Measure Profile

Nearshore Reefs

Flood Adaptation Measure

ECOLOGICAL INFRASTRUCTURE

WATER LEVEL RANGE:

Intertidal to subtidal

SHORELINE LOCATION:

In Water

Oyster Reef in the Gulf Coast, Texas ©Jerod Foster

DESIGN LIFE	ADAPTABILITY	IMPACT ON THE WATERFRONT	CONSTRUCTION COST
N/A	Low	Minor Intervention	TBD

COASTAL FLOOD HAZARDS MITIGATED:

Enhancements can provide flood protection when combined with other physical infrastructure

Sea Level Rise

Storm Surge

Groundwater

Waves

Erosion

MEASURES COMPATIBILITY:

Flood	Seismic
All	All

ECOSYSTEM SERVICES: Measure may affect these shoreline values

Aquatic Habitat	Terrestrial Habitat	Water Quality	Carbon Storage
—	—	— / ↑	—

DESCRIPTION:

Nearshore reefs are made of bags or baskets of oyster shells, concrete structures (ex: Reef Balls™, Oyster Castles™, cement oyster rings), rip-rap, or concrete blocks. They are best suited to shallow waters with low wave energy. Reefs with subtidal or intertidal crests dissipate wave energy and reduce wave transmission. Depending on location and layout, reefs can also trap sediment on their lee side and stabilize the bottom. Nearshore reefs provide habitats for a variety of marine species, and promote the growth of rock dwelling mollusks and aquatic vegetation.

CONSIDERATIONS:

- Nearshore reefs can augment subtidal and intertidal habitat. They perform best when wave environments, water levels, and geotechnical and seismic

ADVANTAGES:

- Habitat creation.
- Local shoreline erosion protection.
- Low visual impact.
- Shellfish reefs can improve water quality by filtering out pollutants.

DISADVANTAGES:

- Shallow water depths only.
- Low wave energy environments only.
- Potential shoreline changes in vicinity of project site due to altered wave environment.

PORT OF SAN FRANCISCO

Waterfront Resilience Program

Nearshore Reefs

Flood Adaptation Measure

conditions are carefully considered in the design. • Target habitats should be consistent with environmental conditions (wave energy, water circulation, contaminant inputs, water levels, existing flora and fauna) at the site.	• Can provide educational opportunities. • Compatible with seismic mitigation measures. Seismic performance depends on foundation and type of construction.	• Potential navigation hazard.

CONSTRUCTION IMPACTS TO THE PUBLIC:	SEA LEVEL RISE ADAPTATION OPPORTUNITIES:	CASE STUDIES:
• Installation can be completed from the water. Possible marine traffic disruption.	• Can be designed for a range of water levels, however once constructed, adjustments to mitigate for long term sea level rise would be difficult and costly. • Increased water levels can result in less wave attenuation, however there is some potential for the reef to grow due to natural processes with time which could mitigate for the effects of sea level rise.	• None cited

DESIGN OPPORTUNITIES:

Ecological Enhancements	Urban Design	Form
• Provides and protects nearshore habitat, and enhances biodiversity and food supply for wildlife.	• Though predominantly underwater, intertidal reef crests can pose educational opportunities to visually engage people with the water.	• Form is maximized to provide shelter to marine organisms.

DESIGN CONSIDERATIONS:

- Environmental conditions (water levels, waves, currents, water quality, sedimentation potential) should be well defined for each site considered.
- Bottom conditions should be such that they will support the placement of shells or artificial reef structures.

SITE-SPECIFIC CONSIDERATIONS:

- Conditions at the site must be compatible with the target habitat.
- For shellfish reefs, the presence of live oysters on hard substrate at the site or historical knowledge of areas where the target shellfish existed can give an indication of the potential for success.
- The site should have adequate circulation to deliver food and oxygenated water to the reef as well as carry away waste products.
- Sites with point sources of pollution (sediment, stormwater), and/or high or persistent wave activity are not appropriate.

Nearshore Reefs

Flood Adaptation Measure

INSTALLATION AND CONSTRUCTABILITY CONSIDERATIONS:

- Requires the placement of reef material on the bottom. Placement can be challenging depending on reef size, materials, and site conditions, and will require a marine contractor. Construction would need to consider marine weather time windows to minimize downtime and potential marine traffic disruption. Improper timing of construction relative to growing or spawning seasons of the target habitats may delay recruitment.

OPERATIONS AND MAINTENANCE CONSIDERATIONS:

- Periodic inspections should be performed to check for settlement and wave damage.