Wisconsin Water - Our Way of Life

An Action Guide for Community Leaders

Wisconsin Water - Our Way of Life

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You can find a copy of this document at: www.cleanwisconsin.org

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Clean Wisconsin, an environmental advocacy organization, protects Wisconsin's clean water and air and advocates for clean energy by being an effective voice in the state legislature and by holding elected officials and corporations accountable. Founded in 1970 as Wisconsin's Environmental Decade, Clean Wisconsin exposes corporate polluters, makes sure existing environmental laws are enforced, and educates citizens and businesses. On behalf of its 10,000 members and its coalition partners, Clean Wisconsin protects the special places that make Wisconsin such a wonderful place to live, work and play.

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Wisconsin Water - Our Way of Life

Water largely defines who we are in Wisconsin – Ojibwa for "gathering of the waters." As a leader of your community you recognize the importance of clean and abundant water for human consumption, for the operation of industries and businesses, as the foundation for tourism and recreational activities, and as an aesthetic asset for all to enjoy.

Water defines our communities and is celebrated in their design and organization. Our major cities and small rural centers were settled and grew around our waterways. Lakes and rivers define Green Bay, La Crosse, Milwaukee, Eagle River, Madison and so many other urban centers. The numerous lakes, rivers and streams that dot our landscape provide wonderful places for Wisconsinites to live, work and play.

We have a unique responsibility to be stewards of this rich and valuable resource. Clean Wisconsin has developed this *Action Guide* to help you engage other leaders and residents in your community to ensure a healthy future for Wisconsin's water. We hope to engage Wisconsin leaders and residents around four key principles:

Protect water resources by preventing water pollution.

Conserve water supply by using water efficiently.

This *Action Guide* discusses the problems underlying these four principles, and it provides examples of what communities throughout Wisconsin and the nation are doing to address them. Clean Wisconsin wants to help you develop solutions to water problems in your community. We hope to stimulate ideas that actively engage your community in protecting, conserving, restoring and improving your water resources. This guide includes resources, tools and contacts to assist you.

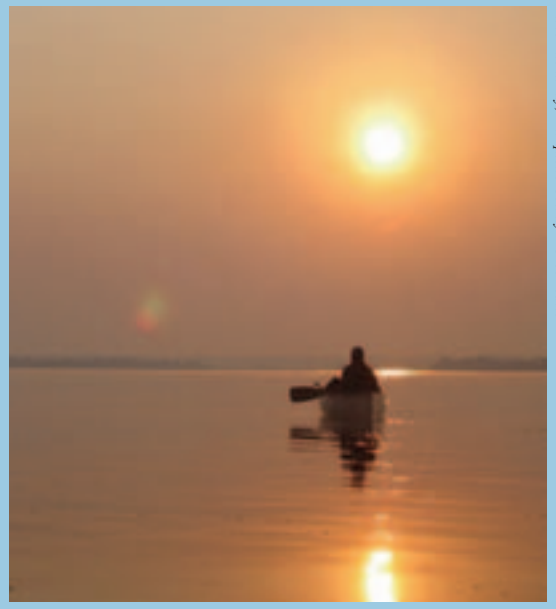
We invite you to use this *Action Guide* as you join community leaders throughout the state working together for Wisconsin's future.

Thank you for your interest and your leadership!

Menomonee River, Milwaukee - Eddee Daniel

Water largely defines who we are in Wisconsin – Ojibwa for "gathering of the waters."

A Challenge for Wisconsin's Waters



Lake Puckaway, Marquette County - Greer Sutter

This Action Guide is designed to educate community leaders on the issues facing Wisconsin's water resources and the means to protect and sustain our water resources for all to use.

Wisconsin's water is our most precious resource. And in Wisconsin, water means more than what comes out of the tap - it is a part of life that belongs to all of us. Our beautiful lakes, rivers and natural areas are the places where our families go to fish, swim, boat, hike and just plain enjoy.

Because water seems to be so abundant, we tend to take it for granted. However, a great challenge to Wisconsin in the coming decades will be how to manage our water resources. We can be proud of a strong legacy of stewardship and protection. To continue this tradition, we must work together to protect the quality of our water resources from chemical and biological contaminants from a variety of sources: atmospheric deposition, agricultural and urban runoff and residual point source pollutants.

At the same time, our demands on existing water resources continue to increase. Each community must meet human needs, support economic development, provide services and sustain natural ecosystems. Already some regions in the state are experiencing water shortages. The conflict among competing uses and demands will increase in years to come.

Worldwide, water consumption doubles every 20 years. In Wisconsin, a growing number of communities are pumping groundwater faster than it can recharge, resulting in higher infrastructure costs. As regional, national and global demands for water continue to increase, Wisconsin's abundant ground and surface waters, including the Great Lakes, will become a sought-after resource.

Careful planning and stewardship will be necessary to assure a safe and adequate supply of water for future generations. Wisconsin and the Great Lakes region currently lack a comprehensive water policy to address current and future demands on our water resources. To enact such a policy will require that citizens, policy makers and businesses work together. This *Action Guide* is designed to educate community leaders about issues facing Wisconsin's water and the means to protect and sustain our water

"Scarcity and abundance are not nature given – they are products of water cultures. Cultures that waste water or destroy the fragile web of the water cycle create scarcity even under conditions of abundance." Vandana Shiva

Person on Dock - UW Extension

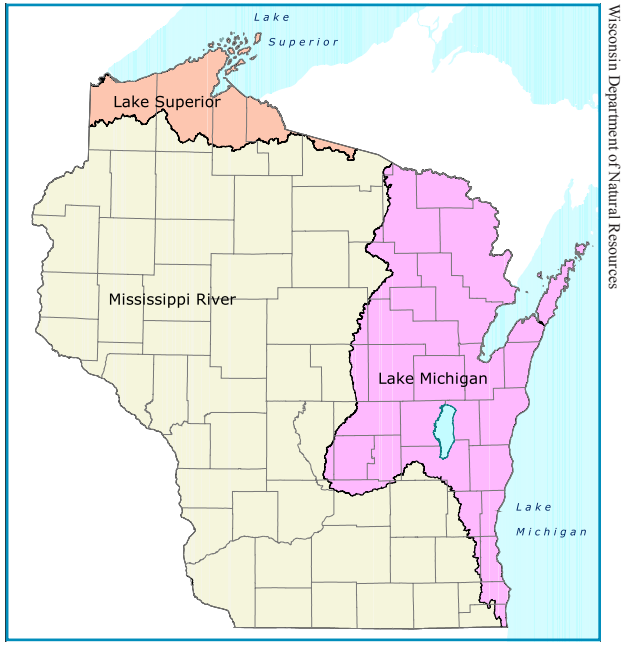
Facts About Wisconsin's Water

Kayakers - Stanley Solheim, Wisconsin Department of Tourism

A May 2003 poll of 1,200 Wisconsin voters found that in the past year:
87% visited a lake or river
45% went motor boating or fishing
51% visited a Great Lakes beach.

Water defines Wisconsin's way of life in numerous ways. Our borders are largely defined by water: Lake Superior to the North, Lake Michigan to the East and the Mississippi and St. Croix rivers to our west. Wisconsin has over 15,000 inland lakes and ponds, 32,000 miles of perennial streams and rivers and over 5.3 million acres of wetlands.

Wisconsin's Major Basins



Wisconsin Department of Natural Resources

The state is divided into three major basins: the Lake Superior Basin, Mississippi River Basin and Lake Michigan Basin. A basin, or watershed, is the land surface that collects water draining to a particular lake or river. Within the three major basins, Wisconsin contains **334 watersheds** that drain into our thousands of inland lakes, streams and rivers. Through this network of waterways, a raindrop that falls anywhere in Wisconsin will eventually make its way either to the Great Lakes

In addition to the water we see all around us, Wisconsin has an estimated ***1.2 quadrillion* gallons of groundwater** in four major underground aquifers. If we could bring all this water to the surface, it would be enough to cover the entire state under 105 feet of water!

Wisconsin depends on precipitation in the form of snow and rainfall to replenish our aquifers, lakes and streams. Wisconsin receives on average **30-34 inches of precipitation** every year, more than twice that of western states like Arizona.

Value of Wisconsin's Water Resources

Water is important to our citizens' way of life and to our economy. Water provides a wide range of services to our communities.

At home we use water for drinking and cooking, cleaning, washing and for our yards and gardens. On average, a Wisconsin resident uses 63 gallons of water per day.

In our towns and cities, water is used to fight fires, clean streets, irrigate parks, fill pools and supply commercial customers.

Clean and abundant water is essential for the economic health of Wisconsin communities. It is a necessary **input for industrial and manufacturing processes**, from power generation and paper production to cheese making and beer brewing. It is also essential for dairy production and agricultural irrigation.

Water also provides the **foundation for tourism and recreational opportunities** in our communities. Over 71% of travelers in the state are leisure vacationers contributing over $8 billion to the state and local economies. Water plays an integral role in Wisconsin's appeal as a tourist attraction. Local communities thrive on a variety of water-related recreational activities such as charter fishing on the Great Lakes; duck hunting on the Mississippi wetlands; or swimming, boating or fishing on a northern lake.

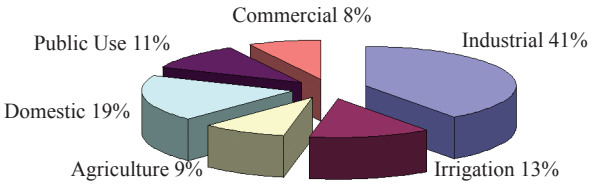
Finally, the **aesthetic value** of our water-related natural areas is incalculable, allowing us to enjoy a sunset over our neighboring lake, bird watching by our favorite wetland, or canoeing down one of our many rivers and streams. The aesthetic value is also evident in **waterfront property values**.

Water Use in Wisconsin

Since 1950, Wisconsinites' water use has tripled, growing twice as fast as the rate of population growth.

Every day we withdraw almost 7,600 million gallons of water for a variety of uses. **Power generation is a highly water intensive** activity, using 75% of all water withdrawn in Wisconsin.

Daily Water Use in Wisconsin
(Excluding Thermoelectric Power)
Source: Waters of Wisconsin 2003



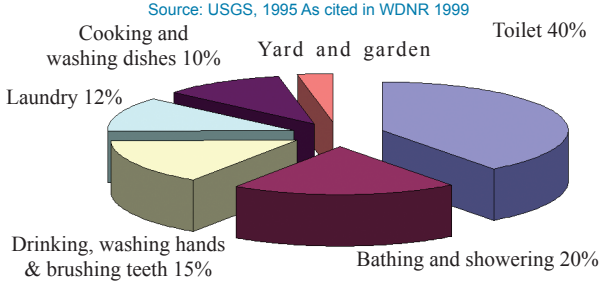
Wisconsin residents use **289 million gallons of water daily for domestic activities**. At 19% of the total (excluding power generation), it is the second greatest category of water use in the

Irrigation - Wisconsin Department of Natural Resources

Agricultural uses are also important. Irrigation uses 195.25 million gallons of water daily, and 90% of this water use is consumptive and does not return to the system. What does return often contains **pesticides, herbicides** and other harmful as well as significant amounts of **excess nutrients** that contribute to algal blooms in our lakes.

While Wisconsin's water resources on the whole are plentiful, we must **plan and act strategically** to guarantee we continue to meet our water demands and address the threats to the quality and supply of our water resources and the integrity of their associated ecosystems.

Domestic Groundwater Use in Wisconsin
Source: USGS, 1995 As cited in WDNR 1999



Water Return

Some of the water withdrawn from streams, groundwater aquifers and lakes to meet human needs is "consumed" through use. The remainder returns to the local surface or groundwater system and is available for subsequent use downstream. However, often the water is not returned to the same system from where it was withdrawn. Other times it carries pollutants or returns at a different temperature than that of the receiving body. All these changes in water quality affect the natural system as well

Water Outlet - Lynn Betts, US Dept. of Agriculture Natural Resources Conservation Service

Groundwater: Our Hidden Treasure

Wisconsin Aquifers - Waters of Wisconsin Report - US Geological Survey, 1984

Wisconsin has 1.2 quadrillion gallons of groundwater contained in four major aquifers, some of which overlap.

As 97% of Wisconsin's municipalities and 750,000 private wells rely on groundwater supplies, it is critical for your community to understand where groundwater comes from and how it is sustained.

For a moment, think of Wisconsin's land as a slightly leaky roof of a house: when it rains, some of the water pools on top (the lakes), some flows down the gutters (streams and rivers) and some of the water "leaks" through the roof. This "leaking" water is groundwater.

Groundwater and surface water are intimately connected. Precipitation in the form of rain or snow feeds lakes, rivers and streams as surface runoff, or seeps into the ground. Gravity pulls the water down through the spaces between particles of soil or through cracks in rocks, where it is stored as groundwater. A saturated soil or rock layer with spaces that allow water to move through it is called an **aquifer**.

Groundwater naturally moves from upland **recharge areas** – where rain or snow soak into the soil and reach the water table, to lowland **discharge areas** – the wetlands, lakes or streams. Water evaporates from these surface water bodies and the water cycle starts all over again.

Because surface waters are intimately connected to our groundwater, and vice-versa, **laws**

Wisconsin has 1.2 quadrillion gallons of groundwater contained in four major aquifers (see map at left):

(a) The **sand and gravel aquifer** resides in sand and gravel deposits. It provides water for irrigation in central, southern and northwestern Wisconsin. Because it is the land surface in much of the state, it is highly susceptible to pollution.

(b) The **eastern dolomite aquifer** holds groundwater in interconnected cracks that can provide a direct surface to groundwater connection, making it also susceptible to pollution.

(c) The **sandstone aquifer** supplies the groundwater-intensive use areas in eastern Wisconsin, where it occurs deep beneath the dolomite aquifer.

(d) The **crystalline bedrock aquifer** underlies

Water Above, Water Below: The Connection Between Wisconsin's Water

Clean Wisconsin has produced a documentary video and DVD on the surface to groundwater connection. Copies can be obtained free of charge by contacting Clean Wisconsin at www.cleanwisconsin.

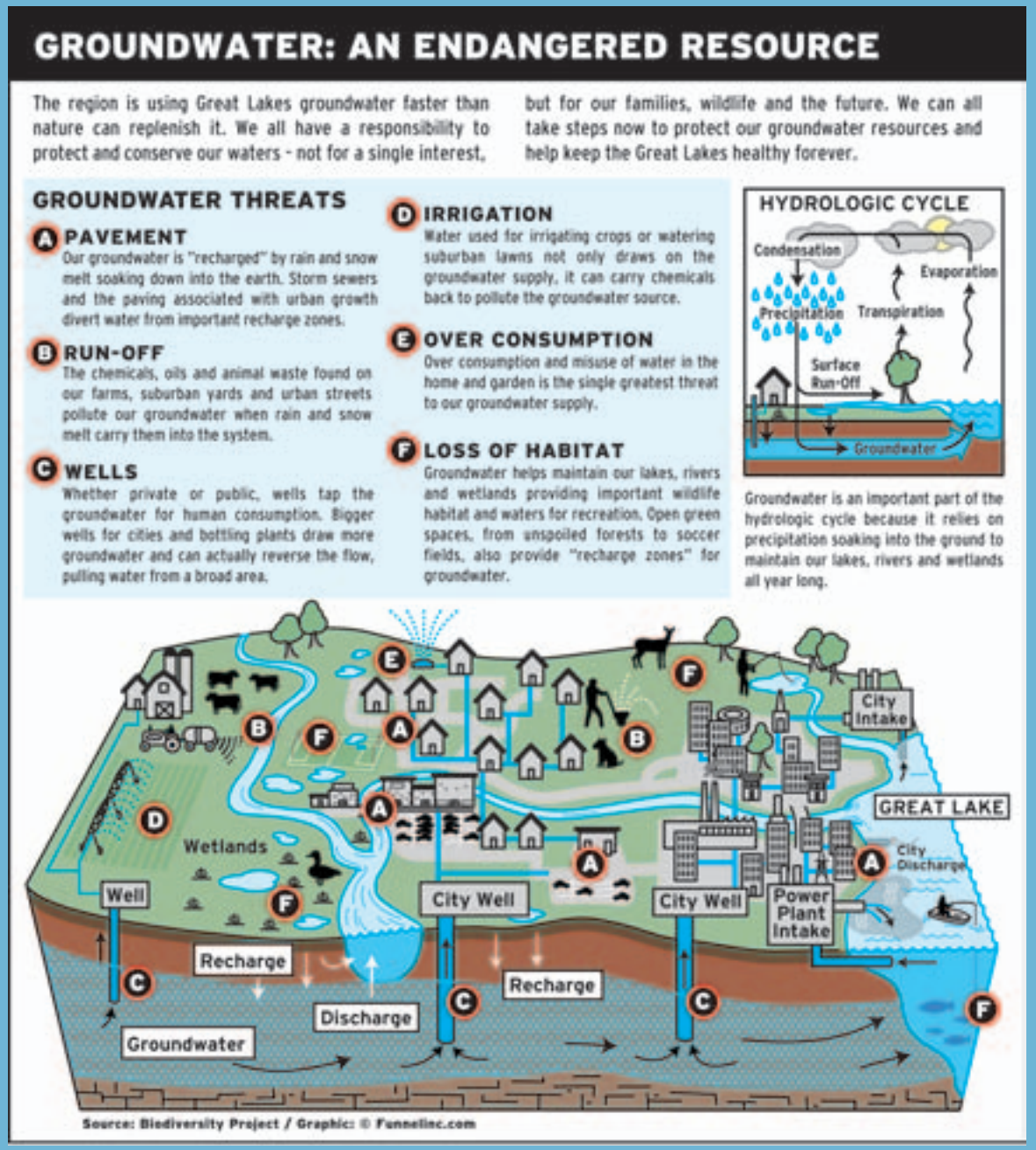
The Groundwater Protection Act

In March 2004 the Wisconsin Legislature passed the Groundwater Protection Act, a solid first step toward comprehensive management of the state's groundwater resources. The Act:

- Gives Wisconsin's Department of Natural Resources (WDNR) authority over groundwater wells by requiring advance notice of well construction
- Mandates WDNR to evaluate the environmental impacts of proposed high capacity wells within 1,200 feet of trout streams and exceptional resource waters
- Gives WDNR authority to deny well applications when impacts are significant
- Forms an Advisory Committee to make recommendations and evaluate how the law is working by the end of 2007
- Establishes Groundwater Management Areas in places experiencing dramatic declines
- Provides funding for a monitoring program to help answer future management questions

While the Groundwater Protection Act is a significant step forward, it still does not protect all areas. Future efforts should ensure protections for all of Wisconsin's groundwater-reliant water

Pheasant Branch, Middleton - Treva Breuch



The Great Lakes

Kids at Beach - Gene Alexander, US Dept. of Agriculture Natural Resources Conservation Service

Wisconsin has over 1,000 miles of Great Lakes coast, on Lake Michigan to our east and Lake Superior to our north.

The Great Lakes are the largest body of fresh water in the world. Together they hold over 5,500 cubic miles of water – 20% of the world's fresh water. The Great Lakes Basin defines a massive geographical and ecological region running from western New York state to eastern Minnesota and encompassing countless rivers, streams and smaller tributaries. Eight states and two Canadian provinces share coastlines on the Great Lakes Basin: Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, New York, Quebec and Ontario.

Wisconsin and Michigan are the only states with shorelines on more than one of the Great Lakes. Wisconsin has over 1,000 miles of Great Lakes coast, on Lake Michigan to our east and Lake Superior to our north. Cities in Wisconsin that lie in the Great Lakes Basin include Milwaukee, Kenosha, Racine, Green Bay, Oshkosh, Fond Du Lac, and Superior, among others.

Issues relating to the water of the Great Lakes Basin affect large numbers of Wisconsinites. About 52% of Wisconsin's population, or over 2.5 million people, live within the Great Lakes Basin. Their individual and collective actions can directly impact water quality and coastal habitats. At the same time, the quality and supply of Great Lakes resources directly impact the economy and

Take a Stand to Protect the Great Lakes

The Great Lakes belong to all of us. They are one of the natural wonders of the world and a resource for us to use and protect. They support the ecosystems that we rely on for the region's economic vitality, our jobs and our way of life.

The Great Lakes are not a commodity to buy and sell like oil and lumber. They are not a resource to be abused by one individual, industry or interest at the expense of all of us. We all have a responsibility to protect the Great Lakes for today's needs and future generations.

Great Lakes Basin

US Army Corps of Engineers Detroit District; Map courtesy of Great Lakes Information Network

Great Lakes Charter and Annex

The Great Lakes Governors and the premiers of Quebec and Ontario, known as the **Council of Great Lakes Governors**, exercise their collective authority over the Great Lakes through two essential tools:

- The **Great Lakes Charter**, a voluntary agreement signed in **1985** to collectively manage Great Lakes water uses
- The **Federal Water Resources Development Act of 1986** requiring the Governors' unanimous approval on any proposed out-of-basin diversion or export of water from the Great Lakes Basin

Proposed withdrawals prompted the development of the **2001 Great Lakes Charter Annex.** The Annex calls for new standards for Great Lakes diversions and withdrawals to be developed by the end of 2004.

Clean Wisconsin is working with the **Council of Great Lakes Governors** and other key players to help shape this agreement to protect the supply and quality of Wisconsin's water resources.

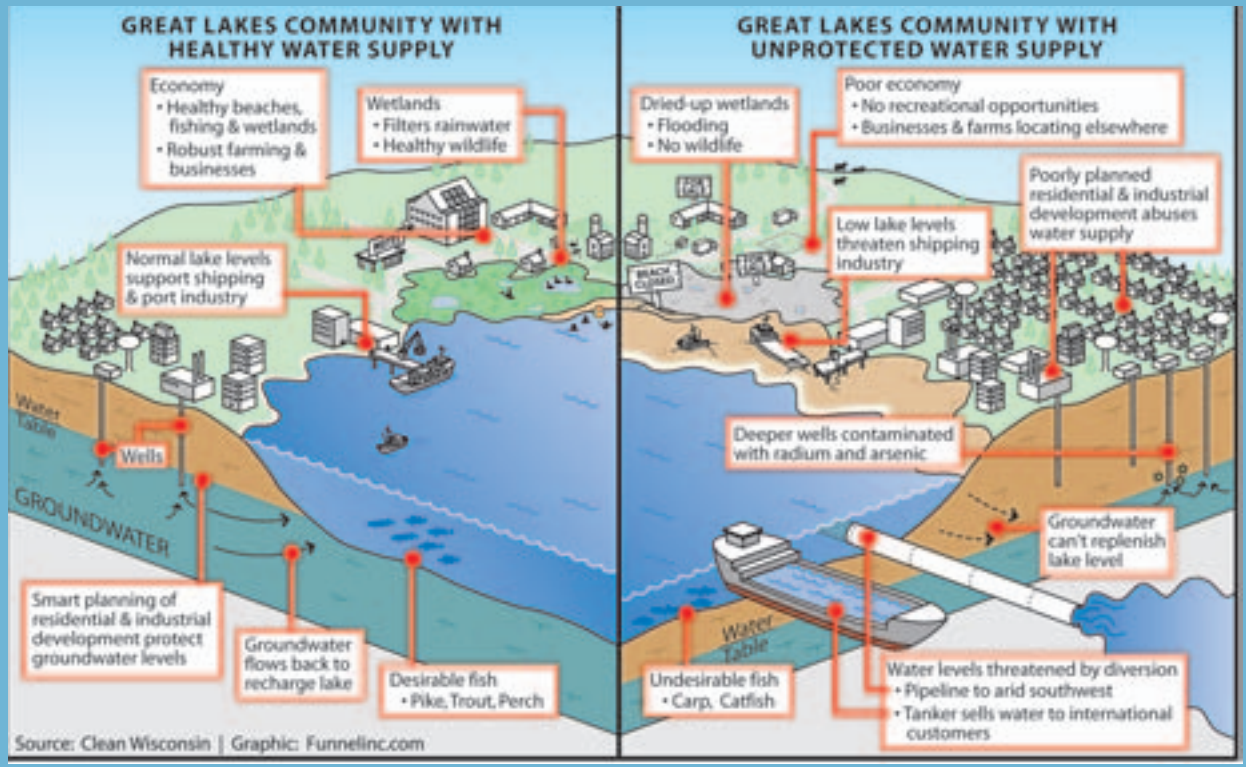
The Council of Great Lakes Governors is a partnership among the Governors of the eight Great Lakes states and Premiers of Ontario and Quebec. Its mission is to encourage and facilitate environmentally responsible economic growth in the Great

The Great Lakes Charter Annex standards are:

- Prevent or minimize basin water loss through return flow and implement environmentally sound and economically feasible water conservation measures
- No adverse individual or cumulative impacts to the quality or supply of the waters and water-dependent natural resources of the Great Lakes Basin
- Improvement of the waters and water-dependent natural resources of the Great Lakes Basin
- Compliance with the applicable state,

For more information about the Annex and priorities, projects and water management initiatives of the Council of Great Lakes Governors, visit their website at www.cglg.org..

Lake Superior - USDA Forest Service / US EPA Great Lakes National Program Office



The Upper Mississippi River Basin

Upper Mississippi River - Bob Nichols, US Dept. of Agriculture Natural Resources Conservation Service

The Upper Mississippi River Basin drains an area of approximately 190,000 square miles, and includes over 1,300 miles of navigable waterways.

The Upper Mississippi River Basin is almost 700 miles long and 500 miles wide. It includes over 1,300 miles of navigable waterways in Illinois, Indiana, Iowa, Minnesota, Wisconsin, Missouri and South Dakota.

The Upper Mississippi River Basin is the only water body in the nation to be recognized by Congress as both: "a nationally significant ecosystem" and "a nationally significant commercial navigation system." The river supports a broad range of **uses**:

(a) **Commercial navigation**. In 2000, barges carried 122 million tons of commodities in the river system.

(b) **Recreation**. Millions of people visit the area each year to boat, fish, swim and enjoy the river's beauty. Annual recreational expenditures exceed $1.2 billion.

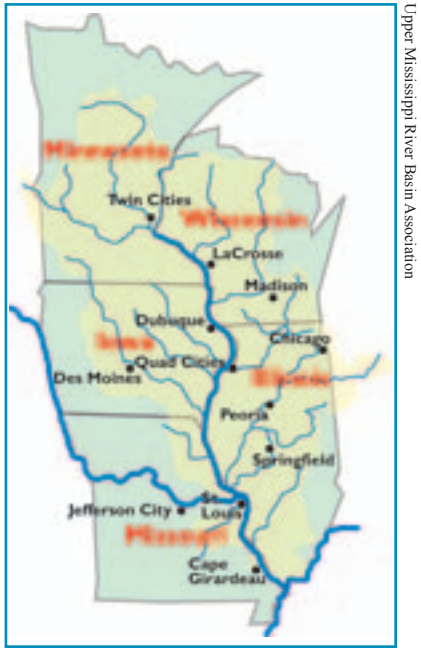
(c) **Habitat**. The basin is home to 127 species of fish and a wide range of other wildlife. The Mississippi Flyway is the migration corridor for 40% of North America's waterfowl and shorebirds.

(d) **Water supply.** It provides water for the region's more than 30 million residents for domestic, public, industrial, agricultural and

Nearly 80% of the basin's population lives in **major urban areas**. In addition, 66% of the Upper Mississippi River floodplain is used for crop and pastureland. **Erosion and runoff** from urban and agricultural land-use is increasing the amount of sediments entering the Mississippi River, accompanied by excess nutrients, pesticides and other toxic chemicals.

The Army Corps of Engineers is conducting a **decade-long study** to propose ways to improve navigation and restore the river ecosystem. Visit: www2.mvr.usace.army.mil/umr-iwwsns/

Upper Mississippi River Basin



Upper Mississippi River Basin Association

"For the last 15 years, the federal government has spent about $10 on commercial and navigation operation and maintenance to every $1 spent on maintaining and restoring the ecosystem of the rivers. " - Scott Hassett, Wisconsin Department of Natural Resources

Threats to Wisconsin's Water

Oak Creek Power Plant - Clean Wisconsin

Pollution from a variety of sources and the proliferation of invasive species threaten Wisconsin's water quality. Our supply is also threatened by growing demand.

THREATS TO WATER QUALITY

Water quality refers to how clean and safe water is for your community to use for drinking, swimming, fishing, industry and manufacturing. Threats to water quality come from **pollution** and **invasive species**.

Point Source Pollution

Point source pollution comes from a specific location, such as wastewater from an industrial facility. Since the passage of the **Clean Water Act** in 1972, water quality problems related to point source pollution have substantially declined. Heavily polluted rivers, such as the Fox and the Milwaukee Rivers, have recovered dramatically from previous levels of pollution. However, problems persist. According to the Wisconsin Department of Natural Resources (2002) 49% of surveyed river and stream miles and 35% of surveyed inland lakes are impaired, meaning they do not fully support their designated uses.

Persistent pollutants, such as Polychlorinated Biphenyls (PCBs) and mercury, remain in river and lake sediments for decades. They enter the food chain through small algae and microbes. As fish eat these plants and microbes they ingest the pollutants and pass them to the next predator up the food chain. **These pollutants are a direct threat to the health of the people in your community**.

Non-Point Source Pollution

Non-point source pollution, also called ***polluted runoff***, occurs when water flows across city streets, lawns and farm fields, picking up

The Clean Water Act is the cornerstone of our clean water protections. Its goal is to restore and maintain the chemical, physical and biological integrity of the nation's waters so we can fish and swim in our waterways. The 1972 Act was successful in multiple ways. It:

- Sharply reduced direct pollution discharges into waterways
- Financed thousands of municipal wastewater treatment facilities
- Improved public participation opportunities in water resource protection
- Provided for wetland protection through the 404 and 401 permitting systems

Under natural (unpaved) conditions, water flows slowly, infiltrating the soil and recharging groundwater supplies. **Wetlands and natural shoreline vegetation act as living filters** that intercept sediments and store excess nutrients and pollutants.

However, **land use changes** significantly alter natural processes. Urban and suburban development creates paved surfaces, increasing runoff and channeling contaminated water directly to lakes and streams. Runoff pollution results in **eutrophication** (over-fertilization) of water bodies, leading to excessive growth

Airborne Pollution

Mercury from coal-burning power plants is a major source of pollution in lakes and rivers. Mercury attaches to water and dust particles, and enters water bodies through rain, snow and runoff.

The mercury that enters Wisconsin's waters **contaminates fish**. In 2001, the Department of Natural Resources issued more protective advice for eating fish from Wisconsin waters. Under the updated health advisory, **all of Wisconsin's 15,057 lakes and 57,000 miles of rivers and streams are under a health advisory because of unsafe levels of mercury in fish**.

Invasive Species

The arrival and spread of aquatic invasive species are two of the major threats to the quality and integrity of Wisconsin's waters. Since European settlement, **162 species of fish, aquatic plants and invertebrates** have been introduced into the Great Lakes, and many have spread to inland lakes and rivers. The new arrivals are dramatically affecting Wisconsin's ecological diversity, recreational opportunities and the economy.

Exotic species often crowd out native species thus **endangering the survival of native plants and wildlife**. Some species, like Eurasian water-milfoil, grow in the shallow waters of lakes and interfere with boating, swimming and fishing. Invasives can also cause **serious financial impacts**. In 1993, zebra mussels

Zebra Mussels - Great Lakes Environmental Research Laboratory US EPA Great Lakes National Program Office

THREATS TO WATER SUPPLY

Water supply refers to the amount of water available for use by your community's residents, businesses and industries, and for water-dependent natural areas. The main threat to water supply is **inefficient use**.

Intense groundwater pumping to meet a growing demand from cities, agriculture and industry, is causing water levels to fall dramatically in some parts of the state. Since European settlement, groundwater levels have dropped:

- 450 feet in Southeastern Wisconsin
- 350 feet in the Fox River Valley
- 60 feet in Dane County

Groundwater levels are also falling in the Central Sands region of Wisconsin, due to growing irrigation demands.

Declining groundwater levels decrease the flow of water to streams and lakes and cause **springs to disappear and wetlands to dry up**. They also increase the vulnerability of water supply wells to **contamination from naturally occurring and radium.** This is already happening in communities in southeast Wisconsin, such as Mukwonago and New Berlin.

Declining water supply will result in increasing costs as water has to be pumped from greater depths or brought from far away sources. Dwindling supplies may also lead to conflicts between competing regions.

Communities outside the Great Lakes Basin are looking to the Great Lakes to help solve their water shortages. Low water levels also limit the capacity to ship cargo and use structures such as ports and piers on the Great Lakes and Mississippi River.

Even the Great Lakes, with their apparently endless supply of fresh water, are threatened. Rain and snowmelt annually replenish only 1% of the water in the Great Lakes system. The other 99% is finite and nonrenewable.

Stresses on water supply are **exacerbated in times of drought**. Scientists predict that periods of drought will increase in frequency and duration

Health Advisory

Because of mercury levels in Wisconsin fish, the DNR advises pregnant and nursing women, women of childbearing age and children under fifteen to severely limit how much large fish they eat from Wisconsin waters. To view the advisory and learn which fish are safer to eat, please visit: www.dnr.wi.gov/org/water/fhp/fish/pages/consumption/choosewisely04.pdf

A Call to Action: Protecting Your Community's Water

Cravath Lakefront - Whitewater, Wisconsin

Whitewater, Wisconsin has undergone an urban revitalization program for its waterfront.

Your Community and Its Water

Your community needs water to thrive. Clean and abundant water attracts manufacturing. Community residents rely on clean water for drinking, gardening and washing. Your community needs to be able to access water to fight fires and serve commercial needs. And everyone needs enough clean water in lakes and rivers to swim, fish and boat.

Protect, Conserve, Restore and Improve

Water management systems in Wisconsin need to be simple, durable and efficient. They must retain and respect authority within each basin. And most importantly, they must **protect, conserve, restore and improve** waters and water-dependent natural resources. These principles need to be reflected in decisions about water management at the regional, state and local levels.

At the local level, this means taking advantage of what programs that can make a difference in water protection. For example, identifying and planning for the use of green infrastructure, natural water retention areas, recharge areas and native plantings can reduce expenses from flooding, polluted runoff and required watering systems. Ideally a community would be as deliberate about planning and investing in its green infrastructure as its built infrastructure.

Many communities have taken steps to recognize the value of their water resources. Urban revitalization programs such as the redevelopment of the Sheboygan waterfront and the river edge in Beloit highlight the importance of water to the community's image and economic well being. In Chicago, Mayor Daley launched the Great Lakes Cities Initiative with other cities to recognize the important role of the Great Lakes to communities that rest on the shorelines. Join these forward looking cities and become a leader for enlightened

In Chicago's *Water Agenda 2003* the long-unrecognized connections between surface and groundwater are made. The Agenda outlines plans for recycling water and making all water consumers pay for what they use by metering all households and businesses. It restores the long neglected Chicago River shoreline and wetlands that provide critical ecosystem functions such as flood control and water filtering. It promotes Green Infrastructure that allows water to soak into the ground to recharge aquifers rather than run off through the stormwater systems. It is a comprehensive guide sharing what a large forward-thinking city can do to manage its water resources for the future.

Chicago Shoreline - City of Chicago

Milwaukee Shoreline - Lake Michigan Federation US EPA Great Lakes National Program Office

Water supports a wide variety of uses in Wisconsin. Whether for drinking, industrial use or dairy production, water needs to meet a certain quality level.

The Problem: Pollution threatens local water supplies.

Water supports a wide variety of uses in Wisconsin. Whether for drinking, industrial use or dairy production, water needs to meet a certain quality level. Furthermore, clean water is necessary to ensure the health of aquatic ecosystems – lakes, rivers, and wetlands – and the plants and animals that depend on those systems for their survival.

Threats to water quality come from a variety of sources.

Point-source pollution (direct discharges from industries, municipal wastewater treatment plants, or large animal operations) has significantly declined since the passage of the Clean Water Act in 1972. But while closely regulated, these sources continue to add pollutants to waterways that have little capacity left to assimilate them.

Runoff pollution (or non-point source pollution) occurs as rainwater and snowmelt flows over agricultural land, city streets, lawns and parking lots. The runoff picks up soil particles, nutrients, and pollutants such as pesticides, road salt and car oils, and carries them to our rivers, wetlands and lakes.

Atmospheric pollutants, especially mercury from coal burning power plants, continue to pollute our waters. These new sources of mercury add to the mercury and Polychlorinated Biphenyls

Declining water supply can also affect the quality of our water. As groundwater levels drop, naturally occurring substances such as arsenic or radium can enter the water supplies, as happened in Waukesha and Green Bay. At the same time, as river flows or lake levels decline, their ability to assimilate pollutants also diminishes and the concentration of existing pollutants increases.

Finally, an increasing number of **aquatic invasive species** are outcompeting native plants and animals, disrupting recreational activities, and causing economic harm to Wisconsin's businesses.

The Solution: Protect water resources by preventing pollution.

Local leaders can take a variety of actions to protect water resources from pollution:

- Work with neighboring municipalities to implement regional pollution prevention measures
- Account for the cumulative impacts of all water users in local water policies
- Manage urban stormwater and wastewater effectively through the implementation of best management practices (see *Improve* section)
- Protect groundwater recharge areas where water filters back into the ground
- Prevent the introduction of invasive species
- Institute reductions in the use of phosphorus and road salt

Phosphorus is a pollutant of particular concern because it is a limiting nutrient in Wisconsin's surface waters. This means that adding phosphorous to Wisconsin's lakes is like fertilizing the water, causing excessive **blooms of algae** and growth of other aquatic plants. These blooms block out light and deplete oxygen needed by aquatic organisms, and become a nuisance for swimmers, boaters and anglers.

Toxic blue-green algae also thrive in phosphorus-rich water, and may cause illness in humans and animals.

Phosphorus is used in heavy concentrations for fertilizer (both agricultural and from lawns) and livestock feed. It is also present in livestock manure. Phosphorus molecules bind to soil particles and are washed to surface water through

About 50% of Wisconsin soil samples recently tested had excessive levels of phosphorous. Keeping phosphorous and soil out of the waterways is the most effective way of reducing nutrient overloads in Wisconsin's waterways.

Algae Bloom, Racine - Julie Kinzelman

"Think Fresh Protect our Lake" Storm Drain, Taupo, New Zealand - Madison Environmental Group, Inc.

The first stormwater utilities were established in the 1970s and today there are hundreds of utilities throughout the country. Many Wisconsin communities – including Appleton, River Falls, Madison and New Berlin – already have stormwater utilities.

Establish a Stormwater Utility in Your Community

Phase II of the National Pollutant Discharge Elimination System (NPDES) stormwater regulations and compliance requirements with total maximum daily load (TMDL) limits, are forcing many municipalities to upgrade or replace older stormwater infrastructures at great cost. Municipalities are looking for reliable and consistent sources of funding for stormwater management and therefore considering the option of creating a stormwater utility.

A stormwater utility is a special assessment district set up to provide funding for stormwater management. Users pay a fee and the revenue directly supports stormwater infrastructure and programs. Some of the characteristics of stormwater utility fees are:

- Revenues generated can only be used for stormwater management
- Fees are proportional to the amount of runoff a property generates
- Tax-exempt organizations are assessed for their contribution to stormwater
- Fees can be calculated based on the percentage of impermeable or permeable cover in the parcels, and

WATER WISDOM

Reducing Phosphorus Inputs in Dane County

In April 2004, the Dane County Board passed an ordinance limiting phosphorus in lawn fertilizers in order to improve water quality. The ordinance phases out the use of phosphorus-containing lawn fertilizers unless soil tests show that phosphorus is necessary. The ordinance, effective in January 2005, will apply to residential lawns, golf courses, farmsteads and commercial lawn applications. It exempts newly established turf and lawns during their first growing season as well as fertilizers intended primarily for garden and indoor plant application, and fertilizers applied to trees and shrubs and for agricultural uses. This ban is a step in the right direction to address new phosphorus inputs to the County's lakes and streams.

Dane County Lakes and Watershed Commission
City County Building, Room 421
210 Martin Luther King Jr. Boulevard
Madison, WI 53703
(608) 267-0118
www.co.dane.wi.us/commissions/lakes/phosphorus.shtml

Storm Drain - Roger Bannerman

Street Sweeper - City of Madison

Street Sweeping Study to Reduce Water Pollution in Madison

Street surfaces are the major source of pollutants affecting urban waterways. One way to control roadway runoff is to use street sweeping to remove pollutants that are transported in stormwater runoff. This option may be preferable to structural solutions such as catch basins, since these are costly and take up considerable space.

The City of Madison is evaluating alternative street sweeping practices. The study uses a paired basin approach. A control basin has no sweeping except at the start of the test periods. A second basin is swept once per month with a mechanical sweeper and no parking restrictions (Madison's current method). A third basin is swept with mechanical sweepers and parking regulations in place to allow full access to the curb. The final basin is swept with the same parking regulations as the previous basin but using a new generation sweeper. Preliminary results for the study will be available in the summer of 2005.

City of Madison Engineering Department
210 Martin Luther King Jr. Boulevard
Madison, WI 53703
(608) 267-1199
www.cityofmadison.com/engineering/stormwater/street_

Alternatives to Road Salt

Use of road salt has been linked to high concentrations of sodium and chloride in surface and groundwater. At high levels, salt is toxic to aquatic organisms. It can harm shoreline vegetation with runoff containing high levels of dissolved salt. High salt concentrations in groundwater can also aggravate heart-related health problems.

Salt use can be reduced by establishing "low salt areas" near sensitive environments or residential areas, or by using a higher percentage of sand in the salt/sand mix. Wetting the salt that sticks to the road can also lead to fewer applications.

The state of Vermont uses infrared sensors on the bottoms of snowplows to measure the actual temperature of the roadway to allow a more accurate calculation of the amount of salt needed. This has resulted in 20-30% reductions in salt use, saving the state $2.2 million.

The state of Massachusetts has examined the costs of using road salt and alternatives, and determined that the most cost-effective alternative to straight salt is a "pre-mix" of 4 to 1 sodium chloride and calcium chloride. In Massachusetts, use of this mix has been shown to save two dollars in environmental costs to every dollar spent on the pre-mix.

Massachusetts Department of Public Works
10 Park Plaza, Room 4261
Boston, MA 02116

Racine Beach Health Monitoring

The City of Racine has had a consistent recreational water testing program for over twenty years. Coastal beach water is tested for *E. coli* bacteria that may indicate the presence of other harmful organisms such as viruses and bacteria. Since 1999, pilot research studies have aimed to establish better public notification about recreational water quality issues and reduce the frequency of beach closures. Management strategies include:

- Monitor stormwater discharge
- Evaluate and improve the efficacy of remediation efforts at storm sewer outfalls
- Investigate the use of phytoremediation in stormwater management
- Research sources of contamination
- Evaluate wildlife management methods

In 2003, the City of Racine was awarded one of four national "Beach Buddy" awards by the National Resource Defense Council. In 2004, Racine's North Beach was the first Wisconsin beach to be certified as a "Blue Wave" beach by the Clean Beaches Council. When the Wisconsin Department of Natural Resources prepared statewide guidelines for beach water quality standards and monitoring programs (required by the USEPA BEACH Act of 2000), many of the practices already employed in Racine were included.

City of Racine Health Department
730 Washington Avenue
Racine, WI 53403
(262) 636-9201
www.racinehealth.org

Wellhead Protection Programs

Communities can protect their drinking water supply through wellhead protection planning. This program requires a community to:

- Identify recharge areas for their drinking water wells
- Identify potential contaminant sources within that area
- Manage the area to protect the water supply from these contaminants

For information on over 200 Wisconsin communities with wellhead protection programs in place, examples of wellhead protection ordinances and other helpful resources, please check the DNR's Wellhead Protection Program Directory at:
www.dnr.state.wi.us/org/water/dwg/gw/whp/

Seagulls on North Beach, Racine - Julie Kinzelman

Boating on the Wisconsin River - Eric Mosher

Water Drop - Unknown

Water use in Wisconsin has tripled since 1950, growing twice as fast as the rate of population growth. Conservation is critical.

The Problem: Increasing water demand causes water shortages.

With Wisconsin's 15,000 lakes and ponds, 32,000 miles of streams and rivers, vast underground water resources and proximity to the Great Lakes and the Mississippi River, thinking about water scarcity may seem alarmist. We live in a state gifted with an abundance of water. However, we are starting to experience shortages. Water use in Wisconsin has increased steadily since 1950. Groundwater use grew from 570 to 754 million gallons per day from 1985 to 1995, and is still rising.

Drops in the water table of over 300 feet in the Fox River Valley and 450 feet in the Milwaukee metropolitan area are affecting water supply in communities such as Waukesha and New Berlin. In Dane County, drops in the water table of over 60 feet are drying up springs and wetlands and affecting streamflows.

Water shortages result from the following causes, acting alone or in combination:

- **Overuse of local water supplies**, usually groundwater, due to increasing demand from communities and industry
- **Lack of rain** to recharge water above and below ground which may cause seasonal or long-term shortages, and can produce dramatic impacts on the landscape
- **Pollution** that reduces the amount of usable water for drinking, manufacturing or

The Great Lakes are also being impacted by overuse of water from the surface and connected groundwater. Imagine a bucket of water with a multitude of straws. Even if everyone took tiny sips, eventually the water supply would diminish. Wisconsin law provides mechanisms to challenge new large users of water but there is little protection from a multitude of small users.

Water shortages result in **higher infrastructure costs**, as communities are forced to seek a supply further away or pump from greater depths. Decreasing water levels on the Great Lakes and Mississippi River may restrict transportation, recreation and commercial activities.

Furthermore, communities along the Great Lakes that have drawn down their groundwater supplies have inadvertently caused radium contamination in the remaining supply. This has forced communities such as Waukesha to seek

Lake Michigan - Eric Mosher

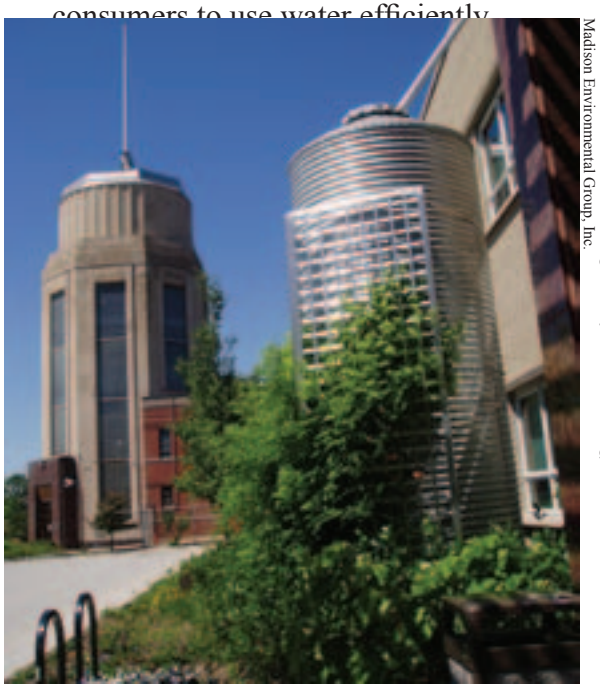
The Solution: Conserve water supply by using water efficiently.

Rather than wait for a water supply crisis, communities can plan for future water needs by using water efficiently now. Using water efficiently means both:

- **Reduce water use and waste**
- **Reuse water where appropriate**

Examples of how communities can **reduce water use and waste** include:

- Detect and repair leaks in municipal water systems
- Use natural landscaping or *xeriscaping* with plants that require less water
- Meter and bill customers based on their actual water use
- Provide education and incentives for consumers to use water efficiently



Water Tower and Rain Cistern, Chicago Center for Green Technology - Madison Environmental Group, Inc.

Communities may also implement measures to **reuse water** such as:

- Use reclaimed wastewater for landscape and agricultural irrigation, fire protection, industrial cooling and cleaning, and construction
- Pump reclaimed wastewater to residential and business consumers for irrigation and cooling
- Provide education and incentives for

Consider Greywater

Clean Wisconsin

Greywater is the used and wasted water from our sinks, showers and washing machines (which comprises 50-80% of residential wastewater). This water may be reused for other purposes, especially landscape irrigation. Greywater eliminates the waste of irrigating with great quantities of high-quality drinking water. Moreover, plants thrive on used water containing small bits of compost! The benefits of using greywater include:

- Conservation of fresh water
- Less strain on failing septic systems and treatment plants
- Less energy and chemical use
- Groundwater recharge
- Healthier topsoil and better plant growth
- Reclamation of otherwise wasted

WATER WISDOM

Regional Cooperation in Southeastern Wisconsin

Southeastern Wisconsin is facing the challenges of growing water demand from a sprawling population. Three communities – Mukwonago, East Troy and New Berlin – are voluntarily working with the Wisconsin Department of Natural Resources to protect surface waters and natural areas and to respect the water needs of neighboring communities. Business, agriculture, environmentalists and others are coming together to work out a regional approach to managing groundwater. By planning together, hopefully Wisconsin will avoid the path that many western states have taken, where water rights have become a commodity to be traded rather than a shared public resource.

Wastewater Reuse in Cary, North Carolina

The town of Cary, North Carolina, began a program in 1999 to distribute treated wastewater, free of charge, to customers who completed a training course on how to use reclaimed water. The water is used for activities that do not require potable water, such as irrigation and car washing. The town is allowed by the state to divert 5 million gallons of wastewater per day to give to individuals and businesses who will make use of it. The reuse of water is a part of a plan to reduce per capita consumption of water in Cary by 20% by 2015.

Department of Public Works and Utilities
P.O. Box 8005

Water Rationing in the Village of Plover, Wisconsin

To deal with increasing water demands in the Central Sands area of Wisconsin, where water is intensively used for agricultural irrigation, the Village of Plover enforces a four-stage water rationing program for all residential and business customers. Stage 1 – voluntary water conservation – goes into effect when the water supply or the capacity of the waterworks system to deliver water approaches a pre-determined alarm threshold. During Stage 1, users are urged to conserve water in any way possible in their homes and businesses.

Stages 2, 3 and 4 – water rationing – go into effect when total consumption for the preceding day exceeds thresholds determined by the Village Board. During Stage 2, sprinkling is restricted to every other day during the hours of 8:00 p.m. and midnight or between the hours of 6:00 a.m. and 10:00 a.m. During Stage 3, sprinkling is restricted to one day a week during the same hours. And during stage 4, no sprinkling is permitted. Stages 2-4 also include restrictions on washing cars and filling swimming pools.

Plover Water Systems Department
300 Water Way
Plover, WI 54467
(715) 345-5254
www.eplover.com/water-conservation.htm

Water Rationing Meter, New Zealand - Madison Environmental Group, Inc.

City of Seattle Tiered Rate Structure

Although Seattle has plenty of water in the wintertime, the city depends on stored water during the summer when demand is highest. Higher summer water rates encourage customers to use water wisely. Summer rates incorporate a three-tiered rate structure with progressively higher rates as water consumption increases.

Seattle´s Tiered Rate Structure

Water Use in 60 days	Rate per ccf
Less than 10 ccf	$2.88
Between 10 and 36 ccf	$3.35
More than 36 ccf	$8.55

(1 ccf = 100 cubic feet = 748 gallons)

Seattle Public Utilities
700 Fifth Avenue, Suite 4900
P.O. Box 34018
Seattle, WA 98124-4018
(206) 684-3000
www.seattle.gov/util/Services/Water/index.asp

Natural Landscaping and Xeriscaping

Natural landscaping has become a proven way to save money and water. Cities and businesses around the country are beginning to realize the benefits of replacing monocultures of turf grass with native plant species suitable to the area. The U.S. Environmental Protection Agency produced *The Source Book on Natural Landscaping for Public Officials,* a guide to natural landscaping in the Chicago area.

U.S. Environmental Protection Agency
Great Lakes National Program Office
77 West Jackson Boulevard
Chicago, IL 60604-3511
(312) 353-2117
www.epa.gov/glnpo/greenacres/toolkit

Denver, Colorado, has coined the landscaping term "xeriscaping" to represent very efficient use of water. The city created many demonstration gardens to show people how xeriscaping can be done and what it can look like. Their website includes many sources for municipalities to learn about landscapes that are beautiful, but require very little water.

Denver Water Administration Building
1600 W. 12th Avenue
Denver, CO 80204


Rain Garden - Clean Wisconsin

Milwaukee's Rain Barrel Program

A rain barrel collects and stores rainwater from your rooftop which you later can use to water your lawn or garden, or to wash your car. A 1999 study for the City of Toronto indicates that rain barrels can reduce the volume and peak water discharge for frequent storms. Rain barrels should be used in conjunction with other water management practices, such as rain gardens, green roofs and porous pavement. But using a rain barrel is a great first step to conserve water and improve water quality.

Rain barrels are easy to build and install. They help water quality by reducing runoff from individual properties. They also help lower water bills by providing free water for watering plants and washing your car.

In an effort to limit stormwater peaks, the Milwaukee Metropolitan Sewerage District (MMSD) is selling rain barrels at cost, $23 for an unpainted barrel or $33 for a painted barrel. Once used to deliver pickles, the barrels come from Dean Foods in Green Bay, Wisconsin. MMSD hired the Milwaukee Community Service Corps to clean and transform the 55 gallon plastic drums into rain barrels.

Milwaukee Metropolitan Sewerag
260 W. Seeboth St.
Milwaukee, WI 53204
(414) 225-2128
www.mmsd.com/rainbarrel

Rain Barrel - Madison Environmental Group, Inc.

Los Angeles Water Conservation Plan

The Los Angeles Department of Water and Power has implemented a comprehensive water efficiency program to address water use by households, businesses and industries. The program includes a free meter loan program, a school education and incentive program, a water awareness month, and a business and industry awards program.

The residential program includes an ultra low-flush toilet rebate program, home water surveys and low-interest conservation loans. To limit outdoor water use, the City offers a water conservation garden contest, demonstration gardens, a large-turf water curtailment program, and xeriscape requirements for new construction. Los Angeles has also adopted a seasonal pricing structure under which water is priced at a higher rate during the summer months.

The program resulted in a 4% reduction in water consumption between 1987 and 1990.

Los Angeles Department of Water and Power
P.O. Box 51111
Los Angeles, CA 90051-0010

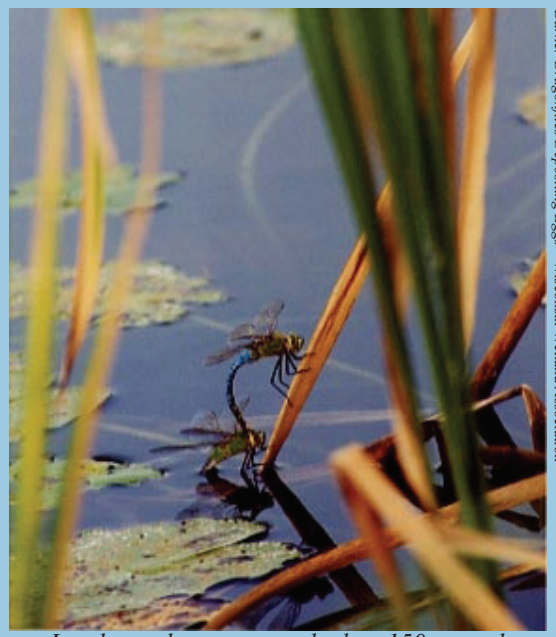
Water Meter - Madison Environmental Group, Inc.

Dane County EnAct Program

EnAct Team Meeting - EnAct

EnAct (Environmental Action Teams) is an action-oriented program to encourage healthy and sustainable living, save families money and build stronger communities. Currently operating in Dane County, EnAct is poised to expand to other areas of the state. EnAct uses a small group model, in which teams of five to eight households meet regularly in informal settings over a four-month period. With the help of a detailed EnAct Participant Guide, they learn and support each other in making lifestyle changes. EnAct produces measurable results by surveying participants about household waste, resource use, and expenditures before and after the program. In just over a year of operation, 105 households have completed the program and conserved a total of 1.42 million gallons of water (more than 7 Olympic-size swimming pools).

EnAct Program Managers
Madison Environmental Group, Inc.
25 N. Pinckney St., Suite 310
Madison, WI 53703
(608) 204-2888



Darner Dragonflies Depositing Eggs - Wisconsin Wetland Association

Land use changes over the last 150 years have disrupted Wisconsin's aquatic ecosystems.

The Problem: We have lost or altered natural areas and waterways that clean water and provide wildlife habitat.

Over the last 150 years, land use changes and a variety of human activities have altered the hydrologic cycle and led to a loss of biodiversity in Wisconsin's aquatic ecosystems. These effects have been exacerbated by deteriorating water quality and supply as well as by gradual changes in our climate.

Since European settlement, Wisconsin has lost approximately **half of its original 10 million acres of wetlands**. There are over **3,800 dams** altering the flow of Wisconsin's streams and rivers. Riverbeds such as the Milwaukee River have been paved over, destroying valuable habitat. As communities grow, they increasingly **pave over natural areas** that previously served to recharge groundwater or as natural flood retention zones.

Some of these land use changes provide benefits to humans, from employment and transportation to power generation and recreational opportunities. However, **we are now experiencing the costs of**

Volunteers Restoring Whitecliff Fen, Door County - Jodi Milske, Door County Land Trust

The loss and degradation of natural areas leads to:

- **Loss of capacity to filter pollutants**
- **Loss of infiltration and replenishment of groundwater supplies**
- **Increased incidence of flooding in urban areas**
- **Extinction of aquatic and wetland species** (32% of Wisconsin's threatened and endangered plants and animals are wetland-dependent)
- **Increase in polluted or nutrient-loaded runoff from parking lots and streets**

Increasing polluted runoff leads to eutrophication (or over-fertilization) of lakes, stimulating excessive growth of weeds and algae. Eutrophication can cause loss of biodiversity, beach closings, and declining fishing resources.

Invasive species represent another major threat to Wisconsin's aquatic ecosystems. Species such as the zebra mussel, the Asian carp, Eurasian water-milfoil and reed canary grass are displacing native

The Solution: Restore freshwater habitats and natural waterways.

Wisconsin has a legacy of ecological restoration efforts and numerous resources and organizations to help restore waterways and wetlands in or near your community.

Wisconsinites were **early leaders in wetland restoration**, beginning with the restoration of Horicon Marsh in the late 1920s. Wetland restoration programs – managed by state and federal departments and private conservation organizations – have restored an estimated 70,000 acres of wetlands since 1991. In the spring of 2001, Wisconsin was the first – and remains the only – state to pass a wetland protection law to fill a regulatory gap created by a January 2001 decision of the U.S. Supreme Court that opened hundreds of thousands of wetland acres in Wisconsin to development.

Wisconsin is also **the nation's leader in small dam removal and river restoration**, with more

Horicon Marsh - United States Fish and Wildlife Service

Since the problems of deteriorating waterways and aquatic ecosystems are multi-faceted, there are many restoration approaches you can take in or near your community. These include:

- Mobilize conservation groups and volunteers to remove invasive species
- Educate boaters about how to prevent the spread of invasive species
- Remove or immobilize excess nutrients, such as phosphorus, in water bodies
- Clean up pollutants such as PCBs and mercury
- Remove small dams from nearby streams or rivers
- Restore wetlands and integrate existing wetlands into planned development
- Restore shoreline habitats by planting buffers of native vegetation along rivers, streams and lakes
- Provide incentives and resources to residents to restore wetlands and shoreline ecosystems on their property
- Ensure that city zoning ordinances are friendly to wetland and shoreline restoration

Unraveling the Past: What are we restoring to?

When we speak of restoring a natural area or ecological system in North America, we are often talking about restoring it to *pre-European settlement conditions*. However, every site has a unique history that can influence the restoration goals and outcomes.

When planning your restoration project, it is to acquire soil maps and aerial photographs of the property at: www.wi.nrcs.usda.gov

You may also obtain aerial photographs from the Wisconsin State Cartographers Office website at www.sco.wisc.edu, and topographic maps from the Wisconsin Geological and Natural History Survey at (608) 263-7389 or www.topozone.com.

It is also helpful to interview previous landowners or a town historian to learn how the site has changed over time.

According to the Wisconsin Wetlands Association, "the most ecologically sound and most cost-efficient approach to wetland restoration is to restore degraded, formerly drained wetlands by systematically undoing the activities that were done to alter them."

Restoring pre-European settlement conditions is often impossible, and "restoration" may mean improving certain environmental functions, such as water filtration or biodiversity. Learning more about the history of the site will help you

WATER WISDOM

Dam Removal on the Baraboo River

On October 11, 2001, the old Linen Mill Dam west of the city of Baraboo was removed, allowing the Baraboo River to run free for the first time in 150 years. The river's 115 miles are the longest stretch of flowing water in the United States to be restored through dam removal.

The city of Baraboo and other communities along the river are experiencing economic benefits – for example a riverwalk and a number of restored buildings with a river view. Other benefits include cleaner water, downstream safety and better fishing.

Since restoration, the fish populations in the Baraboo River have changed from mostly carp to smallmouth bass, a fish that thrives in clean water. Sturgeon from the Wisconsin River will likely return to spawn in the river, signaling a genuine return of the river to its historic character (the name Baraboo comes from the French "de la

See also *Dam Removal: A Citizen's Guide To Restoring Rivers,* a handbook produced by the River Alliance of Wisconsin and Trout Unlimited that is designed for citizens, groups, local officials and others who are interested in learning about the option of dam removal: www.wisconsinrivers.org/SmallDams/toolkit-order-info.html

River Alliance of Wisconsin
306 East Wilson Street, #2W
Madison, WI 53703
(608) 257-2424
www.wisconsinrivers.org

Devil's Lake Phosphorus Removal

The 372-acre Devil's Lake in Sauk County has received excessive inputs of phosphorus since the late 1800s from resorts and cottages historically located around the lake, a broken sewer pipe during the late 1970s and early 1980s, and runoff from farm fields on the southwest bluff. Because Devil's Lake is a seepage lake with no natural outlet, these phosphorus inputs have led

Devil's Lake State Park - Robert Queen, Wisconsin Department of Natural Resources

algae that have become especially noticeable since the mid 1970s.

The Department of Natural Resources is undertaking a 15-year project to reduce phosphorus by constructing a siphon pipe system to withdraw water from the deepest part of the lake, where phosphorus accumulates in bottom sediments. Since 2002, 1,358 pounds of phosphorus have been removed.

Reducing the phosphorus should indirectly help reduce the incidence of swimmer's itch, lower mercury levels in fish, and enhance the cold-water fishery in Devil's Lake.

WI Department of Natural Resources
680 North Park Street
Madison, WI 53706
(608) 261-7593

Linen Mill Dam Removal
Baraboo, Wisconsin

Before

After

Wisconsin Department of Natural Resources

Underwood Creek Restoration

Underwood Creek is a sub-watershed of the Menomonee River Watershed, which empties into the Milwaukee River and Lake Michigan. In the 1970's, much of Underwood Creek was diverted from its original course and channelized with concrete.

Friends of Milwaukee's Rivers is undertaking a restoration project on Underwood Creek in order to improve water quality, restore floodplain, provide some natural flood storage, restore hydrological connections, and improve aquatic and terrestrial habitat.

Friends of Milwaukee's Rivers has hosted meetings with stakeholders to facilitate the rewatering of the original, natural streambed of Underwood Creek. They have also promoted stream naturalization in Elm Grove and Wauwatosa in coordination with flood control management efforts of municipalities and the Milwaukee Metropolitan Sewerage District. The project also includes an outreach and education program to promote small-scale stormwater management techniques in the watershed.

Friends of Milwaukee's Rivers
1845 N. Farwell Avenue, Suite 100
Milwaukee, WI 53202

Resources for Wetland Restoration

The Wisconsin Wetlands Association publishes an excellent guide for wetland restoration: *Wetland Restoration Handbook for Wisconsin Landowners, Second Edition*. The handbook targets landowners, but much of the information can be applied at the municipal level as well. The book includes detailed instructions on how to assess, plan and implement a wetland restoration, plus a wealth of educational resources, regulatory information, and information on restoration incentive programs.

Wisconsin Wetlands Association
222 S. Hamilton Street #1
Madison, WI 53703
(608) 250-9971
www.wiscwetlands.org

Burnett County Shoreline Preservation and Restoration Programs

Burnett County provides financial incentives and tax deductions to shoreline property owners who place a voluntary covenant on their property committing them to maintain natural shoreline vegetation. In addition, financial assistance in the form of cost-sharing (70% county/30% landowner) and technical assistance are available to help landowners pay for plants, materials and labor to restore shoreline buffers when these have been altered or destroyed.

Burnett County
Land and Water Conservation Department
7410 County Road K, #109
Siren, WI 54872
(715) 349-2186

Volunteer Invasive Species Removal

Throughout Wisconsin, community volunteers are working with the Department of Natural Resources and youth groups to restore waterways infested with invasive species.

Students at Minocqua/Hazelhurst/Lake Tomahawk Middle School launched the Milfoil Masters program in 2002. The program offered workshops and materials to educate boaters about preventing the spread of Eurasian water-milfoil. The group also coordinated weekly water inspections, published newsletter articles and organized information meetings and television public service announcements. In 2004, the statewide Clean Boats, Clean Water program is picking up where the Milfoil Masters left off.

UW Extension-Lakes Program
800 Reserve Street
Stevens Point, WI 54481
(715) 365-2659
www.uwsp.edu/cnr/uwexlakes

Meanwhile in southeastern Wisconsin, the Lake Pewaukee Sanitary District worked with a sixth grade class at Pewaukee Middle School to combat purple loosestrife through raising and releasing *Galerucella* beetles, a species that feeds uniquely on the aggressive wetland invader.

Purple Loosestrife - Miles Falck, Great Lakes Indian Fish & Wildlife Commission

Purple Loosestrife Bio-control Coordinator
UW Extension / WI Dept. of Natural Resources
1350 Femrite Drive
Monona, WI 53717
(608) 221-6349
www.dnr.state.wi.us/org/land/er/invasive

Improve

Chicago City Hall's Green Roof - Madison Environmental Group, Inc.

As our communities grow and change, there are constant opportunities to improve development practices to better steward our water resources.

The Problem: Conventional development practices often miss opportunities to improve water resources.

Communities are continually building, redeveloping and redesigning structures and infrastructure. Farmland is purchased and transformed into new suburban homes and office parks. Shopping malls are renovated and new office buildings replace old ones. Homeowners move in and out of neighborhoods, renovating older homes and planting trees and gardens.

How we approach all of these developments has implications for the water resources in our communities. When we build without considering the flow and drainage of stormwater, the existence of wetlands, or the shorelines of our lakes and rivers, we create numerous problems:

- Basements and streets flood
- Sewers overflow and release untreated waste and stormwater into lakes and rivers
- Beaches close due to excess contaminated runoff to our lakes and rivers
- Costs of wastewater pumping and treatment increase
- Shorelines erode, depositing excessive soil and nutrients into water bodies
- Local groundwater levels decline because of reduced recharge
- Critical urban wildlife and plant habitat

Flooded Highway, Central Wisconsin - Madison Environmental Group, Inc.

The Solution: Improve water resources through stormwater best management practices and green infrastructure.

As our communities grow and change, there are constant opportunities to improve development practices to better steward our water resources. We can take advantage of these opportunities by implementing measures to appropriately manage stormwater and by including green infrastructure in the planning process.

Stormwater Management

Traditional stormwater management practices aim to rapidly move stormwater away from buildings and streets via gutters, sewers and artificial channels. This approach prevents water from naturally soaking into the ground to recharge groundwater resources, moves pollutants directly into lakes and streams, and can increase the frequency of flooding. Rather, developments should be planned and constructed using stormwater best management practices, with the goals of:

- Reducing the amount of impervious (or impermeable) surface areas in order to reduce stormwater runoff
- Utilizing the landscape and soils to naturally move, store and filter stormwater runoff

To effectively manage stormwater, developers and municipalities should consider:

- Green roofs - rooftop gardens that capture rainwater and improve air quality
- Rain barrels and cisterns to capture rainwater from downspouts
- Permeable paving for parking lots and access roads to reduce runoff and improve infiltration
- Natural landscaping with native species that require less water and maintenance
- Filter strips (vegetated areas adjacent to impervious surfaces) to slow the flow of stormwater runoff and clean out pollutants
- Rain gardens that allow rainwater to infiltrate into the ground and provide a natural system to filter contaminants
- Drainage swales (broad, vegetated channels) to move and temporarily store stormwater runoff
- Naturalized detention basins that emulate lakes and wetlands to store and gradually release stormwater runoff
- Vegetative buffers along shorelines to prevent erosion, filter out pollutants and provide wildlife habitat

Climate change scenarios predict that extreme storm events will become more common, necessitating adaptive and more effective approaches to managing stormwater. For information on how climate change may impact your community, see the DNR publication

Green Infrastructure

When we think of infrastructure we typically think of built structures – such as roads, electric power lines and water systems – and social institutions such as schools, hospitals and libraries.

The concept of *green infrastructure* recognizes that the natural environment is equally important to the built and social infrastructure in providing a foundation on which our communities can function and grow. Green infrastructure is an interconnected network of land and water that supports native species, maintains natural ecological processes, sustains air and water resources and contributes to the health of our communities.

Alliant Energy Greenspace, Fond du Lac

Dog Park Prairie Redevelopment Plan - Madison Environmental Group, Inc.

Latticed Pavers for Water Infiltration - Katie Owen

Examples of green infrastructure include:

- Planning developments in areas that optimize the use of wetlands for retention and filtering of water
- Buffering lakes and rivers with naturally landscaped green areas
- Designing trails and parks that provide access to lakes and rivers

Green infrastructure highlights water resources in your community that will draw manufacturers and businesses looking for clean water, as well as residents looking for recreational opportunities and an attractive place to live. Thinking in terms of green infrastructure can also save communities money by determining the most efficient, cost-effective locations for development and growth.

WATER WISDOM

Green Roofs in Chicago and Milwaukee

The **City of Chicago** is a national leader in creating and promoting green roofs, including a 20,300 square foot garden on top of City Hall. Green roofs help manage stormwater and improve water quality by retaining and filtering rainwater through the soil and roots of the plants. In addition, green roofs reduce heating and cooling costs, keep buildings cooler, improve air quality and create an attractive relaxing retreat on previously unused space. The City is collecting data to monitor temperature, energy savings, and changes in runoff to evaluate the gardens and provide advice to other municipalities.

Chicago Department of Environment
30 North LaSalle Street, Suite 2500
Chicago, IL 60602-2590
(312) 744-5903

Chicago City Hall's Green Roof - Madison Environmental Group, Inc.

The Milwaukee Metropolitan Sewerage District is also experimenting with green roofs for stormwater management. It recently installed 435 containers with a synthetic growing material and native prairie plants on the roof of the headquarters building in downtown Milwaukee.

Milwaukee Metropolitan Sewerage District
260 West Seeboth Street
Milwaukee, WI 53204
(414) 277-6383
www.mmsd.com

Rain Garden Streets in Madison

The City of Madison's Engineering Department and the Friends of Lake Wingra propose to build a rain garden demonstration on a street scheduled for reconstruction within the Lake Wingra watershed. A rain garden is a plot of deep-rooted native species planted in a depression to absorb stormwater runoff from impermeable surfaces such as roofs, driveways, streets and parking lots. The street will be planted with extensive rain gardens along the terraces and extending into the street in places. The design of the street will allow rainwater to run into the garden, thereby reducing the quantity of runoff and nonpoint source pollutants into Lake Wingra. This project will include outreach to help the community understand the impact of urban runoff on our lakes and how infiltration can help mitigate these impacts.

Friends of Lake Wingra
1000 Edgewood College Drive
Madison WI 53711
(608) 663-2838

Terraced Rain Garden, Madison - Sue Ellingson

City of Madison Engineering Department
210 Martin Luther King Jr. Boulevard, Room 115
Madison, WI 53703
(608) 266-4751
www.cityofmadison.com/engineering/stormWater/Adams_street.htm

Seattle Street Edge Alternatives Project

Similar to Madison's Rain Garden Streets, the City of Seattle conducted a Street Edge Alternatives project in 2000. The objective was to modify an existing residential street so the drainage more closely followed natural drainage patterns. By narrowing the street, using a curvilinear street design, and incorporating swales and natural vegetation, the project reduced the total volume of stormwater runoff by 98% during a two-year storm event.

Seattle Public Utilities
Key Tower
700 Fifth Avenue, Suite 4900
Seattle, WA 98104
(206) 684-4601

Headwaters Project in British Columbia

Another similar, but larger, project has been undertaken in Surrey, British Columbia, called The Headwaters Project. It aims to create more sustainable urban communities that make use of natural designs to decrease stormwater runoff, among other things.

University of British Columbia
Landscape Architecture Department
2357 Main Mall
Vancouver, BC Canada V6T 1Z4
(604) 822-5148
www.sustainablecommunities.agsci.ubc.ca/projects/Headwaters.html

Green Infrastructure in Whitewater

The City of Whitewater and the Whitewater Community Development Authority recognized an opportunity to use green infrastructure to revitalize its downtown and lakefront by creating Cravath Lakefront Park in 2001. The city transformed a once-blighted waterfront area into a vibrant community park providing accessible, diverse, connected and engaging open space for the city's residents and visitors.

The project improved connections between downtown, older neighborhoods and the UW-Whitewater Campus, and tied together several city buildings bordering Cravath Lakefront Park and along the Whitewater Creek Path. The centerpiece of the park is Lakefront Center, which reflects architectural themes from the Whitewater historic train

Cravath Lakefront - City of Whitewater, Wisconsin

depot, located at the foot of the park. This green infrastructure project engages the community's history while providing a year-round gathering site and venue for community festivals and events.

Whitewater Community Development Authority
402 West Main Street
Whitewater, WI 53190
(262) 473-0540
www.cityofwhitewater.com

Community Open Space Partnership
200 North Blount Street
Madison, WI 53703
(608) 255-9877
www.ouropenspaces.org

Thank You

Thank you for taking action to protect, conserve, restore and improve Wisconsin's water resources. We invite you to share your community's experiences and achievements with us for our next edition.

Clean Wisconsin

Living Machine at Cedar Grove Cheese

Cedar Grove Cheese makes traditional, specialty and certified organic cheeses in Plain, Wisconsin. Wastewater from the factory is cleaned using a Living Machine™, a series of tanks containing plants, algae, fish, invertebrates and a diversity of microorganisms and bacteria. The system uses natural ecosystem processes to break down waste. After processing, the clean water is discharged into Honey Creek, a tributary of the Wisconsin River. The Living Machine™ is open to the public for tours. This is a clear example of how thinking about wastewater treatment facilities can be changed.

Cedar Grove Cheese
E5904 Mill Road
PO Box 185
Plain, WI 53577

Living Machine - Peter DeWaard, Cedar Grove Cheese

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Wisconsin's Water Policies website. www.aqua.wisc.edu/waterpolicy

Xeriscape Colorado! Inc. website. www.xeriscape.org

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Lake Monona, Madison - Per Kieland-Lund

clean water

The Wisconsin River flows 430 miles before joining the Mississippi River - Michael Wolfertz

clean wisconsin

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