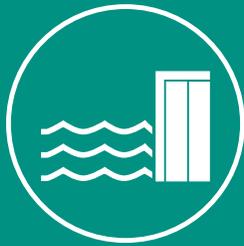


# Sea Level Rise



## Participant Workbook

Name:

Table #:



# Notes

# Stakeholders



**Jonathan - Emergency Room Doctor**

- Works at a hospital in a low-income neighborhood that offers affordable emergency care
- The hospital acts as a crisis community center during major flooding events
- Often drives to the hospital to cover night shifts



**Matthew - Oyster Farmer**

- Operates his family owned mussel and oyster farm business and gives eco-tours on the side
- His property value shot up recently, but his offices are located in the flood zone
- Farming will become more difficult if the sea levels rise, but the plans to protect the city from rising waters might affect his taxes and the local ecosystem



**Andrea - Power Plant CEO**

- She has noticed tidal flooding around the power plant increasing over the last few years
- Concerned about impacts of a strong storm at high tide
- Renovations to make the power plant more flood proof would be unpopular with the public due to the cost and service disruptions

# Stakeholders



**Tina - Economic Development Director**

- Works with local investors to redevelop valuable land on the coastline
- Must consider the local economy, coastal ecosystems, and public safety in planning decisions
- Sea level rise has impacted her decision making due to the mixed impacts of each resilience plan she proposes



**Frank - Transit Worker**

- Union delegate who helps negotiate major transit system changes
- Some of his colleagues think the system should be protected from the effects of a major storm and flooding
- Others think the system first needs general improvements before doing any huge protection projects



**Sandra - Local Resident**

- Single mother who works at the fishing docks and lives in a housing project near the coastline
- Worried new high rises in the neighborhood will affect her rent
- Recently, nearby houses flooded during a storm at high tide. She is worried huge construction projects to flood proof the city will impact day to day life

# Resilience



## KEEP WATER OUT

Keep Water Out involves building man-made barriers or using natural flood protection to prevent coastal flooding. This could mean installing a massive lock, erecting seawalls, or even restoring wetlands.

### ECONOMIC ★★

Barriers are expensive to build and coastal armoring and artificial beaches require costly annual maintenance and regular monitoring. Vegetative methods, such as a living shoreline, are less costly. Massive locks are a possible tourist attraction, although the city will lose money in real estate since some of the extremely valuable coastline will no longer be available for redevelopment.



## LIVING WITH WATER

Living with Water accommodates rising sea levels by allowing water into city spaces. This means elevating roads and buildings above water levels, waterproofing electrical and transportation infrastructures, and building floating or floodable development.

### ECONOMIC ★★★

Floodable development is untested and therefore a risky investment, while flood-proofing structures presents challenges to existing frameworks such as freshwater and electricity. Retrofitting buildings can be expensive but may be a cost effective strategy for new buildings.



## MANAGED RETREAT

Drastic managed retreat involves completely relocating vulnerable structures and neighborhoods, while less-intensive measures include prohibiting development in vulnerable zones and offering incentives for residents and businesses to relocate on their own.

### ECONOMIC ★★★

Relocating is costly in areas that are significantly developed, but usually less expensive than armoring strategies. The federal government would save money in the long run by reducing losses that they would have to pay for under the National Flood Insurance Program.

# Strategies

## ENVIRONMENTAL ★★★

Barriers can cause environmental damage by restricting and altering the natural flushing of an estuary. Even small seawalls cut off water from its floodplains, which are often valuable breeding and feeding zones. Wetlands are valuable because they filter pollutants, sequester carbon, and create critical habitats for fish and wildlife.

## SOCIAL ★★★➤

Barriers protect large vulnerable areas from flooding, saving lives and preventing property damage. Similarly, coastal armoring protects development along coastlines. In addition to their flood protection services, beaches and wetlands provide recreational space for communities.

## ENVIRONMENTAL ★★★★

Natural areas such as floodable waterfront parks create green space and habitat. Floating structures can provide a dynamic aquatic habitat in a similar way to a coral reef or sunken ship.

## SOCIAL ★★

Floodable spaces can be used as recreational areas, although they can also be a public health hazard when filled with polluted stormwater. Floating buildings provide flood and hurricane safety for coastal residents. However, retrofitting and/or closing infrastructure can be an inconvenience.

## ENVIRONMENTAL ★★★★★➤

Managed retreat can be designed to allow the restoration of flood-buffering wetlands and natural shoreline habitat.

## SOCIAL ★★

Important landmarks and attractions can be lost in the relocation process, which can disrupt personal roots to a place. There are also significant political complications involving tremendous legal and equity issues with land and property disputes. Despite this, retreat minimizes human suffering by relocating before a catastrophic flood.



# Resilience Plans



## KEEP WATER OUT

### Plan A

- A massive lock will protect most coastal areas surrounding the Kingtown peninsula from flooding against a 20-foot water level.
- The huge floodgate will close during coastal storms without major disruption to shipping activities or coastal views during non-flood periods.
- The project will cost an estimated \$4 billion over a period of approximately 5 years and would pose some disruption to shipping and coastal commerce activities during installation.
- A living shoreline surrounding the barrier will help to sustain coastal marshes and oyster grounds.

### Plan B

- Coastal neighborhoods will be armored with seawalls and levees.
- Vulnerable structures such as the Kingtown electric station, the Kingtown hospital, and existing residences in the coastal neighborhood of East Kingtown will be better protected.
- The seawalls could be incrementally heightened over time if more protection is required.
- The installation, which will cost about \$350 million, will negatively impact certain coastal ecosystems and beaches will need to be periodically replenished.

# Resilience Plans



## LIVING WITH WATER

### Plan A

- The city will spend \$5 billion to elevate roadways and structures in vulnerable zones.
- It will also transform infrastructures and public spaces to accommodate water during coastal flooding events.
- Street levels in coastal neighborhoods will be raised by 12 feet and lined with floodable vegetation.
- City planners will use the construction period to waterproof electrical, sewer and transportation infrastructures.

### Plan B

- A \$500 million investment in flood accommodation measures, along with new zoning rules, will help Kingtown better accommodate storm surges.
- Ten new underground parking garages will store storm water during times of extreme coastal flooding, subway stations will be used as underground reservoirs, and floodable waterfront parks will act as storm barriers.
- Newly constructed buildings in coastal neighborhoods must elevate electrical systems to the roofs of buildings and must be made flood proof or floatable.
- Grants from the city will be made available to help existing residents upgrade to these new standards over time.

# Resilience Plans



## MANAGED RETREAT

### Plan A

- Through \$3 billion in city-funded projects and programs, the most vulnerable structures and neighborhoods will be relocated and replaced with natural protection.
- The Kingtown Power Station will be moved several miles inland, along with East Kingtown Hospital.
- The Kingtown Redevelopment Authority will establish a “Rising Tide” incentive program to purchase coastal land parcels from property owners at near-market prices, replacing these buildings and structures with natural floodable areas and protecting the inland areas from coastal storm surges.

### Plan B

- For this \$25 million plan, zoning requirements will immediately prohibit developers from purchasing land on the coastal side of a determined setback line.
- The city announces that it will no longer offer basic services such as trash removal, subway service, street maintenance, or public schools in the retreat zone after a period of 10-15 years.
- A city-sponsored program will offer relocation grants to help coastal residents and small businesses relocate.
- Publicly owned buildings along the coast will be replaced with beaches, parks and a series of outdoor monuments, and the shoreline will be open to aquaculture, fishing, and tourism activities.





# My Resilience Plan 2

KEEP WATER OUT 	LIVING WITH WATER 	MANAGED RETREAT 
Plan A	Plan A	Plan A
		
Plan B	Plan B	Plan B
		

**What resilience plan would you make for Kingtown? Why did you choose this plan?**

*Mark the empty coin spaces to choose a plan. Remember you only have three coins and can't use all three on one strategy!*

---

---

---

---

**What would you change about this plan? Are there specific resilience actions you would like to add or remove?**

---

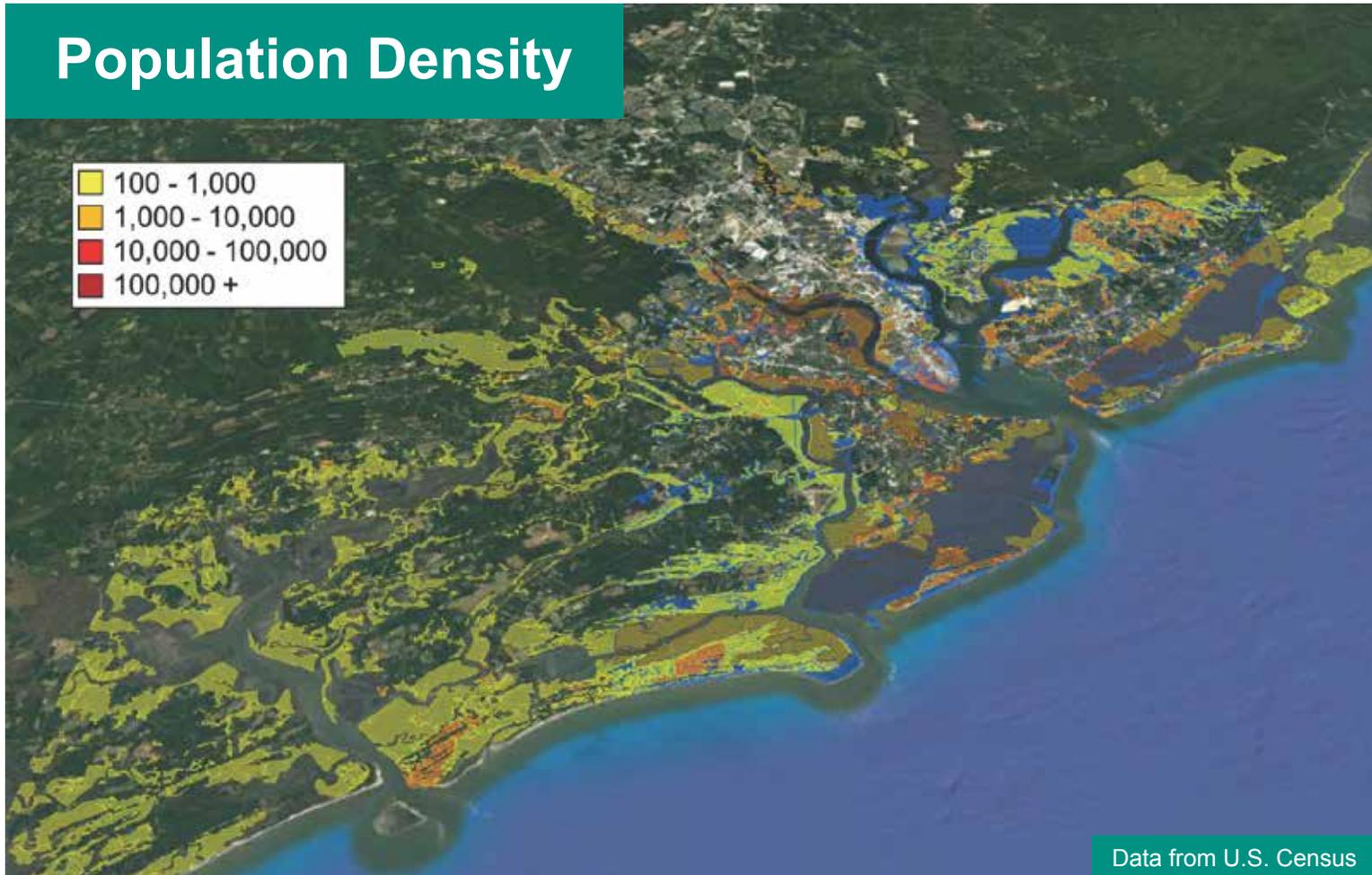
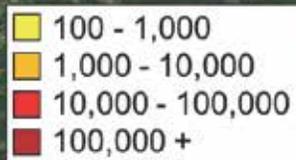
---

---

---

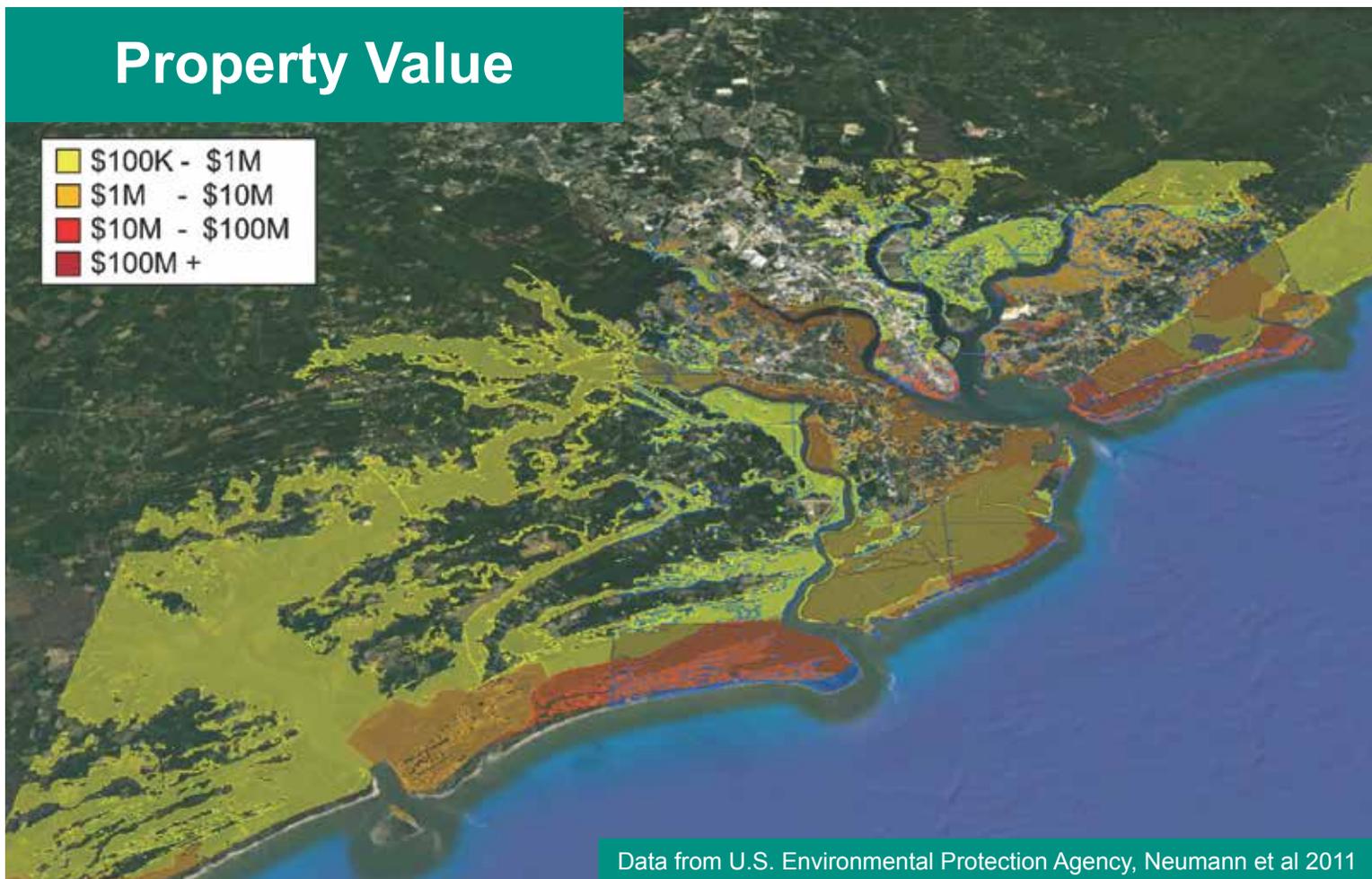
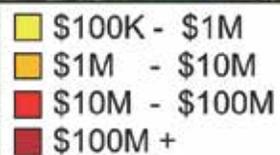
---

# Population Density



Data from U.S. Census

# Property Value



Data from U.S. Environmental Protection Agency, Neumann et al 2011

# Kingtown

