way to address water conservation is to reexamine water utility rates. Wisconsin's long history in this area has focused on establishing an equitable rate structure and responsible fiscal management for water utilities. However, the Public Service Commission's (PSC) declining block rate structures provide no pricing signals to foster conservation among residential and public institutional users or large industrial customers. Utilities worry that reduced usage, a goal of water conservation, translates into reduced revenue streams and fiscal problems. However, by reducing the demand for water, the cost of maintaining and upgrading water supply infrastructure may be offset.

Another area to be explored is the idea of water reuse. For example, there are options for reusing stormwater and graywater for nonpotable purposes such as lawn-watering, flushing toilets, and irrigation. Industries or commercial sites may find that irrigation with stored stormwater has a triple bonus of water savings, groundwater recharge and natural nutrient application. However, the reuse of wastewater or stormwater, even for non-potable purposes, raises concerns about

ensuring public health and safety. As we deal with water quantity issues in Wisconsin, we will need to consider water conservation, pricing structures, and reuse as strategies in a comprehensive effort.

Potential Strategies

1. Promote water conservation incentives in new codes and rules dealing with water use and supply.
2. Develop a mechanism for prioritizing water uses (private wells, public drinking water systems, irrigation wells, industrial users, baseflow) when and where shortages occur.
3. Collect data and summarize annual pumping rates from all high capacity well permit holders.
4. Support and involve water utilities in promoting innovative efforts at water stewardship within their industry as well as with their customers (e.g. a rebate program for water saving fixtures).
5. Revisit water-pricing structures to promote conservation, both by individuals and large water users.
6. Review stormwater and wastewater treatment rules that allow for recycling and reuse to promote water conservation while protecting public health.
7. The PSC, working with the array of affected stakeholders, should undertake a study of alternative rate designs that influence customer behavior and favor water conservation.

G. Exploring Options for Regionalization of Water Management

The Vision

Groundwater is managed as a regional resource, transcending political boundaries, to better match aquifer boundaries or

groundwater basins and to be able to address and resolve problems at an appropriate scale.

Narrative

There is a spatial mismatch between the jurisdictions of local units of government and management entities and the resource being managed (aquifers and groundwater flow systems). Smaller communities and water utilities are unable to manage and protect water supplies for the longer-range future; their scope and jurisdiction is too limited. Regionalization (consolidation of utility management and operations across many communities, cooperative networks of communities/utilities) not only allows the problem to be effectively addressed, but can help achieve economies of scale and improved overall performance in water supply and protection. The challenge is in how to proceed – should we examine the possibilities of regionally-based water management, including the establishment of new regional authorities having the requisite management powers to achieve their goals? Should we expand the authority of Regional Planning Commissions to enable them to implement plans through binding reviews of permits? Or should we expand statutory authority to require agencies to consider regional water plans in their decision-making? Or would such changes in authority be politically unthinkable?

Regional hydrogeologic models are being developed for several areas of the state. For example, Dane County has an ongoing program involving federal and state resource management agencies and local water utilities to make use of information and computer models developed from a regional hydrological study. A similar effort in Southeastern Wisconsin has led to meetings of water utilities in the region aimed at

fostering cooperation. Institutional arrangements are needed that can utilize these models and our increased understanding of these regional groundwater systems. Legislation related to intergovernmental cooperation, utility services, and the establishment of joint local water authorities should be carefully reviewed for its potential in establishing regional institutions for groundwater management.⁸

Potential Strategies

1. Promote optimization of well siting and pumping rates on a regional basis.
2. Identify regions or areas with "critical" water quantity issues to apply special management strategies.
3. Promote water supply planning at the regional level, including linkages with population growth/change and land use plans.
4. Encourage formation of groundwater technical advisory committees tied to regional planning commissions and/or DNR watershed basins with representation from water utilities.
5. Develop and use regional hydrologic models to identify recharge areas and optimal pumping strategies.
6. Delineate groundwater basins to educate the public and to help identify the proper scale for management.
7. Investigate the use of regional water authorities (such as in Central Brown County) to manage water supply needs in other parts of the state.
8. Establish incentives for sharing resources among jurisdictions (wells, treatment and distribution systems) to better match supply and demand.
9. Manage groundwater and surface water as a single resource on a regional basis.

⁸ See Chap. 66, Wis. Statutes [especially 66.0301; 66.0813; 66.0823; 66.0827]

H. Building a Groundwater Constituency through Public Education and Involvement

The Vision

Wisconsin residents have a basic understanding of where groundwater comes from, its relationship to other water resources, the importance of drinking water testing, and the types of land use and land management practices that may protect groundwater, or contaminate or deplete it. They put this knowledge to work in personal and societal actions that protect both private and community water supplies and groundwater resources. They develop and exercise leadership skills, and assist in the education of their neighbors and elected officials. Informed citizen involvement and action effect the personal, societal and governmental changes necessary to ensure long-term sustainability of the groundwater resource.

Narrative

Many activities done on a daily basis by the average Wisconsin resident have the potential to affect groundwater resources. Thus, informed citizens are essential to groundwater protection. DNR and UW-Extension, along with other agencies and the help of the GCC Education Subcommittee, have produced an impressive collection of educational materials over the last 20 years.⁹ These include videos, public service announcements, brochures, magazines, a poster, a curriculum guide, and a physical model of groundwater movement. However, many people still do not understand the basics of groundwater movement, the processes of contamination,

⁹ The Wisconsin Groundwater Education Resources Directory (1994) lists many of these resources. An updated version will be available in late 2002.

or the need for water conservation. Partly, this lack of understanding relates to a shortage of people to carry out public education. However, there is also some complacency among citizens about Wisconsin's apparently abundant and high-quality water resources, as well as a belief that state and local regulatory agencies are able to repair or prevent all problems.

Building a groundwater constituency - developing the groundwater awareness and knowledge, as well as the leadership abilities of individual citizens- is essential to protecting groundwater over the long term. An active and involved constituency would advocate for sound groundwater management by governments and individuals on a daily basis, rather than reacting to periodic local crises. This constituency would not be merely the audience for groundwater education, but would also be requesters, facilitators, and providers of education for other audiences. They would identify local needs, bring in specialists when needed, and bring legitimacy and urgency to local education efforts.

Potential Strategies

1. Hold a "Groundwater Education Summit" to strategize and further develop innovative ideas for affecting knowledge, attitudes and behavior.
2. Revisit the idea of groundwater education for the state legislature. Involve citizens, Groundwater Guardian groups, school children, and other constituents of the legislators.
3. Use the annual GCC Report to the Legislature as a tool to promote groundwater management needs. Make the Report more easily searchable on the Web.

4. Hold groundwater seminars for local officials and planning commissions.
5. Continue groundwater education efforts for teachers and K-12 students.
6. Educate private well owners and drillers about the importance of monitoring and proper well construction
7. Educate the public and utilities about water conservation strategies at the household and community level.
8. Educate the public about water quantity issues and the interrelationship of groundwater and surface water.
9. Develop leadership and renewed interest within the environmental and conservation community on groundwater issues, especially identifying and involving interest groups with non-traditional ties to groundwater (e.g. fishing groups, lake groups).
10. Provide educational opportunities for citizen advocates on groundwater issues.
11. Promote and provide support for the "Groundwater Guardian" program within the state.
12. Add representatives of private laboratories, consultants, and industry to the Education Subcommittee of the GCC for the purpose of sharing strategies for public information.
13. Extend GCC Local Government Subcommittee membership to include representatives from nonprofit groups, industry, and/or water utilities.

I. Collecting Long-Term Groundwater Data to Address Long-term Problems

The Vision

Groundwater monitoring is strategically coordinated to establish background water quality and quantity, signal emerging threats, and evaluate best management practices.

Narrative

Wisconsin's Groundwater Law identifies four types of monitoring: 1) management practice monitoring; 2) problem assessment monitoring; 3) at-risk monitoring; and 4) regulatory monitoring. These types of monitoring are generally focused on addressing *quality* concerns and are often *short-term* in duration. Information from these types of monitoring is necessary to address immediate threats to groundwater quality.

However, the above monitoring does little to address groundwater *quantity* issues and addresses *long-term* quality problems as an afterthought. The State's long-term groundwater monitoring well network is the main mechanism to address groundwater quantity concerns. This network, while improved over recent years is limited to a very small set of wells. A network of monitoring wells, stream gages and climate stations are necessary to define baseline conditions and hydrologic trends. The design of the network should be representative of hydrologic conditions in watersheds throughout Wisconsin at a scale that is appropriate to supply data for management of water resources and completion of environmental assessments when development is proposed.

Long-term monitoring should include the measurement of groundwater levels in all of Wisconsin's water-bearing formations, reflecting both water-table conditions and deep confined and unconfined aquifers. It should include areas of groundwater development (pumping centers, both urban and rural, with large withdrawals) and undeveloped areas. In order to understand groundwater systems and the effect of groundwater development or climate change on groundwater systems, monitoring must

include stream flow, climate (meteorology), water use, and groundwater quality in addition to groundwater levels. Key parameters can be identified as indicators of groundwater quality to contain costs.

Potential Strategies

1. Seek funds for the maintenance and improvement of the existing groundwater monitoring well network, stream flow gaging stations and meteorological stations.
2. Expand the monitoring well network to include water quality observations.
3. Improve the accessibility of groundwater data systems.
4. Establish a strategic groundwater monitoring plan on a multi-year basis.
5. Seek ways to better integrate groundwater monitoring data among agencies and universities.
6. Use innovative technology (GIS, Internet Mapping applications) to provide better access to well data, as well as water quality and use information.
7. Explore alternatives to wells for recording ambient water quality data (i.e. stream baseflow sampling).

Next Steps (Implementation)

The Key Themes and Strategies presented in *Sharing Our Buried Treasure* represent a compilation and summary of groundwater management needs and directions identified by participants at the Groundwater Summit. The next step is to put these ideas into practice. A number of implementation strategies have been identified to make this Summary more widely available and to encourage its use as a guide for groundwater management in Wisconsin.

1. *Distribution of this Summary to agency, university, and local government partners, as well as organizations originally invited to attend the Summit.*

Hard copies of this Summary will be mailed to the original invitation list, all GCC members and their affiliated institutions, and libraries throughout the state. An electronic version will be made available on the GCC web page.¹⁰

2. *Presentation of this Summary to the Legislature as part of the GCC's Annual Report.*

The GCC as part of its charge, is instructed to submit an annual 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 in the state, an assessment of groundwater management programs, information on the implementation of Chapter 160 and a list and description of current and

anticipated groundwater problems."¹¹ This Summary fulfills several of these requirements, and goes above and beyond the usual information presented.

3. *Endorsement of Sharing Our Buried Treasure by Summit participants and the organizations they represent.*

"Endorsement" means that the endorsing entity is willing to lend its name in support of *Sharing Our Buried Treasure*, as a statement of need for further dialogue and to express its willingness to work toward implementation of its sections and support of its goals. It does not mean that every entity supports every statement. It means that it is willing to "sign on" to the summary of pertinent issues it represents. An endorsing group is free to include with its endorsement a statement with any caveats or clarifications.

4. *Encourage individual agencies and groups to use Sharing Our Buried Treasure to evaluate their current groundwater management activities and develop specific strategies to achieve the visions and needs identified in this Summary.*

Instead of specifying which groups or agencies should carry out a specific strategy, all are encouraged to make use of this Summary in reviewing and developing their own management strategies (e.g., defining research priorities, guiding agency planning, finding collaborative solutions, evaluating decision-making processes, etc.). The GCC hopes that this Summary can provide a common framework or vision within which these strategies can be implemented.

¹⁰ <http://www.dnr.state.wi.us/org/water/dwg/gcc/>

¹¹ s.15.347 (13)(g) Wis. Stats.

5. *Provide opportunities for further citizen involvement and input through public forums and presentations on the Groundwater Summit outcomes and this Summary.*

Opportunities may include regional forums, presentations to Groundwater Guardian and other interested groups, and inviting continued feedback from Summit participants.

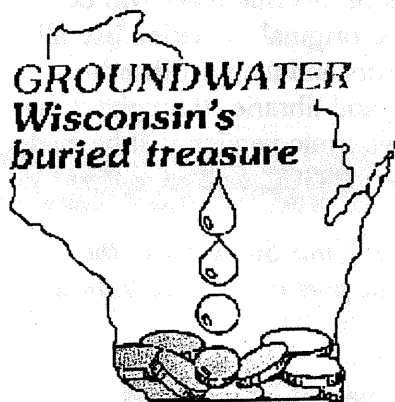
6. *Intentionally create linkages with the Waters of Wisconsin Initiative to address the longer term and bigger picture strategies presented in this Summary.*

The themes and strategies identified in this Summary will be incorporated into the Waters of Wisconsin Initiative of the Wisconsin Academy of Sciences, Arts and Letters¹² to the extent possible. Waters of Wisconsin aims to examine and analyze the current state and long-term sustainability of Wisconsin's waters through a process of informed discussion, including public participation and outreach activities, a statewide forum in October of 2002, and a report on the status and potential future of Wisconsin's water resources. Groundwater components of this initiative will draw extensively from the Groundwater Summit outcomes. The GCC intends to support the Academy's promotion of the Year of Water in 2003.

7. *Continued role for the GCC.*

The GCC will serve as an "institutional catalyst" to ensure that the ideas and directions presented in this Summary are made available to its member agencies, legislators, local and private interest groups and Wisconsin citizens. The GCC will develop its own goals and strategies to guide its activities in the next few years. In addition, the GCC will track and evaluate progress made on these strategies as they are implemented.

For more information on the Groundwater Coordinating Council and the Groundwater Summit, please contact Tim Asplund, GCC staff person at (608) 267-7449 or tim.asplund@dnr.state.wi.us.



¹² <http://www.wisconsinacademy.org/wow/index.html>

Table 1. Affiliations of Groundwater Summit Participants.

Carmody Data Systems, Inc.	U.S. Environmental Protection Agency - Region V
Center on Wisconsin Strategy	University of Wisconsin Extension
Central Wisconsin Groundwater Center	University of Wisconsin System
CH2M Hill	USDA Natural Resources Conservation Service
Concerned Citizens of Newport	UW Environmental Resources Center
Dane County Regional Planning Commission	UW Water Resources Institute
Dane County UW Extension	UW-Madison
Department of Agriculture, Trade, and Consumer Protection	UW-Milwaukee
Department of Commerce	UW-Oshkosh
Department of Health and Family Services	Waukesha County Environmental Health Division
Department of Justice	Wisconsin Academy of Sciences, Arts, and Letters
Department of Natural Resources	Wisconsin Agribusiness Council
Department of Transportation	Wisconsin Association of Land Conservation Employees
DeWitt Ross & Stevens	Wisconsin Builders Association
Dodge County UW Extension	Wisconsin Council of Trout Unlimited
Great Lakes Indian Fish and Wildlife Commission	Wisconsin Farm Bureau Federation
Ho-Chunk Nation	Wisconsin Fertilizer and Chemical Association
International Bottled Water Association	Wisconsin Geological and Natural History Survey
Layne Christensen Company	Wisconsin Groundwater Association
League of Wisconsin Municipalities	Wisconsin Land and Water Conservation Association
Municipal Environmental Group - Water Division	Wisconsin Manufacturers and Commerce
Policy Solutions, Ltd.	Wisconsin Pork Producers Association
River Alliance of Wisconsin	Wisconsin Potato and Vegetable Growers Association
Rock Basin UW Extension	Wisconsin Realtors Association
Rock County Planning & Development Agency	Wisconsin Rural Water Association
Ruekert * Mielke, Inc.	Wisconsin State Cranberry Growers Association
Sierra Club -- John Muir Chapter	Wisconsin State Laboratory of Hygiene
Southeastern Wisconsin Regional Planning Commission	Wisconsin Stewardship Network
Town of Blue Mounds, Dane County	Wisconsin Towns Association
Town of Mukwonago, Walworth County	Wisconsin Water Association
U. S. Geological Survey - Wisconsin District	Wisconsin Water Well Association
	Wisconsin Wildlife Federation

***Wisconsin Groundwater
Coordinating Council***

***REPORT TO THE
LEGISLATURE***



August 2002

GROUNDWATER COORDINATING COUNCIL MEMBERS

Department of Natural Resources - Susan L. Sylvester (Chair)
Department of Agriculture, Trade, and Consumer Protection - Nicholas Neher
Geological and Natural History Survey (State Geologist) - James Robertson
Governor's Representative - John Metcalf
Department of Health and Family Services - Dr. Henry Anderson
Department of Commerce - Cathy Cliff
Department of Transportation - Carol Cutshall
University of Wisconsin System - Frances Garb

SUBCOMMITTEE MEMBERS

Research

Geological and Natural History Survey - Ken Bradbury (Chair)
Central Wisconsin Groundwater Center - Paul McGinley
Department of Agriculture, Trade and Consumer Protection - Jeff Postle
Department of Commerce - Harold Stanlick
Department of Health and Family Services - Henry Anderson and Lynda Knobeloch
Department of Natural Resources - David Lindorff and Steve Karklins
University of Wisconsin System - David Armstrong and Maureen Muldoon
U. S. Geological Survey - Jim Krohelski and Randy Hunt

Monitoring & Data Management

Department of Natural Resources - Jeff Helmuth (Chair), Mike Lemcke and Randell Clark
Department of Agriculture, Trade and Consumer Protection - Bruce Rheineck
Department of Commerce - Harold Stanlick
Department of Health and Family Services - Mark Werner
Geological and Natural History Survey - Ron Hennings and Bill Bristoll
University of Wisconsin System - Dave Mechenich
U. S. Geological Survey - Chuck Dunning

Planning and Mapping

Department of Transportation - Bob Pearson (Chair)
Department of Natural Resources - Lisa Morrison and Mike Lemcke
Department of Agriculture, Trade and Consumer Protection - Cody Cook
Department of Commerce - Leroy Jansky
Department of Health and Family Services - Chuck Warzecha
Geological and Natural History Survey - Ron Hennings
University of Wisconsin System - Steve Born
U. S. Geological Survey - Judy Horwatic

Education

Central Wisconsin Groundwater Center - Christine Mechenich (Chair)
Department of Agriculture, Trade and Consumer Protection - Jane Larson and Randy Zogbaum
Department of Commerce - Lynita Docken
Department of Health and Family Services - Lynda Knobeloch
Department of Natural Resources - Tim Asplund and Dorie Turpin
Department of Transportation - Bob Pearson
Geological and Natural History Survey - Ron Hennings
Governor's Representative - John Metcalf
Natural Resources Conservation Service - Jim Kaap
State Laboratory of Hygiene - Amy Mager
University of Wisconsin System - Jim Peterson
U. S. Geological Survey - Chuck Dunning

Local Government

Department of Natural Resources - Dave Lindorff (Chair)
Central Wisconsin Groundwater Center - George Kraft
Council of Regional Planning Organizations - Chuck Kell and Bill Lane
Department of Agriculture, Trade and Consumer Protection - Jim Vanden Brook
Department of Commerce - Roman Kaminski
Department of Health and Family Services - Chuck Warzecha
Geological and Natural History Survey - Ron Hennings
Wisconsin Alliance of Cities - Mayor Carol Lombardi and Mayor John David
Wisconsin County Code Administrators - Ray Schmidt and Bruce Haukom
Wisconsin Rural Water Association - Ed Morse
Wisconsin Water Association - Nancy Quirk



State of Wisconsin \ GROUNDWATER COORDINATING COUNCIL

Scott McCallum, Governor

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August, 2002

To: The Citizens of Wisconsin

The Honorable Governor Scott McCallum
Senate Agriculture and Environmental Resources Committee
Assembly Environment Committee
Assembly Natural Resources Committee
Secretary Gene E. Kussart - Department of Transportation
Secretary Philip Edw. Albert - Department of Commerce
Secretary James E. Harsdorf - Department of Agriculture, Trade & Consumer Protection
Secretary Phyllis Dubé - Department of Health and Family Services
Secretary Darrell Bazzell - Department of Natural Resources
President Katharine Lyall - University of Wisconsin System
State Geologist James Robertson - Geological and Natural History Survey

Susan L. Sylvester,
Council Chair
DNR

Carol Cutshall
DOT

James Robertson
WGNHS

Nicholas Neher
DATCP

Henry Anderson
DHFS

Cathy Cliff
COMMERCE

Frances Garb
UWS

John Metcalf
GOVERNOR'S REP.

This is the 2002 Groundwater Coordinating Council (GCC) Report to the Legislature. The GCC was formed in 1984 to help state agencies coordinate non-regulatory activities and exchange information on groundwater. The GCC has served as a model for interagency coordination and cooperation among state government officials, the Governor, local government and the federal government. 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 GCC and agency activities related to groundwater protection and management in FY 02 (July 1, 2001 to June 30, 2002) and provides an overview of the condition of the groundwater resource. See the *Executive Summary* for highlights and the GCC's recommendations in *Directions for Future Groundwater Protection*. This report is also available online at <http://www.dnr.state.wi.us/org/water/dwg/gcc/RTL-2002.pdf>.

The main focus of the GCC's activities during the past year has been the planning, implementation and follow up to Wisconsin's Groundwater Summit, held in October of 2001. The Summit presented an opportunity to evaluate the State's approach to groundwater management, identify education and research needs, and provide direction for future activities. The document "*Sharing Our Buried Treasure: A Summary of the 2001 Groundwater Summit*" is provided as a companion to the 2002 Report to the Legislature, and is also available online at <http://www.dnr.state.wi.us/org/water/dwg/gcc/SOBT.pdf>.

We hope you, your staff, and the public will find this report to be a useful reference in protecting Wisconsin's valuable groundwater resource.

Sincerely,

Susan L. Sylvester, Chair
Groundwater Coordinating Council

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LIST OF ABBREVIATIONS AND ACRONYMS

AAA.....	Arsenic Advisory Area
ACCP.....	Agricultural Chemical Cleanup Program
ASR.....	Aquifer Storage and Recovery
BMP.....	Best Management Practices
BRRTS.....	Bureau of Remediation and Redevelopment Tracking System
CERCLA.....	Comprehensive Environmental Response Compensation Liability Act
COD.....	chemical oxygen demand
Comm.....	Department of Commerce (formerly part of DILHR)
CWGC.....	Central Wisconsin Groundwater Center
DATCP.....	Department of Agriculture, Trade and Consumer Protection
DHFS.....	Department of Health and Family Services
DILHR.....	Department of Industry, Labor and Human Relations
DNR.....	Department of Natural Resources
DOT.....	Department of Transportation
EPA.....	U. S. Environmental Protection Agency
ERC.....	Environmental Resources Center
ERS.....	Division of Environmental and Regulatory Services
ES.....	Enforcement Standard
ESA.....	ethane sulfonic acid
FHWA.....	Federal Highway Administration
FSTRAC.....	Federal/State Toxicology and Risk Analysis Committee
FY.....	Fiscal Year
GCC.....	Groundwater Coordinating Council
GEMS.....	Groundwater and Environmental Monitoring System
GIS.....	Geographic Information System
GMU.....	Geographic Management Unit
GPS.....	Global Positioning System
GRAC.....	Groundwater Research Advisory Council
GRN.....	Groundwater Retrieval Network
IPM.....	Integrated Pest Management
LUST.....	Leaking Underground Storage Tank
LWRV.....	Lower Wisconsin River Valley
mg/L.....	milligrams per liter
MOU.....	Memorandum of Understanding
NPM.....	Nutrient and Pest Management
NRCS.....	(USDA) Natural Resource Conservation Service
PAL.....	Preventive Action Limit
PCB.....	polychlorinated biphenyl
PCR.....	polymerase chain reaction
PECFA.....	Petroleum Environmental Clean-up Fund Act
PMP.....	Pesticide Management Plan
ppb.....	parts per billion
ppm.....	parts per million
RR.....	Bureau for Remediation and Redevelopment
SEWRPC.....	Southeast Wisconsin Regional Planning Commission
SMP.....	State Management Plan
SWAMP.....	System for Wastewater Applications, Monitoring, and Permits
SWAP.....	Source Water Assessment Program
TDS.....	total dissolved solids
µg/L.....	micrograms per liter

UIC.....Underground Injection Control
 USDA.....US Department of Agriculture
 UW.....University of Wisconsin
 UWEX.....University of Wisconsin Extension
 UWS.....University of Wisconsin System
 USGS.....US Geological Survey
 VOC.....volatile organic compound
 VPLE.....Voluntary Party Liability Exemption
 WGNHS.....Wisconsin Geological and Natural History Survey
 WHP.....Wellhead Protection
 WPDES.....Wisconsin Pollution Discharge Elimination System
 WRI.....Water Resources Institute
 WSLH.....Wisconsin State Laboratory of Hygiene
 WUWN.....Wisconsin Unique Well Number

EXECUTIVE SUMMARY

This is the annual Report to the Legislature by the Groundwater Coordinating Council (GCC) as required by s. 15.347, Wisconsin Statutes. The report describes the condition and management of the groundwater resource and summarizes the Groundwater Coordinating Council's activities for fiscal year (FY) 2002.

In 1984, the Legislature enacted Wisconsin Act 410 to improve the management of the state's groundwater. The GCC 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."

Membership of the GCC includes the Secretaries of the Departments of Natural Resources (DNR); Commerce; Agriculture, Trade and Consumer Protection (DATCP); Health and Family Services (DHFS); Transportation (DOT); the President of the University of Wisconsin System (UWS); the State Geologist; and a representative of the Governor. Agency designees are listed on the inside of the front cover. More information about the GCC and its activities can be found on the GCC web pages: (<http://www.dnr.state.wi.us/org/water/gcc/index.htm>).

Since the last report, the Groundwater Coordinating Council, its Subcommittees, and member State agencies have accomplished the following:

- 1) *The GCC initiated and implemented a statewide meeting of groundwater professionals and interest groups in October 2001, titled Wisconsin's Groundwater Summit. This Summit presented an opportunity to evaluate the state's efforts in managing and protecting groundwater resources and to provide direction for future education, policy, research, and data management activities. The document "Sharing Our Buried Treasure: A Summary of the 2001 Groundwater Summit" is provided as a companion to the 2002 Report to the Legislature, and is also available online at <http://www.dnr.state.wi.us/org/water/dwg/gcc/SOBT.pdf>. Several related activities and outcomes are reported under the section titled *Coordination Activities*.*
- 2) *The GCC and the UWS Groundwater Research Advisory Council (GRAC) continued coordination of the annual solicitation for groundwater research and monitoring proposals among state agencies. UWS, DATCP, and DNR funded thirty-three projects in FY 02 (see Table 1). The GCC approved the FY 03 joint solicitation package for groundwater research and monitoring, which was sent out in September 2001 (see Appendix). A total of 38 project proposals were received. A comprehensive review process resulted in the selection of 7 new projects for funding for FY 03. At their February 22, 2002, meeting the GCC unanimously approved the proposed UWS groundwater research plan as required by s. 160.50(1m), Wis. Stats. The UWS will fund 7 continuing and 6 new projects in FY 03. The FY 03 groundwater monitoring and research projects are listed by funding agency in Table 2, including 13 projects that were carried over from FY 02.*
- 3) *Three GCC Subcommittees participated in a joint effort to produce a set of three Fact Sheets related to comprehensive planning (Smart Growth) and groundwater. These fact sheets are intended to highlight the need for including groundwater protection in local land use activities and comprehensive planning, provide resources for further information and provide an example of groundwater protection provisions in residential development. The fact sheets were distributed to each of the communities that received comprehensive planning grants, the DNR Land Use Team, and the Wisconsin Land Council. They are also available on the GCC's web page under "Publications" (<http://www.dnr.state.wi.us/org/water/dwg/gcc/>).*
- 4) *The GCC released the document "Recommended Minimum Elements for Groundwater Databases" in order to promote the standardization, sharing and exchange of groundwater information. This document, developed by the Monitoring and Data Management Subcommittee, provides a listing of recommended minimum*

elements for groundwater databases to enable users to share data with others more easily. Copies were provided to County Health Departments, state agencies, UW Extension, and university partners. The document is also available on the GCC's web page under "Publications" (<http://www.dnr.state.wi.us/org/water/dwg/gcc/>).

- 5) *The GCC sought to broaden its base of representation and partners through expansion of its Subcommittees.* For example, representatives from the League of Wisconsin Municipalities, and the Southeastern Wisconsin Regional Planning Commission, and the Wisconsin Technical College Board attended meetings in FY 02 and continue to be included in GCC mailings. A representative of the Wisconsin State Laboratory of Hygiene joined the Education Subcommittee in 2001 and contributed a section to this year's report on p. 45. Representatives from the Natural Resource Conservation Service (NRCS) and the U. S. Geological Survey (USGS) continue to attend GCC meetings and serve as *ex officio* subcommittee members.
- 6) *In partnership with the DNR, the Central Wisconsin Groundwater Center hired a statewide Groundwater Guardian program coordinator.* This effort involves using the national Groundwater Guardian program to build the groundwater knowledge and leadership skills of Wisconsin citizens in order to develop a Wisconsin grass-roots groundwater constituency. The program has developed outreach materials including a display, presentation, and brochure; made numerous presentations to interested groups; and assisted the seven existing Wisconsin Groundwater Guardian communities in carrying out their activities. More about the Wisconsin Groundwater Guardian program can be found on the internet: (<http://www.uwsp.edu/cnr/gwguardian>).
- 7) *The Department of Agriculture, Trade and Consumer Protection (DATCP) released the report "Groundwater Quality: Agricultural Chemicals in Wisconsin Groundwater" in May 2002.* Beginning in October 2000 and ending in May 2001, DATCP collected 336 samples from private drinking water supplies to determine the statewide impact of pesticides on groundwater resources. A total of seven common herbicides, ten metabolites and nitrate were included in the latest survey. This study also was compared to previous surveys to attempt to understand trends in groundwater quality over time. Results from this survey have been summarized in the May 2002 report *Groundwater Quality: Agricultural Chemicals in Wisconsin Groundwater* available on the DATCP web site: <http://datcp.state.wi.us/>. Highlights from this overall study show:
 - An estimated 37.7% of wells contain a detectable level of a herbicide or herbicide metabolite.
 - Alachlor ESA and metolachlor ESA are the most commonly detected herbicide compounds with estimates that 27.8 and 25.2% of Wisconsin wells contain these compounds, respectively.
 - A significant decline in parent atrazine concentrations in groundwater occurred between 1994 and 2001.
- 8) *The Department of Natural Resources (DNR) implemented a GIS Registry of Closed Remediation Sites in November 2001.* Revisions to NR 726, 716, 749, and 811/812, Wis. Adm. Code, implement a GIS Registry of Closed Remediation Sites to replace the requirement to record groundwater use restrictions at the County Register of Deeds Office. The GIS Registry currently includes locational information on sites closed with residual groundwater contamination above the NR 140 enforcement standards, as well as specific information pertaining to the location of the contaminant plume and its concentration at the time the closure decision was made. This database is to be used with well construction requirements for private wells, and with a setback distance for new municipal wells.
- 9) *Several State agencies have taken proactive steps to address high arsenic levels in Wisconsin aquifers in FY 02.¹*
 - An Arsenic Web Page (<http://www.dnr.state.wi.us/org/water/dwg/arsenic/index.htm>) has been developed to provide DNR staff and public with information and updated recommendations.

¹ On October 31, 2001 EPA announced that the Federal Drinking Water Standard for arsenic would be lowered from 50 parts per billion for public water systems to 10 parts per billion. The new standard became effective in February 2002 and compliance must be reached by 2006. The arsenic rule affects municipally owned water systems and those that serve an average of at least 25 people daily for six months of the year, among them schools, mobile home parks, apartment buildings, day care centers, and factories.

- Department of Health and Family Services (DHFS) staff completed a DNR-funded study to investigate the relationship between exposure to inorganic arsenic in water and health outcomes. A summary of the final report is available on the DNR's Arsenic Web Page under "Studies." As part of this research effort, local health departments, DNR and DHFS staff, town clerks and others have carried out township-based well sampling campaigns throughout Winnebago and Outagamie counties. More than 2200 families completed questionnaires aimed at assessing arsenic exposure and related health outcomes.
- In FY 02 the WGNHS completed field experiments in the Fox River Valley that evaluated mechanisms of arsenic release to groundwater from domestic wells completed in the St. Peter sandstone aquifer, including studies of arsenic exposure to residents in the area and the effects of well chlorination on arsenic levels. Results of this study were presented to DNR Drinking Water and Groundwater Program staff and used by the DNR to develop well construction guidelines for the Towns of Algoma and Omro.
- Including the two studies mentioned above, a total of 9 DNR and UWS-funded projects addressed issues related to arsenic in FY 02. Two additional studies that have recently been completed include an analysis of the effectiveness of special well construction requirements in high arsenic areas and a study refining analytical methods for detection of arsenic compounds. Ongoing projects include a study of the role of chlorination in releasing arsenic, three projects investigating treatment methodologies for both private and public water supplies, and a new project investigating the occurrence of arsenic in southeastern Wisconsin aquifers. These studies will help provide needed information about the occurrence, health risks, and remediation of arsenic in drinking water supplies. Results will be made available in FY 03 as final reports are completed.

INTRODUCTION

PURPOSE OF THE REPORT

The Groundwater Coordinating Council 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 FY 02.

The activities of the Groundwater Coordinating Council and its subcommittees are described in the section titled *Coordination Activities* and in the minutes which are contained in the Appendix. The section *Summary of Agency Activities* describes groundwater management programs and implementation of ch. 160, Wis. Stats., by the individual state agencies. *Groundwater Monitoring and Research* provides information on monitoring and research activities to address groundwater issues in Wisconsin and describes the condition of the groundwater resource. The recommendations of the Council are contained in *Directions for Future Groundwater Protection*.

SUMMARY OF WISCONSIN'S GROUNDWATER LEGISLATION

Wisconsin has a long history of groundwater protection. The culmination of this effort was adoption and implementation of 1983 Wisconsin Act 410, Wisconsin's Comprehensive Groundwater Protection Act, which was signed into law on May 4, 1984. The law expanded Wisconsin's legal, organizational, and financial capacity for controlling groundwater pollution. The Groundwater Protection Act created Chapter 160, Wisconsin Statutes, which serves as the backbone of Wisconsin's program. Chapter 160 provides a multi-agency comprehensive regulatory approach, using two-tiered numerical standards, based on the premise that all groundwater aquifers in Wisconsin are entitled to equal protection. There are a number of major components to Wisconsin's groundwater protection program:

- 1) Standards. Under chapter 160, Wis. Stats., the Department of Natural Resources (DNR) must establish state groundwater quality standards based on recommendations from the Department of Health and Family Services (DHFS). Standard setting is a continuing process based on a priority list of substances detected in groundwater or having a high possibility of being detected, established by the DNR in conjunction with other state agencies. The state groundwater standards are contained in chapter NR 140, Wisconsin Administrative Code. For each substance there is an enforcement standard (ES) which determines when a violation has occurred and a preventive action limit (PAL) which is set at a percentage of the ES. The PAL serves as a trigger for possible remedial action.
- 2) Regulatory Programs. Once groundwater quality standards are established, all state agencies must manage their regulatory programs to comply. Each state regulatory agency must promulgate rules to assure that the groundwater standards are met and to require appropriate responses when the standards are not met. The state regulatory agencies are the DNR (solid and hazardous waste, industrial and municipal wastewater, spills, wetlands and water supply); the Department of Commerce (private sewage systems, petroleum product storage tanks); the Department of Agriculture, Trade and Consumer Protection (DATCP) (pesticide use and storage and fertilizer storage); and the Department of Transportation (DOT) (salt storage). The implementation of the groundwater standards by the state agencies is described under "Summary of Agency Activities".
- 3) Aquifer Classification. One of the most important features of Wisconsin's groundwater law is an item that was omitted. When Wisconsin was debating the groundwater protection legislation, the U. S. Environmental Protection Agency (EPA) tried to develop a nationwide groundwater approach. A keystone of EPA's proposal

was aquifer classification - a scheme whereby each aquifer would be classified according to its potential use, value or vulnerability, and then would be protected to that classification level. This entails "writing off" certain aquifers as industrial aquifers not entitled to protection and never again usable for human water supply. Wisconsin said "no" to aquifer classification. The philosophical underpinning of Wisconsin's groundwater law is the belief that all groundwater in Wisconsin must be protected equally to assure that it can be used for people to drink today and in the future.

- 4) **Monitoring and Data Management.** At the time the groundwater legislation was created, there was concern that Wisconsin needed a groundwater monitoring program to determine whether the groundwater standards were being met. Therefore, a groundwater monitoring program was created under s. 160.27, Wis. Stats. Money from the Groundwater Account of the Environmental Fund has been used for problem-assessment monitoring, regulatory monitoring, at-risk monitoring, and management-practice monitoring, as well as establishment of a data management system for collection and management of the groundwater data. See the "Groundwater Monitoring and Research" discussion in this report for further information.
- 5) **Research.** Although all state agencies must comply with the groundwater standards, the processes by which groundwater becomes contaminated, the technology for cleanup, the mechanisms to prevent contamination, and the environmental and health effects of the contamination are often not well understood. In addition, the basic data on geology, soils, and groundwater hydrology is often not available. The UWS and the state agencies have recognized that additional efforts in these research areas are badly needed. The Governor and the Legislature included a new groundwater research appropriation for the UWS beginning with the 1989-1991 biennial budget. Since 1992, the UWS, DATCP, DNR and Commerce have participated in a joint solicitation for groundwater-related research and monitoring proposals. See the "Groundwater Monitoring and Research" section for more details.
- 6) **Coordination.** In establishing the groundwater law, the Legislature recognized that management of the state's groundwater resources was a responsibility divided among a number of state agencies. Therefore, the Groundwater Coordinating Council was created to advise and assist state agencies in the coordination of non-regulatory programs and the exchange of information related to groundwater. The Coordinating Council has been meeting since 1984. See the "Coordination Activities" discussion in this report.
- 7) **Local Groundwater Management.** The Groundwater Protection Act clarified the powers and responsibilities of local governments to protect groundwater in partnership and consistent with state law.
 - a. Zoning authority for cities, villages, towns and counties was expanded to "encourage the protection of groundwater."
 - b. Counties can adopt ordinances regulating disposal of septage on land (consistent with DNR requirements); cities, villages, or towns may do so, if the county does not.
 - c. Counties can regulate (under DNR supervision) well construction and pump installation for certain private wells.
 - d. Property assessors must consider the time and expense of repairing or replacing a contaminated well or water supply when assessing the market value of real property; they must consider the "environmental impairment" of the property value due to the presence of a solid or hazardous waste disposal facility.

The following report is intended to update the Legislature and Governor on the status of the state's groundwater program and the activities of the Groundwater Coordinating Council.

COORDINATION ACTIVITIES

GROUNDWATER COORDINATING COUNCIL

The Groundwater Law, 1983 Wisconsin Act 410, established the GCC to advise and assist state agencies in coordinating non-regulatory programs and exchanging groundwater information. The GCC consists of the heads of all state agencies with some responsibility for groundwater management plus a Governor's representative. The agency heads have appointed high-level administrators with groundwater responsibilities to sit on the Council. The state agencies include the DNR, Commerce, DHFS, DATCP, DOT, WGNHS, and the UWS. The GCC has created five subcommittees to assist in its work. The subcommittees are composed of approximately 60 people including members of the GCC, employees of state and federal agencies, university researchers and educators, representatives of counties and municipalities and public members. Additionally the DNR has one permanent position with half of its responsibilities related to coordination of the GCC.

The GCC had four meetings during the past year. The meeting minutes are included in the Appendix. The following activities are highlighted and summarized here.

Wisconsin Groundwater Summit. In May of 2000, the GCC initiated an effort to assess the current status of groundwater management in the state and to provide future direction for the GCC and its member agencies. This effort culminated in an event called "Wisconsin's Groundwater Summit" held on October 30, 2001 in Waukesha, WI. The Summit brought together a broad spectrum of groundwater users and stakeholders to discuss issues facing groundwater protection and management and develop solutions to better protect Wisconsin's groundwater. Representatives from over 50 organizations, agencies, and other groups with a stake in safe and adequate groundwater supplies attended the meeting. These included environmental, conservation, and agricultural groups, industrial users, water utilities, local and tribal government, planning agencies, state and federal agencies, and university researchers and educators. The Summit structure included a set of keynote presentations and a panel discussion, followed by breakout sessions where participants were asked to address specific issues and suggest solutions. A core group of GCC Subcommittee members helped to synthesize the discussion and formulate a set of findings and recommendations that are contained in the document *Sharing Our Buried Treasure: A Summary of the 2001 Groundwater Summit* available online at <http://www.dnr.state.wi.us/org/water/dwg/gcc/SOBT.pdf>.

A number of other products and follow-up activities resulted from the Groundwater Summit, which are also summarized on the GCC Summit web page (<http://www.dnr.state.wi.us/org/water/dwg/gcc/GCC-GWSUMMIT.HTM>.) These include:

- Development of a "Breakout Session Matrix", which compiles over 435 specific comments, ideas, or needs identified by the Summit participants in the afternoon breakout sessions.
- Review of the breakout session comments by each of the GCC Subcommittees and development of goals or directions for further action in the areas of Research, Monitoring and Data Management, Mapping, and Education.
- Preparation of press releases immediately following the Summit and during Groundwater Awareness Week providing information on key ideas discussed at the Summit.
- Interaction with the Waters of Wisconsin Project of the Wisconsin Academy of Sciences, Arts and Letters, including making findings available for the project report and developing a follow-up session for the Waters of Wisconsin Forum to be held in the fall of 2002.

The GCC will continue to follow up on the Summit findings in the context of the Wisconsin Waters of Wisconsin Initiative and through the GCC's ongoing meetings and Subcommittees. Full Summit proceedings will be made available by the end of 2002.

Smart Growth Fact Sheets. Members of three subcommittees participated in a joint effort to produce a set of three fact sheets related to comprehensive planning (Smart Growth) and groundwater. These fact sheets are intended to

highlight the need for including groundwater protection in local land use activities and comprehensive planning, provide resources for further information and give examples of groundwater protection ordinances for residential developments. The fact sheets were distributed to each of the communities who has received comprehensive planning grants, the DNR Land Use Team, and the Wisconsin Land Council. Information will also be sent to local government organizations to share with their membership. They are also available on the GCC's web page under "Publications" (<http://www.dnr.state.wi.us/org/water/dwg/gcc>).

Minimum Data Elements. The GCC released the document *Recommended Minimum Elements for Groundwater Databases* in order to promote the standardization, sharing and exchange of groundwater information. This document, developed by the Monitoring and Data Management Subcommittee, provides a listing of recommended minimum elements for groundwater databases to enable users to share data with others more easily. Copies were provided to County Health Departments, state agencies, UW Extension, and university partners. The document is also available on the GCC's web page under "Publications" (<http://www.dnr.state.wi.us/org/water/dwg/gcc>).

Joint Solicitation. The GCC and the UWS Groundwater Research Advisory Council (GRAC) continued coordination of the annual solicitation for groundwater research and monitoring proposals among state agencies. (Details are found in the section on *Coordination of Groundwater Monitoring and Research*). The GCC approved the FY 03 Joint Solicitation package in August of 2001 (see Appendix). Members of 2 GCC Subcommittees reviewed the proposals that were submitted and made their recommendations to the agencies and GRAC. Three GCC members participated in the GRAC review. At their February 22, 2002 meeting the GCC unanimously approved the proposed UWS groundwater research plan as required by s. 160.50(1m), Wis. Stats.

State budget shortfalls limited the number of new projects that were selected for funding during FY 03. The GCC directed that a letter be sent to the secretary of each of the agencies represented on the GCC asking that funding for groundwater monitoring and research activities be restored in future years. A copy of the letter is included in the Appendix.

Several improvements were made to the Joint Solicitation process in FY 02, including the debut of online proposal submittal and the development of an electronic database for coordinating reviews and managing projects. In addition, a meeting was held between the GCC staff person, DATCP staff, and the manager of the Wisconsin Fertilizer Research Council to explore ways of coordinating and streamlining the two proposal review and funding processes. These activities will help create efficiencies in the proposal submittal process and help ensure that taxpayer dollars are directed at the most pressing needs for groundwater information.

Other coordination activities. The GCC continued to promote communication, coordination, and cooperation between the state agencies through its quarterly meetings. The GCC received briefings and heard presentations on:

- Subcommittee activities (see below)
- FY 03 Joint Solicitation
- 2001 GCC Report to the Legislature
- UWS FY 03 Groundwater Research Plan
- Ideas for improving Joint Solicitation review process
- Agency groundwater budgets
- Planning for and outcomes of the Wisconsin Groundwater Summit
- Source Water Assessment Program (SWAP)
- Monitoring and modeling of nonpoint pollution in agricultural fields
- DATCP survey of agricultural chemicals in private wells
- Water system security issues
- Waters of Wisconsin Initiative of the Wisconsin Academy of Sciences, Arts and Letters
- Passage of microorganisms in septic system effluents through mound sand
- Performance monitoring of Private Onsite Wastewater Treatment Systems (POWTS) by Commerce
- Source water modeling of Sauk County
- Access to well information on the DNR internet site

WWW site. Several updates to the World Wide Web site for the GCC have been made in the past year (<http://www.dnr.state.wi.us/org/water/dwg/gcc/>). The site provides information on the activities of the council, a list of members on the council and members of the subcommittees, information on the annual Joint Solicitation for groundwater research proposals, documents in web viewable and downloadable format, and links to other relevant groundwater or related web sites. Links can also be found to GCC-related information on other institution's web sites, including research summaries at the Water Resources Institute and a karst information web page at the WGNHS.

SUBCOMMITTEE ACTIVITY SUMMARIES

The GCC is directed to "serve as a means of increasing the efficiency and facilitating the effective functioning of state agencies in activities related to groundwater management". The Subcommittees of the GCC carry out this charge by regularly bringing together staff from over 15 different agencies, institutions, and organizations to communicate and work together on a variety of research, monitoring and data management, planning and mapping, educational, and local government issues.

In addition to the specific Subcommittee activities reported below, several collaborative efforts among agencies and Subcommittees were accomplished in FY 02. In addition, numerous contacts and informal conversations are generated both at meetings and through email communications among Subcommittee members, leading to better communication across agency lines on a variety of issues. These activities related to participation of agency staff on GCC Subcommittees create efficiencies and provide intangible benefits to Wisconsin's taxpayers. For example:

- At Farm Progress Days, groundwater-related booths sponsored by UW-Extension, WGNHS, CWGC, DNR, DHFS, Comm, and DATCP were located in one tent, providing drinking water screening for nitrate and information on drinking water quality, drinking water treatment and backflow prevention, healthy homes, proper disposal of agricultural chemicals, and proper sealing of abandoned wells.
- Members of the Education, Planning and Mapping, and Local Government Subcommittees developed three comprehensive planning and groundwater fact sheets, titled "Groundwater and its Role in Comprehensive Planning", "Resources to Help You Protect Your Drinking Water Supply", and "Residential Development and Groundwater Resources."
- Through agency reports and discussion at the Education Subcommittee meeting, DHFS and DATCP corrected a gap in communication with private well owners about the results of pesticide testing.
- Through discussion at several Subcommittee meetings, access to well locational information in DNR's groundwater and drinking water databases was restored to several agencies, and the importance of this information as a public resource was emphasized as a priority for DNR consideration.
- Through discussion of the DNR's source water protection program, DOT learned of the need to locate salt storage facilities for their source water protection maps. DOT recently implemented a new salt storage inspection program and had similar needs. The DOT was able to obtain GPS coordinates for salt storage facilities as part of their routine inspections and in doing so was able to provide the DNR with geographic locations of 1,193 salt storage facilities.

Research Subcommittee

The purpose of the Research Subcommittee is to assist the GCC in establishing priorities for groundwater research and monitoring activities and to review proposals submitted through the joint solicitation process. To this end, the subcommittee reviewed and revised the priorities for the DNR's groundwater management practice monitoring program for FY 03. The revised priorities were included in the joint solicitation distributed by the UWS, DNR, Commerce, and DATCP in September 2001.

The subcommittee met with the Monitoring and Data Management Subcommittee in January 2002 to review the 38 proposals that were received as a result of the joint solicitation. Subcommittee members made recommendations that were used by the three agencies and the UWS in deciding which groundwater-related proposals to fund for FY 03. The projects to be funded in FY 03 are listed in Table 2.

Monitoring & Data Management Subcommittee

The goal of the Monitoring & Data Management Subcommittee (MDMS) is to coordinate groundwater monitoring and data management activities of state agencies to maximize value and efficiency. MDMS members continued to work collectively, individually, or in small groups on GCC activities or action items targeted by the subcommittee. In FY 02 progress was made on the following issues:

- The MDMS reviewed the priorities for the DNR's groundwater management practice monitoring program for FY 03. The subcommittee met with the Research Subcommittee in January to review the 38 research and monitoring proposals that had been received in response to the joint solicitation. Subcommittee members made recommendations that were used by the three agencies and the UWS in deciding which groundwater-related proposals to fund for FY 03. The projects to be funded in FY 03 are listed in Table 2.
- A document of "Recommended Minimum Data Elements" was completed. This document was written over the last several years and was influenced by the DNR's Locational Data Standards guidance and the National Water Quality Monitoring Council's draft *Data Elements for Reporting Water Quality Results of Chemical and Microbiological Analytes*. The document was produced as guidance for Wisconsin data managers on how to select and use data elements when constructing groundwater databases.
- A computer application was developed to make the karst reporting form available for electronic data entry and storage. The program features on-screen data entry, creation of an automated database, online help features, the ability to upload or attach files to the form (jpg, gif, Word, etc.), search capability, and an export/import function. Users will be able to create their own karst database on their computer and share files with other users or ultimately with the WGNHS. This is part of a larger effort to create a statewide database of karst features and is also beneficial to people with existing databases.
- Several subcommittee members took part in the Groundwater Summit held in October of 2001, contributing to follow-up work synthesizing the ideas presented and putting together a strategy to guide future management activities. The subcommittee as a whole helped to prioritize research and monitoring/data management needs that were identified in the Summit breakout sessions.

A continuing goal for the MDMS is for members to communicate on each program's monitoring programs and data management activities to prevent duplication and increase the utility of monitoring results. This goal is met through regular meetings where members can update one another on their agencies' activities. In FY 02 the subcommittee met three times to track important monitoring and data management issues such as the confidentiality requirements of 1999 Wisconsin Act 88, outside access to DNR databases, arsenic and pesticide monitoring results, electronic data submission through the DNR's Well Forms Program and web page, the DNR's FY 02 Groundwater Monitoring Plan, source water assessment program data management, and agency access of well sample data through the DNR's Groundwater Retrieval Network (GRN) on the DNR's Bureau of Drinking Water and Groundwater web page.

Planning and Mapping Subcommittee

The purpose of the Planning and Mapping Subcommittee is to help the State integrate groundwater management and protection strategies into local and regional land use planning with an emphasis on identifying and prioritizing specific physical (water quantity) and chemical (water quality) hydrogeologic mapping needs (natural resources and anthropogenic impacts). During this reporting period the Subcommittee has been in a state of transition with the selection of a new chairperson and selection of replacement subcommittee members. The subcommittee held meetings on December 5, 2001 and April 3, 2002 during this reporting period.

Progress continues in implementing karst feature inventories and mapping goals. Accomplishments and activities in this long-term project of establishing a statewide karst database and creating regional or local maps includes:

- Assisting with the development of a karst informational brochure produced by the Rock River Coalition, Inc. and the UW-Extension, with funds through the Environmental Quality Incentives Program Educational Assistance funds of the USDA. The brochure is used statewide for educational outreach to teach the public and private sector the importance of karst features and how easily groundwater can be contaminated in karst environments. Many new environmental regulations reference special criteria for groundwater protection in karst settings (e.g., waste facility location requirements, stormwater infiltration requirements, and environmental remediation requirements). The brochure received the 'Gold Award' in the promotional materials category by the Association of Natural Resources Extension Professionals, a national award.
- Presenting a talk at the American Water Resource Association (Wisconsin Section) conference to promote the use of the voluntary karst feature inventory reporting form.
- Meeting in a small workgroup to continue development of a database, factoring in the demonstration of a karst inventory electronic form developed by the MDMS.

Pursuant to s. 16.967 (6), Wis. Stats., eleven State Agencies are required to annually submit Plans to Integrate Land Information to the Wisconsin Land Information Board. These plans were due March 31, 2002 and they are intended to enable such information to be readily translatable, retrievable and geographically referenced for use by any state, local government or public utility. The current focus of the subcommittee is to review these plans to determine if there is a subset of groundwater specific land information that can be compiled in a reference index catalog, which can be updated annually for the use of groundwater practitioners.

A key activity of the subcommittee is providing Agency updates of groundwater related mapping efforts. This important communication enables each Agency to share information and not duplicate efforts. This year, for example, DOT learned that the DNR source water protection program needed to locate salt storage facilities among many other items (e.g., landfills, environmental clean-up sites, etc.) for their source water protection maps. DOT recently implemented a new salt storage inspection program and had similar needs. The DOT was able to obtain GPS coordinates for salt storage facilities as part of their routine inspections and in doing so was able to provide the DNR with geographic locations of 1,193 salt storage facilities. This interagency communication continues to be a focus for the subcommittee.

Education Subcommittee

The Education Subcommittee met five times during the past year. Its mission is to review public information and education materials, coordinate educational messages among agencies, and serve as a forum to identify groundwater education needs, ideas and concerns. At each meeting, representatives share information about current agency activities related to groundwater.

The subcommittee coordinated agency activities for large events such as National Drinking Water Week and Wisconsin Farm Progress Days. At Farm Progress Days in Rock County in September, 2001, groundwater-related booths sponsored by UW-Extension, WGNHS, CWGC, DNR, DHFS, Comm, and DATCP were located in one tent. Exhibits provided drinking water screening for nitrate and information on drinking water quality, drinking water treatment and backflow prevention, healthy homes, proper disposal of agricultural chemicals, and proper sealing of abandoned wells.

The subcommittee also provided input and volunteer help for the Groundwater Summit, and analyzed the results to identify education needs and themes for future action. Groundwater quantity education, which the subcommittee is continuing to develop, was one of the needs identified by the Summit. The subcommittee also provided input into revisions to brochures on pesticides in drinking water, nitrate in drinking water, and common questions about groundwater. It discussed the need to balance the educational benefits of public access to well information on the Internet with privacy and security concerns following September 11.