

# Emergency Room Doctor



Jonathan works long hours as head of the emergency room department of Kingtown Hospital. He often gets called in to cover night shifts and drives into town, rather than taking public transportation like he does for his daily commute. The hospital provides care for underserved populations and acts as a crisis and community center in times of flooding. Lately, he's been thinking a lot about proposed renovations to help protect the building, especially after Hurricane Katrina. He worries that major construction could impact the day-to-day operations of the hospital in the near term and drive up the cost of emergency health care for patients who already can't afford it.



**Emergency Room Doctor**



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# Local Resident



Sandra is a single mother of two, lives in a low-income housing project in East Kingtown, and has a part-time job working on the local fishing docks. Property developers built several new high-rise structures with views of the harbor last year, so she's worried about what might happen to her rent. Sandra loves living close to the water and her job, but her aging, low-rise building is vulnerable - the next building over was flooded in a storm at high tide last year. She heard at a community meeting that the city may pursue large-scale construction projects to make the project more flood-proof, but she's worried that this could make day-to-day life more difficult with two kids and a job.



Local Resident



Local Resident



Local Resident



Local Resident



Local Resident



Local Resident



Local Resident



Local Resident

# Oyster Farmer



Matthew owns and operates a small aquaculture business harvesting oysters and mussels in East Kingtown. His family bought a small plot of land before the property values shot up. Matthew also gives eco-tours of the urban coastline. Although his oyster beds can protect the shoreline from rising seas, farming will be harder if water levels rise, and his business offices are in a flood zone. Matthew has read about plans to protect the neighborhood with coastal armoring or large storm surge barriers, but worries that these ideas could increase his taxes and might impact the local ecosystems he depends on.



Oyster Farmer



Oyster Farmer



Oyster Farmer



Oyster Farmer



Oyster Farmer



Oyster Farmer



Oyster Farmer



Oyster Farmer

# Power Plant CEO



Andrea is the CEO of Kingtown Power Station which provides electricity to the city and surrounding neighborhoods. She's observed increased tidal flooding on the grounds of the plant in recent years, and has been increasingly concerned about the potential impacts of a high-impact storm at high tide. She knows that renovations to make the station more flood proof, or to move it, will be unpopular because of higher cost and service disruptions.



Power Plant  
CEO



Power Plant  
CEO



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CEO



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Power Plant  
CEO

# Transit Worker



Frank has been a supervisor for the Kingtown subway system for 21 years, and serves as a union delegate to help negotiate major system changes on behalf of transit employees. Storm surges and flooding are a major concern for the already stressed public transit system, and transit workers are divided about what actions to take. Some of them say the existing system would shut down if an event like Superstorm Sandy happened in Kingtown. Others are afraid that large-scale protections would delay other much-needed improvements to the system's infrastructure. These large updates could even lead to the cancellation of scheduled pay raises.



**Transit Worker**



**Transit Worker**



**Transit Worker**



**Transit Worker**



**Transit Worker**



**Transit Worker**



**Transit Worker**



**Transit Worker**

# Economic Development Director



Tina is the Chief Economic Development Officer for the City of Kingtown. Her office is responsible for the city's planning, zoning and permitting of new building projects, which includes working with local investors to redevelop the valuable land on the East Kingtown coastline. In her permitting decisions, she considers the potential impacts of proposed projects on Kingtown's economy, coastal ecosystems, and public safety. Sea level rise is making these decisions more complex, because all of the proposed resilience strategies have mixed impacts.



**Economic  
Development  
Director**



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KEEP WATER OUT 	LIVING WITH WATER 	MANAGED RETREAT 
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## SLR\_001

Our plan puts a lot of money towards the Keep Water Out strategy and a little money towards the Living with Water strategy. Once completed, the plan eliminates most of the risk from ocean flooding into the downtown core, but many coastal areas and marshlands will be left vulnerable to flooding. A massive ocean lock and a living shoreline have been installed to block stormwater from passing onto land. The city will also install flood control areas such as plazas and underground reservoirs, as well as a system of pumps to help remove floodwaters from vulnerable structures and areas. In addition, new buildings along the seashore must be designed so they are more resistant to flooding. While these updates will help decrease the risk from storm surges in the city, some people are displeased. Seawalls will be extended from the lock to help protect some neighborhoods outside the floodgates, but some neighborhoods right on the ocean are still left vulnerable. Also, the coastal shipping industry is negatively impacted, because some ships can no longer get past the locks.

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## SLR\_002

Our plan puts a lot of money towards the Keep Water Out strategy and a little money towards the Managed Retreat Strategy. Once completed, the downtown and eastern suburban neighborhoods of the city are protected from most storm surges, but the western part of the city will remain vulnerable to flooding. A massive ocean lock and a living shoreline have been installed to block stormwater from passing onto land. The areas along the southern sandbars and certain other areas will be phased out for development over time, so that the most vulnerable sections outside the protection of the lock will be transformed into natural flood protection zones. While these updates will greatly decrease the amount of flooding in the city, some people are unhappy. Because the city does not have the resources to move everyone in the floodzones away from the water, some residents and businesses still along the shoreline will remain as long as they can. These people will both be left vulnerable to flooding and will lose basic services like communication, waste removal and hospitals as the city gradually lets these floodprone neighborhoods go back to the sea over a period of 10 to 15 years. Also, the coastal shipping industry is negatively impacted by the construction of the huge storm barrier, because some ships can no longer get past the locks.

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## SLR\_003

Our plan puts a lot of money towards the Keep Water Out strategy with one leftover coin. Once completed, the plan eliminates most of the risk from ocean flooding into the downtown core, but many coastal areas and marshlands will be left vulnerable to flooding. A massive ocean lock and a living shoreline have been installed to block stormwater from passing onto land. While seawalls will be extended from the lock to help protect some neighborhoods outside the floodgates, some neighborhoods right on the ocean are still left dangerously vulnerable, and this problem will increase as sea levels rise. The coastal shipping industry is negatively impacted, because some ships can no longer get past the locks.

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## SLR\_004

Our plan puts a small amount of money towards each of the strategies. Once completed, some flooding risk decreases in the most vulnerable areas downtown. However, considerable risks remain in the edges of the city and near the coastal marshlands. In the downtown areas, a system of flood control areas and reservoirs that will hold stormwater is combined with seawalls to protect vulnerable installations, such as the power plant. The areas along the southern sandbars and certain other areas will be protected with levees and seawalls, but eventually phased out for development over time. Certain crucial structures, such as the Kingtown hospital, are relocated to more inland locations. While these updates will help decrease the amount of flooding in the city, some people are unhappy with the changes. Because the city does not have the resources to move everyone in the floodzones away from the water, some residents and businesses still along the shoreline will remain as long as they can. These people will both be left vulnerable to flooding and will lose basic services like communication, waste removal and hospitals as the city gradually lets these floodprone neighborhoods go back to the sea over a period of 10 to 15 years. However, some of these people will be awarded incentives to either make their residences floodproof or relocate to safer locations.

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## SLR\_005

Our plan puts a small amount of money towards the Keep Water Out and Managed Retreat strategies. Once completed, much of the coastal flooding risk remains and will get worse as the sea levels rise. A system of seawalls and levees will be put into place to help protect coastal areas and vulnerable locations such as the power plant. The areas along the southern sandbars and certain other areas will be phased out for development over time. These updates do not sufficiently decrease the amount of coastal flooding risk in the city, and so many people are unhappy with the updates that have been made. Crucial systems such as the hospital and the central subway station are likely to flood with major coastal storms. Because the city does not have the resources to move everyone in the floodzones away from the water, some residents and businesses still along the shoreline will remain as long as they can. These people will both be left vulnerable to flooding and will lose basic services like communication, waste removal and hospitals as the city gradually lets these floodprone neighborhoods go back to the sea over a period of 10 to 15 years.

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## SLR\_006

Our plan puts a small amount of money towards the towards the Keep Water Out strategy and a little money towards the Living with Water strategy. Once completed, the flooding risk in the downtown core and along the water is decreased substantially, but not eliminated everywhere. A system of seawalls and levees will be put into place to help protect coastal areas and vulnerable locations, such as the power plant. The city will also install flood control areas such as plazas and underground reservoirs, as well as a system of pumps to help remove floodwater from vulnerable structures and areas. In addition, new buildings along the seashore must be designed so they are more resistant to flooding. These updates help to reduce vulnerability to the most exposed areas on the southern sandbars, but the city remains vulnerable to flooding and some residents are not happy about the changes. Many neighborhoods are still at risk for floods and coastal property values decrease substantially as views are blocked by the seawalls. Also, local businesses such as oystering and fishing will be impacted by the construction of these coastal barriers. The public is also thinking about safety precautions of the water plazas as children can easily fall into the open pool of standing seawater.

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## SLR\_007

Our plan puts a small amount of money towards the Keep Water Out strategy with two coins leftover. Once completed, the downtown, suburban neighborhoods, and rural areas of the city will remain vulnerable to storm surges. A system of seawalls and levees will be put into place in to help protect coastal areas and vulnerable locations such as the power plant. These updates help to reduce vulnerability to the most exposed areas on the southern sandbars, but the city remains vulnerable to flooding and some residents are not happy about the changes. Crucial system such as the hospital and central subway station are likely to flood during major coastal storm events, and roadways will often be impassable. Many neighborhoods are still at risk for floods, and coastal property values decrease substantially as views are blocked by the seawalls. Also, local businesses such as oystering and fishing will be impacted by the construction of these coastal barriers.

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## SLR\_008

Our plan puts a lot of money towards the Living with Water strategy and a small amount of money towards the Managed Retreat strategy. Once completed, many downtown and suburban neighborhoods of the city are better protected from floodwaters, but the coasts are still vulnerable. Many structures and streets are elevated so that flooding will no longer be dangerous, and the public transit system and power plants are protected with barriers and elevations. While these updates will help decrease the risk and danger from flooding in the city, some people are unhappy about these impending changes. Flooding will still occur in places that cannot be elevated, including the areas on the southern sandbars. Because the city does not have the resources to move everyone in the floodzones away from the water, some residents and businesses still along the shoreline will remain as long as they can. These people will both be left vulnerable to flooding and will lose basic services like communication, waste removal and hospitals as the city gradually lets these floodprone neighborhoods go back to the sea over a period of 10 to 15 years. Also, the construction to elevate the city and buildings will be disruptive to people's daily lives and the economy.

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## SLR\_009

Our plan puts a lot of money towards the Living with Water strategy and a small amount of money towards the Keep Water Out strategy. Once completed, most neighborhoods of the city are better protected from floodwaters. By investing a large portion of money in the Living with Water strategy, many structures and streets are elevated so that flooding will no longer be dangerous. The public transit system and power plants are protected with barriers and elevations. A system of seawalls and levees will be put into place to help protect coastal areas and vulnerable locations such as the power plant. While these updates will substantially help protect the city from coastal flooding damages, some people are unhappy about these impending updates. Coastal property values decrease substantially as views are blocked by the seawalls, and local businesses such as oystering and fishing will be impacted by the construction of these coastal barriers. Also, the construction to elevate the city and buildings will be disruptive to people's daily lives and the economy.

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## SLR\_010

Our plan puts a lot of money towards the Living with Water strategy with one leftover coin. Once completed, most downtown neighborhoods of the city are better protected from floodwater, but flooding will occur regularly in coastal zones. By investing a large portion of money in the Living with Water strategy, many structures and streets are elevated so that flooding will no longer be dangerous, but some vulnerabilities remain. The public transit system and power plants are protected with barriers and elevations. However, flooding will still occur in places that cannot be elevated, including the areas on the southern sandbars. While these updates will help decrease the damage from flooding to certain neighborhoods, coastal flooding on roadways at high tide will get worse as sea levels rise. Also, oystering will become more difficult in the deeper water, impacting the local marine economy.

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## SLR\_011

Our plan puts a small amount of money towards the Living with Water strategy with two leftover coins. Once completed, the downtown and suburban neighborhoods of the city will remain vulnerable to coastal flooding damage. The city will install flood control areas such as plazas and underground reservoirs, as well as a system of pumps to help remove floodwater from vulnerable structures and areas. In addition, new buildings along the seashore must be designed so they are more resistant to flooding. While these updates will help decrease the damage from flooding to certain downtown neighborhoods, much of the coastal flooding risk remains and will get worse as the sea levels rise, leaving many people unhappy. Not only is flood insurance becoming more expensive for many residents, but the power plant, roads, and subway system remain exposed and unprotected, impacting travel and making daily life very challenging and dangerous.

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## SLR\_012

Our plan puts a small amount of money towards the Living with Water and strategy and a lot of money towards the Managed Retreat strategy. Once completed, many areas of the city will remain vulnerable to flooding damage, but the most vulnerable areas and residents are relocated. By investing in the Managed Retreat strategy, the city implements a plan to move crucial infrastructures such as the hospital and power plant further inland. Residents and businesses in the locations near the coast are provided with a “Rising Tide” incentive program to help move them further from dangerous flooding areas. The city will also install flood control areas such as plazas and underground reservoirs in downtown locations, as well as a system of pumps to help remove floodwater from vulnerable structures and areas. While these updates will help decrease the damage from flooding to certain neighborhoods and eliminates much of the risk at the coastal locations, coastal flooding on roadways at high tide will get worse as sea levels rise. For those who aren’t in a retreat zone and don’t need to relocate, flood insurance may become expensive since flooding is likely to increase and no structures are being erected to keep the water out.

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## SLR\_013

Our plan puts a small amount of money towards the Keep Water Out strategy and a lot of money towards the Managed Retreat strategy. Once completed, many areas of the city will remain vulnerable to coastal flooding events, although the risk will decrease for those residents living nearest to the coastline. By investing in the Managed Retreat strategy, the city implements a plan to move crucial infrastructures such as the hospital and power plant further inland. Residents and businesses in the locations near the coast are provided with a “Rising Tide” incentive program to help move them further from dangerous flooding areas. A system of seawalls and levees will also be put into place to protect coastal areas and vulnerable locations. This strategy helps to reduce flooding vulnerabilities and moves most at-risk populations and structures away from harm’s way, but some people are unhappy and some systems are still vulnerable. The Central Subway station remains unprotected and prone to flooding. Coastal property values also will decrease substantially as views are blocked by the seawalls. The local economy can benefit from increased use of the natural areas near the seashore, but many businesses in the coastal zones must move, impacting them economically.

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## SLR\_014

Our plan puts most of the money towards the Managed Retreat strategy with one leftover coin. Once completed, most areas of the city will remain vulnerable to flooding damage, but residents living in the most vulnerable areas are relocated. By investing in the Managed Retreat strategy, the city implements a plan to move crucial infrastructures, such as the hospital and power plant, further inland. Residents and businesses near the coast are provided with a “Rising Tide” incentive program to help move them further from dangerous flooding areas. While these updates will help decrease the damage from flooding to certain neighborhoods and eliminates much of the risk at the coastal locations, coastal flooding on roadways at high tide will get worse as sea levels rise. For those who aren’t in a retreat zone and don’t need to relocate, flood insurance may become expensive since flooding is likely to increase and no structures are being erected to keep the water out. Businesses in the coastal retreat zones must move, impacting them economically. The Central Subway station remains unprotected and prone to flooding, but the local economy can benefit from increased use of the natural areas near the seashore.

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## SLR\_015

Our plan puts a small amount of money towards the Managed Retreat strategy with two leftover coins. Once completed, all downtown, suburban neighborhoods of the city will remain vulnerable to coastal flooding damage. This plan will help some businesses and people to move away from the flooding zones, but most residents will be unhappy about the changes. Crucial systems, such as the hospital and Central Subway station, are likely to flood with major coastal storms. Also, coastal flooding on roadways at high tide will get worse as sea levels rise, and flood insurance will become very expensive for some residents who are out of the retreat zones. Because the city does not have the resources to move everyone in the floodzones away from the water, some residents and businesses still along the shoreline will remain as long as they can. These people will both be left vulnerable to flooding and will lose basic services like communication, waste removal and hospitals as the city gradually lets these floodprone neighborhoods go back to the sea over a period of 10 to 15 years.

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## SLR\_016

Our plan puts a small amount of money towards the Living with Water strategy and the Managed Retreat strategy. Once completed, the downtown and suburban neighborhoods of the city will remain vulnerable to coastal flooding damage. The city will install flood control areas such as plazas and underground reservoirs, as well as a system of pumps to help remove floodwater from vulnerable structures and areas. In addition, new buildings along the seashore must be designed so they are more resistant to flooding. This plan will help some businesses and people to move away from flooding zones, but crucial systems, such as the hospital and Central Subway station, are likely to flood with major coastal storms. Also, coastal flooding on roadways at high tide will get worse as sea levels rise, and flood insurance will become very expensive for some residents who are out of the retreat zones. Because the city does not have the resources to move everyone in the floodzones away from the water, some residents and businesses still along the shoreline will remain as long as they can. These people will both be left vulnerable to flooding and will lose basic services like communication, waste removal and hospitals as the city gradually lets these floodprone neighborhoods go back to the sea over a period of 10 to 15 years.

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## SLR\_017

No strategies implemented. The city continues to experience growing vulnerabilities to sea level rise without a resilience plan.



# KEEP WATER OUT



## Plan A

A massive lock, similar to the Thames Barrier in London, will protect most coastal areas surrounding the Kingtown peninsula from flooding against a 20-foot water level. The huge floodgate will close during major coastal storms without major disruption to shipping activities or coastal views during non-flood periods. A living shoreline surrounding the barrier will help to sustain coastal marshes and oyster grounds; however, the project will require dredging of soil from the harbor to accommodate the lock structure. Also, some of the extremely valuable coastline in the East Kingtown neighborhood will no longer be available for previously planned real estate. 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 the installation period.

## Plan B

Coastal neighborhoods will be armored with seawalls and levees, protecting against a total water height of 23 feet during major storm events. While this plan cannot protect the entire city and certain regions will be left exposed, vulnerable structures such as the Kingtown electric station, the Kingtown hospital, and existing residences and low-lying structures in the coastal neighborhood of East Kingtown will be better protected. Some views from beaches and seaside properties will be obstructed, potentially lowering property values. The seawalls could be incrementally heightened over time (at additional expense) if more protection is required. The installation will negatively impact certain coastal ecosystems by disrupting the movement of water and organisms. Beaches will need to be replenished periodically with sand mined from the ocean, as they will no longer reform naturally, and some oyster and fishing habitats very close to the shore will be lost. The estimated cost of implementing this plan is \$350 million.



# 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 while improving emergency response. Street levels in coastal neighborhoods will be raised by 12 feet and lined with floodable vegetation. The ten-year construction period is certain to disrupt local businesses, but city planners will use this period to waterproof electrical, sewer and transportation infrastructures on and under the streets. Subway stations will automatically close and drain during flooding, and new submersible trains will allow workers to make emergency system repairs if the tunnels do flood. The underground highway tunnels will shut during storms and emergency exits will lead directly to public shelters. The buildings at Kingtown Power Station will be flood proofed, and backup generators will be installed at elevated heights to avoid inundation.

## Plan B

A \$500 million investment in flood accommodation measures, along with new zoning rules, will help Kingtown better accommodate storm surges, reducing risk to property and public safety. Ten new underground parking garages will store storm water during times of extreme coastal flooding. Subway stations will also be used as underground reservoirs. Floodable waterfront parks, converted from land parcels that were previously zoned for coastal development, will act as storm barriers. As a result of new zoning rules, newly constructed buildings in coastal neighborhoods must elevate electrical systems to the roofs of buildings and must either be flood proof (impervious to salt water) or floatable on anchored poles when water levels rise to as high as 12 feet. These restrictions will not immediately apply to existing buildings, but grants from the city will be made available to private homeowners and small businesses to help existing residents upgrade to these new standards over time.



# MANAGED RETREAT



## Plan A

The most vulnerable structures and neighborhoods will be relocated and replaced with natural protection to reduce flooding vulnerability, through \$3 billion in city-funded projects and programs. The Kingtown Power Station will be moved several miles inland, reducing the risk of power loss and infrastructure damage, and East Kingtown Hospital will also be shifted from the coastline. 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. Owners who will not sell their properties must purchase costly city flood insurance, which will help to finance protective measures.

## Plan B

The Kingtown Redevelopment Authority will draw a blue “Rising Tide” line around the city. Zoning requirements will immediately prohibit developers from purchasing land on the coastal side of the setback line. While existing construction projects will continue, 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, and low-income families will receive financial stipends, low mortgages and tax incentives to encourage moving elsewhere. New regulations will prohibit hospitals and power stations from operating in 100-year storm zones. Publicly owned buildings along the coast will be replaced with beaches, parks and a series of outdoor monuments, which will educate the public about sea level rise and encourage people to move away from the shore. The shoreline will be open to aquaculture, fishing, and tourism activities. The cost of this plan is estimated at \$25 million.