

REPETITIVE LOSS AREA ANALYSIS

City of Greenville, North Carolina

Public Version

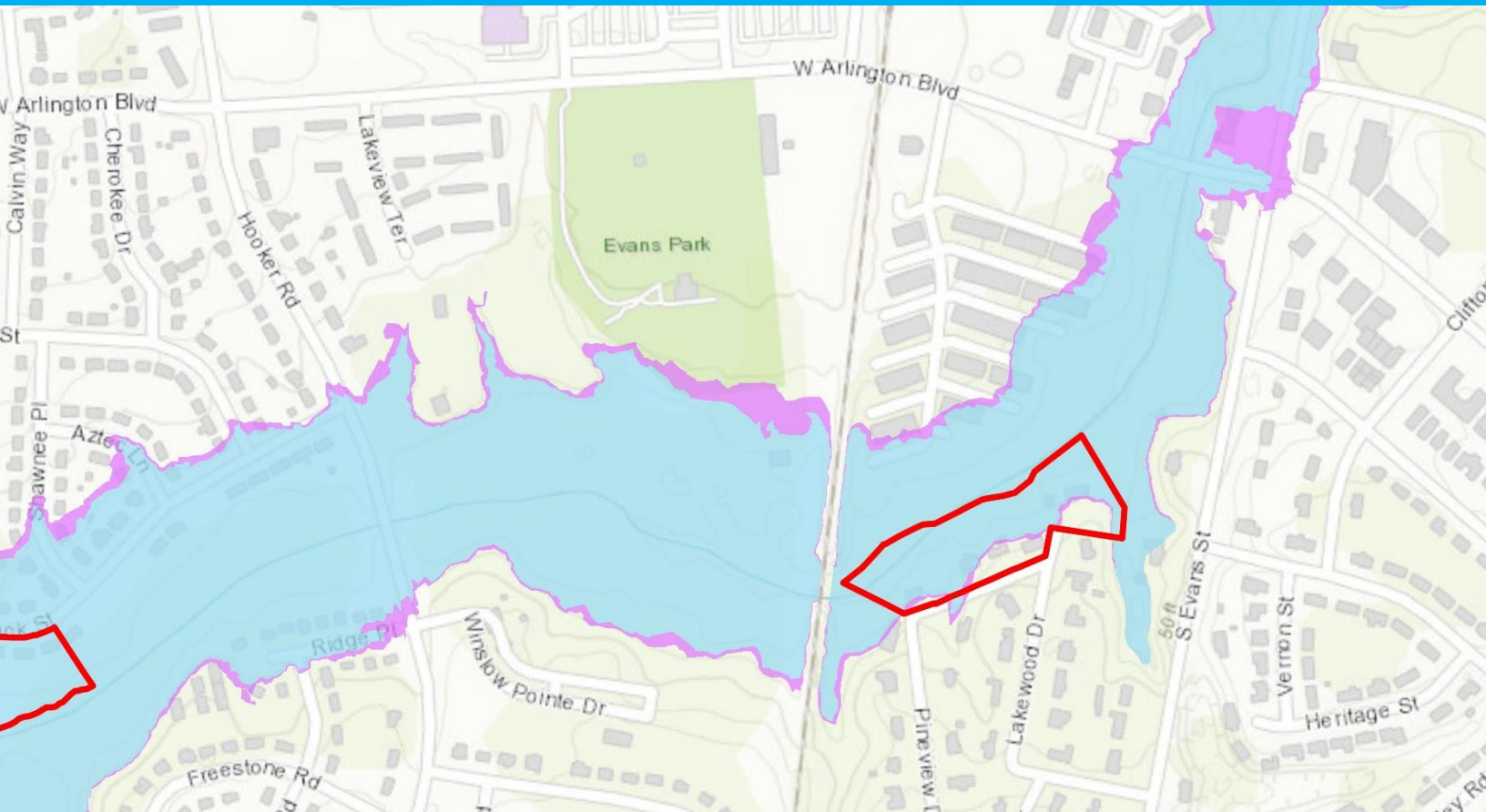


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1 Repetitive Loss Area Analysis

Background

Flooding is the most common natural hazard in the United States. More than 20,000 communities experience floods and this hazard accounts for more than 70 percent of all Presidential Disaster Declarations. In the United States, over 8 million residential and commercial structures are currently built in areas at risk to flooding. The cost of recovery is spread over local, state and federal governments and the victims themselves, who are directly affected by these disasters.



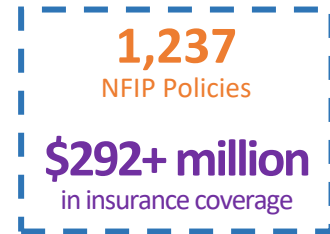
The National Flood Insurance Program (NFIP) is continually faced with the challenge of balancing the financial soundness of the program with the competing expectation of keeping premiums affordable. Repetitive loss properties are one of the two largest obstacles to achieving financial soundness of the NFIP. Since the inception of the NFIP, almost \$9 billion have been paid to repetitive loss properties, about one-fourth of all NFIP payments. While the NFIP has resulted in forty years of successful floodplain management, and many of these structures are no longer insured, repetitive loss properties are still a drain on the NFIP. Currently, repetitive loss properties represent 1.3% of all policies, but are expected to account for 15% to 20% of future losses.

Private insurance companies faced with high losses have several options to keep turning a profit. They can raise income through premium rate increases, decrease payments to insurers or reduce the exposure to the hazard. Unfortunately, the NFIP can only do what is allowed by statute. If losses increase, the Federal Emergency Management Agency (FEMA) is authorized by Congress to make incremental adjustments to increase the premium rates and reduce overall coverage. FEMA is not permitted to eliminate coverage for any policy holder including high-risk properties. Actuarial rates cannot be charged to buildings built before State and local floodplain management regulations went into effect. Since repetitive flood claims must be paid, FEMA has no choice but to spread these costs among all policyholders.

Sometimes floodplain management regulations mitigate repetitive flood losses when a building is substantially damaged. A structure where the cost to repair is equal to or exceeds 50 percent of the building's value is considered substantially damaged. A substantially damaged building must be brought up to the same flood protection level as a new building under a community's floodplain management ordinance. Many repetitive loss buildings are not in a regulated floodplain or they do not get substantially damaged and remain at risk to future damage.

Many owners of properties that experience repetitive flooding are not aware of the magnitude of damage they are exposed to because they either purchased the property after the last flood or the seller or lender did not disclose the flood hazard. Disclosure of repetitive flooding is a problem due to the fact that repetitive loss areas are not shown on Flood Insurance Rate Maps (FIRMs) but instead must be identified and mapped by local communities.

The City of Greenville (CID-370191) has been a regular participant in the NFIP since July 3, 1978. In addition to meeting the basic requirements of the NFIP, Greenville has completed additional floodplain management activities to participate in the Community Rating System (CRS) program, which rewards local communities with insurance premium discounts for taking actions to reduce flood risk and vulnerability. The City of Greenville is currently a CRS Class 7 which rewards all policyholders in the SFHA with a 15 percent reduction in their flood insurance premiums. Non-SFHA policies (Standard X Zone policies) receive a 5% discount, and preferred risk policies receive no discount. Greenville entered the CRS program on October 1, 1992.



As of June 27, 2019, there are 1,237 NFIP Policies in force in the City with insurance coverage of over \$292.5 million. The City has a total of 496 paid losses, which have resulted in a total payout of \$21,135,838.82. Included among these losses, there have been 196 substantial damage claims since 1978.

A repetitive loss property does not have to currently be carrying a flood insurance policy to be considered a repetitive loss property or a severe repetitive loss property. In some cases, a community will find that properties on its repetitive loss list are not currently insured. An insured property with two or more claims of \$1,000 or more will make it a repetitive loss property. Once it is designated as a repetitive loss property, that property remains as a repetitive loss property from owner to owner; insured policy to no policy; and even after that property has been mitigated with flood protection. However, the community does not need to address mitigated properties like other repetitive loss properties; they are provided for community planning purposes only. The City of Greenville has 17 repetitive loss properties, 5 of which have been mitigated. Of the remaining 12 unmitigated properties, two thirds are currently insured (see the Repetitive Loss Requirement Section).

TERMINOLOGY

REPETITIVE LOSS: Any insurable building for which two or more claims of more than \$1,000 were paid by the NFIP within any rolling 10-year period, since 1978. Two of the claims paid must be more than 10 days apart but, within 10 years of each other. A repetitive loss property may or may not be currently insured by the NFIP.

SEVERE REPETITIVE LOSS: As defined by the Flood Insurance Reform Act of 2004, SRLs are 1-4 family residences that have had four or more claims of more than \$5,000 or at least two claims that cumulatively exceed the building's value. The Act creates new funding mechanisms to help mitigate flood damage for these properties.

According to May 2018 repetitive loss data from FEMA, there are a total of 12 unmitigated and 5 mitigated repetitive loss properties within the City of Greenville. The 2017 CRS Coordinator's Manual states that any community with at least 1 but less than 50 repetitive loss properties—considered a "Category B Community"—must map repetitive loss areas, describe its repetitive loss problem, and undertake outreach to all addresses in the repetitive loss areas that have insurable buildings. In an effort to take greater responsibility for these repetitive loss properties and encourage mitigation, the City has opted to complete a Repetitive Loss Area Analysis (RLAA) using the 2017 CRS Coordinator's Manual. The RLAA will benefit the City by examining potential mitigation measures for specific repetitive loss areas and increasing its credit in the CRS Program.

Setting

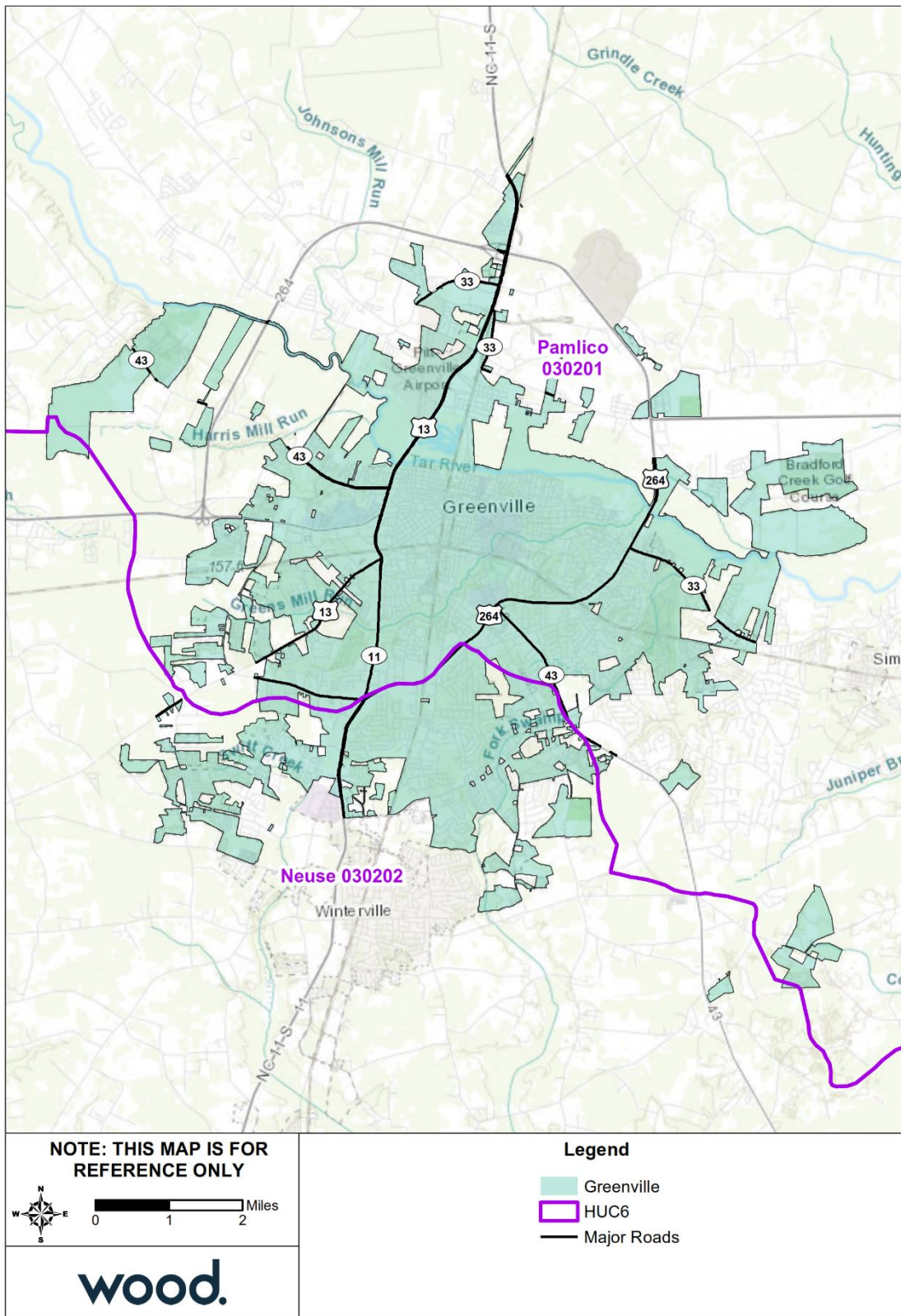
The City of Greenville is located in Pitt County in the Coastal Plain of eastern North Carolina. The City has a total land area of 34.6 square miles as well as 0.75 square miles of water area. The City straddles the Neuse River Basin and the Pamlico River Basin.

The City is served primarily by US Route 264, which runs east to west and bypasses the City around its northern edge. The Greenville SW Bypass extends US 264 around the southwest quadrant of the City. US 264 Alternate runs east-west through the City and connects to US 264 on the eastern side of the City. US Route 13 splits from US 264 Alternate in the southwest quadrant of the City and connects to the Pitt-Greenville Airport and further north to US Route 64.

As of 2018, according to the U.S. Census Bureau's Annual Population Estimates, the population was 93,137.

Figure 1.1 reflects the City of Greenville's location, showing major transportation routes and HUC-6 drainage basins.

Figure 1.1 – City of Greenville Location Map



Repetitive Loss Requirement

Repetitive loss data must be maintained and updated annually in order to participate in the CRS. Since a disproportionate number of losses under the NFIP come from repetitively flooded properties, addressing these properties is a priority for participating in the CRS Program. Depending on the severity of the repetitive loss problem, a CRS community has different responsibilities.

- **Category A:** A community with no unmitigated repetitive loss properties. No special requirements from the CRS.
- **Category B:** A community with at least one, but fewer than 50, unmitigated repetitive loss properties. Category B communities are required by the CRS to research and describe their repetitive loss problem, create a map showing the location of all repetitive loss properties (areas) and complete an annual outreach activity directed to repetitive loss properties.
- **Category C:** A community with 50 or more unmitigated repetitive loss properties. Category C communities are required to do everything in Category B and prepare either a floodplain management plan that covers all repetitive loss properties (areas) or prepare a RLAA for all repetitive loss areas.

As of the latest repetitive loss data obtained from FEMA from May 2018, the City of Greenville contains a total of 12 unmitigated repetitive loss properties, therefore the City is designated as a Category B repetitive loss community. All 12 repetitive loss properties are summarized in Table 1.1.

Table 1.1 – Summary of Unmitigated Repetitive Loss Properties

Flood Zone ¹	Insurance Coverage		Losses	Total Building Payment	Total Content Payment	Total Paid
	Insured	Uninsured				
AE	X		4	450,393.82	4,569.36	454,963.18
AE		X	4	74,505.64	0.00	74,505.64
A06		X	3	20,276.26	0.00	20,276.26
A	X		3	26,075.43	104.78	26,180.21
AE	X		3	60,381.75	3,262.72	63,644.47
X		X	2	20,449.91	1,806.65	22,256.56
C	X		2	30,266.72	0.00	30,266.72
X	X		2	53,274.49	2,032.27	55,306.76
AE	X		2	14,203.74	0.00	14,203.74
AE	X		2	16,424.65	10,000.00	26,424.65
X		X	2	15,630.28	0.00	15,630.28
A07	X		2	103,087.37	0.00	103,087.37
Total	8	4	31	\$884,970.06	\$21,775.78	\$906,745.84

Source: NFIP Repetitive Loss Data, May 2018

¹Flood Zone is based on FIRM when most recent loss occurred. These zones do not reflect the current Effective FIRM zone for each property.

Mapping Repetitive Loss Areas

There were nine Repetitive Loss Areas identified within the City of Greenville in accordance with the principles outlined in the CRS guidance titled *Mapping Repetitive Loss Areas* dated August 15, 2008. These Repetitive Loss Areas include the 12 unmitigated repetitive loss properties as well as historic claims properties (those with one paid claim against the NFIP), plus additional surrounding properties that have the same or similar flood conditions but have not had any claims paid against the NFIP. A total of 48 properties were included within the RLAA.

For reporting purposes, the Repetitive Loss Areas were broken into two subareas based on the type of flooding they typically experience. Subarea 1 contains repetitive loss areas prone to overbank flooding from rivers and streams, and Subarea 2 contains repetitive loss areas prone to localized/stormwater flooding. The subareas and repetitive loss areas within these general flooding areas are summarized below.

Subarea 1: Overbank Flooding

- Pamlico River Basin: Areas 1 – 3, Area 9
- Neuse River Basin: Areas 5 – 7

Subarea 2: Localized/Stormwater Flooding

- Area 4, Area 8

A detailed map of each Repetitive Loss Area is provided in Section 2. An overview map of the City of Greenville Repetitive Loss Areas, showing subareas and FEMA floodplains, is provided in Figure 1.2 on the following page. Areas 4, 6 and 8 are located entirely outside the SFHA; however, area 6 is located just outside of a studied area along Gum Swamp creek.

This Repetitive Loss Area Analysis (RLAA) covers all repetitive loss properties across all repetitive loss areas of the City of Greenville.

Figure 1.2 – City of Greenville Repetitive Loss Areas and FEMA Floodplains



2 The RLAA Process

The RLAA planning process incorporated requirements from Section 510 of the 2017 *CRS Coordinator's Manual*. The planning process also incorporated requirements from the following guidance documents: 1) FEMA publication *Reducing Damage from Localized Flooding: A Guide for Communities*, Part III Chapter 7; 2) CRS publication *Mapping Repetitive Loss Areas* dated August 15, 2008; and 3) Center for Hazards Assessment Response and Technology, University of New Orleans draft publication *The Guidebook to Conducting Repetitive Loss Area Analyses*. Most specifically, this RLAA included all five planning steps included in the 2013 *CRS Coordinator's Manual*:

- Step 1:** Advise all the properties in the repetitive loss areas that the analysis will be conducted and request their input on the hazard and recommended actions.
- Step 2:** Contact agencies or organizations that may have plans or studies that could affect the cause or impacts of the flooding. The agencies and organizations must be identified in the analysis report.
- Step 3:** Visit each building in the repetitive loss area and collect basic data.
- Step 4:** Review alternative approaches and determine whether any property protection measures or drainage improvements are feasible.
- Step 5** Document the findings. A separate analysis report must be prepared for each area.

Beyond the 5 planning steps, additional credit criteria must be met:

1. The community must have at least one repetitive loss area delineated in accordance with the criteria in Section 503.
2. The repetitive loss area must be mapped as described in Section 503.a. A Category "C" community must prepare analyses for all of its repetitive loss areas if it wants to use RLAA to meet its repetitive loss planning prerequisite.
3. The repetitive loss area analysis report(s) must be submitted to the community's governing body and made available to the media and the public. The complete repetitive loss area analysis report(s) must be adopted by the community's governing body or by an office that has been delegated approval authority by the community's governing body.
4. The community must prepare an annual progress report for its area analysis.
5. The community must update its repetitive loss area analyses in time for each CRS cycle verification visit.

STEP 1. Advise All Property Owners

Before field work began on the RLAA, individual letters were mailed to property owners within the nine identified Repetitive Loss Areas. Figure 2.1 on the following page shows an example of the property owner notification letter. Letters were mailed to all properties within each area, including repetitive loss properties, historical claims properties (those with one paid claim against the NFIP), and additional properties with similar flooding conditions but which have no claims paid against the NFIP. In total, 48 notification letters were mailed to property owners. The letters were sent out on February 4, 2020. Copies of all mailed letters are maintained on file with the City of Greenville Engineering Department. In accordance with the Privacy Act of 1974, the letters will not be shared with the general public.


Mailed Questionnaire

A property owner questionnaire was included with each letter mailed to building owners. The questionnaire asks about the type of foundation and if the building has a basement, if the building has experienced any flooding and the type of flooding, cause of flooding, flood protection measures and whether the owner has flood insurance. The Flood Protection Questionnaire is shown in Figures 2.2 and 2.3 on the following pages.

Website Announcement

The completed report will be made available for review on the City's website. This gives property owners an opportunity to review the general findings of the analysis and provide feedback to the City to further improve the City's and property owner's knowledge of flood issues.

Figure 2.1 – Example RLAA Property Notification Letter



Greenville
NORTH CAROLINA
Find yourself in good company®

[DATE]

[NAME]
[ADDRESS]
Greenville, NC

Property Address: XXXXXX **Parcel Number: XXXXXXXXX**

Dear Property Owner or Resident:

As part of the City of Greenville’s participation in the National Flood Insurance Program’s (NFIP) Community Rating System (CRS), the Engineering Department is evaluating properties that have experienced repetitive flood damage. This analysis will include the review of all previous flood data and studies conducted in these locations.

The repetitive loss analysis involves the collection of the following property level data elements:

- Building permit records (including application and associated records)
- Structure and site elevation information (elevation certificate if available)
- Tax ID and lot and parcel number
- Building property value on record (assessed value, replacement value or both)
- Land property value on record
- Building codes/floodplain development regulations exceeding minimum standards
- Historical flood event information (when events occurred, amount of damage to property, etc.)

In addition, the City of Greenville and its contractor will visit each property to survey the flood risk and to take photographs. Property owners are encouraged to provide any relevant flooding information. The survey crews will be looking at the type and condition of the foundation, drainage patterns on the lot and whether outside mechanical equipment is elevated.


The results of the repetitive loss area analysis will include a review of alternative approaches for property protection measures or drainage improvements where feasible. Once the analysis is complete, a copy of the report can be obtained from the Engineering Department or by calling (252) 329-4350.

You can help us perform this analysis by **completing this questionnaire and returning to me at City of Greenville Engineering Department, 1500 Beatty Street, Greenville, NC 27834**. If you have any questions, please call me at (252) 329-4350.

Sincerely,

Daryl Norris, P.E., CFM, CPSWQ
Engineering Department
City of Greenville

Figure 2.2 – RLAA Survey, Page 1



CITY OF GREENVILLE

FLOOD PROTECTION QUESTIONNAIRE

Name: _____

Property Address: _____

1. How many years have you occupied the building at this address?
- | | |
|--------------------------------------|-------------------------------------|
| <input type="checkbox"/> Less than 1 | <input type="checkbox"/> 5-10 years |
| <input type="checkbox"/> 1-5 years | <input type="checkbox"/> 10+ years |

2. Do you rent or own this building?
- Rent
 Own

3. What type of foundation does the building have?
- | | |
|--------------------------------------|---------------------------------------|
| <input type="checkbox"/> Slab | <input type="checkbox"/> Basement |
| <input type="checkbox"/> Crawl Space | <input type="checkbox"/> Other: _____ |

4. Have you ever encountered flooded roads in or near your neighborhood? If yes, where?
- Yes: _____
 No

5. Has your building or property ever been flooded or had a water problem?
- Yes No – if no, skip to question 12.

6. In what year(s) did the building or property flood? _____

7. Where did you get water and how deep did it get?
- | | |
|--|---|
| <input type="checkbox"/> In basement; Depth: _____ | <input type="checkbox"/> Over 1 st floor; Depth: _____ |
| <input type="checkbox"/> In crawl space; Depth: _____ | <input type="checkbox"/> In yard; Depth: _____ |
| <input type="checkbox"/> Water was kept out of building by sandbagging, sewer valve, or other protective measure | |

8. What was the longest time that water stayed in the building or on the property? _____

9. What do you feel was the cause of your flooding? Check all that affect your building or property.
- | | |
|---|---|
| <input type="checkbox"/> Storm sewer backup | <input type="checkbox"/> Flooding from ditch/creek/river: |
| <input type="checkbox"/> Sanitary sewer backup | _____ |
| <input type="checkbox"/> Standing water next to house/building | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Drainage from nearby properties | _____ |
| <input type="checkbox"/> Saturated ground / leaks in basement walls | |

10. Have you taken any of these flood protection actions on the property?

	Yes	No		Yes	No
Installed sump pump	<input type="checkbox"/>	<input type="checkbox"/>	Installed backup power system / generator	<input type="checkbox"/>	<input type="checkbox"/>
Waterproofed the outside wall	<input type="checkbox"/>	<input type="checkbox"/>	Sandbagged	<input type="checkbox"/>	<input type="checkbox"/>
Re-graded yard to keep water away	<input type="checkbox"/>	<input type="checkbox"/>	Other:	<input type="checkbox"/>	<input type="checkbox"/>
Moved things out of basement	<input type="checkbox"/>	<input type="checkbox"/>			

Figure 2.3 – RLAA Survey, Page 2

 **FLOOD PROTECTION QUESTIONNAIRE**
(CONTINUED)

11. Which flood protection measures (checked in question 10) worked?

12. Is this building located in a FEMA floodplain?

- Yes
- No
- I don't know

13. Do you have flood insurance for this building?

- Yes
- No
- I don't know

14. Please include any additional information and comments you may have about flooding on this property or the surrounding area:

For more information on flood protection measures for your buildings or property, please contact Daryl Norris, info below.

Please help us by completing this survey by **March 6, 2020** and returning it to:

Daryl Norris, Civil Engineer III
Engineering Department
1500 Beatty Street
Greenville, NC 27834
(252) 329-4350

Surveys can also be emailed to DNorris@greenvillenc.gov

Of the 48 mailed notification letters and questionnaires, the City of Greenville received 3 responses which corresponds to a response rate of approximately 6 percent. The questionnaire responses are summarized below. Note: Respondents may have skipped questions and/or provided more than one response to a question.

Q1: How many years have you occupied the building at this address?

Answer Choices	Percentage	Number Responding
Less than 1	0.0%	0
1-5	0.0%	0
5-10	0.0%	0
10+	100.0%	3
Total		3

Q2: Do you rent or own this building?

Answer Choices	Percentage	Number Responding
Rent	0.0%	0
Own	100.0%	3
Total		3

Q3: What type of foundation does the building have?

Answer Choices	Percentage	Number Responding
Slab	0.0%	0
Crawl Space	75.0%	3
Basement	0.0%	0
Other	25.0%	1
Total		4

Other:

- Pit in crawl space that holds sump pump

Q4: Have you ever encountered flooded roads in or near your neighborhood?

Answer Choices	Percentage	Number Responding
Yes	100.0%	3
No	0.0%	0
Total		3

If yes, where?

- Millbrook St., Memorial Dr., and Hooker Rd.
- Millbrook St.
- Pineview Dr.

Q5: Has your building or property ever been flooded or had a water problem?

Answer Choices	Percentage	Number Responding
Yes	100.0%	3
No	0.0%	0
Total		3

Q6: In what year(s) did the building or property flood?

- Every year since year 2000
- Hurricane Floyd in 1999 and Hurricane Matthew
- 1999, 2011, and 2016

Q7: Where did you get water and how deep did it get?

Answer Choices	Flood Depths	Percentage	Number Responding
In basement		0.0%	0
In crawl space	12'	37.5%	3
Over 1 st floor	8"	25.0%	2
In yard	12'	37.5%	3
Water was kept out of house by sandbagging, sewer valve, or other protective measure		0.0%	0
Total			8

Q8: What was the longest time that water stayed in the building or on the property?

- A couple of days in the crawl space
- Several hours – unsure because we evacuated

Q9: What do you feel was the cause of your flooding? Check all that affect your building or property.

	Percentage	Number Responding
Storm sewer backup	25.0%	2
Sanitary sewer backup	0.0%	0
Standing water next to house/building	0.0%	0
Drainage from nearby properties	12.5%	1
Saturated ground / leaks in basement walls	25.0%	2
Flooding from ditch/creek/river: _____	25.0%	2
Other	12.5%	1
Total		8

Ditch/creek/river flood source:

- Green Mill Run, Tar River

Other:

- Inappropriate allowance of nearby buildings allowed in the floodplain

Q10: Have you taken any of these flood protection actions on the property?

Answer Choices	Percentage "Yes"	Number Responding "Yes"
Installed sump pump	33.3%	2
Waterproofed the outside walls	0.0%	0
Re-graded yard to keep water away	16.7%	1
Moved things out of basement	16.7%	1
Installed backup power system / generator	0.0%	0
Sandbagged	0.0%	0
Other	16.7%	1
None	16.7%	1
Total		6

Other:

- Kept storm drains clear

Q11: Which flood protection measures (checked in question 10) worked?

- Pump: used in extracting water from crawl space
- None

Q12: Is your home located in a Federal Emergency Management Agency (FEMA) floodplain?

Answer Choices	Percentage	Number Responding
Yes	66.7%	2
No	0.0%	0
I don't know	33.3%	1
Total		3

Q13: Do you have flood insurance?

Answer Choices	Percentage	Number Responding
Yes	66.7%	2
No	33.3%	1
I don't know	0.0%	0
Total		3

Q14: Please include any additional information and comments you may have about flooding in your area:

- Needs upgrades to property due to flooding
- I am hoping with this new installation of the drainpipe it may not be as bad
- I am curious to why FEMA hasn't offered a buyout since over the years I have received over \$50,000 worth of damages. After Hurricane Floyd, our neighborhood met with city planners. We were told that flooding would never occur again like it did during Floyd. Not so in Lakewood Pines.

The following trends in survey responses should be considered when evaluating mitigation measures:

- One third of respondents did not know whether their property was in a FEMA floodplain.
- All respondents reported having experienced flooding.
- One respondent considered recently built buildings in the floodplain to be the cause of their flooding.
- One third of respondents haven't taken any flood protection actions on their property.
- Two thirds of respondents have flood insurance. Considering that all respondents have had multiple flooding incidents, property owners should be encouraged to purchase flood insurance.
- All responses received were from property owners. It is unclear how responses and trends may vary for renters.

STEP 2. Contact Agencies and Organizations

The City of Greenville contacted external agencies and internal departments and reviewed plans or studies that could affect the cause or impacts of flooding within the identified repetitive loss areas. The data collected was used to analyze the problems further and to help identify potential solutions and mitigation measures for property owners. Those reports which were analyzed and reviewed included:

- FEMA Flood Insurance Study, Pitt County, Revised July 7, 2014
- FEMA/ISO – Repetitive Loss and Flood Insurance Data
- FEMA Community Information System Data
- City of Greenville Horizons 2026 Community Plan, Updated August 2016
- City of Greenville Code of Ordinances, Updated April 2019
 - *Flood Damage Prevention*
 - *Zoning Regulations*
 - *Subdivision Regulations*
- City of Greenville Capital Improvements Program, FY 2015 through FY 2019
- City of Greenville Stormwater Master Plans, October 2013 through August 2016
- Pitt County 2030 Comprehensive Land Use Plan
 - *Adopted 2030 Land Use Plan Map*
- Neuse River Basin Regional Hazard Mitigation Plan, June 2015

Summary of Studies and Reports

FEMA Flood Insurance Study, Revised July 7, 2014

FEMA's Effective FIS for Pitt County, NC, including the City of Greenville, was revised July 7, 2014. The FIS also includes revised Flood Insurance Rate Maps (FIRMs) released on the same date.

Flood Insurance Claims Data

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of flood insurance policy and claims data to the public. This information can only be released to state and local governments for the use in floodplain management related activities. Therefore, all claims data in this report are only discussed in general terms. This data was gathered from both FEMA/ISO and through the FEMA Community Information System.

City of Greenville Horizons 2026 Community Plan, updated August 2016

The Horizons 2026 Greenville Community Plan is the City's framework for growth and development. The plan addresses future land use, housing, transportation, infrastructure, sustainability, conservation, recreation and open space, and capital improvement. For each section addressed, the plan identifies specific goals, policies, and actions to implement. Floodplain protection and flooding is addressed in the fostering a resilient city element. Specifically, the plan calls for low impact development, a better rating in the Community Rating System, protecting stream buffers and wetlands, and limiting development in the 100-year floodplain.

City of Greenville Flood Damage Prevention Ordinance, updated April 2019

The City of Greenville Flood Damage Prevention ordinance explains the impacts of a flood and the hazard associated. This code prohibits uses which could increase the hazard or endanger health, safety, and life. Specific standards include requiring that the lowest level of new construction must be floodproofed.

City of Greenville Zoning and Subdivision Ordinances, updated April 2019

The City of Greenville Zoning and Subdivision Ordinances stipulate where and how development can occur in the City. These ordinances outline the zoning use districts and purposes and establishes requirements for new development. They do not specifically address flooding but are an important regulatory tool through which flood protection can occur in conjunction with the Comprehensive Plan and the Flood Damage Prevention ordinance.

City of Greenville Capital Improvements Program, 2015-2019

The Capital Improvement 5-Year Plan for 2015-2019 identifies and budgets for three drainage improvement projects. Two projects were budgeted through 2015 and one was budgeted through 2016. Funding sources for drainage improvements will not change operations and maintenance personnel. Planned and budgeted projects include storm drainage emergency repairs, major maintenance improvements in locations such as on Haw Drive, and minor improvements in locations such as the Bloomsbury Road Culvert.

City of Greenville Stormwater Master Plans, 2013-2016

The City of Greenville utilizes a Master Plan for each of the seven watersheds within the City. One was completed in October 2013 and the remaining six were completed in July or August of 2016. These watersheds are Johnson Mill/Parkers Creek, Hardee Creek, Meetinghouse Branch, Fork Swamp, Swift Creek, Greens Mill Run, and Schoolhouse Branch/Harris Mill Run. These plans assess hydrologic and hydraulic conditions of the City, assist with maintenance activities, and aid in quality assurance of development efforts.

Pitt County 2030 Comprehensive Land Use Plan, updated December 2011

The Pitt County Comprehensive Land Use Plan sets goals, objectives, and policies for the development and conservation of land and natural resources over the following 20 years. The 2030 Land Use Map illustrates the general land use categories planned throughout the County and shows the expected expansion of the County's extraterritorial jurisdiction (ETJ).

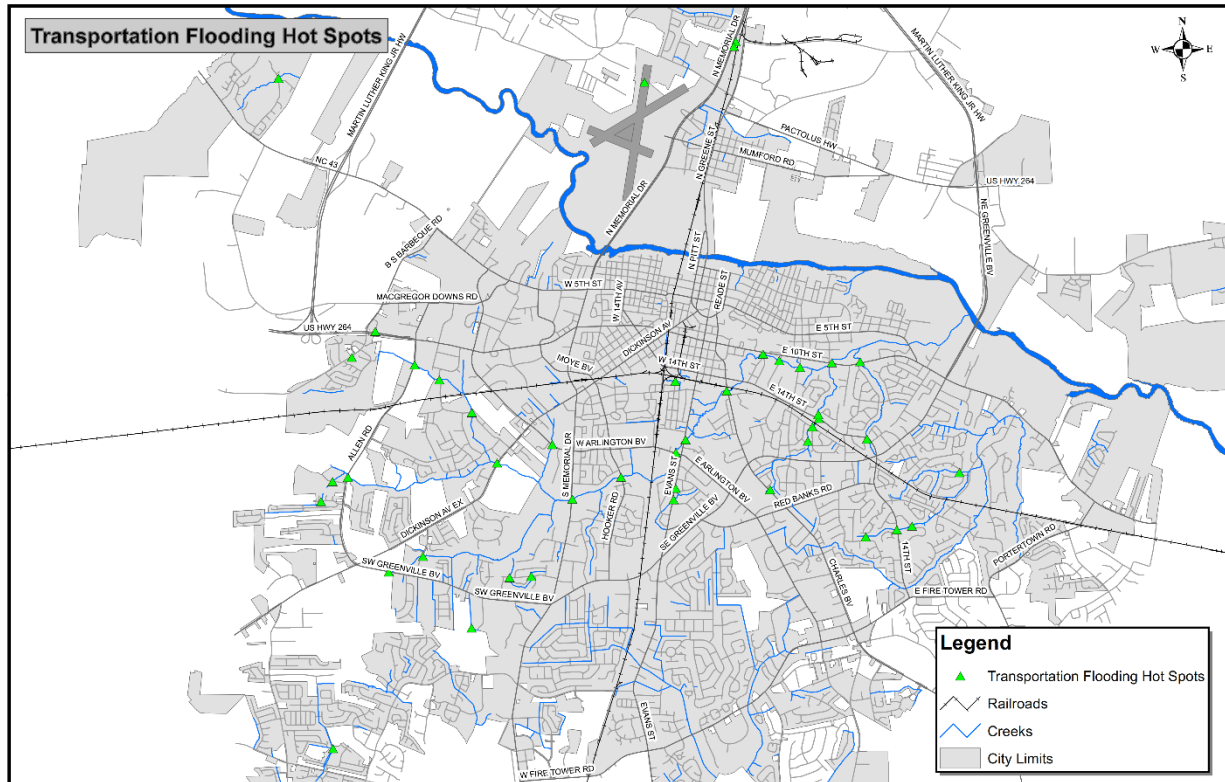
Neuse River Basin Regional Hazard Mitigation Plan, June 2015

The Neuse River Basin Regional Hazard Mitigation Plan (HMP) is a multi-hazard mitigation plan for five counties in eastern North Carolina including Pitt County. The plan devotes a chapter to flooding, the NFIP, and the CRS, which assesses the flood hazard risk and vulnerability throughout the counties and identifies mitigation projects that have been and/or can be implemented.

City of Greenville Transportation Flooding Map

The City of Greenville has mapped the location of known problem flooding hot spots linked to transportation infrastructure, including roads and inadequately sized culverts. These hot spot locations are shown in Figure 2.4 on the following page. It should be noted that several of the City's Repetitive Loss Areas, including Areas 1, 2, 3, and 9, correspond with known transportation flooding hot spots and therefore may be mitigated by capital improvement projects to improve drainage.

Figure 2.4 – Transportation Flooding Hot Spots



STEP 3. Building Data Collection

The on-site field survey for this analysis was conducted on February 11, 2020. The National Tool Limited View was not utilized in this effort, but most of the information required by the National Tool was incorporated into a mobile application survey. The data collection forms generated by the mobile application are included in Appendix A. (Note: In accordance with the Privacy Act of 1974, Appendix A will not be shared with the general public).

In addition, multiple site photos were taken of each structure on the property. Photos were also taken of current drainage features and mitigation and floodproofing measures if evident from street or parking lot views. The following information was recorded for each property:

- Existing mitigation observed
- Type and condition of the structure and foundation
- Number of stories
- Height above street grade and height above site grade
- Presence and type of appurtenant structures
- Likely areas and severity of damage on property
- Presence of any HVAC units that would be vulnerable

Data was also gathered, when possible, through conversations with property owners and/or residents. These conversations provided detail on the extent of flooding, potential causes of flooding, and recollections from past flood events, which help to better understand flooding issues for these areas.

Data was also incorporated from off-site research, including a review of FEMA Flood Insurance Rate Maps and the location of the Repetitive Loss Areas in relation to FEMA flood zones.

Table 2.1 details the percentage of each repetitive loss area that falls within the 100-year, 500-year or Unshaded Zone X flood zone.

Table 2.1 – Repetitive Loss Area Percentage by Flood Zone

Repetitive Loss Area	Percentage of Area			
	Zone AE 100-yr	Zone AE Floodway	Zone X Shaded 500-yr	Zone X Unshaded
1	37.5%	30.9%	22.0%	9.7%
2	52.9%	47.3%	0.0%	0.0%
3	46.7%	29.9%	4.6%	18.9%
4	0.0%	0.0%	0.0%	100.0%
5	63.0%	29.3%	7.4%	0.0%
6	0.0%	0.0%	0.0%	100.0%
7	86.7%	0.0%	0.0%	13.3%
8	0.0%	0.0%	0.0%	100.0%
9	30.0%	70.0%	0.0%	0.0%

Source: FEMA Effective DFIRM, NCFRIS

Subarea 1: Areas of Overbank Flooding

Problem Statement:

Of the nine identified Repetitive Loss Areas in the City of Greenville, seven are in areas vulnerable primarily to overbank flooding from nearby drainage features. These Areas include locations along Greens Mill Run, Gum Swamp, and Fork Swamp. These areas are all located within the 100-year floodplain. In the detailed summary that follows, these Areas are divided into those located in the Pamlico River Basin and those located in the Neuse River Basin.

The primary flood source in these areas is overbank flooding, resulting from prolonged rains that oversaturate the soil and eventually overwhelm the capacity of the drainage system. Many losses have occurred in these areas as a result of hurricanes and tropical storms, including Hurricane Fran in 1996, Hurricane Bonnie in 1998, Hurricane Floyd in 1999, Tropical Storm Charley in 2004, and Hurricane Irene in 2011 resulted in flood insurance claims. The last hurricane or tropical storm to have a major flooding impact on the City of Greenville was Hurricane Matthew in 2016. Flooding from Hurricane Matthew produced nine of the claims on the repetitive loss list.

Tidal influences can also impact flash flooding in Greenville when heavy rains fall during a high tide, which can prevent the Tar River and Neuse River from draining as quickly to the Pamlico Sound.

Additionally, these areas are also likely subject to periodic flash flooding from heavy rains and localized stormwater flooding. Flash flooding can occur if conveyance is obstructed by debris, sediment, and other materials that limit the volume of drainage.

The approach to reducing repetitive flooding in these areas will require a combination of floodproofing techniques, drainage improvement projects, and education.

The following pages contain detailed summaries of each repetitive loss area within Subarea 1. These summaries are broken down by river basin as follows:

- Pamlico River Basin: Areas 1 – 3, Area 9
- Neuse River Basin: Areas 5 – 7

Pamlico River Basin

Repetitive Loss Area 1 is almost 70% in the 100-yr floodplain. The properties back up to Greens Mill Run. This area is mainly multi-family residential, but two buildings are commercial. Most structures are on no fill and are at grade with one elevated 2-3 feet above grade and two below grade. The structures in this area have slab-on-grade foundations except for one building with crawl space and one with a basement. All buildings in Area 1 were built between 1953 and 1993; all but one building were built prior to the community's first FIRM, dated 1978. During field survey of the area, it was noted that most buildings had living units below grade or below street grade and have a creek in the rear of the properties. One building had a retaining wall but a water mark was still visible above basement apartments. One HVAC unit was not visible during field survey; however, one was seen with some elevation, one structure had a window air conditioning unit, one was elevated above the first floor, and two were not elevated. This area contains two parcels that were found to be vacant parking lots. No residents from this area completed the flood protection questionnaire.

Repetitive Loss Area 2 is located completely within the 100-yr floodplain. This area is single-family residential with crawl space foundations and wood frame construction. All six homes are built on no fill, with three elevated between 2-3 feet above grade, two elevated between 3-4 feet above grade, and one elevated between 4-6 feet above grade. All six structures were built in 1974 and 1975. Only two HVAC units were visible during field survey, and they were not elevated. Three properties had drainage inlets in front of them, with one in the property's driveway. Three of the properties had no guttering. Two residents of this area completed a flood protection questionnaire and reported flooding issues that had not yet been resolved. However, one resident mentioned a planned drainpipe project that may help mitigate flooding. This area contains one parcel that was found to be a vacant lot.

Repetitive Loss Area 3 is over 75% located within the 100-yr floodplain. Greens Mill Run runs along the back of these properties. This area is residential with single family homes. The homes in this area were built between 1940 and 2014; all but one was built prior to the community's first FIRM, dated 1978. Most foundations are crawl spaces and all the structures are of wood frame construction. Most of the structures were built below grade with one at grade and one 3-4 feet above grade. Several structures lack guttering. Only two HVAC units were visible during field survey. One was not elevated and information on the other was not provided. During field survey, one resident said that their house had flooded during three different hurricanes and that their neighbor's homes often flood as well. One resident of this area completed a flood protection questionnaire and reported unresolved flooding issues. This area contains one parcel that was found to be a vacant lot.

Repetitive Loss Area 9 is completely located within the 100-yr floodplain. The properties back up against Greens Mill Run. This area is commercial, and the buildings were built between 1963 and 1972; all were built prior to the community's first FIRM, dated 1978. All foundations are slab-on-grade and all are of masonry construction. Most of the structures were built either at grade or below grade. No residents from this area completed the flood protection questionnaire. This area contains two parcels that were found to be vacant parking lots.

Neuse River Basin

Repetitive Loss Area 5 is located almost entirely within the 100-yr floodplain. The properties back up to Fork Swamp. This area is residential with 2-4 family homes. Most structures are on minimal fill and sit at grade. The structures in this area have slab-on-grade foundations with wood frame construction. All buildings in Area 1 were built between 1993 and 1994; all were built after the community's first FIRM, dated 1978. No HVAC units were visible during field survey. All homes have no guttering and only one home has a drainage inlet in front. Two buildings were built at the lowest point of the neighborhood. No residents from this area completed the flood protection questionnaire.

Repetitive Loss Area 6 is not located in a high flood hazard area because it is outside the flood study limits. However, Gum Swamp extends the length of the rear of the area, so it is likely this area is almost completely, if not totally, within the 100-year floodplain. This area is single family residential with mostly slab-on-grade foundations and wood frame construction. One home has a crawl space foundation. Two homes are built on minimal fill, with one elevated 1 foot above grade, one elevated 2 feet above grade, and only one below grade. The structures were built between 1992 and 2016; all were built after the community’s first FIRM, dated 1978. All HVAC units are not elevated. Two properties have guttering, and two homes have storm drains or drainage ditches in front. The field survey data reports that one home is under construction. No residents from this area completed the flood protection questionnaire.

Repetitive Loss Area 7 is located almost entirely within the 100-yr floodplain. Gum Swamp runs through this area along the backs of the properties. This area is residential with single family homes. The homes in this area were built between 1989 and 1991; all were built after the community’s first FIRM, dated 1978. Most foundations are crawl space and all the structures are of wood frame construction. Most of the structures were built either 2-3 feet above grade or 3-4 feet above grade. Most structures lack guttering but two have it in place. During field survey, standing water was noted along the street and in ditches in front of several properties. No residents from this area completed the flood protection questionnaire.

Table 2.2 – Repetitive Loss Area Overview for Subarea 1

Repetitive Loss Area	# of RL Properties	# of Historic Claims Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
1	1	4	1	6	S. Elm St., E. 10 th St.
2	3	3	1	7	Millbrook St.
3	1	4	0	5	Pineview Dr., Lakewood Dr.
9	1	0	3	4	E. 10 th St., E. Rock Spring Rd.
5	1	0	5	6	Bridge Ct.
6	1	0	2	3	Frog Level Rd., Dearborn Ct.
7	2	5	1	8	Woodridge Dr., Valley Dr.
Total	10	16	13	39	

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix A.

Subarea 1 contains a total of 39 properties, consisting of 22 properties in the Pamlico River Basin and 17 properties in the Neuse River Basin. This total includes six vacant parcels in the Pamlico River Basin that were discovered during field visits.

Figure 2.5 – Repetitive Loss Area 1

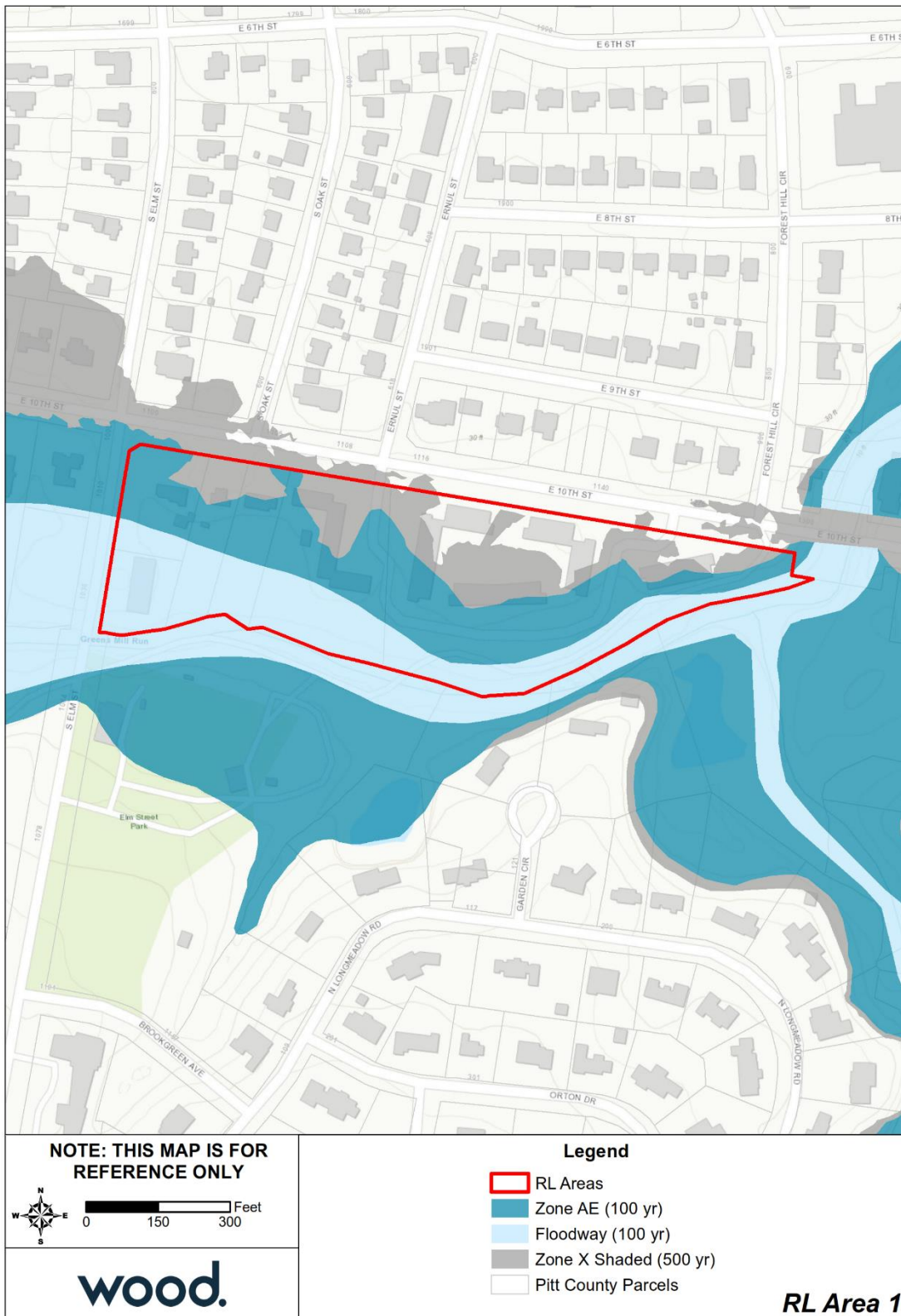


Figure 2.6 – Repetitive Loss Area 2

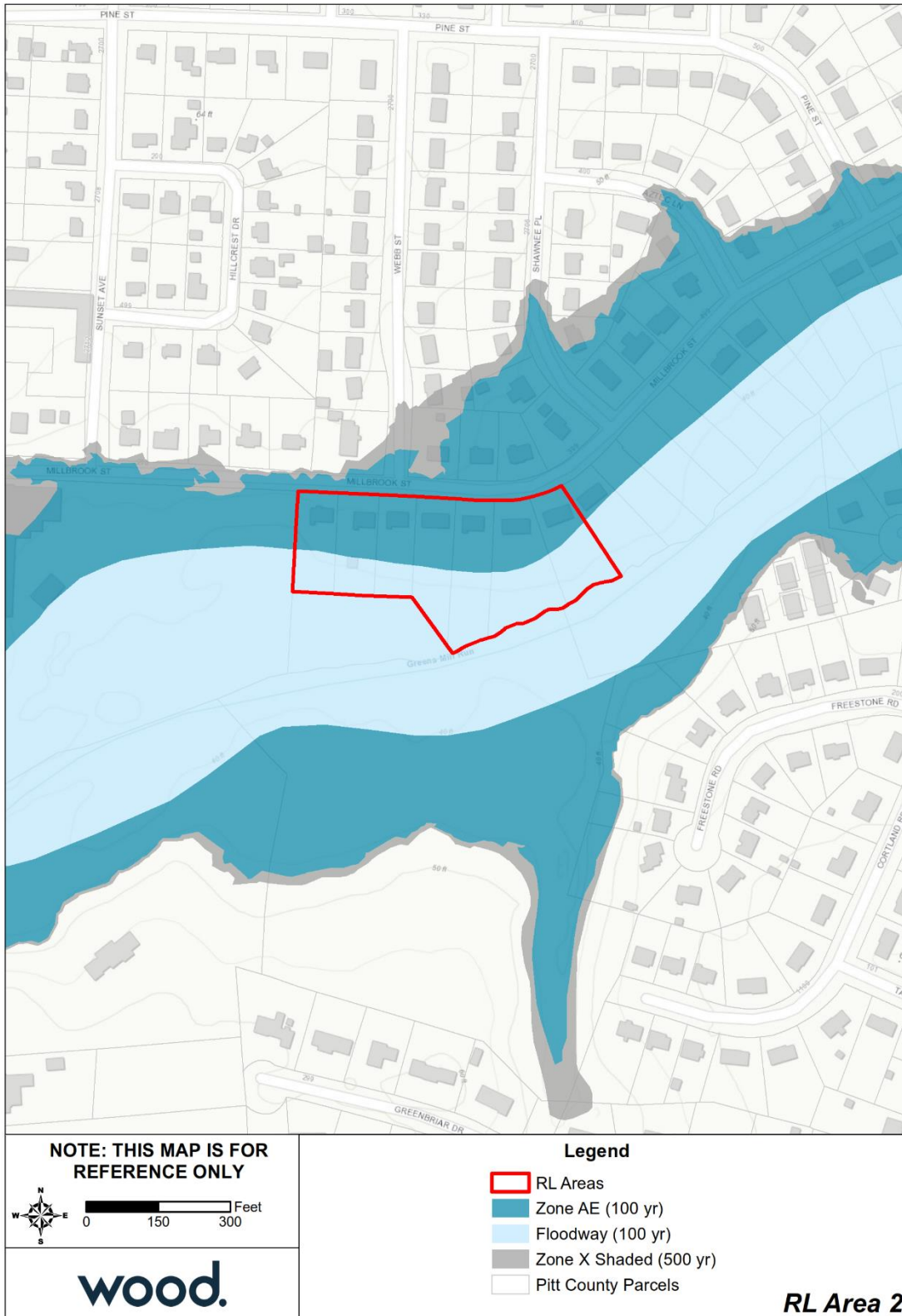


Figure 2.7 – Repetitive Loss Area 3

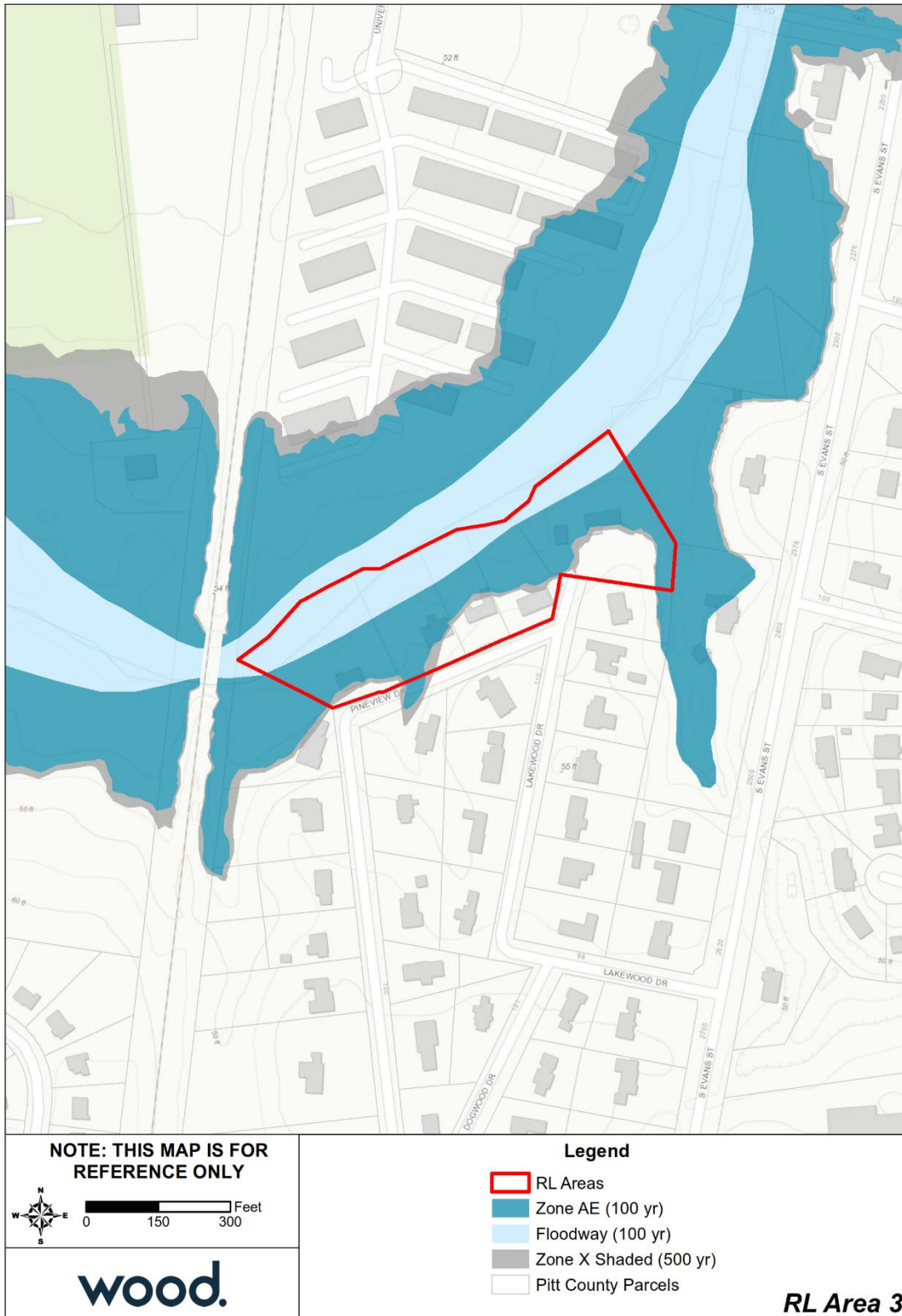
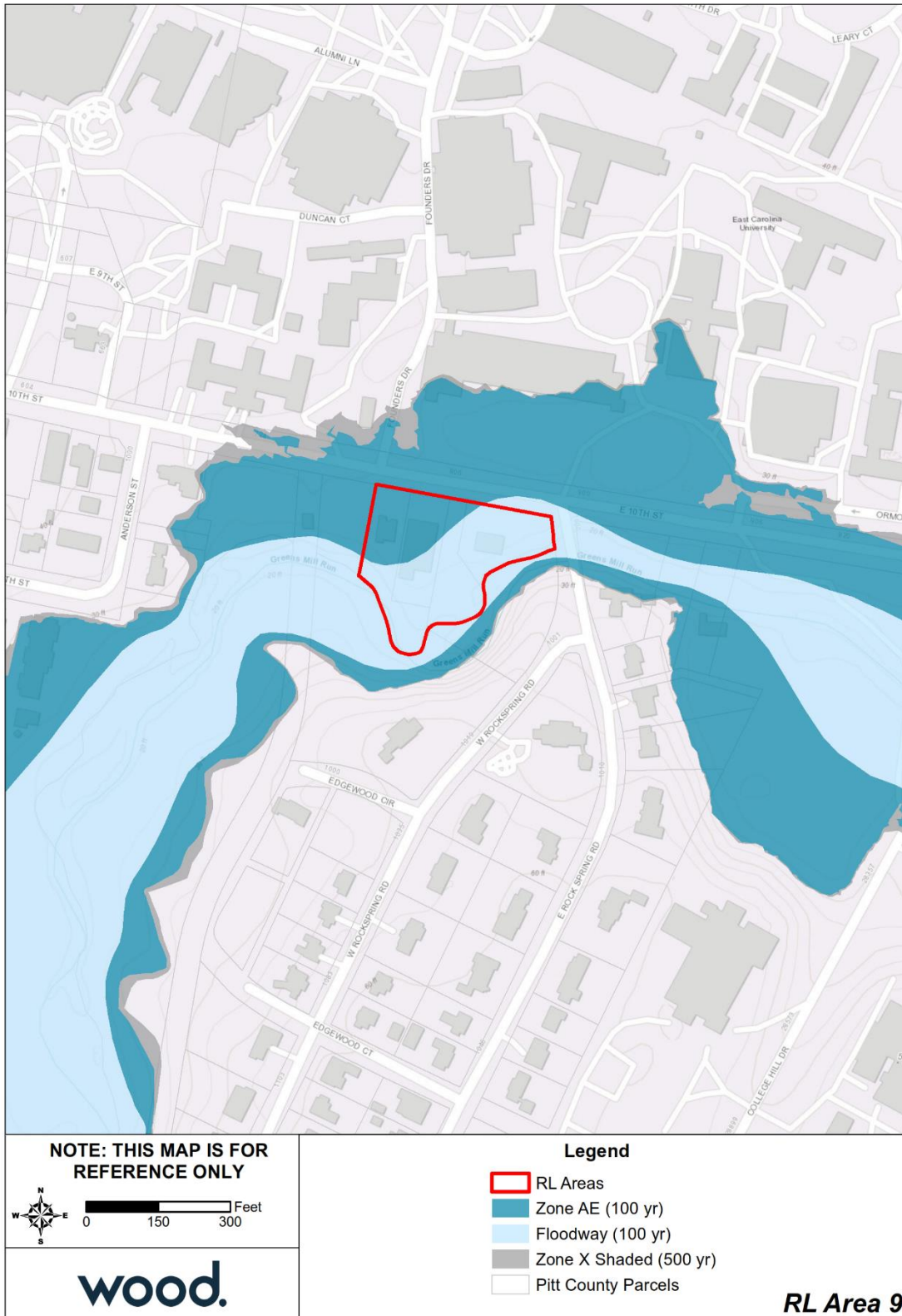


Figure 2.8 – Repetitive Loss Area 9



Example Properties in Area 1



Living units below grade



Visible water mark on side of apartment building



Below grade apartments



HVAC not elevated

Example Properties in Area 2



Guttering drains onto driveway



HVAC not elevated on left side of home



Garage converted to living space and not elevated

Example Properties in Area 3



House below street grade



Front entrance below grade

Example Properties in Area 3



Creek in rear of building



Building with at-grade construction

Figure 2.9 – Repetitive Loss Area 5

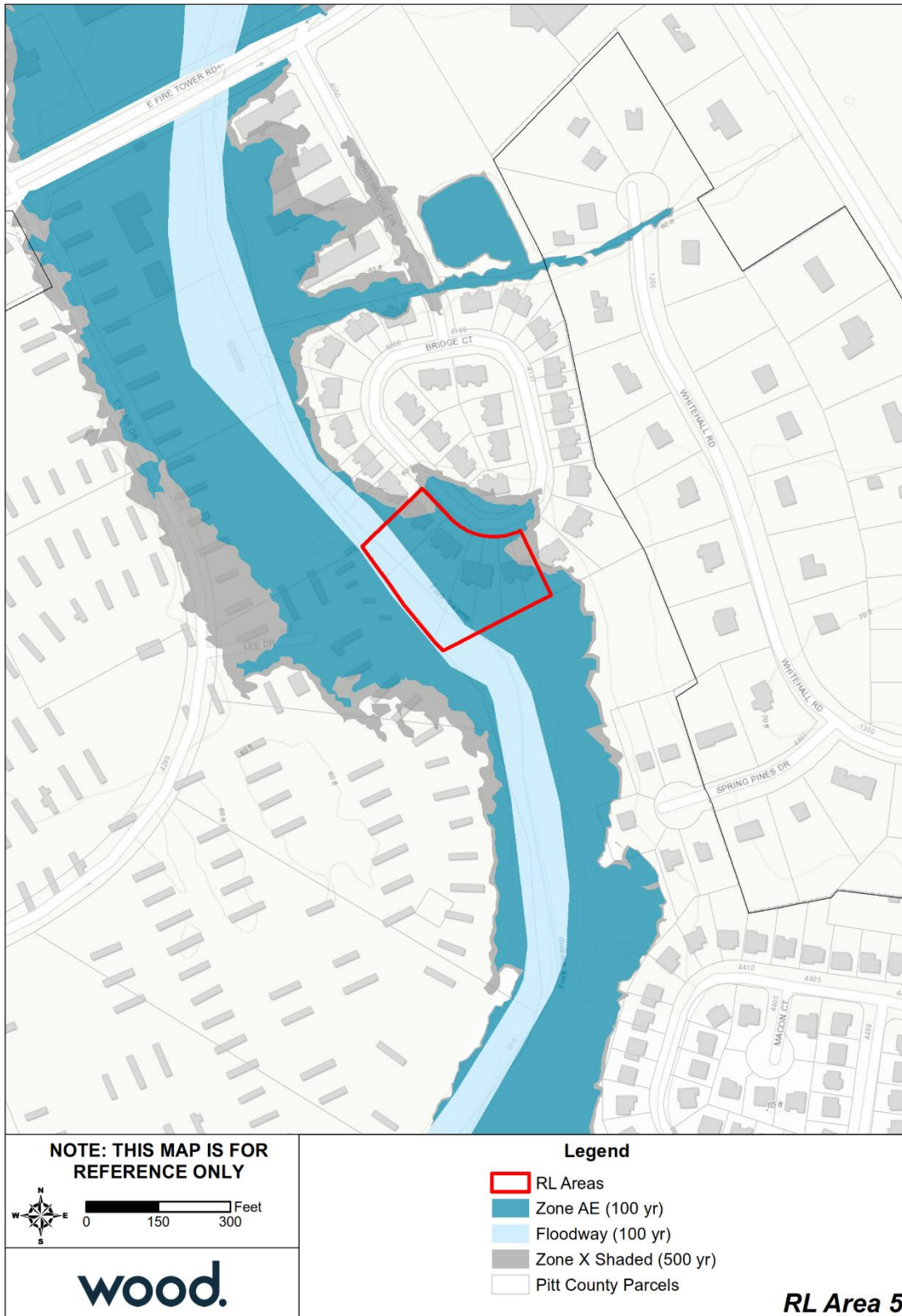
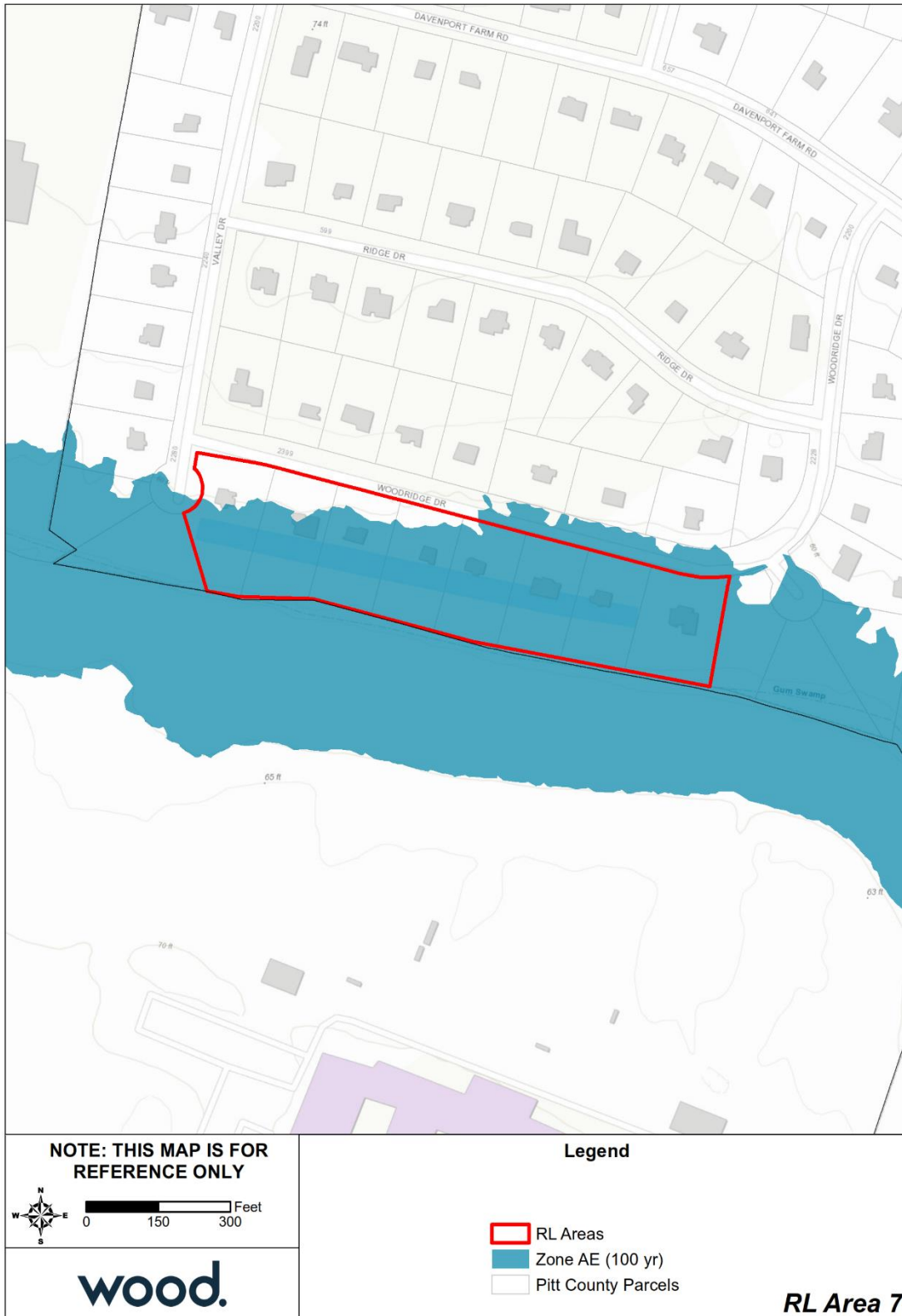


Figure 2.10 – Repetitive Loss Area 6



Figure 2.11 – Repetitive Loss Area 7



Example Properties in Area 5



Building sits at lowest point of neighborhood



Building at lowest end of neighborhood



Drainage inlet out front



No guttering

Example Properties in Area 6



Guttering goes under grade and storm drain at street



Drainage ditch along road



Guttering in front of house under construction

Example Properties in Area 7



Standing water in drainage ditch



No guttering on structure; standing water in ditch



Below street grade



Guttering on lower level

Subarea 2: Areas of Localized/Stormwater Flooding

Problem Statement:

Of the nine identified Repetitive Loss Areas, two are located entirely outside the 1-percent annual chance floodplain and away from major drainage features. These areas are primarily subject to periodic flooding from heavy rains and localized stormwater drainage problems. Losses have occurred in these areas as a result of hurricane and tropical storm rains; specifically, Hurricane Floyd in 1999 and Tropical Storm Charley in 2004 resulted in flood insurance claims.

Most repetitive loss flooding in this area is considered flash flooding that causes damage to residential and commercial buildings as well as street closures due to floodwaters overtopping the roadway. Flash flooding can occur when the capacity of the stormwater system is exceeded or if conveyance is obstructed by debris, sediment, and other materials that limit the volume of drainage. The approach to reducing repetitive flooding in these areas will require a combination of floodproofing techniques and drainage improvement projects.

Repetitive Loss Area 4 is not located in a high-risk flood zone. This area is residential with single family homes. The homes in this area were built between 1963 and 1982; only one was built prior to the community’s first FIRM, dated 1978. The foundations are all different with one slab-on-grade, one crawl space, and one with elevated walls. All the structures are of wood frame construction. The structures were built above grade with one 0-1 foot above grade, one 1-2 feet above grade, and one 2-3 feet above grade. Several structures lack guttering. All HVAC units were visible during field survey. One was not elevated, one had some elevation, and one was a window unit. During field survey, one resident said that their neighbor’s yard is like a river during heavy rain events. No residents from this area completed the flood protection questionnaire. Railroad tracks run adjacent to this area and may act as a levee during heavy rains, causing water to get trapped and pond in this area. This area contains two vacant parcels discovered during the field visit.

Repetitive Loss Area 8 is not located in a high-risk flood zone. This area is single-family residential with crawl space foundations and wood frame construction. The homes in this area were built in 1971; all were built prior to the community’s first FIRM, dated 1978. The structures were built above grade with two 1-2 feet above grade and two 2-3 feet above grade. Several structures lack guttering. No HVAC units were visible during field survey. Two homes appear unoccupied and three have a drainage ditch in front, one of which had standing water at the time of the field visit. The entire neighborhood sits several feet below the main road grade. No residents from this area completed the flood protection questionnaire.

Table 2.3 – Repetitive Loss Area Overview for Subarea 2

Repetitive Loss Area	# of RL Properties	# of Historic Claims Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
4	1	0	4	5	McClellan St., Blount St.
8	1	0	3	4	Moore Rd.
Total	2	0	7	9	

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix A.

Subarea 2 contains a total of nine properties including two vacant lots discovered during the site visit.

Figure 2.12 – Repetitive Loss Area 4

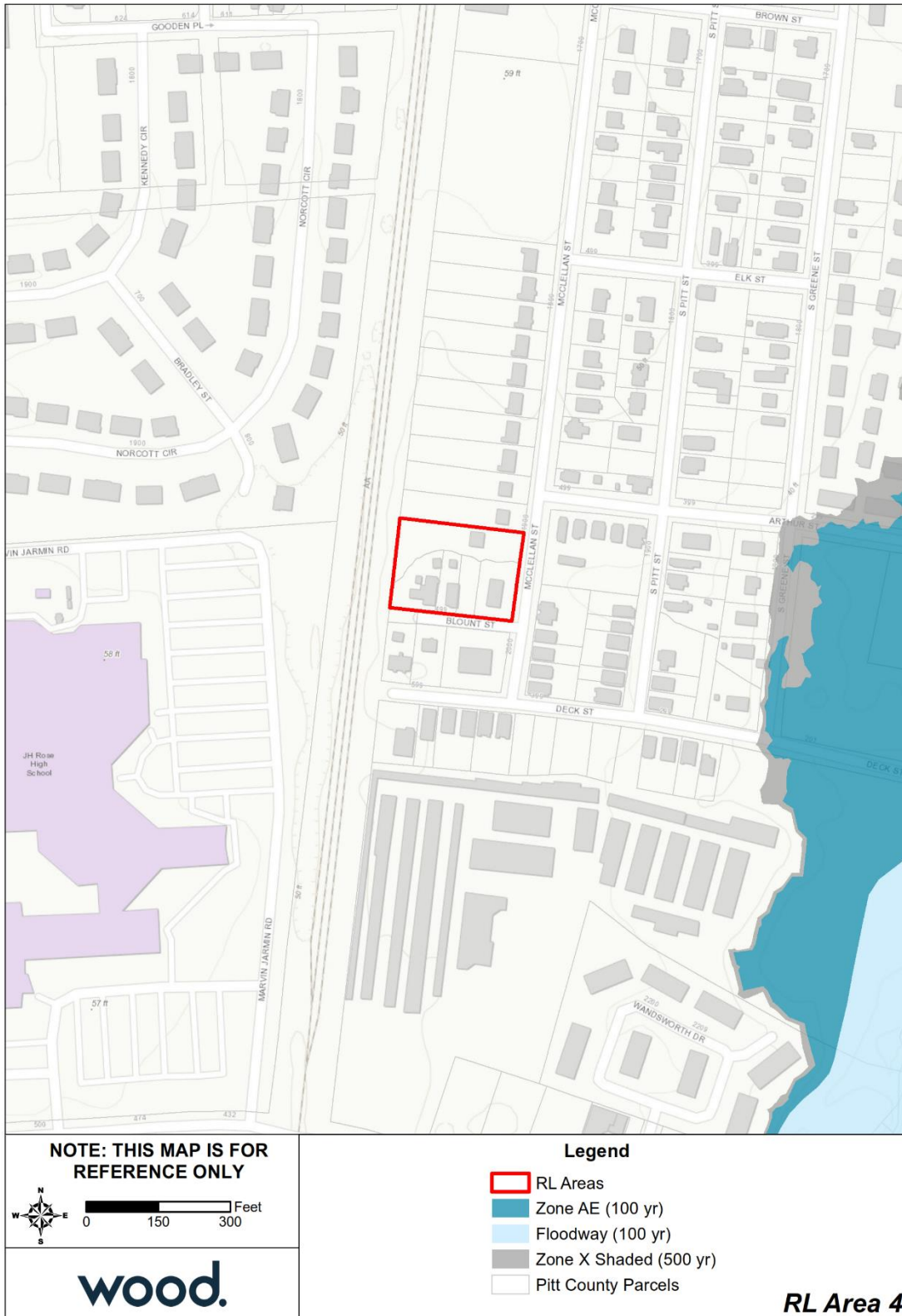
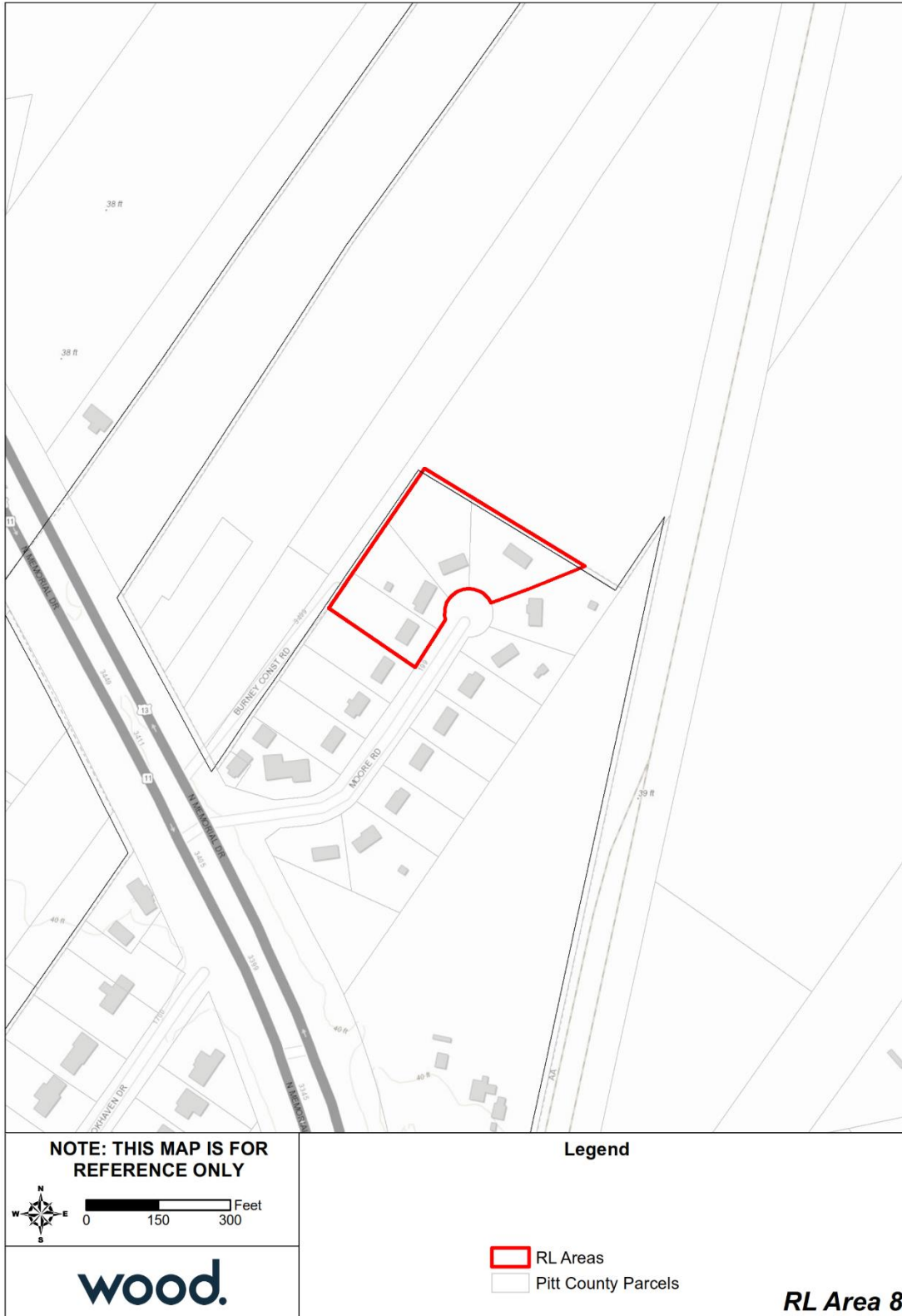


Figure 2.13 – Repetitive Loss Area 8



Example Properties in Area 4



Next to railroad track that may act as levee



Lawn slopes toward house



No guttering



Window unit HVAC system

Example Properties in Area 8



Drainage ditch in front



Standing water in ditch



Structure with minimal elevation



Neighborhood sits several feet below main road grade

STEP 4. Review Alternative Mitigation Approaches

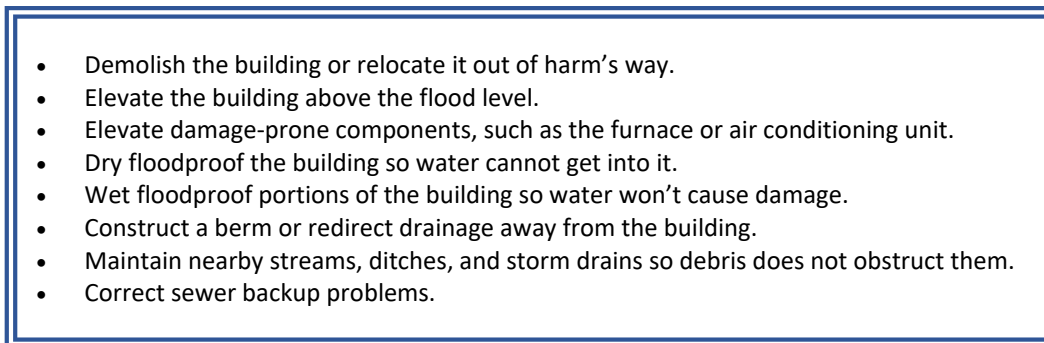
Mitigation Alternatives

According to the 2017 CRS Coordinator’s Manual, mitigation measures should fall into one of the following floodplain management categories:

- Prevention
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information and Outreach

Property protection is essential to mitigating repetitive loss properties and reducing future flood losses. There are many ways to protect a property from flood damage. Property protection measures recognized in the 2017 CRS Coordinator’s Manual include relocation, acquisition, building elevation, retrofitting, sewer backup protection, and insurance. Different measures are appropriate for different flood hazards, building types and building conditions. Figure 2.14 below, found in the 2017 CRS Coordinator’s Manual, lists typical property protection measures.

Figure 2.14 – Typical Property Protection Measures

- 
- Demolish the building or relocate it out of harm’s way.
 - Elevate the building above the flood level.
 - Elevate damage-prone components, such as the furnace or air conditioning unit.
 - Dry floodproof the building so water cannot get into it.
 - Wet floodproof portions of the building so water won’t cause damage.
 - Construct a berm or redirect drainage away from the building.
 - Maintain nearby streams, ditches, and storm drains so debris does not obstruct them.
 - Correct sewer backup problems.

Source: 2017 CRS Coordinators Manual.

Improving the stormwater drainage system and storage capacity throughout the City of Greenville may eliminate some building damage and road closures in these areas. Additionally, continuing to pursue elevations and/or acquisitions of high-risk properties will reduce losses. These mitigation methods require large capital expenditures and cooperation from private property owners. Promoting floodproofing and flood insurance and increasing public education and awareness of the flood hazards can be the next best alternative for property owners in these areas. The City’s websites, e-mail distribution lists, and press releases can help get these messages out to business owners and residents.

Mitigation Funding

There are several types of mitigation measures, listed in Table 2.4, which can be considered for each repetitive loss property. Each mitigation measure qualifies for one or more grant programs. Depending on the type of structure, severity of flooding and proximity to additional structures with similar flooding conditions, the most appropriate measure can be determined. In addition to these grant funded projects, several mitigation measures can be taken by the homeowner to protect their home. Please note, the Biggert-Waters 2012 National Flood Insurance Reform Act eliminated the previously available Repetitive Flood Claims grant program.

Table 2.4 – Mitigation Grant Programs

Types of Projects Funded	HMGP	FMA	PDM	SRL	ICC	SBA
Acquisition of the entire property by a gov't	X	X	X	X		
Relocation of the building to a flood free site	X	X	X	X	X	X
Demolition of the structure	X	X	X	X	X	X
Elevation of the structure above flood levels	X	X	X	X	X	X
Replacing the old building with a new elevated	X			X	X	X
Local drainage and small flood control projects	X			X		
Dry floodproofing (non-residential buildings only)		X	X	X	X	X
Percent paid by Federal program	75%	75%	75%	75%	100%	0%
Application Notes	1,2	1	1	1	3	2,4

Application notes:

1. Requires a grant application from your local government
2. Only available after a Federal disaster declaration
3. Requires the building to have a flood insurance policy and to have been flooded to such an extent that the local government declares it to be substantially damaged. Pays 100% up to \$30,000
4. This is a low interest loan that must be paid back

Potential Mitigation Measures

Structural Alternatives
Dry floodproofing. Commercial structures and even residential structures are eligible for dry floodproofing; however, in many instances this requires human intervention to complete the measure and ensure success. For example, installing watertight shields over doors or windows requires timely action by the homeowner; especially in a heavy rainfall event.
Wet floodproofing. Wet floodproofing a structure involves making the uninhabited portions of the structure resistant to flood damage and allowing water to enter during flooding. For example, in a basement or crawl space, mechanical equipment and ductwork would not be damaged.
For basements, especially with combined storm sewer and sewer systems, backflow preventer valves can prevent storm water and sewer from entering crawlspaces and basements.
Acquire and/or relocate properties/target abandoned properties.
Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the BFE.
Construct engineered structural barriers, berms, and floodwalls (Note: Assuming lot has required space for a structural addition).
Increase road elevations above the BFE of the 100-year floodplain.
Implement drainage improvements such as increasing capacity in the system (up-sizing pipes) and provide additional inlets to receive more stormwater.
Improve stormwater system maintenance program to ensure inlets and canals are free of clogging debris.

Non-Structural Alternatives
Provide public education through posting information about local flood hazards on City websites, posting signs at various locations in neighborhoods or discussing flood protection measures at local neighborhood association meetings.
Implement volume control and runoff reduction measures in the City's Stormwater Management Ordinance.
Consider expanding riparian impervious surface setbacks.
Relocate internal supplies, products/goods above the flooding depth.
Promote the purchase of flood insurance.
Improve the City's floodplain and zoning ordinances

Current Mitigation Projects

Capital Improvements Plan Drainage Improvements

In the City's Capital Improvement 5-Year Plan for 2015-2019, seven drainage improvement projects were identified and assigned funding, including Watershed Master Plan projects. Funding is assigned through a revenue bond which will be paid back through the Stormwater Utility Fund. As of the Capital Improvements Plan Report in January 2018, the City had decided to add an additional stormwater project. This project is scheduled to be completed by Summer 2020. None of the identified projects were within any of the nine Repetitive Loss Areas, but all of them were in the Pamlico River Basin which may extend benefits to Repetitive Loss Areas in the same watershed.

There was recently a Request for Qualifications regarding a Request for Proposals (RFP) for the Elm Street Drainage Improvement Project. This project falls under the Harris Mill Run/Schoolhouse Branch Watershed Master Plan and is one of 150 projects under the Watershed Master Plan. Projects under this Plan are intended to be funded through the Capital Improvements Program.

Advantages and Disadvantages of Mitigation Measures

Seven primary mitigation measures are discussed here: acquisition, relocation, barriers, floodproofing, drainage, elevation, and insurance. In general, the cost of acquisition and relocation will be higher than other mitigation measures but can completely mitigate risk of any future flood damage. Building small barriers to protect single structures is a lower-cost solution, but it may not be able to offer complete protection from large flood events and may impact flood risk on other properties. Where drainage issues are the source of repetitive flooding, drainage improvements can provide flood mitigation benefits to multiple properties. Each of these solutions is discussed in greater detail below.

Acquisition:

Property acquisition and/or relocation are complex processes requiring transferring private property to property owned by the local government for open space purposes. Acquisition is a relatively expensive mitigation measure, but it provides the greatest benefit in that lives and property are protected from flood damage. The major cost for the acquisition method is for purchasing the structure and land. The total estimated cost for acquisition should be based on the following:

- Purchase of Structure and land
- Demolition
- Debris removal, including any landfill processing fees
- Grading and stabilizing the property site
- Permits and plan review

Table 2.5 – Advantages and Disadvantages of Acquisition

Advantages	Disadvantages
<ul style="list-style-type: none">• Permanently removes problem since the structure no longer exists.• Allows a substantially damaged or substantially improved structure to be brought into compliance with the community's floodplain management ordinance or law.• Expands open space and enhances natural and beneficial uses.• May be fundable under FEMA mitigation grant programs.	<ul style="list-style-type: none">• Cost may be prohibitive.• Resistance may be encountered by local communities due to loss of tax base, maintenance of empty lots, and liability for injuries on empty, community-owned lots.

There are 3 criteria that must be met for FEMA to fund an acquisition project:

- The local community must inform the property owners interested in the acquisition program that the community will not use condemnation authority to purchase their property and that the participation in the program is strictly voluntary,
- The subsequent deed to the property to be acquired will be amended such that the landowner will be restricted from receiving any further Federal disaster assistance grants, the property shall remain in open space in perpetuity, and the property will be retained in ownership by a public entity, and,
- Any replacement housing or relocated structures will be located outside the 100-year floodplain.

Relocation:

Relocation involves lifting and placing a structure on a wheeled vehicle and transporting that structure to a site outside the 100-year floodplain and placed on a new permanent foundation. Like acquisition, this is one of the most effective mitigation measures.

Table 2.6 – Advantages and Disadvantages of Relocation

Advantages	Disadvantages
<ul style="list-style-type: none">• Removes flood problem since the structure is relocated out of the flood-prone area.• Allows a substantially damaged or substantially improved structure to be brought into compliance with a community’s floodplain management ordinance.• May be fundable under FEMA mitigation grant programs.	<ul style="list-style-type: none">• Cost may be prohibitive.• Additional costs are likely if the structure must be brought into compliance with current code requirements for plumbing, electrical, and energy systems.

The cost for relocation will vary based on the type of structure and the condition of the structure. It is considerably less expensive to relocate a home that is built on a basement or crawl space as opposed to a structure that is a slab on grade. Additionally, wood-sided structures are less expensive to relocate than structures with brick veneer. Items to consider in estimating cost for relocation include the following:

- Site selection and analysis and design of the new location
- Analysis of existing size of structure
- Analysis and preparation of the moving route
- Preparation of the structure prior to the move
- Moving the structure to the new location
- Preparation of the new site
- Construction of the new foundation
- Connection of the structure to the new foundation
- Restoration of the old site



Barriers:

A flood protection barrier is usually an earthen levee/berm or a concrete retaining wall. While levees and retaining walls can be large spanning miles along a river, they can also be constructed on a much smaller scale to protect a single home or group of homes.

Table 2.7 – Advantages and Disadvantages of Barriers

Advantages	Disadvantages
<ul style="list-style-type: none"> Relative cost of mitigation is less expensive than other alternatives. No alterations to the actual structure or foundation are required. Homeowners can typically construct their own barriers that will complement the style and functionality of their house and yard. 	<ul style="list-style-type: none"> Property is still located within the floodplain and has potential to be damaged by flood if barrier fails or waters overtop it. Solution is only practical for flooding depths less than 3 feet. Barriers cannot be used in areas with soils that have high infiltration rates.

The cost of constructing a barrier will depend on the type of barrier and the size required to provide adequate protection. An earthen berm will generally be less expensive compared to an equivalent concrete barrier primarily due to the cost of the materials. Another consideration is space; an earthen barrier requires a lot of additional width per height of structure compared to a concrete barrier to ensure proper stability. Key items to consider for barriers:

- There needs to be adequate room on the lot
- A pump is required to remove water that either falls or seeps onto the protected side of the barrier
- Human intervention will be required to sandbag or otherwise close any openings in the barrier during the entire flood event

Floodproofing:

Wet floodproofing a structure consists of modifying the uninhabited portions (such as a crawlspace or an unfinished basement) to allow floodwaters to enter and exit. This ensures equal hydrostatic pressure on the interior and exterior of the structure which reduces the likelihood of wall failures and structural damage. Wet floodproofing is practical in only a limited number of situations.

Table 2.8 – Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> Often less costly than other mitigation measures. Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors. 	<ul style="list-style-type: none"> Extensive cleanup may be necessary if the structure becomes wet inside and possibly contaminated by sewage, chemicals and other materials borne by floodwaters. Pumping floodwaters out of a basement too soon after a flood may lead to structural damage. Does not minimize the potential damage from a high-velocity flood flow and wave action.

A dry floodproofed structure is made watertight below the level that needs flood protection to prevent floodwaters from entering. Making the structure watertight involves sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete; installing watertight shields over windows and doors; and installing measures to prevent sewer backup.

Table 2.9 – Advantages and Disadvantages of Dry Floodproofing

Advantage	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program. 	<ul style="list-style-type: none"> • Requires human intervention and adequate warning to install protective measures. • Does not minimize the potential damage from high-velocity flood flow and wave action. • May not be aesthetically pleasing.

Drainage Improvements:

Methods of drainage improvements include overflow channels, channel straightening, restrictive crossing replacements, and runoff storage. Modifying the channel attempts to provide a greater carrying capacity for moving floodwaters away from areas where damage occurs. Whenever drainage improvements are considered as a flood mitigation measure, the effects upstream and downstream from the proposed improvements need to be considered.

Table 2.10 – Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
<ul style="list-style-type: none"> • Could increase channel carrying capacity through overflow channels, channel straightening, crossing replacements, or runoff volume storage. • Minor projects may be fundable under FEMA mitigation grant programs. 	<ul style="list-style-type: none"> • May help one area but create new problems upstream or downstream. • Channel straightening increases the capacity to accumulate and carry sediment. • May require property owner cooperation and right-of-way acquisition.

Elevation:

Elevating a structure to prevent floodwaters from reaching living areas is an effective and one of the most common mitigation methods. Elevation may also apply to roadways and walkways. The goal of the elevation process is to raise the lowest floor of a structure or roadway/walkway bed to or above the required level of protection.

Table 2.11 – Advantages and Disadvantages of Elevation

Advantages	Disadvantages
<ul style="list-style-type: none"> • Elevating to or above the BFE allows a substantially damaged or substantially improved house to be brought into compliance. • Often reduces flood insurance premiums. • Reduces or eliminates road closures due to overtopping. • May be fundable under FEMA mitigation grant programs. 	<ul style="list-style-type: none"> • Cost may be prohibitive. • The appearance of the structure and access to it may be adversely affected. • May require property owner cooperation and right-of-way acquisition. • May require road or walkway closures during construction.

NOTE: Elevating a structure with a slab-on-grade foundation can cost over 30 percent more than elevating a structure on a crawlspace foundation. Over 30% of the properties located in Greenville’s Repetitive Loss Areas have slab-on-grade foundations, which may mean this mitigation alternative will be cost-prohibitive.

Flood Insurance:

Insurance differs from other property protection activities in that it does not mitigate or prevent damage caused by a flood. However, flood insurance does help the owner repair and rebuild their property after a flood, and it can enable the owner to afford incorporating other property protection measures in that process. Insurance offers the advantage of protecting the property, as long as the policy is in force, without requiring human intervention for the measure to work.

Table 2.12 – Advantages and Disadvantages of Flood Insurance

Advantages	Disadvantages
<ul style="list-style-type: none">• Provides protection outside of what is covered by a homeowners' insurance policy.• Can help to fund other property protection measures after a flood through increased cost of compliance (ICC) coverage.• Provides protection for both structure and contents.• Can be purchased anywhere in a community, including outside of a flood zone.	<ul style="list-style-type: none">• Cost may be prohibitive.• Policyholders may have trouble understanding policy and filing claims.• Does not prevent or mitigate damage.

STEP 5. Conclusion and Recommendations

Conclusion

Based on the field survey and collection of data, the analysis of existing studies and reports, and the evaluation of various structural and non-structural mitigation measures, the City of Greenville has identified several projects that should be implemented for these Repetitive Loss Areas, detailed below under Recommendations. Table 2.13 examines past and current mitigation actions in these areas.

Table 2.13 – Past and Current Mitigation Actions

Past and Current Mitigation Actions	
1	Property owners have documented flooding and identified flooding concerns in returned questionnaires from this analysis.
2	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense.
3	The City has identified areas of localized stormwater flooding related to transportation infrastructure and inadequate drainage. This information can help the City to target capital improvements for flood reduction.
4	During field visits it was discovered that several buildings in repetitive loss areas have been demolished. The City can continue to pursue acquisition and demolition for mitigation of the most vulnerable properties in these areas.

Prioritization

In order to facilitate the implementation of the following recommended mitigation actions, a prioritization schedule is included based on the following:

- Cost
- Funding Availability
- Staff Resources
- Willingness of Property Owner to Participate
- Additional Planning Requirements

The priority rating for the following mitigation actions is summarized in Table 2.14. Each of the above prioritization variables was rated on a scale of 1 to 5, with 5 indicating the greatest difficulty for implement. The weight of each variable is indicated in the prioritization table. Those mitigation actions with the lowest overall priority scores should be implemented first. An overall priority rating of high, medium, or low is assigned to each recommended action, using the following scale:

- High Priority: Score of 0.00 – 1.99
- Medium Priority: Score of 2.00 – 3.99
- Low Priority: Score of 4.00 – 5.00

Recommendations

The City will encourage property owners to use floodproofing measures to help protect lower levels of their property. The City will also increase its public education efforts to increase awareness of flood preparedness and flood protection measures including moving valuable items to above the flood elevation and permanently elevating vulnerable HVAC units. At the same time, the City will work with property owners, citizens, the state and other regional and federal agencies to implement capital improvement projects which will help to eliminate flooding in the repetitive loss areas.

Mitigation Action 1: Flood Insurance Promotion

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The City will continue on an **annual basis** to target all properties in the repetitive loss areas reminding them of the advantages of maintaining flood insurance through its annual outreach effort. Repetitive Loss Areas are noted as a target area in the City's Program for Public Information (PPI).

Responsibility: The City's Engineering Department will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas through annual outreach and other efforts.

Funding: The cost will be paid for from the City's operating budget.

Priority: High

Target Area: Subarea 1 & Subarea 2

Mitigation Action 2: Preferred Risk Policy Promotion

As part of the annual outreach to the repetitive loss areas, the City will provide specific information on the availability of Preferred Risk Policies for property owners in the low-risk Zone X.

Responsibility: The City's Engineering Department will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas through annual outreach and other efforts.

Funding: The cost will be paid for from the City's operating budget.

Priority: High

Target Area: Subarea 2 & Area 6

Mitigation Action 3: Property Protection Information

Property owners should not store personal property in basements or crawl spaces since personal property is not covered by a flood insurance policy without contents coverage. Additionally, property owners should consult with the City to understand their options for property protection. The City will increase its outreach efforts on an **annual basis** for the identified repetitive loss areas to include this specific information in the outreach materials.

Responsibility: The City's Engineering Department will provide the most relevant up-to-date information to all property owners within the repetitive loss areas and will provide advice and assistance to property owners.

Funding: The cost will be paid for from the City's operating budget.

Priority: High

Target Area: Subarea 1 & Subarea 2

Mitigation Action 4: Floodproofing

When appropriate, commercial property owners should consider floodproofing measures such as flood gates or shields, flood walls, hydraulic pumps, and elevating electrical services including electrical outlets.

Responsibility: The City's Engineering Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding: The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Priority: Medium

Target Area: Subarea 1

Mitigation Action 5: Acquisition & Demolition

The City will continue acquisition and/or demolition mitigation of high-risk flood-prone properties. The highest priorities are properties at the greatest flood risk and where drainage improvements will not provide an adequate level of protection. Acquisition and demolition have already been used to mitigate properties in repetitive loss areas.

Responsibility: The City's Engineering Department will continue to target properties for acquisition and demolition.

Funding: The acquisition and demolition can be paid for using FEMA's Hazard Mitigation Grant Program (HMGP). Staff time to develop the list of target properties will require funds from the City's operating budget.

Priority: Low

Target Area: Subarea 1 & Subarea 2

Mitigation Action 6: CIP Drainage Improvements

Prioritize CIP projects to focus on drainage improvement projects. Prioritize drainage and capacity improvements in areas of transportation flooding hotspots that are located in or near repetitive loss areas.

Responsibility: The City's Public Works Department.

Funding: The cost will be paid for by the City's operating budget.

Priority: Medium

Target Area: Subarea 1 & Subarea 2

Mitigation Action 7: Elevate Mechanical Equipment

HVAC units were found to be not elevated in all repetitive loss areas. The City will encourage property owners to elevate inside and outside mechanical equipment above the BFE. The City will also provide information to HVAC contractors, who are noted as a target audience in the City's PPI.

Responsibility: The City's Engineering Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an on-going program.

Funding: The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Priority: Medium

Target Area: Subarea 1 & Subarea 2

Mitigation Action 8: Contents Coverage for Renters

Several buildings in the repetitive loss areas are multi-unit apartment buildings, and the City's parcel data suggests that several other properties in the repetitive loss areas are renter-occupied. Renters typically have less power to implement physical changes to mitigate flooding, but they do have the ability to protect themselves with flood insurance. Therefore, the City's Engineering Department will encourage renters to purchase flood insurance for their contents. Renters are also being targeted through the City's PPI, which includes multi-unit residential buildings as a target area.

Responsibility: The City's Engineering Department along with local insurance agents will promote the benefits of renter's insurance.

Funding: The cost will be paid for by the City's operating budget.

Priority: Medium

Target Area: Subarea 1 & Subarea 2

Prioritization Table

Table 2.14 – Prioritization of Recommended Mitigation Actions

Mitigation Action #	Prioritization Variables (Weight)					Total
	Cost (30%)	Funding Availability (25%)	Property Owner Willingness (20%)	Staff Resources (15%)	Planning Needs (10%)	
1: Ongoing outreach to promote flood insurance	2	2	1	1	1	1.55
2: Promote availability of Preferred Risk Policies (PRP)	2	2	1	1	1	1.55
3: Ongoing outreach about personal property protection	2	2	1	1	1	1.55
4: Promote and advise on floodproofing	2	3	4	2	2	2.65
5: Continue acquisition and demolition	5	4	5	4	4	4.50
6: Prioritize drainage-related CIP projects	4	2	2	3	4	2.95
7: Encourage property owners to elevate mechanical equipment	2	2	3	2	1	2.10
8: Encourage renters to purchase flood insurance	2	2	3	2	2	2.20

3 References

City of Greenville Horizons 2026 Community Plan. August 2016.

City of Greenville, Code of Ordinances. Updated April 2019.

City of Greenville, Capital Improvements Program. FY 2015 through FY 2019.

City of Greenville, Stormwater Master Plans. October 2013 through August 2016.

Pitt County, 2030 Comprehensive Land Use Plan.

Neuse River Basin Regional Hazard Mitigation Plan. June 2015.

Federal Emergency Management Agency, Community Information System. June 2019.

Federal Emergency Management Agency, Flood Insurance Study, Pitt County. Revised July 7, 2014.

Federal Emergency Management Agency/ISO, City of Greenville Repetitive Loss Data, May 2018.

Federal Emergency Management Agency, National Flood Insurance Program, Community Rating System CRS Coordinator's Manual. FIA-15/2017. Section 510.

Federal Emergency Management Agency, National Flood Mitigation Data Collection Tool and RLP Viewer, User's Guide. FEMA 497/August 2008.

Federal Emergency Management Agency, Reducing Damage from Localized Flooding: A Guide for Communities. FEMA 511/June 2005. Part III Chapter 7.

Federal Emergency Management Agency, Selecting Appropriate Mitigation Measures for Floodprone Structures. FEMA 551/March 2007.

Federal Emergency Management Agency, National Flood Insurance Program, Community Rating System, Mapping Repetitive Loss Areas, August 2008.

University of New Orleans, Center for Hazards Assessment, Response and Technology, Draft Guidebook to Conducting Repetitive Loss Area Analyses, 2012.

Appendix A – Building Survey Data

Note: In accordance with the Privacy Act of 1974, Appendix A will not be shared with the general public.