How to Save Nichols, SC: A Small Town Lost in the Floods

Southeast Stormwater Association (SESWA)

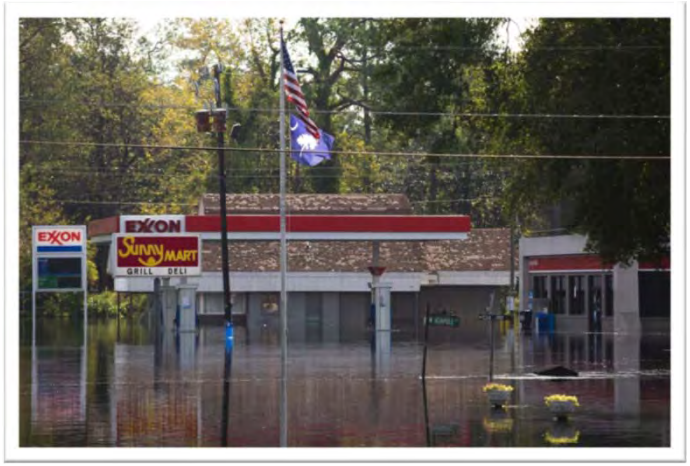
Thursday, October 2020

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

Topics of Discussion

- What Happened?!
- The Cause of the Flooding
- Possible Solutions
- Moving Forward

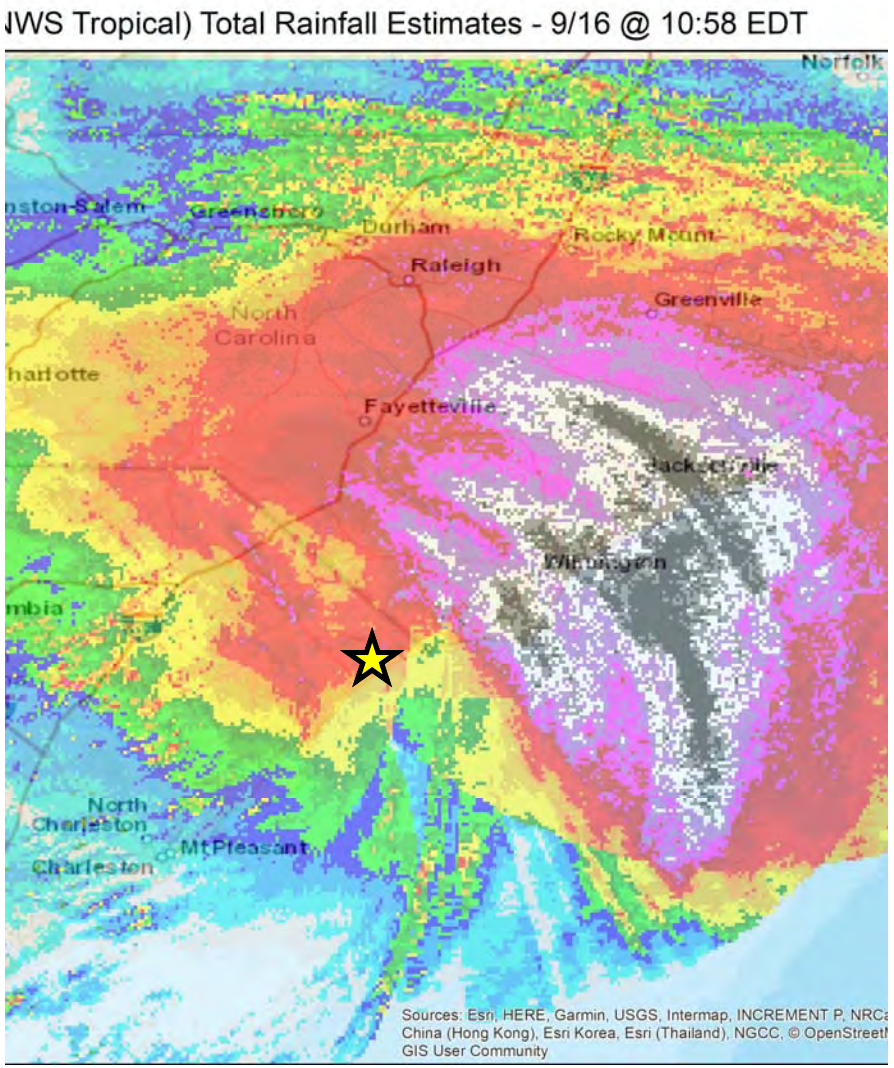
Flooding Impacts



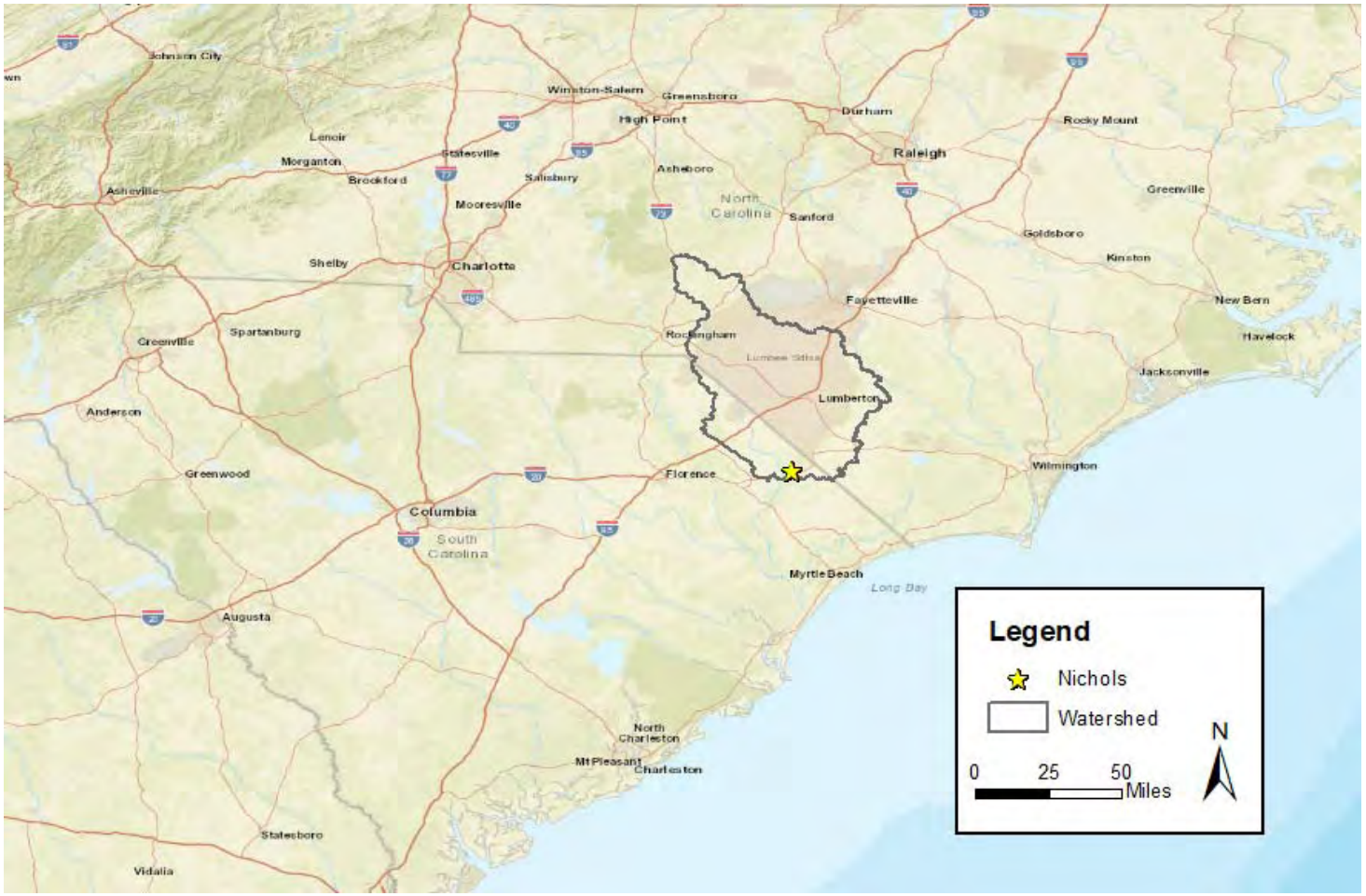
Lingering Flooding Impacts

Review Flooding

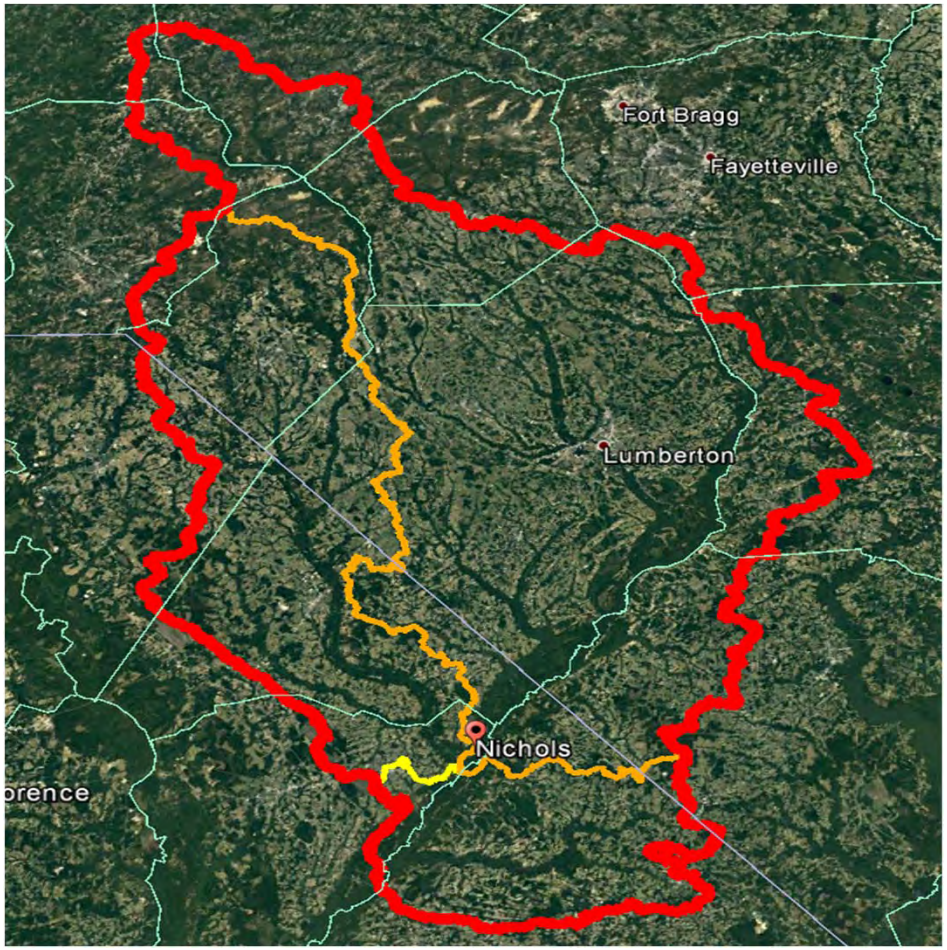
- 2016: Hurricane Matthew
- 2018: Hurricane Florence
- Water from Lumber River and the Little Pee Dee River



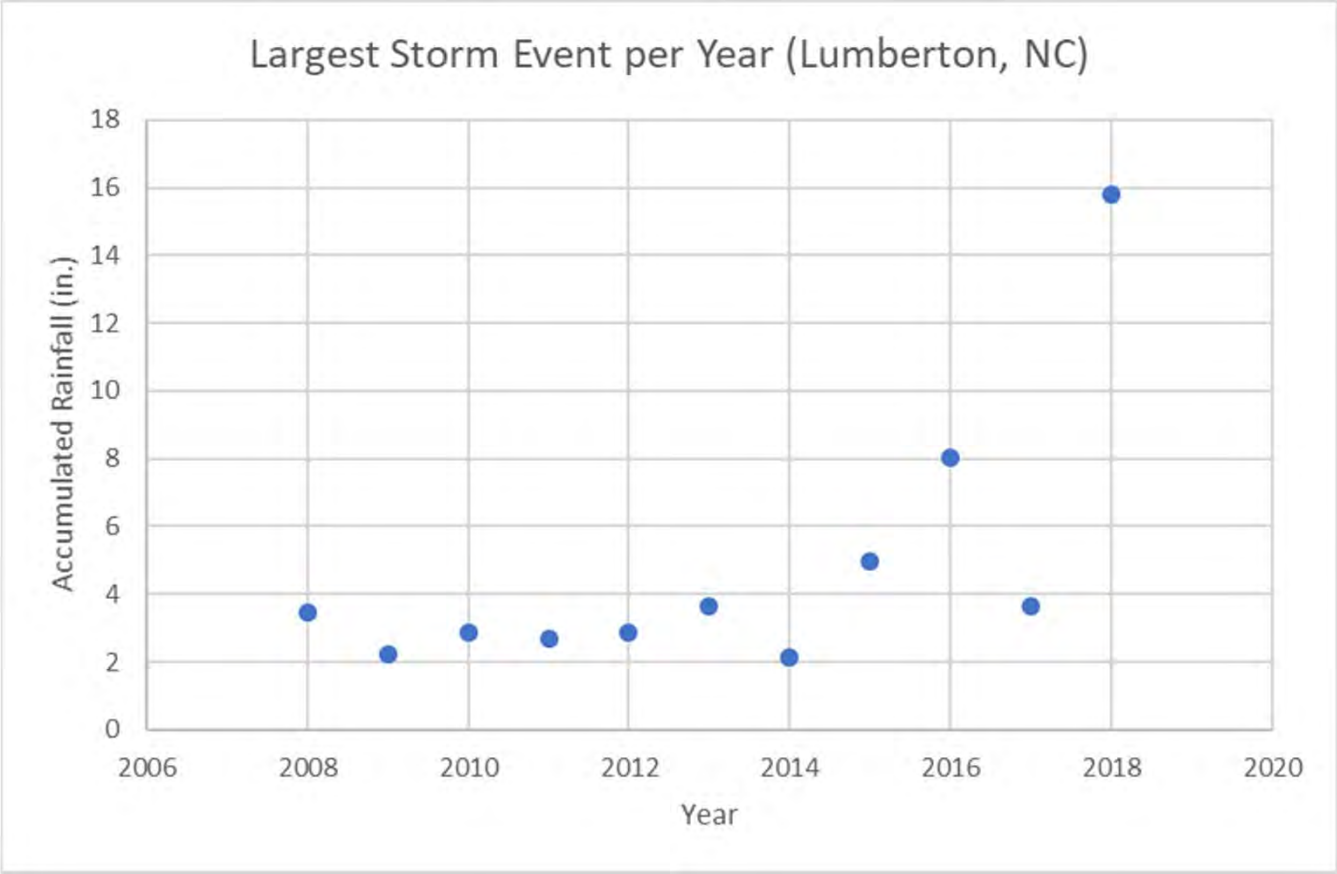
Watershed Analysis



Watershed Analysis



Upstream Rainfall Data

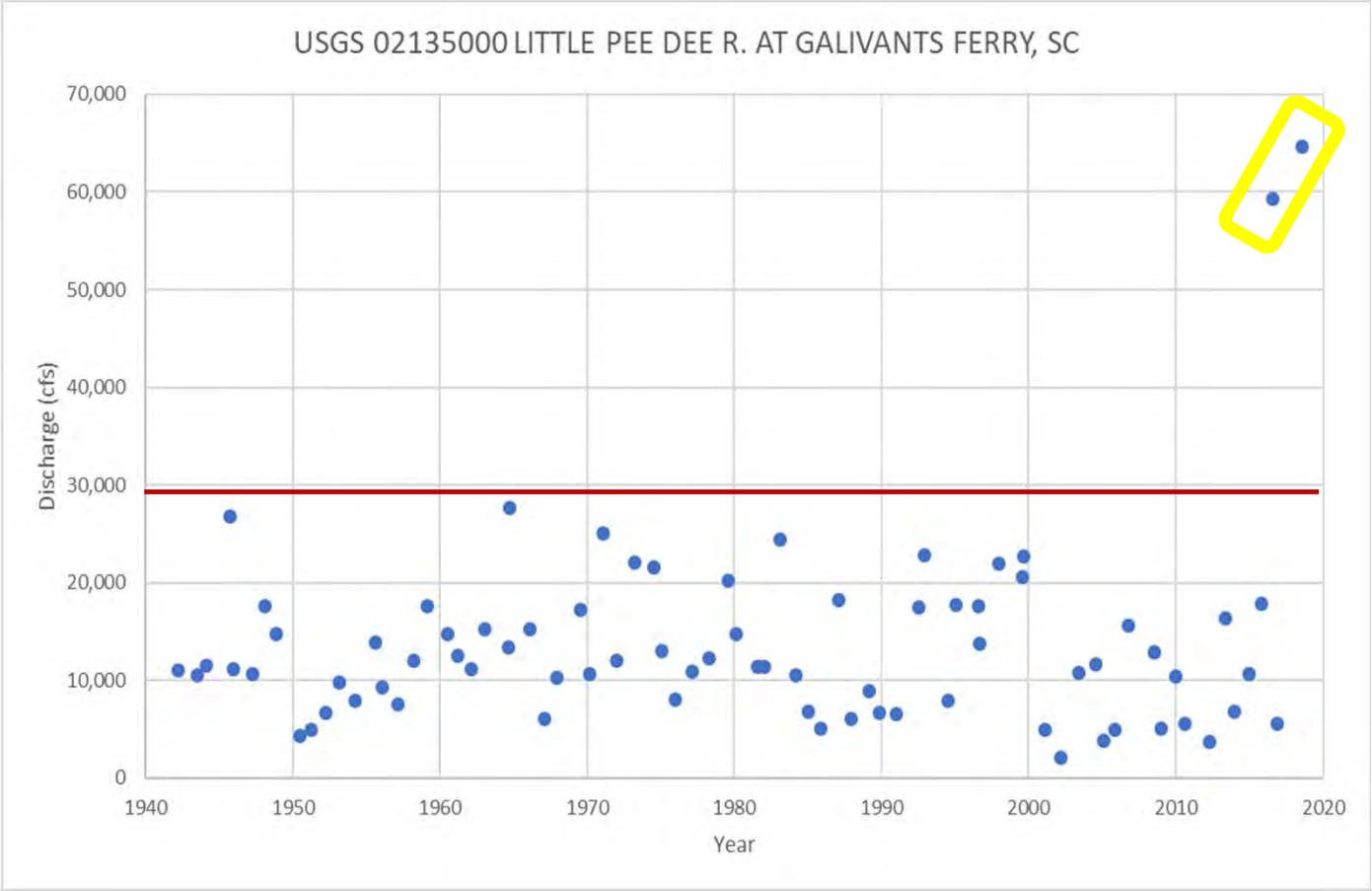


Rainfall Data

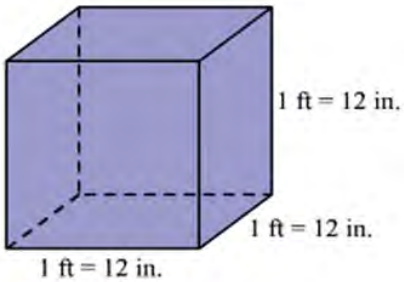
PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.456** (0.418-0.497)	**0.539** (0.495-0.588)	**0.630** (0.576-0.688)	**0.703** (0.642-0.765)	**0.794** (0.722-0.863)	**0.864** (0.782-0.938)	**0.932** (0.839-1.01)	**1.00** (0.894-1.09)	**1.09** (0.965-1.18)	**1.16** (1.02-1.26)
10-min	**0.728** (0.668-0.794)	**0.862** (0.791-0.940)	**1.01** (0.923-1.10)	**1.12** (1.03-1.22)	**1.27** (1.15-1.38)	**1.38** (1.25-1.49)	**1.48** (1.33-1.61)	**1.59** (1.42-1.72)	**1.72** (1.53-1.87)	**1.82** (1.61-1.98)
15-min	**0.910** (0.835-0.992)	**1.08** (0.994-1.18)	**1.28** (1.17-1.39)	**1.42** (1.30-1.55)	**1.61** (1.46-1.74)	**1.74** (1.58-1.89)	**1.87** (1.69-2.03)	**2.00** (1.79-2.17)	**2.17** (1.92-2.35)	**2.29** (2.02-2.49)
30-min	**1.25** (1.14-1.36)	**1.50** (1.37-1.63)	**1.81** (1.66-1.98)	**2.06** (1.88-2.24)	**2.38** (2.16-2.58)	**2.62** (2.38-2.85)	**2.87** (2.58-3.11)	**3.11** (2.78-3.38)	**3.45** (3.06-3.74)	**3.71** (3.27-4.03)
60-min	**1.56** (1.43-1.70)	**1.88** (1.72-2.05)	**2.33** (2.13-2.54)	**2.68** (2.45-2.92)	**3.17** (2.88-3.44)	**3.55** (3.22-3.86)	**3.95** (3.56-4.29)	**4.37** (3.91-4.74)	**4.94** (4.39-5.37)	**5.41** (4.77-5.88)
2-hr	**1.81** (1.67-1.98)	**2.19** (2.02-2.40)	**2.76** (2.54-3.02)	**3.23** (2.96-3.53)	**3.88** (3.53-4.24)	**4.42** (4.01-4.82)	**4.99** (4.50-5.45)	**5.59** (5.01-6.09)	**6.45** (5.72-7.04)	**7.16** (6.29-7.83)
3-hr	**1.93** (1.76-2.13)	**2.33** (2.13-2.58)	**2.95** (2.69-3.26)	**3.47** (3.16-3.84)	**4.22** (3.82-4.66)	**4.86** (4.37-5.35)	**5.55** (4.95-6.10)	**6.29** (5.57-6.90)	**7.38** (6.45-8.10)	**8.30** (7.18-9.13)
6-hr	**2.29** (2.07-2.55)	**2.76** (2.51-3.09)	**3.50** (3.17-3.89)	**4.13** (3.73-4.59)	**5.04** (4.51-5.59)	**5.81** (5.16-6.43)	**6.65** (5.86-7.35)	**7.57** (6.62-8.35)	**8.93** (7.70-9.85)	**10.1** (8.60-11.1)
12-hr	**2.67** (2.41-3.00)	**3.23** (2.91-3.62)	**4.11** (3.70-4.61)	**4.88** (4.38-5.46)	**5.99** (5.34-6.67)	**6.96** (6.16-7.73)	**8.02** (7.03-8.90)	**9.19** (7.97-10.2)	**10.9** (9.34-12.1)	**12.4** (10.5-13.7)
24-hr	**3.11** (2.84-3.43)	**3.76** (3.44-4.16)	**4.83** (4.41-5.33)	**5.73** (5.21-6.31)	**7.04** (6.37-7.74)	**8.16** (7.33-8.98)	**9.40** (8.36-10.3)	**10.8** (9.48-11.8)	**12.8** (11.1-14.1)	**14.5** (12.4-16.0)
2-day	**3.62** (3.30-4.01)	**4.38** (4.00-4.86)	**5.58** (5.08-6.18)	**6.59** (5.99-7.30)	**8.07** (7.27-8.92)	**9.32** (8.35-10.3)	**10.7** (9.49-11.8)	**12.2** (10.7-13.5)	**14.4** (12.5-16.0)	**16.3** (13.9-18.1)
3-day	**3.87** (3.56-4.24)	**4.67** (4.29-5.12)	**5.92** (5.43-6.48)	**6.96** (6.37-7.62)	**8.48** (7.71-9.27)	**9.76** (8.81-10.7)	**11.1** (9.98-12.2)	**12.7** (11.2-13.9)	**14.9** (13.0-16.5)	**16.8** (14.5-18.6)
4-day	**4.12** (3.81-4.46)	**4.96** (4.59-5.38)	**6.26** (5.77-6.78)	**7.33** (6.75-7.95)	**8.89** (8.14-9.63)	**10.2** (9.28-11.1)	**11.6** (10.5-12.6)	**13.1** (11.8-14.3)	**15.4** (13.6-16.9)	**17.3** (15.1-19.1)
7-day	**4.80** (4.45-5.18)	**5.77** (5.35-6.24)	**7.19** (6.65-7.78)	**8.36** (7.71-9.03)	**10.0** (9.18-10.8)	**11.4** (10.4-12.3)	**12.8** (11.6-13.9)	**14.3** (12.9-15.6)	**16.5** (14.7-18.1)	**18.4** (16.2-20.3)

Historical Stream Gauge Data



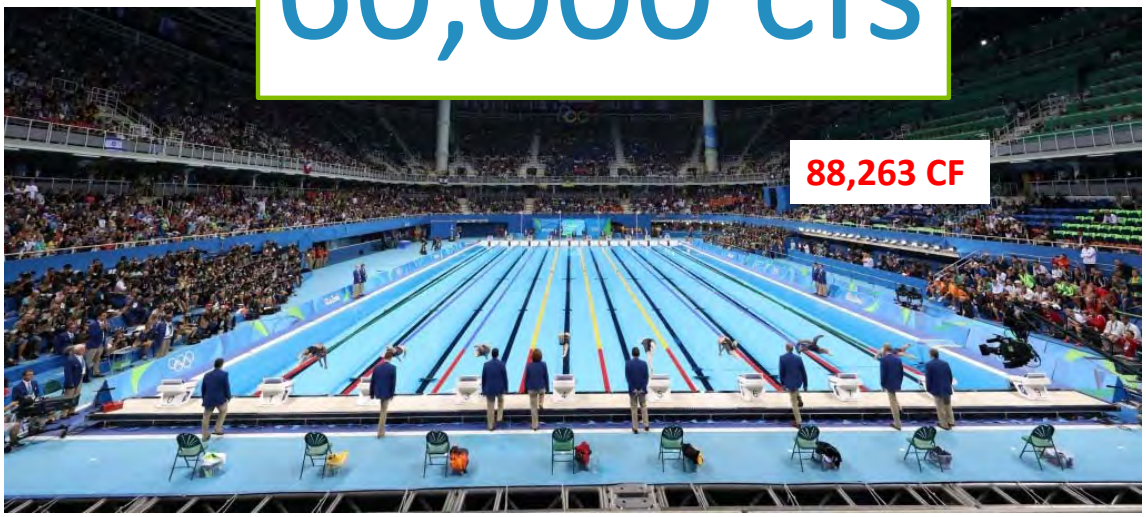
Flow Rates



1 Cubic foot

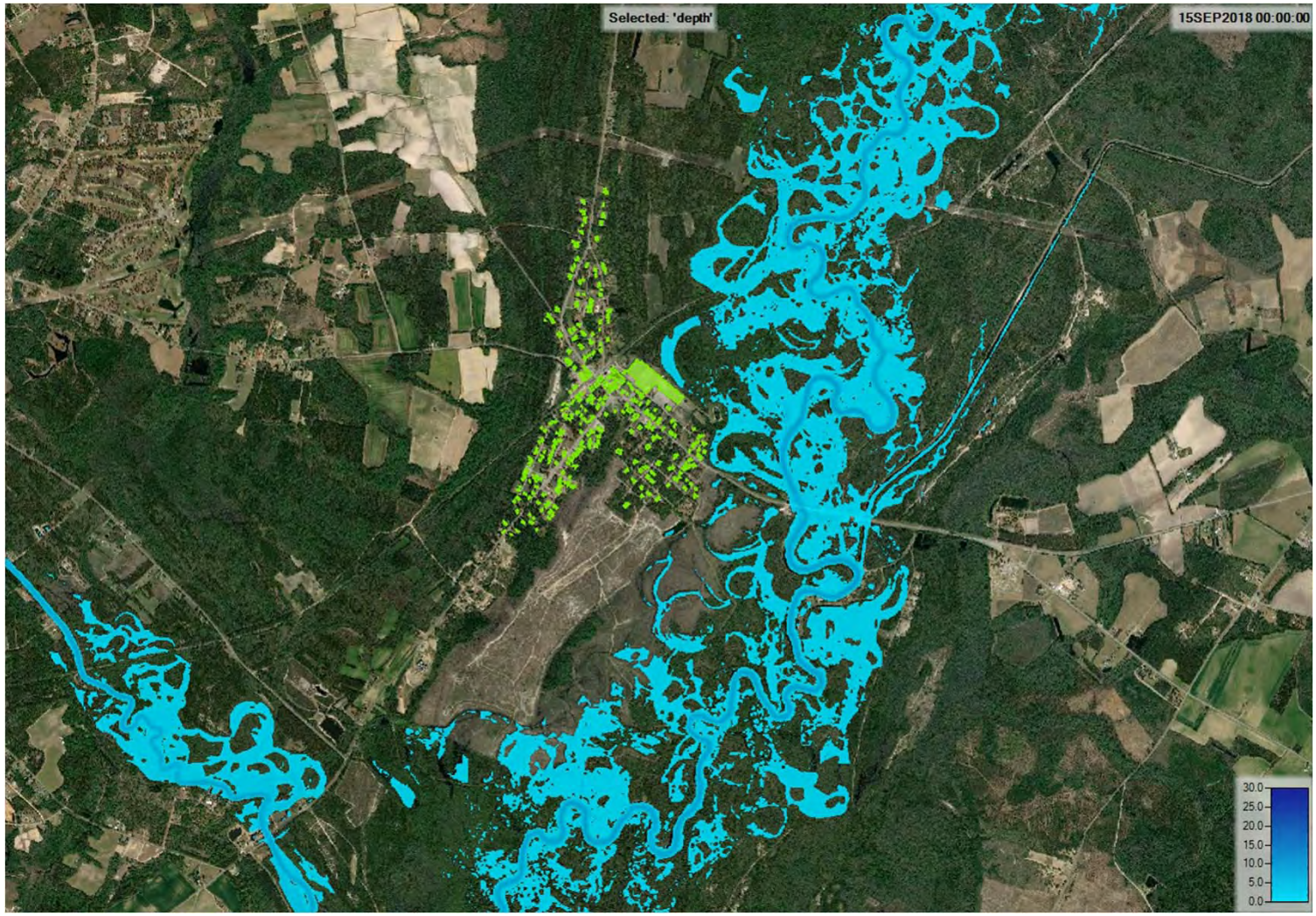
64CY

60,000 cfs

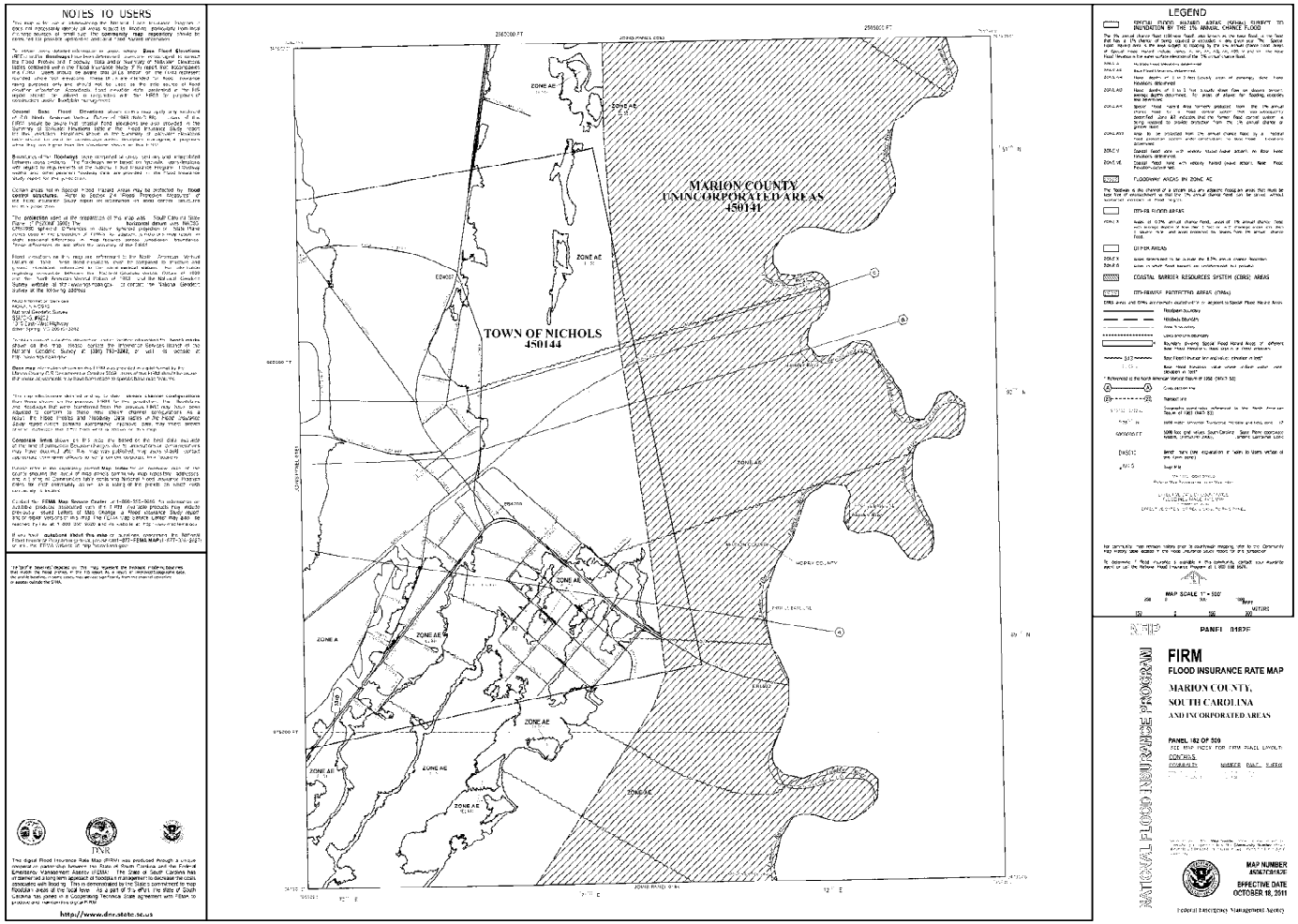


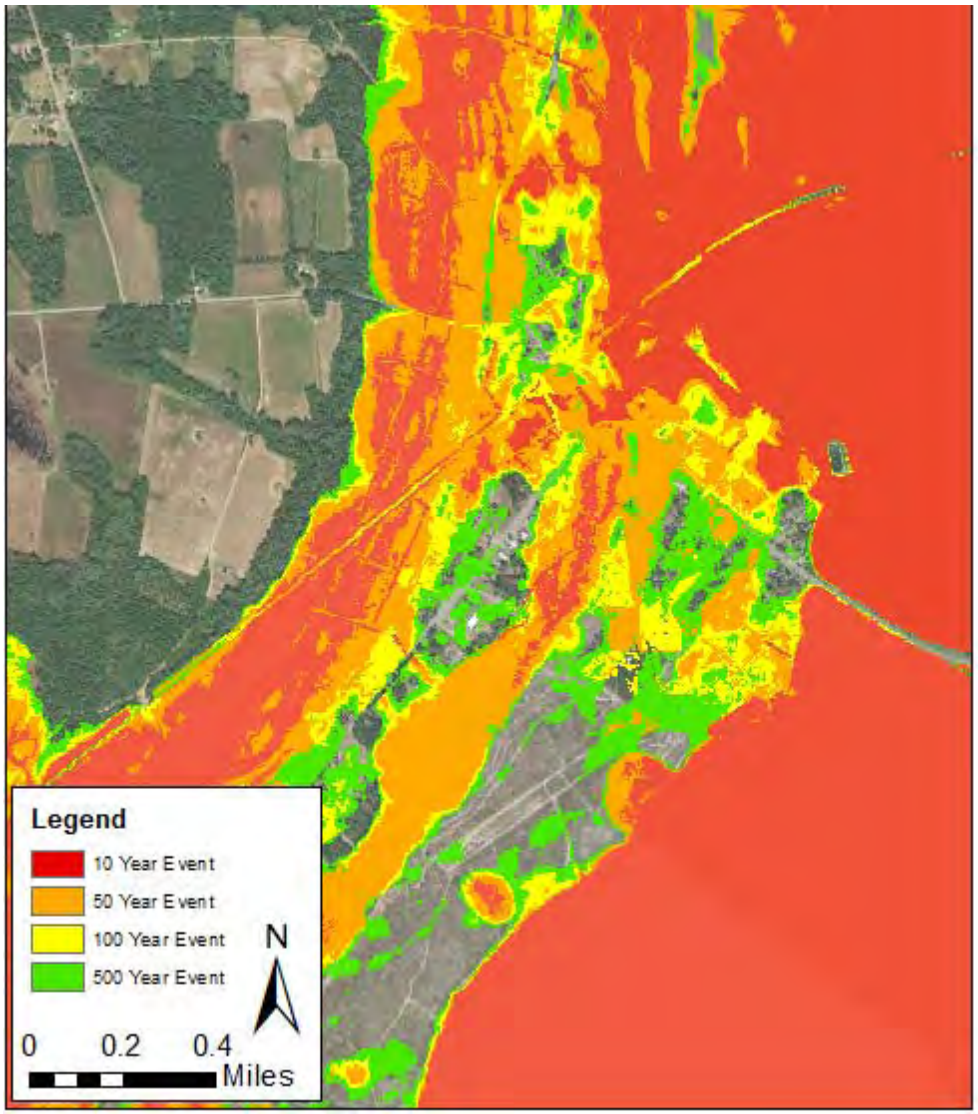
88,263 CF

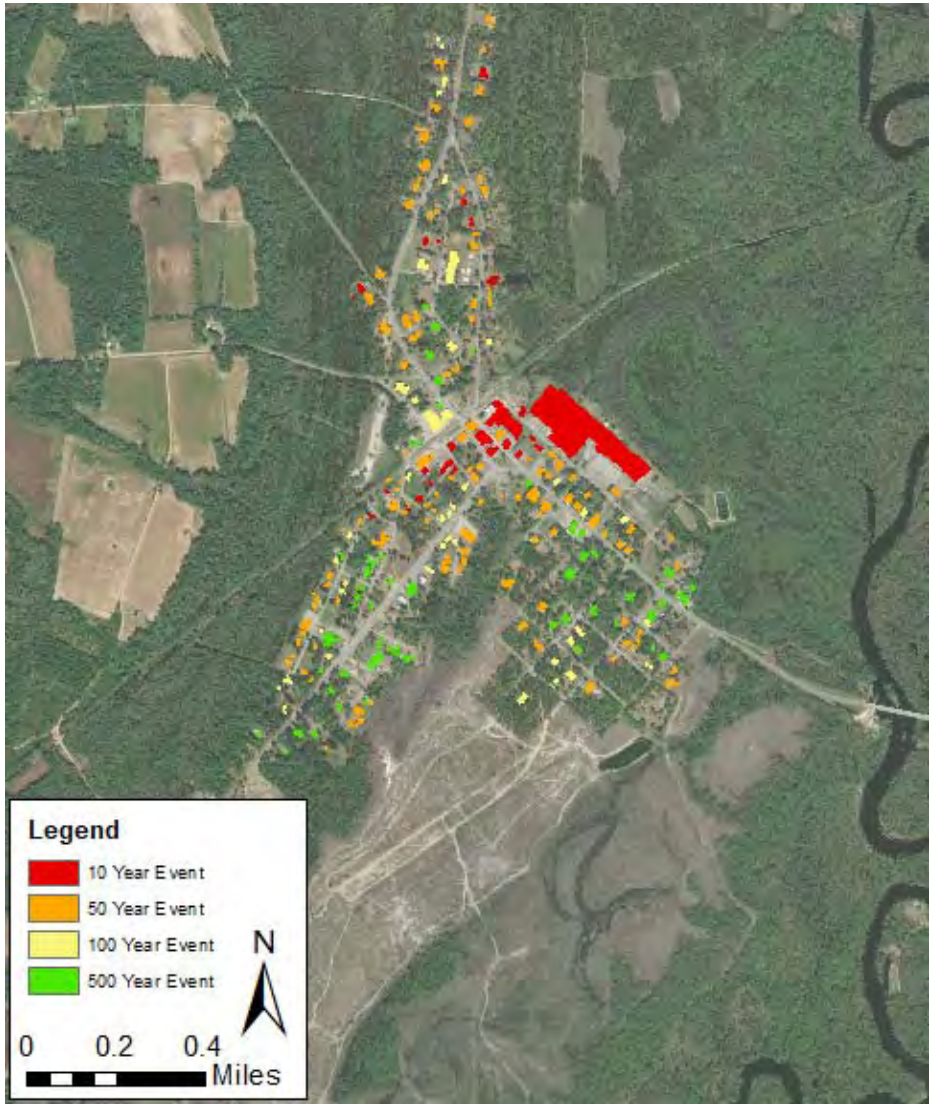
FLORENCE FLOODING



FEMA Floodplains




Legend
10 Year Event
50 Year Event
100 Year Event
500 Year Event
N
0
0.2
0.4
Miles


Legend
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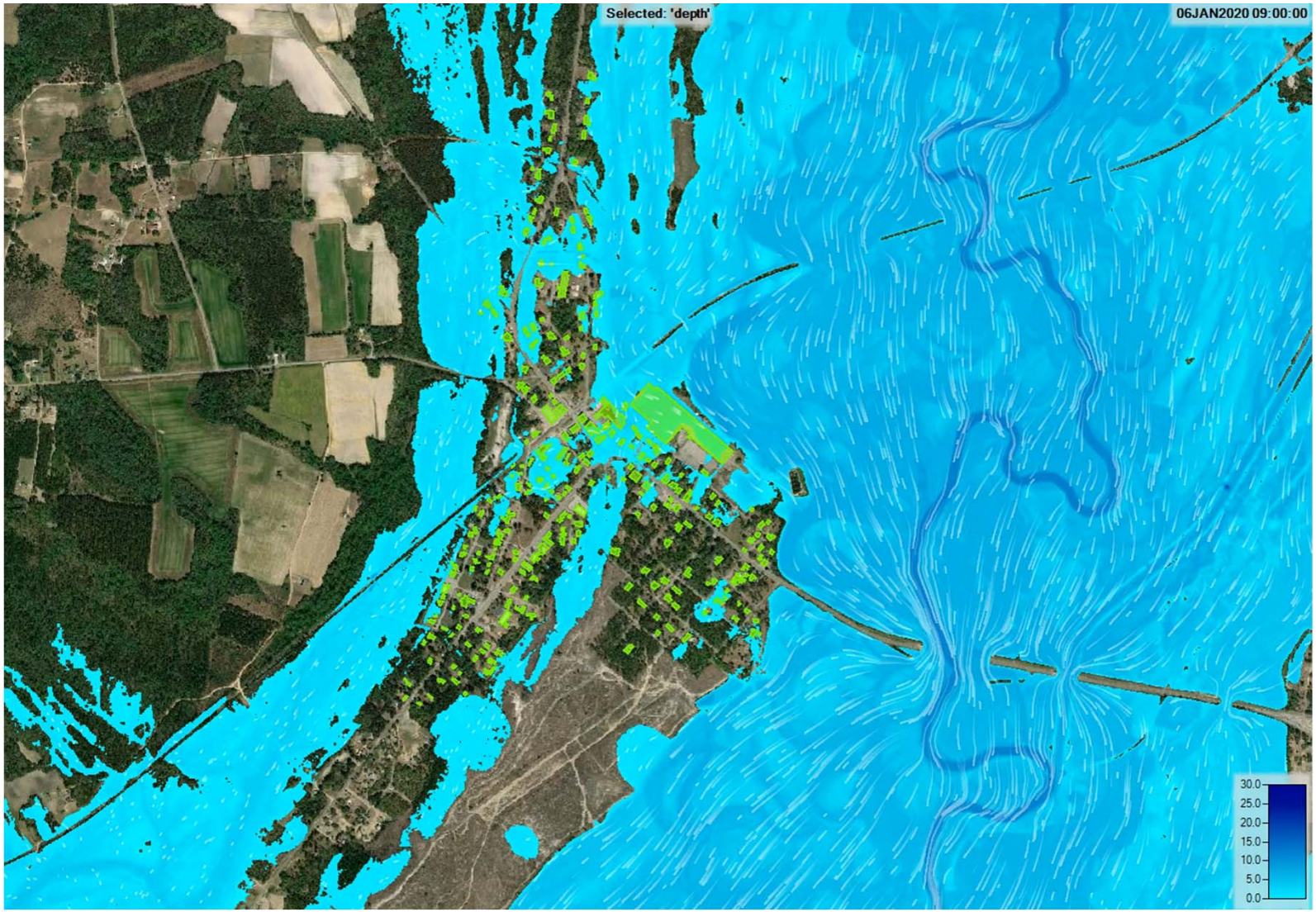
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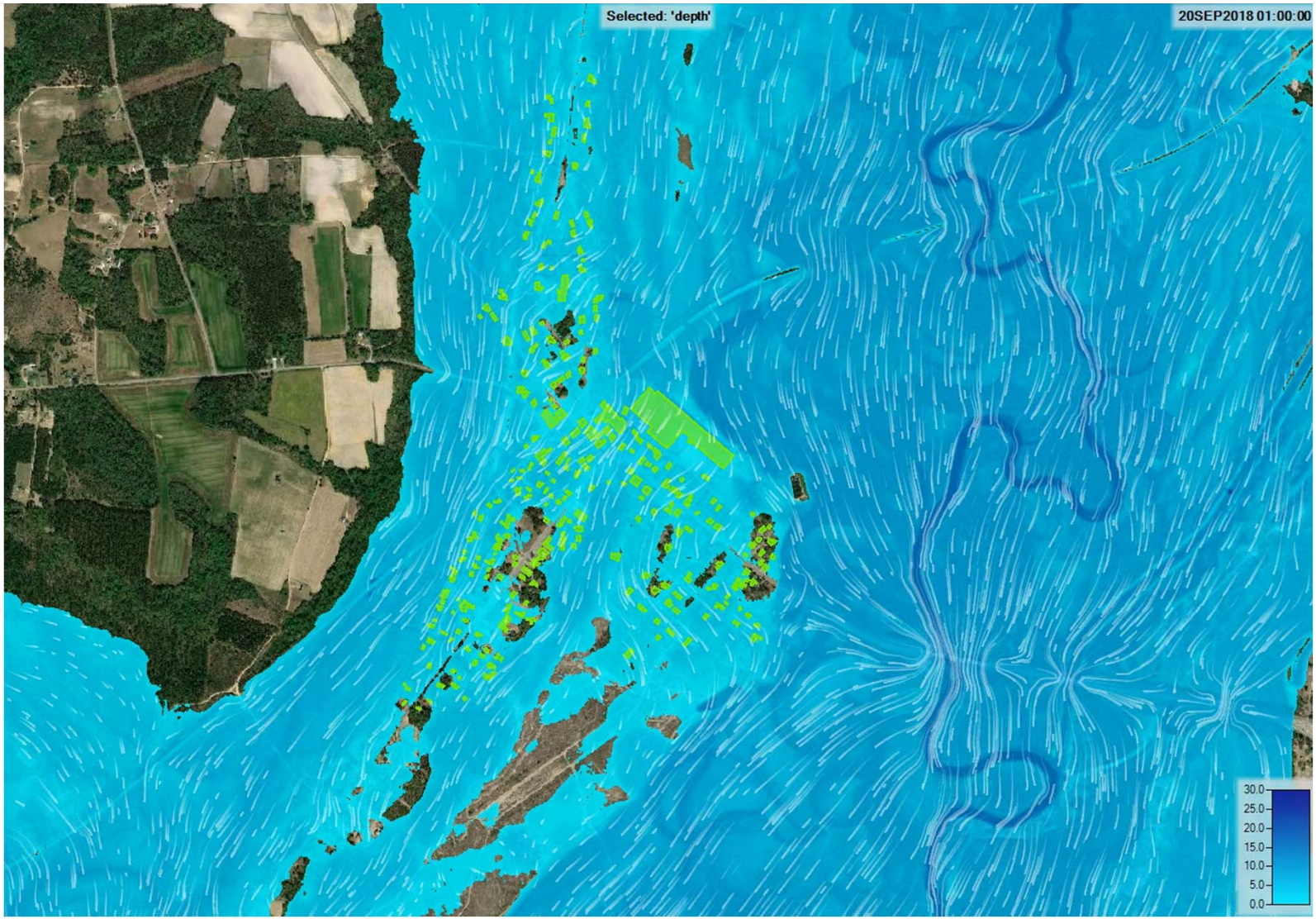
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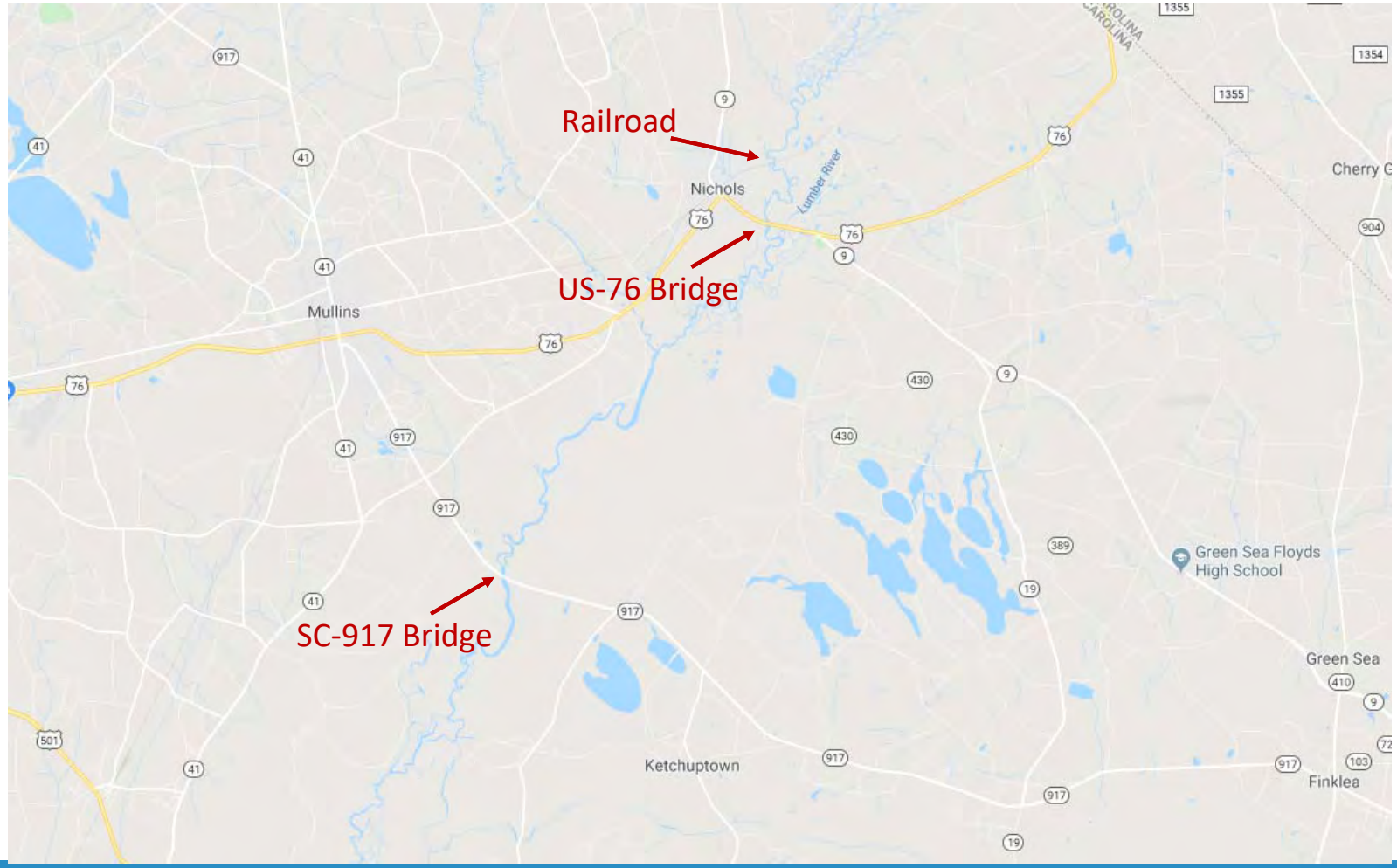
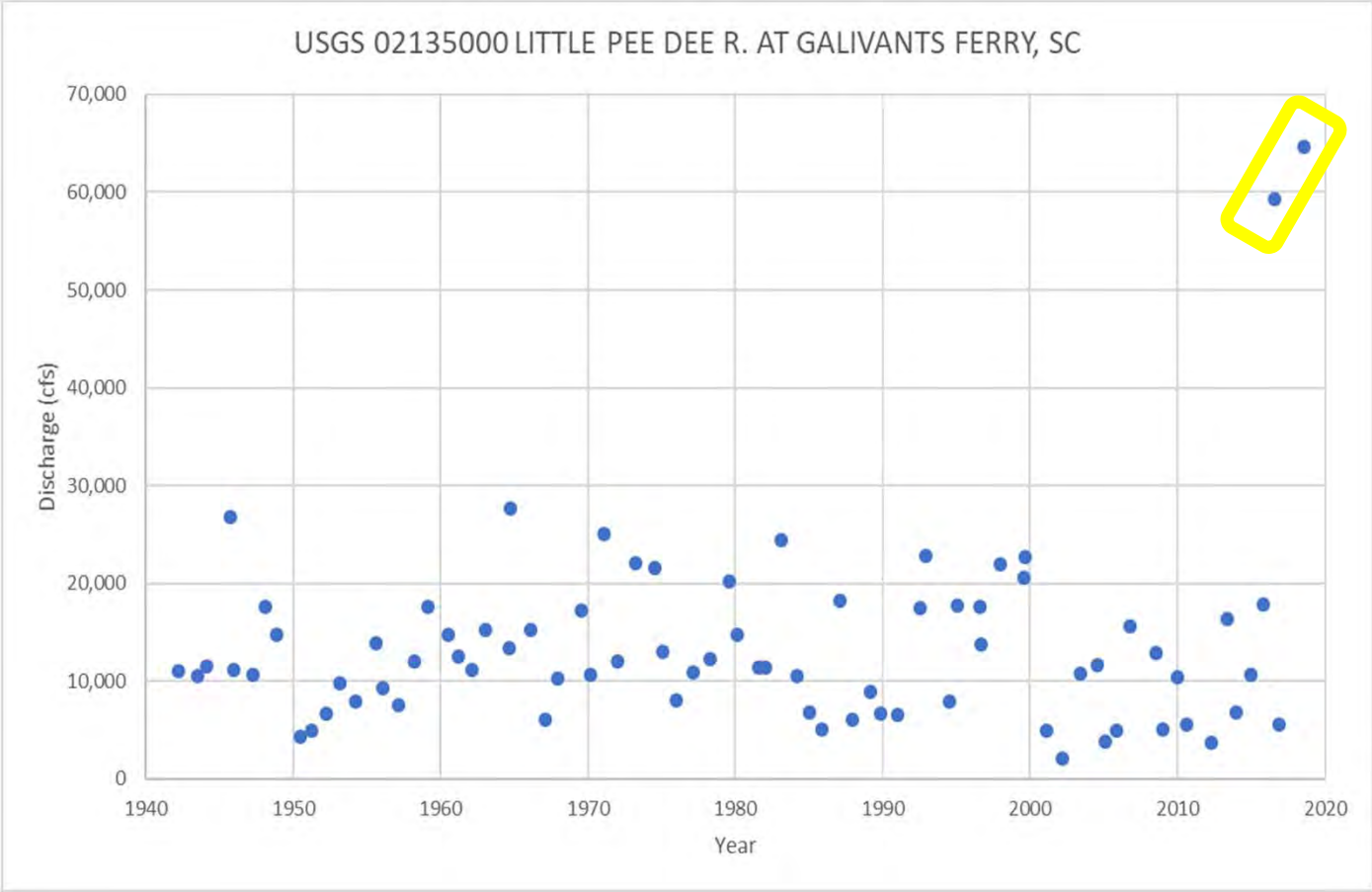
Possible Contributing Factors

- Upstream dam failure
- River debris
- Road crossings
  - US-76
  - US-917

SC-917 Bridge



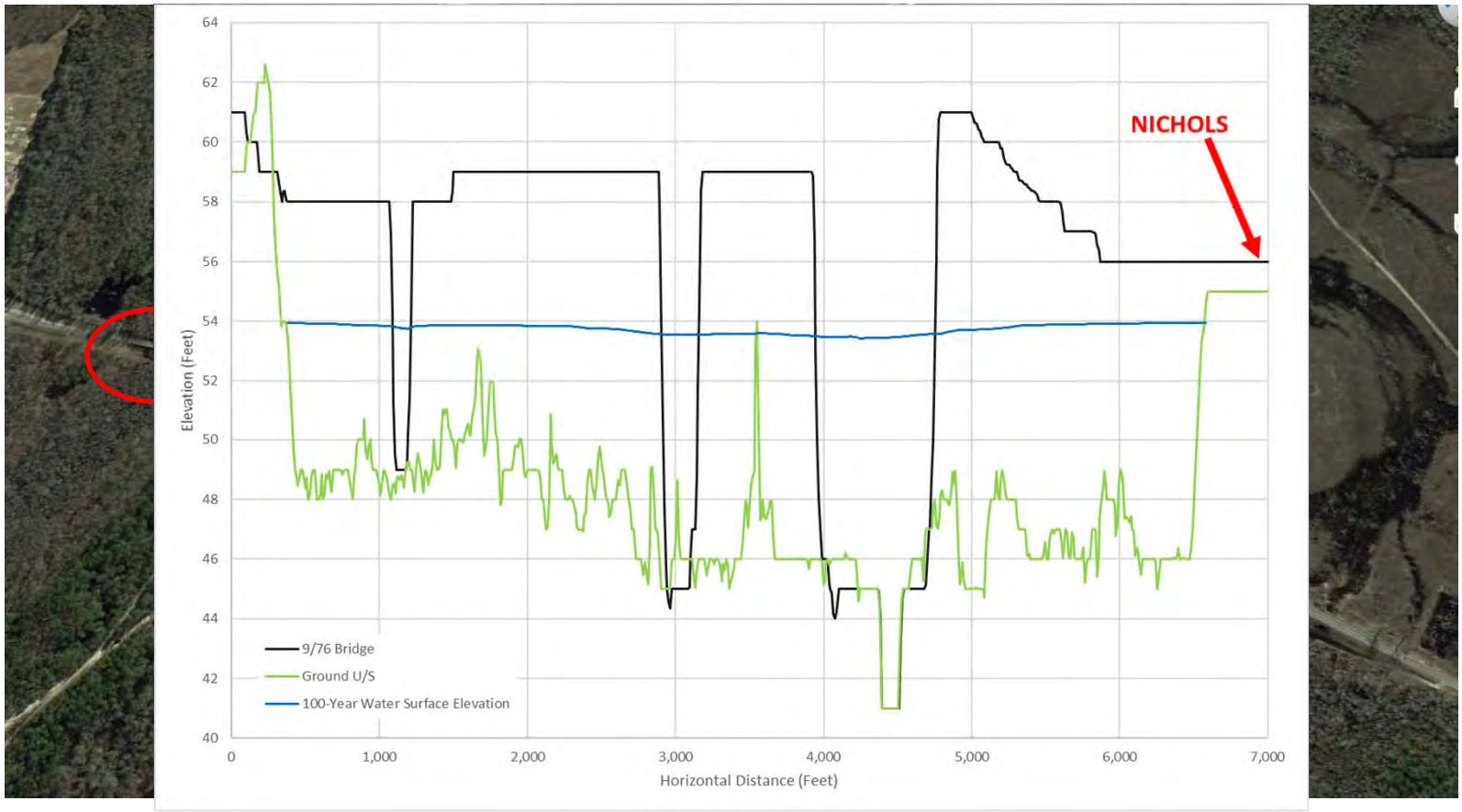
Historical Stream Gauge Data



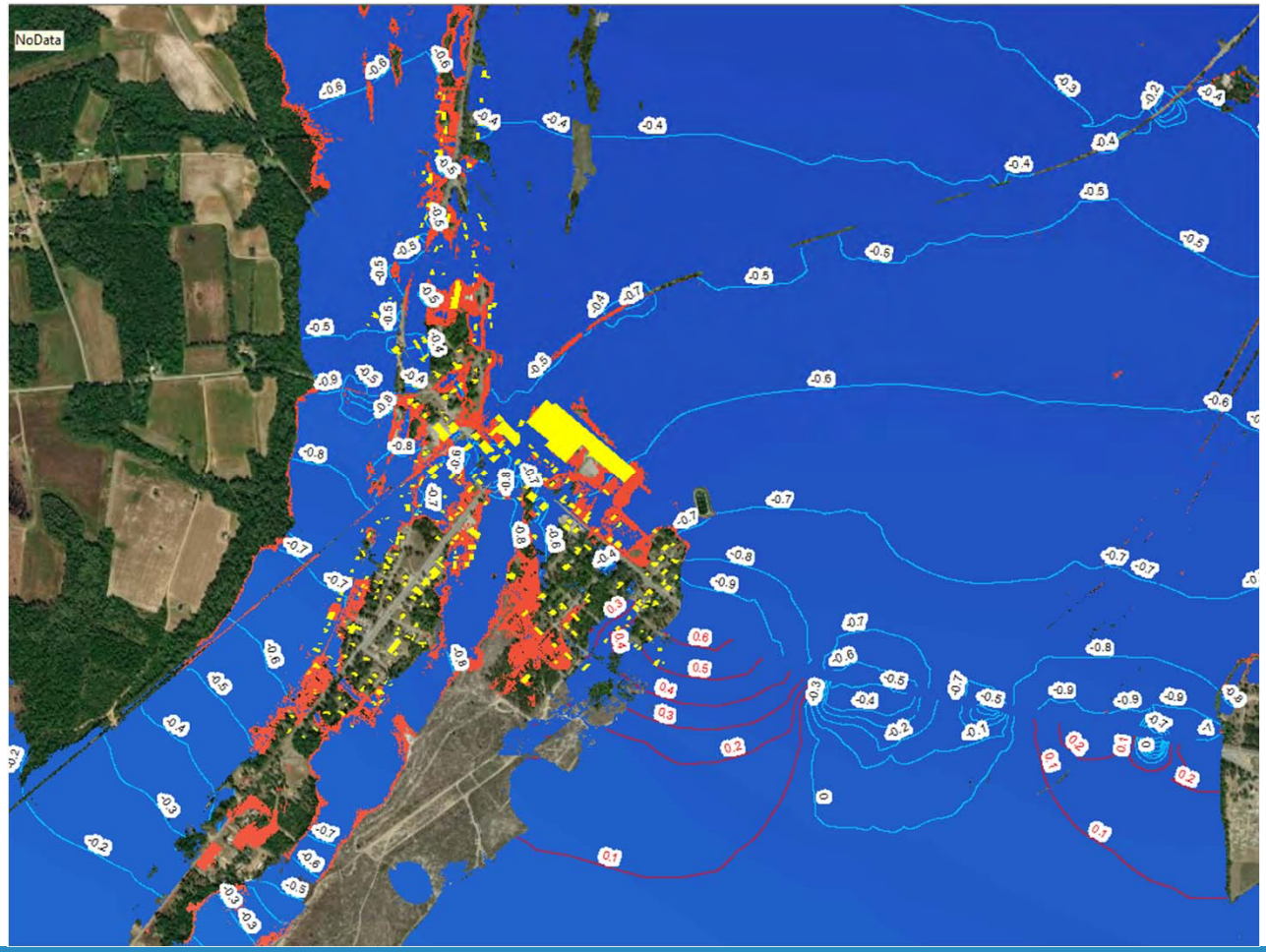
Possible Solutions

- Increase US-76 Bridge Opening
- Levee Protection
- Elevate Structures
- Relocation

Increase US-76 Bridge Opening

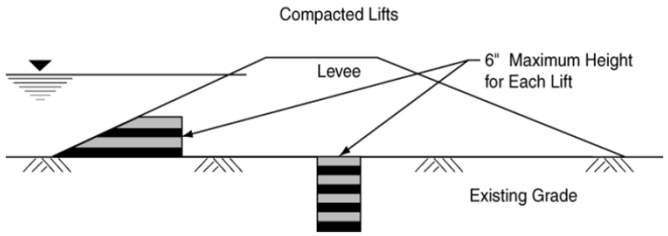


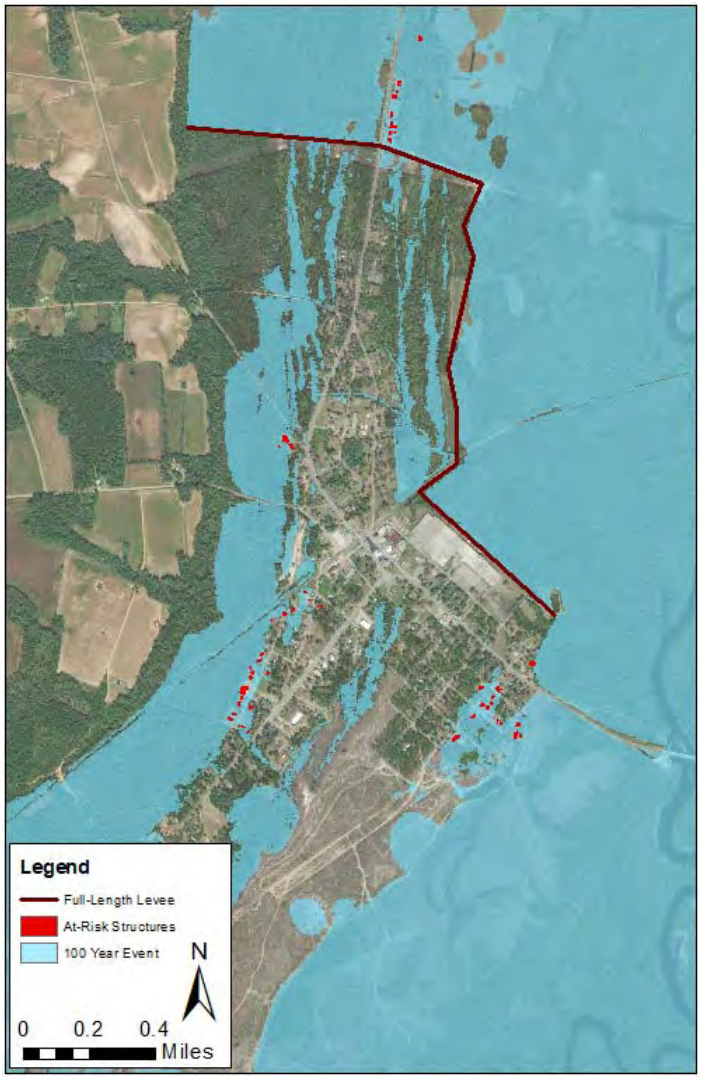
Increase US-76 Bridge Opening



Full-Length Levee

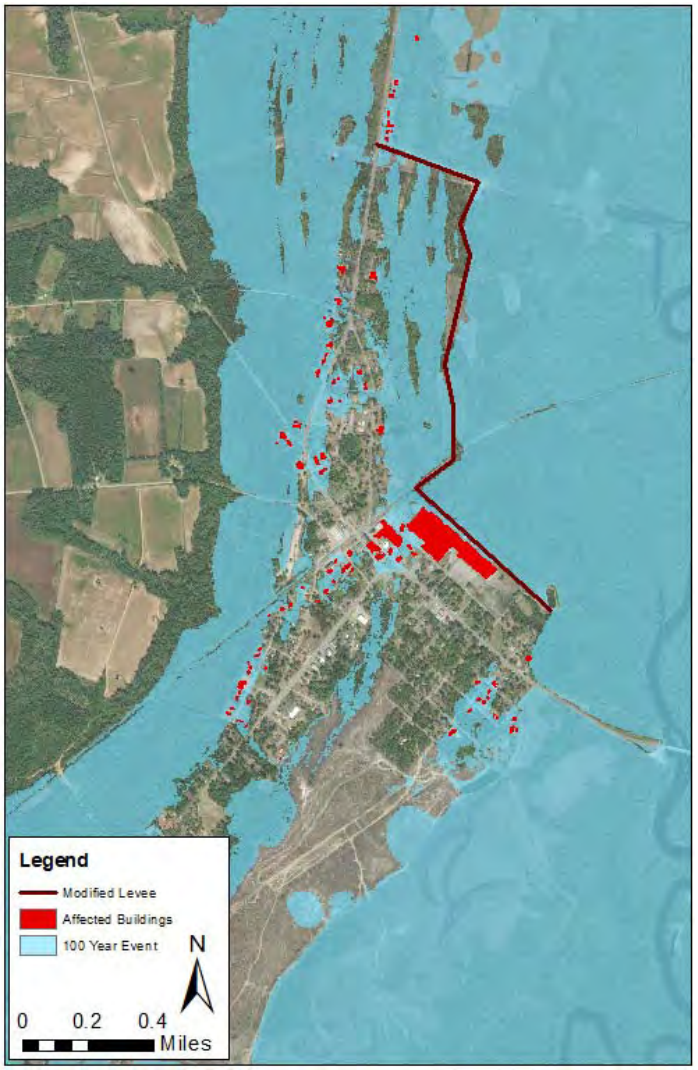
- Earthen Embankment to hold back floodwaters
- Due to topography, levee would be large (13,000 linear feet)
- Permanent structure





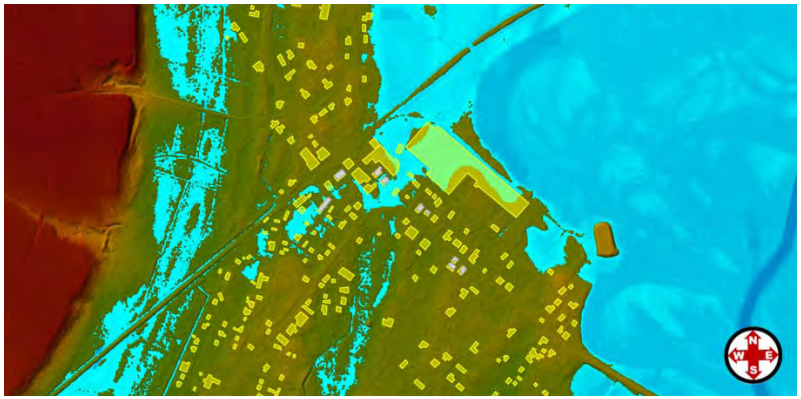
Modified Levee

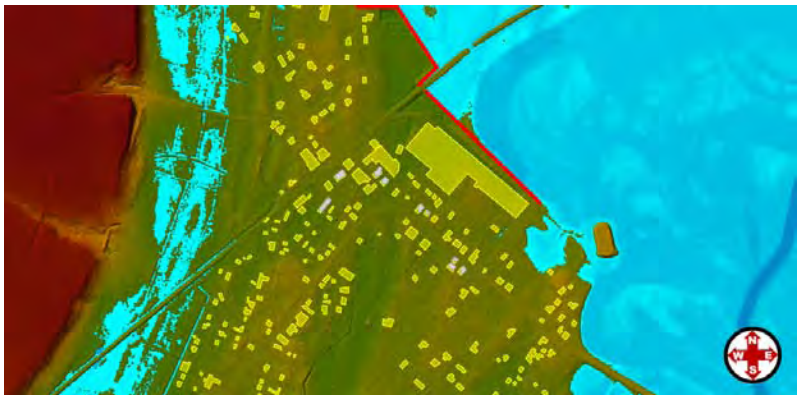
- Goal of similar protection at a lower cost
- Same path as full levee, with section west of SC-9 removed
  - Backflow preventer
- Reduced level of protection



Small-Scale Levee

- Attempt to provide some level of protection
- Focused on main intersection
- Would provide protection for the 25-year storm event
- Potential to work with warehouse owner



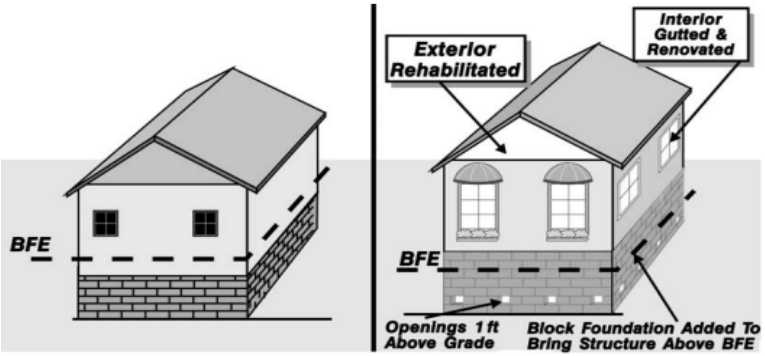


Manufactured Levee System

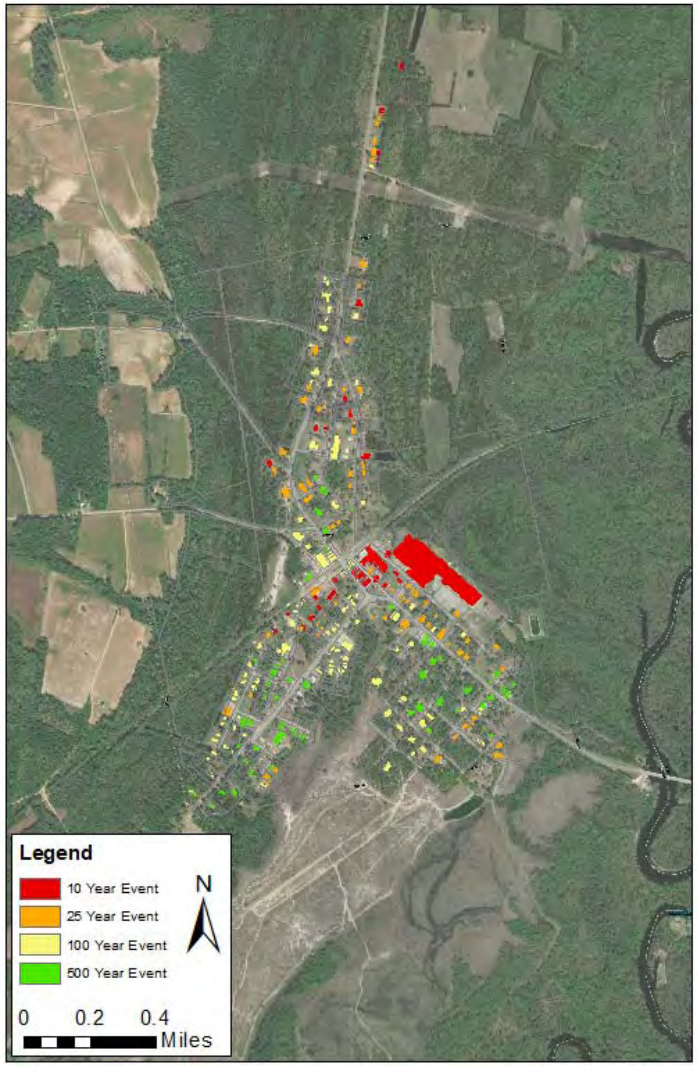
- Pre-fabricated systems
- Multiple options for different situations
- Would be used to protect critical buildings
- Concerns over storage space, clearing needed before installation, install

Elevation

- Elevate individual structures above the Base Flood Elevation
- Homes and businesses remain on the same land and the same footprint as existing conditions, with a higher finished floor elevation
- Currently underway for some homes
- Investigating options for downtown

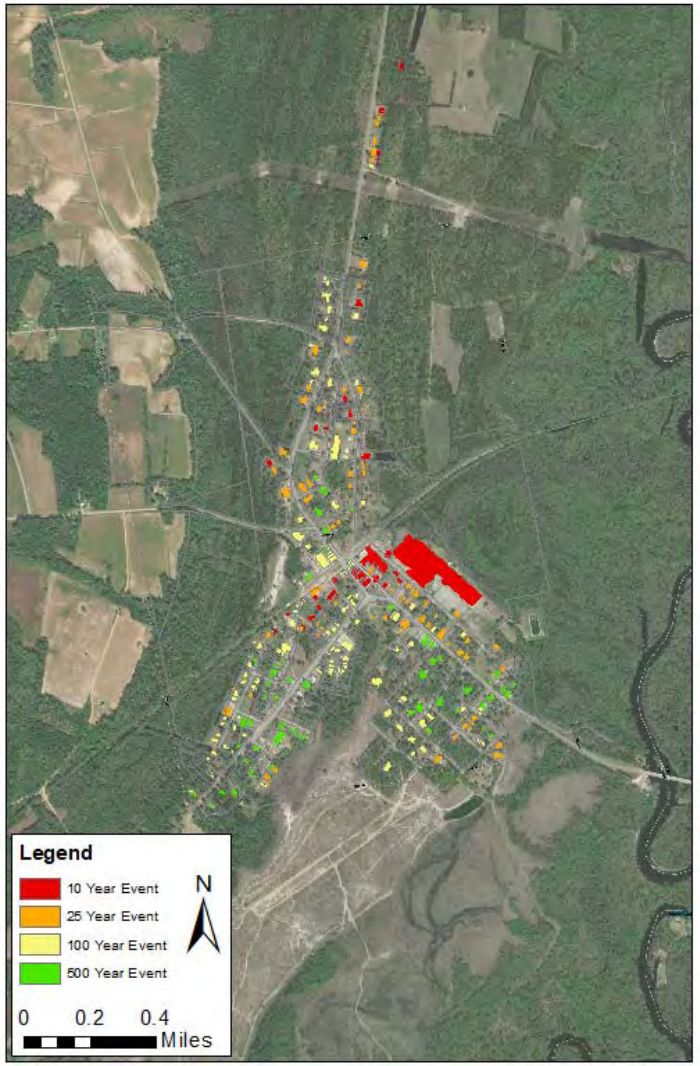


Source: FEMA NFIP Unit 8



Targeted Relocation

- Relocate the most at-risk structures to a safer area
- This could involve moving an entire structure or demolition and construction of a new structure in the safer area



Next Steps

- Develop a layered approach
- Seek additional elevation grants (HMGP)
- Continue working with SCDRO to obtain funding for flood reduction projects
- Work with Clemson to finalize their Community Planning Study
  - Rebranding
  - Ecotourism
- Monitor additional funding opportunities through HUD, FEMA, and others
- Maintain infrastructure and ditches

Ongoing efforts

QUESTIONS?

Thank you!

Crystal Muller, PE
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Woolpert, Inc.