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NOTE:

This manual does **not** discuss any dry flood-proofing design techniques for non-residential buildings. Please refer to FEMA Publication 259 - *Engineering Principles and Practices for Retrofitting Flood-prone Residential Buildings*, or FEMA Publication 102 - *Floodproofing non-Residential Structures*.

3.0 Introduction

Chapter 3 provides guidance for incorporating flood damage resistant techniques in the design and construction of building utilities. This guidance is applicable for both new construction and substantially improved buildings. The material is covered in terms of performance characteristics rather than specific construction techniques or approaches. In many cases, a specific design technique can be implemented in a variety of ways, as long as the minimum performance requirements of the National Flood Insurance Program (NFIP) and State, and community laws and ordinances, are met.

The NFIP requirements for building utilities are detailed in Section 44 of the Code of Federal Regulations (CFR) Chapter 1, Section 60.3(a). The NFIP requires that all new and substantially improved structures located in flood-prone areas be designed and constructed by methods and practices that minimize or eliminate flood damage to electrical, heating, ventilation, air conditioning, plumbing, and other building utility systems. A detailed discussion of the NFIP requirements can be found in Section 2.5.

NOTE:

The Design Flood Elevation (DFE) is a regulatory flood elevation adopted by a community that is the BFE, at a minimum, and may include freeboard, as adopted by the community.

The primary protection methods that apply to residential and non-residential building utilities and meet the minimum requirements of the NFIP include:

- the elevation of equipment and system components above the Design Flood Elevation (DFE) on pedestals, platforms, or fill, suspending them from structural elements, or moving them to upper floors or attics; and
- the protection of system components that exist below the DFE by utilizing water tight enclosures, protective utility shafts, and anchoring systems.

In the subsequent sections of this chapter we will examine these techniques for the following building utilities:

- Heating, Ventilating, and Air Conditioning (HVAC) Systems
- Fuel Systems

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Introduction



- Electrical Systems
- Sewage Management Systems
- Potable Water Systems

Each building utility section will provide an introduction and summary of NFIP requirements, discuss principles and practices for the protection of major and minor system components, and conclude with a flowchart and design checklist for floodproofing the utility system. In addition, *Table 3.0* is a checklist that can be used to quickly review a new building's NFIP compliance.



FLOOD RESISTANT NEW CONSTRUCTION CHECKLIST

Property ID:
Property Name:
Property Address:
Reviewed By / Date:
<input type="checkbox"/> Met with the building official, floodplain manager, and other relevant community officials <input type="checkbox"/> Identified the Base Flood Elevation (BFE), First Floor Elevation (FFE), and Design Flood Elevation (DFE) <input type="checkbox"/> Building utilities must be protected from flood damage up to the DFE: _____ <input type="checkbox"/> Elevated all controls, equipment, piping wiring, ducts, etc. above the DFE
<ul style="list-style-type: none"> • Heating Ventilating and Air Conditioning (HVAC): <ul style="list-style-type: none"> <input type="checkbox"/> All components are elevated above the DFE <input type="checkbox"/> Protected controls from flood inundation <input type="checkbox"/> Protected exterior units from floodwater inundation, scour, and impact <input type="checkbox"/> Protected exterior piping and wall penetrations below the DFE from impact and water infiltration <input type="checkbox"/> Protected boilers from water infiltration and impact damage • Fuel Systems: <ul style="list-style-type: none"> <input type="checkbox"/> All components are elevated above the DFE <input type="checkbox"/> Protected exterior piping and wall penetrations below the DFE from impact and water infiltration <input type="checkbox"/> Protected fuel tank from impact, buoyancy, and scour • Electrical: <ul style="list-style-type: none"> <input type="checkbox"/> All components are elevated above the DFE <input type="checkbox"/> Protected transformers, switch panels, service connections and meters from water infiltration <input type="checkbox"/> Protected wiring, outlets and switches from water infiltration and damage <input type="checkbox"/> Protected wall penetrations below the DFE from water infiltration. • Plumbing: <ul style="list-style-type: none"> <input type="checkbox"/> All components are elevated above the DFE <input type="checkbox"/> Protected plumbing components below the DFE from impact and scour <input type="checkbox"/> Protected sewer tank and distribution system from impact, buoyancy, and scour <input type="checkbox"/> Protected wall penetrations below the DFE from water infiltration <input type="checkbox"/> Protected water taps and drains below the DFE from infiltration and impact damage <input type="checkbox"/> Protected water heaters from water infiltration and impact damage

Table 3.0: Checklist for building support utility systems in new construction