CASE STUDY

New York State Pollution Prevention Institute

Green Lakes Golf Course Implements Irrigation Audit Procedure and Analysis

Challenge
Green Lakes State Park Golf Course wanted to evaluate the quality of their irrigation system.

Solution
Implemented an irrigation audit to measure irrigation uniformity.

Results
Cornell and NYSP2I identified only minor adjustments to improve irrigation, but confirmed overall acceptable to excellent levels of distribution uniformity for all four greens audited.

Green Lakes State Park Golf Course

Green Lakes State Park Golf Course (Green Lakes) is an 18-hole public golf facility in Fayetteville, NY managed by the New York State Department of Parks, Recreation and Historical Preservation. Green Lakes offers an affordable and accessible golfing experience for residents of New York. The course was an early design of the famous Robert Trent Jones Sr. characterized by rolling topography, challenging green complexes, and beautiful views of Green Lakes.

Challenge

Maintaining adequate soil moisture on putting surfaces is essential to providing resilient, high-performance playing conditions. Maintaining consistent soil moisture on Green Lake's putting surfaces presents a challenge, however, due to severe sloping of the putting surfaces. As a result, the existing irrigation system needs careful modification to ensure the uniform application of water.

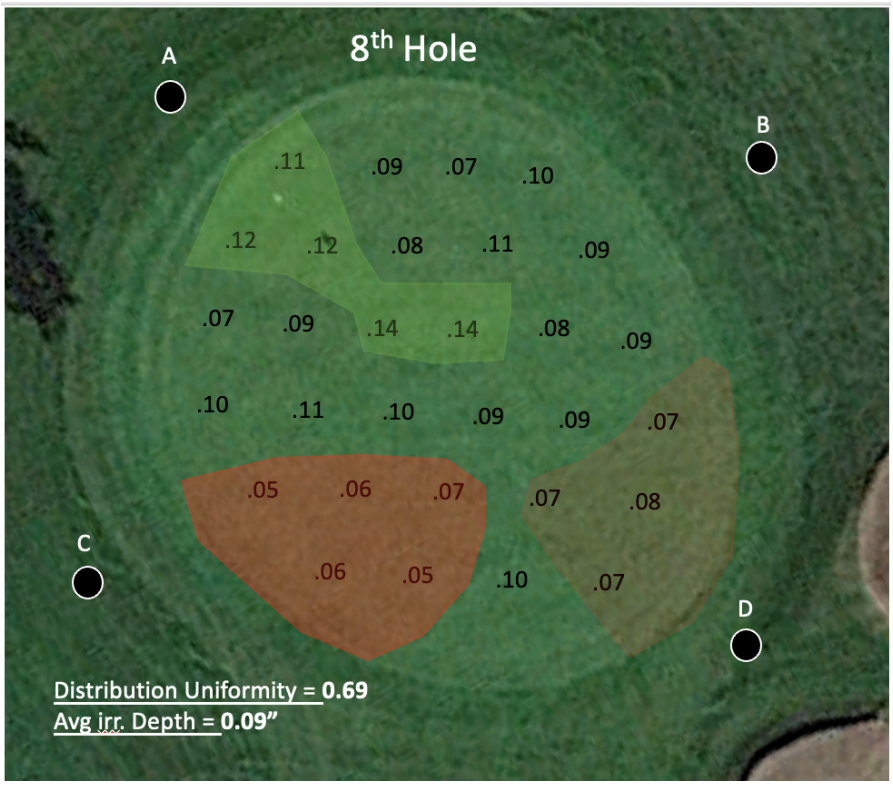
Solutions

Irrigation uniformity can be measured through an irrigation audit. Irrigation auditing is an easy and rapid method to inform managers of appropriate sprinkler modifications (precipitation rate, run time, nozzling, etc.) required to assure acceptable

uniformity. To conduct an irrigation audit, catch-cups are evenly placed across a playing surface, and an irrigation cycle of predetermined length is run. After the cycle, water volumes in the catch-cups are recorded and a distribution uniformity coefficient is calculated using the following formula:

$$Distribution\ Uniformity\ (DU) = \frac{Avg\ volume\ of\ bottom\ 25\%\ of\ readings}{Avg\ volume\ of\ all\ readings}$$

This standard irrigation audit procedure was performed at four greens at Green Lakes. Catch-cups were placed 15-feet apart, and irrigation sprinklers were run for 10 minutes. Ideally, sprinklers should be run for at least 20 minutes, but high soil moisture due to excessive rain made this impractical. Soil moisture readings were collected at catch-cup locations before and after irrigation as well. The catch-cup data provide context for how water is distributed across the greens, while soil moisture data can be used to inform where water infiltrates the soil profile.



Results

As an example, the 8th hole had acceptable distribution but did have the lowest DU of the greens audited at Green Lakes. Observation of sprinkler performance indicated that sprinkler A had a low throw angle, leading to high water application amounts in its quadrant of the green. Re-leveling of this sprinkler is likely to improve uniformity in this area. Sprinklers **C** and **D**, while applying less water in their quadrants, were functioning correctly through observation. In this case, their position at different elevations relative to the green level causes variation in irrigation depth. To remedy this, run times on Sprinklers **C** and **D** can be run 30% longer than **A** and **B** to increase overall uniformity.

Irrigation Audit results at Green Lakes State Park

Green Surface	*Irrigation distribution uniformity*	*Avg depth of irrigation applied per 10 min cycle*	*Soil Moisture Increase*
8th Green	*0.69 (Acceptable)*	*.089 inches*	*3.2%*
10th Green	*0.72 (Good)*	*.088 inches*	*3.8%*
11th Green	*0.80 (Excellent)*	*.076 inches*	-
18th Green	*0.76 (Good)*	*.084 inches*	-

** DU values above .8 are considered "excellent", .7-.8 considered "good", .6-.7 considered "acceptable", below .6 considered "poor"*

*** Soil moisture readings taken only on 8th and 10th greens due to high variability of point-to-point readings*

Overall, there was acceptable to excellent distribution uniformity (DU) of overhead irrigation of the four audited greens, and only minor alterations were required to individual sprinkler run times. Results exceeded expectations considering the topography/shape of putting surfaces, and age of the irrigation system (2006). These results validate the proper functioning of the existing irrigation system design and maintenance.

Auditing conditions were not ideal for assessing soil moisture. Antecedent soil moisture was very high, close to saturation prior to initiation of the audit. Consequently, adding additional moisture data seemed to increase the variability of the soil moisture measuring device. Typically, saturated soil conditions on undulated surfaces promote lateral flow of water, thereby confounding the wetting front and varying the soil surface moisture measurements. Irrigation audits using soil moisture as a method of assessing effectiveness are more applicable on sand-based rootzones that have been dried down, where longer cycles in excess of 20 minutes can be run.

Partners

RIT · Binghamton University, State University of New York · Clarkson University · Cornell CALS, College of Agriculture and Life Sciences · Rensselaer · New York Manufacturing Extension Partnership

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