RFA Appendix 7 – Flood Resilience Upgrades

DOEE has identified the following resilience upgrades as potential improvements, but an applicant may propose other measures that will increase residential flood resilience. These measures are categorized by the level of effort required to implement them:

(a) Light Utility Work

1. Anchoring hot water heaters. Anchoring hot water heaters with a metal strap prevents tanks from being subjected to buoyancy during a flood. This prevents damage to the unit and prevents the floating tank from damaging other components in the room.
    a. Reference – FEMA P-348 Section 4.3 and FEMA P-312 Section 9.0.

2. Replacing all standard electrical outlets below the Design Flood Elevation with Ground Fault Circuit Interrupter (GFCI) outlets. GFCIs automatically interrupt the flow of electricity to the outlet if a short circuit is detected. This prevents the conductance of electricity from an outlet to an occupant during wet conditions.
    a. Reference – FEMA P-348 Section 4.3 and FEMA P-312 Section 9.0.

3. Sealing heating, ventilation, and air conditioning (HVAC) ducts to prevent water intrusion. Sealing HVAC ducts with tape or another water-resistance material protects continuity of operations for HVAC equipment. It also reduces the risk of health hazards from mold growth due to water accumulation.
    a. Reference – FEMA P-348 Section 4.3 and FEMA P-312 Section 9.0.

4. Deployable flood barriers. Several types of temporary barriers are available to address typical flooding problems. They work with the same principles as permanent barriers, such as floodwalls or levees, but can be removed, stored, and reused in subsequent flood events. Most of these barriers are meant to take the place of sandbag floodwalls and may also be used to reinforce existing permanent barriers such as levees.
    a. Reference – FEMA P-348 Section 4.3 and FEMA P-312 Section 9.0.

(b) Heavy Utility Work

5. Installing a backflow prevention valve on the main sanitary sewer line. Flooding can inundate and overload sanitary sewer systems and combined sanitary/storm sewer systems. As a result, water can flow backward through sewer lines and out through toilets or drains. The best solution to this problem is usually to install a backflow valve. These valves include check valves, gate valves, and dual backflow valves.
    a. Reference – FEMA P-348 Section 4.3 and FEMA P-312 Section 9.0.

6. Installing or upgrading sump pump(s). Sump pumps are used where basement flooding happens regularly and to solve dampness where the water table is above the foundation of a home. Sump pumps send water away from a house to any place where it is no longer problematic, such as a municipal storm drain or a dry well. It can be helpful to have a sump pump with battery-operated backup in case of electrical failure.

b. Reference – FEMA DR-4421- IA FS 022 (Fact Sheet: Be Flood Smart. Protect Your Property)

7. Elevation of electrical equipment. Power outages after a flood event often last much longer if a house's electrical panel is located below the flood elevation because the panel must be replaced before power can be restored. To address this problem, the electrical panel should be relocated to an elevation above the lowest floor (into the living space). When moving electrical panels to an elevation above the lowest floor, additional components, such as a service disconnect, may need to be incorporated into the system to meet the requirements of the National Electrical Code. Also, when relocating electrical panels, codes or local requirements may require replacing significant portions of the house wiring.
    a. Reference – FEMA P-348 Section 4.3 and FEMA P-312 Section 9.0.

8. Drainage and Grading. Stormwater should always drain away from a home. Building up any sunken areas around the foundation, digging small depressions to properly channel water, making landscape improvements to adjust yard slope, and reducing the amount of impervious surface can keep rainwater from accumulating and causing damage.
    b. Reference – FEMA Fact Sheet (Protect Your Home from Flooding: Low-Cost Projects You Can Do Yourself)

(c) Structural Work

9. Installing flood vents in a crawlspace. The most important part of a wet floodproofing project is installing wall openings that allow the entry and exit of floodwaters. The openings must be installed in foundation walls and in garage walls as appropriate, below the expected flood level. The goal is not simply to allow the entry and exit of floodwaters, but also to ensure that the water level inside the home rises and falls at roughly the same rate as the water level outside so that hydrostatic pressures inside and outside are continuously equalized.
    a. Reference - FEMA Technical Bulletin 1.

10. Complete wet floodproofing. The benefit of wet floodproofing is that, if floodwaters are allowed to enter the enclosed areas of the home and to quickly reach the same level as the floodwaters outside, the effects of hydrostatic pressure, including buoyancy, are greatly reduced. As a result, there are equalized loads imposed on the home during a flood and the likelihood of structural damage may be greatly reduced. Wet floodproofing is generally used to limit damages to enclosures below elevated buildings, walkout-on-grade basements, below-grade basements, crawlspaces, or attached garages.
    b. Reference – FEMA P-1037

11. Basement/cellar fill. Basement infill has been proven to be effective at reducing damages to building elements and contents located below the BFE. Sections of the basement walls that remain above ground must be retrofitted with flood openings that allow automatic entry and/or exit of floodwaters.

Any basement utility systems and associated equipment must be elevated to protect utilities from damage or loss of function from flooding. When the mitigation is properly completed, a flood insurance policy will be rated based on the new lowest floor living level. The higher the reference level of the lowest floor, the more significant the premium rate decreases will be. Basement infill is considered a relatively high-cost measure with an expected useful life of 30 to 50 years and little or no additional annual maintenance costs beyond maintaining flood openings.

c. Reference – FEMA P-1037

12. Whole-home elevation or mitigation reconstruction. Available elevation methods include elevating the existing structure on piles, posts, or piers, filling in the basement and replacing it with an elevated floor, and elevating by vertically extending the foundation walls of the home. Mitigation reconstruction consists of the construction of an improved, elevated building on the same site where an existing building and/or foundation has been partially or completely demolished or destroyed.
    d. Reference – FEMA P-312 Chapter 5, FEMA P-347, and Hazard Mitigation Assistance Guidance

(d) Alternative Options

13. Sandbags. Grantee to procure and deliver sandbags to residents who want assistance without going through the home resilience assessment process.

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