# RESILIENCE HUB BUSINESS PLAN

## Margaret Fuller House


## OVERVIEW

Resilience Hubs are community-serving facilities augmented to support residents, coordinate communication, distribute resources, and reduce carbon pollution while enhancing quality of life. Hubs can meet a myriad of physical and social goals by utilizing a trusted physical space such as a community center, recreation facility, or multi-family housing building as well as the surrounding infrastructure such as a vacant lot, community park, or local business. They provide an opportunity to effectively work at the nexus of community resilience, emergency management, climate change mitigation, and social equity while also providing opportunities for communities to become more self-determining, socially connected, and successful before, during, and after disruptions. At a minimum, a resilience hub needs to:

- provide wanted day to day community services;
- be equipped to support the community in the event of an emergency, including providing shelter and electricity; and
- be able to run on its own for at least 72 hours without power from the grid.

In addition to providing shelter and electricity, a resilience hub should have the capacity to:

- communicate with residents during and after an emergency;
- maintain a supply of and provide access to freshwater and resources such as food, ice, refrigeration, charging stations, basic medical supplies, and other emergency supplies;
- educate residents about emergency preparedness in their homes; and
- have a plan and system in place to care for vulnerable individuals.

## THE PORT DEMOGRAPHICS

- Population: 2,828
- White: 71.2%, Black: 10.5%, Asian: 13.1%
- Hispanic/Latino: 4-17%
- Nonfamily Households: 67.8%
- Under 18: 10.6%
- Over 65: 4-16%
- 1,295 households
- 1,162 occupied units
- 362 owner-occupied units (31.1%)
- 800 renter-occupied units (68.8%)
- Languages spoken: Bengali, Haitian/Creole, Chinese, Cape

Through a grant from the Massachusetts Municipal Vulnerability Preparedness Program, the City of Cambridge hired Kim Lundgren Associates, Inc. to assess the current and potential capacity of the Margaret Fuller House to operate as a Resilience Hub in the Port Neighborhood. The consultants, which also included the firms Woodard and Curran and Climate Resilience Consulting, conducted an in-person meeting with the Executive Director, a physical site assessment and online research to understand the organization's mission, site amenities, and the services provided to its members. All of this was completed over the course of three months.

These steps resulted in a recognition that the Margaret Fuller House (MFH) is already serving many essential social resilience functions of a Resilience Hub. However, there are several programmatic changes and physical upgrades that could be implemented to make the organization even stronger, especially when faced with climate impacts. This business plan summarizes the short- and long-term programmatic and physical changes MFH could embrace that will support and enhance the mission of this long-standing and important organization in the Port Neighborhood.

## The Objective

The Margaret Fuller House (MFH) is located at 71 Cherry Street in Cambridge which is the Old CambridgePort Historic District area of the City, now known as "the Port". MFH is a social services organization with an overall mission to "strengthen and empower youth, families and community residents" and address the "economic, social and political inequities that shape the lives and futures of Port/Area IV residents."

Using their mission as the foundation for the assessment, the purpose of this project was to determine what programs, features and assets of the Margaret Fuller House could be upgraded and/or supplemented to serve as a Resilience Hub. The ultimate objective was to enhance the current mission of MFH and to make recommendations on how to become a Resilience Hub in a way that supports their mission and makes them more resilient as they conduct their work. In order to make a determination, the consultant team followed 3 steps:

1. Conduct a Meet and Greet with the Executive Director, Selvin Chambers in May 2019. At this Meet and Greet we reviewed which elements of our Resilience Hub checklist (see attached) that MFH currently addressed. The team focused on the *Structure and Services* and *Administration* tabs of the checklist.
2. Perform a Physical Resilience Audit (see attached under *Physical Resilience Audit* tab) to assess the structural features available on site in May 2019. This included investigating past, current and future flood and heat risks, and looked at the energy system, emergency backup systems, and condition of the building.
3. Research background of the organization, site, and neighborhood. Who lives here? Who does the organization serve? What are their stressors? This was primarily conducted online but was supplemented by the Meet and Greet with Mr. Chambers.

Based on the consultants' research and assessments, the following observations were made:

- Observation 1: While emergency plans are in place, the organization has not experienced an emergency in a while and cannot operate fully on its own for 72 hours without grid-supplied power.
- Observation 2: The structure is vulnerable to climate impacts, including localized flooding in the basement where mechanical equipment is located. In case of a power outage, there is no backup generator.
- Observation 3: The neighborhood residents experience a myriad of health issues, do not have easy access to healthy food (the largest percentage of food insecure residents in Cambridge live in the Port neighborhood), and some members do not have emergency childcare services accessible to them.

## The Opportunity

The timing is right for the Margaret Fuller House to consider establishing itself as a Resilience Hub, especially given the current strategic planning exercise with the MFH Board of Directors, increasing focus on, and local experience with, the impacts of climate change, and the availability of guidance and funding to prepare our communities to address our vulnerabilities. There a myriad of funding sources, incentives, companies and organizations that can assist MFH in this endeavor. Recognizing the needs of MFH to increase its resilience, the following goals were identified:

- Goal #1: Prepare the organization to experience emergencies and operate on its own for 72 hours.
- Goal #2: Increase the resilience of the site to withstand climate change impacts.
- Goal #3: Increase personal resilience of the MFH members.

## The Solution

The recommendations that were created to address the goals take into consideration how to sustain the organization and how to advance the mission. The Margaret Fuller House has embraced many of the Resilience Hub components, including a strong commitment to social cohesion. The final recommendations embrace MFH's current efforts, with an eye towards how to strengthen the organization and improve their ability to provide top notch services to their members. The three recommendations include:

- Recommendation #1: Create and implement an emergency preparedness plan
- Recommendation #2: Implement short-term site improvements to improve the structural resilience of the building
- Recommendation #3: Enhance the programmatic capabilities of MFH to accomplish its mission, specifically related to building member skills and access to resources

The plan, and implementation steps necessary to achieve the plan, are outlined in detail.

## RESILIENCE HUB PLAN OF ACTION

In June 2019, MFH began a strategic planning exercise with the Board of Directors. This presents an exciting opportunity to present recommendations that MFH can incorporate into their planning efforts and ensure they continue to create a resilient organization to serve their members. In addition to the implementation steps below, a full-detailed report from the Physical Resilience Audit is included in the Appendix.

**Margaret Fuller House**
**4 Pillars of Service**

1. Food Service
2. Community Advancement Services
3. Child and Teen Services
4. Adult Enrichment

### Actions and Implementation Steps

In order to accomplish the goals of this Plan, three categories of actions have been developed:

1) Ensure the Organization and Site are Prepared for an Emergency;

2) Create A Resilient Structure;

3) Adopt Programs to Create more Resilient Community Members.

The following table includes a list of these actions, their implementation steps, a description of each step, which of MFH's 4 Pillars of Service are supported, the timeframe for implementation, the partners needed (including an MFH Champion to take the lead), and any resources and best practices that can be consulted to help the organization complete the steps. Please note: compliance with the Americans with Disabilities Act was highlighted as a priority by the organization. All capital improvements and actions included below should consider and incorporate ADA accessibility.

| Actions and Implementation Steps | Description | Pillar(s) of Service Supported | Timeframe to Implement | Partners (C = MFH Champion) | Resources and Best Practices |
|---|---|---|---|---|---|
| **Action 1: Conduct an Emergency Preparedness (EP) Exercise** | | | | | |
| Review existing Emergency Preparedness Plan | MFH has an existing Emergency Preparedness Plan (EPP) in place. Review this first to see what is included, how to create an exercise that addresses the plan components and determine whether they are complete/adequate. | All Pillars | 6-8 months | • Facility Manager (C)<br>• Executive Director<br>• Cambridge Emergency Management | http://safe-wise.com/downloads/EmergencyPlanningGuidelinesforNonprofits_001.pdf |

| Actions and Implementation Steps | Description | Pillar(s) of Service Supported | Timeframe to Implement | Partners<br>(C = MFH Champion) | Resources and Best Practices |
|---|---|---|---|---|---|
| Conduct Emergency Preparedness Drill | Emergency drills and practice exercises are important for preparing for emergency situations. An organization should follow these six steps to successfully conduct emergency drills and exercises:<br>1. Develop emergency plans<br>2. Train employees<br>3. Conduct tabletop exercises<br>4. Conduct drills<br>5. Conduct functional exercises<br>6. Conduct full-scale exercises | All Pillars | 3-6 months | • Facility Manager (C)<br>• Executive Director<br>• Cambridge Emergency Management<br>• MFH Staff | https://www.emcins.com/Docs/OFILib/AA083001483_20140723.PDF?lc=true |
| Debrief the Results, Conduct After-Action Reporting and Improvement Plan | After the drills, it is important to assess how effective the exercises were. An After-Action Report and Improvement Plan (AAR/IP) is used to provide feedback to participating entities on their performance during the exercises. The AAR/IP summarizes exercise events and analyzes performance of the tasks identified as important during the planning process. It also evaluates achievement of the selected exercise objectives and demonstration of the overall capabilities being validated. The IP portion of the AAR/IP includes corrective actions for improvement, along with timelines for their implementation and assignment to responsible parties. Plans should be reviewed annually, at a minimum, and revised as necessary. | All Pillars | 2-3 months | • Facility Manager (C)<br>• Executive Director | https://sfdem.org/phase-4-after-action-report-and-improvement-planning-0 |

| Actions and Implementation Steps | Description | Pillar(s) of Service Supported | Timeframe to Implement | Partners (C = MFH Champion) | Resources and Best Practices |
|---|---|---|---|---|---|
| **Action 2: Create a Resilient Structure** | | | | | |
| Conduct an Energy Audit | A comprehensive energy audit can identify opportunities for increasing energy efficiency throughout a building, highlight relationships between various building systems, and provide cost and savings estimates for conducting the improvements. There are a variety of national energy audit standards that can guide decisions about what type of audit meets the project needs. Capital improvements can include easy projects with a short cost-recovery period, such as many lighting replacement projects or air-sealing a drafty building, as well as larger projects such as equipment replacements or window replacements. | All Pillars | 6-8 months | • Facility Manager (C) | https://www.pnnl.gov/main/publications/external/technical_reports/pnnl-20956.pdf[1] |
| Develop a Capital Improvements Plan | A capital improvements plan lays out a budget which includes asset purchases (such as equipment, facility acquisition, or leasehold improvements), asset investments (such as production costs of a product the organization will sell), financial stability targets (such as building an operating reserve or eliminating a deficit), or strategic targets (such as building a fund to support program or management initiatives per its strategic plan). Capital budgets often require a funding plan separate from and in addition to the operating budget. This funding plan can include a capital campaign as well as other funding strategies. The improvements laid out in this plan should be included in a capital improvements plan. | All Pillars | 12-15 months | • Executive Director (C)<br>• Director of Business & Finance Operations | http://www.capitalcampaigns.com/<br>http://www.nonprofit-knowhow.com/blog/capital-funding-20-the-new-approach-to-nonprofit-capital-projects |

[1] *Resilience Hub Guide,* Urban Sustainability Directors Network, May 2019.

| Actions and Implementation Steps | Description | Pillar(s) of Service Supported | Timeframe to Implement | Partners (C = MFH Champion) | Resources and Best Practices |
|---|---|---|---|---|---|
| Install an Uninterruptable Power Supply (UPS) | Power quality is important for electronic devices and sudden voltage changes can do significant damage, whether to a sensitive computer or a simple elevator motor. Uninterruptible Power Supplies (batteries) for mission-critical equipment and servers are important. These systems do not replace a generator, which provides continuous power. UPS systems are intended to run your critical systems for enough time to properly shut them down or switch to a generator. Sizing these to provide sufficient power for all of your critical devices is crucial and should be part of your conversation with your system tech. | All Pillars | 6-8 months | • Facility Manager (C)<br>• Director of Business & Finance Operations | https://www.goalzero.com/shop/power-stations/goal-zero-yeti-1250-portable-power-station/ |
| Install a Supplemental Sump Pump | The current sump pump system does not have a backup. It is recommended to add a battery system to supply interim mitigation. Small packaged systems can pump a few thousand gallons of water per hour for over 4 hours. | All Pillars | 6-12 months | • Facility Manager (C)<br>• Director of Business & Finance Operations | https://challenge.abettercity.org/toolkits/climate-resilience-toolkits/flooding-and-sea-level-rise/pumps |
| Install a Solar Photovoltaic System | Solar arrays (mounted either on the roof, ground or overhead in canopies) can play a very important role for the Resilience Hub. During normal mode, they provide significant economic and sustainability benefits that can reduce utility costs and impact on the grid. During outage and recovery modes, they can play a role in providing additional power generation. | All Pillars | 2-3 years | • Facility Manager (C)<br>• Director of Business & Finance Operations | https://amherstsurvival.org/solar-donor/<br>http://northeast-solar.com/blog/solar-and-social-justice-peace-development-fund-receives-free-solar-power |
| Elevate or Weather-Proof Critical Infrastructure | The best technology systems will be rendered useless if exposed to the environment during a weather event. Some considerations to mitigate that risk are liquid-tight conduit to protect cabling systems, and weather-proof enclosures for equipment like wireless access points that are installed throughout the building. | All Pillars | 2-3 years | • Facility Manager (C)<br>• Director of Business & Finance Operations | |

| Actions and Implementation Steps | Description | Pillar(s) of Service Supported | Timeframe to Implement | Partners<br>(C = MFH Champion) | Resources and Best Practices |
|---|---|---|---|---|---|
| Perform Floodproofing on the Building | Solutions include:<br>**Wet floodproofing:** engineered flood vents, water-resistant building materials, and elevating equipment.<br>**Dry Floodproofing**: Solutions include flood gates, backflow preventers on drains, sealing openings in walls and foundations, sump pumps and waterproof enclosures.<br>**Site Perimeter Floodproofing:** Sandbags, water-inflated tube systems and flood panels. | All Pillars | 2-3 years | • Facility Manager (C)<br>• Director of Business & Finance Operations | https://challenge.abettercity.org/toolkits/climate-resilience-toolkits/flooding-and-sea-level-rise/floodproofing<br>https://www.dhs.gov/publication/st-national-resilience-standards-flood-proofing-products-project-fact-sheet |
| Install Backup Storage | Batteries (the predominant form of storage a Resilience Hub will consider) produce electricity using an electrochemical reaction. The size and complexity of the system will dictate its footprint. However, in Resilience Hub applications, the size of the battery system will generally range from a few suitcase sized boxes to the size of several refrigerators. Larger systems (typically up to the size of a small shipping container) are possible. | All Pillars | 2-3 year | • Facility Manager (C)<br>• Director of Business & Finance Operations | https://www.techsoup.org/support/articles-and-how-tos/your-organizations-backup-strategy |
| Install Backup Generation | Backup or standby generation is usually provided in the form of a gasoline, diesel, propane or natural gas-fired unit that automatically starts in an outage. These systems are typically housed outdoors in rectangular boxes. Backup generation incorporates automatic transfer switches to ensure that they do not feed electricity back onto the utility's distribution lines during a power outage. Diesel, propane and gasoline systems require an external fuel tank while natural gas systems are fueled by the local gas utility's distribution lines. Though a relatively low-cost | All Pillars | 3-5 year | • Facility Manager (C)<br>• Director of Business & Finance Operations | https://www.consumerreports.org/cro/generators/buying-guide/index.htm |

| | | | | | |
|---|---|---|---|---|---|
| | solution for backup power, most conventional solutions do not offer the incentives and benefits that hybrid solutions[2] do during normal operations. | | | | |
| **Actions and Implementation Steps** | **Description** | **Pillar(s) of Service Supported** | **Timeframe to Implement** | **Partners (C = MFH Champion)** | **Resources and Best Practices** |
| **Action 3: Adopt Programs to Create more Resilient Members** | | | | | |
| Expand Healthy Eating/Active Living Program | Addressing and avoiding health issues is a key component of social resilience. One of the stressors identified for members of MFH was health issues. Incorporating healthy living programs (cooking classes, tips for talking with your doctor, pain management, walking groups, exercise classes, and health tips) into the organization's programs can help to address member health issues. | Food Services<br>Community Advancement Services | 6-12 months | • Senior Director of Programs (C)<br>• Community Liaison and Adult Enrichment Coordinator | http://www.healthyliving4me.org/programs/ |
| Investigate Local Food Generation | Another important tool for ensuring personal resilience is access to healthy foods. Resilience Hubs across the US are building community gardens of all shapes and sizes to provide local, nutritional food for their members. If the site doesn't have the capacity for a garden, partnering with local community gardens is an option as well. Squirrel Brand Community Garden is 0.5 miles from MFH and could provide a nice linkage to the rest of the Cambridge Community. | Food Services<br>Community Advancement Services | 6-12 months (depending on the level of action) | • Food Pantry Manager & Facility Manager (C) | http://www.urbanaglaw.org/non-profit-urban-ag/<br>https://citygrowers.wordpress.com/<br>https://www.millcitygrows.org/ |

[2] One possible resilience solution is a Hybrid Resilience System (HyRS), which typically incorporates solar photovoltaic generation (PV) with an energy storage system (batteries) and firm generation (diesel or natural gas). The HyRS approach creates generation diversity, offers value during normal operating conditions, and can be more economically sized to meet full operational requirements. Source: *Resilience Hubs: Shifting Power to Communities and Increasing Community Capacity*, Urban Sustainability Directors Network, January 2019.

| Actions and Implementation Steps | Description | Pillar(s) of Service Supported | Timeframe to Implement | Partners (C = MFH Champion) | Resources and Best Practices |
|---|---|---|---|---|---|
| Create an Emergency Childcare Plan | One of the issues communicated during the Meet and Greet was the lack of childcare for members in emergency situations. In the case of an emergency (Power outage, Nor'easter, etc.) it is important to know that your children can be cared for, even if you still must go to work. The center may be able to play that role if there is interest, funding and capacity. | Child and Teen Services | 6-12 months (depending on availability of back up generation at the facility) | • Senior Director of Programs (C) | https://cardinalatwork.stanford.edu/benefits-rewards/worklife/financial-assistance/emergency-back-care |
| Prepare the Center to Serve Residents Before, During and After Emergencies | In addition to providing shelter and electricity, each Resilience Hub should maintain a supply of and provide access to freshwater and resources such as food, ice, refrigeration, charging stations, basic medical supplies, and other supplies needed in the event of an emergency. Determining the amount of food, water, and supplies to have at each site will depend on neighborhood size and the number of people likely to utilize the site. Many of these details can be coordinated in conjunction with building upgrades and will involve outreach and engagement with community members. | All | 12 months | • Executive Director (C)<br>• Facility Manager<br>• Director of Business & Finance Operations<br>• Food Pantry Manager | https://www.enterprisecommunity.org/<br>https://seatpleasantmd.gov/smart-city/ |

## *Costs*

The following outlines the recommended actions and their steps, the potential costs or methods of implementation (where we could not find a specific cost), and the potential sources to fund the steps. Please note: the Massachusetts Non-Profit Network has access to grant funding opportunities that could fund many of these initiatives: http://massnonprofitnet.org/. In addition, the Nonprofit Finance Fund (NFF) helps mission-drive organizations adapt, thrive, and drive positive change through financing, consulting and partnering. This could also be a source of financing for many of these capital costs: https://nff.org/.

| Steps | Potential Cost or Method of Implementing | Funding Source(s) and Resources |
|---|---|---|
| **Building Upgrades** | | |
| Develop a Capital Improvements Plan | Develop through a Committee or hire a consultant. Fees vary for a consultant. Request for proposal recommended. | https://www.grantwatch.com/cat/3/capital-funding-grants.html<br>http://massnonprofitnet.org/ |
| Elevate or Weather-Proof Critical Infrastructure | Consider consolidating critical infrastructure such as heating equipment and electrical panels above flooding levels. | Incorporate into the Capital Improvements Plan<br>https://nff.org/ |
| Conduct Floodproofing | Varies with solution and facility. | Incorporate into the Capital Improvements Plan<br>https://nff.org/ |
| Install Backup Generation | A 25kW generator that would carry the site load would be approximately $50-100,000 depending on the degree of work on existing conditions and site work required. | Incorporate into the Capital Improvements Plan<br>http://massnonprofitnet.org/blog/non-profit-411-energy-efficiency-resources-organization/<br>https://nff.org/ |
| **Equipment** | | |
| Install Uninterruptable Power Supply (UPS) | $1,200 | Energy Star Product and Rebate Finder: https://www.energystar.gov/products/data_center_equipment/uninterruptible_power_supplies |
| Install a Supplemental Sump Pump | $3,500 | Incorporate into the Capital Improvements Plan |

| Steps | Potential Cost or Method of Implementing | Funding Source(s) and Resources |
|---|---|---|
| Install a Solar Photovoltaic System | $2.50 to $3.50 per watt[3] | MFH could consider a Power Purchase Agreement (PPA). A PPA is an agreement where the center would provide roof space and buy electricity. As part of the PPA, MFH could require energy storage for system deployment. The current Massachusetts solar programs include additional incentives for energy storage coupled with solar.<br><br>The State's Commercial PACE (Property Assessed Clean Energy) Program could also be an option. This involves the City opting into the program, which then allows property owners to agree to a betterment assessment on their property, which repays the financing. This would allow MFH to adopt more comprehensive energy upgrades and pay for them over a longer period, up to 20 years.<br><br>https://www.massdevelopment.com/what-we-offer/key-initiatives/pace<br><br>https://www.masscec.com/government-non-profit/solar<br><br>https://challenge.abettercity.org/toolkits/emissions-reduction-toolkits/renewable-energ/on-site |
| Install Backup Storage | $7,000 - $50,000+[4] | A growing number of incentives and rebates create opportunities to reduce (or potentially eliminate) cost to the Resilience Hub, while still providing benefit. |
| **Programs** | | |
| Conduct Emergency Preparedness Drill and Follow up | Staff Time | https://nff.org/ for partnering |
| Prepare the Center to Serve Residents Before, During and After Emergencies | • Charging Stations: 100W to 1250W ranging from $200-$1,000<br>• Assess available space to hold extra food, water, and supplies to accommodate the estimated number of members that will need to be served | • Partner with likeminded organizations or companies to sponsor components of the planning and implementation<br>• Individual funders through a "Preparedness Campaign" |
| Conduct an Energy Audit | $1,000 and $15,000 depending on the level of the audit:<br>• Level 1: Walk Through Analysis<br>• Level 2: Energy Survey and Engineering Analysis<br>• Level 3: Detailed Analysis of Capital-Intensive Modifications | http://massnonprofitnet.org/blog/non-profit-411-energy-efficiency-resources-organization/<br><br>https://emsenv.com/2016/04/28/commercial-energy-audit-cost/ |

[3] *USDN Resilience Hub Guide*

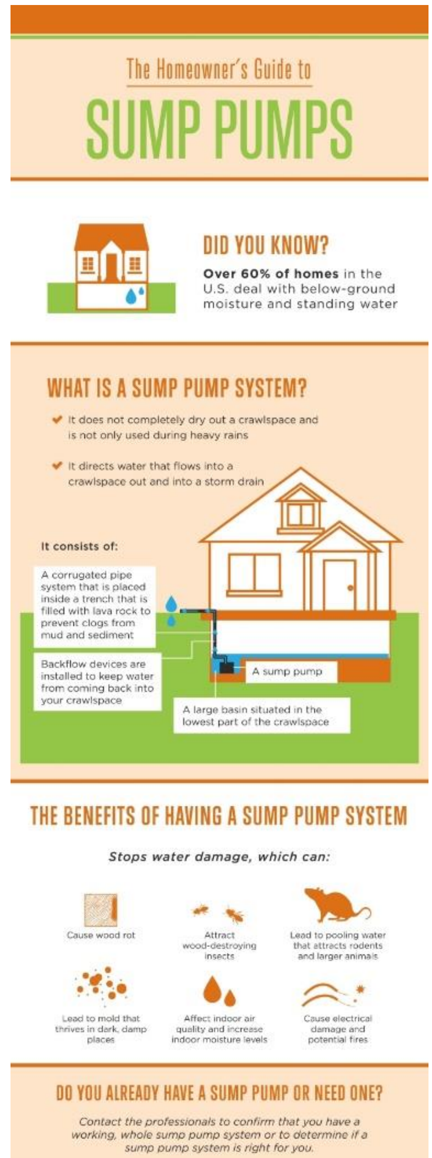
[4] *USDN Resilience Hub Guide*

| Steps | Potential Cost or Method of Implementing | Funding Source(s) and Resources |
|---|---|---|
| Expand Healthy Eating/Active Living Program | • Cost to hire additional staff<br>• Program material and printing costs | https://mapublichealth.org/priorities/access-to-healthy-affordable-food/ma-food-trust-program/ |
| Investigate Local Food Generation | • Staff time to establish the garden or the relationship with a local garden<br>• Cost of materials to set up a garden on-site (if feasible) – costs vary by size of community garden | https://www.mass.gov/how-to/apply-for-the-food-ventures-grant-program<br>https://www.maymca.com/initiatives/living |
| Create an Emergency Childcare Plan | • Needs Assessment<br>• Additional staffing<br>Costs will depend on whether the assessment is done in house and additional staff is hired | https://kresge.org/programs/human-services |
| | | |

## NEXT STEPS

The goal of this exercise was to create a Business Plan that enhances the mission of the Margaret Fuller House while helping them increase their resilience. The following steps should be taken to begin implementing the recommendations in this Business Plan:

- **Incorporate the implementation steps into the Capital Improvements Plan (CIP).** In the CIP we would recommend prioritizing the steps listed in the order they are presented, as they are associated with timelines and could be helpful to have in place before others are implemented. For example, elevating critical equipment is an important first step as floodproofing could be costly and time intensive. Having the equipment elevated will at least help alleviate damage from flooding if that happens before the building is floodproofed.
- **Be creative with funding**. Building resilience requires teamwork and community building. Here are some creative ways to fund resilience by forging new partnerships to support and fund your work:
  - Continue partnering with foundations, especially those that are funding emergency preparedness and resilience-building efforts.
  - Contact the companies that manufacture the products recommended above. These companies encourage the use of their products to create resilient structures. Funding MFH's upgrades or acquisitions presents a great opportunity for them to promote their product being used to create a more resilient non-profit and be part of the solution.
  - Habitat for Humanity could be a good source of donations of people and materials to support building upgrades. Alternatively, they could be a partner on a grant application to fund building improvements that incorporate floodproofing, installing a sump pump, and elevating or weatherproofing critical infrastructure.
- **Marketing:** As Mr. Chambers mentioned, "People want to fund impact." In addition to grants, incentives and creative funding sources, some of these structural and programmatic improvements will require private donations. It's not sexy to fund a sump pump, but when you link it to the space and program that will be protected if that sump pump is installed, it will make that important connection to the impact the improvement will have. It is also important to connect the implementation step(s) to the Pillars of Service that are impacted and how the project will make the organization stronger. In your capital campaign, you could include a fun infographic of how the equipment works and how it will protect MFH programs, creating an appealing way to encourage funders to give. *See sample graphic*. Two great resources for creating graphics for any type of project are Piktochart and Canva.



# APPENDICES

*Margaret Fuller House Resiliency Audit*, 2019. Woodard and Curran

*Margaret Fuller House Resilience Hub Checklist*, 2019. Kim Lundgren Associates

# MARGARET FULLER HOUSE

Resiliency Audit
June 2019

WOODARD & CURRAN

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woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

**KLA**
**City of Cambridge, MA**
232424.00

# TABLE OF CONTENTS

# EXECUTIVE SUMMARY

The City of Cambridge Resilience Hub project selected two Community Based Organizations to focus on with the purpose of enhancing their overall resilience ability to serve as emergency response centers and offer support programs in the community during an emergency event.

A physical resilience audit of the Margaret Fuller House was conducted on May 29, 2019 and focused on the building's ability to withstand and respond to being impacted by flooding and temperature changes. Focus was given to the building's flood resilience, cooling and heating capacity, energy systems (solar plus storage) and communication systems.

The Margaret Fuller House (MFH) is located at 71 Cherry Street in Cambridge which is the Old Cambridgeport Historic District area of the City, now known as "the Port" and formerly known as Area Four. MFH is a social services organization that serves the public. The overall mission of the MFH is *to "strengthen and empower youth, families and community residents"* and address the *"economic, social and political inequities that shape the lives and futures of Port/Area IV residents."*

To support the community, the MFH provides a free computer lab, computer classes, a food pantry, after-school services for children, meeting room space for various activities for the public and a daytime summer camp for children. Much of the financial support for the MFH is provided through fundraisers. The house is a National Historic Landmark which was designated in 1974 for its association with Fuller, a pioneer in feminism.

# 1. GENERAL SITE INFORMATION

The MFH is located on an approximately 17,000 square foot lot in the Residence C-1 Zoning District. The site consists of two connected structures (see **Figure 1**). One structure, the "main" house, is a wooden Federal style house which according to assessors records was built in 1807 that is 4,128 square feet (see **Photo 1**). The second structure, is the foundation of an addition that was started in 1928 and functions as a Youth Center (see **Photo 2**). The youth center is 4,944 square feet and approximately 5-7 feet below grade.

**Figure 1: Assessors Record of Main House and Youth Center**

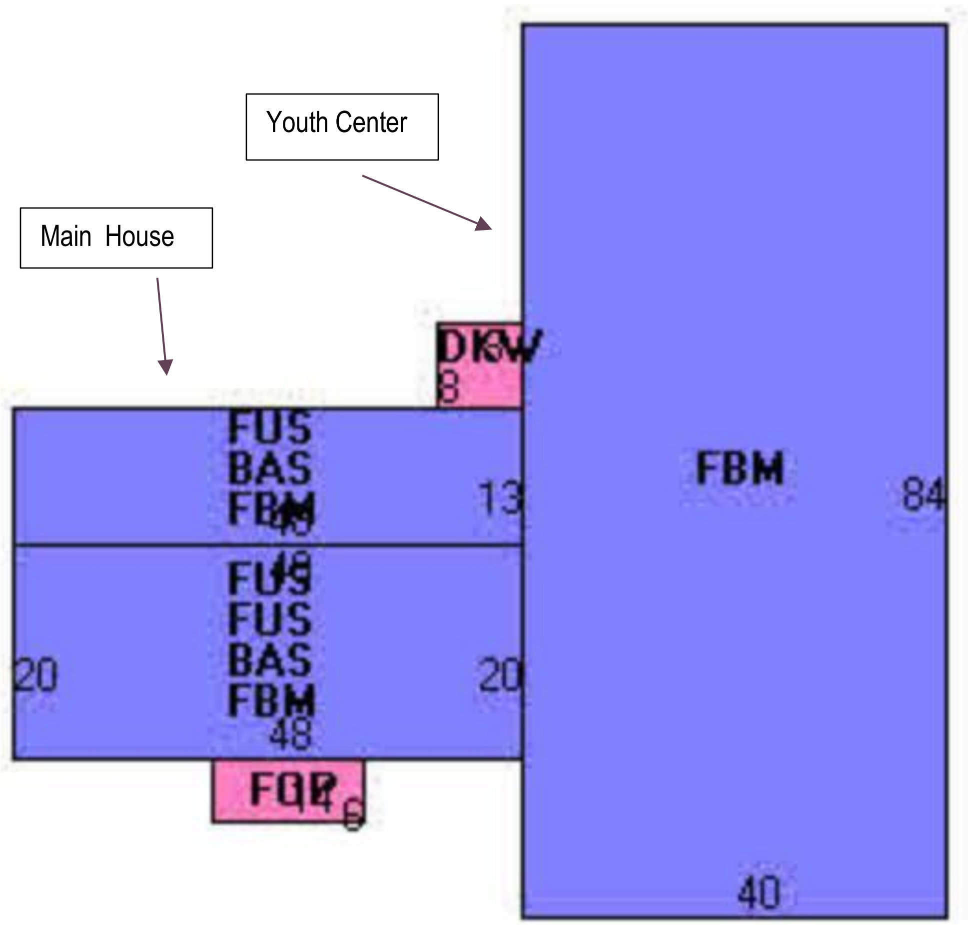


**Photo 1: Margaret Fuller House Main Structure**


**Photo 2: Youth Center (White Block Structure at back of parking lot)**

The site has been continuously in operation since approximately 1807 or 1928 for the different sections of the building. Work on the structure has been completed piecemeal over time with some renovations being started but nothing major has been finished. Site conditions are mixed with some modern upgrades intermixed with original features. Most of the site mechanical systems are located in the basement of the main house.

A checklist (Resilience Hub Checklist) was developed to gather key information about the building that focused on its overall resiliency, including:

- Ability to manage and withstand a flooding event,
- Details on heating and cooling systems,
- Asset information about what each floor is used for and where utilities and other systems are located,
- Energy Systems, and
- Communication Systems

Utilizing the Resilience Hub Checklist, the general building information in **Table 1** was collected.

### Table 1: Margaret Fuller House Building Resilience Hub Checklist

| General Conditions | Notes |
|---|---|
| How is weather information received? | Internet or phone |
| Fire alarm system status, condition | The fire alarm system appears to be a mix of hard wire and battery operated smoke detectors. Smoke detectors and fire extinguishers are distributed throughout the building. |
| What are the current communication systems of the building? Phone, Internet Service, etc. Any dispatch connections? | Site has internet and phone connection. |
| What is the construction type and foundation type of the building? | Wood frame building with brick, stone and block foundation |
| Routers | For workstations/networking |
| Computer Work Stations | 13 “high top” workstations with chairs, 2 PCs with chairs on the first floor, 6 in youth center/basement with chairs. |
| Primary Electric Power Systems | Main Feed located at front entrance, panel is located in the basement. |
| Secondary Electric Power Systems | None |
| Generator | None |
| Heating System | Hot water heating /Hydronic system located in basement of Main House |
| Air Conditioning System | Approximately 4-6 window units. One central unit for youth center at grade |
| Security System Controls | Main House Basement |
| Telephone/Communications | Main House |
| Fuel, Gas | Main House Basement |
| Potable Water | Main House Basement. Water coolers are distributed throughout. |

| General Conditions | Notes |
|---|---|
| Wastewater | Main house basement |
| Are there trees/vegetation around the building? | Yes (trees on the street), one with the potential for falling on the building |
| Any pruning needed for exterior vegetation? Other noticeable hazards? | No |
| Any cracks or openings in foundation? | Brick and block foundations are in reasonable condition. |
| Status of roof insulation? | No known upgrades |
| Insulation value of exterior walls | No known upgrades |
| Location of mechanical equipment | Main House Basement |
| Emergency lighting? | None |
| Is there a history of power outages in the area? | Limited history of power outages |
| Are there issues with cell service in the area? | No known issues |

# 2. FLOOD RISK DETAILS

The MFH is located in a relatively flat section of Cambridge that does experience some flooding during more frequent, smaller storms. There is a storm drain located off the sidewalk immediately adjacent to the site. As part of a larger scale mitigation project for The Port area, the City anticipates making roadway and sidewalk improvements along Cherry, Pine and School Streets as well as Bishop Allen Drive. To help mitigate stormwater, a stormwater tank will be installed underneath the basketball courts in Morgan Park on Columbia Street.

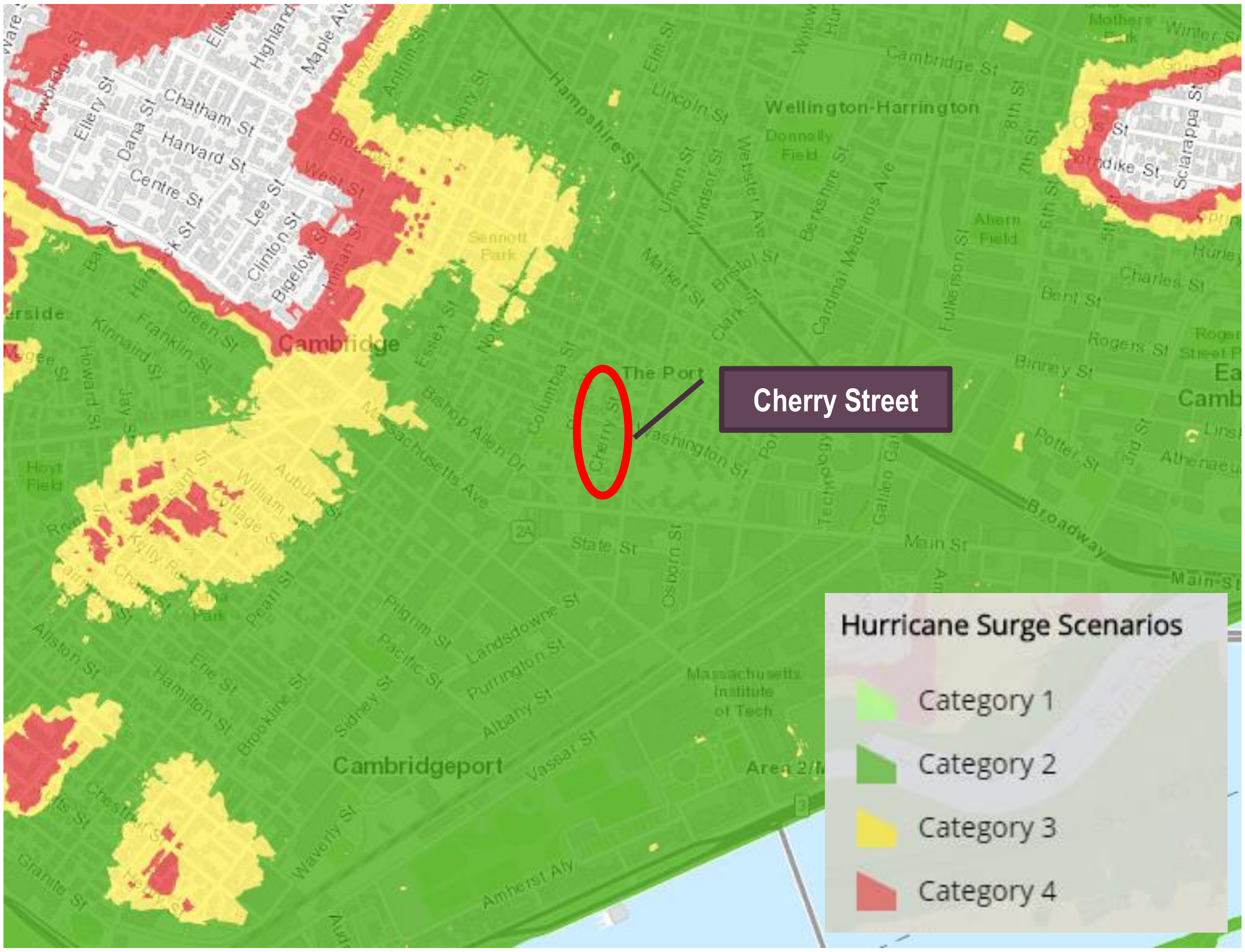
Utilizing the Resilience Hub Checklist, the Flood Risk information in **Table 2** was collected.

**Table 2: Margaret Fuller House Building Flood Risk Details**

| Flood Risk | Notes |
|---|---|
| Is the building and/or any of the site located in a floodplain? | No - According to the Current Effective FEMA map for Cambridge, MA (dated June 4, 2010), the site is not located in a floodplain. |
| Is the site in a hurricane surge inundation zone? | Yes – According to the Massachusetts Sea Level Rise and Coastal Flooding Viewer, the site would start to be impacted when a Hurricane reaches Category 2 status (see **Figure 2**). |
| Will the site be impacted by Sea Level Rise? | Yes - According to the Massachusetts Sea Level Rise and Coastal Flooding Viewer, the site would start to be impacted when sea levels reach between 4-6 feet over the average highest daily tide (see Figure 3). |
| Is the site near a body of water even if its in or not in an official floodplain? | The MFH is within a mile of the Charles River. |
| First Floor Elevation of Building | The First floor of the main house is approximately 3 feet above grade. |
| What is the Base Flood Elevation (BFE)? | The Flood Zone associated with the Charles River in this area of Cambridge is a AE zone with a BFE of 4 feet. |
| What is the minimum level of flooding protection required by Cambridge regulations? | Cambridge does have a Flood Plain Overlay District that follows the boundary of the June 4, 2010 FEMA Floodplain maps. The City follows the Massachusetts State Building Code (780 CMR). |
| What is the history of urban flooding in this area? Discuss local surface drainage problems due to inadequate drainage. | The site has had limited flooding based on site personnel's experience. The site does have a sump pump that appears to be in working condition. |

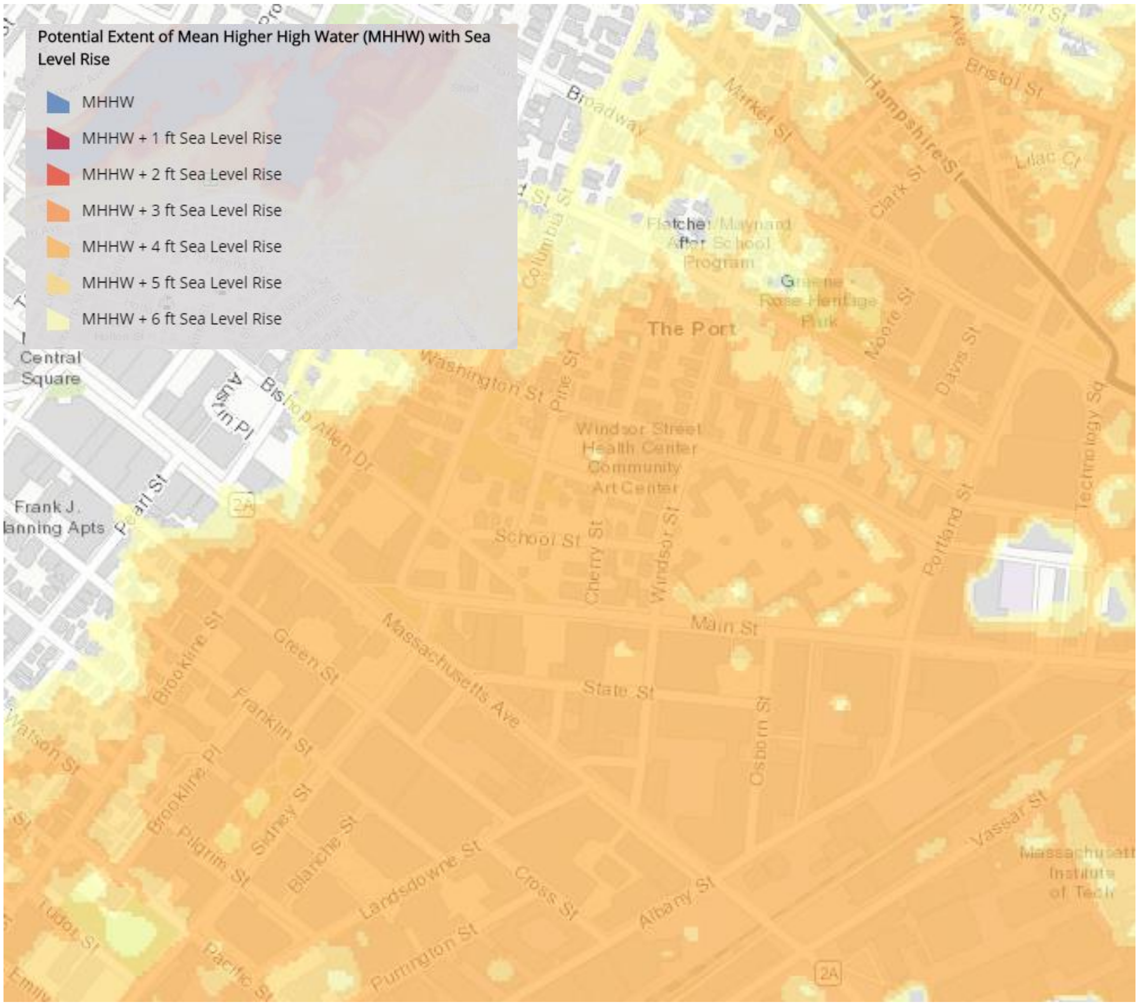
| Flood Risk | Notes |
|---|---|
| Does surrounding topography contribute to site flooding? | The site topography appears to be flat with limited surface area draining to the site. A storm drain is located on the south west corner of the property line. |
| Has water from other sources entered the building (water main breaks, high groundwater)? | Unknown |
| Is there a history of water intrusion through floor slabs? | Unknown. The site has a sump pump indicating that basement flooding may have been an issue in the past. |
| Are there underground utility systems or areas that can contribute to basement flooding? | At least one hot water heater is located in the basement and this would drain to the sump pump in a failure. |
| Are there stormwater sewer manholes upslope of windows or openings that allow local drainage to enter basement or lower floors? | No |
| Is there at least one access road passable during flood events? | The site is located near larger outlet streets, Washington and Harvard. It is unknown if Cherry Street or Eaton Street would be passable during a flood given the relatively close elevations and similar impacts to these street . Washington Street does experience flooding and may not be passable. More information is needed on Harvard Street as an exit point. |
| Is there a risk of evacuation access being cut off due to roads flooding, if so, where? And has access been cut off in the past? | Access has not been cut off in the past but flooding may be a risk given the relatively flat topography and risk of both roads flooding. |
| Are at grade parking lots located in flood prone areas? | The at grade parking lot is not located in a FEMA Floodplain, but it is located in a Hurricane Surge Inundation area and is projected to be impacted by Sea Level Rise. |
| Are below grade parking areas susceptible to flooding? | N/A - there are no below grade parking spots |
| What critical functions are located on lower floor levels or the basement? | Most of the site mechanical equipment and electrical panels are in the basement. |
| Can critical functions be relocated? | Relocation would be challenging given the lack of space in the main building and the lack of a central panel. |
| If critical functions can't be relocated is floodproofing feasible? | Flood proofing would be challenging given the nature of the foundations and the entrances at or below grade. |
| Was the building designed to resist hydrostatic and hydrodynamic flood loads? | Unknown but unlikely |
| Is the building constructed of any floodproof materials? | No |
| Are there backflow valves installed at the building? | Yes. The City of Cambridge has a comprehensive back flow preventer program for applicable valves. |
| Do staircases to basements have flood protection doors? | No |

**Figure 2: Hurricane Surge Inundation Zones**




Source: MassGIS based on NOAA and USACE data

**Figure 3: Potential Extent of Sea Level Rise**




Source: MassGIS based on NOAA and USACE data

The City of Cambridge is currently working on "The Port Project" (TPP). The Port area of Cambridge, where Cherry Street is located, has experienced significant flooding in the past. The City is focusing on this area to improve flooding conditions by building two underground storage tanks so that stormwater during rain events will be captured and pumped to systems that can carry the water away from The Port to the Charles River via a Massachusetts Avenue storm pipe. According to a brochure from the Department of Public Works, **Figure 4**, **Figure 5** and **Figure 6** highlight areas of flooding if no improvements are made ("Existing Conditions") and the potential areas of flooding once TPP is complete ("Storage Tanks Installed").

According to "The Gray and Green Infrastructure Analysis" for the project, a number of drainage infrastructure improvement projects are either being constructed by the City or are in final design and are expected to be complete by 2020 in The Port neighborhood that will benefit MFH.

**Figure 4: Existing Conditions**

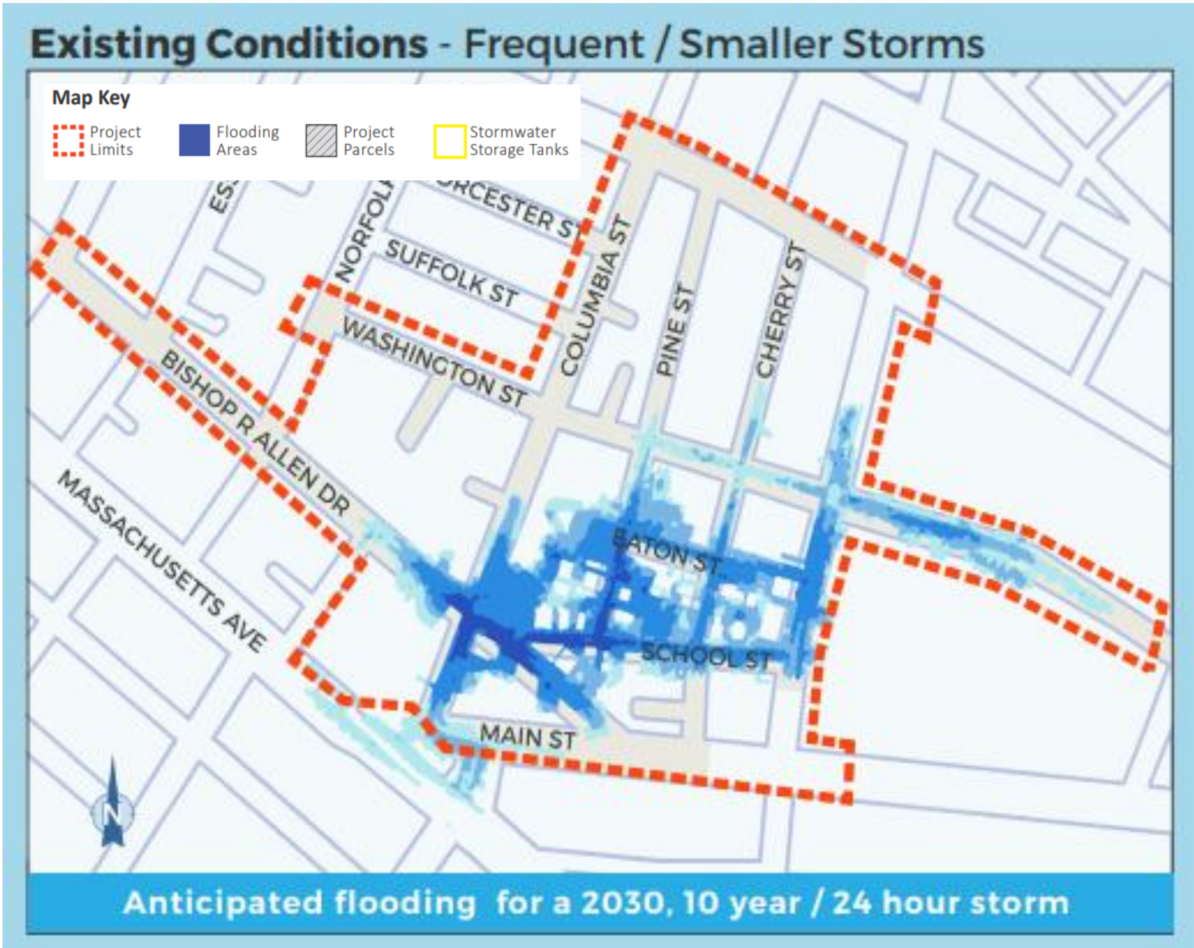


**Figure 5: Storage Tanks Installed | Frequent/Smaller Storms**

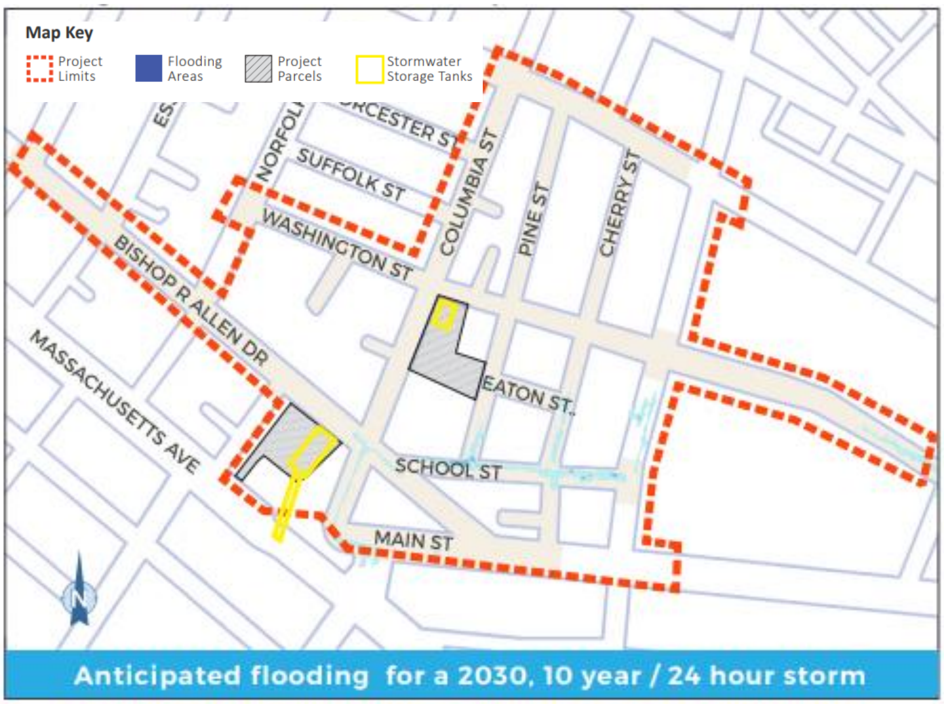
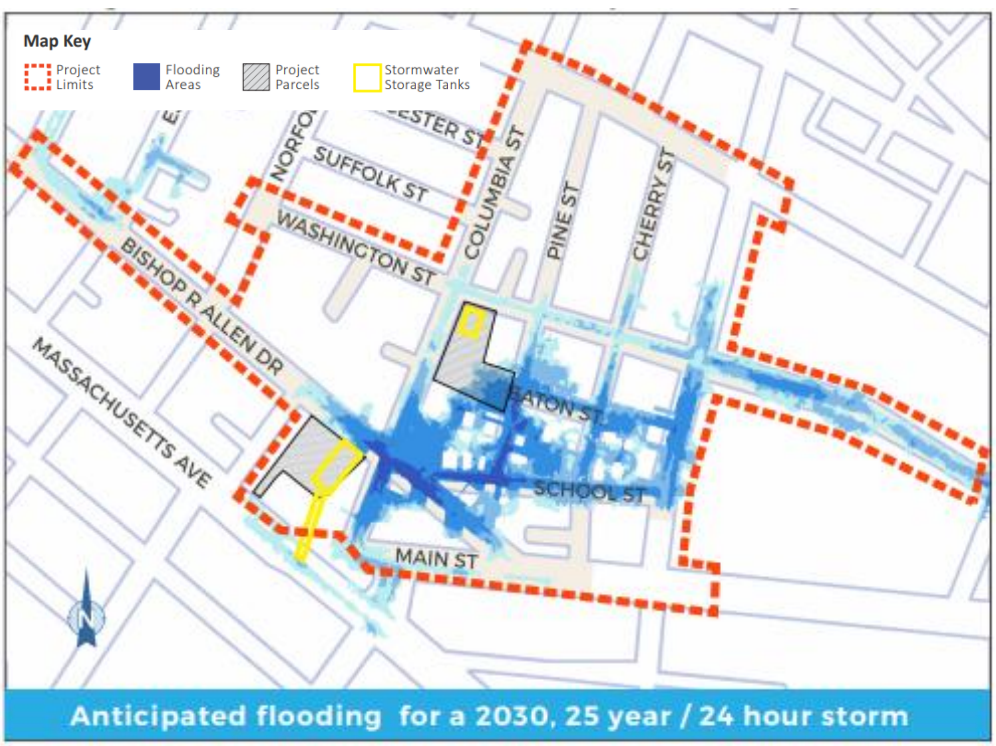



**Figure 6: Storage Tanks Installed | Less Frequent/Larger Storms**



## 3. ENERGY SYSTEMS

The MFH site is currently served by Eversource Gas and Electric. As an urban customer, site supply of both gas and electricity are relatively reliable. The MFH has no back up fuel supply or generator to support gas or power interruption. The site is heated by a hot water heating system from two Burham boilers with 232,000 Btu/hr and 130,000 Btu/hr capacities. Site cooling is provided by air conditioning window units for the main house and a larger central air conditioning unit for the youth center.

Peak site electric load per the Everource bills for the single site (account # 1191 724 0027) was approximately 16 kW which is based on the past 13 months of operations (April 2018 to April 2019). The peak electric load occurred in July 2018 with August and September reaching slightly below this level at 14-15 kW. Peak gas load was not available based on billing statements.

The gas usage is 25 therms per day from the single site according to the MFH Eversource gas account (# 1191 724 0019). With the boiler sizing of 362,000 Btu/hr and other site needs, we would assume that the site requires somewhere in the 300,000-500,0000 Btu/hr to ensure that heating loads and other site requirements are met. To gather information for future resiliency efforts, the Resilience Hub Site Checklist was completed for Energy Systems (see **Table 3**).

**Table 3: Margaret Fuller House Building Energy System Information**

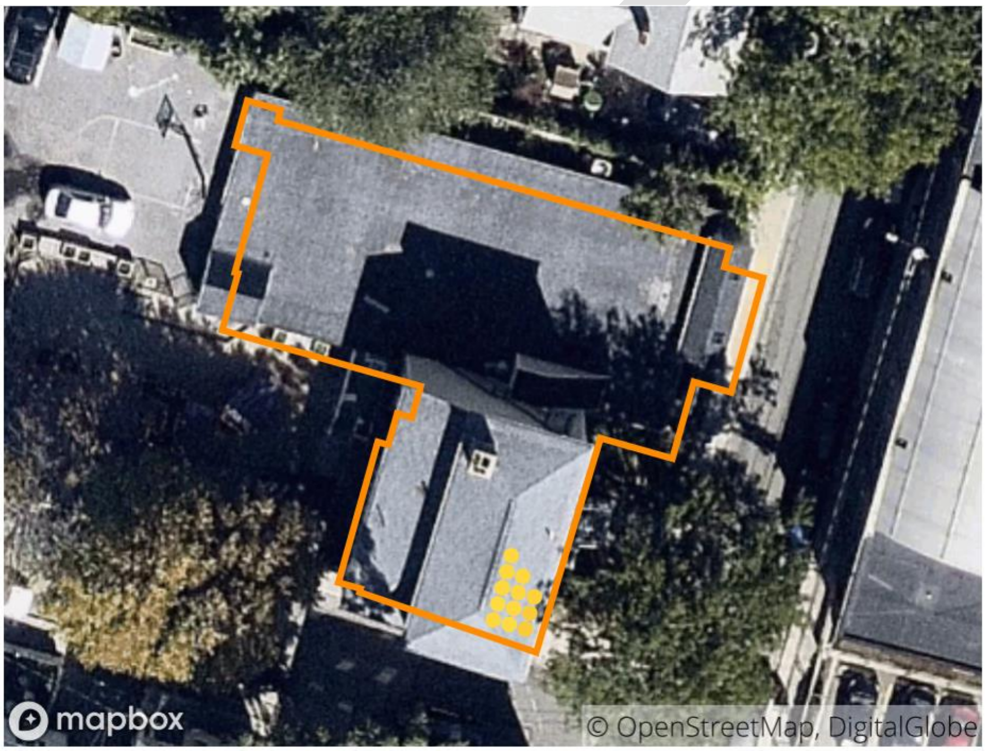
| Energy Systems | Notes |
|---|---|
| Energy system in place - description, condition, etc. | Two gas boilers that appear to be in good condition. Window air conditioners in varying conditions. The larger central unit for the youth center appears to be in good condition. |
| Status of building insulation? | Unknown |
| Condition of windows and doors? Are they energy efficient? | Windows are single pane with storm windows. They are of unknown vintage and are not energy efficient. |
| Are the windows operable? Can you open them? | Yes |
| Ability to have drinking water, toilets, sinks with no power? | Yes- If the City distribution system has power. |
| Vegetated Roof? | No |
| High reflective or paving materials used? | No |
| Any onsite water retention systems? | No |
| Any ability for islanding or for thermal energy connections? | No |
| 12 months of electric bills that include demand charges | Max kW appears to be 16 kW |
| Efficiency and demand reduction opportunities on energy load? | An energy program was implemented in the past and lighting measures have been completed. |
| Verify loads, panels and other information available from as built drawings. | Service appears to be 200-300 amps with multiple service panels. |
| Can heating system run on back up power, is it duel fuel? | No |
| How many days of fuel (i.e. oil) is available? | No - Oil back up is not available |
| Are there any water booster pumps on site? | No |
| Heating system in place - description, condition, etc. | Hot water boiler – good condition |
| Cooling system in place - description, condition, etc. | Window units and Central Unit for youth center – Good Condition |

| Energy Systems | Notes |
| --- | --- |
| Communication/IT systems in place (phone, email, cell, pagers, dispatch, etc.) | Yes |
| Condition and status of HVAC, ductwork and other mechanical equipment. Above flood levels? | Most of the mechanical equipment is in the basement of the main house. There is no central ductwork. |

# 4. ON SITE SOLAR AND STORAGE OPPORTUNITY

Based on the site visit, the area most suitable for solar is the is the roof on top of the youth center. This portion of the building was originally intended to be a larger building so what is currently built is essentially a foundation and framing for the first floor. Based on this area of approximately 5,000 square feet, a solar array of 15 kW DC is likely to fit on the site roof (this is based on NRELs PV Watts tool shown in **Figure 8**) but may not be practical or have optimal production given the shading on that location. Using the city of Cambridge Solar Mapdwell Tool (see **Figure 7**), the results yielded a smaller system of 1.76 kW DC that more likely takes in to account impacts of shading.

**Figure 7: City of Cambridge Solar Mapdwell Tool Image:**




Given the potential impacts of shading a solar array of 2-10 kW DC might be practical at this site. This would be done utilizing some of the main building and roof and the area of the youth center that is shaded the least. Coupled with a solar array of this size, an energy storage system of 10-40 kWh would likely be appropriate for this site. At this size and based on a peak load from the Eversource bills, the solar array could carry the site for up to four hours if site loads could be managed. If critical loads could not be isolated, the storage system is likely to only carry the building for a brief time at peak load of 16 kW. In the case of emergency, the site may want to isolate critical loads such as refrigeration and the sump pumps.

**Figure 8: NREL PV WATTS Output**

# SOLAR RESOURCE DATA

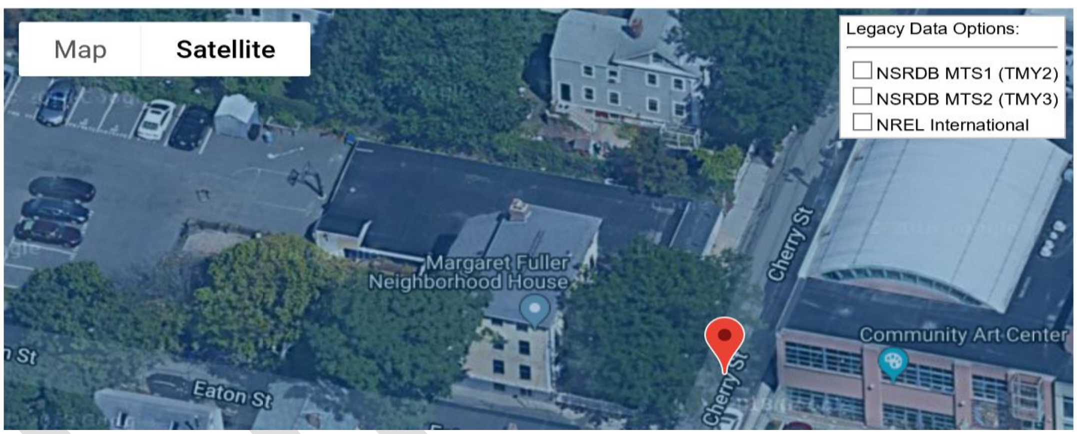
The latitude and longitude of the solar resource data site is shown below, along with the distance between your location and the center of the site grid cell. Use this data unless you have a reason to change it.

**Solar resource data site**

| | |
|---|---|
| **Lat, Lon: 42.37, -71.1** | **0.4 mi** |

## Resource Data Map

The blue rectangle on the map indicates the NREL NSRDB grid cell for your location. If your location is outside the NSRDB area, the map shows a pin for the nearest avaliable NREL international data site instead of a rectangle. If you want to use data for a different NSRDB grid cell, double-click the map to move the rectangle. *Dragging the rectangle will not move it.* Use the Legacy Data Options check boxes to show pins for legacy data sites. Click a legacy data pin to use legacy data instead of the recommended NSRDB data. See **Help** for details.

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# 5. CONCLUSIONS

The May 2019 site visit was intended to capture basic information on the Margaret Fuller House and explore overall site conditions. In general, the MFH reflects the building stock that is common in Cambridge. This building serves as an important resource to the community and the physical infrastructure has been supported over time and remained open without significant renovations.

Key areas that could be considered for improved resiliency may broadly be considered in two categories – smaller scope projects and larger scope projects (see **Table 4** and **Table 5**).

**Table 4: Smaller Scope Projects**

| | Project Summary | Implementation |
|---|---|---|
| Solar and Storage | Evaluate the use of a combined solar storage system to provide short term (up to 4 hour) back up power. | MFH could consider a Power Purchase Agreement (PPA). A PPA is an agreement where the MFH would agree to provide roof space and buy electricity. As part of this PPA, MFH could require energy storage as part of the system deployment. The current Massachusetts solar programs include additional incentives for energy storage coupled with solar that make energy storage economically attractive as part of a solar PPA. |
| Supplemental Sump Pump Back Up | The current sump pump system does not have a backup. Add a battery system to supply interim mitigation. Small packaged systems are capable of pumping a few thousand gallons of water per hour for over 4 hours. | There are several packaged commercial sump pump systems that might be cost effective to implement and mitigate risk. A system capable of a few thousand gallons per hour would be approximately $3,500 installed. |
| Lighting with Battery Back Up | Utilize back up lighting with battery packs. | As lighting is evaluated, consider battery back-up integration. Several commercial systems are cost effective options when new lights are installed. |
| Procure a small portable battery system | Use a small battery system that could power multiple devices. | A system like the Goal Zero 1250 Portable Power system could be purchased for approximately $1,200 and can charge up to 10 devices and may provide 50 or more total charges. |

**Table 5: Larger Scope Projects**

| | Project Summary | Implementation |
|---|---|---|
| Flood Proofing | Develop and install comprehensive flood mitigation measures including flood proof doors, site configuration and waterproofing. | This is an extensive program that could be incorporated into larger renovations. |

| | | |
|---|---|---|
| Back Up Power Generation | Implement back up power generation plan that could be dispatched during larger power interruption. | A 20-25kW generator that would carry the site load would be approximately $50-100,000 depending on the degree of work on existing conditions and the site work required. This should be considered as part of more comprehensive building upgrades. |
| Elevate Critical Infrastructure | Currently critical infrastructure (electrical, heating, etc.) is spread out through the basement. | Consider consolidating critical infrastructure such as electrical panels and heating equipment above flooding levels. |
| Incorporate Air or Ground Source Heat Pumps in to the design evaluation | Given the lack of central cooling and the economic case for heat pumps in Massachusetts larger scope renovations should evaluate the use of heat pump systems. | Consider as part of future renovations. |

For a comprehensive assessment of the site a more thorough evaluation needs to be conducted. This summary was completed as a preliminary assessment of site infrastructure and to provide a summary of potential options that would improve site infrastructure and overall resiliency.

## 5.1 The Port Preparedness Plan

TPPP has specifically identified Energy Resilience strategies for existing buildings in The Port area of Cambridge. MFH should reference and leverage TPPP prior to advancing any projects for the building. Below is a summary of strategies and actions for existing building energy resilience that was developed as part of TPPP – they focus on flood and heat protection (see **Table 6**).

**Table 6: The Port Preparedness Plan Flood & Heat Protection Strategies for Existing Buildings**

| | Strategy | Action | Implementation | Benefits | Implementation Considerations |
|---|---|---|---|---|---|
| **B3** | **Flood Protection for Existing Buildings** | Elevate critical building systems | Elevate or protect vulnerable utilities such as fuel storage, furnaces, and electrical panels above the 2070 10-year flood elevation. | Minimizes flood damage, lessened need to retrofit later due to increasing flood risks. | Split incentives between owners and renters. Lack of space on upper floors. Structural retrofit may be needed for equipment relocated to building roof. |
| **B** | **NEW** | High-efficiency electric heating and cooling | Replace equipment with high-efficiency electric heating and cooling systems that exceed ENERGY STAR requirements. | Requires less floor area within building; more feasible to install at higher elevations. Reduced energy consumption and GHG emissions. | Eligible for rebates and incentives, including financing. Vulnerable to outages if no back-up power provided. In-unit systems may be more feasible for condo owners. |
| **B4** | **Heat Protection for Existing Buildings** | Solar PV with energy storage | Install solar power with storage capabilities sufficient to provide two (2) consecutive days at 24 hrs./day of backup power or as required by LEED v4 for backup generation.[37] | Improves passive survivability. For a typical building, renewable energy would offset 8-12% of annual energy consumption and 12-14% of GHG emissions. | Eligible for rebates and incentives, including financing. Potential issues with permitting and approvals. Possible to integrate with microgrid or community energy system. |
| | | High performance building envelope | Require minimum R-20 wall insulation, R-40 roof insulation, maximum of U-0.3 glazed windows, and limit air leakage to less than or equal to 3 ACH at 50 pascals | Improves passive survivability. For a typical residential building, enhancements would result in an estimated 50-60% reduction in annual energy consumption, and a 40-50% reduction in total GHG emissions. | Eligible for rebates and incentives, including financing. Difficult to implement in buildings with multiple tenants, although single-unit upgrades may be possible for condo owners. |

*Note: Strategies are ordered as presented in the CCPR Handbook and the order of presentation is not indicative of their relative importance.*

TPPP also discusses energy resilience at a neighborhood scale – specifically focusing on traditional microgrids and community energy systems. Both of these can facilitate the adoption of renewable energy sources, modernize and relieve stress on local electricity distribution, reduce GHG emissions, and potentially energy costs, and improve business performance by mitigating potential losses resulting from power outages. The MFH should consider any projects in the context of the larger neighborhood. A link to the Energy Resilience for the Port report can be found here: https://www.cambridgema.gov/CDD/Projects/Climate/~/media/5D83391A50F84D798FDF230297F183B1.ashx

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