

GRADING: BARRIERS (BERMS/LEVEES/FLOODWALLS)

When properly designed and constructed, berms and levees can be effective in reducing structural damage from overbank flooding. The sides of a levee or berm are sloped to provide stability and resist erosion; thus, the width is usually six to eight times its height. As a result, taller levees require more land. A floodwall is an engineered structure made of reinforced concrete or reinforced concrete block and varies in height from 1-to 20-feet. Similar to berms and levees, a floodwall can surround a structure or a portion of a structure. Barriers are not typically used to resolve structural flooding in urban areas due to the potential impacts on adjacent properties; however, there are some situations where this flood mitigation strategy may be used. Some appropriate applications of barriers include areas outside the regulatory floodplain where the barrier can be constructed without adverse impacts to adjacent properties, and structures with a low opening that can be protected without adverse impacts to adjacent properties. The local floodplain management ordinance must be reviewed for restrictions on the use of barriers. Levees, berms, and floodwalls may not be used to bring a substantially improved or substantially damaged home into compliance with the local floodplain management ordinance. The height of the barrier needed to adequately protect the structure should also be considered. If the height of the levee, berm, or floodwall would make the project cost-prohibitive, then alternatives should be considered.

DESIGN CONSIDERATIONS

Levees and floodwalls should be built to protect the residence from predicted flood heights as depicted on FEMA FIRMs, FIS, or local flood vulnerability analysis. The higher the levee or floodwall, the greater the depth of water that builds behind it and the greater the water pressure exerted on the barrier. Taller levees and floodwalls must be designed and constructed to withstand the increased pressures. Local zoning and building codes may restrict the use, size, and location of barriers. If the flood depth at the project site is above the practical height limits of available barriers, an alternative mitigation method should be considered. The bearing capacity and permeability of the soils encountered may have a significant impact on the choice of barriers as a flood protection option. A berm or floodwall should be as far from the building as possible to reduce the threat of seepage and hydrostatic pressure. The levee or floodwall can always be overtopped by a higher-than-expected flood regardless of the height of the barrier. Overtopping is a greater concern for a levee than a floodwall because a small amount of overtopping can cause erosion at the top of the levee and cause it to fail.

CONSTRUCTION AND COSTS

To facilitate slope stability as well as maintenance and safe grass mowing, the side slopes of most levees should not be steeper than 1 foot vertically to 3 feet horizontally (1:3). Trees and large shrubs should not be located on barriers as they can be overturned during high wind events and compromise the structural integrity of the levee. When trees and shrubs die, their roots decay, leaving cavities for water to pass through, which can cause the barrier to fail.

The costs can vary greatly depending on the height, length, construction materials, labor, access closures, interior drainage systems, and the distance between the construction site and the source of the fill dirt used to build the levee or berm. In general, the practical, cost-effective heights of these levees and floodwalls are usually limited to 6 feet and 4 feet, respectively.

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- Reduces the flood risk to the structure and contents (if the design flood level is not exceeded),
- Reduces the physical, financial, and emotional strains that accompany flood events,
- Can protect multiple structures,
- Occupants usually do not have to leave the structure during construction,
- Typically, less expensive than structure elevation or relocation, and
- Structural flood protection is provided without significant changes to the structure.

- May require land to construct (levees and berms typically require more land than floodwalls),
- Will not reduce flood insurance premiums,
- Overtopping or failure eliminates any protection provided,
- Human intervention is required to seal any openings,
- May restrict access to the structure,
- Interior drainage must be provided, and
- Could cause flooding of upstream and downstream properties.

MAINTENANCE

A barrier requires periodic inspections and maintenance to address any necessary repairs. Small problems, such as cracks, loss of surface vegetation, erosion and scour, animal tunnels, and trees and shrubs can quickly become large problems during a flood event. A barrier should be inspected at least each spring and fall, before each impending flood, and after each flood event.

FLOOD REDUCTION

Berms, levees, and floodwalls have been proven to protect structures from flooding; however, they may increase the risk of flooding upstream and downstream. As a result, there are strict regulations on the construction of barriers that may prevent their implementation in some areas. Typically, construction of a barrier will block the flow to an area and that lost storage volume must be compensated. When barriers are used, they are effective up to the design elevation. If the barrier is overtopped, the flood protection is lost.