



JUMP Into

Pool Water Efficiency



Thoughtful residential swimming pool design and ongoing maintenance can help save pool owners water, energy, and money. Addressing issues related to evaporation, water quality, leaks, or pool usage can all save water. The U.S. Environmental Protection Agency's (EPA's) WaterSense® program developed this guide to help residential pool owners and maintenance professionals understand and minimize pool water use. Commercial pool owners can find additional information in [*WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities*](#) at www.epa.gov/watersense.

Introduction

Pools provide a fun and relaxing way to keep cool during warmer months. However, if not adequately maintained, your pool could be sending water and money down the drain. Pools can consume water through evaporation, pool cleaning, leaks, and splashing. Investing in new equipment or employing targeted maintenance techniques can save water, energy (for heated pools), and money.

This guide provides an overview of design considerations, retrofits, and maintenance practices that are aimed to improve the water efficiency of residential pools. WaterSense developed this guide with a focus on in-ground and above-ground residential pools, but many of the practices also apply to commercial pools or spas. For more information, consult the additional resources listed at the end of this document.

Evaporation

Evaporation is one of the leading causes of water loss in residential pools, especially in hot, drier climates where pools are most prevalent. The rate of evaporation from a pool is dependent on a number of variables, including temperature, humidity, and wind speed. EPA estimates that, depending on climate, an uncovered 500-square-foot swimming pool could lose between 12,000 and 31,000 gallons of water per year due to evaporation, with this number being even higher for heated pools. Not only does this contribute to water waste,

but it can also cost homeowners money! Reducing water loss from evaporation is the best way to reduce overall water usage in your pool.

Size Pools for Use

A pool's surface area directly impacts the volume of evaporation that may occur. In effect, the larger a pool, the more water that is likely to be lost due to evaporation. Further, a deeper pool requires more water to fill and more resources to maintain (e.g., filtration, chemicals, heating).

Therefore, when planning a new pool installation, consider how you want to use the pool and select a size and design that will meet your needs while minimizing potential water usage. A smaller pool design can result in lower maintenance costs and helps reduce water consumption.

Cover Up

Pool covers are the most effective method of reducing water losses from evaporation. When in use, solid pool covers can reduce evaporation by more than 90 percent and, in the case of heated pools, save between 50 and 70 percent of pool heating costs.¹ Any pool can

Cover Your Bases

According to data collected as part of the 2016 *Residential End Uses of Water* study, only 15 percent of pool owners have and regularly use a pool cover.²

¹ Minos, 2021

² DeOreo et. al., 2016

Table 1: Types of Pool Covers and Their Attributes

Type	Effectiveness at Reducing Evaporation When in Use ³	Can It Serve as a Safety Cover?	Additional Information and Considerations
Solid/mesh/hybrid	Up to 95 percent	Yes	Mesh covers are lighter weight than solid covers but allow more evaporation to occur.
Solar (bubble cover, solar rings, thermal)	50 to 95 percent (varies based on shape and coverage)	No	Solar covers are designed to use the sun's energy to heat the pool.
Liquid evaporation suppressant	15 percent	No	Non-toxic, chemical evaporation suppressant is applied to pool surface on a regular basis.



Figure 1: Solid Pool Cover



Figure 3: Reel Used For Applying Bubble Pool Cover



Figure 2: Bubble Pool Cover



Figure 4: Solar Rings³

³Muleta, 2016

be retrofitted with a cover, so if your pool doesn't have one, this is the most effective first step you can take to reduce evaporation. If you already own a cover, use it as often as possible, as covers are only effective at reducing evaporation when they are applied.

Pool covers can be made from a variety of materials and can significantly vary in terms of cost, usability, safety, and efficiency. Solid covers prevent debris and precipitation from entering the pool, but water can collect on top, which may require a pump to remove. Mesh covers allow some debris and precipitation to pass through, so no water will collect on top. Table 1 on page 3 displays the most common types of pool covers on the market and their associated attributes.

Pool covers are only effective when applied to the surface of the pool; therefore, pool owners should consider ease of use when making a purchase so that any time the pool is not in use, the pool cover is. Automatic covers, which are installed on a track at the edge of your pool, can be deployed at the press of a button and can take the heavy lifting out of pool cover use. If an automatic pool cover is not practical, a motor-driven reel or hand crank can be used with some types of covers to help guide the cover over the pool surface.

Winter covers are a subset of pool covers. A winter cover is used over an extended period during the pool offseason to protect it from damage and debris. Winter covers can be more secure and typically double as safety covers, but often are not practical to be used on a daily basis for evaporation reduction.

Some utilities offer rebates of up to \$200 for qualified covers. Check with your local water utility to see if they offer a rebate to purchase and install a pool cover.

Cool Off

Water temperature affects the evaporation rate of a pool, since higher temperature water evaporates more quickly. In a heated pool,

Safety First

When purchasing a cover for your pool, prioritize safety, in addition to potential water and energy savings. Safety covers help inhibit pool access by children, animals, or other unwanted swimmers during unsupervised periods.

Pool covers can be certified as safety covers under [ASTM F1346-91](#), the *Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs*. The standard test methodology includes tests for load bearing and surface water drainage, and also ensures no openings are present between the cover and pool. Many states and local jurisdictions have established safety requirements for residential pools, and in some cases require a safety cover if fencing and locked gates are not installed.

evaporation reduces the water temperature, which means additional energy is needed to keep the pool at the desired temperature. Most heated pools are kept between 78°F and 82°F, and depending on your location, each degree increase could increase energy costs by 10 to 30 percent.⁴ For an outdoor pool, keeping the pool temperature lower can reduce evaporation and heating costs. For an indoor pool, keeping the ambient air temperature higher than the water temperature can reduce evaporation. If you are planning to be away for several days, be sure to turn the pool heater off or turn the temperature down. Don't forget to throw on a pool cover, too!

Other Ways to Reduce Evaporation

Many pools have water features such as fountains or waterfalls. While these features can

be aesthetically pleasing when the pool is in use, the turbulence added to the pool surface increases evaporation and can also result in water lost to wind or splashing. To reduce water loss, only turn on these features when the pool is in use. Alternatively, put water features on a timer to make sure they turn off after a set amount of time or at night.

Installing a windbreak to reduce wind speed around the pool can also help to reduce evaporation. Landscaping or other physical barriers, such as stone walls or fencing, can increase wind protection. Increasing shade through landscaping can also keep the pool cooler and reduce the effects of evaporation. Be sure to carefully select landscape plants so they don't contribute more debris to the pool.

Water Quality

Maintaining a pool's water quality keeps water safe and looking clean for swimmers, but it can also reduce water loss! The California Urban Water Conservation Council (CUWCC) estimated that 23 percent of quantifiable pool water use is attributed to filter backwashes, the process of sending water backwards through a filter to remove debris build-up, and 21 percent is attributed to control of

Pump It Up

Pool pump upgrades can make your circulation system energy-efficient and extend the life of your pool filter. Beginning in 2021, pool pumps sold in the United States are required to be variable-speed pumps. A variable-speed pump offers substantial energy savings compared to older models. ENERGY STAR® certified pool pumps take energy efficiency even further, reducing energy use by 11 to 18 percent.⁶

total dissolved solids (TDS), which can only be maintained by dumping portions of contaminated water and replacing it with fresh water.⁵ Keeping a pool free of debris and microbes can reduce corrosion, decrease the risk of developing leaks, and increase the longevity of your pool water.

Filtration

Deploying a high-performance filter can keep debris out of a pool and reduce the risk of leaks. Filters range in their filtration ability



⁵ Koeller and Hoffman & Associates, 2010

⁶ ENERGY STAR, n.d.

Table 2: Types of Filters and Their Attributes

Filter Type	Filtration Ability	Water Usage	Filter Media Lifetime	Maintenance Practices and Other Notes
Sand	20 - 40 microns ⁷	💧💧💧	3 - 6 years ⁷	<ul style="list-style-type: none"> • Backwash once per week
Glass	5 microns ⁸	💧💧	7 - 15 years ⁹	<ul style="list-style-type: none"> • Backwash once per week • Alternative to sand with shorter backwash cycles • Requires less frequent replacement of media than sand filters
Diatomaceous Earth (DE)	5 microns ⁷	💧	2 to 3 years (grid lifetime) ⁸	<ul style="list-style-type: none"> • Backwash every 4 to 8 weeks • DE media must be added after every backwash • DE can be harmful if inhaled
Cartridge	10 microns (can vary) ⁷	💧	2 to 4 years ⁷	<ul style="list-style-type: none"> • Frequency of cleaning depends on cartridge • Clean by spraying with hose, no backwash required

(measured in terms of the smallest particle they can filter out); cost; maintenance practices; and water efficiency. Filtration ability is discussed in terms of microns (one micron is one millionth of a meter). The smaller the micron that can be removed, the better the filtration ability. Table 2 displays the main types of pool filters on the market and their associated characteristics.

Each filter type has its advantages and disadvantages. Sand filters are the most commonly used filter type for residential pools due to lower initial cost and ease of maintenance. A comparable, but more water-efficient, alternative to sand filters is a filter with glass media, which allows a shorter backwash cycle. Glass media can often be used as replacement media within an existing sand filter. Cartridge filters are the most water-efficient because they do not require backwashing. Using oversized cartridge filters can also cut down on water use because cleaning frequency is reduced. Diatomaceous

Earth (DE) filters offer the highest performance but are also the most costly and require additional DE after each backwash.

Heat Up Energy Savings

Take energy efficiency into consideration when purchasing a new pool heater. Consider replacing your gas heater with a solar heater or heat pump to reduce long-term energy costs.

If purchasing a heat pump pool heater, check its coefficient of performance (COP) to determine the energy efficiency. COPs typically range from 3 to 7; the higher the COP, the more efficient the heater.¹⁰

Check the [DOE's Energy Saver pages on efficient pool heaters](#) for more information.

⁷Koeller and Hoffman & Associates, 2010

⁹1st Direct Pools, 2021

⁸Giovanisci, 2021

¹⁰DOE, n.d.

If you are constructing a new pool, consider using a cartridge filter to jumpstart your pool's water efficiency. If you are looking to upgrade to a different filter type, it is important to know whether changing filter systems would require extensive plumbing alterations to operate efficiently.

The best way to reduce water use is to minimize the frequency and length of backwashes or cleanings. Using skimmers and vacuums to manually remove leaves and debris can reduce the load on filters and increase the time before a backwash is necessary. Installing a pressure gauge on the filter can help determine when it is time to backwash. When the water pressure increases by 10 pounds per square inch (psi), a backwash is usually necessary. You can also consider using backwash water on your lawn or garden. Just be sure the backwash water is not freshly chlorinated, so it is safe for your plants.

Other Ways to Maintain Water Quality

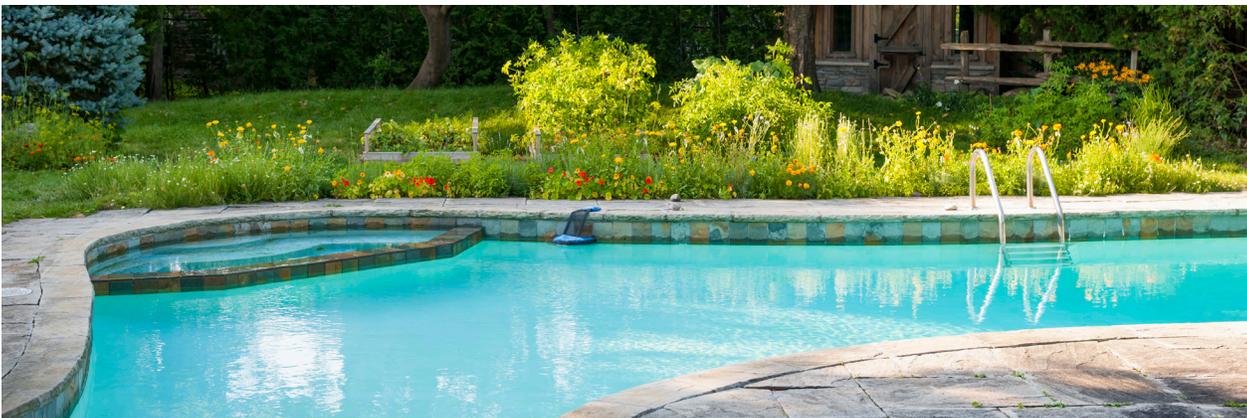
Other ways to maintain pool water quality include use of ozone, ultraviolet light, copper-silver ionizers, reverse osmosis, and nanofiltration. Ozone is a disinfectant that can be used in place of chlorine, and ultraviolet light is a system that sanitizes pool water. Copper-silver ionizers are used in conjunction with low levels of sanitizers (e.g. chlorine, bromine) and release small amounts of copper and silver ions into a pool, which kills bacteria and prevents algae growth. All three methods can be used to reduce the need for chlorine, which in turn reduces TDS.

Periodic reverse osmosis (RO) treatment or nanofiltration are alternative methods to maintain water quality. These processes send contaminated water through a membrane to remove particles and generate a wastewater stream of concentrated contaminants. RO and nanofiltration can be used to reduce TDS levels in a pool, reduce the use of chemicals such as chlorine, and can increase the time before any pool water needs to be dumped. However, RO treatment systems can be costly and waste a lot of water depending on their efficiency, so carefully compare water consumption from a RO system to other methods of treatment. While permanent RO systems are generally impractical to use for regular pool water treatment, some companies offer mobile RO treatment, where an industrial-sized RO system can be brought to a property to clean pool water. Some of these larger RO systems can recover up to 85 percent of the pool water. This process is an alternative to dumping and refilling pools.

When working with professionals in design or pool maintenance, look for companies with professional certifications, like those certifications offered by the [Pool & Hot Tub Alliance](#).

Leaks

One important way to reduce water loss is to learn to recognize potential leaks. Annual water loss from pool leaks is difficult to quantify, as leaks can often go unnoticed for extended periods of time. However, small leaks can quickly turn into big leaks if they go unattended.



Do-It-Yourself Leak Test

It's important to periodically test for leaks in the pool by performing an evaporation bucket test.

1. On a day without rain or heavy winds, shut down all pool systems (filtration systems, pool cleaners, automatic fills, etc.), and close the pool for 24 hours.
2. Fill a 2.5- to 5-gallon bucket to about 1 inch from the top and set the bucket in the pool (on a bench or step) such that at least two-thirds of the bucket is submerged in the pool, and the bucket water level is a little higher than the pool level.
3. Mark the initial water level within the bucket with a marker, piece of tape, or by using a ruler to record the distance from the top of the bucket. Mark/measure the initial height of the still pool water the same way.
4. Leave the bucket for 24 hours, then re-record the pool and bucket water levels. If pool water loss is greater than bucket water loss, the pool may have a leak.

For more details, refer to the [ANSI/APSP/ICC-13 Standard for Water Conservation Efficiency in Residential and Public Pools, Spas, Portable Spas, and Swim Spas.](#)

Leaks can be found in the pool liner, the pump seal, pool piping, the pool-to-pipe connection, pool edges, and in pipe joints. If your pool is losing more than 2 inches of water per week, or 3 inches in hot, dry areas with high evaporation rates, then it is likely you have a leak. Wet spots around the pool, or air bubbles in the water return pipeline or in the pump strainer can also be signs of leakage. Installing a water meter can

help you actively monitor water consumption and identify potential leaks.

You can also add water manually, rather than automatically, to be aware of your pool's weekly water loss. If you have an automatic refill for your pool, then once every three months, the automatic fill should be shut off for 24 hours to test for leaks.

Automatic fill valves can sometimes malfunction and send water to a pool's overflow drain. Periodically confirm your fill valve is shutting off properly by plugging the overflow drain and monitoring if the pool level is rising. If it is, your fill valve may be stuck in the open position and should be repaired or replaced.

In cooler climates, another step to prevent leaks from forming is to make sure your pool is properly prepared for the winter. Winterize your pool by cleaning the pool water and all parts of the pool, balancing out pool chemicals, and adding winterization chemicals such as shock and algaecide, which kills bacteria and algae. Balancing chemicals is important, as a chemical imbalance could corrode the pool and lead to structural damage. It is also important to drain water from equipment such as filters, pumps, heaters, and piping, as freezing water can cause cracks, which can later cause leaks.

Pool Usage

Water can also be lost to splashing and "drag out," which is the water that is removed as a person exits a pool. Like leaks, the total water loss from splashing and drag out is hard to quantify, but mitigation techniques can be implemented during pool design and construction. Many pools are built such that the pool edges are cantilevered and divert water back into the pool. An example of a cantilevered edge is shown in Figure 5 on page 9.

Some pools also have a gutter or grate system around the pool edges to drain water back



Figure 5: Cantilevered Pool Edge

into the pool. Implementing these common features during the design of your pool will work to reduce water loss.

You can also reduce water loss from human activity by preventing overfilling and maintaining water levels at an appropriate height. Maintain 4 inches of freeboard, or the distance from the level of the pool water to the top of the overflow or pool deck, to prevent water overflowing when there is activity in

the pool. Also consider plugging the overflow drain(s) when the pool is being used.

More Ways to Improve Water Efficiency

While draining your pool should be relatively infrequent, it is sometimes unavoidable to make repairs or improve overall water quality. The frequency at which water needs to be removed can vary depending on local water quality and conditions, but a well-maintained pool should only need to be drained every 3 to 7 years to keep TDS levels down. If this becomes necessary, consider opportunities for water reuse. Before draining, let the water sit in your pool for 48 to 72 hours without adding chemicals; at that point, pool water is often safe enough for garden or landscape use. However, be sure to check for local regulations on pool water discharge before draining your pool water into sanitary or storm sewers or onto your property.

References and Additional Resources

The following are resources that were used in the development of this guide:

1st Direct Pool. 11 January 2021. "How Often Should You Replace Your Swimming Pool Filter?" www.1stdirectpools.com/blog/post/how-often-should-you-replace-swimming-pool-filter.

Association of Pool & Spa Professionals (APSP). 6 January 2017. ANSI/APSP/ICC-13 2017 *American National Standard for Water Conservation Efficiency in Residential and Public Pools, Spas, Portable Spas, and Swim Spas*. American National Standards Institute. <https://webstore.ansi.org/Standards/APSP/ANSIAPSPIC132017>.

APSP. 2014. "Copper-Silver Ionizers." www.phta.org/pub/?id=082CD55C-1866-DAAC-99FB-D9CCF4026297.

Aquanomics Pools. 23 August 2017. "Pros and Cons of Different Pool Filters." www.aquanomicspools.com/pros-and-cons-of-different-pool-filters/.

ASTM International (ASTM). February 2018. ASTM F1346 - 91(2018), *Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs*. www.astm.org/f1346-91r18.html.

DeOreo W., Mayer P., Kiefer J., Dziegielewski B. 2016. *Residential End Uses of Water (REUWS) Study Update*. Water Research Foundation (WRF).

DOE Energy Saver. "Swimming Pool Heating." www.energy.gov/energysaver/swimming-pool-heating.

ENERGY STAR. "Pool Pumps." www.energystar.gov/products/pool_pumps.

Giovanisci, Matt. 4 May 2021. "How to Select the Best Pool Filter." Swim University,[®] www.swimuniversity.com/pool-filter/.

Koeller, John, and H.W. (Bill) Hoffman & Associates LLC. September 2010. "Evaluation of Potential Best Management Practices—Pools, Spas, and Fountains." CalWEP, The California Urban Water Conservation Council, calwep.org/wp-content/uploads/2021/03/Pools-Spas-and-Fountains-PBMP-2010.pdf.

Let's Pool Together. "Pool, Hot Tub & Spa Water Conservation Tips." Accessed 1 March 2022. www.letspooltogether.com/pool-spa-tips/.

Minos, Scott. 5 July 2021. "Stay above Water with an Efficient Swimming Pool." U.S. Department of Energy (DOE), www.energy.gov/energysaver/articles/stay-above-water-efficient-swimming-pool.

Muleta, Misgana. January 2016. "Cal Poly Study: Effectiveness of Pool Covers to Reduce Evaporation from Swimming Pools." National Plasterers Council (NPC), www.npconline.org/page/cal-poly-study.

Pool & Hot Tub Alliance. Certification. www.phta.org/certification/.

Water – Use It Wisely. "Saving Water Outdoors." <https://wateruseitwisely.com/saving-water-outdoors/swimming-pools/>.

WaterSense. *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities*. www.epa.gov/watersense/best-management-practices.