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Uncovering the Potential of Peabody's Hidden North River: A Greenway for Social and Ecological Connectivity

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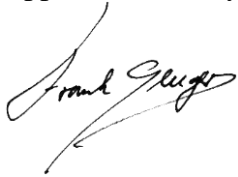
Master's Project by
Mitch Johnson

Master of Landscape Architecture
May, 24, 2019

Uncovering the Potential of Peabody's Hidden North River: A Greenway for Social and Ecological Connectivity

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Last but not the least, I would like to thank my family for supporting me throughout these last three years during my time at UMass.

1.0 Introduction

Where dense forest, grassy meadows, large hills and numerous streams all meet the North River this area was once described as the most beautiful areas in 17th century Massachusetts. The City of Peabody (Fig 1) has been historically dependent upon the North River and its surrounding streams for the economic and civic success. First settled around 1626 by a group of English colonists they called their village Brooksby for its "several sparkling brooks of clear water" which later became Salem then South Danvers to what it is today Peabody. Due to its many brooks Peabody became an ideal location for industry and beginning in the late 19th century these bodies of water were squeezed and covered over in places for urban development and industrial uses, which resulted in significant contamination and water quality degradation. By 1919 Peabody was the "the Leather Capital of the World." After 1919 to the present, due to the rising cost of labor, accessibility to markets, and environmental regulations, many tanneries closed in Peabody. Leaving many of the former tanneries to be converted to elderly housing or condominiums, while others remain vacant or are used for warehousing and storage. After World War II thousands of homes were built in West Peabody on what had previously been farmland. The Northshore Shopping Center was built in 1958 that drew retail traffic from Peabody's Downtown and many businesses have shifted to other parts of the city Peabody ma (Peabody Historical Society, 2018).

Today the North River flows practically unnoticed in the heart of downtown Peabody except when it occasionally overflows causing flooding to the surrounding areas. While Main

Street in downtown Peabody has seen a revive in recent years the area directly behind Main Street all the way to Walnut Street were the North River flows struggle to bring in new development because of the occasional flooding from the streams. Today structures Walnut Street are mostly former mills, factory structures, parking lot or vacant land (Peabody Historical Society, 2018).

There have been plans for a river walk in Downtown since the early 90s but this has never gotten past the conceptual stage. The city has taken steps to help reduce flooding over the years but with climate change and sea level rise these flooding's will continue to get worse and it is imperative for the city to do more for a more resilient future.

2.0 Project Goal

Demonstrating the opportunity to strengthen both urban and ecological qualities, this project has the goal to transform an old industrial corridor in downtown Peabody (Fig 2) into a green corridor integrating stormwater management, habitat restoration, recreational, and catalyst for urban development.

The site's location at the downstream end of existing creeks combined with its proximity to the Salem Sound makes this an extremely sensitive area to flooding events. This design proposal transforms this risk into an opportunity by restoring this former industrial site to its former function as a floodplain within the existing North River Watershed.

In a phased process, businesses along the river corridor will be relocated to more suitable locations and reestablish the desecrated lands and channelized streams to a picturesque and healthy landscape. Elevated views along the urban edges will allow residents and visitors to look down into the meadow fields and the wetlands of the North River being as the central asset of the landscape. This project transforms this neglected landscape to a scenic urban ecological corridor to provide a more sustainable urban environment for downtown Peabody.

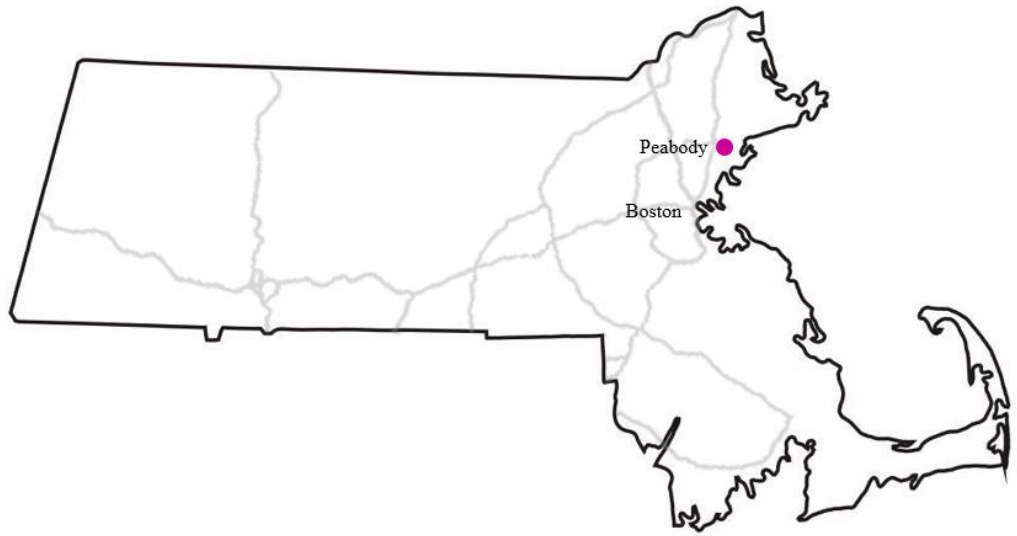


Fig. 1: Peabody is located in Eastern Massachusetts 15 miles north of Boston. (Courtesy of MASS GIS 2019)

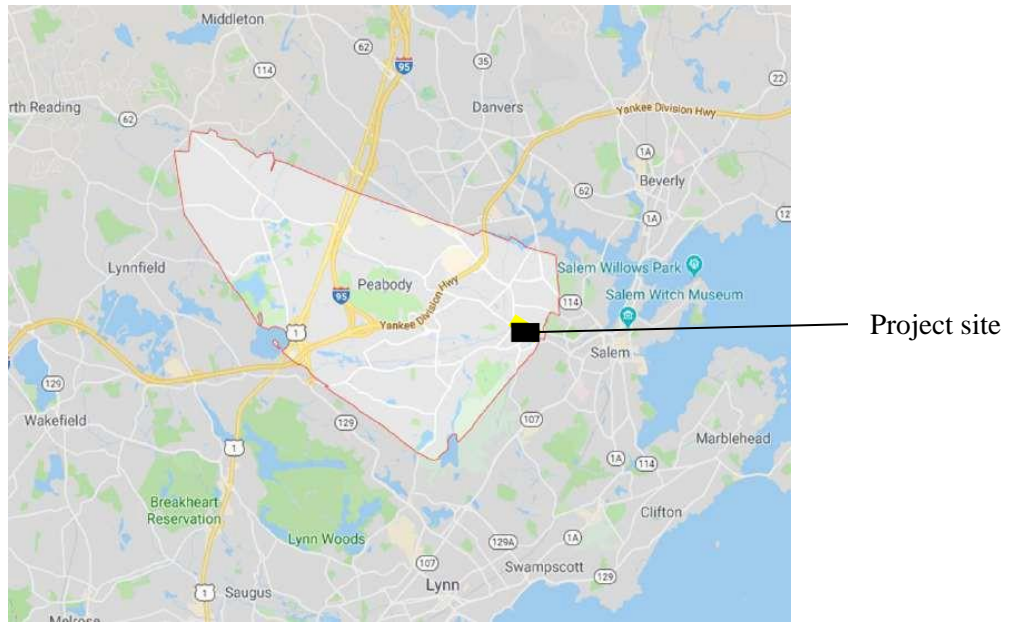


Fig. 2: The project site is located in the eastern side of Peabody. (Courtesy of Google Maps 2019)

Project Objectives

The following four planning and design objectives are central for the success of this project. The first objective is a phased land use strategy that will relocate businesses along the North River floodplain and infilling them in other parts of downtown. The next objective is to improve the riparian health and beauty of North River through stream restoration, wetland restoration and recreating a landscape of the grassy meadows. The third objective is to provide a network of paths through the landscape and connect to the North River and a promenade along Walnut Street. The final objective is to restore the connection of downtown Peabody and the surrounding neighborhoods to the North River.

Land Use Strategy

The industrial history along the river is still evident today as the form of the river has been changed from its natural state into a controlled shape by masonry walls, retaining structures, as well as it has been piped underground in certain locations. Along the river are former tannery buildings that have been transformed mainly into light industry and auto-oriented land uses. It is proposed to develop a long-term strategy for removing these unsuitable land uses adjacent to the North River and create a green corridor that improves the ecological health of the area and provides human enjoyment to these natural resources. This includes the phasing out of light industrial and auto-oriented uses as opportunities arise for the city to purchase these properties and replace them with open space. Then businesses can be relocated to more suitable parcels that accommodate these uses with the highest possible efficiency and use of space. The city should foster incentives to accelerate this process.

Improve Riparian Health and Beauty of North River Watershed

The riparian health of North River in downtown Peabody through a phased design approach has to be improved. Strategies that can be implemented on a shorter time line call for a river restoration in the vacant lands adjacent to the north river on the south side of the river. The active flood plain in these areas should be expanded by removing the canal walls and excavation fill to create sloping banks along the North River to reduce potential flash flooding and aid in sediment filtration. The banks with riparian vegetation should be stabilized to reduce erosion and flood water velocity. The long-term strategy includes an expansion of the river restoration on the north side of the river removing the adjacent rail line along North River and relocating properties along Walnut Street in the flood plain. The final objective is to recreate and redesign a landscape of streams and grassy meadows in the core of downtown Peabody.

Pedestrian Promenade and Path Network

This proposal envisions a path network around the greenway that takes you from the urban edges down into the riparian landscape providing scenic views of this natural landscape. The paths take you through the native meadow landscape and down to the water's edge. A pedestrian promenade along Walnut Street lined with Linden trees that provides seating and views between Wallis and Caller Street will rejuvenate Walnut Street and the surrounding area while also providing a transition from the urban environment into the green corridor.

Edge & Neighborhood Connections

It is necessary to establish strong pedestrian connections between the North River with the surrounding neighborhoods. To the south multiple paths take you from Main Street, the heart of downtown to North River Meadow Park; to the north multiple entrances along the promenade invite you from Walnut Street into the greenway. Pathway connections to the west and east finally take you from Howley Street through the greenway to Wallis Street.

3.0 Project Methods

The Methods include GIS mapping, site observations, interviews with planning officials and stakeholders, case study research of successful urban greenways in urban floodplains, and a literature review of greenway history and theory. All these strategies are used to get the best understanding of the site and the surrounding area to create a design that responds to place and people.

GIS Mapping

GIS mapping was used to inform design decision making. The following data gathering, and site analysis/assessment included mapping the following resources.

- Adjacent land uses, zoning
-
- Surrounding open space
-
- Topography
-
- Impervious Surfaces
-
- Flood prone areas
-
- Development opportunities

Site Observation

Site specific research included walking, observing, and photographing the North River. Regular site visits throughout the conceptual design processes were undertaken in order to ground-truth the design ideas.

Interviews with Planning Officials and Stakeholders

Meetings with city officials was informative for the project, specifically a discussion of their thoughts on the area and about future and past projects on the North River. Moreover, it was important to support the practicality of the envisioned design ideas.

Case Studies

Several case studies were investigated and selected to support the design approach and look for inspirations and solutions. Each of these case studies had important aspects of resilient design from stream and wetland restoration to their planting designs that could be applied to this project.

4.0 Literature Review & Case Studies

Introduction

Central Peabody has numerous challenges that include flooding, lack of green space, water pollution, high building density, lack of connectivity, loss of cultural identity. This literature review aims to look at the multiple types and functions of greenways and how they could be applied to help revitalize this old industrial corridor in Peabody. The study examines the rich and vast history of greenways overtime, the number of different types of greenways and the different benefits greenways have.

The definition of Greenway

Greenways are linear green corridors connecting natural areas that create a linkage between human development and natural systems (Lanarc Consultants, 1995). Other descriptions include greenways are systems and/or networks of protected lands that are managed for multiple uses including: nature protection, biodiversity management, water resources, recreation, and cultural/historic resource protection (Ahern, 2002). In recent works there are numerous names given to greenways including: ecological infrastructure, ecological framework, ecological network, extensive open space systems, multiple use modules, habitat networks, wildlife corridors, and landscape restoration framework (Ahern, 2002)

History

Since the 19th century greenways have played an important role in urban development. The history of Greenway planning could be generally organized in five phases (Fábos, 2004) . The first-generation greenways from 1867 and 1900 was mainly to address aesthetic and recreational needs of city dwellers that introduced nature into the city (Searns, 1995). Originating in the United States with Frederick Law Olmsted's Boston's Emerald Necklace, also known as the Boston Park System (Kent, R and Elliot, C, 1995). Charles Eliot, Olmsted's pupil suggested a comprehensive park system for the entire Boston Metropolitan Region. The plan linked together combined 6 wide green spaces connected to each other in the slums of main city into 3 big rivers (Fabos & Ahern, 1995).

Second generation greenways between 1900-1945 with important landscape planners such as Olmsted Brothers work of the 40-Mile Loop in Oregon, Portland and Charles Eliot II open space plan for the state of Massachusetts (Fabos, 2004). The third-generation greenways between 1960-1970 responded to the harms of industrialization through motor-free recreational corridors, also known as the environmental decades. The next phase of greenway evolution was by Phil Lewis with his plan called Wisconsin Heritage Trail Proposal (Lewis, 1964). That created a statewide network of green spaces and greenways. The plan identified many cultural resources and natural resources and most of his connections were along rivers, streams and wetland systems (Fabos & Ahern, 1995). By the end of the 1960s the word, greenway started to appear more often in the literature. Writers such as William White and agencies such as Housing and Urban Development started to use the word greenways (Searns, 1995).

The fourth generation of greenways 1980s- 1990 include a range of objectives that include wildlife and habitat preservation, reduction of urban flood damage, enhancement of water

quality, preservation of cultural resources, provision of recreational corridors, urban beautification, and educating the public. Julius Fabos lead the METLAND research team at the University of Massachusetts. The METLAND team used parametric approach that uses infinite number of variables and can compare between and afford greater consistency and its suited to assessment with computers (Fabos, 1979). The fifth generation of greenways 1990-present saw the beginning of an international movement in design and development of greenways.

Greenways types

Greenways can be broken down into different types. Charles Little describes five general types of greenways. Urban riverside or other water body greenways, usually created as part of a redevelopment program along neglected, often run-down, city waterfronts. Recreational greenways, featuring paths and trails of various kinds, often relatively long distance, based on natural corridors as well as canals, abandoned rail beds, and public rights-of-way. Ecologically significant natural corridors, usually along rivers and streams and less often ridgelines, to provide for wildlife migration and species interchange, nature study and hiking. Scenic and Historic routes, usually along a road, highway or waterway, the most representative of them trying to provide pedestrian access along the route or at least places to alight from the car. Comprehensive greenway systems or networks, usually based on natural landforms such as valleys or ridges but sometimes simply an opportunistic assemblage of greenways and open spaces of various kinds to create an alternative municipal or regional green infrastructure (Little, 1995).

While the New England green categorizes it into three different types. Recreational Greenways feature paths and trails of various kinds, often of relatively long distances, based on natural corridors as well as canals, abandoned rail beds, and other public rights-of-ways. Trails

and routes often have scenic quality as they pass through diverse and visually significant landscapes. Many successful recreational greenways and green spaces occur where networks of trails link with water-based recreational sites and areas. Ecological Greenways are significant natural corridors and open spaces that usually along rivers and streams and ridgelines, to provide for wildlife migration and biodiversity, nature study, and appropriate nature studies. Cultural and Historic Greenways are places or trails with historic heritage and cultural values to attract tourists and to provide educational, scenic, recreational, and economic benefit. They are usually along a road or highway, the most representative of them trying to provide pedestrian access along the route or at least places to alight from the car. They can also provide high quality housing environments at the edges of greenway for permanent and seasonal housing; accommodate water resources and flood prevention and sensitively located alternative infrastructure for communing (Fabos & Ahern, 1995).

Benefits of greenways

Greenways are networks that provide multiple functions including: recreation, wildlife habitat and movement, water resource management and cultural resource connections (Fabos & Ahern, 1995). Greenways make healthy recreation opportunities by providing people with attractive, safe, accessible places to cycle, walk, hike, jog or skate. Greenways help with transportation with their ability to avoid congested streets and travel through natural areas. Greenways protect plant and animal species and allow people to experience nature with minimal environmental impact. Communities have experienced an economic revitalization due in whole or in part to trails and greenways and trails can increase property values and spur development in the area (Walmsley, 1995). Security problems and vandalism decrease with increased trail use also

Increases use in the location helping decrease illegal dumping. Trails have become sources of community identity and pride – Trails highlight and provide access to historic & cultural resources (Lanarc Consultants, 1995).

Hellmund and Smith point out the many benefits of greenway from social, recreational, beauty, historic preservation, economic development and ecological. The social and cultural benefits of greenways are significant as they offer opportunities of connecting diverse neighborhoods and helping to encourage positive social interaction. Greenways can create jobs, enhance property values, expand local businesses, attract new or relocating businesses, increase local tax revenues, decrease local government expenditures, and promote local community (Hellmund & Smith, 2006).

Conclusion

The greenway's multi-functionality makes it an appropriate approach for sustainable urban development. The connectivity of green space, the ecological and recreational functions all contribute to a more sustained, healthy and functional urban space. With the current degraded conditions of the project site, an urban greenway has a great potential and opportunity for a more sustainable environment for downtown Peabody and the region. An urban greenway will result in future investment in the downtown area that has been overlooked for a long time.

Peabody flood migration report

In 2010 the city of Peabody partnered with AECOM an American multinational engineering firm that provides design, consulting, construction, and management services did a flood migration report in downtown Peabody. The study uses a Preliminary Design Report (PDR) for flood mitigation facilities for the Peabody Square area done in 2008 by, the City and AECOM. The study also investigated stormwater management strategies through use of Low Impact Development (LID) and Best Management Practices (BMPs), as well as river and stream restoration components.

The first part of the report (PDR) came up with three different design projects to address flooding in Peabody square. Project 1 (Fig 5) relocates and enlarges the culvert carrying Goldthwaite Brook streamflow to include twin 4-feet high by 10-feet wide culverts extending approximately 1,950 feet, generally along Foster Street beginning at Oak Street and extending to the North River (Doyle-Breen, Weieneth, & Haney, 2010). Project 2 (Fig 6) widens approximately 1,600 feet of the North River to a uniform width of 38 feet extending from the confluence of Goldthwaite Brook and North River (approximately 100 feet east of Wallis Street) to Howley Street (Doyle- Breen et al., 2010). Project 3 (Fig 3) widens approximately 400 feet of the North River downstream of Howley Street in Peabody and approximately 2,800 feet in Salem extending to approximately 600 feet downstream of Grove Street in Salem to a uniform width of 38 feet (Doyle-Breen et al., 2010).



Fig. 3: AECOM identified three project areas along the North River to help improve flooding in downtown Peabody. (Courtesy of AECOM 2008)

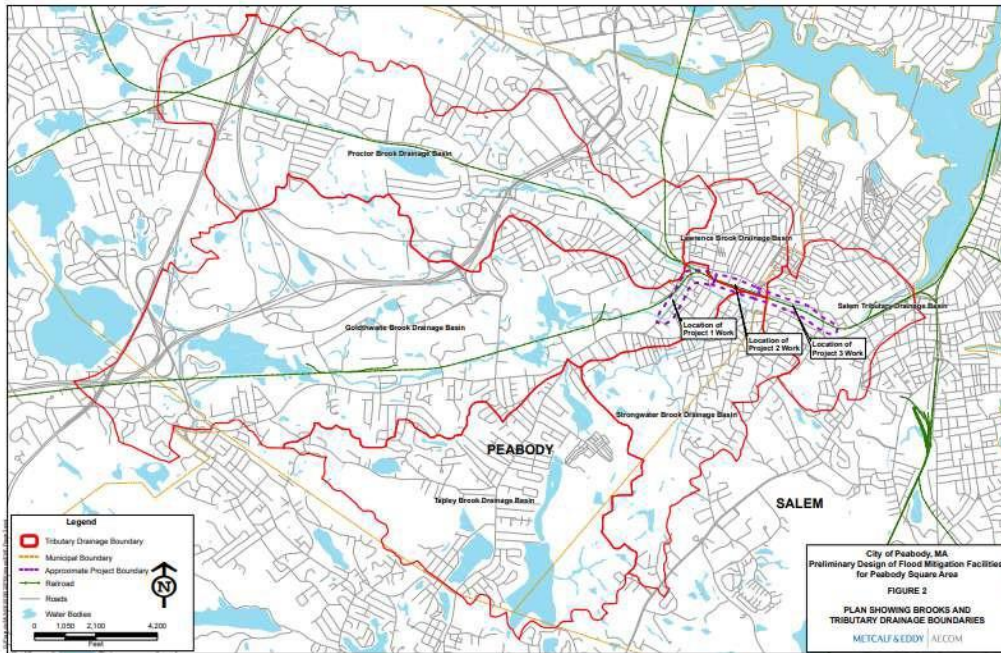


Fig. 4: The North River Watershed was mapped out by AECOM. Highlighted are the locations of the proposed three projects within the watershed. (Courtesy of AECOM 2008)

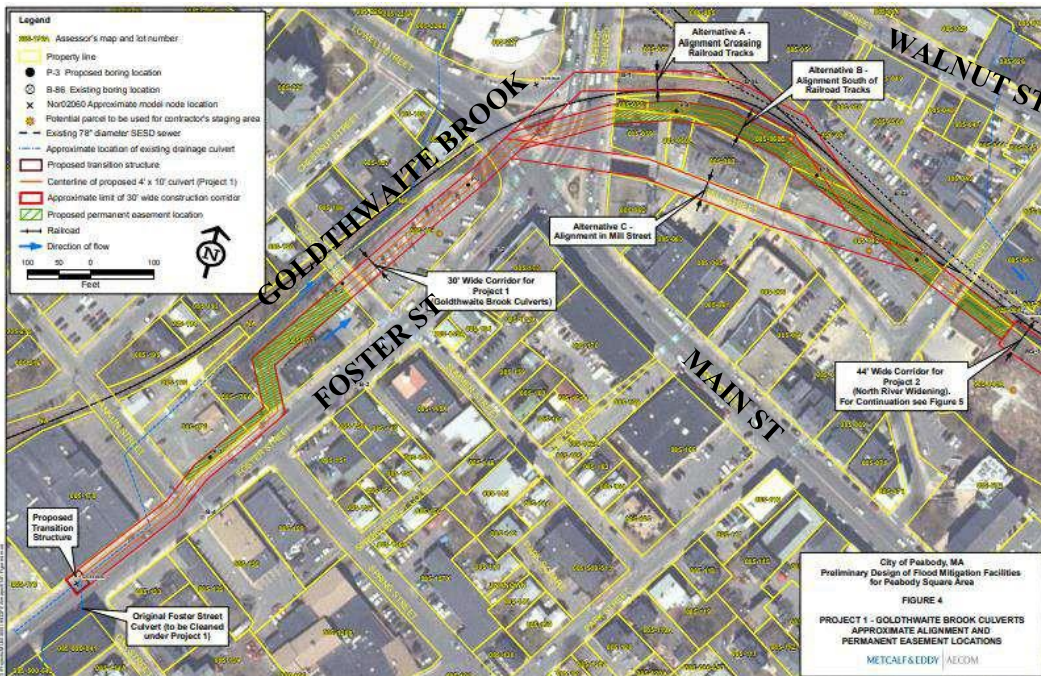


Fig. 5: Project 1 relocates and enlarges the culvert carrying Goldthwaite Brook streamflow along Foster Street beginning at Oak Street and extending to the North River. (Courtesy of AECOM 2008)

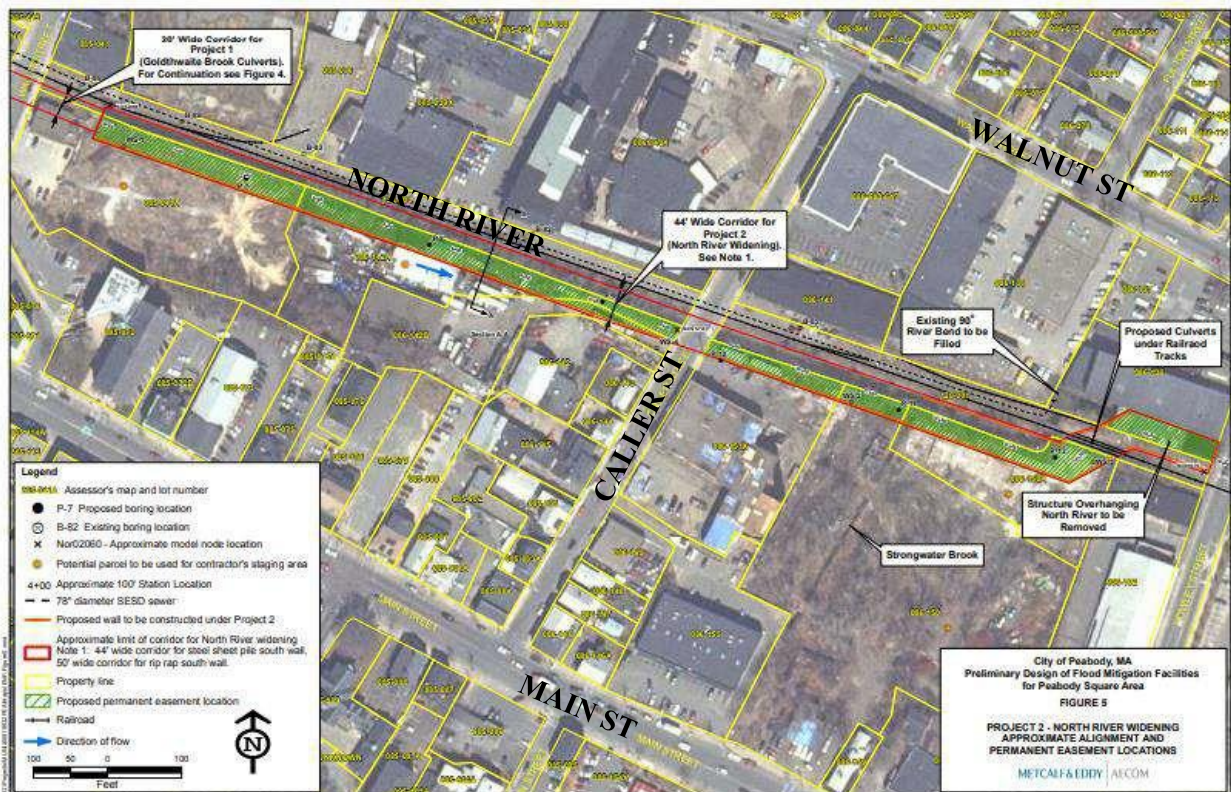


Fig. 6: Project 2 widens approximately 1,600 feet of the North River to 38 feet extending from the Goldthwaite Brook and North River to meet at Howley Street. (Courtesy of AECOM 2008)

The second part of the report looked at upstream storage in order to manage flood flows in local sub-basins to a greater extent. The city and AECOM evaluated numerous ponds and surface water impoundments upstream of Peabody Square to identify locations that would be suitable storage opportunities to retain flows upstream and reduce severe flooding. The report also saw these storm water management projects as opportunities to redevelop brownfield sites in the downtown area and plans to pursue development of a Downtown Riverwalk. The Peabody Downtown Flood Mitigation Project looks at the watershed as a whole while addressing flood mitigation and stream restoration in downtown Peabody.

Conclusion

Even with these engineering strategies of increasing the culvert width and widening the North River the report highlights that this will not sufficient to address flooding in downtown Peabody. Creating suitable flood storage areas along the watershed is a very important strategy that was articulated in the report. This upstream strategy should be pursued because more flooding events can be expected due to the issues of climate change. The brownfield sites in the downtown area along the North River are potential areas for flood storage because of their low elevation and location at the convergence of four streams.

Case Studies

A collection of parks and greenway were examined as precedent studies for this project. Located within the regional context of the site (Northeast United States) each of these case studies were selected because of their resilient design strategies within a urban setting.

Mill River Greenway

Location - Stamford, Connecticut

Landscape Architect - Olin Studio

Size – 12 acres

Completed – 2013

Years of neglect and mismanagement had destroyed the Mill River's natural ecological systems and inhibited pedestrian access to the water. The Mill River was dammed and channelized leading to greater flood risk for the surrounding downtown. Olin Partnership was brought in to reconfigure the dammed river and to develop a design for an urban riverfront park. The plan (Fig 7) envisioned the river as an amenity and connector, anchored by a park to the north and with a multimodal greenway stretching down to Stamford Harbor. The first phase of the plan, Mill River Park embraces the newly naturalized banks (Fig 8) with a design that includes passive meadows, pedestrian and bicycle trails, lawn areas for play and events, as well as access points down to the water's edge. While future phase of the park development includes trail connections extending beyond the park to Stamford Harbor. This master plan includes regional ecological restoration; hydrology & flood control; habitat restoration; stormwater management.

The Miller River similarly channelize like that North River is a great regional example of how stream and wetland restoration can be integrated with design to address flooding in an urban

environment. These ideas can be applied to the North River to create a more sustainable environment in downtown Peabody.



Fig. 7: The Master Plan of the Mill River Greenway with a park to the north and a multimodal greenway stretching down to Stamford Harbor. (Courtesy of OLIN 2014)



Fig. 8: The newly naturalized banks of the Mill River designed with access points down to the water's edge. (Courtesy of OLIN 2014)

Fisher Hill Reservoir Park Location

– Brookline, Massachusetts

Landscape Architect - KMDJ

Size- 10 acres

Completed – 2016

Built in 1888, the Fisher Hill Reservoir was part of the water system of Brookline until 1970 when maintenance was curtailed, creating wetland in the basin of the former reservoir. KMDJ was awarded the opportunity to redesign the reservoir. The park design is centered around an open basin for soccer with spectator seating on the sloped landform, surrounded by various landscapes. A series of terraces and ramps retain the historic relationship of the reservoir to Fisher Avenue (Fig 9) but will allow greater access with places to sit and changing views for people walking through the park. The planting plan for the site is a range of no-mow grasses (Fig 10) cover much of the slopes and help reduce fuel consumption and maintenance costs for the Town. While the layered woodlands wrap around the outer edges to provide screening from the adjacent residential neighbors, the front of the park facing Fisher Avenue is more formal with plantings of maple, oak and black tupelo. A planted swale collects and filters stormwater from the parking area carrying it to a catch basin installed below the soccer field which ultimately drains to the wet meadow during heavy storm events helping to keep all stormwater on site. The biodiverse plantings both create wildlife habitat and add seasonal interest throughout the park.

With its surrounding slopes similar to the North River in downtown Peabody, this is a great case study to look at minimalist design with its native plants that is resilient and blends in with the surrounding landscape. No-mow grasses is an example of a maintenance strategy that is successful while still encompassing aesthetic values.



Fig. 9: Design Plan Fisher Hill Reservoir Park. The park is centered around an open basin for soccer surrounded by various landscapes that feature seating and play areas. (Courtesy of KMDJ 2016)



Fig. 10: KMDJ focused on resiliency by using meadow fields and native grass for stormwater management. The image displays the meadow fields and the slopes around the Center Basin. (Courtesy of KMDJ 2016)

Wilkes-Barre River Common Location

– Wilkes-Barre, Pennsylvania

Landscape Architect – Sasaki

Size – 25 acres

Completed – 2009

The city of Wilkes-Barre PA was cut off from the Susquehanna River after a levee was created in 2003 along the River. Sasaki was chosen to design park spaces and pedestrian routes that would integrate the River with the surrounding urban landscape. The riverfront design with its walkways and seating through the meadows (Fig 11) has contributed to the social and economic revitalization of Wilkes Barre, and allows the community to interact with and enjoy the natural beauty of the Susquehanna River (Fig 12). Local contractors, tradespeople, and materials were engaged for implementation, providing great economic benefit to the region.

This project is a great example at how a meadow landscape that requires low maintenance can look beautiful and help contributed to the social and economic revitalization of a small city.



Fig. 11: Wilkes-Barre River Common along the Susquehanna River. At the center of the common, an amphitheater is surrounded by meadows fields. (Courtesy of Sasaki 2009)



Fig. 12: Viewers perspective standing in the meadows with the city of Wilkes-Barre and the Susquehanna River in the background. (Courtesy of Sasaki 2009)

Conclusion

The three case studies convey important design ideas that can be adapted in the North River greenway project. The Mill River Greenway incorporates stream and wetland restoration. The Wilkes-Barre River Common creates park spaces and pedestrian routes that integrate the river landscape with the urban fabric. The Fisher Hill Reservoir Park provides a look at a minimalist design with a variety of native plants that are suitable for stormwater management. These case studies provide peace's of inspiration for the North River greenway.

5.0 PROJECT CONTEXT & HISTORY

Downtown Peabody & North River Watershed History

Downtown Peabody and the North River bears little resemblance to when it was first settled in 1634 by William Trask (Fig 13). The area around Peabody Square was described as largely thickly wooded, with many meadows, large hills, swamp, and pastures. While the area around what is now Peabody square was a large pond were various brooks ran into. The North River was then a real river, open to small boats at high tide as far as the general area of Peabody Square. The shores of the brooks were wooded to the edges of the banks. The early settlers named their village Brooksby (Wells, 1973).

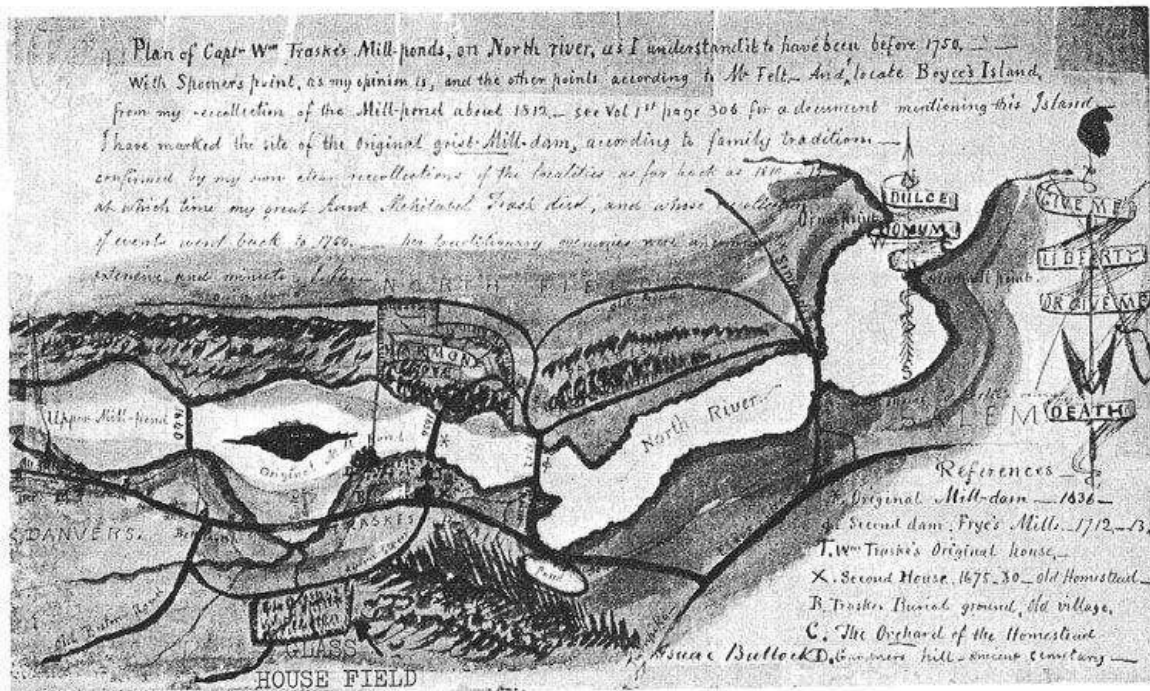


Fig. 13: A map of the North River based on early descriptions from William Trask from the 1600's. (courtesy of Peabody Historical Society)



Fig. 14: Painting of Downtown Peabody in 1857. The City is surround by meadow/prairie landscapes. (courtesy of Peabody Historical Society)

Because of its many streams and brooks downtown Peabody became a prime location during the industrial revolution (Fig 14). Numerous mills began to pop up along the north river and its surrounding brooks. As time moved on, the River and brooks in downtown Peabody were transformed by both the industrial revolution and urban development. The railroad came along and narrowed the banks with fill. Land pressures from urban development brought more fill and channelization of the River.

The main industry that took off in Peabody was the leather industry. A very messy business leather production required numerous toxic chemicals to treat the animal hides. After they were finished with the chemicals, they dumped them into the North River, creating highly polluted water (Wells, 1973).

Since the tanneries and factories have closed, the North River and Proctor Brook still look the same as they did over a 100 years ago. The effects of the industry are still felt today the shrinking of the North River and its high

urban density has caused heavy flooding in downtown Peabody during high intensity peak rainstorms for over 100 years. With the construction of new homes, roads, and shopping centers further up the watershed, downtown Peabody has been even more highly susceptible area to flooding. This construction paved over much of the permeable surface in Peabody leaving the rainwater no place to go (Fig 15).



Fig. 15: North River Watershed Impervious Surface (Mass GIS)A map showing impervious surfaces within the North River Watershed. (courtesy of MASS GIS)

Flooding

During heavy rain, the water runs-off the streets into the storm drains, which all run into the North River. There is simply too much water for the tiny river to handle, so the city floods (Fig 16).

Generally flooding occurs in the areas of Peabody Square, Lowell Street, Walnut Street, Railroad Avenue and Foster Street. Many of the culverts and channels designed to prevent flooding were built and installed more than a century ago and not able to handle major rain events.



Fig. 16: FEMA flood map. The flood prone areas are indicated within the project site. (Courtesy of FEMA)

The North River Watershed

The North River watershed (Fig 17) covers nearly 11.5 square miles. The watershed consists of the Goldthwaite, Lawrence, Tapley, Strongwater, and Proctor brooks that converge in the vicinity of downtown Peabody, MA to form the North River that flows into Salem Harbor. (Doyle-Breen et al., 2010)

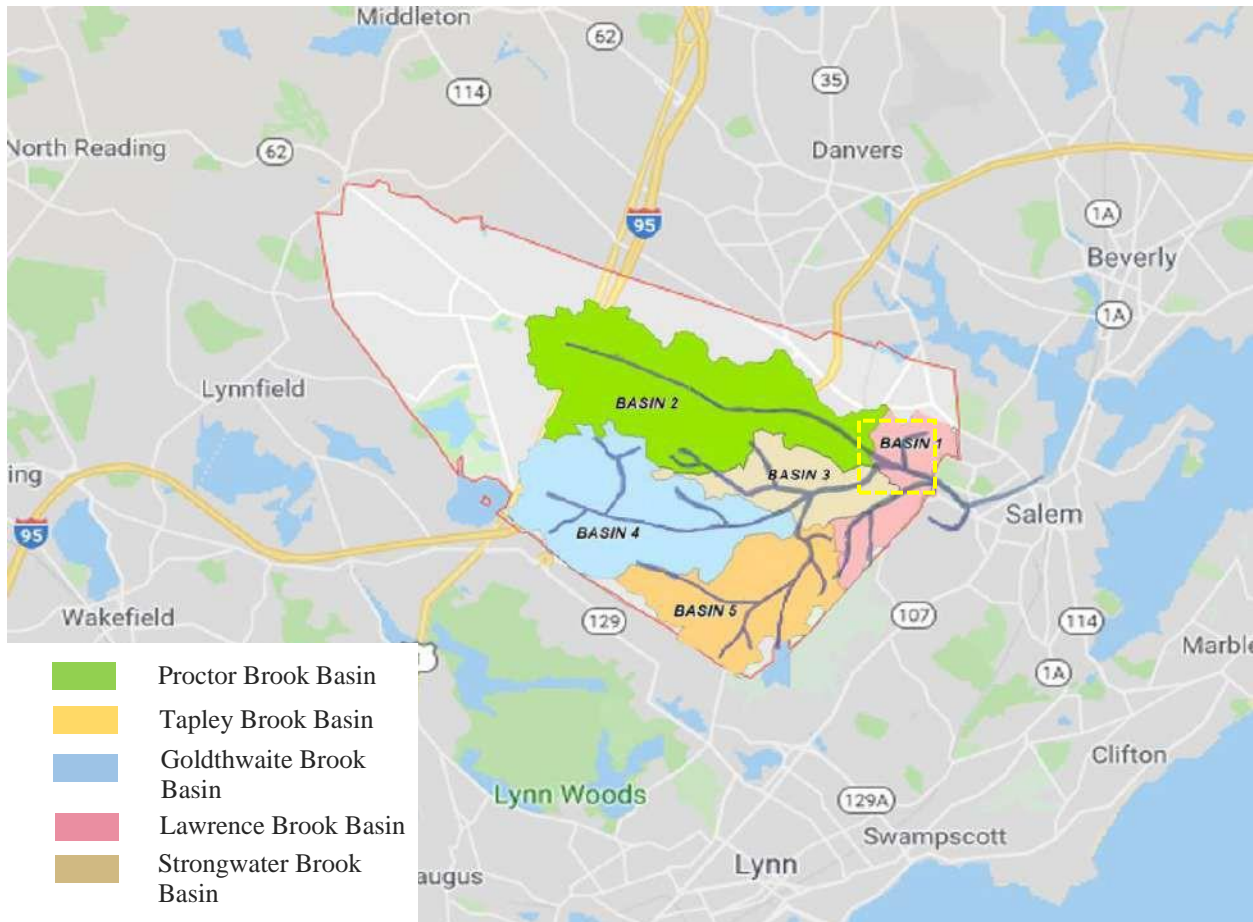


Fig. 17: North River watershed basins. All five basins all converge in downtown Peabody. (Courtesy of Google)

Most of the North River watershed has been modified to flow through culverts and channels to suit the needs of factories, houses, and railroads. Approximately 9.2 square miles, or 80 percent of the tributary watershed area, is conveyed to the North River through two culverts, identified as the Goldthwaite Brook and the Proctor Brook culverts, that converge into a main culvert at a subterranean intersection in the downtown area at Peabody Square. (Doyle-Breen et al., 2010)

During large storms, the main culvert is not capable of conveying the combined flow from Goldthwaite and Proctor Brooks, and this is the main cause of flooding in the downtown area. The city of Peabody partnered with AECOM in 2008 and did a flood migration report of downtown Peabody and came up with the following recommendations to address flooding in downtown.

- Project 1 – Relocating and enlarging the culvert carrying Goldthwaite Brook streamflow to include twin 4-foot high by 10-foot wide culverts extending approximately 1,950 feet, generally along Foster Street beginning at Oak Street and extending to the North River.
- Project 2 – Widening approximately 1,600 feet of the North River to a uniform width of 38 feet extending from the confluence of Goldthwaite Brook and North River (approximately 100 feet east of Wallis Street) to Howley Street.
- Project 3 – Widening approximately 400 feet of the North River downstream of Howley Street in Peabody and approximately 2,800 feet in Salem extending to approximately 600 feet downstream of Grove Street in Salem to a uniform width of 38 feet.

The City just recently decided against project 1 and are still consider project 2 and 3. The City has taken steps to address flooding with stormwater management and upstream storage solutions. The construction of East End Peabody Veterans Memorial Park is a the first park in the City that is designed to flood during storm events to mitigate the damaging effects of the flooding. The envisioned proposal of this project builds on this practice and will create a beautiful landscape that is designed around the River and its frequent flooding events. Other recent measures of the City are improved detention basins upstream that have helped reduce flooding in the downtown.

The People of the City Center Neighborhood

The Project location lies within the City Center Neighborhood (Fig 18), as determined by census tract. This analysis discusses the parks and open space, environmental justice thresholds, and demographic characteristics relating to population, racial mix, and poverty levels. All data discussed in this section was taken from the 2010 U.S. Census, and local information was obtained from the City’s website,



Fig. 18: The project area(yellow) is located within the City Center Neighborhood of Peabody(red). (courtesy of Google)

Parks and Open Space

The City Center Neighborhood lacks park and open space compared to the other neighborhoods in Peabody. Veterans Park and Peabody Common are currently the only parks in the neighborhood that are well maintained. Unfortunately, these two parks have a relatively low use rate throughout most of the year. While there are several parks (Fig 19) within walking distance of the neighborhood such as Emerson Park, Pierpont Park and Connolly Park, the lack of connectivity and access to them from the neighborhood is a problem.

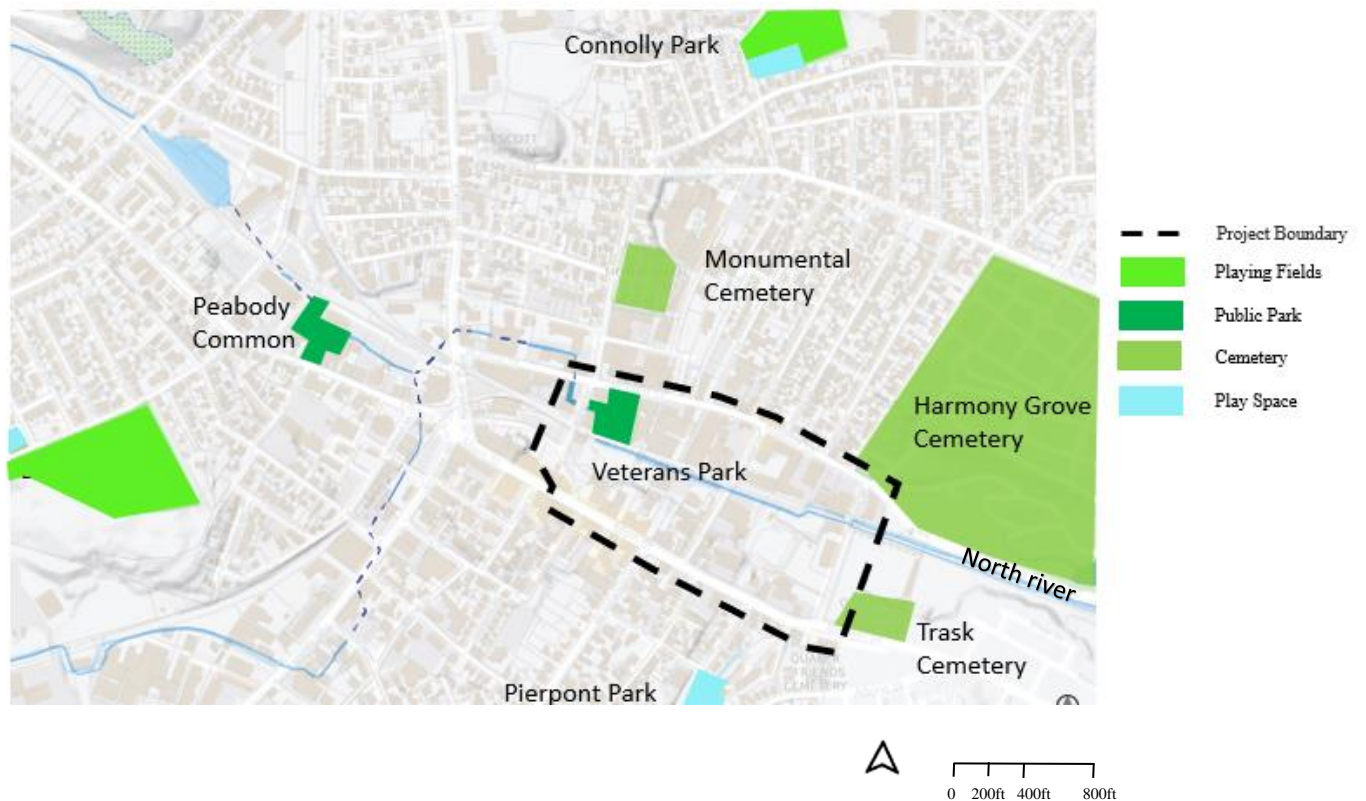
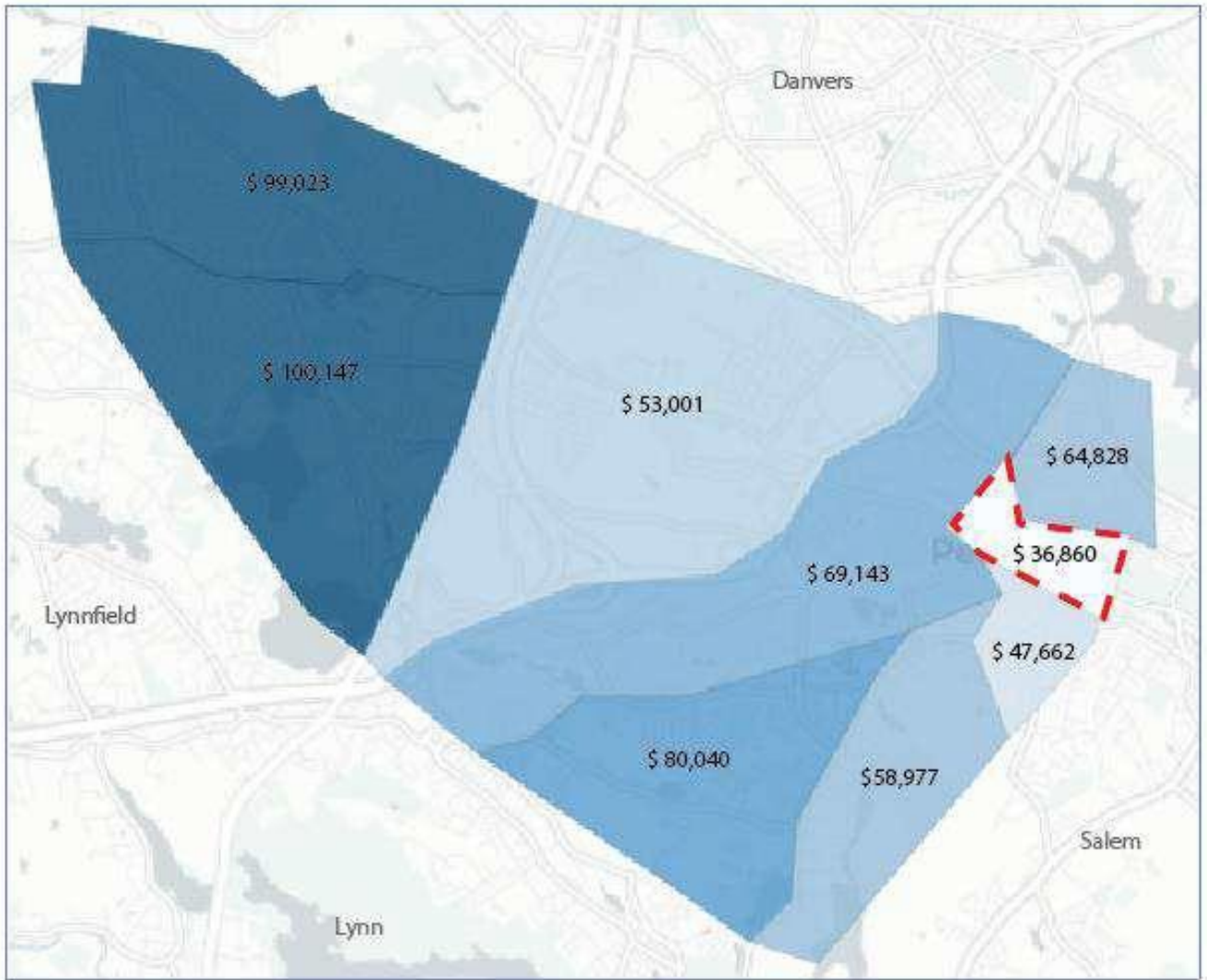


Fig. 19: Downtown Peabody Public Open Space Map. The different types of public open spaces that can be found in downtown Peabody. (Mass GIS)

Neighborhood Demographics

With 0.4 square miles the City Center Neighborhood is one of the smallest of the city's nine neighborhoods but is the most densely populated with 14,268 people per square mile. It is bounded by Endicott Street to the west; Central Street and Tremont Street on the north; Howley Street and Mount Vernon Street on the east; and the Main Street and a portion of Lowell on the south.

City Center is one of the most diverse neighborhoods in the city with 35 percent of its population being foreign born (Fig 21). The White population is (73%) lower than the city average of 84%. The Hispanic population (16%) is higher than the city average of 9%. With a median household income (Fig 20) of 36,860 and a poverty rate of 23 % percent the city center neighborhood is one of the poorest neighborhoods in the city.



Census Bureau 5 year Estimates

Fig. 20: Median Household Income. The median household income within the City Center Neighborhood is the lowest in the city of Peabody. (Courtesy of Mass GIS and US Census)

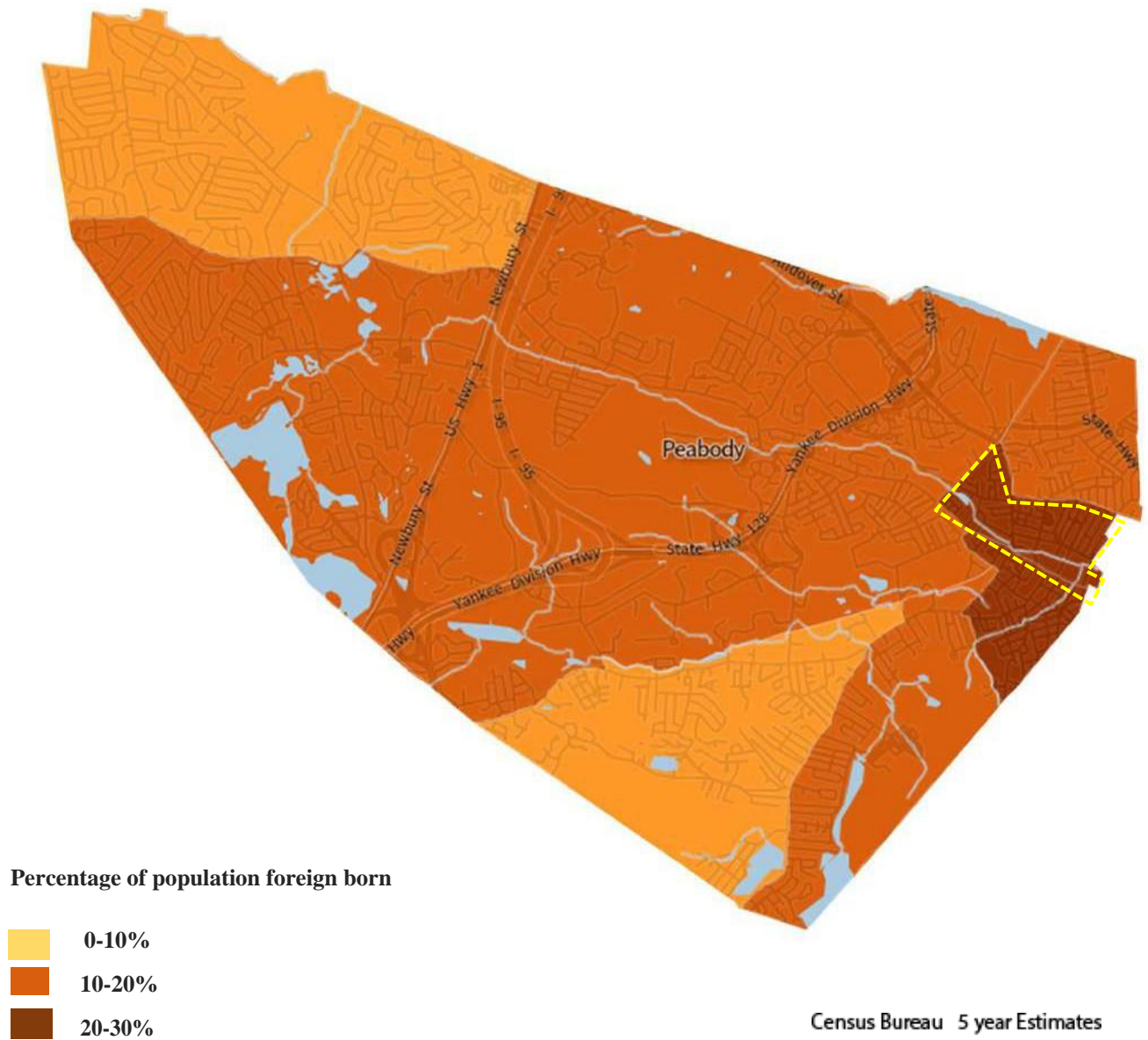


Fig. 21: Foreign Born Population. The foreign-born population within the City Center Neighborhood is one of the highest in the city of Peabody. (Courtesy of Mass GIS and US census)

Environmental Justice Thresholds

Census data assessing neighborhood thresholds for Federal Environmental Justice (EJ) considerations are mapped below (Fig 22). Federal Environmental Justice thresholds are met when minority population is higher than 25%, median income is lower than 65% of the state average, and English language proficiency is met in fewer than 75% of households. Parts of the City Center neighborhood meet the minority and income threshold. While adjacent neighborhoods to the site location feature minority and English isolation thresholds.

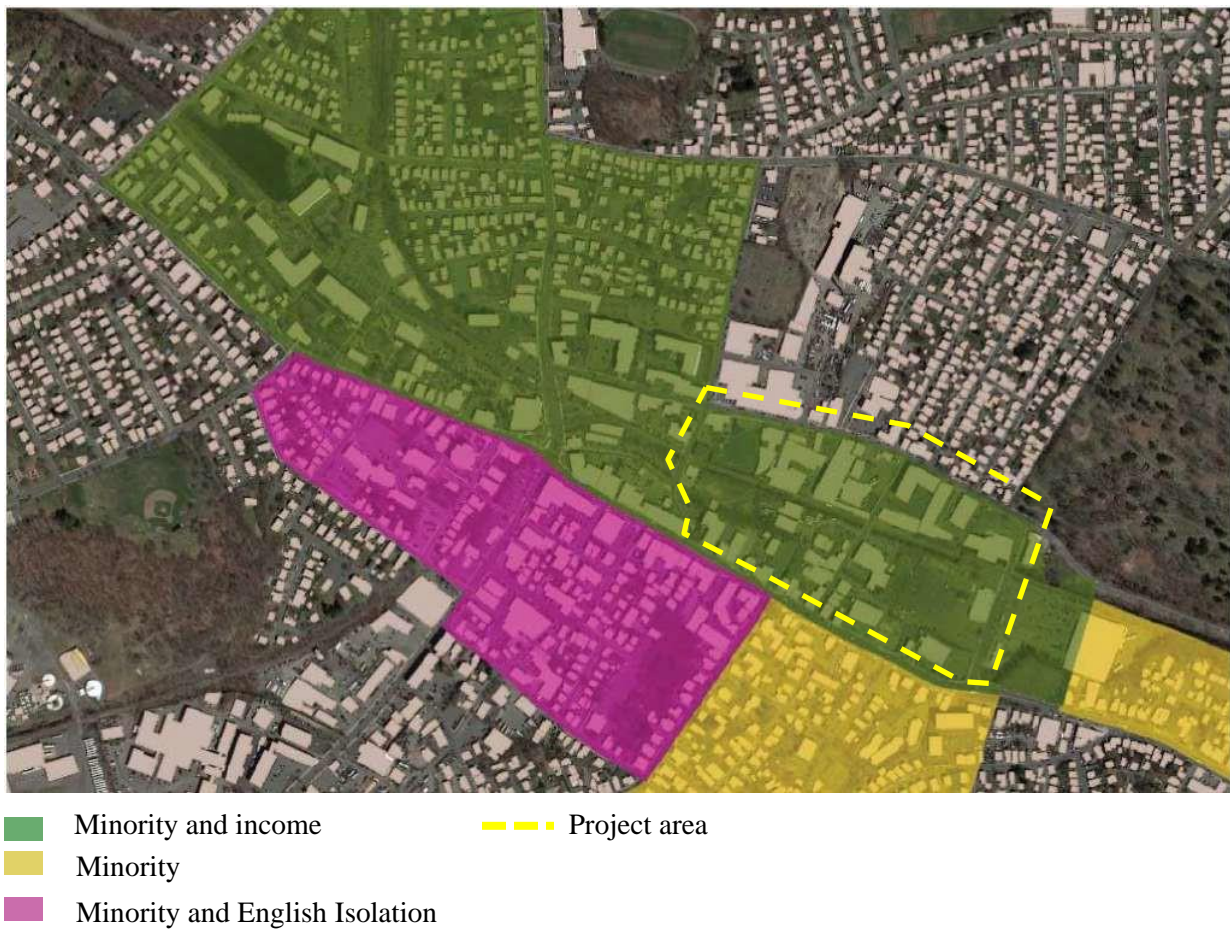


Fig. 22: Downtown Peabody Environmental Justice Thresholds. The project meets the recruitments of an environmental justice neighborhood based on minority and income levels. (Courtesy of Google Maps and US census)

6.0 Project Site

The Project Area is bounded by Walnut Street, Howley Street, Main Street, and Wallis Street (Fig 23). This segment of the watershed was selected because it is a prime location to connect Downtown to its surrounding neighborhoods and addresses the issues of flooding in the area. The map below illustrates the general boundaries of the study area.

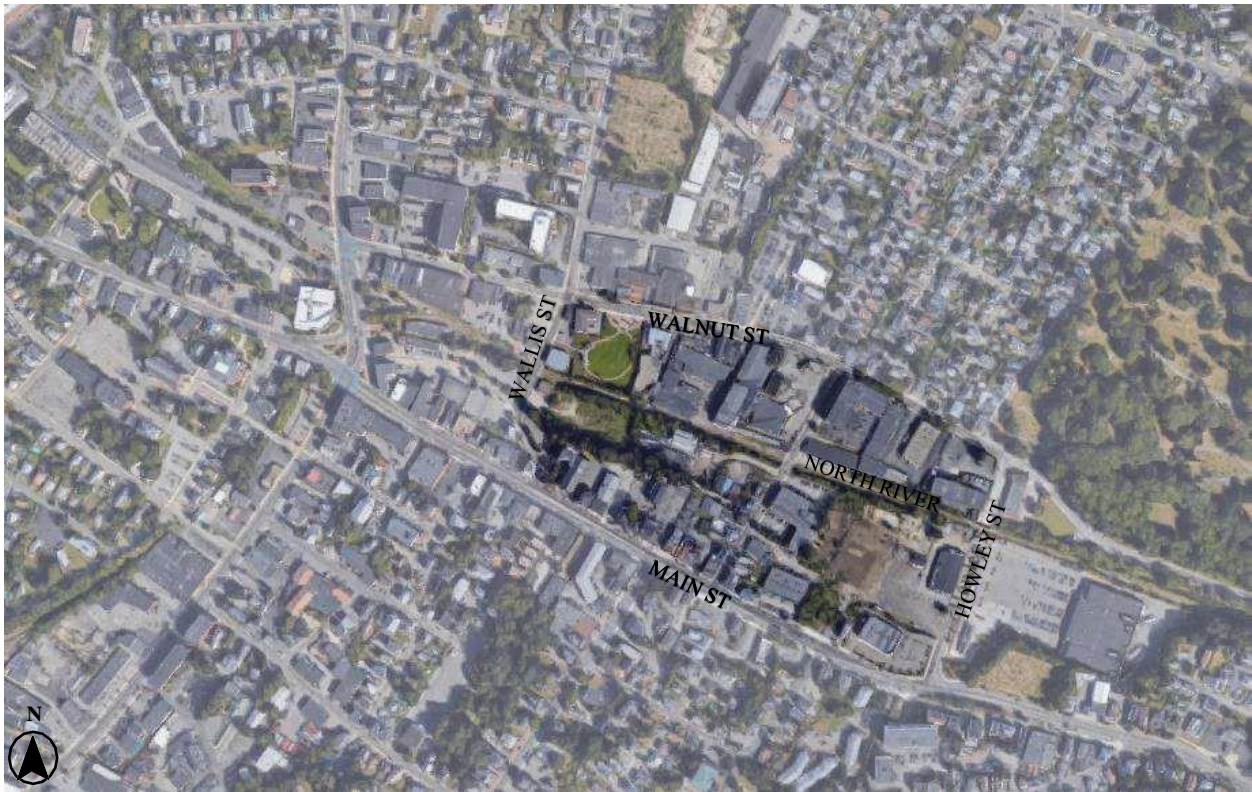


Fig. 23: The project site is bounded by Main Street, Walnut Street, Howley Street and Wallis Street. (courtesy of Google Maps)

North River Corridor- The North River Area has been historically an industrial district featuring many former tannery sites adjacent to the north river and the railroad. This area today (Fig 24) includes several brownfield sites and underutilized properties that have potential for public access, pathways, open space, flood mitigation, and limited redevelopment.



Fig. 24: The North River flows through the center of the project area. (courtesy of Google Maps)

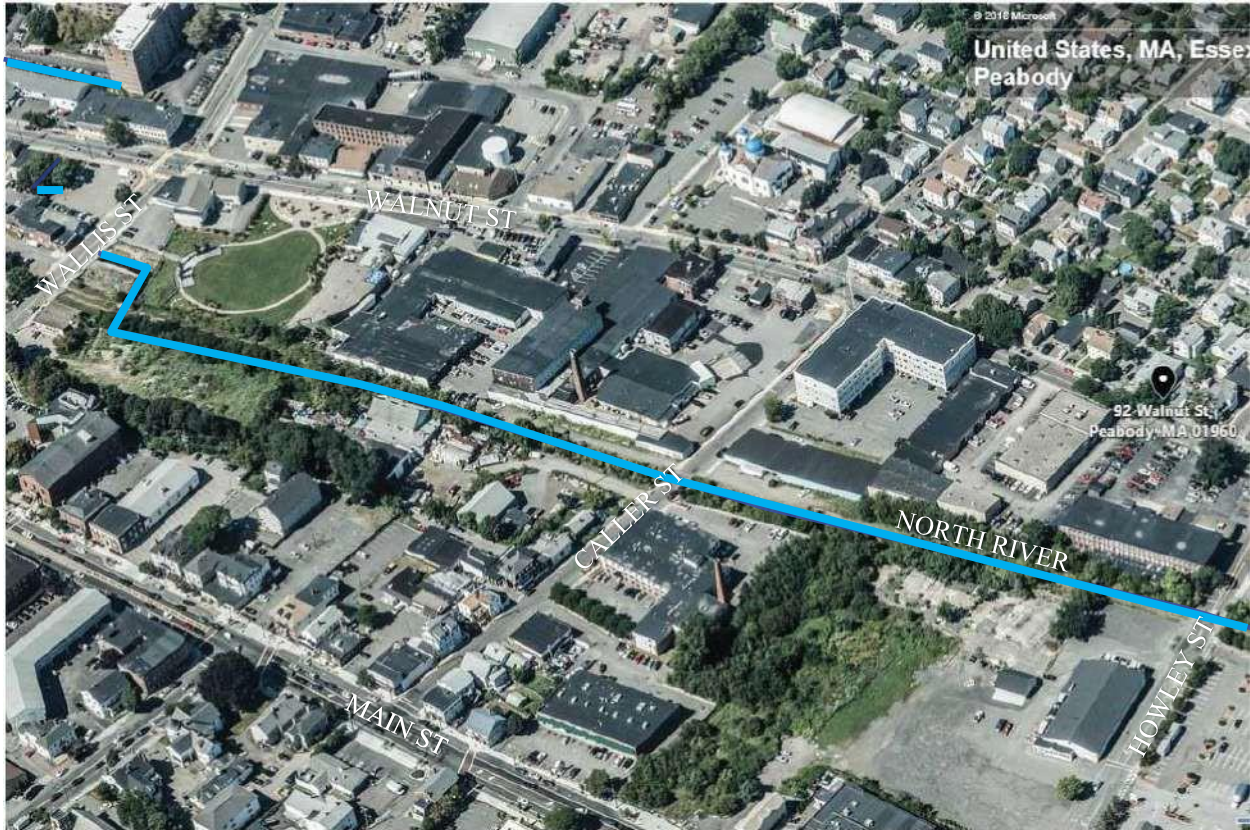


Fig. 25: Aerial view of the North River in downtown Peabody between Walnut Street and Main Street. (Courtesy of Bing Maps)

Between Howley Street and Wallis Street (Fig 25), the North River corridor is the auto-oriented “back” of downtown, and the North River is constrained into a narrow granite wall channel with the rail line running along adjacent to it. The area is surrounded by dense residential neighborhoods to the north and to the south is Main Street that is lined with elegant two- to four-story commercial and mix use buildings. With its steep slopes behind Main Street and the constant fret of flooding has made the location an undesirable area for private development. As a result, vacant lots are found mostly in the area directly south of the North River with their steep embankments in the back of Main Street. A railroad line runs adjacent along the northern side of the River. This line is used only for freight trains that pass two to three times a month for the Rousselot company that manufactures and sells gelatin products in the United States and

internationally. The company is located about a mile south of the corridor. Located between the railroad and Walnut Street are existing industrial buildings that are mainly converted into auto-oriented type of businesses (Fig 26).



Fig. 26: Railroad Running alongside the North River at Wallis Street. (Photo by Mitch Johnson)

Recent and Ongoing Planning and Investments

Veteran Memorial Park

Veteran Memorial Park was a park built on 45 Walnut Street (Fig 27) in 2014 to remediate and redevelop a 1.3 acre lot formerly used as a tannery. Located along a channeled section of the North River, this area of Peabody is prone to flooding during major storm events due restrictions in the channel construction. The park design incorporated elements of resiliency to flooding (Fig 28), and the cleanup of a former brownfield site. The park design embodied the concept of resiliency by using sturdy natural structures including a boardwalk and stage made from native wood, and boulders organized as classroom seats. A pervious surface made of 70% from recycled materials was used to create a plaza and circular walkway, and educational signage relaying historical and ecological information was added. This park is a noteworthy approach as a first step, and it would be great to see more of these strategies along North River that turn brownfields into usable open space. The park does lack connectivity, so this project proposal is integrating the park into a larger greenway network vision.



Fig. 27: Aerial view of Veteran Memorial Park with the North River to the right (Drone Image by Mitch Johnson)



Fig. 28: Veteran Memorial Park during a flash flood in 2016 acts as a retention pond for stormwater runoff. (Courtesy of Salem News)

North River Walk Plan

The River Walk project was first conceived under the former Mayor Peter Torigian more than 20 years ago. Planning documents for the project that date to 2001 show concepts for a complete revitalization of the rail corridor and old industrial properties that run along the North River.

That plan calls for a pedestrian walkway with greenery, benches, and access to shops, restaurants, studios, and other commercial and residential uses (Fig 29). Plans for the River Walk never advanced beyond a conceptual stage over the years, and the city has had difficulty obtaining numerous land easements or buying these properties that would allow the project to move forward.

Thanks to several grants from the State, the City has begun to acquire the money necessary to begin to buy these properties along the North River for a future greenway. The map below (Fig 30) shows the Peabody vision for the futures of downtown that includes the North River and the surrounding area. This Master's Project will take the North River Walk Plan a step further by using strategies of softening the river's edge, expanding the flood plain into a meadowland. Then creating a network of pathways, overlooks and a promenade all to create a scenic ecological corridor in downtown Peabody.

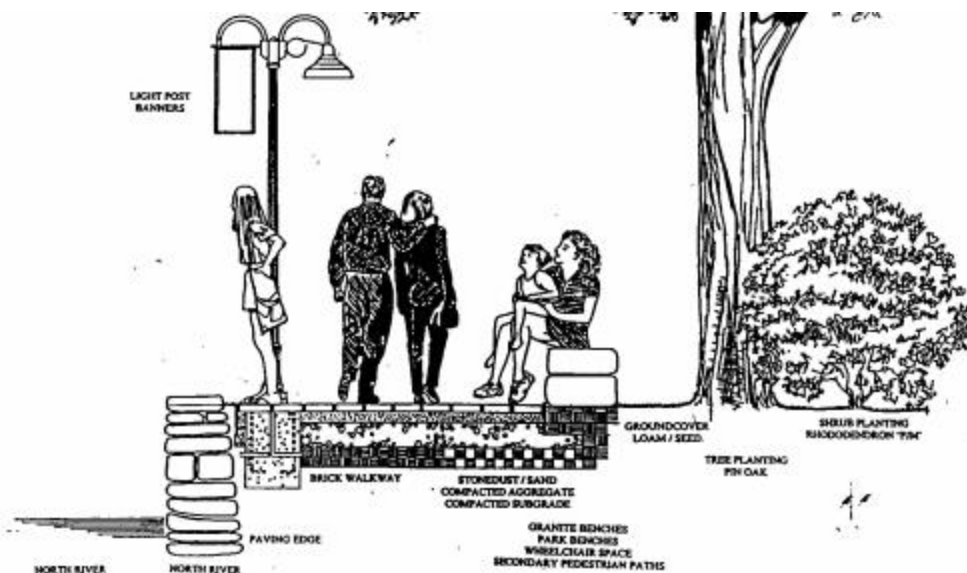


Fig. 29: A proposed cross section of the North River Walk Plan that includes lighting seating, and trial along the North River. (courtesy of City of Peabody)

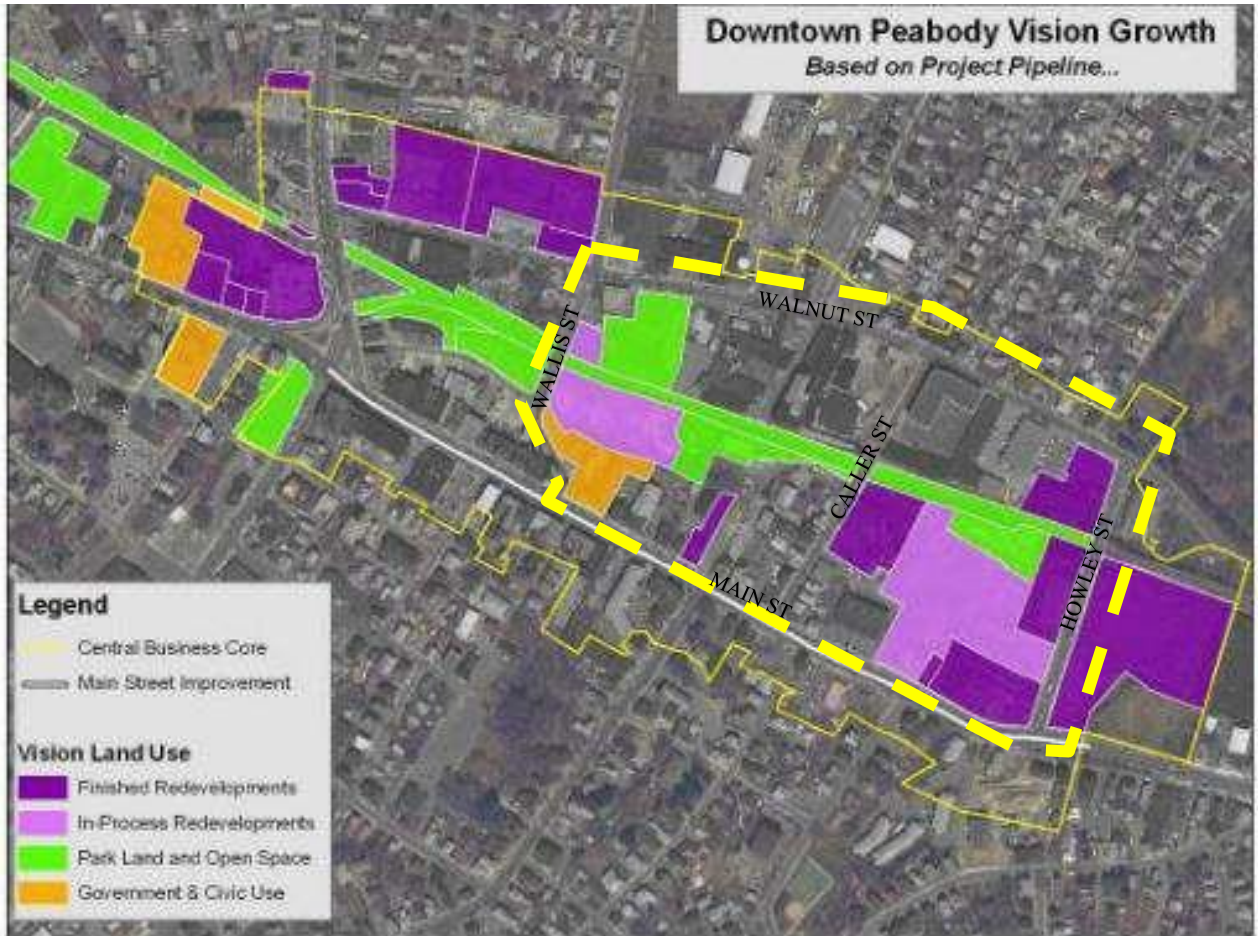


Fig. 30: Downtown Peabody Vision Growth. This plan envisions new land uses in the Central Business Core and proposes parks and open space along the North River surrounded by locations for new redevelopment projects. (courtesy of City of Peabody)

Analysis Maps

Topography

The topography map (Fig 31) illustrates that downtown Peabody is located in the North River's floodplain with most of its elevation around 10-30 ft. During rain events stormwater converges down to these low points. The project site has some of the lowest elevations in the City. Under the influence of climate change these areas are going to continue to be more at risk and are not suitable for development.

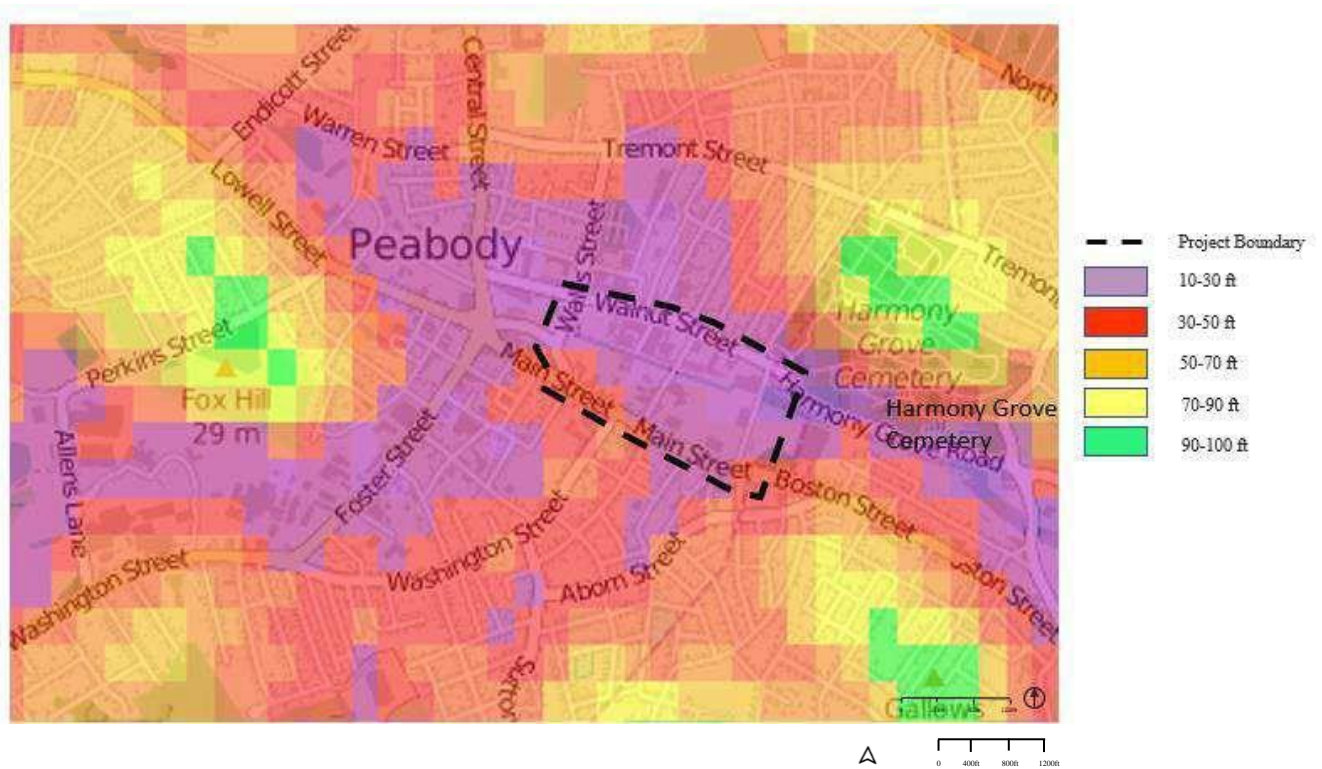


Fig. 31: Elevation map of downtown Peabody (Courtesy of GIS)

Zoning

Two types of zoning districts can be identified in the project area (Fig 32), the General Business District and the Central Business District. With the new zoning the city is trying to encourage developers to come in and bring new mixed-use and commercial buildings to the neighborhood. The area has had a hard time attracting developers because it is such a flood prone site (Fig 16).

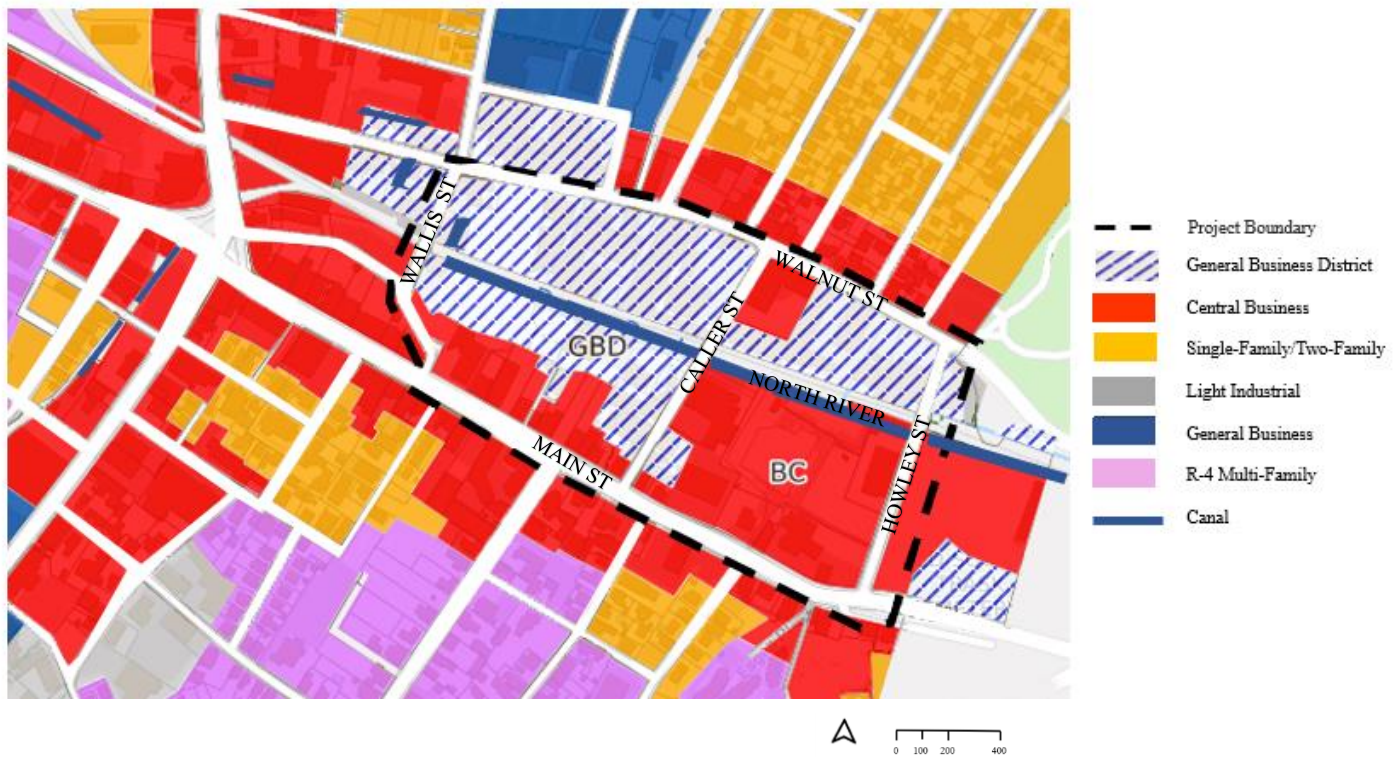


Fig. 32: Zoning map of downtown Peabody (Courtesy of MASS GIS)

Land Use

There is a mixture of land uses throughout the site (Fig 33). Main Street contains a mix of commercial and mixed-use buildings. Directly behind Main Street are a couple of large vacant parcels of land and small amounts of commercial and residential uses. Along Walnut Street the land uses are mixed and contain industrial, commercial, mixed and residential uses.



Fig. 33: Land use map of downtown Peabody (Courtesy of MASS GIS)

Conclusion

After studying the topography, land use and zoning of the project site, it can be concluded that this area is not suitable for industrial and residential uses because of its constant threat to flooding. It can be projected that the area will have difficulties attracting developers and that this area will inherently have the risk of having vacant store fronts and buildings with a lack of future investments.

7.0 DESIGN CONCEPT

Project Statement

For over a century, the scenic North River has been dominated by industry, leaving the city of Peabody, MA with a broken link between the community and the North River. With the riverfront occupied by overgrown vacant land, an underused rail line and a number of rundown buildings there is virtually no space is available for the needs of the people or environment.

The North River Greenway proposal revitalizes a 30-acre industrial corridor along the River. Focusing on the issues of public access, economic viability, and environmental restoration, this proposal confronts the mismanagement of the North riverfront with a vision of a practical and sustainable alternative. The unique site conditions and input from local city officials have resulted in the transformation of this site into a vibrant green corridor that will fulfill the needs of people and environment for generations.

Design Concept

This proposal for the quarter mile section of riverfront at North River Park addresses both the environmental issues and city directives. More importantly, it provides a vision that will re-connect the people of Peabody with their River by providing long awaited public access, economic sustainability, and habitat restoration. The greenway design is built around two ideas: the resilient riparian corridor at the center of the greenway and the two urban park edges adjacent to Walnut Street and behind Main Street.

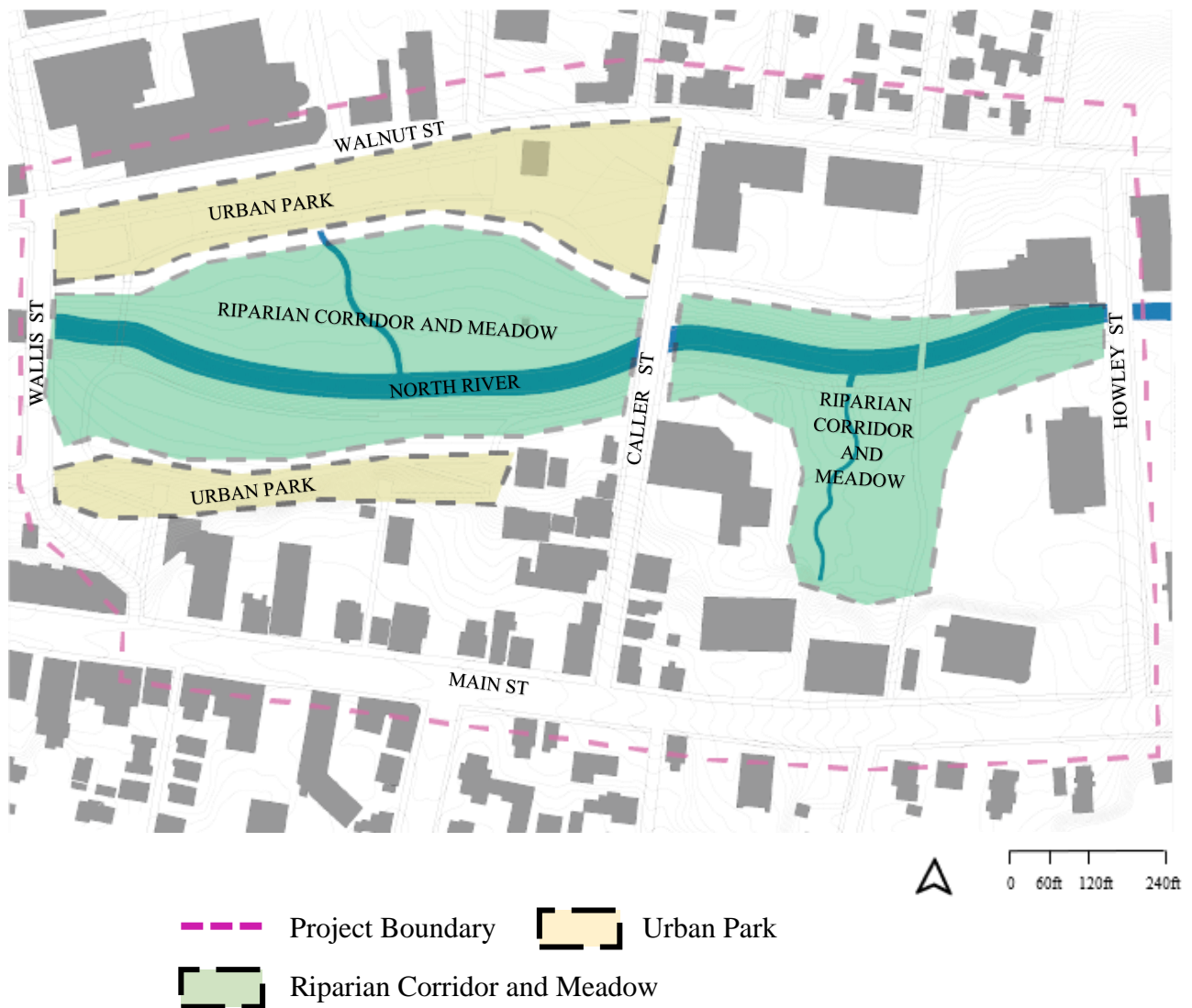


Fig. 34: Design concept plan for the greenway. (Map by Mitch Johnson)

Riparian Corridor

At the center of North River Meadow Park is the riparian corridor of the North River with dense wetlands plants and trees surrounded by large meadow fields to address flooding during heavy rain events. A network of paths takes you through these meadow fields and along the North River. Providing access for the public to enjoy this natural landscape whether it be taking a stroll or sitting along the river's edge. Transforming this once hazardous and inaccessible stretch of the riverfront into a flourishing realm of recreation and lush riparian habitat. Repurposed and proposed design elements embrace these storm events to guarantee a resilient and long-lasting design.

Urban Edge

This edge is comprised of the area in transition from the river landscape into the urban landscape. Perpendicular to Main Street, three new paths take you from buzzing Main Street onto the greenway corridor. The first and second terminate with gabion-structured overlooks. In the shade of proposed white, scarlet and pin oaks, magnificent views are provided looking down to the North River and the spectacular native meadows. A series of pathways lead down into the flowing meadows and bring people down to the river's edge with opportunities for walking, running, sitting, fishing along the North River. Along Walnut Street a shaded linden tree promenade creates a new urban edge to Walnut Street while also providing views of the meadows and North River. Recycled materials of granite blocks that were used to strangle the river are now repurposed to enliven the North River Meadow Park. They provide places to sit and reference back on the old industrial uses of the area. This promenade will serve as the "economic engine" to reinvent Walnut Street as a new destination to live, play, and work in downtown Peabody.

Existing elements

Existing elements play a unique role in the proposed design. Debris from old buildings and existing pavement can be used to fill the gabion walls. The Granite walls from the canalized River's edge could be repurposed for seating throughout the site as well as being used to create surfaces out of crushed gravel for the trees and grasses along the promenade. It is also proposed that the smokestack at one of the former tanneries can be preserved as an iconic symbol of the site's history that provide a visual link and landmark to the City.

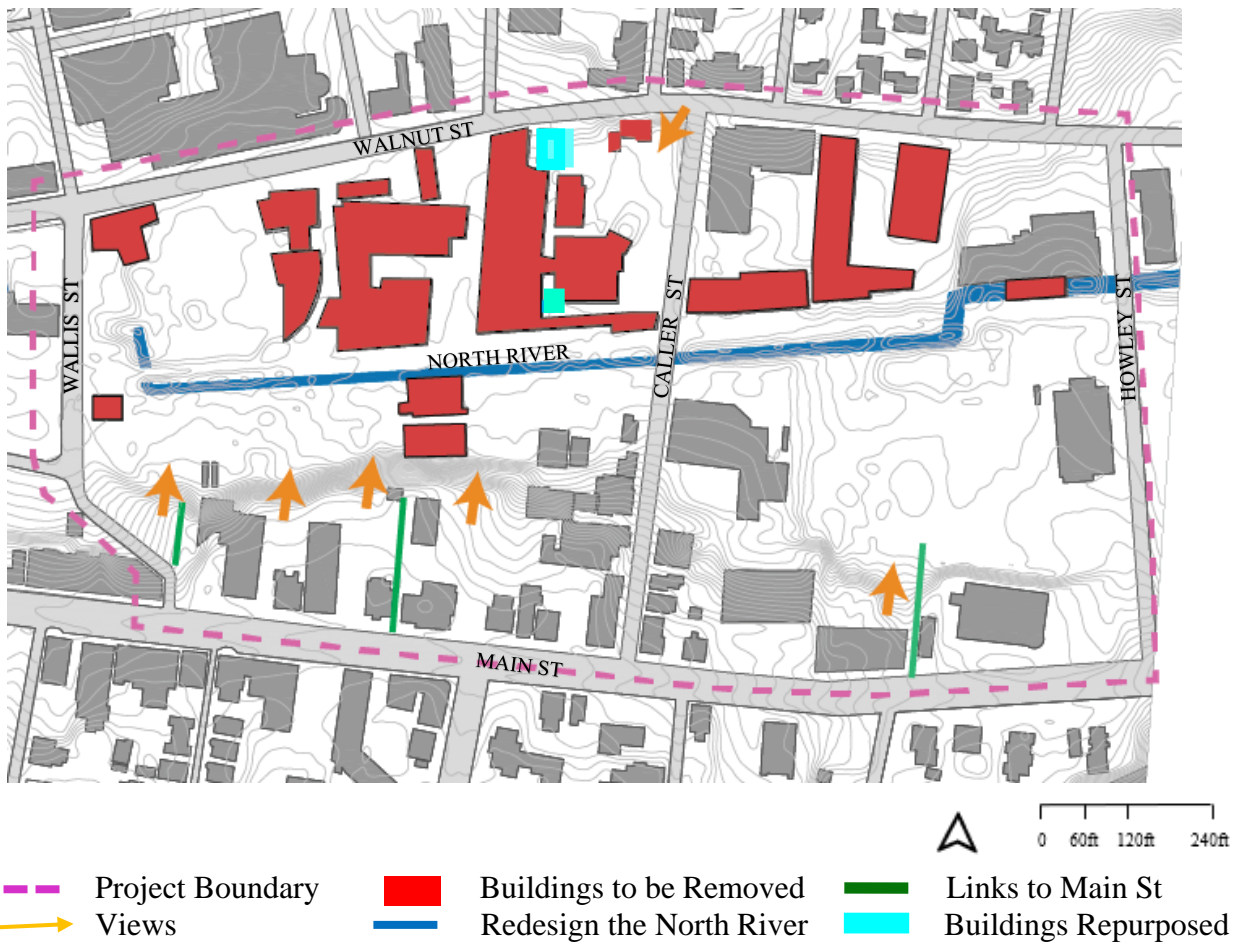
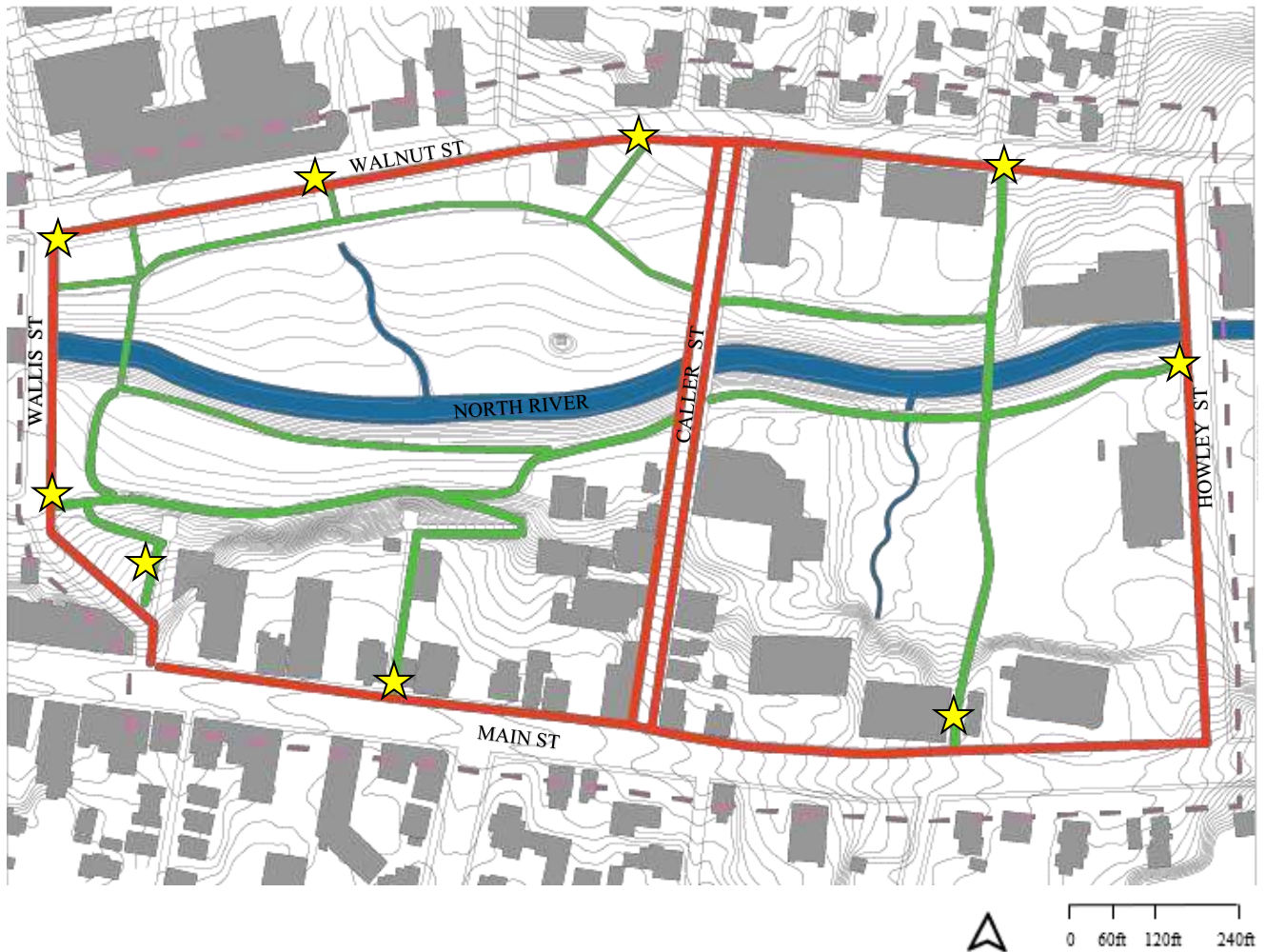


Fig. 35: The different design challenges and tasks for this project. (map by Mitch Johnson)



- - - Project Boundary
 - Existing Pedestrian Circulation
- Proposed Pedestrian Circulation
 - ★ Key Entry Points

Fig. 36: Pedestrian circulation and entry points for North River Meadow Park. (Map by Mitch Johnson)

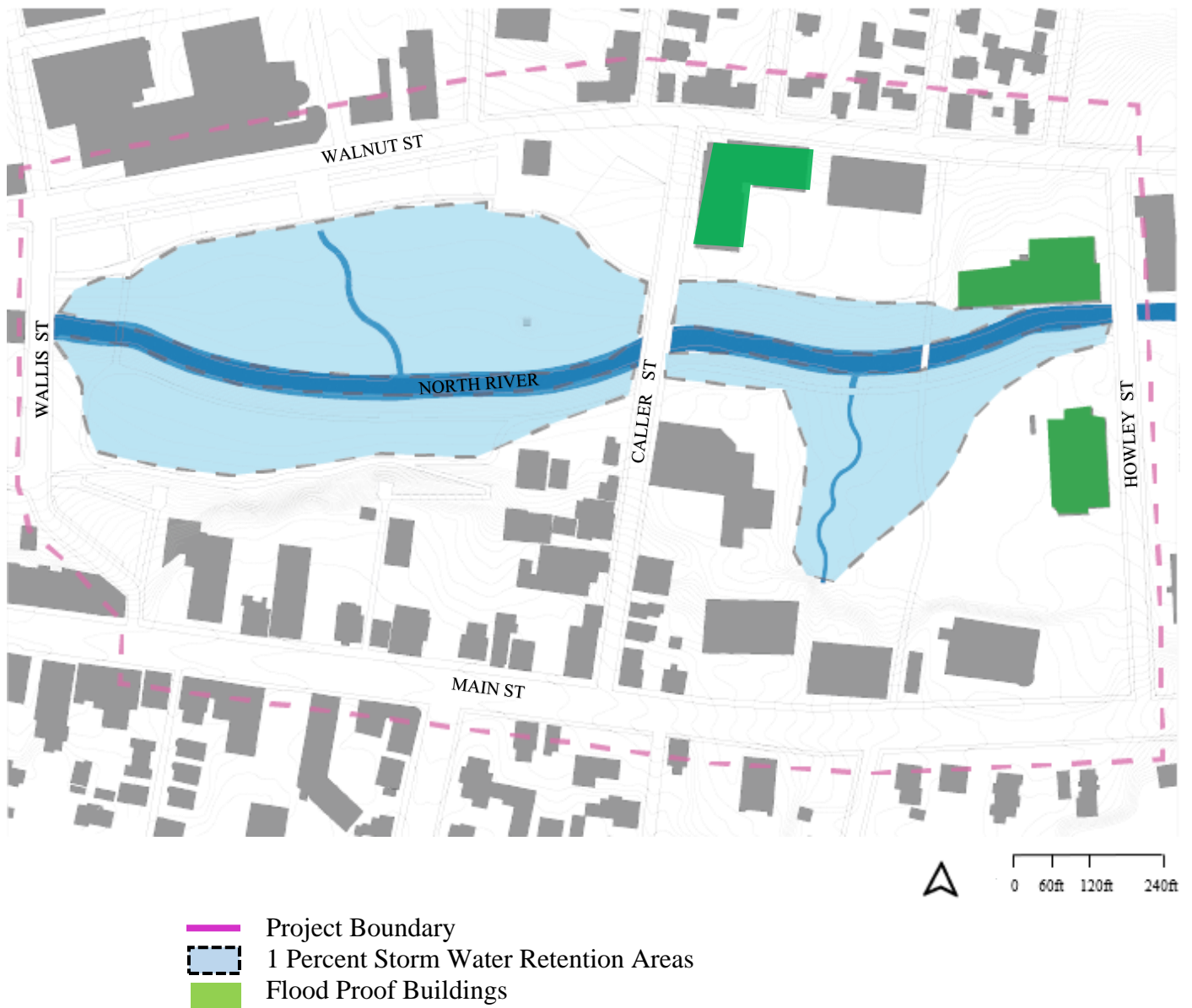


Fig. 37: The meadows store stormwater during rain events and buildings located in the floodplain will be retrofitted to be flood proof. (Map by Mitch Johnson)



Fig. 38: The locations of different planting zones throughout the site. (Map by Mitch Johnson)

Meadow

The Meadow zone (Fig 38) is normally dry but may flood during snowmelt and after large storms. It is gently sloping down towards the river and streams. Floodplain species must be adapted to extremes in hydrology - they may be inundated for long periods in the spring and be dry during the summer. The meadow zone will feature mainly wildflower and grass plantings with tree plantings in clumps or specimen trees such as *Fraxinus americana* (White Ash) and *Acer saccharinum* (Silver Maple).

Wetland

The wetland zone (Fig 38) is a constantly moist area that is inundated even after heavy rainfalls in the summer. The transitional area between the river and the upland area is steeper and prone to erosion. Therefore, it is an important area to establish dense and plant communities with expansive root systems that hold the soil in place. *Cornus* (dogwoods), *Salix* (willows), *Cephalanthus occidentalis* (buttonbush) and *Aronia* (chokeberry) would be well-suited for this area and are complimentary to the understory vegetation such as wet-meadow grasses, sedges, flowers and shrubs, such as are well suited to this zone.

Woodlands

The woodland zone (Fig 38) transitions from the urban edge into the riparian corridor. Native groundcovers, shrubs, and trees such as *Acer negundo* (Box Elder Maple), *Acer saccharum* (Sugar Maple) and *Fraxinus pennsylvanica* (Green Ash) can create this continuous transition from the urban environment to the River corridor.

Street Trees

New street trees (Fig 38) such as *Tilia americana* (American Linden), *Quercus palustris* (Pin Oak), *Platanus × acerifolia* (London Plane) are proposed along Caller, Wallis, Howley and Walnut Street. They create a more pedestrian-friendly experience for walking and biking and reduce heat-island effects on the streets

Design Illustrations



Fig. 39: North River Meadow Park transforms this old industrial corridor to a scenic landscape in the heart of downtown Peabody. (Rendering by Mitch Johnson)



Fig. 40: North River Meadow Park during intense storm events retains stormwater in the meadows surrounding the River. (Rendering by Mitch Johnson)

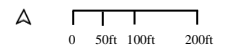


Fig. 41: Master Plan of the North River Greenway. (Rendering by Mitch Johnson)

Phasing

The North River Greenway is a phased design approach. The City of Peabody cannot afford buying all these properties at once. Another constraint is the active rail line adjacent to the North River that is used a couple times a month for freight purposes. Therefore, it is proposed to break the design down into two phases: Phase 1 short term 5-10 years and Phase 2 long term 25-50 years.

Phase 1

Phase 1 is the short-term plan in the area on the south side of the North River (Fig 42). There are only a three structures that are called to be removed on this side of the North River while the rest is vacant land. The first step is to remove the canaled river walls on the south side of the North River. Then the width of the North River can be expanded to approximately 40 feet. The fill from the river expansion will be used along the steep slopes behind Main Street to create overlooks and ADA accessible paths leading down to the River. The first phase will kick start the North River Greenway but for the complete success of the greenway the next phase will have to take place.

Phase 1

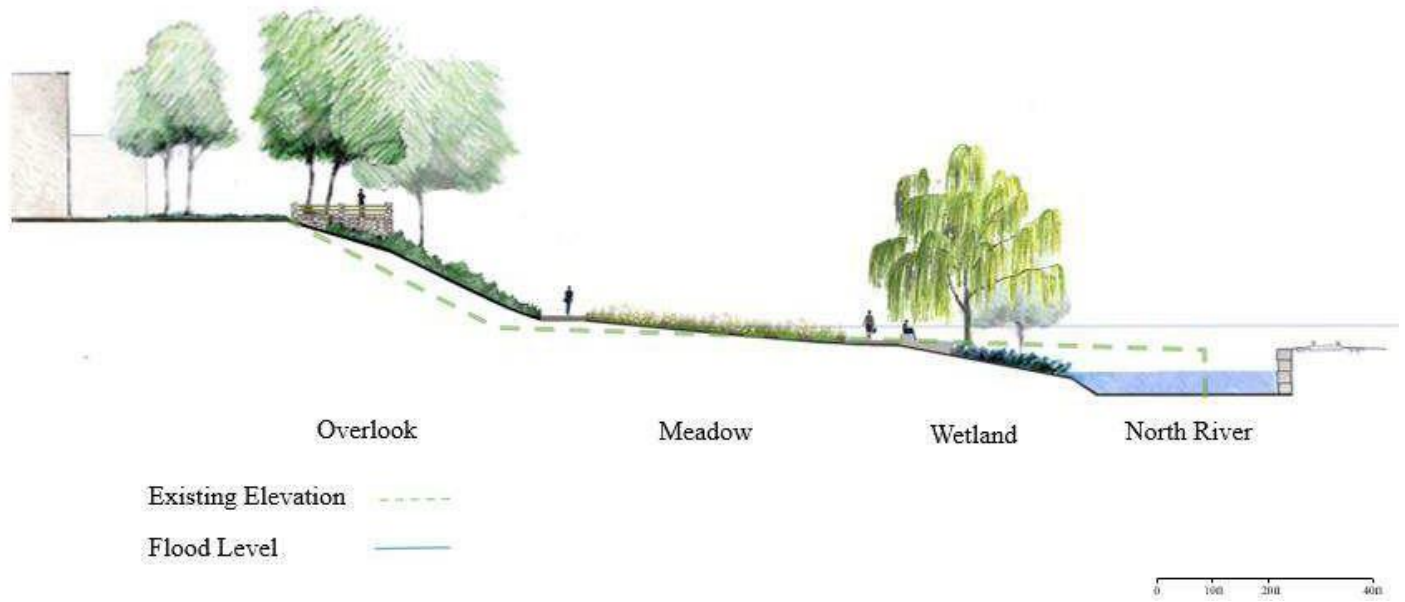


Fig. 42: Phase 1 focuses on the area behind Main Street down to the North River. (Rendering by Mitch Johnson)



Fig. 43: Bird's Eye of Back Side of Main Street - Transforming the back side of Main Street into a scenic landscape along the North River. (Rendering by Mitch Johnson)



Fig. 44: View on Top of a Gabion Overlook - Gabion overlooks provide scenic views of North River Meadow. (Rendering by Mitch Johnson)



Fig. 45: View Along North River - Paths and seating reconnect people with the North River. (Rendering by Mitch Johnson)

Phase 2

Phase 2 is the long-term plan in the area on the north side of the North River (Fig 46). This side of the River calls for thirteen structures and the rail line to be removed. The canal walls on the north side of the North River has also to be removed and reused in the design. Then creating a meadow floodplain by excavating fill along the North River creates shallower banks along the North River to reduce potential flash flooding and help with sediment filtration.

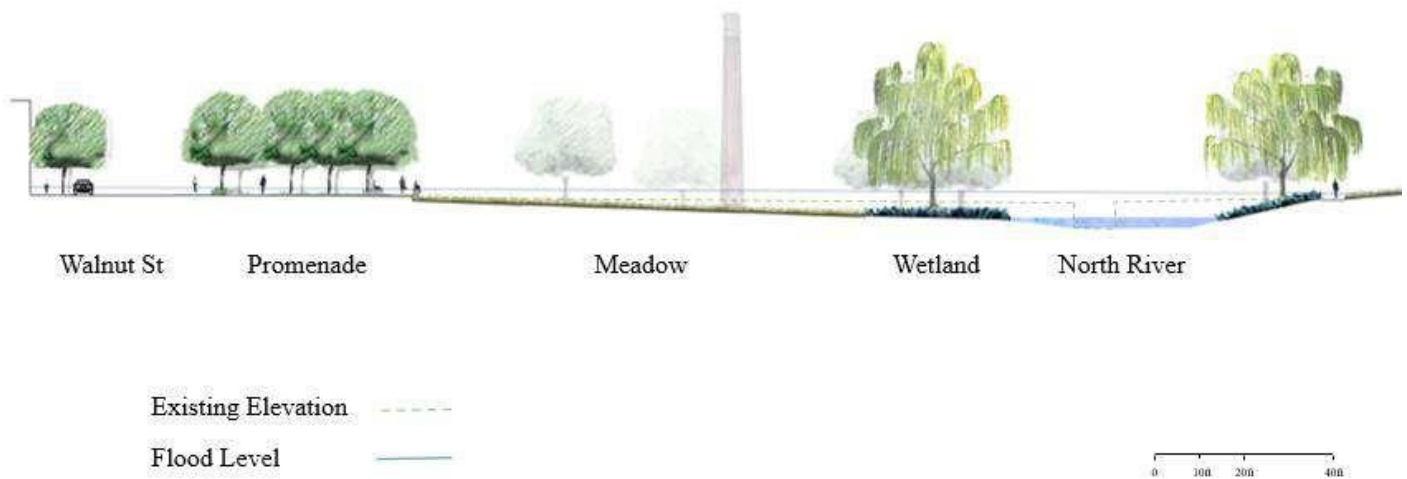


Fig. 46: Phase 2 focuses on the area from Walnut Street down to the North River. (Rendering by Mitch Johnson)



Fig. 47: Birds Eye of Promenade along Walnut Street – The Promenade is lined with linden trees and seating to sit and enjoy the scenery. (Rendering by Mitch Johnson)



Fig. 48: Walking under the linden trees along the promenade with views along of the North River and Meadows. (Rendering by Mitch Johnson)



Fig. 49: Views from Walnut Street – On Walnut Street pedestrians can get great views onto the North River and the meadows. The trees are planted in rhythmical patterns and that frame the views. (Rendering by Mitch Johnson)

8.0 Conclusion

Focusing on the issue of river accessibility, economic viability and environmental sensitivity, this proposal confronts the mismanagement of the North River with a vision for a beautiful and sustainable alternative in the postindustrial landscape of North River Park and Greenway. This design is built around a healthy riparian corridor at the center of the greenway that improves the health of the North River through stream restoration and returning the native wetlands.

Simultaneously it addresses the problem of flooding in the Downtown area by creating meadow fields to capture stormwater during intense storm events. Moreover, it creates an urban edge that will integrate the landscape of the River with the urban fabric of downtown Peabody through the design of a pedestrian path that takes you from the city scape into the greenway providing spectacular views and access to the North River. A tree-lined promenade along Walnut Street brings a new character and aesthetics to the surrounding neighborhood. In conclusion, this project provides a design that transforms this neglected landscape into a scenic urban ecological corridor providing for a more sustainable and healthier environment for Peabody and its people.

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