Draft North Carolina Flood Resiliency Blueprint

Executive Summary

March 2024

This document serves as the Executive Summary for the **Draft North Carolina Flood Resiliency Blueprint**, representing the most significant statewide flood resiliency investment in North Carolina's history. The Blueprint is designed to bring together all flood-related resources and knowledge in the state into one unified platform. It will offer decision-makers at all levels a standardized methodology for flood planning, an online decision-support tool, and river basin-specific action strategies to address flooding in North Carolina communities. It will also allow the state to make targeted decisions about where to allocate resources for the most significant impact. The Blueprint will continue to be refined based on further stakeholder and community engagement, the pilot Neuse River Basin Flood Resiliency Action Strategy, the development and implementation of the Flood Resiliency Blueprint Tool, and on-the-ground project implementation.

The primary audiences for the Draft North Carolina Flood Resiliency Blueprint are intended to include the North Carolina General Assembly, state agencies, regional planning organizations, local governments, community leaders, academics, and other stakeholders interested in building flood resilience in the state of North Carolina.

Executive Summary

Introduction

The North Carolina Flood Resiliency Blueprint is a first-of-its-kind program in the country and represents North Carolina's largest statewide flood mitigation investment. It is designed to bring together and build upon all the relevant existing resources and knowledge in the state to create one unified initiative to realize a more resilient North Carolina. The vision for this effort was developed through state legislation and extensive communication with state agencies, other states involved in robust flood mitigation and resiliency, communities on the frontlines of flood events, academics, nonprofits, climate and flood resiliency experts, legislators, and other stakeholders.

The Blueprint provides a statewide flood planning framework and decision-support tool that enables state, tribal, regional, and local entities and their stakeholders to identify, prioritize, and direct resources to implement effective flood resilience strategies based on the best available science and understanding of likely future conditions. The Blueprint serves as the backbone of North Carolina's flood planning process and will help increase community resiliency to flooding. By investing in a more flood-resilient state now, North Carolina will protect and improve the lives and livelihoods of North Carolinians, secure and build upon its thriving economy, expand tourism, support agriculture, forestry, and other working land businesses, fortify transportation infrastructure, protect critical aspects of the military mission, and steward natural resources.

Within the last ten years, major hurricanes, tropical storms, and other severe rain events have highlighted a flood-risk crisis that threatens North Carolina's communities, businesses, and people. Since 1977, North Carolina has received federal aid for 29 major flooding events. Hurricanes Matthew and Florence in 2016 and 2018 caused $27 billion in damage and resulted in 76 storm-related fatalities across the state. As of April 2020, the state and federal governments have spent over $3.5 billion as a result of these two storms alone, and recovery needs continue to exist for communities.[1] The current flood risk experienced by communities is expected to be heightened as storm events and rainfall increase in frequency and intensity and the state's population continues to grow, highlighting the need for enhanced community flood resilience (Figure 1).

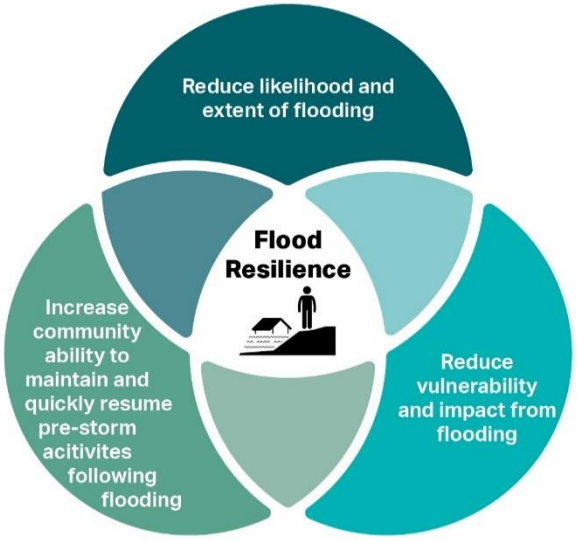

Figure 1. Flood Resilience

Many jurisdictions face challenges related to current levels of flooding, even as the state

[1] "HUD Approves NC Plan for Spending Hurricane Florence Recovery Funds," NC Department of Public Safety, April 30, 2020, https://www.ncdps.gov/news/press-releases/2020/04/30/hud-approves-nc-plan-spending-hurricane-florence-recovery-funds-0.

continues to grow, attracting new businesses and residents. While North Carolina's growing economy and population are an overall positive trend for many communities, this growth is often accompanied by an increase in the amount of impervious surface area that reduces the ground's ability to absorb rainwater, increasing water flow into rivers, and worsening local and downstream flooding. The state's growth has also led to structures and infrastructure being built within areas that are beginning to experience flooding beyond historical patterns or that may be susceptible to flooding in the future.

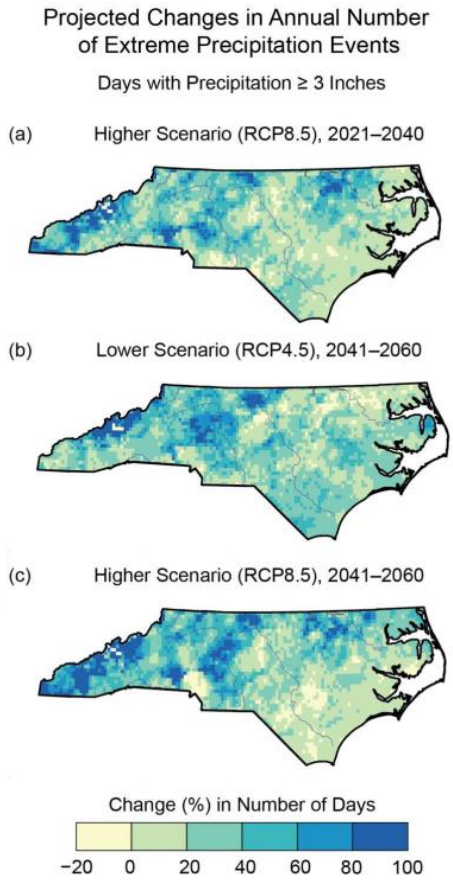

Figure 2. Changes in Precipitation

In highlighting the current flood risk that threatens North Carolina, it is important to consider the role of a changing climate, including increases in rainfall and sea level rise, and its potential to worsen the crisis. North Carolina is expected to experience further amplification of flood risk, partly attributed to rising precipitation levels and heightened flooding intensity (Figure 2).[2] While all North Carolinians will experience these effects in the future, resource-limited communities are disproportionately located in flood-prone areas, meaning these communities may bear a greater share of the increased flood risk.[3]

To better equip the state and its communities to manage current and future flood risk, the North Carolina General Assembly passed Section 5.9(c) of Session Law 2021-180 in 2021, which directed the North Carolina Department of Environmental Quality (NCDEQ) to develop a Flood Resiliency Blueprint (Blueprint).[4] The General Assembly provided additional guidance on the Blueprint's development in 2022 in Section 22 of Session Law 2022-75.[5]

The Blueprint planning framework and the decision-support tool are not envisioned as a static set of plans or tools but rather as a dynamic process incorporating new information as it becomes available. The effort will provide multi-scale flood modeling for future conditions, scenario exploration systems, guidance documents, and an iterative and interactive online planning tool to increase decision-makers' ability to understand flood risk and prioritize and implement flood resilience actions to protect communities, economies, and the environment. It will help to link and build on existing data, strategies, projects, plans, and efforts underway by local, state, and federal

[2] "North Carolina Climate Science Report," North Carolina Institute for Climate Studies, June 2020, https://ncics.org/programs/nccsr/.

[3] Alireza Ermagun, Virginia Smith, and Fatemeh Janatabadi, "High Urban Flood Risk and No Shelter Access Disproportionally Impacts Vulnerable Communities in the USA," *Communications Earth & Environment* 5, no. 1 (January 2, 2024), https://doi.org/10.1038/s43247-023-01165-x.

[4] 2021 Appropriations Act, SL 2021-180, https://ncfloodblueprint.com/documents/SL2021-180.pdf.

[5] Regulatory Reform Act of 2022, SL 2022-75, https://ncfloodblueprint.com/documents/SL2022-75.pdf.

entities, academia, businesses, and nonprofits, as well as capitalize on lessons learned from existing programs in peer states.

The Blueprint's unique nature and scope require its development to emphasize an adaptive learning and management approach that encourages flexibility to continuously leverage the expertise of relevant stakeholders, incorporate existing and ongoing flood resiliency efforts, and take advantage of technological advancements as they mature. Moreover, the Blueprint aims to identify and address gaps in ongoing flood resiliency efforts in the state, foster regional collaboration, and strengthen local programs by incorporating community and stakeholder knowledge as a primary foundation for its efforts.

The development of the Blueprint has been divided into phases. Phase I - Develop the Draft Blueprint began in late 2022 and included a focus on generating over two dozen documents and reports based on extensive research covering diverse topics related to flood resiliency and the successful development and implementation of the Blueprint. This foundational research and gap analysis, along with extensive stakeholder engagement, enabled the development of the Draft North Carolina Flood Resiliency Blueprint, a preliminary Draft Neuse River Basin Flood Resiliency Action Strategy (Neuse Action Strategy), and requirements for a Flood Resiliency Blueprint Tool (Blueprint Tool).

As their titles suggest and as directed by the General Assembly, the Preliminary Draft Neuse River Basin Action Strategy and the Draft North Carolina Flood Resiliency Blueprint are subject to change based on continuous engagement and feedback from stakeholders as well as new and refined key findings and recommendations that arise during Phase II of the Blueprint.

Phase II - Develop the Flood Resiliency Blueprint Tool launched in late 2023 to focus on developing the Blueprint Tool and refining the Draft Blueprint and Preliminary Draft Neuse Action Strategy. Local decision-makers and residents will have the opportunity to participate in several workshops in the Neuse River Basin to review and provide feedback on the preliminary draft action strategy. Further stakeholder engagement will be conducted to inform the development of the Blueprint Tool. Phase III - Apply to Targeted Basins Statewide is projected to begin in the spring of 2024 and will involve NCDEQ and coordinating stakeholders strategically implementing the Blueprint's planning framework and the Blueprint Tool across additional targeted river basins to develop River Basin Action Strategies (Figure 3).

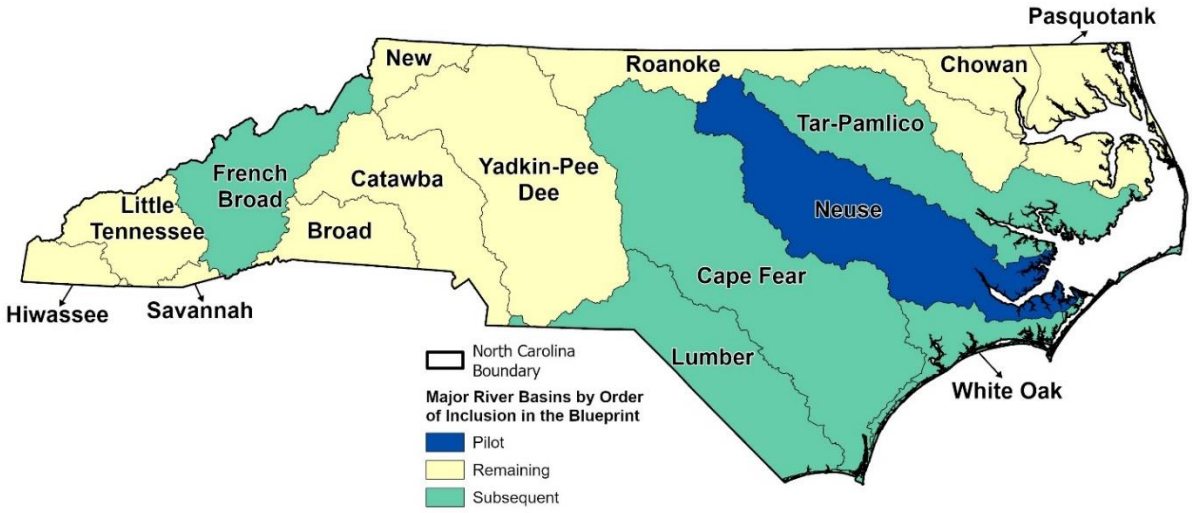

Figure 3. North Carolina Major River Basins by Order of Inclusion in Blueprint

In addition to the Blueprint's initial funding, which is being used to develop the Blueprint and priority River Basin Action Strategies, the General Assembly appropriated $96 million for the implementation of flood resiliency projects. Session Law 2021-180 authorized, set the requirements, and allocated the funds to NCDEQ, while Session Law 2022-43 amended the requirements. NCDEQ is developing the spending strategy for these funds and will implement on-the-ground projects in parallel to the continued development of the tool and action strategies.

As Phase I ends, stakeholder engagement will continue to play a critical role in the Blueprint's development process. From the beginning, it was recognized that input from external stakeholders would be critical to the success of the Blueprint (Figure 4). Every step of the development process included feedback and collaboration from a diverse set of stakeholders. NCDEQ took the proactive step of involving outside entities in crafting a work plan for Phase I. The work plan was informed by several one-on-one meetings and workshops that brought together NCDEQ staff, flood resiliency experts, key stakeholders, and potential Blueprint end-users from various sectors. These included other state agencies, academic institutions, local government representatives, and nonprofits.

At the outset of Phase I, NCDEQ engaged more than 150 subject matter experts and key stakeholders to participate across six Technical Advisory Groups (TAGs), a Neuse Regional Advisory Group, and a Principal Advisory Group (PAG). These groups served as the foundation for stakeholder involvement by providing valuable input on each component of Phase I across seven rounds of TAG and Neuse Regional Advisory Group meetings, as well as five PAG meetings. In addition, NCDEQ hosted 13 open house-style public meetings and workshops with local and regional decision-makers.

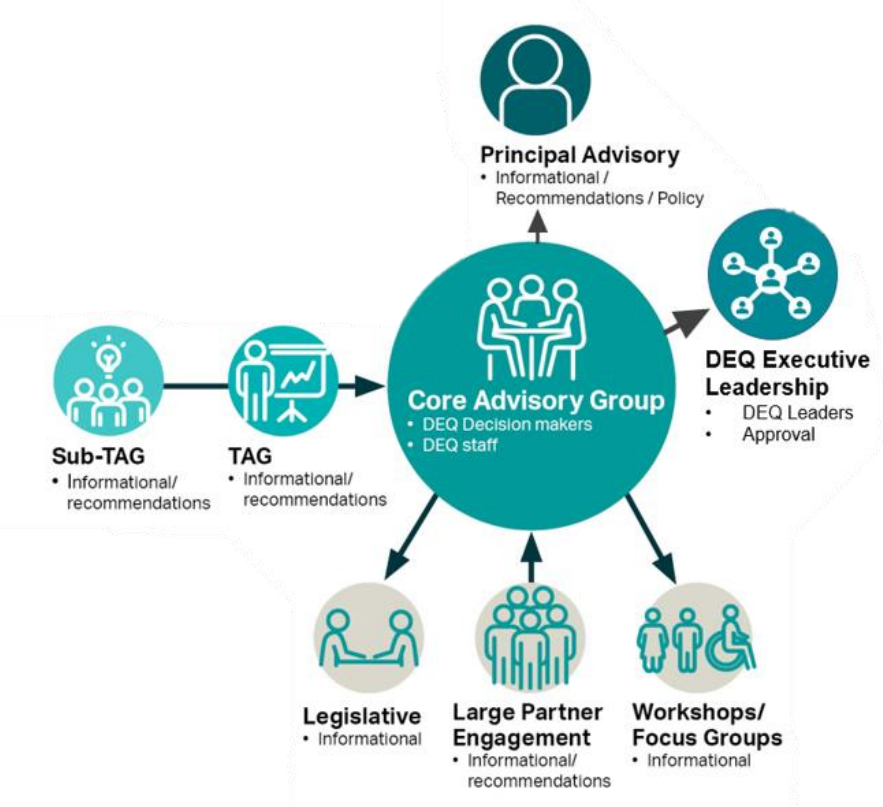

Figure 4. Blueprint's Phase I Stakeholder Engagement Design

The stakeholder groups and NCDEQ worked together to create and review foundational documents during Phase I that were divided into four tasks covering Stakeholder Outreach/Facilitation, Gap Analysis, Recommendations, and Decision Framework, and the drafts of the North Carolina Flood Resiliency Blueprint and Preliminary Draft Neuse River Basin Flood Resiliency Action Strategy.

With Phase I ending, Phase II already underway, and Phase III on the horizon, it is essential to take stock of the progress made, the relationships built, and the next steps the Blueprint will take to realize North Carolina's vision and increase community resiliency to flooding.

Recommendations

No element of the Blueprint (e.g., documents, tool, program, staff) is intended to add any regulatory steps or authorities. It is also not intended to replace or usurp any federal, state, or local plans, projects, or authorities. The Blueprint is meant to link and enhance existing flood resilience efforts and provide new tools for decision makers. Participation is completely voluntary.

The Draft North Carolina Flood Resiliency Blueprint includes three primary sections: a River Basin Action Strategy Development Process with a Planning Workflow, Case Studies, and Blueprint Recommendations that directly apply to the program's long-term vision for increasing statewide flood resiliency. The Workflow is a multi-step process that the state and communities will be able to use to develop and implement River Basin Action Strategies (Figure 5). Case Studies are used to demonstrate the Workflow implementation, highlighting the adaptability built into the Workflow that assists the Blueprint in addressing the unique flooding challenges and distinct goals of each participating community and region within a river basin. In addition, a set of recommendations for Blueprint program implementation covering diverse topics is proposed, informed by the supporting research and documentation from Phase I. These are intended to guide Blueprint development through Phases II, III, and beyond, as well as guide flood resiliency project implementation and support long-term program success. The Draft Blueprint and related documents provide a clear direction for how the Blueprint can serve as the central platform for flood resiliency planning and implementation at the state, regional, and local levels to achieve a more resilient North Carolina.

The Draft Blueprint includes guidelines to ensure consistent practices and procedures statewide yet remains sufficiently flexible to account for different physiographic settings, development intensity, regional differences, and other types of variability. The Workflow is designed as a recurring cycle for each river basin, where each iterative planning cycle builds on the efforts of the previous planning cycle. The Workflow is adaptable and considers future conditions during project planning, implementation, and maintenance phases. The implementation of these projects is balanced between shovel-ready projects and longer-term action.

Steps 1 through 6 of the Blueprint's Workflow focus on flood risk and vulnerability assessments and identifying potential flood resilience actions through collaboration between state agencies, regional planning groups, and local communities. The Blueprint Tool supports the planning process throughout the Workflow. These steps culminate in a River Basin Action Strategy with a ranked collection of local and regional actions and potential funding sources. Action implementation commences in Step 7 of the Workflow, overseen by NCDEQ in collaboration with a local, state, or regional sponsor for on-the-ground execution of flood resiliency projects. Step 8, the final piece of the Blueprint's Workflow, ensures program and project accountability. Through the Blueprint Tool, users can understand flood risk for a particular area and access and share information from a dashboard

communicating metrics on spending, risk reduction, and milestone completion in a highly visual format.

Figure 5. North Carolina Flood Resiliency Blueprint Workflow

This Workflow was designed to be a scalable framework for flood resiliency planning. While NCDEQ intends to use this to develop River Basin Action Strategies for all basins in the state, the fundamental steps can be utilized by decision-makers at all levels, even outside of NCDEQ's process.

The Blueprint draws upon a strong foundation of prior flood resiliency work in the state. Analysis during Phase I revealed more than 50 flood resiliency or flood reduction plans and programs across the state, in addition to federal efforts. NCDEQ developed the Blueprint Workflow to link, fill gaps, and build upon the existing plans and programs rather than replace them. As noted earlier, the increase in flood risk due to a variety of factors underscores the need for enhanced resiliency planning and project implementation based on future conditions modeling — a task the Blueprint is designed to accomplish.

Phase I of the Blueprint identified several gaps across North Carolina's current flood resilience planning, policy, and programming. The Draft Blueprint outlines recommendations to remedy these gaps as well as recommending what actions the State should take to implement the Blueprint and continuously improve it. Through a collaborative effort, TAG and PAG members, NCDEQ, and the consultant team drafted recommendations to provide actionable steps to implement the program as it moves into future phases of work. These recommendations span seven primary categories: Program Development, Tool Development, Characterizing Flooding, Workflow Implementation and River Basin Strategy Development, Project Ranking, Financing and Funding, and Pilot Project Implementation (Table 1).

The Draft North Carolina Flood Resiliency Blueprint is the first significant step in achieving the legislature's long-term vision for the Blueprint, which is stated as "…the backbone of a State flood planning process that increases community resiliency to flooding, shall be a resource for riverine and stream management to reduce flooding, and should support the establishment and furtherance of local government stormwater maintenance programs" (S.L. 2021-180, Section 5.9(c)). The individual communities that make up each of North Carolina's 17 river basins have unique needs, a wealth of expertise, and a desire to find solutions to the challenges of flooding. As the state grapples with the impacts of future change and the likelihood of increased flooding, the Blueprint serves as a central decision-support and implementation platform for numerous resiliency efforts and guides stakeholders and communities toward more resilient futures. The Blueprint's tools and processes, which let science drive flood mitigation decisions, will ultimately assist decision-makers in making more informed choices for why, where, and how to deal with flooding in ways that support a more resilient and vibrant state.

Table 1. Recommendations to Implement the North Carolina Flood Resiliency Blueprint

Category	Recommendation
Program Development	• Integrate Other Flood Resiliency Strategies into the Blueprint's Planning Process and the Blueprint Tool
	• Create and Administer Stakeholder Engagement Programming
	• Build the Blueprint's Staffing Capacity
	• Integrate Lessons Learned from Peer State Programs into the Blueprint
	• Evaluate Options for a Blueprint Oversight Group
	• Create a Nature-Based Solutions Policy Digest
Tool Development	• Implement Lessons Learned from Existing Online Flood Mitigation Decision-Support Tools
	• Use the Best Available Data for the Flood Resiliency Blueprint Tool and Planning Process
	• Use Advanced Technologies Where Appropriate
	• Update Statewide Datasets Relevant to the Blueprint
Characterizing Flooding	• Partner with NCEM and NCDOT to Conduct 2-D Future Conditions Flood Modeling
	• Use a Two-Tiered Approach to Flood Modeling
	• Study the Benefits of Natural Assets for Flood Reduction, Flood Storage, and Flood Dispersion
Workflow Implementation & River Basin Strategy Development	• Implement a 5-Year Cycle for Action Strategies
	• Develop and Implement a Data Quality Review Process
	• Update Tool with Resiliency Action Plan Project Information Annually
	• Create River Basin Advisory Groups for Each River Basin
	• Conduct Basin-Specific Financial and Technical Capacity Needs Assessments
	• Provide Support to Under-Resourced Communities Throughout the Implementation of the Blueprint
Project Ranking	• Develop a Dynamic Resiliency Project Ranking Methodology
	• Incorporate Local Priorities into Project Ranking
Financing and Funding	• Integrate Identified Funding Sources
	• Develop a Compensation Program for the Agricultural Community Based on the Use of Farmland for Flood Storage and Reduction
	• Implement Multiple Finance and Organizational Approaches to Address Local Stormwater Programs
	• Provide Grant Opportunities to Establish Stormwater Programs
	• Incentivize Multipurpose and Multi-benefit Solutions
	• Coordinate State-Funded Projects Through the Flood Resiliency Blueprint
Pilot Project Implementation	• Complete Implementation of Stoney Creek Pilot Projects
	• Explore Agency Partnerships for Implementation
	• Implement Pilot Flood Resiliency Projects from River Basin Action Strategies

Acknowledgments

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Stakeholders

Local

Tim Trautman | Charlotte-Mecklenburg County
Nancy Watford | City of Asheville
Byron Reeves | City of Fayetteville
Steve Miller | City of Kinston
Christopher Seaberg | City of New Bern
Craig Harris | City of Wilmington
Ken Vafier | New Hanover County
Lee Duncan | Pender County
Nancy Daly | Wake County

Regional

Wes McCloud | Cape Fear COG
Emily Barrett | Central Pines Regional COG
Carlton Gideon | Eastern Carolina COG
Diane Cox | Kerr-Tar Regional COG
Mary Roderick | Land of Sky Regional COG
David Richardson | Lumber River COG
Haley Hogg | Mid-Carolina COG
Ben Farmer | Upper Coastal Plain COG
Charlie Colie | Neuse Regional Sewer and Water Authority
Bob Carruth | North Carolina Association of County Commissioners
William Glenn | North Carolina Association of County Commissioners
Kevin Leonard | North Carolina Association of County Commissioners
Robert Hiett | North Carolina Association of Regional COGs
Bryan Evans | North Carolina Association of Soil and Water Conservation Districts
Sarah Collins | North Carolina League of Municipalities

State

Peter Daniel, Jr. | North Carolina Chamber of Commerce
Greg Richardson | North Carolina Commission of Indian Affairs
Joe French | North Carolina Department of Agriculture and Consumer Services
Dewitt Hardee | North Carolina Department of Agriculture and Consumer Services
Scott Melvin | North Carolina Department of Agriculture and Consumer Services
Maria Polizzi | North Carolina Department of Agriculture and Consumer Services
Alexander Stewart | North Carolina Department of Agriculture and Consumer Services
David Williams | North Carolina Department of Agriculture and Consumer Services
Will Best | North Carolina Department of Commerce
Sarah Hatcher | North Carolina Department of Health and Human Services
Autumn Locklear | North Carolina Department of Health and Human Services
Natalie Rivera | North Carolina Department of Health and Human Services

Colleen Kiley | North Carolina Department of Information Technology
Michael Ware | North Carolina Department of Information Technology
Pak Yip | North Carolina Department of Insurance
Misty Buchanan | North Carolina Department of Natural and Cultural Resources
Maggie Battaglin | North Carolina Department of Public Safety
Marlena Byrne | North Carolina Department of Public Safety
Chris Crew | North Carolina Department of Public Safety
Paul Ervin | North Carolina Department of Public Safety
Tom Langan | North Carolina Department of Public Safety
Amanda Martin | North Carolina Department of Public Safety
Gary Thompson | North Carolina Department of Public Safety
Andrea Webster | North Carolina Department of Public Safety
Holly White | North Carolina Department of Public Safety
Kurt Golembesky | North Carolina Department of Transportation
Matthew Lauffer | North Carolina Department of Transportation
Stephen Morgan | North Carolina Department of Transportation
Jamille Robbins | North Carolina Department of Transportation
Steve Bevington | North Carolina Department of Environmental Quality
Patrick Beggs | North Carolina Department of Environmental Quality
Stephanie Bolyard | North Carolina Department of Environmental Quality
Brad Cole | North Carolina Department of Environmental Quality
Josh Colley | North Carolina Department of Environmental Quality
Joselyn Harringer | North Carolina Department of Environmental Quality
Jimmy Johnson | North Carolina Department of Environmental Quality
Shannon Leonard | North Carolina Department of Environmental Quality
Rachel Love-Adrick | North Carolina Department of Environmental Quality
Sharon Martin | North Carolina Department of Environmental Quality
Sushma Masemore | North Carolina Department of Environmental Quality
Klaus Albertin | North Carolina Department of Environmental Quality
Tancred Miller | North Carolina Department of Environmental Quality
Bailey Recktenwald | North Carolina Office of the Governor
Mackenzie Todd | North Carolina Department of Environmental Quality
Jordan Thompson | North Carolina Department of Environmental Quality
Mackenzie Todd | North Carolina Department of Environmental Quality
Jordan Thompson | North Carolina Department of Environmental Quality
Lin Xu | North Carolina Department of Environmental Quality
Toby Vinson | North Carolina Department of Environmental Quality
Tim Watkins | North Carolina Department of Environmental Quality
Julie Woosley | North Carolina Department of Environmental Quality
Lanier McRee | North Carolina Office of State Budget and Management
Shannon Deaton | North Carolina Wildlife Resources Commission
Chris Wood | North Carolina Wildlife Resource Commission

Federal

Valerie Anderson | Federal Emergency Management Agency
Carville Edwards | Federal Emergency Management Agency

Jeffery Keenum | Federal Emergency Management Agency
Pier Janrhett | Federal Emergency Management Agency
Kristen Martinenza | Federal Emergency Management Agency
Doug Marcy | National Oceanic and Atmospheric Administration
Christine Brayman | U.S. Army Corps of Engineers
Wesley Brown | U.S. Army Corps of Engineers
Jason Glazener | U.S. Army Corps of Engineers
Keith Keeney | U.S. Army Corps of Engineers
Ryan Loadholt | U.S. Department of Agriculture
Vic Engel | U.S. Geological Survey
Mary Giorgino | U.S. Geological Survey
Stephen Harden | U.S. Geological Survey
John C Weaver | U.S. Geological Survey

Non-Governmental, Academic and Tribal Organizations

Jack Krolikowski | American Flood Coalition
Tony McEwen | American Flood Coalition
Gian Tavares | American Flood Coalition
Rick Savage | Carolina Wetlands Association
Chris Canfield | Conservation Trust for North Carolina
Mary Alice Holley | Conservation Trust for North Carolina
Sara Mason | Duke University
Lydia Olander | Duke University
Katie Warnell | Duke University
Derek Tahquette | Eastern Band of Cherokee Indians
Adam Gold | Environmental Defense Fund
Michelle Lovejoy | Environmental Defense Fund
Will McDow | Environmental Defense Fund
Kasey Ginsberg | Golden Leaf Foundation
Scott Hamilton | Golden Leaf Foundation
Jonathan Hinkle | GPI
Preston Jacobsen | Haywood Waterways
Ken Ashe | North Carolina Association of State Floodplain Managers
Chad Martin | North Carolina Black Alliance
LaMeshia Whittington | North Carolina Black Alliance
Chris Baillie | North Carolina Coastal Federation
Lauren Kolodij | North Carolina Coastal Federation
Todd Miller | North Carolina Coastal Federation
Keith Larick | North Carolina Farm Bureau
Tom Potter | North Carolina Foundation for Soil & Water Conservation
Amanda Sand | North Carolina Foundation for Soil & Water Conservation
Yesenia Cuello | North Carolina Inclusive Disaster Recovery Network
Bethany Cutts | North Carolina Inclusive Disaster Recovery Network
Lariza Garzon | North Carolina Inclusive Disaster Recovery Network
Brittany Love | North Carolina Inclusive Disaster Recovery Network
Grady McCallie | North Carolina Inclusive Disaster Recovery Network
Andrew Shoenig | North Carolina Inclusive Disaster Recovery Network
Kathie Dello | North Carolina State Climate Office
Barbara Doll | North Carolina State University
Bill Hunt | North Carolina State University
Susan White | North Carolina Water Resources Research Institute
Leila Hashemi Beni | North Carolina A&T University
Dani Moore | North Carolina Justice Center
Beth Roach | Sierra Club
Samantha Krop | Sound Rivers, Inc.
Kendall Paramore | Southeast Drainage Commission
Bill Holman | The Conservation Fund
Shawna Alkon | The Nature Conservancy
Thomas Caggiano | The Nature Conservancy
Danica Schaffer-Smith | The Nature Conservancy
Katherine Skinner | The Nature Conservancy
Kristiane Huber | The Pew Charitable Trusts

Danielle Hiraldo | University of North Carolina at Chapel Hill's American Indian Center
Todd BenDor | University of North Carolina at Chapel Hill
Greg Characklis | University of North Carolina at Chapel Hill
Rick Luettich | University of North Carolina at Chapel Hill
Toni Sebastian | University of North Carolina at Chapel Hill
Steve Wall | University of North Carolina Policy Collaboratory
Joanne Halls | University of North Carolina Wilmington
Mikey Fulk | Working Lands Trust

Peer States

Louisiana

Louisiana Coastal Master Plan | Louisiana Coastal Protection and Restoration Authority
Louisiana Watershed Initiative | Louisiana Council on Watershed Management

South Carolina

Strategic Statewide Resilience and Risk Reduction Plan | South Carolina Office of Resilience

Texas

Texas State Flood Plan | Texas Water Development Board
Texas Coastal Resiliency Master Plan | Texas General Land Office

Virginia

Virginia Coastal Resilience Master Plan | Virginia Department of Conservation and Recreation

Contractors

AECOM
ESP Associates
Insight Planning & Development
Wildlands Engineering

NCDEQ Core Blueprint Team (Current and Former)

Anjie Ackerman
Elizabeth Christenson-Diver
Grace Dodge
Michelle Ferree
Joy Hicks
J Todd Kennedy
Shrikar Nunna
Marc Recktenwald
Kirsten Ullman