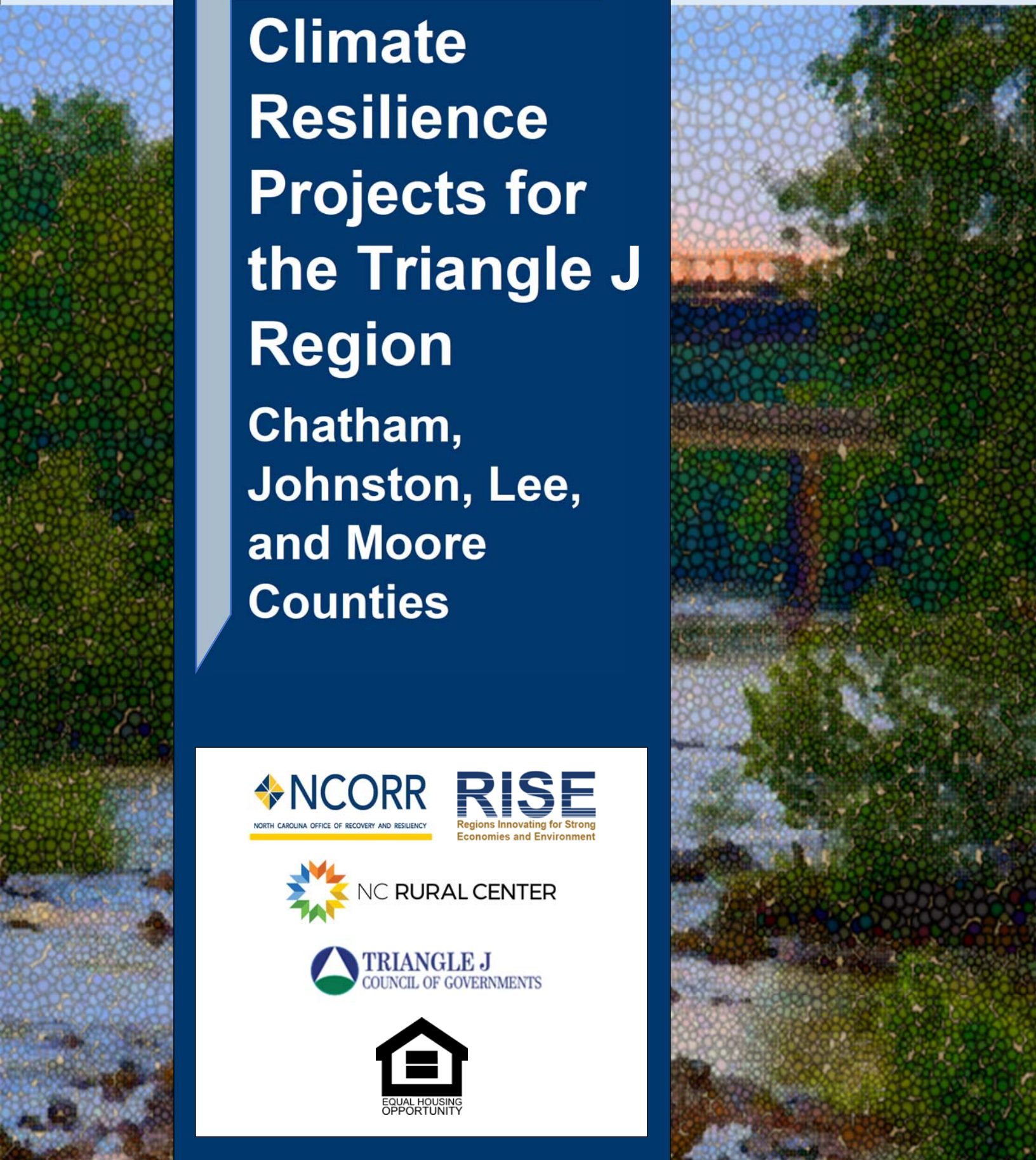
Climate Resilience Projects for the Triangle J Region

Chatham, Johnston, Lee, and Moore Counties



NCORR
NORTH CAROLINA OFFICE OF RECOVERY AND RESILIENCY

RISE
Regions Innovating for Strong Economies and Environment

NC RURAL CENTER

TRIANGLE J
COUNCIL OF GOVERNMENTS

EQUAL HOUSING OPPORTUNITY

Climate Resilience Projects for the Triangle J Region

Chatham, Johnston, Lee, and Moore Counties

DRAFT FOR PUBLIC COMMENT

December 2022

Land Acknowledgements

We wish to acknowledge and honor the Indigenous communities native to this region and recognize that projects proposed in these pages are built on Indigenous homelands and resources. We recognize the Lumbee, Skaruhreh/Tuscarora, Cheraw, and Mánu: Yį Įsuwą people as past, present, and future caretakers of this land. We also recognize the unnamed tribes that once oversaw these lands and have since relocated or been displaced.

About NCORR

In the wake of Hurricane Florence in 2018, the State of North Carolina established the Office of Recovery and Resiliency (NCORR) to lead the state's efforts in rebuilding smarter and stronger. At that time, eastern North Carolina communities were still recovering from Hurricane Matthew, which had impacted the State in 2016. NCORR manages nearly a billion dollars in U.S. Department of Housing and Urban Development (HUD) funding in two grant types, Community Development Block Grant – Disaster Recovery (CDBG-DR) and Community Development Block Grant – Mitigation (CDBG-MIT). These are aimed at making North Carolina communities safer and more resilient from future storms. Additional funding is provided through the State Disaster Recovery Acts of 2017 and 2018, the Storm Recovery Act of 2019, and Economic Development Administration Disaster Supplemental Funds. NCORR manages programs statewide that include homeowner recovery, infrastructure, affordable housing, resilience, and strategic buyouts. To learn more about NCORR programs, visit ReBuild.NC.Gov. NCORR is a division of the Department of Public Safety.

About RISE

Developed in partnership with North Carolina Rural Center, NCORR's Regions Innovating for Strong Economies and Environment (RISE) program supports resilience in North Carolina by:

- Facilitating the Regional Resilience Portfolio Program, which provides coaching and technical assistance to regional partners in the eastern half of the state to build multi-county vulnerability assessments, identify priority actions to reduce risk, and enhance resilience in their region and develop paths to implementation.
- Developing the North Carolina Resilient Communities Guide, a statewide resource that will provide tools, guidance, and opportunities for building community resilience.
- Hosting the Homegrown Leaders program, a NC Rural Center leadership training workshop, which operates in the eastern half of the state, that emphasizes resilience as a tool for community economic development.

The RISE Regional Resilience Portfolio Program covers nine areas, which align with the North Carolina Council of Government regions (Figure 1). This portfolio of projects is the second and final deliverable of the Regional Resilience Portfolio Program for the Triangle J Region.

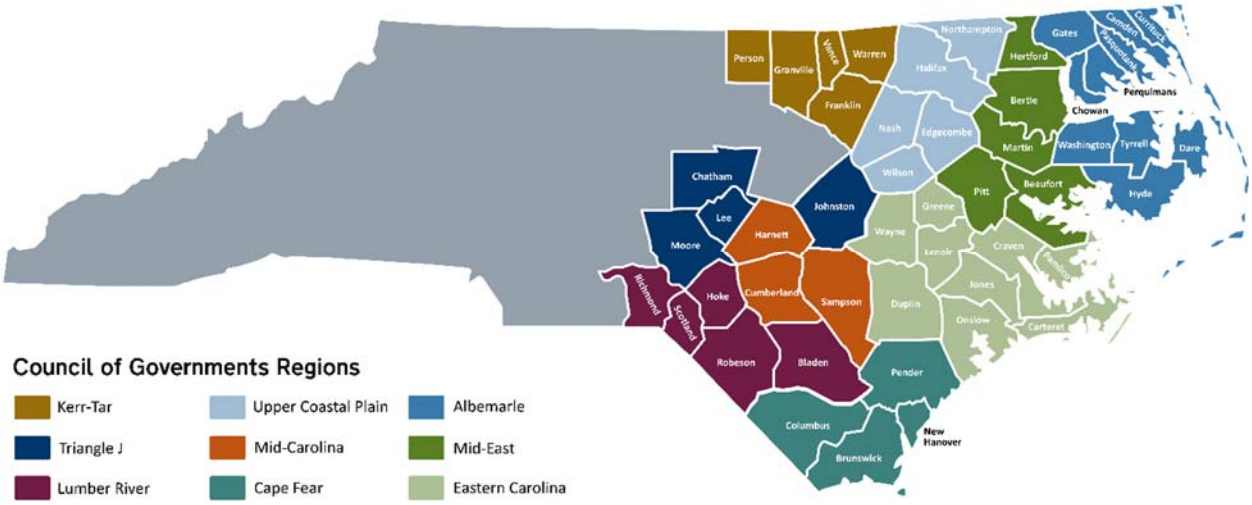


Figure 1. Council of Government Regions

RISE is funded by the U.S. Economic Development Administration and the U.S. Department of Housing and Urban Development's Community Development Block Grant – Mitigation funds, with in-kind support from NCORR and North Carolina Rural Center. In addition, the Duke Energy Foundation committed $600,000 in grant funding to support the Regional Resilience Portfolio Program.

Letter from the Triangle J Council of Governments

Letter from the Triangle J COG forthcoming

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1. Introduction

North Carolina's residents, businesses, nonprofit organizations, and governmental organizations are increasingly concerned by the growing frequency and intensity of heat waves, storms, changing precipitation patterns, and their impacts. To encourage regional coordination on identifying vulnerabilities and solutions to these challenges, the North Carolina Office of Recovery and Resiliency (NCORR), with staff support from the North Carolina Rural Center (NC Rural Center), created the Regions Innovating for Strong Economies and Environment (RISE) program. One RISE program component is the Regional Resilience Portfolio Program, which consists of two steps: a vulnerability assessment and a portfolio of projects. Each of the nine regions participating in RISE has developed a vulnerability assessment and a portfolio of projects to reduce risk and increase resilience in those regions.

This document presents the portfolio of projects for Chatham, Johnston, Lee, and Moore Counties in the Triangle J Council of Governments region, referred to herein as the "Triangle J region." Three counties included in the Triangle J region but not in this document were included in the 2019 *Triangle Regional Resilience Assessment*.[1]

1.1 Purpose of the Portfolio

The aim of the portfolio of projects, the final deliverable in the two-step RISE program, is to identify high-impact priority actions that reduce risk and enhance resilience across the region. Each project includes a pathway to implementation. Local leaders selected actions that address the vulnerabilities identified in the Triangle J Region Vulnerability Assessment, developed as the first deliverable of the RISE program, and selected actions that can be implemented in the near to medium term. The goal is to produce shovel-ready actions with detailed implementation steps, including estimated costs, where to find funding opportunities, staff resources needed to complete the project, additional resources needed, likely project completion challenges, and more.

NCORR Project Commitment Paragraph

1.2 Portfolio Development Process

The project team which includes staff from NCORR, the Triangle J Council of Governments, AECOM, and a local facilitator, worked with the Stakeholder partnership which involved local leaders across the public, private, and nonprofit sectors to develop the projects included in the Triangle J portfolio. The Stakeholder Partnership included representation from the four Triangle J RISE counties. **Appendix A Table A-1** lists the Triangle J Region Stakeholder Partnership members.

[1] Triangle J Council of Governments, *Triangle Regional Resilience Assessment*. 2019. https://www.tjcog.org/publications/triangle-regional-resilience-assessment.

The project team held a series of meetings with the Stakeholder Partnership members between January 2022 and December 2022.

The project team developed the proposed project actions that make up the project portfolio. Using subject expertise, existing planning documents, Stakeholder Partnership suggestions, and input from the public. Members of the Stakeholder Partnership and participants in public workshops voiced support for all actions in the portfolio.

The Triangle J Region Vulnerability Assessment[2], summarized in Section 1.3, served as a basis for brainstorming and action-building. Initially, Stakeholder Partnership members were asked for ideas of projects at the county level. Actions were created through county-specific breakout groups and existing hazard mitigation plans for Chatham, Johnston, Lee, and Moore Counties. Common themes and goals emerged from shared concerns across the counties, which helped to determine appropriate actions for region-wide resilience.

The project team and the Stakeholder Partnership by identified a long list of 26 projects. The long list was narrowed down with input and analysis from the project team, a prioritization tool, and members of the public. These projects can be viewed in **Appendix B**. During Stakeholder Partnership meetings, attendees discussed potential solutions for proposed actions, locations of needed actions, and contextual details to help determine the needed actions. The Stakeholder Partnership reviewed all potential actions and narrowed the list to 10 projects by determining the need of the action by all counties at the June 2022 meeting. The project team prioritized the 10 remaining projects using a tool developed by AECOM. The prioritization tool compared projects based on their ability to address social vulnerabilities and climate vulnerabilities identified in the Vulnerability Assessment, the availability of relevant funding options, and the potential return on investment. The projects were further refined based on ability to merge actions or lack of information for the viability of the action In September 2022, the project team presented eight projects for input at two public meetings. Subsequent discussion led the team to combine two of the projects into one, and the project team to settled on the final seven projects included in this Portfolio of Projects.

Once the project team finalized the list of projects, they held meetings and conducted research to identify project leads and refine the implementation pathways. The project leads are listed in **Table A-2** in **Appendix A**, as well as within each project's Implementation Pathway section.

1.3 Vulnerability Assessment Summary

The following summary is taken from the Vulnerability Assessment for Region J. For a full description of the region's vulnerabilities, refer to *Climate Change and Natural Hazards Vulnerability Assessment for the Triangle J Region*.

The following is The Triangle J region, like much of eastern and central North Carolina, is vulnerable to climate change and natural hazards. Past experiences of disaster and climate stressors in the Triangle J region show the greatest vulnerabilities that the region faces. However, climate change is shifting the profile of risk and vulnerability in the region, and it is

[2] NCORR, Climate Change and Natural Hazards Vulnerability Assessment for the Triangle J Region, 2022

critical to understand how the future may look different from the past. The region can expect future conditions of more storms, more intense storms, more extreme weather changes, and larger amounts of precipitation. Anticipating these impacts helps to build a region's resilience to climate change and natural hazards.

Assessing vulnerabilities at the regional scale has several advantages. Natural hazards, including rapid-onset hazards like hurricanes and slow-onset hazards like drought, often have an impact larger than one county but smaller than the state. In other words, they have regional impact. Regional-scale resilience strategies can build economies of scale in responding to shared vulnerabilities. Collaboration and partnerships among smaller communities can contribute to outcomes that would not be possible if undertaken individually.

The Triangle J RISE Region Vulnerability Assessment supports priority problem identification, establishing a common understanding of multi-county hazards, hazard-prone areas, associated impacts and affected populations. With this information, stakeholders can craft solutions that respond to the highest priority needs and address lesser-known concerns that emerge in the analysis.

The Triangle J region is vulnerable to the following climate change and natural hazards:

- Hurricanes and storms
- Flooding
- Heavy precipitation and wind damage
- Extreme temperatures, including high heat indexes
- Drought and wildfires

These vulnerabilities are enhanced by additional complexities, described below.

- **Flood vulnerability**. The Triangle J region is highly vulnerable to flooding from hurricanes and other storms. Hurricane Matthew (2016) flooded hundreds of homes and businesses in the region, closed roads and led to other infrastructure failures. Furthermore, the context for flooding is changing rapidly as climate change increases the likelihood of more intense storms with heavier rainfall amounts inside and outside the region. These occurrences directly impact homes, businesses, people and infrastructure.
- **Flood vulnerability and land use change**. One of the challenges to reducing flood risk is that new development and growth are accelerating in and around the Triangle J region. Growth contributes to a community's economic prosperity, associated land use changes and increases in impervious surfaces, all of which drive increased flood risk for new and old residents alike. An increase in impervious surfaces has adverse impacts on natural systems like forested ecosystems and wetlands, which act as sponges to absorb precipitation and runoff. More impervious surface area leads to less infiltration and more stormwater runoff. This reduction in natural water absorption is leading to increased strain on stormwater systems and additional flood impacts. Any new development placed in or near the floodplain also creates new vulnerabilities. However, it is evident that the region needs additional housing development, as regional growth has strained the existing housing stock and there is a shortage of housing to meet growing population.

- **Housing conditions and disparities**. In the Triangle J region, pockets of high social vulnerability and concentrations of inadequate housing and housing characteristics put people at risk. Flooding is the greatest threat to a building in North Carolina, but wind and extreme heat also present problems for the region's housing stock. Moore, Lee, Chatham and Johnston Counties have high concentrations of mobile homes, which typically are less able to withstand severe weather of all kinds. The lowest income residents have some of the greatest vulnerabilities, facing cost burden from housing and energy consumption.
- **Infrastructure at risk**. The Triangle J region's infrastructure is at risk, especially from flooding. There are many roadways that overtop during typical rain events, in addition to hurricanes and other extreme storms. Hurricane Matthew exposed weaknesses in stormwater systems, many of which were built with older design standards set when engineers needed to account for fewer users and lower precipitation levels. Hurricane Matthew also demonstrated catastrophic impacts typical of larger storms in the region, such as overtopping wastewater systems and closing interstates.
- **Health concerns**. Public health impacts are a major concern, as well, in the Triangle J region. Cardiovascular and respiratory systems are taxed by high heat and humidity, as well as poor indoor air quality after floods. While high heat is the number one weather-related cause of death in the country according to NOAA and the Centers for Disease Control and Prevention (CDC), major storms in the region have also led to injuries and deaths. Experiencing a major disaster is often traumatic, and mental health burdens are among the least reported health problems associated with disaster. Collective levels of trauma lead to adverse impacts inside and outside the home.

1.3.1 Strengths Related to Resilience

Because North Carolina has suffered multiple large-scale flooding and coastal storm disasters in recent years, there has been an urgent focus on planning for recovery and resilience. The Triangle J region has increased awareness of flood risk and the need to prioritize adaptation measures.

1.3.1.1 Strong Planning Capacity and Previous Planning Efforts

At the county scale, the Triangle J region has a breadth of plans, ordinances and capabilities that reflect capacity to build resilience and commitment to strategic action. All Triangle J counties are included in the current Cape Fear Regional Hazard Mitigation Plan. All four counties also have Hurricane Matthew Resilient Redevelopment Plans, discussed in the next section. Notably, all four counties have comprehensive plans, open space management plans and zoning ordinances. These plans and ordinances can be helpful for directing development in safe areas and aligning hazard resilience with local vision. Within these plans are programs, policies and ordinances that help protect environmental, historic and cultural resources within each community. These tools present significant opportunities to integrate resilience principles and practices into the local decision-making processes to increase resilience at the regional scale. Specific to flood hazards, all counties have floodplain ordinances and flood damage prevention ordinances, and all participate in the National Flood Insurance Program. Only Lee County does not have a Stormwater Management Plan or Ordinance.

1.3.1.2 Hurricane Matthew Resilient Redevelopment Plans

In December 2016, the North Carolina General Assembly established the North Carolina Resilient Redevelopment Planning program as part of the 2016 Disaster Recovery Act in response to Hurricane Matthew. All 50 of the affected counties, including Chatham, Johnston, Lee and Moore, developed a Hurricane Matthew Resilient Redevelopment Plan. The purpose of these plans was to empower communities to prepare locally driven, resilient redevelopment plans. These plans aimed to identify redevelopment strategies, innovative construction projects and other actions that allow each county to adequately respond to natural hazards as they continue to increase in frequency and intensity. This planning effort highlights the region's capacity to proactively respond to devastation to reduce future impacts. The development and partial implementation of the resilient redevelopment plans involved collaboration between state, county and local agencies displaying the region's ability to leverage efforts to achieve the most beneficial outcome.

Based on the work that each County in the region has completed from the Hurricane Matthew Resilient Redevelopment Plans, intact emergency management plans and operations centers, the region has a good foundation from which to further address vulnerabilities and increase resilience.

1.3.2 Previous Disaster Experience

The Cape Fear Regional Hazard Mitigation Plan lists the past federally declared disasters for the Triangle J RISE counties (Table 1-1).

Table 1-1. List of Declared Disasters for Triangle J RISE Counties

Year	Description	Chatham	Johnston	Lee	Moore
1968	Severe Ice Storm		X	X	X
1996	Blizzard of ’96	X	X	X	X
1996	Hurricane Fran	X	X	X	X
1999	Hurricane Floyd	X	X	X	X
2000	Severe Winter Storm	X	X	X	X
2002	Severe Ice Storm	X	X	X	X
2003	Hurricane Isabel		X		
2011	Severe Storms, Tornadoes and Flooding		X	X	
2011	Hurricane Irene		X		
2016	Hurricane Matthew	X	X	X	X
2018	Hurricane Florence	X	X	X	X
2019	Tropical Storm Michael	X			

Source: NCEM, *Cape Fear Regional Hazard Mitigation Plan Final*. 2020 https://gis.aecomonline.net/irisk2/Documents/Cape%20Fear%20Regional%20Plan/Support/Cape_Fear_Regional_HMP_Final.pdf

The Cape Fear Regional Hazard Mitigation Plan shows the Triangle J region RISE counties as experiencing 19 years of drought occurrences (including abnormally dry) from 2000 to 2019 with Chatham, Lee and Moore counties having three years of exceptional drought occurrences and Johnston County having two years of exceptional drought occurrences. The plan also stated that there were no reported extreme heat or heat wave events in these counties. However, all four counties were ranked as a medium probability of future occurrences meaning there is between a 1% and 10% annual probability of a drought or extreme heat event happening in the future.

2. Portfolio of Projects

This chapter provides details on the portfolio of projects for the Triangle J region. The descriptions include vulnerabilities that would be addressed by the project, potential locations for the project, steps for implementation, possible funding sources, and potential barriers. Table A-2 in Appendix A lists the portfolio of projects covered in the following sections, as well as recommended lead implementers. Lead implementers were selected based on their area of expertise, familiarity with the project and capacity to lead the project.

2.1 Project 1: Develop a River Warning System

2.1.1 Project Overview

2.1.1.1 Project Description

The Stakeholder Partnership identified the need for a river warning system to address hazards caused by hurricanes, storms and heavy precipitation. The river warning system would include a mile-marker system, a notification system, and educational programming. The mile-marker system would be created in coordination with emergency responders to improve locational awareness for both river users and emergency management response teams to ensure that, if a river rescue is needed, responders can accurately locate individuals relevant to river access points.

The notification system would display the river level, river heath and potential riverine dangers at defined times. The information provided by the notification system would enable safe use of the river by all river users (including but not limited to recreational users). The notification system would a coordinated process for the watershed's community to be alerted of flooding problem locations along the river network.

An educational program would be created to inform residents and river users of the mile-markers and notification systems. Data on river conditions could be gathered through North Carolina Emergency Management's (NCEM's) Flood Inundation Mapping Alert Network (FIMAN) and distributed to river users via a digital platform and through message boards located at river put-ins and other access points.

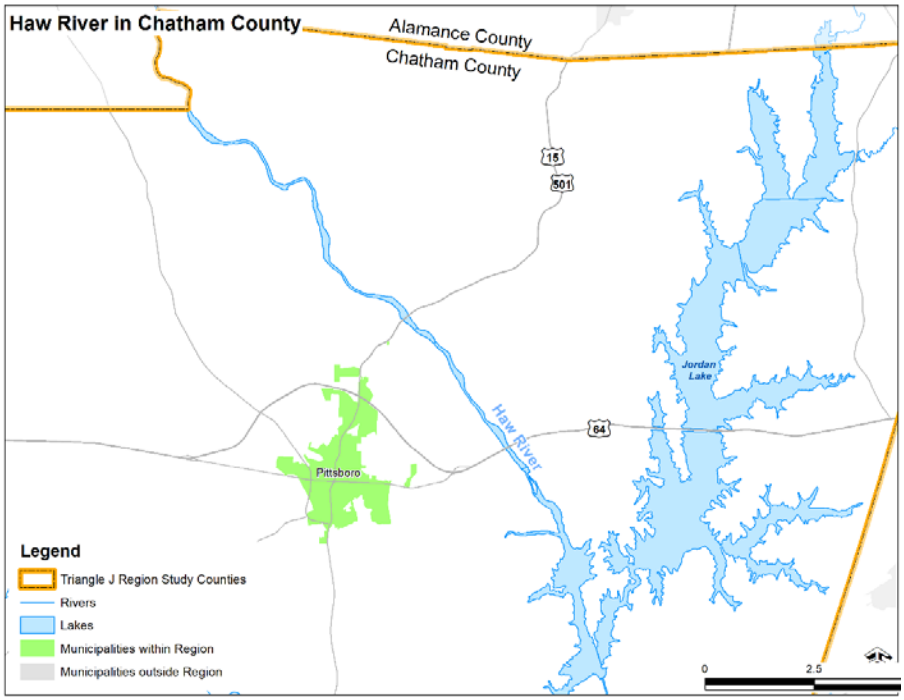

Figure 2. Haw River from Alamance/Chatham County Line to Jordan Lake

The Stakeholder Partnership identified the Haw River from the Chatham - Alamance boundary to Jordan Lake as a potential pilot project location (see Figure 2).

2.1.1.2 Vulnerabilities Addressed

The river warning system would alert river users and individuals near the river of potentially dangerous high-water levels. Several of the counties in the region noted that river users are often unaware of where structures could cause harm along the river, especially when rivers are at elevated levels. Further, river users are often unaware that river conditions can vary along different segments due to dam releases and localized heavy rains. Education would encourage the proper use of the river, allowing for better utilization of the natural resource and the ability to take care of oneself and those around them in the case of a river hazard.

2.1.1.3 Potential Impact

A river warning system could save lives and reduce injury, as well as reduce costs associated with river rescues. Costs associated with rescues are high and typically passed on to the taxpayers. While costs vary, past rescues have been estimated to cost taxpayers thousands of dollars with some rescues costing upwards of $20,000. During the period from 2012 to 2016, 11 swift water rescues occurred on the Haw River.[3]

The opportunity for collaboration and partnerships is a valuable co-benefit. Rivers in the region cross multiple county and cities lines, and several political boundaries are defined by rivers. As such, a river warning system requires multi-jurisdictional coordination, which would help strengthen partnerships in emergency management and other governmental agencies at every level.

2.1.1.4 Relevant Context

Currently, Haw River water levels are available through the National Weather Service, the U.S. Geological Survey, and links such as the Friends of Lower Haw River State Natural Area website. The Friends of Lower Haw River State Natural Area is a chapter of the non-profit North Carolina Friends of State Parks, Inc. Recreational users can see graphs for recent, forecast, and 99-day historic river levels for the Haw River at three locations, including two in the Triangle J region in Chatham County. However, most recreational river users are unaware of these resources or do not make use of them in advance of a river activity.

Members of the Carolina Canoe Club have an informal notification system that uses social media (Facebook, Slack, etc.) and SMS messaging to notify other users when and where they find manmade or natural obstruction such as a tree, root system, fencing, or guard rails and other river hazards.

2.1.1.5 Locations and Beneficiaries

Implementation of the proposed river warning system at the pilot location would directly benefit Haw River's recreational users and emergency responders in Chatham County. If successful in the Haw River, the project could be applied to other river systems in the Triangle J region, such as the Deep River and the Neuse River. The project could also serve as a template for other river systems throughout the state.

[3] WRAL, "Taxpayers foot big bill for dangerous Haw River rescues." 2016. https://www.wral.com/taxpayers-foot-big-bill-for-dangerous-haw-river-rescues/15904836/.

2.1.2 Implementation Pathway

The lead implementer recommended for this project is Emily Sutton, Haw River Assembly Haw Riverkeeper. Ms. Sutton indicated that she has the capacity to organize the planning efforts for the project, but would need assistance in identifying project partners and, potentially, technical assistance if engineering or other specialized input is required. Gretchen Smith with the Friends of the Lower Haw River State Natural Area can also help with the implementation of the project.

The lead implementer will serve as the project manager, coordinate partnerships and find funding for project completion. Potential project partners include:

- County and municipal emergency managers
- County and municipal parks and recreation departments.
- Recreational groups such as the Carolina Canoe Club
- Non-profit river supporters such as the Friends of Lower Haw River State Natural Area.

2.1.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project:

1. Establish a steering committee made up partners who will guide the development of the three facets of the river warning system: the mile marker system, the warning system and the educational outreach.
2. Coordinate meetings between the steering committee and all emergency responders that could respond to calls along the extent of the Haw River to discuss an effective mile marking system for the river basin. Specific tasks include the following:

    a. Determine the methods for marking the river so that it can be seen by users and emergency responders.
    b. Determine whether there are current marking systems that could be used or incorporated into the warning system.
    c. Determine who will be responsible for the maintenance of the markers, and what type of maintenance may be needed based on the type of markers used.
    d. Identify structure owners (i.e., North Carolina Department of Transportation [NCDOT] bridges) that will need to be coordinated with and how the coordination will take place. Identify other coordination partners, such as river users and nonprofit organizations who can help inform river users and the general public about the river warning system.
    e. Determine how the mile maker system will be incorporated into the warning system (discussed below).

3. Coordinate meetings between the steering committee and recreational groups, park managers, and non-profit organizations with vested interest in developing a river warning system that would alert users of current river conditions. At this meeting:

    a. Identify a preferred warning system type, such as static kiosks at put-ins and other access points, electronic kiosks at put-ins and other access points, an app that river users could download to mobile devices, or a combination of all three. Signage

guidelines developed in the American Whitewater Open-Source Signage Toolbox[4] could be used as a basis for kiosks and other signage related to the warning system (Figure 3).

b. Determine the frequency of updates or alerts and who will be responsible for updating the notification system
c. Identify the parties responsible for implementation and maintenance.

4. Once the mile marker system and river notification system have been identified and implemented, develop and implement an outreach approach to educate river users on how to use the two systems. In identifying the outreach methods, consider the following questions:

   d. Who needs to know about these projects?
   a. How will people use the system?
   b. How will people update information to the system?
   c. Who will train end users and organization staff?

5. Meet annually to solicit input from emergency managers on the successes or failures of the mile marker system and the river warning system with the goal of making improvements to ensure that the system is effective.

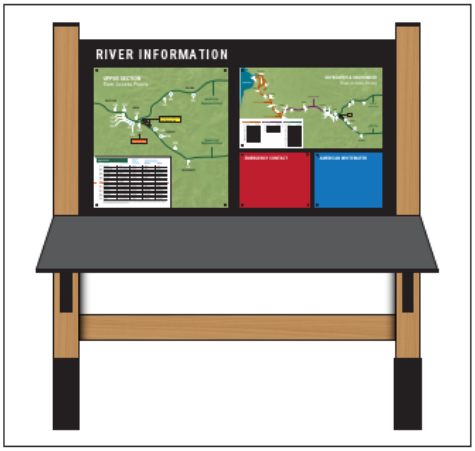

Figure 3. Example of Informational Kiosk for River Warning System

Source: American Whitewater Open-Source Signage Toolbox, 2022

2.1.2.2 Resources for Implementation

Costs and Funding

The cost of developing a river warning system is determined by the cost of a consultant to assist the steering committee. Consultant costs could range from $25,000 to $150,000 depending on the extent of the consultant involvement and the extent of the river covered. Costs to implement the river warning system will be developed during the planning process and would include costs for infrastructure (i.e., signposts for the mile marking system).

Potential funding sources include:

- **Emergency Management Performance Grant (EMPG)**. NC Department of Public Safety (NCDPS) funds are available annually to county governments and are used to support comprehensive emergency management at the state and local levels. The EMPG Program provides states with federal funds to sustain and enhance all-hazards emergency management capabilities. North Carolina uses EMPG to enhance its ability and to help counties support emergency management activities while addressing issues

[4] American Whitewater, Open-Source Signage Toolbox. 2022. https://www.americanwhitewater.org/content/Safety/signage

of national concern. The national priorities associated with the 2022 EMPG Program include:

- Equity
- Climate Resilience
- Readiness

This funding source could be used for the development and implementation of the mile marker system and river warning system.

- **Duke Energy Accelerator Grant**. The RISE Regional Resilience Portfolio Program will grant a total of $600,000 (or approximately $65,000 per region) for projects identified in the RISE program. Grant projects must be regional in scope and partners' letters of support for completion of the project must be included. This funding can be used to secure additional funding from other sources. The deadline for this grant is spring 2023. This funding source could be used for the development and implementation of the mile marker system and river warning system.

Personnel Capacity and Expertise

The development of the mile marker system and river warning system would likely require technical expertise that may not be available locally. The steering committee would likely need to retain a firm with river wayfinding experience and emergency management experience.

Information, Mapping and Data

Accurate mapping of the Haw River would be needed to establish the mile marker system.

2.1.2.3 Challenges and Barriers to Implementation

One of the challenges to developing the river warning system is that it could be the first of its kind in North Carolina, and possibly the country. While the warning system may utilize existing infrastructure (i.e., FIMAN gauges) used for warning the public of rising waters, the idea of passing that information to recreational users is new. Therefore, there is no template for developing the warning system. Coordination of multiple emergency management districts would also challenge the development of the mile marker system.

2.1.2.4 Maintenance and Operations

Maintenance related to the mile marker system will include inspection of, repair to and possibly replacement of sign poles and other infrastructure. Similarly, the river warning system would need regular maintenance and repair if kiosks are chosen to distribute the information. The parties who are responsible for ongoing maintenance of both the river warning system and the mile marker system should be vetted in implementation steps 1 and 2.

2.1.2.5 Opportunities for Integration

The United States Army Corp of Engineers (USACE) has mile marker systems of inland waterways and the Gulf Intracoastal Waterway (Figure 4). These mile marker systems along major river networks were created for navigation purposes. The markers appear in a geospatial digital form but do not appear to be used for emergency response.

Figure 4. USACE River Mile Markers (Source: USACE Waterway Mile Markers)

2.2 Project 2: Plan and Prioritize Stream Restoration

2.2.1 Project Overview

2.2.1.1 Project Description

The Stakeholder Partnership identified the need to plan and prioritize stream restoration. The project would mitigate flood issues that impact developed areas along an entire stream or river network in Johnston and Chatham Counties. Examples of problems to be addressed include natural or manmade erosion, debris buildup and other climate-driven issues such as regular flooding in developed areas. The project would identify local sources of impairment, develop a process for identifying and prioritizing stream restoration solutions, and demonstrate regional benefits by taking downstream and upstream actions into consideration. The intention would be to avoid damage to natural habitats and manmade structures while holistically considering the stream network, from headwater to output. The locations along stream networks that are most vulnerable would be prioritized in coordination with state and local officials as well as stream restoration experts.

2.2.1.2 Vulnerabilities Addressed

This project has the potential to address several vulnerabilities. Members of the Stakeholder Partnership from Johnston and Chatham Counties identified stream erosion and debris buildup as issues caused by land use changes associated with continued development. Some stream impairments can lead to flooding during heavy rain events as well as increased damage to already impacted locations along the river. Restoring streams can reverse ecological damage to a stream network and maintain or improve natural habitats. Stream restoration can also provide safe locations for recreation such as swimming, canoeing and fishing.

In addition, land use changes directly impact stream networks. Planners and developers consider impacts in the immediate area of the change, but often miss the upstream and downstream impacts. The addition of impervious surface decreases the amount of water that can be handled on-site, sending more water to the stream, which causes erosion, sedimentation and debris buildup. This project would attempt to manage flooding in one stream that crosses multiple jurisdictions, identifying solutions for locations that have been impacted by erosion or degradation from upstream and downstream land use changes. Ideally, the project would alleviate flooding impacts on housing, infrastructure and public health.

2.2.1.3 Potential Impact

Stream restoration would have both regional and local benefits. On a regional scale, stream restoration has the potential to prevent damage from floods, improve aquatic habitat, improve habitat along the banks of the waterway and compensate for impacts that result from roadway projects or other development. Locally, restoring streams could prevent flooding of residences and businesses as well as improve water quality, reduce erosion, provide recreational opportunities for residents and increase ecosystem resilience.

This project could prevent flooding that occurs because of stream impairment and stream degradation, as well as improve downstream water quality. Stream restoration projects can

benefit communities that are prone to flooding and that have experienced pollution from upstream actions.

2.2.1.4 Relevant Context

All four of the Resilient Redevelopment Plans[5] for the Triangle J region discuss stream restoration and identify locations in need of flood prevention. Additionally, the North Carolina Department of Natural and Cultural Resources has conducted stream restoration projects throughout the state, including in the Triangle J region, with financing from the North Carolina Land and Water Fund. All 2021 projects in the Triangle J region, including five projects in Moore County, three in Chatham, and one in Lee, were land acquisitions. More information on these projects can be found at https://nclwf.nc.gov/funded-projects.

2.2.1.5 Locations and Beneficiaries

The Stakeholder Partnership identified several locations in need of stream restoration:

- Chatham County identified restoration needs for a tributary of the Rocky River northeast of Siler City.
- Chatham County also identified Pokeberry Creek near where it enters the Haw River, an unnamed tributary of the Haw River adjacent to the US 64 Haw River Canoe Access, and the canoe input/takeout on the Haw River above the Bynum Dam.
- Johnston County identified the Neuse River, Middle Creek, Swift Creek, Little River and its tributaries.
- The Lee County Resilient Redevelopment Plan identified Little Buffalo Creek near Sanford.
- The Moore County Resilient Redevelopment Plan identified the need for stream restoration along the eastern section of Little River from Crystal Lake Dam to Spring Lake Streams, Crane Creek around McGill Road and north to US 1, Bear Creek, and Deep River.

2.2.2 Implementation Pathway

The lead implementer recommended for this project is Rick Savage, Carolina Wetlands Executive Director. Mr. Savage has indicated that he has the capacity to take on the project.

The lead implementer will serve as the project manager, coordinate partnerships and work to find funding for project completion. Potential partners include:

- NC Department of Natural and Cultural Resources
- NCDOT
- NC Floodplain Mapping Program
- Stream restoration experts
- Local governments impacted by the stream
- Floodplain managers

[5] https://www.rebuild.nc.gov/resiliency/hurricane-matthew-resilient-redevelopment-plans

- Local government planners

2.2.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project:

1. Establish a steering committee made up partners who will help identify stream restoration solutions and methods, identify funding sources and work with contractors to do the stream restoration work.
2. Considering streams within the region that have been identified through the RISE program as needing restoration, along with other streams that may be identified by the steering committee, develop an overall list of stream restoration projects in the region.
3. Prioritize the list of stream restoration projects based on a methodology developed by the steering committee. This methodology could include the level of impairment (i.e., pollution levels in the stream), length of impairment, number of residents affected by the impairment, high-level costs for restoration and benefits or impacts of restoration.
4. Identify one to three pilot projects from the prioritized list that could serve as templates for future projects in the region. Selection of the pilot projects could be based on the geographic size of the restoration project or the level of restoration effort. It could also be based on the total population affected by the restoration, such as the number of residents within a one-mile buffer of the stream.
5. Have restoration experts review the pilot locations to create a site-specific plan for the stream restoration, including identifying the source and cause of impairment, potential method or methods of restoration, costs associated with the restoration, and impacts of the restoration actions. This information would allow for the application of grants for the specific site needs.
6. Document the best practices used in the pilot project work to help stream restoration be replicated in other streams where issues and concerns are similar.

2.2.2.2 Resources for Implementation

Costs and Funding

Generally, estimating costs for stream restoration is based on the total linear foot of the proposed improvements. Estimating costs for stream restoration is difficult because many variables affect the cost, including (but not limited to) whether the stream is in an urban or rural environment, the length of the restoration and how accessible the stream is for constructing stream restoration improvements. The inclusion of stream restoration experts on the steering committee could provide clarity related to costs early in the process.

Potential funding sources include:

- **Section 205(j) Water Quality Management Planning Grant**. Through the Section 205(j) Grant program, the U.S. Environmental Protection Agency provides states with funding for water quality planning. North Carolina typically receives around $150,000 for competitive funding of water quality planning projects. These projects can involve identifying the nature, extent and cause of water quality problems or planning work to address those problems. Projects can include but are not limited to conducting

engineering designs for stormwater best management practices, and watershed assessments of pollutant sources.

- **North Carolina Land and Water Fund**. The North Carolina Department of Cultural Resources offers a Land and Water Stewardship grant. This grant is given to (1) enhance or restore degraded waters; (2) protect unpolluted waters; (3) contribute toward a network of riparian buffers and greenways for environmental, education and recreational benefits; (4) provide buffers around military bases to protect the military mission; (5) acquire land that represents the ecological diversity of North Carolina; and (6) acquire land that contributes to the development of a balanced state program of historical properties. This grant could potentially be used as a funding source for stream restoration activities identified by the steering committee.
- **Duke Energy Accelerator Grant**. The RISE Region Resilience Portfolio Program will grant a total of $600,000 (or approximately $65,000 per region) for projects identified in the RISE program. Grant projects must be regional in scope. This funding can be used to secure additional funding from other sources. The deadline for this grant is spring 2023. This grant could potentially be used as a funding source for stream restoration activities identified by the steering committee.

Personnel Capacity and Expertise

Stream restoration is a specific skill set focused on restoration benefits and engineering. The project would likely require hiring specialists that have a knowledgeable background in restoration needs and impact of restoration practices. This need can add a significant cost to the work that needs to be done to ensure the correct measures are followed for the benefit of the community.

Information, Mapping and Data

Accurate stream Geographic Information System (GIS) data as well as updated National Pollutant Discharge Elimination System GIS data would be useful in identifying the location of potential stream restoration locations.

2.2.2.3 Challenges and Barriers to Implementation

Debris removal and erosion repair can have positive stream restoration impacts; however, sometimes the best practice is to leave the damage and debris alone. Decisions on how a stream should be managed are often controversial and can cause contention among the participating parties. Mechanisms must be in place to manage the differing opinions associated with these tasks.

2.2.2.4 Maintenance and Operations

Stream restoration may be a one-time practice for a specific location but continuing land changes and manmade infrastructure will result in further stream restoration needs. Future opportunity exists to work with floodplain managers and the NC Land and Water Fund to determine in advance how any local land changes may impact waterways upstream and downstream, thereby resolving issues before they become a problem.

2.2.2.5 Opportunities for Integration

Several stream restoration projects are ongoing. Regular meetings should be scheduled with the NC Land and Water Fund to see how work progresses in the future so that local governments can plan for stream needs in their jurisdiction.

2.3 Project 3: Install Backup and Redundant Power Sources

2.3.1 Project Overview

2.3.1.1 Project Description

Staff at Lee and Moore County governments, with support from other counties in the region, identified the need to have backup and redundant power sources at 22 critical locations.. The project would identify the correct alternative power solutions for each location and provide the equipment and connections to ensure sufficient power to maintain operations during and post-disaster. Backup power sources include but are not limited to generators, voltage converters and automatic transfer switches that enable continuous delivery of electrical power during disasters. Redundant power sources may include other power sources such as microgrids, which can be disconnected from the traditional energy grid and operate autonomously.[6]

2.3.1.2 Vulnerabilities Addressed

By preventing power outages at critical facilities, this project would reduce lost school and public service operations, as well as loss of life caused by inoperable critical facilities and equipment. Power outages are often caused by hurricanes, flooding, and extreme temperatures, three climate change and natural hazard risks that pose the most threat to the Triangle J region.

2.3.1.3 Potential Impact

This project would prevent power disruptions at multiple facilities. Given the locations identified for backup and redundant power sources, this action would increase response capacity and speed, keep the community connected with loved ones, avoid potential health impacts and reduce illness and loss of life. Some locations may serve as cooling stations where vulnerable populations can gather to get out of the heat. Other locations will allow emergency response centers to continue operations during electrical outages.

Many times an individual county does not act alone in emergency event response; adjacent counties often provide service to support evacuation and sheltering needs. Shelter locations with a reliable power source provide the resilience the region needs.

The backup power sources provided by this project would serve residents of the municipalities and counties where the power sources are placed. Since the backup power sources would be placed in shelters that serve individuals who are sheltering from outside of the region, they would provide a regional benefit to residents from all over the state. The additional power sources would also benefit low-income populations, particularly related to cooling centers, since low-income populations generally have limited access to air conditioning or may be hesitant to operate air conditioning and cooling units due to potentially high electricity costs during peak heat hours. Cooling centers can provide a cool environment for these individuals.

[6] Department of Energy, Office of Electricity. The Role of Microgrids in Helping to Advance the Nation's Energy System. 2022. https://www.energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid/role-microgrids-helping

2.3.1.4 Relevant Context

Backup power needs for critical facilities and shelters have been identified in other planning documents, including the 2016 Cape Fear Regional Hazard Mitigation Plans,[7] 2020 Cape Fear Regional Hazard Mitigation Plan[8] and the Resilient Redevelopment Plans developed for the Triangle J region after Hurricane Matthew.[9]

2.3.1.5 Locations and Beneficiaries

This project would identify and install appropriate backup power solutions for the 18 locations identified in the 2017 Lee County Resilience Redevelopment Plan and four locations identified in the 2017 Moore County Resilience Redevelopment Plan. The Lee County locations include three backup shelter locations, Sanford City Hall, Sanford Civic Center, Sanford City Service Center, Lee County Administration/Finance Office, Sanford Planning/Inspections Building and 10 schools. The Moore County locations include two fire stations, two buildings operated by the County Parks and Recreation department and a pump station.

The backup power sources provided by this project would serve residents of the municipalities and counties where the power sources are placed. Specifically, the project would benefit teachers and students, government employees individuals served by government operations, and low-income populations, which are often hit first with power outages and are the most likely population to live without air conditioning. However, cooling centers and shelters provide services for residents and visitors from all income levels.

2.3.2 Implementation Pathway

The lead implementer recommended for this project is Matt Britt, Lee County Emergency Management Director.

Using the implementation steps below the lead implementer will define and coordinate partnerships and take charge of finding funding for project completion.

Potential project partners include:

- Power utilities
- Local emergency managers
- North Carolina Department of Environmental Quality (NCDEQ) State Energy Office
- Site-specific owners and facility managers

Collaboration is also needed between the counties within and adjacent to the region.

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[7] NCEM. Cape Fear Regional Hazard Mitigation Plan. 2016. https://www.moorecountync.gov/images/departments/public-safety/Cape_Fear_Regional_HMP_FINAL_012016.pdf. Note: The 2016 Cape Fear Regional Hazard Mitigation Plan includes actions for multiple municipalities and counties in the Triangle J Region.

[8] NCEM, Cape Fear Regional Hazard Mitigation Plan. 2020. https://gis.aecomonline.net/irisk2/Documents/Cape%20Fear%20Regional%20Plan/Support/Cape_Fear_Regional_HMP_Final.pdf.

[9] NCDPS. Hurricane Matthew Resilient Redevelopment Plans. 2017. https://www.rebuild.nc.gov/resiliency/hurricane-matthew-resilient-redevelopment-plans.

2.3.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project:

1. Identify project partners. Work with individuals who manage the 22 sites identified in the Resilient Redevelopment Plans. Include partners from other towns or entities in the region that also have back-up power needs.
2. Identify locations and location-specific needs.

    a. Many sites have already begun researching and making progress toward power backup installations. Make a note of the documentation each site has already gathered and what steps remain to complete the backup power installation. Documentation could include quotes, type of electrical connections needed for generation, electrical plans for installation, amount of power expected to be used, and total number of individuals that the shelter was designed to handle.
    b. Try to fill in the documentation gaps for each site.
    c. Identify the projects that are ready to seek funding.

3. Prioritize locations based on the greatest need. The prioritization methodology could be based on the number of people the shelter can provide services to, the numbers of socially vulnerable populations that will use the shelter or amount of work that would be required to install power backup.
4. Identify the alternative energy options that would work at each prioritized location. Work with partners such as the NCDEQ State Energy Office to determine the best power options for each facility, considering what's best for the impacted community. Backup and redundant power options include:

    d. Generators
    e. Microgrids
    f. Other types of power sources to be determined by the Energy Office

5. Seek funding for each site, considering the specific equipment needs at each site.
6. Install backup power at each location.

2.3.2.2 Resources for Implementation

Costs and Funding

Generators and related equipment are eligible for federal funding if they are cost effective, contribute to long-term solutions and meet all other program criteria. For example, a generator that is a stand-alone project can be considered for regular Hazard Mitigation Grant Program funding if the generator protects a critical facility.

Costs differ for each site. The 2017 Lee County Resilient Redevelopment Plan's recommendation for backup and redundant power sources estimated costs at $40,000 per 120kW generator, and $16,500 per generator for an automatic transfer switch. Microgrid costs were not included in the plan, but research conducted by the U.S. Department of Energy

indicates that costs vary based on microgrid location, size, complexity and intended use. Microgrid costs range from $2 to $4 million per megawatt.[10]

Potential funding sources include:

- **Emergency Management Performance Grant (EMPG)**. This NCDPS fund is available annually to county governments and are used to support comprehensive emergency management at the state and local levels. The EMPG Program provides states with federal funds to sustain and enhance all-hazards emergency management capabilities. North Carolina uses EMPG to enhance its ability and to help counties support emergency management activities while simultaneously addressing issues of national concern. The national priorities associated with the 2022 EMPG Program include:

  - Equity
  - Climate Resilience
  - Readiness

  This grant could be used to purchase backup and redundant power solutions.

- **Duke Energy Accelerator Grant**. The RISE Region Resilience Portfolio Program will grant a total of $600,000 (or approximately $65,000 per region) for projects identified in the RISE program. Grant projects must be regional in scope. This funding can be used to secure additional finding from other sources. The deadline for this grant is spring 2023. This grant could serve as an additional funding source for the purchase of backup and redundant power solutions.
- **Building Resilient Infrastructure and Communities (BRIC) Grant**. The BRIC grant, offered by the Federal Emergency Management Agency (FEMA) and coordinated by NCEM, provides states, local communities, tribes and territories with funding to address future risks to natural disasters. This grant could be used to coordinate multiple backup and alternate power installations for sheltering and infrastructure across the Triangle J region.
- **Infrastructure Investment and Jobs Act (IIJA)**. Several grants are available from the federal government through the IIJA. Work with the NCDEQ State Energy Office to determine whether any of the IIJA grants, many of which will be one-time funding opportunities, could help fund back up and redundant power.

Personnel Capacity and Expertise

Local staff has the expertise to handle the purchase and installation of the backup power sources. The installation of microgrids would likely require the retention of an engineering firm that can design the microgrid to handle the integration into the larger power network.

[10] Giraldez, Julieta, Francisco Flores-Espino, Sara MacAlpine, and Peter Asmus. 2018. Phase I Microgrid Cost Study: Data Collection and Analysis of Microgrid Costs in the United States. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5D00-67821. https://www.nrel.gov/docs/fy19osti/67821.pdf.

Information, Mapping and Data

Information on the various shelters within the region, such as information on the capacity of shelters, numbers of socially vulnerable populations that may use the shelter, and size of the shelters would be needed for the prioritization process.

2.3.2.3 Challenges and Barriers to Implementation

There are several challenges to adding additional generators to shelters and to the development of microgrids. A challenge to adding generators is the sheer number of sites that need some sort of backup power supply. While the prioritization step would identify the locations with the greatest need, it would result in some sites being bypassed. This challenge may be addressed by making this project a recurring project, perhaps annually, so that additional sites may be addressed in future years.

Sites with backup power sources also require fuel for generators, and additional fuel needs to be stored on-site, and the shelter needs to be accessible if additional fuel is needed. This means that it needs to be accessible by a flood free road.

New facilities that are constructed in the region that may potentially be used for sheltering purposes are often not constructed with additional power sources in mind. Schools, for example, which can be used for sheltering are regularly built without consideration for the electrical wiring needed to support additional generators.

Microgrids also present challenges to implementation in that they need to be incorporated into the larger power network and therefore require coordination with utility providers.

Another limitation is current staff availability for implementing projects. The need of staff to oversee the site-specific implementation of power is a burden on the communities and county. Staffing is an overarching problem for all the projects. This could be addressed by the addition of staff at the COG level who would be focused on implementing regional projects identified in the RISE program. The staff member or members could also minimize the challenge of coordination across the region, as well as assist in grant writing and regional communication related to the availability of grant funding and other relevant information.

2.3.2.4 Maintenance and Operations

Once funding is secured and backup power solutions are purchased, minimal capacity is needed to maintain and operate generators. The generators and other backup power sources would need regular testing and maintenance to ensure that they are in working order; however this could be included in the regular maintenance at the facilities where they are located. Additionally, additional training may be needed at the facilities where the generators and other backup power sources are located to train staff on how to operate the equipment. Staff would need to ensure that facilities with generators always have fuel on-site or have a plan to access fuel during emergencies.

2.3.2.5 Opportunities for Integration

Existing regional coordination processes, both informal and – if available – formal, particularly among emergency management regional efforts, can be leveraged to include discussions of where emergency backup power sources are needed.

The purchase of backup and redundant power sources can be included in other processes such as capital improvement plans for local governments. Local governments can also include redundant power sources in the management and retrofitting of public properties.

2.4 Project 4: Establish a Locally Administered Repetitive Loss Program

2.4.1 Project Overview

2.4.1.1 Project Description

The Stakeholder Partnership identified the need for a county-administered repetitive loss program to address vulnerabilities related to flooding. The goal of the project is two-fold: (1) identify structures that repetitively flood and need flood mitigation and (2) fund and implement flood mitigation activities for the identified structures. The proposed program will fund flood mitigation activities such as structure elevation, property acquisitions and reconstruction for residences and businesses susceptible to repetitive flooding.

2.4.1.2 Vulnerabilities Addressed

A locally administered repetitive loss program would address a program gap by enabling flood mitigation for structures that do not qualify for existing state or federal programs. State and federal programs often have eligibility requirements and prioritizations that are designed to fund mitigation for structures that are most at-risk, damaged during an event, damaged by non-riverine flooding, or are located inside of the Special Flood Hazard Area. Structures that meet the definition of “severe repetitive loss” or “repetitive loss,” or are insured by the National Flood Insurance Program, qualify for existing mitigation funding programs. However, some structures in the Triangle J region do not meet the eligibility requirements for these programs but still experience repetitive flooding.

With growing climate impacts and increasing development in the Triangle J region, some areas are becoming more vulnerable to flooding from moderate precipitation events. A locally administered repetitive loss program would offer a voluntary opportunity for residents to move out of harm’s way by allowing the government to purchase their property, partially or fully fund the elevation of structures on their property and support other flood mitigation activities.

2.4.1.3 Potential Impact

The proposed project would reduce or even eliminate flood damages during a flood at locations not covered by existing federal and state programs. Over time, these mitigation actions would have a financial return on investment by reducing repair costs and improving property values for the area. In addition, reducing the frequency and impact of residential flooding would reduce the emotional and mental distress among residents at risk, improve property values for the area and create sustainable housing. By targeting structures that have experienced floods but may not yet meet more stringent definitions of “repetitively flooded,” the program would encourage early action towards regional climate resilience.

This project would also offer intangible benefits. The structure identification process, analysis, and collaboration at the county-level with those that administer other flood-related programs would strengthen working relationships needed to advance climate resilience. These efforts would also enable local government staff to better understand the need for preparing structures as flood risks increase in their jurisdictions. In addition, reducing the frequency and impact of

residential flooding would reduce the emotional and mental distress among residents at risk. Further, by targeting structures that have experienced floods but may not yet meet more stringent definitions of “repetitively flooded,” the program would encourage a pathway to early action towards regional climate resilience. In other words, the program would mitigate structures before increased frequency and severity of flooding qualifies structures for flood funding assistance through other programs.

2.4.1.4 Relevant Context

All four of the region’s Resilient Redevelopment Plans identified actions relevant to this project. The Moore County plan identifies the development of a similar program for flood mitigation activities in the Riverbend and Riverview Acres residential communities. The Chatham County Resilient Redevelopment Plan identifies “detailed mapping of unmapped areas with future conditions” as a medium priority action. The Lee and Johnston County plans propose acquisition and demolition projects as medium and high priority actions. In particular, the City of Sanford identified the acquisition and demolition of 13 flood-prone residential properties and two commercial properties. As noted in the Johnston County Resilient Redevelopment Plan, 53 affected homeowners in Benson, Smithfield, Princeton, Kenly and unincorporated areas of the county expressed interest in flood mitigation activities for their property. Due to data privacy restrictions on repetitive loss status at the homeowner level, data identifying specific properties is only available to the local floodplain administrators.

2.4.1.5 Locations and Beneficiaries

The Stakeholder Partnership noted that repetitive flooding occurs throughout the region. The areas listed in the previous section are good candidates for pilot implementation of the proposed county-administered repetitive loss program. Properties included in the county administered repetitive loss program are often structures that fall outside of requirements for state administered events or programs. Further locations for targeted outreach could be identified by examining the latest floodplain mapping. Beneficiaries of the program include homeowners and business owners.

2.4.2 Implementation Pathway

The lead implementer recommended for this project is Emily Barrett, Triangle J Council of Governments Environment and Resilience Program Manager.

Using the implementation steps below, the lead implementer will coordinate partnerships, drive team understanding of project needs, and facilitate conversations to identify decisions and actions.

Potential project partners include:

- County and municipal planning departments
- Local and regional housing staff
- NCORR Strategic Buyout Program

2.4.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project. The project includes two concurrent implementation pathways: one for the property identification component of the project and one for the hazard mitigation assistance component. Project kickoff coordination is relevant to both project components.

Project Kickoff Coordination

1. Convene a steering committee made up of project partners and other interested parties.
2. Set up kick-off meeting and standing meetings as needed.
    a. Develop a work plan for program development including a timeline and point of contact for implementation steps. The workplan should include the following questions. Who should be engaged, to what extent, and how? And Who are key decisionmakers?
3. Ensure that the counties within the region agree to the work plan.

Property Identification – Phase 1: Current State Analysis

1. Review existing Resilient Redevelopment plans for each County and the Cape Fear Hazard Mitigation Plan to extract identified areas that repetitively flood.
2. Meet with planning departments to collect existing lists of repetitively flooded properties, if available.
3. Meet with county employees administering flood-related programs to collect lists of repetitively flood properties, if available.
4. Meet with floodplain administrators to collect lists of repetitively flooded properties, if available.
5. Review applicable flood analyses and previous accounts of flooding to identify additional areas that flood in the Triangle J region.
6. Collaborate with county planning departments to conduct new flood analyses if applicable for areas that have not been analyzed.

Property Identification – Phase 2: Engagement and Communications

1. Develop an outreach strategy to engage homeowners.
2. Set up a process for homeowners to self-report repetitive flooding.

Property Identification – Phase 3: Establish Property Identification Process

1. Develop standard operating procedures (SOP) for property identification and establish data management practices for maintaining and updating lists of identified properties.

Hazard Mitigation Assistance – Phase 1: Program Design

1. Determine eligibility requirements.
    a. Create the program definition of “repetitively flooded properties”.
    b. Determine eligibility requirements for structures, such as whether structures quality for other programs and if there are a minimum amount of flooding requirements

2. Determine requirements for applicants of hazard mitigation assistance, such as what information is required in the application (e.g., cost-effectiveness, flood history, social vulnerability, information about the structure, claims history).

3. Determine eligible mitigation activities.

    a. Identify which flood mitigation project types would be ineligible for mitigation assistance?
    b. If mitigation is not possible, consider how the acquisition of a structure work. For example, would the county acquire the structure at fair market value?

4. Determine the hazard mitigation assistance funding model. Questions for consideration are listed below.

    a. Would a match be required or will the county fund at 100%?
    b. Is funding competitive or non-competitive?
    c. What is the cadence of funding availability? Will it be available annually? Bi-annually?

5. Determine selection criteria for hazard mitigation assistance. Questions for consideration are listed below.

    a. How is the program prioritizing equity?
    b. Are there certain flood mitigation project types that will be encouraged more than others?

6. Determine other miscellaneous elements. For example, reporting requirements, timeline requirements (i.e., period of performance), etc.

Hazard Mitigation Assistance – Phase 2: Program Development

1. Develop an application process for hazard mitigation assistance.

    a. Identify how a homeowners would express interest and apply for hazard mitigation assistance and what the process is between homeowner and the county.
    b. Establish if there is a letter of interest process first before the application period where a potential applicant can express interest in the hazard mitigation assistance, and what the requirements for assistance would be.
    c. The dates and length of the application period.

2. Establish an application review process. The process should identify the individual, group or panel responsible for reviewing the applications and awarding the hazard mitigation assistance.

Hazard Mitigation Assistance – Phase 3: Outreach and Communication

1. Draft funding opportunity information that includes the intent of the funding opportunities, what types of structures are eligible, and where to find more information on the funding opportunity.
2. Develop a communications package. Develop consistent key messages that can be easily tailored to local governments that want to share information with residents. The information should specify who to contact if interested. Produce a variety of materials (printed, digital

campaign, social media), ensuring access for all (e.g., translated materials, accessibility compliance).
3. Develop an outreach and communications plan. To develop this plan, meet with a public relations liaison or communication team in each county. Determine how to leverage existing channels.

Hazard Mitigation Assistance – Phase 4: Program Implementation

1. Finalize and publish funding opportunity information on county websites and using other public notification methods such as media announcements and direct mailings to properties identified in Property Identification – Phase 1.
2. Implement outreach and communications plan. For example, conduct webinars, host booths at community events and pass out fliers.
3. Receive applications by the established deadline and review applications. During the application review process, use consistent eligibility criteria and review criteria as determined in the program design phase.
4. Using the application review process, select applications for funding and administer funds.

2.4.2.2 Resources for Implementation

Costs and Funding

Costs for both implementation pathways—property identification and hazard mitigation assistance—could vary widely, depending on the extent of flood modeling conducted to support the property identification and the number of eligible properties.

Potential funding sources include:

- **FEMA Flood Mitigation Assistance (FMA) Grant**. FEMA's annual FMA program provides funds to states, U.S. territories, federally recognized tribal governments and local governments to reduce or eliminate the risk of repetitive flood damage to buildings and structures insured under the National Flood Insurance Program. In the FY22 FMA Notice of Funding Opportunity (NOFO), capability and capacity-building (C&CB) is a program priority. Within the C&CB priority, FEMA includes "Partnership Development; Enhancing Local Floodplain Management; Severe Repetitive Loss (SRL)/Repetitive Loss (RL) Strategy Plan Development; and other eligible C&CB activities" as eligible activities. Typically, the NOFO is posted in August, the application period opens in late September, and it closes in late January. This funding source could be used for a discrete related partnership cost related to property identification. The steering committee can consider exploring what other components of the project may be eligible under FMA C&CB.
- **NCORR Mitigation Services**. Working with NCORR's Strategic Buyout Program could provide options for funding through the NCEM and FEMA buyout programs. The Triangle J RISE project team provided a list of properties to NCORR to understand if these homes could be covered by grants already managed by NCORR.

Personnel Capacity and Expertise

The steering committee could consult with other entities across the region and state that have developed grant programs to fund resilience projects, such as the NCDEQ Resilient Coastal Communities Program. NCDEQ may have best practices or pitfalls useful to the steering committee for grant program design, development and implementation. Legal expertise would also be needed for overall project development, and legal and real estate expertise may also be needed related to the acquisition component of the project.

Information, Mapping and Data: To identify potential eligible properties, the lead implementer and partners will need to integrate existing lists of repetitively flooded properties. Other data sets, such as the CDC Social Vulnerability Index data, may be needed if social vulnerability is included in the program design. Additionally, information on the structures such as square footage and building structure type would be needed for program design.

2.4.2.3 Challenges and Barriers to Implementation

One potential challenge is the risk of duplication of benefits (DOB). DOB can occur when an individual household receives financial assistance from multiple sources for the same purpose, and the funds received exceed the need to complete the purpose. As the steering committee identifies a new funding source, they should consider what scenarios may result in DOB, if any. The steering committee can mitigate DOB concerns by investigating DOB policies early in the development process, working closely with those administering other similar funding opportunities at the local level, and clearly communicating to program administrators and potential applicants what (if any) DOB concerns to consider. Another potential challenge could be confusion between this county-administered repetitive loss program and existing programs at the state and federal level, particularly related to eligibility requirements. Clear and frequent communication, perhaps including scheduled webinars or one-on-one support with interested homeowner and potential applicants, could help to address this challenge.

2.4.2.4 Maintenance and Operations

The steering committee can consider the following actions to ensure effective maintenance and monitoring of the property identification process and hazard mitigation assistance provided through the repetitive loss program. First, conducting a review of the inaugural program can establish a common understanding of what went well and what challenges were encountered during the first program rollout. The review can include key stakeholders including steering committee members, others consulted during the development of the program and those who administered the program. Findings from the review and experiences from the inaugural rollout can inform the development of an SOP. This SOP can be circulated to future participating jurisdictions when the program is expanded beyond the pilot area.

Another key component of maintenance and operations is to follow or enforce any established monitoring and project closeout processes as identified during the program design phase. This process will ensure that selected projects come to fruition. The steering committee can also identify applicants and projects to highlight as success stories in future communication materials to encourage program participation.

2.4.2.5 Opportunities for Integration

There is great opportunity for integration from this project. The property identification component would establish processes and build relationships among key flood experts and grant administrators across counties. It would also result in an improved understanding of flood risk locations in the Triangle J region. Jurisdictions in the region can leverage this geospatial knowledge and relationship building to develop flood-related projects and grant applications for other programs (e.g., federal and state programs that do have stringent requirements). Additionally, if and when other funding is made available (e.g., Hazard Mitigation Grant Program funding post-disaster or other federal or state funds), jurisdictions would have an existing list of properties and homeowners interested in pursuing flood mitigation.

2.5 Project 5: Develop a Privately Owned Dam Inventory and Dam Ownership Guidebook

2.5.1 Project Overview

2.5.1.1 Project Description

The Stakeholder Partnership identified the need for an inventory of privately held dams and stormwater facilities in the Triangle J region, as well as an ownership guidebook. The project contains three key components: (1) create an inventory of privately-owned dams and stormwater facilities, (2) prioritize needed maintenance and repairs at high impact dam and stormwater facilities, and (3) develop a dam ownership guidebook for property owners with responsibility over these facilities.

The proposed inventory of privately-owned facilities across the region would help the counties and jurisdictions maintain awareness of potential dam safety hazards and conduct improved outreach to residents responsible for these facilities.

The prioritized list of maintenance and repairs can be informed by input from the Stakeholder Partnership. One example is the area along the Little River between Southern Pines and Vass in Moore County. Many stormwater ponds in this area need repair and could potentially have flooding effects on the Little River if they are breached. The Stakeholder Partnership also mentioned Moore County as a focus area given the concentration of dams noted in the Moore County Resilient Recovery Plan as aging and needing repairs.

The dam ownership guidebook would compile best practices for construction and maintenance, including for preventing potential failures of private stormwater, dam and storm drainage ponds. The document would be relevant to owners and buyers of properties responsible for this type of maintenance. It would be developed in coordination with local, county and state governments. It would also identify inspection services and funding opportunities (e.g., grants, tax credits) to assist residents, homeowners' associations, farmers and other private entities with maintenance and repairs. Several high priority stormwater or dam facilities would be selected as repair case studies to be featured in the dam ownership guidebook.

2.5.1.2 Vulnerabilities Addressed

This project would address educational and climate-related vulnerabilities. As mentioned on multiple occasions by the Stakeholder Partnership, several privately owned stormwater dams need maintenance and repairs, and the owners of the dams are either unaware of their responsibilities for maintenance or financially unable to provide the necessary maintenance.

In terms of climate vulnerabilities, storms and heavy precipitation can cause dams and other stormwater infrastructure to overtop and cause flooding. Stormwater facilities are used to provide water storage, control stormwater runoff and reduce the likelihood of floods. One way to control stormwater runoff is the installation of filters, ponds, ditches, underground tanks and dams. Ensuring proper protocols when maintaining stormwater systems is imperative when trying to sustain the normal operation of counties and residents. Private dams are a threat because of the lack of regulation around their construction, understanding by private owners

that they are responsible for maintenance, and the community's recognition of the potential damage of unmaintained structures.

An additional challenge is that the frequency of 50- and 100-year storms is increasing, overwhelming the design capacity of existing stormwater facilities. Most farm ponds are designed to handle 25-year storm events,[11] and they may not be designed to handle the capacity needed for larger storms. County-level precipitation data for the four counties in the Triangle J region for the last five years can be seen in Table 2-2. The "Precipitation Anomaly" columns refer to the variation of the year's average county rainfall from the average county rainfall for the years between 1901 and 2000. All four of the counties have experienced their wettest year on record since 2017.[12] This data demonstrate the importance of preventing dam failures as precipitation amounts increase.

Table 2-1. Triangle J County-Level Precipitation Data

Year	1901-2000 Average Precipitation	Precipitation Anomaly	Precipitation Ranking*
Chatham County			
2017	46.14"	-9.46"	11th Driest
2018	46.14"	18.5"	1st Wettest
2019	46.14"	-0.68"	64th Driest
2020	46.14"	13.16"	5th Wettest
2021	46.14"	-4.10"	36th Driest
Johnston County			
2017	47.01"	-3.78"	39th Driest
2018	47.01"	15.61"	3rd Wettest
2019	47.01"	6.45"	23rd Wettest
2020	47.01"	19.16"	1st Wettest
2021	47.01"	2.16"	47th Wettest
Lee County			
2017	46.37"	-12.67"	4th Driest
2018	46.37"	18.36"	1st Wettest
2019	46.37"	-0.92"	67th Driest
2020	46.37"	13.80"	6th Wettest

[11] United States Department of Agriculture. Agriculture Handbook 590: Ponds – Planning, Design, Construction. 2016. https://naldc.nal.usda.gov/download/CAT11133077/pdf.
[12] NOAA National Centers for Environmental information. Climate at a Glance: County Time Series, Precipitation. 2022. https://www.ncdc.noaa.gov/cag/.

Year	1901-2000 Average Precipitation	Precipitation Anomaly	Precipitation Ranking*
2021	46.37"	-2.88"	51st Driest
Moore County			
2017	47.06”	-9.98"	12th Driest
2018	47.06”	21.32"	1st Wettest
2019	47.06”	-2.85"	56th Driest
2020	47.06”	12.70"	8th Wettest
2021	47.06”	-0.75"	68th Driest

*Since 1895

2.5.1.3 Potential Impact

Based on data from the NCDEQ Division of Energy, Mineral and Land Resources (DEMLR)—the state agency that maintains data on privately owned dams in North Carolina, there are 337 privately owned dams in the Triangle J region. This includes 105 that are classified as high or medium hazard dams.[13] Two factors influence the hazard potential of a dam: the amount of water impounded, and the density, type and value of development and infrastructure located downstream. The potential impact of a dam failure would be felt by the people and the built and natural environments downstream. The return on investment in making sure that dams and other stormwater facilities are maintained is proportional to those downstream resources. Most dams built for river management or water impoundment are maintained and managed by DEMLR. The dams and structures of concern are smaller and are built on privately owned property for use in agriculture or beautification.

2.5.1.4 Relevant Context

The Cape Fear Regional Hazard Mitigation Plan[14] discusses dam and levee failure as a hydrologic hazard in the region and includes mitigation action recommendations related to identifying the location of dams and conducting vulnerability assessments associated with dam failures. The Moore County Resilient Redevelopment Plan also discusses privately owned high hazard dams and how two dams either breached or nearly breached during Hurricane Matthew. Woodlake Dam, which helps form Surf Lake, nearly failed, and Pine Valley Pond Dam breached and spilled downstream to Lake Diamond.

DEMLR provides oversight of more than 3,000 dams statewide including private dams. DEMLR provides for the certification and inspection of dams to reduce the risk of failure through the Dam Safety Program.

[13] Division of Energy, Mineral, and Land Resources, North Carolina Department of Environmental Quality. Dam Safety. 2022. https://deq.nc.gov/about/divisions/energy-mineral-and-land-resources/dam-safety
[14] Cape Fear Regional Hazard Mitigation Plan: https://gis.aecomonline.net/irisk2/NCHMP.aspx?region=5

2.5.1.5 Locations and Beneficiaries

The privately owned and unmaintained dam and stormwater infrastructure problem is widespread throughout the four counties in the Triangle J region. A privately owned dam could have localized flooding impacts if it were to breach. For each location with structural issues, the proposed project could provide downstream protection to homes, businesses, infrastructure and natural resources. The project would also benefit emergency responders, particularly for dams that fail without warning.

Furthermore, neighborhood associations and other owners of stormwater infrastructure would understand the responsibility of infrastructure ownership, including maintenance and repairs. These benefits would also extend to marginalized communities that may not have the financial means to maintain and repair localized stormwater facilities, especially since the guidebook would provide information on repair and maintenance funding resources.

Moore County is the recommended pilot project location for this project; however, the project should be developed with the intention to expand the program to other counties. All private dam owners in the Triangle J region are the target audience for educational materials developed in this project.

The Moore County Resilient Redevelopment Plan recommends making modifications to dams that are aging and may be prone to failure. These identified dams, all of which are in Moore County, are good candidates for preliminary outreach related to conducting maintenance and repairs of the dams:

- Woodlake Dam
- Lake Auman Dam
- Lake Diamond Dam
- Seven Lakes Dam #1 (Echo Lake Dam)
- Seven Lakes Dam #2 (Lake Sequoia Dam)
- Seven Lakes Dam #3 (Big Juniper Dam)
- Seven Lakes Dam #4 (Longleaf Lake Dam)
- Seven Lakes Dam #5 (Little Juniper Dam)
- Seven Lakes Dam #7 (Ramapo Dam)
- Crystal Lake Dam
- Pine Lake Dam
- Thagards Lake Dam
- Pine Valley Pond Dam

2.5.2 Implementation Pathway

The lead implementer recommended for this project is Deborah McGuffin, Moore County Cooperative Extension Director. Ms. McGuffin indicated that she has the capacity to lead the planning process, with assistance from her soil and water staff, but may need assistance bringing in technical specialists.

The project will require partnerships between several entities to develop a mechanism that can identify, prioritize and coordinate improvements to private dams and stormwater infrastructure.

An important partnership for the project's success is with the NCDEQ DEMLR, which manages the NC Dam Safety Program. The Dam Safety Program provides oversight of more than 3,000 dams statewide, providing certification and inspection to reduce the risk of dam failure.

Potential project partners could include:

- NCDEQ DEMLR
- NCDEQ Division of Water Quality
- NC Department of Natural and Cultural Resources
- County planning staff
- Municipal planning staff
- Private landowners
- NCDOT
- Real estate brokers

2.5.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project.

1. Assemble a project steering committee comprised of project partners. The steering committee should have expertise in dam management, land use planning, stormwater management and public outreach.

Create an Inventory of Privately Owned Dam and Stormwater Facilities

1. Develop a GIS-based spatial database of privately owned dams within the region. This database, which will be focused on the Triangle J region, can build on the DEMLR's dam inventory. The steering committee can help identify resources for locating privately held dams and stormwater facilities that are currently unlisted in DEMLR's inventory.
2. Notify property owners of the dams that are not listed in the DEMLR inventory regarding dam inspections to determine the condition of the dam and identify types of improvements needed at the dams.

Prioritize Needed Maintenance and Repairs for High-Impact Dams and Stormwater Facilities

1. Prioritize impacts of known and newly determined locations based on the number of people and the amount of infrastructure in harm's way, potential downstream impacts of breaching and overtopping, and which facilities are most likely to have an issue because of age and condition.
2. Create and implement a prioritization process to develop a list of upgrades needed at each site.

Develop and Distribute a Dam Ownership Guidebook for Property Owners with Responsibility for These Facilities

1. The guidebook is intended to provide information on the responsibilities of dam and stormwater ownership, how to maintain these facilities and the potential legal ramifications of infrastructure failure. DEMLR and the Association of State Dam Safety Officials may be useful resources in developing this guidebook.

2. Using the inventory of privately owned dam and stormwater infrastructure, develop and implement a plan to distribute the guidebook publicly and to the core audience. Information could be provided to potential buyers through real estate agents as well as developers and existing homeowners to show how to maintain these facilities and plan for the future.

2.5.2.2 Resources for Implementation

Costs and Funding

The cost of inputting dam locations in GIS is variable depending on the collection method, the number of facilities included and the information available about each location. A high level cost estimate for building the GIS database is 3 to 5 hours per county, including prioritizing maintenance and repairs.

Costs for the development of a dam and stormwater facilities guidebook could cost $5,000 to $15,000 or upwards of $70,000 depending on the distribution plan. Most project costs would be from staff time and material production (e.g., printing and production costs, advertisements, translation services), and would be based on the number of printed materials, the amount of outreach done, and the amount of training needed.

Personnel Capacity and Expertise

This project would require staff time to coordinate the dam and stormwater infrastructure inventory, a GIS Specialist to develop the GIS database and to provide dam inspections, and either staff time or a consultant to write and distribute the dam ownership guidebook. The guidebook would require legal, engineering and marketing professionals for its development.

Information, Mapping and Data

The latest version of DEMLR's dam inventory would be needed as a basis for the region's dam inventory development.

2.5.2.3 Challenges and Barriers to Implementation

The biggest challenge would be working with the owners of the dam and stormwater infrastructure. The goal of this project is to get people on their own land to make a change because it may impact others outside of their property. It could be that this policy determines there should be some sort of permitting or maintenance process that will be an additional cost to property owners. This topic would need to be presented in a manner that clearly explains the benefits to everyone planning for and maintaining infrastructure.

2.5.2.4 Maintenance and Operations

Once a database is developed, someone would need to maintain the database and determine the necessity of a regular inspection schedule and work with DEMLR on coordinating the need for dam inclusion into their database. Keeping track of property ownership changes and new structures would be challenging. The lead implementer and steering committee would need to determine a method for ongoing tracking and education of facility owners.

2.5.2.5 Opportunities for Integration

Any privately owned dams identified through the development of a GIS database could be incorporated into DEMLR's dam inventory. The project could also provide DEMLR with the maintenance and repairs prioritization so that they can potentially work with those owners to provide inspection services.

2.6 Project 6: Develop Regional Guidance for Coordinated Stormwater Infrastructure Improvements

2.6.1 Project Overview

2.6.1.1 Project Description

The Stakeholder Partnership identified the need to develop regional guidance for coordinated stormwater infrastructure improvements. This project would provide guidance to local governments on how to coordinate and prioritize stormwater infrastructure projects with projects planned by NCDOT. Well-maintained stormwater infrastructure, such as ditches and culverts, is an important mechanism to ensure transportation access as well as flood management. However, stormwater infrastructure may not meet demand or function at capacity. This may be due to trash and debris blockages, lack of regular maintenance, or undersized infrastructure that cannot handle increases in stormwater due to regional growth or other development patterns. An underlying challenge with stormwater infrastructure management is that different entities such as the state and county need to coordinate improvements for those improvements to be effective. Infrastructure often needs to be updated in tandem with its adjacent infrastructure to avoid stormwater backups.

For example, a municipality may improve a culvert within its jurisdiction to handle increased stormwater runoff coming from increased impervious surfaces and increased precipitation intensity. However, downstream culverts outside of the municipality's jurisdiction are owned by a different entity (such as the county the municipality lies in, an adjacent county, or NCDOT). If the adjacent infrastructure is too small to handle the volume of water, the upgrade will cause flooding in and around the municipality, potentially damaging nearby homes and businesses as well as infrastructure.

2.6.1.2 Vulnerabilities Addressed

This project addresses vulnerabilities related to flooding from heavy precipitation that result from the lack of coordination among communities, NCDOT and other stormwater infrastructure owners.

2.6.1.3 Potential Impact

Across the region, this project would formalize coordination of stormwater improvements across jurisdictions. It could ensure that stormwater improvements made in one location coincide with related downstream improvements. Within individual communities, the project would reduce the likelihood of localized flooding related to undersized infrastructure.

The project would serve the governmental entities that manage stormwater infrastructure and would also benefit residents, potentially including vulnerable populations, who might otherwise be impacted by flooding from heavy precipitation. Because the project encourages intergovernmental coordination and could direct spending in a coordinated manner, the project would support the efficient use of taxpayer dollars.

2.6.1.4 Relevant Context, Locations and Beneficiaries

All four counties in the Triangle J region identified and supported this project. Developing a coordination process across jurisdictions would help communities throughout the Triangle J region more effectively and efficiently deal with increasing amounts of stormwater. This project is worth the investment because the costs of coordination are small relative to the costs of flood damage to homes, businesses and infrastructure.

2.6.2 Implementation Pathway

The lead implementer recommended for this project is Stephen Wensman, Town of Smithfield Planning Director. Mr. Wensman indicated that he has the capacity to help lead the discussion on an implementation process but may need assistance in identifying partners that would make it a regional project.

The project would require partnerships with several entities to develop a mechanism that can identify, prioritize and coordinate improvements to stormwater infrastructure. Potential project partnerships include:

- NCDOT
- Counties
- Municipalities
- Railroads
- Private landowners

One opportunity for collaboration is to work with NCDOT Highway Divisions 4 and 8 to incorporate the planned stormwater improvements that are included in the 2022-2026 Highway Maintenance Improvement Plan (HMIP). The HMIP is a five-year plan for scheduled maintenance improvements to NCDOT roads, including planned stormwater structure improvements. This list could help match the timing of municipal and county stormwater improvements with NCDOT improvements downstream or upstream.

2.6.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project.

1. Establish a steering committee comprised of local and county stormwater managers, NCDOT Division representatives and other relevant stormwater managers. The steering committee would be responsible for developing the coordination approach and identifying the lead agency for grant applications.
2. Establish a coordination framework for stormwater infrastructure improvements by multiple entities, including county, municipal and other providers of stormwater infrastructure.

    a. Identify opportunities for coordination and collaboration including sharing information such as planned infrastructure improvements and potential cost sharing opportunities. The proposed improvements by all parties could be used as a reference point for these coordination events.

        i. Obtain the latest HMIP list from the NCDOT divisions and districts within the region to understand future relevant stormwater improvements.

ii. Obtain local municipal and county initiatives for stormwater upgrades and improvements.
iii. Obtain plans for planned or proposed stormwater improvements by others such as railroads and private owners, if available.

b. Identify individuals or groups to serve on regional coordinating committees (i.e., the Regional Stormwater Coordination Committee) with the intention that these individuals would meet regularly to coordinate stormwater infrastructure improvements. These groups could be based on the geography of the NCDOT District or, if it makes more sense regionally, the relevant NCDOT Division office.
c. Identify a regional lead for the groups and establish a meeting frequency structure such as annually or semi-annually to review and update potential coordination and collaboration opportunities.

3. Develop a sample prioritization methodology that would prioritize coordinated improvements by both local municipalities and counties as well as NCDOT. The prioritization could be based on locations that regularly flood, or combined costs for all improvements, for example. The prioritization could also favor routes that NCDOT designates as resilient routes. The prioritization methodology would be based on regional conditions and needs and developed with input from the committee. The methodology could be adapted and modified by the regional committees.
4. Work with established regional planning organizations such as the Council of Governments or a Metropolitan Planning Organization to ensure that the coordination framework established in step 1 occurs at regular intervals.

2.6.2.2 Resources for Implementation

Costs and Funding

The primary cost associated with this project is staff time. The partnership should also determine the level of need and potential requirements outside of staff time.

The potential source of project funding is discussed below.

- **FEMA's Building Resilient Infrastructure and Communities (BRIC)**. The BRIC program, facilitated through NCEM, provides $1,000,000 guaranteed and possibly more to the State for projects that mitigate flooding or build capacity and capability to handle flooding. Projects that feature innovation, partnerships between entities and nature-based solutions will stand out for this funding opportunity. BRIC funds can be used for "capability- and capacity-building" activities (i.e., building codes activities, partnerships, project scoping, and planning and planning-related activities), hazard mitigation projects, and project management costs. The deadline to apply is typically early fall. Discussing the project with NCEM in advance helps chances for success. This grant could be used to coordinate stormwater improvements identified by the Regional Stormwater Coordination Committee.

Personnel Capacity and Expertise

Local planning staff and NCDOT personnel have the expertise needed to develop the coordination guidance plan.

Information, Mapping and Data

The most up to date of the NCDOT HMIP information related to stormwater improvements along with other planned stormwater improvements by municipalities, counties and other entities if available, would be needed for this project.

2.6.2.3 Challenges and Barriers to Implementation

Some of the challenges to the development of a coordination guidance plan for stormwater improvements are related to timing and available funding for those improvements. For example, NCDOT's improvements are scheduled using maintenance funds included in the HMIP maintained by the NCDOT divisions. Funds for those improvements are limited, and NCDOT officials noted that changing the scheduled dates for those improvements is difficult, making it challenging to match improvements scheduled by municipalities or counties. Instead, when possible, matching municipal and county improvements to the NCDOT HMIP would allow for coordinated improvements along a stream or waterway.

2.6.2.4 Maintenance and Operations

Once developed, the coordination guidance plan should be reviewed on a regular basis and modified as needed. Additionally, the steering committee should ensure that projects are reprioritized annually, and that the coordination is ongoing using the Council of Governments or a Metropolitan Planning Organization as outlined in implementation step 4.

2.6.2.5 Opportunities for Integration

The prioritized list of stormwater improvements could be incorporated into municipality and county capital improvement plans. Similarly, NCDOT could use the prioritized list as a way to update the HMIP.

2.7 Project 7: Develop a Heat Wave Response Protocol Template

2.7.1 Project Overview

2.7.1.1 Project Description

The Stakeholder Partnership identified the need for a heat wave response protocol template that can be used by local governments across the region and beyond to address vulnerabilities related to extreme heat. The document would include community educational materials for municipal and county governments as well as for the Triangle J Council of Governments. The CDC Heat Response Plan guidance would inform the protocol template design. As described in the CDC's document, a heat response protocol describes and organizes government and community activities to prevent heat-related morbidity and mortality. It may be a standalone document or an annex to an all-hazards plan depending on the jurisdiction. The protocol would guide government agencies and partners to provide services and information to the public and at-risk groups during periods of dangerously high heat and humidity. It would also provide education to municipal and county officials. Supporting educational documentation would help local governments understand the level of need for heat response and help to inform the public about heat response efforts, available resources and where to find them.

2.7.1.2 Vulnerabilities Addressed

With increased climate impacts, the Triangle J region is experiencing more high temperature days and nights. Populations particularly vulnerable to heat-related health impacts include the elderly, young children, individuals with pre-existing health challenges, unhoused persons and others who work outside or spend a significant amount of time outdoors. Additionally, this project can address heat vulnerabilities that may be exacerbated due to power outage or other failing energy infrastructure that prevents cooling systems from operating properly. Power outages or other failing energy infrastructure may be caused by hurricanes, flooding, or other storms.

2.7.1.3 Potential Impact

Developing a heat wave response protocol template for use and replication at the regional and local level would streamline the development process, as jurisdictions would not need to determine the structure or components of the protocol. The template would decrease protocol development and adoption times. In addition, once the protocols are adopted, the region would be able to respond to heat crises in a uniform manner.

A template would also increase the attention given to the increasing number of high heat days and nights occurring because of climate change. Heat kills more people in the United States each year than any other extreme weather event. Yet, the hazard does not get a lot of attention in the Triangle J region. The heat wave response protocol template would help local governments and the public understand the health risks of heat and how to prevent illnesses and death.

The template would also outline priority response protocols for individuals most vulnerable to heat-related health impacts. The project team can use the CDC Social Vulnerability Index geospatial data to identify areas of the community that may be most vulnerable to extreme heat.

2.7.1.4 Relevant Context

Temperatures in the state and region are continually getting warmer. In North Carolina, 2019 was the warmest since recordkeeping began in 1895, and three of the four warmest years on record have occurred in the past six years.[15] County-level heat data for the four counties in the Triangle J region for the last five years can be seen in Table 2-3. The "Temperature Anomaly" column refers to the variation of the year's average county temperature from the average county temperature for the years between 1901 and 2000. Since 2017, three of the four counties within the region—Johnston, Lee and Moore Counties—have experienced their warmest year on record.[16]

Table 2-2. Triangle J County-Level Heat Data

Year	1901-2000 Average Temperature	Temperature Anomaly	Temperature Ranking *
Chatham County			
2017	59.1°	2.5°	3rd Warmest
2018	59.1°	1.7°	14th Warmest
2019	59.1°	2.6°	2nd Warmest
2020	59.1°	2.1°	10th Warmest
2021	59.1°	1.5°	17th Warmest
Johnston County			
2017	60.1°	3°	1st Warmest
2018	60.1°	2.2°	6th Warmest
2019	60.1°	2.9°	2nd Warmest
2020	60.1°	2.5°	3rd Warmest
2021	60.1°	1.2°	21st Warmest
Lee County			
2017	59.8°	2.8°	3rd Warmest
2018	59.8°	2°	10th Warmest
2019	59.8°	2.9°	1st Warmest

[15] Dello, Kathie and Corey Davis. North Carolina State Climate Office, Q&A: Our Record Warmest Year in 2019. 2020. https://climate.ncsu.edu/blog/2020/01/qa-our-record-warmest-year-in-2019.
[16] NOAA National Centers for Environmental information. Climate at a Glance: County Time Series, Precipitation. 2022.https://www.ncdc.noaa.gov/cag/.

Year	1901-2000 Average Temperature	Temperature Anomaly	Temperature Ranking *
2020	59.8°	2.4°	4th Warmest
2021	59.8°	1.5°	19th Warmest
Moore County			
2017	59.9°	3.3°	1st Warmest**
2018	59.9°	2.4°	7th Warmest
2019	59.9°	3.3°	1st Warmest**
2020	59.9°	2.5°	6th Warmest
2021	59.9°	1.9°	13th Warmest

*Since 1985; **Tied

Because of rising temperatures throughout the country, the CDC has developed *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*, a robust guide on heat wave response protocols and plans to support local and regional governments in understanding the value and impact of such documents.[17] It also details key components of a heat response plan, strategies to identify vulnerable populations and locations and potential interventions for inclusion in a heat response plan.

Heat wave response "protocols" and "plans" vary in form and depth. A template heat response protocol outlines SOPs for local government officials and community service providers and lists key interventions. One example can be seen in the state of Connecticut's Division of Emergency Management and Homeland Security's Extreme Heat Emergency Management Procedure. Heat response plans, on the other hand, can be comprehensive standalone documents with a community needs assessment and detailed outreach, design and implementation strategies. For example, the City of Clarksville, Indiana, produced a standalone heat management plan in June 2022 titled Beat the Heat Clarksville. Actions within the plan are focused on reducing temperatures within the city through strategic tree planting efforts, home cooling strategies and more. Clarksville's document includes a heat wave response protocol that focuses on the operations of the local government in advance of and during a heat wave.

This project is meant to be a protocol document, and it closely aligns with the North Carolina Emergency Operations Plan (NCEOP), which includes a Heat Emergency Response Plan in Annex B, Appendix 9. The Heat Emergency Response Plan "outlines the coordinating actions taken by the State Emergency Responses Team (SERT) following a heat related emergency that impacts North Carolina." The Heat Emergency Response Plan also recommends that

[17] Climate and Health Program, Centers for Disease Control and Prevention. *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*. 2020. https://www.cdc.gov/climateandhealth/docs/HeatResponsePlans_508.pdf.

counties “develop comprehensive county emergency heat response plans in order to be prepared to quickly provide a unified response in heat crisis situations.”[18]

The 2018 North Carolina Hazard Mitigation Plan (NC HMP) identifies the following as a high priority: implementing projects through which “the state will provide training and publications to local governments, state agencies and other organizations on emergency management and mitigation. Encompassed in this, the state will develop and implement an outreach program to receive feedback on mitigation programs and policies.”[19] One listed effort included in the NC HMP under this goal is to “Develop, publicize and provide a wide variety of risk assessment products and planning services to assist local officials in their planning and risk reduction activities.” The development of a heat response protocol template is a good example of this action.

2.7.1.5 Locations and Beneficiaries

The proposed heat wave response protocol template can be populated and adapted as needed to fit a community’s needs. The template would be developed using climate data for the Triangle J region so that it can be used by any local jurisdiction (county, city, or town) and would include a particular emphasis on households that are more vulnerable to heat impacts. Areas of higher vulnerability would be prioritized in the heat wave response protocol template to ensure support is provided to community members that are at highest risk.

2.7.2 Implementation Pathway

The lead implementer recommended for this project is Anne Lowery, Chatham County Environmental Health Director.

The role of the lead implementer will involve convening and leading a working group to develop the protocol template, as well as identifying and collaborating with researchers and practitioners working in the heat wave response and adaptation field to gather best practices that could be included in the protocol.

The project would require partnerships with several entities. Potential project partnerships include:

- NC Department of Health and Human Services
- National Oceanic and Atmospheric Administration
- County health departments
- County emergency managers
- Local health professionals
- American Red Cross

[18] NCEM. 2020 North Carolina Emergency Operations Plan. “Annex B, Appendix 9, Heat Emergency Response Plan.” 2020. https://files.nc.gov/ncdps/documents/files/Divisions/EM/EOP/NCEOP_2020_FINAL-Entire-Plan-488-Pages.pdf.

[19] State of North Carolina Hazard Mitigation Plan. 2018. https://files.nc.gov/ncdps/documents/files/State%20of%20North%20Carolina%20Hazard%20Mitigation%20Plan%20Final%20As%20Adopted.pdf.

2.7.2.1 Implementation Steps

The lead implementer would undertake the following steps to implement the project.

Phase 1: Organization

1. Convene a working group of the potential project partners who will guide the development of the heat wave response protocol template.
2. Draft and circulate a charter document for the working group to communicate scope of work, timeline and phases, anticipated level of effort from working group members, and other relevant components to clarify expectations and roles of working group members.

Phase 2: Current State Assessment and Research

3. Hold working group meetings focused on existing heat response activities in each county or jurisdiction represented in the working group. To understand the current state of heat wave response across the Triangle J region, ask the participants to consider the following regarding their county and/or jurisdictions within it:

    a. Threshold that triggers heat response activities (e.g., maximum temperatures are forecasted to be above the 95th percentile).
    b. Processes in place for heat wave response, including what works well and what could be improved.
    c. Individuals involved in heat wave response coordination.
    d. How households most vulnerable to heat are prioritized in heat wave response.

4. With the support of the working group, identify researchers and practitioners specializing in heat response and heat adaptation to understand best practices and common pitfalls of heat response protocols. Taking time to understand the current landscape of scholarship and practice for heat response will provide common context for working group members. It will also jumpstart discussions and protocol development to best available information and avoid "reinventing" the wheel.

    a. Schedule meetings with the working group and identified researchers and practitioners.
    b. Record protocol best practices shared by researchers and practitioners that are relevant to the Triangle J region.

Phase 3: Protocol Development

1. Determine an approach to identify the threshold for activation of heat response activities. The working group may consult the CDC guide *Heat Response Plans: Summary of Evidence and Strategies for Collaboration and Implementation*, which dedicates a section to activation phases. Be sure to account for humidity when identifying the threshold. The working group should consider:

    a. If the threshold to activation will be phased or binary. Phased thresholds indicate more interventions and processes will be triggered as the heat wave risk grows and binary thresholds indicates all activities be triggered as heat wave risk grows.
    b. What threshold for activation of heat response activities will be (e.g a consistent threshold for activation for all counties and jurisdictions that use and populate the

template or is it to be based on local concern and local context such as demographics, energy infrastructure, and housing quality, for example).

c. The source dataset that the threshold for activation be linked to. Consider federal heat data sources displayed on Heat.gov, a project of the National Integrated Heat Health Information System.

2. Develop a methodology to identify households most vulnerable to extreme heat to prioritize in the heat wave response protocol template. The working group should consider the following:

   a. The data source that will be used to determine vulnerability (e.g., CDC Social Vulnerability Index, US Census data or other data sources). The working group should also determine the appropriate threshold for the identified metric(s) that the protocol template identifies as most vulnerable
   b. Determine if there are other local datasets with available data that should be considered.
   c. Determine if the protocol template will have a consistent methodology and data threshold to identify those most vulnerable, or if it will be determined by local context and local knowledge.

3. Draft the steps of the protocol template. Ensure that those most vulnerable to heat-related risk are prioritized in the protocol steps.
4. Draft potential interventions and activities to include in the heat wave response protocol template. A list of activities will provide template users with options that can be adapted as needed to best fit the jurisdiction using the template. Working group members can extract potential activities from information collected during the current state assessment and research phase. The working group may also consult the CDC guide, which dedicates a section to potential interventions.

Phase 4: Supporting and Educational Material Development and Outreach

1. Develop supporting materials along with the release of the protocol template. These materials could include a “How to use the heat wave response template protocol” guide, a sample populated protocol template, a list of experts willing to answer questions about the template and additional information as needed. The target audience for these materials is county and local governments that will be using the heat wave response protocol template and adjusting it for their jurisdiction.
2. Develop educational materials designed to be released by the county or local jurisdiction that uses the protocol template. The target audience for these educational materials is the public. The materials could include ready-made flyers, fact sheets, social media posts and others and communicate the dangers of heat waves and how individuals can prioritize their health and safety during extreme heat events. All educational materials should be translated into Spanish (and additional languages as needed) to ensure access for all residents.
3. Develop an outreach plan (including protocol adoption goals) to disseminate the protocol template and supporting educational materials and encourage county and local jurisdictions to use the protocol template and adopt it to their own needs and local contexts.

2.7.2.2 Resources for Implementation

Costs and Funding

Costs for the development of a heat wave response protocol template may be as little as $5,000 to $15,000 or upwards of $70,000 depending on the level of educational outreach. Staff time would be determined by the amount of detail in the protocol template and supporting community educational materials. Most of the costs associated with this project would be from staff time and educational and supporting material production (e.g., printing and production costs, advertisements, translation services).

Potential funding sources include:

- **Demonstration Sites in Climate and Health**. funds are made available by the National Association of County and City Health Officials (NACCHO) with the support of the Climate Program at CDC. In 2022, NACCHO aims to select up to four entities for funds up to $20,000 each to be used "to support climate change and health adaptation initiatives at local organizations."[20] NACCHO made a similar funding opportunity available in 2021; this may be an annual opportunity. This grant is anticipated to be offered in 2023, with an expected deadline of December 2023. This funding could be used for all the activities listed here related to the heat wave response protocol template, including the production of supporting educational and communications materials.
- **Emergency Management Performance Grant (EMPG)**. EMPG funds from the NCDPS are available annually to county governments and are used to support comprehensive emergency management at the state and local levels. The EMPG Program provides states with federal funds to sustain and enhance all-hazards emergency management capabilities. North Carolina uses EMPG to enhance its ability and to help counties support emergency management activities while simultaneously addressing issues of national concern. The national priorities associated with the recent 2022 EMPG Program include:

    - Equity
    - Climate Resilience
    - Readiness

    This funding could be used for all the activities listed here related to the heat wave response protocol template, including the production of supporting educational and communications materials.

Personnel Capacity and Expertise

Convening a working group of individuals with experience in emergency management and response, expertise in heat impacts and community knowledge would be needed for project

[20] NACCHO, "Request for Applications: Climate and Health Demonstration Sites (2022-2023)." 2022. https://www.naccho.org/blog/articles/request-for-applications-climate-and-health-demonstration-sites-2022-2023.

completion. Collaborating with other heat adaptation researchers and practitioners would ensure that the heat wave response protocol template leverages best available data and expertise.

Data on locations that are currently used as cooling centers could be used in development of the county protocols. Additionally, any information related to heat protocols at the state and county level that could be used to guide the development of the protocol template should be gathered.

2.7.2.3 Challenges and Barriers to Implementation

One potential challenge to implementing a heat wave response protocol template is meeting the balance of generalized template instruction and customization for local contexts. For example, more densely populated jurisdictions have different needs and response capacities than a very rural area in the Triangle J region. One advantage of including working group member representation across counties is to understand how different contexts may have different needs for a protocol template. Further engagement with additional stakeholders from different community contexts could also help the working group address and overcome this challenge.

2.7.2.4 Maintenance and Operations

After the heat wave response protocol template is disseminated, the working group can reduce meeting cadence or introduce an ad-hoc meeting schedule. To monitor this project, the working group (or a selected representative) can track the usage of the heat wave response template protocol. The working group can also solicit feedback from early users of the heat wave response template protocol and supporting educational materials to make any necessary updates to the template for clarify or content. For example, new sample activities and interventions could be added to the list of options or referencing new best available datasets. The working group can consider updates on an annual basis to ensure that the template protocol reflects latest knowledge and continuously improves.

2.7.2.5 Opportunities for Integration

As temperatures rise, heat-related risk will increase. Jurisdictions across the country and around the world are developing and adopting heat response plans and some are even hiring “Chief Heat Officers” to respond to the already serious and growing threat of heat. With continuing projected temperature increases in North Carolina and the Triangle J region due to climate change, heat risk will become an increasingly critical hazard to address and mitigate. The heat wave response protocol template will be a valuable asset to any future heat-related activities in the Triangle J region, such as a regional or state-wide heat response plan. Additionally, the knowledge cultivated and shared by the working group will be valuable to leverage in any future heat-related activity opportunities in the Triangle J region.

Appendix A. Portfolio Partners

Table A-1. Triangle J Region Stakeholder Partnership Members

Name	Organization
Matt Britt	Lee County Emergency Services
Scott Brooks	Moore County Emergency Management
Henry Crews	Green Rural Redevelopment Organization
Matt Day	Triangle J Council of Governments, Triangle Area Regional Planning Organization
Debra Ensminger	Moore County
Jason Epley	Regional Land Use Advisory Commission
Mark Helmer	Town of Smithfield
Wesley Johnson	Wetland Solutions
Anne Lowrey	Chatham County Public Health Department
Lacee Monte	Chatham County Council on Aging
Steve Newton	Chatham County Emergency Management
Mark Schell	NCDPS Division of Emergency Management

Table A-2. Triangle J Region Project Lead Implementors

Project	Name	Title, Organization
Project 1: Develop a River Warning System	Emily Sutton	Haw Riverkeeper, Haw River Assembly
Project 2: Plan and Prioritize Stream Restoration	TBD	Rick Savage, Carolina Wetlands Executive Director
Project 3: Install Backup and Redundant Power Sources	Matthew Britt	Director, Lee County Emergency Management
Project 4: Establish a Locally Administered Repetitive Loss Program	Emily Barrett	Environment and Resilience Program Manager, Triangle J Council of Governments
Project 5: Repair Private Dams and Stormwater Infrastructure and Provide Educational Materials to Infrastructure Owners	Deborah McGuffin	Director, Moore County Cooperative Extension
Project 6: Develop Regional Guidance for Coordinated Stormwater Infrastructure Improvements	Stephen Wensman	Planning Director, Town of Smithfield
Project 7: Develop a Heat Wave Response Protocol Template	Anne Lowery	Environmental Health Director, Chatham County

Appendix B. Proposed Projects

Table B-1. Triangle J Region List of All Proposed Projects

Project Name	Project Description
Warning systems	Signage that will display the river level and a warning message depending on the situation. We would also benefit from waterway marking, to aid in locating those calling for assistance from the waterways.
Real estate disclosure	Education about buyer beware related to storm drainage ponds and how/who needs to maintain them, as well as responsibilities if the dams fail
Stream restoration	Many older streams could benefit from stream restoration
Forest management erosion control permit	There is a need for an erosion control permit when it comes to clearing forests. Currently the timber companies just use best management practices.
Backup/Redundant Power solutions to reduce outage issues	Loss of power caused by flooding and downed trees from saturated soil and high wind were the primary causes of power loss. Power was out for several days during/after Hurricane Matthew, making it difficult for county and city staff to respond and begin short term recovery. Overall, back-up, supplemental and redundant power is needed to create better energy assurance and consistent connectivity post-disaster and to make sure that critical facilities have sufficient power to maintain operations.
Repetitive loss program	Work with County residents on the application for Hazard Mitigation Assistance funding for the elevation/floodproofing/acquisition/ relocation of repetitive loss properties. Be prepared to purchase when HMPG funding is available
Acquisition/Elevation of damaged homes	Develop a program to address widespread repetitive flooding of homes and continual flood risk in the Riverbend and Riverview Acres residential communities. The county would like to use elevation, reconstruction, and/or acquisition as a part of this program.
Southeast sector revitalization and natural park	From Crystal Lake Dam down to Spring Lake (southeast corner of county) create a recreational park and a natural, preserved, open space area that can be used to foster eco-tourism in the southeast sector through various recreational activities such as walking, running, biking, hiking, kayaking, and fishing among others.
Repair private stormwater/dam facilities and provide educational materials related to ownership of storm drainage ponds, and responsibilities of ownership (maintenance, repair)	Private dams need repair and maintenance. Decaying privately owned infrastructure. Education about buyer beware related to storm drainage ponds and how/who needs to maintain them, as well as responsibilities if the dams fail

Project Name	Project Description
Improve stormwater infrastructure	Infrastructure (ditches/culverts, etc.) are filled with trash and pollutants. Regional coordination with NCDOT, and other owners of stormwaters infrastructure.
Increase government funding for staff capacity and recruitment	Increase staff capacity to focus on applying for grants, individual buyouts, grant administration, and other programs. Increase surge capacity. Ensure that staff has equipment to safely conduct rescues. Additional staff is needed to enforce the erosion and sediment control ordinances
Develop an open space management plan	Develop open space plan for Lake Jordan and the river areas. The Plan could also include: ▪ Reevaluated riparian buffers based on future rather than past conditions ▪ Forest management - different requirements for logging close to streams and rivers ▪ Wetland preservation and restoration based on future rather than past conditions
Additional cell towers	Additional cell towers are needed for areas where there is no service
Advertise hazard education materials	Advertise all-hazard education materials for public consumption
Broaden efforts to disseminate information for all hazard events, emergency preparedness and hazard mitigation	Moore County Public Safety will work to broaden efforts regarding the dissemination of information relating to natural and man-made hazard events. This effort will focus on forwarding information provided by NCEM to municipal staff members and elected officials. Outreach activities will also be aimed at educating citizens towards emergency preparedness and hazard mitigation of all hazards and business owners about addressing the issue of continuity of operations in the face of natural and man-made disasters.
Hydrologic and hydraulic study	A need for an updated analysis of flood risk has been identified by the county for specified area to better understand and more accurately determine downstream risk during high rainfall events.
River mile-markers	EM would like to have mile makers along the rivers so they can more easily respond to rescues when there is not locational information
Warehouse facility	Storage space for equipment and other emergency supplies is limited. The addition of a warehouse facility would allow us to better prepare, organize and store emergency equipment and supplies.
Increase retention capacity and upgrade stormwater management system to protect businesses	Increase retention of Aberdeen Town Pond as it is a shallow pond. May need to look at upgrading drainage system. Current infrastructure is around 12 to 15 years old.
Dam water release communication	Develop a communication tool that alerts downstream communities about dam releases, and what the potential impacts would be.
Backup power	Provide backup power for critical facilities including cell towers.

Project Name	Project Description
County coordination for infrastructure impacts	Develop a coordination tool for dams, parks and other infrastructure are in danger during an event. Could be expanded to other counties to allow for regional coordination
Backup power for shelters	Three shelters in the county do not have an onsite generator or the ability to connect a mobile generator. Due the way the buildings were wired initially, generators or transfer switches will involve significant cost.
Community owned waterway education	Develop education programs for property owners about ownership of property related to navigable waterways. Education programs about downstream impacts from upstream actions
Update/Review the zoning ordinance	Increase freeboard requirement in the 100-year flood zone to help people avoid environmentally sensitive areas. Include a study to determine which buildings should be included.
Amend building ordinances	Amend building ordinances to include building inspections to include inspections for any and all portions of buildings that have been submerged for any length of time