Chapter II

Water Use and Conservation: Perception vs. Reality

Summary

Precise definitions of water types and water uses are essential. Some mandates have proven to increase, not decrease, water use. Conservation efforts can be most effective when consumers are well-informed.

When told we have to start conserving water, the average person might reasonably ask two apparently simple questions: "How much am I using now?" and "How much do I need to conserve?"

What Water Are We Conserving?

The perception is we all know what "water" we're talking about conserving — and that if we can all agree on how much is being "used," we can then determine how much to "conserve."

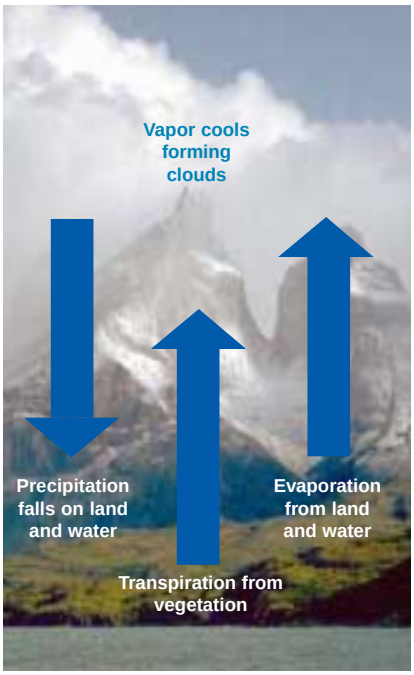
The reality is far different and much more complex, beginning with a definition of the simple word "use."

Unlike other renewable resources such as lumber and corn oil or non-renewable resources such as coal and oil, water is not used or consumed in the traditional definition of the words. More appropriately, it is stored in various forms and in various vessels. The forms can be solid, liquid or vapor. The vessels can be anything from the environment, such as glaciers, oceans, rivers and lakes, to pipes, tanks, cans and bottles and even plants, animals and humans. The reality is that a dinosaur may well have consumed the same water we drink today – because it has been recycled through the atmosphere time and time again. Just because that dinosaur drank the water, it was not irretrievably lost to today's use.

Scientists have concluded that the amount of water present on Earth has been relatively stable for eons, an estimated 290 million cubic miles of water.

Through a process called the "hydrologic cycle," precipitation in the form of rain, snow or hail generally equals the amount of water lost to evaporation. Because on a global average there is 30 percent more precipitation onto the land than evaporates from it, there is a potential annual net gain of approximately 9,000 cubic miles of water on the land every year. This is the fresh water that recharges our ground and surface water supplies, feeding the streams and rivers and eventually flowing into the oceans.

The Hydrologic Cycle



Although there is a potential annual net gain of approximately 9,000 cubic miles of water on the land every year, the paradoxical reality remains– water is not increased, it is only recycled.

The paradoxical reality is that while we are never going to exhaust our water supply, we cannot increase it – we can only recycle it.

What Type of Water Are We Talking About Conserving?

There is also a perception that we know what type of water we are talking about conserving.

But in reality, we lack agreement as to whether the water to be conserved should include all types: fresh water only, or salt water and

effluent as well? Should all fresh water including ground and surface water be conserved, or only publicly treated and supplied water? Should conservation apply to all industrial, commercial, agricultural and domestic water use, or only to domestic outdoor use?

Confusion also can arise when it comes to distinguishing between off-stream and in-stream uses; between domestic, self-supplied and publicly supplied domestic and commercial water; and between direct, indirect or mixed-supply users. Furthermore, the term "personal use" can be understood either as what one individual actually consumes or requires for hygienic purposes, or it may incorporate the amount of the water used to provide that person with everything from drinking and bath water to the agricultural and industrial water used to produce an egg, car or newspaper!

Units of measure may be perceived as adding clarity, but in reality, they too can create confusion. Terms and abbreviations such as *million gallons per day* (Mgal/d); *acre-feet* (A-ft); *gallons per capita per day* (gpcd) and *100 cubic feet* (ccf) can be mind-numbing. Then consider converting everything to the metric system of cubic kilometers, liters, meters and hectares!

Who Owns the Water We Are Conserving?

Another perception/reality question relates to who "owns" water. Mark Twain once said of the western United States, "Whiskey is for drinking, and water is for fighting." He was right then, but the geographic application of his comment can now be considered to be global.

In some areas, you can "own" the water you can pump from beneath your property or whatever flows through it. But more and more that seems to be changing. Now greater consideration has to be given to "downstream" uses including those not only for human consumption or for production demands but also for environmental requirements. This results in the practice that requires water purveyors who withdraw water from a river to fully treat and return a certain percentage of that water to the river or face severe costs or penalties.

Many public water suppliers pay fees or have limits on the amount of water they can withdraw from a source (usually a stream or surface water) but are credited for the amount of treated water they return to that source. Under this arrangement, the public supplier has an obvious incentive to discourage outdoor water use because there is no way of accurately measuring how much water is being returned to the system, even if the costs for treating the returned water are extremely high. Thus there may be a

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systemwide disincentive to use effluent water for many of the same reasons.

In such circumstances, the use of recycled or effluent water for industrial purposes or on landscapes must be discouraged, or there will not be sufficient return flow for downstream use. While the perception may be that recycled water usage can conserve potable water, the reality is that downstream needs may prohibit its consideration.

Who Directly Consumes the Highest Percentage of Water?

There is also a perception, in at least some circles, that homeowners directly consume the highest percentage of water and therefore they should be capable of conserving the largest amounts most easily. But this notion is debatable, depending again upon definitions. Cooling for ther-

moelectric generation and production agriculture requires the greatest amounts of fresh water, but domestic uses require the largest quantities of publicly supplied water.

Another reality is that water purveyors traditionally look first to their customers whose usage is highest when significant changes of volume in consumption are needed. Thus, it is not surprising that public water-system officials in expanding urban areas first look longingly at homeowners as the primary target for conserving publicly supplied water and then at the volume of water used for agriculture.

Ultimately, though, water-policy decision-makers usually conclude that by focusing their conservation attention on the greatest volume uses of water they will always achieve the largest savings. Thus, for publicly supplied water, domestic use is typically the first general target of conservation — and within that market outdoor water use has traditionally been the first segment of conservation-related activity, with considerable attention focused on turfgrass water use.

Conservation efforts typically unfold in predictable stages. First would come non-threatening, educational water-conservation messages in the media and as water-bill stuffers asking people to use less water.

As the need to conserve grew, so too would the severity of the plan, going from alternate-day outdoor watering, to turf-area limits, to outlawing some grass species in favor of others, and eventually to outright bans on the use of turfgrass. Alternative plants, defined either as "low-water using," or "native," would be prescribed or legislated for perceived conservation landscaping.

To one degree or another, some or all of this scenario has unfolded in locales including Marin County, California; Reno, Nevada; Atlanta, Georgia; Seattle, Washington; London, England; and parts of the Middle East.

New Thinking Is Starting To Emerge

While some of these measures may have had initial success, it is now being learned there is little scientific water-use data to support the listing of non-turf plants as "low-water using" or "native." In fact, while many such alternative plants may be able to survive on little applied water, they become high water users when people do irrigate them in an effort to develop a pleasing landscape.

Outdoor water use has traditionally been the first segment of conservation-related activity.

It is also recognized that water-use rates can actually increase with alternate-day watering because people incorrectly believe they must water every other day without regard for the plant's actual need.

In addition to the fact that a variety of mandates intended to conserve water have not proven particularly effective, there is an increasing level of recognition that overall environmental quality can be dramatically diminished by such measures. Without trees and turfgrass to cool a surrounding area, "heat islands" can develop. These require increased use of air conditioners, which burn more and more energy that could be used in other ways or reserved for future use.

This causes pollutants that would otherwise be trapped in turf to be washed into waterways along with increased amounts of soil and silt, further defiling the downstream water supply or groundwater resources.

Research Findings About Urban Water Conservation

Residential End Uses of Water, an in-depth study conducted in 14 cities in the United States and Canada that

was funded by the American Water Works Association Research Foundation and released in the year 2000, provides some intriguing findings about urban water conservation.

- The mix of indoor and outdoor water use is strongly influenced by annual weather patterns. As expected, sites in hot climates like the Phoenix area (including Tempe and Scottsdale) had a higher percentage of outdoor use (59-67 percent), while sites in cooler, wetter climates like Seattle, Tampa and Waterloo, Ontario, had much lower percentages of outdoor use (22-38 percent).
- 10 percent of homes were responsible for 58 percent of the leaks found. Households with swimming pools have 55 percent greater overall leakage on average than other households.
- Leakage is found to be generally lower for households that use drip irrigation or use a hand-held hose for watering as well as for those who have reported taking behavioral and technological actions to conserve water outdoors.
- Because outdoor water use is more discretionary than indoor uses, outdoor use can decline more rapidly when prices rise.
- Homes with in-ground sprinkler systems use 35 percent more water outdoors than those without in-ground systems.
- Households that use automatic timers to control their irrigation systems used 47 percent more water outdoors than those without timers.
- Homes with drip-irrigation systems use 15 percent more water outdoors than those without drip irrigation systems.
- Households that water with hand-held hoses use 33 percent less water outdoors than other households. Households that maintain gardens use 30 percent more water outdoors than those without a garden.

Perhaps most remarkable was this finding: The low water-use landscape group (xeriscapes) actually received slightly more water outdoors annually than the standard landscape group because of homeowners' tendency to overwater. A similar result also was documented in a 1998 Arizona State University study funded by the U.S. Environmental Protection Agency.

Yesterday's perceptions are being challenged with new information, and as a result, the potential exists for new realities. Chief among them is that water-policy decision-makers will realize the importance of clearly defined and understood terms, conditions and data.

Without clarity, there will be confusion. And confusion often leads to chaos, not conservation.

What is 1 inch of water?

One inch of water a week is generally recommended for maintaining a viable landscape including vegetables, turf, trees and flowers. But what is 1 inch of water?

The following conversions help make this clear.

1 inch of water (applied or rainfall)
- on 1,000 square feet = 624 gallons or 5,200 pounds
- on 1 acre = 27,200 gallons or 200,000 pounds
- on 1 square mile = 17.4 million gallons or 145 million pounds

1 gallon equals
- 128 fluid ounces, 8.337 pounds, 3.782 kilograms
- 15,100 drops, 16 cups, 8 pints, 4 quarts
- 231 cubic inches, 0.2337 cubic feet
- 0.83262 British or Imperial gallon
- 3,785.4 milliliters or cubic centimeters

1 cubic foot equals 7.48 gallons, 62.4 pounds

1 cubic yard equals 202 gallons, 1,685 pounds, 764.5 liters

1 cubic meter equals 264.2 gallons, 2,002 pounds

1 acre-foot (12-inch depth across 43,560 square feet) equals 325,851 gallons, 2.7 million pounds