



# NORTH CAROLINA FLOOD RESILIENCY BLUEPRINT

Tar-Pamlico River Basin Action Strategy (RBAS)

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# EXECUTIVE SUMMARY

The Tar Pamlico River Basin Action Strategy (RBAS) is a core component of North Carolina’s Flood Resiliency Blueprint, providing a comprehensive, data-driven plan to reduce flood risk and strengthen long-term resilience across the basin. The strategy integrates technical modeling, stakeholder engagement, and economic analysis to identify and prioritize effective flood mitigation actions at regional and local scales.

Flood resilience is the capacity of individuals, a community, a basin, or the environment to reduce, withstand, respond to, and recover from flooding by mitigating the impacts while also adapting to changing conditions including increased rainfall, sea level rise, and changes in land use.

The Tar Pamlico River Basin is the third-largest river basin in North Carolina, covering approximately 6,150 square miles across 19 counties and supporting a population of nearly 975,000 residents, projected to grow by 16.7% by 2060.

The basin faces substantial flood risk due to multiple contributing factors:

-  A diverse and economically vulnerable population, with higher-than-average poverty rates
-  Rapid development, with developed land expected to nearly quadruple by 2100
-  A humid subtropical climate with increasing temperatures, precipitation, and storm intensity

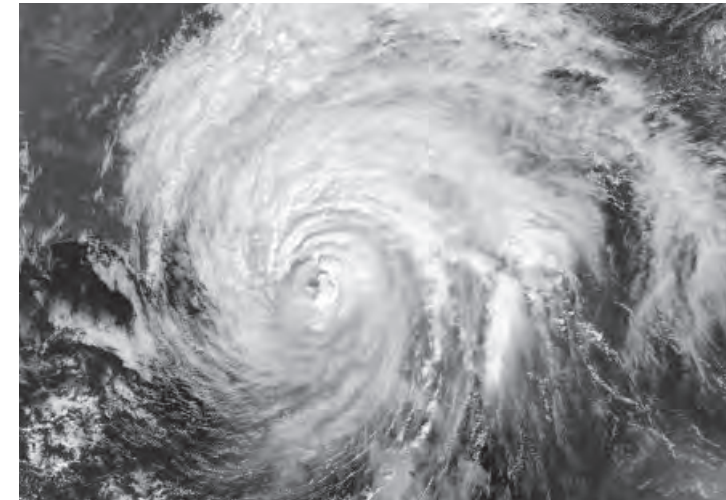
**19 counties**

**6,150 sq. miles**

**975,000 residents**

Flooding is driven by multiple sources, including:

- Riverine (fluvial), rainfall-driven (pluvial), coastal, and stormwater flooding
- Dam and levee failure risks
- Increasing impacts from climate change, sea level rise, and land development



Historic events such as Hurricanes Floyd (1999) and Matthew (2016) demonstrate the significant social, economic, and environmental impacts of flooding in the basin.

The basin faces widespread and increasing flood risk, compounded by climate change and development trends:

- 19,000+** buildings currently at risk, increasing to 26,071 under future conditions
- 306** dams (44 high-risk) and four levee systems, most with elevated risk levels
- High Risk** Highly vulnerable areas including Rocky Mount, Princeville, Greenville, Washington, and coastal communities

Future modeling indicates expanded exposure and higher damages, particularly in coastal and low-lying regions.

The RBAS follows a structured five-step planning process:



The process evaluated 347 resilience actions and incorporated extensive input from local governments, tribal communities, nonprofits, and residents—especially under-resourced and vulnerable populations.

Actions were prioritized based on benefit-cost ratios (BCR  $\geq$  1.0) over a 50-year life cycle, resulting in a balanced portfolio of regional and local projects:

## Major Regional Actions

- Rocky Mount Area: Floodplain restoration, drainage improvements, and levee upgrades
- Princeville Area: Internal drainage improvements and new levee construction (BCR  $\sim$ 2.93)
- Greenville Area: Levee construction and floodplain restoration (BCR  $\sim$ 1.81)
- Hyde County: Levee system upgrades (BCR  $\sim$ 1.33)

## High-Impact Local Actions

- Hatteras Village storm drainage improvements (very high BCR  $\sim$ 23.6)
- Stormwater and drainage improvements in Buxton, Enfield, and Washington Park
- Green stormwater infrastructure and flood attenuation projects

## Residual Risk Reduction

- Building-level mitigation (e.g., elevation, acquisition, floodproofing) for structures outside regional protection areas

These actions combine infrastructure, nature-based solutions, and policy measures to deliver multi-layered flood resilience.

The RBAS outlines a comprehensive funding strategy, identifying federal, state, and local sources such as FEMA mitigation programs, USDA watershed programs, and state grants.

Given the scale and cost of major projects, successful implementation will require:

- Leveraging multiple funding sources
- Strategic partnerships (e.g., FEMA, USACE, NC agencies)
- Support for cost-share requirements, especially in under-resourced communities

### Key Takeaways

- Flood risk in the Tar Pamlico Basin is significant and growing, driven by climate change, development, and aging infrastructure.
- The RBAS provides a comprehensive, data-driven roadmap for reducing risk and improving resilience.
- Priority actions focus on protecting high-risk communities, critical infrastructure, and vulnerable populations.
- Regional actions provide broad protection, while local and building-level actions address remaining risks.
- Successful implementation will depend on sustained funding, coordination, and improved data and modeling.
- There are currently capacity challenges for local governments. The Blueprint process, including capacity building, will improve flood resiliency outcomes for these areas and the basin.



Outer Banks Coastline in Buxton, NC

# TERMS & ACRONYMS

AADT	Annual Average Daily Traffic	COG	Council of Governments
Action	in the Blueprint, "actions" denote specific flood resilience measures identified and ranked at the basin scale. DEQ, in collaboration with communities, utilizes the Flood Resiliency Blueprint Tool to assess and prioritize these actions based on a variety of parameters.	CRS	Community Rating System
ALE	Annualized Loss Estimate	CWA	Carolina Wetlands Association
AMEXCAN	Association of Mexicans in North Carolina	CWSRF	Clean Water State Revolving Fund
Annual-Chance Flood Event	the probability that a flood event will occur in a given year.	DDF	Damage Depth Function
ADSO	Association of State Dam Safety Officials	DEQ	North Carolina Department of Environmental Quality
Basin	an area of land that contains a common set of waterbodies (streams, rivers, lakes, or wetlands) that all drain into a single larger body of water. Watersheds can be defined at multiple geographic scales. In North Carolina, 17 "major" watersheds (basins) are defined by statute.	DOT	Department of Transportation
BCA	Benefit-Cost Analysis	DWR	Division of Water Resources
BLE	Base Level Engineering	DWSRF	Drinking Water State Revolving Fund
BRIC	Building Resilient Infrastructure and Communities	ECL	End of Century Lower
BUILD	Better Utilizing Investments to Leverage Development	ECH	End of Century Higher
CB&TC	North Carolina Budget and Tax Center	ECS	End of Century Severe
CDBG	Community Development Block Grants	EEG	Environmental Enhancement Grant
CDBG-DR	Community Development Block Grants- Disaster Recovery	EPA	Environmental Protection Agency
CDBG-MIT	Community Development Block Grants- Mitigation	EQIP	Environmental Quality Incentives Program
CIP	Capital Improvement Plan	EWP	Emergency Watershed Protection
		FAST	Flood Assessment Structure Tool
		FEMA	Federal Emergency Management Agency
		FFE	Finished Floor Elevation
		Flood Resilience	the capacity of individuals, a community, business, or natural environment to reduce, withstand, respond to, and recover from flooding by positively mitigating the impacts of changing conditions and challenges including climate change, increasing rain fall, and sea level rise, and adapting to those conditions.

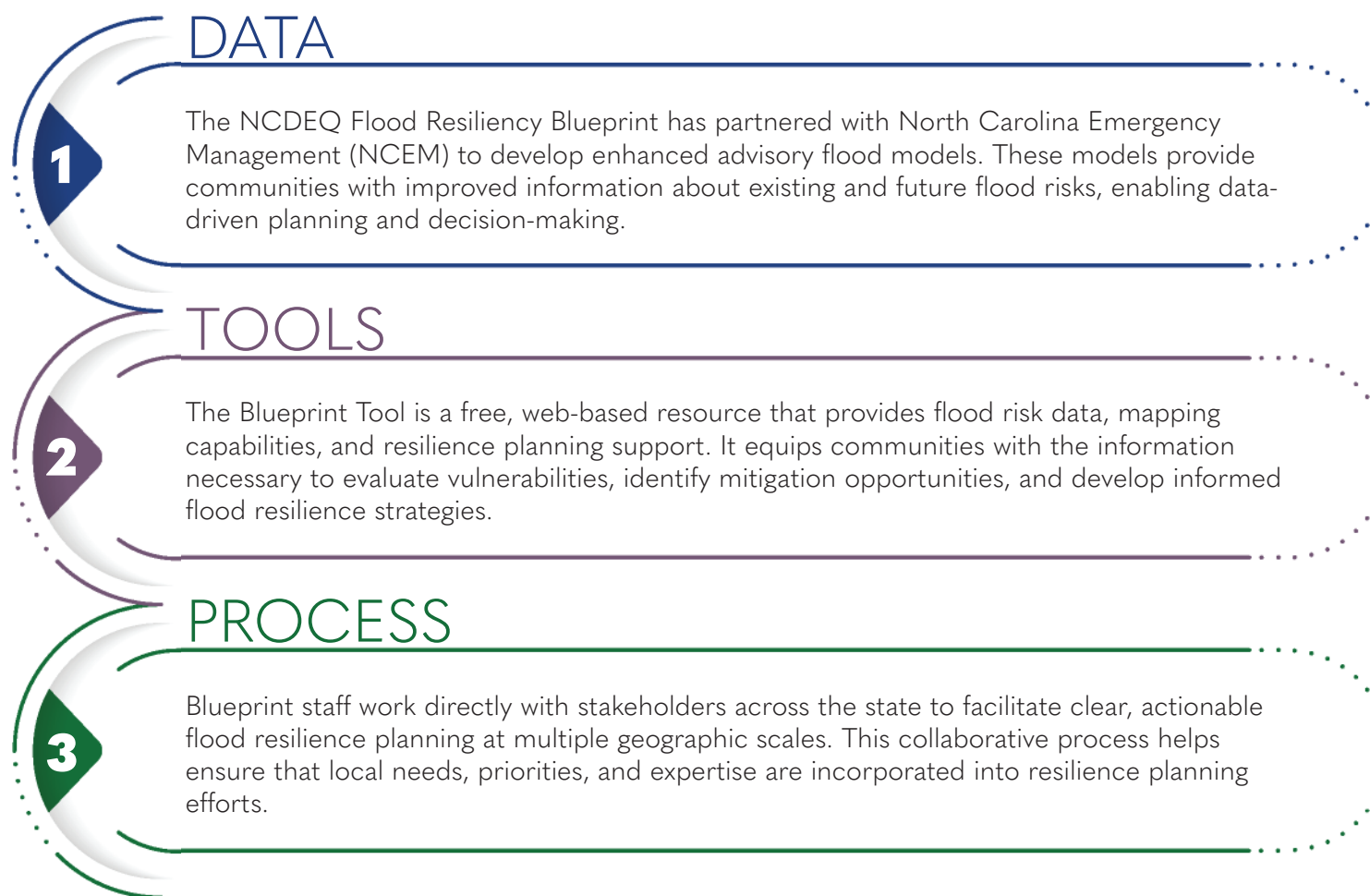
FMA	Flood Mitigation Assistance	NVA	Natural Valley Analysis
H&H	Hydrologic and Hydraulic	O&M	Operations and Maintenance
HMGP	Hazard Mitigation Grant Program	OSBM	North Carolina Office of State Budget and Management
ICLUS	Integrated Climate and Land Use Scenarios	PDM	Pre-Disaster Mitigation
LSAC	Levee Safety Action Classifications	PROTECT	Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation
MCL	Mid Century Lower	RCCP	Resilient Coastal Communities Program
MCH	Mid Century Higher	RBAG	River Basin Advisory Group
MPO	Metropolitan Planning Organization	RBAS	River Basin Action Strategy
NC	North Carolina	RL	Repetitive Loss
NCB&TC	North Carolina Budget and Tax Center	RPO	Rural Planning Organization
NCBA	North Carolina Black Alliance	SCOR	South Carolina Office of Resilience
NCCN	North Carolina Conservation Network	SDTSA	State Designated Tribal Statistical Area
NCDA&CS	North Carolina Department of Agriculture and Consumer Services	SERA	State Emergency Response Application
NCEM	North Carolina Emergency Management	SCSJ	Southern Coalition for Social Justice
NCGA	North Carolina General Assembly	SILC	North Carolina Statewide Independent Living Council
NCICS	North Carolina Institute for Climate Studies	SLR	Sea Level Rise
NCIDR	North Carolina Inclusive Disaster Recovery Network	SRF	State Revolving Fund
NCLWF	North Carolina Land & Water Fund	USACE	United States Army Corps of Engineers
NFIP	National Flood Insurance Program	USDA	United States Department of Agriculture
NFWF	National Fish and Wildlife Foundation	WFPO	Watershed and Flood Prevention Operations
NGO	Nongovernmental Organizations	WIFIA	Water Infrastructure and Innovation Act
NLCD	National Land Cover Database	WRDG	Water Resources Development Grant
NLD	National Levee Database	WSE	Water Surface Elevation
NOAA	National Oceanic and Atmospheric Administration		
NRCS	Natural Resources Conservation Service		
NRI	National Risk Index		

# INTRODUCTION

Over the past decade, North Carolina has experienced an increasing number of significant flood events, including Hurricanes Matthew (2016), Florence (2018), and Helene (2024). In just the last two years alone, Hurricanes Helene and Debby, Tropical Storm Chantal, and Potential Tropical Cyclone Eight have caused devastating impacts across the State of North Carolina. These events underscore the urgent need for proactive planning and strategic investments to strengthen flood resilience throughout the state.

Flood resilience is not the responsibility of a single agency or program. It requires coordinated action among communities, local, state, tribal, and federal governments, as well as a wide range of public and private stakeholders. Through effective planning, collaboration, and investment, communities can reduce flood damage and recover more quickly when flooding occurs. The North Carolina Flood Resiliency Blueprint was established to support this coordinated effort by providing the data, tools, and processes needed to guide decision-making and prioritize investments that reduce future flood risk, address gaps in existing mitigation efforts, and minimize the economic and social impacts of flooding.

The Blueprint is built upon three foundational components:



The North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS), was directed by the North Carolina General Assembly through Session Law 2021-180 (Senate Bill 105) to develop a Statewide Flood Resiliency Blueprint. Additional funding was later provided through Session Law 2022-75 (House Bill 911). The Blueprint serves as a statewide flood planning framework and decision-support system that enables state, tribal, regional, and local stakeholders to identify, prioritize, and implement effective flood resilience strategies.

By leveraging the best available science, data, and future-conditions modeling, the Blueprint help communities better understand long-term flood risks within their river basins. The framework is designed to be adaptive, incorporating new information as it becomes available to ensure that planning and investment decisions remain relevant and effective. Through improved coordination among agencies, programs, and all levels of government, the Blueprint seeks to maximize the use of available resources and support informed decisions that increase flood resilience across North Carolina.

## BLUEPRINT GOALS

The Blueprint is guided by three overarching goals:

- 1 Develop a statewide online decision-support tool.**  
The Blueprint Tool was created to serve stakeholders and communities in their flood resiliency planning efforts by offering flood risk data in tandem with a decision support tool. This Tool offers a flood resilience and community data hub to bolster the flood mitigation work that is already happening.
- 2 Establish community- and basin-specific planning processes.**  
Through the River Basin Action Strategies (RBAS), the Blueprint process creates a structured approach to identify and develop solutions tailored to the needs and priorities of individual communities and river basins. Addressing this challenge on a basin-wide scale allows for a more coordinated approach that is in concert with the hydrologic profile of the basin.
- 3 Create a repeatable statewide methodology.**  
Developing RBAS plans for all North Carolina river basins using a consistent methodology that enables each basin to identify and advance appropriate flood resilience solutions.

# PROGRAM APPROACH

To achieve these goals, the Blueprint program is being implemented through three integrated phases:

- Blueprint Process Development: Establishing a statewide planning framework that utilizes the best available data, science, and resources.
- Blueprint Tool Development: Creating an accessible platform that supports planning, analysis, and stakeholder engagement across North Carolina.
- River Basin Action Strategy Development: Developing RBAS plans for all North Carolina river basins using a consistent methodology that enables each basin to identify and advance appropriate flood resilience solutions.

Together, these efforts (broken down into the eight key steps in Figure 1) provide North Carolina with a comprehensive, data-driven approach to reducing flood risk, strengthening community resilience, and supporting long-term recovery and adaptation in the face of increasing flood hazards.

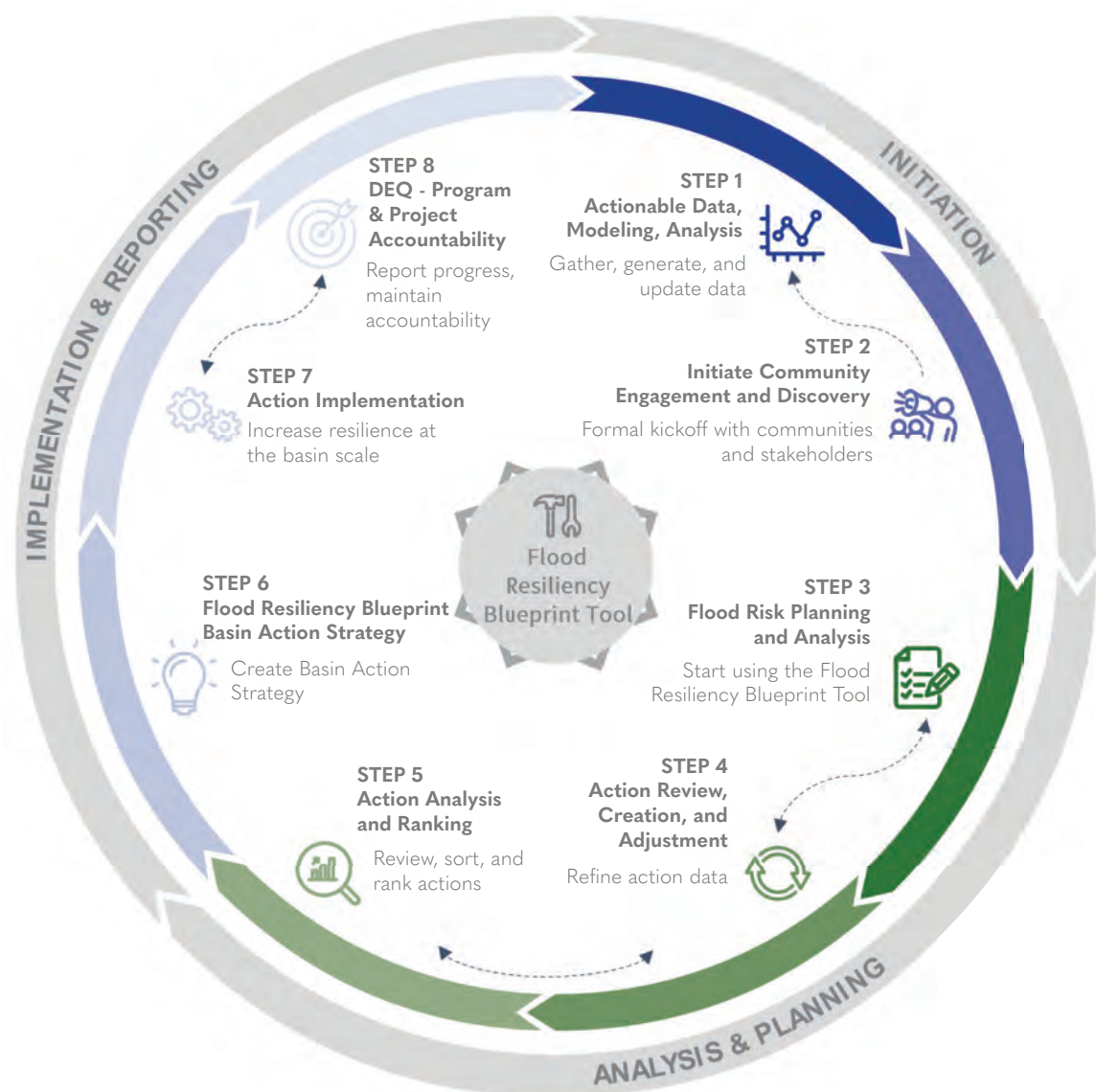


Figure 1. North Carolina Department of Environmental Quality (DEQ) Flood Resiliency Blueprint Tool and Planning Process (NCDEQ, 2024b).

# RATIONALE FOR RIVER BASIN ACTION STRATEGIES AND CONTEXT WITHIN THE BLUEPRINT

The RBAS is a strategic plan specific to an individual river basin developed with the assistance of the Blueprint Process and Tool. The strategy will be informed by community and stakeholder input and will outline specific flood resilience actions and potential funding sources.

## OBJECTIVES OF THE RBAS

The Blueprint process includes a unified approach to identifying resiliency actions across the state, but each basin has its unique needs. NCDEQ’s objective for the RBAS is to identify priority regions and mitigation actions within each basin. Additionally, any data needs or limitations are presented to highlight the growth and continued efforts needed within the basin. Development of an RBAS will utilize the latest detailed flood modeling datasets for both current and future conditions, ensuring that long-term planning is incorporated. Stakeholder engagement is also a large component of the RBAS process to ensure that decisions and recommendations are made in conjunction with local and regional entities and the specific needs of the basin. Overall, the RBAS will result in a list of prioritized actions, providing a starting point to making the basin more resilient to flooding.



The Cape Hatteras Lighthouse near Buxton, North Carolina



# BASIN OVERVIEW

## About the Basin

### Location

The Tar-Pamlico River Basin is the third-largest river basin in North Carolina (NC), spanning approximately 6,150 square miles of land and open water in the northeastern part of the state. The headwaters of the Tar River originate in Person County and the basin encompasses a portion of 19 counties (Figure 2). In these counties, there are 67 municipalities with Greenville, Rocky Mount, Wilson, Henderson, and Tarboro having the largest populations.

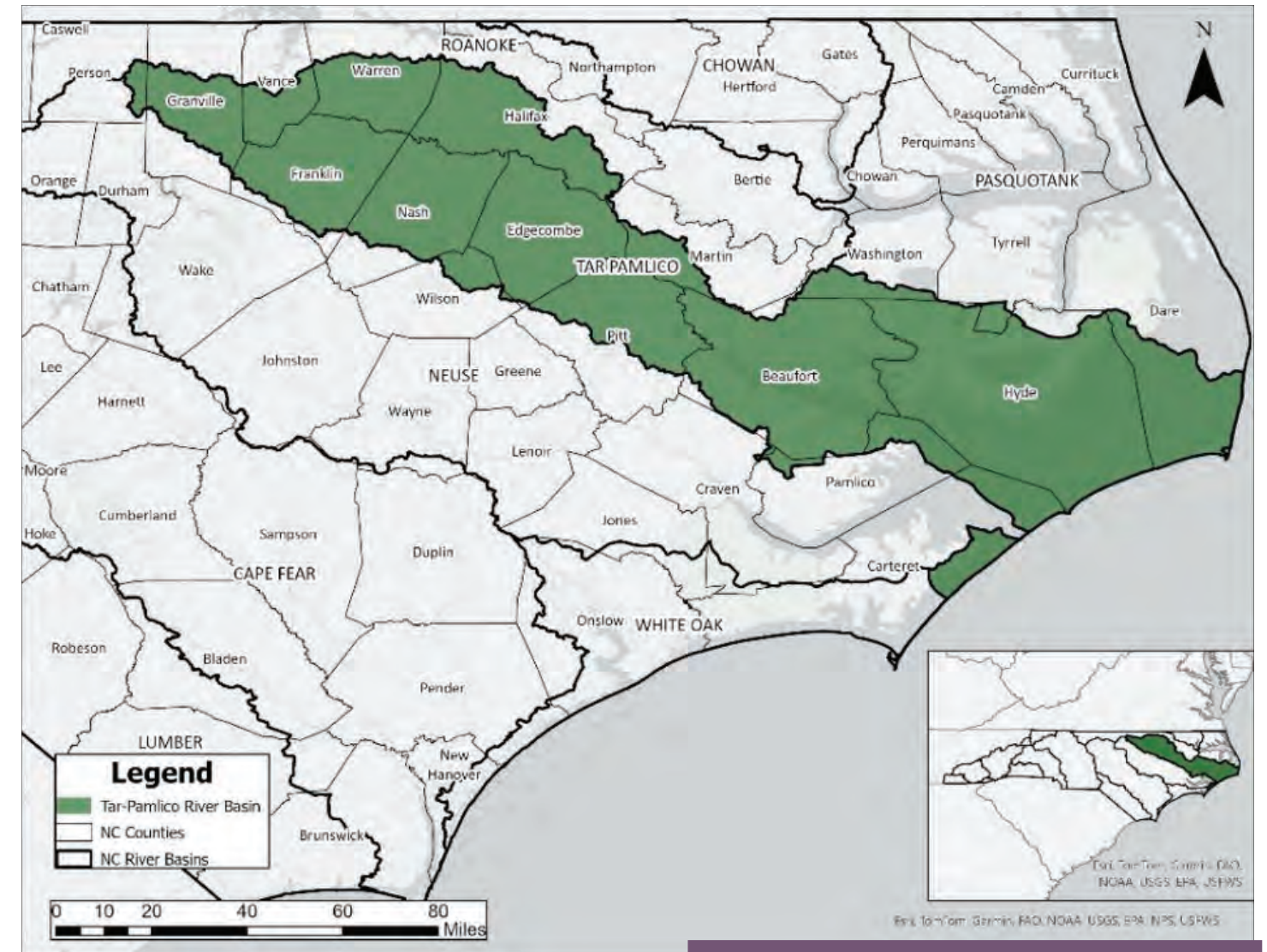


Figure 2. Location of the Tar-Pamlico River Basin and other North Carolina River Basins.

### Demographics

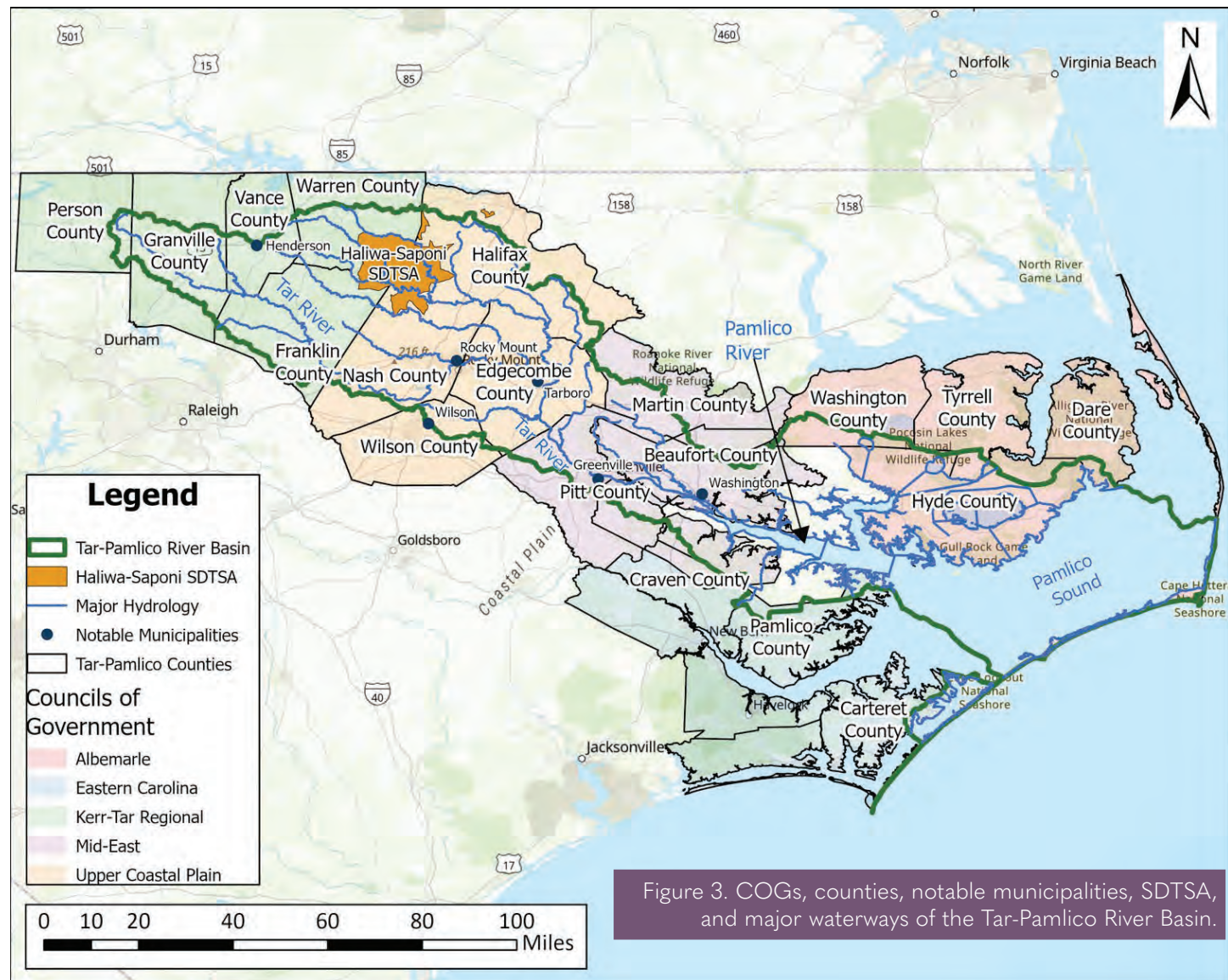
As of the 2020 US census, there are 974,518 people living in the Tar-Pamlico River Basin. Census data reported that the population of the counties within the basin grew by 10.2% from 2000 to 2020 (US Census, n.d.). The North Carolina Office of State Budget and Management (OSBM) projects an additional 16.7% in growth by 2060 (OSBM, 2025).



The basin's counties are racially diverse, with the non-white population making up of 44.3% at the county level and 47.5% at the community level. The county level poverty rate of 18.2% is higher than the state average of 13.2%. Additionally, the median county household income of \$57,997 is lower than the state median of \$69,904 (US Census Bureau, 2023).

The basin contains Haliwa-Saponi Tribe, which is the third largest state designated tribal statistical area (SDTSA) in NC. The tribe consists of 3,800 enrolled members that reside across Halifax, Warren, Nash, and Franklin Counties with its headquarters in the Town of Hollister (NCDQA, n.d.).

There are five Councils of Government (COGs) serving these communities that provide additional services and support (Figure 3).



### Climate

The climate of the Tar-Pamlico Basin, like much of the southeastern United States, is classified as a humid, subtropical climate characterized by hot, humid summers and mild winters (Koppen-Geiger Climate Classification) (GloH2O, 2025). According to 1991-2020 climate normals, the average annual temperature in the basin is 61.6 degrees Fahrenheit, which is higher than the state's annual average of 59.9 degrees Fahrenheit. The basin experiences an average annual rainfall of approximately 51.4 inches per year, just below the state average of 51.6 inches (PRISM, 2025).

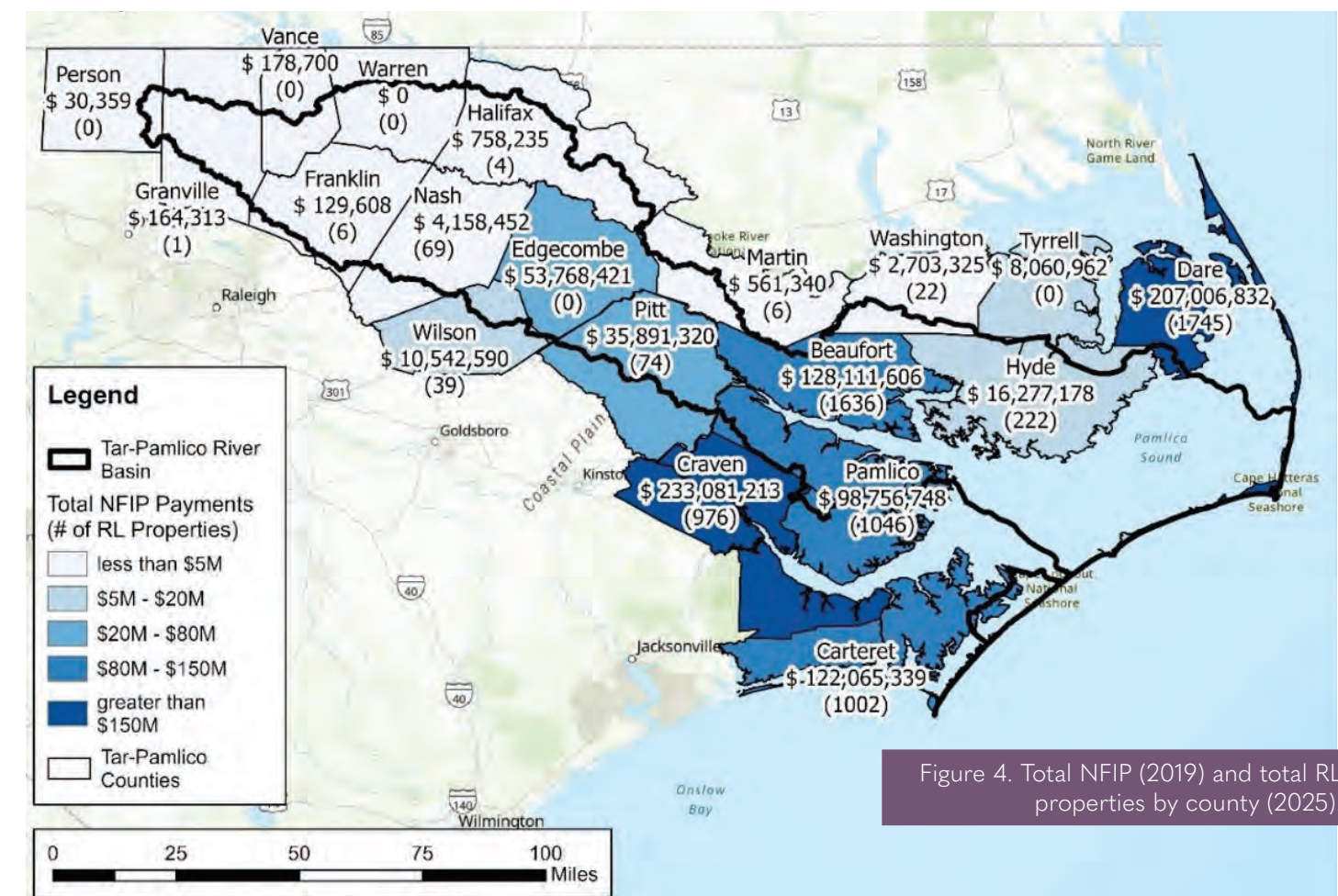
## Flood Risk

The Tar-Pamlico River Basin has faced multiple severe flooding events, causing widespread social, environmental, and economic impacts on communities throughout the basin.

Five main flooding sources were identified within the basin: fluvial flooding, pluvial flooding, coastal flooding and sea level rise, urban and stormwater flooding, and flooding resulting from the breach of dams and levees. Compound flooding is a concern within the basin, especially within the coastal communities. Compound flooding results from the interaction of two or more flooding sources, most commonly coastal, fluvial, and pluvial in any combination. Other secondary flooding sources including groundwater flooding may contribute to flooding within the basin. However, groundwater flooding was not assessed as a separate source in this report.

The Federal Emergency Management Agency's (FEMA) National Risk Index (NRI) investigates a county's vulnerability to 18 hazards, including riverine and coastal flooding, relative to all counties within the U.S. (FEMA, n.d.). The Tar-Pamlico Basin contains counties that exhibit all levels of risk, with the lowest being Person County in the 13th percentile of risk up to Carteret County being in the 98th percentile of risk within the state. NRI scores for counties within the Tar-Pamlico River Basin are provided in **Appendix A**.

In addition to the NRI, FEMA's National Flood Insurance Program (NFIP) collects data on flood related insurance claims including information on Repetitive Loss (RL) properties. These properties have flooded multiple times over a 10-year period causing more than \$1,000 in damages for each flooding event (FEMA, 2020). (Figure 4) shows the NFIP payments, as of 2019, and total RL properties, as of 2025, within the Tar-Pamlico Basin counties.



# History of Flooding

Hurricane	Year	Basin Impacts
Fran	1996	<ul style="list-style-type: none"> <li>6 inches of rain</li> <li>Storm surge of 9 feet was observed in Belhaven and Washington</li> <li>\$5+ billion in damages across NC*</li> <li>23 NC deaths (NWS, n.d.-a)</li> </ul>
Floyd	1999	<ul style="list-style-type: none"> <li>Preceded by Hurricane Dennis 2 weeks prior which created highly saturated conditions</li> <li>Peak Rainfall of 16 inches</li> <li>Record flood depths at 11 locations throughout Basin (USACE, 2024)</li> <li>36 NC deaths (NWS, n.d.-b)</li> </ul>
Matthew	2016	<ul style="list-style-type: none"> <li>Parts of the basin received 18 inches of rain in a 36-hour period</li> <li>\$1.5+ billion in flood damages in NC* (NWS, 2021)</li> <li>Record Tar-Pamlico Storm Surge Height (multiple locations)</li> </ul>

\*Damages not adjusted for inflation

# Basin Dynamics

## Land Use Changes and Development

The percentage of the Tar-Pamlico River Basin that is developed is expected to almost triple from 2023 to 2050 and increase by four-fold by 2100. The predicted increase in developed areas throughout the basin could impact surface runoff levels, water storage capacity, and reduce the level of natural stormwater mitigation.

Current Conditions		2050 Land Use		2100 Land Use	
Land Use Type	Percentage	Land Use Type	Percentage	Land Use Type	Percentage
Open Water	24.9%	Open Water	24.9%	Open Water	24.9%
Forest	21.9%	Wetlands	23.2%	Wetlands	14.6%
Cultivated Land	21.7%	Croplands	20.5%	High-Density Exurban	16.7%
Developed Area	6.7%	Developed Area	23.5%	Developed Area	30.6%

Sources: (MRLC, 2023) and (EPA, 2025)

## Climate

Average temperatures across NC are projected to increase by up to 10 degrees Fahrenheit by 2100 (NCICS, 2020). The actual level of warming is dependent on the future emissions of heat trapping gas. Annual precipitation levels have increased and are projected to continue to increase in future conditions. With increasing temperatures, hurricane storm events are projected to become more frequent and more intense, leading to increased levels of flooding in coastal and low-lying communities (NCICS, 2020).



Lake Mattamuskeet at Sunrise



## Population Shifts

The North Carolina Office of State Budget and Management (OSBM) projects an additional 16.7% in growth by 2060 across the Tar-Pamlico River Basin. Although the total population within the Tar-Pamlico River Basin is expected to increase, population changes will not be uniform across the communities within the basin. The populations of some communities are expected to increase while others are expected to decrease (Table 3). Franklin County is expected to grow faster than any other county in the basin from 2020 to 2060 (OSBM, 2025).

Table 1. Population projections for the Tar-Pamlico River Basin counties (OSBM, 2025).

County	Census 2020 Pop.	Projected 2040 Pop.	Projected 2060 Pop.	% Change 2020-2060
Beaufort	44,652	43,819	43,820	-1.9
Carteret	67,686	78,322	87,576	29.4
Craven	100,720	103,336	103,335	2.6
Dare	36,915	44,583	58,521	58.5
Edgecombe	48,900	48,730	48,731	-0.3
Franklin	68,573	112,525	143,437	109.2
Granville	60,992	73,991	88,979	45.9
Halifax	48,622	40,304	33,096	-31.9
Hyde	4,589	3,819	2,787	-39.3
Martin	22,031	18,021	14,303	-35.1
Nash	94,970	102,907	103,375	8.9
Pamlico	12,276	12,918	12,918	5.2
Person	39,097	42,411	45,770	17.1
Pitt	170,243	208,982	252,666	48.4
Tyrrell	3,245	3,480	3,479	7.2
Vance	42,578	41,221	41,222	-3.2
Warren	18,642	18,804	18,804	0.9
Washington	11,003	8,882	6,840	-37.8
Wilson	78,784	79,352	79,356	0.7
<b>Basin</b>	<b>974,518</b>	<b>1,086,407</b>	<b>1,189,015</b>	<b>16.7</b>
<b>State</b>	<b>10,439,388</b>	<b>12,966,080</b>	<b>15,369,596</b>	<b>47.2</b>

Rocky Mount Nash County North Carolina



# RIVER BASIN ACTION STRATEGY DEVELOPMENT PROCESS

The River Basin Action Strategy (RBAS) development process involved five main steps (Figure 1). Step 1 involved the development of an inventory of local actions, existing data, planning efforts, research projects, studies, and existing regional-scale modeling within the basin. The community engagement process (Step 2) has been an ongoing process, with the River Basin Advisory Group (RBAG) receiving updates and providing feedback throughout the process. Step 3 involved conducting flood risk and vulnerability analyses and development of regional resiliency actions to address identified areas of concern. Steps 4 and 5 of the Blueprint process involved the development of a list of priority resilience actions. This section summarizes the outcomes from these steps.

## ACTIONABLE DATA, MODELING, & ANALYSIS

### Inventory of Existing Data, Programs, & Studies

A literature review of all potential data, studies, plans, and programs (through January 2025) was performed to obtain knowledge on resiliency planning and action implementation within the Tar-Pamlico River Basin. The outcome is a list of 347 resiliency actions that have been proposed, planned, or completed within the Tar-Pamlico River Basin (See **Appendix A**). Qualifying actions fall under one of the following investment types: structural, non-structural, nature-based, planning, and policy. Common themes that emerged from the inventory of existing data, programs, and studies were post-hurricane recovery, future flood prevention through resiliency, and funding sources.

The existing flood risk data within the Tar-Pamlico River Basin comes in the form of hydrologic and hydraulic (H&H) modeling and floodplain data. National, statewide, and local level data sources were inventoried, and this data was utilized to determine the level of flood risk and vulnerability in communities across the basin. NCDEQ collaborated with NCEM to complete 2D flood modeling for the Tar-Pamlico River Basin as part of the Blueprint process and development of the RBAS. The 2D modeling work considered both current and future conditions flooding. A complete list of the modeling and dataset sources found through the literature review can be found in **Appendix A**.

## Local & Regional Capacity

The capacity of communities is a key factor in their ability to develop, fund, manage, and implement resiliency actions. Governmental structure, population, demographics, and socioeconomics all influence a community's capacity. Understanding each community's staffing, budget, and programmatic composition is vital to assessing its ability to successfully participate in the Blueprint process.

The Blueprint Capacity Analysis assessed each municipality or county's capacity to participate in the following six components:

1. Blueprint Tool and planning process training;
2. Independent or supported use of the Blueprint Tool to identify, analyze, and prioritize action strategies;
3. Project feasibility or conceptual design creation for selected strategies;
4. Action strategy funding;
5. Action strategy implementation; and
6. Ongoing stewardship or management of completed action strategies.

Eleven counties in the Tar-Pamlico River Basin were deemed to have moderate capacity and 8 counties were deemed to have high capacity to participate in the Blueprint process (Figure 5). Municipalities and unincorporated communities were more varied, with 37 at low, 22 at moderate, and 7 at high for the overall capacity rating (Figure 6). Details on the metrics and data that were used in the capacity analysis can be found in **Appendix C**. A lower ability to engage in the six Blueprint components with communities leads to gaps in action with some of the highest risk and vulnerable areas. Capacity building is paramount to the effective resiliency in the Tar-Pamlico River Basin.

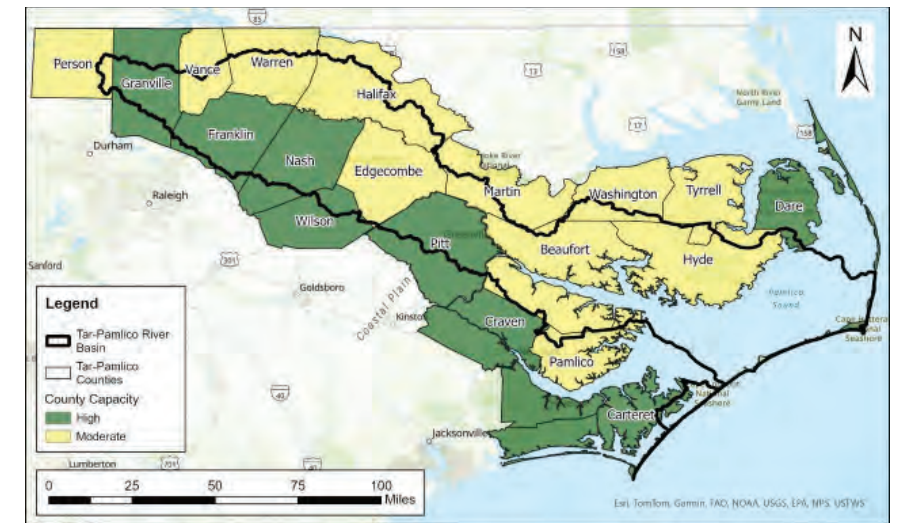


Figure 5. Tar-Pamlico Basin county level overall Blueprint capacity.

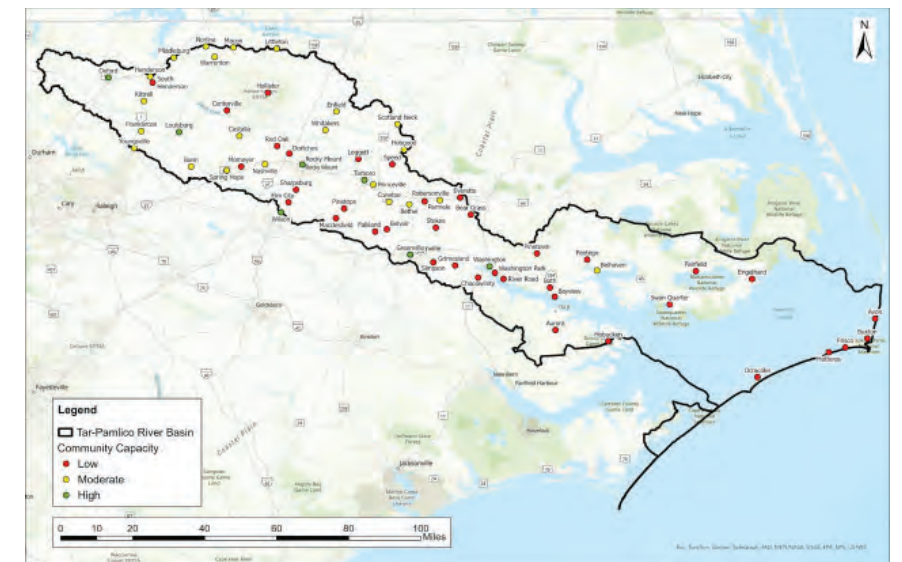


Figure 6. Tar-Pamlico Basin community level overall Blueprint capacity.

# COMMUNITY ENGAGEMENT & DISCOVERY

## Engagement with Local Communities & Agencies

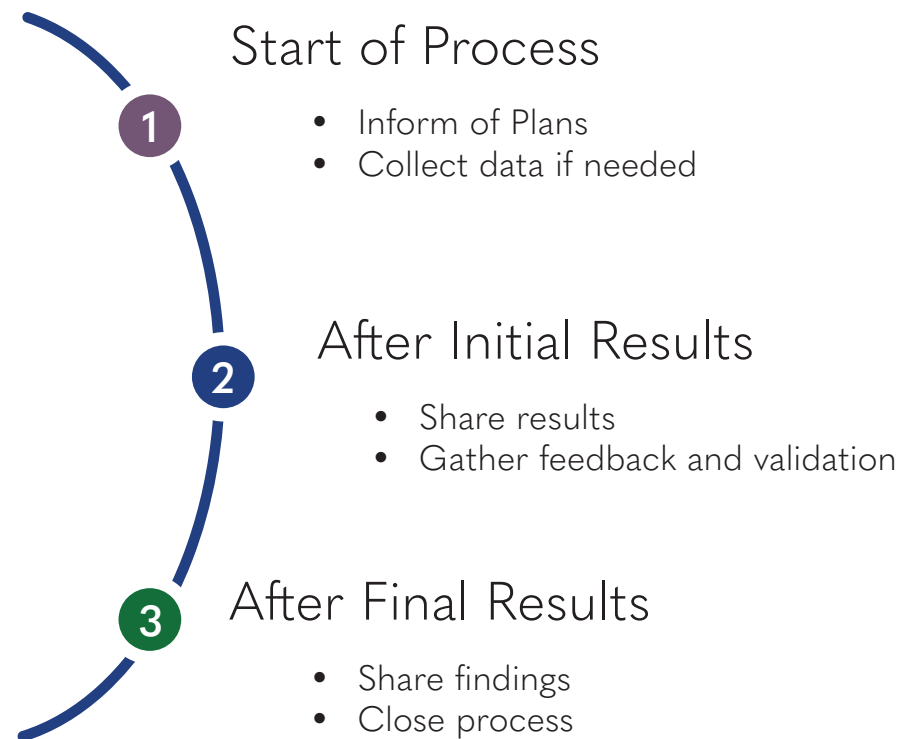
Planning for flood resilience works best when it is shaped by the people and communities who experience flooding firsthand. In the Tar-Pamlico River Basin, outreach and engagement were designed to make sure local voices, experiences, and priorities played a central role in developing the Tar-Pamlico River Basin Action Strategy.

During the development of the River Basin Action Strategy, engagement efforts focused on regional and basin-wide planning, and included communities, local governments, tribal representatives, along with nonprofit and regional organizations across the basin. A structured Outreach and Engagement Plan guided this work, establishing a coordinated approach to sharing information, gathering feedback, and building partnerships (Figure 7). A strong focus was placed on reaching and including vulnerable, under-resourced, and underserved communities to ensure their perspectives helped shape the process.

Central to this approach was the commitment to two-way communication and trust-building. Regular meetings, training sessions, and accessible “office hours” provided opportunities for stakeholders to learn, ask questions, and offer feedback. Continuous one-on-one support ensured that participants could engage at a level appropriate to their needs. As the process progressed, stakeholder input directly informed improvements to tools, data, and planning methods.

Through these sustained engagement efforts, the Action Strategy reflects a collaborative, data-informed approach to reducing flood risk. By integrating technical analysis with local expertise and community perspectives, the Blueprint process supports decision-making that is both regionally coordinated and responsive to on-the-ground needs.

Figure 7. River Basin Action Strategy Data Analysis Engagement Cycle.



## Blueprint Tool Trainings

To ensure the success of the Flood Resiliency Blueprint, stakeholders across the river basin were given multiple opportunities to become familiar with the Flood Resiliency Blueprint Tool, understand the

The Blueprint Tool is just one step within a structured planning and decision-making process. Stakeholder trainings and communications help to explain how users move from an initial vulnerability analysis to identifying potential actions, comparing multiple options, including cost-benefit considerations, and finally selecting an action or project concept for submission as a formal proposal.

planning process, and apply it to strengthen their community’s flood resilience. DEQ encouraged stakeholders to use the Tool and planning framework and committed to providing training and ongoing technical support to maximize project impact. Partners who become Blueprint Tool users can share information within their agencies or neighborhoods and help train others. Some Partners may not use the Tool directly but can still contribute valuable community knowledge relevant to flood resiliency.

The Blueprint Tool training process began with a kickoff meeting introducing the Tool, its purpose within the broader Blueprint process, and available training options. Regular email updates kept stakeholders informed about Tool developments, planning progress, and meeting activities, while also offering a structured way to submit questions, concerns, and suggestions.

Virtual office hours and one-on-one meetings provided Partners with additional opportunities to ask about Tool registration and strengthen community networks. Stakeholders were also invited to review and provide feedback on community guidance materials and the effectiveness of the overall use of the Blueprint Tool, with the process being continuous such that changes can continue to be incorporated.



NCDEQ Resiliency Blueprint Tool

## River Basin Action Stakeholders

Several main groups were involved in developing the Action Strategy: the Blueprint Partners, River Basin Advisory Group, and the General Public, including collaborations outside of regularly scheduled meetings. These groups met from March 2025 through July 2026 and were structured to include a diverse range of participants, including municipal and county staff, watershed experts, nonprofit leaders, and community representatives. The result is a network of individuals at varying levels of involvement that will continue to engage and grow after the action strategy is complete. Detailed information on the network of stakeholders and meeting summary notes can be found in **Appendix B**. The roles of Additional Collaborators and Councils of Government Participation in the process are included in the appendix.

Geographical representation of the basin was also a key consideration as stakeholder groups were formed. To create inclusive and effective groups, DEQ staff selected a diverse set of representatives from local and tribal municipalities, as well as regional and statewide resilience groups.



### Blueprint Partners

Blueprint Partners are community leaders and end users who are interested in the Blueprint Tool and can assist with training and communication to other members of their community and the broader river basin. Partners had several opportunities to learn about the Blueprint process and Tool at information and hands-on training sessions. Details about this group and meeting summary notes are included in **Appendix B**.



Tar-Pamlico Blueprint Partners meeting in Rocky Mount

## River Basin Advisory Group

Advisory Group members represent diverse perspectives, with emphasis on under-resourced communities, including rural and unincorporated areas, people of color, individuals with disabilities, non-English-speaking communities, and those with low socioeconomic status. Members come from local and tribal governments, community and faith-based organizations, and other groups involved in flood-related issues across the basin.

RBAG members provided guidance on how to effectively engage with and use information from the NC Flood Resiliency Blueprint at the regional scale. They reviewed summaries of existing flood mitigation plans, flood risk and vulnerability analyses, and potential actions to strengthen regional flood resilience. They also helped prioritize these actions and offered feedback on DEQ's community guidance for using the Blueprint Tool and planning process.



## Engagement with the General Public

Throughout the development of the River Basin Action Strategy, DEQ Basin Leads connected with community-focused individuals and organizations interested in the Blueprint Tool and planning process. While these groups wanted to stay informed, they were not identified as Blueprint Partners or Advisors due to limited capacity, roles that did not align with intended tool users, or commitments in other Blueprint river basins.

This two-way relationship building, which took place outside specific stakeholder meetings, enabled DEQ to share information and learn from communities. Participants shared their organization's priorities, challenges and on-the-ground experiences, many of which were in vulnerable, underserved, and under-resourced communities. Basin Leads provided updates and resources that could be shared with networks. These partnerships gave DEQ a clearer understanding of local needs and strengthened DEQ's engagement approach. They also ensured that the Blueprint Tool and planning process better supported DEQ's goal of making all of North Carolina's communities more resilient to flooding.

These additional collaborators include, but are not limited to:

- The Association of Mexicans in North Carolina (AMEXCAN)
- North Carolina Black Alliance (NCBA)
- NC Statewide Independent Living Council (SILC)
- Southern Coalition for Social Justice (SCSJ)
- North Carolina Budget & Tax Center (NCB&TC)
- North Carolina Conservation Network (NCCN)
- North Carolina Inclusive Disaster Recovery Network (NCIDR)
- Carolina Wetlands Association (CWA)
- Upper Coastal Plain Council of Governments
- Mid-East Commission
- North Carolina Department of Environmental Quality Division of Coastal Management
- NC State Coastal Dynamics Design Lab
- The Stimulus

The NC Flood Resiliency Blueprint Program also hosted a public information session in March 2026. The session recording can be viewed on DEQ's YouTube page.



Tar-Pamlico RBAG meeting in Rocky Mount



## Engagement with Under-Resourced Communities

To help ensure engagement efforts included the basin communities most affected by flooding, DEQ and project partners used a data-driven approach to identify areas with higher flood risk and greater social and economic challenges. This analysis combined national and state data with local knowledge to better understand where support and engagement were most needed.

Using mapping and analysis tools, the project team reviewed data on flood risk, economic conditions, and community vulnerability across the basin and identified and ranked areas based on overall vulnerability and flood risk. The initial findings were presented to the Basin Lead and the engagement team who work in these communities. Based on their input, additional communities and counties were identified for outreach.

DEQ then contacted representatives from these communities and invited them to take part in the engagement process, including Blueprint Partners and RBAG meetings. Stakeholders were also encouraged to meet one-on-one with the Basin Lead for more personalized conversations about the community's interest and ability to be involved in the Blueprint process. In some cases, outreach resulted in community representatives inviting the Basin Lead to present information about the Blueprint Tool and process to their local government.

This approach helped ensure outreach was fair and reached the communities most impacted by flooding. It also created new connections and strengthened existing relationships.

Detailed information on the data inputs used, findings, and additional outreach completed, are included in **Appendix B**.

Cape Hatteras Lighthouse



# FLOOD RISK PLANNING & ANALYSIS

A basin-scale risk and vulnerability analysis was completed to identify vulnerable areas within the basin and develop up to 20 new regional or multi-jurisdictional resiliency actions that mitigate the risk of flooding. The regional actions, however, may not mitigate all the risk within the basin. Local actions were selected to mitigate the residual risk, after the regional actions are in place.

The flood risk analysis estimated the potential damage to buildings and other infrastructure because of flooding.

The vulnerability analysis identified the areas that exhibit the highest levels of risk density across the

basin. Regional or multi-jurisdictional resiliency actions were developed for the areas that exhibited the highest levels of risk density.

To develop a comprehensive list of areas vulnerable to flooding and potential mitigation actions, the risk and vulnerability analysis was completed separately for the dam and levee breach flooding source, and for the combined fluvial, pluvial, coastal, and urban and stormwater flooding sources.

The combined fluvial, pluvial, coastal, and urban & stormwater flood risk was assessed under existing climate conditions and future climate conditions.

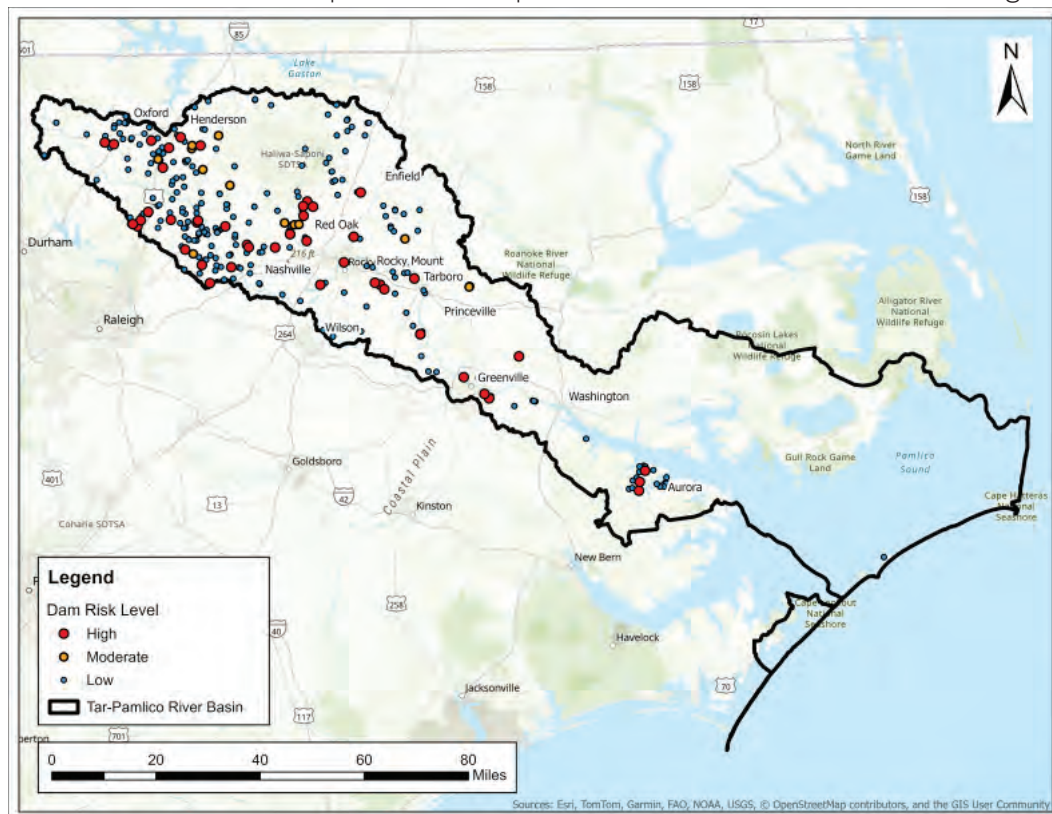
## Flood Risk Analysis Dam and Levee Breach Risk

Within the Tar-Pamlico River Basin, there are 306 dams and four levee embankment systems: the Princeville Dike, Merita Bakery Levee, Deep Creek FDRP, and Swan Quarter Dike.

Four key criteria were summarized at the dam level to provide a comprehensive view of dam risk: the average damage ratio, total losses, maximum Annual Average Daily Traffic (AADT) disrupted (NCDOT, 2025), and impacts to other critical infrastructure.

Levee breach risk analysis was performed on the four levee systems utilizing information from the National Levee Database (NLD) (USACE, n.d.), NCEM 2D BLE modeling, NC Statewide building footprints, and terrain data provided by NCEM (NCEM, 2026).

Figure 8. Tar-Pamlico River Basin dam breach risk analysis results.



Lake Mattamuskeet

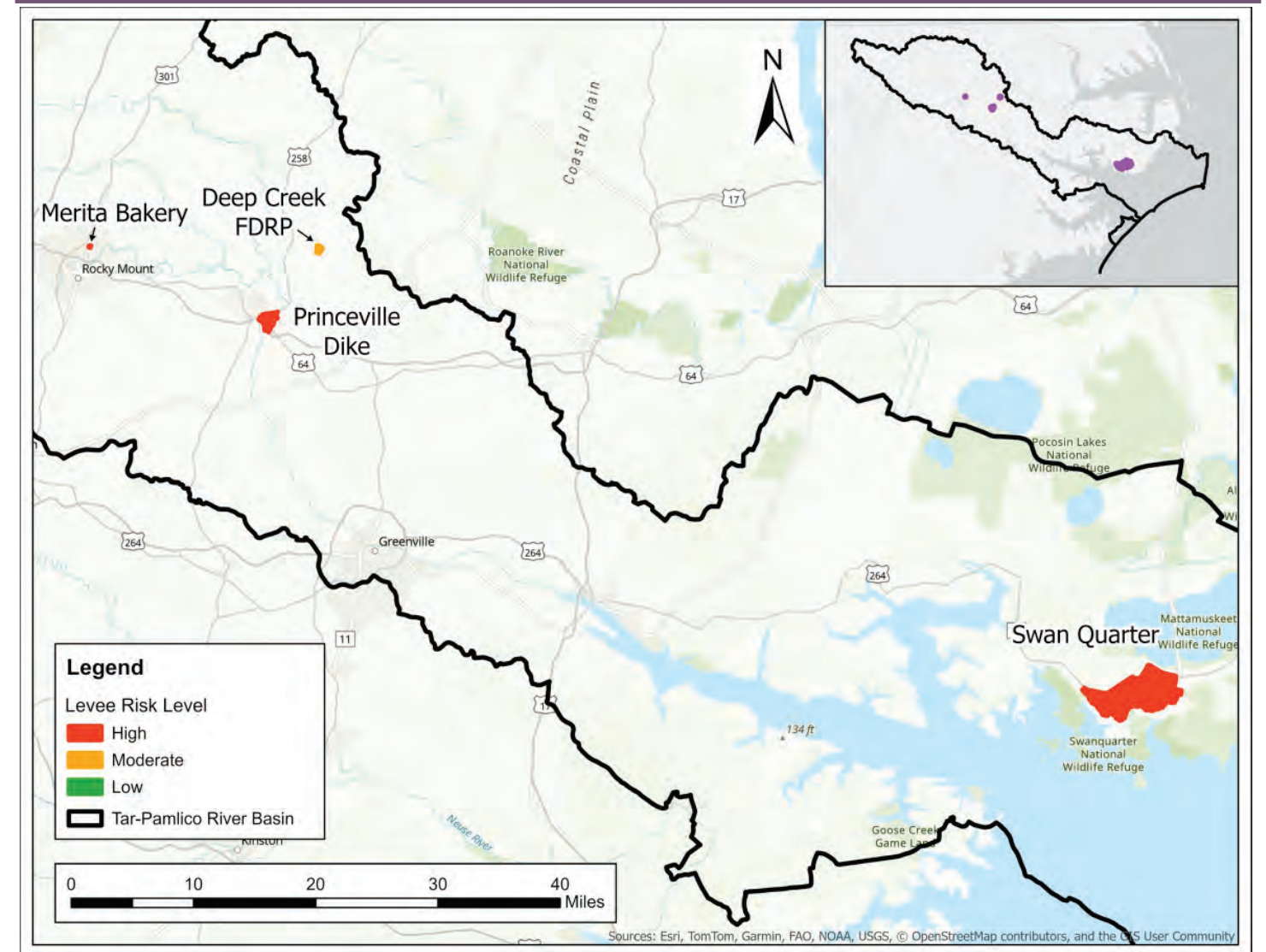


The risk levels for the 306 dams show a picture of dam breach flood risk. In total, 44 dams were identified as high risk, 13 moderate risk, and 249 low risk (Figure 8).

The Princeville Dike, Merita Bakery, and the Swan Quarter Dike levee systems were observed as high risk and the Deep Creek FDRP levee was observed as moderate risk based on the flood risk analysis. Figure 9 identifies the area that would be impacted if each levee were to breach and floodwater is not held back.

Further information on the dam and levee breach flood risk analysis can be found in **Appendix E**.

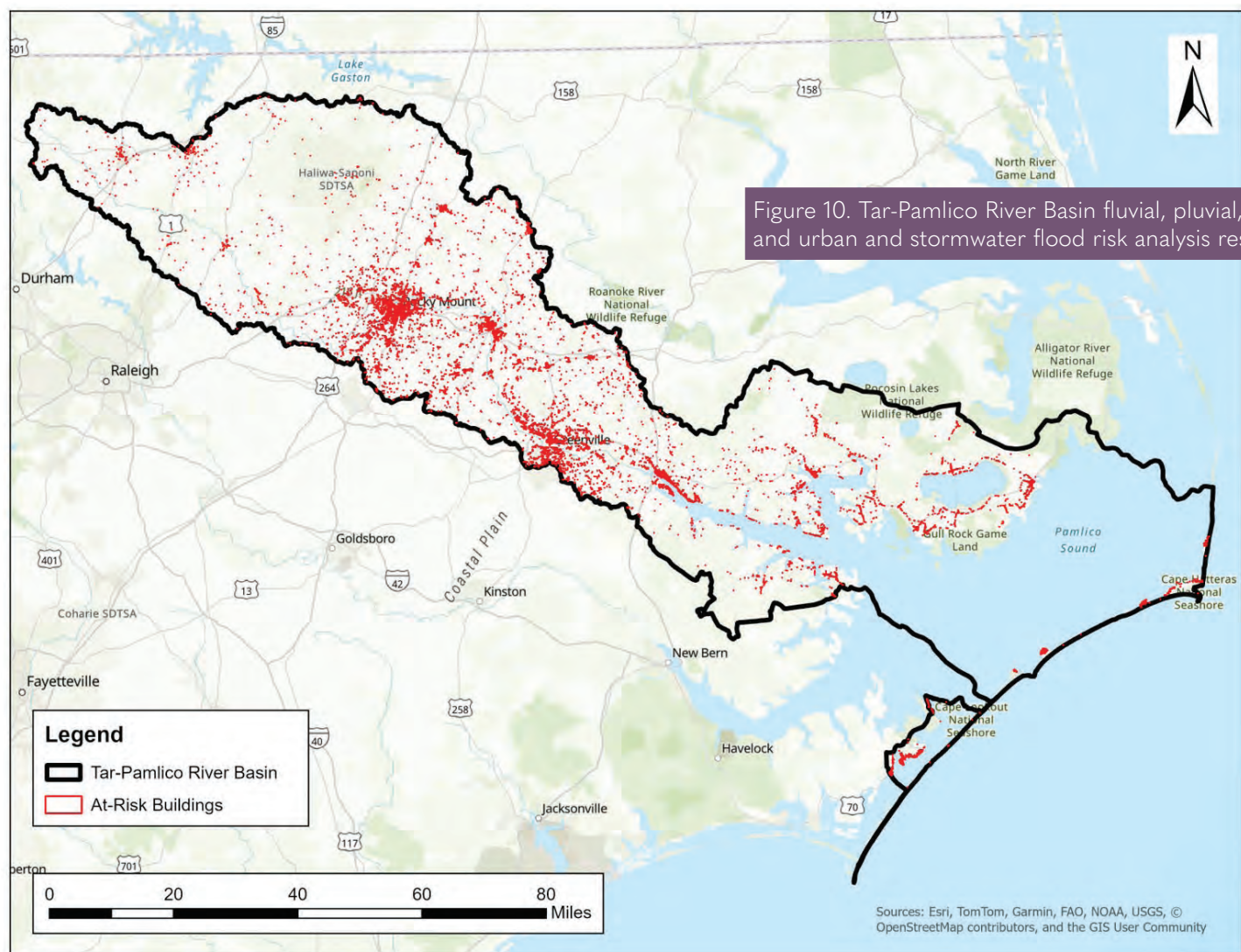
Figure 9. Tar-Pamlico River Basin Levee breach risk analysis results.



### Fluvial, Pluvial, Coastal, and Urban and Stormwater Flood Risk Analysis - Current Conditions

A part of the Blueprint process was the development of 2D BLE deliverables, which included building-level risk data for current land use and precipitation conditions, reported as risk scores, for all impacted buildings in the Tar-Pamlico River Basin. A risk score provides an estimate of the likelihood that a structure would experience damage during a flood event using an annualized loss estimate (ALE) value and the building’s replacement value (NCDEQ, 2025a).

Of the 263,866 total buildings within the basin, 19,926 had a risk score greater than zero based on current conditions modeling (Figure 10). Additional details can be found in **Appendix E**.

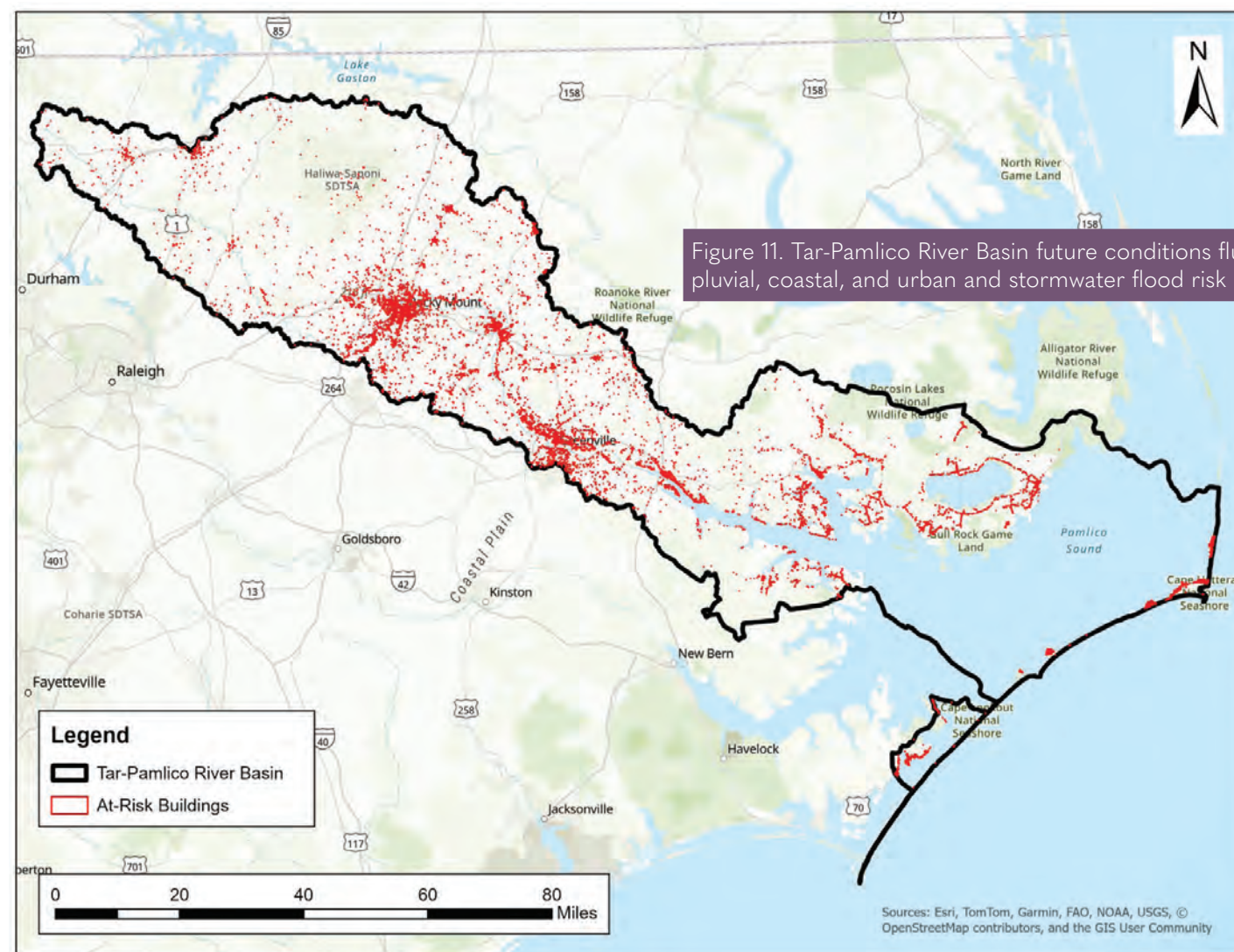


### Fluvial, Pluvial, Coastal, and Urban and Stormwater Flood Risk Analysis - Future Conditions

The NCEM 2D BLE models incorporated future land use and precipitation conditions for five climate scenarios (Mid Century Lower (MCL), Mid Century Higher (MCH), End of Century Lower (ECL), End of Century Higher (ECH), and the End of Century Severe (ECS)) and two buildout conditions scenarios that incorporate future land use (2050 Buildout and 2100 Buildout).

To understand the total losses in relation to each future event, the ratio of the total losses relative to the total building replacement value was calculated, referred to here as the “damage ratio.” The ratio was then scaled to make the possible range 0 to 100. A damage ratio value of zero indicates the flood depth would not cause any damage at that building and 100 indicates that the total losses were equal to the total building replacement value.

The future flood risk analysis indicates that there are 26,071 buildings impacted by at least one of the seven future or buildout condition scenarios (Figure 11). The results of the future flood risk analysis point to increased flood risk in the future. More information on the future conditions flood risk analysis can be found in **Appendix E**.



# Flood Vulnerability Analysis

## Dam and Levee Breach Vulnerability

Two factors that influence the likelihood of a dam breach are condition and age, with both metrics included in the NC Dam Inventory (NCDEQ, 2025b). A poor rating indicates that action may be necessary to reduce risk for realistic conditions, while an unsatisfactory rating indicates a deficiency that requires “immediate or emergency remedial action for problem resolution” (ASDSO, 2025). Therefore, the downstream impacted area of an identified high risk dam which is also noted as being in poor or unsatisfactory condition was classified as highly vulnerable.

The age of a dam is important because the quality and integrity of the structure itself can degrade over time. Older dams are also likely to have been designed using outdated design standards and may not be equipped to handle the same hydrologic loads as newer dams. As such, the downstream impacted area of an identified high risk dam which was also indicated as being over 50-years old was classified as highly vulnerable.

Overall, current analysis and available data identified 44 areas vulnerable to dam flooding. Of these, 22

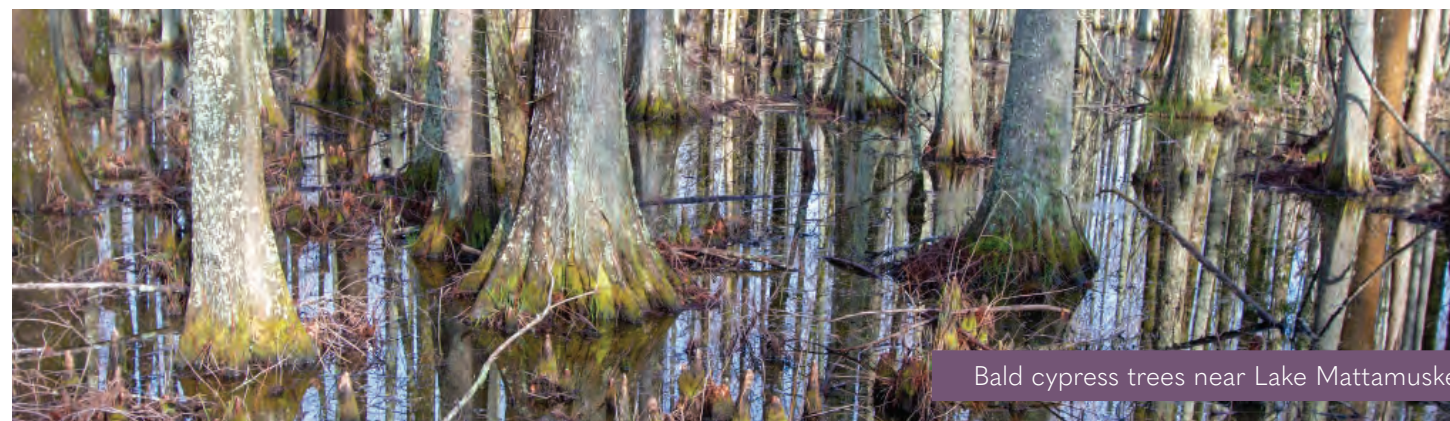
of the areas were classified as highly vulnerable, as they are also downstream of dams with either an age greater than 50 years or in poor or unsatisfactory condition.

The National Levee Database (NLD) describes the condition and past performance of the levee, which provides context for the risk ratings. A levee with a history of overtopping or breaching may have remaining deficiencies that require mitigation. The Levee Safety Action Classification (LSAC) ratings and qualitative descriptions of condition, and history were gathered from the NLD. Taking these factors into consideration, areas protected by levees with high risk levels were considered vulnerable and high risk levees with noted condition issues or a history of failure were classified as highly vulnerable. Based on this classification, the Princeville Dike levee system was denoted as highly vulnerable and the other 3 levee systems within the basin (Merita Bakery, Deep Creek FDRP, and Swan Quarter Dike) were denoted as vulnerable.

Detailed results of the vulnerability analysis can be found in **Appendix E**.

## Fluvial, Pluvial, Coastal, and Urban and Stormwater Vulnerability Analysis - Current Conditions

A cluster analysis was performed on the current conditions building risk results to delineate the regions with the highest risk density, denoting high vulnerability. Five concentrated areas of risk were identified as highly vulnerable within the Tar-Pamlico River Basin: the City of Rocky Mount and surrounding areas, the Town of Princeville and surrounding areas, the City of Greenville and surrounding areas, the City of Washington and surrounding areas, and Core Sound.



Bald cypress trees near Lake Mattamuskeet

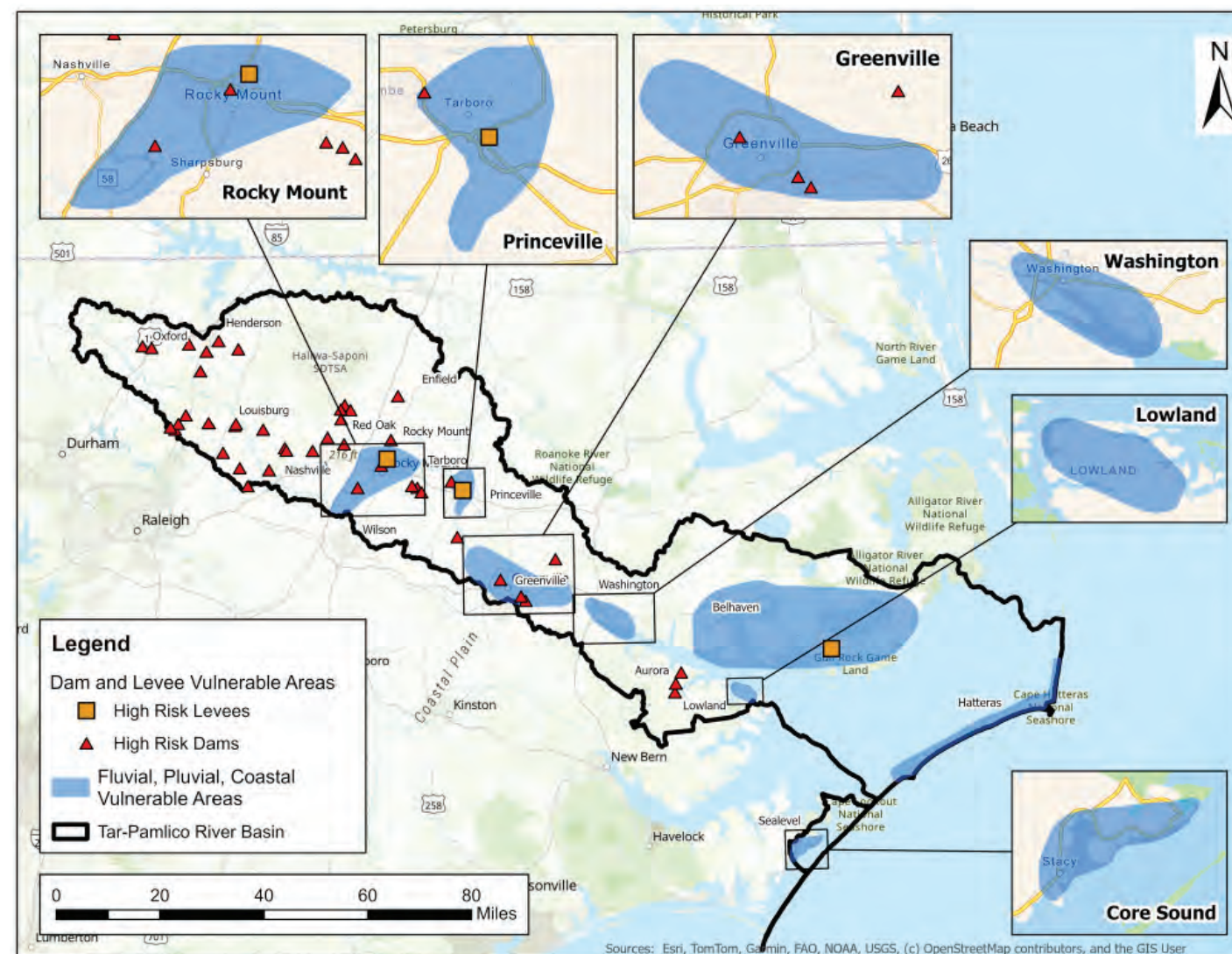
## Fluvial, Pluvial, Coastal, and Urban and Stormwater Vulnerability Analysis - Future Conditions

A cluster analysis was performed on the future conditions building risk results to delineate the areas with the highest risk density, indicating high vulnerability. The future conditions analysis indicates that the areas that are highly vulnerable under current conditions will be even more vulnerable in the future. There will also be new areas of vulnerability under future conditions: the Community of Lowland and surrounding areas, Lake Mattamuskeet and surrounding areas, and the Outer Banks. These results are elaborated further in **Appendix E**.

## Tar-Pamlico River Basin Flood Vulnerability Overview

The identified vulnerable areas for the Tar-Pamlico River Basin can be seen in Figure 12. The figure depicts the regions within the basin that are currently vulnerable or will become vulnerable to flooding in the future.

Figure 12. Fluvial, pluvial, and coastal vulnerable areas to flooding in the Tar-Pamlico River Basin.



# Identification of Regional Resiliency Actions

The vulnerability analysis identified the regions or areas within the Tar-Pamlico River Basin that exhibit the highest flood risk for both future and current conditions. Regional actions were identified to mitigate flood risk within these vulnerable regions. If one action could not mitigate the flood risk within each vulnerable area, a group of actions was proposed that would mitigate the flood risk when implemented together. However, there were some areas where regional actions could not currently be identified to fully mitigate the identified flood risk. The proposed regional actions are:

- 1 Basin-wide Identified Dam Vulnerable Areas  
Regional Dam Inspections, Maintenance, and Modification or Removal

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- 2 Basin-wide Identified Levee Vulnerable Areas  
Levee System Inspection, Maintenance, Repairs, and Upgrades

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- 3 City of Rocky Mount and surrounding areas  
Floodplain Restoration, Stream and Drainage Maintenance System Program, and Dry Dam Construction

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- 4 Town of Princeville and surrounding areas  
Internal Drainage Improvements, Levee Construction in Shiloh Hills, Levee Construction in Tarboro, and Dry Dam Construction

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- 5 City of Greenville and surrounding areas  
Floodplain Restoration and Levee Construction

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- 6 City of Washington and surrounding areas  
No Identified Actions

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- 7 Core Sound  
No Identified Actions

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- 8 Community of Lowland and surrounding areas  
No Identified Actions

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- 9 Lake Mattamuskeet and surrounding areas  
No Identified Actions

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- 10 Outer Banks  
No Identified Actions

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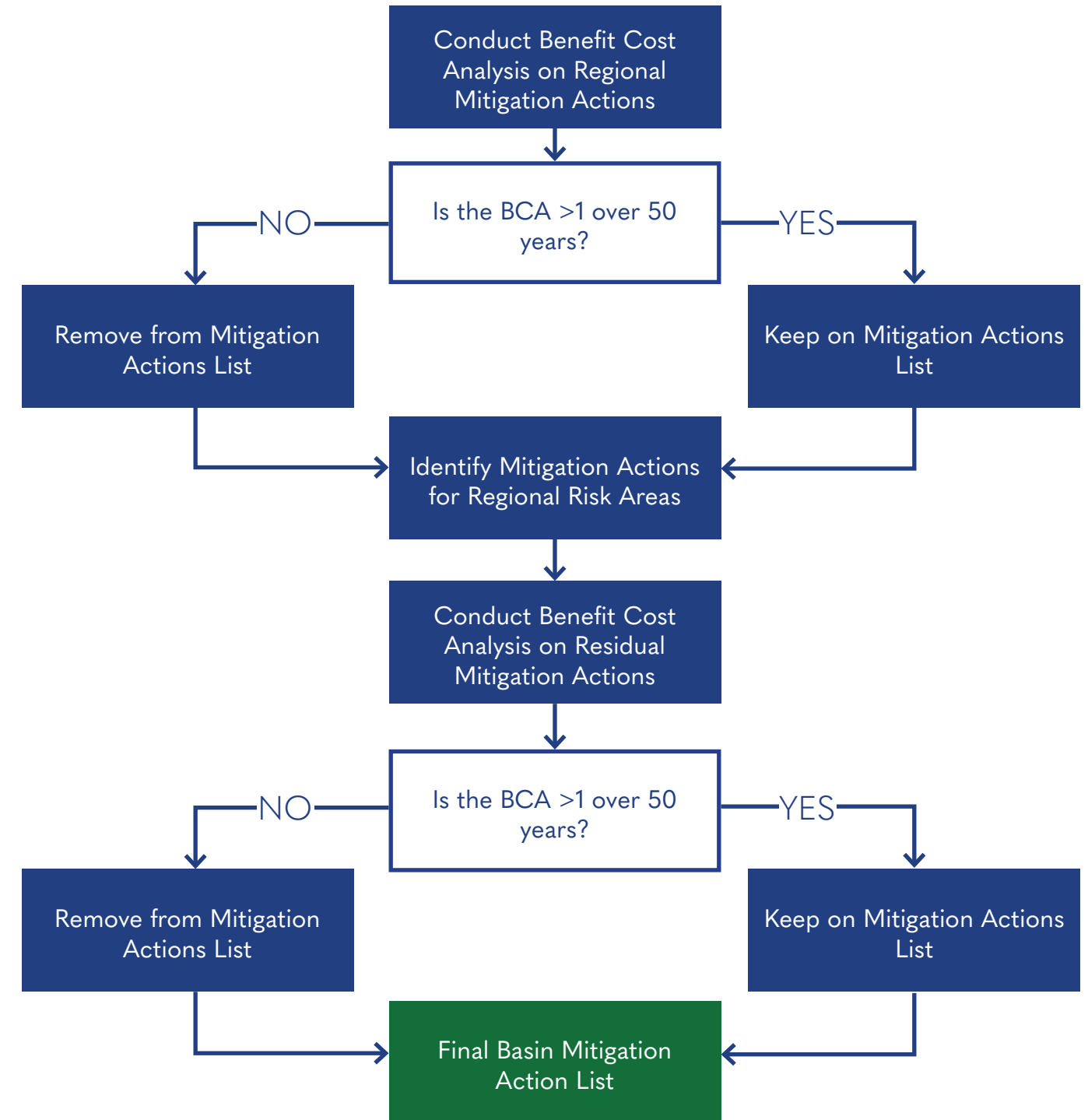
- 11 Residual Risk Areas  
Building Level Mitigation Program, Cleaning and Clearing Drainage Systems, and Roadway Upgrades

Specific details regarding all identified regional mitigation actions can be found in **Appendix E**.



# ACTION REVIEW & SELECTION

The flowchart below outlines the steps used in developing the prioritized mitigations actions list.



A factored BCA analysis was employed based on feedback from the River Basin Advisory Group. Factors were either considered as having a positive impact (Benefit) or a negative impact (Cost). The factors that were incorporated into the benefit cost analysis for the Tar-Pamlico Basin are:

### Level of Protection (Benefit)

Level of protection is defined as the proportion of the flood risk mitigated by an action in the affected area. The most effective actions, mitigating 90-100% of the flood risk receive a weight of 30%. An example of a highly effective action would be levee construction. Less effective actions, like wet floodproofing, that mitigate approximately less than 90% of risk receive a 0% weight.



### Environmental Benefits (Benefit)

This factor considers the contributions of flood resiliency actions to the health of the environment, which can include improving water quality, increasing biodiversity and ecosystem health, and reducing erosion. Nature-based solutions received the highest weight of 20% due to the core design elements benefiting the environment. The middle tier, receiving a 10% weight, is for non-nature-based solutions that provide secondary environmental benefits. An example could include floodproofing at a wastewater plant that prevents pollutants from entering the environment during a flood event. Actions that do not have an environmental benefit beyond flood resilience are given a weight of 0%.



### Capital Cost (Cost)

A high capital cost can be a significant obstacle to implementing an action. Based on the range of estimates in the final action list, three tiers were created at natural break points after identifying clusters in the distribution of costs. The highest tier is for actions greater than \$200 million and receives the full 20% weight. The middle tier is for projects with an implementation cost between \$50 million and \$200 million and receives a 10% weight. The lowest tier is for projects less than \$50 million and receives no weight.



### Risk of Failure (Cost)

The risk of failure reflects the severity of the consequences resulting from the failure of an action. The factor is separated into high risk actions, which receive a weight of 20%, moderate risk actions at 10%, and low risk actions at 0%. Examples of high risk of failure actions include new large dams and levees which have the potential to breach and severely damage protected areas. Examples of low risk actions include nature-based solutions and upgrading existing infrastructure. Moderate risk actions include channel modification and new non-high-hazard dams that introduce some failure risk to protected areas.



### Maintenance Requirements (Cost)

Maintenance requirements include the frequency and cost of the upkeep necessary to ensure the implemented projects mitigate flooding as intended. Projects with a significant level of requirements received a weight of 20%, like floodgate construction, due to the specialized expertise requirement to operate and maintain the structure. Actions with a standard or regular level of maintenance requirements, like roadway upgrades, receive a weight of 10%, because they require consistent maintenance activities that would be more common in a community. A weight of 0% is given to project types with insignificant or minor maintenance requirements, like riparian buffers, which should not need significant additional work following implementation.



To ensure that multiple actions that protect the same location were not selected, regional actions were analyzed first, followed by local actions. Refer to **Appendix F** for details about the action prioritization process.



# TAR-PAMLICO RIVER BASIN PRIORITIZED ACTIONS

Lake Mattamuskeet Lighthouse, North Carolina

# What is an Action?

An action is a proactive flood mitigation or resilience measure implemented to minimize an area’s vulnerability and risk of flooding and associated disruptions and damages. NCNCDEQ has six action type categories: Building Level Mitigation, Channel Modification, Infrastructure & Control Structures, Nature Based Solutions, Policy & Planning, and Other. A selected action may be implemented on a local, regional, or basin-wide scale. The action type will determine the level of coordination required.

## Building Level Mitigation

A building level mitigation action focuses on the physical changes that can be implemented on an individual structure to reduce flood risk. Action types within this category include Acquisition/Demolition (purchasing and/or removing flood-prone structures), Dry Floodproofing (making structure watertight to prevent floodwaters from entering), Mitigation Reconstruction (rebuilding or updating a structure to improved standards and codes), Relocation (moving a structure out of flood-prone areas), Structural Elevation (raising the structure first-floor elevation above predicted flood levels), Utility Elevation (raising critical mechanical, electrical, and plumbing systems), and Wet Floodproofing (designing a structure to allow water to enter certain areas while minimizing damage and protecting critical infrastructure).

Building level mitigation allows for small-scale targeted resiliency from an individual property to a neighborhood-scale based on specific needs. While implementation only impacts the specific residents and structure, these actions serve to protect property and life. Since these actions operate at the individual structure scale, they can sometimes be faster to implement but may face funding and property ownership challenges. The acquisition of at-risk properties shall be undertaken exclusively on a voluntary, property-by-property basis. Participation by property owners is entirely optional and the State does not intend to pursue involuntary acquisition or the use of eminent domain for these properties.

### Action Types

- **Acquisition/Demolition**
- **Dry Floodproofing**
- **Mitigation Reconstruction**
- **Relocation**
- **Structural Elevation**
- **Utility Elevation**
- **Wet Floodproofing**

## Channel Modification

Channel modification actions involve natural or engineered solutions to alter waterways and improve the water storage capacity and functionality. Action types within this category include Channel Dredging, Widening, and Diversion which entails deepening, expanding, or changing the flow path of the channel to increase capacity or Debris Removal where any natural or artificial debris blockages in the channel

are removed such that the channel can more closely perform as normal during flooding events. These actions target improving the flow of water through channels which can minimize the risk of flooding to surrounding buildings, roadways, and critical infrastructure. Depending on the waterway and flooding event intensity these actions may need to be repeated to maintain optimal channel performance.

### Action Types

- **Channel Dredging**
- **Widening**
- **Diversion**
- **Debris Removal**



# Infrastructure & Control Structures

Infrastructure and control structure actions focus on structure implementation to divert water from vulnerable areas. Action types for this category include Critical Infrastructure (planning and implementation of infrastructure to improve runoff, reducing flood risk and impacts), Levee/Dike/Berm (modifying or constructing new barriers to contain, divert, or control water flow), New and Existing Dam Structures (adding or improving wet or dry dams to contain flood waters), Quarries (repurposed to

serve as temporary flood water storage), Roadway Elevation/Road Crossing Modification (raising or modifying roadways to improve accessibility during floods), and Storm Water Management Activities (planning, design, and implementation of stormwater infrastructure to reduce flood risk). These actions are generally implemented within communities and are key to protecting the residents, structures, and critical infrastructure during flooding events and minimizing disruptions to communities.

### Action Types

- **Critical Infrastructure**
- **Levee/Dike/Berm**
- **New and Existing Dam Structures**
- **Quarries**
- **Roadway Elevation/Road Crossing Modification**
- **Storm Water Management Activities**

## Nature Based Solutions

Nature based solutions (NBS) actions utilize sustainable planning, design, environmental management, and engineering practices that focus on natural processes and features to reduce flood risk. Action types include Afforestation (planting forest vegetation to reduce flow velocity), Bioretention (uses soil and vegetation to promote infiltration and storage of flood waters), Flood Storage Wetlands (engineered or restored wetlands designed to capture, store, and gradually release flood waters), Floodplain Preservation (protecting floodplains to maintain natural ability to absorb and reduce flood waters and mitigate erosion), Floodplain Restoration (rehabilitating degraded floodplains to enhance their ability to perform as

intended), Green Roofs (incorporates vegetation on rooftops to intercept rainfall and reduce runoff), Living Shorelines (use of native materials to stabilize a shoreline and enhance wildlife habitat), Permeable Pavement (infiltrate runoff to reduce flood risk in the implemented traffic areas), Raingardens/Sand Filters/Bioswales (engineered green infrastructure to capture runoff and promote infiltration), and Riparian Buffers (areas of healthy vegetation from grasses to woody shrubs that reduce runoff speed and promote infiltration). Implementing an NBS action can assist in flood risk mitigation while also offering additional benefits of promoting biodiversity and wildlife habitat, improved aesthetic value, and public green space.

### Action Types

- **Afforestation**
- **Bioretention**
- **Flood Storage Wetlands**
- **Floodplain Preservation**
- **Floodplain Restoration**
- **Green Roofs**
- **Living Shorelines**
- **Permeable Pavement**
- **Raingardens/Sand Filters/Bioswales**
- **Riparian Buffers**



## Policy & Planning

Policy and planning actions focus on regulations that will impact land use, management, and future development to manage and mitigate flood risk. Action types include Advanced Regulations, focusing on GIS capacity building, land use and impervious surface restrictions, and enhanced zoning (adopts stricter standards such as higher freeboard requirements, not allowing certain construction, and stricter rules for critical facilities), Multi-use Floodplains (restored or managed floodplains that

provide flood storage and infiltration along with secondary benefits such as community green space or wildlife habitats), and Stormwater, Water Quality, and Floodplain Regulations (polices and regulations to control stormwater volume and flow, reduce pollutants in waterways, and preserve or restore floodplains). The policies and planning will build more long-term flood resilient communities and infrastructure.

### Action Types

- **Advanced Regulations (GIS Capacity Building)**
- **Advanced Regulations (Land Use and Impervious Surface Restrictions)**
- **Advanced Regulations (Enhanced Zoning)**
- **Multi-use Floodplains, and Stormwater, Water Quality, and Floodplain Regulations**

## Other

There are some actions that do not fit into the defined categories and designated as 'Other'. These include Beaver Management (allows for the restoration of waterways to remove flood risk from artificial dams), Coastal-Building Mitigation (building level mitigation actions focused on structures impacted by coastal flooding including tidal flooding,

storm surge, and sea level rise), and Coastal-Road Elevation/Modification (infrastructure improvements to raise or modify roadways to endure coastal and tidal conditions and sustain transportation). These actions are more individualized, but also provide critical flood resilience to communities.

### Action Types

- **Beaver Management**
- **Coastal - Building Mitigation**
- **Coastal - Road Elevation/Modification**



## Why are these Actions Needed?

Resiliency actions are needed to mitigate flooding risk within the basin and to build more long-term resilient communities. Without these actions, the basin and its population will continue to be vulnerable to flood risk. The identified flood hazard type and vulnerability and risk of an identified area along with the area's characteristics including population, properties at risk, geographical limitations, and infrastructure will determine which action category and type is most applicable.

### Flood Hazard Types

Location within the basin impacts flooding type, such as riverine, rainfall, urban stormwater, or coastal flooding, and severity which will play a critical role in the appropriate action selection. For example, inland communities will face different flood risk concerns than coastal communities and will impact which action is deemed most effective.

### Vulnerability

Vulnerability refers to the populations, infrastructure, and areas susceptible to flood risk and the adverse impacts. Assessing vulnerability helps identify the higher at-risk areas and develop prioritized actions to ensure the greatest impacts across the basin are mitigated.

Buxton North Carolina Outer Banks



# PRIORITIZED RESILIENCY ACTIONS

The prioritized or selected resiliency actions for the Tar-Pamlico River basin are the regional/multi-jurisdictional and local actions with calculated benefit cost ratios (BCR) of at least one over a 50-year project life period. The local actions complement the regional actions by mitigating the flood risk in areas that are not protected by regional actions.

As previously discussed, resiliency actions were proposed for all identified vulnerable areas within the Tar-Pamlico River Basin. The identified actions for the vulnerable areas ranged in scale from local to basin-wide and went through a prioritization process to determine which would be most effective for the basin.

Additionally, communities within the basin provided NCDEQ with a list of actions which are important to their stakeholders. These actions, which were developed as part of the RBAS process, are listed as “locally prioritized actions”. Locally prioritized actions have not undergone the factored benefit cost analysis described in this report as most of them are not yet “shovel ready”, and hence their cost and benefits cannot be estimated with a reasonable level of confidence.

## RBAS Process Prioritized Basin Action

The factored BCA process identified four regional resilience actions, five local actions, and multiple building level mitigation actions that met the criteria of the 50-year BCA equaling at least 1.0 (Table 2). Further details regarding each prioritized action can be found below.

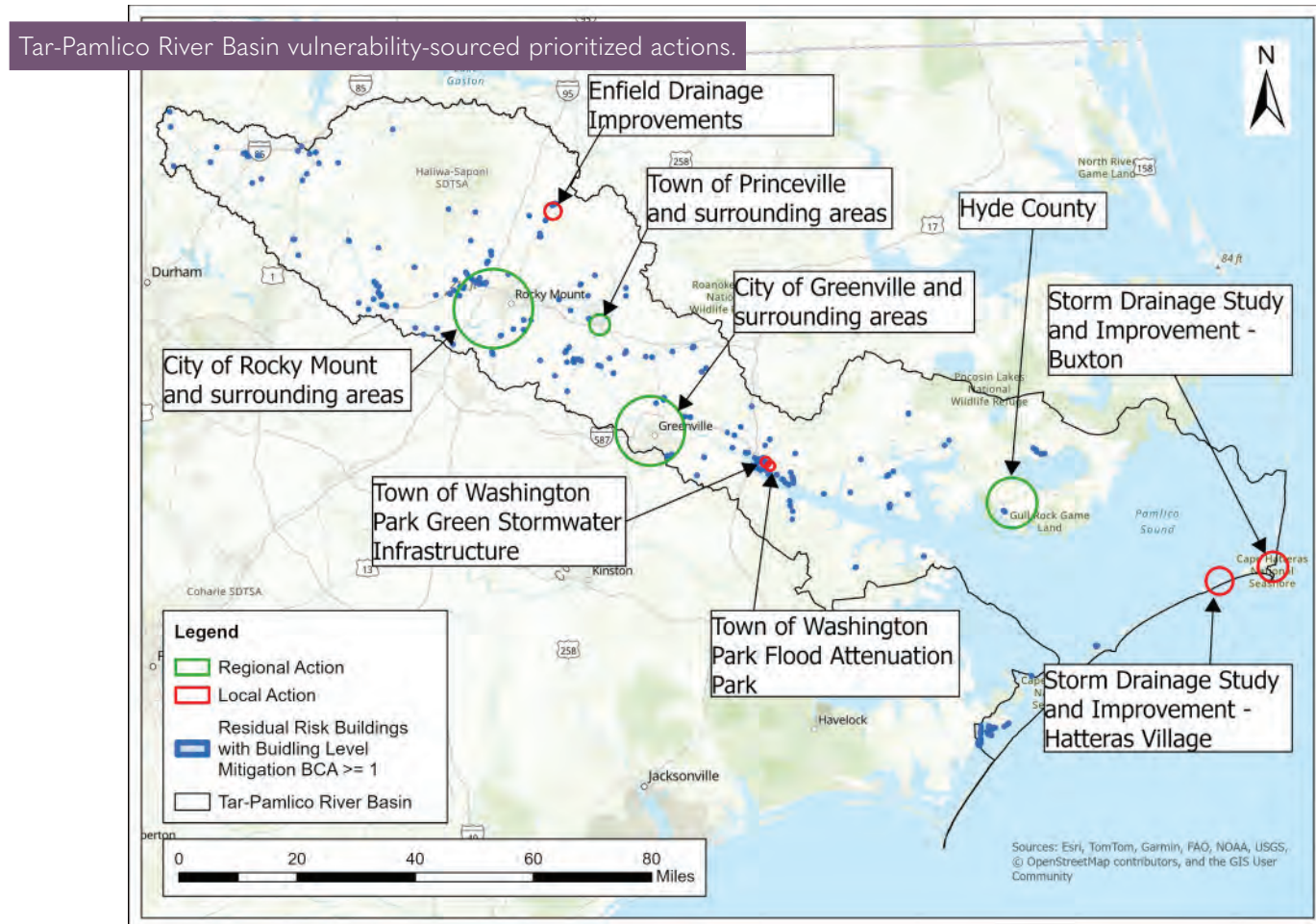


Table 2. Full prioritized actions list for the Tar-Pamlico River Basin.

Action Name	Components	Regional, Local, or Building Level?	BCA	Location
City of Rocky Mount and surrounding areas Regional Action	<ul style="list-style-type: none"> <li>Floodplain Restoration</li> <li>Stream and Drainage Maintenance System</li> <li>Levee System Inspection, Maintenance, Repair, and Upgrades (Merita Bakery Levee System)</li> </ul>	Regional	5.26	City of Rocky Mount and surrounding areas
Town of Princeville and surrounding areas Regional Action	<ul style="list-style-type: none"> <li>Internal Drainage Improvements</li> <li>Levee Construction (Shiloh Hills)</li> <li>Levee Construction (Tarboro)</li> <li>Levee System Inspection, Maintenance, Repair, and Upgrades (Princeville Dike)</li> </ul>	Regional	2.93	Town of Princeville and surrounding areas
City of Greenville and surrounding areas Regional Action	<ul style="list-style-type: none"> <li>Levee Construction</li> <li>Floodplain Restoration</li> </ul>	Regional	1.81	City of Greenville and surrounding areas
Hyde County Regional Action	<ul style="list-style-type: none"> <li>Levee System Inspection, Maintenance, Repair, and Upgrades (Swan Quarter Dike)</li> </ul>	Regional	1.33	Hyde County (Swan Quarter Dike)
Hatteras Village Storm Drainage Study and Improvement	<ul style="list-style-type: none"> <li>Hatteras Village Storm Drainage Study and Improvement</li> </ul>	Local	23.63	Hatteras Village, NC
Buxton Storm Drainage Study and Improvement	<ul style="list-style-type: none"> <li>Buxton Storm Drainage Study and Improvement</li> </ul>	Local	2.75	Buxton, NC
Enfield Drainage Improvements	<ul style="list-style-type: none"> <li>Enfield Drainage Improvements</li> </ul>	Local	2.72	Enfield, NC
Town of Washington Park Green Stormwater Infrastructure	<ul style="list-style-type: none"> <li>Town of Washington Park Green Stormwater Infrastructure</li> </ul>	Local	2.51	Washington Park, NC
Town of Washington Park Flood Attenuation Park	<ul style="list-style-type: none"> <li>Town of Washington Park Flood Attenuation Park</li> </ul>	Local	1.06	Washington Park, NC
Building Level Mitigation	<ul style="list-style-type: none"> <li>Residual Risk Building Level Mitigation by Community Jurisdiction</li> </ul>	Building Level	-	Tar-Pamlico River Basin Residual Risk Areas

# City of Rocky Mount and surrounding areas Regional Action

Location:	The City of Rocky Mount and surrounding areas
Owner:	The City of Rocky Mount
Cost:	\$153,186,006
Status:	Conceptual

## Floodplain Restoration:

A nature-based floodplain restoration project could be completed along the reach of the Tar River from Interstate 95 to just upstream of Leggett Road through the City of Rocky Mount (Figure 13). This project would rehabilitate areas of the floodplain that have been degraded. Updating the floodplain of these waterways within Rocky Mount will restore the natural

hydrology of this area. Increasing the capability of the floodplains can assist in reducing the overflow volume and velocity of floodwaters that occur during a flood event and reduce pluvial and fluvial risk.

## Stream and Drainage System Maintenance Program:

Clogged streams and drainage systems within the City of Rocky Mount will cause flooding during a storm event, putting infrastructure, buildings, and residents at risk. These areas should be inspected regularly and before major storms to determine if they would benefit from cleaning and clearing to improve overall function (Figure 14). Any locations within the stormwater drainage system that are clogged can result in ponding and increase the risk of pluvial flooding. Inspection and cleaning of the network ensures that pluvial flood waters within the protected area are efficiently diverted away, mitigating risk.

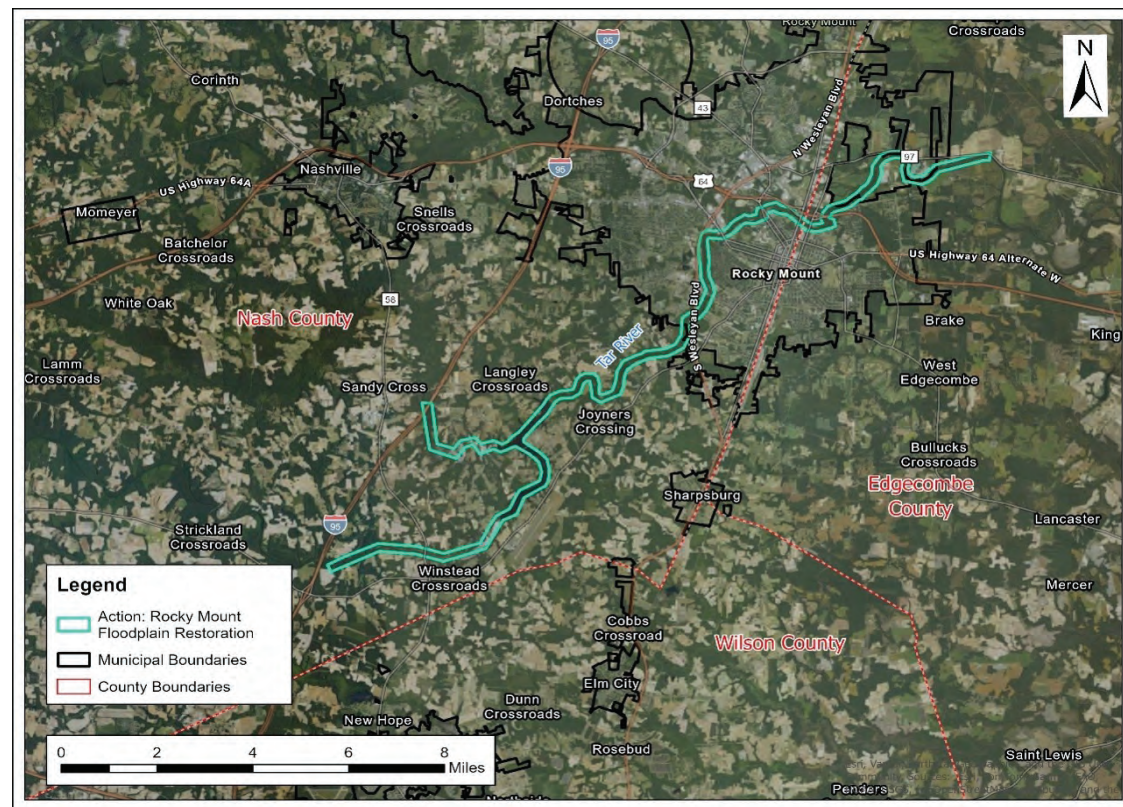


Figure 13. City of Rocky Mount and surrounding areas floodplain restoration location.

## Levee System Inspection, Maintenance, Repair, and Upgrades (Merita Bakery Levee System):

This action supports the inspection, maintenance, repair, and upgrades for the Merita Bakery levee system near the intersection of North Church Street and Airport Road within the Tar-Pamlico River Basin (Figure 15). Currently, USACE indicates that levees that are under their jurisdiction should be inspected every 5 years (USACE, 2024). Regardless of jurisdiction, inspections on this system should be conducted more frequently, particularly after severe flood-loading events to ensure potential overtopping or breaching or any structural deficiencies are identified and addressed early. This could include standard repairs and upgrades and adaptations to the system to evolve the protection with changing conditions and community needs. Regular and routine maintenance should also be done on this system to extend the life cycle.

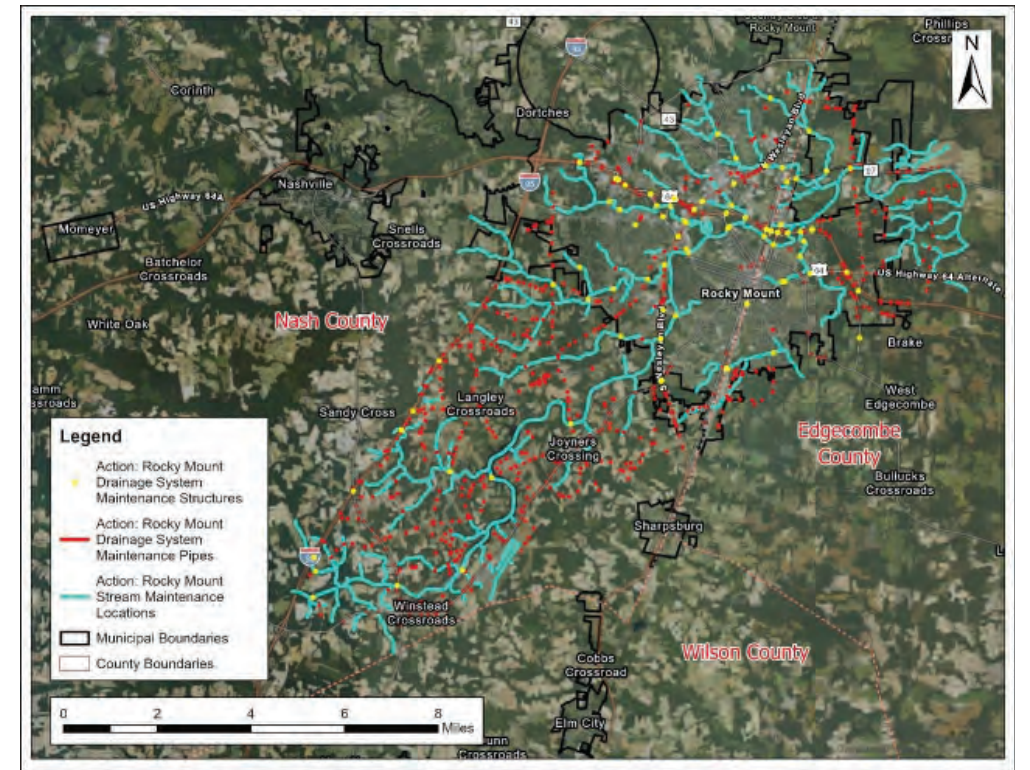


Figure 14. City of Rocky Mount and surrounding areas stream and drainage system maintenance program location.

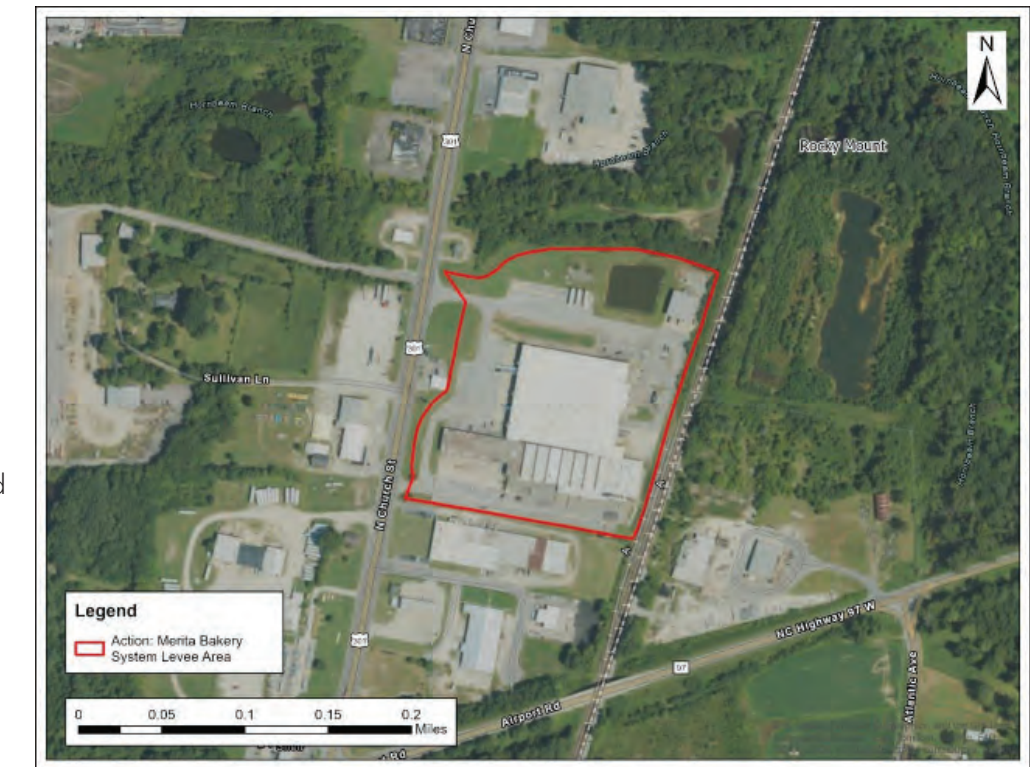


Figure 15. Merita Bakery Levee System inspection, maintenance, repair, and upgrades extent.

# Town of Princeville and surrounding areas Regional Action

Location:	The Town of Princeville and surrounding areas
Owner:	Town of Princeville
Cost:	\$68,673,662
Status:	Conceptual

## Internal Drainage Improvements:

The inspection of internal drainage networks and stream pathways could increase the resiliency within the Town of Princeville behind the Princeville Dike (Figure 16). Any locations within the stormwater drainage system that clogged can result in ponding and increase the risk of pluvial flooding. Inspection, cleaning, and modification of the network ensures that pluvial flood waters within the protected area are efficiently diverted away, mitigating risk.

## Levee Construction in Shiloh Mills:

Based on the future climate conditions scenarios, Shiloh Mills will be susceptible to fluvial and pluvial flooding. Knowing that the Town of Princeville incorporated a levee system for flood protection gives confidence that Shiloh Mills can greatly benefit from a levee system as well. The levee system would tie into the existing Princeville Dike and extend along US-258 until it ties back into high ground just north of East Northern Boulevard. A needed barrier would be created to protect the infrastructure, buildings, and residents within Shiloh Mills from future Tar-River flooding (Figure 17).

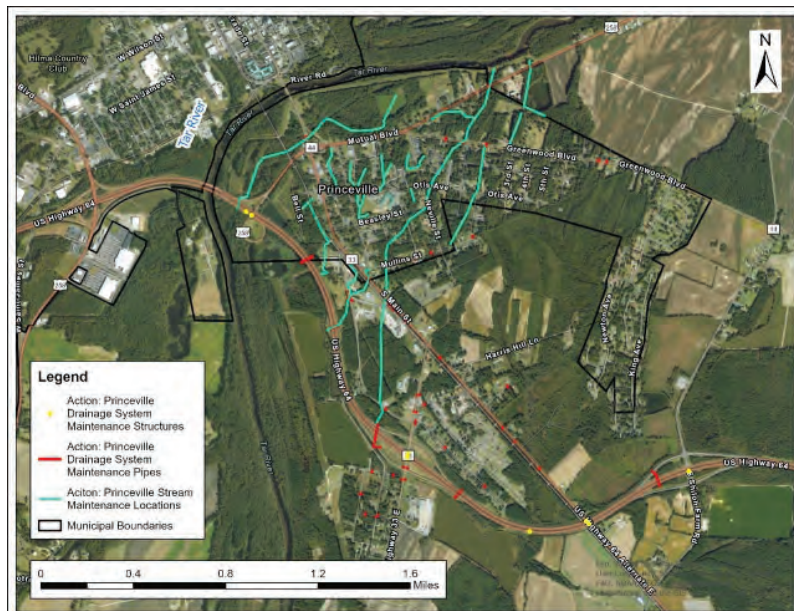


Figure 16. Town of Princeville and surrounding areas internal drainage improvements location.



Figure 17. Levee Construction in Shiloh Mills location.

## Levee Construction in Tarboro:

Based on the future climate conditions scenarios, Tarboro will be susceptible to fluvial and pluvial flooding. Knowing that the Town of Princeville incorporated a levee system for flood protection on the south bank of the Tar River gives confidence that the north bank of the Tar River can greatly benefit from a levee system as well. The levee system would tie into US-64 and extend along the Tar River overbank until it ties back into the high ground just north of East Northern Boulevard. A needed barrier would be created to protect the infrastructure, buildings, and residents within Tarboro from future Tar-River flooding (Figure 18).

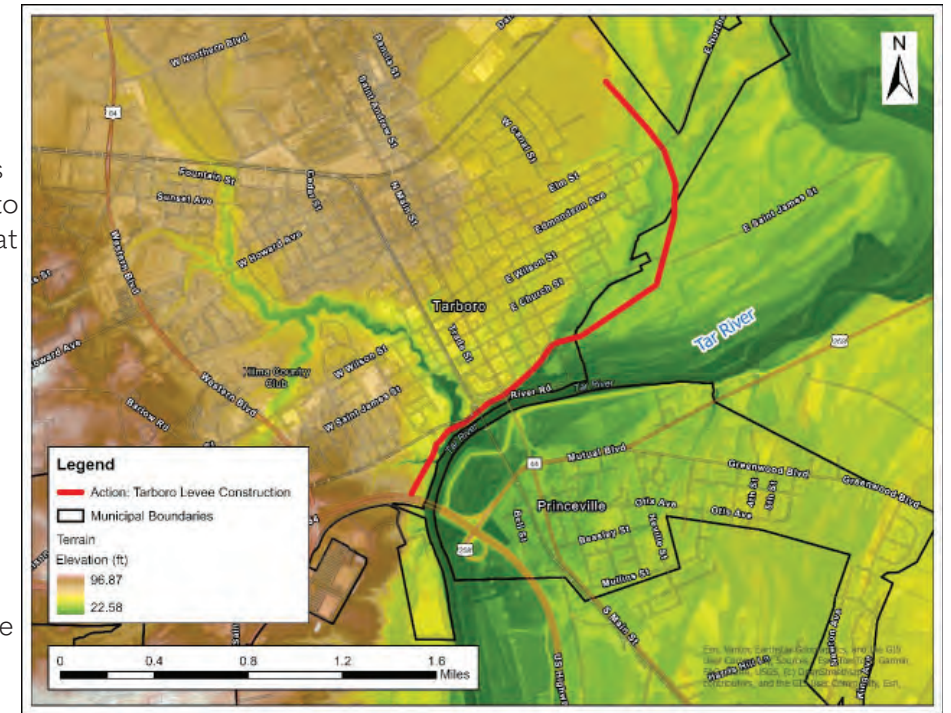


Figure 18. Levee Construction in Tarboro location.

## Levee System Inspection, Maintenance, Repair, and Upgrades (Princeville Dike Levee System):

This action supports the inspection, maintenance, repair, and upgrades for the Princeville Dike levee system within the Tar-Pamlico River Basin (Figure 19). Currently, USACE indicates that levees that are under their jurisdiction should be inspected every 5 years (USACE, 2024). Regardless of jurisdiction, inspections on this system should be conducted more frequently, particularly after severe flood-loading events to ensure potential overtopping or breaching or any structural deficiencies are identified and addressed early. This could include standard repairs and upgrades and adaptations to the system to evolve the protection with changing conditions and community needs. Regular and routine maintenance should also be done on this system to extend the life cycle.

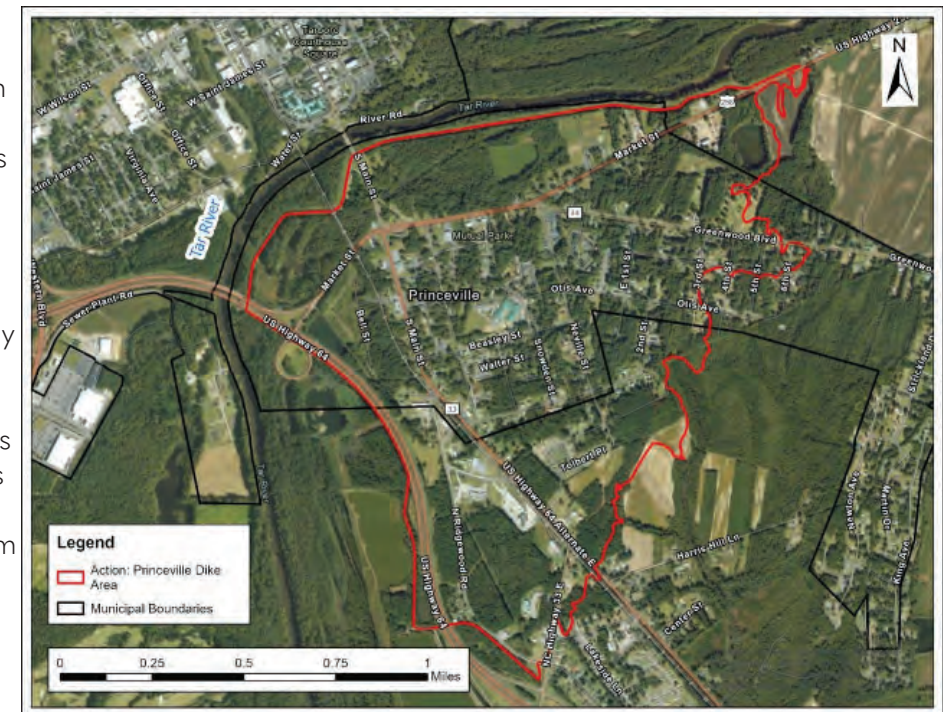


Figure 19. Levee Construction in Tarboro location.

# City of Greenville and surrounding areas Regional Action

**Location:** The City of Greenville and surrounding areas  
**Owner:** City of Greenville  
**Cost:** \$354,795,868  
**Status:** Conceptual

## Levee Construction:

Proposed through the Whiteville Community The north bank and a portion of the south bank of the City of Greenville are lower in elevation, making these areas the most vulnerable to fluvial flooding. To mitigate this risk, a levee system could be installed which can increase the level of protection for the infrastructure, buildings, and residents along these lower elevation areas. The levee would be split into two parts, with the first part tying in near the intersection Martin Luther King Jr. Highway, extending along the Tar River until it ties back into the US-264 roadway near Old Pactolus Road. The second levee section ties into the high ground near Wyndham Circle, extending along the Tar River until it ties back into the US-264 embankment (Figure 20).

## Floodplain Restoration:

A nature-based floodplain restoration project could be completed along the reach of the Tar River from 8,500 feet upstream of NC-222 to just upstream of US-264 and just downstream of US-264 to approximately 5,000 feet upstream of the confluence of Grindle Creek (Figure 21). This project would rehabilitate areas of the floodplain that have been degraded. Updating the floodplain of these waterways within Greenville will restore the natural hydrology of this area. Increasing the capability of the floodplains can assist in reducing the overflow volume and velocity of floodwaters that occur during a flood event and reduce pluvial and fluvial risk.

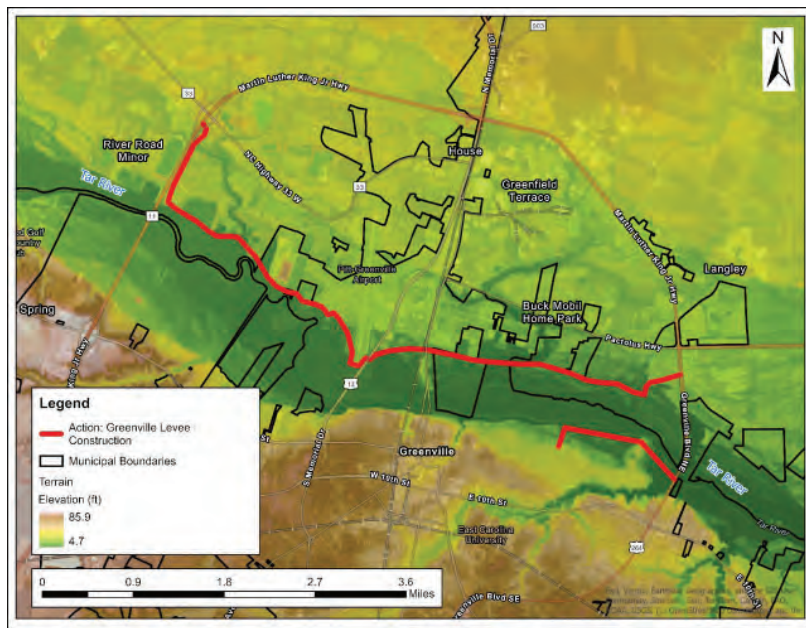


Figure 20. Levee construction extent in Greenville location.

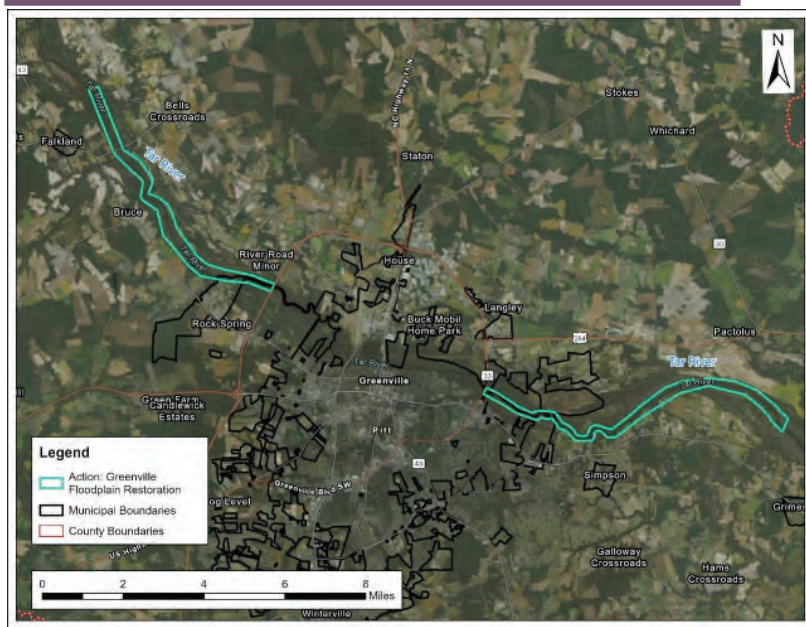


Figure 21. Floodplain restoration extent in Greenville location.

# Hyde County Regional Action

**Location:** Hyde County  
**Owner:** Hyde County  
**Cost:** \$2,490,840  
**Status:** Conceptual

**Levee System Inspection, Maintenance, Repair, and Upgrades (Swan Quarter Dike Levee System):**

This action supports the inspection, maintenance, repair, and upgrades for the Swan Quarter Dike levee system

within the Tar-Pamlico River Basin (Figure 22). Currently, USACE indicates that levees that are under their jurisdiction should be inspected every 5 years (USACE, 2024). Regardless of jurisdiction, inspections on this system should be conducted more frequently, particularly after severe flood-loading events to ensure potential overtopping or breaching or any structural deficiencies are identified and addressed early. This could include standard repairs and upgrades and adaptations to the system to evolve the protection with changing conditions and community needs. Regular and routine maintenance should also be done on this system to extend the life cycle.



Figure 22. Swan Quarter Dike inspection, maintenance, repair, and upgrades extent.

# Hatteras Village Storm Drainage Study and Improvement

**Location:** NC 12 Eagle Pass Road, and other frequently impacted roads in Hatteras Village, NC

**Owner:** Community of Hatteras Village

**Cost:** \$525,000

**Status:** Proposed

## Hatteras Village Storm Drainage Study and Improvement:

Dare County has conducted a storm drainage study and recommends improvement for areas of Hatteras Village that were called out by a citizen survey as flooding hot spots within the village. Originally identified in the Dare County Resilient Coastal Communities Program Project Portfolio, NC-12, Eagle Pass Road, and adjacent roads create safety hazards to the population during a flooding event (Figure 23).

These areas are particularly susceptible

to significant flooding from ocean overwash and rainfall, impacting homes, roadways, and emergency response. The study identifies swales, existing culvert structures, and grading at these locations and provides recommendations on how to combat the pluvial and coastal flooding in these areas. Dare County has received most of the funding for these projects, and it needs additional funding to move to implementation (NCDEQ, 2022).



Figure 23. Hatteras Village storm drainage study and improvement location.

# Buxton Storm Drainage Study and Improvements

**Location:** NC-12, Old Lighthouse Road and adjacent streets in Buxton, NC

**Owner:** Town of Buxton

**Cost:** \$525,000

**Status:** Proposed

## Buxton Storm Drainage Study and Improvement:

Dare County has conducted a storm drainage study and recommends improvement for areas of Hatteras Village that were called out by a citizen survey as flooding hot spots within the village. Originally identified in the Dare County Resilient Coastal Communities Program Project Portfolio, this location is a known safety hazards to the population during a flooding

event. Old Lighthouse Road is particularly susceptible to significant flooding from ocean overwash and rainfall, impacting homes, roadways, and emergency response (Figure 24). The study identifies swales, existing culvert structures, and grading at these locations and provides recommendations on how to combat the pluvial and coastal flooding in these areas. Dare County has received most of the funding for these projects, and it needs additional funding to move to implementation (NCDEQ, 2022).

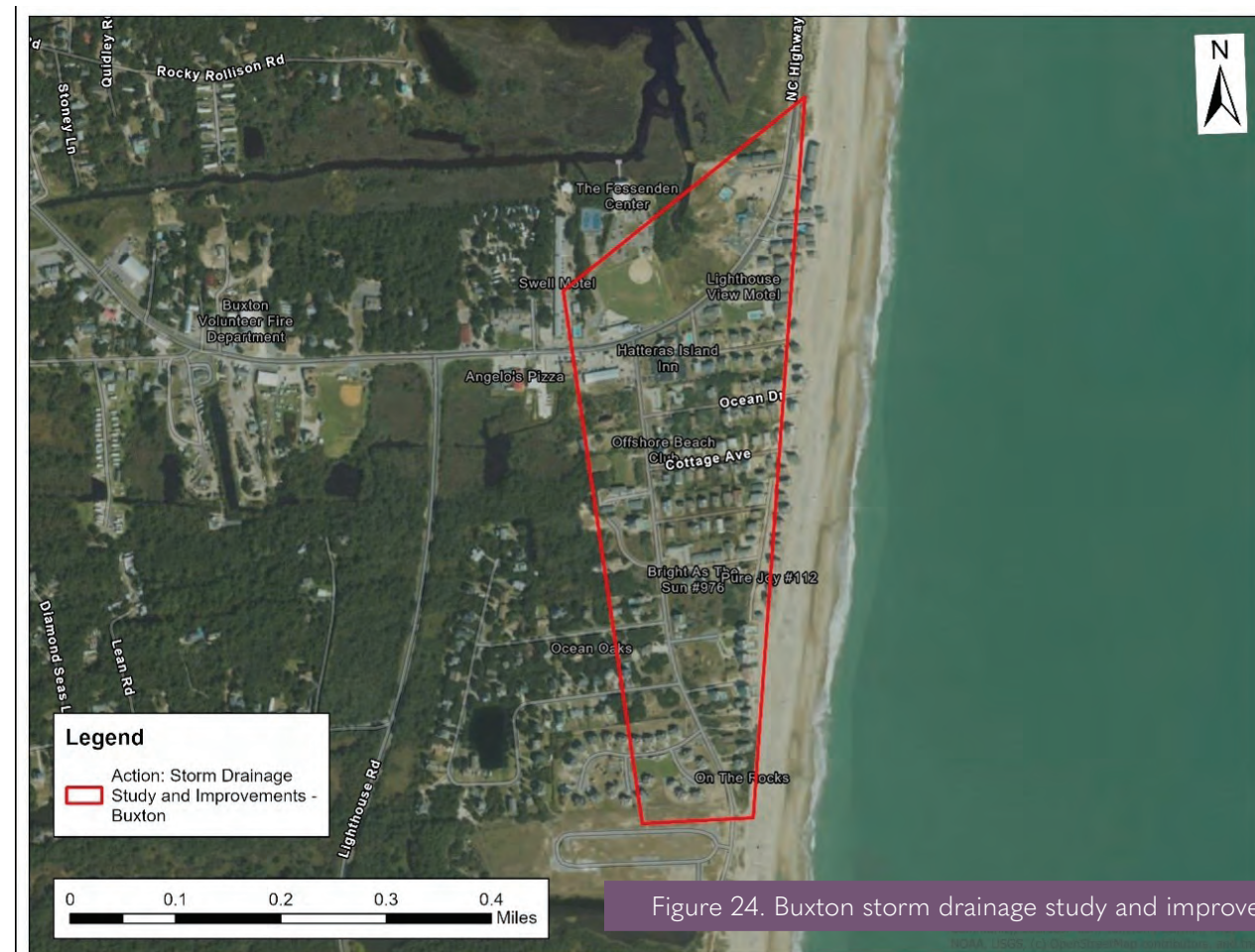


Figure 24. Buxton storm drainage study and improvements location.

# Enfield Drainage Improvements

Location: Downtown Enfield, NC  
 Owner: Town of Enfield  
 Cost: \$750,000  
 Status: Proposed

## Enfield Drainage Improvements:

Downtown Enfield, NC has experienced localized flooding issues that have put several homes and the downtown library at risk of pluvial flood damage (Figure 25). This action, originally proposed in the Halifax County Hurricane Matthew Resilient Redevelopment Plan, is for upgrades to drainage structures and the improvement of the drainage system within historic downtown Enfield.

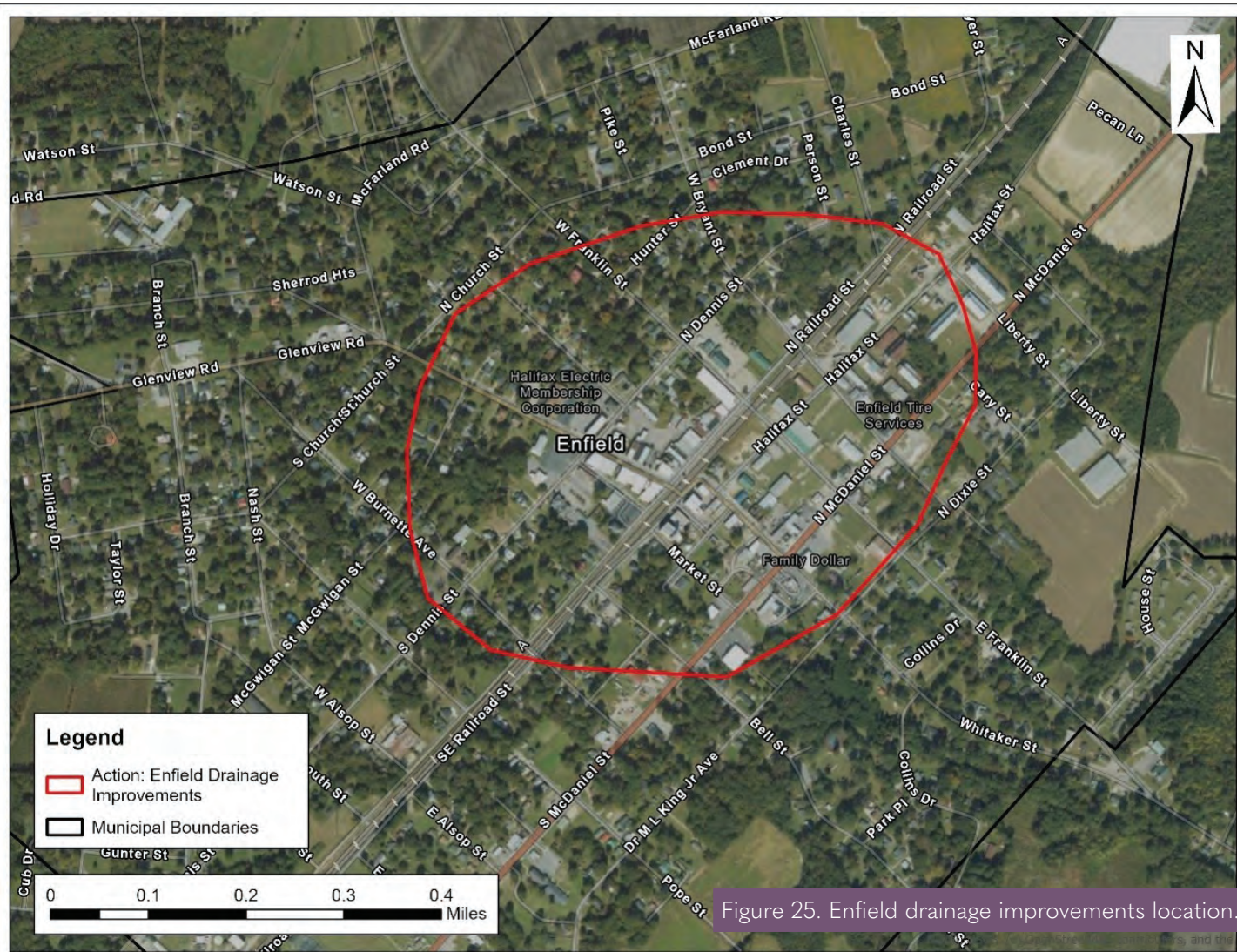


Figure 25. Enfield drainage improvements location.

# Town of Washington Park Green Stormwater Infrastructure

Location: Riverside Drive and West Isabella Avenue in Washington Park, NC  
 Owner: Town of Washington Park  
 Cost: \$690,000  
 Status: Proposed

## Town of Washington Park Green Stormwater Infrastructure:

This project looks to incorporate green infrastructure into the current stormwater system along Riverside Drive and West Isabella Avenue in Washington Park, NC (Figure 26). Originally from the Washington Park Resilient Coastal Communities Program Project Portfolio, bioretention ponds, permeable pavement, or a

submerged gravel wetland have been proposed as solutions for pluvial flooding issues (NCDEQ, 2024). Four total structures are estimated to be needed for this project, assuming two per road.



Figure 26. Town of Washington Park green stormwater infrastructure location.

# Town of Washington Park Flood Attenuation Park

Location: Riverside Drive in Washington Park, NC

Owner: Town of Washington Park

Cost: \$450,000

Status: Proposed

Town of Washington Park Flood Attenuation Park:

This project looks to create a park in Washington Park, NC that would be used as the first barrier from flooding (Figure 27). First proposed in the Hyde County Hurricane Matthew Resilient Redevelopment Plan, the park would be between the Pamlico River and the town, so it would be able to store

pluvial and fluvial flood waters to prevent damage to properties (NCORR, 2017). Rain gardens and stormwater wetlands will be implemented to achieve this goal, and the recreational aspects of the park will be upgraded and maintained for the residents of Washington Park to enjoy.



Figure 27. Town of Washington Park flood attenuation park location.

# Residual Risk Building Level Mitigation

Location: Residual Risk areas of the Tar-Pamlico River Basin

Owner: NCDEQ

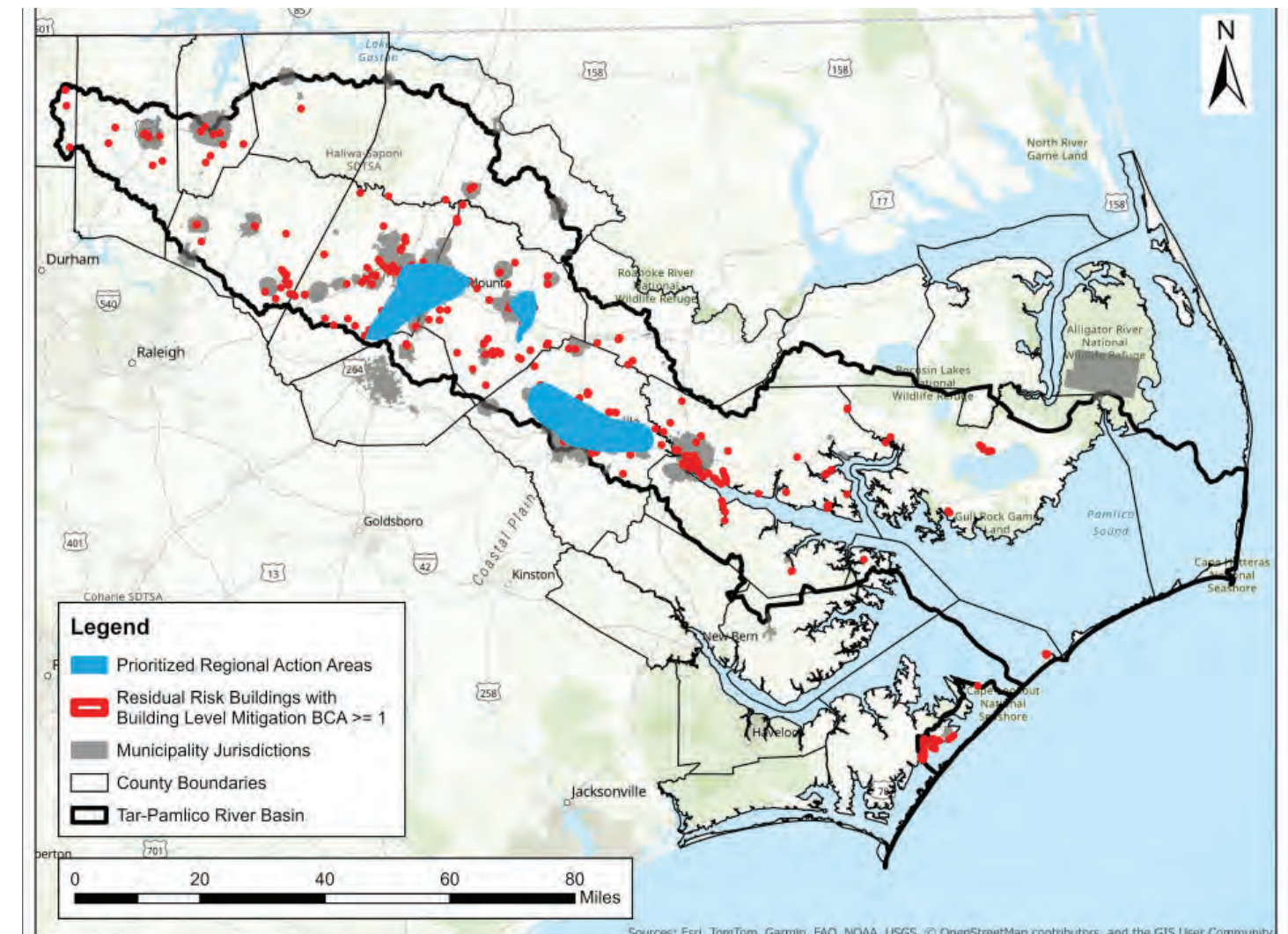
Cost: \$17,329,544

Status: Proposed

Residual Risk Building Level Mitigation:

At-risk buildings outside the areas of impact of the regional mitigation actions were analyzed to determine the cost effectiveness of implementing building level mitigation techniques to combat against pluvial and fluvial flooding. The NCEM building mitigation BCA methods were used to calculate the building level mitigation technique with the highest BCA between acquisition, relocation, elevation, dry floodproofing, and wet floodproofing. The residual risk buildings with mitigation options with a BCA greater than 1 are shown in Figure 28.

Figure 28. Residual risk buildings with building level mitigation actions with a BCA > 1 in the Tar-Pamlico River Basin.



# Locally Prioritized Actions

Locally prioritized actions were developed by communities and deemed important to their stakeholders (Table 3). The communities worked with NCDEQ to add these actions to the Blueprint Tool with the best available data. Further information is likely needed to complete a full analysis, but should still be considered for increased flood resiliency within the basin. Blueprint Tool reports for each action are provided in **Appendix H**.

Table 3. Tar-Pamlico River Basin Locally Prioritized Actions

Resiliency Action Name	Jurisdictions	Counties	Description
Avon Stormwater Improvements	Dare County	Dare	Construct and install stormwater infrastructure improvements and roadside swales to reduce flooding caused by rainfall and ocean overwash.
Briley Road Culvert Upsizing	Pitt County	Pitt	Conduct an upsize of the culvert across Briley Road near the intersection of Gum Swamp Road. Upsizing the culvert will increase the capacity of the crossing and reduce the overflow impacting the nearby buildings
Conetoe Community Park Drainage Improvements	Town of Conetoe	Edgecombe	Drainage Improvements and detention/infiltration area installation at Conetoe Community Park to improve flooding at Conetoe Station Community Center (201 Dawson St) and surrounding residential neighborhood.
Emergency Shelter Feasibility Study within the Upper Coastal Plain COG	Town Of Nashville; Town Of Enfield; and City Of Wilson	Wilson; Halifax; Edgecombe; and Nash	Emergency shelter Feasibility Study--conduct a feasibility analysis for identifying a large (400+ person) regional facility that could be utilized as a shelter during disasters and emergencies.
Flood-Resilient Roadways for Critical Facilities in the Upper Coastal Plain Region COG	Town Of Nashville; Town Of Enfield; and City Of Wilson	Wilson; Halifax; Edgecombe; and Nash	This project identifies critical facilities that are accessible by road that tend to flood during storm events. The report notes locations in Wilson; Enfield; Edgecombe County; and Nashville.
Frisco Fire Station & Community Resilience Hub	Dare County	Dare	Replace critical facility built before FEMA Flood Ordinance adopted. Building sits (4ft) below FEMA (6ft) and Local (9ft) Flood Elevation Standards. Existing Fire Station is frequently exposed to flooding. The proposed project will allow for uninterrupted emergency response capability during flood events; reduce long term disaster costs; and protect essential emergency apparatus.
Greenfield Terrace - Multi Use Flooding Response Hub	City of Greenville	Pitt	This action will develop a multi use floodplain which would include the opportunity for educational programs; walking trail up to the boys and girls club; would install a gymnasium which would provide recreation during blue sky scenarios. During flooding events this would be a disaster resource warehouse location for the first responder and disaster relief organization staging.
Holland Road Bridge Replacement	Pitt County	Pitt	Conduct a bridge replacement along Holland Road near Bud Parker Road in Greenville, NC. The new concrete bridge will span 6,181 ft in roadway and have an area of 2,100 square feet. The bridge replacement will increase the hydraulic capacity of the structure.



Action Category	Action Type	Potential Funding Sources
Infrastructure & Control Structures	Storm Water Management Activities	Hazard Mitigation Grant Program (HMGP); Disaster Relief and Mitigation Fund (DRMF) Grants; Local Assistance for Stormwater Infrastructure Investments (LASII)
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program
Infrastructure & Control Structures	Storm Water Management Activities	Community Conservation Assistance Program; Streamflow Rehabilitation Assistance Program (StRAP); Flood Mitigation Assistance (FMA)
Infrastructure & Control Structures	Critical Infrastructure	Hazard Mitigation Grant Program (HMGP); Community Conservation Assistance Program; Emergency Management Performance Grant (EMPG)
Infrastructure & Control Structures	Critical Infrastructure	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program
Building Level Mitigation	Mitigation Reconstruction	Hazard Mitigation Grant Program (HMGP); Flood Mitigation Assistance (FMA)
Policy & Planning	Multi-Use Floodplains	Local Assistance for Stormwater Infrastructure Investments (LASII); National Coastal Resilience Fund (NCRF); Hazard Mitigation Grant Program (HMGP)
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program



Resiliency Action Name	Jurisdictions	Counties	Description
Jack's Creek Flood Resiliency Project	City of Washington	Beaufort	The action will complete infrastructure projects identified from recent community planning processes that upsize current infrastructure in flooding hotspots. The actions to be completed provide considerable stormwater volume storage (on city-owned lands); a floodplain restoration project already completed; impoundment dredging of 55,000 cubic yards of material from the Jack s Creek impoundment area; automated trash screens to protect the stormwater pump station; and an ongoing monitoring and education program to ensure long-term viability of the project.
Littleton Butterwood Creek Drainage Improvements	Town of Littleton	Halifax	Drainage improvements to improve flow of stormwater to Butterwood Creek; including culvert replacements on Ferguson Street; grading improvements along E Warren St; and ditch cleanout between Ferguson Street and Butterwood Creek to prevent recurring flooding on adjacent residential properties; including those along Habitat Way.
NC-11 Bridge Raising	Pitt County	Pitt	This project constructs a raised bridge across Grindle Creek along NC-11 in Greenville, NC. The 8,200 square foot bridge will span 12,919 feet of roadway and increase the hydraulic capacity of the structure.
NC-33 New Bridge over Conetoe Creek	Pitt County	Pitt	The project will construct a bridge along NC-33 over Conetoe Creek near Greenville, NC. The 4,400 square foot bridge will span 12,264 feet of roadway and increase the hydraulic capacity of the structure.
NC HWY 12 Long Term Transportation Improvements	Dare County	Dare	Construct bridge to address vulnerable section of NC HWY 12 between Avon and Buxton.
NC121 - New Bridge over Lawrence Run	Pitt County	Pitt	The project will construct a bridge along NC-121 over Lawrence Run near Greenville, NC. The 4,757 square foot bridge will span 8,250 feet of roadway and increase the hydraulic capacity of the structure.
North US 13/NC11 Business New Bridge/ Culvert	Pitt County	Pitt	This project constructs a raised bridge across Grindle Creek along North US-13/ NC-11 in Greenville, NC. The 4,100 sqft bridge will span 15,338 feet of roadway and increase the hydraulic capacity of the structure.
Prioritization of Critical Facilities Vulnerable to Flooding in the Upper Coastal Plain COG	Town Of Nashville; Town Of Enfield; and City Of Wilson	Wilson; Halifax; Edgecombe; and Nash	Project D Flood-Resilient Roadways for Critical Facilities: create a prioritized list of regionally significant critical facilities that are vulnerable to flooding. In addition; the project will apply for funding to prevent flooding in priority locations that experienced inundations in previous storms (e.g.; Hurricanes Matthew; Florence; Floyd).
Tar River Main Channel Snag and Drag	Pitt County	Pitt	Conduct debris removal along the Tar River reach within Pitt County. 186,276 feet of stream would be cleared in order to allow the channel to flow more smoothly.
Tar-Pamlico Tributary Snag and Drag	Pitt County	Pitt	Conduct debris removal along tributaries of the Tar River within Pitt County. 130,038 feet of stream would be cleared to allow the channels to flow more smoothly.



Action Category	Action Type	Potential Funding Sources
Nature-Based Solution	Floodplain Preservation	EPA Clean Water State Revolving Fund; NRCS-EQIP Water Resources Development Grant: Stream Restoration Projects; USDA Watershed and Flood Prevention Operations Program
Infrastructure & Control Structures	Critical Infrastructure	Community Conservation Assistance Program; Local Assistance for Stormwater Infrastructure Investments (LASII); Streamflow Rehabilitation Assistance Program (StRAP)
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program; Hazard Mitigation Grant Program (HMGP)
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program
Infrastructure & Control Structures	Roadway Elevation/Road Crossing Modification	Promoting Resilient Operations for Transformative' Efficient, and Cost-Saving Transportation (PROTECT) Formula Program
Infrastructure & Control Structures	Critical Infrastructure	North Carolina Land and Water Fund - Innovative Stormwater Program; Community Conservation Assistance Program; Local Assistance for Stormwater Infrastructure Investments (LASII)
Channel Modification	Debris Removal	North Carolina Streamflow Rehabilitation Assistance Program (StRAP)
Channel Modification	Debris Removal	North Carolina Streamflow Rehabilitation Assistance Program (StRAP)



Resiliency Action Name	Jurisdictions	Counties	Description
Town of Washington Park Tributary Improvements	Town of Washington Park	Beaufort	This project looks to increase flood capacity along the tributary running east of Isabella Avenue and Shorewood Drive. Improving this tributary would allow the channel to hold more water during high storm events; thus reducing flooding within the town. Specific improvements could include bioswales; stream restoration; floodplain restoration and/or wetland creation. Project was developed through RCCP Phases 1 and 2.
Washington Park Stormwater Action Plan	Town of Washington Park	Beaufort	This project will complete a stormwater ground assessment and surface hydrology analysis that will be incorporated into an online mapping system that can submit real-time data to analyze; prioritize and take action on potential problem areas. The plan will also incorporate a maintenance plan.

Action Category	Action Type	Potential Funding Sources
Nature-Based Solution	Raingardens/Sand Filters/Bio-Swales	North Carolina Land and Water Fund - Planning Program; Community Conservation Assistance Program; North Carolina Land and Water Fund - Innovative Stormwater Program
Policy & Planning	Stormwater; Water Quality; Floodplain Regulations	Hazard Mitigation Grant Program (HMGP); National Coastal Resilience Fund (NCRF); North Carolina Land and Water Fund - Planning Program

Buxton North Carolina Outer Banks



Buxton North Carolina Outer Banks



# REVIEW OF FUNDING SOURCES

North Carolina communities face growing challenges from flooding, aging infrastructure, rapid development, and climate driven extreme weather. To address these risks, a wide ecosystem of federal, state, regional, and private funding sources exists—but navigating this landscape is complex. **Appendix G** provides a comprehensive catalog of the programs available to support resilient infrastructure, watershed restoration, nature based solutions, disaster recovery, stormwater improvements, and long-range community planning.

This summary synthesizes the full document into three pages, highlighting the major categories of funding, core features of key programs, and strategic considerations for project selection, eligibility, and implementation. It is intended to support staff, local governments, and partners in identifying viable funding pathways and aligning resilience needs with the strongest opportunities.

## Federal Funding Programs

Federal agencies administer a wide range of programs that support flood mitigation, disaster recovery, transportation resilience, water/wastewater infrastructure, land conservation, and ecosystem restoration. Many of these programs are competitive, require detailed benefit cost analysis, and operate on recurring annual cycles or disaster specific funding streams.

### FEMA Programs

FEMA funds are among the most significant sources for hazard mitigation and flood resilience.

# 25%

Across all FEMA programs, eligible applicants in North Carolina include local governments, tribes, and state agencies. Projects generally require a 25% local match unless the community qualifies for disadvantaged or severe repetitive loss adjustments.

- **Building Resilient Infrastructure and Communities (BRIC)**

provides competitive funding for mitigation projects, with strong emphasis on shovel-ready infrastructure protection solutions, improved codes and code enforcement and long-term resilience in the face of changing conditions.

- **Flood Mitigation Assistance (FMA)**

supports repetitive loss and severe repetitive loss properties through elevation, acquisition, and floodproofing, floodplain restoration and flood mitigation planning.

- **Hazard Mitigation Grant Program (HMGP)**

is available after major disasters and supports a wide range of projects such as buyouts, structural mitigation, and infrastructure retrofits.



## HUD Community Development Block Grants

HUD administers **CDBG Disaster Recovery (CDBG DR)** and **CDBG Mitigation (CDBG MIT)** programs following major disasters. These funds support:



Housing Reconstruction



Long-term Recovery



Mitigation



Infrastructure Upgrades



Planning

States manage allocation plans that define eligible activities and target low and moderate income communities.

## USDA Programs

The U.S. Department of Agriculture supports agriculture focused and rural community water infrastructure:

- NRCS Watershed and Flood Prevention Operations (WFPO)
- Emergency Watershed Protection (EWP)
- Rural Development Water & Waste Disposal Loans and Grants

These programs fund watershed improvements, streambank restoration, emergency stabilization, and water/sewer infrastructure in rural communities.

## EPA and Water Infrastructure Programs

EPA's major programs include:

- Clean Water State Revolving Fund (CWSRF)
- Drinking Water State Revolving Fund (DWSRF)
- WIFIA Loans for large scale water infrastructure

These sources offer low interest loans and forgivable principal for eligible communities.

## Department of Transportation (DOT) Resilience Programs

DOT's resilience programs—including **PROTECT**, **RAISE**, and other discretionary grants—support projects that improve resilience of transportation systems, culverts, roadways, and multimodal networks.

## NOAA and Interior Programs

Environmental agencies support conservation, floodplain restoration, and nature based solutions. NOAA's funding for habitat restoration and coastal resilience and the U.S. Fish & Wildlife Service's programs for wetlands, rivers, and wildlife corridors offer opportunities for ecosystem based flood mitigation.

## Congressional Spending

Legislative Pre-Disaster Mitigation (L-PDM) and Community Project Funding (CPF) are Congressionally directed spending programs that can be used to mitigate against flooding. These funds are accessed directly through the local Congressional representative.

## State of North Carolina Funding Programs

North Carolina has one of the most diverse state level funding environments for water, land, flood, and resilience related projects. Many state sources provide match flexibility, technical assistance, or planning support not available from federal programs.

### North Carolina Land & Water Fund (NCLWF)

NCLWF supports land acquisition, stream and floodplain restoration, innovative stormwater management, and planning for water quality and flood resilience. Programs include:

- Acquisition Grants for riparian buffers, wetlands, and floodplain conservation
- Restoration Grants for streams, wetlands, and natural infrastructure
- Innovative Stormwater Projects
- Planning Grants for long-range watershed and restoration strategies

### NC Division of Water Resources (DWR)

DWR administers several programs including:

- Water Resources Development Grant Program (WRDG)
- State cost share support for flood mitigation and water-based recreation
- Planning assistance for hydrologic and watershed studies

These programs support construction and planning for flood reduction projects, stormwater controls, and water supply solutions.

### State Revolving Funds (SRF)

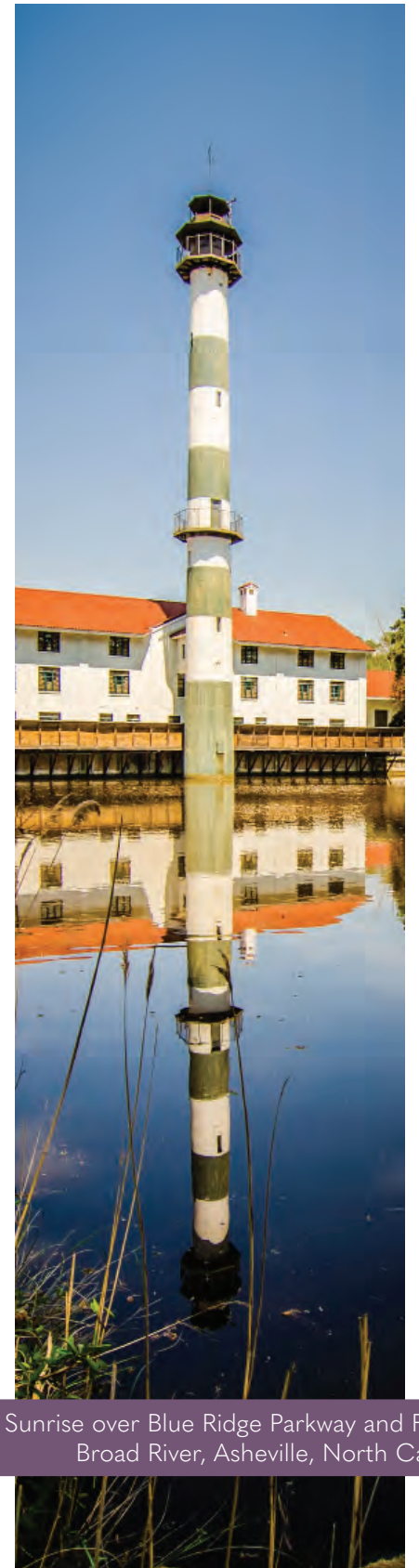
North Carolina administers CWSRF and DWSRF with added benefits for disadvantaged communities. Funds include loan forgiveness, match assistance, and priority scoring for resilience and green infrastructure.

### Coastal and Environmental Programs

For coastal communities, the state offers:

- Coastal Storm Damage Mitigation Fund
- Resilient Coastal Communities Program (RCCP)
- CAMA grants for shoreline, planning, and hazard mitigation

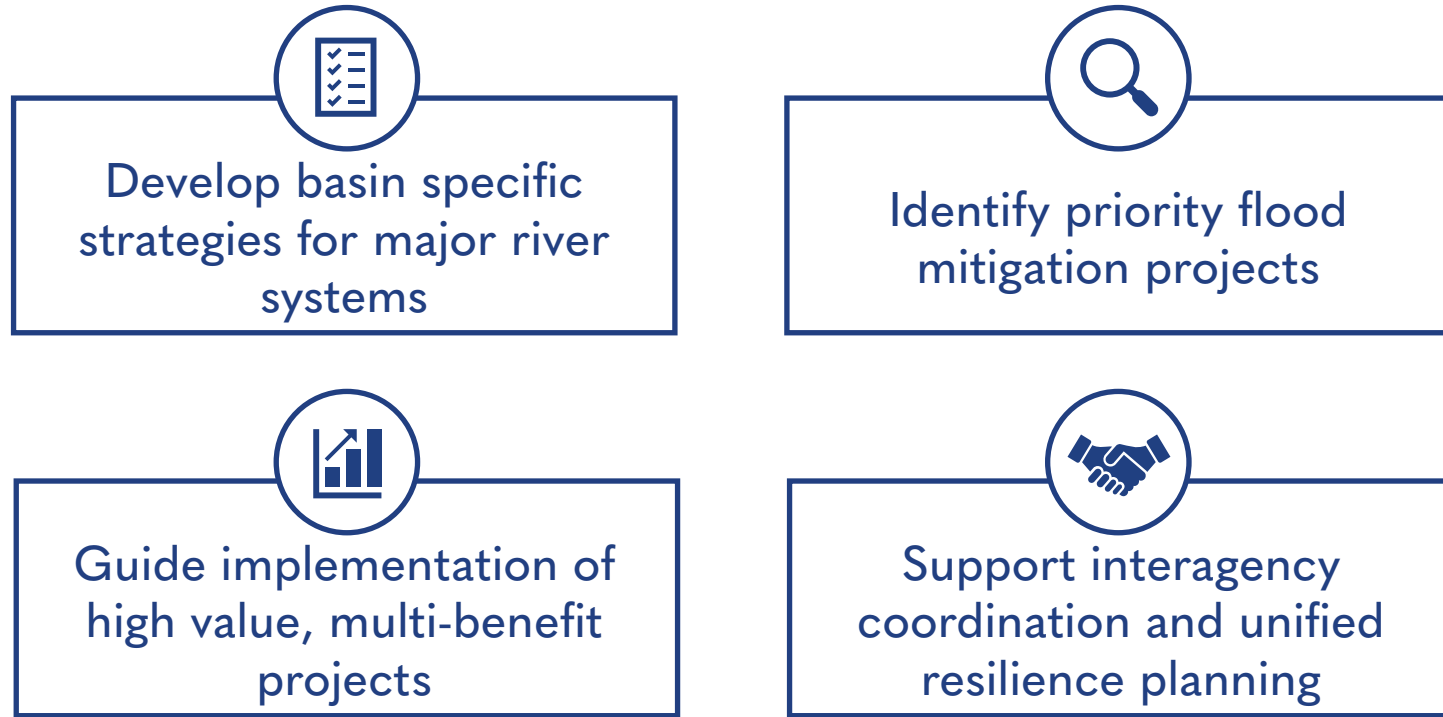
Other programs, such as the Environmental Enhancement Grant (EEG) and agricultural conservation programs, support habitat restoration, water quality enhancements, and preservation of natural lands.



Sunrise over Blue Ridge Parkway and French Broad River, Asheville, North Carolina

# Blueprint Project Implementation Funding

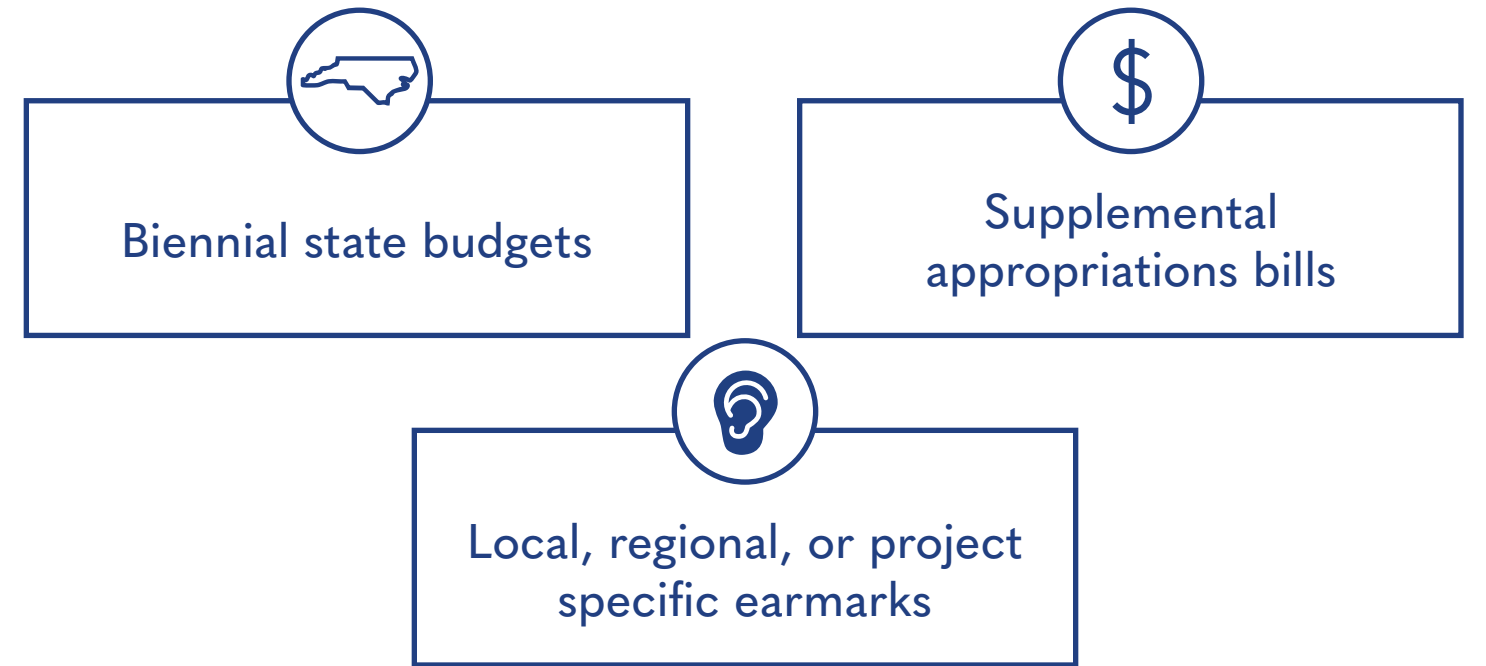
The North Carolina Flood Resiliency Blueprint represents one of the largest state investments in long term flood mitigation planning. Funded initially with \$96 million and now operating with \$76 million, the Blueprint aims to:



Blueprint implementation funds are designed to move high priority projects from concept to construction, particularly where solutions reduce community flood risks, restore natural systems, and provide durable watershed benefits. As strategies are finalized for each basin, these funds will act as a state-level catalyst for projects that align with Blueprint priorities.

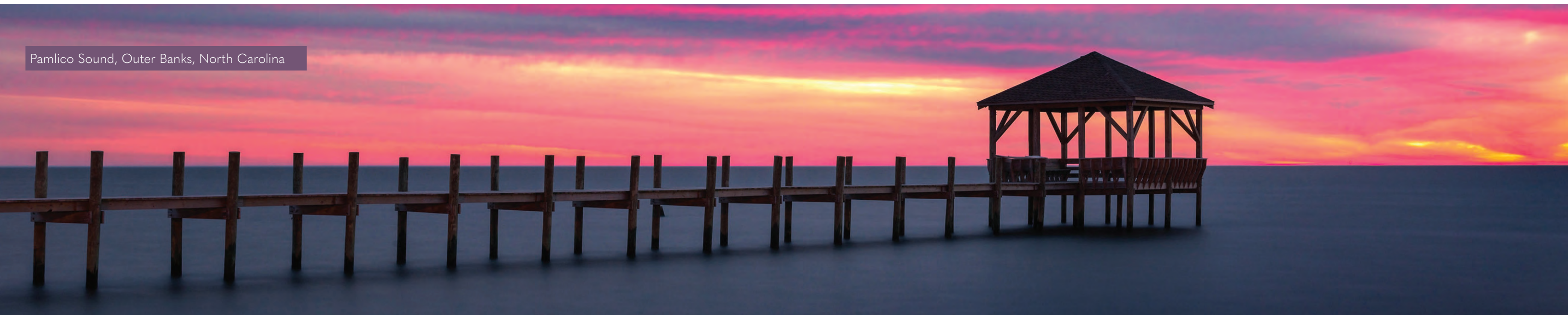
# Legislative Appropriations from the NC General Assembly

The North Carolina General Assembly (NCGA) can allocate funding for resilience and infrastructure through:



Recent budgets have included substantial statewide investments in water, sewer, and stormwater infrastructure, as well as direct allocations to counties, municipalities, and utilities. Legislative appropriations are often strategic tools for addressing urgent needs or advancing major projects that do not fit traditional grant programs. Local governments can work with legislators to elevate priority projects for potential inclusion in budget cycles, especially when projects align with statewide resilience, infrastructure, and economic development objectives.

Pamlico Sound, Outer Banks, North Carolina



# Local, Regional, and Nonprofit Funding Programs

Local governments, regional planning organizations, and nonprofit partners provide essential complementary resources that can fill match requirements, support early-stage planning, or implement smaller scale resilience solutions.

## Local and Utility Funding

Local sources include:



These funds can be used as match for federal or state programs or to advance preliminary engineering.

- **General funds**
- **Stormwater utility fees**
- **Water & sewer enterprise funds**
- **Local capital improvement plans (CIPs)**

## Regional Transportation Planning Funds

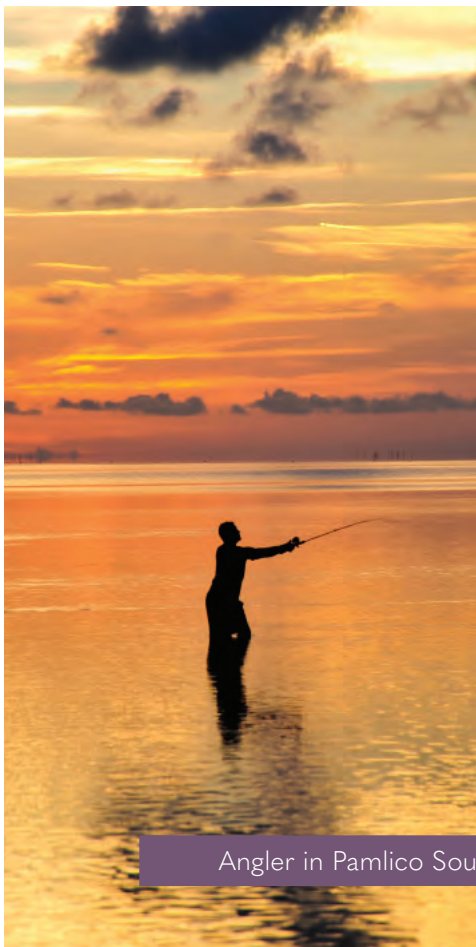
Metropolitan Planning Organizations (MPOs) and Rural Planning Organizations (RPOs) can incorporate resilience components into transportation improvement programs, often unlocking federal dollars for culverts, bridges, greenways, and road related stormwater improvements.

## Nongovernmental Organizations (NGOs) and Philanthropy

Nonprofit organizations can serve as applicants, co applicants, match partners, land stewards, or technical supporters. Key partners include:

- North Carolina Community Foundation
- National Fish & Wildlife Foundation (NFWF)
- The Nature Conservancy
- Conservation Trust for NC
- Local land trusts and conservation groups

These partners often bring additional capacity, volunteer support, specialized expertise, and access to philanthropic funding streams.



Angler in Pamlico Sound



# Strategic Considerations for Project Success

The document highlights several cross cutting considerations:

## Eligibility and Governance

Eligibility differs across programs:

- Some require the applicant to be a unit of local government
- Others accept nonprofit organizations or special districts
- Utility authorities may be eligible for water infrastructure funds
- FEMA programs require state sponsorship and hazard mitigation planning compliance

Understanding institutional eligibility early in project development is critical.

## Matching, Cost Share, and Funding Stacking

Most major programs require local match contributions, typically ranging from 0% to 25%, though disadvantaged community provisions may reduce this requirement. Many projects are financed through braided funding, combining:

- Federal grants
- State grants or loans
- Local funds
- Philanthropic contributions

## Planning and Readiness

Competitive programs prioritize:

- Strong benefit cost analysis
- Permitting readiness
- Engineering feasibility
- Multi benefit outcomes (e.g., water quality + flood reduction + recreation)
- Community engagement and social impact outcomes

## Nature-Based Solutions

Many programs strongly encourage or explicitly prioritize nature based approaches such as:

- Floodplain reconnection
- Wetland restoration
- Stream restoration and buffer enhancement
- Green stormwater infrastructure

These solutions typically score well in competitive evaluations and provide durable long term benefits.

North Carolina has access to one of the most diverse and strategically aligned funding environments for flood mitigation, watershed restoration, and resilience in the United States. The programs cataloged in the Funding Sources Writeup provide a broad spectrum of opportunities for planning, engineering, land conservation, stormwater improvements, resilient infrastructure, and long-term community capacity building.

Aligning local project needs with the right funding source—while leveraging multi agency partnerships and taking full advantage of the Flood Resiliency Blueprint—positions communities to make transformative progress in reducing flood risks and improving watershed health.



## Funding Sources for RBAS Process Prioritized Actions

As a final step in developing the RBAS, federal, state, regional, and local funding programs were evaluated for possible fit with the identified Blueprint projects so that these projects can move toward implementation. Information about these programs were gathered in an organized manner and is available in **Appendix G**.

Many of the regional priority projects identified for their impact in mitigating risk, were large projects with substantial cost estimates that would need success in large federal grant programs to complete the work. In many instances, the non-federal cost share that would be required of the community was prohibitively high for the small communities in which the action is proposed. To address this need, when the community is under-resourced and the project is large, the strategy also considers sources of cost-match from non-federal sources. For some actions, partnerships with state or federal agencies would likely aid in the success of the project, and these partnerships are identified.

Several factors were considered in making funding program matches, including routing projects to a variety of programs so that basin projects were not in competition for the same funding resources. Other factors included the purpose of the program, award size, previously funded projects, and eligibility. Two funding subject matter experts developed independent funding strategies for the priority basin actions, then met to discuss results to determine the best fit for each project component, the needs for cost-match assistance and the necessary partnerships to implement each project. An overview is available in Table 4 and discussed below.

Table 4. Funding Strategy Overview

Project Name	Program Match	Cost Matching Source	Partnerships
Rocky Mount and surrounding areas: Floodplain Restoration	USDOT Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT)	NCLWF: Acquisition Program	-
Rocky Mount and surrounding areas: Stream and Drainage Maintenance System	North Carolina Streamflow Rehabilitation Assistance Program (StRAP)	Stormwater Utility Fees	-
Rocky Mount and surrounding areas: Levee System Inspection, Maintenance, Repair and Upgrades (Merita Bakery Levee System)	EDA Disaster Supplemental: Implementation Path	Blueprint or Appropriations	NCEM Floodplain Mapping Program, USACE Charleston
Greenville and surrounding areas: Levee Construction	USACE Continuing Authorities Program	Blueprint or Appropriations	NCEM Floodplain Mapping Program

Project Name	Program Match	Cost Matching Source	Partnerships
Greenville and surrounding areas: Floodplain Restoration	FEMA Building Resilient Infrastructure and Communities	North Carolina Land and Water Fund: Restoration Program	-
Princeville and surrounding areas: Internal Drainage Improvements	USDA Emergency Watershed Protection	Asset & Inventory Assessment Grants	-
Princeville and surrounding areas: Levee Construction (Shiloh Hills)	FEMA Hazard Mitigation Grant Program	Blueprint or Appropriations	NCEM Floodplain Mapping Program
Princeville and surrounding areas: Levee Construction (Tarboro)	USACE Continuing Authorities Program	Blueprint or Appropriations	NCEM Floodplain Mapping Program
Princeville and surrounding areas: Levee System Inspection, Maintenance, Repair, and Upgrades (Princeville Dike)	USACE Continuing Authorities Program	-	NCEM Floodplain Mapping Program
Hyde County: Levee System Inspection, Maintenance, Repair, and Upgrades (Swan Quarter Dike)	FEMA Pre-Disaster Mitigation	NC WRDG: Flood Resiliency Grants	NCEM Floodplain Mapping Program
Enfield Drainage Improvements	Golden LEAF	Rural Infrastructure Program	-
Hatteras Village: Storm Drainage Study and Improvement	Environmental Enhancement Grant	CWSRF	-
Buxton: Storm Drainage Study and Improvement	DOT Better Utilizing Investments to Leverage Development (BUILD)	Roads Funds	-
Washington Park: Flood Attenuation Park	National Coastal Resilience Fund	NCLWF: Acquisition Program	North Carolina Audubon Society, NC Community Foundation
Washington Park: Green Stormwater Infrastructure	North Carolina Water Resource Development Grant Program: State and Local Projects	NC WRDG: Flood Resiliency Grants	-
Regional: Building Level Mitigation	FEMA Flood Mitigation Assistance	-	-



Aerial view from the top of Hatteras Lighthouse

## Rocky Mount and surrounding areas: Floodplain Restoration:

Due to its mitigation of transportation infrastructure and coastal location, the USDOT Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT) program was selected as a viable option for this project. This program requires a 20 percent nonfederal cost match, which could be funded through the North Carolina Land and Water Fund: Acquisition Program, using the funds for acquisition of land.

As transportation is infrastructure, this project may also fit well into the FEMA Building Resilient Infrastructure and Communities (BRIC) program, that prioritizes hazard mitigation projects that protect infrastructure. Other alternatives include the Transformational Habitat Restoration program from NOAA, which includes a purpose of connecting waterbodies to their floodplains to improve habitat and mitigate flooding. Additionally, the National Fish & Wildlife Foundation National Coastal Resilience program, which could also be used for match funding if needed. This program also focuses on restoring coastal habitats.

## Rocky Mount and surrounding areas: Stream and Drainage Maintenance System:

Finding funding for maintenance projects can be challenging, but the North Carolina Streamflow Rehabilitation Assistance Program (StRAP) serves this purpose. The program does not require cost-match, and could be used to get the drainage system in good working order.

Long-term drainage maintenance will need to be programmed locally on a recurring basis, and Rocky Mount should consider setting aside a portion of the Stormwater Utility funds for this purpose or for future cost matching for alternative programs. The USDA Watershed Protection and Flood Prevention Operations (WFPO) program could be accessed to help develop an effective approach to establishing local maintenance program.

## Rocky Mount and surrounding areas: Levee System Inspection, Maintenance, Repair and Upgrades (Merita Bakery Levee System):

With its primary function to protect a major employer in the area, the Economic Development Administration Disaster Supplemental: Implementation Path, is a good fit because jobs can be directly tied to the investment in resilience. To access this funding, a disaster declaration in the previous two years is required. The application should describe the economic impact of the project. It provides 80 percent funding, leaving a need for a partner program to raise the cost-match needed. Levee systems have limited funding options, likely leaving only Blueprint funding or Legislative Appropriations to address this need.

Alternative funding programs could include the HUD Community Development Block Grant-Mitigation (CDBG-MIT) funding after a disaster or possibly FEMA Hazard Mitigation Grant Program (HMGP), to help scope the project. This project could benefit from partnerships with the NCEM Floodplain Mapping division in planning for accreditation and any provisional map change letters needed for the project. The USACE Charleston District in identifying useful data to develop the project.

## Greenville and surrounding areas: Levee Construction:

With a larger more urbanized population in a growing community, and a large cost, the Greenville levees would likely need the USACE Continuing Authorities Program to lead this project to completion. The USACE is the expert in large water infrastructure projects in the United States, and the larger population protected by this project will likely lead to a favorable benefit-cost ratio.

As a large project, Blueprint funding or Appropriations will likely be needed to meet non-federal cost-share



obligations. Alternatives would be to use CDBG-MIT funding after a disaster to propel this project forward. This is another project that can benefit from partnership with the NCEM Floodplain Mapping division to ensure compliance with NFIP provisions and levee accreditation.

## Greenville and surrounding areas: Floodplain Restoration:

Improving floodplain performance in the Greenville area would protect the airport and other identified critical infrastructure, making this project a good fit for the FEMA BRIC program, which prioritizes the protection of infrastructure. The National Fish & Wildlife Foundation's National Coastal Resilience Program may serve as a viable alternative.

This project will likely need cost-match assistance, and will likely need to access state funding through the North Carolina Land and Water Fund: Restoration Program to meet program funding requirements. This program could serve as a primary source for a pared down project or an incremental approach.

## Princeville and surrounding areas: Internal Drainage Improvements:

The USDA Emergency Watershed Protection Program can be used to clear debris and improve stream banks in disaster-impacted areas with or without a disaster declaration, providing a funding alternative to improve Princeville's internal drainage. It requires a 25 percent match, which is likely more than Princeville could set aside for this purpose. The Asset & Inventory Assessment grant, could help close that gap. This funding helps water and wastewater authorities assess impacts to the system, and address concerns, and could be used to identify and plan for priority risks to infrastructure.

Alternatives for funding this project would be the North Carolina StRAP program, which can be used for clearance activities and does not require cost-match.

## Princeville and surrounding areas: Levee Construction (Shiloh Hills):

The Shiloh Hills levee would protect a small community that lacks the resources to provide cost-match for the project. As levees go, however, it is a smaller project, and thus likely fundable outside of the USACE process. It may be small enough to fit within the Hazard Mitigation Grant Program (HMGP) allocations from a larger disaster. Levee construction, repairs and improvements qualify as eligible activities under this post-disaster program. Blueprint funding or Appropriations are the likely sources of cost-match funding because there are limited non-federal resources that can be used for levee construction.

As an alternative, levees are considered critical infrastructure under HUD Guidelines, and thus, the project could be funded using CDBG-MIT allocations after a disaster. For a non-disaster alternative, the FEMA Pre-Disaster Mitigation program is accessed through the federally elected representative, and this project would fit well within its typical award size and scope. This project can also benefit from partnering with the NCEM Floodplain Mapping division, as it likely involved compliance concerns with the NFIP and accreditation after construction.

## Princeville and surrounding areas: Levee Construction (Tarboro):

Similar to the Shiloh Hills levee construction project, the Tarboro levee protects a relatively small community with limited resources, but is relatively small for a levee project. However, this proposed levee would be across the river from the existing Princeville USACE levee, and this interaction with this existing piece of federal water management infrastructure makes the project best suited to remain under the authority of the USACE through their Continuing Authorities Program to ensure that the levees on both banks operate in a way that does not lead to increased risk. Blueprint funding or Appropriations will likely be needed to meet cost-match requirements.



Alternative funding sources include using post-disaster CDBG-MIT funding or applying for funding through the FEMA Flood Mitigation Assistance (FMA) program. FMA would require there to be a suitable number of NFIP properties to counteract the costs of the project to pass a FEMA-approved Benefit-Cost Analysis. If there are Repetitive Loss or Severe Repetitive Loss properties, defined by the number of NFIP claims over time, the project may have a reduced or waived cost-match requirement under FMA. NCEM would need to be included to verify the NFIP properties and claims in the protected area.

## Princeville and surrounding areas: Levee System Inspection, Maintenance, Repair, and Upgrades (Princeville Dike):

The USACE built and manages the Princeville Dike, and it has studied and identified the repairs and upgrades needed for this project, so keeping it in the USACE Continuing Authorities Program makes sense, especially with the proposed project in Tarboro across the river. This project is valued at more than \$20 million, and thus would likely need assistance through an Appropriation to meet any cost-match needs. The USACE Floodplain Management Services (FPMS) will likely be involved in the development of project details. The NCEM Floodplain Mapping Division should also be involved to ensure that NFIP guidelines are followed.

## Hyde County: Levee System Inspection, Maintenance, Repair, and Upgrades (Swan Quarter Dike):

This is another project with a prohibitively high cost in a smaller community at regular risk of flooding. As levee projects go, this is a relatively low-cost project. Targeting FEMA Pre-Disaster Mitigation through the area's federally elected representative would fit in traditional project scopes and awards, and there are likely sufficient population and infrastructure protected to pass a FEMA-approved Benefit Cost Analysis. To reach cost-match requirements, Swan Quarter and partners would likely need to access state funding programs. The North Carolina Water Resources Development Grant: Flood Resiliency Grants, would help, and its purpose is to provide cost-assistance for shovel-ready flood resilience projects.

Alternatives for funding this project include CDBG-MIT after a disaster of the Safeguarding Tomorrow Revolving Loan Fund through FEMA, which would require repayment.

## Enfield Drainage Improvements:

This project meets the guidelines and within the priorities of Golden LEAF funding goals. Golden LEAF is money from the tobacco settlements used to improve communities that were once heavily reliant on tobacco production. Golden LEAF can fund smaller project with economic benefits, which this project is. For cost-match, the North Carolina Rural Infrastructure Program supports projects in rural areas that have economic development benefits. Improving drainage in downtown Enfield would do that.

Other funding programs that may be available for this project include FEMA programs such as HMGP, or the Clean Water State Revolving Fund. HMGP also requires cost-match, and CWSRF would require repayment over time.

## Hatteras Village: Storm Drainage Study and Improvement:

This project includes the addition of swales, culverts and grading to improve stormwater drainage. This small rural community, could partner with a non-profit entity to access the Environmental Enhancement Grant, which is a program to improve the air, water, and land quality in underserved areas. This fund exists as the result of an agreement with the state and Smithfield Foods, and is designated for specific basins, including the Tar-Pamlico. No cost-share is required for this program.

Alternatives include the CWSRF, which would require payback over time, and may be more suitable for cost-share for other sources such as PROTECT and BUILD, which are programs focused on protecting transportation infrastructure, which this project would do.

## Buxton: Storm Drainage Study and Improvement:

Buxton is trying to fund completed designs and construction for needed swales, culvert upgrades, and grading to manage stormwater. Because this project would improve roadway conditions in the community, a USDOT Better Utilizing Investments to Leverage Development (BUILD) grant may be a good fit for this project. For a BUILD grant, this is considered a small request, and one in a rural area, making it competitive. Similarly, the Rural Surface Transportation grant may be a solid USDOT alternative. County Roads funds should be considered for cost-match.

## Washington Park: Flood Attenuation Park:

To develop this riverside park with wetlands and rain gardens, the National Coastal Resilience Fund through the National Fish & Wildlife Foundation would be an ideal target. This program promotes nature-based solutions and restored habitat in coordination with changing conditions. The park would also provide a site for continuing education and capacity building. This program does not have a cost-match requirement.

Alternatives include the NCLWF: Acquisition Program to assist with land assembly, and the North Carolina WRDGP: State and Local Projects, which is flexible enough to allow to park development. Projects such as parks can also attract investment from the private sector through the purchase of benches, gazebos or other features, and large employers can sometimes assist with even larger features as an opportunity to give back to the community in lasting ways.

## Washington Park: Green Stormwater Infrastructure:

Washington Park's plan to alleviate ponding through the incorporation of permeable pavement, bioretention ponds and submerged gravel wetlands, the North Carolina Water Resources Development Grant Program: State and Local Projects could be accessed, as it identifies green infrastructure as an eligible activity.

Alternative programs for this program include mixing funding from the North Carolina Section 205(j) Water Management Planning Grant to assist with design, with funding from the Five Star Urban Water Restoration Grant to assist with bioretention and/or wetland features. This project would require bringing on partners. Suggested partners include the North Carolina Audubon Society, and the North Carolina Community Foundation. Each of these partners could bring resources or funding to help meet gaps and to engage the community with this space. These partners could also help with the park project in Washington Park.

## Regional: Building Level Mitigation:

For building-level mitigation, an umbrella organization a consortium of counties, or each county should apply for funding from the FEMA FMA program, which allows funding to create buyout and elevation programs for NFIP properties. This funding could be used for outreach and program materials to identify interested parties so that when additional FEMA programs such as Public Assistance or HMGP become available, there is a roster of properties with willing parties that can move quickly to access these resources.

For locally generated projects in the Blueprint Tool, the funding subject matter team grouped projects into groups with a similar purpose of project type and identified a set of programs that are viable for similar projects.



## Beach nourishment programs:

Coastal Storm Damage Mitigation Fund, USACE Continuing Authorities Program.

## Stormwater infrastructure construction programs:

FEMA programs, HUD CDBG, the Clean Water State Revolving Fund, Water Infrastructure and Innovation Act Program, the North Carolina Land & Water Innovative Stormwater Program and, North Carolina Water Resources Development: Flood Resiliency grants.

## Culvert and bridge construction programs:

FEMA programs, Better Utilizing Investments to Leverage Development Grant Program (BUILD), National Culvert Removal, Replacement, and Restoration Grant Program, Bridge Improvement Program, Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT), and the National Fish Passage Program.

## Emergency shelter programs:

FEMA programs, CDBG.

## Resilient roadway programs:

FEMA programs, Better Utilizing Investments to Leverage Development Grant Program (BUILD), Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT).

## Critical facility protection programs:

FEMA programs, CDBG-DR, CDBG-MIT, CDBG-Infrastructure, Rural Development Water & Environmental Programs, Water Infrastructure and Innovation Act Program, the Rural Infrastructure Program, Southeast Rural Community Assistance Program and the National Rural Water Association Revolving Loan Fund.

## Park development programs:

FEMA programs, North Carolina Land & Water Fund: Acquisition Program, Partners for Green Growth, North Carolina Community Foundation, Golden LEAF.

## Nature-Based Solutions/green infrastructure programs:

FEMA programs, Clean Water State Revolving Fund, National Coastal Resilience Fund.

## Watershed planning programs:

FEMA programs, North Carolina Land & Water: Planning Program.

## Debris clearance programs:

Emergency Watershed Protection Program, North Carolina Streamflow Rehabilitation Assistance Program (StRAP).



Lake Mattamuskeet at sunset



# ACTION STRATEGY TAKE-AWAYS

The Tar-Pamlico River Basin Action Strategy is intended to support local governments, regional partners, state agencies, and other organizations in identifying and advancing flood resilience actions that are appropriate to different conditions across the basin. The vulnerability assessment shows that flood risk is increasing under future conditions, with more people, homes, critical facilities, and essential systems exposed to flooding over time. These and other findings support the need for an action strategy that can guide both near-term risk reduction and longer-term flood resilience planning across the basin.

This Action Strategy includes a mix of actions that were identified through steps 1 through 5 of the flood resiliency blueprint tool and planning process (Figure 1), and locally prioritized actions by the communities. The actions identified through the flood resiliency blueprint tool and planning process are the regional/multi-jurisdictional and local actions with calculated benefit cost ratios (BCR) of at least one

over a 50-year project life period. The local actions complement the regional actions by mitigating the flood risk in areas that are not protected by regional actions. Locally prioritized actions are actions that were provided by the various communities. Benefit cost ratios have not been calculated for locally prioritized actions.

The resiliency actions included in this strategy reflect differences in flood risk, vulnerability, and implementation context across the Tar-Pamlico River Basin. Some actions are intended to mitigate reduce concentrated flood losses in more developed areas, some are intended to protect infrastructure and maintain access to essential services, and others are intended to support adaptation in places where flooding is widespread or persistent. Taken together, the Action Strategy provides a basin-wide framework for the Blueprint to understand flood resilience needs and to advance actions through continued coordination, funding, technical assistance, and project development.



## Current Limitations

The analysis, results, and recommendations in this report are subject to the following limitations:

- 1 Utilizing existing BLE data as the main source of fluvial and pluvial flooding data provides a strong baseline for fluvial and pluvial flood extents within the Tar-Pamlico River Basin. However, the BLE modeling does not incorporate detailed terrain or detailed survey data in the analysis, which can provide refined results. Creating updated hydraulic modeling for the highly vulnerable areas can provide more detailed and accurate data to develop more specific mitigation options per area.
- 2 The updated BLE modeling data does account for sea level rise (SLR), which gives further insight into coastal flooding, which can be used for mitigation action selection. However, there are many other dynamics involved with coastal modeling including storm surge, wave run-up, overtopping, propagation, storm-induced erosion, and tides, all of which can change the coastal landscape. Currently there are datasets available for only storm surge and overland wave modeling, however these were created as early as 2012. Using these potentially out of date datasets can limit the level of actions selected and the potential success of these actions, so updated coastal modeling data is needed for all coastal dynamics.
- 3 Fluvial and pluvial flood risk was only conducted on a building-level. The data used was developed in recent modeling efforts and provided building-level damage across the basin. However, there are many other components with associated risk including transportation infrastructure damage and limited access to critical infrastructure. Data on these systems across the basin could provide refined high-risk and vulnerable areas and more detailed actions.
- 4 There was a lack of dam breach modeling through SERA or any other data source for most of the dams within the Tar-Pamlico River Basin. 256 of the 306 total dams do not have existing breach modeling, so the potential risk level of the properties downstream of these dams, including AADT and buildings at risk, had to be estimated.
- 5 The NC Dam Inventory had information missing on the status of some dams about hazard level and structure condition or may not be up to date. It was observed in the data from the NC Dam Inventory that the listed inspection dates for certain dams went back to 1970, with some not having an inspection date listed. Over the period since that listed inspection, the condition and hazard class could have potentially changed based on downstream updates as well as natural degradation. However, without this information accurate risk categorization could not occur.
- 6 Breach data was not available for the levees within the Tar-Pamlico River Basin. The levee risk and vulnerability analysis utilized the latest 2D BLE modeling, but these models were not developed with the levee system as a main component, nor does the modeling include any natural valley analysis or breach analyses. As such, some levee systems could have a higher risk than estimated in this report.
- 7 Simplifying assumptions were made for the urban and stormwater, and coastal flooding sources, and compound flooding due to lack of data. Additionally, there were gaps in analyses for each flooding source which are reviewed below.
- 8 Capacity challenges can prevent some local communities from developing local action plans and locally prioritized actions. Further engagement and capacity building are needed to meaningfully prioritize local actions and ensure all are able to participate.

# NEXT STEPS & IMPLEMENTATION

## DEQ Program and Project Accountability

Through the development of the River Basin Action Strategies, local governments, Councils of Government, and other partners have used the Blueprint Tool and staff support to develop local resilience plans. River Basin Advisory Groups and Blueprint Teams have further evaluated and prioritized actions for inclusion in the RBAS. These planning efforts are a critical part of building a more resilient state, but they must be matched with funding and implementation.

The completion of the River Basin Action Strategies is not an endpoint. The Blueprint team will continue working with local governments and other partners to support flood resilience planning and will collaborate with basin partners to help identify funding for prioritized mitigation actions. As of April 2026, NCDEQ has received funding for RBAS development in six basins, as well as an additional \$96 million for project implementation in those basins. To implement projects, NCDEQ has used a range of funding mechanisms, including direct partnerships with local governments, funding private firms for full-delivery flood mitigation projects, and collaboration with fellow state agencies and programs, including North Carolina Emergency Management (NCEM), the North Carolina Land and Water Fund (NCLWF), the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), the Division of Water Resources (DWR), and the North Carolina Department of Transportation (NCDOT). These partnerships support the efficient implementation of priority projects and help address gaps in current mitigation efforts. The RBAS process has also identified a need for funding to support engineering and design, in addition to construction. Moving forward, this is an area where the Blueprint can be especially impactful.

Additional funding is needed to complete RBAS development, identify projects, and support project implementation in the remaining eleven river basins. In addition, the RBAS process will identify areas where data improvements are needed, allowing those needs to be prioritized to ensure that the most accurate data is used to inform these critical decisions.

Overall, NCDEQ is committed to making the state more flood resilient by providing local governments, state agencies, and other partners with the data, tools, and support needed to guide investments that reduce the cost and disruption of future flooding.



Louisburg North Carolina

## Blueprint Tool

The Blueprint Tool is available statewide, but its functionality is limited outside the initial six basins. With additional funding, improved flood mapping and expanded data development will be completed for the rest of the state, allowing the Blueprint Tool to effectively support all communities across North Carolina. Continued investments to improve and refine the Blueprint Tool will better serve North Carolina's residents and ensure the state remains a leader in data-driven flood resilience planning.

In the basins currently engaged, Blueprint staff will continue providing support and resources to build local capacity to use the Tool from project conception through completion. This approach will enable local entities and basins to continue applying the Blueprint Process beyond the initial RBAS effort.



Lake Mattamuskeet

# ACKNOWLEDGEMENTS

## RBAG Members

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Thomas Shrader  
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## Collaborating Entities

The Association of Mexicans in North Carolina (AMEXCAN)  
North Carolina Black Alliance (NCBA)  
NC Statewide Independent Living Council (SILC)  
Southern Coalition for Social Justice (SCSJ)  
The Conservation Fund (TCF)  
North Carolina Budget & Tax Center (NCB&TC)  
North Carolina Conservation Network (NCCN)  
North Carolina Inclusive Disaster Recovery Network (NCIDR)  
Carolina Wetlands Association (CWA)  
Upper Coastal Plain Council of Governments  
Mid-East Commission  
North Carolina Department of Environmental Quality Division of Coastal Management



Flooded bald cypress forest near Lake Mattamuskeet

This report was developed by AtkinsRéalis for NCDEQ.

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# APPENDICES

# APPENDIX A: Data Collection Report



# APPENDIX B: Public Engagement Plan



# APPENDIX C: Blueprint Capacity Results



# APPENDIX D: Gap Analysis Report



# APPENDIX E: Flood Risk and Vulnerability Analysis Report



# APPENDIX F: Actions Prioritization Report



# APPENDIX G: Funding Data Sheets



# APPENDIX H: Detailed Prioritized Resiliency Actions Profiles

