

Fall 2014

Greening Worcester: Planning and Designing Green Infrastructure Networks for Habitat, Recreation, and Landscape Interpretation:

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GREENING WORCESTER:

PLANNING AND DESIGNING GREEN INFRASTRUCTURE NETWORKS FOR HABITAT, RECREATION, AND LANDSCAPE INTERPRETATION

Graduate Landscape Planning Studio LA 607. Fall 2014

Instructor: PROFESSOR ROBERT L. RYAN, FASLA

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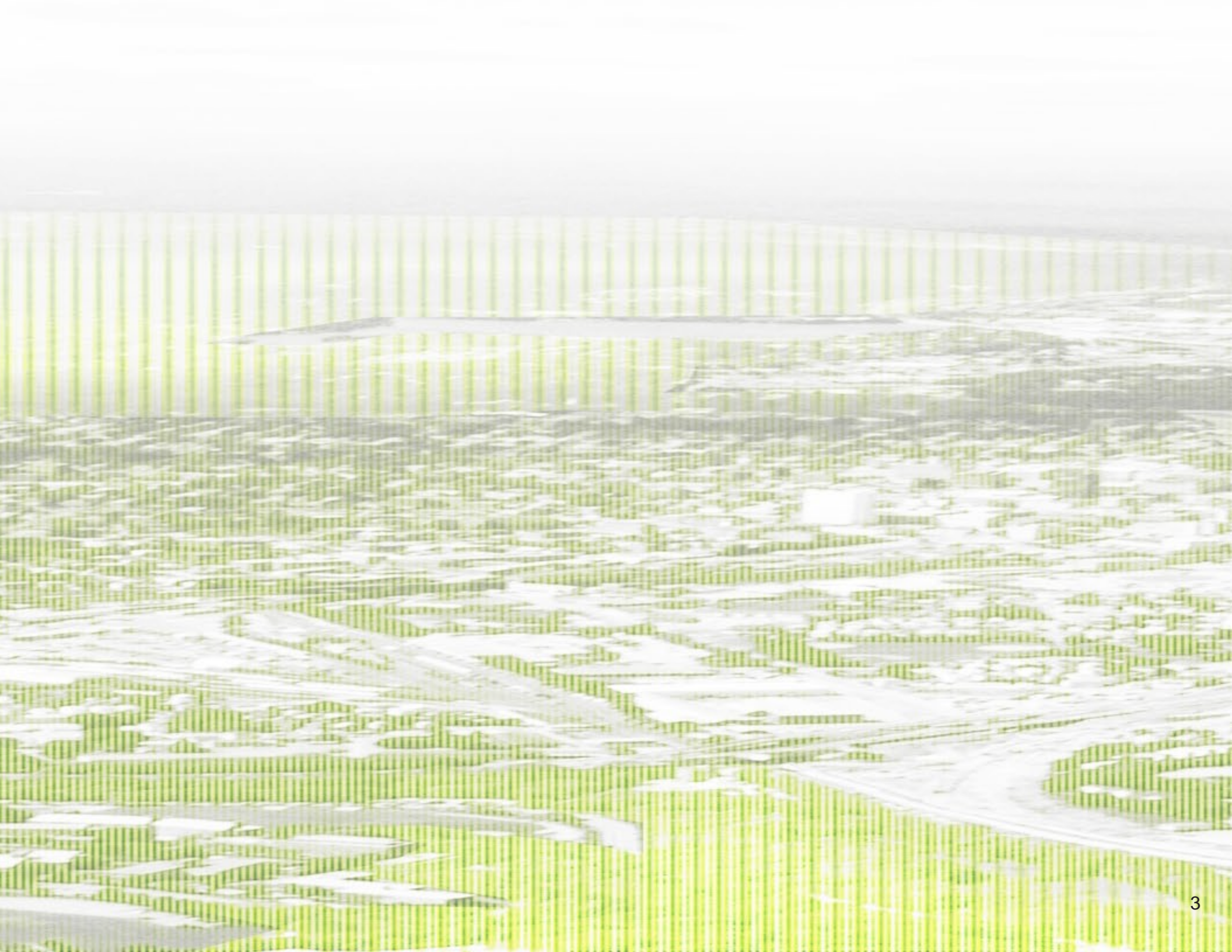


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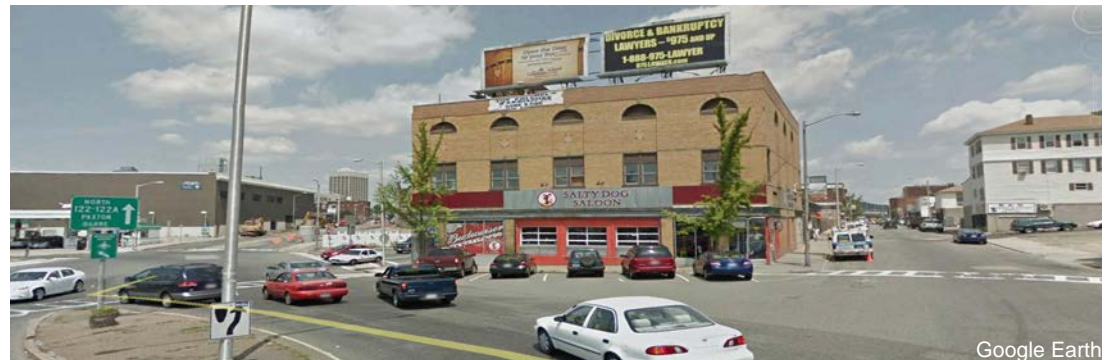
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www.worcesterMA.gov



Google Earth



Shu Liu Photography

ACKNOWLEDGEMENTS:

We would like to extend a thanks to all who have helped frame this project, and to the City of Worcester for providing a platform for learning and discovery about the ways that landscape planning can promote sustainability in a “real-world” context. Through meetings with members of the Central Massachusetts Regional Planning Commission, City of Worcester Planning and Regulatory Services and Economic Development, and BikePed Worcester, we learned about the existing city and regional plans, and were given direction and input during our studio. In conjunction with these meetings, information and guidance from the EcoTarium Science Museum during our class fieldtrip there was a major source of inspiration.



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Professor Ryan’s work at the EcoTarium is partially-supported by the National Science Foundation under Grant No. DRL1323168. However, any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. Additional support for this studio project, Greening Worcester came from the Department of Landscape Architecture and Regional Planning, University of Massachusetts-Amherst.

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City of Worcester Planning and Regulatory Services

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Luba Zhaurova, *Sustainability Project Manager*

Heather Gould, *Economic Sustainability Chief of Staff*

BikePed Worcester

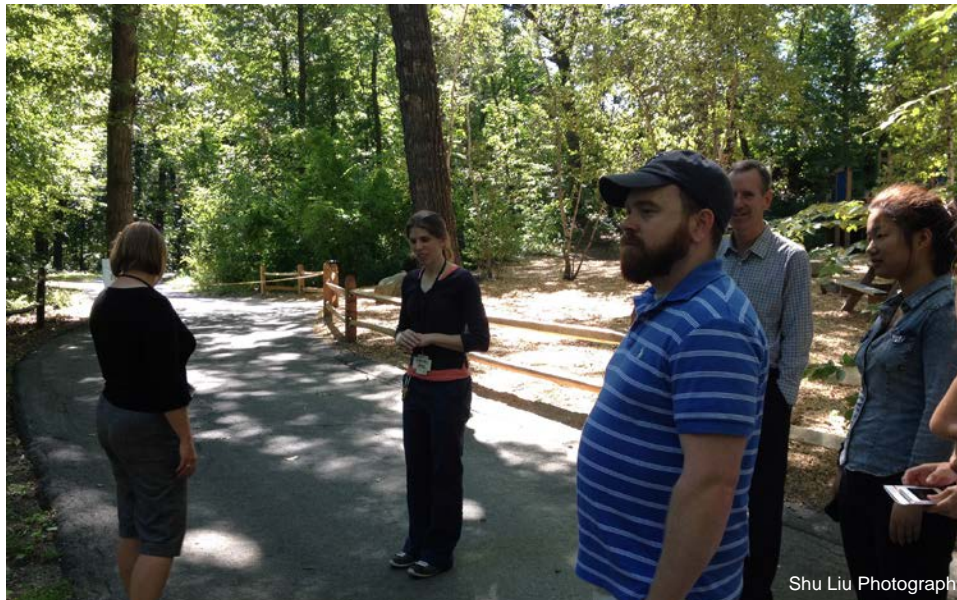
Karen Valentine Goins

EcoTarium Museum

Betsy Loring, *Director of Exhibits*

Shana Hawrylchak

Alice Promisel



BACKGROUND:

This studio focused on the creating green infrastructure networks in Worcester, Massachusetts which is the 2nd most populated city in Massachusetts. Worcester is located near the upper end of the Blackstone River, which generated power for some of the early industrial development in the United States. Historically, industry attracted waves of immigrants to Worcester that created vibrant, tight-knit neighborhoods. However, like many industrial cities in New England, the decline in manufacturing along outmigration to neighboring suburbs has left Worcester with many economic and social challenges. Fortunately, the City also has a rich cultural legacy with many museums and institutions of higher education, including Clark University, Holy Cross College, and Worcester Polytechnic Institute that have been partners in urban revitalization and education efforts.

The studio worked in conjunction with the EcoTarium, an innovative science museum in Worcester. The EcoTarium covers 55 acres with indoor and outdoor interactive exhibits, a tree canopy walk, and planetarium. With over 130,000 visitors a year, the EcoTarium is the second most visited science museum in Massachusetts. Currently, the studio instructor, Professor Robert L. Ryan is working on a NSF funded research project with the EcoTarium¹, along with partners from Clark University and Loyola Marymount University (Los Angeles) to develop a new exhibit called City Science. This exhibit will teach museum visitors about urban ecology, climate change, and land-use change, and have them apply this knowledge to city planning issues.

One of the challenges for the studio is to bring this idea of learning about urban ecology outside the museum to the surrounding community as part of developing a green infrastructure network that connects cultural and open space resources such as the EcoTarium to the city of Worcester. The museum has been involved in another NSF funded project, called The Art of Science Learning that focuses on looking at innovative transportation solutions (www.artofsciencelearning.org). In addition, the EcoTarium is in a residential neighborhood and can be difficult for visitor's to find, so green infrastructure improvements should look at issues of legibility and wayfinding.

This work at the EcoTarium is an outgrowth of the instructor's participation in the Boston Metropolitan Area Urban Long Term Research Area (ULTRA-Ex) project (www.umass.edu/urbaneco/index.html.) that brought together scientists, planners, and non-profit groups to study urban ecology and future scenarios (NSF-BCS #0948984).

¹ Pathways: From the Lab to the Neighborhood: An Interactive Living Exhibit for Advancing STEM Engagement with Urban Systems in Science Museums NSF#DRL1323168



<http://worcestermag.com/>

STUDIO GOALS:

The aim of this studio was to gain experience in synthesizing information at various scales that inform decision making for greenway system planning and design. Additionally, the studio explored innovative ways to introduce green infrastructure and landscape interpretation for a regional system.

SPECIFIC OBJECTIVES:

To develop techniques for working at multiple scales, from regional and city watershed to neighborhood and sitescales. This includes the ability to understand how regional ecological forces and management decisions affect areas at smaller scales.

To manage various competing goals of environment equality, human use, existing infrastructure, and current city initiatives.

To strengthen the ability to communicate landscape planning solutions in a meaning and engaging manner to local residents and officials alike.

To learn and apply innovative strategies for green infrastructure development.

To allow students' the ability to explore a range of design and planning tools including visual simulations and Geographic Information Systems.



http://commons.wikimedia.org/wiki/File:Seal_of_Worcester,_Massachusetts.svg



GREENING WORCESTER

Introduction

Worcester Massachusetts, incorporated in 1848, is the second largest city in New England and is regarded as the “Heart of the Commonwealth”. 2010 population was 181,631 and its boundary covers about 39 square miles with about 3% being water. The city is located about 50 miles west of Boston to which it offers active daily commuter rail service from the newly renovated Historic Union Station. Worcester is alive with many vibrant cultural and recreational activities and has many historic parks, theaters, buildings and districts. Shrewsbury Street, also known as “restaurant row”, is located slightly east of downtown and is a popular night time destination with over 40 restaurants many of whom are world class and beloved by area residents. ([HTTP://WWW.WORCESTERMA.GOV/](http://www.worcesterma.gov/))

Historically, Worcester was an industrial and agricultural city laid out in relationship to its natural form. Many mills and factories were in proximity to water sources and residential neighborhoods mostly developed on the hilly uplands. Central park areas were designated for open spaces but little other large scale planning for future growth was implemented. Roads therefore are either built excessively large or small for current traffic flows and modes of increasing bicycle and pedestrian travel. As with many other post industrial, legacy cities across the nation, stormwater management was never addressed holistically. Thus, new retrofits to the existing system have only recently began, and are hampered by the lack of available space as well as lack of funding.



Photo Taken by Laura Keskula



www.blackstonedaily.com



www.visitusa.com



en.wikipedia.org

PROJECT OVERVIEW:

This studio focused on the City of Worcester, Massachusetts, located centrally between Amherst and Boston, and notably at the headwaters of the Blackstone River, which runs south to Providence, RI and the Atlantic Ocean. In 2013, the City of Worcester updated and published its Open Space and Recreational Plan. The plan provided the city and its residents with a clear understanding of its existing green space resources, as well as outlined a 7-year action plan, which gathered input from stakeholders and residents and formed a framework of goals for the future of the city's parks, streets, playgrounds and other resources. (WDPW-PRS, 2013).

Worcester is known as a key starting point for the American Industrial Revolution, and as such has drawn a large amount of cultures, ideas, and resources into its municipality. The city has a large amount of existing parks, playgrounds, water resources, and several regional bike and hiking trail connections. However, the lack of wayfinding make these resources difficult for both residents and visitors to find, which is further

exacerbated by the lack of safe connections. The need to reinforce existing connections, and promote bicycle and pedestrian access has become a key goal for both the city, as well as the Central Massachusetts Regional Planning Commission (CM-RPO-2011).

In addition to safe, and well-marked access to these parks, ecological considerations are also a focus for the city. With a high amount of urban development planned for the downtown, a thriving educational industry with ten colleges and the second highest visited Science Museum in the state, the need for ecological education is key. The city's location at the headwaters of the Blackstone River makes it geographically well-suited to implement green infrastructure that would benefit the entire watershed and address water quality issues exacerbated by stormwater runoff and combined sewer overflows. With a wide dimensioned road base and many community initiatives, such as the Art of Science Learning, the potential for educating its public with real-life solutions has become a unique opportunity. (Annual Report, 2012)



Wayfinding in Kelley Square

Worcester Gazette, 2012



Historic, Industrial Downtown

flickr.com



Recreation on Lake Quinsigamond

Key Project Considerations:

The City of Worcester lies at the headwaters of the Blackstone River, and it's metro area is situated at the valley of those headwaters.

The 2013 Open Space and Recreational Plan clearly outlined that the city would like to focus on improving access to local water resources, integrate parks and open space into other city and community initiatives, as well as improve connectivity to existing parks and open space, all while planning and designing for future needs

Wayfinding in the city can be difficult, and current bicycle and pedestrian connectivity is a young city initiative.

Highway and rail systems often make biking and pedestrian connections to Eastern portions of the city challenging.

The City of Worcester Open Space and Recreation Plan 2013

To meet the increasing needs and issues related to future sustainability and growth, the City of Worcester developed a 2013 Open Space and Recreation Plan, designed to act as a seven year plan acting as a “celebration of people and culture”. It “seeks to provide a diverse open space and recreation system that provides all citizens of the community with relevant opportunities for use, enjoyment, and the maintenance of healthy lifestyles.”

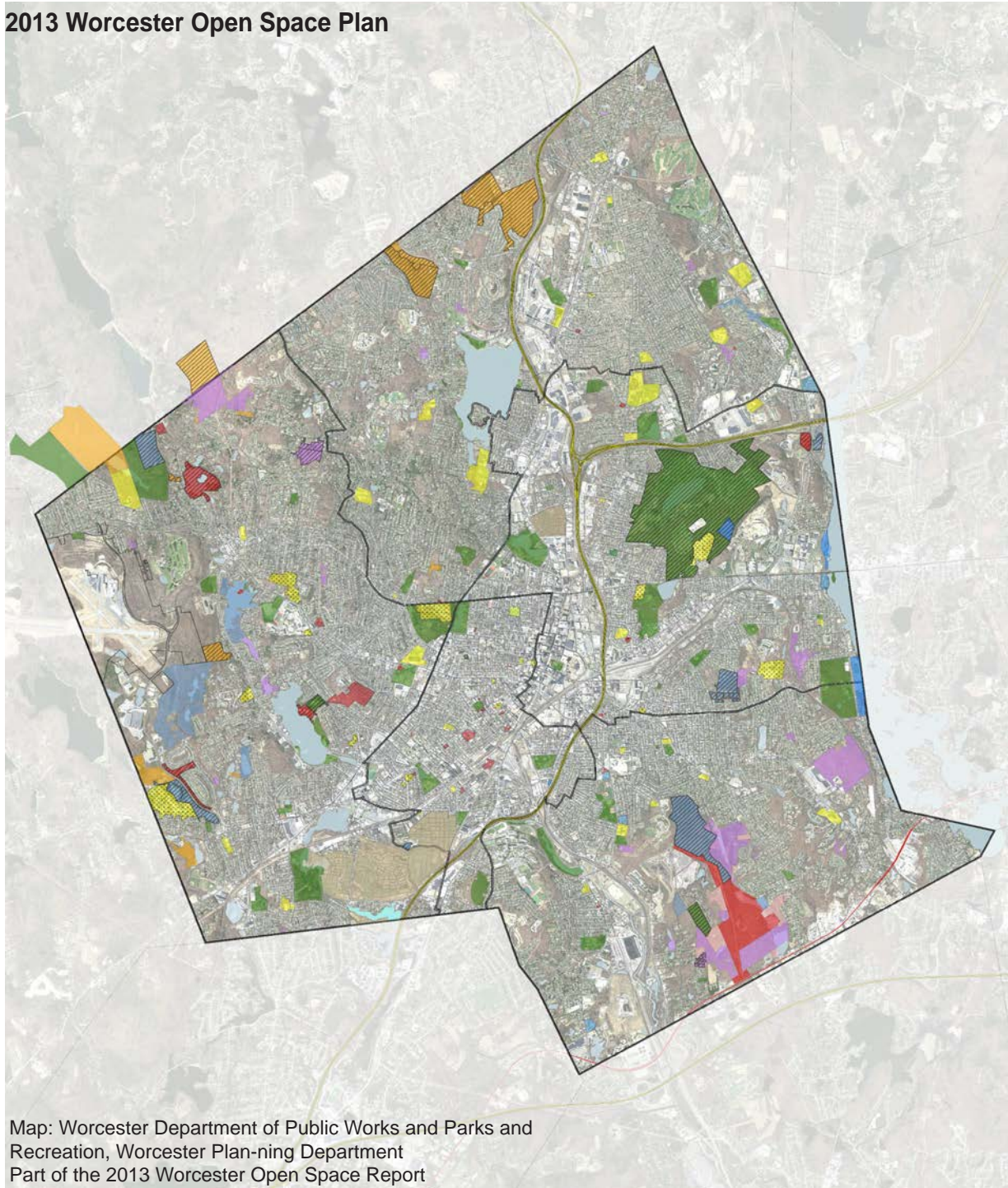
The plan goals are to:

1. *Enhance natural and cultural resources;*
2. *Improve public access to water resources;*
3. *Invest in recreation facilities;*
4. *Upgrade the delivery of parks and open space maintenance services;*
5. *Integrate parks and open space planning;*
6. *Promote urban landscape improvements;*
7. *Improve open space system connectivity;*
8. *Plan/design open space improvements to meet current and future needs;*
9. *Expand recreation programming.*

The plan suggests an “emphasis on the development of residential uses within downtown and close to downtown areas” and due to the overall limited open space (as compared to Boston) implies a “pressure to provide meaningful recreational opportunities”. Specifically it suggests “continued expansion into the few remaining undeveloped areas of the City” (to the North and West) and “continued redevelopment [and recreation] of underused and environmentally stressed commercial and industrial properties within [and near] downtown”. Bike lanes are currently used infrequently and are of limited occurrence, and about 90 miles of city roads are considered private and are unpaved. ([HTTP://WWW.WORCESTERMA.GOV/UPLOADS/8C/D3/8CD3BB9C5265B-4106BE90EE7BA9873A9/OSRP-REPORT.PDF](http://www.worcesterma.gov/uploads/8c/d3/8cd3bb9c5265b-4106be90ee7ba9873a9/osrp-report.pdf))

Major tasks of this studio were therefore to assess this plan, and design similar or more effective design interventions to handle issues of sustainability; stormwater management; future growth potentials; increased recreation opportunities and safe travel of bicycles and pedestrians.

2013 Worcester Open Space Plan



Map: Worcester Department of Public Works and Parks and Recreation, Worcester Plan-ning Department
Part of the 2013 Worcester Open Space Report



Shu Liu Photography



Shu Liu Photography



Shu Liu Photography



Shu Liu Photography



Shu Liu Photography

Studio Process:

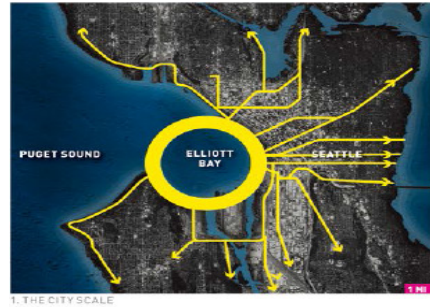
Site Visits: Toured the City of Worcester to gain perspective from a commuter and pedestrian standpoint.

Client Visit: Fieldtrip and tour of EcoTarium with staff to understand its mission, layout, and presence in the community.

Client Meetings: Met with both officials from the Central Massachusetts Regional Planning Commission, City of Worcester Public Works and Parks Department, as well as representatives from several community programs.

Case Studies: Prepared overview of green infrastructure projects from cities, such as Denver; New York City; Seattle; and Philadelphia, to provide inspiration and insights for Worcester.

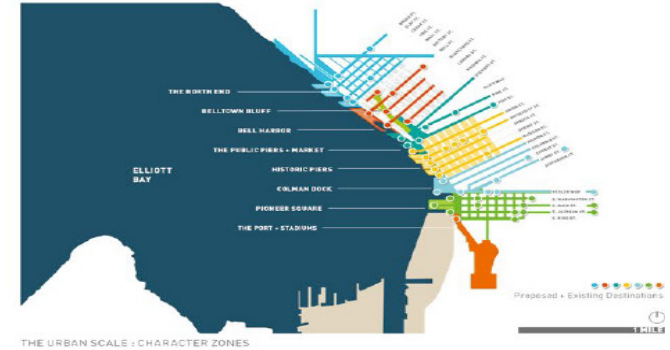
Case Studies:



Seattle: Riverfront Project

- Insights:
- Historic Piers
 - Incorporations of arts and education
 - Well designed urban streets

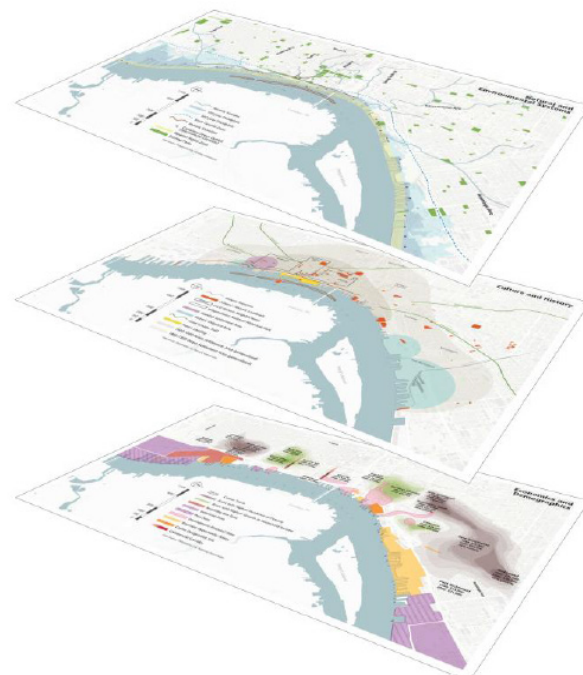
Images: Seattle.gov



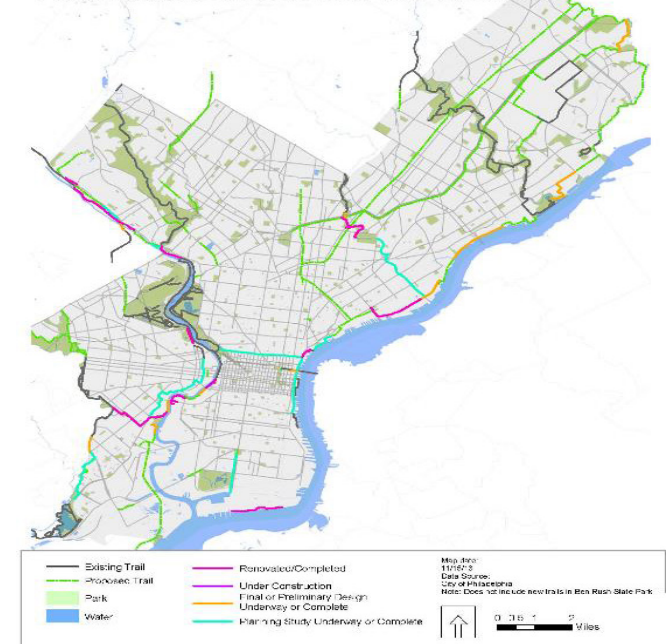
Philadelphia: Central Delaware River Greenway

- Abundant cultural and historic resources
- New design is adaptable to many land uses

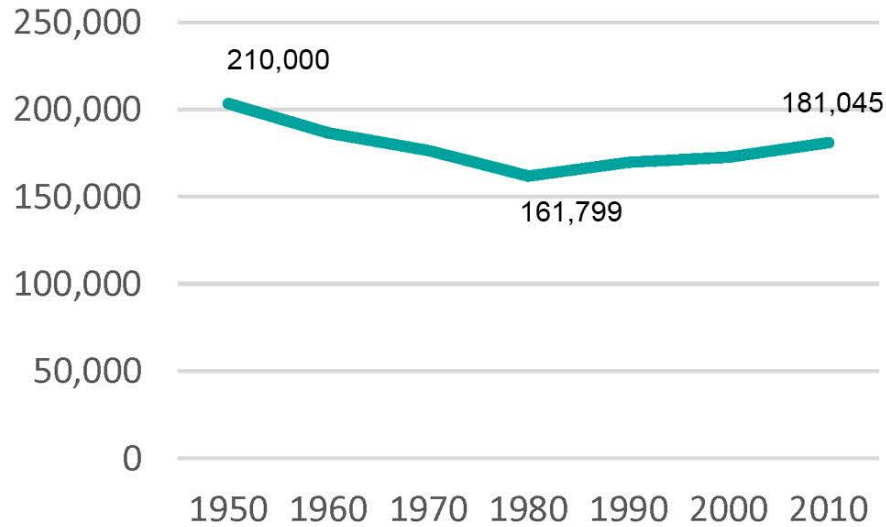
Philadelphia Trail Images: ASLA.org



Philadelphia Trail Network Status - November 2013



WORCESTER REGIONAL PLANNING DEMOGRAPHY

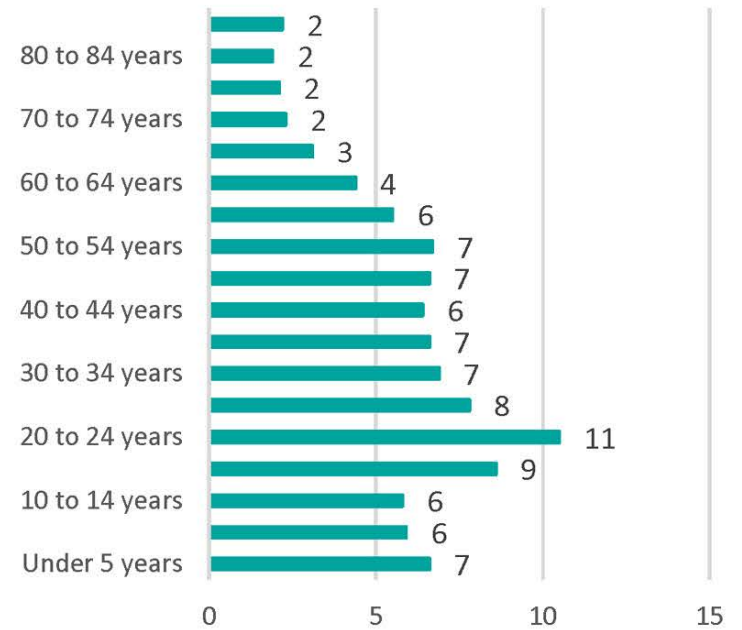


POPULATION FROM 1950- 2010

Between 2000- 2010 Worcester had the 3rd highest rate of population growth compared to similar cities in United States

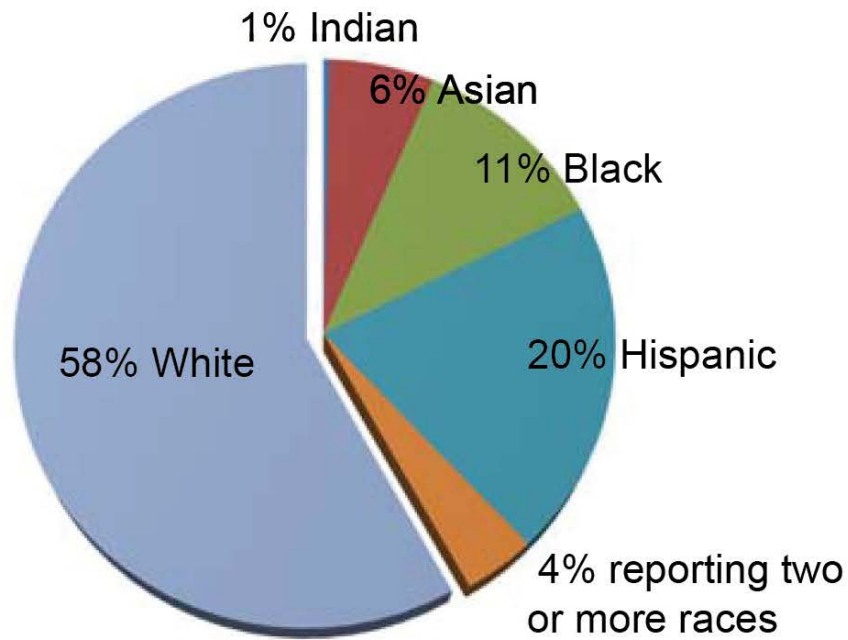
- 2nd highest rate in New England

Source: 2013 Worcester Open Space Plan



PERCENTAGE OF POPULATION BY AGE

- The average age is 33.4 years
- 37% are under the age of 25



PERCENTAGE RACIAL COMPOSITION

- 28% are obese and 35% are overweight
- 18% of families live in poverty
- 57% of families are within the low to moderate income bracket levels
- Spanish and Vietnamese most commonly spoken non-English languages
- Average child lives in a neighborhood where the poverty rate is 9.5%

Source: 2013 Worcester Open Space Plan



EDUCATION

- 30.2% high school graduates
- 16.7% Bachelor's degrees
- 10.3% graduate or professional degrees
- 10 Colleges & Universities
 - WPI (Worcester Polytechnic Institute)
 - UMass Medical School
 - Clark University

Resources:

1. osrp
2. http://en.wikipedia.org/wiki/College_of_the_Holy_Cross
3. <https://www.flickr.com/photos/masstravel/7535744224/>
4. http://en.wikipedia.org/wiki/Worcester_Polytechnic_Institute

Analysis

Hydrology Assessment and Conclusions:

Worcester lies in large part at the headwaters of the Blackstone River. This river is significant to the region both as a cultural and historic asset, but also to the Northeast because of its confluence with Narragansett Bay in Rhode Island and the terminus with the Atlantic Ocean. Historically the Blackstone River was utilized for power, and it was said at some point to have salmon swimming through its waters. Centuries later the water became polluted, so much so that it was declared in the 1990's by the EPA to be the most polluted river in the country. Since then the Blackstone has been the focus of remediation and sediment clean up efforts which have dramatically lessened its severely polluted status. Still in this day, efforts to protect this valuable asset, source and habitat should remain strong, and addressing these mitigation issues today in terms of green infrastructure improvements; daylighting; shade increasing and insulating tree canopy and stormwater best management practices will help ensure its ecology for generations to come.

Region Watersheds:

The majority of Worcester is in the Blackstone River Watershed. A very small remaining portion lies in the Nashua Watershed. Worcester itself gets their drinking water from both the Quinapoxet Reservoir, located in the Nashua Watershed to the North, as well as from the Holden Reservoirs which are located in the North West corner of the Blackstone Watershed. Boston receives part of the cities drinking water from the Wachusett Reservoir located in the Nashua Watershed. This Reservoir additionally flows through tributaries into Lake Quinsigamond, which then thru tributaries flows into the Blackstone River.

Slopes:

Worcester lies in a steep and level alternating topography profile, with the majority of the downtown city in a low valley in the center of 7 named hills. Various businesses, town communities and streets derive their names from these hills, and these hills help define the city and region as a whole. They also contribute to the erosion and runoff into streams and rivers, and provide a certain level of difficulty in terms of winter maintenance.

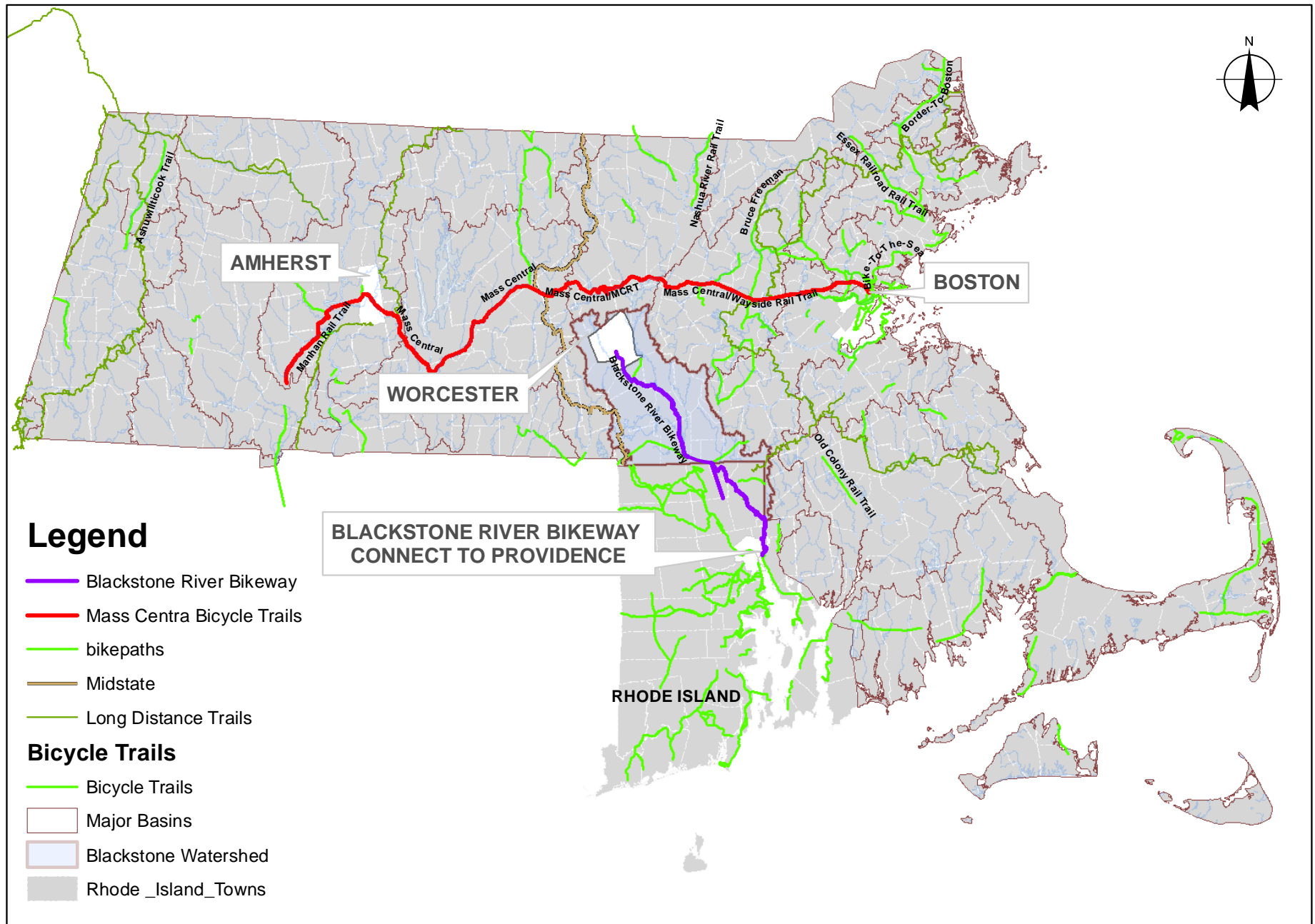
Soil Assessment:

The majority of the soils in Worcester are suitable for green infrastructure improvements related to infiltration capabilities. The soils unsuitable are those primarily underlay-ed of bedrock; outcrops; hydric with a high water table or those with a seasonally high water table or a high restricting soil profile layer.

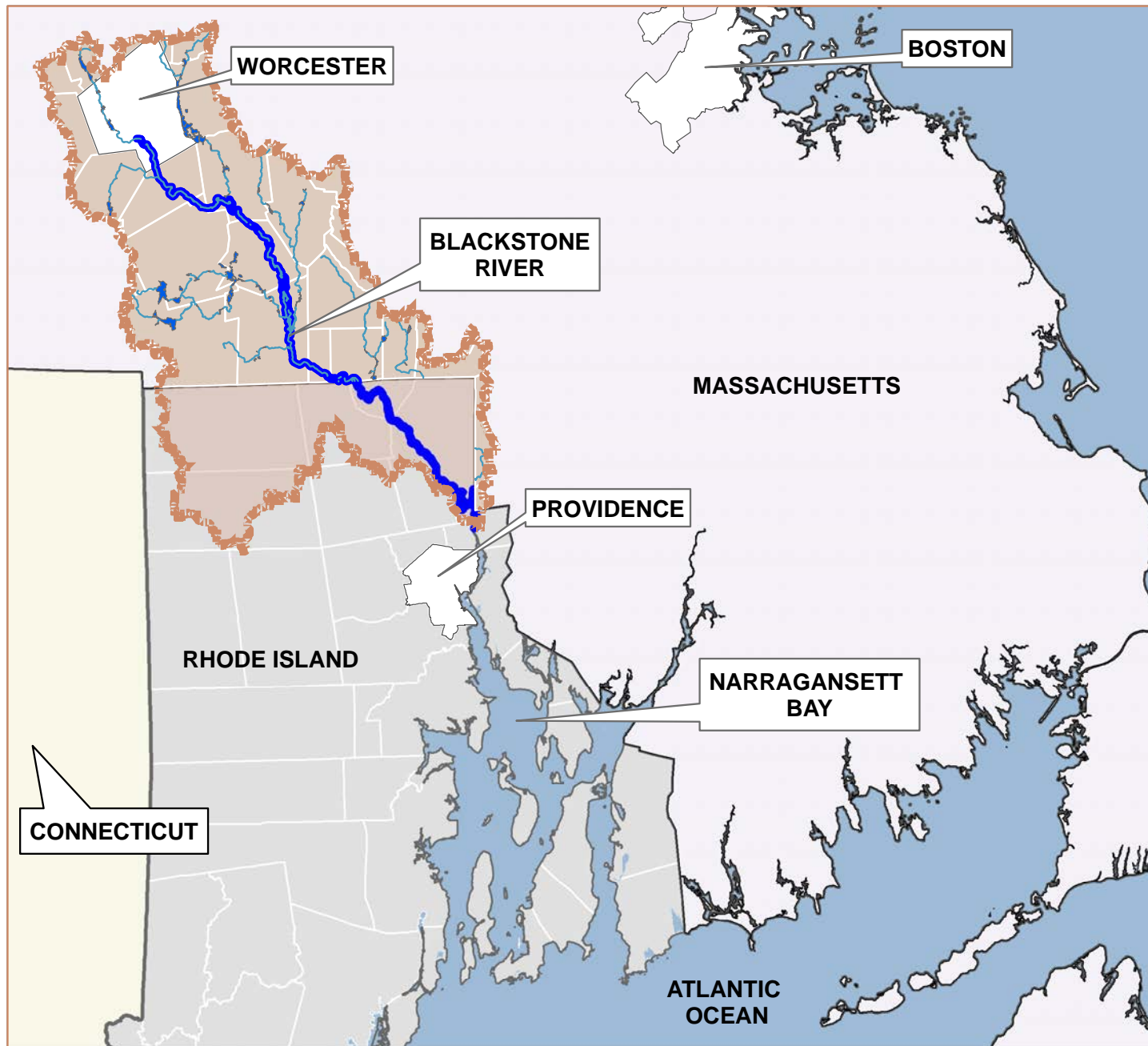
Region Habitats:

Worcester county has a significant portion of its lands designated as Core Species Habitat, Critical Natural Landscape and Priority Rare Species Habitat. A large number of these areas are to the North, and they surround reservoirs, lakes, rivers and streams. Some of these areas are portions of still active farmland, acreage of natural forest, and airports with wild meadow grasses.

MASSACHUSETTS REGIONAL MAP BICYCLE TRAILS



WORCESTER REGIONAL MAP BLACKSTONE RIVER CONFLUENCE



Legend

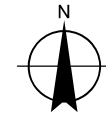
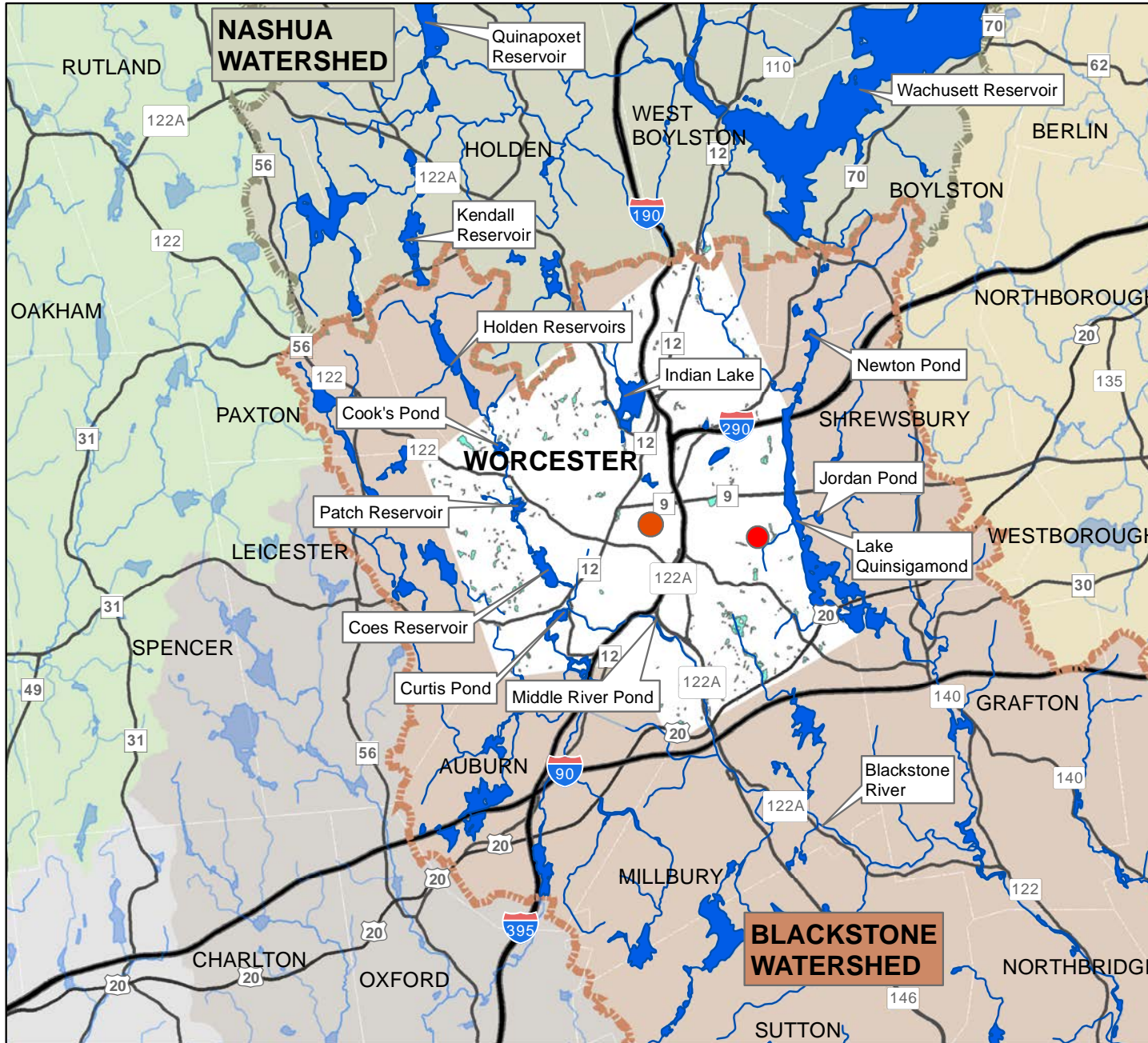
- Streams
- Blackstone River
- Ponds
- Watersheds**
 - Blackstone
 - Blackstone Watershed

Prepared by: Laura Keskula
September 2014

1 in = 9 miles 0 4.5 9 18 27 Miles

Data Source: Mass GIS, RI GIS

WORCESTER REGIONAL MAP HYDROLOGY AND WATERSHEDS



Legend

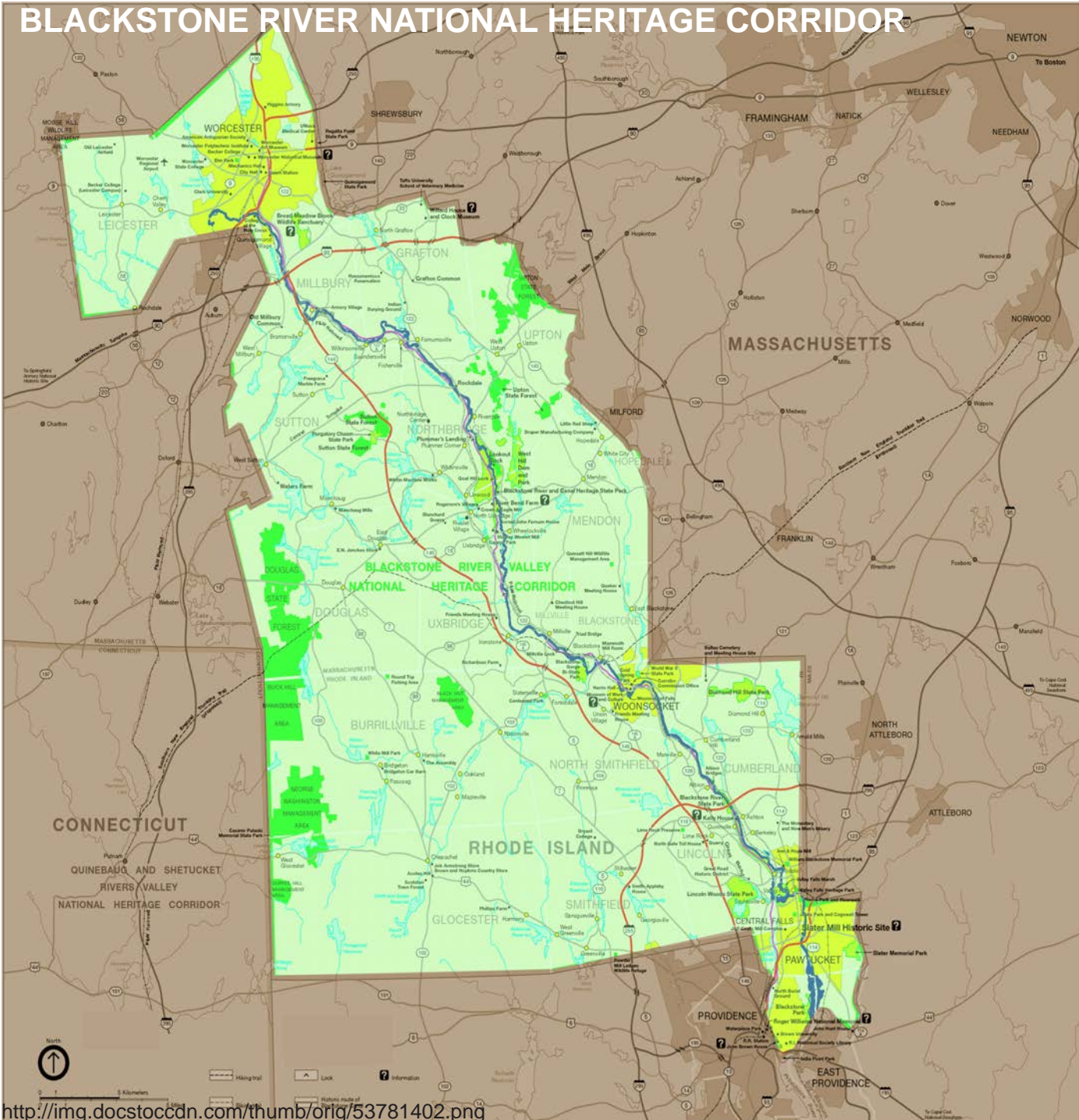
- Streams and Rivers
- Lakes and Ponds
- Wetlands
- Nashua watershed
- Blackstone Watershed
- MassDOT Major Roads**
- Interstate
- U.S. Highway
- State Route
- FRENCH
- BLACKSTONE
- CHICOPEE
- CONCORD/SUASCO
- QUINEBAUG
- NASHUA

Prepared by: Laura Keskula
September 2014

1 in = 2.5 miles 0 2.5 5 10 Miles

Data Source: Mass GIS, Soil Survey NRCS

BLACKSTONE RIVER NATIONAL HERITAGE CORRIDOR



The John H. Chafee Blackstone River National Heritage Corridor, designated by Congress in 1986, includes some 24 cities and towns over 500 square miles in the Blackstone River watershed. The 46 mile Blackstone River itself is an American Heritage River. For nearly 60 years this river corridor has influenced aspects of commerce in America beginning in 1790 with the opening of the Slater Mill in Pawtucket RI spawning the American Industrial Revolution. To the 1820's which saw immigrant labor build a canal from Providence RI to Worcester MA. Ending with the redoubled efforts of the Railroads in the 1840's to monopolize the trade coming out of Worcester.

And now in a new century this river corridor has invigorated the phenomenon of Eco-tourism and green way planning by connecting regional bike ways and historic interpretive sites together continuing the legacy of the Blackstone River.

This National Heritage Corridor does not own or manage any of the land within its borders. Instead lands and sites of historic significance are managed by the localities of which they reside.

http://www.thecanalndistrict.com/images/CFT10History_1x1.jpg

The Blackstone Canal was built to connect Worcester and the Blackstone Valley towns to the sea at Narragansett Bay in Rhode Island.

Completed in 1828 with its first successful journey of the *Lady Harrington* upriver from Providence to Worcester.

The Canal itself was 32 feet wide at the top, 18 feet wide at the bottom with 3-4 feet of water. It was 45 miles long from Thomas St. in Worcester stretching to Narragansett Bay in Providence with a rise of over 10 feet per mile. 49 locks in all to either raise or lower boats the 451 1/2 foot difference in elevation.

The Canal was successful in ushering in the American Industrial Revolution. Unfortunately its success urged railroads to expand to reconnect Boston and Providence to Worcester. This together with textile mill disputes over water rights saw the demise of the canals use by 1848.

In the city of Worcester the Canal became an open sewer and was arched over with roads by the 1890s

<http://www.teachhistory.org/detoqueville-vis-its-united-states/article/blackstone-canal-artery-heart-commonwealth.org>



Historic Photo of Canal District
circa 1890

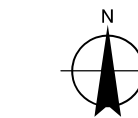
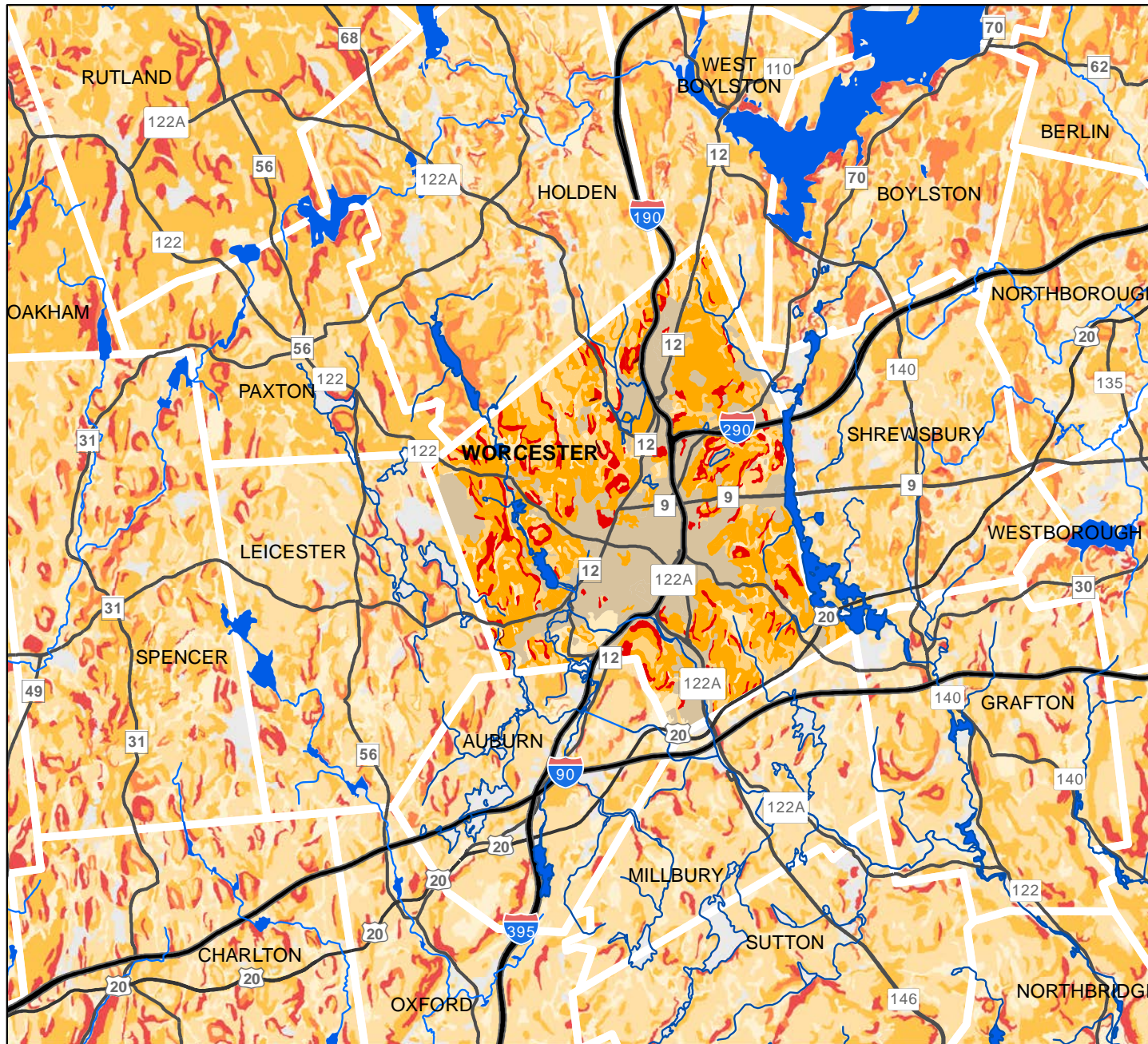
<http://worcesterhistory.org/wp-content/uploads/2012/08/Blackstone-Canal.jpg>














Present Day Canal Remnants
South of Downtown Worcester

http://farm1.staticflickr.com/89/267524820_a00adc330b_z.jpg?zz=1

WORCESTER REGIONAL MAP SLOPE ANALYSIS



Legend

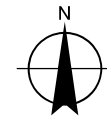
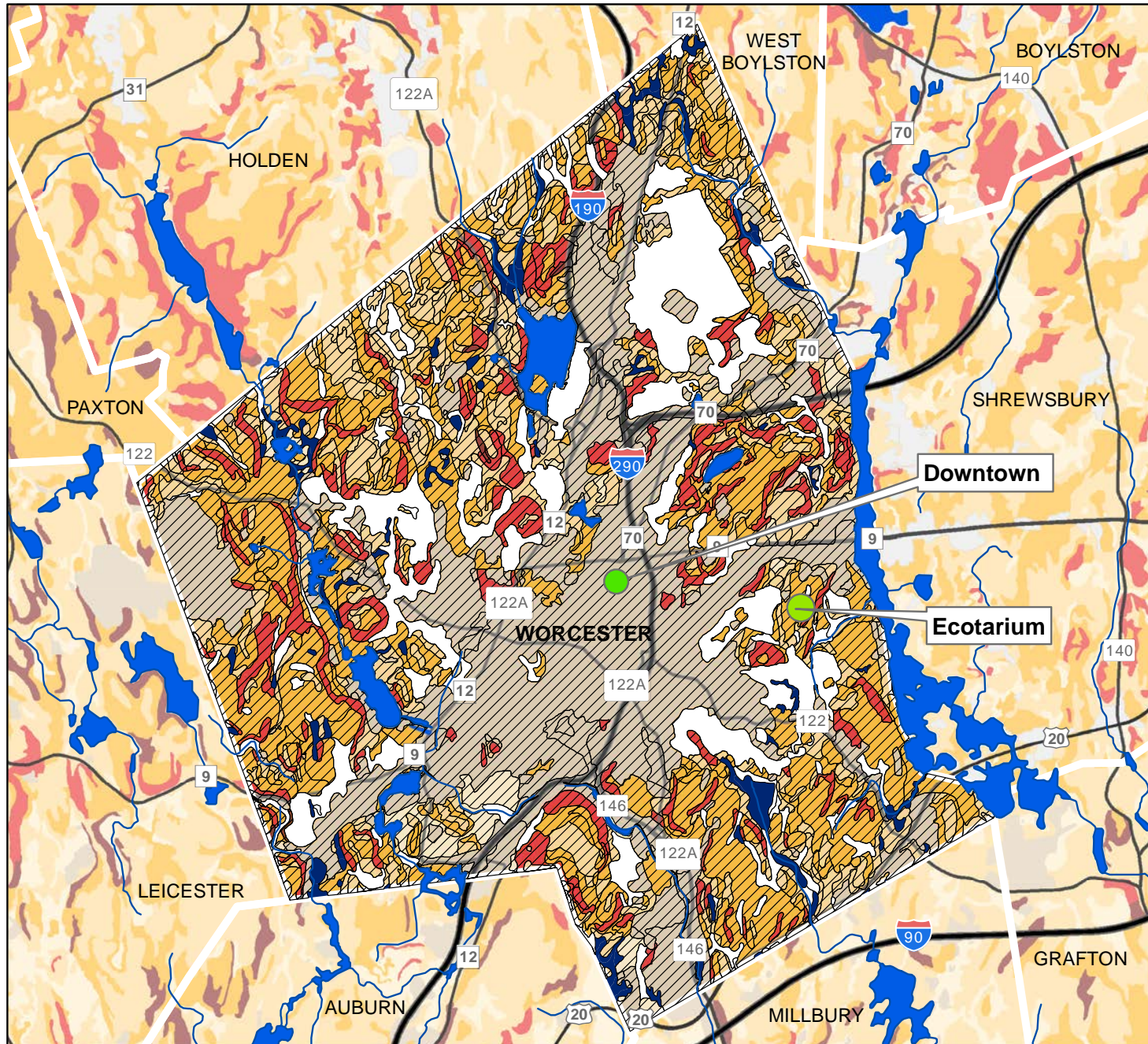
-  Streams and Rivers
-  Lakes and Ponds
- MassDOT Major Roads**
-  Interstate
-  U.S. Highway
-  State Route
- SLOPE**
-  25-35%
-  15-25%
-  8-15%
-  3-8%
-  0-3%
-  Urban

Prepared by: Laura Keskula
September 2014






1 in = 2.5 miles 0 2.5 5 10 Miles

Data Source: Mass GIS, Soil Survey NRCS

WORCESTER REGIONAL MAP SOILS WITH INFILTRATION SUITABILITY ANALYSIS









Legend

-  Suitable composite
-  Unsuitable
-  Wetlands/hydric
-  Lakes and Ponds
-  Streams and Rivers

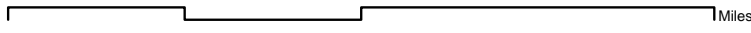
MassDOT Major Roads

-  Interstate
-  U.S. Highway
-  State Route

SLOPE

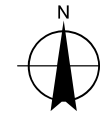
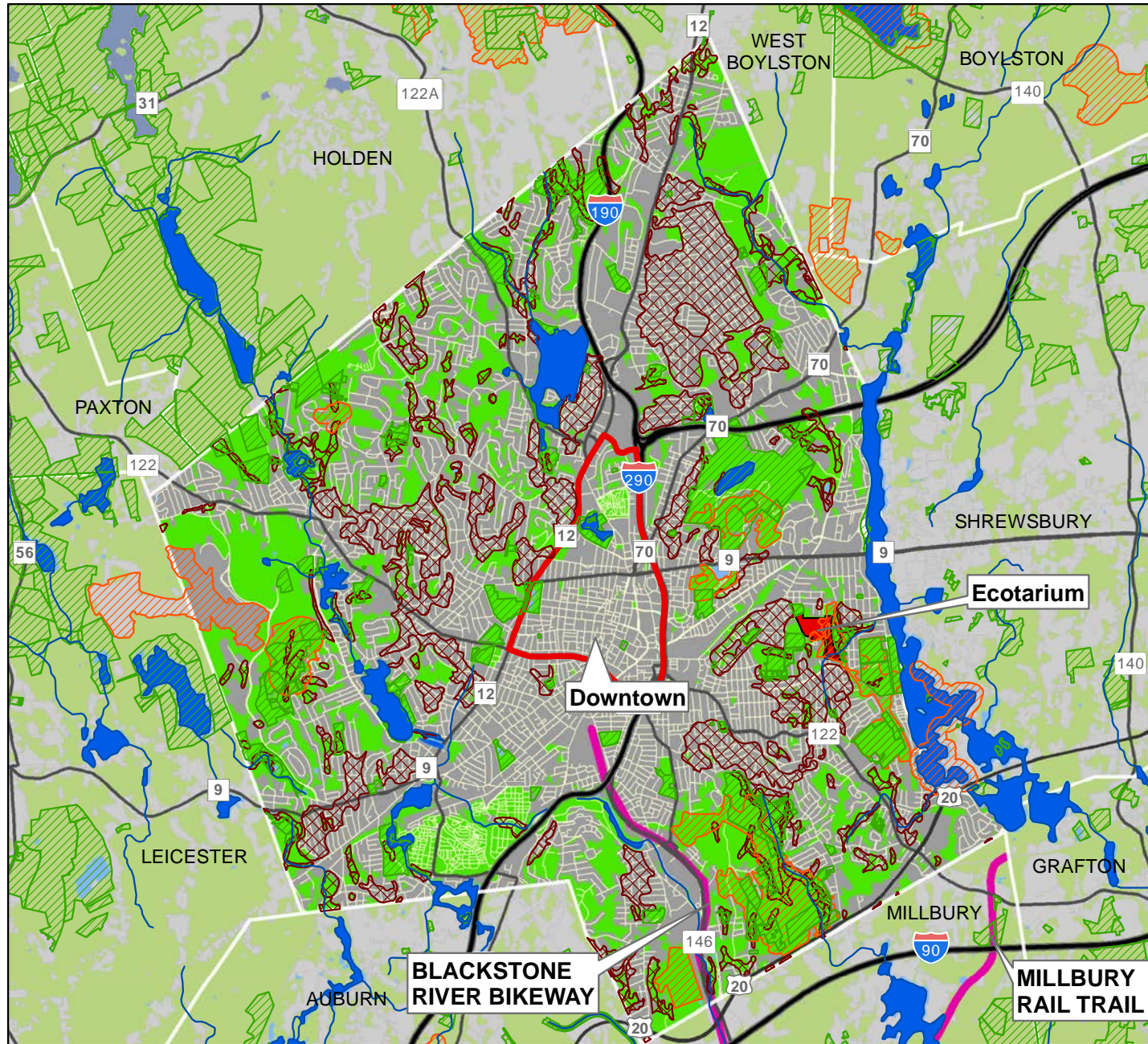
-  25-35%
-  15-25%
-  8-15%
-  3-8%
-  0-3%
-  urban

Prepared by: Laura Keskula
September 2014










1 in = 1.25 miles  Miles

Data Source: Mass GIS, Soil Survey
MDC/NESC/...

WORCESTER REGIONAL MAP COMPOSITE OPEN AND DEVELOPED SPACE



Legend

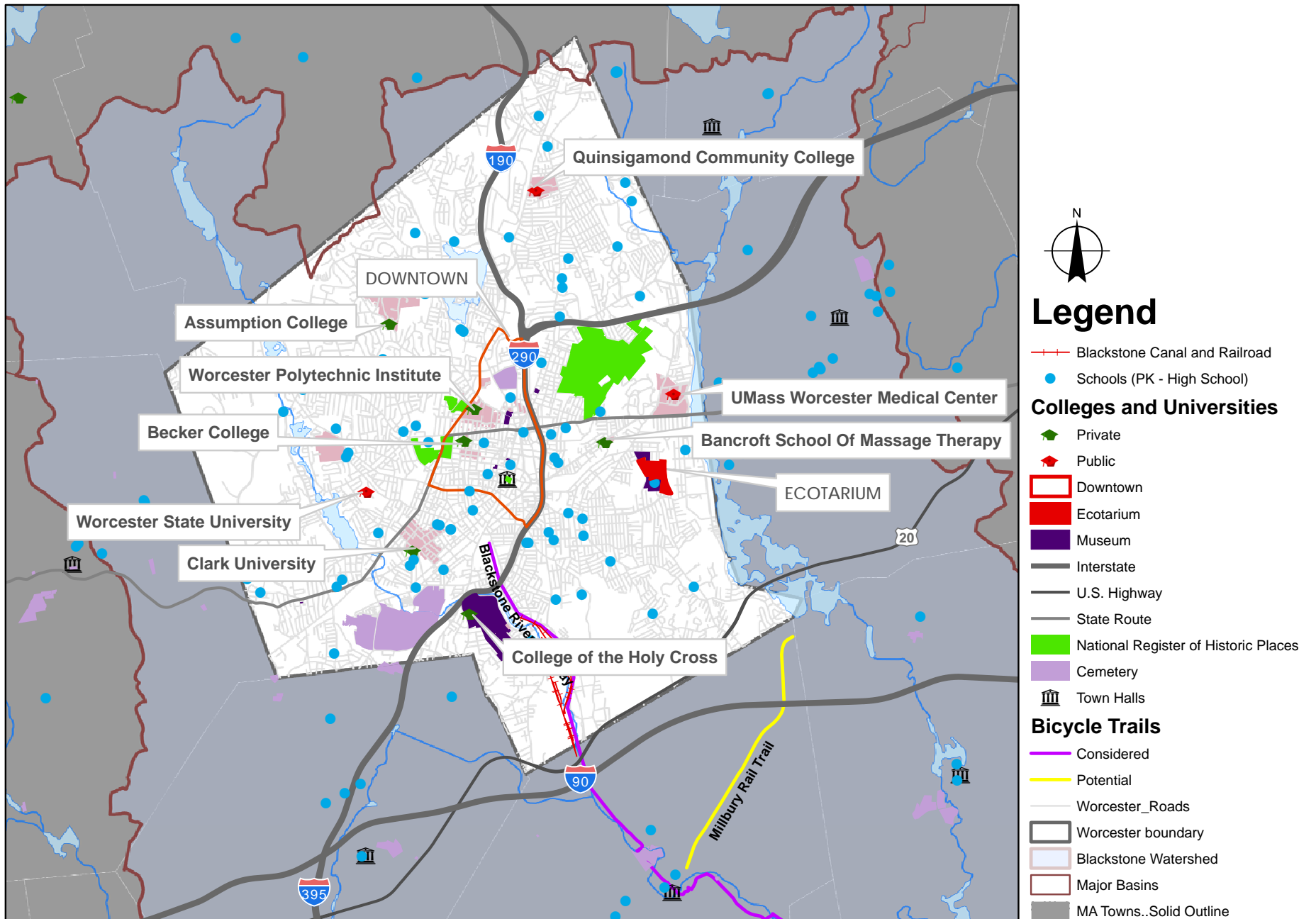
-  NHESP Priority Rare Species Habitats
-  Unsuitable to build
- OpenSpace: Level of Protection**
-  In Perpetuity
- Land Use**
-  Open Space
-  Developed
-  Streams and Rivers
-  Lakes and Ponds
-  Bicycle Trails
-  Secondary Roads

Prepared by: Laura Keskula
September 2014

1 in = 2.5 miles 0 1.25 2.5 5 Miles

Data Source: Mass GIS

WORCESTER REGIONAL MAP CULTURAL & HISTORICAL ANALYSIS

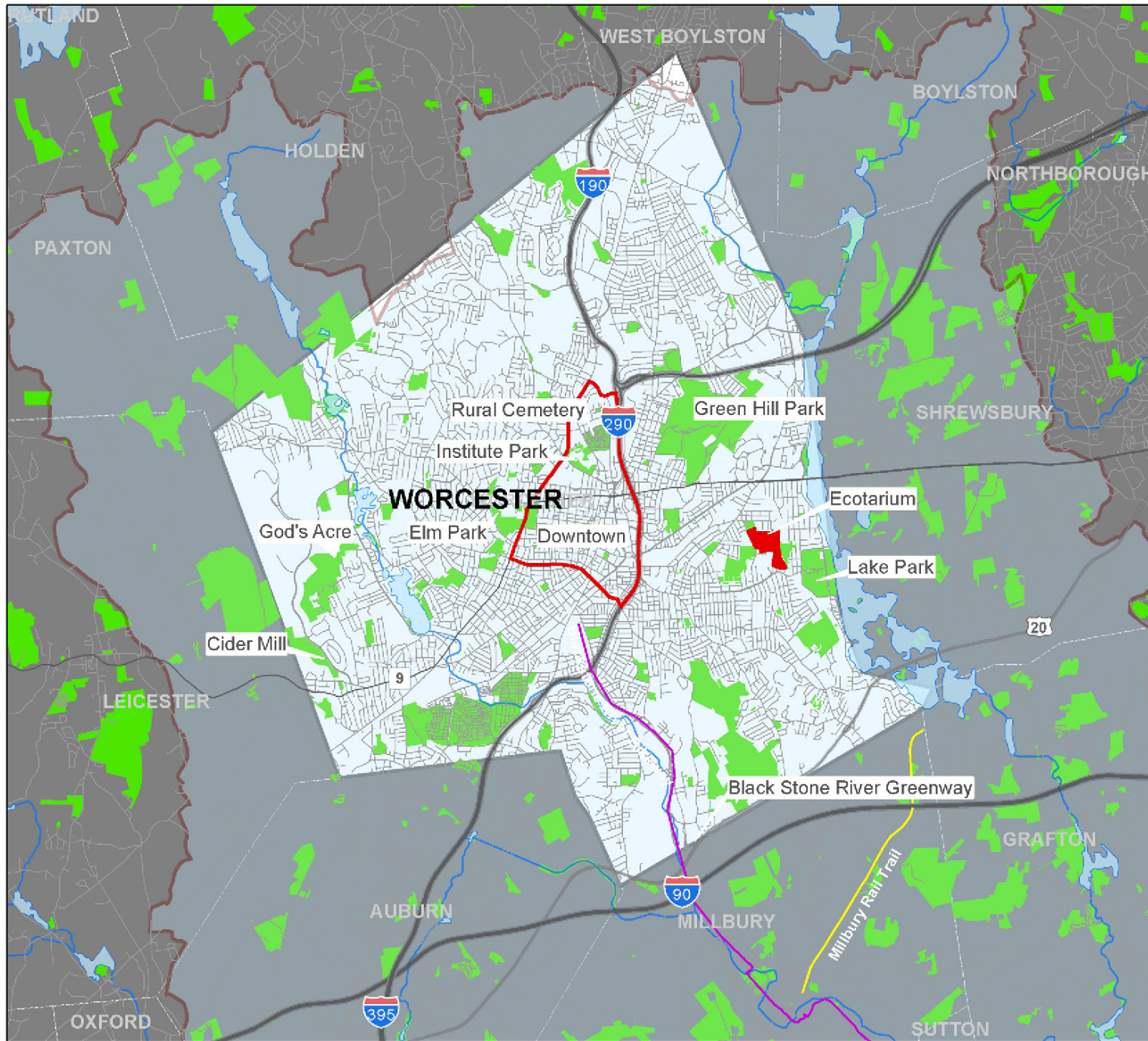


Prepared by: Zhuoya Deng Date: 2014

1 in = 1.5 miles 0 1.5 3 6 Miles

Data Source: Mass GIS

WORCESTER REGIONAL MAP SCENIC, LANDSCAPE RESOURCES



Legend

Bicycle Trails

- Existing
- Existing Unimproved
- On-Road Connection
- Underway
- Considered
- Potential

- Ecotarium
- Downtown

Major Routes

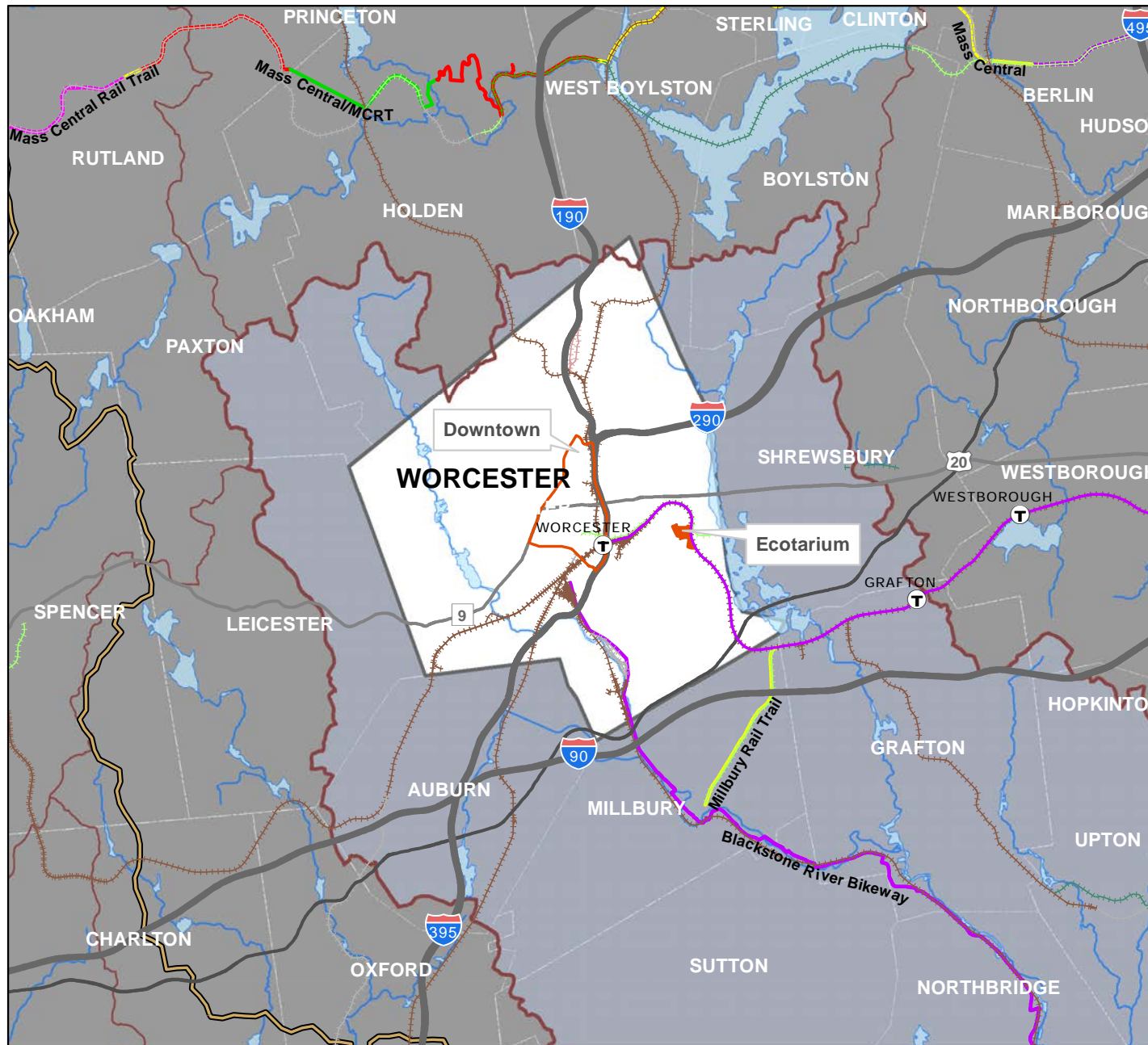
- Interstate
- U.S. Highway
- State Route
- Road
- Blackstone Watershed
- Open Space
- Worcester boundary

Data Source:

1. http://en.wikipedia.org/wiki/Blackstone_Valley
2. www.destinationworcester.org
3. <http://nicolecommawoo.wordpress.com/category/gods-acre/page/2/>
4. <http://www.tripadvisor.com/LocatorPhotoDirectLink>
5. <http://en.wikipedia.org/wiki/Institute>
6. <http://www.trashpaddler.com>
7. arollingcrone.blogspot.com
8. www.autonomic.com
9. mass.gis



WORCESTER REGIONAL MAP TRANSPORTATION SYSTEM



N

Legend

- Regular Service
- Regular Service
- Downtown
- Ecotarium

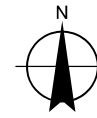
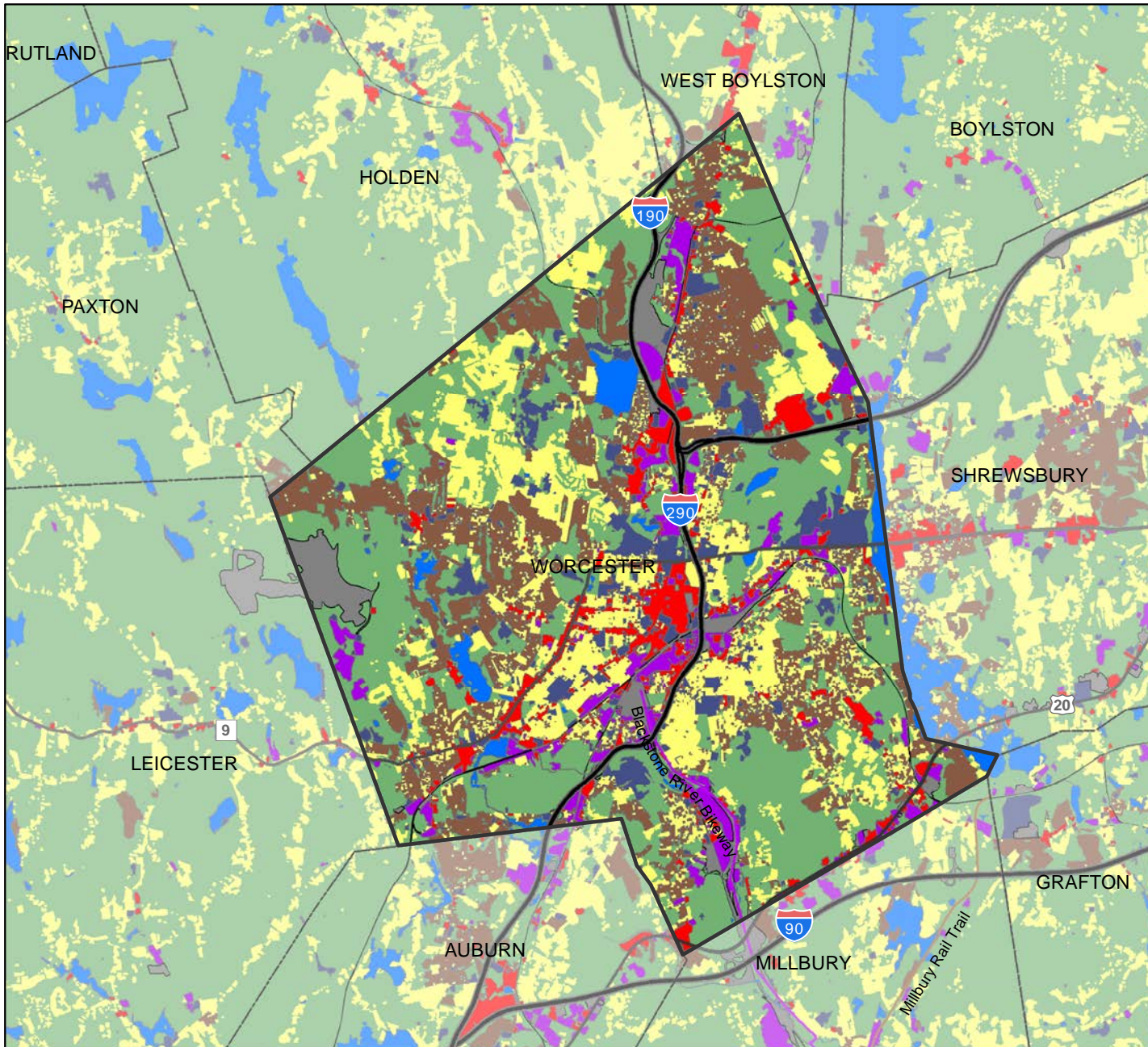
Major Roads

- Interstate
- U.S. Highway
- State Route
- Active Rail Service
- Right-of-way Hiking / Biking
- Right-of-way, never built
- Abandoned Service
- Abandoned / Out of Service
- Unknown
- Midstate

Bicycle Trails

- Existing
- Existing Unimproved
- On-Road Connection
- Underway
- Considered
- Potential
- Blackstone Watershed
- Major Basins

WORCESTER REGIONAL MAP LAND USE

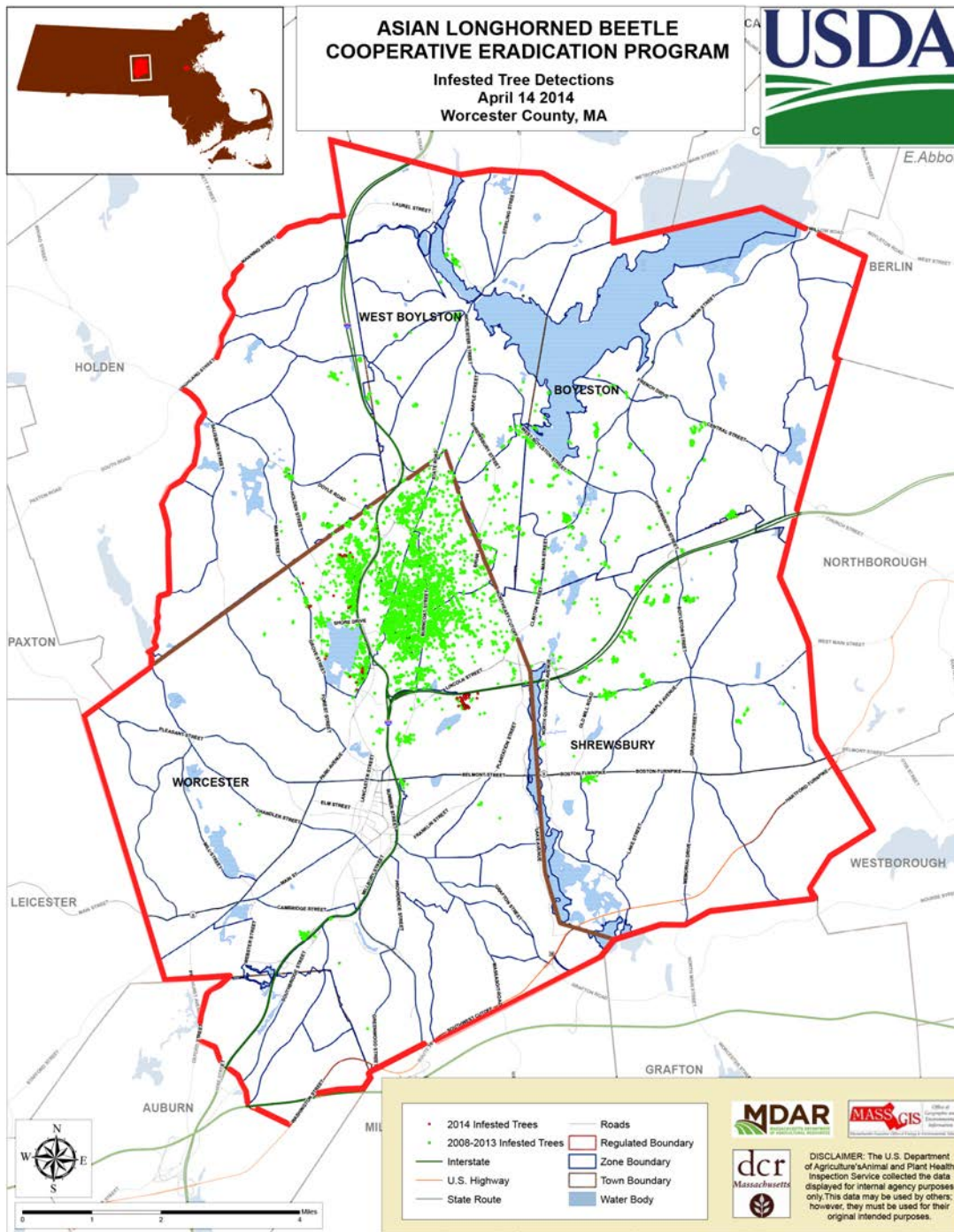


Legend

- Worcester
- Land Use**
- Water
- Commercial
- Open Space
- High Density Residential
- Industrial
- Residential
- Transportation
- Urban Public/Institutional
- Bicycle Trails**
- Status**
- Existing
- Existing Unimproved
- On-Road Connection
- Underway
- Considered
- Potential
- Mid State Trail
- Hiking Trail

Prepared by: Tharyn Nein-Large Date: 2014 1 in = 1.5 miles

Date Source: Mass GIS



<http://www.acacamps.org/sites/default/files/images/hottopics/AsianBeetleonly.jpg>



The extent of the quarantine area for the Asian Longhorned Beetle is approximately 110 square miles. As seen in the map to the left this includes the entire towns of Worcester, Shrewsbury, Boylston and West Boylston. A portion of Holden is also under the quarantine.



This beetle is a pest of hard wood trees including maple, birch and horse chestnut and is considered a serious threat to the nursery, lumber, wood products, maple syrup and tourist industry. If established in a large area the beetle is capable of disrupting the natural forest ecosystem.



For us in this studio it means any tree specie proposed for planting within this quarantine area needs to be from the replacement list. This list can change based on surveys of on going damage from the field. Consulting DCR or MDAR for the most current recommendations is priority.

According to Clint McFarland program director of the USDA Asian Longhorned Beetle Eradication Program Worcester County has lost some 34,000 trees to date because of this infestation.

The beetle is jet black and 3/4 to 1 1/4 of an inch long with mottled white spots on its back. The long antennae are 1 1/2 to 2 1/2 times the body length with white and black segments. The feet of the beetle have a blueish tinge.

Damage is seen here with before and after pictures from the U.S. Forestry department showing a typical residential street in Worcester.

Beetle image: http://www.massnrc.org/pests/linkedddocuments/pestaalerts/ALB_Aug2008.htm



Before <http://forestryimages.org/images/384x256/5392793> 5392793



After <http://forestryimages.org/images/768x512/5392794> 5392794

Greenway Suitabilities- Conclusions:

Worcester has a considerable amount of open space mostly on the outskirts of the city. Closer to downtown itself there remains a very small amount, but what is there is in permanently protected status. Open space outside of downtown is mostly unprotected which shows a need for both more open, and in permanently protected designations. Priority rare habitats are found in both unprotected and protected open spaces which could pose a problem for

future species survival. Greenways and recreation access points built through these areas could influence and encourage city or state departments of conservation to purchase and permanently protect these areas. However, to protect natural habitats and future recreation interests the greenways and recreation access points should be extremely sensitive of, and harmonious to, existing and future habitats.

Regional Greenway Plan

Preserve Life: Ensure Our Resources

Based on overall regional assessments of existing infrastructure, natural resources, and an evaluation of the 2013 Worcester Open Space Development Plan , there exist potential areas and infrastructure connections that pose an alternative to those outlined in the plan. Our studio's proposed regional greenway plan, Preserve Life, Ensure Our Resources embodies these connections.

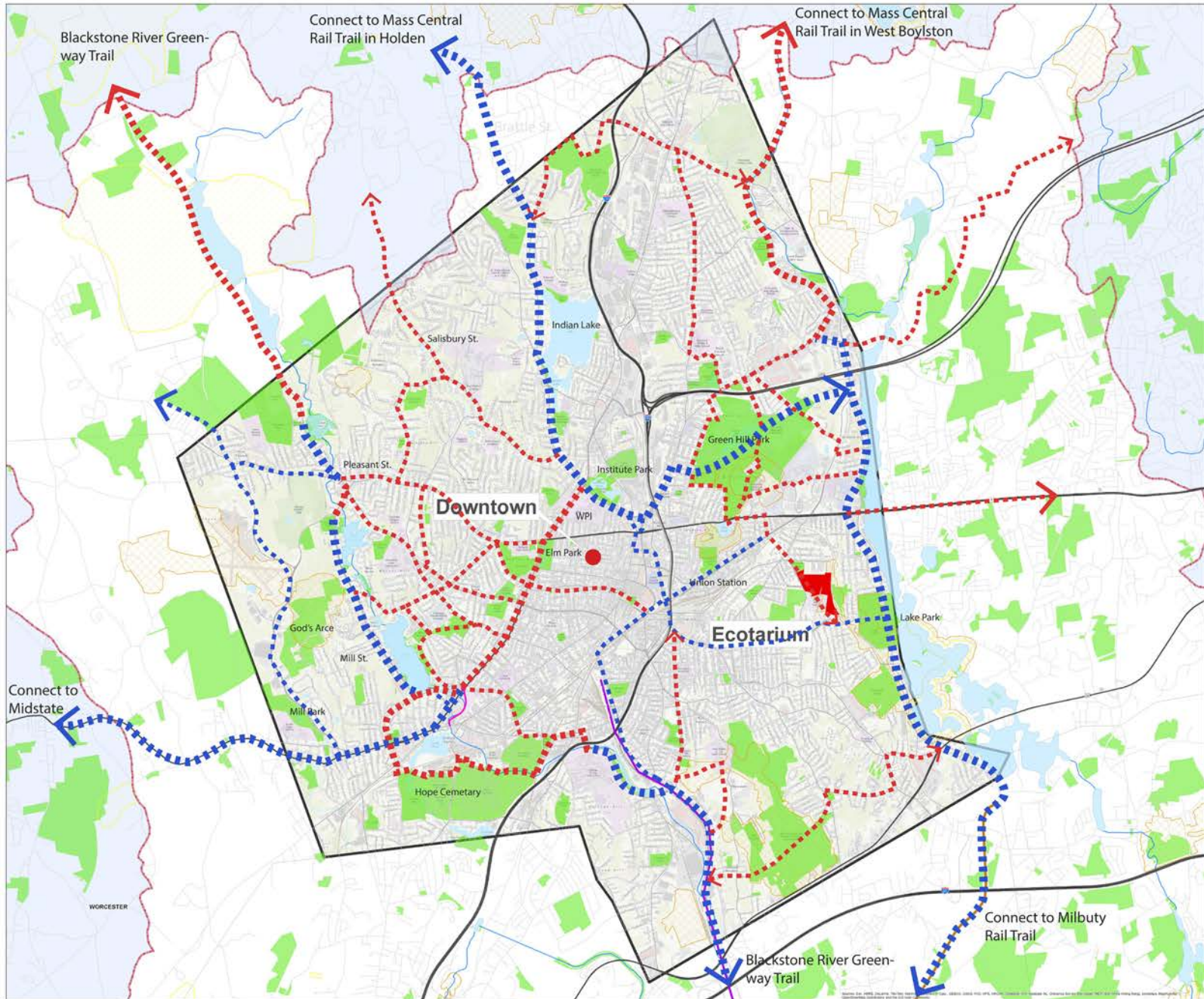
According to the OSDP, Worcester seeks to improve open space access and connectivity; pursue new land acquisitions; and improve bicycle facilities and pathways, playgrounds, recreation fields, picnic and swimming spots. Additionally, access should be close to home; spaces should be well designed and offering of "meaningful recreation opportunities" fit for a changing community; and regular maintenance and safety enhancements of these spaces are desired (Open Space Plan, 2014).

A thorough connection of existing open space as well as enhancements and additional habitat and stormwater management corridors therefore would be an early improvement that could lead to more aggressive and expansive alterations in the future. Our proposed plan strives to promote safe pedestrian and recreation access for people of all ages while increasing awareness of local connections and resources as the catalyst for a more pedestrian

and ecologically friendly city. Preserving life therefore is not only about wildlife and biodiversity to which Worcester has several rare habitat sites, but also in response to the cities high obesity and overweight rate of around 30%. Ensuring our resources explores connections made through existing rich cultural and historical heritage sites such as cemeteries, corridors, districts, and parks; as well as helping to protect and remediate stormwater both flooding city areas and entering the Blackstone. Currently the 60 city parks within Worcester are unconnected, operating as isolated units, and the Blackstone River is virtually an unknown to many area residents. The proposed plan will 1) connect these valuable resources through a network of complete streets, and off-road bike and pedestrian trails; 2) support wildlife habitat through stormwater infiltration trenches and basins, and open space connections; 3) increase public access to the river ; and 4) promote ecological awareness and sustainability.

Key areas exist as prime locations for stormwater management, water remediation and expanded recreation activities. Preserving Life, Ensuring Our Resources promises a lasting vitality in the health, biodiversity and all encompassing sustainability of the region.

WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources



Legend

- ⋯ Our Proposed Bike Trail
- - - City Proposed Bike Trail
- Blackstone Watershed
- Priority Rare Habitat
- Protected Openspace
- Worcester Boundary
- Ecotarium

Data Source: mass.gis

Prepared By: Laura, Meilan, Tharyn, Zhuoya Date: 2014

Scale: 1" = 1500'



GREENING WORCESTER

Assessment Overview

Existing city infrastructure favors the automobile

- new pedestrian and bike trails, paths, and lanes will connect the city and surrounding communities

City lacks Stormwater management controls and urban canopy

- BMP's will increase water quality and reduce infrastructure costs
- re-planting of non ALB host species will provide valuable ecosystem services

Area rich in cultural and scenic elements and open spaces

- increased access and wayfinding features will enable greater personal enjoyment
- increased community pride will result in additional habitat preservations

Active city with young population

- implementing 'quality over quantity' recreation will inspire residents to get out there and lower high city obesity rates

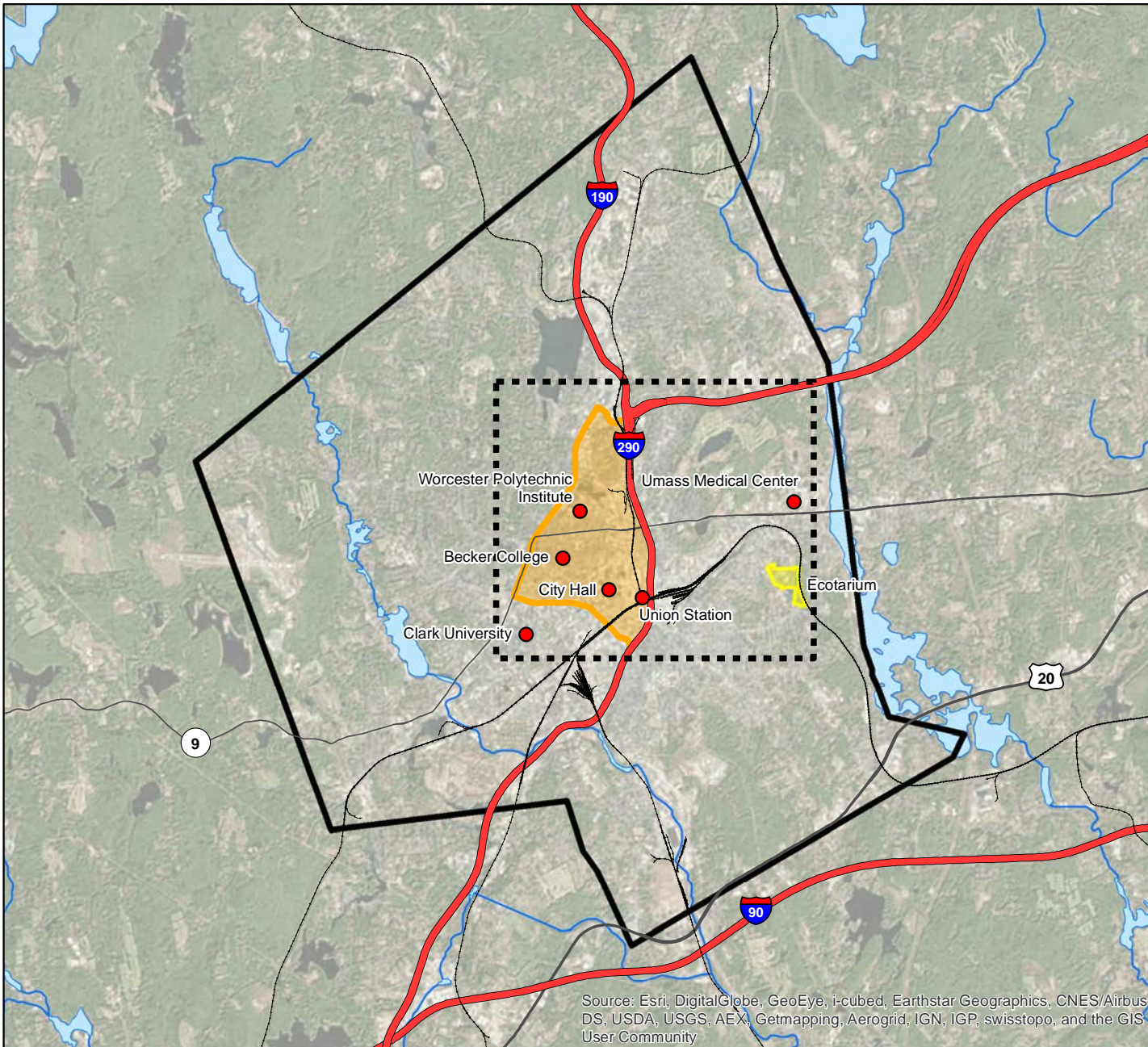


DOWNTOWN WORCESTER

An assessment of the downtown area of Worcester was conducted to get a better understanding of the opportunities and constraints factoring into the implementation of a green infrastructure plan. Union Station was considered the central point for the entire city due to the multitude of traffic that flows through it everyday and for that reason there was a focus on improving connectivity to and through the downtown area to

allow for better access to this hub. The following maps are a portion of the assessment conducted that attributed to this projects understanding of the downtown area of Worcester. Their role in influencing the decisions made for a downtown greenway plan are described in brief at the end of the section.

WORCESTER DOWNTOWN MAP Downtown Context



Legend

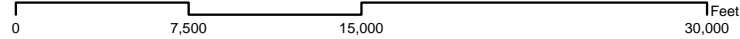
- Area of Interest
- Focus Area
- Active Rail Service
- Downtown
- Ecotarium
- Worcester

Roads

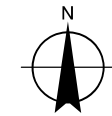
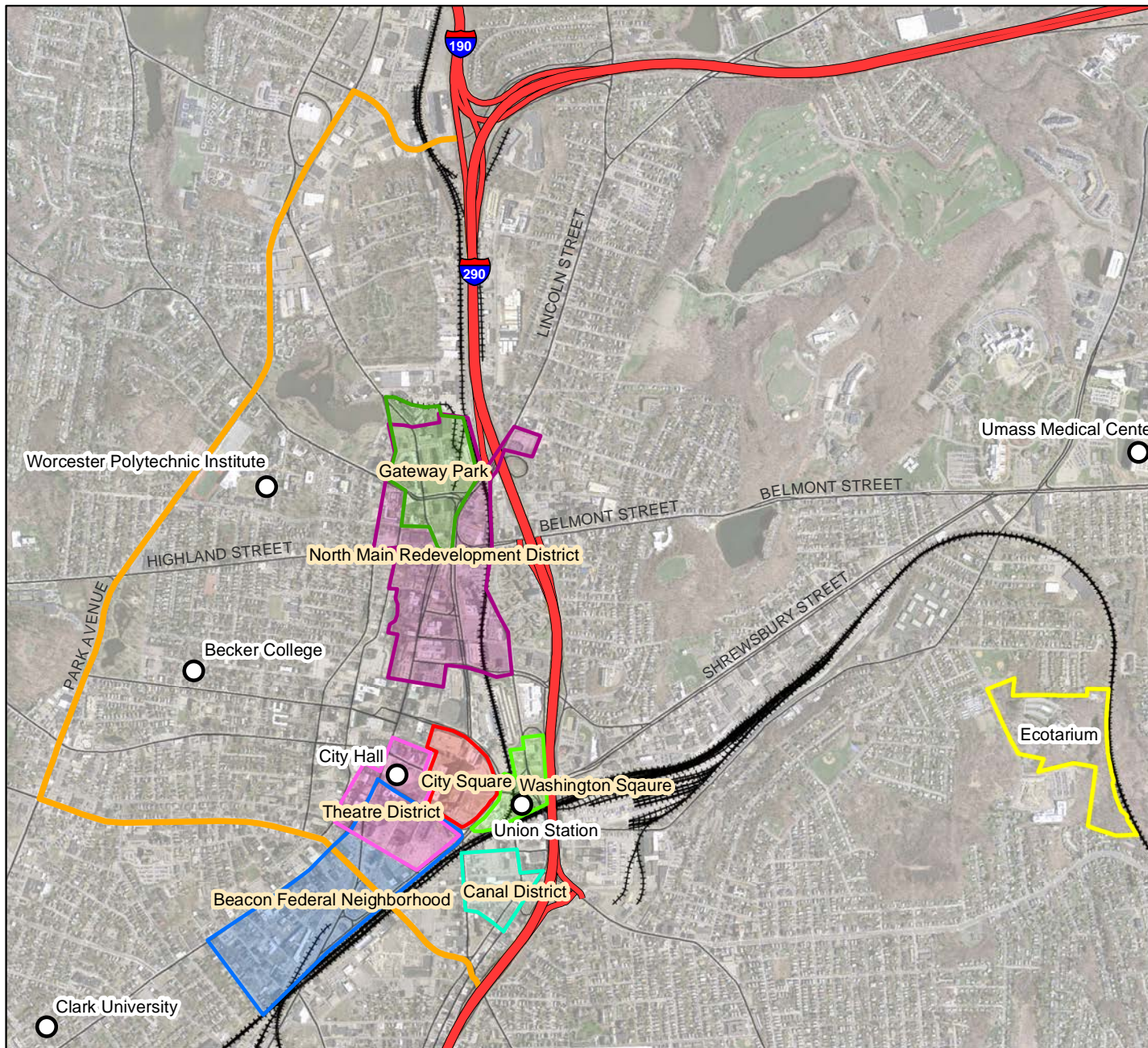
- Interstate
- Major Road
- Arterial Road

Prepared by: Matt Hisle Date: 2014

1 in = 7500 feet



WORCESTER DOWNTOWN MAP CURRENT KEY PROJECT AREAS

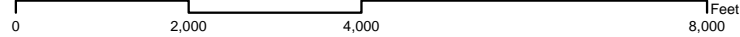


Legend

- Point of Interest
- ▭ Downtown
- ▭ Ecotarium
- ++++ Active Rail Service
- Roads**
- Interstate
- Major Road
- Key Project Areas**
- ▭ Beacon Federal Neighborhood
- ▭ City Square
- ▭ Gateway Park
- ▭ North Main Redevelopment
- ▭ Theatre District
- ▭ Washington Square
- ▭ Canal District

Prepared by: Matt Hisle Date: 2014

1 in = 2000 feet



Washington Square



City Square



Theatre District



Beacon Federal Neighborhood



WORCESTER DOWNTOWN MAP PUBLIC BUILDINGS



Map Source: <https://www.google.com/maps>

WORCESTER CITY HALL



WORCESTER COMMON



PUBLIC LIBRARY



UNION STATION



POST OFFICE

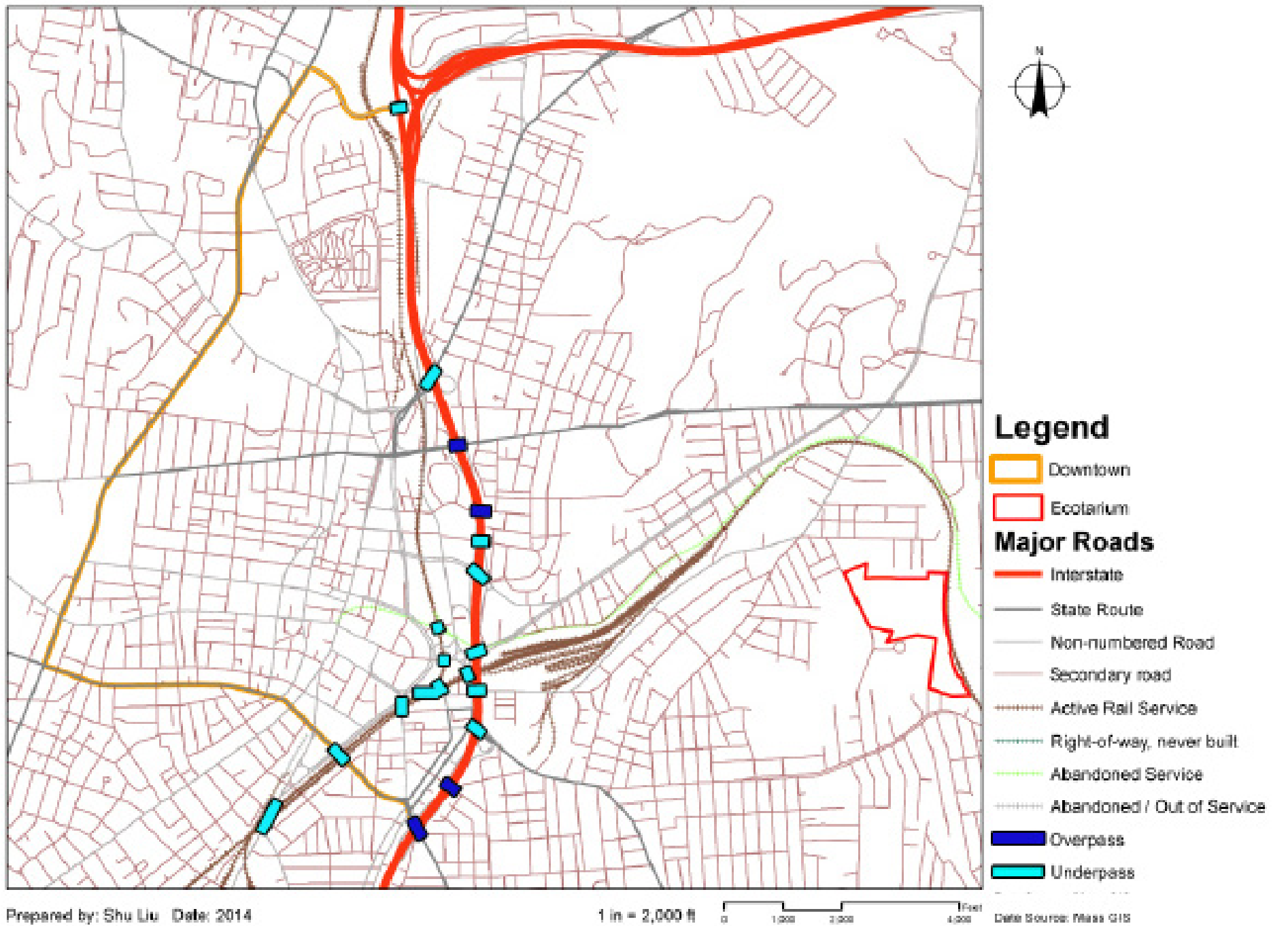


ECOTARIUM

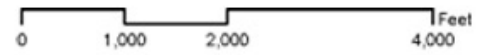
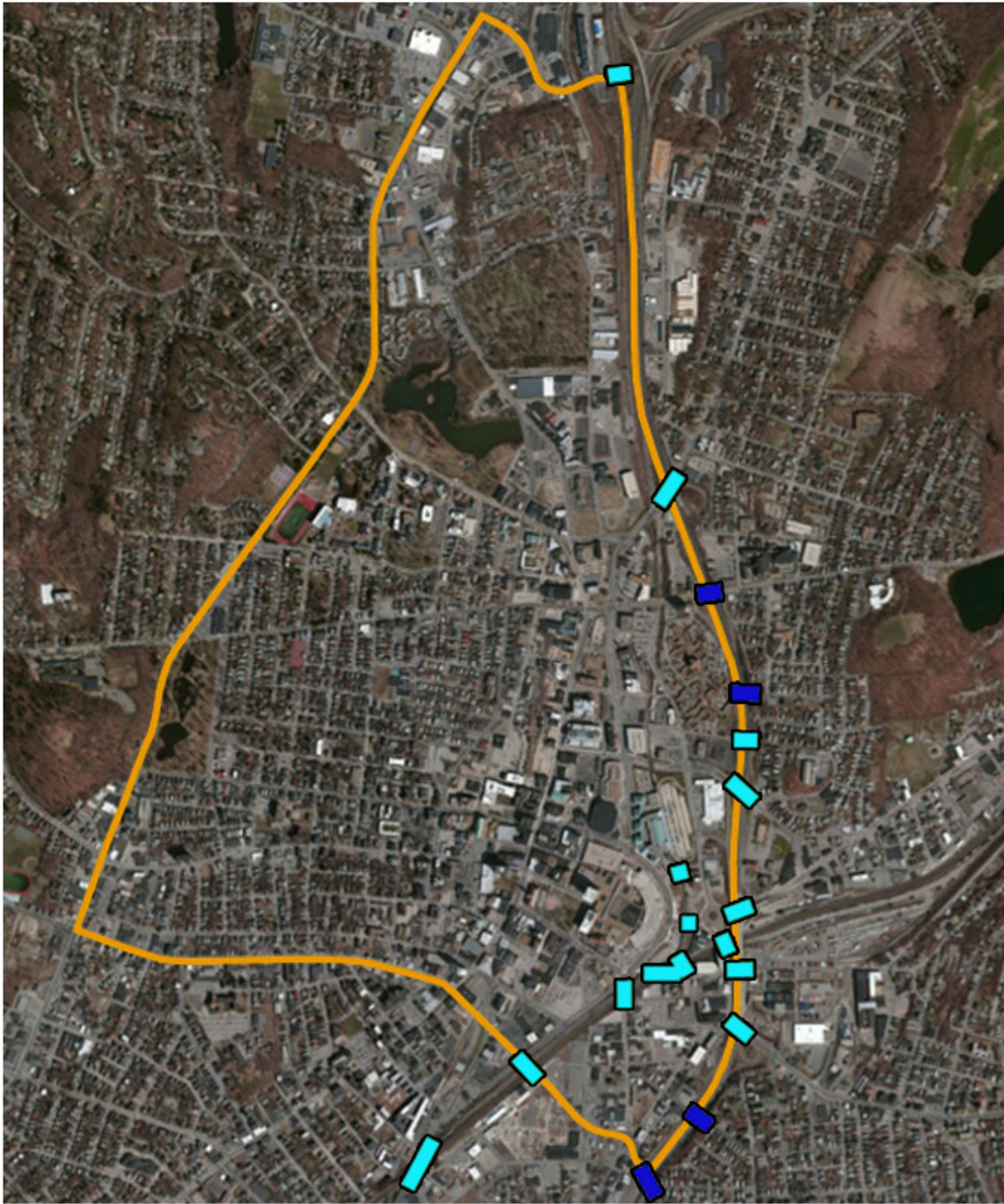


Photo Source: <https://www.google.com/maps>

WORCESTER DOWNTOWN MAP OVERPASS AND UNDERPASS CONNECTION OF I-290 & RAILROAD



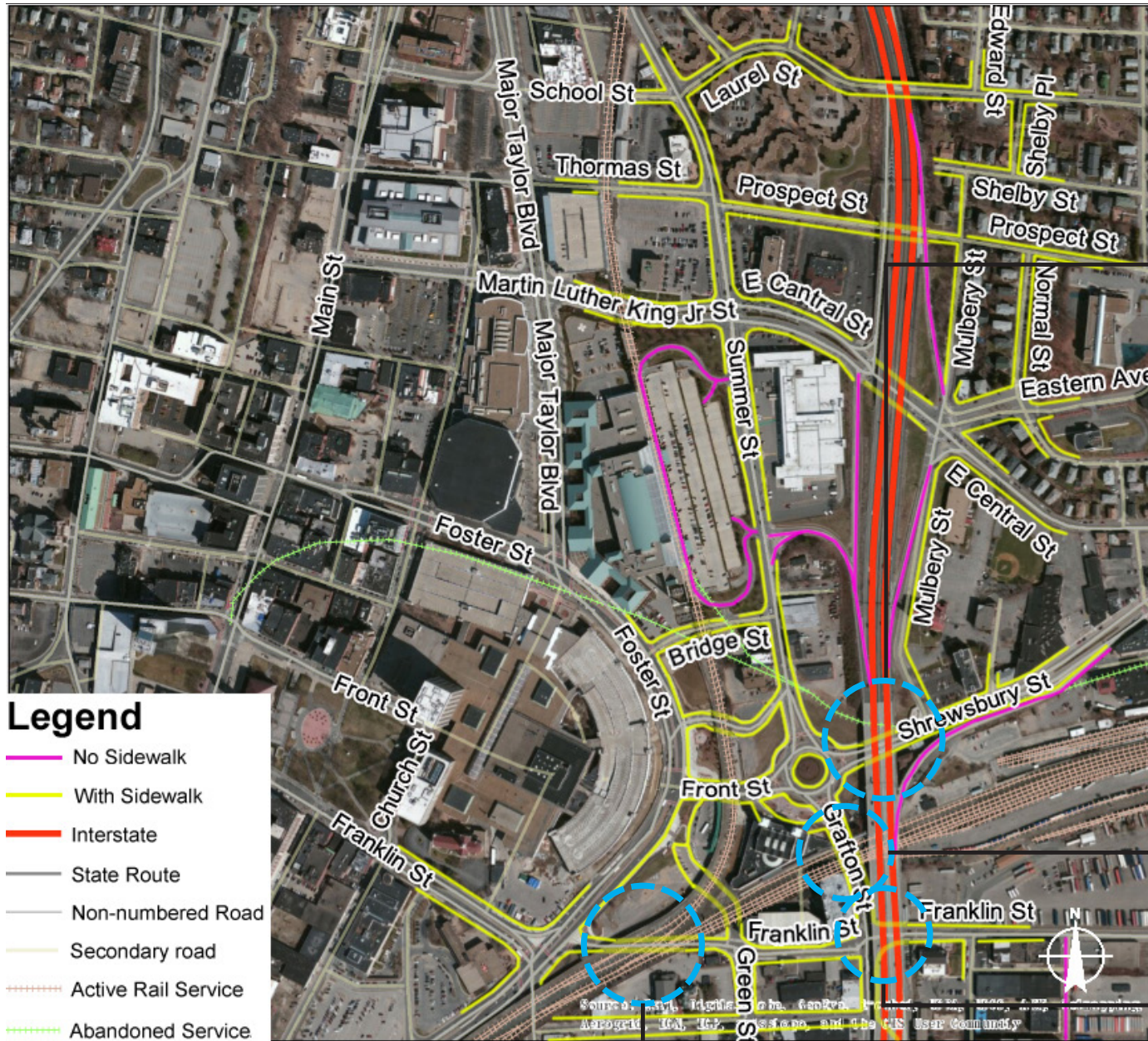
Prepared by: Shu Liu Date: 2014



Date Source: Mass GIS

WORCESTER DOWNTOWN

OVERPASS AND UNDERPASS CONNECTION OF I-290 & RAILROAD



Prepared by: Shu Liu Date: 2014

1 in = 500 ft 0 250 500 1,000 Feet Date Source: Mass GIS



SHREWBURY ST
(UNDER H-290)



GRAFTON ST
(UNDER H-290,
PARALLEL TO H-290)



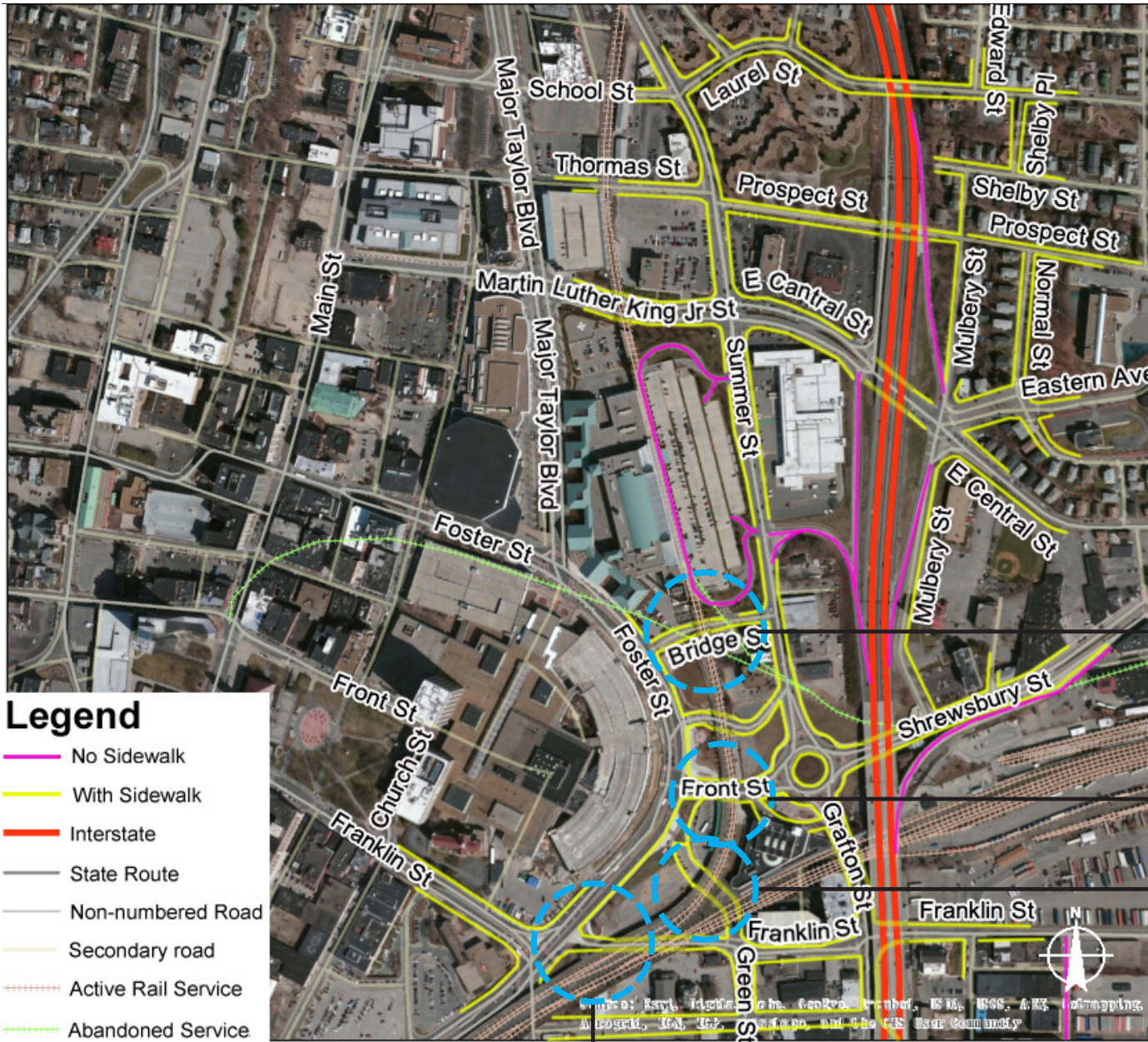
FRANKLIN ST
(UNDER H-290)



FRANKLIN ST
(UNDER RAIL ROAD)

Photo Source: <https://www.google.com/maps>

WORCESTER DOWNTOWN OVERPASS AND UNDERPASS CONNECTION OF H-290 & RAIL ROAD



Prepared by: Shu Liu Date: 2014

1 in = 500 ft



Date Source: Mass GIS

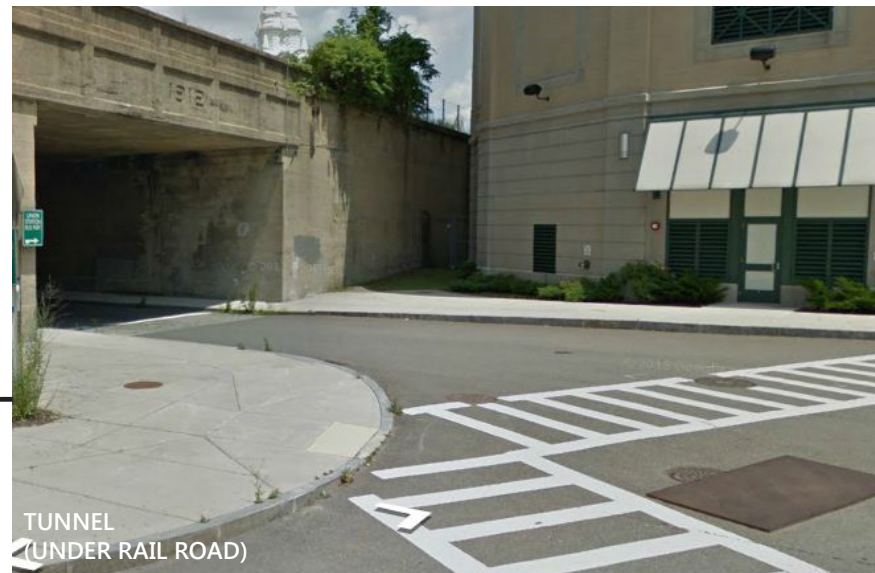
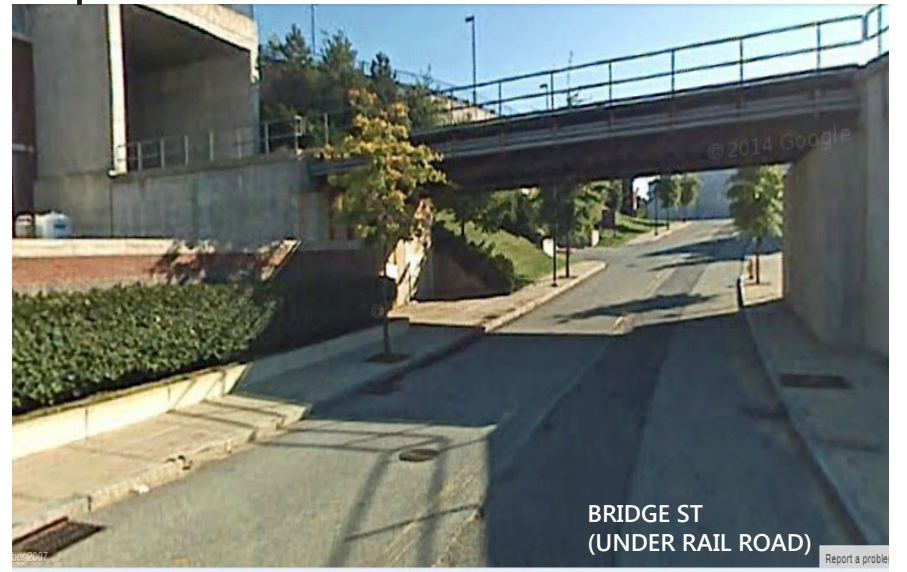


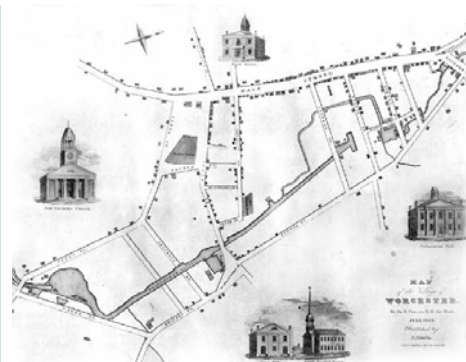
Photo Source: <https://www.google.com/maps>

WORCESTER DOWNTOWN BLACKSTONE CANAL INFORMATION

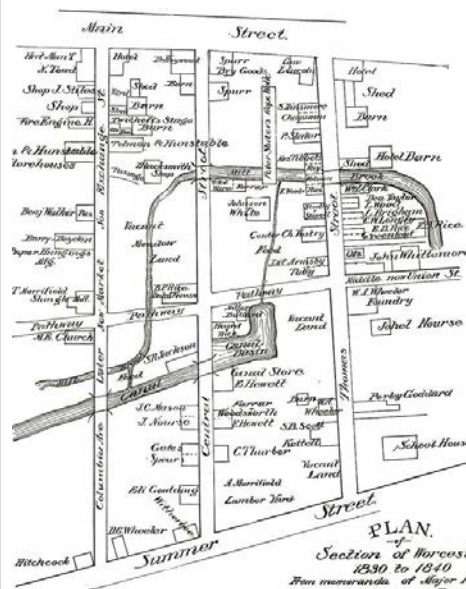


The Canal District

<http://www.thecanaldistrict.com/images/feasibility.pdf>



Worcester Historical Map in 1829



Worcester Historical Map in 1840

<http://www.worcesterhistory.org/bcinfo/bcinfo-maps.html>

INTRODUCTION

The Blackstone Canal, sitting at the head of the Blackstone River National Heritage Corridor and adjacent to major transportation services, is poised to become a new and exciting gateway to the Downtown and all of Worcester.

<http://www.thecanaldistrict.com/images/feasibility.pdf>

TIME LINE

1792: John Brown has an idea of building a canal, linking Worcester, MA to Providence, RI

1825: Workers begin building the Blackstone Canal.

1828, the Blackstone Canal is opened from Worcester to Providence. The first canal boat, the Lady Carrington, arriving in Worcester on October 7, 1828.

1848: Blackstone Canal closes.

1849: Blackstone Canal is placed underground, functioning as part of the city's sewer system.

NOW: A series of historic markers at sites along the route of the canal in the city was unveiled on 7 October 2003 to mark the 175th anniversary of the canal.

<http://www.worcesterhistory.org/bcinfo/why.pdf>



BY THE CANAL-HISTORIC WALKING TOUR:

Although the Blackstone Canal was abandoned as a commercial enterprise 20 years later, it stimulated significant economic growth and left its imprint on the city's street network – as well as hastening the advent of the railroads and introducing an influx of Irish immigrants, who had been hired to dig the canal. Arched over and forgotten in the 1890s, it still flows beneath current-day Harding Street.

<http://www.preservationworcester.org/pages/images/analWebsiteMap-forwebsite.jpg>



The first boat "Lady Carrington"



Thomas Street Canal Basin

<http://www.worcesterhistory.org/bcinfo/bcinfo-home.html>



Placing Blackstone Canal underground began in 1949



WORCESTER DOWNTOWN BLACKSTONE CANAL--FREE THE BLACKSTONE REPORT



Illustrative Plan



"You must dig it up and let it run free once again. 'Free the Blackstone.' "

David Brower, the first executive director of the Sierra Club, and one of the principal founders of the environmental movement, during his 1992 visit to Worcester, after he was informed that the Blackstone Canal existed, buried under City streets.

CORE ELEMENTS

The Plan is grounded in a set of core goals and objectives for the District, established by the Task Force and Community early in the planning process.

1. Tell the Canal District's story
2. Maximize the Canal District's waterfront potential
3. Respect the area's historic fabric
4. Take full advantage of underutilized parcels of land
5. Designate three themed Gateways: Washington, Kelley and Brosnihan Squares
6. Establish Kelley Square as a new front door to Worcester and the Canal District
7. Organize the Plan around the Canal District's squares, unique settings and water linkages
8. Create a pedestrian and bicycle network to and through the Canal District

Relationships of Blackstone Canal District to other city initiatives



Water Segments



Canal District Sub-areas



Looking north towards Union Station and the new Water Street Market Place

WORCESTER DOWNTOWN MAP HIGHER EDUCATION

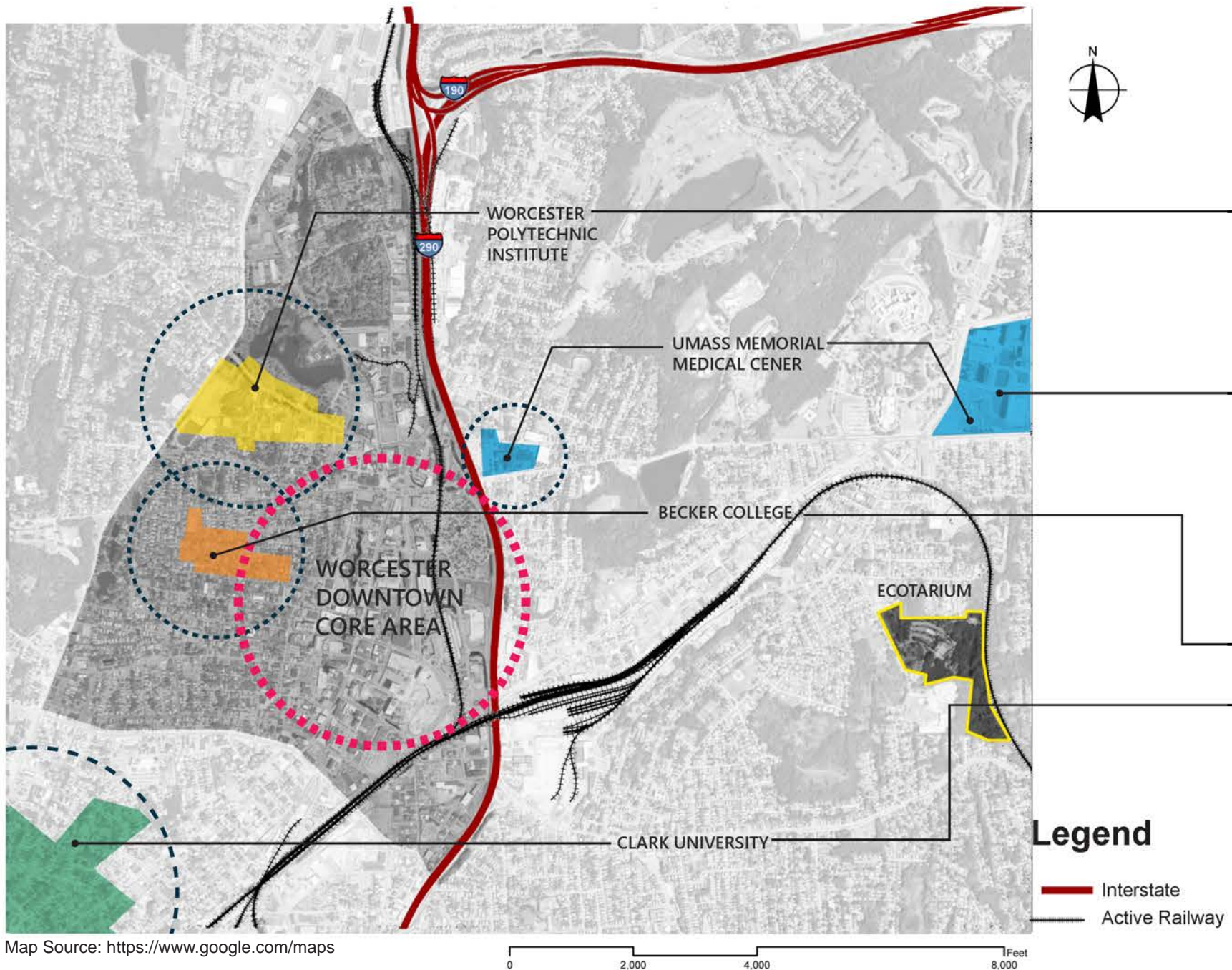
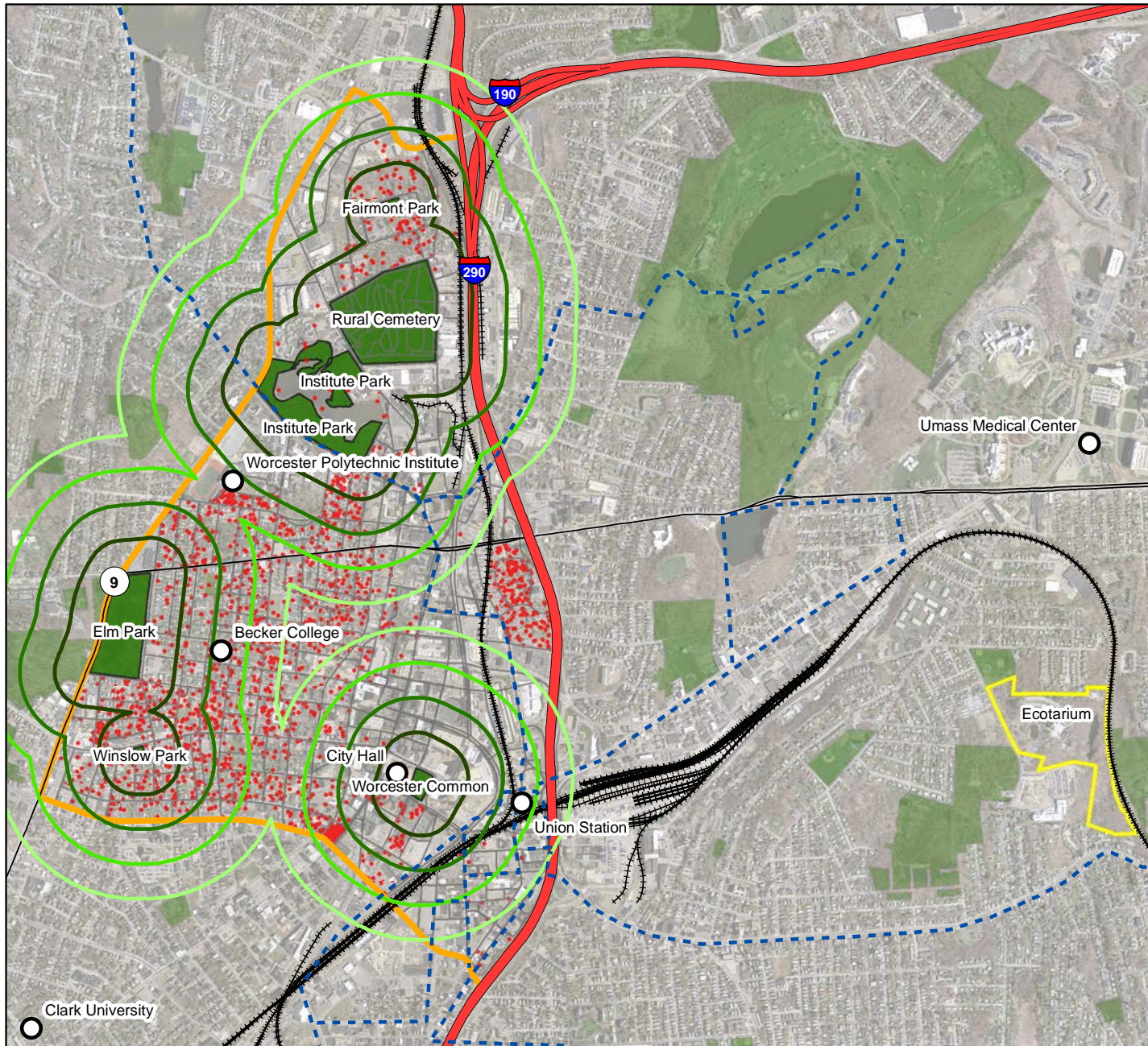




Photo Source: <https://www.google.com/maps>

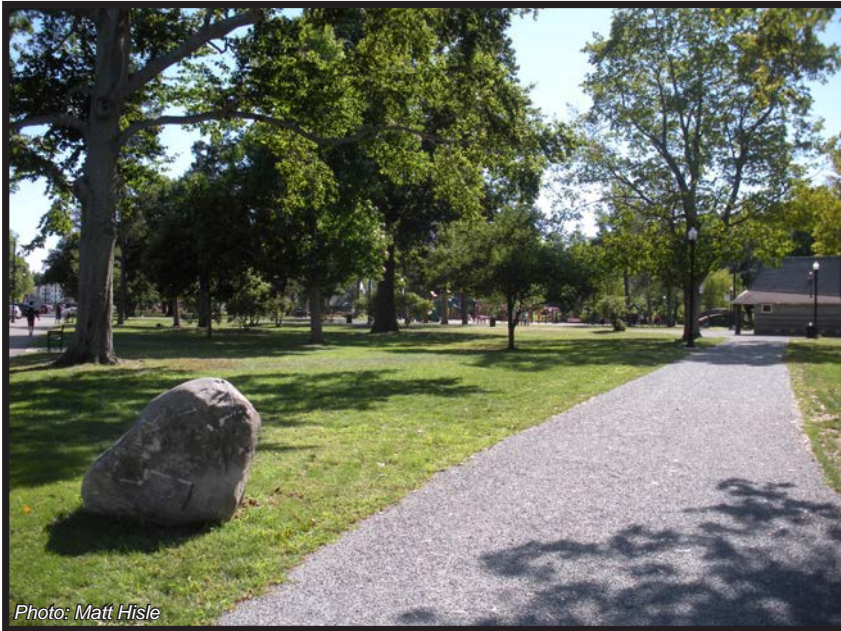
WORCESTER DOWNTOWN MAP PROXIMITY TO OPEN SPACE



- Legend**
- Point of Interest
 - ++++ Active Rail Service
 - Ecotarium
 - Public Open Space
 - Downtown
 - Bicycle Trail
- Road System**
- Interstate
 - Highway
 - Arterial Road
- Proximity to Open Space Buffer**
- 500 ft.
 - 1000 ft.
 - 1500 ft.
 - 2000 ft.
- Population**
- 1 Dot = 10

Prepared by: Matt Hisle Date: 2014 1 in = 2000 feet 0 2,000 4,000 8,000 Feet

Elm Park



Worcester Common



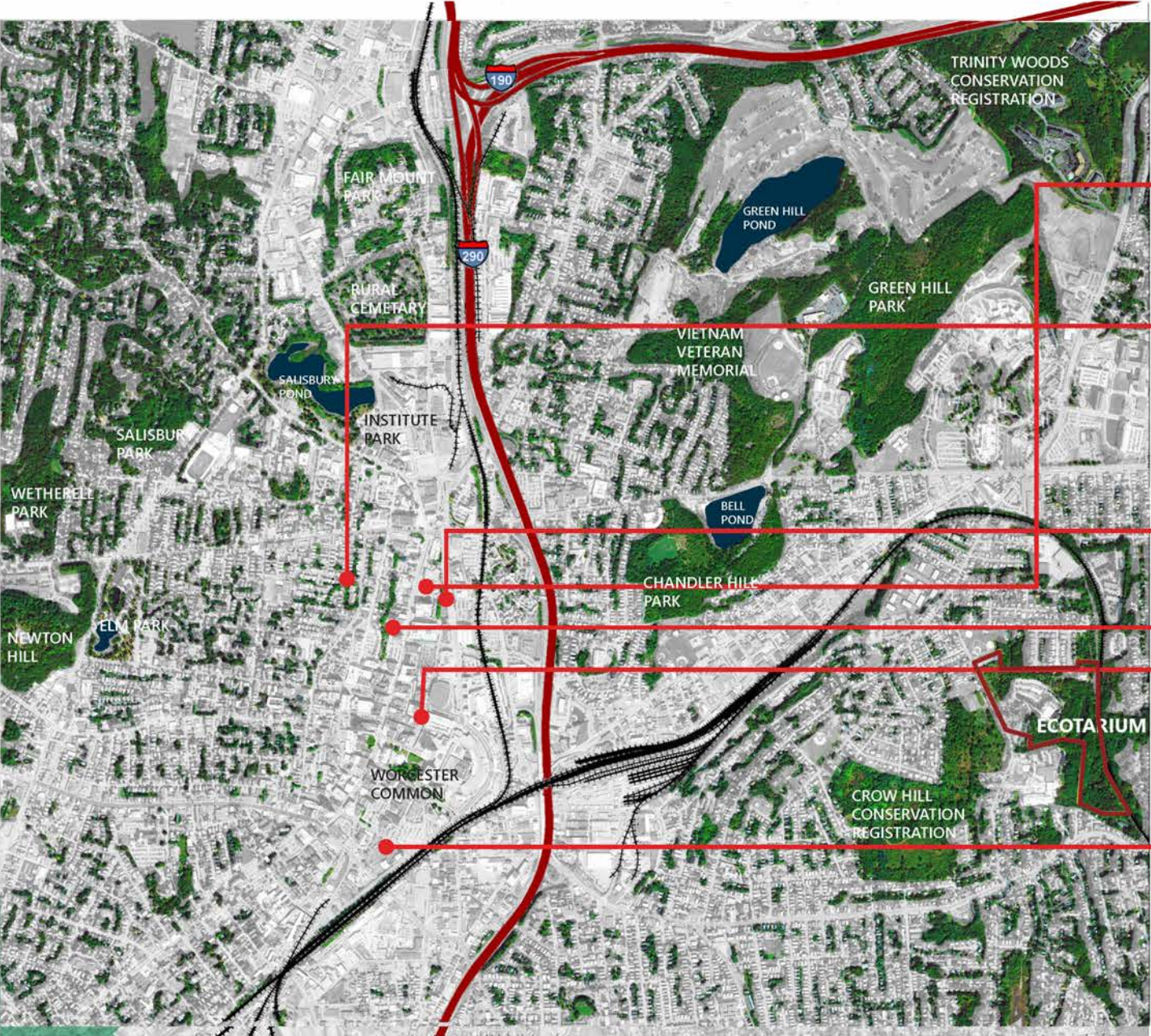
Institute Park



Winslow Park



WORCESTER DOWNTOWN MAP TREE SHADE MAP



Legend

- Interstate
- Active Railway

Map Source: <https://www.google.com/maps>



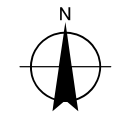
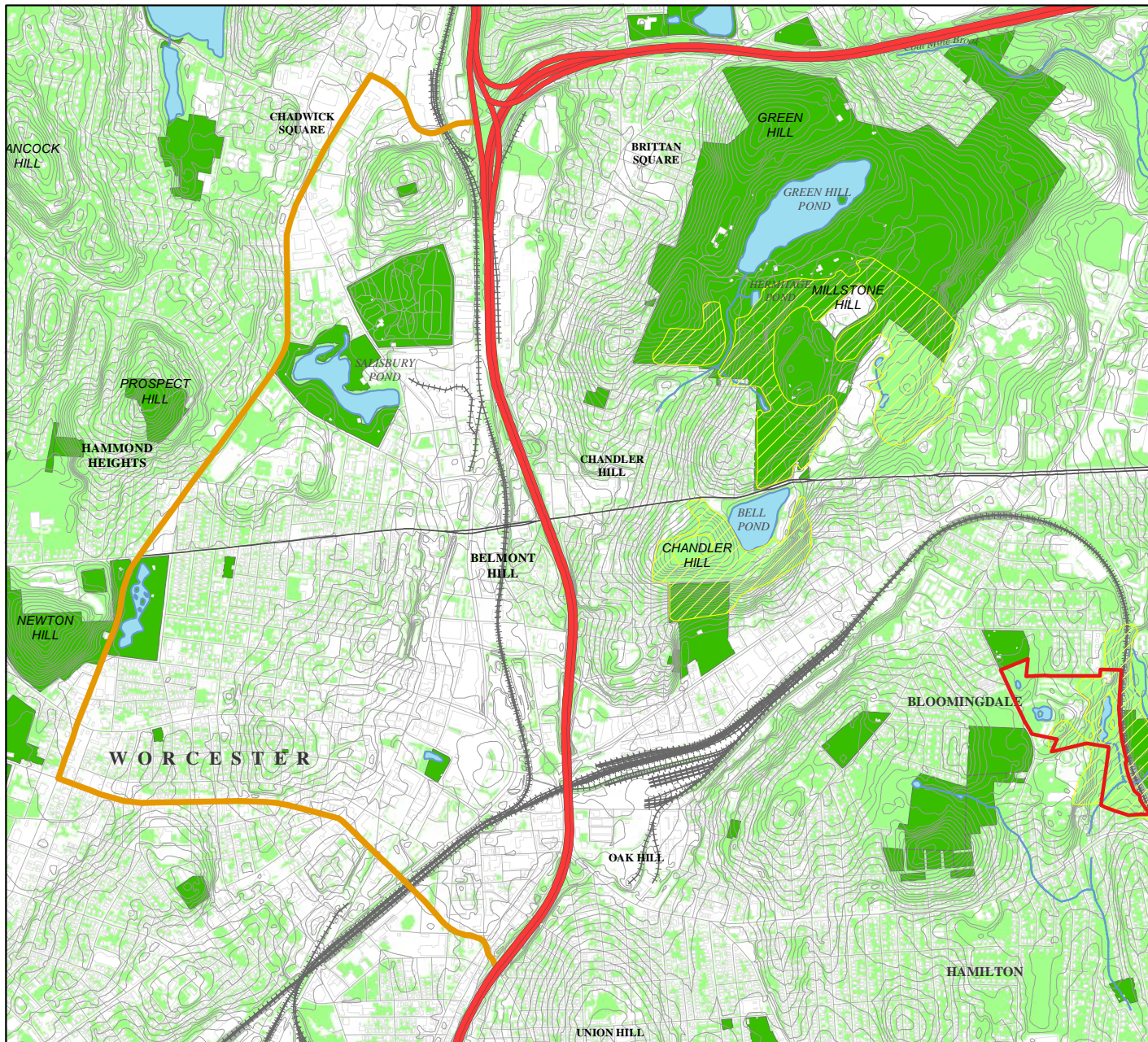


Downtown Worcester Assessment Process










A major influence on this project were the CURRENT KEY PROJECT AREAS that are currently a point of focus for a significant portion of city resources. These projects are concentrated in the core of downtown along the interstate boundary. City officials are striving to make it a place that attracts people for more than just one's job, but rather a place for entertainment and gathering. Individually these projects are in different phases of development. Some have been completed, like Washington Square, Some are in development like City Square, and some are in planning stages like the Theatre District. This presents an opportunity for the city to consider some of the ideas that we propose. Within the same core are of downtown are a number of important PUBLIC BUILDINGS to go for people that live in the city. These buildings all exist to serve the public so we found it important to create a linkage between them. With all of the development going on coupled with the important resources in this area there was a concern about the interstate and rail line constraining movement into the downtown area from everyone living on the East and South side of these major obstacles. Looking at these boundaries an inventory of all of the existing UNDERPASS AND OVERPASS CONNECTIONS was made. In doing this, specific connections were made along the interstate that were of higher importance to focus attention on in order to make them more navigable for pedestrian and bicyclist traffic. This same process was conducted along the large rail line that separates the downtown area from the Canal District. The Canal District is another one of the completed key project areas. Although the BLACKSTONE CANAL is closed and buried it is still remembered in several ways. For example the "By the Canal Tour" leads people through the canal area with some remaining historic buildings. In the proposal we include this tour route as part of our greenway system and as shown later this feature influenced some a portion of an individuals design proposals. On the other side of downtown there is a line of important

HIGHER EDUCATION facilities that contribute to making Worcester an educational hub in Central Mass. Worcester Polytechnic is an innovative leader in engineering, Clark University was the first all graduate school in the country, and Becker College is a private college. It is necessary to connect these schools together, to increase the opportunities on communication and interaction between students and other people, their environment and surroundings. To get a better understanding of how people and the environment interact in downtown a PROXIMITY TO OPEN SPACE study was conducted. It was imperative to see where people were living in the downtown area and how closely they lived to public open space. To do this offsets were created extending away from public open space at 500 foot increments and then the estimated number of people living within each level of the buffer was calculated. The total population of this focus area was nearly 18,000 people and roughly 6,000 people lived 1,500 feet or more away from one of these open spaces. This can be attributed to a void of open space in the downtown area. This led to looking for areas of POTENTIAL OPEN SPACE in the downtown area. There are several potential parcels for green space in the city including abandoned land, parking lots, and empty spaces that could be improved. Along with a lack of greenspace there is also a lack of TREE CANOPY. Worcester has a lot of green space and tree canopy but most of them are distributed in suburban and residential areas. This lack of green space and tree canopy has impacts on the stormwater and CSO issues prevalent in the city of Worcester. The limited amount of green space impacts the HYDROLOGY by giving way to impervious surfaces that increase stormwater runoff into the sewer system. There is a stark contrast between the area of downtown and the surrounding residential areas. So it is clear that there is a need for more green space to help attenuate the effects associate with runoff.

WORCESTER DOWNTOWN MAP HYDROLOGY AND GREEN NETWORK



Legend

-  PRIHAB_POLY
-  Downtown
-  Perennial Stream
-  Intermittent Stream
-  Pond, Lake, Ocean
-  Ecotarium
-  Existing Vegetated Land
-  Pervious Surface
-  Impervious Surface

Prepared by: Junbo Zhang Date: 2014

1 in = 2,000 ft



Data Source: Mass GIS

Downtown Worcester Assessment Composite

This map shows the culmination and combination of the assessment of the downtown area. Shown in blue is the only existing bicycle infrastructure running through this area which was seen as a good start, but something that provided an opportunity to build upon. The population can be seen as the red dots where each dot represents ten people. The existing bicycle infrastructure can be seen serving areas that seem to be less populated. The lack of green space in the central core of downtown is shown by the large white space that represents impervious surfaces. It is clear that this area attributes greatly to many of the CSO issues in the city. This lack of green space also shows how under served this area of the city is with park and recreational opportunities. Through this assessment several goals became a priority as the project progressed.

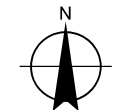
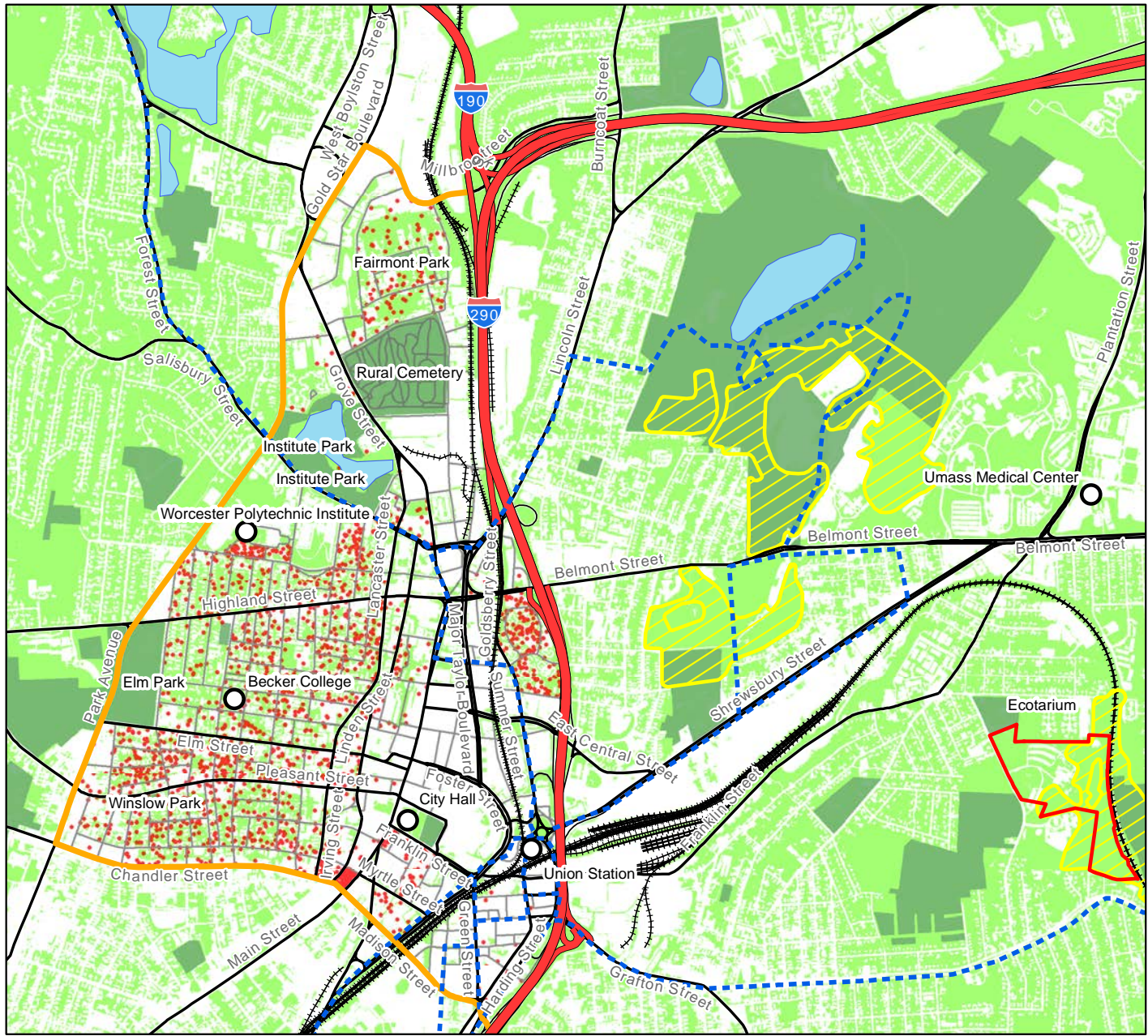
downtown became creating a more connected downtown that connects outwards to all parts of the city.

2. The secondary goal was to utilize any means possible to introduce new green space to downtown. This is intended to help mitigate stormwater runoff issues while also providing citizens with recreational opportunities and aesthetically pleasing environments.

3. A third goal was to address the major concerns surrounding the interstate and railroad lines that cut downtown off from adjacent areas. To create a most vibrant downtown it is crucial to allow for the best possible connection to areas on the other sides of the railroad and interstate.

1. The primary goal for a greenway system implementation through

WORCESTER DOWNTOWN MAP ASSESSMENT COMPOSITE



Legend

- Point of Interest
 - ▭ Downtown
 - ▭ Ecotarium
 - ▨ Priority Habitats of Rare Species
 - ▭ Pond, Lake, Stream
 - ▭ Open Space
 - ⋯ Active Rail Service
 - - - Bicycle Trail
- ### Roads
- ▬ Interstate
 - ▬ Highway
 - ▬ Arterial Road
- ### Population
- 1 Dot = 10
- ### Permeability
- ▭ Pervious
 - ▭ Impervious

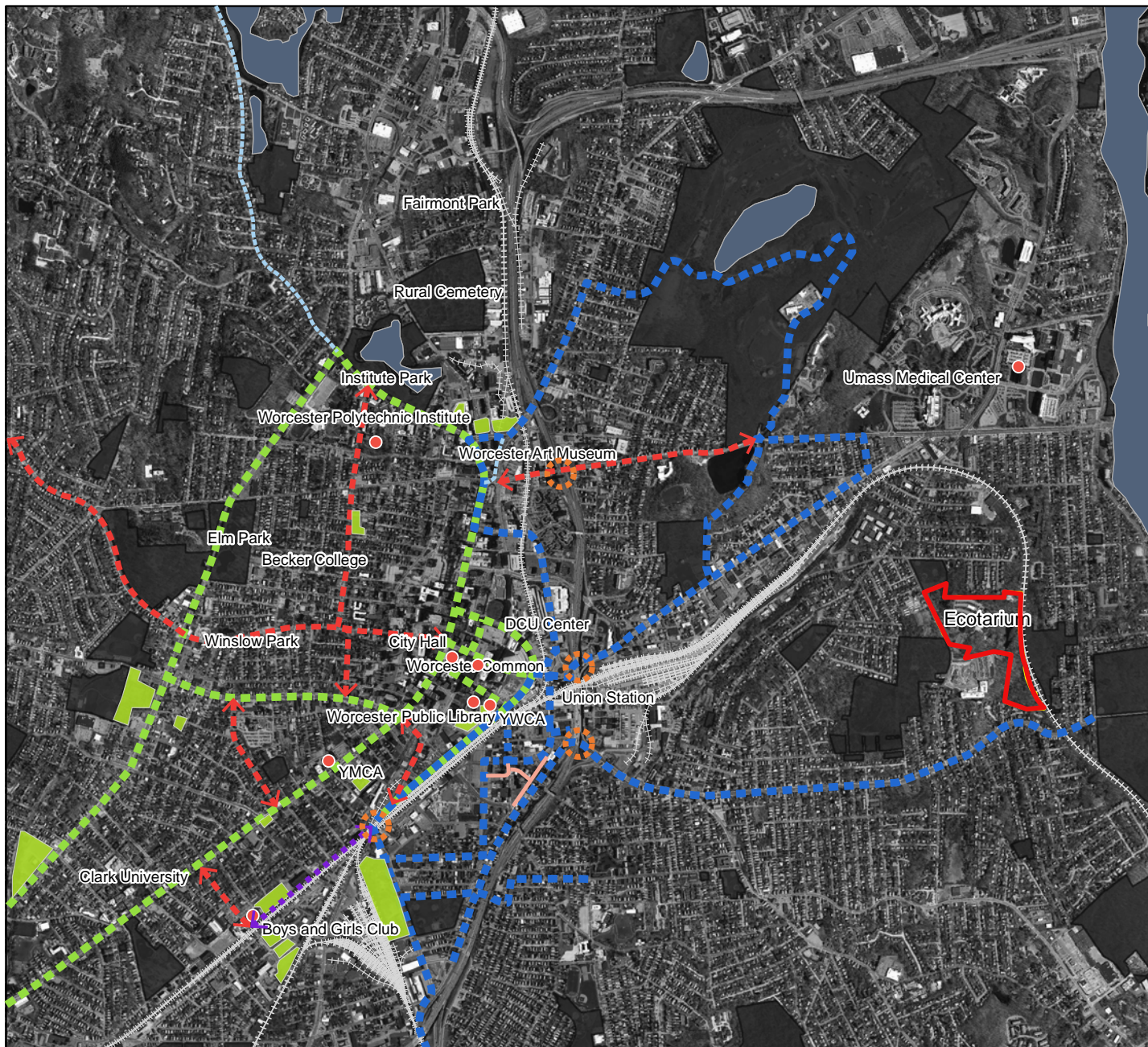
Prepared by: Matt Hisle Date: 2014 1 in = 2000 feet 0 2,000 4,000 8,000 Feet

Downtown Worcester Proposed Greenway System

Through the assessment process a clear set of goals was established for a greenway system proposal. This greenway proposal was developed as a plan that originates in the core of the city and branches outward connecting key landmarks, cultural resources, proposed greenspaces, and most importantly people and neighborhoods. We developed a hierarchy of trails for navigating this greenway. Primarily, a complete green street that offers bike lanes, vegetated buffers to help manage stormwater runoff, pedestrian friendly street crossing, and traffic calming measures is used for streets of major importance. The second level is applied to secondary

streets that offer bike lanes and improved pedestrian conditions. These routes serve as a connectors between the more developed complete green streets. Since they reside on streets with less traffic they do not require as many improvements. Lastly we have a proposed trail that runs along the train tracks for a unique connection from existing bicycle infrastructure to a proposed green space next to the Boys and Girls Club. These routes seek special consideration when crossing overpass or underpass corridors along the interstate or railroad. These considerations are shown in an individuals work.

WORCESTER DOWNTOWN MAP GREENWAY PLAN



Legend

- Existing Proposed Bike Lane
- Complete Green Street
- Bike Lane
- Off Street Trail
- Canal District Walking Tour
- Proposed Green Space
- Interstate Crossing

Prepared by: Junbo

Date: 2014

1 in = 2500 feet

0 2,550 5,100 10,200 Feet

SOUTH MAIN STREET CORRIDOR - Matt Hisle



Design Solutions For A Stronger Connection to Downtown



Downtown Worcester is not necessarily a thriving destination where everyone in the city flocks. It is clear that the city wants to reshape downtown into a place that is a destination for more than just employment, but a place for gathering and entertainment. The Executive Office of Economic Development in Worcester has outlined a series of priorities that include: strengthening neighborhood centers with new residential and retail alternatives; building the vitality of the downtown core with new residential, business, retail, cultural and entertainment options; and improving connections between the city's many economic generators (Augustus). The realization of these priorities can be seen in the many new city initiatives that Worcester is currently allocating a significant portion of tax dollars and resources to. Some of these projects including; City Square, Beacon Federal Neighborhood, Washington Square, and the Theatre District are located in the core of downtown Worcester. Others stretch from downtown outward, such as, the development of North Main Street, Shrewsbury Street, the Canal District, and Gateway Park (Augustus, 11). These projects range in their completion level with some being fully constructed and others existing only in the early stages of planning. The scope of these undertakings, upon full realization, could have a trickle down affect that opens doors and creates opportunities for communities and people living near these economic development areas to become more connected to the benefits associated with new development. It is the purpose of this report to detail the possibility of one such opportunity that exists along the South Main Street corridor.

South Main Street is a secondary road that offers an alternative to Interstate-290 as a means of accessing downtown Worcester from the Southwest. As the road enters the city it splits and the upper split becomes Park Avenue and the lower split continues as Main Street towards downtown (Figure 1). In 2011, a traffic count was administered to this street and it recorded 11,001 cars on a the Wednesday the recording took place (MassDOT, 2014). This paper will focus on the corridor from this split until Main Street reaches City Hall, nearly two miles later.



Figure 1: Main Street enters Worcester from the Southwest and then Park Avenue splits off to the north.

The South Main Street corridor passes through a portion of Worcester that has a relatively low socioeconomic status when compared to the rest of the city. The median household income for this area ranges from \$18,885 to \$25,625, while the average for the city of Worcester is \$67,529 (Figure 2). According to the National Household Travel Survey (Data), households with an annual income of less than \$25,000 are nine times more likely to have no car than households with incomes greater than \$25,000. This presents the likelihood that many people in this area rely on alternative forms of transportation as their primary means of travel. This could be by walking, bicycling or utilizing public transit. With the abundance of economic development taking place in downtown there is potential for employment opportunities, as well as, an attraction to recreational and entertainment values for people living along the South Main Street corridor. This presents a purposeful connection that could prove beneficial to residents

WORCESTER SOUTH MAIN STREET MEDIAN HOUSEHOLD INCOME

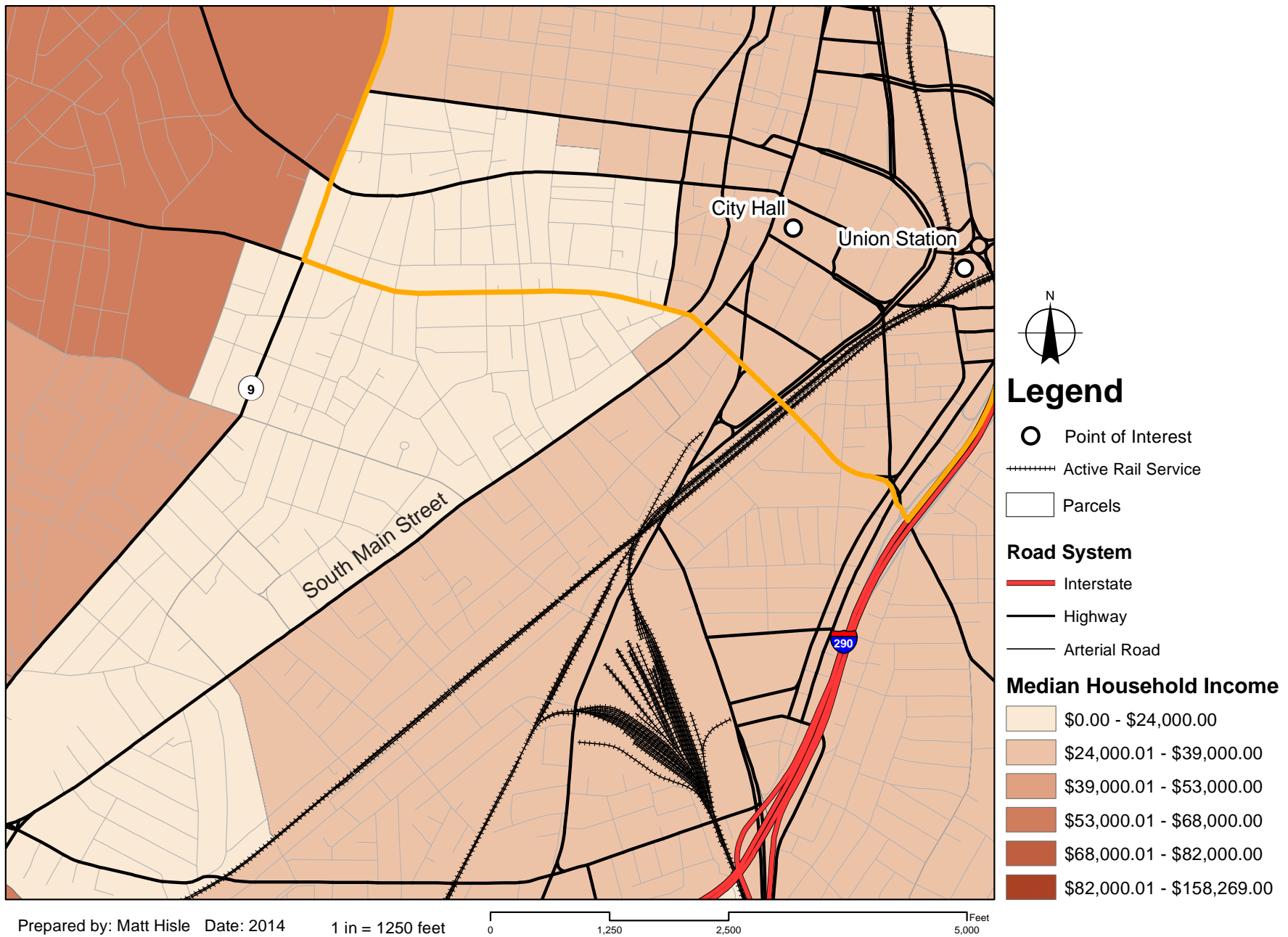


Figure 2: The neighborhood surrounding South Main Street has a relatively low socioeconomic status.

who are unable to own an automobile and are seeking new employment or interested in participating in the rejuvenation of downtown Worcester.

To better facilitate the movement of people into the downtown area is a crucial concern along this corridor. To do this every method of transportation must be considered. Currently the road caters to automobiles with a significant portion of the public right-of-way designated for drive lanes and parallel parking (Figure 3). Bicyclists that wish to travel along South Main Street are subjected to the risks involved with sharing the same drive lanes as automobiles and are simultaneously flanked by a constant row of parked vehicles. These conditions are undoubtedly a factor in the high rate of bicycle crash clusters seen in the CMRPC Regional Trail System Map (Figure 4). The area that is set aside for pedestrian use is lined desultorily with street trees, spaces that once housed street trees and little other vegetation to create a patchwork canopy along the sidewalk (Figure 5). Many of the sidewalks have issues with upheaval and the width fluctuates creating a precarious network to travel down. There are several intersections that also pose an unwelcoming gesture to anything beside vehicles as the crossing length between sidewalks is so expansive (Figure 6).

It is the goal of this report to provide design solutions for this corridor that will help foster a better relationship between the street and the pedestrians that use it. In an area of town that is so close to, and could benefit so much from, the revitalization taking place at the heart of Worcester there is a clear opportunity to implement a beautifully functional system of street that allows for a pleasant, functional and safe means of travel for all forms of transportation down South Main Street. This system could entice many users to participate in the convenience of alternative forms of travel, beautify the street creating a strong sense of pride, and exemplify a sense of place for the community. In the following paragraphs the process used to identify areas of concern and opportunity are detailed and followed with design



Matthew Hisle Photography

Figure 3: A drive lane is accompanied by a lane of parallel parking on each side of South Main Street.

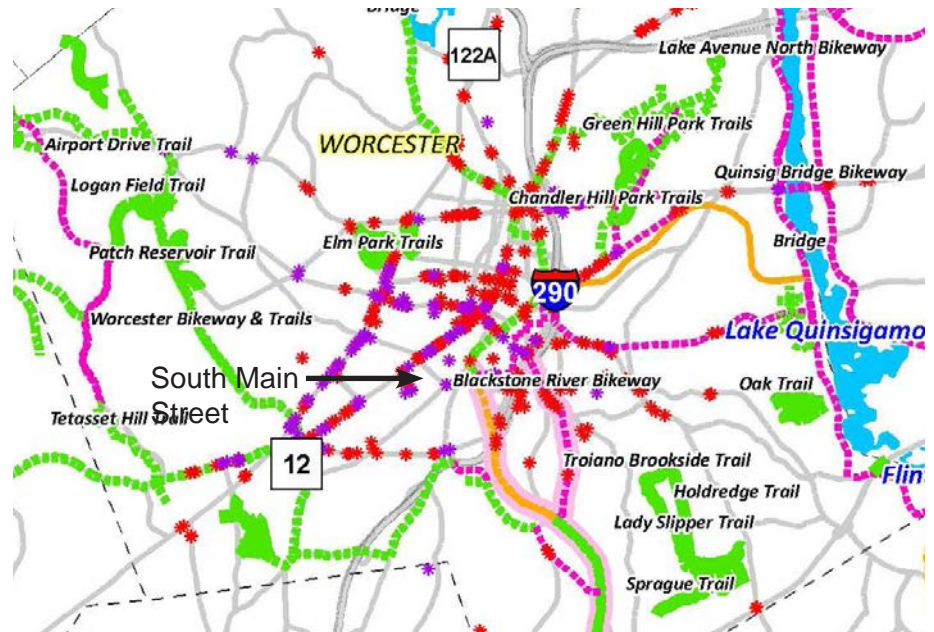


Figure 4: This map provided by the CMRPC shows the high rate of bicycle crashes (Purple symbols) along South Main Street. (CMRPC 1)



Matthew Hisle Photography

Figure 5: Vegetation along South Main Street is sporadic.



Matthew Hisle Photography

Figure 6: Large crosswalks create unfavorable conditions for pedestrians crossing the street.

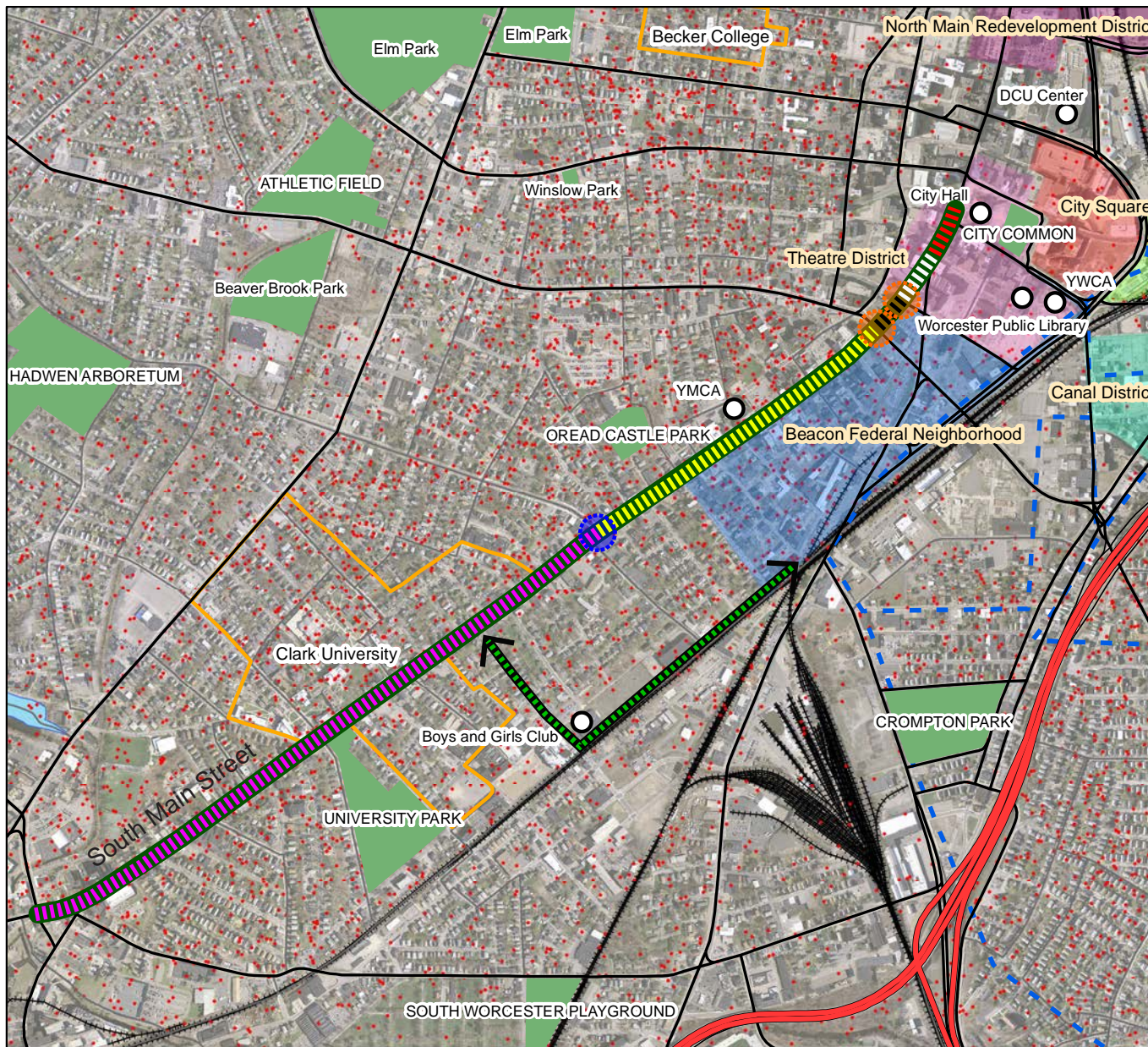
recommendations and the benefits to the community that they intend.

The early stages of creating design solutions for this corridor involved developing an inventory of the character and functionality of the two mile stretch of South Main Street from City Hall to the Park Avenue merger. How the road changes affects the recommendation possibilities so it was imperative to understand the fluctuations in how it was used. The width of the road, how many travel lanes existed, where parallel parking was available, the interaction between cross streets and when intersections promoted issues were all taken into consideration. These aspects were synthesized to find distinct separations in road character (Figure 7). This allowed for the identification of where the street changes and how it can then be manipulated to accept a new system of movement.

The first concern that arose during the inventory process was two major intersections near downtown. The intersections of Myrtle and Main Street along with the intersection of Madison and Main Street pose serious boundaries for people walking or biking towards or away from downtown. The distance to cross covers between four to five lanes of traffic and the only facilitation for crossing are a crosswalk painted onto the asphalt and standard traffic signals. There is an absence of any bicycle indicators on the asphalt which reduce the likelihood of motor vehiclist becoming aware of someone riding through the intersection.

The intersection of Madison and Main St. was selected as a platform for visualizing a new system (Figure 8). The major concern for this intersection was safely enabling pedestrians and bicyclists across the street. The first design move was to raise the intersection to curb level creating what is known as a pedestrian table (Figure 9). This has been shown to more clearly give the impression that this area is pedestrian territory (Appleyard, 300). By changing the materials to something like brick or stamped asphalt there is a more definite indication of where pedestrians

WORCESTER DOWNTOWN MAP SOUTH MAIN STREET CORRIDOR



Legend

- Point of Interest
- ++++ Active Rail Service
- - - Existing Bicycle Trail
- College or University
- Open Space
- Pond, Lake, Stream

Key Development Areas

- Beacon Federal Neighborhood
- Canal District
- City Square
- Gateway Park
- North Main Redevelopment District
- Theatre District
- Washington Square

Population

- 1 Dot = 10

Roads

- Interstate
- Highway
- Arterial Road

Prepared by: Matt Hisle Date: 2014 1 in = 2000 feet 0 1,250 2,500 5,000 Feet

Figure 7: This map characterizes the road character along South Main Street. The variation in colors represent a significant change in how the road operates and functions.

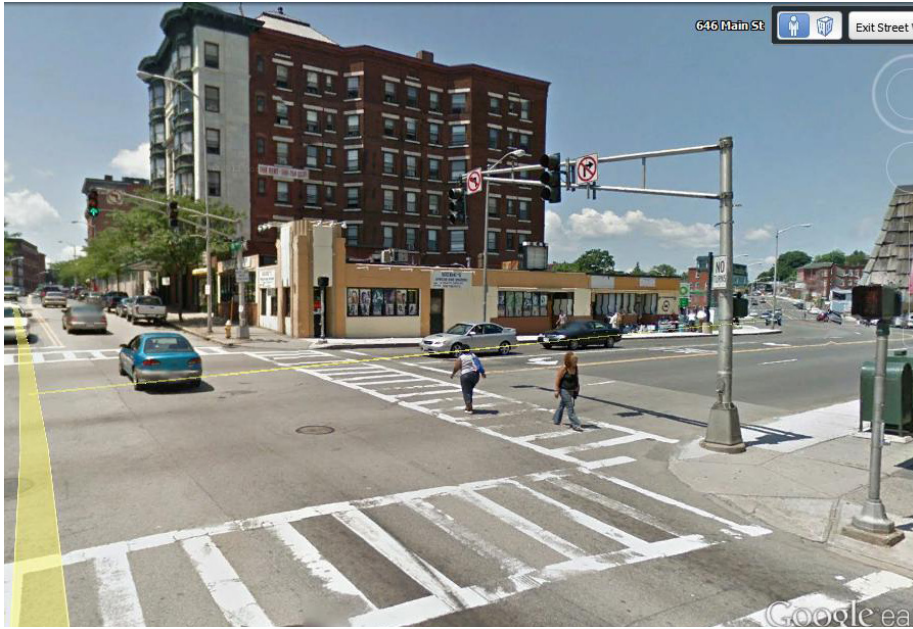


Figure 8: The existing conditions of the Main Street and Madison Street intersection are unfavorable for pedestrian activity.

are to cross in these intersections as well. When a car approaches this raise in elevation and change in material they are subtly encouraged to lessen their speed which then accentuates their awareness to the environment. This favors the pedestrians as they become more visible to automobiles.

A major goal for the city is to incorporate more bike lanes into the city (Worcester 09-6) The next element added to the intersection is a continuous brightly painted bike lane that crosses the intersection. Looking to Europe for inspiration in bicycle facilitation ideas from a Dutch cycle track were considered (Figure 10). A cycle track is a path that bicycles can travel on that runs with, but is separated from, the travel lane of automobiles (McIntyre and Murphy). This is different from most American bike lanes which are not physically separated from the road. The intersection is designed in a way to help bicyclists turn left in a safe manner. Following the same Dutch model a two-phase left turn is implemented. A rider wishing to turn left first fully crosses



Figure 9: This rendering shows the raised pedestrian table that facilitates pedestrian movement across wide intersections.

the intersection and then waits in designated zones near the corner of the sidewalks until it is safe to change direction and carry on (McIntyre and Murphy).

The next phase of developing design solutions entailed identifying the width of the road. Through the inventory process it was found that South Main Street begins narrower the closer it is to downtown and slowly begins to get wider as it extends outward (Figures 11, 12). Realizing this, the intersection of Main Street and May Street was found to be a point of bisection that separates the road pieces into two different categories (Figure 13). The road segment that began in downtown and reached this intersection was deemed a narrow street as it was less than forty feet in width, while the opposite end of the South Main Street was deemed a wide street due to it being greater than forty feet in width. Design considerations were first developed for the narrow street.

Along the stretch of road deemed narrow there is a

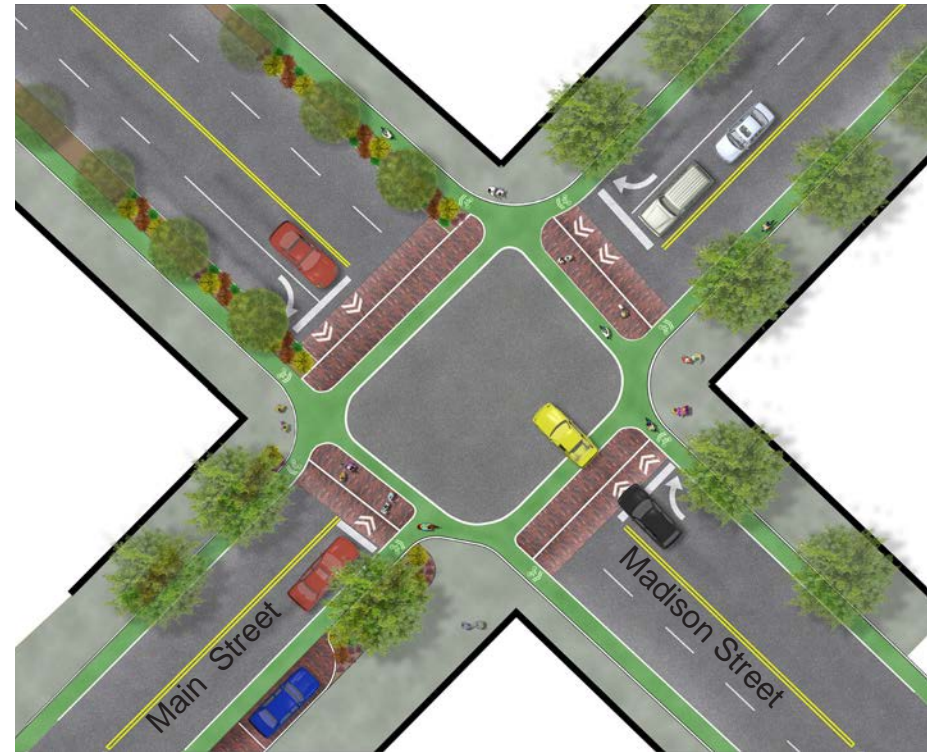


Figure 10: The intersection of Main Street and Madison Street is shown in its existing condition on the left, while the rendering on the right shows how a bike lane can be incorporated into the intersection to allow for bicycle traffic in a safe and unobstructive manner.



Figure 11: The narrow portion of Main Street begins closer to downtown.



Figure 12: As Main Street continues away from downtown it becomes wider.



Figure 13: At the intersection of Main Street and May Street is the point of bisection for this corridor.

lane of vehicular traffic heading in each direction and a row of parallel parking on each side of the street (Figure 13). This is the typical cross-section for a street on these primary streets around the downtown area (Worcester 8). This leaves little room for any bicycle infrastructure making it very difficult to navigate for a cyclist. The proposed design solution for this street is to eliminate both rows of parallel parking to provide more space for implementing a new system of movement. On top of this recommendation is narrowing the two travel lanes to somewhere between ten and eleven feet depending on the exact width of the street. By narrowing a street you can slow the movement of vehicles creating a safer environment for pedestrians (Appleyard, 301).

With the additional space provided on the two sides of the drive lanes there can be exciting new additions that create a more appealing atmosphere for pedestrian and cyclists. First, on either side of the two reduced travel lanes would exist a buffer zone that begins at five feet in width. This buffer is intended to be a flexible accommodation that presents itself in different forms as it is required to carry out different functions. The main priority of this buffer is to separate the vehicular traffic from the pedestrian and bicycle traffic. After this main function it has myriad possibilities and benefits. One of the goals from the Worcester Open Space and Recreation Plan is to improve the viability of street tree plantings (Worcester, 09-6). Touching on this goal is the secondary function of this buffer, which allows for planting with a variety of street trees and shrubs. The design and implementation of these plants can bring a vibrancy to the street with all of the color and textures that are possible from such a large plant palette. This beautification can enhance a sense of place along this corridor that people can be proud of and identify with. This vegetation can also be strategically chosen to be capable of accepting large amounts of stormwater runoff from the street (Figure 14). In doing this the buffer acts as a cleansing mechanism that helps attenuate the negative impact that stormwater runoff inflicts on the overloaded sewer system in Worcester. This buffer has small curb cuts that

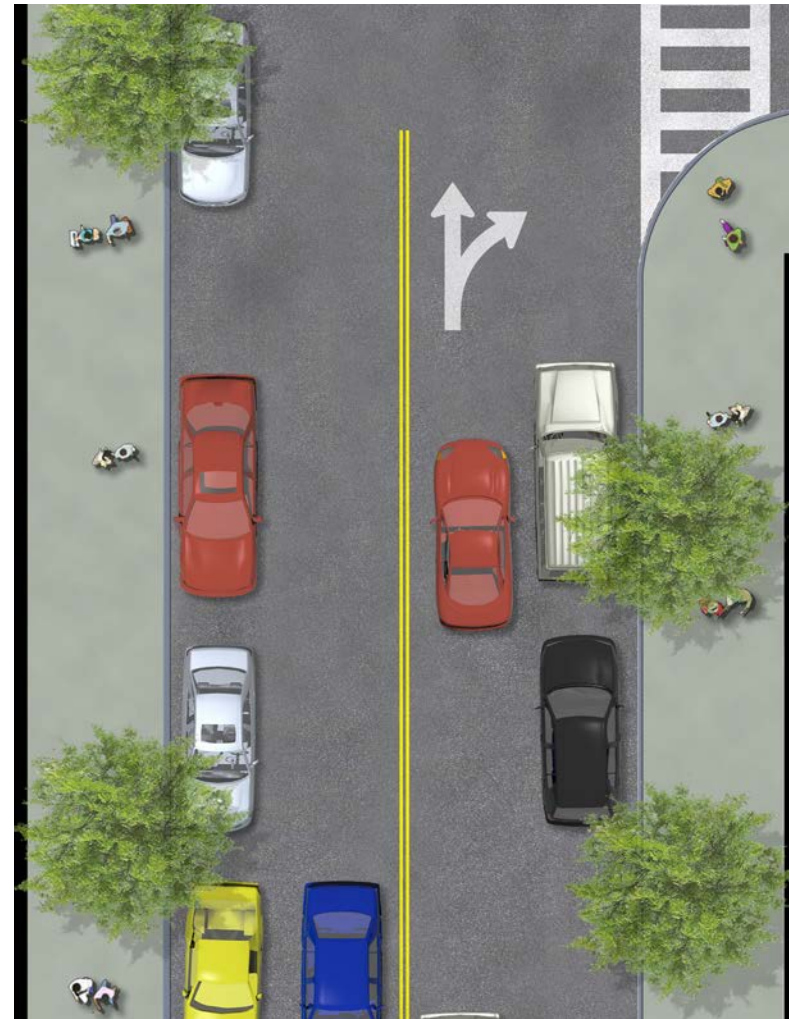
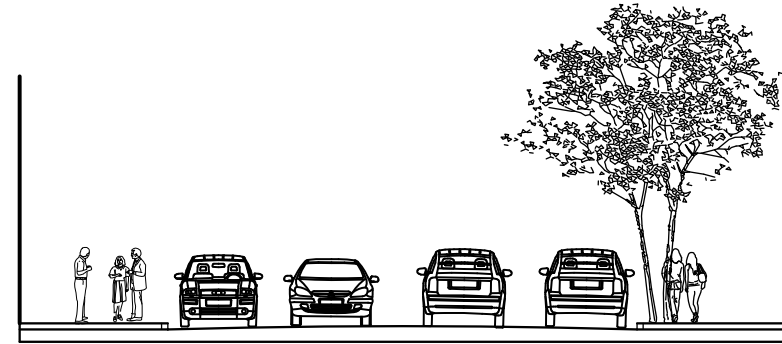


Figure 13: A typical narrow street along Main Street shown in section and plan.



Alternative Buffers



Perennial planting



Paved



Bulb-out



Figure 14: The proposed buffer system allows for flexibility of use and separation of traffic.

Figure 15: Including alternative buffers is what makes the system flexible. The first is planted with perennials for snow removal purposes, the second is paved to allow for snow storage areas, and the last alternative shows a bulb out in the road to allow access for buses or parallel parking.

allow water to come in from the street and the plantings within the buffer work to soak up this rain water as it percolates into the soil naturally. These plants can include Summersweet Clethra, Red Twig Dogwood, Catmint, Black Eyed Susan, Coneflower, Sea Oats and many others (Bloomberg and Strickland Jr. 8). Other benefits to a highly visible vegetated buffer and an increased tree canopy is a more pleasing atmosphere beneath it for users of the new system. This canopy provides relief to the urban heat island effect that is associated with the sun constantly heating up the large expanses of asphalt creating an increase in temperature on the ground. In areas along the street where it is deemed necessary to provide space for winter issues like snow storage there could be a different style of planting that includes perennials that lie dormant during the winter or a paved surface (Figure 15). The last function that the buffer system could possess is a bumping in of the roadway for bus access or parallel parking where necessary (Figure 15). There are many establishments and bus stops along South Main Street that require accommodations and this buffer system allows for these concerns. The idea is that through a detailed inventory and analysis of the South Main Street corridor, that was unable to be carried out in this effort, an appropriate plan can be completed that details the locations best served for each option of buffering. This would create a seamless and highly functional buffer system that spans the length of the road providing the appropriate use at the appropriate location.

Beyond the buffer would be a dedicated four foot wide bicycle lane that runs flush with the sidewalk. This bicycle lane would follow the same design principles as the one that spanned the intersection discussed earlier. The only difference would be that the highly visible green paint may not be a necessary inclusion on areas not associated with intersections or conflict points. A typical white stripe and bicycle symbol would be sufficient designation for this lane. By running the bicycle lane flush with the sidewalk it allows the bicyclist the opportunity to exit the bike lane and use the sidewalk if necessary. This also allows rain water that lands on the bike lane or sidewalk the ability to drain into the rain garden planting beds.

Along South Main Street, at the point of bisection mentioned earlier, the road begins to consistently measure greater than forty feet in width. Despite this increase in size the function of the road remains the same (Figure 16). One travel lane each way accompanied by parallel parking on either side.

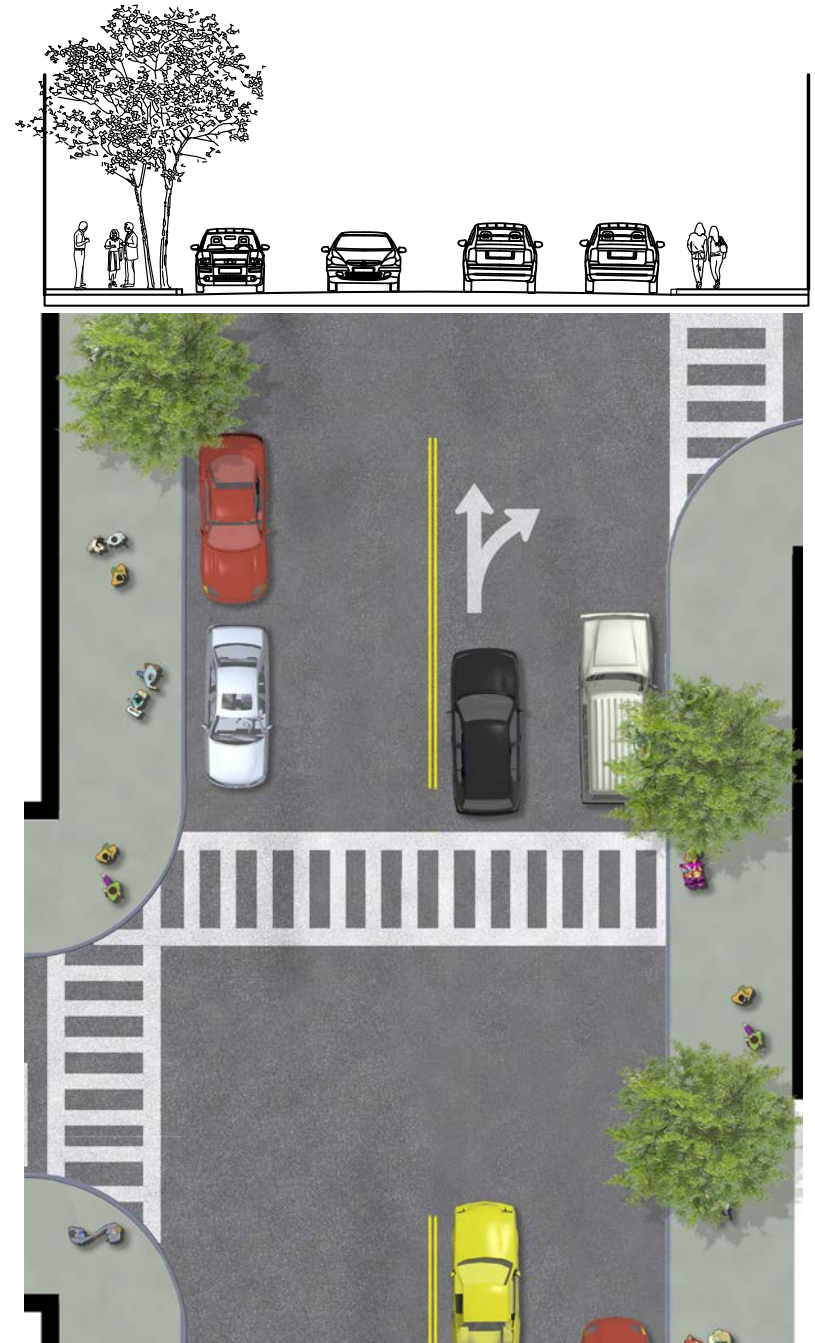


Figure 16: A typical wide street along Main Street. The intersections across Main Street are questionable.

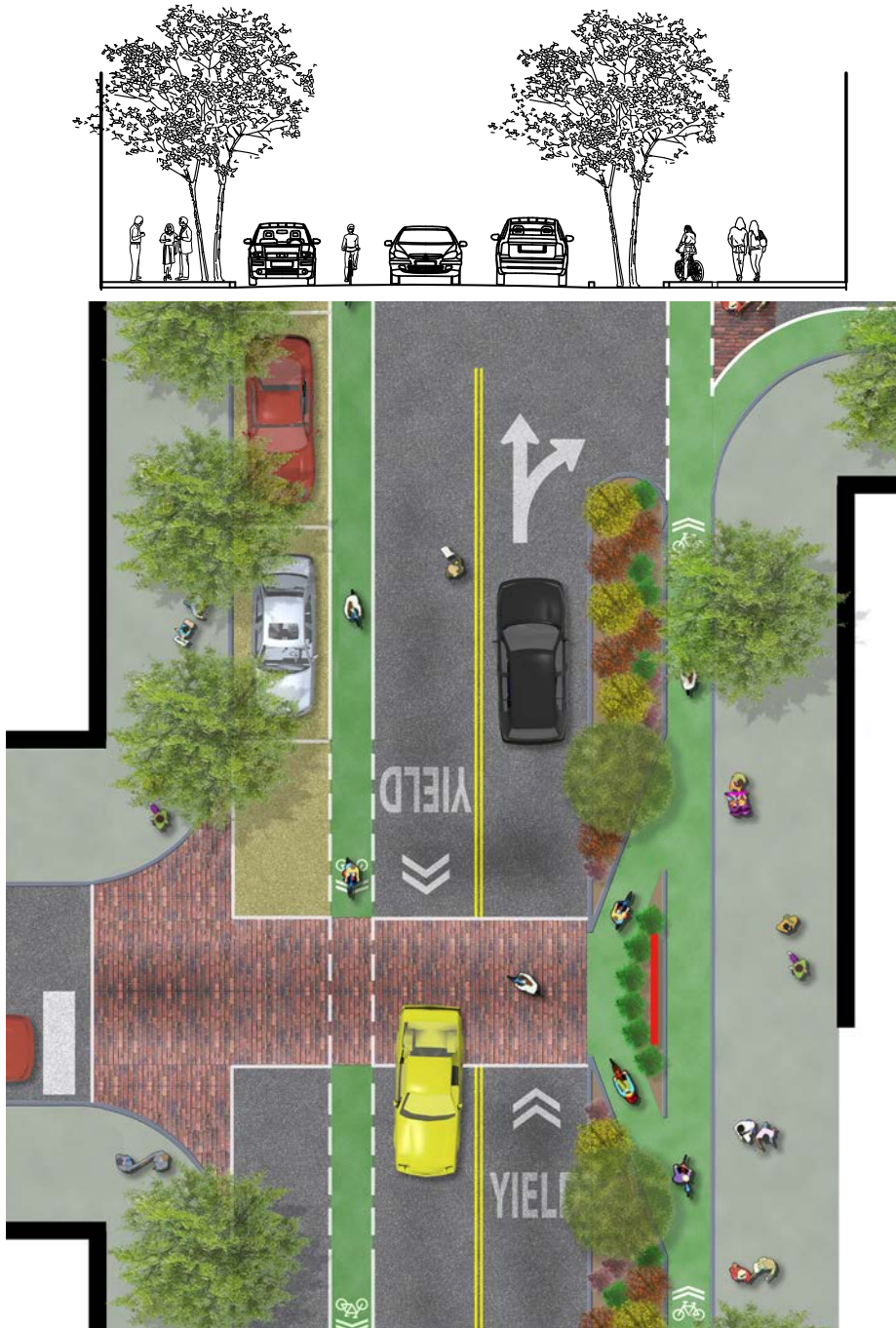


Figure 17: The design proposal for the wide street include egress for the bike lane to access crosswalks leading to the other side of the street.

This provides more room to continue the system from the narrow street model, but with a couple modifications (Figure 17). Mainly, the buffer can increase in width from five feet up to eight or ten feet in width. This provides more room for planting which increases the capacity for rainwater. Also, with this extra width an entire lane of parallel parking could remain on one side of the street. This alleviates the need for parking along the buffer thus increasing its capability for stormwater management (Figure 18). In keeping with the goals of reducing runoff on the street the remaining parallel parking could be fitted with a permeable surface that helps drain water into the soil.

Along South Main Street there are many times where a cross street does not carry through, but instead ends. This creates a need for many crosswalks from one side of the street to the other. One of the major concerns with creating this buffer system is how it prevents one from crossing the street. The last thing you would want is for trampled planting beds. To address this issue a design solution was developed to allow for an opening in the buffer to allow egress. By including the same material change shown earlier in the intersection crosswalk the idea of pedestrian dominated space is reinforced for crosswalks spanning from one side of the street to the buffer egress point.

In the quest to provide unique and creative ideas for the benefit of Worcester an additional means of bicycle infrastructure is proposed. This means could offer an alternative to the system presented for South Main Street, but it is rather intended to work in tandem as a cooperation that provides options for travel routes. The active rail line that runs by the area associated with South Main Street could be a radical option for placement of an off street bicycle trail. This route proposes to begin at a point that branches off from the existing bicycle infrastructure in Worcester and then access the rail line through a narrow opening along Lagrange Street (Figure 19). This point of access lies within the Beacon Federal Neighborhood development district. This presents the opportunity to allocate some of the resources available for this project to be used for creating an access point for this off road trail. The route would continue

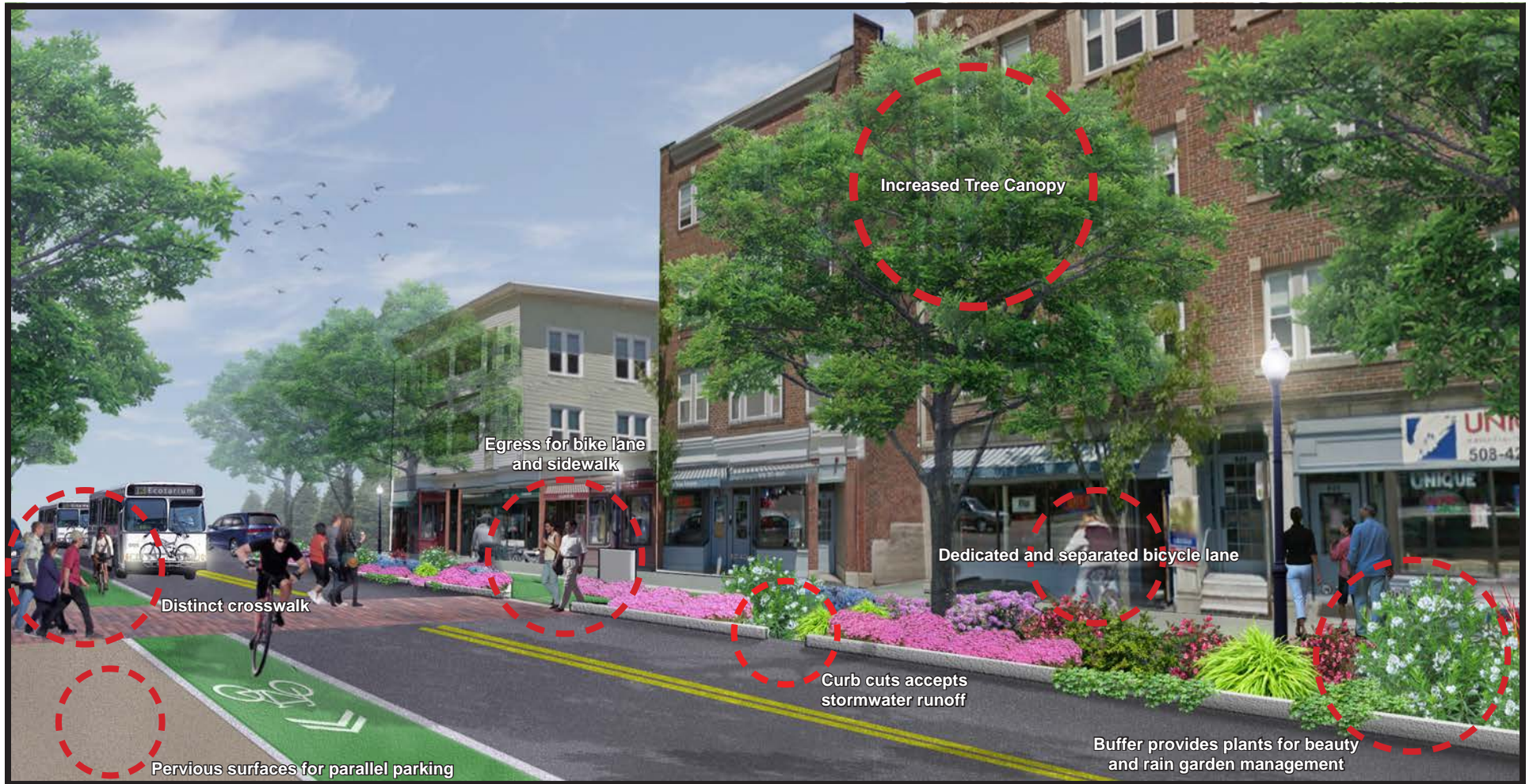
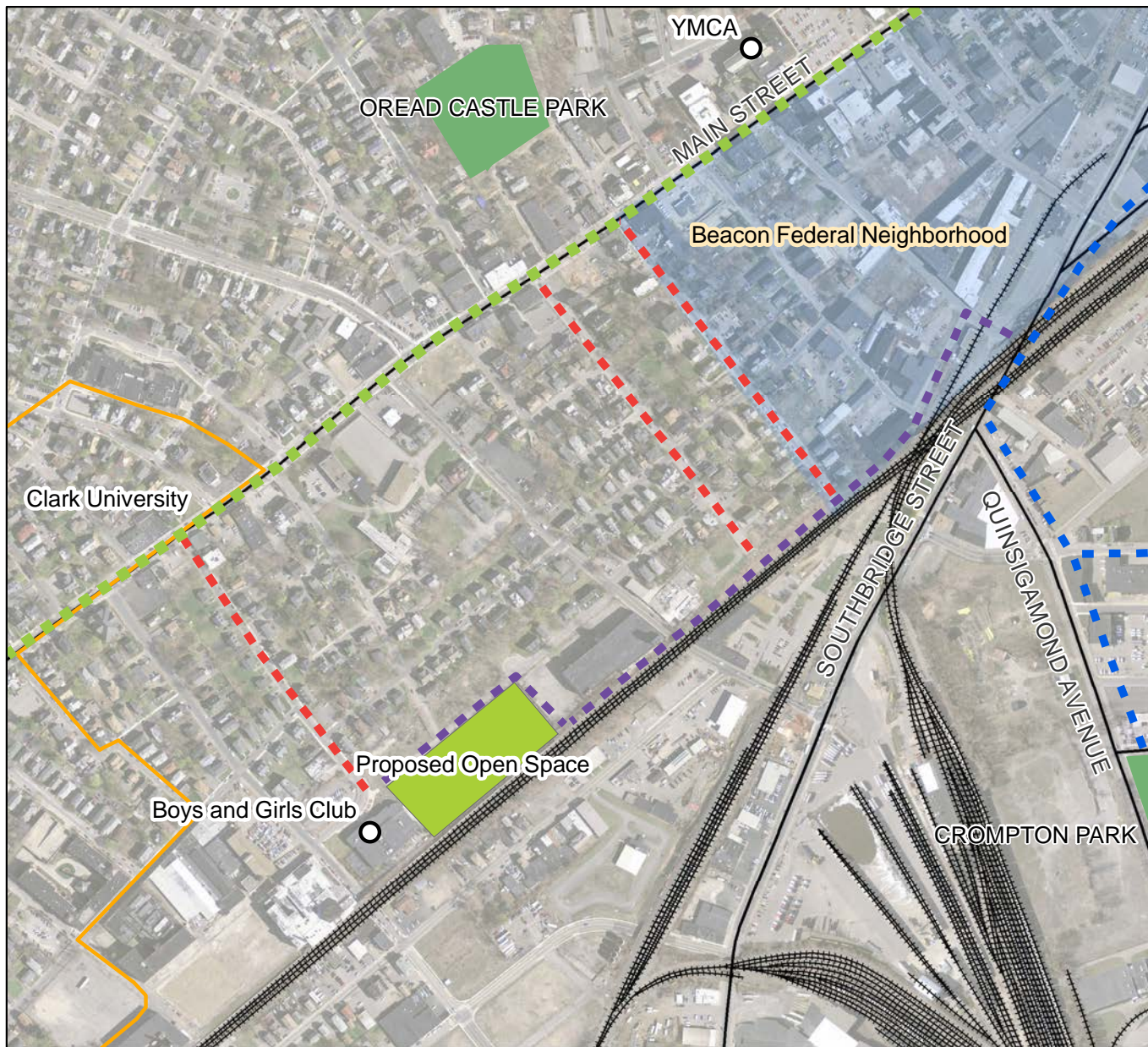


Figure 18: The design proposal for a typical wide street with crosswalk. A wider street allows for a increased buffer size on one side and parallel parking on the opposite side that can be designed with pervious materials to allow for infiltration into the soil. The crosswalk provides a distinct visual change that creates a safer experience when crossing the street.

WORCESTER SOUTH MAIN STREET Rail with Trail Connection



Legend

- Complete Green Street
- Bicycle Trail
- Rail Trail
- Proposed Open Space
- - - Existing Bicycle Trail
- Point of Interest
- + + + + + Active Rail Service
- College or University
- Open Space
- Pond, Lake, Stream

Key Development Areas

- Beacon Federal Neighborhood

Roads

- Interstate
- Highway
- Arterial Road

Prepared by: Matt Hisle Date: 2014 1 in = 400 feet 0 500 1,000 2,000 Feet

Figure 19: The proposed rail trail intends to connect the existing bike trail to a proposed open space next to the Boys and Girls Club.

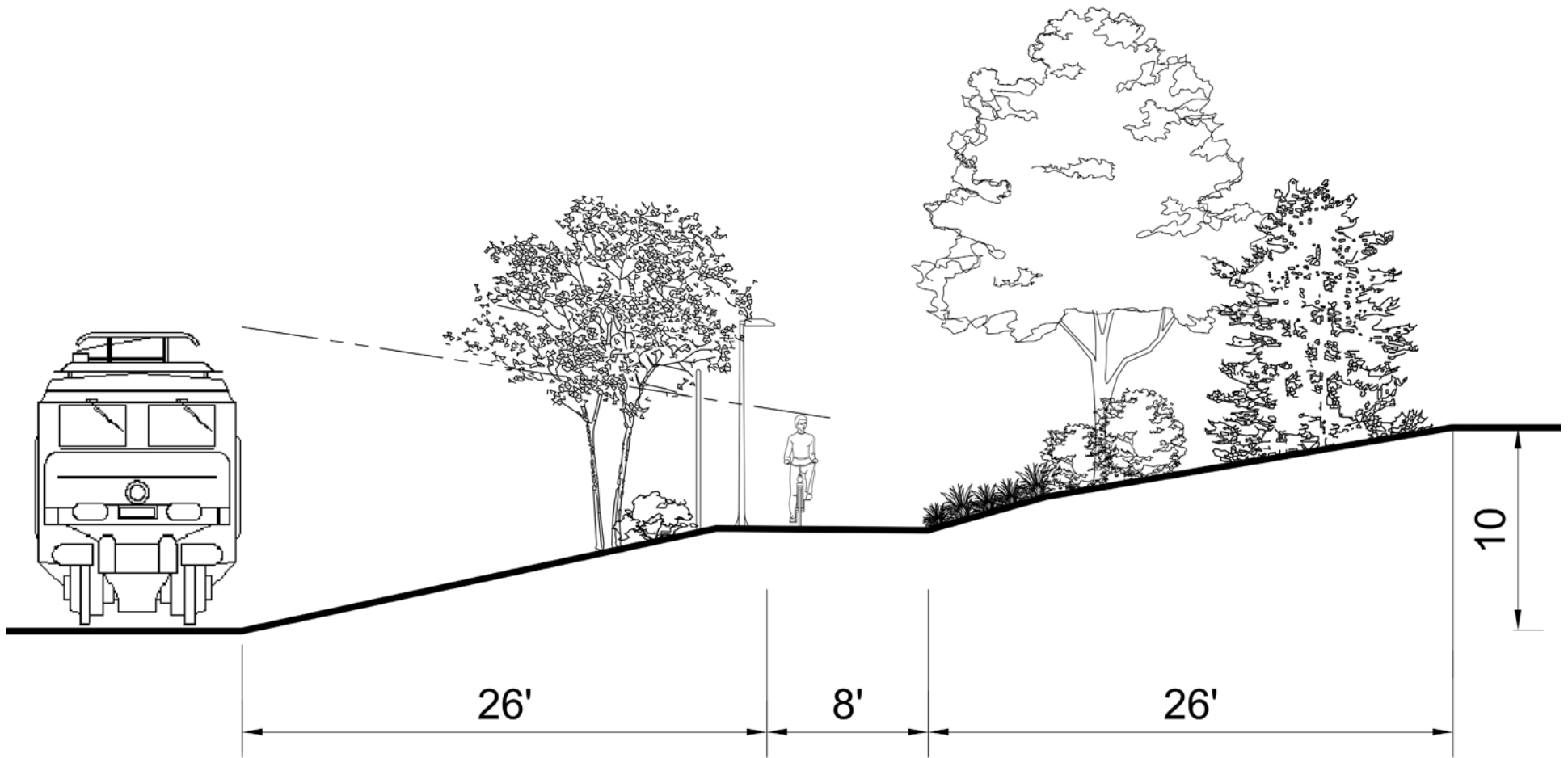


Figure 20: A section of the proposed rail trail shows how the trail can be separated from the train tracks with a vegetation buffer, fence and change in elevation.

through the rail line's property boundary until it reaches a large vacant open space adjacent to the Boys and Girls Club and then it would continue back towards Main Street via Gardner Street. This large vacant space is one that has been proposed for a new green space in the city by this reports recommendations. Along this trail would be access to the existing Oread Street and Sargent Court providing additional opportunities for access. At any given point along the trail the width from rail line to the edge of the rail road's property where it abuts the city property boundary is approximately fifty-five and sixty-five feet with difference in elevation between the tracks and the property line being ten feet higher at the property

line (Figure 20). This provides plenty of space to design a fully functional trail system. Having a trail along an active rail line seems dangerous, but in recent years the popularity and viability of such trails is increasing ("Rails" 4). Certain measures are provided in this design to ensure that safety is the top priority. According to the Rails to Trails Conservancy guidebook to Rails with Trails the top safety guidelines include: providing adequate distance between track and trail, providing safe fencing, barriers, or grade separation, and installing adequate trail-user warning signs ("Rails" 7). All of these considerations are represented in this proposal (Figure 21). By running the trail midway between the tracks and the property

line there is a distinct separation in terms of distance, as well as, grade separation. To reinforce the separation a fence and row of planting is placed between the trail and the tracks (Figure 22). Access to Oread Street and Sargent Court could be administered through pathways that break off from the main trail. These would have to break off at an angle to compensate for the additional five feet of elevation change to get from the trail to the street. Also at these entry points it is proposed to have lighting to increase safety in case there was a biker at night. Although this is a radical idea it does provide a legitimate access route for people in the South Main Street neighborhoods, especially near Clark University, to reach the existing bicycle trail that leads south to Crompton Park.

All of the design solutions presented are intended to improve the viability of the South Main Street Corridor as a thoroughfare that reaches into a community that may be passed over when public works projects are decided. Communities that have a lower socioeconomic status like this one could benefit greatly from an improved system for transportation. The opportunities that are becoming apparent in the downtown area are intended for everyone because it is their tax dollars funding the projects. By improving this connection the city would be extending the benefits and opportunities that are blossoming in the downtown core of the city to the community surrounding South Main Street Corridor.

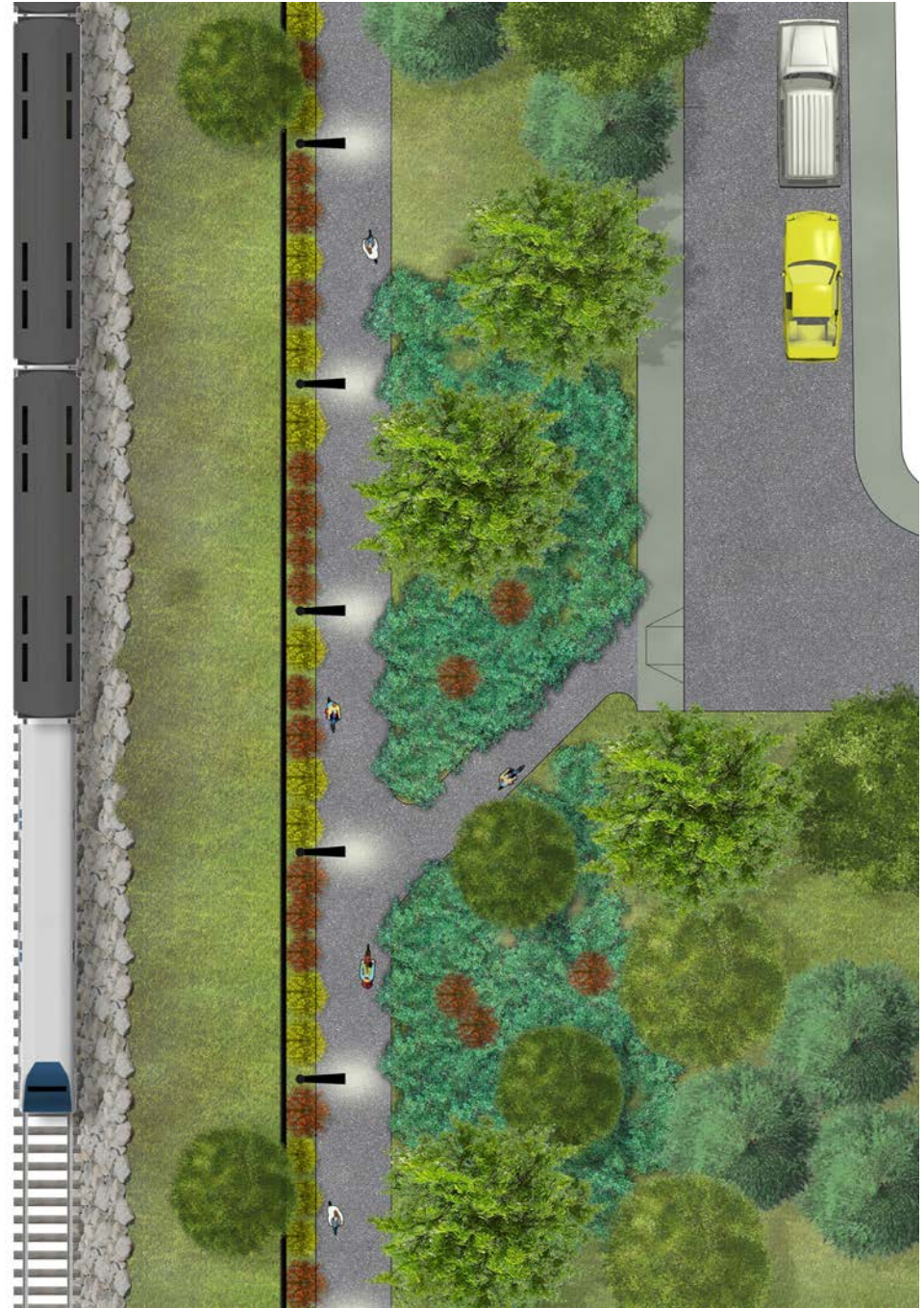
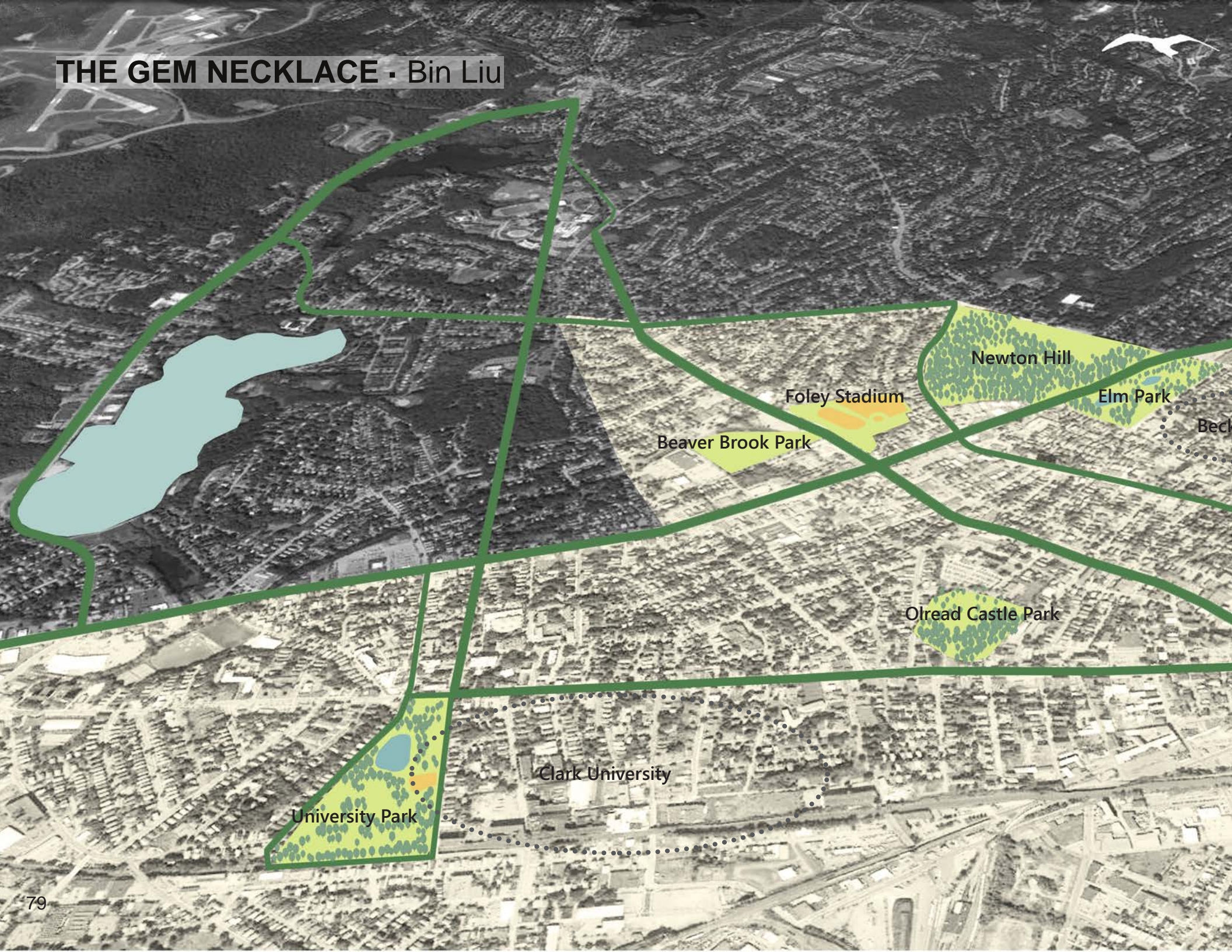


Figure 21: This plan rendering shows the separation of space between the tracks and the trail and how the trail can connect to existing streets.



Figure 22: The design proposal for the rail trail includes emphasizing a strong separation between the trail and train tracks. This is done with fencing, vegetation and a change in elevation. This separation is intended to create a safe environment for users while also preventing access to the tracks.

THE GEM NECKLACE - Bin Liu



University Park

Clark University

Beaver Brook Park

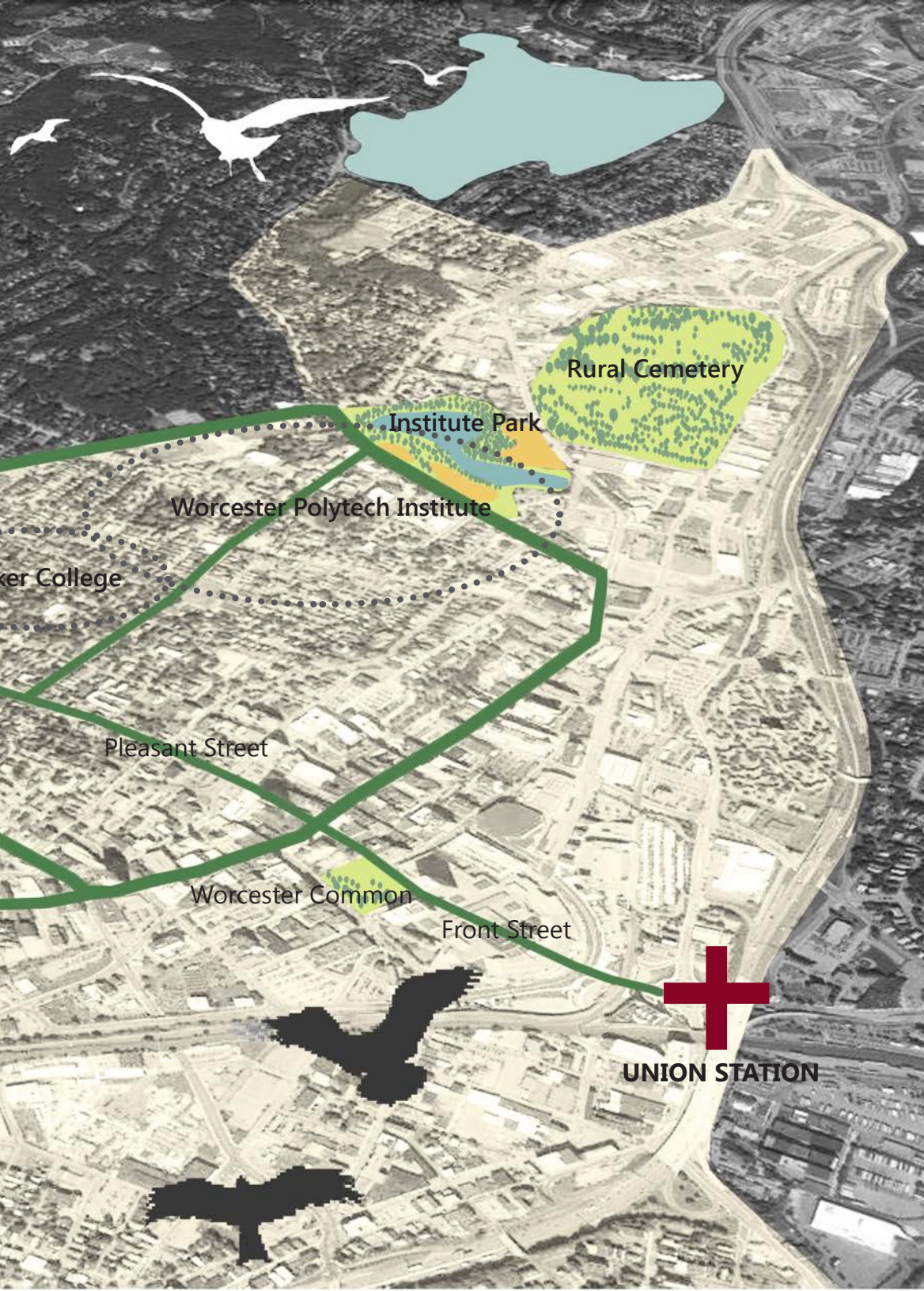
Foley Stadium

Newton Hill

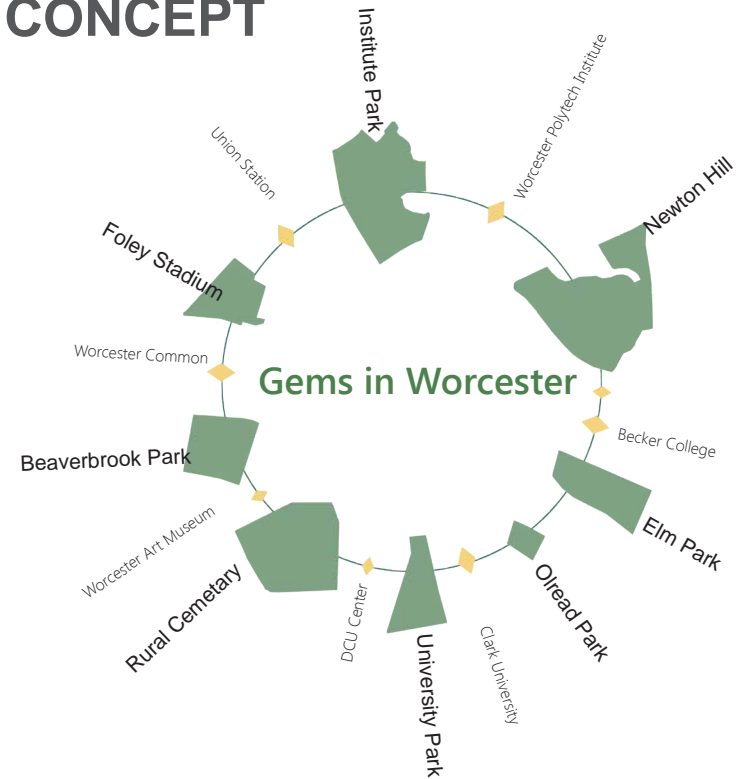
Elm Park

Olread Castle Park

Beckley Park



CONCEPT



Worcester is the second largest city in New England, with rich natural, cultural and recreational resources. Around the downtown area, there are numerous parks including University Park, Newton Hill, Elm Park, Institute Park, Worcester Common, Rural Cemetery, Beaver Brook Park. Also several colleges including Worcester Polytechnic Institute, Becker College and Clark University next to Worcester downtown. They are like the beautiful gems in Worcester. The problem is all the green space and rich resource are disconnected and separated. The concept is by using Park Avenue and Pleasant Street connect these gems into a green necklace.

PLAN

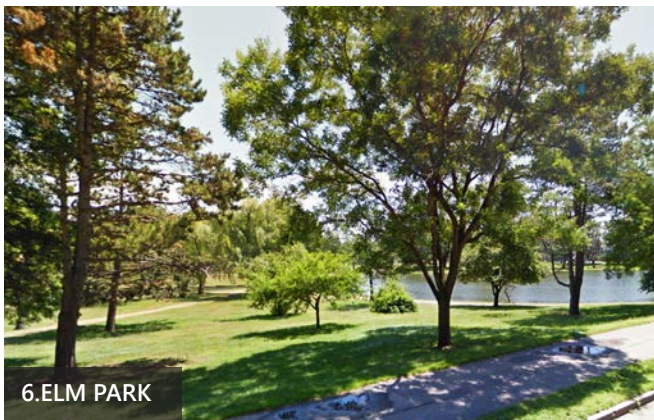




4.WORCESTER COMMON



5.INSTITUTE PARK



6.ELM PARK

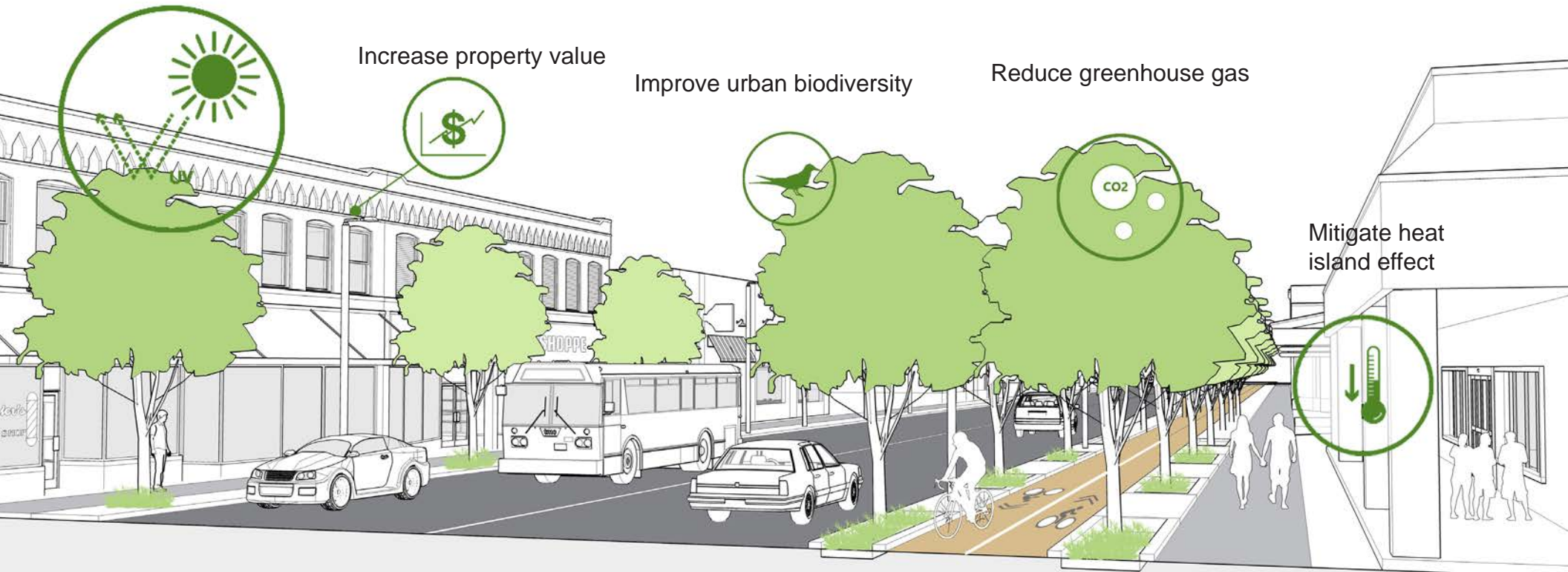
For green infrastructure, connectivity is the key. And the greenway should perform multi-functions on natural, social and economical aspects. By developing new green street and complete street around downtown Worcester, green spaces, colleges and public places for recreation will be well connected with surrounding neighbourhood and transportation hub just like the gems on a necklace. With this better connection, residents in surrounding neighbourhoods can easier access green space and walk to downtown. Students in the City's schools and colleges will also be better connected to these resources and other campuses, fostering more interaction between the City's rich cultural and educational resources. With better walking and biking experience, people will be encouraged to exercise and improve their health.

WHY WE NEED STREET TREES

Benefits of street trees

1. Reduce exposure to UV Rays: trees shade can reduce the risk of sunburn and skin cancer for pedestrian and bikers.
2. Increase property value: the street tree can add value on property value, a lot of economic studies show that property values are higher with water feature and vegetation.
3. Improve urban biodiversity: tree canopy can provide habitat for animals also fruit can provide food for the urban ecosystem.
4. Reduce greenhouse gas, improve air quality: street trees can absorb carbon dioxide and capture the gaseous pollutant.
5. Mitigate heat island effect: street trees can provide shade for building and cooling the air through transpiration.

Reduce exposure to UV Rays



Increase property value

Improve urban biodiversity

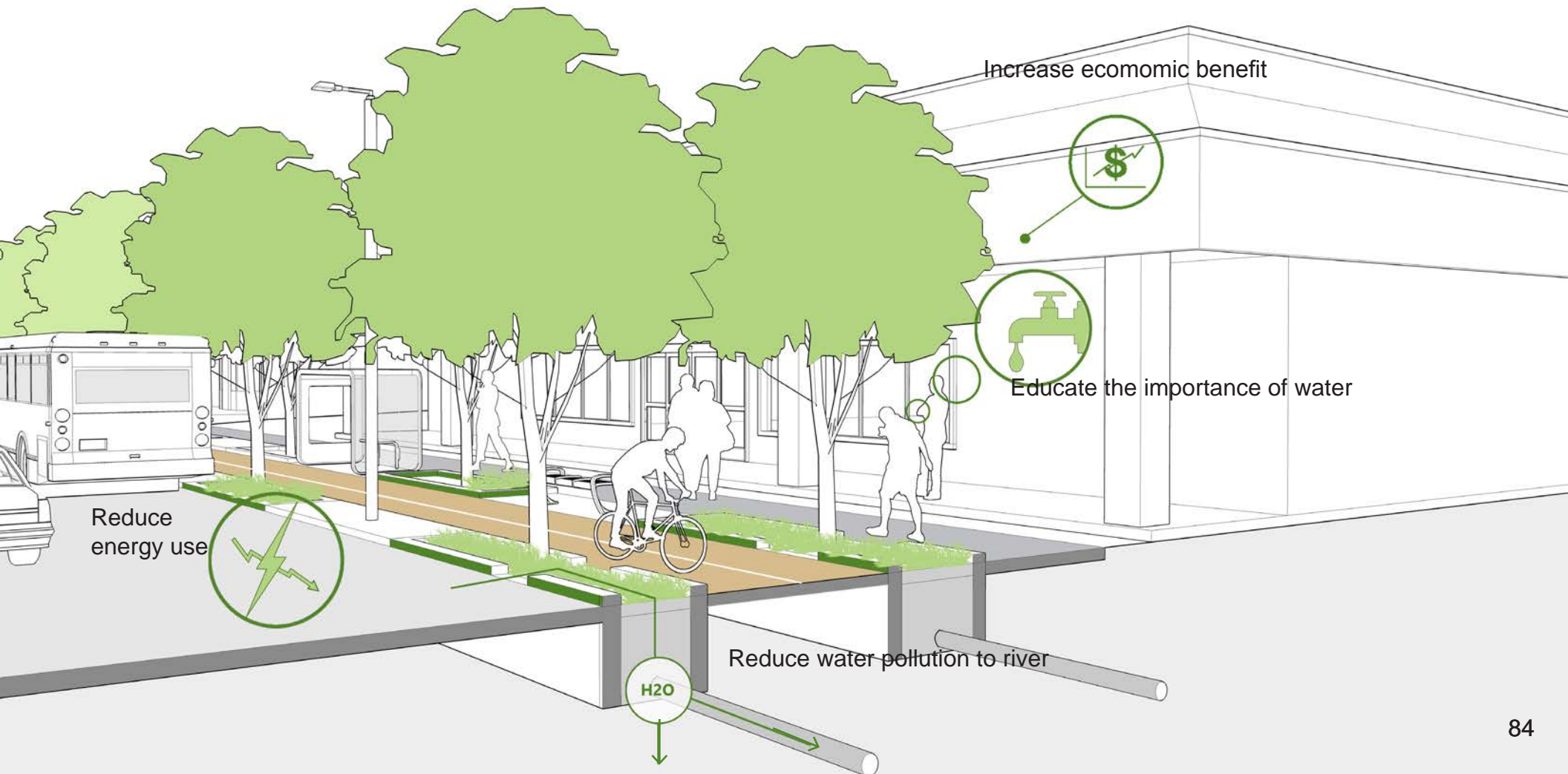
Reduce greenhouse gas

Mitigate heat island effect

WHY WE NEED STORMWATER MANAGEMENT

Benefits of street trees

1. Increase Economic Benefits: Some surveys shows that consumers are willing to stay longer, visit more frequently, and even pay more for parking in shaded, well-landscaped business districts.
2. Educate the importance of water: When people see the rainwater flow into planted area, they will more likely to understand the importance on the water management in the city.
3. Reduce energy use: For using traditional CSO(Combined sewer operation), water will go to the waste water treatment plant, and by using green infrastructure can help to reduce the use of energy to pump and treat the water.
4. Reduce water pollution to the river: stormwater management can reduce the amount of stormwater runoff from road and buildings, plant and soil can help to filter and clean the pollutatn in rain water.



PARK AVENUE: GREEN LINE CONNECT GEMS IN WORCESTER

Along the Park avenue, there are rich natural, cultural and recreational resource. Among the parks, Elm park is a historical park designed by Frederick Olstead Office and according to the memorial plaque's claim, the Elm park was the first public park in the United States(1854). The park has a playground, tennis court, basketball and winter skating. By designing park avenue into a complete green street will help to connect the parks into a more integrated park system, at the same time provide more oppurtunities for people to access to surrounding green space do recreational activities.

Reference:

<http://www.worcesterma.gov/dpw/parks-rec/city-parks/elm-park>

Currently the park avenue is 4 lanes street, with 12 feet wide sidewalk on each side without street trees. The proposed idea is still keep the park avenue as 4 lanes street considering the heavy traffic. Shrink the width of travel lane from 14 feet to 11 feet. A 8 feet wide two lanes bike lane will be proposed, separated by planting area and street trees, provide safer experience for pedestrians and bikers. Also planting bed will be designed into rain garden help to collect rain water and the run off from the road.



RURAL
CEMETARY

INSTITUTE
PARK

WORCESTER
POLYTACH
INSTITUTE

NEWTON
HILL

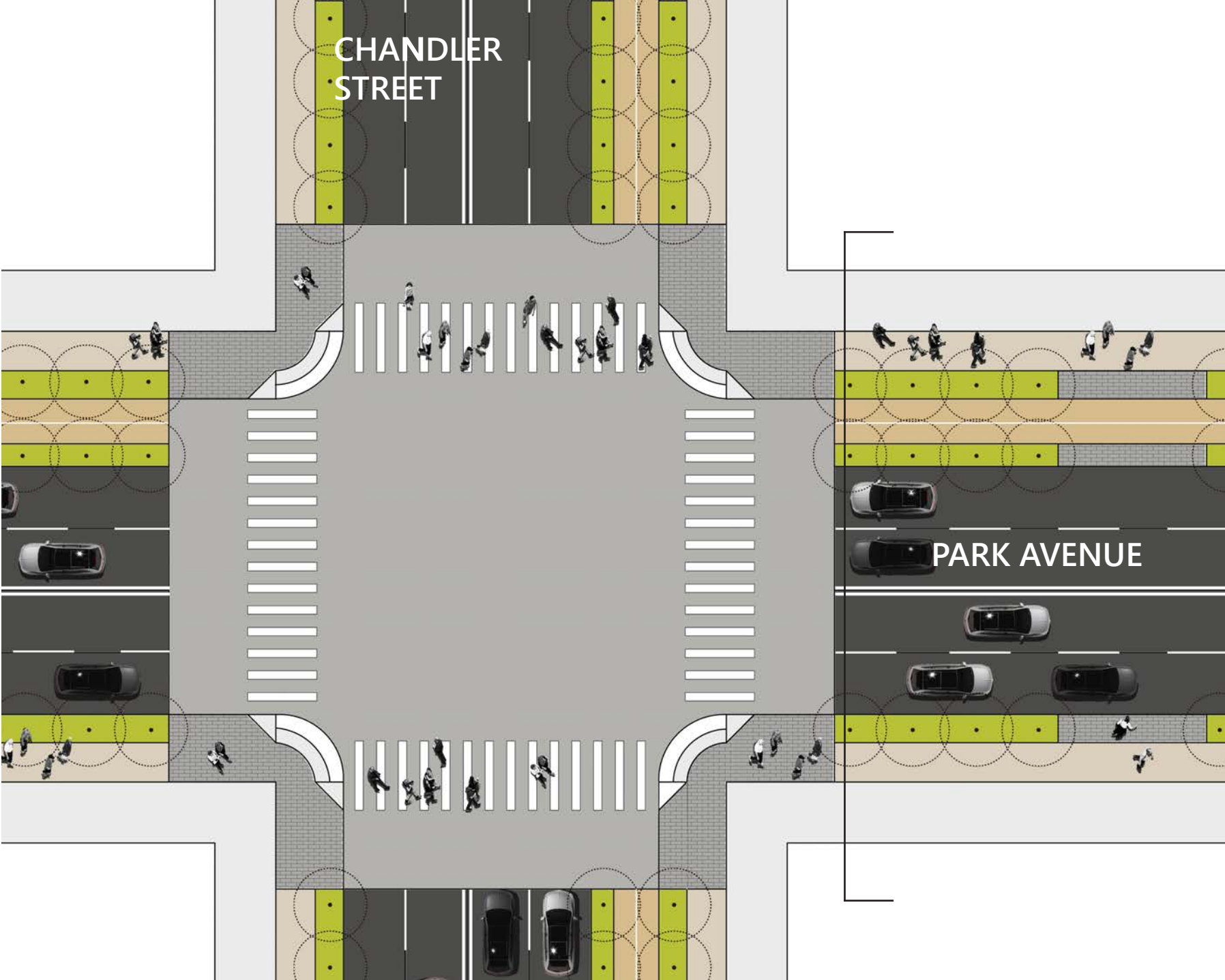
ELM
PARK

BECKER
COLLEGE

FOLEY
STADIUM

BEAVER
BROOK
PARK

PARK AVENUE TYPICAL PLAN

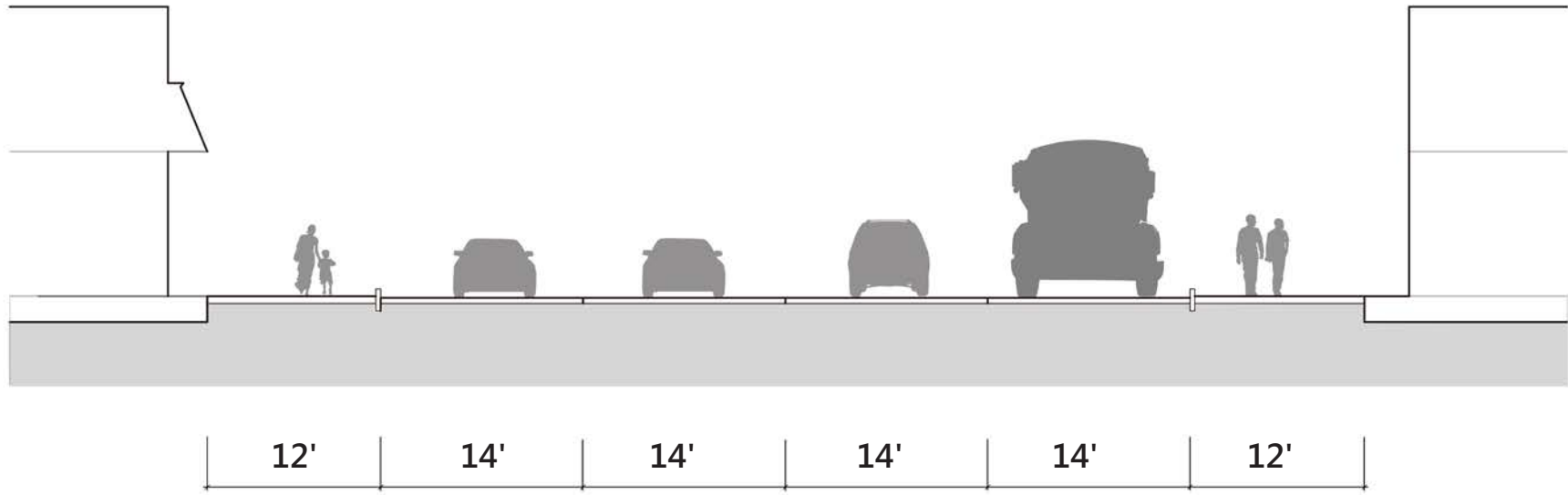


CHANDLER STREET

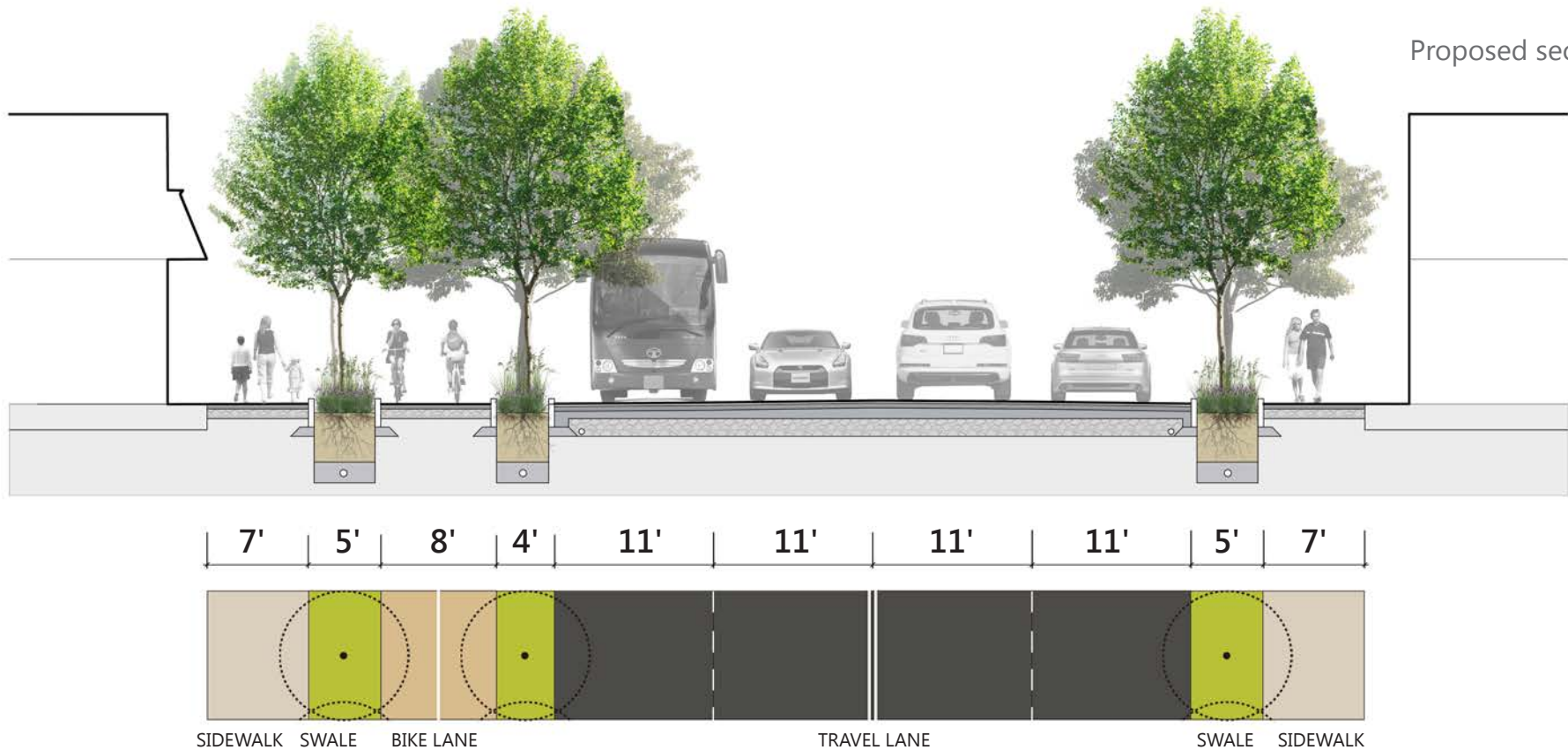
PARK AVENUE

PARK AVENUE SECTIONS

Existing condition



Proposed section



TREE CANOPY PROVIDE HABITAT FOR BIRDS

EASY ACCESS TO RECREATIONAL SPACE

PROVIDE FOOD FOR POLLINATORS

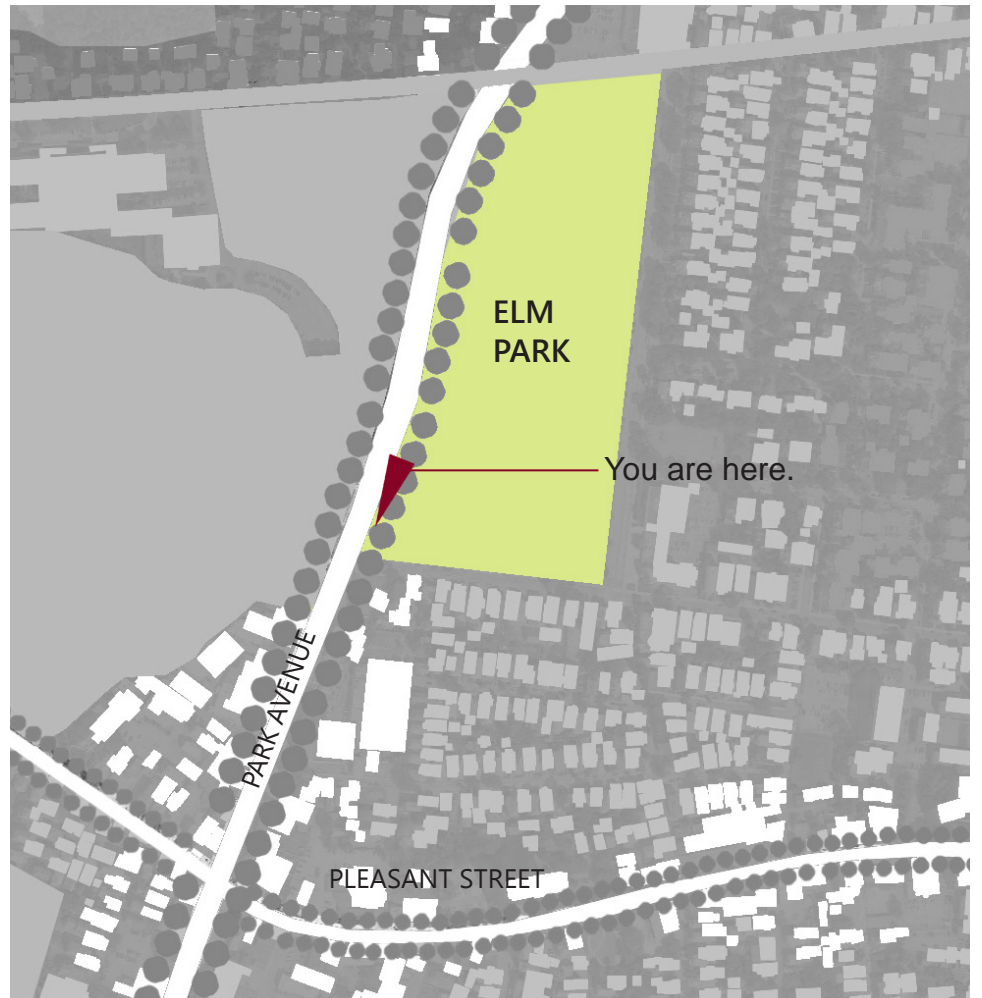
HELP STORMWATER INFILTRATE

PERMEABLE PAVING





Bin Liu Photography



PLEASANT STREET: **IMPORTANT CONNECTION**

Pleasant Street is the most important road connecting the surround neighborhood with the City's transportation hub Union Station, open space Worcester Common and the Park Avenue linking several green spaces.

Worcester City Hall and Common also named Paul V Mullaney Plaza is the civic heart of the city. The common was established in 1669, originally encompassed about 20 acres compared with its present size of 4.4 acres. A meeting house used for both town meetings and religious functions was constructed on the Common in 1719. The city hall and common were added to the National Register of Historic Places in 1978.

And Union Station is located at Washington Square in downtown

Worcester. It was originally built in 1911 and was abandoned in 1975 then fell into disrepair. And the union station got renovated and opened in 2000 serve as bus and commuter rail terminal also hosts a single Amtrak train daily. There is a talk about extend high speed train service to Worcester. So Union Station will be a more and more important transportation hub in Worcester.

By redesigning Pleasant Street, residents will benefit from better access to the core of city and the transportation hub to travel. New street trees, street furniture and wayfinding will be provided. Travel lane will be designed as the shared lane for bikes and cars considering the traffic condition of the street, 8 feet wide on street parking will be kept for people's convenience and help to calm down traffic.

Reference:

http://en.wikipedia.org/wiki/Worcester_City_Hall_and_Common

<http://www.worcesterma.gov/dpw/parks-rec/city-parks/city-hall-common/>

[http://en.wikipedia.org/wiki/Union_Station_\(Worcester,_Massachusetts\)](http://en.wikipedia.org/wiki/Union_Station_(Worcester,_Massachusetts))



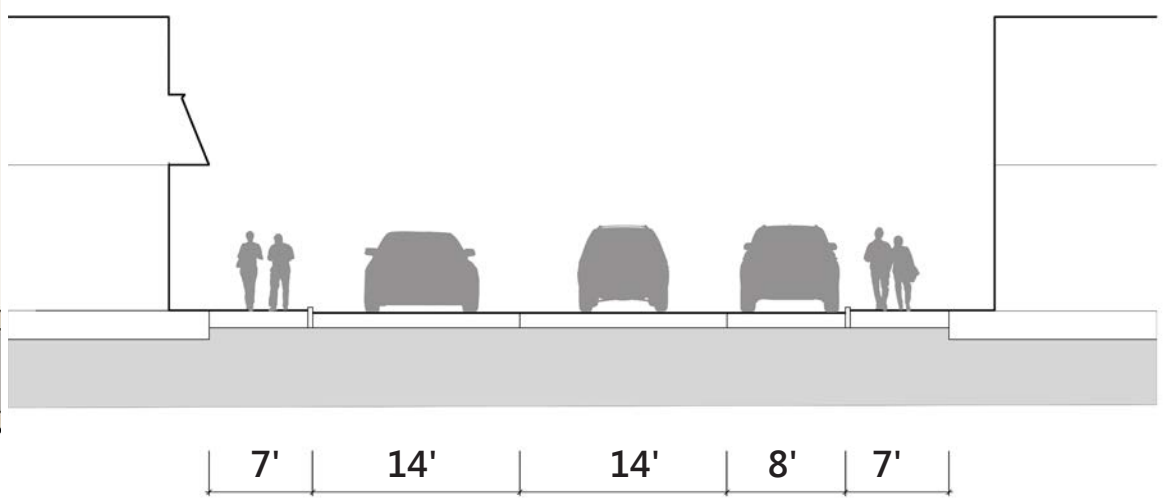
NEWTON HILL

WORCESTER COMMON

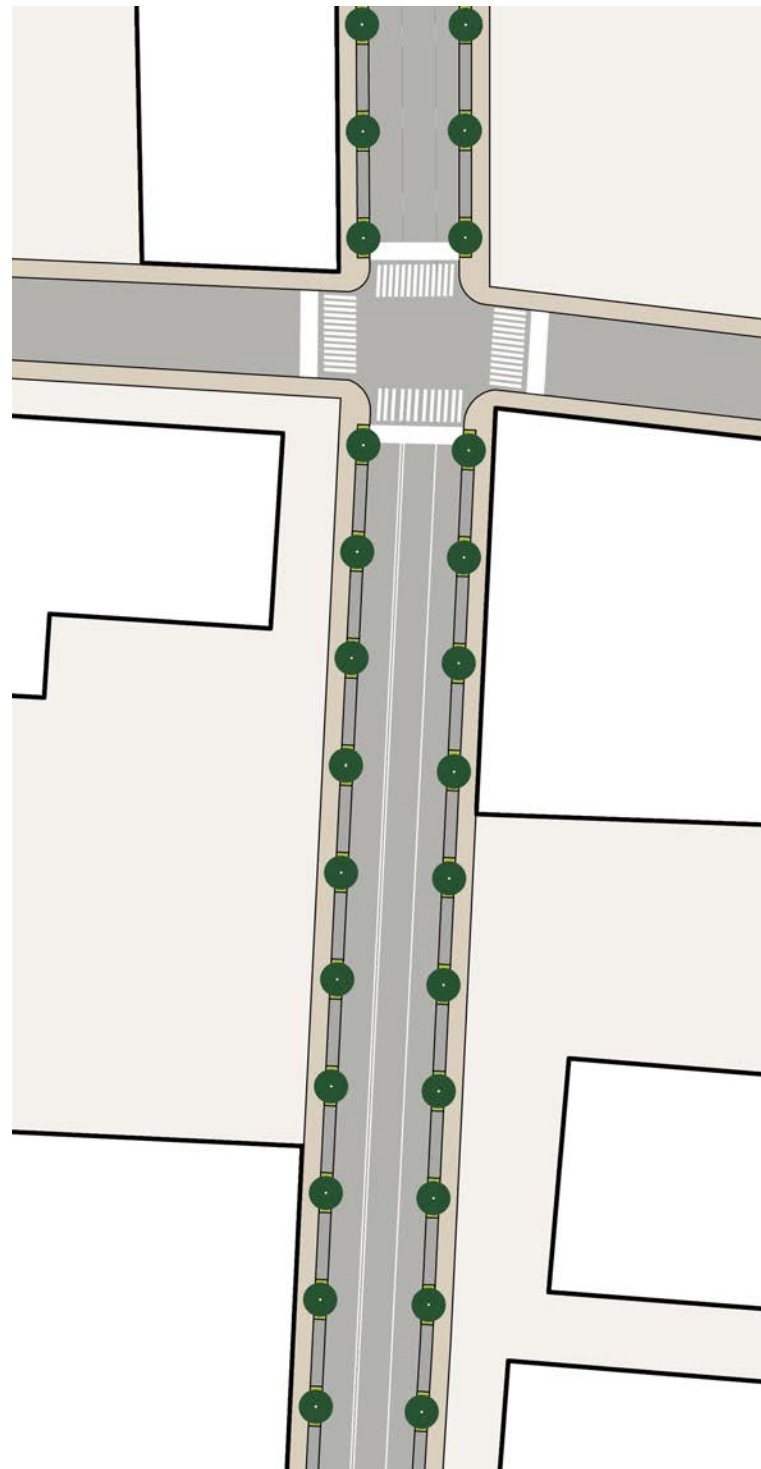
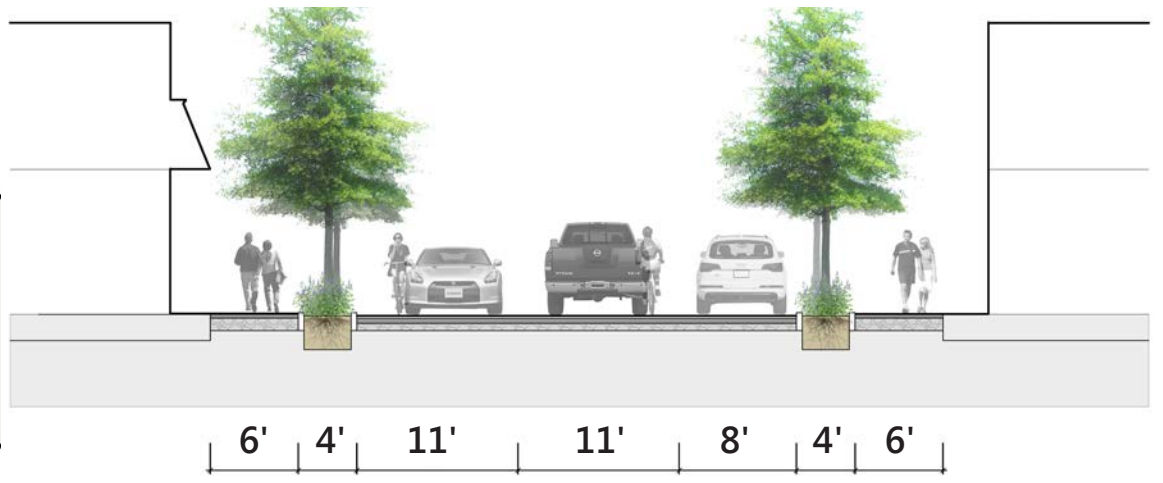
UNION STATION

PLEASANT STREET TYPICAL PLAN

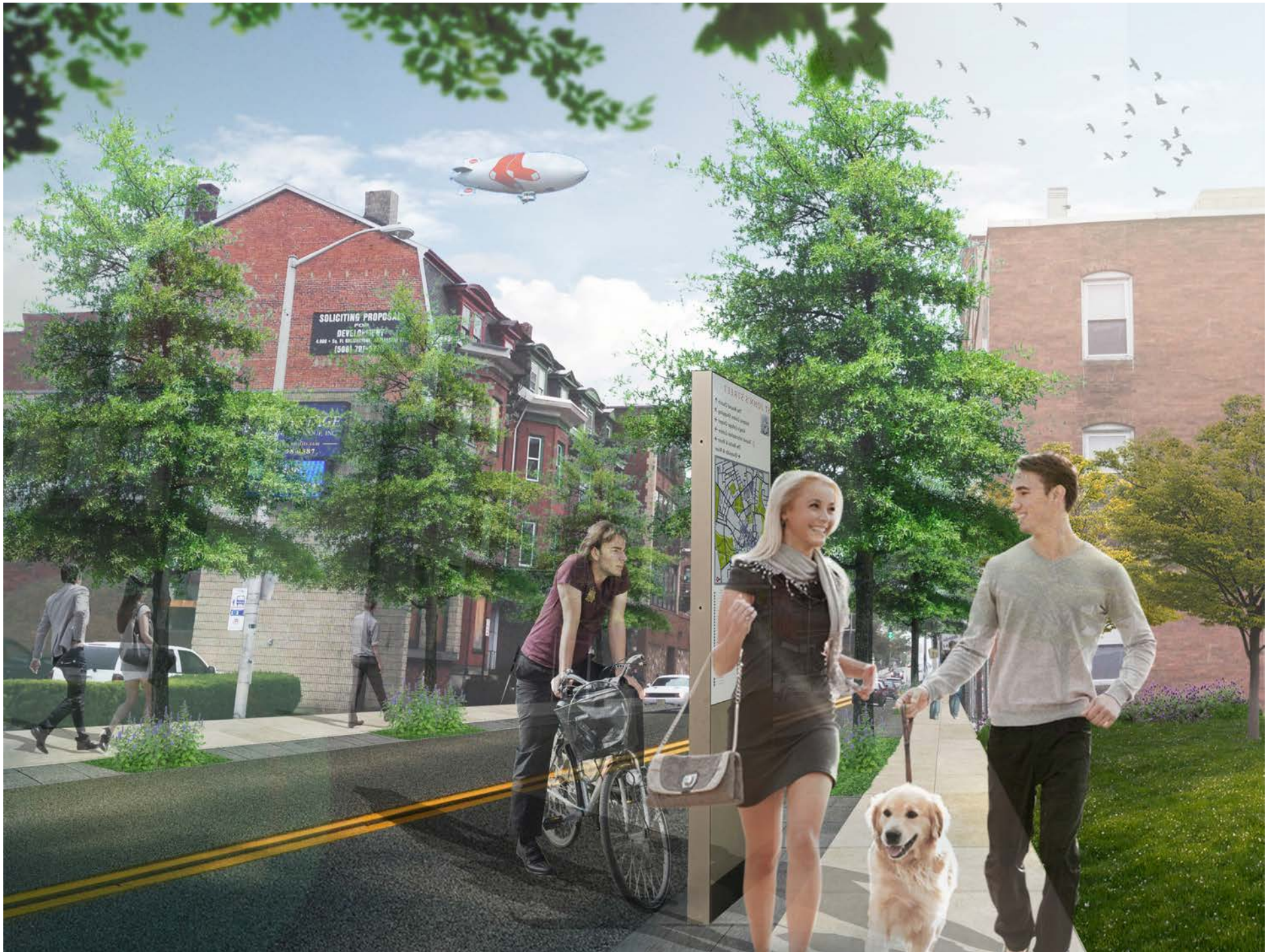
Existing condition



Proposed section



SIDEWALK TREE PIT SHARED LANE PARKING LANE TREE PIT SIDEWALK



FLUX ECO-CORRIDOR · Junbo Zhang



6.2 MILE ECO-CORRIDOR

Reinstating the role of the Blackstone Canal as spine connecting north and south area of Worcester. Linear ecological corridor implemented with green infrastructure for dealing with stormwater runoff and gathers the neighborhoods together, connecting the Indian Lake and Middle River. Generating a adaptive greenway reduce the water energy low and increase the water infiltration

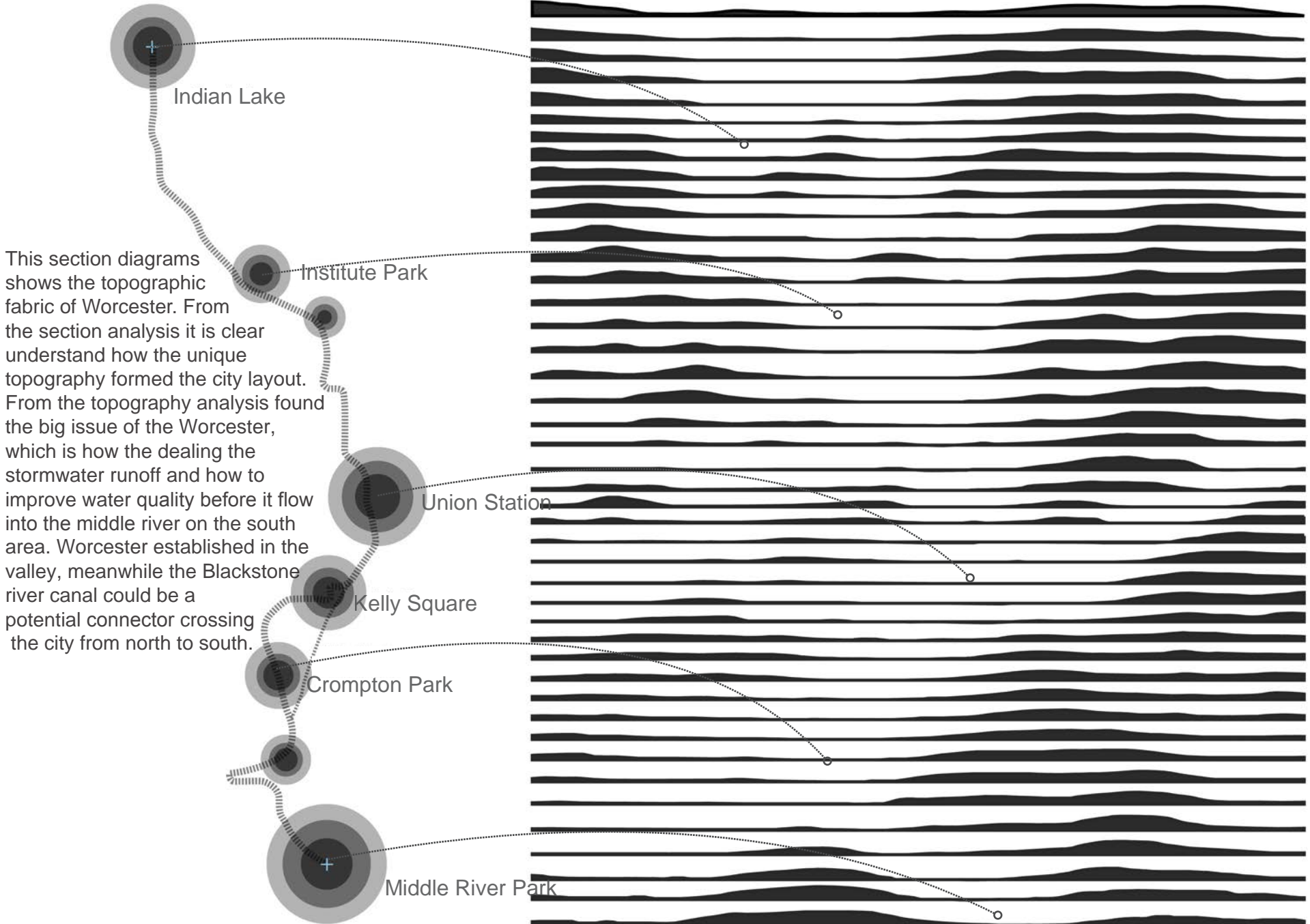
MULTI-PROGRAM + EXPERIENCE

1. Stormwater Management
2. Eco-diverse Wetland
3. Bike Park
4. Trail
5. Sport Park
6. Education
7. Watching

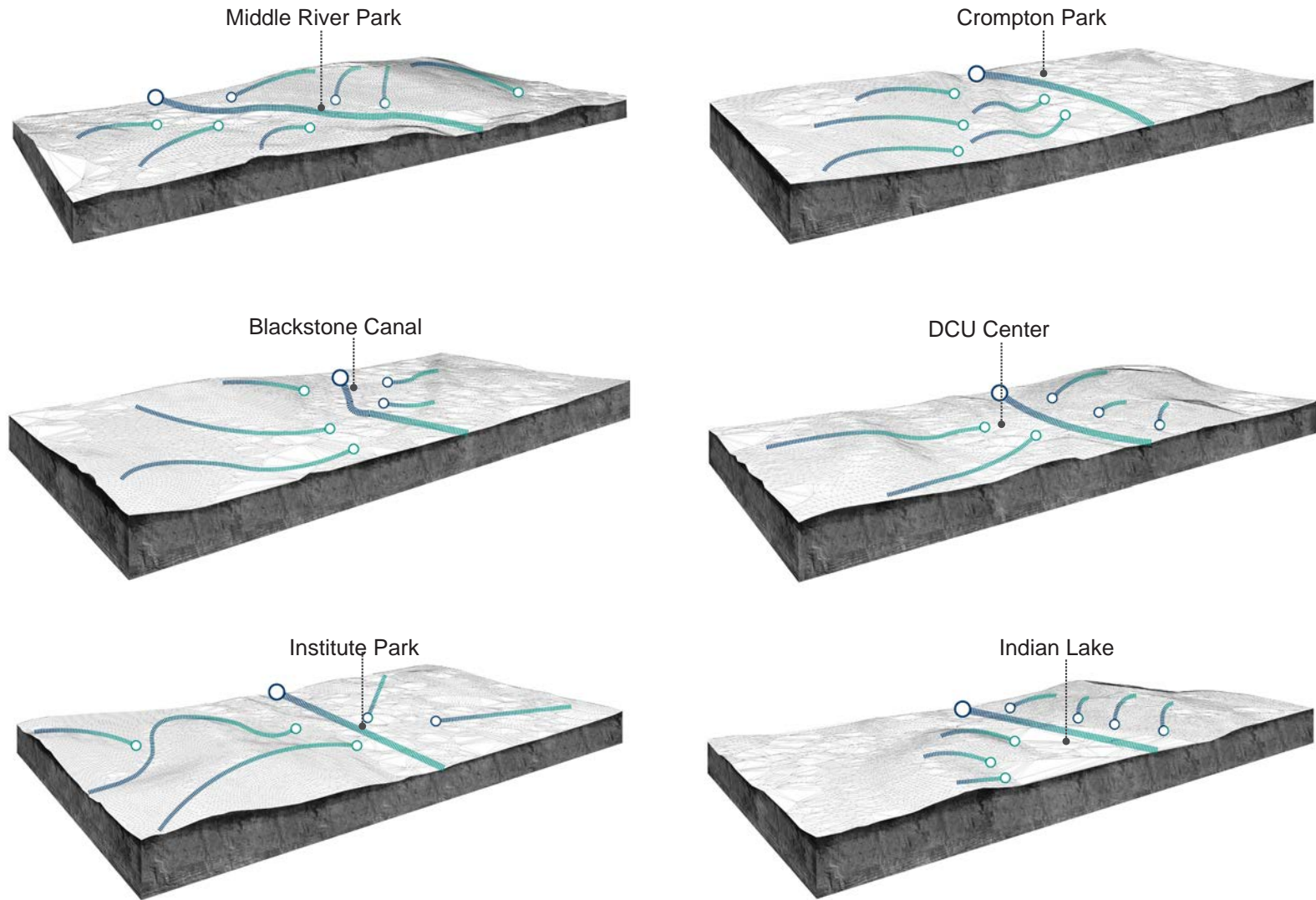


URBAN TOPOGRAPHIC GRAIN

SECTION



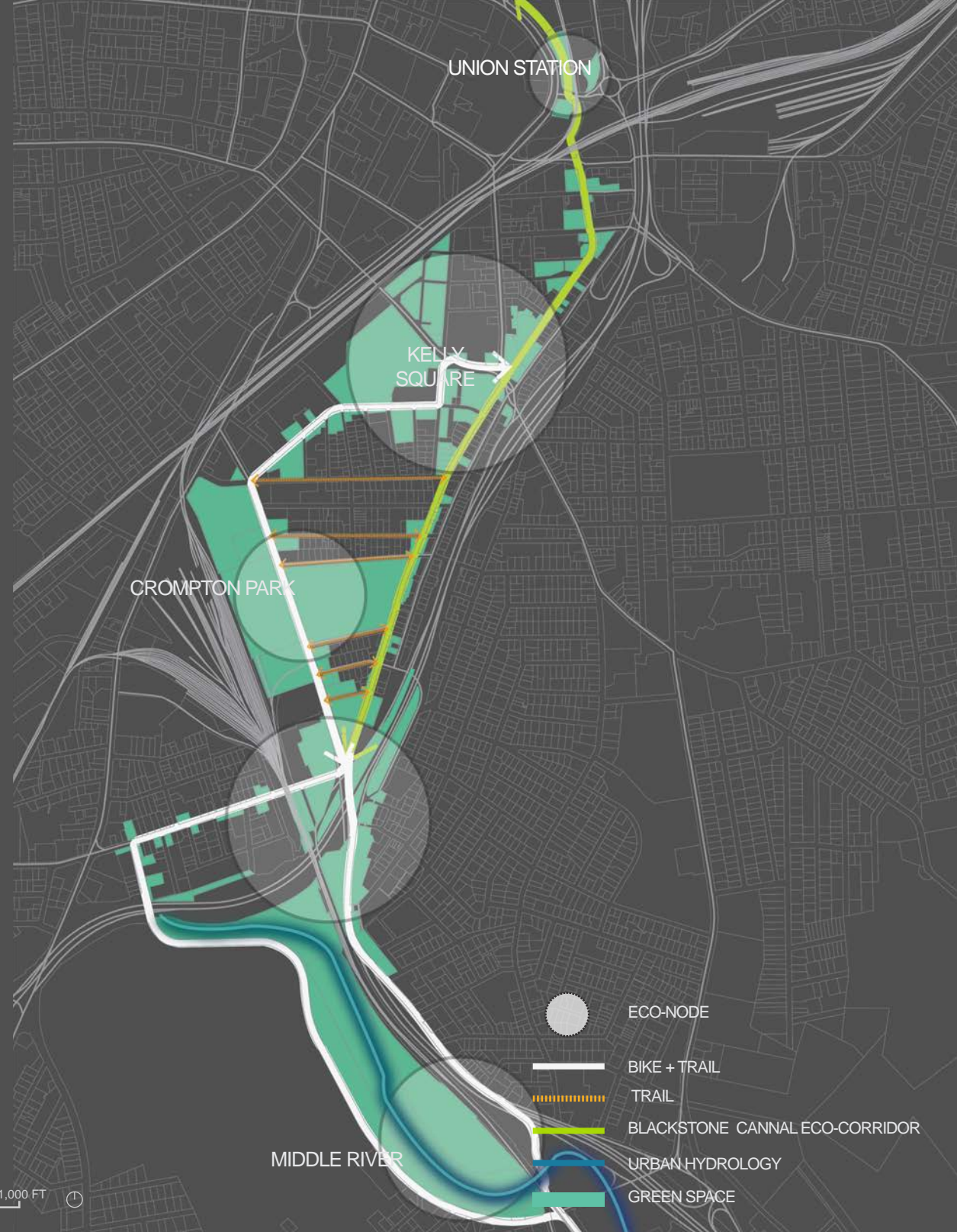
RAIN WATER FLOW

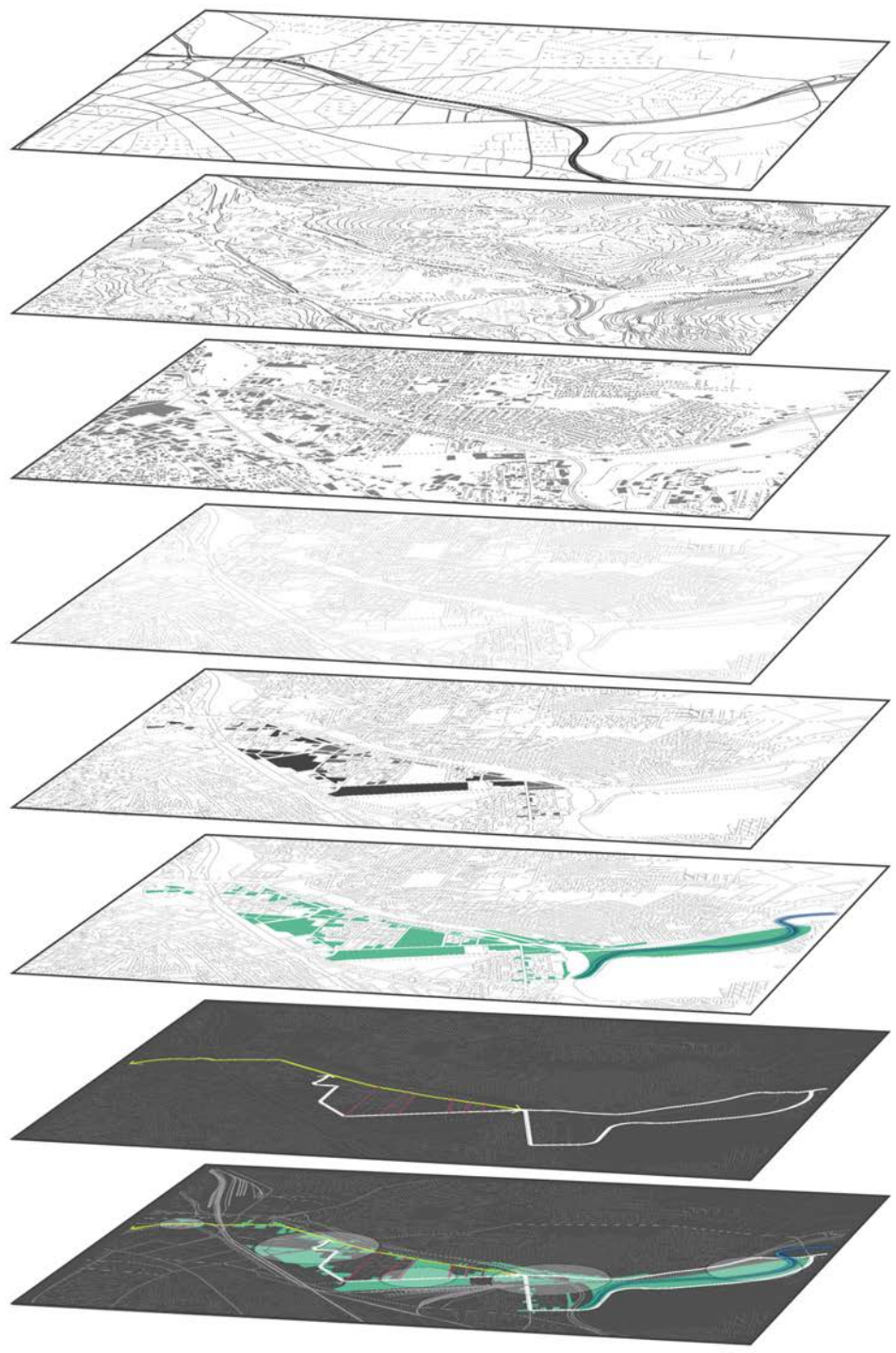


The diagrams show the rainwater following the topography going to the low point, and those water flow into the Blackstone canal underground. Blackstone canal connect each Eco-node together. Therefore the canal will be a better green way to implemented green infrastructure and multiple programs for improving stormwater management and tour experience.

ECO - ISLAND

Connecting existing green space and park on the each side of the Blackstone canal, find the abandoned lot as the potential open space implement with green infrastructure for generating a green infrastructure system to deal with stormwater runoff. Also the spine idea will reinforce the connection, the green street, from east to west, cross the Blackstone canal will extend the eco-corridor influence for the east and west neighborhoods, bring the each side of residents to the downtown area.





Urban Mobility

Topography







Structure Footprint

Urban Fabric

Vacant Lots
+
Impervious Lots

Proposed Green
Space

Proposed
Connection

-  ECO-NODE
-  BIKE + TRAIL
-  TRAIL
-  BLACKSTONE CANNAL ECO-CORRIDOR
-  URBAN HYDROLOGY
-  GREEN SPACE

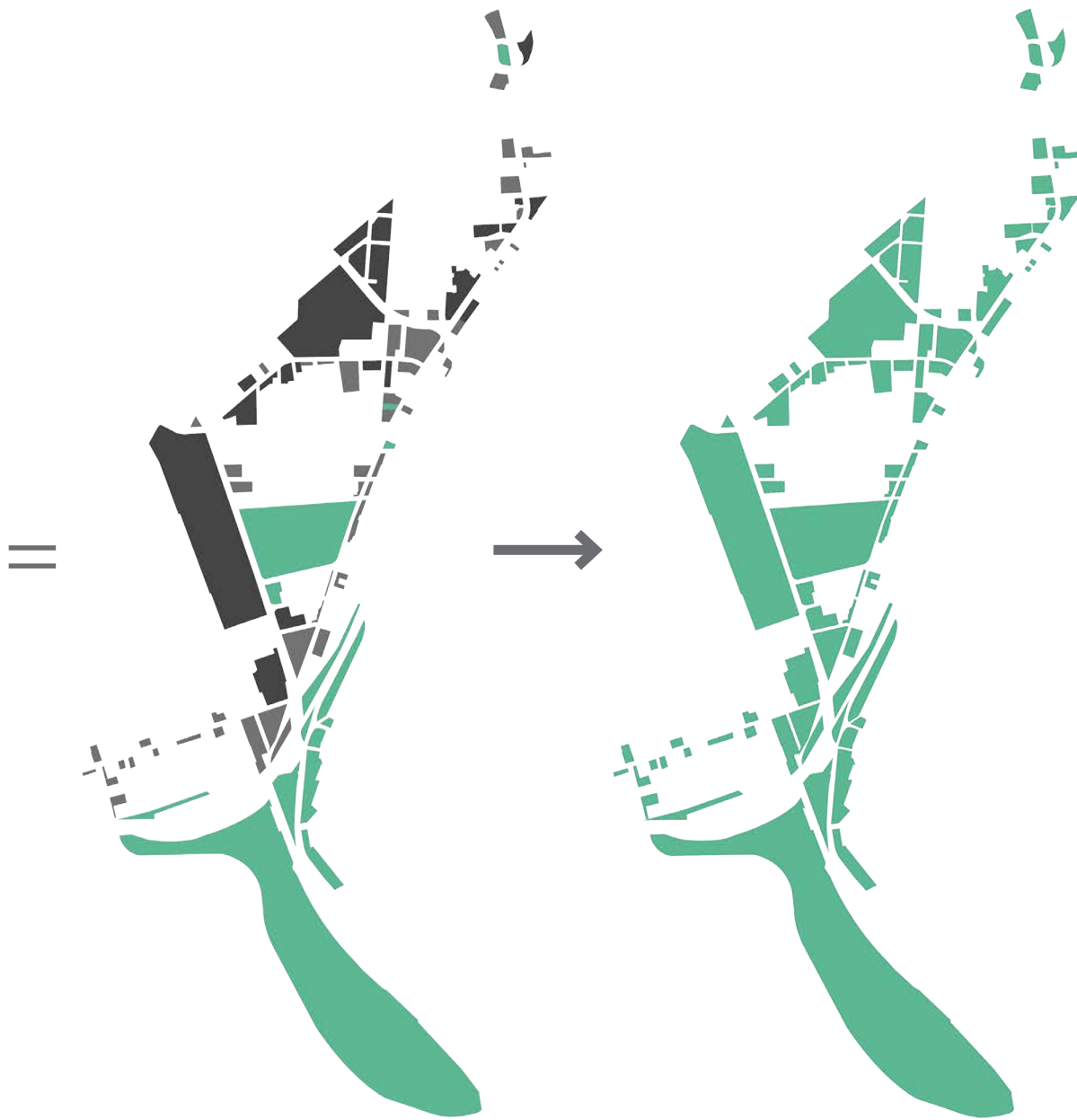
ECO-ISLAND STRATEGY



Vacant Lots

Impervious Lots

Existing Green Space

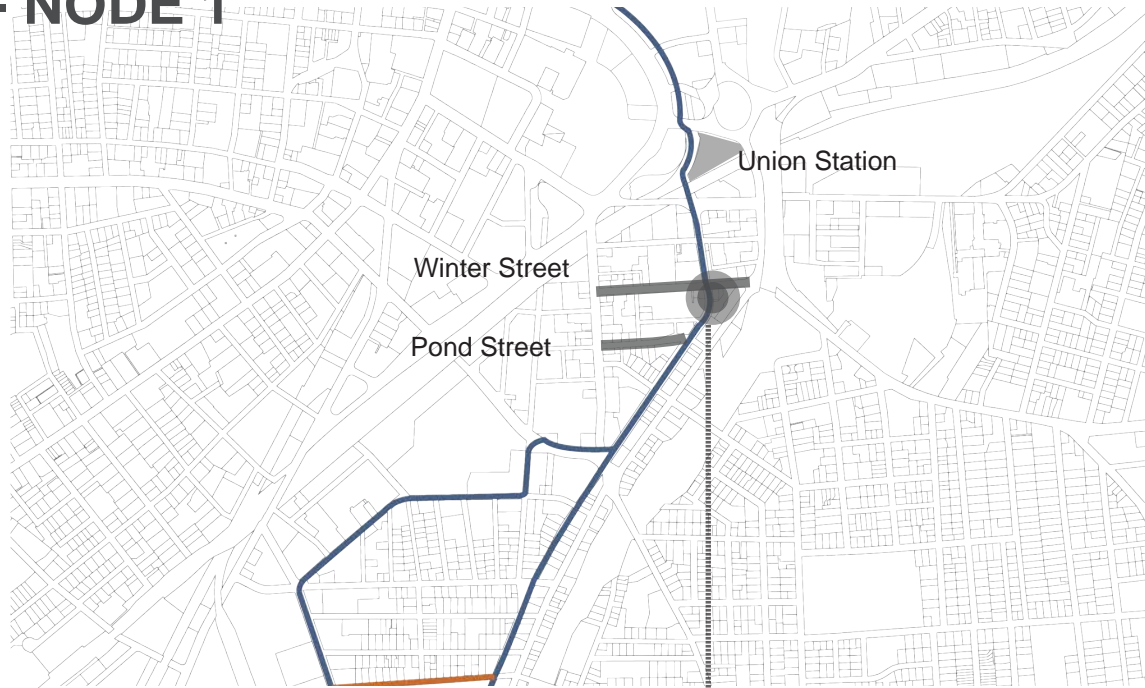


Lot Grain

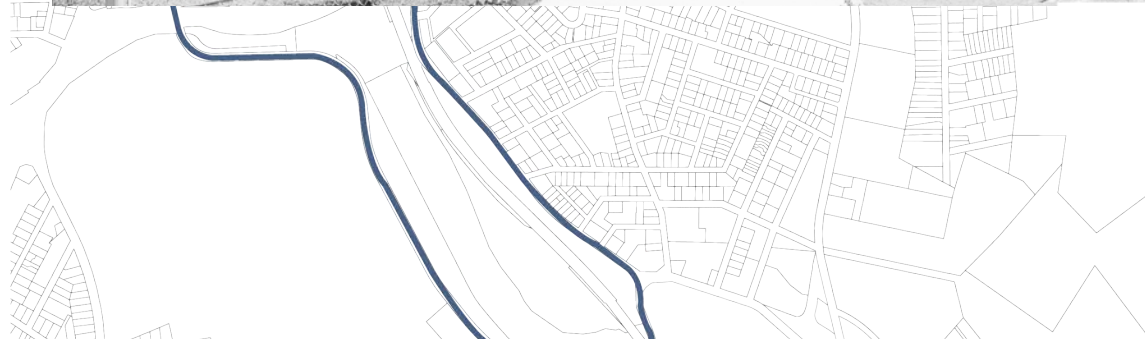
Proposed Green Fabric

Connecting existing green space and park on the each side of the Blackstone canal, find the abandoned lot as the potential open space implement with green infrastructure for generating a green infrastructure system to deal with stormwater runoff. Also the spine idea will reinforce the connection, the green street, from east to west, cross the Blackstone canal will extend the eco-corridor influence for the east and west neighborhoods, bring the each side of residents to the downtown area.

ECO - NODE 1



BEFORE



AFTER



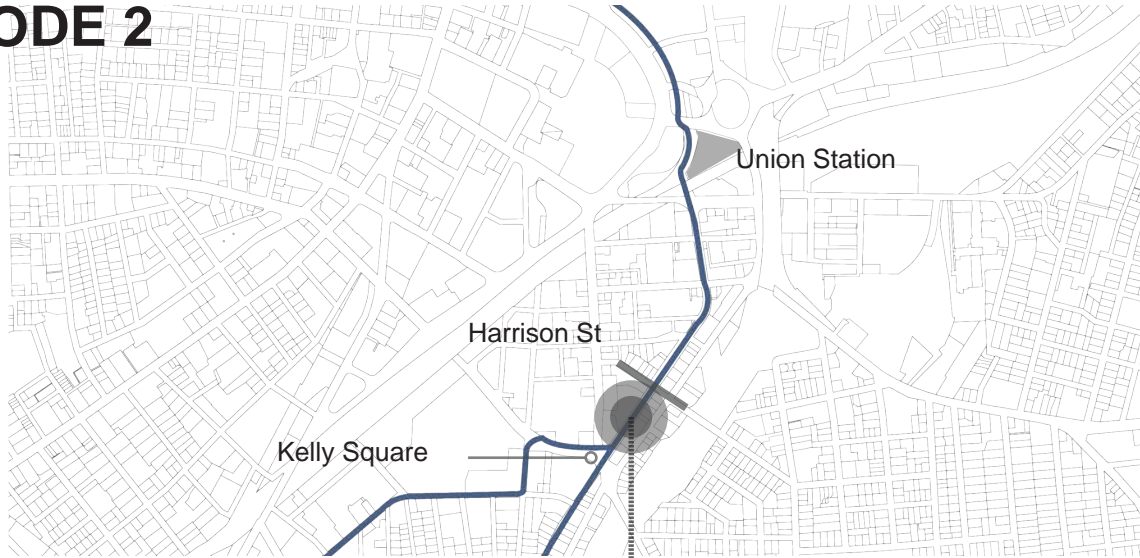
PROPOSED GREEN SPACE

BIKE LANE

TRAIL

BLACKSTONE CANAL

ECO - NODE 2



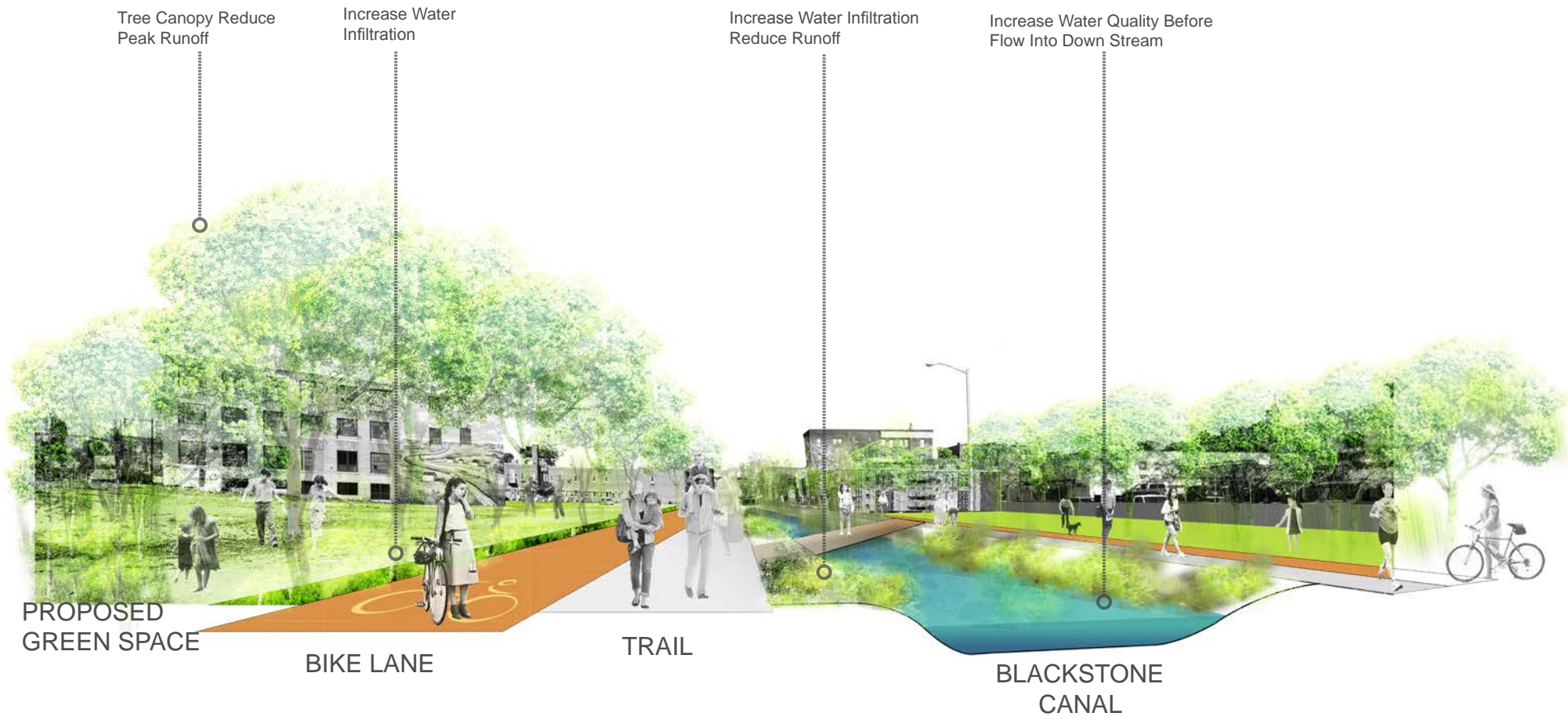
BEFORE



Junbo Zhang Photography



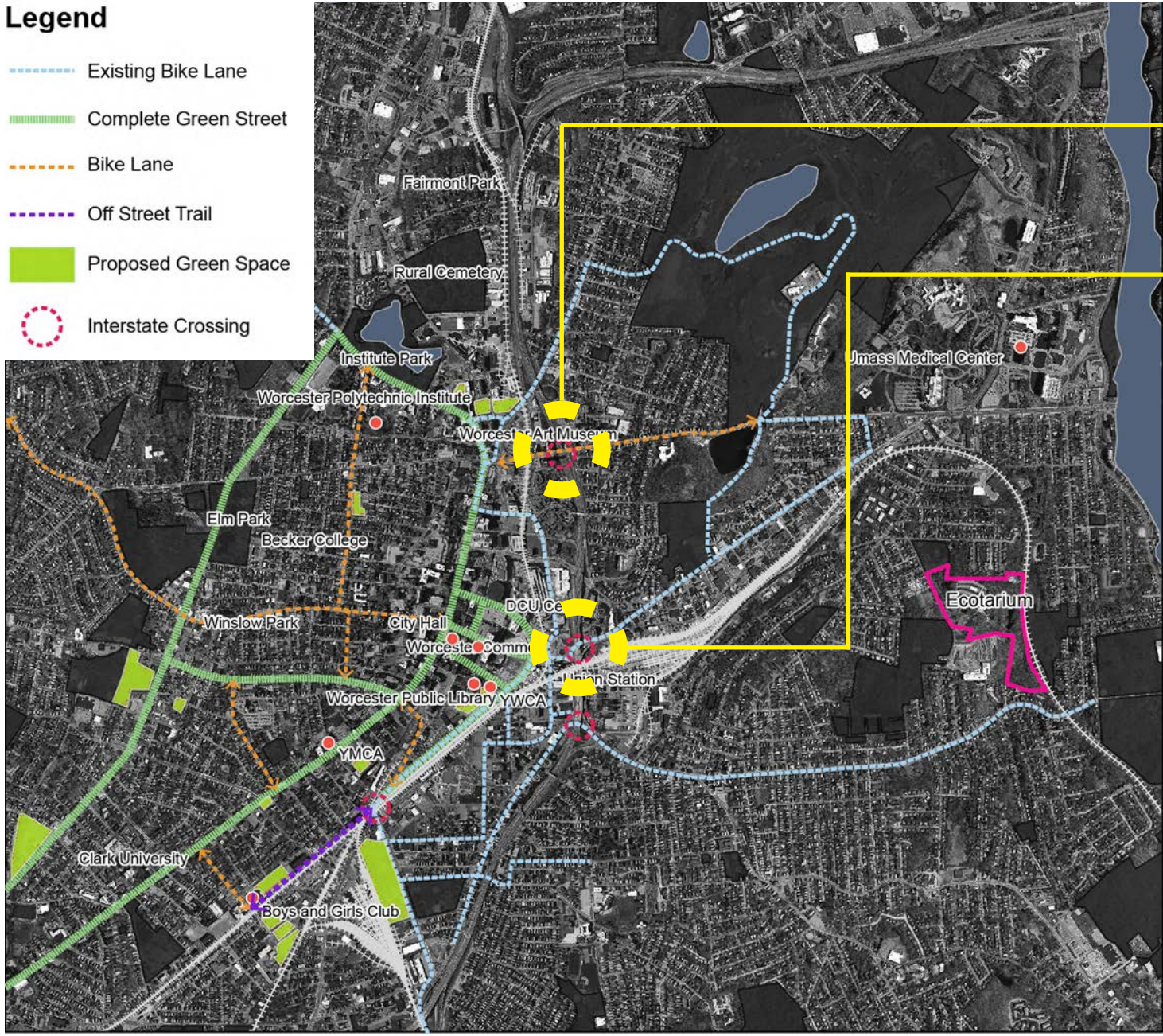
AFTER



ACCESS TO DOWNTOWN AREA: OVERPASS AND UNDER PASS - Shu Liu

Legend

-  Existing Bike Lane
-  Complete Green Street
-  Bike Lane
-  Off Street Trail
-  Proposed Green Space
-  Interstate Crossing



FOCUS AREA 1:
BELMONT ST/ R 09

FOCUS AREA 2:
SHREWSBURY ST

FOCUS AREA

Along Eastern Boundary—Highway 290—of Downtown Area, Two Crossing connections among all three connections that are proposed in the team greenway plan, which is Belmont St/R 09 and Shrewsbury St

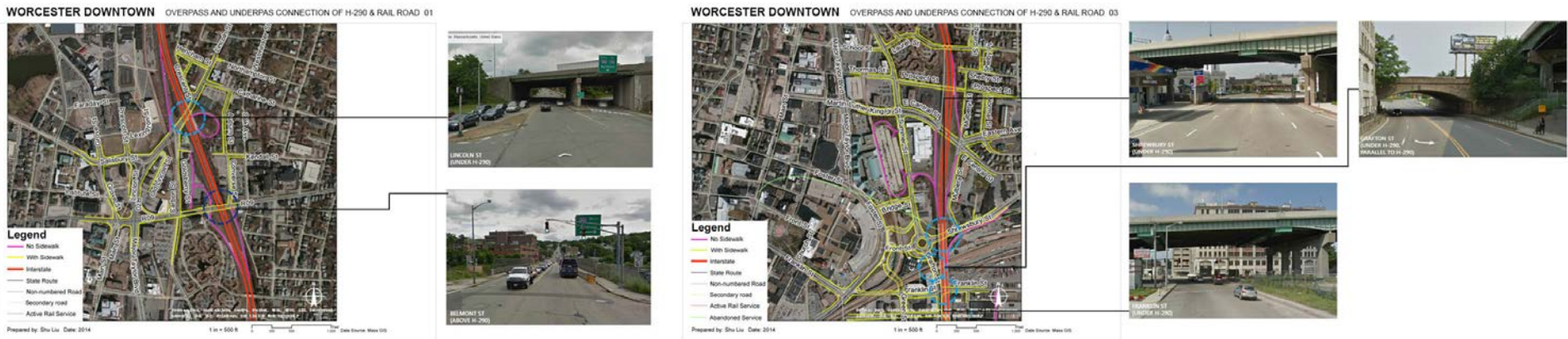
Prepared by: Junbo Date: 2014 1 in = 2500 feet 0 2,550 5,100 10,200 Feet

Data Sources: Google maps; Mass GIS

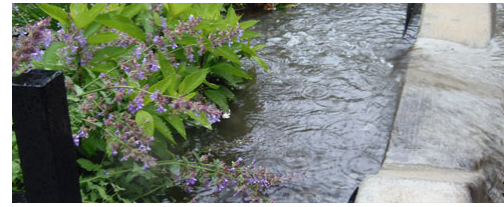
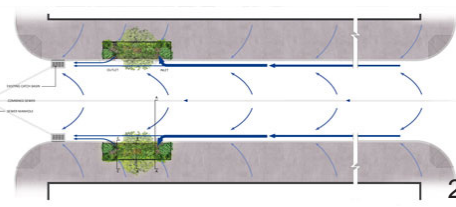
BIG CONCEPT:

1. Better Connections between DOWNTOWN AREA and EASTERN AREA based on the consideration of all the Existing Overpass and Underpass of highway about their condition, walk-ability, width, with or without street tree and related potential empty space or vacant block, and the connection with the Ecotarium in the eastern area.
2. Form the crossing part of the whole Greenway plan of the whole downtown team proposal and also in larger scale of the regional scale with proposal of change of Street Line—adding of bike Lane, street tree, separating green area, change of Sidewalk, new function of related open space.
3. Improving the environment of the connecting areas by adding new open space (including garden, small park), green area and s series of Green Infrastructure in those areas.

EXISTING OVERPASS/UNDERPASS CONNECTION

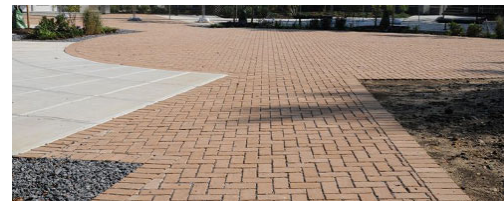


GREEN INFRASTRUCTURE OPTIONS

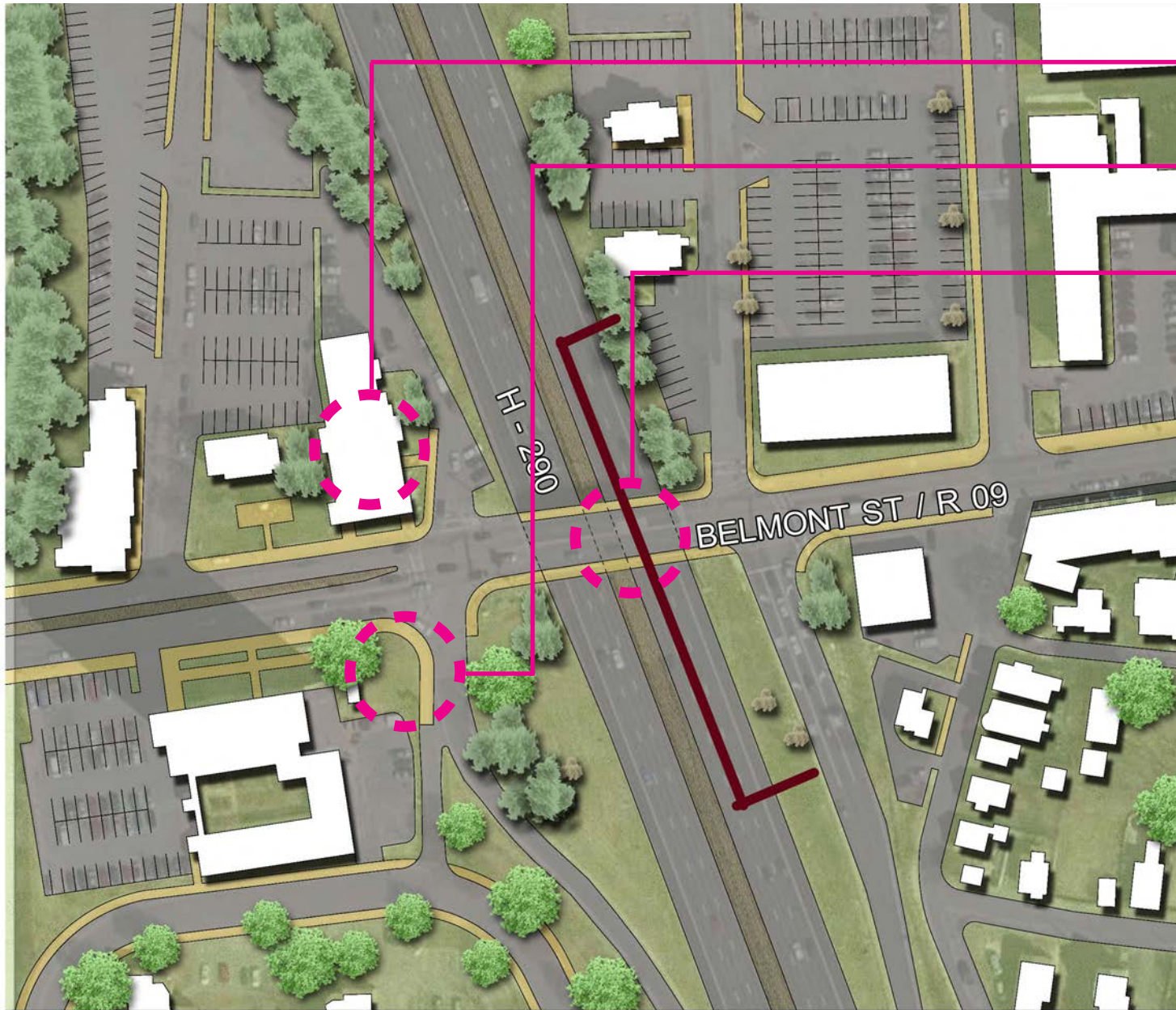


- 1,2,3. Right-of-way Bioswales
4. Stormwater Greenstreet
5. Permeable Paving

http://www.nyc.gov/html/dep/html/stormwater/combined_sewer_overflow_bmps.shtml#greenstreets



EXISTING PLAN



- Church
- Potential Open Space
- Belmont St / R 09
Overpass Sidewalk
too narrow

Site Plan and Analysis:

Belmont St/ R 09 is an Overpass above Highway 290 which has Buffer Green Area on Both side with existing vegetations ;

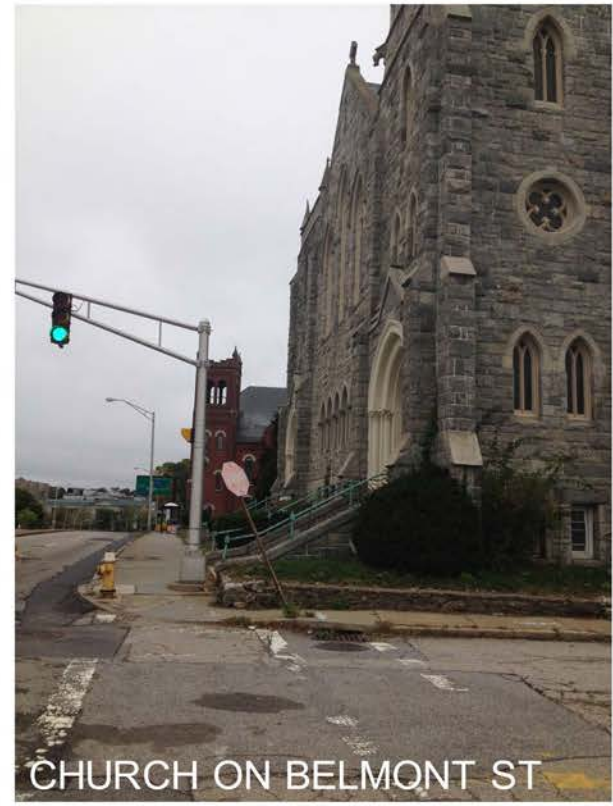
Belmont St has sidewalk on both sides, but the sidewalk on the Overpass Bridge is too narrow;

Several potential green space that can be proposed for new functions;

Lots of Parking Lots in surrounding area with large area of impermeable surface;

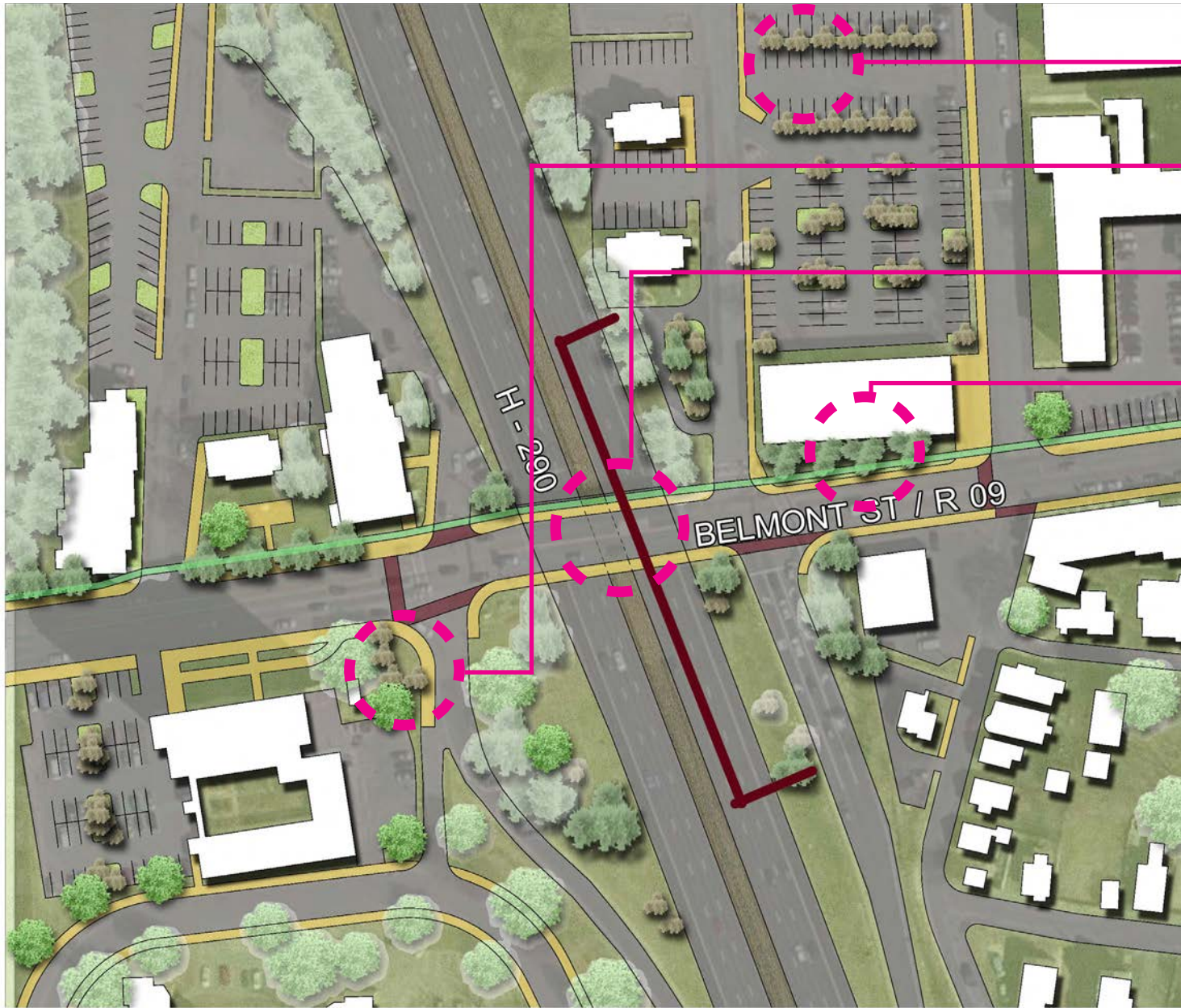


SITE PHOTO



Shu Liu Photography

PROPOSED PLAN



- Bioswale and Green Area in Parking Lot
- New Open Space
- Belmont St / R 09 Overpass Bridge Adding Structure
- Bike Lane and Street Tree

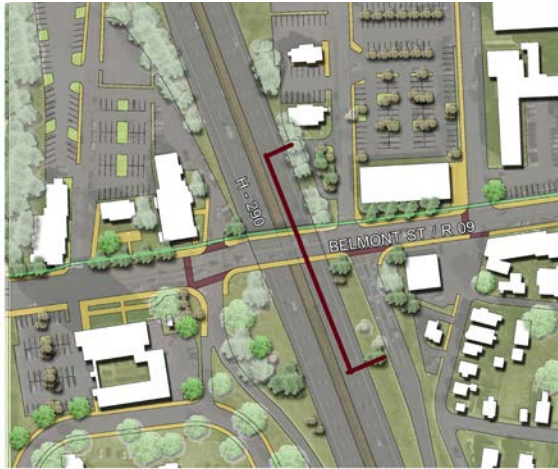
Proposed Plan:

- Adding structure on the bridge for extra width for wider sidewalk and bike Lane
- Bike Lane(labeled green)
- Adding Street trees and other vegetation
- Adding open space in the area
- Adding green space and green infrastructure—bio swale with native plants in the parking Lot

Adding Crossing Walk



NEW SECTION & EXISTING SECTION

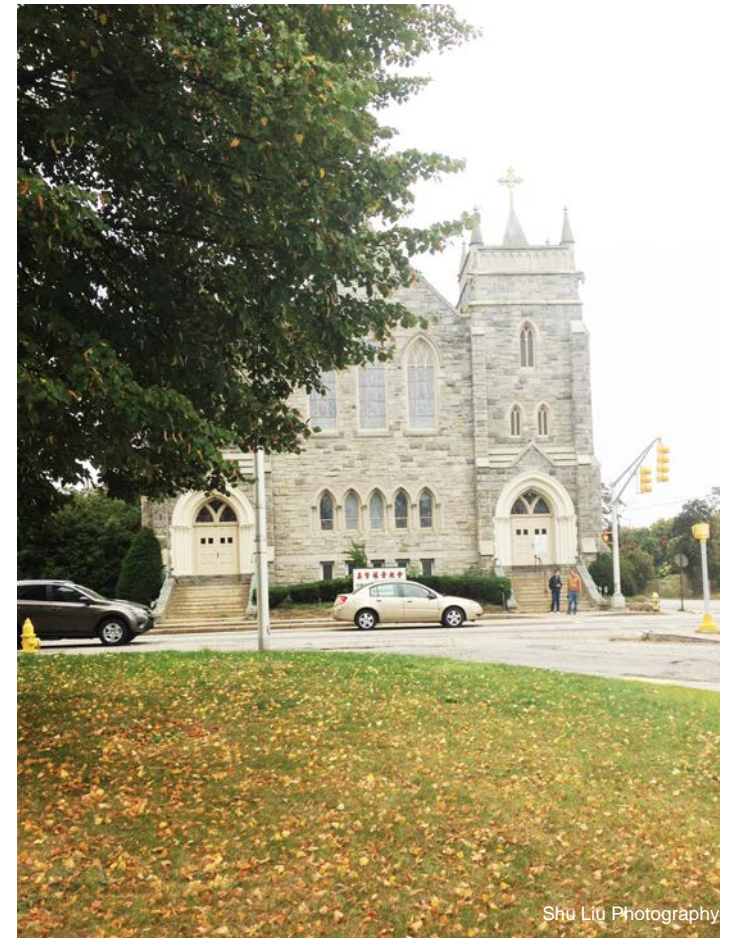


PERSPECTIVE 1: Overpass Bridge with adding structure



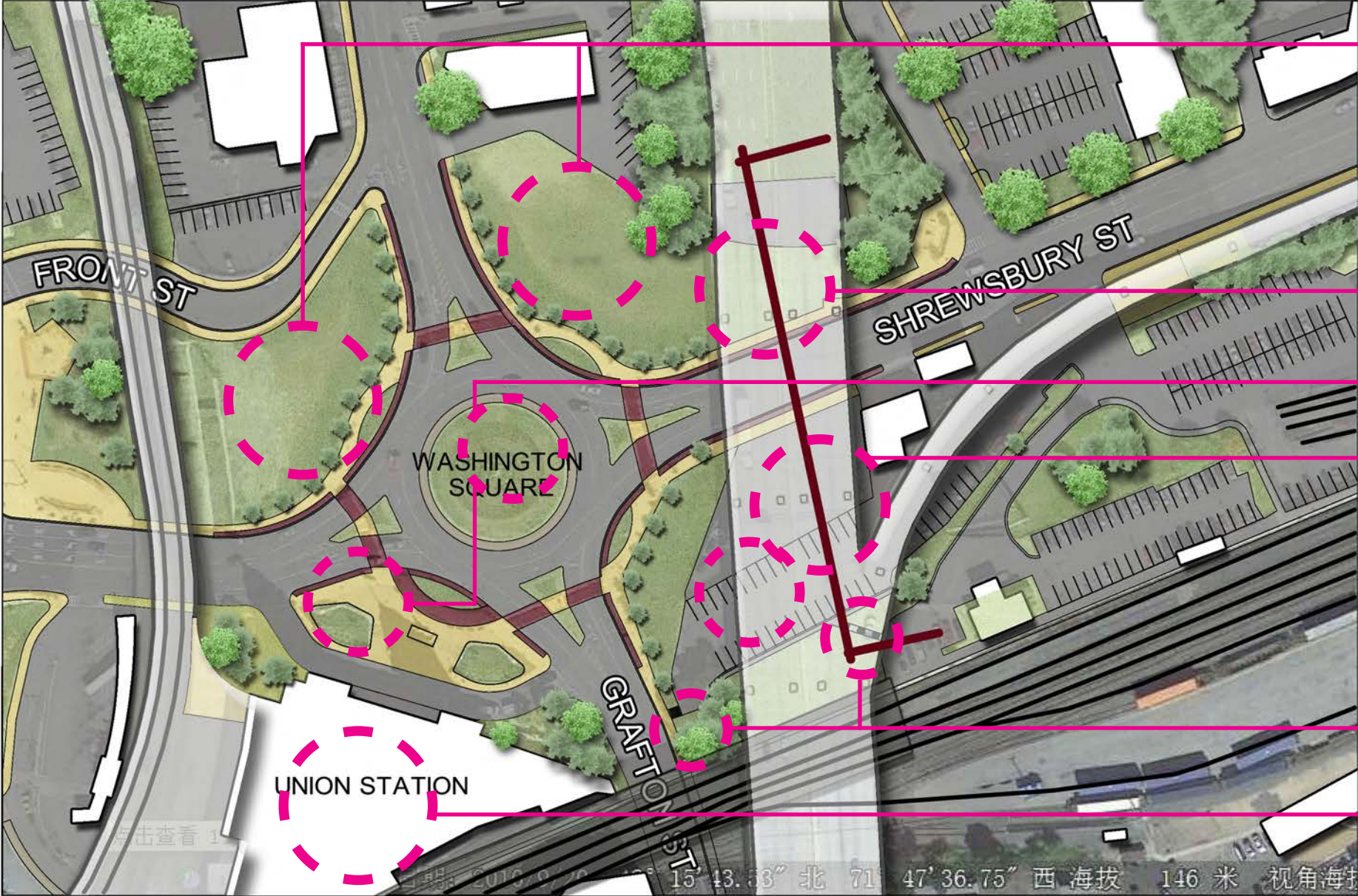
Shu Liu Photography

PERSPECTIVE 2: New Open Space across from the church on the west side of the bridge



Shu Liu Photography

EXISTING PLAN



SITE PHOTO

Potential Green Space



Potential Empty Space under the highway

Existing Open Space / Landscape Washington Square & Open Space

Parking Lots (one Private Parking Lot)



OPTION A BUILDING MASSING STUDY PLAN
Washington Square Redevelopment Strategy
FIGURE 8

WASHINGTON SQUARE REDEVELOPMENT REPORT STRATEGY

Stairs

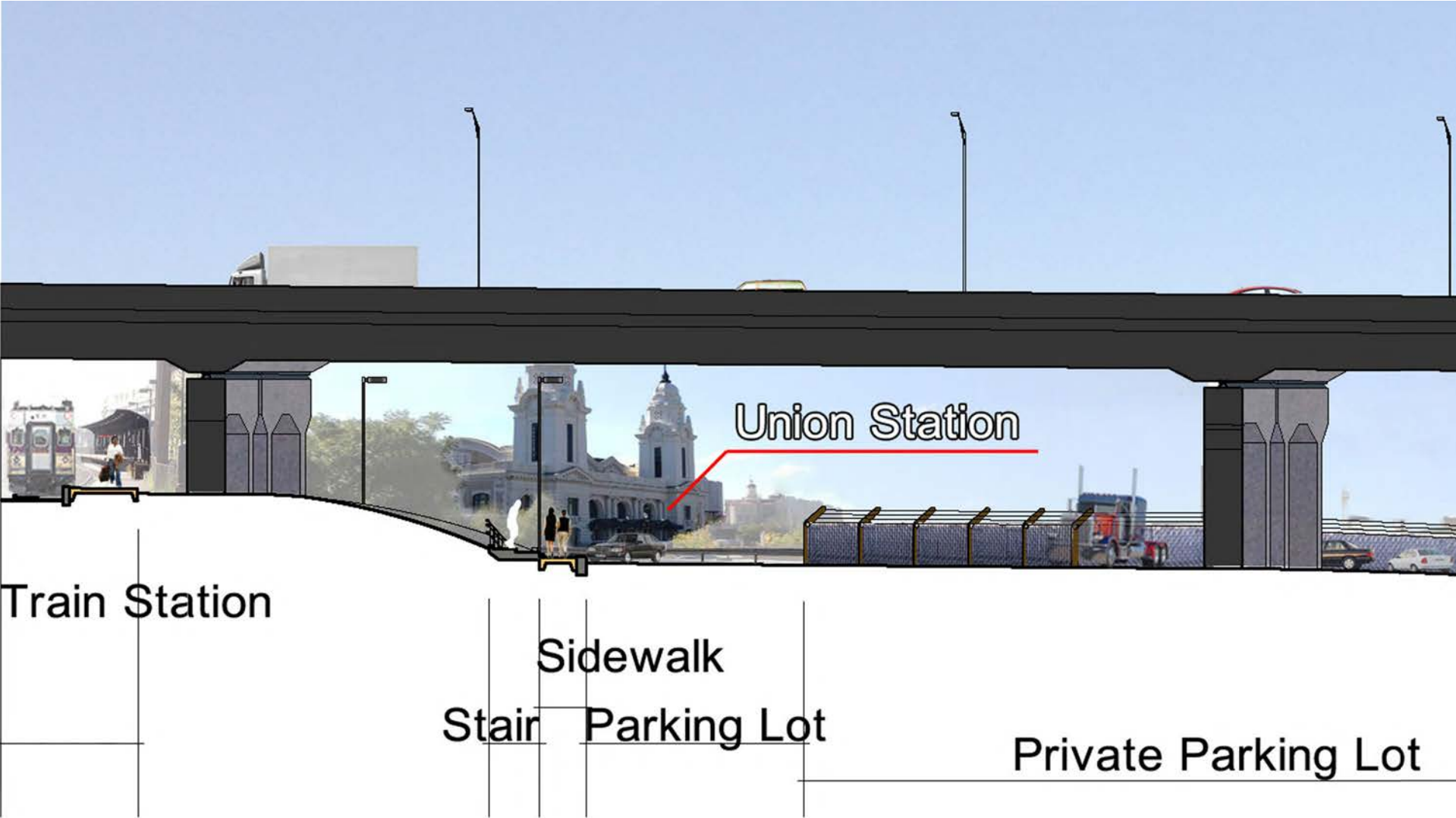
Union Station

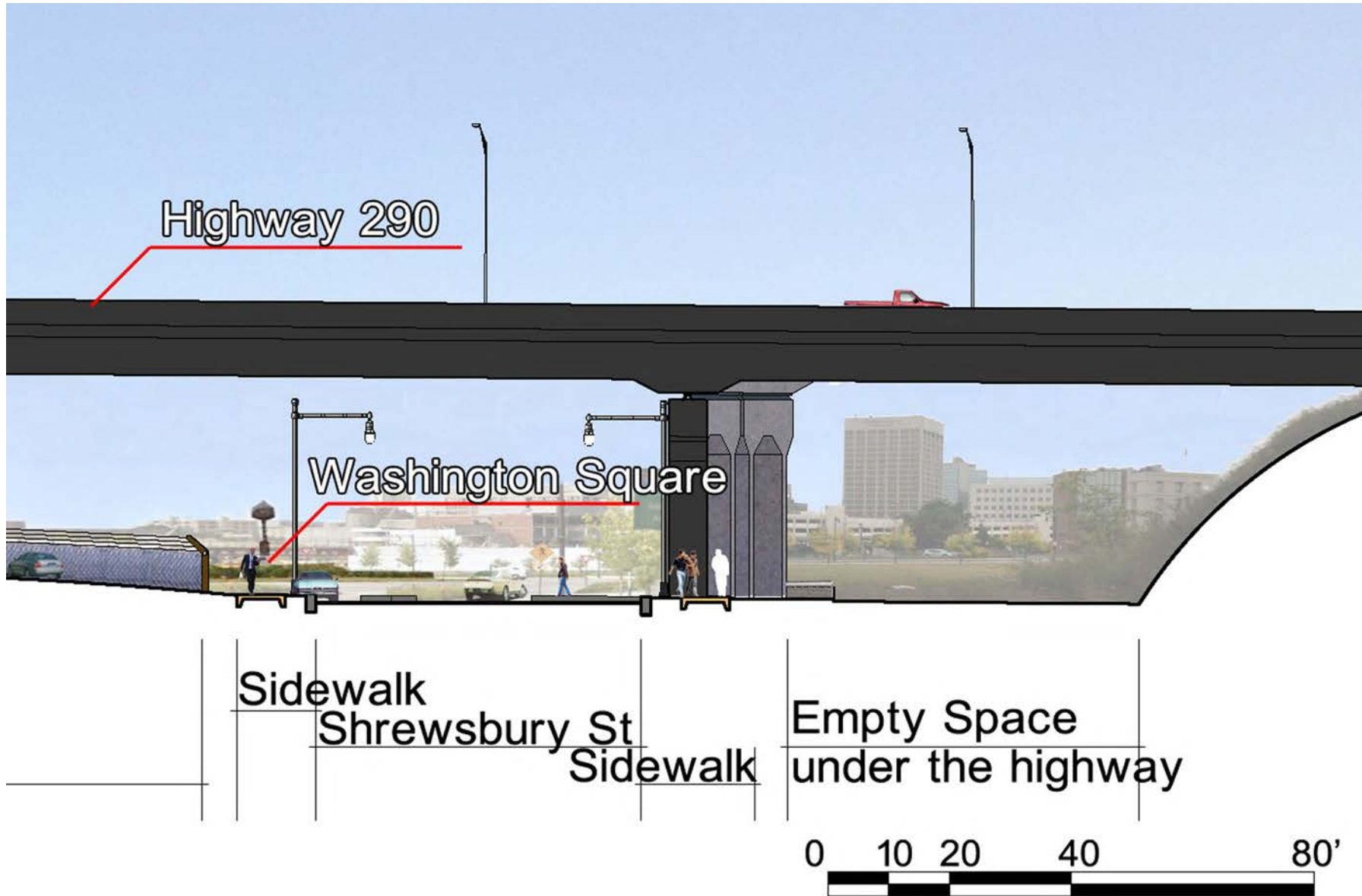
WASHINGTON SQUARE REDEVELOPMENT REPORT STRATEGY

“The reconstruction of the Washington Square Rotary, in front of Union Station, to a smaller ‘Roundabout’, will result in the creation of new parcels, that are surplus to the transportation needs of the City.”

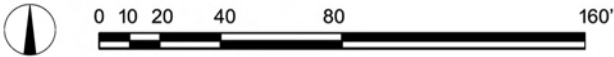
New proposed building shown in the City Proposed Plan is considered in personal design.

EXISTING SECTION





PROPOSED PLAN



New Proposed Building

Parking Lot under related to the New Building
with a new entrance on Shrewsbury St

New Open Space with Path and Bench

Skateboard Park as new open space under the
highway

Stairs

Landscape Fence

Bike Lane & Street Tree & Right-of-way
Bioswales

CASE STUDY FOR UNDER-BRIDGE SPACE



Park under Brooklyn Bridge

<http://land8.com/forum/topics/looking-for-examples-of-parks>



Bruparkenat Park in Stromso.

http://www.geocaching.com/geocache/GC2PN00_bruparken?guid=3823a0d2-2c42-4878-b267-530b631ea344



Chicano Park under bridge in San Diego

<http://placesandplatie.com/archives/021513-Murals.html>



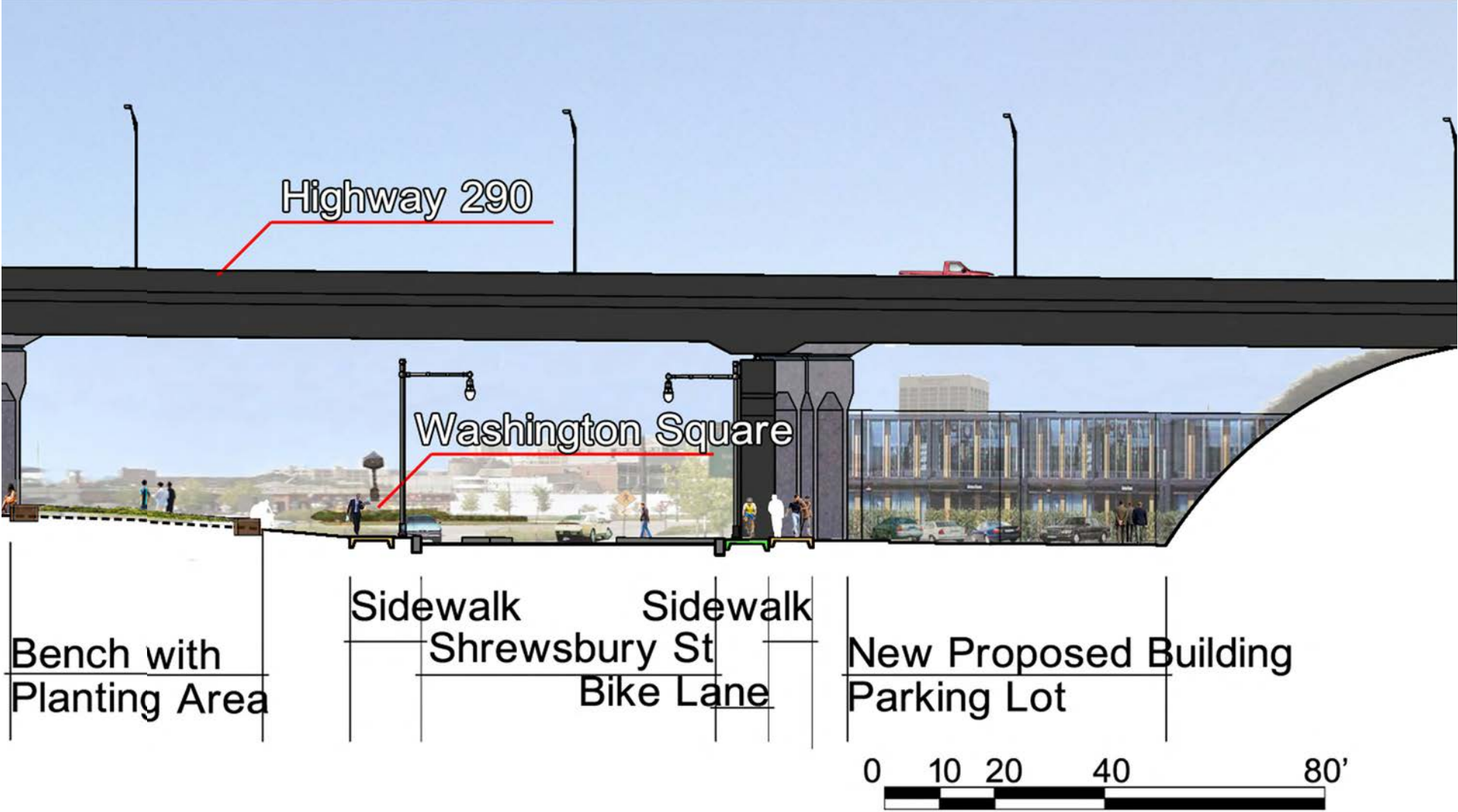
Basketball Court at Underpass in Toronto

<http://viewinphotos.wordpress.com/2013/01/04/urban-landscape-basketball-court-at-underpass-park/>

PROPOSED SECTION

SHREWSBURY ST





PERSPECTIVE 1: Bike Lane and Right-of-way Bioswales



Shu Liu Photography

PERSPECTIVE 2: Skateboard Park under the Highway



Shu Liu Photography

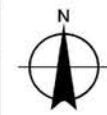
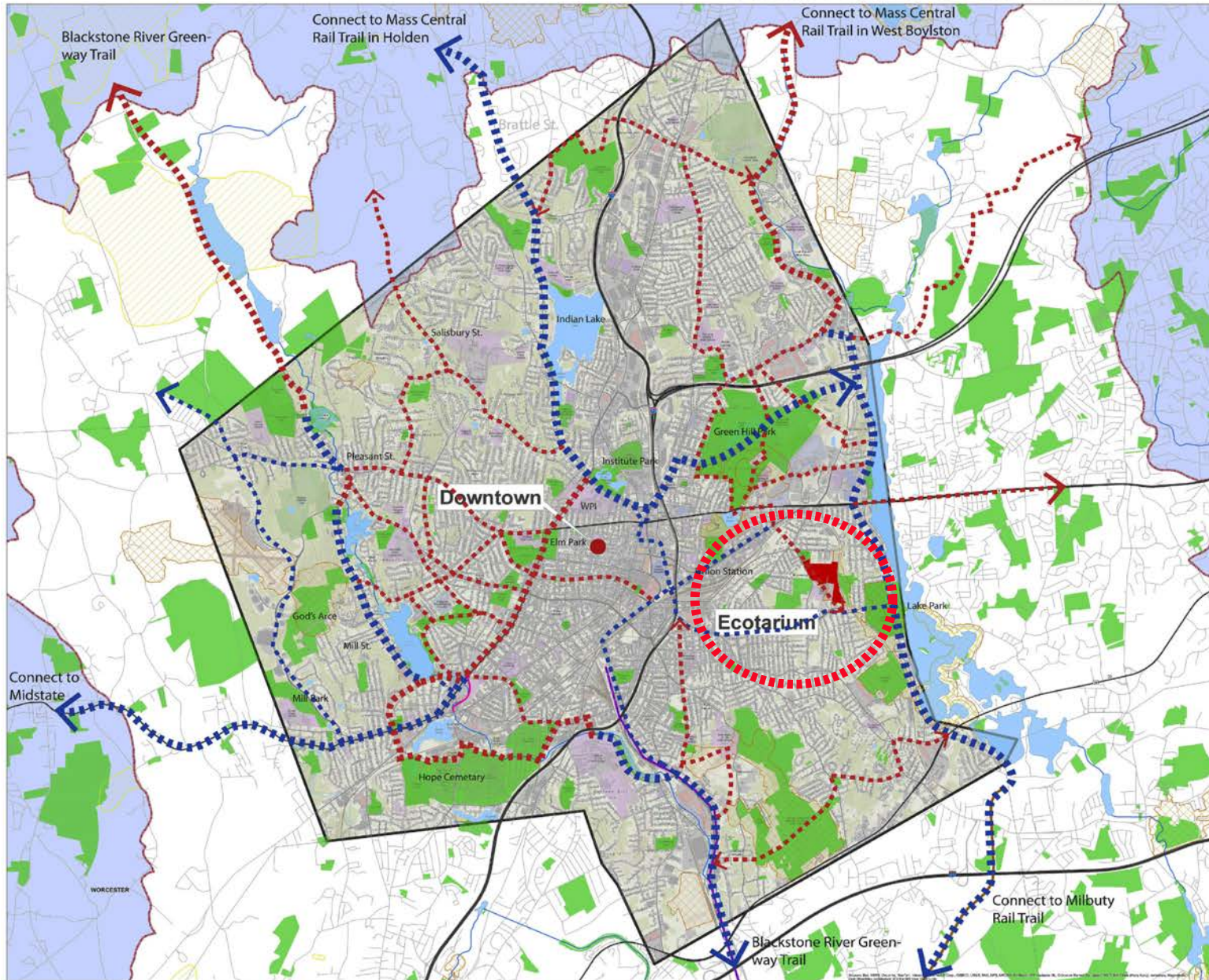
Introduction: Eastern Worcester and the EcoTarium

The EcoTarium, located along Harrington Way in the eastern portion of Worcester, is the second largest science museum for children in New England, offering a unique experience of both indoor and outdoor ecological learning experience for children. Originally founded in 1825 by the Worcester Natural History Society, with the name "Worcester Lyceum of Natural History:", its mission has been to focus attention towards the hands-on learning of the environment, culture, wildlife and soon an extension into urban ecology, with the City Science exhibit.

With it's highest visitation rate in 2013, the EcoTarium has become has become a front-runner in displays that creatively bring the science s to life for families. With this high visitation rate, comes the issue of guiding and directing visitors to its location in Worcester, and even more specifically around its 60 acre site.

The City of Worcester's 2013 Open Space and Recreation Plan has listed nine primary goals that aimed to improve the city's open spaces, strengthen their connections, and enhance their presence in the community. With this, the city also aimed to incorporate more of its open space to current city initiatives, and local institutions such as the EcoTarium. This team's focus was to utilize the current proposal for increased connectivity along Hamilton Street and Shewsbury Street, and add additional opportunities for visitation and signage for the EcoTarium from the Metro Downtown and points east toward Lake Quinsigamond. Additionally, an emphasis was placed upon aspects of the EcoTarium's site itself, and how improvements can be made for a well-interpreted and clear set of experiences along its outdoor displays.

WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources



Legend

- - - Our Proposed Bike Lane
- - - City Proposed Bike Lane
- Blackstone Watershed
- Priority Rare Habitat
- Protected Openspace
- Worcester Boundary
- Ecotarium

Data Source: mass.gis

Prepared By: Laura, Meilan, Tharyn, Zhuoya Date: 2014

Scale: 1" = 1500' 0 0.5 1 2 3 4 Miles

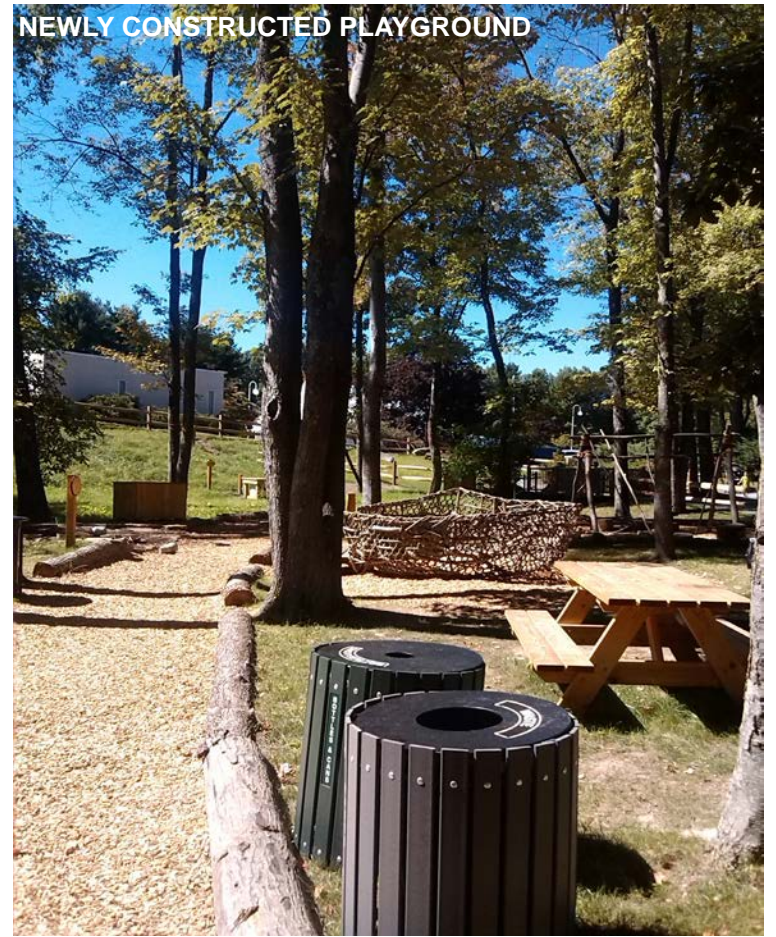


MASTER PLAN



Gorman Richardson Lewis Architects

NEWLY CONSTRUCTED PLAYGROUND



INDOOR EXHIBITS

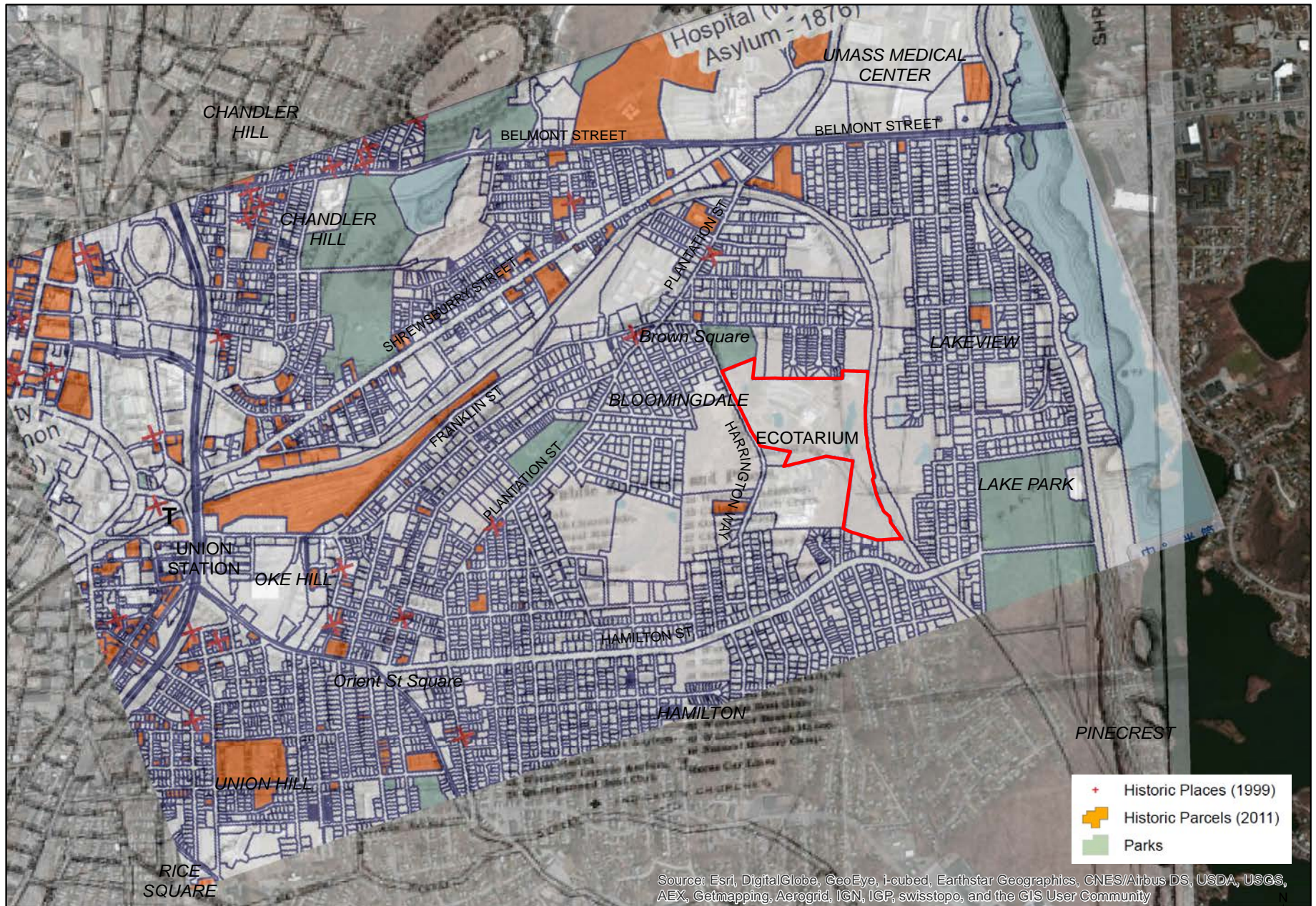


www.blackbird.com



Tyler Trahan Photography

EASTERN WORCESTER HISTORIC RESOURCES



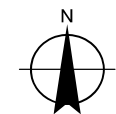
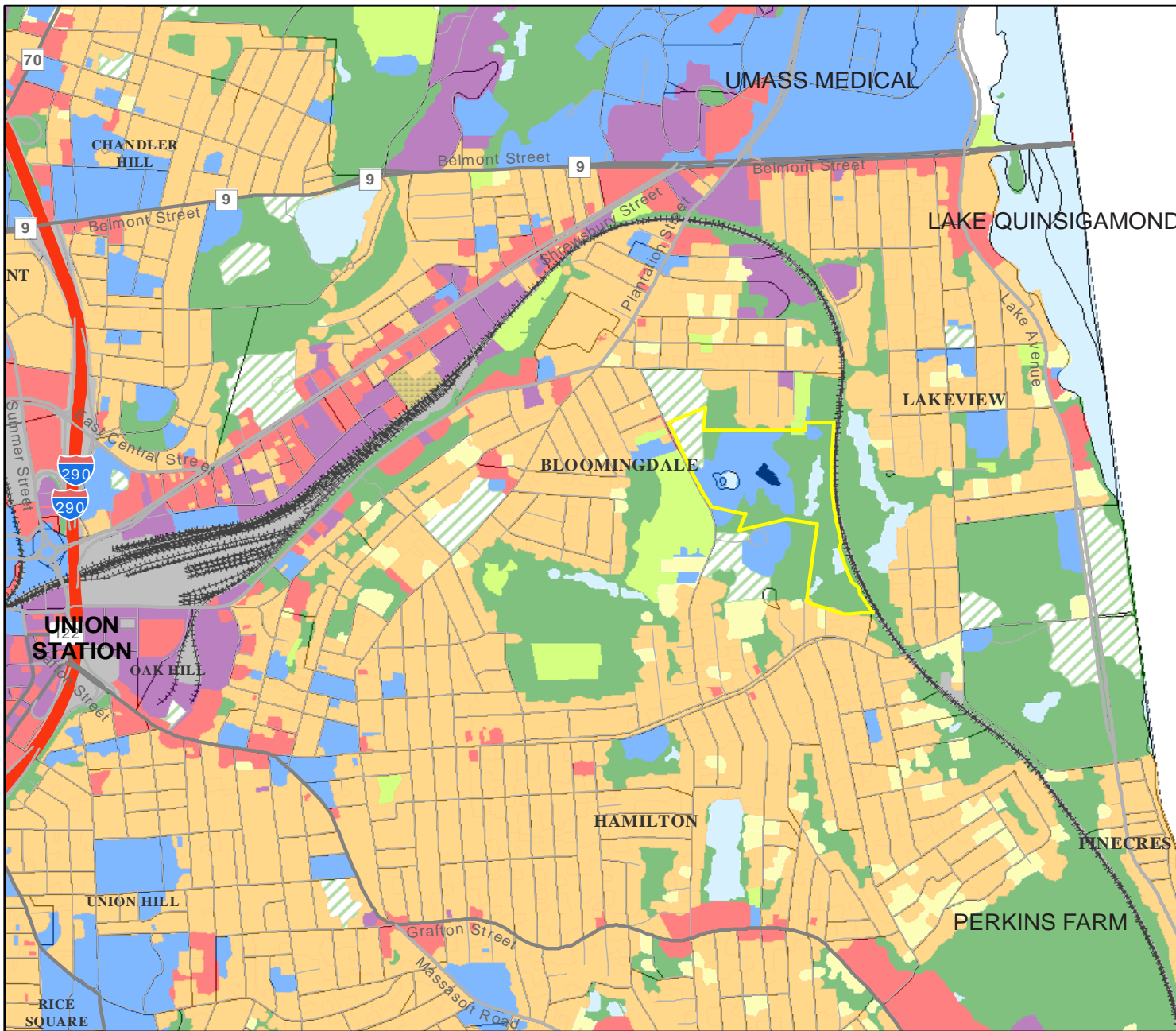
Prepared by: Wenjie Liu Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS



EASTERN WORCESTER LAND USE



Legend

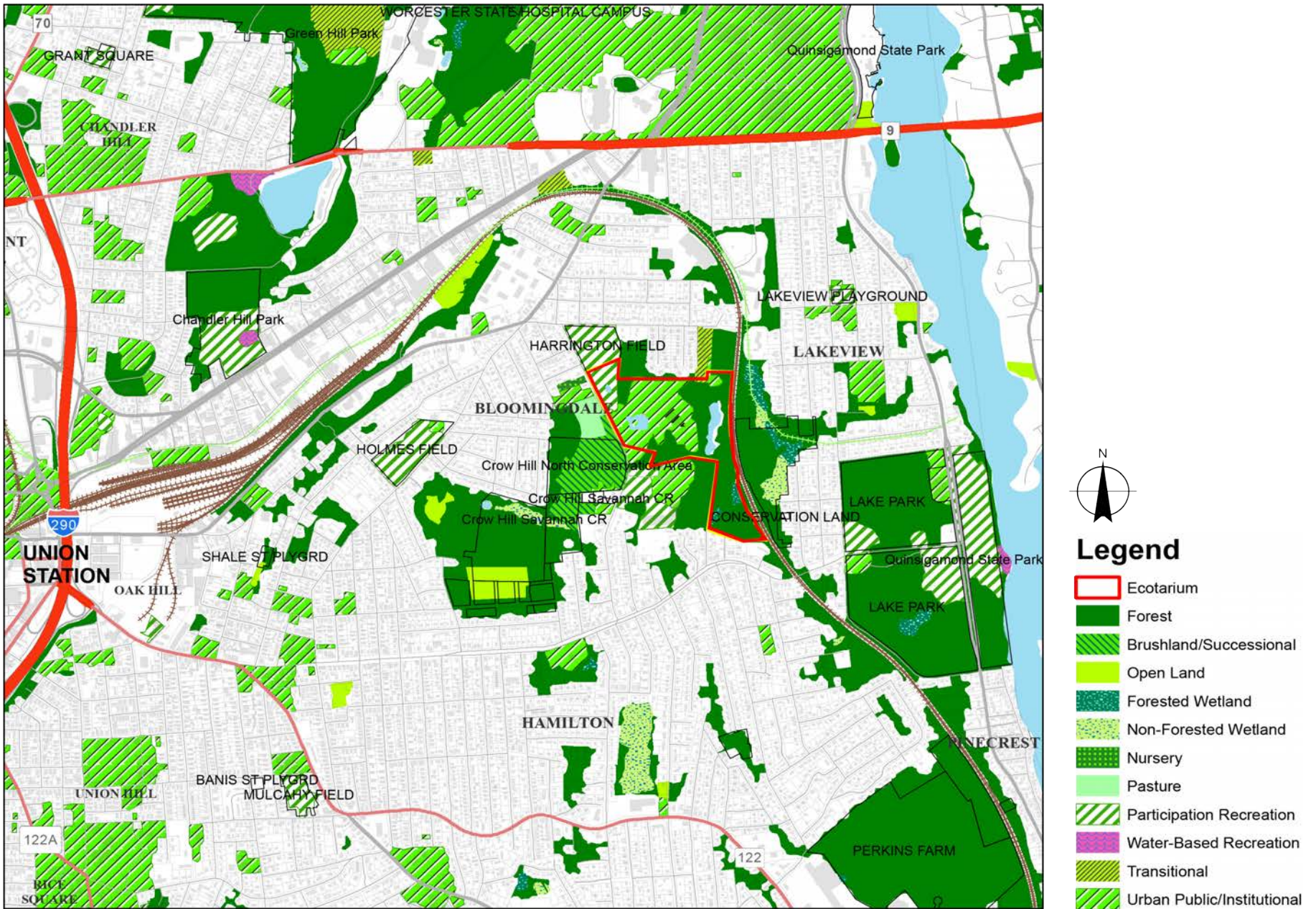
- Ecotarium
- Forest
- Open Land
- Participation Recreation
- Multi-Family Residential
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Very Low Density Residential
- Transitional
- Urban Public/Institutional
- Commercial
- Industrial
- Transportation
- Powerline/Utility
- Mining
- Waste Disposal
- Junkyard
- Railroads - Active Service

Prepared by: Ericka Duym Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS

EASTERN WORCESTER Green Space Composition

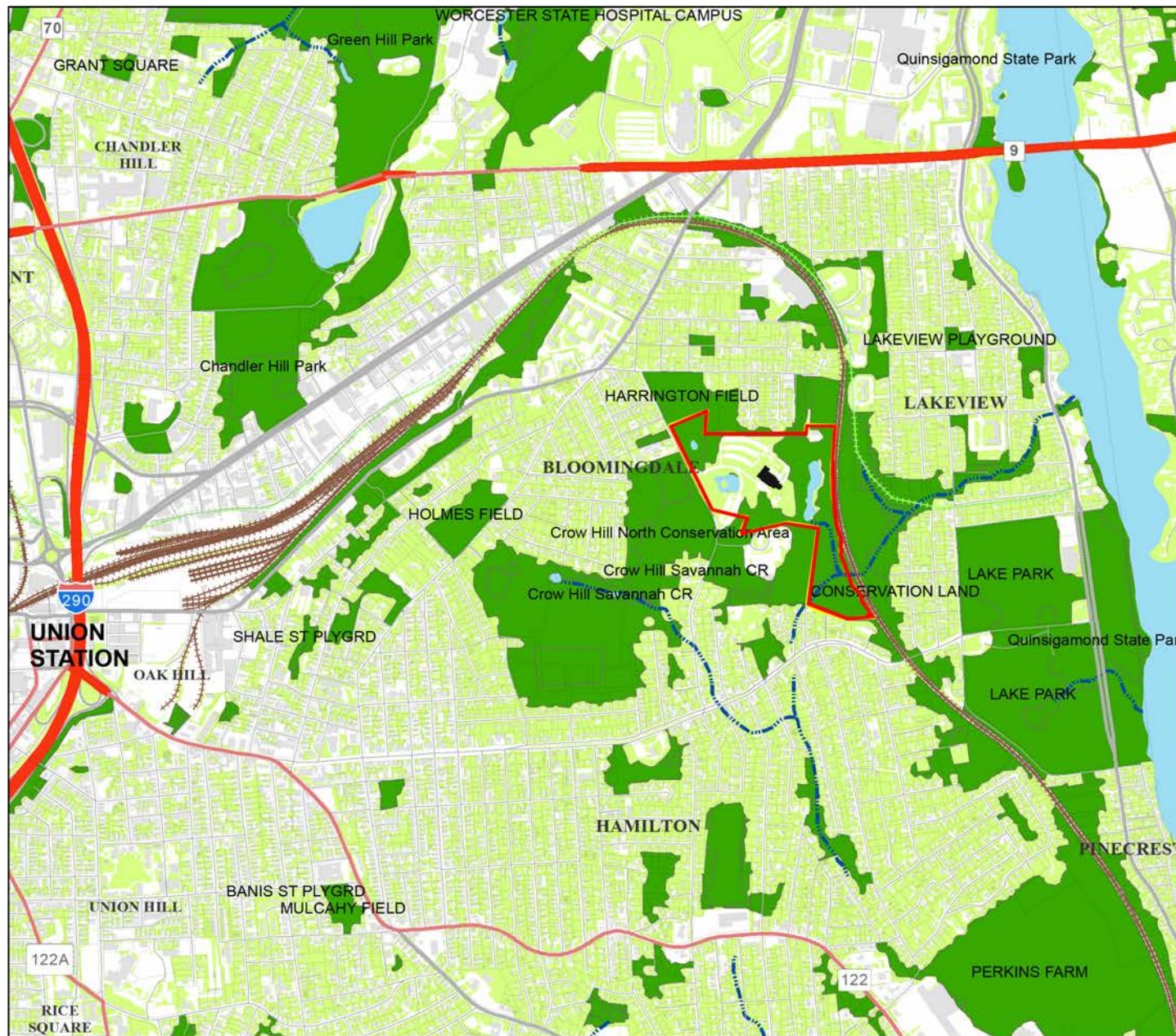


Prepared by: Joe LaRico Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS

EASTERN WORCESTER HYDROLOGY AND GREEN NETWORK



Legend

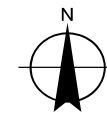
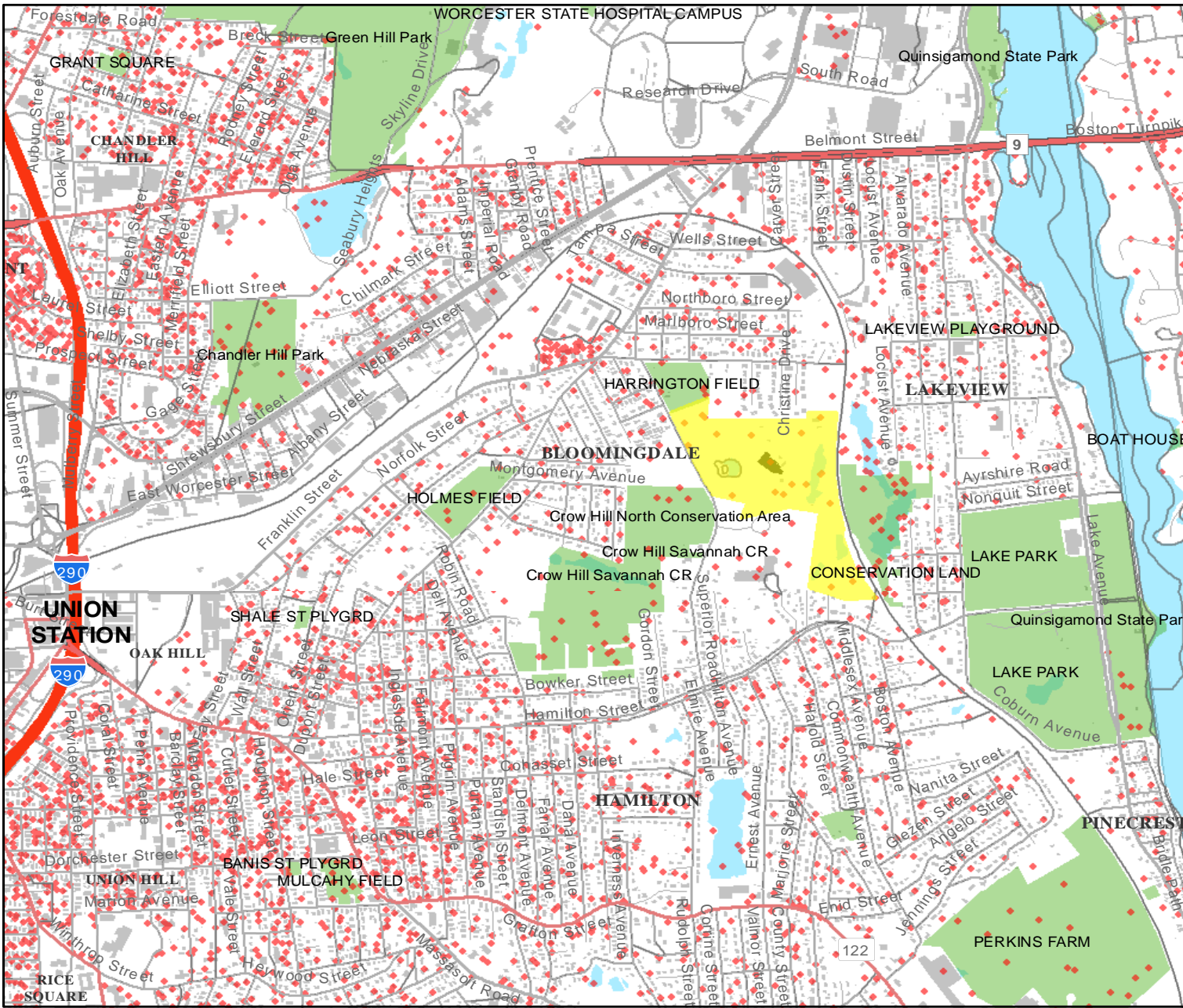
- Ecotarium
- Perennial Stream
- Intermittent Stream
- Pond, Lake
- Existing Vegetated Land
- Pervious Surface
- Impervious Surface

Prepared by: Joe LaRico Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

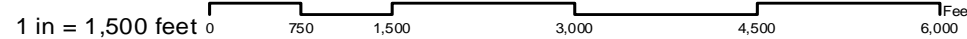
Data Source: Mass GIS

EASTERN WORCESTER PROXIMITY TO PUBLIC GREEN SPACE



- Legend**
- Ecotarium
 - Population Density**
 - 1 Dot = 10
 - POP10
 - Public Greenspace

Prepared by: Ericka Duym Date: 2014



Data Source: Mass GIS



Green Hill Park Connections

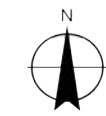
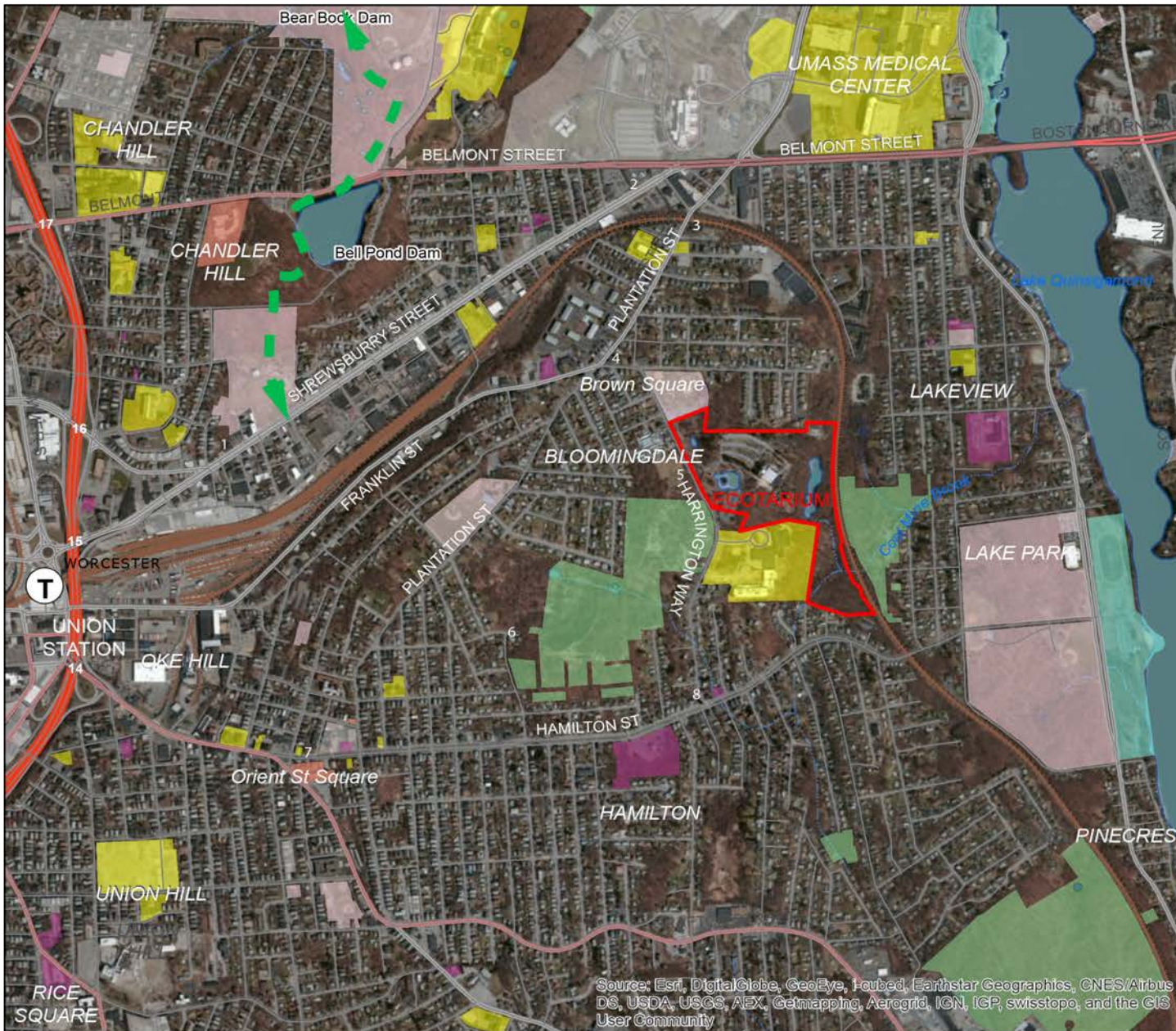


Lake Park



Crow Hill Conservation Area

EASTERN WORCESTER CONNECTIONS AND INTERSECTIONS



Legend

- Ecotarium
- MHC Historic Inventory
- School Parcels
- Church parcels
- Protected & Recreational OpenSpace**
- Conservation
- Recreation
- Recreation and Conservation
- Agriculture
- Habitat
- Historical/Cultural
- Scenic (Official Designation Only)
- Water Supply
- Flood Control
- Underwater
- Other
- Unknown
- Certified Vernal Pools
- Potential Vernal Pools

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Prepared by: Wenjie Liu Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS



1 SHREWSBURY STREET



2 SHREWSBURY STREET



3 PLANTATION STREET



4 PLANTATION STREET



5 ECOTARIUM ENTRANCE



6 HARMON STREET

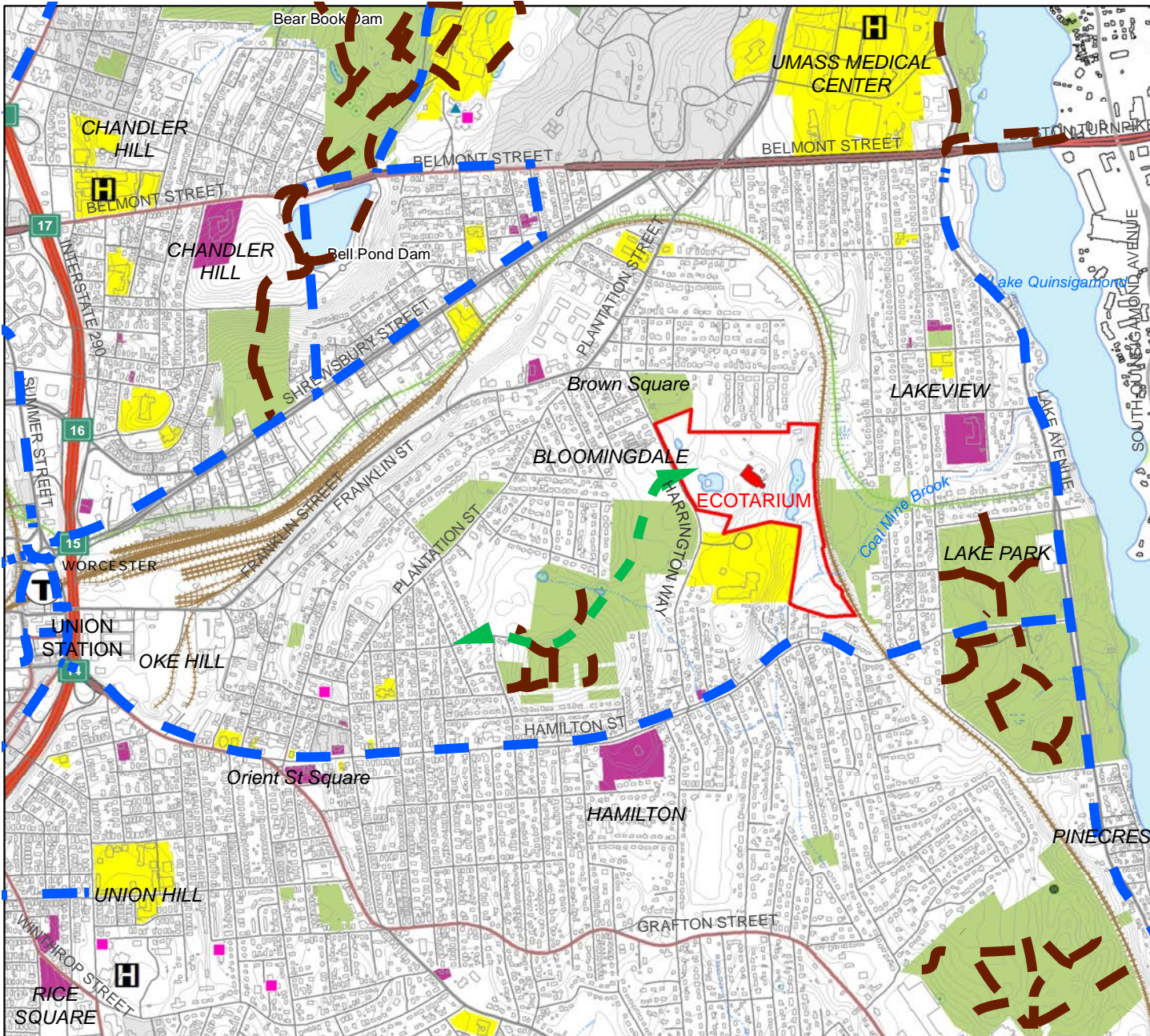


7 ORIENT ST SQUARE
Photo Source: <https://www.google.com/maps>



8 HAMILTON STREET

EASTERN WORCESTER EXISTING TRAILS



Legend

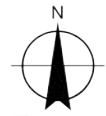
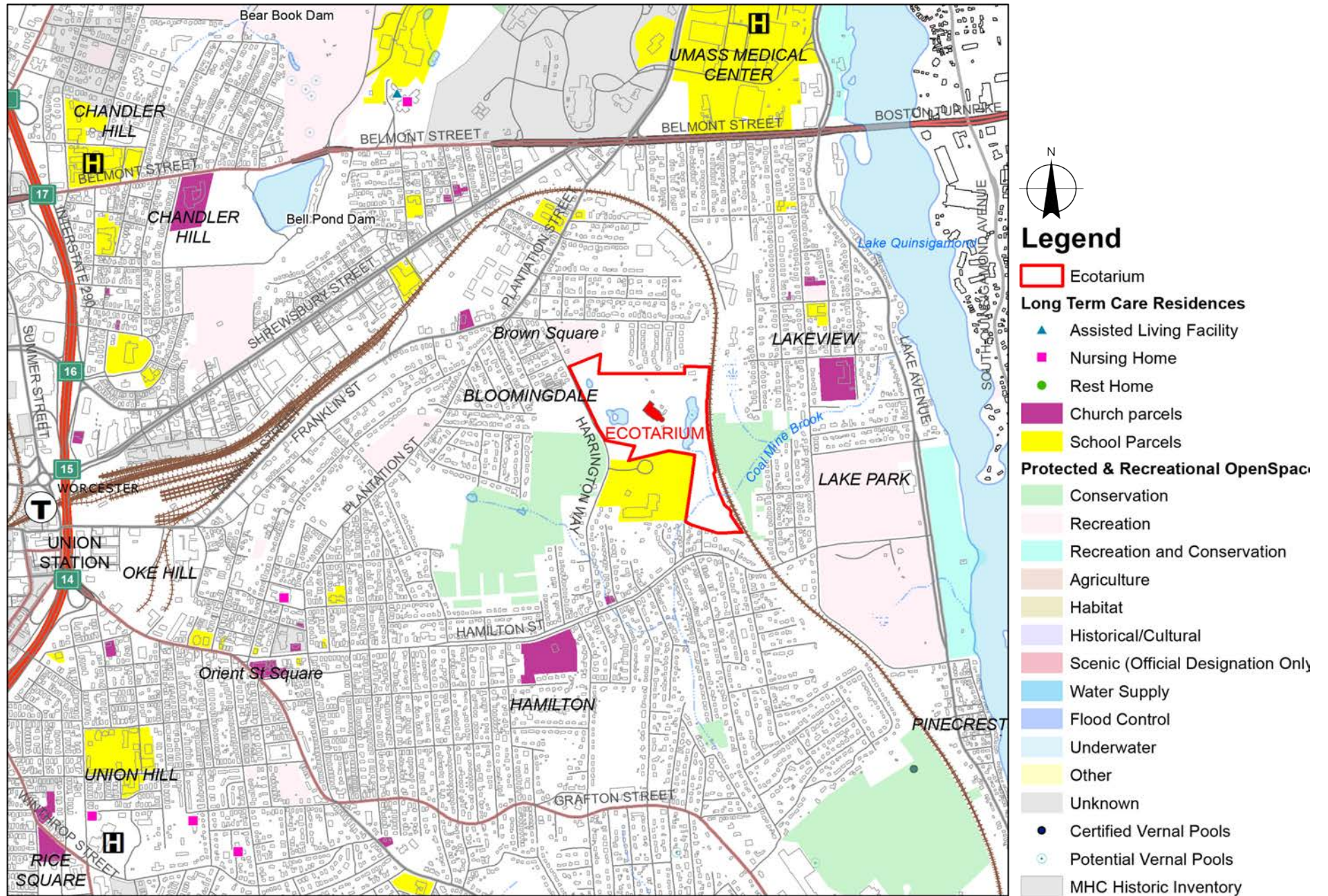
- Ecotarium
- Trail
- Bike Trail
- Church parcels
- School Parcels
- Protected & Recreational OpenSpace**
- PUB_ACCESS**
- LIMITED
- UNKNOWN
- YES
- Certified Vernal Pools
- Potential Vernal Pools
- MHC Historic Inventory

Prepared by: Wenjie Liu Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS

EASTERN WORCESTER LOCAL VISITOR RESOURCES FOR ECOTARIUM



Legend

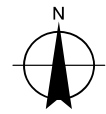
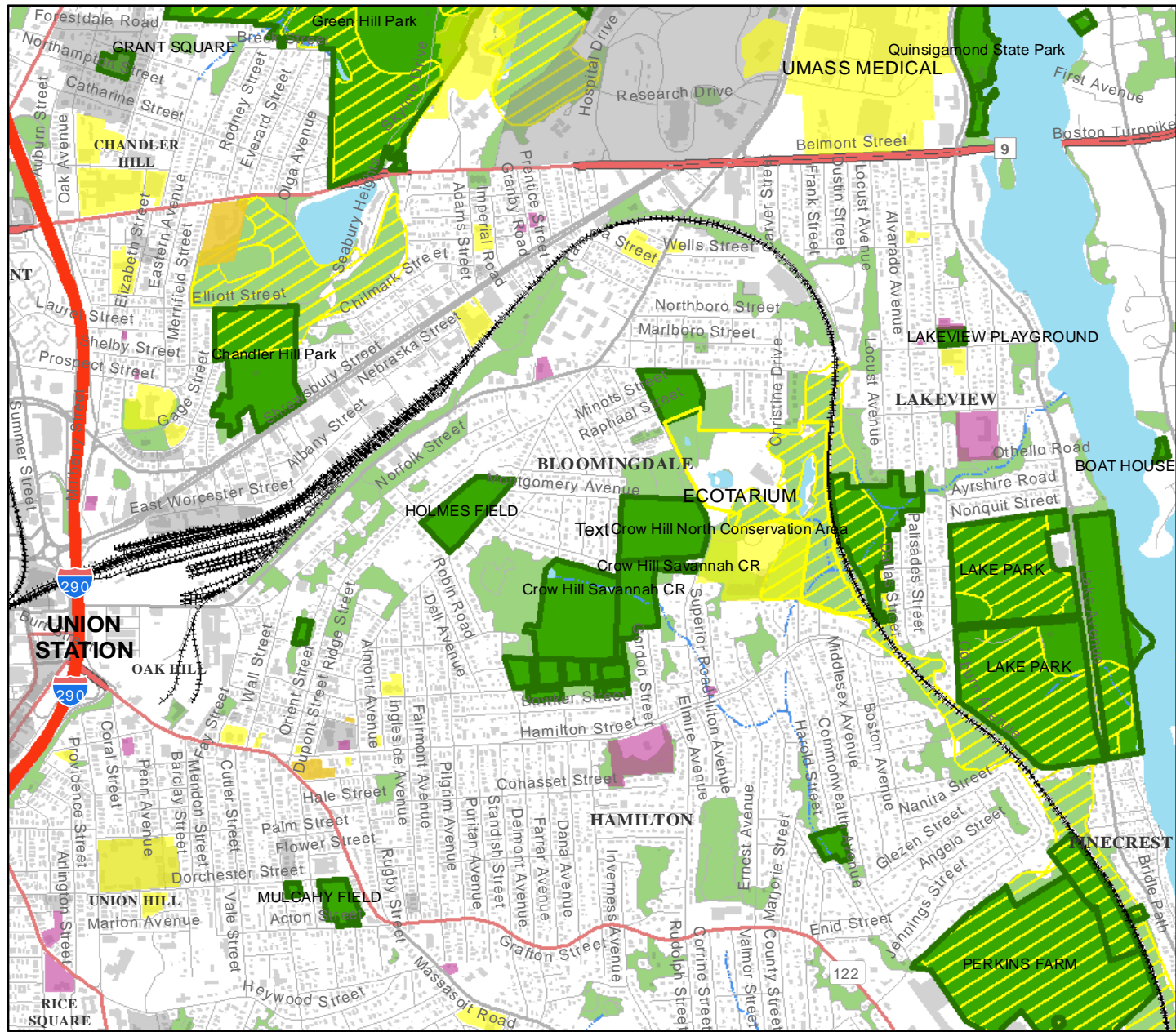
- Ecotarium
- Long Term Care Residences**
 - ▲ Assisted Living Facility
 - Nursing Home
 - Rest Home
 - Church parcels
 - School Parcels
- Protected & Recreational OpenSpace**
 - Conservation
 - Recreation
 - Recreation and Conservation
 - Agriculture
 - Habitat
 - Historical/Cultural
 - Scenic (Official Designation Only)
 - Water Supply
 - Flood Control
 - Underwater
 - Other
 - Unknown
 - Certified Vernal Pools
 - Potential Vernal Pools
 - MHC Historic Inventory

Prepared by: Wenjie Liu Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS

EASTERN WORCESTER GREENWAY COMPOSITE



Legend

- School Parcels
- Church parcels
- Ecotarium
- Public Greenspace
- Historic Inventory
- Priority Habitats of Rare Species
- Perennial Stream
- Intermittent Stream
- Pond, Lake, Ocean
- Conservation and Recreation
- Existing Vegetated Land

Prepared by: Ericka Duym Date: 2014

1 in = 1,500 feet 0 750 1,500 3,000 4,500 6,000 Feet

Data Source: Mass GIS

Analysis and Conclusion:

This team was tasked with analyzing an area of eastern Worcester that includes the EcoTarium, and exploring ways to connect the EcoTarium to downtown as well as the other resources in the area in a comprehensive green network consistent with the other teams efforts.

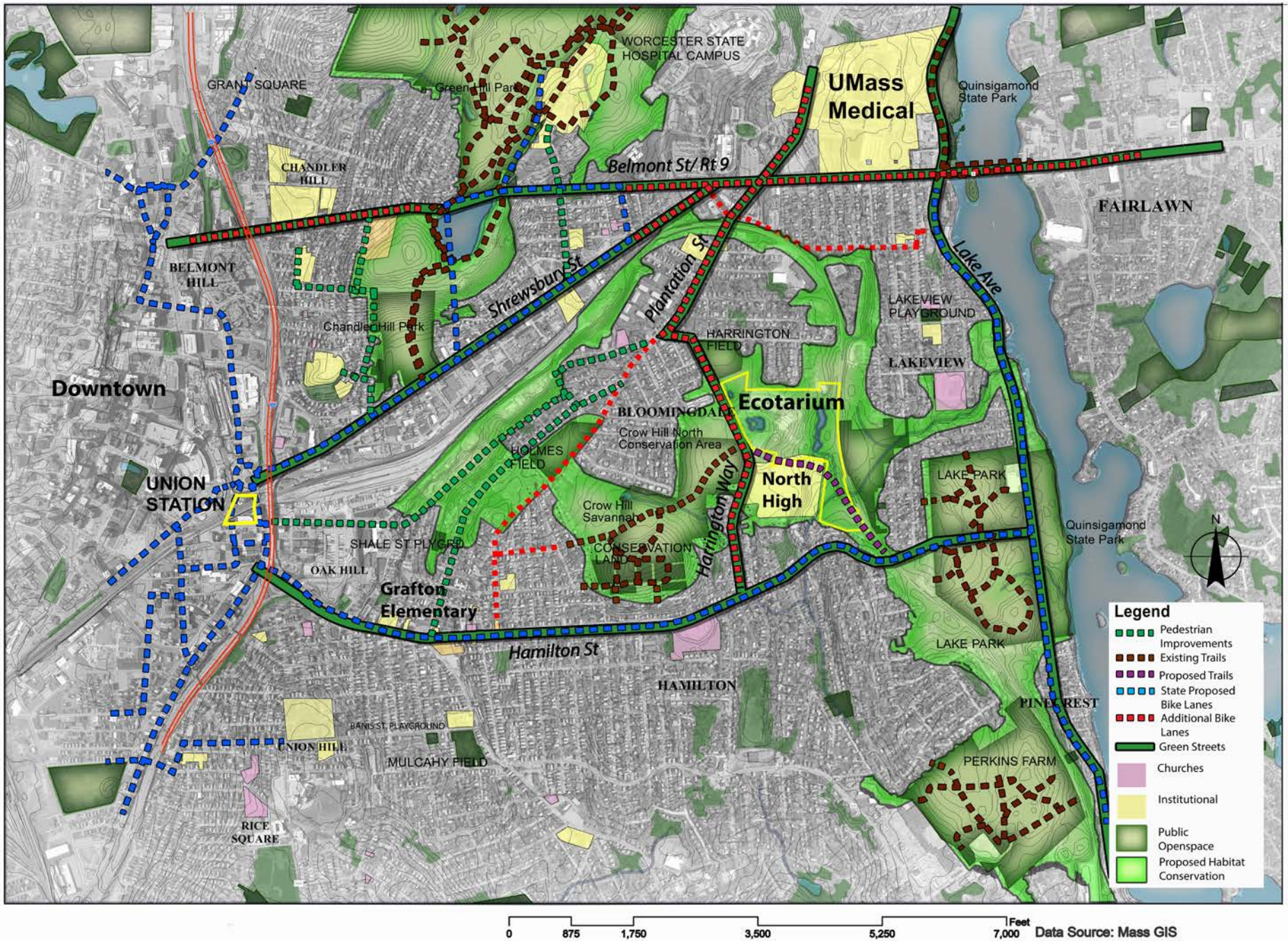
There were several aspects of the site area that were analyzed to compile a composite map from which a greenway plan was developed and designed. Part of the analysis was to recognize historic areas of Worcester, of which several are parks that may contribute to the green system. The team examined current land use, which shows the largely residential nature of the area. A system of sizable green spaces also becomes evident in the land use analysis. Further analysis of the composition of green space showed a range of open space typology, from forested conservation land and recreational fields, to some pasture and wetland areas. There is state designated priority habitat that passes into the site from the south. There are a number of intermittent streams and a high percentage of existing pervious surface, although runoff from parking lots and roads is predominantly culverted. Population density analysis shows a denser population in downtown the further one travels

away from most of the areas green space.

The area is surrounded on three sides by the highway to the west, and the railroad to the north and east. Access across these barriers is limited with there being only two roads that cross each; Plantation and Hamilton Streets across the railroad, and Franklin and Grafton under the highway. There are a number of city proposed bike lanes for the area according to 2013 city open space plan, and several existing trails in the conservation areas. There are also several educational institutions as well as medical facilities.

The overall assessment indicated a large connection of green and open space interconnected along the railroad corridor that would be suitable for habitat. In the final green space design, this area is targeted for conservation. Additional bike routes and green streets are recommended in addition to those proposed by the city. The purpose of these additional connections is to connect the most predominant educational institutions with each other and the green space network at large to improve safety and recreation for the sake of education and wellness, as well as access for those who live further from this area.

EASTERN WORCESTER GREENWAY PLAN



SAFETY, SIGNAGE AND EDUCATION ON HAMILTON STREET - Ericka Duym

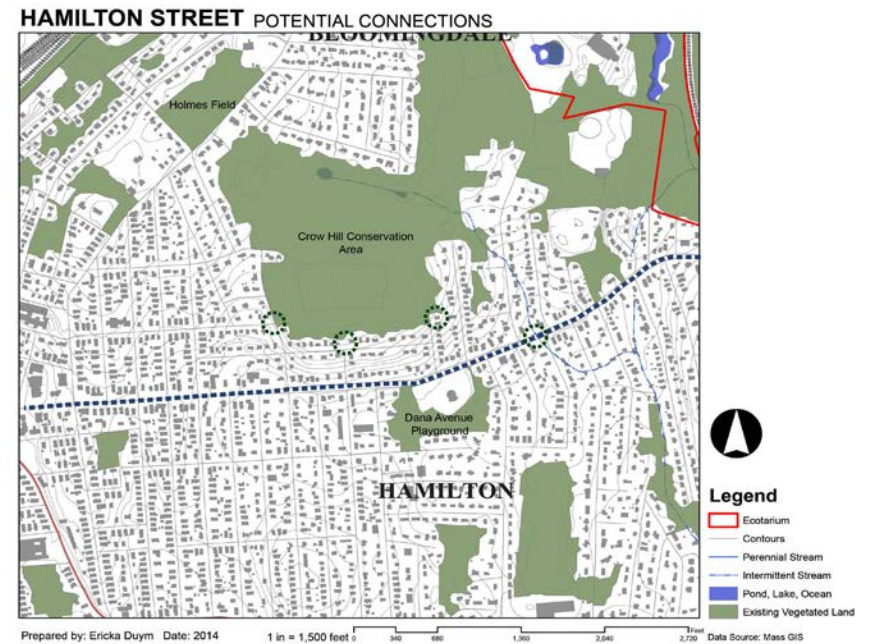
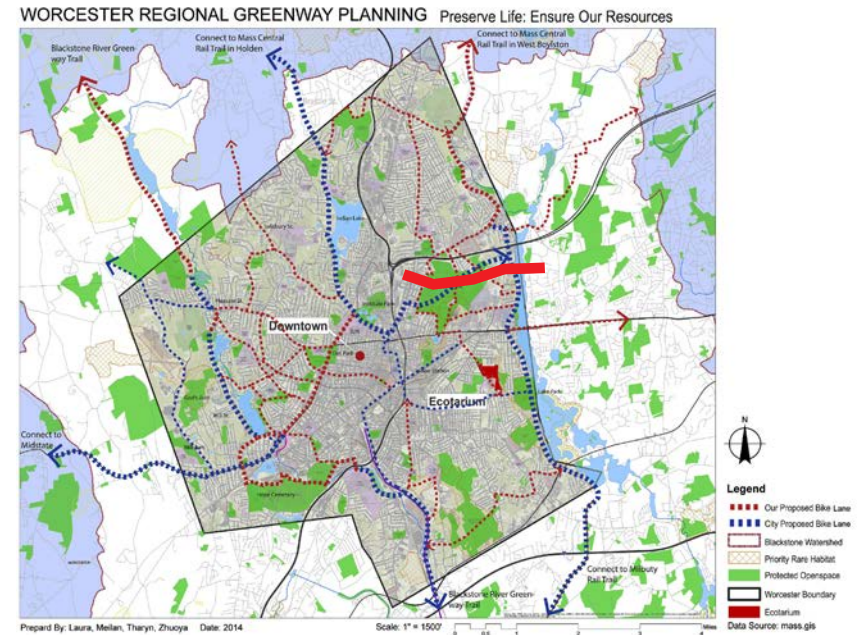
With visitation rates at an all time high in 2013, the Ecotarium located just to the north of this focus area, has a difficult time directing its patrons to its site on Harrington Way, on the eastern side of Worcester. With many local recreational, cultural and educational resources, the opportunity to connect the popular interactive displays and programs of the Ecotarium to the rest of the city has become the focus of this project.

In the 2013 Open Space and Recreational Plan, put forth by the City of Worcester, Hamilton Street was designated as a direct route for proposed bicycle connection between the downtown and Lake Quinsigamond (and Lake Park). Going off of this, the focus areas chosen in this project look at areas along the nearly 2.5 mile commute along Hamilton to the Ecotarium's location.

Two key focus areas were chosen as study sites for the safety of biking and pedestrian access for families, local school children and residents. Also looked at was signage for the Ecotarium. Current signage is very limited, and is not present at all along Hamilton Street. The first location chosen at Stanton Square depicts the possibility of having off-street bike and pedestrian connections, while preserving the parking needs of the community. The second area addresses interpretation, and commuting needs along the eastern end of Hamilton Street, where it intersects with Harrington Way. Proper signage, and the possibility of a corner-pocket park with interpretation for the EcoTarium is shown.

Ecotarium, Annual Report (2013)

City of Worcester Open Space and Recreational Plan (2013)



HAMILTON STREET FOCUS AREAS

Focus areas were chosen because of their proximity to both the Ecotarium, local elementary schools, as well as the existing street conditions.

Dartmouth Elementary School, now closed, though recently purchased, was chosen as a point of interest for its potential to teach children and the community on the ecological processes involved in nature's reclamation of a site.

Grafton Street

Dartmouth Elementary

Ecotarium



**FOCUS AREA 1
STANTON SQUARE**

**FOCUS AREA 2
LEMAY SQUARE**



FOCUS AREA 1
Hamilton Street
Stanton Square
EXISTING



The above photo shows existing conditions on Hamilton Street at Stanton Square (Intersection of Hamilton Street and Plantation Street). Pedestrian access along the sidewalks has been impeded by vertical parking.

FOCUS AREA 1
Hamilton Street
Stanton Square
PROPOSED



The proposed plan would increase safety for both cyclists and pedestrians as well as retain parking spaces for local businesses and residents. This concept introduces a buffer strip, angled parking, as well as off-street bike and pedestrian lanes.

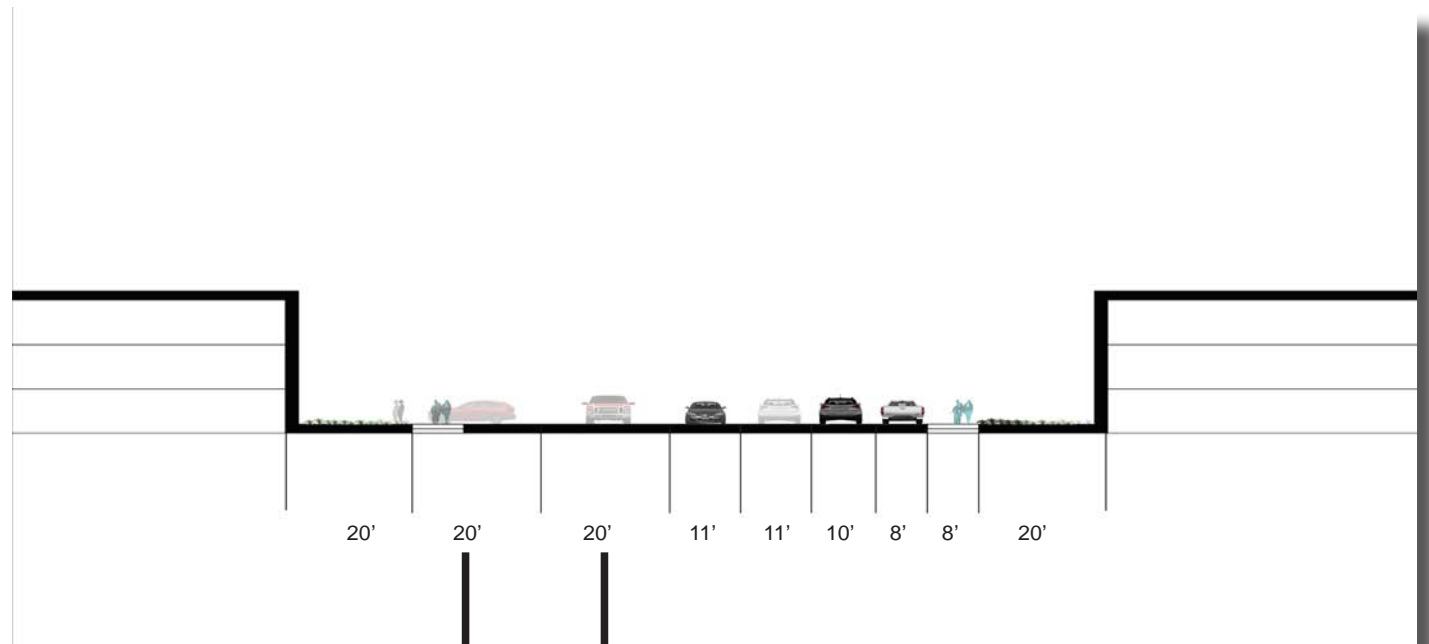
FOCUS AREA 1
Hamilton Street
Stanton Square
EXISTING

Unsafe Sidewalks

Wide-undefined lanes

Parking a necessity

Section A
Existing

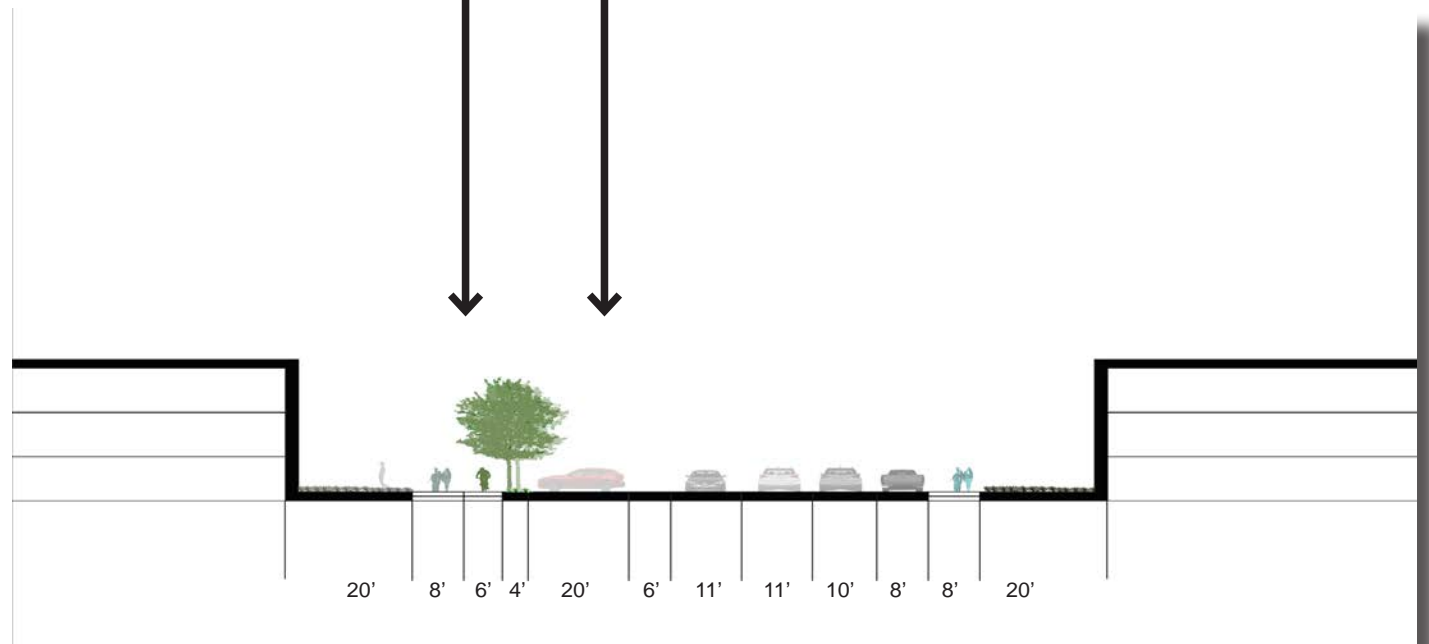


FOCUS AREA 1
Hamilton Street
Stanton Square
PROPOSED

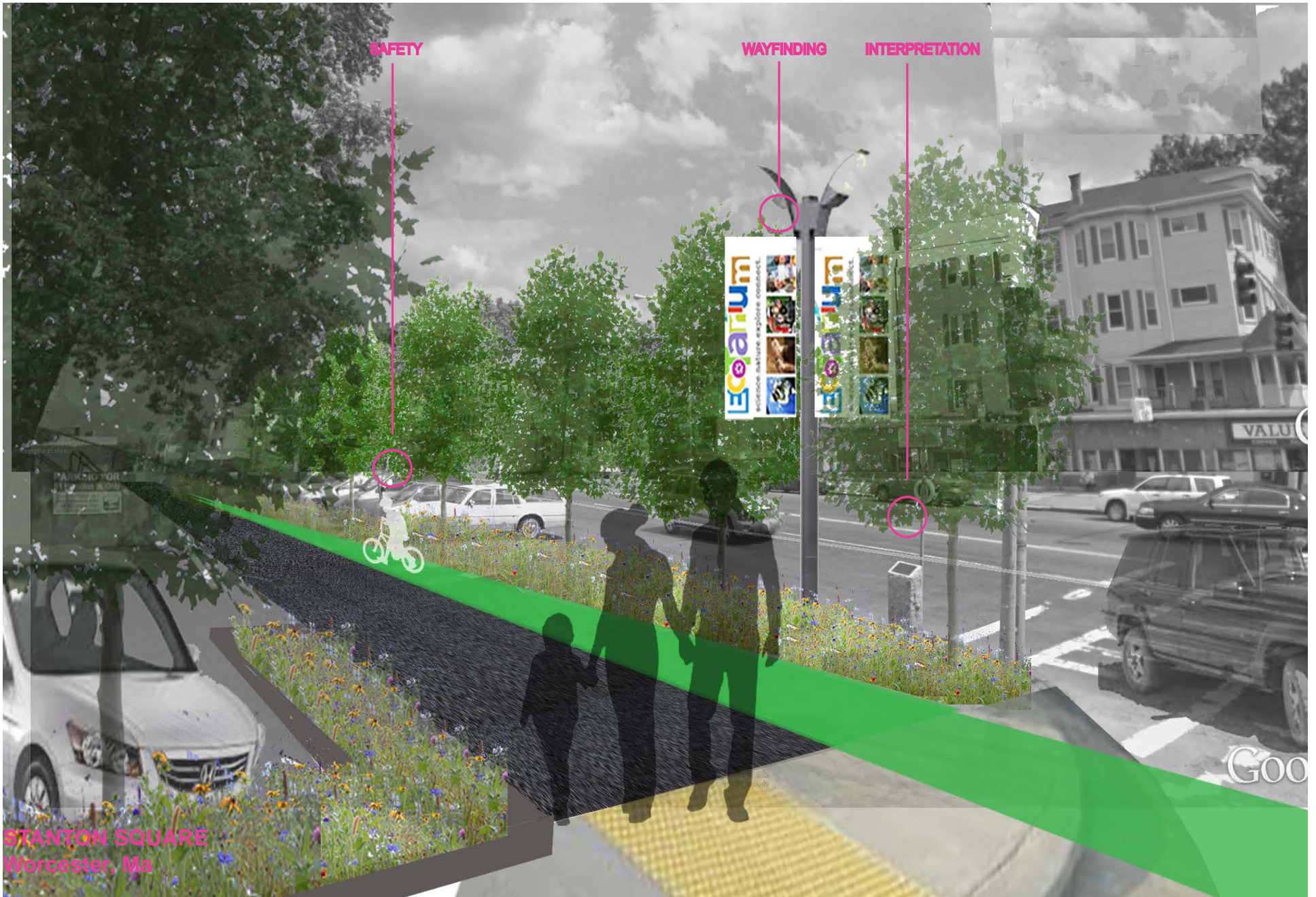
Separate bike and pedestrian

Angle Parking solution

Section B
Proposed



Duym 2014



STANTON SQUARE
Worcester, Ma

Rendered perspective showing proposed off-street bicycle and pedestrian access along the west bound lane of Hamilton Street for safer access to points downtown, and west to Lake Quinsigamond and the EcoTarium.

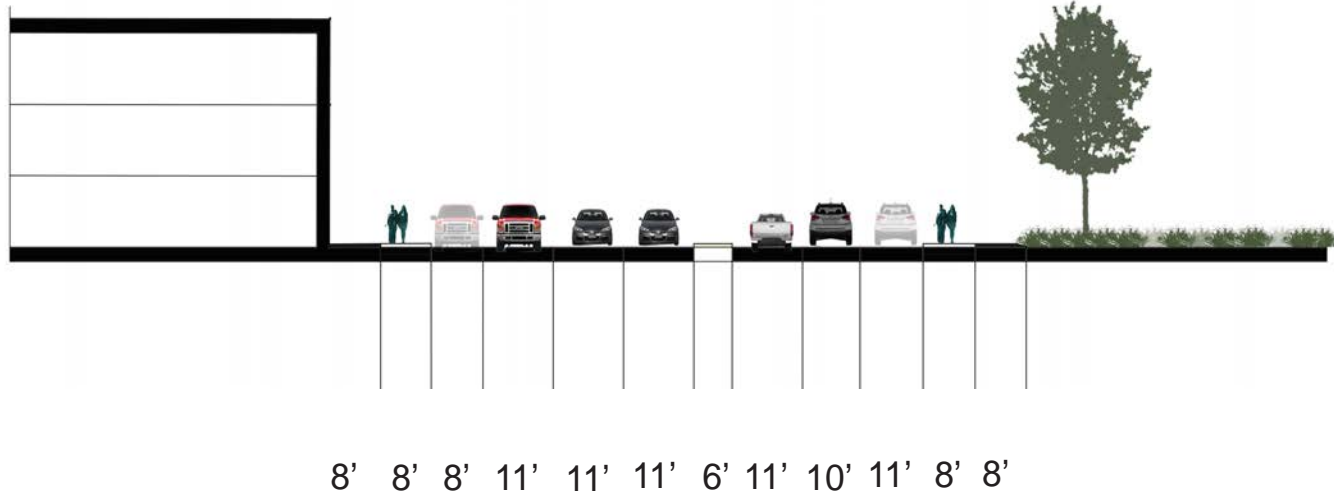
FOCUS AREA 2
Hamilton Street
Lemay Square



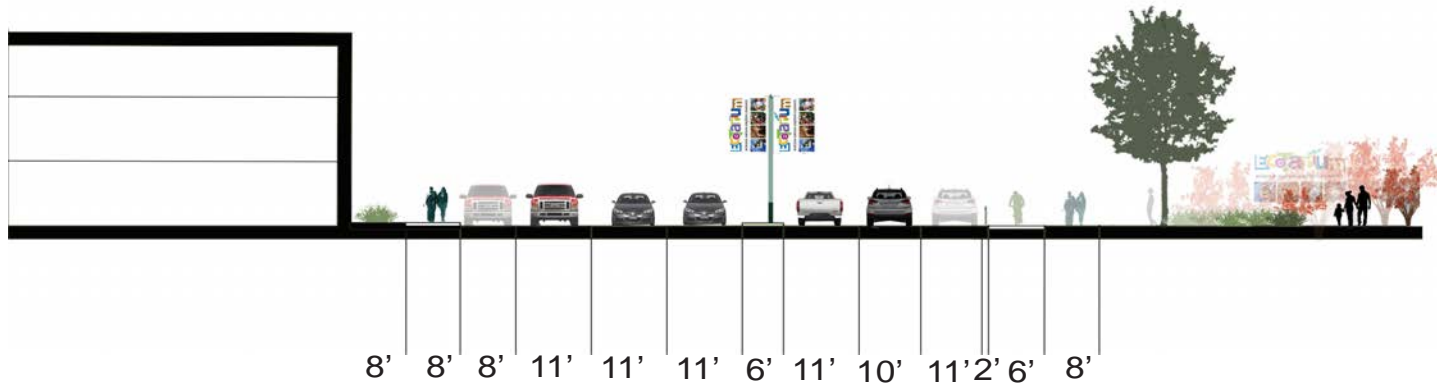
-  Proposed Trees
-  Bike Lane
-  Bollard Strip
-  Proposed Signage

FOCUS AREA 2
Hamilton Street
Lemay Square

Section A
Existing



Section B
Proposed





WIDE TRAVEL LANES

UNDEFINED LANES

HIDDEN SIGNAGE

LEMAY SQUARE
Worcester, MA

EXISTING
Duym 2014

Ericka Duym Photography



LEMAY SQUARE
Worcester, MA

PROPOSED: Rendered perspective showing proposed off-street bicycle and pedestrian access along the west bound lane and interpretive area for the EcoTarium on the corner.

Hamilton Street summary:

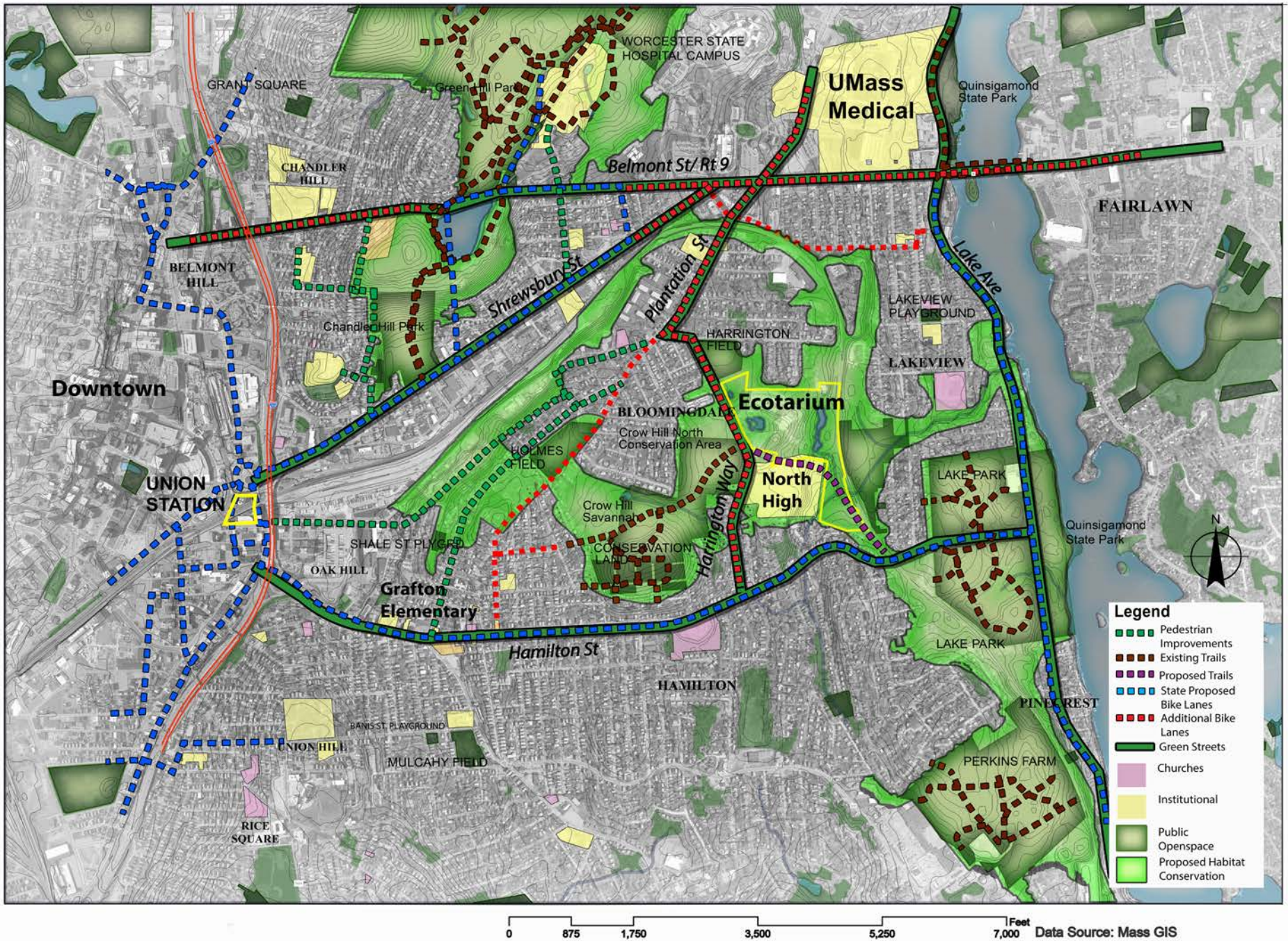
Stemming from the team Eastern Worcester Greenway Plan, as well as from the city's Open Space and Recreational Plan, Hamilton street has become an important east-west route for the connection of the downtown, through to Lake Quinsigamond and its opportunities. Current conditions of this street have made pedestrian and biking access difficult to maneuver at key areas.

What can be learned from this, is that Hamilton Street not only possess the ability to connect residents to recreational opportunities, but also has the unique advantage of being a route for interpretation and signage for the Ecotarium. With wayfinding being a challenge in Worcester, Hamilton

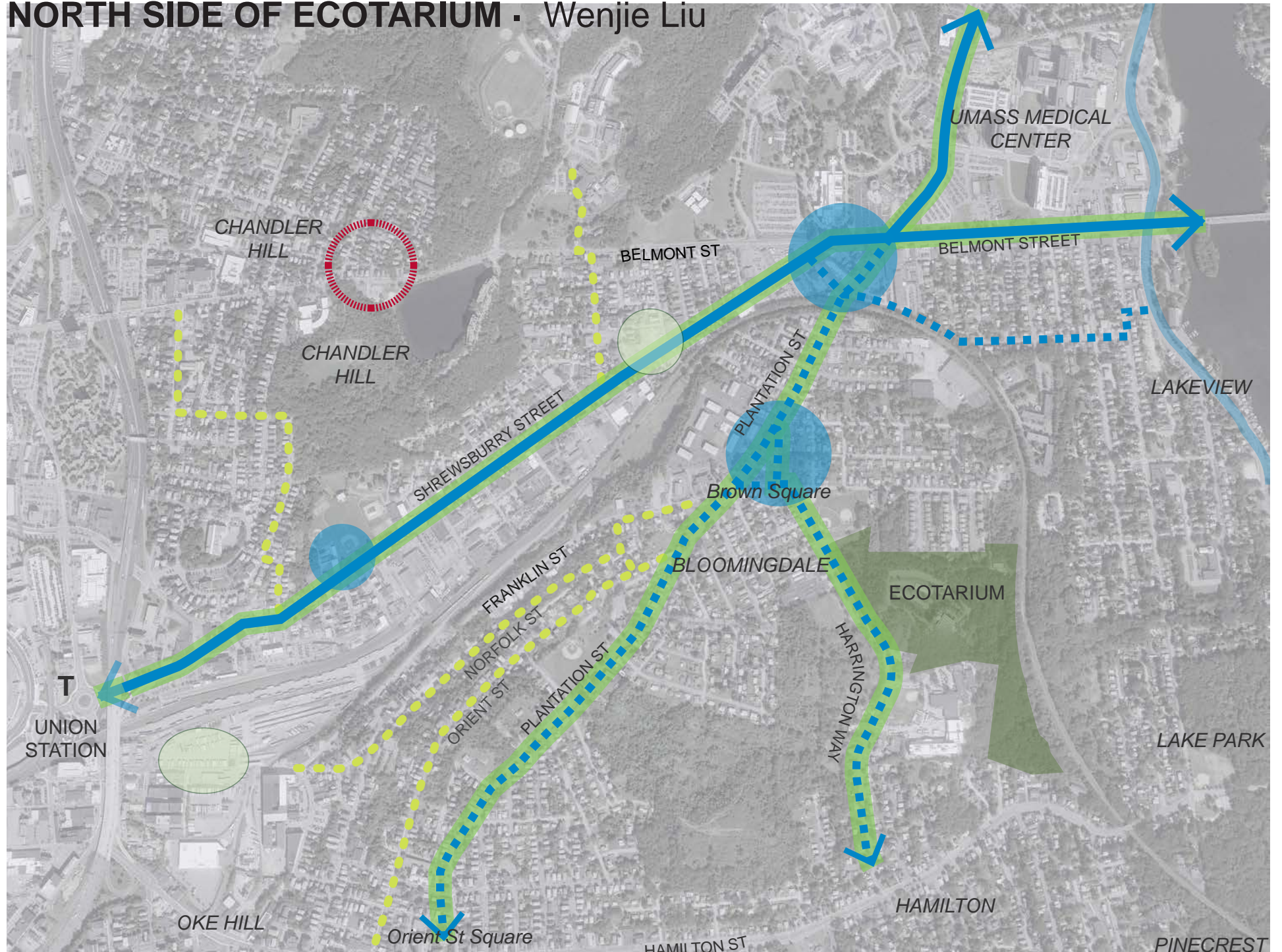
Street has clearly shown its potential to be a starting point for city initiatives such as Wayfinding Worcester, and other programs, such as the National Safe Routes to School Initiative.

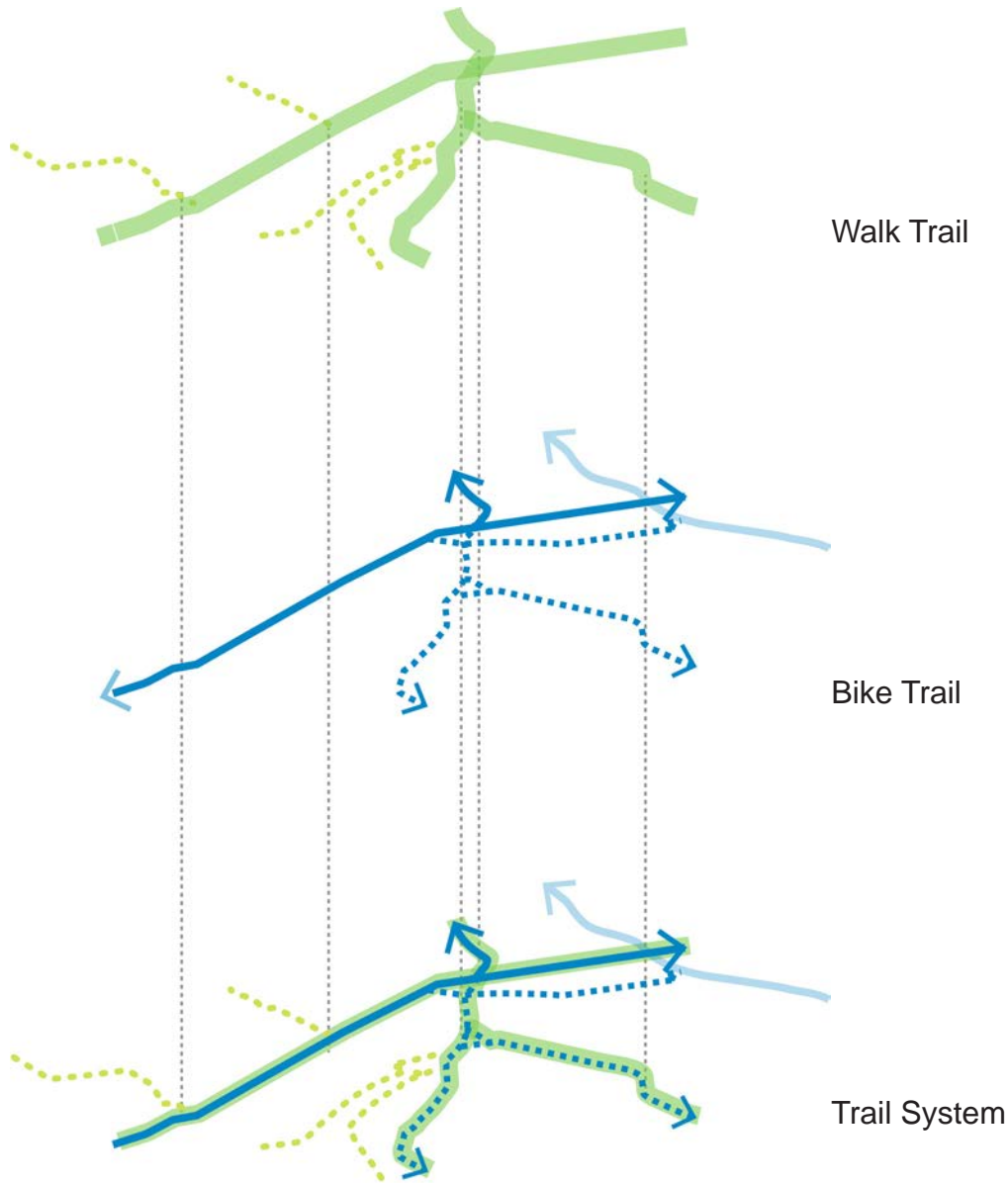
The two focus areas along Hamilton Street have demonstrated their ability to both creatively solve parking problems, keep biking and walking residents safe and on a direct, and well marked route. The more the city has the opportunity to solve several problems in small, highlighted areas, with safe connections between, the more attainable a commuter friendly environment can be achieved.

EASTERN WORCESTER GREENWAY PLAN



NORTH SIDE OF ECOTARIUM - Wenjie Liu





LEGEND

- Primary Walk Trail
- ⋯ Secondary Walk Trail
- Primary Bike Trail/ Bike Lane
- ⋯ Primary Bike Trail/ Bike Lane



GOALS:

- Provide easy connection to cultural resources
- Improve trail system and promote healthy living
- Environmental benefit

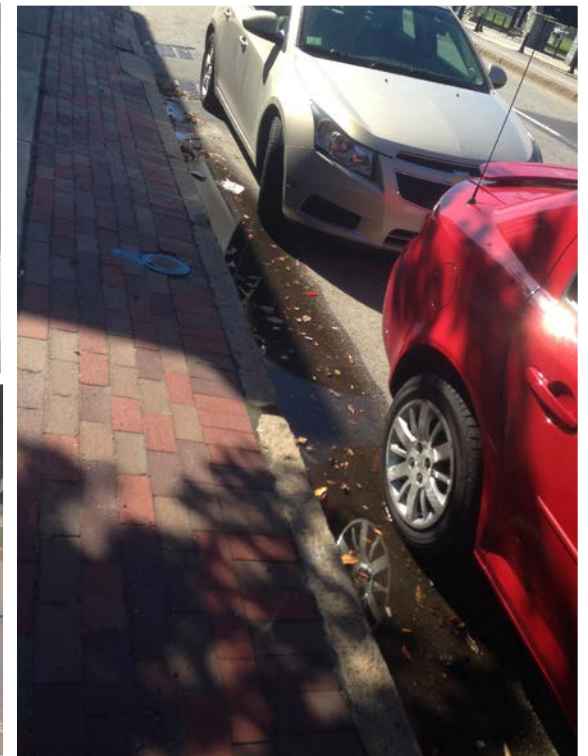
INTRO:

This part of work focuses on the area above EcoTarium, which includes Shrewsbury Street, Harrington Street and the neighborhood streets around this area. The goals are to improve the trail system and to provide a easy way-finding to EcoTarium.

As the city has been using Combined Sewer System, this greenway plan proposes a few green infrastructure tools to deal with the stormwater issues.

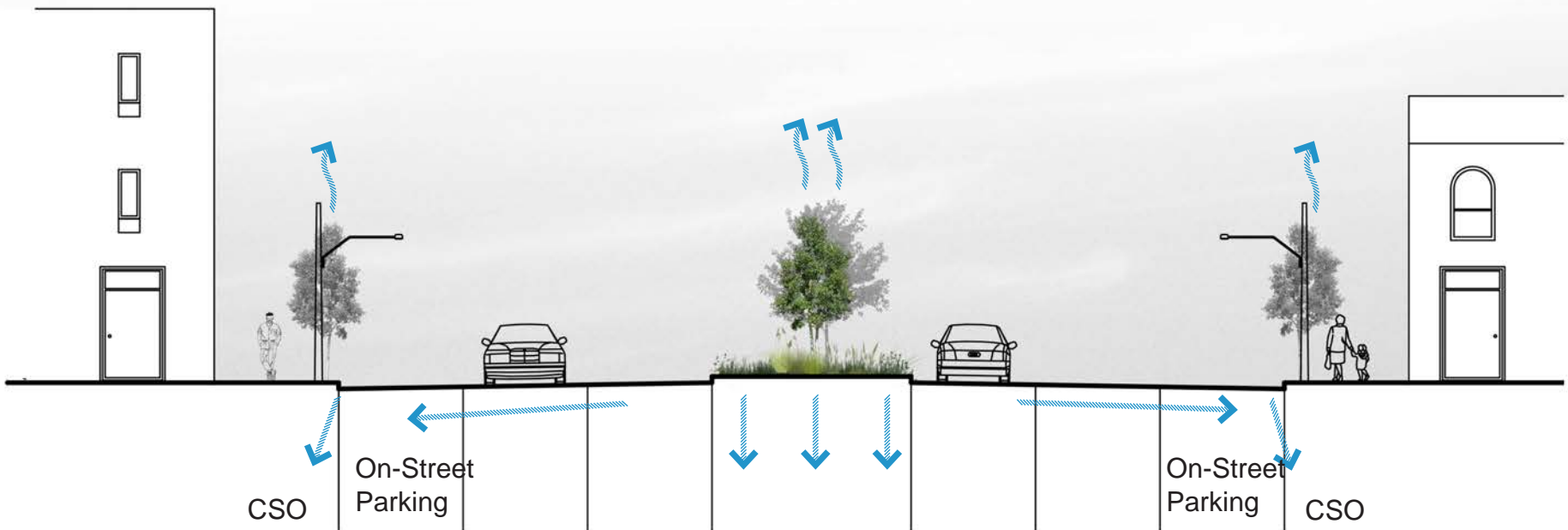
First, to connect Quinsigamond to downtown Worcester, there will be bike lanes added to Shrewsbury Street. Secondly, to connect the northeast area to the Ecotarium where the UMass Medial Center located, the plantation Street should be made improvement. Also when Shrewsbury Street and Plan-tation Street come together, the intersection is very busy. To avoid the traffic conflict, there will be an alternative street for the bikers. Thirdly, to connect the neighborhood to the green resources and education resources, there will be secondary walk trails among the main neighborhood streets.

Shrewsbury Improvement

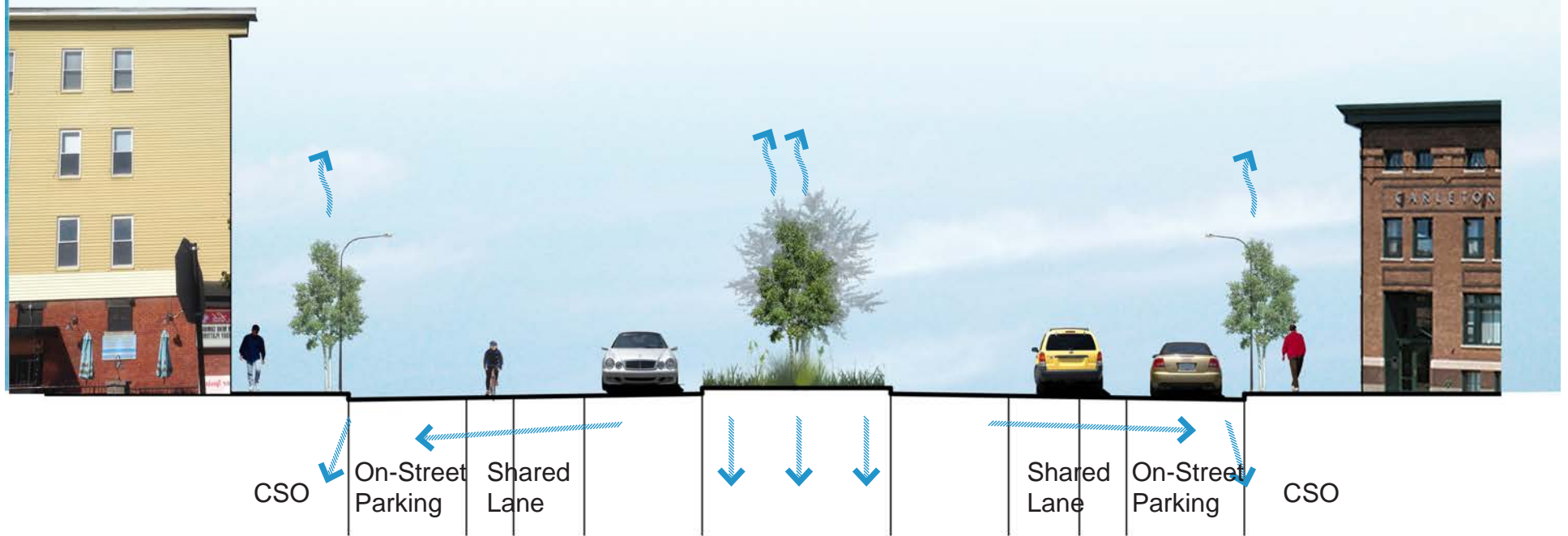


SITE PROBLEMS

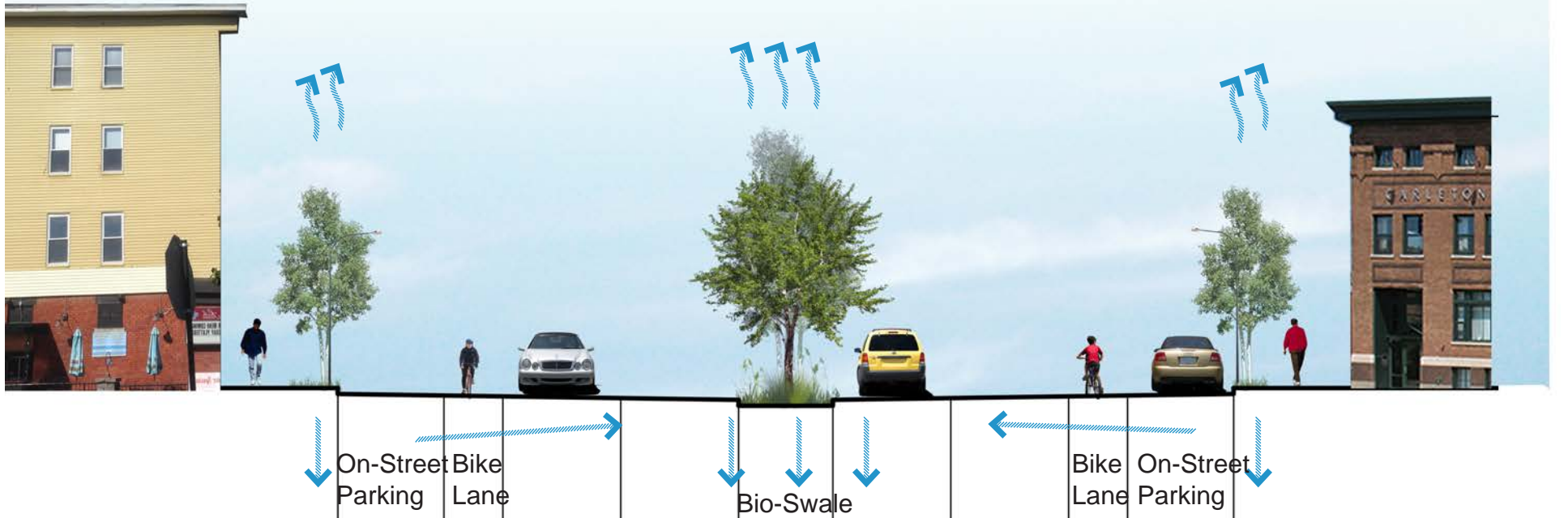
- Narrow sidewalk
- No bike lane
- Combine sewer system



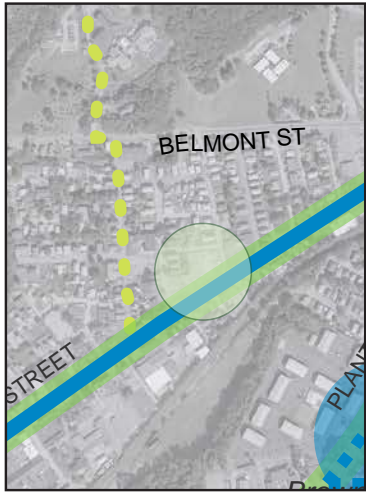
OPTION 1



OPTION 2



Shrewsbury Vacant Lot



Urban Agriculture

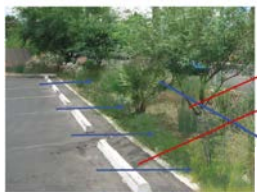


http://66.147.244.60/~ /wp-content/uploads/2011/10/costs-benefits_diagram1.jpg?w=1024

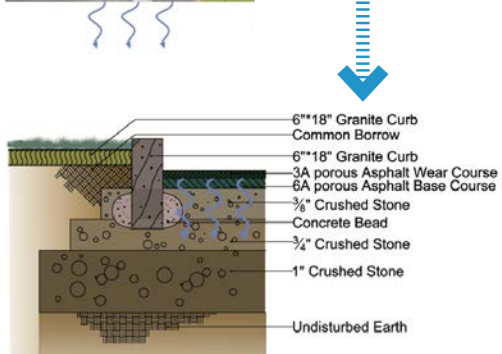
Shrewsbury Parking Lot



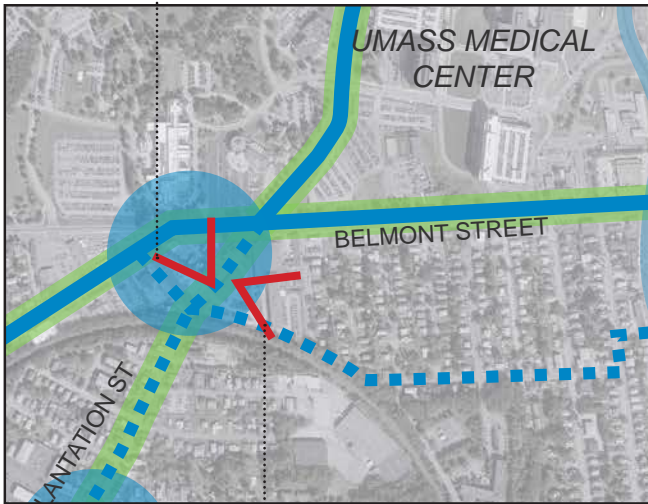
Green Parking Lot



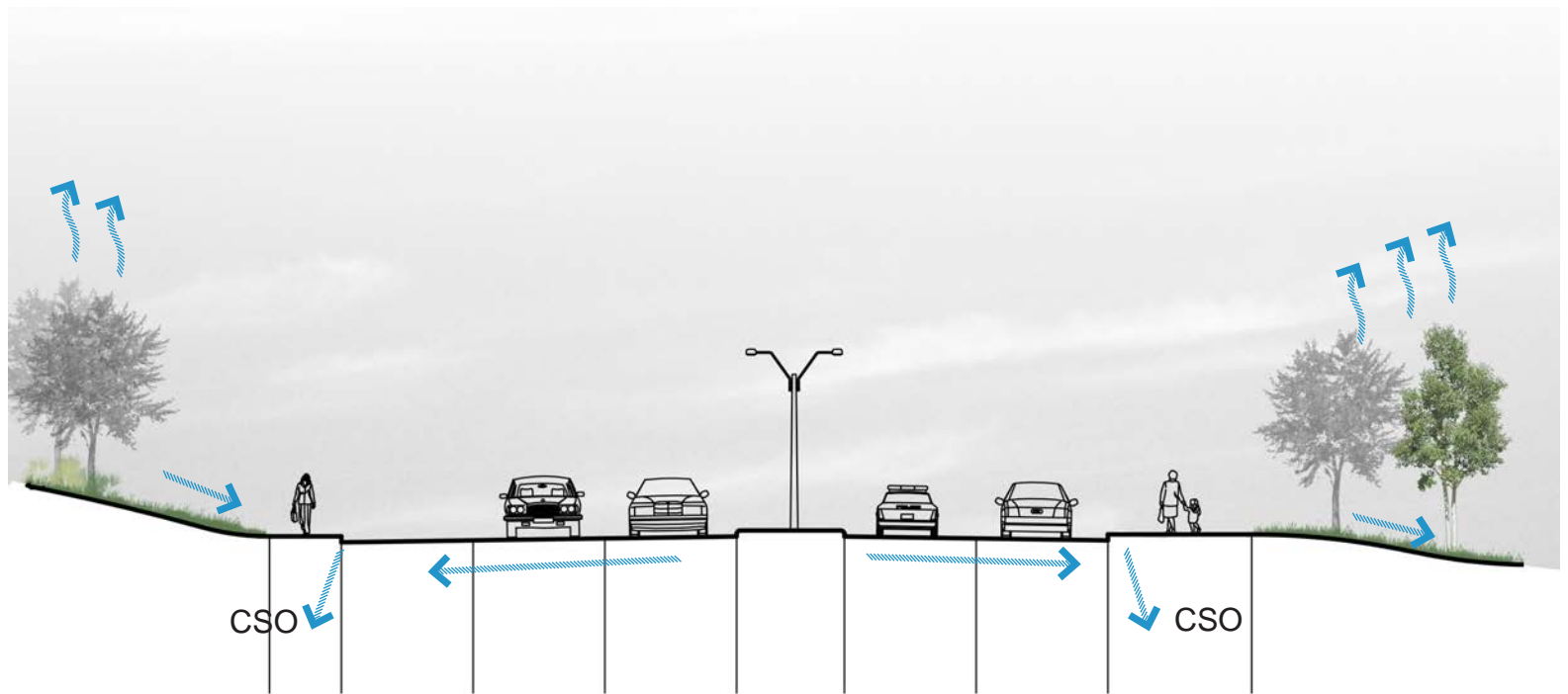
Rain Garden
Pervious paving



Intersection Alternative

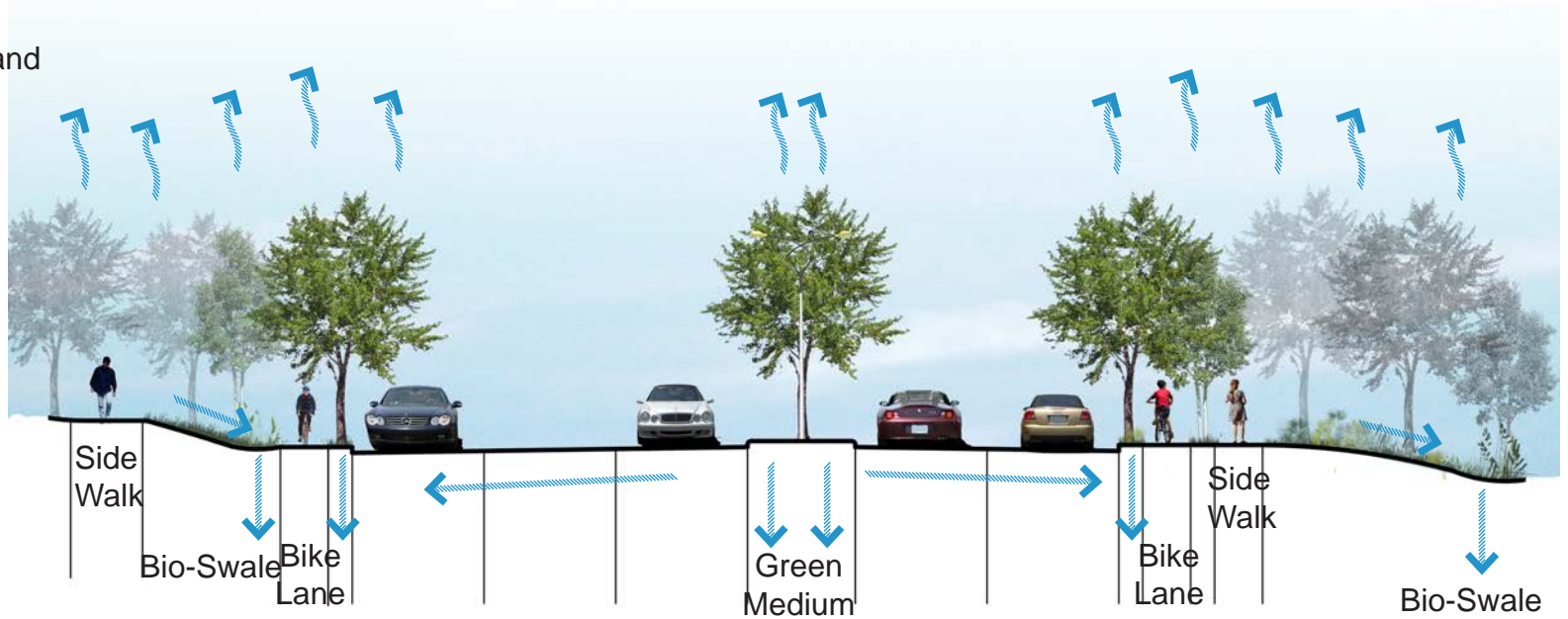
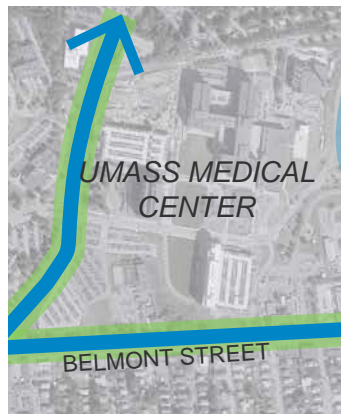


Plantation St

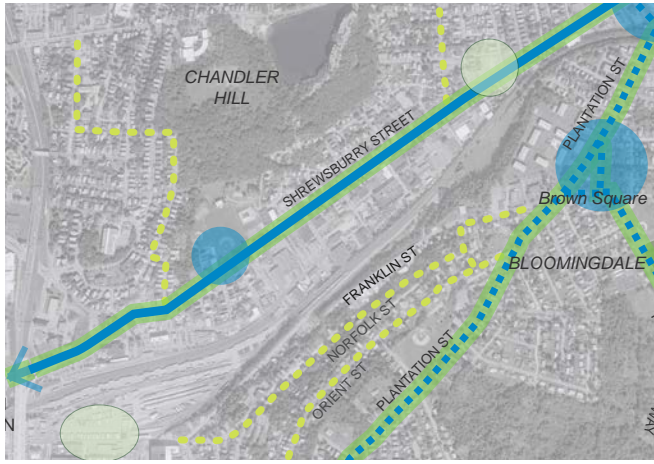


STREET IMPROVEMENT

- Street trees and green medium
- Separate side walk and bike trail

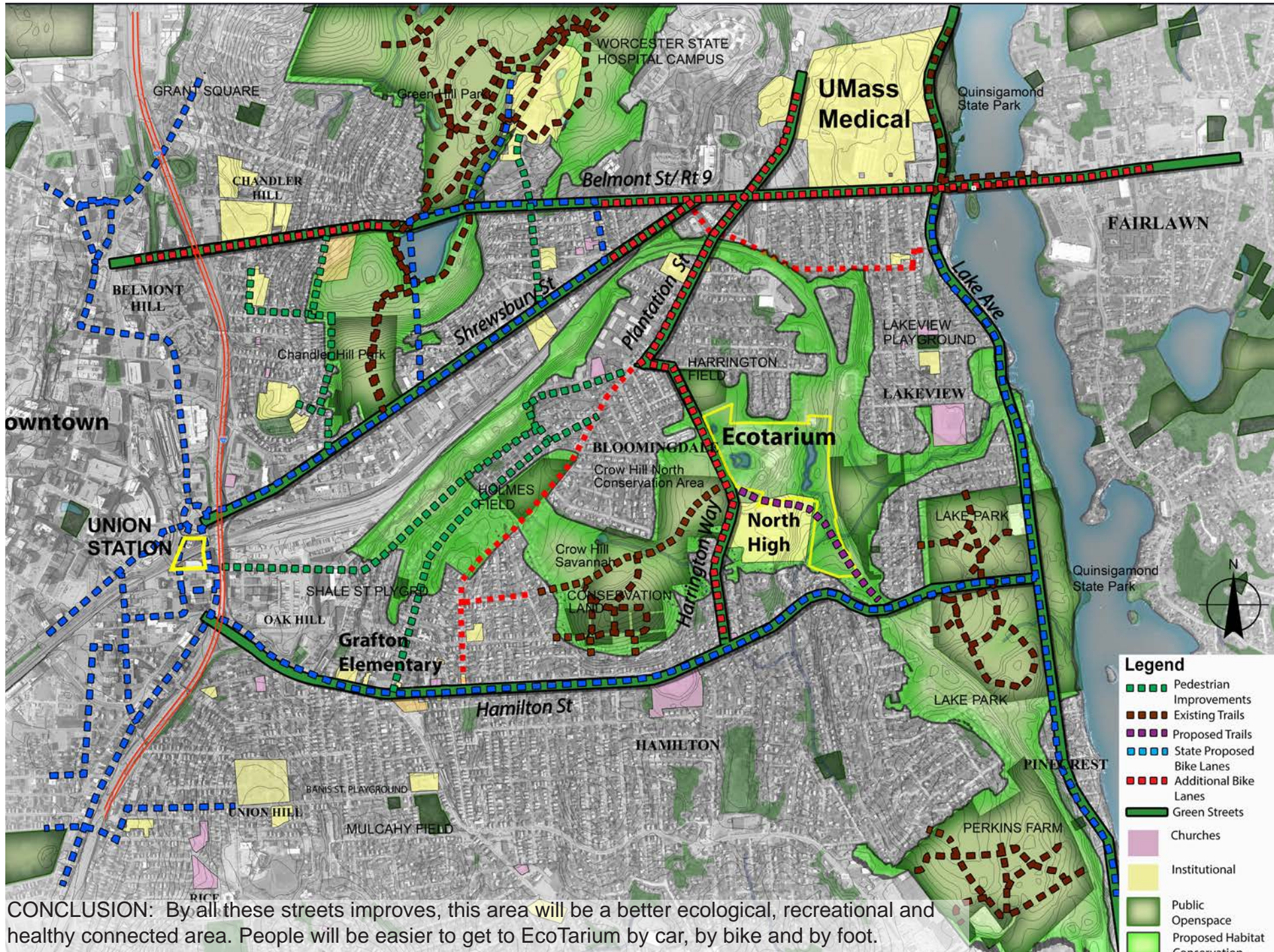


NEIGHBORHOOD IMPROVEMENT



The Norfolk Street and Orient Street are both quiet and low-traffic street. By greening the sidewalk, adding bike lanes and signage of Eco-Tarium, such neighborhood street will eventually be a good connection between residents and the local green and education resources.





CONCLUSION: By all these streets improves, this area will be a better ecological, recreational and healthy connected area. People will be easier to get to EcoTarium by car, by bike and by foot.

ECOTARIUM SITE - Joseph LaRico

The EcoTarium

The EcoTarium, located in eastern Worcester, is the second largest science museum in Massachusetts with over 130,000 visitors per year. The institution has a storied history, well rooted in Worcester and the region. Founded in 1825 as the Worcester Lyceum of Natural History, the EcoTarium is a private, non-profit institution dedicated to the study of science and nature. The EcoTarium's legal identity, the Worcester Natural History Society was incorporated in 1884. Although the museum's location changed over the years, the current location was built in 1971 on 60 acres of donated land. In 1998 the EcoTarium name was adopted with a new focus on hands-on exploration and discovery. The name change accompanied a major capital development project that has transformed the building and grounds into a learning and discovery center for families. The EcoTarium is a forerunner in science and ecological education to schoolchildren from elementary to high school, with a progressive combination of interactive and live exhibits. The EcoTarium's current focus is to invest in new exhibits inside the museum building that bring the wonder of science and nature to life all year round (<http://www.ecotarium.org/about-us>).

The EcoTarium Mission:

*“To inspire a passion for
science and nature.”*

The Project

The EcoTarium is currently on the precipice of a new capital campaign and is looking for potential areas where site improvements may be made. There was a master plan commissioned during the last capital campaign that was largely implemented but there are site issues that currently exist. I was tasked with assessing the site, determining areas in need of intervention, and proposing design solutions for those areas. Along with some consultation by EcoTarium representatives, there were several areas where noticeable improvements could be made. An additional goal was to make the EcoTarium part of a greater green network in the city of Worcester.

Site Observations

- Wayfinding to the property is difficult. There is no noticeable signage on the multiple highways, and small illegible signage on Rt.9 and Hamilton St.
- On site signage is not at eye level allowing it to be overlooked. Much of the directional signage contains relatively small print as well.
- Some paths seem to end at dead ends causing backtracking or walking in the drive way. Most specifically the path to the otter exhibit that leads to the timescape walk is confusing. There is an intersection where the path splits and leads to dead ends on either side. This has led to some cut throughs, mostly to the driveway, where one is left directionless. This creates a pedestrian-vehicular conflict with potential safety concerns. The other alternative is to backtrack, creating poor overall circulation for this area.
- The cross walk to the land across the street is a problem, especially if there were to be any increased use. Traffic is fairly fast through that area despite the speed limit, and there is limited visibility when crossing back to the EcoTarium entrance.



ECOTarium

science.nature.explore.connect.



Joseph Larico Photography

- There is a sizeable area behind the museum past the rear patio that appears to be underutilized. It is centrally located and could have potential for some kind of development or activation.
- The lower lot entrance does not feel like an entrance. There is little sense of arrival or design to this entrance. There is a map, but there is little indication that it is a main entrance. There is also a lack of direction to the wildlife and playground paths. Pedestrians are forced to use the driveway to get there. There is also pedestrian conflict/ confusion with the rear entrance access road that runs along side the entrance to this area toward the fox exhibit.
- Upon multiple visits to the EcoTarium my primary observation is that the EcoTarium is so fun! It is a truly unique museum and grounds that evoke wonder in exploration and learning, primarily in children but even in adults.

Goals For Design

Based on these observations I developed four goals for design, that were of most consideration in implementing design interventions for the EcoTarium. The first goal was to improve wayfinding on the EcoTarium property as well as to the EcoTarium making the EcoTarium part of a larger city network. The second goal is to introduce green infrastructure and renewable energy for demonstration and learning. The third goal was to utilize the land across the street as an extension of the EcoTarium. The final design goal was to design according to the mission and current goals of the EcoTarium. The landscape of the EcoTarium should be one of interactivity with nature and exploration in the spirit of science learning.

Site Improvements and Design

Based on the site observations and goals, I identified several areas of priority for improvement and design. Some of the recommendations are off site but most are on the EcoTarium property itself.

One off site recommendation is for additional advertising and signage on the major highways. These would serve not only for advertisement but wayfinding as Worcester roads can be difficult to navigate. This should be combined with additional city and state signage, recognizing the EcoTarium for the cultural institution it is and assisting people in knowing about it and then finding it. Harrington Way should be included in the cities bikeway, and bike lanes added not only to connect bike systems but also for traffic calming. The crosswalk across the street in front of the EcoTarium should be better labeled and marked to make the crossing safer for visitors wanting to utilize the trails, etc. A bus stop should be added to give additional access to the museum for those without cars or visitors by bus or rail through Union Station.

One of the first on site recommendations would be to change the name of the parking lots from upper and lower lots to otter and fox lots. This is not merely for whimsy but will give people an additional reference for wayfinding once they encounter the first site map. This would also serve to peak immediate interest in two of the museums bigger live attractions. It was expressed by representatives of the EcoTarium that the otter exhibit is possibly missed by some visitors as a result of its location and a lack of awareness. By naming the lots after these closely located exhibits it will hopefully raise the awareness that they are close by. I also think a new standard crosswalk that had the two recognizable white stripes and paw prints internally. The prints are an opportunity for learning as well as tool to guide people throughout the property.

For the fox lot I would make several recommendations. There are substantial vegetated buffers between lot sections that would be suitable for rain gardens. This would serve to assist in water management on the lot, but more importantly would be a opportunity for the demonstration and possible monitoring and experimentation of green technologies and methods. Solar powered street lamps would also be good to demonstrate the use of renewable energy. The entrance located at the end of this lot should be redesigned to invoke a



sense of arrival and place. The design calls for a minor road realignment on the east side of the lot losing approximately four parking spaces, but would allow for a more sizable lobby-like area and a sidewalk towards the fox exhibit, wilderness trails, and playground to prevent people from walking into the car traffic areas except for crossings. At the new entrance, signage reminiscent of the main entrance would help people recognize it as a main entrance as well, and create a sense of arrival. A solar powered interactive kiosk would demonstrate renewable energy while also updating the EcoTarium's technological resources and assisting in way finding and information on exhibits and special opportunities. There is also an opportunity for sculpture in the way of the Art of Science Learning initiative that the EcoTarium and city of Worcester are participating in. The other big change would be to eliminate the access road that heads toward the fox exhibit and relocate it to the other side of the lot and along the northern property boundary to eliminate any pedestrian-vehicle conflict.

Around the EcoTarium building there are a couple of potential opportunities for currently underutilized space. One space is the roof at grade level with the front entrance. It could be a great place for a green roof. A structural analysis of the building would have to be done and would determine whether it would be purely for demonstration or if it could be an extension of the deck that people could walk on and have further exhibits, sitting, or gathering space. The other space is located in the rear of the building just past the back patio. There is some kind of concrete slab surrounded by plantings. This would be a fantastic area for a large exhibit with potential year round interest. I suggest a frog and fish pond as an expansion of the New England's watery habitats exhibit inside the building.

Around the upper pond area I recommend two new paths that would return people to the main entrance at the Otter lot. One of these paths would be a boardwalk that would create a different experience around the pond, as well as improve circulation, eliminate the pedestrian-vehicular conflict that currently exists, and provide areas for additional interpretation such as an interactive birds of New England board with pictures and sounds.

Finally I would recommend activating a portion, if not the whole property across the street as the EcoTarium community garden and trails. This would most likely require a combination of cooperative efforts with local farms or nurseries and a community group, but would be a great opportunity for additional community outreach and learning. It would also serve as an extension of the EcoTarium that could be free of charge. The size and structure of the garden would vary with demand and maintenance capabilities and remaining land can remain open space for overflow parking or events such as farmers markets, art shows, camps, and other special events. The design for this sight includes the planting of boarder plantings as well as a wildflower meadow as the entrance to the trails. Plant species would be determined by their suitability for local fauna such as moths, butterfly, and pollinators. An array of different bird houses could serve as living exhibits as well as promote species biodiversity. A separate pedestrian entrance from a parking area would minimize conflict and promote safety. Another sculpture could create a sense of arrival and place as well as learning. An example would be showing the life cycle of the Orange Swallowtail Moth, a species of concern that resides on the property. Activating the space also provides additional opportunities for exploration, discovery, and learning through interpretation, tours, and community events.

Conclusion

The EcoTarium is a unique and wonderful place for exploration and learning. My hope for this design was primarily to help optimize the visitor experience and expand on the already very successful program. The design is meant to improve existing areas of need without too many large infrastructure changes in order to make the suggestions implementable based on available funding. One area where the sight could use additional investigation for improvement is handicap accessibility, which would require survey information for accurate and believable recommendations. I enjoyed the design experience and every interaction I had with the EcoTarium. I wish the entire museum and staff great success, and I am sure that the Ecotarium will continue to inspire generations of children to learn about science and nature into the future.



Joseph Larico Photography



picture from tripadvisor.com



Joseph Larico Photography



Joseph Larico Photography



Joseph Larico Photography

Existing Site



Site Observations

-No noticeable signage on highways and small illegible signage on Rt.9 and Hamilton St.

-Some paths seem to end at dead ends causing backtracking or walking in drive way

-Signage is not at eye level allowing it to be overlooked

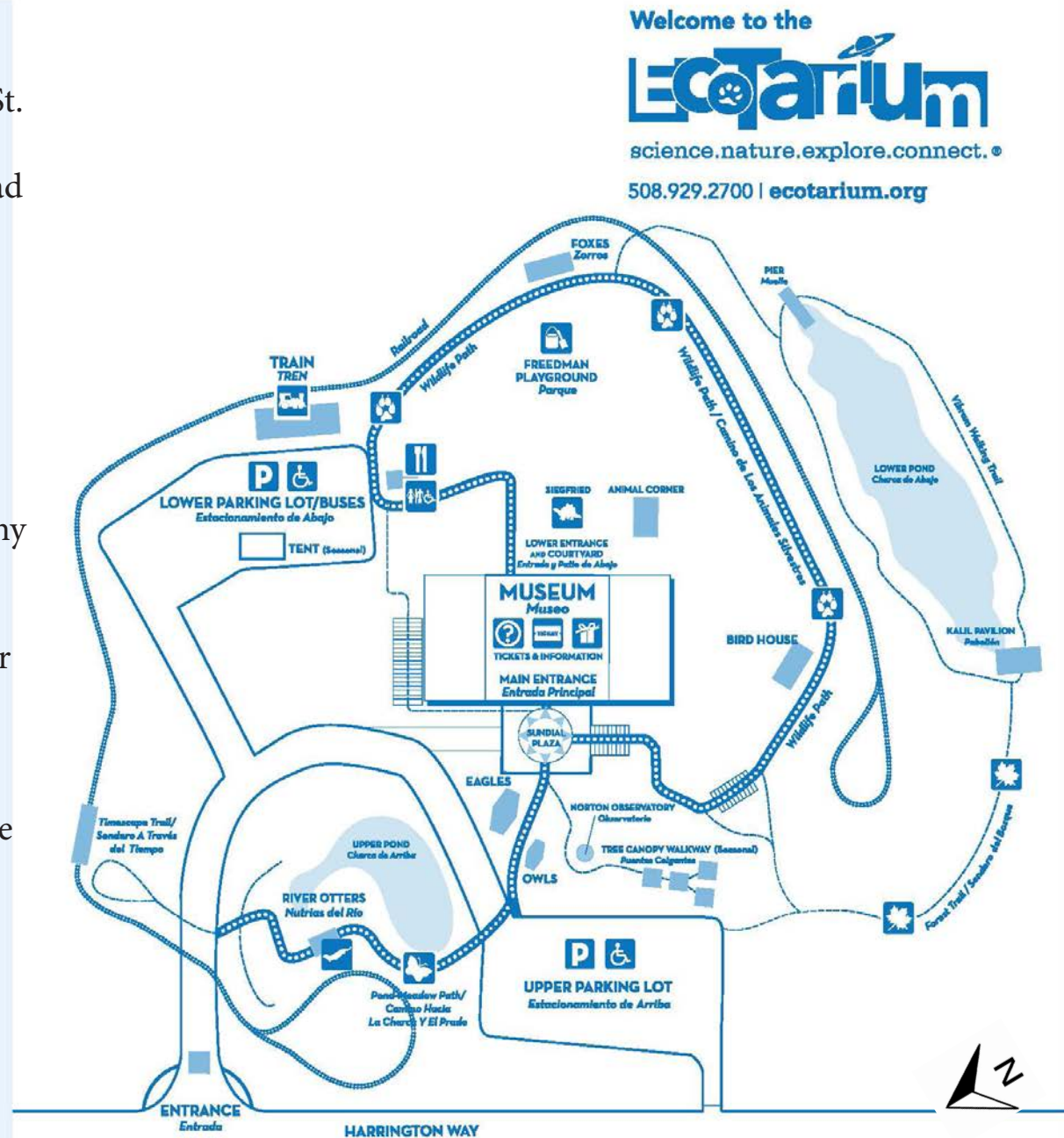
-Pedestrian safety would be an issue if land across street had any higher use

-Great opportunity in back near animal corner for the large unactivated space in middle

-Rear entrance does not feel like an entrance

-Pedestrian conflict/ confusion with rear entrance access road

-The Ecotarium is so fun!



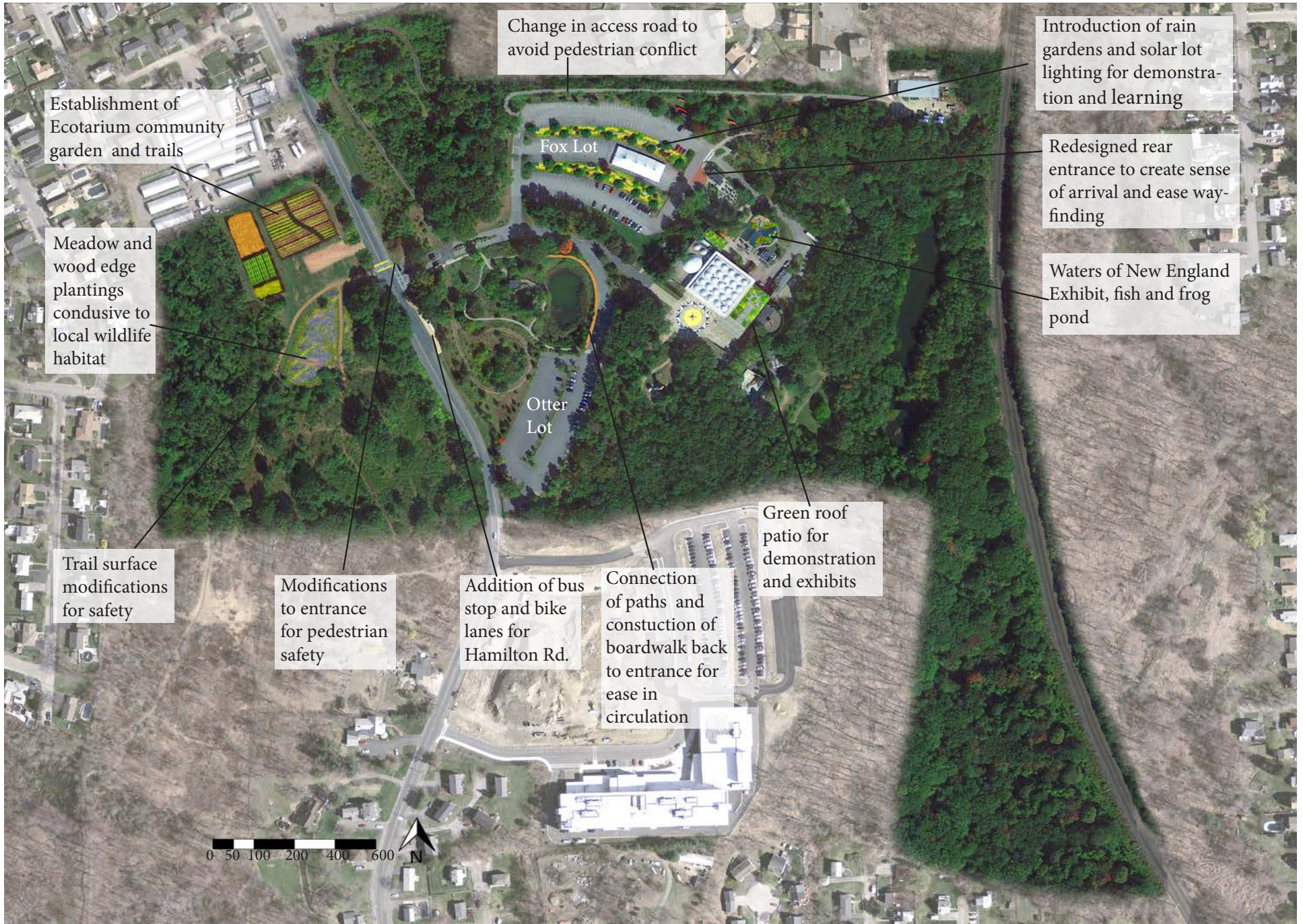
Areas for Design Intervention



Goals for Design:

- Improve Wayfinding on Property
- Introduce green infrastructure and renewable energy for demonstration and learning
- Utilize the land across the street as an extension of the Ecotarium
- Design according to the mission and current goals of the Ecotarium

Site Improvements

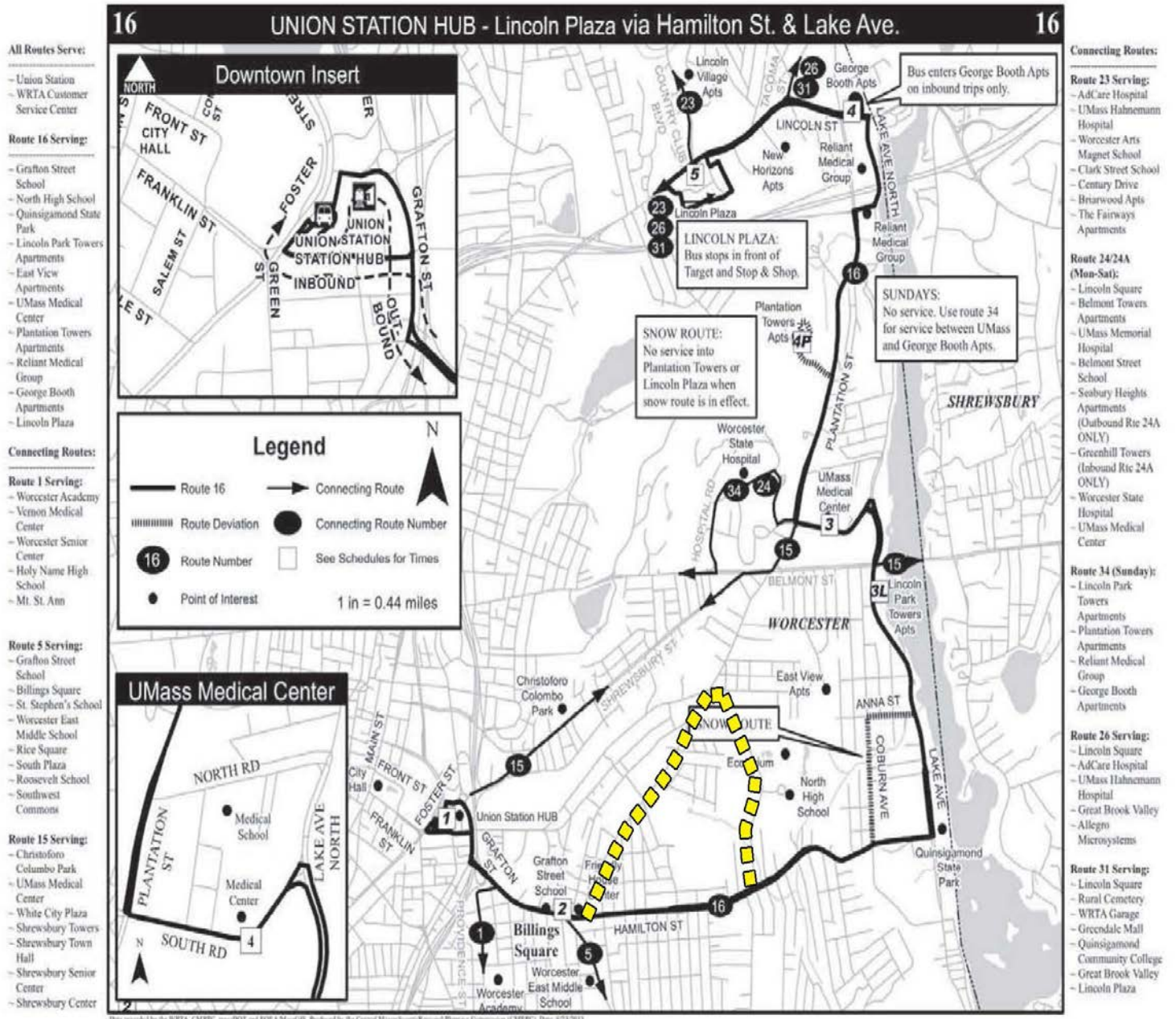


Opportunities for Advertisement, Signage, and Wayfinding

Recommended alternate bus route

-increase access to ecotarium for people without cars

-opportunities to advertise in Union Station



Combination of billboard adverts as well as state and interstate highway signage

-Raise interest and awareness, as well as increase in patronage

-assist in wayfinding on confusing Worcester Streets



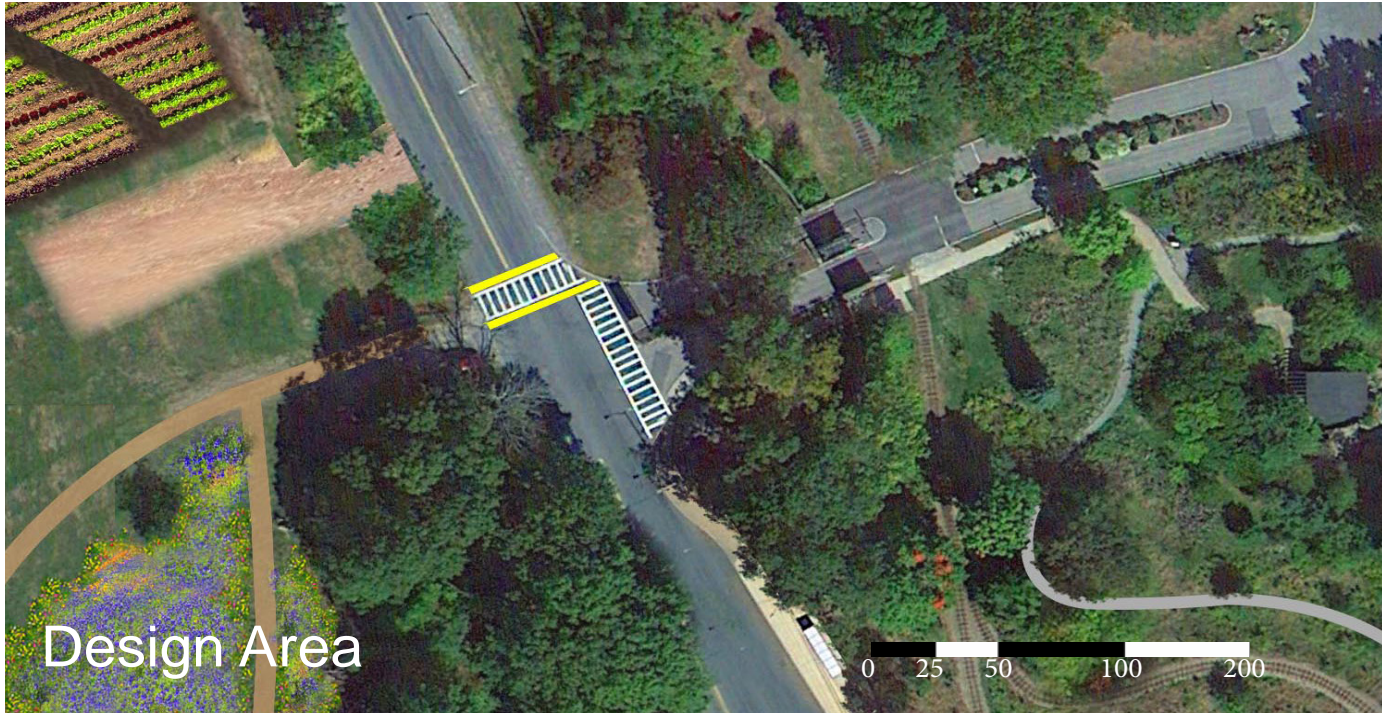
Road Improvements on Harrington Way

Existing conditions looking south east



Road improvements





Design Area



Existing Conditions

Joseph Larico Photography

Harrington Way Entrance and Pedestrian Crossing

Granite posts to prevent car traffic

Signage for garden and trails distinct from main sign

Flashers and bright paint for road crossing

Paw prints create fun educational new standard for Ecotarium crossings





Design Area



Existing Conditions

Joseph Larico Photography

“Rain Machine” sculpture
by Joe Chirchirillo



<http://www.schuylkillcenter.org>

Rear Fox Lot Entrance

Some road realignment and access rd. removal

Expanded lobby and sidewalk area

Solar Powered Interactive Kiosk

Logo sign to emulate front

Educational Sculpture





Boardwalk Around Front Pond

Interactive Birds of
Massachusetts display

Reuse lights moved
to inside curb edge

Boardwalk to
enhance circulation





Design Area

0 25 50 100 200



Ecotarium Parcel Across from Main Entrance



Joseph Larico Photography

Ecotarium Community Garden and Trails



Forest edge plantings preferred by native wildlife

Meadow Wildflowers preferred by moths, butterflies, and pollinators

Various kinds of bird houses

Row crops

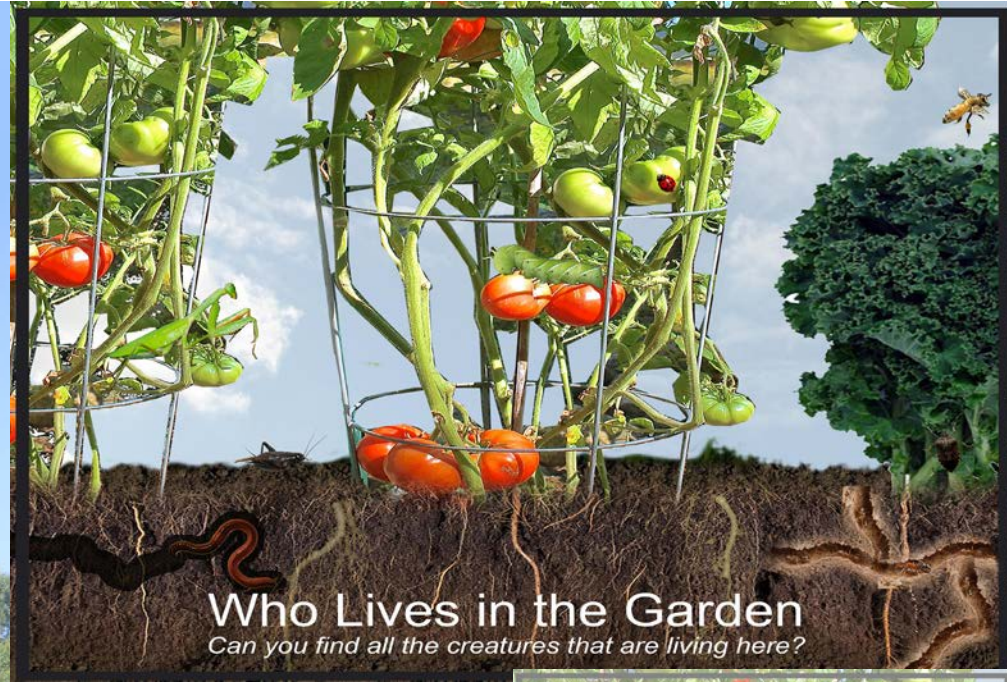


Flower from "Giant Iris"
public sculpture from
Glenrose Scotland
(flower picture from
wikipedia.com)



Life cycle of
Swallowtail
Moth Sculpture

Community garden with interpretation





Equipped with his five senses, man explores the universe around him and calls the adventure Science.

-Edwin Powell Hubble

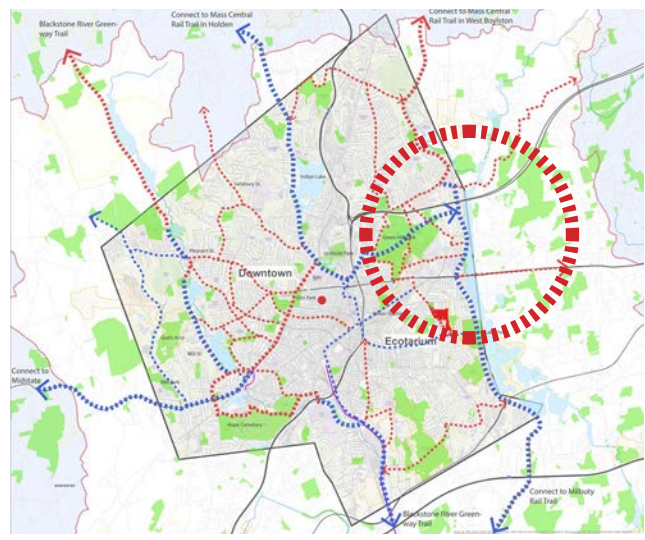


LAKE AVENUE GREENWAY PLANNING - Meilan Chen

LAKE AVENUE IS AN IMPORTANT ROAD ALONG LAKE QUINSIGAMON, THE EASTER GATEWAY TO WORCESTER. LAKE QUINSIGAMOND IS VALUABLE CULTURAL AND NATURAL RESOURCE, BUT THERE ARE SOME IMPORTANT ISSUES THAT NEED TO BE SOLVED IN ORDER TO PROTECT THE LAKE AND TO IMPROVE THE EXISTING CONDITIONS OF LAKE AVENUE. BY INTEGRATING GREEN INFRASTRUCTURE AND GREEN WAY INTO LAKE AVENUE, WE CAN ALSO GET OTHER BENEFITS.

Perkins Farm





SITE ANALYSIS: History Of Quinsigamond Lake



Early Boating



The Causeway



Tatassit Canoe Club

In the middle of the 19th century, crew racing became an important catalyst to the recreational development. The long, narrow waterway proved ideal for regattas, or boat races. Soon, several private boating clubs, canoe clubs, social clubs, parks and bathing beaches dotted the shores.



The Bridge

In order to have more direct access between Worcester and Boston, they try to build a bridge across the lake since 1806. Until 1861, an earthen causeway was constructed. But it created a road-block for larger boats. So the causeway be removed a suitable bridge be constructed in 1919.



Lincoln Park Boat Landing



White City 1907



Quinsigamond State Park



Lincoln Park Boat Landing



White City Roller Coaster



Regatta Point State Park

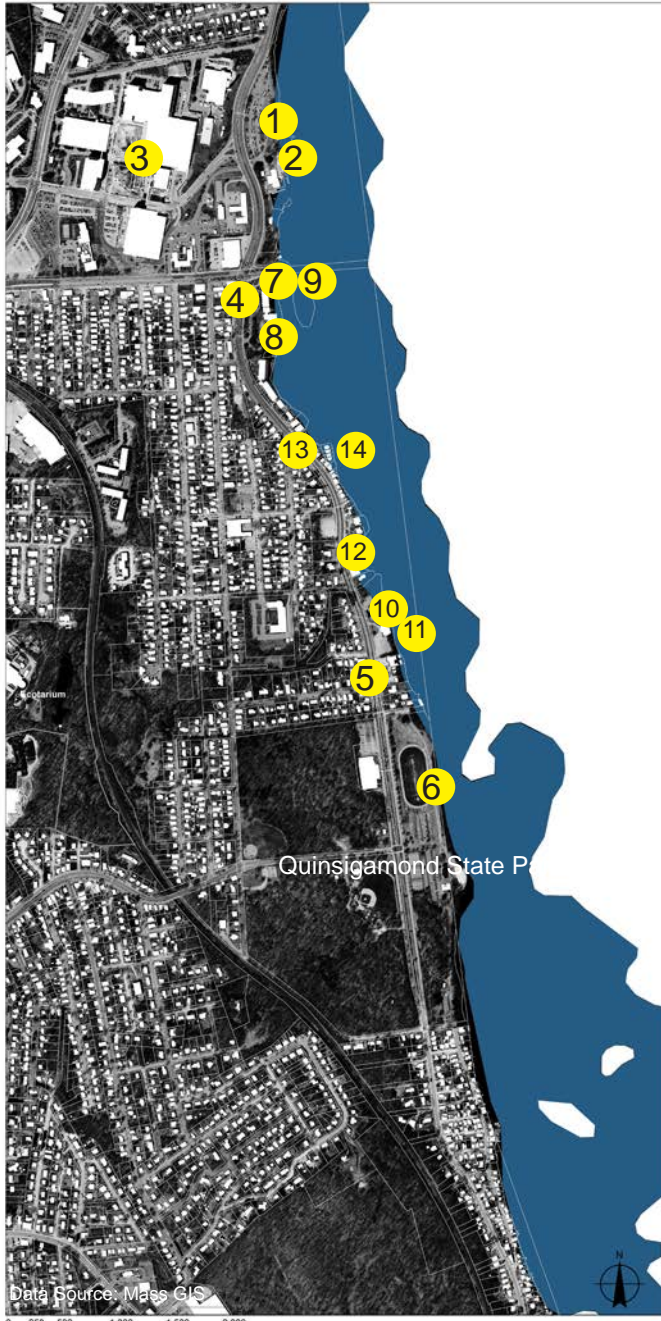
J.J. Coburn bought Ramshorn Island and built Quinsigamond House Hotel in 1867. He provided steamboat service on the lake and later developed what would come to be called Lincoln Park, which offered picnic areas, boat rides, concerts, fireworks and would eventually include amusements, a dance hall, theater and roller skating rink.

Horace H. Bigelow purchased much of the land surrounding the lake and built summer homes. He also built a world-class amusement park on the lake. White City was officially opened to the public on June 18, 1905. The park, one of many across the nation to be called White City, was named after a popular attraction at the 1893 Chicago World's Fair.

In 1952 the Olympic rowing trials were held at Lake Quinsigamond. National publicity of this event accorded the lake status to bring about the enactment of legislation creating 2 state parks, Quinsigamond State Park and Regatta Point State Park.

Source: <http://www.lqwa.org>

SITE ANALYSIS: Existing Condition



1 Regatta Point State Park



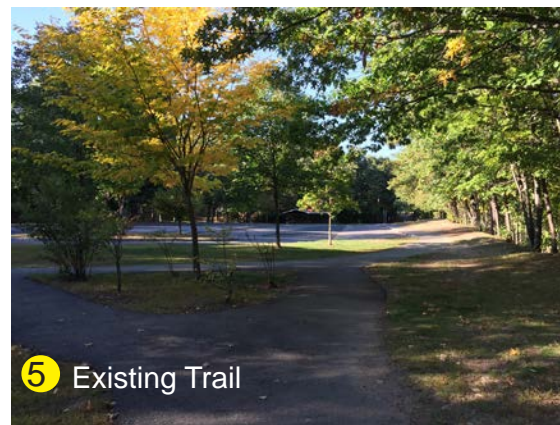
2 Regatta Point State Park



3 UMass Memorial Medical Center



4 On Road Parking



5 Existing Trail



6 Quinsigamond State Park

Even though there is a very good view in the Quinsigamond Lake, it also faces many challenges. There is a lot of impervious surface (including structures, parking lot, and road) in the upper land that impact the water quality in the Quinsigamond lake. Some buildings like Lincoln Park Apartment and the private houses along the Quinsigamond lake are too close to the river bank. This will not only affect the water quality of Quinsigamond lake, but also challenges the greenway propose along the lake. The high report of crime in Regatta Point State Park and Quinsigamond State park is also a great issue in this area. So to solve these problems, it is necessary and it is also a challenge to build a greenway in Lake Avenue.



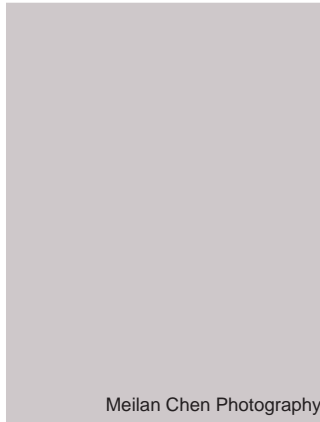
7 Lincoln Park Tower



8 Lincoln Park Tower, Apt



9 Ramshorn Island Park



Meilan Chen Photography



10 Vacant Parking Lot



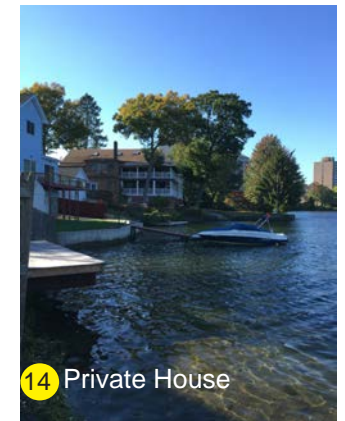
11 Wood Edge



12 Impervious Pavement

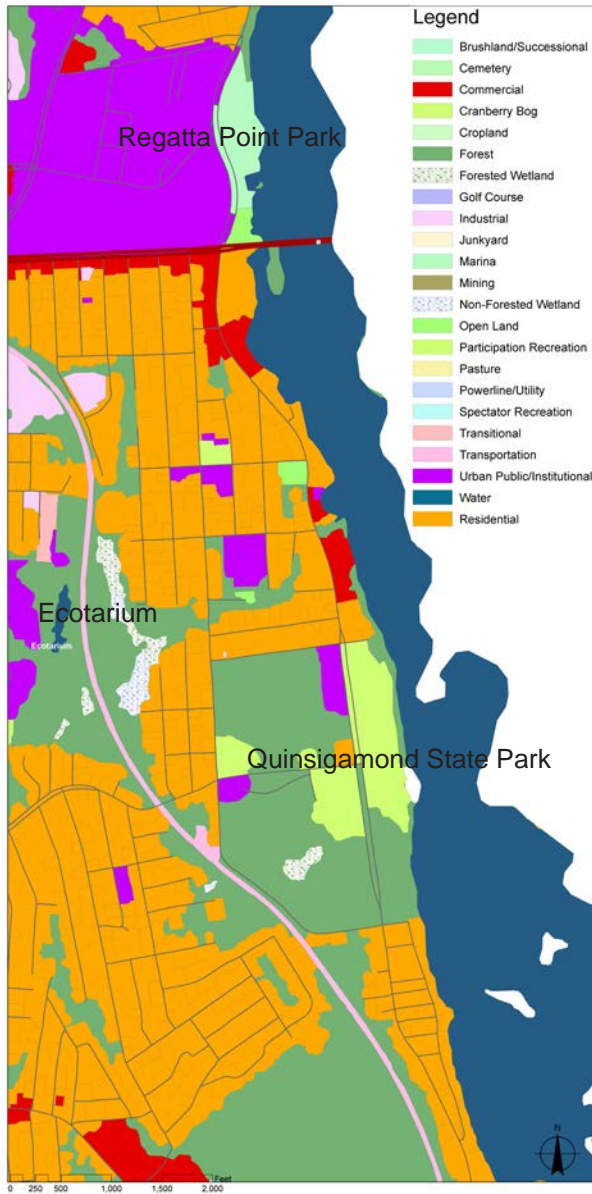


13 Private House



14 Private House

SITE ANALYSIS



All Maps- Data Source: Mass GIS

LAND USE

The residential in the lakeside affects the water quality.

ROAD

The street grid provide oppertunity to the green infrastructure.

HABITAT

It is possible to build a green corridor along the rail line to protect the habitat.



OPEN SPACE

We need to improve the existing open space.



IMPERVIOUS SURFACE

A lot of impervious surface affect the water quality.



COMBINE ASSESSMENT

Combine all the key important area.

All Maps- Data Source: Mass GIS

PLANNING CONCEPT



CONNECTION

Using two corridor to connect these key area.



USE VACANT LOT

Change the existing vacant lot along the riverfront to open space.



ACCESS TO LAKE

Make people more accessible to the riverfront by creating a clear greenway.

All Maps- Data Source: Mass GIS



BIKE IN THE PARK

It is impossible to create a bikelane along the riverfront, but we can still bike in park.



GREEN STREET

To form a green system by integrating green infrastructure into city street grid.



WATER MANAGEMENT

Integrate green infrastructure in street & park to better deal with stormwater.

All Maps- Data Source: Mass GIS

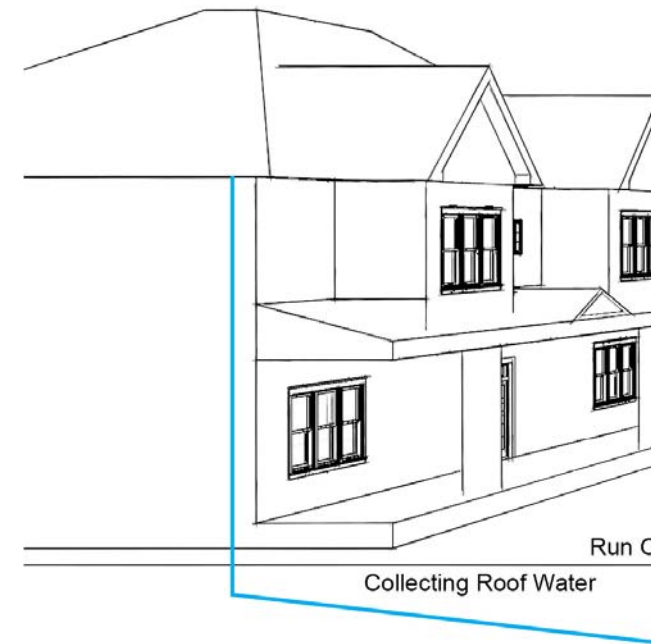
GREEN INFRASTRUCTURE STORMWATER MANAGEMENT

GREEN INFRASTRUCTURE TOOL



STORMWATER INFILTRATION TRENCH

Source: igreenhero.com

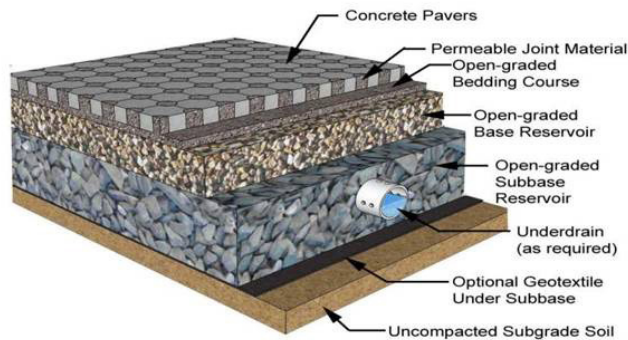


permeable pavement



BIOSWALE

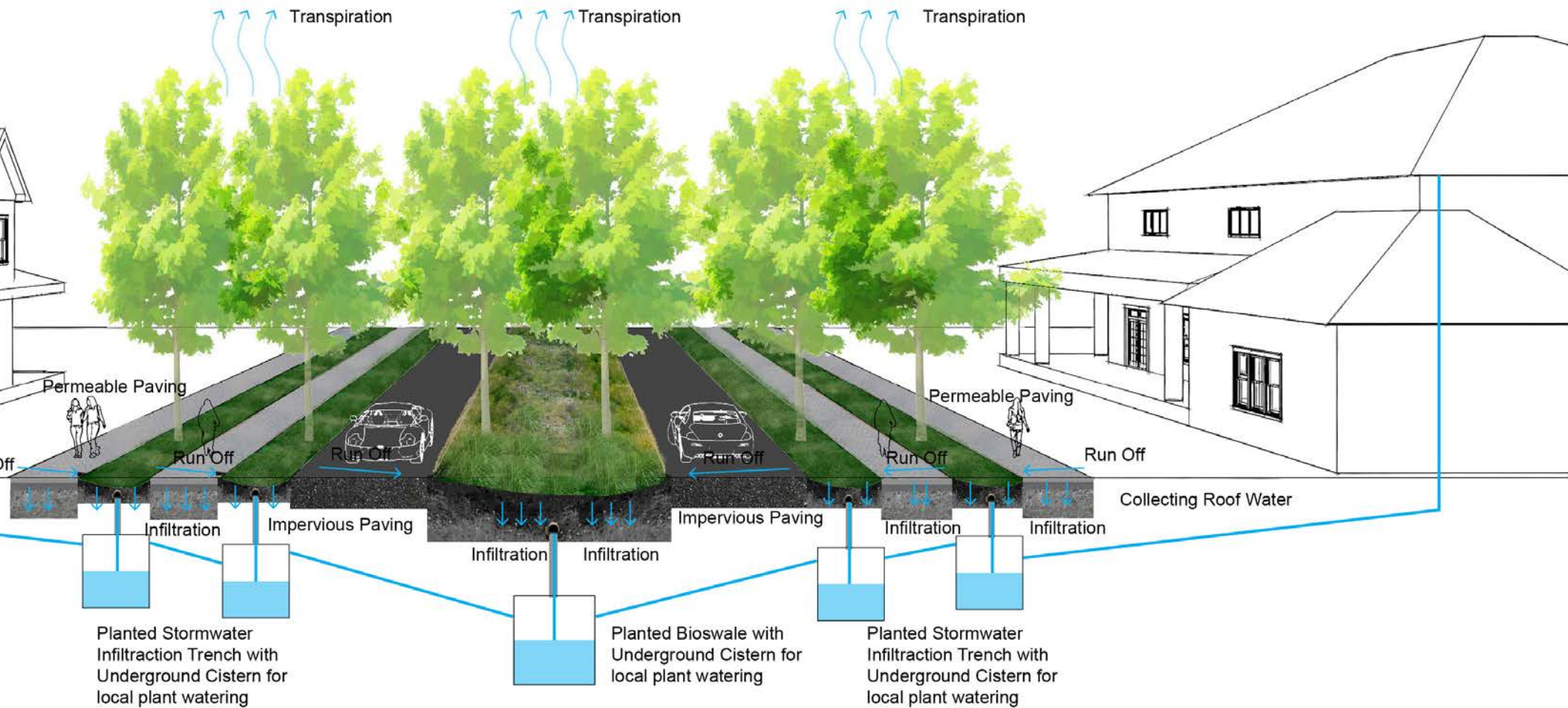
Source: <http://hpigreen.com/>



PERMEABLE PAVEMENT

Source: vwrrc.vt.edu

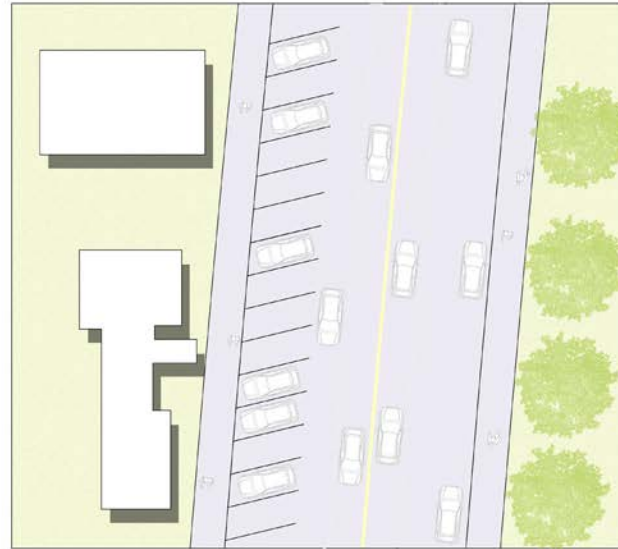
INTEGRATING GREEN INFRASTRUCTURE INTO STREET



DETAIL 1: Lincoln Park Area



EXISTING

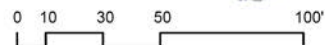


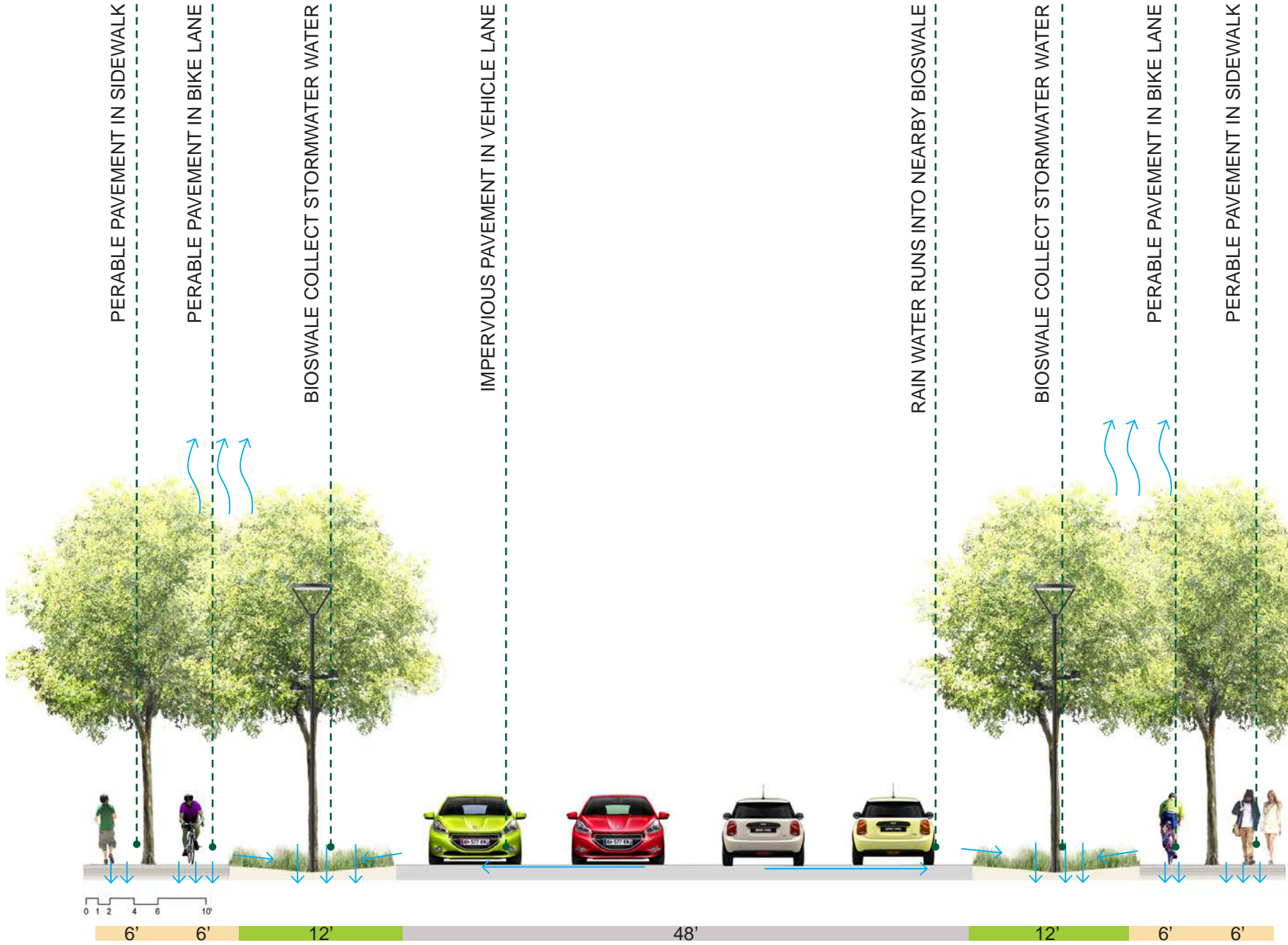
- No trees
- Too much impervious pavement
- No comfortable sidewalk
- No bikelane

PROPOSED



- Plant trees
- Transfer sidewalk to pervious pavement
- Add bikelane
- Add bioswales in two sides





DETAIL 2: Residential Area

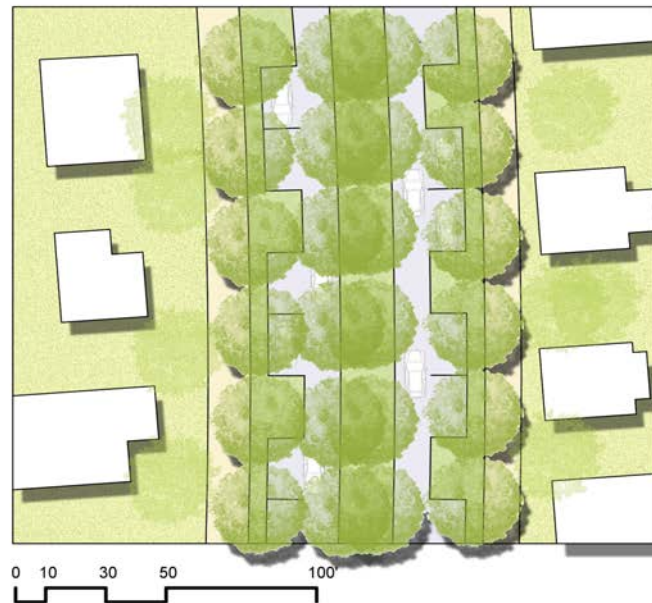


EXISTING

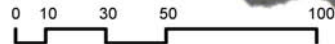


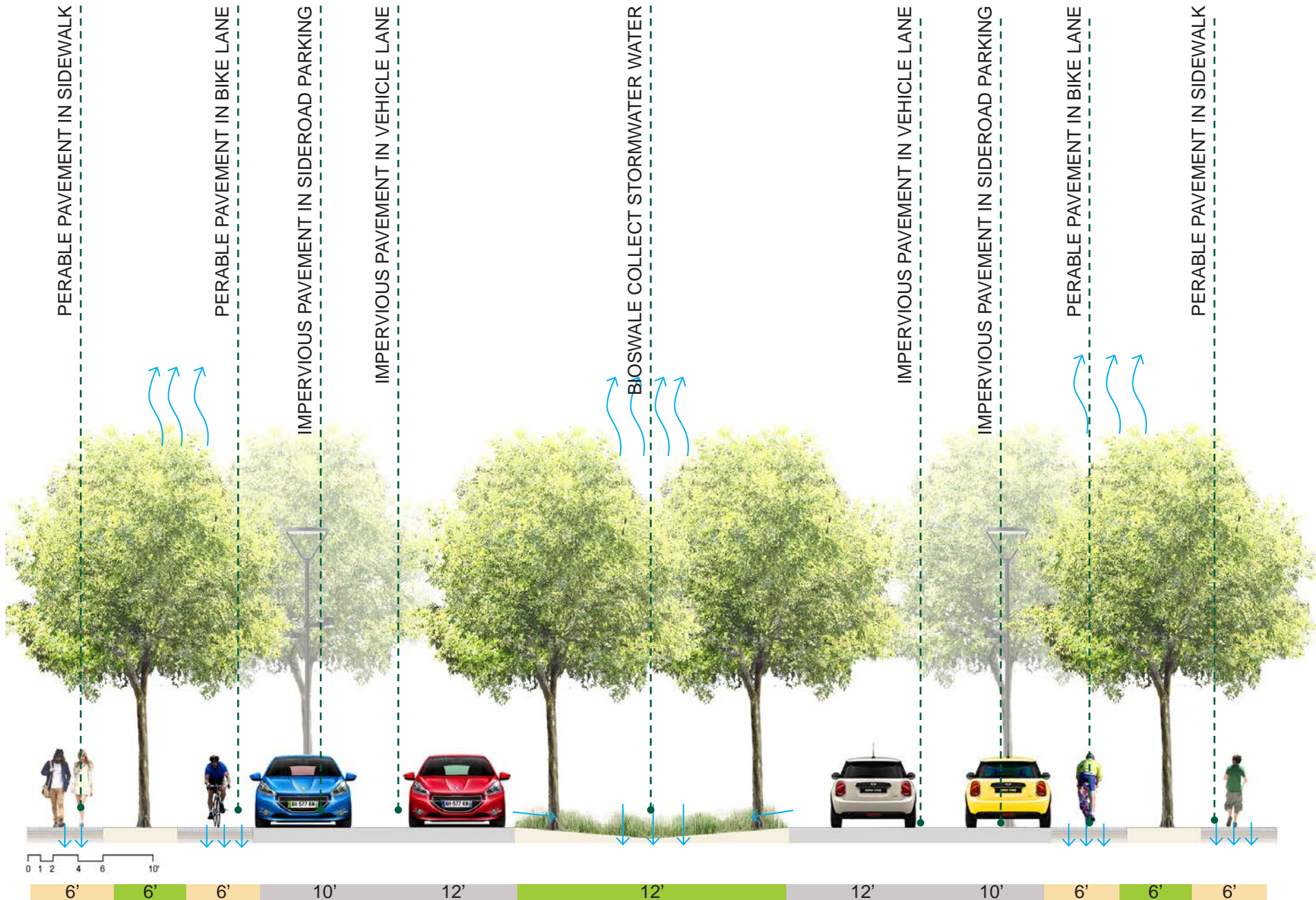
- Too much unnecessary impervious pavement
- No comfortable sidewalk
- No safety bikelane

PROPOSED



- Plant trees
- Transfer impervious pavement in sidewalk & bikeland to pervious pavement
- Change center impervious pavement to bioswale
- Add infiltration trench between sidewalk, bikelane & roadside parking

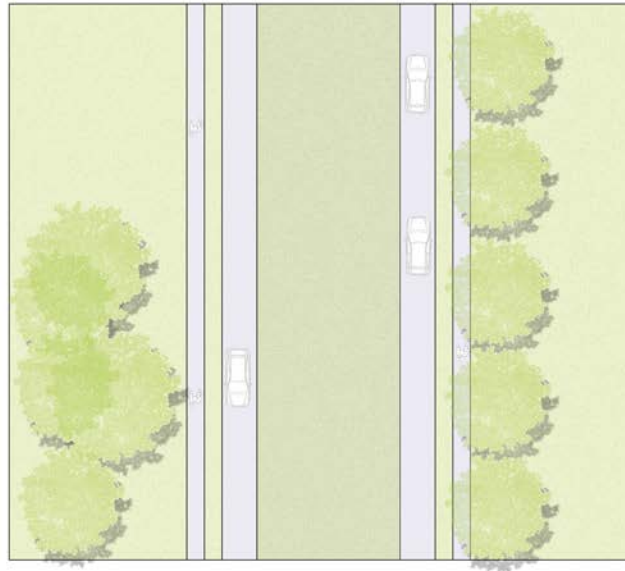




DETAIL 3: Quinsigamond Lake Park Area

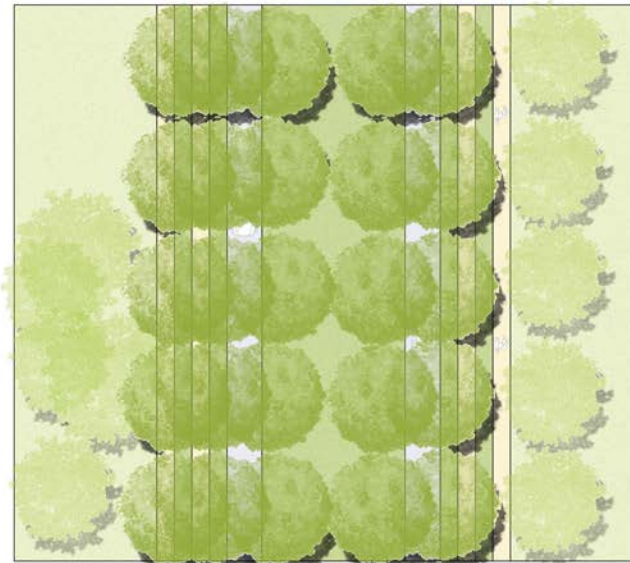


EXISTING

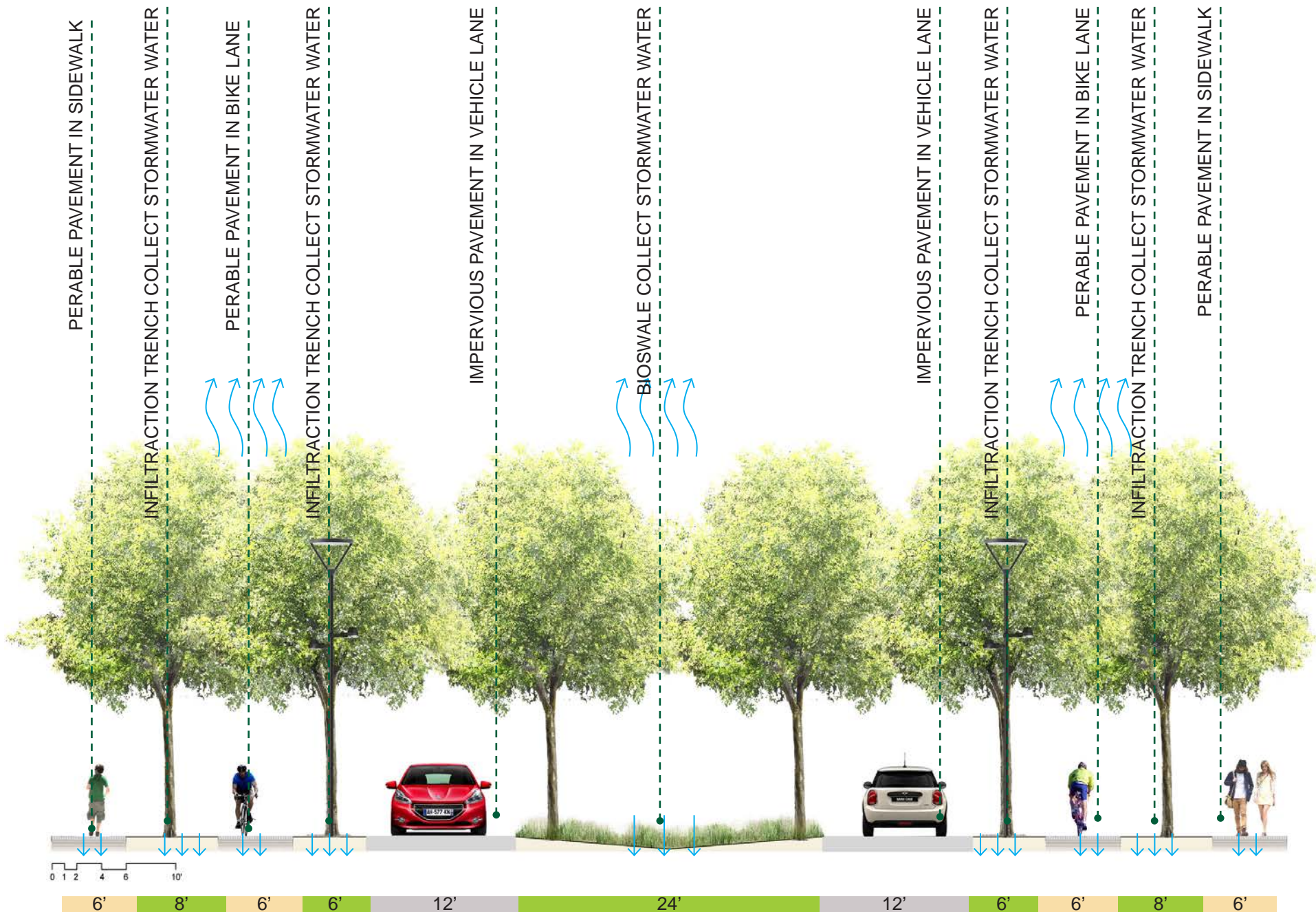


- Too much unnecessary impervious pavement
- No comfortable sidewalk
- No safety bikelane

PROPOSED



- Transfer impervious pavement in sidewalk & bikeland to pervious pavement
- Change center impervious pavement to bioswale
- Add infiltration trench between sidewalk, bikelane & roadside parking



ECONOMIC & ENVIRONMENTAL BENEFIT

	OVERALL BENEFIT	STORMWATER	ENERGY	AIR QUALITY	CARBON DIOXIDE
Description		<ul style="list-style-type: none"> • Intercepting and holding rain • Increasing infiltration and storage • Reducing soil erosion 	<ul style="list-style-type: none"> • Reduces the amount of heat absorbed and stored by buildings • Evapotranspiration of moisture 	<ul style="list-style-type: none"> • Absorbing pollutants • Intercepting particulate matter • Releasing oxygen • Lowering air temperatures 	<ul style="list-style-type: none"> • sequester CO2 in roots, trunks, stems, and leaves • reducing CO2 emissions from heating and air conditioning
2014	\$12 X 800 = \$9,600	\$3.56 X 800 = \$2,848	\$7.50 X 800 = \$6,000	\$0.29 X 800 = \$232	\$.78 X 800 = \$624
2064	\$62 X 800 = \$49,600	\$21.64 X 800 = \$17,312	\$36.27 X 800 = \$29,016	\$2.22 X 800 = \$1,776	\$1.87 X 800 = \$1,496
2014-2064	\$2,549 X 800 = \$2,039,200	\$700 X 800 = \$560,000	\$1615 X 800 = \$1,292,000	\$134 X 800 = \$107,200	\$100 X 800 = \$80,000

Data Calculate from i tree. com

There are a lot of benefit that we can get from green infrastructure, greenway. It is obviously that green infrastructure can help us manage stormwater as what I illustrated. Green infrastructure can also help us save energy. In summer time, they can reduce the amount of heat absorbed and stored by buildings. Green infrastructure can also improves our air quality by absorbing pollutants, intercepting particulate matter, releasing oxygen and lowering air temperatures. Green infrastructure can also help us reduce carbon dioxide that comes from heating and air conditioning, cars by sequester carbon dioxide in roots, trunks, stems, and leaves. According to the “iTree Design”, if we plant 800 trees in 5

inch diameter in 2014, we can get benefit about \$9,600 dollars in this year from stormwater management, energy saving, improving air quality and reduce carbon dioxide. And we can get benefit about 2 million dollars in fifty years in the future.

Some other benefits such as increase outdoor activity, increase our human health, increase biodiversity, education value community health, is very hard to documented. But it is true that green infrastructure can bring us these benefits. Thus, it would be a great value if we integrate green infrastructure into Lake Avenue.

HUMAN SOCIAL AND COMMUNAL HEALTH BENEFITS



Source: www.merseyforest.org.uk

OUTDOOR RECREATION



Source: <http://archleague.org>

INCREASE HEALTH



Source: www.chestercycleday.org

IMPROVE COMMUNITY COMMUNICATION



Source: www.gfsertoma.org

EDUCATION VALUE



ATHLETIC VALUE

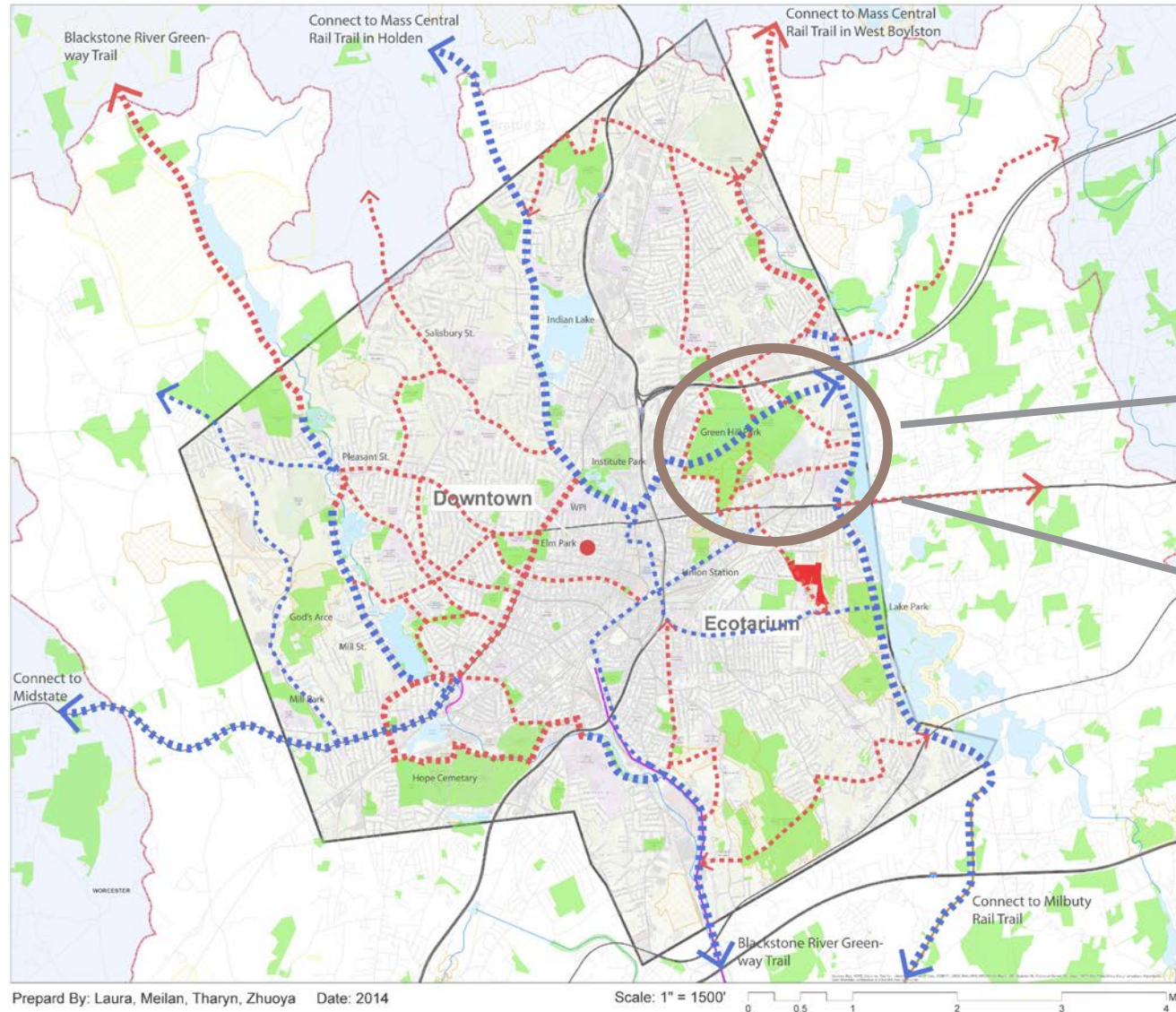


Source: <http://hpigreen.com/>

IMPROVE PROPERTY VALUE

EAST SIDE WINDOW: A New Breeze Through Worcester - Laura Keskula

WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources



Project Statement:

A current focus for the city for improved recreation and connectivity is Lake Avenue. Green Hill and Regatta Point Parks represent some of the best that Worcester has to offer but they are isolated and adjoining connectivity is limited. East Side Window seeks to open this connectivity and be the model of new sustainability blowing through the city and region.



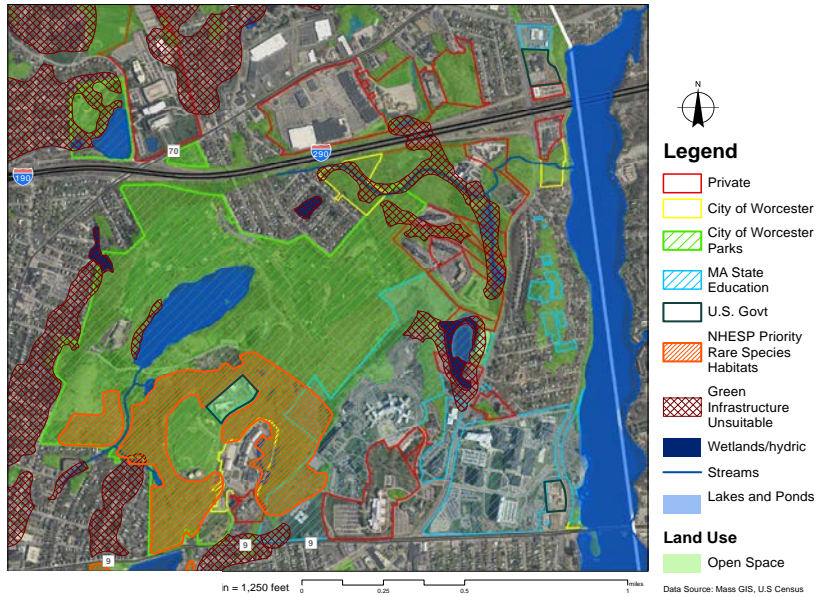
Legend

- - - Our Proposed Bike Lane
 - - - City Proposed Bike Lane
 - Blackstone Watershed
 - Priority Rare Habitat
 - Protected Openspace
 - Worcester Boundary
 - Ecotarium
- Data Source: mass.gis

Prepared By: Laura, Meilan, Tharyn, Zhuoya Date: 2014

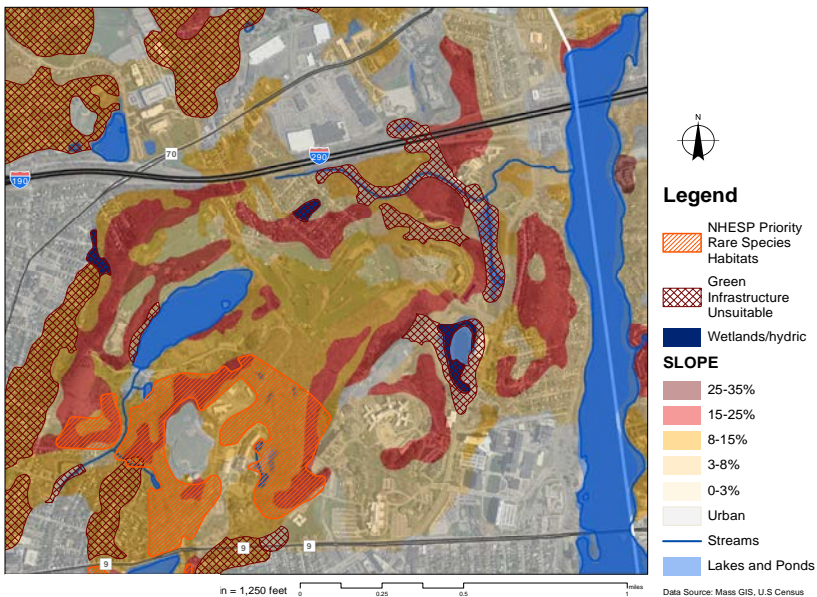
GREEN HILL AND REGATTA POINT PARKS EAST SIDE ANALYSIS

Property Delineations

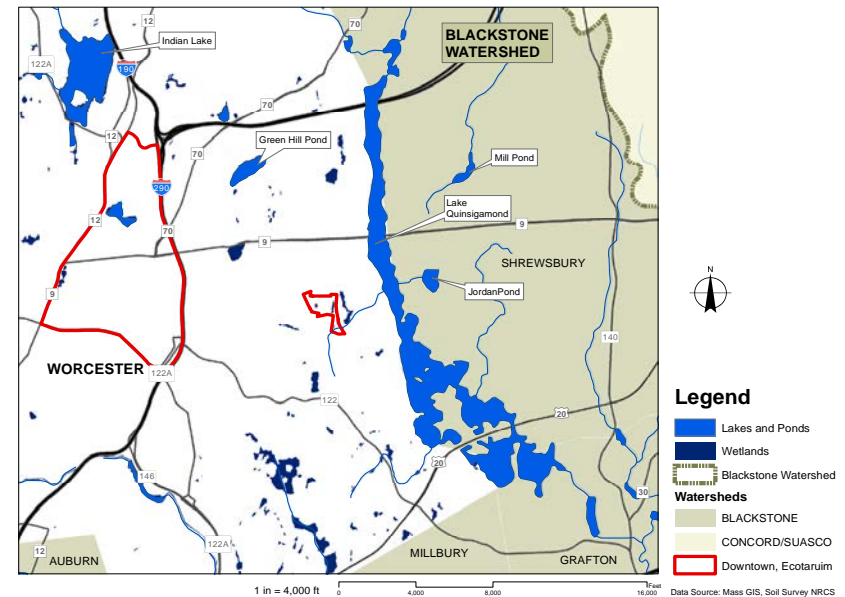


Analysis shows large part of area owned by City of Worcester Parks and MA State Education (Umass Medical and teaching university).

Soils and Slope



Hydrology



This area has very steep slopes, most notably over 15%. Hydrology shows Lake Quinsigamond is a very significant water body and asset in Worcester.

These steep slopes then contribute runoff, and parking contaminants from the largely paved Umass property into the Lake.

From the Regional hydrology assessment it was shown that Lake Quinsigamond is in the Blackstone River Watershed which then through its tributaries terminates into the Atlantic.

CONNECT the greater city

ENABLE access to natural features and open spaces

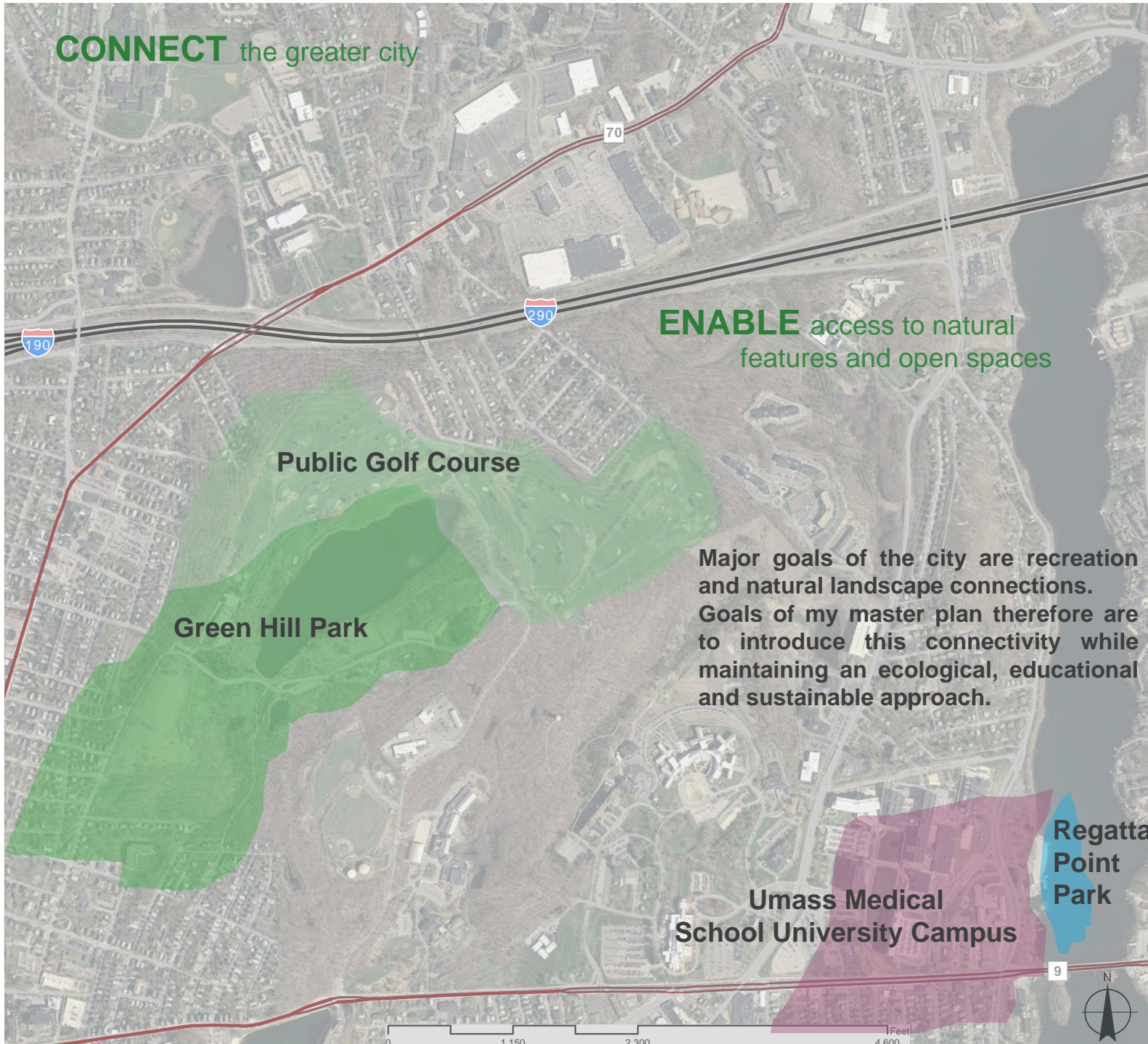
Public Golf Course

Green Hill Park

Major goals of the city are recreation and natural landscape connections. Goals of my master plan therefore are to introduce this connectivity while maintaining an ecological, educational and sustainable approach.

Umass Medical School University Campus

Regatta Point Park

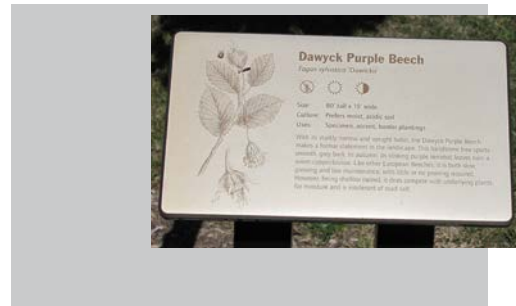


EAST SIDE WINDOW: A New Breeze Through Worcester

MASTER PLAN GOALS



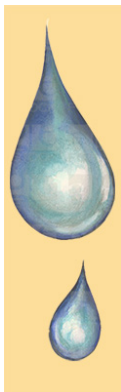
<http://www.treeworcester.org/serviceberry.html>



URBAN FOREST reintroduction

EXPAND the arboretum with non ALB host species

The arboretum at Green Hill Park could be expanded across the city. Non host trees should be planted and displayed with species name plaques and the non ALB graphic to help inform the public.



PUBLIC ART as way finding tool and educational opportunity

Take back our area from the ALB hold have beetle benches



Beetle sculpture by local artist Wesley Fleming. City could propose his creation of large scale benches and commission the installation across the hardest hit communities to help embrace this sore spot in the history of the area.

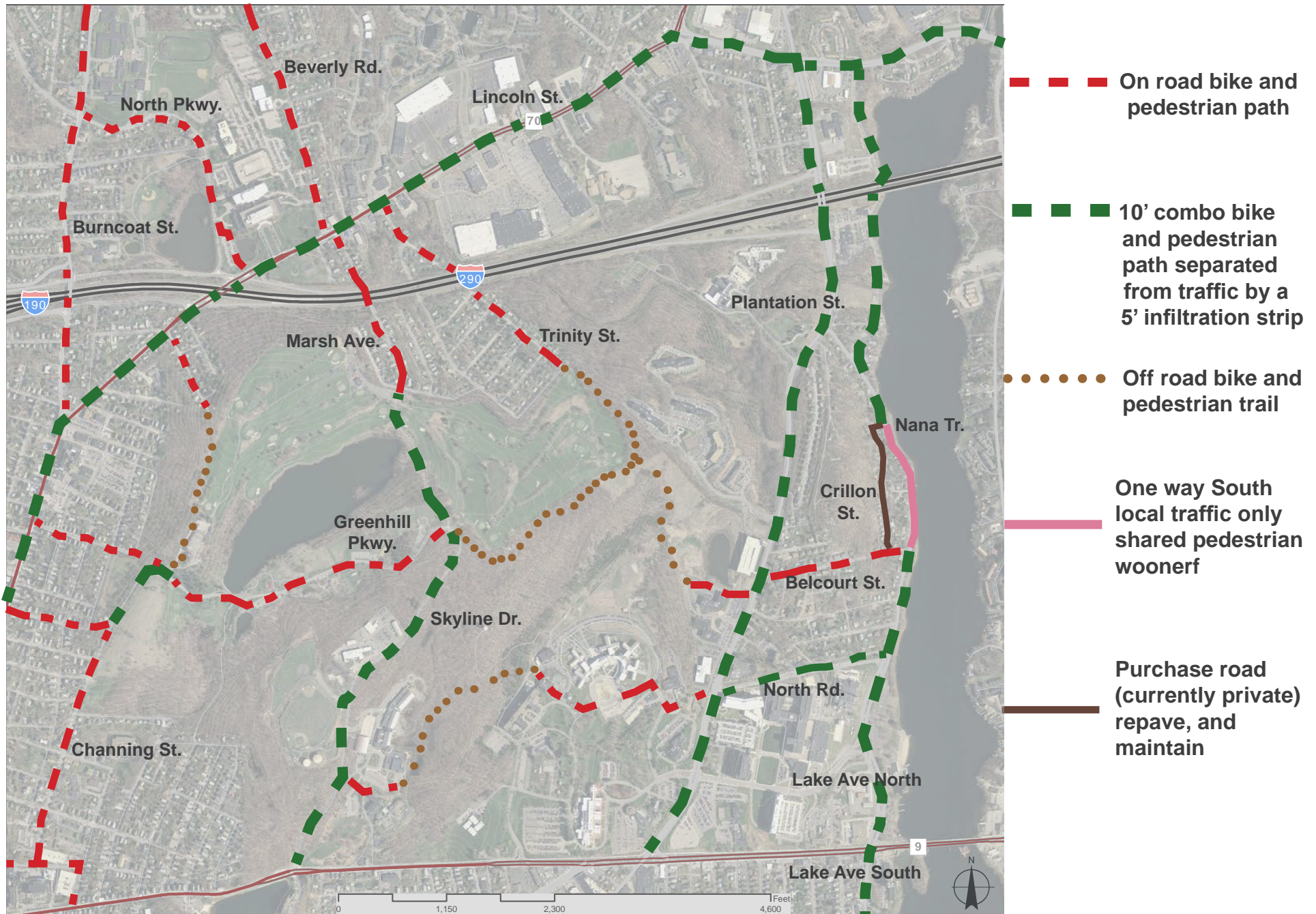
REMEDiate bank erosion and improve water quality



A three bay, three layered cell consisting of three different sizes of stone, overlay-ed with soil will help filter and infiltrate runoff before it enters Lake Quinsigamond.

EAST SIDE WINDOW: A New Breeze Through Worcester

MASTER PLAN



EAST SIDE WINDOW: A New Breeze Through Worcester

Lake Ave runs parallel to lake Quinsigamond and is split into North and South by Rt 9. By implementing a one way South woonerf (shared pedestrian/bike/vehicular space) traffic will be discouraged from taking this road as a cut through alternative to Plantation St. This traffic decline will allow for 1 lane of travel moving on Lake Ave South.

4 lanes- 2 North/South 

2 lanes- 1 North/South 

2 lanes South, unchanged North 

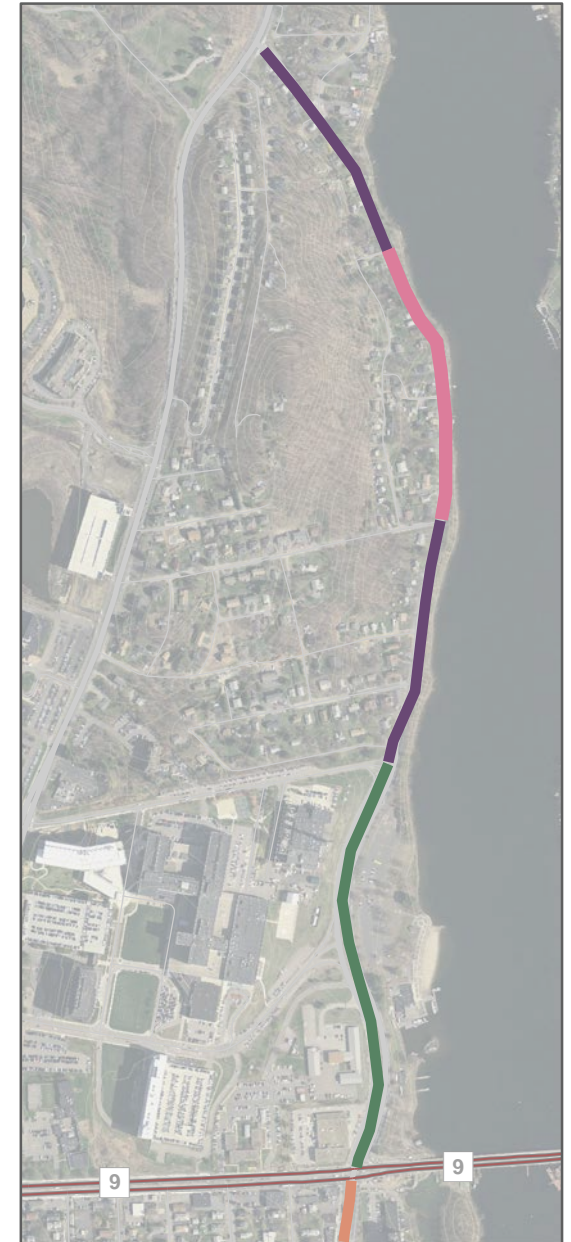
1 lane South, unchanged North 

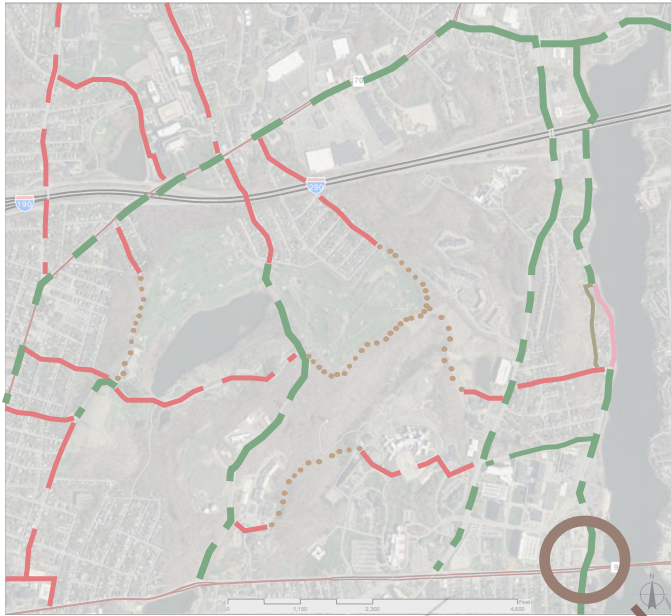
1 lane South 

Existing travel ways



Proposed





Existing Conditions



By eliminating 1 travel lane South, and reducing the travel lanes to 15', that allows for an extra planted median and large rain garden at the right to filter runoff coming down Rt. 9.

PUBLIC ART as way finding tool and educational opportunity

Glass and steel rain drip structure

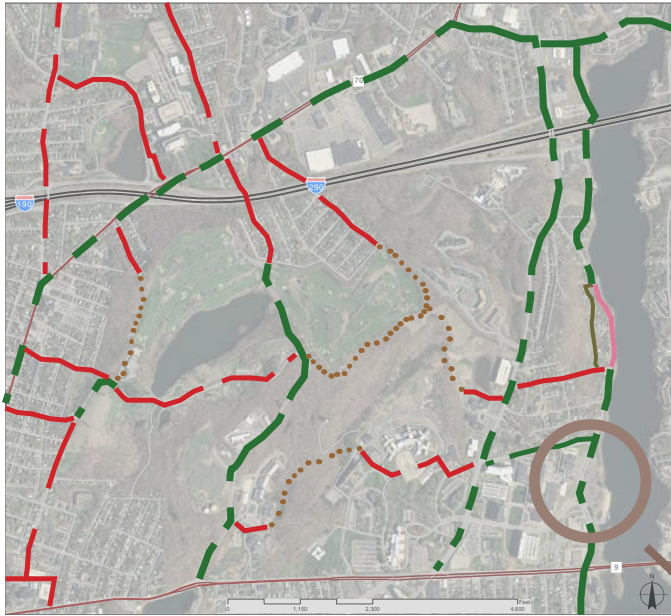
Educational signage

Central infiltration basin and rain garden

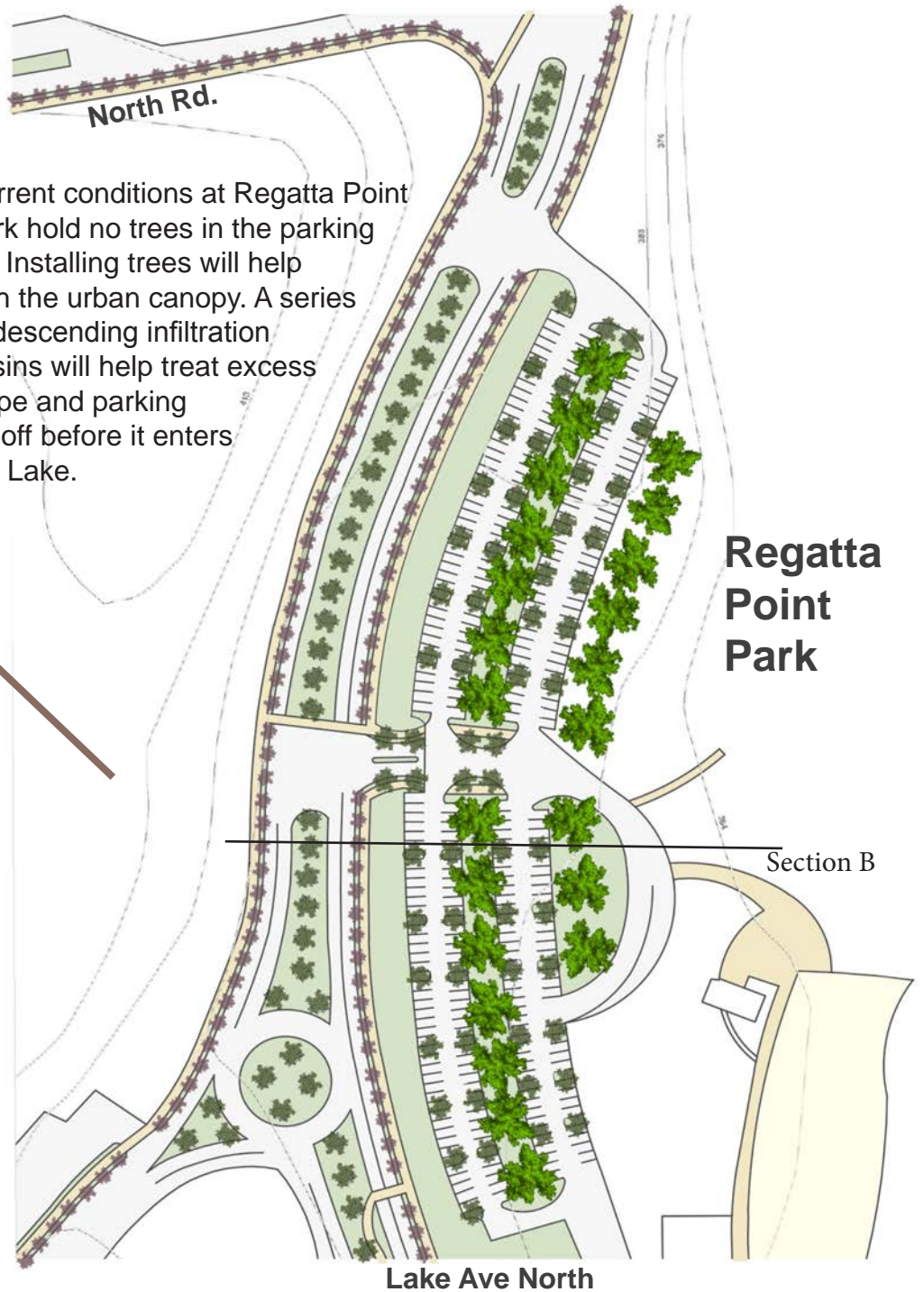
Proposed

Intersection Lake Ave North and Rt.9





Current conditions at Regatta Point Park hold no trees in the parking lot. Installing trees will help with the urban canopy. A series of descending infiltration basins will help treat excess slope and parking runoff before it enters the Lake.



ENABLE access to natural features and open spaces

URBAN FOREST reintroduction

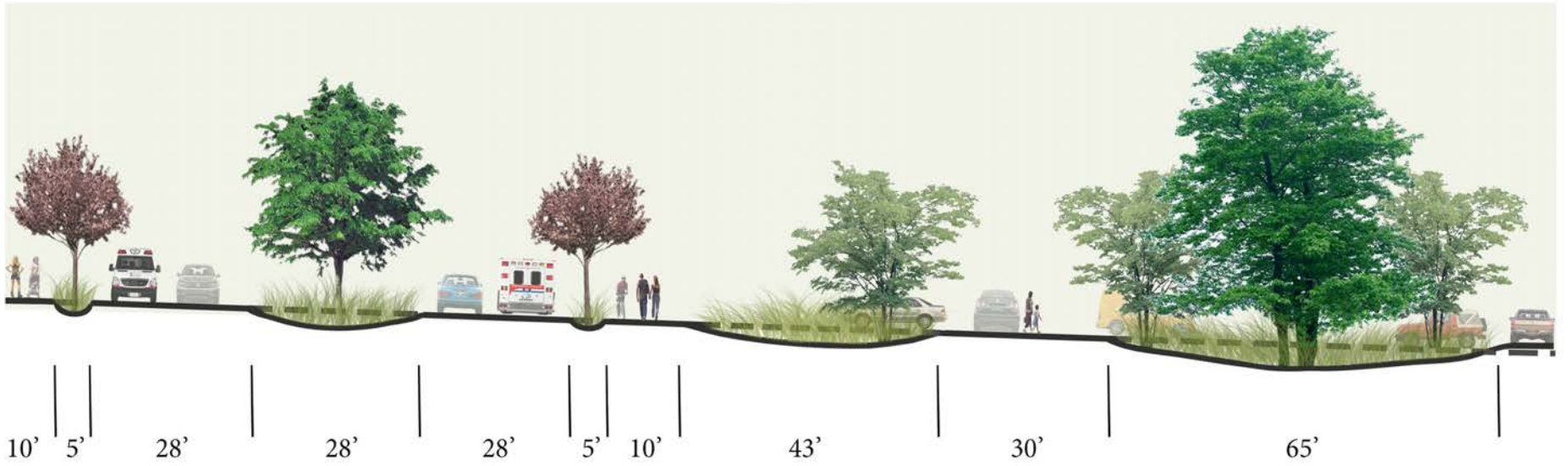


Plan
Lake Ave North and Regatta Point Park

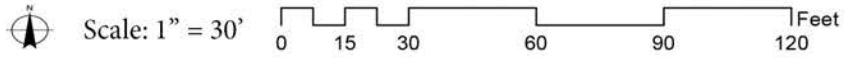
Scale: 1" = 175'

Laura Keskula

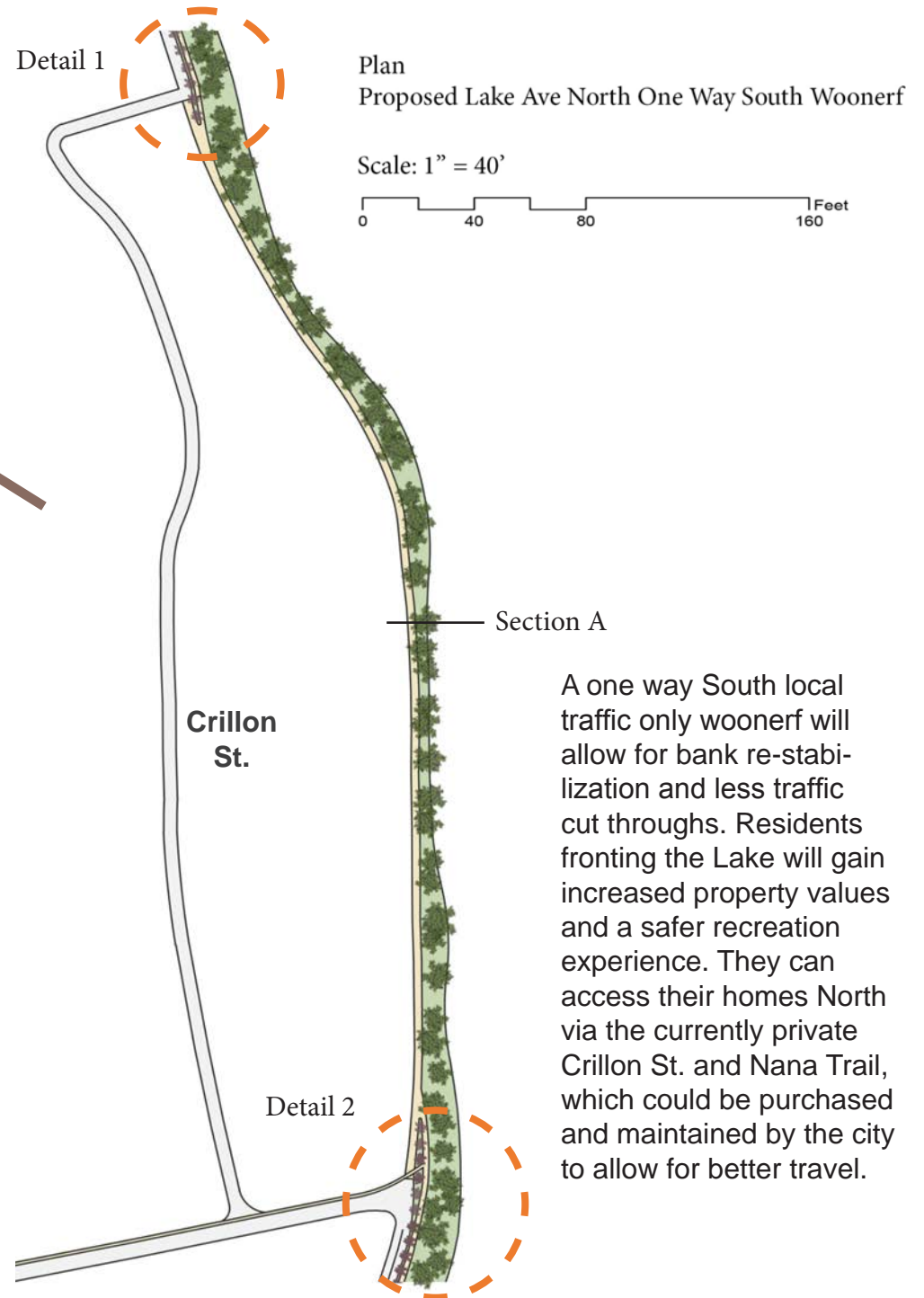
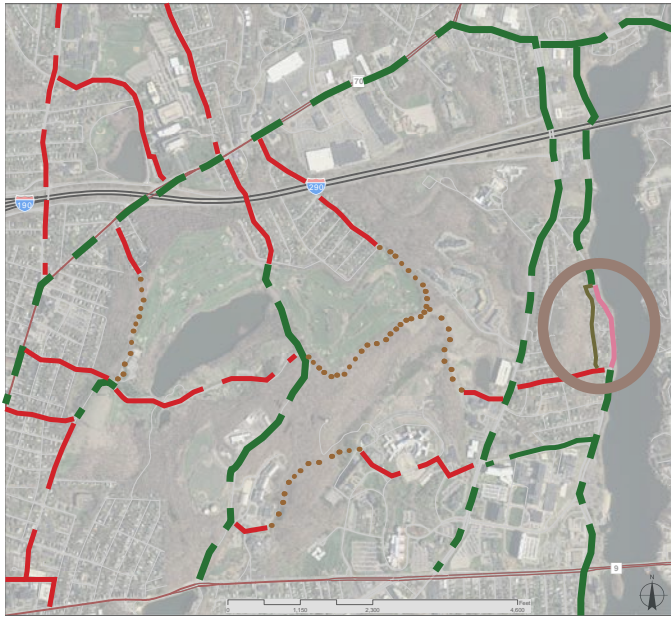




Section B
Lake Ave North and Regatta Point Park



Laura Keskula



What Is A Woonerf?



- Popular in Europe, Australia, Japan and Israel
- Street designed more efficiently with no designated vehicle lane or curbs
- Street becomes public recreation space
- Low speed limit of 10 mph reduces accidents
- Clearly marked entrance and exit
- Traffic calming measures such as on street amenities and infiltration strips or planters



http://nacto.org/docs/usdg/woonerf_concept_collarte.pdf

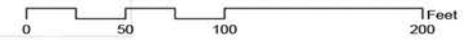
A one way South local traffic only woonerf will allow for bank re-stabilization and less traffic cut throughs. Residents fronting the Lake will gain increased property values and a safer recreation experience. They can access their homes North via the currently private Crillon St. and Nana Trail, which could be purchased and maintained by the city to allow for better travel.



EXPAND the arboretum
with non ALB host species

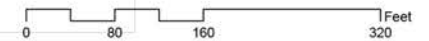
Detail 1
Proposed Woonerf South at Nana Trail

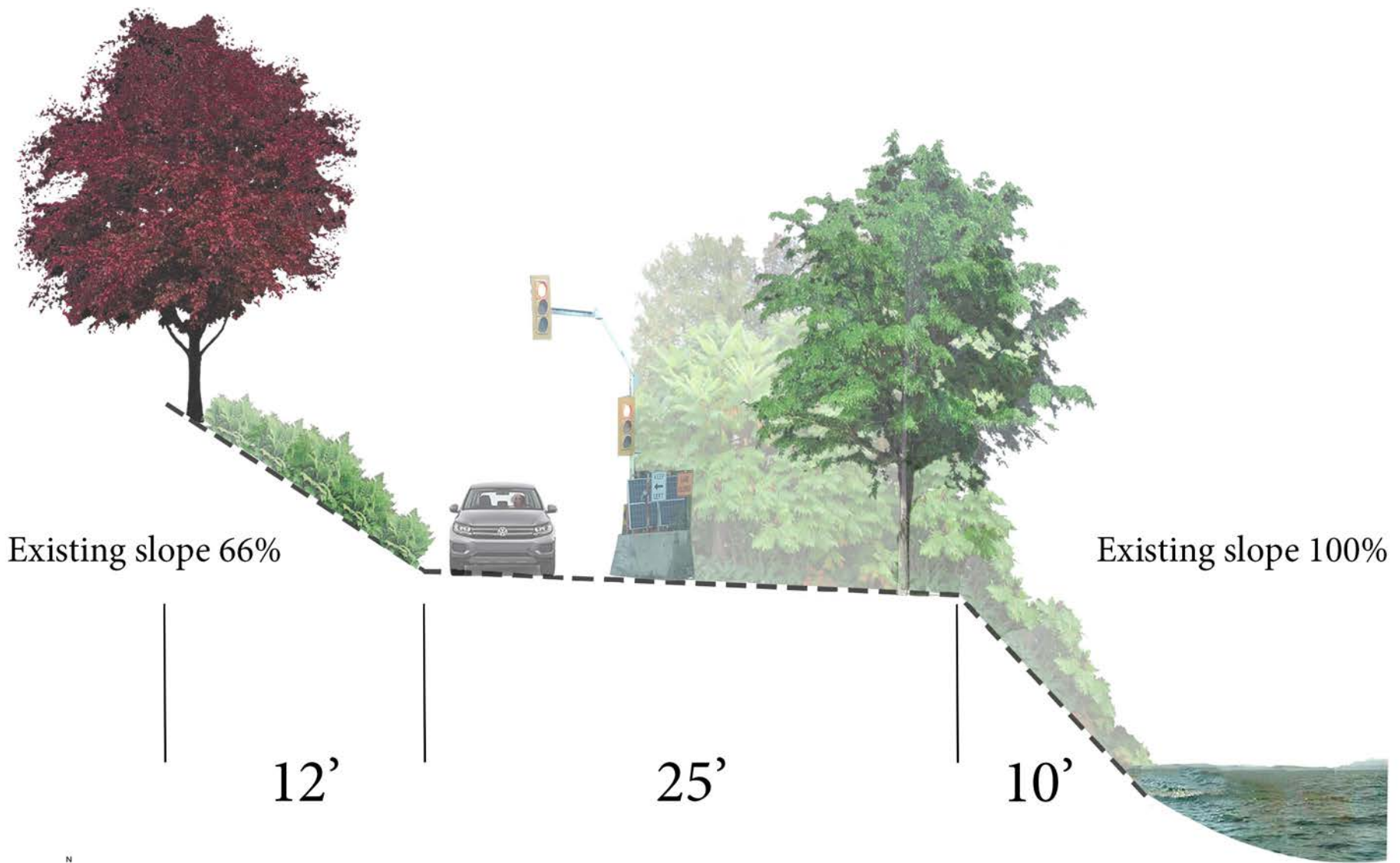
Scale: 1" = 50'



Detail 2
Proposed Woonerf North at Belcourt St.

Scale: 1" = 80'





Existing slope 66%

Existing slope 100%

12'

25'

10'



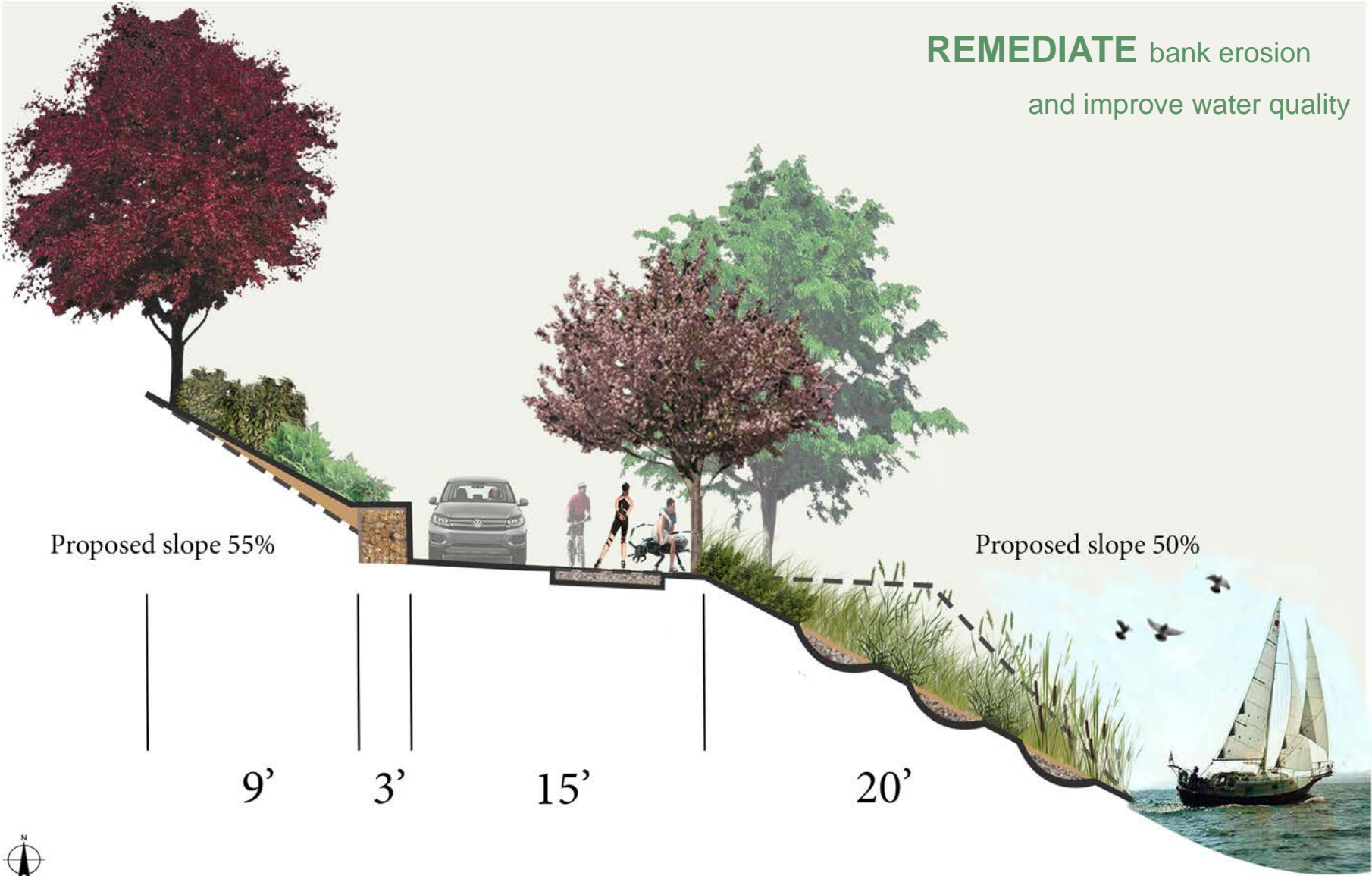
Existing Streetscape
Lake Ave North

Scale: 1/8" = 1'

Laura Keskula

Currently Lake Ave North at a stretch of around 200' is a one way travel lane determined by a light allowing passage, due to the road eroding off the bank and into Lake Quinsig. This has been the condition for 4 years and the city of Worcester has interest in taking residents property by eminent domain to move the road to the left and continue the two lane travel. The riverbank slope is a 10' rise over a 10' run and seems inevitable to runoff erosion.

REMEDiate bank erosion
and improve water quality



Proposed Woonerf Section A
Lake Ave North

Scale: 1/8" = 1'
Laura Keskula

This seizure seems unnecessary as the road could transform into a one way south, local traffic only woonerf. By cutting the road back 10' and limiting it to a 15' width travel lane, allows for a tiered and more gentle slope of 50% to the bank. The infiltration cells planted with native vegetation allow for infiltration and lasting habitat. A gabion wall lessens the slope on the left and reduces the facing slope runoff.

PUBLIC ART as way finding tool and educational opportunity



Existing Conditions

Lake Ave North at Nana Trail

Proposed Woonerf



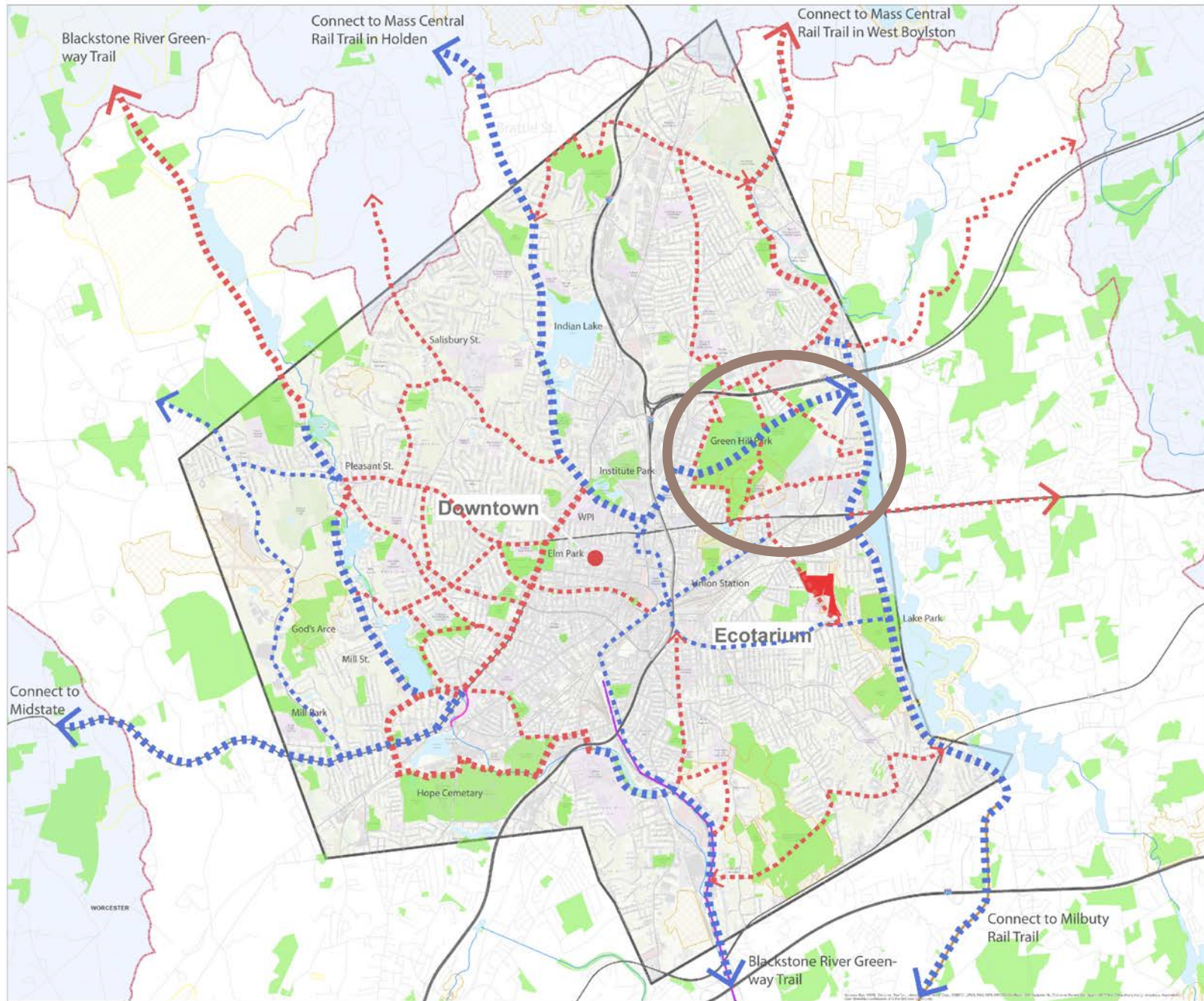
Gabion Wall

permeable paving allows infiltration before bank runoff

Beetle benches

Interpretive trail educating about ecology

WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources



Legend

- - - Our Proposed Bike Lane
- - - City Proposed Bike Lane
- Blackstone Watershed
- Priority Rare Habitat
- Protected Openspace
- Worcester Boundary
- Ecotarium

Data Source: mass.gis

Prepared By: Laura, Meilan, Tharyn, Zhuoya Date: 2014

Scale: 1" = 1500' 0 0.5 1 2 3 4 Miles

EAST SIDE WINDOW: A New Breeze Through Worcester

CONCLUSIONS

Branching from the regional master plan, East Side Window connects natural assets in the city of Worcester. These connections further allow for increased recreation and enjoyment for city as well as regional and tourist populations.

Sustainability and remediation issues have been addressed and their implementation will lead to a lasting habitat, water supply and overall ecosystem in the area and beyond.

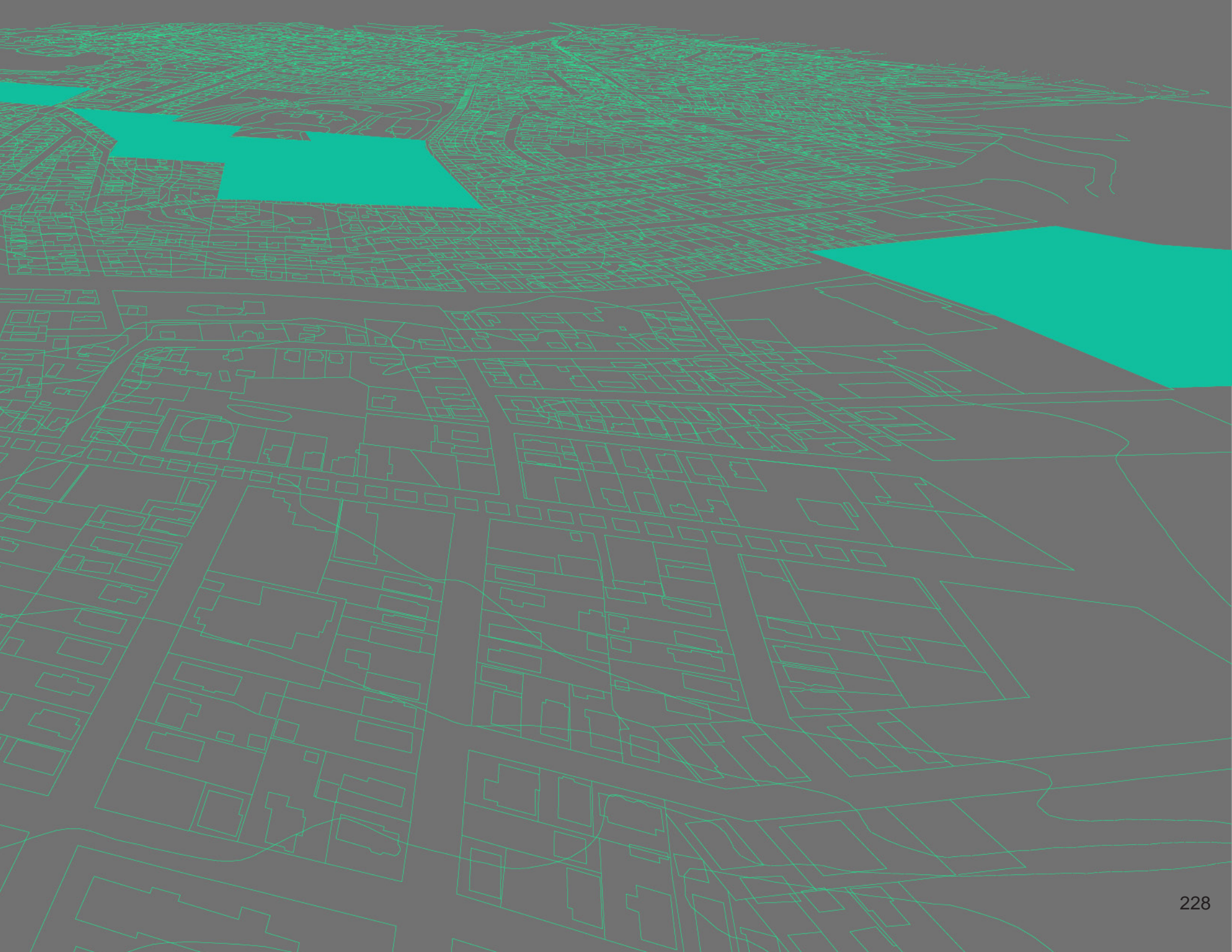
Artistic way finding and educational features serve to inform the public and develop a sense of unique pride and cultural embrace for the area.



WORCESTER NECKLACE · Zhuoya Deng

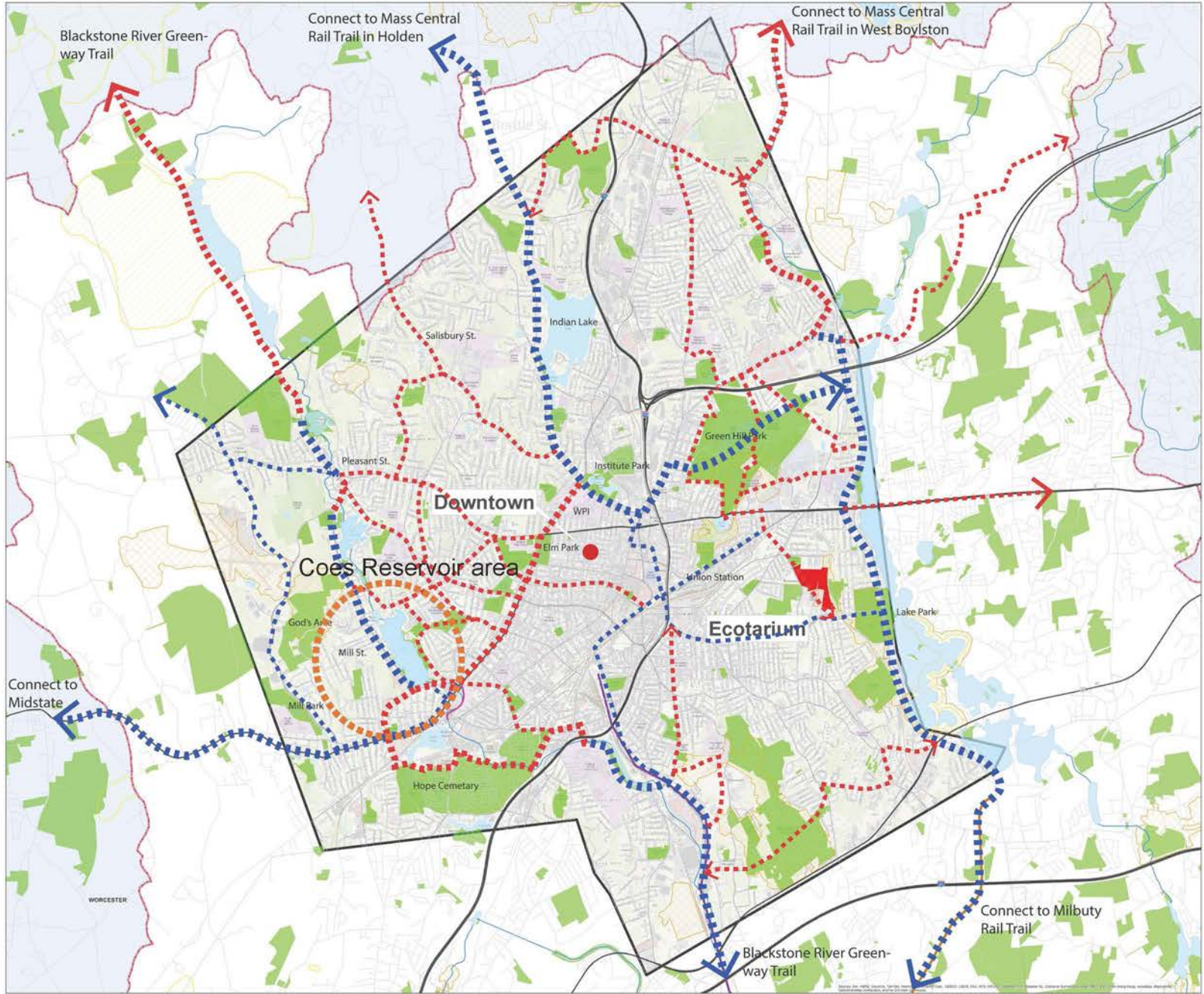
Coes Reservoir area is located in the west side of Worcester, it has the most advantage condition to build green infrastructures in this area. There are many reasons for it, first of all, it is the closest area to connect the Mid-state long distance bike trail on the west side and to connect the Mass-Central bike trail on the north side, which means tourist who is coming from those two trails will first arrive at the Coes Reservoir area; Secondly, Coes Reservoir is not only the headwater of Blackstone River, but also it is the drinking water

resource for the whole city, in this case, the green infrastructure is very important for protecting and improving water quality in this area; thirdly, there already are a series of open spaces around the Coes Reservoir that should be maintained well and connected with a bike path. Based on these three reasons, the concept was developed using green infrastructure to connect all these open space just like a beautiful emerald necklace in Worcester.



WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources

Zhuoya Deng



- Legend**
- - - Our Proposed Bike Trail
 - - - City Proposed Bike Trail
 - Blackstone Watershed
 - Priority Rare Habitat
 - Protected Openspace
 - Worcester Boundary
 - Ecotarium
- Data Source: mass.gis

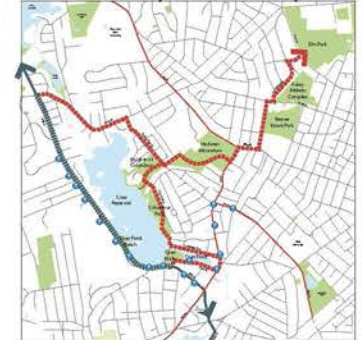
Prepared By: Laura, Meilan, Tharyn, Zhuoya Date: 2014

Scale: 1" = 1500' 0 0.5 1 2 3 4 Miles

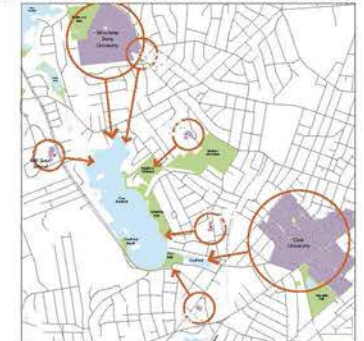
WORCESTER BIKE TRAIL MAP RESERVOIR AREA



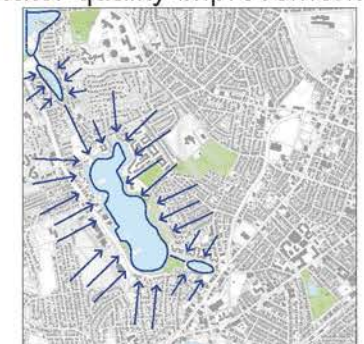
Goal1: Bike loop around pond



Goal2: Connection to schools



Goal3: Water quality improvement



Data Source: Mass GIS

1 inch = 400 feet 0 0.125 0.25 0.5 0.75 1 Miles



Focus Area 1 - Coes Square

Zhuoya Deng

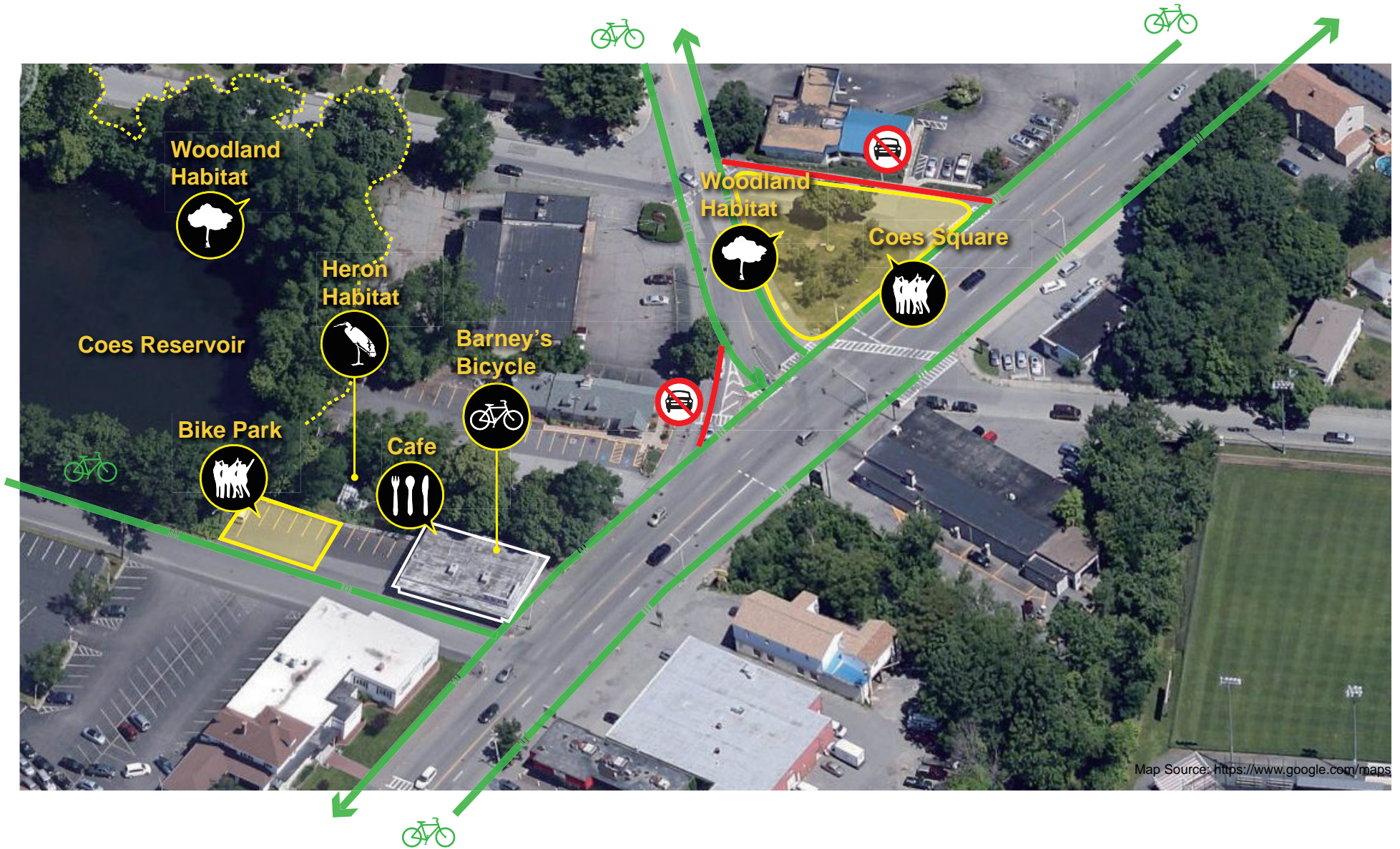




Photo Source: <https://www.google.com/maps>

Problem:

1. Dangerous traffic surrounds Coes Square, there are 5 roads heading together, threatening the safety for pedestrians and especially blocking the connection between Coes Reservoir and the surrounding schools.
2. Park Ave is very wide with four lanes of traffic but has no bike path for cyclist.
3. Park Avenue lacks green space and trees for collecting the polluted surface runoff water from road runoff.



Solution:

1. Keep three major road and remove other two sub road. Make a safety cross walk for pedestrian.
2. Expand Coes Square, make it pedestrian friendly, turning it into a gathering place and a rain garden area.
3. Build a 7feet wide bike path on each side of Park Ave to give cyclists a friendly bike experience.
4. Build a 4feet wide bio-swale between bike path and drive on each side of the road, it function as parts of green infrastructural system and buffers cyclists from traffic.
5. Trees and bio-swales help reduce the storm water surface run off, and clean it before it flows into the nearby Coes Pond.



Hadwen School

Hadwen Arboretum
Zhuoya Deng

Knights of Columbus

Coes Reservoir

Columbus Park

Coes Pond Beach

Coes Knife

Coes Pond

Columbus Park Elementary School

Lakeside Ave

Coes St

Park Ave

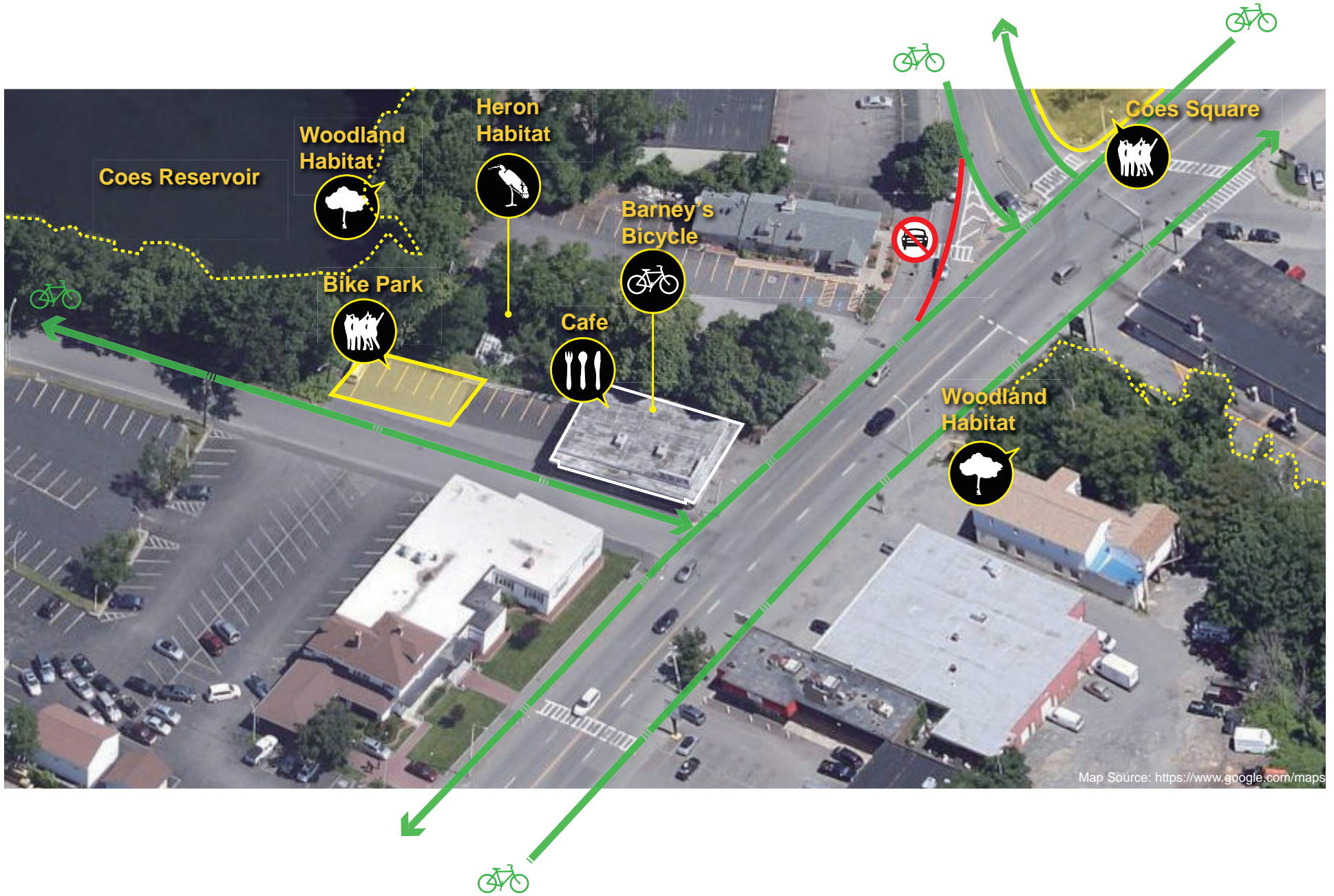
Data Source: Mass GIS

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235

chools

Focus Area 1 - Bike Park

Zhuoya Deng

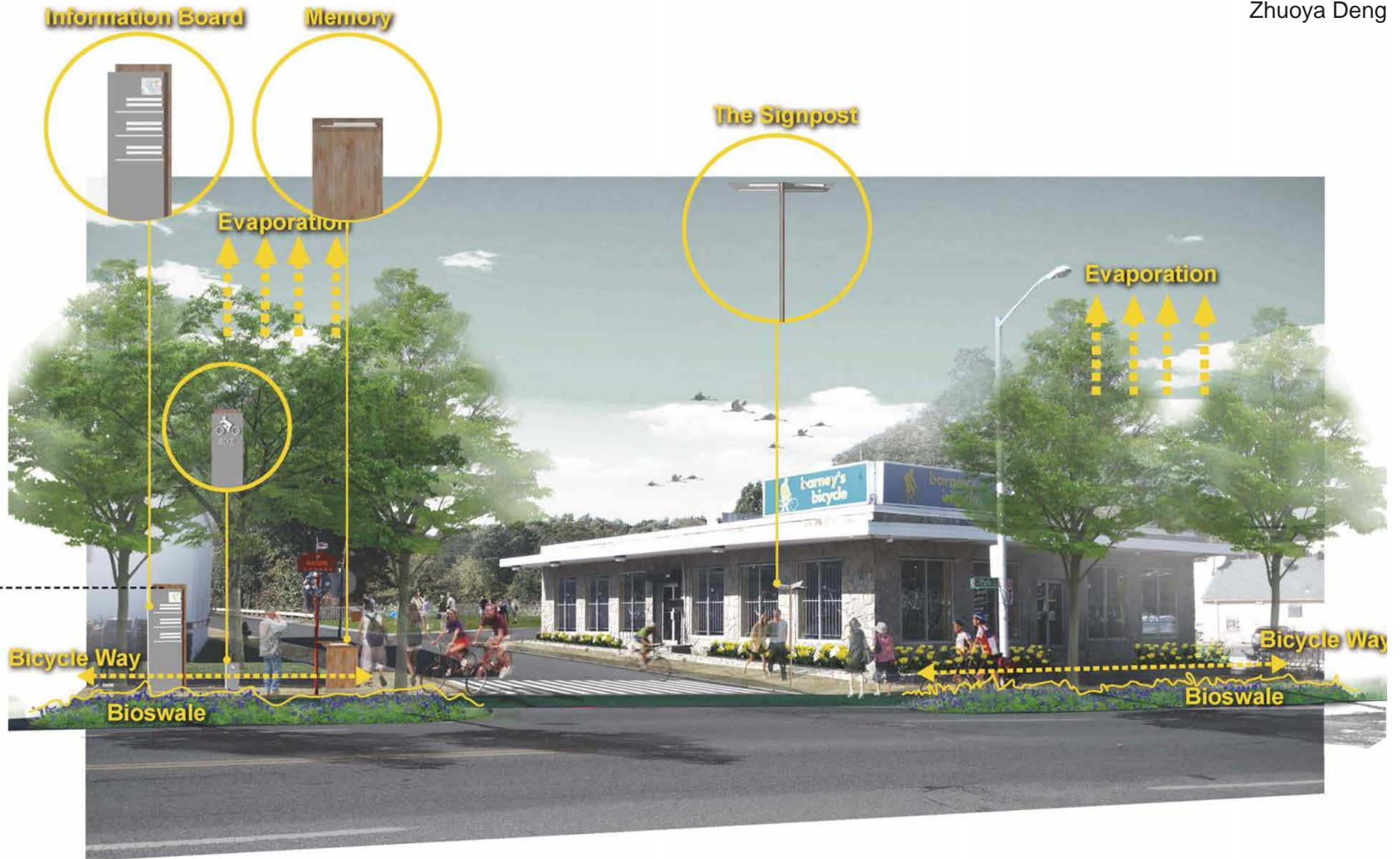




Zhuoya Deng Photography

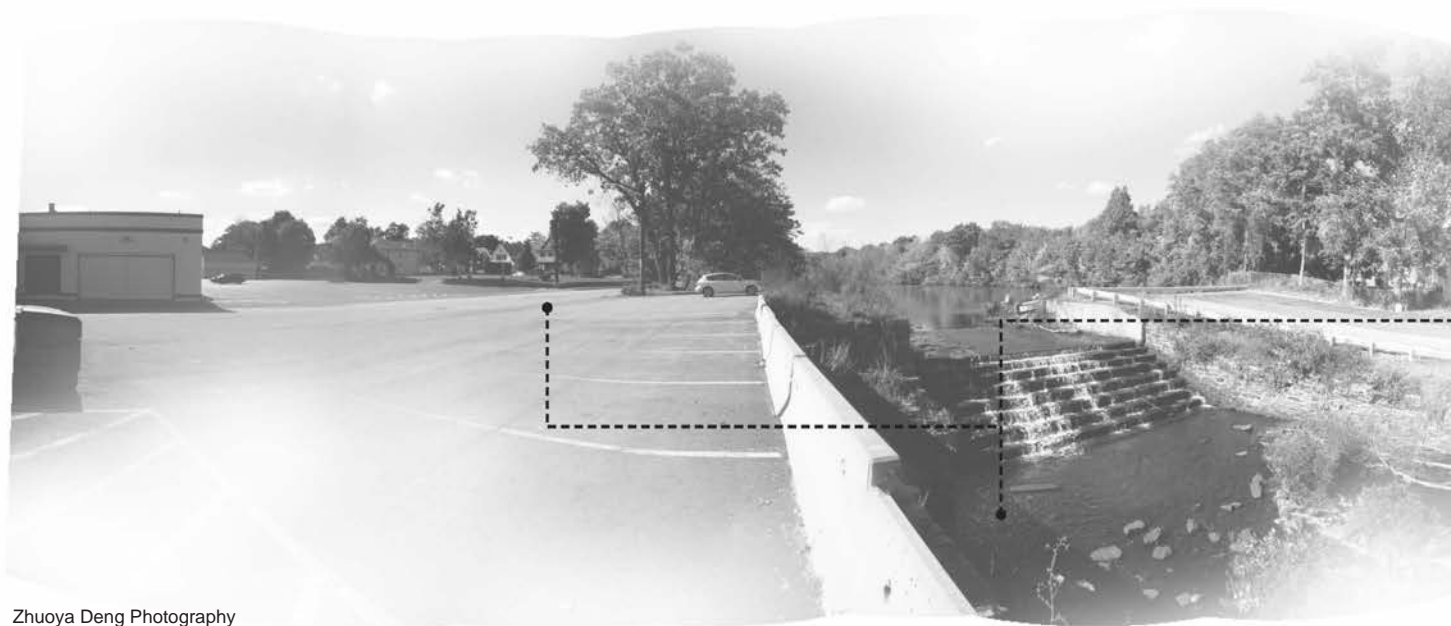
Problem:

1. No guide system for helping people way finding the Coes Reservoir open space area.
2. No bike path to connecting the Coes Reservoir open space area to the city.
3. No street trees along the Park Ave



Solution:

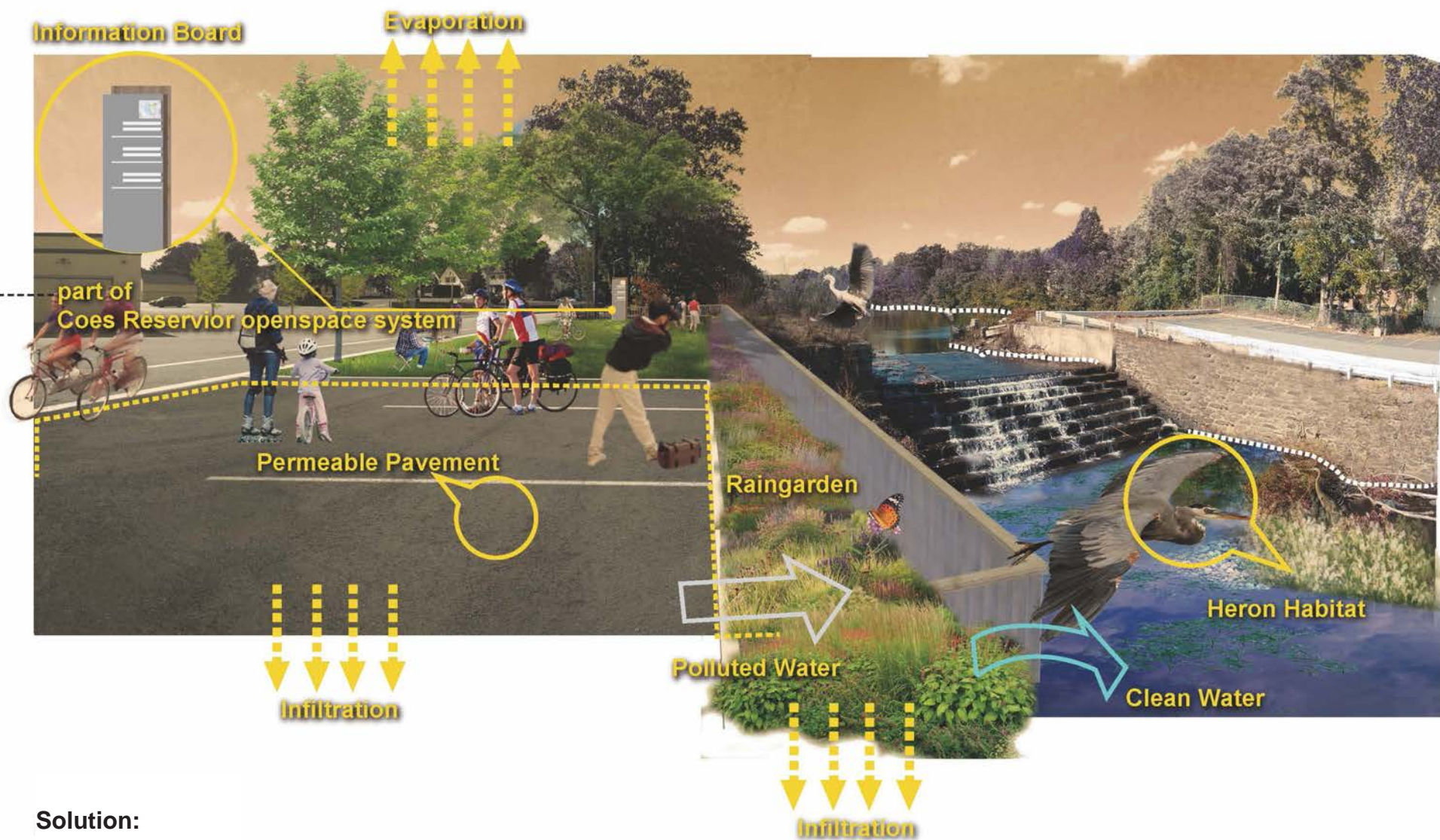
1. By setting a series of guide system to help people find the Coes Reservoir open space area, and knowing their position.
2. Build a bike path to connecting the Coes Reservoir open space area to Park Ave.
3. Street trees and bio-swale as a buffer to keep cyclist safety.



Zhuoya Deng Photography

Problem:

1. The parking lot is always empty and not highly used, which can be an opportunity to build a new greenspace as a start of Coes Reservoir openspace system.
2. The existing Heron habitat is not well protected
3. No green buffer between parking lot and Coes Pond.
4. No bike path connecting all the surrounding openspace around Coes Reservoir.



Solution:

1. Build a new Bike park close to the woodland habitat by keeping the other half of parking lot for vehicle. And the new Bike park is a part of Coes Reservoir open space system, and also it can be the gate way park for those cyclist who coming from Park Ave.
2. Using rain garden as a buffer to keep people away from the Heron habitat, and also to help clean the polluted surface runoff water before it enters into the Coes Pond.
3. Changing the parking lot pavement to permeable pavement, for infiltrating water into the ground.



d
241
Stops

Data Source: Mass GIS

Focus Area 2 - Circuit Ave

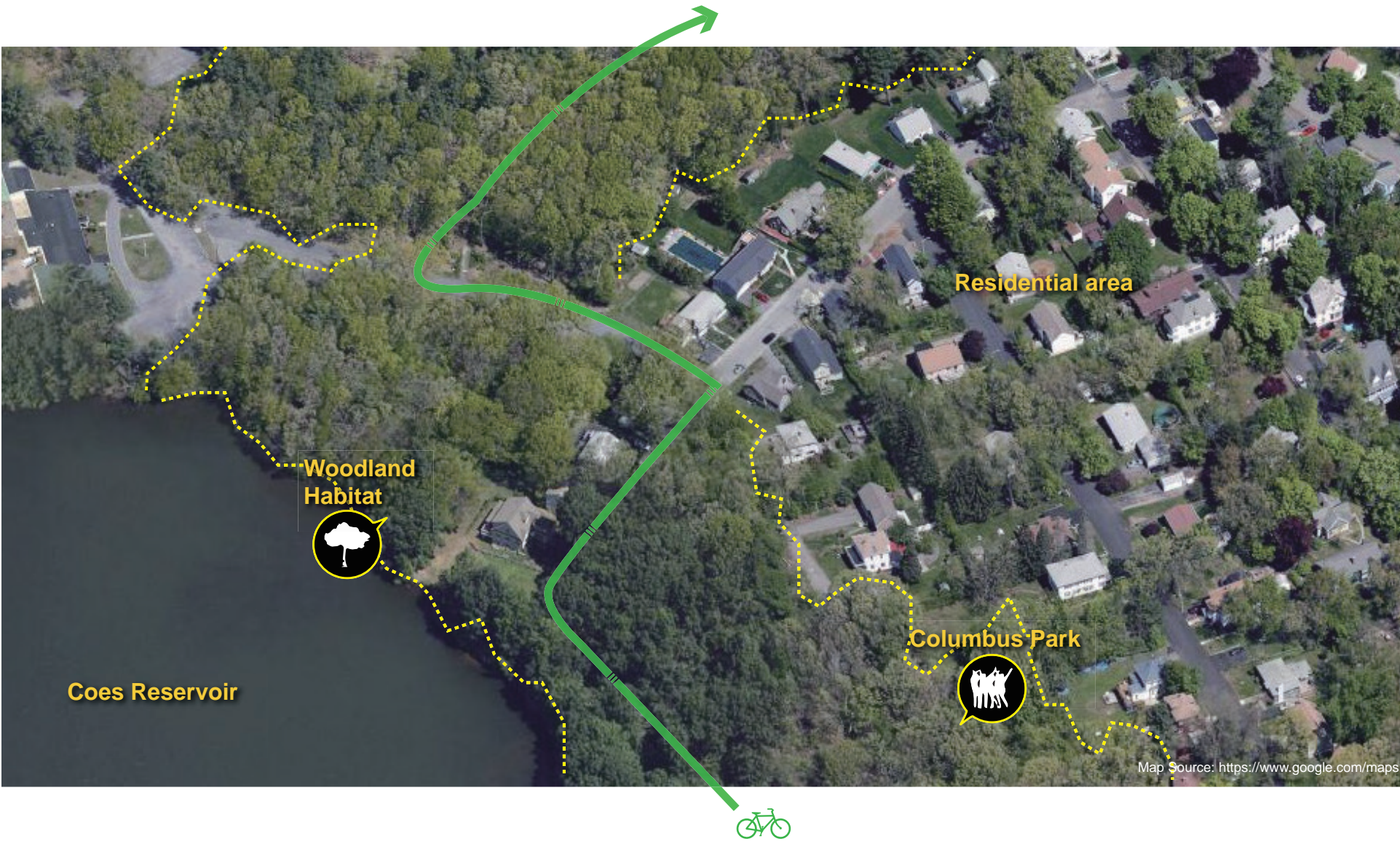




Photo Source: <https://www.google.com/maps>

Problem:

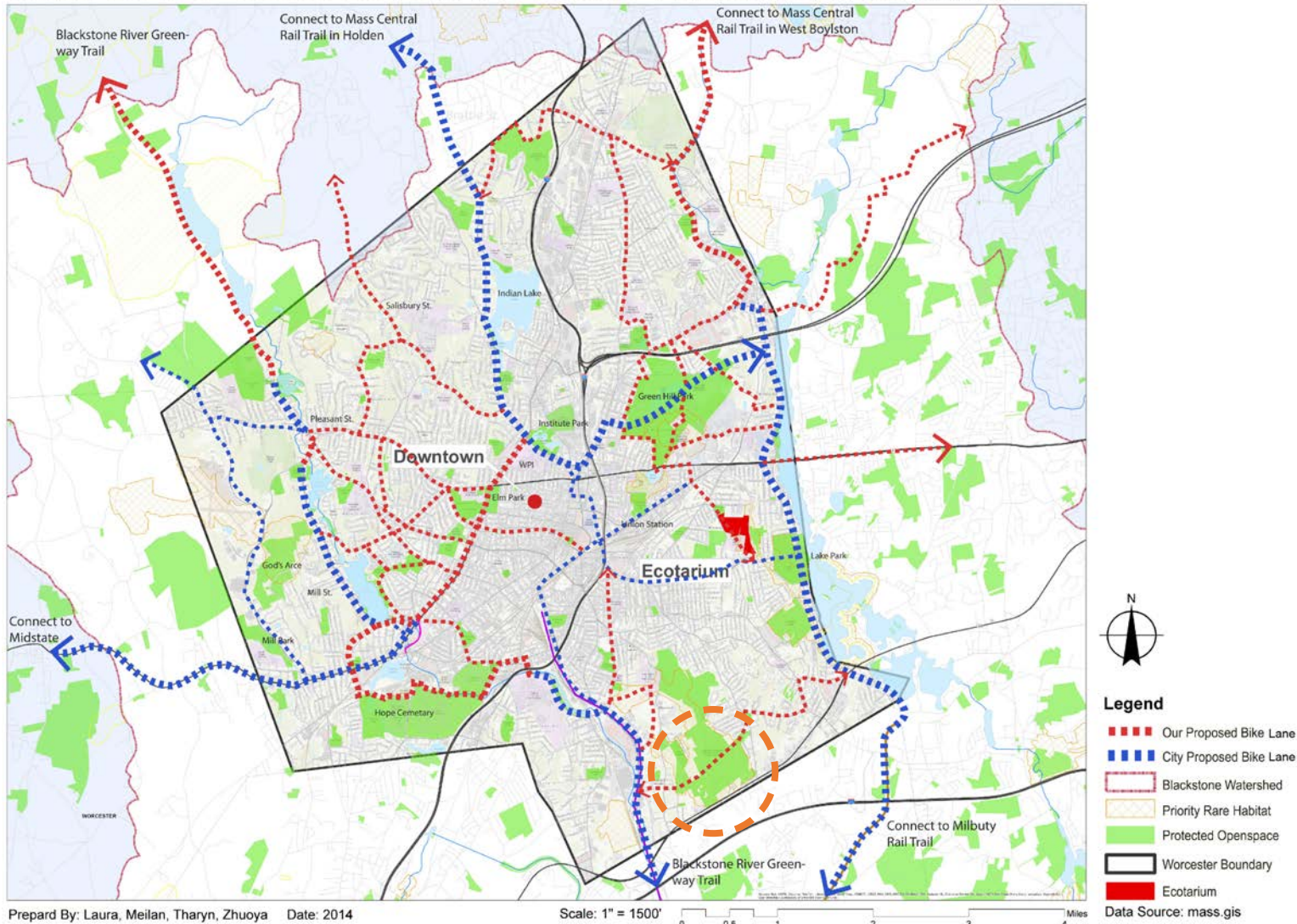
1. Circuit Ave is not pleasant for people to walk, because there are no sidewalks and the road is in poor condition..
2. There is no buffer between residences and Circuit Ave, causing an unsafe condition for the residents.
3. There are several open spaces around this area, but the lack connection.



Solution:

1. To build bioswales along each side of Circuit Ave that have many functions. They can be a green infrastructure for reducing surface run off and collecting polluted water from the road; function as a wild life corridor for insects; be a safe buffer for these residents from the street; and also can bring a pleasant look to this community.
2. To build a bike path along the road to connect the surrounding open spaces.

WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources



This shows a proposed regional connection from the city of Worcester to the outlying regional bike trails. Namely the Mid State Trail which is to the North that connects Amherst MA and Boston MA and the Blackstone Canal Bikeway which will connect Worcester to Providence RI.

KELLY SQUARE - Tharyn Nein-Large



This is an expanded site view of the proposed greenway connections from the Blackstone River Bikeway to Union Station together with connections up Quinsigamond Ave toward the bike way along Francis J. McGrath Blvd. With the focus area of Kelly Square itself as a major intersection requiring design intervention.

Kelly Square Current Condition



Kelly Square as it exists today is a loosely organised free-for-all of multiple intersections. Although these intersections may function somewhat for the vehicle now it really does nothing for the cyclist and less for the pedestrian.

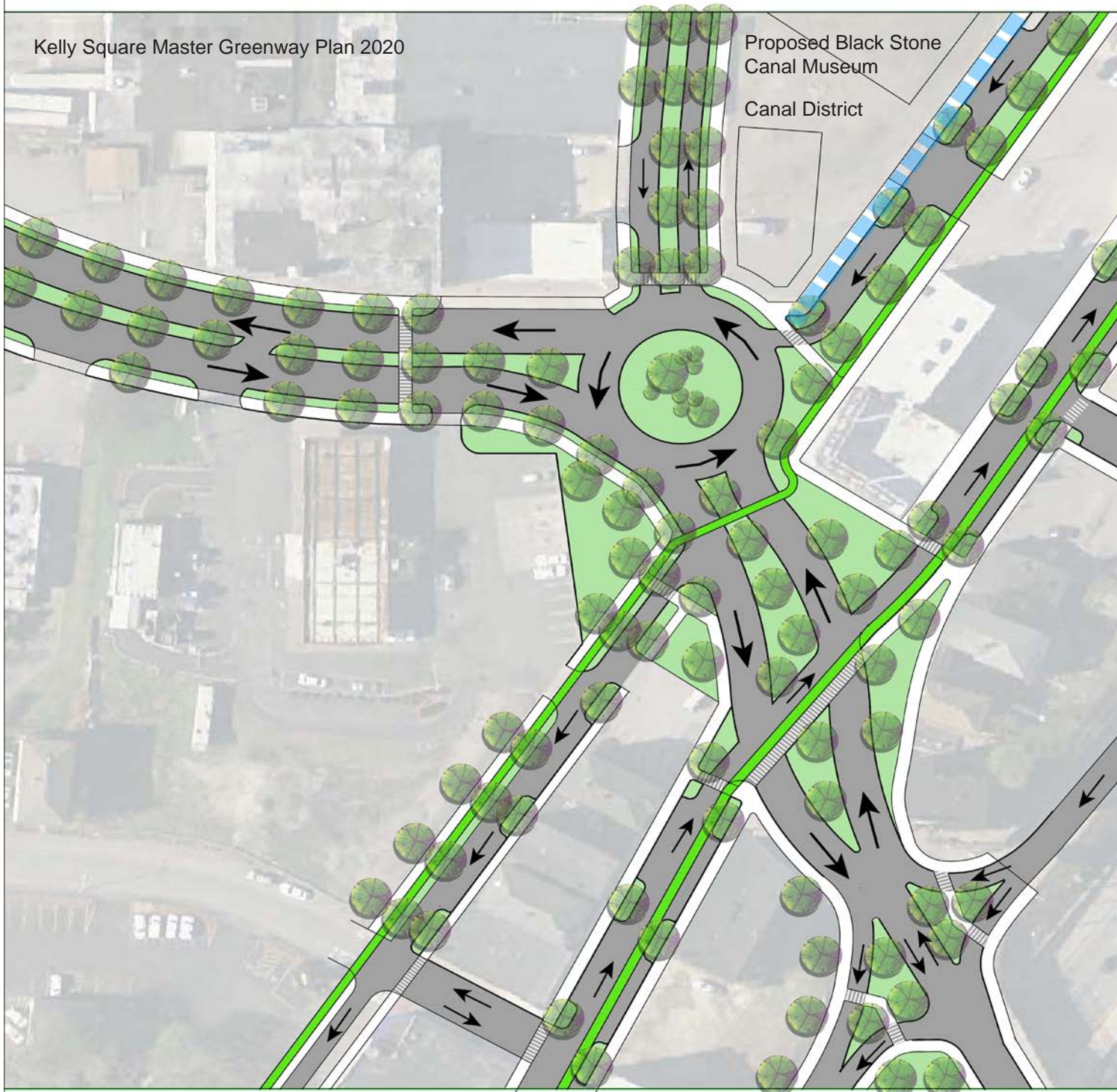
Worcester's goal of having a bicycling connectivity from the Black Stone Canal Bike Way and Union Station is now disconnected by Kelly Square. The oversized lanes and sea of paved area further put emphasis on the disconnect between the vehicle and the pedestrian.

Here the vehicle really is king.

| 290

Map Source: <https://www.google.com/maps>

Tharyn Nein-Large

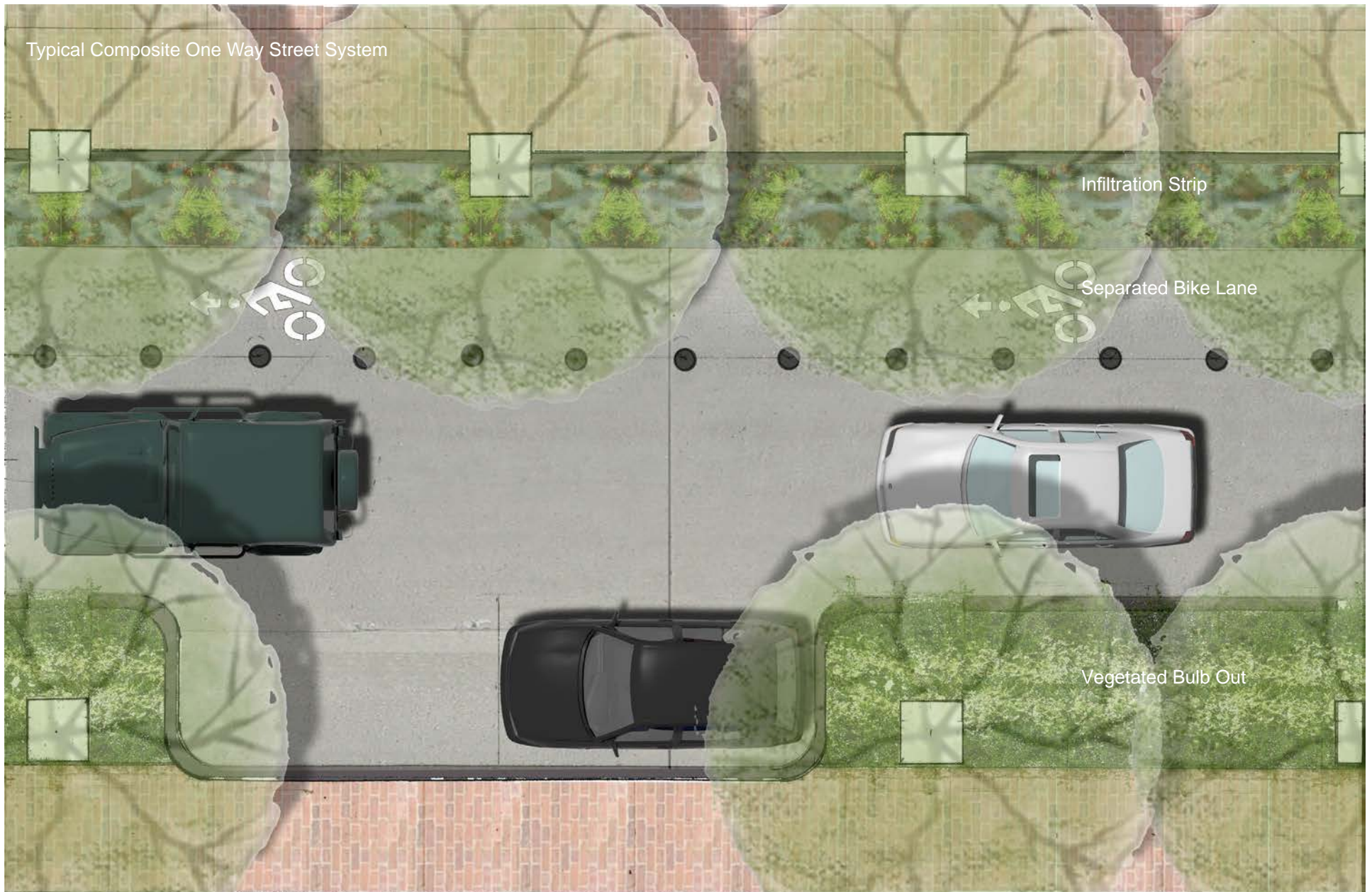


The first concept for Kelly Square was to align the one way bike ways to and from Union Station. The second theory employed for the redesign of Kelly Square involved a 'Road Diet' making delineated travel lanes for the vehicle. Lastly, after suggestion from the Planning Board to eliminate left hand turns.

The one way streets were reduced to eleven foot lanes and the main roads are twelve foot lanes.

More direct raised pedestrian and bicycle crossings. Together with a lighting system designed to alert drivers to yield to pedestrians.

Making connections to the Historic Canal District with the building of a Museum featuring a working replica of the Lock that was once here.



A typical composite plan view showing all elements that could be employed for a one way street system. These include varigated sys-tem of parallel parking and vegetated bulb-outs with curb cuts allowing for storm water infiltration. The 'infiltration strip' can be used to either separate vehicle and cyclist or cyclist and pedestrian. Bollards to be implemented as needed.



A typical composite section view showing elements of the one way street system. With eleven foot travel lane for vehicles and eight foot parallel parking with bio-swales on either side.



Section across Kelly Square outside Salty Dog Saloon

Vegetated Median
Strip Width Varies

Tharyn Nein-Large



Salty Dog Tavern

24' Travel Lane

Concrete
Planter
Buffer

Outdoor Cafe Style Dining
and Beer Garden

8' Sidewalk

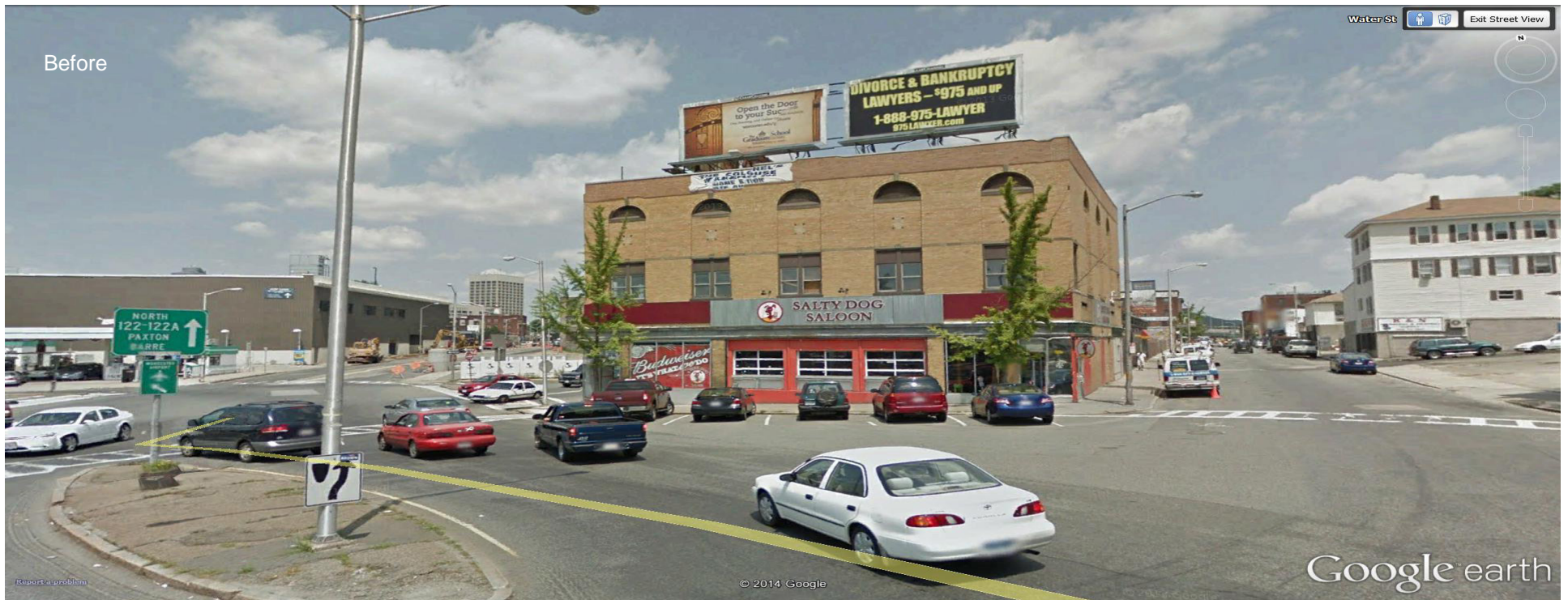
Tharyn Nein-Large



A before image taken from Google Earth standing in the widest paved section of Kelly Square looking back toward the on and off ramps to Interstate 290. This area is also the lowest point of the intersection making it a possible area for water collection and infiltration.



An after image showing the new green space created by implementing a traffic circle in this area. This new green space will become a designed Bioretention Storm Water Remediation/Infiltration System.



A before image of Kelly Square taken from Google Earth looking toward the Salty Dog Saloon. The route going toward Union Station to the right of the Saloon. This image shows vehicles three abreast in an unarticulated travel lane.



An after image of the previous intersection showing the designed travel lanes for the car as well as pedestrian and bicycle lanes. Bollards at the corner of Water St. keep cars from turning onto the bicycle lane. By narrowing the vehicle lanes and adding large concrete planters for safety an outdoor dining area or beer garden is created in front of the Salty Dog Saloon.

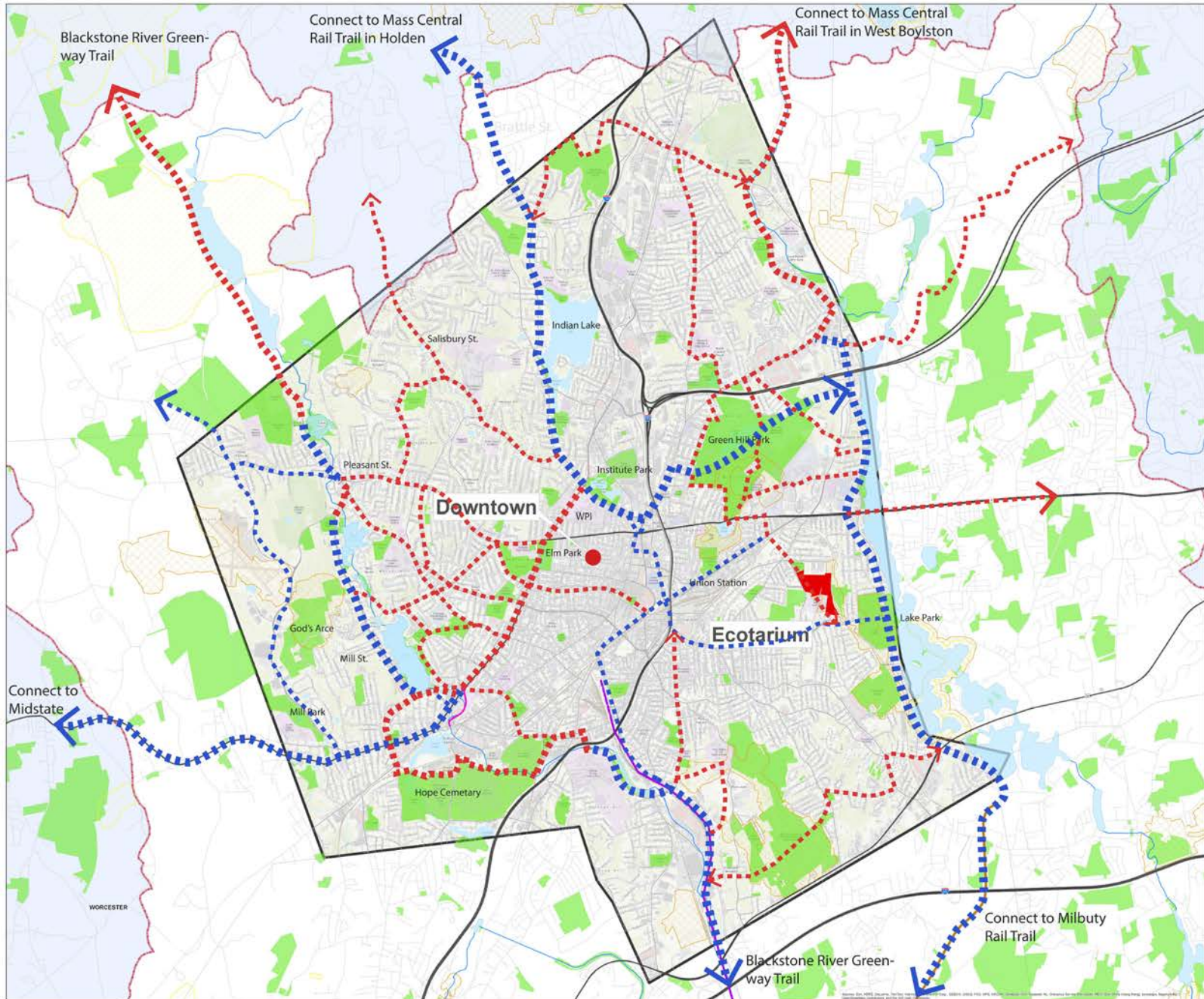


GREENING WORCESTER

Summary of Plan Objectives

1. **Connect existing parks and open space** through an integrated network of bike and pedestrian routes.
2. Provide **access to natural areas** and water resources for urban residents.
3. Improve **ecological health** by create a green corridors for wildlife and people.
4. **Improve water quality** by reduce surface storm water runoff.
5. **Promote a healthy lifestyle** for residents by creating a greenway system.

WORCESTER REGIONAL GREENWAY PLANNING Preserve Life: Ensure Our Resources

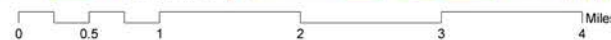


Legend

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- Worcester Boundary
- Ecotarium
- Data Source: mass.gis

Prepared By: Laura, Meilan, Tharyn, Zhuoya Date: 2014

Scale: 1" = 1500'



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