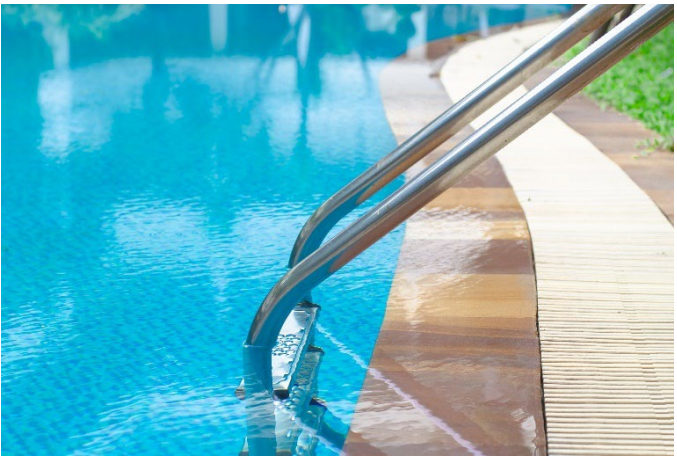
WaterSense at Work

Outdoor Water Use

5.3 Commercial Pool and Spa Equipment



Best Management Practices for Commercial and Institutional Facilities

EPA WaterSense

November 2023

WaterSense® is a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA) that seeks to protect the nation's water supply by transforming the market for water-efficient products, services, and practices.

WaterSense at Work is a compilation of water efficiency best management practices intended to help commercial and institutional facility owners and managers from multiple sectors understand and better manage their water use. It provides guidance to help establish an effective facility water management program and identify projects and practices that can reduce facility water use.

An overview of the sections in *WaterSense at Work* is below. This document, covering water efficiency related to commercial pool and spa equipment, is part of **Section 5: Outdoor Water Use**. The complete list of best management practices is available at www.epa.gov/watersense/best-management-practices. WaterSense has also developed worksheets to assist with water management planning and case studies that highlight successful water efficiency efforts of building owners and facility managers throughout the country, available at www.epa.gov/watersense/commercial-buildings.

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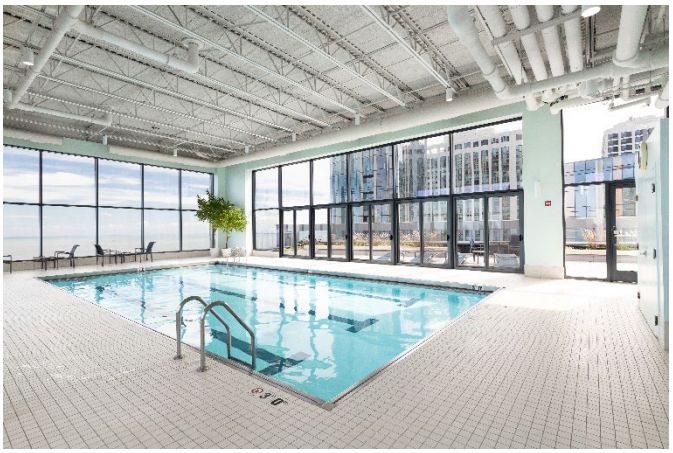
This document is one section from *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities* (EPA-832-F-23-003). Other sections can be downloaded from www.epa.gov/watersense/best-management-practices. Sections will be reviewed and periodically updated to reflect new information. The work was supported under contract 68HERC20D0026 with Eastern Research Group, Inc. (ERG).

Overview



Indoor commercial swimming pool

Pools and spas are found in many commercial or institutional settings, including hotels, schools, community centers, hospitals, and apartment complexes. The size and features of these pools vary widely depending on their intended use and setting. Table 1, which summarizes typical pool sizes for commercial pools and spas in California, shows that a typical commercial pool can contain between 34,000 and 860,000 gallons of water (130,000 and 3,300,000 liters of water). Spas are much smaller, containing on average 1,100 gallons (4,200 liters) of water. Due to a lack of data, EPA assumes that typical pool sizes obtained from a California Urban Water Conservation Council (CUWCC) report on the California Water Efficiency Partnership website are representative of pool sizes nationally.

Table 1. Typical Sizes for Commercial Pools and Spas[1,2]

Pool Type	Area (square feet)	Depth (feet)	Volume (gallons)
Spa	40	3.0	1,100
Hotel (In-Ground)	1,000	4.5	34,000
Public (In-Ground)	4,000	5.0	150,000
Olympic (In-Ground)	14,000	8.0	860,000

Overall, a large volume of water is used to fill commercial pools or spas. Much of this water is often lost in day-to-day operation due to evaporation, leaks, and splashing.

[1] Koeller, John and H.W. (Bill) Hoffman & Associates, LLC. September 2010. *Evaluation of Potential Best Management Practices—Pools, Spas, and Fountains*. Prepared for the California Urban Water Conservation Council (now known as the California Water Efficiency Partnership). Page 3. https://calwep.org/wp-content/uploads/2021/03/Pools-Spas-and-Fountains-PBMP-2010.pdf.

[2] To convert to metric units, use the following conversions: 1 square foot = 0.093 square meters; 1 foot = 0.305 meters; 1 gallon = 3.79 liters.

Ongoing pool or spa maintenance also creates significant losses from filter cleaning and mineral buildup control.

Because evaporation, filter cleaning, and mineral buildup control represent the greatest uses of water for commercial pools and spas, they also provide the most significant opportunities to achieve water savings. CUWCC estimated that water evaporation, filter backwashing, and mineral buildup control account for 56, 23, and 21 percent of pool water use, respectively, across all pools installed in California.[3] Water losses from leaks and splashing are not included in this estimate because they are difficult to quantify. Although the estimates used in this document are specific to California, EPA assumes that, with the exception of evaporation (which is dependent on local climate), they are applicable to and representative of pools and spas nationwide.

Evaporation

Water continually escapes pools and spas due to evaporation from the pool/spa surface. The rate of evaporation will depend upon several factors, including water temperature, the pool's ambient conditions (e.g., indoor or outdoor), the extent of convection over the pool's open surface, and the surface area of water that comes in contact with air. Table 2 provides an overview of evaporation losses for various pool sizes, as estimated by CUWCC. These estimates show that water losses from evaporation can be significant. For example, the total volume of water lost annually in spas is several times larger than the volume of the spa itself. For larger pools, this effect is reduced; however, the water loss still can be significant and of the same order of magnitude as the volume of the pool itself. More water is lost from larger pools due to increased surface area, so it is important to size a pool according to intended use to reduce water lost to evaporation.

Table 2. Evaporation Water Losses by Pool Type[4,5]

Pool Type	Pool Volume (gallons)	Water Loss (gallons/year)
Spa	1,100	6,300
Hotel (In-Ground)	34,000	40,000
Public (In-Ground)	150,000	160,000
Olympic (In-Ground)	860,000	570,000

[3] Koeller, John and H.W. (Bill) Hoffman & Associates, LLC, *op. cit.*, Page 30.
[4] *Ibid.* Page 10.
[5] To convert to metric units, use the following conversions: 1 square foot = 0.093 square meters; 1 foot = 0.305 meters; 1 gallon = 3.79 liters.

The best way to reduce evaporation is by using a pool cover as often as possible. Solid, mesh, and hybrid are the most common types of pool covers. Solid pool covers can prevent debris from entering the pool, but water can collect on top, which may require a pool pump to remove. Mesh pool covers allow water and some debris to pass through. Hybrid pool covers are solid on the outside and mesh in the middle, so they allow some water to pass through and are lighter than solid covers. Pool covers can also be certified as safety covers under ASTM F1346 *Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas, and Hot Tubs* to protect children, animals, and other unwanted swimmers from drowning.

Solar covers and bubble covers float on a pool's surface and are easy to remove and replace, especially for the purposes of reducing evaporation. Solar covers can come in the form of bubble covers or solar rings and are designed to heat the pool with the sun's energy. Bubble covers can be deployed via a hand-crank reel located near the edge of a pool. Some covers, including solid ones, can attach to an automatic or semi-automatic reel, which makes them easier to deploy.

Solar bubble cover

Liquid covers are an alternative to traditional pool covers. Liquid covers, also called liquid evaporation suppressant (LES) covers, are non-toxic, chemical, ultra-thin films dispersed on the water surface to reduce evaporation. The chemical is easy to deploy and reduces evaporation, even when the pool is in use, but does not prevent debris from getting in the pool.

Winter covers are a subset of pool covers used to close the pool at the end of the season. These covers are usually held onto the pool via anchors in the concrete, which makes them more difficult to remove and replace. Therefore, they are not commonly used to prevent evaporation during the pool season. Winter covers are often solid, mesh, or hybrid type.

Solid cover

Cover with reel

Table 3 provides an overview of pool cover effectiveness at evaporation reduction, as estimated by a study from the California Polytechnic State University.

Table 3. Typical Sizes for Commercial Pools and Spas[6]

Cover Type	Effectiveness at Reducing Evaporation When in Use	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 Covers	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.

In addition to pool covers, evaporation can also be reduced by implementing other environmental controls. Higher water temperature can cause water to evaporate more quickly, so keeping heated pools at lower temperatures can reduce both water losses from evaporation and heating costs. For indoor pools, an ambient air temperature higher than the water temperature can reduce evaporation. Landscaping or other physical barriers, such as stone walls or fencing, can reduce windspeed or increase shading, which can also help reduce the effects of evaporation. Limiting the use of water features—either manually, by using timers, or through use of wind control systems—can also reduce water lost to evaporation, splashing, and wind.

Filter Cleaning

All swimming pools require pool filtration systems to keep the water free of particulate matter, which in turn reduces corrosion and prolongs the useful life of pool water. These systems include pumps, filters, drains, and skimmers. In terms of water efficiency, the distinguishing factor is the type of filter and the amount of maintenance associated with it. The other components of the filtration system have little impact on water use.

Pool filters are differentiated by the media used to treat pool water. These media primarily include sand or glass, sorptive media (i.e., pre-coat filters), and cartridge filters. While these filter types operate on the same principle of circulating water through filter media to

[6] Muleta, Misgana. January 2016. *Effectiveness of Pool Covers to Reduce Evaporation from Swimming Pools*. Prepared for the National Plasterers Council (NPC). www.npconline.org/page/cal-poly-study.

separate suspended particles, their design differences affect how often they need to be cleaned, which in turn affects how much water they use. Each type requires a trade-off between water and material use efficiency.

Pool and spa filters must be cleaned on a regular basis to maintain efficiency. As debris builds up on the filter, water flow becomes restricted and reduces filter efficiency, performance, and sanitation. The rule of thumb is that filter cleaning is necessary after the filter pressure has increased by 5.0 to 10.0 pounds per square inch (psi) (35 to 70 Kilopascal [kPa]).[7] Pressure gauges can help automate the filter backwash process, so it is only initiated when needed.

Pool operators must backwash sand, glass, and sorptive media filters to clean them. During this process, water is run backwards through the filter to remove the accumulated debris and particulates from the filter media. The filter backwash water is typically drained to sanitary sewer lines.

Sand and glass filters are one of the most common types of filters due to their cost-effectiveness, and are composed of silica sand, zeolite, or crushed recycled glass. These filters can be backwashed many times before the media must be replaced, often lasting for many years, but they use the greatest amount of water to flush particulates out of the filter and have the lowest level of filtration performance of the main three types of filters. Filtration performance is determined by the smallest particle a filter can remove from water and is usually measured in terms of microns—one millionth of a meter. For example, human hair is about 50 microns in diameter, dust is about 4 microns, and bacteria is about 2 microns in diameter.[8]

Sorptive media filters have a diatomaceous earth, cellulose, or perlite base. Sorptive media filters use less water than sand or glass filters and have the highest filtration performance, but must be replenished after every backwash as the media is purged from the filter grid along with the debris. Replenishment is accomplished by mixing new sorptive media with water and pouring it into the skimmer closest to the pump. The pump then transports the sorptive media to the filter and deposits it onto the filter grid.

Dirty cartridge filter

Cartridge units eliminate backwashing by using pleated filters made from a paper-type material that can be reused or disposed. Instead of backwashing, disposable cartridge filters are removed, discarded, and replaced with a new filter. Reusable filters are rinsed

[7] Koeller, John and H.W. (Bill) Hoffman & Associates, LLC, *op. cit.,* Page 19.
[8] Giovanisci, Matt. May 2021. "How to Select the Best Pool Filter." www.swimuniversity.com/pool-filter/.

with a spray hose or soaked in a cleaning solution before being brushed or rinsed. While cartridge filtration is the most water-efficient, it is not usually a viable option for large commercial pools, because the cartridge replacement rate quickly becomes cost-prohibitive and labor-intensive.[9]

Large commercial pools sometimes use a fourth filter type—industrial filters—which are a specific type of sorptive media filter. These filters are more efficient than traditional sorptive media filters because they can recycle the sorptive media up to 30 times before it must be discarded and replaced, and no water is lost when the filter is recoated with media. Industrial filters are also water-efficient, as the total volume of water used during backwashing is only twice the volume of the filter.[10] A summary of the different filter types and their attributes is provided in Table 4.

Table 4. Typical Sizes for Commercial Pools and Spas[11]

Filter Type	Filtration Ability (Microns)	Media Replacement Frequency	Maintenance Practices
Sand	20-40	3-6 years	Backwash every week
Glass	5	7-15 years	Backwash every week; however, requires shorter backwash cycles than sand
Sorptive Media	5	Every backwash; grid lasts 2 to 3 years	Backwash every 4-8 weeks
Cartridge	10	2-4 years	Frequency depends on filter type; wash by rinsing with hose
Industrial	5	Replaced after media has been recycled up to 30 times	Backwash every 4-8 weeks

Table 5 on the next page provides an overview of the water use associated with each filter type, as estimated by CUWCC. These estimates show that, for smaller pools and spas, cartridge filters use less water than sand, sorptive media, or industrial filters. For larger pools, industrial filters are much more efficient.

[9] East Bay Municipal Utility District (EBMUD). 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. Page POOL4. www.ebmud.com/water/conservation-and-rebates/commercial/watersmart-guidebook.
[10] Koeller, John and H.W. (Bill) Hoffman & Associates, LLC, *op. cit.*, Page 18.
[11] *Ibid*. Pages 16-19.

Table 5. Filter Cleaning Water Consumption Estimates by Pool and Filter Type[12,13]

Pool Type	Pool Volume (gallons)	Water Use (gallons/year)			
		Sand	Sorptive Media	Cartridge	Industrial
Spa	1,100	940	470	300	N/A*
Hotel (In-Ground)	*34,000*	30,000	9,400	3,600	5,000
Public (In-Ground)	*150,000*	170,000	42,000	N/A	9,000
Olympic (In-Ground)	*860,000*	960,000	240,000	N/A	17,000

*N/A: not applicable

Mineral Buildup Control

Water in pools and spas experiences a continual buildup of total dissolved solids (TDS) in the form of mineral salts and treatment chemicals. This buildup must be treated or removed to prevent scale buildup or corrosion of pool surfaces and equipment. Proper pool maintenance and water quality control are essential for extending the useful life of the water. Water quality control significantly saves water by reducing the number of times the pool must be completely drained and refilled, the number of filter backwashes needed, and the potential for leaks due to corrosion or other factors.

Conductivity Controllers and Water Meters Can Save

It is easier to manage water when you are measuring it. Although all pools require water to be exchanged periodically to control solids buildup, using conductivity controllers to measure a pool's TDS concentration can save water by limiting water exchanges to only when necessary. The controller can also be used to determine how much water to drain to achieve the desired TDS concentration, instead of draining for an arbitrary length of time, which may waste more water. In addition, installing water meters on pool make-up supply lines can help a facility easily identify total consumption or leaks. Conductivity controllers and water meters are excellent tools to help with pool maintenance and water efficiency.

All pools require water to be exchanged periodically to control the buildup of solids and other contaminants. This water exchange can be either partial or full and can be controlled manually or through an automated process. When draining the pool manually, the pool operator will simply pump pool water directly to the drain at some predetermined point in time. The automated approach utilizes conductivity controllers, which drain a portion of the pool water once a predetermined concentration of TDS is reached. Conductivity controllers save water by limiting exchanges to when they are necessary. The amount of water lost in the exchange process will depend upon pool volume, dissolved

[12] *Ibid.* Pages 27-28.
[13] To convert to metric units, use the following conversion: 1 gallon = 3.79 liters.

solids concentration in the make-up water, type and amount of treatment chemicals added, and the local evaporation rate.

Reverse osmosis and nanofiltration systems, which operate independently from pool filters, can also be used to prolong the useful life of pool water. Reverse osmosis has a higher filtration ability than nanofiltration and can remove more particles. During either filtration process, pool water is passed through a membrane filter, which selectively excludes dissolved minerals and suspended particles from passing through the filter. Water can permeate through the barrier and is recovered and returned to the pool. However, a portion of the pool water is lost as the dissolved minerals and suspended particles that are trapped behind the membrane filter are discharged to sanitary sewer lines as reject water.

A common way to utilize reverse osmosis to avoid fully draining pool water is to hire a company with a mobile, industrial-scale reverse osmosis system that will service a pool when needed; however, some commercial pools may have their own permanent reverse osmosis system onsite. Some of these larger reverse osmosis systems can recover up to 85 percent of the pool's water; therefore, treating the pool water with reverse osmosis or nanofiltration instead of dumping and refilling the pool has the potential to save water, since most of the pool's water will be treated and reused and additional water will only be needed to replace the water rejected from the reverse osmosis process that is sent to drain. Before installing a permanent reverse osmosis system to support ongoing pool water treatment, a facility should consider the amount of reject water that would be produced and make-up water needed if utilizing this equipment.

Ozone generators, ultraviolet (UV) light sanitizers, and copper-silver ionizers are additional tools that can be used to maintain water quality. Each tool uses a disinfectant, ozone gas, UV light, and copper and silver ions, respectively, in conjunction with small amounts of chlorine to kill bacteria and prevent algae growth. Each method can reduce the amount of chlorine needed to keep the pool sanitized, which in turn reduces TDS levels and increases water longevity.

Leaks and Splashing

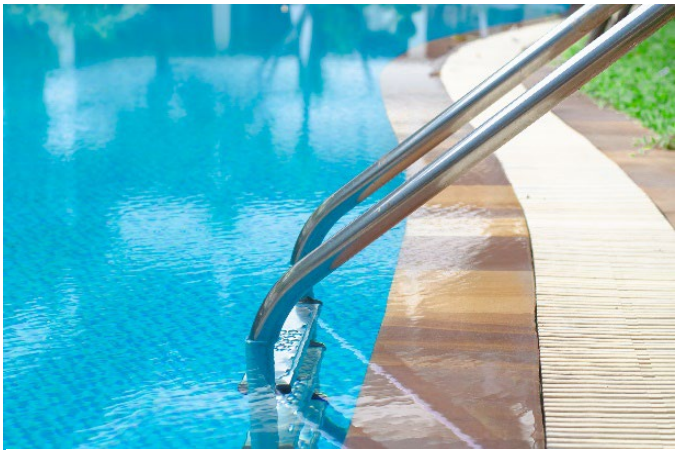
Water is lost in pools and spas from leaks and splashing. Although leaks and splashing contribute to water loss, it is difficult to quantify the frequency and extent to which they can occur.

Leaks can be caused by a variety of reasons, including chemical corrosion on pool walls, age, shifts in surrounding soil, or frozen water in pool piping.

Splashing

Common leak locations include pump seals; pipe joints; piping in filtration system suction or return lines; pool liners; and along pool edges. A leak may be present if a pool is losing more than two inches (5.1 centimeters) of water per week, or three inches (7.6 centimeters) in hot, dry areas with high evaporation rates. Air bubbles in either the pump strainer basket or water return line can also indicate the presence of a leak. Many pools have automatic water supply valves to replenish lost pool water; however, leaking pools cause automatic supply valves to replenish the pool more often, which in turn wastes more water. It is important to perform a manual leak test every 3 months and confirm supply valve operation to mitigate water lost from leaks. For the most accurate leak test, a pool must be closed for 24 hours, or the maximum time between closing the pool and opening it the next day.[14] A water meter on the pool supply line can help monitor and confirm a pool's regular water use and help identify leaks.

Water is also lost during pool use from splashing and drag-outs as swimmers exit. Some pools have cantilevered pool edges, which can help divert water back into a pool and reduce water lost from splashing. Water loss from drag-outs can be mitigated by gutter and grate systems installed along the edge of the pool.



Pool with gutter and grate system

It is also important to prevent overfilling and maintain water levels at an appropriate height. A water level lower than the skimmer can mitigate water lost due to splashing. In pools with an automatic fill valve, maintaining proper water levels can be assisted by float devices that mount to the deck. Many float devices often come with automatic hose shut-off capabilities that can prevent overfilling.

In cooler climates, it is important to properly prepare a pool for winter to reduce the risk of leaks. Equipment such as filters, pumps, and piping must be drained of all water as frozen water can crack equipment and later cause the pool to leak. Additionally, balancing chemicals before pool closure can also lower the risk of corrosion and structural damage, which could later cause leaks.

[14] Association of Pool & Spa Professionals (APSP) and the International Code Council (ICC). 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.* Page 2.

Operation, Maintenance, and User Education

Controlling evaporation, splashing, leaks, and mineral buildup and ensuring that filters are cleaned properly are important operation and maintenance measures to ensure commercial pool and spa equipment efficiency. When working with professionals in pool maintenance, look for companies with professional certifications such as those offered by the Pool & Hot Tub Alliance,[15] and consider the operation and maintenance tips below.

Evaporation

To control evaporation, consider the following:

- Most heated pools are kept between 78° and 82°F (26° and 28°C). Keep pools at lower temperatures to reduce water evaporation rates and save energy. Each degree increase can also increase energy costs by 10 to 30 percent.[16]
- For an indoor pool, keep the air temperature 2°F (1°C) higher than water temperature.[17]
- If the pool is closed for an extended period of time, turn the pool heater off or turn the temperature down.
- Run filters when wind velocity is low.[18]
- Use pool covers on indoor and outdoor pools to reduce evaporation rates during periods in which the pool is not in use. Some covers also prevent debris from entering the pool, which in turn leads to reduced water usage from filter backwashing.
- Limit the use of sprays, waterfalls, and other features. At a minimum, only turn them on when the pool is open.
- Maintain liquid evaporation barriers according to the manufacturer's instruction to control evaporation.

Splashing

Splashing and other pool activity contributes to water loss. To reduce the amount of water loss from splashing, set the pool water level to four inches below the edge of the pool and

[15] Pool & Hot Tub Alliance. Certification. www.phta.org/certification/.
[16] Minos, Scott. July 2021. "Stay above Water with an Efficient Swimming Pool." Prepared for U.S. Department of Energy (DOE). www.energy.gov/energysaver/articles/stay-above-water-efficient-swimming-pool.
[17] APSP and ICC, *op. cit.,* Page A-1.
[18] *Ibid.*

the overflow. In addition, plug the overflow line when the pool is in use or when adding water.[19]

Filter Cleaning

Water use from filter cleaning can differ based on the type of filter system installed. To reduce water used for filter cleaning, consider the following:

- Vacuum the pool and skim floating debris off regularly to reduce the load on the filtration system.
- Clean filter media only as necessary and not on a set schedule (i.e., clean only when the filter is no longer operating effectively). Although there are several methods by which effectiveness is measured, the typical rule of thumb is that filter cleaning is necessary after the filter pressure has increased by 5.0 to 10.0 psi (35 to 70 kPa), which can be easily determined using an installed pressure gauge.[20]
- Utilize the sight glass (if one is installed) to monitor the visual quality of the backwash water running through the filter and determine when backwashing is complete, rather than backwashing for a predetermined set amount of time (e.g., 5 minutes). Backwashing is complete once the water that passes through the sight glass is clear and free of particulates.

Mineral Buildup Control

To prolong the useful life of pool water and reduce the need for draining, consider the following:

- Maintain proper pH, alkalinity, and hardness levels to avoid the need to drain the pool or to avoid using excess make-up water to correct water quality issues.
- Follow manufacturer recommendations when using disinfecting methods, such as ozone, UV light sanitizers, or copper-

Before Draining a Pool, Understand Local Requirements

While draining a 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.

Be sure to understand local regulations on pool water discharge before draining pool water into sanitary or storm sewers or onto the property. Some jurisdictions require permits, dedicated sewer connections, and/or prior notification, Depending on the treatment chemicals used to maintain the pool chemistry, there may also be limitations on whether water can be discharged without prior treatment. For example, chlorinated pools may be required to sit idle for 48 to 72 hours to lower chlorine levels.

[19] *Ibid.*
[20] Koeller, John and H.W. (Bill) Hoffman & Associates, LLC, *op. cit.*, Page 19.

silver ionizers to ensure these systems are operating optimally to reduce chlorine levels and prolong the useful life of the water.

- Use a mobile reverse osmosis or nanofiltration service to prolong the useful life of pool water rather than fully draining the pool.
- When draining the pool, perform a partial drain rather than a full drain. Consider using the drained pool water for irrigation or other purposes. See *WaterSense at Work Section 8: Onsite Alternative Water Sources* at www.epa.gov/watersense/best-management-practices for more information.

Leaks

To reduce the risk of leaks, consider the following:

- Actively monitor the pool's water levels. If the pool is losing more than two inches (5.1 centimeters) of water per week, it could be leaking.[21]
- Actively monitor for leaks around the pump seals; pipe joints; piping in filtration system suction or return lines; pool liners; and along the pool edges. Repair leaks as soon as they are identified.
- Perform regular leak tests by using the bucket test procedure listed in ANSI/APSP/ICC-13 *Standard for Water Conservation Efficiency in Residential and Public Pools, Spas, Portable Spas, and Swim Spas*.[22]
- Add water manually instead of automatically to be aware of pool water loss.
- Maintain pool fill valves and overflow drains and confirm that they are operating properly.
- In areas with cooler climates, winterize your pool by balancing chemicals, cleaning pool water, and draining water from pool equipment.

Retrofit and Replacement Options

If retrofitting an existing pool or spa, there are a several options to minimize overall water use by addressing evaporation, filter cleaning, mineral buildup control, leaks, and splashing. If designing a new or replacement pool or spa, look for companies with professional certifications such as those offered by the Pool & Hot Tub Alliance, use the management techniques listed in the previous section, and consider the equipment options below.

[21] *Ibid.,* Page 12.
[22] APSP and ICC, *op. cit.,* Page B-1.

Evaporation

Consider the following to control the evaporation of pool or spa water:

- When constructing a new pool, size the pool according to needs. Smaller pools lose less water to evaporation and require fewer resources to maintain.
- Reduce wind movement across the water by using fences, walls, non-shedding hedges, or other similar barriers.
- Install a timer or wind control system for water features with vertical drops over 12 inches.[23]
- Increase shade on the pool area through landscaping. Be sure to carefully select landscape plants so they don't contribute more debris to the pool.
- Install a pool cover that is easy to use, such as an automatic pool cover that can be activated by pressing a button of a motor-driven reel or hand crank cover.
- If regularly using a physical pool cover is too cumbersome for large pools, use a liquid evaporation suppressant as an alternative. Liquid evaporation barrier products are available through pool supply vendors.

The Importance of Pool Covers

Evaporation accounts for the greatest loss of water from pools, accounting for over 50 percent of a pool's water use. To reduce evaporation from a facility's pool, it is imperative to use a pool cover whenever the pool is not in use. Automatic pool covers that can be deployed by pressing a button or hand-crank covers can make covering a pool during closed hours simple and quick. Liquid pool covers prevent evaporation by forming a thin film on the pool surface and can be used even when a pool is in use. The most effective way to reduce evaporation is to use a liquid cover to reduce water loss during the day and use a physical cover at night. Winter covers, which are typically held down via anchors, should be used at the end of the season to prevent water loss during the pool's dormant months.

Filter Cleaning

In addition to the operation and maintenance tips outlined in the previous section, consider the following for optimum filter efficiency:

- Install a pool filter pressure gauge. This will provide a means for determining when filter cleaning is necessary (i.e., after a pressure increase of 5.0 to 10.0 psi [35 to 70 kPa]).
- Install a pool filter sight glass to provide a visual means for determining when backwashing is no longer necessary and minimize the backwashing time.
- If replacing existing filtration systems, consider installing oversized cartridge filters for small pools and spas, sorptive media filters for medium-sized pools, or

[23] APSP and ICC, *op. cit.,* Page A-1.

industrial filters for very large pools. Oversizing cartridge filters can reduce the overall number of cleanings.[24]

- Consider reusing backwash water wherever possible on the property. See *WaterSense at Work Section 8: Onsite Alternative Water Sources* at www.epa.gov/watersense/best-management-practices for more information.

Mineral Buildup Control

To control mineral buildup, consider the following:

- Install a conductivity controller system to manage the concentration of TDS in the pool. This system will monitor the buildup of dissolved solids so that at a predetermined level, a portion of the pool water can be drained and replaced, rather than the entire volume. This also offers the added benefit of providing a frequent source of water that can be used for irrigation or other purposes.
- Install a reverse osmosis or nanofiltration system to prolong the useful life of pool water or hire a company with a portable reverse osmosis system to periodically service your pool. Using these filtration systems can reduce the frequency that the pool must be drained for TDS control.
- Use other disinfecting methods, such as ozone, UV light sanitizers, or copper-silver ionizers, to reduce chlorine levels and prolong the useful life of the water.
- Consider using drained pool water for irrigation or other purposes. See *WaterSense at Work Section 8: Onsite Alternative Water Sources* at www.epa.gov/watersense/best-management-practices for more information.

Leaks

To reduce water loss from leaks, install a water meter to the pool's make-up line. This will provide a means for directly monitoring and tracking water use for signs of potential leaks.

Splashing

To reduce water loss from splashing, install pool gutter and grate systems along the pool perimeter to mitigate drag-out

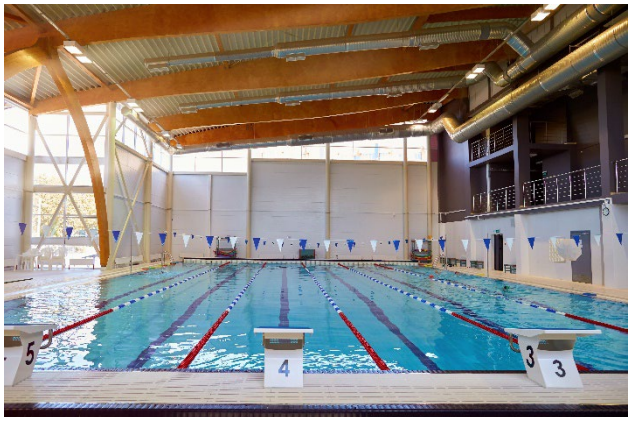
Cantilevered pool edge

[24] *Ibid*.

losses during pool use. When constructing a new pool, cantilever the edges so water can be diverted back into the pool.

Savings Potential

Significant water savings can be achieved through proper pool and spa operation and maintenance and other water-efficient technologies. Following are a few examples of savings that can be realized from implementing water-efficient practices or technologies in pools or spas.



Large indoor pool

- CUWCC estimated that evaporation losses can be reduced by 30 to 50 percent by using pool covers.[25] Liquid evaporation barriers can reduce water use by 15 percent. Therefore, for an Olympic-sized pool, using a liquid or solid cover could save between 86,000 gallons (325,000 liters) and 290,000 gallons (1.1 million liters) of water per year.
- CUWCC estimated that replacing conventional sand and sorptive media filters with cartridge or industrial filters, where appropriate, can save between 68 and 98 percent of backwash water, depending on pool size. For an Olympic-sized pool, replacing sand filters with industrial filters could save up to 940,000 gallons (3.6 million liters) of water per year.[26]
- Using a mobile or industrial-scale reverse osmosis system to periodically treat water to reduce minerals and other total dissolved solids can recover up to 85 percent of pool water that would otherwise be drained to control mineral buildup. If a facility with an Olympic-sized pool chooses to treat the pool with reverse osmosis instead of dumping the entire pool and refilling, it could save up to 731,000 gallons (2.8 million gallons) of water.

Additional Resources

Association of Pool & Spa Professionals (APSP) and the International Code Council (ICC). 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*.

[25] Koeller, John and H.W. (Bill) Hoffman & Associates, LLC, *op. cit.*, Page 34.
[26] *Ibid*. Page 35.

East Bay Municipal Utility District (EBMUD). 2008. *WaterSmart Guidebook—A Water-Use Efficiency Plan Review Guide for New Businesses*. www.ebmud.com/water/conservation-and-rebates/commercial/watersmart-guidebook.

Giovanisci, Matt. May 2021. "How to Select the Best Pool Filter." www.swimuniversity.com/pool-filter/.

Koeller and Company and H.W. (Bill) Hoffman & Associates, LLC. September 2010. *Evaluation of Potential Best Management Practices—Pools, Spas, and Fountains*. Prepared for the California Urban Water Conservation Council. https://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. www.letspooltogether.com/pool-spa-tips/.

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

Muleta, Misgana. January 2016. *Effectiveness of Pool Covers to Reduce Evaporation from Swimming Pools*. Prepared for the National Plasterers Council. www.npconline.org/page/cal-poly-study.

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

Southern Nevada Water Authority. "Pools and spas." www.snwa.com/landscapes/pools-and-spas/index.html.

Texas Water Development Board. May 2018. *Best Management Practices for Commercial and Institutional Water Users*. www.twdb.texas.gov/conservation/BMPs/CI/index.asp.

U.S. Department of Energy Energy Saver. "Swimming Pool Heating." www.energy.gov/energysaver/swimming-pool-heating.

U.S. Environmental Protection Agency's WaterSense program. September 2022. *Jump into Pool Water Efficiency*. www.epa.gov/system/files/documents/2022-09/ws-outdoor-pool-guide.pdf.

Williams, Kent. Professional Pool Operators of America. November 2002. "Liquid Pool Covers Save Energy." *Pumproom Press*. # 25. www.lincolnaquatics.com/Documents/7536.pdf.

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