



Maine Public Working Waterfront Infrastructure Fund

Resiliency Guidelines

Purpose

To communicate industry standards and practical best methods for projects that increase resiliency in waterfront infrastructure for various types of structures on the coast of Maine. The purpose of this guide is to provide basic guidance to the Maine Public Working Waterfront Infrastructure Fund applicants for resiliency engineering to mitigate the effects of sea level rise, increased storm frequency and intensity, and general fortifying of structure(s) to resist or mitigate overtopping and uplift. This list serves to outline qualifiers for the grant program's resiliency requirements. This is a guide and not intended to be a comprehensive list of all resiliency engineering practices or approaches. These guidelines were adapted from the [Working Waterfront Resiliency Grant Program](#). The Maine Climate Council recommends the state commit to manage for 1.5 feet of relative sea-level rise by 2050, and 3.9 feet by 2100. Use information from [Maine Won't Wait](#), as appropriate.

Piers/Wharves

These critical pieces of infrastructure are most vulnerable to the effects of climate change and most dramatically impacted by storm surge and sea level rise. Resiliency examples include:

- Raising existing structures to mitigate overtopping and uplift.
 - Recent rule changes allow for up to 4 feet of elevation increases under the Maine Department of Environmental Protection [Permit by Rule](#) process.
- Utilizing through bolting and heavy galvanized hardware where practical to make more positive physical connections between structural members such as piles, pile caps, stringers, and bracing.
- "Tie Down" practices (galvanized plate strapping, bolts, etc.) to replace or augment dead weight connections such as "pinned" pile caps.
- Heavier decking with timberlock or GRK augmentation of traditional spikes. Decking should be 4" dimensional lumber (3.5" actual) and a width appropriate for application (6-12") with appropriate gaps (1/2" recommended) between to

allow unimpeded flow of water both up and down yet allow safe pedestrian and hard wheeled (forklift, pallet jack, dolly) traffic.

Buildings

Pier based buildings can exert tremendous lateral forces upon their host structure during inundation/overtopping conditions. Mitigation efforts to these factors include the following:

- Raising the host structure by an appropriate amount to mitigate inundation, overtopping and uplift.
 - Ramping into a storage facility may be needed to ensure safe access and egress by users.
- Installation of blow out panels.
 - These panels are made to blow out from hydraulic force during inundation allowing the unimpeded flow of water through the structure and minimizing lateral forces exerted by wave action and tidal currents
 - Typically, these panels are 18" to 36" high and placed in exterior walls. They can be hinged, or force fit.
- Drainage systems, scuppering, and wave breaks.
 - Other systems designed to allow water to flow through the structure or be diverted around the structure resulting in a lessening of wave and tidal current forces against the structure.
- Elevating or relocating harbor master buildings out of flood prone areas. Harbor master buildings would have to be physically moved or elevated. The existing building could not be demolished and then a new building constructed, as the construction of new facilities is ineligible under this funding opportunity.

Electrical and Mechanical Systems

Most working waterfront facilities have multiple electrical and mechanical systems in use. These include refrigeration, water pumps, hoists, hydraulics, 110v and 220v outlets, and other conveyance and material handling equipment. Mitigation of inundation and overtopping are crucial to ensure longevity of these systems.

- Raise all electrical systems to a height well above recent water levels witnessed on site.
- Cofferdam sensitive mechanical equipment on pier faces and ensure proper breakers and GFCI circuits are employed.

Fuel Systems and Tanks

Fuel systems and tankage are ubiquitous along the working waterfront and protections must be made to ensure resiliency to high water events. These can include:

- Moving tankage up and away from flood prone areas.
- Raising pier side pumps to mitigate inundation.
- Ensuring tank vents and caps are functional and vents are high enough to resist inundation, and caps are sealing properly.