FLOOD RISK EDUCATION IN THE TRACE CREEK WATERSHED USING HEC-RAS AND ARCGIS STORY MAPS

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INTRODUCTION

Flooding is an issue that affects communities in the United States and abroad. One such community that was recently impacted by flooding was Waverly, Tennessee. Located in the Trace Creek Watershed, Waverly and the surrounding areas experienced high levels of precipitation in August 2021, leading to major flooding. The impact of the flood was especially felt by this economically disadvantaged community. While prediction efforts could have helped reduce the impact of the flood, Waverly and the surrounding area have limited data required for hydraulic and hydrologic modelling. The goal of this project is **to provide an educational tool for the people living in the flood prone areas to have a better understanding of how flooding accumulates and the potential areas of risk using the Trace Creek watershed as a case study.**

BACKGROUND

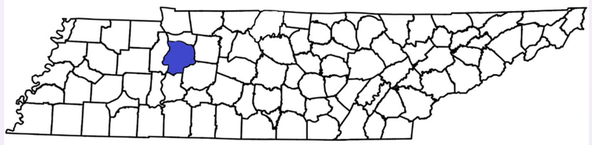


Figure 1. Location of flooding study in Humphreys County, TN

In August of 2021, the Trace Creek watershed of Humphreys County, Tennessee experienced high levels of precipitation and flash flooding. On August 21, 2021, the National Weather Service (NWS) recorded 17.02 inches of precipitation over 24 hours on August in McEwen, Tennessee (NWS, 2021). The impacts of this flooding were felt by the rural communities of Waverly and McEwen, Tennessee, which experienced the damage of approximately 523 houses and the loss of 20 lives (Hineman, 2021).

Figure 2. August 2021 flood damage in Waverly, TN (Source: *The New York Times*, 2021)

STUDY OBJECTIVES

- Collect and organize relevant data
- Develop a 2D Unsteady HEC-RAS model for the Trace Creek watershed.
- Compare HEC-RAS model to known data.
- Develop an ArcGIS Story Map in order to communicate the project's findings to the general public.

METHODOLOGY

- Characterized the Trace Creek watershed through existing data gathering.

Data Type	Source
Flow data	NOAA, HEC-HMS
Historic land-cover data	MRLC
Topographical information	TNGIS
Bridge information	TDOT
High water mark GIS data	USACE

- Developed HEC-RAS 6.0 2D model to compare results from National Water Model (NWM) and HEC-HMS flowrates.
- Calculated PBIAS, RMSE, and RMSE% metrics to compare the modeled water depths to the US Army Corps of Engineers measured high water marks.
- Developed an ArcGIS Story Map to display the results in an accessible and easy to understand way.
- Surveyed participants with both technical and non-technical backgrounds to evaluate the accessibility of the Story Map.

RESULTS & DISCUSSIONS

I. Data Collection and Organization

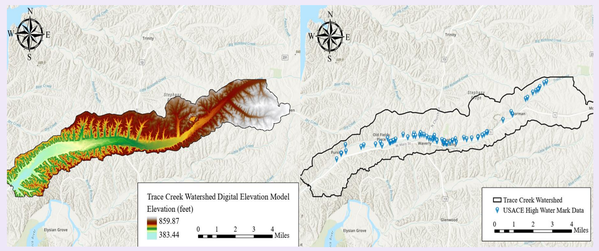


Figure 2. Watershed Elevation (Source: TNGIS)

Figure 3. High Water Marks (Source: USACE)

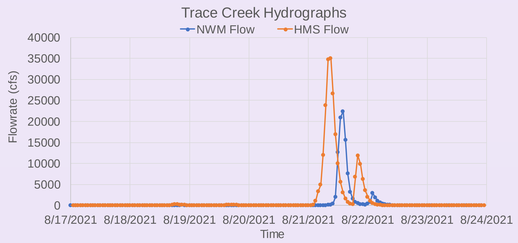


Figure 4. Flowrates obtained from HEC-HMS Model and NWM (Source: NOAA)

II. HEC-RAS Model Development

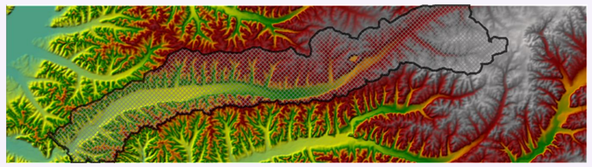
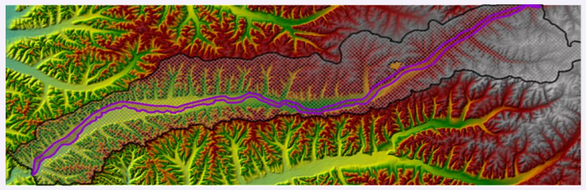
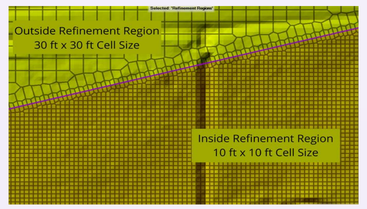


Figure 5. HEC-RAS Model 2D Flow Area





Figures 6-7. HEC-RAS Model Refinement Region (above); Zoomed in Refinement Region (right)

Figure 8. Maximum Depths from HEC-HMS Flows

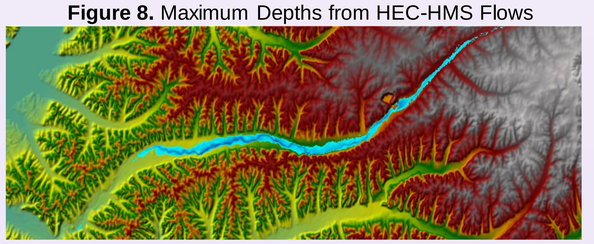


Figure 9. Maximum Depths from NWM Flows

III. Preliminary Results Comparison

Comparison	HEC-HMS	NWM	Acceptable Range
PBIAS (%)	-0.032	0.48	±25%
RMSE (ft)	4.61	3.00	Closer to 0
RMSE%	0.89	0.55	< 15%

IV. Story Map Development

Figure 10. Sections of the Story Map

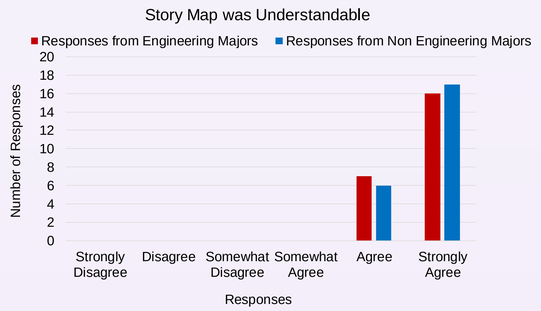


Figure 11. Story Map Accessibility

CONCLUSIONS & FUTURE WORK

A hydraulic model for the Trace Creek watershed were developed using USACE HEC-RAS 6.0 software. Preliminary results generated for the watershed are uncalibrated. It is highly recommended to perform a full calibration and validation in future efforts. Using the preliminary results of the HEC-RAS model and the data collected, an ArcGIS Story Map was developed to communicate potential flood risk in the Trace Creek watershed to a non-scientific audience. Of the participants surveyed, 70% of technical participants strongly agreed that the Story Map was easily understandable and accessible, while 74% of non-technical participants strongly agreed that the Story Map was easily understandable.

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