THE American Surveyor

A Foot In The Past... An Eye To The Future

October 2009

Rebuilding *the* Greens

Google Earth QUADS
User-friendly and FREE!

Custer's Last Stand
GPS helps solve mysteries

Product Review
Magellan Professional ProMark500

Rebuilding the Greens

at The Olympic Club Lake Course

The history of San Francisco's Olympic Club dates back to 1860, making it one of the oldest such golf clubs in the country. The club has hosted four US Open tournaments over the years–with its fifth slated for 2012–and the Lake Course enjoys certain notoriety. It has no water hazards, no out-of-bounds, only one fairway bunker, and is one of the shortest golf courses to host the US Open, but nevertheless is considered by most in the game to be an excellent example of golf course design; some would even say a masterpiece. Ben Hogan, who is considered one of the greatest ball strikers in the history of the game, was said to have called it "the longest short course in the world".

Given its storied history, the idea of ripping up 18 green complexes and rebuilding them on a course that will host the US Open, arguably one of the most televised golf tournaments in the world, in less than four years is enough to cause any golf course superintendent more than a few sleepless nights. In other words, it had to be done correctly because the whole world will be watching.

>> By Eric Gakstatter

Nicholas Scigliano, President and CEO of Frontier Golf, maps the existing green surface of Hole #3 at the Olympic Club. The data collector records a point every 12" along the putting surface. Gathered points will be used to create a detailed grading plan.

As seen from #3 tees, the greens mix is roughly placed in the green cavity on the re-aligned 8th hole before mmGPS is used to create the final surface.

The driving force behind the renovation might surprise you–nematodes. These microscopic roundworms were feasting on Olympic Club's Poa annua greens. These specific nematodes are prevalent particularly on golf courses in Northern California along the coast. An organophosphate nematicide called Nemacur has historically been used to manage these creatures but Nemacur has been withdrawn from the market. No other treatment is available so replacing the Poa annua with Bentgrass becomes one of the few viable alternatives. That's what the Olympic Club decided to do. They also decided that at the same time they would build the new greens to United States Golf Association (USGA) specifications and address lingering drainage issues. Essentially, a total rebuild of all 18 push-up green complexes.

The challenge was that the greens committee didn't want much to change. Out of 18 putting surfaces and three practice greens, club members wanted 14 of the greens on the Lake Course to remain exactly the same–as in, "exactly as is," explained Brian Koffler, the Lake Course superintendent.

"The membership was happy with those fourteen surfaces," Koffler said. This, coupled with the history of the course, made it critical to preserve the green surfaces just as they are. "The club was very adamant about putting the exact contours back on those putting surfaces," he added.

The operative phrase is "exactly as is". How does one create a 3D model of each green complex and then rebuild them exactly the same as they were with the exact same contours? The degree of horizontal measurement accuracy and even more so, the vertical measurement accuracy, required to accomplish this is on the order of two hundredths of a foot, or six millimeters.

Even without that level of accuracy, rebuilding the greens of a golf course is no simple matter. It requires creating a detailed contour map of each green complex before tearing it up and then rebuilding it layer by layer from the bottom up. It can be a tedious process to say the least, requiring a lot of data collection, as elevations must be checked at every point on the green as each layer is built; vertical accuracy is a must. The vertical measurement accuracy requirements of the Olympic Club Lake Course greens project increased the complexity of the task by orders of magnitude.

With 17 years of golf construction experience and on the leading edge of technology, Frontier Golf from Jones Mills, Pennsylvania was selected as the contractor. Frontier CEO Nick Scigliano said his company had done this sort of work before, but never to this magnitude; not all 18 greens and certainly not on a high profile track like The Olympic Club. The stakes were high as well as the pressure to perform.

Scigliano knew he needed a strong support team. After receiving the news that Frontier had been awarded the project, one of his first calls went to his survey equipment provider in Saxonburg, PA, Productivity Products and Services, Inc (PPS). PPS's salesman Dave Krautz had been a top-level earth moving and grading superintendent prior to working for PPS.

"Nick called me the day before Election Day," recalled Krautz. "He said he needed this project to be 'a hundred and ten percent' and asked me to come with him to get started. A few days later, I was on a plane to San Francisco."

To begin with, Frontier needed to create a very accurate topographic survey of each green complex. Using a one foot survey grid, at least 2,500 shots were

Pictured above is the existing 2nd green before construction.

Frontier Golf's construction crew trenches the herringbone drainage pattern into the sub-grade of the 2nd green. Gravel will be placed at the bottom of the clean trenches followed by 4-inch perforated pipe and a top layer of gravel.

Drainage is completed on the 2nd green with the 4-inch gravel blanket in place. Next, the greens mix will be roughed into the green cavity before achieving the final grades using mmGPS.

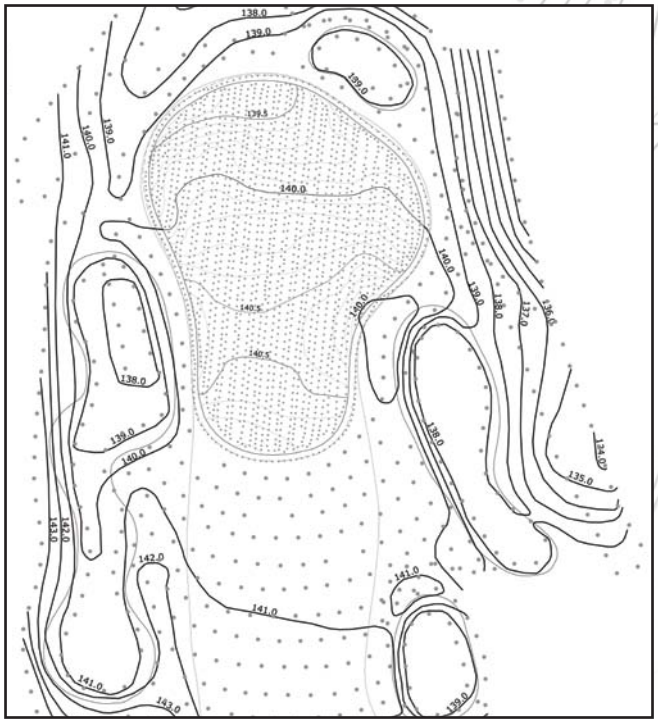
collected on the smaller greens and as many as 4,000 points were collected on the larger greens. The green complexes were then pulverized and the ground was prepared before the construction process could begin. Constructing a green consists of building several layers; subsurface drainage, gravel and sand. Each time a layer was built, Frontier had to grade check the entire green and cut/fill as necessary to match the original surface.

Frontier was planning on using Topcon's GR-3 GNSS receiver that tracks both GPS and GLONASS constellations. They were counting on the combined constellation to achieve the horizontal and vertical accuracy requirement. It became readily apparent from the start that GNSS alone wasn't going to cut it on this project given the tight vertical accuracy requirements, and the fact that too many of the satellites were blocked by the numerous tall trees that line much of the Lake Course. Two greens in particular required careful satellite mission planning to make sure enough satellites were in view during data collection and staking thanks to heavy tree canopy.

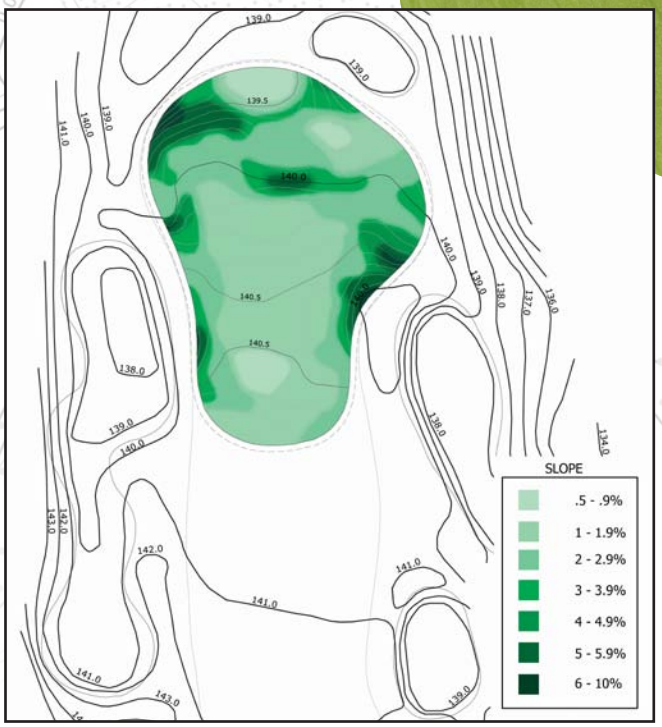
Fortunately, Frontier and PPS's Krautz had a back-up plan. They anticipated the potential problem posed by the thousands of trees on the Lake Course, especially with some being tightly nestled around the greens. They had the knowledge and experience to understand that GNSS alone may not work.

Krautz came prepared and packed Topcon's Millimeter GPS system with him on the flight to San Francisco. Millimeter GPS combines laser leveling for vertical accuracy with GNSS for horizontal positioning. This patented technology improves grading accuracy up to 300 percent over existing 3D-GPS machine systems, according to Topcon. Its PZL-1 laser transmitter sends out a wall of light 33 feet tall and up to 2000 feet in diameter and works with a PZS-MC machine control sensor or PZS-1 rover sensor that can be added to existing GPS systems.

"It's the first time we've used it at this magnitude," said Scigliano of Millimeter GPS. Frontier had used it on specific greens for various projects before, but never for each and every green on an entire 18-hole course. The technology has brought the firm a level of accuracy that it hasn't been able to achieve before. Prior to using Millimeter GPS, using only GNSS technology precluded



Grading plan for the 3rd green complex. The points shown were collected with mmGPS and used to create the contours. A TIN surface will be created in CAD and returned to the data collector to be used during the reconstruction of the green.



Frontier Golf has the capability to create slope maps of each green complex for both the client and the golf course architect. Above is the slope map for the 3rd green.

the ability to obtain vertical accuracy better than a half an inch. "But with the Millimeter unit, there is zero bounce. It locks it in tight and allows us to work with fewer satellites," Scigliano said.

During the "core-out" phase of construction, when a green is being excavated to the new subgrade, Frontier would constantly utilize a GR-3 rover to check grade and make sure all of the little details of the green's original topography were present. It was a painstaking process. "In working days it was a day to core, half [a day] to drain, half [a day] to gravel blanket, and just about a day to mix, so it takes us three to three and a half days to turn a green complex over with that level of perfection because you can't go back–it's tedious, tedious stuff," Scigliano said.

Frontier actually utilized two Millimeter GPS systems and was able to work on two greens at the same time. Not only did the technology provide the accuracy necessary for the Lake Course greens construction, but Scigliano believes it enabled Frontier Golf to finish the project relatively quickly and with less manpower and cost than other contractors would have required. Others that had expressed interest in the project were looking at using two to three times the man hours to complete the project that Frontier required, Koffler explained.

Koffler was impressed with the relatively short amount of time it took to complete the project, which commenced in mid-November 2008. Frontier was essentially done by the first of February 2009; Koffler and his crew started sodding the greens in mid-March of 2009. Weather also aided the effort; the Olympic Club had planned on losing a month to rain delays. But the golf and weather gods smiled on San Francisco. While Northern California gets the bulk of its annual precipitation in the winter months, there had been very little rain through the middle of late January; "that aided us greatly," Koffler said. "The whole process moved much quicker than we had originally planned."

Frontier estimates that without using the Millimeter GPS technology, the entire Olympic Club project would have taken seven to eight times as long as it did, given the club's accuracy requirements. It also reduced the architect's need to be onsite; with the data points Millimeter GPS provided, CAD drawings for each green could be generated quickly and accurately both on and off-site. The technology also allowed the firm to respond quickly to some fine-tuning adjustments. Golf Architect Bill Love wanted to make on a couple of greens during the course of the project, Scigliano said. Having that data enabled them to redo the green in question quickly and review the new data with the client.

Overall, the experience of replacing the Olympic Club's Lake course greens using Topcon's Millimeter technology left Scigliano suitably impressed. "On our next greens restoration project, I'm going to turn to Millimeter GPS right out of the gate. The vertical accuracy is right on. I won't even try with GPS alone," he said. "It's pretty neat stuff," he said of the Lake Course project. "We are doing stuff here that's unique in our field."

All of the trouble the Olympic Club and Frontier Golf went to insure the accuracy of the greens surfaces begs the question–what changes were made to the greens on the four holes that didn't remain the same? Most of the changes are relatively minor and actually involve undoing changes that had been made in years past. On No. 7 tee, for example, a short Par 4, the Olympic Club's greens committee made the decision to move the green back 16 yards and create a two-tiered green, instead of a three-tiered green (the hole had been changed to a

Nicholas Scigliano of Frontier Golf confers with salesman Dave Krautz of PPS, Inc. on the 2nd green.

From where the gallery will be watching the best golfers in the world finish the U.S. Open in 2012, the 18th green at the Olympic Club is seen cored out 16 inches below finished grade.

three-tiered green in the 1970s), and the bunkers were changed accordingly.

No. 8 saw the most substantial change. A Par 3, it used to be 140 yards facing straight toward the clubhouse. Frontier reoriented it, with the tee rotated 45 degrees to the right. "The Lake Course is a great layout," Koffler said. "But one of the big comments from the membership and golfers in general was that the Par Three's didn't offer enough variety." Another Par 3, No. 15, didn't get a length change, but a historical reorientation. Back in the 1990s when this green was rebuilt, there were changes made to the bunkers and contours of the putting surface; the Olympic Club had Frontier change the No. 15 green back to what it was conceptually prior to that change.

Perhaps the most notable change, however, came on the putting green at No. 18 on the Lake Course. It had a rather severe back-to-front slope at one time, so much so that it actually had a controversial effect on the end of the 1998 US Open, which was determined by one stroke. With the pin placed on a ridge at No. 18, a number of putts were rolling well past the pin. As a result, the green was flattened in 2000, but as Koffler explained, Olympic Club members felt it had become a little too flat; it had gone from perhaps too challenging to not challenging enough– they could two-putt from anywhere on the green. So the Olympic Club decided to put back some of the challenge on No. 18.

For the club's part, not only did the project provide the Lake course with USGA spec greens while preserving the integrity of the original course, but it also provided the Olympic Club with a wealth of topological and survey data on the course, including the location of drainage and related pipes. Since the course had never been rebuilt before, there was no pre-existing data on drainage. This will insure the integrity of the course greens going forward. "This gives us a baseline for the future," Koffler said. "A golf course is a living breathing entity. It's going to evolve . . . so if fifteen years down the road, if we think something has changed dramatically, then we can check and see."

Eric Gakstatter has been involved in the GPS industry for 19 years, both as a product manager and power user. He is a contributing editor to *GPS World* magazine.