

Irrigation Water Use Reduction

MPower understands that water is a growing concern across the globe and will continue to be as we increasingly feel the impact from global climate change. Addressing irrigation water consumption can be as simple as monitoring utility bills to identify leaks or as comprehensive as replacing all irrigation and landscaping with a maintenance and water free environment. As always, we like to start with the low hanging fruit. We suggest assessing landscape conservation opportunities in the following order:

Monitor Water Bill



- Review the water bill monthly.
- Monitor indoor and outdoor water leaks.
- Encourage tenants to report leaks.
- Consider a separate irrigation meter for a lower water rate.
- Monitor the property for:
 - Soft or soggy spots in the grass, at hose bibs, and irrigation heads.
 - Irrigation overspray on hardscape areas.

Review Maintenance Program



- Develop portfolio and property landscape goals.
- Share outcomes with the property manager and the maintenance company.
- Consider lengthening maintenance contract to incent long term health of the landscape and time to achieve established goals.

Irrigation Control Evaluation



- Change the irrigation schedule after the first year and adjust seasonally.
- Separate zones by plantings (bushes, trees, turf) and use proper irrigation heads for each zone.
- Water infrequently to develop deep roots.
- Cap irrigation heads when plants in zones have matured.
- Use ET sensors and water in the mornings.

Redesign the Landscape



- Use licensed landscape designers.
- Plants selection: native or climate adapted, slow growing.
- Mulch alternatives:
 - Rock, large wood chips, crushed granite, or filbert shells reduces the possibility of it blowing away.
- Turf alternatives:
 - Community gardens, dog runs, play gyms, or artificial turf.
 - Clover to reduce fertilizer and mowing.
 - Meadow grasses and flower seed mix on slopes.

Advanced Water Saving Opportunities for Multifamily Affordable Housing

MPower understands that water is a growing concern across the globe and will continue to be as we increasingly feel the impact from global climate change. From access to clean drinking water and increasing utility rates, the need to reduce water consumption is on the rise. Previously we have supported the reduction of indoor water through faucet aerators and ultra-low-flow toilets. We are taking this initiative further with water submetering and irrigation interventions.

Addressing irrigation water consumption can be as simple as monitoring utility bills to identify leaks or as comprehensive as replacing all irrigation and landscaping with a maintenance and water free environment. As always, we like to start with the low hanging fruit. We suggest assessing landscape conservation opportunities in the following order:

1. Monitor water bill
2. Review maintenance program
3. Irrigation control evaluation
4. Redesign the landscape

1. Monitor Water Bills

Indoor water leaks:

Many leaks go unnoticed and unreported. A tiny faucet drip (1 drip/minute) wastes 34 gallons per year. A small toilet flapper leak can waste 30 gallons per day or 11,000 per year! Across a 50 unit complex the water from these two small leaks could fill 28 swimming pools and cost an owner over \$1,600/year.

Irrigation leaks:

Irrigation leaks can be harder to catch than indoor leaks because the water reenters the ground and isn't always visible. When surveying the landscape, look for soft or soggy spots in the grass and at hose bibs and irrigation heads. Overspray is much easier to spot when the sprinklers are running. Any hardscape area that is wet is being over sprayed. The heads can be adjusted to correct the waste of water. A pressurization test can be performed to identify if there is an unground leak.

Irrigation meter:

Reviewing the water bills highlights whether a separate irrigation meter may be beneficial. Having a separate water meter for irrigation can be helpful if non-potable water is provided, a lower utility rate is provided for irrigation, or you want to easily track irrigation water separately from tenant water use. Some municipalities may offer a flat rate for irrigation and it is necessary to review the financial benefit of this designation. If the irrigation meter is charged a flat rate, year round, regardless of the water consumption, it may be favorable to switch to a meter that charges based on use. For example, if a property is charged \$300/month (\$3600/annually) but only uses water from June to September at \$600/month (\$2400/annually), it would be less expensive to only pay for the water used. Additionally, separate bills may come with a monthly billing fee which can add up month after month.

2. Review Maintenance Program

No matter the landscape design, it very likely will require maintenance – weekly, monthly, or quarterly mowing, pruning, weeding, fertilizing, power washing, or planting. The owner will discuss the property goals with the landscape company and develop a scope of work that will meet the goals in an agreed

upon time period. Because it takes time to cultivate the right landscape, the time can range from one season to multiple years. For a program to be successful, the scope of work within the landscape maintenance contract should be shared with the property managers and landscape maintenance crews so they can aid in the landscape program goals. Without knowledge of the scope, if the property manager requests maintenance outside of the contract, such as watering more frequently, changing the irrigation schedule, or requesting another site visit, this may not be in line with the long term property goals. This can change the cultivation time of the maintenance program that the owner and landscape provider agreed upon.

Landscape Maintenance Contract and Communication:

When collecting landscape design or redesign bids, also collect maintenance bids. Reviewing the life cycle costs of a landscape can change the design and provide a better perspective of the future maintenance costs. It is recommended that the landscape installers maintain the site for 3-5 years because they know the design intent. Additionally, the landscape company knows where materials were initially sourced and they intimately know the location of the irrigation heads. Having knowledge of the design prior to maintenance can save the owner fees in the future.

When a landscape contract is less than a few years, the landscape company may not be held accountable to the goals past the contract, beyond winning the next contract. This can lead to over fertilizing, watering, and replanting, which could cost more. Contracts longer than 5 years will allow the landscape company to be invested in the property's landscape success, allowing them to work toward the end goal. When a landscape crew maintains a property over time, it gives them an opportunity to learn the site and understand which areas of the site require additional attention. And, maintenance crews can effectively work on small maintenance projects, while already on-site, without additional cost to the owner.

Prior to each schedule visit, the property manager can email the landscape contractor to inform them of any special considerations needed on the next visit. For instance, if an irrigation head is damaged or a bush's growth needs some attention. The work can quickly be addressed while performing scheduled maintenance activities. When the maintenance crew is called on site, even for a small adjustment, the cost of just showing up can out spend the cost of the water wasted.

It is important to remember that plants are living organisms and it can take multiple seasons to cultivate a landscape to meet the maintenance goals. For example, excessive trimming may allow the plant to appear in good health but could kill the plant the next season if not done properly. Proper communication between the owner, property manager, and landscape contractor can prevent unnecessary maintenance activities.

3. Irrigation Control Evaluation

Once an irrigation system has been installed, the irrigation schedules are set to ensure adequate water during the establishment period, typically one season. As plants age, less frequent watering is necessary to keep the plants healthy and thriving because their root systems have expanded. Typically, an inch of water per week is sufficient, though each region is different to replenish the evapotranspiration (ET) rate. However, in standard practice the irrigation schedule is set to the peak water needs, which may only be necessary for two weeks out of the year and is often higher than 1"/week. This rate is rarely

reset or stepped down to accommodate the landscape's adjusting needs, costing thousands of dollars in unnecessary water use.

A certified landscape auditor should conduct a review of the irrigation system starting with minimizing overspray and set irrigation clocks to ensure the most efficient schedule for the site needs. The auditor will test the system's pressure, controllers, and sensors as well.

Zoning

An irrigation zone is defined by an area where all irrigation heads rise at the same time, regardless of plant material. Within the zone there may be subzones, such as a group of heads with a lower inches per hour (in/h). Water rates should be adjusted based on the weather, requiring the water use to change nearly weekly. In Portland, a lawn can require as much as 1.7 inches of water per week, but only for a few weeks out of the entire watering season. Just as under-watering can damage plants, so too can over watering, not to mention cause building problems such as foundation settling or basement flooding.

Because of varying water needs, it is necessary to irrigate turf areas separately from shrub beds and trees. Trees, shrubs, and ground covers have vastly larger root systems than turf and require different schedules to maintain their optimum vibrancy. If the in/h is set equally in these zones, the shrubs and beds are likely receiving twice as much water as is necessary, potentially causing issues with mold, fungus, and decay. Shrubs and trees should be on drip irrigation to minimize evaporation and overspray. Trees and shrubs can go much longer between watering because of their expansive root systems. Drip irrigation allows for water volume adjustment at the emitter to provide each plant the necessary water. In more temperate climates like the Willamette valley, irrigation can be turned off for tree and shrub zones for all but the peak summer weeks. However, this isn't the case in central and eastern Oregon where the dry weather requires a higher ET rate.

In large areas of turf, the central zone could be watered as little as twice a month while the perimeter could be watered more frequently. The goal should be to move toward longer intervals between watering. This develops a deeper root structure which increases overall turf health. A deeper root structure reduces thatch and provides better frost control which means less plant replacement.

Overspray

Overspray onto hardscape from just one half circle irrigation head can waste over 300 gallons of water per year. This fix is easy by replacing the head to cast the proper amount of water to the zone. It may be necessary to redesign the landscape when there is a lot of overspray. Planting ground cover, shrubs, and trees around the perimeter will allow the overspray hits the beds instead of the hardscape. Weekly site evaluations and prompt corrective action can save thousands of gallons per year. The property manager and maintenance crew should keep an eye on typical overspray areas to watch for ice forming on the sidewalk in early mornings and check for broken heads. These items should be included in the scope of work within the maintenance contract.

Capping heads

As trees mature, the shade and soil changes can impact the vegetation that can grow. Therefore, it may no longer be necessary to irrigate some areas and these zones can benefit from capping the heads. Capping the head preferred over screwing the nozzle because the nozzle can leak if not properly done.

Schedule

The irrigation schedule is very important to set, and continue to adjust based on the vegetation needs and seasonal changes. Within the contract, the landscape maintenance team should adjust the monthly watering schedule based on the local conditions. This will avoid overwatering and keep the vegetation healthy.

Operating the irrigation system during work hours is reasonable to keep an eye out for performance issues, however, climatic conditions don't provide the best operating conditions. Daytime wind and high temperatures leads to wasted water due to overspray and evaporation. The water applied doesn't generally have enough time to soak into the roots for the plants to utilize before it evaporates, encouraging the growth of surface weeds. Operating the irrigation system during the early evening can lead to plant material fungal, disease, or freezing problems, killing the plant. Most plants should be watered in the early morning before the temperatures begin to rise or the wind picks up. This provides plants a good supply of water to combat the heat of the day. Established plantings need deep, infrequent watering to encourage deeper rooting, leading to stronger, healthier plants. Finding the right schedule will depend on the climate conditions and site activity. As the cold season sets in, plants should be watered until their natural cold dormancy sets in. This allows the plant to awake healthy in the spring.

Sensors

Moisture and ET rate sensors can further help reduce water use by not operating the irrigation system when the weather has been moderate to keep adequate moisture in the soil or when adequate amounts of rain have fallen. In the Willamette Valley rain shutoff devices can save between 3-15% water use during the summer. However, since they operate as an on/off sensor, it may not save much water if there isn't any rain.

Evapotranspiration rate sensors are helpful in all climates because they adjust the run time of the irrigation system based on the necessary water use to fill the landscape based on the ET rate. The drawback is that this sensor can require a lot of set up and some on-going maintenance. ET rate sensors are easier than changing the irrigation schedule manually when satellite sensors are not available.

Other sensors such as wind sensors may be beneficial on a site by site basis.

Irrigation Heads

The three main types of heads are broadcast, surface, and subsurface. Each head provides a different volume of water in in/h. The water pressure, vegetation, surface area, and microclimate can greatly vary the head recommendation and should be considered on a zone by site zone.

Broadcast heads are the least efficient and cheapest. This type of head is best for turf. They throw water across a surface with a stream or spray rotator head to provide uniform distribution. Spray heads are often the most common and most inefficient way to water the roots since water can be lost to wind or evaporation. High efficiency rotator nozzles be used for all lawn areas 6 feet, or wider. If older spray heads are being used, then replace them with newer/efficient rotator nozzles.

Drip irrigation distributes water directly to the root, such as surface and subsurface drip irrigation. Surface drip irrigation provides water on top of the soil by emitters that are keenly selected for each

plant. Subsurface irrigation is buried until the soil, or under the mulch. The water to each plant is determined by the hole diameter and can be adjusted.

4. Redesign the Landscape

Altering an aging landscape instantly refreshes a property and can increase interest from prospective tenants. However, adding or removing vegetation and hardscape can be expensive and should only be considered if a new, efficient design is desired, much of the landscape was misplanted or has died, or construction activity has destroyed the landscape. When possible, instead of demolishing the existing landscape and redesigning everything, consider phasing landscape projects. Prioritizing a site's landscape needs can preserve costs by focusing on immediate needs while preparing for future landscape design opportunities.

Redesigning landscape for water efficiency includes evaluation of the plant materials and on-going maintenance. Like many efficiency measures, spending money upfront can reduce operation costs later. Spending \$2/SF may replace like material for like, while spending upward of \$5/SF could include less lawn, higher quality irrigation, and more hardscape and reduce future maintenance costs.

Selecting a landscape designer:

A landscape architect or landscape design professional should be consulted prior to any redesign to ensure that local codes, rules, or community guidelines will be met. For most multi-family housing developments there are specific landscaping rules/guidelines that need to be met – as well as any pertinent city requirements. Hiring a professional who is familiar with these requirements can save time and money.

Consider adding a second party design review for the landscape drawings to ensure that the water use program goals will be met with the design. If this is not possible, ensure the landscape designer review the irrigation shop drawings for efficiency. For example, due to unplanned site constraints the irrigation pipes may need 90 degree angles. Instead of installing pipe that may need future maintenance or replacement, consider a small landscape redesign to avoid the future cost.

Plant alternatives

Large turf areas can be turned into community garden areas. Including automated irrigation controls in garden plots can save water over requiring tenants to water. Additionally, this allows for the selection of drip irrigation which will deliver water directly to the root, using less water.

Artificial turf can also replace turf to provide a relatively maintenance-free consistently green area suitable for children's' play, and dog duties. This material will require the occasional "washing" with a hose during the dryer months. For a high quality synthetic grass, expect to pay a premium price.

Plant selection

Select plants that are native or have adapted to the climate, are slow growing, and group plants efficiently to save water. Planting native or adapted plants can save water, reduce pesticide use and maintenance costs. Selecting slow growing plants can minimize monthly trimming needs and reduce the need for replacement of overgrown vegetation. Grouping vegetation by similar water and maintenance needs can reduce water use and provide for efficient maintenance visits. For example, providing one large turf area instead of multiple small, scattered areas, can save maintenance time and improve water efficiency.

Turf

As global climate change provides for wetter winters and dryer, hotter summer, property owners may need to reevaluate our need for the typical lush green lawn. Turf is the largest landscape water use at a property. If the goal is the reduce the amount of irrigation water use, the turf could be removed, or the clover, and other low growing vegetation could be cultivated to take over. Clover grows by rhizomes and growth can be fostered by not fertilizing, watering less, and stretching the time between mowing. All of these steps lead to less maintenance costs and will provide a naturally low growing green area that is resilient to frequent foot traffic.

Selecting plant materials that are microclimate appropriate can reduce water and maintenance time as well. Choose clover, or low growing sedums over turf, where appropriate, to reduce water use and mowing. Choose meadow grasses and flower seed mix on slopes. Meadow areas only need to be mowed down a few times a year.

Using rock or large wood chips as mulch reduces the possibility of it blowing away, the material being dragged inside and ruining floors, or the on-going cost to reinstall annually. If the apartment population is not conducive to rock, consider crushed granite or other stone. Filbert shells are also a good alternative because they are local, nonflammable, and deter people and animals from walking on them.

The life cycle cost analysis for landscape should be considered because what appears inexpensive upfront, can provide years of prolonged operating costs. The average multifamily affordable property may spend \$2.50/SF installing new turf (\$0.50/SF), irrigation (\$1.50/SF), mulch (\$1.00/SF), and plants (\$1.50/SF) plus the cost of trees for the beds. The average property will spend \$1.21/SF/year on water (\$0.05/SF), maintenance (\$0.16/SF), and mulch (\$1.00/SF). Selecting the most efficient irrigation system can reduce the overall cost of water use by 30% and reducing turf area and opting for crushed stone over mulch can save over 80% on annual landscaping budget.

Like all efficiency projects, there are many non-cost saving sustainability benefits to smart landscape design. Reducing the number of property maintenance trips lessens the global warming potential due to fossil fuel transportation. Planting native vegetation reduced transportation, supports a local economy, and uses less petroleum-based chemicals. Additionally, efficient landscaping can:

- Reduce visual fatigue by varying plantings
- Provide landscape diversity with meadows
- Attract tenants and reduces turn over
- Reduce slip and fall claims
- Limit heat island effect and reduce the need to cool units
- Encourage tenants to keep the property nice if it is visually appealing.
- Attract butterflies and song birds.

Examples:

HAJC's property did a major landscape overhaul, removing turf, planting native and drought tolerant plants, as well as upgrading the irrigation heads. The cost of this was \$45K and anticipated saving over 3M gallons of water, or nearly 50% of their total water use (irrigation and indoor water.) They were previously overwatering, so this value is higher than we would normally expect to see.

A property in Central Oregon redesigned their landscaping to a lesser extent than the HAJC's property. They removed 18,000SF of turf and irrigation, installed a kids play area with foam mat, dog run with gravel, and other non-turf amenities. We anticipate that this will save them 225,000 gallons of water, or 8% of their total property water use.

Conclusion:

Hiring a qualified professional can provide valuable information to achieve program goals. With some planning and communication across asset management and site operations, there are some easy ways to evaluate and preserve water use on-site, saving operation costs. Reviewing water bills and maintenance contracts are simple ways to save. With an eye on future property development, landscaping projects can be phased to address the highest water using activities in a cost effective manner such as scheduling the irrigation and slowly redesigning the landscape. These activities will continually improve the property over time.