City of Key West
BUILDING DEPARTMENT – FLOODPLAIN MANAGEMENT
1300 White St. • Key West, Florida 33040 • 305-809-3810 • CityOfKeyWest-FL.Gov/Flood

FLOODPROOFING CHECKLIST

Permit Application #: _____ Location: _____

I. Plan Review/Permitting Phase

☐ Non-Residential use only (motel/hotel rooms are residential use) [ASCE 24-14 6.2.1]

☐ Prohibited in type "VE" (Coastal High Hazard Area) & "Coastal A" flood zones [ASCE 24 6.2.1)

☐ Elevation Certificate, original (signed & sealed only by Florida licensed land surveyor) [FBC B. 1603.1.7(2) & 1612.5(1.1)]

☐ Construction Drawings/Documents:

- ☐ Site plan requirements: flood zone(s),
- ☐ BFE(s) & DFE(s) plotted on plans [FBC B. 107.3.5(1)] (Base Flood Elevation & Design Flood Elevation)
- ☐ Base Flood Elevation (BFE) on building cross-section [FBC B.1612.5 (1.1) & Section 1612 [FBC B. 107.3.5(8)]
- ☐ Flood design data (including elevation of floodproofing, specified in ASCE 24 Table 6-1) on building cross-section, along with Finished First Floor (A-Zones) or lowest horizontal cross-member of the lowest floor (V-zones), & height of lowest adjacent grade alongside building. [FBC B. 1603.1(5) and 1603.1.7].
- ☐ Counter-buoyancy measures engineering for structure. Resistant to hydrodynamic & hydrostatic loads [ASCE 24-14 6.2.2(1)]
- ☐ Soil/fill adjacent to structure compacted & protected against erosion and scour [ASCE 24-14 6.2.2(2)]
- ☐ Building walls & floors impermeable to passage of water. [ASCE 24-14 6.2.2(1)]
- ☐ Building flood load calculations submitted showing combined loads survivability. [ASCE 7 & ASCE 24-14 6.2.2]
- ☐ List of materials showing those below DFE – not protected by floodproofing – will be resistant to flood damage [ASCE-24 5.2]
- ☐ Interior pump to remove seepage, with discharge above floodproofing protection. [ASCE 24-14 6.2]
  - ☐ Emergency power for interior pump. [ASCE 24-14 C6.2]
- ☐ Utilities: Identification & appropriate height above DFE of attendant utilities/machinery [ASCE-24 6.2.2 & 7.1]
- ☐ Underground or through-slab building services (power, steam, water, sewer, fire safety, telecommunications etc.) designed to prevent water intrusion. [ASCE 24-14 C6.2]

Electrical, if not located within floodproofed protected portion of building:

- ☐ Electric meters above elevation specified in Table 7-1 [ASCE-24 7.2.3]
- ☐ Disconnect switches & circuit breakers above elevation specified in Table 7-1 [ASCE-24 7.2.4]
- ☐ Maximum 120V voltage below elevation specified in Table 7-1 [ASCE-24 7.2.5]
- ☐ Submersible-type wiring/conduits/cables/switches/receptacles/fixtures [ASCE-24 7.2]
- ☐ Powered from common distribution panel above and accessible from above elevation specified in Table 7-1 [ASCE-24 7.2.5]

☐ Sewerage backflow prevention for all sanitation connections below the elevation in Table 7.1 [ASCE-24 7.3.3]

☐ Statement that dry floodproofing is designed in accordance with ASCE 24 & ASCE 7. [FBC B. 1612.5(1.3) & ASCE 24-14 1.6.1]

☐ Building flood Load Calculations (included with construction documents) [FBC B. 1603.1, 1605.2.2 or 1605.3.1.2, & 1612.4]:

☐ Hydrostatic/Hydrodynamic Resistant Construction - Load calculations showing structure will be resistant to expected Hydrostatic/Hydrodynamic pressures & buoyancy [ASCE-24 6.1, 6 .2.2(1) & FBC B. 1603.1 or 1605.3.1.2]

☐ Exit Door/Primary Means of Escape: Plans need to show exit door or primary means of escape above DFE that complies with *2010 Florida Building Code* [FBC 1612.5(1.3) & ASCE-24 6.2.2(3)]

☐ Absent a door above top of floodproofing, an appropriate size emergency escape/rescue [FBC E.912.4.1(7)]

☐ Approved FEMA Floodproofing Certificate - Construction Drawings Phase [FBC 1612.e(1.3)]

☐ Signed & Sealed (shaded for digital imaging) by Florida licensed design professional. (ONLY LAND SURVEYOR COMPLETES TOP SECTION OF PAGE TWO ESTABLISHING ELEVATIONS. The Elevation Certificate shows elevations.)

☐ Flood panel preliminary designs, showing type of panels and general installation method.

II. Final Inspection/Certificate of Occupancy Phase

☐ Flood panel shop designs, specific to this project. Certified by a State of Florida licensed Engineer.

☐ Photos of each floodproofing panel in installed position.

☐ Load Calculations for panels [FBC B. 1603.1, 1605.2.2 or 1605.3.1.2, & 1612.4]:

☐ Demonstrating flood panels themselves will withstand expected DFE loads (with calculations) [ASCE-24 6 .2.2(1); 6.2.3(2-3) & FBC B. 1603.1 or 1605.3.1.2]

☐ FEMA Floodproofing Certificate – Final Construction Phase Approved by Floodplain Administrator [FBC 1612.e(1.3)]

☐ Signed & Sealed (shaded for digital imaging) by Florida licensed design professional

☐ **Flood Emergency Operation Plan: An approved FEP is required [ASCE-24 6.2.3(3)]**

☐ **Floodproofing Inspection & Maintenance Plan (can be part of FEP above) [ASCE-24 6.2.3(3)]**

☐ Building Department, Floodplain Management, Floodproofing Inspection.

Note: Remaining pages include citations.

Regulatory References: The following are useful excerpts from directly relevant floodproofing regulations. They are not intended as all-encompassing reproductions of these regulations. In all cases, the original regulations should be consulted.

ASCE-24 (2014)
American Society of Civil Engineers
Flood Resistant Design and Construction

5.0 MATERIALS; 5.1 GENERAL

New construction and substantial improvements in flood hazard areas shall be constructed with flood-damage-resistant materials below the elevations specified in Table 5-1. Flood-damage-resistant materials shall have sufficient strength, rigidity, and durability to adequately resist all flood-related and other loads, unless designed to break away or as permitted elsewhere in this standard.

Exposed structural and nonstructural construction materials, including connections, shall be capable of resisting damage, deterioration, corrosion, or decay due to precipitation, wind-driven water, salt spray, or other corrosive agents known to be present.

Structural and nonstructural construction materials, including connections, below the elevations specified in Table 5-1 shall be capable of resisting damage, deterioration, corrosion, or decay due to direct and prolonged contact with floodwaters, associated with design flood conditions.

5.2 SPECIFIC MATERIALS REQUIREMENTS FOR FLOOD HAZARD AREAS

5.2.1 Metal Connectors and Fasteners Metal plates, connectors, screws, bolts, nails, and other fasteners exposed to direct contact by flood water, precipitation, or wind-driven water shall be stainless steel or equivalent corrosion-resistant material, or hot-dip galvanized in accordance with ASTM A 123/A 123M *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products,* Ref. [9], ASTM A 153/A 153M *Standard Specification for Zinc Coating (Hot-Dip)on Iron and Steel Hardware,* Ref. [10], ASTM A 653/A 653M *Standard Specification for Steel Sheet,*
Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process, Ref. [11], or ASTM A 924/ A 924M *Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process,* Ref. [12].

5.2.2 Structural Steel: Steel piles shall conform to ASTM A 36/A 36M *Standard Specification for Carbon Structural Steel,* Ref. [13], ASTM A 572/A 572M *Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel,* Ref. [14], or ASTM A 690/A 690M *Standard Specification for High-Strength Low-Alloy Steel H-Piles and Sheet Piling for Use in Marine Environments,* Ref. [15].

5.2.2.1 Corrosive Environments: Structural steel exposed to direct contact with salt water, salt spray, or other corrosive agents known to be present shall be hot-dipped galvanized after fabrication. Secondary components such as angles, bars, straps, and anchoring devices shall be stainless steel or hot-dipped galvanized after fabrication, in accordance with Section 5.2.1. ASCE/SEI 24-05

5.2.2.2 Noncorrosive Environments: In areas where salt spray and other corrosive agents are known not to be present, exposed structural steel either shall meet the requirements of Section 5.2.2.1 or shall be primed, coated, plated, or otherwise protected against corrosion due to direct contact with floodwaters, precipitation, or wind-driven water. Secondary components such as angles, bars, straps, and anchoring devices shall be stainless steel or hot-dipped galvanized after fabrication, in accordance with Section 5.2.1. Damage to protective finishes and coatings caused by handling or installation shall be repaired using procedures that result in protection equivalent to the requirements stated above.

5.2.3 Concrete: Ingredients of concrete, including admixtures and reinforcing steel; quality of concrete; and the design and construction thereof shall comply with ACI 318 *Building Code Requirements for Structural Concrete,* Ref. [4], with special consideration for requirements concerning durability, including protection from chlorides and sulfates found in a saltwater environment.

5.2.4 Masonry: Materials used in masonry construction, including masonry units, mortar, grout, reinforcing steel and accessories; quality of masonry; and the design and construction thereof shall comply with ACI 530/ASCE *5ITMS* 402, *Building Code Requirements for Masonry Structures,* Ref. [2], and ACI 530.1/ASCE *6ITMS* 602 *Specification for Masonry Structures,* Ref. [3].

5.2.5 Wood and Timber: Wood and timber members, exposed or enclosed, solid or built-up, shall be naturally decay resistant or pressure treated with preservatives to resist damage, deterioration, or decay due to insect infestation, decay-producing fungi, or, when exposed, marine borers; or direct and prolonged wetting from floodwaters, precipitation, wind driven water, moisture, salt spray, or other corrosive agents known to be present. The design and construction of wood and timber shall comply with *National Design Specification for Wood Construction,* Ref. [16].

5.2.6 Finishes: Interior finishes and trim shall be flood-damage-resistant material.

6.2 DRY FLOODPROOFING

Dry floodproofing shall be accomplished through the use of flood-damage-resistant materials and techniques that render the dry-floodproofed portions of a structure substantially impermeable to the passage of floodwater below the elevations specified in Table 6-1. Sump pumps shall be provided to remove water accumulated due to any passage of vapor and seepage of water during the flooding event. Sump pumps shall not be relied upon as a means of dry floodproofing. All materials below the elevations specified in Table 6-1 shall conform with the requirements of Section 5.

6.2.1 Dry Floodproofing Limitations; Dry floodproofing of **nonresidential and nonresidential areas of mixed-use structures** shall not be allowed unless such structures are located outside of High Risk Flood Hazard Areas, Coastal High Hazard Areas, and Coastal A Zones. Dry floodproofing of residential structures or residential areas of mixed-use structures shall not be permitted.
Dry floodproofing shall be limited to the following:

1. Where flood velocities adjacent to the structure are less than or equal to 5 ft/sec during the design flood; and
2. If human intervention is proposed, where conformance with the limitations of Section 6.2.3 is provided.

6.2.2 Dry Floodproofing Requirements: Dry floodproofed areas of structures shall

1. Be designed and constructed so that any area below the applicable elevation specified in Table 6-1, together with attendant utilities and sanitary facilities, is flood resistant with walls that are substantially impermeable to the passage of water. Walls, floors, and flood shields shall be designed and constructed to resist hydrostatic, hydrodynamic, and other flood-related loads, including the effects of buoyancy resulting from flooding to the elevation listed in Table 6-1;

2. Have any soil or fill adjacent to the structure compacted and protected against erosion and scour in accordance with Section 2.4; and

3. Have at least one door satisfying building code requirements for an exit door or primary means of escape, above the applicable elevation specified in Table 6-1, and capable of providing human ingress and egress during the design flood.

TABLE 6-1. Minimum Elevation of Floodproofing, Relative to Base Flood Elevation (BFE) or Design Flood Elevation (DFE)-Outside of High Risk Flood Hazard Areas

Structure Category'	Minimum Elevation of Floodproofing
I	BFE + 1 ft or DFE, whichever is higher
II	**BFE + 1 ft or DFE, whichever is higher**
III	BFE + 1 ft or DFE, whichever is higher
IV	BFE + 2 ft or DFE, whichever is higher

6.2.3 Limits on Human Intervention: Dry floodproofing measures that require human intervention to activate or implement prior to or during a flood shall be permitted only when all of the following conditions are satisfied:

1. The flood warning time (alerting potential flood victims of pending flood situation) shall be a minimum of 12 hours, unless the community operates a flood warning system and implements an emergency plan to ensure safe evacuation of flood hazard areas, in which case human intervention is allowed only if the community can provide a minimum flood warning time equal to or longer than the cumulative
   (a) time to notify person(s) responsible for installation of floodproofing measures, plus
   (b) time for responsible persons to travel to structure to be floodproofed, plus
   (c) time to install, activate, or implement t1oodproofing measures, plus
   (d) time to evacuate all occupants from the flood hazard area;
2. All removable shields or covers for openings such as windows, doors, and other openings in walls shall be designed to resist flood loads specified in Section 1.6; and
3. Where removable shields are to be used, a flood emergency plan shall be approved by the authority having jurisdiction and shall specify, at a minimum, the following information: storage location(s) of the shields; the method of installation; conditions activating installation; maintenance of shields and attachment devices; periodic practice of installing shields; testing sump pumps and other drainage measures; and inspecting necessary material and equipment to activate or implement t1oodproofing. The flood emergency plan shall be permanently posted in at least two conspicuous locations within the structure.

7.2.1 Service Conduits and Cables: Electrical service conduits and cables below the Design Flood Elevation (DFE) shall be waterproofed or conform to the provisions of NFPA 70 *National Electrical Code,* Ref. [17], for wet locations. Underground service conduits and cables shall be buried to a depth sufficient to prevent movement, separation, or loss due to erosion and scour under design flood conditions.

7.2.2 Exposed Conduits and Cables: Electrical conduits and cables emerging from underground shall be designed, constructed, and installed to withstand flood-related loads, including the effects of buoyancy, hydrodynamic forces, and debris impacts. Waterproofing or protective enclosures shall be provided for non-waterproof conduits and cables extending vertically to elevated structures. The enclosures shall be securely fastened to the structure; however, protective enclosures and electrical conduits and cables shall not be fastened to walls, enclosures, or structures intended to break away under flood conditions. Electrical conduits and cables and protective enclosures installed below the elevations specified in Table 7 -1 shall be sealed to prevent the entrance of floodwaters into electrical conduits and electrical service components.

7.2.3 Electric Meters: Electric meters shall be located above the elevation specified in Table 7-1 unless the connection between the meter and electric lines extending vertically from the meter is within a waterproof enclosure.

7.2.4 Disconnect Switches and Circuit Breakers: The main disconnect switch and all circuit breakers shall be located above and be accessible from above the elevation specified in Table 7-1. Switches and circuit breakers shall be located no more than 5 ft above the floor, or a platform shall be installed to provide access.

7.2.5 Electric Elements Installed Below Minimum Elevations: Where electrical conduits and cables are located below the elevation specified in Table 7-1, they shall be installed so as to drain water away from panel-boards, controllers, switches, or other electrical equipment in accordance with NFPA 70 *National Electrical Code,* Ref. [17].

Where required to meet life safety provisions of the code, a minimum number of lighting circuits, switches, receptacles, and lighting fixtures operating at a maximum voltage of 120 volts to ground shall be permitted below the elevation specified in Table 7-1. Electrical wiring

shall be suitable for submergence in water and only submersible-type splices shall be used. Switches, receptacles, and fixtures shall conform to the provisions of NFPA 70 *National Electrical Code,* Ref. [17], for wet locations and shall contain no fibrous components.

All circuits, switches, receptacles, fixtures, and other electrical components and equipment installed below the elevation specified in Table 7-1 shall be energized from a common distribution panel located above and accessible from above the elevation specified in Table 7-1.

7.3.3 Plumbing Systems Installed Below Minimum Elevations: Plumbing systems and components, including plumbing fixtures, shall be elevated above the elevation specified in Table 7-1. Where plumbing systems and components have openings below the elevation specified in Table 7-1, the openings shall be protected with automatic backwater valves or other automatic backflow devices. Devices shall be installed in each line that extends below the DFE to prevent release of sewage into floodwaters and to prevent infiltration by floodwaters into the plumbing. Redundant devices requiring human intervention shall be permitted.

2010 Florida Building Code - Buildings

Section 1603, Construction Documents

1603.1 General. *Construction documents* shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the *construction documents.*

Exception: *Construction documents* for buildings constructed in accordance with the *conventional light-frame construction* provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof live loads.
2. Reserved.
3. Ultimate design wind speed, V_{ult}, (3-second gust), miles per hour (mph) (km/hr) and nominal design wind speed, V_{asd} , as determined in accordance with Section 1609.3.1 and wind exposure.
4. Reserved.
5. **Flood design data, if located in *flood hazard areas* established in Section 1612.3.**
6. Design load-bearing values of soils.

1603.1.7 Flood design data. For buildings located in whole or in part in *flood hazard areas* as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.5, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. In *flood hazard areas* not subject to high-velocity wave action, the elevation of the proposed lowest floor, including the basement.
2. **In *flood hazard areas* not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry floodproofed.**
3. In *flood hazard areas* subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1612.5 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and shall be submitted to the building official:

1. For construction in flood hazard areas not subject to high-velocity wave action:
   - **1.1 The elevation of the lowest floor, including basement, as required by the foundation inspection and the final inspection in Section 110.3.**
   - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.6.2.1, ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.6.2.2 of ASCE 24.
   - **1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.**

2010 Florida Building Code – Existing Buildings

912.4.1(7) Escape/Rescue Opening: Where emergency escape and rescue openings are required, an existing operable window with clear opening area no less than 4 square feet (0.38 $m_{2)}$ and with minimum opening height and width of 22 inches (559 mm) and 20 inches (508 mm), respectively, with maximum sill height at 44 inches (1118 mm) above the floor or approved permanent elevated area, shall be accepted as an emergency escape and rescue opening.

Code of Federal Regulations (CFR) – Chapter 44

Section 60.3(c)(4): Provide that where a non-residential structure is intended to be made watertight below the base flood level, (i) a registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the applicable provisions of paragraph (c)(3)(ii) or (c)(8)(ii) of this section, and (ii) a record of such certificates which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained with the official designated by the community under §59.22(a)(9)(iii);