



Data Collection Towards Understanding Stormwater Management in the Town of Gainesboro, Jackson County, TN

Maci Arms, Kalei Hair, Dr. Tania Datta, Dr. Alfred Kalyanapu
Department of Civil & Environmental Engineering and Water Center



INTRODUCTION

During the summer of 2018, the Town of Gainesboro in Jackson County experienced significant flooding and stormwater management issues (shown in Figure 2) that have continued to this day.

Ideas surrounding the causes of the recent flooding relate to: overgrown Vegetation present in Doe Creek, the age and condition of the Town's stormwater

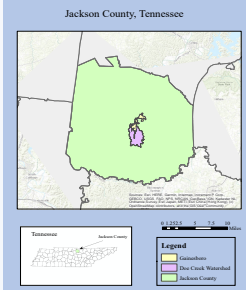


Figure 1. Map of Jackson County

infrastructure, and increased stormwater runoff due to land-use change in the draining locations. However, no data repository exists for the Town to what may be leading to the flooding. This research project, therefore, focused on data collection and organization to allow for a better understanding of what may have caused the floods. It is part of a larger project that aims to develop a watershed-wide stormwater management plan for the Town of Gainesboro.



Figure 2. June 27, 2018 Flooding in Jackson County (Source: Town of Gainesboro)

OBJECTIVES

- Collect available and relevant data surrounding the recent significant flooding and stormwater management issues affecting the Town of Gainesboro
- Identify data gaps that are necessary to understand the cause of flooding
- Address these gaps by collecting additional data cost-effectively

METHODOLOGY

The following data was collected to characterize the watershed

- Historic weather data
- Historic land-use data
- Topographical information
- Soil data
- Flow data on Doe Creek and its tributaries
- Water quality data
- Flood maps
- Storm drain and sewer maps

All information was stored in a shared drive and organized in a Geodatabase if it was GIS data. A continuous water level logger was installed at Doe Creek to understand stream flow in response to the storm events.

RESULTS

I. Data Collection and Analysis

- Historic weather data was compiled since Year 2000 and displayed graphically. As shown in Figure 3, the total annual precipitation was plotted for each of the nineteen years. The mean total annual precipitation for Gainesboro for these years was calculated to be 57.999 inches. This value is plotted in light blue while the true total annual precipitation levels of the town are plotted in dark blue. A formal hypothesis test was performed utilizing RStudio to investigate whether the 2000 to 2019 mean annual precipitation exceeded the mean annual accumulated precipitation from 1981 to 2010 of 56.000 inches. A one-sided t-test was employed and found that there is not sufficient evidence to suggest that the mean annual precipitation level for Gainesboro increased significantly.

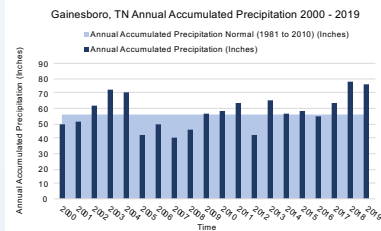


Figure 3. Gainesboro, TN Accumulated Precipitation 2000 to 2019 (Source: NWS NOAA NOWData)

- Land-use data from the Multi-Resolution Land Consortium (Figure 4) revealed little to no changes in land cover between 2001 to 2016. Therefore, it is unlikely that the flooding is caused by land-use change.

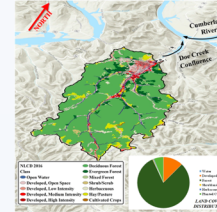


Figure 4. Doe Creek Watershed 2016 Land Cover (Source: MRLC)

- Topographical information includes digital elevation model (DEM) data, which was analyzed using the Slope tool in ArcMap.
- Sinkhole data revealed that although there are sinkholes present in Jackson County, there are no sinkholes present in Gainesboro or the Doe Creek Watershed.
- Data on Doe Creek and its tributaries from the U.S. Geological Survey revealed a historic stream gauge in Gainesboro. Its location was used to aid in determining where to install a new water level logger.
- A 2010 FEMA flood map and a 2012 flood map prepared by Triple A Mapping LLC was collected as PDFs as well as GIS shapefile data. These maps help to identify flood-prone areas.
- A Gainesboro sewer map was collected from Triple A Mapping LLC as a PDF and as shapefile data.

II. Identifying Data Gaps

- Data gaps were identified to be Flow data; Water quality data; Storm drain maps

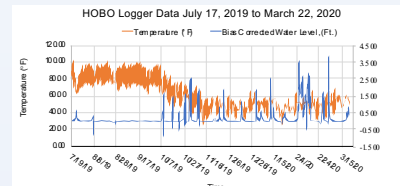


Figure 5. HOB0 Logger Data July 17, 2019 to March 22, 2020 (Source: TTU)

III. Addressing Data Gaps

- A HOB0 Water Level Logger was installed on July 19, 2019 in Doe Creek in order to provide water level data. This instrument collects data every 15 minutes. The results as of August 5th are displayed in Figure 5 as well as temperature data.

CONCLUSIONS

Through initial data collection and analysis, it is being hypothesized that the age and overall inadequacy of the Town's stormwater infrastructure, combined with overgrowth and debris accumulation in Doe Creek may be causing the floods; however, additional surveying is necessary in order to confirm this.

FUTURE WORK

Data collected during this project will be used to continue efforts on stormwater management for the Town. A university-community partnership with the town is formed with the goal of finding a cost-effective solution for the Town's recent flooding.

REFERENCES

- Federal Emergency Management Agency (2010). FEMA Flood Map Service Center.
- Multi-Resolution Land Characteristics Consortium Data Collection. Retrieved June, 2019, from <https://www.mrlc.gov/data>.
- United States Department of Agriculture Natural Resources Conservation Services (2019). Web Soil Survey. Last Accessed July 9, 2019, from <https://websoilsurvey.nrcs.usda.gov/app/>
- United States Department of Commerce, and NOAA. "National Weather Service." National Weather Service, NOAA's National Weather Service, www.weather.gov/.
- Water Quality Assessment Viewer, Tennessee Department of Environment and Conservation, Last Accessed May 2019, from tdeconline.tn.gov/dwrwqal/.

ACKNOWLEDGEMENTS

Special thanks to Mayor Randy Heady of Jackson County and the Tennessee Department of Environment and Conservation.