Reducing Flood Risk to Buildings that Cannot be Elevated
The Homeowners Flood Insurance Affordability Act (HFIAA) Sec. 26 tasked FEMA with:

- Providing alternative mitigation measures for residential buildings that cannot be elevated due to structural characteristics
- Informing property owners of the affect of the measures on flood insurance premiums under the NFIP
Study Objectives

- Develop guidelines for alternative mitigation measures to reduce flood risk to residential buildings.
- Release an outreach publication that helps property owners compare the benefits and costs of a variety of mitigation methods.
Approach

- FEMA convened a workgroup of subject matter experts
  - Building science
  - Floodplain management
  - Actuary
  - Contractor staff

- Reviewed existing FEMA and USACE publications
- Solicited input from outside agencies
- Established general parameters for the mitigation measures to be considered
Approach

- Developed a comprehensive list of 40 partial and complete alternative mitigation measures in the following categories:
  - Wet Floodproofing (12 measures)
  - Dry Floodproofing (5 measures)
  - Barriers (5 measures)
  - Interior Modifications (11 measures)
  - Other – Stormwater Improvements, Green measures, Education (11 measures)
The 40 plus measures were ranked and down selected based on the following parameters:

- Passive Measures
- Substantial Improvement (SI)
- BFE + 1 ft Protection
- Mitigation Reconstruction
- Flood Hazard Conditions (High Velocity)
- Local Jurisdiction Prohibition
- Effectiveness as Stand-Alone Measure
- Probability of Insurance Premium Reduction
10 alternative mitigation measures selected for evaluation

1) Hydrostatic openings
2) Elevate all building utilities
3) Floodproof all building utilities
4) Flood-damage resistant materials
5) Passive dry floodproofing system
6) Floodwall
7) Berm / Levee
8) Basement Infill
9) Abandon Lowest Floor
10) Elevate Lowest Interior Floor
Mitigation Measures and Insurance

- Flood insurance premium ratings are available for a subset of the mitigation measures evaluated:
  1. Hydrostatic Openings
  2. Basement infill
  3. Abandon lowest floor
  4. Elevate lowest interior floor
Figure 1: Basement infill before and after mitigation
Abandoning the Lowest Floor

BEFORE

AFTER

Lowest floor
BFE

Lowest floor
Portal frame
Shear wall
Garage door
Flood opening
BFE
Interior Modification / Retrofit

Before Mitigation
2 story slab on grade, 10 foot ceilings

After Mitigation
2 story elevated interior floors, 8 foot ceilings

Living area 10 ft
Living area 10 ft
Living area 8 ft
Living area 8 ft
Common walls (party walls) between row houses
Non-elevated row houses
Freeboard
BFE
Grade
Stairs
The following 8 measures require further evaluation:

1. Elevate all building utilities
2. Floodproof all building utilities
3. Flood-damage resistant materials
4. Passive dry floodproofing system
5. Floodwall with gates
6. Floodwall without gates
7. Levee with gates
8. Levee without gates
Next Steps

- Full implementation of flood insurance premium rating for all measures will require
  - Evaluation by FIMA actuaries
  - Modifications to the FEMA Flood Insurance Manual and Submit For Rate Guide
  - Training of the Write Your Own (WYO’s) companies
  - Review of the policy implications for floodplain management, building sciences, and flood insurance
Conclusions

Premium reductions are important incentives but Losses avoided is the ultimate objective.
Questions?

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## Evaluation Results

<table>
<thead>
<tr>
<th>Mitigation Measure</th>
<th>Life Cycle Cost</th>
<th>Expected Useful Life</th>
<th>Design Complexity</th>
<th>Potential for Reducing Flood Damage</th>
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<tr>
<td>Flood Openings</td>
<td>Low</td>
<td>15–20 years</td>
<td>Low</td>
<td>High</td>
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<tr>
<td>Elevate building utilities</td>
<td>Low to Moderate</td>
<td>15–20 years</td>
<td>Low</td>
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<tr>
<td>Floodproof building utilities</td>
<td>Low to Moderate</td>
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<td>Limited</td>
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<tr>
<td>Flood damage-resistant materials</td>
<td>Moderate</td>
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<td><strong>Dry Floodproofing Measures</strong></td>
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<tr>
<td>Dry floodproofing system</td>
<td>High</td>
<td>15–30 years</td>
<td>High</td>
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<td><strong>Barrier Measures</strong></td>
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<tr>
<td>Floodwall with or without gates</td>
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<td>50 years</td>
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<tr>
<td>Levee with and without gates</td>
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<td><strong>Interior Modification/Retrofit Measures</strong></td>
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<tr>
<td>Basement infill</td>
<td>Moderate to High</td>
<td>30–50 years</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Abandon lowest floor</td>
<td>Moderate to High</td>
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<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Elevate lowest interior floor</td>
<td>Moderate to High</td>
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</tr>
</tbody>
</table>
Case Study – Basement Infill

- Estimated cost range: $72,000 to $108,000 including annual maintenance
- Useful life: 30 to 50 years
- Current annual flood premium: $6,537 for maximum coverage
- Estimated annual flood insurance premium post mitigation: $1,631 for maximum coverage
- Estimated annual reduction in premium: $4,906
- Estimated time to recover mitigation cost: 15 to 22 years

- Composite BCR = 3.81, based on average benefits of $342,631 over 30-year project life