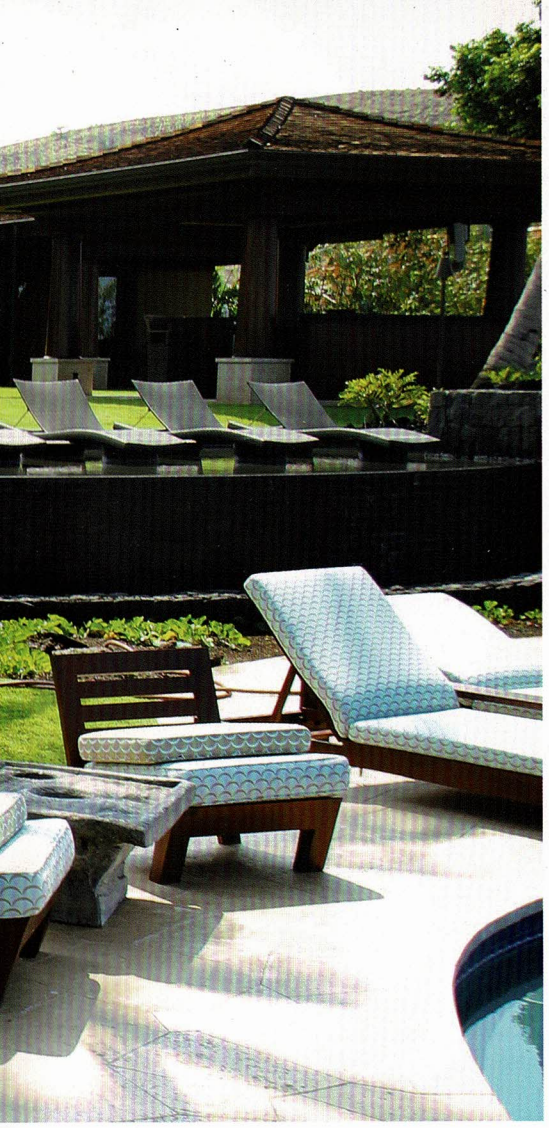
Intelligent Water Management for Hawaii's Landscapes

My very first landscape maintenance account was a rather large luxury property with approximately 15,000 square feet of residential resort landscaping. The client observed areas of their landscape that were always soggy and wet, and complained of very high water bills. They requested a thorough assessment and reduction of irrigation consumption as the first order of business. I was alarmed to measure the irrigation usage averaging 40,000 gallons per week, which is around 2 million gallons per year. I calculated this to be the equivalent of nearly 230 inches of annual precipitation. This translated to a water bill averaging $3,300 per month for this residential lot at Kuki'o resort community. Over the next three years I developed the landscape into a water conserving, chemical free environment, halving the amount of water required and saving the client about $12,000 annually in landscape water expense.

I began by tracking water usage weekly. Every Monday I would stop by the property, log the water meter readings and inspect plant health. Every Thursday was our scheduled maintenance day, and I would again inspect plant health. It was crucial in the beginning to inspect the landscape plants twice per week because I was running experiments in irrigation scheduling and a reduction in water being applied. I ran the risk of causing unsightly wilted plants and turf at this billionaire's residence, and this was not something I took lightly.

My experiments started with a baseline of water usage by measuring the GPM (gallons per minute) output of each irrigation zone. This property had 32 irrigation zones, and most of them were conventional spray heads. Next, I researched publications from the University of Hawaii on landscape management and irrigation. UH stated in one of its publications that warm season turf needs .75" - 1" of precipitation (water) at the first sign of wilt or about every 3-4 days. I then programmed a new schedule into the controller watering for a longer duration per application and less frequently. I experimented with different run times for turf zones, shrub zones, shady zones and sunny zones. I shut the water off and learned how long it would take both turf and shrubs to show the first signs of wilt. Through this process I was able to determine just how much water was needed to maintain good plant growth and health at this property. Over time I was able to drop water usage from 40,000 gallons per week to 19,000 gallons per week, a reduction of 52.5%. I was ecstatic at the results, but felt I had only scratched the surface of water savings for two reasons. First, this conventionally installed landscape I was working with had soils that were not meant to retain water. The soils were a standard cinder soil blend widely used on Hawaii Island. Soil testing of this cinder soil revealed an astounding 88% gravel sized particle content with extremely high drainage characteristics. Furthermore, the soil was at best a 12" deep layer installed on compacted base course - not the best for plants and trees to grow on. Secondly, the irrigation system was not designed to conserve water as the majority of the property was watered with conventional spray nozzles which are said to be only 55% efficient - meaning 45% of the water applied either misted into the atmosphere



or evaporated off the plant surfaces without ever infiltrating the soil. I soon began to dream of how much water we could save if a landscape was engineered and built to conserve water.

What astonished me the most about this process of reducing water consumption was the drastic improvement of plant health. Pest issues started to clear up on their own without any use of pesticides. Most notably, the scale and black sooty mold started to disappear. What I learned is that infrequent watering encourages the plant's root systems to expand in search of water. This gave the plants a greater access to vital nutrients and minerals in the soil because they had larger, more established root systems. Moreover, by giving the soil a chance to dry out in between waterings, I believe the soil microbiology changed in response to having more air in the pore space in the days where no water was applied. As the soil became more balanced, plant health improved, pests decreased and I observed an improvement of the entire landscape ecosystem. It had become apparent that healthier plants resisted pests better and were more drought tolerant, and this is the goal we strive for when establishing a sustainable landscape.

Leaks. I dreaded leaks back then. One leak can take a months worth of excellent water performance and literally flush it down the drain. There are 3 main types of leaks I've found that waste an enormous amount of water: mainline leaks, seeping valves, and a zone with leaks at the base of the sprinkler heads. The mainline of an irrigation system is the part that is always pressurized with water (unless a master valve is installed). In most cases when there is a leak on the mainline, water will be leaking non-stop until it is found and fixed. Many times it's very hard to find mainline leaks and the discovery of a leak usually starts with a high water bill - meaning its been going on for over a month. The most common causes of mainline leaks I've found are PVC joints or fittings that fail, HPDE fusions that fail, rocks being buried next to the mainline or large trees roots that lift or put pressure on the mainline. Another advantage of water meter tracking is that you can easily detect a mainline leak or seeping valve by observing meter flow when the irrigation system is off. A one gallon per minute mainline leak will waste 1,440 gallons per day, which is 43,200 gallons per month and unfortunately often goes unnoticed.

Seeping valves are automatic irrigation valves that do not close properly when they shut off. Commonly this is caused by debris such as small rocks, soil, or pipe shavings that can get into the pipes during repairs made up stream and prevent the rubber diaphragm from sealing shut. This can waste an enormous amount of water very quickly, in one case I had a valve that did not close properly and resulted in an entire drip irrigation zone running for about 3 days. This zone had a flow of 12.5 GPM and wasted water at a rate of 18,000 gallons per day. Trouble is, because it was a drip zone no body noticed it was running and over 3 days, 54,000 gallons were wasted.

More recently I discovered another major issue that turns out to be very common in irrigation systems: broken funny elbows. Funny elbows are the fitting used to connect sprinkler heads to flexible funny pipe, and is a standard in sprinkler head applications. These plastic fittings can face significant amounts of stress as plant root systems mature and push on sprinkler heads. Even when these fittings break, water pressure and flow is enough to continue to run the sprinklers as if nothing is wrong and this issue can go on for years undetected. It usually isn't until 3 or 4 funny elbows break that there is a noticeable difference in sprinkler function. Our protocol with this situation is to cap all the sprinkler heads and turn on the zone to evaluate which heads are leaking. We then dig up the heads and replace the broken parts. When multiple leaks occur it can easily add another 5 GPM to the zone, and if the zone runs for 10 minutes per day every day this can waste 350 gallons per week which is 18,200 gallons per year.

With fresh water scarcity quickly becoming one of the greatest challenges facing mankind, it is imperative that we take a more thorough approach to managing the water needs of our landscapes. When it comes to irrigation management in the arid resort landscapes of Hawaii, the two main things we can do to save water are re-programming our irrigation controllers for less frequent watering, and monitoring for and repairing major leaks. There are numerous products on the market these days that can help with remote monitoring of irrigation usage to help determine when and even where a leak occurs. However, the one thing you can't buy is the wisdom and knowledge that comes from experience in establishing a drought tolerant landscape. I encourage the landscape industry to run experiments with infrequent watering schedules. Observation and a deeper understanding of the relationship between soil, plants and water is indispensable for our industry as we move into the future. What I ultimately came to understand through this journey is that we are not watering plants, we are watering the soil. It is the soil that in turn holds the water and provides it to plants. We need to develop landscaping with drought tolerant soil, drought tolerant plants, and precise irrigation that is monitored for leaks. With irrigation easily accounting for 75-90% of the water being used at a residential resort property on Hawaii's leeward coasts, we as landscapers have a tremendous opportunity to conserve and protect our islands precious water resources for generations to come.

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