



Strategic Statewide Resilience and Risk Reduction Plan

# 9 | **RECOMMENDATIONS**

## OVERVIEW

The following recommendations are intended to improve the ability of communities, economies, and ecosystems within South Carolina to anticipate, absorb, recover, and thrive when presented with environmental change and natural hazards. Additionally, these serve as a framework to guide state investment in flood mitigation projects and the adoption of programs and policies to protect the people and property of South Carolina from the damage and destruction of extreme weather events. Implementation of these recommendations will require action at the local, state, and federal levels of government as well as participation of the private and non-profit sectors.

The process of implementation will allow for development of coordinated resilience efforts and the identification of projects that maximize the benefit to South Carolinians while minimizing the risk of failure to adjust appropriately to current and future conditions.

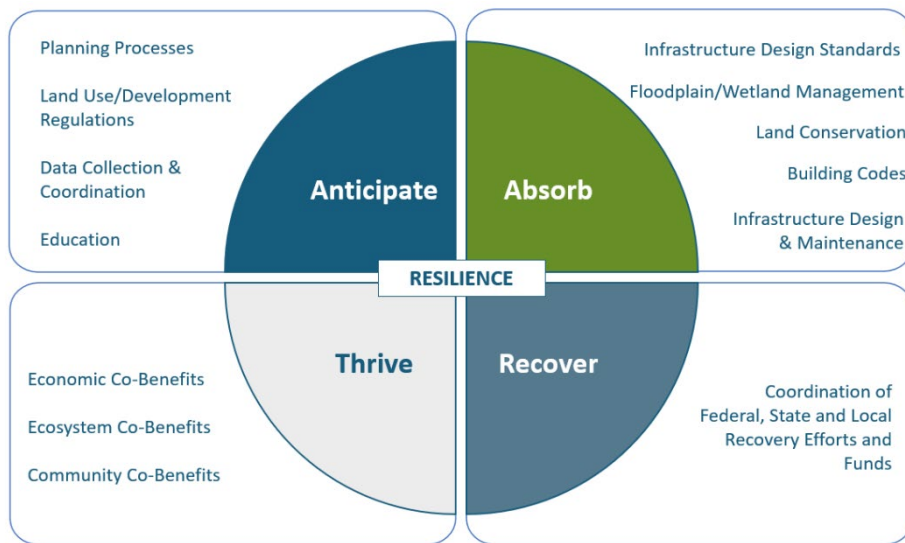


Figure 9.1

The Disaster Relief and Resilience Act directs SCOR to consider the long-term costs of the plan’s recommendations. When available, estimates of the cost to implement each recommendation is provided. The costs provided are estimates only, based on information available at the time this plan was written, and should be further investigated.

The involved parties listed may not be comprehensive and additional stakeholders will likely need to be engaged for implementation.

In order to adapt to changes in conditions and to incorporate new information, these recommendations should be reviewed periodically.

Many of the recommendations provided here have multiple co-benefits that may be achieved beyond reduction of vulnerabilities to flooding or other hazards.

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## IMPROVE DATA COLLECTION & COORDINATION

The resilience planning process returned a wealth of datasets maintained by various state, local, and federal entities, but also illustrated the need for strategic efforts to enhance the state's data resources. Current processes related to the State's data can be found in Chapter 7 (Current Processes). Investments in information infrastructure can promote efficient and cost-effective decision making through:

- Providing a better understanding of what data exists, who manages it, who can access it, and how it may be applied across sectors
- Decreasing duplication of effort related to data acquisition, analysis, and data management
- Connecting decision makers to accurate and up-to-date and sources of relevant information
- Reducing project development costs and barriers for project implementation
- Enhancing geospatial understanding and data visualization for current and future programs
- Ensuring equitable coverage across the state to provide needed tools for the most vulnerable

Effective implementation of these recommendations will require engagement with communities to understand local contexts, needs, and vulnerabilities. These recommendations will guide the State and its stakeholders into the future with confidence that policies and programs are well informed.

### CREATE A DATA COORDINATION OFFICE

**Results:** The creation of a Data Coordination Office will result in improved data collection, management, and utilization for data for decision making statewide.

A Data Coordination Office is needed to coordinate, catalog, document, and make accessible the wide range of data produced by and for the state. This data includes (but is not limited to) programmatic, quantitative, geographic (GIS), and financial data at the state and local levels. Coordination will allow for data integration across platforms and agencies. When this data is cataloged and coordinated effectively, existing programs can target resources more efficiently, agencies can more easily pursue novel funding opportunities, and state-derived data can enhance accountability reporting schemes that otherwise rely on non-official sources.

This office would work closely with state-level agencies and local partners for a reciprocal exchange of knowledge, providing technical assistance as necessary to help partners understand, access, and use data for planning, project implementation, and grant writing. Based on this essential collaboration from various levels, this office should establish standards for state data acquisitions and management, as well as best management practices to facilitate data accessibility.

A statewide study should be completed to determine the most efficient means of creating and running the Data Coordination Office.

Many of the subsequent recommendations could be coordinated or managed by this office.

**Time Frame:** 1-5 years

**Involved Parties:** All State Agencies

**Estimated Costs:** \$250,000

**Funding Source:** State Appropriations

### INCREASE THE DENSITY OF WEATHER STATIONS

**Results:** Placement of additional weather stations will provide greater precision in developing weather models, hydrologic models, drought assessments, flood forecasting and other decision-making processes.

Weather monitoring is essential to decision making before, during, and after an event. SCOR will coordinate a committee to determine specific station needs, locations, and specific costs and funding. This committee will require coordination with the State Climatology Office, National Weather Service, academia, and USGS to ensure efficient deployment and data management of additional stations. These may include the use of low-cost sensors to supplement data from benchmark stations and the identification and addressing of gaps in rain gauge coverage for shorter duration rainfall events (i.e. 1-hour precipitation data).

**Time Frame:** 1-5 years

**Involved Parties:** Academia, EMD, NWS, SCDNR, USGS

**Estimated Costs:** \$1.5 million upfront cost (one benchmark station per county), \$500,000 per year operations cost (5 positions [1 data quality analyst, 3 field techs, program director] for operations and maintenance of the network)

**Funding Source:** To be determined for installation; state recurring funds required for operation.

### INCREASE THE DENSITY OF RIVER GAGES

**Results:** New gages will be used to develop better hydrologic models and to inform and improve water planning, drought assessments, flood forecasting, and flood frequency estimates.



Additional river gages are needed, providing for better data distribution across the State. SCOR will coordinate a committee to determine specific gage needs, including specific locations, costs, and funding mechanisms. This will include coordination between state agencies such as SCDNR, DHEC, SCDOT, and SCOR, academia, and federal agencies (USGS) to ensure that efficient deployment and data management of additional gages, which may include combination stations for additional purposes such as river gages, as well as the use of low-cost sensors to supplement data from benchmark gages.

SCDNR has identified 256 potential gage sites needed to inform drought monitoring, bridge scouring, flood mitigation, water usage, and permitting. A USGS river gage that monitors stage and discharge currently costs \$15,800 per year, and a gage that monitors stage, discharge, and velocity currently costs \$24,950 per year. Each USGS gage also has an installation fee, which is waived if the gage has more than 5 years of funding commitment. SCDNR recently received \$470,000 that will cover a minimum of 30 gages. It would require an additional \$3,575,000 per year to install gages that monitor stage and discharge; an additional \$5,920,000 per year would be needed to install and operate gages that monitor stage, discharge, and velocity. Low-cost optical sensors may be considered to fill data gaps between USGS gage locations.

**Time Frame:** 1-5 years

**Involved Parties:** Academia, DHEC, EMD, NWS, SCDNR, SCDOT, SCOR, USGS

**Estimated Costs:** \$5,920,000 per year (to fill all identified data gaps)

**Funding Source:** To be determined for installation; state recurring funds required for operation

## INCREASE THE DENSITY OF TIDAL GAUGES

**Results:** Increasing the density of tidal gauges will enable better monitoring and modeling of conditions.

Additional tidal gauges are needed to monitor conditions along the coast. South Carolina currently has direct measurement gauges in Charleston and Myrtle Beach, while tides for the rest of the state are calculated. Due to the increase in tidal flooding and the complex nature of the South Carolina coastline, increasing monitoring through gauges will provide a more accurate representation of the water levels in the coastal environments. SCOR will coordinate a committee that will work to determine specific gauge needs, including specific locations, costs, and funding mechanisms. This committee will include SCDNR, NOAA, OCRM and academia to coordinate efficient deployment and data management of additional gauges. These additional gauges may include combination stations for additional purposes such as river gages, and low-cost optical sensors to supplement data from benchmark gauges.

**Time Frame:** 1-5 years

**Involved Parties:** Academia, NOAA, OCRM, SCDNR, USGS, SCEMD, SECOORA

**Estimated Costs:** To be determined, \$3,000 per low-cost optical sensor

**Funding Source:** To be determined for installation; South Carolina Legislative Appropriation recurring funds required for operation

## DEVELOP A STATEWIDE NETWORK TO MONITOR SURFICIAL GROUNDWATER

**Results:** Developing a statewide network to monitor surficial groundwater will provide a better understanding of the impacts of sea level rise and changes in rainfall infiltration on shallow systems including septic fields.

Monitoring of surficial groundwater should be continued and expanded. In coastal zones, sea level rise can cause the water table to rise, leading to flooding from soil saturation and tidal fluctuation, especially in low-lying areas. Additionally, sea level rise is increasing the salinity of coastal groundwater through saltwater intrusion, which puts infrastructure at risk of deterioration and can cause water quality and septic issues. Statewide, surficial groundwater can be impacted by changes in precipitation rates, land cover, and compaction of sediment.

The surficial aquifer monitoring wells in the SCDNR Groundwater Monitoring Network are primarily used for drought monitoring. In 2018, SCDNR and USGS added more wells in the surficial aquifer, but a baseline is still being established. SCOR, SCDNR, and many counties and municipalities recognize the importance of monitoring the surficial aquifer as sea level changes and saltwater intrusion occurs, impacting septic tanks and causing soil saturation that can exacerbate flooding impacts.

**Time Frame:** 1-5 years

**Involved Parties:** SCDHEC, SCDNR, USGS

**Estimated Costs:** To be determined, approximately \$6,000 for installation per 30-40 foot well, \$820 per well for instrumentation, plus ongoing monitoring costs

**Funding Source:** To be determined for installation; South Carolina Legislative Appropriation recurring funds required for operation.

## INSTALL THREE EXTENSOMETERS & MONITOR LAND SUBSIDENCE

**Results:** Install three extensometers to monitor vertical land movement to develop a better understanding of relative versus absolute sea level rise and improved understanding of the causes of subsidence.

At least three extensometers are needed along the coast to monitor and measure land subsidence. These extensometers should extend through the full sediment stack so that the causes of land subsidence can be determined. Causes may include excessive groundwater extraction, surficial weighting, or natural processes.

Currently there are no extensometers in South Carolina. One extensometer should be paired with USGS Groundwater Monitoring Well CHN14. The second should be placed in the Andrews/Georgetown area, and the third located in the Lowcountry near Beaufort, paired with a groundwater monitoring cluster. Additional funding and resources should be provided for remote sensing technology such as Interferometric Synthetic Aperture Radar (InSAR), allowing for more widespread monitoring in the coastal area.

**Time Frame:** 1-5 years

**Involved Parties:** SC Geodetic Survey, SC Geological Survey (SCDNR), USGS

**Estimated Costs:** \$6M (installation of 3) and operating costs

**Funding Source:** To be determined for installation; South Carolina Legislative Appropriation recurring funds required for operation.

## INCORPORATE UPDATED ATLAS 14/15 INTO INFRASTRUCTURE DESIGN

**Results:** Updating Atlas 14 will allow for the incorporation of more recent precipitation patterns into infrastructure design. The upcoming Atlas 15 will account for non-stationarity and the potential increase in extreme weather events anticipated in the coming decades. Having forward-looking precipitation frequency estimates will enable infrastructure investments to build long-term resilience into system designs.

SCOR, the SC Department of Transportation (SCDOT), and SC Department of Natural Resources (SCDNR) have agreed to provide funding to include South Carolina in the update of the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency estimates for the Mid-Atlantic Region. Once completed, the updated estimates for SC will include data gathered after the year 2000, allowing for a better understanding of the probability of rain events.

In addition to updating precipitation frequency estimates with more recent historical data, NOAA has been authorized to develop estimates that use downscaled global climate projections to be published as Atlas 15. Once released, the updated Atlas 14 and Atlas 15 numbers should be used to revise regulations and guidance utilized for planning and design.

In the interim, projects should at a minimum consider the high-end estimate of the currently published Atlas 14 numbers and plan for future climate conditions over the intended design life. SCOR recognizes the need to ensure a balanced approach to resilience that considers economic and environmental needs. Therefore, project-specific factors, such as the consequences of failure, current and future economic feasibility, and environmental impacts may warrant the use of higher or lower projections.

**Time Frame:** Updated Atlas 14 expected to be released in 2025. Atlas 15 expected to be released in 2026.

**Involved Parties:** NOAA, Federal Highway Administration (FHWA), SCDNR, SCDOT, SCOR

**Estimated Costs:** \$308,000

**Funding Source:** SCOR (\$185,000), SCDOT (\$103,000), SCDNR (\$20,000)

#### ESTABLISH A GROUP TO EVALUATE CLIMATE INFORMATION

**Results:** Establishing a group to evaluate climate information will inform decision makers on how future climate trends will likely impact the State.

To anticipate future climate-driven hazards, as well as future changes to sea level, the creation of a group to evaluate emerging climate information is needed. International organizations periodically release reports on the status of global climate and future projections. The Global Change Research Act of 1990 also mandates a national report every four years that includes climate assessments. Considering these global and national reports, the group will advise the State on how future climate trends are likely to impact South Carolina specifically and how these trends are likely to impact the State's vulnerability to natural hazards. The group should be coordinated by the SCDNR State Climatology Office and include representatives from SCOR, S.C. Sea Grant Consortium, academia, and others. The Council should coordinate with Modeling Technical Advisory Groups.

**Time Frame:** 1-5 years

**Involved Parties:** Academia, SCDNR State Climatology Office (lead), SCOR, S.C. Sea Grant Consortium

**Estimated Costs:** \$100,000 per year

**Funding Source:** To be determined

#### COLLECT LIDAR DATA STATEWIDE ON A REGULAR BASIS

**Results:** Cyclical updated LiDAR will allow decision makers to use the most up-to-date elevation data to use in computational models and in decision making.

Light Detection and Ranging (LiDAR) is a fundamental dataset used in urban, environmental, transportation, and emergency planning, as well as scientific research, and various types of modeling. Several recent flights for LiDAR in the last five years, including a county-led flight in 2020 and flights done by SCDNR's Flood Mitigation Program, have resulted in improved statewide coverage. However, not all this data is easily accessible for use. Where federal money was used for the flights, the data is customarily hosted for public download; however, several county flights are not available as they were not federally funded.

Recently, House Bill H. 3055 came into effect, mandating that the South Carolina Geological Survey Unit conduct LiDAR collection for the State on a 7-year cycle, provided that the necessary funding is appropriated. It is estimated that this effort would require \$2.5M per year for collection, a dedicated full-time employee (FTE) to manage LiDAR data acquisition, data storage and processing, and robust information technology (IT) infrastructure to handle the volume of data. Integrating this effort with the proposed Data Coordination Office could improve efficiency.

The LiDAR program manager should work with local, state, and federal partners for funding and cost-sharing opportunities.

A committee should be convened to determine the appropriate collection specifications, designate priority areas of the state, and determine essential LiDAR derivatives to be produced.

**Time Frame:** 1-5 Year

**Involved Parties:** NOAA, SC Geological Survey, SCDNR, SCOR, USGS

**Estimated Costs:** \$2.5 million per year

**Funding Source:** South Carolina Legislative Appropriation

#### CREATE A ROADWAY ELEVATIONS INVENTORY

**Results:** Creation of a roadway elevations inventory will improve understanding of the State's roadways' vulnerability to flooding.

Currently, there is no statewide road elevation data set. SCEMD, in conjunction with Clemson University, is working to develop a dataset that may be used for a vulnerability analysis; however, this project does not cover the entire state's roads.

**Time Frame:** Current, 1-5 years

**Involved Parties:** SCOR, SCEMD, Clemson University, SCDOT

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### OBTAIN HIGHER RESOLUTION LAND COVER DATA

**Results:** Obtaining one-meter resolution land cover data would allow for a more detailed catalog of the type and area coverage of various land cover types, allowing for better forecasting, planning, and modeling. SCOR will also use this data to improve the mapping of Prioritized Flood Mitigation Areas for Conservation by supporting the mapping and modeling of marsh migration and infiltration areas.

NOAA is developing a high-resolution land cover product, the Coastal Change Analysis Program (C-CAP) High-Resolution Land Cover and Change dataset. The resolution of this product is 1 to 5 meters, compared to the USGS's National Land Cover Dataset's (NLCD) 30-meter resolution, allowing for a more precise understanding of the state's landscape. Currently, C-CAP is being produced for NOAA's coastal areas. There is the potential for the dataset to encompass all of South Carolina's hydrological footprint with state-based funding and the use of our State's high-resolution imagery. NOAA estimates the cost of this expansion at \$1,500,000. This information would serve as a key input to hazard modeling. Higher-resolution data will be used by various stakeholders. Integrating this effort with the proposed Data Coordination Office could improve efficiency.

**Time Frame:** 1-5 Years

**Involved Parties:** EPA, NOAA, SCDNR, SCOR, USGS

**Estimated Costs:** \$1,500,000, with updates in 3–5-year increments. Subsequent updates would be at a lower cost according to NOAA.

**Funding Source:** \$425,000 from EPA Climate Pollution Reduction Grant (proposed), Balance TBD

## COMPLETE A STATEWIDE SEDIMENT STUDY

**Results:** A sediment study would improve our understanding of the sediment budgets, including the impact of reservoirs and identify potential engineering and policy solutions to remobilize sediment in the system.

The study should examine the potential contaminants that may be deposited with the sediment to determine if there is a risk of remobilization through planned activities or flooding events. Additionally, this study should include investigation into the beneficial use of dredge materials to keep sediment in the system.

**Time Frame:** To be determined

**Involved Parties:** Academia, DHEC, SCDNR, SCOR, US Army Corps of Engineers, reservoir owners/operators

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## COMPLETE THE STATEWIDE FLOOD INUNDATION MODELING AND MAPPING

**Results:** The SCDNR Flood Inundation Modeling and Mapping Project will provide emergency responders and others with the information needed for evacuations, search and rescue, road closures, and other emergency response activities.

The SCDNR Flood Mitigation Program was tasked with assisting with search and rescue through the production of inundation mapping for the resulting flooding from Hurricane Matthew in 2016. In 2018, the Flood Mitigation Program provided a prediction one week prior to Hurricane Florence making landfall and updated the information through the resulting flooding. The response to these events along with others since 2015 resulted in the development of the SC Flood IMPACT website ([scfloodimpact.com](http://scfloodimpact.com)) that provides inundation information to the public and emergency officials. Currently, SCDNR has developed or has under development the Pee Dee Watershed and a portion of the Santee Watershed. Funding for additional watersheds has been applied for through FEMA's Hazard Mitigation Grant Program (HMGP).

**Time Frame:** Current, 1-5 years

**Involved Parties:** SCDNR

**Estimated Costs:** \$4,500,000 to finish the state and approximately \$425,000 annually to maintain and update data.

**Funding Source:** State Funds, HMGP

## COORDINATE MODELING EFFORTS STATEWIDE

**Results:** Coordinating modeling efforts statewide will improve data modeling of hazard vulnerabilities and reduce duplication of efforts.

A Modeling Technical Advisory Group has been created and tasked with inventorying existing models and technical capabilities, identifying data gaps, making recommendations on modeling needs, and evaluating proposals for modeling improvements, with a focus on flood inundation, hydrologic and hydraulic, and storm models. The need for collaboration across municipalities, state agencies, federal agencies, and academia has become evident as the need for computational models becomes more commonplace and efficient. By engaging with academia and the technical community, local communities and state agencies can be more efficient with their resources by having a publicly accessible catalog of existing models and having a better starting point to answer the question at hand.

The first meeting of this group was on August 2nd, 2022. The group should coordinate across political boundaries and include representation from North Carolina and Georgia as appropriate. The group may also coordinate with the National Weather Service on the National Flood Inundation Model, estimated to be available in 2023, with a national map produced by 2027.

Once completed, the inventory of models would be made publicly available with contact information for the entities responsible for model development to enable state and local government agencies to access existing models specific to planning, project design, and grant-writing goals.

SCOR should create a position to coordinate this group and act as a point of contact for interested parties.

**Time Frame:** Current, 1-5 years

**Involved Parties:** Academia, County & Municipal Governments, DHEC, EMD, NOAA, NWS, SCDNR, SCDOT, SCOR, USGS

**Estimated Costs:** \$150,000 per year

**Funding Source:** To be determined



## ASSESS THE NEED FOR ADDITIONAL POST DISASTER IMAGERY

**Results:** The collection of post disaster imagery can be used to better assess the damage extent post event. This can aid SCEMD, FEMA, and SCOR to identify where to focus response and recovery efforts.

A committee should be formed to assess the need for post event imagery to improve the efficiency and accuracy of completing disaster damage assessments to guide community recovery efforts. This can be accomplished via multiple platforms, including airplanes, satellites, and drone surveys, with each platform having its own advantages and disadvantages. There are existing frameworks for airplane and satellite collection efforts, but these require formal partnerships and contracts. The committee could designate the appropriate collection platform for specific disaster events, establish partnership contracts, and determine the event threshold needed to invoke these collection activities. For flood events, acquisition of imagery timed to capture maximum flood extents should be prioritized. This information would help support both recovery and mitigation efforts undertaken post-event and fill gaps when existing thresholds for imagery collection are not met. Integrating this effort with the proposed Data Coordination Office could improve efficiency.

**Time Frame:** 1-5 Year

**Involved Parties:** EMD, FEMA

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## DEVELOP HIGHER RESOLUTION POPULATION PROJECTIONS

**Results:** Higher resolution projections related to population movement, growth, and reduction would inform local, county, municipality, and state planning processes.

Resources should be allocated to allow the department to produce detailed, downscaled population and demographic projections based on data collected from the U.S. Census Bureau and to include new projections related to land use and development pressure. This information would be used to inform local decision making. While projections are currently available at the county level, it is critical to understand where, why, and how population change is occurring within a county to identify threats to natural systems caused by growth as well as threats to social vulnerability brought by population growth and decline. It can also inform infrastructure decisions, support smart planning on where to extend services and put in infrastructure, and

minimize the loss of lands important for natural flood mitigation to keep populations away from hazard areas.

**Time Frame:** 1-5 Years

**Involved Parties:** Academia, Counties,

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### DEVELOP A STATEWIDE PROPERTY LEVEL DATA STANDARD

**Results:** Developing a statewide property level data standard will improve data collection and coordination and enable better monitoring and modeling.

Property level data is currently collected and managed at the local level. SCOR recommends development of a standardized schema of what data should be collected for each property and providing best management practices to local governments on data management. This data should be organized in a central database to improve resilience planning. Damage statistics would be improved as a result of additional data collection and sharing of property level data.

Data to collect would include address, tax use description, number of structures, primary structure's year of construction, first (finished) floor elevation, parcel value, structure value, construction type, owner type, owner name, subdivision name, parcel data source, and parcel data date.

**Time Frame:** 1-5 years

**Involved Parties:** County & Municipal Governments, SCEMD

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### INVENTORY & ANALYZE CURRENT ZONING AND LAND USE POLICY STATEWIDE (ZONING ATLAS)

**Results:** Inventorying and analyzing zoning and land use policy statewide will help decision makers better understand how local jurisdictions implement zoning and the ways in which land use regulations shape a community's development and resilience.

As with other data collected on the local level, existing zoning maps and ordinances are decentralized and inconsistent, making statewide comparison and understanding of zoning's

role difficult. A zoning atlas will make comparisons of jurisdictions possible, open up research opportunities to explore the impacts of land use regulations on resilience, strengthen city and regional plans, better inform stakeholders, and update zoning and land use regulation to better align with risk and vulnerability, decreasing development in flood-prone locations and encouraging smart growth in lower-risk areas. In addition to the geospatial analysis, this process would include an analysis of existing zoning ordinances and classifications across the state to determine similarities between communities and determine if classifications can be collated for statewide comparison. In areas that are not zoned, this analysis will also look at other land development regulations such as setbacks, minimum lot sizes, and floodplain ordinances.

The National Zoning Atlas process for How to Make a Zoning Atlas, already being used in other states, may provide guidance to this end. This analysis could be supported through the statewide watershed-based resilience planning process.

**Time Frame:** Current

**Involved Parties:** SCAPA, SCOR

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### CREATE A CULTURAL RESOURCES RESILIENCE COORDINATOR POSITION TO DEVELOP A CULTURAL RESOURCES INVENTORY

**Results:** Improved data management and coordination of disaster preparedness and recovery activities and resilience efforts for the State’s cultural resources. Allows for comprehensive planning that mitigates the potential loss of cultural resources across the State and promotes efficient recovery and resilience efforts.

A Cultural Resources Resilience Coordinator position should be created to coordinate and conduct a Statewide Cultural Resources Inventory to begin understanding the vulnerabilities cultural resources face to natural hazards. This coordinator will also manage education and training associated with cultural heritage such as disaster preparedness and recovery workshops for cultural heritage stewards (e.g., archives, libraries, and museum employees and volunteers) and community members.

A cultural resources inventory should catalog the institutions and organizations that manage the State’s cultural, historic, and artistic collections so that their vulnerability to flooding and other hazards can be assessed. This inventory will also assist in creating a network of historical and cultural resource conservationists, which will serve as a platform for annual training and

outreach, building upon the information held by FEMA's Heritage Emergency National Task Force (HENTF) to aid in local coordination.

Additional cultural resources survey and inventory should be conducted for known and potential cultural resources (e.g., archaeological sites, cemeteries, buildings/structures, cultural landscapes, and traditional communities) across the State's coastal counties and at-risk watersheds. This survey and inventory should include qualitative and quantitative data on the impacts cultural resources are experiencing and assess their vulnerability to flooding and other hazards. Such data would allow for pre-disaster mitigation and response. A subsequent monitoring program for at-risk cultural resources should be established. Similarly, the State should focus on mapping the extent and locations of traditional cultural places and communities. This needs to be an ethnographic endeavor, capturing oral histories and perspectives of the people who give South Carolina its rich and diverse cultural landscape.

These inventories will support the South Carolina Emergency Management Division's Natural and Cultural Resources (NCR) Recovery Support Function (RSF) Annex by helping emergency managers know what cultural resources are at risk when an event is on the horizon, as well as coordinating subsequent recovery and response.

**Time Frame:** 1-5 years

**Involved Parties:** SCOR, SCDNR Heritage Trust, SC PRT, SC Department of Archives and History/State Historic Preservation Office, SC Institute for Archaeology and Anthropology, SC State Library, Gullah/Geechee Nation, Gullah/Geechee Sea Island Coalition, Gullah Geechee Cultural Heritage Corridor NHA, Lowcountry Alliance for Response, SC African American Heritage Commission, SC Battleground Preservation Trust, Preservation South Carolina, SC Commission for Minority Affairs, SC Council of Chiefs, Tribal Nations, Confederation of SC Local Historical Societies, SC Federation of Museums, Palmetto Archives, Libraries, and Museums Council on Preservation, other cultural institutions, federal partners.

**Estimated Costs:** \$100,000-\$200,000 per year

**Funding Source:** To be determined

## EDUCATION, OUTREACH & DISCLOSURE

The following recommendations focus on education and outreach to a variety of audiences. The recommendations include the development of tools and processes to engage and educate individual citizens, government organizations, and other stakeholders on resilience related topics. The disclosure recommendation specifically focuses on the disclosing of flood related information during real estate transactions.

### STATEWIDE RESILIENCE PLAN REGIONAL WORKSHOPS

**Results:** Hosting Statewide Resilience Plan regional workshops will educate the public on the information included in the Resilience Plan.

Following the release of this plan, SCOR will hold regional workshops to present information in this plan to a variety of stakeholders.

**Time Frame:** 0-1 year

**Involved Parties:** SCOR, Planning Advisory Members

**Estimated Costs:** <\$10,000

**Funding Source:** Reserve Fund

### DEVELOP THE SCOR RESILIENCE ATLAS

**Results:** Development of the SCOR Resilience Atlas will provide a centralized location for resilience related GIS data to aid in decision-making statewide.

To present and share data analyzed as part of SCOR's Vulnerability Assessment and visualize other relevant data for use by multiple stakeholders and decision makers, SCOR will develop a comprehensive and easy-to-use mapping tool to be known as the SCOR Resilience Atlas that will function similarly to the SC DHEC Watershed Atlas. SCOR will work to consolidate existing tools such as the Water Resources Registry and the SC Green Infrastructure Plan Hub Site. Additional data layers from federal, state, local, and private sources may be added to increase local insight and context. An accompanying training or tutorial will help users navigate this tool. To ensure the tool is useful and easy to use, SCOR will collect feedback from representative end users during the Atlas development process.

**Time Frame:** Current, 1-5 years

**Involved Parties:** SCOR

**Estimated Costs:** \$150,000 per year

**Funding Source:** Proposed SCOR budget

#### DEVELOP A RESILIENCE RESOURCE LIST

**Results:** The Resilience Resource List will provide a centralized location for communities and other identified audiences to access decision-relevant information and resources.

The South Carolina Office of Resilience will continue to refine and organize the resources found on the [Resilience Resources](#) webpage. This list will contain vetted resources that are most needed and relevant to South Carolina.

**Time Frame:** Resource list currently exists but needs further development and update.

**Involved Parties:** SCOR will solicit feedback on currently listed tools and resources and ensure these resources are easily accessible on the SCOR website and shared more broadly.

**Estimated Costs:** \$100,000 per year

**Funding Source:** Proposed SCOR budget

#### MAINTAIN THE S.C. SEA GRANT CONSORTIUM RESILIENCE PLANNING ARCHIVE

**Results:** An easy-to-use database cataloging the resilience planning efforts undertaken across the states will inform planning and implementation of projects and allow for cross jurisdictional coordination.

The S.C. Sea Grant Consortium has compiled a comprehensive survey of resilience planning efforts across South Carolina, including state agencies, counties, municipalities, non-governmental organizations, colleges and universities, and private companies. The archive allows for keyword and publication type searches, as well as a place for reports and plans to be submitted. Funding and staffing should be dedicated to maintain this archive as resilience-related planning across the State continues to grow and existing plans are updated. Additional tools and components of the archive may continue to develop including additional sorting categories and integration of regional plans with a South Carolina component, as well as a method to highlight newly included materials or view plans spatially, which would improve statewide and watershed-based coordination.

**Time Frame:** Currently in place

**Involved Parties:** SCOR, S.C. Sea Grant Consortium (lead)

**Estimated Costs:** \$20,000 per year

**Funding Source:** South Carolina Sea Grant Consortium

#### DEVELOP A RESILIENCE TRAINING/CERTIFICATION PROGRAM

**Results:** Developing a resilience training and certification program to build community capacity and facilitate local implementation of statewide resilience principles.

SCOR and partners will develop a curriculum of training related to resilience. These trainings will utilize existing training series and sector group meetings and be developed with partners with extensive experience in hosting trainings. This may include but is not limited to groups such as the Municipal Association, SC Association of Counties, Councils of Governments, and other groups depending on the intended audience. Audiences may include local government officials and staff, property owners, citizens, the real estate industry, and others. In addition to providing content, these trainings should incorporate case stories, highlighting successes and challenges, that show the impact of resilience work. To make these trainings most successful, goals, topics, and target audiences will be defined using a needs assessment, and based on that, the best avenues of delivery and content will be developed for different audiences.

**Time Frame:** Ongoing

**Involved Parties:** Professional CE/credit organizations, SCOR, LLR, Clemson Extension, S.C. Sea Grant Consortium, DNR Coastal Training Program

**Estimated Costs:** \$150,000 per year

**Funding Source:** Proposed SCOR budget

#### DEVELOP A CULTURAL RESOURCES TRAINING FOR DISASTER PLANNING AND RECOVERY

**Results:** Developing and implementing a cultural resources training will increase the preparedness and reduce the vulnerability of cultural institutions and resources.

The training can include templates that small and independent cultural institutions can use to develop disaster preparedness and recovery plans. Continued dialogue between cultural institutions at all levels of the state and using an adaptive management framework will encourage diverse and creative solutions to resource preservation and conservation challenges. Additional training should target the public so they can be prepared to care for family collections and heirlooms. This recommendation builds on the vulnerability to cultural resources discussed in Chapter 5 (Flood Risk & Vulnerability).

**Time Frame:** 1-5 years

**Involved Parties:** SCOR, SCDNR Heritage Trust, SC Department of Archives and History/State Historic Preservation Office, SCEMD, SC PRT, Gullah Geechee Cultural Heritage Corridor NHA, SC African American Heritage Commission, Lowcountry Alliance for Response, Gullah/Geechee Sea Island Coalition, SC Institute for Archaeology and Anthropology, SC State Library, Confederation of SC Local Historical Societies, SC Federation of Museums, Palmetto Archives, Libraries, and Museums Council on Preservation, Other Cultural Institutions, Federal partners

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### REESTABLISH A FLOOD HAZARD SIGNAGE PROGRAM

**Results:** Reestablishment of a flood hazard signage program will increase public awareness of flood risks and vulnerabilities, as part of a comprehensive flood hazard education program.

In the past, the Water Resources Commission and SCDNR worked on a floodplain and storm surge signage program. Restarting such a program should be considered, but should be carefully planned, with a defined purpose and strategic locations along with careful considerations of positive and negative implications.

**Time Frame:** 1-5 years

**Involved Parties:** County & Municipal Governments, NWS, SCDNR, SCOR, SCEMD

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### STRENGTHEN HAZARD DISCLOSURE IN REAL ESTATE TRANSACTIONS

**Results:** Strengthening hazard disclosure in real estate transactions will provide purchasers a more complete knowledge of risk and conditions related to flooding and other natural hazards.

The South Carolina Residential Property Condition Disclosure Act currently requires some level of flood risk disclosure in property sales (see Chapter 7: Current Processes), but efforts should be made to strengthen disclosure procedures in real estate transactions. Recent additions to the SC Residential Property Condition Disclosure Statement have strengthened flood disclosure, but additional edits are needed. While there has been some clarification on the use of “no representation” on the form, which is called for in statute, the presence of this choice in the



form has been identified as a potential barrier to accurate disclosure of hazard related information.

Additionally, there are several items found in the form that are not specifically mentioned in the current statute. Therefore, this recommendation considers two points: what should be in the form, and how to get these provisions written into the statute.

In addition to flood risk, there are needed additions regarding coastal issues, and the dynamics of coastal vulnerability. While some of these changes were made in the June 1, 2023 update, it is important to note that some of this information is publicly available but is not all inclusive or all in one place. Therefore, there is a need for a tool such as a website where an address could be entered and returns and a list of all publicly available data about a property, such as any permits and flood zone designations associated with it. The group discussed Louisiana's disclosure form as a useful example for edits to South Carolina's disclosure form.

**Time Frame:** Current, 1-5 years

**Involved Parties:** Legislature (Amendment of Residential Property Condition Disclosure Act), South Carolina Real Estate Commission (S.C. Residential Property Condition Disclosure Statement), DHEC OCRM

**Estimated Costs:** N/A

**Funding Source:** N/A

## WATERSHED-BASED RESILIENCE PLANNING & PROJECTS

In addition to the development, implementation, and maintenance of the Statewide Resilience Plan, the Disaster Relief and Resilience Act charged SCOR with providing technical planning assistance for state and local governmental entities. The Act specifies that the plan should include a strategy for providing resources, technical assistance, and other support to local governments for flood risk reduction efforts.

This recommendation focuses on resilience planning on the watershed scale that will enable the development, implementation, and coordination of resilience projects, programs, and policies on the local level.

The watershed planning process will also provide opportunities for stakeholder input from citizens around the state that will be incorporated into the second edition of the Statewide Resilience Plan. Through this process, data and information gaps that affect the capacity of state agencies or local governments to adequately evaluate and address the factors that increase flood risk may be identified and recommendations for strategies to reduce flood risk will be developed.

### SCOR WATERSHED-BASED RESILIENCE PLANNING PROCESS

**Results:** The watershed-based resilience planning process will result in prioritized projects and strategies, supported by data and community input, that will increase community and watershed resilience and build community capacity to access funding for the implementation of projects.

SCOR will coordinate with communities at the watershed level to identify risk and vulnerability, develop actionable flood mitigation and resilience solutions, and build community capacity by leveraging local, regional, and state partnerships. By considering the principles and data in the Statewide Resilience Plan, and pairing them with local needs assessments, this process will allow for the implementation of projects that meet local needs and consider the impact of potential projects on the larger watershed. The process will enable communities across the watershed to leverage their capacity to access the increase in federal funding that is available to deliver a pipeline of prioritized projects throughout the watershed that do not cause adverse upstream or downstream effects.

Each of the state's eight major watersheds should have a full-time coordinator, who can support local governments to ensure comparable data is collected across and within watersheds, coordinate cross-jurisdictional projects, and serve as the liaison between local communities, SCOR, and other statewide planning efforts.

As part of this process, communities statewide will receive technical assistance to complete the following tasks, resulting in actionable watershed-based resilience plans for each of the State's major river basins.

- Information Gathering, Planning & Community Engagement
  - Collect and organize available information for the watershed
  - Engage the community to identify vulnerabilities and resilience priorities
  - Inventory existing plans
  - Identify and work to fill data gaps
- Community Risk, Vulnerability & Resilience Reports
  - Identify community risks and vulnerabilities
  - Complete top-down (data-driven) and bottom-up (community-driven) resilience assessments
- Recommendations to Improve Watershed-Based Resilience
  - Identify and prioritize projects at local and regional scale
  - Make policy and planning recommendations

The result of this process will be a cohesive watershed-based resilience plan that outlines watershed risk and vulnerability and prioritizes projects and policies for implementation that increase the resilience of the watershed, considering both upstream and downstream impacts.

This process will enable many other recommendations proposed in this chapter, as well as enable communities to meet the new comprehensive planning requirement, develop best management practices, and integrate resilience across multiple planning and implementation processes.

**Time Frame:** Current, 1-5 years

**Involved Parties:** SCOR, state agencies, local government, regional governments, citizens, and interest groups.

**Estimated Costs:** \$5,000,000 to complete initial plans for each of the eight basins

**Funding Source:** To be determined; SCOR has received funding from the National Fish and Wildlife Foundation (NFWF) to complete this process in the Salkehatchie River Basin. SCOR has applied to other grant programs to implement this approach in other watersheds across the State. The Disaster Relief and Resilience Reserve Fund can also be used to complete this process statewide.

**ESTABLISH A RESILIENCE GRANT/LOAN PROGRAM UNDER THE DISASTER RELIEF AND RESILIENCE RESERVE FUND (RESERVE FUND) TO IMPLEMENT RECOMMENDATIONS OF THE STATEWIDE RESILIENCE PLAN AND WATERSHED-BASED RESILIENCE PLANNING**

**Result:** A Resilience Grant/Loan Program will enable the implementation of mitigation projects, programs, and policies identified in the statewide resilience plan and watershed-based resilience planning process.

Establishing a Resilience Grant/Loan Program using the Reserve Fund will make funds available to implement projects, programs, and policies identified through watershed-based resilience planning. Projects may be traditional “gray” infrastructure projects such as stormwater systems or flood control structures or “green” infrastructure such as nature based and conservation projects.

Recurring funds should be allocated to the Resilience Grant/Loan Program to ensure that projects, programs, and policies identified through watershed-based resilience planning are implemented in a timely manner.

**Time Frame:** 1-5 years

**Involved Parties:** SCOR

**Estimated Costs:** To be determined

**Funding Source:** Disaster Relief and Resilience Reserve Fund

## **INCORPORATE RESILIENCE INTO PLANNING & LAND USE, AND OTHER REGULATORY PROCESSES**

The Disaster Relief and Resilience Act calls for recommendations related to land use management, technical planning assistance for state and local government, and integration of recommended approaches into existing state strategies. The Act amended Section 6-29-51(D) by requiring a resilience element in local comprehensive plans (discussed in Chapter 7: Current Processes).

These recommendations not only address the comprehensive plan, but other facets of local planning and the implementation of those plans that occur through zoning and land use policies and procedures.

These recommendations also consider the other types of planning processes occurring across the State (covered in Chapter 7: Current Processes) including hazard mitigation plans and other state planning efforts that relate to resilience, such as drought planning.

In line with the above recommendations related to data, there are several existing data gaps that hinder the ability of local communities to integrate resilience into their land use planning, programs and policies that need to be addressed to improve these planning processes.

### **COMPLETE STATE AGENCY RESILIENCE REVIEWS**

**Results:** State agency resilience reviews will provide policy and regulatory recommendations to ensure that current and future vulnerabilities are considered across state government.

Section 48-62-40 of the Disaster Relief and Resilience Act sets up the Statewide Resilience Plan Advisory Committee, composed of select state agencies for the development of the plan (see Chapter 1: Introduction). Implementation of the plan will require a whole-of-government approach. Every state agency should designate a resilience liaison to assist with interagency coordination and implementation of the Resilience Plan.

Each agency should conduct a resilience review based on the climate and flood risk and other hazard data presented in this report's vulnerability assessment and make recommendations on policy and regulatory changes that are needed to reduce vulnerabilities. Recommendations on policy and regulatory changes should be submitted to SCOR for inclusion in the second edition of the Strategic Statewide Resilience and Risk Reduction Plan.

**Time Frame:** 5 years

**Involved Parties:** All State Agencies

**Estimated Costs:** To be determined

**Funding Source:** Each agency should identify resource needs for inclusion in budget requests.

#### INCREASE REGULATION OF DEVELOPMENT IN FLOOD PRONE AREAS

**Results:** Increasing regulation of development in flood prone areas will reduce future vulnerabilities and reduce the risk of loss of life and property.

Utilizing best available data, counties and municipalities should adopt policies that restrict new development in flood prone areas, whether or not they are designated by FEMA as a special flood hazard area (described in Chapter 7: Current Processes). Any new structures in flood prone areas should be designed to withstand a 1% flood event over the design life of the structure, considering changes in future conditions.

**Time Frame:** Current

**Involved Parties:** Counties, Municipalities

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### DEVELOP BEST MANAGEMENT PRACTICES FOR COMMUNITIES TO INCORPORATE RESILIENCE INTO COMPREHENSIVE PLANS

**Results:** Developing best management practices for resilience in comprehensive plans will increase the ability of communities to anticipate, absorb, recover and thrive when presented with environmental changes and natural hazards.

A comprehensive plan is the primary long-range plan adopted by the governing body of a jurisdiction that guides the development of the community and serves as a roadmap to decision making regarding growth and development, public facility investments, regulation of land uses, siting of green space, and economic development initiatives (see Chapter 7: Current Processes). The South Carolina Local Government Comprehensive Planning Enabling Act of 1994 (S.C. Code Ann. § 6-29-310 *et seq.*), which was updated in 2020 by Disaster Relief and Resilience Act, now requires a resiliency element that considers the impact of flooding, high water, and natural hazards on individuals, communities, institutions, businesses, economic development, public infrastructure and facilities, and public health, safety, and welfare.

While resiliency is its own element in a comprehensive plan, vulnerabilities and opportunities for implementation are present in all the plan's elements, and as such the resiliency element should be drafted with that in mind.

SCOR has developed a one-pager, available to the public on the SCOR website, to present the legislative requirements mentioned above (Appendix F).

Beyond best practices, model ordinances that support implementation of the plan through zoning, land use and development regulations may be beneficial in addition to creating funding incentives for communities to develop and implement resilience plans. This analysis will be supported through the statewide watershed-based resilience planning process.

**Time Frame:** Current

**Involved Parties:** County, Municipal & Regional (COG) governments, SCAPA, SCOR

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## PROMOTE RESILIENT DEVELOPMENT THROUGH LOCAL ZONING, LAND USE AND DEVELOPMENT REGULATIONS

**Results:** Implementation of zoning and land use regulations that incorporate resilience will increase the ability of communities to anticipate, absorb, recover and thrive when presented with environment change and natural hazards.

SCOR will develop best management practices and provide principles that enable communities to develop local strategies to implement resilient policies, aligning with their comprehensive plans, through zoning and land use codes, subdivision regulations, overlay zones, floodplain management, and stormwater ordinances or other tools as described in the Land Development Regulation section of Chapter 7: Current Processes). Since there are large parts of the state that are not currently zoned, these practices will also need to focus on the role of other land-use policies and practices, including but not limited to: cluster development, overlay districts, impervious surface regulations, annexations, closing loop-holes, density bonuses, nature based solutions and conservation, as well as the land development permitting process. These best management practices will provide a flexible toolkit for communities across the state, drawing on examples and lessons learned from communities within South Carolina, such as Charleston's elevation-based zoning and nationwide, such as Norfolk, Virginia's Resilience Quotient.

**Time Frame:** 1-5 years

**Involved Parties:** SCAPA, SCOR

**Estimated Costs:** \$100,000 per year

**Funding Source:** To be determined

#### WATER SYSTEMS SHOULD INCORPORATE RESILIENCE INTO LONG-RANGE PLANNING

**Results:** Incorporating resilience into water system planning will ensure that water systems are prepared for future conditions.

Water systems should conduct a resilience review of their water systems based on the climate and flood risk and other hazard data presented in this report's vulnerability assessment. Plans should consider changes in water availability and development patterns. Water systems should coordinate with SCDNR State Climatology Office to update drought response plans. Water systems should plan for redundancies in operations such as the conjunctive use of surface and groundwater to meet long term demand under changing conditions.

**Time Frame:** Ongoing

**Involved Parties:** SCDNR, SHEC Office of Rural Water (ORW), Water Systems

**Estimated Costs:** To be determined

**Funding Source:** To be determined



**DEVELOP LAWS AND REGULATIONS FOR THE PROTECTION OF ISOLATED WETLANDS**

**Results:** Conserving and protecting isolated wetlands will maintain the current level of flood mitigation and ecosystem services.

The May 25, 2023, U.S. Supreme Court decision in *Sackett v. Environmental Protection Agency*, 598 U.S. \_\_\_ held that only wetlands that are connected to other surface waters are regulated under Section 404 of the Clean Water Act. It states EPA Clean Water Act regulated wetlands are limited to only those areas that have a “...continuous surface water connection with a larger body of water.” The decision puts some of South Carolina’s unique isolated wetlands features such as Carolina Bays at risk of unregulated development. There is currently no state-level legislation to protect isolated wetlands. Isolated wetlands, such as Carolina Bays, offer habitat and flood mitigation in South Carolina. A majority are in the coastal zone where populations are increasing and therefore at an increased risk of loss to development. New state legislation should be enacted to regulate the alteration of these unique systems to reduce the potential loss of function.

**Time Frame:** 1-5 years

**Involved Parties:** SC Legislature

**Estimated Costs:** N/A

**Funding Source:** N/A

## MAINTAIN AND STRENGTHEN BUILDING CODES

The Disaster Relief and Resilience Act requires SCOR to consider alterations to state building codes. In South Carolina, building codes are adopted at the state level, with a modification and adoption process that follows a regular schedule. This process is outlined in Chapter 7: Current Processes, under the Absorb section. The following recommendations consider the Residential, Commercial and Energy Codes.

### MAINTAIN UPDATED BUILDING CODES

**Results:** Maintaining the current building code update schedule will ensure our codes incorporate the latest information and best practices to increase resilience.

South Carolina has an on-schedule code modification and adoption process following the update of the International Code, which is updated every three years. South Carolina should maintain this schedule for both the Residential and Commercial codes to keep up with reasonable standards of construction for public health, safety, and welfare.

**Time Frame:** Ongoing

**Involved Parties:** Building Codes Council, International Codes Council (ICC), SC Department of Insurance, SC Department of Labor, Licensing, and Regulation (LLR)

**Estimated Costs:** To be determined

**Funding Source:** To be determined

### REDUCE MODIFICATIONS TO BUILDING CODES THAT REDUCE HAZARD RESILIENCE

**Results:** Reducing modifications to the International Codes will ensure our codes incorporate the latest information and best practices to increase resilience.

South Carolina currently modifies the International Codes, including requirements related to hurricane and seismic maps. The State should not make modifications to the International Codes that reduce resilience. For more information on this, please see the Current Processes chapter, which includes maps of the areas identified by FEMA as having a weakened code.

**Time Frame:** Ongoing

**Involved Parties:** Building Codes Council, ICC, SC LLR

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### DEVELOP PROFESSIONAL EDUCATION PROGRAMS RELATED TO BUILDING CODES

**Results:** Development of professional education program related to building codes will ensure that practitioners are trained on the most up-to-date practices and technologies to increase resilience.

Innovations are being made on a regular basis to increase resilience as it applies to planning, design, and construction. However, these innovations are only put into practice if professionals are kept up to date on the latest technology, products, and methods.

South Carolina requires licensing of general contractors, mechanical contractors, residential builders, and residential specialty trade contractors, but does not mandate continuing education for renewal of licenses in any category. SCOR recommends LLR develop continuing education opportunities to ensure that contractors can remain current on using new materials and techniques and investigate whether a continuing education requirement is needed.

Architecture school curriculums currently provide limited education to students on building codes. Clemson University's School of Architecture is the only National Architectural Accrediting Board accredited program in South Carolina. Courses on building codes, that are important to consider in design, should be built into their curriculum. Such education should be supported through the continuing education requirements pursuant to SC Code of Regulations, §11-8.1 as well. Additionally, code education should be built into the professional development curriculum for engineers, as pursuant to SC Code §49-600.

**Time Frame:** 1-5 years

**Involved Parties:** Accreditation and Licensing Organizations, Building Officials Association of South Carolina, Education Providers, IBHS, South Carolina Association for Hazard Mitigation

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## EVALUATE ENERGY CODE STANDARDS

**Results:** An evaluation of energy code standards will allow for a more complete understanding of how utilization of the 2009 Energy Code impacts the resilience of the electric grid.

The SC Energy Standard Act adopts the 2009 edition of the International Energy Conservation Code as the Energy Standard with which all new and renovated buildings and additions constructed within the state must comply. This code is not part of the normal code adoption process, and future versions must be adopted by statutory amendment. While SC is still using the 2009 edition, the ICC has released several updates to the International Energy Conservation Code, most recently in 2021.

Steps should be taken to assess the impacts that updating the state’s energy standard to a newer code might have. This assessment should include how an update the code could impact the resilience of the power grid in the state and consider both the costs of construction and operation of buildings as well as the impacts on public health, safety, and welfare.

**Time Frame:** 1-5 years

**Involved Parties:** South Carolina Department of Commerce, South Carolina Energy Office

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## UTILIZE MOST CONSERVATIVE WIND ZONE MAP

**Results:** Utilization of the most conservative wind zone map will ensure that structures can withstand projected wind speeds.

The SC Building Codes Council approved county level wind maps for the 2021 code cycle based on the 2015 International Residential Code. These maps determine the boundaries for wind design in South Carolina for single- and two-family dwellings.

In cases where there is a question of which side of the wind boundary a property is on, the higher of the two requirements should be used.

**Time Frame:** 1-5 years

**Involved Parties:** Building Codes Council

**Estimated Costs:** To be determined

**Funding Source:** To be determined

#### CLARIFY SCORING CRITERIA FOR ISO PROCESS

**Results:** Clarifying the scoring criteria for the Building Code Effectiveness Grading Schedule will allow building officials to adopt best practices to improve their scores.

Building code officials need more guidance on how to fill out the reports and more education on how they will be scored. Coordination is needed between ISO and building code officials to ensure officials understand how they will be scored and how to accurately complete their reports. Support and coordination are also needed to ensure officials understand where they may have lost points so that they can take actions to improve their score.

**Time Frame:** 1-5 years

**Involved Parties:** Building Officials Across the State, Building Officials Association of South Carolina, ISO, SCEMD

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## **INCORPORATE RESILIENCE INTO INFRASTRUCTURE DESIGN, CONSTRUCTION, AND MAINTENANCE**

Infrastructure, especially stormwater infrastructure, is a major component of flood mitigation and resilience. The following recommendations focus on infrastructure design, with a focus on stormwater and critical infrastructure.

These recommendations should be used for infrastructure projects.

### **CONSIDER FUTURE CONDITIONS FOR CRITICAL INFRASTRUCTURE DESIGN**

**Results:** Designing and building critical infrastructure considering future conditions ensures that infrastructure will be able to withstand hazards they are likely to encounter during their design life.

Critical infrastructure can be defined as those assets, systems, and facilities that communities rely upon for everyday health, safety and welfare and lifeline functions. This can include anything from transportation systems to facilities that provide clean water and electricity to communities. The benefits of diversification of assets such as multi-modal transportation system design, conjunctive use of surface and groundwater, and a distributed electrical grid should be considered. SCOR recognizes the need to ensure a balanced approach to resilience that considers economic and environmental needs. Therefore, for the design of critical infrastructure, project-specific factors, such as the consequences of failure, current and future economic feasibility, and environmental impacts may warrant the use of higher or lower design standards.

To understand said future conditions, SCOR worked with SCDNR State Climatology Office, S.C. Sea Grant, and the University of South Carolina's Carolinas Integrated Sciences and Assessments (CISA) program to generate a report that includes an analysis of South Carolina's observed climate record, translation of model output into future state-level climate projections, and synthesis of relevant peer-reviewed research.

**Time Frame:** Ongoing

**Involved Parties:** All levels of government

**Estimated Costs:** To be determined

**Funding Source:** To be determined

### **REVIEW OF STORMWATER INFRASTRUCTURE DESIGN REGULATIONS**

**Results:** Reviewing and updating stormwater infrastructure design regulations will ensure that infrastructure will be able to withstand hazards they are likely to encounter during their design life.

Current stormwater infrastructure design is a result of federal, state and local regulations. This is discussed in Chapter 7: Current Processes.

Much of the stormwater infrastructure statewide uses a 10-year, 24-hour storm event per the State of South Carolina Regulation 72-300 through 72-316: Standards for Stormwater Management and Sediment Reduction. A regulatory review identifying project-specific factors, such as the consequences of failure, current and future economic feasibility, and environmental impacts should be conducted. Based on the outcome, higher design standards may be warranted.

South Carolina Code Annotated §48-14-40 provides provisions for certain land-disturbing activities to be exempt from the provisions of the Act. These include most agricultural activities, as well as mining, and the construction of individual single-family residences. These exemptions should be reviewed to gain a greater understanding of their potential impacts.

While the above Act and regulations provide minimum standards, guidelines, and criteria, local governments are responsible for implementing local stormwater management programs and may establish stormwater utilities. A comprehensive inventory of existing stormwater regulations across local governments is needed.

An analysis of the current implementation of watershed master plans under §48-14-130 of The Stormwater Management and Sediment Reduction Act should also be conducted.

Long-term cost of natural infrastructure can be lower than gray infrastructure, even if the up front is higher. There are also other benefits to natural infrastructure that can support outdoor recreation/habitat, etc. State and local regulation and planning should identify and remove barriers to permitting nature-based solutions.

**Time Frame:** Ongoing

**Involved Parties:** DHEC, Local Governments, MS4s, and Stormwater Utilities

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## IDENTIFY FUNDING SOURCE FOR MAINTENANCE OF INFRASTRUCTURE PROJECTS

**Results:** Identifying funding sources for maintenance of infrastructure projects prior to construction will ensure that they function properly over the intended life of the project.

SCOR has identified, through conversations with state and local government agencies and community stakeholders have identified lack of maintenance as a major cause of failure of infrastructure. Current federal, state, and local funding sources often do not allow for maintenance costs, therefore funding sources for infrastructure maintenance should be identified.

**Time Frame:** Ongoing

**Involved Parties:** Entities responsible for infrastructure

**Estimated Cost:** To be determined

**Funding Source:** To be determined

## INCORPORATE RESILIENCE INTO PORT INFRASTRUCTURE PLANNING

**Results:** Incorporating resilience into port infrastructure planning will ensure that the port is able to anticipate, absorb, recover, and thrive when presented with environmental change and natural hazards.

Port infrastructure is a critical asset during the disaster recovery period. The future conditions identified in the climate and vulnerability sections of this report should be considered in planning and port infrastructure investments. When identified, investments that increase the resilience of the port infrastructure and operations should be prioritized.

**Time Frame:** Ongoing

**Involved Parties:** SC Ports Authority

**Estimated Costs:** TBD

**Funding Source:** TBD



## MAINTAIN NATURAL PROTECTION THROUGH CONSERVATION

### DEVELOP A PRIORITY FLOOD MITIGATION CONSERVATION MAP

**Results:** Development of a priority flood mitigation conservation map will allow the state to maximize flood protection from conservation dollars spent.

The landscape is the first line of defense for flood hazard mitigation as undeveloped lands provide the essential ecosystem services of water infiltration and stormwater conveyance.

SCOR has used a combination of public and private datasets to better understand the landscape's role in flood mitigation across South Carolina. This data model is targeted at identifying areas where floodwaters are expected, where wetlands can help absorb excess water, and those areas where water is most likely to infiltrate the ground as opposed to creating excess runoff. Protecting these areas may help attenuate the impact that future development has on South Carolina's population. Alternatively, developing these areas could amplify upstream and downstream communities' flooding risks. An in-depth methodology and maps are available in Appendix G.

SCOR will promote the use of this model with partner agencies when evaluating potential land acquisitions as well as use this as a tool to demonstrate to communities the landscape's role in flooding. SCOR will also work to ensure local governments are aware of the availability of the model for the development of comprehensive plans and zoning and land use decision making. Conservation layers will also be available in the coming Resilience Atlas.

**Time Frame:** Ongoing

**Involved Parties:** SCOR, SC Conservation Bank, SCDNR, South Carolina Forestry Commission (SCFC), South Carolina Parks, Recreation, and Tourism (SCPRT), local governments, land trusts

**Estimated Costs:** N/A

**Funding Source:** N/A

### DEVELOP A GRANT PROGRAM TO COMPLETE LAND ACQUISITIONS THAT MAXIMIZE FLOOD REDUCTION BENEFITS

**Results:** Development of a grant program allows for implementation of the Priority Flood Mitigation Conservation Map.

Pending funding availability from state or federal sources, SCOR will establish a grant program for state and local governments and non-profits to acquire properties so that natural flood reductions benefits can be maintained. Potential criteria for grant awards may include:

- Property's location relative to SCOR's Conservation Priority Areas.
- If the property is currently available for purchase.
- If the property meets requirements set forth by the funding source and/or authorizing act.
- Whether there is an identified entity willing and able to hold the land in a way that preserves or enhances the property's long-term flood mitigation characteristics and maintains public access.
- If the property provides conservation values beyond flood mitigation, such as those areas identified by the SC Conservation Bank.
- Priority will be given to properties that face development pressure or land use change that would reduce the flood mitigation characteristics.
- Priority will be given to those areas that have unique landforms or critical habitats, or offer cultural significance.
- Priority will be given to projects that leverage funds from additional state and external sources.
- If the property provides co-benefits identified by federal, state or local partners.

**Time Frame:** Ongoing

**Involved Parties:** SCOR, SC Conservation Bank, SCDNR, SCFC, SCPRT, DHEC, SC Department of Agriculture, local governments

**Estimated Costs:** To be determined

**Funding Source:** Disaster Relief and Resilience Reserve Fund, other state and federal funds

## INCORPORATE RESILIENCE INTO HOUSING RECOVERY

Any future disaster recovery and mitigation action plans, policies, and procedures developed for the State should refer to the principles of the Strategic Statewide Resilience and Risk Reduction Plan. Additionally, the recommendations below will increase the resilience of housing to future disasters. These recommendations are informed by the Recover section of Chapter 7 of this plan, Current Processes, which outlines how federal disaster recovery assistance flows to the state and communities and is managed at the state level.

### REDUCE USE OF MANUFACTURED HOUSING UNITS

**Results:** Replacement of manufactured homes with stick built or modular homes will increase the ability of the housing stock to absorb the impacts of future natural hazards.

Housing recovery plans should state that, where possible, manufactured housing units needing full replacement should be replaced with stick built or modular homes. Exceptions can be made when it is not possible or practical to replace a manufactured home with a stick built or modular home.

**Time Frame:** Ongoing

**Involved Parties:** SCOR

**Estimated Costs:** To be determined

**Funding Source:** State and federal disaster recovery funds

### UTILIZE WIND/IMPACT WINDOWS

**Results:** Using wind/impact windows will increase the ability of the housing stock to absorb the impacts of future natural hazards.

Impact windows should be used when homes are repaired or replaced following a disaster, regardless of the wind zone the home is located in. Exceptions can be made to meet federal, state, or local requirements.

**Time Frame:** Ongoing

**Involved Parties:** SCOR

**Estimated Costs:** To be determined

**Funding Source:** State and federal disaster recovery funds

## INCREASE HOUSING ELEVATION STANDARDS

**Results:** Increasing housing elevation standards will reduce structures' exposure to flood waters.

In areas that are prone to flooding, require replacement homes to have a first-floor elevation built to Base Flood Elevation (BFE) +3 feet. If this requirement would cause the home's first floor elevation to be elevated above 10 feet above land surface, the home would be recommended for replacement and would instead be offered a voluntary buyout. The property would then have a building restriction attached to the deed thereby preventing future development.

**Time Frame:** Ongoing

**Involved Parties:** SCOR

**Estimated Costs:** To be determined

**Funding Source:** State and federal disaster recovery funds

## RESTRICT USE OF DISASTER RECOVERY FUNDS FOR REPAIR OR REPLACEMENT OF HOMES IN FLOOD PRONE AREAS

**Results:** Restricting the use of disaster recovery funds for the repair or replacement of homes in flood prone areas will reduce the risk of future losses.

Housing funds allocated to South Carolina should not be used to repair or construct homes if they are:

- A FEMA Repetitive Loss Property
- Properties in the FEMA Regulatory Floodway
- Properties seaward of DHEC-OCRM Setback Line

**Time Frame:** Ongoing

**Involved Parties:** SCOR

**Estimated Costs:** To be determined

**Funding Source:** State and federal disaster recovery funds

## **ESTABLISH A VOLUNTARY PRE-DISASTER BUYOUT PROGRAM**

**Results:** Establishment of a voluntary pre-disaster buyout program will allow the state to be proactive rather than reactive to reduce the risk of future losses.

The Disaster Relief and Resilience Act requires SCOR to develop an estimate of the current number and cost of residential properties within the State for which a buyout may be appropriate. The following criteria were used to develop this estimate and are proposed for the prioritization of the properties under a pre-disaster buyout program:

- Tier 1: Repetitive Loss Properties in the FEMA Regulatory Floodway & Repetitive Loss Properties Seaward of the DHEC Beachfront Setback Line
- Tier 2: Properties in the FEMA Regulatory Floodway & Properties Seaward of the DHEC Beachfront Baseline
- Tier 3: All Other Repetitive Loss Properties
- Tier 4: First Street “100-Year” Event (Current) with 6+ feet of inundation
- Tier 5: First Street “100-Year” Event (Future) with 6+ feet of inundation

Additional details of SCOR’s estimate can be found in Appendix H.

Developing a voluntary buyout program would require a more detailed analysis and eligibility of individual properties and property owners and would be ultimately determined by the funding source and require collaboration with communities.

**Time Frame:** Ongoing

**Involved Parties:** SCOR, participating communities

**Estimated Costs:** To be determined

**Funding Source:** To be determined

## **IDENTIFY AND MAXIMIZE ALL AVAILABLE FUNDING SOURCES FOR RESILIENCE ACTIVITIES**

SCOR seeks to maximize federal and non-federal funding to South Carolina to implement resilience planning, projects, programs, and policies. This will require coordination, collaboration, and cooperation among state agencies, local and regional governments, non-profits, special purpose districts, and tribal governments.

As noted throughout this plan, resilience covers a wide range of natural and human systems, requiring coordination between stakeholders that have not traditionally worked together.

Collaboration is essential as federal and non-federal sources require recipients to incorporate resilience practices into their projects. Coordination requires the sharing of information and alignment of efforts to encourage organizations to work outside their traditional boundaries, reduce duplication of effort, and maximize benefits. SCOR will operate as a resilience hub to advance resilience initiatives while coordinating with other groups to increase resilience statewide.

More information about funding related to resilience, including sources and current processes specific to the State and SCOR can be found in Chapter 8: Funding.

### **DEVELOP A RESILIENCE FUNDING HUB**

**Results:** Developing a resilience funding hub will enable coordination, collaboration, and cooperation among state agencies, local and regional governments, non-profits, special purpose districts, and tribal governments seeking resilience funding.

Coordinating and obtaining grant funds will further resilience efforts statewide and locally. SCOR recognizes the challenge that many local governments may have in seeking, applying for, and managing funds.

SCOR seeks to support communities by creating the Resilience Funding Hub to collect, coordinate and disseminate information related to funding. The hub, maintained as a web-based portal by SCOR, will provide a better understanding of aspects of funding opportunities. In addition, the hub can be used to highlight how funding sources were utilized for successful resilience projects.

Coordination, collaboration, and cooperation among state agencies is a continued need to implement resilience-related projects, programs, and policies. This coordination should continue to occur with an emphasis on funding coordination including what agencies are pursuing what funding and share opportunities and discuss partnering on them. This

coordination would require a staff person at SCOR who interfaces with all state agencies on how to ensure resilience is addressed and implemented.

**Time Frame:** Ongoing

**Involved Parties:** SCOR, All relevant state and local agencies

**Estimated Costs:** \$150,000 per year

**Funding Source:** To be determined

#### DEVELOP BEST MANAGEMENT PRACTICES FOR COMMUNITIES TO INCORPORATE RESILIENCE INTO FUNDING PROGRAMS AND PROJECTS

**Results:** Developing best management practices will enable communities to incorporate resilient practices in a range of programs and projects.

Many federal and non-federal funding sources require that grant applications and projects incorporate resilient practices. SCOR will develop best management practices on how communities can incorporate resilience into programs and projects. Best management practices will be made available through SCOR's Resilience Hub.

**Time Frame:** 1-5 years

**Involved Parties:** SCOR

**Estimated Costs:** To be determined

**Funding Source:** To be determined