CONSTRUCTION OF BARRIERS

There are two techniques employed in the construction of barriers: installation of free-standing barriers such as berms, levees, and floodwalls that are not attached to the structure and the incorporation of "dry flood proofing" techniques. Dry flood proofing would include installation of sewer check valves to keep sewer water from backing up through the system and the coating of the lower portions of exterior walls with an impermeable sealant. The BFE plus an additional safety factor should be taken into consideration.

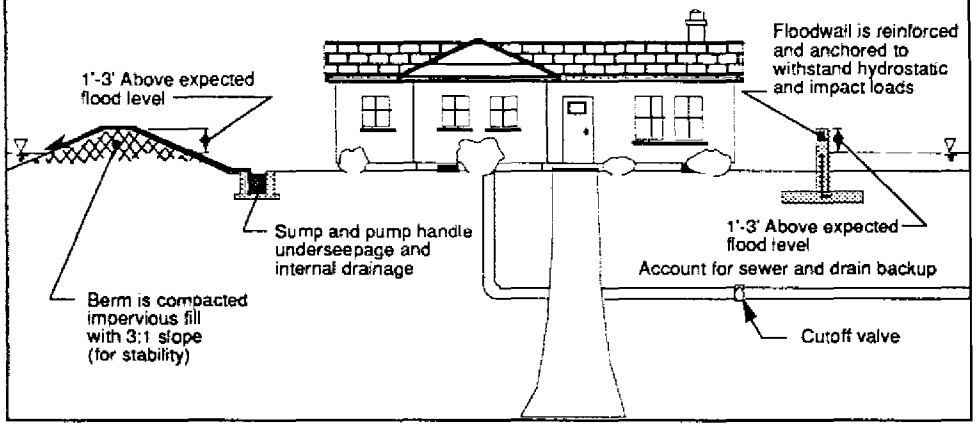
FREE-STANDING BARRIERS

The primary free-standing barriers used to reduce flood damages are berms, levees, and floodwalls. These measures should be designed by an engineer and constructed in accordance with design specifications. Permits will be required. A berm is an earthen structure constructed between a watercourse and building that stops flood waters from reaching the structure. Berms must be constructed with impermeable materials with correct side slopes. Levees, which are similar to berms, are also earthen structures of compacted local fill. Levees are usually constructed along riverbanks to prevent the flood water from spilling over and flooding structures. The levee in Scottsville, Virginia along the James River is a good example. Berms, on the other hand, serve the same purpose but usually are constructed closer to the homes themselves and often protect individual buildings. It could be said that levees and floodwalls protect many buildings while berms keep water away from one or two structures. Floodwalls are usually constructed with reinforced concrete, brick, or stone, and are anchored into the ground.

Why Barriers?

Many people prefer berms, levees and floodwalls because they require no change to the building. The appropriateness of using berms or levees becomes increasingly questionable with deeper flood waters. Deeper waters pose greater pressures against these barriers. If they fail, the forces of the flood water would do more flood damage than if the structures were flooded naturally. Both berms and levees are generally appropriate for flood proofing a structure where flood water is less than 6 feet deep. Levees can be constructed in areas where flood water exceeds 6 feet, but the cost and the land area required for these levees usually make them impractical for the average homeowner. Floodwalls, because of their greater cost, would normally be considered only on lots that are too small to have room

FIGURE 4 - 1. BERMS, LEVEES, AND FLOODWALLS



for berms or levees or where flood velocities may erode earthen berms or levees. Berms, levees, and floodwalls may not be appropriate for homes with basements since they are more susceptible to underseepage.

Advantages of the Construction of Barriers

- Not dependent upon the size, type, or condition of structure being protected.
- Protects property located outside a structure such as sheds, outbuildings, garages, etc.
- Can be aesthetically pleasing and provide privacy and security in addition to flood protection.

Disadvantages of the Construction of Barriers

- Levees, berms, and floodwalls can fail or be overtopped by large floods and would pose a significant hazard if not properly engineered and constructed.
- Maintenance is required and internal drainage must be handled.
- Local drainage can be affected, possibly resulting in water problems for others.
- Flood insurance rates usually are not reduced.
- The need to evacuate is still present.
- May require access openings that must be closed during a flood which could require warning time.
- May violate local, state, or federal floodplain ordinances. Consult community officials.

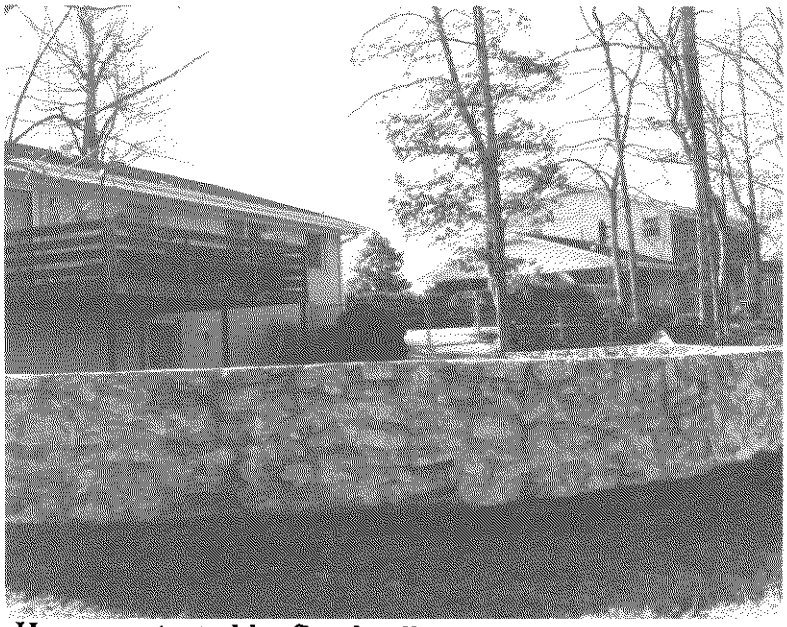
Home protected by berm

Costs

Costs depend on initial design fees, height, length, availability of construction materials, labor, access closures, drainage for the enclosed area, and protection against sewer backup. Depending upon specific site requirements, costs may also be incurred for relandscaping; maintenance to insure a watertight condition; levee and berm erosion protection; power used for pumping; and removal and replacement of walkways, driveways, or patios to accommodate a berm, levee, or floodwall. A berm or levee can be constructed for minimum costs if the owner provides the labor and the appropriate fill is available on site. If several floodprone houses are located next to each other, the cost can be reduced significantly through joint ventures and merging with existing high ground. Due to the number of variables involved, construction costs could range from a few hundred dollars to $15,000 or more.

Conclusions

Like relocation, the choice of using berms, levees, and floodwalls may depend upon your unique site characteristics. For the average home in a subdivision or urban neighborhood setting, the use of these approaches may be limited. However, if this is the flood proofing technique of choice, it is strongly recommended that these options be designed and constructed under the supervision of qualified professional engineers since berms, levees, and floodwalls can fail because of poor design, improper material and/or construction practices, poor maintenance, or inadequate pumping facilities. A proposed berm site may not be located in a floodway. Floodway regulations stipulate that no development can occur which would increase the 100-year flood elevation. A property owner should ask the local Zoning or Building Official about special zoning requirements and permit requirements before constructing any berms.



Home protected by floodwall

DRY FLOOD PROOFING

All flood proofing techniques discussed thus far in this manual would keep flood waters away from the home and, therefore, provide a significant degree of protection. But for some homeowners, these techniques are simply too expensive. A second flood proofing technique that can be used to construct a barrier against flood water is known as "dry flood proofing."

For frequent, low-level (3' or less) flooding, dry flood proofing, if properly designed and constructed, can be just as effective as any other method in preventing flood damages. With this technique, a home is sealed so that flood waters cannot get inside. All areas below the flood protection level are made watertight. Openings such as doors, windows, sewer lines, and vents are closed with permanent closures or removable shields, sandbags, valves, etc. Walls are coated with waterproofing compounds or impermeable sheeting. A sewer "check valve" or one-way flap is installed in the sewer line to permit outgoing sewage to flow during non-flooding conditions. During flooding conditions the pressure of the water will hold the flap shut and will prohibit the flow of incoming flood waters and other debris. Examples of "dry flood proofing" techniques are shown in illustrations and photographs which follow.

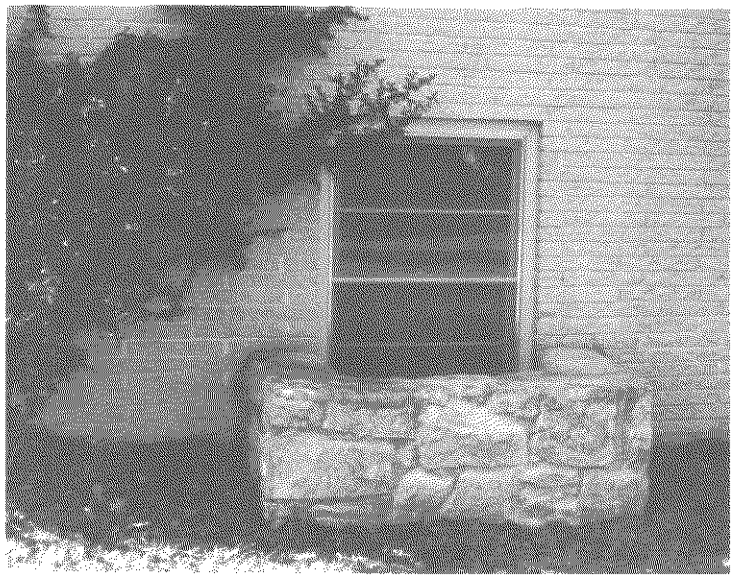
Why Dry Flood Proof?

Dry flood proofing has limitations based upon the construction style and condition of your home. Is it of brick construction with a somewhat impermeable exterior or clapboard or siding through which small amounts of water may flow? These

flood proofing techniques are only appropriate where flood waters are less than about 3 feet since most walls and floors in houses will collapse under higher water levels. The technique is not usually as successful on homes with basements since those homes are difficult to protect from underseepage.

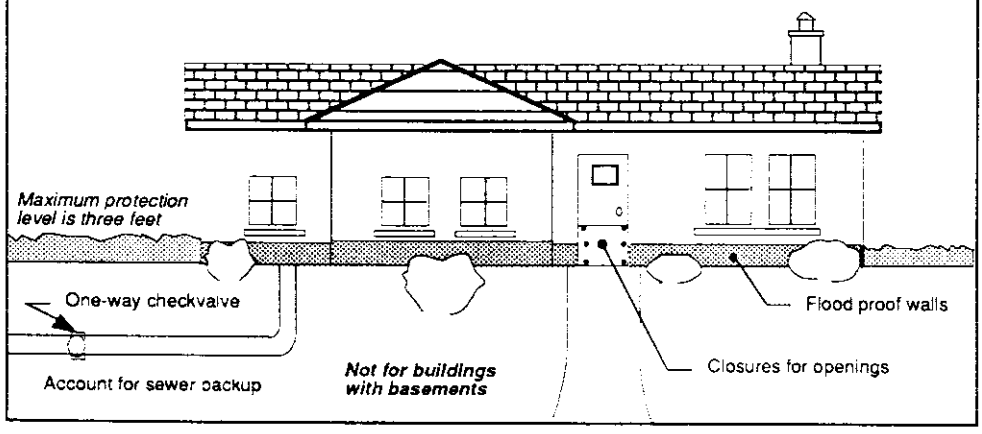
Advantages of Dry Flood Proofing

- Homeowners can get started to do something to protect themselves, thereby reducing the potential damage and providing some sense of control and direction over their predicament.



Opening protected by permanent closure

FIGURE 4 - 2. DRY FLOOD PROOFING



- Flood proofing may be done on a selective basis to only those openings through which water enters and only to the height desired.

Disadvantages of Dry Flood Proofing

- Water seepage through sealed surfaces may occur when flooding conditions are prolonged or the sealants are not maintained.

- Contents of the home are kept dry if the design flood heights are not exceeded.

- Dry flood proofing can be simple and less costly than berms, levees, or floodwalls, especially for flood depths of 3 feet or less.

- It is not acceptable for flood depths deeper than about 3 feet without evaluation by a structural engineer.

- There will be no reduction in flood insurance premiums. Elevation and relocation are the only

techniques that will reduce premiums.

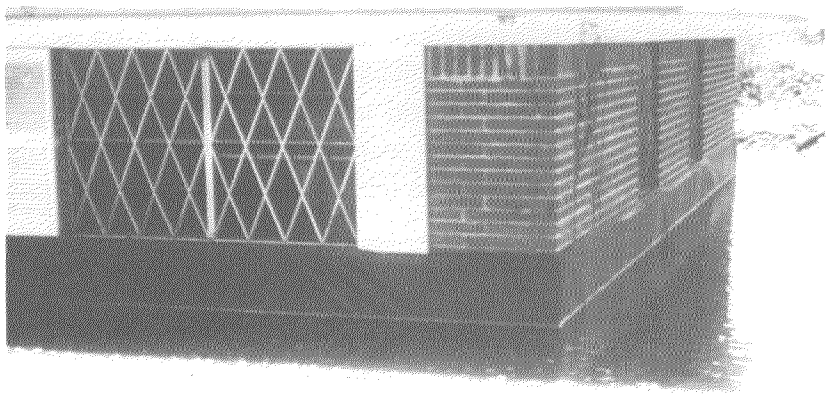
- Human intervention necessary to close some openings will require adequate warning.
- It may create a false sense of security and induce people to stay in their home longer than they should.
- Dry flood proofing measures can fail or be exceeded by larger floods.
- Some damage to the exterior of the home is still likely and damage to landscaping and other property is not reduced.
- The need to evacuate is still present.

Costs

Sometimes dry flood proofing requires no more than the cost of buying and applying tar, heavy plastic, and plywood. More expensive techniques include window wells, outside wall coverings, and electric pumps. Costs vary considerably depending on the type and depth of flooding and the size and strength of your home.

Conclusions

If you expect to spend much money dry flood proofing your home, you should give careful consideration to advancing up the scale of flood proofing options and choose to raise your home. But if dry flood proofing is your only option, keep in mind several rules of thumb: 1) Holding flood waters at bay produces tremendous loads. Make sure your home can withstand these loads. Otherwise collapse and gushing water could spell disaster. Do not consider dry flood proofing for depths greater than 3 feet. Use a professional engineer or at least seek guidance from your community building official. 2) Remember, you must flood proof up to certain elevations all around the home. It will do nothing for you to beautifully flood proof your doorways and provide nothing for your sliding glass patio door. 3) Finally, in your determination to protect your home with these innovative techniques. don't linger around as flood waters rise. Your welfare and the concern for you by others is far more important than getting that seal just right.



Building protected by impermeable coating