

| Waterbody Type   | Primary concerns  | Extent in Wisconsin  | Comments Related to Averaging Period  |
|--|---|--|---|
| Stream –<br>suspended algae                              | May result in low dissolved oxygen  | <p>Uncommon in wadeable streams.</p> <p>9 of 240 streams in Wisconsin wadeable stream study had median suspended chlorophyll a concentrations exceeding 10 ug/L.<sup>2</sup></p>   | May see response to change in nutrient concentrations.  |
| Rivers (non-wadeable) --<br>suspended algae <sup>3</sup> | May result in low dissolved oxygen; generally considered to have minimum dissolved oxygen concentrations of more than 4 mg/L (MPCA 2010) <sup>4</sup> . | <p>Common in 46 “rivers” listed in s. NR 102.06, Wis. Adm. Code.</p> <p>18 of 42 study sites had median growing season suspended chlorophyll a concentrations of greater than 10 ug/L.</p> <p>Suspended algae contributes to turbid conditions</p> | May see response to change in nutrient concentrations, however, response tempered by volume of water and surface area reaeration. |

<sup>2</sup> At least two of the nine wadeable streams were sampled downstream from eutrophic impoundments. One of the nine is generally considered as a non-wadeable stream and classified as a river in s. NR 102.06, Wis. Adm. Code.

<sup>3</sup> Generally have great enough water depths such that adequate light does not penetrate to bottom. Bed surveys for macrophytes and benthic algae were not anticipated and, therefore, not included in the study.

<sup>4</sup> Conditions considered similar to those in Minnesota rivers where in nearly all study rivers minimum dissolved oxygen conditions were above 5 mg/L.

| Waterbody Type  | Primary concerns   | Extent in Wisconsin   | Comments Related to Averaging Period  |
|---|--|---|---|
| <b>Lakes and Reservoirs</b>                                       |  |   |   |
| Great Lakes, excluding Lower Green Bay <sup>5</sup>               | Accumulation of filamentous algae mats on shores inhibiting recreational uses  | Common on Lake Michigan and Green Bay shores; not common along Lake Superior likely due to colder water temperatures. | <p>Not considered responsive to short duration changes in water column concentrations due to very long water residence times.</p> <p>Conditions in nearshore waters likely the response to mixing of tributary waters and the upwelling of open waters.</p> <p>Cladophora associated with zebra and quagga mussel accumulation of phosphorus and excretion of phosphorus.</p> |
| Deep stratified drainage lakes, including two-story fishery lakes | <p>Growth of algae in epilimnion and loss of dissolved oxygen in hypolimnion.</p> <p>Inhibits recreational uses, may result in change in aquatic community, and may result in loss of cold water species</p> | Common in Wisconsin, but few receive discharges from wastewater treatment plants <sup>6</sup>                         | <p>These lakes tend to have long water residence times, some may exceed a year.</p> <p>Modeling of lakes generally based on annual phosphorus inputs.</p>   |

<sup>5</sup> Lower Green Bay exhibits conditions similar to the large lakes and reservoirs. The water residence time for Lower Green Bay is less than one year.

<sup>6</sup> Big Green Lake is an example. Ripon POTW discharges to Silver Creek which flows to Big Green Lake.

| <b>Waterbody Type</b>                   | <b>Primary concerns</b>   | <b>Extent in Wisconsin</b>  | <b>Comments Related to Averaging Period</b>  |
|---|---|---|--|
| Deep stratified seepage lakes           | Similar to deep stratified drainage lakes   | Common in Wisconsin, but few receive discharges from wastewater treatment plants <sup>7</sup> | These lakes tend to have long water residence times that may or may not exceed a year.<br><br>Modeling of lakes based on annual phosphorus or growing season inputs.   |
| Shallow drainage and seepage lakes      | Aquatic community shift from macrophytes to algae; inhibits recreational uses                   | Common in Wisconsin, but few receive discharges from wastewater treatment plants <sup>8</sup> | Generally have water residence times of less than a growing season.  |
| Large shallow lakes and reservoirs      | Growth of nuisance algae inhibits recreational uses, may result in change in aquatic community. | Common, including Winnebago Pool lakes and reservoirs along the Wisconsin River               | Water residence times vary, but generally less than one year. For some, phosphorus loads during spring runoff events may rapidly pass through the body of water emphasizing growing season contributions.<br><br>Modeling of these lakes and reservoirs may be based on either annual phosphorus loads or growing seasonal phosphorus loads. |
| Impoundments as defined in s. NR 102.06 | Respond similar to flowing streams or rivers  | Common  | See streams and rivers above   |

<sup>7</sup> Silver Lake in Manitowoc County is an example. Silver Lake receives direct discharge from the Silver Lake Convent and College wastewater treatment plant.

<sup>8</sup> Goose Lake in Columbia County is an example. Goose Lake, a very shallow pond that supports a large goose population, received discharge from Arlington's POTW.

From: [REDACTED]  
Sent: Monday, August 06, 2012 8:28 PM  
To: Anderson, Russell A - DNR  
Subject: Fw: HC wells Seperation

----- Original Message -----

From: [REDACTED]  
To: Dan.Baumann@dnr.state.wi.us  
Cc: [REDACTED]  
Sent: Monday, August 06, 2012 8:18 PM  
Subject: HC wells Seperation

Dan we are very concerned over the idea of Golden Sands dairy trying to separate out the 5 wells from the others. This is not Mr. Wysocki's water. The residents of Saratoga, Rome and Wi Rapids were here first and many of those wells are only sand points. We are working on the listing of well depths in and around this projected dairy area. Please give us time to get that information out to the DNR. Also will you take into account the 40 HC wells already in existence on the Ten Mile Watershed drawing out massive amounts of water daily. The quantity of water is not going to last forever especially in the years of drought which we are currently in. We will give you copies of the petitions to the DNR that we have accumulated to date that request no HC wells permits be allowed. Please forward this where appropriate.

Thanks [REDACTED]

Representing Protect Wood County & Its Neighbors

**From:** [REDACTED]  
**Sent:** Monday, August 06, 2012 9:00 PM  
**To:** Anderson, Russell A - DNR  
**Subject:** Hello

was given your email address today by [REDACTED]. My husband and I have been working with [REDACTED] and [REDACTED] to try and stop the Wysocki's from building their dairy in the Town of Saratoga. I was given a copy of the Wysocki's plan – the same one given to the Town that is signed by Robert J. Pofahl. I have gone over the document and have some concerns about what it contains and what it doesn't say. I'd like to share my concerns with you.

The first thing I noticed about this plan is that it appears to be something written for another project, perhaps another CAFO, and some of the statements are questionable. For example, page 2, 1.3 Background, 1<sup>st</sup> paragraph: *The proposed facility is a new operation that will integrate dairy into the current irrigated potato and vegetable production cropland.* And in the 2<sup>nd</sup> paragraph, *Dairy crop production will enhance the sustainable farming methods of the current potato production systems.* There are no "current irrigated potato and vegetable production cropland" here, there is only timberland and I doubt crops have ever been grown on this land. The Central Sands Dairy was built in an agricultural area. Was the Wysocki's Saratoga dairy plan made with "Saratoga coordinates and facts" just cut and pasted into the Central Sands Dairy plans? If so, you can see why I'm worried about what this proposal contains. The lands in the Town of Armenia were already croplands and there are far less folks living in Armenia than we have here in Saratoga. It is as if this Saratoga dairy, and the folks living around it, are not worth being given a plan that is tailored to conditions here.

Under Water Table Information on page 5, the Wysocki's are using water table information from 1981. There weren't as many people living in Saratoga then, for one thing. Surely there must be more current data than 1981 to draw from!

On page 6 of their plan at 2.1 Leachate Collection System, when speaking of silage leachate, Wysocki says that: *Leachate and runoff will flow to the collection trenches and flow to the collection tank where runoff will be pumped to storage.* It doesn't say whether these collection trenches will be concrete or just sand. If just sand, the leachate will not flow to any tank but will "flow" into the ground. I have learned just how lethal silage runoff is to groundwater and streams – especially sweet corn leachate.

On page 7, under 2.1.3 Hydrology, it speaks of having 240,000 feet of trenches. Further down at 2.1.4.2 Collection Trenches, it says that the collection trenches are designed to be "watertight". The implication is that the runoff trenches will be concrete because they have included the feed storage pad and runoff under the Hydrology heading. However, nowhere does it specifically say that the silage leachate will be collected by something that will keep it out of the groundwater. Perhaps I am "nit-picking" but I have learned the hard way that what isn't written in black and white can come back to haunt you. We are all counting on our water remaining free of contaminates. The silage leachate has the potential to make our water acid, smelly, and not fit to drink. Please be sure the words in the permit have all the T's crossed and the I's dotted. So much is at stake here.

At the July 19<sup>th</sup> meeting in Wisconsin Rapids when Wysocki presented their plan to the people of Saratoga, Jim Wysocki told me – and the audience – that the digester would be in and working “before the first cow arrives at the dairy”. In the plan, the digester is mentioned as being built in phase II, when the dairy is at “90% capacity”. To me 90% implies that there will be a large gap between the arrival of the cows and the building of the digester. So many parts in the Wysocki plan are based on the use of the digester. My concern is that if the digester isn’t built “before the first cow” arrives, all that manure and sand bedding will be sitting around on pads (for who knows how long) with their runoff getting into the groundwater. Here again the wording says that the rainfall and runoff from the solids pad will be collected, but it doesn’t specify collected into concrete or if they plan to “just let it go”! Why would they want the expense of building concrete trenches that they may not need once the digester is built?

The lagoon is worrisome. The idea that so much wastewater will be just sitting there uncovered, open to the wind allowing ammonia and particulates to enter the air. Here again, is the information listed under site conditions for the lagoon current? Is the lagoon’s size, its capacity, and design built for the soil conditions found here in Saratoga? The soil in Saratoga is rated as the ‘most easily contaminated area in Wood County’. Will Wysocki be monitored regularly to see that the nutrients are stored and spread correctly and safely? Or will it just be checked at 5-year intervals? Only you DNR folks know those answers.

From the beginning, the groundwater has been our main concern. We can close the windows or go somewhere else for a while, but if our water becomes contaminated, we have no other water source. Please protect us. Make the wording of the Wysocki permit specific to Saratoga and complete – maybe even going overboard on their being specific and complete. There are 5300 folks depending on the DNR to protect us.

Thank you for “listening” to me. We are grateful that you are willing to communicate with us. I appreciate your time and thank you for anything that you are able to do to keep the residents of Saratoga safe and healthy.

[REDACTED]

**From:** [REDACTED]  
**Sent:** Tuesday, August 07, 2012 8:07 PM  
**To:** Anderson, Russell A - DNR  
**Subject:** Mega dairy farm

Hello, my name is [REDACTED] and I wanted to express my dislike for the 5300 dairy cao facility. Tis is not good for the state of Wisconsin for several reason. First it will take the place of many family farms which in turn put more people out of a job than this new place will employ. These places are so automated they do not require many people to run them. Secondly, the very large concentration of manure is dangerous to the ground water as well as any nearby streams, rivers or lakes. One mishap could cause environmental problems on a large scale, yes manure is natural but even too much of a natural thing can have grave consequences. Fourth, 49 wells? Really? The impact on the ground water levels will be great and could even require some area residents to have to drill deeper wells. Additionally the lowering of groundwater affects stream,lakes, rivers and wetlands impacting the ecology and wildlife in this area. Especially in a drought year like this one we are having now. There are many hidden consequences that are not seen and will not be incorporated into the true costs of the product produced by this facility. For example the extra nitrogen and phosphate added to the eco-systrm that will take hundreds of years to dissapate, the chemicals used on the crops to feed these animals, not to mention the fields taking to feed these animals that may ave once provided food for people or other important corm products. I can not see anything positive coming out of this, I have worked on farms in my past, I know employment numbers for smal farms and I know personally ofe these automated system. I additionally feel qualified to comment on this subject as I am a non-traditional student of wildlife ecolgy, environmental studies, wetland and prairie/wetland restoration. I urge you to not let this facility come to our state and keep our treasured small farms alive.

Sincerely,

[REDACTED]

**From:** [REDACTED]  
**Sent:** Wednesday, August 08, 2012 4:38 PM  
**To:** 'russell.anderson@wisconsin.gov'  
**Cc:** [REDACTED]  
**Subject:** Proposed Golden Sands Dairy - concern and comment

*Greetings Russ,  
and thank you for accepting this brief comment with regard to the proposed Golden Sands Dairy in the Town of Saratoga, Wood County.*

*Concern and comment:*

*Should the proposed Golden Sands Dairy move forward and should the decision of the DNR is to issue a permit to Golden Sands Dairy to install a large number of high capacity wells for the proposed 6,400 acres of crop land – then the approved DNR permit should contain a condition that if the ground water table reaches a specified low level established by the DNR and/or a condition that fertilizer contamination of the ground water exceeds DNR established drinking water guidelines, then the high capacity well or wells will be shut down until the condition that prompted the shutdown is corrected and approved by the DNR.*

[REDACTED]  
[REDACTED]  
Nekoosa, WI 54457  
[REDACTED]

**From:** [REDACTED]  
**Sent:** Wednesday, August 22, 2012 8:45 AM  
**To:** Baumann, Dan G - DNR  
**Subject:** Public Hearing Comments--Golden Sands Dairy--Town of Saratoga, Wood Co.

Dear Mr. Baumann...I've attached my comments for the proposed dairy and would like them included in the public comments for the August 23rd hearing at the Town of Saratoga Town Hall. If there's a problem with this, please let me know and I'll try to present them in person.

Thanks.

[REDACTED]  
[REDACTED]  
Wisconsin Rapids, WI 54494  
[REDACTED]

**COMMENTS FOR WISDNR HEARING REGARDING THE  
PROPOSED GOLDEN SANDS (WYSOCKI) AGRICULTURAL  
OPERATION IN THE TOWN OF SARATOGA  
WOOD COUNTY, WI.  
AUGUST 23, 2012**

Although the proposed operations are very large, I support a Finding of No Significant Impact for the proposal providing that all regulatory approvals required by law, including those for high capacity wells, are obtained.

Currently, the land involved consists mainly of scrub oak and jack pine, and offers little to society. The proposed operation will be the highest and best use of the land by putting it under cultivation and supporting a large dairy operation that will benefit many people.

The opposition movement is based primarily on suppositions that negative impacts will occur to residents living in the area. I understand the concern citizens may have...change can be very traumatic to some people... but I also have faith in the governmental entities charged with overseeing the public welfare. We can't allow NIMBYism to drive decisions of this magnitude,

The proposed operation will provide good jobs for a number of individuals. We must also recognize the domino effect that it will have on the local economy by providing work for truck drivers, cheese makers, milk processing employees, workers at local stores receiving business from the farm and dairy, etc. With a slow economy, it is incumbent upon government to provide opportunities for job growth when minimal negative impacts to the environment, based on studies utilizing procedures accepted in the scientific community, are anticipated.

If your department has questions or criticisms of the proposed operation, you should discuss them with the individual(s) seeking your approval in order to work out solutions that provide a win-win situation for all involved parties.

  
Wisconsin Rapids, WI 54494  
Town of Saratoga

**From:** [REDACTED]  
**Sent:** Monday, August 27, 2012 5:40 PM  
**To:** Kafka, Terence - DNR  
**Subject:** Saratoga CAFO info  
**Importance:** High

Hi Terry,

It was nice to meet you at the Saratoga Town Hall last Thursday. I was reviewing the website that the DNR put up for the CAFO, and according to my calculations, the CAFO and cropland would use over **7 billion gallons of water per year**. That seems ridiculous, but I took the average water usage for each of the 47 wells and the 2 CAFO wells from the permit applications and multiplied it out...see below. Could you tell me if my calculations are correct??

The average proposed water usage for the 47 high capacity wells used for irrigation from April-October is 720,000 gallons per day, per well, at 47 wells = 33,840,000 gallons per day! There are 213 days in that time period –  $213 \times 33,840,000 = 7,207,920,000$  gallons per year! This is the AVERAGE submitted by Wysocki in their high capacity well permit application; the MAXIMUM per day is 1,400,000 gallons. The average proposed water usage year-round for the CAFO's 2 high capacity wells is over 51 MILLION gallons per year. Approximately 140,000 gallons per day  $\times$  365 days = 51,100,000 gallons. This is the AVERAGE...the MAXIMUM per day combined is 684,000 gallons per day.

Thanks for your time!

[REDACTED]

**From:** [REDACTED]  
**To:** [REDACTED]  
**Sent:** Tuesday, August 28, 2012 6:36 AM  
**Subject:** Re: Saratoga CAFO

<http://www.lakebeulah.org/pdf/hicaplaw.pdf>

The DEQ denied a CAFO permit, not a high capacity well permit.

[REDACTED]

On Mon, Aug 27, 2012 at 9:37 PM, [REDACTED] wrote:

Hi I am [REDACTED] leader of the opposition to the Golden Sands Dairy at Saratoga Wisconsin. [REDACTED] mentioned he spoke to you. We also conference called with Sierra Club.

We had our DNR scoping meeting with the DNR. We have been given an EIS. While talking to the DNR I mentioned that the Michigan Dept of Enviromental Quality( or whatever your DNR is called) was able to deny the first high capacity wells ever. Our DNR wanted to know how and on what grounds that was able to be accomplished. I believe I read it in CAFO watch, but am unable to track the article down. it did not give the specifics needed though in the article I read however. Any assistance you could give would be appreciated. Thanks [REDACTED] or [REDACTED]

--

Lynn Henning, CAFO Water Sentinel  
2010 Goldman Environmental Prize  
Sierra Club Michigan Chapter  
109 E. Grand River Ave, Lansing, MI 48906  
517-605-7740 [lynn.henning@sierraclub.org](mailto:lynn.henning@sierraclub.org)

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**Modernizing Wisconsin  
Groundwater Management:  
Reforming the High Capacity Well Laws**

**August 2000  
Report # 2000-1**

**MODERNIZING WISCONSIN GROUNDWATER MANAGEMENT:  
REFORMING THE HIGH CAPACITY WELL LAWS**

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## EXECUTIVE SUMMARY

Although Wisconsin has one of the most comprehensive groundwater quality protection laws in the nation, the legal framework for managing groundwater quantity has become a serious concern as demands for water increase. This report is not intended to be a comprehensive study of water resources management in the state. Rather, its focus is on high capacity wells, groundwater-surface water interactions and environmental impacts. This report discusses the potential impacts of high capacity wells on the environment, summarizes the existing law for managing groundwater quantity in Wisconsin, reviews programs in selected states, and discusses issues and strategies for improving groundwater quantity management in Wisconsin.

Groundwater is the major source of water supply in Wisconsin, where an average of 759 million gallons of groundwater is withdrawn each day. Groundwater pumping has been associated with substantial declines in groundwater levels in Wisconsin. While field data on environmental impacts of groundwater pumping is very limited, cases reported here illustrate potential problems. In Madison, water table levels have dropped three to six feet, threatening arboretum wetlands and fens. Irrigation pumping has reduced streamflow by 25-30% in the Central Sands Plain region; projected pumping rates indicate that the Little Plover River faces severe ecological impacts. Bloody Run Creek, a Class 1 trout stream, has been dewatered by high capacity wells.

The current high capacity well laws are inadequate to manage and protect Wisconsin's groundwater and related environmental resources. Water use has grown 33% over the past 15 years and is likely to continue rising into the future. The Wisconsin Department of Natural Resources (WDNR) has explicit authority to restrict permits for high capacity wells only in cases where the supply of water to a public utility well may be impacted. Further, the WDNR has not routinely required high capacity well users to report water use, except in the case of impact to a public utility well, so water use is largely based on estimates.

While increased scientific understanding of surface water and ecological impacts from groundwater withdrawals is needed in Wisconsin, several other states have modernized their statutes and management practices so as to acknowledge the hydraulic continuity between surface water and groundwater. Florida has an integrated permitting process that ensures biological input and review. Minnesota has provisions to adapt management programs and incorporate new information as it becomes available. Oregon and Washington address groundwater management in a broader watershed and planning context. All four states include public interest and environmental protection criteria in the permit review process.

To close the gaps in groundwater resource management without pursuing statutory changes, Wisconsin could pursue citizen suits involving the public trust doctrine, expand on nuisance common law, and exercise agency discretionary authority to enforce existing statutory language.

We identify several issues that any new legislation for improved groundwater quantity management should address, including: explicit legislative recognition of hydraulic continuity; expanded criteria for review and permitting; program targeting; monitoring, reporting and data acquisition strategies; exemptions; cumulative impacts and future uses; and continuing research support. As the new century begins, Wisconsin has the opportunity to be proactive in addressing these issues and enhance protection of the quantity and quality of its "buried treasure."

## PREFACE AND ACKNOWLEDGMENTS

This report is the result of a project undertaken in my graduate seminar on “Water Resources Policies and Institutions.” It was written, reviewed and finalized in the spring and summer of 2000 – a period when the Perrier Group of America announced plans for wells and a bottling plant in the headwaters of one of Wisconsin’s outstanding trout streams. The proposal gave rise to intense public controversy and became a well-publicized statewide issue. Rather than a singular battle among interests over the allocation and use of a local resource, the issue focused public attention on the adequacy of state laws pertaining to groundwater withdrawals to protect public resources – particularly interconnected surface waters and related environmental resources. Legislative proposals for changes in the state’s high capacity well laws were introduced in mid-year. Although they were not passed, the issue will clearly be revisited in upcoming legislative sessions.

The opportunity now exists to begin to address proactively the task of modernizing the legal framework for effectively managing our groundwater and related resources to meet societal demands in the new century. Although we are concerned with more comprehensive and integrated management of all of our state’s environmental resources, we limit our focus in this report to the array of issues likely to arise in legislative efforts to modify the legal framework related to high capacity wells. Working within the budgetary and time constraints of a class project, the research team has attempted to illuminate key issues and provide a better information base in support of the public dialog among policy-makers, agencies, interest groups and citizens as they contemplate changes.

This project could not have been completed without the cooperation and contributions of many organizations and individuals. We would like to acknowledge the following people for their generous assistance with this undertaking:

Todd Ambs, Wisconsin River Alliance; Kenneth Bradbury, Wisconsin Geological and Natural History Survey; Bryant Browne, UW-Stevens Point; Thomas Dawson, Wisconsin Strategic Pesticide Information Project; Stephen Gaffield, Wisconsin Geological and Natural History Survey; Robert Glennon, University of Arizona-Tucson; Ronald Hennings, Wisconsin Geological and Natural History Survey; Laura Hewitt, Trout Unlimited; Todd Holschbach, Office of State Sen. Kevin Shibilski; Randall Hunt, U. S. Geological Survey; James Japs, Minnesota Department of Natural Resources; George Kraft, UW-Stevens Point; James Krohelski, U. S. Geological Survey; Frederick Lissner, Oregon Water Resources Department; Charles Luthin, Wisconsin Wetlands Association; Doug McChesney, Washington State Department of Ecology; Kenneth Potter, UW-Madison; Christina Pratt, Gathering Waters; Jeff Scott, South Florida Water Management District; Susan Swanson, UW-Madison; Jake Szramek, Oregon Water Resources Department; Caryl Terrell, Sierra Club

Also, special thanks to the numerous Wisconsin Department of Natural Resources staff, including: Judy Adams, Kenneth Christopherson, Randell Clark, Margie Damgaard, William Furbish, Roger Gerhardt, Mark Hazuga, Sandy Hershberger, Thomas Jerow, David Johnson, Kenneth Johnson, Lisa Karr, Edwina Kavanaugh, Ronald Kazmierczak, Kelly Kearns, David Lindorff, Thomas Riewe, William Rock, Robert Schaefer, David Siebert, Dale Simon, Patricia Trochlell

Stephen M. Born  
Professor of Planning and Environmental Studies

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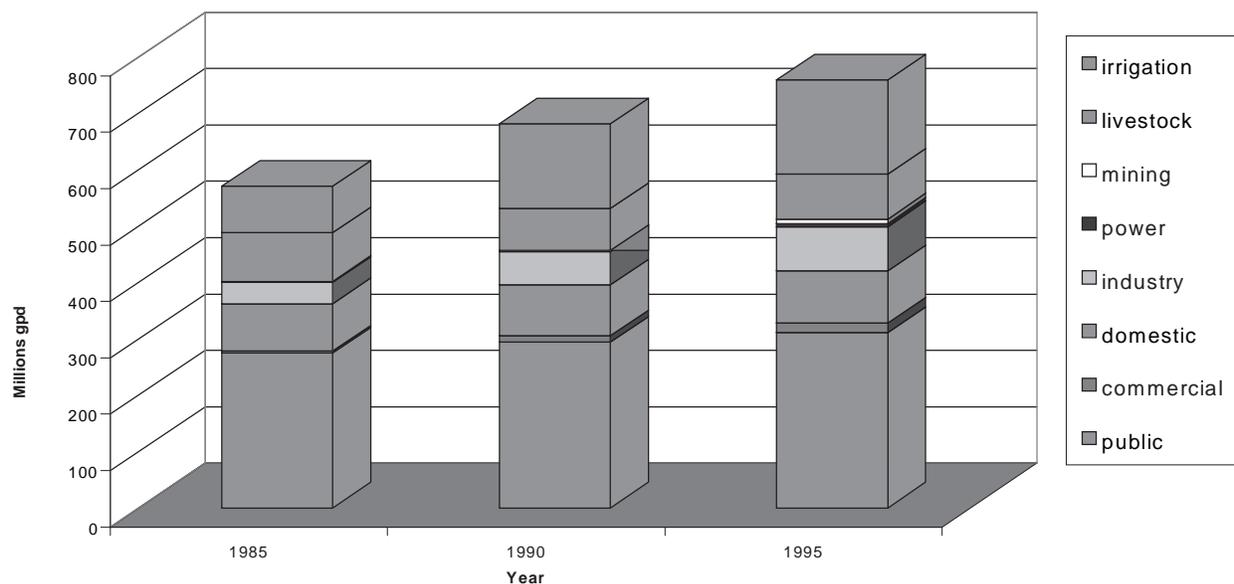
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## INTRODUCTION

Groundwater is one of Wisconsin's most vital natural resources. It is our major source of water supply, providing water for domestic, municipal, industrial and agricultural uses. Groundwater is the source of water for approximately 97% of Wisconsin communities and 70% of the population. Statewide, groundwater withdrawals in 1985 were estimated at 570 million gallons per day (gpd; Lindorff et al., 1997); in the past 15 years, that figure has increased to roughly 759 million gallons daily (Chern et al., 1999; Figure 1).



**Figure 1.** Groundwater use trends in Wisconsin over time (1985-1995).

Source: Lawrence & Ellefson, 1982; Ellefson et al., 1993; Ellefson et al., 1997

Recognizing both our dependence on clean adequate supplies of groundwater and increasing pollution threats to the resource, in 1983 – following several years of debate – Wisconsin enacted one of the most comprehensive groundwater protection laws in the nation. The law focused on groundwater quality and was largely regulatory in nature (Kent, 1994).

In contrast, the inextricably related issue of groundwater quantity has never been addressed comprehensively. Perhaps this lack of legislative and policy action stems from the recognition that Wisconsin's climate and geology have resulted in large, extensive aquifers that store and transmit enormous amounts of water and are readily taken for granted. The Wisconsin Department of Natural Resources (WDNR) estimates that two million billion (**2,000,000,000,000,000**) gallons of groundwater are stored in state aquifers. Groundwater supplies are not distributed homogeneously across the state; geology and hence aquifer characteristics vary. This variability, coupled with growth in regional populations and demands for water, has resulted in serious concerns in some areas of the state with regard to declining groundwater levels and the long-term adequacy of groundwater supplies (particularly southeastern Wisconsin, the Lower Fox River Valley, and Dane County). Periodic droughts have also created a sense of urgency over the years, but public and political attention tends to fade with the end of droughts.

Wisconsin enacted a high capacity well law in 1945 which regulates groundwater withdrawals greater than 100,000 gpd; applications for permits can be denied where any such well(s) adversely affect or reduce the availability of water to any public utility furnishing public water supplies. There have been numerous attempts over the years – all largely unsuccessful – to expand the scope and efficacy of laws governing the withdrawal of Wisconsin groundwater. In 1971, the Natural Resources Council of State Agencies recommended a study to identify specific groundwater use problems which could be alleviated by change of the present laws, including the relationship to surface waters. In 1977, a legislative proposal was drafted by Prof. James MacDonald, University of Wisconsin-Madison, and introduced (AB 1026) which would have established a water appropriation permit system. This comprehensive groundwater and surface water legislative proposal – developed during drought conditions – was never adopted. Wisconsin Act 60 (the Water Resources and Conservation Act), enacted in 1985 to fulfill Wisconsin's commitments under the Great Lakes Charter, addressed water quantity management by providing additional criteria (proposed withdrawals and uses “...will not be detrimental to the public interest....(and) will not have a significant detrimental effect on the quantity and quality of the waters of the state”) for consideration in

approving high capacity wells, but these criteria applied only to new wells with very large pumpage thresholds – more than two million gpd. Act 60 also directed the WDNR to prepare a statewide water quantity resources management plan, which was published in 1988. This nine-volume plan, a little utilized but useful summary of water quantity issues in the state, contained a number of recommendations to improve water quantity management in Wisconsin. In subsequent years, various state agency staff made recommendations to broaden the regulation of high capacity wells, with an emphasis on how to consider environmental effects of such wells. In 1994, the state Groundwater Coordinating Committee requested the WDNR to prepare a report on groundwater quantity issues. The report, completed in 1997 (Lindorff et al.) provides an excellent overview of groundwater quantity problems and issues, with several recommendations, including a call to evaluate regulation of water withdrawals.

During the past year, the Perrier Group of America, a water bottling corporation, revealed a groundwater development proposal and associated bottling plant in the vicinity of the headwater springs of one of central Wisconsin's finest trout streams. This proposal catalyzed a highly publicized and contentious controversy among an array of interests in the state, focused on the adequacy of state laws pertaining to groundwater withdrawals to protect public resources. Although the proposed locations for development of Perrier's water supply wells and related production facilities have changed, the public policy issues associated with the proposal are very much alive. Recent legislative proposals (AB 775 and SB 414) died, but the issue is likely to be revisited in upcoming legislative sessions. These proposals in general provided that if a proposed high capacity well adversely affects public rights in navigable waters, the application must be denied or conditioned to eliminate adverse impacts.

While water management in some states is still governed by laws that are blind to the hydrologic realities that ground and surface waters are interconnected – in spite of the advances in the sciences of hydrology and hydrogeology in recent decades – many states have been modernizing their laws, administrative rules, and management practices to recognize the interconnections (Glennon & Maddock, 1997). Moreover, groundwater is now increasingly recognized not only as an economic resource, but also as an environmental resource that is critical to the health of wetlands and water resources. It has become

clear that groundwater pumping can directly or indirectly affect streams, rivers, wetlands, lakes and their ecologic processes. The Wisconsin Supreme Court in the benchmark 1974 decision in *State v. Michels Pipeline Construction, Inc.* recognized that we have advanced our knowledge greatly from the time of the classic 1903 *Huber v. Merkel* case, which had defined groundwater rights in Wisconsin. The Court in its *Huber* holding accepted the rationale that the ways of underground water were too mysterious and unpredictable to allow the establishment of adequate and fair rules for regulation of competing groundwater rights. In *Michels Pipeline*, the Court brought our laws more in harmony with modern scientific principles and understanding.

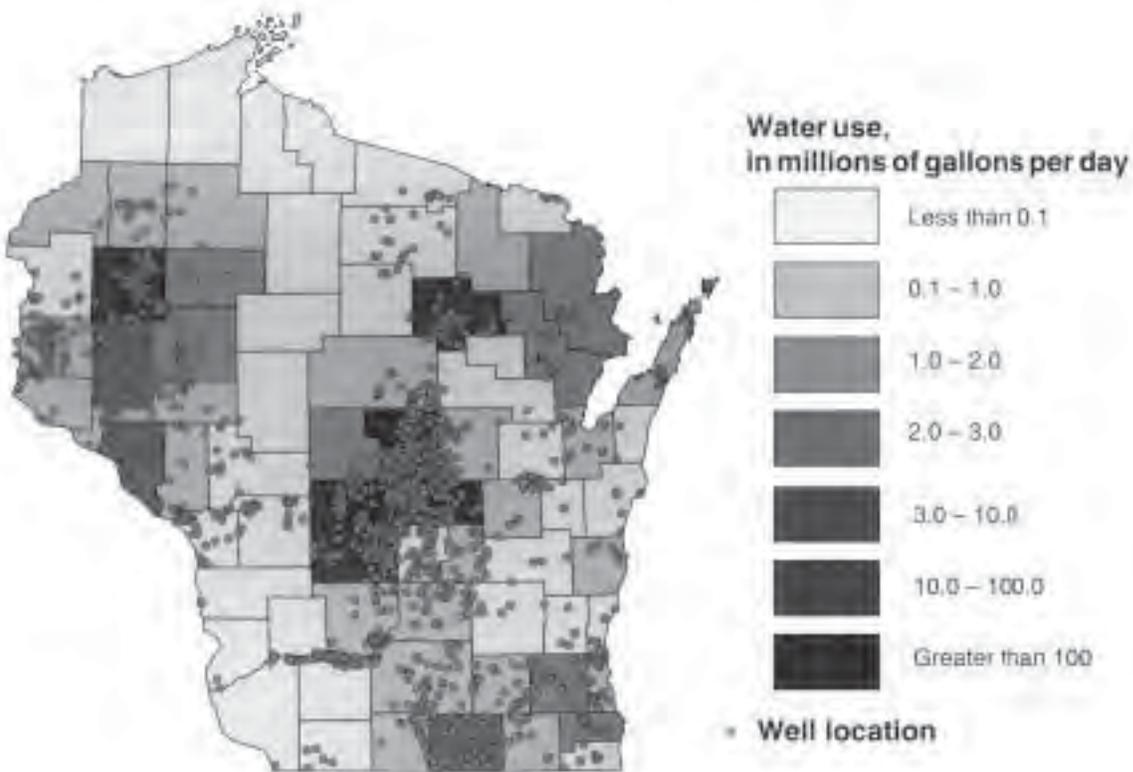
As the 21<sup>st</sup> century begins, there is every indication that managing the growing and competing demands on Wisconsin's ground and surface waters will be a critical public policy issue. We believe that the opportunity now exists to begin to address proactively the task of modernizing the legal framework for effectively managing our water and related resources. While the state may proceed somewhat incrementally – issue by issue – issues can and should be addressed within a more comprehensive and science-based context.

This report – limited in its focus – has been prepared to assist policy-makers, agencies, interest groups and citizens in better understanding and addressing the issues and choices associated with modernizing Wisconsin's legal framework for managing/regulating high capacity wells and the affected natural resources.

## **HIGH CAPACITY WELLS IN WISCONSIN**

High capacity wells are wells that pump at least 100,000 gpd, or 70 gallons per minute (gpm). Operators of high capacity wells need to obtain a permit from the WDNR (§281.17(1) Wis. Stats.). Permit applications will be denied if the proposed withdrawal will adversely affect or reduce the availability of water to any public utility. The application must also comply with §281.35(5)(d) Wis. Stats. if the proposed water loss averages over two million gpd.

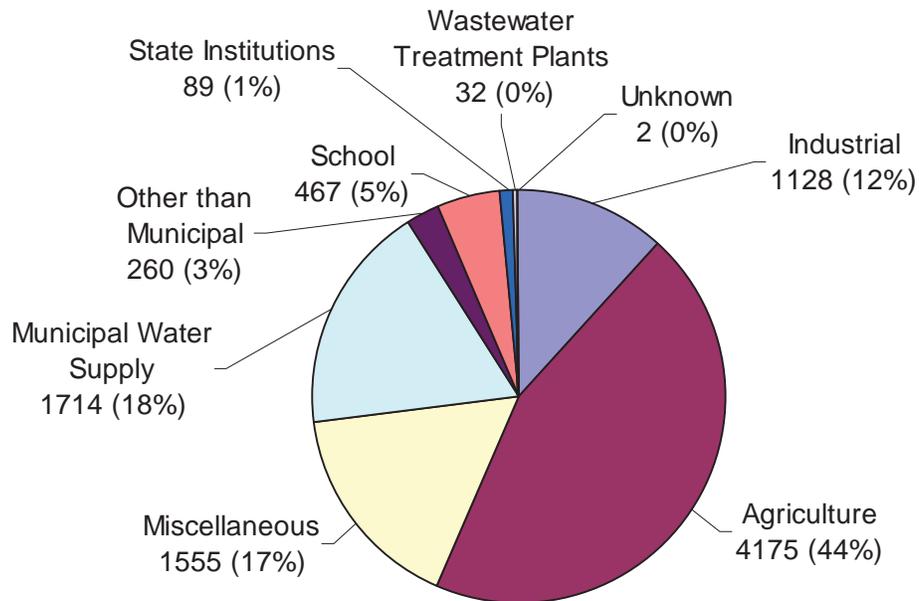
There are approximately 9,422 high capacity wells in Wisconsin (WDNR, 2000, [http](http://)). The majority of these wells (37%) are located in west central Wisconsin, followed by northeastern Wisconsin (20%), south central (19%), southeastern (15%) and northern (9%; Figure 2). Approximately 14% of the state's high capacity wells are inactive (11%) or have been abandoned (3%).



**Figure 2.** Distribution of high capacity wells.

Source: Ellefson et al., 1997

High capacity wells in Wisconsin are used primarily for agriculture (44%), municipal water supply (18%) and industry (12%; Figure 3). They are also used for schools, state institutions, non-municipal (e.g., mobile home parks, apartment buildings), and miscellaneous purposes (e.g., water bottling operations, breweries).

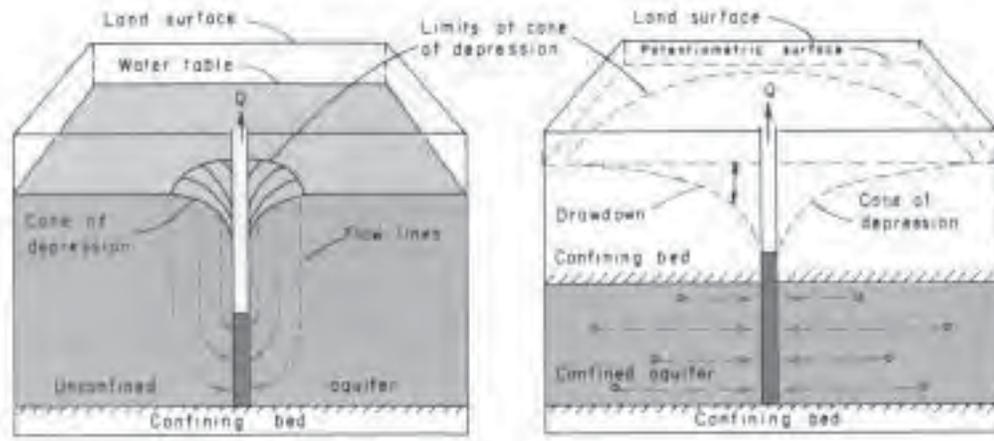


**Figure 3.** High capacity wells are used for a variety of purposes.

Source: WDNR, 2000, <http>

## SOME HYDROGEOLOGIC BASICS

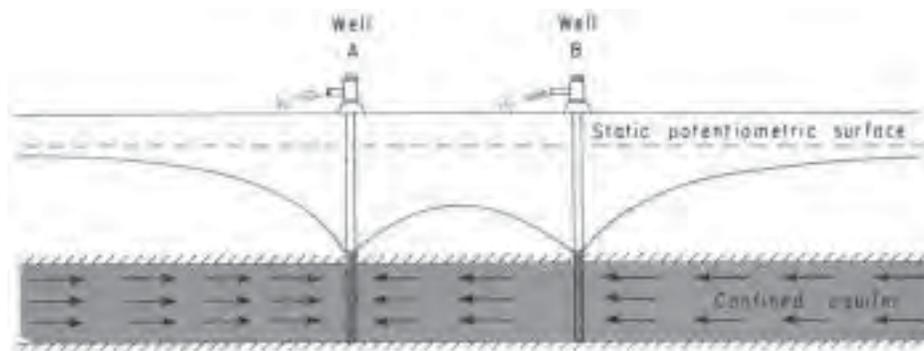
Hydrogeology is the study of the interrelationships of geologic materials and water (Fetter, 1994). See Appendix A for a brief discussion of groundwater concepts and terminology. The major water quantity impact of withdrawing groundwater from a high capacity well is the decline of water levels in the aquifer and the decrease in flows to surface water bodies or the inducement of flow out of surface water bodies to the underlying aquifer and ultimately to the well. The decline in water level is greatest near the well and decreases with distance from the well. This decline in water level is often referred to as the cone of depression, owing to the shape of this decline in water level in the aquifer (Figure 4).



**Figure 4.** The cone of depression is greatest near the well.

Source: Heath, 1983

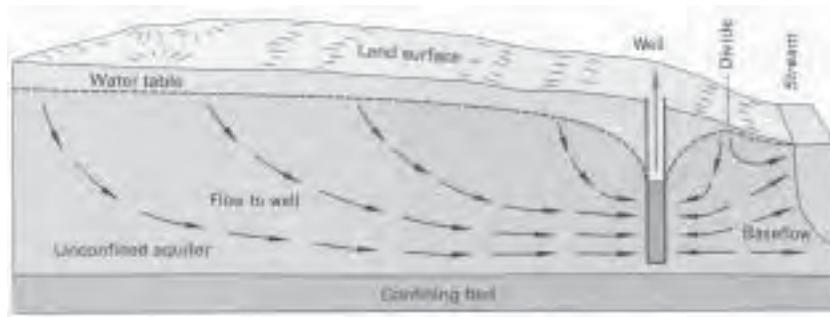
If another well is pumped nearby, the cones of depression around each well may intersect and increase the decline in water level in the aquifer, and the water level in each well. This effect is known as *well interference*. If several wells are pumping from an aquifer and the cones of depression around each well intersect, the head throughout the aquifer will decline (Figure 5). In this case, the depth from which groundwater must be pumped in each well increases, increasing the pumping cost. The water levels in flowing artesian wells may fall, decreasing the flow rate, or if the water level falls below the land surface, the well will cease to flow without the aid of a pump. Shallower wells in unconfined aquifers go dry if the water level in the aquifer declines below the elevation of the well.



**Figure 5.** Intersecting cones of depression may result in well interference.

Source: Heath, 1983

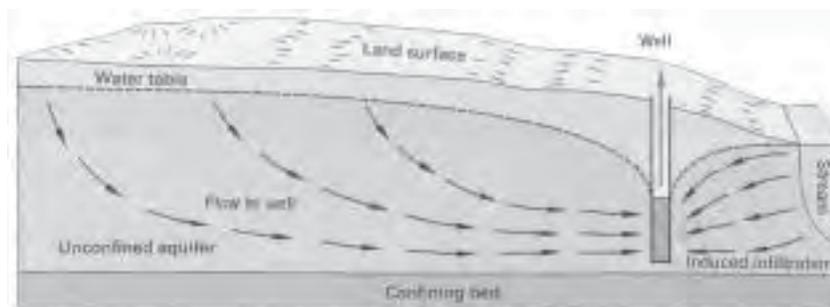
Groundwater withdrawals from water table (near-surface) aquifers affect surface water bodies, including streams, lakes, wetlands and springs. As groundwater is removed from an aquifer, the amount of water that is available to provide baseflow to surface water is decreased. Some of the water that would flow to a surface water body in the absence of the well is now diverted to the well (Figure 6).



**Figure 6.** Pumping of a well may reduce baseflow to a stream.

Source: Modified after Winter et al., 1999

With an increased pumping rate, groundwater withdrawals may not only reduce baseflow to surface water bodies, but may also cause *induced infiltration* from the water body (Figure 7). Induced infiltration occurs when the water level of the aquifer falls below the level of water in the surface water body. This situation causes water to flow from the surface water body (higher water level) into the aquifer and to the well (lower water level). Quite often, wells are sited near surface water bodies to take advantage of induced infiltration (Mechenich & Kraft, 1997; Fetter, 1994).



**Figure 7.** Induced infiltration may result from pumping of a well.

Source: Modified after Winter et al., 1999

## ENVIRONMENTAL IMPACTS

High capacity wells are exempt from assessments of their impacts to surrounding environments unless over two million gpd of water is consumed. Still, the impacts of high capacity wells on water quality and quantity have the potential to seriously impact the environment and threaten ecological, economic and human health. These effects can occur within an aquifer itself and in surface water bodies (streams, lakes, wetlands and springs) that are hydraulically connected to aquifers. Groundwater withdrawals from aquifers in hydraulic continuity with surface water bodies will necessarily affect their water chemistry, temperature and quantity.

While investigation into the effect of groundwater withdrawals on wetlands and streams has been limited (Trochlell, 2000; Hunt, 2000; Siebert, 2000), legitimate reasons exist for concern. Groundwater withdrawals are associated with substantial declines in groundwater levels in several parts of the state. Cases are well documented in the Lower Fox River Valley, southeastern Wisconsin and Dane County (Lindorff et al., 1997). In the Madison area, water table levels reportedly have declined measurably near municipal wells (Furbish, 2000). Near the University of Wisconsin-Madison Arboretum, they have dropped three to six feet, which may play a factor in the degraded quality of arboretum wetlands and fens (Trochlell, 2000). Wetland plants, which depend on root saturation for a portion of the year, may decline in abundance or become locally extinct due to the altered hydrology brought about by groundwater withdrawals (Winter et al., 1999).

Hydrologic parameters can be an influential factor in wetland composition. In Wisconsin, Ashworth (1992) investigated the factors responsible for changes in wetland composition. In a wetland restoration project in Dane County, willow (*Salix*) invaded the community. Of 12 environmental variables analyzed, five hydrologic parameters and one soil parameter were statistically significant; the two most significant parameters were average depth to water level and low water levels. Preliminary findings that hydrology affects wetland composition indicate that groundwater withdrawals exert an ecological impact.

The awareness of potential effects of high capacity well operation on wetland communities has been enough for some municipalities to adjust their operations. The village of Mukwonago entered into a voluntary memorandum of understanding with the WDNR to conduct ecological monitoring when it learned that the municipality's high capacity well may threaten rare fen species at Vernon marsh (Luthin, 2000). This agreement established three steps to conserve wetland species: 1) the village agreed to allow the WDNR to conduct monitoring; 2) the village agreed to reduce water withdrawal during high stress periods; and 3) the village agreed to reduce water flow regimes based on recommendations of the WDNR.

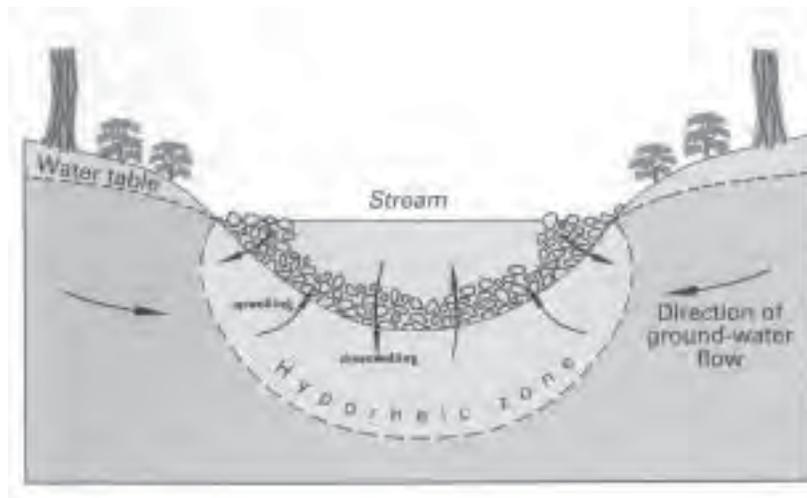
Springs are found where the water table intersects the land surface (Alley et al., 1999) and often form the headwaters of streams in Wisconsin. Since springs are a constant source of water to the land surface, they generally have an abundance of plant life and often create unique habitats. Nearby pumping may reduce springflows, change springs from perennial to ephemeral, or even dry up springs (Alley et al., 1999).

Agricultural groundwater withdrawals for irrigation allow for the return flows of the irrigation water to the aquifer, and therefore may not affect the groundwater flow system as much as a fully consumptive use. However, 75% to 85% of irrigation water is either lost to evapotranspiration or evaporation (Winter et al., 1999). Seasonal timing of the pumping is critical as pumping will reduce baseflows or induce infiltration from surface water during pumping, even if some return flow is occurring at the same time.

Water quality issues associated with changes in water chemistry arise with high capacity groundwater withdrawals. These changes include both naturally occurring and human-induced pollution, and may appear in both groundwater and surface water. Agricultural wells, in particular, are often associated with chemical changes in water quality. Water quality can be altered in organic and nutrient composition. In areas that are both heavily irrigated and highly fertilized, the water flowing back into the watershed from agricultural fields carries some of the materials, including pesticides and nitrates, that were applied to the field (Hunt, 2000), and can pose health issues.

Groundwater pumping that causes induced infiltration or baseflow reduction affects streamflows, lake and wetland levels, as well as the chemistries of ground and surface waters. Induced infiltration from streams may carry contaminants, such as organic chemicals and pathogens, from the stream or lake to the well field. For example, in 1993 the Black River Falls municipal well field, which induces infiltration from the Black River, began testing positive for fecal coliforms and *Cryptosporidium* (Rheineck, 1995). Pumping can also induce changes in oxygen levels and nutrient concentrations of a water body (Alley et al., 1999), as well as changes in temperature (Furbish, 2000). These types of changes in the characteristics of the water body may have implications for the aquatic life present. Also, springs tend to form where there is convergence of groundwater flows that originate from different recharge areas. The effects of pumping on the chemistry of a spring may vary with the amount of groundwater withdrawals in each of the contributing recharge areas.

Another effect of pumping on stream systems may be to alter the *hyporheic zone* near a stream (Figure 8). The hyporheic zone is the zone below the stream in which water from the stream mixes with discharging groundwater. Groundwater pumping will cause downwelling (downward flow) of stream water into the hyporheic zone, and fine suspended sediment in the water may reduce the hydraulic conductivity of the stream bed (Browne, 2000). The hyporheic zone appears to be important to the benthic organisms (aquatic invertebrates) that represent the bottom of the food chain in stream systems; therefore, changes propagate up the food chain. With groundwater pumping, the extent of the hyporheic zone could be altered, as could the relative amounts of river water and groundwater present. Both induced infiltration and reduction in baseflow would reduce the relative proportion of groundwater in the hyporheic zone either by the reduction of groundwater or the addition of more river water. Since the chemical compositions of surface waters and groundwater are different, changing the relative proportions of each in the hyporheic zone would change the chemistry (e.g., nutrients, oxygen levels, water temperature) of the hyporheic zone (Browne, 2000). These changes may have significant effects on the benthic communities and spawning fish that depend on the chemical conditions of the hyporheic zone (Alley et al., 1999).



**Figure 8.** Pumping may cause downwelling of stream water into the hyporheic zone.

Source: Modified after Winter et al., 1999

### **Selected case studies**

Wisconsin has observed the impacts of high capacity well withdrawals. The following are selected examples that highlight quantity and related quality issues that have been encountered across the state.

#### ***Irrigated agriculture in the Central Sands Plain***

Several users share groundwater in the Central Sands Plain. Most municipalities in the region use groundwater. Industries associated with agriculture, such as canneries and potato-packing sheds, use small amounts of groundwater. Recreational users, such as anglers, boaters and swimmers, depend on groundwater to provide baseflow to streams and lakes in the area. Groundwater is also needed to maintain the natural aquatic communities (Weeks & Stangland, 1971). Approximately 167 million gpd, almost all of it groundwater, is withdrawn during the growing season to support Wisconsin's irrigated agriculture (Chern et al., 1999).

The Central Sands Plain of Wisconsin has enjoyed a strong economy, partly due to intensive development of irrigated agriculture. A 1971 report studied the impacts of irrigated agriculture on



researchers predicted that streamflow could be reduced by as much as 70% to 90% during drought conditions due to increased crop irrigation and increased evapotranspiration (Weeks & Stangland, 1971).

Since 1971, irrigation development has increased in this area. In 1984, the maximum total irrigation pumping was estimated to be 31,700 million gallons of water (Krohelski et al., 1987). The increasing amounts of water lost to evapotranspiration have further reduced streamflow and groundwater levels.

The Central Sands Plain region clearly demonstrates the cumulative impacts of large numbers of high capacity wells. Separate studies indicate that nitrates, chlorides and pesticides contaminate the groundwater of irrigated agricultural areas in the Central Sands Plain (Mossbarger et al., 1989; Kraft et al., 1999). These impacts, linked with high capacity well use, limit the aquifer's value as a source of drinking water and reduce the potential for municipal uses and the overall environmental health of the region (Kraft et al., 1999). Agriculture in the Central Sands Plain would be much more limited, and therefore these impacts would be more limited, were it not for irrigation from high capacity wells.

### ***Municipal high capacity withdrawals: Little Plover River***

Conflicting groundwater demands (e.g., agriculture, domestic use, natural wildlife habitat) exist in the Little Plover River region. The village of Plover is located in Portage County, on the northern tip of the Central Sands Plain (see Figure 9). The Little Plover River basin is underlain by the Stevens Point-Whiting-Plover aquifer, which supplies water to irrigated agriculture, industry and at least 40,000 residents. The aquifer also provides baseflow to streams and wetlands, supporting aquatic communities such as the Little Plover River, a Class I trout stream (Mechenich & Kraft, 1997).

In 1989, the village of Plover began pumping groundwater for municipal use (Lindorff et al., 1997). Because of concerns about groundwater contamination by agricultural nitrates and pesticides, a groundwater flow model was developed to predict the behavior of the aquifer and its reactions to different agricultural practices. Using year 2005 projected pumping rates, the model predicted that groundwater withdrawals would deplete about 10% of the baseflow to the Plover River, and possibly more than 40% of the flow to the Little Plover River. The Plover River is a larger stream that might be able to sustain this

impact without negative effects on the aquatic ecosystem. However, the ecology of the smaller Little Plover River would be severely impacted by a loss of 40% of normal baseflow. Even lower-than-projected pumping rates would likely impact the Little Plover River (Mechenich & Kraft, 1997).

***Municipal high capacity well: Fitchburg and the Nevin Fish Hatchery***

The current high capacity well permitting process falls short of considering important environmental resources in the face of development pressures. In this case in southern Wisconsin, voluntary action by the municipality alleviated concerns that a proposed new well would adversely affect natural springs, but there is no legal requirement that other municipalities be similarly cooperative in analogous future conflicts.

The city of Fitchburg in Dane County uses high capacity wells to pump groundwater for domestic use. Two aquifers underlie Fitchburg: the shallow Paleozoic bedrock units and the deeper Mount Simon sandstone, which are separated by 15 feet of the Eau Claire shale. Nitrate contamination of groundwater forced Fitchburg to discontinue use of its shallow well (Johnson, 2000). In 1999, a year of high water stress, the city of Fitchburg recognized the need to replace the discontinued shallow well.

The WDNR Nevin Fish Hatchery in Fitchburg uses springs to supply its fish propagation operations. These springs also feed wetlands. The city of Fitchburg planned to locate a new well to supply a proposed 900-house subdivision (Nine Springs subdivision) south of the fish hatchery. Staff at the hatchery expressed concerns that the well would impact the recharge area of the springs and asked that the development be postponed until information about these interactions could be researched. They requested that the WDNR be given an extended time period to assess the high capacity well permit, a request that the planning commission granted. The Mayor established a nine-person citizens' advisory committee, which studied the situation for one year. Their recommendations were that the city should employ conservation designs and not continue with development until they were certain about the impacts (Johnson, 2000).

The fish hatchery staff worked with Fitchburg's Public Works Department and geologists from the University of Wisconsin-Madison to assess the potential impacts of the proposed well using tritium

tracer studies and a groundwater flow model for Dane County. They found that the proposed well would have no impacts on the fish hatchery because the well was planned to be drilled into the sandstone aquifer, which is not in hydraulic continuity with the Upper Paleozoic bedrock aquifer that fed the fish hatchery springs (Swanson, 2000). If the study had indicated that there would be an adverse impact on the fish hatchery springs, it is unlikely that the WDNR would have denied the high capacity well permit because they lack explicit statutory authority to require that the potential impacts on groundwater and surface water be assessed (Johnson, 2000). An understanding of the potential impacts of the well was achieved only because the city of Fitchburg agreed to cooperate by delaying development pending further study.

***Municipal high capacity well withdrawals: Bloody Run Creek***

The Wisconsin Rapids Water Works & Lighting Commission (WW&LC), a utility in central Wisconsin, has a number of high capacity wells that have raised great concern among town of Grand Rapids residents and the WDNR. The concern is over flows in Bloody Run Creek, a Class 1 trout stream that runs through Grand Rapids. The WW&LC has been pumping since 1994. The water level has dropped and, at times, has dried up one-fourth of the four-mile stream in an area that runs through the southeast corner of the town (Laack, 1999).

The WDNR is considering options for putting water back into Bloody Run Creek. Possible sources for augmentation include groundwater wells adjacent to the stream or water piped in from a nearby lake or stream (Hazuga, 2000). With the option of augmentation, there are concerns regarding iron levels in the water, which would be 6 - 8 parts per million (ppm). Because high iron levels can be toxic to trout and the aquatic insects in cold water communities, the WDNR wants levels of 1 - 1.5 ppm so as not to disturb aquatic life (Laack, 2000). The WW&LC admits that they have impacted the creek, but are not sure that they are solely responsible for covering augmentation costs (Laack, 2000).

Some Grand Rapids residents want stricter enforcement imposed upon the WW&LC (Laack, 1999). From their perspective, the only way to force remediation is through a court order; however, with the current broad laws regulating the use of water, there is little chance of success in court. At an

informational meeting in Grand Rapids in March 2000, the WDNR noted that Bloody Run Creek is the most severe case in Wisconsin of environmental impact caused by high capacity wells. They point to it as an example of why there should be legislation modifying how well permits are issued (Laack, 2000).

## THE LEGAL FRAMEWORK

### Groundwater law

Legal authority over Wisconsin water resources is derived from the public trust doctrine. Traditional English common law informed the 1787 Northwest Ordinance, which extended United States sovereignty over the territory from which Wisconsin was formed. The Ordinance contained language declaring all navigable waters to be held by the state for the public. Article IX, Section 1 of the Wisconsin Constitution states that all navigable waters leading to the Mississippi and St. Lawrence Rivers are “common highways and forever free, as well to the inhabitants of the state as to the citizens of the United States.” Initially, only waters navigable by trading vessels were considered to be covered; over time, the test for navigability has been broadly construed, expanding the reach of the public trust doctrine. Public trust protection has not been explicitly extended to groundwater.

The 1903 Wisconsin Supreme Court decision *Huber v. Merkel* affirmed that groundwater was not covered by the public trust, and asserted that property owners have an *absolute* right to the groundwater beneath their property. In the strong language of the opinion, a property owner could use as much groundwater as could be pumped from a property, even with evident malice and waste. The justices did not, however, base their opinion on any special property rendering groundwater fundamentally different than surface water, but rather on the complete lack of knowledge of the nature and behavior of groundwater. Their decision was based on English legal precedent, *Acton v. Blundell* (1843), that “the ways of groundwater were too mysterious and unpredictable to allow the establishment of adequate and fair rules for regulation of competing rights to such water.” Two cases in 1956 failed to overturn the *Huber* rule of groundwater, *Fond du Lac v. Empire* and *Menne v. Fond du Lac*.

The case of *State v. Michels Pipeline Construction, Inc.* (1974) marked a fundamental change in Wisconsin groundwater law. In this case, a citizen's well was dewatered by the construction of a nearby municipal sewer line. Under the *Huber* rule, the citizen could have no relief from the court; however, the court saw fit to revisit the justification for the *Huber* decision: "... today, scientific knowledge in the field of hydrology has certainly advanced to the point where a cause and effect relationship can be established between a tapping of groundwater and the level of the water table in the area so that liability can be fairly adjudicated consonant with due process."

The rule adopted by the court in *Michels Pipeline* allowed for any reasonable use as long as it did not infringe upon reasonable uses by others. All beneficial uses of the water are not considered equal. This critical aspect of the rule means that courts can balance the utility and harm of one use versus another in adjudicating groundwater rights conflicts. A municipal well can be judged more socially useful than a private well, even if their uses are both "reasonable." Groundwater used to maintain baseflow in a stream could also be judged to be socially useful. The *Michels Pipeline* rule is still guiding nuisance common law of groundwater.

Current Wisconsin high capacity well law addresses cumulative impacts only for wells on one property for which the combined pumping rate exceeds 100,000 gpd; the property is then deemed to be a high capacity property (§281.17 Wis. Stats., Wis. Admin. Code ch. NR 812). It does not address the density of the wells. The current law also does not address the potential impacts of high densities of wells *not* on one property that *individually* have capacities of less than 100,000 gpd but *collectively* have a combined pumping rate exceeding 100,000 gpd. Under Wis. Admin. Code ch. NR 812, the WDNR may deny or modify a permit application for a proposed high capacity well or high capacity property on the basis of deleterious physical impacts *only* if the supply of water to a public utility well may be impacted.

Provisions were added to the statutes in 1985 that regulate withdrawals of any kind (surface or ground) from waters of the state. Any withdrawals (including wells) of over two million gpd are subject to review and reporting requirements, over and above those in §281.17 Wis. Stats., under §281.35 Wis. Stats. Section 281.35 Wis. Stats. also adds a series of general considerations for permitting withdrawals

over two million gpd, including public rights, environmental quality, and consultation with other Great Lakes states. This allows the state to make a detailed census of water impacts and uses.

Several commentators have pointed out that there is nothing “magical” about either the 100,000 gpd limit nor the two million gpd limit. These are arbitrary markers that arguably have little to do with the actual protection of groundwater quantity in Wisconsin. Furthermore, the minimal reporting requirements imposed on any withdrawal under two million gpd, as well as the inability of WDNR to deny permits for any reason save impacts to a municipal system, have been identified as major problems in groundwater conservation.

### **Permitting and other agency responsibilities**

Wisconsin has modified its groundwater laws considerably through the development of a permit system. The state enacted the high capacity well law in 1945, allowing itself to regulate to some degree larger-volume pumping. Since 1958, new wells that pump over 100,000 gpd on average over a 30-day time period must obtain the approval of the WDNR (§271.17 Wis. Stats.). The operator must report the volume and rate of pumping, as well as the estimated water loss (through evaporation or interbasin transfer). See Appendix B for a more detailed overview of Wisconsin’s high capacity well permitting process.

There are numerous entities with groundwater management-related responsibilities in Wisconsin (Table 1). The WDNR, as the principal permitting agency for water withdrawal, regulates high capacity wells in addition to surface water diversions. The WDNR has broad statutory authority to “protect, maintain, and improve the quality and management of the waters of the state, ground and surface, public and private” (§281.11 Wis. Stats.).

Responsibilities for managing groundwater quantity are dispersed across several sections of the WDNR. The Bureau of Drinking Water and Groundwater (BDWG), Private Water Systems Section issues permits for high capacity wells (see Appendix B), regulates well construction and pump installation and registers well drillers and pump installers (Lindorff et al., 1997). The Public Water Systems Section regulates water supply systems. The Groundwater Section has several responsibilities, in addition to

coordinating state groundwater activities. They include setting groundwater quality standards, monitoring, coordinating wellhead protection activities, regulating well construction and abandonment, and maintaining a groundwater data management system.

**Table 1.** Agencies with Responsibilities for Groundwater Management

| <b>Agency</b>   | <b>Responsibility</b>  |
|---|--|
| Central Wisconsin Groundwater Center, University of Wisconsin-Stevens Point                       | Provide educational and technical assistance on groundwater issues   |
| Groundwater Coordinating Council  | Improve management of state's groundwater by sharing information and improving interagency cooperation                           |
| Local units of government through general purpose government agencies or special purpose entities | Provide adequate supply of good quality water to customers   |
| Public Service Commission   | Approve expenditures of new public water/electrical utilities, regulate setting of rates   |
| State Lab of Hygiene  | Conduct research on virus and pathogen occurrence in groundwater   |
| U. S. Geological Survey, Wisconsin District Office  | Research surface and groundwater interactions, monitor groundwater levels  |
| University of Wisconsin-System  | Provide education on groundwater protection; conduct basic groundwater research  |
| Wisconsin Department of Agriculture, Trade and Consumer Protection                                | Regulate pesticide use and cleanup, oversee farm nutrient management, research where pesticides have entered groundwater         |
| Wisconsin Department of Commerce  | Inspect underground storage tanks, enforce septic system regulations   |
| Wisconsin Department of Health and Family Services  | Recommend enforcement standards for substances of health concern, investigate health effects from contamination                  |
| Wisconsin Department of Natural Resources   | Protect, maintain and improve state's water quality and management; monitor groundwater, set state groundwater quality standards |
| Wisconsin Department of Transportation  | Conduct research on road salt and groundwater  |
| Wisconsin Geological and Natural History Survey; University of Wisconsin-Extension                | Assess, characterize and map groundwater resources; provide information and education on hydrology and groundwater resources     |

Source: Modified after Lindorff et al. (1997) and Chern et al. (1999)

As noted previously, the Water Resources Conservation and Management Act (1985 Wisconsin Act 60) directed the WDNR to participate in regional water quantity resources management activities (Lindorff et al., 1997). The passage of the act fulfilled Wisconsin's commitment to the Great Lakes Charter to enact legislation providing authority to regulate and manage major uses of the state's water

resources. The Great Lakes and Planning Section of the Bureau of Watershed Management is responsible for carrying out the mandates of 1985 Wisconsin Act 60. These activities include the development of a water withdrawal registration system, administration of a water loss program, development of a statewide water quantity resources plan, and participation in regional water quantity resources management activities.

Two other WDNR sections have groundwater management-related responsibilities. The Rivers and Regulations Section of the Bureau of Fisheries Management and Habitat Protection issues permits for surface water diversions, and the Bureau of Waste Management regulates metallic mining activities (Lindorff et al., 1997).

## **OTHER STATES' APPROACHES AND THE IMPLICATIONS FOR WISCONSIN**

States are increasingly recognizing the interdependence of atmospheric water, surface water and groundwater in the hydrologic cycle and are developing management and allocation approaches that are based on those relationships. For example, Mississippi has a state policy that conjunctive uses of groundwater and surface water are to be encouraged, and in Massachusetts, surface water and groundwater are to be managed as a single hydrologic system (Sherk, 1990). Additionally, several states have taken action to ensure that the impacts of proposed water uses on hydrologically-interconnected waters, especially as regards public rights, are considered during regulatory review processes. For this report, we have selected four states for review that have “modernized” their statutes and management practices to address these and other concerns. A review of the laws, rules and administrative review systems in these states (Florida, Minnesota, Oregon and Washington) may help Wisconsin address issues pertinent to Wisconsin’s high capacity well law. There are two aspects that make these states especially interesting for comparison. First, in all four states, the law recognizes the scientific fact of hydraulic continuity between surface water and groundwater, and this fact is considered in the permitting review process. Second, each of the four states considers protection of some or all of the following resources in

every decision to grant or deny a groundwater withdrawal permit: wildlife resources, recreation, groundwater and surface water quality, and wetlands. Table 2 illustrates which of these resources receive protective consideration in each of the four states.

Minnesota law is especially relevant because of the state’s geographical proximity to Wisconsin and because of the climatic and cultural similarities between the two states. Florida shows how their regional authorities, Water Management Districts, handle groundwater permitting in a comparatively integrated fashion. Oregon’s proactive system highlights the benefits of comprehensive planning. Finally, Washington’s experience illustrates the benefits and difficulties of managing and reviewing groundwater withdrawals in a watershed context.

**Table 2.** Water Resources Considerations in Other States

|            | Ground-water Quality | Surface Water Quality | Wildlife Resources | Recreation | Calcareous Fens | Other Wetlands |
|------------|----------------------|-----------------------|--------------------|------------|-----------------|----------------|
| Florida    | ◆                    | ◆                     | ◆                  | ◆          |                 | ◆              |
| Minnesota  | ◆                    | ◆                     | ◆                  | ◆          | ◆               | ◆              |
| Oregon     | ◆                    | ◆                     | ◆                  | ◆          |                 |                |
| Washington | ◆                    | ◆                     | ◆                  | ◆          |                 |                |

### Florida

In Florida, the state Department of Environmental Protection has the authority to issue groundwater use permits, but they issue very few each year. The state’s five Water Management Districts (WMDs), regional authorities that have been delegated many significant governmental powers by the legislature, issue the vast majority. The rules and procedures vary in the WMDs. We chose to examine the South Florida WMD (SFWMD) because of its size, hydrologic setting (it regularly experiences droughts), and the critical surface water resources within its jurisdiction.

State legislation (Fla. Stat. ch. 373) sets the permitting framework, requiring a permit for new consumptive uses of surface water or groundwater. The SFWMD exempts only single-family dwellings that are the sole users of the withdrawal facility and water used strictly for fire fighting. The permit applicant must establish that the proposed withdrawal has a “reasonable-beneficial use”, which is defined as “the use of water in such quantity as is necessary for economic and efficient utilization for a purpose and in a manner which is both reasonable and consistent with the public interest” (Fla. Stat. §373.019(13)). Furthermore, the applicant must establish that the proposed use will not interfere with any existing uses.

Another provision of the statute (Fla. Stat. §373.236) stipulates that permits have a duration of 20 years, if requested for that long and if there is a reasonable assurance that the conditions of the permit can be met for that long. If not, they may be issued for shorter periods. For 20-year permits, the SFWMD may require a compliance report every five years, and may modify the permit based on review of that report. The limit may be extended to up to 50 years for permits where municipal or similar bonds are issued to finance the facility and more than 20 years are required to retire the bonds.

### ***Permitting process***

In addition to the three requirements of the Florida statute noted above, several other “reasonable assurances” must be provided by applicants for a consumptive use permit from the SFWMD (Fla. Admin. Code §40E-2.301). Assurances germane to this report include that the proposed use:

- will not adversely impact offsite land uses
- will not cause adverse environmental impacts
- will not cause pollution of the water resources

### ***Administrative review process***

The SFWMD staff issue general permits for consumptive uses under certain thresholds. These thresholds vary from 10,000 average gpd to 500,000 gpd. Individual permits, issued by the WMD Governing Board, cover uses that exceed these thresholds (SFWMD, 1997, [http](#)). The duration of permit

varies by type of permit. General permits have typically been issued for 20 years, but individual permits have been issued for five or 10 years.

For both general and individual permits, the reasonable-beneficial use criterion is judged by the need and demand for the water. The applicant must also provide reasonable assurances that the proposed type and amount of water use are compatible with local zoning regulations and a comprehensive plan. In establishing “demand” for the water, irrigators, commercial and industrial users, and municipal users must carefully document their conservation practices or plans (SFWMD, 1997, [http](#)).

Some critical water sources have restrictions on the amount of water to be withdrawn from them. For example, in the Eastern Okeechobee-Northwestern St. Lucie Basin, withdrawals from the Florida aquifer are limited to 1.5 acre-inches per property acre per month (SFWMD, 1997, [http](#)). When the SFWMD has a special concern about the adverse impacts from a proposed irrigation use and reclaimed water is not feasible, then the permit may limit the amount of water used to that needed for micro-irrigation. *Withdrawal of water must not adversely impact natural water bodies, watercourses, or wetlands, nor habitat for threatened or endangered species, nor any other “environmental features” dependent on water resources* (SFWMD, 1997, [http](#)) [emphasis added].

Withdrawals that would lead a stream of pollutants into a previously unpolluted area are not permitted (SFWMD, 1997, [http](#)). Permits shall also be denied if the withdrawal would have an unmitigated adverse impact on existing land use, such as crops or other vegetation, or other water uses. All water users are required to monitor and report the quantity of water they use. Monitoring of the level of water tables or surface water, and other environmental monitoring are required with some types of permits. In times of water shortage, the SFWMD may restrict withdrawals under existing permits. Any adverse impacts occurring at any time must be mitigated by the user.

The permit applications are reviewed by the staff at the Water Use Division, who are generally trained as geologists or hydrogeologists. Copies of the submitted permit applications are sent to Natural Resource Management staff for review by biologists, thus selectively allowing broader interdisciplinary

review. Very few permits are denied, but many permits are granted only after various modifications or revisions to the original project design have occurred within the permitting process.

### ***Evaluation***

It is hard to say whether the process has effectively protected watercourses, as many tend to be canals supplied by some other surface water source (Scott, 2000). Naturally occurring lakes are considered a Type I (permanently inundated) wetland and therefore are protected. Wetlands are protected, with drawdown one foot or greater considered an adverse impact not allowed within the permitted process (current rulemaking may make this provision more stringent).

### **Minnesota**

In Minnesota, all appropriations and uses of surface water or groundwater are regulated under the same permit system from the Minnesota Department of Natural Resources (MDNR). It should be noted that the Minnesota use of “appropriation” does not imply any connection with the doctrine of prior appropriation. “Appropriating” is defined as “withdrawal, removal, or transfer of water from its source regardless of how the water is used” (Minn. Stat. §103G.005, subd. 4). While there is no specific high capacity well law, a permit is required to appropriate groundwater in quantities greater than 10,000 gpd and/or 1 million gallons per year (Minn. Stat. §103G.271). Minnesota takes connections between the groundwater and surface water into account in the permitting process, and a permit for groundwater appropriation can be limited or denied if the appropriation would have adverse impacts on surface waters. Furthermore, the MDNR Commissioner has broad authority to deny a permit application, or require that it be modified, in order to protect the public interest (Minn. Stat. §103G.315, subd. 5).

### ***Permitting process***

When applying for a permit, the applicant has the burden of proof to show that “the proposed project is reasonable, practical, and will adequately protect public safety and promote the public welfare” (Minn. Stat. §103G.315, subd. 6(a)). Permits must be consistent with state, regional and local land resources management plans (Minn. Stat. §103G.271, subd. 2). If the application is for an area where the commissioner has inadequate groundwater availability data, the applicant must gather and include

information about the aquifer to be tapped and the area of influence of the proposed well (Minn. Stat. §103G.295, subd. 3-4).

In reviewing the permit application, the commissioner is instructed to consider, among other factors, the hydrology and hydraulics of the water resources; the quantity, quality and timing of any waters returned after use and their impact on the receiving waters; and comments received from governmental agencies, private persons, and other interested parties (Minn. R. §6115.0670, subp. 2A). *Any groundwater appropriation permit must be limited in amount and timing when a direct relationship between surface water and groundwater is determined to exist, and when the appropriation would threaten to have an adverse impact on surface waters, either through reducing in-stream flows below designated protected levels or lowering lakes below designated protected elevations* (Minn. R. §6115.0670, subp. 3C(2)) [emphasis added].

Minimum flows are set at Q90 (the flow which is exceeded 90% of the time) for most streams. The MDNR believes that using Q90 does not necessarily protect instream flow needs, and MDNR fisheries staff are gathering data to determine adequate flow requirements to protect fishery resources. Calcareous fens, the rarest wetland plant community in the state, are mentioned specifically as being protected from any disturbance, including draining (Minn. Stat. §103G.223).

The precautionary principle is applied to groundwater appropriations where the available hydrologic data are insufficient to give an adequate picture of the effects of the proposed appropriation. The MDNR shall then either deny the permit application or grant it conditionally, subject to modification or denial when further data become available (Minn. R. §6115.0670, subp. 3C(3)).

The permitting process is also used to gather data for better management of surface water and groundwater. All permit holders are required to record the amount of water they use on a monthly basis and report this to the MDNR (Minn. R. §6115.0750, subp. 3A) by February 15 each year. All permits are held conditionally, and can be cancelled or modified unilaterally by the MDNR to protect the public interests, or if the relevant law is changed (Minn. Stat. §103G.315, subd. 11). The only exceptions are certain permits related to mining, which are irrevocable (Minn. Stat. §103G.315, subd. 14).

Other than the mining exemptions, existing consumptive users of water enjoy no special protection. When there is conflict over use, existing and proposed future users vie on equal terms. Conflict is deemed to exist “whenever the total withdrawals and uses of ground or surface waters would exceed the available supply based on established resource protection limits...” (Minn. R. §6115.0740). In other words, protecting natural resources is a principal tenet of state water policy. After technical remedies, like conservation, are exhausted, then the water is apportioned according to priorities set by the legislature, with domestic water supply having the highest priority (Minn. Stat. §103G.261).

### ***Administrative review process***

After the water appropriation permit application is submitted to the MDNR, it is sent by the MDNR to the city (if the appropriation takes place within a city’s limits), the county-level Soil and Water Conservation District, and the appropriate Watershed Management Organization or Watershed District. Any application for groundwater extraction is sent to the area MDNR hydrologist, who may request assistance from MDNR’s groundwater hydrologists in St. Paul.

Well hydraulic equations are used to evaluate most permit applications, with more sophisticated models used if the hydrologist(s) deem it necessary. If it appears that the proposed extraction could have an adverse impact on some public resource, then the hydrology is examined in greater detail. A trout stream would be one example of a public resource that the permitting process is designed to protect.

### ***Evaluation***

While the law and rules as written seem adequate to protect surface flows from the effects of excessive groundwater extraction (Japs, 2000), there is not sufficient scientific information to allow the law to be fully implemented. Questions that need more scientific clarification include how much stream flow must be protected to achieve a desired level of ecological protection and what affect individual wells have on surface water flows. The statutory language placing the burden of proof on a permit applicant to show that “the proposed project is reasonable, practical, and will adequately protect public safety and promote the public welfare” would seem to give some room for a similar burden of proof to be placed on the groundwater appropriation permit holder when low water levels threaten a public resource. In

practice, however, the burden of proof is placed on the MDNR to justify permit denials, modifications, or suspensions (Japs, 2000).

The requirement of monthly reporting of groundwater use for all permit holders has yielded many years of data on which to base the formation of management plans. The MDNR is cooperating with appropriators, although often the most difficult aspect of cooperation is convincing them that there is a resource problem that needs to be addressed. In addition, the MDNR is doing Geographic Information Systems (GIS) modeling of all permitted wells in the state as a reconnaissance measure, to see where a concentration of groundwater appropriation near a stream may be significantly affecting the stream. Location-specific studies to further examine the relationship between groundwater and surface water are also being conducted.

## **Oregon**

In Oregon, a water right permit or certificate is required from the Water Resources Department (WRD) for all new water uses, including groundwater, lakes and streams. Once granted, water rights are administered under the system of prior appropriation (with an exception for drought conditions; Or. Rev. Stat. §536.720-536.780).

In Oregon, the Water Resources Commission has adopted basin programs for all but two of the state's 18 major river basins. Basin programs set policies for managing river basins. River basins are defined to include all the land area, water bodies, aquifers and tributary streams that drain into the major namesake river. Each basin program lists all of the water uses within the basin eligible for receiving a groundwater permit, and all of the uses within the basin eligible for receiving a surface water permit. If a proposed groundwater withdrawal is not used for one of the uses eligible in that basin, the permit is denied. If hydraulic continuity exists, the proposed withdrawal must be for an eligible surface and groundwater use in the basin.

If hydraulic continuity is determined to exist between the aquifer from which the proposed withdrawal will be made and a nearby surface water body, the WRD must consider the effects of the proposed withdrawal on senior surface water rights holders, natural resources, water quality, minimum

instream flows, and scenic waterways. The WRD has the authority to deny permits if they interfere with any of the aforementioned criteria, as well as to grant conditional permits.

Minimum instream flows are set by the WRD (Or. Rev. Stat. §536.235) in consultation with various agencies. For example, the WRD will consult the Department of Fish and Wildlife to determine the minimum instream flows necessary to support fish populations, and the Department of Environmental Quality to determine the flows necessary to protect water quality (Szramek, 2000). When setting minimum instream flows, consideration is given to natural resource issues, including sensitive, threatened, or endangered species of wildlife, plus recreation, fish and wildlife on a scenic waterway.

The Water Resources Commission can declare a critical groundwater area in the most severely threatened areas (i.e., where pumping exceeds the long-term natural replenishment of an aquifer, where there is interference between wells and senior surface water users, or there is deterioration of groundwater quality). Once a critical groundwater proceeding is initiated by the Commission, no new well permits are issued until a final order is made. The final order may restrict both existing and future uses in order to stabilize the resource. Additionally, the order setting the limits of the critical area may give certain water uses priority over other uses, regardless of the establishment dates for water rights priority holders (Or. Rev. Stat. §537.730- 537.740).

If existing groundwater withdrawals are causing substantial interference with surface water, the WRD has the authority to restrict withdrawals when the well is located less than 500 feet from the surface water body. If the well is greater than 500 feet from the surface water body, the WRD may limit withdrawals if doing so would provide effective and timely relief to the surface water body. If the affected surface water body is greater than one mile from the well, withdrawals may only be regulated through a critical groundwater area designation (Or. Rev. Stat. §537.143, Or. Admin. R. §690-009-0050). The current system has been in effect since 1988. Users with permits from before 1988 may or may not be subject to the same flow restrictions as users who acquired their permit since the new system was adopted, depending on specific permit conditions (Szramek, 2000).

### ***Permitting process***

The WRD is required by statute to process all permit applications in eight months or less (Or. Rev. Stat. §537.153), and permits take two to eight months to process. This includes an initial review period of two months or less, and a period of six months or less in which the impacts of the proposed withdrawal may be investigated. Applicants are advised not to drill a well before a permit is approved because permits can be, and often are, denied. Groundwater uses exempt from the permitting process are stock watering, lawn or non-commercial garden watering not exceeding one-half acre in area, domestic purposes not exceeding 15,000 gpd, industrial or commercial purposes not exceeding 5,000 gpd, down-hole heat exchange uses, and watering school grounds with an area of less than 10 acres in critical groundwater areas (Or. Rev. Stat. §537.545).

### ***Administrative review process***

After data from permit applications are entered into a database, and the WRD carries out an initial review, the permit application is sent to the groundwater section where a determination is made regarding whether there is significant potential for surface water interference (Szramek, 2000). If the proposed well would be withdrawing from an unconfined aquifer located less than one-fourth mile from a surface water source, it is automatically assumed to have the potential to substantially interfere with the surface water unless the applicant or appropriator provides satisfactory documentation to the contrary.

If the well is greater than one-fourth mile away from surface water, the basis of the determination is a calculation of interference using information from a Water Well Report. When information in the report is not available or adequate, other best available information is used to make the determination (Or. Admin. R. §690-009-0040). This may include topographic maps, hydrogeologic maps or reports, water level and other pertinent data collected during a field inspection, and any other available data or information that is appropriate, including any that are provided by potentially affected parties.

If the proposed well is determined to have the potential to interfere substantially with surface water, the WRD must then determine whether there is surface water available for additional

appropriation. If there is, the groundwater permit may be issued. If there is not, the groundwater permit may not be issued.

### ***Evaluation***

The system reportedly is working well for Oregon. The WRD's Groundwater Section has not had difficulty completing necessary investigations within the required time frame. Citizens who are denied permits often challenge the WRD's decision; however, there have been no significant court cases to date that have limited the WRD's authority (Szramek, 2000).

### **Washington**

In Washington, all appropriations and uses of water are regulated under a permit system from the Department of Ecology (DOE). In 1917, the riparian water rights system was replaced with a permit system, which grandfathered in existing riparian rights but required that any new rights be acquired by appropriation through a state administered permit system (Wash. Rev. Code §90.44.060, 90.03.250-90.03.340).

In 1945, groundwater was brought into the appropriation-administrative permitting system. Previously, groundwater was treated in a similar manner to surface water riparian rights, i.e., correlative with other users and in existence as a coincidence of land ownership (Wash. Rev. Code §90.44.050). The only exemptions to the permit requirements are domestic and industrial users of less than 5,000 gpd, and withdrawals used for stock-watering or watering a lawn or a noncommercial garden not exceeding one-half acre in area (WDOE, 1998a, [http](#)).

Groundwater withdrawal permits can be denied if the appropriation interferes with the flow of appropriated water from a spring, lake, river or other body of surface water (Wash. Rev. Code §90.22.030). A permit may also be denied if it will interfere with minimum flows or levels for streams, lakes, or other public waters. The DOE has the authority to set these levels when it is in the public interest, when requested by the Department of Fish and Wildlife to protect fish, game or other wildlife resources under the jurisdiction of the requesting state agency, and when it is necessary to preserve water quality (RCW 90.44.035).

### ***Permitting process***

Parties wishing to obtain a groundwater withdrawal right must apply to the DOE for a permit and may not use or divert water until a permit has been secured (Wash. Rev. Code §90.03.250). Upon receipt of a proper application, the DOE instructs the applicant to publish notice in a newspaper of general circulation in the counties in which the storage, diversion, and use is to be made. They also send the relevant information to the director of the Department of Fish and Wildlife (Wash. Rev. Code §90.03.280). Before issuing a permit, the DOE must make four determinations:

- whether any water is available for appropriation and how much
- what the beneficial uses are to which the requested water is to be applied
- whether the appropriation will impair existing rights
- whether the appropriation will detrimentally affect the public welfare

They have the authority to approve any permit for an amount of water less than that applied for, if there is a reason for doing so.

### ***Administrative review process***

Historically, the DOE has processed well permits in the order that applications were made. However, after legislative budget cuts reduced staff and forced them to process applications more efficiently, they began doing watershed assessments and then synchronously processing all of the applications in the investigated watershed. This “batch” permit processing was challenged in 1997, in *Hillis v. State Department of Ecology*. In this case, the Supreme Court ruled that since it was in conflict with historical precedent, the DOE did not have the authority to do batch processing without an official change of administrative rules following public comment. The DOE did this and currently processes applications in watershed-based “batches”, which allows some assessment of cumulative impacts of withdrawal requests. However, the DOE still considers the specifics of each application and decides on each permit individually (McChesney, 2000).

In the administrative review process of permit applications, a variety of models are used, ranging from water balance calculations to computerized numerical codes such as MODFLOW. The most common natural resource consideration taken into account when permitting is the impact on salmon.

Previously, in keeping with the aim of the prior appropriation system of allocating all surface waters to beneficial use, almost 100% of permit applications were approved. However, as use increases and instream flows are adopted to protect aquatic habitat, many surface water bodies in the state are closed or subject to intense competition. Consequently, groundwater is increasingly being sought as a source of water supply.

The DOE examines water right applications in the context of watershed assessments that evaluate the availability of water for new uses. In areas where stream flow was judged to be too low to support existing uses or instream flows that protect fish, groundwater permits for proposed wells that would capture surface water have been denied. Permits for wells capturing water from lakes or wetlands have also been denied in areas where lake or wetland levels were judged to be too low. The DOE issued approximately 600 water rights decisions in 16 watersheds in 1996. Roughly half of these were denials (WDOE, 1998b, [http](#)).

The authority of the DOE to deny permits in order to protect minimum instream flows has recently been challenged. Declining surface flows in the Seattle area prompted them to deny groundwater withdrawal permits for wells in hydraulic continuity with those surface water bodies. Several of the individuals who were denied permits sued. The Washington Supreme Court is currently deciding the case.

### ***Evaluation***

The success of the law at protecting surface water and natural resources associated with surface water flows has been mixed (McChesney, 2000). Reasons for the mixed success of the legislation include increasing population and land use pressures, limited resources for obtaining the scientific data necessary for permitting decisions, and hydrologic uncertainty and variability.

### **Conclusions from reviewed states**

Groundwater law in Florida, Minnesota, Oregon and Washington is science-based and clearly acknowledges the hydraulic continuity between surface water and groundwater. These resources are managed and regulated conjunctively in all four states. All reviewed states have broad criteria for permit review, including public interest and environmental protection criteria. Both Oregon and Washington

place groundwater management in a broader watershed context, with Oregon proactively using watershed plans and Washington conducting permit reviews at the watershed scale. Washington's approach allows, at least in theory, an assessment of potential cumulative impact of groundwater withdrawals in a region. In their efforts to protect sensitive surface waters and environmental resources, the reviewed states tend to put the burden of proof on the applicant for a groundwater withdrawal permit as opposed to the regulatory agency. At least two of the reviewed programs, Florida's and Minnesota's, are data sensitive – they specifically make provisions to use the best available data and incorporate new information as it becomes available, including provisions for modifying permits. Additionally, reporting requirements incorporated in management and regulatory programs (if faithfully carried out) help develop the database essential to sound management of groundwater and surface water resources over the long term. All reviewed programs employ computer models in their regulatory and management programs, subject to the nature of the permit application and data availability. Florida provides a particularly good example of an integrated permitting process that ensures biological input and review into the regulation of groundwater use permits.

Implementation of these modernized groundwater protection and management laws is not without problems. As noted by one agency manager, “The science needs to catch up with the law” (Japs, 2000). Baseflow standards in lakes, water courses, and wetlands are still being defined. In Minnesota, the MDNR is struggling to collect data to determine whether a stream's ecological community is protected at Q90, or whether flows below Q75 can lead to lasting damage. Water managers in Florida wonder whether wetlands really can tolerate the one-foot drawdown that is now the trigger for action, and wonder what are the minimum baseflow levels for which to manage at different times of year. Washington is grappling with the development of watershed-scale groundwater models to facilitate a timely and scientifically sound assessment of potential withdrawals and the subsequent effects on surface water flows.

Where standards for flows and levels are established, groundwater extraction management strategies are needed to ensure that those levels are maintained. The MDNR will be looking to restrict surface water permits, but not groundwater permits, in the summer of 2000 on those streams in which

flows go below protected levels. The MDNR does not feel they have an adequate knowledge base to identify the wells where groundwater extraction is causing flow problems in the stream. States have tried to cope with this scientific uncertainty by giving agency staff variable degrees of discretion in permitting procedures.

In short, agency staff indicate that a better scientific understanding of surface water and ecological impacts from groundwater withdrawals is needed to better protect and allocate natural resources in practice. These concerns suggest that an adaptive management approach such as Minnesota's – one that allows adjustments in management and regulatory programs as new knowledge and information becomes available and is based on the precautionary principle – has great value in managing groundwater-surface water conjunctively.

## **GAPS IN WISCONSIN WATER RESOURCE MANAGEMENT AND POSSIBLE REMEDIES**

As noted earlier, gaps in Wisconsin's institutional arrangements for managing groundwater quantity, and related issues, have been pointed out over the years. In the early 1990s, the WDNR voiced several internal agency concerns when the issue of environmental impacts of groundwater withdrawals was brought up by the Public Intervenor (Lindorff et al., 1997). The WDNR noted that evaluating the potential environmental impacts of every application for a high capacity well permit would be a time-consuming process and that the issue was considered to have low priority. Furthermore, modeling capability was inadequate at the time to accurately predict the interaction between groundwater and surface water. Concerns over cumulative impacts and the lack of consensus on how to resolve competing water uses were also raised. The WDNR did propose restricting high capacity wells within 1,000 feet of trout streams and outstanding resource waters (Lindorff, 2000).

One responsibility of the state Groundwater Coordinating Council (GCC) is to assist state agencies in program coordination and information exchange (§160.51 Wis. Stats.). The eight-member council is comprised of five department secretaries, the University of Wisconsin system president, the

state geologist and a representative of the Governor. The GCC convened a meeting of state and federal agency representatives in July 1994 to discuss issues of groundwater quantity. Three recommendations were made: 1) restrict high capacity wells in sensitive areas unless no impact can be shown, 2) allow flexibility in regulating high capacity wells that may jeopardize water resources, and 3) formally bring the groundwater quantity issue to the GCC (Lindorff et al., 1997).

The third recommendation was advanced when the issue was brought before the GCC one month later (no action was taken on the other two recommendations). The GCC asked the WDNR Groundwater Section to prepare a report on groundwater quantity in Wisconsin. The report was published in 1997, in collaboration with several other state and federal agencies, and presents an overview of the major groundwater issues in the state. The report included several recommendations (Lindorff et al., 1997):

- establish regular meetings of federal, state, and local agencies to address issues of concern
- assign the WDNR Groundwater Monitoring Team, or other work group, the responsibility of evaluating groundwater quantity issues and propose a course of action
- evaluate regulation of water withdrawals
- prioritize information needs identified in the report
- evaluate existing databases for quantity information
- develop an information and education plan
- review and update the Water Quantity Resources Management Plan

None of these recommendations have been actively pursued (Furbish, 2000; Hennings, 2000; Lindorff, 2000). It should be noted that the GCC has a system to pool resources among agencies to address cooperatively and strategically areas needing research (UW WRI, 1999a, [http](#)). In the Joint Solicitation of Groundwater and Related Research/Monitoring Proposals for fiscal year 2001, the WDNR identified groundwater-surface water interactions as a topic of concern (UW WRI, 1999b, [http](#)):

**Groundwater - surface water interaction** - Monitoring of surface and groundwater flow to determine hydrologic connections and pathways between them to assess the potential movement and fate of contaminants from one hydrologic regime to another. *Examples: investigation of the occurrence and causes of aquifer drawdowns that affect surface water features such as springs, streams and wetlands; identification of areas of the state sensitive to groundwater withdrawals; quantification of environmental, social and economic impacts of groundwater withdrawals; impact of induced flow of surface water to groundwater* [emphasis added].

The Perrier case may mark a turning point for public attention and systematic review. As part of granting a well withdrawal permit, the WDNR would monitor the effects of withdrawals on wetland communities (incorporating aquifer stress tests during the dry season of the year, when plants are water-limited, would strengthen the design of this monitoring plan). In this proposed agreement, the WDNR would have authority to adjust the allowable water quantity withdrawals based on surface water and wetland impacts.

This proposed plan bears many similarities to the *adaptive management* approach, which has gained attention among ecologists and resource managers (e.g., Lee, 1993). Adaptive management is the incorporation of a research component into an iterative management process; data analysis and conclusions serve as the basis to modify allowable resource extraction. In the Perrier-WDNR partnership, the WDNR would gain a better understanding of the hydrological-ecological system because monitoring, data collection and analysis would be on-going. In the long term, data and conclusions from this project could be coordinated with data from other projects to develop a larger scale understanding of the system.

Some drawbacks to using the Perrier case as a model for management do exist. This approach is expensive (Furbish, 2000). It entails multiple data collection points over an extended period. In addition, given the current legal framework for groundwater, it is completely voluntary (Trochlell, 2000). Environmental Assessments (EA) and Environmental Impact Statements (EIS) are required by state and federal laws if the proposed action may significantly affect the quality of the human environment. While the draft EA in this case considers the potential impacts of the high capacity well on groundwater, surface water and water quality, the WDNR cannot consider the impacts on other factors (e.g., traffic, economy) in its decision on whether or not to grant the permit. With this in mind, the preliminary finding of the WDNR in the Perrier case is that the proposed wells will not significantly impact the environment (Brixey, 2000). See the draft environmental assessment on the World Wide Web (<http://www.dnr.state.wi.us/org/water/dwg/>).

Upon examination of the existing statutes and administrative codes that govern the installation and use of high capacity wells in the state of Wisconsin, it is doubtful whether the current laws are

adequate to ensure sound long-term management and protection of Wisconsin's groundwater and interconnected surface water resources. Two of these deficiencies might be addressed without new legislation: 1) permit denial criteria based only on potential impact on a public utility well, and 2) lack of enforcement of legislation requiring the reporting of water use.

The inability of the WDNR to deny a permit proposal except in the case where it is expected to adversely impact a public utility severely limits the agency's ability to protect Wisconsin's groundwater resources. Further, the statutes do not address the issue of the cumulative impacts of multiple high capacity wells in rural areas. For example, in central Wisconsin there is a high density of high capacity wells that are used for irrigation (see Figure 2) but in a rural area, it is unlikely that these wells will impact a public utility well.

Lack of enforcement by the WDNR regarding the requirement of high capacity well users to report water use and consumption is a major problem. The WDNR has not routinely required high capacity well users to report water use since the late 1980s (Krohelski, 2000) unless it is suspected that the well may impact a public utility. This water use reporting requirement is not enforced largely due to the inaccuracy of self-reported data as well as a lack of resources allocated to the program (Furbish, 2000). As a result, quantification of water use in Wisconsin by the U. S. Geological Survey has been based largely on estimations over the past decade (Krohelski, 2000). This creates a huge gap in the information base for resource managers and policy makers. It is impossible to assess the current status of and intelligently manage Wisconsin's groundwater resources without a reliable understanding of how the resource is currently being used, and the issue could be resolved administratively.

### **Legal strategies under existing laws**

Three legal strategies that might be pursued *without* any statutory change are outlined below. These include strategies related to the public trust doctrine, nuisance common law, and enforcement of existing statutory language. The most recent attempt to address groundwater through statutory provisions is also reviewed.

**Public trust doctrine**

Many states have sections in their constitution directing the state to hold certain resources in the public trust, but Wisconsin has developed an especially strong legal tradition of broadly interpreting the meaning of public trust. In the case of navigable waters, the Wisconsin courts have established a pattern over the past century of gradually widening the aspects of water that are held under the public trust (*Olson v. Merrill*, 1877). As the timber economy of the state declined and the recreation economy grew, the courts saw several cases that placed increasingly shallow waters (not suitable for log transport, but suitable for hunting and boating) in the public trust. In the landmark case of *Muench v. Public Service Commission* (1952), a decision which has laid the foundation for all subsequent public trust law in Wisconsin, the court found that the rights protected by the public trust extended beyond commerce to all areas of recreation and scenic beauty connected with navigable waters.

The obvious obstacle to the expansion of public trust to groundwater is the concept of navigability which underlies the public trust doctrine, and which would seem to limit the concept, even in the extreme, to surface waters. However, several cases involving surface waters suggest that offsite activities that impact the rights affirmed in *Muench* might also be covered to some degree by the public trust doctrine. The decision in *Omernik v. State* (1976) extended the WDNR's permitting program outlined in ch. 30 Wis. Stats. to include diversions from non-navigable waters as well as navigable ones. Two other cases, *DeGayner & Co. v. DNR* (1975) and *Just v. Marinette County* (1972), held that impacts in a non-water area, which might affect navigable waters, could be enjoined by the public trust. The *DeGayner* decision can be read as condoning regulation of activities in an upland area where navigable waters are affected. Groundwater, which provides the baseflow to navigable waters, might be included in a very broad construction of the state's public trust responsibilities.

The citizen suit provisions attached to the protection of the public trust have been interpreted with unusual strength. In *Gillen v. City of Neenah* (1998), the court forced the WDNR to adequately regulate an impact to a public water, citing §30.294 Wis. Stats.: "A citizen may bring suit under this section, pursuant to the public trust doctrine, directly against a private party for abatement of a public nuisance

when the citizen believes that the DNR has inadequately regulated the private party.” The tradition of citizen suits in environmental affairs has grown rapidly in this country since the early 1970s and might be a viable legal strategy given a favorable “facts situation” involving public interest in groundwater and possible applicability of the public trust doctrine.

### ***Nuisance common law***

A second possible strategy might be to expand on the evolution of nuisance common law represented by the *Michels Pipeline* decision. In that case the court clearly recognized the role of increasing scientific understanding in changing what is considered a nuisance. The linkages between groundwater and surface water are the focus of research; new knowledge and a scientifically based rationale might allow for considering particular groundwater withdrawals to be public or private nuisances.

### ***Enforcement of existing statutory language***

While common law strategies are possible, the long-term solution may lie in statutory enforcement (Dawson, 2000). While the WDNR could conceivably request the Attorney General to file a nuisance suit against a person withdrawing groundwater in violation of the public trust, the burden of proof in such a case would rest entirely on the state. Conversely, enforcement of existing statutory or administrative language would force the permit applicant to document their case and prove compliance with statutory provisions.

Wisconsin Administrative Code uses strong language in directing the WDNR to protect the public trust and the state’s environment. Under Wis. Admin. Code §NR 142.06(3), the WDNR is obliged to approve water withdrawals only if “no public or private water rights in navigable waters will be adversely affected,” and if the “proposed withdrawal and uses are consistent with the protection of public health, safety and welfare and will not be detrimental to the public interest,” or “the environment and ecosystem of the Great Lakes basin or the upper Mississippi river basin.” This mandate is very broad. Given that courts traditionally grant considerable discretion to agencies in the interpretation of their own code, the possibilities of using the existing groundwater code may be worth pursuing.

Aside from the existing specific language covering high capacity groundwater wells, the most relevant statutory language can be found in two places. Chapter 160 Wis. Stats. was the product of Wisconsin Act 410, and lays out agency programs to deal with issues of groundwater contamination and agency enforcement procedures. As such, it has little to say about the protection of groundwater *quantity* and the maintenance of baseflow through aquifer management.

However, in the opening clause, the statute is relatively clear on its purpose: “The legislature intends, by the creation of this chapter, to minimize the concentration of polluting substances in groundwater...regulatory agencies are free to establish any type of regulation which assures that regulated facilities and activities will not cause the concentration of a substance in groundwater...to exceed the enforcement standards.” The dilution of pollutants through management of groundwater quantity might be a possible regulatory strategy, consistent with the goals of ch. 160.

Chapter 281 Wis. Stats. broadly relates to the protection of water quality and quantity. In §281.11 Wis. Stats., the WDNR is given the extensive authority and mission “to protect, maintain and improve the quality and management of the waters of the state, ground and surface, public and private.” Moreover, in §281.12(1) Wis. Stats. it is stipulated, “the Department shall have general supervision and control over the waters of the state.” These outline broad general powers for the WDNR in setting acceptable water resource policy in Wisconsin consistent, in the WDNR’s view, with the general purposes of ch. 281 Wis. Stats., and could serve as the basis for stronger groundwater management.

Against this broad reading, Kavanaugh (2000) notes that opponents of increased groundwater protection/regulation might point to §281.17 and §281.35 Wis. Stats., which are quite specific in setting water quality standards and daily pumping quantities. The legislature, it can be argued, has been specific in circumscribing the purpose of ch. 281 Wis. Stats. There is potentially contradictory language here that may find resolution only through court cases.

### **New legislation – options and issues**

Attention surrounding proposed Senate Bill 414 in Spring 2000 addresses the issue in terms of new legislation. WDNR Secretary George Meyer said in testimony on the bill, “There’s a gap in the law”

and only new legislation can fill it. SB 414 would have amended §281.17(1) Wis. Stats. in order to extend the WDNR's authority to deny high capacity well permits, allowing them to protect "high-quality spawning areas or habitat for fish, rare wetland types or habitat for threatened and endangered species." One clause allowed WDNR to deny permits that would have an "adverse effect on scarce resources." However, the bill exempted all agricultural uses, all municipal wells, and all industrial uses from review using these criteria. In testifying for the bill, Secretary Meyer clearly indicated the many difficulties associated with bringing a synoptic view of hydrology to the law.

Another straightforward avenue for statutory reform would be to apply the rules guiding the actual permitting process in §281.35(5)(d) Wis. Stats. (the "grounds for approval"), which is aimed only at water withdrawals over two million gpd, to *all* high capacity well permitting (§281.17 Wis. Stats.). Also, locational criteria for wells and specific classes of protected features (as opposed to "scarce resources") could be named and added to the list of considerations for permit approval.

There are numerous issues that should be considered in any new legislation for improved groundwater quantity management; we briefly summarize a selection of those below.

#### ↪ ***Explicit legislative recognition of hydraulic continuity***

Statutory recognition of groundwater-surface water interconnections (hydraulic continuity) is an important first step towards protecting both groundwater and surface water resources. In an unconfined or water-table aquifer, surface water bodies are inherently connected to the aquifer. In a confined aquifer, the water contained in the aquifer will be strongly connected to surface waters only through fractures and faults, or if the overlying confining bed is absent or varies in hydraulic characteristics. If hydraulic continuity is demonstrated, then a well's impacts on both surface water and groundwater resources should be assessed.

#### ↪ ***Expanded criteria for review and permitting***

The basis for reviewing applications for high capacity wells is too narrow. At a minimum, criteria for assessing and permitting wells should be expanded to include protection of public rights in the state's waters (public interest criteria) and of environmental resources related to interconnected surface

waters (springs, wetlands, rivers and streams, lakes, and fish and wildlife). The basis for denying a permit application could also be expanded beyond the singular criterion of adverse impacts on a public utility, and could include consideration of impacts on other public and private water supplies, as well as possible water quality/public health impacts. The administering agency could be required to determine acceptable levels of environmental impact from high capacity well proposals in administrative rules.

**↪ *Scope/geographic targeting***

The substantive reach and geographic scope could be limited to categories of highly-valued environmental resources (outstanding resource waters, Class I trout streams, rare wetlands, habitat for threatened and endangered species, or other sensitive public resources such as parks and scientific areas); or targeted at priority hydrogeologic regions, watersheds, or other management units where groundwater and/or related surface water problems are known to exist. Reducing the scale of management attention would allow resource managers to focus on priority issues/regions, and more efficiently deploy personnel and fiscal resources.

**↪ *Monitoring, reporting and strategies for data acquisition***

Sound long-term management of state water resources requires adequate information about the resource and uses. There are currently large data gaps that a) limit present management as well as b) impair the development of better understanding of the effects of high capacity wells on surface waters and ecosystems. Monitoring and reporting requirements associated with high capacity well permits need to be enforced. Voluntary reporting of water use information from other groundwater users should be encouraged. Funding for data management and analysis is essential. Such information, when added to long-term monitoring data gathered by state and federal agencies, will lead to an increased understanding of the hydrogeologic system in Wisconsin and better management of both groundwater and related surface waters. Additionally, monitoring and reporting “feedback” is essential to an adaptive management approach.

### ↪ **Exemptions and retroactivity**

Most states exempt one or another category of wells from state regulation (Glennon & Maddock, 1997). The most common exemption is for groundwater used for domestic purposes, which might also include some limited amount of stock watering, and other designated uses. These uses are presumably low-volume in comparison to high capacity wells, and a policy judgment has been made that it is probably not worth the time and trouble to require domestic users to obtain a permit (Glennon & Maddock, 1997). However, high capacity well legislative proposals that provide regulatory exemptions and review limitations for various uses, such as agricultural irrigation, really represent unregulated “loopholes.” They may seriously impact surface waters and related resources; moreover, failure to ensure monitoring and reporting at exempted well categories undermines the goal of gaining adequate data and information regarding the state’s water resources. In short, the decision regarding regulatory review exemptions for particular categories of wells is a political decision and in many respects impairs the state’s ability to scientifically manage its water resources. Similar reasoning pertains to whether or not to include existing wells in any reform of the high capacity well law. New legislation could consider whether existing wells that are causing demonstrable damage to surface water and related resources (the burden of proof would presumably be on the regulatory agency) should be subjected to another round of regulatory review and possible permit modification or denial. In the interest of gaining essential information about groundwater and groundwater uses, pre-existing high capacity wells should be required to adhere to reporting requirements.

### ↪ **Addressing cumulative impacts and future uses**

The cumulative effect of new wells being installed every year, together with the recognition that the impacts of these wells/uses occurs over time, is well illustrated by the Central Sands Plain case study. High capacity well permit decisions are made incrementally – one at a time – without considering future demands on the aquifers and societal preferences. While this is admittedly a difficult issue, one mechanism for addressing future needs, resource availability and cumulative impacts is *planning*. A variety of plans either exist or are being developed (watershed plans, WDNR Geographic Management

Unit plans, other natural resource plans, “Smart Growth” land use plans). Where possible, an assessment of groundwater resources and development potentials and threats might be conducted as part of preparing or modifying such plans. Where comprehensive water management plans exist, they may be of use in anticipating future uses and conflicts or environmental problems. Plans are of limited value if they do not influence decision-making. Reviewing high capacity well applications for consistency with any relevant plans, where they exist, offers one option for incorporating cumulative impacts in future years into decision-making.

#### ↪ ***Administrative review issues***

There are a number of issues related to the administrative review procedures used by regulatory agencies that could be addressed in any new high capacity well regulation initiatives. Provisions could be made to ensure that any application for a high capacity well permit with potential impact on surface waters and related resources is reviewed not only by hydrologists, engineers and hydrogeologists, but also by agency staff trained in ecology and biology. Achieving a more integrated, interdisciplinary permit review may be considered an internal agency management issue, but could also be specifically addressed in legislative language. The burden of proof to show that the public’s waters and related resources will not incur significant adverse effects as a result of high capacity well development could be placed explicitly on the permit applicant (as is being done voluntarily in the case of the Perrier Group permit application in central Wisconsin). Placing this burden on a permit applicant rather than the regulatory agency internalizes the full costs of any groundwater development, and additionally generates data and information to further water management in the state. Legislation could also incorporate specific language establishing realistic streamlined permit review procedures and timelines, akin to the Oregon approach; however, any such measures should be sensitive to the need to have sound multi-seasonal information as a basis for decision-making. Of course, the degree of administrative discretion accorded the regulatory/management agency is an important legislative prerogative.

**↳ Continuing research support**

Wisconsin, through the state Groundwater Coordinating Council, has been innovative in directing research to state priorities to solve/clarify management problems and strategies. Continuing research support is essential to better understand Wisconsin's groundwater and related resources, use impacts, and management alternatives.

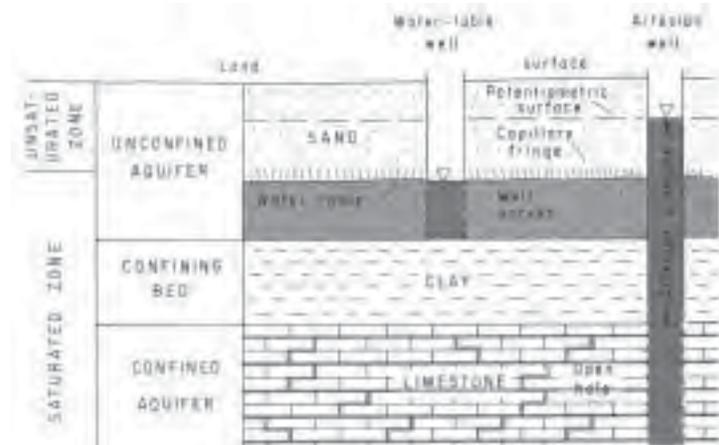
**CONCLUDING COMMENTS**

We have assembled information in this report that will hopefully be of value to policy-makers and others concerned about the future management of Wisconsin's "buried treasure" – groundwater, and related resources. We have provided information on the potentially negative impacts of high capacity wells, including the effects on interconnected surface waters. By examining experiences in other states that have modernized their groundwater quantity management laws and practices, we have tried to suggest the range of choices that might be considered for legislative change in Wisconsin. Our aim has been to illuminate key issues and better inform upcoming legislative initiatives. While we are concerned about more comprehensive and integrated management of all of our state's environmental resources and have interest in broader reforms, we have limited our focus here to dimensions likely to attend efforts to modify the legal framework related to high capacity wells. Based on our study, we believe that changes are needed to maintain the integrity of Wisconsin's waters while ensuring an adequate supply of high-quality water for future uses. We hope that a future historian, perhaps as the state looks ahead to the 22<sup>nd</sup> century, will conclude that we have contributed positively to that goal.

## APPENDIX A. GROUNDWATER TERMINOLOGY, CONCEPTS, AND APPLICATION: A BRIEF REVIEW

The following discussion of the properties and flow of groundwater is drawn from Heath (1983) and Fetter (1994). An *aquifer* is a geologic material (rock or sediment) that provides water in useable quantities to wells or springs (Figure 10). A *confining bed* is a geologic material that restricts the flow of groundwater between aquifers. Any geologic material may be *saturated*, meaning that water fills all the spaces between grains of the material, or *unsaturated*, meaning that at most, the spaces between grains are only partially filled with water. The *water table* demarcates the boundary between geologic materials that are unsaturated (above) and geologic materials are saturated with water (below).

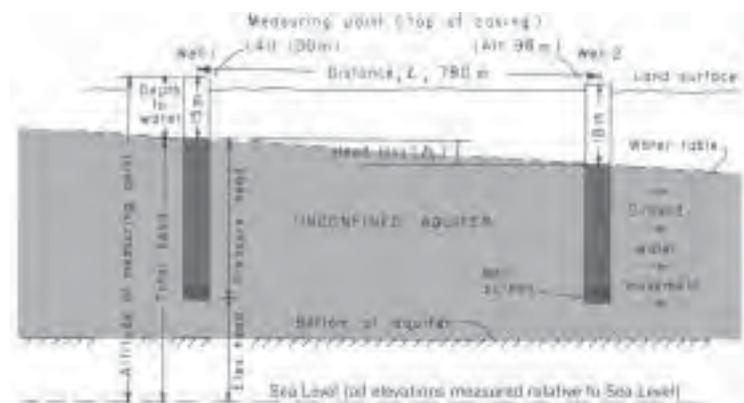
Groundwater may occur in *unconfined aquifers* (also known as *water table aquifers*) in which the water table in the aquifer is free to rise and fall. Wells open to unconfined aquifers are called *water table wells*, as the water level in the well generally indicates the elevation of the water table in the aquifer. Where an aquifer is saturated with water and overlain by a confining bed, the aquifer is referred to as a *confined aquifer*. The water level in wells within confined aquifers will rise above the top of the aquifer because of *artesian pressure*. Artesian pressure accumulates because water cannot flow easily into the overlying confining unit. Wells in these aquifers are known as *artesian wells*, and if the water level in the well is above the land surface, water will flow to the surface without being pumped. The *potentiometric surface* of a confined aquifer is the surface that represents the level to which water will rise in tightly cased wells open to the aquifer. The water levels in tightly cased artesian wells represent the level of the potentiometric surface of the aquifer, somewhat analogous to the water table of an unconfined aquifer.



**Figure 10.** The groundwater system consists of aquifers that supply water to wells.

Source: Heath, 1983

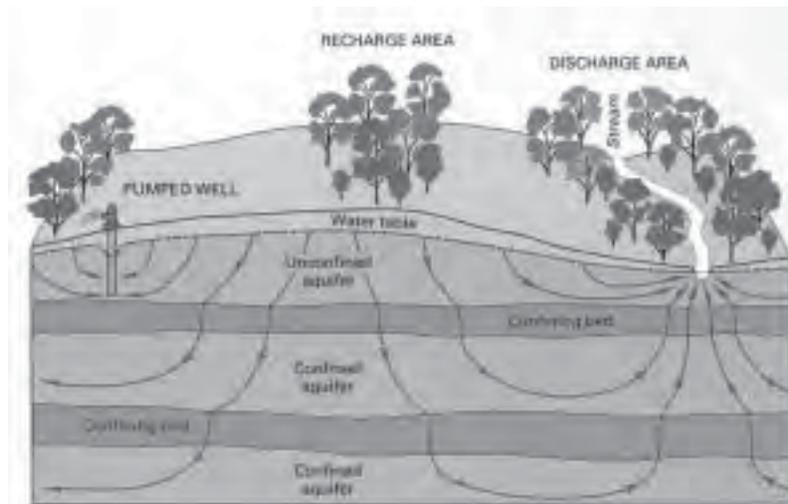
Groundwater flows from areas of high water levels to areas of low water levels, i.e., from areas where the water table in unconfined aquifers is high to areas where it is low, and from areas where the potentiometric surface of confined aquifers is high to areas where it is low. The *hydraulic gradient* is the slope of the water table in unconfined aquifers and the slope of the potentiometric surface in confined aquifers (Figure 11). Groundwater flows in the direction of the steepest hydraulic gradient, and the rate of groundwater flow is proportional to the magnitude of the gradient. The steeper the gradient, the greater the rates of groundwater flow. The rate of groundwater flow is also proportional to the *hydraulic conductivity* of the aquifer geologic materials, a measure of how easily the aquifer materials transmit water.



**Figure 11.** Hydraulic gradient is the slope of water flow from high to low areas.

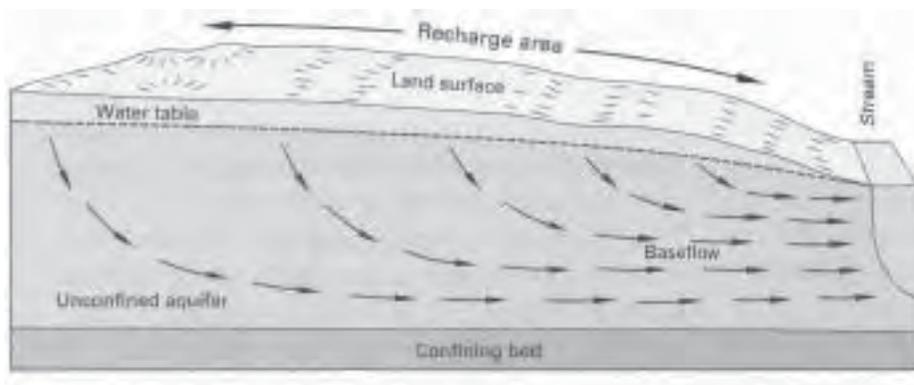
Source: Modified after Heath, 1983

Water enters groundwater systems at recharge areas, moves through aquifers, and exits at discharge areas. In relatively humid areas, such as Wisconsin, *recharge areas* generally include all areas, except lakes, streams and adjoining floodplains. Lakes and streams are generally *discharge areas* meaning that they receive water from groundwater flow, as well as surface runoff (Figure 12). This flow of groundwater to surface water bodies is referred to as *baseflow* (Figure 13). Baseflow is generally the minimum constant flow in a stream or a lake in the absence of surface runoff.



**Figure 12.** Groundwater flows from recharge areas to pumping wells or natural discharge areas, such as streams. The arrows show the paths of groundwater flow. Longer groundwater flow paths may require thousands of years for groundwater to travel from a recharge area to a discharge area, while shorter paths may require only days.

Source: Modified after Winter et al., 1999



**Figure 13.** Baseflow is the flow of groundwater to surface water.

Source: Modified after Winter et al., 1999

The impacts of groundwater withdrawal from a well depend on several factors, including the pumping rate, the distance of the pumping well to other wells, the distance to surface water bodies, the properties of the aquifer (permeability and storage capacity), and the timing of the pumping (e.g., cyclical vs. constant, seasonal vs. year-round; Alley et al., 1999). The greater the pumping rate, the larger the cone of depression that will form in a given aquifer, both in terms of the magnitude of the water level decline and the area over which that decline occurs. The nearer a well is to other wells, the more likely the cones of depression around each will intersect, and the greater the well interference. Similarly, the nearer a well is to surface water bodies, the greater the impact (reduced baseflow, induced infiltration, chemical changes) on the surface waters. The permeability and storage properties of the aquifer will determine the size of the cone of depression around a well, and how quickly that cone of depression will form and stabilize. It is not possible to derive a single rule of thumb about the optimal distance between a well and features of interest (e.g., other wells, wetlands, rivers, aquifer recharge zones) because prospective well sites are all physically different (Hunt, 2000). Finally, the timing of pumping will determine how much time the aquifer and surface water bodies have to recover between pumping periods. In reviewing permits, the relative locations of the proposed well, other nearby wells and surface water bodies, along with the properties of the aquifer should be considered.

Period of operation should be considered in an analysis of a well's potential impact on the surrounding biophysical systems. Wells that operate year-round, such as municipal or commercial wells, affect groundwater patterns very differently than those that operate on a seasonal basis, such as irrigation wells. Seasonal withdrawals allow for periods of recharge, whereas year-round withdrawals do not allow for the same degree of recharge. If a pump is drawing water for only a couple of months a year, it has a different effect than a pump that is in production year-round (Hunt, 2000). For example, an irrigator that is pumping 1,000 gpm for 0.10 year is pumping as much water as a commercial well that is pumping 100 gpm year-round. Yet, the two wells affect the hydrology differently, because the land surface near the seasonal well has a recharge period. This aspect of the temporal dimension should factor into review of the well permit.

For the purposes of reviewing permits, hydrogeologists can analyze and predict the effects of well interference and aquifer water level declines using several different methods. Several analytical methods exist for predicting the declines in water levels due to pumping (Heath, 1983; Fetter, 1994). Jenkins (1968) provides an analytical method for determining the reduction in streamflow over time caused by a pumping well. Unfortunately, these methods require knowledge of aquifer properties that are often uncertain, and these methods make simplifying assumptions about aquifer systems that may not be valid under certain conditions. However, such analytical solutions may provide reasonable estimates of the effects of wells. Numerical modeling techniques (e.g., use of computer codes such as MODFLOW) allow for reductions in some of the simplifying assumptions made about the aquifer system, but are still subject to errors resulting from uncertainties in aquifer properties. For many aquifer systems, however, numerical modeling of the flow system allows investigators to explore the likely effects of different scenarios relatively quickly. While the predictions from both analytical and numeric models are not precise, they may be the best available information for decision-making (Alley et al., 1999).

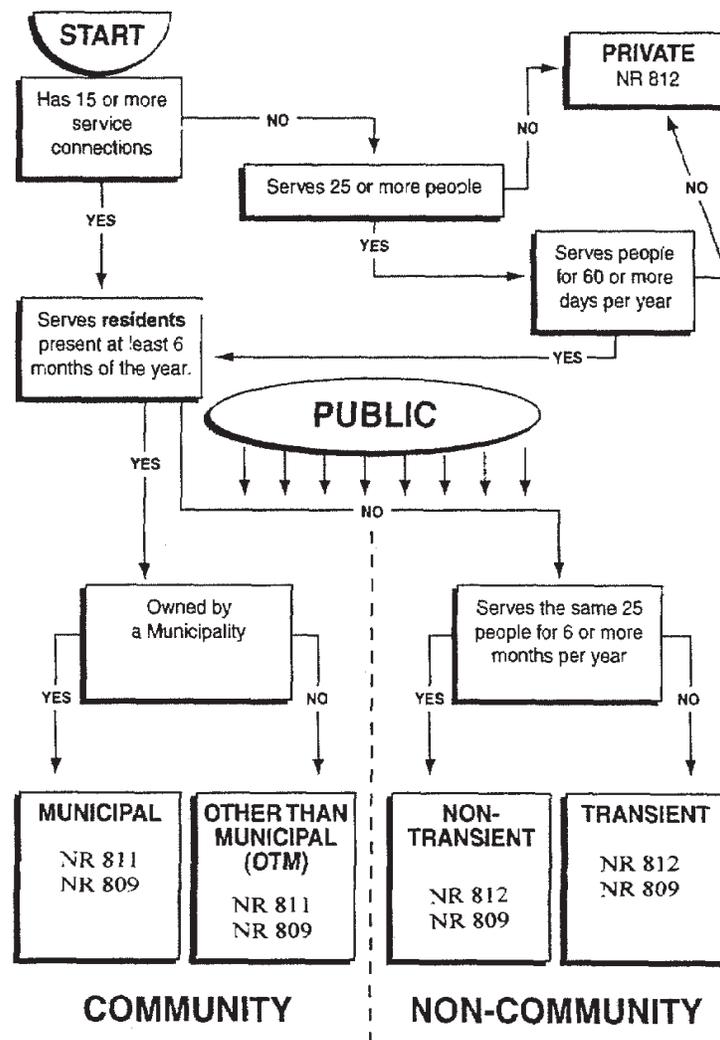
## Appendix B. Wisconsin's High Capacity Well Permitting Process

The Private Water Systems Section of the WDNR requires an approval for any well or system of wells that is classified as a high capacity extraction system (WDNR, 2000). The Private Water Systems Section reviews approximately 150-200 high capacity well applications per year (Rock, 2000). There are 9,422 high capacity wells in Wisconsin; approximately 4,175 (44%) for agriculture, 1,714 (18%) municipal water supply wells, and 1,128 (12%) industrial wells; the remainder serve schools, commercial establishments, and other purposes (see Figure 3; WDNR, 2000, [http](#)).

The specific classification of a water system dictates what information is required for the proposal of a high capacity well. High capacity wells can be categorized under public water systems or private water systems (Figure 14). As a result, the proponent of a high capacity well must look to the requirements in the specific state statute(s) that are relevant to their water system classification.

A public water system means “a system for the provision to the public of piped water for human consumption, if a system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. A public water system is either a ‘community water system’ or a ‘non-community water system’” (Wis. Admin. Code §NR 811.02(21)). A community water system can either be a municipal water system or other than municipal (OTM) water system. The difference between the two is that a municipal water system is owned by a municipality, i.e., city, town, village, county, or sanitary district, whereas an OTM water system is not. Usually, public water systems serving seven or more homes, 10 or more mobile homes, 10 or more condominiums, or 10 or more apartments are identified as OTMs.

A private water system is “any water system supplying water that is not a public water system” (Wis. Admin. Code §NR 812.07(78)). The following sections provide a summary of the permitting process as described in Wis. Admin. Code chs. NR 811 and NR 108 for public water systems and ch. NR 812 for private water systems.



**Figure 14.** Water systems may be private or public.

Source: WDNR, 1999

## Community

The approval requirements for developing a community water system that will have a source capacity greater than 70 gpm can be found in Wis. Admin. Code ch. NR 108. The requirements for submitting a community water system plan are described in Wis. Admin. Code §NR 108.04(2). All final plans and specifications submitted to the WDNR “shall be accompanied by a request for approval and by

information pertinent to the design of the system, including general plans, construction details, specifications and an engineering report.” The plans and specifications and pertinent information shall be submitted at least 90 days prior to the date upon which the construction of the project is planned to commence.

Design requirements for community water systems can be found in Wis. Admin. Code ch. NR 811. Clarifications to the plan submittal requirements for community water systems are covered under Wis. Admin. Code §NR 811.13. Proposals must contain information describing the locale of the well in relation to existing water supplies, its features of sanitary significance and specific information pertaining to well construction. In addition to the general plan, a well site investigation report shall also be submitted to the WDNR for all final wells. The site investigation report shall include such information as history of the proposed site, potential contamination sources within one-half mile of the well location, pumping capacity of the well, recharge area for the well, and other relevant information about the proposed site (Wis. Admin. Code §NR 811.13(3m)).

### **Private and non-community**

As stated in Wis. Admin. Code §NR 108(10), a non-community water system is “a public water system that is not a community water system. A non-community water system typically serves a transient population rather than permanent year round residents.” Examples of these systems are churches, parks, motels, resorts, taverns and restaurants. However, if the public water system serves at least 25 of the same people for six or more months per year, it is identified as non-transient. Schools, day-care centers and factories are examples of non-transient, non-community water systems.

The overall purpose of Wis. Admin. Code ch. NR 812 is to establish criteria and standards for the location, construction, reconstruction and maintenance of water systems; the abandonment of drill holes and wells; and the installation of pumping and treatment equipment. The established minimum standards and methods conform to chs. 280 and 281 Wis. Stats. which govern standards for pure drinking water and general water quality, respectively. The provisions of Wis. Admin. Code §NR 812.02 apply to the construction and installation of all new and existing water systems with the exception of those governed

under Wis. Admin. Code chs. NR 811 and NR 141, which cover community water systems and nonpotable surface water systems.

Wis. Admin. Code ch. NR 812 lists restrictions to well placement based on location relative to buildings and contamination sources. In addition, there are specific design requirements for various well types depending on both the geology of the well site and the proposed use of the well (WDNR, 2000). Information that must be submitted to the WDNR in order to receive approval of a high capacity well system includes general information about water need and owner information, design information, possible impacts, and capacity evaluation requirements (when applicable). Under general information, a description of the purpose of the well (e.g., irrigation, school supply) must be provided along with the identity and contact information of the property owner and well operator.

Information on the possible impacts of the well that must be provided includes the location of nearby municipal and private wells, the proximity to local contamination sources and the potential impacts of the well on nearby wetland communities (WDNR, 2000). For all OTM systems, the applicant must also provide the WDNR with a capacity evaluation form [WDNR Form 3300-247]. The capacity evaluation form is submitted with the final plan to be reviewed by the WDNR. The Capacity Development Program was developed by the WDNR “to address the technical, managerial, and financial capacity of water systems to comply with the Safe Drinking Water Act (SDWA) and thereby provide safe drinking water” (WDNR, n. d., [http](http://www.wdnr.gov)). If the proposal and capacity evaluation are approved by the WDNR, an approval letter and capacity certification will be sent to the applicant.

### **Application approval process**

Upon completion of the proposal for a high capacity well, the applicant submits the application to the Private Water Systems Section of the WDNR. Proposals are reviewed by the WDNR on a first come, first served basis. The regulatory review time mandated by state statutes for processing is to be no more than 65 working days (three months) from the date of receipt of a complete submittal (WDNR, 2000). It is possible to receive emergency approval to install a high capacity well system such as in the case of fire hazard or imminent crop damage (Wis. Admin. Code §NR 812.09(4)(a)4).

There are two reasons why the WDNR may reject or modify the permit proposal. The first reason is administrative – the application is incomplete. If this is the situation, the WDNR will send the proposal back to the applicant and will not review it until it is complete and meets all the requirements. The second reason why the WDNR would deny an approval is if the proposed project would have an adverse effect on public utility wells. As defined in Wis. Admin. Code §NR 812.09(4)(a)1, “The department may deny approval, grant a limited approval or modify an approval under which the location, depth, pumping capacity or rate of flow and ultimate use is restricted so that the supply of water for any public utility, as defined by s. 196.01, Stats., will not be impaired.” The WDNR also has the authority to revoke any approval if it determines that the applicant submitted an incomplete proposal, or if the system is not constructed and operated in accordance with all the conditions of the WDNR (WDNR, 2000).

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**From:** [nkarris@wtrm.com](mailto:nkarris@wtrm.com) [<mailto:nkarris@wtrm.com>]  
**Sent:** Wednesday, August 15, 2012 10:52 AM  
**To:** [Lawrence.Lynch@Wisconsin.gov](mailto:Lawrence.Lynch@Wisconsin.gov)  
**Cc:** [russell.anderson@Wisconsin.gov](mailto:russell.anderson@Wisconsin.gov), [Dan.Baumann@Wisconsin.gov](mailto:Dan.Baumann@Wisconsin.gov)  
**Subject:** cranberry water study notice

Mr Lynch,  
Please see attached.  
I welcome your reply.  
Thank you.  
Nick Karris

August 15, 2012

Mr. Larry Lynch  
Hydrogeologist, Water Use Section  
Wisconsin Dept. of Natural Resources  
PO Box 7921  
Madison WI 53707-7921

Re: Proposed early approval for five high-capacity wells associated with the Golden Sands Dairy  
*MARS Project Number: 1561*

Dear Larry ,

Montgomery Associates: Resource Solutions, LLC (MARS) has been retained by Nick Karris, who operates several cranberry marshes near the proposed Golden Sands Dairy. Mr. Karris has asked us to review the water resource impacts that the proposed Golden Sands Dairy could produce. We plan to participate in the Environmental Impact Statement comment sessions later this month. It has come to our attention that Golden Sands Dairy has asked for approval of five high-capacity wells that were originally proposed for the project in a way that would avoid the EIS process. Our understanding is that these five wells are a subset of the wells identified in the Golden Sands high capacity well application as Application Set 6, located in the southwesternmost corner of Wood County.

In our view, separating the five wells and approving them prior to completion of the EIS process is not appropriate, for the following reasons:

1. The five wells are clearly part of a much larger proposed well field that is in turn part of the proposed Golden Sands CAFO operation that will involve very substantial irrigation and manure spreading. The Golden Sands project is likely to alter the quality and quantity of groundwater and surface water resources that sustain both existing agricultural uses and the natural environment. Segmenting these five wells from the detailed EIS review process that is now just beginning is not appropriate.
2. The hydraulic impact that these five wells will create has apparently been evaluated by a consultant for Golden Sands dairy. However, we have yet had time to critically review these hydraulic impacts with respect to local streams, wells and on the water storage reservoirs and surface and groundwater supplies that are critical to the operations of the many cranberry marshes in the area. These reservoirs are under stress at this time due to the recent drought conditions. Careful objective review of the simultaneous operation of wells drawing as much as 1.4 million gallons per day each on the water supply for critical existing uses should be conducted as part of the EIS process.
3. We are particularly concerned about the potential for groundwater quality impacts produced by the agricultural operations that the irrigation wells will support. Of particular concern will be groundwater nutrient quality impacts that are likely to occur due to fertilizer (including manure)

application to the permeable soils of the area. Increased concentrations of, for example nitrates, can have significant implications for cranberry production, in addition to the well-known concerns regarding human consumption. These potential groundwater quality impacts of the agricultural operations are a clearly foreseeable consequence of the installation of the high-capacity wells, and should be reviewed carefully in the multi-objective framework that the EIS process provides.

We are continuing to review the available documentation on the request for permitting these five wells, and will provide you with additional comments as appropriate.

We would be happy to meet with you or answer any questions you may have on my remarks contained in this letter. Please keep us informed of the progress of your review for permitting of these five wells, and please add MARS to the list of entities that will be noticed as issue your responses.

Thank you very much for considering these remarks.

Sincerely,

Montgomery Associates: Resource Solutions, LLC



Robert J. Montgomery, PE  
Principal

Copy: Nick Karris

**From:** [REDACTED]  
**Date:** August 8, 2012 1:02:12 PM CDT  
**To:** [dan.baumann@wisconsin.gov](mailto:dan.baumann@wisconsin.gov)  
**Subject:** **Saratoga Dairy**

Hi Dan,

In respect of your time, I am a Saratoga resident helping with research. Can you please forward any specific detail plans of the proposed Anaerobic Methane Digester for the proposed Saratoga dairy. I assume that they had to be submitted with the request for permits and have an engineer that can help oversee what faults may be present. We feel this information may be very helpful in our search for complete details in what the proposed dairy may bring to our community. It is our hope that any negative effects be stopped before the building takes place instead of dealing with the negative effects once they are already established. Any information that you can pass on is greatly appreciated.

Thanks in advance,

[REDACTED]

Wisconsin Rapids, WI 54494

[REDACTED]

From: [REDACTED]  
Sent: Thursday, August 09, 2012 9:05 AM  
To: Anderson, Russell A - DNR  
Cc: Watson, Scott M - DNR; Meronek, Thomas - DNR  
Subject: Golden Sands Dairy Proposal - additional comment on nutrients

Mr. Anderson - In addition to other concerns, there is the issue of nutrients for this proposed dairy. And often, CAFOs have the bare minimum of acreage to accommodate all available nutrients.

Phosphorus (P) is not very mobile in the soil in most situations (though P-laden runoff can be a big issue). However, in very sandy soils, due to the open soil structure, P can percolate down through such sandy soils to groundwater, and thence into streams. Wind erosion is a problem in the Golden Sands area, and airborne P-laden sediments end up in area streams. And as indicated, there may also be P-laden runoff from rain and spring thaw.

Nitrogen (N) is another concern. Anaerobic manure digestion would be expected to yield ammonia, which is normally bound in the soil. However, under conditions common in the Golden Sands area, ammonia from landspread manure or liquids readily converts to nitrate, which is easily leached to groundwater unless immediately used by plants. Even then, heavy rains may bypass root uptake of nitrate.

And how will this be accepted by those concerned with an already degraded Petenwell Flowage and WDNR efforts in the area?

If permitted, is waterway nutrient monitoring above and below the facility an option to determine impacts? But ideally, this would occur prior to commencement of activity.

Once a facility of this dimension is up and running, it is very difficult to reverse course.

[REDACTED]

From: [REDACTED]  
Sent: Tuesday, August 07, 2012 10:29 AM  
To: Anderson, Russell A - DNR  
Cc: Stu; Watson, Scott M - DNR; Meronek, Thomas - DNR  
Subject: Golden Sands Dairy Proposal - comment

Mr. Anderson - In my opinion, this is a project with too many potential problems and consequences to allow. Such as...

If this CAFO is constructed, what will happen if drought lowers the groundwater to the point that these 49 high capacity wells must be shut down to protect groundwater and other water resources? And would there be such cease-pumping language mandated in the permit? Will the CAFO pull political strings to continue pumping? The WDNR secretary is from business, without resource credentials, and seems more friendly to development than resource protection. And then there's the governor, who shows his development backing up front.

Given that this is proposed in highly permeable soils, which have very limited water holding capacity above groundwater. And that CAFOs feed large amounts of antibiotics to avoid disease under crowded conditions. What will prevent these antibiotics and their metabolites from leaching to groundwater? These antibiotics are unlikely to be completely attenuated in the proposed manure digester; municipal wastewater plants see considerable antibiotic residuals and pass-through.

Several CAFOs I was involved with have had problems with manure runoff and over-application; given the vast amounts of material generated, problems have been quite frequent. And this CAFO would sit in the midst of several trout streams, Seven and Ten Mile Creeks, which empty to the Petenwell Flowage.

And this is a massive project to allow in very close proximity to a large municipal and outlying residential area. Ongoing conflict is too likely for the relatively few jobs.

In addition, this is simply no way to raise animals. How so? Well, traditionally grazed dairy cows should have a productive life of 10 years or more. But CAFOs blow cows out in 2-3 years, whence they are hamburger. We simply don't need this type of activity.

[REDACTED]

From: [REDACTED]  
Sent: Tuesday, August 07, 2012 5:54 PM  
To: Anderson, Russell A - DNR  
Subject: Golden Sands Dairy proposal

Dear Mr. Anderson,

I was concerned about the permit application for this factory farm for a number of reasons, particularly the need for 49 high capacity wells drawing from the aquifer. There are so many reasons to oppose factory farms, and while I understand it isn't the DNR's duty to address ethical considerations, the drawdown of area water and the waste from the cows is particularly concerning. I know I'd never want to live anywhere near this proposed farm.

I hope you'll do what you can to ensure that the people's concerns are heard and appreciated, even under pressure from corporate interests. It seems this farm would benefit very few and hurt many.

Thank you for considering my comments.

Sincerely,

[REDACTED]  
Whitefish Bay, WI 53211

3-5pm Air



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

We would like to know what laws they are exempt from such as air or water pollutants.

For instance, the law in 2010 that exempts them from ammonia levels.

Is there a list of laws exempting pollutants for air + water?

Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.

Name: [Redacted]

Contact Information: [Redacted]



## Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

I own property in township of Port Edwards S  
 northeast of the CAFO in Armenia. I  
 have on numerous occasions recieved  
 offensive odors possibly generated by the  
 CAFO. I have a home in Saratoga that  
 will be northeast of the purposed New  
 CAFO. Can I expect offensive odors as  
 the proximities of both my properties will  
 be similar? Can I get information  
 from the DNR CAFO air Contaminants?

Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.

Name: \_\_\_\_\_

Contact Information: \_\_\_\_\_

3-5 pm Air



**Saratoga Town Hall Public Listening Session**  
**Issues Identification Comment Form**

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

Please protect our air

from rich farmers + WALKER

*Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.*

Name: \_\_\_\_\_

Contact Information: \_\_\_\_\_

3-5 pm Air



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

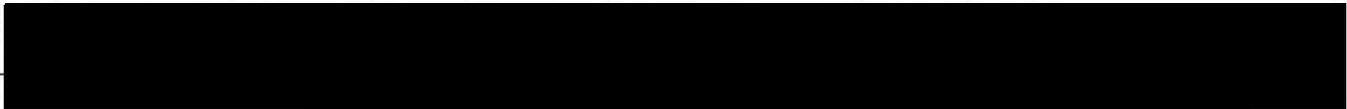
August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

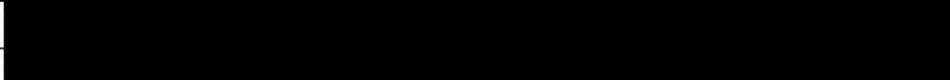
I want to know what chemicals are put on the crops, + aerial sprays used - I have a swimming pool + grandkids 500 yds from the proposed agriculture land - they said they will let the neighbors know when they do it. What god does that do me. Just tape my house up + drain my pool the grandkids are swimming in !!!

Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.

Name:



Contact Information:



3-5 pm Air



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

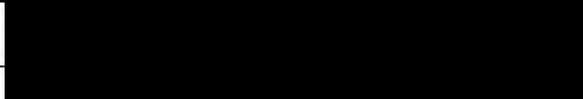
Air control of crop dusting  
acres sprayed at one time  
5,000 + or no more than  
600

Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.

Name



Contact Information:



3-5pm Air



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

Please protect our quality of life from rich farmers & WALKER  
enforce the peoples laws!

Thank you

Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.

Name: \_\_\_\_\_

Contact Information: \_\_\_\_\_

3-5pm AM



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

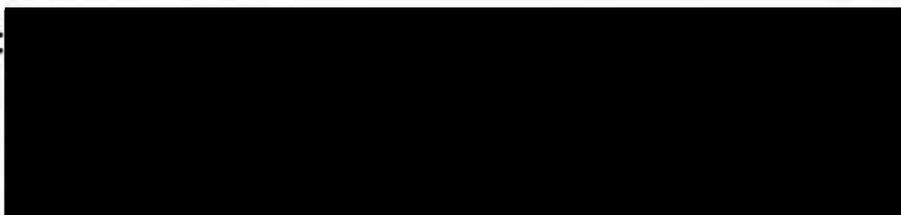
Concerns about spraying the manure, other industries (Septic pumps can't spray) what pathogens chemicals? Will they let us know when they are spraying?

Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.

Name:



Contact Information:



6-8pm Air



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

What is the emissions off of a generator burning gas from a digester of manure.

*Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.*

Name: [Redacted]

Contact Information: [Redacted]



6-8pm Air



### Saratoga Town Hall Public Listening Session

### Issues Identification Comment Form

For the Proposed

Golden Sands Dairy

August 23, 2012 Meeting

Public information gathering for the Environmental Impact Statement (EIS). Please clearly state the issue(s) you feel should be addressed by WI Department of Natural Resources in the EIS:

How will Wysocki apply their manure?  
Spray through irrigation?

Will manure be spread through irrigation?

Will they replace our wells - all 5300 people -  
should their manure through irrigation  
contaminate them?

*Completion of this form and inclusion of personal information is voluntary. We will use your contact information to seek clarification of your comments, if necessary. All comments subject to Wisconsin's Open Records Law.*

Name: \_\_\_\_\_

Contact Information: \_\_\_\_\_

DNR Public Hearing

**Water**

What right does anybody have to hog water that belongs to everyone? The law should be anyone using water should be responsible to replace it . If they use it they should replace it. We have enough problems already with the shortage of water in our lakes they are losing water, also making our creeks and rivers to go dry. Would you like to have expensive lake property with less water every year, that can happen. We now have many people with wells not having enough water now going dry. Who is going to be responsible for the water that will be be gone by putting in 49 high volume wells? Who will want to buy property in the area that has a problem to get enough water. How will people be compensated if they have a shortage of water caused by these high volume wells?

Any one that has a problem to get water after this big farm comes into existence must be compensated. Also they better get after their tax assessor because their property will be worth much less or not sellable.

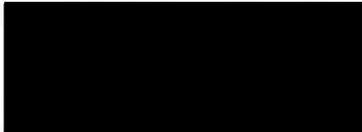
**TREES**

Will we have a problem after the land has been cleared, then will we have to put up with sandstorms? Many properties will be worth less if there are sandstorms and water shortage problems in the area. When the trees are gone and land cleared what protection will they have from sandstorms?

Who will compensate people for sandstorm damage and nuisance problems? Will this happen when this amount of land is cleared off?

Any forest that is taken down and turned into irrigated farmland should retain a buffer zone of forest wherever the fields abut residential, such as my subdivision, Manhattan Woods.

*Land Owner,*



Wisc Rapids, WI 54494

## Preface

**In 1948, a temperature air inversion, coupled with a cloud of air pollution from local coal processing, killed 20 people in Dora Pennsylvania.**

**In 1952, 3,000 people died in London from a killer industrial fog.**

**In 1955, the US Congress passed the Air Pollution Control Act. This legislation provided taxpayer funds for Federal research of air pollution. It took EIGHT years for that research to produce the Clean Air Act.**

**In 1963, Congress decided there was need for air pollution control. The US Public Health Service was delegated with the authority to develop techniques for monitoring and controlling air pollution.**

**In 1967, the Air Quality Act was enacted to expand their activities, to include prevention and control of interstate air pollution transport. It also authorized more taxpayer funds for expanded research.**

**In 1970 (22 years after people died), comprehensive emission regulations were finally put in place:**

**National Air Quality Standards**

**State Implementation Plans**

**New Source Performance Standards**

**National Emission Standards for Hazardous Air Pollutants**

**Enforcement was increased and the EPA was created to implement the Regulations of the Air Quality Act.**

**In 1977, the Air Quality Act was amended and provisions were added for PREVENTION OF SIGNIFIGANT DETERRIORATION OF AIR QUALITY. This was done, basically, to control industrial acid rain. Permits were created to control toxic air emissions. Industrial agriculture was still in its infancy, and not even on the radar of environmentalists.**

**In 1990, Congress once again amended the Air Quality Act, adding greater controls to acid rain deposition, and protecting ozone. But the emphasis was on cost effective approaches to reduce emissions. That**

**was the last major piece of legislation Congress passed to protect ambient air quality. That was TWENTY TWO years ago.**

**Since 1990, Congress delegated enforcement of the Air Quality Act to States and Local Government. “The Federal Government established policy guidelines. It is the States’ responsibility for enforcement.”**

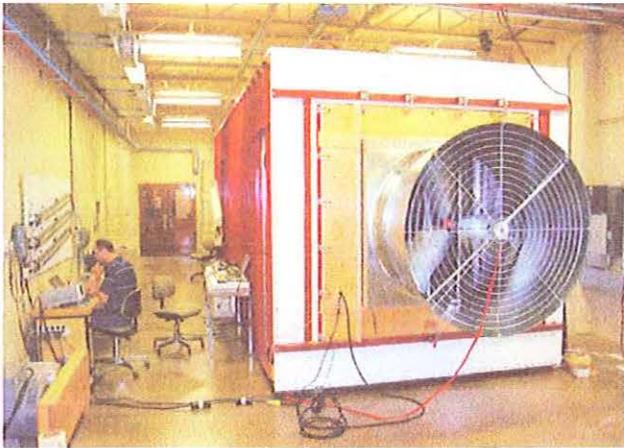
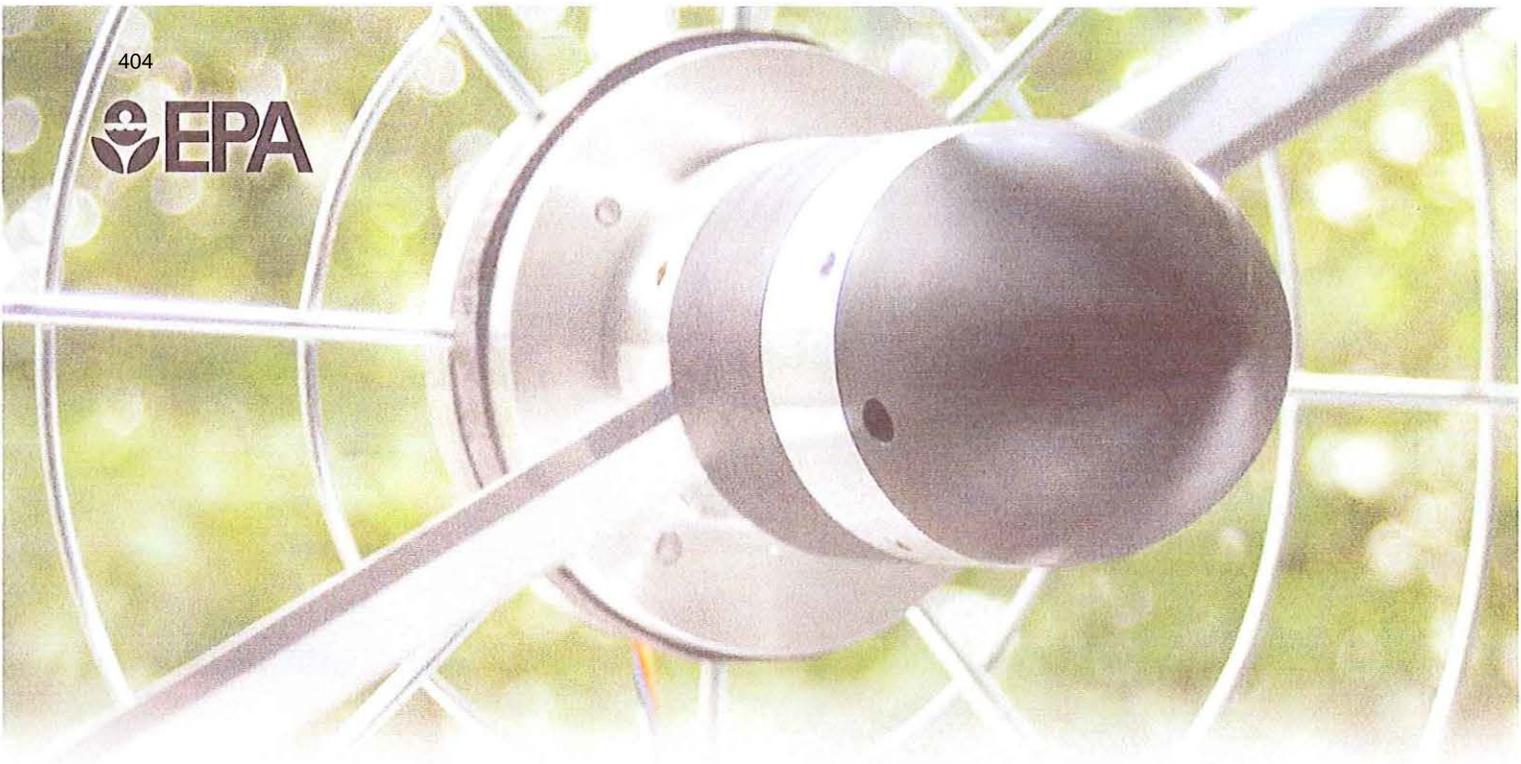
**In 2002, the rules changed, and big industry took over. The long-time head of the Office of Regulatory Enforcement resigned, and Congress rolled back regulations.**

**In 2005, (7 years ago) the EPA and industrial agriculture agreed to the Air Compliance Agreement. The EPA agreed not to prosecute CAFOs for air pollution violations, and in exchange for cash to fund research on CAFO air pollution. Since then there has been virtually no regulation of air emissions from CAFOs.**

**The research was to end in 2012.**

**In January of 2012, the EPA published a 2, 600 page document so complicated & convoluted, it is nearly impossible for the layman to understand. There has been no serious legislation requiring CAFOs to conform to ambient air standards, because congress has set the threshold so high, most CAFOs are considered exempt. But there ARE ways to accurately measure ambient air emissions from large dairy CAFOs.**

**Utilizing emission sensors inside a dairy barn, and monitoring the movement of air using a full scale anemometer, studies have shown the emissions from CAFO dairy barn fans can accurately be monitored.**



## Turbulent Air Flow Anemometer

Air pollutant emission quantity and emission rate are a primary interest for environmental protection, policy making, and law enforcement. The SkySight Technologies Full Scale Anemometer (FSA) has strongly demonstrated its feasibility as an economical device for measurement of real time airflow rate at the exhaust of large ventilation fans.

Testing has consistently documented the FSA's high level of precision. Further, the research has demonstrated that it could be installed on ventilation fans regardless of which direction the host ventilation fan rotates.



The FSA responds to the need for an anemometer that provides instant and continuous air flow volume measurement for large diameter agricultural and industry fans. Because these are often harsh environments, the FSA's electronics are enclosed for protection, furthering its significant competitive advantages of continuous air flow measurement at a low cost and in a small, compact format.