Water Usage and Sprinkler Coverage: Furman University Golf Course

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I. Abstract

In recent years, increasing demand for water, more frequent and intense droughts, and increasing awareness of sustainable behaviors have brought more attention to water use and conservation. When considering possible sources of water waste, the large amount of water used on golf courses make them an obvious target for examination. Though the importance of maintaining ideal turf conditions through vigilant watering is obvious, various changes in watering practices could be enacted with relative ease and result in significant reductions in water use.

To address this issue, we examined several aspects of the irrigation system, including locations and number of sprinkler heads, sources of water used for irrigation, water usage, and the efficiency of current system. We mapped locations of sprinkler heads on the course that would show both the types of head and the area covered by each head **[Figure 2]**. Our results show that although much of the golf course's water is drawn from the lake within the golf course that doesn't cost anything and be considered a sustainable source, during peak summer time additional county water is usually needed **[Figure 3]**. Upgrading the irrigation system will improve the efficiency and provide savings in electricity, water, and maintenance costs associated with outdated system that is used currently. These changes could greatly contribute to sustainability efforts .

Figure 1. The sprinkler system watering hole Hole #9

II. Introduction/Background

As sustainability efforts have gained increasing attention across the globe, Furman has sought to act as a leader in sustainable practices amongst institutions of higher learning. These efforts have required extensive examination of numerous and varied aspects of on-campus operations. One area that must be studied is the water consumed by the vast irrigation systems required to maintain the flora of our campus. Though modernization of irrigation technologies are being carried out on the main campus, the golf course is one area that could greatly benefit from these technologies. Though the course was recently (fall 2008) renovated, the changes focused on the layout of the course rather than the irrigation system. The sprinkler heads, along with the software package that accompanies them, have been in place for over 10 years. The current system offers little flexibility, with little ability to measure, record, and more tightly control water use, relying almost entirely on human judgment to determine watering practices.

One positive of the current system is that it draws the majority of the water needed from a small lake located on the course **[shown in Figure 2].** This lake is fed by a nearby stream, and drastically decreases reliance on county water. However, this lake frequently falls short of the amount of water necessary, especially during drought periods, forcing Furman to supplement our irrigation with water purchased from the county **[Figure 3]**.

Figure 2. Map of golf course irrigation system with sprinkler heads, water coverage, and inset of Hole #2 Green illustrating Green and Perimeter heads.

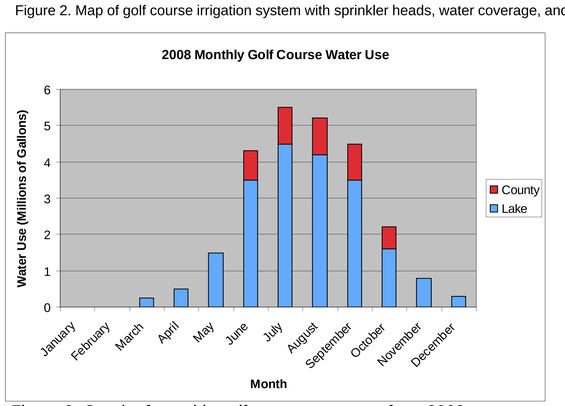

Figure 3. Graph of monthly golf course water use from 2008.

Average water drawn from lake per year	13.7 million gallons
Average water drawn from county per year	2.5 million gallons (15%)
Average total water used per day on course	44,383.6 gallons
Average water used per person per day in U.S.	90.0 gallons
Water used per day on course per FU student	16.7 gallons

Figure 4. Water use statistics, based on golf course water use averages from 2002-2008.

III. Methods

To begin, we set out to map the irrigation system of the golf course. Using a simple strip map provided by the Golf Course Superintendent, we located each sprinkler head and marked its location on a printed aerial photo of the course. To ensure accuracy, we then used a tape measure to find the distance between each head as well as the distance to a nearby landmark visible on the aerial photo, such as a tree or the golf cart path (unfortunately the time consuming nature of this process combined with the time constraints on data collection forced us to limit our mapping to the front nine holes).

The marked aerial photos and accompanying measurements were then used to create a shape file of points representing the locations of sprinkler heads using ESRI's ArcGIS. Each point was then classified according to its head type, either Tee, Fairway, Perimeter, or Green **[Figure 2]**. In order to illustrate the area covered by each head, we created a buffer of 80 feet around each head, representing the range each head sprays while watering.

For water usage data, we then accessed the computer system that tracks the water usage of the irrigation system. This provided us with monthly usage totals for the entire course over the past 7 years, along with the sources the water was drawn from. This data was then used to make several graphs and to estimate water use for months and days for comparison **[Figures 3 and 4]**.

IV. Results/Discussion

One product of our project is the computerized map **[Figure 2]** providing the location of each sprinkler head on the front nine holes, as well as the area watered by each head. An important result of this analysis is that some areas of the course may be receiving more water than needed, as the current irrigation system offers limited means to analyze water needs.

The water data also illustrates that although the majority of the water used for irrigation is drawn from the lake, in 2008 the golf course still required 17% of its water (4.4 mil gallons) from the county **[Figure 3]**.

V. Conclusions

Our results illustrate the extent to which an updated irrigation system could reduce water usage and even improve the health of the grass through more even and consistent watering. Such systems include moisture and evaporation sensors that can be used to identify areas of the course that are either being under or over watered, allowing the grounds crew to make the necessary adjustments. Such a system would thus eliminate significant amounts of waste by ensuring that each area receives the appropriate amount of water. In addition to the benefits from new technology, Furman could also enact several more low-tech practices to increase water efficiency. By limiting irrigation to vital areas of the course, eliminating water to ruff areas and other non-essential regions, the course could decrease water use.

Though the current golf course staff has done a fine job given the current irrigation system, we feel that a more advanced system could result in more efficient watering and decreased reliance on county water, playing a vital role in Furman's drive for a sustainable campus.

VI. References/Data Sources

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VII. Acknowledgements

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