

On-site water reuse systems

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Only 15% of the water used in homes actually needs to be potable.  
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Most people think of Wisconsin as having abundant water resources. As population growth and expanding industries continue to increase our state's thirst, however, water conservation is becoming more and more important.

Water is conserved every time we pump less from lakes, rivers, or groundwater. While water-saving technologies have helped to reduce the amount that we use on a daily basis, reusing water can also cut down on our consumption.

Water reuse—using the same water to perform more than one function—enables us to get the most out of every drop. Water reuse is becoming increasingly popular as a tool for Wisconsin citizens and communities to achieve their water conservation goals.

Why be concerned about water use?

Water quantity is an issue in some parts of Wisconsin, where concentrated pumping of groundwater threatens the health of nearby streams. In other areas, communities have had to locate alternative sources of water because of contamination in existing groundwater aquifers. And some have trouble extracting sufficient groundwater because of the local geologic conditions.

Even in areas that have not experienced water quantity issues, incorporating water reuse is still good for the overall health and prosperity of local communities:

- It helps to ensure clean and abundant ground- and surface water supplies for future generations.
- It protects sensitive springs, lakes, and streams that may be negatively affected by water withdrawals.
- It reduces the volume of wastewater requiring treatment.
- It can help to reduce the impact of sudden surges of stormwater flowing into our lakes, rivers, and streams.

By reusing water that would normally just go down the drain, people can begin to dramatically cut down on their daily water consumption without having to change their daily routines. Such water reuse could save money, energy, and—ultimately—our water supply.

ON-SITE WATER REUSE SYSTEMS: USING WATER TO ITS FULL POTENTIAL

Water reuse can save money for households, businesses, and water utilities by:

- Lowering the energy costs associated with pumping groundwater.
- Reducing the chemical inputs for water treatment.
- Downsizing private on-site wastewater treatment systems.
- Promoting greater efficiency of the existing water supply. Water reuse helps save money by minimizing or eliminating the need for further expansion of the water supply and/or wastewater treatment infrastructure.

The concept of on-site water reuse is quite simple: recycling usable water that otherwise just goes down the drain. This water is then reused for other purposes in or around your home or facility that do not require as high-quality a grade of water. (The grade or category water is given depends on its original source; see table 1.)

At present, potable water—water suitable for drinking—is used to fill most of the needs of our homes, yards, and many businesses. As all that high-quality water is being used, very little of it is actually being “consumed” in the sense that a glass of water that we drink or water applied to our lawns and gardens is used up and no longer available for other purposes. Most household water, for example, is simply transformed from potable drinking water into a variety of lower-quality grades when it is used for showering, laundry, or flushing toilets and then treated as waste as it is discharged through various drains to a municipal wastewater treatment system or a septic system.

With the appropriate treatment, water generated from showers, bathroom sinks, and clothes washers as well as rainwater collected from roof areas can be used to supply water to flush toilets or to irrigate lawns and landscaping.

With conventional plumbing systems there is enormous untapped potential in how we use and consume water. With appropriate treatment, *more than half* of the water used inside our homes could be made suitable for reuse (figure 1 and table 2).

In addition to households, many businesses are well suited to water reuse and could see significant benefits by investing in the practice. The challenge is for businesses to recognize opportunities specific to their industry. Some car washes already collect water used to wash cars; after appropriate treatment the water can be used again to wash multiple vehicles. In addition, hotels may find it beneficial to collect graywater from showers or laundry operations and use it again for flushing toilets. Other businesses may find that stormwater collected off of rooftops or parking lots can also be used to flush toilets or irrigate landscaping.

Table 1. Water quality is categorized based on its source, which in turn determines its potential use

Water quality category	Characteristics	Source	Use or potential use (after appropriate treatment*)
Potable	<ul style="list-style-type: none"> • Highest quality of water • Meets or exceeds drinking water standards 	Municipal water utility or private well	Any household water use
Clearwater	Wastewater where impurity levels are below a minimum concentration considered harmful	Primarily non-contact cooling water or condensate from chillers	<ul style="list-style-type: none"> • Flushing toilets • Irrigating lawns and landscaping
Graywater	Wastewater that does not contain urine, feces, or industrial or food waste	Generated from the use of: <ul style="list-style-type: none"> • Showers • Bathroom sinks • Washing machines 	<ul style="list-style-type: none"> • Flushing toilets • Irrigating lawns and landscaping
Stormwater	Water from rain or melting snow	Collected rain or snowmelt from a roof or other impermeable surface	<ul style="list-style-type: none"> • Flushing toilets • Irrigating lawns and landscaping
Blackwater	<ul style="list-style-type: none"> • Lowest quality of water • Water that has been contaminated by human body waste or food waste with large organic matter content 	Generated from the use of: <ul style="list-style-type: none"> • Toilets • Urinals • Kitchen sinks • Dishwashers 	After more complex treatment, can be used for flushing toilets and irrigating lawns and landscaping

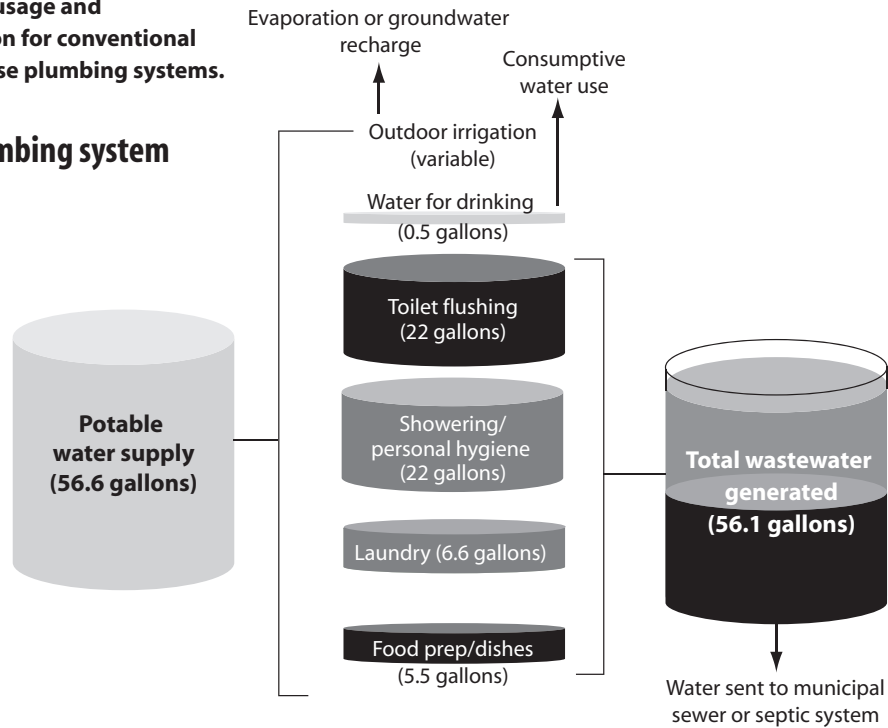
* Treatment standards can be found at www.legis.state.wi.us/rsb/code/comm/comm082.pdf

ON-SITE WATER REUSE SYSTEMS: USING WATER TO ITS FULL POTENTIAL

Figure 1. Daily water usage and wastewater generation for conventional and on-site water reuse plumbing systems.

Conventional plumbing system

- Potable water
- Graywater
- Blackwater



Water reuse plumbing system

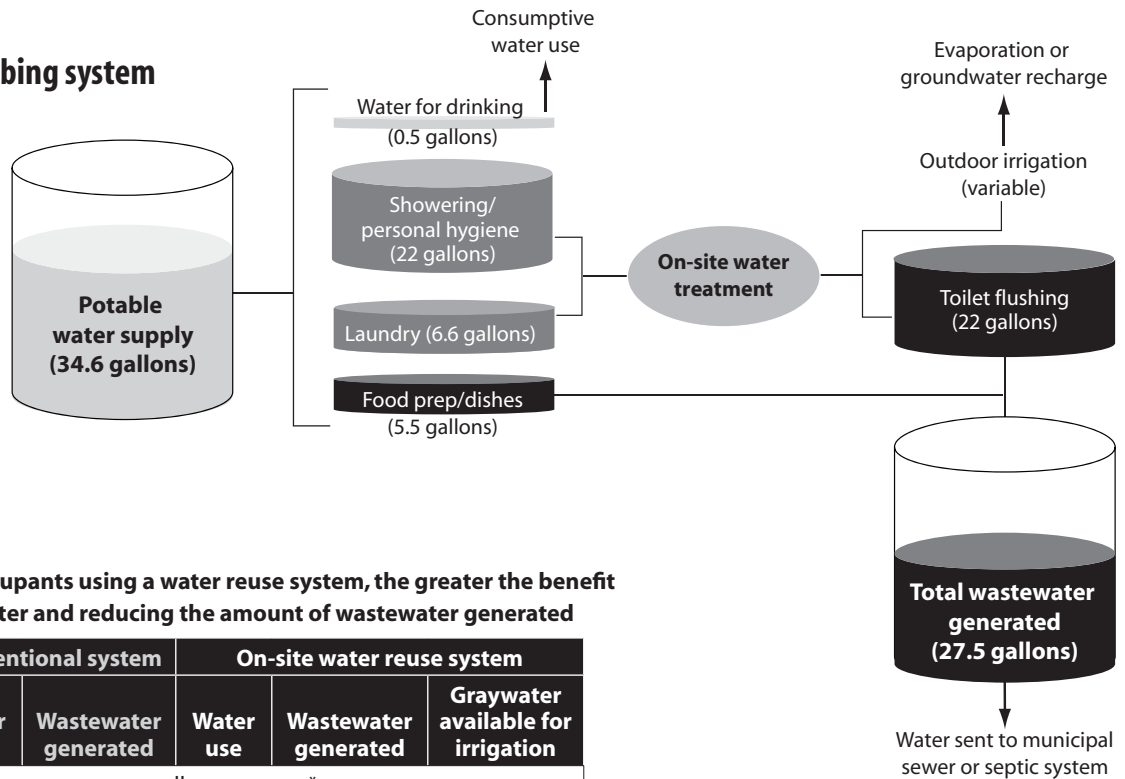


Table 2. The more occupants using a water reuse system, the greater the benefit in terms of saving water and reducing the amount of wastewater generated

Number of occupants	Conventional system		On-site water reuse system		
	Water use	Wastewater generated	Water use	Wastewater generated	Graywater available for irrigation
----- gallons per year* -----					
2	41,318	40,953	25,258	20,075	4,818
3	61,977	61,430	37,887	30,113	7,227
4	82,636	81,906	50,516	40,150	9,636

*Based on daily water use estimate of 56.6 gallons/person.

Is water reuse safe?

There are already a small but growing number of on-site water reuse systems that are operating safely and successfully right here in Wisconsin. When water reuse systems are *properly installed and maintained*, the health and safety concerns from reused water are no greater than those from existing municipal or private well-water supplies.

The main issues to be considered are those of health and hygiene. The water treatment equipment that is required depends on the quality of the collected water and its intended reuse. For instance, to use graywater or stormwater in the home for doing laundry or flushing toilets, disinfection through the addition of chlorine or other approved methods is necessary. Water reuse systems such as these that are properly installed and carefully maintained are perfectly safe and will not contaminate potable water supplies.

In Wisconsin, the average person uses between 50 and 60 gallons of water inside the home per day.

Who regulates on-site water reuse in Wisconsin?

Because on-site water reuse is largely a plumbing issue, it is regulated by the Department of Commerce, which is responsible for administering the plumbing code. The Wisconsin, s. Comm 82.70 of the Wisconsin Administrative Code implemented May 1, 2003 allows the reuse of water to promote water-use efficiency. This section specifies the water quality standards that must be met in order for water to be reused. Thus, any plumbing system that supplies water at an outlet or at its termination must be designed to meet or exceed the minimum water quality requirements for the

use it will be put to. See the **Resources** at the end of this publication for the Department of Commerce website that provides this information in detail.

Can I install an on-site water reuse system?

Yes. However, the Wisconsin Department of Commerce currently requires state-level plan review and approval for plumbing systems that reuse gray-, clear-, or blackwater or use stormwater as a source of water inside a home or business.

Water reuse is not for everyone. Retrofitting plumbing systems in existing homes and businesses is often cost-prohibitive for remodeling projects. Owners interested in water reuse should be aware that additional time, cost, and maintenance are necessary to keep these systems running safely and efficiently.

Some gain more easily than others from water reuse opportunities. Homes or businesses that use large amounts of water will see economic benefits from the reduction in water use. And water reuse may simply be part of an overall goal of making a new or existing building more water efficient or fulfilling water-use reduction standards for LEED building certification. For up-to-date information on how on-site water reuse systems meet LEED requirements, see the **Resources** at the end of the publication.

New construction is often best suited to installing water reuse systems. Local governments may have a role to play implementing water reuse and conservation in proposed municipal buildings as well as property developments, particularly in cases where tax increment financing or other incentives are awarded.



Industrial tanks such as these can store hundreds or thousands of gallons of rainwater that has been collected from rooftops for later use.

How do I get started?

1. Find a plumber, engineer, architect, or contractor who is knowledgeable about water reuse systems. Work together to develop a plan that meets your household or facility needs. Any water reuse system or component being considered must have plumbing product approval from the Department of Commerce. See **Resources** to find a source for products that are approved for water reuse in Wisconsin.
2. Submit a plumbing plan for review by the Department of Commerce. The plan review focuses on the plumbing engineering of the system(s), component reliability, contingency plans, and system maintenance. Your plan should include:
 - Plumbing Plan Review Application (SBD-6154)
 - Scaled plot plan
 - Scaled floor plan
 - Drain, waste, and vent system isometric drawing for the engineered blackwater/graywater system
 - Non-potable water system isometric drawing
 - Potable water system isometric drawing
 - Operational description of the system along with a maintenance plan with a manual addressing all serviceable components or systems
 - Written contingency plan that provides instructions in case of system malfunction
 - Water calculation worksheets for the complete non-potable water system and any connection to the potable water system
 - Copy of the plumbing product approval letter for the water reuse system being installed. *Additional stipulations related to the use and monitoring of the system can be found in the product approval letter.*

For system installations that include irrigation and/or infiltration, information must also be provided on soil type and infiltration rate.

The plan must be:

- Signed by a Wisconsin licensed Master Plumber, registered architect, designer, or engineer.
- Approved by the Wisconsin Department of Commerce prior to any actual work taking place.
- Accompanied by a copy of the deed attachment. The deed attachment must contain the following minimum information: a written functional description of the system and anticipated effects and a written statement that specifically acknowledges that if the maintenance of the system is not performed on schedule or reports are not received in time, the system will be ordered shut down and removed.

3. After the plan review process is complete and the installation finished, a State Plumbing Consultant must inspect the completed installation. The system shall *not* be put into service before the final installation is completed, inspected, and passed. The owner will need to test the water and send in results and maintenance records on a regular basis; frequency depends on the nature of the wastewater and the risk associated with human contact or environmental impact if the system malfunctions.

The future for water reuse systems

Public acceptance has been one of the major obstacles to implementing water reuse in many parts of the world. Because water reuse is still a relatively new practice in modern homes and businesses, the public often has reservations about health risks or aesthetic concerns. As more water reuse systems are properly installed and put to productive use, however, these concerns will lessen over time.

Pioneers of water reuse in Wisconsin must follow design requirements closely and carefully manage and monitor systems to ensure that they are working efficiently and safely. While the current regulations and permitting of these systems might seem complex, they are critical to ensuring that the systems function as designed, water conservation promises are met, and the public health is protected.

Water reuse is the next great advance in water conservation because of its tremendous potential to increase water use efficiency and reduce our water consumption. Those who implement water reuse will have the opportunity to save money on water and energy costs. At a community and state level, water reuse is a tool that will allow us to expand industrial and business opportunities without greatly increasing the overall demand for water.



On-site water reuse systems that allow graywater to be used for outside irrigation require a separate hose bib clearly marked for non-potable use only.

References

- Wisconsin Administrative Code Chapter Comm 82: legis.state.wi.us/rsb/code/comm/comm082.pdf
- Wisconsin Department of Commerce – Safety and Buildings Division: commerce.state.wi.us/SB/
- Asano, T., F.L. Burton, H.L. Leverenz, R. Tsuchihashi, G. Tchobanoglous. 2007. *Water Reuse: Issues, Technologies, and Applications*. McGraw-Hill Companies, Inc.: New York.

Resources

- For a description of water quality standards that on-site water reuse systems must meet, see:
- Wisconsin Administrative Code Chapter Comm 82: legis.state.wi.us/rsb/code/comm/comm082.pdf
- For a list of products approved for water reuse in Wisconsin go to: commerce.wi.gov/php/sb-ppalopp/prodcode_alpha_list.php
- For the latest information on LEED certification requirements, visit the U.S. Green Building Council website: www.usgbc.org
- For more information on other water conservation strategies in and around the home, including the installation of rain barrels, please consider the following:
- Better Homes and Groundwater, 2004. Wisconsin Department of Natural Resources. (PUB-DG-070 2004) dnr.wi.gov/org/water/dwg/pubs/bhgw.pdf
- Rain Barrels, 2008. University of Wisconsin–Extension (XHT1157) wihort.uwex.edu/gardenfacts/XHT1157.pdf
- Rethinking Yard Care, 1999. University of Wisconsin–Extension (GWQ009) clean-water.uwex.edu/pubs/pdf/home.rethink.pdf

Water reuse will help to ensure that there is adequate water for our lakes and streams for generations to come.



Did you know?

One inch of rain collected from a 1,000 square foot area of roof amounts to 623 gallons of water. That equals 389 flushes of a new water-efficient toilet. With Wisconsin's average annual rainfall of 32 inches, reusing the water from that rooftop would save 12,448 flushes.

Groundwater is the source of water for 95% of Wisconsin communities; in addition to pumping by municipal wells, groundwater is tapped by private wells, irrigation wells, and industries. Because groundwater also feeds springs, streams, and lakes, concentrated pumping in close proximity to these surface waters can sometimes result in environmental damage.

The collection and use of rainwater helps reduce volumes of stormwater runoff and can be an important tool for new developments to meet stormwater regulations.

Rain barrels are an easy way for homes and businesses to practice water reuse. Rain barrels collect and store rainwater from roofs or other impervious surfaces that can then be used to water the landscaping or garden.

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