Memorandum

To: Scott McThompson and Dr. Kwangyul Choi

From: Joseph M. Zaborek

Date: 8/03/2021

Subject: Flooding Evacuation Plan for Hickory Hills Neighborhood in Oconee County, Georgia

Summary: In Oconee County, Georgia there are multiple waterways that are designated as higher risk of flooding by the National Fish and Wildlife Service. In case of flooding in Oconee County, Georgia, outlined here are emergency evacuation routes including contingencies for prospective bridge outages.

Introduction to Problem: There are many moving bodies of water that intersect with surface streets in Oconee County, Georgia. Additionally there is significant rainfall in the county annually "March is the wettest month in Oconee County with 4.7 inches of rain, and the driest month is April with 3.1 inches. The wettest season is Spring with 27% of yearly precipitation and 23% occurs in Summer, which is the driest season. The annual rainfall of 48.1 inches in Oconee County means that it is drier than most places in Georgia." (Best Places) Even though in the context of the whole state of Georgia, Oconee is considered drier than normal, it is still susceptible to flooding when rainfall is not distributed across long enough periods of time.

This memo seeks to identify suitable emergency evacuation routes from the Hickory Hills neighborhood in case of flooding of the vulnerable waterways in the county. Reference Figure 1.0 for a map of the vulnerable waterways in the county.

Method: In order to create the resultant evacuation routes, the researcher sought to implement a travel network and add hypothetical impediments to the established routes of the intersections of roadways with the vulnerable waterways. The first step in the process was to limit the unit of analysis and limit all of the subsequent datasets to that area of interest. The researcher utilized a shapefile from the Georgia Department of Transportation to outline the boundaries of Oconee County.

Next, the researcher utilized data from the National Fish and Wildlife Service in order to describe the waterways considered vulnerable to localized flooding. Once the waterways were added and projected properly, the researcher obtained five different classifications of roads from the Georgia Department of Transportation, each of which detail some stratum of surface roads between major interstates, down to surface streets. Each of these five shapefiles were properly projected and then finally merged into a single feature. The resultant feature contained over 871,000 records! See figure 7.0

After the new, properly projected, feature was added to the map, the researcher created a new geodatabase in order to house all of the source data, and generate empty feature to be populated by the network analysis toolbox. All of the supporting files created up to this point were added to the new geodatabase, and a new network dataset was created.

Once the new line and point files were created by the network analyst tool, it was noted by the researcher that the point files were not properly considering elevation when generating routes, so the researcher had to move through the dataset and manually merge line segments, such as highway overpasses, in order to correctly reflect the county road topography. This process was done in areas of knows route intersection, and was not exhaustive in respect to the entire dataset. The network dataset then had to be re-generated with these newly created merged line segments, and with the source data clean of errant vertices.

The last items required for the unimpeded routes to be created was a digitization of the route's point of origin, and the evacuation points. Once digitized, the routes were able to be solved for, and maps for three separate routes, and the turn-by-turn directions were created by the software package ArcMap. See figures 2.0 through 4.1 describing these routes and directions.

The last step was to simulate bridge outages for the routs that intersected the vulnerable waterways. The third route was the only route that fit this particular scenario and figures 5.0 and 5.1 show the new route considering those simulated outages.

Findings and Discussion: One of the most interesting findings for the neighborhood is that the first evacuation route is certainly the fastest, though the county line is actual drawn as a border to a major river in Georgia. It is possible that in the scope of this study it is the fastest evacuation route, it is likely that in a flooding even it may not be the safest route. The first rout also proceeds east, which is a largely rural area and there are likely to be less emergency services available in that direction.

The second route is likely the safest route in an evacuation due to flooding type situation. It has the most direct rout with the least proximity to the vulnerable waterways. This route falls victim to the same type of vulnerability as the first route however. It is a suitable route, but it leads to a largely rural area, and in that southward direction, an individual can drive for many hours before reaching another major metro.

The researcher also found the route calculation of line segments and point data incredibly interesting. Provided in the appendix is an incomplete map intended to only display the software processing steps, and not convey any spatial information. See figure 6.0.

The last route is the most likely to lead a refugee to hospitals, and other emergency services, but it is also the most likely to use bridges impacted by flooding scenarios. When the researcher places impervious impediments to the network analyst

on those impacted bridges, the route is increased slightly in duration, but still leads toward a major metro, and the evacuation point can be reached with complete avoidance of the waterways.

The conclusion of the research is that likely the safest route from a flooding impact perspective and best route toward emergency services is likely the third route with the bridge outages considered. The increase on travel duration is not significant enough to take any other route in the event of a localized flood.

Appendix:

Citations:

Climate in Oconee County, Georgia. Oconee County, GEORGIA CLIMATE. (n.d.). https://www.bestplaces.net/climate/county/georgia/oconee#:~:text=Oconee%20County%2C%20Georgia%20gets%2048,%2C%20on%20average%2C%20per%20year.

Figure 1.0

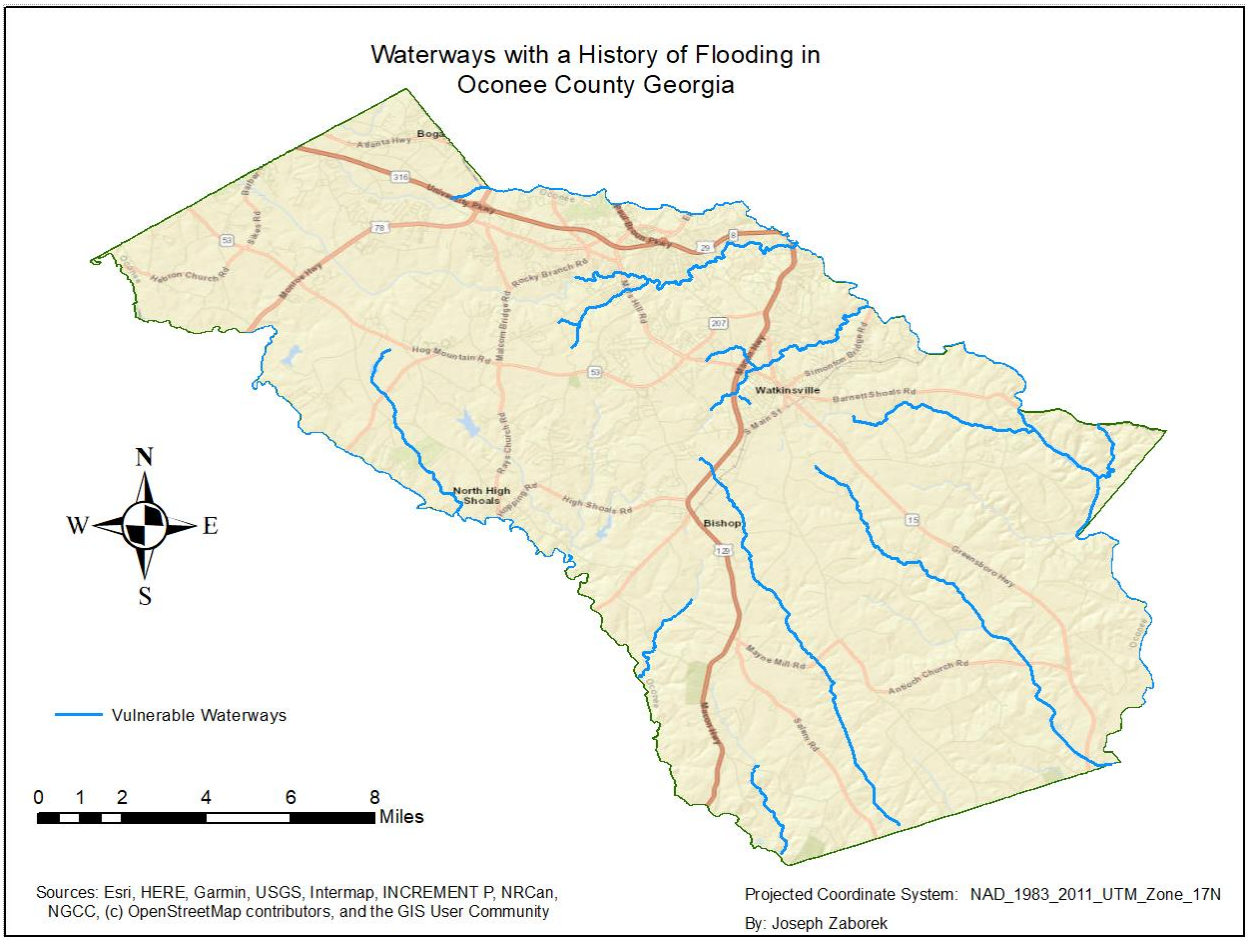


Figure 2.0

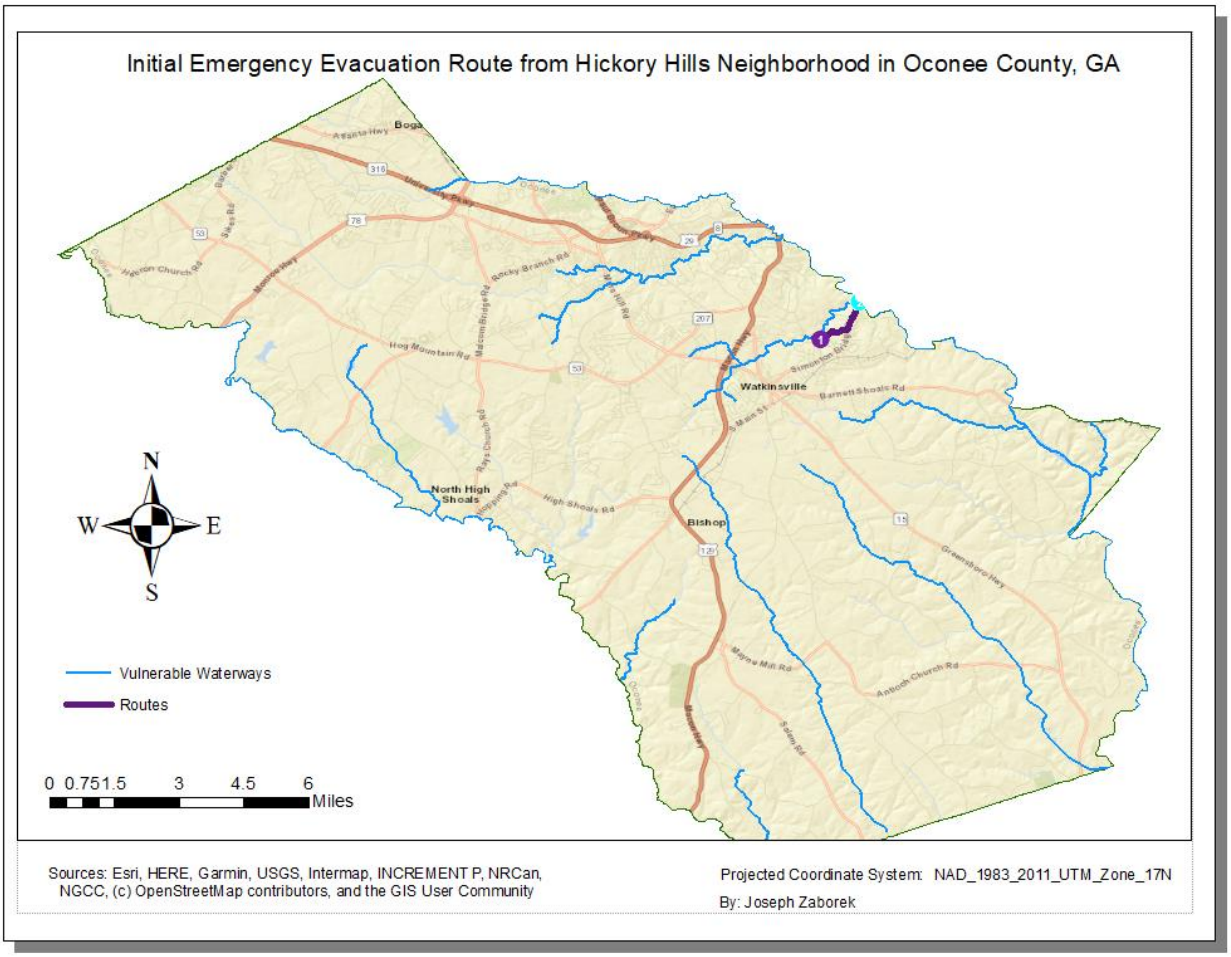


Figure 2.1

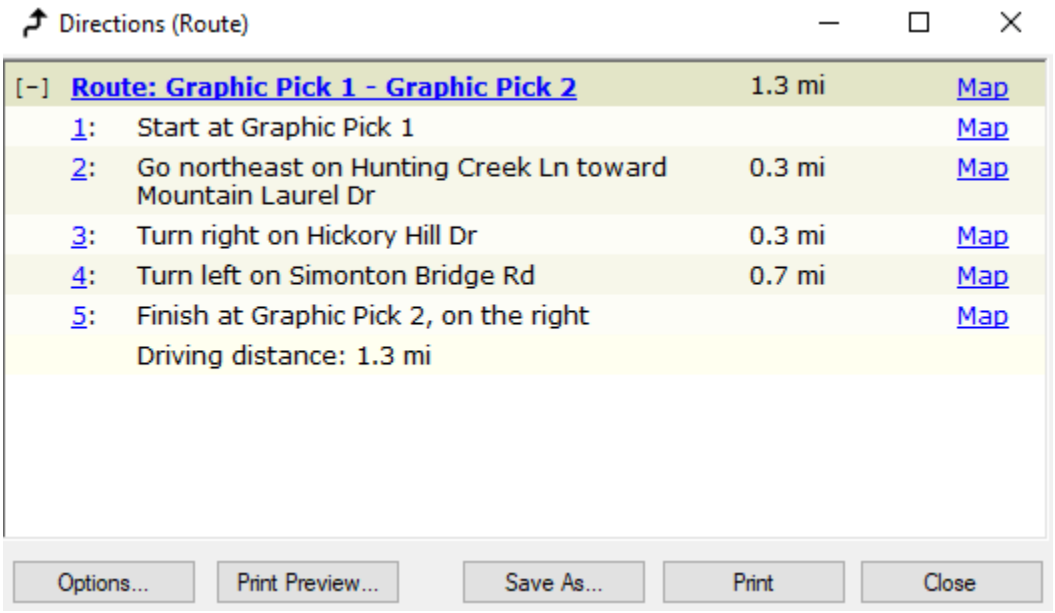


Figure 3.0

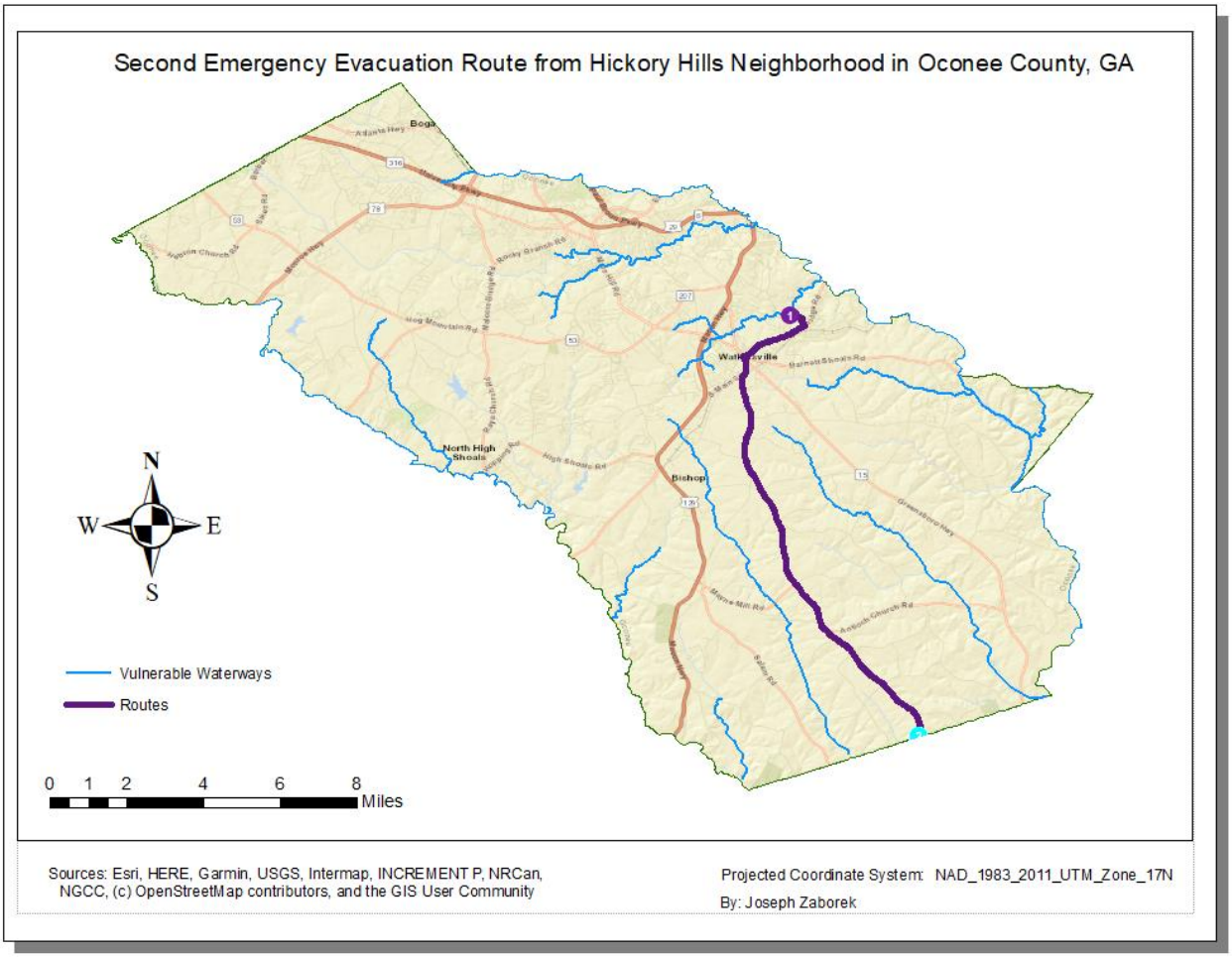
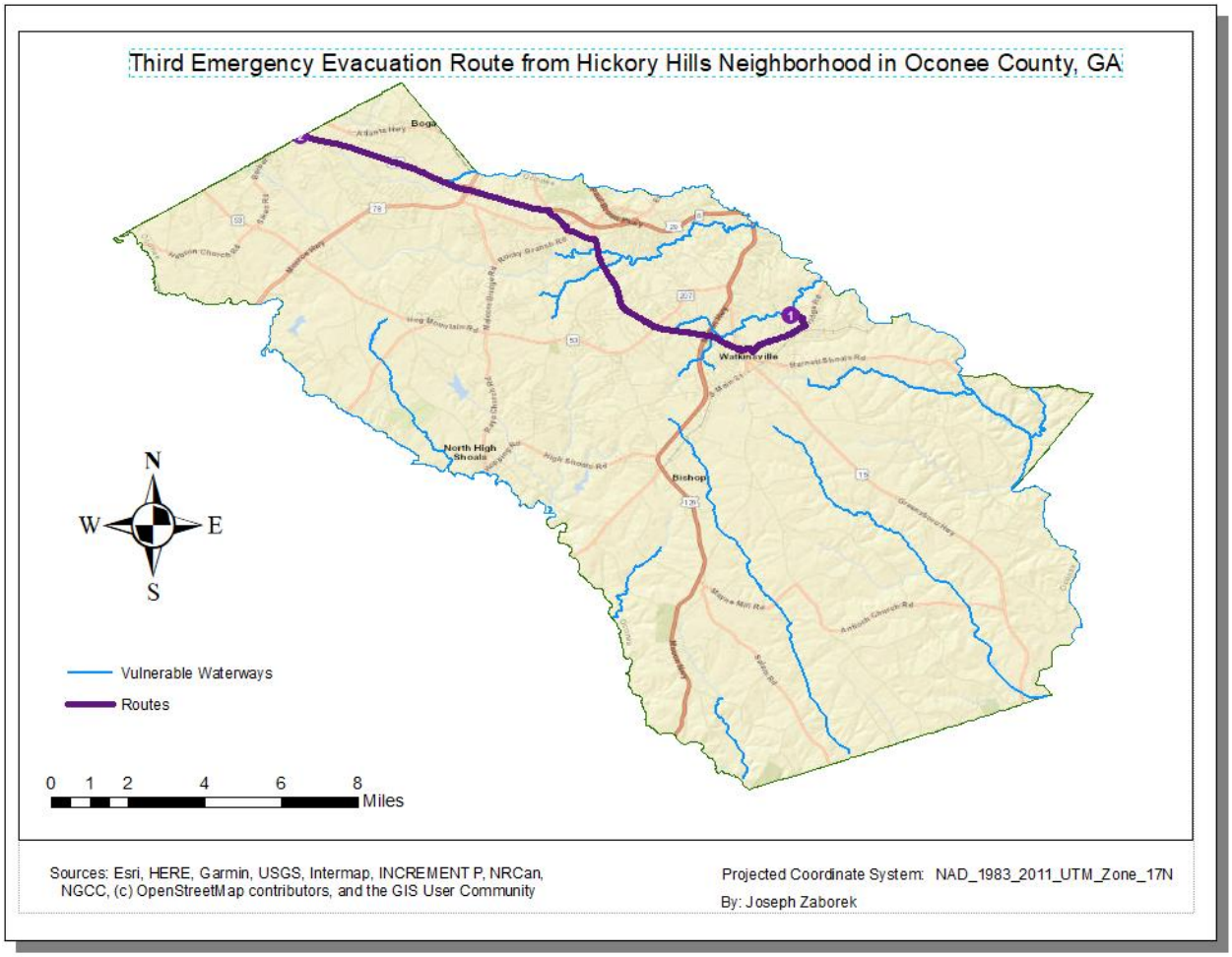

Second Emergency Evacuation Route from Hickory Hills Neighborhood in Oconee County, GA
Bogart
Watkinsville
North High Shoals
Bishop
N
W
E
S
Vulnerable Waterways
Routes
0 1 2 4 6 8
Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Projected Coordinate System: NAD_1983_2011_UTM_Zone_17N
By: Joseph Zaborek

Figure 3.1


Directions (Route)
[-] Route: Graphic Pick 1 - Graphic Pick 1 13 mi Map
1: Start at Graphic Pick 1 Map
2: Go northeast on Hunting Creek Ln toward Mountain Laurel Dr 0.1 mi Map
3: Turn right on Mountain Laurel Dr 0.2 mi Map
4: Turn right on Brookfield Dr 0.2 mi Map
5: Turn right on Simonton Bridge Rd 1.6 mi Map
6: Turn left on S Main St 455 ft Map
7: Bear right on Macon Hwy 0.4 mi Map
8: Bear left on Colham Ferry Xing Exd 0.1 mi Map
9: Turn left on Colham Ferry Rd 6.9 mi Map
10: Continue on Marshall Store Rd 0.2 mi Map
11: Continue on Colham Ferry Rd 3.5 mi Map
12: Finish at Graphic Pick 1, on the left Map
Driving distance: 13 mi
Options...
Print Preview...
Save As...
Print
Close

Figure 4.0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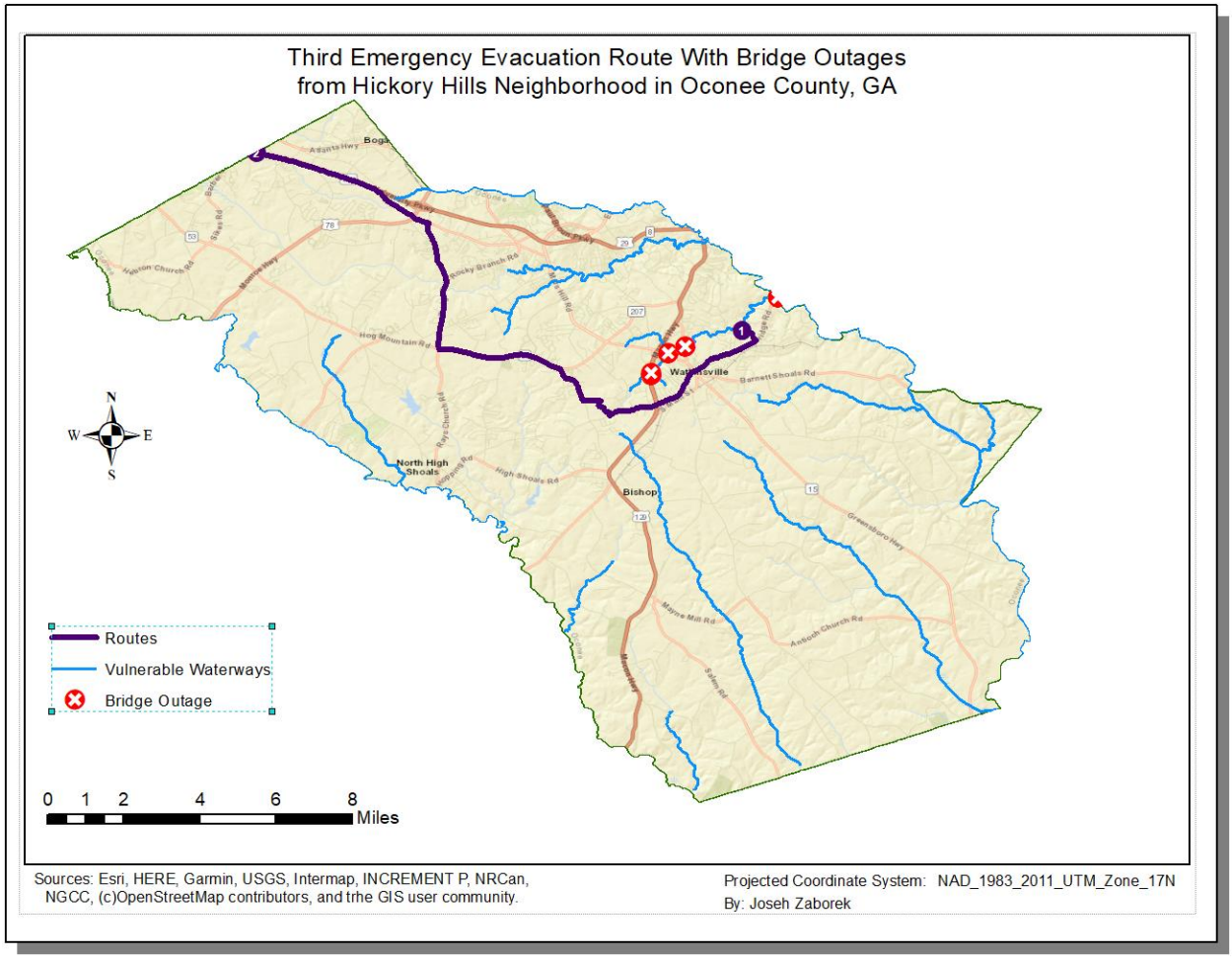
Projected Coordinate System: NAD_1983_2011_UTM_Zone_17N
By: Joseph Zaborek

Figure 4.1


Directions (Route)
[-] Route: Graphic Pick 1 - Graphic Pick 1 14 mi Map
1: Start at Graphic Pick 1 Map
2: Go northeast on Hunting Creek Ln toward Mountain Laurel Dr 0.1 mi Map
3: Turn right on Mountain Laurel Dr 0.2 mi Map
4: Turn right on Brookfield Dr 0.2 mi Map
5: Turn right on Simonton Bridge Rd 1.4 mi Map
6: Turn right on 3rd St 0.3 mi Map
7: Turn right on 1st St 0.1 mi Map
8: Turn right on N Main St 266 ft Map
9: Bear left on Experiment Station Rd 1.9 mi Map
10: Continue on Mars Hill Rd 1.7 mi Map
11: Continue on Oconee Con 1.1 mi Map
12: Turn left on Mars Hill Rd 0.7 mi Map
13: Turn right on Virgil Langford Rd 358 ft Map
14: Turn left on Jimmy Daniel Rd 0.6 mi Map
15: Turn left on US Hwy 29 5.7 mi Map
16: Finish at Graphic Pick 1, on the right Map
Driving distance: 14 mi
Options...
Print Preview...
Save As...
Print
Close

Figure 5.0


Third Emergency Evacuation Route With Bridge Outages
from Hickory Hills Neighborhood in Oconee County, GA
Watkinsville
North High Shoals
Bishop
N
W
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S
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Vulnerable Waterways
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Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, NGCC, (c)OpenStreetMap contributors, and trhe GIS user community.
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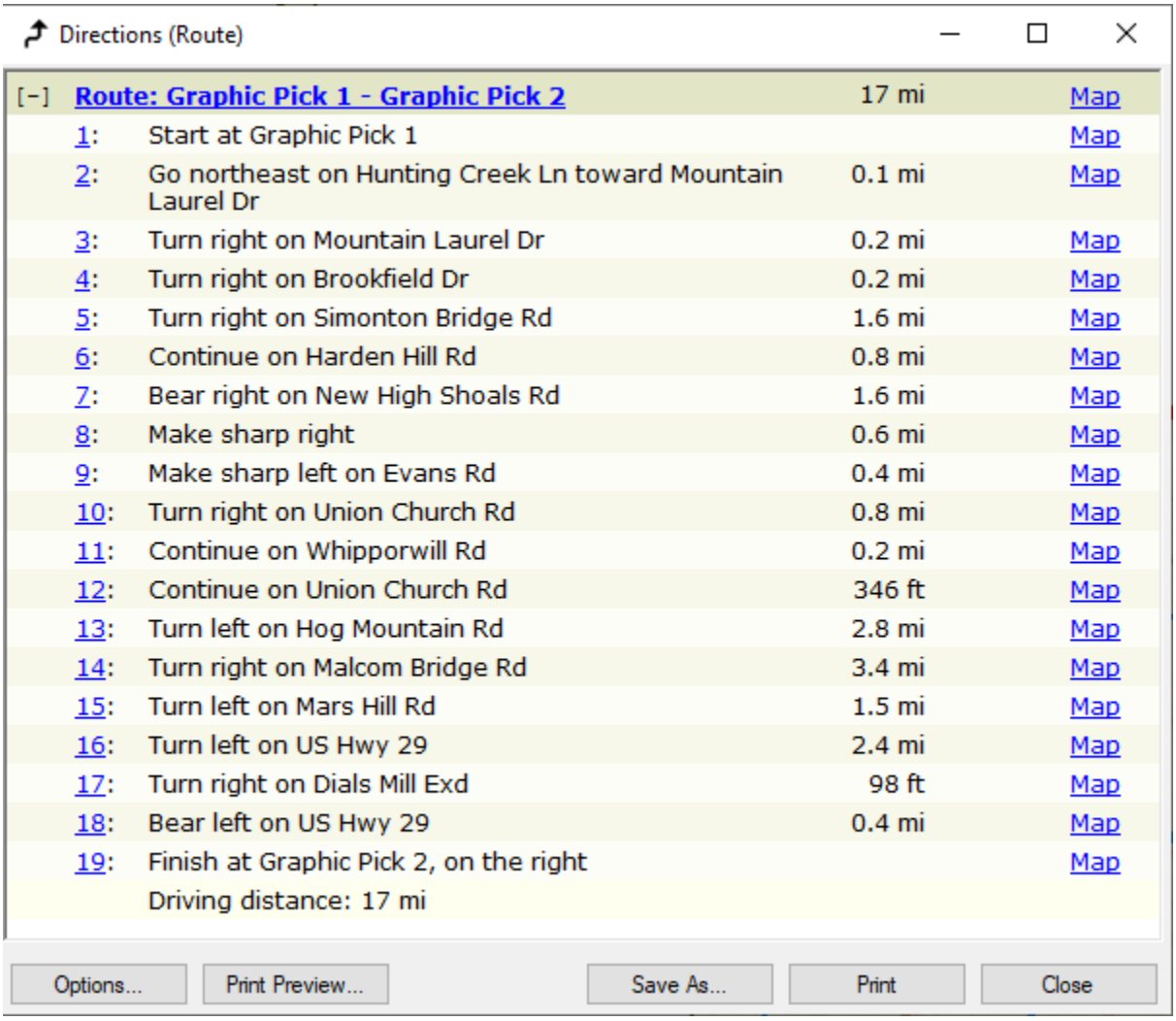
Directions (Route)
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2: Go northeast on Hunting Creek Ln toward Mountain Laurel Dr 0.1 mi Map
3: Turn right on Mountain Laurel Dr 0.2 mi Map
4: Turn right on Brookfield Dr 0.2 mi Map
5: Turn right on Simonton Bridge Rd 1.6 mi Map
6: Continue on Harden Hill Rd 0.8 mi Map
7: Bear right on New High Shoals Rd 1.6 mi Map
8: Make sharp right 0.6 mi Map
9: Make sharp left on Evans Rd 0.4 mi Map
10: Turn right on Union Church Rd 0.8 mi Map
11: Continue on Whipporwill Rd 0.2 mi Map
12: Continue on Union Church Rd 346 ft Map
13: Turn left on Hog Mountain Rd 2.8 mi Map
14: Turn right on Malcom Bridge Rd 3.4 mi Map
15: Turn left on Mars Hill Rd 1.5 mi Map
16: Turn left on US Hwy 29 2.4 mi Map
17: Turn right on Dials Mill Exd 98 ft Map
18: Bear left on US Hwy 29 0.4 mi Map
19: Finish at Graphic Pick 2, on the right Map
Driving distance: 17 mi
Options...
Print Preview...
Save As...
Print
Close

Figure 6.0

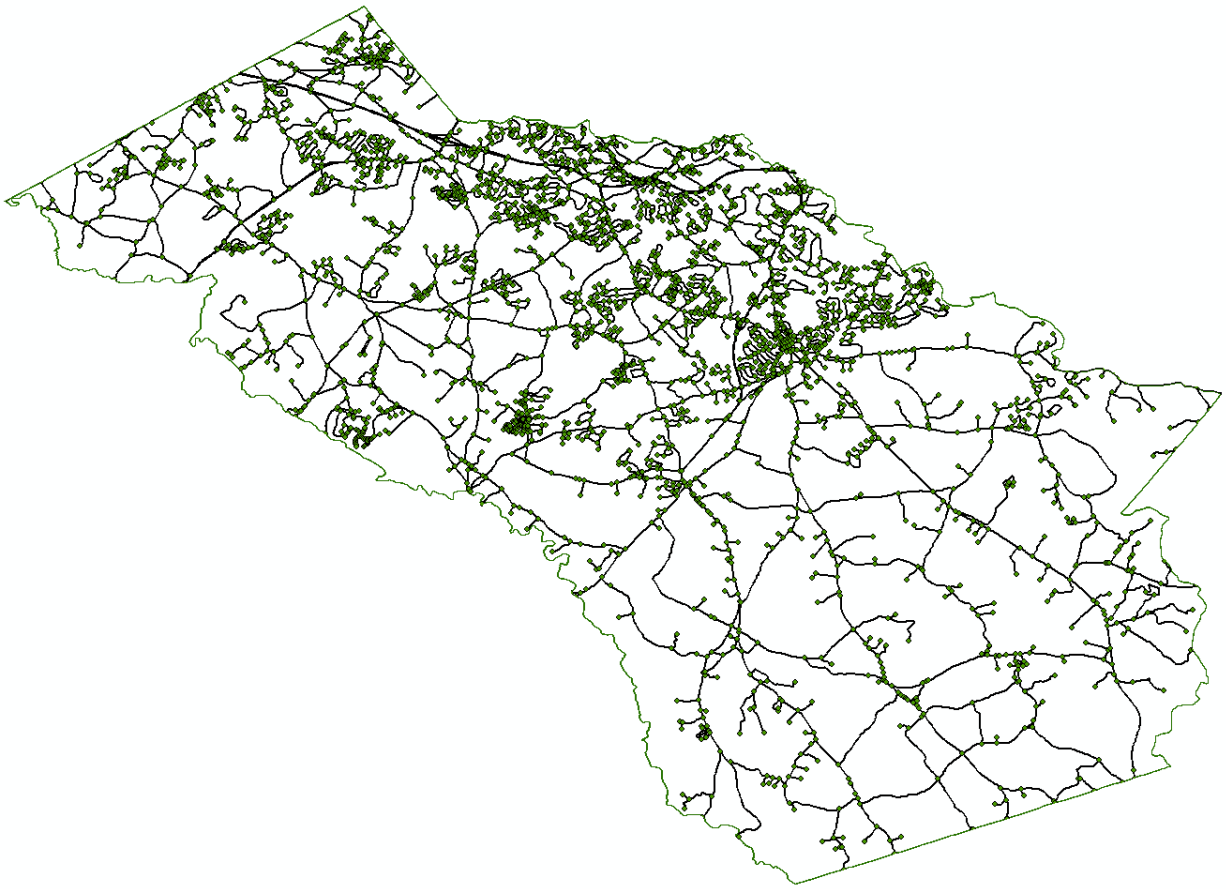

Figure 7.0

Table

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