

# Coastal Resilience Workshop



CITY OF  
**SOUTH  
PORTLAND**

**JUNE 20, 2024**

This workshop is a learning exercise, designed to help community members understand the complexities surrounding resilience planning. It also serves to raise awareness about the range of possible approaches and strategies for building coastal resilience. Community input from this workshop will be paired with feedback received from the Comprehensive Plan update about land use preferences. This information will guide a deeper dive assessment of cost, functionality, permitting, etc for potential resilience strategies, and inform future land use planning. These are all factors that will help define which priorities the community moves forward with.

## AGENDA

- I. Welcome and overview (6:00-6:15pm)
- II. Review of workshop & materials (6:15-6:45pm)
- III. Deeper dive (6:45-7:45pm)
- IV. Report out (7:45-8:00pm)
- V. Wrap up (8:00-8:15pm)

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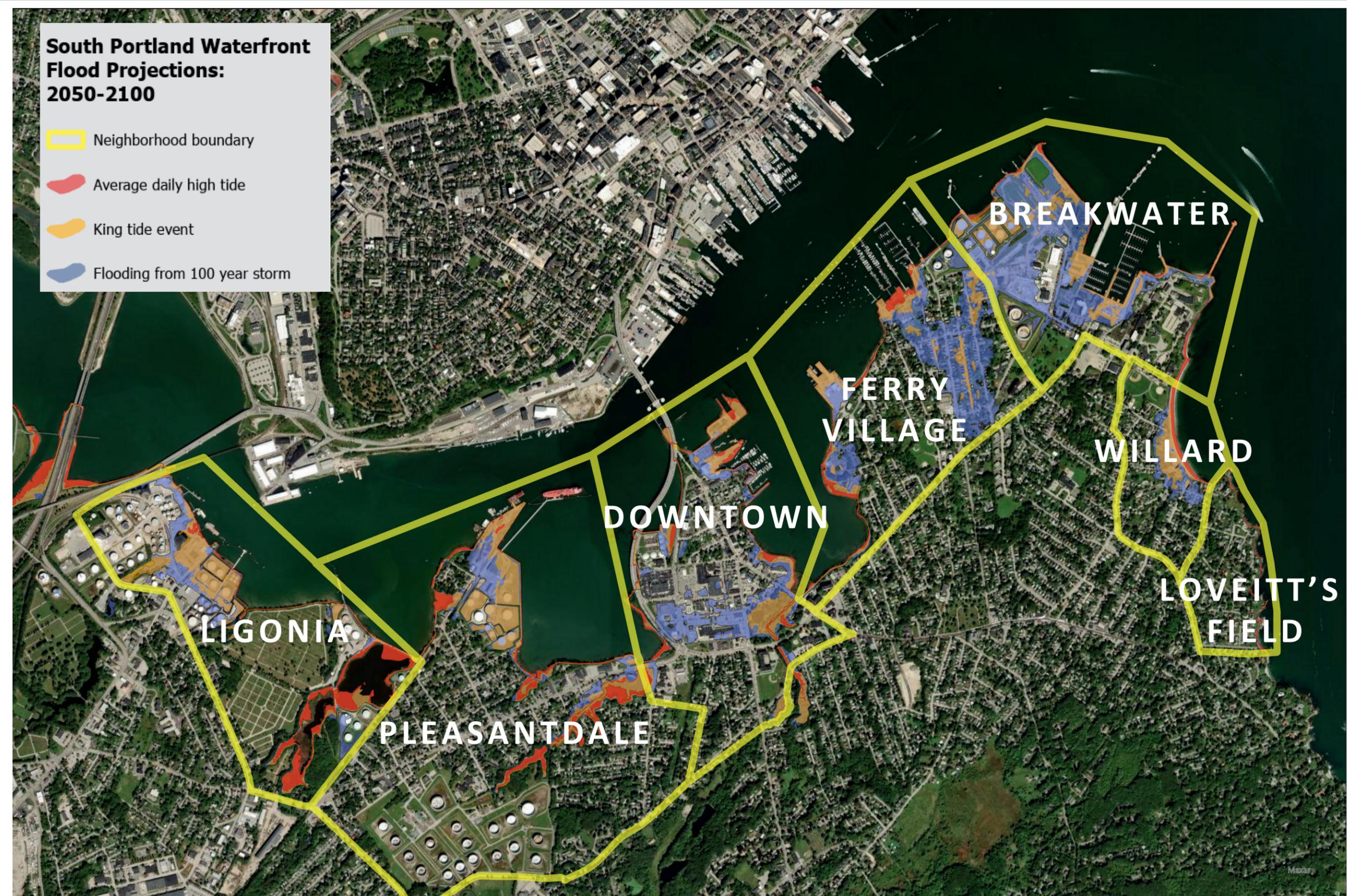
## CONTACT INFO

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# Waterfront Neighborhoods



# AVOID

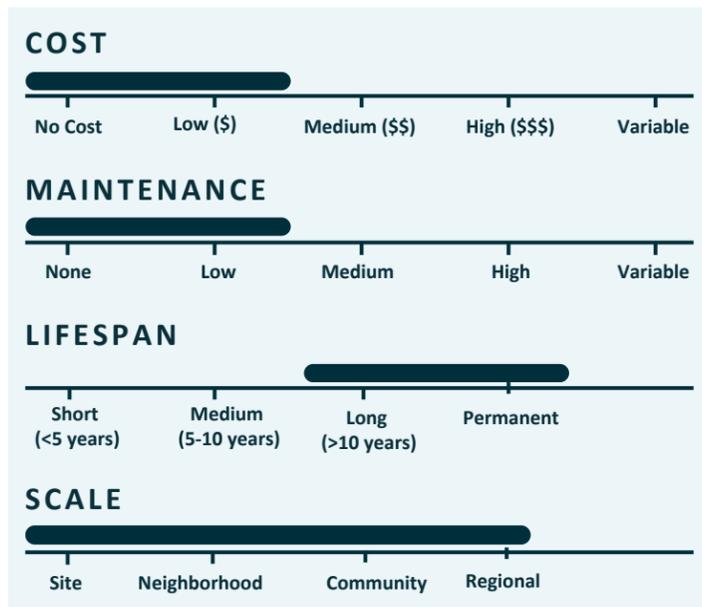
Avoid new development in areas most vulnerable to flooding.

STRATEGY

## Development Restrictions



Willard Beach



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Create policies or regulations to restrict development in areas that are vulnerable to coastal threats. Examples include creating a zoning district that regulates use types based on risk and/or disallows any development in vulnerable areas. Expand ongoing protection of existing wetland, drainage system and natural resource buffers to provide a natural defense system.

- ADVANTAGES:**
- Avoid new development thereby limiting damages from flood events.
  - Prevent expensive repairs by limiting development on land that will be flooded in the future.
  - It can be paired with strategies that allow for partial development on parcels by requiring buildings and infrastructure to be sited away from flood prone areas.
  - Protects wetlands, drainage systems and/or buffer zones which in turn serve as habitat and help protect against upland flooding and erosion.
  - Regulations can be revised over time as coastal resources and hazards change.

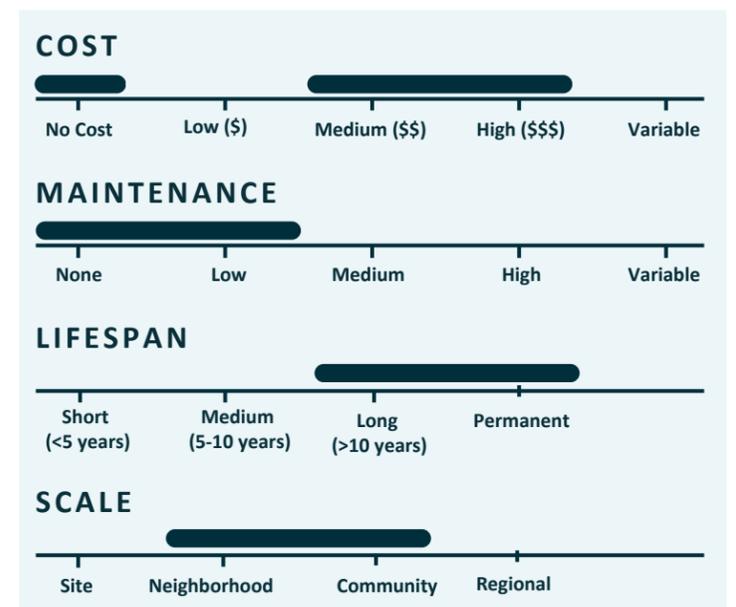
- DISADVANTAGES:**
- Limiting development may impact beachfront property value and potential real estate tax funds from new development.
  - Limiting development potential can reduce value and development options on undeveloped parcels.

STRATEGY

## Land Conservation



Anthoine Creek Park



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** The City, land trust, or other private entity can purchase, donate, or conserve public or private property through a legally binding agreement. This will limit or prevent development and preserve undeveloped land and coastlines to ensure continued functions of the existing natural resources. Examples include conservation easements, rolling easements, or transfer of development rights (TDR).

- ADVANTAGES:**
- Allows for the conservation of land that can serve as habitat or flood buffers.
  - Land donation or conservation easement can provide a tax benefit to the private property owner.
  - Prevents development in areas likely to become inundated or hazard areas.
  - Prevents construction of structures and shoreline armoring within hazard areas.
  - TDRs allow for the same development potential in a community by redirecting development to other areas.
  - Reduced opportunity for damages (costs) and repetitive losses from flooding.
  - Sellers still get to own their property when they sell their development rights.

- DISADVANTAGES:**
- Limiting development potential can reduce property value and development options on parcels.
  - May require lengthy legal assistance to prepare the easement and requires approval by several parties.
  - Acquisition of coastal properties is expensive.
  - Programs may be difficult to set up and administer so that they function as intended.
  - May encourage the development of previously undeveloped inland lands, instead of encouraging more dense development in previously-developed inland lands.

# AVOID

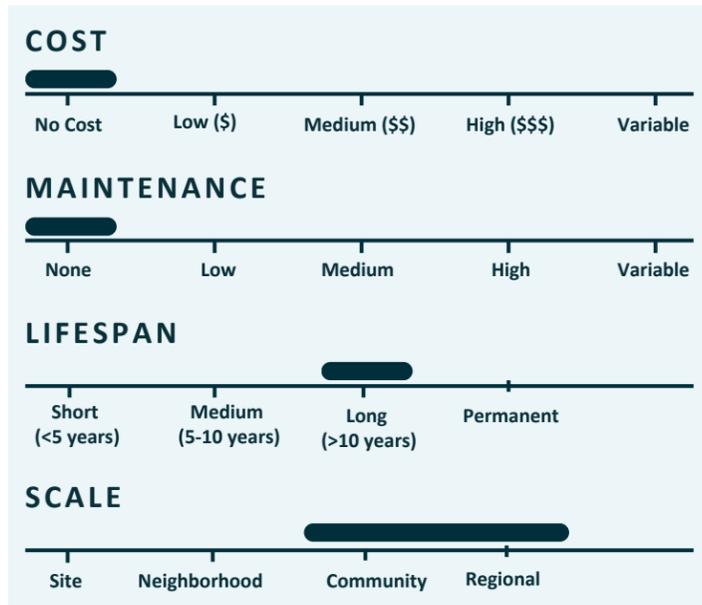
Avoid new development in areas most vulnerable to flooding.

STRATEGY

## Municipal Sea Level Rise Investment Policy



Sawyer Road. Photo credits: Town of Scarborough, via Portland Press Herald



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Adopt a municipal sea level rise policy that limits municipal investment in flood hazard areas, unless expressly for adaptation, mitigation, or resilience measures.

**ADVANTAGES:**

- Disincentivizes but does not prevent development in areas likely to become inundated or hazard areas.
- Prevents expensive repairs costs borne by taxpayers
- Reduced opportunity for damages (costs) and repetitive losses from flooding.

**DISADVANTAGES:**

- May distance future development in vulnerable areas from services.

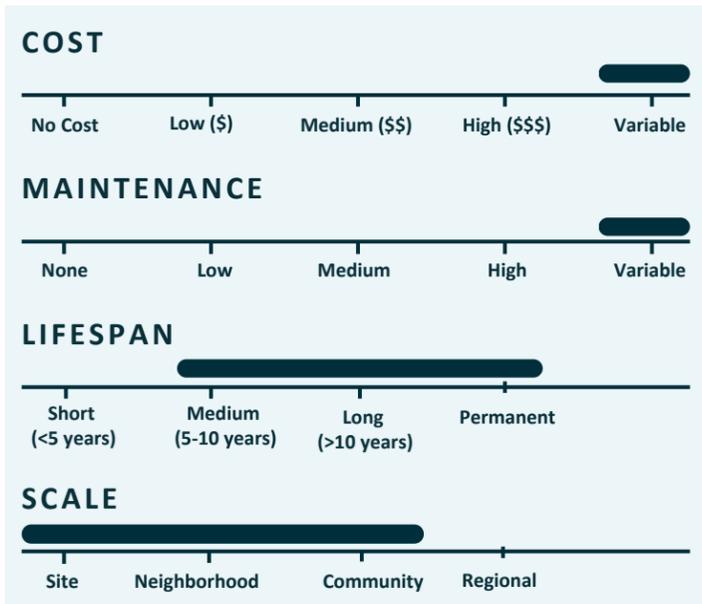
# ACCOMMODATE

Instead of preventing tidal inundation, erosion, and flooding, coping strategies are developed that enable continued human habitation with periodic flooding.

STRATEGY  
**Building Design**



Pearl Street. Photo credits: GMRI's Ecosystem Investigation Network



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Structural requirements or modifications to new and existing buildings that reduces or prevents flood damage. Examples include waterproofing techniques that allow building materials to get wet or prevent them from getting wet, flood panels that allow water to flow in and back out of structures and elevating a structure on piers or stilts. This can limit damage to buildings while allow water to flow in and out.

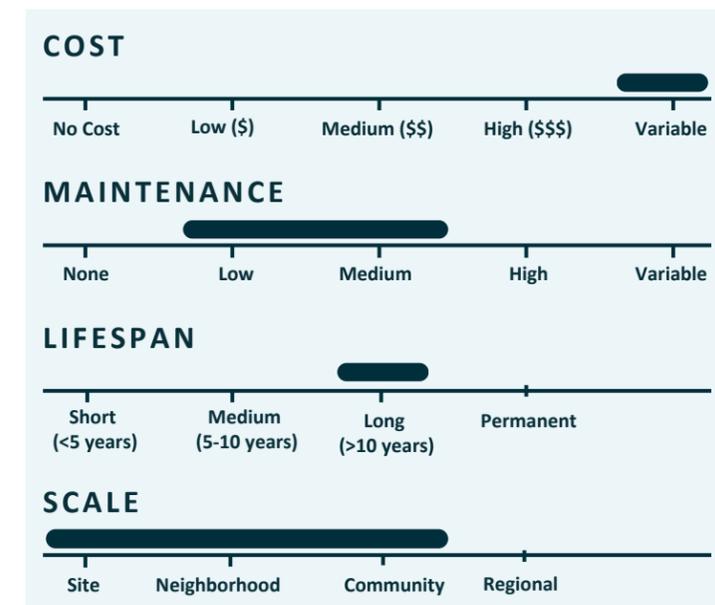
- ADVANTAGES:**
- Protection from tidal and storm flooding damage.
  - Potentially reduce flood insurance premiums.
  - Economic and public safety risk reduction from flooding and storm surge.
  - Maintains sediment supply and continuity of floodplain.
  - Maintains landform.
  - Allows continued habitation in vulnerable areas.

- DISADVANTAGES:**
- Change in appearance or functionality of the structure. May have impacts on the character of the neighborhood.
  - Elevated structures may impact viewshed for neighboring structures.
  - Allows continued habitation in vulnerable areas.
  - Construction and installation costs would likely increase with the need for more advanced building materials, floodproofing, and location away from wetlands or buffer zones.

STRATEGY  
**Floodable Greenspace**



Anthoine Creek Park, January 2024



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Create recreational paths and parks designed to accommodate flooding and assist with stormwater filtration. This can also include converting impervious surface to permeable surfaces to aid in stormwater management, adding vegetation islands within large impervious areas, or creating drainage filtration areas.

- ADVANTAGES:**
- Will increase stormwater absorption and decrease runoff from lawns and impervious surfaces. This can increase groundwater recharge and improve water quality.
  - Can be implemented piecemeal by targeting more at risk spaces first.
  - Provides habitat, ecosystem services, flood water storage, and recreational and tourism uses.
  - Preserves and/or enhances recreational greenspace
  - Dissipates wave energy thus reducing storm surge, erosion, and flooding.
  - Increases natural stormwater infiltration and improves water quality.

- DISADVANTAGES:**
- As sea level rise increases, may have limited capacity for stormwater.

# ACCOMMODATE

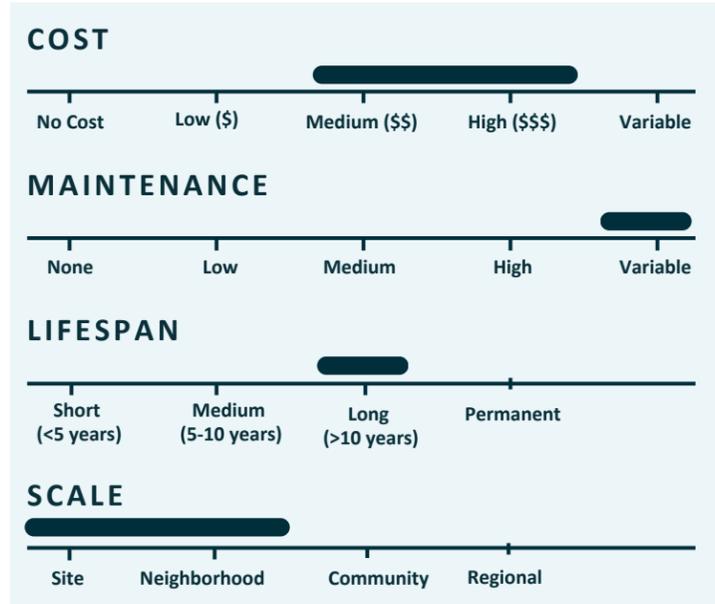
Instead of preventing tidal inundation, erosion, and flooding, coping strategies are developed that enable continued human habitation with periodic flooding.



STRATEGY  
**Wave Attenuation**



Wave attenuation and sand accretion



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Install infrastructure along the coastline to reduce wave energy and mitigate erosion. Examples include:

- Implementing a low-elevation structure in the intertidal zone parallel to shore (sill). The area landward of the sill is filled with sand and may be planted with salt marsh grasses to stabilize sediment.
- Installing a Wave Attenuation Device anchored to the ocean bottom, which sits both above and below the water, or installed in the intertidal zone to reduce wave energy reaching the shoreline.

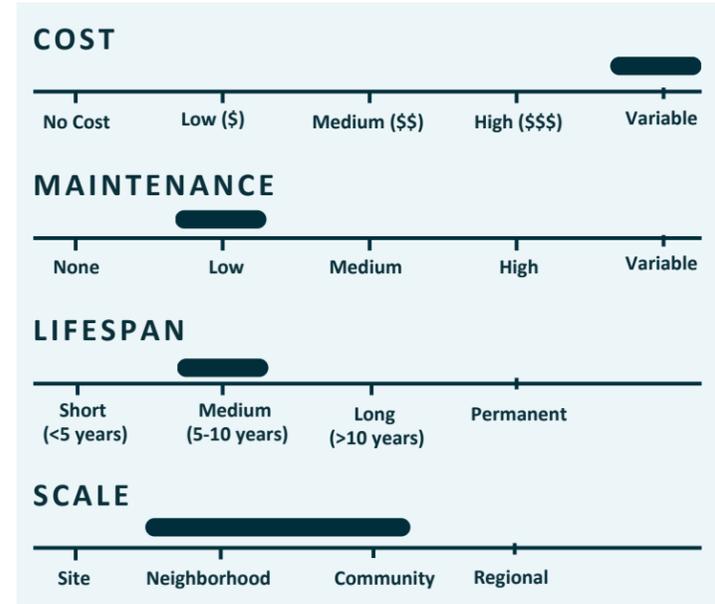
- ADVANTAGES:**
- Reduces wave force and height thus reducing storm surge, flooding, and erosion. Slows inland water transfer.
  - Stabilizes sediments and creates sheltered areas that can support wetlands or submerged aquatic vegetation growth.
  - Can provide habitat and increase habitat complexity.
  - Creates hard structure for non-mobile marine life.
  - Can modulate wave action, reducing damage to harbor areas including moored boats and marine infrastructure as well as inland properties.

- DISADVANTAGES:**
- May create a navigational hazard.
  - Change from existing habitat type could have negative impacts to existing resources and degrade habitat by fragmentation and other means.
  - Can have negative impacts to adjacent properties from limited redirected wave energy and erosion.

STRATEGY  
**New Services and Equipment**



Willard Beach closure sign. Photo credits: Portland Press Herald



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** New services and equipment to protect residents and businesses in vulnerable areas such as enhanced emergency communications, road closure equipment and procedures, debris clean up, and public utility flood proofing.

- ADVANTAGES:**
- Enhances community safety during reoccurring flood events.
  - Allows continued habitation in vulnerable areas.
  - Streamlines road/infrastructure recovery from flooding.

- DISADVANTAGES:**
- Increases municipal responsibility and associated cost with flood response.
  - Allows continued habitation in vulnerable areas.
  - Increased annual budgetary spending likely not fundable through grants.

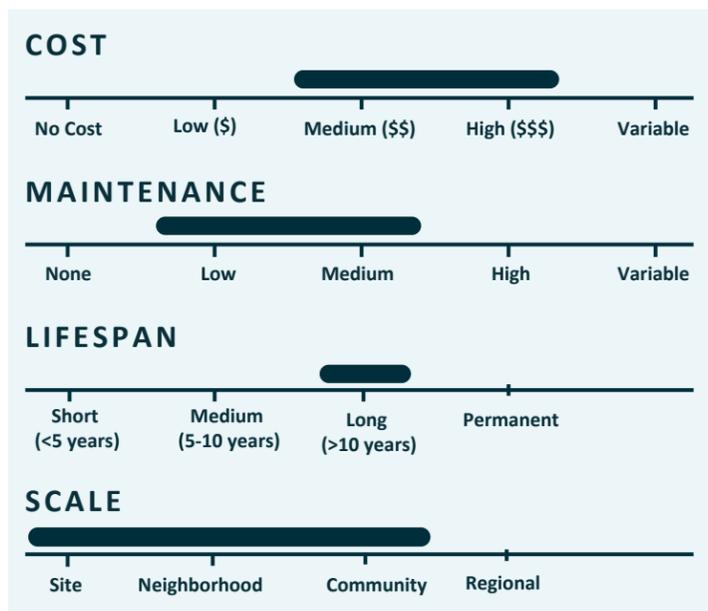
# PROTECT

Protect land and buildings from erosion and flooding with new infrastructure.

STRATEGY  
**Hardscape Wall**



Bug Light. Photo credits: Corey Seeman, via Flickr



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Prevent flooding and erosion with physical barriers added to the coastline. Examples include seawalls, earth or stone embankments, and/or gabions, which are baskets made of a steel mesh, filled with rocks, and stacked on top of each other. It can also include revetments, which are sloped walls along eroding coastal banks, to reflect wave energy and protect upland structures from erosion.

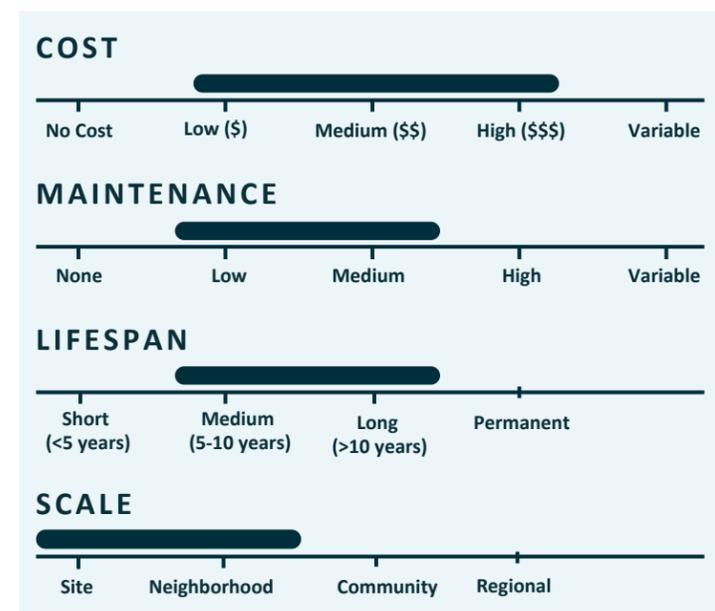
- ADVANTAGES:**
- Helps to stabilize shoreline, mitigates wave action, prevents modest erosion, and protects inland properties and infrastructure from flooding and sea level rise.
  - Creates hard structure for non-mobile marine life and can increase habitat complexity.
  - Materials may be flexible and porous, so they are able to better absorb wave energy than more solid hard engineered structures.
  - Gabions offer ease and speed of installation, often filled with rocks in-situ and can be lower in cost than other hard armoring techniques. Can also be buried with sand and vegetation.

- DISADVANTAGES:**
- Loss of natural coastline and resource areas such as intertidal habitat and recreation area.
  - Cannot be established in areas with existing dunes.
  - Can be aesthetically unpleasing depending on the installation.
  - Impacts adjacent properties by redirecting wave energy and erosion to adjacent unreinforced sites.
  - Reduces longshore sediment transport.
  - May be hazardous to boaters and beach walkers.

STRATEGY  
**Living Shoreline**



GeoReef baskets and coir bags at Maquoit Bay Conservation Lands, MGS



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries. The footprint is made up mostly of native material and incorporates vegetation or other living, natural elements alone or in combination with harder shoreline structure (e.g. oyster reefs or rock sills) for added stability. Living shorelines and bank stabilization techniques provide a buffer to upland areas and act as a physical barrier to waves.

- ADVANTAGES:**
- Provides habitat, ecosystem services, flood water storage, and recreational and tourism uses.
  - Dissipates wave energy thus reducing storm surge, erosion, and flooding.
  - Increases natural stormwater infiltration and improves water quality.
  - Becomes more stable over time as plants, roots, and reefs grow. Ability to migrate as a living system as opposed to a static structural measure alone.
  - Stabilizes sediments and creates sheltered areas that support wetlands or submerged aquatic vegetation growth.
  - Direct physical protection from erosion but allows continued natural erosion to supply down-drift beaches.

- DISADVANTAGES:**
- Only applicable in certain locations
  - Successful vegetation growth and competition with invasive species can be challenging.
  - May limit the use of a beach or bluff.
  - May be more difficult to obtain state and federal permits than more conventional structural or non-structural strategies.
  - May provide limited storm-surge flood level reduction.
  - When used, wire and synthetic installations can be harmful to coastal/marine environments.
  - Strong storms can destroy fragile/new living shoreline installations.

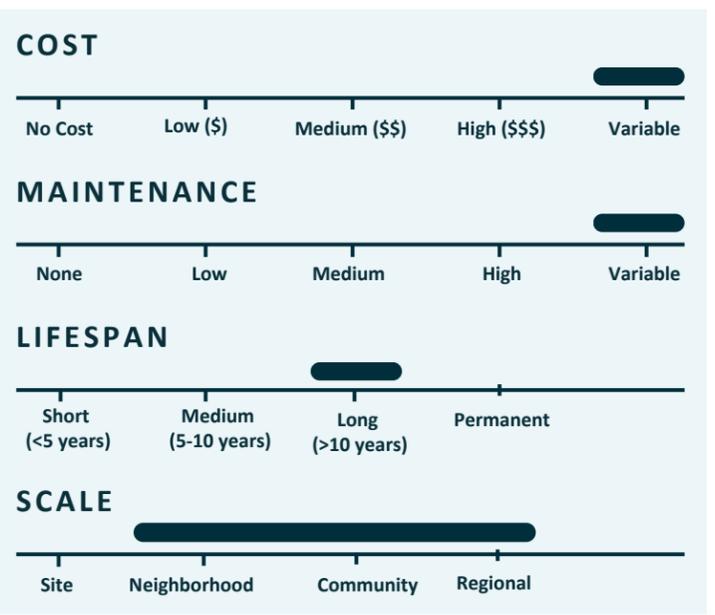
# PROTECT

Protect land and buildings from erosion and flooding through new infrastructure.

STRATEGY  
**Site Retrofits**



Portland Harbor



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Retrofit existing utilities, development sites, and roadways to make infrastructure more resilient to flooding. Modifications may include raising the elevation of the site and/or raising utility infrastructure or installing it below ground.

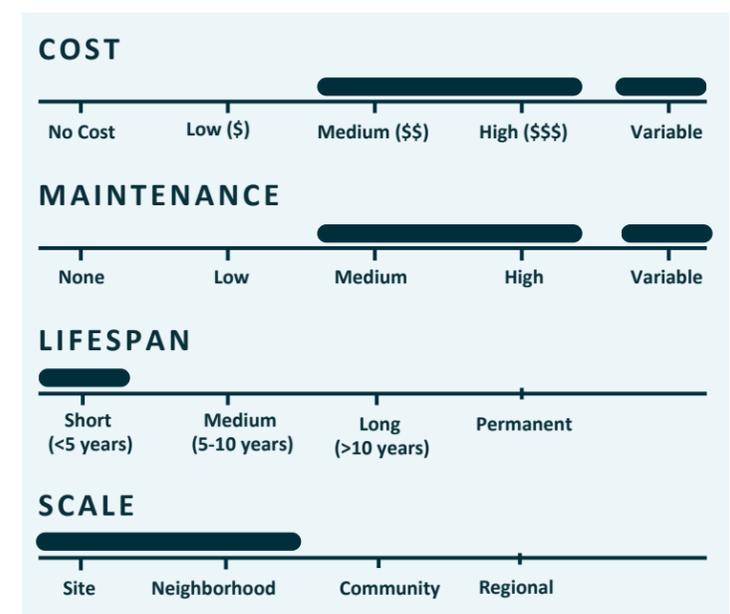
- ADVANTAGES:**
- Proactively protects development from flooding.
  - Reduces costs and staff time spent on road and infrastructure repair.
  - Prevents road closures due to inundation.
  - Prevents salt water intrusion to sewer infrastructure.
  - Raising the road and/or site can protect inland properties at risk from flooding.

- DISADVANTAGES:**
- Over time, if people leave a vulnerable area where utilities and infrastructure have been upgraded, the long-term cost savings of the infrastructure retrofit may not balance the upfront costs.

STRATEGY  
**Beach/Dune Restoration**



Dune Replanting, Willard Beach. Photo credits: WGME



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Restore coastal dunes using a combination of renourishment strategies to prevent erosion and protect inland areas from waves, flooding, and erosion. Examples include planting salt-tolerant plants with extensive root systems along the dunes and adding sediment (sand) to an eroding beach to maintain or advance the shoreline seaward.

- ADVANTAGES:**
- Preserving the existing dunes helps absorb and dissipate wave energy thus reducing flooding, erosion, storm surge.
  - Vegetation captures wind-blown sand to help nourish dunes, and serves as a barrier to human foot traffic in erosion-prone areas.
  - Provides bird and wildlife habitat and ecosystem services.
  - Easy to install compared to structural or water-based measures, can be redesigned with relative ease, and there is little environmental disruption after construction.
  - Expands usable beach area and preserves beaches for recreational use.

- DISADVANTAGES:**
- Expensive to maintain: requires continual supply of sand resources for renourishment.
  - Beach nourishment sand usually erodes faster (2-3x) than natural beach sand because it is not compacted.
  - If sand is sourced from nearshore dredging, it can result in wave dissipation and a change in local sediment transport patterns, disruption of marine habitat.
  - Can have limited negative impacts on marine life, beach life, and endangered species (e.g. piping plover) during construction.
  - May limit beach and dune area available for recreational use.

# RETREAT

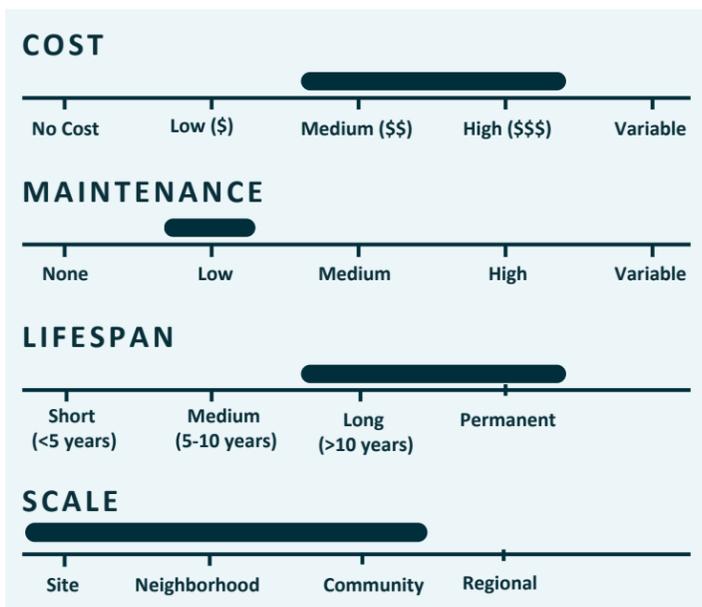
Allow wetlands, beaches, and other coastal habitats to migrate naturally as the sea encroaches inland. Move people and structures in areas most vulnerable to flooding out of harm's way.

STRATEGY

## Managed Realignment



Scarborough Marsh. Photo credits: nefasth, via Flickr



STRATEGY TYPE



ADDRESSES RISK OF COASTAL HAZARDS



**DESCRIPTION:** Restore floodplains by removing or altering existing manmade shoreline structures such as bulkheads, revetments, and seawalls in order to create or expand intertidal habitats. This can provide more flood protection for properties further inland because it will restore floodplains.

ADVANTAGES:

- Reduces danger and potential economic effects of sudden erosion or flooding events.
- Preserves intertidal and upland habitats, greatly reducing flood risks in other areas due to their ability to attenuate wave energy.
- Reduces use and maintenance costs of coastal defense structures.
- Improves habitat, carbon storage, recreation and ecotourism, and water quality.

DISADVANTAGES:

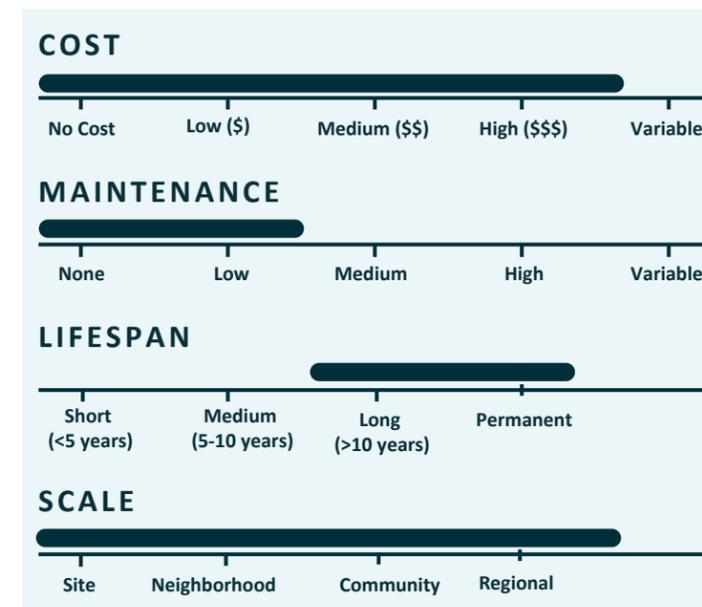
- Requires extensive planning and technical studies to evaluate potential impacts on adjacent areas. May require large scale planning to assess area impacted by erosion or flooding.
- Environmental and/or economic effects of losing valuable land to the sea, including loss or transfer of coastal property values and tax income for the community.
- Will expose nearby properties and infrastructure to flooding or erosion.

STRATEGY

## Managed Relocation



Spurwink Marsh. Photo credits: Town of Cape Elizabeth



STRATEGY TYPE



ADDRESSES RISK OF COASTAL HAZARDS



**DESCRIPTION:** Moving people, development, and infrastructure away from the coastline and out of harm's way.

- Developing programs and investment to facilitate relocation of families and business to less vulnerable areas.
- Removing development from existing locations by land purchase or land donation, flood insurance buy-out programs, or other means.
- Developing a local buyout program or other incentives for flood-prone properties.

ADVANTAGES:

- Publicly acquired property may be converted to public open space.
- Reduces danger and potential economic effects of erosion or flooding events to both current and future development.
- Reduces use and maintenance costs of coastal defense structures.
- The site can be restored to provide the beneficial functions of flood storage capacity, habitat, buffers allowing for the natural migration of coastal resources, and recreational access.

DISADVANTAGES:

- May require large scale planning to assess area impacted by erosion or flooding.
- Environmental and/or economic effects of losing valuable land to the sea, including loss or transfer of coastal property values and tax income for the community.
- Significant disruption for families and businesses in affected areas.
- Complex social, legal and financial issues must be addressed.

# RETREAT

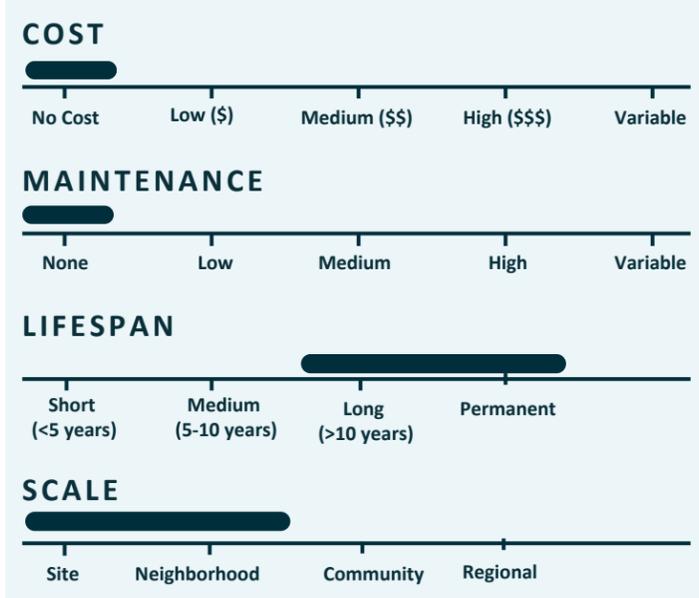
Allow wetlands, beaches, and other coastal habitats to migrate naturally as the sea encroaches inland. Move people and structures in areas most vulnerable to flooding out of harm's way.

STRATEGY

## Discontinuation of Municipal Services



Ferry Village. Photo credits: GMRI's Ecosystem Investigation Network



**STRATEGY TYPE**

- Policy/Program
- Nature-based
- Hardscape

**ADDRESSES RISK OF COASTAL HAZARDS**

- Erosion
- Storm Surge
- Sea Level Rise

**DESCRIPTION:** Discontinuing municipal services in areas with high vulnerability such as sewer, road maintenance, snow plowing, trash pick-up, etc. Affected properties create associations to pay privately.

**ADVANTAGES:**

- Reduces public spending in areas with high likelihood of inundation from sea level rise or coastal erosion.
- Saves municipal resources and capacity for other resilience-building efforts.
- May lead to managed relocation.

**DISADVANTAGES:**

- Provides additional financial burden to property owners in coastal areas.
- May lead to managed relocation.