

# Alternative Water Sources

*Editor's Note: Water quality and availability remains the number-one issue facing golf today and the near future. The following articles discuss how two clubs sought solutions to those challenges.)*

## 'Horizontal Well' Taps Surficial Aquifer, Returns Investment

By Tom Trammell, CGCS

In August of 2000, I was facing quite a dilemma at Hawks Nest in Vero Beach. My charge was maintaining one of the top golf courses in Florida, we were already in a drought, we were going into the dry season (and the busy season) and



Tom Trammell, CGCS, stands in front of the horizontal well installed more than one year ago. The well provides more than 300,000 gallons of water per day for irrigation usage. Trammell notes that he has made sizeable savings over the last year due to improved water quality and reduced electrical cost for pumping from the shallow source. Hawk's Nest is scheduled to add one more well in the summer of 2002.

my water supply was terribly inadequate. My two conventional vertical wells were yielding approximately 40 gallons per minute and the effluent that I had been promised by the county was not arriving. Even though the two existing wells were running 24 hours a day, the course was still short 400,000 to 500,000 gallons per day.

Some effluent arrived, but not nearly enough. Fortunately, I remembered a presentation that I had attended in 1990. The subject was "horizontal wells" that tap the surficial aquifer a few feet below the surface.

In my files were the brochures that I had stored away from the presentation with the appropriate phone numbers. To make a long story short, I called and received a "re-education" on horizontal wells and decided that they may be the answer for our golf course. My green committee was a little suspect at first, because no one had heard of a "horizontal well."

I asked the company to come in and give a presentation to the committee. The company presented a short video, made a presentation, answered questions, and the committee said, "Go ahead." I was a little nervous, because it was all on my recommendation, but I plunged forward and had the well installed.

I am writing this article in March of 2002 and, here in Florida, we were still in the midst of a drought. The horizontal well not only has provided ample, good quality water (and continues to do so), I am using less electricity because the well is only 18 feet deep. Additionally, I am applying fewer soil supplements because of the quality of the water, and I am recycling anything that is unused. I was able to make a presentation to my green committee that demonstrated our horizontal well would pay for itself in 10 years.

The horizontal well taps the water that lies near the surface and directly beneath the golf course in a surficial water zone. This technology has the ability to recover water from this resource and deliver it in sufficient quantity to satisfy irrigation and lake augmentation needs. Surplus water that is not used in actual irrigation is returned to the surficial aquifer to be reused later. The system can be permitted to be used as a stand-alone water supply source or to supplement existing water supplies.

The horizontal wells are site specific. However, they work in most places in Florida. To determine if a horizontal well will work at your golf course, you need to spend approximately \$2,500 to \$3,000 for a 25- to 30-foot boring and have a hydrologist run computer models. The report will be pretty accurate and give you a much better idea of what you will get with the horizontal well than you

will ever have when you drill a conventional vertical well.

This is a technology whose day has come. If your site will accommodate a horizontal well, then chances are you will not only have a more-than-adequate supply of good quality water; you will also have a return on your investment.

## Club Taps Surficial, Floridan Aquifers, Processes in Own RO Plant

By Michael Caglioni, P.G. and Peter Brooks, CGCS

The Everglades Club is located in the Town of Palm Beach, which is located on an elongated barrier island, the Island of Palm Beach, bounded to the west by the man-made saline estuary of Lake Worth/Intracoastal Waterway, to the east by the Atlantic Ocean, and to the north and south by man-made inlets. The Everglades Club is a private, par 70, 18-hole golf club that covers 70 acres.

The original irrigation water supply was potable drinking water purchased from the Town of Palm Beach Utilities, which purchases its bulk water from the City of West Palm Beach. The City of West Palm Beach obtains its raw water from a surface water body, Clear Lake, and is treated mainly through green sand filtration. The Everglades Club irrigation water was supplied by transferring a drinking water source to the barrier island and then to the golf course. When using potable water purchased from the Town of Palm Beach, The Everglades Club Golf Course had an average monthly water bill of \$20,000.

## Alternative Water Source No. 1: Surficial Aquifer

In order to reduce the irrigation costs to the golf course, the Everglades Club investigated the potential of installing its own well field for irrigation purposes. Hydrogeologic investigations indicated that the Everglades Club could install a shallow, surficial aquifer well field that would supply brackish raw water with a total dissolved solids range of 2,000 to 6,000 milligrams per liter to an on-site, reverse osmosis plant for treatment. The finished water is to be utilized for irrigation of the golf course. The Everglades Club received a permit from the South Florida Water Management District to withdraw 146 million gallons per year total from both surface water and ground water (surficial aquifer) sources.

Topography plays an important part in the surficial hydraulic regime of a barrier island and, therefore, the Everglades Club. Normally, the water table will approximate the topography (contours) of the land surface. The height of the water table above mean sea level is a function of the elevation of the land surface, the nature of the hydrogeology (aquifer characteristics), and the amount of rainfall. The topography of the Everglades Club golf course is relatively low, approximately six feet above mean sea level at the eastern edge of the property. To the east of the golf course is a topographic high (consolidated and unconsolidated sand dune to  $\pm 15$  feet MSL) on which housing and roadways have been





The top of the Floridan Aquifer is more than 1000 feet below the surface of the Everglades Club.

developed. This topographic high increases the height of the freshwater head between the golf course and the Atlantic Ocean and impedes the potential of lateral saltwater movement from the Atlantic Ocean to the golf course.

The hydrogeologic investigation (which included the drilling of a test well and collection of lithologic and water quality samples) indicated the presence of a really extensive, clay unit, approximately 1-2 feet thick, from a depth of approximately 29 feet to 31 feet below MSL. The clay unit impedes the upward movement of saline water. As is expected on a barrier island, the water increased in salinity (conductivity) with depth. Below the clay unit, the water quality decreased significantly (more saline).

Twelve irrigation wells were constructed along the eastern edge of the golf course and withdraw water from approximately 19 to 29 feet MSL. This water is pumped and treated through a reverse osmosis membrane plant designed to treat brackish ground water with TDS levels of 2,000 to 6,000 mg/L.

The average TDS concentration of the production wells is 1,500 mg/L. This treated water is pumped into lakes for storage and is then pumped from the lakes to the irrigation system for distribution.

The brackish water lens and the well field are monitored by six saltwater monitor wells. The wells are used to monitor for saline intrusion,

both lateral intrusion and upconing of saline water from greater depths.

The RO water treatment plant at the Everglades Club is designed to output (permeate) 75% of the raw water intake. Each RO plant must consider the raw water quality for proper design and efficiency.

In addition, the disposal method of the reject water (concentrate) must also be considered. The Everglades Club currently discharges its concentrate water to a pond for percolation and evaporation near the Intracoastal Waterway. This pond naturally has a higher salinity than the concentrate water. This disposal option is available to the Everglades Club because of its proximity to saltwater bodies. Other options for concentrate disposal in South Florida include infiltration trenches, injection wells, and discharge to a sanitary sewer system. Each option has its associated regulations and costs. Each of these options should be investigated prior to installation of an RO plant.

The surficial aquifer has limitations of use during drought conditions because of upconing and lateral saltwater encroachment. Computer groundwater modeling was performed to assess the limitations of the surficial aquifer. The model predicted that lateral saltwater encroachment would occur after 10 days of continuous pumping with no recharge.

The Everglades Club is able to minimize the potential for the lateral encroachment of saltwater

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by adhering to a 12-hour pumping schedule (12 hours on and 12 hours off). The model also indicated that without proper, self-imposed, well field management, the Everglades Club could potentially alter the water quality by increasing chlorides, sulfates, and TDS through upconing. The Everglades Club has voluntarily monitored water quality and water levels in the monitor wells and the production wells.

### Regional Drought Conditions

In April 2000, due to regional drought conditions, the SFWMD imposed Phase II (severe) water restrictions in Palm Beach County, among others. These restrictions apply to all surface water and surficial ground water sources. Because the Everglades Club's well field withdraws water from a shallow surficial aquifer, it was included in the restrictions. Due to the uniqueness of the Everglades Club's well field (located on a barrier island with brackish water), the Everglades Club requested from the SFWMD a variance/exception to the water restrictions. The variance was denied based on the reasoning that "under the modified phase 2 water shortage rules, the surficial aquifer system is a restricted source regardless of location, treatment system, or water quality up to that of seawater."

### Alternative Water Source No. 2 - Floridan Aquifer

In anticipation of water restrictions during drought conditions, the Everglades Club submitted an

application for, and received, a well construction permit from the SFWMD to install one well into the deeper Floridan aquifer. Based on the denial from the SFWMD regarding the variance/exception to the use of the surficial aquifer, the Everglades Club contracted to have the Floridan aquifer well installed. Under the current SFWMD rules, the Floridan aquifer is an unrestricted water source.

No increase in water-use permit allocation was requested, only the transfer of the Surficial aquifer allocation to the Floridan aquifer during drought conditions. This would eliminate the need to utilize the Town of Palm Beach's potable water supply for irrigation purposes during drought conditions and therefore constitutes a reasonable and beneficial use of the state's resources.

At the Everglades Club site, the top of the Floridan aquifer occurs at approximately 1,050 feet below land surface. The water in the Floridan aquifer is brackish, having a chloride concentration of approximately 1,800 mg/L, sulfates of approximately 370 mg/L, and total dissolved solids of approximately 2,900 mg/L.

This water quality is similar to the brackish water from the existing surficial water supply system being treated by the Everglades Club. No modifications to the existing RO plant or discharge will be required.

However, there are minor modifications to monitoring requirements when the Floridan aquifer is being used. Two additional parameters, hydrogen sul-

fide and un-ionized ammonia, must be monitored and reported.

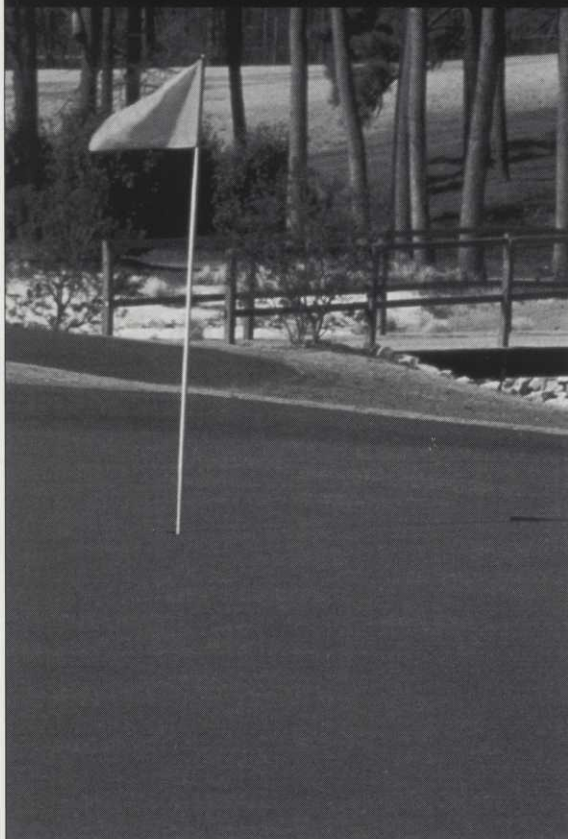
The Everglades Club golf course irrigation well field can be operated successfully with a withdrawal rate of 800,000 gallons per day withdrawn from one 10-inch-diameter irrigation well designed to produce 556 gallons per minute. This well was recently constructed and should be on line in November 2001.

### Cost effectiveness

The Everglades Club was paying \$3.15 per 1,000 gallons for potable water supplied by the Town of Palm Beach. This irrigation water source was costly and subject to mandatory water restrictions. The RO plant was a cost-effective means of reducing the water bill, whether using the surficial aquifer or the Floridan aquifer as the source. The surficial aquifer supplies water for irrigation under non-drought conditions and provided the initial alternative water supply at a lesser cost for installation. However, the surficial aquifer well field was also subject to mandatory water restrictions. The Floridan aquifer well was then constructed at a higher installation cost but has the advantage of not being subject to mandatory water restrictions.

The R.O. water treatment plant at the Everglades Club produces 1,000 gallons of water for \$0.40. Based on the rate the Everglades Club was charged to irrigate with potable water, a 200-acre golf course irrigating 0.20 inches per acre per night (hot,

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*To comply with restrictions on withdrawing brackish water from the surficial aquifer during drought conditions, The Everglades Club installed a well into the deeper saline Floridan aquifer to provide water for its reverse osmosis plant to irrigate the golf course.*

dry season) would equal a monthly cost savings of \$89,620. Likewise, to irrigate with 0.10 inches per acre per night (cool, wet season) the monthly cost savings would be \$44,814.

#### Summary

The Everglades Club was paying \$3.15 per 1,000 gallons of potable water used for irrigation. The Everglades Club then built an RO plant and constructed its own well field into the surficial aquifer system. Regional drought conditions caused the Everglades Club to adhere to mandatory water restrictions and once again rely on potable water treated by the City of West Palm Beach. The Everglades Club then installed a Floridan aquifer well, currently an unrestricted water supply source.

The water treatment plant at the Everglades Club now produces water at a cost of \$0.40 per 1,000 gallons. The benefits of switching to the Floridan aquifer during drought conditions are that potable water or surficial aquifer water prone to salt water intrusion is not used and the Everglades Club can irrigate during drought conditions.

To date, the Everglades Club has investigated and used all potential water supply sources currently available. The use of each source has evolved as the requirements and costs of irrigation have changed. The Everglades Club has successfully withdrawn and treated surficial aquifer ground water by skimming a brackish water lens on a barrier island. This was

accomplished through proper well field design, installation, monitoring, and management. Through the use of the newly completed Floridan aquifer well, the Everglades Club will be able to keep its greens alive during drought conditions and will have lessened the impact to the surficial aquifers of the state.

## The Suncoast Scramble Began Research Fundraising in 1982

On March 19th, Joel Jackson and I attended the Suncoast Scramble at Misty Creek Golf Club. A check for \$2,500 was presented to me for the

### BENHAM'S BEAT



Don Benham

FTGA's Research Foundation. Another check was also presented specially for the Florida Golf Economic Impact Study (see page 40) initiated by WCI Communities through the FTGA.

When I learned that this was the 20th annual Suncoast Scramble, I went to James Svabek, superintendent of Bradenton Country Club to see what information I could find on

the history of this event. Boy! Did I go to the right source. Jim had a complete folder on the scramble.

It was started in 1982 to provide funds for research and scholarship for the betterment of golf. Allen Hanchey, was president of the chapter golf program at Sarasota Jr. College. This teaching program was receiving national recognition for its outstanding program of teaching golf to the students. The Suncoast chapter also wanted to be involved with research funding to the FTGA. This certainly was forward thinking for a local chapter in 1982.

Since I live at the Palm Aire Country Club in Sarasota, I was surprised to learn that the first Suncoast Scramble was held there. Checks were presented to Sarasota Jr. College and the FTGA. Jim Larner was superintendent of Palm Aire and the tournament stayed here through 1988.

The Scramble moved to River Wilderness in 1989 with Mike Miles as host superintendent; then in 1990 to the River Club with George Cook superintendent and in 1991 to Bent Tree with Tom Biggy as host. The Venice G&CC and Troy Smith, GCS played host from 1992 to 1994. The past seven years (1995 - 2002), the event has been at the Misty Creek CC with Tom Crawford as the host superintendent.

Each year the Suncoast Scramble research tournament has grown till it now fills the playing field to capacity. The last few years they have had to turn away some entries. The format has stayed about the same with a golf superintendent, golf professional, general manager, or board member and a supplier making up each team.

In the mid-90s they decided to add some entertainment to the pre-lunch program. One year they perpetuated a giant hoax on the audience by announcing a speaker from the "Penn State Institute of Turfgrass Development" who proceeded to tell the audience they were releasing a new grass that only needed to be mowed once a week even on greens.

The new grass was immune to disease and completely resistant to all pests including mole crickets. The speaker then proceeded to tell the golf superintendents they should probably start to look for a new profession because even a high school student could take care of the golf course.

Jim Svabek told me he watched jaws drop open and eyes widen as the speaker continued. Jim said it was all he could do to not fall off his chair laughing. Of course by the end of the talk most people realized that they had been bamboozled. From 1996 until now, McCurdy's Comedy Club has provided the entertainment.

What a success story for the Suncoast Chapter. Twenty years of the membership working together to successfully have this tournament each year. Their original purpose has not changed. It is still to support research and the betterment of golf in Florida.

P.S. Congratulations to Greg Richardson (from Hibiscus Golf Club) for a hole in one on the 12th hole at Misty Creek in this year's event.

*Editor's note: This column was written on March 30, before Tom Crawford's death in May. The column celebrates the success and history of the Suncoast Chapter of which Tom will forever be a part.*