TESTING THE WATERS:

CHALLENGES ACHIEVING RESILIENCY

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AGENDA

- Welcome & Introduction
- Overview of Traditional Strategies
- Local Policy & Code
  - Unintended Consequences
  - Exemptions & Responsible Approach
- Case Studies in Hampton Roads
  - Mowbray Arch Residence
  - Surrey Crescent Residence
  - Filer Street Residence
  - Municipal House Museum
- Future Work
- Questions

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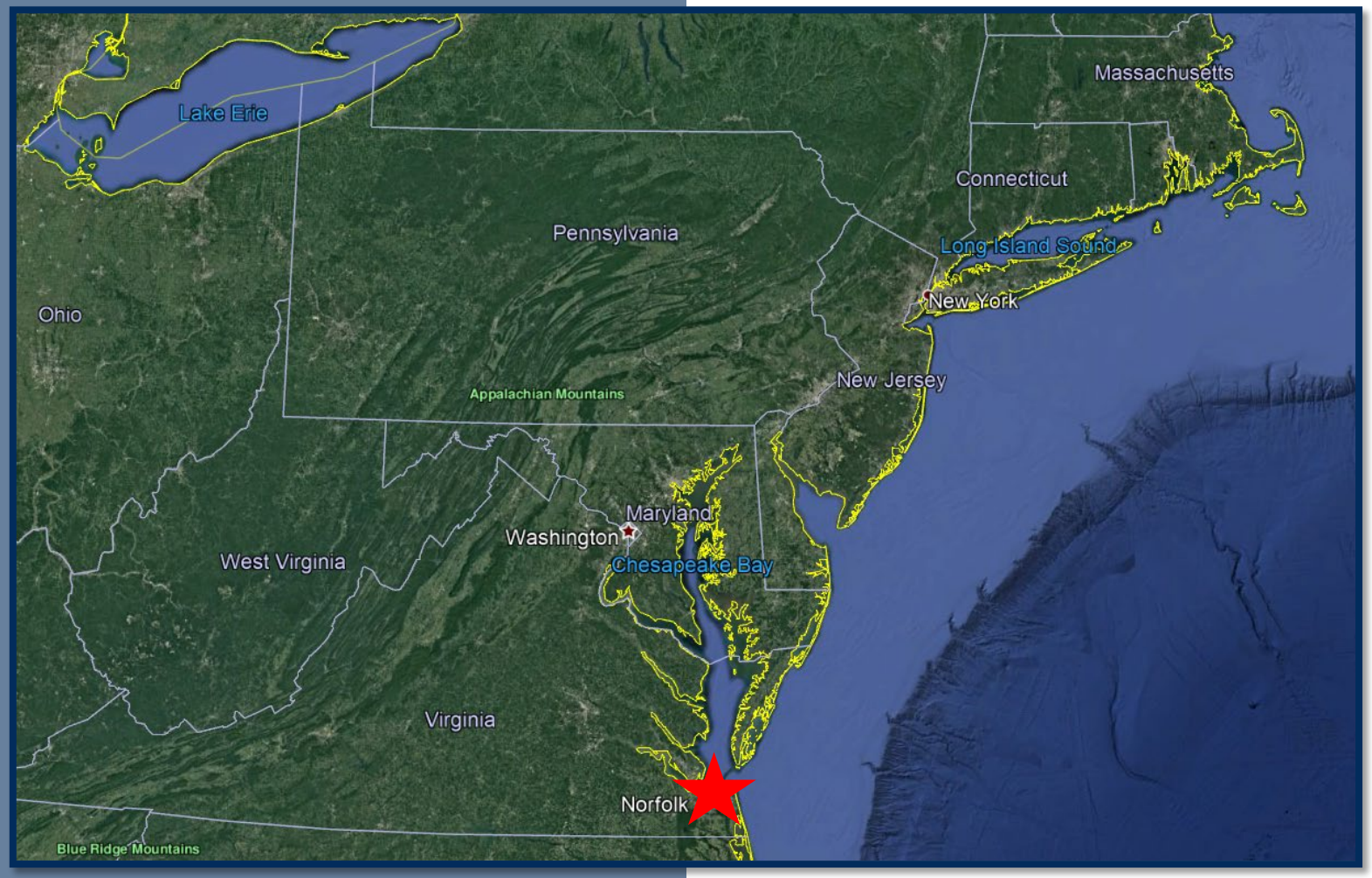
INTRODUCTION

- Paige Pollard
  - Principal, Commonwealth Preservation Group
  - Co-owner, Building Resilient Solutions
- Building Resilient Solutions
  - Joint Venture between:
    - Commonwealth Preservation Group
    - Museum Resources Construction and Millwork
  - Established in 2018
  - RISE Coastal Community Challenge Grant Recipient in 2019
  - Specializing in:
    - Building and Site Analysis
    - Monitoring and Testing
    - Providing Informed Retrofit Solutions

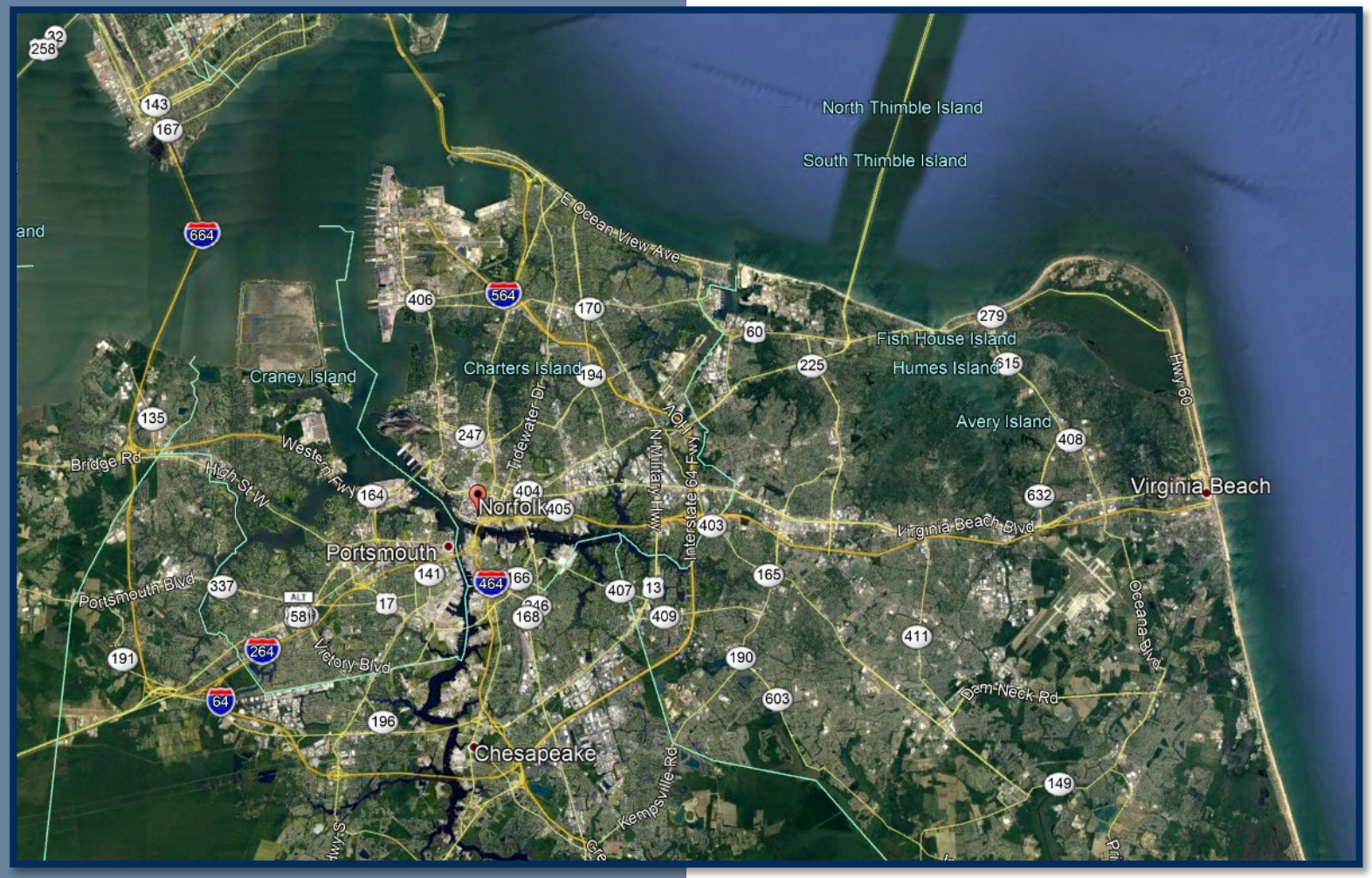
ORIENTING HAMPTON ROADS



Hampton Roads

- Southeast corner of Virginia
- Along the Atlantic Ocean
- At the mouth of the Chesapeake Bay

ORIENTING HAMPTON ROADS



Norfolk & Virginia Beach

- Norfolk has approximately 144 miles of shoreline (including lakes, rivers, inlets, and bay)
- Virginia Beach has approximately 31 miles (not including lakes and rivers) with the majority running along the Atlantic Ocean

OVERVIEW OF TRADITIONAL STRATEGIES: FEMA Rate Reduction Options

Utilities

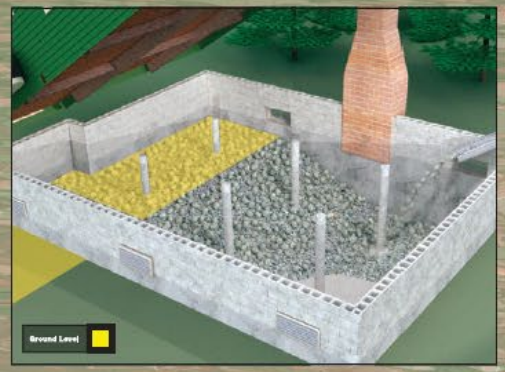
If you locate any machinery or equipment that services your building (i.e., electrical, heating, ventilation, plumbing, and air conditioning equipment) below the base flood elevation, an additional surcharge will be added to your insurance premium causing your annual insurance rates to increase. If your house was elevated to a safer level, maximize your savings and reduce your losses by relocating your machinery and equipment above the base flood elevation. Consider using your attic, an extra closet, or an elevated platform (as shown) to store utilities.

For more information on relocating utilities see FEMA publication 259: Engineering Principles and Practices of Retrofitting Floodprone Residential Structures

Flood Openings

One common reason why insurance policies are rated so severely is due to a lack of proper flood openings. IBC/IRC minimum building code requirements for "foundation vents" in areas outside the floodplain may not meet the same specifications as "flood openings" or "flood vents" within a floodplain. For buildings in the floodplain, there must be at least two openings with 1 sq. inch of opening per sq ft of enclosed area, and the bottom of those openings can be no higher than 1 ft above the exterior finished grade. There are no discounts for "partial credit." If you have 1000 sq feet of enclosed crawlspace and 900 sq inches of openings, you will be charged as though there are no openings (i.e., basement loading fees could apply). Don't forget that garage doors, windows, and doors do not count as flood openings unless they have openings installed within them.

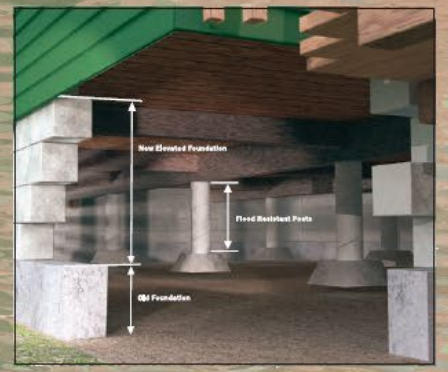
For more information on flood openings, see FEMA Technical Bulletin 1-93



Basements

Unless explicitly authorized, basements in new buildings constructed in the floodplain are prohibited. FEMA considers "crawlspaces" that are sub-grade on all sides to be basements as well. If your community has adopted building standards that allows such construction, homeowners in the floodplain with an excavated sub-grade crawlspace will bear an additional financial burden through a 15-20% increase on their flood insurance premiums. When building, you can save that cost by backfilling any excavated areas within the foundation. It can also be done at a later date by using pea-gravel or other suitable material to raise the interior crawlspace floor elevation to the same height or higher than the exterior finished grade.

For more information on basements, see FEMA Technical Bulletin 11-01



Elevation

Elevating above the base flood elevation is the fastest way to reduce the cost of your annual flood insurance premium. You can save hundreds of dollars for every foot the elevated floor is located above your community's established base flood elevation. Elevating just one foot above the base flood elevation often results in a 30% reduction in annual premiums. A homeowner with an elevated home, like the one shown on this poster with its first floor elevated 3 feet above the base flood elevation, can expect to save 60% or more on annual flood insurance premiums.

For more information on elevation, see FEMA Technical Bulletin 2-93

Relocation

One of the most effective options is relocating your home on an area of your property that has its natural grade above the base flood elevation. This method may be costly, but can reduce or eliminate the need to pay flood insurance entirely. If you are preparing to build a new home or structure, evaluate your property to determine if there is a suitable building area outside of the floodplain. Be warned; homes constructed outside the floodplain (or on natural ground above the base flood elevation) are not 100% safe from flooding. On average, between 20-25% of all flood insurance claim payouts go to buildings that are located outside of the special flood hazard area. If your home is located outside the floodplain and you still want to be covered, affordable "Preferred Risk" policies are available.

For more information on relocation, see FEMA Technical Manual 312, Homeowner's Guide to Retrofitting.

NORFOLK ZONING ORDINANCE

Updated in 2018

Touted as most resilient zoning ordinance in the nation

2019 APA award for best implementation of sustainability & resilience in an adopted law, policy or tool

Provides increased risk reduction and protection measures for all properties and development

Implements FEMA exemption allowances for historic properties

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VIRGINIA CODE UPDATE

Building Code Updates

Starting September 4, 2019, any new construction or substantial improvements will have to be built to the same standards as ones in the highest-risk coastal areas, said Jeff Brown, the director for the State Building Code Office.

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UNINTENDED CONSEQUENCES

Impact properties indiscriminately

Trigger not limited to flood related events

Loss of historic inherently resilient building materials

Enter permanent cycle of replacement with disposable materials

Property value reduction

Impact to real estate assessment

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EXEMPTION ELIGIBILITY

A property must be listed on the:

National Register of Historic Places,

Virginia Landmarks Register,

OR

as a landmark or contributing within a locally designated historic district….

Must Demonstrate that….

Repair or rehabilitation would preclude the structure's continued designation as a contributing resource

AND

Propose alternative strategies to reduce risk

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MAINTAINING A RESPONSIBLE APPROACH

- Exemption is not a free pass
- Design community must balance ethical standards with risk and solutions
- Responsibility to identify alternate, more effective, protective measures
- Opportunity to realize more cost effective and tailored retrofit solutions
- Exemption requests and alternative approaches should be site specific

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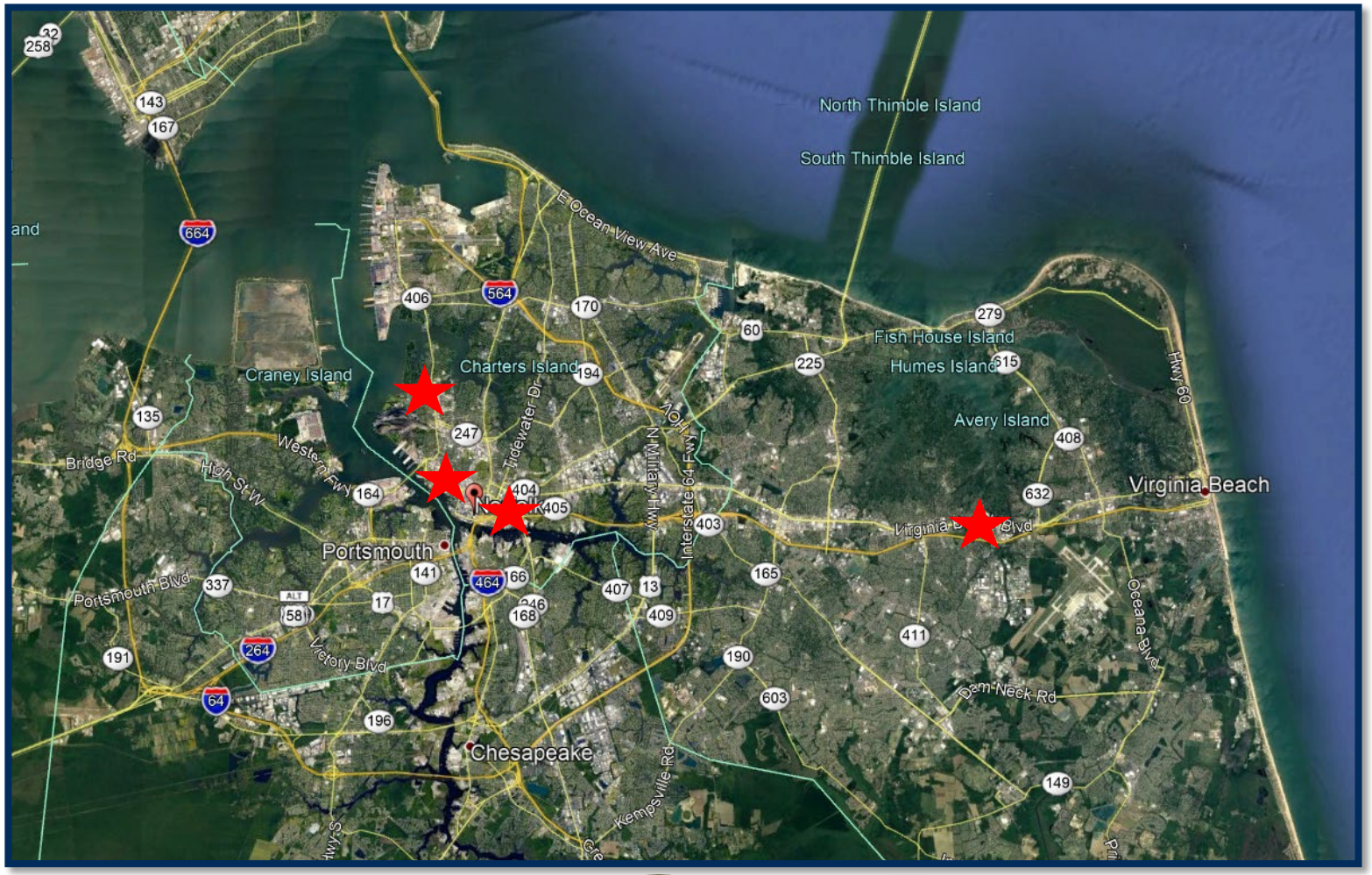
CASE STUDY LOCATIONS



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CASE STUDY 1:
GHENT RESIDENCE

- Directly across from The Hauge waterway
- House Built: c1901
- Historic District Designation(s):
  - Ghent Historic District (Local District)
  - Ghent Historic District (Virginia Landmarks Register)
  - Ghent Historic District (National Register of Historic Places)
  - Potentially eligible for exemption
- Reason for initial contact between client and CPG/MR/BRS:
  - Powdering of the brick on both interior and exterior elevations

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CASE STUDY 1:
GHENT RESIDENCE

- Flood Zone: AE (High Risk)
- Base Flood Elevation: 8 feet
- Design Flood Elevation: 11 feet
- First Story Floor Level: 4 feet
- No known FEMA NFIP claims
- Initial Assessment:
  - Limited pervious area
  - Exterior brick and mortar deterioration
  - Interior basement deterioration

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CASE STUDY 1:
GHENT RESIDENCE

Property Owner Goals:

- Retain long-term ownership of property
  - Capacity and willingness to invest
- Supports necessary remediation of home
  - Groundwater penetration
  - Foundation masonry deterioration
  - Stabilization of building and its value

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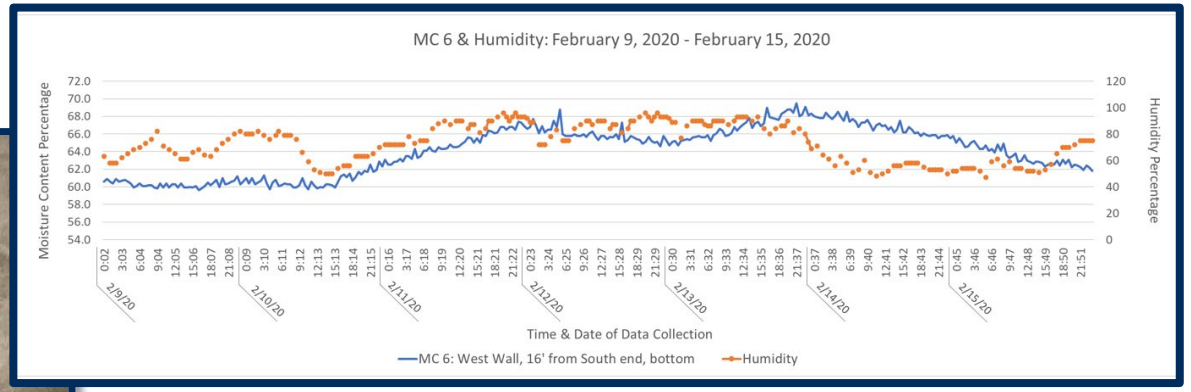
CASE STUDY 1: GHENT RESIDENCE

Monitoring the site:

- Equipment installed for 81 days
- Continuous measurements
- Seven probes
- Tidal positions
- Temperature
- Relative humidity



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CASE STUDY 1: GHENT RESIDENCE

Findings:

- Soil and brick moisture content impacted by tidal position, temperature, and relative humidity
- Rain events compound water accumulation
- Most significant impact is the forced movement of moisture up the masonry column

Conclusion: The focus of the retrofits should be based on eliminating introduction of ground water and improving the evaporation of moisture from the surrounding soils

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CASE STUDY 1: GHENT RESIDENCE

Recommendations:

- Alter the grade around the structure
- Remove all organic ground covers
- Remove all or a portion of the concrete pad along the west elevation
- Repair gutter leaders
- Redirect HVAC drainage
- Add sloped roof covering over cellar entrance/repair door (make watertight)
- Repoint and repair masonry

Reinstall monitoring equipment and reassess

- Potential 2nd campaign:
  - Explore adding sacrificial layer of lime plaster on west exterior wall

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CASE STUDY 2:
CHESTERFIELD HEIGHTS RESIDENCE

- Directly north of the Elizabeth River
- House Built: c1921
- Historic District Designation(s):
  - Chesterfield Heights Historic District (Virginia Landmarks Register)
  - Chesterfield Heights Historic District (National Register of Historic Places)
  - Potentially eligible for exemption
- Reason for initial contact between client and CPG/MR/BRS:
  - Disruption and damage from multiple significant flood events in a short period

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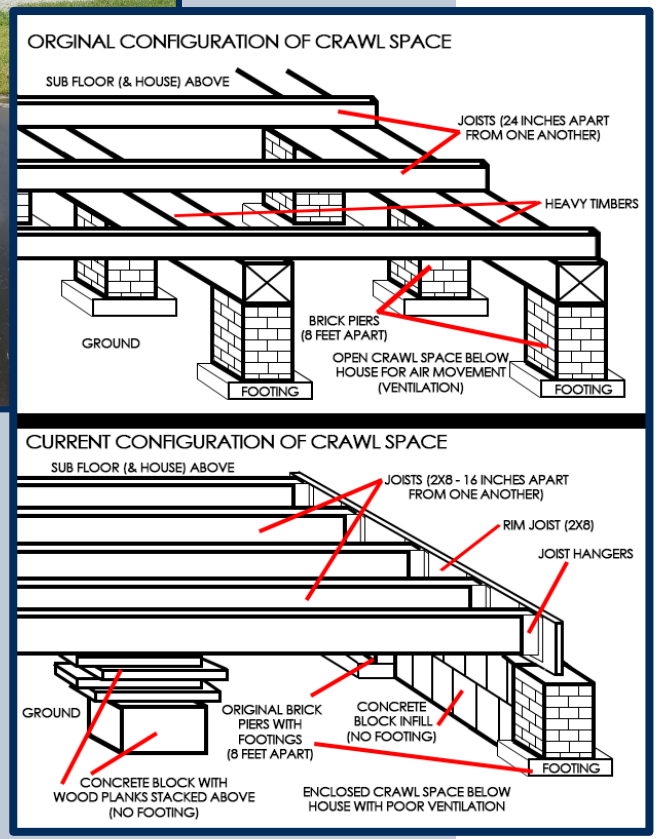
CASE STUDY 2:
CHESTERFIELD HEIGHTS RESIDENCE



- Flood Zone: AE (High Risk)
- Base Flood Elevation: 9 feet
- Design Flood Elevation: 12 feet
- First Story Floor Level: 4 feet
- Second Story Floor Level: 13 feet
  - 1 foot above DFE
- Two FEMA NFIP claims since 2009
  - Repetitive Loss Property
- Initial Assessment:
  - Neighboring new construction impacting client's home
  - Previous NFIP funded repairs did not address underlying factors
  - Replacement material issues from previous work

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CASE STUDY 2:
CHESTERFIELD HEIGHTS RESIDENCE

Property Owner Goals:

- Strong desire to age in place with elderly parent
  - Accessibility concerns
- Balance value over necessary flood protection
  - Cannot sell house due to flood history
  - Correct previous NFIP funded repairs and also perform backlog maintenance needs
  - Reduce future flood damage

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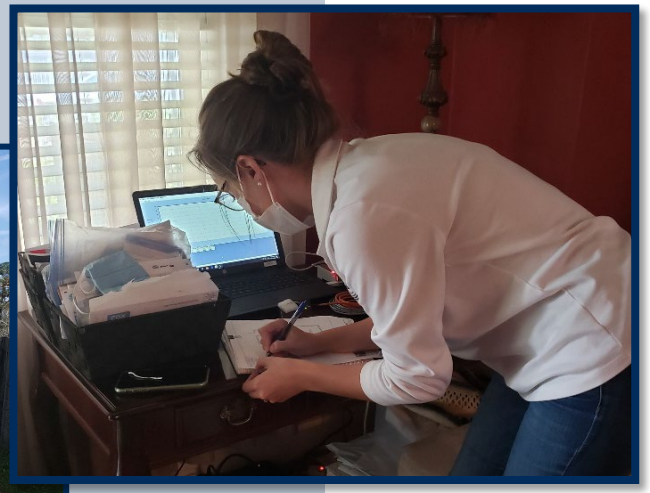
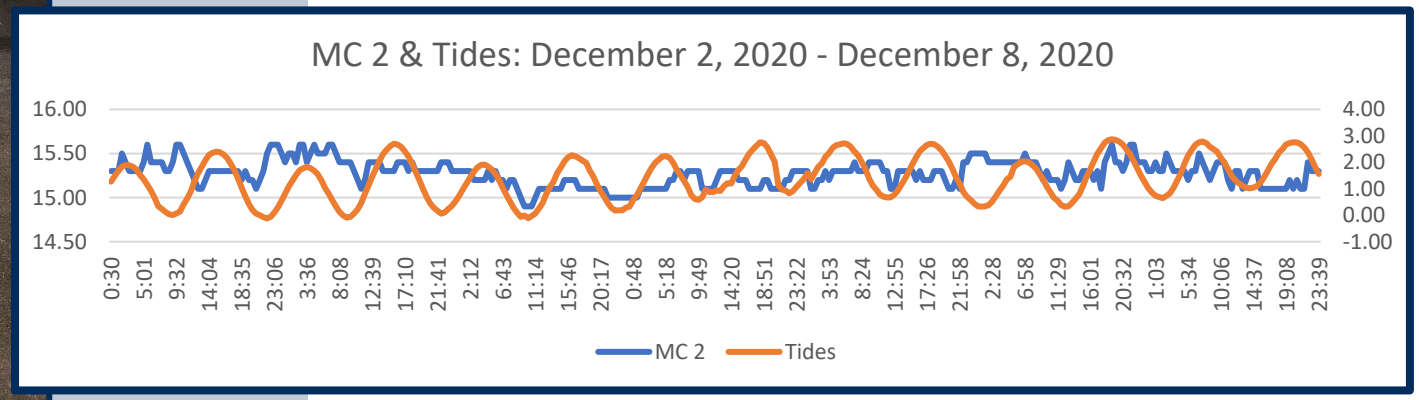
CASE STUDY 2:
CHESTERFIELD HEIGHTS RESIDENCE



Monitoring the site:

- Equipment installed for 41 days
- Continuous measurements
- Eight probes
- Tidal positions
- Temperature
- Relative humidity



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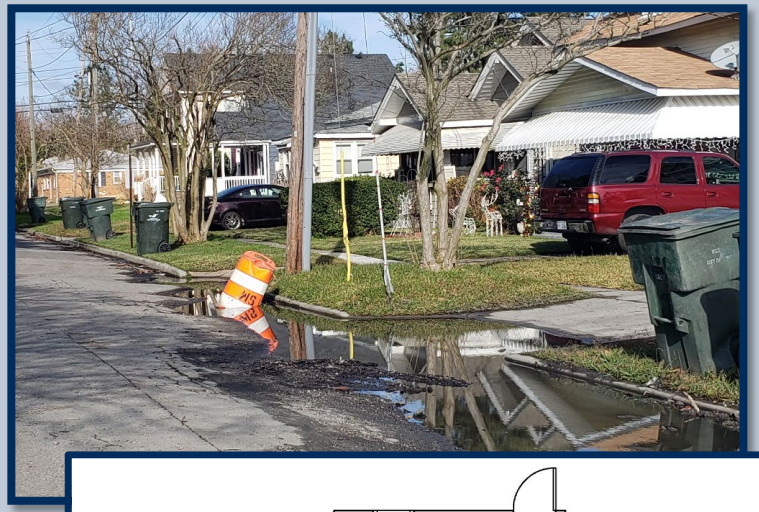
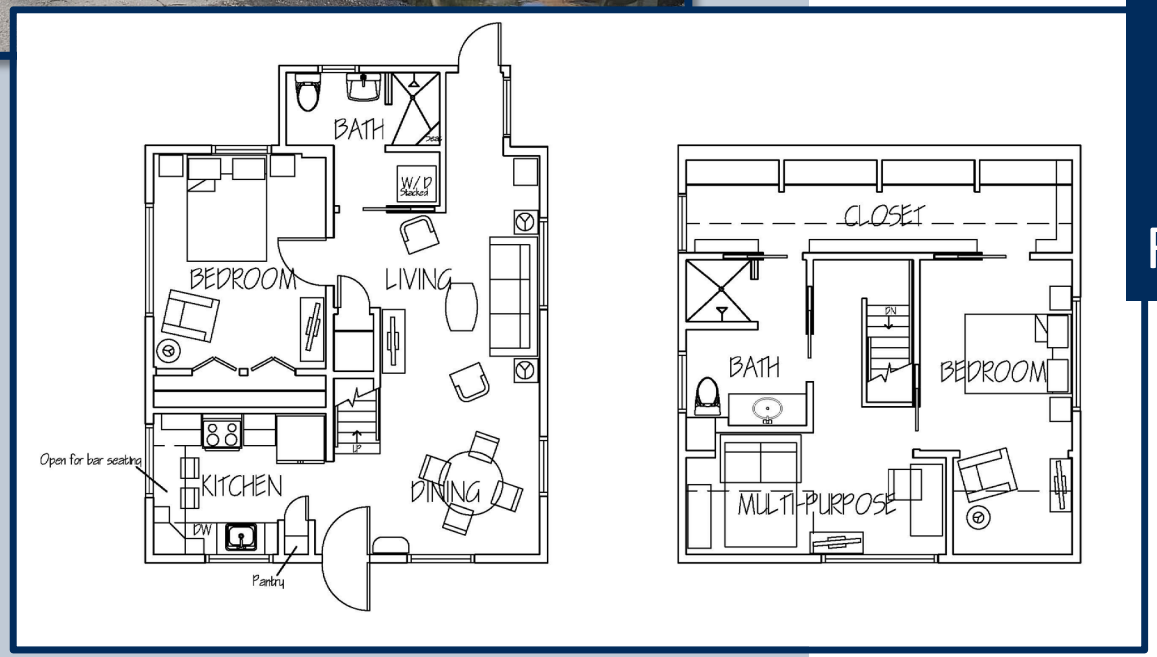
CASE STUDY 2:
CHESTERFIELD HEIGHTS RESIDENCE





Recommendations:

- Apply for a Historic Structure in SFHA Exemption
- Repair previous NFIP funded foundation work
- Incorporation of surrounding infrastructure improvements to site plan and grading
- Utilization of resilient materials on exterior and interior
- Roof repair
- Mechanical equipment will be raised above BFE
- Universal design for aging in place

Reinstall monitoring equipment and reassess

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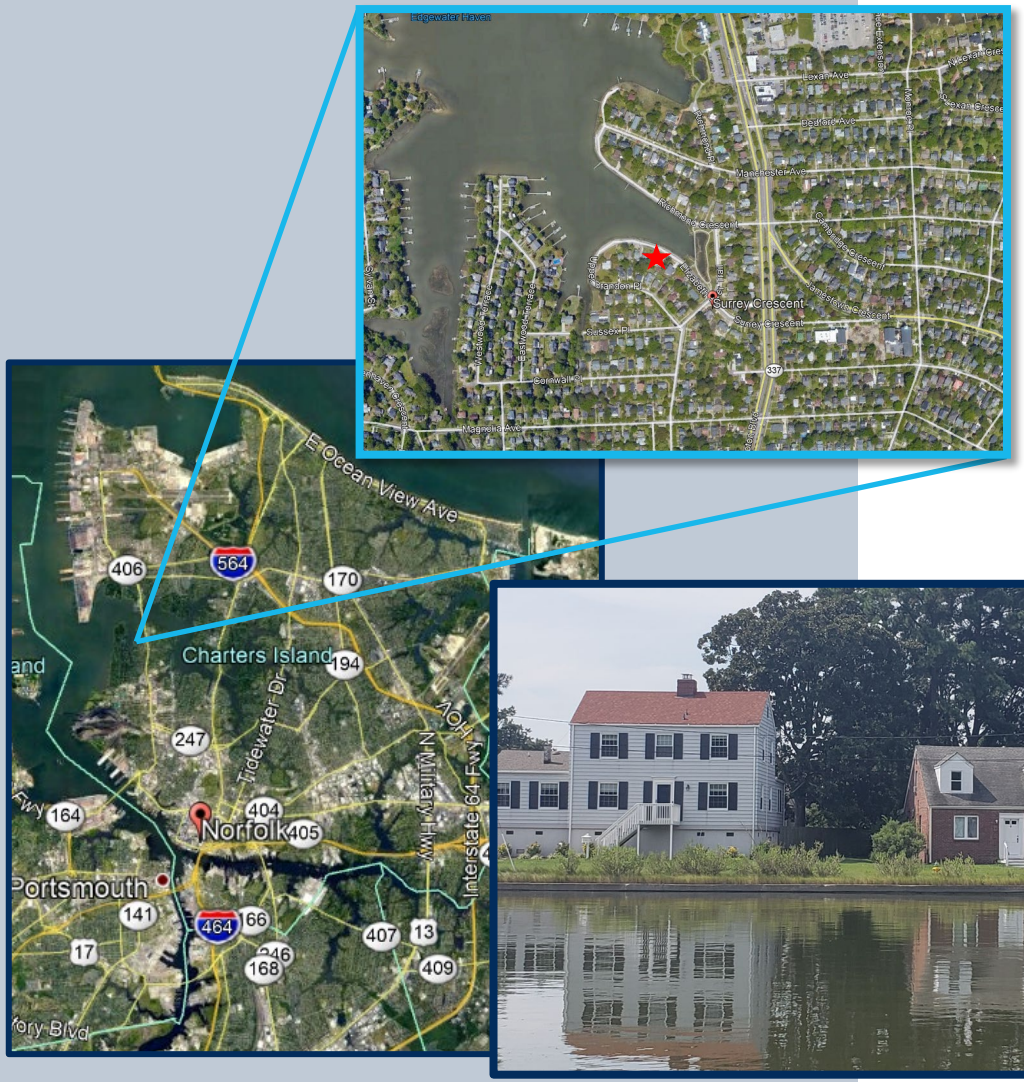
CASE STUDY 3:
LARCHMONT RESIDENCE



- Along an inlet south of Lafayette River
- House Built: c1953
- Historic District Designation(s):
  - No Historic Designations
- Rental property:
  - Not eligible for NFIP funded elevation or buyout
  - During 12 years of ownership, flooding occurred twice
    - Each time resulted in less than 6 inches of water in building for less than 2 hours duration

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CASE STUDY 3:
LARCHMONT RESIDENCE

- Flood Zone: AE (High Risk)
- Base Flood Elevation: 9 feet
- Design Flood Elevation: 12 feet
- First Story Floor Level: 3 feet
- Second Story Floor Level: 12 feet
  - Approximately at DFE
- Property Concerns:
  - Has been for sale off and on every year since 2017
  - Sunny day flooding more than once a month, limiting access to property
  - Majority of adjacent properties are primary residences that have been raised using FEMA funding

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CASE STUDY 3:
LARCHMONT RESIDENCE

Property Owner Observations:

- First flood remediation funded with NFIP claim
- NFIP claim resulted in removal of historic floor framing, flooring, and plaster
  - Property owner deemed this a mistake
- Property owner maintains flood insurance, but self-funded remediation of second flood to implement new approach which did not meet NFIP requirements

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CASE STUDY 3:
LARCHMONT RESIDENCE

Property Owner Approach:

- Doesn't believe flood impacts warrant cost to elevate
- Privately funded retrofits
- Limit disruption of tenants
- Predictable cost and duration
  - $8,000 per flood
  - 30 days

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CASE STUDY 4:
MUNICIPAL HOUSE MUSEUM

- Landlocked in north central Virginia Beach
- House Built: c1805
- Historic District Designation(s):
  - Local Historic District
  - Individual Virginia Landmarks Register
  - Individual National Register of Historic Places
  - Potentially eligible for exemption
- Reason for initial contact between client and CPG/MR/BRS:
  - Serving as a historic preservation consultant on major renovation

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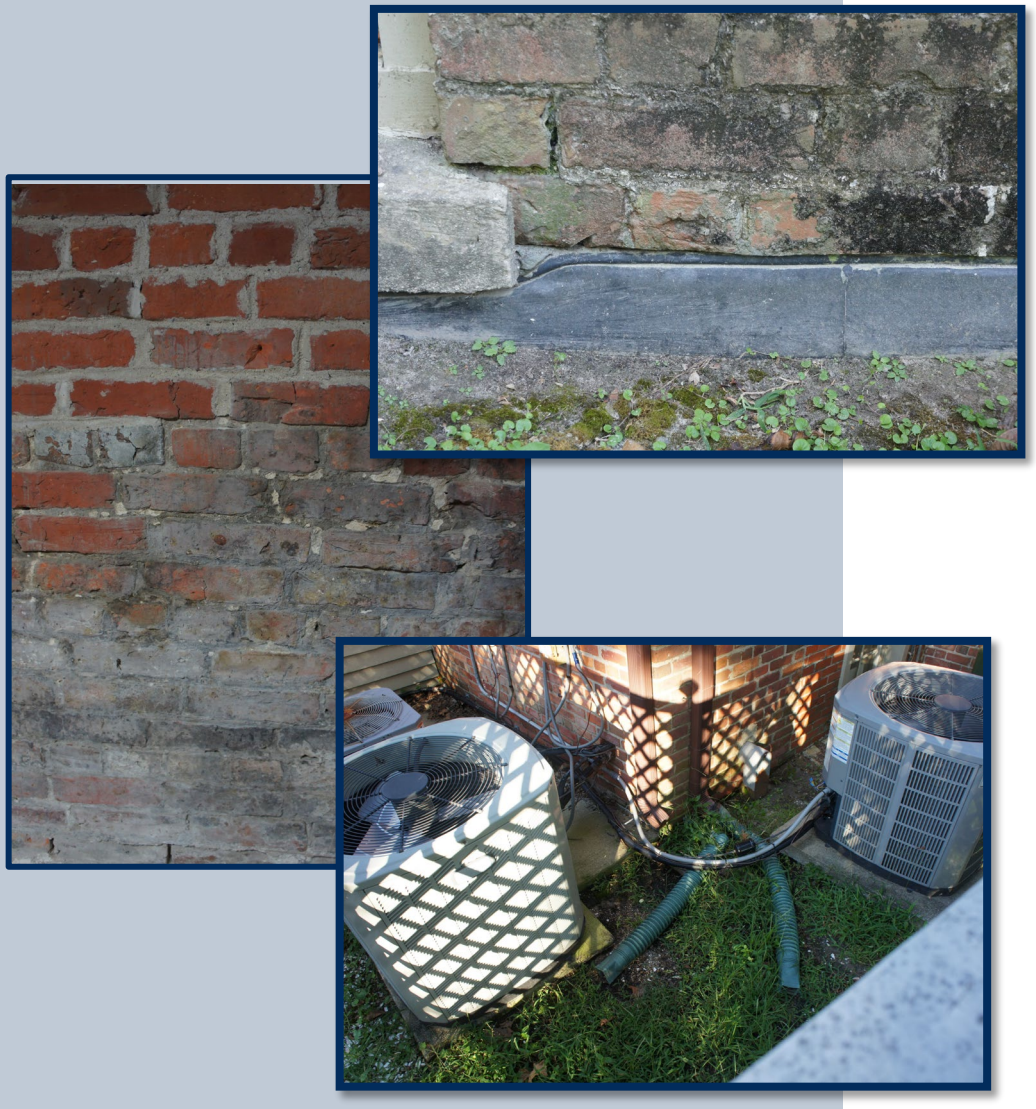
CASE STUDY 4:
MUNICIPAL HOUSE MUSEUM



- 1950s:
  - Basement renovation – concrete floor then tiled
- Late 1970s and Early 2010s:
  - Installation of moisture barriers during rehabilitation projects
- 2020 Renovation
  - proposed materials replacement similar to above work
- Initial Assessment:
  - Previous renovations and maintenance issues contributed to historic material degradation
  - No initial testing performed before renovation plans
  - Proposed work does not address cause of moisture issues, rather applied contemporary solution to a historic building that would likely cause same damage

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CASE STUDY 4:
MUNICIPAL HOUSE MUSEUM

Property Owner Goals:

- Retain and restore historic materials
  - Decrease and limit moisture retention
- Test site to determine water infiltration sources
  - Address questions of drainage, moisture dynamics, and interior climate
  - Seek recommendations based on testing to make informed decision on appropriate rehabilitation procedures

Foresee long-term ownership

- Okay with some regular maintenance not requiring special skills

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CASE STUDY 4:
MUNICIPAL HOUSE MUSEUM

- Monitoring the site:
  - Equipment installed for 36-40 days
  - Soil moisture monitors measured for 26 days
  - Continuous measurements
  - Probes distributed throughout basement
  - Tidal position measurements
  - Temperature
  - Relative humidity

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CASE STUDY 4:
MUNICIPAL HOUSE MUSEUM

Findings – multiple conditions contributing to moisture problem:

- Poor drainage
- Poor grading
- Organic material near foundation walls
- Earlier waterproofing efforts failed
- Addition of the concrete slab forced more moisture up the masonry column, adding to the problem
- Unregulated RH in basement

Conclusion: Reinstalling similar waterproofing modern materials will not abate the issues. Also, current grading has brought water to building rather than away from it.

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CASE STUDY 4:
MUNICIPAL HOUSE MUSEUM

- Recommendations:
  - Apply for a Historic Structure in SFHA Exemption
  - Reutilize found culvert pipe for site drainage
  - Regrade site and remove organic material from house perimeter
  - Install and repair gutter system
  - Remove existing moisture barrier and clean brick; apply vapor-permeable membrane
  - Elevate HVAC units to allow for evaporation
  - Remove concrete slab in basement and install porous material under a brick floor
  - Perimeter underground drainage system
- Reinstall monitoring equipment and reassess

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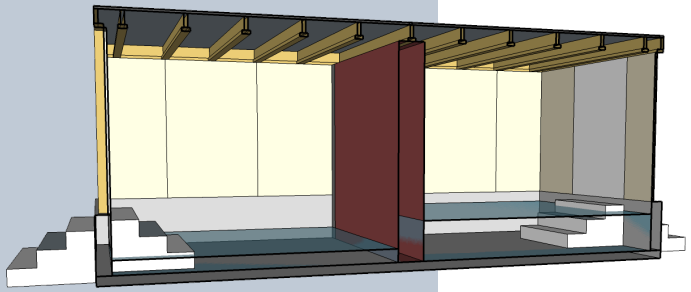
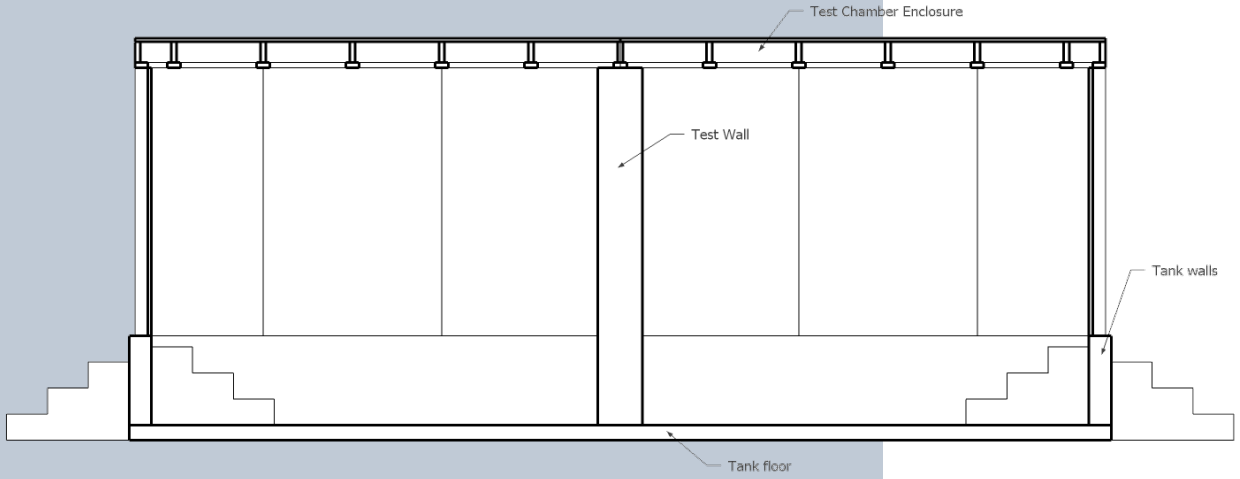
TESTING LAB – OPERATIONAL IN 2021





Opportunity to test alternative retrofits

- Water infiltration prevention assemblies
- Materials wet/dry analysis as well as survivability
- Insulation
- Flood proofing
- Moisture analysis
- Relative humidity for developing best post event solutions

Resulting in thoughtful, informed retrofit solutions.

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QUESTIONS?

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