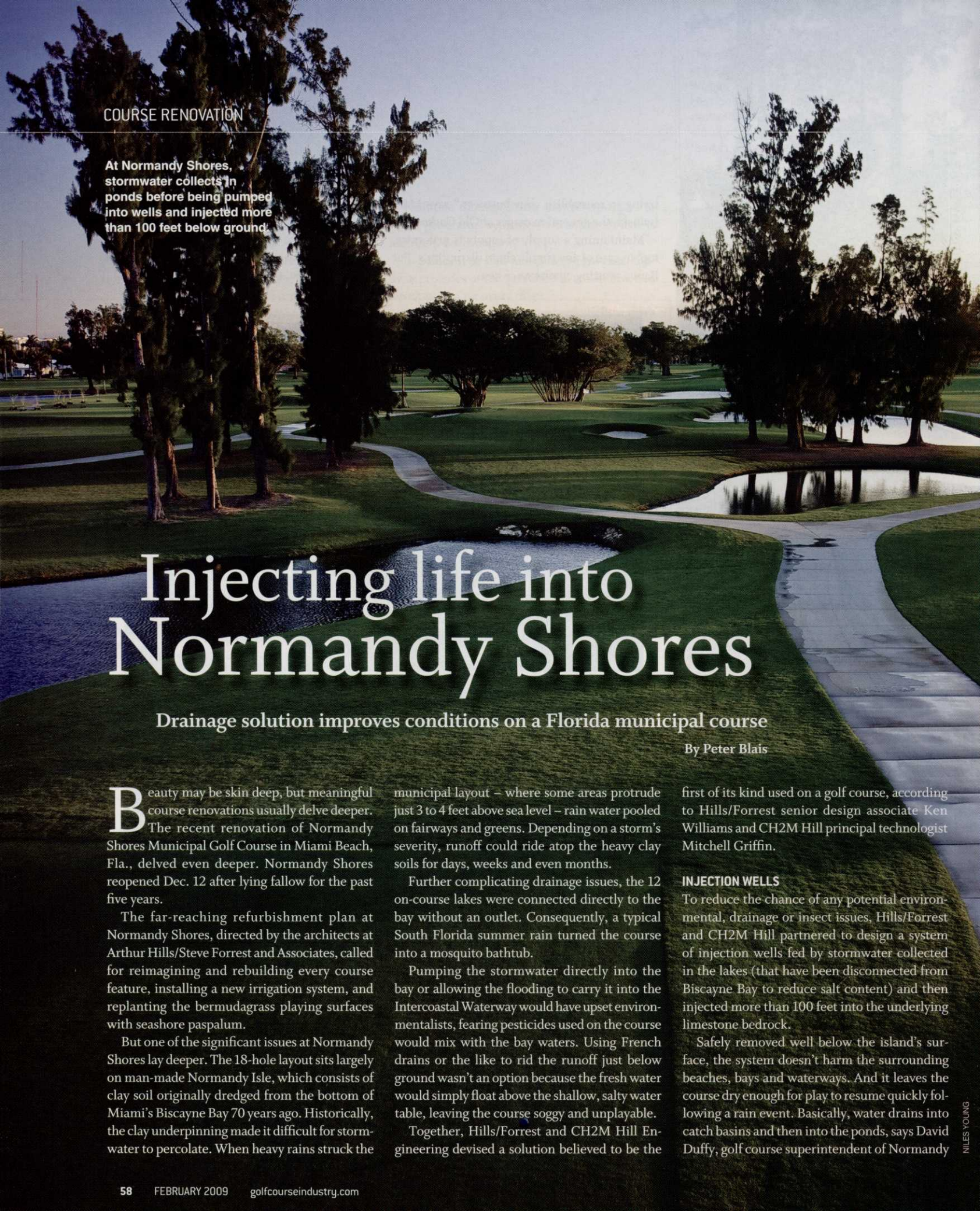




COURSE RENOVATION

At Normandy Shores, stormwater collects in ponds before being pumped into wells and injected more than 100 feet below ground.

Injecting life into Normandy Shores

Drainage solution improves conditions on a Florida municipal course

By Peter Blais

Beauty may be skin deep, but meaningful course renovations usually delve deeper. The recent renovation of Normandy Shores Municipal Golf Course in Miami Beach, Fla., delved even deeper. Normandy Shores reopened Dec. 12 after lying fallow for the past five years.

The far-reaching refurbishment plan at Normandy Shores, directed by the architects at Arthur Hills/Steve Forrest and Associates, called for reimagining and rebuilding every course feature, installing a new irrigation system, and replanting the bermudagrass playing surfaces with seashore paspalum.

But one of the significant issues at Normandy Shores lay deeper. The 18-hole layout sits largely on man-made Normandy Isle, which consists of clay soil originally dredged from the bottom of Miami's Biscayne Bay 70 years ago. Historically, the clay underpinning made it difficult for stormwater to percolate. When heavy rains struck the

municipal layout – where some areas protrude just 3 to 4 feet above sea level – rain water pooled on fairways and greens. Depending on a storm's severity, runoff could ride atop the heavy clay soils for days, weeks and even months.

Further complicating drainage issues, the 12 on-course lakes were connected directly to the bay without an outlet. Consequently, a typical South Florida summer rain turned the course into a mosquito bathtub.

Pumping the stormwater directly into the bay or allowing the flooding to carry it into the Intercoastal Waterway would have upset environmentalists, fearing pesticides used on the course would mix with the bay waters. Using French drains or the like to rid the runoff just below ground wasn't an option because the fresh water would simply float above the shallow, salty water table, leaving the course soggy and unplayable.

Together, Hills/Forrest and CH2M Hill Engineering devised a solution believed to be the

first of its kind used on a golf course, according to Hills/Forrest senior design associate Ken Williams and CH2M Hill principal technologist Mitchell Griffin.

INJECTION WELLS

To reduce the chance of any potential environmental, drainage or insect issues, Hills/Forrest and CH2M Hill partnered to design a system of injection wells fed by stormwater collected in the lakes (that have been disconnected from Biscayne Bay to reduce salt content) and then injected more than 100 feet into the underlying limestone bedrock.

Safely removed well below the island's surface, the system doesn't harm the surrounding beaches, bays and waterways. And it leaves the course dry enough for play to resume quickly following a rain event. Basically, water drains into catch basins and then into the ponds, says David Duffy, golf course superintendent of Normandy

Shores. From the ponds, it feeds into a collection area where it's pumped into one of three underground injection wells.

The island technically has no natural water table or aquifer because it's man-made, Williams says. The underlying limestone bedrock acts as a natural sponge, filtering impurities out of the injected drainage even if some migrate up into what passes for a water table. Having the ponds sealed off from the bay further reduces any impurities in the injected water.

THE RIGHT CONDITIONS

What made the injection-well system possible was the course's proximity to the coast and the fact it's an island in the middle of Biscayne Bay, Griffin says. The island's geology allows for the injection of stormwater down the 120-foot-deep wells into the porous subsurface bedrock, well below the island's shallow aquifer. Doing so maintains surface-water quality and doesn't hurt the already low-quality groundwater.

Few places in Florida allow for this technology, says Griffin, a Gainesville-based engineer who has designed three systems and has another dozen in the planning stages – all primarily in urban areas. It's possible only where the aquifer

has greater than 10,000 milligrams per liter of total dissolved solids, where the groundwater is salty.

Florida regulates what's put into the ground because of ground-water contamination concerns. But when the groundwater is already salty and has no users, then one is simply adding stormwater to it at worst, Griffin says. Miami-Dade County gets its drinking water from inland sources because the groundwater along the coast is too salty. No one is using the groundwater along the coast, he says.

"You have to have the right underground conditions," he says. "You need porous layers of rock or old seabed that accept the pumped water as you pump it down into the ground. Normandy Shores has that."

PUMPING THE WATER

The first order of business with injection wells is finding a good place to collect stormwater, usually a central spot that minimizes the number of needed wells because drilling wells can be expensive, Griffin says. At Normandy Shores, water is collected in ponds. Debris settles out of the water bodies; although in other situations, some type of screening may be needed to filter

debris that could clog pipes.

The pump station receives water piped from ponds located east and west of the station. The station has three pumps leading to three separate wells, which are interconnected so the pressure is stabilized between them. Only one pump operates most of the time. During a large storm, all three pumps may operate simultaneously for a short time. The pumps are necessary to move the mostly fresh drainage water through the underlying salty water table. Gravity alone won't do it, necessitating the pressurized drainage well system.

The 24-inch-diameter wells are encased by metal pipe to depths of 50 to 60 feet and grouted in with cement. The grouted casing keeps the water from percolating up.

Beyond the metal casing, the well is drilled another 50 to 75 feet into the bedrock to reach a permeable, geologic layer that will accept the water.

Test wells are needed beforehand to determine the geology of the site. Most of the stormwater pumped into the wells remains below ground where it doesn't harm the environment or course conditions.

"No other golf courses I know of use this tech-



Normandy Shores' injection-well system was possible because the course sits on a man-made island in the middle of Biscayne Bay.

At A Glance:

Normandy Shores Municipal Golf Course

Location: Miami Beach, Fla.

Type of facility: Public

Type of project: Renovation

Cost: \$6.5 million

Construction started: September 2007

Construction ended: November 2008

Length: 6,465 yards

Architect: Ken Williams of Arthur Hills/Steve Forrest and Associates

Golf course superintendent: David Duffy

nology with a pump system," Griffin says. "They may do it using gravity, but not with pumps."

A LITTLE HISTORY

Golfers may never know about the unique water injection system at Normandy Shores. To them, the reopening of the course is a small miracle because Hills/Forrest's year-long, \$6.5-million renovation resuscitated a course that had been buried beneath the weeds of the island since 2003.

"The term 'hidden gem' has been beaten to death, but Normandy Shores is the real thing: a gem of a course once loved, once hidden, but now open to the public again and better than it ever was," Williams says. "The best part is that visitors can play without beating up themselves or their wallets – like they might at one of the \$200-per-round resort courses in this neighborhood."

Originally designed by architect William Flynn and partner Howard Toomey, the facility was dedicated officially by the city in December 1941. Retaining the original Flynn/Toomey routing, Mark Mahannah redesigned Normandy Shores in the 1950s, but most of Flynn's bunkering influence and green contours disappeared. It then became a stereotypical Florida course – slightly elevated tees, flat fairways and bunkers, elevated greens and a lot of water.

Eventually, Normandy Shores faced the same decline experienced by South Beach in the late 1960s, '70s and '80s. Courses such as Links at Crandon Park (previously The Links at Key Biscayne) and Doral took over the spotlight. Budget cuts and lack of maintenance eventually led to Normandy Shores' closing in 2002.

The closing was never meant to be permanent, however. Miami Beach City Commission already retained Hills/Forrest to orchestrate its revival. Work finally began at Normandy Shores in September 2007. Like Mahannah, Williams retained the original Flynn routing, although he flipped the two nines. The result is a 6,465-yard layout that locals may have trouble recognizing.

A NEW LOOK

The redesigned par-71 track represents a return to a more traditional approach to strategy and visuals. In contrast to the modern trend of expensive water bodies and enormous sand features, Normandy Shores is a picturesque, straightforward golf experience distinctly lacking ostentation. In an era of 7,000-plus-yard behemoths, it may be the only newly renovated course that kept its original yardage. It's a medium-length course with 70

bunkers and a handful of ponds on 89 acres, compared to 120 acres or more for most modern layouts. Most of the landing areas are bordered by bunkers or water.

The new bunkers are deeper than those they replaced. Many are grass-faced, and some have fairly steep walls. Ponds were combined and new ones dug, creating the fill Williams required to add mounding and contour.

The new turf, seashore paspalum, can be irrigated with brackish or salty water and requires few chemical inputs.

"It survives better underneath standing water, which is still an occasional issue here," Duffy says. "We received 5 inches of rain one day on top of the new paspalum during construction. We had standing water for quite awhile. If we had planted bermudagrass, we probably would have had to replant that section of the course. But the paspalum came through the flooding very well."

Construction started in fall 2007 and was completed mostly in a year.

"The soil conditions were bad, the turf was old and the course was weed-infested," Duffy says. "Ken overcame those challenges and the job went smoothly." **GCI**

Peter Blais is a freelance writer in North Yarmouth, Maine.



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