Case Study

Municipality/Nonprofit Organization: City of Medford
Project Title: Flood Mitigation Strategy Feasibility Analysis and Conceptual Design
Grant Award: $93,529.00
Match: $31,176.33

Community Overview:
Provide a general description of your community as a brief introduction to the project.

The City of Medford is located approximately 6.7 miles north of Boston. The City has a population of about 56,000 (2010 US Census). Medford covers 8.6 square miles and is located entirely within the Mystic River watershed. The City is home to Tufts University and is largely residential, with some commercial areas along Mystic Avenue and Riverside Avenue.

Description of Climate Impact:
Address the community's current and potential future vulnerability to climate change impacts. What are the specific threats to the project area/site and reasons for applying to the grant program?

The two locations evaluated, Tufts Park and Barry Park, are city-owned open space and recreational facilities and are in areas that were identified through the previous MVP grant-funded study phase as at risk for increased inundation of either depth or duration during the future design storms, which equates to the 10-year 24-hour storm in the year 2070. Both of the locations are included in the City's DRAFT Open Space and Recreation Plan ("Medford Open Space and Recreation Plan Update 2019-2027" prepared by the Metropolitan Area Planning Council (MAPC)) as priorities for installation of green infrastructure stormwater management elements to enhance the appearance of the parks, protect populations vulnerable to climate change impacts, and contribute to improved use and accessibility for residents of the City. Based on an evaluation completed in the first task of the project, it was determined that the flood reduction benefit of stormwater infrastructure in Tufts Park would be more significant than in Barry Park. For the remainder of the project, flooding mitigation strategies were evaluated for Tufts Park only.

Once flooded, the Tufts Park takes time to drain and dry out due to a high groundwater table. As a large, low-lying park, Tufts Park benefits the City since the ponding that occurs on site reduces the volume of stormwater ponding and accumulation on the adjacent streets. However, ponding still often occurs on roads such as Morton Avenue, Medford Street, Main Street, and Marion Street. During significant storm events, the drainage system flowing into Tufts Park will back up

into Granville Avenue and Winchester Street. The drainage system will overflow onto Harvard Street at an underpass beneath the railway. This flooding can disrupt travel on this important through street.

Project Goals:
What were the specific goals of the project?

The primary goal of this project was to conduct a site-specific feasibility analysis for installation of a subsurface detention tank system at Tufts Park that was modeled in the previous MVP grant-funded study. This tank would alleviate current and projected flooding at the underpass on Harvard Street. It will also shave down the peak flow rate of stormwater passing downstream of Tufts Park, to other portions of the City's storm drain system that are also prone to flooding.

An additional project goal was the evaluation and conceptual design of opportunities for surface enhancements and green infrastructure at Tufts Park. The green infrastructure improvements, and park underdrain system were developed to a concept level. These systems are intended to reduce street surface flooding on Morton Avenue and to help Tufts Park dry out faster after routine storm events to return to a useable condition for recreational purposes.

Finally, additional green infrastructure elements were considered that have the potential for water quality benefits in and around the area of Tufts Park.

Approach and Result:
How did the project team implement the project? Describe the methodology or your approach to achieve the project goals. Describe, and quantify (where possible) project results (e.g. square footage of habitat restored or created). Provide web links, if available, to your project deliverables.

The original approach to this project involved evaluation of two City-owned sites for stormwater infrastructure that would provide flood reduction benefits. Two borings at each park (4 borings total) provided results that indicated that infiltrating stormwater into the ground was infeasible at both locations due to high groundwater. It was determined through the initial investigations that Tufts Park would receive more benefits from flood reduction than Barry Park, and the scope was adjusted to include the conceptual design of a stormwater detention tank at Tufts Park.

The project team then utilized the City's PCSWMM 2D storm drain model for South Medford to test three different tank concepts and a variety of tank sizes to recommend a preferred tank arrangement, operation mode, and storage volume. The conceptual tank design involved researching and meeting with multiple stormwater detention tank vendors to determine the most feasible solution for Tufts Park. The subsurface tank designed in this project is proposed to cover about 45,000 square feet and have a 730,000-gallon capacity. It would be located north of the 42" storm drain and south of the 20" MWRA water main. As a result of the installation of this tank, there would be a peak outlet flow reduction from 80 cubic feet per second (cfs) to approximately 60 cfs.

The project team also evaluated and developed a conceptual design of surface green infrastructure and an underdrain system to capture and treat stormwater runoff and facilitate park drainage at Tufts Park. After a thorough evaluation of potential green infrastructure locations, an independent drainage system, utilizing an open vegetated swale concept, was proposed to address field flooding in the southern portion of Tufts Park. The underdrain system is designed to help alleviate flooding issues in the central-northern portion of the field. The design storm for the subdrain is the present day 2-year 24-hour storm.

Lessons Learned:

What lessons were learned as a result of the project? Focus on both technical matter of the project and process-oriented lessons learned.

There were several lessons learned from implementing this project, including:

1. The importance of including the right people on the project team. For example, the original scope of the project did not include any environmental investigations. However, it became apparent after analyzing soil samples that ash and metals were present. Involving environmental expertise allowed the project team to better anticipate possible environmental issues down the road. Another example was the inclusion of the City's Parks Foreman, Mike Nestor. Mike had a significant amount of personal experience with flooding at Tufts Park and a lot of photographs of flooded conditions.
2. The importance of adjusting the scope when field investigations indicated that the original scope would not be feasible. Limited field investigations made it clear that both high seasonal groundwater and baseflow (in existing storm sewer) were key design constraints to consider for this project (in addition to soil conductivity and past site use/environmental conditions).
3. The importance of re-tailoring the problem statement when new modeling analyses were completed. The subsurface storage tank has more benefit in terms of peak-flow mitigation at downstream end than original emphasis on upstream flooding at the Harvard Street underpass. The analysis also showed that downstream capacity exists in

the storm drain system (between Tufts Park and the Mystic River) and that a future project may be able to better optimize with green or gray infrastructure interventions.

4. The importance of adapting the design as new information became available from an external source. The project team adapted our design to accommodate new information related to changed drainage from Somerville and new road grade changes associated with Green Line Extension. This information became available after start of project and was incorporated into an update model.
5. The importance of site reconnaissance and developing new modeling analyses, which showed that short-duration type storms (i.e., "flash flooding") are a significant driver of roadway flooding at Morton Avenue, and can occur independently of downstream neighborhood flooding. Green infrastructure interventions are particularly of interest to address this type of phenomenon while providing additional co-benefits.

Partners and Other Support:

Include a list of all project partners and describe their role in supporting/assisting in the project.

Name	**Organization**	**Project Role**
Timothy McGivern	City of Medford, Engineering Department	Project Oversight
Penny Antonoglou	City of Medford, Engineering Department	Project Manager
Mike Nestor	City of Medford, Parks Department	Foreman
David Peterson	Kleinfelder	Consultant: Project Manager

Project Photos:

In your electronic submission of this report, please attach (as .jpg) a few representative photos of the project. Photos cannot show persons who can be easily identified, and avoid inclusion of any copyrighted, trademarked, or branded logos in the images.

Figure 1: Representative Flooding Photos (Source: Mike Nestor, City of Medford)