

Flood Resiliency Blueprint Update

Agriculture & Forestry Awareness Study Committee

August 29, 2024

Kenansville, NC



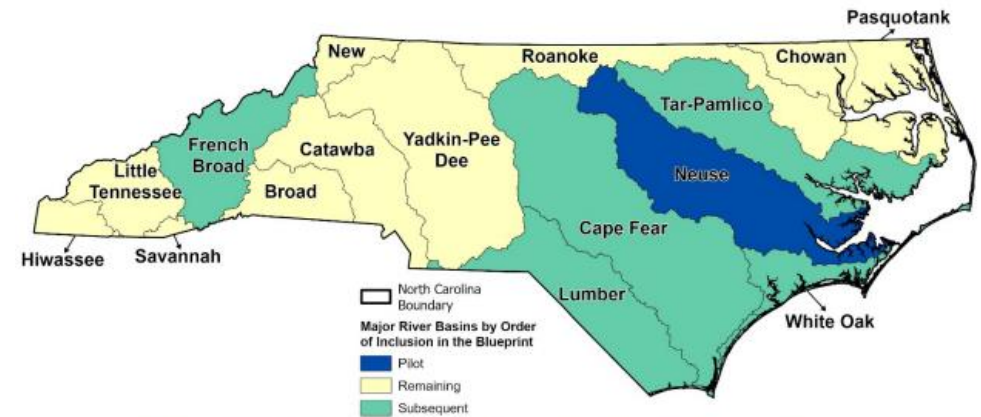
Agenda NC Flood Resiliency Blueprint

- Overview
- Blueprint Development
 - *The processes and tools that “Shall form the backbone of a State flood planning process”*
 - *Decision support tool*
- Blueprint Implementation
 - *Implementing resilience projects*

NC Flood Resiliency Blueprint Goals

- Serve as the backbone of State flood planning
- Increase community resilience to flooding
- Reduce the cost and complexity for local government in the planning and implementation of flood risk reduction projects
- **“...A successful blueprint should ultimately lead to a prioritized set of projects and funding strategies that the State can implement.”**

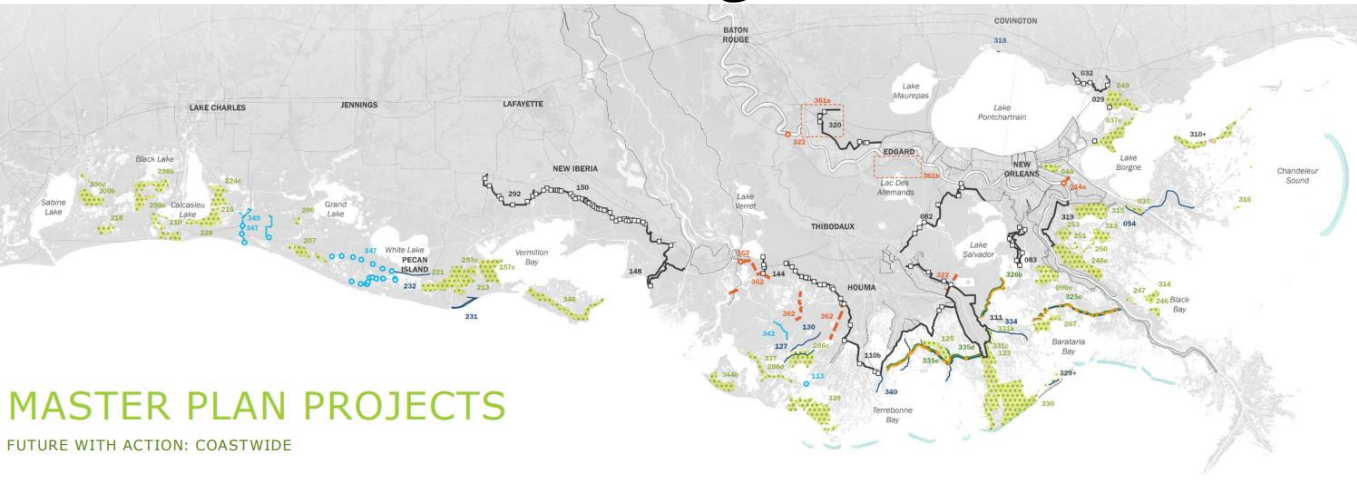
Basins: Neuse, Cape Fear, French Broad, Lumber, Tar-Pamlico, and White Oak



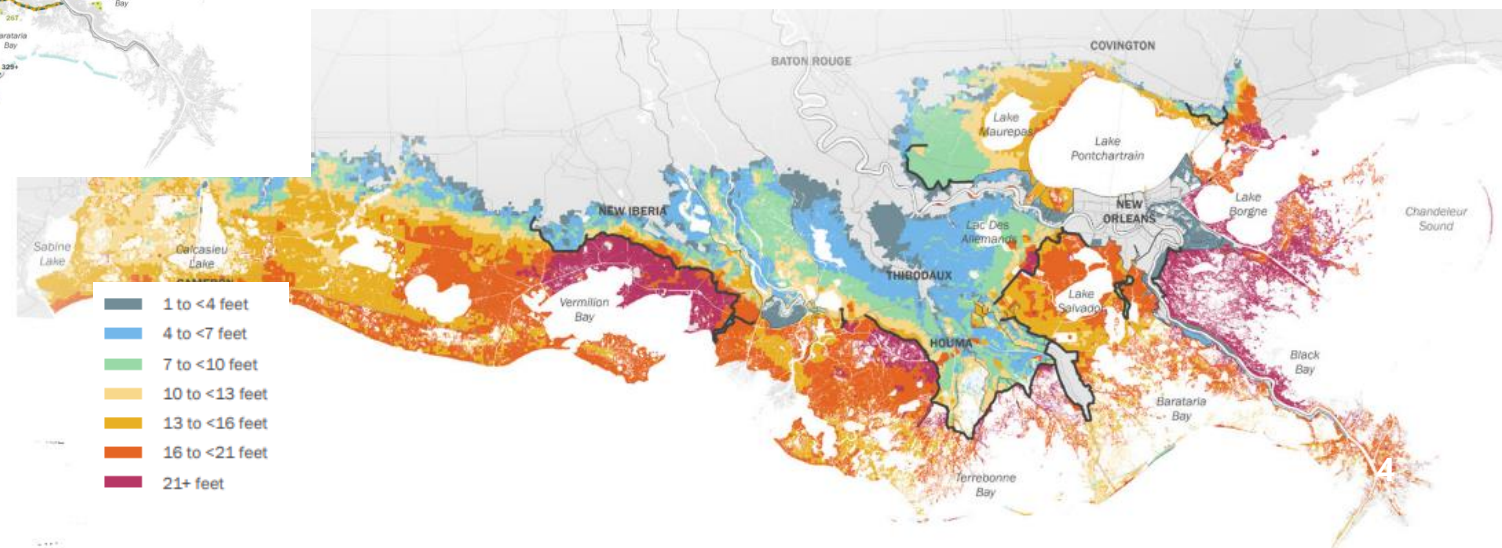
ES-Figure 3. North Carolina Major River Basins by Order of Inclusion in Blueprint

NC Flood Resiliency Blueprint Goals

- Build off “examples from other states such as the **Louisiana Coastal Master Plan** or the flood resiliency planning processes in South Carolina and Virginia.”



MASTER PLAN PROJECTS
FUTURE WITH ACTION: COASTWIDE



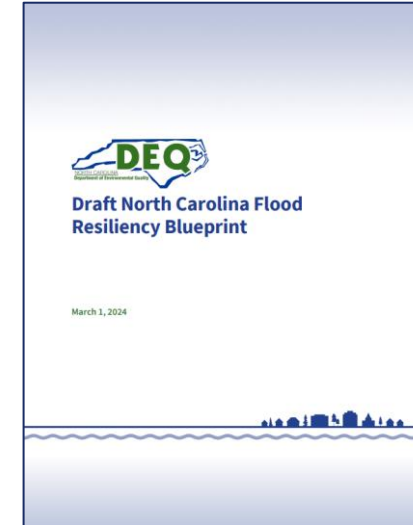
Louisiana – NC Comparison

Louisiana Master Plan	NC Flood Resilience Blueprint
<p>Mature program</p> <ul style="list-style-type: none"> • Mandated in 2005; First MP in 2007; First model-based plan in 2012; Now updated every 6 years • 15+ years of model development and improvement • Evaluate four types of risk reduction projects 	<p>New program</p> <ul style="list-style-type: none"> • Leveraging and improving existing models and datasets • Developing unique tools/methodologies <ul style="list-style-type: none"> • Evaluate 30+ Resilience Action types
<p>Risk Reduction</p> <ul style="list-style-type: none"> • Prioritize investments to direct state funding • Educate – Illustrate how the coast is going to change and how that will impact communities 	<p>Resilience</p> <ul style="list-style-type: none"> • Prioritizing state investments • Support local government’s resilience planning and marshal funding
<p>Process</p> <ul style="list-style-type: none"> • 6-year cycle for: <ul style="list-style-type: none"> • Project development • Evaluation • Prioritization 	<p>Process</p> <ul style="list-style-type: none"> • In-tool project development, evaluation, prioritization • Led by local government empowered to identify, evaluate, and prioritize resilience actions

Blueprint Development - Multiphase Process



- **Phase I (2022 - 2024) - Complete**
 - Research and evaluation
 - Gap analysis
 - Recommendations and decisions (Programmatic, Policy, Tools, Approaches, Needs)
 - Neuse River Basin Action Strategy (Pilot)
 - Draft Blueprint
- **Phase II (2023 - 2025) - Ongoing**
 - Develop online decision support tool (Blueprint Tool)
 - Begin implementation
- **Phase III (2024 - 2025) - Ongoing**
 - Develop Action Strategies for five prioritized areas
 - Refine of Decision Support Tool
 - Continue Blueprint implementation
 - Refine Blueprint and Neuse Action Strategy (including additional modeling)

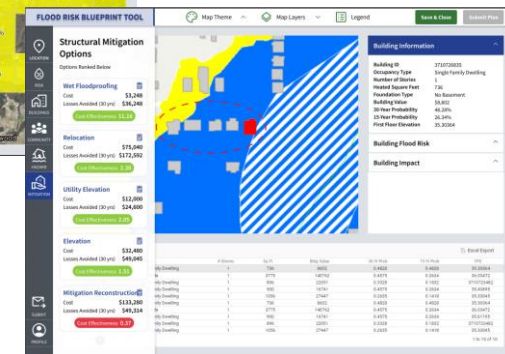
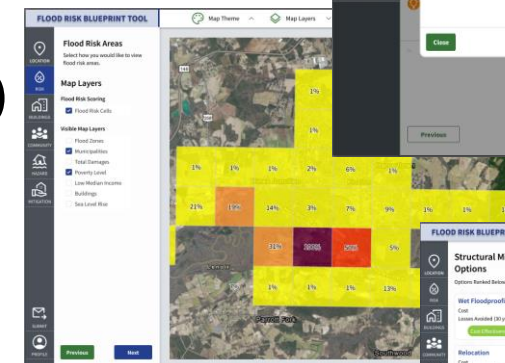
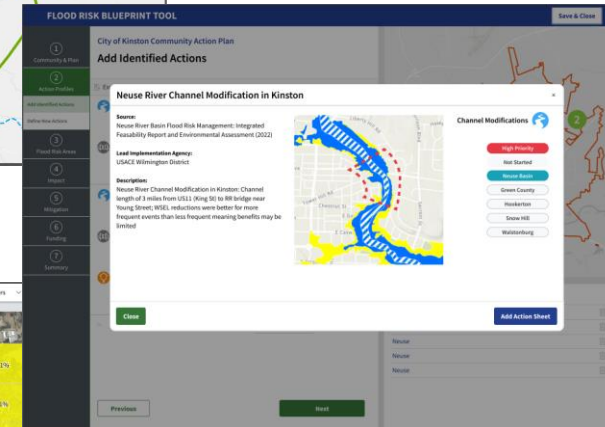
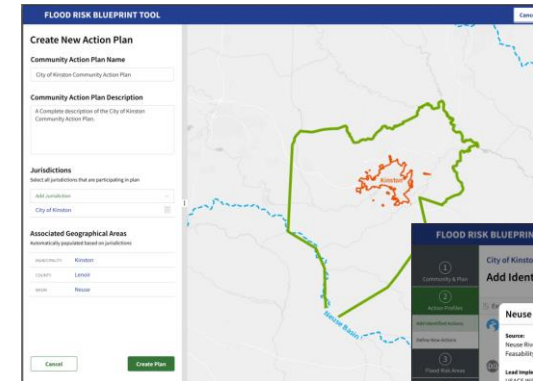


Community Engagement Q&A Meeting in Canton, 6/22/2023

Blueprint Development - Multiphase Process



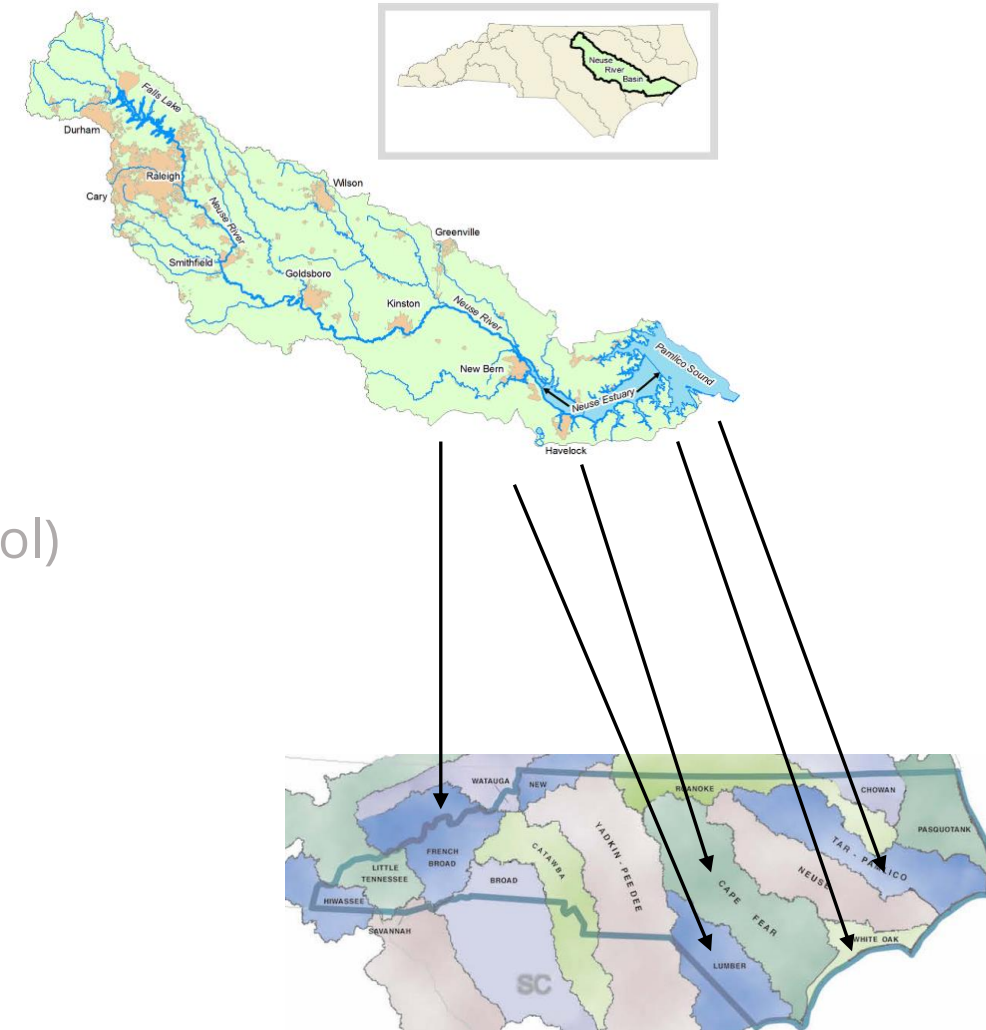
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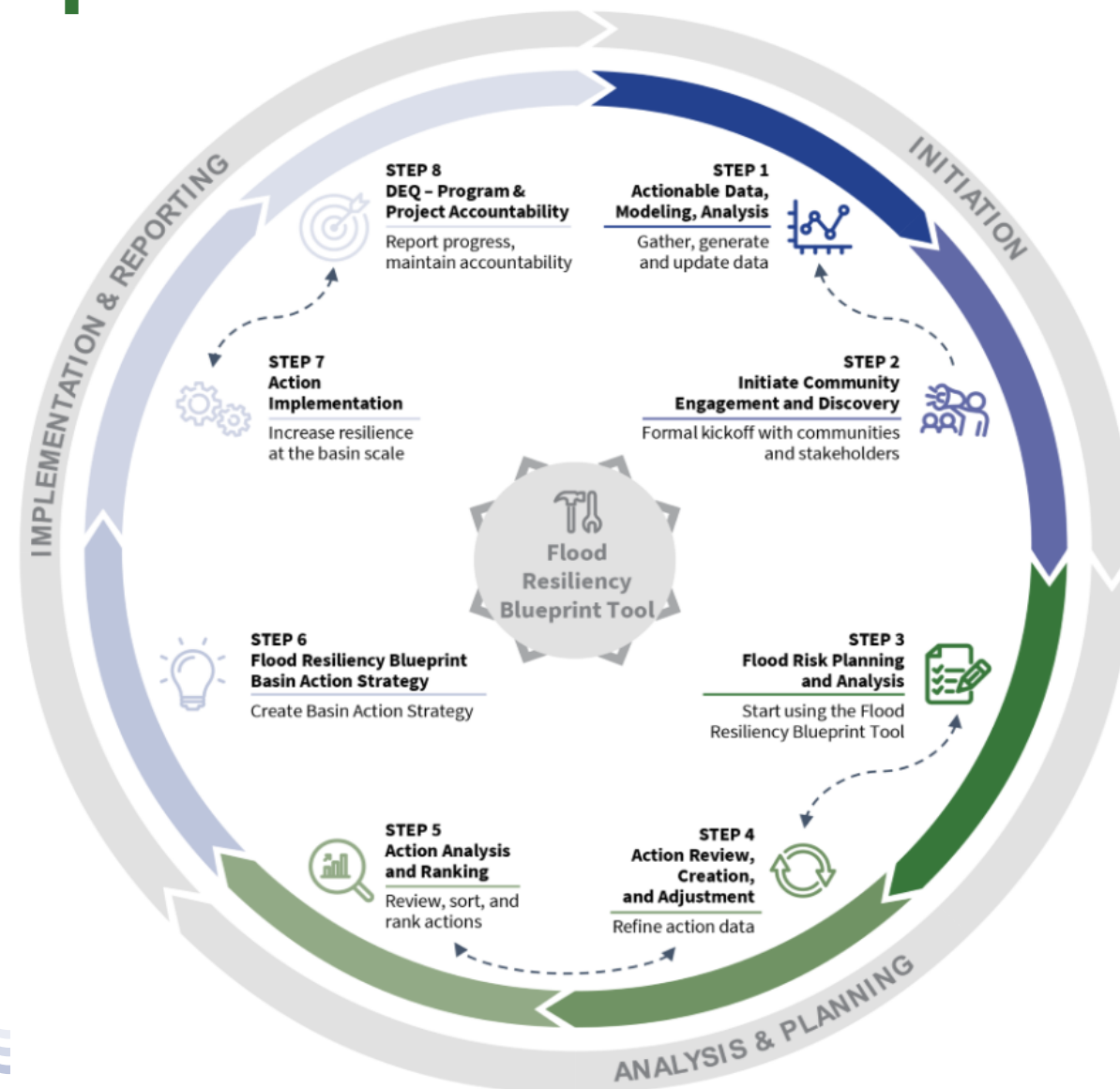


Flood Resiliency Blueprint Tool



NC Flood Resiliency Blueprint Tool

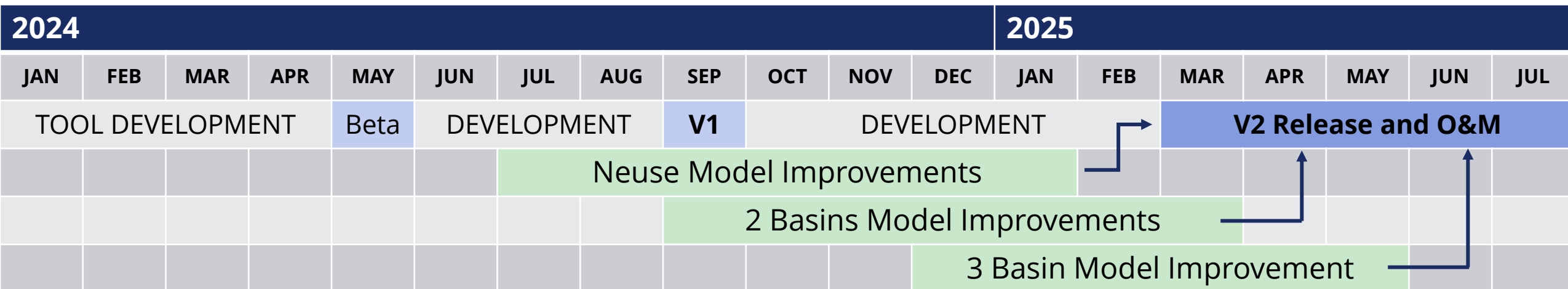
- Built on Hydrologic and Hydraulic (H&H) models
 - New methodologies allow users to:
 - Develop, Evaluate, Prioritize Resilience Actions
 - Plan and marshal funding to implement priority resilience measures
- Who is the Tool for:
 - Local governments
 - planners, floodplain managers
 - Fellow state agencies
 - Policymakers
 - Soil and Water Conservation District Staff, NRCS staff, SeaGrant extension, COG members
 - Public



NC Flood Resiliency Blueprint Tool

Tool Development and Model Improvement

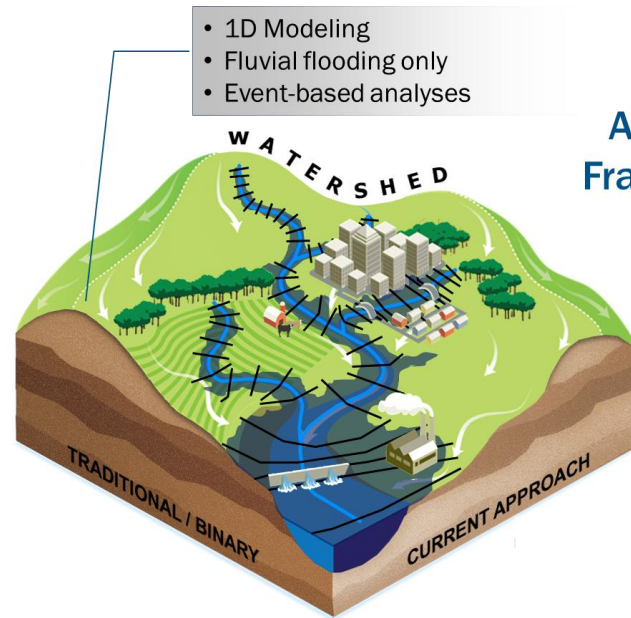
- April 2024 - Beta Testing
- September 2024 – Version 1 - *Testing*
- Spring 2025 – Version 2 - *Public*



Flood Resiliency Blueprint Model Improvements

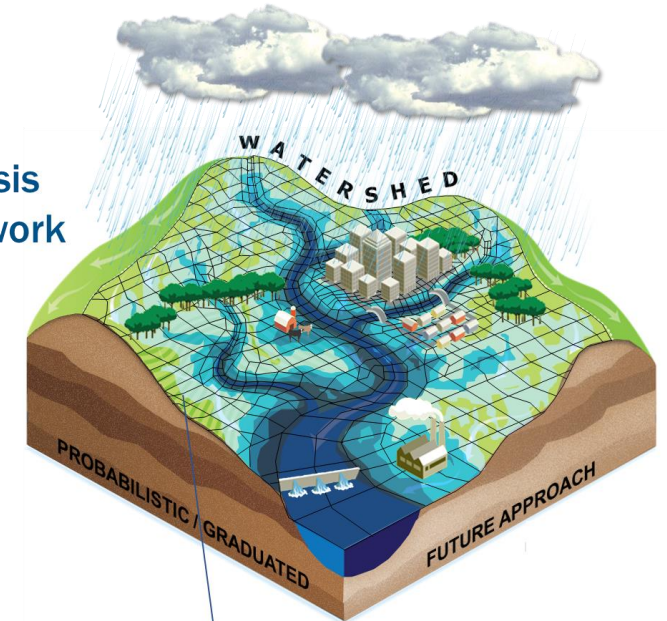
Better define flood extent and exposure

- **Current Conditions**
- Capture *future* flooding
 - Changes in precipitation patterns
 - Sea level rise
 - Increased impervious surfaces
- Facilitate future improvements
 - Storm surge and compound flooding
 - Probabilistic framework



Inland/Riverine Flooding Examples

Analysis Framework



- 2D Modeling
- Fluvial and pluvial flooding
- Probabilistic analyses

Support tool functionality

Flood Resiliency Blueprint Model Improvements

ENERGY & ENVIRONMENT

Nearly \$10B in Hurricane Debby damage occurred in areas without flood insurance requirements

BY SAUL ELBEIN - 08/13/24 12:36 PM ET



Study: U.S. Flood Damage Risk Is Underestimated

February 22, 2022 | [Laura Oleniacz](#) | 5-min. read

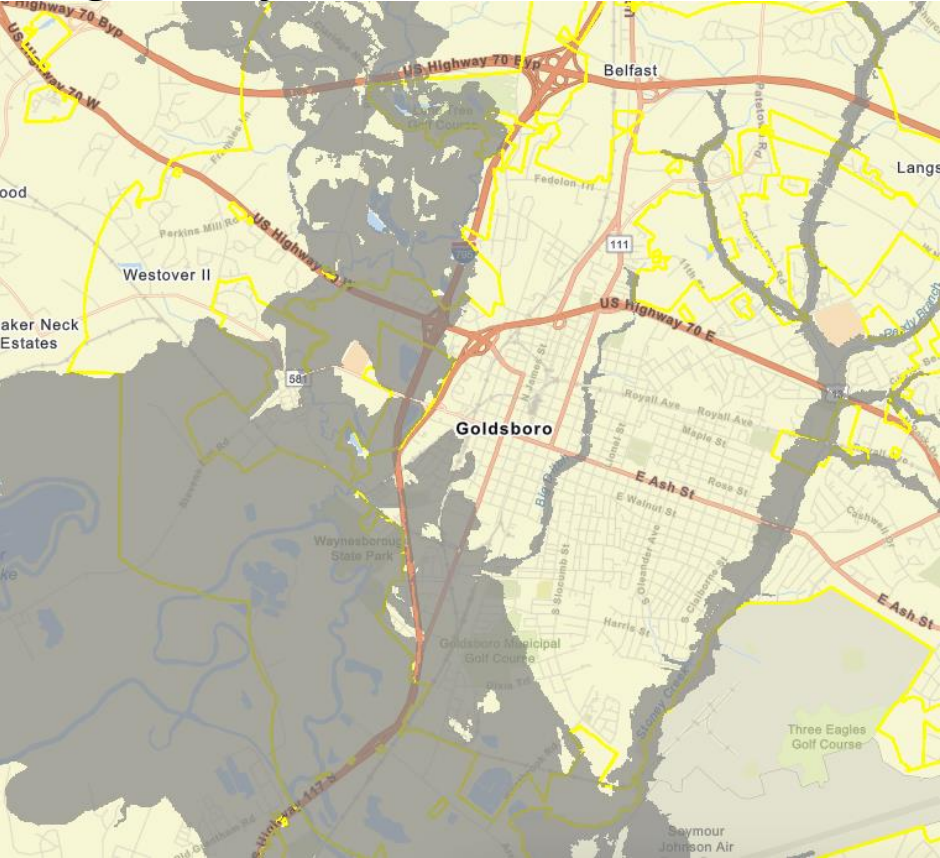
“According to a 2022 study from North Carolina State University, 68% of flood damage reports were outside of FEMA's high-risk flood zones in 2020 [and]... 16% of damage reports were in unmapped locations.”

Flood Resiliency Blueprint Tool



1% Annual Chance

Regulatory Flood Plain



2D Rain on Grid

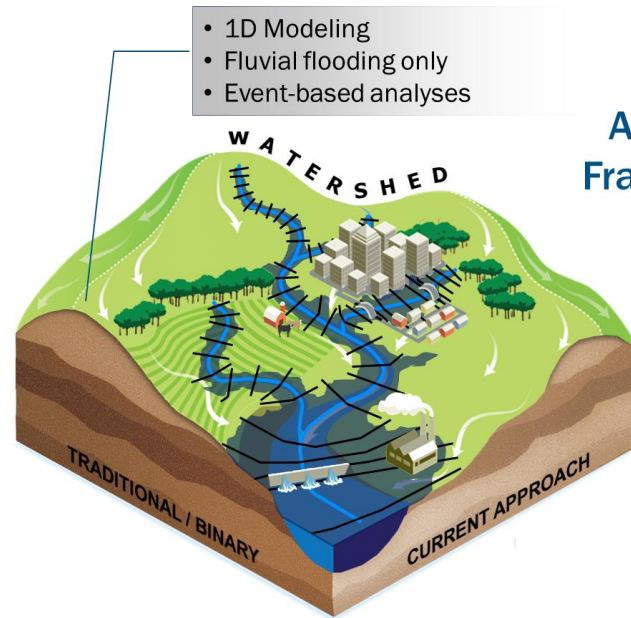


NCEM Advisory Flood Data

Flood Resiliency Blueprint Model Improvements

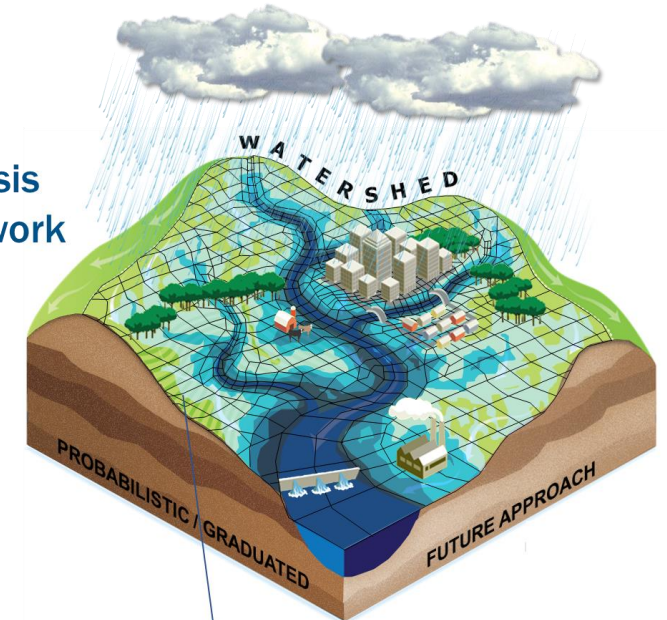
Better define flood extent and exposure

- Current Conditions
- **Capture *future* flooding**
 - Changes in precipitation patterns
 - Sea level rise
 - Increased impervious surfaces
- **Facilitate future improvements**
 - Improved surge and compound flooding
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Inland/Riverine Flooding Examples

Analysis Framework



- 2D Modeling
- Fluvial and pluvial flooding
- Probabilistic analyses

Support tool functionality

Flood Resiliency Blueprint Tool



- Expands on existing tools with new data and methodologies
- Integrates forecasted changes
- Is scalable (catchment to statewide)
- Allows for integration of future data and logic generated through multiple sources
- **Is dynamic** and improves as data and methodologies improve



Blueprint Tool Functionality



Develop a Detailed Community Profile	Develop New Resilience Actions	Build a local Action Plan
Explore Flood Risk	Action Management (internal)	Fund Matching Tool
Project Complexity	Flood Risk Scores	Ranking Actions
Estimating Impacts of Flooding on People, Environment, Infrastructure, and Economic Sustainability +	Community Capacity	Data Repository

- Goals:
 - Be a resource for riverine and stream management to reduce flooding
 - Reduce the cost and complexity for local government in the planning and implementation of flood risk reduction projects
 - Lead to a prioritized set of projects

Blueprint Tool Functionality



Develop a Detailed Community Profile

Develop New Resilience Actions

Build a Local Action Strategy

Explore Flood Risk

Action Management (internal)

Fund Matching Tool

Project Complexity

Flood Risk Scores

Ranking Actions

Estimating Impacts of Flooding on People, Environment, Infrastructure, and Economic Sustainability +

Community Capacity

Data Repository

Flood Resiliency Blueprint Tool



Develop a Detailed Community Profile

Build a Local Action Strategy

Develop New Resilience Actions

The screenshot displays the 'Community Profile' section of the Flood Resiliency Blueprint Tool. The interface includes a top navigation bar with links for 'Community Profile', 'Flood Risk Management', 'Resiliency Action Evaluation', 'Action Management', and 'Data Repository'. A search bar is located at the top right of the main content area. The left sidebar contains a list of categories: Critical Facilities, Critical Infrastructure, Emergency Services, Environmental Concerns, Historic Buildings & Areas, Housing (selected), Land Use, Population & Demographics, Social Vulnerability, and Capacity Assessment. The main content area is titled 'City Of Kinston - Housing' and features a legend for 'Houses at Risk by Flood Depth (Based on 1% Annual Chance)'. The legend categories are: More than 5 Feet (dark purple), 4 - 5 Feet (purple), 3 - 4 Feet (magenta), 2 - 3 Feet (red), 1 - 2 Feet (orange), 0 - 1 Feet (yellow), and Less than 0 Feet (light yellow). The map shows a residential area with houses colored according to the legend, situated near the Neuse River and labeled with street names like Queen St, Lakeland Dr, and E New Bern Rd. The map also indicates 'ZONE AE' and includes a 500 ft scale bar and navigation controls.

Flood Resiliency Blueprint Tool



Community Profile Flood Risk Management Resiliency Action Evaluation Action Management Data Repository SB

Community Profile

? Help

Critical Facilities

- Critical Infrastructure
- Emergency Services
- Environmental Concerns
- Historic Buildings & Areas
- Housing
- Land Use
- Population & Demographics
- Social Vulnerability
- Capacity Assessment

City Of Kinston - Critical Facilities

Edit Mode OFF

- | Sector | Visibility |
|------------------------------|--------------------------|
| Food and Agriculture | <input type="checkbox"/> |
| Banking and Finance | <input type="checkbox"/> |
| Chemical | <input type="checkbox"/> |
| Commercial Facilities | <input type="checkbox"/> |
| Communications | <input type="checkbox"/> |
| Critical Manufacturing | <input type="checkbox"/> |
| Defense Industrial Base | <input type="checkbox"/> |
| Emergency Services | <input type="checkbox"/> |
| Energy | <input type="checkbox"/> |
| Government Facilities | <input type="checkbox"/> |
| Healthcare and Public Health | <input type="checkbox"/> |
| Information Technology | <input type="checkbox"/> |

Save and Exit Next

Search by address, place, or intersection

Editor

- Settings
- Edit features
 - Select
- Create features
 - Filter types

Develop a Detailed Community Profile

Build a Local Action Strategy

Develop New Resilience Actions

Flood Resiliency Blueprint Tool



Develop a Detailed Community Profile

Build a Local Action Strategy

Develop New Resilience Actions

The screenshot shows the 'Flood Risk Management' section of the tool for the 'Kinston' community. A modal titled 'Add New Resiliency Action' is displayed over a map. The modal contains three options:

- Add Pre-Identified Action:** I Want to Use a Resiliency Action That Was Identified in a Previous or Ongoing Planning Effort. Description: There have been numerous flood mitigation and resiliency planning efforts undertaken in the past. If you are interested in reviewing and possibly selecting previously identified resiliency action(s) from these efforts, select this option.
- Create My Own Action:** I Know What Resiliency Action I Want to Create. Description: If you already know the resiliency action you would like to select for inclusion in your Basin Action Strategy, select this option.
- Explore by Area of Interest:** I Want to Explore Risk and Resiliency Action Options. Description: If you want to take advantage of one of the most impactful functions of the Blueprint Tool, select this option to explore the flood risk and the 30+ resiliency actions to reduce the risk.

Flood Resiliency Blueprint Tool



Develop a Detailed Community Profile

Build a Local Action Strategy

Develop New Resilience Actions

**NORTH CAROLINA
Flood Resiliency
BLUEPRINT**

[Community Profile](#)
[Flood Risk Management](#)
[Resiliency Action Evaluation](#)
[Action Management](#)
[Data Repository](#)
SB

Flood Risk Management
Kinston [Change](#)
View Summary
? Help

Resiliency Action Planning

Pre-identified ^

Lenoir County Sherrifs Department

evaluate ways to keep the basement of the Lenoir County Sheriff's Office from flooding. Options include hardening of the building, water proofing, and/or evaluating methods to direct stormwater away from the building.

County	Lenoir
Community	Not Available
Estimated Cost	\$51,000 - \$100,000
Plan	HMRRP
Plan Year	2017
Owner/Manager	Lenoir County
Status & Barriers	1-2 years

Next

Resiliency Action Type v

Add Action To Plan

Search by address, place, or intersection 🔍

Select the Pre-Identified Resiliency Action you want to import Viewing Actions: In Jurisdiction

Name	Plan	Location	Basin	County	Community	Category
<input checked="" type="checkbox"/> Lenoir County Sherrifs Department	HMRRP	Lenoir	Neuse	LENOIR		
<input type="checkbox"/> Lenoir County Center for the NC Cooperative	HMRRP	Lenoir	Neuse	LENOIR		Policy & Planning

Add Previously Identified Action

Export to Excel
1 - 2 of 2 Buildings

Flood Resiliency Blueprint Tool



Develop a Detailed Community Profile

Build a Local Action Strategy

Develop New Resilience Actions

The screenshot shows the 'Flood Risk Management' interface for Kinston, NC. The 'Add New Resiliency Action' section is highlighted with a blue box and contains three options:

- Add Pre-Identified Action:** I Want to Use a Resiliency Action That Was Identified in a Previous or Ongoing Planning Effort. Description: There have been numerous flood mitigation and resiliency planning efforts undertaken in the past. If you are interested in reviewing and possibly selecting previously identified resiliency action(s) from these efforts, select this option.
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Below the screenshot, two white boxes with black text provide additional context:

- Add New, Known Action:** Corresponds to the 'Add Pre-Identified Action' option.
- Explore & Develop New Action:** Corresponds to the 'Explore by Area of Interest' option.

Flood Resiliency Blueprint Tool



Develop New Resilience Actions

Identify an area of interest



Community Profile Flood Risk Management Action Management Data Repository TU

Flood Risk Management

Kinston Change

View Summary ? Help

Resiliency Action Planning

- Assess Your Risk
- Area of Impact

Identify the area that will be impacted by your resiliency action:

- Zoom to the area of impact on the map to the right, using the search bar or manually.
- Draw an area of impact polygon on the map using the drawing tools in the upper right.

Able to sketch

Clear Next

Resiliency Action Type

Resiliency Action Location

Add Action To Plan

Flood Resiliency Blueprint Tool



Community Profile | Flood Risk Management | Action Management | Data Repository

Flood Risk Management

Kinston Change View Summary Help

Resiliency Action Planning

Assess Your Risk

Area of Impact

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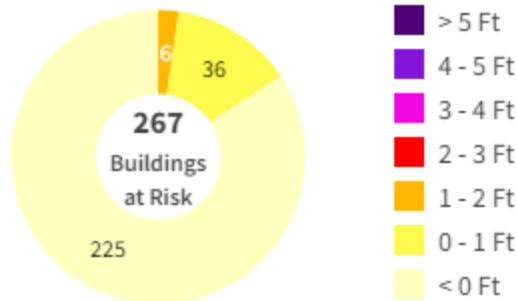
Resiliency Action Type

Resiliency Action Location

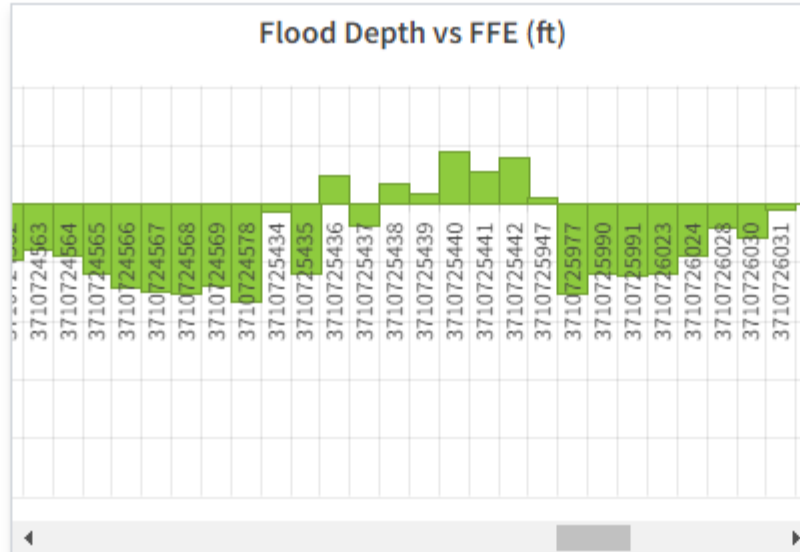
Develop New Resilience Actions

Assess flood Risk

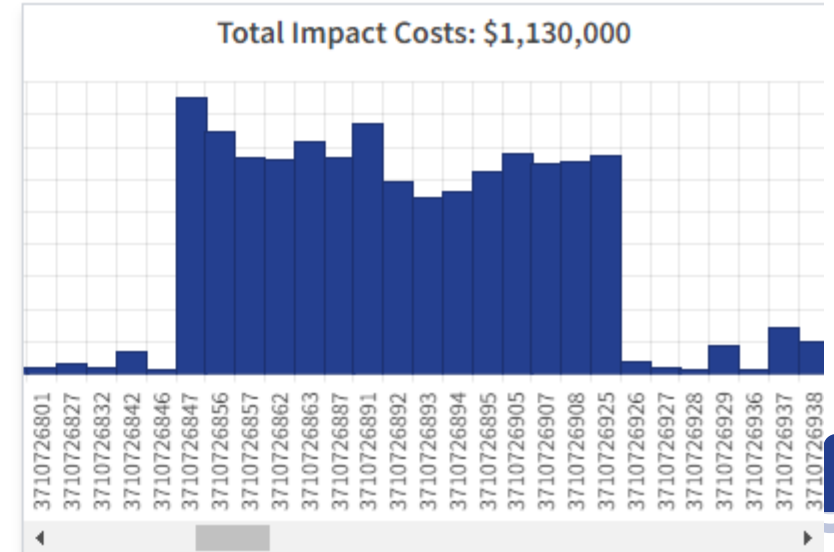
Buildings at Risk by Flood Depth (ft) ?



Flood Depth vs FFE (ft)



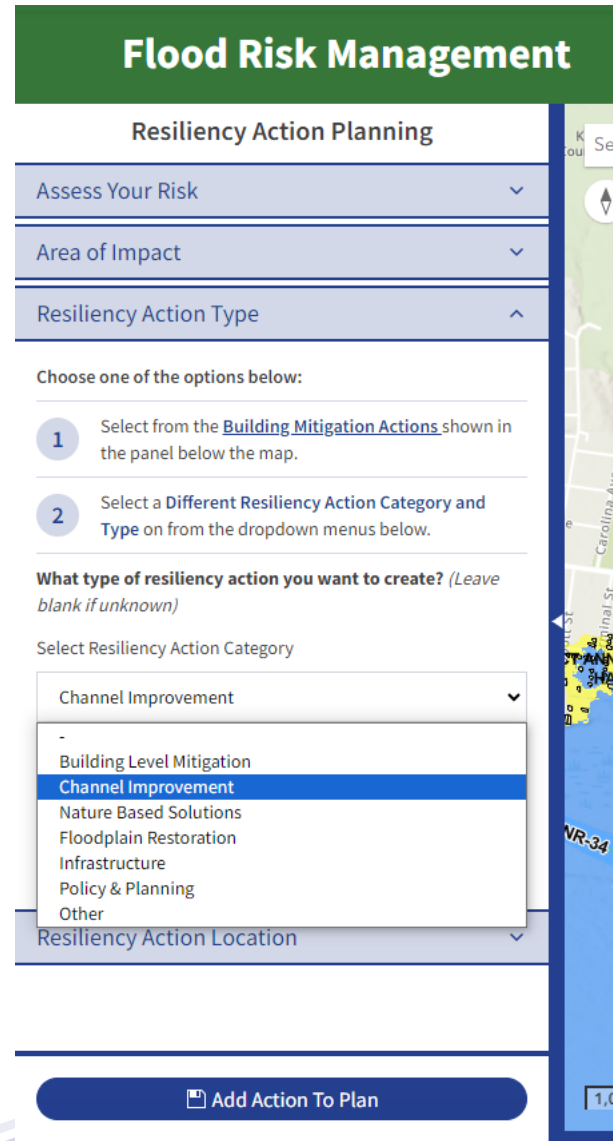
Total Impact Costs: \$1,130,000



Flood Resiliency Blueprint Tool

Develop New Resilience
Actions

Explore Resilience Actions



Flood Risk Management

Resiliency Action Planning

Assess Your Risk

Area of Impact

Resiliency Action Type

Choose one of the options below:

- 1 Select from the **Building Mitigation Actions** shown in the panel below the map.
- 2 Select a **Different Resiliency Action Category and Type** on from the dropdown menus below.

What type of resiliency action you want to create? (Leave blank if unknown)

Select Resiliency Action Category

- Channel Improvement
-
- Building Level Mitigation
- Channel Improvement**
- Nature Based Solutions
- Floodplain Restoration
- Infrastructure
- Policy & Planning
- Other

Resiliency Action Location

Add Action To Plan

Resilience Action Categories

- Building level mitigation
- Detention/Runoff reduction
- Channel Improvement
- Nature Based Solutions
- Floodplain Restoration
- Infrastructure
- Policy and Planning

Flood Resiliency Blueprint Tool

*** Unique:** Distinctive, offering capabilities not available in any other tools
+ Enhanced: Exists in other tools, but the Blueprint Tool extends these functionalities significantly, enhancing them to provide greater efficiency and effectiveness
= Leverage/Coordinated: Leverages the capabilities of similar tools, coordinating to provide cohesive advancements in data and function.

Detention/Runoff Reduction

- Reduction New structures +
- Retrofit Existing structures +
- Quarries *
- Dry dams +

Floodplain Restoration

- Riparian buffers +
- Floodplain mitigation preservation *
- Floodplain restoration/Multi-use floodplains *

Nature-Based Solutions

- Water farming *
- Afforestation +
- Bioretention +
- Raingardens, bio-swales, etc. +
- Permeable pavement +
- Flood storage wetlands *
- Stream restoration =

Channel Improvement

- Debris removal =
- Channel dredging =
- Channel widening =

Building Level Mitigation

- Relocation =
- Utility elevation =
- Structural elevation =
- Reconstruction =
- Wet floodproofing =
- Dry floodproofing =
- Acquisition/Demolition =

Infrastructure

- Levee =
- Dike/ Berm =
- Roadway elevation/ Road crossing modification =
- Stormwater management activities +

Policy & Planning

- Enhanced zoning *
- Land use/impervious area restrictions =
- River corridor/ Greenspace implementation *
- Stormwater, water quality, floodplain regulations =

Flood Resiliency Blueprint Tool



Community Profile Flood Risk Management Action Management Data Repository TU

Develop New Resilience Actions

Stream Debris Removal

- Define Area of impact
- Define Action Location

Flood Risk Management

Kinston Change

View Summary ? Help

Resiliency Action Planning

- Assess Your Risk
- Area of Impact
- Resiliency Action Type
- Resiliency Action Location
- Resiliency Action Profile

Search by address, place, or intersection

Length of Stream (ft) 11,179.756 Estimated by Tool 11,179.756

Coverage Area Piedmont Cost Per Foot \$20 Est by Tool \$20

Cost to Remove \$223,595 Estimated by Tool \$223,595.118

Building Damages in Area of Impact \$508,697

Annual Losses Avoided: \$30,735 Cost Effectiveness 0.138

Residual Building Damages 254,349

Add Action To Plan

Flood Resiliency Blueprint Tool



Develop a Detailed Community Profile

Build a Local Action Strategy

Develop New Resilience Actions

Resiliency Action Evaluation

Filter By:

Basin: Cape Fear, French Broad, Neuse, Roanoke

County: Cape Fear

Municipality: Roanoke

Status:

Search For Location: [Search]

Action Strategy	Action Name	Jurisdictions (Link to Comm Capacity)	Resiliency Action Category	Resiliency Action Score
Local/Basin	Action 1	Jurisdiction	Study	Score
select one	Action 2	Juris 1, Juris 2	Mitigation Action	Structural
	Action 3	Score	Study	-
	Action 4	Score	Mitigation Action	Infrastructure
	Action 5	Score	Mitigation Action	Nature-Based Solution
	Action 6	Score	Mitigation Action	Structural
	Action 7	Score	Policy Change	-
	Action 8	Score	Mitigation Action	Infrastructure
	Action 7	Score	Mitigation Action	Structural
	Action 8	Score	Mitigation Action	Infrastructure

Resiliency Action Score Details

Resiliency Action Name	Resiliency Action Name
Resiliency Action Description	Description Text
Action Category/Type	Action Category/Action Type
Location	Location
Jurisdiction	Jurisdiction Name

Adjust Weights

- Economic Sustainability and Development
- Environmental Benefits
- Equity and Social Vulnerability
- Flood Impacts to Business and Industry
- Flood Impacts to Homes
- Ease of implementation
- Life/Safety During Flood Events

Attribute	Definitions & Scoring Criteria	Base Score	Weighting Factor	Points
1 Risk Score				
1A Life/Safety Risk Score				
1B Direct Damages Avoided				
1B.1 Direct Damages Avoided - Homes				
1B.2 Direct Damages Avoided - Businesses				
1B.3 Direct Damages Avoided - Businesses				
2 Social Vulnerability				
3 Regulatory Floodway or Coastal V Zone				
4 Future Risk				

Flood Resiliency Blueprint Tool



**NORTH CAROLINA
Flood Resiliency
BLUEPRINT**

Flood Risk Management Action Management Data Repository CS

[Home](#) > [Flood Risk Management](#) > [City of Kinston Action Plan](#)

+ Add Action
Weights

City of Kinston Action Plan Action Plan Summary

Action Name	Action Type	Mitigation Type	
Action 1	Study	-	
Action 2	Mitigation Action	Structural	
Action 3	Study	-	
Action 4	Mitigation Action	Infrastructure	
Action 5	Mitigation Action	Nature-Based Solution	
Action 6	Mitigation Action	Structural	
Action 7	Mitigation Action	Structural	
Action 8	Policy Change	-	
Action 9	Policy Change	-	
Action 10	Mitigation Action	Infrastructure	

First
1
2
Last

*Breakdown by
Action Type*

6

Mitigation Actions

5

Studies

3

Policy Changes

*Mitigation Action
Breakdown by Type*

5

Structural

5

Infrastructure

4

Nature-Based Solutions

[← View All Action Plans](#)
Generate Draft Report
Submit Plan to DEQ

Blueprint Tool Functionality



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Explore Flood Risk	Action Management (internal)	Fund Matching Tool
Project Complexity	Flood Risk Scores	Ranking Actions
Estimating Impacts of Flooding on People, Environment, Infrastructure, and Economic Sustainability +	Community Capacity	Data Repository

Fund Matching

- Match proposed resilience actions with funding opportunities
 - Actively updated
 - Federal, state, philanthropic programs



Flood Resiliency Blueprint Implementation



Project Implementation

- In 2021, the N.C. General Assembly allocated \$96M to DMS, which became available Spring 2024, to implement priority flood resilience projects.
- As a first step in administering the funds, the Blueprint team is coordinating with fellow state agencies and programs with overlapping resilience priorities
 - Department of Agriculture's Streamflow Rehabilitation Assistance Program (StRAP)
 - N.C. Land and Water Fund,
 - N.C. Emergency Management



Project Implementation

Prioritizing projects based on:

- their ability to reduce flood damage to infrastructure, homes, businesses, etc.,
- whether the project has been identified in a Hazard Mitigation or Resilience Planning efforts,
- whether the project is in a high-risk area,
- their likelihood of reducing flood risk to underserved communities,
- whether the projects serve additional public benefit (e.g. parks, trails, etc.).



Flood Resiliency Blueprint Tool



- Planned Awards to date
 - (Work with NCEM not captured)

Partner	River Basin	Sum of Proposed DEQ Award
NCLWF	Cape Fear	\$800,000.00
NCLWF	French Broad	\$914,625.00
NCLWF	Lumber	\$3,596,814.00
NCLWF	Neuse	\$1,886,750.00
NCLWF	Tar-Pamlico	\$704,809.00
NCLWF	White Oak	\$1,150,000.00
NCLWF Total		\$9,052,998.00
Other	Cape Fear	\$1,500,000.00
Other	Lumber	\$569,476.00
Other	Neuse	\$110,000.00
Other	White Oak	\$1,500,000.00
Other Total		\$3,679,476.00
StRAP	Cape Fear	\$921,775.00
StRAP	French Broad	\$495,200.00
StRAP	Lumber	\$975,500.00
StRAP	Neuse	\$686,536.00
StRAP	Tar-Pamlico	\$1,642,980.00
StRAP Total		\$4,721,991.00
Grand Total		\$17,454,465.00

DRAFT







Closing



What's Next

Flood Resiliency Blueprint Program Consultants

<p>Jessica Gray <i>Cape Fear</i></p> 	<p>Shana Shapiro <i>Lumber</i></p> 	<p>Chris Dreps <i>Tar-Pamlico</i></p> 
<p>Suna Morkoc <i>French Broad</i></p> 	<p>Chris Dreps & Brad Connell <i>Neuse</i></p>	<p>Brad Connell <i>White Oak</i></p>

What's Next

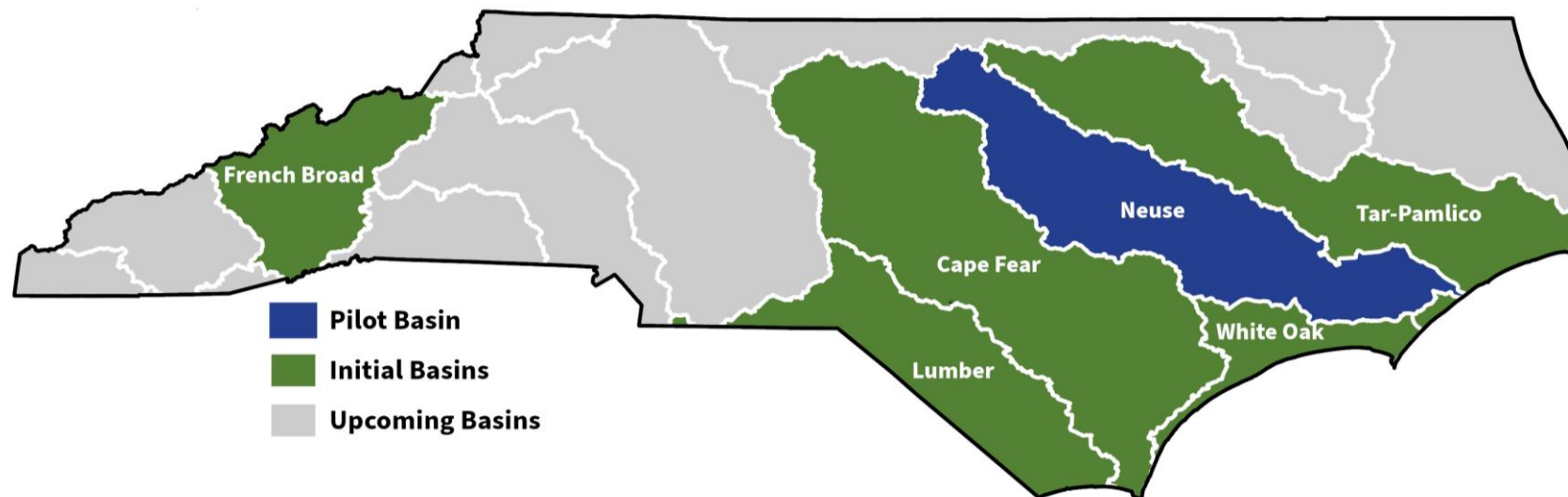
PHASE II - Tool Development and Model Improvement

- September 2024 – Version 1 Testing
- Spring 2025 – Version 2

What's Next

Phase III

- Blueprint contracting with vendors – *In Process*
- Supporting the development of Basin Action Strategies
 - Cape Fear, French Broad, Lumber, Tar-Pamlico, and White Oak
 - Establishing Basin Technical Advisory Committees



What's Next

Continued Implementation

- Working with NCEM
- Mining Hazard Mitigation plans and other planning efforts
- Agricultural Pond Flood Storage pilot project with Dept. of Agriculture



Thank You! | Questions?

Stu Brown

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