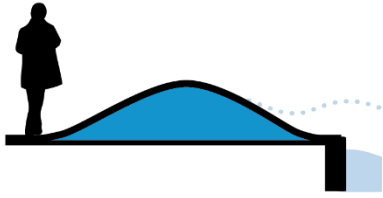


# Earthen Levee

## Flood Adaptation Measure



### PHYSICAL INFRASTRUCTURE



### SHORELINE LOCATION:



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<b>DESIGN LIFE</b> 75+ years	<b>ADAPTABILITY</b> Varies	<b>IMPACT ON THE WATERFRONT</b> Major Intervention	<b>CONSTRUCTION COST</b> TBD
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### COASTAL FLOOD HAZARDS MITIGATED:



Sea Level Rise



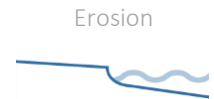
Storm Surge



Groundwater



Waves



Erosion

<b>MEASURES COMPATIBILITY:</b>		<b>ECOSYSTEM SERVICES:</b> Measure may affect these shoreline values			
Flood	Seismic	↑	↑	—	—
Floodwalls, Revetment, Ecological Shorelines	Nearshore Buttress, Landside Buttress	Aquatic Habitat	Terrestrial Habitat	Water Quality	Carbon Storage
		—	—	—	—

### DESCRIPTION:

Levees are areas of raised ground made of earthen embankments or fill placed along shorelines to prevent flooding. Levees are used along creeks to prevent overflow of flood waters or in coastal areas to protect against storm surge. Levees can be built to host a number of different uses, such as roadways and walkways.

### CONSIDERATIONS:

- TBD

### ADVANTAGES:

- Top of levee can be used for other functions such as paths or roadways.
- Can incorporate vegetation that provides terrestrial habitat functions.

### DISADVANTAGES:

- May require a large amount of contiguous land or Bayward fill.
- Has a large footprint that can separate natural process connections between intertidal and supratidal areas.

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	<ul style="list-style-type: none"> <li>Can provide increased access to the bay and bay views.</li> </ul>	<ul style="list-style-type: none"> <li>Can be unsightly and block bay views, depending on height and site-specific viewpoints.</li> <li>Can impede surface water runoff on the shore side of the levee.</li> </ul>
<p><b>CONSTRUCTION IMPACTS TO THE PUBLIC:</b></p> <ul style="list-style-type: none"> <li>Lengthy construction disruption which would require traffic and pedestrian re-routing.</li> </ul>	<p><b>SEA LEVEL RISE ADAPTATION OPPORTUNITIES:</b></p> <ul style="list-style-type: none"> <li>Floodwalls can be added to the crest to reduce flooding due to rising sea levels without increasing the overall footprint of the levee.</li> </ul>	<p><b>CASE STUDIES:</b></p> <ul style="list-style-type: none"> <li>None cited</li> </ul>
<p><b>DESIGN OPPORTUNITIES:</b></p>		
<p><b>Ecological Enhancements</b></p> <ul style="list-style-type: none"> <li>Levees with sufficiently shallow side slopes can be vegetated to provide terrestrial habitat/ecosystem functions.</li> </ul>	<p><b>Urban Design</b></p> <ul style="list-style-type: none"> <li>Levees can be designed to incorporate uses like running trails or pathways.</li> </ul>	<p><b>Form</b></p> <ul style="list-style-type: none"> <li>Where there is sufficient space levees can be integrated into natural landforms</li> </ul>

**DESIGN CONSIDERATIONS:**

- Levee height should be set to account for extreme high waters plus wave runoff and overtopping.
- Side slopes should be designed to resist erosion from wave attack on the water side and from runoff and erosion (typically with vegetation) on the land side.
- Slopes must be designed to ensure geotechnical stability.
- Pumping systems may be required if the levee interrupts natural drainage from the land side.

**SITE-SPECIFIC CONSIDERATIONS:**

- Waves and water levels should be well defined.
- Need to understand and account for established drainage patterns to prevent ponding/flooding on the land side.
- Geotechnical investigations should be performed to determine potential for settlement and global stability failure.
- May require acquisition of a significant amount of contiguous land.

**ARCHITECTURAL CONSIDERATIONS:**

- A levee is a massive structure that does not have flexibility to avoid the obstruction of views.
- Slopes could be steps, concrete, random rip-rap or fitted stone.

**HISTORICAL RESOURCE CONSIDERATIONS:**

- A levee would need to be aligned around and possibly encroach in the bay to avoid a historical resource.

**URBAN DESIGN CONSIDERATIONS:**

- Can require an extensive amount of land or bayward fill.
- Height of levees can interrupt sightlines and views of the bay.

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### INSTALLATION AND CONSTRUCTABILITY CONSIDERATIONS:

- Construction would be performed from landside with typical land-based equipment and would likely require importation of material via truck through city streets with increased traffic, noise, dust, etc.
- Lengthy construction disruption which would require traffic and pedestrian re-routing.

### OPERATIONS AND MAINTENANCE CONSIDERATIONS:

- Once constructed, little to no maintenance of the levee itself should be required.
- Levee should be inspected periodically and following significant storm events.