A Guide for Higher Standards in Floodplain Management

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ASFPM Floodplain Regulations Committee

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Introduction

The purpose of the Guide for Higher Regulatory Standards in Floodplain Management is to provide options for communities that want to implement floodplain regulations which reduce flood damage and the overall impacts of floods. These impacts include human risk, environmental damage, property damage, flood insurance claims, displacement of residents, and burden on community infrastructure and services.

The Guide is not a substitute for a set of community floodplain regulations, nor is it a model floodplain ordinance. Rather it is a guide to enhancing existing regulations with higher standards that will greatly reduce risk, and provide (protections to functional floodplains – deleted) a high level of protection to floodplain benefits and functions.

Photo Credit: Delaware DNREC

The higher standards options in this guide are described in detail because they are recommended for safer development and use the natural protection provided by the natural functions and resources of the floodplain. Please note that the model language presented in this document was developed to promote effective floodplain management, and mesh with the FEMA minimum flood damage reduction standards described in 44CFR§60.3. Each community can tailor the model language to meet its own specific needs, and should consider local legal issues when drafting specific language.

Words and phrases that are underlined are defined in the Glossary (see Chapter XXVI).

A note about enforcement:

Higher regulatory standards are only as good as the enforcement process that supports them. Many of the higher regulatory standards suggested in this guide necessitate increased documentation requirements and enforcement efforts compared to the minimum NFIP standards. Communities should assess their administrative and enforcement capacity when considering higher floodplain standards. In many cases, higher standards reduce administrative burden by preventing damage and thus post flood permitting associated with repairs.

ASFPM strongly believes the minimum NFIP floodplain regulations do not provide adequate long-term flood risk reduction for communities and that the benefits of flood risk reduction achieved by higher regulatory standards far outweighs the burden of administering them.

ASFPM RECOMMENDED HIGHER REGULATORY STANDARDS

I. FREEBOARD

RATIONALE:
Freeboard is the single most effective means for reducing flood risk to a structure in the floodplain. Freeboard is standard for placing the first floor of a structure above the elevation of the calculated 1% flood level in order to allow for nature's uncertainty and future changes in the watershed that will increase flood levels. Freeboard is relatively inexpensive to build into development, and typically pays for itself in reduced insurance premiums and prevented flood damage within the first 10 years of a structure's lifetime. Significant Community Rating System (CRS) credit is available for this activity, which leads to lower flood insurance premiums for all policy holders in the community.

A. In Zone A, A1-30 and AE:

OBJECTIVE:
To protect structures against damage from floods in floodplain areas with 1% annual-chance elevations and in areas where no 1%-annual-chance flood elevations are available.

MODEL LANGUAGE:
Add the following sentence (bolded) to specific requirements for Residential Structures and Non-Residential structures:

Option 1:
New Construction and substantial improvement of any structure, including manufactured homes, shall have the lowest floor, including basement, elevated (1, 2, or 3) feet above the base flood elevation. Where base flood elevation data is not available, a floodplain study must be performed by a Professional Engineer (PE) establishing the base flood elevation (BFE) and the floodplain and floodway boundaries prior to issuing a development permit.

Option 2:
New Construction and substantial improvement of any structure, including manufactured homes, shall have the lowest floor, including basement, elevated (1, 2, or 3) feet above the base flood elevation. Where base flood elevation data is not available, the structure shall have the lowest floor, including basement, elevated

at least two feet above the highest adjacent natural grade or above the crown of the nearest street, whichever is higher.

B. Zone X (shaded):

OBJECTIVE:
To protect structures against damage from floods in areas where flood elevations are calculated in addition to the 1% annual chance flood elevation. These include 0.2%-chance flood elevations; areas of 1% annual chance flood with average depths of 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

MODEL LANGUAGE:
Add the following sentence to specific requirements for Residential Structures and Non-Residential structures:

Residential and Non-Residential Structures in areas mapped as Zone X (shaded) on the community Flood Insurance Rate Map (FIRM).
Where flood elevations are available, new construction and substantial improvement of any structure, including manufactured homes, shall have the lowest floor, including basement, elevated (1, 2, or 3) feet above the elevation of the flood hazard elevation.

C. Zone X (unshaded):

OBJECTIVE:
To educate about the risk of flooding outside of mapped flood hazard areas.

MODEL LANGUAGE:
Add the following sentence to specific requirements for Residential Structures and Non-Residential structures:

This document does not recommend freeboard in Zone X (unshaded) as these areas are determined to be outside any area with a predicted likelihood of flooding.

However, these areas are not immune from flooding, as a flood is any general and temporary condition of partial or complete inundation of normally dry land areas. Flood insurance is available for any property in a community that participates in the NFIP, whether the property is in a mapped flood hazard area, or not.

D. ALTERNATIVES TO FREEBOARD

1. Wet floodproofing

OBJECTIVE:
FEMA recognizes that wet-floodproofing may be appropriate for certain types of agricultural structures, as well as low-cost, small detached residential accessory structures. If a community wishes to allow non-elevated accessory structures, it must establish the meaning of "low-cost" and "accessory". Unless a community adopts specifications for these types of structures within its floodplain management ordinance, a variance will be necessary.

MODEL LANGUAGE:
Add the following language to specific requirements for small, detached residential accessory structures:

Small detached residential structures (garages, storage sheds) may be exempt from the freeboard requirements if they are not used for human habitation; designed to have low flood damage potential; firmly anchored and placed on the building site in a way that presents minimum resistance to flood flows; constructed with electrical and other services mounted above the flood hazard elevation; and fitted with openings that allow the automatic entry and exit of floodwater. For details refer to FEMA Technical Bulletin 7-93.

2. Dry floodproofing

OBJECTIVE:

FEMA recognizes that dry floodproofing may be appropriate for certain types of non-residential structures. This option is not available to residential buildings, or mixed-use buildings with a majority of floor area dedicated to residential uses. When evaluating a mixed-use building that is designed to be dry flood-proofed, the applicant should submit proposed building plans to an insurance agent for a "submit to rate" to determine whether higher flood insurance premiums will apply to residential units.

MODEL LANGUAGE:

Add the following language to specific requirements for non-residential buildings and mixed-use buildings where residential floor area is less than non-residential floor area:

Non-residential structures may be exempt from the freeboard requirements if they are constructed with flood-resistant material that protect to one foot above the flood hazard elevation. Flood-resistant materials are building products that can withstand direct and prolonged contact with floodwaters for at least 72 hours, without resulting in damage other than what can be corrected cosmetically. This option is not available to residential buildings, or mixed-use buildings with a majority of floor area dedicated to residential uses. For details refer to FEMA Technical Bulletin 2-93.

II. ACCESS (INGRESS-EGRESS)

RATIONALE:

Buildings in high risk floodplains can be elevated to reduce flood damage by elevating the building to higher standards, such as to or above the 1% flood level. However, residual risk remains on the property. Ensuring that building sites have dry land access during floods decreases the likelihood of stranded residents, reduces the need for water rescues which places emergency personnel at risk, and increases public safely.

OBJECTIVE:

To promote development design which will reduce flood damage and facilitate emergency vehicular access and/or pedestrian access and evacuation during flood events.

MODEL LANGUAGE:

Add to specific requirements for Subdivisions and Planned Developments

New development proposals will be designed, to the maximum extent practicable, so residential building sites, walkways, driveways, and roadways are located on land with a natural grade with elevation not less than the base flood elevation and with dry land access.

Add to specific requirements for Nonresidential Structures:

New development proposals will be designed, to the maximum extent practicable, so non-residential building sites, walkways, driveways, and roadways are located on land with a natural grade with elevation not less than the base flood elevation and with dry land access.

III. COMPENSATORY STORAGE

RATIONALE:
Floodplains provide the critical and beneficial functions of flood storage, natural habitat, and water quality. The placement of fill impairs these functions and should be avoided. Where some placement of fill is unavoidable, requiring compensatory storage can mitigate some of the negative impacts of floodplain fill.

OBJECTIVE:
To compensate for the loss of floodplain storage caused by filling in the floodplain, which can result in raising flood elevations, especially with the impact of cumulative fills.

MODEL LANGUAGE:
There are a number of versions of compensatory storage language. The following sample language is provided as developed from a review of existing regulations:

Add to language for the Assurance of Flood Carrying Capacity:

Compensatory Storage Required for Fill

Fill within the special flood hazard area shall result in no net loss of natural floodplain storage, or increase in water surface elevations during the base flood. The volume of the loss of floodwater storage due to filling in the special flood hazard area shall be offset by providing an equal volume of flood storage by excavation or other compensatory measures at or adjacent to the development site.

If your regulations explain the minimum application items necessary to seek a permit, add to the language for the Application Requirements section:

Volumetric calculations demonstrating compensatory storage.

The City of Dallas, Texas adopted detailed floodplain development regulations related to loss of valley storage as follows:

Section 51A-5.105 Filling in the Floodplain
Subsection (e)(4)(g)(4) Filling to remove a FP designation

The FP area may be altered only to the extent permitted by equal conveyance reduction on both sides of the natural channel. The following valley storage requirements apply to all FP areas except those governed by a city council-adopted management plan that contains valley storage regulations, in which event the valley storage regulations contained in the plan apply:

(A) Except as otherwise provided in Subparagraph (B):

(i) no loss of valley storage is permitted along a stream with a drainage area of three square miles or more;

(ii) valley storage losses along streams with a drainage area between 130 acres and three square miles may not exceed 15 percent, as calculated on a site by site basis; and

(iii) valley storage losses along streams with a drainage area of less than 130 acres is not limited.

(B) Hydrologic computations may be performed to evaluate basin-wide valley storage loss impacts on the design flood discharge. If the computations demonstrate that valley storage losses do not result in increases in the design flood discharge at any point downstream of the project, valley storage losses are permitted even though they exceed the limits provided in Subparagraph (A).

IV. CRITICAL DEVELOPMENT PROTECTION

RATIONALE:
Facilities which provide critical services, or services that are depended on during flooding and other hazardous events should be protected to an even higher standard than other development. Failure to provide flood protection to these types of critical facilities creates severe and unacceptable public safety risk.

OBJECTIVE:
To protect critical facilities and development against damage, and to minimize the potential loss of life from flooding.

MODEL LANGUAGE:
The standard used in Executive Order 11988 is the 0.2%-chance flood event (aka 500-year flood event), or the historically highest flood (if records are available), whichever is greater. Two definitions are presented below, the first being more general, the second being more specific. Three use regulations are suggested, ranging from the most permissive to the most restrictive.

Add to Definitions:
[Option 1]
Critical Development

Critical development is that which is critical to the community's public health and safety; is essential to the orderly functioning of a community;, store or produce highly volatile, toxic or water-reactive materials; or house occupants that may be insufficiently mobile to avoid loss of life or injury. Examples of critical development include jails, hospitals, schools, daycare facilities, public and private utilities, fire stations, emergency operation centers, police facilities, nursing homes, wastewater treatment facilities, water plants, gas/oil/propane storage facilities, hazardous waste handling and storage facilities and other public equipment storage facilities.

[Option 2]
Critical Development

1. *Class I Critical Facilities are those facilities that must remain accessible during the 0.2% flood event because they are the base of operations for emergency responders, are particularly difficult to evacuate during a flood event, or facilities that provide services essential to the life, health, and safety of the community. Class 1 critical facilities include police and fire stations, emergency medical centers, communication centers, hospitals, jails, nursing homes, and other residential uses for persons with limited mobility and/or dependency on life-sustaining medical equipment.*
2. *Critical Facilities are structures that store public records; museums and libraries; schools; and other buildings that store rare and/or valuable items and information that sustain the history and public records of a community. These structures are not expected to remain accessible or functioning during a flood event, though in many instances their functions must resume as soon as possible after a flood event. Critical Facilities also include public infrastructure such as water distribution and wastewater treatment facilities, which are expected to remain functioning during a flood event although they may be temporarily inaccessible or accessible only by watercraft during a flood event.*

Add to Use Regulations (Prohibited Uses):
[Option I]

Critical facilities and developments are prohibited in the 1% flood hazard areas. Where critical developments are located adjacent to 1%-chance flood areas, the flood protection elevation shall be two feet above the 0.2% flood elevation and that elevation shall be used as the basis for the ACCESS (INGRESS-EGRESS) provisions in section II.

[Option II]

Class 1 Critical Facilities are prohibited in all flood hazard areas, including the 1% and 0.2% change flood areas.
Critical Facilities must be constructed to 1 foot above the 0.2% flood elevation.

[Option III]

Critical facilities and developments are prohibited in all special flood hazard areas, including the 1% and 0.2% annual (500-year) floodplains.

V. CUMULATIVE SUBSTANTIAL DAMAGE / SUBSTANTIAL IMPROVEMENT

RATIONALE:
The vast majority of flood damages to structures amount to less than 50% of the value of the structure. Without cumulative substantial damage/improvement provisions, the cycle of flood-repair-flood is typically never

broken by mitigating risk. The NFIP Increased Cost of Compliance provisions (provides added funds to substantially damaged flood insurance claims for mitigating the structure) are most effective in communities with cumulative provisions.

OBJECTIVE:
To track cumulative improvements or damages to structures in special flood hazard areas to ensure that flood protection measures are incorporated. For substantial improvements that increase floor area by 25%, a community will need to determine whether (in the case of horizontal expansions) the existing home and the addition must be elevated, or if only the addition must be elevated. In cases where a vertical addition is proposed and the original floor area is increased by 25%, the lowest floor of the existing structure must be elevated to one foot above the flood hazard elevation.

MODEL LANGUAGE:
Add the following sentence at the end of the "substantial damage" definition:

Substantial Damage

Substantial damage also means flood related damage sustained by a structure on two (2) separate occasions during a 10-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds 25 percent of the market value of the structure before the damage occurred.

Add the following sentence (bolded) to the "substantial improvement" definition:

Substantial Improvement

Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. If a community wishes to apply a cumulative measure of substantial improvement based on value, the following sentence should be included: When the combined total of all improvements or repairs made after the adoption of this regulation (include date) equals or exceeds 50 percent of a structure's market value, that structure is considered to be substantially improved.

Substantial improvement also includes any addition which increases the original floor area of a building by 25% or more.

VI. FILL STANDARDS

RATIONALE:
Nearly all floodplain filling activities create negative consequences to adjacent areas. Improperly designed and constructed fill can also jeopardize structures elevated on fill.

OBJECTIVE 1:
To provide guidelines for the placement of fill in special flood hazard areas.

MODEL LANGUAGE:
There are many variations and combinations of standards that can be used for fill. Your community may choose to prohibit any fill in a flood hazard area, other than soil brought in for landscaping projects. The model language below incorporates standards for quality, stability, and compaction.

Add to Use and Development Standards for Flood Hazard Reduction:

Fill

The following standards apply to all fill activities in special flood hazard areas:

A. *Fill sites, upon which structures will be constructed or placed, must be compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test method or an acceptable equivalent method;*
B. *Fill slopes shall not be steeper than one foot vertical to two feet horizontal;*
C. *Adequate protection against erosion and scour is provided for fill slopes. When expected velocities during the occurrence of the base flood are greater than five feet per second armoring with stone or rock protection shall be provided. When expected velocities during the base flood are five feet per second or less protection shall be provided by covering them with vegetative cover;*
D. *Fill shall be composed of clean granular or earthen material.*

OBJECTIVE 2:

To ensure structures built in areas removed from the floodplain via Letters of Map Revision Based on Fill (LOMR-F) are built "reasonably safe from flooding." Your community may choose to not recognize LOMR-F, as Cedar Falls, Iowa did when they adopted a new floodplain management ordinance.

MODEL LANGUAGE:

Add the following provisions to the residential and non-residential development requirements for new construction or substantial improvement:

In any area that has been removed from the floodplain via a Letter of Map Revision Based on Fill, any existing or new structure, addition, or substantial improvement must meet the required elevation freeboard requirements of the underlying flood hazard elevation.

Cedar Falls Municipal Code 29-156-e-9

No floodplain map revisions (Letter of Map Revision-fill or LOMR-f) involving placement of fill or involving land alterations in the floodway fringe overlay district, even if otherwise approved by FEMA, shall be allowed after January 1, 2010, provided, however, that owners of properties in the floodway fringe who have applied for a LOMR and which were in the process of being approved as of January 1, 2010, shall be exempt from this prohibition.

VII. FLOODWAY RISE

RATIONALE:

Communities with flood studies based on FEMA's standard floodway encroachment typically see more frequent and more severe flood events because those standards allow the carrying capacity to be reduced by pinching in the floodway until flood levels raise one foot, thus encroaching the allowable development area into the natural floodway. Base flood elevations and flood insurance premiums do not account for these increases, leaving communities unprotected during the base flood event, and property owners uninsured or under-insured.

OBJECTIVE:

To delineate a larger area within the 1%-annual-chance floodplain for flood flow conveyance and to restrict future encroachments that could increase flood levels.

MODEL LANGUAGE:

Add the following provisions to the floodway requirements:

The allowable floodway rise is that level in the community flood study. For new studies, floodway encroachment analyses shall be performed using (a ___ foot surcharge to be determined by the community where practicable – removed). (The ASFPM recommends an allowable floodway rise of – removed) no more than 0.5 foot surcharge, and as little as 0.1 feet where vulnerable or critical development exists as well as in watersheds that are not fully developed.

VIII. FOUNDATION DESIGN

RATIONALE:
ASCE-24 provides a standard of practice for flood resistant design and construction in flood-prone areas.

OBJECTIVE:
To ensure proper design and construction of building foundations to protect building structural integrity against the effects of buoyancy, uplift, debris impacts, and other flood forces.

MODEL LANGUAGE:
Add the following sentence (bolded) to the Residential Construction section:

> ***New construction and substantial improvement of any residential structure, including manufactured homes, shall have the lowest floor, including basement, elevated to or above the base flood elevation plus two feet of freeboard. Support structures and other foundation members shall be certified by a registered professional engineer or architect as designed in accordance with ASCE 24, Flood Resistant Design and Construction, or shall be constructed with designs meeting this standard.***

IX. FUTURE CONDITIONS HYDROLOGIC MAPPING

RATIONALE:
In many cases, flood studies reflect current conditions at best, and more likely past conditions since the studies often rely on old data. As watersheds are developed, future flood heights are likely to increase. The flood risk criteria used to site and design a project should rely on conditions the location is likely to experience during the project's lifetime, not past or current conditions.

OBJECTIVE:
To protect property against impacts of increased flood heights due to anticipated future development anywhere in the watershed, especially in rapidly developing areas.

MODEL LANGUAGE:

Communities that are experiencing rapid urban and suburban growth and development should require that all new construction and substantial improvement have the lowest floor elevated to or above the future conditions flood level, ideally with the freeboard and other higher standards recommended in this document.

Add the following definition:

> *Future Conditions Flood Hazard Area – Also known as area of future conditions flood hazard, the land area that would be inundated by flood based on future conditions hydrology.*

Add the following sentence to the "special flood hazard area" definition:

> *Any areas outside the flood hazard area identified by FEMA and designated as Future Conditions Flood Hazard Area on FEMA's Flood Insurance Rate Map shall also be considered special flood hazard areas.*

Add specific requirement to Subdivisions and Planned Developments:

> *Require that all map revisions and watershed studies include analyses based on future conditions associated with anticipated watershed growth and land-use and land-cover changes. These future condition analyses shall be included on community floodplain maps and will serve as the basis for this regulation.*

X. MATERIALS STORAGE

RATIONALE:
Storage of materials is often difficult to regulate. because of changing contents in warehouse buildings over time and a lack of regulation for contents in self-storage units. Many storage facilities are located in flood hazard areas because of the relatively low land values and minimum cost associated with metal storage buildings. Stored materials can become waterborne debris during floods, discharging pollutants into surface water, endangering adjacent properties, and creating potential debris blockages where bridges or culverts exist.

OBJECTIVE:
To protect the community against flood damage from materials that may block flood flows or which become buoyant, flammable, explosive, or cause other environmental health hazards during floods.

MODEL LANGUAGE:
Add the following to the Prohibited Uses section:

A. *Storage or processing of materials that are hazardous, flammable, or explosive in the identified special flood hazard area.*

B. *Storage of material or equipment that, in time of flooding, could become buoyant and pose an obstruction to flow in identified floodway areas.*

Add the following to the Storage of Materials section:

> *Storage of material or equipment not otherwise prohibited shall be firmly anchored to prevent flotation.*

XI. SETBACKS

RATIONALE:
Most floodplain regulations protect lands adjacent to streams with property protection and flooding conditions in mind. Floodplains provide a wide range of natural and beneficial functions, and many of these resource protection functions can only be achieved with setbacks that preserve a riparian corridor adjacent to streams. Significant CRS credit is available for this activity, if it results in floodplain open space.

OBJECTIVE:
To provide a limited use/development set-aside area along a stream for flood damage prevention, resource protection, floodwater storage, water quality, pollutant/sediment removal, and natural stream function.

MODEL LANGUAGE:

Add specific requirement to Subdivision and Planned Development:

Setbacks in riverine floodplains
Proposed development adjacent to riverine floodplains shall be set back (50', 100', 200'…) from the floodway boundary or from the centerline of the stream if the floodway has not been delineated.

Setbacks adjacent to blue-line tributaries
Proposed development adjacent to blue-line tributaries as shown on the United States Department of the Interior Geological Survey (hereafter referred to as "USGS") quadrants shall be set back (30', 40', 50'…) from the center line of the stream. The setback shall be increased in areas with flood prone soils which are contiguous to blue line streams.

Setbacks in coastal floodplains
Proposed development adjacent to coastal floodplains, mapped as Coastal High Hazard Areas –Zones V, V1-30 and VE, shall be set back (100', 200', 300') from the mean low tide boundary.

Proposed development in areas designated as coastal A Zones (areas between the 3' breaking wave and the 1.5', 1.0' breaking wave), shall have the same development requirements as development in Coastal High Hazard Area, Zones V, V1-30 and VE.

Setbacks in erosion areas
Development in areas with annual erosion (advance) rates of (5, 10…) feet or more per year, based on a study by a Federal, State or local agency and adopted by the community, shall be set back (100', 200', …) from the mean low tide boundary in coastal areas and setback (100', 200'…) from the floodway boundary or stream centerline if the floodway has not been defined.
[In areas with severe erosion rates the community may elect to require more stringent requirements]

Specific model language has not been developed due to the technical and planning information needed to establish a setback for a given watercourse. The Center for Watershed Protection (www.cwp.org) has developed some excellent materials about setbacks and has sample ordinances that can be downloaded from the internet.

XII. STORMWATER MANAGEMENT

RATIONALE:

One of the most effective ways to prevent flooding problems from getting worse over time is to limit the changes in watershed hydrology that increase flood flows. Probably the single most effective way to accomplish this is through storm water regulations which limit increases in runoff that result from new development. Significant CRS credit is available for this activity.

OBJECTIVE:
To prevent increased flood flows and limit increased runoff from a proposed development to pre-development conditions, and to maintain floodplains and stream channels by reducing erosion and sedimentation from construction activities in flood hazard areas.

MODEL LANGUAGE:
Communities should adopt comprehensive storm water management regulations which address water quality issues associated with development, and address increased runoff quantity by adopting regulations which ensure, at a minimum:

All subdivision and other development proposals which (involve disturbing more than 10000 square feet of land – removed) disturb one acre of land or more shall include a storm water management plan which is designed to limit peak runoff from the site to predevelopment levels for the 1, 10, and 100 year rainfall event. These plans shall be designed to limit adverse impacts to downstream channels and floodplains.

For an example of comprehensive storm water management regulations, the State of Delaware's regulations are here:
http://regulations.delaware.gov/AdminCode/title7/5000/5101.shtml

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XIII. SUBDIVISION STANDARDS

RATIONALE:
Whenever possible, avoiding floodplains in favor of developable land on higher ground is far preferable to setting standards and allowing building in the floodplain. The promise of tax revenues are not a good reason to allow development in a floodplain – public expenses for flood recovery and long-term public maintenance of land purchased in a buy-out are far greater than tax revenues generated by a development. Property owners are saddled with flood insurance premiums and face devastating losses if their insurance is inadequate to cover contents. Those with homes built on land that is incrementally above the flood elevation aren't required to carry flood insurance, but can experience flood damage to the same extent as their neighbors and without the benefit of any insurance benefits.

OBJECTIVE:
To ensure subdivisions, including infrastructure and lots are created and designed to minimize risk of damage to property and potential loss of life from flooding, and to minimize the disturbance of floodplain riparian zones.

MODEL LANGUAGE:
The following higher standards language should be adopted into the community's subdivision regulations (if applicable) and/or flood damage reduction regulations:

Modify the section on subdivisions and Planned Development to incorporate the bolded text:

In all areas of special flood hazard where base flood elevation data are not available, the applicant shall provide a hydrologic and hydraulic engineering analysis that generates base flood elevations and floodway boundaries and future conditions flood elevations for all subdivision proposals, and other proposed developments at least 5 acres or 5 lots in size (optional language: greater than 1, 2, 5 acres) . These studies shall be submitted to FEMA as a request for map revision and the record plan and all permitting documents shall reference the revised floodplain and base flood elevations accepted by FEMA and the community.

Add the following to the section for Subdivisions and Planned Development:

A. *All preliminary plans for platted subdivisions shall identify the flood hazard area and the elevation of the base flood as well as future conditions flood elevations.*

B. *All final subdivision plats will provide the boundary of the special flood hazard area, the floodway boundary, and base flood elevations.as well as future conditions flood elevations.*

C. *In platted subdivisions, all proposed lots or parcels that will be future building sites shall have a minimum buildable area outside the natural (non-filled) 1% chance annual floodplain. The buildable area shall be large enough to accommodate any primary structure and associated structures such as sheds, barns, swimming pools, detached garages, on-site sewage disposal systems, and water supply wells, if applicable.*

D. *Approval shall not be given for streets within a subdivision, which would be subject to flooding in the base flood. All street surfaces must be located at or above the base flood elevation.*

XIV. USE RESTRICTIONS

RATIONALE:
No construction activity, other than water-dependent uses (piers, docks) or stream bank stabilization activity should be permitted in the floodway. The floodway provides the minimum amount of conveyance necessary for transporting water during a flood, and encroachment in the floodway can lead to increased flood elevations. Hazardous, flammable, and explosive materials can be transported downstream during a flood event creating dangerous situations for landowners adjacent to the flooded land, and leading to diminished water quality and threats to native habitat. Concentrating populations of people with limited mobility in a flood hazard area increases the risk of injury or loss of life, and creates additional hazards for emergency responders. Finally, it is in a community's best interest to discontinue non-conforming uses in a flood hazard area, and require that non-conforming structures be elevated or flood proofed as a condition of remaining in their current location.

OBJECTIVE:
To restrict or prohibit uses of the floodplain which are dangerous to health, safety or property in times of flood, or which cause excessive increases in flood stages or velocities.

MODEL LANGUAGE:
Add the following to the Prohibited Uses section:

A. New construction of any residential or nonresidential structures in floodway areas.

B. Storage or processing of hazardous, flammable, or explosive materials in special flood hazard areas. [Caution: while this policy defines the floodplain, floodway and BFE's future conflicts may occur when the watershed is remapped or modified by a LOMC]

C. Critical development in special flood hazard areas. (Note: Must also adopt a critical development definition – see critical development higher standard).

D. The use of nonconforming structures shall not be changed from a non-residential structure to a residential structure or a mixed-use structure, or increase the residential use area of a mixed-use structure.

E. The use of any structure shall not be changed to a critical facility, where such a change in use will render the new critical facility in violation of Section IV - Critical Development Protection.

XV. REGULATING AREAS NOT MAPPED ON FIRM

RATIONALE:
At best, most flood insurance studies do not map floodplains in watersheds with drainage areas, of less than one square mile, floodplain widths less than 200', and in areas with poor drainage not associated with flooding sources. In many undeveloped areas, some larger watersheds may not have been mapped. Estimates are that nationally, over 1/3 of flood damage occurs outside of mapped floodplains.

OBJECTIVE:
To provide a means for a community to regulate development in areas at risk to flooding that have not been mapped on FEMA's FIRMs.

MODEL LANGUAGE:
Add the following sentence to the "special flood hazard area" definition:

> *Any area outside the FEMA studied areas lying along streams as shown on the United States Department of the Interior Geological Survey (hereafter referred to as "USGS") quadrants of which [community name] is contained and/or areas with poorly draining or hydric soils which are contiguous to blue line streams as shown on the [community name] Flood Prone Soils Map or Soil Survey shall also be considered special flood hazard areas.*
>
> *[Note – in determining the extent of land "contiguous" to streams, (blue line streams on some USGS maps) communities may elect to establish a buffer defined by width, land elevation, historical flooding, or other data]*.

In areas upstream of the Limit of Detail Study, as delineated on the community FIRM, where *base flood elevation data is not available, a floodplain study must be performed by a Professional Engineer (PE) establishing the base flood elevation (BFE) and the floodplain and floodway boundaries, as well as future conditions flood hazard areas, prior to issuing a development permit.*

Add the following references to the flood hazard data adopted in Basis for Establishing the Areas of Special Flood Hazard:

A. USGS quadrants in which [community name] is contained;
B. [community name] Flood Prone Soils Map or Soil Survey.

XVI. ELEVATION OF ALL ADDITIONS

OBJECTIVE:
To protect all new horizontal additions that are subject to costly damages from flooding.

RATIONALE:
Building an addition below flood level is essentially expanding a non-conforming use – a practice that has been prohibited in many contexts. By amending the definition of "Substantial Improvement" to include any addition that increases the building's original floor area by 25%, many horizontal expansions will have to be elevated. There may be instances where a horizontal addition is just below 25% of the building's original floor area. There may also be instances where a horizontal addition is for low-damage potential use, like parking or storage, in which case a community must consider whether they want to exempt this type of addition from the elevation requirement.

MODEL LANGUAGE:
Add the following provisions to the residential and non-residential development requirements:

> ***All new horizontal additions must have the lowest floor and all HVAC elevated to one foot above the base flood elevation. Non-residential additions may be dry flood proofed to one foot above the base flood elevation.***

If a community wishes to allow an exception to the elevation standard for low-damage potential uses, the language should include a specific exception to the minimum elevation for an addition that is not used for human habitation; designed to have low flood damage potential; firmly anchored and placed on the building site in a way that presents minimum resistance to flood flows; constructed with electrical and other services mounted above the flood hazard elevation; and fitted with openings that allow the automatic entry and exit of floodwater.

XVII. COASTAL SITING

RATIONALE:
Coastal flood risk increases dramatically with proximity to oceans and bays. While the NFIP has no siting requirements for V-Zones, locating new construction landward of frontal sand dunes and erosion prone lands provides tremendous protection. Note: several states have higher regulatory standards requiring new development to be landward of mean high or mean low tide.

OBJECTIVE:
To provide greater protection to coastal resources and structures that would be at risk of experiencing damage from wave action (V Zones).

MODEL LANGUAGE:

Add the following provisions to the general requirements for development in V Zones:

All new structures shall be located on the lot so as to minimize exposure to coastal hazards and shoreline erosion, and to accommodate primary frontal sand dunes. Structures should be located outside of the V-Zone, to the greatest extent possible. Building setback requirements should consider predicted future erosion rates, or historical erosion rates.

XVIII. DUNE PROTECTION

RATIONALE:
Sand dunes act as flood protection barriers along shorelines, and absorb wave energy before it causes damage to buildings. Land altering activities can destabilize sand dunes, and reduce the ability of the dune to absorb wave energy.

OBJECTIVE:
To provide greater protection to sand dunes and their flood mitigation qualities.

MODEL LANGUAGE:
Add the following provisions to the general requirements for development in V Zones:

Retaining walls, landscaping, dune crossovers and other non-essential accessory structures shall be designed and located to minimize impacts to sand dunes. Primary frontal dunes shall not be altered unless a qualified engineer demonstrates and certifies that flood risk will not be increased to the subject, or other, properties. Activities which reduce the volume of sand on the dunes or beach can generally be presumed to increase flood risk to landward locations. Adding sand volume to the dune or beach can generally be presumed to not increase flood risk.

Photo Credit: Delaware DNREC

Photo Credit: Delaware DNREC

The community in the bottom photograph required coastal construction behind primary frontal sand dunes. The top photo shows adjacent community with no dune setback requirements.

XIX. COASTAL CONSTRUCTION

RATIONALE:
Because of the extreme potential for damage from wave energy and high velocity flows and debris associated with coastal flooding, higher construction standards are essential. Breakaway enclosures are a compromise strategy which allow coastal property owners ground level improvements, but maintain structural integrity. Breakaway walls typically create debris problems and should be kept to a minimum. Enclosures, below BFE, should be limited to less than 300 square feet to permit the parking of not more than two vehicles, limited storage and building access.

OBJECTIVE:
To provide a greater factor of protection to structures built in V Zones.

MODEL LANGUAGE:
Add the following provisions to the residential and non-residential development requirements for V Zone construction:

A. *New and substantially improved structures shall have the bottom of the lowest horizontal structural member elevated (1', 2', 3') above the base flood elevation.*

B. *Enclosures below the lowest floor of elevated buildings shall be usable solely for parking, access, and limited storage. These enclosures shall be less than 300 square feet in area, and shall be designed and constructed with breakaway walls which minimize the amount and impact of debris and adverse effects on adjacent properties.*

C. *Option to B – Enclosures below the lowest floor of elevated buildings is prohibited in V Zones.*

D. *Breakaway walls for enclosures below the lowest floor shall be designed to meet building code wind requirements. Such enclosures shall be less than 300 square feet in area, and may be used only for limited storage, parking and access and shall be designed to minimize adverse debris impacts to adjacent properties. Where enclosures are used as access ways to elevated buildings, a secure door located at the elevated floor level must separate the enclosed area from the elevated building.*

E. *Detached accessory structures such as sheds or garages shall be prohibited in V-Zones.*

XX. COASTAL A-ZONE

RATIONALE:
Flooding with wave heights of as little as 1.5 feet can transmit significant energy loads to buildings or other obstructions. A reasonable amount of protection can be provided to development in these A-Zone areas with the potential for 1.5 feet or greater by adopting V-Zone standards in these areas.

OBJECTIVE:
To better protect structures in coastal areas where storm-induced velocity wave actions are unknown.

MODEL LANGUAGE:
Add the following provisions to the residential and non-residential development requirements for Coastal A Zone construction:

> *In areas which have been identified as subject to limited wave action (between 1.5 and 3 feet) and designated as a Coastal A-Zone, new and substantially improved structures shall comply with all of the V-Zone provisions of this ordinance. Elevation requirements should refer to the bottom of the lowest horizontal structural member of the lowest floor.*

XXI. SINKHOLES [The following standards and ordinance language is patterned after the Lexington, Kentucky Sinkhole Ordinance and can be modified as needed]

Background:
Sinkhole flooding can be divided into 3 categories:
1) Sinkhole flooding that is predominantly from surface runoff;
2) Flooding predominantly from surcharging of the caves below, and
3) Flooding that can be a mixture of the two.

The first category is the easiest to analyze though you may get one sinkhole overflowing into another, and that one into another, and so on, and so on. Bowling Green, Kentucky, for example, has a series of seven (7) sinkholes that share water during big flood events.

Category (2) is the hardest to analyze because often the caves below cannot be entered. They operate basically as storm sewers that cannot be inspected or maintained. Massive changes in underground drainage caused by debris/sediment plugging have been documented. Analysis of sinkhole systems (three categories) requires that you can identify the correct category for any given sinkhole. This can only be done by careful field investigation and/or eye witness accounts. Once you have the sinkhole classified as to flooding in categories 2 & 3, then you must delineate the groundwater basin and somehow model the cave hydraulics.

Sinkhole-- Any closed depression formed by removal (typical underground) of water, surficial soil, rock, or other material. The existence of a sinkhole shall be indicated by the closed depression contour lines on the Unified Mapping Program topographic maps or other documents as approved by the Community Floodplain Manager. Its actual limits may, however, be determined by field measurements with concurrence of the Community Engineer. Sinkholes may be either circular in plan or irregular, depending upon structural control.

Add the following to the section for Subdivision and Planned Development:
Plan Requirements - A sinkhole, the immediate sinkhole drainage area, a sinkhole cluster area, or portions of such items shall be shown on any development or preliminary subdivision plan for land where they exist. Sinkhole-related nonbuildable areas and restricted fill areas shall be shown on final subdivision plans and development plans.

Sinkhole-Related Nonbuildable Areas - Based upon the topography, geology, soils, and known history of the sinkhole (such as past filling) and the developer's engineer's storm water analysis and the community Planning Commission shall establish sinkhole-related, non-buildable areas. No buildings, parking areas, or other structures shall be permitted within the sinkhole related, non-buildable area.

This non-building area shall follow the limits of the sinkhole in most cases. However, the non-building area may be expanded or contracted by action of the Community Planning Commission where warranted due to the nature of the specific sinkhole, the underlying geology, soils, drainage, and any related information such as depth to bedrock. In sinkhole cluster areas, the Community Engineer may require the developer to provide recommendations from a consulting engineer and a consulting hydrologist based upon substantial and state-of the-art field studies and evaluation of the specific sinkhole system. Such studies shall be submitted to the Community Floodplain Manager, which shall review said studies and make recommendations to the Community Planning Commission.

Development in Sinkhole Drainage Areas - Development may occur in the immediate sinkhole drainage area if the developer provides alternative surface drainage away from the sinkhole, while keeping the water in the same surface drainage basin, and provided further that the water shall not go into another sinkhole drainage area off the petitioner's property, nor into another stream of known flooding problems. The immediate sinkhole drainage system area (or portion thereof) which cannot be provided with an alternative drainage system can be deleted from the development area and can be used to meet the normal open space requirements. The developer may request that the Community Planning Commission increase the density on the remainder of the developable area, with the total resulting density no greater than if the entire area were developed to the permitted density.

For portions of the immediate sinkhole drainage area where alternative surface drainage methods cannot be provided, as determined by the Community Engineer, the developer may choose one of the options described below.

Sinkhole Surface Drainage Analysis - The sinkhole can be used for surface runoff drainage of a proposed development of the conditions of either of the following alternatives are met:

Alternative 1
A sinkhole can be used for surface runoff of a proposed development with or without retention or detention facilities as recommended by a consulting Engineer and a consulting hydro-geologist, provided that any increase in the quantity of surface runoff due to development of the entire sinkhole drainage area in question will nit aggravate flooding on the proposed development, adjacent existing development, or connected/adjacent sinkhole sub-surface systems. Such engineering and geology reports must be substantive and based on state-of the-art field studies and evaluation of the specific sinkhole system. The Community Planning Commission shall not approve developments of this subsection unless the Community Engineer concurs with those findings and recommendations.

Alternative 2
A sinkhole can be used for surface drainage of a proposed development if all of the following conditions and provisions are met:

1. That the runoff from the development area is either completely retain in a retention basin or detained in a detention basin. The flow rate out of the above basin shall be regulated so that it is no greater than the flow rate into the sinkhole of the development area prior to development of each of the following storms: 10 year/1-hour, 25year/24-hour storm or a 100 year/1-hour storm. The outflow rate shall not aggravate flooding on downstream properties for any of these storms.

2. As previously noted, the developer may elect to divert enough of the sinkhole drainage area so that the development of the remaining area does not increase the total quality of the runoff into the sinkhole where additional runoff is anticipated, a consulting engineer and hydro-geologist shall evaluate and show the effect of any additional quantity of runoff to the sinkhole and sinkhole system. For approval, the study must show the development will not aggravate flooding on the proposed development, adjacent lands, or connected/adjacent sinkhole systems. The Community Engineer shall review the study findings and make recommendations to the Community Planning Commission for alternative 2 to be accepted .

3. Where the sinkhole outlet is offsite, either the runoff leaving the subject property must be shown to be no greater in flow or in quantity than that which existed before development or written approvals must be submitted from owners of property where any increase in flow or quantity of water must go to reach the sinkhole outlet. Easement areas shall be approved by the Community Engineer based upon the calculations of the engineer of the developer on the proposed ponding elevation.

Filling in Sinkholes and Drainage Areas - Development may involve some filling of the sinkhole drainage area or sinkhole upon approval by the Community Engineer. However, no principal or accessory buildings with soil-bearing foundations shall be permitted to be constructed on fill within the limits of any sinkhole.

XXII. PLAYA LAKES

Background:

The Spanish word *playa* (pronounced [ˈplaʝa]) literally means "beach". Dry lakes are known by this name in some parts of Mexico and the western United States. This term is also used on the Llano Estacado and other parts of the Southern High Plains.

In South America, the usual term for a dry lake is **salar**, Spanish for "salt pan".

The surface of a dry lake is typically dry, hard and rough during the dry season, but wet and very soft in the rainy season. Dry lakes are generally small, round depressions in the surface of the landscape.

A playa lake is formed when rain fills a round depression in the landscape, creating a small lake. The water is generally freshwater, When all of the water evaporates, a playa is formed. The playa appears as a flat bed of clay, generally encrusted with precipitated salts. These evaporate minerals are a concentration of weathering products that have been left behind. Some examples of evaporite minerals are sodium carbonate, borax, and other salts. Playas are often found in bajadas, a depositional landform of desert environments.

Dry lakes can also form when the water table intersects the surface and water seeps into them.

Dry lakes are typically formed in semi-arid to arid regions of the world. The largest concentration of dry lakes in the world (nearly 22,000) is in the southern High Plains of Texas and eastern New Mexico.

Most dry lakes are small, however Salar de Uyuni in Bolivia, near Potosi, the largest salt flat in the world is of 4,085 square miles (10,582 square km).

Many dry lakes contain shallow water during the rainy season, especially during wet years. If the layer of water is thin and is moved around the dry lake by wind, an exceedingly hard and smooth surface may develop. Thicker layers of water may result in a "cracked-mud" surface and "teepee" structure desiccation features. Very little water can result in dune formation.

While the dry lake itself will be devoid of vegetation, they are commonly ringed by shadscale, saltbrush and other salt-tolerant plants that provide critical winter fodder for livestock and other herbivores.

Threats to dry lakes include pollution from concentrated animal feeding operations such as cattle feedlots and dairies, erosion, fertilizer, pesticide and sediment runoff from farms, and overgrazing.

The extremely flat, smooth and hard surfaces of dry lakes make them ideal for motor vehicles and bicycles. Furthermore, large-sized dry lakes are excellent spots for pursuing land speed records, as the smoothness of the surface allows low-clearance vehicles to travel very fast without any risk of disruption by surface irregularities, and the path traveled has no obstacles to avoid. The dry lakes at Bonneville Salt Flats in Utah and Black Rock Desert in Nevada have both been used for setting land speed records. Dry lake beds that do not fill with water at any time are sometimes used as locations for air bases, for similar reasons. Examples include Area 51 in Nevada, and Edwards Air Force Base (originally known as Muroc Dry Lake) in California.

Brines from the subsurface of dry lakes are often exploited for valuable minerals in solution.

Under United States law, a "playa lake" may be considered isolated wetlands, and may be eligible to enroll in the new wetlands component of the Conservation Reserve Program, enacted in the 2002 farm bill (P.L. 107-171, Sec. 2101).

Development Requirements:

[The following requirements were established by the City of Lubbock, Texas regarding development in Playa Lake areas and may be modified as needed by a community with Playa Lake flood hazards]:

In Playa Lake areas, there are 5 criteria that would be used to determine what a new structure's lowest floor should be, based upon Local Floodplain Administrator's requirements:
(1) - The floor shall be a minimum of 12" above the highest adjacent top of curb (or street crown).
(2) – If the structure is located within a playa lake, the lowest finish floor (LFE) shall be a minimum of 1' above the FEMA BFE **OR** a minimum of 2' above the lake overflow, ***whichever is higher***. If the playa is a 'true non-overflow lake' (where it doesn't overflow even in the 500-year event) the LFE shall be a minimum of 1' above the 500-year event.
(3) - If a Drainage Analysis has been prepared for a **new** development, the LFE is to be a minimum of 6" above the established BFE.
(4) - If a new structure is to be built in the SFHA shown on the FIRM, then the LFE shall be built a minimum of 1' above FEMA's BFE.
(5) - The lowest floor elevation may have to be raised to allow the site to drain properly, consistent with COL requirements.

Whichever of these 5 requirements yields the highest elevation will govern and shall be used to set the floor level for the proposed structure.

XXIII. ALLUVIAL FANS

Alluvial Fans are usually mapped on Flood Insurance Rate Maps (FIRMs) as Zone AO (shallow overland flooding) by FEMA. Development in Alluvial Fan areas creates unique floodplain management issues for local communities, developers and homeowners. The ASFPM Arid Regions Committee prepared an excellent companion White Paper entitled *Riverine Erosion Hazards & Floodplain Management.* The Arid Regions Committee has been requested to provide guidance and higher standards recommendations to CBOR regarding development in Alluvial Fan areas to help guide communities in their quest to mitigate flood risks.

XXIV. LEGAL RIGHT OF ENTRY TO ENFORCE FLOODPLAIN ORDINANCE

OBJECTIVE:
The community floodplain administrator must have legal authority to enter private property to enforce the community floodplain ordinance and the minimum requirements of the NFIP. While this may not be considered a higher standard this authority is paramount for a community to have a sound floodplain management program.

RATIONALE:
44 CFR

- Part 60.2 (h) - The community shall adopt and enforce floodplain management regulations…
- Part 60.3 (a) (1) - Require permits for all proposed construction and other developments in the community…
- Part 73 - a property that has been declared to be in violation of State or local laws, regulations or ordinances using Section 1316 of the National Flood Insurance Act of 1968

The *Texas Guide to Local Floodplain Management*, RG-12 (Rev. 8/06), Chapter 4 (page 33) - Duties of a Floodplain Administrator include:

- enforcing ordinances, which includes follow-up inspections on all permits granted;
- addressing violations by working with the community's attorney and informing citizens of the penalties of noncompliance with NFIP requirements;

Texas Guide to Local Floodplain Management, Chapter 4 (page 42), Importance of Enforcing Permit System:

- Your community is violating its agreement with the NFIP by failing to maintain a permit system, by granting variances regularly, and by being lax about enforcement responsibilities

FEMA 480, *A Study Guide and Desk Reference for Local Officials, Unit 7* Section D, page 7-39:
Later Inspections:

- "Your office should periodically check to ensure that the property continues to remain in compliance over time. Later inspections are particularly important when a structure contains an enclosure below the lowest floor. Such areas can be easily modified and made into habitable spaces in violation of regulations".

- Note: "In some states, communities do not have the statutory authority to go onto private property to look for violations."

FEMA 480, Unit 7 Section E, page 7-40:
Enforcement

- "In order to ensure that development is meeting these requirements, you must monitor the floodplain, and where necessary, conduct an inspection of a property. Some permit officials have statutory limits on where they can go to inspect a potential violation. Be sure to review your authority to access onto private property with your attorney."

Texas Water Code 13.315 [example of a State Code]
"... All political subdivisions are hereby authorized to take all necessary and reasonable actions to comply with the requirements and criteria of the National Flood Insurance Program, including but not limited to:..." those political subdivisions are acting as functionaries of state, and federal government in the enforcement of those actions necessary to comply with the "Flood Control Insurance Act". The authority to inspect on private property is passed on from the federal, and state government, to county government by the Texas Constitution's description of the rights and duties of county government as it acts as an extension of the State therefore the authority does not have to be specifically created in additional statute.

MODEL LANGUAGE:
Add the following provisions to the Community flood damage prevention ordinance or court order:

> ***"The community floodplain administrator, or his designee, has the right to enter any structure to perform any duties or responsibilities imposed by this Chapter (Ordinance or Court Order)".***

XXV. ENFORCEMENT – FINES AND PENALTIES

Several Flood Damage Prevention Ordinances, adopted by participating NFIP communities, contain the following language:

PENALTIES FOR NON COMPLIANCE

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this ordinance and other applicable regulations. Violation of the provisions of this ordinance by failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Any person who violates this ordinance or fails to comply with any of its requirements shall upon conviction thereof be fined not more than $1,000 or imprisoned for not more than 30 days, or both, for each violation, and in addition shall pay all costs and expenses involved in the case. Nothing herein contained shall prevent (name of community) from taking such other lawful action as is necessary to prevent or remedy any violation.

The following City of Houston Flood Damage Prevention Ordinance contains language where a person violating the ordinance can be guilty of a misdemeanor punishable by a fine of not less than $250.00 nor more than $2,000.00. Each day that any violation continues shall constitute a separate violation. This is considered a "higher standard" action making violation of the flood damage prevention ordinance a serious offense.

MODEL LANGUAGE:

It is recommended that a community consider amending their flood damage prevention ordinance to include authority to enforce and criminal sanctions similar to the City of Houston ordinance.

NFIP communities are encouraged to modify this document as needed to meet their floodplain management requirements necessary to minimize flood hazards.

City of Houston Section 19-91 Actions authorized to enforce chapter.

(a) The city, acting through the city attorney or any attorney representing the city, is hereby authorized to file an action in a court of competent jurisdiction to:
    (1) Enjoin any person from violating the terms, conditions and restrictions of any permit issued under this chapter:
    (2) Enjoin the violation of the provisions of this chapter:
    (3) Recover civil penalties for violations of the terms, conditions and restrictions of any permit issued under this article;
    (4) Recover civil penalties for violations for conditions of this article; or
    (5) Recover damages from the owner of a site in an amount adequate for the city to undertake any construction or other activity necessary to bring about compliance with this chapter.

This authority is in addition to all provisions of this code and the Construction Code relative to the definition of offenses and the provision of penalties for violations of such ordinances.

(b) The city, acting through the city attorney or any other attorney representing the city, is hereby authorized to enter into agreements in lieu of litigation to achieve compliance with the terms, conditions and restrictions of any permit issued under this article or the provisions of this article.
(c) The city engineer is authorized to:
    (1) Whenever any work authorized by a development permit is being performed contrary to the provisions of this chapter, or other pertinent laws or ordinances implement through the enforcement of this article, order the work (other than work to cure a violation) stopped by notice in writing served on any persons performing the work or causing the work to be performed. Any such persons shall forthwith stop the work until authorized by the city engineer to proceed with the work.
    (2) At the time a stop order is issued, the person performing the work and the permit holder shall be given notice of a right to a hearing on the matter pursuant to Section 116.2 of the Building Code for permits authorized by that Code. Upon request, such a hearing shall be held within three business days unless the permit holder or person who was performing the work requests an extension of time. Any stop order that has been issued shall remain in effect pending any hearing that has been requested unless the stop order is withdrawn by the city engineer.

Section 19-92 Criminal sanctions

Any person violating any provision of this chapter within the corporate limits of the city shall be guilty of a misdemeanor punishable by a fine of not less than $250.00 nor more than $2,000.00. Each day that any violation continues shall constitute a separate offense.

[Reference City of Houston Ord. No. 85-1705, 1, 9/25/1985; Ord. No. 92-1449, 34, 11/4/1992; Ord. No. 02-399, 48, 5/15/2002; Ord. No. 03-1190, 16, 12/3/2003; Ord. No. 06-894, 30 &31, 8/30/2006]

XXVI. GLOSSARY

Adjacent Natural Grade: The highest point of elevation of the finished surface of the ground within the area between the building and the property line or, when the property line is more than five feet from the building, between the building and a line five feet from the building.

Base Flood Elevation (BFE): As determined by the community, either the elevation of the 1%-annual-chance flood, or the elevation of the 0.2%-annual-chance flood. At a minimum, the community must establish the 1%-annual-chance-flood as BFE in accordance with FEMA rules.

Basement: An enclosed area that is below grade on all sides. For the purposes of floodplain regulations, the floor elevation of a basement is the lowest floor.

Community Rating System (CSR)®: A program administered by FEMA that recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Participating in the CRS provides an incentive to maintaining and improving a community's floodplain management program over the years, by automatically reducing flood insurance premiums for the participating community.

Dry land Access: walkways, driveways, and roadways on land with an elevation not less than the 1%-chance-flood elevation.

Floodplain: Any land susceptible to being inundated by water as a result of a specific frequency flood. For instance, the 1% floodplain is the area of land that, in any given year, has a 1% likelihood of flooding. The 0.2% floodplain is the is the area of land that, in any given year, has a 0.2% likelihood of flooding.

Floodway: The channel of a river or stream and those portions of the floodplains adjoining the channel which are reasonably required to carry and discharge floodwaters so that confinement of floodwaters to the floodway area will not result in substantially higher flood elevation.

Freeboard: A margin of safety added to the base flood elevation to account for waves, debris, miscalculations, lack of data, or an assumed rise in flood elevation over time.

Improvement: Repair, reconstruction, or improvement of a structure. Improvement is considered to occur when the first alteration of any wall, ceiling, floor or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not include any project for improvement of a structure to comply with existing state or local health, sanitary or safety code specifications which are solely necessary to assure safe conditions for the existing use.

Landscaping: Minor excavation or filling for the purposes of enhancing the exterior appearance of a structure with plant materials or decorative structures. When fill material is brought onto a site for the purposes of elevating the existing grade in a floodplain, the fill is subject to standards in VI., Fill Standards.

Lowest Floor: The floor of the lowest enclosed area in a building, including a basement, except when all the following criteria are met:

A. The enclosed area is designed to flood to equalize hydrostatic pressure during floods with walls or openings; and

B. The enclosed area is unfinished (not carpeted, dry walled, etc.) and used solely for low damage potential uses, such as building access, parking or storage; and

C. Machinery and service facilities (e.g., hot water heater, furnace, electrical service) contained in the enclosed area are located at least one foot (1') above the flood hazard elevation; and

D. The floor is not below grade on all sides.

Manufactured Home: Any structure designed for residential use which is wholly or in substantial part, made, fabricated, formed or assembled in manufacturing facilities for installation or assembly and installation on a building site. Manufactured housing includes factory built homes, mobile homes, manufactured homes and modular homes and also includes park trailers, travel trailers and other similar vehicles placed on a site for greater than one hundred eighty (180) consecutive days.

Original Floor Area: The square footage of a home at the original date of construction or, in the case of a home built prior to a community's entry into the NFIP, the square footage of a home at the time a community was issued its first FIRM. Original floor area includes all space used for habitation, storage, and access to utilities.

Sinkhole: Any closed depression formed by removal (typically underground) of water, surficial soil, rock, or other material. The existence of a sinkhole shall be indicated by the closed depression contour lines on the Unified Mapping Program topographic maps or other documents as approved by the Community Floodplain Manager. Its actual limits may, however, be determined by field measurements with concurrence of the Community Engineer. Sinkholes may be either circular I plan or irregular, depending upon structural control.

Substantial Improvement: Any improvement to an existing structure that equals or exceeds 50% of the structure's market value prior to the start of the improvement. A community may elect to cumulatively measure the 50% value against all improvements since the date of original construction, or the date when the community entered the NFIP (whichever is most recent). Substantial improvement also includes expansions that increase the original floor area of the home by 25%. (See "original floor area").