5.0 OVERVIEW OF FLOOD DAMAGE REDUCTION MEASURES

Flood damage reduction consists of two basic techniques – structural and non-structural. Structural methods modify the flood and "take the flood away from people" by measures such as levees, floodwalls, dams, dredging and channelization. Non-structural flood damage reduction techniques basically "take the people away from the floods" leaving the flood to pass unmodified. Non-structural techniques consist of measures such as relocation, flood proofing, acquisition, and flood preparedness. The following structural and non-structural flood damage reduction techniques were considered for this study. To familiarize the reader with these flood damage reduction measures, general descriptions are presented below.

5.1 STRUCTURAL TECHNIQUES

The types of structural measures that were considered for Huntington include levees, floodwalls and dredging. Levees and floodwalls are freestanding structures located adjacent to or away from the buildings that prevent the encroachment of floodwaters. Dredging the flood-prone waterway may allow the waterway to carry more floodwater, reducing the depth of floodwaters.

5.1.1 Levees

Typically, levees are constructed of compacted fill taken from locally available impervious soils. Depending upon the availability of suitable local soil, levees may be one of the least expensive flood damage reduction measures. Levees have the advantage of being compatible with the landscape since they are easy to shape and are covered with grass (Figure 5.1).

Figure 5.1: Typical Levee

Unlike other flood proofing measures, a well designed and constructed levee results in no water pressure on the structures themselves. Consequently, as long as the levee holds or is not overtopped, the building should not be exposed to damaging hydrostatic or hydrodynamic forces. Another advantage with this technique is that there is no need to make major structural alterations to the flood prone buildings.

When constructing a levee around buildings or along the side of buildings, sump pumps must be incorporated to provide proper interior drainage from groundwater seeping under the levee and rainwater from the building side of the protection. During a flood, the storm drain pipes that usually take rain water from the community to the river (under or through the levee) are closed so that flood water from the river does not back up and flood the community. Typically, one or more large pump stations are needed during a flood to pump the rain water that is trapped on the land side of the levee over the levee to the river side. The pump also pumps any water that seeps under the levee over to the river side.

Levees require periodic maintenance, including removing debris from any check valves on pump discharge pipes after each storm, inspecting the sump pump for proper operation, and maintenance of the flap gates. In addition, the levees must be inspected for signs of erosion, settlement, animal burrows, and tree growth.

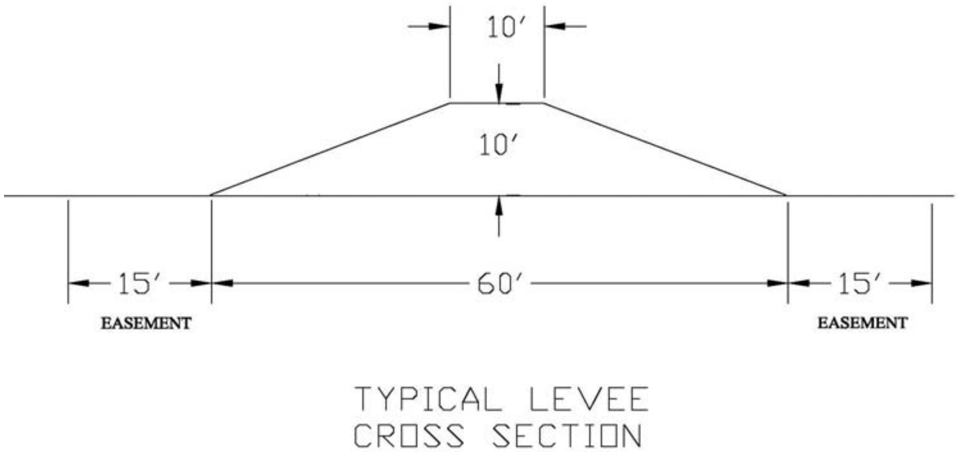
Although levees can provide protection to an area and prevent or reduce flood damages, they are not free from risk. Levees can create a false sense of security about property protection. Every flood is different, and one could exceed the design height and overtop the levee at anytime. For this reason, the protected area should always be evacuated prior to flooding.

If a levee fails due to overtopping or for any other reason, damage to the protected structure will be as great or greater than if no protection was provided. Additional damage could result because it takes longer to remove the flood water from the inside of the levee once flood levels subside.

Although levees may be attractive in terms of economics and appearance, one potential drawback is the amount of property space required. To minimize erosion and to provide adequate stability, their embankment slopes must be fairly gentle, usually a ratio of one vertical to two or three horizontal (Figure 5.2).

Any sewers or drain pipes passing through or under a levee will require closure valves to prevent backup and flooding inside the building and protected area.

Figure 5.2: Typical Simple Cross Section of a Levee
(for 10 foot-high levee)



5.1.2 Floodwalls

Similar to levees, floodwalls also keep water away from the building. However, floodwalls are constructed of stronger materials, are thinner, take less space, and generally require less maintenance than levees. Floodwalls can be constructed using a variety of designs and materials, such as steel sheetpiles and concrete. However, flood walls are typically more expensive than levees and they require closure structures for access to the waterway. Since there is ample space available for a levee to provide protection to the Huntington community, a floodwall was not evaluated any further (Figure 5.3).

Figure 5.3: Typical Floodwall

5.1.3 Dredging

Waterways change over time and sometimes they accrete (fill with sediments) and sometimes they erode. The reach of Cameron Run adjacent to Huntington has filled with sediment over time. Based on available records, it has filled in with approximately 5 feet of sediment during the last 40-50 years since it was re-routed for the construction of the Capital Beltway in the early 1960's. Dredging waterways deeper and/or wider can provide more capacity for floodwaters, lowering the flood elevation; however the dredging must be done on a regular basis. As shown in the Sediment Study (USACE, 2008), Cameron Run near Huntington is a depositional area for sediment, and it is likely to fill in quickly. A site to place the dredged material must also be identified. Dredging portions of Cameron Run was investigated as part of this study.

5.1.4 Channelization

Channelization typically means modifying a stream by activities such as straightening, widening, narrowing and/or lining with concrete. The reach of Cameron Run adjacent to Huntington is already straight as it was reconfigured for the construction of the Capital Beltway. Narrowing the channel would reduce its flood capacity. Widening the channel would be difficult due to the existence of the Riverside Apartment property and the Capital Beltway ramps, and widening, even if possible, would likely increase sedimentation in this area. The only channelization activity that could possibly be effective in this area would be to line the channel with concrete to speed up the flow and possibly reduce water surface elevations. However, creating a concrete channel can have a significant impact on the environment. One of the project objectives was to minimize environmental impacts. In addition, the county and Corps are currently conducting the Cameron Run/Holmes Run watershed study, whose goal is to restore aquatic and riparian habitat in the watershed. Channelization is contrary to these goals, therefore it was not further evaluated during this study.

5.2 NON-STRUCTURAL TECHNIQUES

5.2.1 Flood Proofing

Dry flood proofing typically involves sealing the exterior building walls with waterproofing compounds, impermeable sheeting, or other materials and using shields for covering and protecting openings from floodwaters. Shields can be used on doors, windows, vents, and other openings. Sewer lines need to be fitted with check valves that close when flood waters rise in the sewer to prevent backup and flooding inside the building.

When evaluating the feasibility of flood proofing techniques, there are important analysis/design criteria that must be considered such as flood characteristics (level, duration, and velocity); elevation of the first habitable floor, type and condition of construction, lot size, location and type of utilities, accessibility, etc.; building codes, zoning/site restrictions, flood insurance guidelines, etc.; and owner/community input and reasonable aesthetics. It should be noted, National Flood Insurance Program ordinances do not allow dry flood proofing of residential structures where substantial damages exist or substantial improvements are to be made. Substantial damages/improvements are defined as restoring or improving the structure for which the costs equals or exceeds 50% of the market value of the structure before the damage occurred or the value of the structure prior to start of the improvements

Generally, dry flood proofing should only be employed on buildings constructed of concrete block or brick veneer on a wood frame. Weaker construction materials may fail at much lower water depths from hydrostatic pressure. Even brick or concrete block walls should not be flood proofed above a height of approximately three feet, due to the danger of structural failure from hydrostatic forces, unless a structural engineer has confirmed that the building is designed to handle the forces.

Dry flood proofing is not a recommended measure for reducing flood risks to structures with basements and the Huntington houses have basements. Only under limited conditions can structures with basements be flood proofed (walls were properly designed and constructed). Based on the flood proofing team's observations, the walls of the structures in Huntington were not constructed with proper reinforcement to withstand hydrostatic pressures that would occur during a storm event.

Therefore, dry flood proofing the Huntington structures is not recommended. However, for the houses where only the basement is vulnerable to flooding, one option is to fill the basement and add more living space that is above the 100-year flood elevation to the side or rear of the house if adequate space is available.

Dry flood proofing the Huntington Community Center, which does not have a basement, is a viable option and was evaluated during this study.

5.2.2 Elevation

Elevation involves raising the flood-prone buildings in place so that the lowest floor is above the flood level for which flood proofing protection is required. The buildings are jacked up and set on new or extended foundations above the level of protection. For houses that include basements (such as Huntington), the basements can be filled in, the house raised, and additional living space can be added to compensate for the lost basement space. Elevating the houses in Huntington is a viable option and was evaluated during this study.

5.2.3 Buy-Outs

A buy-out, also known as acquisition, is when the local government purchases the flood-prone houses and assists the homeowners in locating new houses out of the floodplain. The local government then returns the flood-prone area back to a natural floodplain. Although this can be costly, it does eliminate the risk of flood damages to structures and the risk to human life and safety. Fairfax County did not request that the Corps evaluate this option. However, during flood studies that could possibly lead to the construction of a federal project, the Corps must evaluate all feasible structural and non-structural solutions. Buying out the flood-prone houses in Huntington is a potential non-structural solution that was evaluated during this study.

5.2.4 Flood Warning

The implementation of a flood warning system is also a non-structural technique for reducing damages and protecting lives. A flood warning system was implemented by Fairfax County in September 2008. The county uses the Community Emergency Alert Network, or CEAN, to deliver important emergency alerts, notifications and updates during an emergency, such as flooding to the Huntington Community residents. Fairfax County is also installing more river gages in the areas throughout the region to better understand the risk of potential flood events.