County of McHenry – Division of Water Resources

Water Resources Action Plan

Section III: Water Conservation

Prepared by:
Cassandra McKinney – Division of Water Resources &
Groundwater Protection Task Force

Professionally Edited: Carl Vogel

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Items in Blue – Appendix or Attachment available

Items in Red – Definition available

Water Resources Action Plan
Section 3. Water Conservation
A) Introduction

The Water Conservation Section of the McHenry County Water Resource Action Plan (WRAP) is designed to foster a culture of conservation. It is a resource to be used by McHenry County business owners, farmers, homeowners, water service providers, and government officials to achieve greater water efficiency and help sustain the county's water resources.

Historically, McHenry County's water resources have been viewed as inexhaustible. In years with normal levels of rainfall, McHenry County's water resources are plentiful; however, the county's water supplies are vulnerable to inevitable drought conditions. The county's growing population and economy have the potential to intensify this vulnerability, as identified in the 2007 Groundwater Resources Management Plan.

McHenry County residents, businesses, and water providers face the necessity of changing how to view water resources. As the commitment to sustaining water resources grows, dependence on restrictions and emergency water-use reductions will diminish. Water conservation does not lower quality of life or deter business. It can lead to more efficient and effective business operations and help water users recognize the value of water. The ultimate goal of water conservation is to maximize the benefit from each gallon used, while not preventing water use.

What is water conservation

Water conservation is defined by the US Water Resources Council as activities designed to (1) reduce the demand for water, (2) improve efficiency in use and reduce losses and waste of water, and (3) improve land management practices to conserve water.[1] Conservation, implemented as a long-term water management practice, is fiscally responsible and can enhance the county's ability to grow.[2]

Although the terms water withdrawal and water use are often used interchangeably, the two have different meanings,. *Water withdrawal* is the removal of water from a natural water body, such as a river, stream, or aquifer.[3] *Water use* is the utilization

[1] Alliance for Water Efficiency: Glossary of Common Water Related Terms.
[2] Georgia Comprehensive State-wide Water Management Plan. Section 2: Definitions (40) and Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs.
[3] See O.C.G.A. Section 12-5-31

of water for natural and human uses.[4] After water is used, some portion of that water is usually returned to the source. Consumptive use is the difference between the total amount of water withdrawn from a water body (aquifer or stream), and the total amount of that withdrawn water that is returned to that same water body over a specified period of time.[5]

Though conservation does entail some expense, it is a highly cost effective water management practice when compared to major structural practices such as boring new wells, transferring water, and building reservoirs. To experience the array of benefits water conservation offers, it should be fully integrated into a mix of water management strategies and implemented as a cost effective, long-term water management practice.

Water in McHenry County

Throughout McHenry County's history, its diverse water users and local economy have benefited from opportunities to withdraw water to meet growing demands. While local water resources may appear to be abundant, McHenry County's water resources are actually finite.

The McHenry County Groundwater Resources Management Plan (GRMP) indicates that in the year 2000, water use in the county amounted to an annual average of 34.6 million gallons per day (mgd). The baseline forecast indicates that average annual water use will grow to 51.0 mgd by 2020, and by 2030 that number is estimated to rise to 67.5 mgd, using the forecast 2020 per capita water use and the 2030 CMAP population projections. It is important to note that during the drought of 2005, the Chicago Metropolitan Agency for planning estimates that McHenry County withdrew approximately 50.6 million gallons per day from its groundwater aquifers,[6], nearly the average annual water usage projected for 2020.

The existing and anticipated rate of growth has sparked concerns regarding the impact of growth on local natural resources, including groundwater. Water is critical to sustaining a healthy economy and a high quality of life for McHenry County residents. The water withdrawn from the county's aquifers supports a broad range of uses, which this plan categorizes into five major water use sectors.

Improperly managed withdrawals and excessive consumptive use can negatively impact McHenry County's aquifers, its water uses, and the environmental services waters provide. Because drought occurs in Illinois and local aquifers are susceptible

[4] Georgia Comprehensive State-wide Water Management Plan. Section 2: Definitions.
[5] Georgia Comprehensive State-wide Water Management Plan. Section 2: Definitions.
[6] B.Dziegielewski and F.J. Chowdhury. 2008. Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050. Project Completion Report. Southern Illinois University Carbondale. Available at: http://www.cmap.illinois.gov/WorkArea/showcontent.aspx?id=10294 2005 was a drought year. Normal withdrawals would have been closer to 38.8 MGD.

to overuse, proper management of water withdrawals is important to sustain McHenry County's groundwater resource for current and future populations.

McHenry County also faces uncertainty regarding impacts that global climate change may have on the region's climate conditions. Scientists around the world believe that changes in the climate may have negative impacts on water supply reliability, flood risk, and ecosystem health.[7] They warn that current water management practices are likely to be inadequate in the face of changing patterns of temperature and rainfall.

In January 2006, the Governor of Illinois issued Executive Order 2006-1, which called for a comprehensive program for state and regional water supply planning and water management, a strategic plan for its implementation, and development of Regional Water Supply Plans in two Priority Water Quantity Planning Areas. The eleven counties of northeastern Illinois, including McHenry County, is one of those two priority planning areas.[8] The regional planning initiative launched in November 2006 and the resulting Regional Water Supply Plan – *Water 2050* - was completed in March 2010.

The Water Conservation section draws on three sources of data regarding water use in McHenry County. The first and primary source of data is the *2006 Groundwater Resources Management Plan*[9] written by Baxter and Woodman. The second source of data is the *Regional Water Supply Plan – Water 2050*[10]. The third source of data is the *2008 Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*[11].

McHenry County Water Resources Division will publish an annual report indicating the status of progress on implementing the elements of the Water Conservation section of the WRAP. This section will be reviewed and revised every five years as part of the cycle to update the Water Resource Action Plan, and new data and technology will be incorporated.

In addition the to the regular five year updates, McHenry County Water Resources may also periodically update the section with supplemental information. Comments

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[7] Kundzewicz, Z.W., L.J. Mata, W. Arnell, P. Doll, P. Kabat, B. Jimenez, K.A. Miller, T. Oki, Sen and I.A. Shiklomanov, 2007: *Freshwater resources and their management. Climate Change 2007: Impacts, Adaptions and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, 173-210.

[8] Chicago Metropolitan Agency for Planning and NE IL Regional Water Supply Planning Group Regional Water Supply Plan, March 2010. Water 2050.

[9] McHenry County Groundwater Resources Management Plan, June 2007.

[10] Chicago Metropolitan Agency for Planning and NE IL Regional Water Supply Planning Group, 2009. Draft Northeastern Illinois Regional Water Supply Plan.

[11] B. Dziegielewski and F.J. Chowdhury. 2008. Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050. Project Completion Report. Southern Illinois University Carbondale. Available at: http://www.cmap.illinois.gov/WorkArea/showcontent.aspx?id=10294

and/or suggestions regarding topics McHenry County Water Resources might consider including in these updates and/or supplemental information may be addressed to: McHenry County Planning and Development - Division of Water Resources, 2200 N Seminary Ave, Woodstock, IL, 60098.

Benefits of water conservation

Case studies, research projects, and programs throughout the world have documented that water conservation is a powerful demand management tool that can extend the life of existing supplies, eliminate the need for costly new or expanded supplies, lower water treatment costs, and preserve water for recreational and environmental needs and future economic development or environmental opportunities.[12]

The ultimate goal of water conservation is not to prevent water use, but to maximize efficiency and the benefit from each gallon used. Efficient water use is considered the minimal amount of water that is technically and economically feasible to achieve an intended water use function.[13] Efficient use can be maximized by implementing water conservation efforts to:

- Reduce water waste, which is water that meets an intended use, but may not be considered efficient
- Reduce water loss, which is water that does not make it to an point of intended use, usually due to leaks or faulty equipment
- Reduce efficient water use, which when necessary, can be accomplished through the use of new or high-efficiency technology or changing water using behavior.

With water conservation, businesses can streamline operations and reduce operating costs. Water providers can significantly reduce water treatment and production costs. Landscapes can be less vulnerable to drought conditions. At the county or regional level, investments in water conservation today may afford water users in the same region the opportunity to provide water to more users in the future. At the watershed level, reducing the volume of water drawn from an aquifer may protect base flow in rivers and streams, thus maintaining aquatic environments and recreational opportunities of that river or stream.

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[12] U.S. EPA. 2002. "Cases in Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs." Office of Water EPA832B02003. 2002; Pacific Institute. 2003. *Waste Not, Want Not: The Potential for Urban Water Conservation in California* www.pacinst.org; AwwaRF and U.S. EPA 2007. *Water Efficiency Programs for Integrated Water Management. www.awwarf.org*

[13] Georgia Comprehensive Statewide Water Management Plan. Section 2: Definitions, (47) "Water use efficiency"

Recommendations in the Water Conservation Section

For most water users, this section helps identify practical ways to conserve water. For local governments and regional organizations, this section helps evaluate and identify practices appropriate for the water users within their service area and/or region. For state-wide associations, organizations, and agencies this section helps organize water management efforts to achieve common goals. All of these goals within the Water Conservation Section (WCS) have been developed with assistance from the McHenry County Groundwater Task Force and the Water Conservation Implementation Plan for the State of Georgia.

The recommendations in this section provide a framework of water conservation designed to foster a culture of conservation among McHenry County's diverse water users. The framework is flexible. It is designed to help water users within a particular sector choose the recommendations and practices appropriate for their situation and current level of efficiency and to encourage multiple levels of assistance from a host of organizations and associations. The framework has four major elements:

- **Water conservation goals** are sector-specific, long-term aspirations for water use and efficiency. The goals are not one-size-fits-all targets for reductions in water use; they were designed to be flexible, so that they are applicable for users with differing circumstances and recognize prior investments in conservation.

- **Recommendations** are quantifiable metrics of efficiency. These measures can help determine progress toward a long-term water conservation goal. In cases where additional data are necessary, time-oriented activities are the recommendations to help determine progress toward a particular water conservation goal.

- **Best practices menus of options** are compilations of practices that those within the water use sector can implement to achieve Recommendations and reach goals. The water conservation practices included in the menus are considered to be generally cost-effective and applicable for McHenry County water users. Inclusion of practices, however, does not imply that all users within a sector should implement each practice. Each water user should evaluate the practices in the menu to determine those that are cost-effective and beneficial to them.

- **Implementation actions** identified throughout the section include activities, such as providing technical guidance or financial assistance or evaluating general conservation trends. When resources are available, the implementation actions can be taken by local governments, agencies, associations, organizations, and other groups to support the implementation of practices.

As an implementation plan, the WCS has four primary functions:

1. Educating water users: Each chapter contains a menu of water conservation practices that can help water users within that sector achieve their Recommendations and goals. The menu provides individual water users many options that can conserve water and, in some cases, save money.

2. Informing local governments and water providers: When a gap exists between the forecasted demand and available water supplies, this section's recommendations can identify additional water conservation practices or investments in efficiency. Local governments and water providers can determine the mix of water management practices most appropriate for their service area. To assess the benefit of water conservation, local governments and water providers should consider the cost per unit of saved water or reduced demand and compare it to the cost per unit of developed water that can be achieved from the other water quantity management practices. If a gap does not currently exist between forecasted demand and available supplies, there still may be shortfalls in supply or unexpected growth/demands in the future.

3. Helping sector member's work together: The recommendation include actions that can be taken by the associations and organizations affiliated with each sector, serving as an educational and organizational tool for McHenry County's major water use sectors. Major water use sectors can benefit through a growing culture of conservation within their sector. When the majority of users within the sector join the effort to conserve water, new strategies and technologies for conserving water will be developed and adopted more quickly. In addition, as people become aware of the importance of water conservation, water use sectors can benefit from showing themselves to be leaders in the drive to sustain water resources.

4. Providing sufficient water availability to sustain aquatic ecosystems, economic development, and residents. The WRAP has a primary goal of sustaining water resources for the built and natural environments. Water conservation is recognized as an effective and efficient management practice. Through cooperative planning and a proactive approach, water conservation can assist the county and its local governments in meeting the county's future water needs.

Creating a Culture of Conservation

The culture of conservation is one that encourages people to more fully appreciate natural resources and actively participate in their protection. McHenry County's culture of conservation should strengthen individual and collective commitments to water conservation as an effective way to sustain water resources for current and future generations. This culture of conservation can be realized through the pursuit of seven fundamental water conservation goals, which are reflected throughout this sections recommendations:

1. Educate and empower water users: Education and outreach efforts should foster an understanding, not only among those within the same water use sector, but also among the public at large. Educational efforts should also build appreciation for the multiple uses to which water is put in this state, the challenges to the water resources, and the steps that can be taken to use less water. Local governments, state agencies, nongovernmental organizations, and professional associations all play a role in implementing educational programs and disseminating information to McHenry County's diverse water users.

2. Create incentives to encourage water use efficiency: In many cases, users lack the financial and technical resources to initiate a successful water conservation program or implement a water conservation practice. Local governments and organizations and associations affiliated with major water use sectors should consider instituting new programs or enhancing existing programs that provide financial incentives, funding or technical assistance. Financial incentives, such as conservation oriented rate structures for customers of public water providers, can help people understand the value and cost of sustaining healthy water supplies. In addition, recognizing water users who have achieved high levels of water efficiency can be highly effective at promoting a culture of conservation.

3. Enhance data collection, monitoring, research and evaluation: This plan encourages further study of water use, water conservation practices, and the effect of water conservation investments, so that water users are able to make the best possible decisions when managing water supplies. Local and state governments, research institutions, special interest groups, conservation organizations, and professional associations are encouraged to support building a stronger scientific foundation of the science of water conservation in McHenry County.

4. Measure water use efficiency: Water efficiency metrics vary across water use sectors, so no single way to measure efficiency exists. For example, water users in the industrial and commercial sector are able to measure the amount of water used for each unit of output. However, this metric is not useful for the agricultural sector, since natural rainfall greatly affects the amount of irrigation that will be necessary.

5. Plan for the future: Water users within all sectors should prepare various kinds of management plans so that they can be prepared to meet future challenges (such as resource limitations or growing demands for a particular product). Water users

should integrate water conservation goals and practices, as well as their potential costs and benefits, into long-term plans to ensure all sectors continue to advance towards more efficient water use.

6. Integrate water conservation and energy conservation: Large amounts of water are needed to produce energy at thermoelectric power plants, and significant energy is used to treat and transport water to customers. In homes and businesses, much of the energy used for domestic purposes is to heat water in kitchens and bathrooms. Also, farmers can use large amounts of energy and fuel to pump and deliver water to crops. Each is dependent on the other, but energy and water are rarely integrated in local or statewide plans and policies.

Today, understanding of the relationship between energy and water is limited by a lack of data. There are efforts underway to fill this information gap.[14] During the development of the Regional Water Supply Plan, delegates identified the interrelationship between water and energy as an important area of policy concern and thus created nine stakeholder-interest groups, including business, industry, and power.[15]

The WRAP is an opportunity to build on the information gathered by CMAP in addressing issues related to water and energy, focusing specifically on the intertwined relationship of energy and water conservation efforts. Where appropriate, the WCS addresses energy issues by encouraging:

- The assessment of the feasibility of integrating water and energy demand planning
- Partnerships to build the information critical for make informed decisions related to the management of McHenry County's finite natural resources
- The education of McHenry County's citizens about the benefits of conserving energy and water resources.

7. Secure funding to implement water conservation: Implementing water conservation requires capital investment. A source of funding (state, local, or federal) is necessary to provide consistent and reliable training and technical assistance to water users, as well as financial incentives to encourage greater water

[14] For example, in the US Congress a bill, known as the "Energy and Water Integration Act of 2009," was introduced in early 2009 to provide for an in-depth analysis of the impact of energy development and production on the water resources of the United States. For a copy of the draft bill, visit: http://energy.senate.gov/public/_files/S531EnergyH2OIntegrationActIS0.pdf Similarly, the World Economic Forum's "Energy Vision Update 2009" acknowledges that while energy and water challenges are global, the water solutions are, in fact, local. The report states that translating global water worries into local solutions will require not only increasing awareness of the water challenge but also better understanding of the complex relationship between water and energy. See the World Economic Forum "Energy Vision Update 2009. Thirsty Energy: Water and Energy in the 21st Century.

[15] Chicago Metropolitan Agency for Planning and NE IL Regional Water Supply Planning Group, 2009. Draft Northeastern Illinois Regional Water Supply Plan.

efficiency. At the local level, funds can be used to staff positions to help planners and water users within an area implement water conservation practices in their homes and businesses. Funding is also critical to the implementation of a water conservation program (such as a retrofit program or change in billing structures).

Fortunately, there are a variety of funding sources and professional assistance programs available to help water users, agencies, and organizations implement water conservation practices. Federal funds may be available through loans and grants. Specifically, water providers can take advantage of the Clean Water and Safe Drinking Water State Revolving Funds (SRF) to replace water meters, fix leaks and retrofit inefficient devices.[16] Also, state agencies, such as the Cooperative Extension and Department of Natural Resources (DNR) may have experts available to assist with the implementation of water conservation efforts.

Additionally, federal funds have recently been allocated to help communities and utilities invest in efficiency practices (both water and energy efficiency). The American Recovery and Reinvestment Act of 2009 provides competitive loans and grants to help communities and utilities throughout the country invest in water efficient programs. Of the $6 billion appropriated for local infrastructure improvements, 20 percent is designated for projects that "…address green infrastructure, water or energy efficiency improvements, or other environmentally innovative activities."[17]

Ongoing investments in water conservation will require water users at all levels from all sectors to invest resources and time to gain from the many benefits water conservation can provide. Unfortunately, no general pool of funding is available to assist all water users interested in water conservation projects. Where funding sources are available, they are often sector-specific, and in many cases activity-specific. Where appropriate this section identifies the funds and resources that are available to water users within the sector-specific chapters.

[16] EPA 2003. Fact Sheet "Funding Water Efficiency Through The State Revolving Fund Programs." EPA 816F03022. Available online at http://www.epa.gov/OGWDW/dwsrf/pdfs/fact_dwsrf_water_efficiency030902.pdf

[17] For a copy of the Act, visit http://thomas.loc.gov/home/bills_res.html and type in "American Recovery and Reinvestment Act of 2009."

Water Resources Action Plan
Section 3. Water Conservation
B1) Agricultural Irrigation Recommendations

Agricultural water use includes water used on farms for the production of food or fiber, as well as the water used by commercial nurseries and greenhouses with agricultural water withdrawal permits. The majority of irrigated agricultural lands are located the western half of McHenry County.

McHenry County agricultural water use is estimated to be about 7.86 mgd on an average annual basis.[18] Generally speaking, all the water withdrawn for agricultural irrigation is consumptive, however it is generally understood, that depending on the region, some amount of water does return to the source from which is was withdrawn. Agricultural irrigation needs vary by season, and the highest water use occurs during the crop growing season, May through October. As a result, during these peak irrigation months in regions with a large amount of agricultural land, agricultural irrigation can be disproportionately large compared to other uses.

Historically, much of the water used within the agricultural water use sector has not been monitored, and few studies have been conducted to assess overall agricultural water use. However, according to the USGS data compilation for 2005, the 11 counties in Northeastern Illinois had withdrawn an estimated 30.44 mgd of water for irrigation of cropland. The largest withdrawals were reported for Kankakee County (12.45 mgd) followed by McHenry County (7.86 mgd).

Table 1: Cropland Acres under Irrigation and Estimated Water Demand in 2005

County	Irrigated Cropland (acres)	Groundwater (MGD)	Surface Water (MGD)	Total Withdrawals (MGD)
McHenry	7,040	7.80	0.06	7.86

Available information indicates that irrigation of crops (7.86 MGD in 2005) is by far the largest use of water on farms in McHenry County, while non-irrigation uses such as those in livestock operations and in small on farm processing facilities are much smaller.[19]

Water used for agricultural irrigation purposes (Where available, 2005 Withdrawals indicated below)*:*

[18] Ibid.

[19] Additional information on Agricultural Water Usage is available in B.Dziegielewski and F.J. Chowdhury. 2008. Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050. Project Completion Report. Southern Illinois University Carbondale.

- **Significant** (7.86 MGD)
    - Row Crops and Small Grains

- **Moderate** (0.90 MGD)
    - Orchards and Vineyards
    - Vegetables and Truck Crops
    - Greenhouses, Nurseries and Sod Farms

- **Relatively minor**
    - Hay and Pasture Land

Water used on farms for non-irrigation purposes:

- **Relatively minor** (0.51 MGD)
    - Livestock watering and cooling, animal waste management
    - On-farm processing, cleaning, cooling of produce
    - On-farm vehicle washing, chemical mixing and shop use

Irrigation Technology

The efficiency of agricultural irrigation depends primarily on the technology employed. The technology used for agricultural irrigation has changed significantly over the past 20 years. The first irrigation systems used were sprinkler systems, which are considered inherently inefficient compared to current technologies. Later agriculturalists began to retrofit sprinkler systems and install equipment to support the use of travelers that could be used in a variety of conditions, using existing hardware and water sources.

As labor costs mounted and labor availability decreased, the preferred means of irrigating agricultural lands became center pivots, which have a 30 percent to 40 percent greater application efficiency than traveler systems. Though higher in initial costs than travelers, center pivots are more reliable, more energy efficient, have a longer operational life span, and take very little of a farmer's time. The water used by the systems is also applied to greater depths, helping plants become more tolerant to dry conditions. However, over the course of the growing season, center pivots apply more water on average than most other types of systems.

GOAL #1: Enhance their understanding of water use and levels of efficiency of existing agricultural irrigation.

In order to make informed decisions about water use and irrigation, researchers and state agencies, in close cooperation with agriculturalists, should make a concerted effort to gather more data about agricultural water use and crop needs.

This information can improve understanding of the timing of agricultural withdrawals, which can inform decisions related to managing stream flows or drought response. This data can be aggregated at the county or watershed level and used to prepare summaries about McHenry County's agricultural water use. It can also help agriculturalists plan for farm water use and measure the success of their conservation efforts.

The first steps in this information-gathering effort should be to 1) determine the efficiency of current irrigation practices in McHenry County and 2) utilize the information provided in the SIU Regional Water Demand Scenarios for Northeastern Illinois (SIU RWDSNI) report to establish a baseline of water use for agriculture irrigation. The water use information collected through the SIU RWDSNI provides a foundation for determining a how efficient Illinois's agriculture irrigation is and for establishing a statewide baseline for agricultural water use.

Water use data should continue to be collected and enhanced in partnership with the University of Illinois Extension and the Farm Bureau. Yearly irrigation audits could be conducted. Audits can provide information that is important for water planning purposes and can help agriculturalists assess the efficiency of their system and identify problems that can be addressed. Information should also be collected about the technologies (such as irrigation systems or devices) and water-using practices (such as the type of soil tillage practice or irrigation schedule) employed to produce food or fiber.

Research institutions should also initiate studies to determine the optimum levels of irrigation for different crop varieties, and then incorporate the results of their research into educational and outreach programs. Agriculturalists can use this information to choose crop varieties (see Goal #3).

Policy Recommendations

Recommendation 1A: By December 2010, McHenry County Water Resources should form a partnership with the Soil and Water Conservation District (SWCD), Natural Resources Conservation Service (NRCS), and Farm Bureau to evaluate the extent of water conservation implementation currently in place on McHenry County farms. *See Best Practice 3*

Recommendation 1B: By December 2010, an inventory should be conducted of irrigators in the county by the NRCS in conjunction with the County. Consideration should be given to place meters on all agricultural irrigation systems (note well size, well depth, and pumping capacity). *See Best Practices 1 and 2*

Recommendation 1C: By December 2011, the SIU Regional Water Demand Scenario on Agricultural Water Usage for McHenry County should be updated incorporating water use information collected from meters on agricultural irrigation

systems. This information should be utilized to establish a county-wide baseline for agricultural water. *See Best Practices 1 and 2*

Recommendation 1D: By January 2011, McHenry County should work with the NRCS, SWCD, Farm Bureau and other research institutions to assist agriculturalists with learning about the variability in water needs by crop variety. Assistance should be made available to agriculturalists wishing to calculate the water needs of their crops and to properly calibrate their irrigation equipment**.** *See Best Practice 4*

Recommendation 1E: By January 2020, water and energy auditing teams should be established to conduct voluntary irrigation audits at the end of each growing season for all irrigating McHenry County farms. *See Best Practice 5*

GOAL #2: Improve the efficiency of irrigation systems.

Improving how efficiently irrigation systems apply water to crops is one of the most effective ways of conserving water used for agricultural irrigation. The measure most often used to describe irrigation system efficiency is application efficiency. It is defined as the ratio of the amount of water reaching the plant's root zone to the amount of water withdrawn from the source.[20]

Research in Georgia and throughout the Southeast shows that 85 percent application efficiency is obtainable by existing and new agricultural irrigation systems.[21] This measure provides an achievable level of efficiency for most irrigation systems on McHenry County farms, but may be difficult and costly for some agriculturalists to achieve. This level of efficiency is most applicable for moving or set irrigation systems with excellent application uniformity, located in cool or humid climates, with low winds. Average application uniformity for irrigation systems is usually lower than excellent, therefore 85 percent application efficiency may be difficult to obtain. However, using a variety of practices and devices, all agricultural water users can work to achieve this measure.

Greater application efficiency can be achieved by changing water-using practices and installing more water efficient irrigation devices. A systematic examination of the irrigation process (from the point of water withdrawal to the point of water uptake by the plant) and the devices used to deliver water can reveal potential improvements in efficiency. The examination should determine 1) the steps in the

[20] Many industrial water users can establish similar quantifiable goals based on water input per unit of output. However, because of variations in natural rainfall, this kind of metric (i.e., inches of water applied per crop or gallons of water per pound of produce) are not useful for crop commodity outputs.

[21] Thomas, D.L. ed., 1998. *Irrigation Conservation Practices Appropriate for the Southeastern United States*. Project Report 32 by R.O. Evans, K.A. Harrison, J.E. Hook, C.E. Privette, W.I. Segars, W.B. Smith, D.L. Thomas, and A.W. Tyson.

irrigation process and if any steps can be eliminated, 2) what water losses can be reduced, and 3) what water waste can be transferred into water use.[22]

Agricultural operations can also realize greater application efficiency through irrigation scheduling. Irrigation scheduling is used to plan precisely when and how much water to apply to crops – ideally, no more and no less than needed to ensure optimal growth.[23] It can help agriculturalists eliminate unnecessary and wasteful water use on farms. Irrigation scheduling can also help agriculturalists ensure seed, fertilizers, agrichemicals, and lands are used as efficiently as possible.

Policy Recommendations

Recommendation 2A: By July 2010, U of I Extension, the Farm Bureau, the SWCD, the USDA-NRCS and other agricultural research entities should provide irrigation education to agricultural operations that irrigate. *See Best Practices 1, 3, 4, 5, and 6*

Recommendation 2B: By January 2012, all new, and by January 2020, all existing agricultural irrigation systems should have application efficiencies of 80 percent or greater. *See Best Practices 7 through 19*

Recommendation 2C: By January 2012, one quarter of agricultural operations using irrigation on their fields should adopt irrigation scheduling based on crop needs and available water supplies. By January 2017, half of agricultural operations using irrigation on their fields should adopt irrigation scheduling based on crop needs and available water supplies. *See Best Practices 15, 16, 17, 18, and 19*

GOAL #3: Agricultural operations should choose appropriate crop varieties, cropping systems and irrigation systems to maximize the efficient use of water on farms.

Agricultural operations should be encouraged to incorporate water conservation into decisions about crops and management systems, like tillage and irrigation systems, that maximize the efficient use of water on farms and conserve water. Agriculturalists can significantly reduce the amount of water needed for irrigating crops by planting water efficient crop varieties, practicing conservation tillage, and choosing water efficient irrigation systems.

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[22] Florida, Texas, and other states have used a "BMP" approach to improve irrigation efficiency. The benchmarks and practices established under this goal are similar to the BMP approach from these states.

[23] Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms*. WaterPlow Press. 446 pgs, pg 359. Irrigation BMP's can also be found on the North Dakota State University website at http://www.ag.ndsu.edu/pubs/h2oqual/watgrnd/ae1116w.htm

Cropping systems is a term used to describe a specific crop or crop rotation and the associated cultural and mechanical practices used to grow that crop. For example, conventionally tilled corn or soybeans and conservation-tilled corn or soybeans describe two different cropping systems with the same crop.

Conservation tillage systems[24] provide a method of retaining rainfall on agricultural fields so as to decrease the amount of supplemental irrigation agriculturalists must apply to crops. Scientific studies estimate that increasing the number of farms with conservation tillage systems by only 10 percent could result in water savings of 5 to 15 percent.[25] Not all agricultural land is suitable for conservation tillage systems, and certain weed pressures may also not allow for these practices as they may require deep soil tillage for effective control. However, researchers estimate that approximately half of all row-crop land may benefit from conservation tillage.[26] The selection of farm management practices is controlled by many external factors that are often more important to the farmer than conserving water. This aim of this goal is to make water use efficiency another factor in the decision process.

Policy Recommendations

Recommendation 3A: By December 2012, agriculturalists should use information developed pursuant to Goal #1 and incorporate water conservation into cropping and management choices. *See Practices 3, 4, 5 and 20*

Recommendation 3B: By January 2020, agriculturalists should increase the number acres managed under conservation tillage systems to 50% of all row-crop land, where such management practices are suitable. *See Best Practice 21*

Goal #4: Municipalities and Agriculturalists should work together to utilize wastewater for irrigation.

McHenry County has extensive wastewater treatment systems in which a large percent of treated effluent is released to a surface water source and a small amount is land applied. Two potential users of treated wastewater in the agricultural sector include turf irrigation and agricultural crop irrigation.

Turf Irrigation. Turf irrigation is the simplest of the potential uses, as water quality needs, while important, are not as stringent as they would be with agricultural use

[24] By definition, the crop must have at least 30% residue on soil surface after planting – USDA-NRCS Conservation Tillage Specification.
[25] Hawkins, G.L., D. Sullivan, and C. Truman, 2007. *Water Savings through Conservation Tillage.* University of Georgia Extension Circular 916.
[26] Personal communication Jim Hook and Gary Hawkins, UGA College of Agriculture and Environmental Science.

or as varied as they might be with industrial use. Irrigating turf in park districts, golf courses, and sod farms are good candidates for a reclaimed wastewater program[27].

Agricultural Irrigation. There are a few instances of using reclaimed wastewater on cropland in the Chicago Metropolitan Region, generally on small plots. Although agricultural reuse is permitted under Illinois regulations, some buyers have apparently instituted a policy to refuse crops which have been irrigated with reclaimed wastewater, but it is not known how widespread this policy is among purchasers.[28] For more on wastewater uses, see Section 2, B7 Wastewater.

Policy Recommendations

Recommendation 4A: By December 2011, Wastewater treatment facilities should begin discussions with agricultural and turf irrigation operations within the Facility Planning Areas (FPA's) to determine the feasibility of an irrigation connection. If feasible, connections should be coordinated and carried out.

Best Practices: A Menu of Options

Information-gathering and educational practices are primary steps that should be taken at the beginning of an effort to conserve water used for the production of food and fiber. Following information gathering, agriculturalists can choose from a variety of practices to minimize water lost to leaks, minimizing non-target application of water, minimizing wind drift and evaporative losses, schedule irrigation, and implement cropping and management practices such as conservation tillage. Partnership should be formed between U of I Ext, NRCS, SWCD, Farm Bureau, and McHenry County Water Resources to conduct the following Best Practices.

Information-gathering and educational practices

Best Practice 1: Irrigation water metering
Historically, many agricultural withdrawals have not been metered. An irrigation metering program should be established to help farms install, read, and maintain meters. The data from meters can assist agriculturalists with planning and farm management. Data from water metering allows agriculturalists to verify the volume of water used, to compute water use efficiency field by field, and to plan for future

[27] CMAP Regional Water Supply Plan, Draft Plan, July 2009.
[28] Noted by the Agriculture caucus delegate to the Regional Water Supply Planning Group, June 24, 2008 meeting. It was thought that the rationale for refusing crops irrigated with wastewater was the potential for contamination with heavy metals. Delegates from the Wastewater and Non-Municipal Water Suppliers caucus noted, however, that heavy metals are typically from industrial operations, which are regulated under the National Pretreatment Program, substantially reducing the heavy metal load reaching wastewater treatment plants. Furthermore, metals associated with the solid fraction of wastewater during treatment tend to be removed with the sludge.

water needs field by field. Agriculturalists can also compare their data against regional summaries to evaluate their comparative water use.

Implementation Actions:

1.1 Locate funding in order to obtain and install flow meters that will measure water used by all agriculturalists. Meters should be read annually and establish a database of agricultural water use.

1.2 Provide feedback reports to agriculturalists for comparison of their water use with others.

Best Practice 2: Real-time metering

Agriculturalists can monitor selected systems in real time. Real-time metering serves as an early warning system of increased seasonal demands on streams and groundwater.

Best Practice 3: Data collection on cropping and water conservation practices

Agriculturalists can document the water conservation practices already in place on their farms, including the best practices in use and the number of acres under irrigation on their farms. Surveys and an irrigation database should be developed. Once in place, agriculturalists can participate in surveys and field visits, and consider using voluntary databases of cropping and conservation practices. These data can help to develop a statewide water efficiency baseline and assist with research into the water needs of crops.

Implementation Actions:

1.3 Develop and conduct a survey to inventory irrigation frequency, duration, time of day, and quantity. Survey should be conducted annually at the end of the cropping season.

1.4 Include in the irrigation survey questions targeted at determining the extent of water conservation implementation on farms.

1.5 Conduct field visits and agriculturalist surveys to gather more information about irrigation BMPs. Farms should be selected using random sampling, and participation should be voluntary.

1.6 Report information about levels of water conservation practice implementation and examine ways to overcome barriers to implementation. This information should be used in regional and statewide water planning.

Best Practice 4: Determination of variability in water needs by crop variety

Because water use has not been monitored until recently, very little information currently exists on water needs by crop variety and production system. Such

information could help agriculturalists making management and cropping decisions, and can be incorporated into any educational efforts.

Implementation Action:

1.7 The United States Department of Agriculture Agricultural Research Service (www.ars.usda.gov) should research and conduct outreach on drought resistant varieties, cultivation techniques, and other irrigation efficiency studies. Since available crop varieties continue to change, this must be an ongoing effort.

Best Practice 5: Irrigation audits

Irrigation audits are procedures to collect and present information concerning the uniformity of application, precipitation rate, and general condition of an irrigation system and its components. Irrigation audits can inform statewide and regional water management decisions and can help agriculturalists evaluate their water use and identify inefficiencies within their irrigation system. Agriculturalists should consider participating in programs that offer audits.

Implementation Actions:

1.8 The Farm Bureau, SWCS, NRCS and the County should partner to offer on-farm audits of water and energy use on five- and 10-year cycles. The effort should use the following intermediary recommendations as guidelines:

1. By 2010, establish water and energy audit team(s) and procedure.

2. By 2012 conduct on-farm audits of water and energy use for 20% of farms

3. From 2012 to 2020 conduct audits on 10% of the systems each year.

1.9 Establish/expand financial assistance programs for cost share to agriculturalists who use audited irrigation systems that are in compliance with pre-determined performance standards (to be developed).

1.10 Report farm-specific and average water use information to each farmer. Water use information should be organized by crop type and watershed.

1.11 Secure moneys for the auditing program.

1.12 Develop new programs to measure application efficiencies and application uniformity on existing systems.

Best Practice 6: Irrigation workshops

Annual irrigation efficiency workshops and field days for agriculturalists are essential to helping agriculturalists recognize the changes needed to improve system efficiency. These efforts should include information about the practices

listed under the other goals in this chapter. The conservation practices with the most rapid payback for agriculturalists should be an educational priority.

Implementation Actions:

1.13 Develop and offer annual irrigation efficiency workshops and field days.

1.14 Establish an interagency team to coordinate activities and outreach associated with agricultural irrigation. This will include all of the information gathering and education practices covered by this plan.

Minimizing water lost to leaks

Best Practice 7: Inspecting pipes and plumbing

Water lost before it reaches the field does not help improve crop production. Agriculturalists can eliminate leaks and losses in delivery of water by inspecting pipe and plumbing in the water transmission system.

Minimizing non-target application of water

Best Practice 8: End-gun shutoffs with pivots

Water applied to forests, field borders, waterways, fencerows, and roads surrounding irrigated fields, and water sprayed onto fields irrigated by other systems does not contribute to production of a crop. Often these areas fall under irrigation as agriculturalists design and build pivots that attempt to reach the corners of irregularly shaped fields with their circular center pivots.

Best Practice 9: Subsurface drip irrigation or micro-sprinkler systems

In orchards, especially new orchards, there are traffic rows and other spaces between trees that lack tree roots needed in supplying water to the tree. Water that reaches these often grass-covered areas is wasted. Orchard studies show that it is not necessary to reach all of a tree's roots to supply all the water the tree needs. Subsurface drip and micro-sprinkler irrigation wet smaller areas of land, avoid spraying lower branches of the tree, and avoid wetting the rows in between the trees[29].

Best Practice 10: Variable Rate Irrigation (VRI) controls on center pivots

VRI can prevent water from being applied to areas where there are no crops (such farm ponds and streams), or vary the amount of water applied to areas with different water needs. When soils under a cropped portion of a pivot are highly variable, some water may fall on wet soil while in other areas fail to adequately wet

[29] For more information on Subsurface Drip Irrigation, please refer to the USDA-NRCS Field Office Technical Guide - Drainage Water Management. In addition, subsurface irrigation utilizing water level control devices on agricultural drain tiles would require very flat land to be effective and successful.

a dry soil. Using computer systems, VRI enables each part of the system *to* receive the correct amount, and thus increase efficiency.

Best Practice 11: Enhanced pivot control panels
The water application efficiency of a center pivot irrigation system can often be improved by installing a pivot control box that adjusts the system's travel speed or shuts off an end gun or boom segment based on position in the field. These include some of the functionality of a VRI, but are less expensive to install.

Best Practice 12: Field arrangement
Conventional (non-VRI) center pivot booms wet a moving radius from one end of the boom to the other. If fields are arranged so that part of the boom is covering the target crop and another part is not, water applied to the non-crop portion is wasted. If the pivot field is split among crops or only partially irrigated, the wetted portion should be aligned with pie-shaped segments.

Minimizing wind drift and evaporative losses

Best Practice 13: Low pressure irrigation systems
Where soil conditions permit, agriculturalists can lower the system operating pressure of center pivot irrigation systems and install spray nozzles with pressure regulators on drops or on the boom. Many types of modern sprinklers apply water using large droplets and limited throw. Low pressure systems with pressure regulators reduce the droplet surface area-to-volume ratio and the time it takes for droplets to travel from the nozzle to the ground. These systems use lower water pressure (depending on the designated nozzle rates) and position the nozzle as near to the ground as crop and other conditions allow.

Both reduce the exposure of irrigation water to evaporation and wind drift so that more water reaches the ground. As long as the application rate does not exceed the infiltration rate of the soil, water use efficiency is improved. Also, reductions in system pressure are usually associated with lower energy requirements and pumping costs.

Best Practice 14: Minimize or eliminate the use of high-pressure spray guns on fixed and traveler systems
High pressures are often used on fixed pipe systems and traveler systems just as they are on center pivot systems. These high-pressure systems spray water high into the air for effective coverage of land with as few sprinklers and pipe as possible. But a substantial portion of the water (often more than half) is lost to evaporation and wind drift. If these systems must be used, a lower angle of throw and lower pressures can improve application efficiency. Nozzles and lane or pipe spacing must be changed to assure complete and uniform coverage.

Scheduling practices

Best Practice 15: Night-time irrigation

In Illinois, nighttime weather conditions include reduced wind speed and lower temperature, as well as reduced thermal (sunlight) load. All of these changes reduce evaporative losses that occur, as compared with afternoon irrigation. Unattended night-time irrigation increases risks of undetected shut-down, breaks, or other system failures, but relatively inexpensive remote motoring can be added to sound alarms or place calls for corrective action.

Best Practice 16: Eliminating timer-only irrigation controls

While convenient and inexpensive for drip systems, especially those with several watering ones, timer controls for automated irrigation systems are unresponsive to the actual water needs of the soil and crop. They apply water during, and in spite of, rainfall. They apply water whether or not the crop has already removed the previous application amount from the soil, and they may miss irrigation needed when evaporation exceeds anticipated water rates.

Best Practice 17: Rainfall shut-off devices

As in residential and commercial irrigation systems with timers, adding a rainfall shut-off device can eliminate some of the wasted water. Rainfall shut-off devices can be especially effective if the return interval (time before the irrigation timer cycle is restarted) is adjusted by the amount of the rainfall actually received.

Best Practice 18: Soil moisture sensor, evapotranspiration (ET) sensor, or crop water use model to timer cycles

New technologies allow both wired and wireless communication between devices that detect soil moisture and timer controls for automated irrigation systems. Soil moisture sensors can be used to initiate irrigation as a dryness threshold is reached, or can be used to cancel a scheduled irrigation cycle because the soil already has enough moisture. Sensors can also confirm whether the irrigation water reached the necessary part of the root zone or added so much that a portion drained away unused. Sensor-based controls add complexity, cost, and some risk of failure. If designed correctly, systems failure will result in no water savings, not in loss of the crop.

ET sensors are devices that estimate the quantity of water that has evaporated from soil surfaces and has been transpired by plants during certain times of day. Generally, the sensors measure ET rates that represent water lost to the atmosphere.[30] ET sensors usually work through a series of weather stations or station networks that send advisories or data back to agriculturalists who employ the technology.

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[30] Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs., pg. 331.

Implementation Actions:

1.15 Develop and make available an interactive irrigation website to be used by irrigating agriculturalists.

1.16 Make online ET data available to those agriculturalists using ET sensors or other similar technologies.

Best Practice 19: Real-time weather and soil data and models to aid scheduling decisions

Both farmer- and consultant-operated scheduling tools are available. Many agriculturalists use climate-based (historical) estimates of weekly water use to determine the amount of irrigation needed during the crop growing seasons. Others use regional weather measurements to estimate potential maximum daily evaporation. Those can be adjusted by the growth stage and crop species to estimate actual water to be consumed by the crop. Regardless of the method used to estimate water use, rainfall must be measured in or near individual fields to determine how much of the water used by the crop should be provided by irrigation.

Cropping and management practices

Best Practice 20: Water needs to inform cropping and management practices

Agriculturalists can use information about crop water needs developed by USDA, UofI Extension, and other agricultural research entities to determine cropping and management practices and plan for water needs based on crop variety and production system.

Implementation Action:

1.17 Educate agriculturalists on typical water use by crop.

Best Practice 21: Conservation tillage

Conservation tillage[31] systems provide a method of retaining rainfall on agricultural fields so as to decrease the amount of supplemental irrigation agriculturalists apply to crops. Generally, conservation tillage systems can improve the soil so that rain or irrigation water can infiltrate the ground and be retained on-site. Interception of rain or irrigation water, i.e. the prevention of runoff, is accomplished by leaving plant residues from winter cover, grain crops, or prior crops on fields. This residual plant material can help improve the amount of growing plants can absorb from both rain and supplemental irrigation. Residues also minimize formation of crust on the soil that reduce the infiltration late season irrigation water.

[31] For more information on Conservation Tillage, see the USDA-NRCS Field Office Technical Guide.

Conservation tillage also offers other benefits such as water quality protection and reduced inputs. Agriculturalists growing corn, cotton, soybeans, and peanuts should especially consider converting land to rotations that primarily use conservation tillage systems with winter cover crops where effective.

Implementation Actions:

1.18 Kofi Ext, SWCD, and NRCS should offer education and demonstration programs, cost share programs and technical assistance.

Water Resources Action Plan
Section 3. Water Conservation
B2) Golf Courses Recommendations

The information in this chapter is designed as a resource to guide golf course superintendents (GCSs), golf course owners and managers, and professional organizations and associations involved in golf course development, maintenance, and management. This chapter principally addresses the agronomic practices associated with turfgrass and water use efficiency. However, in the spirit of fostering a culture of conservation, it also addresses water use inside golf facilities and activities that extend beyond the golf community.

- **Appendix 3.1** "References Used to Develop Section 3, Golf Courses Recommendations"

The 995 acres of golf courses in McHenry County use an estimated 1.4 mgd on an average annual basis.[32] Golf course water use accounts for more than 5 percent of the public water supply withdrawals, and, their use, like agricultural irrigation, varies seasonally. The growing season for turfgrass is April through November, and during these months golf course irrigation can be disproportionately large compared to the other water use sectors within the county (especially in areas with a large number of golf courses). Water used by golf courses tends to be highly visible to the public and provide the golf industry the unique challenge and opportunity to demonstrate water conservation efforts.

Golf courses use most of their water to maintain healthy turfgrass along the course. Irrigation of turfgrass, like agricultural irrigation, varies seasonally. The turfgrass growing season is April through November. Even during the irrigation season, irrigation needs are heavily dependent upon weather conditions and precipitation.

When supplemental irrigation is needed, GCS and managers depend on groundwater, surface water, and treated wastewater sources. GCSs and managers play a significant role in making sure golf courses are as water efficient as possible. To a large degree, the turfgrass plant is relatively efficient at utilizing water resources, but GCS and turfgrass managers can accentuate the natural efficiency of the turfgrass through many scientifically sound agronomic practices. They can also adopt a variety of best management practices (BMPs) to ensure the application and delivery of applied water is as efficient as possible, eliminating potential of loss and waste.

The appropriate practices for conserving water used on golf courses will vary depending on the local weather and soil conditions and the course circumstances.

[32] Ibid.

GCSs should develop and implement a best management practices plan that provides site-specific operating guidelines that can be used during periods of adequate and limited supply. A key component of BMPs planning is gathering water use data, and using that information to inform future water management decisions. The goals in this chapter recognize the unique nature of each golf course in McHenry County and encourage GCSs and others to adopt practices appropriate to the specific circumstances facing the course, the community, and the water resources.

GOAL #1: Form a McHenry County Golf Management Association

McHenry County Water Resources should work with GCSs and other golf management professionals to form a McHenry County Golf Management Association to achieve the goals and Recommendations presented in this chapter.

Policy Recommendations

Recommendation 1A: By September 2010, a McHenry County Golf Management Association should be formed to begin addressing the remainder of the goals in this chapter of the Water Conservation Section.

GOAL #2: Develop and implement site-specific Best Management Practices

McHenry County Water Resources should work with golf course superintendents or managers to develop and implement site-specific Best Management Practices (BMP) plans for turfgrass water conservation. BMP plans are general guidelines for golf course turf and water management. These plans can ensure that managers incorporate water conservation practices into their decisions. BMP plans are operating guidelines that can guide the GCS's management of water during periods of both adequate and insufficient supply. BMP plans can establish predetermined actions and water use responses in the event that water reductions are necessary. BMP plans should be reviewed and revised every five years.

Many GCS have implemented site-specific BMP plans. Due to typical job loss and turnover, 100 percent participation is unrealistic. However, the industry should work toward 100 percent participation in this approach to managing and conserving water on golf courses.

Policy Recommendations

Recommendation 2A: By 2011, GCSs in McHenry County should be participating in educational activities regarding BMPs, planning, and agronomic practices that affect water use. *See Best Practice 1*

Recommendation 2B: By 2012, GCSs in McHenry County should implement conservation practices that are cost-effective and develop an information base that can inform BMPs planning and decisions related to water management. *See Best Practices 5, 7, 8, 9, 10, and 11*

Recommendation 2C: By 2011, McHenry County's Golf Courses should have developed site-specific BMPs plans and submitted them to the McHenry County Golf Management Association. *See Best Practice 1 and 5*

Recommendation 2D: All new construction Golf Courses and Golf Courses undergoing renovations should consider utilizing BMPs. *See Best Practices 5 and 12*

Recommendation 2E: GCSs should review and revise BMPs at least every five years, and resubmit these plans to the McHenry County Water Resource Manager & McHenry County Golf Management Association. *See Best Practice 5 and 7*

GOAL #3: Determine a typical water use range for golf courses in Northeastern Illinois

In order to implement the BMP plan to enhance water use efficiency on golf courses, reliable data is needed to help GCSs understand typical water needs. Reliable data can also help assess the success of water conservation practices.

McHenry County Water Resources and the McHenry County Golf Management Association should work to develop partnerships with the Midwest Association of Golf Course Superintendents (MACGS), Golf Course Superintendents (GCS's), Illinois Department of Natural Resources (IDNR) and United States Golf Association (USGA). The cooperative efforts of these groups should develop a database of reliable, standardized golf course water use data to help determine the typical range of golf course water use over multiple years. This would be a helpful tool for measuring the effectiveness of water conservation efforts, newly installed technology and BMPs. Some golf courses have already implemented conservation practices, so even the earliest data may reflect water use with some conservation practices in place.

When determining a typical water use range for golf courses in Illinois, calculations should account for variations in rainfall and other climatic conditions. Water use during drought years should be given special attention when analyzing data and developing recommendations.

After preliminary calculations have been established, GCSs can use this database to measure their own water use more effectively. Since golf courses all face different conditions, direct comparisons should not be made between golf courses, and data should not be used in a punitive manner. GCSs can contribute their own data to the database and begin to assess any improvements in how efficiently water is used on the golf course.

Policy Recommendations

Recommendation 3A: Establish partnerships with the Midwest Association of Golf Course Superintendents (MACGS), Golf Course Superintendents (GCS), Illinois Department of Natural Resources (IDNR) and United States Golf Association (USGA).

Recommendation 3B: By 2012, the partnership should standardize techniques and reporting information for monitoring golf course water usage, identify an appropriate entity to maintain a database of collected water use information and begin building that database. The database should be used to record reliable water use data specific to turfgrass maintenance practices for golf courses in Illinois. *See Best Practice 6*

Recommendation 3C: From 2012 through 2020, GCSs in McHenry County should report water use information for their golf course facilities to the database. *See Best Practice 6*

Recommendation 3D: By December 2018, use database information to identify a typical water use range for golf courses in Illinois that accounts for variations in rainfall and other climatic conditions. *See Best Practice 6*

Recommendation 3E: Beyond 2020, jointly demonstrate and document progress toward improved water use efficiency. *See Best Practices 6 and 7*

GOAL #4: Encourage GCSs and other golf industry groups to help foster a culture of water conservation inside and outside of Illinois's golf industry

Since 2004, Golf Course Superintendents in Illinois have been using BMPs plans and practicing the BMPs to improve water use efficiency on golf courses. Their knowledge and experience can be applied to other areas, including those specific to turfgrass management and others. This knowledge and expertise can be shared beyond the golf course.

Policy Recommendations

Recommendation 4A: By December 2010, McHenry County Water Resources should assist the McHenry County Golf Management Association in their education and outreach efforts to encourage golf course staff to improve water use efficiency inside golf course facilities. *See Best Practices 2 and 13*

Recommendation 4B: By 2012, McHenry County Water Resources should utilize the knowledge gained with the McHenry County Golf Management Association to assist with development of site-specific water conservation BMPs for other water users with similar water use patterns, such as sports and athletic field maintenance and professional lawn care. *See Best Practice 3*

Recommendation 4C: By 2012, encourage GCSs to participate in educational programs, such as those developed by water providers and landscape and irrigation professionals pursuant to Goal #1 in Chapter 5, that aim to educate homeowners about the importance of water conservation in landscape irrigation. *See Best Practice 2*

Recommendation 4D: By 2020, encourage GCSs and other golf industry groups to help educate the non-golfing public regarding water use on golf courses across Illinois.

Best Practices: A Menu of Options

Golf course superintendents and managers can employ a variety of practices to meet the goals and recommendations in this chapter. Lacking support from outside organizations, the local GSC & Golf Management Association of McHenry County should do their best to initiate these practices.

Educational practices

Best Practice 1: Education for GCSs
The McHenry County Golf Management Association (MCGMA) and/or other golf-related associations should regularly offer educational workshops on agronomic practices that affect water use, water management, water use conservation and BMPs. GCSs and golf course staff, whether or not they are members of the association, should take advantage of these opportunities. Education material should also be developed for golf course architects and construction companies.

Implementation Action:

2.1 MCGMA (and/or the Illinois State Golf Association (ISGA) or other organizations) should offer scholarships to members and nonmembers to help them attend education events.

Best Practice 2: Education for staff, members, and the community about conservation

GCSs can develop programs to encourage course employees, club members, and others who use the facilities to conserve water both indoors and outdoors. Programs could include periodic classes at the facility and the distribution of articles, email bulletins, and other informational materials. GCSs should become more involved with local water issues. GCSs should write articles, speak at community events, and act as a local resource on water use efficiency.

Implementation Action:

2.2 The MCGMA, in conjunction with the McHenry County Water Resources should develop educational materials to assist GCSs in educating others on the facts of turfgrass and golf course water use.

Best Practice 3: Develop BMPs for others

Work to build partnerships between golf-related professionals and organizations representing water users with similar water use patterns but that have not adopted the BMPs approach to water conservation. These partnerships should develop BMPs templates for those water users.

Implementation Action:

2.3 The MCGMA should assist in developing these BMP templates.

Planning practice

Best Practice 4: Best Management Practices (BMP) Plan

These plans consist of four parts:

1) Statement of goals, process, and water conservation philosophy

2) Site assessment and information collection

3) Identification of specific and reasonable BMPs for water-use efficiency

4) Implementation and review of BMPs plan

To complete a BMP plan, the GCS should review a facility's existing water management practices and use current technical resources to identify opportunities for improved water-use efficiency and conservation. The GCS should evaluate the

elements, as described in detail in the 2007 document "BMPs and Water-Use Efficiency/Conservation Plan for Golf Courses: Template and Guidelines."[33]

- Turfgrass and landscape plant selection
- Use of alternative (non-potable) irrigation water sources
- Irrigation system design and devices for efficient water use
- Irrigation guidance/operation for efficient water use
- Landscape and golf course design for water conservation
- Altering management practices to enhance water use efficiency
- Indoor and other landscape water conservation practices
- Education
- Development of written water conservation and contingency plans
- Monitoring, reviewing, and modifying conservation strategies

Technical resources already exist[34] to help golf courses select the best practices that can be implemented or enhanced to improve how efficiently water is used on courses. GCSs who have already completed BMPs plans are encouraged to offer support and assistance to those who are still developing BMP plans.

BMP plans should be reviewed and revised every five years to identify new water efficiency opportunities and reflect updates in industry best management practices. Any improvements in efficiency that have been realized should be documented.

Implementation Actions:

2.4 McHenry County Water Resources should create an archive of BMPs plans and maintain an up-to-date list of GCSs and golf courses that have completed and filed site-specific BMPs.

2.5 Encourage golf industry associations (e.g. MCGMA, ISGA.) to adopt a "code of participation" as criteria for being a member in good standing. This practice can demonstrate a commitment by the GCS and the golf course membership and administration to the BMPs approach to water management.

[33] information obtained from the Department of Geography and Environmental Resources at the Southern Illinois University Carbondale, "Regional Water Demand Scenarios For Northeastern Illinois: 2005-2050", May 20, 2008. Tables 2.2 and 5.4. (By Carrow et al.)

[34] Available online at http://www.commodities.caes.uga.edu/turfgrass/Illinoisturf/Water/Articles/BMPs_Water_Cons_07.pdf

2.6 Encourage MAGCS and or other golf industry associations to provide water conservation and BMPs educational material and workshops offered to members (see BP 1) to nonmembers.

2.7 Encourage GCSs to publicize the successful implementation of BMPs at golf courses.

Data and Measurement Practices

Best Practice 5: Water use database

MCGMA should work with research institutions and other associations to build a database of reliable water use data specific to turfgrass maintenance practices for golf courses in Illinois, with assistance from golf courses and managers.[35] This data could be managed by a third-party independent source (e.g. the University system or a research institution) that can guarantee a secure repository that will not be used for regulatory purposes.

This database would rely on GCSs to report data from their course, which they should be able to submit via a secure web site. MCGMA should work with other institutions to establish and promote standard methods for collecting and calculating water use data in order to establish the consistency and uniformity necessary to make the data most useful.

Implementation Action:

2.8 MCGMA should work with IDNR and/or turfgrass scientists to recommend measurement methods, collection techniques, protocols for monitoring water use, and ways of demonstrating and documenting progress toward greater efficiency on golf courses. MCGMA should consider protocols and methodology established by the Irrigation Association (www.irrigation.org). These recommendations should by ground-truthed by field testing measurement techniques and protocols at different types of golf courses around the state.

Best Practice 6: Water conservation logs

Water conservation logs can help GCSs evaluate the effectiveness of water conservation practices and review and revise BMPs plans. Water conservation logs are records of all of the water management choices and water conservation practices that have been implemented at a golf course facility. The log should be

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[35] The most comprehensive manuscript specific to the agronomic practices associated with golf course water use and options for conserving water is "Golf Course Water Conservation: Best Management Practices (BMPs) and Strategies" it is available online at www.commodities.caes.uga.edu/turfgrass/Illinoisturf/Water/Articles/BMP_GCSAA_05_Chapt_ALL_ref.pdf

ongoing and include data specific to water use and conservation, and justification of practices. This log can be useful when GCSs need to demonstrate a golf course's water conservation efforts during times of limited supply or drought.

Implementation Action:

2.9 MCGMA should develop a model water conservation log.

Water efficiency practices

Best Practice 7: Leak detection and repair

Inspection and maintenance of irrigation equipment can prevent water loss due to leaks and faulty equipment.

Best Practice 8: Preconditioning turfgrass

GCSs should adjust agronomic programs (e.g. mowing, fertility, cultivation, pest management, irrigation, soil wettability, etc.) to precondition turfgrass for minimizing water needs.

Best Practice 9: Routine site surveys

GCSs can routinely conduct a site survey of golf course areas under irrigation. These surveys help GCSs identify areas that may not require regular irrigation to remain healthy.

Best Practice 10: Irrigation system audits

GCSs can perform an irrigation audit every five years. The audit can be performed internally (i.e., by GCS and staff), but documentation of methodology and results should be maintained in the water conservation log. Irrigation system audits should include assessments of irrigation devices, distribution uniformity, and delivery lines, etc. This practice works in tandem with routine irrigation system monitoring, adjustments, upgrades, and repairs.

Implementation Action:

2.10 MCGMA should work with irrigation manufacturers to identify systems and technologies that improve distribution uniformity contributing to water conservation.

Best Practice 11 – Alternative water sources

There are many ways golf courses that can use non-potable water as a primary water source. Golf course architects and construction companies can design for capture and storage of storm water within the golf course facility, so that it can be reused for irrigation. Golf courses may also want to work with local water providers,

municipal governments, and wastewater treatment plants to obtain suitable quality water for irrigation.[36]

Implementation Action:

2.11 MCGMA should work with an appropriate organization with expertise in golf course design, such as the American Society of Golf Course Architects (www.asgca.org) to identify specific design elements that could improve water capture and reuse within golf course facilities.

Best Practice 12: Improve efficiency inside golf course facilities

GCSs can work with the facility's general manager and others to identify methods and practices that reduce water use while maintaining sanitation and quality expectations. General Managers may want to take advantage of incentives offered by local and/or regional water providers or the state when available (such as toilet rebates or other fixture replacement programs).

Implementation Actions:

2.12 MCGMA should recommend BMPs for non-agronomic areas associated with golf course operations (e.g., clubhouse, kitchen, golf carts, pro shop, etc.) based on water conservation practices common to domestic water use.

3.13 Local water providers should work with golf courses to determine the most effective way to improve efficiency and share educational materials.

[36] In the summer, Huntley recycles a minimum of 34% of the water from its waste water treatment plant for use on its local golf course.

Water Resources Action Plan
Section 3. Water Conservation
B3) Industrial and Commercial Facilities Recommendations

The industrial and commercial (IC) water use sector includes large and small facilities that employ practices for cooling, heating, and processing. This water use sector includes mining activities, but does not include institutions that are owned or operated by the state (like prisons or universities). Institutions are included in the state agencies' water use sector. Consumptive water use for industrial and mining facilities will vary depending on the type of industry or the type of mining activity.

The industries covered in this chapter contribute significantly to McHenry County's economy. Water is used in nearly every aspect of IC operations, from cooling machines, to cleaning facilities, to actual production of goods. Water is vital to these businesses and the state's economic growth.

Industrial and commercial facilities and mining operations that have their own water withdrawal permits (i.e., facilities that are self-supplied) withdraw major amounts of water on an average annual basis.[37] Actual water use by industrial and commercial facilities may exceed this amount since many facilities do not hold a withdrawal permit, but purchase water from a public or private water provider. Consumptive water use for industrial and mining facilities within this sector will vary depending on the type of industry or the type of mining activity.[38]

IC facilities principally use water for cooling, heating, or processing. Some of these uses are non-consumptive, such as noncontact cooling water, and some are consumptive, such as steam generation. The most common water-using processes and activities in IC facilities are:

1. Heating to initiate chemical reactions, maintain temperature, temper metal, press material, or other such needs. These operations usually require the continuous flow of hot water or steam to maintain or raise temperatures within the operation.

2. Cooling to prepare a product for further processing, packaging, storage, or to complete a chemical process. Water may be used directly for product cooling or as a means to carry heat away from a process. Also, evaporative cooling towers are commonly used to transfer heat to the atmosphere and maintain a temperature-critical process environment.

[37] CMAP RWSPG Draft Report
[38] Ibid.

3. Vacuum systems for conducting various operations and operating equipment. Vacuum pumps require water for cooling and to enhance the sealing characteristics of the vacuum pump.

4. Air compressors for operating equipment or maintaining the pressure in a process. Water is sometimes used to cool large compressors, but most small to midsized air compressors are air-cooled.

5. Mixing or liquefying chemicals with water to promote chemical reactions. Such water use may remain in the final product, or removed by drying or settling to reclaim the final product.

6. Material cleaning.

7. Transport and control of materials between processes.

8. Dilution for proper formulation necessary to achieve the final product properties.

9. Regulated emissions control.

Determining how to use water conservation

IC facilities can realize significant benefits from pursuing water conservation. When properly researched and implemented, water conservation practices can improve facility operation, increase productivity, and reduce costs. Expenses incurred to implement water conservation practices are often offset by the financial savings that may result from reduced utility bills or reduced water pumping and treatment costs.

IC facilities can conduct a cost-benefit analysis to identify the water conservation practices that offer the best opportunities for significant water savings. A cost-benefit analysis is a tool for evaluating new water efficient technologies and methods that compares the value of the benefits to the costs incurred for implementation.

Water efficient practices should be compared to the cost of the alternatives to conserving water, including the costs of purchasing more water or the cost of developing new supplies. The analysis can help facilities select the practices that are best suited to their circumstances. When performing a cost benefit analysis, facilities should consider the practices listed in this chapter, practices used by similar facilities in their subsector and practices promoted by relevant trade and professional associations.

This chapter first presents a set of goals that can be used by a wide range of IC facilities in McHenry County to improve their overall water efficiency. Following each goal is a set of recommendations that can be used to measure progress toward these goals. The recommendations in this chapter do not set fixed dates by which conservation efforts should be completed, although they do identify the amount of time specific actions should take, from the beginning of an effort to its completion.

Following each recommendation is a menu of the best practices that IC facilities can choose to implement to help reach that recommendation or goal. The best practices are accompanied by implementation actions, which can be taken by government entities or outside organizations, when resources are available, to assist IC facilities in implementing particular best practices.

The water use in IC facilities varies by facility type, product, location, water source, and other local circumstances. The actions identified in this chapter can be easily adapted to a variety of situations. At the center of the goals and recommendations is the concept that for water conservation to be effective practices should be 1) implemented in a carefully evaluated, facility-specific manner and 2) efficiency should be quantified before and after a conservation program is started.

The water conservation section of the WRAP should be used as a resource and is not intended to prevail over any federal, state, county or municipal regulations. Where possible, efforts to conserve water should be aligned with regulatory requirements. IC facilities should not violate any water or other regulatory requirements related to air quality, waste management or others in the process of implementing the elements of this plan.

Facility-specific best practices for water conservation should be continuously updated to reflect new facility conditions and new methods or technologies as they are proven in the marketplace. Current technologies that may not be justifiable at current production levels may become justifiable as production increases and technologies mature.

IC facilities can use improvements in water use intensity to demonstrate progress toward water conservation goals, as may be required in the future. Also, acknowledging that information regarding water use intensity may be proprietary; provisions should be made to maintain confidentiality, where necessary.

This section will be modified every five years to incorporate new data and information about innovative technologies. IEPA may also periodically release supplemental information to provide users with the most accurate and up-to-date information. IC facilities can share the results of their efforts with the IEPA and/or McHenry County Water Resources to help improve the WRAP in future revisions.

GOAL #1: Industrial and commercial facilities should determine baseline water use, in terms of water use intensity.

Each IC facility should first establish a baseline of current water use, using an efficiency metric such as water use intensity or another efficiency metric. Water use

intensity is the ratio of water use to a measure of output, function, or service.[39] This metric can be employed by a wide variety of facilities to communicate a level of efficiency based on facility-specific information. Water use intensity, or other appropriate efficiency metrics, should be consistent, so, when appropriate, a facility's efficiency can be evaluated in comparison to other similar facilities in the region. The use of intensity measurements allows facilities to keep their individual water use and production information confidential, while providing a basis for comparison with similar facilities with different production levels or water use practices.

The first step in an IC water conservation program is to determine the current level, or baseline, of water use. When a baseline is established at the beginning of a program, IC facilities are better able to evaluate and quantify the effect of water conservation practices, as well as communicate their conservation successes to the others.

Measuring water use in terms of water use intensity is an effective way to begin or enhance water conservation efforts at IC facilities. Creating a facility-specific water use intensity baseline can provide IC managers with a site-specific measure of how much water is used to accomplish a particular output, function, or service. This measure can be used for comparison when water conservation efforts are enhanced or introduced. In this way, when more efficient technologies or practices are implemented in the facility, managers will be able to accurately record how much water has been saved. IC water use baselines can be calculated in a variety of ways, depending on the conditions and operations of the facility.[40]

Policy Recommendations

Recommendation 1A: IC facilities should collect data regarding water use and current water-using practices and technologies. Initial data gathering efforts should be completed within 9 months of inception. (This preliminary data collection effort should use existing data and best estimates. More detailed data should be collected once major use areas within the facility are identified as described in Goal #2.) *See Best Practices 1, 2, and 3*

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[39] A variety of output measures (the denominator in the ratio calculation) can be to develop the ratio for this metric. To represent outputs, individual facilities can use units of production (volume of product or pieces of products, etc.) or functional units, such as service life or operational space. Where confidentiality is not a significant concern, facilities may also use profit margin to develop the water use intensity measure. If confidentiality is a concern, dollar value-added may be used to protect proprietary business information.

[40] Examples of measures of water use intensity include gallons of water used per unit of production or gallons of water used per unit of revenue, or gallons of water used per area of space occupied.

Recommendation 1B: IC facilities should adopt appropriate water use intensity metric(s) for their facility and begin to use them. This effort should be completed within 12 months of inception. *See Best Practice 3*

GOAL #2: Industrial and commercial facilities should establish reduction targets for existing water uses and implement practices to achieve those targets.

Water use in IC facilities is not always efficient. For example, water may be used to move apples through a processes to produce applesauce, for example, in a manner that is beneficial but not water efficient. New, more water efficient methods of transporting apples are available. Almost daily, innovative new technologies and conservation practices are emerging from facilities and researchers throughout the country that can reduce the amount of water necessary to accomplish certain tasks. Facilities should try to achieve greater water efficiency in a systematic way, and should be able to quantify the results of their efforts.

IC facilities at the initial stages of implementing water conservation practices should begin by selecting technologies that may be available to improve their water efficiency and evaluating them using cost-benefit analysis. The estimated savings from these technologies, compared against the established baseline (as discussed in Goal #1), can be used to set water use reduction targets for the facility. When selecting the most appropriate water conservation practices, IC facility managers must consider several things, including:

1) The cost benefit of implementing the practice

2) Available water supplies and whether the water use is consumptive

3) The impact the practice may have on production safety, process yields and effectiveness, product quality and safety, and regulatory compliance

4) Periods of drought and other extreme weather conditions

After selecting a suite of effective practices, facilities should set reduction targets based on estimated water savings that the facility could achieve. The water conservation practices the facility plans to implement, as well as their reduction targets, should be compiled into a single water management plan that can be used by water managers and employees to guide decision-making. All facilities should adopt as a conservation practice an education program for their employees.

Information about technologies and practices that have documented success in achieving greater water efficiency[41] can help IC facilities create realistic estimates of

[41] Case studies can be found online at the Alliance for Water Efficiency website and at http://www.p2ad.org/documents/ma_pubs.html.

their water savings from these technologies. These reduction targets can be facility-wide, or particular to an area of water use within the facility (such as water lost to leaky pipes).

These reduction targets, and the practices that will be used to achieve them, should be included into a facility-wide water management plan. These plans can guide managers in making decisions about facility operations, and inform employees how they should perform specific water-using tasks within the facility. The plans can also show others how the facility is conserving water. In general, these plans serve to institutionalize the facility's commitment to water conservation.

The effect of water conservation efforts on facility processes and other facility resources should be a factor in evaluating alternatives to prevent negative effects on other facility and environmental resources. There are many operations within a facility where water use is superior to other "dry" technologies when operational efficiency and the environment are considered. Proper evaluation of alternatives should verify that water is the best choice for accomplishing the task at hand, and that it is used as efficiently as possible.

Policy Recommendations

Recommendation 2A: IC facilities should conduct cost-benefit analyses to identify which water conservation practices are effective and could reduce the water use intensity of their facility. This effort should be completed within 18 months of inception. *See Best Practices 1, 2, 3, and 4*

Recommendation 2B: IC facilities should identify the water reuse and water recycling practices that can help achieve reduction targets. This effort should be completed within 24 months of inception. *See Best Practice 5*

Recommendation 2C: IC facilities should implement the practices, identified pursuant to Recommendations 2A and 2B, that can help achieve reduction targets. This effort should be completed within 24 months of inception. *See Best Practices 5, 6, 7, 8, and 9*

Recommendation 2D: IC facilities should develop or update water management plan(s) that incorporate reduction targets and the water conservation practices appropriate for each facility. This effort should be completed within 5 years of inception. *See Best Practice 11*

GOAL #3: Develop programs to educate employees and those contracted by facilities about water use and water conservation efforts.

Education is critical to building a culture of conservation in McHenry County. Efforts to educate employees and those on contract with IC facilities about water use and water conservation practices will help foster this culture of conservation.

Education from industrial and commercial facilities can inform employees and contractors about the importance of water conservation and empower them to make better decisions about how water is used. Exercises that determine where water is being used inefficiently (through leaks or wasteful practices) require the commitment of the facility employees and management team. Educated employees can help change inefficient practices and repair areas where water is lost. They can also encourage their fellow employees and neighbors to understand the importance and benefits of water conservation. *See Best Practice 12*

GOAL #4: Industrial and commercial facilities should integrate water and energy conservation practices, where practicable.

Water and energy use are closely connected, water conservation and energy conservation are also closely connected. Practices implemented to improve energy savings can also result in water savings, and likewise, water efficiency practices can improve energy efficiency.

New water-and energy-efficient technologies are emerging every year. IC facilities in McHenry County should be leaders in testing these new technologies to determine the savings that can result and under which circumstances they should be implemented. For IC facilities that develop energy management plans, water conservation efforts should be integrated into them, where practicable. Energy and water conservation efforts should be complimentary, and IC facilities should consider energy use when evaluating the cost and benefits of the water conservation options.

Policy Recommendations

Recommendation 4A: IC facilities should consider piloting new state-of-the-art technologies that are considered to be feasible and have the potential to offer significant water and/or energy savings. *See Best Practice 6*

Recommendation 4B: IC facilities should update energy management plans, if applicable, to incorporate appropriate water conservation practices. This effort should be completed within 60 months of inception. *See Best Practices 10 and 13*

Best Practices: A Menu of Options

IC facilities can select a set of water conservation practices that is tailored to their particular operations and conditions. Facilities may use this list of practices, which is not exhaustive, to meet recommendations and goals. Information-gathering practices, which help facilities to gain a better understanding of their water use and evaluate their water efficiency, can be useful for any facility. Planning and educational practices can also be implemented at any facility. The most effective water saving practices will vary from site to site.

Information-gathering practices

Best Practice 1: Water audits
Regular water audits can help facilities identify opportunities to improve water efficiency and evaluate beneficial water use within the facility. Water audits can document the tasks that require water, as well as the major points of water use and the volume used at each major point of use. Water audits can also, using methods appropriate for their subsector, document all water using practices and technologies. Water audits may also, where practicable, associate water use with units of production (such as gallons of water per square foot of carpet dyed).

Water audits should be conducted when initiating a water management plan and when major process changes occur. The definition of a major process change will vary by facility. Generally, any change that results in more than a 20 percent increase or reduction in water use for that process should be re-measured.

Implementation actions:

3.1 Local IC entities with common goals should come together and petition industrial or trade associations to provide guidance on methods of documenting water use and/or conducting water audits at industrial and commercial facilities. Lacking their support, McHenry County professionals should form IC committees to take the lead in developing these practices.

3.2 The County Water Resource Manager will contact the Illinois Environmental Protection Agency (IEPA) for their assistance and training of IC facility managers in analyzing facility water use and cost savings potential.

Best Practice 2: Measuring water use
All water withdrawals should be measured. A water use measurement verification program can ensure that a facility's decisions regarding water conservation are based on sound data. Accurately measuring water use at specific points within an IC facility and correlating this water use with plant production/operation are critical to identifying areas of potential improvement and measuring improvements in efficiency.

Case studies from various IC facilities have demonstrated that continuously monitoring specific water use areas in a facility uncovers a greater number of conservation opportunities than estimates or periodic measurements.[42] Facilities should at a minimum use temporary measurement devices to monitor key water use areas for several days to see if process variations warrant closer monitoring. Many facilities have reduced water consumption with few, if any, process changes by simply posting recent water use at major use areas within a facility.

Measuring devices, such as meters, should be maintained, calibrated, and replaced according to the manufacturers' recommendations. Accuracy should be verified annually and any time measurements are in question.

Implementation Actions:

3.3 Once audit procedures have been established, the entity responsible for developing the audit procedures should provide follow-up guidance on appropriate water use measurement verification programs

3.4 McHenry County IC committees and their trade or professional associations should identify financial resources that can help facilities install devices (such as meters) needed to measure total water coming into IC facility, or where practicable.

Best Practice 3: Water use efficiency metrics
Water use efficiency metrics, such as water use intensity, allow IC facilities to more precisely identify conservation opportunities and evaluate conservation practices. Water use intensity can be measured in a variety of ways. Each IC facility should evaluate the information generated by water audits, information related to the business output, function or service, and relevant information from other facilities within their subsector, to determine the ideal water use intensity measure(s) for their facility. A specific water use intensity measure may be best for a facility (i.e., gallons of water used per unit of carpet finished or gallons used to create a toaster). Or a variety of water use intensity metrics for different operations within the facility

[42] See "Georgia Success Stories" online at http://www.p2ad.org/documents/wa_home for examples.

may be appropriate (i.e., gallons of water used to transport apples to be made into applesauce or gallons of water used for dying carpet in the facility).

Where possible or practical, IC facilities can compare their water use intensity measurements to those of other similar facilities. Through cooperative efforts, inefficient facilities can learn a great deal from similar facilities that are more efficient.

Implementation Actions:

3.5 McHenry County IC committees should work together and with professional and/or trade associations to determine the most appropriate water efficiency metrics for their subsector. These groups should also develop guidance for calculating water use intensity or other relevant metrics.

3.6 County Water Resource Manager will solicit the IEPA or other like entity for assistance to associations and businesses working to develop water use intensity or efficiency metrics.

Best Practice 4: Cost-benefit analysis of water conservation practices

Cost-benefit analysis should estimate the cost of a practice as well as the resultant reductions in water use (or water use intensity). The cost of the practice should also be compared to the cost of alternatives to conservation, such as purchasing more water or developing new supplies. To fully account for all costs and benefits, the analysis should consider the potential benefit to the operation, potential adverse impacts of the practice, feasibility of success, and steps to implement.

Facilities should consider using cost-benefit analysis to evaluate the practices listed in this chapter, as well as the practices used by similar facilities in their subsector and those promoted by relevant trade and professional associations. Also, IC facilities should consider the impact more water efficient technologies or practices may have on operational reliability and product quality, as well as the effect business growth may have on water demand for that region of the state.

Facilities can choose practices for this analysis based on current water-use data in the facility. Information gathered through data collection activities (BMPs 1, 2, and 3) to document those areas within the facility where water is being used inefficiently, including areas of water loss and water waste. Conservation practices that address these areas are most likely to be cost-effective and have the shortest payback period.

Implementation Action:

3.7 McHenry County IC professionals and trade associations should share information on IC facilities that have already implemented water conservation practices or installed new technologies, and

inform those within their subsector about available cost-effective technologies.

Water saving practices

Best Practice 5: Recycle and reuse water

IC facilities can minimize their need for new water withdrawals through water reuse and recycled water. Reuse is defined as the use of reclaimed water as a substitute for another, generally higher quality water source. Water reuse and recycling can be especially useful for facilities that are growing and are dependent on limited water resources, as it allows facilities to expand production without increasing water withdrawals. However, enhancing reuse and recycling may increase consumptive use of water (i.e., water may not be returned to the source).

To identify opportunities to save water through reuse and recycling, IC facilities should conduct feasibility studies that consider the infrastructure requirements, such as tanks, pumps, piping, and treating equipment and the cost for implementation. Studies should consider water volume, water quality, potential uses, and potential problems (such as with process operation, corrosion, product quality/purity, and other constraints). Studies should also consider water treatment costs that may be required for a discharge or delivery to a wastewater treatment facility.

IC facilities can document the volume of water reused and recycled and the accompanying improvements in water efficiency. This information can be recorded regularly and reported to EPD as needed, following guidance issued by the Director. Facilities should also adopt reuse plans that comply with the appropriate state guidelines for monitoring, system function and reliability, operation, storage, and water quality standards. Suggested methods for recycling or reusing water include

1) Using reclaimed water for half or more of total outdoor water needs where practical and reasonably available[43]

2) Implementing storm water capture to collect clean rainwater as a substitute for freshwater in and around the facility. Storm water ponds must be constructed according to local and state environmental regulations

3) Counter-flow cooling/rinsing methods (for manufacturing industries)

Implementation Actions:

3.8 The IC committees, working with the Water Resource Manager, should solicit the IEPA, IC professional and trade associations, or

[43] When determining the extent practicable, consideration should be given to the cost benefit and commercial availability of technologies, as well as any legal or regulatory constraints to its application.

other like entity for possible applications of reused and recycled water, and methodologies to verify the water quality, quantity, and consistency required to maintain operations.

3.9 As the processes above are defined, the County's IC committees should request assistance in evaluating the cost effectiveness and feasibility of using reuse or recycled water.

3.10 McHenry County's local governments should consider regional investments in water reuse and recycling technologies, especially when multiple IC facilities within their jurisdiction may benefit.

3.11 The IC committees should work with IEPA, IC professionals and trade associations to identify possible applications for counter-flow systems, and verify the water quality, quantity and consistency required. This effort should include evaluating the overall cost-effectiveness and feasibility of counter-flow processes.

Best Practice 6: Piloting innovative technologies

When appropriate, facilities should consider testing new technologies, including products and practices that can conserve water. Pilot projects provide a good opportunity for IC facilities to test water-conserving products and practices and discover potential problems. In order to accurately evaluate the methods, water use should be measured before and after pilot implementation. After pilot tests, these products and practices can be subjected to a cost-benefit analysis. IC facilities should give special consideration to piloting methods that offer both water and energy savings.

Implementation Actions:

3.12 The County's IC committees should petition U.S. EPA, U.S. Department of Energy (www.energy.gov), IEPA, professional and trade associations, and educational institutions for financing of pilot systems and for facilities installing innovative technologies.

3.13 As processes advance, all groups involved (industrial and commercial trade and/or professional associations) should work with McHenry County's IC water users from their sector to develop industry-specific practices that help IC facilities maximize water efficiency.

3.14 The IC committees should encourage the IEPA and applicable technical or industrial trade organizations or associations to develop or identify possible applications of new energy and/or water conserving equipment, and verify that any new equipment meets all state and federal requirements for safety, water quality, and water quantity.

Best Practice 7: Dry methods for cleaning and dust control
Cleaning and dust control methods that do not use water can be effective in many IC processes that do not involve contact with food. Dry methods should only be used if they can be employed safely and facilities can maintain compliance with the regulations of federal agencies, including U.S. Occupational Safety and Health Administration (OSHA), USDA, U.S. Food and Drug Administration (FDA), and U.S. EPA.

Best Practice 8: Leak detection and repair
Facilities do not benefit from water that does not reach its intended destination. Facilities can adopt a leak detection and repair program for pipelines, intakes, and discharge structures. Leak detection and repair is one of the simplest ways to improve a facility's efficiency and will usually be cost-effective.

Leak detection and repair programs could include a process to identify areas where water use in a facility is higher than can be accounted for by a water audit. In such a case, temporary meters can be used to verify water use and to locate areas where longer term monitoring may be needed. Leak detection and repair programs can help prevent small leaks from becoming serious and causing disruptions in operation that may greatly exceed the cost of the initial repair.

Best Practice 9: Discontinuing discretionary use of water.
Facilities should consider prohibiting activities that use a great deal of water but are not critical to the operation of the facility. Such practices include non-recycling decorative fountains, parking or loading dock wash down using fresh potable water, discharge of reusable process water, and use of inefficient water softeners.

Best Practice 10: Increasing the efficiency of cooling towers and boilers using performance-based contracting.
Two of the largest energy and water using-processes are cooling towers[44] and boilers.[45] These areas are therefore the most logical places for IC facilities to investigate integrating water and energy conservation. Facilities should consider

[44] Cooling towers are used extensively from relatively small facilities such as office buildings and supermarkets to large facilities such as hospitals and manufacturing and industrial plants. Cooling towers can be among the largest water using systems in industrial and commercial settings. Generally, a cooling tower uses evaporation to lower the temperature of water that conveys heat from mechanical equipment such as air conditioning systems, heat exchangers, condensers, or process machinery.

[45] 92 Boilers (and steam generators) are used in heating or processing steam. Boilers (and steam systems) vary in size and design, depending on the operation and function. Commercial boilers are primarily found in larger buildings, multiple-building institutions such as campuses, commercial cooking facilities, or in some cases where process steam is required. Industrial boilers are used for electric power generation for the facility or for processes or manufacturing needs, usually in large facilities.

using performance-based contracts for the operation of cooling tower and boiler operations. This type of contracting, also known as performance-based acquisition, is a technique for structuring all aspects of an acquisition around the purpose and outcome desired, as opposed to the process by which the work is to be performed.

When considering using this type of contracting, IC facilities should investigate the water quality and quantity needs for specific heating, ventilation and air conditioning (HVAC) equipment.

Implementation Actions:

3.15 IC Committee, along with the Water Resource Manager, will contact research institutions for verification of water quality and quantity needs with vendor for HVAC equipment.

3.16 The IC Committee, along with the Water Resource Manager, will seek out IEPA, IC professional and trade associations with assistance to prepare model contracts using examples from other performance-based contracts.

Planning and educational practices

Best Practice 11: Water management plans

A water management plan should outline a systematic, facility-specific approach to improving water efficiency. Water management plans should include current baseline water use (discussed under Goal #1), water reduction targets for the facility and the cost-effective practices the facility intends to use to reach those targets (discussed under Goal #2). Reduction targets, which should reflect reasonable water use reductions, can be stated in terms of either water use intensity or volume of water consumed (total gallons/yr, average gallon/month, etc).

Water management plans should also document the areas of inefficient water use and identify opportunities for increasing water use efficiency in the future. If appropriate, IC water management plans could reflect the Recommendations outlined in this chapter.

IC facilities should update water management plans regularly, especially after major changes in operations, to reflect new technologies and changing conditions related to growth projections, water availability and efficiency improvements. Facilities that purchase water from a regional or local water provider should share these management plans with the provider, when possible. This is especially important if the facility expects an increase in water use efficiency that may result in reduction in the amount of water purchased from the provider.

Implementation Action:

3.17 The Water Resource Manager will contact the IEPA regarding training for employees of IC facilities on developing and implementing a facility-specific water management plan.

Best Practice 12: Educational programs

Facility managers should engage employees in water conservation efforts and supply information regarding their water conservation efforts and water use. Facility managers can use many methods for educating employees, including displaying facility water use information in a conspicuous location and regularly circulating information about progress towards water reduction targets through information boards, break-room flyers, electronic notices or other means.

Implementation Actions:

3.18 The County's Water Resource Manager will work with the IEPA and public water providers to develop a model program of simple and effective methods for educating employees about the status of conservation initiatives.

3.19 The County's Water Resource Manager will encourage the IEPA and IDNR to participate in "train the trainer" instruction for IC facility personnel.

Best Practice 13: Energy management plans

IC facilities should update each facility energy management plan to incorporate appropriate water conservation practices. Plans should include a timeline for installing new, efficient technology and other water conservation practices, as well as the anticipated energy savings from water conservation efforts.

Implementation Action:

3.20 The IC committee and applicable technical or industrial trade organizations or associations, in cooperation with the IEPA, should provide guidance for IC facilities updating or developing energy management plans to include water conservation efforts.

Water Resources Action Plan
Section 3. Water Conservation
B4) Landscape Irrigation Recommendations

Landscape irrigation includes water used to irrigate residential and commercial landscapes. The activities that can help conserve water used for landscape irrigation are targeted at landscape and irrigation professionals involved in installing and maintaining landscape features, as well as businesses and homeowners who choose to irrigate their landscapes. Also, some of the activities in the landscape irrigation chapter pertain to water providers and local governments who may play a roll in supplying water used for irrigation.

Like water use for agriculture and golf courses, landscape irrigation varies significantly season to season, with the greatest use occurring in summer months. It is estimated that public water use outdoors increases between 30 percent to 50 percent in the summer months.[46] A lawn sprinkler spraying five gallons per minute uses 50 percent more water in one hour than the combination of ten toilet flushes, two five-minute showers, two dishwasher loads, and a full load of clothes in a washing machine.

The main sources of landscape water waste are:

- Poor irrigation scheduling
- Inefficient irrigation systems and practices
- Fixed notions about what constitutes an attractive and functional landscape.

At the present time, it is difficult to measure precisely how much water is used for landscape irrigation. Most customers' water use is metered, but customer meters rarely segregate outdoor water use from total water use, and few water providers offer separate meters for outdoor uses. Therefore, most of the calculations of how much and when water is used outdoors in Illinois are estimates.

When water is supplied by a public or private entity, outdoor water use, including landscape irrigation, can cause peak water demands, stretching the capacity of water treatment and delivery. Significant peaks can make it difficult for water providers to supply water to all customers because, among other things, it reduces water pressure within the system. Water providers must be able to maintain adequate pressure and supply to support basic functions, such as drinking water

[46] Waltz C., and G. Wade (2007). Best Management Practices for Landscape Water Conservation: Introduction Chapter. 52 pgs. Available online at http://pubs.caes.uga.edu/caespubs/pubcd/B1329/B1329.htm.

and toilet flushing; to supply tall buildings; and especially to provide sufficient flow and pressure for firefighting.[47]

Conservation methods

Often when water supplies become limited, outdoor water use is banned or restricted. Such actions can have a negative impact on the landscape industry, the water providers, and the overall economy of the state, region, or independent community[48]. By implementing somewhat permanent practices to increase the efficiency of landscape irrigation, communities may be able to minimize the need for emergency measures, such as watering bans, in times of drought.[49]

Various conservation measures have been proposed and implemented across the country to counter landscape wasteful sources.[50] Examples include:

- Xeriscaping: Landscaping in which soil analysis, proper plant selection and efficient irrigation may result in 50 percent water use reduction compared to conventional landscaping
- Landscaping with native vegetation
- Improvements in irrigation technology, including the use of moisture sensors and evapo-transpiration (ET)data)
- Reuse of municipal wastewater or use of greywater for irrigation purposes

If properly installed and maintained, healthy urban landscapes can mitigate the environmental impact of urbanization by improving air quality, reducing energy consumption, and providing groundwater recharge. Urban landscapes also can serve to improve water quality by reducing storm water runoff and soil erosion.[51] Incorporation of native plants, rain gardens, and xeriscaping should be given priority in designing urban landscapes. If the proper steps are taken when designing, installing residential and commercial landscapes, they can be maintained and irrigated while still protecting natural resources, environmental quality and economic vitality.

Two important and often overlooked elements of landscapes include the condition of the soils and plant selection. Traditional development practices can strip away topsoil and organic material that is critical to maintaining a healthy and water-efficient landscape. Organic and inorganic amendments can be added to soils that

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[47] Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs., pg. 140.

[48] Bauske, E.M. and G. Landry. 2007; Bauske, E.M., W. Florkowski, and G. Landry. February, 2008; Flanders, A., E. Bauske, and J. McKissick. March 2008.

[49] California Drought Handbook has recommendations for drought preparedness and drought response.

[50] CMAP Draft Regional Water Supply Plan, July 2009.

[51] Environmental Fact Sheet: *How Green Spaces Benefit the Environment.* Project Evergreen. http://www.projectevergreen.com/pdf/EnvironmentalFactSheets.pdf

have been compacted or altered during development. These amendments can improve the physical, chemical, and biological properties of the soil. Amendments help the soil hold water and improve water and nutrient movement throughout the soil.

Finally, attention should be given to the type of plants selected for a development. Native plants provide many benefits to the community and region, including, but not limited to: reduced water use, fertilizer and pesticide use, and air pollution; they do not require mowing; and they provide a beautiful, hardy, drought resistant, low maintenance landscape.[52]

Much of the following information was drawn from successful programs in Florida, Texas, Georgia, and California as well as the Regional Water Supply Draft Plan written by the Chicago Metropolitan Agency for Planning (CMAP).

GOAL #1: Provide education on proper and efficient landscape water use practices.

McHenry County's landscape and irrigation professionals and water providers should cooperatively engage in a comprehensive water conservation education program to influence how customers use water for landscape irrigation. The educational materials should provide a consistent educational message about the importance of using water efficiently outdoors. Education is a three step process:

- Creating awareness of the issue(s)
- Providing information to address the issue(s)
- Providing the tools needed for action

Landscape and irrigation professionals can deliver the educational message through garden centers, nurseries, or landscape maintenance employees. Water providers can deliver the educational message to the customers through water bills or educational programs.[53] The information used should be based on Best Management Practices.

- **Appendix 3.2** "Examples of Homeowners and Businesses Best Management Practices"

To be comprehensive, an education program on proper and efficient landscape water use practices should include:

[52] Gas powered garden tools emit 5% of the nation's air pollution. For more information on Native Landscaping, please refer to the Raingarden brochure at www.mchenryh2o.com.
[53] Village of Algonquin Water Conservation Plan is a local example.

- Information about their water sources and the challenges facing those sources.
- Information about the economic, health, recreational, aesthetic and environmental benefits associated with water resources and water efficient landscapes,
- Information about water efficient landscape designs and plants, and
- Information about proper landscape installation and maintenance.
- Some education materials should be targeted at high-water use customers, who often drive peak water demands. These customers have the opportunity for the greatest reduction in water consumption by improving landscape irrigation practices.

Policy Recommendations

Recommendation 1A: In 2010, McHenry County's landscape and irrigation professionals and water providers should organize a Professional Association and begin implementing a comprehensive educational program to inform their customers of the importance of proper and efficient water use practices. *See Best Practices 1, 2, 3, 4, and 5*

Recommendation 1B: In 2011, water providers should target education programs and distribute materials to high water use customers. *See Best Practices 3 and 5*

Recommendation 1C: In 2011, the county's landscape and irrigation professionals should promote a sustainable approach to landscaping by offering citizens a checklist of practices and instructions on how to implement the practices along with a process for certifying a water efficient landscape. *See Best Practice 4*

GOAL #2: Establish statewide standards for systems dealing with landscape water conservation.

Local standards for design, installation and maintenance of landscapes and landscape irrigation systems can help reduce landscape water use. These standards can also help homeowners and business owners understand the importance of proper landscape water use and avoid problems from faulty irrigation systems or inefficient landscapes. McHenry County's landscape and irrigation professionals should utilize professional associations to establish statewide standards for design, installation and maintenance of Illinois landscapes, landscape irrigation systems, and other systems dealing with landscape water conservation, such as rainwater catchments systems.

Standards for design, installation and maintenance of landscapes and irrigation systems should be developed through a cooperative effort of landscape and irrigation professionals, professional associations, and researchers. Standards should also address the use of alternative sources for landscape irrigation, such as rainwater harvesting. As part of this effort, the committee should develop a process for certifying professionals as proficient in the state standards. Standards should be incorporated into local rules and regulations where it is reasonable to do so.

Lacking statewide standards, McHenry County's landscape and irrigation professionals are encouraged to be on the leading edge in Illinois for developing standards that will set the "bar" for efficient water usage.

It is important that at least one employee of landscape and irrigation businesses is certified as proficient in the statewide or regional standards developed for their operations. Because these individuals direct and train the employees responsible for landscape and irrigation system installation and maintenance, they can impact how efficient and effective of the work is.

In other states (such as Florida and New Jersey) legislation has been passed to require professional certification proficiency for landscape and irrigation contractors. In many communities ordinances have been used to attain a similar goal. Ordinances have also been used to require a landscape plan and installation review process.

Continuing education is also critical to ensure that employees have the latest information regarding landscape and irrigation system design, installation, and maintenance. Standards may change and every year new technologies emerge. Individuals engaged in continuing education programs are more likely to commit to establishing water efficient landscapes and enhancing the water efficiency of existing landscapes. Business owners that employ certified professionals can offer consumers confidence in their services and equipment.

Policy Recommendations

Recommendation 2A: By December 2010, McHenry County will have served a key role in organizing landscape and irrigation professionals, water providers, researchers, and others to convene as a local advisory committee to develop local standards and lead the way for statewide and/or regional standards for design, installation and maintenance of landscapes and landscape irrigation systems in Illinois.[54] *See Best Practice 7*

[54] Florida with "Landscape Irrigation & Florida-Friendly Design Standards" provides a good example of such landscape and irrigation design standards.
http://www.dep.state.fl.us/water/waterpolicy/docs/LandscapeIrrigationFloridaFriendlyDesign.pdf

Recommendation 2B: In 2011, McHenry County and the local Professional Landscape and Irrigation Association and advisory committee should encourage the development of an Illinois statewide advisory committee to develop statewide and/or regional standards for design, installation and maintenance of landscapes and irrigation systems in Illinois, as well as professional certification standards for the industry. *See Best Practice 7 and 8*

Recommendation 2C: By 2012, the Illinois statewide advisory committee and representatives from local governments and the local advisory committee should recommend that the statewide standards for design, installation and maintenance of landscapes and irrigation systems in Illinois and professional certification be incorporated into rules and regulations.

Recommendation 2D: By 2020, all landscape and irrigation businesses operating in Illinois should employ appropriately certified professionals who can ensure compliance with statewide or regional standards. *See Practices 7, 8, 9, and 10*

GOAL #3: Reduce summer peak use.

McHenry County's water providers, local governments, and landscape and irrigation professionals should help water customers reduce summer peak use. Peak use refers to the maximum demand for water that occurs over a given time period, such as hourly or daily during summer months (May to September).

Water providers should help customers reduce peak use, because peaks can limit the provider's ability to serve customers with basic water needs. Reducing peak use can help water systems become more efficient. Water providers must design and size their water treatment, pumping and delivery systems so that they have the capacity to meet peak use. If the peak use is close to normal demand, water facilities can be smaller, more efficient, and less costly. In addition, peaking can reduce pressure in the water delivery system, so reducing peaks in demand also protects human health and safety.

A first step in helping customers reduce high summer water use is for water providers to determine their baseline peak use and peaking factor, the ratio of peak daily water use by customers to average daily water use by customers. The higher the peaking factor, the higher the peak use, and the more likely a water provider will experience difficulty in meeting the demands of their customers.

Water providers can employ a variety of practices to reduce peak use, including financial and technological incentives/disincentives for customers to conserve. Changing to more water efficient devices or switching to alternative sources such as rainwater harvesting for irrigation purposes can offer somewhat permanent water

savings. Strategies related to conservation billing have also proven effective in many areas.[55]

Policy Recommendations

Recommendation 3A: By 2011, all McHenry County water providers should improve their understanding of outdoor water use for landscape irrigation by calculating their baseline peak use and peaking factor and, where appropriate, establish a peak reduction target. *See Best Practices 5 and 6*

Recommendation 3B: By 2012, water providers with high peaking factor and peak reduction targets (as identified in Recommendation 3A) should, with assistance from local governments, offer incentives to customers implementing practices to reduce system's peaking factor. *See Best Practices 11, 12, 13, 14, and 15*

Recommendation 3C: By 2015, and every five years thereafter, McHenry County's water providers should evaluate the success of their outdoor water conservation efforts and revise incentives and programs, as needed. Note: This recommendation should be coordinated with Recommendation 1C in the Domestic and Non-Industrial Uses section, which calls for an assessment of the overall water conservation program. *See Best Practice 6*

Best Practices: A Menu of Options

Educational practices

Best Practice 1: Adapt existing educational programs
McHenry County's landscape and irrigation professionals and water providers can adopt or adapt educational programs available through, but not limited to: University of Illinois Extension, DNR Water Smart, EPA Water Sense.[56] Any education program adopted should involve:

- Distributing information to homeowners and business owners about water efficient landscaping and irrigation practices and providing additional tools and resources to help customers make good decisions about irrigating.[57]

Appendix 3.3 "Examples of Homeowners and Businesses Best Management Practices"

[55] AWWARF Report, 91205. 2008. Water Budgets and Rate Structures—Innovative Management Tools. www.awwarf.org
[56] Also see the Village of Algonquin, IL Water Conservation Plan for a local example.
[57] See the Alliance for Water Efficiency, EPA Water Sense, or www.ConserveWaterGeorgia.net for more information.

- Coordinating educational efforts between water providers and the landscape and irrigation professionals to ensure that they contain a consistent message.

- In communities where summer water use is very high, educational programs should also focus on reducing peak water use.

Implementation Actions:

6.1 County associations for landscape/irrigation professionals, associations for Illinois water providers, CMAP, University of Illinois Extension, and state agencies should formalize a cooperative outdoor water use education program. Lacking a local association, first step is to form that association and seek out other groups as defined herein.

6.2 McHenry County's association professionals should work with CMAP, local governments, state agencies, U.S. EPA, and University of Illinois College of Agriculture, Consumer, and Environmental Science (UofI ACES) to coordinate and enhance water conservation programming and educational material regionally.

6.3 These entities should assess the success of existing programs designed to educate Illinois citizens and offer incentives to customers to irrigate landscapes more efficiently (e.g. Georgia Outdoor Water Use Registration Program and the Georgia water-smart statewide education campaign). If existing programs prove successful, these programs should be enhanced.

Best Practice 2: Utilize conservation educators

McHenry's landscape and irrigation businesses or water providers can individually or collectively hire or contract with an educator to begin implementing a sustainable water efficient landscape program locally or regionally.

Best Practice 3: Distribute information to high-use customers

McHenry County's water providers can distribute information through direct mail, websites, or customer water bills. Information should encourage high-use customers to implement more efficient irrigation practices or to consult an irrigation professional to identify why water use is high and make recommendations for improvement.

Implementation Action:

6.4 McHenry County's landscape and irrigation professionals' associations should regularly update the information available for water providers to distribute to high use customers.

Best Practice 4: Create checklists and establish certification for sustainable landscapes

Landscape and irrigation professionals should promote a sustainable approach through the distribution of checklists outlining all the specific practices and ways to implement them.

- **Appendix 3.4** "Examples of Sustainable Landscape Certification Checklist"

Certification of a water efficient or sustainable landscape could occur through a ranking system in which the homeowner or business is awarded points for implementing certain best practices on their property. Landscape and irrigation professionals (ideally those certified, once the professional certification process is established), such as the Master Gardeners of Illinois, could be used to verify the certification.

This effort is already offered in several states to promote long-term landscape health and environmental sustainability.[58] Some water providers offer rebates for implementing efficient landscape irrigation practices, and have also used the certification checklist as a tool in determining which customer should receive the rebates.

Implementation Actions:

6.5 The McHenry County Association for landscape and irrigation professionals should develop or enhance a "Sustainable Landscape Certification Checklist" of conservation practices for landscapes that includes, but is not limited to, the following topic areas:

- Water efficiency
- Mulching
- Recycling
- Wildlife habitat
- Right plant-right place
- Native plants
- Moisture sensors
- Fertilization
- Pest control
- Composting
- Stormwater runoff control
- Protection of riparian areas
- Yard maintenance techniques
- Alternative sources of water

6.6 County landscape and irrigation professionals and related associations should distribute the checklist through the U of I Extension

[58] California, New Jersey and Texas offer certification for sustainable landscaping.

and state water conservation Web sites, county offices, local landscape retail centers, and local water providers.

6.7 McHenry County or regional landscape and irrigation professionals and/or researchers should offer training to county extension agents, county officials or volunteers (e.g. Master Gardeners) on checklist components, scoring, and certification verification.

6.8 Landscape and irrigation associations, local businesses, or nongovernment organizations should provide incentives to homeowners who participate in the checklist program and implement the practices (or attain a predetermined level of efficiency or sustainability).

6.9 County landscape and irrigation associations, along with municipal authorities, should encourage state agencies to develop a state-funded rebate program that is dedicated to individuals that meet a set level of conservation.

Water use assessment practices

Best Practice 5 : Assess outdoor water use

Residential outdoor water use can be measured directly or estimated by water providers using their customers' billing data. Water providers may employ both indoor and outdoor meters to directly measure customers' indoor and outdoor water use, though dual meters are not economically feasible in most areas. Using the single meter approach, the water provider must indirectly calculate residential outdoor water use.

There are a variety of methods for calculating outdoor water use estimates. Water providers may also estimate outdoor use using representative samples of the customer base. These estimates can be used to gain a better understanding of outdoor uses and encourage more efficient practices and to identify high-use customers.

Implementation Action:

6.10 McHenry County's landscape and irrigation professionals should work with CMAP and Associations for Illinois water professionals to provide a template and protocol for calculating indoor and outdoor water use.

Best Practice 6: Calculate peaking factor

A water system's peaking factor is the ratio of peak daily water use by customers to the average daily water use by customer. For example, if a water system peak daily

water use is 5 million gallons a day and average daily water use is 3 million gallons a day; the peaking factor would equal 1.67.[59]

The baseline peaking factor should be measured before water conservation practices are implemented. Water providers can calculate this factor for their system and assess changes in their peaking factor, using guidance provided by Southern Illinois University (SIU). Baseline peaking factors should account for high water use during drought conditions and average demand during non-drought conditions. After a baseline is calculated, water providers should continue to calculate the system's peaking factor, and incorporate results into water management plans.

Implementation Actions:

6.11 SIU and associations of Illinois water professionals should offer technical assistance to water providers evaluating changes in their peaking factors.

Standards and certification

Best Practice 7: Establish statewide standards for landscape and irrigation systems

McHenry County's professionals involved in landscape, irrigation, and water management should participate in or organize an advisory committee to develop statewide and/or regional standards for the design, installation and maintenance of landscapes and irrigation systems in Illinois. Collaboration of a diverse group of individuals will help build an acceptable and equitable set of standards that can be implemented statewide or regionally.

The advisory committee should consider creating standards related to:

- Irrigation system technologies and installation and maintenance techniques for capturing and using rainwater for irrigation
- Landscape design and maintenance practices including, but not limited to, low impact landscape design practices such as preserving native plants or grouping plants according to water needs, and stormwater management practices that can help enhance water efficiency
- Certification requirements for those professionals committed to following the landscape and irrigation standards. Consideration should be given to existing certification programs such as those offered through the Irrigation Association and EPA WaterSense.

[59] Refer to SIU Water Demand report for more information on peaking factors.

Standards will be most effective if adopted by local and/or state governments as rules and ordinances. Standards should be regularly updated as new information and technologies emerge.

Implementation Actions:

6.12 Once McHenry County's landscape and irrigation professionals are organized, they should encourage the development of a statewide advisory committee to develop landscape and irrigation standards. IDNR, with support of IEPA should provide administrative and technical support for the statewide advisory committee formed to develop landscape and irrigation system standards.

6.13 State agencies, landscape and irrigation organizations, and irrigation and other appropriate equipment manufacturers should fund research and education to refine the landscape BMPs for irrigation efficiency.

6.14 Once organized, landscape and irrigation associations, in coordination with IML (organization for local governments), and associations for Illinois water professionals should develop model ordinances and recommend incentives for local water providers and local governments to consider.

6.15 The landscape and irrigation associations, should work through the DNR legislative representatives to amend state rules and regulations to include irrigation system design, installation, and maintenance standards.

6.16 Local governments should incorporate irrigation system efficiency standards in construction codes. Should statewide codes be lacking, they should consider the recommendations of McHenry County's landscape and irrigation association professionals.

6.17 County landscape and irrigation professionals, water providers and local governments should encourage water customers to implement the landscape and irrigation system standards

Best Practice 8: Establish certification practices for landscape and irrigation professionals

At least one employee per landscape and irrigation businesses, and other professionals involved in water issues, should be certified as proficient in the statewide standards for landscape and irrigation system design, installation and maintenance. Landscape and irrigation professionals should document and publicize their training and certification. Medium and large water providers should also consider having at least one representative participate in certification programs.

Implementation Actions:

6.18 McHenry County landscape and irrigation businesses and water providers can disseminate educational material to customers informing them of the benefits of choosing certified landscape and irrigation professionals.

6.19 County landscape and irrigation associations should endorse the certification programs and offer low-cost trainings for landscape and irrigation maintenance workers.

6.20 Various local and state university systems and research institutions should develop and implement post high school degree programs that cover irrigation science that could be used as part of a certification program.

6.21 Landscape and irrigation associations, in coordination with local government associations (county and state), should develop model ordinances for local governments to consider (i.e. ordinances requiring certification for operating a landscape or irrigation business, or requiring certification for occupying a business license.)

Best Practice 9: Utilize irrigation system certified auditors

McHenry County landscape and irrigation professionals can offer homeowners and business owners the service of an irrigation audit to help ensure that installed systems are working correctly and according to standards. Auditors, who are certified by the Irrigation Association,[60] are trained in gathering water-use data and testing irrigation systems. Auditors can determine irrigation uniformity and efficiency and can identify malfunctioning equipment.

Implementation Action:

6.22 McHenry County's local governments can adopt ordinances requiring irrigation installation businesses to use a certified irrigation auditor.

Best Practice 10: Provide continuing education for landscape and irrigation professionals

Standards and technologies change. Continuing education programs can help landscape and irrigation professionals stay current. Participating in these programs can also encourage a commitment to water conservation.

Implementation Action:

6.23 U of I Extension and others should offer continuing education courses and programs for foremen, crew leaders, and employees of landscape and irrigation businesses. These courses should provide up-to-date information

[60] http://www.irrigation.org/

about landscape and irrigation system design, installation and maintenance standards, including information regarding new emerging technologies.

Incentives

Best Practice 11 : Utilize innovative technologies
There are many innovative landscape and irrigation technologies that can help save water. Examples include:

- Micro-irrigation, or other certified water application technologies that can automatically adjust irrigation based on plant needs and environmental conditions. Technologies should meet the EPA WaterSense61 standards or the Irrigation Association Smart Water Application Technologies (SWAT)62 standards.
- Using non-potable water for irrigation (reuse water, captured rainwater, captured stormwater, greywater, air conditioner condensate, etc.),
- Improving soil quality by saving the top soil or adding organic and/or inorganic amendments.
- Using irrigation inhibitors, such as rain or soil moisture sensors, for automatic irrigation systems.

Implementation Action:

6.25 McHenry County's local governments, water providers, and/or state agencies should consider offering incentives or adopting ordinances promoting innovative technologies.

Best Practice 12: Monitor and offer assistance to those who have high water use
The County's water providers should monitor those who have high water use and provide them with information and resources to encourage evaluation of their irrigation system by a certified professional. These water audits should evaluate changes in landscape and changes in technology, particularly if water use increases dramatically.

Best Practice 13: Create guidelines for preconstruction practices
Often, inefficient water use is the result of extensive grading and soil compaction that occurs during construction, before plants and irrigation systems are installed. These practices should be minimized or corrective actions taken to prepare a high quality, functional soil system that provides a proper planting site. Guidelines might include low impact development (LID) techniques and landscape designs associated with the U.S. Green Building Council's (www.usgbc.org) Leadership in Energy and

[61] http://www.epa.gov/watersense/
[62] http://www.irrigation.org/smartwater/

Environmental Design (LEED) certification program or other water conservation programs in early development.

Best Practice 14: Utilize water budget-based rates
Water budget-based rates, also known as individualized rates are a version of inclining block rates in which the blocks or tiers are determined for each customer by the customer's usage history, and are usually set based upon the quantity of occupants and the square footage of landscape. Water budget-based information can be an educational tool for the system's highest users even if it is not tied to billing.

Appendix 3.5 "Examples of Sustainable Landscape Certification Checklist"

The Alliance for Water Efficiency (www.allianceforwaterefficiency.org) writes: "Water budget based rate structures are very effective in promoting conservation, though more difficult to implement. In this design, each residence has an inclining block rate structure designed according to its individual needs. The rate tiers are usually set based upon the quantity of occupants and the square footage of landscape; known to be the two most significant factors in residential water use. The prices of the tiers increase significantly (greater than 50 percent) after the base usage tier is established. This rate system requires a robust billing system to accommodate the quantity of individual rate structures (possibly equal to the quantity of customers); and the system requires a formal process to establish each homes base water usage, and respond to the many customers likely to appeal their base tier allotment. Water budget based rates are not only an effective water conservation strategy; the rate structure is the most equitable means to base rate on needs of each individual household. This rate structure can also be adapted for nonresidential customers."[63]

A detailed guidance document about the use of water budgets is available from the AWWA Research Foundation (AWWARF).[64]

Implementation Action:

6.26 McHenry County's water providers, with assistance from CMAP, Alliance for Water Efficiency, U of I, and state agencies should implement pilot water budgeting projects that target large landscapes. These projects could determine water needs for specific landscapes and evaluate potential water savings from landscape and/or irrigation standards or new state-of-the-art efficiency technologies. If pilot projects prove successful, wider application may be considered.

[63] For more information on water budget based billing, visit the Alliance for Water Efficiency at http://www.allianceforwaterefficiency.org/ - search for "water budget billing" in the Resource Library.
[64] AWWARF Report, 91205. 2008. *Water Budgets and Rate Structures—Innovative Management Tools.* *www.awwarf.org*

Best Practice 15: Utilize conservation-oriented rates

This best practice is discussed in detail under Goal # 3 of the water conservation section with recommendations for Domestic and Non-Industrial Public Use. Water conservation oriented rates are designed to encourage customers to use water more efficiently.

Water Resources Action Plan
Section 3. Water Conservation
B5) Domestic and Non-Industrial Public Use Recommendations

The activities outlined in this chapter are intended for water providers that supply water to the public (often referred to as municipal water providers) and local governments that have direct contact with the water customers and may play a role in setting water rates.

Many local governments are themselves water providers, but even those who are not have a direct connection to both water customers and water providers. Water customers depend on local governments for assurance of quality public water services. Local governments often provide oversight to water providers' rate setting efforts. They also have the power to institute water-related ordinances and incentive programs.

Due to the integral role local governments usually have in the provision of water, local governments have a responsibility to work closely with those providing water and their citizens to communicate the importance of sustaining water resources and the role everyone plays in helping conserve public water for domestic and nonindustrial public uses.

What is public use

Domestic water use includes indoor water that flows through fixtures, such as toilets, faucets, and showerheads, and is used by appliances, such as clothes washers and dishwashers. These uses occur in residential and non-residential settings. Non-industrial uses include water used for business purposes but not related to industrial and commercial cooling, heating, and processing (these uses are addressed in the series of recommendations of the Water Conservation section for Industrial and Commercial Facilities).

Water use for domestic and nonindustrial commercial purposes is often referred to as public supply water. The public water use sector has steadily grown since the 1980s, concurrent with increasing population. About 14.2 billion gallons of water per year (or 38.8 mgd) on an average annual basis is withdrawn for public supply and domestic uses in McHenry County. This estimate is reached using Chicago Metropolitan Agency for Planning (CMAP) numbers for reported withdrawals from public supply water.[65]

[65] CMAP Regional Water Supply Plan Chapter 2 table on 2005 water withdrawals (MGD) by sector in NE IL.

Replacing older toilets with high-efficiency toilets (HET) can save about 4,000 gallons per year. New water and energy efficient clothes washers can save 8,000 to 10,000 gallons per year compared to a 12-to-15 year-old traditional top-load washer. Also, new high efficiency Energy Star dishwashers can save 1,200 to 1,300 gallons per year compared to a 10-to-12 year-old dishwasher. For information about high-efficiency fixtures and appliances, visit the EPA WaterSense website: www.epa.gov/watersense

If produced water is used more efficiently, water providers may be able to continue to meet demand as the population grows. Such efficiency may contribute to offsetting the development of some new water supplies. Facilities can also reduce their own costs by reducing water waste and loss.

A decrease in water use can be accomplished through the use of conservation methods such as improved metering and reporting, as well as a decrease in outdoor water use. Conservation of domestic and nonindustrial water can help sustain public water supplies by helping to accomplish the following objectives:

- Reduce waste of quality drinking water.
- Minimize the loss of water during production, treatment, and distribution.
- Redistribute saved water. The volume of water saved through increased efficiency can be redistributed to support other needs in the community, such as a new industrial facility or environmental protection.
- Helping customers appreciate the value of water. Often, when conservation programs are implemented and water use diminishes, water rates must be adjusted to cover the utilities fixed costs. Customers can mitigate the impact of the new rates by taking steps to reduce their own water use.

How to approach reducing public use

This section consists of a series of specific goals designed to guide this sector toward greater water efficiency. The goals are not one-size-fits-all targets for reductions in water use; they were designed to be flexible, so that they are applicable for users with differing circumstances and recognize prior investments in conservation.

In order for conservation efforts to be successful, water providers and/or local governments must influence the choices available to water customers. The amount of water required to support domestic and non-industrial uses is determined largely by the characteristics of existing housing stock (i.e. plumbing equipment), customers' behavior and economic condition, and the technologies customers employ.

Water providers can encourage efficiency among their customers through educational programs that stress the importance of water conservation and give customers tools for maximizing efficient water use. Water providers and local

governments can also institute programs and incentives that foster more efficient water use, such as retrofit or rebate programs, incentives for Green Building, and conservation-oriented rates. Water providers and local governments should encourage efficient use both indoors and outdoors.

The goals and recommendations in this chapter also address the efficiency of water providers' treatment and delivery systems. The level of efficiency within a water system is greatly affected by the type and age of technologies, infrastructure employed (such as methods of water treatment, water meters, and distribution pipes), and maintenance procedures. Maximizing efficiency within water treatment and delivery systems is critical to protecting finite water resources and maintaining water services. It can also help water providers set an example for their customers.

Water conservation efforts work best when they are approached systematically, with quantifiable goals and a way to measure the progress toward those goals. Water providers should make an effort to measure customers' per capita water use. Thorough data about water use will help providers educate their customers and, where necessary, set reduction targets to evaluate whether or not the practices they have implemented have had the desired effect and are cost-effective.

Likewise, water providers should be able to quantify their own efficiency. The best way to evaluate water system efficiency is to measure the system's nonrevenue water, defined as the volume of water going into a system that is not billed or producing revenue for the water provider. Once a provider has quantified the current losses within the system, they can set targets for reducing water loss.

All of the practices for improving efficiency within a water system and among customers should be compiled into a comprehensive water conservation program. While the general components of a comprehensive water conservation program are the same, the manner in which each component is implemented is dependent on the unique characteristics and challenges facing the community.

When developing a water conservation program, water providers and local governments should consider the behavior and water use patterns of water customers, the technologies employed within the water system, the commitment of the local elected officials, and the condition of the water sources.[66] Achieving water conservation goals across a unique community of varied users requires that water providers and local governments implement a cost-effective water conservation program that reflects the community's values and characteristics.

[66] When water suppliers are abundant, a water conservation program may not include aggressive practices, like those necessary for an area where water supplies are limited.

GOAL #1: The County, water providers, and local governments should implement a comprehensive water conservation education and outreach program.

One of the most critical components of a local water conservation program is a robust education and outreach program.[67] An education and outreach program should raise awareness about the value of local water resources and the need to conserve water. It should also empower individuals and businesses to make informed decisions about their water using behavior and the fixtures and appliances they employ.

Each local community in McHenry County is unique, so water providers and local governments should develop and initiate a water conservation education and outreach program that fits the unique values and characteristics of their community. Programs should provide information about the local water source and the challenges facing the source, and make a clear connection about how conserving will affect the local water source. An education and outreach program should also provide information about the associated economic, health, recreational, aesthetic ,and environmental benefits of water conservation, as well as the benefits that conserving offers to individuals and a broader set of users. Programs that target the most inefficient users are usually the most successful.

Because conservation education and outreach programs can build acceptance among water users, education and outreach efforts should begin before the full water conservation program is implemented. For example, public acceptance of and compliance with watering schedules can be enhanced if preceded by an outreach effort that articulates the need for such restrictions in terms of maintaining system capability and safeguarding environmental resources. In addition, outreach efforts that educate consumers and public officials about the true cost and value of water can help with acceptance of new conservation-oriented rate structures.

As an education and outreach program progresses, water providers and local governments should assess the effectiveness of the program. This assessment is critically important in informing if, and what types of, adjustments are needed to ensure that the program is affecting the changes desired in customer behavior and water use patterns. Adjustments may also be needed to meet any changing needs of the community.[68]

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[67] Researchers found that investments in targeted education and outreach have high water conservation returns, and that public awareness tends to build political support and participation. Keyes, A., M. Schmitt, J. Hinkle. 2004 "Critical Components of Conservation Programs That Get Results: A National Analysis." AWWA – Water Sources Conference Proceedings.

[68] San Antonio, TX adjusts its program annually, while some areas, like California, require adjustments every 3 to 5 years. See the California Urban Water Conservation Council Memorandum of Understanding, June 2007 for more information – www.cuwcc.org

Policy Recommendations

Recommendation 1A: In 2010, water providers and local governments should assess their water customers' demands to help develop an education and outreach program. This Recommendation should be coordinated with Recommendation 1B in the Landscape Irrigation chapter, which calls for an outdoor water conservation education program for customers. *See Best Practices 1 and 2*

Recommendation 1B: In 2010, water providers and local governments should initiate a water conservation education and outreach program that reflects local values and characteristics and communicates the long-term benefits of conservation. *See Best Practices 9, 10, 11, 12, 13*

Recommendation 1C: By 2015, and every five years thereafter, water providers and local governments should assess and adjust their program(s) as needed. This should be coordinated with Recommendation 3C in the Landscape Irrigation chapter, which calls for an evaluation of the outdoor water conservation efforts. *See Best Practices 1, 2, 9, 10, 11, 12, and 13*

GOAL #2: Water providers should maximize the efficiency of the systems that treat and deliver water to customers.

Maximizing efficiency within water treatment and delivery systems is critical to protecting finite water resources and maintaining water services. It can also help water providers set an example for their customers.[69]

The cost of inefficiency within a water system can be high. Water lost to leaks and faulty equipment and water wasted through inefficient operations produces no revenue for water providers, and can increase a water system's costs for water supply development, pumping, treatment, and delivery. Additionally, water lost to leaks can be the cause of washed out roads and/or sink holes, both of which can require expensive remedial actions.

The first step water providers must take is to ensure that they are accurately accounting for the water moving through the treatment and distribution systems. In Illinois, water providers have traditionally measured system efficiency using the expression "unaccounted for water" (UAW). The measure, expressed as a percent, is calculated as the difference between the amount of water pumped into the front end of the water treatment plant from the source(s), and the amount of water actually

[69] Water providers that invest in their own system's efficiency can expect better response from conservation efforts targeted at their customers. Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs.

delivered to metered water use customers. UAW generally includes system leakage and unmetered water uses, such as fire fighting, flushing, broken water mains, etc.

The International Water Association (www.iwahq.org) water audit method, which is recommended by the American Water Works Association (www.awwa.org) and being adopted by water systems across the country, is considered a more accurate method of identifying and accounting for system leaks and unmetered uses.[70] The IWA/AWWA water audit method provides detailed guidance for all water providers on measuring a water system's water treatment and delivery performance based on system-specific features. The IWA/AWWA method outlines seven major components to be assessed within each system:

1. System input volume
2. Authorized consumption
3. Water losses
4. Apparent losses
5. Real losses,
6. Revenue water
7. Non-revenue water

Measuring non-revenue water, defined as the volume of water going into a system that is not billed or producing revenue for the water provider, provides a clearer understanding of water losses in the system than prior methods that measured UAW.[71]

Once a system has an accurate picture of their water loss, water providers can set system-specific targets for the reduction of nonrevenue water. Reduction targets can help focus a water provider's efforts to minimize water loss and maximize their system efficiency. Many practices are available to help facilities progress toward their targets.

Policy Recommendations

Recommendation 2A: In 2010, water providers should consider and adopt the IWA/AWWA water audit method and conduct the audit annually thereafter. Water providers should try and gather the most accurate data possible for these audits. *See Best Practices 3, 4 and 5*

[70] An August 2003 report of the American Water Works Association's (AWWA) Water Loss Control Committee supports the use of the IWA water audit method. "Applying Worldwide Best Management Practices in Water Loss Control." AWWA Journal, August 2003. Pgs. 65-79.

[71] For more information on the IWA methodology, visit http://www.awwa.org/Resources/Content.cfm?ItemNumber=588

Recommendation 2B: By 2012, water providers should set system-specific reduction targets for nonrevenue water. Reduction targets should focus on minimizing both real and apparent losses within the water system. *See Best Practices 3, 4, and 5*

Recommendation 2C: By 2013, water providers should implement practices to meet their nonrevenue water reduction targets and verify their reductions. *See Best Practices 14, 15, 16, and 17*

GOAL #3: Implement conservation-oriented rates.

Water providers and local governments should implement conservation-oriented rates to encourage citizens to conserve, and to help maintain the water system's financial stability. Recent research in by the Alliance for Water Efficiency and in the state of Georgia show water rates can be one of the most effective tools water providers have to promote water conservation.[72]

Conservation-oriented rates are designed to encourage customers to choose more efficient ways to meet their water needs. Water providers should look to achieve the following goals when they adopt a water conservation rate structures: [73]

- Reduce daily peak usage
- Reduce seasonal peak usage
- Reduce total system demand.

Conservation-oriented rates can also help maintain the financial stability of water systems by more accurately reflecting the true cost of water, including a) the future costs for additional water supplies for growing communities and b) funds required to cover capital improvements and replacement of aging water infrastructure for enhancing the system's efficiency. Conservation-oriented rates can be structured to help water providers and local governments control revenue fluctuations that may occur when supplies are limited or when water use decreases. In most cases, rate structures discourage the use of large volumes of water within a particular customer class by charging more for each unit above baseline use.

Equitable pricing is critical to the success of a conservation program and the basic operation of a water system. It is important to set rate structures in a way that does not undermine the ability of all users, regardless of income or location, to have access to affordable water and water services. Before a rate structure is selected, a utility should thoroughly research the best water rate structure available. In

[72] Environmental Finance Center. "Water Price Signals in Georgia." November 28, 2007. Online at http://www.efc.unc.edu/ga/rates.html
[73] Alliance for Water Efficiency, Resource Library, *Conservation Oriented Rates*.

general, the rate structure needs to be designed to balance conservation goals with price equity and the water purveyor's revenue stability.

Inclining tier block rate structure is the most common conservation rate structure used by water purveyors. The best examples of this residential rate design include the following features: the first tier provides minimal water usage for a typical household at the minimum reasonable price; the subsequent tiers are priced significantly higher (greater than 50%) than the prior tier. Usually three to four tiers are adequate for an effective residential rate design. An effective rate design will have more than half of residential customers exceeding the first tier when the new rate structure is first implemented, and at least 30 percent and 10 percent of customers using water in the 3rd or 4th tiers respectively (at least during seasonal peak demand).[74]

Water budget based rate structures are also very effective in promoting conservation, though more difficult to implement. In this design, each residence has an inclining block rate structure designed according to its individual needs. The tiers are usually set based upon the quantity of occupants and the square footage of landscape; known to be the two most significant factors in residential water use. The prices of the tiers increase significantly (greater than 50 percent) after the base usage tier is established.

This rate system requires a robust billing system to accommodate the quantity of individual rate structures (possibly equal to the quantity of customers), and the system requires a formal process to establish each homes base water usage, and respond to the many customers likely to appeal their base tier allotment. Water budget based rates are not only an effective water conservation strategy; the rate structure is the most equitable means to base rate on needs of each individual household. This rate structure can also be adapted for non-residential customers.[75]

Policy Recommendations

Recommendation 3A: In 2010, water providers should categorize customers by class. At a minimum, residential and nonresidential customer classes should be defined. Care should also be given to ensure that "commercial" customers that only serve residential customers – i.e. apartment buildings – are profiled as special commercial or residential. *See Best Practice 6*

Recommendation 3C: By 2015, water providers should evaluate different conservation-oriented rate structures and adopt the most appropriate one for their customers. *See Best Practice 18*

[74] Alliance for Water Efficiency Resource Library, *Conservation Oriented Rates*.
[75] Ibid.

Recommendation 3B: By 2012 water providers should eliminate decreasing block rate structures.

GOAL #4: Water providers and local governments should help customers maximize the water efficiency of indoor residential and domestic uses.

Water used indoors accounts for approximately 70 percent of average residential water use in the U.S.[76] Showers/tubs, bathroom sinks, and washing machines can compromise anywhere between half to 80 percent of residential water use. Average indoor water use is 69.3 gallons per capita per day (gpcd) in a non-conserving home, and 45.2 gpcd in a conserving home.[77] Therefore, a significant amount of savings can be realized by even modest improvement in water efficiency in this area. The greatest amount of savings can be gained from residential areas with a large number of homes built before 1992.[78]

Most indoor residential and domestic water use is for cleaning and sanitation, but many factors affect the amount of water used for these purposes.[79] Individual behavior, the type of fixtures and appliances employed, the cost of water, household income, and the age and lifestyle of residents all contribute to the amount of water used by residences and domestic purposes.[80]

Water providers and local governments should, at the beginning of any water conservation program, try to more precisely measure water efficiency within the community, and set their own quantifiable and achievable goals for the program. One of the best ways to do this is to estimate or calculate average per capita indoor water use. Simply calculated, residential indoor water use is a water provider's total residential winter demand divided by the total residential population served. This metric enables water providers to assess the potential of indoor efficiency programs and to evaluate those programs after implementation.

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[76] Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs.

[77] Average indoor water use from Amy Vickers (2001) Handbook of Water Use and Conservation. Amherst, MA: WaterPlow Press. Northeastern Illinois average use from Dziegielewski, Ben. "Estimating Water-Use Effects of In-Fill Growth versus Suburban Expansion Within the 11-County Area in Northeastern Illinois" March 17, 2009.

[78] The federal Energy Policy Act was passed in 1992 requiring low-flow fixtures to be installed in new homes. Homes built prior to 1992 would most likely have inefficient fixtures, such as toilets that could use up to 7 gallons per flush (as compared to the 1.6 gallons per flush required after 1992.)

[79] Water softeners also have an impact on indoor residential water usage. More information is available in the McHenry County Groundwater Protection Action Plan Wastewater Model Policy.

[80] Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs.

After residential indoor water use is calculated, water providers should compare their customers' use to the use in a water-efficient home. Sharing this information with customers can be an effective educational tool. Research conducted in the late 1990s by the American Water Works Association (AWWA) found that conservation could reduce indoor water use from about 69 gpcd to 45 gpcd for single-family homes.[81] Since that original study was published, other researchers and agencies have considered 45 gpcd an achievable level of indoor water use for homes with efficient fixtures and appliances as well as pressure adjustments for efficiency.[82] The degree to which 45 gpcd can be achieved by individual providers in McHenry County should be evaluated.

Comparisons of customers' residential water use to that of a water-efficient residence can also be used to guide the development of system-specific recommendations. Where reduction targets would be beneficial, water providers should consider reducing water use by an equal amount or percentage each year based on the amount by which they exceed the desired level of efficiency.[83]

In most cases, the most effective way for customers to maximize water efficiency is to replace inefficient fixtures and appliances with newer high-efficiency fixtures and appliances (e.g., toilets, showerheads, and washing machines). Research has shown that water providers and local governments can increase water efficiency by providing incentives for replacing less-efficient fixtures and appliances with newer more-efficient models.[84] Often a low cost incentive,[85] such as free low-flow faucet aerators to residential customers, can save thousands of gallons of water per residence per year.[86] Once water efficient fixtures and appliances are installed, water savings and improved efficiency last for the life of the fixture or appliance. Incentive programs also have the tangential effect of sensitizing customers to the need to be more efficient water users in all facets of their daily life.

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[81] Mayer, P.W. et al, Residential End Uses of Water, AWWA Research Foundation and AWWA, Denver, CO, 1999, p. 114.

[82] The original report of residential end uses of water and water efficiency was published in 1999, but information from the study was made available earlier through presentations and preliminary reports. The U.S. EPA Water Conservation Plan Guidelines (1998) estimates water use in a water efficient home to be 44.7 gpcd and encourages water providers to use system specific assumptions and estimates, where possible. Comparably, Vickers (2001) *Handbook on Water Use and Conservation*, built off the original 1997 study, reported that after installing water efficient fixtures and appliances and adjusting water pressure to 80 psi, indoor water use can reach 45.2 gpcd.

[83] For example, with the desired level of indoor residential efficiency is 45 gpcd, and a water provider's is 75 gpcd, their goal would be to reduce indoor residential use by 2 gpcd each year (calculated by subtracting 45 from 75 and then dividing by 15 years).

[84] Cobb County Water Authority, GA, San Diego County Water Authority, CA; Seattle Public Utilities, WA; and Town of Cary, NC provide good examples of successful incentive programs targeted, in part, to help reduce indoor residential water use.

[85] Examples of incentives can be found on the Alliance for Water Efficiency website under the Resource Library - Water Conservation Programs.

[86] Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms.* WaterPlow Press. 446 pgs.

Policy Recommendations

Recommendation 4A: In 2010, water providers should calculate or estimate average per capita residential indoor water use within the community. Water providers should also include information on water usage in metrics the water users can understand (i.e. gallons) on water bills and on the water providers website. *See Best Practices 6 and 7*

Recommendation 4B: By 2011, water providers and local governments should compare their average per capita residential indoor water use to an achievable level of efficiency and, where necessary, set water use reduction targets. *See Best Practices 7 and 25*

Recommendation 4C: By 2015, water providers and local governments should evaluate potential water-saving practices and incentives with a cost-effectiveness analysis,[87] then implement those practices and offer incentives that help customers maximize indoor water use efficiency. *See Best Practices 8, 12, 18, 19, 20, 21, 22*

GOAL #5: Help customers and citizens maximize efficiency of outdoor water uses.

Water providers, county, and local governments play an important role in helping water customers use water more efficiently outdoors, as well as indoors. Outdoor water uses include pools, spas, pressure washing, and noncommercial car washing. The majority of outdoor use is for landscape irrigation, covered in the series of recommendations in Landscape Irrigation.

Policy Recommendations

Recommendation 5A: In 2010, water providers, county government, local governments and the appropriate trade/professional associations should develop educational materials related to efficient water use for pools, spas, pressure washing and noncommercial car washing. *See Best Practices 23 and 24*

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[87] Cost-effectiveness (CE) analysis is a comparison of water management alternatives that work differently to achieve the same end result, such as water savings. Generally, the comparison is performed by calculating the costs required to achieve one unit of water savings. The potential water savings that result from water conservation practices or an array of practices can then be compared on a per unit basis to the alternative to saving water—developing new water supply or expanding existing water supplies**.** Therefore, the conservation practices that are lower cost than developing new water supply or expanding existing water supplies can be considered cost effective.

Recommendation 5B: By July 2010, local governments and water providers should distribute information to homeowners and professionals through service providers and local business bureaus. *See Best Practice 13*

Best Practices: A Menu of Options

Information-gathering and measurement practices

Best Practice 1: Analyze water use data
Detailed information about customer water use can be used to develop targeted educational programs, as well as to evaluate the effect of those programs. There are a number of ways to assemble a more complete picture of a community's water use and water needs. One approach is for water providers to evaluate water production and water distribution data. Water providers can also use current and historic customer bills to gain insight into the water use patterns and trends of customers before and after a conservation program is implemented.

In order to accurately assess the effect of conservation efforts, water providers and local governments can use ten years of data. This amount of data will most likely include a variety of weather conditions, such as drought years and wet years. Weather conditions, especially rainfall and temperature, should be considered as key data points when assessing water usage.

Best Practice 2: Listen to customers
Water providers and/or local governments may also want to create water conservation "citizen's councils," which can provide advice on community water needs and help plan conservation programs and assess the affect of those programs.[88] Conservation forums may also be helpful in some areas. Customer surveys can also provide valuable information about customers' water use and acceptance of education and outreach programs. This information can be used to retarget conservation programs or incorporate new program elements. Consider the need of a utility budget for supporting these volunteer groups.

Best Practice 3: Utilize the IWA/AWWA water audit method
The International Water Association/American Water Works Association water audit method gives water providers a detailed way of calculating efficiency that is specific to their system, yet consistent with calculations used by other providers.

The IWA/AWWA water audit method accounts for all water moving through the water treatment and distribution system, through direct metering or estimation. All water is categorized as either consumed or lost. Hence no water is "unaccounted-

[88] San Antonio Water System (SAWS) has a successful citizens council. Go to www.saws.org for more information.

for." The AWWA Water Loss Control Committee recommends water providers replace UAW with the specifically defined term "non-revenue water" defined as the volume of water going into a system that is not billed or producing revenue for the water provider.

The IWA/AWWA water audit method provides a process for determining and understanding real losses and apparent losses, the two major categories of non-revenue water. Real losses are the physical losses of water from the treatment and distribution system, including leakage and storage overflows. Because real losses represent water that is withdrawn and treated yet never used, they inflate production costs and contribute to undue stress on water resources.

Apparent losses are the "paper losses" that occur within system operations due to customer meter inaccuracies, billing system errors and unauthorized consumption. In other words, this water is consumed but is not properly measured, accounted, or paid for. These losses cost water providers revenue and distort data on customer water use patterns and trends.

In early 2009, AWWA released a manual of water supply practices *M36: Water Audits and Loss Control Programs, Third Edition*,[89] the first publication in North America to provide detailed and comprehensive instructions on the IWA/AWWA Water Audit Method. This manual, and the free software that accompanies it, can be a valuable tool for water providers trying to maximize their system efficiency.

Water providers should strive to reduce water losses to the lowest attainable level. Water providers can establish reduction targets as a way to demonstrate how they are progressing toward the goal of maximizing water efficiency within their system.

Implementation Actions:

6.1 Local governments in conjunction McHenry County should petition state and federal representatives (DNR) to update the rules and regulations related to water conservation planning to replace the term "unaccounted-for water" with the term "non-revenue water," as defined and supported in the IWA water audit method.

6.2 Associations for Illinois's water professionals should enhance, standardize, and expand technical guidance on conducting the IWA water audit method.

[89] To read a review or to order a copy of the M36 Manual, go to www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47957

Best Practice 4: Improving customer metering
Water providers can improve the accuracy of their metering by implementing a meter repair and installation program in accordance with the AWWA guidelines.[90] Water providers should consider replacing meters that have exceeded the manufacturer's recommended lifetime. Water providers should consider metering all connections, with the exception of fire services, and aggressively pursue and minimize unauthorized water service connections. Water providers may also improve their metering by adopting automatic meter reading (AMR) technology.

These programs may be funded by the Illinois Rural Water Association as well as through low-interest loans from the drinking water state revolving fund (DWSRF). These are funds provided through the federal Safe Drinking Water Act. In order to repay such a loan, the utility will have to find a sustainable and predictable funding source, such as altering water rates etc. The DWSRF can also fund incentive programs for water conservation (provided that the costs are included as part of a larger project).

Implementation Actions:

6.3 Water providers should use DWSRF funds for the installation of water meters, and where possible increase the amount of funding available.

6.4 Illinois Rural Water Association should assist water providers in locating and obtaining loans and partial grant opportunities for installing water meters.

Best Practice 5: Accurately measuring source withdrawals
It is important to be able to account for water withdrawn from the source. Water providers should calibrate and maintain the source water meters at the point of water withdrawal on a semiannual or quarterly schedule.

Best Practice 6: Categorize customers by class
By categorizing customers by customer class (i.e. commercial or residential), water providers can better understand which water users are demanding the most of the system and when. Water customers ultimately determine how much water is produced and delivered by water providers. Simple assessments of water use by customer class can often reveal water use patterns and trends that may lead to inefficient operations and use. Water providers can use this information to inform the selection of the most appropriate rate structure to meet the needs of the community and the water provider. Because almost all water systems in McHenry County serve some residential and non-residential customers, these two classes should be categorized first.

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[90] AWWA, 2001. Water Meters: Selection, Installation, Testing, and Maintenance (M6), Fourth Edition. For more information go to http://www.awwa.org/Bookstore/productDetail.cfm?ItemNumber=4531

There are a variety of methods to categorize water customer classes, and some are more precise than others. The most straightforward and accurate method of classification is through direct observation and information about the type of customer, such as residential, commercial, institutional or industrial.

Indirect methods, like using water meter sizes or the customer codes, commonly used for solid waste services, can also be used. However, these indirect methods are not as accurate as actually classifying the users by use type. Water providers can back up these indirect methods by surveying water customers.

Water providers can also employ billing software that recognizes and functions under rate structures with different customer classes.

Best Practice 7: Calculate average utility-specific per capita residential indoor water use

Residential indoor water use,[91] measured in gallons per capita per day (gpcd), is a metric that can be used to describe how efficiently residential customers use water. Residential indoor water use can be measured directly or estimated using billing data. Water providers may employ both indoor and outdoor meters to directly measure customers' indoor and outdoor water use, though dual meters are not economically feasible in most areas. Using the single meter approach, the water provider is therefore left to indirectly calculate residential indoor water use.

There are a variety of methods for calculating residential indoor water use. An example method is included in Appendix 3.6. Providers may also estimate indoor and outdoor use using representative samples of the customer base. Estimates of residential indoor water use will be more useful if they are consistent and comparable to one another.

- **Appendix 3.6** "Calculating Indoor and Outdoor Water Use"

Research conducted in the late 1990s by the AWWA found that conservation could reduce indoor water use from about 69 gpcd to 45 gpcd for single-family homes.[92] Since that original study was published, other researchers and agencies have considered 45 gpcd an achievable level of indoor water use for homes with efficient fixtures and appliances as well as pressure adjustments for efficiency.[93]

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[91] Simply calculated, residential indoor water use is a water provider's total residential winter demand divided by the total residential population served.

[92] Mayer, P.W. et al, Residential End Uses of Water, AWWA Research Foundation and AWWA, Denver, CO, 1999, p. 114.

[93] The original report of residential end uses of water and water efficiency was published in 1999, but information from the study was made available earlier through presentations and preliminary reports. Such is the case for the reference in the U.S. EPA Water Conservation Plan Guidelines (1998)

Comparisons of existing customer water use to that of a water-efficient home can also be used to guide the development of system-specific recommendations.

Implementation Actions:

6.5 McHenry County should coordinate with local governments**,** state agencies, and associations for Illinois water professionals to provide a template and protocol for calculating indoor and outdoor water use.

6.6 CMAP, in partnership with an independent third party such as a research institution or university, should conduct a statistical study of Illinois's indoor residential water use and publish this information for the broader use of Illinois's water providers. This study should examine a statistically meaningful sample of residential water bills from large and medium water systems. The sampling diversity should allow an analysis including, but not limited to, the following parameters:

- Size and type of water supply system (ground or surface water)
- Water system conservation efforts (toilet rebates, etc.)
- Type of structure (single family, multifamily, etc.)
- Quality of structure (Leadership in Energy and Environmental Design (LEED) certified, WaterSense certified, etc.)
- Age of structure
- Type of toilets
- Size and average age of household
- Household income
- Location (urban, suburban, exurban, rural, etc)
- Cost of water
- Wastewater disposal (municipal system or septic tank)
- Other (this list is not meant to be all-inclusive)

Best Practice 8: Perform Cost-effectiveness analysis

Cost-effectiveness analysis is a comparison of water management alternatives that work differently to achieve the same end result, such as water savings. Generally, the comparison is performed by calculating the costs required to achieve one unit of water savings. The potential water savings that result from water conservation

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that estimates water use in a water efficient home to be 44.7 gpcd and encourages water providers to use system-specific assumptions and estimates, where possible. Comparably, Vickers (2001) *Handbook on Water Use and Conservation*, built off the original 1997 study, to report that after installing water efficient fixtures and appliances and adjusting water pressure to 80 psi, indoor water use can reach 45.2 gpcd.

practices or an array of practices can then be compared on a per unit basis to the alternative to saving water—developing new water supply or expanding existing water supplies. Also, it is important to note that while certain conservation practices may be less costly than new or expanded water supply, other water management options may be necessary to meet the needs of McHenry County communities.

Cost-effectiveness analysis can help water providers select the best set of practices for conserving water uses within their community.

Implementation Actions:

6.7 State agencies, CMAP, associations of Illinois water professionals, and associations for County and local governments should provide cost-effectiveness evaluation training to water providers and local governments to help determine the most effective water conservation practices for their community.

6.8 State agencies, CMAP, and associations of Illinois water professionals should provide timely guidance on cost-effectiveness evaluation, and information on available, cost-effective programs and technologies.

6.9 McHenry County Government should encourage communities to utilize free tools available to perform some cost-effectiveness analysis when developing comprehensive and land use plans.[94]

Educational programs

Best Practice 9: Focus education and outreach programs to reach targeted audience

Education and outreach programs can be targeted towards a community's most inefficient uses and users, to produce the greatest results quickly. Common components of successful education and outreach programs include, but are not limited to:

- Educational lessons and material for kindergarten through high-school children
- Informational material for adults distributed through the media and public water providers,
- Training and educational opportunities for government and public service employees
- Targeted outreach efforts designed to influence high water users within the community.

[94] For more information about the study and the tool, visit http://www.smartcommunities.ncat.org/landuse/tools.shtml

Water providers, County and local governments can create a water conservation education media campaign to engage newspapers, television stations, and radio stations in efforts to educate and inform the community. These campaigns should include practical information, such as daily tips on ways to conserve water. Water providers can offer information and instruction to customers on how to read meters and check for leaks, as well.

Resources are available to help local governments and water providers develop targeted education and outreach programs, including:

- U.S. EPA's WaterSense Program (www.epa.gov/watersense) provides educational material, special labeling and media relations packets to its partners, making it easier for the public to choose water-efficient products.
- AWWA's "M52 Water Conservation Programs—a Planning Manual" provides guidance for water system managers on developing local water conservation plans. The manual describes goal-setting, water use analysis, potential savings, costs and benefits, conservation rate setting, program implementation, success measurement, and others.
- The Alliance for Water Efficiency (www.allianceforwaterefficiency.org) provides a variety of information about water efficiency programs, products, and practices.

These resources can be customized to address local conditions. Education and outreach programs should be updated every five years based on its success within the community and to incorporate new information.

Water providers, County and local governments can use existing funding mechanisms to develop and implement public education programs on water efficiency. For example, the Clean Water state revolving fund (CWSRF)[95] provides low-interest loans for such efforts.

Implementation Actions:

6.10 McHenry County Government, CMAP, associations for Illinois water professionals, local government associations, and state agencies should provide a model water conservation education and outreach program and provide guidance on developing community-specific water conservation education and outreach programs.

6.11 DNR and U.S. EPA should enhance the availability of media packets and promotional materials related to waterSmart, waterSense, and Energy Star.

[95] These are funds provided through the federal Clean Water Act.

6.12 DNR and U.S. EPA should provide guidance on education and outreach program evaluation methodologies.[96]

Best Practice 10: Integrate water conservation into existing educational programs

Water providers and county and local governments can offer teacher's training to kindergarten through 12th grade educators in the community. McHenry County Water Resources (Water Education for K12 Teachers) provides classroom-ready teaching aids on stewardship of water resources (www.mchenryh2o.com).

Water providers and county and local governments can also incorporate water conservation into school curricula and into nontraditional educational programs, such as those offered at nature centers and zoos.[97]

Best Practice 11: Designate Water Conservation Coordinator

Coordinating an education and outreach program can be challenging and time-consuming. Water providers and local governments should consider employing a professional to coordinate efforts and to ensure citizens and customers are receiving accurate and consistent messages and information. Multiple service areas should consider using a county or regional coordinator to take advantage of economies of scale and to ensure a consistent message.

Best Practice 12: Improve information provided on water bills

Bills that reflect a customer's monthly use can help customers better understand their water use. Providing simple price information to customers about their water usage and water rates causes demand to be more responsive to rate changes. Ideally, water bills can be structured to reflect the marginal cost of water, which can be calculated using estimates of the cost of developing the new supply needed to satisfy an increase in water usage, Research has found that, all other factors equal, when marginal prices are included on a water bill a water provider can achieve the same level of conservation as a 30 percent to 40 percent higher rate increase.

Implementation Action:

6.13 Local water providers in cooperation with McHenry County Water Resources should develop a model water bill that includes information about conservation-oriented rates, as well as clear information about the volume of water used and the charge per unit used.

Best Practice 13: Distribute information about efficient outdoor water use

Water providers, county and local governments can distribute any guidance on noncommercial outdoor water uses, developed according to Best Practice 24,

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[96] Texas' WaterIQ program is a statewide education campaign that has conducted similar assessments to determine effectiveness. For more information go to www.wateriq.org

[97] * McHenry County Schools Environmental Education Program (MCSEEP) currently offers a second grade and eighth grade lesson to all schools in McHenry County.

through their website, the local water provider water bills, electronic lists (via email) or through the following venues:

- Pressure washing BMPs can be distributed with information from the local storm water utility or through local venues that rent pressure washers (such as hardware stores or garden centers).
- At-home car washing BMPs can be distributed through local car-related retailers (automotive stores like Autozone, Pepboys, etc.).
- Pool and spa BMPs can be distributed through the local department of health or through local pool/spa service providers.

All materials can be distributed as a part of the larger educational efforts described in Best Practice 10.

Reducing waste and loss within the water system

Best Practice 14: Initiate program of leak detection, repair, and prevention
A great deal of water can be lost through system leaks. Practices such as pipe and fixture inspection, lining, cleaning, and basic maintenance tasks can identify existing leaks and prevent future leaks and ruptures from occurring. Water providers should include in a leak response plan efforts to reduce the time between locating a leak and repairing it, and should continually conduct field audits of water distribution system leak detection.

Implementation Action:

6.14 Associations for Illinois's water professionals should enhance and expand technical guidance on leak detection and repair programs.

Best Practice 15: Reduce water waste within the water system
Water waste is considered the inefficient use of water for a specific function or task, and can be eliminated when more efficient alternatives are implemented. For example, cleaning the floor of a water treatment plant can be accomplished using a wet broom, rather than using a high-pressure water sprayer. Water providers can evaluate their operations to identify areas of water waste.

Implementation Action:

6.15 Associations for Illinois's water professionals should enhance and expand technical guidance on reducing water waste with water systems.

Best Practice 16: Install efficient fixtures
Water systems can realize savings from replacing the fixtures used within the system itself. Water providers or local governments can apply for funding through the USDA rural development program to support the installation or retrofitting of

water-efficient devices, provided these are within the water system and not on private property.

Best Practice 17: Consider new practices from AWWA
The AWWA recently released the third edition of their Water Loss Control Manual (M36).[98] Water providers should consider the new practices listed in the new edition, as well as those included in any subsequent updates.

Reducing customers' water use

Best Practice 18: Utilize conservation-oriented rate structures
Many types of conservation-oriented rate structures are available for consideration (see Appendix 3.7 for a list of possible rate structures). The type of conservation-oriented rate structure selected for a community should reflect the unique characteristics of the water system and the mix of customers served. Water providers can use guidance developed by state agencies to help research customer demands and determine the most appropriate conservation-oriented rate structure for their community. Water providers should also consider using data gathered through information gathering practices to evaluate different rate structures.

- **Appendix 3.7** "Examples of Conservation Oriented Rates"

Water providers should consider redesigning customer bills to reflect new rate and customer usage. Redesigning bills is covered in more depth by Best Practice 13. Regardless of the type of conservation-oriented rate structure adopted, the rate should have three important characteristics:

1) **Reflect the true cost of water.** Often the price of water (i.e. the price paid by water customers) only reflects the cost of continuing to pump, treat, and deliver the same amount of water to the same number of customers. In fact, research shows that the price should reflect the true cost of water, including a) the future costs for additional water supplies for growing communities and b) funds required to cover capital improvements and replacements of aging water infrastructure and for enhancing the system's efficiency.[99] By failing to reflect such true costs, a water provider is subject to financial instability when changes occur in customer demands or infrastructure breaks down.

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[98] To read a review or to order a copy of the M36 Manual, go to www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47957

[99] Chesnutt, T.W., J.A. Beecher, P.C. Mann, D.M. Clark, W.M Hanemann, G.A. Raftelis, C.N. McSpadden, D.M. Pekelney, J. Christianson, and R. Krop (1997). *Designing, Evaluating, and Implementing Conservation Rate Structures.* Available at www.cuwcc.org or www.awwa.org .

2) **Send a price signal to customers.** Recent research in Georgia finds that effective conservation-oriented rate structures are not restricted to one single type. However, all rate structures can be designed to send customers a strong price signal about the value of water and water services and encourage them to use water more efficiently. For example, water providers can set steep rates that send strong signals to all customers. But establishing an equitable structure for all customers is important (low water using customers should not be penalized for using minimal amounts of water to meet basic needs.)[100] According to some, the strongest price signals can be sent by handling revenue requirements separately from, but not unrelated to, the volume of water used.[101]

3) **Help stabilize a water system's revenue.** Often times a conservation-oriented rate structure with a strong price signal will generate additional revenues for the water provider (i.e. during times of high water use like summer months when landscape irrigation is practiced.) These sources of additional revenues can be set aside and used to help a water system stabilize revenues when water uses by customers fluctuate. Additional revenues can also be invested into a fund to help improve efficiency in the water plant and delivery system or to help customers reduce water use.[102]

Implementation Actions:

6.15 The county, local governments, and local water providers should refer to the Alliance for Water Efficiency and CMAP for guidance on conservation-oriented rates. This guidance should be applied county-wide.

6.16 CMAP, county and local governments, local water providers, and associations for Illinois water professionals should develop educational material for elected officials and the public regarding the value and cost of sustaining healthy water supplies.

6.17 CMAP, McHenry County Government, and associations for Illinois water professionals should provide educational material to water providers and local governments to help build public understanding and acceptance of conservation-oriented rate structures.

6.18 Associations for Illinois water professionals and associations for Illinois local governments should offer training and guidance to water system

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[100] Environmental Finance Center. "Water Price Signals in Georgia." November 28, 2007. Online at http://www.efc.unc.edu/ga/rates.html

[101] Raucher, B. (2005). "The Value of Water: What it Means, Why it's Important, and How Water Utility Managers Can Use It." *Journal AWWA* 97:4. April 2005. Pages 9098.

[102] San Antonio has developed such a fund, which allows them to develop and implement conservation programs for all their customer classes. www.SAWS.com

employees and managers, local governments' employees, and elected officials on the benefits of conservation rates and methods for implementing them.

Best Practice 19: Establish retrofit and rebate programs

Retrofit program or rebate programs can be effective in replacing older plumbing fixtures, such as toilets, showerheads, and faucets, and older water-using appliances, such as dishwashers and clothes washers, with high efficiency fixtures. Replacing inefficient fixtures and appliances can be an effective and long-term way to save water. Water providers or local governments could also consider offering rebates for state-of-the-art water conservation products such as "toilet repair" or "toilet improvement" parts and technologies.

Water providers or local governments can also apply for low-interest rate loans from the DWSRF for the installation or retrofitting of water-efficient devices. In order to repay such a loan, the water provider will have to find a sustainable and predictable funding source, such as altering water rates.

Best Practice 20: Establish incentive programs

Local governments and water providers can offer a variety of incentives to their customers, such as distributing free low-flow faucet aerators to residential customers. Water providers can provide leak detection tablets to customers to encourage them to check for leaky toilets within their home or business. The State of Illinois should consider providing for an exemption from both state and local sales and use taxes for specific energy and water efficient products (specifically products certified as WaterSense and Energy Star.)

Local governments and water providers can also offer incentives to commercial and industrial customers to maximize their nonindustrial use. For example, these customers can be encouraged to collect condensate and use it within the business, use water quality ponds for permanent storage for irrigation use or use process water for irrigation. Care should be given to check with local and state regulations regarding water re-use.

Best Practice 21: Expand metering programs

It is easier to convince customers to conserve water when their personal water use is measurable. Frequently, tenants in multifamily buildings do not receive water bills. Local governments can require new customers serving multi-family housing units to provide sub-meters on individual units. Water providers and local governments can also encourage sub-metering through the use of water audits and by offering financial incentives for retrofitting existing apartment buildings with sub-meters. To help reduce financial impacts on tenants, guidance could be adopted that specify acceptable methods of metering and billing.[103]

[103] For an example of equitable metering and billing visit http://www1.gadnr.org/cws/ or http://www.northgeorgiawater.com/files/WSWC_SECTION5.PDF

Best Practice 22: Review and update building codes and local ordinances
There are several changes that local governments can make to ordinances and codes to permit or encourage innovative technologies. For example, greywater, defined as water that has been used in the home in sinks, showers, or other non-toilet uses, may be reused in toilets if allowed by the State of Illinois and then by local ordinances and codes. Local governments can change plumbing codes to require the installation of high efficiency toilets in new homes or business, or to prohibit fixtures that are wasteful and designed to skirt current efficiency codes. Local governments can also alter codes or provide incentives to encourage Green Building. For more on greywater, see Section 2, B7: Wastewater.

Implementation Actions:

6.19 Homebuilders associations, US EPA, and Green Builders should offer water efficiency certification for developers and/or homes/businesses that have certified or approved indoor water efficiency fixtures installed (LEED or EPA WaterSense certification).

6.20 The State of Illinois should consider a proposed amendment to the state plumbing code that prohibits the use of multiple showerheads and shower tower systems[104] that are wasteful and designed to evade current regulations and efficiency codes.

Best Practice 23: Publish guidance documents for outdoor water uses
Water providers and local governments can develop a best management practices guidance document for key outdoor uses, including:

- Water used in pools and spas: These guidelines can be developed in cooperation with local health departments, DNR and appropriate professional associations. Guidelines could include a leak test protocol for pools and spas.

- Pressure washing: These guidelines can be developed in cooperation with professional power washers.[105]

- Noncommercial car washing: This guidance should consider limiting the amount of water used and minimizing water lost due to evaporation.

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[104] Multiple showerheads and shower towers can deliver up to 21 gallons per minute. For more information go to www.Allianceforwaterefficiency.org

[105] Gwinnett County has already created guidance on this topic and it could be used as a model for other areas. See Gwinnett County Stormwater Management Division. WQ01 : Water Quality Protection Guideline, Surface Cleaning.
www.gwinnettcounty.com/departments/publicutilities/pdf/WQ01%20Surface%20Cleaning.pdf

Guidance may recommend using a bucket or shut off nozzle, or washing cars on grass to maximize the water use and minimize runoff.

Implementation Actions:

6.21 Appropriate professional organizations should help local governments develop best management practices and distribute them to water customers.

6.22 Associations of Illinois's local governments and the appropriate professional and trade associations should offer technical assistance to develop guidance documents.

Best Practice 24: Develop and Adopt water waste ordinances

Local governments can adopt water waste ordinances that minimize losses from noncommercial outdoor water uses not related to landscape irrigation. Such ordinances could include, but not be limited to 1) requiring pool covers be placed on pools during the offseason or 2) prohibiting the use of hoses without shutoff nozzles for washing cars.

Implementation Action:

6.23 CMAP in conjunction with county and local governments should develop a model water waste ordinance addressing outdoor water uses.

Planning

Best Practice 25: Incorporate water conservation into plans

Reduction targets and the practices implemented to achieve those targets can be incorporated into a provider's water management and conservation plan. The results from conservation programs can also be incorporated into land-use and capital improvement plans.

Implementation Actions:

6.24 McHenry County Water Resources should offer assistance to local governments and water providers throughout McHenry County to inform them of the elements of the Water Conservation Chapter and encourage them to consider water conservation when reviewing local land-use and comprehensive plans.

6.25 Technical assistance should be offered to guide local governments responsible for land use planning on ways to incorporate water conservation into those plans.

Prepared by:

County of McHenry
Division of Water Resources
2200 N Seminary Ave
Woodstock, IL 60098
www.mchenryh2o.com

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Groundwater Protection Task Force