Mapping Furman's Irrigation Network

Hannah Pearcy, Introduction to GIS, Fall 2009
Department of Earth and Environmental Sciences, Furman University, Greenville, SC 29613

I. Abstract

With recent droughts pushing water scarcity to the front of the issue list throughout the Southeastern United States, water conservation has generated increasing interest. Furman University, with its strong commitment to sustainability, has a marked interest in water conservation. The mapping of sprinkler head locations, the goal of this project, is a vital component of working towards water conservation on Furman's campus. Once the locations of the sprinklers are known, the volume of water used can be known and it can be determined whether or not switching from 70 percent municipal water and 30 percent lake water to 100 percent lake water is a viable option.

II. Introduction

The Furman campus is made up of a few different soils; Cecil and Hiwassee Series soils, that are formed from weathered granite, gneiss, and schist, were originally *moderately permeable*. Over the years this area has had many different uses, however, it was mainly used for the cultivation of cotton. This agricultural use and the subsequent construction of the Furman Campus severely compacted the soil making it nearly impervious (up to 70-99%).

Furman's irrigated green surfaces constitute nearly 109 acres of the total 700 acres of the campus. Furman Lake supplies 30% of this water; the other 70% comes from the city water system.

As the campus expanded over the years, new sections of irrigation lines were installed without considering the efficiency of the entire system, resulting in a fragmented system lacking central control. Sprinkler heads are frequently replaced with heads of different kinds and flow rates, making it nearly impossible to quantify the water consumption. With the completion of Furman University's proposed architectural plans in 2008, the campus is now uniquely positioned to begin fixing their flawed irrigation system.

The project started last spring by Luke Howerter, Michael Short, and Cameron Tommey began the process of mapping the sprinkler head locations and looking at the flow rates to help facilities services attain a better knowledge of the irrigation system. They found that a typical 20 minute watering period for the Milford Mall irrigation zones would use a total of 8,152 gallons of lake water. This project specifically addresses the recommendation of the previous project that the spatial inventory of the campus' irrigation network is a necessary part of reworking the campus irrigation system to become more sustainable.

Lake Vs. City Water used on irrigation

FURMAN UNIVERSITY

III. Objectives

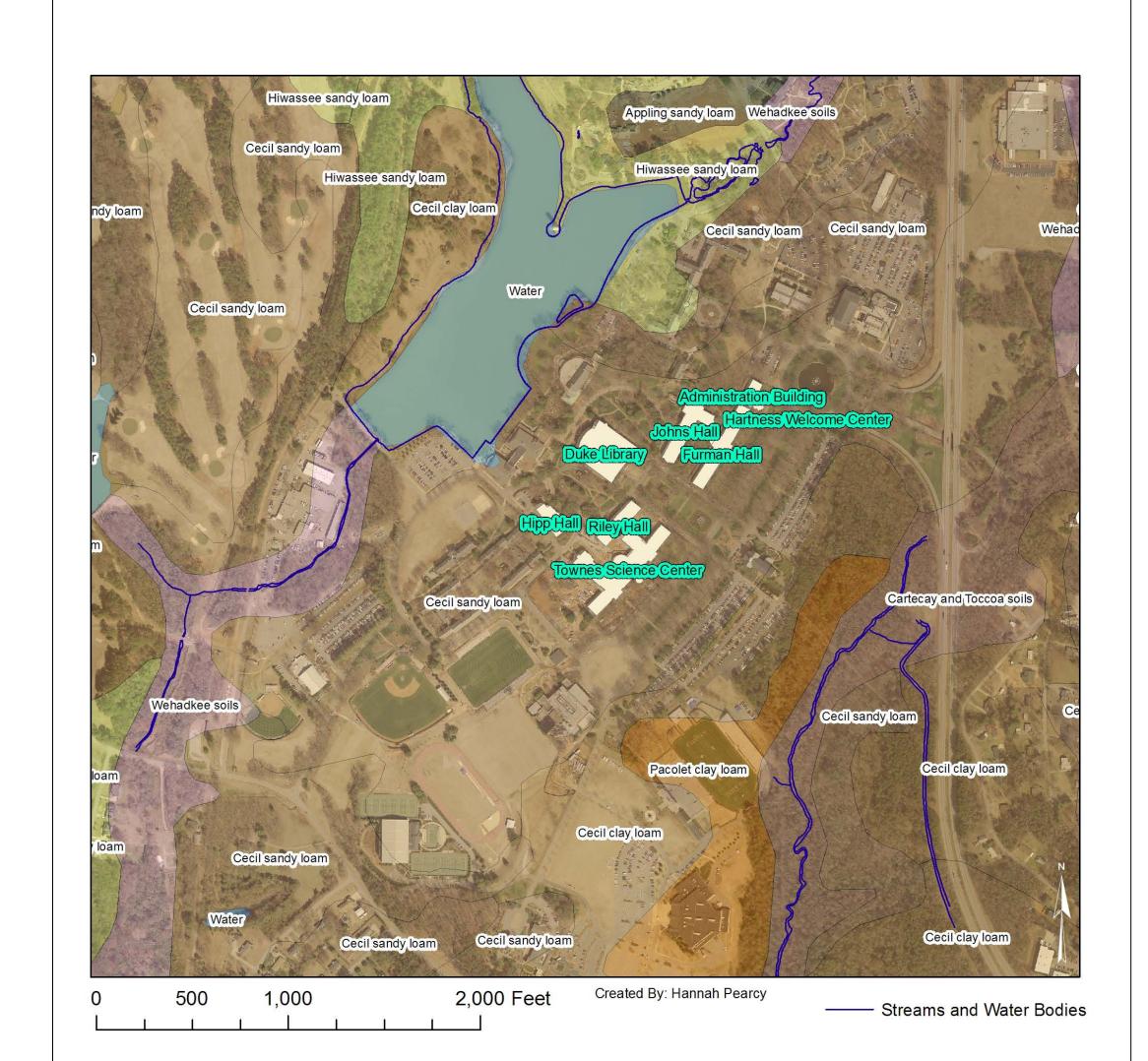
This objectives of this project are (1) to map and create a database of sprinkler heads and control valves and (2) to update the existing database of sprinkler heads on campus.

IV. Methodology

After meeting with Furman facilities services, it was decided that the project would begin by mapping the sprinklers on the Southeastern side of Furman Hall and would continue towards the Furman Mall side of the Townes Science Center. Facilities services flagged all of the sprinkler heads in the areas to be mapped with flags color coordinated to head type. The mapping was done by printing aerial photographs of the area of campus to be mapped and then going out into the field with 50 meter tape measures and measuring the distances between the various sprinkler heads. These measurements were recorded on charts made in Excel with a minimum of three measurement relationships for each sprinkler head. Then, the data was taken back to the GIS lab and put into the ArcGIS database using the editor tool and the measure tool. After this, the data was overlaid on to the aerial photograph along with previously collected data to represent all of the data that had been collected and put into the ArcGIS database so far.



Furman Soil Varieties



This is a map of soil data acquired from SSURGO overlaid on to the aerial photograph of Furman University. Also overlaying the soil data are the polygons of the academic buildings. All of the sprinklers mapped in this project are in the Cecil Soil Series.

V. Product

This project has produced a database of more than 170 additional sprinkler heads and pump valve locations as well as the type of the sprinkler heads outside of Furman Hall and the Townes Science Center. This data, along with the map of soil varieties, will be beneficial to Furman facilities services as they continue to make Furman's irrigation network more efficient and environmentally sustainable. Previously collected soil permeability data is still relevant as these sprinklers need to be adjusted based on the type of soil they are watering. More efficient watering will reduce the city water used on the campus that will help the campus become more sustainable.

VI. Discussion/Conclusion

The Furman irrigation system is large and the age of elements and components across the campus varies widely. There are many factors that go in to creating a more sustainable way to irrigate the sweeping green lawns the campus is known for. While this project has added a large amount of new data to the resources we possess, there is still much more data to collect to complete the mapping of whole campus.

A centrally controlled irrigation system will allow for better control over duration and schedule of watering and will address issues such as watering during rain events. Another problem with the irrigation system is the spatial accuracy of the sprinkler heads; many areas of campus experience sidewalk watering or double watering because of poorly positioned and programmed sprinkler heads.

In order to fully have a sustainable campus irrigation system we need to:

Complete the spatial inventory of the campus' irrigation system. As seen in this research and the previous research, it is possible to spatially map each element of the system and to add them to current data sources that depict the other elements of the campus. In addition to helping a system controller efficiently plan watering cycles, it will also allow other data elements to be integrated into a GIS system to further our understanding of its functioning (such as head type, gallons per minute data, and overall water use).

Transition the system to use only lake water. There are plans to transition the campus to a lake water only system, however, there must first be an analysis to determine if the Furman Lake can handle campus-wide irrigation needs.

Change perceptions about landscaping practices to reduce water intensive plants. The Furman campus strongly holds to the belief that green lawns are good: a significant feature of the Furman image is the exquisitely manicured landscapes and lawns that grace our campus. However, many of these practices are unsustainable in their water-use and the use of chemical treatments. To reduce these harmful effects, there must be a campus-wide change in how we perceive green space on our campus and we must chose to opt for less water-intensive and native plant species.

VII. Acknowledgements

I would like to thank Dr. Suresh Muthukrishnan and Amelie Davis for all of their help throughout the project; for teaching the finer points of GIS as well as field mapping techniques. Andy Medgyesy and the rest of facilities services deserve a huge amount of thanks for their help with flagging the sprinkler heads as well as the wealth of information they provide. I would also like to thank Conserve Furman members Sofi Delgado-Perusquia and Andy Wallin as well as Furman students Heather Basehoar, and Rachel Thompson for all of their help in holding ends of tape measures and tramping through mud while collecting data.

VIII. References

"Mapping Soil Characteristics for Optimizing Water Use on Furman's Green Surfaces" By Michael Short and Luke Howerter, Furman University, Spring 2009

IX. Data Sources

Projection used: NAD 1983 HARN State Plane South Carolina

Datum used: D North American HARN 1983

Updated Aerial Photograph (SID file) → Richard Hanning, 2008, Greenville County GIS Data, Greenville, SC Soil Data: Soil Survey of Greenville County, South Carolina, United States Dept. of Agriculture Soil Conservation Service in cooperation with South Carolina Agricultural Experiment Station and South Carolina Land Resources Conservation Commission,