



APPENDIX B

ADAPTATION STRATEGIES MATRIX

Table B.1 Adaptation Strategies Matrix

ADAPTATION TYPE	ADAPTATION TITLE	DESCRIPTION	SHORT, INTERMEDIATE, OR LONG TERM	MICRO / MACRO	GRAY, GREEN, OR HYBRID	DEGREE OF PROTECTION (LOW, MED, HIGH)	COST (\$,\$\$,,\$\$)
Economic Assessment and Planning	Taxation and Budgets	Add climate change considerations to taxation and budget reform	LONG TERM	MACRO	GREEN	MEDIUM	\$
Economic Assessment and Planning	Building Code Incentives	Create incentives for individuals and businesses to reduce risk of losses due to climate through building design codes	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Economic Assessment and Planning	Funding Support for Relocation	Identify financial and economic support mechanisms in response to relocation	INTERMEDIATE	MACRO	GREEN	LOW	\$
Economic Assessment and Planning	Financial Impact Assessment	Assess financial impact of property value changes	SHORT	MACRO	GRAY	LOW	\$
Economic Assessment and Planning	Funding for Adaptation Strategies	Provide funding for local communities to develop and implement location appropriate adaptation strategies	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Economic Assessment and Planning	Social Impacts Vulnerable Communities	Assess potential social impacts of climate change on incomes, and other measures of well-being in vulnerable communities	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Economic Assessment and Planning	Insurance Costs	Address increased insurance costs, especially in disaster sensitive, remote and/or economically challenged areas	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Economic Assessment and Planning	Economic Incentives	Provide economic incentives for building in non-risk zones	LONG TERM	MACRO	GREEN	MEDIUM	\$\$
Economic Assessment and Planning	Encourage Climate Impact Investments	Encourage private insurers, as investors, and the state pension funds to consider climate impact prevention in the prudent investment of portfolios. Create incentives for private investment in creating 'climate safe' development	LONG TERM	MICRO	HYBRID	MEDIUM	\$
Economic Assessment and Planning	Federal Funding	Seek federal funds for climate costs	SHORT	MICRO	HYBRID	MEDIUM	\$
Economic Assessment and Planning	Short, Mid, and Long Term Budgets	Establish short-, mid- and long-term budgets that include adaptation strategies and capital investments over time	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Emergency Strategies	Sandbags	Temporary barriers constructed of sandbags can be used to protect structures or system components from flooding or provide additional height to existing flood barriers before flooding reaches critical levels	SHORT	MICRO	GRAY	MEDIUM	\$
Emergency Strategies	Temporary Flood Barriers	Temporary, self-supporting flood barriers that can be assembled, moved into place, anchored, and filled with water, sand or gravel and then removed after flood threats have passed.	SHORT	MICRO	GRAY	MEDIUM	\$\$
Emergency Strategies	Flood Wrapping Systems	Flood wrapping systems are temporary emergency measures in which plastic or other synthetic waterproof sheeting material is used to seal buildings and prevent water intrusion into the building and associated systems.	SHORT	MICRO	GRAY	MEDIUM	\$
Emergency Strategies	Flood Shelters	Flood shelters are created in areas which experience severe flash flooding. Elevated flood shelters should be constructed above the highest expected flood levels. They should be easily accessible and should be able to accommodate all people in the vicinity.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Emergency Strategies	Protection of Life Support Facilities / Dangerous Goods	Life support facilities and dangerous goods like nuclear plants should be well defended against climate extremes. This vital infrastructure should be up and running even during extreme conditions.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Emergency Strategies	Emergency Evacuation	Coordinate emergency evacuation and supply transportation routes with emergency preparedness systems to ensure capacity and resilience of escape routes compromised by natural disasters related to climate change	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Identification and Monitoring	Online Mapping	Include online mapping capability in planning information for multiple audiences including local governments	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Identification and Monitoring	Sea Level Rise Visualization	Create visualization tool for sea level rise and associated hazards	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Identification and Monitoring	Assessment of Trends	Conduct assessment of trends in change in land use and stability of natural landscapes	INTERMEDIATE	MACRO	GREEN	LOW	\$
Identification and Monitoring	Data Collection	Support ongoing collection and analysis of sea level rise, storm surge, and tidal data by existing institutions	LONG TERM	MACRO	GREEN	MEDIUM	\$
Identification and Monitoring	Transportation Routes Effectuated	Identify and reevaluate use of transportation routes in floodplains and coastal hazard zones	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$
Identification and Monitoring	Vulnerability Assessment	Conduct a vulnerability assessment for cultural resources such as museums and historical sites	INTERMEDIATE	MACRO	GRAY	LOW	\$
Identification and Monitoring	Evaluate Water Supply	Evaluate the vulnerability of the water supply systems and networks to climate change related impacts. Develop strategies to add resilience to these systems.	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Identification and Monitoring	Identify Vulnerable Species	Map vulnerability of full spectrum of biodiversity (terrestrial, aquatic and marine)	INTERMEDIATE	MACRO	GREEN	LOW	\$

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Identification and Monitoring	Map Land Changes	Map vulnerability of areas subject to salinification and erosion under different climate scenarios	SHORT	MACRO	GREEN	LOW	\$
Identification and Monitoring	Consolidate Ecological Monitoring	Consolidate and cross-reference ecological monitoring networks	SHORT	MACRO	GREEN	LOW	\$
Identification and Monitoring	Develop Biological Indicators	Develop a system of biological indicators for impact assessment	INTERMEDIATE	MACRO	GREEN	LOW	\$
Identification and Monitoring	Vulnerability of Flora and Fauna	Assess the vulnerability of special designation areas, areas of unique flora and fauna and areas of essential ecosystem goods and services	SHORT	MACRO	GREEN	LOW	\$
Identification and Monitoring	Mapping of Impacts on Watersheds	Improve mapping and characterization of likely storm and precipitation impacts to watersheds and riverine flood zones.	SHORT	MACRO	GREEN	LOW	\$
Identification and Monitoring	Coastal Models	Develop morphodynamic and ecological response models of primary coastal zones according to different climate scenarios	INTERMEDIATE	MACRO	HYBRID	LOW	\$\$
Identification and Monitoring	Coastal Vulnerability	Inventory and map the estuarine and ocean shoreline and its bathymetry, sediments, and vegetation. Assess vulnerability.	INTERMEDIATE	MACRO	HYBRID	LOW	\$\$
Identification and Monitoring	Shoreline Assessment	Conduct a shoreline impact assessment to establish baseline of data on the existing coastal resources and the projected impacts of sea level rise, include tides, weather	SHORT	MACRO	GREEN	LOW	\$
Identification and Monitoring	Vulnerable Populations	Identify health-related vulnerabilities of people, region, infrastructure and the economy	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Identification and Monitoring	Identify Vulnerable Cultural Resources	Complete a vulnerability assessment to identify specific cultural resources that may be most sensitive to climate change.	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Identification and Monitoring	Assess Disruptions	Assess potential disruption to states major economic sectors due to climate change	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Identification and Monitoring	Assess Value of Beach Services	Assess full value of beach services including habitat, tourism, storm buffer, etc.	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Identification and Monitoring	Tourism Climate Change Assessment	Conduct a climate change impact assessment by tourist region and resources, with a focus on most vulnerable sectors and locations and develop tourism policies integrating economic and resource conservation issues in the face of potential and observed consequences of climate change	SHORT	MICRO	GRAY	LOW	\$
Information and Education	Trades and Vocational Training	Establish structured training and vocational support for trades and others involved in implementation of new design standards	INTERMEDIATE	MICRO	HYBRID	LOW	\$
Information and Education	Integration into Higher Education	Integrate climate change and adaptation issues into advanced training in university, community college, and technical training programs	INTERMEDIATE	MICRO	HYBRID	LOW	\$
Information and Education	Healthy Waterways	Support healthy rivers, streams and riparian vegetation to maintain water quality	LONG TERM	MACRO	GREEN	MEDIUM	\$
Information and Education	Public Education	Provide outreach to the public and others to plan and prepare for climate change	INTERMEDIATE	MACRO	GREEN	LOW	\$
Information and Education	Educate Tourists	Ensure accurate information reaches current and potential tourists on behaviors and uses that ensure environmental quality and ecosystem resiliency at popular travel destinations	INTERMEDIATE	MICRO	HYBRID	LOW	\$
Infrastructure Management	Promote Wetland Accretion by Introducing Sediment	Maintains sediment transport to wetlands, which protects coastal land from storms	LONG TERM	MACRO	GREEN	HIGH	\$\$
Infrastructure Management	Utility Elevation	Installing or locating utility systems and components at or above the flood protection level required by local flood plain management regulations or building codes.	LONG TERM	MICRO	GRAY	HIGH	\$
Infrastructure Management	Utility Relocation	Moving existing utility systems and components previously installed below the base flood elevation to less vulnerable locations, preferably above the flood protection level required for new construction.	Intermediate	MICRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Component Protection	Protection of a system, equipment component, or group of components for exposure when located below the required flood protection level. Can include dry floodproofing for non-residential.	Intermediate	MICRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Flood Barriers (Passive or Active)	Barriers around a building system utility components to protect from flooding.	Intermediate	MICRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Protection of Exposed Risers, Conduits, and Cables	Installation on the most sheltered side of building. Protect by enclosing in insulated, rigid, and watertight conduits.	Intermediate	MICRO	GRAY	MEDIUM	\$
Infrastructure Management	Flood Damage-Resistant Materials	The utilization of materials that provide partial protection to elements exposed to flood.	Intermediate	MICRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Fast Replacement of Components	If elements cannot be elevated, relocated, or protected; installing components that allow for quick isolation and replacement is a viable option.	SHORT	MICRO	GRAY	MEDIUM	\$

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Infrastructure Management	Building on Partially Elevated Areas	Building on partially elevated areas reduces the flood risk locally. A farm located in a flood plain can for instance be constructed on an elevated area. The surrounding area is allowed to be flooded while the farm and its accompanying buildings remain dry.	LONG TERM	MICRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Construction on Piles	Constructions on piles are raised constructions built on piles. The piles can be used to create solid foundation and to make it possible for water to flow underneath the building. The ground flood level should be built above the design water level.	LONG TERM	MICRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Dams (To Redirect Water)	An artificially raised dam at a strategic location in a river or stream can redirect a part of the water flow into another direction. Most dams have a section called a spillway or weir over which, or through which, water flows, either sometimes or always. Dams generally serve the primary purpose of retaining water.	LONG TERM	MACRO	GRAY	HIGH	\$\$\$
Infrastructure Management	Elevated Flood Wall / Flood Gate	A flood wall can be constructed to protect individual vital buildings/facilities against flooding. They can be either permanent or dismantable. Sometimes gates are built in a flood wall to create space for roads. These gates are only closed during flood events.	LONG TERM	MACRO	GRAY	HIGH	\$\$\$
Infrastructure Management	By-Pass Creation	Creating a bypass for a river or canal can reduce flood levels in a specific location. A bypass provides extra discharge capacity for the river or canal. Thereby known bottlenecks can be solved.	LONG TERM	MACRO	GRAY	MEDIUM	\$\$\$
Infrastructure Management	Amphibious (Floatable) Constructions / Buildings	Amphibious buildings rest on the ground level and only start to float during a flood period. The structure is built on a float. Like in floating buildings, these floats are guided by vertical posts to avoid drift of the amphibious building.	LONG TERM	MACRO	HYBRID	MEDIUM	\$\$\$
Infrastructure Management	Artificial Islands	An artificial island is a man-made island is an island, which can be integrated with flood protection. The island can be created by land reclamation, expanding existing islets, construction on existing reefs, or merging several natural islets into a bigger island. Artificial islands may vary in scale from small islets for a single structure, to islands that support entire communities and cities.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Check Valve / Non-Return Valves	A check valve or non-return valve is installed in pipes which are vulnerable for backflow in flood conditions. Backflow is known to take place in toilets and sewer systems. The valve will block flow if water flows in the wrong direction.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$\$
Infrastructure Management	Compartments in Dike Rings	A compartment in a dike ring is a smaller area enclosed by secondary flood protection within a main dike ring. The main reason for dividing a dike ring in smaller compartments is to reduce damage in case of a dike failure / breach. Compartments in dike rings will also slow down a flood in case of a major dike breach to create more time for evacuation protocols.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Compartments in Inflowing Large Waters	The compartments will divide large water surfaces into smaller and better controllable segments. These segments are connected with each other through a system of interacting locks or dams. A smaller amount of water can cause damage to low level terrain in case of a dike breach.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Dikes	A dike is an elongated artificially constructed embankment or levee, which protects low-lying areas against higher water levels. It is usually made of clay and sand. Rock or concrete are used to protect the water facing outer slope against waves. Most dikes are constructed parallel to the course of a river in its floodplain or along low-lying coastlines.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Dismountable and Temporary Buildings	Dismountable and temporary buildings can be an option for flood prone locations. For instance, temporary beach pavilions can be built along beaches to be used during summertime. During the stormy winter season, the buildings are dismantled.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$\$
Infrastructure Management	Evacuation Routes at Elevated Level	Evacuation routes at an elevated level are necessary to as a route for safe evacuation in flood events. They should be constructed above the highest expected flood level. People affected by the floods can use the routes to reach safe (higher) ground.	LONG TERM	MACRO	GRAY	HIGH	\$\$\$
Infrastructure Management	Floodable Dike	A floodable dike is designed to protect a floodplain against frequent high-water levels. The dikes crest level is designed relatively low, so it is flooded in extreme high-water levels. This way the flood plain can be used for instance agriculture in normal conditions and for water storage in extremely wet conditions. A secondary dike further inland is frequently used to protect the vulnerable hinterland against extreme high-water levels.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Floodplain Evacuation or Enlargement	The floodplain can be enlarged by lowering the level or increasing the width of the floodplain. Enlarging the floodplain will create more room for the river thereby increasing the discharge capacity and provide upstream retention. The risk of flooding is decreased as the capacity of the river to convey water is increased.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Overtopping Proof Dike	An overtopping-proof dike is designed to withstand one of the most common failure mechanisms: overtopping of a dikes by waves. Prolonged overtopping could cause collapse of the landward slope. For better resistance against overtopping the dikes crest must be raised and the landward slope should contain a gentle slope.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$\$
Infrastructure Management	Polder	A polder is a low-lying area enclosed by dikes or levees and forms an artificial hydrological entity. There is no connection with surface water outside the polder other than through manually operated pumps or inlets. There are three types of polders: Land reclaimed from a body of water, flood plains separated from the sea or river by a dike, marshes separated from the surrounding water by a dike and subsequently drained. A polder usually has an excess of water as its ground level is often lower than surrounding water levels. Pumping or opening sluices at low tide is necessary.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$

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Infrastructure Management	Quay / Wharf	A Quay or wharf is a structure on the shore of a harbor or on the bank of a river or canal. It can be a good flood protection in locations where available space is limited. Quays are mostly reinforced concrete structures.	LONG TERM	MACRO	GRAY	MEDIUM	\$\$\$
Infrastructure Management	Raising Land	Raising land is often used to increase the difference between water levels and construction levels. Usually sand is used to raise new roads above the existing ground level. This measure reduces the flood risk. Ground water and surface water levels can rise	LONG TERM	MACRO	HYBRID	MEDIUM	\$\$\$
Infrastructure Management	Relocation of Buildings, Utility, Facilities, and Infrastructure	Some public utilities or vital infrastructure could be located in vulnerable flood prone locations. Relocation to higher ground is an option to minimize flood risk.	LONG TERM	MACRO	GREEN	HIGH	\$\$\$
Infrastructure Management	Seepage Barrier	The main purpose of a seepage barrier is to reduce the rate of seepage: for instance, to reduce the loss of water from a reservoir or to reduce the water pressure on the structure. The seepage barrier can also be used as a vertical levee enforcement.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Super Dike	A super dike is much higher and wider than a traditional dike. It is designed to be unbreakable and to reserve space for urban developments on top of the dike.	LONG TERM	MACRO	GRAY	HIGH	\$\$\$
Infrastructure Management	Unbreakable Dikes	An unbreakable dike is an over-dimensioned dike which will protect low lying land for a longer time span than a traditional dike. Most likely the dike is higher and wider than required by design standards. An unbreakable dike requires less maintenance during its lifetime.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Use of Buildings as Flood Defense	New and existing buildings in flood risk areas can be used as flood defense. The buildings should be completely integrated in the flood defense to create a reliable flood defense.	INTERMEDIATE	MACRO	GRAY	LOW	\$\$\$
Infrastructure Management	Deepen Water Bodies	To mitigate droughts, it is necessary that sufficient water can be stored during the wet period, so it becomes available during a drier period. To maximize storage capacity the volume of water bodies can be increased. One way to increase the storage volume is by increasing the depth of rivers, canals and ponds. The amount of water which can be stored in this way can become available when water is scarce. The water bodies are refilled when water is abundant during wet periods. Increased helps reducing flood risk as rivers are able to transport a larger amount of water and ponds and lakes have a larger retention capacity.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$\$
Infrastructure Management	Increase Height Difference Between Street Level and Ground Floor Level	Rainwater is usually collected in streets. To reduce probability for flood water to enter buildings the difference between street level and ground floor level can be increased. This way more water can be stored in the street profile without flooding the buildings	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Increased Pump Capacity	By increasing the pump capacity water tables can be controlled better. Responding to heavy rains becomes easier, and the chance of flooding is reduced. The need for buffer capacity, translated into low water tables in rivers and channels, is also reduced as the managers have more pumping capacity. Water levels can remain at higher levels which increases the retention capacity of the system in case of droughts.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Increased Storage or Discharge Capacity of Surface Water	Increasing the size of a channel or pond, the discharge and storage capacity of surface water can be improved. The discharge of a river can be improved by, removing obstacles and lowering groins. Excavating floodplains, increasing the area of the water body or depoldering large areas along the river, improves the storage capacity of the water bodies. Both measures have the ability to reduce flood risk and improve the ability to manage the water.	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$\$
Infrastructure Management	Pumping Stations	A pumping station is used to discharge water out of an area. It can be used to transport sewer water in pressure mains. Another option is use in polder systems to pump water from a low-lying area into a main water body like a river or a lake. It is always applied when no natural flow of water is possible.	SHORT	MICRO	GRAY	LOW	\$\$
Infrastructure Management	Raised Curbs / Hollow Roads	Raised curbs and hollow roads are used to increase the storage and transport capacity of a road. In extreme rainfall events excess water is stored in between the curbs instead of flowing into buildings directly.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Storage / Settling Tank and Storage Basins	Storage/settling tanks are designed to store excess runoff in urban drainage systems during wet periods, primarily if runoff exceeds the discharge capacity of the urban drainage system some. The settling tank is designed to prevent polluted runoff to be discharge in surface water.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Increased Capacity of Sewer System	Increasing the capacity of the sewer system increases the ability of the system to drain excess surface water during heavy rains and prevent flooding.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Reconstruct Combined Sewer Systems to Separate Sewer Systems	Old sewer systems were often constructed as combined sewers systems, collecting rainwater and wastewater in one system. A separate sewer system is designed to collect sanitary and storm water runoff separately. Rainwater can be stored and/or treated, therewith creating an additional water resource. The sanitary water in a separate sewer system is more concentrated and wastewater runoff is more steady.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Smart-Drain (Ground Water)	A smart drain is used to control groundwater levels. The drain operation is based on the actual groundwater levels. If the groundwater level is too high, more water is drained. If the groundwater level is too low, drainage is limited.	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$

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Infrastructure Management	Infiltration and Transport Sewer	An infiltration and transport-sewer (IT) can function as a underground storage and infiltration mechanism, or a storm water drain. The IT sewer is a permeable pipeline which buffers the water until it is able to infiltrates back into the soil. During heavy rain, when soils are fully saturated and water can no longer infiltrate, the IT sewer functions as a storm water drain. excess water is diverted to the ends of the pipeline where it is discharged into another water body. With this buffering capacity the IT sewer is able to reduce flooding and improve water availability during periods of droughts.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Ditches	A ditch is usually defined as a small to moderate depression created to channel water. A ditch can be used for drainage, to drain water from low-lying areas, alongside roadways or fields, or to channel water from a more distant source for plant irrigation. A trench is a long narrow ditch. Ditches are commonly seen around farmland especially in areas that have required drainage such as low land areas.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Use of Groundcover and Shrubbery	Using groundcover and shrubbery has a few benefits compared to unplanted surfaces. By reducing the velocity of the water on the surface, trees and shrubs improve the infiltration of the water. In addition, plants improve the infiltration rate of the soil. In short, planted surfaces improve the infiltration capacity of the surface and thereby reduce the chance of flooding. Planted surfaces also cool the environment through evapotranspiration and by providing shade. Planted surfaces thereby have the ability to reduce the heat island effect and reduce peak summer temperatures by 1 to 5 degrees Celsius. As it provides shade reduce surface runoff as their features reduce the velocity of the water on the surface. This ability is especially interesting in urban areas where heat reduces the livability of the city.	LONG TERM	MACRO	GREEN	LOW	\$
Infrastructure Management	Porous Pavements	Permeable paving is a range of sustainable materials and techniques for permeable pavements with a base and subbase that allow the movement of water through the surface. In addition to reducing runoff, this effectively traps suspended solids and filters pollutants in the soil. Besides pavements examples include roads, lawns and lots that are subject to light vehicular traffic, such as parking lots.	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Infrastructure Management	Improve Soil Infiltration Capacity	Improving the soil infiltration capacity means improving the permeability of the soil. If the infiltration capacity of the soil is increased, more water will percolate into the soil and less water will runoff directly. This will reduce peak runoff and promoted groundwater recharge.	LONG TERM	MACRO	GREEN	LOW	\$
Infrastructure Management	Infiltration Fields and Strips with Above-Ground Storage	Infiltration fields and strips with above-ground storage combine infiltration and water storage. This way peak runoff is reduced.	INTERMEDIATE	MACRO	HYBRID	LOW	\$\$
Infrastructure Management	Rainwater Retention Ponds With or Without Infiltration Possibilities	Increasing the storage can be applied on different scales. Capturing runoff from the roof of the house is seen as the smallest scale. This is followed by the retention of runoff of an agricultural field by creating small dams within small channels or depressions in the field. And ultimately large areas can be designated as a flood area to temporarily store excess discharges of the river.	INTERMEDIATE	MACRO	HYBRID	LOW	\$\$
Infrastructure Management	Wadi (Bioswales / Infiltrating Filter Swales)	A wadi is a naturally designed buffer and infiltration filter. A wadi can be a shallow ditch or depression in the field. The wadi detaches rainwater runoff from streets and rooftops from the traditional sewer system. For the larger part of the year, the wadi remains dry. Only during heavier rain events will the wadi be filled with water. This way clean water is infiltrated into the soil it can be used during drier periods.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Shallow Infiltration Measures	Shallow infiltration measures are focused on increasing infiltration in the shallow unsaturated zone. By increasing infiltration run off peaks are lowered, reducing pluvial flood risk. Also, groundwater is recharged, reducing the impact of droughts. Examples of shallow infiltration measures are infiltration crates and soakaways.	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$\$
Infrastructure Management	Flexible Water Level Management	By using flexible natural fluctuations in the water level can improve rainfall runoff characteristics. In wet periods water levels are allowed to rise, in dry periods water levels are allowed to lower. This reduces the use of pumping stations or water inlet systems.	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Infrastructure Management	Water Squares	This type of square can combine water storage with the improvement of the quality of urban public space. The water square can be understood as a twofold strategy. It makes money invested in water storage facilities visible and enjoyable. It also generates opportunities to create environmental quality and identity to central spaces in neighborhoods. Most of the time the square can be used as a recreational space. When heavy rains occur, rainwater that is collected from the neighborhood will flow into the water square for a short times pan. After it has been in use as buffering space, the filtered water is returned to the water system.	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Artificial Urban Wetlands	Natural wetlands function as water retention basins, sediment traps and wastewater treatment areas by filtration and the immobilizing harmful microorganisms. The wetlands can be implemented with or without additions which improve the treatment capacity. Would extra treatment capacity is needed due to regular overtopping of the sewage system, mining or heavy industry, additional techniques can be implemented. Aeration, alteration soil composition or the introduction of a particular plant species in the area can all improve the treatment capacity.	LONG TERM	MACRO	GREEN	MEDIUM	\$\$

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Infrastructure Management	Rainwater Tanks	A rainwater tank (sometimes called a rain barrel in North America, or a water butt in the UK) is a water tank used to collect and store rainwater runoff, typically from rooftops via rain gutters. Stored water may be used for watering gardens, agriculture, flushing toilets, in washing machines or washing cars during dry periods	SHORT	MICRO	GREEN	LOW	\$
Infrastructure Management	Reduced Paved Surfaces	Paved surfaces like roofs, roads and parking lots, reduce the infiltration capacity of the soil and increase the surface water runoff. As a consequence, flood risk and the need for additional water retention capacity is increased. By decreasing the total area of paved surfaces, more water is can infiltrate the soil and extra green space is created. The increase in green space also has a positive effect on the heating of a city. Green areas help cooling the area by providing shade and the possibility of evapotranspiration.	LONG TERM	MACRO	GREEN	MEDIUM	\$\$
Infrastructure Management	Gutter	A gutter is a non-permeable open drain to collect transport rainwater. Usually a gutter runs along a road. It is connected to either a manhole or a surface water body.	LONG TERM	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Public Infrastructure Design	Build to last: build resiliency into public infrastructure	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Infrastructure Management	Increased Design Standards for Industrial Systems	Design industrial systems to reduce vulnerability to future sea level rise and associated hazards	LONG TERM	MICRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Sewage and Solid Waste Management	Improve sewage and solid-waste management infrastructure to reduce vulnerabilities to climate change (i.e. storm surge, flooding, inundation)	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Evaluate Stormwater Infrastructure	Evaluate and improve capacity of storm water infrastructure for high intensity rainfall events	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$\$
Infrastructure Management	Beach Nourishment	Use beach nourishment to protect infrastructure in coastal areas	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$\$\$
Infrastructure Management	Management of Possible Submerged Structures	Develop retreat strategies for the management of existing structures or conditions that may become submerged hazards to navigation or public health (e.g. effluent outfalls, water intakes, septic fields, rock walls, docks and piers)	INTERMEDIATE	MACRO	GREEN	LOW	\$
Infrastructure Management	Industrial Systems	Site industrial systems away from areas vulnerable to extreme changes in weather conditions	LONG TERM	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Relocation of Structures	Consider relocation of threatened structures	LONG TERM	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Strengthen Building Codes	Strengthen building codes and increase building inspection frequency	LONG TERM	MACRO	GRAY	MEDIUM	\$\$
Infrastructure Management	Research Potential Gray Structures	Investigate consequences of installation of hard structural options (such as dikes, levees, floodwalls, and saltwater intrusion barriers) and soft structural options (such as dune restoration and creation wetland restoration, periodic beach nourishment temporary barriers) to ensure comprehensive and effective response	SHORT	MACRO	GRAY	LOW	\$
Infrastructure Management	Construction Standard Review	Review construction standards for piers and wharves for wave strength resistance	SHORT	MICRO	GRAY	LOW	\$
Infrastructure Management	Public Housing Resilience	Make sure urban housing stock, including multi-family homes and public housing units are resilient to likely climate change effects	INTERMEDIATE	MICRO	HYBRID	LOW	\$\$
Infrastructure Management	Storm Water Capacity	Evaluate and improve capacity of storm water infrastructure for high intensity rainfall events	LONG TERM	MACRO	GRAY	MEDIUM	\$\$\$
Infrastructure Management	Storm Water Capacity	Evaluate and improve capacity of storm water infrastructure for high intensity rainfall events.	LONG TERM	MACRO	HYBRID	HIGH	\$\$\$
Infrastructure Management	Maintenance of Drainage	Increase maintenance and cleaning of gutters, drainages ditches and culverts	SHORT	MICRO	HYBRID	LOW	\$
Infrastructure Management	Modify Communication Infrastructure	Incorporate modifications to communications infrastructure to increase resiliency during routine maintenance and upgrades	INTERMEDIATE	MACRO	GRAY	LOW	\$\$
Infrastructure Management	Identify Energy Infrastructure	Identify key energy infrastructure (networks, pipelines, power lines or points of production or distribution) that may be affected by climate change impacts	SHORT	MICRO	GRAY	LOW	\$
Infrastructure Management	Modify Energy Infrastructure	Incorporate modifications to energy infrastructure to increase resiliency during routine maintenance and upgrades	INTERMEDIATE	MACRO	GRAY	LOW	\$\$
Infrastructure Management	Hydrology Models	Develop complete climate-hydrology models to create reliable scenarios of all aspects of the hydrological cycle, including extreme events	SHORT	MACRO	GRAY	LOW	\$
Infrastructure Management	Modify Topography	Modify land topography to reduce runoff, improve water uptake, reduce erosion and sedimentation in streams	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Infrastructure Management	Living Shoreline	Reduce loss of wetlands due to hardening of estuarine shoreline	LONG TERM	MACRO	GREEN	MEDIUM	\$\$

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Infrastructure Management	Ocean Outfalls	Reduce or eliminate ocean outfalls	LONG TERM	MICRO	GREEN	LOW	\$
Infrastructure Management	Green Spaces	Increase urban vegetation- plant trees, roof gardens through planned growth and local ordinances protecting vegetation and open space.	LONG TERM	MICRO	GREEN	MEDIUM	\$\$
Infrastructure Management	Pedestrian Friendly Planning	Adapt the built environment to make communities more walkable and pedestrian friendly, and ensure consideration of climate change planning	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Special Area Management Plan (SAMP)	Plans which provide for increased specificity in protecting significant natural resources, reasonable coastal dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making"	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$\$
Policies & Strategic Planning	Allow Coastal Wetlands to Migrate Inland	Through the use of setbacks, density restrictions, or land purchases a city can mitigate the effects of sea level rise. This adaptation preserves habitat for venerable species and preserves coastal land from developments.	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Prohibit Hard Shore Protection	Create policies that restrict the implementation of hard structures along coastal properties	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Develop Planning Laws	Review planning laws, maps, plans, and development guidelines for Effective Response to Climate Impacts such as sea level rise, saltwater intrusion, drought, more frequent and intense storms, storm surges and flooding, erosion, heat waves.	INTERMEDIATE	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Review Land Use Plans	Review land use plans in anticipation of change development pressures and shifts in development patterns due to climate change	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	Adaptations in Land Use Planning	Support/Conduct Comprehensive Land Use Planning that incorporates adaptation strategies	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Regional Planning with Climate Change	Engage in regional planning processes in relationship to climate change	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Adaptative Land Use Planning	Develop a series of models for adaptive land use planning for decision-makers at all jurisdiction levels	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Climate Change Projection in Urban Planning	Require consideration of climate change projections in urban planning	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Critical Area Planning	Integrate critical area planning requirements with comprehensive planning laws, including emergency planning and infrastructure planning requirements	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Require Comprehensive Planning	Require that counties act on comprehensive planning requirements	INTERMEDIATE	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Critical Area Planning	Strengthen existing critical area planning and implement requirements to address sea level rise and associated coastal hazards	INTERMEDIATE	MACRO	HYBRID	MEDIUM	\$
Policies & Strategic Planning	Deter Development in Vulnerable Areas	Guide future development out of areas vulnerable to sea level rise and associated hazards	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	End Permitting in Vulnerable Areas	End permitting of new home construction in areas vulnerable to sea level rise and associated hazards	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Update Floodplain Maps	Develop a strategy to regularly update floodplain maps	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Identify High Hazard Areas	Identify high hazard areas (at risk for flooding, sea water inundation, etc.)	SHORT	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Sheltered Coastlines	Increase erosion and hazard planning focused on sheltered coastlines	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	Transportation and Land Use	Integrate transportation and land use planning	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$
Policies & Strategic Planning	State Transportation Plan	Ensure climate change is considered in reviews of state transportation plan	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$
Policies & Strategic Planning	Metropolitan Planning	Require/enable metropolitan planning organizations to take climate change into account	LONG TERM	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	Existing Programs in Transportation	Review existing coastal programs for coverage of sea level rise & other climate impacts on transportation	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	Transportation Planning	Develop joint transportation strategies with adjacent communities, regions and states to accommodate changing conditions and transportation system use	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$
Policies & Strategic Planning	Task Force	Establish Climate Change and Public Infrastructure Task Force	LONG TERM	MACRO	GREEN	MEDIUM	\$

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Policies & Strategic Planning	Local and State Coordination	Establish a coordinating mechanism to assure that local governments act in concert with the state to reduce future impacts from climate change SLR and associated hazards	LONG TERM	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	State Building Codes	Review State Building and Design Codes to promote resiliency of communities, to mitigate storm and flood damage.	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Policies & Strategic Planning	Evaluation of Mechanical and Electrical	Establish a mechanism to evaluate and recommend new design standards for structures (and placement of mechanical and electrical equipment) that may be vulnerable to SLR and associated hazards	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Policies & Strategic Planning	Limit Infrastructure	Limit infrastructure investments in hazard-affected coastal areas	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Institute Design Standards	Institute new hazard-resistant building codes and design standards to reduce vulnerability of structures to future sea level rise and associated hazards	LONG TERM	MACRO	GRAY	MEDIUM	\$\$
Policies & Strategic Planning	Increased Design Standards	Increase infrastructure design standards to address lower probability events	LONG TERM	MACRO	GREEN	MEDIUM	\$\$
Policies & Strategic Planning	Building Regulations to Include Climate Change	Require consideration of climate change projections in building guidelines	LONG TERM	MACRO	HYBRID	MEDIUM	\$\$
Policies & Strategic Planning	Building Regulations to Include Adaptation	Support/Conduct Comprehensive Building Regulation that incorporates adaptation strategies and requirements	LONG TERM	MACRO	HYBRID	MEDIUM	\$\$
Policies & Strategic Planning	Review Building Codes	Review existing building and plumbing codes that are likely to be affected by climate change	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Update Building Codes	Update building codes, design standards to include setback zones and phased-out or no development in exposed areas	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Limit Construction in Flood Plains	Limit construction in 100-year floodplain	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Address Ingress and Egress	Develop strategies to address situations of changing ingress/egress to structures as support for access roads in areas vulnerable to sea level rise and associated hazards is withdrawn	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Limitations of Existing Policies	Investigate potential and limitations of eminent domain, vesting, grandfathering, and amortizing strategies to support relocation activities	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Analysis of Migration Strategies	Analyze incentivized / forced, subsidized migration	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	High Hazard Buyouts	Buyout unused properties in areas vulnerable to sea level rise and associated hazards	LONG TERM	MACRO	GREEN	HIGH	\$\$\$
Policies & Strategic Planning	Relocate from Vulnerable Areas	Relocate from highest risk barrier islands and low-lying lands, removing infrastructure that may exacerbate flooding and natural processes	LONG TERM	MACRO	GREEN	HIGH	\$\$\$
Policies & Strategic Planning	Rolling Easements	Enact law that authorizes the state to secure a rolling property easement as sea level rises	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Strategic Plans	Require that local government coastal land use plans include a strategic plan for responding to sea level rise, and other climate risks.	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Climate Safe Communities	Develop new criteria for 'climate safe' communities and developments	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Real Estate Disclosures	Update real estate transaction disclosure requirements for hazards related to climate change	INTERMEDIATE	MACRO	GRAY	LOW	\$
Policies & Strategic Planning	Require Disclosure of Hazards	Enact legislation to require sellers of coastal properties to disclose potential hazards to buyers. Coastal hazards disclosure should accompany all real estate transfers of properties in coastal counties	INTERMEDIATE	MACRO	GRAY	LOW	\$
Policies & Strategic Planning	Environmental Standards	Increase environmental quality standards to enhance resilience of natural water systems	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Flood Plain Mapping	Improve flood plain mapping given increasing frequency of major flood events	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Coastal Zone Management Plan	Create integrated coastal zone management (ICZM) plans and support Coastal Zone Management program	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Implement Living Shorelines	Conduct coastal re-alignment planning including conversion of land to salt marsh and grassland to provide sustainable sea defenses (IPCC)	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Coastal Resource Action Policies	Develop coastal resource action policies for adapting to more frequent severe storms, sea level rise, drought, erosion, and acute flooding events	INTERMEDIATE	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	Coastal Adaptation Program	Create a Coastal Adaptation Program	INTERMEDIATE	MACRO	GREEN	LOW	\$

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Policies & Strategic Planning	Beach Nourishment	Create or update State Beach Nourishment Program	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Beach Management Plan	Create or update Strategic Beach Management Plan with climate impacts	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Climate Driven Immigration	Anticipate and prepare for potential climate-driven immigration from neighboring countries, especially along border states	LONG TERM	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Assistance Programs	Design assistance programs to respond to potential economic impacts, housing needs, dislocation and chronic deficiencies impacting health and quality of life in communities	INTERMEDIATE	MACRO	HYBRID	LOW	\$
Policies & Strategic Planning	Adaption Action Area (AAA) Zoning	Enact planning laws that prevent new construction in vulnerable zones, Coastal High Hazard Area (CHHA) / Adaptation Action Areas(AAA)	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Establish Leadership	Establish leadership in climate adaptation technology and career fields: engineering and design services, climate-sensitive infrastructure systems, ecosystem and beach management, economic security and services related to human health and safety.	INTERMEDIATE	MACRO	GREEN	LOW	\$
Policies & Strategic Planning	Adapt Industries	Adapting state industries to more frequent severe weather events and disruption of once predictable patterns	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$\$
Policies & Strategic Planning	Engage Business Representatives	Identify and engage representatives of key business areas potentially vulnerable to specific climate change effects	INTERMEDIATE	MICRO	GRAY	LOW	\$
Policies & Strategic Planning	Conservation in Tourism	Implement aggressive water conservation, energy conservation and efficiency and recycling/waste management at popular travel destinations	INTERMEDIATE	MICRO	GREEN	LOW	\$
Policies & Strategic Planning	Restructure Permitting	Refining permitting programs to account for climate change	INTERMEDIATE	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Restructure Zoning	Zoning Development away from sensitive and hazard prone areas	LONG TERM	MACRO	GREEN	HIGH	\$\$
Policies & Strategic Planning	Setbacks and Easements	Creating setback or rolling easements	LONG TERM	MACRO	GREEN	HIGH	\$
Policies & Strategic Planning	Restrict Hard Structures	Restricting the use of shore protection structures	LONG TERM	MACRO	GREEN	MEDIUM	\$
Policies & Strategic Planning	Impervious Surfaces	Minimizing extent of impervious surfaces	LONG TERM	MACRO	HYBRID	MEDIUM	\$
Policies & Strategic Planning	Buffers	Establishing buffers around natural features	LONG TERM	MACRO	GREEN	MEDIUM	\$\$
Policies & Strategic Planning	Restructure Building Codes	Instituting or strengthening building codes in flood- and erosion-prone areas	INTERMEDIATE	MACRO	GRAY	MEDIUM	\$