V Zones: Coming Soon to a Great Lake Near You
Introduction to Coastal High Hazard Areas for Illinois Stakeholders
March 2019
So you’re getting new maps...

...and they have new zones (VE zones) on them.

Now what?

Erie County PA, effective 6/7/17
You need to know about:

- What makes coastal flooding different from riverine flooding;
- Finding relevant data for floodplain management in coastal areas;
- Floodplain management standards for coastal high-hazard areas.
NFIP participating communities:

- Will need to adopt floodplain management regulations that meet NFIP standards for coastal high-hazard areas. 
  
  44 C.F.R. § 60.3(e)

- In Illinois, FEMA and Illinois DNR will work with Lake County SMC and affected Cook County communities to revise floodplain management regulations to meet these standards.
I. COASTAL FLOODING

Basics of coastal flooding
How is coastal flooding different from riverine and lacustrine flooding?

- A river floods when the discharge exceeds the capacity of the channel and it overflows its banks into areas that are “normally” dry.

- A pond or small lake floods when the water level rises above the ordinary high water mark and overflows onto normally dry land areas.

- In both cases, the usual primary hazards to property (i.e. buildings and their contents) are the hydrostatic and buoyant forces from the rising water, and the fact that stuff gets wet.
Coastal flooding:

- Tides (or fluctuating water levels)
- Currents
- Waves
- Wind

Coasts flood when storm surge (rising water) combines with wave effects (runup, overtopping, and/or overland wave propagation) to inundate normally dry land areas.
Coastal flooding in the Great Lakes

- Tidal variation in Great Lakes is negligible
- Water levels do vary over long periods (years and decades) and seasonally (month to month)
- Storm events, varying atmospheric pressure, and wind-driven wave setup can produce storm surge over short periods (hours)
- Presence of ice cover may reduce the effects of storm events on water levels
- Great Lakes studies account for all of these probabilities
Rising water + waves

- In addition to rising water (surge plus wave setup), coastal flood hazards include some component of onshore wave effects.

- Generally, where the coastal topography is inundated by the rising water, the onshore wave component will include wave heights and may include overland wave propagation.

- Generally, where the slope is steeper or where there is a bluff face or vertical wall close to the shoreline, the onshore wave component will include wave runup where runup height is 3 feet or more.

- If runup exceeds the barrier crest height by 3 feet or more, landward of the barrier is an overtopping splash zone.
Wave runup

Wave runup depth ≥ 3 feet

100-year stillwater elevation

100-year wave runup elevation = BFE

100-year wave crest elevation

Inland extent of wave runup

Datum (e.g., NGVD, NAVD)
Wave runup/overtopping:

- Click on link for video of wave runup and overtopping example (Aberystwyth, Wales UK, 2014)
- Second link is Minnesota’s Lake Superior coast in October 2018

https://www.youtube.com/watch?v=v0OKbJaLsk4
https://www.duluthnewstribune.com/video/X6NH4aZy
What does this look like on a map?

Cedar Point
Erie County, OH
(Prelim FIRM)

Presque Isle,
Erie County, PA
Additional forces acting on buildings in coastal areas

- **Hydrodynamic forces**
  - Velocity flow
  - Breaking waves
  - Wave uplift

- **High winds**
  - Lateral
  - Uplift

- **Debris**
  - Windborne
  - Waterborne

- **Erosion and scour**
Not in the SFHA = No flood risk
Not just rising water
Waves and debris impacts
No flood risk in any of these places...
Additional, different damaging forces

- Several additional forces can act on buildings in a coastal flood hazard area, including hydrodynamic forces, waves, and winds.
  - Also debris impacts, generalized erosion and localized scour.

- Additional, different regulations to protect buildings.

- Don’t plan for the best case of the worst case: plan for the worst case of the worst case.
II. FLOODPLAIN MANAGEMENT USING COASTAL DATA

TABLE 5: SUMMARY OF COASTAL STILL WATER ELEVATIONS – continued

<table>
<thead>
<tr>
<th>FLOODING SOURCE AND LOCATION</th>
<th>10-PERCENT</th>
<th>2-PERCENT</th>
<th>1-PERCENT</th>
<th>0.2-PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAN CARLOS BAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Punta Rassa and Bunch Beach</td>
<td>5.2</td>
<td>10.0</td>
<td>11.5</td>
<td>14.0</td>
</tr>
<tr>
<td>Between Bunch Beach and Boscawen Point</td>
<td>5.4</td>
<td>9.8</td>
<td>11.3</td>
<td>14.1</td>
</tr>
<tr>
<td>GULF OF MEXICO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Island and Big Pass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pass</td>
<td>4.9</td>
<td>9.6</td>
<td>11.2</td>
<td>14.3</td>
</tr>
<tr>
<td>y Pass</td>
<td>4.9</td>
<td>9.6</td>
<td>11.2</td>
<td>14.3</td>
</tr>
<tr>
<td>section of Bonita and along the intersection of</td>
<td>4.8</td>
<td>8.9</td>
<td>11.3</td>
<td>13.2</td>
</tr>
<tr>
<td>Boulevard along the</td>
<td>4.8</td>
<td>8.9</td>
<td>11.3</td>
<td>13.2</td>
</tr>
<tr>
<td>intersection of Boulevard along the</td>
<td>4.8</td>
<td>8.9</td>
<td>11.3</td>
<td>13.2</td>
</tr>
</tbody>
</table>

TABLE 7: TRANSECT DESCRIPTIONS - continued

<table>
<thead>
<tr>
<th>TRANSECT</th>
<th>LOCATION</th>
<th>STILL WATER ELEVATION IN FEET (NAVD88)</th>
<th>ELEVATION (feet NAVD88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>At the intersection of Sand Dollar Road and Southside Plantation Avenue</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>9</td>
<td>At the intersection of Sand Dollar Road and Southside Plantation Avenue</td>
<td>4.63</td>
<td>10.63</td>
</tr>
<tr>
<td>10</td>
<td>About 1 mile from intersection of Capital Road and motorists lane</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>11</td>
<td>Extends through DEP monitored number 2-166</td>
<td>4.53</td>
<td>10.53</td>
</tr>
<tr>
<td>12</td>
<td>About 4,000 feet north of the intersection of Capital Road and motorists lane</td>
<td>4.12</td>
<td>10.62</td>
</tr>
<tr>
<td>13</td>
<td>About 2,300 feet southeast of the intersection of Capital and motorists lane</td>
<td>4.12</td>
<td>10.62</td>
</tr>
<tr>
<td>14</td>
<td>At the intersection of White House Road and Waterford Lane</td>
<td>4.13</td>
<td>9.63</td>
</tr>
<tr>
<td>15</td>
<td>At the intersection of Sawgrass Place and West Gulf Drive</td>
<td>4.13</td>
<td>11.23</td>
</tr>
<tr>
<td>16</td>
<td>About 500 feet east from the intersection of Daniels Drive and West Gulf Drive</td>
<td>4.13</td>
<td>11.23</td>
</tr>
<tr>
<td>17</td>
<td>About 500 feet east from the intersection of Daniels Drive and West Gulf Drive</td>
<td>4.13</td>
<td>11.23</td>
</tr>
<tr>
<td>18</td>
<td>At the intersection of Sand Dollar Drive and Lindner Boulevard</td>
<td>4.72</td>
<td>12.82</td>
</tr>
<tr>
<td>19</td>
<td>About 70 feet east from the intersection of South Lee Street and East Gulf Drive</td>
<td>4.92</td>
<td>13.22</td>
</tr>
<tr>
<td>20</td>
<td>About 300 feet west of the end of Sand Dollar Drive</td>
<td>4.92</td>
<td>13.22</td>
</tr>
<tr>
<td>21</td>
<td>At the intersection of Sand Dollar Drive and Matanzas Street</td>
<td>4.92</td>
<td>12.82</td>
</tr>
<tr>
<td>21.5</td>
<td>100 feet of the intersection of South Lee Street and Pinecrafts Wharf Drive</td>
<td>4.92</td>
<td>12.82</td>
</tr>
</tbody>
</table>
Riverine BFE: Cross Sections and Profiles

City of Byron 170526

**FEDERAL EMERGENCY MANAGEMENT AGENCY**

**TABLE 12**

**OGLE COUNTY, IL AND INCORPORATED AREAS**

<table>
<thead>
<tr>
<th>CROSS SECTION</th>
<th>DISTANCE</th>
<th>WIDTH (FEET)</th>
<th>SECTION AREA (SQUARE FEET)</th>
<th>MEAN VELOCITY (FEET PER SECOND)</th>
<th>REGULATORY LIMIT</th>
<th>WITHOUT FLOODWAY</th>
<th>WITH FLOODWAY</th>
<th>INCREASE</th>
</tr>
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<tbody>
<tr>
<td>Rock River (continued)</td>
<td>113.14</td>
<td>1,330</td>
<td>16,477</td>
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<td>114.17</td>
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<td>14,506</td>
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<td>115.75</td>
<td>1,170</td>
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<td>681.0</td>
<td>681.0</td>
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<td>116.94</td>
<td>116.94</td>
<td>963</td>
<td>14,961</td>
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<td>681.7</td>
<td>681.7</td>
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<td>118.34</td>
<td>118.34</td>
<td>1,127</td>
<td>14,500</td>
<td>4.1</td>
<td>682.6</td>
<td>682.6</td>
<td>682.6</td>
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<td>119.17</td>
<td>119.17</td>
<td>681</td>
<td>12,023</td>
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<td>683.1</td>
<td>683.1</td>
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<td>120.87</td>
<td>1,141</td>
<td>12,768</td>
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<td>121.34</td>
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<td>19,169</td>
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<td>683.9</td>
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<td>121.73</td>
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<td>684.0</td>
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<td>122.19</td>
<td>122.19</td>
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<td>122.92</td>
<td>122.92</td>
<td>1,075</td>
<td>11,946</td>
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<td>684.4</td>
<td>684.4</td>
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<td>124.23</td>
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<td>11,275</td>
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<td>684.9</td>
<td>684.9</td>
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<tr>
<td>124.96</td>
<td>124.96</td>
<td>575</td>
<td>10,363</td>
<td>6.8</td>
<td>685.4</td>
<td>685.4</td>
<td>685.4</td>
<td>0.0</td>
</tr>
<tr>
<td>125.94</td>
<td>125.94</td>
<td>655</td>
<td>5,444</td>
<td>6.4</td>
<td>685.9</td>
<td>685.9</td>
<td>685.9</td>
<td>0.0</td>
</tr>
<tr>
<td>126.50</td>
<td>126.50</td>
<td>886</td>
<td>14,045</td>
<td>4.3</td>
<td>685.9</td>
<td>685.9</td>
<td>685.9</td>
<td>0.0</td>
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<tr>
<td>127.23</td>
<td>127.23</td>
<td>814</td>
<td>11,513</td>
<td>5.2</td>
<td>686.0</td>
<td>686.0</td>
<td>686.0</td>
<td>0.0</td>
</tr>
<tr>
<td>127.81</td>
<td>127.81</td>
<td>680</td>
<td>10,505</td>
<td>5.7</td>
<td>686.4</td>
<td>686.4</td>
<td>686.4</td>
<td>0.0</td>
</tr>
<tr>
<td>128.87</td>
<td>128.87</td>
<td>945</td>
<td>13,010</td>
<td>4.6</td>
<td>687.1</td>
<td>687.1</td>
<td>687.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* Miles above confluence with Mississippi River

**FLOODWAY DATA**

**ROCK RIVER**
Coastal BFE: Where’s the Base Flood Elevation?

**TABLE 5 - SUMMARY OF COASTAL STILLWATER ELEVATIONS - continued**

<table>
<thead>
<tr>
<th>FLOODING SOURCE AND LOCATION</th>
<th>ELEVATION (ft NAVD88)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10-PERCENT</td>
</tr>
<tr>
<td>San Carlos Bay</td>
<td>Between Punta Rassa and Beach Beach</td>
</tr>
<tr>
<td>Between Beach Beach and Bodwich Point</td>
<td>5.4</td>
</tr>
<tr>
<td>Gulf of Mexico</td>
<td>Between Bodwich Point and Cottage Avenue on Estero Island</td>
</tr>
<tr>
<td>Between Cottage Avenue on Estero Island and Big Carlos Pass</td>
<td>4.9</td>
</tr>
<tr>
<td>Between Big Carlos Pass and New Pass</td>
<td>4.1</td>
</tr>
<tr>
<td>Between New Pass and Big Hickory Pass</td>
<td>5.2</td>
</tr>
<tr>
<td>Between Big Hickory Pass and county boundary</td>
<td>4.8</td>
</tr>
<tr>
<td>About 1 mile northwest of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline</td>
<td>4.8</td>
</tr>
<tr>
<td>About 2,400 feet northeast of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline</td>
<td>4.8</td>
</tr>
<tr>
<td>About 1,500 feet southeast of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline</td>
<td>4.8</td>
</tr>
</tbody>
</table>

**TABLE 7 - TRANSECT DESCRIPTIONS - continued**

<table>
<thead>
<tr>
<th>TRANSECT</th>
<th>LOCATION</th>
<th>STILLWATER ELEVATION IN FEET (ft NAVD88)</th>
<th>BASE FLOOD ELEVATION (ft NAVD88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>At the intersection of Sand Dune Road and South Seas Plantation Road</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>9</td>
<td>At the intersection of Sea Turtle Court and South Seas Plantation Road</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>10</td>
<td>About 1 mile from intersection of Captiva Road and Merrand Lane</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>11</td>
<td>Extends through DIP's portion number 3</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>12</td>
<td>About 6,000 feet south of the intersection of Watten Road and Tram Court, through Clan Bayou</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>13</td>
<td>About 2,700 feet southwest of the intersection of Backlund Lane and Sable Caprina Road</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>14</td>
<td>At the intersection of White Birch Road and Wannem eller Lane</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>15</td>
<td>At the intersection of Sawgrass Place and West Gulf Drive</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>16</td>
<td>About 300 feet east from the intersection of Daniels Drive and West Gulf Drive</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>17</td>
<td>At the intersection of South Seas Drive and Longshore Boulevard</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>18</td>
<td>At the intersection of South Seas Drive and Longshore Boulevard</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>19</td>
<td>At the intersection of South Seas Drive and Longshore Boulevard</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>20</td>
<td>At the intersection of Spann Hill Court and East Gulf Drive</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>21</td>
<td>At the intersection of Matanzas Street and Matanzas Street</td>
<td>4.52</td>
<td>10.52</td>
</tr>
<tr>
<td>21.5</td>
<td>At the intersection of End Blvd and Fisherman's Wharf Drive</td>
<td>4.52</td>
<td>10.52</td>
</tr>
</tbody>
</table>
The BFE is the number ON THE MAP for the area bounded by the gutter lines.

Town of Fort Myers Beach 120673
What if the site crosses over the gutter lines?

And therefore has multiple BFEs?

Or multiple flood zones (VE, AE, AO…)?

- Always use the more hazardous zone for the area encompassed by the development.
- Always use the highest BFE for the area encompassed by the development.
- If the development is a building, the whole building needs to meet the requirements for the most hazardous zone and highest BFE that applies to any part of the building.
Where’s the floodway? How do I show there’s no rise?

- In locations where the 1%-annual-chance flood is solely the result of coastal flooding effects, there is no floodway.

- The floodway concept applies to areas where there is flow in a channel.
Designing and building a compliant building in a coastal high-hazard area

- **Coastal high-hazard** means Zone VE

- Not a simple matter of “raising it up high enough.”

- A qualified design professional will need to be involved.

- Relies on data from the FIRM and FIS, and on that design professional’s calculations and judgments.

- Much guidance on this topic is in FEMA’s Coastal Construction Manual (FEMA 55), and companion publications.
Zone AO with depth number

Lorain County, OH Prelim FIRM
AO zone regulations (review)

- Elevate lowest floor, including basement, of new construction and substantial improvements to or above the depth number specified on the FIRM (or 2 feet if not specified), measured from the highest adjacent natural grade.

- Community needs to keep a record of the natural grade prior to construction in order to document that construction in Zone AO was compliant.

- KEEP A RECORD OF THE NATURAL GRADE PRIOR TO CONSTRUCTION!
III. FLOODPLAIN MANAGEMENT STANDARDS IN COASTAL ZONES

Minimum NFIP Provisions, Building Codes, and Consensus Engineering Standards
NFIP Floodplain Management Standards for Coastal High Hazard Areas (highlights)

- 44 CFR §60.3(e):

“When the Federal Insurance Administrator […] has identified on the community’s FIRM coastal high hazard areas by designating Zones V1-30, VE, and/or V, the community shall: […]”

Remember the staircase from E273?
60.3(e)(4)(i)

“Provide that all new construction and substantial improvements in Zone[…], VE […] on the community’s FIRM are elevated on pilings and columns so that (i) the bottom of the lowest horizontal structural member of the lowest floor (excluding the pilings or columns) is elevated to or above the base flood level[…].”
Where’s the bottom of the lowest horizontal structural member?
60.3(e)(4)(ii)

- “[…] and (ii) the pile or column foundation and structure attached thereto is anchored to resist flotation, collapse and lateral movement due to the effects of wind and water loads acting simultaneously on all building components. Water loading values shall be those associated with the base flood. Wind loading values shall be those required by applicable State or local building standards.” (emphasis added)

104.2.1; 1612.1; 1612.4 (through reference to ASCE 24); R322.3; R322.3.2; R322.3.3
60.3(e)(4)

“A registered professional engineer shall develop or review the structural design, specifications and plans for the construction, and shall certify that the design and methods of construction to be used are in accordance with accepted standards of practice for meeting the provisions of paragraphs (e)(4)(i) and (ii) of this section.”

“accepted standards of practice”:

ASCE/SEI 7-16 Minimum Design Loads for Buildings and Other Structures

ASCE/SEI 24-14 Flood Resistant Design and Construction

1612.5(2.2); R322.3.3; R322.3.6
Continuous load path:

“Superstorm” Sandy November 2012
60.3(e)(5)

“Provide that all new construction and substantial improvements within Zone[...] VE [...] on the community’s FIRM have the space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls, open wood lattice-work, or insect screening intended to collapse under wind and water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or supporting foundation system.”

Wood lattice-work:
Breakaway wall enclosures

“Such enclosed space shall be useable solely for parking of vehicles, building access, or storage.”

Separate rooms?

“Roughed in” plumbing and electrical?

Windows and French double-doors in “breakaway” walls?

What’s that blue glow coming from the windows after dark?

Community must be diligent in ongoing enforcement.
60.3(e)(6)

“Prohibit the use of fill for structural support of buildings within Zones V1-30, VE, and V on the community’s FIRM.” (emphasis added)

1612.4 (through reference to ASCE 24; G401.2; R322.3.2(3)
No fill?

How am I going to get my LOMR-F so I can get out of paying for flood insurance?!

NO LOMR-F in Zone VE.  End of discussion.

NO BASEMENT in Zone VE.  End of discussion.
Things to remember about floodplain management regulations in Zone VE:

- Elevate lowest horizontal supporting member to or above BFE on piling or column foundation, with space below open to present no obstruction, or enclosed only with breakaway walls/latticework
- NO FILL FOR STRUCTURAL SUPPORT
- NO DRY-FLOODPROOFING (see above)
- NO LOMR-F (see above)
- ENGINEERING is not optional
- NO, NO, NO, NO, NO BASEMENTS. NO BASEMENTS!
Residual risk ≠ No risk

- Site is shown outside SFHA.
- Pre- and post-construction grade is below BFE.
  - Is there truly *no* risk of flooding during the base flood?
- How clearly is the site outside the SFHA? Is there no chance that a Flood Hazard Determination Vendor is going to call the building “in” the SFHA?

- If you apply for a LOMA or LOMR-F and the lowest adjacent grade is below BFE, the result is a non-removal.
Amend-In and Deny

“non-removal”

“supersedes previous determination”
Coastal areas challenge conventional assumptions:

- There is not necessarily a viable engineering solution to every site-related factor.

- Wise subdivision practices, and wise siting decisions, can minimize the cost of building design and construction to resist anticipated coastal hazards.

- Following *only* the NFIP-minimum floodplain management regulations could allow design practices that could result in reduced coverage or very costly flood insurance premiums.

- Plan for the future events, not the past events:

  [http://www.geol.ucsb.edu/faculty/sylvester/UCSB_Beaches/IVCLIFFS/pillarhus.html](http://www.geol.ucsb.edu/faculty/sylvester/UCSB_Beaches/IVCLIFFS/pillarhus.html)
Resources:

- FEMA P-55 Coastal Construction Manual
  - [https://www.fema.gov/media-library/assets/documents/3293](https://www.fema.gov/media-library/assets/documents/3293)

- FEMA P-499 Home Builder’s Guide to Coastal Construction
  - [https://www.fema.gov/media-library/assets/documents/6131](https://www.fema.gov/media-library/assets/documents/6131)

- FEMA P-762 Local Officials Guide for Coastal Construction
  - [https://www.fema.gov/media-library/assets/documents/16036](https://www.fema.gov/media-library/assets/documents/16036)

- IS-386 Introduction to Residential Coastal Construction

- [https://www.fema.gov/coastal-flood-risk-resources](https://www.fema.gov/coastal-flood-risk-resources)
More training opportunities and outreach will be coming to NE Illinois and NW Indiana in the coming months.

QUESTIONS?