USACE AND FLOOD RISK MANAGEMENT:

AN INTRODUCTION TO USACE FLOOD PROOFING TECHNICAL ASSISTANCE

"Weather It Together: Protecting Maryland's Historic Buildings from Floods"

Presented by: Stacey M. Underwood, FPMS Program Manager

Ray Tracy, Civil Engineer and Eva Falls, Archeologist

Maryland Historical Trust, Crownsville, MD

25 May 2017

"The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."

US Army Corps of Engineers

U.S.ARMY

PRESENTATION AGENDA

1. Flood Proofing Measures (Flood Risk Adaptive Measures)
2. USACE Technical Assistance Programs
3. Recent/On-going Studies
4. Questions & Discussion

US Army Corps of Engineers.

U.S.ARMY

Is this the new Normal?

Property damages of $10.2 Billion annually from 1985-2015

Hurricane Sandy

Colorado Flooding

Louisiana Flooding

2016 Major Disaster Declarations (Flooding)

Arkansas	Kentucky	Louisiana	Wisconsin	Montana	Oklahoma	West Virginia
Texas	Montana	Texas	Mississippi	Pennsylvania	Texas	Delaware
New Jersey	Louisiana	Virginia	Maryland	Georgia	District of Columbia	
Georgia	Oregon	Alaska	Oklahoma	Texas	Arkansas	Washington
Alabama	Missouri	Washington	Iowa	Minnesota	Hawaii	

US Army Corps of Engineers.

U.S.ARMY

Flood Risk

Risk = *f* [(Probability of Flooding) x (Consequences)]

(Probability of Flooding) is the frequency of flooding or how often does flooding occur in a particular location. Reduce the frequency of flooding and risk is reduced.

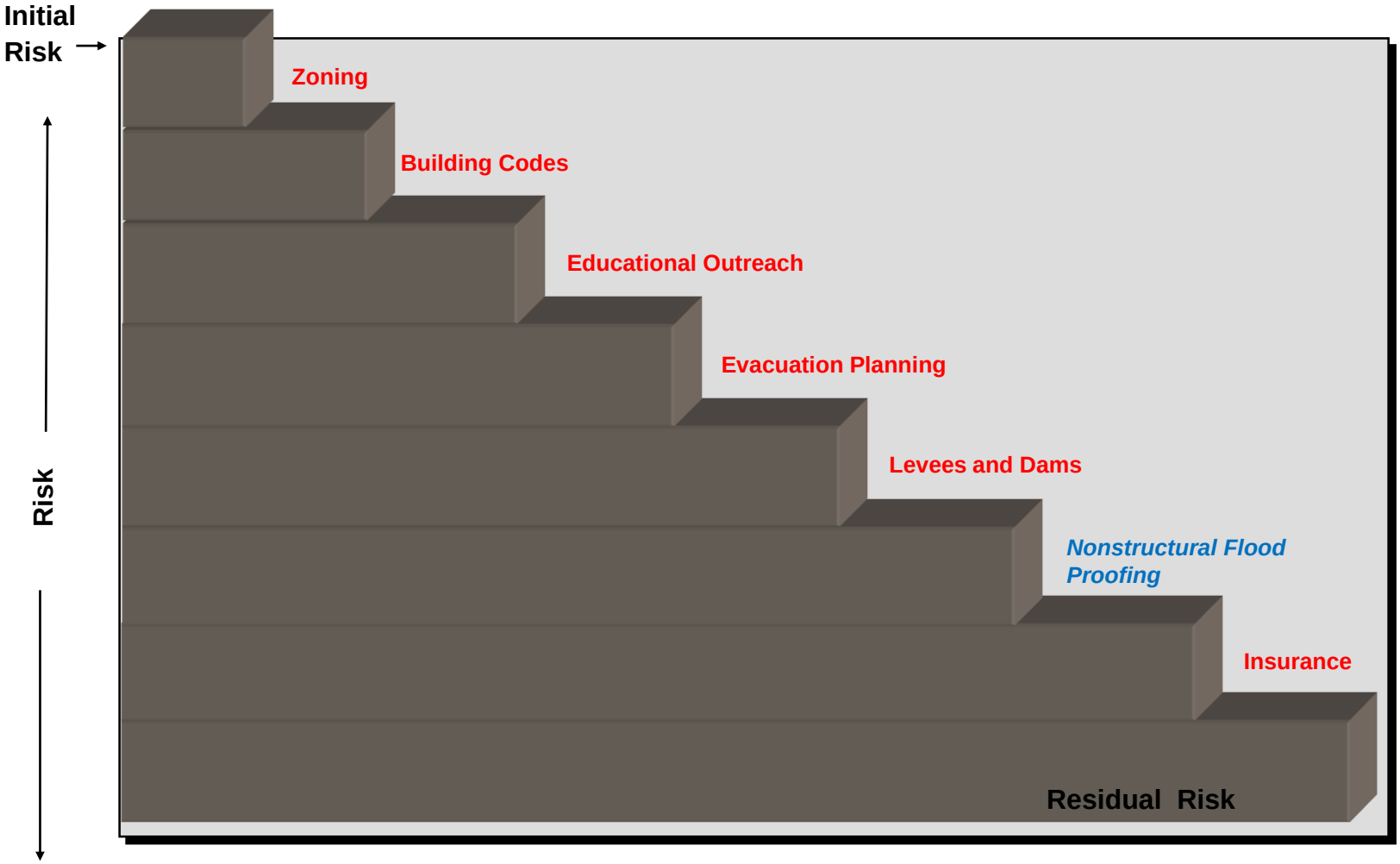
(Consequences) are the potential damages and life loss associated with flooding. The structures (critical, residential, commercial, public, and industrial), land use (agricultural, urban, public) , and infrastructure (highways, roads, rail, utilities) make up the potentially damageable assets. Reduce the consequences of flooding and risk is reduced.

Note: If critical facilities become inoperative during a flood event the area of impact extends beyond the area of flooding (i.e. electrical service, fire and rescue, hospitals, water and wastewater, etc).

US Army Corps of Engineers.

U.S.ARMY

Flood Risk = *f* [Probability of Flooding x Consequences]



RISK REDUCTION TECHNIQUES

US Army Corps of Engineers.

U.S.ARMY

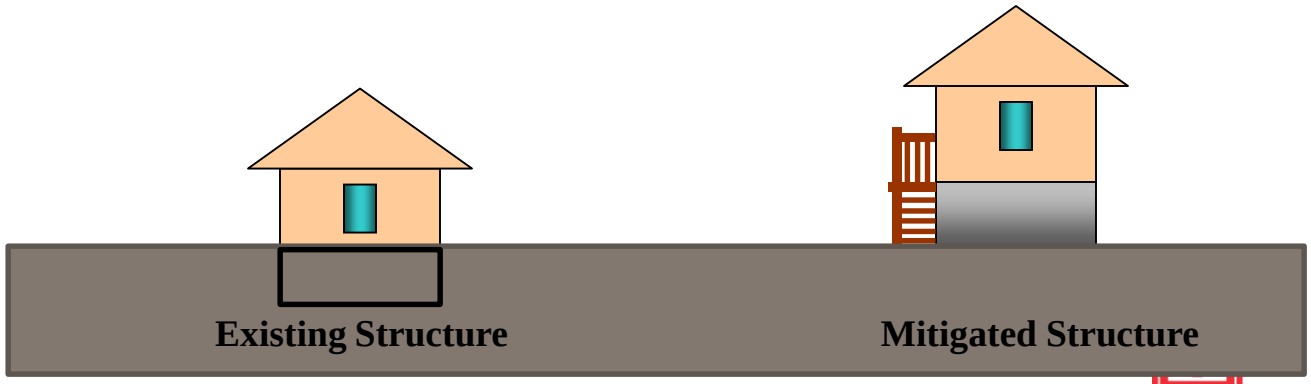
Flood Proofing

The most common physical flood proofing measures implemented for flood damage and life loss reduction are considered to be:

Acquisition; Relocation; Elevation; Dry Flood Proofing; Wet Flood Proofing; Basement Removal

Nonphysical flood proofing measures are considered to be:

Floodplain Mapping; Land Use; Flood Insurance; Evacuation Plans; Flood Warning Zoning; Operational Changes; Emergency Preparedness Plans



US Army Corps of Engineers.

Assessing the Situation

Flood Characteristics

depth, velocity, duration, rate of rise, debris/ice flows, wave action, floodway, floodplain

Site Characteristics

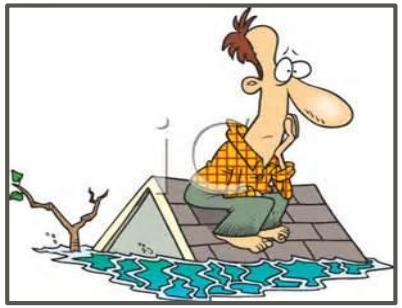
location, soil type, topography, site size, urban/rural

Building/Structure Characteristics

type of construction, foundation material, condition of the building, lower levels (basement/crawlspace), historical significance, building modifications

Other Considerations

occupancy, building codes, zoning, ordinances and local restrictions, building aesthetics, future conditions, public health/safety/welfare



US Army Corps of Engineers.

U.S.ARMY

* Caution Caution Caution *

While flood proofing measures <u>may</u> result in lower property damages, there could be potential restrictions which the property owner <u>needs</u> to investigate prior to implementation:

- **Local Ordinances**
- **State and Federal Regulations**
- **National Flood Insurance Program (NFIP)**

Some of the methods shown in this presentation may not comply with local code or the NFIP minimum requirements and may not be creditable for flood insurance savings. USACE focuses on flood damage reduction.

Flood insurance is always recommended, even for structures which may have been retrofitted with nonstructural measures

US Army Corps of Engineers.

U.S.ARMY

SELF-HELP FLOOD RISK MANAGEMENT MEASURES

US Army Corps of Engineers.

U.S.ARMY

ACQUISITION

Acquire the land and structures
Demolish structures or sell and remove
Technique eliminates risk of flooding

US Army Corps of Engineers.

U.S.ARMY

RELOCATION

US Army Corps of Engineers.

U.S.ARMY

Elevation on Fill

US Army Corps of Engineers.

U.S.ARMY

ELEVATION ON PIERS, POSTS, PILES, OR COLUMNS

Elevation on Extended Foundation Walls

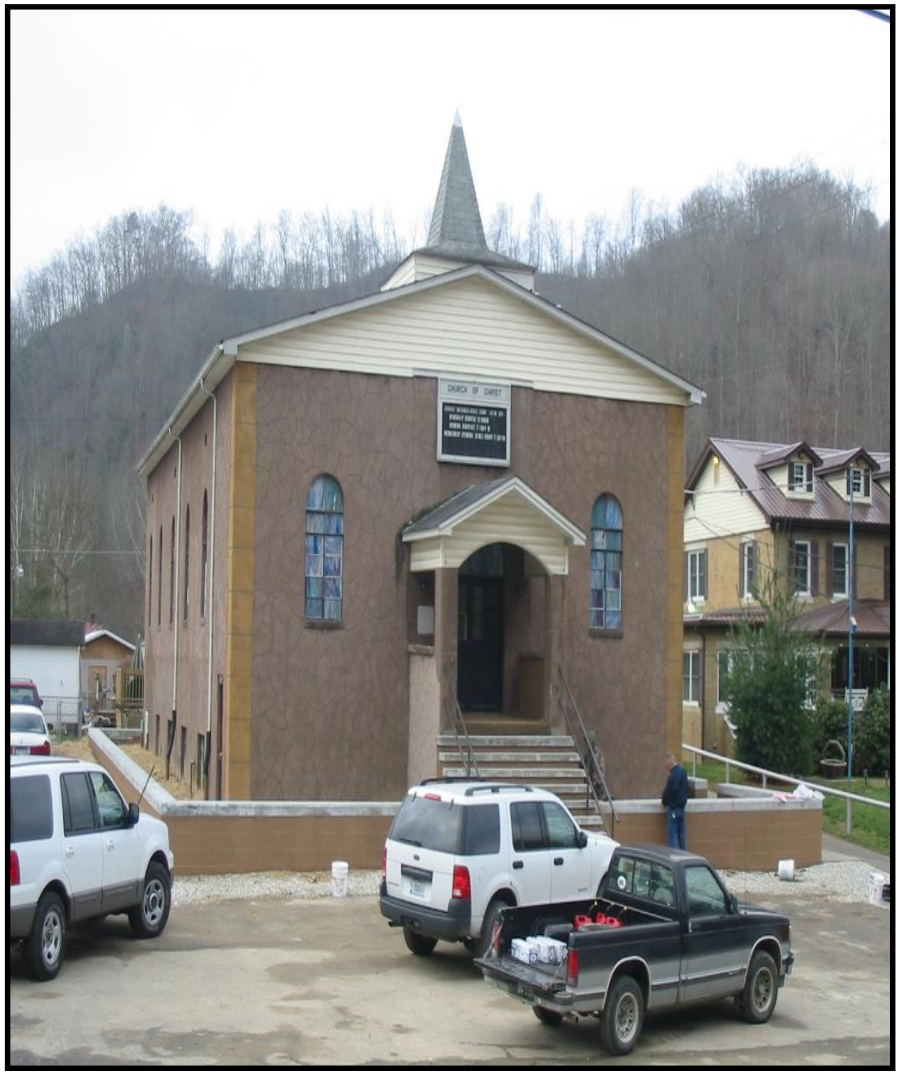
Flood Vent

Elevate to Reduce Flood Risk (cannot inhabit lower level)

US Army Corps of Engineers.

U.S.ARMY

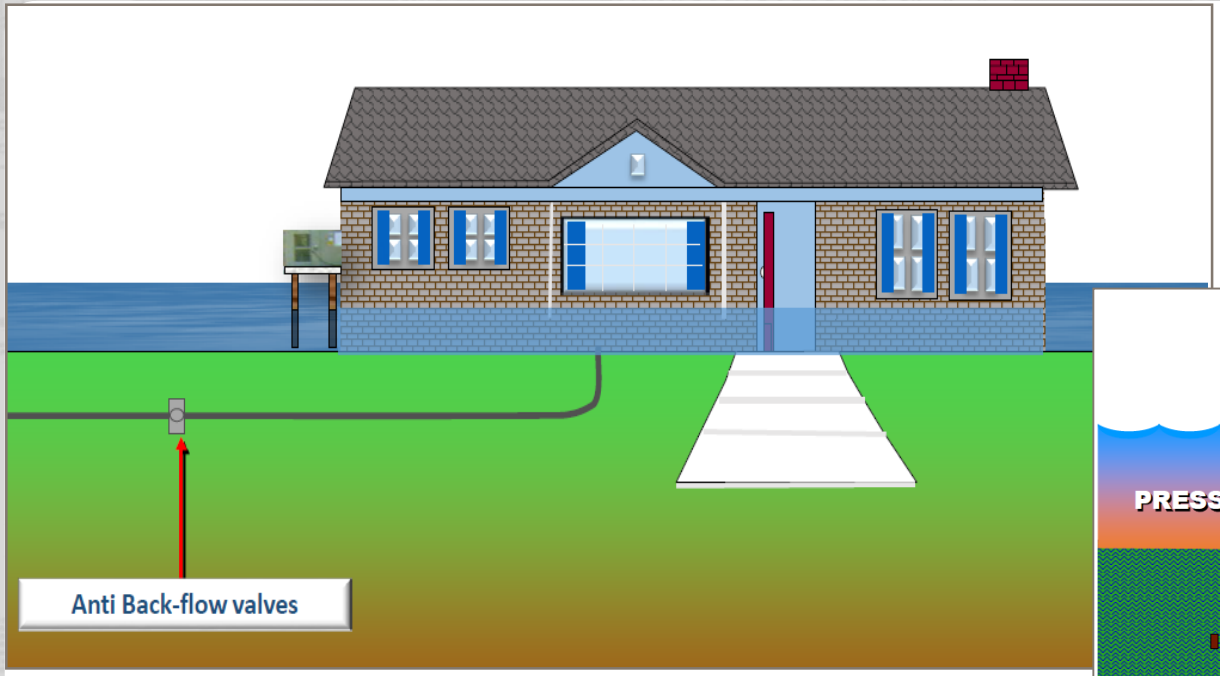
FLOODWALLS AND BERMS

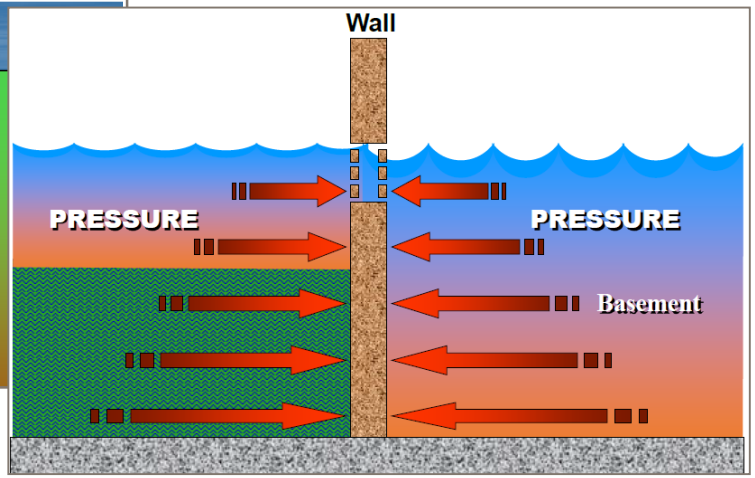


US Army Corps
of Engineers.

U.S.ARMY

Wet Flood Proofing





US Army Corps of Engineers.

U.S.ARMY

Elevate External Utilities

Air Conditioning Unit

US Army Corps of Engineers.

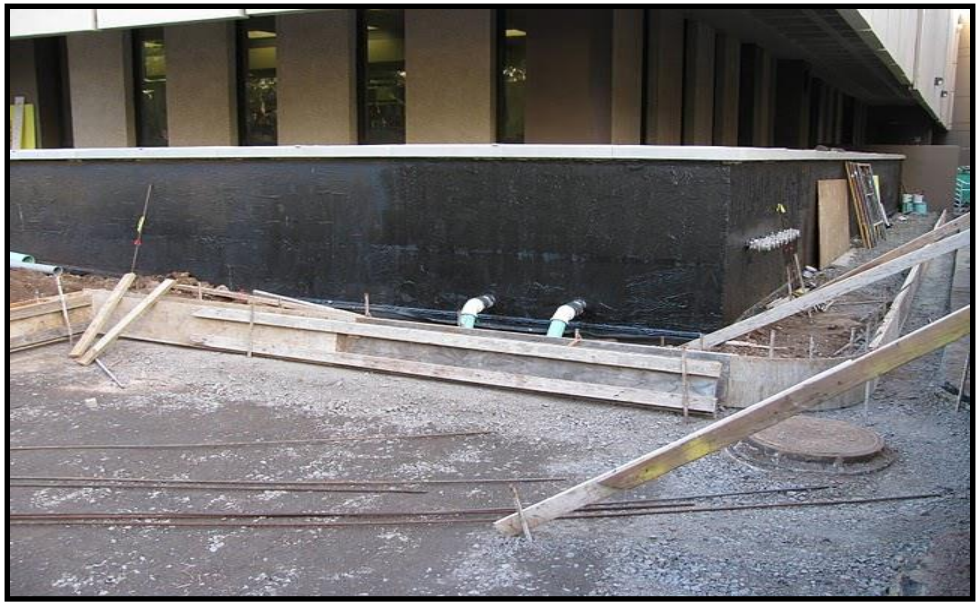
U.S.ARMY

Dry Flood Proofing

US Army Corps
of Engineers.

U.S.ARMY

Dry Flood Proofing



US Army Corps of Engineers.

U.S.ARMY

Darlington, Wisconsin Commercial Flood Proofing

US Army Corps
of Engineers.

U.S.ARMY

Elevation and Flood Proofing within a Commercial (Historic) Structure

US Army Corps of Engineers.

U.S.ARMY

Elevation within an Existing Structure

US Post Office

- **within 100-yr floodplain**
- **high ceilings**
- **elevated interior**
- **concerns:**
  - **seepage**
  - **no flood vents**
  - **standard glass doors**

US Army Corps of Engineers.

U.S.ARMY

Flood Barriers for Doors and Windows

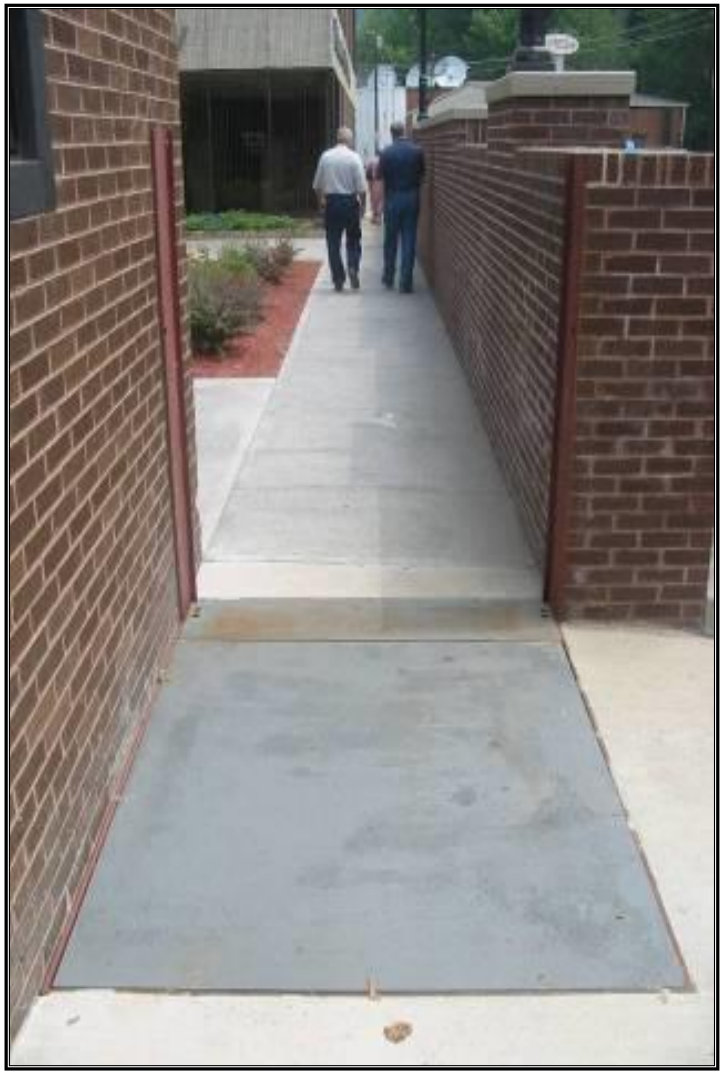
US Army Corps
of Engineers.

U.S.ARMY

FLOODWALLS AND BARRIERS

National Archives

swing gate closure



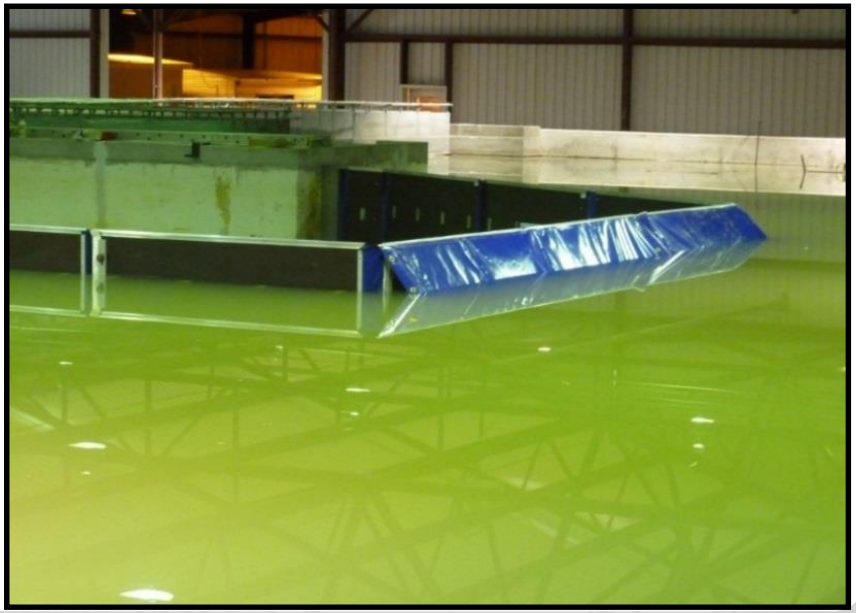
hydraulic gate closure

US Army Corps of Engineers.

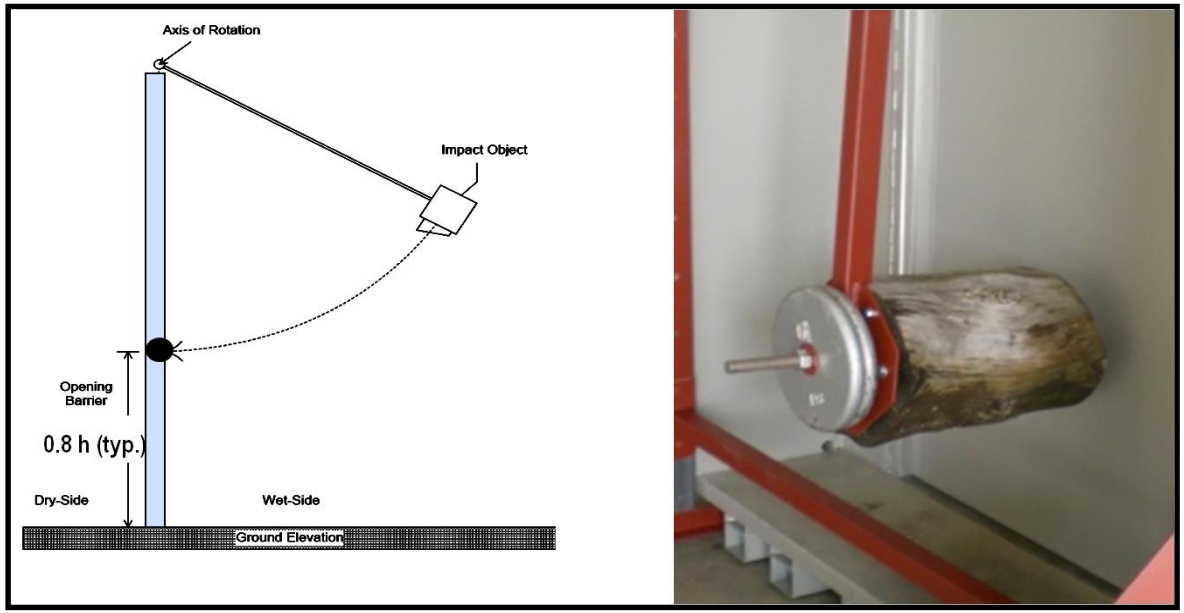
U.S.ARMY

National Flood Barrier Testing & Certification Program

ERDC
Engineer Research and Development Center



PEDESTRIAN AND VEHICLE OPENING BARRIER TESTING



website: http://nationalfloodbarrier.org/

US Army Corps of Engineers.

U.S.ARMY

USACE National Nonstructural Flood Proofing Committee

Chartered: 1985

NFPC Members and Advisors

- **Randall Behm, Chair, Omaha**
- **Steve O'Leary, Secretary, Huntington**
- **Kim Gavigan, Phoenix**
- **Keven Lovetro, New Orleans (MVD)**
- **Lea Adams, Davis (HEC)**
- **Mary Weidel, Detroit (IWR)**
- **Brian Rast, Kansas City (IWR)**

Technical Resources

- **Nonstructural Techniques**
- **Publications**
- **Assessment Tools**
- **National Flood Barrier Testing & Certification Program**
- **Links to Associated Sites**

Google: **NFPC**

National Nonstructural Flood Proofing Committee (NFPC)

Nonstructural Flood Proofing measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Nonstructural Food Proofing measures differ from Structural Flood Proofing measures in that they focus on reducing the consequences on flooding instead of focusing on reducing the probability of flooding.

Nonstructural Flood Proofing measures include:

- Elevation
- Relocation
- Buyout / Acquisition
- Dry flood proofing
- Wet flood proofing
- Berms or floodwalls

Nonphysical Nonstructural measures include:

- Flood Warning Systems
- Flood Insurance
- Floodplain Mapping
- Flood Emergency Preparedness Plans
- Land Use Regulation
- Zoning
- Evacuation Plans
- Risk Communication

The National Nonstructural Flood Proofing Committee was founded in 1985 to promote the use of nonstructural flood proofing methods.

US Army Corps of Engineers
Nonstructural - Flood Proofing
National Nonstructural / Flood Proofing Committee

Association of State Floodplain Managers

National Flood Barrier Testing & Certification Program

National Nonstructural Flood Proofing Committee

Flood Damage Reduction Matrix

View on dvidshub.net

National Nonstructural Flood Proofing Committee (NFPC)

Collapse All Expand All

- NFPC History
- About NFPC
- Current NFPC Membership:
  - - - Chairman: Randall Behm, P.E.

NFPC Links

The following websites contain information related to nonstructural measures to reduce flood damages and promote floodplain management techniques.

- ASFPM ...
- FEMA ...
- NAFSMA ...
- Natural Hazards Center ...
- USACE Flood Risk Mgmnt ...
- USACE Silver Jackets ...

Upcoming Events

ASFPM National Conference

- 39th Annual Association of State Flood Plain Managers - National Conference "Mitigation On My Mind", Atlanta, GA **June 1-5, 2015**

read more ...

NAFSMA Annual Meeting

- 2015 - National Association of Flood and Stormwater Management Agencies - Annual Meeting, Jackson Hole, WY **August 18-20, 2015**

read more ...

Flood Risk Management - Silver Jackets Workshop

- 2015 Flood Risk Management - Silver Jackets Workshop, Southbridge, MA **December 1-4, 2015**

Nonstructural Measures

The different Nonstructural Measures are described provided below. A detailed discussion on each of these types of Nonstructural Measures can be found among our Publications.

web site: http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/nfpc.aspx

USACE TECHNICAL ASSISTANCE PROGRAMS

US Army Corps of Engineers.

U.S.ARMY

PLANNING ASSISTANCE TO STATES

Purpose – "All things water"

Types of Projects

- Stream and wetland assessments, sewer infrastructure inventories and databases, watershed planning, flood risk assessments, GIS mapping, water supply demands, etc.

Funding/Cost-Sharing

- 50% federal/50% non-federal
- 100% non-federal for comprehensive plans
  - Opportunity for public-private partnership studies
  - Non-federal share may include in-kind services

How to Get Started? What's Required?

- Contact the program manager
- Federal and non-federal partners sign a Letter of Agreement

  http://www.usace.army.mil/Missions/Civil-Works/Project-Partnership-Agreements/templates_pas/

More Information

- http://www.iwr.usace.army.mil/Portals/70/docs/frmp/PAS_Factsheet_13SEP12.pdf

US Army Corps of Engineers.

U.S.ARMY

FLOOD PLAIN MANAGEMENT SERVICES

Purpose – “All things flood”

Types of Projects

- Flood inundation tools and mapping, risk communication, flood risk assessments, flood proofing assessments, mitigation planning, post-flood documentation, emergency table top exercises, flood preparedness and more

Funding/Cost-Sharing

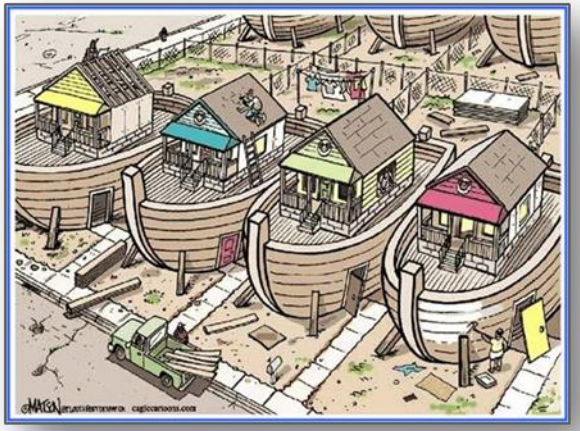
- Federal funds; can utilize voluntary contributions to expand the study

How to Get Started? What’s Required?

- Contact the program manager
- Federal and non-federal partners sign a Letter of Agreement if voluntary contributions

More Information

- http://www.nab.usace.army.mil/technical-services/

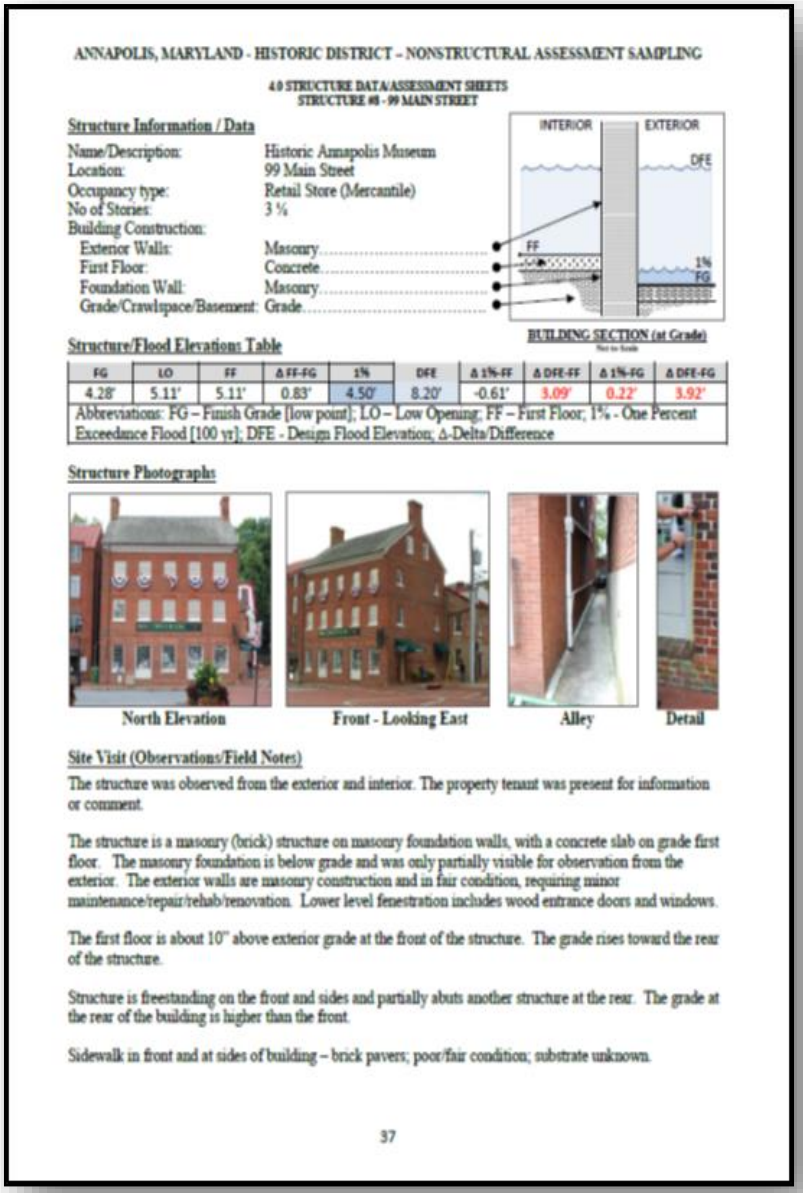


US Army Corps of Engineers.

U.S.ARMY

FLOOD PROOFING STUDIES

- City of Annapolis, MD
- Baltimore City, MD
- Ellicott City, MD
- Washington Navy Yard, DC
- Watts Branch, DC



ANNAPOLIS, MARYLAND - HISTORIC DISTRICT – NONSTRUCTURAL ASSESSMENT SAMPLING

4.0 STRUCTURE DATA/ASSESSMENT SHEETS
STRUCTURE #8 - 99 MAIN STREET

Structure Information / Data

Name/Description: Historic Annapolis Museum
Location: 99 Main Street
Occupancy type: Retail Store (Mercantile)
No of Stories: 3 ½
Building Construction:
Exterior Walls: Masonry
First Floor: Concrete
Foundation Wall: Masonry
Grade/Crawlspace/Basement: Grade

BUILDING SECTION (at Grade)

Structure/Flood Elevations Table

FG	LO	FF	Δ FF-FG	1%	DFE	Δ 1%-FF	Δ DFE-FF	Δ 1%-FG	Δ DFE-FG
4.28'	5.11'	5.11'	0.83'	4.50'	8.20'	-0.61'	3.09'	0.22'	3.92'

Abbreviations: FG – Finish Grade [low point]; LO – Low Opening; FF – First Floor; 1% - One Percent Exceedance Flood [100 yr]; DFE - Design Flood Elevation; Δ-Delta/Difference

Structure Photographs

North Elevation | Front - Looking East | Alley | Detail

Site Visit (Observations/Field Notes)

The structure was observed from the exterior and interior. The property tenant was present for information or comment.

The structure is a masonry (brick) structure on masonry foundation walls, with a concrete slab on grade first floor. The masonry foundation is below grade and was only partially visible for observation from the exterior. The exterior walls are masonry construction and in fair condition, requiring minor maintenance/repair/rehab/renovation. Lower level fenestration includes wood entrance doors and windows.

The first floor is about 10" above exterior grade at the front of the structure. The grade rises toward the rear of the structure.

Structure is freestanding on the front and sides and partially abuts another structure at the rear. The grade at the rear of the building is higher than the front.

Sidewalk in front and at sides of building – brick pavers; poor/fair condition; substrate unknown.

37

US Army Corps of Engineers.

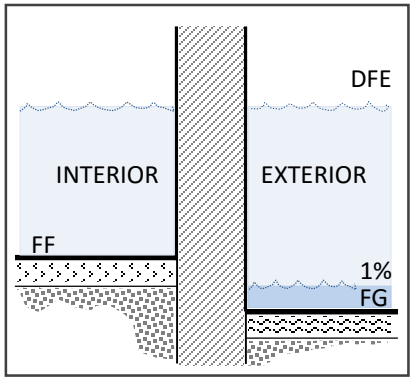
U.S.ARMY

Historic Annapolis Museum

99 Main Street

Rear Equipment/Exit Stair

Alley



BUILDING SECTION (at Grade)

Not to Scale

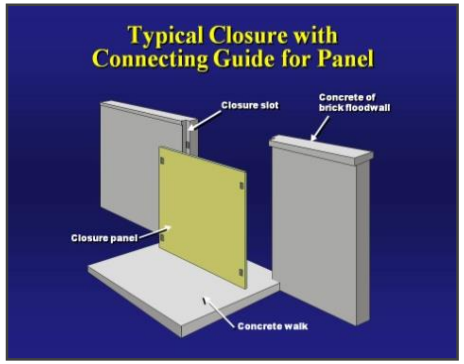
US Army Corps of Engineers.

U.S.ARMY

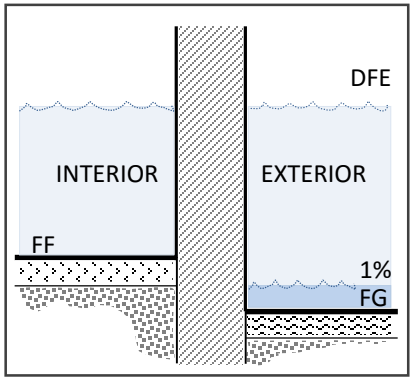
Historic Annapolis Museum

99 Main Street

Temporary Barrier



Closure/Shield



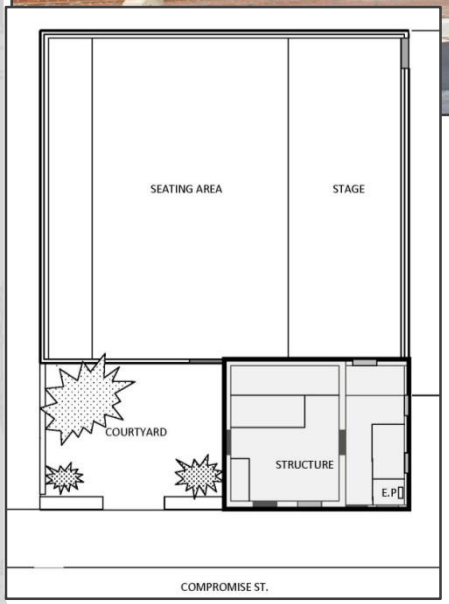
BUILDING SECTION (at Grade)

Not to Scale

US Army Corps of Engineers.

U.S.ARMY

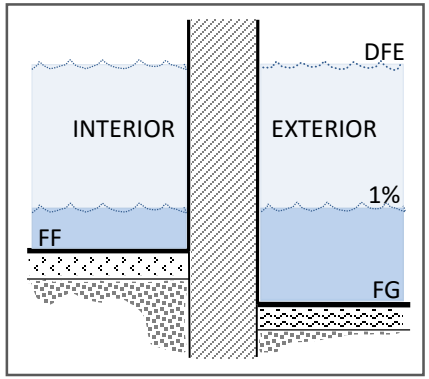
Interior Opening



SITE PLAN
Not to Scale

Annapolis Summer Garden Theater

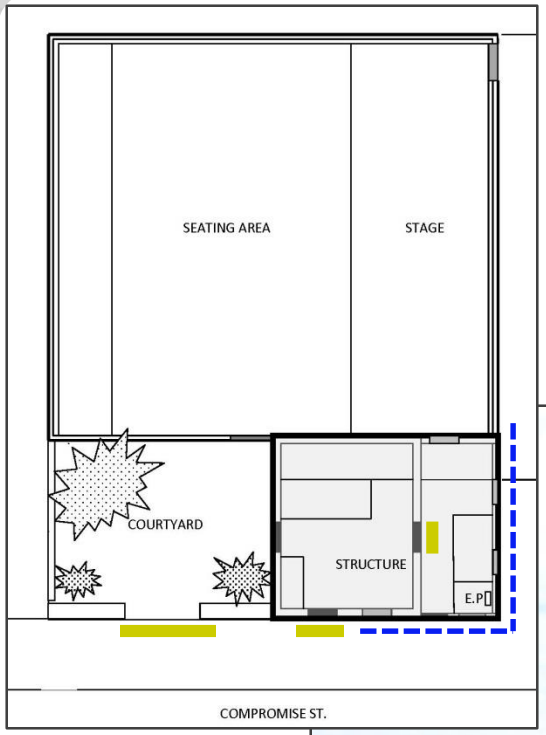
143 Compromise Street



BUILDING SECTION (at Grade)
Not to Scale

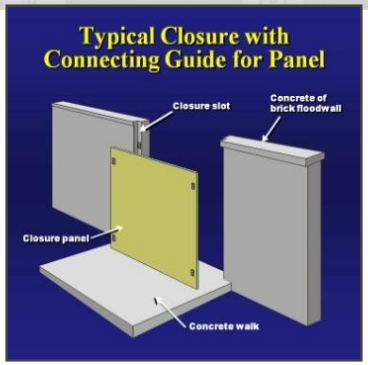
US Army Corps of Engineers.

U.S.ARMY



SITE PLAN
Not to Scale

Elevated Equipment



Closure/Shield

Temporary Barrier

Annapolis Summer Garden Theater

US Army Corps of Engineers.

U.S.ARMY

ELLICOTT CITY STUDY

15-20 sample buildings

- Main Street corridor between Patapsco River and US 29
- Considerations include:
  - Flood risk
  - Historic status
  - Commercial vs. residential
  - Architectural features
  - Warning time

General flood proofing concept plans and preliminary cost estimates to be developed for each building

Study scheduled for completion in fall 2017 (September/October)

US Army Corps of Engineers.

U.S.ARMY

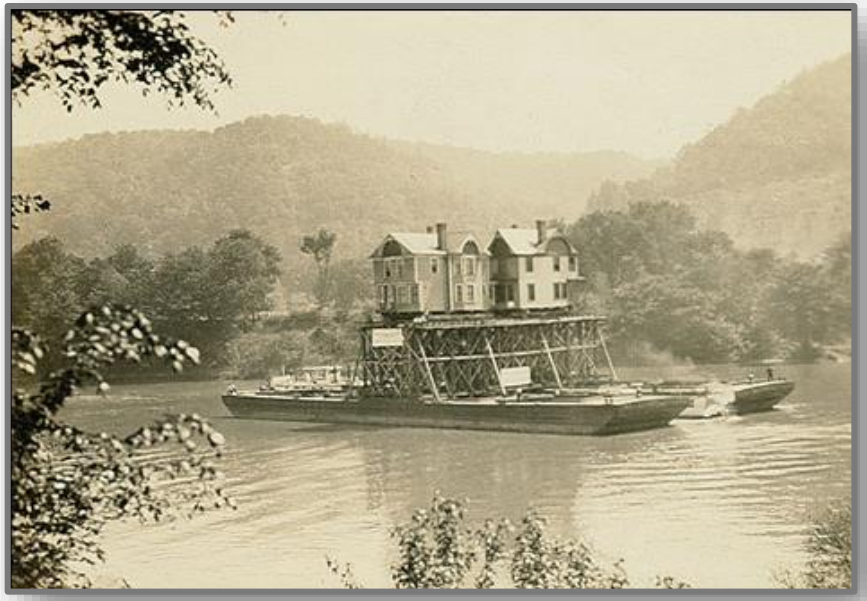
QUESTIONS & DISCUSSION

Points of Contact

Stacey Underwood, FPMS Program Manager
410-313-6413
stacey.m.underwood@usace.army.mil

Ray Tracy, Civil Engineer
410-962-6114
raymond.m.tracy@usace.army.mil

Eva Falls, Archeologist
410-962-4458
eva.e.falls@usace.army.mil



THANK YOU!