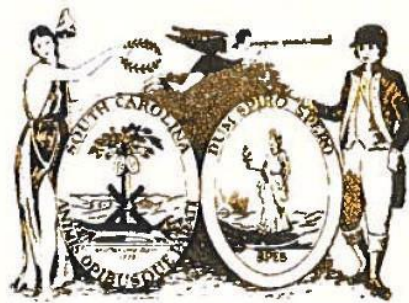




# State of South Carolina



Governor Henry McMaster

Thomas S. Mullikin, Chairman

## South Carolina Floodwater Commission

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# *INITIAL TASK FORCE REPORT FINDINGS*

August 26, 2019

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# State of South Carolina

GOVERNOR HENRY McMASTER



THOMAS S. MULLIKEN, CHAIRMAN

## South Carolina Floodwater Commission

South Carolina has experienced numerous episodes of flooding in recent years – along the coast, rivers, and low-lying interior areas due to rains, storms, hurricanes and tides. Together, these incidents highlight the need for a statewide plan to accommodate and mitigate flooding impacts in the state.

Since Governor McMaster created the South Carolina Floodwater Commission on October 15, 2018, this state has experienced unprecedented collaboration and cooperation among many stakeholders, including subject matter expert academics, agency personnel, senior private sector executives, non-governmental organizations, as well as local, state and federal elected officials. The Governor’s leadership, guidance and direct involvement has inspired thousands of hours of volunteer support addressing the tripartite challenges associated with extreme weather and associated flooding.

Our Commission efforts are dedicated to mitigating flooding and lessening the negative impacts to our state's economy. Our charge is to help people – while facilitating growth, promoting tourism and assisting communities and businesses struggling from repeated flooding events.

Together, we have worked to develop short-term and long-term recommendations to alleviate and mitigate flood impacts to this state, with special emphasis on cities, communities and enterprises located on or near the coast and rivers across South Carolina. We have and will continue to consider all relevant studies, data, reports and expert and lay opinion on storm water management and use, urbanization impact, coastal shoreline fluctuation, project and operational financing, affordability, available grants, appropriate partnerships, and the impact such decisions have upon neighboring cities, counties and states.

We welcome all input, comments, edits and criticisms. Our efforts are not a destination but rather a start to establish a plan to address our “new normal” and determine how best to protect families across our state and establish a position of global leadership.

In Marion County, we demonstrated that we can come together as one state to begin addressing potential strategies. Our commission – working alongside more than 400

volunteers including the Governor, Lieutenant Governor, Congressman Rice, mayors, and members of the General Assembly – succeeding in clearing 25,000 ft of roadside drainage and 1.5 miles of canal. This is how government is supposed to work.

Together, our senior elected, agency, private sector stakeholders and volunteers became one team – for one fight. Now, we are completing an exhaustive report which addresses a resiliency strategy to protect our state. This plan will not recommend expanding government - but rather consolidating resources in order to create cost efficiencies and strategic effectiveness. We will encourage broad private sector participation and seek federal funds to address serious challenges where they may arise. Further, we will ensure a “big tent” approach that will engage all sectors – and all good ideas – across our beautiful and diverse state. We will work with legislative leadership to explain the details of our efforts and allow time for thoughtful consideration. In short, we will move forward as one team to address the complex challenges we face. As one team, we will prepare and execute a plan that provides a bright and protected future for all South Carolinians.

President Reagan recognized that, “If we've learned any lessons during the past few decades, perhaps the most important is that preservation of our environment is not a partisan challenge; it's common sense. Our physical health, our social happiness, and our economic well-being will be sustained only by all of us working in partnership as thoughtful, effective stewards of our natural resources.”

We agree. Please join us at our November 8 meeting, when we will unveil our recommendations in full.

There is no doubt that South Carolina will soon be a world leader in water management. We look forward to working with you as we endeavor to take this state to even greater heights.

### **Public Comment**

The public comment period on the initial task force recommendations will last for 60 days – concluding at 5:00 pm on October 24, 2019. Comments may be submitted via email at [floodwatercommission@governor.sc.gov](mailto:floodwatercommission@governor.sc.gov) or U.S. mail at:

South Carolina Floodwater Commission  
Office of the Governor  
South Carolina Statehouse  
1100 Gervais Street  
Columbia, SC 29201

### **Summary**

A summary of each task force’s initial findings and recommendations follow. The top takeaways of the task force report recommendations include:

## Key Recommendations

1. Continue and enhance development of operational models for addressing deferred maintenance of the state's drainage system. Various stakeholder groups are being engaged for feedback on other flood and drainage projects. To date, the initial draft contains 244 projects from 31 counties and will be ongoing.
2. Incentivize the use of green infrastructure as a cost-effective approach for managing and reducing stormwater at its source, through such methods as tree canopies, stormwater tree trenching, stormwater basins and stormwater wetlands. Planting of native vegetation along the coast in conjunction with beach renourishment projects. Identify high-priority floodplains, wetlands and open spaces through existing maps and analyses on a county by county basis and maintain the flood storage capacity of floodplains, wetlands and critical open space.
3. Construct 1-2 demonstration artificial reefs seaward of coastal areas experiencing shoreline erosion in order to evaluate the impact of the engineered reef system and the protection potential for similar reefs covering significant segments of the coast. Additionally, continuation and investment in artificial oyster reefs to provide both erosion resilience and protection for wetlands and an economic boost.
4. Stabilization of marsh edges by identifying locations coast-wide where living shorelines and other emerging methods may be used to allow marshes to regrow where they have been eroded, and replenish marshes not keeping up with sea-level rise. Identifying and conserving transition areas for future marsh movement inland.
5. Consolidation of state resources to create greater efficiencies and cost effectiveness. Coordination among multiple state agencies to develop a comprehensive, science-based regulatory process to address the design of living shorelines and streamline permitting processes where possible.
6. Grid protection through undergrounding of some distribution circuits and hardening the overall transmission systems to increase the stability of the grid in areas along with streamlining stricter vegetation management to protect the power lines. Additional Grid protection through continued development of Distributed Energy Resources (DERs), Microgrids and integrated planning.
7. Developing and coordinating of the sharing of available river modeling data, optimizing the modeling and then utilizing these results for development

planning, emergency planning, and emergency operations. Shared modeling will allow South Carolina to develop in an ecologically friendly manner that reduces the potential for damage from flooding. Build in control structures in the development and operate as part of the Smart River Operations with the goal of preparing real time smart river topography for the coordination of actions by states, counties, local authorities and private companies and individuals based on modeling before during and after emergencies.

8. Ensuring that military facilities better withstand flooding and severe weather issues by coordination with the Department of Defense (DoD) to make appropriate changes to installation master planning, design, and construction standards including efforts to better understand rates of coastal erosion, natural and built flood protection infrastructure, and inland and littoral flood planning and mitigation.
9. Development of flood water channelization and the construction of reservoirs to assist with flooding while providing regions with lakefront property, business and recreational opportunities and energy.
10. Development of a capacity building program to assist under-resourced local governments in identifying solutions and developing a plan and applying for federal funding. Timeliness of the release of federal disaster funds allocated to the state from the recent disaster relief bills is important to South Carolina's recovery from the devastation of storms. It is essential that efforts on initiatives to help recovery and preparation for the future be coordinated and data collection be shared at all levels.

## **ARTIFICIAL REEF SYSTEMS TASK FORCE**

### **MEMBERS**

**Alvin A. Taylor (Chair)**

Director of South Carolina Department of Natural Resources (Retired)

**Dr. Will Ambrose (Secretary)**

Vice Dean of the School of the Coastal Environment at Coastal Carolina University

**Barbara Bellamy**

Mayor of Conway, South Carolina

**Brendon Barber**

Mayor of Georgetown, South Carolina

**Representative Heather Crawford**

South Carolina House of Representatives

**Representative Jeff Bradley**

South Carolina House of Representatives

**Major Glenn Hamm**

South Carolina State Guard

**Mark Robertson**

The Nature Conservancy



## **PURPOSE**

The purpose of the Artificial Reefs Task Force is to assess the suitability of artificial reefs to help prevent erosion along the South Carolina coastline to protect against floods by: reviewing current knowledge of artificial reefs and their potential in South Carolina; laying out a plan to deploy and evaluate the effectiveness of a test reef; and considering the issues involved in using artificial reefs on a large scale.

## **BACKGROUND**

Beach preservation is a common strategy for shoreline protection and serves to restore the beach and dune system, as well as its storm-surge-barrier and ecosystem functions. This process involves the implementation of coastal management techniques such as beach nourishment, sand dune restoration using sand fencing and native vegetation, beachfront construction control using setback lines and rebuilding rules, landward movement and/or removal of habitable structures, and the conservation of undeveloped shoreline.

Beach preservation is not limited to the foregoing, however; other methods exist for mitigating the effects of coastal erosion and flooding on coastal communities. These include: installing living shorelines, a form of soft or natural stabilization; and sinking artificial reefs or submerged breakwaters, which is a difficult engineering solution but one that takes place off the beach and lacks many of the negative impacts incurred by shoreline armoring.

## **FINDINGS / RECOMMENDATIONS**

The task force analysis outlines several challenges in establishing an artificial reef for shoreline protection along the South Carolina coast including: Financial Analysis, Engineering Analysis, Environmental Impact Analysis, Navigation/Safety and National Security Analysis.

Upon considering these challenges for constructing an artificial reef for shoreline protection along the South Carolina coast, the Artificial Reef Systems Task Force recommends the following:

1. Consolidate state assets that are devoted to studying and establishing artificial reefs along the coast to mitigate erosion and flooding. Both OCRM and SCDNR Marine Resources Division currently have extensive knowledge of artificial reefs in South Carolina for marine/fishery purposes.
2. Determine to what extent the U.S. Army Corps of Engineers (USACE) can assist the effort by helping to evaluate and assess the feasibility and effectiveness of an artificial reef extending along significant portions of the South Carolina coast and to what extent the USACE Authorities may be utilized to access federal funding for engineering studies.

3. Charge the South Carolina institutes of higher learning in coordination with other institutes of higher learning across the United States with developing a graduate program to study the effects of submerged breakwaters on wave energy dissipation for the purpose of utilizing the findings in engineered artificial reefs in South Carolina.
4. Construct 1-2 demonstration reefs seaward of coastal areas experiencing shoreline erosion. This would involve:
  - a. Identifying suitable areas.
  - b. Conducting a study of the coastal morphology and hydrodynamics of the areas if they do not already exist.
  - c. Engineering an artificial reef(s).
  - d. Obtaining local, state, and federal permits.
5. Construct and deploy the reef(s) and evaluate the impact of the reef for its desired effect and for additional impacts as outlined above. Reefs should be studied for long enough to include seasonal changes in coastal conditions and episodic events such as storms and hurricanes.
6. In conjunction with steps 1, 2 and 3, coordinate with local municipalities and NGOs to address their needs and concerns regarding the initial demonstration reef(s) and the potential for reefs covering significant segments of the coast.
7. In conjunction with steps 1, 2, and 3, conduct the necessary studies to assess the environmental impacts of an extensive, nearshore artificial reef.
8. Design additional reef(s) covering significant portions of the South Carolina coast based on the results from the demonstration reefs.

The models for combining local, state, and federal funding for beach nourishment might be adapted to construct artificial reefs. Legislation and regulatory amendments may be needed to accommodate artificial reefs designed primarily for shoreline protection which are close enough to shore and the sea surface to be effective in stabilizing beaches.

As an alternative, the task force suggests establishing an institute within the South Carolina university system devoted to studying the ramifications of and working towards the establishment of an extensive artificial reef. This approach has the advantages of including an educational component in the process and engaging geologists, biologists, engineers, attorneys, and policy experts in an interdisciplinary effort. The charge of such a 'center of excellence' should also be broadened to include the work of other Floodwater Commission task forces (e.g. Living Shorelines) and could greatly enhance our general understanding of South Carolina's coastal ecosystem beyond the study of methods for floodwater control and mitigation.



# **LIVING SHORELINE TASK FORCE**

## **MEMBERS**

### **Dr. Paul Gayes (Chair)**

Executive Director of the Burroughs and Chapin Center for Marine Systems Science  
Coastal Carolina University

### **Sharon Richardson (Secretary)**

Audubon Society

### **Dr. Nicole Elko**

President of Elko Consulting, Inc.

### **Dr. Robert Young**

Western Carolina University

### **Mark Robertson**

The Nature Conservancy

### **Dr. Till Hanebuth**

Associate Professor, Coastal Carolina University

### **Joy Brown (Liaison)**

The Nature Conservancy

## **PURPOSE**

The Living Shoreline Task Force was charged with identifying the potential for Living Shoreline applications as relates to:

1. Helping reduce erosional pressures along various types of shorelines across the state;
2. Enhancing the resilience of properties and communities in the face of increasing vulnerability to flooding;
3. Contributing to restoration of important ecosystem functions in areas impacted by land use change and erosional/storm pressures (e.g. habitat, water quality, sustainable natural resource utilization, etc); and
4. Being incorporated within other flood mitigation strategies and associated engineering and landscape modifications towards a more integrated, systems-oriented approach to addressing flooding and other changes.

## **BACKGROUND**

Living shorelines seek to restore or enhance natural habitat functionality and resistance to erosional pressures. Traditionally, they are focused on estuarine and salt marsh settings and are designed to emulate coarser or partially cemented materials such as oyster bars that are considerably more resistant to erosion by waves and currents than the surrounding fine-grained materials found in mud-flats and adjacent habitats. Similarly, erosion resistant materials such as dense mats of plant root structures can also be simulated. These rooted structures help bind sediment that otherwise could become mobilized routinely by wave and current energy.

The Living Shoreline Task Force has explored living shoreline applications, the regulatory framework for living shorelines, as well as a range of shoreline types to consider potential applications of living shoreline concepts beyond the traditional estuarine/marsh system. Action items include: 1) improving the efficacy of, and establishing best practices for, traditional living shoreline applications in estuarine and marsh settings in South Carolina; 2) establishing an effective and efficient regulatory structure and pathways to managing and permitting living shoreline applications in the state; and 3) identifying other areas or potential applications of living shoreline approaches to mitigate undesirable outcomes in the considerably broader range of shoreline environments beyond marsh and estuarine settings.

## **FINDINGS / RECOMMENDATIONS**

### **1. Traditional Living Shoreline Applications**

The proposed resilience strategy for traditional applications include:

- Complete a coast-wide assessment and correlation of shoreline erosion rates, social vulnerability data, and critical infrastructure vulnerable to flood and storm impacts to identify the most vulnerable and important areas where salt marsh protection and restoration is needed. Study oversight and participants could include: the South Carolina Emergency Management Division, the South Carolina Disaster Recovery Office, the South Carolina Department of Transportation, DHEC, DNR, The Nature Conservancy (TNC), and academic institutions;
- Identify locations coast-wide where living shorelines and other emerging methods will be most beneficial to stabilize marsh edges, allow marshes to regrow where they have been eroded, and replenish marshes not keeping up with sea-level rise;
- Assess the feasibility and benefits of additional methods to sustain vulnerable salt marshes, such as thin-layer sediment application;
- Identify funding sources for living shoreline and salt marsh protection and restoration. For example, FEMA or HUD disaster mitigation funds, modifications to wetland mitigation procedures to include living shorelines and salt marsh enhancement (e.g., thin-layer sediment application);
- Keep current intact marshes undeveloped into the future; and
- Identify and conserve transition areas for future marsh movement inland.

## **2. Living Shoreline Regulatory Framework and Best Practices**

The lack of specific project standards or regulatory definition for living shorelines has resulted in longer permit review times, loose design requirements, and potentially ineffective projects. To address these gaps, the SC Department of Natural Resources and ACE Basin National Estuarine Research Reserve (NERR), in coordination with DHEC's Office of Ocean and Coastal Resource Management (OCRM), are undertaking a multi-year strategy to develop a comprehensive, science-based regulatory process to address the design of living shorelines and streamline the permitting process where possible. This strategy includes an ongoing research project involving the installation, monitoring and evaluation of oyster-based living shoreline projects. The study will comprehensively analyze optional living shoreline designs specifically suited to South Carolina and evaluate performance under varying physical and environmental conditions.

Information gathered from this study will be used to determine regulatory options to streamline and simplify authorization of living shoreline installations. A simpler

permitting process may encourage property owners to use living shorelines as an alternative to hardened erosion control structures, which has the potential benefit of creating marsh and reducing the negative impacts that can result from hardening estuarine shorelines.

### **3. Diverse Shoreline Types and “Systematic Engineering and Infrastructure” Potential Applications Beyond Estuaries/Marsh**

Application of the living shoreline concept of restoring or enhancing natural habitat functionality and resistance to erosional pressures has traditionally been focused on estuarine and salt marsh settings. There are, however, a wide range of other forms of shorelines more broadly distributed across the state that collectively span all regions under pressure from flooding. These include natural and constructed environments such as river flood plains, wetlands, storm-water retention ponds, and lakes as well as open ocean shorelines. In addition to potential for erosion and loss of land, restoration of enhanced shoreline habitats and associated ecosystem services may play important roles in water and overall environmental quality locally.

#### Floodplains

There presently exist vast areas of the state composed of largely undeveloped flood plains and wetland areas. The state and local communities could incentivize reduction of future risk and cost by sustaining existing hydrologic storage and environmental quality functions of these vast areas. That is most directly accomplished by reducing or eliminating new development within both floodplain and bottom lands. Permitted development should be designed to be minimally impacted when the site is flooded and isolated for extended periods.

#### Stormwater Retention Ponds and Other Short to Long Term Storage

A comprehensive inventory and assessment of storm water retention ponds was recently completed by researchers at USC, Sea Grant and others. Such retention ponds seek to emulate natural short- to mid-term storage capacity of modest rain events and water quality functions of wetlands and flood plains. At present, there are estimated to be 14,000 stormwater retention ponds in the SC coastal region. There is an opportunity to build on the recent body of work related to both the water quality and ecological functionality of this primary tool to address local flooding associated with small to modest scale events. There may be opportunities to consider larger but distributed storm-water retention capacities within uplands and developments.

#### Groundwater

Groundwater is another significant reservoir that can modulate runoff and affect flooding across several spatial and temporal scales. Considerable concern and

resources have gone into reducing the amount of impervious surfaces that accelerate the discharge of local runoff downstream in urbanized areas. In effect, increasing use of pervious surfaces whether through conservation or materials used in roads, parking lots and other developed surfaces seeks to restore or enhance natural infiltration of precipitation within a potentially large, but still finite, shallow groundwater system. Slow flow of water through the groundwater system helps reduce the rates of initial flows into the drainage network during events. The water eventually returns to the surfaced drainage over the long term, also helping to moderate water levels within the system during dry periods.

It is recommended to convene a panel of experts in storm water retention ponds, storm water management, groundwater, wetland restoration and related areas to consider the potential of integrated hydrologic management to determine a series of recommendations related to best practices that are working or could work better and need to be reconsidered.

### Ocean Front Shoreline

Communities across the state and nation have committed to beach nourishment as a primary means to combat the threat of erosion and flooding to coastal property and communities. Beach nourishment seeks to modify the rate of sediment input to a section of the coast to replace volume of sand lost from the cell from waves and currents to adjacent cells or the active beach system as a whole. One of the first order defenses from property damage and coastal inundation is the presence of a large, healthy sand dune complex forming a barrier to inundation well above mean sea level. Beachfront sand dunes are an example of a living shoreline with which the state has some experience and success. Parallels between oceanfront sand dunes and estuarine living shorelines include dunes functioning as important flood reduction barriers and ecosystem features, the presence of a dense growth of living dune vegetation and their roots which help bind sediment.

Renourishment and dune restoration should be considered as mid-term strategies to a long-term problem. It is likely that for some areas these will remain effective for decades to come. For other areas, the costs and relative benefits of renourishment strategies may approach marginal returns as increased pressure from storms and competition for sand resources alter the cost of this form of emulating a natural system. Regardless, rising sea levels present a longer-term threat to coastal property and economies. Continued review of the viability of holding ocean shoreline through these constructed environments should remain ongoing.





# **INFRASTRUCTURE AND SHORELINE ARMORING TASK FORCE**

## **MEMBERS**

### **Christy Hall (Chair)**

Secretary, South Carolina Department of Transportation

### **Marguerite McClam (Secretary)**

Palmetto Consulting and Engineering Group

### **Dr. Richard Viso**

Director, School of Coastal and Marine Science, Coastal Carolina University

### **Bryan P. Stirling**

Director, Department of Corrections

### **Kim Stenson**

Director, Emergency Management Division

### **Jay Faison**

ClearPath Foundation

### **Senator Stephen Goldfinch**

South Carolina Senate

### **Representative William Cogswell**

South Carolina House of Representatives

### **Alan Williams**

Academic Program Manager, Trident Technical College

### **Sel Hemingway**

Administrator, Georgetown County

### **Dr. Robert Young**

Western Carolina University

### **Mark Robertson**

The Nature Conservancy

## **PURPOSE**

The purpose of the Infrastructure and Shoreline Armoring Task Force is to focus on the drainage and flow infrastructure, as conveyance of water in the urban and rural environments as well as inland and coastal shoreline armoring.

## **BACKGROUND**

### **Drainage Infrastructure**

Every community has a drainage system that conveys surface water from where it falls through various channels to a receiving body of water. The drainage system is typically a combination of natural channels and man-made elements such as ditches, pipes and inlet structures.

A community's drainage system typically covers a large area and includes drainage elements such as pipes, drop inlets, ditches, stream channels and retention/detention ponds before the system empties into a larger body of water such as a river or lake. Since the system can be vast, it will often involve many entities, each with their own level of responsibility with regards to maintenance. It is common for a drainage system to involve privately-owned elements, municipal-owned elements, county-owned elements, state-owned elements and occasionally, elements that fall under the jurisdiction of the federal government.

Deferred maintenance on any of the elements of the drainage system may impact the overall performance of the drainage system. In order for the system to function at its full designed capacity, it is necessary to ensure that the system is clean and clear of obstructions and make repairs to any damaged element. Removal of debris, replacement of crushed pipes and re-establishment of proper slopes on ditches are typical maintenance items encountered with drainage infrastructure.

South Carolina has experienced multiple, successive natural disasters over the past several years which has resulted in the accumulation of a significant amount of debris in some of our communities, including within the drainage systems. The debris issue, coupled with deferred maintenance, has the potential to impact the overall ability of the drainage system to effectively convey water in some communities of the state. While addressing deferred maintenance on the existing drainage system will not prevent flooding during significant flooding events, it is expected to aid in properly draining communities during normal weather events as well as enable floodwaters to recede at potentially faster rates in the future.

Therefore, the Infrastructure and Shoreline Armoring Task Force has determined that it is appropriate to initially focus its efforts on formulating a systematic process to evaluate, prioritize and coordinate locally identified needs relative to maintenance of the existing drainage infrastructure. This systematic approach is designed to be locally-driven and

bring the various owners of the drainage infrastructure together in a collaborative manner in order to effectively and efficiently address the prioritized needs. Resident and volunteer groups may also engage in these efforts.

A pilot program for these locally-led task forces has been initiated in three counties: Charleston, Marion and Georgetown. The task force in Charleston county was the first one established through the vision of the legislative delegation in order to ensure proper communication and coordination amongst the various governmental bodies and home owners associations to resolve drainage concerns. Marion and Georgetown counties were selected in order to formulate a collaborative approach in counties with small public works departments and limited local government funding available to tackle drainage maintenance.

As mentioned earlier, a locally-driven, systematic approach is needed in order to bring the various owners of the drainage infrastructure together in a collaborative manner and prioritize the work. This systematic approach is accomplished through the formulation of Local Task Forces, which is comprised primarily of local and state government technical staff and charged with identifying the areas of concern, prioritizing the needs, developing a work plan and working collaboratively to resource the work plan.

### **Shoreline Armoring**

This task force has also considered shoreline armoring and stabilization methodologies that balance the needs of manmade protection and that of natural systems. These areas may be found along the coast or the state's inland waterways and could involve areas of considerable development or critical infrastructure. Along the coast of South Carolina, hard armoring such as the construction of bulkheads, seawalls, and other barriers have been debated at a policy level for many years. The Task Force will provide information on the tools in the shoreline armoring toolbox. Additionally, there may be opportunities to identify critical infrastructure and other key areas of concerns outside of the coastal zone that could benefit from a shoreline hardening project.

The goal for shoreline armoring for flood hazards is to promote public health, safety and general welfare by minimizing public and private losses due to flood conditions in specific areas and by maintaining and restoring natural flow patterns. Flood management armoring should be located, designed, constructed and maintained to protect: the physical integrity of the shoreline and properties that may be damaged by alterations to the geo-hydraulic system; water quality and natural groundwater movement; fish, vegetation and other life forms and their habitat vital to the aquatic food chain; and recreation resources and aesthetic values such as point and channel bars, islands and other shoreline features and scenery.

## **FINDINGS / RECOMMENDATIONS**

In order to achieve the following objectives:

To reduce the vulnerability of localized flooding by maximizing the effectiveness of flow infrastructure for water drainage;

To engage drainage system owners through the formulation of local task forces, comprised of state, local governments and citizens, with a shared mission and vision of addressing deferred maintenance and implementing a regular maintenance plan;

To develop a tool box for asset owners considering shoreline armoring;

And, to identify potential candidates for “armoring” outside of the coastal zone through the careful use of site-specific methodologies that balance the needs of manmade protection and those of natural systems.

The Task Force recommends the following:

Formulation of Local Task Forces on a pilot program basis for an urban and rural area of the state.

Through the work of the Local Task Forces, identify culverts, ditches, and other existing water drainage and flow infrastructure in need of maintenance.

Through the work of the Local Task Forces, prioritize the needs associated with the identified deferred maintenance items relating to culverts, ditches, and other existing water drainage and flow infrastructure.

Through the work of the Local Task Forces, develop a work plan to address the prioritized needs associated with the identified deferred maintenance items relating to culverts, ditches, and other existing water drainage and flow infrastructure.

As required by the Local Task Force work plans, solicit community volunteer groups to assist in cleaning drainage structures.

As required by the Local Task Force work plans, replace undersized and/or collapsed culverts.

Review and provide recommendations for South Carolina non-coastal shoreline areas which may benefit from armoring while considering site-specific stabilization methods that balance the needs of the public with the needs of the natural system.

Review existing SC flooding and vulnerability studies and conduct a gap assessment.

## **SMART RIVERS AND DAM SECURITY TASK FORCE**

### **MEMBERS**

**Major General (ret) Robert Livingston (Chair)**  
Adjutant General (Retired)

**Dr. Leonard Pietrafesa (Secretary)**  
Research Scholar, Coastal Carolina University

**Marshall Taylor**  
Acting Director, South Carolina Department of Health and Environment Control

**Dr. Hanif Chaudhry**  
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**Dr. Inthuorn Sasanakul**  
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**Dr. Duke Brantley**  
Acting Director of the Earth Sciences and Resources Institute, University of South Carolina

**Dr. Jeffrey Allen**  
Executive Director of the South Carolina Water Resources Center, Clemson University

**Senator Kent Williams**  
South Carolina Senate

**Representative Richie Yow**  
South Carolina House of Representatives

**Marguerite McClam**  
Owner, Palmetto Consulting Engineering Group, Inc.

**Sel Hemingway**  
Administrator of Georgetown County

**Dr. Erfan Goharian**  
College of Engineering and Computing, University of South Carolina

## **PURPOSE**

The purpose of the Smart Rivers and Dam Security Task Force is twofold: combine datasets and multiple models, and identify data and modeling needs, to produce better flood mitigation planning and management, and review the status of the state's dams and make recommendations for safety and reliability for flood mitigation.

## **BACKGROUND**

Massive flooding was experienced across South Carolina from the five recent hurricanes, and coastal flooding is now occurring during higher high tides, as so-called "nuisance flooding" and the potential for coastal inundations due to offshore events, such as tsunamis and meteo-tsunamis, also exist. Finally, public health issues have arisen resulting from floodwaters and standing water. The Task Force is focused on building a next-generation cyberinfrastructure and a community for modeling and analysis practices, to better inform the citizenry of South Carolina.

The modeling is expected to cover periods prior to the arrival of a storm and then during and following the storm's passage. The intention is to provide visualized, validated model guidance to emergency managers and decision makers, up to the Office of the Governor, for informed planning and evacuation scenarios to save lives and property of residents of South Carolina utilizing cyberinfrastructure. The report provides a complete report on modeling. Among the topics covered are the following:

- What defines a "model";
- Explanation of the necessary models including purposes and limitations;
- Coverage of current models;
- Gaps in models and what is needed to fill in the gaps;
- Needed models including areas that need to be modeled and new forms of modeling;
- How to coordinate modeling and prevent or circumvent duplication;
- Planning models versus emergency models;
- Access to models and model output by all interested parties;
- Existing data required to initialize the models and to validate the model outputs;
- Additional data required to conduct the modeling;
- Computer platforms required to conduct the modeling;
- Examples of various model outputs;
- The conduct of model retrospectives;
- Real-time visualization of model outputs;
- Hierarchy of players that will communicate and explain the model outputs;
- Public health issues;
- Utility of artificial intelligence;

- Explanation of model outputs;
- Estimated costs of the entire modeling enterprise;
- Proof of application of the various models and model systems under prior well-documented storm events such as Hurricanes Joachim (2015), Matthew (2016), Irma (2017) Florence (2018) and Michael, by way of example. One size does not fit all.

The Task Force addressed four major topics and an overall goal:

- The need to better integrate extreme events in flood modeling, broadly defined. Low-probability, high-magnitude events often dictate landscape form and have the potential to reset the directionality for long-term change. However, presently existing and operational models might not run on spatial or temporal scales that capture such a hazard.
- Human actions across South Carolina can trigger or magnify natural flood hazards in an evolving landscape. A “cyberinfrastructure” to better integrate multiple models and data is required. For example, cascading natural flood hazards are common. Although many single-hazard models exist, almost none are capable of integrating across hazards, which is a necessity to truly assess risk. Coupling frameworks can accommodate for this.
- Interdisciplinary research is necessary. Modeling the evolution of landscapes for risk assessment requires incorporating human dynamics. Human actions can trigger or magnify natural hazards in an evolving landscape. There is value, therefore, in having the human factor integrated or coupled to environmental models.
- Developing strategies for model testing, validation and benchmarking against natural flood disasters, as they happen and immediately thereafter, with the recent explosion in data acquisition, remote sensing data would provide insight into model uncertainty and to what extent models can be implemented.
- The overall goal is to Weather Proof South Carolina, in the sense of providing validated trustworthy and dependable, advanced, visualized and detailed numerical model output across the state.

## **FINDINGS / RECOMMENDATIONS**

A consensus among task force members was reached of the critical nature of sharing modeling across all stakeholders. Modeling should not be used just to drive emergency operations but also help all stakeholders make appropriate development decisions. This predictive intelligence may be used to guide development and property use, proactive preparation for water events, response to water events and recovery water events.

Many agencies have been modeling SC river and coastal flooding for many years. The



effect of that modeling has helped the state in very specific areas, but the data is not widely known or utilized. We must begin sharing the data, optimize the modeling and then use the results for development planning, emergency planning, and emergency operations. Shared modeling allows SC to develop in an ecologically friendly manner that reduces the potential for damage from flooding. Control structures can be built into development and operated as part of the smart river operations. Operation of new and existing control structures must be coordinated across all levels of government and the private sector. Keys to successful use of modeling lie in model coordination, sharing and optimization; use of models to guide development; providing control structures at every level to include automation according to the modeling; and coordination of actions by states, counties, local authorities and private companies and individuals based on modeling before during and after emergencies.

In addition, meteorological stations and other environmental data sources should be installed in all areas of the state that are currently without data sources. This will increase modeling and forecasting accuracy significantly and is critical for emergency planning, response, and flood prevention at all levels of government and the private sector, as well as enabling more intelligent development. This is one of the least costly solutions with the largest pay-off for providing critical information.

The modeling would also give a good look at the value of coordination among dam owners, from private to those regulated by the Federal Energy Regulatory Commission (FERC). During the recent flooding events, most owners prior to the floods did not coordinate with each other even at the FERC level. The modeling information would give responsible agencies the information to make regulatory changes and recommended legal changes. It could even drive coordinating private dam water release for water quality and quantity along major tributaries. It would certainly provide conversation between state agencies, major dam owners and states about water release coordination pre-, during and post events.

The Task Force believes the key to dealing with flood waters and other natural events is intelligent development by private and governmental entities that works with the environment to control the quantity and quality of water and enables the channeling of those events where possible. That intelligence should be coordinated by an entity that has the ability to influence public and private partners to prepare the information. That entity should have no agenda other than to provide the best information to all parties and to encourage collaboration across all sectors. Other parties and agencies have the responsibility to properly respond to the information provided by the modeling.



## **GRID SECURITY TASK FORCE**

### **MEMBERS**

**Keller Kissam (Chair)**

President of SCE&G

**Senator Thomas C. Alexander (Secretary)**

Chairman of the State Regulation of Public Utilities Review Committee

**Babs Warner**

Vice President of Legal Services Santee Cooper

**James Clark**

President of South Carolina State University

**Ben Duncan**

Program Director of the South Carolina Disaster Recovery Office

**Major General Robert Livingston**

South Carolina Military Office

**V. Nelson Peeler (Liaison)**

Senior Vice President and Chief Transmission Officer of Duke Energy

**Henry Sideris (Liaison)**

Chief Distribution Officer of Duke Energy

## **PURPOSE**

The Grid Security Task Force was tasked to examine and explore possible ways to best mitigate flooding issues as related to the protection of South Carolina's electric grid giving priority to efforts directed towards hardening and modernizing the grid itself with an emphasis on disaster prevention, service survivability, and rapid recovery.

## **BACKGROUND**

Electrical power is typically generated through a variety of renewable and non-renewable means and sent via transmissions lines to substations, which condense the voltage levels, so power can be supplied through distribution lines to end use customers. Generation, transmission, and distribution are the three major systems involved in ensuring that customers will have reliable power at all times.

South Carolina's bulk electrical, intermediate, and small voltage systems span over 16,700 miles of transmission lines, sending power from power plants to the various networks. Approximately 125,000 miles of distribution lines across the state supply power directly to customers. Together, these lines dispense power from the various power plants, supplying power from nuclear, coal, natural gas, hydroelectric, and renewable power sources around the state. Understanding the vulnerability of South Carolina's electrical grid is vital to assessing the outage problems that citizens stand to face and to building resiliency within the state's infrastructure.

The United States' electricity delivery system is more than 100 years old and many of the transformers, capacitors, and voltage regulators have been in place for several decades. This infrastructure is fundamental but shows signs of an increasing difficulty to maintain as it continues to age. Needs continue to arise and increase as the state's population grows. Our current power grid faces demands to grow energy resources, create a more reliable electrical system, and continue hardening/securing the grid as new requirements arise.

Weather related power outages remain the leading cause of outages on the bulk electrical system. Natural events, including severe storms and flooding, have traditionally posed the greatest challenge to the reliability of the electrical grid. A 2018 Department of Energy study noted that while severe weather only accounted for 51 percent of outage events, they affected 92.4 percent of all customers. A 2009 study noted that an eight-hour interruption cost the average residential customer \$10.60 but increased to \$5,195 for a small commercial customer and nearly \$70,000 for a medium industrial customer.

While downed distributions lines can result in the simple loss of power to a handful of individual customers at a time, the larger reality of the state's electrical grid carries a far greater weight. Prolonged outages can result in devastating effects to communities throughout our state. As water treatment facilities begin to fail, raw sewage is released directly into local waterways, contaminating drinking water. Hospitals are forced to

evacuate all of their patients with a risk to those in delicate conditions as power is lost. Cell phones and internet accessibility begin to fail, making it difficult to communicate with those in flooded areas. In urban areas, high rises will face struggles as large populations lose power at once; while in more rural environments, well water will be difficult to recover. Elderly, disabled, and low-income citizens may be hit harder than most as they, and the rest of South Carolina's flood impacted citizens, struggle to overcome the devastating effects that such natural disasters can impose.

## **FINDINGS / RECOMMENDATIONS**

The task force analysis determined several areas of focus for consideration and recommended courses of action.

1. Flood Zone Mapping
2. Distributed Energy Resources (DERs)
3. Integrated Planning
4. Undergrounding
5. Emergency Power Supply Systems
6. Microgrids
7. Vegetation Management
8. Funding

### **1. Flood Zone Mapping**

NOAA, National Weather Service (NWS), and several other groups possess data driven maps related to flooding across the United States. However, with more resources available to South Carolina's scientists, planners, and citizens, preparing for flooding disasters throughout the state could become even more effective. In this regard, several mapping models could be emulated throughout our state:

- Flooding Inundation Mapping and Alert Network
- Coastal and Inland Flooding Observation and Warning Project
- Flood Risk Information System
- The Hurricane Genesis and Outlook (HUGO) Model and the Southeast Atlantic Econet (SEA Econet)

### **Recommendation**

Any of the above mapping and alert systems would be excellent models for South Carolina to build upon by partnering with groups like the U.S. Geological Survey, the National Severe Storms Laboratory, the Flood Risk Information System, and Coastal Carolina University (HUGO and SEA Econet) to gather more data from rivers and coastal waterways. Creating better mapping and alert systems for floodplains throughout South Carolina will allow for more effective preparation to protect life and property during future flooding scenarios.

## 2. Distributed Energy Resources (DERs)

DERs “include demand response, efficiency programs, and other demand-side management tools, as a [demand generation] such as solar photovoltaic installations, small wind turbines, combined heat and power, fuel cells, micro-turbines, and storage devices such as large lithium batteries or grid-connected electric vehicles (EVs).”

South Carolina’s Distributed Energy Resources Program Act was passed in 2014 (Act 236) to address the growing need within the state to develop and integrate DERs. Since the passage of the Act, South Carolina’s solar capacity has seen a 9,000% increase from July 2015 to July 2018, rising from approximately 5MW to 470MW. In part, this was accomplished not only by Act 236, but by federal investment tax credits for solar, state tax credits, the declining cost of renewable energy, utility incentives, and the involvement of the Public Utility Regulatory Policies Act of 1978 (PURPA). As of 2017, South Carolina was second, behind only Florida, in installed solar capacity.

### Recommendation

While Act 236 has been under recent review and revision in parts, continuing to develop activity under the Act to benefit both the development of DERs and energy storage could be extremely beneficial to mitigate power outages and bolster the electric grid within South Carolina.

## 3. Integrated Planning

Joint efforts between local governments, emergency services, and community stakeholders can help mitigate loss of life and property damage during natural disasters, such as flooding or severe storms.

### Recommendation

Each community in South Carolina is recommended to have a clear and concise community plan that will cover response to natural disasters and recovery efforts in their aftermath. Communities should take special effort in including emergency services in this planning process to help ensure a clear response and recovery effort from all parties involved.

## 4. Undergrounding

Undergrounding of electrical lines has become more common practice in recent years. While some estimates of the process can be costly, studies note that when underground installation of electrical lines are entrenched with other utilities, like natural gas or telephone, then costs may be reduced.

SC House Bill 3628 - Proposed 2019 House Bill 3628 would require that all electrical utilities operating in South Carolina would have to bury all new transmission lines beginning January 2, 2020 and would have to bury all existing transmission lines no later than January 1, 2025. This bill could decrease the

state's risk of cascading outages from downed or damaged transmission lines. However, 80% of all power outages are caused by damage to distribution lines. When distribution lines are undergrounded, there is an improvement of 10 times.

### **Recommendation**

Current proposed legislation aims to underground transmission lines in hopes of preventing the large-scale blackouts which could leave many customers around the state without power. This legislation could be beneficial in mitigating outage problems associated with flooding and severe storms. Encouraging the undergrounding of some distribution lines – where possible - could greatly increase the stability of the grid in areas where vegetation or other causes lead to frequent outages.

## **5. Emergency Power Supply Systems**

Loss of power to necessary facilities can be extremely detrimental to patients in critical care and cause precarious evacuations to occur in hopes of protecting lives.

SC House Bill 3282 – Proposed House Bill 3282 would require nursing homes and community care facilities to be equipped with an emergency generator. In addition to healthcare facilities, some municipal buildings, police stations, records facilities, fire stations, emergency dispatch centers, prisons, mental health facilities, locations involving any number of hazardous materials, high rises, and airport traffic control towers all have some varying need for emergency power.

### **Recommendation**

Advancing legislation requiring necessary facilities to have some form of backup generation will help protect the essential systems that can be detrimentally affected in the event of natural disasters. Backup generation can make the difference between life and death, whether by helping avoid dangerous evacuations or keeping emergency services active when they are needed most.

## **6. Microgrids**

Microgrids are small scale energy systems that are capable of maintaining stable service within a limited area. Microgrids can be used to power small communities, with operators sharing power to others, or as a form of backup power to be used in case of emergencies.

Recent legislation in other states could serve as a basis for creating predictable microgrid interconnection rules with clear time frames. Example language could “allow microgrid owners and operators to explore more options without the unrealistic requirement that they be regulated like a utility if they serve properties not immediately adjacent to one another.” Such bills lay groundwork for connecting microgrids to the larger distribution grid structures and clarify how operators will be compensated for energy that is imported or exported. Owners

and operators of microgrids can contribute to load shifting and demand response programs that could provide additional value for the parties involved.

**Recommendation**

Developing legislation to expand the use of microgrids throughout South Carolina could increase the amount of renewable energy produced by the state and help increase service survivability during natural disasters that threaten the security of a large distribution grid.

**7. Vegetation Management**

As vegetation becomes better maintained, distribution lines have a lower risk of being detrimentally impacted during natural disasters and the grid they are a part of becomes more resilient. Through streamlining the process and requiring stricter vegetation management which would call for a greater coordination effort on the part of cities, counties and utility companies.

**Recommendation**

Modeling legislation for distribution lines on FERC-003-4 and allowing for supervision of individuals outside of the sole employment of utilities in South Carolina could allow communities, under the direction of a certified arborist, to expand their ability to fully mitigate the threats that vegetation might pose.

**8. Funding**

Funding can prove to be one of the largest roadblocks in the way of creating a more secure grid. Microgrids and underground power lines can have a high upfront cost, though their benefits could save funds through years of mitigated damage.

**Recommendation**

Creating an entity to induce private investment in advancing renewable public energy throughout the state would allow for funding for several of the recommended projects and initiatives.



# **LANDSCAPE BEAUTIFICATION AND PROTECTION TASK FORCE**

## **MEMBERS**

### **Duane Parrish (Chair)**

Director of the South Carolina Department of Parks and Recreation

### **Bill Bruno (Secretary)**

SC State Guard

### **Hugh Weathers**

Commissioner of the South Carolina Department of Agriculture

### **Senator Tom Davis**

South Carolina Senator

### **Representative Leonard Stavrinakis**

South Carolina House of Representatives

### **Sharon Richardson**

Audubon Society

## **PURPOSE**

The purpose of the Landscape Beautification and Protection Task Force is to recommend methods to integrate urban and rural environmental aesthetics and risk reduction as a strategy in response to the conflict between the conservation of green spaces and urban development. Landscape beautification and protection are critical elements for the development of successful and sustainable green infrastructure that can provide natural and man-made flood mitigation mechanisms.

## **BACKGROUND**

Urbanization, deforestation, draining of wetlands, and construction of impermeable surfaces have amplified the effects of flooding events across the state of South Carolina resulting in over \$20 billion in damages across the state, and major losses of beachfront along coastal areas where flooding has eroded beaches and dune sands. This is especially significant during tropical storms, hurricanes, and king tide events. Development along beaches, rivers, and waterways is particularly susceptible to damage from flooding, and the cost of damages continues to increase.

The design, installation, and maintenance of permanent landscaping around properties and public rights-of-way allow for the transformation of property into a landscape that provides greater efficiencies and a higher aesthetic value. Landscape beautification also provides value-added opportunities to use plants in new ways to improve the local quality of life, instilling a greater sense of “pride of place” and ownership among area residents and solidifying the connection between people and their surrounding natural environment. Just as important, these investments protect lives, property and economic livelihoods in both urban and rural parts of South Carolina. Increased urbanization, the clearing of trees, draining of wetlands, and increased paved surfaces have exacerbated flooding in the state’s coastal and inland areas. In addition, chronic erosion and the reduction of sand dunes along the state’s coastal communities have created heightened vulnerabilities for tidal flooding; especially during tropical storms, hurricanes, and king tide events.

## **FINDINGS / RECOMMENDATIONS**

Identify high priority floodplains, wetlands and open spaces through existing maps and analyses on a county-by-county basis.

Expand the Risk MAP program with SCDNR and FEMA to cover all vulnerable communities that have not yet been mapped.

Standardize sand fencing regulations state-wide.

Plant native vegetation along coastal fore dunes (part of the “frontal zone”), especially in conjunction with beach renourishment projects. This should be adhered to as a matter of policy applicable coast-wide.

Encourage and incentivize local governments to participate in the National Flood Insurance Community Rating System administered by FEMA to achieve flood insurance premium discounts for their residents. Make available to all interested communities The Nature Conservancy’s Community Rating System Explorer, an app that helps planners identify areas eligible for open space credit, supports the CRS application process, and enables communities to identify future open space to reduce flood risk and insurance premiums for their residents.

Support the passage of S 217, introduced in the state Senate in 2019 and pending for the upcoming legislative session. This legislation enables the use of revenues from the State Accommodations Tax, Local Hospitality Tax, and Local Accommodations Tax for the control and repair of flooding and drainage.

Make the National Green Values Calculator (from the Center for Neighborhood Technology) available, or adapt it for the state’s needs, and make it available to counties and communities. This tool compares green infrastructure and Low Impact Development to traditional stormwater practices for performance, costs and benefits.

Provide incentives to maintain the flood storage capacity of floodplains, wetlands and critical open space with outright purchases, conservation easements, tax credits, and other economic means (See the Task Force Report on Federal Funding for information on some sources for funding for these efforts).

South Carolina law currently specifies nine required elements of a comprehensive plan requirement. Local government flood prevention and mitigation efforts could be enhanced by adding a requirement to the law for a resilience or natural hazard element, along the lines of the Florida comprehensive planning law.

Review and modify the State Infrastructure Investment Act along the lines of Florida’s approach so that any coastal infrastructure project that receives state funds has a “sea level impact projection’ study before starting construction. This will ensure that infrastructure projects are built to withstand the impacts of sea level rise.

Consider areas subject to repetitive flooding for acquisition for parks and permanent open space by state, county or local governments. Utilize available federal and state funds for this purpose (See the Task Force Report on Federal Funding for information on federal program funds).

Develop model building codes, standards, regulations and/or ordinances to support effective mitigation for new construction to maximize protection from flood risk.

Integrate green spaces into new development by designing to hold the largest rainfall expected to fall, as opposed to relying on historic rainfall amounts, which are inadequate considering current and expected extreme weather events going forward.

In urban areas incentivize the use of green infrastructure as a cost-effective approach for managing and reducing stormwater at its source, through such methods as tree canopies, stormwater tree trenching, stormwater basins and stormwater wetlands, stormwater “bump-outs” and planters along flood-prone roads, use of pervious pavement for sidewalks, roadways, driveways, etc., raingardens and green roofs,

Restore riverine landscapes to their natural state whenever possible to utilize their protective function. Consider the Netherlands example where rivers are given more room to flood safely.

## **NATIONAL SECURITY TASK FORCE**

### **MEMBERS**

**Colonel William M. Connor V (Chair)**

United States Army North  
Emergency Preparedness Liaison Officer (EPLO)

**Colonel (Retired) W. Thomas Smith, Jr. (Secretary)**

South Carolina Military Department (SCMD)

**Colonel (Retired) Steven B. Vitali (Operations Manager)**

United States Marine Corps

**Colonel (Retired) Bryan Hilferty (Editorial Advisor)**

United States Army Central

**Major General Robert Livingston, Jr.**

South Carolina Military Department (SCMD)

**Dr. Till J.J. Hanebuth (Liaison)**

Associate Professor at Coastal Carolina University

**Colonel Scott "Race" Banning (Liaison)**

South Carolina Air Force EPLO

**Captain Steven "Bogey" Goff (Liaison)**

South Carolina Navy EPLO

**Ray Domenech (Liaison)**

Emergency Manager, Fort Jackson

## **PURPOSE**

The purpose of the National Security Task Force (NSTF) is to present findings based on research, assessments, and evaluations regarding vulnerabilities and other floodwater issues to respective military facilities and other national security-related infrastructure within the Task Force's area of responsibility. This report will also make determinations and offer suggestions as to what needs to be done to address all issues.

## **BACKGROUND**

The NSTF responsibilities included all military bases in the state, which included National Guard and Reserve (all services) armories in the state. The strategic importance of South Carolina's military community as part of the broader United States military is critical. South Carolina's military community provides a variety of resources that the nation regularly draws from for training, combat, and support services. These include: Force generation for the long-term sustainability of the U.S. Armed Forces; active engagement in the defense of national interests; and direct support of combat operations.

The S.C. military community collectively creates an economic impact to the state of \$24.1 billion. South Carolina is home to eight major military installations and numerous facilities, supporting 62,520 in Department of Defense (DoD) personnel with \$2.6 billion in payroll. \$2.1 billion in DoD contracts is currently being executed among 752 firms within the state. These figures speak to the criticality of the NSTF's work and why the task force was formed with individual base representatives as well as representatives from the S.C. Emergency Management Division and the Army Corps of Engineers among others.

Additional responsibilities for the NSTF going forward are to continue to hold solutions-based discussions, all of which are open to the public, and to identify and implement short-term and long-term recommendations to alleviate and mitigate flood impacts to South Carolina with a focus on the state's military installations.

The Task Force concluded that flooding has and will affect military facilities in the state, particularly in the Midlands and along the coast. Both freshwater flooding and the rising ocean will also impact coastal military facilities.

In January of 2019, the U.S. Department of Defense (DoD) released its Report on Effects of a Changing Climate to the Department of Defense. This report notes that "The effects of a changing climate are a national security issue with potential impacts to Department of Defense missions, operational plans, and installations... Vulnerabilities to installations include coastal and riverine flooding."

To ensure that military facilities better withstand flooding and severe weather issues, DoD is making appropriate changes to installation master planning, design, and construction standards. This includes efforts to better understand rates of coastal erosion, natural and built flood protection infrastructure, and inland and littoral flood planning and mitigation. DoD is also working to apply, evaluate, and improve scenarios and other tools for projecting interactions of sea level rise, storm surge, precipitation/land-based flooding at U.S. Military Installations.

For each of the South Carolina Military Installations, this report provides an overview, issues and challenges, and goals/way ahead.

## **FINDINGS / RECOMMENDATIONS**

### **Fort Jackson Training Center**

Perform quarterly dam inspections, keep dams mowed to facilitate inspections. Maintain storm water systems, dams and detention ponds.

### **Joint Base Charleston**

JB Charleston is monitoring infrastructure for impacts.

JB Charleston Civil Engineering, Port Operations, and Army Transportation Battalion recommends beginning infrastructure assessment; collaboration with local communities on shared projects to improve infrastructure; and consideration of eventual movement of vulnerable/mission-critical facilities out of the hazard zones.

### **Shaw Airforce Base**

While Shaw AFB has some issues from any major storm event, the general design and condition of the infrastructure is fairly resilient in the face of significant rain events. There are some low-lying areas that require pre-positioning of sandbags at facilities and some localized flooding occurs on some roads, but the water subsides fairly quickly after the rain stops.

The base has significantly improved its resilience of late by relocating the vast majority of the overhead power lines to underground. All mission critical facilities and infrastructure (water wells, sanitary sewage pump stations, and wastewater treatment plant) have back-up generators that are regularly tested and maintained.

### **S.C. National Guard Armories**

The resiliency strategy includes using state and federal funds to provide backup power (generators) and upgrade installation electrical distribution systems, minimizing facility damage through protective works, and increasing storage capacity for organization equipment in key locations.

### McEntire Joint National Guard Base SC

The resiliency strategy includes reducing building/facility damage due to floodwaters and conducting a southwest drainage repair study. The repair design is complete. The contract is expected to be awarded in FY 19/20 to complete rework of southwest drainage ditches. The upgrade of drainage around the ACA facility is projected to be 5 to 10 years out.

### Naval Hospital Support Base, Charleston, SC

The resiliency strategy includes:

Yearly clearing of debris from storm drains;

Relocating of critical electrical equipment from basement to higher location;

And, installation of sump pumps in the basement (in progress).

Naval Hospital Charleston Public Works has taken a proactive approach by moving critical electrical equipment from the facility basement to higher ground. Clearing of debris from storm drains has proven to be very effective and is scheduled on a yearly basis or as needed.

### Marine Corps Air Station Beaufort

The resiliency strategy includes:

Maintenance on the airfield drainage system, industrial and billeting areas drainage system, Laurel Bay Housing drainage system; and, tree removal of overhanging utility lines.

Drainage systems were constructed in 1957 and need replacement. Projects are scoped, drafted and approved by HQMC. Project execution - 2020-21.

Destructive weather events have damaged or caused trees to fall on utility lines or homes. Local funding addressed immediate issues; however, tree removal is an on-going process. The mitigation of short-term issues will occur via quarterly inspections for life safety issues. A project to eliminate all dead or dying trees is scheduled for 2021.

### Coast Guard Sector Charleston

The resiliency strategy includes continuing to work with private industry, local, state, and federal agency partners to determine suitable courses of action to reduce flooding, and researching/studying alternatives for drainage improvement projects and pump site location.

### USMC Recruit Depot / Eastern Recruiting Region

The installation is experiencing the permanent, temporary and ongoing indications of impacts to mission from climate influenced factors. To address these impacts the installation requires a comprehensive assessment and plan to cohesively and cost-effectively address the impacts in the short, medium, and long-term.



The assessment will consider the vulnerabilities of both the built and natural environment and impacts to mission.  
The resilience plan will develop discrete projects to mitigate potential impacts  
Estimated completion date is May 2020.

## **STAKEHOLDER ENGAGEMENT TASK FORCE**

### **MEMBERS**

**John Tecklenburg (Chair)**

Mayor of Charleston, South Carolina

**Ray Farmer (Secretary)**

South Carolina Department of Insurance

**Brenda Bethune**

Mayor of Myrtle Beach, South Carolina

**John McCann**

Mayor of Hilton Head, South Carolina

**David Wielicki**

South Carolina Waterfowl Association

**D. Thomas Johnson**

Jasper County Council

**Mark Lazarus**

Chairman (Former) of Horry County Council

**A. Victor Rawl**

Chairman of Charleston County Council

**D. Paul Sommerville**

Chairman of Beaufort County Council

## **PURPOSE**

The purpose of the Stakeholder Engagement Task Force is to identify key stakeholders who may be affected and facilitate education and communication with these stakeholders.

## **BACKGROUND**

Increased coastal development over the past century has led to an increase in economic losses from the landfall of tropical storms and hurricanes. Greater losses are predicted for the future, even without an increase in the frequency of storm events, due to the increasing coastal population and development. Additionally, the frequency of Atlantic hurricane formation has been increasing since the 1970s and a strong correlation between sea surface temperature and hurricane formation in the North Atlantic suggests that the increase in sea surface temperature will lead to an even greater hurricane frequency in the future.

With more tourism and development along state waterways and more storm and flooding events that will create statewide impacts, South Carolina faces a future full of uncertainty. A state-wide effort is needed to respond to past flooding and prepare for future events. This collaborative effort will require the involvement of many different stakeholders.

Natural disasters such as flooding affect the entire community, not just those who suffer direct damage. Because emergency preparation and management require coordination of all groups involved in order to effectively respond to community needs, stakeholder engagement is vital to any disaster relief program. A Stakeholder is defined as “any person or organization that is either actively involved in, affected by, or can influence a project.” Whole communities face the challenges of preparation and recovery. Elected leaders need to be involved in any such efforts., however, involvement by those with the least power in their communities has been shown to promote the greatest success in implementing innovative and sustainable outcomes. Involvement by a wide variety of stakeholders helps to reveal gaps in knowledge and resources that need to be addressed in both preparation and recovery efforts. Studies suggest that effective planning processes that involve multidisciplinary approaches can compensate for a lack of experience and lead to better disaster recovery outcomes.

## **FINDINGS / RECOMMENDATIONS**

As suggested by literature and initial reports from community surveys, our communities have a strong need for education on flooding and disaster preparation. Educational programs and resources that are both accessible and engaging will be required to reach

out to vulnerable populations. In addition, research on the best practices for community preparation and resilience will rely on studying data about past flooding events and projecting into the future to learn where flooding is likely to happen next and how communities can best address those risks if and when they occur.

Making emergency management information easily accessible is important in connecting communities with the education they need to make informed plans for future flood responses. The creation of a statewide database of emergency information, such as contact information for state agencies and a call list for emergency management based on resident location, would help residents and communities to make their own preparations. The South Carolina Emergency Management Division already has resources on its website for residents, such as hurricane evacuation zone maps, family planning toolkits, and listings of emergency shelters. Building upon resources like this and making sure that local communities are aware of how to access the information should be an important goal of stakeholder outreach.

Other outreach programs and studies such as the Marion County Survey Project (detailed in the Task Force Report) offer opportunities to understand the experiences and opinions of flooding-affected communities. Here the Commission engaged and received more than four hundred surveys that solicited input from families impacted by recent flooding and extreme weather events. There are also projects underway to connect individual residents to a wider audience using online tools. Dr. Jaime McCauley, of Coastal Carolina University, is working on the development of an interactive flooding map, where residents can pinpoint their location and upload images and firsthand accounts of flooding. This kind of project both promotes community solidarity as it allows residents a platform through which to share their stories and offers valuable spatial information for researchers seeking data on the height and extent of past flooding. Building upon such a system could lead to the creation of a statewide flood database, allowing for the combination of personal anecdotes and historic records such as water levels and rainfall to create an interactive map. Such a map, if available online, would provide information to both local residents and researchers interested in both the mechanics and the social impacts of South Carolina's recent flooding history. Future such projects will be important steps to connecting with communities and reaching out to those communities for the purpose of flood recovery and future flood preparation.

Successful stakeholder engagement involves local residents in rescue efforts and data collection during flooding conditions. It will be important for communities to find methods that will connect residents and authorities not only before and after flooding events, but also during events when the need for rescue and relief efforts is greatest. Being able to receive reports about flooding as it happens will also enable researchers to better recognize patterns in the process and extent of flooding, and better refine predictive models in order to issue more accurate flood warnings and evacuation orders. The

more that the state of South Carolina understands about the experiences and needs of flood victims, the better we can prepare for and respond to flooding events in the future.



# **FEDERAL FUNDING TASK FORCE**

## **MEMBERS**

**Congressman Tom Rice (Chair)**

7th Congressional District

**Deborah Jane Stirling (Secretary)**

Department of Coastal and Marine Systems Science, Coastal Carolina University

**Congressman Joe Cunningham**

1st Congressional District

**Senator Chip Campsen**

South Carolina Senate

**Mark Robertson**

The Nature Conservancy

**Ben Duncan (Liaison)**

South Carolina Disaster Recovery Office

## **PURPOSE**

The purpose of the Federal Funding Task Force is to increase the state's resilience for recovery from and in anticipation of future flooding events. The Task Force will identify systemic obstacles and federal resources and assets available for recovery, rebuilding, planning, mitigation and prevention, as well as enabling utilization of existing resources.

## **BACKGROUND**

Recently, South Carolina has faced five recent natural disasters, four of which merited a disaster declaration:

- FEMA 4241-DR: South Carolina Severe Storm and Flooding, 2015
- FEMA 4286-DR: Hurricane Matthew, 2016
- FEMA 4346-DR: Hurricane Irma, 2017
- FEMA 4394-DR: Hurricane Florence, 2018

There are several systemic obstacles and issues that the state faces, which should be addressed in order to more completely recover, and to increase the state's resilience in anticipation of future flooding events. These include:

The speed and efficiency of rebuilding homes and infrastructure, and recovery of businesses, and community facilities;

Not fully utilizing all of the federal funding resources that are available to our state, local governments and citizens;

Lack of information-sharing and coordination among agencies and various units of government across agency and jurisdictional boundaries; and

The need to develop state and local government expertise to comprehensively track and administer federal funding and resources, to better assist citizens in responding, rebuilding and preparing for future events; also to help make a stronger case for federal assistance and investments in future flooding events.

The following section is a summary of the Findings & Recommendations from the Federal Funding Task Force, to address these obstacles. The Task Force's full report contains additional details supporting these recommendations.

## **FINDINGS / RECOMMENDATIONS**

There are several short-term, mid-term and long-term goals that could be achieved to help assist with recovery from previous disasters and preparation for future.



### Timeliness of Release of Funds

Timeliness of the release of disaster funds is important to the recovery of South Carolina from the devastation of these storms. There is funding to be allocated to the state from the two disaster relief bills that have passed Congress – one in September 2018 and one in June 2019. Additionally, there is funding for mitigation activities associated with Hurricane Matthew and the 2015 Floods that was passed by Congress in February 2018 and as of June 24, 2019 the funding has yet to be released to grantees.

### Increase Coordination

Due to the number of disasters that have devastated the state in the past five years, many citizens, municipalities, counties and the state are working on initiatives to help recovery and preparation for the future. However, with such a focus on recovery efforts it is essential that efforts be coordinated and data collection be shared at all levels.

For example, many different communities have determined that a watershed study is necessary to adequately prepare for future storms and prioritizing projects. The state is also coordinating a watershed study for the Pee Dee and Waccamaw watersheds. Since ground water flow is an interconnected system, it is important to develop a coordinated plan. Additionally, the cost of conducting such a study could be expensive for a local community. A cohesive study that includes the interconnectivity of the water systems may be best to be coordinated by the state in order to ensure no overlapping in data collection and lowering costs.

### Creation of Comprehensive Mitigation Strategy

Developing a sustainable mitigation strategy could assist in helping the state adequately prevent future damage from natural disasters. With a comprehensive mitigation strategy, the state can begin focusing their efforts on projects that will reduce damages in the future and begin adopting strategies that will help South Carolina when they are faced with a natural disaster.

With developing a mitigation strategy, the state must focus funding on expertise in this area that will ensure they have prioritized the correct projects and utilized the funding sources to the best of their ability. As a plan is developed at the state level, South Carolina should set standards for state and local actions and establish outcomes and criteria that will be used to evaluate proposed uses of mitigation funds. Goals should be focused on reducing flood risk on a large scale and improved community resiliency with specific measurable outcomes supporting these goals should be developed.

### Identify and Utilize Readily Available Funding

Congress has been appropriating funds to agencies to implement disaster relief programs. Over the years different agencies have developed new and creative programs to help assist victims of disaster relief. As the state of South Carolina and communities identify their needs and develop projects these needs could be

communicated and shared among leaders at the local, state and federal level. If leaders are aware of the needs across the state, then each may be able to assist in identifying funding sources. South Carolina could develop a capacity building program to assist local governments that are under resourced identify solutions, develop a plan, apply for funding in a timely way, and provide support for implementation once funds are received.

Federal funding that is allocated to the state of South Carolina needs to be utilized in the most efficient way possible. For example, in the past Community Development Block Grants-Disaster Recovery (CDBG-DR) funding has only been spent on housing, when the intent from HUD included opportunities to use those funds for infrastructure, economic revitalization and mitigation. South Carolina could develop programs and projects that are eligible for CDBG-DR funding that would address specific needs of the state and begin to build and restore South Carolina communities.

#### Develop Forward Leaning Prevention Strategy

As South Carolina prepares for the future, it will be necessary to continue developing a long-term prevention strategy against natural disasters. Researching and developing innovative resiliency projects that have been utilized around the globe will allow South Carolina to be a leader in this sector.

#### Improve Understanding of Process, Roles and Available Resources when Next Storm Occurs

For an effective team and recovery efforts, all leaders at the federal, state and community must be educated on disaster relief process and resources available. The only way to combat against natural disasters that may devastate the state is to be fully armed with all the tools necessary – understanding the capacity of each stakeholder’s role in a disaster and how the process works so that each of us can be an advocate for our community. When everyone is fully informed, that is when South Carolina can recover to the best extent possible.

## **ECONOMIC DEVELOPMENT TASK FORCE**

### **MEMBERS**

**Joe Ellers (Chair)**

Palmetto Associates

**Kelli S. James (Secretary)**

Executive Vice President of Horry County Chamber of Commerce

**Peter Brews**

Dean of the University of South Carolina School of Business

**Bryan Derreberry**

President and CEO of Charleston County Chamber of Commerce

**Dr. Rick Peterson**

Coastal Carolina University

**Steve West (Liaison)**

- Director, Economic Development, Duke Energy

## **PURPOSE**

The South Carolina Floodwater Commission's Economic Development Task Force's (EDTF) scope is the investigation of commercial mitigation investments. Actions flowing from EDTF recommendations are dependent upon expert estimates of the floodwater risks facing South Carolina, and a general statement of the mitigation steps to be taken to deal with them. Mitigation steps might be described in three categories: those that do not offer potential for economic gain and require public funds to execute (hereafter 'public mitigation investments'), those which on their own merits offer the potential for economic gain and might attract private capital to execute (hereafter 'commercial mitigation investments'), and those where a combination of public and private capital might be deployed in their execution (hereafter 'public/private mitigation investments').

## **BACKGROUND**

Economic growth is primarily based upon the goods and services provided and produced in an area. The general welfare of the public is a large concern for development, taking into consideration the health and social well-being of the people. Economic development is essential to the growth of any community – the scope of which concerns both the improvement and growth of the area. To have economic development, communities must make decisions that will positively affect the revenue and the health of the public.

Flooding is inevitable in South Carolina due to the proximity of towns and cities to rivers and the ocean. However, multiple prospects to make flooding a benefit to our economy should be considered and harnessed.

The EDTF work rests upon the assumption that there will always be flooding, even in years when there are no catastrophic events such as hurricanes. Rising sea levels and more significant storm/precipitation events reflect record levels of water and precipitation over the foreseeable future. Identified mitigation investments include the following:

- Wetlands Expansion
- Offshore Barrier Protection
- Floodwater Channelization
- Recycling of Stormwater
- Building Artificial Lakes/Reservoirs

## **FINDINGS / RECOMMENDATION**

### **1. Wetland Value**

Wetlands, with their retention and filtration abilities, are extremely important to flood prevention. They also provide a unique ability to offer a fertile

environment for both flora and fauna which support fishing industries.

Due to their amazing ability to store water, wetlands offer one of the best and natural flood damage reduction methods available. These natural buffers can reduce flooding peaks by 60% with only 15% of the watershed being maintained.

In South Carolina, wetland forests are worth \$39.6 billion, but with conservation, could increase by \$5.1 billion. Protection from severe weather events and the regulation of water flow is estimated to add \$11.9 billion in economic value, but this figure is projected to rise another \$1.5 billion with conservation investments. Water treatment could be worth \$10.2 billion with wetland conservation, as opposed to the \$9 billion it is now. The value of erosion control and soil formation could increase \$210 million and food and pollination values could increase by \$760 million.

## **2. Off-shore barrier protection / oyster reefs**

Artificial oyster reefs, such as oyster castles, can provide a great boost to the economy in coastal communities. Oysters provide many benefits, such as seafood, water quality, and storm protection.

The structures of oyster reefs also allow species of other fish to be protected from predators. These species feed other harvested fish that hide out in the reefs, such as crabs, fish, perch, trout, and shrimp. Commercial guided fishing expeditions, additional recreational fishing licenses, more tourism (SCUBA and snorkeling), and the creation of more commercial fish hatcheries could result from artificial oyster reefs being added to our shore.

When storms and flooding create additional pollution and overloaded nutrients, oysters naturally improve the water by filtering the water and cutting down on costs for water treatments.

The storm protection services that the oysters are able to provide naturally are valuable with their erosion resilience and protection for wetlands. Wave energy is absorbed by oyster reefs, helping to keep the shoreline stable and protecting beneficial wetlands.

The offshore protection and investment in artificial oyster reefs provides both a way to prevent damage from hazards and a way to boost our economy.

## **3. Flood water channelization**

Channelization is the process of reconstructing a stream or river into smaller paths, also called hydromodification. The alteration of different bodies of

water is done to assist different problems, such as more agricultural production, or to overcome problems related to flooding.

The channelization of rivers presents an opportunity to expand our economic base by providing more prospects for building restaurants and businesses. Building around water has always been an attractive option for both recreational open spaces and commercial use.

City and town planners should be conscious of what floods might do to their waterways, and channelization is a response that should be considered. If such modification of flow paths is considered, care should be taken that they not bypass flow through wetlands and marshes. Ideally such modifications would ultimately transport water into newly created wetlands.

By replicating the types of structures and reservoirs from other areas in the world, South Carolina can add to the removal of excess water from the rivers, stormwaters and floodwaters.

#### **4. Recycling / Reuse of Water**

There are numerous opportunities for the profitable reuse of water that may be explored. Technological advances can be utilized in South Carolina to aid in purifying and storing water. The concept of recycling water offers businesses opportunities to produce products with less cost. This concept could be used for drinking water, beer (48 breweries in South Carolina), soup or soda.

With cheaper options to produce the same amount of product, businesses can create larger profits, leading to larger tax revenues returned to the federal, state, and municipal levels of governments.

#### **5. Building of an Artificial Lake / Building a Reservoir**

The option of building reservoirs has often been utilized to assist with both flooding and droughts. Artificial lakes have been made from dams, providing regions with lakefront property, recreational activities, ideal spots for businesses and vacations, and vast amounts of energy.

As an example, a 400-acre artificial lake could be located in a number of locations throughout South Carolina. With approximately 3 miles of shoreline made available, this lake could have a multitude of business and residences built around it. Assuming an average depth of the 33.4 feet (the average depth of SC lakes), the volume of earth to be moved to form a lake of this size would be approximately 582 million cubic feet. This earth can be distributed to

nearby low-lying areas to raise elevation in flood-prone areas. The lake/reservoir could be located in an area of the state experiencing persistent flooding problems and connected to existing rivers to buffer excess water while providing numerous economic possibilities.