Charleston, South Carolina

Case Study for Steps to Resilience

This case study was developed using a combination of information from public documents and first hand knowledge provided by a former Chief Resilience Officer.

References and Resources

- Resilience | Charleston, SC - Official Website
- 2015 Sea Level Rise Strategic Plan (PDF)
- 2019 Flooding and Sea Level Rise Strategy (PDF)
- 2023 Flooding and Sea Level Rise Strategy Update: City of Charleston (Storymap)
- All Hazards Vulnerability And Risk Assessment (PDF)
- 2023 Status Update of Initiatives
- Dutch Dialogues Final Report 2019 (PDF)
- Charleston Peninsula Coastal Storm Risk Management Study FAQs (Storymap)

Background

Charleston, a mid-sized city on South Carolina's east coast, is split into five areas by water and joined by bridges. Each area has its own unique feel, and locals are very proud of their neighborhoods. With about 150,000 residents, Charleston welcomes over seven million tourists yearly as a top U.S. travel spot.

The city's history is deep, going back to the American Revolution and Civil War. Its economic heart is on a peninsula where the Cooper and Ashley rivers meet the Atlantic Ocean. Most tourism happens around this area, with sites dating back to 1670. The peninsula also houses a thriving medical district, including the state's medical university, a children's hospital, and tech centers. Two major colleges and several smaller ones call it home too.

Charleston loves the arts, especially its yearly Spoleto festival. This 17-day event, a match to Italy's Festival Dei Due Mondi, attracts global visitors.

The International African American Museum (IAAM) is another key spot. It stands where Gadsen's Wharf once did, a place where over 40% of enslaved people entered the U.S.

Charleston's population is mostly white (74%), then black (18%). The typical household income is $83,891, but 12.6% of people live in poverty.

Risk Assessment

Get Started

In 2015, after the devastating floods from Hurricane Joaquin's record rainfall and high tides, Charleston began its official journey towards resilience. The mayor, worried about rising tides, gathered a small team to create a Sea Level Rise Strategy. This was published in 2015.

In 2019, a larger group of city staff, the Planning Team, updated this strategy. They shifted focus and published the 2019 Flooding and Sea Level Rise Strategy. They recognized that while high tides were a major threat, other climate factors like rising seas and heavy rain were also causing more frequent and severe floods.

The Planning Team spent over three months on this update. Key staff members, who had decades of experience with Charleston's flooding issues, offered valuable insights. They understood the impact on different communities from years of working with residents, business leaders, and engineers. The team also included local colleges, government agencies, and a community group focused on Charleston's resilience.

Practitioner's Guide Resource: 1.3 Vision, Values and Goals

A key take-away from the 2019 Strategy was a firm understanding of the city's vision, values, and goals.

The Strategy set a **vision** for the protection of Charleston providing a guiding framework to protect lives and property, maintain a thriving economy, and improve quality of life by The City.

> *"We simply must make flooding and drainage our City's top long-range priority."*
>
> - Mayor John J. Tecklenburg, State of the City Address 2018

Charleston **values** its relationship with water. This was at the core of development of the strategy.

> "In the face of recurrent flooding, the rising seas, and more frequent extreme weather, our mission is clear; as a City, we strive every day to preserve and enhance the quality of life of the citizens of the City of Charleston. We recognize that water is an asset and, as such, we must learn to live with the water. We will approach challenges as opportunities and embrace innovation and learning."
>
> - 2019 City of Charleston Flooding and Seal Level Rise Strategy

Goals to address flooding and promote a more resilient and sustainable future - 2019 City of Charleston Flooding and Seal Level Rise Strategy

1. **Protect our citizens and neighborhoods.** Vibrant neighborhoods have been at the core of our City for hundreds of years. It is imperative that we ensure, through innovative policies, that we are building future neighborhoods resilient to flooding that will maintain their value in spite of future challenges. Likewise, we will continue to make retro-active improvements and modifications, using multiple solutions, to improve the resilience of existing neighborhoods, including elevating homes as appropriate and acquiring homes for removal when necessary.
2. **Protect and enhance critical City infrastructure**. Maintaining the safety of our citizens, public spaces and neighborhoods is our highest priority. We must ensure that critical lifesaving resources such as hospitals, fire stations, police substations and the transportation corridors first responders use to connect our citizens to the services they provide remain as flood free and accessible as possible.
3. **Preserve economic viability for businesses and organizations.** A strong economy that works for everyone depends on businesses and institutions that are flood resilient and organizationally flexible to adapt and thrive in the future. Likewise our city of the future needs to be designed and built, in partnership with these important institutions, with resilience and adaptability at the forefront to ensure our future economic viability.
4. **Protect and enhance vital resources that protect our cities**. We will treat our environment as both a natural and economic resource and seek opportunities to improve conditions and to embrace the guiding qualities nature provides to

help us reshape the way we live with water. Therefore, we must promote natural floodplain function and increase our natural systems' ability to mitigate effects of sea level rise while enjoying the co-benefits of improving the place we live.

5. **Enhance collaboration and partner with others**. We recognize that we are part of a larger region and ecosystem that connects with many other cities and governments. Likewise we recognize and acknowledge that water knows no boundaries. In order for us to be successful we will need to work with our neighbors, both public and private.

Understand Exposure

As part of the 2019 strategy the city committed to conducting an All Hazards Vulnerability and Risk Assessment. A request-for-proposals (RFP) was issued and a consultant was selected to conduct a **parcel based quantitative assessment of the entire city**. Once the contractor was selected and the project timeline approved, a new and larger Planning Team was assembled including many members from previous Planning Teams (2015 and 2019) plus new members representing additional city departments and interests. The assessment was completed in November 2020.

The following was taken from the 2020 City of Charleston All Hazards Vulnerability and Risk Assessment report.

Hazards and Stressors

Eight **hazards** were considered, including four different types of flooding. Of the eight hazards, six are related to climate. The inventory of hazards was based on the planning team's institutional knowledge of past events, NOAA National Centers for Environmental Information (NCEI) Storm Events Database and regional climate trends and projections from the third and fourth National Climate Assessments.

The eight **hazards** considered were

- Floodplain Inundation
- Tidal Flooding Current
- Storm Surge
- Sea Level Rise and Future Tidal Flooding
- Earthquake (non-climate)
- Hazardous Material Hazmat (non-climate)
- Extreme Heat
- Water Shortage

The **climate stressors** were

- Heavy precipitation events
- Drought

- Tropical systems
- Sea Level Rise (considered a hazard and climate stressor)
- Temperature variability

The **non-climate stressors** were

- Population growth and land use conversion
- Socioeconomic disparity
- Commuting time
- Water Demand

This table provides the hazards and related stressors considered in the assessment.

Hazard	Climate Stressor	Non-Climate Stressor
Floodplain Inundation	Sea level rise, heavy precipitation	Impervious surfaces, land use changes
Tidal Flooding (Current)	Sea level rise, heavy precipitation	Impervious surfaces, land use changes
Storm Surge	Sea level rise, tropical systems	Land use change
Sea Level Rise and Future Tidal Flooding	Sea Level Rise	Land use change
Earthquake	N/A	Land use change
Hazardous Materials (Hazmat)	N/A	Land use change
Extreme Heat	Temperature variability	Socioeconomic vulnerability
Water Shortage	Drought, sea level rise	Water use/demand

Assets

Assets were grouped into **Core Systems** and grouped together under four **themes**. Note that some assets supported more than one core system.

Theme 1. Property and Public Services

Core Systems	Assets	Totals
Communities and Homes	Residential property Single and multiple family residences Low income housing Apartments, manufactured and mobile homes	61,781 parcels
Economy Communities and Homes	Commercial and Industrial Property Non-residential properties that serve businesses and organizations.	3,368 parcels
Public Safety Health and Wellness	Government-owned Property Federal, state, county and city owned properties except for those associated with parks and recreation and critical facilities	144 parcels
Utilities Public Safety	Critical Facilities - Fire and police stations that aid in emergency response, some utilities and other critical facilities not included in another category.	347 parcels
Communities and Homes Environment and Sustainability Health and Wellness	Parks and Cultural Property Parks and recreational facilities and buildings, properties that are cultural landmarks or other historic resources.	659 parcels

Theme 2. Roads and Mobility

Core Systems	Assets	Totals
Transportation Economy Public Safety	Major Roads - All major and secondary roads and considers the critical access they provide for emergency services. Road connectivity and accessibility by fire/ emergency services were also considered.	N/A
Transportation Public Safety	Minor Roads - All residential and tertiary roads. Road connectivity and accessibility by fire/ emergency services were also considered.	N/A

Theme 3. Economic Factors

Core Systems	Assets	Totals
Economy	Annual Sales Volume Total reported annual sales volume for individual companies and businesses	$36B
Economy Community and Homes	Jobs/Employees Total number of jobs or employees reported for individual companies and businesses	217,942 jobs

Theme 4. People and Socioeconomics

Core Systems	Assets	Totals
Communities and Homes	Total Population - 15 socioeconomic and demographic metrics are available to examine characteristics of populations and households at the census tract level.	186,782 people
Communities and Homes	Public Housing - Also part of Residential and or Government-Owned Property, includes all identified public housing	103 parcels
Communities and Homes Health and Wellness	SNAP Food Retailers - Also part of Commercial and Industrial Property, includes all SNAP retailers identified by USDA-FNS	

Practitioner's Guide Resource: 2.6 Potential Impacts Matrix

The following is a partial example of Charleston's Impacts Matrix.

Community Assets	Hazards			
	Floodplain Inundation	Sea Level Rise and Future Tidal Flooding	Earthquake	Extreme Heat
Government owned property	x	x	x	
Commercial and Industrial properties	x	x	x	x
Residential properties	x	x	x	
Critical facilities	x	x	x	x
Public Housing	x	x	x	x

Important Consideration

Most asset/ hazard pairs will be classified using measures of vulnerability and risk. However, in some cases, assets will only be evaluated by either *exposure* alone (Sea Level Rise and Future Tidal Flooding was evaluated using five feet of sea level rise) **or** using *vulnerability* alone as we did for an earthquake hazard.

Assess Vulnerability and Risk

Practitioner's Guide Resource: 3.10 Impact Statements

Impact Statement 1

The following example describes the *physical community asset* and *hazard*, and discusses *exposure*.

Community asset, sector, or service:

Commercial Property which include structures such as restaurants, hotels, and industrial facilities.

What is the hazard causing the impact? Is the impact near-term, long-term?

Floodplain Inundation - combination of rainfall-induced and storm surge flooding.

The impact is *current*.

Scale (a particular transportation corridor, neighborhood, entire project or study area):

City-wide Scale

Primary function (what is disrupted by impacts, why do these functions matter):

Retail, office, restaurant, hotel and industrial. These types of facilities also support jobs, commerce and tourism.

Exposure (defined as the presence of people and community assets in places where they could be adversely affected by hazards):

71% of commercial property (2,380 parcels) are categorized as medium or high risk.

Consider what factors or characteristics make the people and community assets more or less vulnerable to impacts. This may be determined by examining the assessment factors, such as building year, or the social vulnerability indicators, or a combination of those. Remember, there are physical and social drivers of vulnerability. Identifying these aspects within the impact statements will help inform the development of options in the Investigate Options step.

The following describes the types and causes of vulnerability.

What are the key ways in which the community asset(s) is/ are vulnerable to impacts? What makes the community asset sensitive to the hazard, have low adaptive capacity?

Structures are vulnerable if in the floodplain with varying degrees of adaptive capacity, depending on the year built.

Adaptive Capacity is…

- ***High*** if the structure is out of floodplain or if in floodplain built after BFE (base floor elevation) requirements were raised to 1-2 feet (2015 for Charleston and 2018 for Berkeley).
- ***Medium*** if the structure in floodplain and built after BFE requirements were in place (1971 for Charleston, 1983 for Berkeley).
- ***Low*** if the structure in floodplain but built before BFE requirements.

Sensitivity depends on the services provided and importance to the community. Sensitivity is high for hotel, retail, restaurants, historic, SNAP all important for communities to function.

Describe the pre-existing stressors, social vulnerabilities, or and any root causes (historical disinvestment, income inequality, limited access to resources or services).

Social vulnerabilities as per the CDC Social Vulnerability Index were highest on the Peninsula and Inner West Ashley areas and both areas are at medium to high risk and vulnerability to flooding inundation.

Impact Statement #1

Using this information, construct an impact statement (one to four sentences). This statement should be a story about the particular neighborhood, area, community asset identified. Why does it matter if this area is affected or function is lost?

> 2,552 commercial properties throughout the city are exposed to floodplain inundation. 71% of all commercial properties are categorized as medium or high risk. The vast majority of the jobs/ employees come from the Peninsula (medical, tourism and education) and upper peninsula (tech and industrial). The impact is that jobs and economic activity are at a very high risk from floodplain inundation.

Impact Statement 2

The following example describes the *physical community asset* and *hazard*, and discusses *exposure*.

Community asset, sector, or service:
Critical Facilities which include fire and police stations, medical facilities, schools, energy and utility facilities, transportation-related facilities.

What is the hazard causing the impact? Is the impact near-term, long-term?
Storm Surge is flooding caused by an abnormal rise in tide from a severe storm (e.g. tropical storm) over and above the usual, astronomical tide using FEMAs SLOSH (Sea, Lake and Overland Surges from Hurricanes) MOM (Maximum of Maximums) Storm surge layer which represents a worst-case flooding scenario for category 1-3 storms.

Scale (a particular transportation corridor, neighborhood, entire project or study area):
Entire City scale

Primary function (what is disrupted by impacts, why do these functions matter):
Critical facilities are structures that house personnel and resources that provide critical and essential services to the public. Examples include - police, fire, medical and utility.

Exposure (defined as the presence of people and community assets in places where they could be adversely affected by hazards):
334 Critical Facilities are exposed throughout the city. 279 or 80% of Critical Facilities exposed are at medium or high vulnerability and risk.

Consider what factors or characteristics make the people and community assets more or less vulnerable to impacts. This may be determined by examining the assessment factors, such as building year, or the social vulnerability indicators, or a combination of those. Remember, there are physical and social drivers of vulnerability. Identifying these aspects within the impact statements will help inform the development of options in the Investigate Options step.

The following describes the types and causes of vulnerability.

What are the key ways in which the community asset(s) is/are vulnerable to impacts? What makes the community asset sensitive to the hazard, have low adaptive capacity?

Critical facilities are **vulnerable** if in the inundation extent with low adaptive capacity.

Adaptive Capacity is

- **High** if the structure is out of floodplain or if in floodplain built after BFE requirements were raised to 1-2 feet (2015 for Charleston and 2018 for Berkeley).
- **Medium** if the structure in floodplain and built after BFE requirements were in place (1971 for Charleston, 1983 for Berkeley).
- **Low** if the structure in floodplain but built before BFE requirements.

Sensitivity is higher if medical, emergency facilities, schools, historic or major medical facilities.

Probability is highest for Category 1 hurricanes and goes down as the storm category rises. There is a smaller probability of more intense, Category 2-5 storms to occur. Consequence is whether there is a structure that is exposed on the parcel within the extent.

Describe the pre-existing stressors, social vulnerabilities, or and any root causes (historical disinvestment, income inequality, limited access to resources or services).

80% of critical facilities are at medium to high risk from storm surge throughout the city. These facilities provide essential services to all citizens during an emergency and would be critical during a major storm surge event which is the greatest threat from any type of flooding throughout the city.

Social vulnerabilities as per the CDC Social Vulnerability Index were highest on the Peninsula and Inner West Ashley areas and Critical Facilities in both areas are at medium to high risk and vulnerability to flooding inundation.

Impact Statement #2

Using this information, construct an impact statement (one to four sentences). This statement should be a story about the particular neighborhood, area, community asset identified. Why does it matter if this area is affected or function is lost?

> Critical Facilities throughout the city (80%) are vulnerable to storm surge. The risk is the greatest on the Peninsula where the risk from storm surge flooding is the greatest, there is a concentration of critical facilities and a high concentration of individuals with the highest social vulnerabilities located in clusters of public housing. In addition, this is the area with the highest concentration of hotels to host more than seven million tourists annually which means they are less familiar with the effects of storm surge and the vulnerabilities of the Peninsula.

Practitioner's Guide Resource: 3.11 Vulnerability and Risk Synthesis Report

All areas of the city and most assets are vulnerable to hazards; however, there are differing types and levels of vulnerability in different areas of the city.

Clarifying note from the report
Characteristics of hazards, including the type of impact and the frequency of occurrence, should be considered when comparing vulnerability and risk metrics across different hazards. For example, impacts from tidal flooding and storm surge are inherently different.

Findings

- Based on the total number of assets, the highest levels of vulnerability citywide are to the hazards of floodplain inundation, storm surge, and earthquake.
- More than half (52%) of all flood-prone properties in the city have buildings that were built before any floodplain development requirements were in place.
- While properties are prone to flooding throughout the city, some areas have much higher levels of vulnerability and risk — especially for commercial property, critical facilities, and government-owned property.
- Storm surge has the potential to impact almost any area of the city. A large storm surge event could have devastating impacts to the core systems and assets that keep the city functioning.
- While fewer assets are vulnerable to current tidal flooding and hazmat hazards, they occur most frequently. Understanding the cumulative effect of hazard events is important.
- The city could face increasing risk due to several factors (both climate and non-climate), particularly sea level rise, increasing frequency and severity of heavy precipitation events, and land use conversion.
- A primary impact from sea level rise will be the increased frequency and severity of tidal flooding.
- Social vulnerability is an important consideration for all threats. Many areas that are the most vulnerable to hazards are also the most socially vulnerable.

Extreme Heat and People
Extreme heat was assessed at the census tract level for the city. This screening-level assessment found that, in the most vulnerable areas (medium to

high), there are about 1,900 households with members 65 years of age or older and about 2,900 households living below the poverty line.

Water Shortage and Water Supply

There were two impacts considered for water shortage: shortage due to drought and shortage due to salinity impacts. For both, current levels of vulnerability are relatively low to moderate. However, due to changing climate conditions and sea level rise, historic conditions should not be the basis for understanding the potential for future risk from both types of impacts.

Moving from Risk Assessment to Risk Management

Investigate Options

Once the Vulnerability and Risk Assessment was complete the Planning Team moved from Risk Assessment (Steps to Resilience 1-3) to Risk Management (Steps to Resilience 4-6).

With the information from the Vulnerability and Risk Assessment in hand, the team reflected on the Vision, Values and Goals and defined/ refined informed Resilience Objectives.

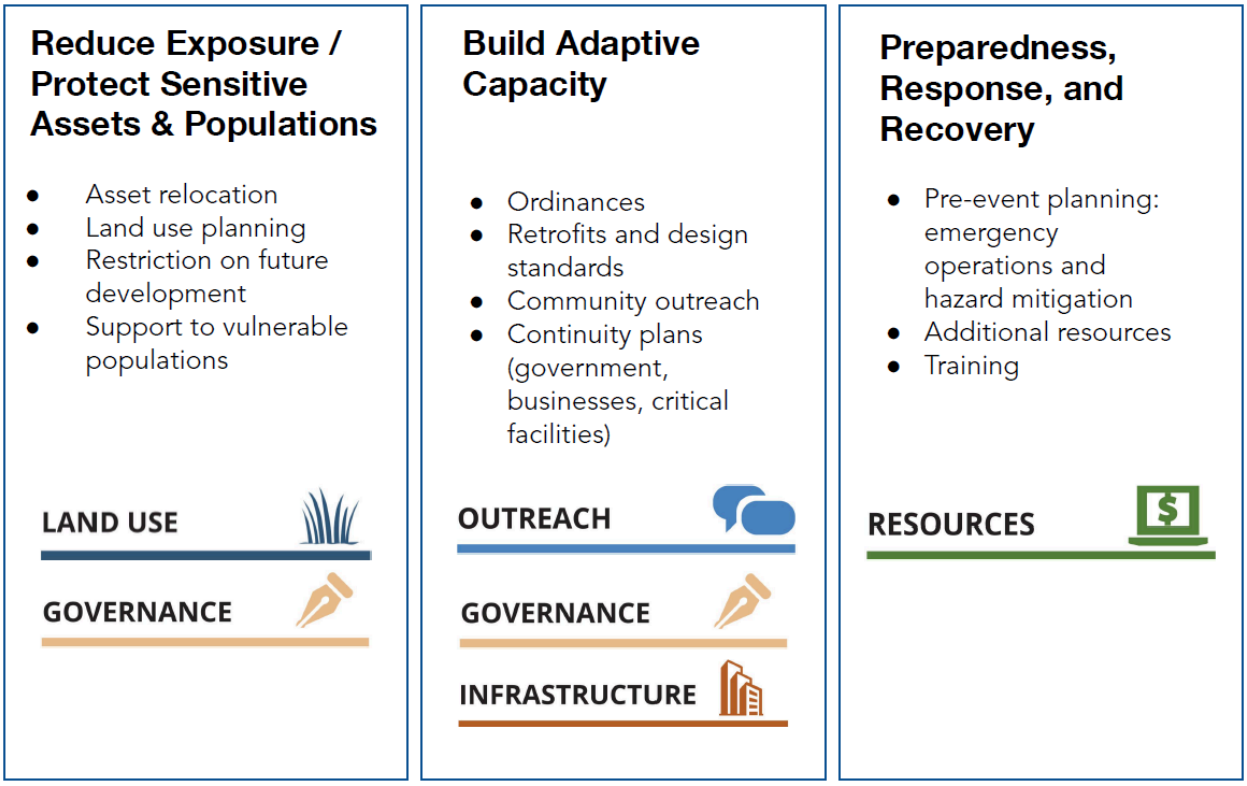
The Resilience Goals developed in 2019 City of Charleston Flooding and Sea Level Rise Strategy were validated and used to begin the assessment, and were determined to still be valid as the assessment team began to move from Risk Assessment to Risk Management.

1. **Protect our citizens and neighborhoods**.
2. **Protect and enhance critical City infrastructure**.
3. **Preserve economic viability for businesses and organizations.**
4. **Protect and enhance vital resources that protect our cities**.
5. **Enhance collaboration and partner with others**.

The team developed and used the five Critical Components of Resilience that were incorporated into the 2019 City of Charleston Flooding and Sea Level Rise Strategy providing a useful way to categorize the required components of resilience that need to be working together to build a more resilient city. The planning team recognized that all five needed to be considered and addressed to be successful. Identifying strategies to support the goals and categorized by the five critical components framework would help balance city resources and efforts and ensure all aspects were being considered.

Five Components of Resilience (Action Types)

The figure below, from page 62 in the report, highlights how various strategies and actions were grouped together as options were considered and characterized before the prioritization step.



Practitioner's Guide Resource: 4.5 Inventory of Community Options

This assessment and report were completed in 2020 before the introduction of U.S. Resilience Toolkit's Options Database. The rationale and process was the same, absent the database. Start by considering existing plans, inspirations from other communities, best practices and input from the planning team. In total, there were 78 options identified. Below are partial listings in three of the five Components of Resilience categories taken directly from the report. They are grouped by Component.

Component	Source	Area/ Location	ID#	Threat	Initiative (Strategy or Project)
Governance	Workshop 2 (Katie)	ALL	60	Flooding and SLR	Participate in future update of COG's LRTP to ensure SLR is included in the plan, making us eligible for funding in future (and include resilience as prioritization criteria)
Governance	Workshop 2 (Katie)	ALL	61	Flooding and SLR	Update current projects in LRTP based on Vulnerability Assessment prioritization? (put priorities on projects based on road map data from VA)
Governance	Assessment Team	ALL	62	Flooding and SLR	Alternate route planning for emergency service vehicles
Governance	CHS Flooding and SLR initiatives	ALL	14	Flooding	Aggressively seek and support new NFIP acquisition legislation for City of Charleston pilot project
Governance	CHS Flooding and SLR initiatives	ALL	15	Flooding	Reduce flood insurance premiums by improving our CRS rating.
Infrastructure	CHS Major Infrastructure Project	Peninsula	51	Sea Level Rise; Storm Surge	High Battery: Repair rip-rap damage from Hurricane Irma
Infrastructure	CHS Major Infrastructure Project	Peninsula	52	Sea Level Rise; Storm Surge	Low Battery Seawall Improvements: Repair 900 feet of seawall damaged by Hurricane Matthew
Infrastructure	CHS Flooding and SLR initiatives	ALL	72	Sea Level Rise	Update City's 1984 Master Drainage Plan for Sea Level Rise
Infrastructure	CHS Flooding and SLR initiatives	ALL	41	Sea Level Rise; Tidal Flooding	Evaluate streets for accessibility for various levels of service given Sea Level Rise to promote best routes
Infrastructure	CHS Flooding and SLR initiatives	Peninsula	24	Sea Level Rise; Storm	Complete the repair and reinforcement of the Battery seawall (Low Battery Project)

Component	Source	Area/ Location	ID#	Threat	Initiative (Strategy or Project)
				Surge; Tidal Flooding	
Infrastructure	CHS Flooding and SLR initiatives	ALL	19	Tidal Flooding	Identify opportunities for and install check valves to prevent tidal inundation
Resources	CHS Flooding and SLR initiatives	ALL	60	Flooding and Sea Level Rise	Collaborate with and learn Dutch and other methods of managing and living with water
Resources	CHS Flooding and SLR initiatives	ALL	61	Flooding and Sea Level Rise	Create and pursue new and emerging revenue sources, both public and private, for the future
Resources	CHS Flooding and SLR initiatives	ALL	65	Flooding and Sea Level Rise	Acquire ten new Stormwater Department positions
Resources	CHS Flooding and SLR initiatives	ALL	66	Flooding and Sea Level Rise	Complete Dutch Dialogues Charleston
Resources	CHS Flooding and SLR initiatives	Peninsula	67	Flooding and Sea Level Rise	Complete USACE Peninsula Flood Risk Management Study
Resources	Workshop 2	ALL	70	Flooding and Sea Level Rise	Develop local funding mechanisms (i.e., gas tax or tax increment financing) to provide dollars towards non-capacity transportation projects

Prioritize and Plan

After the 78 options were categorized by the Components of Resilience, they were categorized into three tiers or priorities.

Tier 1

These are strategic priorities to allocate resources needed for implementation. These actions were identified as Tier 1 because they

- Are holistic in representing the city's Five Critical Components
- Address both near-term urgencies and long-term issues
- Recognize opportunities in preventing added future risk
- Are equitable in addressing all areas of the city while also focusing on the most vulnerable people and areas of the city

Tier 2

These are important options and strategies to move forward as resources become available.

Tier 3

These are supporting options and strategies that have lower priority with limited resources.

Practitioner's Guide Resource: 5.2 Community Options Prioritization Table

Using the options from Resource 4.5 and considering the Tiers assigned, a final exercise was held with the Planning Team to consider the ***Ability to Implement*** for each option. Four criteria were used to evaluate the ability to implement any particular option.

Financial: Is the option financially feasible with current resources?

Political: Does the option have current political support?

Staff Capacity: Is there existing staff capacity available to implement?

Socially Responsible: Is the option socially responsible? Does it help to address social equity goals in the city?

Below is the final Options Prioritization Table for the options in the previous step and recorded on Resource 4.5. This table provides the full set of criteria.

The Final Options Prioritization Table

Component	Source	Area/ Location	ID#	Threat	Initiative (Strategy or Project)	CRITERIA - Ability to Implement 3=Green Light / 2=Yellow Light / 1=Red Light			
						Financial	Political	Staff Capacity	Socially Responsible
Governance	Workshop 2 (Katie)	ALL	60	Flooding and SLR	Participate in future update of COG's LRTP to ensure SLR is included in the plan, making us eligible for funding in future (and include resilience as prioritization criteria)	2	2	2	3
Governance	Workshop 2 (Katie)	ALL	61	Flooding and SLR	Update current projects in LRTP based on Vulnerability Assessment prioritization? (put priorities on projects based on road map data from VA)	3	2	1	3
Governance	Assessment Team	ALL	62	Flooding and SLR	Alternate route planning for emergency service vehicles	3	3	3	3
Governance	CHS Flooding and SLR initiatives	ALL	14	Flooding	Aggressively seek and support new NFIP acquisition legislation for City of Charleston pilot project	3	1	2	2
Governance	CHS Flooding and SLR initiatives	ALL	15	Flooding	Reduce flood insurance premiums by improving our CRS rating.	2	1	2	3
Infrastructure	CHS Major Infrastructure Project	Peninsula	51	Sea Level Rise; Storm Surge	High Battery: Repair rip-rap damage from Hurricane Irma	3	3	3	2
Infrastructure	CHS Major Infrastructure Project	Peninsula	52	Sea Level Rise; Storm Surge	Low Battery Seawall Improvements: Repair 900 feet of seawall damaged by Hurricane Matthew	3	3	3	2
Infrastructure	CHS Flooding and SLR initiatives	ALL	72	Sea Level Rise	Update City's 1984 Master Drainage Plan for Sea Level Rise	2	2	2	3

Component	Source	Area/ Location	ID#	Threat	Initiative (Strategy or Project)	CRITERIA - Ability to Implement (3=Green Light / 2=Yellow Light / 1=Red Light) Financial	Political	Staff Capacity	Socially Responsible
Infrastructure	CHS Flooding and SLR initiatives	ALL	41	Sea Level Rise; Tidal Flooding	Evaluate streets for accessibility for various levels of service given Sea Level Rise to promote best routes	3	3	2	3
Infrastructure	CHS Flooding and SLR initiatives	Peninsula	24	Sea Level Rise; Storm Surge; Tidal Flooding	Complete the repair and reinforcement of the Battery seawall (Low Battery Project)	2	2	2	2
Infrastructure	CHS Flooding and SLR initiatives	ALL	19	Tidal Flooding	Identify opportunities for and install check valves to prevent tidal inundation	2	2	2	3
Resources	CHS Flooding and SLR initiatives	ALL	60	Flooding and Sea Level Rise	Collaborate with and learn Dutch and other methods of managing and living with water	2	1	3	3
Resources	CHS Flooding and SLR initiatives	ALL	61	Flooding and Sea Level Rise	Create and pursue new and emerging revenue sources, both public and private, for the future	3	3	3	3
Resources	CHS Flooding and SLR initiatives	ALL	65	Flooding and Sea Level Rise	Acquire ten new Stormwater Department positions	3	3	3	3
Resources	CHS Flooding and SLR initiatives	ALL	66	Flooding and Sea Level Rise	Complete Dutch Dialogues Charleston	2	1	2	3
Resources	CHS Flooding and SLR initiatives	Peninsula	67	Flooding and Sea Level Rise	Complete USACE Peninsula Flood Risk Management Study	3	2	2	3

Component	Source	Area/ Location	ID#	Threat	Initiative (Strategy or Project)	CRITERIA - Ability to Implement 3=Green Light / 2=Yellow Light / 1=Red Light			
						Financial	Political	Staff Capacity	Socially Responsible
Resources	Workshop 2	ALL	70	Flooding and Sea Level Rise	Develop local funding mechanisms (i.e., gas tax or tax increment financing) to provide dollars towards non-capacity transportation projects	3	1	1	3

Take Action

As a result of the numerous efforts undertaken by the City including the 2015 Sea Level Rise Strategy, 2019 Flooding and Sea Level Rise Strategy and the 2020 All hazards Risk and Vulnerability Assessment and numerous follow on planning efforts such as: Dutch Dialogues Charleston, City Water Plan, City Land Use Plan, Charleston has taken action that supports its plan to build a more resilient city. An up to date web-page is maintained that lists the plans mentioned above, an updated status report and a more updated 2023 Sea Level Rise Strategy.

These planning efforts have resulted in numerous actions being taken across all areas listed in the All Hazards Risk and Vulnerability Assessment Report. Resilience is an iterative process that will continue to evolve, Charleston continues to evolve in its Resilience journey.

All actions required a strong coalition of committed city staff, stakeholder groups, community groups and resilience professionals from numerous disciplines including engineering, architecture, landscape architecture, resilience, science, finance, government and academia.

Some notable actions that have been accomplished from the 2020 report are listed below using the following format.

Charleston has been working hard to build a more resilient city. They've made plans to deal with rising sea levels, flooding, and other risks. These plans include the 2015 Sea Level Rise Strategy, the 2019 Flooding and Sea Level Rise Strategy, and the 2020 All Hazards Risk and Vulnerability Assessment. They've also taken other steps, like the Dutch Dialogues Charleston, the City Water Plan, and the City Land Use Plan.

You can find all these plans, along with updates and the newest 2023 Sea Level Rise Strategy, on the city's website. These plans have led to many actions being taken to address the risks identified in the 2020 assessment. Charleston knows that becoming resilient is an ongoing process, and they're committed to continuing this journey.

All of this work has been possible thanks to a strong team of city staff, community groups, and experts from different fields like engineering, architecture, science, and government.

Here are some of the most important things Charleston has done since the 2020 report framed in the following format:

- Title or Project from 2020 Report
    - Category of the five Components of Resilience
    - Significant partner and or lead city department
    - Brief description of the project or policy
    - Hazard(s) addressed
    - Funding Source(s)

Accomplishments

- Identify opportunities for and install check valves to prevent tidal inundation
    - Infrastructure
    - Stormwater Department
    - Numerous tidal check valves have been installed around the Peninsula to prevent tidal inundation during high tide
    - Flooding
    - City Drainage Funds

- Complete USACE Peninsula Flood Risk Management Study
    - Resources ($1.2 billion dollar cost)
    - USACE Coastal Storm Risk Management Study (CSRM)/ All City Departments
    - Eight mile perimeter protection system around the Peninsula with floodgates and pumps
    - Storm Surge
    - ACOE 65/35 cost share with city

- Huger and King Street Drainage “Tidal Protection”
    - Infrastructure
    - Stormwater Department
    - New and improved rainwater collection and local pump station
    - Flooding
    - Perhaps the most in need area of city for local flooding project
    - FEMA grant

- Update the City’s Comprehensive Plan for Sea Level Rise and reevaluate the City’s Zoning Ordinance
    - Land Use
    - Planning Department
    - Flooding
    - City Funds

- Design Guidelines for retrofitting and elevating historic building
    - Outreach/ Governance
    - Planning Department
    - New guidelines to allow for elevating historic homes
    - Cooperation between city Planning Department and Historic Advocacy Groups
    - City funds