THE TOWN OF
PULASKI
VIRGINIA

NONSTRUCTURAL FLOOD RISK MANAMGEMENT ASSESSMENT

FRIENDS OF PEAK CREEK

SILVER JACKETS

US Army Corps of Engineers
Huntington District

Virginia Silver Jackets
FINAL
December 2020

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APPENDICES:

1. INTRODUCTION

The Town of Pulaski, Virginia (the Town) has been impacted by numerous flood events since its incorporation in 1886. The Town was developed along Peak Creak, and the development that occurred over time may have increased the potential for flooding. In the downtown commercial district, many of the structures were built in areas with a high risk for flood damages. A Silver Jackets project was initiated to investigate potential nonstructural, structural and nature-based flood risk management measures for use in the project area due to the high risk of flooding. During the preparation of the of this report, the Town and surrounding areas of Pulaski County experienced two major flooding events and a few additional minor ones. The issue of flood mitigation is ever-present in the area and remains a high priority for the members of the Town Council.

The focus of this project was a reconnaissance level nonstructural flood risk management (FRM) assessment. Reconnaissance was completed on 12 sample structures that were chosen by the Town, and readily available data and information was used by the project team to identify potential actions that may help manage flood risk in the Town.

To summarize, some of the potential remedial actions for these structures include the following: basement abandonment, structure elevation, elevation of the first floor, dry floodproofing, wet floodproofing, and barriers (flood walls). The potential actions identified in the report will provide a resource for the property owners to understand some of the nonstructural flood risk management options that may be suitable for the sample structures and other similar structures.

The Town has implemented several projects, to reduce its flood risk. These improvements have helped, but they have not reduced the risk and the potential impacts of flooding to the community to tolerable levels. Given the history of flooding in the Town, and the recent trend of storm events of greater intensity and longer duration across the United States, future flood events are likely to occur and may have the potential to be more devastating than past events. Identifying the potential flood risk and planning to manage that risk are the first steps to implementing a solution to increase resiliency and decrease the devastating effects of flooding.

The Silver Jackets program works to promote participation by U.S. Army Corps of Engineers (USACE) staff in small efforts undertaken in conjunction with other partners in order to achieve flood risk management benefits that could not be achieved by any one partner alone. Silver Jackets is an innovative program that brings together multiple state, federal, and sometimes tribal and local agencies, to learn from each other and jointly apply resources to reduce flood risk. The Virginia Silver Jackets program mission is to reduce flood risk within the Commonwealth by identifying and resolving flood hazards through such methods as flood observation and warning systems, planning, flood hazard mapping, flood hazard mitigation, and detention dams. It also includes flood response and recovery activities. The intent of this Virginia Silver Jackets project is to assist in addressing the Town's flooding problems and help increase public awareness and potentially initiate future actions to reduce flood risk, including a larger holistic FRM project.

1.1 PURPOSE AND NEED

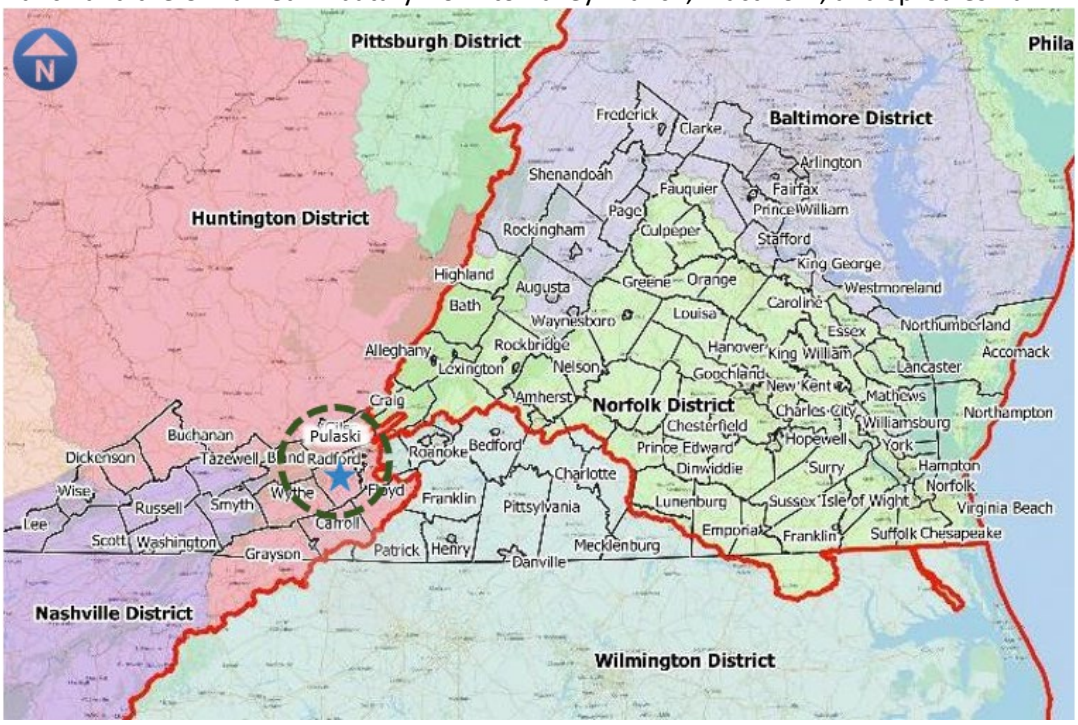
The purpose of this project is to conduct a nonstructural flood risk management assessment for the Town of Pulaski, Pulaski County, Virginia (the Town) to reduce flood risk. The project is a conceptual level assessment that focuses on adapting to flood risk (nonstructural flood risk management), but also explores potential modifications to flood characteristics and the floodplain (structural and nature-based Flood Risk Management (FRM), and low impact development (LID) or green infrastructure) to reduce risk associated with flooding.

1.2 PROJECT LOCATION

Pulaski County, Virginia is in a mountainous area of southwestern Virginia, and within the New River Valley (the New River Watershed). The New River Watershed in Southwestern Virginia is in the USACE – Huntington District Area of Responsibility (AOR). The Town is in the west-central portion of Pulaski County. The Peak Creek watershed is the main source of flooding in the Town.

Peak Creek (the Creek) flows through forest, farmland, and urban area. The Creek has a drainage area of over 60 square miles and meanders over 26 miles from its source in Jefferson National Forest into Claytor Lake, which is a major component of the New River. Flowing north, the New River enters the Kanawha River in southeastern West Virginia, which flows the northwest to the Ohio River.

The Creek flows through the center of the Town, from west to east. At least two tributaries from the north and one tributary from the south enter Peak Creek within the Town. Water supply reservoirs, low head dams, a historic channel structure and road and rail crossings constructed over time in the Peak Creek watershed influence the stream conveyance. The tributaries of Peak Creek in the project area include: Valley Branch and the Unnamed Tributary No. 1 to Valley Branch, Tract Fork, and Sproules Run.



Town of Pulaski, Virginia Coordinates: 37.050094°N 80.772193°W
Figure 1 – Location Map – The Town of Pulaski, Pulaski County, Virginia

2. PROJECT SCOPE

Project activities included the following:

- Coordination with stakeholders.
- Collection and documentation of readily available data.
- Conducted site visit(s) to collect or verify data.
- Conducted structure assessments.
- Analyzed and documented observations and potential actions.
- Developed a report.
- Participated in public outreach.

Project scope and activities did not include the following:

- It is beyond the scope of this assessment to determine the costs or economic feasibility associated with implementing any the potential FRM techniques identified in this report.
- It is beyond the scope of this assessment to conduct structural assessments or develop hydraulic analysis associated with implementing any the potential FRM techniques identified in this report.

2.1 STAKEHOLDER CONCERNS

- Riverine flooding from Peak Creek and its tributaries.
- Flash flooding – Valley Branch and Calfee Park.
- New flood mapping issues.
- Existing environmental issues.

2.2 PROBLEMS

- Riverine flooding – The majority of the downtown business district is within the boundaries of the regulatory floodplain. Past flood events have caused substantial damage properties, severe financial loss and impacted business viability or sustainability.
- Flash flooding from tributaries of Peak Creek affect several areas of the downtown business district and areas of the surrounding community. Development appears to have impacted or overwhelmed the existing storm water infrastructure. Underground stormwater infrastructure is not consistently mapped, making improvements challenging.
- Stream modifications and community development over time have impacted hydrology of Peak Creek and its tributaries. Changed hydrology may have increased flood risk in the downtown business district and areas of the surrounding community.

2.3 OPPORTUNITIES

- Promote community collaboration and preparedness against flood risk.
- Identifying potential green infrastructure and nature-based measures to benefit the community, the environment, and water quality.
- Stream restoration, water quality, and nature-based solutions.
- Help town and property owners to prioritize actions to reduce flood risk.

2.4 OBJECTIVES

- Minimize risk to the community, increase public awareness, and improve resiliency to flood risk.
- Identify potential nonstructural FRM measures for sample structures to reduce flood risk.

- Identify potential structural and nature based FRM measures to reduce flood risk.
- Identify potential low impact development/green infrastructure to reduce flood risk.
- Minimize environmental impacts associated with potential proposed FRM measures.

2.5 CHALLENGES AND CONSTRAINTS

- Flood risk – The majority of the Downtown District is in the regulatory floodplain.
- Stream relocation and historic channel, Fill, Underground streams – When the area that is now downtown Pulaski, Virginia was acquired for development by the Pulaski Land and Improvement Company in the 1880s, Peak Creek meandered through the area to be developed. The company re-channeled the creek to a straight course through the area and constructed walls of native limestone to contain the creek. These walls have stood for 130+ years, are local historic landmarks and are privately owned thus restricting the Towns ability to maintain or modify them
- Historic Commercial District & Structures: The Town's downtown commercial district and several structures in the project area are on the National Register for Historic places.
- Hazardous Material: Based on conversations with project partners, it is possible that deposits of hazardous material from past industry may exist in and around the project area.
- Structures in the watershed are impacting natural conveyance of water through the waterways including, but not limited to, multiple low head dams, railroad trestle, stream culverts, and roadway bridges.
- New development impacting stormwater runoff and overwhelming existing stormwater infrastructure and tributary streams.
- Survey data for first floor elevations was not available for the flood prone structures in the project area.

3. STRUCTURE (BUILDING) CHARACTERISTICS & CONSIDERATIONS

- The structures to be assessed were selected by the Town during the project kick-off meeting.
- A site visit was conducted to observe structures.
- Photographs were taken during field visits to document the structures and assist with determining structure characteristics.
- LiDAR data was used to estimate surface elevations (low adjacent grade and assist in a determination of the estimated first floor elevations of the assessed structures). The first-floor elevations were verified and adjusted based on field observations. See Appendix B for Surface/Structure Elevation Data.
- Cultural Resources (Aesthetic/ Historic Significance): the Pulaski Historic Commercial District is a national historic district.
- Critical Facilities: If critical facilities become inoperable during a flood event, the area of impact extends beyond the area of flooding (i.e. hospitals, fire and rescue, energy, communications, water and wastewater, etc.).
- HTRW (Hazardous, Toxic and Radioactive Waste): Environmental investigations (Phase I and Phase II Environmental Site Assessments) have been conducted on several properties in the project area by a consulting firm under a USEPA Brownfield Assessment Grant. The results of these investigations are not being presented in this report; however, the information gleaned from these investigations should be considered prior to implementation of FRM measures.
- Special conditions: Flood, site, and structure characteristics may impact the feasibility of implementing common FRM measures, thereby requiring special attention or consideration of alternative FRM measures.

3.1 NONSTRUCTURAL FLOOD RISK MANAGEMENT

The focus of this assessment is on nonstructural measures which modify or reduce consequences to help manage flood risk. Consequences in flood prone areas can be reduced by modifying the characteristics of vulnerable structures or modifying the behavior of people living in or near floodplains. Nonstructural measures do not modify the characteristics of floods (stage, velocity, duration) nor do they induce development in a floodplain that is inconsistent with reducing flood risk. Common nonstructural FRM measures for consideration include removing structures from the floodplain by relocation or acquisition; elevating structures; wet or dry floodproofing structures; implementing flood warning and emergency preparedness activities; and implementing floodplain regulation. They may be permanent or temporary and passive or active measures that can be implemented to prevent or reduce flood damage. Many of these nonstructural measures could be implemented in the Town of Pulaski, especially dry floodproofing or elevating first floors in many of the structures.

Nonstructural FRM measures are also categorized as sets of physical or nonphysical measures. The physical measures are action taken to change the built environment such as structure modifications. Nonphysical measures are typically applied to manage and regulate floodplain development and to educate, prepare for and warn about potential flood risk. Both categories are generally compliant with the NFIP and cause little to no effects to the floodplain, flood stages, velocities, or the environment. Common physical and nonphysical nonstructural FRM measures are listed below:

Common **Physical** nonstructural FRM measures include, but are not limited to:

- Acquisition
- Relocation
- Basement Abandonment

- Elevation
- Elevation First Floor
- Dry Flood Proof
- Wet Flood Proof
- Temporary Barriers – removable/portable barrier systems
- Flood Warning Systems, Preparedness Education, and Evacuation Planning
- Land Acquisition
- Floodplain Regulation and Floodplain Management
- Flood Risk Education, Communication, and Awareness

Common **Nonphysical** nonstructural FRM measures include, but are not limited to:

- Flood Warning Messaging, Preparedness Messaging, and Evacuation Plans
- Floodplain regulations and floodplain management
- Flood Insurance (NFIP or Private)
- Flood risk education, communication, and awareness

Nonstructural FRM measures can be applied as a single measure or in combination with one another or with structural measures to reduce flood risk. The range of benefits, costs, and residual damages associated with application of each measure is broad. The extent and severity of social and economic impacts associated with the various measures can be likewise broad and must be identified for any plan.

The consequences associated with locating damageable property and people within floodplain areas can be extreme. Within the context of this assessment, an objective is to identify strategies and measures that can be used in tandem to reduce flood risk in the Town of Pulaski. Some strategies and measures may be more suited for Federal action while others will be more attuned to local regulatory action and administration. In either case, these measures must be effective, socially acceptable, environmentally suitable, and mindful of the existing neighborhood and community social and economic systems within which they would be implemented. It is the intent of this assessment to identify such nonstructural measures.

4. OBSERVATIONS AND ASSUMPTIONS

The Town identified 12 sample structures that had readily available project information and data. Next, field visits were conducted by Silver Jackets team members in the project area in order to 1) observe the individual characteristics and condition of the sample structures, 2) observe the watershed and existing stream conditions and infrastructure upstream and downstream of the Town, and 3) to observe the existing stormwater infrastructure development and land use in the Town.

4.1 SAMPLE STRUCTURES

The site visits allowed Silver Jackets team members to observe each structure from the exterior, and in some cases the interior as well, to visually observe the structures. Structure and site conditions, as well as flood elevations, were compiled with field observations onto structure data/assessment sheets. The compiled information on the structure data/assessment sheets helped to demonstrate the potential flood risk and were used to identify potential nonstructural measures to reduce flood risk.

4.1.1 **FLOOD CHARACTERISTICS** – The source of the most major historic floods in the Project area is due to significant rainfall within the watersheds being conveyed along Peak Creek and its tributaries. The draft regulatory (1%) floodplain was the target event for this assessment to determine flood depth and boundaries. The draft 1% flood within the project area is flashy and relatively shallow (+/- 4 feet maximum).

4.1.2 **STRUCTURE CHARACTERISTICS** – Structures within the Town and surrounding areas consists of residential, commercial, and governmental or public development. Basements and crawl spaces exist in some of the structures. Age of development is from very old (historic significance) to relatively new.

4.1.3 **SITE CHARATERISTICS** – Much of the downtown commercial district, adjacent to Peak Creek, was developed on reclaimed wetland areas. Many structures have foundations that are set on fill material. The depth of the fill is not uniform, and contents of the fill are not known with certainty. Also, hazardous materials were reported in soil samples taken from near the project area and are discussed in the Phase I and II Environmental Site Assessments that were conducted under the USEPA Brownfields Assessment Grant.

5. COMMON NONSTRUCTURAL FRM MEASURES

As stated above, in Section 3.1, common nonstructural FRM measures were considered for reducing flood risk. Individual flood, site, and structure characteristics would be considered to determine if the measure meets the criteria necessary to address needs for a given location prior to implementation.

5.1 TYPICAL NONSTRUCTURAL FRM ASSESSMENT CONSIDERATIONS

Every structure is unique and there are many influences on a flood prone structure that must be evaluated in order to determine the type of nonstructural FRM mitigation measure(s) to consider and the feasibility of implementation. Review and confirmation of the flood problem(s), site conditions, and the features of each structure help determine which nonstructural mitigation measures are most appropriate for the individual situation and location. The basic influences include flood, site, and structure characteristics. Below are some examples of characteristics that were considered during the FRM Assessment:

- Flood Characteristics – Depth, velocity, rate of rise, duration, floodway, debris impact.
- Site Characteristics – Urban/rural, freestanding/connected, topography, site size/accessibility, proximately to flood source, soil type, modifications.
- Structure Characteristics – Occupancy, construction, foundation type, wall openings, condition, first floor construction and configuration (basement/crawl space/slab-on-grade) HVAC and electrical equipment location, heating fuel type openings.
- Other Considerations – Building Codes; Zoning Ordinances and Local Restrictions; aesthetics and historic significance, other Agencies (Local, State, and Federal); Public Health, Safety, and Welfare; future conditions.

The simultaneous review and analysis of the considerations identified above provides a conceptual visualization of the structure and the flood risk associated with it and essential to identifying potential nonstructural FRM mitigation measures.

Table 1 – SAMPLE STRUCTURES/GENERAL INFORMATION				
ID #	Address	Occupancy Classification	Critical Facility	Notes
1	One Magnox Dr.	Non-Residential		Vacant/Historic
2	143 Third St., NW	Non-Residential	X	County Offices
3	45 Third St., N.W.	Non-Residential	X	Courthouse
4	52 W. Main St.	Non-Residential	X	Courthouse/Historic
5	246 N Washington Ave. B	Non-Residential		Offices
6	85/87/89 W Main St.	Non-Residential		Vacant/Under Construction
7	69 W Main St.	Non-Residential		Vacant/Dilapidated
8	67 W Main St.	Non-Residential		Vacant/Dilapidated
9	117 Jefferson Ave N	Non-Residential	X	Fire Station/Historic/Relocating
10	42 1st St. NW	Non-Residential	X	Town Municipal Offices
11	110 N Washington Ave	Non-Residential		Vacant/Historic/Dilapidated
12	89 Commerce St.	Non-Residential	X	Emergency Operations/Above BFE

Table 2 – SAMPLE STRUCTURES/FLOOD ELEVATION DATA							
ID #	Address	FF	LAG	BF/CS	BFE (1%)	DFE (1%+1')	Flood Risk
1	One Magnox Dr.	1918.00'	1915.60'	1915.00'	1918.30'	417.0	1.30'
2	143 Third St., NW	1922.10'	1914.50'	1911.60'	1915.00'	1916.00'	4.40'
3	45 Third St., N.W.	1913.50'	1911.00'	1903.50'	1914.00	1915.00'	1.50'
4	52 W. Main St.	1916.00'	1911.20'	1906.00'	1914.00'	1915.00'	9.00'
5	246 N Washington Ave. B	1910.00'	1909.50'	1900.00'	1913.20'	1914.20'	14.2'
6	85/87/89 W Main St.	1911.50'	1911.50'	1903.50'	1914.50'	1915.50'	12.00'
7	69 W Main St.	1911.90'	1911.20'	1909.90'	1914.00'	1915.00'	5.10'
8	67 W Main St.	1911.90'	1911.20'	1909.90'	1914.00'	1915.00'	5.10'
9	117 Jefferson Ave N	1914.80'	1912.80'	NA	1915.00'	1916.00'	1.20'
10	42 1st St. NW	1912.80'	1911.00'	1902.80'	1914.00'	1915.00'	12.20'
11	110 N Washington Ave	1913.10'	1911.50'	1903.10'	1913.20'	1914.20'	10.10'
12	89 Commerce St.	1916.50'	1912.50'	NA	1914.50'	1915.50'	(1.00')

ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated

5.2 NONSTRUCTURAL FRM MITIGATION DECISION MATRIX

The nonstructural FRM mitigation decision matrix is a tool to assist in making preliminary decisions for potential nonstructural FRM mitigation opportunities. It helps to filter the best solutions based on the project flood, structure, site and other considerations. This figure is included with each of the sample structure information pages in Appendix B.

5.3 POTENTIAL OF NONSTRUCTURAL FRM MEASURES

Based on the data collected for the 12 sample structures and the potential depth of flooding for the 1% annual chance exceedance flood event, the proposed potential mitigation measures are identified in Table 3 – Potential Nonstructural Mitigation Measures. The heart of the nonstructural assessment regarding the recommended nonstructural FRM measure for each of the sample structures is provided in Appendix B which contains the individual inventory/assessment sheets for each structure. See "Nonstructural Floodproofing Concept Sheets" in Appendix B for detailed documentation and analysis of the potential nonstructural mitigation measures for each of the sample structures.

Table 3 – SAMPLE STRUCTURES/POTENTIAL NONSTRUCTURAL FRM MITIGATION MEASURES

ID #	Address	Occupancy Type	Potential Mitigation Measure
1	One Magnox Dr.	Non-Residential	Dry Flood Proof (FP)
2	143 Third St., NW	Non-Residential	Barrier (Wall)
3	45 Third St., N.W.	Non-Residential	Barrier (Wall)
4	52 W. Main St.	Non-Residential	Barrier (Wall)
5	246 N Washington Ave. B	Non-Residential	Dry Flood Proof (FP)
6	85/87/89 W Main St.	Non-Residential	Abandon Basement (Fill)/Dry Flood Proof
7	69 W Main St.	Non-Residential	Abandon Crawl Space (Fill)/Dry Flood Proof
8	67 W Main St.	Non-Residential	Abandon Crawl Space (Fill)/Dry Flood Proof
9	117 Jefferson Ave N	Non-Residential	Wet FP/Elevated floor (Office area)
10	42 1st St. NW	Non-Residential	Dry Flood proof (FP)/Barrier (Wall)
11	110 N Washington Ave	Non-Residential	Abandon Crawl Space (Fill)/Dry Flood Proof
12	89 Commerce Street	Non-Residential	No Action Required – Dry FP (Optional)

As a function of the nonstructural flood risk management assessment, the primary characteristics of flooding, such as rate of rise, depth, velocity and duration, were combined with structure attributes for each of the 12 sample structures to determine the flood risk for the target 1% annual chance exceedance flood event. From this information potential nonstructural flood risk management measures for each structure could be determined. Basement abandonment, dry floodproofing, elevation of first floors, permanent barriers (walls) were the nonstructural measures most appropriate for potential actions to

reduce flood risk for the assessed sample structures. One of these was identified for each of the sample structures, which could be implemented to reduce flood risk. Appendix B contains copies of the individual assessment sheet for each of the 12 sample structures which document observations, considerations and identify and describe the potential nonstructural FRM measure in detail.

6. OTHER CONSIDERATIONS AND RECOMMENDATIONS

Some other considerations for the project area include the following: 1) Pulaski Historic Commercial District is a national historic district, 2) roughly half of the sample structures are considered to be critical facilities, 3) hazardous materials testing has not been completed on soils in the project area, and 4) several of the sample structures have significant HVAC equipment in their basements that is not feasible to relocate or convert to new flood safe systems, and other structures in the area are also likely to have similarly located HVAC equipment.

6.1 THE CANAL

The Town is bisected by Peak Creek. As stated previously, the stream in the current downtown area was modified and relocated to straighten the canal during the late 1800's. The stone channel walls were constructed to create a canal to confine the Creek and the adjacent low-lying wetland terrain was filled, thus allowing development to the edge of the stream. Based on discussions with the Project Partners, much of the fill material that was used to build up the former low-lying wetland terrain consisted of slag from local industrial sources. The canal and the walls have historic significance and are privately owned.

The stream meanders from small sediment islands at the upstream end of the canal to a shallow pool and a flattened stream bed, followed by low head dam at the downstream end. The dam appears to be restricting sediment transport, thus allowing sediment to collect in the canal over time. The regulatory floodway takes up the full girth of the canal. The stone walls of the canal are in poor condition and disrepair at several locations. Vegetation and trees have been allowed to grow in some of the joints between stones, possibly affecting its stability and integrity.

Development encroaches to the edge of the walls and, in some instances, on top of the wall. The structures adjacent to the stream are the central business district area of the Town and include some local government public services as well. The central business district is a national historic district many individual structures along the canal have historic significance.

6.2 GATEWOOD DAM/RESERVOIR

Gatewood Dam was completed in 1958. It is located on Peak Creek in Pulaski County, west of the Town of Pulaski. Construction of the dam resulted in the additional creation of Gatewood Reservoir, a 162-acre water supply impoundment that is owned by the Town. The dam and reservoir are upstream of the Town, within its boundaries. Control of water flow is limited. Water level that exceeds capacity of the reservoir flows out via the spillway that is located on top of the dam. The existing outflow structure is utilized to maintain minimal stream flow or restrict flow when water conservation is required in order to maintain water supply. The outlet structure mechanism appeared to be in disrepair when it was observed during the site visits for this project. It does not appear to be a viable option to flood control for the Town. Other dams exist in the watershed. They are much smaller in detention capacity, are used for water supply, and are not believed to be a viable option for consideration to reduce flood risk for the Town. It was outside the scope of this study to evaluate the structural integrity of or to recommend operational changes to any dam as an FRM measure.

6.3 LOW HEAD DAMS AND STREAM OBSTRUCTIONS

Numerous low head dams exist in the watershed in addition to the one identified previously at downstream end of the canal. They were constructed to restrict stream flow pond water to serve as a consistent source of water supply for various industries. The industries are no longer in operation and these dams are no longer used for their original purpose. These dams may have an impact on local flooding. Due to possible sediment contamination concerns from previous industry in the area, impacts from disturbance of the sediment surrounding the low head dams will have to be taken into consideration if the dams are to be removed in the future.

Other stream obstructions should also be noted. Low water stream crossings (roadway) and utility pipes (sewer or water) cross the stream at several locations. Most are located at, or just above, the stream at normal levels of flow. They restrict natural stream flow, snag debris and impact sediment transport, potentially impacting flood risk.

6.4 STREAM CROSSINGS:

There are many stream and tributary crossing in the project area. They include the elevated bridge crossings connect both sides of the Town divided by Peak Creek. The crossings are typically multi-spans on in-stream piers and have significant clearance between the stream and the bridge structure.

6.5 DEBRIS AND OBSTRUCTION REMOVAL

The Friends of Peak Creek have active members who organize and lead regular events to clean up debris from the Peak Creek and its tributaries within the project area to reduce obstructions. These efforts help keep the water flowing which potentially reduces flood risk.

- Sediment buildup was observed at the upstream end of the canal (Peak Creek) and at several locations along the tributaries the feed into it. The project partners indicated the canal was dredged in the past to remove sediment. The sediment buildup in the canal appears to be an adverse effect of the low head dam the downstream end of the channel. Sediment buildup upstream of other low head dams in the project area was also observed. Sediment buildup in the tributaries was observed at stream crossings where culverts where utilized to convey the stream under roads and railways. In some cases, the culverts were filled with sediment, and appear to be restricting water flow and causing localized flash flooding.
- Miscellaneous debris and trash was observed beneath several bridge structures.
- Large trees that have fallen at the downstream end of the canal add debris that restricts the flow of water in the Creek and may add to flood risk. Vegetation, including vines and trees with trunks of up to six inches, were observed growing through cracks in the stone walls of the canal. The vegetation is slowly degrading the canal walls, which may impact their stability and sustainability. The Town representative indicated the walls were owned by private citizens and the Town has limited ability to perform maintenance on the canal walls.

6.6 STORMWATER INFRUSTRUCTURE AND DEVELOPMENT

The Town expressed great interest in reducing flood risk associated with stormwater management issues, as well as improving stream ecosystem and water quality. These are believed to be priorities to the Town revitalization and sustainability efforts. Much of the focus was in areas along the Valley Branch Tributary adjacent to the Raymond F. Ratcliffe Memorial Transportation Museum and the Unnamed Tributary No.1 (to Valley Branch) at Calfee Park. These areas have been inundated by flash flooding on a regular basis and a viable solution to mitigate this issue is most desired. The town indicated a need for mapping the existing stormwater infrastructure to better understand needs and priorities.

The Valley Branch Tributary and the Unnamed Tributary No.1 (to Valley Branch) at Calfee Park were evaluated for potential mitigation strategies and actions to reduce runoff and flood risk.

6.6.1 Valley Branch – The Valley Branch road crossing (adjacent to the Raymond F. Ratcliffe Memorial Transportation Museum) is a 90-degree concrete box culvert. The town indicated it regularly backs up, overflows into the adjacent street and inundates surrounding areas causing significant localized flooding. The culvert was observed to be full of sediment reducing its flow capacity by half or more. The 90-degree change in direction inside the culvert appears to be impeding water flow and causing stream sediment to drop and settle in the culvert. A buildup of sediment upstream and downstream of the culvert was also observed. The downstream sedimentation appears to be restricting conveyance and negatively impacting its ecosystem.

6.6.2 Calfee Park – Calfee Park is the location of a historic minor league baseball stadium and is situated adjacent to the Unnamed Tributary No. 1 (to Valley Branch). A significant amount of impermeable paved parking surrounds the stadium, and new development (new paved areas and buried pipe in the tributary) appears to be increasing runoff and causing flash flooding at the stadium and in areas downstream and flowing into Valley branch and Peak Creak. The tributary is diverted underground into a metal drainage pipe. The Town indicated past storm events have overwhelmed the drainage pipe and diverted runoff into the parking lots and the stadium. The Town was pursuing mitigation grants to assist with mitigating this issue.

6.7 GREEN SPACE/URBAN GARDENS

Green space and urban gardens, as well as several small and pocket parks, were observed throughout the Town and along Peak Creek. Sidewalk tree planter boxes line Main Street within the downtown business district. A vacant lot between buildings downtown was being utilized as a dog park. The town has made considerable efforts to consider and implement Green Infrastructure and Low Impact Development techniques into the community. These efforts are a great start to incorporating natural processes to help manage storm water and could be enhanced to provide additional benefits.

6.8 STORMWATER RETENTION

Several locations upstream and downstream of the Town appeared to be potential locations to consider for installation of stormwater retention basins. These could be in-stream or adjacent to stream basins. Retention basins could provide additional storage during high water events. Though this action might provide some flood risk reduction during minor flood events and nuisance flooding, they would not likely reduce risk for major or historic flood events. Soil contamination could be a potential roadblock to implementing this action.

6.9 GREEN INFRASTRUCTURE, LOW IMPACTED DEVELOPMENT, AND NATURE BASED FRM

Throughout the execution of this project, several locations included large areas that were paved with impermeable materials. Some of these areas were already impacted by stormwater management issues and additional stormwater management actions have not been implemented to address additional runoff. The Silver Jackets team suggests considering permeable options for implementation to help manage addition stormwater runoff. This includes considering replacement of currently paved areas with permeable alternatives and choosing more permeable options in future development and redevelopment areas.

7. CONCLUSIONS

The Town of Pulaski, Virginia is located along the banks of Peak Creak and its tributaries, where numerous residential and nonresidential structures are located within the 1% annual exceedance floodplain. The stream bisects the Town, flowing through the downtown commercial district putting businesses and property owners at high risk of incurring extensive damages from flooding. Reducing risk associated with localized flooding associated with stormwater runoff and overflowing tributaries was also investigated as priority by the Town. The USACE-Huntington District partnered with the Town of Pulaski and the Friends of Peak Creek on a Virginia Silver Jackets nonstructural flood risk management assessment to identify potential nonstructural measures on a sampling of 12 structures located within the Special Flood Hazard zone. Although nonstructural flood risk management was the primary focus of this assessment, reconnaissance level structural and nature-based flood risk management measures were also considered for potential actions to reduce flood risk for the Town.

As a function of the nonstructural flood risk management assessment, the primary characteristics of flooding, such as rate of rise, depth, velocity and duration, were combined with structure attributes for each of the 12 sample structures to determine the flood risk for the target 1% annual chance exceedance flood event. From this information potential nonstructural flood risk management measures for each structure could be determined. Basement abandonment, Dry flood proof, elevation of first floors, permanent barriers (walls) were the nonstructural measures most appropriate for potential actions to reduce flood risk for the assessed sample structures. At least one option was identified for each of the sample structures, that could be implemented to reduce flood risk. Appendix A contains copies of the individual assessment sheet for each of the 12 sample structures which identify the potential nonstructural FRM measure for consideration.

As this assessment was being completed, new draft floodplain mapping by FEMA indicated an expansion of the Special Flood Hazard zone boundaries in the area of the of sample structure #12 (89 Commerce St. – Emergency Operations Center). Data used for this report indicates discrepancies between the FEMA mapping (base flood elevation) and ground /structure first floor elevations. The Town may want to request that FEMA reevaluate this area and the Special Flood Hazard zone boundaries.

In order for the Town of Pulaski to achieve the greatest amount of flood risk reduction possible, it may be reasonable for the Town to consider structural features such as channel modifications, removal of existing in-stream infrastructure, and retention basin to reduce flood elevations and contain flooding to within the general channel area. These measures should be further investigated in a larger study.

In areas of the Valley Branch tributary and Calfee Park, stormwater runoff appears to be causing localized flooding. Infrastructure mapping, modifying of the existing infrastructure (such as the box culvert adjacent to the transportation museum), and implementing low impact development and green infrastructure practices may help to reduce runoff and the localized flooding. These measures should be further investigated in a larger study.

8. REFERENCES

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Phase II Environmental Site Assessment- Revision 1 143 West Main Street, Pulaski, Virginia Draper Aden Associates Project No. B07226-05/08 USEPA Brownfields Assessment Grant Number: # BF – 963327-01-0 (2018).

APPENDIX A

Educational Documents for Possible Nonstructural Measures

Nonstructural Flood Risk Management Measures: Dry Flood Proofing

Image Source: FEMA

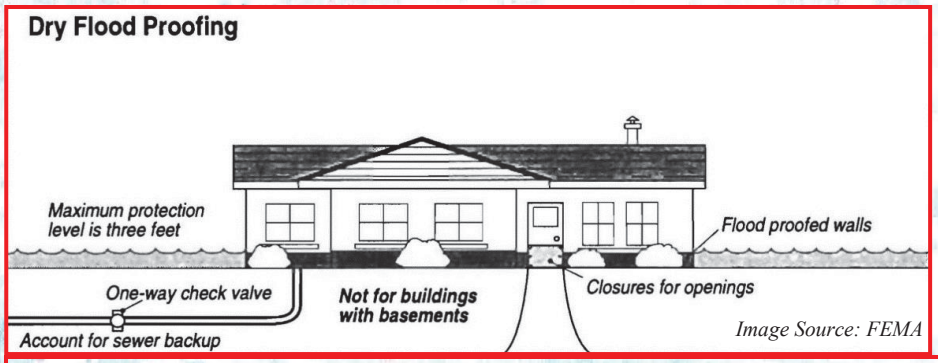


Image Source: FEMA

APPLICABILITY:

Dry flood proofing is generally applicable to any building that does not have a basement or crawl spaces, has substantially impermeable walls, and has walls and a foundation that are strong enough to resist a hydrostatic load up to the flood proofing height and lateral/shear loads from fast moving flood waters. Buildings with concrete or masonry exterior walls are the best candidates for dry flood proofing. Conventionally framed buildings typically lack sufficient strength to resist the hydrostatic load and are difficult to waterproof, which may lead to further moisture control issues in the structure. Dry flood proofing is not recommended for Coastal V-zone. It is generally applicable for flood depths of 3-4 feet of flooding and flood velocities less than 3 ft. /s.

TYPES OF FLOODING MITIGATED:

1. **Coastal/Storm Surge**
2. **Riverine**
3. **Stormwater**

DESCRIPTION:

Dry flood proofing consists of waterproofing a structure up to a design depth to reduce the probability that the building interior will be inundated. Dry flood proofing can generally manage flood risk up to a height of 3-4 feet on the exterior walls, after which point the hydrostatic load on the walls may be sufficiently high enough to cause structural damage. Buildings may be dry flood proofed above the 3 foot line if a full structural analysis is performed and the walls are found to have sufficient strength. Full structural analysis should also be performed if flood velocities are greater than 3 ft. /sec due to lateral/shear forces. Where necessary, sealant can be applied to exterior walls in order to make them sufficiently impermeable to resist water penetration up to the design flood risk management level. Otherwise, provisions can be made for the installation of a temporary impermeable membrane around the building exterior just before a flood event begins. Provisions must also be made for the closure of building openings, specifically doors and any windows with a sill below the design flood protection level. Such openings may have permanent framing installed which allows for the placement of a temporary flood shield to seal the opening in the case of a flood event. Interior drainage collection systems and pumps are required to control the interior water level and collect seepage.

Nonstructural Flood Risk Management Measures: Dry Flood Proofing

ADVANTAGES:

- Relatively low cost
- Does not require additional land
- Does not modify floodplain
- Does not increase flood levels on adjacent properties

VS

DISADVANTAGES:

- Building must be in good condition
- Often requires human intervention and adequate warning
- Ongoing maintenance required
- May not be feasible for adjoining structures

IMPACTS:

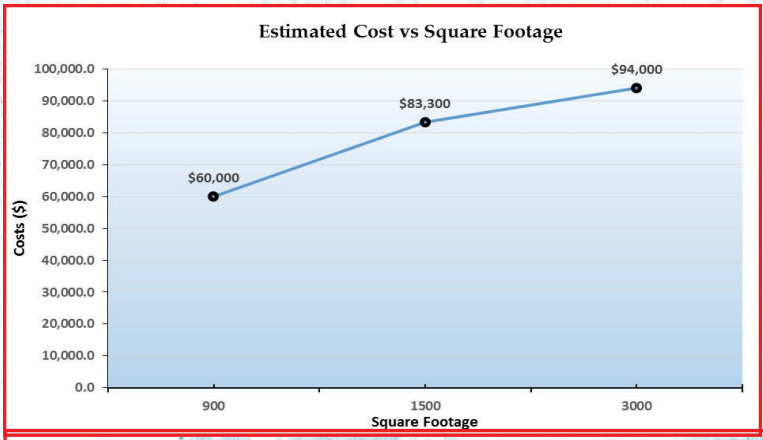
Dry flood proofing methods do not affect the hydrology of the floodplain, and therefore cause minimal environmental impact. If proper inspections of structural condition are not performed, a building that has been dry flood proofed has an increased risk of incurring structural damage in a flood event.

PRE-FLOOD ACTIONS:

Dry flood proofing may require placement of shields over building openings such as doors and windows that extend below the flood proofed elevation, and in some cases, application of a waterproof membrane over the bottom 3-4 feet of exterior wall around the full perimeter of the building. An action plan must be in place to assign responsibility for completing pre-flood actions and to ensure that the proper personnel are trained and practiced in the storage, installation, and maintenance of the required elements. Buildings should be evacuated prior to flood event.

SPECIAL CONSIDERATIONS:

Preserve structural integrity by ensuring that pooling does not occur on the dry side of flood proofing barrier. Incorporation of sump pump (skimmer style) on protected side is recommended. Preservation of integrity and aesthetics of historic buildings must be considered.



$$ COSTS: $$

- General estimated costs estimates developed using the following dimensions:
  - 900 square feet (6 window closures)
  - 1,500 square feet (6 window closures)
  - 3,000 square feet (6 window closures)
- Costs vary based on project size and location.

Nonstructural Flood Risk Management Measures: Wet Flood Proofing

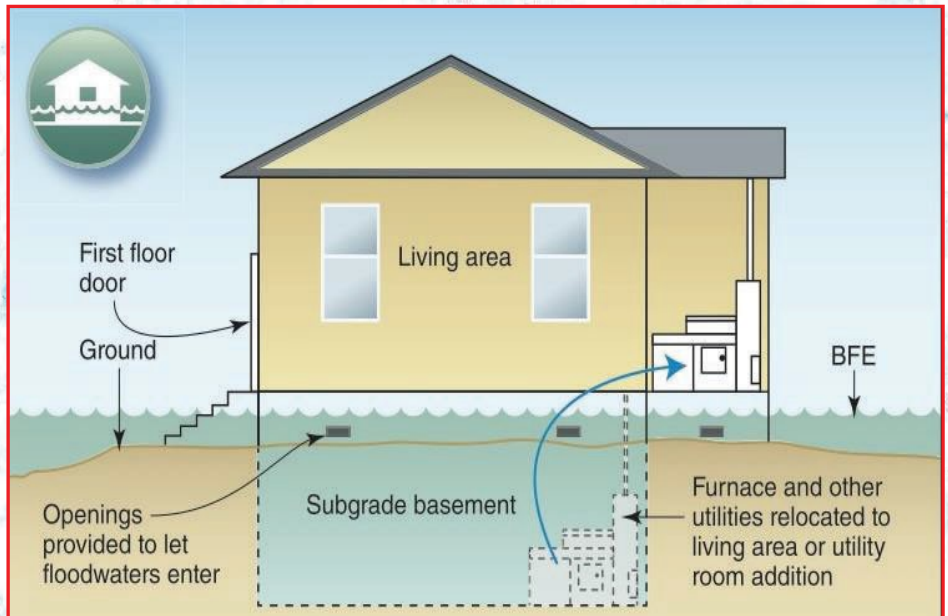


Image Source: FEMA

APPLICABILITY:

Wet flood proofing is applicable in structures that have an uninhabited basement, crawlspace, or other subgrade portion of the building from which all important equipment or other building contents can be relocated. Concrete or masonry construction is the most viable candidate, due to resistance to moisture damage. Depending on the duration of the design flood, other building types may also be candidates for wet flood proofing, as long as the resistance of the structure to water damage has been assessed.

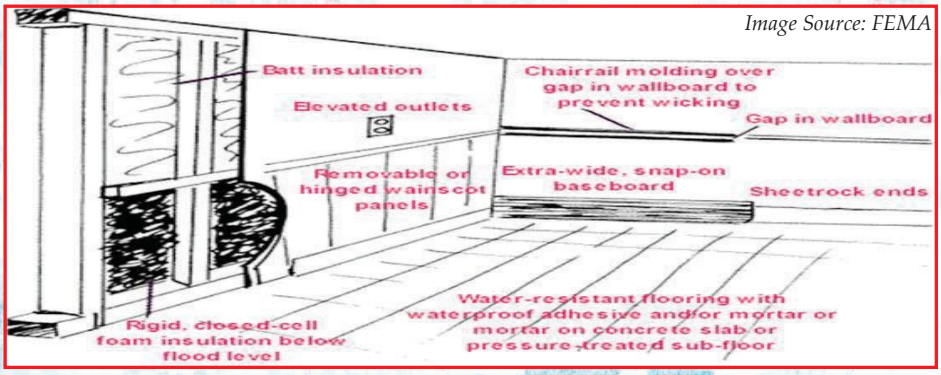


Image Source: FEMA

TYPES OF FLOODING MITIGATED:

1. **Coastal/ Storm Surge**
2. **Riverine**
3. **Stormwater**

DESCRIPTION:

Wet flood proofing is the process of modifying a building to allow flood waters to enter and inundate a portion of the building to minimize the risk of structural damage. The designed inundation area may be the subgrade basement of a building, or otherwise the ground floor up to the design flood elevation. Raising utilities and important building contents and equipment to higher floors above the design flood elevation, using flood damage-resistant materials in the building interior, and installing flood openings in foundation walls to equalize the hydrostatic pressure are examples of some of the most common wet flood proofing measures. Additional provisions may be required to ensure minimal damage to the building mechanical and electrical systems in the event of a flood. A pumping system may also be put in place to remove water from inundated areas of the building after the event. In some cases, additional anchoring of the building to the foundation must be designed as a part of the wet flood proofing measures.

Nonstructural Flood Risk Management Measures: Wet Flood Proofing

ADVANTAGES:

- Typically low cost
- Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors.

VS

DISADVANTAGES:

- Allows water into structure
- May require extensive cleanup
- Pumping floodwaters out too soon after a flood may lead to structural damage.
- Ongoing maintenance required
- May not minimize the potential damage from high-velocity flood flow and wave action.

IMPACTS:

Wet flood proofing methods do not affect the hydrology of the floodplain, and therefore cause no environmental impact. May impact historic aesthetic of building.

PRE-FLOOD ACTIONS:

The extent of pre-flood actions in a wet flood proofed building depend on the specific measures necessary. In cases where a portion of the interior space below the design flood elevation is occupied, action may need to be taken to elevate or remove important electronics or other building contents in that space. The designed inundation spaces of a wet flood proofed structure should be used to minimize the amount of pre-flood action required. Structure must be evacuated prior to flooding event.

SPECIAL CONSIDERATIONS:

Need to consider relocation of utilities and valuables prior to wet flood proofing.

$$ COSTS: $$

Estimated costs for relocating damageable materials and utilities and installing in-wall flood vents:

- ~$ 14,000 (for 6 flood vents)

Cost may vary depending or damageable materials, size of wet flood proofing area, and location of project.

Nonstructural Flood Risk Management Measures: Building Elevation

Images Source: USACE

APPLICABILITY:

Most single family houses can be elevated, if they are in good condition. Large buildings, office buildings and attached (row homes) buildings may be elevated, but may present more challenges. Height limits on building elevations should be in concurrence with local ordinances and building codes.

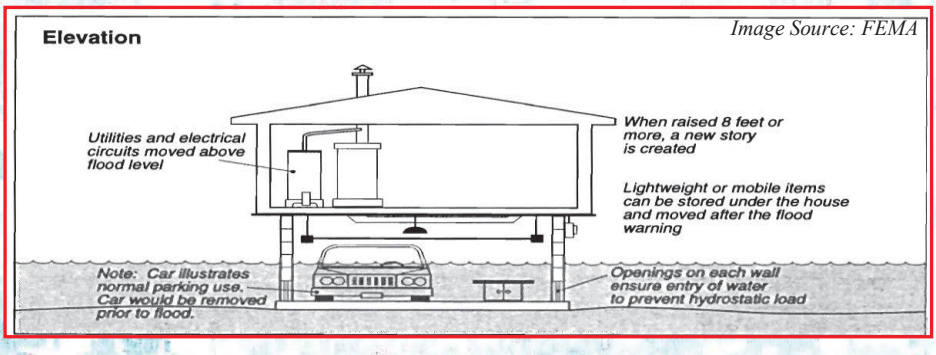


Image Source: FEMA

TYPES OF FLOODING MITIGATED:

1. **Coastal/Storm Surge**
2. **Riverine**
3. **Stormwater**

DESCRIPTION:

Elevation involves raising flood prone buildings in place so that the lowest floor is above the design flood elevation. The building is raised on temporary framing and set on extended foundation walls or structural fill above the design flood elevation. For buildings that include basements or crawl spaces, the basement or crawl space can be filled in, the building raised above the design flood elevation, and additional living space can be added to compensate for the lost basement space. Another option for basements and crawl spaces is wet flood proofing, which would allow water to pass through without damaging the structural integrity of the building. The structure can also be elevated on extended foundation wall breakaway panels, piles, piers, or posts.

Nonstructural Flood Risk Management Measures: Building Elevation

ADVANTAGES:

- Contents and structures have a reduced risk of flooding
- Maintains neighborhood cohesion by eliminating relocation of residents

VS

DISADVANTAGES:

- Must vacate structure during elevation process
- May change historical/visual landscape

IMPACTS:

Changes aesthetics of structure, especially in historically sensitive areas, may create home access issues depending on physical condition of resident(s).

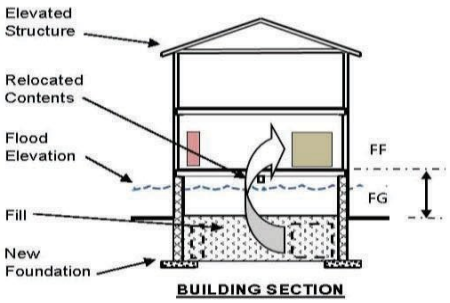
PRE-FLOOD ACTIONS:

Although building flood risk is significantly reduced, occupants are recommended to evacuate prior to impending floods.

SPECIAL CONSIDERATIONS:

Assess structural stability and relocation of utilities prior to building elevation. Community ordinances/ building codes may restrict elevation height.

$$ COSTS* $$



BUILDING SECTION

Elevate Structure Above Flood Elevation - Estimated Cost (2)										
		First Floor Area (Square Feet)								
		600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
Structure Elevation Height (Feet)	8'	$132,800	$134,900	$137,100	$139,200	$141,400	$143,500	$145,600	$147,800	$149,900	$152,000
	7'	$127,700	$129,900	$132,000	$134,100	$136,300	$138,400	$140,600	$142,700	$144,800	$147,000
	6'	$122,700	$124,800	$126,900	$129,100	$131,200	$133,300	$135,500	$137,600	$139,800	$141,900
	5'	$117,600	$119,700	$121,900	$124,000	$126,100	$128,300	$130,400	$132,500	$134,700	$136,800
	4'	$112,500	$114,600	$116,800	$118,900	$121,100	$123,200	$125,300	$127,500	$129,600	$131,700
	3'	$107,400	$109,600	$111,700	$113,800	$116,000	$118,100	$120,200	$122,400	$124,500	$126,700
	2'	$102,400	$104,500	$106,600	$108,800	$110,900	$113,000	$115,200	$117,300	$119,400	$121,600
	1'	$97,300	$99,400	$101,500	$103,700	$105,800	$108,000	$110,100	$112,200	$114,400	$116,500

** Costs based on community in central PA; costs will vary by region and project.*

Nonstructural Flood Risk Management Measures: Acquisition/Demolition

Image Source: Hartford Historical Society

APPLICABILITY:

Acquisition/ demolition is applicable to structures that are at extreme risk of flooding and typically have been flooded one or more times.

TYPES OF FLOODING MITIGATED:

1. **Coastal/Storm Surge**
2. **Riverine**
3. **Stormwater**

DESCRIPTION:

This measure consists of buying the structure and the associated land. The structure is either demolished or the structure is relocated to a location external to the floodplain. Development sites, if needed, can provide locations where displaced structures can be relocated. The site where the building was originally located typically becomes open space and restricted from development.

APPENDIX B

Nonstructural Floodproofing Concept Sheets

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

One Magnox Drive Structure ID #1

Structure Information / Data:

Name / Description: Calfee Training School
Location: One Magnox Drive
Occupancy Type: Nonresidential/Education
Number of Stories: 1 with a crawl space
Critical Facility: ☐ Yes ☒ No

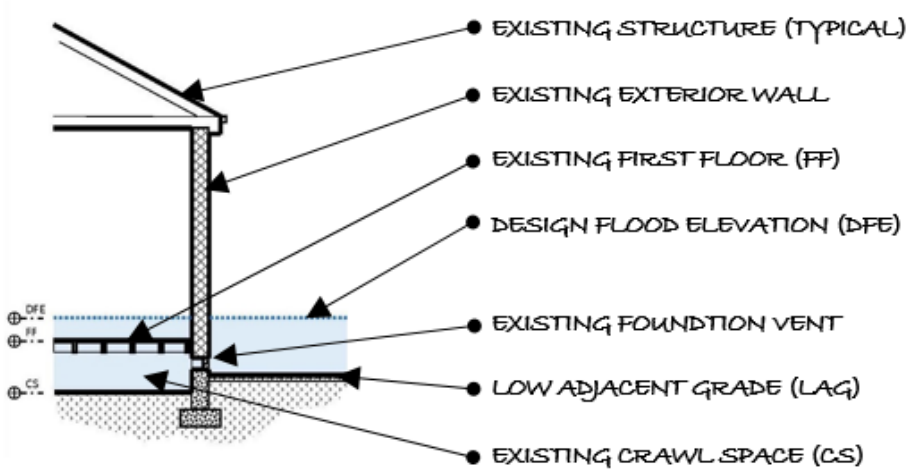
Building Construction:

Exterior Wall: Masonry, load bearing
Floor Construction (1st Flr.): Wood
☐ Grade
☒ Crawlspace
☐ Basement
1st floor doors: To be Determined
Historic Status: Historic Structure (Nature to be Determined)

Key Building Features:

- First floor 1.30 ft. below DFE
- Crawlspace 4.30 ft. below DFE
- Exterior HVAC units at grade

Structure/Flood Elevations Table (all elevations in ft.)						
LAG	FF	CS	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-CS
1915.60’	1918.00’	1915.00’	1919.30’	3.70’	1.30’	4.30’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

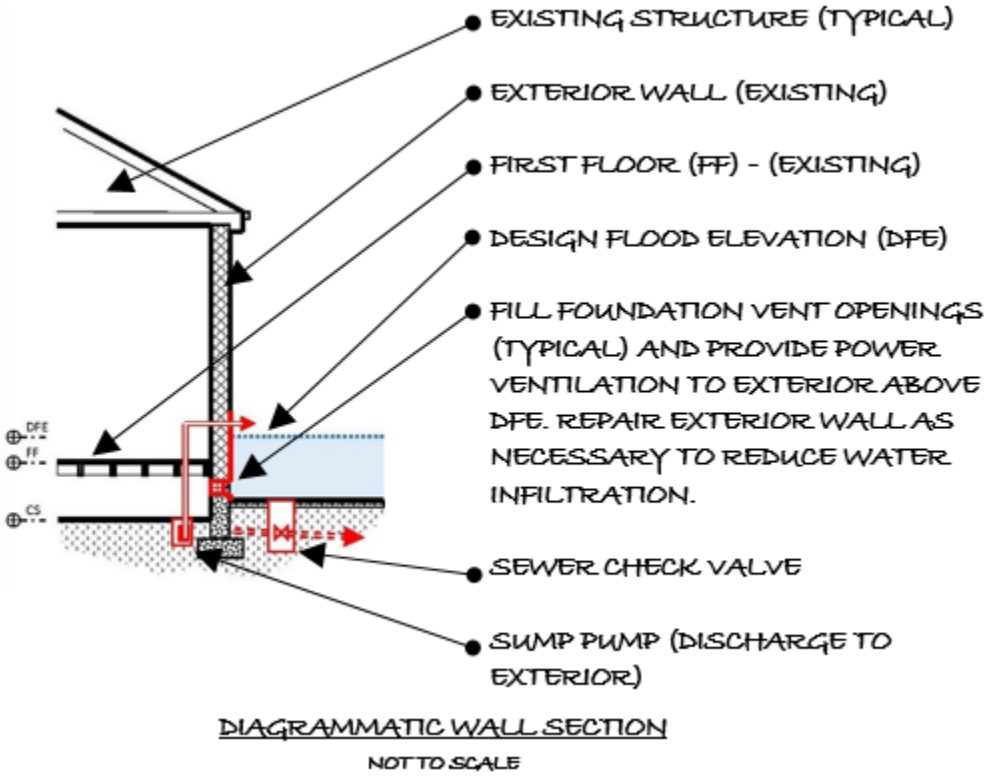
Aerial View

Front (South) Elevation

Background:

The structure is located at the western edge of the downtown commercial district, is free standing and fronts Magnox Drive and has historic significance. The property borders the left descending bank of Tract Fork. It's upstream of the Magnox Drive bridge crossing Tract Fork and about a block away from Peak Creek. The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION

NOT TO SCALE

ALTERNATIVE #1 - Dry Flood Proofing

a) ***Exterior Wall Penetration:*** Inspection and repair of exterior masonry walls to resist infiltration of flood water and verification their structural stability to resist the flood water forces will be required.
b) ***Removable Closures:*** Provide removable closures or replace existing doors with flood resistant doors in the exterior walls.
c) ***Foundation and Crawl Space Penetration:*** Fill in foundation vents and provide mechanical ventilation of the crawl space.
d) ***Sewage Check Valve:*** Assume one check valve to be placed on sanitary line in order to prevent backflow during flood event.
e) ***Pumping:*** Provide internal drainage system and sump pump(s) in the crawlspace to remove water seepage/infiltration, and provide emergency power to the sump pump(s).
f) ***Elevate mechanical and electrical equipment:*** New HVAC equipment (interior and exterior) should be installed above the DFE.

Alternative #2 – Elevate First Floor

An alternative to improve the performance of dry flood proofing this structure would be to remove the existing first floor construction, fill the crawl space and provide a new concrete slab floor at the existing first floor elevation or at a higher elevation (at or above the DFE).

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES							
Structure ID #1			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
FLOOD	Flood										
	Depth	Shallow [< 3 feet]			X	X	X	√	X	X	X
		Moderate [3 - 6 feet]									
	Velocity	Slow [< 3 fps]									
		Moderate [3 - 6 fps]			X	X	X	√	X	X	X
		Fast [> 6 fps]									
		Floodway					NA	NA			
	Rate-of-Rise (Warning time)	Hours [flash flood]			X	X	X	√	X	X	X
		Days									
	Duration	Hours			X	X	X	√	X	X	X
		Days									
	Debris	Structural Impact			X	X	X	√	X	X	X
STRUCTURE	Structure										
	Occupancy (FEMA / NFIP)	Residential						NA			
		Nonresidential			X	X	X	√	?	X	X
	Use (Bldg. Code)	Office									
		Retail									
		Assembly			X	X	X	√	X	X	X
		Storage									
	Construction	Wood / Timber									
		Masonry / Concrete			X	X	X	√	X	X	X
		Other									
	Configuration	Slab on Grade									
		Crawlspace			X	X	X	√	X	X	X
		Basement									
		Freestanding			X	X	X	√	X	X	X
		Attached									
	Condition	Excellent - Good			X	X	X	√	X	X	X
		Fair - Poor					?				
SITE	Site										
	Soil / Surface Permeability	Permeable			X	X	X	√	X	?	?
		Non-permeable			X	X	X	√	X	X	X
	Topography	Level / Flat			X	X	X	√	X	X	?
		Sloped / Uneven									
	Access	Partial / Restricted									
		Unlimited / Full			X	X	X	√	X	X	X
OTHER	Other										
	Aesthetics / Historic Significance				X	X	X	√	X	X	X
	Critical Facility										
	HTRW				?	?	?	√	X	?	X
	Commercial HVAC / Basement										

Matrix Legend

- (blank) — Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? — Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA — Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

143 Third Street, NW Structure ID#2

Structure Information / Data:

Name / Description: Pulaski Co. Administration Bldg.
Location: 143 Third Street, NW
Occupancy type: Business / Assembly (County Administrative Offices)
No. of Stories: 2 with basement
Critical Facility: ☒ Yes ☐ No

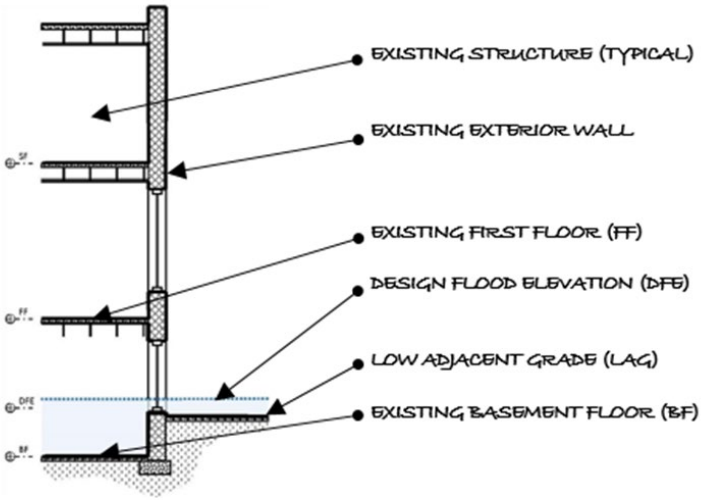
Building Construction:

Exterior Walls: Masonry, load bearing
Floor Construction (1st Flr.): Concrete Floor
Foundation Wall: Concrete
☐ Grade
☐ Crawlspace
☒ Basement
1st floor doors: **To be Determined**
Historic Status: Historic Significance to be Determined

Key Building Features:

- First Floor 6.10 ft. above DFE
- Basement 4.40 ft. below DFE
- Exterior HVAC units at grade (rear/side). Interior systems are in the basement. HVAC to be rehabbed and new equipment moved to a higher level.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1914.50’	1922.10’	1911.60’	1916.00’	1.50’	(6.10’)	4.40’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

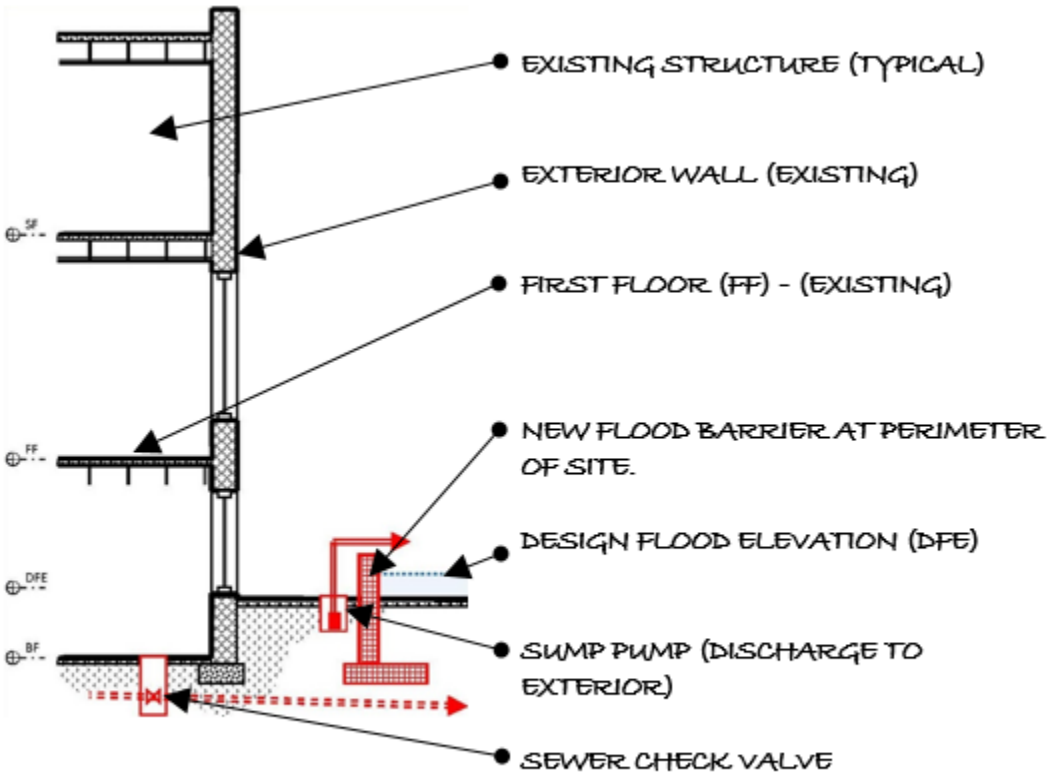
Aerial View

Front (North) Elevation

Background:

The structure is located at the northwest edge of the downtown commercial district, is free standing and fronts Third Street NW. County offices occupy the structure. The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION

NOT TO SCALE

ALTERNATIVE #1 – Wall or Barrier

a) ***Wall or Barrier:*** A wall or barrier system at the perimeter of the site with removable closures may be best measure considered to reduce flood risk. Locating it at the perimeter of the property will have the least impact on structure access, aesthetics, and circulation in the parking areas surrounding it

b) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.

c) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

d) ***Hydraulic Analysis:*** Hydraulic analysis of the site will be required to determine the impact of the wall or barrier on the floodplain. If it would cause a rise in flood elevations it would not be an acceptable mitigation measure.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES								
Structure ID #2			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS	FLOOD	Flood									
		Depth – Shallow [< 3 feet]			X	X	X	X	X	√	X
		Depth – Moderate [3 - 6 feet]									
		Velocity – Slow [< 3 fps]			X	X	X	X	X	√	X
		Velocity – Moderate [3 - 6 fps]									
		Velocity – Fast [> 6 fps]									
		Velocity – Floodway								NA	
		Rate-of-Rise (Warning time) – Hours [flash flood]			X	X	X	X	X	√	X
		Rate-of-Rise (Warning time) – Days									
		Duration – Hours			X	X	X	X	X	√	X
		Duration – Days									
		Debris – Structural Impact									
	STRUCTURE	Structure									
		Occupancy (FEMA / NFIP) – Residential								NA	
		Occupancy (FEMA / NFIP) – Nonresidential			X	X	X	X	X	√	X
		Use (Bldg. Code) – Office			X	X	X	X	X	√	X
		Use (Bldg. Code) – Retail									
		Use (Bldg. Code) – Assembly			X	X	X	X	X	√	X
		Use (Bldg. Code) – Storage									
		Construction – Wood / Timber									
		Construction – Masonry / Concrete			X	X	X	X	X	√	X
		Construction – Other									
		Configuration – Slab on Grade			X	X	X	X	X	√	X
		Configuration – Crawlspace									
		Configuration – Basement			X	X	X	X	X	√	X
		Configuration – Freestanding			X	X	X	X	X	√	X
		Configuration – Attached									
		Condition – Excellent - Good			X	X	X	X	X	√	X
		Condition – Fair - Poor									
	SITE	Site									
		Soil / Surface Permeability – Permeable									
		Soil / Surface Permeability – Non-permeable			X	X	X	X	X	√	X
		Topography – Level / Flat			X	X	X	X	X	√	X
		Topography – Sloped / Uneven									
		Access – Partial / Restricted									
		Access – Unlimited / Full			X	X	X	X	X	√	X
	OTHER	Other									
		Aesthetics / Historic Significance			X	X	X	X	X	√	X
		Critical Facility			X	X	X	X	X	√	X
		HTRW									
		Commercial HVAC / Basement			X	X	X	X	X	√	X

Matrix Legend

- Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

45 Third Street, N.W. Structure ID #3

Structure Information / Data:

Name / Description: Pulaski County Courthouse
Location: 45 Third Street, N.W.
Occupancy type: Nonresidential/Business
No. of Stories: 2 with basement
Critical Facility: ☒ Yes ☐ No

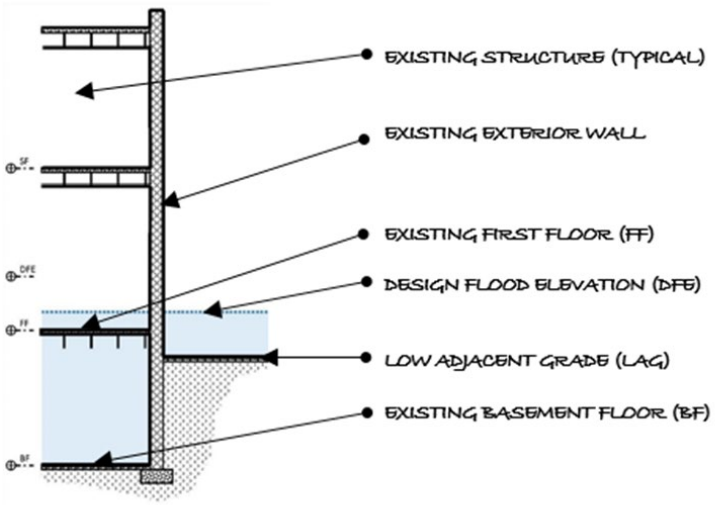
Building Construction:

Exterior Wall: Reinforced Masonry
Floor Construction (1st Flr.): Concrete
Foundation Wall: Concrete
☐ Grade
☐ Crawlspace
☒ Basement
1st floor doors: To be Determined
Historic Status: Historic Structure (Nature to be Determined)

Key Building Features:

- First Floor 1.50 ft. below DFE
- Basement 11.50ft. below DFE
- Exterior HVAC units are on the roof.
- Interior systems are in the basement.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1911.00’	1913.50’	1903.50’	1915.00’	4.00’	1.50’	11.50’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

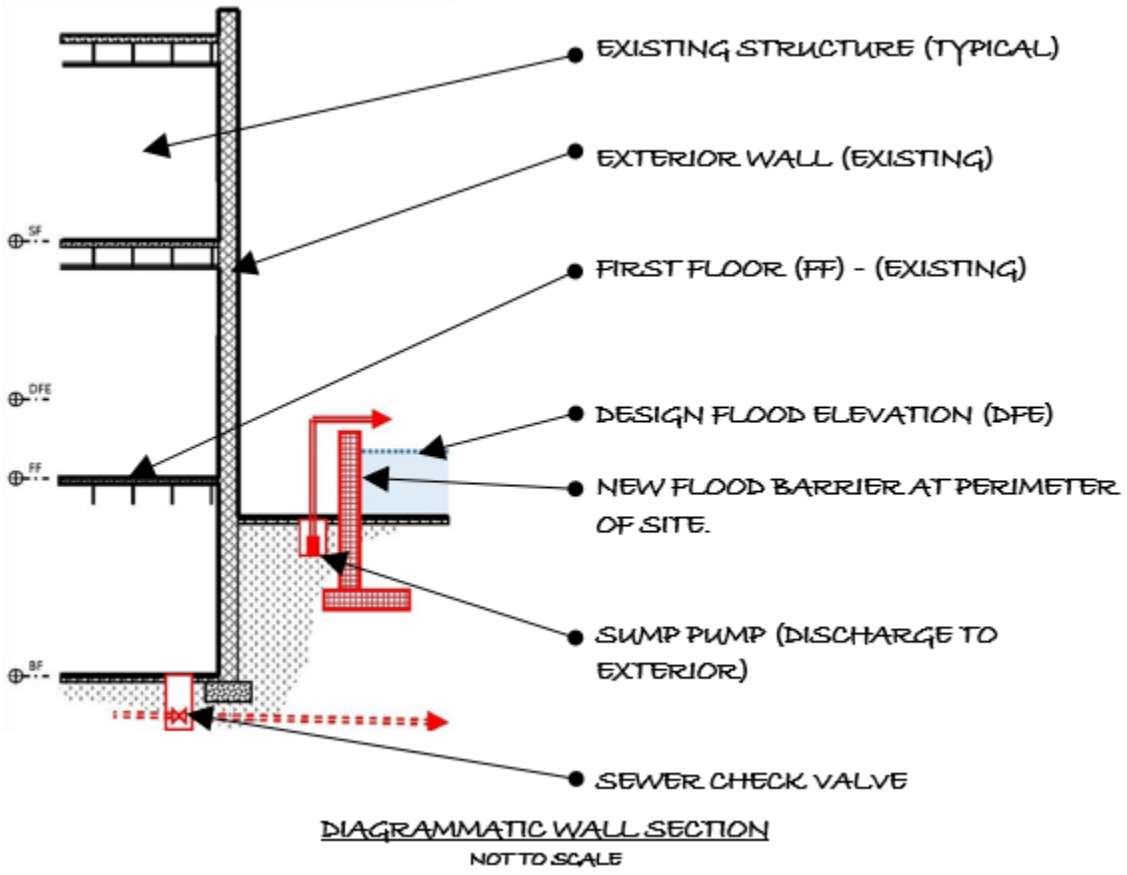
Aerial View

Front (North) Elevation

Background:

The structure is located at the north edge of the downtown commercial district, is free standing and fronts Third Street NW. The structure is the court house. The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION

NOT TO SCALE

ALTERNATIVE #1 – Wall or Barrier

a) ***Wall or Barrier:*** A wall or barrier system at the perimeter of the site with removable closures may be best measure considered to reduce flood risk. Locating it at the perimeter of the property will have the least impact on structure access, aesthetics, and circulation in the parking areas surrounding it
b) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.
c) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).
d) ***Hydraulic Analysis:*** Hydraulic analysis of the site will be required to determine the impact of the wall or barrier on the floodplain. If it would cause a rise in flood elevations it would not be an acceptable mitigation measure.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES								
Structure ID #3			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS	FLOOD	Flood									
		Depth – Shallow [< 3 feet]			X	X	X	X	X	√	X
		Depth – Moderate [3 - 6 feet]						?			?
		Velocity – Slow [< 3 fps]			X	X	X	X	X	√	X
		Velocity – Moderate [3 - 6 fps]									?
		Velocity – Fast [> 6 fps]									NA
		Velocity – Floodway			NA	NA	NA	NA	NA	NA	NA
		Rate-of-Rise (Warning time) – Hours [flash flood]			X	X	X	?	X	√	X
		Rate-of-Rise (Warning time) – Days									
		Duration – Hours			X	X	X	X	X	√	X
		Duration – Days						?			?
		Debris – Structural Impact			?	?	?	?	?	?	NA
	STRUCTURE	Structure									
		Occupancy (FEMA / NFIP) – Residential						NA	NA	NA	NA
		Occupancy (FEMA / NFIP) – Nonresidential			X	X	X	X	?	√	X
		Use (Bldg. Code) – Office			X	X	X	X	NA	√	X
		Use (Bldg. Code) – Retail							NA		
		Use (Bldg. Code) – Assembly							NA		
		Use (Bldg. Code) – Storage							?		
		Construction – Wood / Timber							NA		
		Construction – Masonry / Concrete			X	X	X	X	X	√	X
		Construction – Other				?			?		
		Configuration – Slab on Grade			NA	NA					
		Configuration – Crawlspace			NA			?			
		Configuration – Basement			X	X	X	?	X	√	X
		Configuration – Freestanding			X	X	X	X	X	√	X
		Configuration – Attached			?	NA		?	?	?	?
		Condition – Excellent - Good			X	X	X	X	X	√	X
		Condition – Fair - Poor				NA	?	NA			
	SITE	Site									
		Soil / Surface Permeability – Permeable						?		?	?
		Soil / Surface Permeability – Non-permeable			X	X	X	X	X	√	X
		Topography – Level / Flat			X	X	X	X	X	√	X
		Topography – Sloped / Uneven									?
		Access – Partial / Restricted				?				?	?
		Access – Unlimited / Full			X	X	X	X	X	√	X
	OTHER	Other									
		Aesthetics / Historic Significance				NA					
		Critical Facility			X	X	X	X	NA	√	X
		HTRW				?				?	
		Commercial HVAC / Basement			NA	X	X	?	NA	√	X

Matrix Legend

- Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

52 W. Main Street Structure ID #4

Structure Information / Data:

Name/Description: Pulaski County Courthouse
Location: 52 W. Main Street
Occupancy type: Nonresidential/Business
No. of Stories: 2 story with basement
Critical Facility: ☒ Yes ☐ No

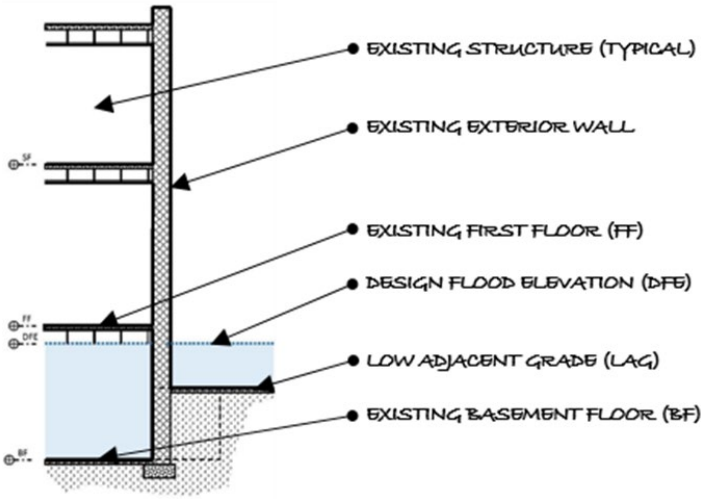
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Concrete
Foundation Wall: Masonry
☐ Grade
☐ Crawlspace
☒ Basement
Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

Key Building Features:

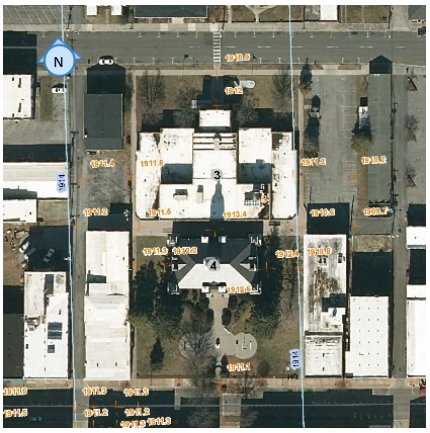
- First Flood 1 ft. above DFE
- Basement 9 ft. below DFE
- Exterior HVAC units are on the roof.
- Interior systems are in the basement.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF / CS	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1911.20’	1916.00’	1906.00’	1915.00’	3.80’	(1.00’)	9.00’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:



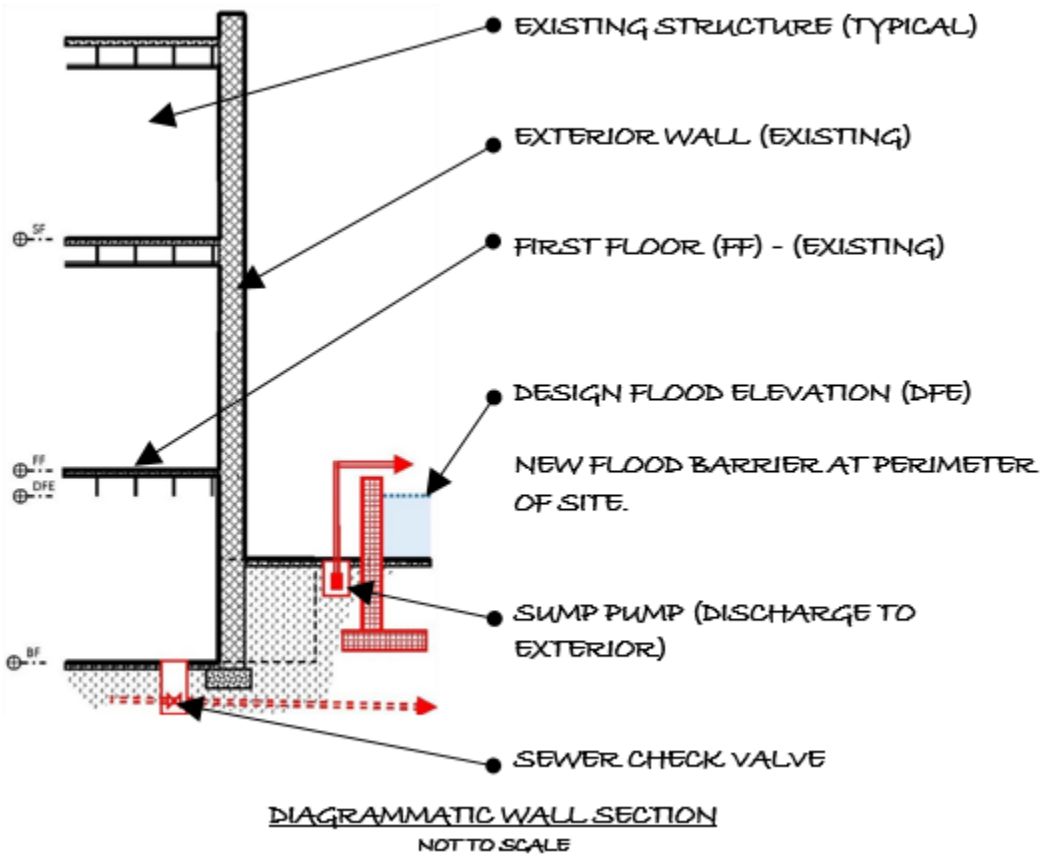
Aerial View

Front (West) Elevation

Background:

The structure is located in the downtown commercial district, is free standing and fronts West Main Street. The structure is the court house and has historic significance. The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION
NOT TO SCALE

ALTERNATIVE #1 – Wall or Barrier

a) ***Wall or Barrier:*** A wall or barrier system at the perimeter of the site with removable closures may be best measure considered to reduce flood risk. Locating it at the perimeter of the property will have the least impact on structure access, aesthetics, and circulation in the parking areas surrounding it

b) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.

c) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

d) ***Hydraulic Analysis:*** Hydraulic analysis of the site will be required to determine the impact of the wall or barrier on the floodplain. If it would cause a rise in flood elevations it would not be an acceptable mitigation measure.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES							
Structure ID #4			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
FLOOD	Flood										
	Depth	Shallow [< 3 feet]			X	X	X	X	X	V	X
		Moderate [3 - 6 feet]									
	Velocity	Slow [< 3 fps]			X	X	X	X	X	V	X
		Moderate [3 - 6 fps]									
		Fast [> 6 fps]									
		Floodway								NA	
	Rate-of-Rise (Warning time)	Hours [flash flood]			X	X	X	?	X	V	X
		Days									
	Duration	Hours			X	X	X	X	X	V	X
		Days									?
	Debris	Structural Impact									
STRUCTURE	Structure										
	Occupancy (FEMA / NFIP)	Residential								NA	
		Nonresidential			X	X	X	X	X	V	X
	Use (Bldg. Code)	Office			X	X	X	X	X	V	X
		Retail									
		Assembly									
		Storage									
	Construction	Wood / Timber									
		Masonry / Concrete			X	X	X	X	X	V	X
		Other									
	Configuration	Slab on Grade									
		Crawlspace									
		Basement			X	X	X	X	X	V	X
		Freestanding			X	X	X	X	X	V	X
		Attached									
	Condition	Excellent - Good			X	X	X	X	X	V	X
		Fair - Poor									
SITE	Site										
	Soil / Surface Permeability	Permeable			X	X	X	X	X	X	X
		Non-permeable									
	Topography	Level / Flat			X	X	X	X	X	V	X
		Sloped / Uneven									
	Access	Partial / Restricted									
		Unlimited / Full			X	X	X	X	X	V	X
OTHER	Other										
	Aesthetics / Historic Significance				X	X	X	X	X	V	X
	Critical Facility				X	X	X	X	X	V	X
	HTRW										
	Commercial HVAC / Basement				X	X	X	X	X	V	X

Matrix Legend

- Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

246 N Washington Ave B Structure ID #5

Structure Information / Data:

Name/Description: Beans and Rice, Inc.
Location: 246 N Washington Ave B
Occupancy type: Nonresidential / Business
No. of Stories: 2 with basement
Critical Facility: ☐ Yes ☒ No

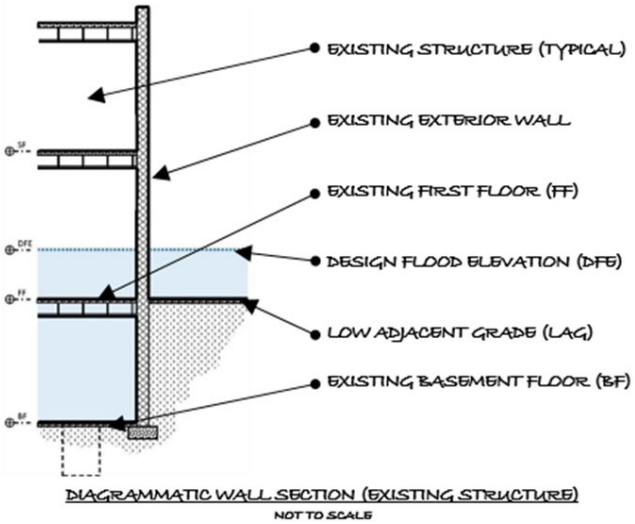
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Wood
Foundation Wall: Concrete
☐ Grade
☐ Crawlspace
☒ Basement
Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

Key Building Features:

- First Floor 4.20 ft. below DFE
- Basement 14.2 ft. below DFE
- Exterior HVAC units are on the roof.
- Interior systems are mostly in second floor mezzanine.
- Some minor utilities/services are in the basement.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1909.50’	1910.00’	1900.00’	1914.20’	4.70’	4.20’	14.2
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

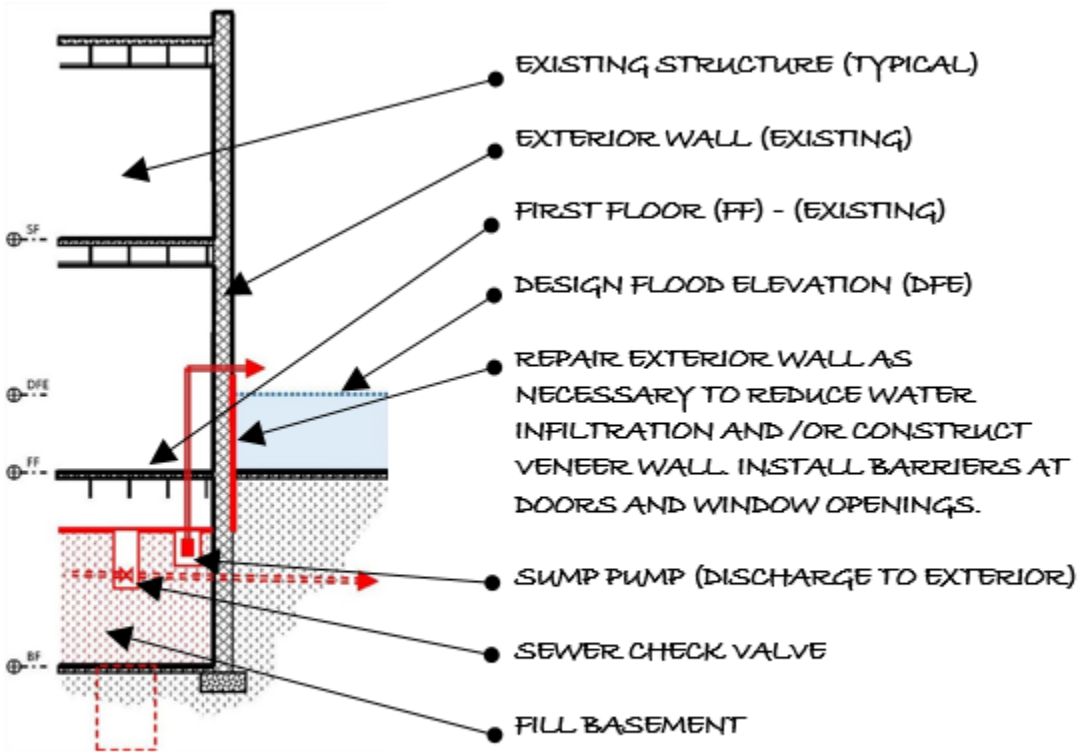
Aerial View

Front (West) Elevation

Background:

The structure is located in the downtown commercial district and fronts on N Washington Street. It is located in the middle of a block and abuts adjacent structures on one side with paved parking or alley at the other side and rear. The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION
NOT TO SCALE

ALTERNATIVE #1 – Dry Flood Proofing

a) ***Abandon and Fill basement***

b) ***Exterior Wall Penetration:*** Inspection and repair of exterior masonry walls to resist infiltration of flood water and verification their structural stability to resist the flood water forces will be required.

c) ***Removable Closures:*** Provide removable closures or replace existing doors with flood resistant doors in the exterior walls.

d) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.

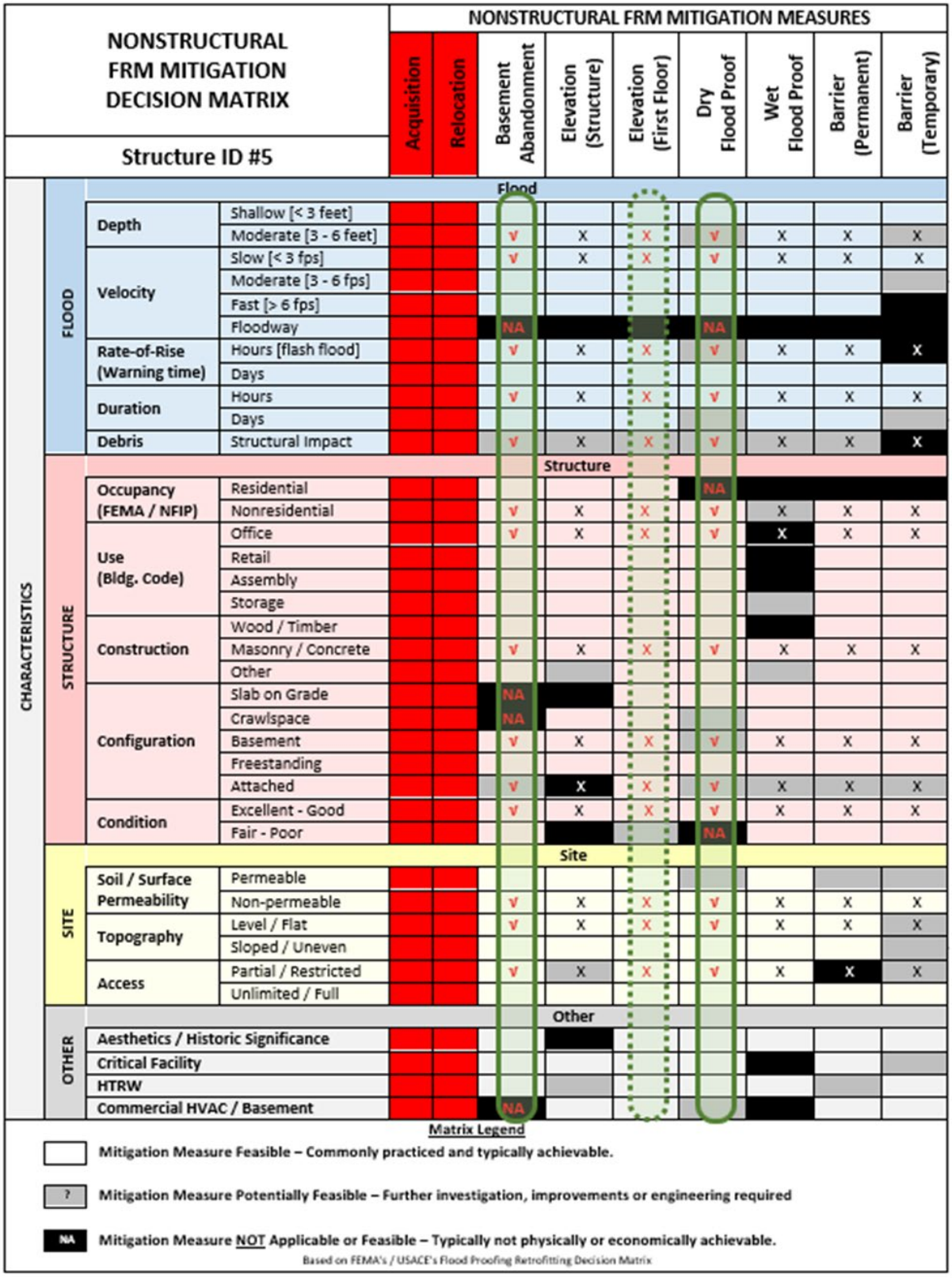
e) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

f) ***Dry floodproof Common Wall***

ALTERNATIVE #2 – Elevate First Floor

An alternative to improve the performance of dry flood proofing this structure would be to remove the existing first floor construction, fill the crawl space and provide a new concrete slab floor at the existing first floor elevation or at a higher elevation (at or above the DFE).

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix



NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

85/86/87 W Main St. Structure ID #6

Structure Information / Data:

Name/Description: Commercial / Business
Location: 85/86/87 W Main St.
Occupancy type: Under Construction, to be determined
No. of Stories: 2 stories with partial basement
Critical Facility: ☐ Yes ☒ No

Building Construction:

Exterior Walls:
Floor Construction (1st Flr.):
Foundation Wall:
☒ Grade
☐ Crawlspace
☒ Basement

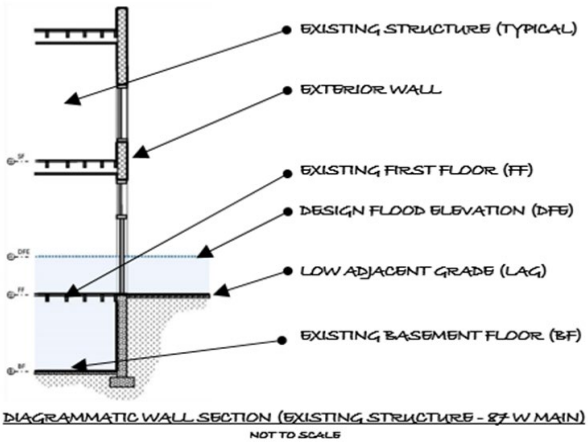
Structure has Partial Basement and Partial Slab on Grade

Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

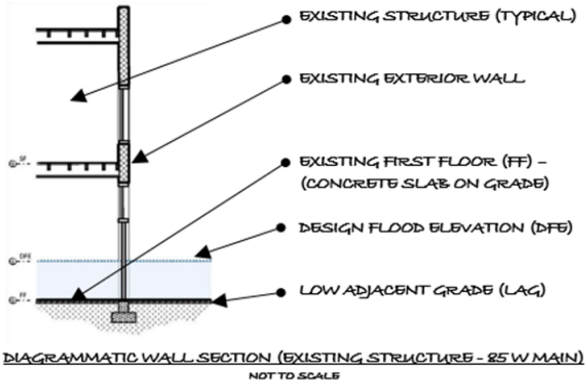
Key Building Features:

- First Floor 4 ft. below DFE
- Partial Basement 12 ft. below DFE
- Location of new HVAC units were not observed because of the building renovation.
- The Electric panels were located in the basement.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1911.50’	1911.50’	1903.50’	1915.50’	4.00’	4.00’	12.00’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE - 87 W MAIN)
NOT TO SCALE



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE - 85 W MAIN)
NOT TO SCALE

Structure Photographs:

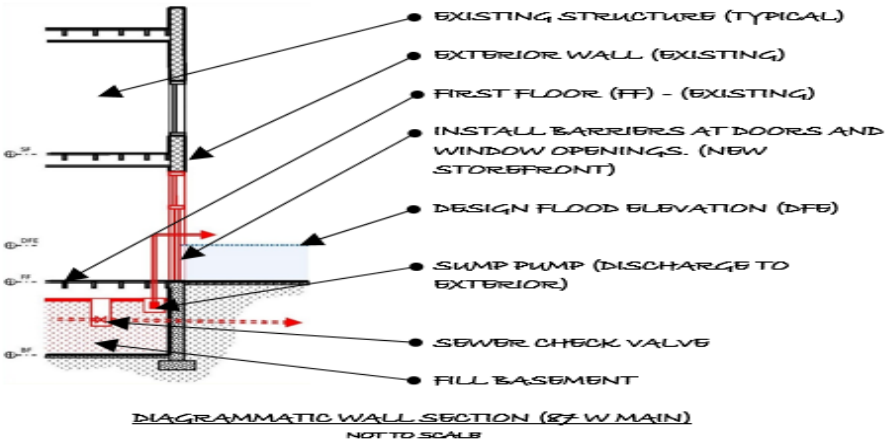
Aerial View

Front (North) Elevation

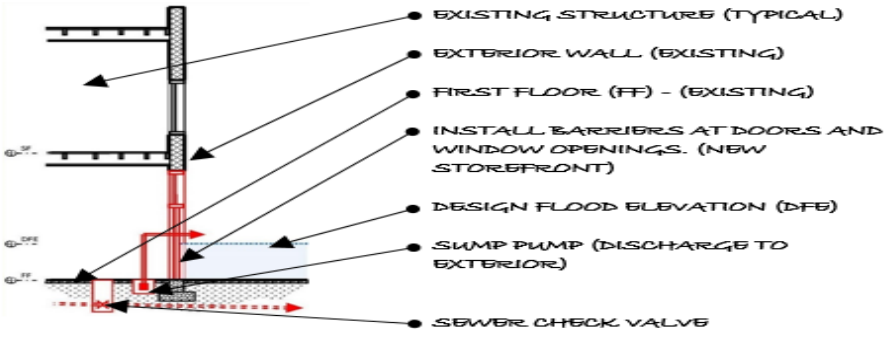
Background:

The structure is located in the downtown commercial district and fronts NW Main Street. It is located in the middle of a block and abuts adjacent structures on both sides. The property is in close proximity to the left descending bank of Peak Creek and within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION (87 W MAIN)
NOT TO SCALE



DIAGRAMMATIC WALL SECTION (85 W MAIN))
NOT TO SCALE

ALTERNATIVE #1 – Dry Flood Proofing

a) ***Abandon and Fill basement***

b) ***Exterior Wall Penetration:*** Inspection and repair of exterior masonry walls to resist infiltration of flood water and verification their structural stability to resist the flood water forces will be required.

c) ***Removable Closures:*** Provide removable closures or replace existing doors with flood resistant doors in the exterior walls.

d) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.

e) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

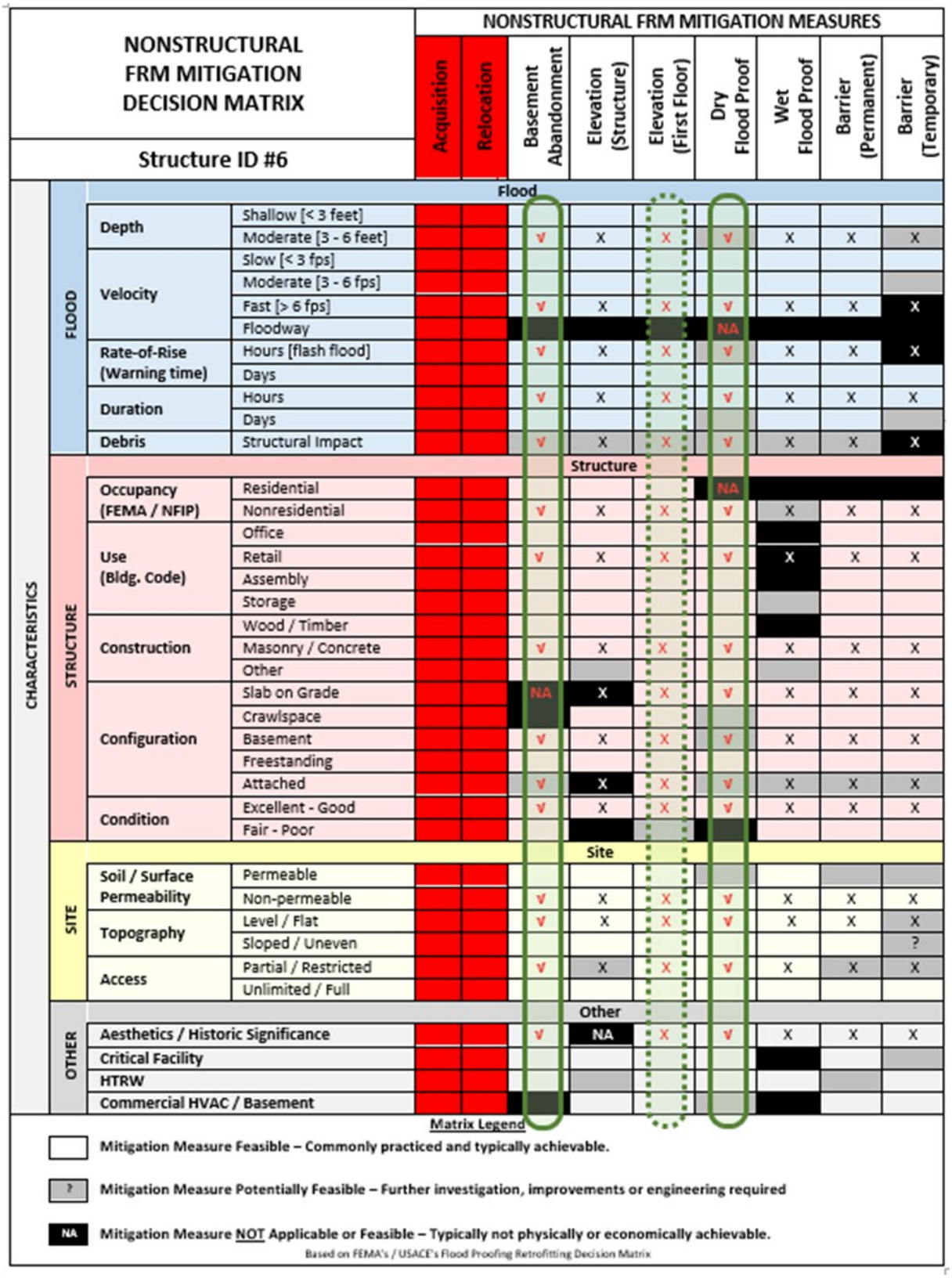
f) ***Dry floodproof Common Wall***

ALTERNATIVE #2 – Elevate First Floor

An alternative to improve the performance of dry flood proofing this structure would be to remove the existing first floor construction, fill the crawl space and provide a new concrete slab floor at the existing first floor elevation or at a higher elevation (at or above the DFE).

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET



NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES								
Structure ID #6			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
FLOOD		Flood									
	Depth	Shallow [< 3 feet]									
		Moderate [3 - 6 feet]			√	X	X	√	X	X	X
	Velocity	Slow [< 3 fps]									
		Moderate [3 - 6 fps]									
		Fast [> 6 fps]			√	X	X	√	X	X	X
		Floodway						NA			
	Rate-of-Rise (Warning time)	Hours [flash flood]			√	X	X	√	X	X	X
		Days									
	Duration	Hours			√	X	X	√	X	X	X
		Days									
	Debris	Structural Impact			√	X	X	√	X	X	X
STRUCTURE		Structure									
	Occupancy (FEMA / NFIP)	Residential						NA			
		Nonresidential			√	X	X	√	X	X	X
	Use (Bldg. Code)	Office									
		Retail			√	X	X	√	X	X	X
		Assembly									
		Storage									
	Construction	Wood / Timber									
		Masonry / Concrete			√	X	X	√	X	X	X
		Other									
	Configuration	Slab on Grade			NA	X	X	√	X	X	X
		Crawlspace									
		Basement			√	X	X	√	X	X	X
		Freestanding									
		Attached			√	X	X	√	X	X	X
	Condition	Excellent - Good			√	X	X	√	X	X	X
		Fair - Poor									
SITE		Site									
	Soil / Surface Permeability	Permeable									
		Non-permeable			√	X	X	√	X	X	X
	Topography	Level / Flat			√	X	X	√	X	X	X
		Sloped / Uneven									?
	Access	Partial / Restricted			√	X	X	√	X	X	X
		Unlimited / Full									
OTHER		Other									
	Aesthetics / Historic Significance				√	NA	X	√	X	X	X
	Critical Facility										
	HTRW										
	Commercial HVAC / Basement										

Matrix Legend

- (blank) — Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? — Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA — Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

69 W Main Street Structure ID # 7

Structure Information / Data:

Name/Description: Commercial / Business
Location: 69 W Main Street
Occupancy type: Nonresidential / Business
No. of Stories: 1 with a crawlspace
Critical Facility: ☐ Yes ☒ No

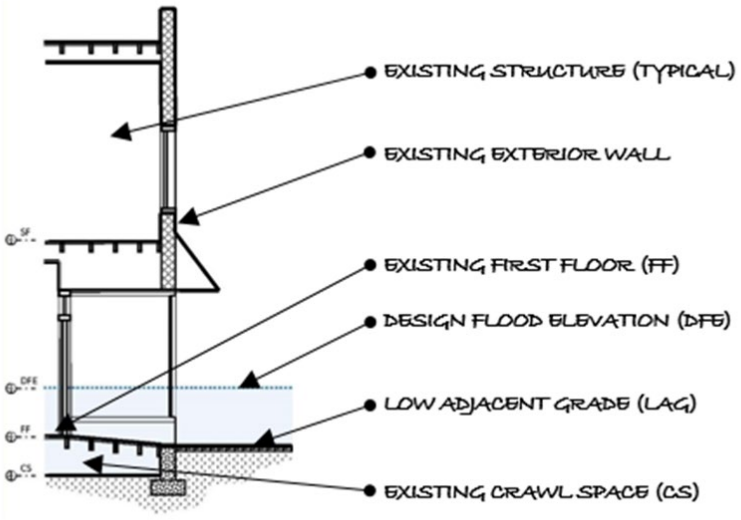
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Wood
Foundation Wall: Masonry/Concrete
☐ Grade
☒ Crawlspace
☐ Basement
Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

Key Building Features:

- First Flood is 3.10 ft. below DFE
- Crawlspace is 5.10 ft. below DFE
- Building systems and utilities were not observed.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	CS	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-CS
1911.20’	1911.90’	1909.90’	1915.00’	3.80’	3.10’	5.10’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

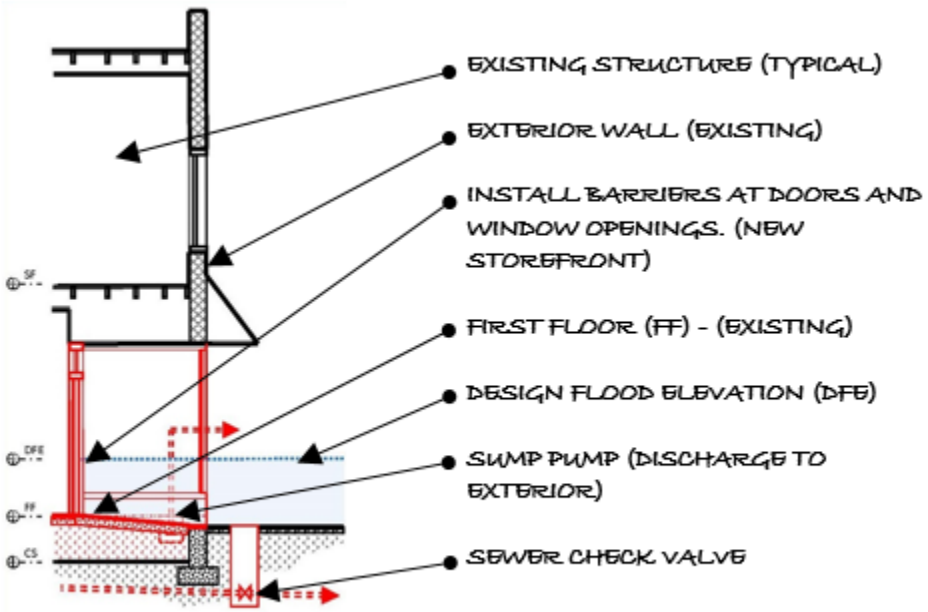
Aerial View

Front (North) Elevation

Background:

The structure is located in the downtown commercial district and fronts W Main Street. It is located in the middle of a block and abuts adjacent structures on both sides. The property borders the left descending bank of Peak Creek and within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



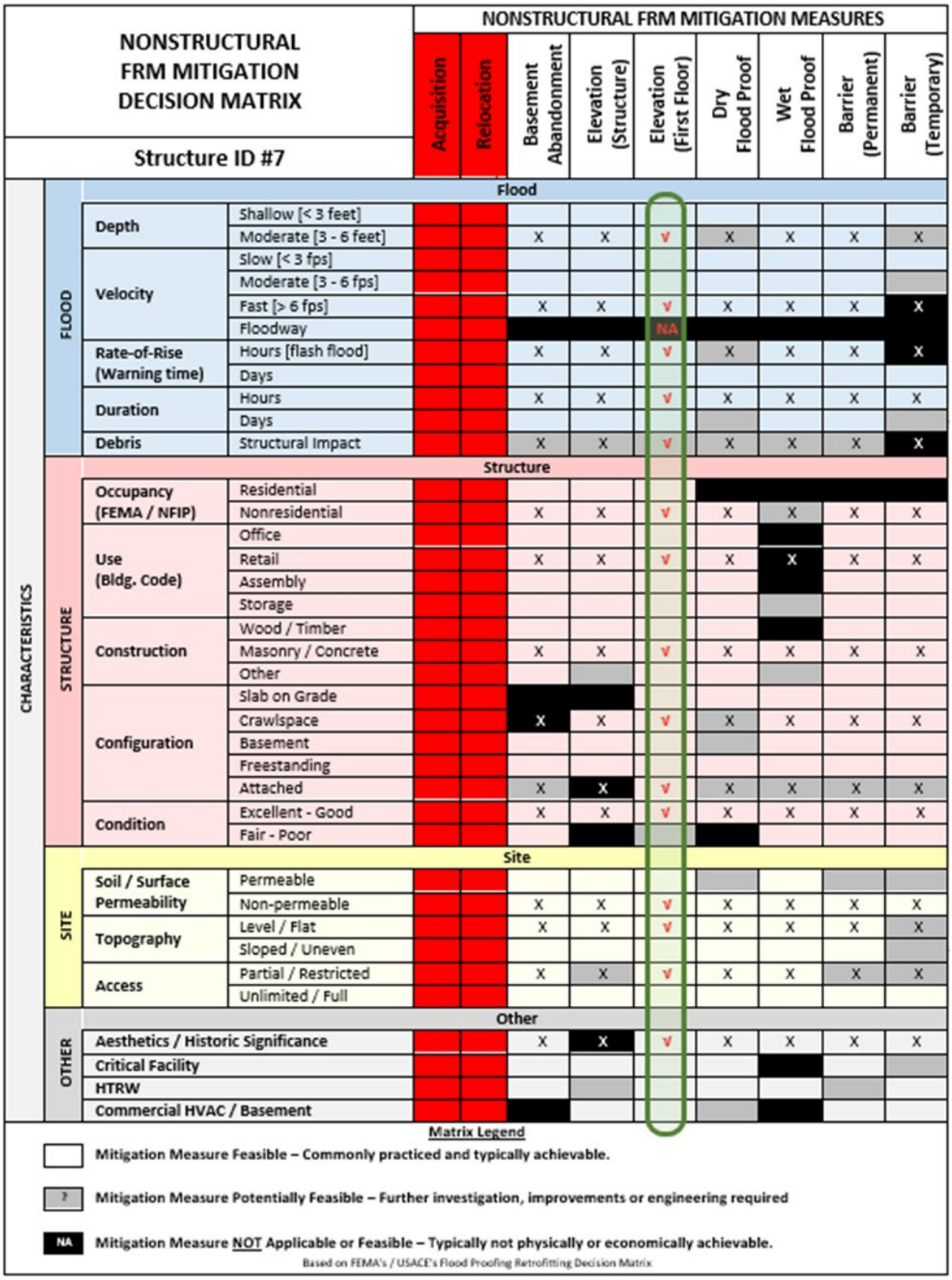
DIAGRAMMATIC WALL SECTION
NOT TO SCALE

ALTERNATIVE #1 – Elevate First Floor

Remove the existing first floor construction, fill the crawl space and provide new floor construction at or above the DFE.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET



67 W Main Street Structure ID #8

Structure Information / Data:

Name/Description: Commercial / Business
Location: 67 W Main Street
Occupancy type: Nonresidential / Business
No. of Stories: 1 with a crawlspace
Critical Facility: ☐ Yes ☒ No

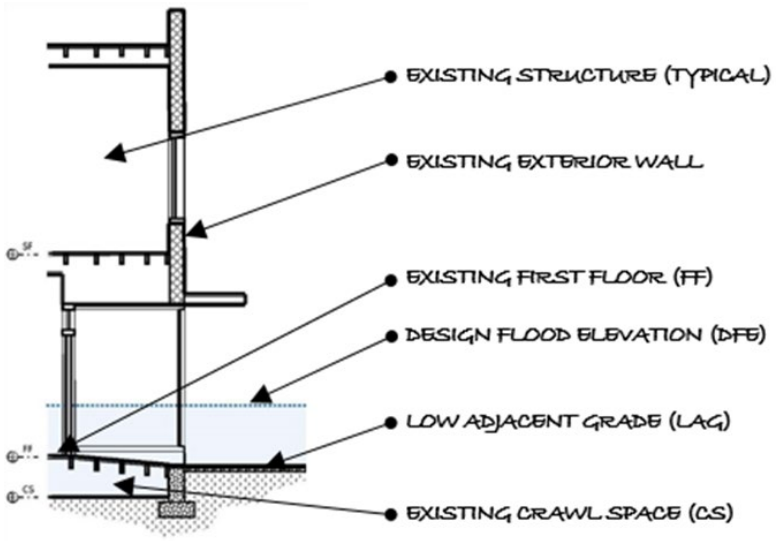
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Wood
Foundation Wall: Masonry/Concrete
☐ Grade
☒ Crawlspace
☐ Basement
Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

Key Building Features:

- First Flood is 3.10 ft. below DFE
- Crawlspace is 5.10 ft. below DFE
- Building systems and utilities were not observed.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	CS	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-CS
1911.20’	1911.90’	1909.90’	1915.00’	3.80’	3.10’	5.10’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

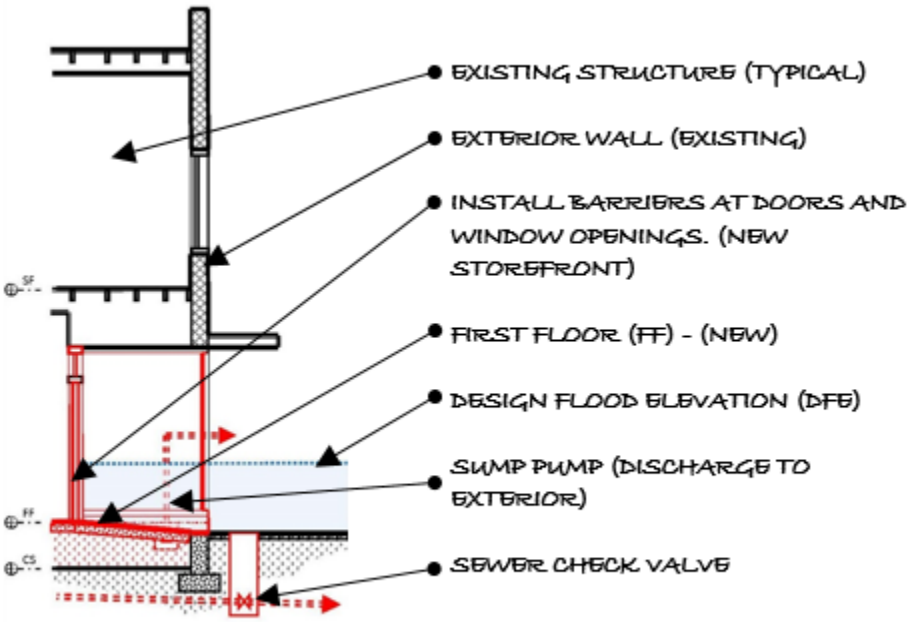
Aerial View

Front (North) Elevation

Background:

The structure is located in the downtown commercial district and fronts W Main Street. It is located in the middle of a block and abuts adjacent structures on both sides. The property borders the left descending bank of Peak Creek and within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:

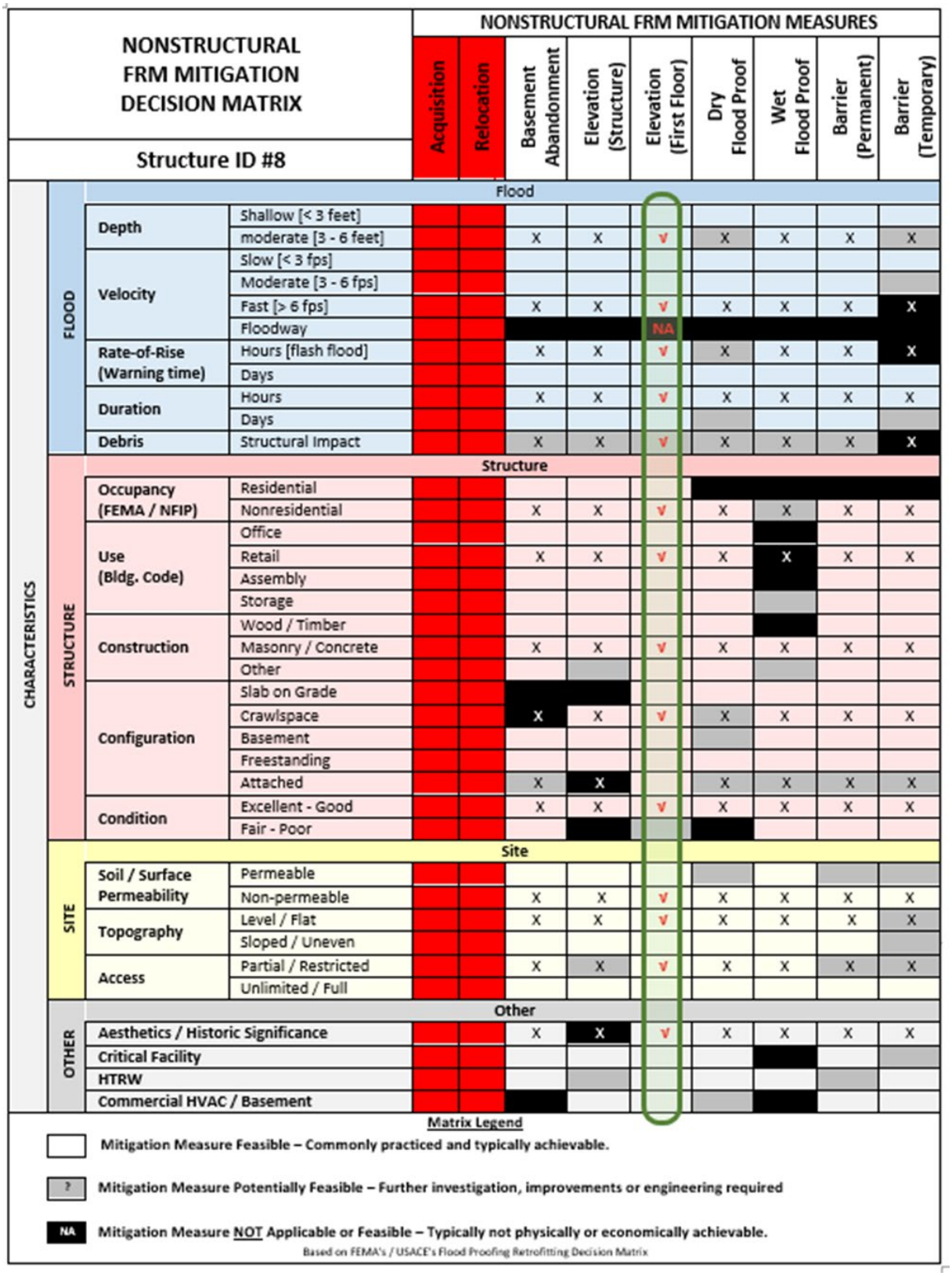


ALTERNATIVE #1 – Elevate First Floor

Remove the existing first floor construction, fill the crawl space and provide new floor construction at or above the DFE.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET



NONSTRUCTURAL FRM MITIGATION DECISION MATRIX		NONSTRUCTURAL FRM MITIGATION MEASURES								
Structure ID #8		Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS										
FLOOD	Flood									
	Depth – Shallow [< 3 feet]									
	Depth – moderate [3 - 6 feet]			X	X	V	X	X	X	X
	Velocity – Slow [< 3 fps]									
	Velocity – Moderate [3 - 6 fps]									
	Velocity – Fast [> 6 fps]			X	X	V	X	X	X	X
	Velocity – Floodway					NA				
	Rate-of-Rise (Warning time) – Hours [flash flood]			X	X	V	X	X	X	X
	Rate-of-Rise (Warning time) – Days									
	Duration – Hours			X	X	V	X	X	X	X
	Duration – Days									
	Debris – Structural Impact			X	X	V	X	X	X	X
STRUCTURE	Structure									
	Occupancy (FEMA / NFIP) – Residential									
	Occupancy (FEMA / NFIP) – Nonresidential			X	X	V	X	X	X	X
	Use (Bldg. Code) – Office									
	Use (Bldg. Code) – Retail			X	X	V	X	X	X	X
	Use (Bldg. Code) – Assembly									
	Use (Bldg. Code) – Storage									
	Construction – Wood / Timber									
	Construction – Masonry / Concrete			X	X	V	X	X	X	X
	Construction – Other									
	Configuration – Slab on Grade									
	Configuration – Crawlspace			X	X	V	X	X	X	X
	Configuration – Basement									
	Configuration – Freestanding									
	Configuration – Attached			X	X		X	X	X	X
	Condition – Excellent - Good			X	X	V	X	X	X	X
	Condition – Fair - Poor									
SITE	Site									
	Soil / Surface Permeability – Permeable									
	Soil / Surface Permeability – Non-permeable			X	X	V	X	X	X	X
	Topography – Level / Flat			X	X	V	X	X	X	X
	Topography – Sloped / Uneven									
	Access – Partial / Restricted			X	X	V	X	X	X	X
	Access – Unlimited / Full									
OTHER	Other									
	Aesthetics / Historic Significance			X	X	V	X	X	X	X
	Critical Facility									
	HTRW									
	Commercial HVAC / Basement									

Matrix Legend

- Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

117 Jefferson AVE N Structure ID #9

Structure Information / Data:

Name/Description: Pulaski Fire Station
Location: 117 Jefferson AVE N
Occupancy type: Nonresidential / Business
No. of Stories: 2
Critical Facility: ☒ Yes ☐ No

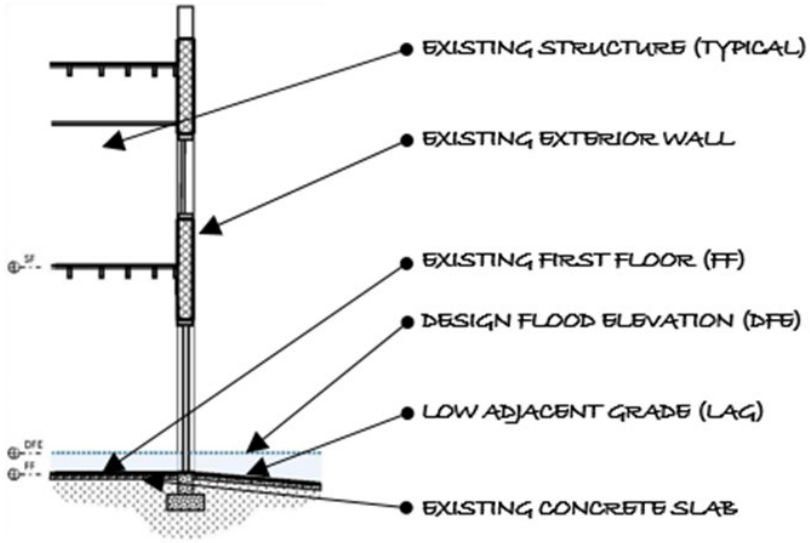
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Concrete
Foundation Wall: Masonry / Concrete
☒ Grade
☐ Crawlspace
☐ Basement
Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

Key Building Features:

- First Floor 1.20 ft. below DFE
- Low Adjacent Grade 3.20 ft. below DFE
- Building systems and utilities were not observed.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF/CS	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF/CS
1912.80’	1914.80’	NA	1916.00’	3.20’	1.20’	NA
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

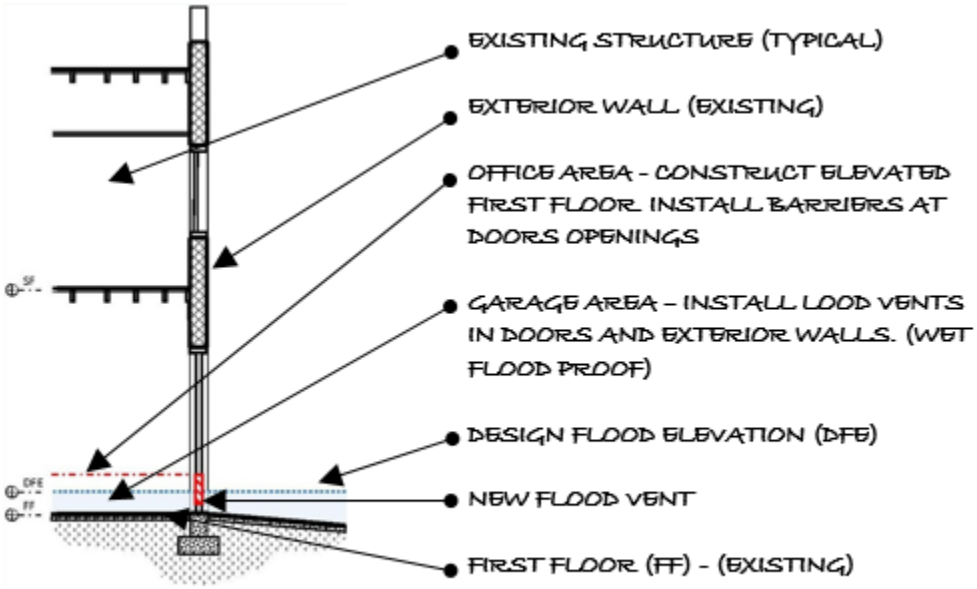
Aerial View

Front (East) Elevation

Background:

The structure is located in the downtown commercial district, is free standing and fronts Jefferson Avenue N. Property and structure borders Peak Creek (right descending bank). The structure is within the boundaries of FEMA's 1% regulatory flood plain. The structure has historic significance.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION
NOT TO SCALE

ALTERNATIVE #1 – Wet Flood Proofing

a) ***Install flood vents*** in the garage doors to the apparatus bays.
b) ***Elevate*** equipment storage areas in the apparatus bays.

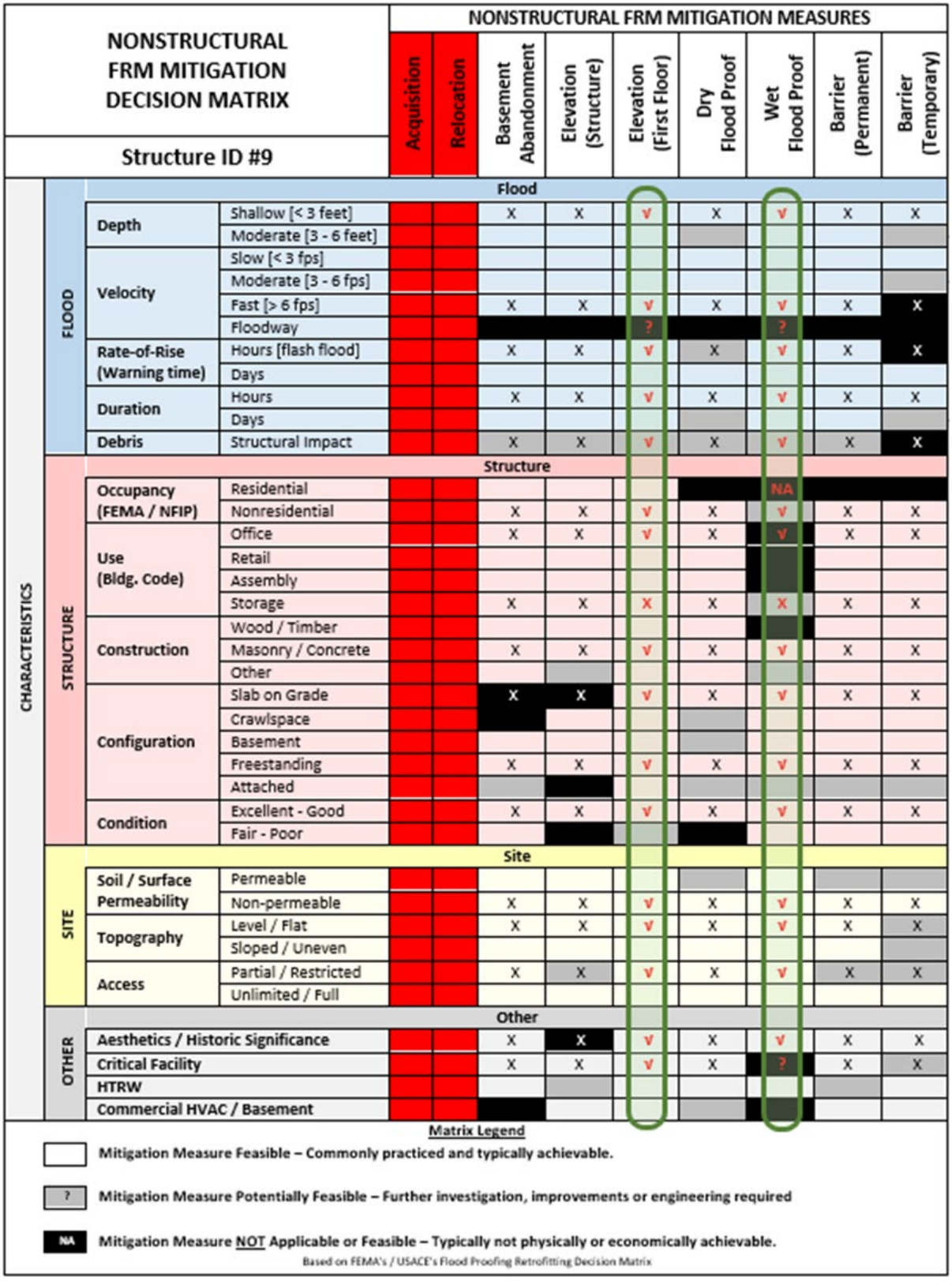
c) ***Provide*** mobile turnout gears storage units.
d) ***Provide*** removable closures or flood resistance doors at all first floor door openings of the office and the walls enclosing it.
e) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.
a) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

ALTERNATIVE #2 – Elevate First Floor (Office Area)

An alternative to dry flood proofing the office area would be to provide new floor construction at or above the DFE in that area.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET



NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES							
Structure ID #9			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
FLOOD			Flood								
	Depth	Shallow [< 3 feet]			X	X	√	X	√	X	X
		Moderate [3 - 6 feet]									
	Velocity	Slow [< 3 fps]									
		Moderate [3 - 6 fps]									
		Fast [> 6 fps]			X	X	√	X	√	X	X
		Floodway					?		?		
	Rate-of-Rise (Warning time)	Hours [flash flood]			X	X	√	X	√	X	X
		Days									
	Duration	Hours			X	X	√	X	√	X	X
		Days									
	Debris	Structural Impact			X	X	√	X	√	X	X
STRUCTURE			Structure								
	Occupancy (FEMA / NFIP)	Residential							NA		
		Nonresidential			X	X	√	X	√	X	X
	Use (Bldg. Code)	Office			X	X	√	X	√	X	X
		Retail									
		Assembly									
		Storage			X	X	X	X	X	X	X
	Construction	Wood / Timber									
		Masonry / Concrete			X	X	√	X	√	X	X
		Other									
	Configuration	Slab on Grade			X	X	√	X	√	X	X
		Crawlspace									
		Basement									
		Freestanding			X	X	√	X	√	X	X
		Attached									
	Condition	Excellent - Good			X	X	√	X	√	X	X
		Fair - Poor									
SITE			Site								
	Soil / Surface Permeability	Permeable									
		Non-permeable			X	X	√	X	√	X	X
	Topography	Level / Flat			X	X	√	X	√	X	X
		Sloped / Uneven									
	Access	Partial / Restricted			X	X	√	X	√	X	X
		Unlimited / Full									
OTHER			Other								
	Aesthetics / Historic Significance				X	X	√	X	√	X	X
	Critical Facility				X	X	√	X	?	X	X
	HTRW										
	Commercial HVAC / Basement										

Matrix Legend

- Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

42 1st Street NW Structure ID #10

Structure Information / Data:

Name/Description: Pulaski Municipal Building
Location: 42 1st Street NW
Occupancy type: Nonresidential / Business
No. of Stories: 2 with basement
Critical Facility: ☒ Yes ☐ No

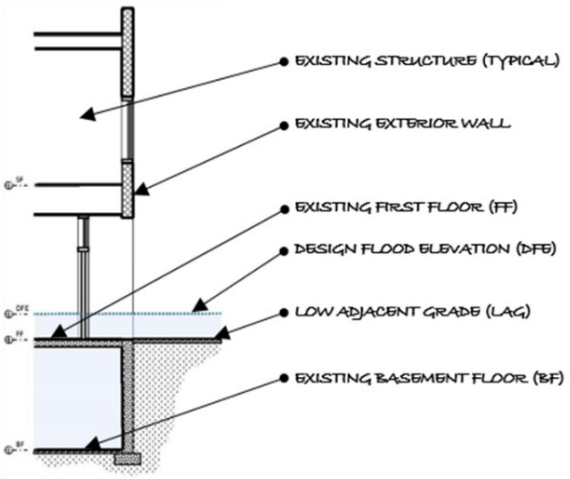
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Concrete
Foundation Wall: Concrete
☐ Grade
☐ Crawlspace
☒ Basement
Historic Status: Not Historic
1st floor doors: **To be Determined**

Key Building Features:

- First Floor is 2.20 ft. below DFE
- Basement is 12.20 ft. below DFE
- Exterior HVAC units are on the roof.
- Interior systems are in the basement.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1911.00’	1912.80’	1902.80’	1915.00’	4.00’	2.20’	12.20’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

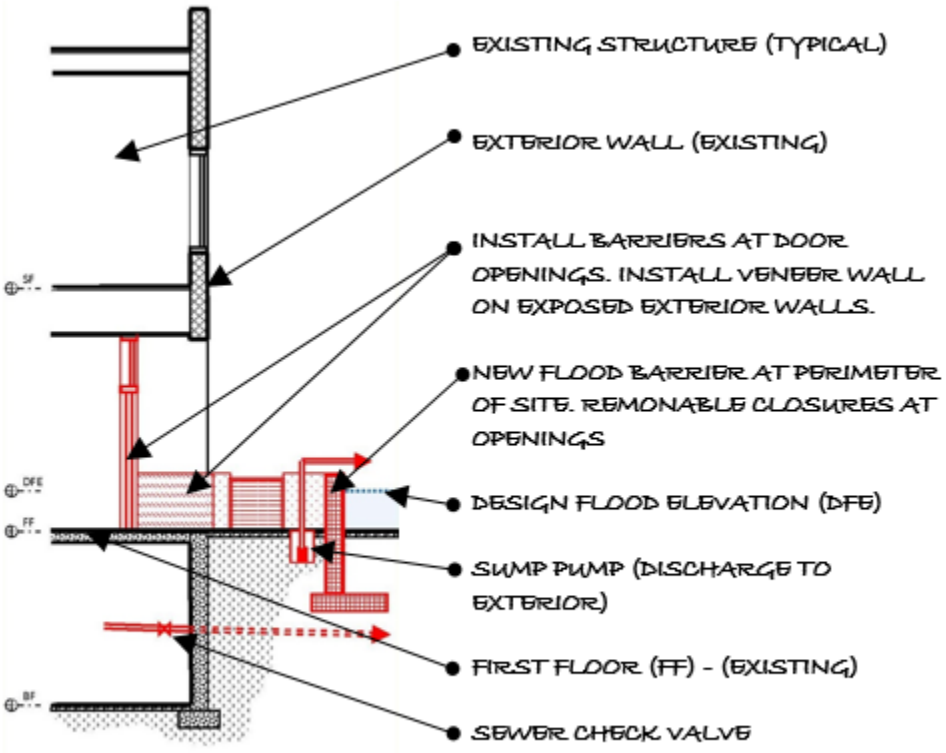
Aerial View

Front (South) Elevation

Background:

The structure is located in the downtown commercial district, is free standing and fronts 1st Street NW. Property and structure borders Peak Creek (right descending bank). The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



DIAGRAMMATIC WALL SECTION

NOT TO SCALE

ALTERNATIVE #1 – Wall or Barrier

a) ***Wall or Barrier:*** A wall or barrier system at the perimeter of the site with removable closures may be best measure considered to reduce flood risk. Locating it at the perimeter of the property will have the least impact on structure access, aesthetics, and circulation in the parking areas surrounding it

b) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.

c) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

d) ***Exterior Wall Penetration:*** Inspection and repair of exterior masonry walls to resist infiltration of flood water and verification their structural stability to resist the flood water forces will be required.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET

NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES								
Structure ID #10			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
	FLOOD	Flood									
		Depth	Shallow [< 3 feet]			X	X	X	X	X	√	X
			Moderate [3 - 6 feet]									
		Velocity	Slow [< 3 fps]									
			Moderate [3 - 6 fps]									
			Fast [> 6 fps]			X	X	X	√	X	√	X
			Floodway								NA	
		Rate-of-Rise (Warning time)	Hours [flash flood]			X	X	X	X	X	√	X
			Days									
		Duration	Hours			X	X	X	X	X	√	X
			Days									
		Debris	Structural Impact			X	X	X	X	X	X	X
	STRUCTURE	Structure										
		Occupancy (FEMA / NFIP)	Residential								NA	
			Nonresidential			X	X	X	X	X	√	X
		Use (Bldg. Code)	Office			X	X	X	X	X	√	X
			Retail									
			Assembly									
			Storage									
		Construction	Wood / Timber									
			Masonry / Concrete			X	X	X	X	X	√	X
			Other									
		Configuration	Slab on Grade									
			Crawlspace									
			Basement			X	X	X	X	X	√	X
			Freestanding			X	X	X	X	X	√	X
			Attached									
		Condition	Excellent - Good			X	X	X	X	X	√	X
			Fair - Poor									
	SITE	Site										
		Soil / Surface Permeability	Permeable									
			Non-permeable			X	X	X	X	X	√	X
		Topography	Level / Flat			X	X	X	X	X	√	X
			Sloped / Uneven									
		Access	Partial / Restricted									
			Unlimited / Full			X	X	X	X	X	√	X
	OTHER	Other										
		Aesthetics / Historic Significance										
		Critical Facility				X	X	X	X	X	√	X
		HTRW										
		Commercial HVAC / Basement			X	X	X	X	X	X	√	X

Matrix Legend

- ☐ **Mitigation Measure Feasible – Commonly practiced and typically achievable.**
- ? **Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required**
- NA **Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.**

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

110 N Washington Ave Structure ID # 11

Structure Information / Data:

Name/Description: Dalton Theater Building
Location: 110 N Washington Ave
Occupancy type: Nonresidential / Assembly
No. of Stories: 3 with a basement
Critical Facility: ☐ Yes ☒ No

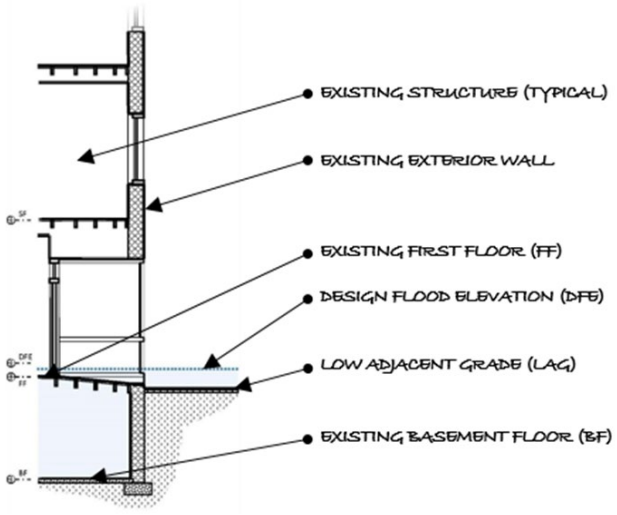
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Wood
Foundation Wall: Masonry / Concrete
☐ Grade
☐ Crawlspace
☒ Basement
Historic Status: Historic Structure (Nature to be Determined)
1st floor doors: **To be Determined**

Key Building Features:

- First Floor 1.10 ft. below DFE
- Basement floor 11.10 ft. below DFE
- Building systems and utilities were not observed.
- Basement floor is dirt

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF
1911.50’	1913.10’	1903.10’	1914.20’	2.70’	1.10’	11.10’
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

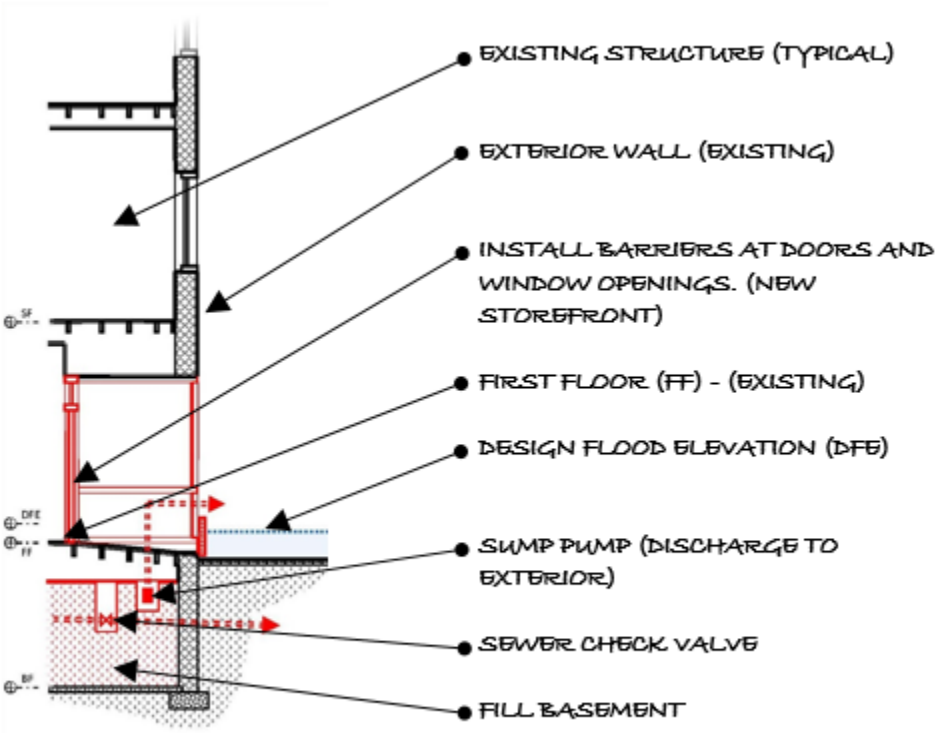
Aerial View

Front (West) Elevation

Background:

The structure is located in the downtown commercial district, is free standing and fronts Jefferson Avenue N. The property and structure border Peak Creek (right descending bank). The structure is within the boundaries of FEMA's 1% regulatory flood plain. The structure has historic significance and vacant.

RECOMMENDATIONS:



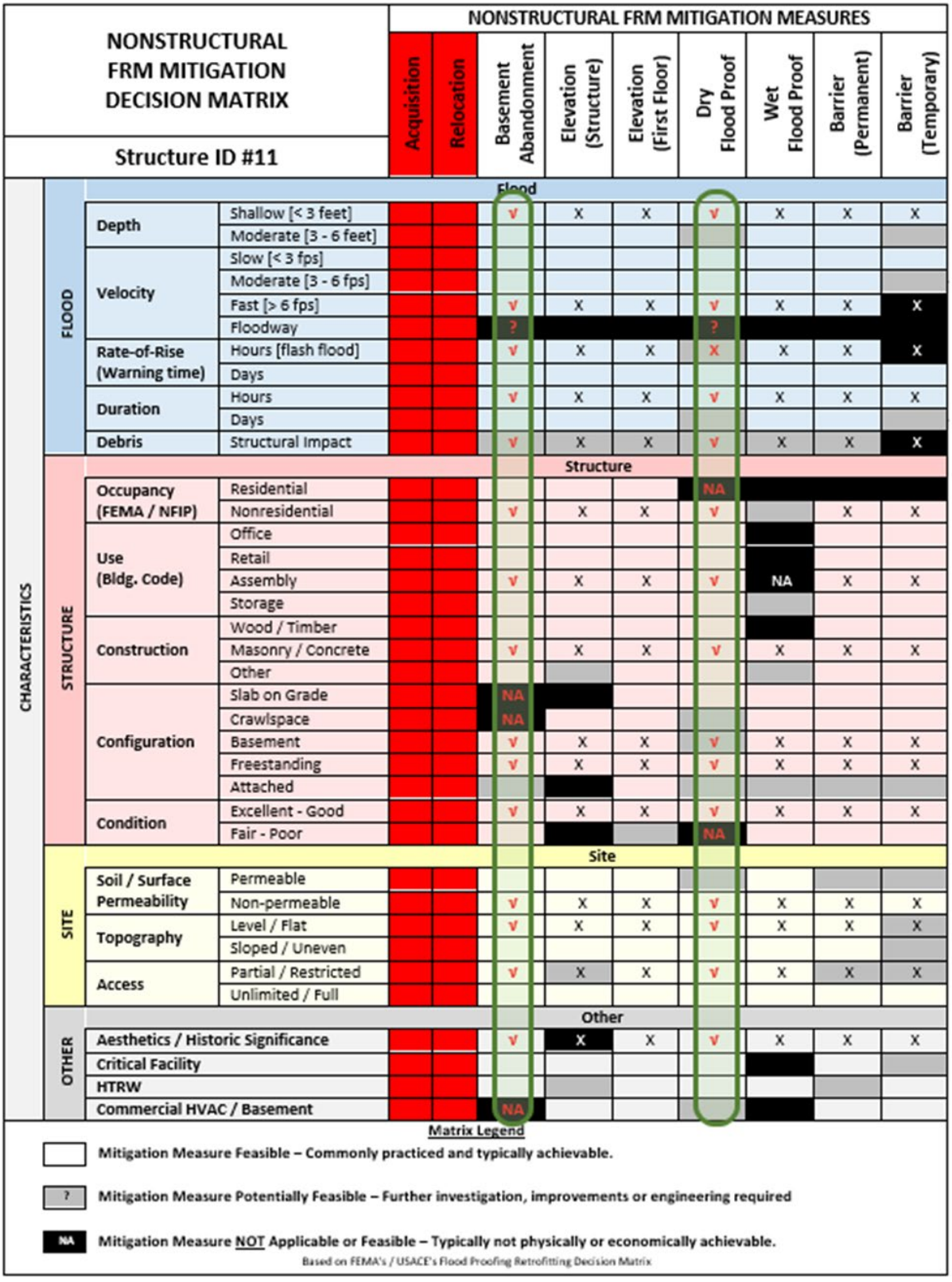
DIAGRAMMATIC WALL SECTION
NOT TO SCALE

ALTERNATIVE #1 – Dry Flood Proofing

a) Abandon and Fill Basement
b) ***Relocate*** existing utilities in the basement to the mezzanine level
c) ***Exterior Wall Penetration:*** Inspection and repair of exterior masonry walls to resist infiltration of flood water and verification their structural stability to resist the flood water forces will be required.
d) ***Removable Closures****:* Provide removable closures or replace existing doors with flood resistant doors in the exterior walls.
e) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.
f) ***Pumping:*** Provide internal site drainage system and sump pump(s) to remove water seepage and precipitation runoff within the protected area, and provide emergency power to sump pump(s).

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix

NONSTRUCTURAL FLOOD RISK MANAGEMENT CONCEPT SHEET



NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES								
Structure ID #11			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
FLOOD					Flood						
	Depth	Shallow [< 3 feet]			√	X	X	√	X	X	X
		Moderate [3 - 6 feet]									
	Velocity	Slow [< 3 fps]									
		Moderate [3 - 6 fps]									
		Fast [> 6 fps]			√	X	X	√	X	X	X
		Floodway			?			?			
	Rate-of-Rise (Warning time)	Hours [flash flood]			√	X	X	X	X	X	X
		Days									
	Duration	Hours			√	X	X	√	X	X	X
		Days									
	Debris	Structural Impact			√	X	X	√	X	X	X
STRUCTURE					Structure						
	Occupancy (FEMA / NFIP)	Residential						NA			
		Nonresidential			√	X	X	√		X	X
	Use (Bldg. Code)	Office									
		Retail									
		Assembly			√	X	X	√	NA	X	X
		Storage									
	Construction	Wood / Timber									
		Masonry / Concrete			√	X	X	√	X	X	X
		Other									
	Configuration	Slab on Grade			NA						
		Crawlspace			NA						
		Basement			√	X	X	√	X	X	X
		Freestanding			√	X	X	√	X	X	X
		Attached									
	Condition	Excellent - Good			√	X	X	√	X	X	X
		Fair - Poor						NA			
SITE					Site						
	Soil / Surface Permeability	Permeable									
		Non-permeable			√	X	X	√	X	X	X
	Topography	Level / Flat			√	X	X	√	X	X	X
		Sloped / Uneven									
	Access	Partial / Restricted			√	X	X	√	X	X	X
		Unlimited / Full									
OTHER					Other						
	Aesthetics / Historic Significance				√	X	X	√	X	X	X
	Critical Facility										
	HTRW										
	Commercial HVAC / Basement				NA						

Matrix Legend

- Mitigation Measure Feasible – Commonly practiced and typically achievable.
- ? Mitigation Measure Potentially Feasible – Further investigation, improvements or engineering required
- NA Mitigation Measure NOT Applicable or Feasible – Typically not physically or economically achievable.

Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix

89 Commerce Street Structure ID # 12

Structure Information / Data:

Name/Description: Emergency Operation Center
Location: 89 Commerce Street
Occupancy type: Nonresidential / Business
No. of Stories: 1
Critical Facility: ☒ Yes ☐ No

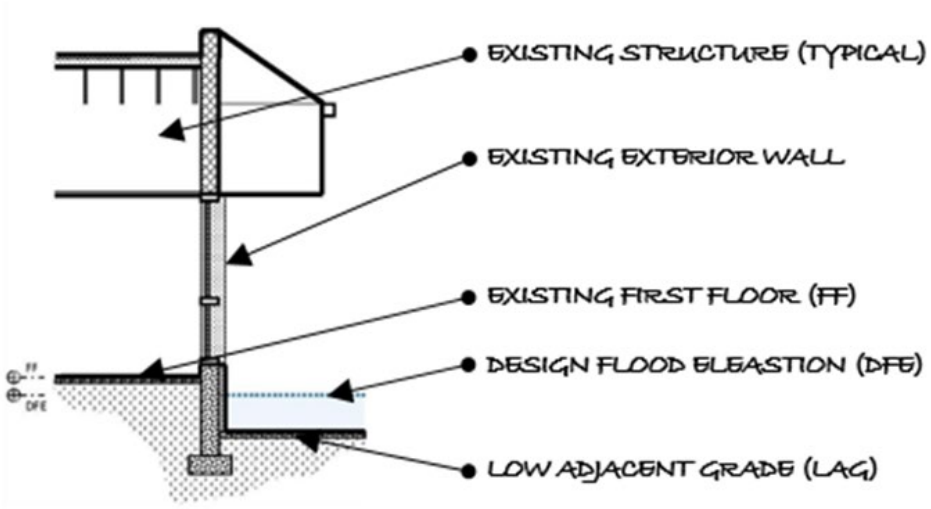
Building Construction:

Exterior Walls: Masonry
Floor Construction (1st Flr.): Concrete
Foundation Wall: Masonry / Concrete
☒ Grade
☐ Crawlspace
☐ Basement
Historic Status: N/A
1st floor doors: **To be Determined**

Key Building Features:

- First floor 1 ft. above DFE
- Low Adjacent Grade 3 ft. below DFE
- Building systems and utilities were not observed.

Structure/Flood Elevations Table (all elevations in ft.)*						
LAG	FF	BF/CS	DFE	Δ DFE-LAG	Δ DFE-FF	Δ DFE-BF/CS
1912.50’	1916.50’	NA	1915.50’	3.00’	(1.00’)	NA
ABBREVIATIONS: FF – First Floor Elevation; LAG – Low Adjacent Grade Elevation; BF – Basement Floor Elevation; CS – Crawl Space Ground Elevation; DFE – Design Flood Elevation; Δ – Delta (Elevation Difference); NA – Not Applicable; * - Estimated						



DIAGRAMMATIC WALL SECTION (EXISTING STRUCTURE)
NOT TO SCALE

Structure Photographs:

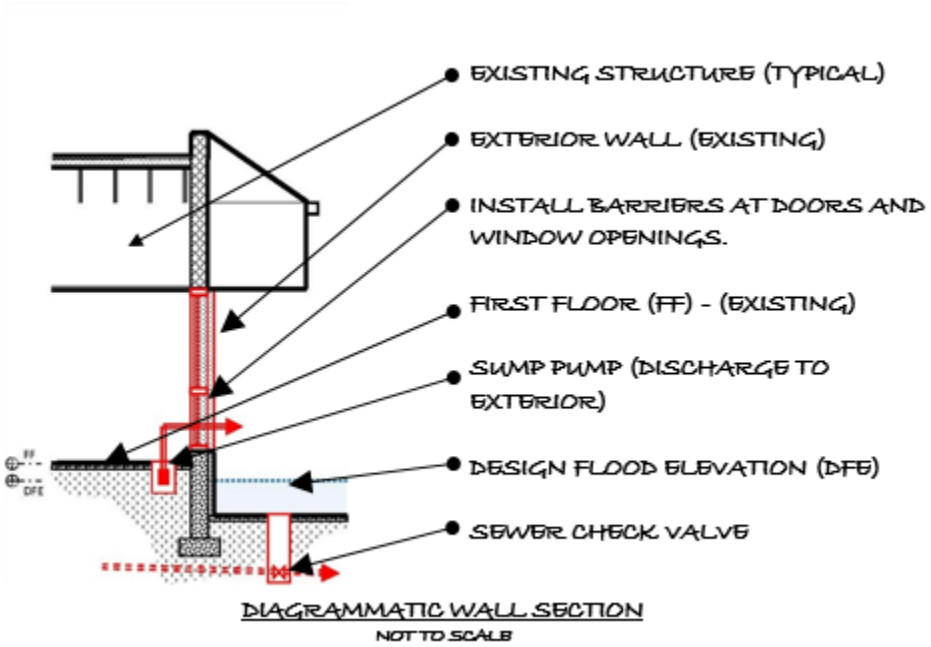
Aerial View

Front (North) Elevation

Background:

The structure is located at the south edge of the downtown district and fronts on Commerce Street. It is located at the end of a block and abuts adjacent structures on one side with paved parking and roadway at the other side, front and rear. The structure is within the boundaries of FEMA's 1% regulatory flood plain.

RECOMMENDATIONS:



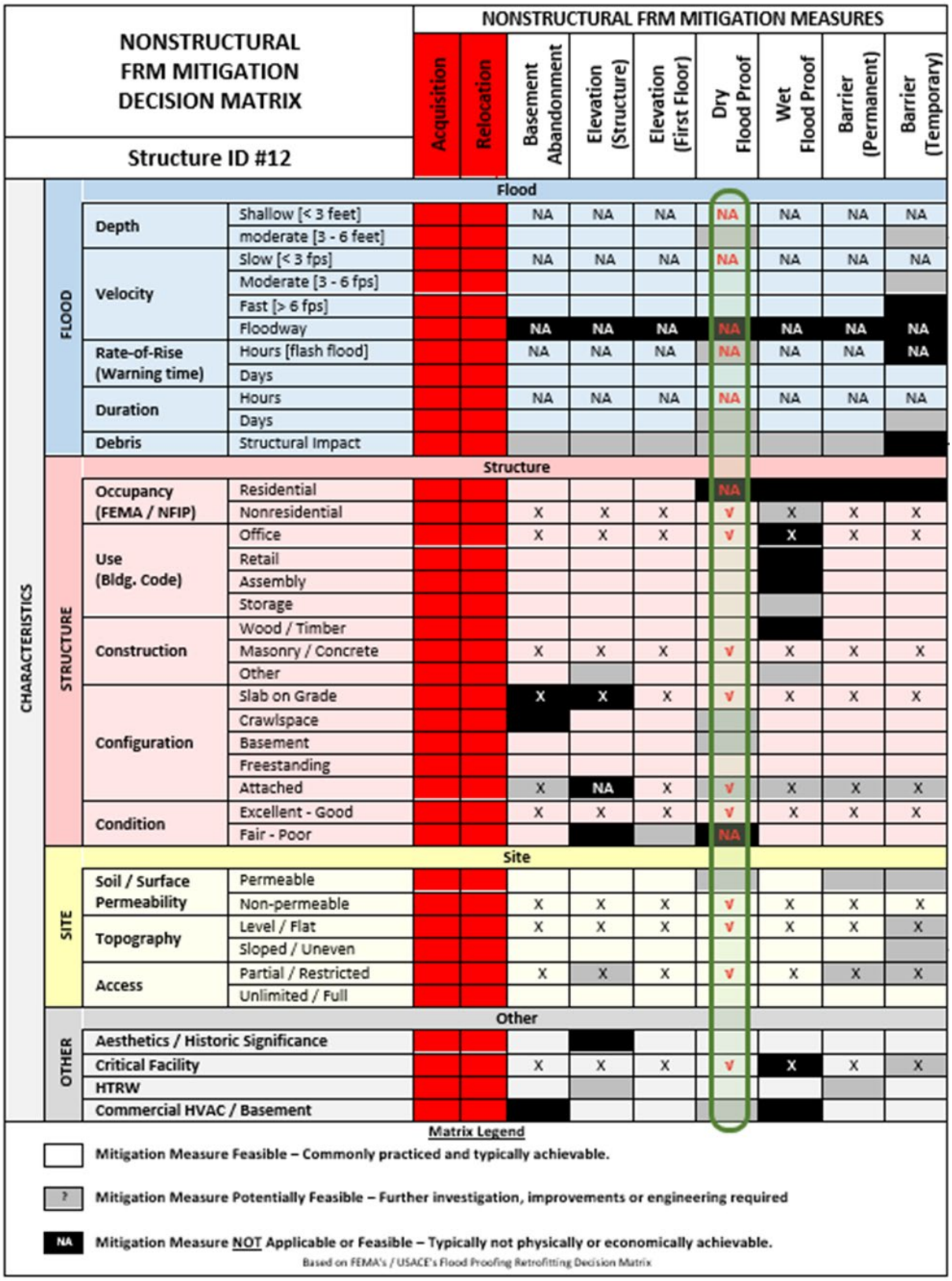
DIAGRAMMATIC WALL SECTION

NOT TO SCALE

ALTERNATIVE #1 – Dry Flood Proofing

a) ***Exterior Wall Penetration:*** Inspection and repair of exterior masonry walls to resist infiltration of flood water and verification their structural stability to resist the flood water forces will be required.
b) ***Sewage Check Valve:*** Provide check valves or back flow preventers in sewer lines and storm water drainage system.
c) ***Pumping:*** An internal drainage system and sump pump(s) inside the structure should be considered to remove internal water seepage from the structure, emergency power is available via an emergency generator at the rear of the building.

Decision Matrix Based on FEMA/USACE's Flood Risk Management Decision Matrix



NONSTRUCTURAL FRM MITIGATION DECISION MATRIX			NONSTRUCTURAL FRM MITIGATION MEASURES							
Structure ID #12			Acquisition	Relocation	Basement Abandonment	Elevation (Structure)	Elevation (First Floor)	Dry Flood Proof	Wet Flood Proof	Barrier (Permanent)	Barrier (Temporary)
CHARACTERISTICS											
FLOOD		Flood									
	Depth	Shallow [< 3 feet]			NA	NA	NA	NA	NA	NA	NA
		moderate [3 - 6 feet]									
	Velocity	Slow [< 3 fps]			NA	NA	NA	NA	NA	NA	NA
		Moderate [3 - 6 fps]									
		Fast [> 6 fps]									
		Floodway			NA	NA	NA	NA	NA	NA	NA
	Rate-of-Rise (Warning time)	Hours [flash flood]			NA	NA	NA	NA	NA	NA	NA
		Days									
	Duration	Hours			NA	NA	NA	NA	NA	NA	NA
		Days									
	Debris	Structural Impact									
STRUCTURE		Structure									
	Occupancy (FEMA / NFIP)	Residential						NA			
		Nonresidential			X	X	X	V	X	X	X
	Use (Bldg. Code)	Office			X	X	X	V	X	X	X
		Retail									
		Assembly									
		Storage									
	Construction	Wood / Timber									
		Masonry / Concrete			X	X	X	V	X	X	X
		Other									
	Configuration	Slab on Grade			X	X	X	V	X	X	X
		Crawlspace									
		Basement									
		Freestanding									
		Attached			X	NA	X	V	X	X	X
	Condition	Excellent - Good			X	X	X	V	X	X	X
		Fair - Poor						NA			
SITE		Site									
	Soil / Surface Permeability	Permeable									
		Non-permeable			X	X	X	V	X	X	X
	Topography	Level / Flat			X	X	X	V	X	X	X
		Sloped / Uneven									
	Access	Partial / Restricted			X	X	X	V	X	X	X
		Unlimited / Full									
OTHER		Other									
	Aesthetics / Historic Significance										
	Critical Facility				X	X	X	V	X	X	X
	HTRW										
	Commercial HVAC / Basement										

Matrix Legend

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Based on FEMA's / USACE's Flood Proofing Retrofitting Decision Matrix