

# Irrigation Puzzle: Sourcing Water for Golf Courses

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*The most important issue facing the golf industry worldwide is water, or lack of it! Population increases and drought have resulted in golf courses successfully converting from potable to recycled water for irrigation. The golf industry has already overcome, through excellent educational outreach, the negative stereotype of irrigation with recycled water, and consequently, golf courses increasingly turn to the use of recycled water. The primary question has become not whether to switch to recycled water irrigation, or even how to manage irrigation with this new source, but how soon an individual course can access a recycled water source.*

The distribution of water on earth has controlled the growth and spread of human activity throughout history. Signs proving the will to deal with water troubles are wells, aqueducts, qanats, and reservoirs of the ancient world, some of which are still serviceable thousands of years later. Today, we use more water than ever; increasing population, as well as increased individual need, particularly in industrially advanced societies, put increased pressure on our water supplies. And, although three-quarters of the earth's surface is covered with water, only a minute fraction of that water is both readily available and of suitable quality for human use, including irrigation of agricultural crops and landscape plants. That small fraction of earth's water includes rain and snow-melt stored in lakes, reservoirs, and aquifers, as well as water available in rivers. Yet all sources of fresh surface and ground water are being rapidly depleted by industrial and agricultural use as well as by direct human consumption. Consequently, the world's golf courses, mostly located in urban centers, therefore compete directly with human consumption for high quality water.

## Impact of Drought on Golf

Drought intensifies the competition for water in much of the world. In the United States over the past two decades, significant annual droughts have affected large areas, particularly in "desert" states. Nevertheless, during this time, Americans migrated in large numbers to arid areas, where housing developments, along with their attendant landscape sites (golf courses especially) have significantly increased the demand for water. Consequently, severe restrictions on turfgrass and landscape irrigation during drought are common, including

**Figure 1. Drought intensifies the competition for water, particularly in 'desert' states where people have migrated in large numbers.**



the complete shutdown of home lawn, golf course or park irrigation. In 2012, drought seriously affected more than half of the United States. A recent national survey conducted by the Environmental Institute for Golf (the philanthropic organization of the Golf Course Superintendents Association of America) indicated the irrigation water sources of US golf courses (Table 1). Most irrigation comes from surface water (ponds, lakes, reservoirs, rivers, creeks, canals, etc.). Another source of substantial amounts of irrigation water is the ground water (wells). Surprisingly, in certain regions of the country, a large percentage of golf courses still have the luxury of using potable municipal water for irrigation. In the dry southwest, 31% of golf courses irrigate with domestic water; nationally, however, the number drops to only 14%. The latter is almost equal to the number of courses across the country using recycled water for irrigation (12%). Recycled water (also known as re-claimed, effluent, re-use, or waste-water) refers to wa-

ter that has undergone one cycle of (human) use and then received significant treatment at a sewage treatment plant to be made suitable for various reuse purposes, including turfgrass irrigation. Use of recycled water for golf course irrigation is scattered around the country, reported by only 3% of golf courses in wet northeastern states compared to 37% of courses in the dry southwest.

### Degraded Water Sources for Golf

With no national water policy, it is not possible to predict future water availability for golf course irriga-

tion. Clearly, however, the accelerating demand for good quality water and the increasing occurrence of drought mean that golf course irrigation will henceforth be closely scrutinized. As water becomes more scarce, irrigation of golf courses with degraded water will become more likely.

The two most obvious sources of degraded water are recycled municipal water, and brackish water, the latter either from shallow saline wells, or waters affected by sea water intrusion. Currently, only a few golf facilities use brackish water for irrigation (Table 1). The number of golf courses using recycled water, however, is significant, as noted above. Many years of research, prac-

**Table 1. Percentage of golf courses that use various types of irrigation water sources in the U.S. and within each agronomic region.**

Water Source	Agronomic Region*							
	US	NE	NC	Trans	SE	SW	UW/ Mtn	Pac
	%							
Open water (Lakes, ponds)	52	64	55	74	62	8	24	17
Wells	46	41	62	32	45	46	37	49
Rivers, streams, creeks	17	22	16	16	12	4	28	15
Municipal water supply	14	16	7	18	8	31	13	25
Re-use water (effluent, reclaimed)	12	3	3	4	24	37	17	17
Canals	4	2	1	1	3	9	18	6
Brackish water	<1	<1	0	<1	<1	0	0	1
On-site desalination plant	<1	0	0	0	<1	0	0	0
Other	3	2	3	2	2	3	7	5

\*Agronomic regions: US, United States; NE, Northeast; NC, North Central; Trans, Transition; SE, Southeast; SW, Southwest; UW/Mtn, Upper West/Mountain; Pac, Pacific.

Source: Anonymous. 2009. Water Use & Conservation Practices on U. S. Golf Courses. Golf Course Environmental Profile--Volume 2. Environmental Institute for Golf. Golf Course Superintendents Association of America. Lawrence, KS.

**Figure 2. The reliability and cost of recycled irrigation water for golf courses and landscapes will continue to encourage its use; however, any cost/benefit analysis of recycled water must include additional turf management costs to deal with salinity.**



tice, and field observation on extensive turfgrass-covered areas (mainly golf courses) show that irrigation with recycled water (or brackish water in a few instances) is a viable means of coping with drought, water shortages and/or the rising cost of potable water.

The reliability (availability) and the cost of recycled water also play a major role in the popularity of recycled irrigation water. Recycled water is available even during droughts, when use of potable, and even well, water may be restricted. Recycled water is also often less expensive than potable water, and in some instances may be free. However, any cost/benefit analysis of recycled water must include management costs in addition to the price of water itself. If recycled water is of low quality (i.e. contains excessive salts, nutrients, etc.), the cost of managing these impurities to prevent plant injury or pollution of lakes may exceed the cost of fresh water. The main value of using recycled water for golf course irrigation is its availability and reliability when other sources become unavailable.

With the possible exception of some brackish waters, recycled water almost always has the highest level of

dissolved salts of any irrigation water. Recycled water, therefore, must be evaluated thoroughly to allow development of appropriate strategies for its use. Recycled irrigation water quality affects the chemical and physical properties of soil, and therefore soil-water-turfgrass relations. The interrelationships must be monitored by regular chemical analysis and managed.

### Conclusion

In conclusion, the most important issue facing the golf industry worldwide is currently water, or lack of it! Population increases and drought mean the industry is far more likely to compete successfully for recycled water than for potable. The golf industry has already overcome, through excellent educational outreach, the negative stereotype of recycled water irrigation; consequently, golf courses increasingly turn to use of this water. The primary question has become not whether to switch to recycled water irrigation, or even how to manage irrigation with this new source, but how soon an individual course can access a recycled water source.