Route 128/I-95

LAND USE & TRANSPORTATION STUDY

Final Report

June 2023

PREPARED FOR

massDOT Office of Transportation Planning

SUBMITTED BY

vhb

IN ASSOCIATION WITH

FHI Studio

Karp Strategies, LLC

City Point Partners, LLC

Acknowledgements

The preparation of this report has been financed in part through the Massachusetts Department of Transportation's (MassDOT) Statewide Planning and Research (SPR) Program agreement with the Federal Highway Administration of the United States Department of Transportation. The views and opinions of the authors and agencies expressed herein do not necessarily state or reflect those of the United States Department of Transportation.

The Route 128/I-95 Land Use & Transportation Study has benefited from the active participation and dedication of a large group of elected officials, municipal, state, and transit agency representatives, and local business leaders. We wish to thank all the participants who have given generously of their time, including many representatives from MassDOT and the Massachusetts Bay Transportation Authority (MBTA) who provided their input and feedback.

Study Participants

Elected Officials

Senator **Michael Barrett** (3rd Middlesex)
Representative **Michelle Ciccolo** (15th Middlesex)
Senator **Cindy Cream** (1st Middlesex and Norfolk)
Representative **Kay Khan** (11th Middlesex)
Representative **Alice Peisch** (14th Norfolk)
Representative **Thomas Stanley** (9th Middlesex)

Working Group Members

Harvey Boshart, Select Board Chair (Town of Weston)
Eric Bourassa, Transportation Director, Metropolitan Area Planning Council
John Ebert, Manager of Building Services, Mass General Waltham
Keir Evans, Vice President – Development, Boston Properties
Nicole Freedman and Josh Ostroff, Director of Transportation, City of Newton
Jim Giammarinaro, President, MetroWest Chamber of Commerce
Mayor **Jeannette McCarthy** (City of Waltham)
Joseph Pasquale, President, 1265 Main Street, LLC
Joe Pato, Select Board Member (Town of Lexington)
Greg Reibman, President and CEO, Charles River Regional Chamber of Commerce
Molyna Richards, Executive Director, Waltham Chamber of Commerce
Erin Sandler-Rathe, Executive Director, Lexington Chamber of Commerce
Monica Tibbits-Nutt, Executive Director, 128 Business Council
Paula Vaughn-MacKenzie, Director of Planning & Land Use, Town of Lincoln

Table of Contents

Appendices

List of Tables

List of Figures

List of Acronyms

AADT	Annual Average Daily Traffic
ACEC	Area of Critical Environmental Concern
ACS	American Community Survey
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AMI	Area Median Income
BD	Bachelor's Degree
BLSF	Bordering Land Subject to Flooding
BOS	Bus on Shoulder
BVW	Bordering Vegetated Wetland
CCTV	Closed-Circuit Television Cameras
C-D	Collector-Distributor
CFR	Code of Federal Regulations
CMF	Crash Modification Factors
CTPS	Central Transportation Planning Staff
DCR	Department of Conservation and Recreation
DHCD	Department of Housing and Community Development
DMS	Dynamic Message Signs
EB	Eastbound
EIR	Environmental Impact Report
EJ	Environmental Justice
ENF	Environmental Notification Form
EOEEA	Executive Office of Energy and Environmental Affairs
EPA	Environmental Protection Agency
ERIS	Environmental Risk Information Services
ESA	Endangered Species Act
EV	Electric Vehicle
FDR	Functional Design Report
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
GHG	Greenhouse Gas
HCM	Highway Capacity Manual
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
ICE	Intersection Control Evaluation
IPaC	Information for Planning and Consultation
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LEHD	Longitudinal Employer-Household Dynamics
LOS	Level of Service
LRTP	Long-Range Transportation Plan
LU	Land Use
LUWW	Land Under Water Bodies and Waterways
MACRIS	Massachusetts Cultural Resource Information System
MAPC	Metropolitan Area Planning Council
MART	Montachusett Regional Transit Authority
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MassEVIP	Massachusetts Electric Vehicle Incentive Program

MassGIS	Massachusetts Geographic Information System
MBTA	Massachusetts Bay Transportation Authority
MCP	Massachusetts Contingency Plan
MCRT	Mass Central Rail Trail
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act
MGL	Massachusetts General Law
MHC	Massachusetts Historical Commission
MIT	Massachusetts Institute of Technology
MPO	Metropolitan Planning Organization
MWRTA	MetroWest Regional Transit Authority
N/A	Not Available
NAICS	North American Industry Classification System
NB	Northbound
NEPA	National Environmental Policy Act
NEVI	National Electric Vehicle Infrastructure
NFIP	National Flood Insurance Program
NHESP	Natural Heritage and Endangered Species Program
NPS	National Parks Service
OD	Origin-Destination
OHM	Oil and/or Hazardous Material
ORW	Outstanding Resource Water
OTP	Office of Transportation Planning
PATI	Plan for Accessible Transit Infrastructure
PH	Priority Habitat
PNF	Project Notification Form
PPDU	Public/Private Development Unit
RAO	Response Action Outcome
R&D	Research & Development
RMV	Registry of Motor Vehicles
ROW	Right-of-Way
RRFB	Rectangular Rapid Flashing Beacon
RSA	Road Safety Audit
RTA	Regional Transit Authority
RTP	Regional Transportation Plan
SB	Southbound
sf	square foot (feet)
SHI	Subsidized Housing Inventory
SSA	Safe System Approach
TAZ	Traffic Analysis Zone
TBD	To Be Determined
TDM	Transportation Demand Management
TMAs	Transportation Management Associations
TOD	Transit Oriented Development
TSMO	Transportation System Management and Operations
TSP	Transit Signal Priority
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
VMS	Variable Message Sign
vpd	Vehicles per Day
vph	Vehicles per Hour
WB	Westbound
WPA	Wetlands Protection Act
WQC	Water Quality Certification

Executive Summary

Introduction

The Route 128/I-95 Land Use & Transportation Study, led by the Office of Transportation Planning (OTP) at the Massachusetts Department of Transportation (MassDOT), establishes the future land use, housing, and economic development assumptions of the segment of Route 128/I-95 between Newton and Lexington. Based on these assumptions, this study makes recommendations intended to address the corridor's current and anticipated transportation issues. These recommendations include land use and regulatory strategies intended to encourage mobility and accessibility along the corridor and make improvements to the transportation system that are focused on the integration of multimodal transportation options. We also present an implementation plan for executing upon each recommendation that identifies key stakeholders, timelines, and potential funding sources.

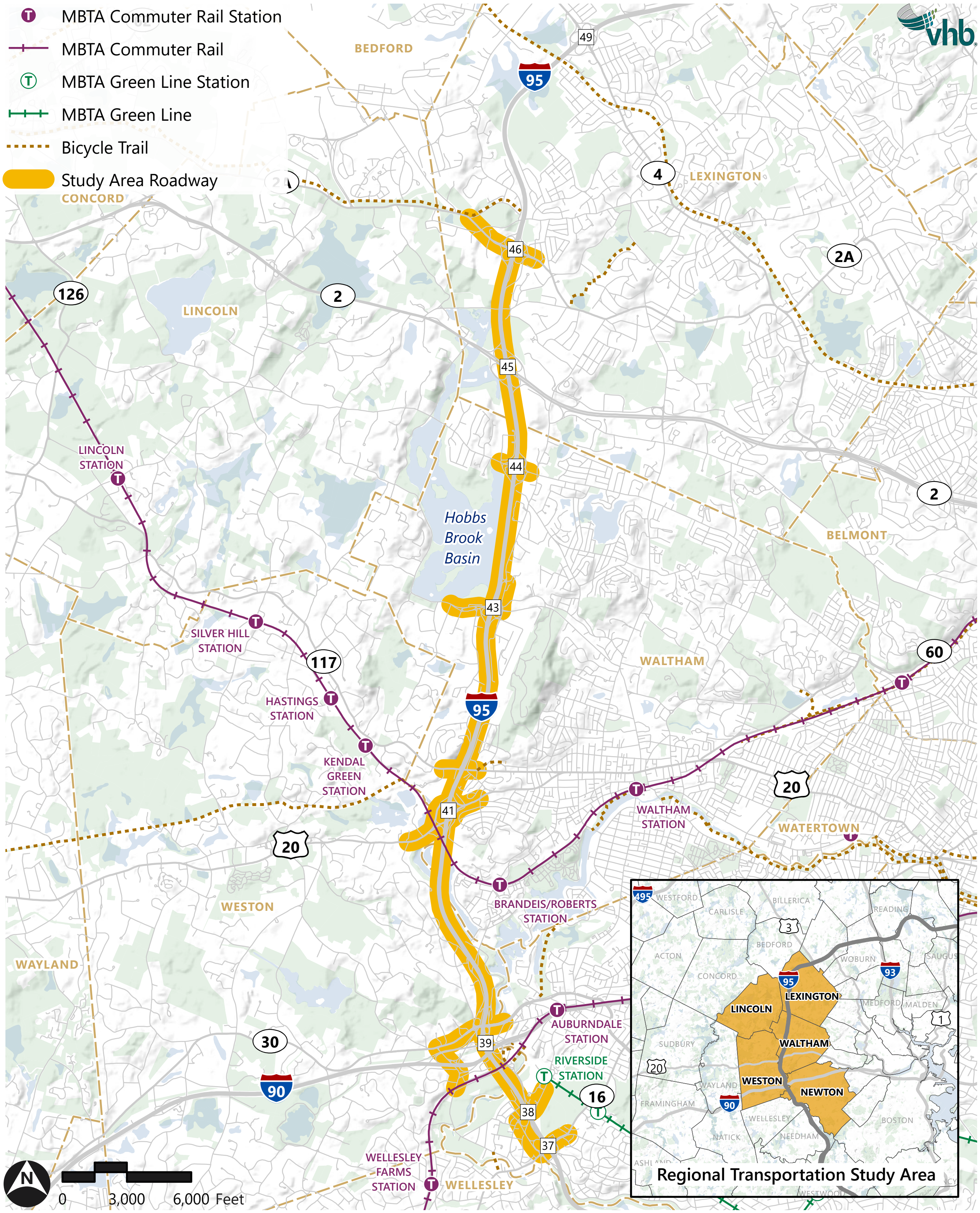
This Executive Summary is a brief review of the overall report, organized by chapter. It first reviews the study area and the goals, objectives, and evaluation criteria for this effort. A description of existing conditions and analysis of future conditions based on available development and permitting data follows. We then describe the process of developing and analyzing alternatives and introduce those alternatives that are ultimately recommended for advancement to implementation. We conclude with a brief description of next steps to implement these actions.

Study Area

The study area encompasses an 8.5-mile segment of Route 128/I-95 between Exit 37 (Route 16) in the south and Exit 46 (Route 2A) in the north, located west of Boston in the municipalities of Newton, Weston, Waltham, Lincoln, and Lexington. The transportation study area includes the Route 128/I-95 mainline, on/off ramps and key local intersections (Figure ES-1) and the land use study area includes a ½ mile buffer area around the Route 128/I-95 study corridor with a larger development zone around the Hobbs Brook Basin.

Figure ES-1: Transportation Study Area

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation_Figures_v4.aprx (kfrench, 2/27/2023)

Public Involvement

The study area is regionally significant due to the degree of major development along the corridor over the past few decades that affects a diverse range of stakeholders. This project recruited major employers, local business leaders, city and state departments and advocacy organizations to participate on the Working Group and used a variety of strategies to engage the public at key project milestones, including virtual public meetings and hosting a virtual public meeting room. The full public involvement plan is available in the report's Appendix C.

Goals, Objectives, and Evaluation Criteria

This study's goals, objectives, and evaluation criteria were developed and refined in collaboration with the Working Group. Goals define the general intentions and purposes for conducting the study based on the issues that have been identified, while objectives describe the ways that the goals could be reached. The evaluation criteria are used to measure how well each alternative meets the goals and objectives according to qualitative and quantitative measures. The five study are goals are:

» Improve Access, Safety, and Mobility for All
» Support Strategic Land Use and Economic Vitality
» Advance Social Equity Throughout
» Contribute Environmental and Health Benefits
» Develop Recommendations with Lasting Benefits

The Working Group and the public provided iterative feedback on the study goals, and weights were assigned to each based on this input to establish a comprehensive set of evaluation criteria.

Existing Conditions

The transformation of Route 128/I-95 began in the late 1950s as technology companies opted for suburban locations along the corridor and outside of Boston's urban core. At the time, the Route 128/I-95 corridor was dubbed "America's Technology Highway". While numerous existing commercial uses anchor the corridor, many parcels are expected to be redeveloped as landowners adapt to changing market demands in Greater Boston and along this corridor.

Existing Conditions Key Takeaways

- The Route 128/I-95 corridor has **low residential density** and **multifamily, rental, and affordable housing is sparse**. There has been little residential construction over the past twenty years, even as the population in the Boston metro area has steadily increased.
- The study area is a **strong jobs center with over 39,000 employees** across the study area tracts. It is home to over 15 million square feet (sf) of office space, with 10 percent growth from 2011 to 2021.
- **Mode shares differ significantly** between municipalities – related to development density and availability of transit and active transportation facilities.
- There are many trips among study area municipalities that may be conducive to walking/ biking, but **gaps in the active transportation network** do not support them.
- **Most workers live outside the study area**, straining the transportation system. With limited transit options, drivers experience extended “rush hour” periods, poor operations, and unreliable travel times.

Reading Between the Lanes

This stretch of Route 128/I-95 is one of the most congested roadway corridors in the state. Its land use is dominated by office space, and to a lesser extent, industrial and retail spaces, which cumulatively attracts 97 times as many workers as there are residents. Nearly 56,000 people work in the study area, but just 500 of these workers live locally due to the lack of available housing. About 60 percent of people who work in this study area live at least ten miles away; what this means is that a lot of people are traveling on the same roads at about the same times to this major employment hub.

Without other modal options that appeal to commuters and potential residents, this situation leads to delay and unreliable travel patterns, which complicates travel for both regional and local stakeholders. Traffic data shows travel time variability throughout the day, not just during the weekday morning and weekday evening peak periods. Travel times on some segments can be as much as three times the average—during morning and evening peak periods as well as midday. This area of the network is not capable of handling the degree and type of travel that local economic development and housing policies currently encourage.

Land Use and Economic Conditions

Land use within this study area varies greatly across its five municipalities. Office, commercial and industrial land uses are clustered most densely in the center of the study area in parcels located in Waltham. Of these commercial uses, office is by far the largest (15 million square feet (sf)) followed by retail (794,000 sf) and industrial (679,000 sf).

There are also a significant number of residential districts within the study area, the majority of which are low-density and consist predominantly of single-family detached houses. Low-density residential districts abutting the corridor are mostly located within Newton and Weston, with smaller portions found in Waltham.

Zoning

Despite the variety of land uses and densities across the study area, parcels are predominately clustered together by use and type exhibiting a general lack of mixed-use residential/commercial districts. Land use regulations within the study area further reflect these single use development patterns.

Residential zoning districts are comprised of largely single-family housing, most notably in Weston and Lincoln where there are no multi-family development districts. Commercial zoning districts are consistent with current land uses with office and laboratory spaces being concentrated in Waltham, Weston and Lexington and retail, hotels, and restaurants found in higher concentrations in Newton's business districts.

Development Trends

Office use drove development in the study area over the last decade, growing more than 9.7 percent, which is significantly higher than growth in the Boston market (5.5 Percent). Industrial and flex development declined at a higher rate than adjacent submarkets largely aligning with national trends away from heavy manufacturing towards light or advanced industries. Conversely, there has been no growth in the multi-family residential inventory within the study area over the subsequent 20 years despite nearby markets, such as Boston (39.6 percent) and adjacent submarkets such as Metro West (35.2 percent) and Route 2 (32.3 percent) seeing considerable growth.

Economic Conditions

Over the past 20 years the study area has developed into a strong jobs center driven by growth within industries such as professional, scientific, management and tech services (18.15 percent) with 14.4 percent growth since 2010. Despite this growth, office vacancies remain higher than comparable geographies, with 13.4 percent of office space and 22.2 percent of industrial space being vacant as of Q3 2021. Recent increases in office and industrial vacancies are the combined product of immediate downward market pressures due to the COVID-19 pandemic and longer standing declines in the traditional industrial building inventory.

Demographics

Population, number of housing units, and number of households all grew by an average of 4-5 percent. All five municipalities in the study area have a higher percentage of residents over 25 years of age with bachelor's degree and higher median household income than the statewide average. With the exception of Weston, each of the municipalities have some Census Tracts that meet at least one environmental justice threshold.

People and Housing

As noted, the Route 128/I-95 corridor, in general, has a low residential density. Almost all residences are single-family detached homes. Directly along the corridor, multifamily housing is sparse, as is rental housing, and affordable housing in general meaning most housing options are not attainable to low-income buyers/renters. Despite the need for greater numbers of housing units, there has been little residential construction in the corridor, even as the population has steadily increased throughout the study area.

Transportation Conditions

Roadways and Intersections

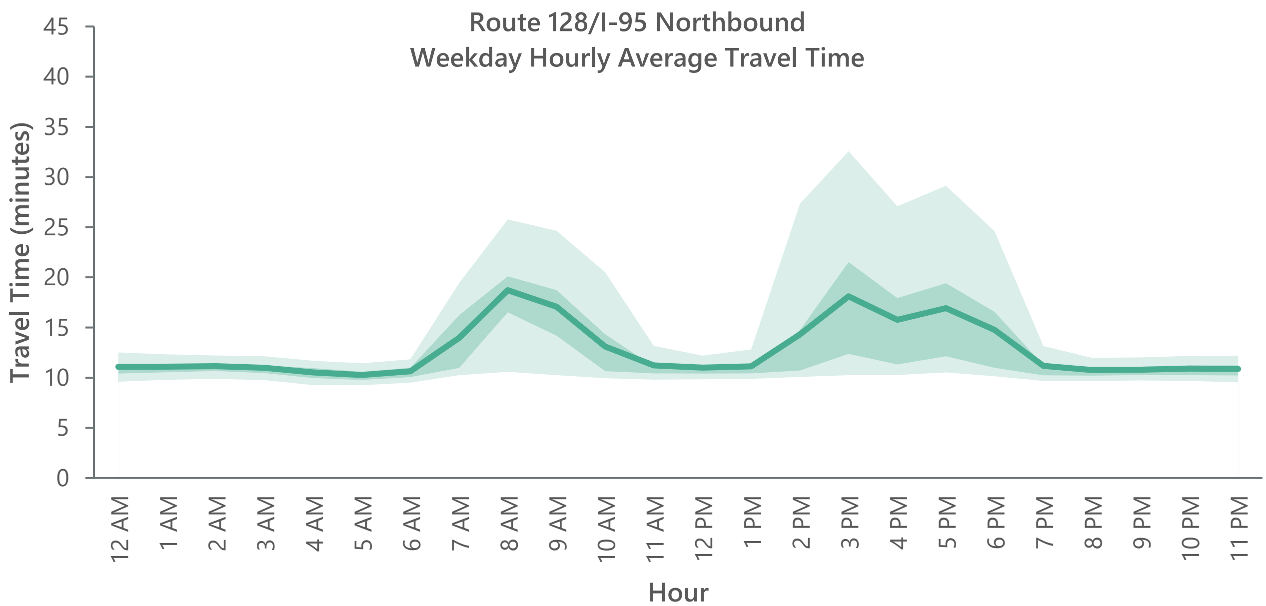
The section of Route 128/I-95 within this study area is one of the most congested roadway corridors in the state. About 60 percent of people who work in this study area live at least ten miles away; what this means is that many people are traveling on the same roads at about the same times to this major employment hub. This relationship between long commutes and high employment concentrations makes Route 128/I-95 one of the state's busiest major roadways carrying approximately 184,000 vehicles per day (vpd) – 89,000 vpd northbound and 95,000 vpd southbound. More than 6,000 vehicles per direction per hour use this corridor during peak periods. These peak volume periods or "rush hour" extend between 7:00 and 10:00 AM in the northbound direction and between 2:00 and 7:00 PM in the southbound direction on a typical day. The great majority of this traffic is generated by commuting behavior into and out of the study area, however, an additional four percent of daily traffic is generated by trucks and heavy vehicles.

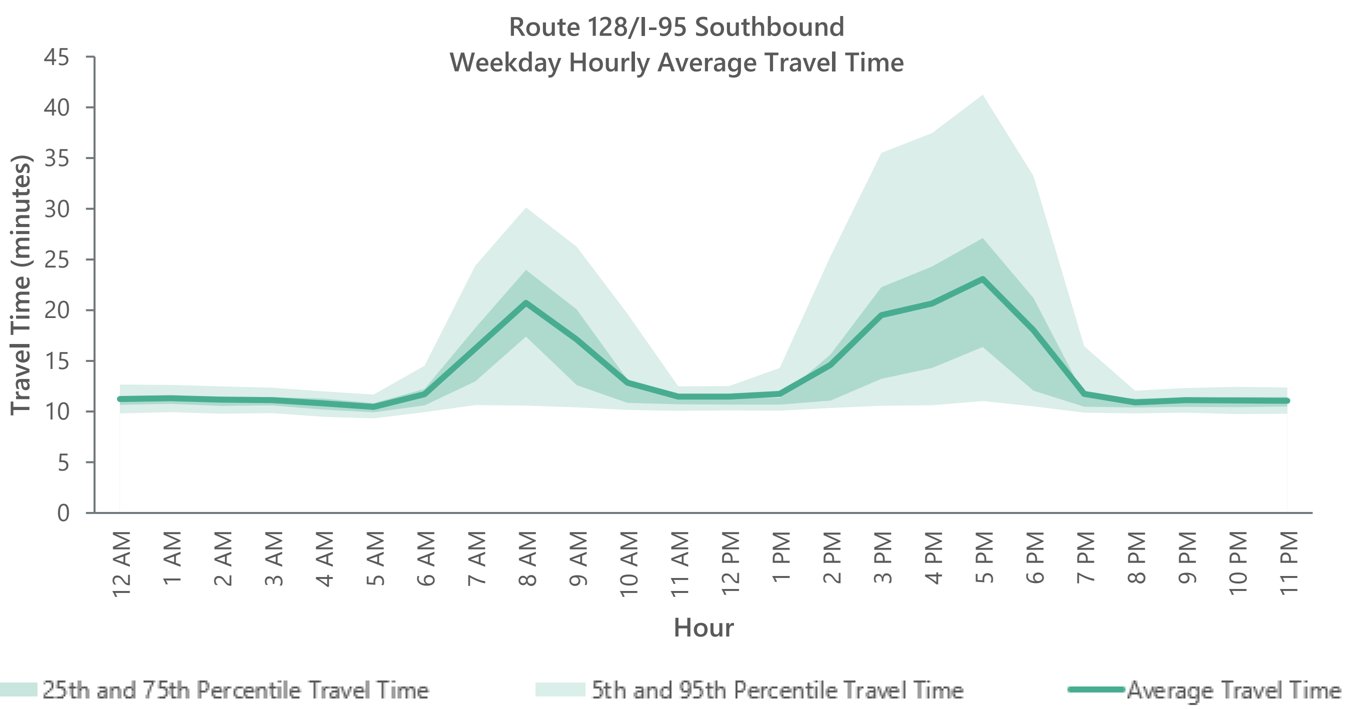
Travel patterns have seen significant changes in recent years. Daily traffic volumes on Route 128/I-95 have grown by an average of two percent per year between 2015 and 2019. In 2020, the onset of the COVID-19 pandemic resulted in traffic volumes decreasing 29 percent from their 2019 levels. In 2021, the most recent available data at the time of this study's publishing, the average daily volumes increased by 26 percent from their 2020 levels. While this was a significant increase, they remained 11 percent lower than 2019 traffic volumes in the corridor.

As shown in Figure ES-2, there is significant travel time variability throughout the corridor for all hours of the day, with certain roadway segments experiencing nearly double that of free flow or off-peak travel time. This results in unreliability for travelers. The long duration of commuter peak periods along the corridor also contribute to unreliability. The combination of high traffic volumes and local economic and housing development policies have placed strain on this area of the network beyond that which can be resolved by transportation capacity and efficiency improvements alone.

At the local level, while most signalized study area intersections currently operate at an acceptable overall level of service, several signalized intersections have operational deficiencies and nearly half of the study area unsignalized intersections currently operate poorly.

Figure ES-2 Route 128/I-95 Travel Time





Source: INRIX, January – December 2019 Tuesday-Thursday average

Transit

There is significant variation in the availability and type of public transportation modes across the study area. The five municipalities within the study area are served by six transit operators (MBTA, MART, MWRTA, Lexpress, 128 Business Council, and the Massachusetts Institute of Technology) which together provide 19 different transit routes across four transit modes (commuter rail, rapid transit, bus, and paratransit). While all five municipalities are served by at least one transit route, their distribution is not uniform with higher transit densities in eastern municipalities such as Newton and Waltham and limited public transport options in less dense communities such as Weston and Lincoln.

Active Transportation

There are also a variety of existing recreational and commuter bicycle connections in proximity to the study corridor, but active transportation facilities within the corridor consist primarily of intermittent sidewalks for pedestrians and on-street striping/signage for bicycles. There are east/west separated active transportation corridors within/proximate to both the northern and southern ends of the study area, but there are few separated facilities in between making north-south connections challenging.

Safety

Crashes within the study area most frequently occur near interchanges, which are influenced by entering and exiting traffic maneuvers. These locations include areas with closely spaced on- and off-ramps and are highly influenced by merging, diverging, and weaving vehicles. Additionally, five of the 42 local road intersections have crash rates higher than their district averages. Despite the presence of certain crash-prone intersections, there have been no fatal crashes within the study area between the years of 2015 and 2019.

Environmental Conditions

The study area contains a variety of environmental resources that are important to the health and quality of life of the intersecting municipalities and the region more broadly. Natural resources in the study area include wetlands, waterways, open space, and other resources influencing biodiversity. These resources are not only important to the environmental health of the area, but also create constraints that are subject to several federal and state regulations. Please see Chapter 2 of the report for a more complete discussion on Environmental Conditions in the study area.

Future Conditions and Issues, Opportunities, and Constraints

Future Conditions refer to what should be expected in terms of future mobility and access along this corridor given what is known about planned and potential land uses and developments. This includes a description of planned infrastructure improvements, land use forecasts, future traffic demand forecasts and operations, and a summary of the issues, opportunities, and constraints that residents, businesses, and other stakeholders can expect along this corridor in the coming years.

Future Conditions Key Takeaways

- More than **6 million sf** of space is either recently or expected to be constructed within the next several years within the study area, with most growth consisting of **laboratory and/or office space,** and approximately 90 percent will be clustered in **western Waltham.**
- An additional **1 million sf** of space, also clustered in **western Waltham,** is anticipated to begin the permitting process for redevelopment in the near future.
- Anticipated local and regional **land use growth will increase traffic demands** along the Route 128/I-95 corridor and at study area intersections – exacerbating **operational challenges**.
- Planned roadway and intersection improvements attempt to accommodate future growth but are designed within physical constraints and **cannot absorb the full pipeline of development**.
- There are **minimal significant transit investments** anticipated to directly benefit the study area.
- Planned improvements to the **active transportation network** improve east-west connectivity in places but still leaves **north-south gaps** in the network.

Reading Between the Lanes

The data and analyses indicate that in the future, extensive development is anticipated along this segment of Route 128/I-95, which is already a significant site of economic activity and employment. This study also suggests that the type of development anticipated will do little to ease the existing challenges and frustrations facing travelers.

The emphasis on commercial development - particularly laboratory space - and effective moratorium on high-density multi-family and market-rate housing will only exacerbate existing issues.

Transportation improvements, including upgrades to the active transportation and transit networks, may offer some relief and alternatives to single occupancy driving. However, without significant increases to local housing supply, these transportation improvements will have limited impacts on congestion and delay.

In short, mobility is already degraded and challenging for people traveling to and through the area and is projected to become far worse if current development trends continue into the future.

Planned Land Uses and Developments

There is a significant volume of development inventory in the project pipeline throughout the study area. More than six million sf of land is expected to be developed within the next several years, most of which will consist of laboratory and/or office space[1]. In addition to these known projects identified through formal state/local permit filings, MassDOT's Public/Private Development Unit (PPDU)

1 Estimated sf is based on communications with staff in the five municipalities in the study area.

identified additional relevant potential projects that are anticipated to formally file permitting documents soon. Table 3-1 in Chapter 3 presents a summary of the anticipated land use growth. Approximately 90 percent of this growth will be clustered in western Waltham, in the center of the study area.

The continued proliferation of laboratory facilities has been particularly transformative along the corridor, as developers seek to benefit from agglomeration economies outside of more expensive opportunity areas like Boston’s Seaport District or Kendall Square in Cambridge.

Despite progress with some residential development proposals moving forward, many others have been rejected or are otherwise stalled. The study team explored the barriers to residential development in the corridor study area, including local resistance and restrictive zoning ordinances. Housing and other development trends are discussed in more detail in Chapter 3 of the report.

Travel Demand Forecasting

Travel demand forecasting projects travel behaviors, and in this study, we relied on the statewide travel demand model maintained by the Central Transportation Planning Staff (CTPS), which forecasts to the year 2040. The household, population, and employment forecasts in the CTPS model were compared to data collected through outreach to study area municipalities and MassDOT. In addition, projected traffic volume growth from the CTPS model were compared to the anticipated volume of trips generated from planned projects. These comparisons found that the CTPS model is underestimating traffic volume growth at the Waltham-area interchanges of Wyman Street/Winter Street (Interchange 43), Route 117, and Route 20 (Interchange 41). To account for anticipated land use growth, a manual adjustment was applied to the CTPS projections to reflect known developments in western Waltham more fully in the Route 128/I-95 study area. A full description of the model’s application and adjustments are provided in Chapter 3 of the report.

Figures ES-3 and ES-4 illustrate the resulting estimated change in **traffic volumes** on the Route 128/I-95 mainline between existing and 2040 future conditions during the weekday morning and weekday evening peak hours, respectively. As shown, significant growth is projected along the Route 128/I-95 corridor, with traffic volumes projected to increase between 6 percent and 30 percent by 2040 as a result of local and regional economic development and population, and the impact of planned development projects within the study area. In both directions, the highest increase in traffic volumes is expected approaching Waltham during the weekday morning peak hour and departing Waltham during the weekday evening peak hour. 2040 traffic volume networks for the Route 128/I-95 mainline and on- and off-ramps and study area intersections during the weekday morning and weekday evening peak hour are included in the report’s Appendix B.

Figure ES-3 Weekday AM Peak Hour Volumes Comparison on Route 128/I-95

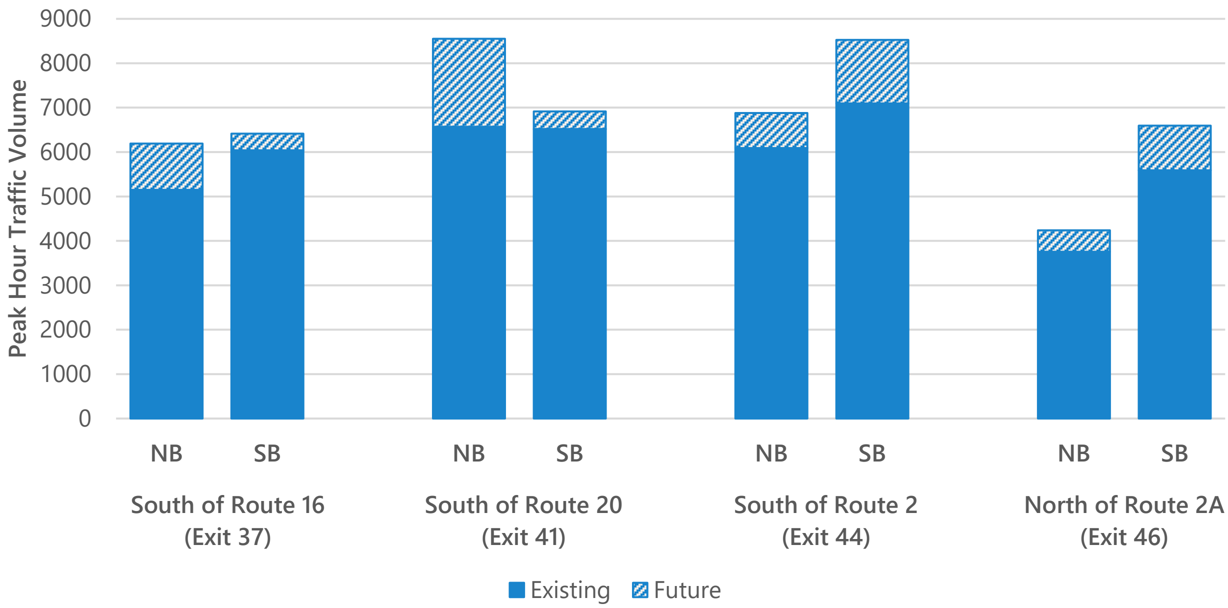
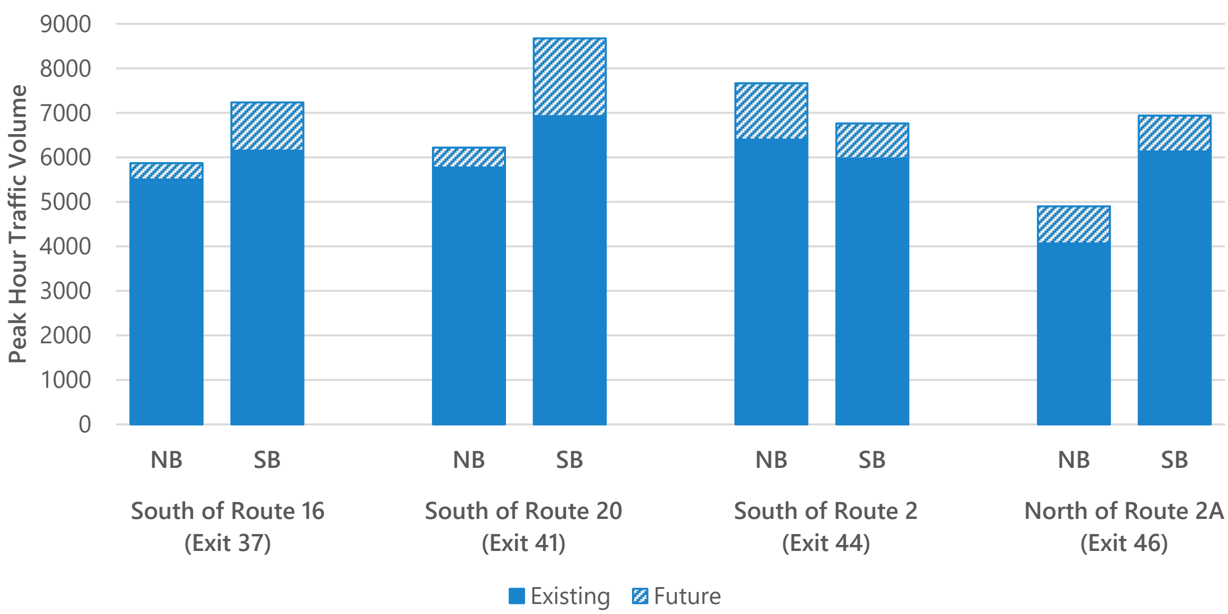


Figure ES-4 Weekday PM Peak Hour Volumes Comparison on Route 128/I-95



Note: Peak hours represent 7:00 – 8:00 AM and 4:00 – 5:00 PM, respectively. Additional details on the development of the Existing and Future peak hour traffic volumes are presented in supplemental memorandums included in Appendix D.

In addition to forecasting the growth of traffic demands on facilities within the study area, CTPS also estimated the growth in "trip ends" (also called person-trips) for study area Traffic Analysis Zones (TAZs). These are trips with an origin or destination within a given TAZ, categorized by mode. Based on the model output, total **person-trips by all modes** from/to the study area towns are projected to increase by approximately 9-10 percent by 2040[2].

The CTPS model further indicates that the **mode share** for study area trips would remain relatively constant between the base year of 2016 and 2040. From a transit trip perspective, the most significant growth was projected in Newton, aligning with the availability of existing transit services to meet increased demand. Active transportation trip growth was also concentrated in Newton and southern Waltham, the densest portions of the study area with land uses amenable to shorter trips.

Future Transportation Conditions

To fully account for the future state of the corridor, this study includes a review and analysis of known, planned roadway improvements that affect conditions for vehicles, transit, pedestrians, and bicyclists.

These projects include:

- Grove Street/Recreation Road Interchange Improvements
- Park Road Reconstruction
- Route 30 Reconstruction
- Route 30 Bridge Rehabilitation over the Charles River
- Main Street (Route 117) and Route 20 at Route 128/I-95 Interchange 41 Improvements
- Winter Street On-Ramp to Route 128/I-95 Southbound Improvements
- Route 2A Bridge Replacement over Route 128/I-95
- I-90/I-95 Bridge Replacement and Rehabilitation

In addition to projects noted above within the study area, the Town of Lexington is considering a complete streets project on Bedford Street/Hartwell Avenue to the north. Detailed descriptions of all projects listed above are included in Chapter 3 of the report.

Traffic Operations

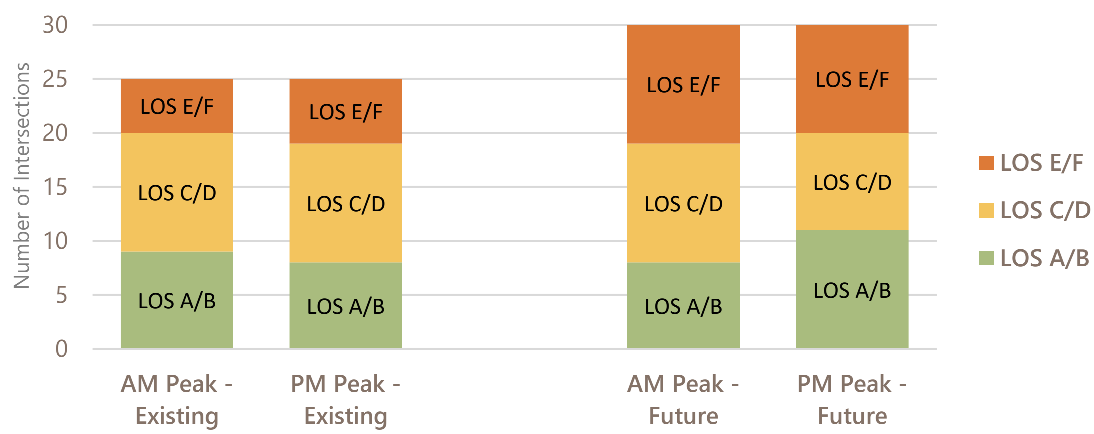
The future conditions analysis includes a technical assessment of the operational qualities of the corridor's roadway segments, ramps, weaving segments, and intersections for existing and projected future conditions. Despite the numerous transportation infrastructure investments planned for the study area, significant operational challenges will remain possibly making conditions much worse for travelers given planned future development.

2 Estimates based on CTPS model output and do not reflect additional Waltham pipeline developments.

Under future conditions, nearly half of the study area ramps (21 of 44 locations) and more than half of the study areas' weaves (5 of 8 locations) are expected to operate at LOS E or LOS F during at least one weekday peak hour, representing a degradation of operations from existing conditions.

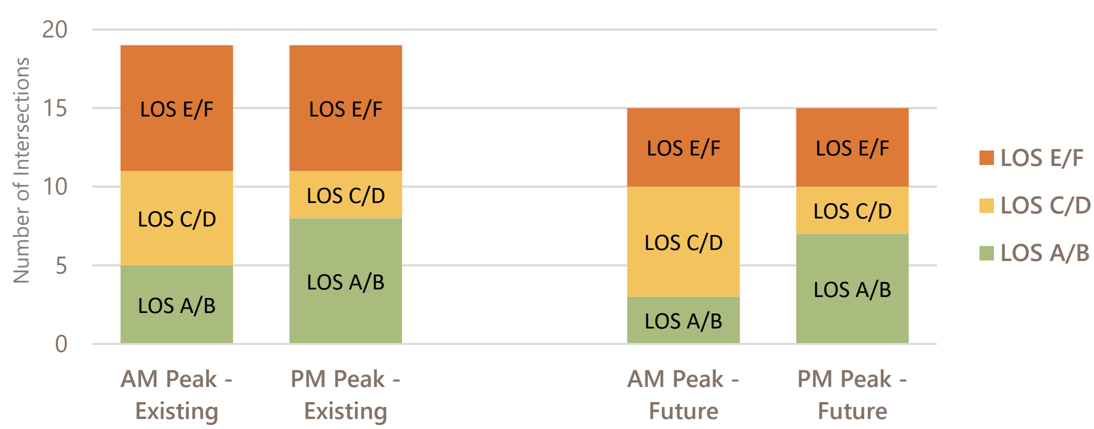
As shown in Figures ES-5 and ES-6, the majority of study area intersections are expected to operate at LOS D or better under existing and future conditions. However, operations are anticipated to worsen under future conditions at signalized intersection.

Figure ES-5 Existing and Future Operations at Signalized Study Area Intersections



Note: Study area includes 25 signalized intersections under existing conditions and 30 signalized intersections under future conditions due to geometric changes proposed by 2040 as part of known planned roadway improvement projects.

Figure ES-6 Existing and Future Operations at Unsignalized Study Area Intersections



Note: Study area includes 19 unsignalized intersections under existing conditions and 15 unsignalized intersections (including four roundabouts) under future conditions due to geometric changes proposed by 2040 as part of known planned roadway improvement projects.

Transit

There are several anticipated public transit improvements that will improve transit service, accessibility, and customer experience within the Route 128/I-95 study area, including projects related to MBTA commuter rail, rapid transit, and bus services, such as Newton Commuter Rail Stations Accessibility Improvements and Bus Network Redesign.

Active Transportation

While there are several dedicated active transportation facilities in the study area, the existing network is limited by facilities that do not connect to each other or provide incomplete coverage. There are several planned active transportation improvements that will help to expand the network and improve connectivity throughout the study area, including:

- Quinobequin Road and Trail Improvements
- Route 16 at Quinobequin Road Intersection Improvements
- Grove Street/Recreation Road Interchange Improvements
- Reconstruction of Charles River Pedestrian Bridge
- Route 30 Reconstruction
- Park Road Reconstruction
- Route 30 Bridge Rehabilitation over the Charles River/Commonwealth Avenue Carriage Road Ped/Bike Facility
- Weston Route 30 Shared Use Path Connection
- Mass Central Rail Trail Connection through Waltham
- Mass Central Rail Trail Connection over Route 128/I-95
- Route 2A Bridge Replacement over Route 128/I-95

Detailed descriptions of all projects listed above are included in Chapter 3 of the report.

Issues, Opportunities and Constrains

The study team identified the particular issues, opportunities, and constraints facing the study area through a thorough review of data as well, but more significantly, from conversations with Working Group members and through public feedback. These challenges and considerations are grouped into the following categories:

- Equity
- Transportation
  - Vehicular
  - Transit
  - Active Transportation
  - Safety
  - General
- Land Use/Economic Development
- Environmental

A detailed table including each issue, opportunity, and constraint, is included in Chapter 3 of the report.

Issues, Opportunities, and Constraints Key Takeaways

- **Reliance on Vehicles:** Several issues surrounding high auto demand and reliance on vehicles were identified, including operational and safety issues on roadways, limited non-auto mode options/facilities, and public health outcomes. In turn, opportunities focus on enhancing transit service/frequency, improving pedestrian/bicycle connections, and supporting programs to encourage non-auto modes are a focus area.
- **Land Use Patterns:** The study area is expected to see a significant increase in the number of job offerings, but a disproportionate increase in housing options. To limit transportation demands, there are opportunities to influence policy/zoning, identify appropriate housing typologies, and improve siting - connecting housing to job centers and open space.

Alternatives Development

The analysis of existing and future conditions and the identification of issues, opportunities, and constraints led us to nominate a range of improvements in the study area that we refer to as alternatives. Improvements were first suggested during discussions with internal MassDOT/MBTA stakeholders, via Working Group guidance, and through public outreach. The alternatives were developed to complement or build upon other on-going planning studies and planned infrastructure improvements projects and were screened to eliminate recommendations that are either outside of the scope of work (e.g., outside the study area), do not address the goals or objectives, or are infeasible.

Alternatives are generally organized into the same categories as the issues, opportunities, and constraints, and over **100 ideas** were initially collected and developed into over **80 alternatives** that were screened against the study goals and objectives. Ultimately, 11 alternatives were recommended for immediate action, 54 alternatives were recommended to be advanced for further study, and 19 were discarded.

Land Use and Economic Development

A combination of policy-based initiatives and infrastructure improvements that focus on:

» Supplying a housing stock that meets demand
» Improving access to jobs
» Supporting multimodal mobility and accessibility
» Enhancing open space and placemaking

In this category, 12 alternatives were developed and screened and 11 were recommended to advance for further study.

Transportation

Vehicular alternatives include primarily infrastructure improvements that focus on:

» Improving roadway network reliability
» Minimizing congestion and delays
» Improving safety to accommodate all modal users in the study area

In this category, 31 alternatives were developed and screened; 2 were recommended as immediate actions, and 19 were recommended for further study.

Transit alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on increasing transit frequency, reliability, and connectivity in the service area. In this category, 12 alternatives were developed and screened; 2 were recommended as immediate actions, and 9 were recommended for further study.

Active Transportation alternatives primarily include infrastructure improvements that focus on supporting multimodal mobility and connectivity. In this category, 10 alternatives were developed and screened; 3 were recommended as immediate actions, and 6 were recommended for further study.

Safety alternatives include infrastructure improvements that focus on mitigating existing identified safety deficiencies in the study area. In this category, six alternatives were developed and screened; four were recommended for immediate action.

General Transportation alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on supporting multimodal mobility and accessibility for all modes of transportation. In this category, nine alternatives were developed and screened, and five were recommended for further study.

Environmental

Environmental alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on:

- Improving existing environmental conditions
- Increasing climate resilience in the study area for the future

In this category, four alternatives were developed and screened, and all were recommended for further study.

Alternatives Analysis

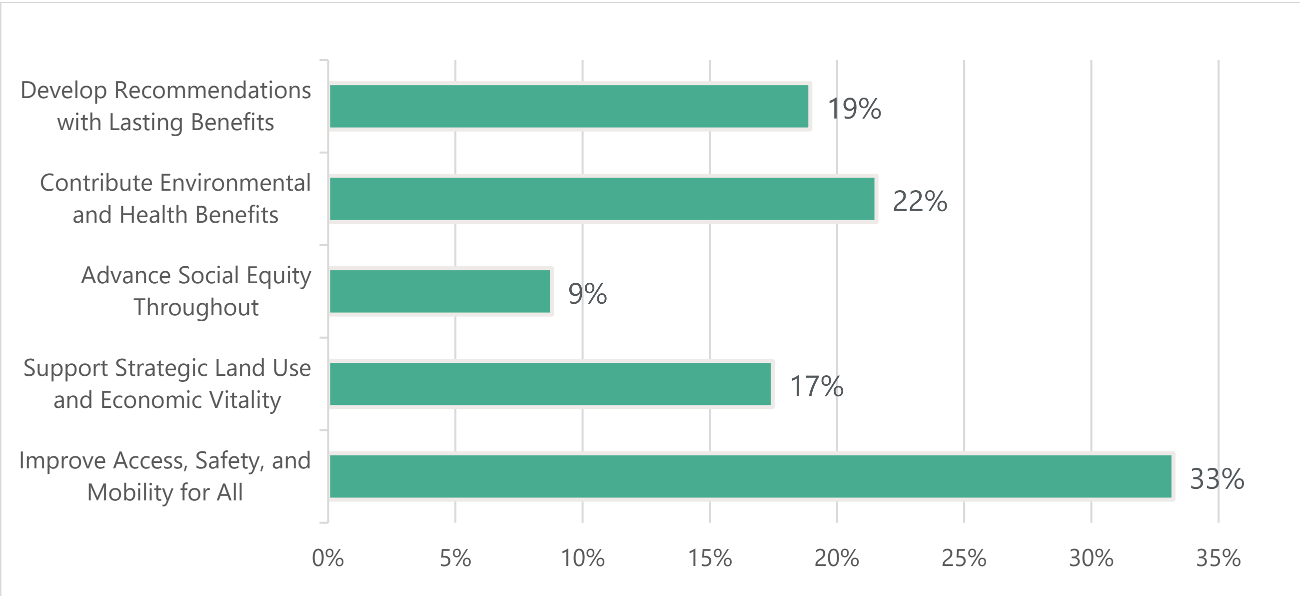
Following the development and initial screening of alternatives, the 54 alternatives undergoing further review were organized around five fundamental themes, which loosely correspond to study area goals and respond to feedback during the studies outreach process regarding priorities for the future of the corridor.

1. Improve Regional Mobility
2. Expand Transportation Choice
3. Align Policies with Mobility Goals
4. Plan for the Future
5. Address Congestion & Improve Safety

Establishing these themes was a critical step to help frame the analysis. Alternatives were then assessed based on the evaluation criteria relevant to goals it aims to achieve. We applied weights to the five study goals, which were used as a decision support mechanism to rate each proposed alternative and help guide phasing and prioritization recommendations.

To determine the weights, we collected feedback from the Working Group and the public. The resulting weights are shown in Figure ES-7. The 'improve access, safety, and mobility for all' goal was weighted the highest, followed by 'contributing environmental and health benefits.'

Figure ES-7 Study Area Goal Weighting



Source: Working Group and Public Informational Meeting Feedback

A brief description of each fundamental theme is below, and more details, including discussions of alternatives within each theme and summary evaluation matrices, is included in Chapter 5 of the report. A detailed alternatives analysis matrix including all of the evaluation criteria and technical memoranda documenting the alternatives analysis process are included in the report's Appendix E. In total, 39 alternatives are ultimately advanced as recommendations of this study.

Improve Regional Mobility: Connecting Route 128/I-95 to the Region

Providing more reliable and robust multimodal access between the region and the Study Area are critical components to accommodating land use needs and protecting the adjacent neighborhoods from cut-through traffic. Alternatives targeted in this theme are multimodal and acknowledge that we cannot build our way out of vehicular congestion and must instead focus on expanding options for travelers. The alternatives ultimately advanced for final recommendation under this theme include:

» Create Fitchburg Line Multimodal Hub
» Identify Opportunities at Route 128/I-95 & I-90 Interchange
» Expand Public Bike Share Program
» Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks

Key Alternative: Fitchburg Line Multimodal Hub

The Fitchburg Line Multimodal Hub is an alternative of particular note as it received the highest score during the alternatives analysis. This alternative represents a major capital investment on behalf of MassDOT and the MBTA. The transportation hub would replace the existing Kendal Green Station and be relocated east in the vicinity of Jones Road/Green Street. This hub would provide a central connection point between major roadways of Route 20, Route 128/I-95, the Commuter Rail Fitchburg Line, and the planned future continuation of the Mass Central Rail Trail. The Fitchburg Line Multimodal hub would provide robust connections to job centers in Waltham, provide new connections to transit services, encourage commuter mode shift, enhance connectivity between the study area municipalities and Boston, and present an opportunity for potential new transit-oriented development adjacent to the hub.

Enhance Transportation Choice

Expanding and diversifying multimodal options from, to, and within the Study Area will help the corridor realize its full potential as an economic engine for the region and protect nearby neighborhoods from unintended traffic impacts from this growth. Currently, the Study Area is hampered by a lack of quality multimodal connections, limiting the potential for mode share shifts for all trip types to more sustainable modes like transit, bicycling, and walking. Feedback at the second Public Informational Meeting underscored the desire to invest in transit and active transportation options ahead of vehicular infrastructure. The alternatives ultimately advanced for final recommendation under this theme include:

- Construct Lower Falls Shared Use Path
- Provide Additional Transit Service in Northern Portion of Study Area
- Improve East-West Bicycle Connections within Waltham
- Expand Shuttle Access for All Passengers
- Improve Station Access and Connectivity
- Improve East-West Bicycle Connections across Route 128/I-95
- Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95
- Improve North-South Bicycle Connections along Route 128/I-95
- Extend Shuttle Network in West Waltham
- Consider Two-Way Winter Street between Waltham and Lincoln (pedestrian/bicycle)

Align Policies with Mobility Goals

The connection between homogeneous land use on the Route 128/I-95 corridor and resulting transportation demands has been highlighted throughout this study. Left unchecked, the continued uniform growth of office/lab space will further overwhelm the Study Area’s transportation infrastructure and leave the corridor vulnerable to economic fluctuations in the face of changing market demands. It is critical to align land use policies with mobility goals and targeted investments. Supportive policies can work to promote sustainable communities and enhance the economic and social well-being of people throughout the study area. The policies presented below seek to diversify land uses, improve transportation choice, enhance access to jobs, open space, and other destinations, as well as promote positive effects on the surrounding community. The alternatives ultimately advanced for final recommendation under this theme include:

» Encourage Transit Oriented Development (TOD)
» Encourage Mixed-Use Development
» Encourage Workforce and Affordable Housing
» Remove or Revise Parking Minimums
» Improve Public Gathering Spaces
» Improve Multimodal Network near Cambridge Reservoir
» Develop Regional TDM Plan
» Implement Resident and Small Business Protection
» Conduct Market Analysis

Plan for the Future

How we live, work, and play is rapidly transforming. While predicting the future is difficult, one thing is certain: change is the only constant. And with change comes opportunity to harness the power of advancing technology to help make Route 128/I-95 and the municipalities it travels through more sustainable, more resilient, and more equitable. Alternatives that seek to leverage emerging technologies, support renewable energy, and address sustainability and resiliency challenges include:

» Consider Transportation Systems Management and Operations Strategies
» Reduce Amount of Impervious Area and Increase Vegetative Cover
» Provide Flood Storage and Stormwater Treatment Areas
» Install Electric Vehicle Infrastructure – Public
» Improve Hobbs Brook Reservoir Water Quality
» Limit Development within Flood-Prone Areas
» Implement Solar Energy Program Expansion
» Install Electric Vehicle Infrastructure – Private

Address Congestion and Improve Safety

While we can't build our way out of vehicular congestion, we acknowledge the need to support vehicular traffic (including freight, delivery, and service) within and through the study area. A series of physical vehicular infrastructure investments focused on addressing local and regional congestion, reliability, and safety issues were developed and evaluated. These physical improvements incorporate enhancement or expansion of pedestrian and bicycle accommodations where appropriate. Alternatives in this category include:

- Trapelo Road at Route 128/I-95 Ramps: Improve Intersections
- Route 128/I-95 Northbound Interchange 37 (Route 16): Close On-Ramp from Route 16 Westbound
- Route 128/I-95 Southbound at Interchange 45 (Route 2): Construct New C-D Road
- Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Two Lane Off-Ramp
- Route 128/I-95 Southbound Exit 37/38: Planning and Design
- Route 128/I-95 Northbound Interchange 39 (I-90/ Route 30): Extend Second Lane of C-D Road
- Lexington Service Plaza: Increase Truck Parking
- Route 128/I-95 Northbound Interchange 43 (Winter Street/ Third Avenue): Extend On-Ramp Acceleration Lane
- Route 128/I-95 Northbound between Interchanges 44 (Trapelo Road) and 45 (Route 2): Auxiliary Lane

Recommendations

In response to the corridor's land use and transportation infrastructure needs identified through the study process, we recommend a comprehensive set of actions that include items for the short, medium, and long terms. More complete implementation plan details, including cost estimates and key stakeholders, are included in Chapter 6 of the report.

Immediate recommendations with a timeframe of under one year are identified in Chapter 4 of the report, and primarily consist of low-scale improvements like pavement markings and signage, bus stop relocations, traffic signal enhancements, and crosswalk installations.

Implementation Plan Elements

Conceptual Cost Estimates

Conceptual cost estimates have been developed for each of the proposed recommendations, and each recommendation has been summarized into one of the following ranges:

- **Low-Cost ($):** Conceptual cost estimated to be under $1 million
- **Medium-Cost ($$):** Conceptual cost estimated between $1 million and $5 million
- **High-Cost ($$$):** Conceptual cost estimated to be over $5 million

Key Stakeholders

The implementation plan identifies a Key Stakeholder for each project. The Key Stakeholder is the agency that will be responsible for leading the permitting, design, funding, and implementation of each specific project and include the study area municipalities, MassDOT, MBTA, the Route 128 Business Council, and other participating agencies.

Implementation Timeframe

An implementation timeframe has been established for each recommendation based on the time required to implement similar projects recently completed or currently underway which include:

- » **Short-Term (1 to 5 years):** Relatively low cost and uncomplicated design with minimal to no permitting required.
- » **Medium-Term (5 to 10 years):** Higher cost and more intensive design with potentially some permitting required.
- » **Long-Term (over 10 years):** High cost and substantial design with moderate to extensive permitting required

Potential Funding Sources

These funding sources based on the anticipated size, scope, and cost of a particular project. Key stakeholders will consider a variety of municipal, state, and/or federal funding assistance for each recommendation, some of which may be eligible for multiple funding sources.

Next Steps

For the recommendations to be implemented, each of the projects will need to follow a multi-step process at the municipal or state agency level. Depending on the project, some of the early steps may have already been completed either as part of this study or in other studies.

- » **Step 1 – Planning Studies:** A comprehensive evaluation in a planning study. This study generally completes Step 1.
- » **Step 2 – Environmental Study:** Most projects will need to go through the permitting process in an environmental study.
- » **Step 3 – Funding Process:** Once a project has completed the preliminary design, the project champion needs to identify funding for the project.
- » **Step 4 – Final Design:** During this phase, the final layout of the project and the design details will be determined.
- » **Step 5 – Implementation**: In the final phase, the project will be constructed.

Recommended Improvement Projects

Corridor wide improvements are presented in Figure ES-8 and the locations of specific improvement projects are presented in Figure ES-9.

Figure ES-8 Corridor Wide Recommended Improvement Projects

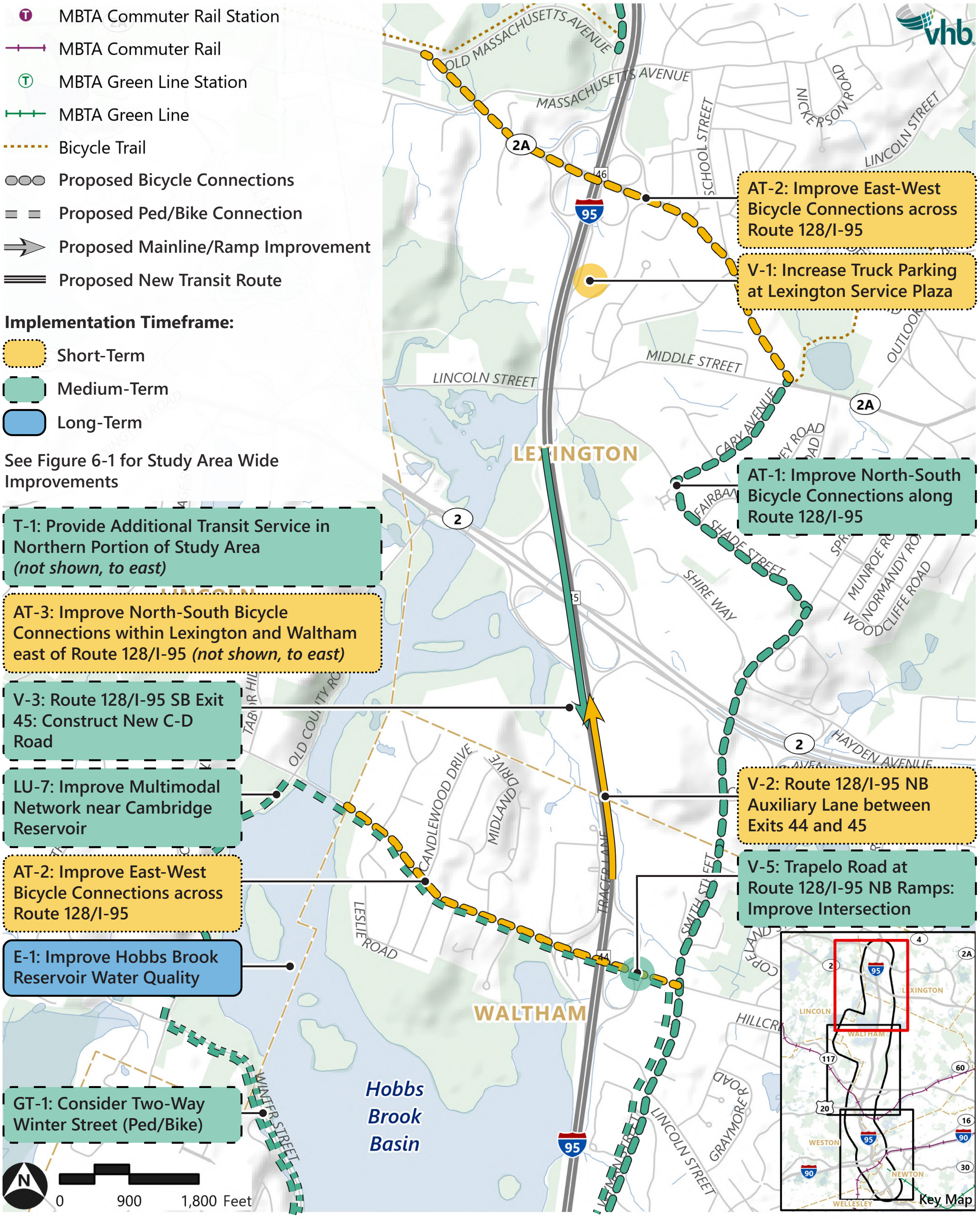
Short-Term:
T-12: Expand Shuttle Access for All Passengers
LU-8: Encourage Workforce and Affordable Housing
LU-2: Implement Resident and Small Business Protection
LU-3: Remove or Revise Parking Minimums
LU-6: Improve Public Gathering Spaces
GT-7: Develop Regional TDM Plan
E-2: Reduce Amount of Impervious Area and Increase Vegetative Cover
LU-4: Implement Solar Energy Program Expansion
GT-8 & GT-9 Install Electric Vehicle Infrastructure

Medium-Term:
AT-10: Expand Public Bike Share Program
LU-1: Conduct Market Analysis
V-29: Consider TSMO Strategies

Long-Term:
T-11: Expand Transit Service Span/Increase Frequency
GT-6: Improve Station Access and Connectivity
LU-9: Encourage Mixed-Use Development
E-4: Limit Development within Flood-Prone Areas
E-3: Provide Floor Storage and Stormwater Treatment Area

Figure ES-9a: Recommended Improvement Projects (Northern Study Area)

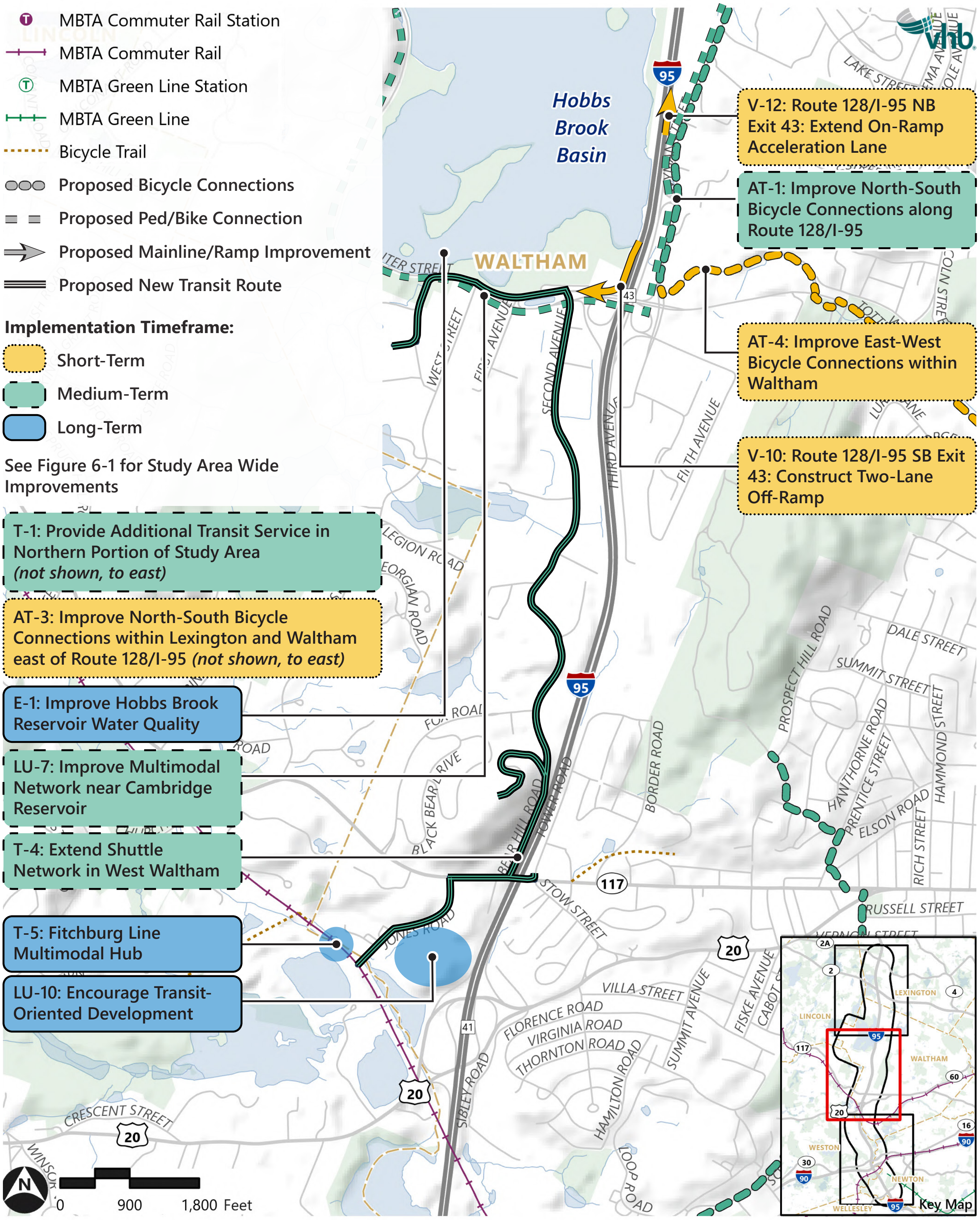
Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS

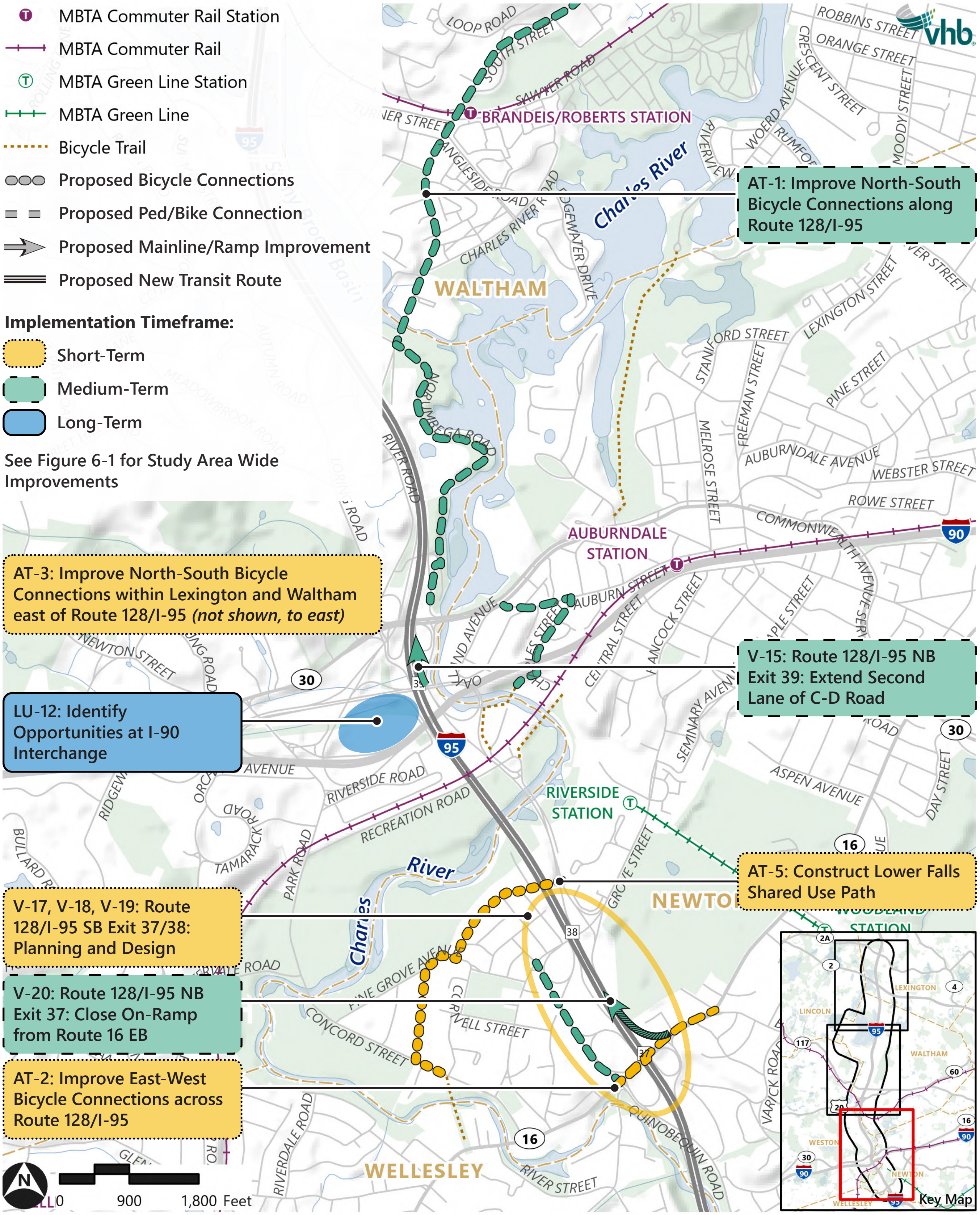
Figure ES-9b: Recommended Improvement Projects (Central Study Area)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS

Figure ES-9c: Recommended Improvement Projects (Southern Study Area)



Source: MassGIS

1

Study Process and Framework

This chapter describes the process and framework for this study. We outline our goals and objectives, along with the criteria by which they are evaluated. Public outreach was woven throughout the study process, and a Working Group was established to share information and ideas, each of which ensured an open, transparent, and collaborative approach to this effort.

Project Vision

Deliver a sustainable, equitable, and future-focused plan for the Route 128/I-95 corridor and surrounding area that brings adjacent communities together to pursue a shared vision of enhanced transportation mobility and access, regional economic vitality and environmental stewardship, and public health benefits for all users.

Introduction

The Route 128/I-95 Land Use & Transportation Study (the study), led by the Office of Transportation Planning (OTP) at the Massachusetts Department of Transportation (MassDOT), establishes the future land use, housing, and economic development assumptions of the segment of Route 128/I-95 between Newton and Lexington. Based on these assumptions, this report presents recommendations intended to address the corridor's current and anticipated transportation issues. Public outreach played an integral part of this study, enabling the study team to gather and disseminate information that informed our recommendations. These recommendations include land use and regulatory strategies to encourage mobility and accessibility along the corridor and improvements to the transportation system that are focused on the integration of multimodal transportation options. We also developed an implementation plan for executing upon each recommendation that identifies key stakeholders, timelines, and potential funding sources. The organization of this study report is presented in Table 1-1.

Table 1-1 Study Report Organization

Chapter	Title	Description
Chapter 1	Study Process and Framework	› Describes the process and framework for this study – outlining the goals and objectives along with the criteria with which these were evaluated. › Discusses public outreach and establishment of a Working Group to share information and ideas.
Chapter 2	Existing Conditions	› Presents an assessment of Existing Conditions within the study area, including demographics, land use and economic development, a multimodal transportation assessment, and a summary environmental resources as of fall 2021.
Chapter 3	Future Conditions, Issues and Opportunities	› Presents the development of a 2040 land use scenario. › Summarizes forecasted transportation demands. › Includes a summary of issues, opportunities, and constraints identified through stakeholder engagement.
Chapter 4	Alternatives Development	› Describes the alternatives that have the potential to address the issues and deficiencies identified in previous chapters. › Presents a first level screening of these alternatives to advance those that have the best potential to meet the goals and objectives of this study.
Chapter 5	Alternatives Analysis	› Evaluates each alternative advanced in Chapter 4 and presents scoring relative to benefits and impacts against the project goals. › Organizes alternatives around five fundamental themes.
Chapter 6	Recommendations	› Summarizes the recommended alternatives that are the most well suited to address the issues along the study corridor in terms of opportunities, constraints, and timing.

Study Area

The first step in the study framework development involved defining land use and transportation study areas. In general, the study area includes the Route 128/I-95 corridor between Newton and Lexington. The land use study area, depicted in Figure 1-1, includes the area approximately one-half mile from the Route 128/I-95 centerline, and is expanded in northwest Waltham to capture development along Winter Street with primary access via Exit 43.

The transportation study area has regional and local components. The local transportation study area, depicted in Figure 1-2, includes the Route 128/I-95 corridor from Interchange 37 to 46 and the major east-west streets crossing Route 128/I-95 with key intersections adjacent to the corridor.

The regional transportation study area incorporates the outlying areas of Newton, Waltham, Weston, Lincoln, and Lexington, which are dependent upon access to Route 128/I-95, transit and para-transit services and the Transportation Management Associations (TMAs) that operate within these communities, as well as many multimodal facilities such as the Mass Central Rail Trail in Waltham/Weston, the Minuteman Bikeway in Lexington and the Riverside Greenway path system that extends the existing greenway paths of the upper Charles River all the way to Riverside Station and Newton Lower Falls.

Additional detail on both the land use and transportation study areas is included in Chapter 2, Existing Conditions.

Study Framework

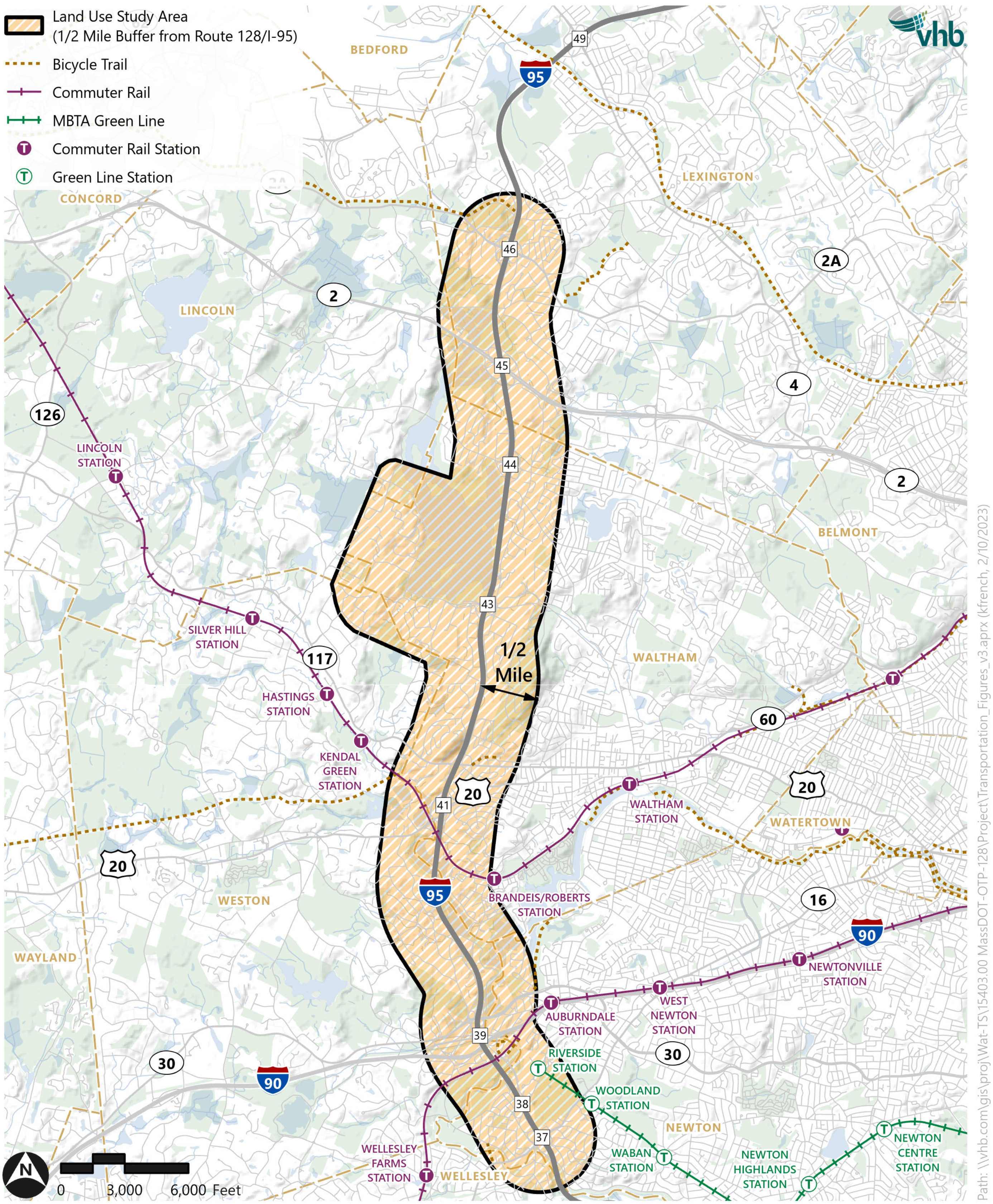
Goals, Objectives, and Evaluation Criteria

This study's goals, objectives, and evaluation criteria were developed and refined in collaboration with the Working Group and are presented in Table 1-2. Goals define the general intentions and purposes for conducting the study based on the issues that have been identified, while objectives describe the ways that the goals could be reached. The evaluation criteria are used to measure how well each alternative meets the goals and objectives according to qualitative and quantitative measures.

The Working Group and the public provided iterative feedback on the study goals, and weights were assigned to each based on this input. The final goals with their weights are presented in Figure 1-3 and were used to inform the alternatives analysis that is discussed in Chapter 5, Alternatives Analysis.

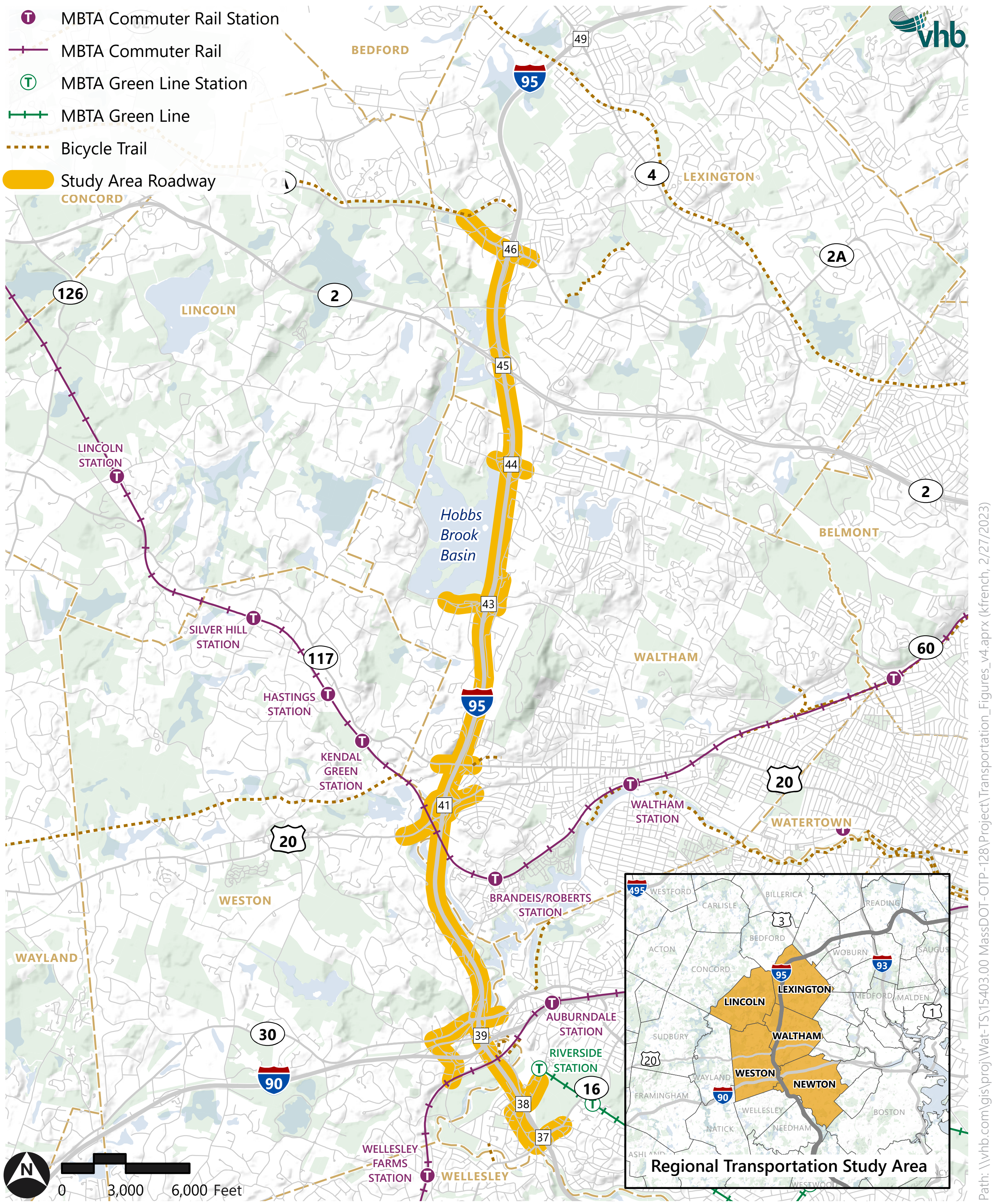
Figure 1-1: Land Use Study Area

Route 128/I-95 LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

Figure 1-2: Transportation Study Area



Source: MassGIS, MassDOT

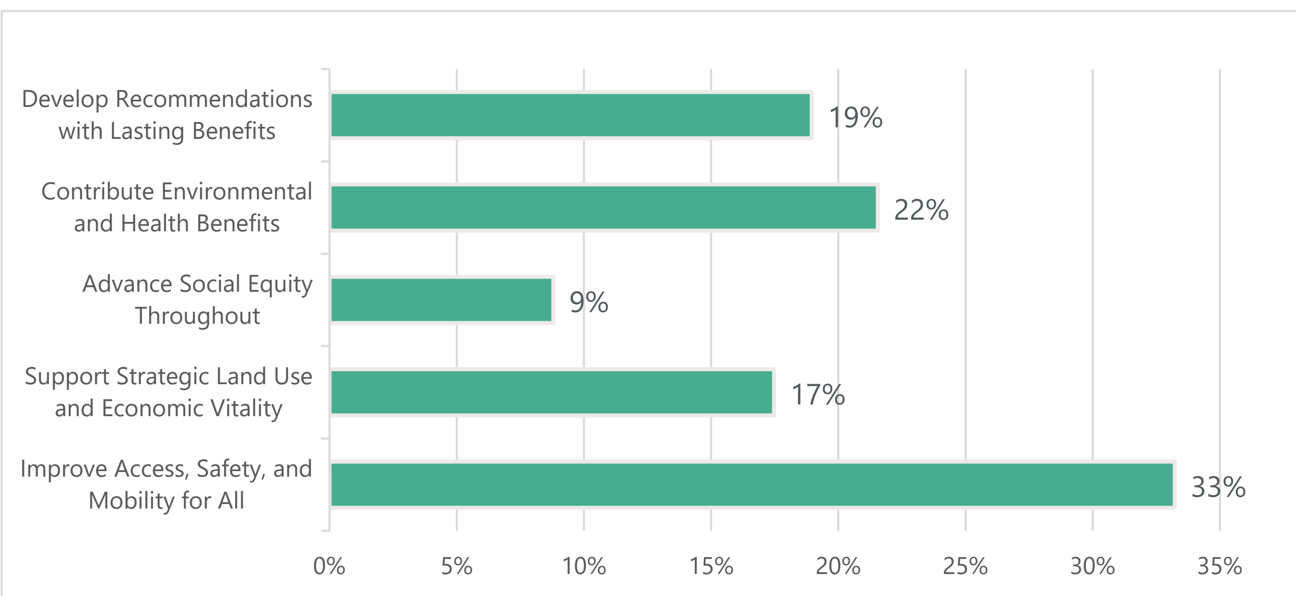
Table 1-2 Study Specific Goals, Objectives & Evaluation Criteria (1 of 2)

Goals/Objectives	Evaluation Criteria
Improve Access, Safety, and Mobility for All	
› Induce a mode shift › Minimize multimodal delays & improve reliability › Enhance safety › Integrate technologies & improve customer experience › Contribute to state of good repair	› Mode share/person trips by mode › Quality, location, and connectivity of pedestrian/bicycle and transit accommodations › Improved vehicle travel times and operations › Improved transit travel times and operations › Potential for crash reductions › Meeting MassDOT and local geometric design standards
Support Strategic Land Use and Economic Vitality	
› Encourage strategies to support mobility and accessibility › Provide connectivity & capacity to support access to jobs › Support local and regional plans › Promote placemaking	› Access to jobs › Impacts to businesses (labor force impacts, property values, increased jobs creation) › Tax base impacts (effects on jobs and employment) › Advances local and regional land use priorities
Advance Social Equity Throughout	
› Advance programs/policies that improve transportation choice › Equitably distribute both benefits and burdens › Address lack of housing diversity, affordability, and access › Maintain an open and inclusive process › Protect and preserve adjacent residential neighborhoods	› Mode share/person trips by mode › Effects on environmental (e.g., air quality, noise, water quality) and social conditions (e.g., economic activity, traffic and safety) in environmental justice communities compared to non-environmental justice communities › Effects on the local/regional housing stock › Effects on community cohesion/disruption or division › Meaningful involvement of environmental justice populations in the planning process

Table 1-2 Study Specific Goals, Objectives & Evaluation Criteria (2 of 2)

Goals/Objectives	Evaluation Criteria
Contribute Environmental and Health Benefits	
› Reduce air/noise pollution, GHG emissions, & energy consumption › Protect the cultural and natural environment › Promote improvements resilient to climate change impacts › Address local environmental concerns › Improve public health outcomes	› Estimated effects on greenhouse gas emissions, criteria air pollutant emissions, and sound levels › Effects on factors linked to local public health outcomes › Effects on the natural environment (e.g., water resources, plant/animal species and habitat, soils) › Effects on cultural or historic properties › Effects on the study area's ability to mitigate or adapt to future climate change
Develop Recommendations with Lasting Benefits	
› Prioritize projects that are implementable and address needs › Establish organizational capacity to advance recommendations › Leverage various funding sources to finance improvements › Identify cost-effective solutions	› Clear project champion › Preliminary capital and operating costs › Assessment of potential funding source(s)

Figure 1-3 Study Area Goal Weighting



Source: Working Group and Public Informational Meeting Feedback

Public Involvement

The study area is regionally significant due to the degree of major development along the corridor over the past few decades that affects a diverse range of stakeholders. This project recruited major employers, local business leaders, city and state departments and advocacy organizations to participate on the Working Group and used a variety of strategies to engage the public at key project milestones, including virtual public meetings and hosting a virtual public meeting room. The full public involvement plan is available in Appendix C.

Table 1-3 Study Outreach Program

Meeting	Date	Topics	Format
Working Group #1	November 30, 2021	Study kick-off; review study area, goals/objectives, evaluation criteria, and public participation plan	Virtual
Working Group #2	January 25, 2022	Existing conditions	Virtual
Public Meeting #1	March 15, 2022	Project framework and existing conditions	Virtual
Working Group #3	May 12, 2022	Future conditions and alternatives development	Virtual
Public Meeting #2	July 13, 2022	Future conditions and alternatives development	Virtual
Working Group #4	September 15, 2022	Alternatives screening and analysis preview	Virtual
Working Group #5	December 8, 2022	Alternatives analysis and draft recommendations	Virtual
Public Meeting #3	January 18, 2023	Alternatives analysis and draft recommendations	Virtual
Working Group #6	March 29, 2023	Final recommendations	Virtual

A draft of the report was made available for public comment in Spring 2023. During that time, input was collected from the public and incorporated into the final version of the report. Letters of support were also received from the study area municipality of Newton and the nearby Town of Wellesley. A list of comments received, responses to each comment, and the comment letters received from Newton and Wellesley are included in Appendix C.

2

Existing Conditions

This chapter provides an assessment of Existing Conditions within the study area, including land use and economic development conditions, demographic information, a multimodal transportation assessment, and a summary of environmental resources.

The transformation of Route 128/I-95 began in the late 1950s, as technology companies opted for suburban locations outside of Boston's urban core; this particular stretch of roadway was even dubbed "America's Technology Highway". While commercial uses continue to anchor our study area, many parcels are expected to be redeveloped as landowners adapt to changing market demands in the region.

Existing Conditions Key Takeaways

- The Route 128/I-95 corridor has **low residential density** and **multifamily, rental, and affordable housing is sparse**. There has been little residential construction over the past twenty years, even as the population in the Boston metro area has steadily increased.
- The study area is a **strong jobs center with over 39,000 employees** across the study area tracts. It is home to over 15 million square feet of office space, with 10 percent growth from 2011 to 2021.
- **Mode shares differ significantly** between municipalities - related to development density and availability of transit and active transportation facilities.
- There are many trips among study area municipalities that may be conducive to walking/ biking, but **gaps in the active transportation network** do not support them.
- **Most workers live outside the study area**, straining the transportation system. With limited transit options, drivers experience extended "rush hour" periods, poor operations, and unreliable travel times.

Reading Between the Lanes

This stretch of Route 128/I-95 is one of the most congested roadway corridors in the state. Its land use is dominated by office space, and to a lesser extent, industrial and retail spaces, which cumulatively attracts 97 times as many workers as there are residents. Nearly 56,000 people work in the study area, but just 500 of these workers live locally due to the lack of available housing. About 60 percent of people who work in this study area live at least ten miles away; what this means is that a lot of people are traveling on the same roads at about the same times to this major employment hub.

Without other modal options that appeal to commuters and potential residents, this situation leads to delay and unreliable travel patterns, which complicates travel for both regional and local stakeholders. Traffic data shows travel time variability throughout the day, not just during the weekday morning and weekday evening peak periods. Travel times on some segments can be as much as three times the average – during morning and evening peak periods as well as midday. This area of the network is not capable of handling the degree and type of travel that local economic development and housing policies currently encourage.

Land Use and Economic Conditions

The following section presents a high-level summary of land use and economic conditions in the study area, including development trends, current land use, zoning, site developability, and the development pipeline. Key takeaways of this section include:

- **The study area is a strong jobs center**. The corridor is home to over 15 million square feet (sf) of office space, with 10 percent growth from 2011 to 2021.
- The study area is also home to 795,000 square feet of retail space, with almost 30 percent growth from 2011 to 2021.
- Industrial space is limited in the corridor and has decreased over the ten-year period.
- During the 20-year period between 2001 and 2021, the Boston metro area increased multifamily inventory by almost 40 percent; **in the Route 128/I-95 corridor, there was zero growth in multifamily inventory**.

Land Use and Zoning

The Route 128/I-95 Corridor study area includes nearly 4,490 unique parcels across roughly 6,603 acres (see Figure 2-1)—a relatively small plot of land for the Greater Boston region, but one that is home to a diverse array of land uses. Development is clustered together by use type, and the area generally lacks mixed-use development.

Commercial zoning districts are located along Route 128/I-95 in Waltham and Lexington and along Route 20 in Weston. Smaller zoning districts in the study area include a conservation/recreation district in Waltham, a public use district in Newton, and a manufacturing district in Lexington.

At over 15 million sf, the largest category of commercial land use, by far, is office space, while significantly smaller portions of the area's building inventory are used for industrial (679,000 sf) and retail (794,700 sf) purposes. Offices are concentrated in Waltham, Weston, and Lexington, while restaurant and retail sites dominate in the Newton segments. Industrial uses in the study area are clustered primarily within Waltham's commercial district that directly abuts the corridor, along with several parcels in Lexington. These sites of industry include traditional construction-based properties, in addition to properties used for research and development.

There are several residential districts in the study area, and a significant portion of the study area is zoned as single-family residential. However, in contrast to the medium-density character of the study area's commercial and industrial properties, these residential districts are almost all low-density and consist of detached houses. The inventory of multifamily housing units is notably limited as multi-residential districts within the study area are only zoned in Waltham and Newton, which allow multifamily housing development either by-right or via Special Permit. There are 1,237 multifamily units within the study area, located mainly in Waltham and Newton.

Development Trends

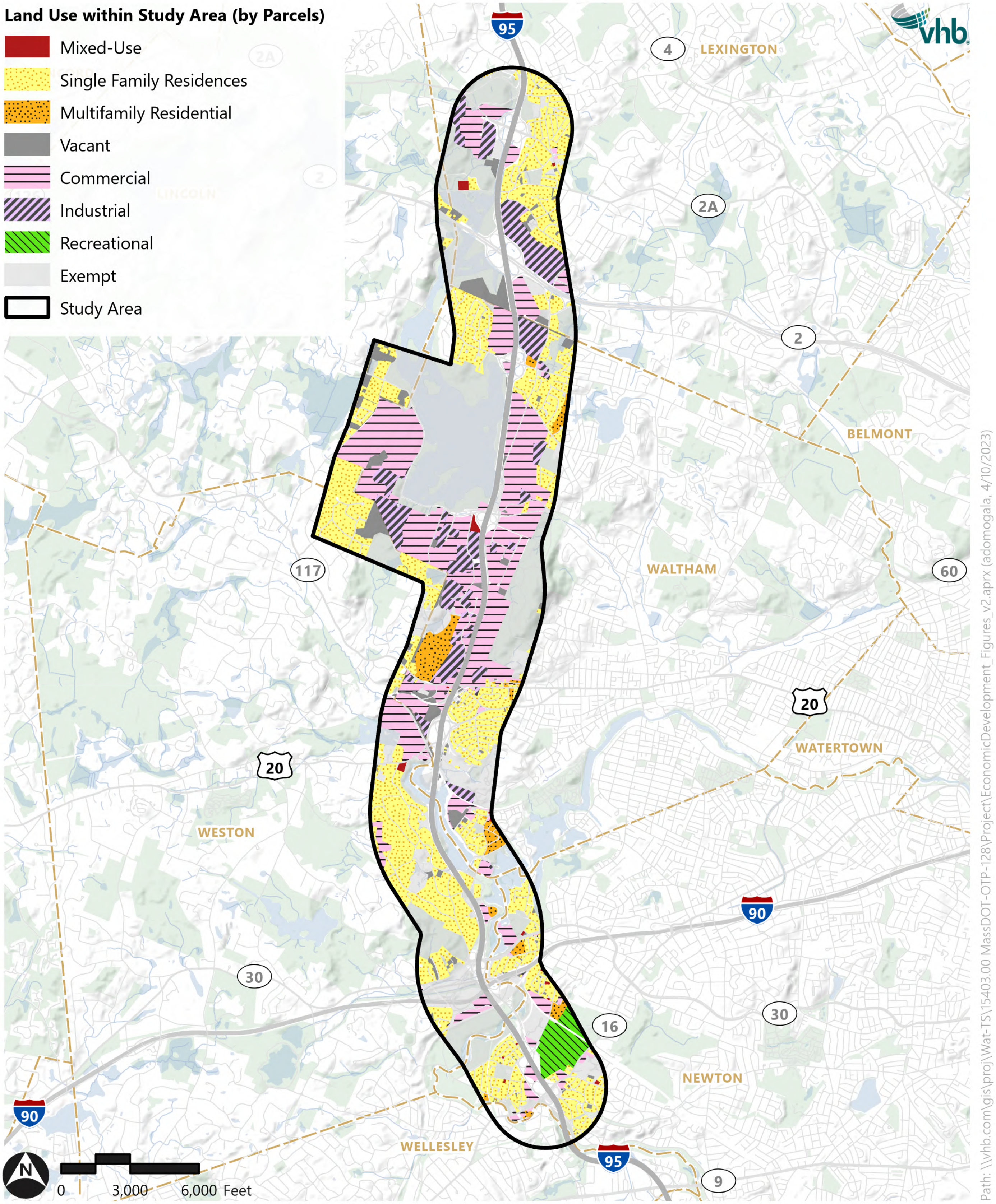
The significance of office space within the study area was reinforced between 2011 and 2021, while other relevant property types like industrial and multifamily properties experienced stagnation or disproportionate decline (Table 2-1). Office use drove development activity in the study area over the course of the decade, with a growth rate of 9.7 percent, which is higher than the rate of office growth in the Boston market (5.5 percent). Office is the only use that is more prevalent in the study area than adjacent submarkets[3].

Industrial and flex development in the study area, already limited in quantity, declined at a higher rate than industrial development in the Boston market and most adjacent submarkets over the past decade. The study area also lost more traditional industrial space than flex space[4], which largely aligns with national and regional trends seeing shifts away from heavy manufacturing toward light or advanced industries (that are more apt to use flex space).

3 CoStar Glossary: Submarkets are divisions of the primary market that are generally recognizable to the real estate industry and the business community by the names given to the areas. Submarkets are defined by specific geographic boundaries that serve to delineate core areas that are competitive with each other and constitute a generally accepted primary competitive set of areas. Submarkets are building type-specific and are non-overlapping, contiguous geographic designations having a cumulative sum that matches the boundaries of the entire market. They contain a number of properties sufficient to provide meaningful information for aggregate statistics.

4 CoStar Glossary: Flex space is space in a flex building, a type of building(s) designed to be versatile, which may be used in combination with office (corporate headquarters), research and development, quasi-retail sales, and including but not limited to industrial, warehouse, and distribution uses. At least half of the rentable area of the building must be used as office space. Flex buildings typically have ceiling heights under 18', with light industrial zoning. Flex buildings have also been called Incubator, Tech, and Showroom buildings in markets throughout the country.

Figure 2-1: Land Use



Source: MassGIS, MassDOT

Over the past 20 years, there has been no multifamily development added to the current 1,237-unit inventory in the study area, despite nearby markets experiencing growth. By comparison, the Boston market increased its inventory by 39.6 percent over the same time. Adjacent submarkets added a total of 8,258 units from 2011 to 2021, with submarkets like Metro West increasing by 35.2 percent and Route 2 by 32.3 percent.

Development conditions have evolved since 2020 and the onset of the pandemic, including the following more recent trends:

- The study area office market recovered from the pandemic faster than urban submarkets like downtown Boston. Office inventory in the study area has grown in the past year and is the only location with active office development in the surrounding submarkets.
- The demand for lab space in the study area remains high and is leading to some speculative development. However, rising interest rates and increasing construction costs could pose challenges for new and speculative development. When asked how rising interest rates may impact lab development, several experts described a speculative lab market that seemed overheated and likely to slow as money becomes more expensive.
- The limited construction of new dwelling units is constraining the study area's multifamily market and no new multifamily development has occurred since 2021, while the Boston market increased slightly during the same timeframe.
- Retail inventory in the study area remains lower than in neighboring submarkets.

Table 2-1 Building Inventory and Change Over Time within the Study Area

	Inventory (sf)*			Vacancy Rate %			Under Construction (sf)
Building Type	**Q1 2011**	**Q3 2021**	**Change**	**Q1 2011**	**Q3 2021**	**Change**	**Q3 2021**
Office	13,998,938	15,351,644	9.7%	13.40%	13.40%	0.0%	757,491
Industrial	1,179,976	679,533	-42.4%	12.40%	22.20%	9.8%	0
Flex	2,237,253	2,178,804	-2.6%	6.80%	6.20%	-0.6%	484,721
Retail	611,384	794,710	30.0%	5.10%	1.00%	-4.1%	0
Multifamily Residential (Units)	1,237	1,237	0.0%	3.90%	4.30%	0.4%	244

Source: CoStar 2011 – 2021

*Inventory and Under Construction for Multifamily Residential is unavailable in square feet and is provided in number of units

Economic Conditions

Over the past 20 years, the study area has developed into a strong jobs center, driven by office growth.

But considering the effects of the COVID-19 pandemic on office work patterns and space demand, the study area likely faces challenging economic conditions ahead. High vacancies and negative net absorption (when more commercial space is vacated/supplied in a particular market than what is leased or absorbed by commercial tenants) in the office and industrial sectors pose challenges to the future economic health of the study area.

Office and industrial vacancies in the study area are higher than in comparable geographies. As of Q3 2021, 13.4 percent of office space in the study area was vacant, along with 22.2 percent of industrial space. Between 2011 and 2021, office vacancy averaged 11.2 percent per year, and only increased above the average vacancy rate with the onset of the pandemic in 2020. Comparatively, the Q3 2021 office vacancy rates of nearby markets are lower: with Boston at 9.7 percent for example. Since 2011, the study area's industrial vacancy rate increased by 9.8 percent, as nearby submarkets all experienced reduced industrial space vacancies ranging between 5.1 percent and 12.6 percent.

Over the past 10 years, the study area averaged 186,555 sf in office space absorption per year, though the past two years have seen negative absorption by -267,200 sf in 2020 and -170,500 sf in 2021, likely due to the pandemic. The permanence of this trend toward negative absorption remains to be seen, but likely reflects the recent shift to hybrid work.

Industrial and flex space have evidenced similar negative absorption, though their trends are longer standing: the study area averaged -31,700 sf net absorption for industrial space and -4,500 sf in flex space per year since 2011. The decline in industrial net absorption is likely tied to the overall decline of traditional industrial inventory in the study area and the Boston market. The lower net absorption in flex space could be the result of building turnover for new development as opposed to an overall decline in the market.

Very few workers who are employed in the study area live nearby.

Data from the Census' 2019 Longitudinal Employer-Household Dynamics survey (the most recently available) shows that of over 60 percent of workers travel from homes at least 10 miles away; this has been constant since 2011, the first year of available data. Although over 7,000 people live in the study area, 92 percent of residents (6,589) must travel outside of the study area to work, despite being employed in the same major industries.

The relative weakness of the multifamily housing market could limit the study area's ability to capture growth for long-term economic vitality.

The study area, with its stagnant 20-year inventory of 1,237 multi-family units, averaged a net absorption of -2 units per year over the past 20 years. This indicates a lack of development activity, limited demand for the existing inventory, and the resistance of individual municipalities to allow multi-family housing options from a zoning/planning perspective. The vacancy rate has remained steady around 4 percent over the past ten years.

Despite historic patterns, the 2021 data shows a net absorption of 15 units, which could be attributable to a 244 residential-unit building that completed construction in 2022. The study area could take advantage of its cheaper market asking rent of $2.30/sf to encourage higher rates of occupancy in new units; by comparison, the Boston market has a market asking rent of $2.82/sf. Though this one development does not represent a trend, it suggests that developers see untapped potential for multifamily housing in the study area.

Modest retail sector growth, coupled with relative stability in the flex market, point to potential opportunities for the study area to diversify its economy.

The study area's retail sector averaged a net absorption of 19,700 sf per year from 2011 to 2021 alongside the growth of 183,300 sf of its inventory (+29.9 percent). Likely due to the pandemic, net absorption - while still positive - fell to 8,291 sf in Q3 2021. Over the last decade, retail vacancies fell from 5.1 percent to 1 percent. All nearby submarkets except Lexington/Arlington measured negative net absorptions, and all maintained higher vacancy rates in that time. While no retail buildings are currently under construction, retail could be a component of a more diversified study area given (A) its relative strength over the last ten years and (B) for the fact that it has a smaller footprint than adjacent submarkets, with room to grow and provide more localized services. Analysis of retail leakage for study area tracts suggests that the area has a high quantity of unmet demand (that is, people who are consuming outside of the study area tracts) for retail in both Retail Trade which has a gap of $999,938,442 (Leakage/Surplus Factor of 34.5) and Food & Drink which has a gap of $97,776,803 (Leakage/Surplus Factor of 28.0).

Though retail could be a component of a more diversified study area given the relative growth of its inventory over the last ten years, the industry itself shrunk from 2014 to 2018 at the county level with a loss of 182 establishments (3.5 percent) and a 2.6 percent decline in employees (65 people) at the study area tract level. These declines might also be explained by significant leakage as of 2017 in almost all retail industry groups in the study area tracts ranging from a factor of 21 (Electronic and Appliance stores had the lowest leakage factor, with a retail gap of $29.5 million) to 73 (Non-store Retailers had the most leakage with a retail gap of almost $67 million) on a scale of 0 to 100.

The flex market in the study area saw 33,500 sf in net absorption as of Q3 2021 and averaged a net absorption of 2,000 sf per year over the past ten years. The average net absorption per year across the past 20 years was -4,500 sf, suggesting that this market in the study area has strengthened over the last decade. Despite the decrease in inventory by 2.6 percent, the vacancy rate remained steady at an average of 6 percent per year over the past 10 years. Highlighted by 484,700 sf of active construction, future flex developments might accommodate growth in the Manufacturing, Information, and Professional, Scientific, and Management, and Tech Services sectors, and could indicate that advanced manufacturing firms or other R&D type establishments are taking root in the study area.

Site Developability

Table 2-2 provides a breakdown of vacant lands by property type within the study area, based on tax parcel data obtained through MassGIS. These properties (227 in total) comprise approximately 354 acres, and include lands that are developable, potentially developable, and undevelopable. With respect to developable and potentially developable lands, 86.2 acres are residential, 31.7 acres are commercial, and 28.3 acres are industrial. Lands that are undevelopable (144.7 acres) may have been determined as such due to a variety of reasons, including location and lot size. It should be noted that further areas may be deemed undevelopable based on identified environmental constraints, such as the presence of wetlands and steep slopes.

Aside from residential, commercial, and industrial classified lands, other vacant land uses within the study area include properties owned by the City of Newton (61.4 acres), the Town of Wellesley (<1 acre), and MassDOT (2 acres). These lands may additionally be available for development depending on whether they are surplus (i.e., not useful for municipal or agency purposes) and based on individual developability assessments.

Table 2-2 Vacant Land Use Inventory

Property Classification/ Developability	Acreage	% of Total
Residential	**214.1**	**60.4%**
Developable	73.2	20.7%
Potentially Developable	13.0	3.7%
Undevelopable	127.9	36.1%
Commercial	**48.5**	**13.7%**
Developable	21.4	6.0%
Potentially Developable	10.3	2.9%
Undevelopable	16.7	4.7%
Industrial	**28.3**	**8.0%**
Developable	25.4	7.2%
Potentially Developable	2.9	0.8%
Undevelopable	0.0	0.0%
Other Vacant	**63.4**	**17.9%**
Total	**354.3**	**100.0%**

Source: MassGIS

Market Trends in the Study Area

This call-out section describes trends related to two of the most important macroeconomic factors affecting mobility and accessibility within and to our study area – housing, and jobs.

This segment of the Route 128/I-95 corridor has long served as a hub for the research, technology, and life sciences industries, which makes it one of the most traveled stretches of roadway in the entire state. For people commuting to this area, opportunities to live where they work have long been limited by the challenges of housing affordability and supply. The limited transit opportunities to and through the growing satellite centers of economic activity in the area compel most workers to drive alone to work from ever-increasing distances.

Job Market Trends

- Historical strong job growth is likely to continue as Boston's economy is also projected to continue growing, especially in Information and Business Services – a significant part of the Study Area's current job sector composition.[1]
- These job growth trends may need to be tempered with the reality of hybrid work.[2]
- Expanding retail and recreational amenities could make the Study Area more competitive with other laboratory "hot spots" such as the Seaport, Alewife, and East Cambridge.[3]

Housing Trends and Constraints

- Low housing production and increasing demand may constrain the Study Area's economic growth. While several new mixed-use developments currently in the pipeline will contribute more housing to the Study Area, they do not represent the scale of supply needed to reduce regional housing costs.

Increasing Costs of Development

- Inflation may impact construction and development over the near term. It is projected that the cost of financing projects will increase, which will weaken development prospects in the near term while slowing future growth in the medium and long term.

1 Denham, Barbara, "City Economic Forecast: Boston," Oxford Economics
2 Preparing for the Future of Work in The Commonwealth of Massachusetts, 2021
3 Szaniszlo, Marie. "Report: Amid COVID, demand for lab space surges, leading to higher rents," Boston Herald, December 7, 2021

Demographics

The following section presents a high-level summary of demographic conditions throughout the study area, including population trends, housing, employment, income, educational attainment, and commuting patterns. These key indicators are directly relevant to transportation demands and are the primary parameters used in travel demand forecasting.

Route 128/I-95 Key Demographics

Population and Housing: Population, housing units, and number of households all grew by an average of 4-5 percent.

Educational Attainment and Income: All five municipalities had a higher rate of population over 25 years of age who had earned a bachelor's degree (BD) and higher median household income than the statewide average.

Environmental Justice: With the exception of Weston, each of the municipalities have some Census Tracts that meet at least one environmental justice threshold.

Employment: There are over 39,000 employees across study area tracts. No single industry comprises more than 20 percent of the share of employees.

Public Health: The study area has a similar average risk for chronic diseases to the surrounding study area municipalities and Boston Metro Area.

People and Housing

Population and housing conditions were reviewed for the corridor and are summarized below. Key takeaways include:

- As noted, the Route 128/I-95 corridor, in general, has a **low residential density**. Almost all residences are single-family detached.
- Directly along the corridor, **multifamily housing is sparse, as is rental housing, and affordable housing** in general. Most housing is not attainable to low-income buyers/renters.
- There has been **little residential construction** in the corridor over the past twenty years, even as the population has steadily increased throughout the study area.

The total population of the five study area municipalities of Lexington, Lincoln, Weston, Waltham, and Newton has increased in recent years as shown in Figure 2-2. Between 2010 and 2019, the population grew by 8,857 people, a rate of 4.5 percent (Table 2-3), slightly less than the statewide population change of 5.0 percent over the same period.

Notably, growth was most pronounced in Weston and Lincoln, the least-populated among the five municipalities. In Lincoln, the population increased 7.4 percent, and in Weston, the population grew by 7.6 percent. In contrast, Waltham had the slowest growth rate of 3.5 percent.

Table 2-3 Population Trends

Municipality	Population (2019)	Density (2019) (per acre)	Population Change (2010-2019)
Lexington	33,340	3.2	6.2%
Lincoln	6,830	0.7	7.4%
Weston	12,112	1.1	7.6%
Waltham	62,777	7.1	3.5%
Newton	88,593	7.6	4.0%

Source: US Census / American Community Survey 5-Year Estimates, 2015-2019 and 2006-2010, Table DP05 (ACS Demographics and Housing Estimates).

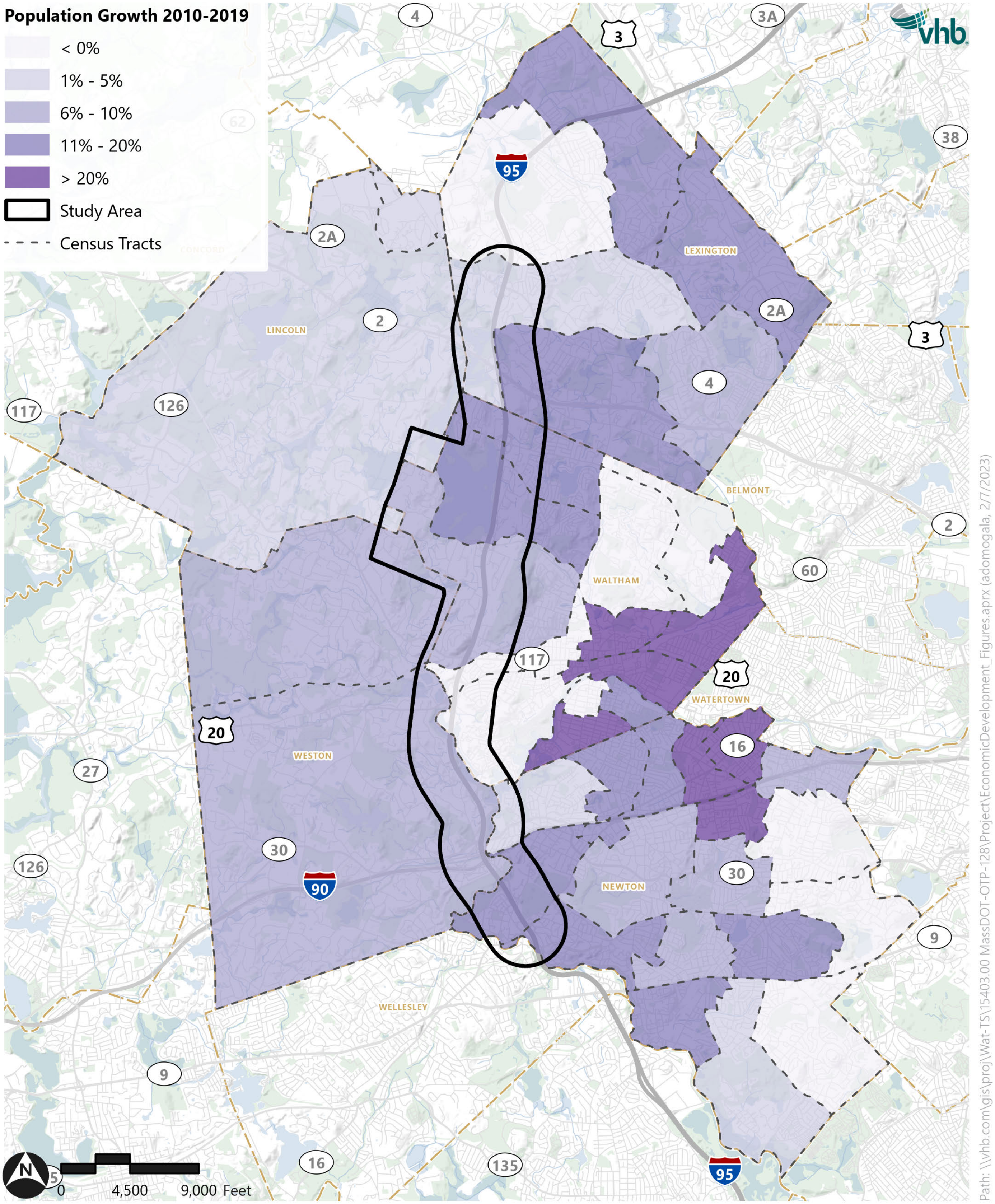
Population Density

Population density varies greatly between municipalities in the study area. Population is most densely concentrated in Newton and Waltham, with population densities of 7.6 and 7.1 people per acre, respectively. Newton and Waltham also contain a significant amount of multifamily residential developments, along with dense commercial districts and corridors. Examples include the Winter Street/Totten Pond Road area in Waltham, featuring a mix of office, retail, hotel, and restaurant uses, and the Interstate 90 (I-90) commercial corridor in Newton, featuring larger commercial parcels strategically positioned along the roadway.

At 3.2 people per acre, Lexington is about half as dense as Newton or Waltham. It is largely characterized by single-family homes, with few multifamily buildings. The towns of Lincoln and Weston are not densely developed, with a combined population that makes up less than 10 percent of the total population of the five municipalities. In fact, Lincoln's population density of 0.7 makes it 10 times less dense than Newton.

Residential population density is relatively low in census tracts within or adjacent to the study area, compared to outside of the study area. All census tracts in Lexington, Lincoln, and Weston that overlap with the corridor study area have less than 3.1 people per acre densities. Waltham and Newton both contain census tracts with greater than 12 people per acre, but those tracts do not overlap with the study area.

Figure 2-2: Population Growth



Source: MassGIS, MassDOT

Income

In general, the municipalities in the study area are higher earning than average for the state. However, this shouldn't mask the fact that the study area also contains low-income tracts, particularly in western Waltham, within the corridor.

Compared to statewide averages, all five municipalities had a higher median household income, a greater share of households earning $200,000 or more, and a lower share of households earning $25,000 or less.

However, income levels fluctuate significantly among the five municipalities (Table 2-4). The towns of Weston and Lexington have the highest-earning populations among them: Weston's median household income was more than 2.5 times greater than the statewide median of $81,215. In Weston, over half of all households earned more than $200,000 annually, making Weston one of the Commonwealth's highest-earning municipalities. The City of Newton is in the middle of the study area's income range, and Waltham and Lincoln are at the lower end.

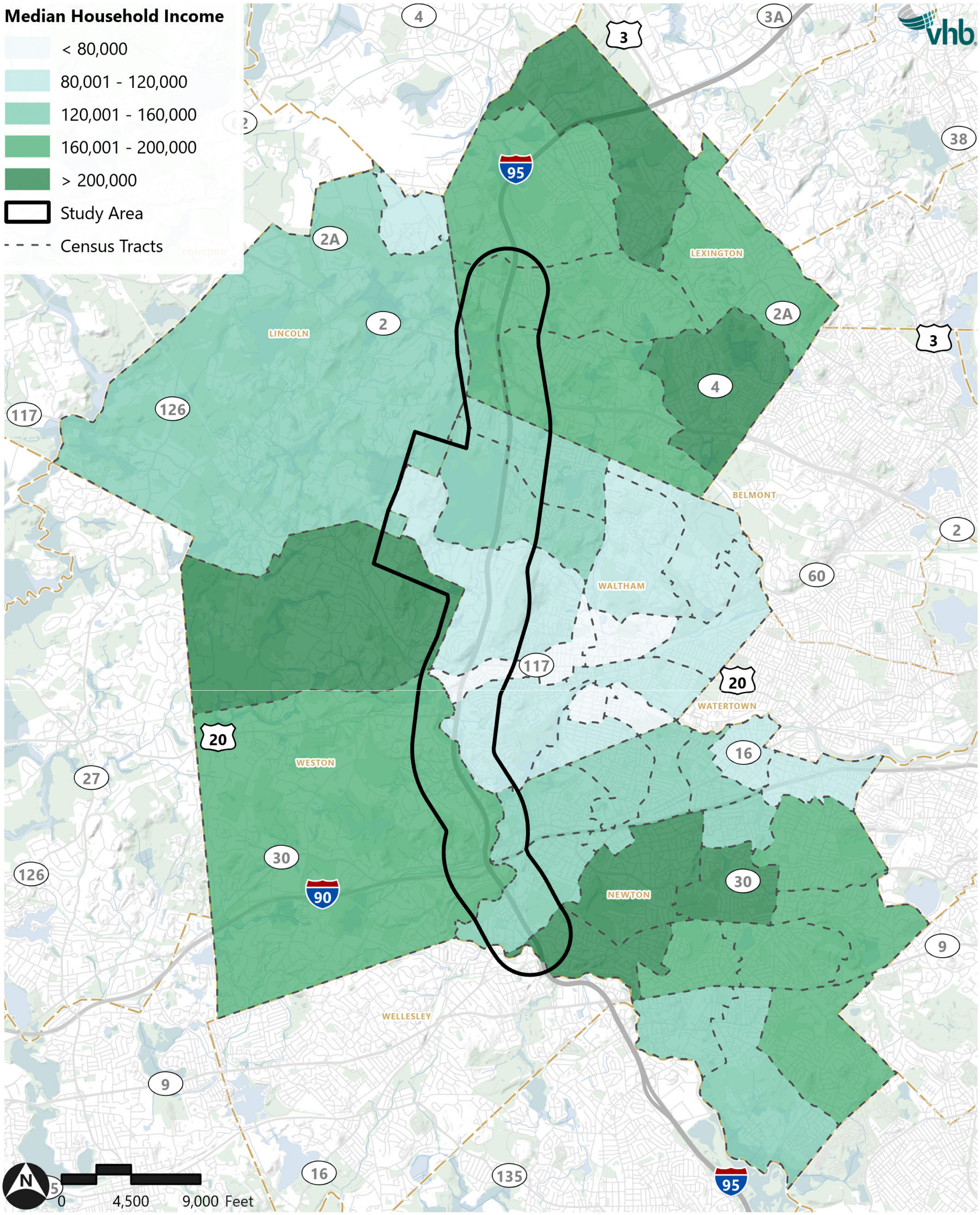
As shown in Figure 2-3, the census tracts that directly abut Route 128/I-95, particularly in Waltham, are closer to the lower end of the income range than the remainder of the broader study area. Further, as shown in Figure 2-4, two of Waltham's census tracts along Route 128/I-95 have poverty rates between 7.5 percent and 10 percent, and one with a poverty rate greater than 10 percent.

Table 2-4 Income (2019)

Municipality	Median Household Income	% of Households Earning <$25k	% of Households Earning >$200k
Lexington	$188,067	8.2%	45.9%
Lincoln	$124,966	10.4%	34.0%
Weston	$213,563	12.4%	50.3%
Waltham	$94,567	11.0%	14.0%
Newton	$156,130	8.2%	37.5%
Massachusetts	*$81,125*	*16.6%*	*13.2%*

Source: US Census / American Community Survey 5-Year Estimates, 2015-2019, Table DP03 (Selected Economic Characteristics).

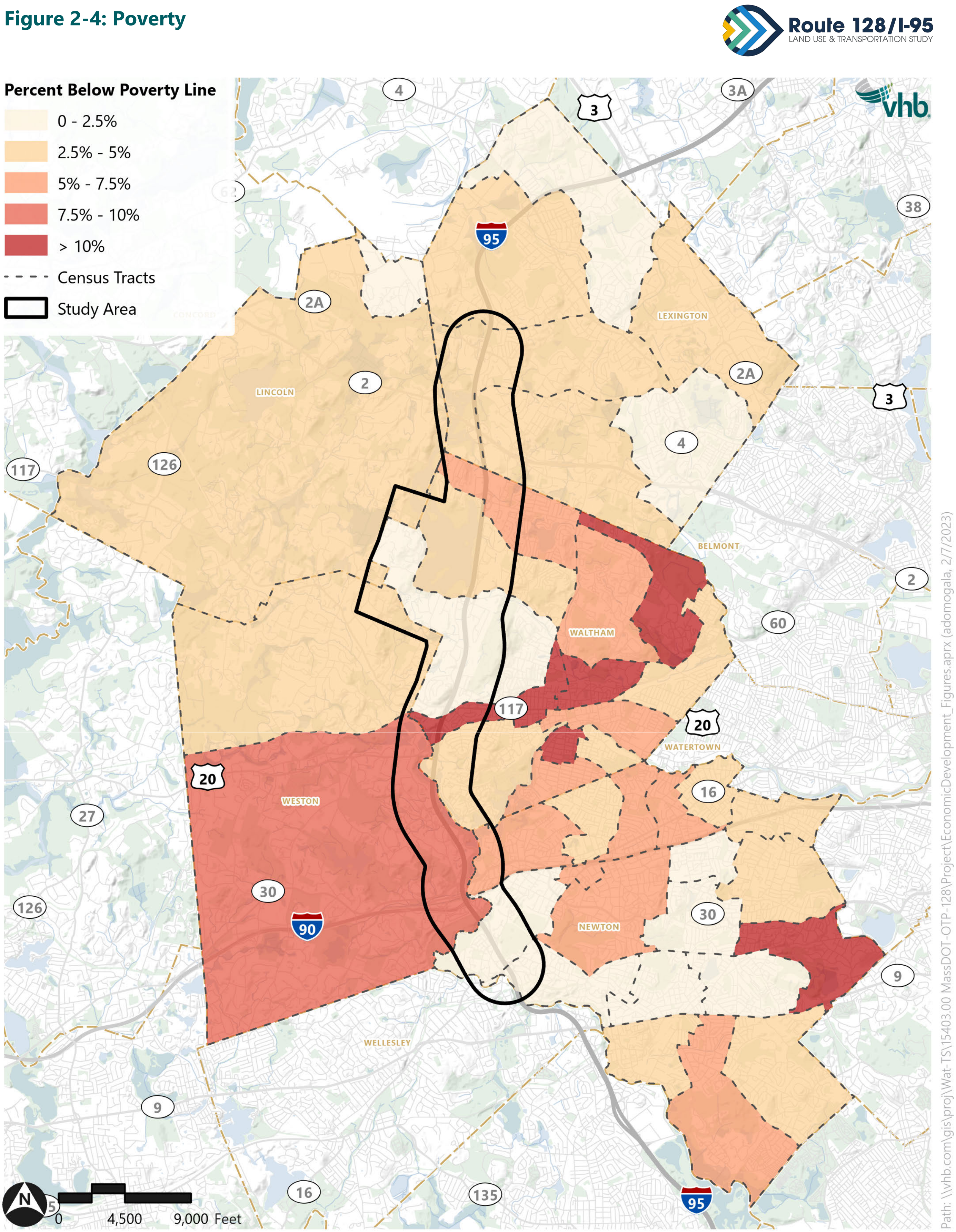
Figure 2-3: Median Household Income



Source: MassGIS, MassDOT

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\EconomicDevelopment_Figures.aprx (adomogala, 2/7/2023)

Figure 2-4: Poverty



Source: MassGIS, MassDOT

Educational Attainment

In 2019, 43.7 percent of the statewide population over 25 years old had earned a bachelor's degree or higher, and all five of the municipalities in the Route 128/I-95 study area surpassed this rate (Table 2-5). The City of Waltham had the lowest share of householders with a bachelor's degree or higher, at 54.2 percent, while the Town of Lexington had the highest share of households with a bachelor's degree or higher, at 84.7 percent.

Table 2-5 Educational Attainment (2019)

Municipality	Population 25 Years and Older with a Bachelor's Degree or Higher
Lexington	84.7%
Lincoln	74.8%
Weston	82.8%
Waltham	54.2%
Newton	79.2%
Massachusetts	*43.7%*

Source: US Census / American Community Survey 5-Year Estimates, 2015-2019, Table S1501 (Educational Attainment).

Housing

As the population has increased, so has the number of statistical households in each of the five municipalities (Table 2-6). The number of physical housing units has also increased throughout the study area. However, the growth in housing supply has not kept pace with the growth in the total number of households in four of the five municipalities. The exception to this was in Newton, where housing units grew by 5 percent and households only grew by 4 percent.

The greatest disparity was in Lexington, where the number of households grew by 3.7 percent, but the supply of housing units only grew by 0.6 percent. These trends underscore the need for a focus on housing production to respond to population and household growth within the study area.

In addition to housing supply in general, the availability of rental units and housing subsidies are critical components of equitable housing. These allow people who cannot afford to buy a home to share a community with those who can. The rates of renter households and housing subsidy vary significantly among the five municipalities.

Rental housing, multifamily housing, and affordable housing are generally sparse along Route 128/I-95 in the study area. Most of the residential zones within the corridor consist of single-family detached houses, often located near Route 128/I-95, but not directly accessible to Route 128/I-95 ramps.

Table 2-6 Household Trends

Municipality	Change in Number of Households (2010-2019) [1]	Change in Number of Housing Units (2010-2019) [1]	Percent Renter Households[1]	Percent Subsidized Households[2]
Lexington	4%	1%	18%	11.2%
Lincoln	23%	21%	41%	14.0%
Weston	7%	6%	14%	8.4%
Waltham	6%	4%	48%	7.3%
Newton	4%	5%	28%	7.8%

1 US Census / American Community Survey 5-Year Estimates, 2015-2019 and 2006-2010, Table S1101 (Households and Families).

2 Derived from the Massachusetts Subsidized Housing Inventory (SHI), an index that tracks the number of subsidized units in each municipality throughout the state. The Commonwealth encourages a goal of 10 percent subsidized units in each city and town through their Chapter 40B statute.

Environmental Justice

According to the Executive Office of Energy and Environmental Affairs' (EOEEA)[5]: "*Environmental justice is based on the principle that all people have a right to be protected from environmental hazards and to live in and enjoy a clean and healthful environment regardless of race, color, national origin, income, or English language proficiency. Environmental justice is the equal protection and meaningful involvement of all people and municipalities with respect to the development, implementation, and enforcement of energy, climate change, and environmental laws, regulations, and policies and the equitable distribution of energy and environmental benefits and burdens.*"

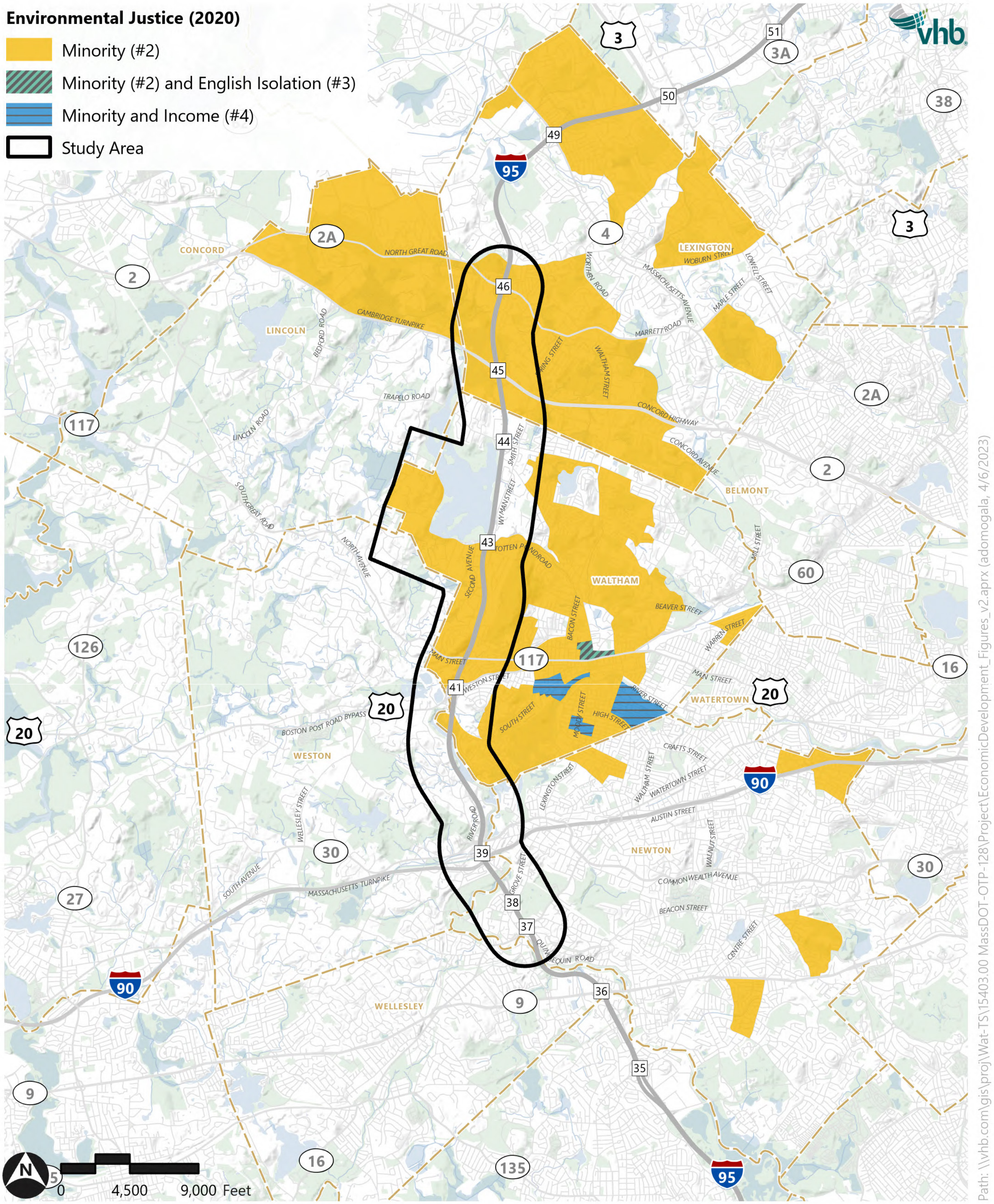
This study considers environmental justice (EJ) to enable a fair distribution of any environmental benefits or impacts that could be associated with the recommendations that are developed. This includes whether, and to what extent, potential transportation-related actions within the study area may impact minority, low-income, or other designated populations.

The project team considered the location of environmental justice populations as defined by the EOEEA Environmental Justice Policy (Figure 2-5). This policy defines an EJ population as a census tract that meets at least one of the following metrics:

1. The annual median household income is not more than 65 percent of the statewide annual median household income.
2. Minorities comprise 40 percent or more of residents.
3. At least 25 percent of households have limited English proficiency.
4. Minorities are 25 percent or more of the population, and the annual median household income of the municipality is less than 150 percent of the statewide annual median household income.

5 Environmental Justice Policy of the Executive Office of Energy and Environmental Affairs, updated June 24, 2021.

Figure 2-5: Environmental Justice



Source: MassGIS, MassDOT

With the exception of Weston, each of the municipalities contain census tracts that meet at least one of the environmental justice thresholds noted above and noted in the following examples:

- Within the half mile buffer of the corridor, in western Waltham and southwestern Lexington, there are census tracts with 25 percent or more of the population designated as a minority[6].
- In one census tract in southwest Lexington, the share of nonwhite residents is 53 percent.
- Outside the half-mile buffer, Waltham has three census tracts that meet both minority and income EJ thresholds, and one census tract that meets the minority and limited English proficiency EJ threshold.

Employment

Employment patterns track closely to land use and zoning patterns. The Route 128/I-95 study area hosts a consistently growing and diverse portfolio of industries, where no single industry type comprises more than 20 percent of the share of employees. In total, there are 39,275 employees in the study area across all sectors[7].

As of 2020, the Professional, Scientific and Management, and Tech Services sector[8] represents the highest share of workers in the study area, with 7,096 employees (18.1 percent), followed by Educational Services with 6,658 employees (17 percent), and Health Care and Social Assistance with 6,017 employees (15.3 percent). All three of these industries grew from 2010 to 2020.

From 2010 to 2020, the study area lost 325 employees in five sectors: Administrative & Support & Waste Management & Remediation, Retail Trade, Public Administration, Finance and Insurance, and Wholesale Trade saw small declines of 136 employees (-11.9 percent), 65 employees (-2.6 percent), 62 employees (-4.9 percent), 58 employees (-2.1 percent), and 4 employees (-0.7 percent), respectively.

Comparing establishments by industry in the study area tracts with Middlesex County reveals similar trends. In 2018, *Professional, Scientific and Management, and Tech Services* had the highest number of 670 establishments (16.2 percent) within the study area tracts, followed by *Health Care and Social Assistance* with 510 establishments (12.3 percent). The same trend held true in Middlesex County*: with Professional, Scientific and Management, and Tech Services* leading with 6,924 establishments (15.5 percent); and *Health Care and Social Assistance* also at the top with 4,941 establishments (11 percent).

As of 2018, *Professional, Scientific, and Management, and Tech Services* had the fourth highest average employee wage by industry in Middlesex County at $138,326 per year, and the highest increase in wages from 2014 to 2018 - growing by $15,186 (+12.3 percent) over that time. Though *Health Care and Social Assistance* in Middlesex County grew as an industry in both number of

6 The census tracts are also located in municipalities where the annual median household income is less than 150 percent of the statewide annual median household income.

7 US Census Bureau, ACS 2010 (5-Year Estimates) and ACS 2019 (5-Year Estimates).

8 North American Industry Classification System (NAICS) codes

employees and number of establishments, the average annual wage fell by $5,022 (-8.6 percent) from 2014 to 2018 to $53,316. Of other high-share job industries in the study area tracts, *Finance and Insurance* had an average annual wage of $105,152, *Manufacturing* averaged $95,141, and *Educational Services* averaged $56,075.

Public Health

Within the US, health outcomes are largely dependent on socioeconomic and environmental factors with health care only shaping 20 percent of a community's overall health[9]. The built environment, such as access to jobs, cultural institutions, healthcare, housing, and active transportation; community design conducive to walking; and environmental pollutants, can support healthy behaviors or create obstacles that contribute to health inequities, leading to populations with a disproportionate burden of chronic disease.

The Intersection of Chronic Disease and COVID-19

Chronic diseases- such as heart disease, diabetes, and obesity, among others- are all conditions that increase the risk for severe illness from COVID-19, exacerbating existing health inequities. As discussed, facets of the built environment, together with other social and environmental determinants of health, influence the health outcomes of populations. Finding ways to plan and design environments that are health promoting, safe, and with decreased environmental exposures can decrease inequities in population health, which can then indirectly decrease population risk for severe illness from viruses such as COVID-19.

To further understand the health profile of the municipalities in the study area and how the built environment influences health outcomes, a community health risk assessment has been conducted based on VHB's Healthy Mobility Model. The Healthy Mobility Model includes two levels of analysis, and correlates socioeconomic, demographic, land use, urban design, and transportation factors to the health of municipalities to determine which potential improvements and policies may have the greatest impact on community health. The Healthy Mobility Model uses data that is readily available and allows for health to be factored into community and transportation planning decision making. The Healthy Mobility Model analysis methodology are included in Appendix C.

Risk Assessment

In terms of overall risk to chronic diseases, the study area has a similar average risk to the surrounding study area municipalities and Boston Metro Area (Figure 2-6). When looking at the prevalence of chronic diseases in the study area, the population has a 1-4 percent lower prevalence of chronic disease than the Metro Boston area across the assessed health outcomes (Table 2-7). The study area municipalities have substantially the same average prevalence as the study area. Within the study area municipalities, census tracts in central and southern Waltham and eastern Newton have above average health outcomes, however one tract in Waltham has below average health.

9 University of Wisconsin Population Health Institute and Robert Wood Johnson Foundation, County Health Rankings Model | County Health Rankings & Roadmaps

Table 2-7 Chronic Disease Existing Conditions

Health Indicator	Weighted Average Prevalence (%)		
	Metro Area	Study Area Municipalities	Study Area
Coronary Heart Disease	5.0	5.0	5.0
Asthma	10.0	9.0*	9.0*
High Blood Pressure	27.0	25.5*	26.0*
Diabetes	8.0	7.0*	7.0*
Obesity	24.0	20.0*	19.5*
High Cholesterol	31.5	30.0*	31.0*

Note: Numbers rounded to nearest 0.5 percent.
* Indicates a lower prevalence when compared to the Metro Area for each health indicator, also shaded green.
Source: 2020 CDC Places Data

Detailed Assessment

As discussed above, the distribution of a number of social and environmental indicators were assessed for their relationship to the geographic pattern of chronic disease prevalence in the study area municipalities. Overall, much like the health outcomes in the study area, many factors that are linked to community health outcomes are also relatively positive. For example, both the median income and the population living above poverty within the study area municipalities are high, and those tracts have above average health outcomes.

Conversely, the census tracts with below average health outcomes also have a high percentage of the population living below the poverty line. The area also has a lot of open space, above average walkability, and air quality indicators that meet national standards. Key takeaways of the detailed assessment are outlined below and additional information is included in Appendix C.

Public Health Key Takeaways

Socioeconomic Factors – Populations over 65, without a bachelor's degree or higher, and living below the poverty line all correlate with a higher the prevalence of chronic disease.

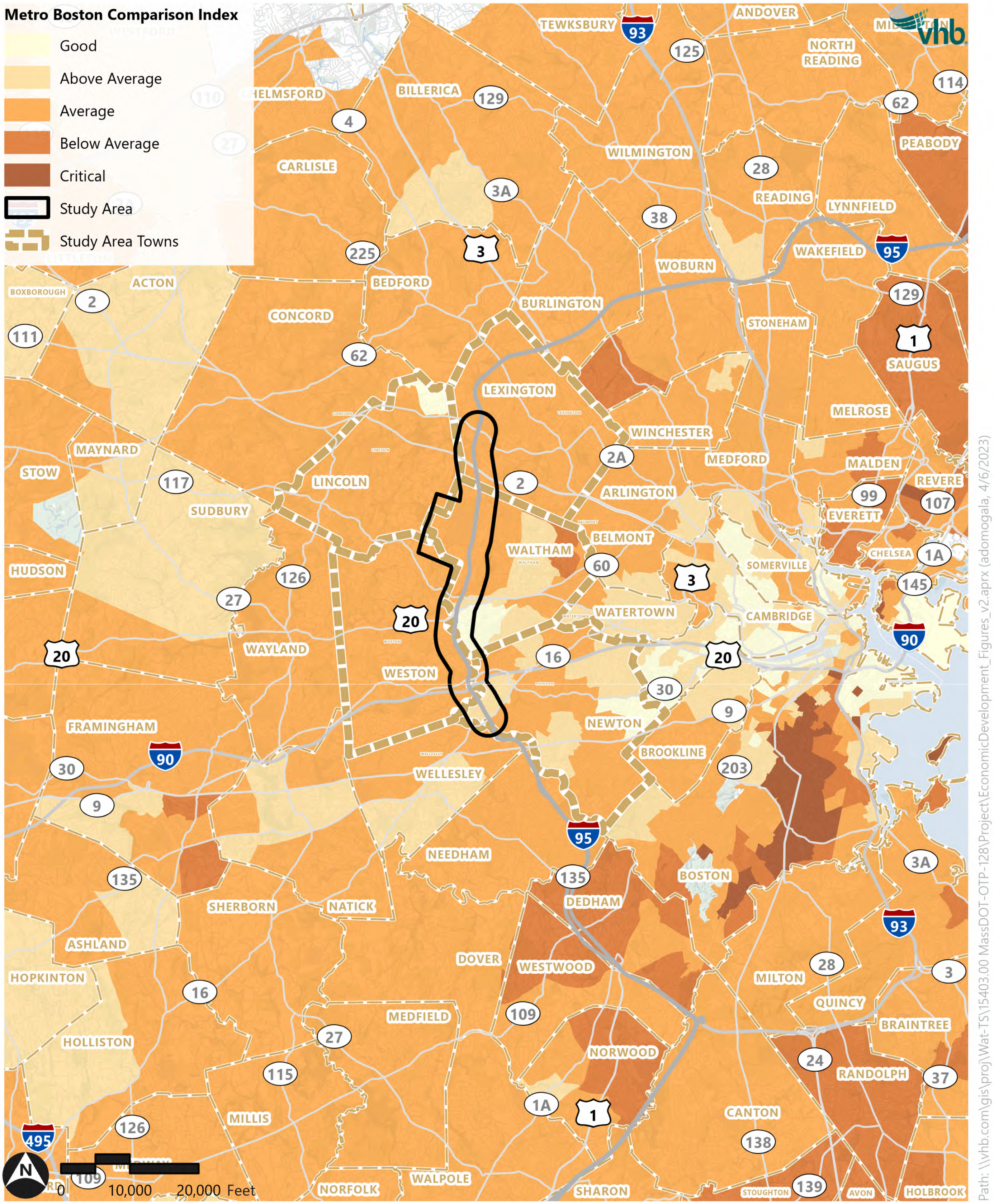
Travel Characteristics – Commuting time and commute mode were found to have a strong correlation with all of the chronic diseases except for asthma.

Infrastructure – Higher average right-of-way (ROW) width and higher number of lanes on roads strongly associated with higher shares of the population with some chronic diseases.

Asthma Prevalence – Asthma prevalence in the assessed areas is greater than it is nationally, and therefore may be important to focus on through improved walkability and decreased vehicle miles travelled/emissions.

Figure 2-6: Health Risk Assessment

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

Existing Travel Patterns

Mode Share

The commuting patterns of households living in the study area differ significantly between municipalities, and sync with levels of development density and the availability of transit and active transportation facilities nearby (see Figure 2-7). In dense, mixed-use areas such as those in Waltham and Newton, a greater share of the population walks to work, and a lower share of the population drives to work. Conversely, in low-density areas like Weston, Lincoln, and Lexington, more people drive, and fewer people walk.

The use of public transportation for commuting to work is highest in Newton (13.2 percent), which is uncoincidentally the municipality with the greatest degree of transit services in the study area. The share of public transit commute trips is much lower in the other municipalities (ranging from 7.0 percent to 8.8 percent), as shown in Table 2-8.

Travel Patterns and COVID-19

The significant changes in travel patterns because of the COVID-19 pandemic are still in flux as people are experimenting with different routines due to fluctuating workplace policies, requirements, and other non-work considerations. At this time, stabilization of traffic patterns has not been fully realized.

Existing conditions data presented in this study reflect a pre-COVID condition.

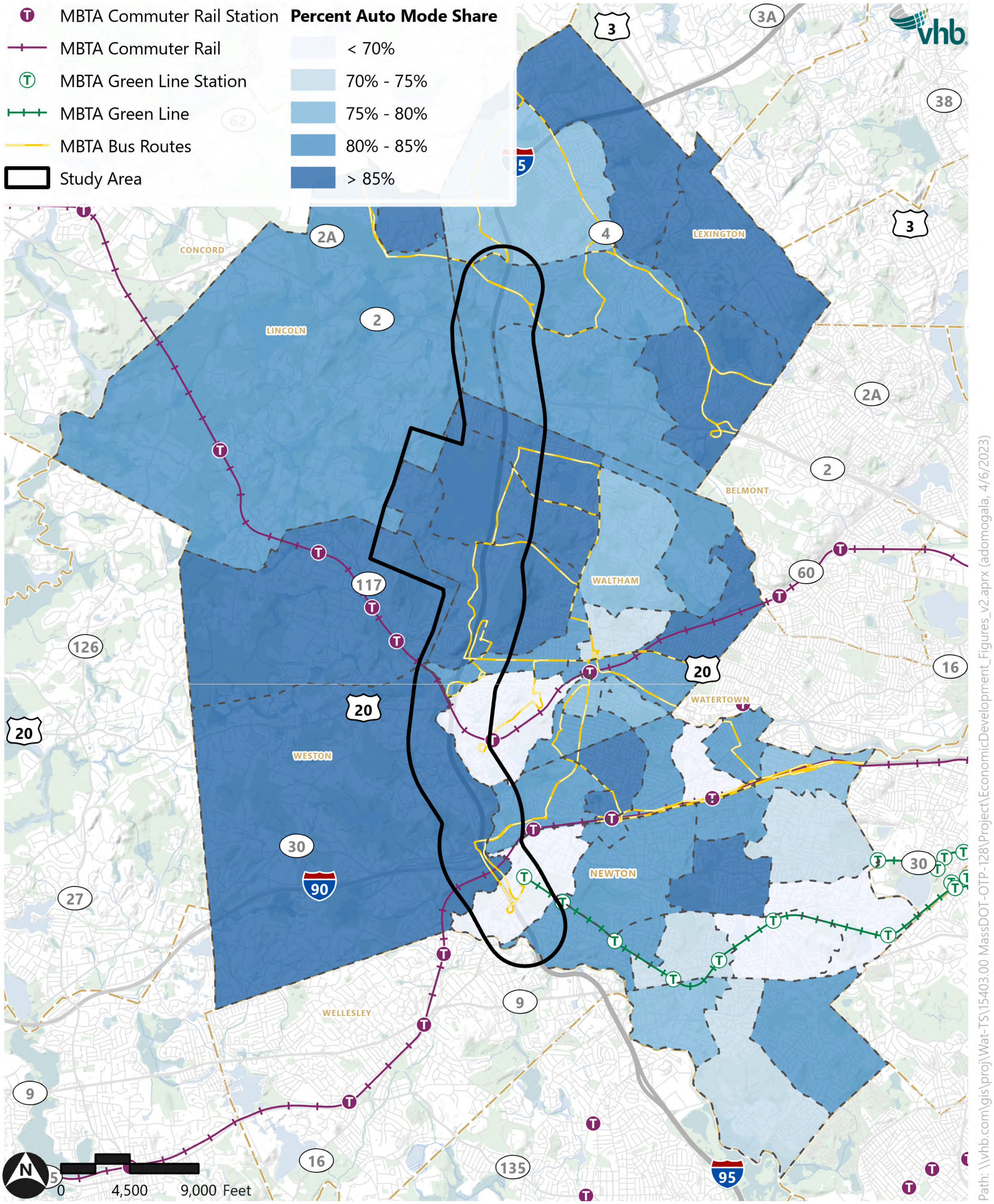
Table 2-8 Mode Share (2019)

Municipality	Drove Alone	Public Transportation	Walked	Worked from Home	Other
Lexington	71.4%	8.8%	2.5%	8.7%	8.6%
Lincoln	73.3%	7.0%	3.3%	8.6%	7.8%
Weston	71.3%	7.4%	3.4%	13.0%	4.9%
Waltham	70.3%	7.5%	8.0%	4.6%	9.6%
Newton	61.8%	13.2%	6.1%	9.6%	9.3%

Source: US Census / American Community Survey 5-Year Estimates, 2015-2019, Table S0801 (Commuting Characteristics by Sex).

Figure 2-7: Auto Mode Share

Route 128/I-95 LAND USE & TRANSPORTATION STUDY

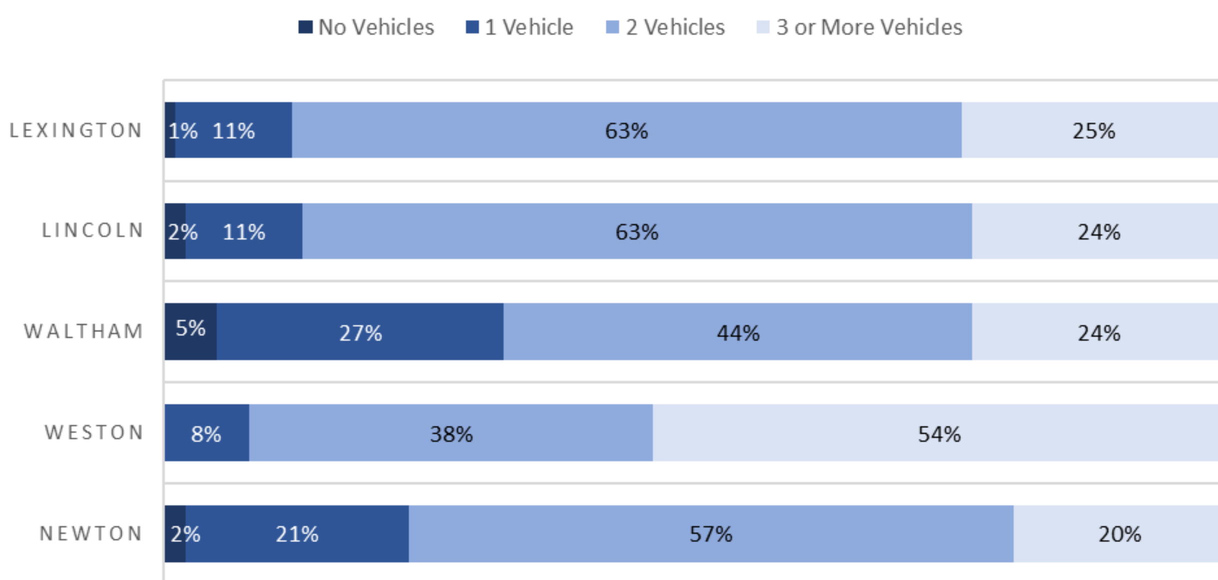


Source: MassGIS, MassDOT

Vehicle Ownership

The project team considered data for vehicle ownership and zero vehicle households[10] to further understand the mobility needs of study area residents (Figure 2-8). The overwhelming majority of households own at least one vehicle – on average, just 1.9 percent of households do not.

Figure 2-8 Existing Vehicle Ownership per Household



Source: US Census / American Community Survey 5-Year Estimates, 2015-2019, Table DP04 (Selected Housing Characteristics).

Vehicle Origin-Destination (OD) Data

One of the key goals of this study is to develop recommendations that would appropriately address issues related to congestion, operations, and safety along the Route 128/I-95 corridor. Understanding vehicle OD data – how vehicles travel from, to, and within the study area and along the corridor – is a key component to the development of those recommendations. StreetLight, a software tool that uses many data sources to understand how people, goods, and services move throughout the region, was used to provide data from the Spring and Fall of 2019 (March, April, September, and October) to represent an average season condition prior to the COVID-19 pandemic[11].

10 Source: US Census / American Community Survey 5-Year Estimates, 2015-2019.

11 It should be noted that this data applies to pre-pandemic average annual weekday conditions and does not reflect travel patterns on the weekend or during the summer months when there is a greater demand for leisure travel.

Study Area Vehicle Trips

The StreetLight OD data were reviewed for trips that either start, end, or occur completely within the study area. The data was reviewed for trips over the course of an average weekday as well as during the weekday peak commuting periods (6:00-10:00 AM and 3:00-7:00 PM).

Table 2-9 summarizes the percent of vehicle trips that start or end in the study area over the course of a typical weekday. Figure 2-9 illustrates the average percent of vehicle trips that started or ended in the study area over the course of a typical weekday.

Table 2-9 Weekday Daily Vehicle Travel Patterns

	Percent of Daily Study Area Vehicle Trips [1]
Study Area City/Town Internal Trips	45%
To Study Area Cities/Towns, from the:	
East	9%
West	9%
North/Northeast	5%
South/Southeast	5%
From Study Area Cities/Towns, to the:	
East	8%
West	9%
North/Northeast	5%
South/Southeast	5%
Total	**100%**

Source: StreetLight Data

1 Represents average of Monday through Thursday daily traffic data collected in March, April, September, and October 2019.

Key takeaways from a review **weekday daily travel patterns** indicate that of all daily vehicle trips that start/end within the study area on a typical weekday:

» Forty-five percent of all daily study area vehicle trips start or end in one of the five study area municipalities

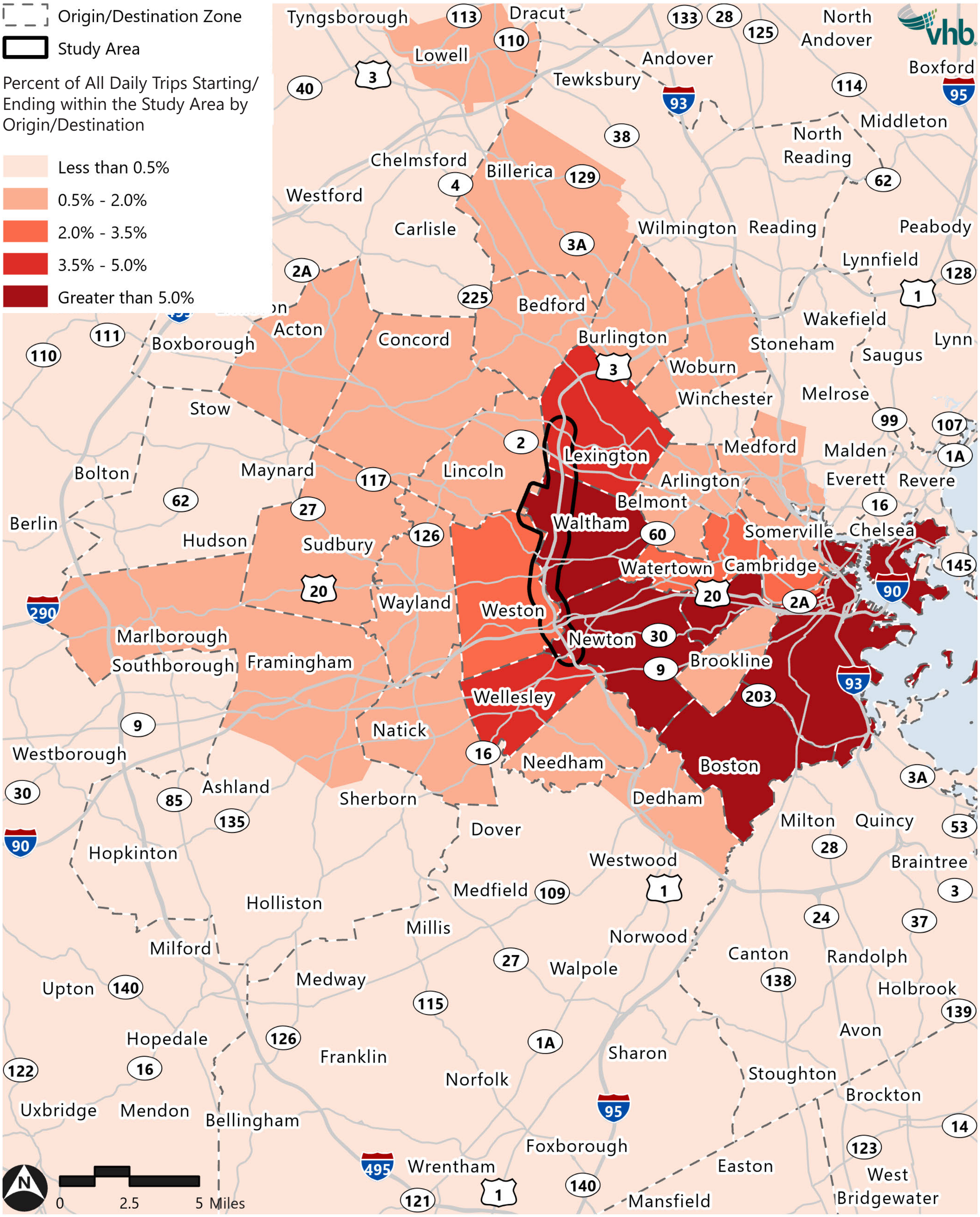
» Waltham is the single largest generator of trips within the study area with over 26 percent of daily study area vehicle trips starting or ending in Waltham

» Only about one percent of daily study area vehicle trips start or end in Lincoln, the smallest proportion of the five study area municipalities

» Over 8 percent of daily study area vehicle trips start or end in Boston, indicating a strong connection even outside of weekday commuter peak peaks

Figure 2-9: Weekday Daily Travel Patterns

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, StreetLight

Table 2-10 summarizes where vehicle trips ending in the study area start during a typical weekday morning peak period. These travel patterns generally represent those of study area workers. As shown, over 65 percent of vehicle study area trips originate outside the study area municipalities during the morning peak period, reflecting a study area workforce that commutes from across the region. Of study area vehicle trips during the morning, nearly 17 percent originate in Waltham and over 8 percent from Newton. Over 8 percent of trips are from Boston, highlighting a prominent reverse commute from the urban core.

Table 2-10 Top Weekday Morning Vehicle Trip Origins

Municipality	Percent of Weekday Morning Study Area Vehicle Trip Origins [1]
Waltham*	16.8%
Newton*	8.5%
Boston	8.2%
Lexington*	4.1%
Wellesley	2.9%
Watertown	2.6%
Weston*	2.4%
Natick	2.3%
Cambridge	2.1%
Needham	2.1%
Lincoln* [2]	0.9%

Source: StreetLight Data

* Denotes study area municipality, also shaded grey.

1 Represents average of Monday through Thursday peak period (6:00-10:00 AM) traffic data collected in March, April, September, and October 2019 for vehicle trips entering the study area.

2 Lincoln is included because it is a study area municipality; it is not one of the top origins.

Table 2-11 summarizes where vehicle trips starting in the study area end during a typical weekday morning peak period. These travel patterns generally represent those of study area residents. As shown, over half of vehicle trips starting in the study area also end in the study area during the weekday morning, with nearly one third destined to Waltham. This suggests a potential connection of high-income earners[12] working/living within the study area. Over 11 percent of vehicle trips originating in the study area are destined for Boston—a significant commuting connection with limited transit options.

12 As discussed in the Demographics section, in general, the municipalities in the study area are higher earning than average for the state.

Table 2-11 Top Weekday Morning Vehicle Trip Destinations

Municipality	Percent of Weekday Morning Study Area Vehicle Trip Destinations [1]
Waltham*	30.8%
Newton*	12.6%
Boston	11.1%
Lexington*	6.6%
Wellesley	4.6%
Cambridge	3.6%
Weston*	3.3%
Watertown	1.9%
Needham	1.9%
Burlington	1.5%
Lincoln* [2]	1.1%

Source: StreetLight Data

* Denotes study area municipality, also shaded grey.

1 Represents average of Monday through Thursday peak period (6:00-10:00 AM and 3:00-7:00 PM) traffic data collected in March, April, September, and October 2019.

2 Lincoln is included because it is a study area municipality; it is not one of the top destinations.

Route 128/I-95 Ramp and Mainline Traffic Patterns

In addition to travel patterns to/from the study area, StreetLight data can also tell us about traveler behaviors *along* the corridor. Specifically, the data was used to understand trips that travel the full length of Route 128/I-95 and movements between study area interchanges (e.g. between I-90 and Route 2). These travel patterns are summarized below and detailed tables are included in Appendix C.

» **Only 25 to 30 percent of travelers stay on Route 128/I-95 through the entire study area** in either direction, not getting on or off at any of the interchanges between Exit 37 and Exit 46

» **Many travelers use this corridor for short trips** with roughly half of all travelers entering <u>and</u> exiting Route 128/I-95 within the study area

» In the southbound direction, there are notable desire lines with movements between:
- Route 2 (Exit 45) and Third Avenue/ Winter Street (Exit 43) reflecting the connection from the suburbs northwest of Boston to major commercial area in Waltham
- Route 2 (Exit 45) and I-90 (Exit 39B), emphasizing east-west regional movements
- Third Avenue/ Winter Street (Exit 43) and I-90 (Exit 39B), connecting the major commercial area in Waltham to regional points east and west
- Route 20 (Exit 41) and I-90 (Exit 39B), further emphasizing east-west regional movements

» In the northbound direction, there are strong connections between:
- I-90 (Exit 39B) and Route 20 (Exit 41) for east-west regional movements
- Route 30 (Exit 39A) and Route 20 (Exit 41) reflecting a local connection between Newton, Weston, Waltham, and the surrounding area
- Route 20 (Exit 41) and Route 2 (Exit 45) connecting to suburbs west/northwest of Boston
- Third Avenue/ Winter Street (Exit 43) and Route 2 (Exit 45) which reflect the draw between the major commercial area in Waltham and suburbs northwest of Boston

Overall, the Streetlight data shows that Route 128/I-95 is used for multiple purposes within the study area. It is a significant connection between major east-west routes such as I-90 and Route 2 and connects the northwest suburbs to destinations within the study area. At the same time, Route 128/I-95 serves north-south regional travelers passing through the study area and connects local traffic traveling between the study area cities and towns. Considering the needs of all corridor users was an important part of the alternatives development process.

Commuter Survey Data

The Town of Lexington and 128 Business Council conducted the Mobility Management Project in 2021, a framework for improving connections across eight municipalities. Two of these municipalities, Lexington and Waltham, overlap with the Route 128/I-95 Land Use and Transportation Study project area. The study focused on transportation solutions that are multi-jurisdictional rather than services centered around one community like the Town of Lexington's Lexpress service. The report recommends the "regionalization" of public transit with fixed-route service as the core service.

A component of the study was a stakeholder survey. Survey respondents emphasized a lack of connections across municipal lines, dependency on single-occupancy vehicles, and lack of public transit options. They also identified trips that had a moderate-to-high likelihood for mode shift to public transit. Although many of these corridors were within Lexington, Route 128/I-95 and the Waltham Street-Lexington Street corridor were among the top multi-jurisdictional corridors.

Transportation

The transportation network within the study area includes infrastructure related to vehicles, transit, pedestrians, and bicyclists. The following sections provide detailed descriptions of the existing infrastructure and demands, as of fall 2021, serving each user, as well as noting deficiencies within the existing network.

Roadways and Intersections

The following section provides a description and assessment of the existing roadway network within the study area. This includes a description of roadways and study area intersections, traffic volumes, and traffic operations.

Study Area

In addition to the Route 128/I-95 mainline and ramps, the study area includes the east-west roadways that have interchanges with Route 128/I-95 as well as several surface-level intersections near each interchange. Specifically, the study area includes the following east-west roadways and nearby signalized and unsignalized intersections on each roadway:

- Route 16 (Washington Street)
- Grove Street
- Route 30 (Commonwealth Avenue/South Avenue)
- Route 20 (Weston Street/Boston Post Road)
- Route 117 (Main Street)
- Winter Street/Totten Pond Road
- Trapelo Road
- Route 2A (Marrett Road)

It should be noted that this list only includes surface-level east-west roadways that have signalized and/or unsignalized intersections within proximity to Route 128/I-95 and therefore does not include I-90 or Route 2. However, the ramps from/to I-90 and Route 2 are included in the Route 128/I-95 study area, as those two roadways are impactful to Route 128/I-95 operations and are critical pieces of the transportation network serving the region.

A total of 42 intersections are included in the study area, all of which are located within approximately one-half mile of Route 128/I-95. Figure 2-10 illustrates the location of each study area intersection. A graphic of the lane use and traffic control of each study area intersection is included in Appendix B. It should be noted that the geometry at the intersection of 3rd Avenue at Prospect Hill Lane/Route 128/I-95 NB Ramps references the improvements completed in Summer 2021.

Table 2-12 Roadway Characteristics Within Study Area

Roadway	Functional Classification	Jurisdiction[1]	Typical Lane Geometry	ADT[2]	Posted Speed Limit	Sidewalks	Bicycle Facilities
Route 128/I-95	**Interstate**	**MassDOT**	**4 lanes NB/ 4 lanes SB**	**184,300**	**55 mph**	**n/a**	**n/a**
Route 16	Principal Arterial	City of Newton	2 lanes EB/ 2 lanes WB	22,000	30 mph	Both Sides	No Formal
Grove Street [3]	Minor Arterial	City of Newton	1 lane EB/ 1 lane WB	13,900	25-30 mph	One Side	No Formal
Route 30 [3]	Principal/ Minor Arterial[4]	Town of Weston	2 lanes EB/ 2 lanes WB[6]	20,100	35-40 mph	One Side (East of River Rd)	No Formal
Route 20 [3]	Principal Arterial	MassDOT	2 lanes EB/ 2 lanes WB[6]	38,000	30-35 mph	One Side (West of Stow St)	No Formal
Route 117 [3]	Minor Arterial	City of Waltham	1 lane EB/ 1 lane WB	19,400	Not Posted	Both Sides	No Formal
Winter Street/ Totten Pond Road	Principal Arterial/ Collector[5]	City of Waltham	2 lanes EB/ 2 lanes WB	19,500	Not Posted	One Side on Winter St, Both Sides Totten Pond Rd	No Formal
Trapelo Road	Minor Arterial	City of Waltham	2 lanes EB/ 2 lanes WB[6]	29,400	30-35 mph	One Side	No Formal
Route 2A [3]	Minor Arterial	MassDOT	2 lanes EB/ 2 lanes WB[6]	17,200	35-45 mph	One Side	No Formal

1 Within the vicinity of Route 128/I-95, all ramps and overpasses across Route 128/I-95 are under MassDOT jurisdiction.

2 Average Daily Traffic (ADT) is for a typical weekday in both directions representing 2019 Existing Conditions.

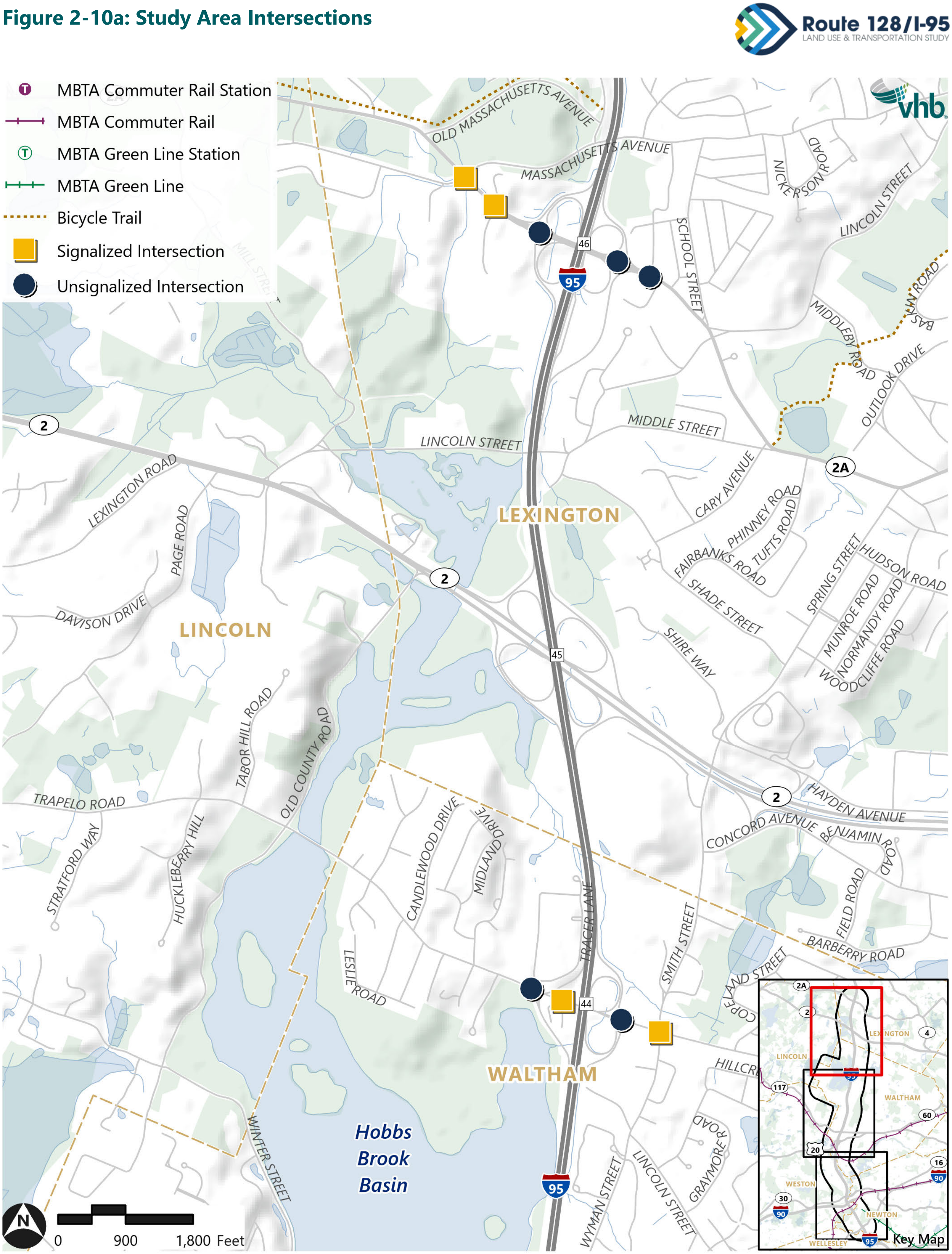
3 Planned roadway improvement projects may impact roadway characteristics. Additional information provided in Chapter 3.

4 Route 30 is classified as a principal arterial east of Route 128/I-95 and a minor arterial west of Route 128/I-95.

5 Winter Street is classified as a collector west of 2nd Avenue and Totten Pond Road is classified as a principal arterial east of 3rd Avenue.

6 Two lanes in each direction through the Route 128/I-95 interchange transitioning to one lane in each direction east/west of the interchange.

Figure 2-10a: Study Area Intersections

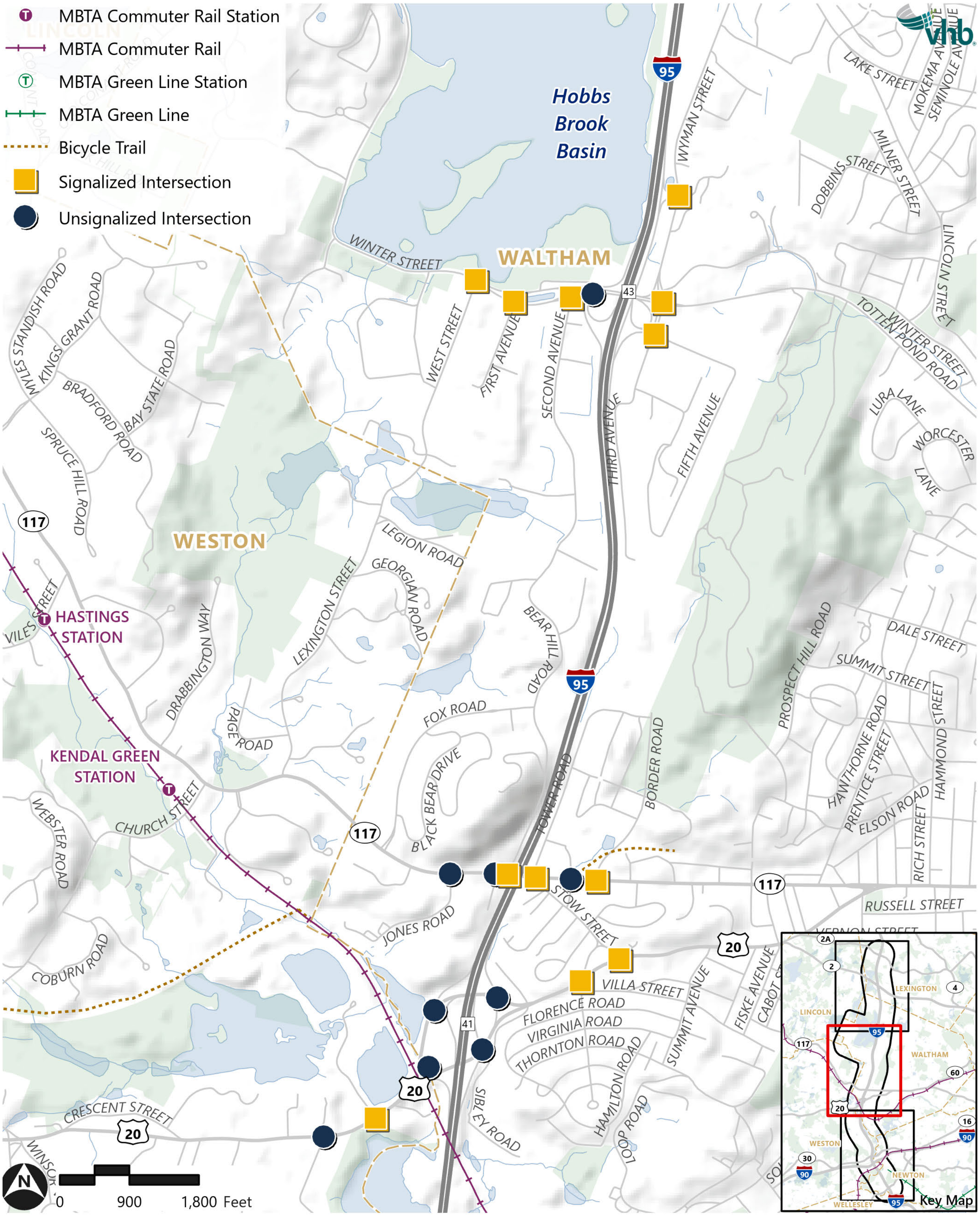


Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Study Area Intersections.indd

Figure 2-10b: Study Area Intersections

Route 128/I-95 LAND USE & TRANSPORTATION STUDY

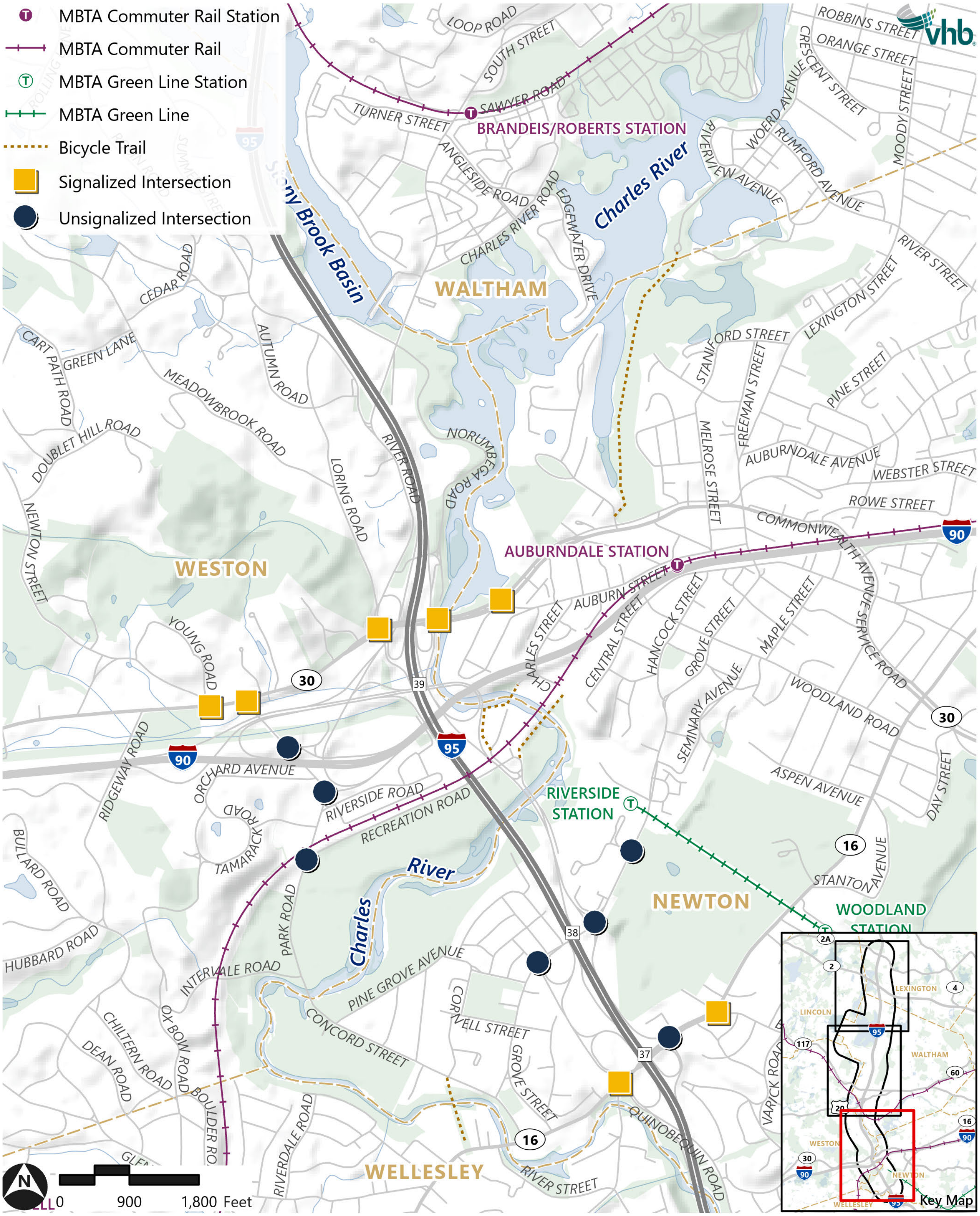


Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Study Area Intersections.indd

Figure 2-10c: Study Area Intersections

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Study Area Intersections.indd

Route 128/I-95 Mainline and Ramps

Existing traffic volumes and corresponding operations along the Route 128/I-95 mainline and ramps are discussed in the following sections.

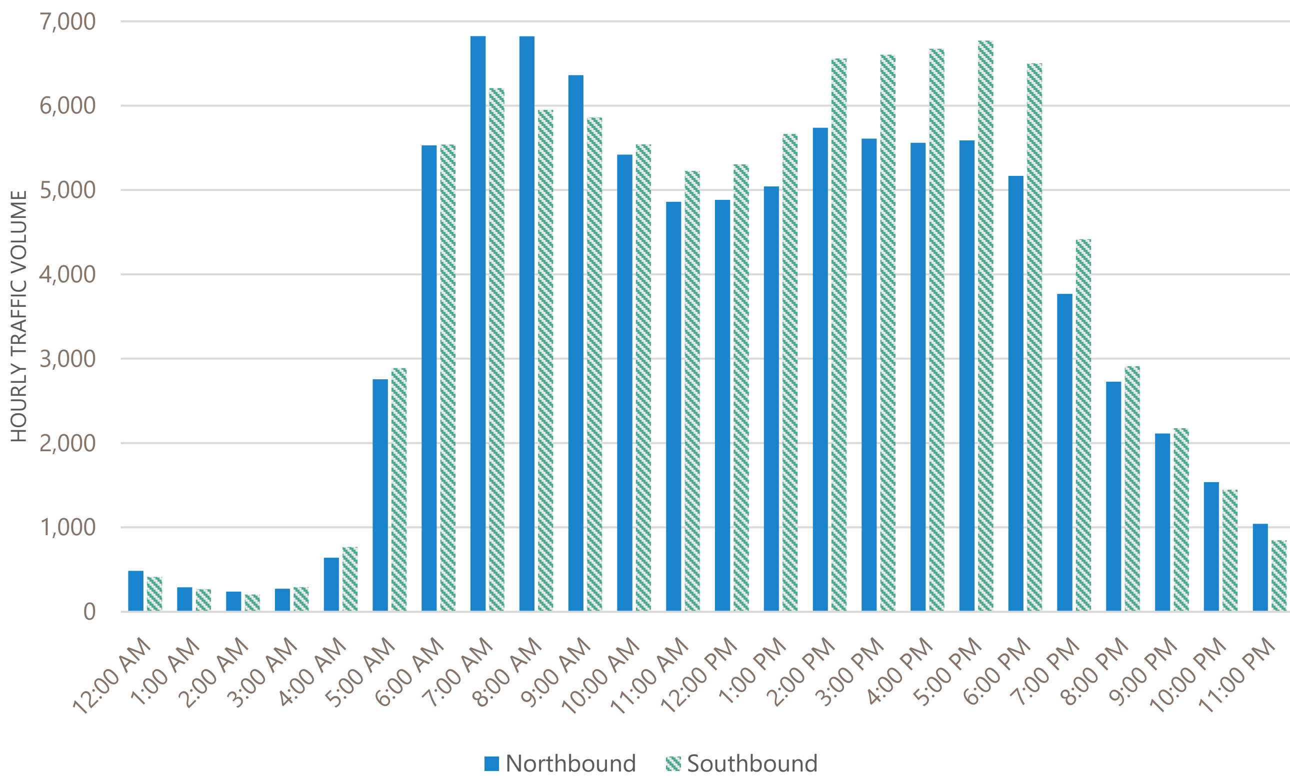
Traffic Volumes

To understand the existing traffic demands on the Route 128/I-95 mainline and ramps, traffic volumes were reviewed at each study area interchange. Both historical and new traffic data were used. Traffic counts conducted between 2015 and 2019 (representing a pre-pandemic condition) were identified at all available locations based on both MassDOT count data and previous reports and studies. Where no previous counts had been conducted, new traffic counts were collected in Fall 2021. To provide a consistent baseline of traffic volumes, historical and new counts were adjusted (if necessary) based on annual growth rates and seasonal adjustments using MassDOT adjustment factors/approved methodologies to represent the Existing Conditions traffic volumes for this study.

Since most traffic volumes were collected prior to the start of the COVID-19 pandemic in March 2020, the existing traffic volumes represent a pre-pandemic condition. Accordingly, the traffic counts conducted in Fall 2021 were adjusted to account for changes in travel patterns caused by the pandemic and be consistent with the rest of the count data. A full methodology of how the Existing Conditions traffic volumes were identified and adjusted is documented in a technical memorandum included in Appendix D for reference.

Daily traffic counts are used to understand how traffic volumes fluctuate along Route 128/I-95 throughout the day. Figure 2-11 displays the average weekday hourly traffic volumes from 2019 on Route 128/I-95 northbound and southbound during a typical weekday south of Exit 43 (Winter Street in Waltham). Additionally, approximately 4 percent of daily traffic in each direction consists of trucks and heavy vehicles—highlighting the importance of Route 128/I-95 for freight movement.

Figure 2-11 Existing Average Weekday Hourly Traffic on Route 128/I-95 South of Exit 43



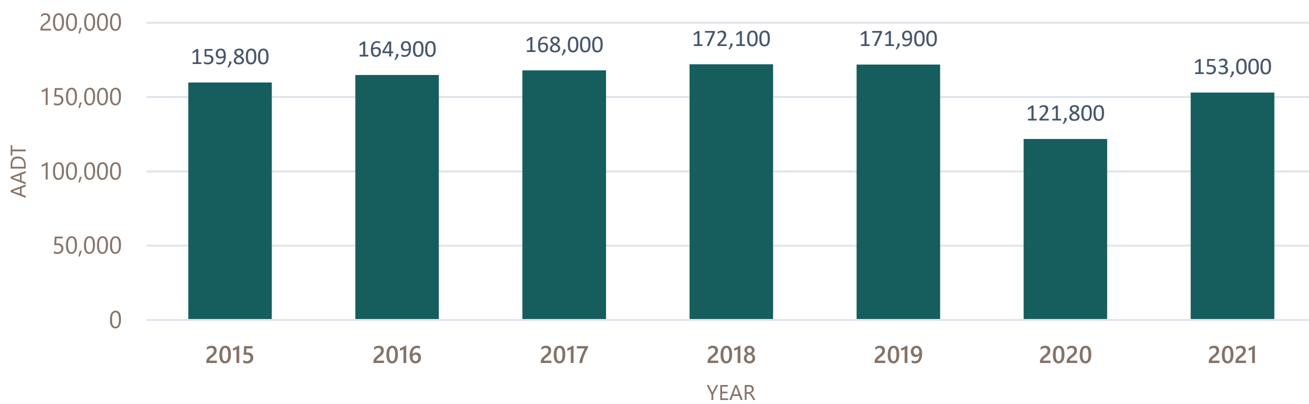
Source: MassDOT Count Station 4119 Average Hourly Traffic by Day of Week for January 1, 2019, through December 31, 2019, average of Tuesday through Thursday volume data.

Route 128/I-95 Daily Traffic Patterns

- Route 128/I-95 carries approximately 184,000 vehicles a day (89,000 NB / 95,000 SB)
- During the peak periods, Route 128/I-95 carries over 6,000 vehicles per direction per hour
- “Rush Hour” generally extends between 7:00-10:00 AM in the northbound direction and between 2:00-7:00 PM in the southbound direction on a typical weekday
- Approximately 4 percent of daily traffic in each direction consists of trucks and heavy vehicles

To understand the change in traffic patterns along the Route 128/I-95 corridor over time, historic traffic volumes between 2015 and 2021 were reviewed[13] as shown in Figure 2-12.

Figure 2-12 Annual Average Daily Traffic (AADT) on Route 128/I-95 South of Exit 43



Route 128/I-95 Historic Traffic Trends

- Daily volumes on Route 128/I-95 grew by an average of 2 percent per year between 2015 and 2019.
- In 2020, average daily volumes decreased by 29 percent from 2019 volumes due to the impacts of the COVID-19 pandemic.
- In 2021, average daily volumes increased by 26 percent over 2020 volumes as the effects of the pandemic began to wane and were only 11 percent lower than overall daily volumes in 2019.

In addition to daily volumes, the weekday morning and weekday evening peak hour traffic volumes have been identified on the Route 128/I-95 corridor and at each on-ramp and off-ramp. Traffic volume schematics illustrating the volumes that use each on- and off-ramp during the weekday morning and weekday evening peak hours (7:00 – 8:00 AM and 5:00 – 6:00 PM, respectively) and the level of service[14] for each movement are presented in Appendix B.

Traffic Operations

Before the pandemic, congestion was common throughout the state and within the study area. Users regularly experienced delays, particularly during the weekday morning and evening commuter peak periods. Land use growth along the corridor in recent years led to steady increases in traffic volumes

13 Annual average daily traffic (AADT) volumes provided by MassDOT were identified from Count Station 4119 on Route 128/I-95 south of Winter Street (Exit 43 in Waltham).

14 Traffic operations are characterized by 'Level-of-Service' (LOS), with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. LOS is a qualitative measure that considers factors such as traffic volume, roadway geometry, speed, travel delay, and freedom to maneuver and provides an index to the operational qualities of an intersection or roadway segment.

and "peak spreading"—the lengthening of the typical weekday morning and evening commuter peak periods. These trends of increasing volumes and degrading operations over recent years impacted weekdays and weekends with increased retail and entertainment uses.

Along Route 128/I-95, queued vehicles can spillback from exit ramps onto the mainline. High levels of congestion also reduce safety and efficiency for drivers, particularly between closely spaced interchanges. At the local street level, additional congestion occurs due to multiple development access points near interchanges. Roadways within the study area cannot process the number of vehicles attempting to travel through the congestion. This level of travel demand that cannot be met results in "latent demand".

While the pandemic resulted in significant decreases in volumes and corresponding congestion, traffic volumes are trending back toward pre-pandemic levels. Future traffic trends are still challenging to predict, since people are still experimenting with different routines due to fluctuating workplace policies, requirements, and other non-work considerations.

Measuring existing traffic volumes only quantifies the traffic flow on study area facilities. Operational analyses assess the *quality* of that flow and how well the facilities can serve the traffic demands placed upon them. Quantifying existing operations is a critical step, providing a baseline for consistent evaluation of alternatives. Additionally, capacity analyses would be required by local, state, and/or federal agencies should any of the alternatives be advanced to design and implementation.

Existing traffic operations were assessed utilizing standard industry practices[15] for the weekday morning and weekday evening peak hours. Analyses were calibrated to represent traffic operations within study area to the degree feasible based on observed traffic operations and user experiences. Details of the capacity analysis methodology are included in Appendix D.

Analyses were conducted for the Route 128/I-95 freeway segments, merge and diverge junctions, and weave areas. Freeway segment analyses indicate how a highway segment operates outside of ramp junctions, while merge, diverge, and weave analyses assess the interaction of traffic maneuvers between interchange ramps and freeway traffic. In total, 16 freeway segments were evaluated (eight each in the northbound and southbound directions) and 55 ramp junctions were evaluated (32 in the northbound direction and 23 in the southbound direction). Figures 2-13 and 2-14 summarize the quality of operations along the Route 128/I-95 mainline (freeway) and ramps (merge and diverge junctions, and weave areas), respectively.

15 Based on procedures outlined in the Highway Capacity Manual, 6th Edition, Transportation Research Board, Washington, D.C., 2016.

Figure 2-13 Existing Operations on Route 128/I-95 Mainline

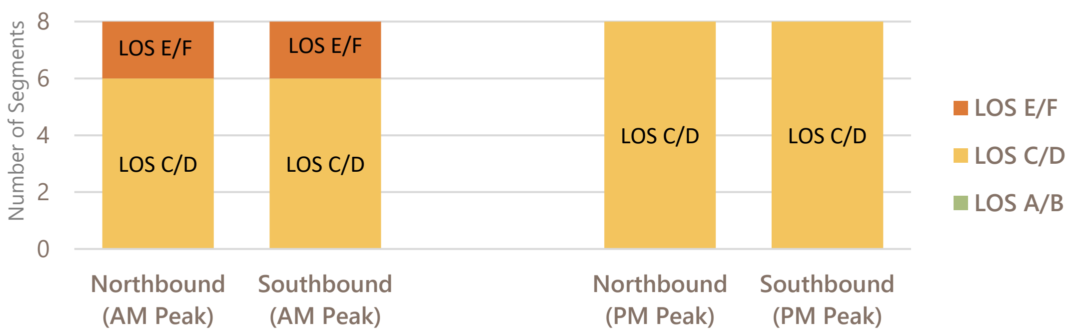
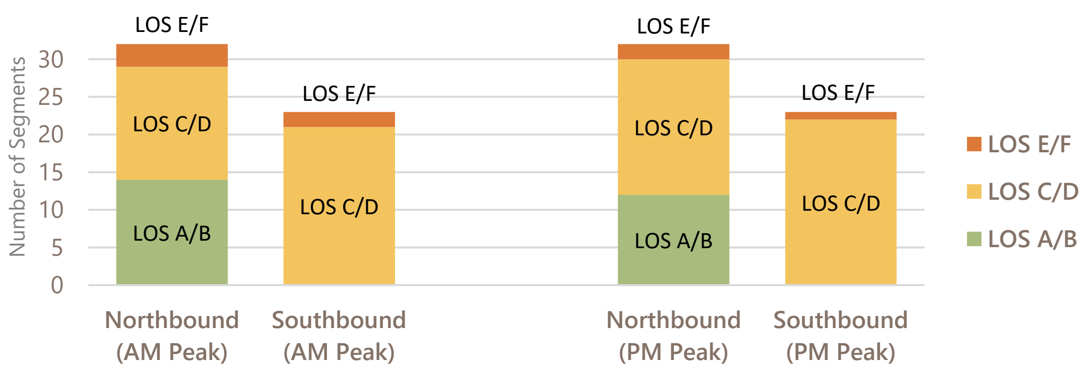


Figure 2-14 Existing Operations at Route 128/I-95 Ramp Junctions



As shown, most mainline segments and ramps along the Route 128/I-95 study area operate at acceptable level-of-services (LOS D or better) based on the HCM analyses, with **less than 10 percent operating at an unacceptable LOS E/F**. Many of the areas that operate poorly are located around I-90 in Newton (Exit 39) and Winter Street in Waltham (Exit 43). Table 2-13 summarizes the freeway segments, merge junctions, diverge junctions, and/or weave areas that currently operate at LOS E or F and full capacity analysis results and summary graphics are included in Appendix D.

Table 2-13 Route 128/I-95 Mainline Segments and Ramps Operating at Poor Levels of Service

Roadway	Location	Facility Type	LOS	Time Period
Route 128/I-95 Northbound	Between I-90 and Third Avenue/ Winter Street (3.1 miles)	Freeway	E	AM
Route 128/I-95 Southbound	Between Route 2 and Third Avenue/Winter Street (1.6 miles)	Freeway	E	AM
Route 128/I-95 Northbound	At Exit 39 (I-90/Route 30) off-ramp	Diverge	F	PM
Route 128/I-95 Northbound Collector-Distributor (CD) Road [1]	Between I-90 on-ramp and Exit 39A (Route 30) off-ramp	Weave	F	AM & PM
Route 128/I-95 Northbound	At I-90/Route 30 on-ramp	Merge	F	AM
Route 128/I-95 Northbound	At Exit 43 (Winter Street/Third Avenue) off-ramp	Diverge	E	AM
Route 128/I-95 Southbound	At Exit 43A (Third Avenue) off-ramp	Diverge	F	AM
Route 128/I-95 Southbound	Between Route 2 westbound on-ramp and Exit 45A (Route 2 eastbound) off-ramp	Weave	F	AM & PM

1 A collector-distributor road is a type of road that parallels and connects the main travel lanes of a highway and frontage roads or entrance ramps.

Travel Time Reliability

To supplement the capacity analyses presented above, travel time data for Route 128/I-95 was evaluated to benchmark reliability along the length of the corridor and for discrete segments.

Figure 2-15 presents typical weekday travel times along Route 128/I-95 within the study area and demonstrates travel time variability. While the average travel time in both directions increases during typical weekday morning and evening commuter peak periods, so does the 95th percentile travel time (i.e., a near worst-case scenario), particularly during the evening hours. As a result, **travel times vary widely and in some hours of the day nearly double**, resulting in unreliability for travelers.

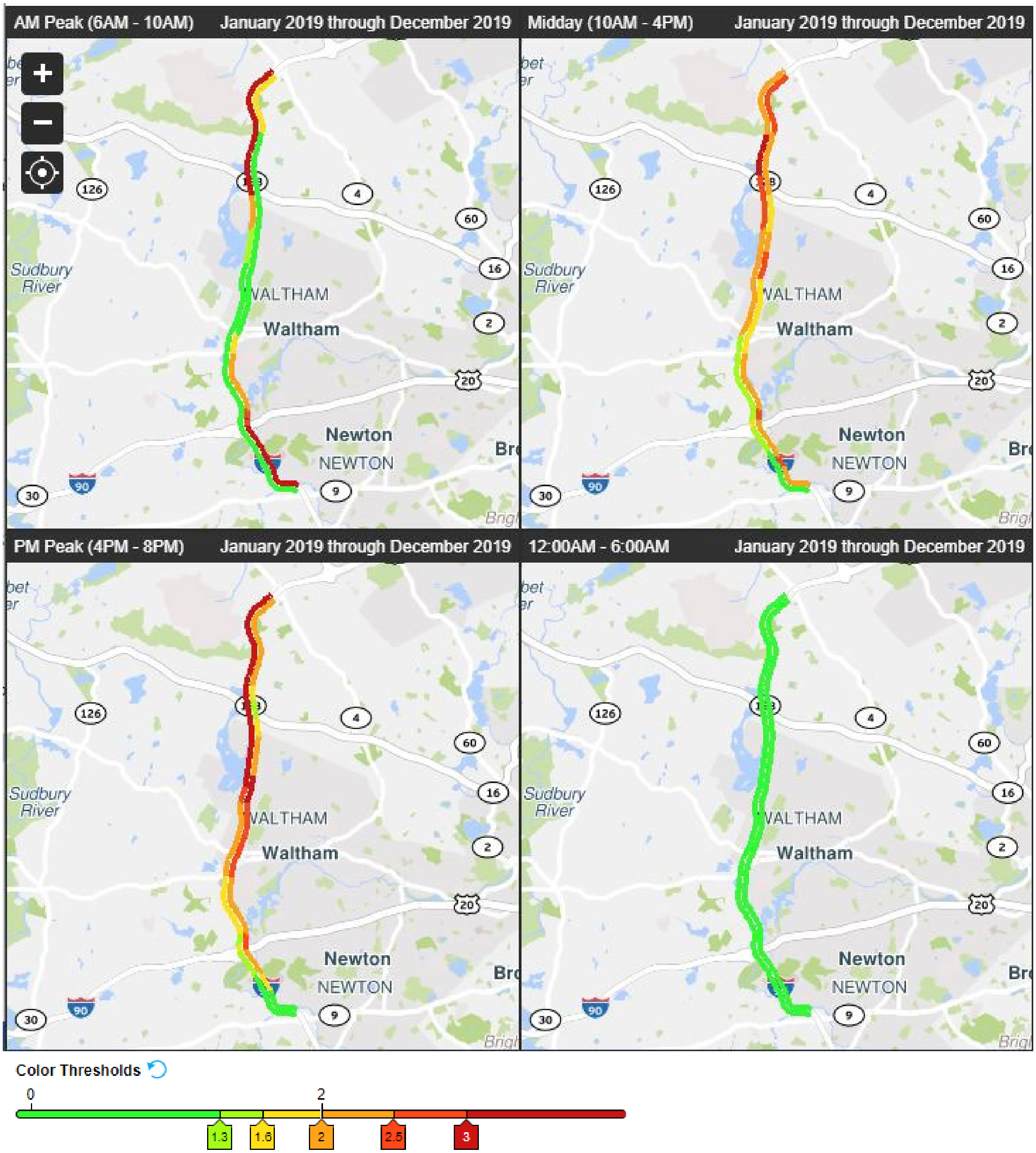
Drilling down further, planning time index on a segment level was reviewed. Planning Time Index is a reliability measure that represents the total travel time that should be planned when an adequate buffer time is included. It compares near-worst case travel time to a travel time in light or free-flow traffic[16]. A value of 2.0 means that for a 20-minute trip in little to no traffic, a traveler should plan on the trip taking 40 minutes. Figure 2-16 presents the planning time index along Route 128/I-95 within the study area for the weekday morning, midday, evening, and off-peak periods.

16 Planning Time Index is calculated as ratio of the 95th percentile peak period travel time to the free flow travel time.

Figure 2-15 Route 128/I-95 Travel Time

Source: INRIX, January – December 2019 Tuesday-Thursday average

Figure 2-16 Route 128/I-95 Planning Time Index



Source: INRIX, January – December 2019 Tuesday-Thursday average

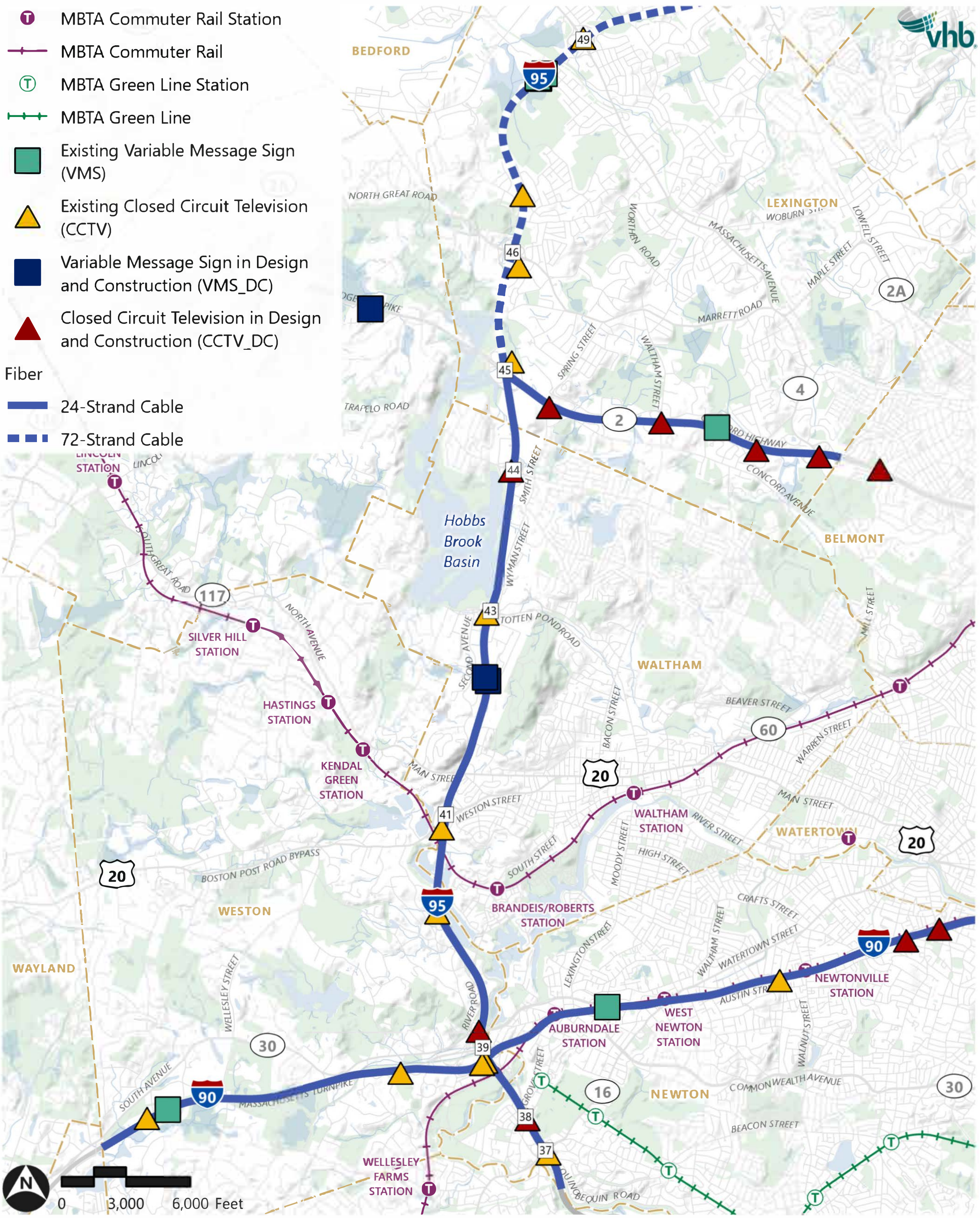
As shown, **there is travel time variability at the segment level throughout all hours of the day**. Travel times on some segments—particularly north of Route 2 and south of I-90—can be more than three times the average during commuter peak periods. During the weekday midday, unreliability is also common with **many segments experiencing 95th percentile travel times of two to three times the average**.

Intelligent Transportation Systems (ITS) Infrastructure

Intelligent Transportation Systems (ITS) improve transportation safety and mobility and enhance productivity through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. ITS encompass a broad range of wireless and wire line communications-based information and electronics technologies[17]. A review of existing ITS technologies along the Route 128/I-95 corridor was conducted to set the baseline and understand the ability of potential transportation improvement alternatives to leverage and integrate this technology. ITS infrastructure and devices located along the Route 128/I-95 corridor are depicted in Figure 2-17 and include variable message signs (VMS), closed-circuit television cameras (CCTV), and fiberoptic cables. A 72-strand fiberoptic cable exists along Route 128/I-95 south of Route 2 and a 24-strand fiberoptic cable exists along Route 128/I-95 north of Route 2. The figure also includes VMS and CCTV assets in design and construction as of February 2023. Understanding the existing ITS infrastructure is a critical component in the development of alternatives that leverage emerging transportation technology.

17 U.S. Department of Transportation

Figure 2-17: ITS Infrastructure



Source: MassGIS, MassDOT

Intersections

Existing traffic volumes and corresponding operations at the study area intersections are discussed in the following sections.

Traffic Volumes

To understand the existing traffic demands, turning movement counts were collected and reviewed at all study area intersections. Similar to the Route 128/I-95 mainline and ramps, both historical and new traffic data were used and adjusted by applying the same methodology as described previously and documented in Appendix D for reference. The resulting existing traffic volumes represent a pre-pandemic condition.

Traffic volume networks showing the individual turning movements for each intersection for the weekday morning and evening peak hours (7:00 – 8:00 AM and 5:00 – 6:00 PM, respectively) are presented in Appendix B.

Traffic Operations

Operational analyses were also completed for the study area intersections to understand the quality of flow and how well the facilities can serve the traffic demands placed upon them. Consistent with the operational analyses for the Route 128/I-95 mainline and ramps, existing traffic operations were assessed for the weekday morning and weekday evening peak hours and characterized by 'Level-of-Service' (LOS). Details of the capacity analysis methodology are included in Appendix D.

Intersection capacity analyses were conducted for the study area intersections to assess operations at the local level. Figures 2-18 and 2-19 summarize the quality of operations at the signalized and unsignalized study area intersections, respectively.

Figure 2-18 Existing Operations at Signalized Study Area Intersections

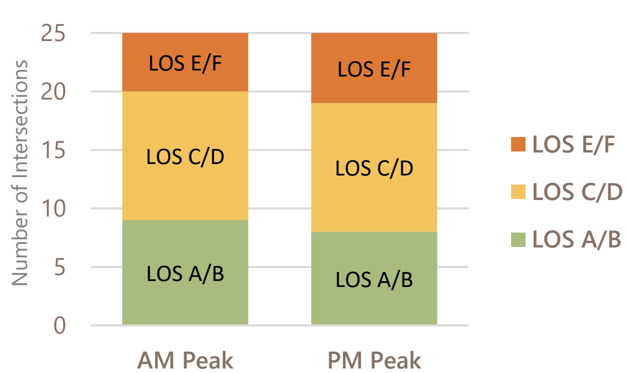
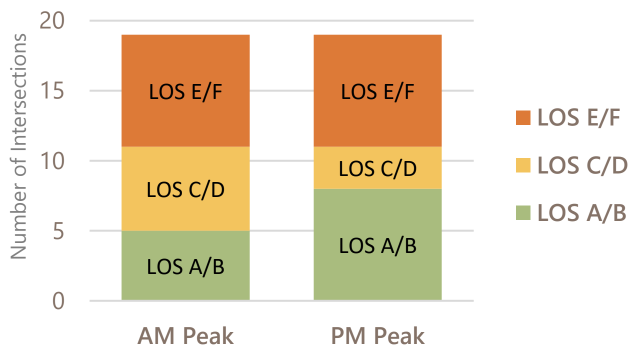


Figure 2-19 Existing Operations at Unsignalized Study Area Intersections



The majority of signalized study area intersections currently operate between LOS B and LOS D (approximately 74 percent). However, there are several signalized intersections (approximately 22 percent) within the study area with operational deficiencies. There are also several approaches of unsignalized intersections (approximately 42 percent) within the study area that currently operate poorly. This can be attributed to high volumes on several east-west roadways that do not provide sufficient gaps for vehicles to turn out of the stop-controlled approaches.

Table 2-14 identifies the signalized and unsignalized intersections that currently operate poorly. Many of these intersections with poor operations are located in the Newton and Waltham areas, consistent with the Route 128/I-95 mainline and ramps issue areas. Full capacity analysis results are included in Appendix D and summary graphics are included in Appendix B.

Table 2-14 Study Area Intersections Operating at Poor Levels of Service

Location	LOS	Time Period
Signalized Intersections		
Route 2A at Massachusetts Avenue	E/F [1]	AM & PM
Route 117 at Tower Road/Stow Street	F	AM
Route 117 at Bear Hill Road	F	AM & PM
Route 30 at Route 128/I-95 SB Ramps/River Road	E	PM
Route 30 at Park Road	F	PM
Route 30 at Newton Street	E/F [2]	AM & PM
Route 16 at Route 128/I-95 SB Ramps/Quinobequin Road	E	AM & PM
Unsignalized Intersections		
Route 128/I-95 northbound off-ramp to Route 2A westbound	E	AM
Tracer Lane southbound left-turn movement onto Trapelo Road	E/F [2]	AM & PM
Green Street northbound approach to Route 117	E	PM
Jones Road northbound left-turn movement onto Route 117	F	AM & PM
Summer Street northbound approach to Route 20	F	AM & PM
I-90 Westbound Off-Ramp to Park Road	F	AM & PM
Riverside MBTA Driveway SB left-turn movement onto Grove Street	F	AM & PM
Asheville Road southbound approach to Grove Street	F	AM & PM
Route 128/I-95 NB off-ramp left-turn movement onto Route 16 WB	F	AM & PM
Route 128/I-95 NB off-ramp right-turn movement onto Route 16 EB	F	AM & PM

Note: Signalized intersection LOS is for the overall intersection; unsignalized intersection LOS is for the stop-controlled or yield-controlled critical movement.

1 LOS F during AM peak hour and LOS E during PM peak hour

2 LOS E during AM peak hour and LOS F during PM peak hour

There are several planned transportation investments within the study area that are intended to address existing operational and safety issues which are discussed in Chapter 3: Future Conditions and Issues, Opportunities, and Constraints and are accounted for in the future conditions analysis.

Transit

Multiple transit agencies and providers operate within the study area. Figure 2-20 highlights the existing transit services operating in the study area.

The transit agencies and providers which operate within the study area include:

- **Massachusetts Bay Transportation Authority (MBTA)** serves the Boston Metropolitan Region and operates two commuter rail lines, one rapid transit line, five bus routes, and paratransit throughout the study area (including one bus route on Route 128/I-95).
- **MetroWest Regional Transit Authority (MWRTA)** serves the MetroWest region centered in Framingham and currently operates one local bus route throughout the study area.
- **Montachusett Regional Transit Authority (MART)** serves northern Worcester County and western Middlesex County and operates one shuttle bus route throughout the study area.
- **Town of Lexington Lexpress** serves Lexington and operates four bus routes, including two bus routes just outside of the study area.
- **128 Business Council** connects from MBTA stations to employment sites in the Route 128/I-95 corridor and operates six shuttle bus routes throughout the study area.
- **Massachusetts Institute of Technology** connects the campus in Cambridge to the Lincoln Laboratory in Lexington with one shuttle bus route through the study area.

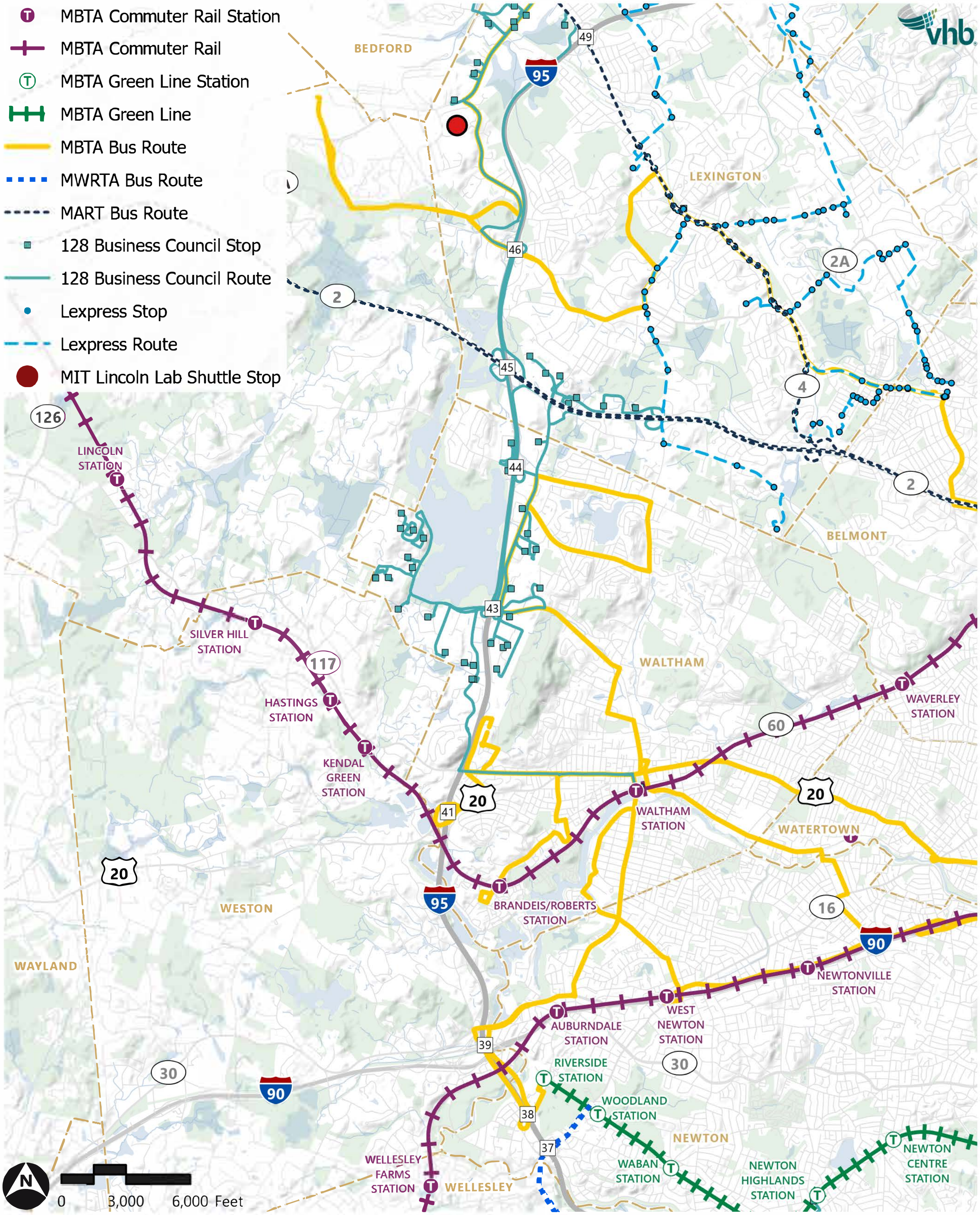
The following sections provide more detail on the rail, bus, and paratransit services in the study area.

Study Area Transit Services

- **6 Transit Operators**: MBTA, MART, MWRTA, Lexpress, 128 Business Council, and Massachusetts Institute of Technology
- **19 Transit Routes**: 8 MBTA, 1 MART, 1 MWRTA, 2 Lexpress, 6 128 Business Council, and 1 Massachusetts Institute of Technology
- **4 Transit Modes**: Commuter Rail, Rapid Transit, Bus, Paratransit
- **5 of 5 Municipalities Served**: Lexington, Lincoln, Waltham, Weston, Newton

Figure 2-20: Overview of Existing Transit Services

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation_Figures_v3.aprx (adomogala, 2/7/2023)

Source: MassGIS, MassDOT

Rail Services

Two MBTA commuter rail lines cross Route 128/I-95 in the study area. A branch of the MBTA's Green Line light rail rapid transit also operates in the study area, to the east of Route 128/I-95. All rail services operate daily. The following sections describe stations in or near the study area, including the drive time from the closest Route 128/I-95 exits.

MBTA Commuter Rail

The **Fitchburg Line** operates between Wachusett station in Fitchburg and North Station in Boston. Ridership on this line ranks sixth in the Commuter Rail system. Fitchburg Line stations in or near the study area include[18]:

- Kendal Green station (in Weston), approximately five minutes (driving) from Exits 41 and 43
- Brandeis/Roberts station (in Waltham), approximately five minutes from Exits 39A and 41
- Waltham station, approximately 10 minutes from Exit 41

The **Framingham/Worcester Line** operates between Worcester station and South Station in Boston. Ridership on this line ranks second in the entire Commuter Rail system. Framingham/Worcester Line stations in or near the study area include:

- Wellesley Farms station, just under five minutes from Exits 37 and 38 and approximately five minutes from Exit 39A
- Auburndale station (in Newton), less than five minutes from Exits 38 and 39A
- West Newton station, just over five minutes from Exits 38 and 39A

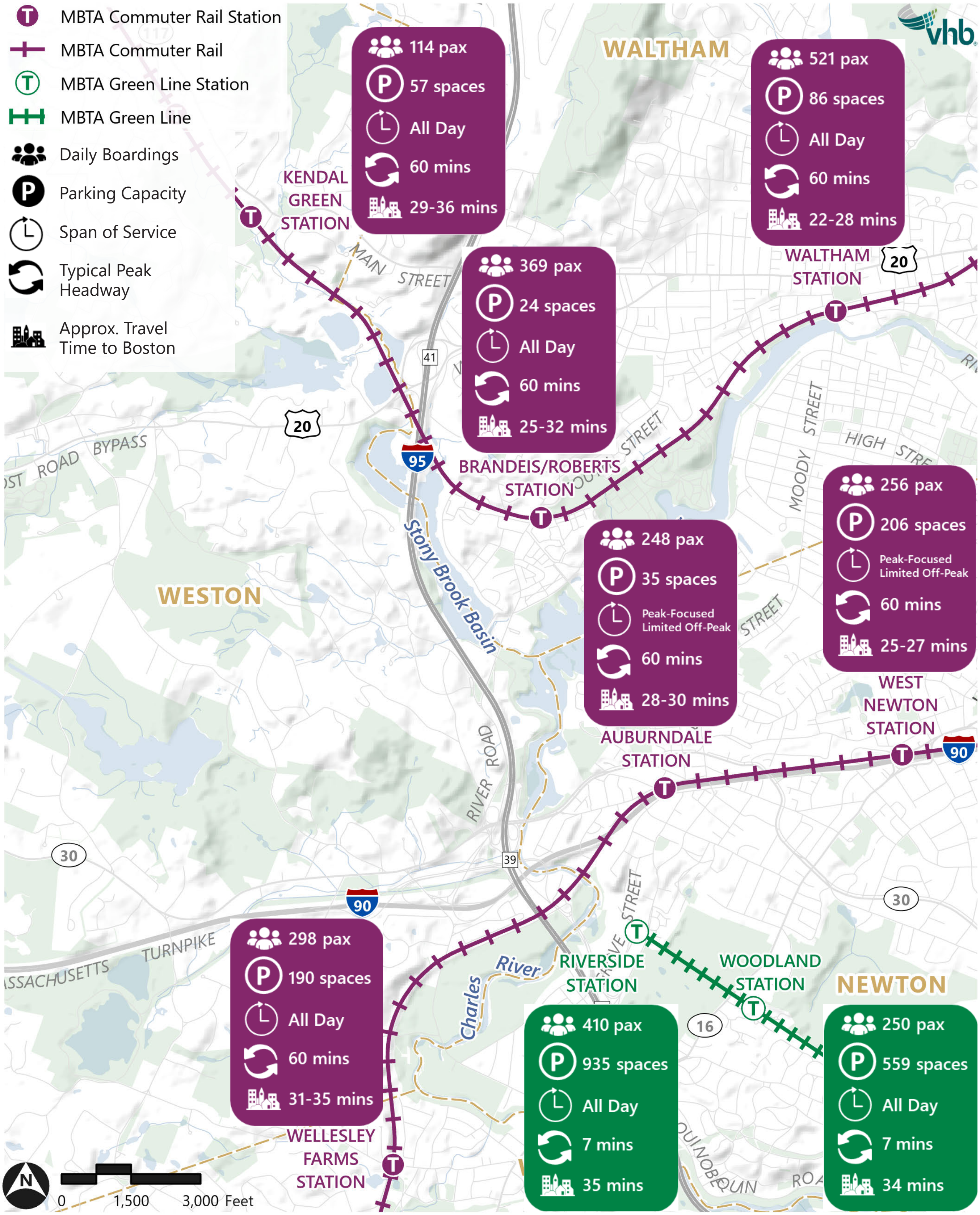
Figure 2-21 identifies the daily boardings, parking capacity, span of service (the number of hours during a day that transit service is provided), typical frequency, and typical travel time to Boston at each station.[19,20] In total, approximately 1,800 commuter rail passengers board at these six stations on a typical weekday as of 2018. Total parking capacity at these six stations is nearly 600 spaces. While Brandeis/Roberts and Waltham are accessible, Kendal Green, Wellesley Farms, Auburndale, and West Newton stations have significant accessibility barriers that may affect their use. For example, Auburndale and West Newton stations are only accessed via staircases. Standard one-way adult fares between Boston and the above stations range from $7.00 to $8.00.

18 Silver Hill Station and Hastings Station (in Weston) were closed beginning on April 5, 2021 due to the COVID-19 Pandemic and remain closed indefinitely, so are not included on this list.

19 Daily boardings are from MassDOT and CTPS 2018 Commuter Rail Counts, available at https://www.mass.gov/lists/2018-commuter-rail-counts. Parking capacity reflects the capacity identified on the MBTA's website as of October 2021. The span of service, typical frequency, and typical travel times shown are based on the MBTA schedules effective October 11, 2021.

20 Note that express service trips on the Framingham/Worcester Line are scheduled during the peak periods, bypassing stations between Natick Center and Newtonville, with additional trips bypassing Auburndale, West Newton, and Newtonville stations during off-peak periods.

Figure 2-21: Existing Rail Services



Source: MassGIS, MassDOT

MBTA Rapid Transit

The **Green Line D Branch** operates between Riverside (in Newton) and North Station.[21] Green Line D Branch stations within or near the study area include:

» Riverside station (in Newton), within one to two minutes of Exit 38 and is the highest ridership station on the surface-level of the D Branch

» Woodland station (in Newton), within one to two minutes of Exit 37

Figure 2-21 identifies the daily boardings, parking capacity, span of service, typical frequency, and typical travel time to Boston at each station.[22] In total, over 650 Green Line passengers board at these two stations on a typical weekday as of 2019. Total parking capacity at these two stations is nearly 1,500 spaces. Both stations are accessible. A standard one-way fare on the MBTA rapid transit system is $2.40.

Bus Services

The MBTA, MWRTA, MART, and three municipal/non-profit/university operators have service in the study area, with only a few routes traveling on Route 128/I-95. It should be noted that this data reflects service as of fall 2021. Changes since that time are discussed in Chapter 3, Future Conditions and Issues, Opportunities, and Constraints.

MBTA Bus Services

The **MBTA** operates five routes in the study area, which connect with other transit services that operate outside of the study area. These routes five include[23]:

» **Route 62/76** operates on weekdays and Saturdays between the Bedford VA Hospital and Alewife Station, serving Bedford, Lexington, Arlington, and North Cambridge.24 Route 62/76 provides a connection to the MBTA Red Line rapid transit at Alewife, and crosses Route 128/I-95 in Lexington on Route 2A (Marrett Road, Exit 46).

» **Route 61** operates seven days a week between North Waltham and Waltham Center. A segment of Route 61, on Wyman Street parallels Route 128/I-95 between Lincoln Street and Totten Pond Road (Exit 43). Route 61 provides a connection to Route 70 at Waltham station.

» **Route 70** operates seven days a week between Market Place Drive in Waltham and University Park in Central Square, serving Waltham, Watertown, Allston, and Cambridge. The Waltham terminus is on local roads adjacent to Route 128/I-95. Of all study area MBTA bus routes, Route 70 ranks highest in terms of bus system ridership at 16th overall.

21 Prior to October 24, 2021 the Green Line D Branch inbound terminus was Government Center.

22 Daily boardings are from MBTA Fall 2019 data, available at https://mbta-massdot.opendata.arcgis.com/datasets/mbta-rail-ridership-by-time-period-season-route-line-and-stop/explore. Parking capacity reflects the capacity identified on the MBTA's website as of October 2021. The span of service, typical frequency, and typical travel times shown are based on the MBTA schedules effective August 29, 2021.

23 Due to the ongoing COVID-19 Pandemic, Route 170 has been suspended. Route 170 operated within the study area, providing service between North Waltham and Waltham Center, Newton, and Nubian Square via I-90.

24 Due to the ongoing COVID-19 Pandemic, Route 62 and 76 have been suspended with all trips combined as Route 62/76.

- **Route 553** operates on weekdays and Saturdays between Roberts and Newton Corner, serving Waltham and Newton. The Waltham terminus of Route 553 is on local roads east of Route 128/I-95.
- **Route 558** operates on weekdays between Riverside station and Newton Corner, serving Newton, Waltham, and Watertown while providing a connection to the MBTA Green Line D Branch rapid transit at Riverside. Route 558 operates on Route 128/I-95 between Exits 38 and 39.

Figure 2-22 identifies the daily boardings, span of service, typical frequency, and key destinations for each route.[25] A standard one-way fare for a MBTA local bus trip is $1.70.

The MBTA developed a Plan for Accessible Transit Infrastructure (PATI) to improve accessibility throughout its system. PATI identified barriers at stations and bus stops like missing curb ramps, heavy station doors, and obstructions in the path of travel and prioritized improvements. The MBTA is currently addressing issues at critical and high priority stops in collaboration with municipalities and private landowners.

Regional Transit Authority Bus Services

Two regional transit authorities (RTAs) operate routes in the study area as shown in Figure 2-22 along with daily boardings, span of service, typical frequency, and key destinations.[26] These include:

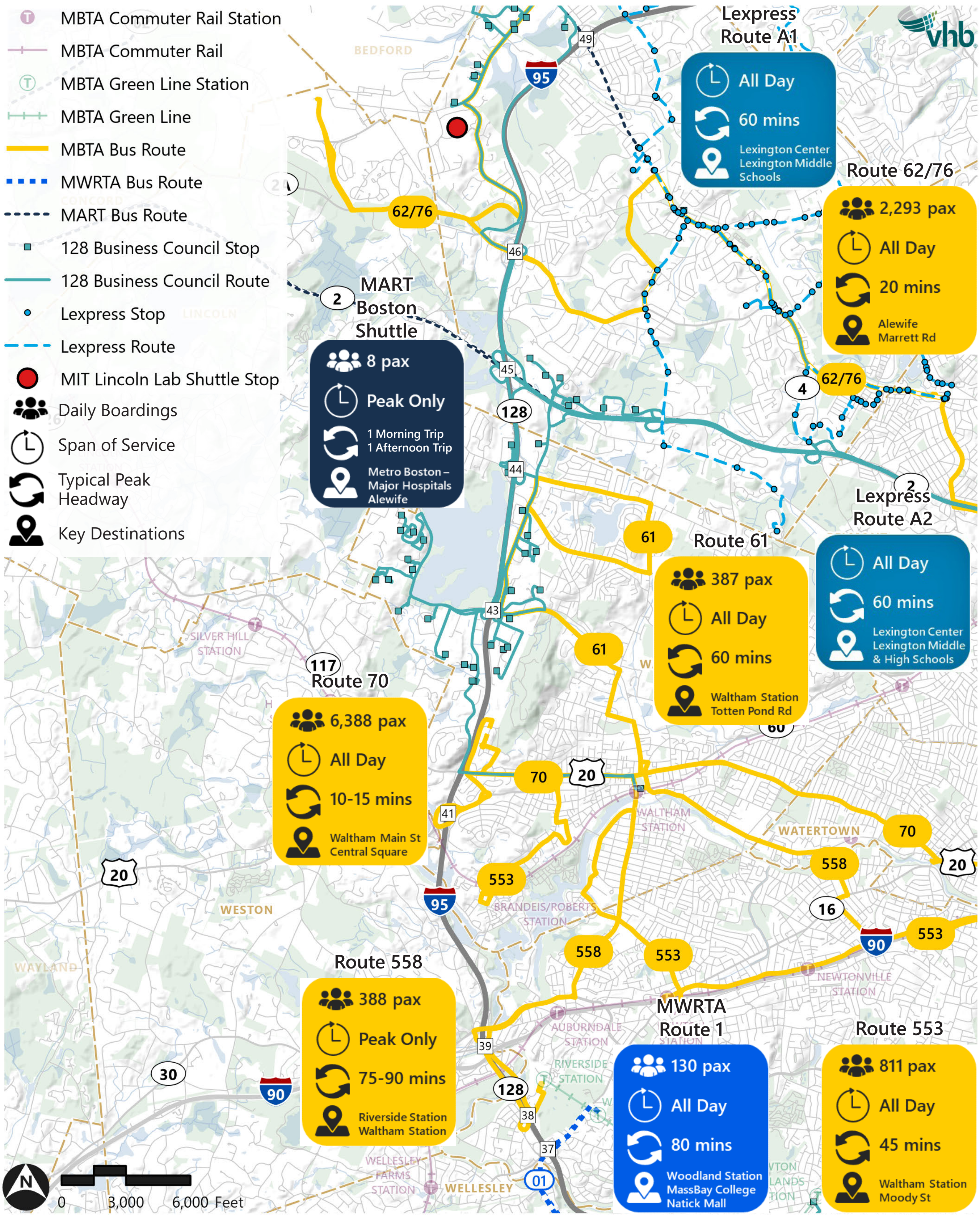
- **MART Boston Shuttle** operates on weekdays and Saturdays between Fitchburg and major hospitals in the Boston area, with stops in Leominster, Devens, Littleton, the Concord Emerson Hospital in Concord, the Bedford VA Medical Center in Bedford, Alewife Station in Cambridge, and in Metro Boston. The MART Boston Shuttle crosses Route 128/I-95 in Lexington on Route 2 (Exit 45). A standard one-way fare is $12.00.
- **MWRTA Route 1** operates on weekdays between Woodland station and either the Blandin Hub in Framingham or the Natick Mall, serving Framingham, Natick, Wellesley, and Newton.[27] Route 1 provides a connection to the MBTA Green Line D Branch rapid transit at Woodland, and crosses Route 128/I-95 in Newton on Route 16 (Washington Street, Exit 37). A standard one-way fare is $1.50 if using cash or $1.25 if using the MBTA Charlie Card.

25 Daily boardings for Routes 62/76, 553, and 558 are from MBTA Fall 2019 data, available at https://public.tableau.com/app/profile/mbta.office.of.performance.management.and.innovation/viz/RiderhsipViewer/Summary. Since Routes 70 and 70A were reorganized into Routes 61 and 70 as part of the MBTA's Better Bus Project (with operations of the new routing beginning December 22, 2019), daily boardings for Routes 61 and 70 are averaged from non-holiday weeks in January and February 2020 from data available at https://massdot.app.box.com/s/21j0q5di9ewzl0abt6kdh5x8j8ok9964. The span of service, typical frequency, and key destinations shown are based on the MBTA schedules effective August 29, 2021.

26 The span of service, typical frequency, and key destinations shown are based on the schedules effective in November 2021.

27 MWRTA's MassBay Riverside Shuttle and Route 20 Shuttle have been suspended since April 2020 due to the ongoing COVID-19 Pandemic. The MassBay Riverside Shuttle provided service between MassBay Wellesley Hills Campus and the Riverside MBTA station. The Route 20 Shuttle provided service along Route 20 in Marlborough, Sudbury, Wayland, and Newton, with a direct connection to the MBTA Green Line D Branch rapid transit service at Riverside, operating on a segment of Route 128 between Exits 38 and 41 in Waltham, Weston, and Newton. Since the COVID-19 Pandemic, MWRTA now operates the Green Line Connector route between Blandin Hub and the Woodland MBTA station, as well as the Wellesley CatchConnect Service, a micro transit system providing service within Wellesley and to Woodland MBTA Station, amongst others.

Figure 2-22a: Existing Bus Services

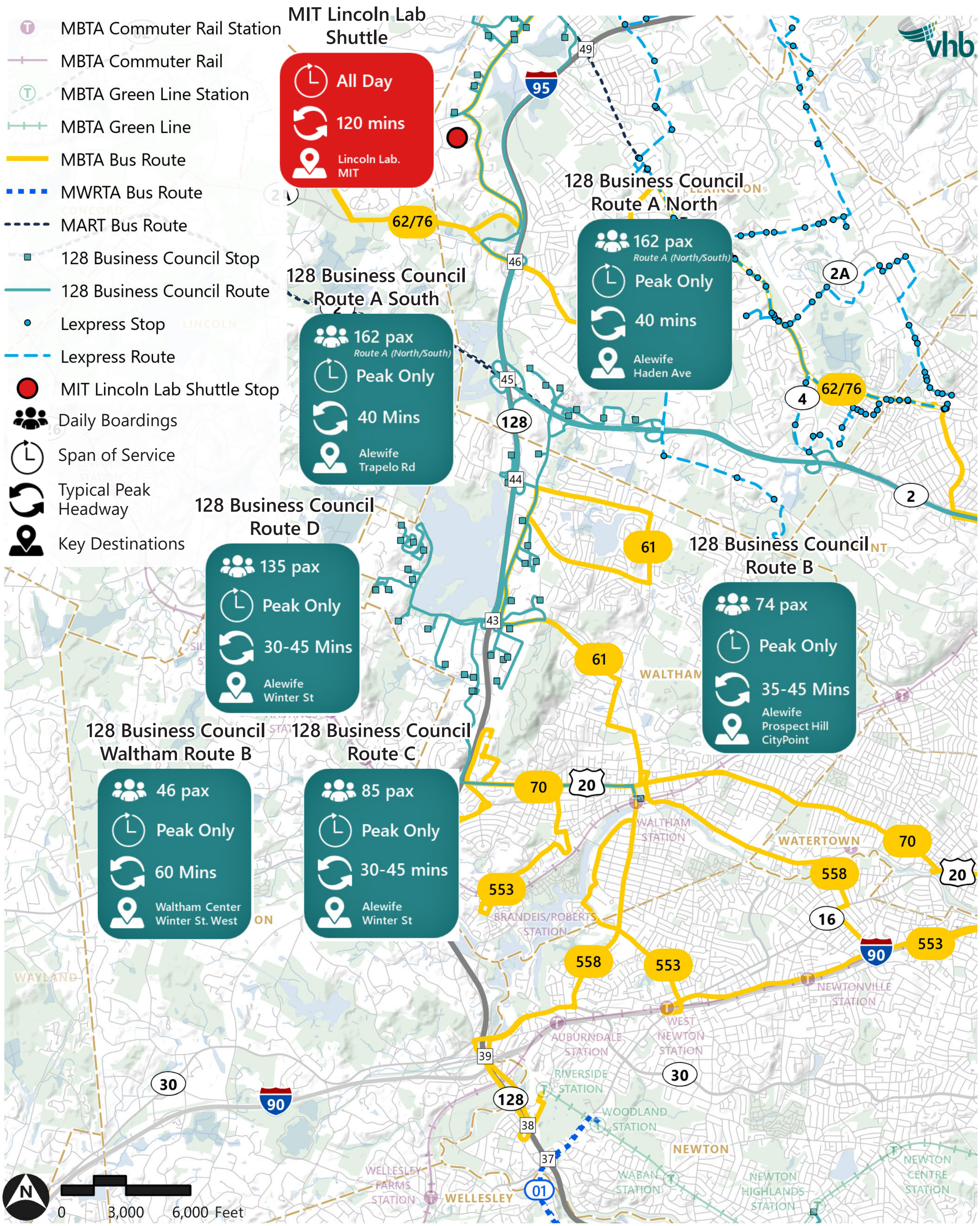


Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Transit_Services.indd

Figure 2-22b: Existing Bus Services

Route 128/I-95 LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Transit_Services.indd

Other Bus Services

The study corridor is host to several bus and shuttle services in addition to those operated by the MBTA, including a municipal system, university shuttles, and the 128 Business Council. Several of these services provide connections to each other and to MBTA bus routes and rail lines. Figures 2-22 identifies the daily boardings, span of service, typical frequency, and key destinations for each route where available.[28]

The **Town of Lexington's Lexpress** bus service operates four local bus routes in Lexington, including two just outside of the study area on weekdays only. **Route A1** operates between Depot Square and northwest Lexington, crossing Route 128/I-95 north of the study area. **Route A2** operates between Depot Square and south Lexington, crossing Route 2 to the east of the study area. Connections to Lexpress Routes B and C can be made at Depot Square. A standard one-way fare for a Lexpress bus trip is $2.00.

The **128 Business Council** is a transportation management association that provides a network of shuttle connections from MBTA stations to employment sites in the Route 128/I-95 corridor.[29] Six routes make stops in the study area and in total, ridership on these routes reflects 71 percent of system ridership. These routes are presented below in Table 2-15 [30].

Table 2-15 Route 128 Business Council Shuttles

Route	Origin	Destination	Study Area Municipalities Served
Alewife Route A North	Alewife Station	Hayden Avenue/Spring Street area	Waltham & Lexington
Alewife Route A South	Alewife Station	Trapelo Road/Wyman Street area	Waltham
Alewife Route B	Alewife Station	Prospect Hill/City Point area	Waltham
Alewife Route C	Alewife Station	Winter Street area east of Gatehouse Dr.	Waltham
Alewife Route D	Alewife Station	Winter Street area west of Gatehouse Dr.	Waltham
Waltham Route B	Waltham Center	Winter Street West area	Waltham

Source: Based on Route 128 Business Council website as of Winter 2023.

The 128 Business Council routes serve specified stops within the Study Area, but riders must notify drivers of their stop when they board. Moreover, the schedule and routing adapt to the needs of the member organizations. Base passenger fares for 128 Business Council shuttles range from $3.00 to $5.00, depending on the route.

28 The span of service, typical frequency, and key destinations shown are based on the schedules effective in November 2021. Average daily boardings for 128 Business Council are from 2019 data.

29 The 128 Business Council is a membership organization, funding it shuttle operations and other travel demand management initiatives primarily through business dues. With the exception of the CityPoint route, 128 Business Council shuttles are open to the general public.

30 Due to the ongoing COVID-19 Pandemic, the CityPoint route has been suspended. The CityPoint route operated within the study area, as an employee-only route providing service between Alewife Station and CityPoint in Waltham.

Massachusetts Institute of Technology (MIT) runs a free shuttle service between the Lincoln Laboratory and the main MIT campus in Cambridge. The MIT shuttle serves specified stops within the study area.

Brandeis University runs several shuttle routes for university members who need to travel between the campus and points within Waltham, Boston, and Cambridge. Specifically, there are four daytime shuttle routes and three evening shuttle routes that connect points on campus, destinations in Waltham, including Moody Street, downtown Waltham, and Market Basket, Harvard Square in Cambridge, and Back Bay in Boston. Most shuttle routes operate seven days a week with service every 15-90 minutes.

ADA Paratransit Services

The RIDE

The RIDE is the MBTA's paratransit service that provides door-to-door, shared-ride transportation to individuals who are unable to use other public transportation modes due to a temporary or permanent disability. The RIDE operates seven days a week in 59 municipalities in the greater Boston Area. All study area municipalities are included within The RIDE's full-service area. The one-way fare ranges from $3.35 to $5.60. An average of over 200 trips per day originated in the study area municipalities in October 2019, with the majority of those originating in Waltham and Newton.[31]

Active Transportation

In recent years, MassDOT and local municipalities have increased their focus on improving active transportation conditions across the Commonwealth. MassDOT provides guidance, technical assistance, and funding through documents such as the Municipal Resource Guide for Bikeability and programs such as Complete Streets Funding and the Shared Streets and Spaces Grant Program to assist municipalities in advancing infrastructure that provides users with safe and accessible options for biking and walking. This focus on prioritizing active transportation options and the recent success of these programs and initiatives has led to improved options and should result in continued expansion of active transportation within the study area.

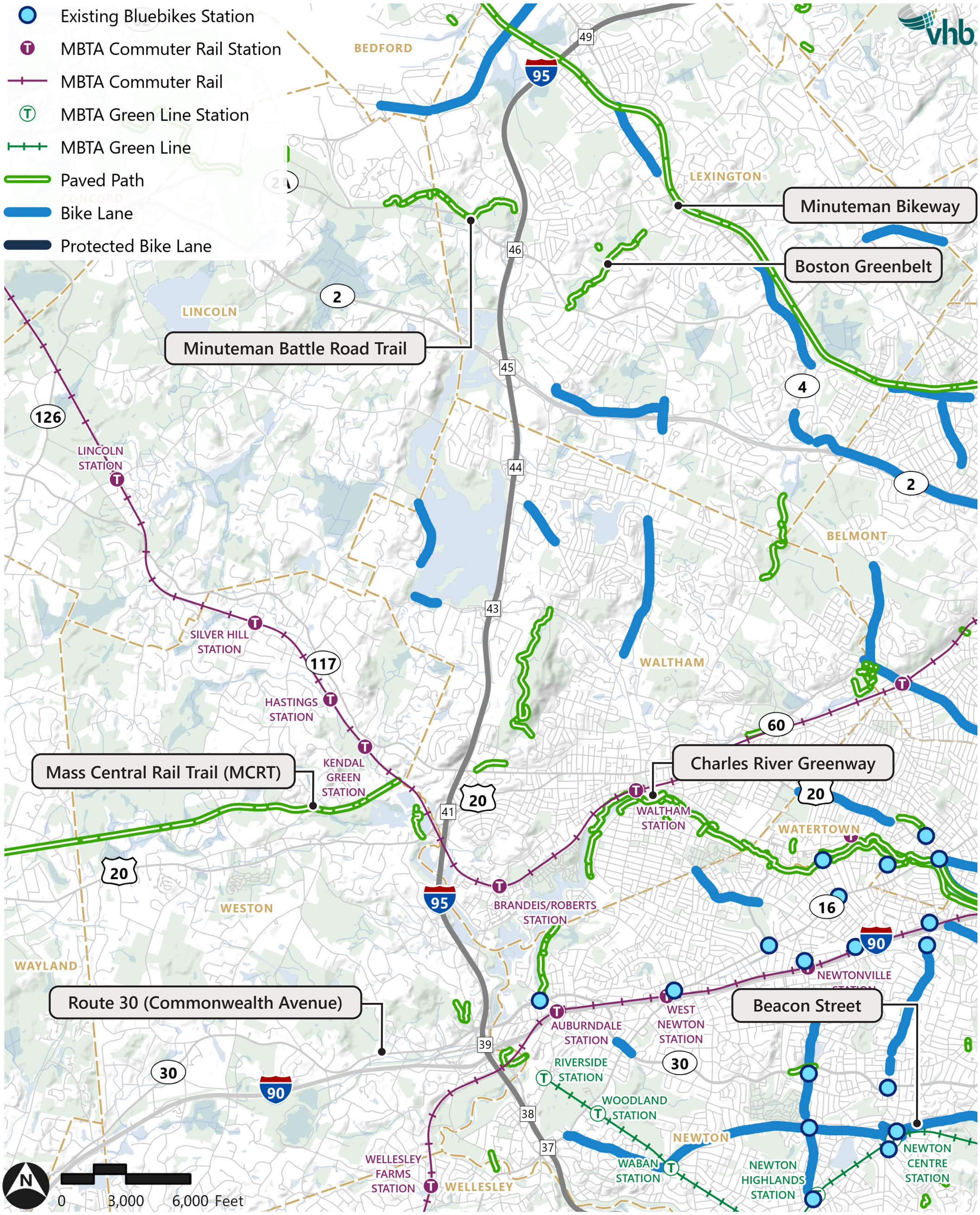
Active Transportation Facilities

There are a variety of existing recreational and commuter bicycle connections in proximity to the study corridor, but active transportation facilities within the corridor consist primarily of intermittent sidewalks for pedestrians and on-street striping/signage for bicycles. There are east/west separated active transportation corridors within/proximate to both the northern and southern ends of the study area, but there are few separated facilities in between making north-south connections challenging.

The section below details those facilities as identified and are shown graphically on Figure 2-23.

31 MBTA, RIDE Trip Picks by Month, October 2019.

Figure 2-23: Existing Active Transportation Facilities



Source: MassGIS, MassDOT, MAPC

- **Minuteman Bikeway** is an approximately 10-mile shared use path that runs east/west from Bedford to Alewife station in Cambridge. The bikeway passes approximately one mile northeast of the study area with connections from the study area to the bikeway currently limited to local roads with limited bicycle infrastructure (paint/signage) to accommodate cyclists. This bikeway is well-traveled by recreational and commuter cyclists and provides a car-free option to Boston via the MBTA's Red Line at Alewife station which offers secure bike parking on site.
- **Minuteman Battle Road Trail** located within the Minuteman National Historic Park in Lexington is primarily for recreational use but does provide an off-road travel option for pedestrians and cyclists between the intersection of Lexington Road and Old Bedford Road in Concord and the trailhead located at the Wood Street/Massachusetts Avenue intersection in Lexington, just northwest of the study area.
- **Boston Greenbelt** is located in Lexington running from Route 2A (Marrett Road) east to a recreation complex at Lexington High School approximately ½ mile from Lexington Center and a connection with the Minuteman Bikeway.
- **Mass Central Rail Trail** (MCRT) is a 104-mile corridor that stretches from Northampton to Boston. The ultimate goal for the corridor is a shared use path that will cover the entire length, but it is currently in varied condition with just over 50 miles complete. The planned corridor passes through the project study area between the Route 128/I-95 at Route 20 interchange (Exit 41) and the Route 117 overpass in Waltham. There is an approximately 7-mile portion of completed shared use path with paved surface starting at the commuter rail tracks less than a half mile from the Route 128/I-95 mainline that travels west into Wayland Center. Planning and design efforts to extend this trail further east toward/through Waltham are currently on-going with construction of the first phase over the commuter rail tracks to Jones Road expected to begin in 2023. The Mass Central Rail Trail provides a connection to the Bruce Freeman Rail Trail which provides a north south connection between Chelmsford and Sudbury.
- **Charles River Greenway** follows the Charles River from Waltham to downtown Boston. The western trailhead is located approximately one mile east of the study area at the Prospect Street Bridge in Waltham. This is a well-used commuter and recreational path that connects the suburbs to downtown commercial/office/institutional locations as well as recreational and cultural resources. There is currently no direct off-road connection to this facility from the corridor, but there are a number of on-road bike routes that provide access.

On-Road Bicycle Facilities

The study area roadways include various levels of bicycle accommodations, with some facilities recently implemented or improved to increase bicycle connectivity within the study area.

- **Route 30 (Commonwealth Ave)** is a critical east/west corridor that travels directly through the study area and the state and the Cities of Newton and Boston have made significant effort to improve the on-road bike facilities along this corridor. A segment of Route 30 west of I-90 is planned to be reconstructed to include a shared use path. East of I-90, a pedestrian/bicycle facility is in design for a section of the Commonwealth Avenue Carriage Road.

» **Beacon Street** is a major east/west corridor that runs through the southern end of the study area. The roadway does not provide separated bike facilities, but various bike facilities including bike lanes are incorporated throughout the stretch from Newton to downtown Boston.

Sidewalks

Generally, sidewalks exist along at least one side of the study area's east-west roadways. However, the condition of repair and usable width of the sidewalks varies greatly, as sections tend to be improved on a piecemeal basis, concurrent with the adjacent property redevelopment. The location of sidewalks (one versus both sides of the street) and crossings could be improved to align with pedestrian desire lines.

Service Facilities

Two service plazas exist within the study area; one located along Route 128/I-95 northbound in Lexington near the Route 2A interchange (Exit 46), and one located along Route 128/I-95 southbound in Newton between Grove Street (Exit 38) and Route 16 (Exit 37). The service plazas provide amenities for the traveling public including passenger vehicle and truck parking, gasoline, food options, and restrooms. The Lexington Service Plaza also provides electric vehicle chargers. Both plazas have a limited number of truck parking spaces, and demand often exceeds availability.

No other facilities, including park-and-ride lots, exist in the study area.

Safety

A detailed safety review was conducted to identify potential vehicle collision trends and/or roadway deficiencies within the study area. The safety review includes an analysis of recent crashes at study area intersections, a review of MassDOT's Highway Safety Improvement Program (HSIP) database, and a summary of recent road safety audits (RSAs) that have been conducted within the study area.

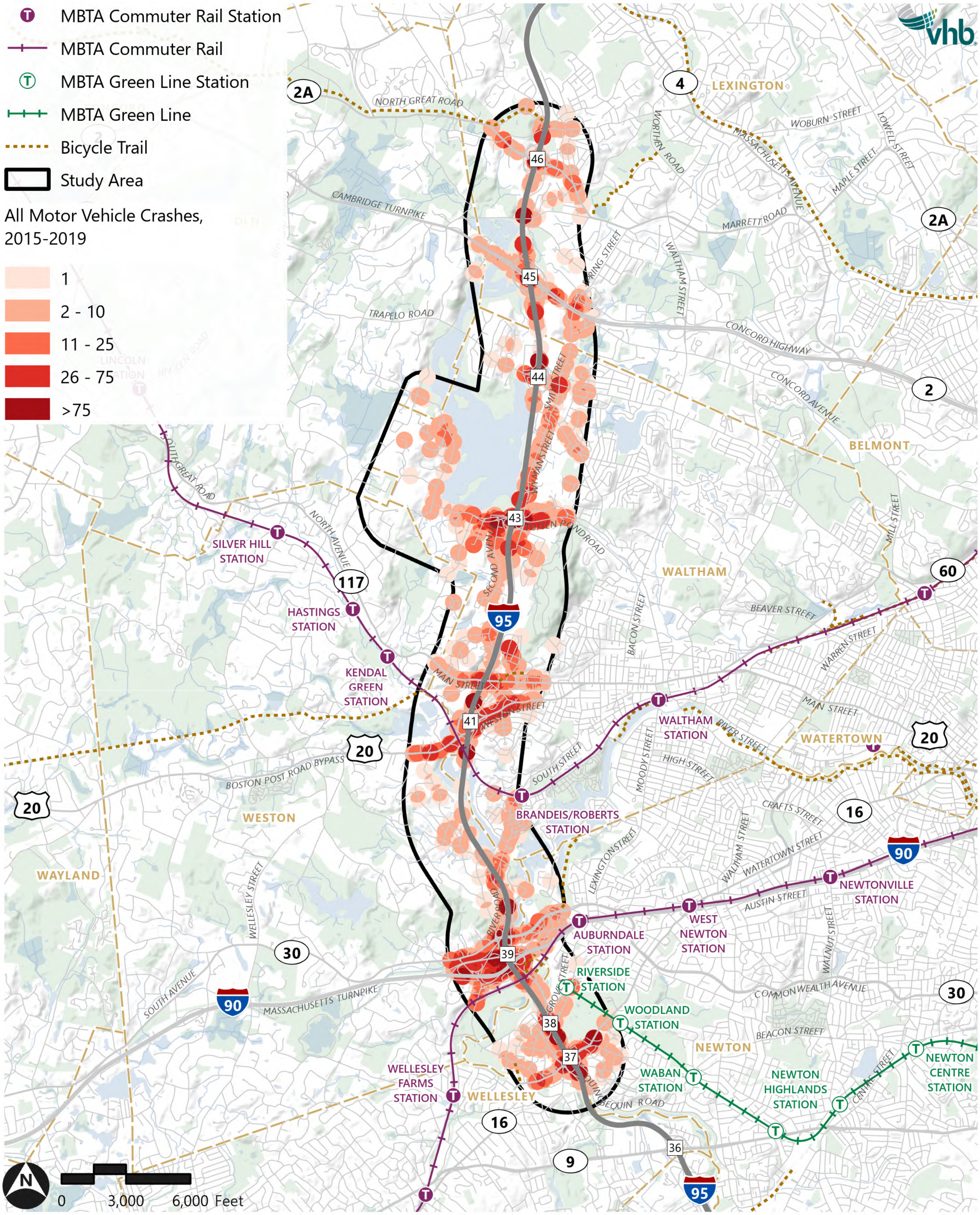
Intersection Crash Data

Vehicle crash data for the transportation study area intersections were obtained from MassDOT for the years 2015 to 2019. The MassDOT database is comprised of crash data from the Massachusetts Registry of Motor Vehicles (RMV). It should be noted that it while the database is intended to be comprehensive, it is possible that some crash records may not be included.

Overall Study Area

Crash data was reviewed for a one-half mile buffer from the Route 128/I-95 mainline over a five-year period (2015-2019) to understand relative geographic density of crashes (Figure 2-24).

Figure 2-24: Crash Data - Study Area



Source: MassGIS, MassDOT

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation_Figures_v3.aprx (adomogala, 4/6/2023)

As shown in Figure 2-24, crashes on Route 128/I-95 frequently occur near interchanges, which are influenced by entering and exiting traffic maneuvers. These locations include areas with closely spaced on- and off-ramps and are highly influenced by merging, diverging, and weaving vehicles. The highest concentrations of crashes are near the following interchanges:

- Route 16 (Exit 37 in Newton)
- I-90 (Exit 39 in Weston)
- Route 20 (Exit 41 in Waltham)
- Winter Street/Totten Pond Road (Exit 43 in Waltham)
- Between Route 2 (Exit 45 in Lexington) and Route 2A (Exit 46 in Lexington) in the northbound direction

More details on the crashes that occurred on the east-west roadways and at the study area intersections are provided in the section below.

Study Area Intersections

Crash data is often summarized by number of crashes and correlated with total intersection traffic volume to develop a crash rate. Crash rates are calculated based on the number of crashes at an intersection and the volume of traffic traveling through that intersection. Rates that exceed MassDOT's average for crashes at intersections (in the MassDOT District in which the town or city is located) could indicate safety or geometric issues for a particular intersection. For this study area, the calculated crash rates were compared to MassDOT's average for District 4 (Waltham, Lincoln, and Lexington) and District 6 (Newton and Weston).

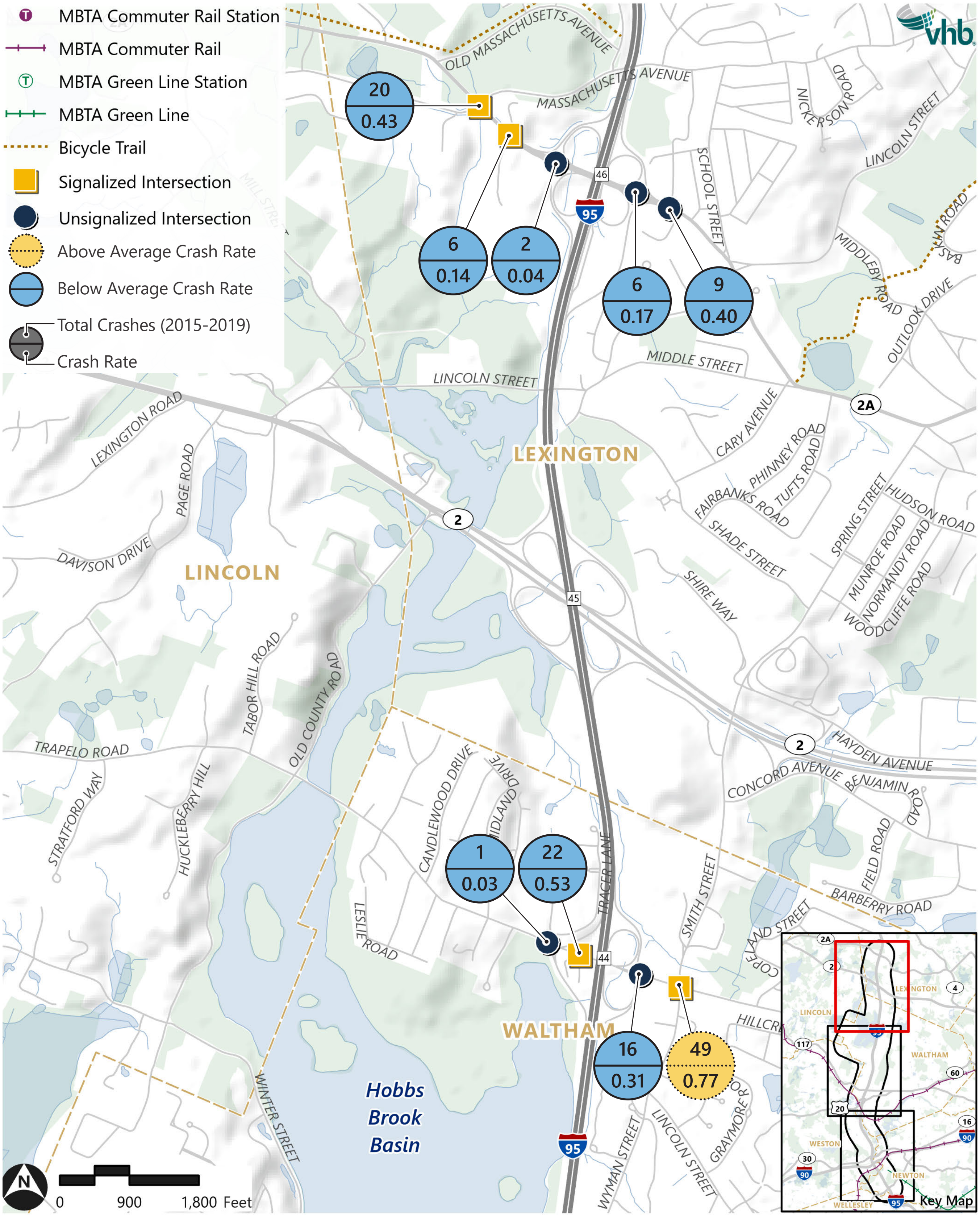
A summary of the total number of crashes, intersection crash rates, and whether the crash rate at each location is above or below the district average for each study area intersection is illustrated in Figure 2-25. The full study area crash history summary is provided in Appendix D for reference.

Study Area Intersection Crash Trends

- Five of the 42 study area intersections have crash rates higher than their district average
- The intersections with the highest crash rates are Route 30 at Route 128/I-95 SB Ramps/River Road and Park Road at Recreation Road in Newton
- No fatal crashes occurred at any of the study area intersections between 2015 and 2019
- The intersection of Trapelo Road at Smith Street had the highest number of crashes involving pedestrians and/or bicyclists, with four such crashes between 2015 and 2019

Figure 2-25a: Crash Data - Study Area Intersections

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

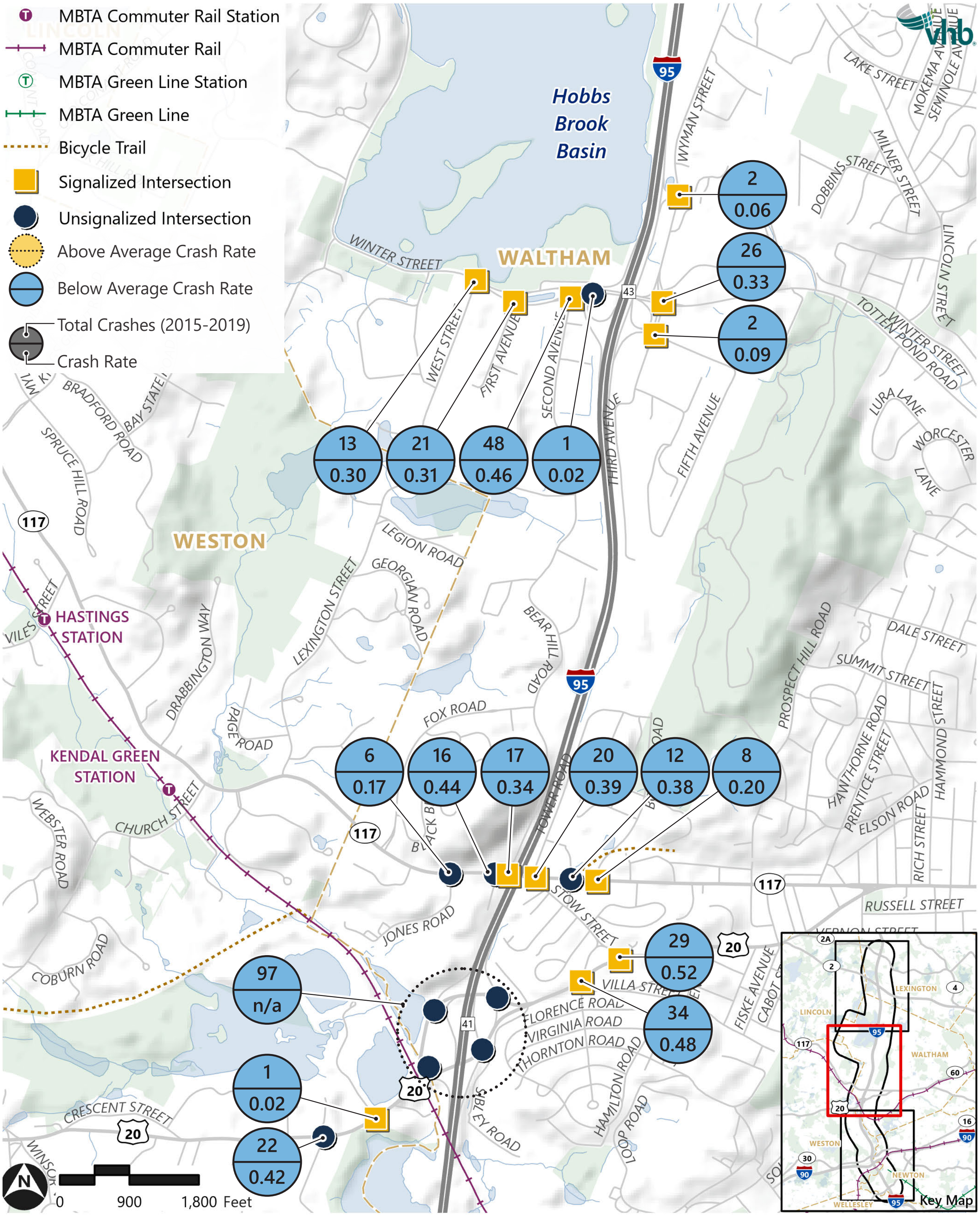


Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Crash_Rates.indd

Figure 2-25b: Crash Data - Study Area Intersections

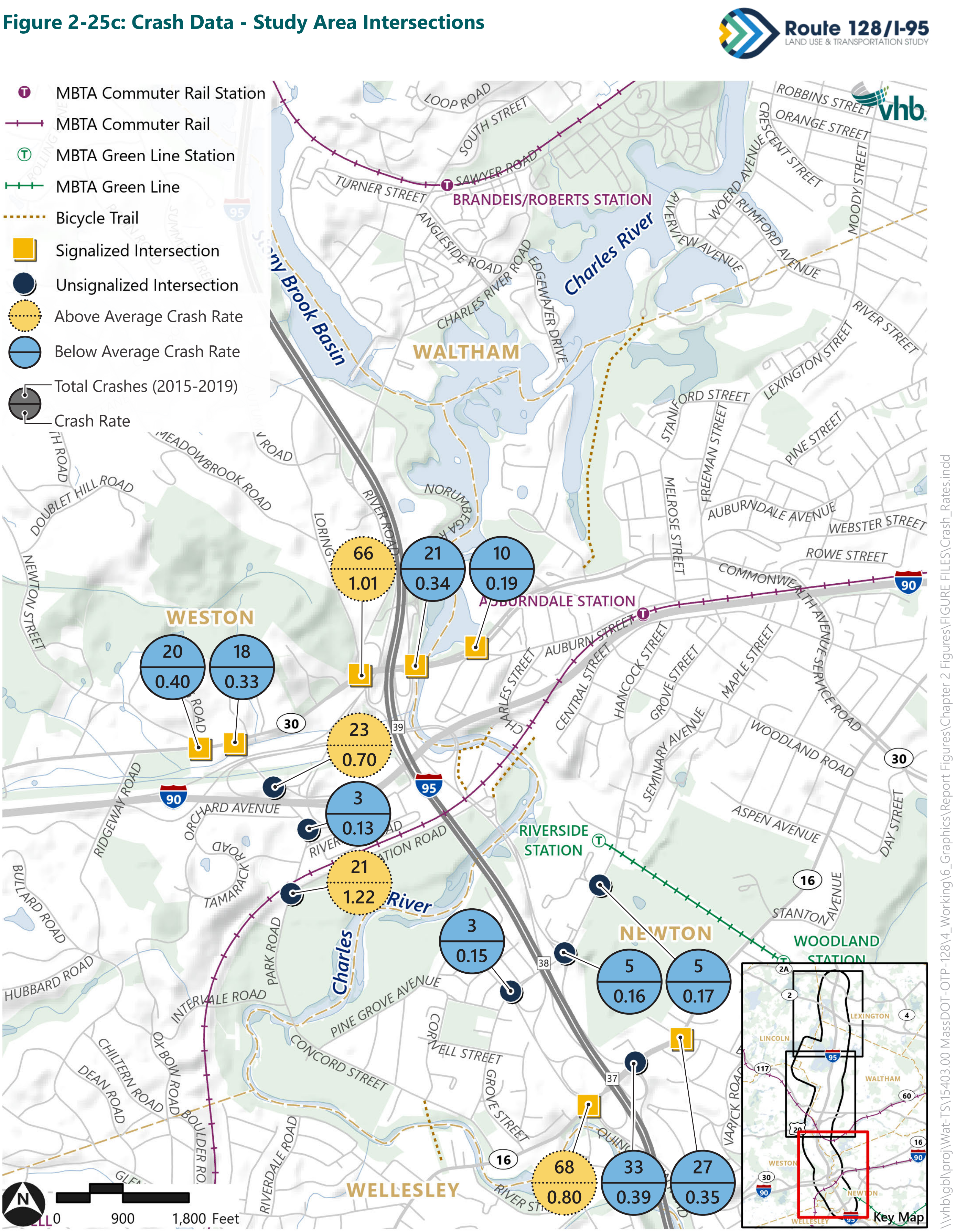
Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 2 Figures\FIGURE FILES\Crash_Rates.indd

Figure 2-25c: Crash Data - Study Area Intersections



Source: MassGIS

Highway Safety Improvement Program

In addition to calculating the crash rates, study area intersections were also reviewed in MassDOT's Highway Safety Improvement Program (HSIP) database. An HSIP-eligible cluster is one in which the total number of "equivalent property damage only "[32] crashes in the area is within the top five percent of all clusters in that region. A status of HSIP-eligible makes the location eligible for FHWA and MassDOT funds to address the identified safety issues at these locations.

The following intersections within the study area are potential 2017-2019 HSIP-eligible clusters:

- Route 30 at Route 128/I-95 SB Ramps/River Road (Weston)
- Route 16 at Beacon Street (Newton)
- Route 16 at Quinobequin Road (Newton)

No intersections within the study area were listed as 2010-2019 HSIP Pedestrian or Bicycle Clusters. However, outside of the study area, 2010-2019 HSIP Pedestrian or Bicycle Clusters can be found in Lexington at Lexington Center, in Waltham on Main Street (including the intersection of Route 20 at Route 117), Moody Street, and Lexington Street, and in Newton at West Newton, Newtonville, and Newton Centre.

Road Safety Audit Review

A road safety audit (RSA) is a formal safety review of a roadway or intersection. RSAs are generally conducted at HSIP locations to identify existing safety deficiencies and determine potential enhancements to improve safety at each location.

RSAs have previously been conducted at the following study area locations:

- Route 16 at Route 128/I-95 SB Ramps/Quinobequin Road, Route 128/I-95 NB Ramps, and Beacon Street (August 2019)
- Grove Street at Route 128/I-95 NB Ramps (August 2019)
- Route 128/I-95 NB at Exit 38 and Exit 39 (August 2019)
- Route 30 at Route 128/I-95 SB Ramps/River Road (August 2019)
- Route 20 Rotary at Route 128/I-95 (April 2017)
- Winter Street at 2nd Avenue, Route 128/I-95 SB Ramps, and 3rd Avenue/Wyman Street (April 2017)

Each RSA included a review of the most recent crash data[33], a discussion on potential safety deficiencies that may have contributed to the crashes, and identification of potential solutions that could be implemented to countermeasure each identified safety concern. The potential solutions

32 Equivalent property damage only" is a method of combining the number of crashes with the severity of the crashes based on a weighted scale. Crashes involving property damage only are reported at a minimal level of importance, while collisions involving personal injury (or fatalities) are weighted more heavily.

33 Since the RSAs in the study area were conducted between 2017 and 2019, the crash data used in each RSA to develop the potential safety solutions approximately corresponds to the study area crash data between 2015 and 2019 presented in this report.

range from short-term and low-cost measures, such as improving signage and pavement markings, to long-term and high-cost measures, such as realigning and reconstructing intersection approaches.

Several of the RSAs conducted in the study area have resulted in enhancements. For example, the RSA at the intersection of Winter Street at 3rd Avenue/Wyman Street was used to inform the design of the Route 128/I-95 NB Exit 43A (3rd Avenue) interchange reconstruction, completed in summer 2021. Similarly, the RSAs at the intersection of Grove Street at Route 128/I-95 NB Ramps and Route 20 Rotary at Route 128/I-95 are informing interchange improvements, currently in the design stage.

The documented safety deficiencies and the recommended enhancements reported in each safety audit will be used to inform alternatives development.

Risk-based Network Screening

MassDOT's IMPACT Safety Analysis Module was reviewed to identify risk sites within the study area and supplement the safety analysis presented above. MassDOT uses risk-based network screening to identify locations that can be improved to help reduce the numbers of fatal and serious injury crashes. The roadway network is screened based on 11 emphasis areas[34] and categorizes roadway segments as a primary or secondary risk sites[35]. Risk sites indicate areas where certain types of crashes are likely to have a higher chance of occurring due to road, traffic, and socioeconomic characteristics. Emphasis areas and identified risk sites pertinent to this study are discussed below and shown in Figures 2-26 to 2-28, comprising of:

» Bicycle Crashes
» Pedestrian Crashes
» Large Vehicle[36] Crashes

As shown in Figure 2-26 and 2-27, bicycle and pedestrian crash risk sites were identified along segments of Totten Pond Road, Route 117, and Route 20 within the study area. This may be attributable to the lack of formal bicycle accommodations and relatively high daily traffic volumes as summarized previously in Table 2-12.

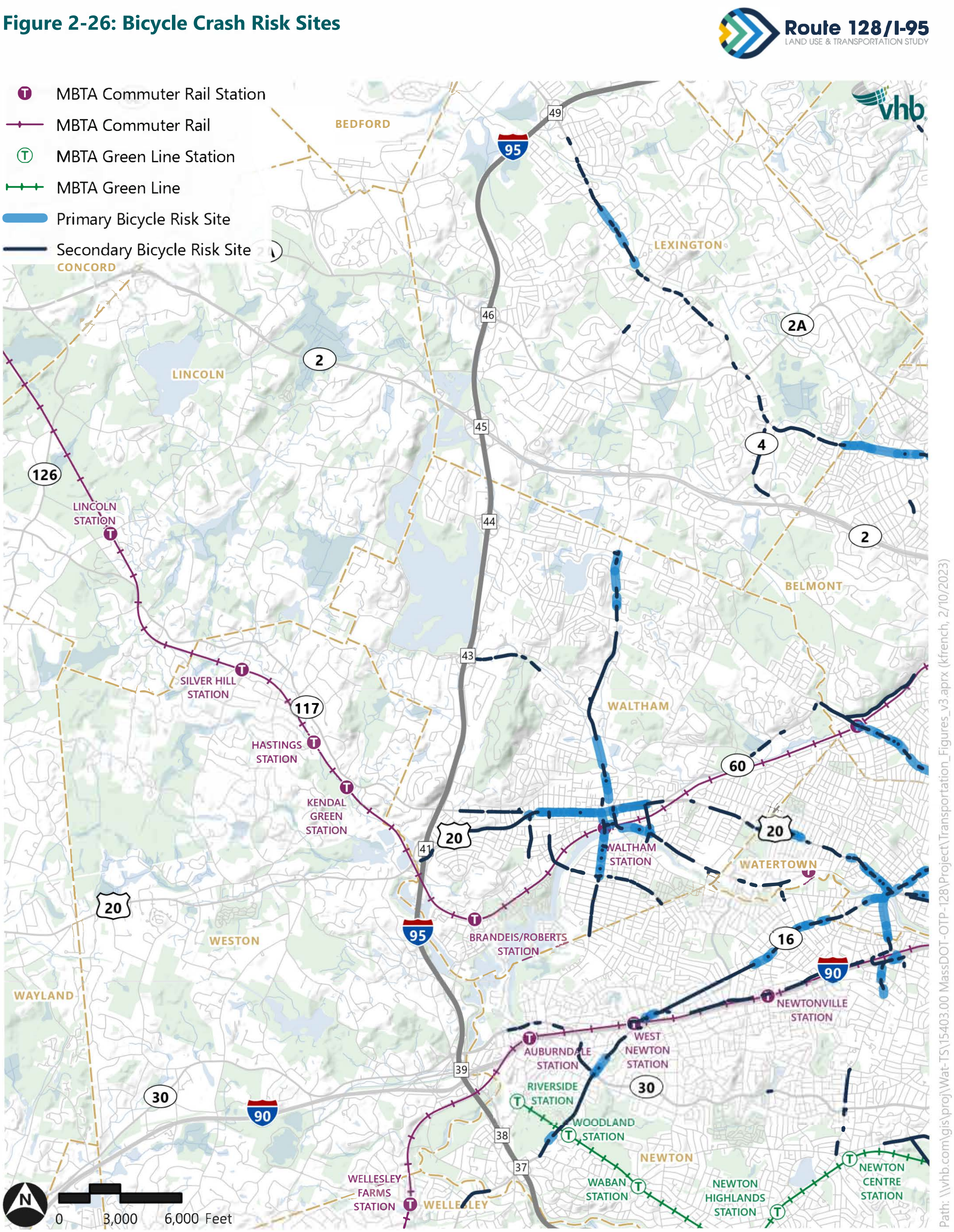
Risk sites for large vehicle crashes were identified along the regional roadways (Route 128/I-95 and I-90) within the study area as shown in Figure 2-28, which is likely attributable to high daily traffic volumes and regular congestion along the corridors. Those roadway segments identified as risk sites within the study area indicate a need for targeted safety improvements. During the alternatives development stage, these primary and secondary risk sites were considered.

34 The 11 emphasis areas included in MassDOT's risk-based network screening are bicycle crashes, distracted driving, impaired driving, large vehicle crashes, motorcycle crashes, pedestrian crashes, occupant protection (unbelted vehicle occupants), older drivers (65+), rural and urban roadway departures, speeding and aggressive driving, and young drivers (24 and under).

35 Risk sites are identified by first identifying contributing circumstances in fatal and serious injury crashes for the specific emphasis area (using crash data between 2013 and 2017) and second by assessing the impact of road, traffic, and socioeconomic characteristics on the probability of a fatal or serious injury crash on a given segment of road.

36 The MassDOT IMPACT Safety Analysis Reports indicate the large vehicles category is generally made up a buses, single unit trucks, and tractor trailers.

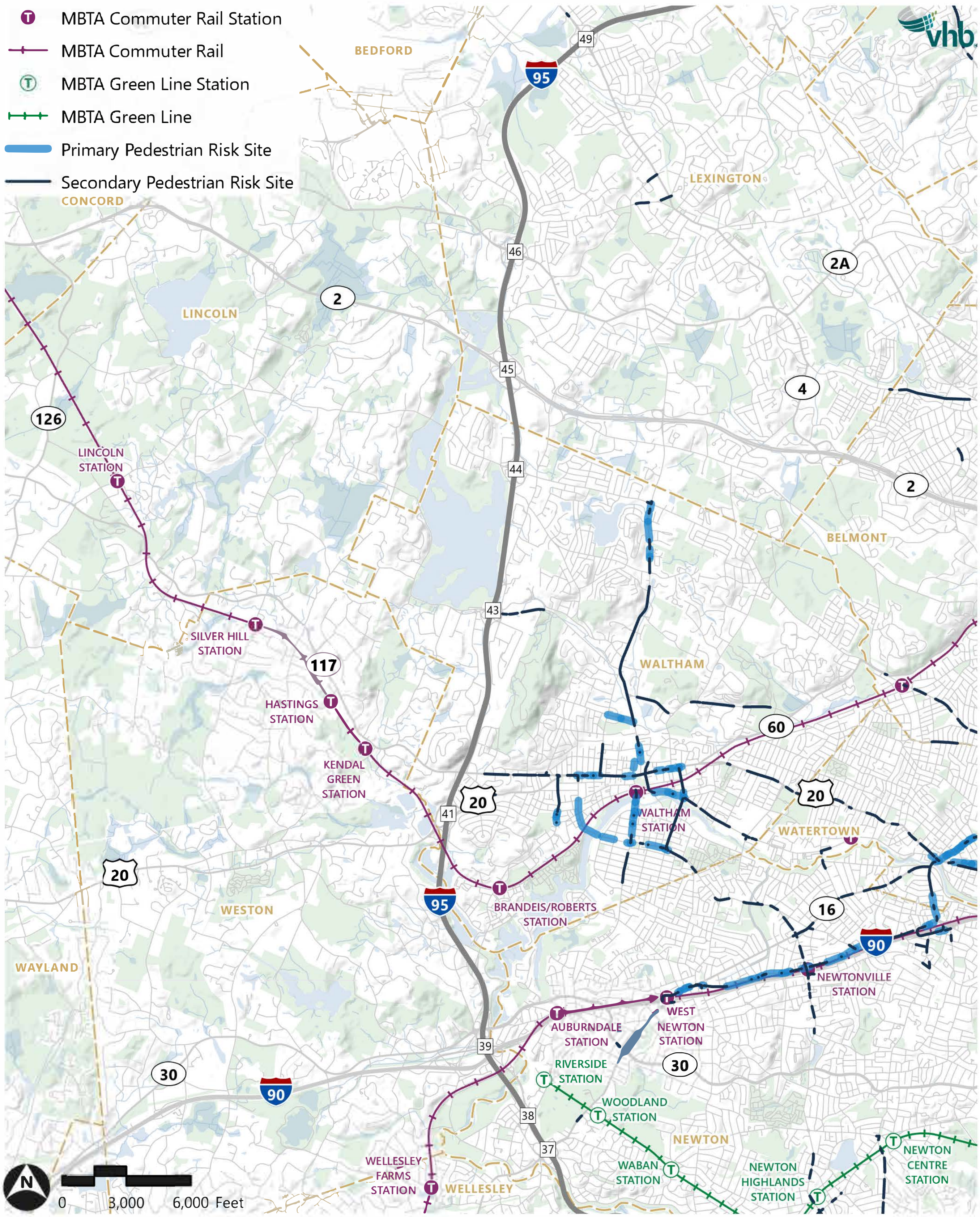
Figure 2-26: Bicycle Crash Risk Sites



Source: MassGIS, MassDOT, MAPC

Figure 2-27: Pedestrian Crash Risk Sites

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

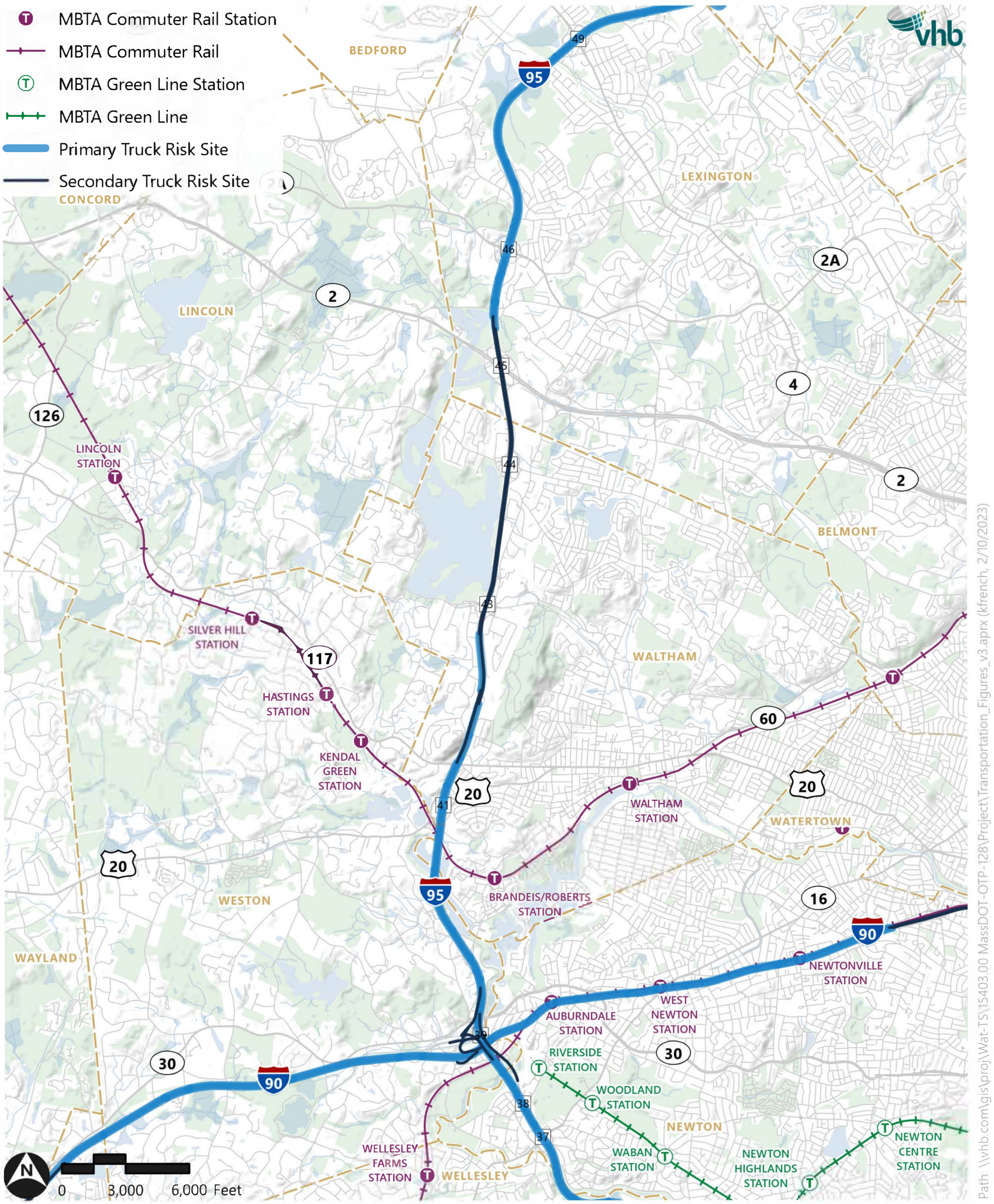


Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation_Figures_v3.aprx (kfrench, 2/10/2023)

Source: MassGIS, MassDOT, MAPC

Figure 2-28: Truck Crash Risk Sites

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, MAPC

Environmental Conditions

The study area contains a variety of environmental resources that are important to the health and quality of life of the intersecting municipalities and the region more broadly. The following sections provide an overview of these resources, including their regulatory implications as they pertain to natural resources, historic and archaeological resources, and oil and hazardous materials.

Any recommended improvement project within the study area requiring federal action such as approval, funding, or permitting by a federal agency, will need to comply with the National Environmental Policy Act (NEPA). Further, any project exceeding review thresholds of the Massachusetts Environmental Policy Act (MEPA) will be required to prepare and file an Environmental Notification Form (ENF) with the MEPA Office and may require an Environmental Impact Report (EIR) for review by the Secretary of Energy and Environmental Affairs.

Natural Resources

Any consideration for physical improvements along the Route 128/I-95 corridor in the study area requires an understanding of the existing natural resources. Such resources in the study area include wetlands, waterways, open space, and other resources influencing biodiversity. These resources are not only important to the environmental health of the area, but also create constraints that are subject to several federal and state regulations. Initial environmental resource mapping for the study area was developed primarily using Massachusetts Geographic Information System (MassGIS) data.

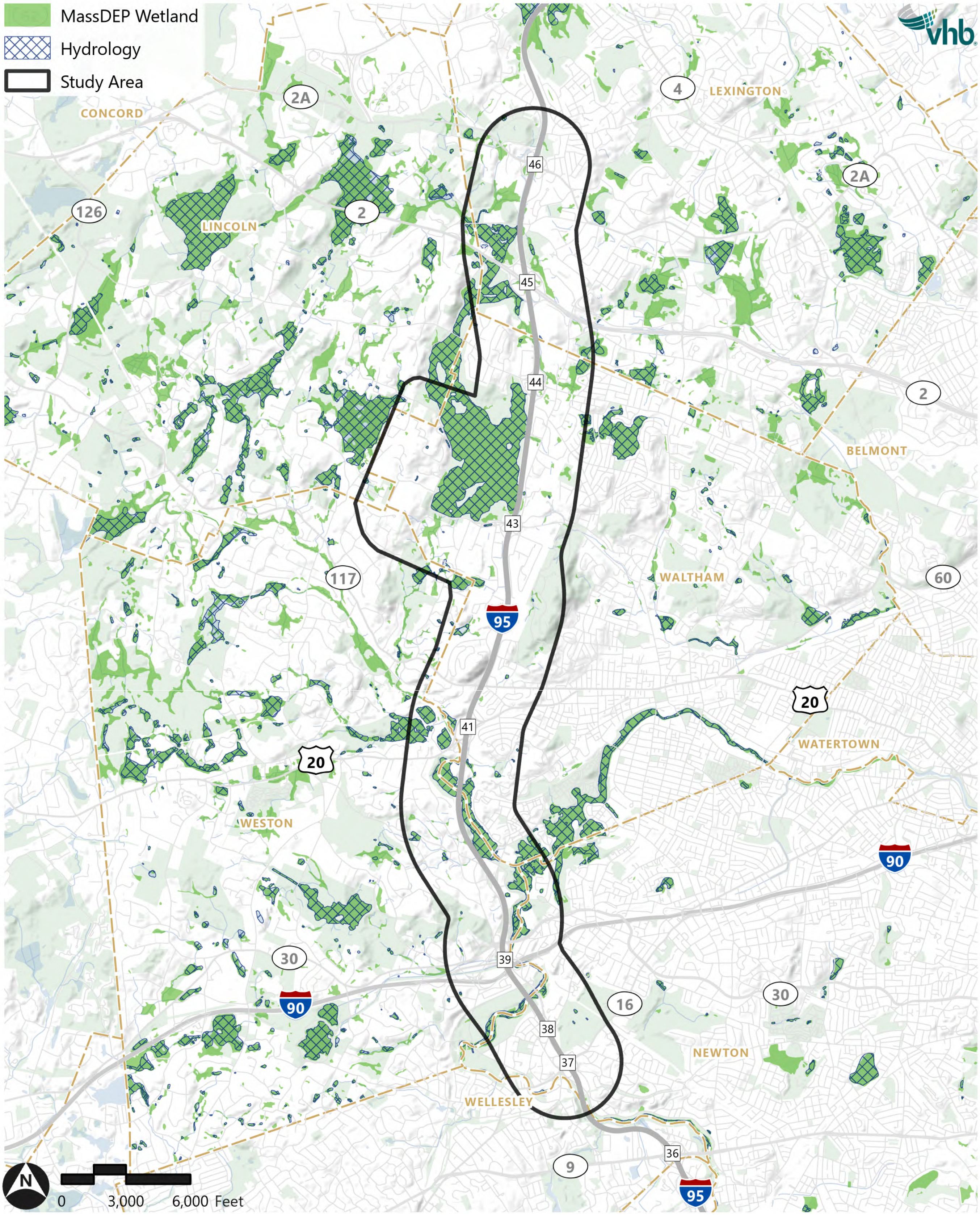
Wetlands and Waterways

As shown in Figure 2-29, wetlands and waterways in the study area include systems associated with the Charles River in Newton, Weston, and Waltham; Stony Brook in Waltham and Weston; and the Cambridge Reservoir in Waltham and Lexington. Wetland complexes in the study area include wooded swamps, emergent marshes, streams, open water ponds, floodplain, and floodways. The study area also contains eight stream crossings, including the Charles River in Newton and Weston; Seaverns Brook and Stony Brook in Weston; and several unnamed perennial and intermittent streams within the interstate highway layout and interchanges. Note that the MassGIS data layer for wetlands is not inclusive of all potentially jurisdictional areas; field delineations should be conducted wherever proposed work may require new land alterations.

Wetland resources in the study area are subject to regulation by the Massachusetts Wetlands Protection Act (WPA) and include Bordering Vegetated Wetland (BVW), Bank, Land Under Water Bodies and Waterways (LUWW), and Riverfront Area. The WPA establishes a 100-foot buffer zone from the limit of BVW and bank associated with these wetland systems. Additionally, the WPA establishes a 200-foot Riverfront Area from the limit of the mean annual high-water line of perennial streams and rivers. The wetland and water resources are also subject to federal jurisdiction pursuant to the Clean Water Act. All wetland resource areas in Lexington are also subject to jurisdiction of the Lexington Wetlands Protection Bylaw.

Figure 2-29: DEP Wetlands and USGS Streams and Waterways

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Environment_Figures.aprx (adomogala, 2/27/2023)

Source: MassGIS, MassDOT, USGS

Any alteration or loss of wetlands or waters will require review and approval from the Local Conservation Commissions, the Massachusetts Department of Environmental Protection (MassDEP), and the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act.

Floodplain

The study area crosses the Charles River and Stony Brook, including areas of adjacent floodplain as mapped by the Federal Emergency Management Agency (FEMA). Figure 2-30 presents the FEMA floodplain overview based on the latest Flood Insurance Rate Maps (FIRM) for the corridor. The 100-year floodplain is regulated by the WPA as Bordering Land Subject to Flooding (BLSF). Portions of Stony Brook within the study area supports a regulatory floodway. Any work in the floodway, including roadway modifications and culvert extensions would require a no-rise analysis pursuant to the FEMA National Flood Insurance Program (NFIP) to determine whether there will be an increase in flood heights.

Additionally, the Newton Floodplain Ordinance regulates all 100-year floodplain and floodways in Newton and establishes a 30-foot buffer zone around each area.

BioMap and Living Waters

BioMap2 is designed to guide strategic biodiversity conservation in Massachusetts by focusing land protection and stewardship on the areas that are most critical for ensuring the long-term persistence of rare and other native species and their habitats, exemplary natural municipalities, and a diversity of ecosystems. Natural Municipalities, Supporting Natural Landscapes, Core Habitat, and Living Waters data layers from MassGIS were reviewed for the study area.

Areas mapped for Species of Conservation Concern are located near the northern limits of the study area and along Totten Pond Road in Waltham. Aquatic Core habitat and associated buffers are mapped along the Charles River in Waltham, Weston, and Newton (Figure 2-31).

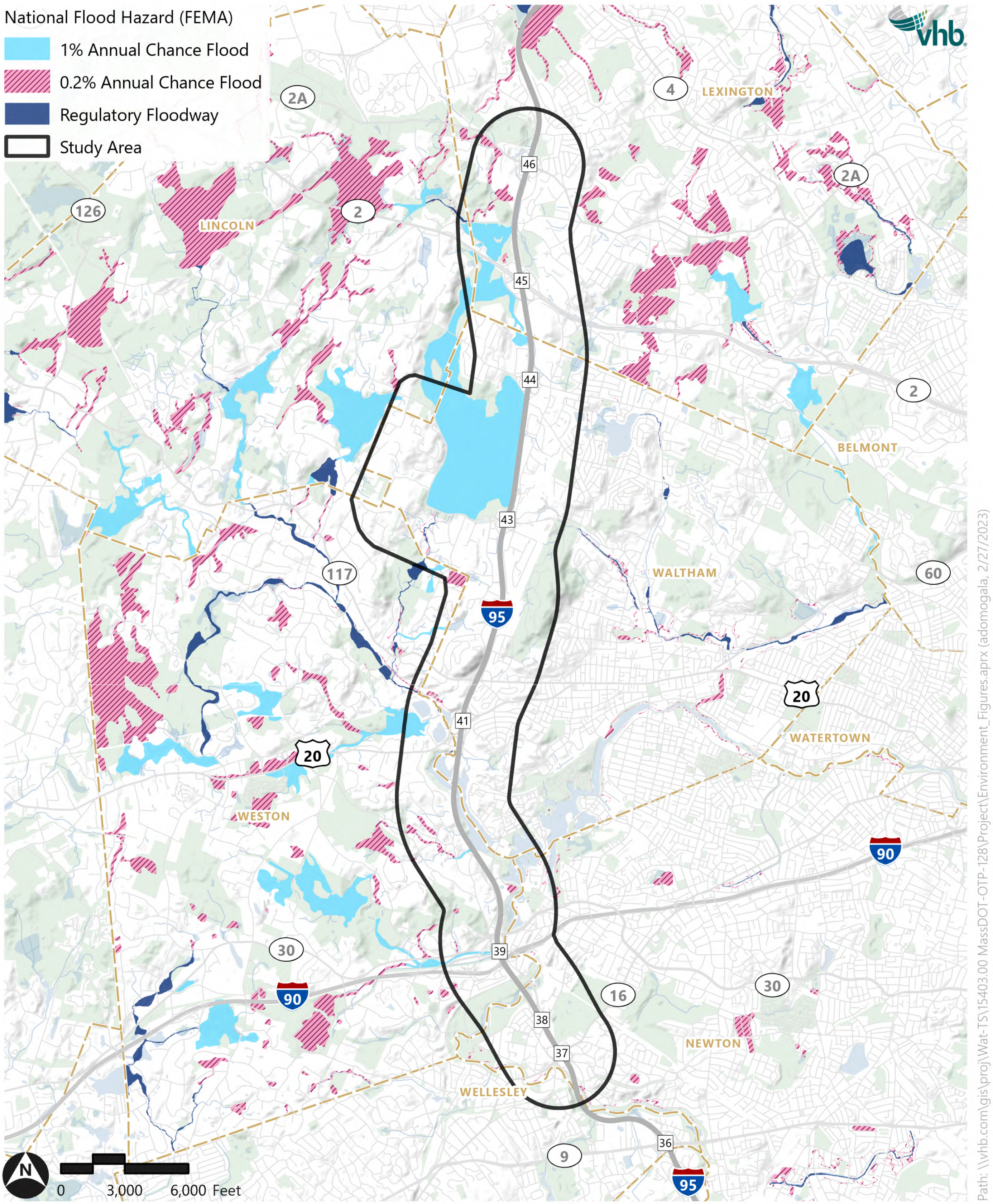
No Forest Core, Species of Conservation Concern, Vernal Pool Core, Upland Habitat to Support Coastal Adaptation, Landscape Blocks, or Foraging Habitat for Tern Species fall within the study area.

Critical Resources

Much of the study area is located within an Outstanding Resource Water (ORW) drainage area (i.e., the Stony Brook Reservoir) mapped as a contributing watershed for a public drinking water supply. ORW areas along the Route 128/I-95 corridor extend from near River Road in Weston to areas north of Exit 46 in Lexington (Figure 2-32). Any work resulting in a discharge of fill to a wetland, waterway, or waterbody within the limits of the ORW would require filing a Section 401 Water Quality Certification (WQC) with MassDEP.

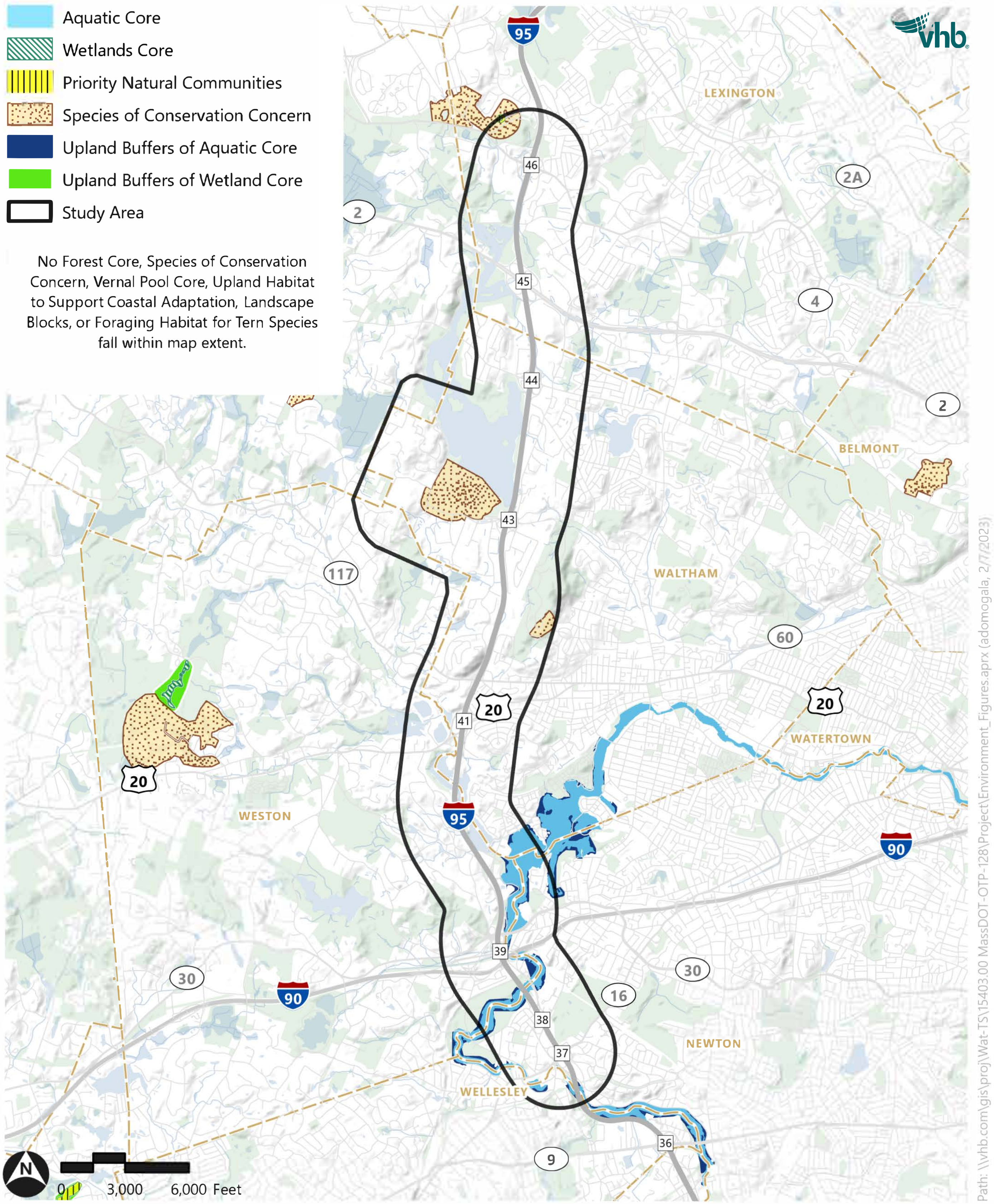
Wellhead protection areas (Zone II) are important for protecting water quality in areas that support public water supplies. Certain land uses may be prohibited or restricted in Zone IIs and aquifer areas and stormwater management measures are more stringent. A small portion of the study area in Lexington is within a MassDEP Approved Wellhead Protection Area (Zone II).

Figure 2-30: FEMA Floodplain and Floodway



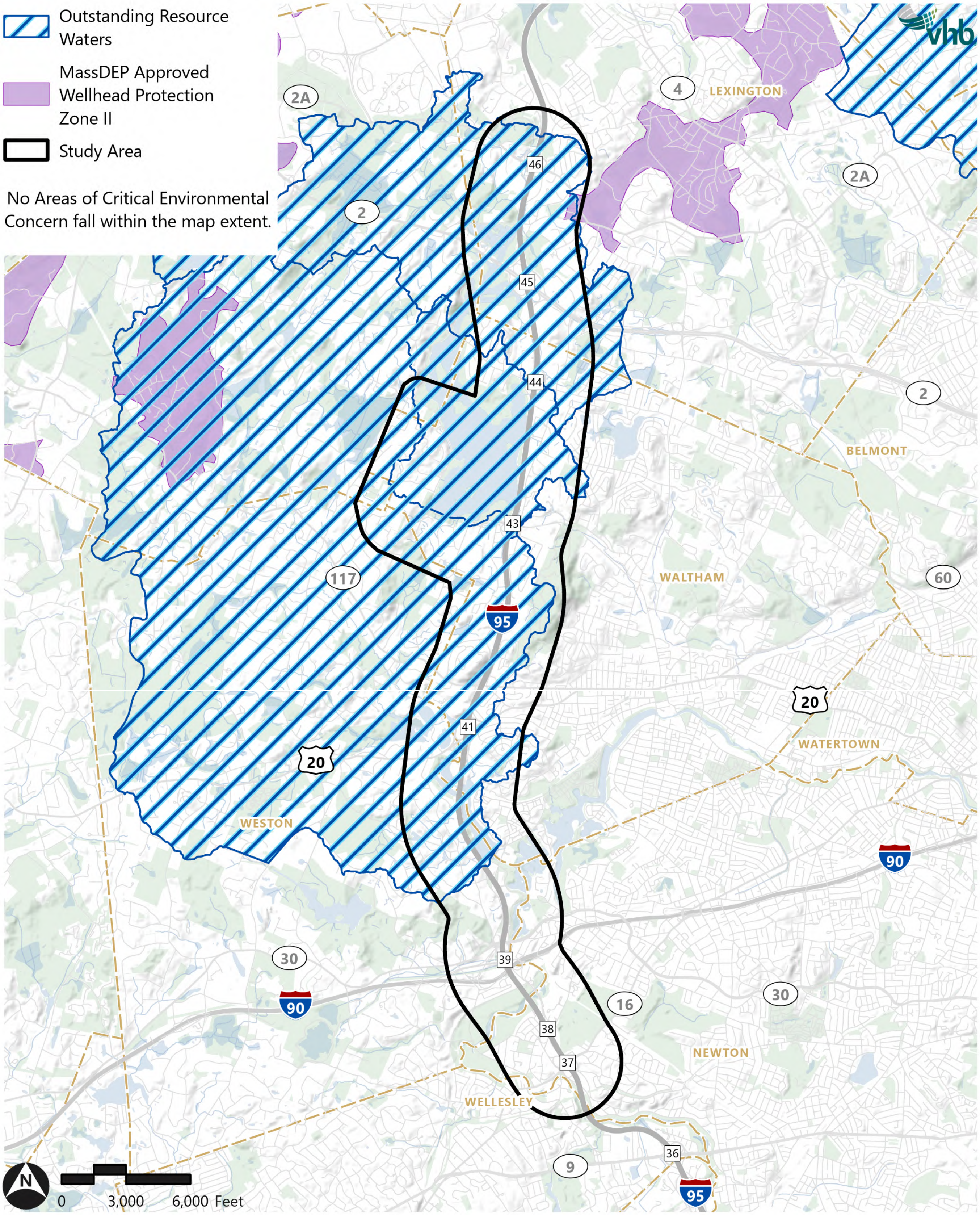
Source: MassGIS, MassDOT

Figure 2-31: BioMap2



Source: MassGIS, MassDOT

Figure 2-32: Critical Resources



Source: MassGIS, MassDOT

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Environment_Figures.aprx (adomogala, 2/27/2023)

An Area of Critical Environmental Concern (ACEC) is a place in Massachusetts that receives special recognition because of the quality, uniqueness, and significance of its natural and cultural resources. The Department of Conservation and Recreation (DCR) administers the ACEC Program. Designation of an ACEC increases environmental oversight by increasing state permitting standards through elevated performance standards and lowering thresholds for review. No portion of the study area is located within an ACEC.

Wildlife and Protected Species Habitat

Rare species are important for biodiversity and their habitats represent elements of an ecological system that are unique, limited, or in decline. Rare species and their habitats are protected by federal law under the U.S. Endangered Species Act (ESA) and state law under the Massachusetts Endangered Species Act (MESA), administered by the Division of Fisheries and Wildlife's (MassWildlife's) Natural Heritage and Endangered Species Program (NHESP). Under these programs, protections cover plants and animals, along with their critical habitats.

Northern long-eared bat (Myotis septentrionalis)
Source: USFWS

Federal protections for Threatened and Endangered Species are provided through the ESA, administered by the U.S. Fish and Wildlife Service (USFWS). According to the USFWS Information for Planning and Consultation (IPaC) online mapping tool, two federally listed species have the potential to occur in the study area including the Endangered[37] Northern long-eared bat (*Myotis septentrionalis*) and the candidate species the Monarch butterfly (*Danaus plexippus*). For any potential projects within the range of these species in the study area, coordination with USFWS under Section 7 of the ESA will be required to determine whether the project would jeopardize the continued existence of the species and to identify appropriate conservation measures to limit a take (50 CFR 402).

Monarch butterfly (Danaus plexippus)
Source: USFWS

NHESP is responsible for the conservation and protection of endangered, threatened, and species of special concern under MESA. According to the most recently published edition of the Massachusetts Natural Heritage Atlas (August 2021), there is one area

37 On November 29, 2022 the U.S. Fish and Wildlife Service published a final rule to reclassify the northern long-eared bat as endangered under the Endangered Species Act. Final rule is anticipated March 31, 2023.

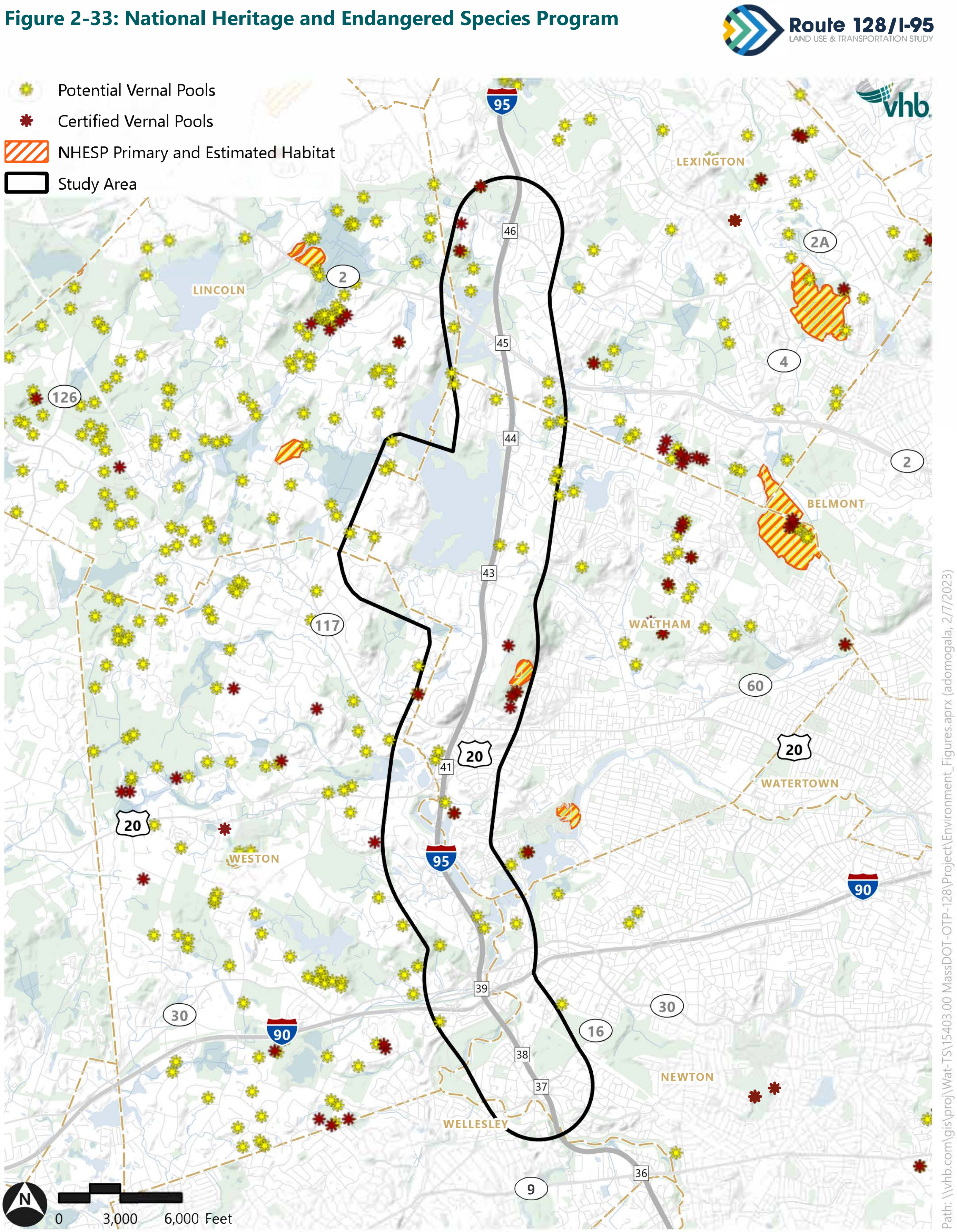
mapped as Priority Habitat of Rare Species (PH 1332) within the east portion of the study area in Waltham. No portion of the study area is within Estimated Habitat of Rare Wildlife. The Atlas also identifies nine certified vernal pools and 24 potential vernal pools located within the study area (Figure 2-33). Vernal pools have a higher level of protection as an ORW and generally require protection of an adjacent upland envelope.

Any potential project involving work within the Priority Habitat of Rare Species in the study area will require coordination with the NHESP pursuant to MESA. Should future projects be located within 100 feet of a Vernal Pool resource, additional studies may be needed, and avoidance and mitigation measures will need to be incorporated into the design.

Parkland and Open Space

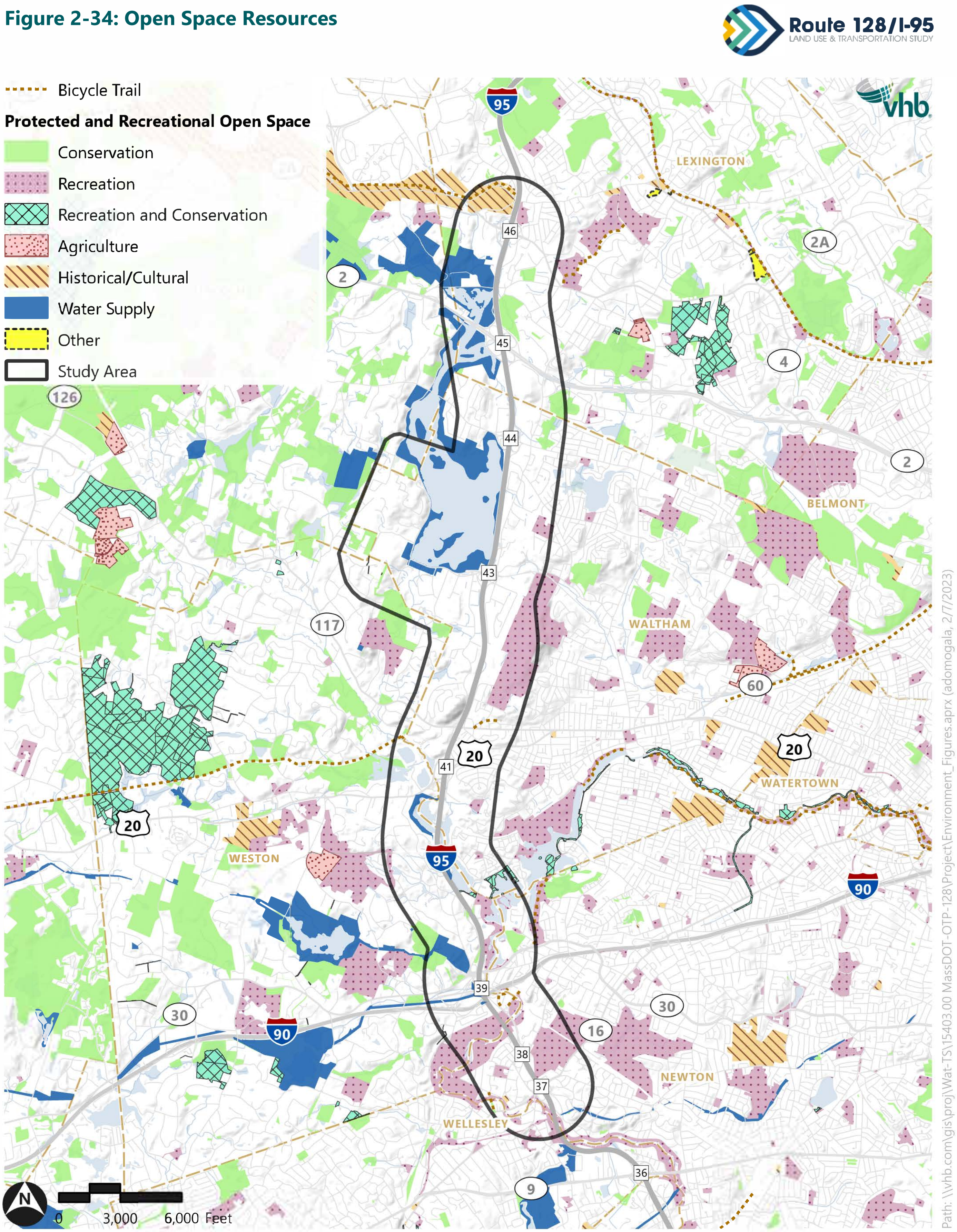
As shown in Figure 2-34 and Figure 2-35, several properties within the study area are regulated as protected open space parcels. These include municipally owned parks and conservation areas, state owned properties managed by the Massachusetts Department of Conservation and Recreation (DCR), water supply protection land, and the National Park Service (NPS)-owned and operated Minuteman National Historical Park in Lexington. Publicly owned open space may be protected at the federal level through Section 4(f) of the Department of Transportation Act or Section 6(f) of the Land and Water Conservation Fund Act. Further, several open space parcels along the corridor are subject to protection under Article 97 of the Amendments to the Constitution of the Commonwealth of Massachusetts, which aims to ensure lands acquired for conservation purposes are not converted to other inconsistent uses.

Figure 2-33: National Heritage and Endangered Species Program



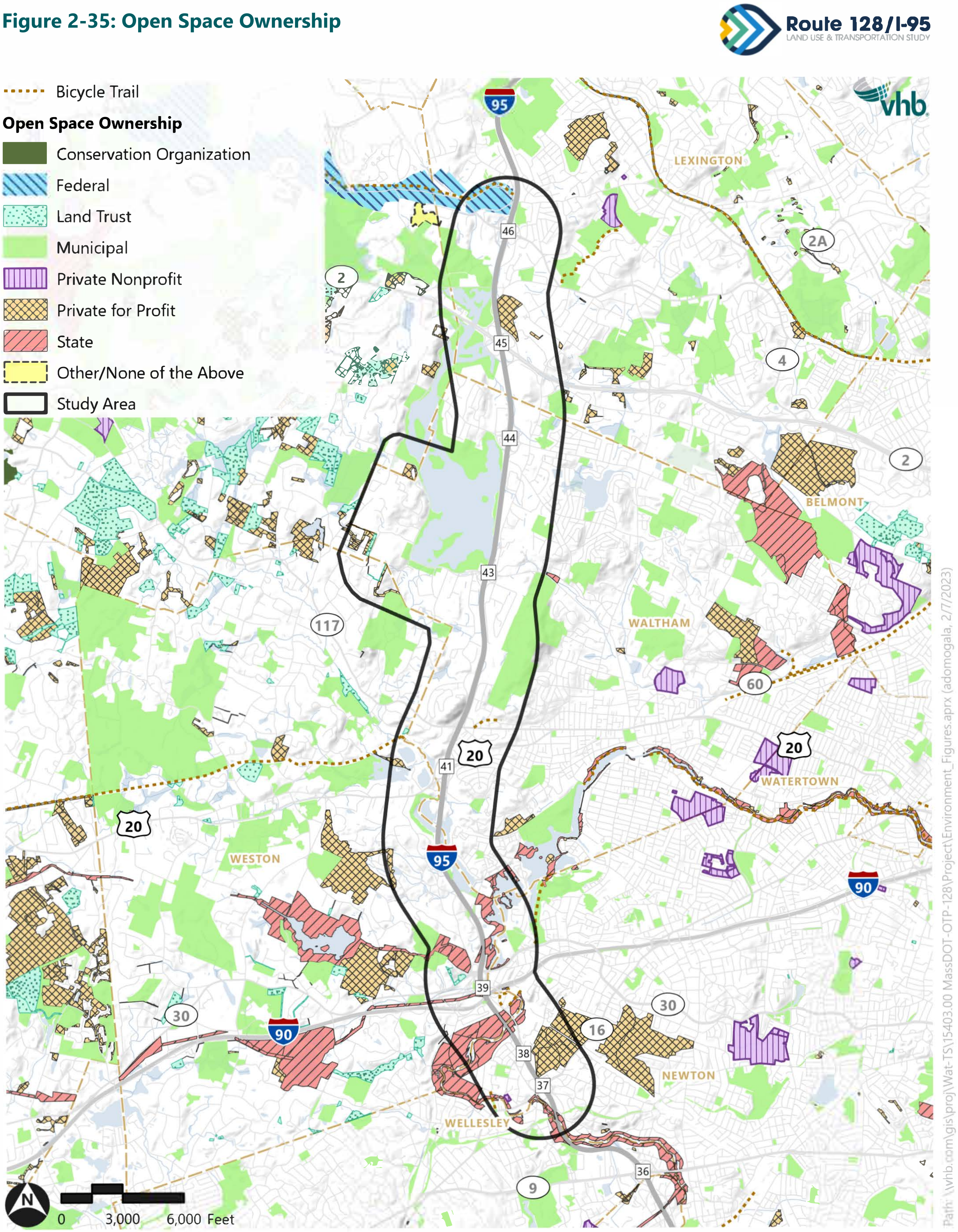
Source: MassGIS, MassDOT

Figure 2-34: Open Space Resources



Source: MassGIS, MassDOT

Figure 2-35: Open Space Ownership



Source: MassGIS, MassDOT

Historic and Archaeological Resources

A search of the Massachusetts Historical Commission's (MHC) Massachusetts Cultural Resource Information System (MACRIS) database and mapping tool was completed to identify aboveground and archaeological properties that have previously been recorded. The results are summarized in this section. The locations of archaeological sites are confidential and related information is restricted; therefore, while considered they are not included in the study area mapping.

Aboveground Properties

The Inventory includes properties that have local, state, and/or national historic designation, as well properties that have no current designation or eligibility evaluation on file. A property may be designated or inventoried as an individual historic resource or grouped together as an inventoried area or historic district comprising multiple properties. All the results from MACRIS, regardless of designation, as well as individually designated properties and properties within designated historic districts in the study area, are included in Appendix B. As shown, there 24 National Register-listed properties and eight National Historic Landmark properties in the study area. These include both individually listed properties and historic districts.

Archaeological Sites

There are 20 previously recorded archaeological sites shown within the study area in MACRIS; their locations are approximate. Six of the sites are identified as prehistoric sites, while the remaining 14 recorded sites are historic. Generally, the recorded historic sites are clustered at the north and south ends of the study area and the prehistoric sites occur more intermittently along the full length of the study area.

Hobbs Brook Basin Gate House, National Register of Historic Places, Individual Listing
Source: Cambridge Water Department

Saint Mary's Episcopal Church, Newton
Source: MACRIS

Oil and Hazardous Materials

VHB reviewed a third-party environmental database report provided by Environmental Risk Information Services (ERIS) for federal and state listed properties within the study area. According to the ERIS report, a total of six federally listed Environmental Protection Agency (EPA) Superfund Sites and 212 state listed disposal sites were identified. The presence of an EPA Superfund Site and a state-listed disposal site indicates that a release of oil and/or hazardous materials (OHM) has been reported to the EPA or MassDEP. The approximate locations of the state and federal environmental listings are depicted in Appendix B.

At the federal level, the Comprehensive Environmental Response, Compensation, and Liability Act (40 CFR 300) governs clean-up of uncontrolled or abandoned hazardous material sites, accidents, spills, and other emergency releases of pollutants and contaminants to the environment through the Superfund program. According to the ERIS report, the following six EPA Superfund Sites were identified within the study area:

- Former BLH Electronics, Waltham, EPA ID MAD081577959: EPA determined that no further federal action was required, and response actions were conducted per the Massachusetts Contingency Plan (MCP) under RTN 3-447. Regulatory closure was achieved under the MCP through the submittal of a Class A-2 RAO Statement.
- Hewlett Packard Company, Waltham, EPA ID MAN000103063: EPA determined that no further federal action was required, and response actions were conducted per the MCP under RTN 3-13311. Response actions are on-going.
- Fruehauf Factor Branch, Waltham, EPA ID MAD006009500: Not listed as a federal National Priority List site. No additional information provided.
- Polaroid Corporation, Waltham, EPA ID MAD001402320: Property formerly manufactured film, developer reagents, and other solvents. Federal cleanup activities are complete.
- DPW Auburndale Yard, Newton, EPA ID MAD980916258: EPA determined that no further federal action will be taken at this Superfund Site.
- Old Colony Petroleum, Waltham, EPA ID MAD981068158: Not listed as a federal National Priority List. No additional information provided.

At the state level, the management of hazardous substances and petroleum products when released into the environment is generally governed by the MCP per 310 CMR 40.0000. A summary of the state listed MassDEP disposal sites, along with a preassessment of their potential to impact environmental conditions within the study area is provided in Appendix B.

The remaining 49 state-listed disposal sites provided in the ERIS report achieved regulatory closure through either a Response Action Outcome (RAO) Statement without a classification or a closure designation from pre-1993 indicating that MassDEP determined that no further action was required. Although these disposal sites have all achieved regulatory closure in accordance with the MCP, they are conservatively assumed to impact environmental conditions within the study area.

3

Future Conditions and Issues, Opportunities, Constraints

This chapter introduces the 2040 land use scenario used to forecast transportation demands and includes a summary of the issues, opportunities, and constraints facing travelers as identified through stakeholder engagement.

Describing future transportation needs requires knowing how economic development initiatives and land use projects will influence and impact travel demands on transportation infrastructure. Much of the planned development along the Route 128/I-95 corridor has been defined through local and state permitting processes, but some development estimates are more speculative. Working closely with MassDOT and the study area municipalities, the project team identified a 2040 land use scenario on which to forecast transportation demands and test future transportation alternatives.

This chapter presents the study's future conditions in terms of future mobility and accessibility along this corridor, informed by what is known about planned and potential land uses and developments. This chapter includes a description of planned infrastructure improvements, land use forecasts, future traffic demand forecasts and operations, and a summary of the issues, opportunities, and constraints that residents, employees, and other stakeholders can expect along this corridor in the coming years.

Future Conditions Key Takeaways

- More than **6 million square feet (sf)** of space is either recently or expected to be constructed within the next several years within the study area, with most growth consisting of **laboratory and/or office space,** and approximately 90 percent will be clustered in **western Waltham.**
- An additional **1 million sf** of space, also clustered in **western Waltham,** is anticipated to begin the permitting process for redevelopment in the near future.
- Anticipated local and regional **land use growth will increase traffic demands** along the Route 128/I-95 corridor and at study area intersections – exacerbating **operational challenges**.
- Planned roadway and intersection improvements attempt to accommodate future growth but are designed within physical constraints and **cannot absorb the full pipeline of development**.
- There are **minimal significant transit investments** anticipated to directly benefit the study area.
- Planned improvements to the **active transportation network** improve east-west connectivity in places but still leaves **north-south gaps** in the network.

Reading Between the Lanes

The data and analyses indicate that in the future, extensive development is anticipated along this segment of Route 128/I-95, which is already a significant site of economic activity and employment. This study also suggests that the type of development anticipated will do little to ease the existing challenges and frustrations facing travelers.

The emphasis on commercial development - particularly laboratory space - and effective moratorium on high-density multi-family and market-rate housing will only exacerbate existing issues.

Transportation improvements, including upgrades to the active transportation and transit networks, may offer some relief and alternatives to single occupancy driving. However, without significant increases to local housing supply, these transportation improvements will have limited impacts on congestion and delay.

In short, mobility is already degraded and challenging for people traveling to and through the area and is projected to become far worse if current development trends continue into the future.

Planned Land Uses and Developments

There is a significant volume of development inventory in the project pipeline throughout the study area. More than six million square feet (sf) of space is recently or expected to be developed within the next several years, most of which will consist of laboratory and/or office space[38]. In addition to these known projects identified through formal state/local permit filings, MassDOT's Public/Private Development Unit (PPDU) identified additional relevant potential projects that are anticipated to

38 Estimated sf is based on communications with staff in the five municipalities in the study area.

formally file permitting documents soon. Table 3-1 presents a summary of the anticipated land use growth. Approximately 90 percent of this growth will be clustered in western Waltham, in the center of the study area as shown in Figure 3-1. Significant projects in the pipeline include the 1265 Main Street project in Waltham and the Riverside project in Newton. Both projects are large, mixed-use developments that will significantly increase the number of workers and, to a lesser degree, residents, in the study area.

In addition to the anticipated project listed in Table 3-1, there are several planned development projects immediately outside of the study area, including:

» One residential project in Weston: 751 Boston Post Road with 180 residential units[39]

» Four R&D projects in Lexington: 335,000 sf of R&D at 440 Bedford Street; 212,500 sf of R&D at 475 Bedford Street; 93,000 sf of R&D at 91 Hartwell Avenue; and 150,000 sf of R&D at Hanscom Air Force Base/Lincoln Labs

All anticipated projects within the study area are redevelopment projects, which means they will be built on previously developed properties, rather than vacant greenfield sites. This is largely due to the convenience and efficiency of developing parcels that are already serviced by utilities and located on easily accessible sites. However, several vacant properties exist within the study area, allowing opportunity for greenfield development should demand ultimately exceed the study area's redevelopment capacity.

The continued proliferation of laboratory facilities has been particularly transformative along the corridor, as developers seek to benefit from agglomeration economies[40] outside of more expensive opportunity areas like Boston's Seaport District or Kendall Square in Cambridge.

In addition to commercial development, the pipeline projects will include some multi-family housing, though minimal compared to the scale of nonresidential development. This includes 550 units in the Riverside development in Newton, 244 affordable units in the 241 2nd Avenue development in Waltham, and several hundred units in Weston. This degree of residential growth is notable, given that over the past twenty years, there has been no significant investment in multi-family development throughout the corridor.

39 The 518 South Avenue project in Weston consisting of 180 residential units was denied by the Zoning Board of Appeal in July 2022.

40 An agglomeration economy refers to a localized economy in which a large number of companies, services, and industries exist in close proximity to one another and benefit from the cost reductions and gains in efficiency that result from this proximity.

Table 3-1 Planned Study Area Developments

ID #	Address/Development	Municipality	Program	Status
1	Riverside Development (333 Grove Street)	Newton	370,000 sf office/R&D 550 residential units 22,000 sf retail (replacing 194-key hotel)	Proposed
2	15 Riverside Road	Weston	340,000 sf R&D (replacing 245,000 sf existing office)	Proposed
3	104 Boston Post Road[1]	Weston	150 residential units	Proposed
4	Jones Road/Green Street Potential Development	Waltham	~975,000 sf office	Not Currently Proposed[2]
5	1265 Main Street (Phase II)	Waltham	850,000 sf office 175,000 sf retail 150,000 sf fitness 300-key hotel 350 units residential (alternate)[3]	Proposed
6	110 Bear Hill Road	Waltham	375,000 sf of office	Proposed
7	21 Hickory Drive	Waltham	121,000 sf of office	Under Renovation
8	341 2nd Avenue	Waltham	244 residential units	Completed in 2022
9	231 2nd Avenue	Waltham	145,000 sf of office (replacing 120,000 sf existing office)	Proposed
10	300 3rd Avenue	Waltham	140,000 sf of office	Under Construction
11	180 3rd Avenue	Waltham	227,000 sf of office	Completed in 2022
12	Prospect Hill Executive Park/CityPoint Potential Redevelopment	Waltham	anticipated redevelopment of existing commercial office parcels to meet current market demands	Not Currently Proposed[2]
13	10 Sylvan Road	Waltham	440,000 sf of office	Proposed
14	910 Winter Street[4]	Waltham	805,000 sf of office	Proposed
15	225 Wyman Street	Waltham	500,000 sf of office (replacing 300,000 sf existing office)	Completed in 2022
16	95 & 99 Hayden Avenue (128 Spring Street)	Lexington	742,000 sf of office/R&D (replacing 416,400 sf existing office)	Proposed
17	400 Shire Way	Lexington	12,655 sf R&D	Under Construction

Sources: Study area municipalities, MassDOT's Public/Private Development Unit (PPDU), project submission documents.

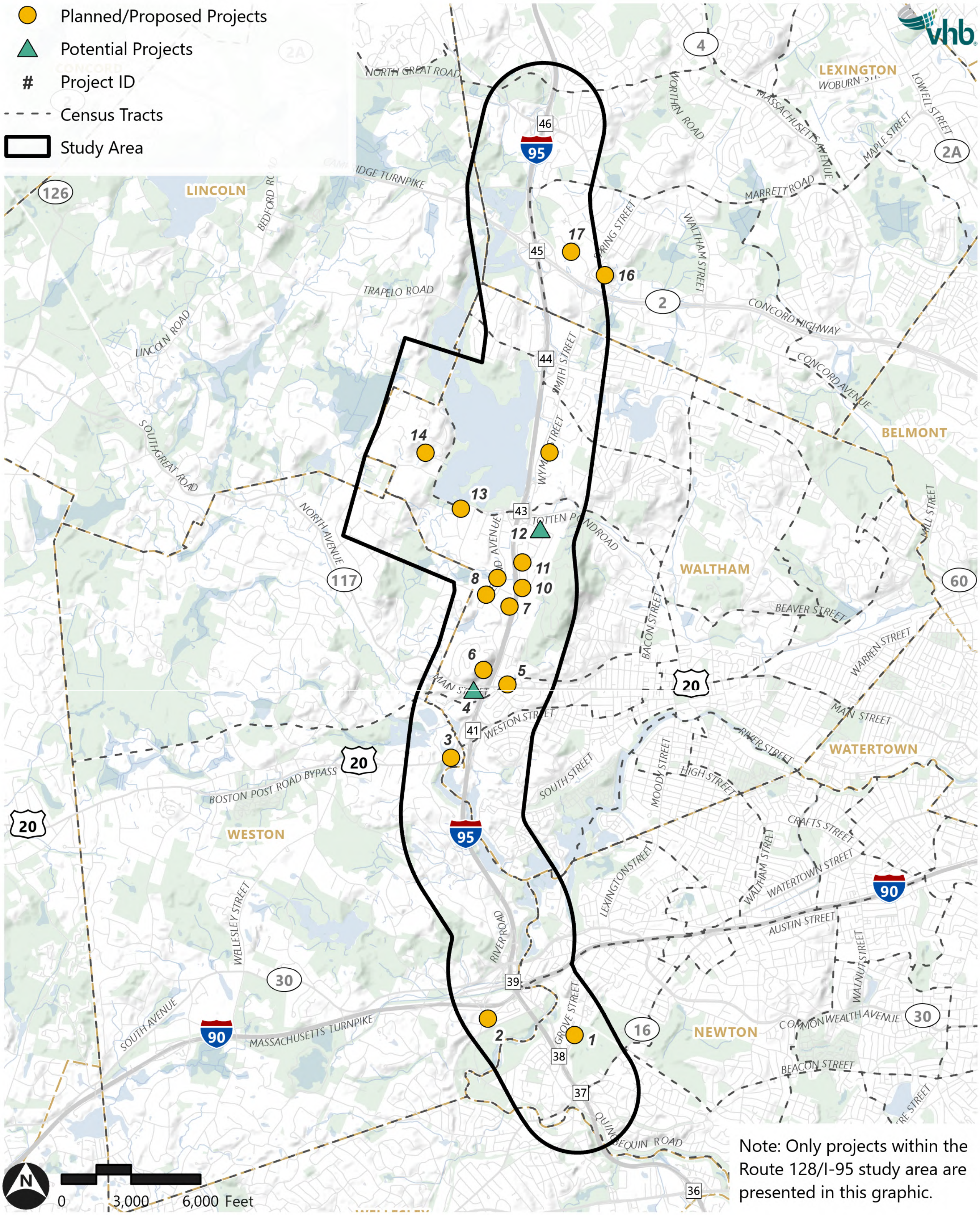
1 Project appeal pending at time of study publication.

2 Identified by MassDOT's PPDU as additional relevant potential project that has not formally filed a permitting document but are anticipated to do so in the near future.

3 The final 1265 Main Phase II development program can be increased by 25,000 sf of retail or an equivalent amount of square footage for another allowed land use with comparable trip generation levels if the potential future "alternative" 350-unit residential component is not included.

4 Overall master plan of the site includes up to 805,000 sf of office. 150,000 sf of this space was under construction at the time of this study.

Figure 3-1: Planned Study Area Developments



Note: Only projects within the Route 128/I-95 study area are presented in this graphic.

Source: MassGIS, MassDOT

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\CensusData\Route 128 Data Exploration_v2.aprx (adomogala, 4/6/2023)

In another shift from recent trends, some of the new units will be delivered within mixed-use development projects. In Waltham, 350 units of housing were considered for the 1265 Main Street project and approved through the MEPA process as an alternative to a portion of the office and/or retail development component. However, this alternative has not been approved by the City of Waltham at this time and therefore is not accounted for in the residential pipeline presented above.

Despite progress with some residential development proposals moving forward, many others have been rejected or are otherwise stalled. The study team explored the barriers to residential development in the corridor study area, including local resistance and restrictive zoning ordinances. This research was conducted in the form of focus groups, and key takeaways are summarized below.

Economic Conditions

Local and regional job market trends, housing and land use trends, and macroeconomic factors will continue to shape the Route 128/I-95 corridor:

» Job Market Trends and Constraints
  - Historical strong job growth is likely to continue as Boston's economy is also projected to continue growing, especially in Information and Business Services – a significant part of the Study Area's current job sector composition.[41]
  - These job growth trends may need to be tempered with the reality of hybrid work for some industries.[42]
  - Expanding retail and recreational amenities could make the Study Area more competitive with other laboratory "hot spots" such as the Seaport, Alewife, and East Cambridge.[43]

» Housing Trends and Constraints
  - Low housing production and increasing demand may constrain the Study Area's economic growth. While several new mixed-use developments currently in the pipeline will contribute more housing to the Study Area, they do not represent the scale of supply needed to reduce regional housing costs.

» Increasing Costs of Development
  - Inflation may impact construction and development over the near term. It is projected that the cost of financing projects will increase, which will weaken development prospects in the near term while slowing future growth in the medium and long term.

41 Denham, Barbara, "City Economic Forecast: Boston," Oxford Economics

42 Preparing for the Future of Work in The Commonwealth of Massachusetts, 2021

43 Szaniszlo, Marie. "Report: Amid COVID, demand for lab space surges, leading to higher rents," Boston Herald, December 7, 2021

Housing Focus Groups – Key Takeaways

The study team held targeted discussions with representatives from private developers, study area municipalities, and housing research/advocacy groups to understand factors influencing the limited residential development - especially multi-family housing - within the Route 128/I-95 study area towns. Several key takeaways emerged from these sessions, including the following:

- There is **significant unmet demand for new housing** throughout the corridor study area. The current need to import workers at a rate of over 7:1 to fill available jobs[1] will continue to grow stronger as more office and laboratory facilities are developed.
- Despite this, proposals to build residential facilities are often meet with strong community resistance. Reasons for the **community resistance** include perceived threats to fiscal conditions, growth in the number of school-aged children, and traffic impacts.
- This pushback, coupled with other barriers to entry including high construction costs and lengthy permitting requirements, has **discouraged several major developers** from even attempting to propose new housing.
- However, the **lack of housing inventory puts the corridor at risk**, making it more vulnerable to shifts in real estate market demand. It also puts more strain on traffic, exacerbates greenhouse gas emissions, and has a negative impact on public health.
- Housing advocates perceive the need to ensure that new housing is introduced and constructed in accordance with specific housing needs relating to unit type and size. For instance, smaller units are desirable in that they will place less pressure on schools.
- The State's **40B[2] affordable housing legislation has been helpful to a degree**; however, several focus group participants noted **shortcomings of the program**. The program's 10 percent Subsidized Housing Inventory (SHI)[3] requirement, for instance, is often regarded as arbitrarily low. Further, the 40B program allows for more affordable housing, and yet does little to support the growth of middle-income or market-rate housing.
- Others suggested that MassDOT could use state funding cycles, such as the MassWorks Infrastructure program or the new multi-family zoning requirement for MBTA communities, as leverage to encourage communities to embrace multi-family housing projects, or further - to reduce permitting requirements on proposed multi-family projects located on state roads.

1 U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

2 Chapter 40B is a state statute, which enables local Zoning Boards of Appeals to approve affordable housing developments under flexible rules if at least 20-25% of the units have long-term affordability restrictions.

3 Subsidized Housing Inventory (SHI) is used to measure a community's stock of low-or moderate-income housing for the purposes of M.G.L. Chapter 40B, the Comprehensive Permit Law.

Multi-Family Zoning Requirement for MBTA Communities

Enacted as part of the economic development bill in January 2021, Section 3A of M.G.L. c. 40A (the Zoning Act) requires that an MBTA community shall have at least one zoning district of reasonable size in which multi-family housing is permitted as of right and meets other criteria set forth in the statute[1]. All **five study area municipalities meet the definition of an "MBTA Community"** and are subject to this law. Newton is categorized as "Rapid Transit", Weston, Lincoln, and Waltham are categorized as "Commuter Rail", and Lexington is categorized as "Adjacent Community."

As such, each municipality is required to ensure that such zoning exists or perform an "up zoning" to come into compliance. In accordance with the program guidelines prepared by the Department of Housing and Community Development, the "reasonable size" required for each multi-family district is 50 acres, at minimum. Each district must be configured to accommodate a minimum number of multi-family units, an amount that is calculated for each MBTA community based on its current number of households and the level of MBTA service that exists there.

The required minimum multi-family unit capacities for the five study area municipalities are:

- Waltham: 3,982 units
- Newton: 8,330 units
- Lexington: 1,231 units
- Lincoln: 635 units
- Weston: 750 units

The Guidelines establish timelines for municipalities to adopt compliant zoning districts. There are two forms of compliance, district (or "full compliance") and interim compliance. Municipalities that fail to comply with this requirement would lose access to three sources of state funding: the Housing Choice Initiative, the Local Capital Project Fund, and the MassWorks infrastructure program. Further, non-compliant communities could be subject to legal action from developers seeking to build multi-family housing projects in proximity to transit hubs and meeting with community pushback.

All five municipalities have submitted an Action Plan to DHCD, outlining the strategy for addressing the requirement.. The next step for each municipality will be to submit a compliance application to DHCD. Newton will need to submit a compliance application by 12/31/2023 while Weston, Lincoln, Waltham, and Lexington will need to do so by 12/31/2024.

1 Multi-Family Zoning Requirement for MBTA Communities | Mass.gov

Travel Demand Forecasting

An important component of this study involves forecasting travel demands into the year 2040. These future conditions analyses are used to model the long-term transportation needs of the region and simulate future travel experiences. Ultimately, this study's infrastructure and policy recommendations will speak to those anticipated long-term needs, to ensure that decisions made today will provide benefits in the long term.

The 2040 forecast year is consistent with the Boston Region Metropolitan Planning Organization (MPO)'s Regional Transportation Plan (RTP) and the statewide travel demand model (CTPS model) maintained by the Central Transportation Planning Staff[44] (CTPS). In a regional travel demand model, traffic volumes and transit demand are forecasted through the lens of supply and demand[45]. Traffic Analysis Zones (TAZs) are defined to include areas of development that represent the demand. Figure 3-2 represents the TAZ for the project study area.

The household, population, and employment forecasts in the CTPS model were compared to data collected through outreach to study area municipalities and MassDOT. In addition, projected traffic volume growth from the CTPS model were compared to the anticipated volume of trips generated from planned projects. These comparisons found that the CTPS model is underestimating traffic volume growth at the Waltham-area interchanges of Wyman Street/Winter Street (Interchange 43), Route 117, and Route 20 (Interchange 41). To account for anticipated land use growth, a manual adjustment was applied to the CTPS projections to reflect known developments in western Waltham more fully in the Route 128/I-95 study area [46].

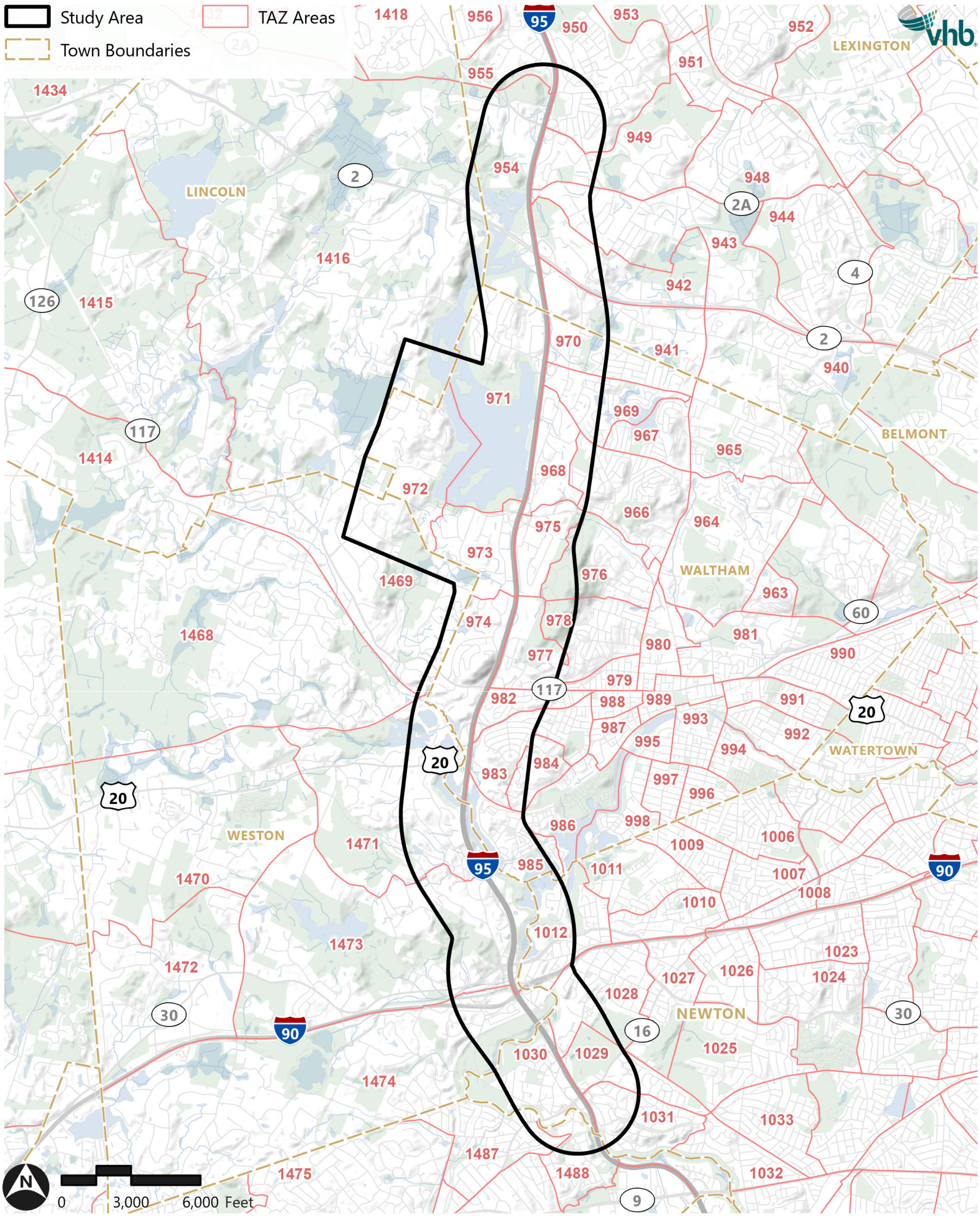
44 Central Transportation Planning Staff, or CTPS, are the technical staff for the Boston Region MPO.

45 The CTPS model forecasts vehicular and transit conditions in Massachusetts and is used to understand daily and peak period travel demands in both existing and future 2040 conditions. The model is implemented in the TransCAD software package and is based on the standard four-step transportation planning process of trip generation, trip distribution, mode choice, and trip assignment. The CTPS model relies on detailed TAZ-level socioeconomic and land use projections developed by the Metropolitan Area Planning Council (MAPC). The road network and transit system together represent the supply and includes highway and transit infrastructure projects included on the Boston Region MPO's Long-Range Transportation Plan (LRTP). MAPC and CTPS are currently developing land use scenarios for the 2050 LRTP which will likely consider development projects identified as part of this study. The final demographics ultimately adopted by the MPO may differ from the projections used here.

46 Reasons for this underestimation may include the timing of model projections relative to development proposals, and the need to maintain a regional balance in socioeconomic projection analysis.

Figure 3-2: Study Area Traffic Analysis Zones (TAZs)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, CTPS

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\IOC Figures.aprx (adomogala, 2/7/2023)

2040 CTPS Model Projections in Route 128/I-95 Study Area Municipalities

- Based on the CTPS regional travel demand model, it is expected that the number of **households will increase by 16 percent** and **employment levels will grow by four percent** by 2040.
- Route 128/I-95 traffic volume growth varies by peak period and direction, because of regional household and employment growth outside of and passing through the study area as well as the existing and future capacity of Route 128/I-95 and the surrounding roadway network:
  - Traffic volume is expected to increase by 13 percent in the Peak Direction[1] and increase by six percent in the Off-Peak Direction[2] by 2040.
- East-west corridors are projected to grow by an average of five percent in the weekday morning peak period and four percent in the weekday evening peak period.

1 Peak Direction is northbound in the weekday morning (6-9 AM) and southbound in the weekday evening (3-6 PM), as presented in Figure 2-11 in Chapter 2, *Existing Conditions*.
2 Off-Peak Direction is southbound in the weekday morning and northbound in the weekday evening.

Traffic Volumes

Initial output from the CTPS regional travel demand model were used as a basis to project traffic volume growth within the study area. A comparison was made between the CTPS regional travel demand model 2040 forecasted traffic volume growth and the anticipated site-generated volumes from the planned major developments (Table 3-1) at each study area interchange. Based on that comparison, the CTPS model generally accounts for the planned developments in Newton, Weston, Lincoln, and Lexington, but underestimates traffic volume growth anticipated in the Waltham area; therefore, additional steps were taken to account for site-specific growth in Waltham[47]:

» **Route 128/I-95 Background Growth:** Based on the CTPS projections and consultation with MassDOT OTP, the 2040 future Route 128/I-95 mainline and ramp volumes were developed by applying a growth rate of 13 percent northbound and 6 percent southbound in the weekday morning peak hour and a growth rate of 6 percent northbound and 13 percent southbound in the weekday evening peak hour, reflecting the anticipated peak direction and off-peak direction growth in traffic volumes along the corridor. The growth rate was applied to the Route 128/I-95 mainline northerly and southerly points and at the on- and off-ramps throughout the study area, with the exception of the Route 20 (Interchange 41) and Winter Street/Totten Pond Road (Interchange 43) in Waltham (as described below).

» **Intersection Background Growth:** For the study area intersections and east/west roadways, a growth rate of 5 percent in the weekday morning peak hour and 4 percent in the weekday evening peak hour were applied to account for local traffic growth based on CTPS projections.

» **Additional Waltham Growth:** To account for the planned development projects in the Waltham area, the site-specific project-generated volumes for projects in the Route 20 (Interchange 41), Route 117, and Winter Street/Totten Pond Road (Interchanged 43) areas were added to the

47 A memorandum providing additional detail on the traffic growth methodology is included in Appendix D.

roadway network. This includes traffic volumes from eight proposed projects and two additional relevant projects that are anticipated begin permitting soon. To account for other regional growth and limit overestimation of future volumes, the Route 128/I-95 mainline and at these locations were grown by one-third of the calculated background growth.

» **Final Adjustments:** After accounting for the background growth and site-specific developments in the Waltham area, final adjustments were made for volumes to balance volumes throughout the study area.

Figures 3-3 and 3-4 illustrate the resulting estimated change in traffic volumes on the Route 128/I-95 mainline between existing and 2040 future conditions during the weekday morning and weekday evening peak hours of 7:00 – 8:00 AM and 5:00 – 6:00 PM, respectively. As shown, significant growth is projected along the Route 128/I-95 corridor, with traffic volumes projected to increase between 6 percent and 30 percent by 2040 as a result of local and regional economic development and population, and the impact of planned development projects within the study area. **In both directions, the highest increase in traffic volumes is expected approaching Waltham during the weekday morning peak hour and departing Waltham during the weekday evening peak hour.**

2040 traffic volume networks for the Route 128/I-95 mainline and on- and off-ramps and study area intersections during the weekday morning and weekday evening peak hour (7:00 – 8:00 AM and 5:00 – 6:00 PM, respectively) are included in Appendix B.

Figure 3-3 Weekday AM Peak Hour Volumes Comparison on Route 128/I-95

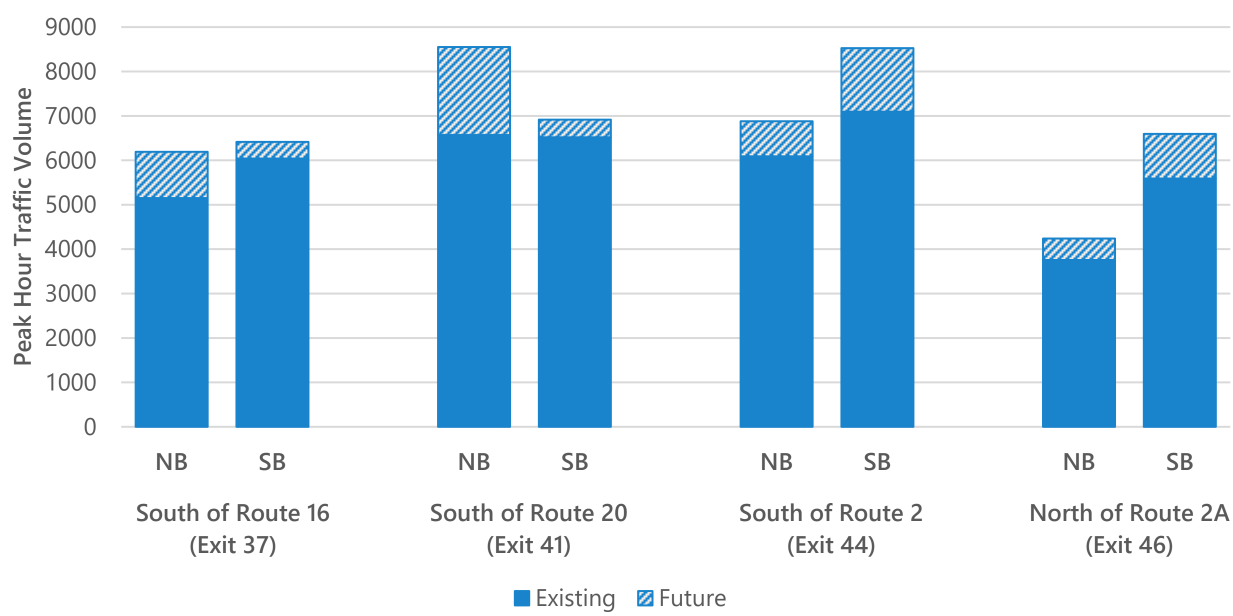
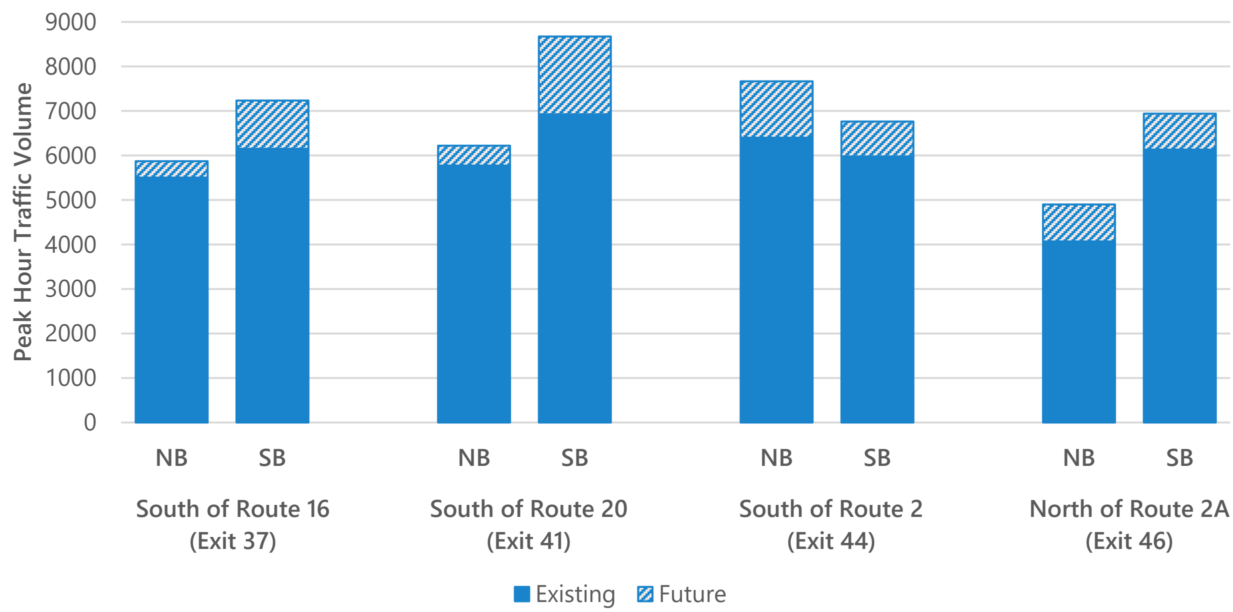


Figure 3-4 Weekday PM Peak Hour Volumes Comparison on Route 128/I-95



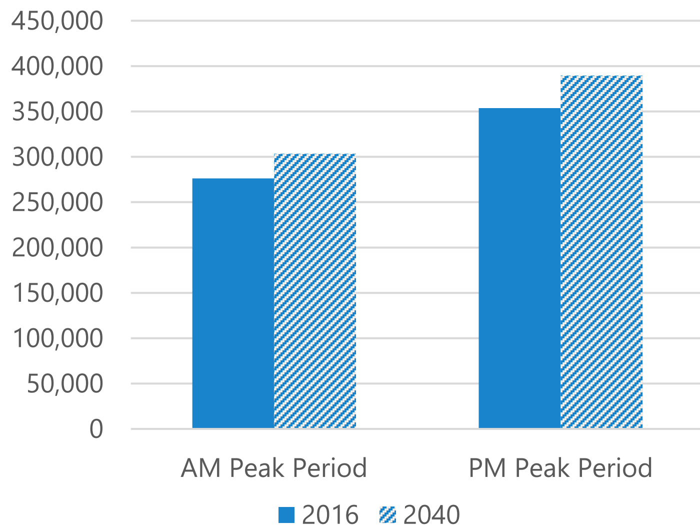
Note: Peak hours represent 7:00 – 8:00 AM and 4:00 – 5:00 PM, respectively. Additional details on the development of the Existing and Future peak hour traffic volumes are presented in supplemental memorandums included in Appendix D.

Person Trips

In addition to forecasting the growth of traffic demands on facilities within the study area, CTPS also estimated the growth in "trip ends" (also called person-trips) for study area TAZs. These are trips with an origin or destination within a given TAZ, categorized by mode. Based on the model output, total person-trips by all modes from/to the study area towns are projected to increase by approximately 9-10 percent by 2040 (Figure 3-5).

The model also indicates that the distribution of person trips among the study area municipalities is not projected to shift between the CTPS model base year of 2016 and the 2040 horizon year. This means that growth in transportation demands across the entire study area are projected to reflect current travel patterns. However, it is important to note that these projections are based on the land uses forecasted included in the CTPS model only, and do not reflect the known Waltham developments in the pipeline discussed earlier. To account for these developments, person-trips associated with the pipeline projects were estimated and added to the baseline 2040 projection. These results indicate approximately an additional four percent growth in peak period person trips as a result of the additional Waltham projects.

Figure 3-5 CTPS Projected Weekday Peak Period Total Person-Trip Growth



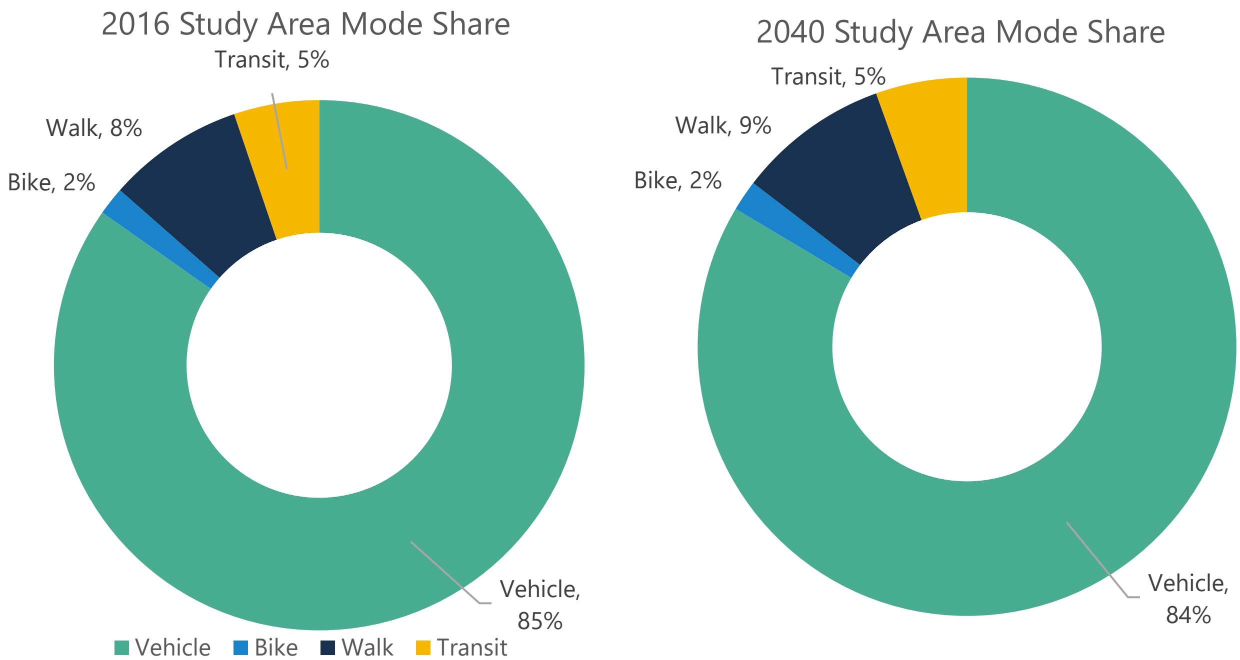
Source: CTPS Statewide Travel Demand Model; 2016 and 2040 weekday morning and evening peak period person trips in study area municipalities.
Note: Estimates based on CTPS model output and do not reflect additional Waltham pipeline developments.

Mode Share

The CTPS model further indicates that the mode share for study area trips would remain relatively constant between the base year of 2016 and 2040 (Figure 3-6). Namely, trips being made by various modes are projected to increase at a similar rate. This is generally expected given the existing dominance of vehicle-based trips and lack of significant planned investments in transit and active transportation facilities along the Route 128/I-95 corridor. Under both the base year and the 2040 future year, more than 8 out of 10 peak period trips are made in a private vehicle.

From a transit trip perspective, the most significant growth was projected in Newton, aligning with the availability of existing transit services to meet increased demand. Active transportation trip growth was also concentrated in Newton and southern Waltham, the densest portions of the study area with land uses amenable to shorter trips.

Figure 3-6 CTPS Weekday Peak Period Mode Share (2016 and 2040)



Source: CTPS Statewide Travel Demand Model; 2016 and 2040 weekday morning and evening peak period person trips in study area municipalities.

Factors Affecting Traffic Projections

The methodology to develop 2040 traffic projections follows standard industry practice and accounts for known conditions at the time of this report's publication. However, there are a series of interconnected factors that will impact the realization of these projections by the 2040 horizon year, including long-term impacts of the COVID-19 pandemic on land use, economic conditions, and transportation demand that are unknown at this time. The study team considered potential adjustments to the 2040 traffic volume projections to account for such factors, but opted to present analysis estimates described above, which are conservative. In reality, future conditions will be impacted by several factors:

- **Impact of Telework:** The shift towards increased teleworking, accelerated by the COVID-19 pandemic, is likely to have significant impacts on commute travel patterns. Massachusetts residents have indicated that they expect to telework more frequently in the post-pandemic future, which may result in fewer days spent commuting to a workplace, but longer distances traveled on a given commute day. Decreases in work miles traveled may also be tied to increases in nonwork miles traveled, with distinct differences in trip characteristics such as time of day, mode, and origins and destinations.

- **Employment Density Shifts:** Employers are considering their own space needs in the wake of the COVID-19 pandemic and the on-going prevalence of telework. It is unknown if the density of regional employment will remain as is, shift out of the urban core, or disperse to satellite offices throughout the region. These conditions will impact how travelers use the regional network, including and possibly especially Route 128/I-95 given the existing and anticipated future density of employment along the corridor.
- **Route 128/I-95 Mainline and Local Roadway Capacity:** There is limited capacity on Route 128/I-95 and demands on certain segments of the highway exceed this capacity during peak periods today. When trips cannot be accommodated on the highway, they either spill over onto adjacent roadways to find the quickest path or sit in traffic longer causing "peak periods" to extend. As traffic volumes increase in the future, these conditions are projected to worsen. Travelers may reconsider their home/work locations and employer flexibility to reduce the delay they experience. For employers, the ability for workers to access the study area is also critically important and worsening congestion could impact the continued commercial growth in the study area.
- **Housing:** The Greater Boston region is recognized as one of the most expensive housing markets in the United States and suffers from limited supply in the face of perpetual population growth, especially with respect to multi-family housing. Trends related to housing production and affordability underscore the ability of people to live close to their job sites, and ultimately influence the degree of traffic congestion and travel desire lines – acutely experienced within the Route 128/I-95 study area. The degree to which study area municipalities are able to add housing stock will impact the number of people who live and travel to the area.
- **State and Federal Policy:** Recent state policies related to zoning requirements for plots of land adjacent to rapid transit and commuter rail stations suggest that transit-oriented development may be a key development trend over the medium and long term, and federal legislation that emphasizes multimodal connectivity, transportation equity, and environmental sustainability will likely lead to significant investment in these areas at the same time. The exact nature of these policies and the responsiveness on the part of stakeholders will also impact travel trends, behaviors, operations, and infrastructure over the study forecast horizon.
- **Peak Spreading:** As discussed in the Existing Conditions chapter, the land use growth along the corridor in recent years has led to "peak spreading" – the lengthening of the typical weekday morning and evening commuter peak periods and wide variability in travel times resulting in unreliability for travelers. With the significant amount of planned development and continued high auto mode-share projected, these trends are expected to continue further exacerbating operational concerns on both the regional and local roadway system.

Building a Flexible Plan for Route 128/I-95

The factors above underscore the need for a flexible plan for Route 128/I-95 that can respond to a variety of future outcomes. It is important to consider that MassDOT is one piece of the puzzle to implement this plan. Decisions and trends at the local, regional, statewide, and federal levels are equally as important and building a successful plan will also include clear project champions and milestones for implementation understood by all.

Anticipating Future Transportation Conditions

Building off the predicted changes in land use throughout the study area and travel demand modeling projections outlined above, this section describes anticipated future transportation conditions for vehicles, transit, pedestrians, and bicyclists.

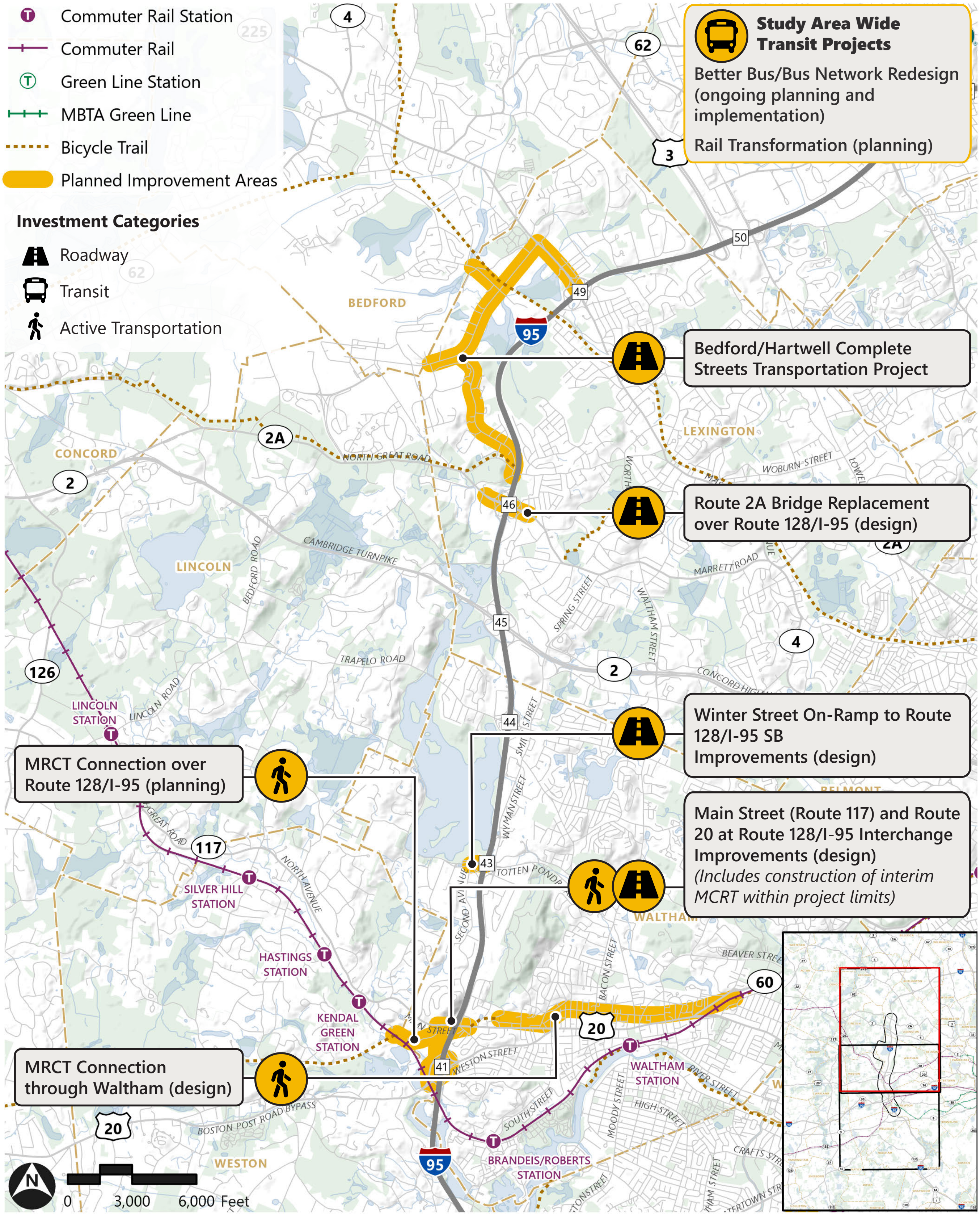
Roadways and Intersections

Planned Infrastructure Improvements

Prior to identifying and evaluating a range of multimodal transportation alternatives to address both the existing and forecasted transportation needs of the study area, it is important to consider projects currently planned and committed to be constructed by public and private sector entities.

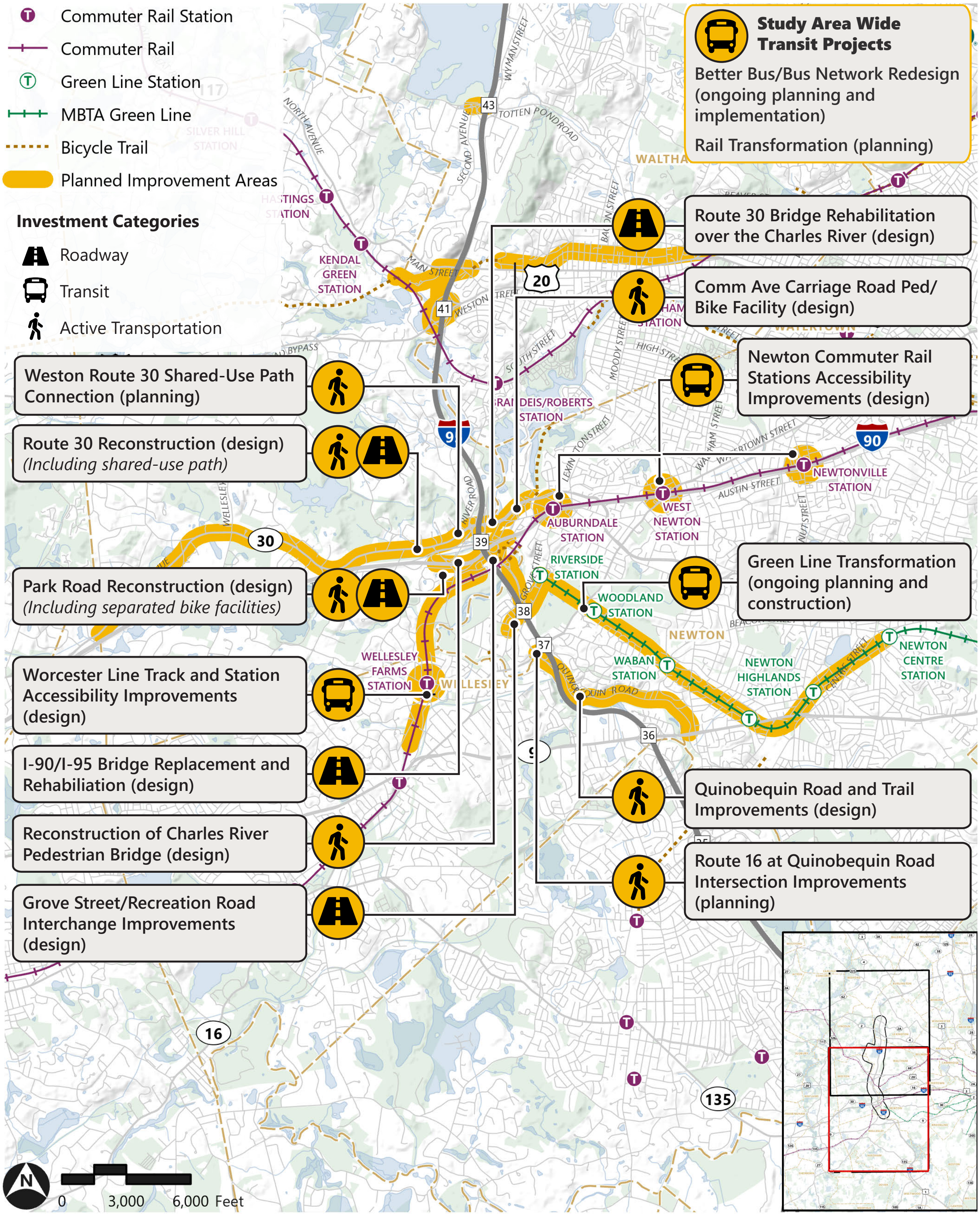
Several roadway infrastructure improvements are planned within the study area that will be completed by the study's 2040 horizon year. Details of known, planned roadway improvements are provided below and illustrated in Figure 3-7. Additional concept plans are included in Appendix C.

Figure 3-7a: Planned Transportation Investments



Source: MassGIS, MassDOT

Figure 3-7b: Planned Transportation Investments



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 3 Figures\FIGURE FILES\Planned Transportation Investments.indd

Grove Street/Recreation Road Interchange Improvements: The following roadway improvements on Grove Street and Recreation Road in Newton and Weston are proposed by the developer as mitigation for the redevelopment of Riverside station. An illustration of the concept plan is provided in Figure 3-8

- Reconstruction of the Route 128/I-95 northbound Exit 38 off-ramp to Grove Street, with the new ramp traveling under Grove Street parallel to the mainline and terminating north of the current location
- Extension of Recreation Road to Grove Street
- Closure of the Recreation Road on-ramp and off-ramp from the Route 128/I-95 northbound collector-distributor road
- Creation of three new signalized intersections, including at the terminus of the Route 128/I-95 northbound Exit 38 off-ramp
- Installation of a roundabout at the intersection of Grove Street at the Route 128/I-95 southbound ramps
- New pedestrian and bicycle infrastructure, including a shared use path along Grove Street and along Recreation Road Extension connecting to Riverside Park
- The project is expected to begin construction by 2024

Park Road Reconstruction: This project is being funded by the developer of 15 Riverside Road and includes the reconstruction of Park Road in Weston between Route 30 and approximately 100 feet south of Recreation Road. The project will include the construction of a two-way street level separated bicycle lane on the west side of Park Road between Route 30 and Orchard Avenue and a two-way sidewalk-level shared use path between Orchard Avenue and Recreation Road. The project also includes an extension of the Park Road northbound approach to Route 30 left turn lane from approximately 150 feet to 450 feet and the installation of a crosswalk across Park Road south of Riverside Road with a rectangular rapid flashing beacon (RRFB). The project is expected to begin construction by 2024.

Route 30 Reconstruction: This project is being funded by MassDOT and includes the reconstruction of Route 30 in Weston between the Weston/Wayland town line and approximately 700 feet west of the intersection of Route 30 at River Road/Route 128/I-95 southbound ramps. The project will include the construction of a shared use path paralleling Route 30 between the Weston/Wayland town line and Park Road. Within the study area, the project also includes the construction of an additional eastbound lane on Route 30 between Newton Street and Park Road and updated traffic signal equipment and timing at the intersections of Route 30 at Newton Street and Park Road. The project is expected to begin construction by 2026.

Route 30 Bridge Rehabilitation over the Charles River: This project is being funded by MassDOT and includes the rehabilitation of the Route 30 bridge over the Charles River between Weston and Newton and geometric improvements on either side of the bridge. West of the Charles River, the project will include the reconstruction of the intersection of Route 30 at the Route 128/I-95 northbound ramps and will include the closure of the on-ramp from Route 30 westbound to Route 128/I-95 northbound, eliminating a merge point on the Route 128/I-95 northbound collector-distributor road. East of the Charles River, the intersection of Route 30 at Auburn Street will be reconstructed as a roundabout. A shared use path will be constructed paralleling Route 30 between the Route 128/I-95 northbound ramps and Bourne Street. The project is expected to begin construction by Summer 2024.

Main Street (Route 117) and Route 20 at Route 128/I-95 Interchange 41 Improvements: The following roadway improvements on Main Street (Route 117) and Route 20 are proposed by the developer as mitigation for the 1265 Main Street redevelopment. An illustration of the concept plan is provided in Figure 3-9.

- Construction of a new north-south roadway (referred to as the Green Street Connector) between Route 117 and the Route 20 Rotary. The Green Street Connector will intersect Route 117 in the north and create a four-way signalized intersection with Bear Hill Road and intersect Route 20 westbound in the south and create a four-way signalized intersection with the Route 128/I-95 southbound on-ramp.
- Elimination of the Route 20 westbound on-ramp to Route 128/I-95 northbound
- Installation of three traffic signals within the Route 20 rotary
- Reconstruction of the Route 117 bridge over Route 128/I-95
- Dead-end Stow Street south of Route 117
- Construction of a full-access on-ramp from Route 117 to Route 128/I-95 northbound
- Construction of a shared use path along Route 117 and the Green Street Connector, providing an interim connection of the Massachusetts Central Rail Trail (MCRT) through the project limits
- The project is expected to begin construction in 2024

Winter Street On-Ramp to Route 128/I-95 Southbound Improvements: This project is being funded by developers with interests along Winter Street and includes the reconstruction of the on-ramp from Winter Street eastbound to Route 128/I-95 southbound (Exit 43) in Waltham. The on-ramp will be reconstructed to widen and extend the two-lane section of the on-ramp, realign the ramp to meet minimum design criteria, and extend the on-ramp acceleration and merge length. The project is currently under construction and is expected to complete construction in 2023.

Route 2A Bridge Replacement over Route 128/I-95: This project is being funded by MassDOT and includes the replacement of the Route 2A bridge over Route 128/I-95 in Lexington and geometric improvements on either side of the bridge. As part of the project, the intersections of Route 2A with the Route 128/I-95 northbound and southbound ramps will be replaced with roundabouts. The on-ramps from Route 2A eastbound to Route 128/I-95 northbound and from Route 2A westbound to Route 128/I-95 southbound will be removed, eliminating weaving segments on the Route 128/I-95 northbound collector-distributor road and southbound mainline. The project will also include the construction of a shared use path between Forbes Road and Wilson Road. The project is expected to begin construction in 2023.

I-90/I-95 Bridge Replacement and Rehabilitation: This project is being funded by MassDOT and includes the replacement and rehabilitation of several bridges included in the I-90/I-95 interchange, including the I-90 bridge over the Charles River and Route 128/I-95. The new bridges are expected to have approximately the same footprint as the existing bridges. The Project is expected to begin construction in 2023.

In addition to projects noted above within the study area, the Town of Lexington is considering a complete streets project on Bedford Street/Hartwell Avenue to the north. This project includes the redesign of Bedford Street, Hartwell Avenue, and Wood Street in Lexington to include complete streets design elements that better accommodate all roadway users. It should be noted that this project is still in the planning/preliminary design stages and no official design plans have been determined, but it could impact regional mobility and access to land uses along this corridor.

Figure 3-8: Grove Street/Recreation Road Interchange Improvements Concept Plan

Source: Riverside Station Redevelopment Supplemental Draft Environmental Impact Report, VHB, May 2021

Figure 3-9: Main Street (Route 117) and Route 20 at Route 128/I-95 Interchange Improvements Concept Plan

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: Main Street (Route 117) and Route 20 at Route 128/I-95 Interchange Improvements 25% Design, VHB, May 2020

Traffic Operations

A technical assessment focused on the operational qualities of the corridor's roadway segments, ramps, weaving segments, and intersections for existing and projected future conditions. The traffic analysis was conducted using the anticipated weekday morning and evening peak hour traffic volumes forecast to 2040 with the anticipated future roadway configuration, including geometric design conditions. Despite the numerous transportation infrastructure investments planned for the study area, significant operational challenges will remain – and in the context of future developments planned for the area, conditions will be much worse for travelers.

Route 128/I-95 Mainline and Ramps Capacity Analyses

Capacity analyses were conducted for the corridor's freeway segments, merge and diverge junctions, and weave areas. Figures illustrating the overall future condition level of service for these facilities during the weekday morning and weekday evening peak hours, respectively, are included in Appendix B and full capacity analysis results are included in Appendix D.

Operations challenges are already severe along this segment of roadway, but it will significantly worsen. In the future, the majority of the Route 128/I-95 mainline segments are expected to operate at LOS[48] E or LOS F - with many of them in the Waltham area between I-90 and Route 2.

This represents a notable degradation in operations from the existing conditions, where approximately 25 percent of the Route 128/I-95 mainline operates at LOS E or LOS F during the weekday morning peak hour and no segments operate at LOS E or LOS F during the weekday evening peak hour.

Under future conditions, nearly half of the study area ramps are expected to operate at LOS E or LOS F during at least one weekday peak hour (21 of 44 locations), representing a degradation of operations from existing conditions. In addition, more than half of the study area weaves are expected to operate at LOS E or LOS F during at least one weekday peak hour (5 of 8 locations), worsening from the existing conditions.

Poorly operating ramps and weaving conditions are concentrated at interchanges that are most likely to be impacted by the study area's planned development projects. Specifically, the I-90, Route 30, Route 20, Winter Street/Totten Pond Road, and Route 2 interchanges would be impacted by the site-generated trips for the planned developments. It should be noted that the removal of several ramps as a result of planned improvements documented above will result in the elimination of merge, diverge, and weaving segments within the study area, and these changes are accounted for in the 2040 Future conditions analysis.

48 Traffic operations are characterized by 'Level-of-Service' (LOS), with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. LOS is a qualitative measure that considers factors such as traffic volume, roadway geometry, speed, travel delay, and freedom to maneuver and provides an index to the operational qualities of an intersection or roadway segment.

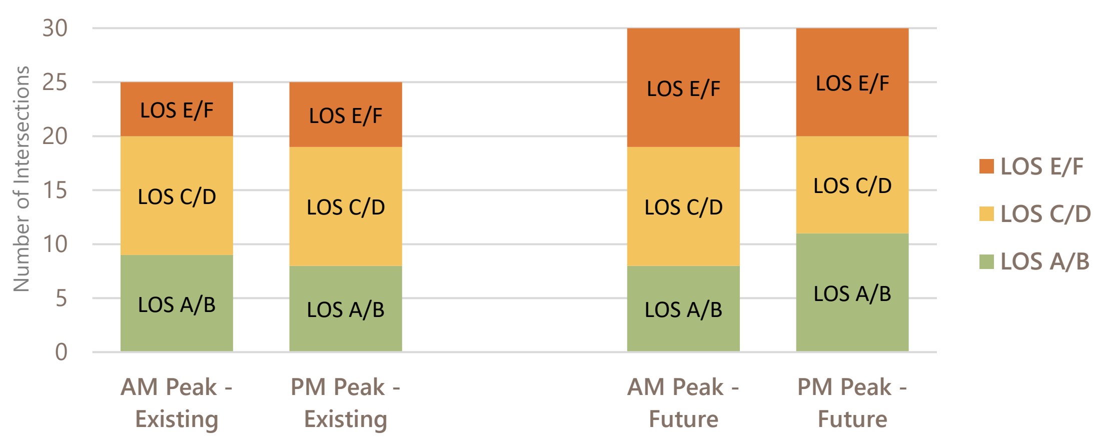
Key Takeaways – Route 128/I-95 Mainline and Ramps Capacity Analyses

Anticipated local and regional land use growth results in significant projected traffic demands along the Route 128/I-95 corridor. Operations on the mainline and ramps are expected to degrade from existing conditions, with **over half of all movements expected to operate at LOS E/F by 2040**. If left unaddressed, this growth will impact reliability along the corridor and could lead to traffic congestion extending to the local roadway network or further lengthening of commuter peak periods.

Intersection Capacity Analyses

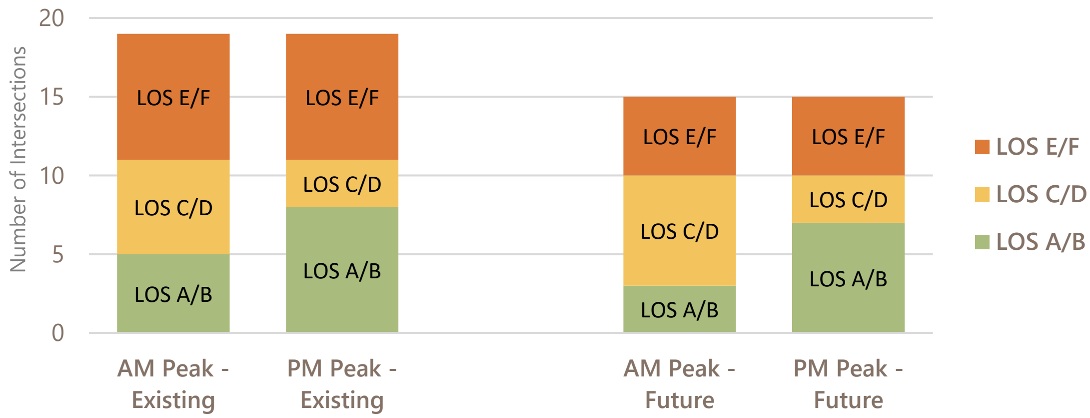
Capacity analyses were also conducted for the study area's intersections to assess operations at the local level. Intersection capacity analyses were conducted for the study area intersections to assess operations at the local level. Figures 2-18 and 2-19 summarize the quality of operations at the signalized and unsignalized study area intersections, respectively. Figures in Appendix B illustrate anticipated level of service at study area intersections during the weekday morning and evening peak hours, respectively. Additional details on the capacity analysis results are presented in a technical memorandum included in Appendix D.

Figure 3-10 Existing and Future Operations at Signalized Study Area Intersections



Note: Study area includes 25 signalized intersections under existing conditions and 30 signalized intersections under future conditions due to geometric changes proposed by 2040 as part of known planned roadway improvement projects.

Figure 3-11 Existing and Future Operations at Unsignalized Study Area Intersections



Note: Study area includes 19 unsignalized intersections under existing conditions and 15 unsignalized intersections (including four roundabouts) under future conditions due to geometric changes proposed by 2040 as part of known planned roadway improvement projects.

As shown, the majority of study area intersections are expected to operate at LOS D or better, but 13 of 30 signalized intersections[49] are projected to operate at overall LOS E or F during at least one weekday peak hour. This represents a degradation of level of service at seven existing intersections when compared to the existing conditions analyses. These intersections are mostly located near the Winter Street/Totten Pond Road interchange (Exit 43) or on Route 117, which are the locations most likely to be impacted by the site-generated trips associated with the planned development projects in the study area.

There are seven stop-controlled approaches within the study area that are projected to operate poorly under 2040 future conditions, which represents an improvement at four locations compared to existing conditions, resulting from planned improvements and installation of a traffic signal or roundabout.

In the future, four of the existing study area intersections are anticipated to be converted from signalized or unsignalized control to modern roundabout control. All four of the roundabouts are expected to operate at overall LOS D or better during the weekday peak hours.

Despite planned or recently completed upgrades for study area locations, the significant amount of planned development in the study area will continue to strain this roadway system. While these infrastructure improvements are attempts to accommodate future growth, existing land uses and environmental restrictions limit the ability to add travel lanes beyond what is already planned.

49 The study area includes 25 signalized intersections under Existing Conditions. New signalized intersections are proposed by 2040 as part of the Grove Street interchange improvements and the Route 20/Route 117 interchange improvements.

Transit

There are several anticipated capital and operational public transit improvements that will improve transit service, accessibility, and customer experience within the Route 128/I-95 study area.

MBTA Commuter Rail

At the systemwide level, the MBTA **Rail Transformation** will build on the work developed in the Rail Vision study and will include both capital and operational improvements. The Rail Vision study was released in February 2020 and provides a framework on how to best leverage the existing commuter rail network to meet shifting mobility needs and support continued economic growth and the Commonwealth's equity and sustainability goals. Some of the recommendations presented in the vision study include increased all day and weekend frequency, electrification of all lines, regional rail to key stations, and high-frequency service to inner core stations, including those in Newton and Waltham. Initial steps taken in 2021 to implement Rail Transformation include providing all day bi-directional service on all lines and providing at least hourly service on most lines. Currently in the planning phase, Rail Transformation Phase 1 will focus on electrification of commuter rail lines outside of the study area, including the Providence/ Stoughton Line, the Fairmount Line, and parts of the Newburyport/ Rockport Line.

Two planned capital improvement projects along the Worcester Main Line are located near or within the study area. The MBTA **Newton Commuter Rail Stations Accessibility Improvements** project, consists of accessibility improvements at the three commuter rail stations in Newton: Auburndale, West Newton, and Newtonville. Currently, each station is not fully accessible and can only be reached by long staircases. In addition, the stations only include platforms on one of the two tracks running on the Worcester Line, which prevents outbound trains from stopping at the stations during the morning peak period and inbound trains from stopping during the evening peak period. This project will provide two fully accessible high-level platforms allowing all Worcester Line trains to stop at each station and will address the MBTA's reliability and modernization needs at these stations, including the installation of elevators at each station. The project is currently in the design phase and while funding for the full construction has not yet been identified (as of Winter 2023), the federal budget for 2023 includes a $7 million earmark to help fund some of the project.[50]

The MBTA **Worcester Line Track and Station Accessibility Improvements** includes the construction of a new third track between Weston and Natick with associated corridor track and signal improvements. Construction of a third track will allow for greater service flexibility and the potential for an increase in the number of express trains between Worcester, Framingham, and Boston. The project also includes station accessibility improvements at Wellesley Farms, Wellesley Hills, Wellesley Square, and West Natick stations. The project is currently in the design phase.

50 For more information, please see https://www.mbta.com/projects/newton-commuter-rail-stations-accessibility-improvements.

MBTA Rapid Transit

The MBTA's Riverside and Woodland stations are located on the Green Line D Branch near the study area. The MBTA's **Green Line Transformation** will modernize the Green Line by focusing on improving safety and the state of good repair, enhanced accessibility, increased passenger capacity, and a modernized rider experience. This project will include both capital and operational improvements. Future improvements that would improve the customer experience for riders at the Riverside and Woodland stations include the introduction of new Green Line vehicles, increased service frequency, and improved reliability.

MBTA, Regional Transit Authority, and Other Bus Services

The MBTA's **Better Bus Project** focuses on closing the gap between current bus service delivery and service delivery standards. Beginning in 2018 as part of the MBTA's 5-year capital investment plan, the Better Bus Project encompasses a number of individual projects intended to improve bus service. One of these projects, the **Bus Network Redesign**, is an operational project that is completely re-imagining the MBTA bus network to reflect the changes seen in the Greater Boston area and create an improved experience for current and future riders. The Bus Network Redesign intends to simplify the network, create a more equitable network, make transit a competitive alternative to driving, and maximize access to opportunities, with extra priority given to riders in transit-critical communities. The Bus Network Redesign will result in changes to the bus network to be implemented in a phased approach from 2023 to 2026.

COVID-19 Recovery and MBTA Bus Service Restoration

The MBTA updates its bus schedules approximately four times a year based on demand, current operating conditions, service availability, and other factors. While some of the updates are relatively minor adjustments to a few routes, other impacts are more notable. For example, since 2020 the MBTA has been **working to restore bus service to pre-pandemic conditions** as ridership has rebounded. Within the study area this included restoring Route 505 between Waltham Center and downtown Boston in Fall 2021 and restoring Routes 62 and 76 in Lexington as separate services in Winter 2022.

Within the study area, the Bus Network Redesign is expected to result in the following changes[51]:

» **MBTA Bus Route 53** will travel between Market Place Drive in Waltham and Woodland Station in Newton via Auburndale and Brandeis/Roberts with service provided at least every 50 minutes seven days a week. This route will approximately replace the existing Route 553 between Waltham Center and Brandeis/Roberts and Route 558 between Waltham Center and Riverside.

» **MBTA Bus Routes 56 and 58** will travel between Market Place Drive in Waltham and Watertown via Waltham Center and Newton Corner. The two routes will deviate between end points with Route 58 serving West Newton and Route 56 serving Newtonville via Walnut Street. Service on each route will be provided at least every 50 minutes seven days a week, resulting in combined

51 Based on the "Revised Bus Network Map" released by the MBTA on November 8. 2022.

service of at least every 25 minutes between Market Place Drive and Waltham Center. These two routes will approximately replace the existing Route 70 between Market Place Drive and Waltham Center and Routes 553, 554, and 556 between Waltham Center and Newton Corner.

» **MBTA Bus Route 61** will travel between North Waltham and Market Place Drive via Bear Hill Road and Wyman Street with service provided at least every 50 minutes seven days a week. This route is a modification of the existing Route 61 which currently operates between Waltham Center and North Waltham via Bacon Street and Totten Pond Road.

» **MBTA Bus Route 76** will travel between Hanscom Field/Lincoln Labs and Alewife via Route 2A, Lexington Center, and Route 2. Service will be provided on weekdays only with trips at least every 30 minutes during peak periods and every 90 minutes during off-peak periods. This route is currently provided by the existing Route 76 and a variation of the existing Route 62.

The regional transit authorities and other bus operators described in the vicinity of the study area have not published planned future changes to their bus networks.

MassDOT Bus on Shoulder Screening Study

MassDOT completed Phase II of the Bus on Shoulder (BOS) Screening Study in November 2022 to determine effective locations to expand a cost-effective BOS program that will improve bus reliability and decrease travel times[52]. Two of these segments along Route 128/I-95 are within the study area, and the results are summarized below:

» **Route 128/I-95 from Route 9 to Route 2 (Corridor 4B)** – BOS appears to be feasible except in the vicinity of I-90 and Route 16 interchanges. Approximately 80 percent of the corridor has a shoulder width of at least 10-feet wide that may accommodate BOS. It is expected that a bus would need to merge into the general-purpose lane up to five times in this segment in the northbound direction and up to six times in the southbound direction mainly due to 11 underpasses or overpasses that have a shoulder of less than 11 feet.

» **Route 128/I-95 from Route 2 to I-93 (Corridor 5A)** – BOS appears to be feasible along most of this corridor. Approximately 85 percent of the corridor has a shoulder width of at least 10-feet wide that may accommodate BOS. It is expected that a bus would need to merge into the general-purpose lane up to three times in this segment in the northbound direction and up to six times in the southbound direction mainly due to the eight underpasses or overpasses that have a shoulder of less than 11 feet.

Active Transportation

While there are several dedicated active transportation facilities in the study area (as noted in Chapter 2, Existing Conditions*)*, the existing network is limited by facilities that do not connect to each other or provide incomplete coverage. There are several planned active transportation

52 Phase I of this study was completed in early 2020 and focused on corridors with existing bus service, high degrees of congestion, and shoulders of sufficient width for BOS. Phase II of the study focused on segments along Route 128/I-95, I-93, Route 2, Route 1, and Route 3. A desktop review of the physical corridor attributes was performed to inventory the study corridors and each corridor was evaluated with respect to shoulder widths, bus ridership, ramp volumes, and congestion.

improvements that will help to expand the network and improve connectivity throughout the study area. Details of these active transportation improvements are provided below, and a map is included in Figure 3-12.

Quinobequin Road and Trail Improvements: Improvements to the pedestrian and bicycle infrastructure along Quinobequin Road between the Route 128/I-95 underpass in the north and Route 9 in the south are proposed to be funded by the Department of Conservation and Recreation (DCR). The project is currently in the planning stages and a preferred concept has yet been determined.

Route 16 at Quinobequin Road Intersection Improvements: Improvements to safety and the pedestrian and bicycle infrastructure at the intersection of Route 16 and Quinobequin Road are proposed to be funded by MassDOT. The project is currently in the planning/permitting stages and submitted a Project Notification Form (PNF) in December 2021.

Grove Street/Recreation Road Interchange Improvements: Roadway improvements along Grove Street and Recreation Road will include several active transportation investments that will enhance connectivity between the Riverside MBTA station, the Lower Falls neighborhood to the west across Route 128/I-95, and Riverside Park to the north across the Charles River. The project is proposed to be funded by the developer of the Riverside redevelopment and is expected to begin construction by 2024.

- A shared use path on the north side of Grove Street between the Riverside MBTA station east of Route 128/I-95 and the Lower Falls Community Center west of Route 128/I-95
- A shared use path along Recreation Road Extension between Grove Street south of the Charles River and Riverside Park north of the Charles River
- Trail enhancements on both sides of the Charles River around Riverside Park
- Funding the design for the conversion of two former rail bridges over Route 128/I-95 into a shared use path between Riverside Station and Newton Lower Falls (the Two Bridges Trail)

Reconstruction of Charles River Pedestrian Bridge: Reconstruction of the existing pedestrian bridge over the Charles River between Newton and Weston north of the Worcester Line commuter rail tracks with a new pedestrian/bicycle bridge in the same location. Proposed to be funded by MassDOT, the project is currently under construction.

Route 30 Reconstruction: Construction of a shared use path paralleling Route 30 between the Weston/Wayland town line and Park Road, approximately 3.5 miles. The project is being funded by MassDOT and is expected to begin construction by 2026.

Park Road Reconstruction: Construction of a two-way street level separated bicycle lane on the west side of Park Road between Route 30 and Orchard Avenue and a two-way sidewalk-level shared use path between Orchard Avenue and Recreation Road. The project also includes the installation of a crosswalk across Park Road south of Riverside Road with a rectangular rapid flashing beacon (RRFB). The project is expected to begin construction by 2024.

Route 30 Bridge Rehabilitation over the Charles River/Commonwealth Avenue Carriage Road Ped/Bike Facility: Construction of a dedicated pedestrian/bicycle facility between the Route 128/I-95 northbound ramps in Weston and Ash Street in Newton. The facility will consist of a new shared use path between the Newton Boathouse Parking Area in Weston and the Marriott Hotel and will repurpose the Commonwealth Avenue Carriage Road to a dedicated pedestrian/bicycle roadway between the Marriott Hotel and Ash Street. The facility will be approximately 0.75-miles in length. Construction of the facility is being funded by MassDOT and construction is expected to begin construction by 2024.

Weston Route 30 Shared Use Path Connection: This project will close the gap between the two Route 30 shared use path projects listed above and is being funded by MassDOT. A shared use path connection is proposed between Park Road and the Route 128/I-95 northbound ramps in Weston, providing a dedicated active transportation facility along Route 30 between the Weston/Wayland town line and Auburndale Village in Newton. The project is currently in the planning stages and a final concept has yet to be determined.

Mass Central Rail Trail Connection through Waltham: Construction of an off-road shared use path, known as the Wayside Trail through Waltham, which will eventually be a part of the larger Mass Central Rail Trail (MCRT) that will travel between Boston and Northampton. The Wayside Trail will extend for approximately 2.75 miles in Waltham between Border Road and Beaver Street and will provide a dedicated pedestrian and bicycle connection between different neighborhoods in Waltham. The project is being funded by the City of Waltham, supported by developer contributions, and is expected to begin construction in 2023.

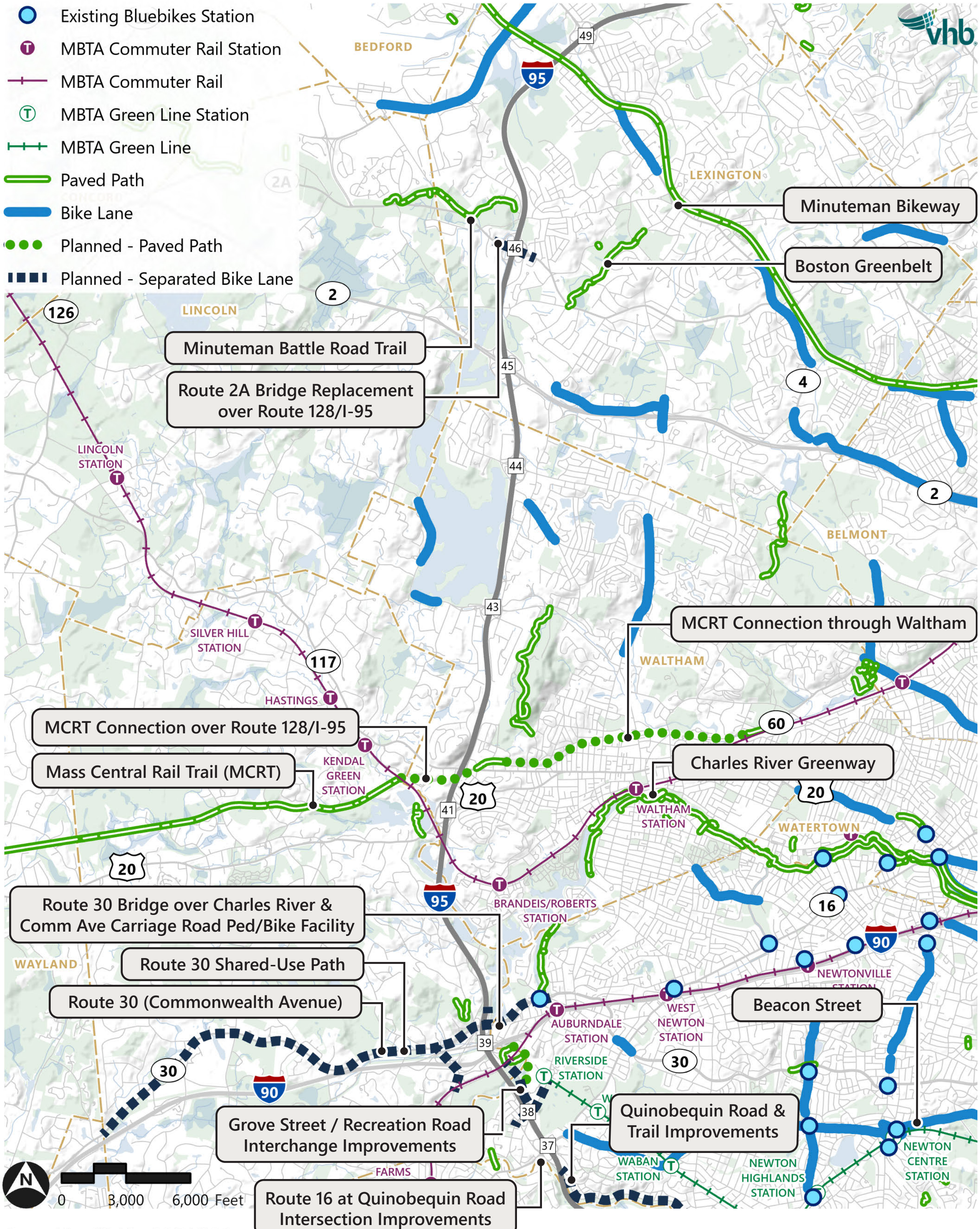
Mass Central Rail Trail Connection over Route 128/I-95: Construction of an off-road shared use path that will connect the existing MCRT trail in Weston and Wayland with the existing and proposed MCRT/Wayside Trail in Waltham. The shared use path will extend for approximately 0.75-miles and will fill in a critical gap in the MCRT over Route 128/I-95. The project is being funded by DCR and is currently in the planning/design stage. Construction of Phase 1 between the current terminus west of the Fitchburg Line tracks and Jones Road is expected to begin in 2023 with Phase 2 over Route 128/I-95 between Jones Road and Route 117 to follow.

Route 2A Bridge Replacement over Route 128/I-95: Construction of a shared use path over Route 128/I-95 between Forbes Road and Wilson Road, approximately 0.5-miles. The project is being funded by MassDOT and is expected to begin construction in 2023.

Future Active Transportation Network Key Takeaways

- **Closing East-West Gaps:** By 2040, planned active transportation projects will result in new/improved connections across Route 128/I-95 for pedestrians and bicyclists at Grove Street, Route 30, the Mass Central Rail Trail (between Route 20 and Route 117), and Route 2A, improving connectivity between the east and west sides of Route 128/I-95.
- **North-South Missing Links:** There are still expected to be significant gaps in the active transportation network within the study area, with no dedicated north-south facilities provided for pedestrians and bicyclists.

Figure 3-12: Future Active Transportation Facilities



Source: MassGIS, MassDOT, MAPC

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 3 Figures\FIGURE FILES\Future Active Transportation Facilities.indd

Issues, Opportunities, and Constraints

The following study area issues, opportunities, and constraints were informed by a thorough review of data; as well as the issues, concerns, and desired outcomes identified through public outreach and stakeholder feedback.

This section presents these issues, opportunities, and constraints of fundamental categories:

- Equity
- Transportation
  - Vehicular
  - Transit
  - Active Transportation
  - Safety
  - General
- Land Use/Economic Development
- Environmental

As these issues, opportunities, and constraints were compiled, it became clear that several general themes are prevalent throughout and impact the entire study. These general topics are discussed in Table 3-2. As shown, these general takeaways include outcomes of land use development patterns, equity considerations, transportation mobility, and environmental conditions.

Issues, Opportunities, and Constraints Key Takeaways

- **Reliance on Vehicles:** Several issues surrounding high auto demand and reliance on vehicles were identified, including operational and safety issues on roadways, limited non-auto mode options/facilities, and public health outcomes. In turn, opportunities focus on enhancing transit service/frequency, improving pedestrian/bicycle connections, and supporting programs to encourage non-auto modes are a focus area.
- **Land Use Patterns:** The study area is expected to see a significant increase in the number of job offerings, but a disproportionate increase in housing options. To limit transportation demands, there are opportunities to influence policy/zoning, identify appropriate housing typologies, and improve siting - connecting housing to job centers and open space.

Table 3-2 General Issues, Opportunities, and Constraints

		Type	Description
Equity		Issue	Commute times and commute modes are found to have a strong correlation with all chronic diseases within the study area, except asthma
		Issue	Asthma prevalence is greater in the study area than it is nationally
		Opportunity	Reducing commute time and improving mode choice are factors that could benefit public health outcomes
		Opportunity	Improving walkability and decreasing vehicle miles traveled/emissions are factors that could reduce asthma prevalence
		Opportunity	Advance programs, policies, and investments that meet the needs of Environmental Justice and other equity-focused communities
		Opportunity	Accommodate future needs of communities (e.g. ability to age in place) by addressing lack of housing diversity, affordability, and access
Transportation	Vehicular	Issue	Congestion and unreliable travel times have resulted in peak spreading on Route 128/I-95
		Issue	Significant congestion on study area roadways/intersections have led to peak period delays
		Issue	Availability of free parking, limited regional park and ride options, and constraints for parking at transit stations have encouraged single-occupant trips to/from the study area
		Opportunity	Enhance TDM policies through a regional, coordinated approach to encourage mode shift
		Opportunity	Leverage regional park and ride options and build upon outcomes of Shared Travel Network Study
		Opportunity	Consider shared parking opportunities with mixed use land uses to more effectively manage demand
		Constraint	Built environment may limit ability to expand transportation facilities

Table 3-2 General Issues, Opportunities, and Constraints (continued)

		Type	Description
Transportation	Transit	Issue	Transit ridership durability is an issue, highlighted by the COVID-19 pandemic
		Issue	Transit service span/frequency do not accommodate all users, especially workers in industries who commute outside of the typical commuter periods (e.g. custodial, healthcare, service industry, etc.)
		Issue	Buses experience delays due to congestion as they do not have dedicated facilities/transit priority within the study area
		Opportunity	Explore partnerships between transit operators and business communities to provide service to residents
		Opportunity	Provide transit service for strong connection to/from Boston (8-10 percent of daily commute trips to/from the study area)
		Opportunity	Build upon findings of MassDOT Bus on Shoulder Phase II report that indicate bus on shoulder is feasible for most of the corridor
		Opportunity	Build upon outcomes of the MBTA's Bus Network Redesign
		Constraint	Transit in Metro Boston is a hub-and-spoke system designed to transport riders to Downtown Boston, lacking an outer-rim connection between spokes to facilitate transit between the suburbs and the urban core
		Constraint	Agency-wide operational challenges related to factors such as fleet size and composition, driver availability and facility space constraints
	Safety	Issue	Frequency of crashes near interchanges, influenced by closely spaced on- and off-ramps and merging, diverging, and weaving vehicles creates a safety issue
		Issue	Route 128/I-90 within study area identified as large vehicle risk site
		Opportunity	Opportunity to incorporate geometric improvements to Route 128/I-95 mainline through alternatives development (e.g. increase shoulder width)
	General	Issue	Limited zero-vehicle households within the study area overshadow the needs of transit-dependent populations
		Issue	Nearly 65 percent of worker trips are from non-study area towns, resulting in the need for commuting to/from the study area with limited transit options
		Issue	Maintenance of existing facilities (e.g. snow removal, vegetation, pavement conditions)

Table 3-2 General Issues, Opportunities, and Constraints (continued)

	Type	Description
Land Use/Economic Development	Issue	Commercial density has outpaced residential density, particularly multi-family housing, resulting in the need for employees to commute to the study area
	Issue	Dominance of commercial development has resulted in homogenous land use character that is more vulnerable to market disruptions
	Issue	Limited access to job opportunities for equity focused populations
	Opportunity	Meet the demand for housing to reduce transportation demands and shift toward 24/7 communities
	Opportunity	Coordinate strategy between public and private stakeholders to provide access to jobs - both from a transportation connectivity and workforce training perspective
	Opportunity	Coordinate a placemaking strategy to better connect the study area
	Opportunity	Explore and communicate the benefits of mixed-use zoning to help increase the municipal tax base
	Constraint	Challenges with and resistance to developing housing within the study area
	Constraint	Limited vacant and developable parcels within study area, resulting in a reliance on redevelopment of existing parcels to accommodate change in land use character
Environmental	Opportunity	Improve environmental conditions through direct and/or indirect means as a result of alternatives
	Constraint	The study area is home to a variety of environmental resources documented in Chapter 2, Existing Conditions, that may impact the feasibility of certain alternatives

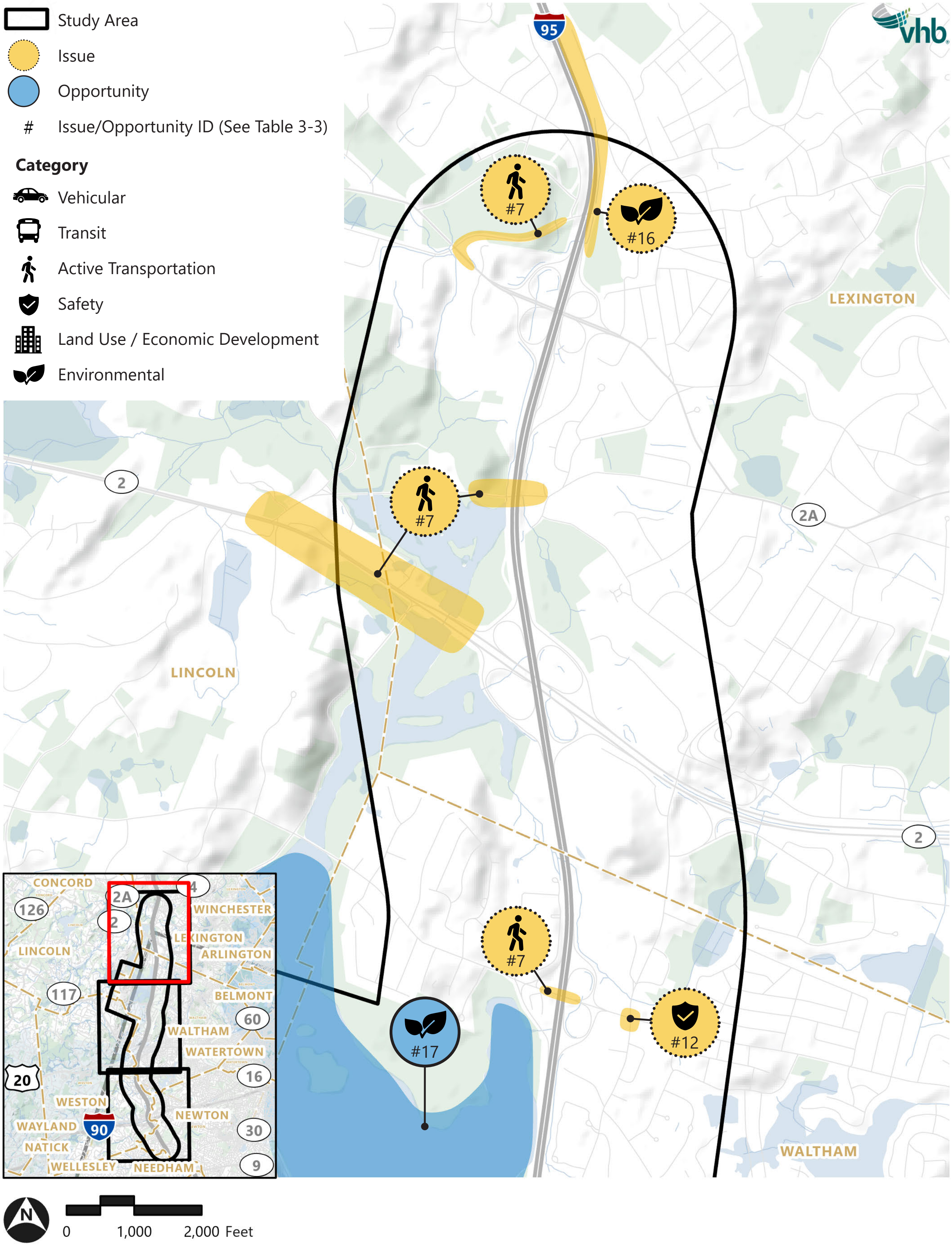
In addition to general issues, opportunities, and constraints, several site-specific conditions were also compiled and are presented in Table 3-3 and Figure 3-13. These are conditions that can be tied to a specific geography or transportation facility, such as an intersection or transit station. Many of the site-specific issues and opportunities identified may correlate to an infrastructure investment that are explored under the alternatives development and analysis section of this study.

Table 3-3 Site-Specific Issues and Opportunities

		ID	Type	Description
Transportation	Vehicular	1	Issue	Challenging merge and resulting congestion where the I-90/Route 30/Grove Street on-ramp merges with the I-95 northbound mainline
		2	Issue	Heavy traffic volumes on Stow Street, a two-lane residential roadway used by drivers to connect to Route 128 with Lincoln, Weston, the 1265 Main Street development, and other points
	Transit	3	Issue	Kendal Green, Wellesley Farms, Auburndale, and West Newton Commuter Rail stations have significant accessibility barriers that may affect their use
		4	Issue	MBTA Bus Route 170 which travels along Bear Hill Road and 2nd Avenue (Waltham) is suspended until further notice
		5	Opportunity	Reconsider benefits of a multimodal transit center on the Fitchburg Commuter Rail Line
		6	Opportunity	Connect the commuter rail from Auburndale to Riverside to create a transit hub at Riverside
	Active Transportation	7	Issue	Limited active transportation facilities and gaps within existing facilities
		8	Opportunity	Connect Mass Central Rail Trail (MCRT) over Route 128/I-95
		9	Opportunity	Improve ped/bike connections to expand the low stress walking and biking network between neighborhoods and to regional facilities
	Safety	10	Issue	Several locations in the study area are identified as ped/bike risk sites
		11	Issue	Safety issues and concerns with the Route 20 Rotary
		12	Issue	Five of the 42 study area intersections have crash rates higher than the district average
		13	Issue	Three of the 42 study area intersections are listed as a potential 2017-2019 HSIP-eligible clusters
		14	Opportunity	Advance safety improvements identified in completed RSAs within the study area
Land Use/ Econ Dev		15	Opportunity	Reconfigure I-90/I-95 interchange to reduce footprint and provide land development and in-fill transit station opportunities
Environmental		16	Issue	No noise barriers provided for the residential neighborhoods north of Route 2A (Lexington)
		17	Opportunity	Improve access to the Cambridge Reservoir for recreational uses

Figure 3-13a: Site-Specific Issues and Opportunities

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

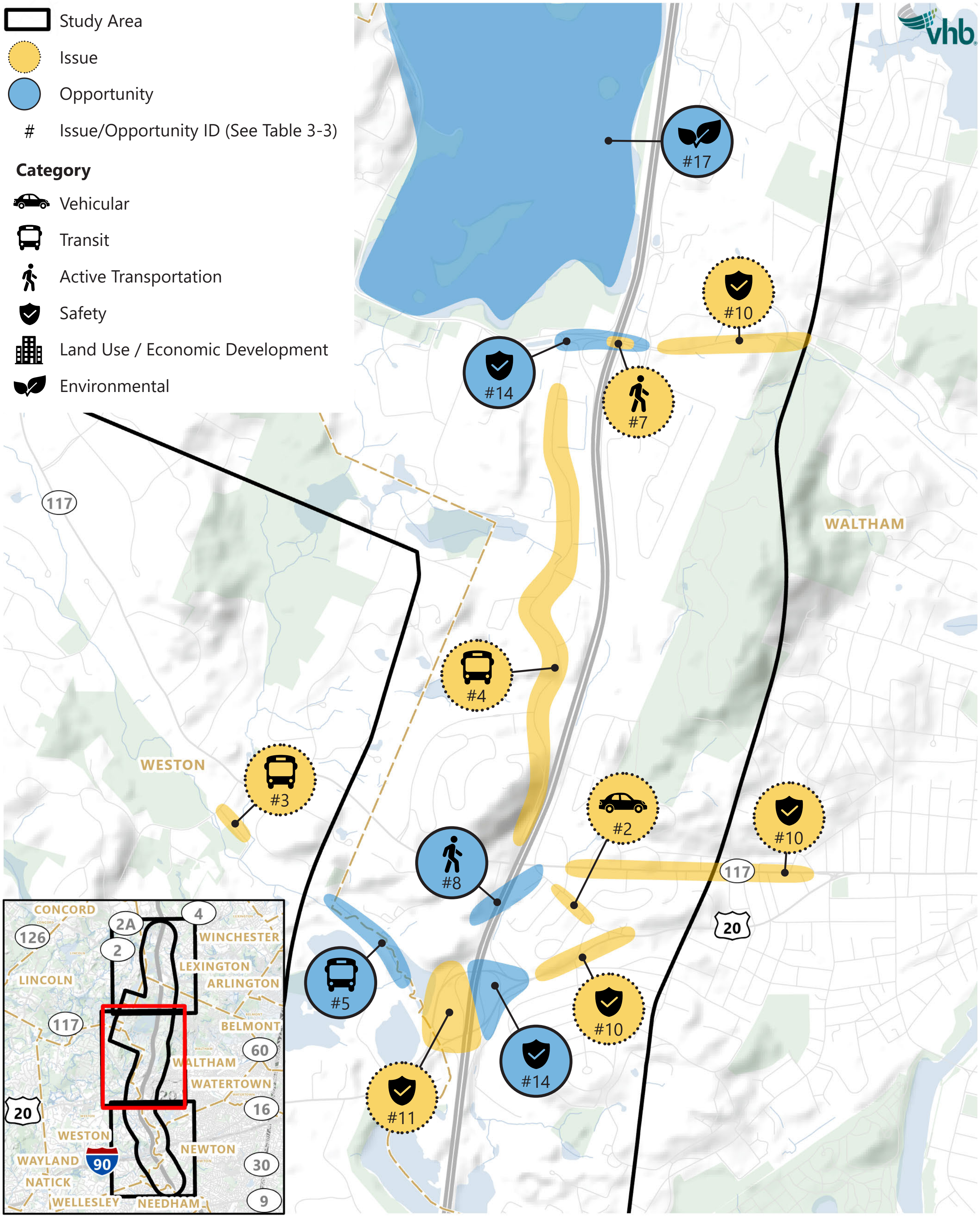


Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 3 Figures\FIGURE FILES\Issues_Opps_Constraints.indd

Figure 3-13b: Site-Specific Issues and Opportunities

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



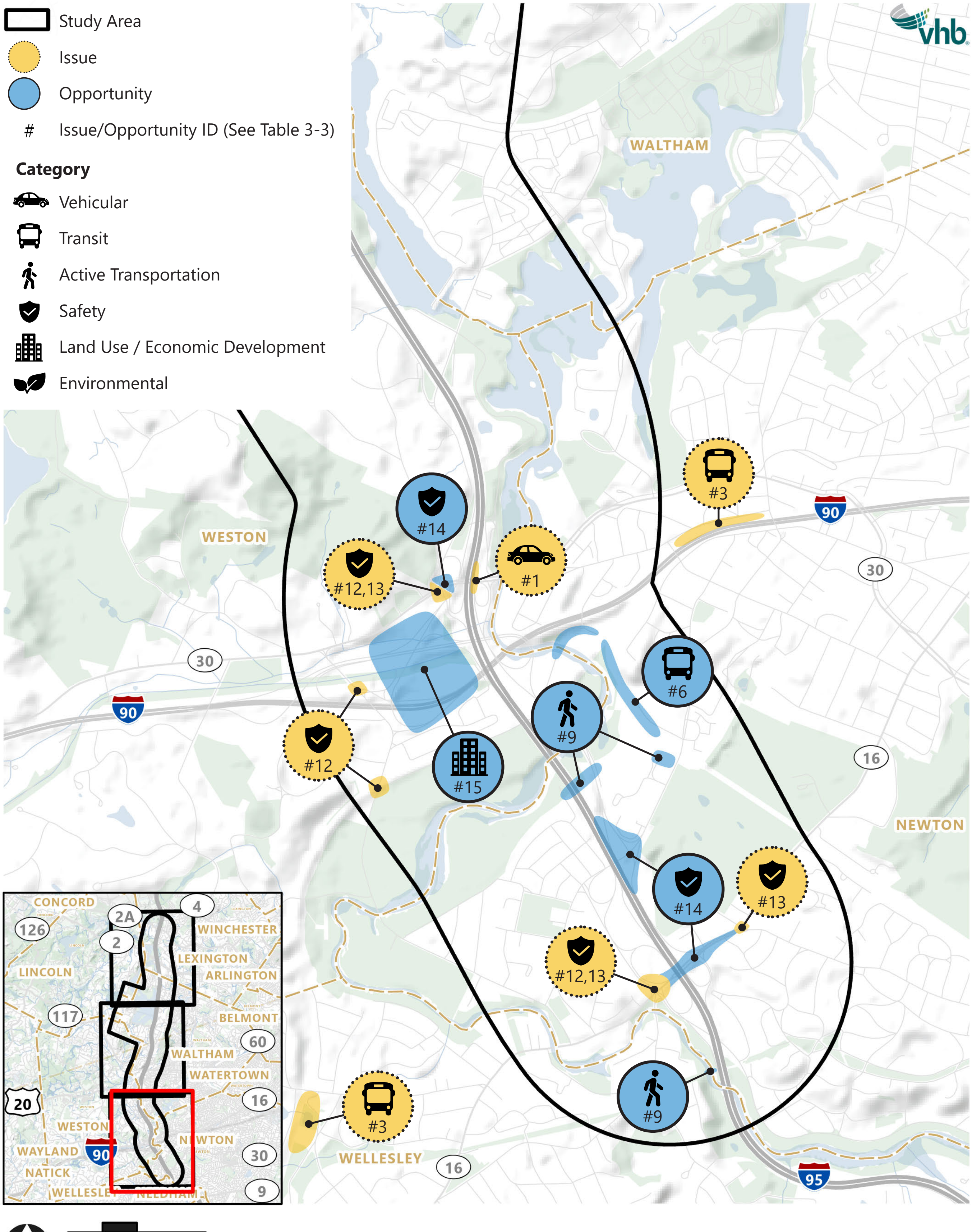
N
0 1,000 2,000 Feet

Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 3 Figures\FIGURE FILES\Issues_Opps_Constraints.indd

Figure 3-13c: Site-Specific Issues and Opportunities

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

4

Alternatives Development

This chapter describes the upgrades and enhancements that have the potential to address the issues and deficiencies that were identified in previous chapters, as well as meet the goals of this study.

The analysis of existing and future conditions and the identification of issues, opportunities, and constraints led us to nominate a range of improvements in the study area that we refer to as 'alternatives'. Improvements were first suggested during discussions with internal MassDOT/MBTA stakeholders, via Working Group guidance, and through public outreach. The alternatives were developed to complement or build upon other on-going planning studies and planned infrastructure improvements projects discussed in previous chapters. The alternatives were screened to eliminate recommendations that are either outside of the scope of work (e.g., outside the study area), do not address the goals or objectives, or are infeasible. The alternatives ultimately recommended for advancement are presented in this chapter.

Alternatives Development & Screening Summary

- Over **100 ideas** were collected and developed into over **80 alternatives** that were screened against the study goals and objectives resulting in:
  - 11 recommended for immediate action
  - 54 advanced for further study
  - 19 discarded

Alternatives Categories

Alternatives are generally organized into the same categories as the issues, opportunities, and constraints:

- Land Use/Economic Development
- Transportation
  - Vehicular
  - Transit
  - Active Transportation
  - Safety
  - General Transportation
- Environmental

Alternatives Screening

From the outset of the study, ideas about improvements or enhancements to and along the corridor were solicited from the public, stakeholders, and the Working Group. Over 100 ideas were collected, primarily from the Working Group sessions and from the web-based mapping tool that allowed respondents to offer site-specific suggestions. The study team reviewed and consolidated these ideas into a series of over 80 alternatives.

First, the study team identified those alternatives that are appropriate for immediate action. These actions generally can be completed within one year and include low-cost options that do not require environmental permitting, prolonged design or approvals, or extensive community vetting. With respect to the remaining alternatives, the study team then screened them against the study goals and objectives and made recommendations to either advance them for further analysis (the results of which is presented in Chapter 5, *Alternatives Analysis*), or to discard them.

The range of alternatives that were developed initially are broad and represent a wide range of stakeholders and interests, and decisions to move alternatives forward rest on the ability of the alternative to meet study goals. All the alternatives that were considered are initiatives or enhancements that could improve mobility and accessibility to and through the study area.

Land Use/Economic Development

Land Use/Economic Development alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on a) supplying a housing stock that meets demand, b) improving access to jobs, c) supporting multimodal mobility and accessibility, and d) enhancing open space and placemaking. In this category, 12 alternatives were developed and screened (Table 4-1):

» **Alternative LU-1: Conduct Market Analysis** – Prepare a market analysis on a regular basis to determine the study area's potential to capture new residential, commercial, and industrial business opportunities. The results of the market analysis would determine the demand and supply of desired development types, which can then be used to inform local development policies. Potentially include nearby municipalities such as Wellesley or Needham to have a better understanding of regional market conditions.

» **Alternative LU-2: Implement Resident and Small Business Protection** – Ahead of proposals for development/ redevelopment within the study area, implement strategies that protect against local resident and small business displacement. The focus of these strategies should be on environmental justice populations. Displacement avoidance strategies may include policies that preserve housing affordability, encourage new affordable housing, as well as meaningful community engagement.

» **Alternative LU-3: Remove or Revise Parking Minimums** – Review parking minimums and shared parking policies within local zoning ordinances and bylaws to ensure they do not encourage an automobile-centric transportation network, similar to Newton's current effort to reduce or eliminate parking minimums on their village center district zoning. Limiting parking and allowing for shared parking in mixed-use developments can encourage use of public transit and active modes of transportation. Land freed up from the local parking inventory could potentially be dedicated to community needs.

» **Alternative LU-4: Implement Solar Energy Program Expansion** – Explore the potential to expand MassDOT's Solar Energy Program by identifying opportunity sites within the study area. Installing ground-mounted solar photovoltaics or photovoltaic canopies over parking lots at service plazas within the study area would support the Commonwealth's goal of achieving net-zero emissions by 2050.

Solar production site along I-90, Framingham
Source: MassDOT

» **Alternative LU-5: Improve Open Space Network** – Study and improve, as necessary, the accessibility of open spaces within the study area, particularly from an equity perspective. This assessment should consider criteria such as walking distance, route safety, available amenities, and quality (e.g., maintenance and general appearance).

» **Alternative LU-6: Improve Public Gathering Spaces** – Develop new community gathering spaces, such as plazas, gardens, neighborhood parks, etc., on both publicly-owned and privately-owned lands. Community gathering spaces provide areas for public activities and social connectivity, enhance community health and well-being, and augment the visual character of a community. Such spaces should relate to each other to the greatest extent practicable.

» **Alternative LU-7: Improve Multimodal Network near Cambridge Reservoir** – Evaluate opportunities to improve public access around and enjoyment of the Cambridge Reservoir within current use limits, including the potential to add a recreational loop.

Cambridge Reservoir west of Route 128/ I-95, Waltham
Source: MassDOT

- **Alternative LU-8: Encourage Affordable and Workforce Housing** – Identify opportunities for the study area to supply affordable and workforce housing for each level of low-income households (e.g., households earning less than 50% Area Median Income (AMI), households earning between 50% and 80% AMI, and households earning between 80% and 100% AMI). This effort would help to address local, regional, and statewide needs.
- **Alternative LU-9: Encourage Mixed-Use Development** – Explore strategies that encourage mixed-use development within the study area. Potential strategies can include the provision of financial and regulatory incentives (e.g., tax abatements, density bonuses), strategic infill development, removal of regulatory barriers in local zoning ordinances/bylaws, and adoption of form-based codes.
- **Alternative LU-10: Encourage Transit-Oriented Development (TOD)** – Develop coordinated TOD plans around existing and planned transit stops within the study area. TOD can support the achievement of many of this study's goals, objectives, and other actions, such as increasing mixed-use developments, adding to the local affordable housing supply, and promoting alternative modes of transportation.
- **Alternative LU-11: Assess and Encourage Infill Opportunities** – Identify vacant or underperforming parcels within the study area, along with potential reasons why redevelopment of these properties has been passed over by developers. Resolve any identified barriers to redevelopment to the extent practicable and revise local zoning bylaws and permitting processes to actively encourage such development.
- **Alternative LU-12: Identify Opportunities at Route 128/I-95 & I-90 Interchange** – Identify opportunities to use the open land within the existing Route 128/I-95 at I-90 interchange footprint for development and/or transportation-related opportunities such as a truck-only layover/rest stop, a park and ride, and/or a regional EV charging and maintenance facility. Any redevelopment within the interchange would be enhanced by a multimodal hub on the Worcester Line, which travels directly south of interchange.

Table 4-1 Land Use/Economic Development Alternatives Screening

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
LU-1	Conduct Market Analysis	◐	●	●	●	●	Advance
LU-2	Implement Resident and Small Business Protection	◐	●	●	●	●	Advance
LU-3	Remove or Revise Parking Minimums	●	●	●	●	●	Advance
LU-4	Implement Solar Energy Program Expansion	◐	●	●	●	●	Advance
LU-5	Improve Open Space Network	●	◐	●	●	●	Advance
LU-6	Improve Public Gathering Spaces	◐	●	●	●	●	Advance
LU-7	Improve Multimodal Network near Cambridge Reservoir	●	●	●	●	●	Advance
LU-8	Encourage Workforce and Affordable Housing	◐	●	●	●	●	Advance
LU-9	Encourage MXD	●	●	●	●	●	Advance
LU-10	Encourage TOD	●	●	●	●	●	Advance
LU-11	Assess and Encourage Infill Opportunities	●	●	●	●	●	Discard[1]
LU-12	Identify Opportunities at I-90 Interchange	●	●	●	◐	◐	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

1 – Discard as a discrete alternative; intent is captured and can be more strategically achieved through a combination of the remaining Land Use/Economic Development Alternatives

● - Benefit ◐ - Neutral ○ - Impact

The 12 Land Use/Economic Development alternatives were screened against the established study goals and objectives and 11 are recommended to advance for further study. **Alternative LU-11** is recommended to be discarded as a discrete alternative because the study team believes its intent is captured and can be more strategically achieved through a combination of the remaining Land Use/Economic Development Alternatives.

Transportation

Vehicular

Vehicular alternatives include primarily infrastructure improvements that focus on improving roadway network reliability, minimizing congestion and delays, and improving safety to accommodate all modal users in the study area. In this category, 32 alternatives were developed (Figure 4-1) and screened (Table 4-2). Appendix C includes preliminary sketches of vehicle alternatives for reference. The alternative cut-sheets accompanying Chapter 5, Alternatives Analysis include additional preliminary concept plans for alternatives which were ultimately advanced as a recommendation.

Truck parking at the Route 128/I-95 Northbound Service Plaza, Lexington

- **Alternative V-1: Increase Truck Parking at Lexington Service Plaza** – Review opportunities for additional truck parking at the Lexington Service Plaza to address existing needs. Consider use of annex lot and/or modifications to existing parking and circulation.
- **Alternative V-2: Route 128/I-95 Northbound between Interchanges 44 (Trapelo Road) and 46 (Route 2A): Construct New C-D Road** – Consider a collector-distributer (C-D) road along Route 128/I-95 northbound either between interchanges 45 (Route 2) and 46 (Route 2A) or between interchanges 44 (Trapelo Road) and 45 (Route 2) to accommodate the traffic demand between the interchanges and separate from mainline traffic.
- **Alternative V-3: Route 128/I-95 Southbound at Interchange 45 (Route 2): Construct New C-D Road** – Consider replacing the auxiliary lane with a C-D road along Route 128/I-95 southbound within the interchange to eliminate the weaving movement between off- and on-ramps.
- **Alternative V-4: Route 128/I-95 Northbound Interchange 45: Two-Lane Off-Ramp to Route 2 Eastbound** – Consider expanding the existing off-ramp from Route 128/I-95 northbound to Route 2 eastbound from one lane to two lanes to provide additional capacity.
- **Alternative V-5: Trapelo Road at Route 128/I-95 Ramps: Improve Intersections** – Consider intersection improvements (signalization or roundabout) at the intersections of Trapelo Road and Data Drive/Route 128/I-95 southbound on-ramp and Trapelo Road at Route 128/I-95 northbound ramps to address operational issues.
- **Alternative V-6: Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Half Clover Interchange and Reconstruct Winter Street** – Reconstruct the Route 128/I-95 southbound ramps to a half clover interchange and Winter Street west of Route 128/I-95 to remove the “goose pond”[53]. The reconstruction would provide direct connections from Route 128/I-95 southbound to Second Avenue and Winter Street westbound to Route 128/I-95 southbound.

53 The “Goose Pond” refers to the area bound by Winter Street eastbound and westbound travel lanes, 2nd Avenue, and 1st Avenue.

» **Alternative V-7: Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Half Clover Interchange with Existing Winter Street Geometry** – Reconstruct the Route 128/I-95 southbound ramps to a half clover interchange and maintain the existing Winter Street geometry. The reconstruction would provide a direct connection from Winter Street westbound to Route 128/I-95 southbound.

Winter Street westbound approaching Second Avenue, Waltham

» **Alternative V-8: Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Half Clover Interchange with Existing Winter Street Geometry and Slip Lane** – Reconstruct the Route 128/I-95 southbound ramps to a half clover interchange and add a slip lane from Route 128/I-95 southbound to Winter Street westbound, removing that traffic from the signal. The reconstruction would provide a direct connection from Winter Street westbound to Route 128/I-95 southbound.

» **Alternative V-9: Route 128/I-95 Southbound Interchange 43 (Winter Street): Reconstruct Winter Street and Southbound Off-Ramp** – Reconstruct Winter Street to remove the "goose pond" and add a jug handle from Route 128/I-95 southbound and Winter Street westbound for access to Second Avenue. Relocate the Bertucci's parcel driveway to the signal at First Avenue.

» **Alternative V-10: Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Two Lane Off-Ramp** – Increase capacity on Route 128/I-95 southbound ramp by providing a two-lane off-ramp.

» **Alternative V-11: Route 128/I-95 Southbound Interchange 43 (Winter Street): Modify Winter Street Eastbound** – Simplify the intersections of Winter Street eastbound and westbound with Second Avenue by eliminating access to Winter Street westbound from Winter Street eastbound and Second Avenue. Winter Street eastbound left-turn movements would be shifted east to a new signalized jughandle intersection east of the Route 128/I-95 southbound off-ramp. Requires modifications to the Route 128/I-95 southbound off-ramp which includes providing a two-lane off-ramp.

» **Alternative V-12: Route 128/I-95 Northbound Interchange 43 (Winter Street/ Third Avenue): Extend On-Ramp Acceleration Lane** – Extend the acceleration lane for the on-ramp to Route 128/I-95 northbound by approximately 400 feet to meet current design standards.

» **Alternative V-13: Route 20 at Summer Street: Install Dedicated Turn Lanes on Summer Street** – Reconstruct the Summer Street northbound approach to include dedicated left-turn and right-turn lanes to improve operations on the Summer Street northbound approach.

» **Alternative V-14: Route 20 at Summer Street: Signalize Intersection** – Evaluate signal warrants and, if warranted, install a signal at the intersection of Route 20 at Summer Street to improve operations on the Summer Street northbound approach.

- **Alternative V-15: Route 128/I-95 Northbound Interchange 39 (I-90/ Route 30): Extend Second Lane of C-D Road** – Consider extending the two-lane section on Route 128/I-95 northbound C-D Road from I-90/Grove Street/Route 30 now that the on-ramp from Route 30 eastbound will be removed as part of Route 30 reconstruction project. Consider including this alternative as part of a current MassDOT design project.

Interchange 38-37B & Service Plaza ramps, Newton

- **Alternative V-16: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Consolidate Service Plaza Ramps** – Consolidate the service plaza on- and off-ramps with the adjacent on- and off-ramps at interchanges 37 and 38 to reduce the number of successive ramps.
- **Alternative V-17: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Modify C-D Road and Service Plaza Access** – Reconfigure the Interchange 38-37B southbound off-ramp to create a roundabout or stop-controlled intersection with the Quinobequin Road. Close the service plaza ramps and provide access via Quinobequin Road. Reconfigure the service plaza circulation.
- **Alternative V-18: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close Off-Ramp to Route 16 Eastbound** – Close the Route 128/I-95 southbound off-ramp to Route 16 eastbound and shift traffic to the Interchange 38-37B southbound off-ramp, removing the weave on Route 128/I-95 southbound. Reconfigure the Interchange 38-37B southbound off-ramp to create an intersection with Quinobequin Road.
- **Alternative V-19: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress** – Close the on-ramp from Grove Street to Route 128/I-95 southbound and shift traffic to the on-ramp from Quinobequin Road south of Route 16, benefiting the Route 128/I-95 southbound weave movement by removing some traffic demand. Reconfigure the service plaza egress and consolidate with the adjacent ramp.
- **Alternative V-20: Route 128/I-95 Northbound Interchange 37 (Route 16): Close On-Ramp from Route 16 Westbound** – Close the Route 128/I-95 northbound on-ramp from Route 16 westbound to remove the weave movement between that on-ramp and the Exit 39 (Grove Street) off-ramp. Provide access from Route 16 westbound to the existing Route 128/I-95 northbound on-ramp by creating a signalized intersection that allows left-turns. Extend the Route 128/I-95 northbound on-ramp acceleration lane.
- **Alternative V-21: Route 16 at Route 128/I-95 Northbound Ramps and Quinobequin Road: Install Roundabout(s)** – Convert the intersections of Route 16 at Quinobequin Road and at Route 128/I-95 Northbound Ramps into roundabouts to improve intersection operations.

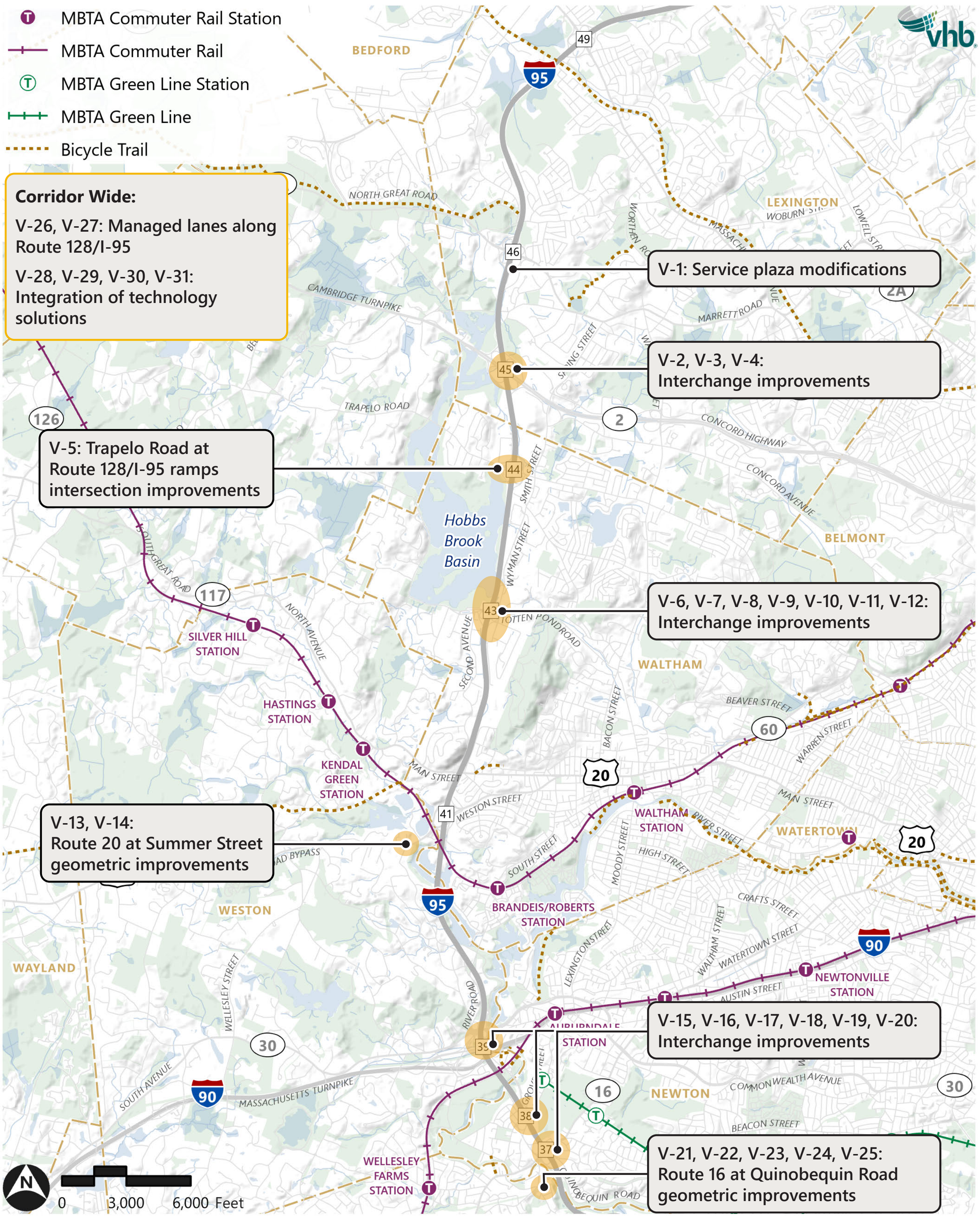
- **Alternative V-22: Route 16 at Quinobequin Road: Close Wales Street** – Consider the closure of Wales Street to improve intersection operations.
- **Alternative V-23: Route 16 at Quinobequin Road: Install Dedicated Eastbound Right-Turn Lane** – Install a dedicated right-turn lane on the Route 16 eastbound approach to Quinobequin Road and make the eastbound right-turn signal phase protected only.
- **Alternative V-24: Route 16 at Quinobequin Road: Extend Westbound Left-Turn Lane** – Restripe the Route 16 Westbound approach on the bridge over Route 128/I-95 to narrow the median and extend the left-turn lane to approximately 650 feet approaching Quinobequin Road to better accommodate the queues. MassDOT initiated an intersection improvement project at Route 16 at Quinobequin Road, (MassDOT Project 612613). As of Winter 2023, the project is in the design stages. Improvements at this location should be coordinated with this project.

Route 16 WB approaching Quinobequin Road, Newton

- **Alternative V-25: Route 16 at Quinobequin Road: Extend Southbound Two-Lane Approach on Quinobequin Road** – Restripe the Quinobequin southbound approach to provide two lanes for up to 500 feet approaching the intersection to better manage queues.
- **Alternative V-26: Convert General-Purpose Lane on Route 128/I-95 to Managed Lane** – Convert one general purpose lane to a managed lane, assuming a reduced typical section with no buffer separation and/or reduced shoulder widths.
- **Alternative V-27: Widen Route 128/I-95 to Accommodate Managed Lane** – Widen Route 128/I-95 to add a new managed lane which could be comprised of directional lanes or a reversible express lane.
- **Alternative V-28: Consider Connected/Autonomous Vehicle Technology** – Evaluate opportunities to enable future vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications along the Route 128/I-95 corridor.
- **Alternative V-29: Consider Transportation Systems Management and Operations Strategies** – Identify opportunities to deploy Transportation Systems Management and Operations (TSMO) strategies such as incident detection monitoring and integrated multimodal traveler information.
- **Alternative V-30: Consider Dynamic tolling on I-90** – Implement dynamic tolling[54] on I-90 to more consistently maintain optimal traffic flow.
- **Alternative V-31: Build upon Outcomes of Shared Travel Network Study** – Consider components of an ideal shared travel network, particularly where future and/or mobility enhancements are being considered along the Fitchburg Line and Worcester Line.

54 FHWA: Dynamic tolling (also referred to as congestion pricing) is a system in which tolls are continually adjusted according to traffic conditions to maintain a free-flowing level of traffic. Under this system, prices increase when the tolled lane(s) get relatively full and decrease when the tolled lane(s) get less full.

Figure 4-1: Vehicular Alternatives



Source: MassGIS, MassDOT

Table 4-2 Vehicular Transportation Alternatives Screening

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
V-1	Increase Truck Parking at Lexington Service Plaza	●	◐	◐	◐	●	Advance
V-2	Route 128/I-95 Northbound between Interchanges 44 (Trapelo Road) and 46 (Route 2A): Construct New C-D Road	●	●	◐	○	◐	Advance
V-3	Route 128/I-95 Southbound at Interchange 45 (Route 2): Construct New C-D Road	●	●	◐	○	●	Advance
V-4	Route 128/I-95 Northbound Interchange 45: Two-Lane Off-Ramp to Route 2 Eastbound	●	●	◐	○	●	Advance
V-5	Trapelo Road at Route 128/I-95 Ramps: Improve Intersections	●	●	◐	◐	●	Advance
V-6	Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Half Clover Interchange and Reconstruct Winter Street	●	◐	◐	○	◐	Discard
V-7	Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Half Clover Interchange with Existing Winter Street Geometry	○	◐	◐	○	●	Discard
V-8	Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Half Clover Interchange with Existing Winter Street Geometry and Slip Lane	●	◐	◐	○	●	Discard
V-9	Route 128/I-95 Southbound Interchange 43 (Winter Street): Reconstruct Winter Street and Southbound Off-Ramp	●	●	◐	○	◐	Advance
V-10	Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Two Lane Off-Ramp	●	●	◐	○	●	Advance
V-11	Route 128/I-95 Southbound Interchange 43 (Winter Street): Modify Winter Street Eastbound	●	◐	◐	◐	●	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

● - Benefit ◐ - Neutral ○ - Impact

Table 4-2 Vehicular Transportation Alternatives Screening (continued)

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
V-12	Route 128/I-95 Northbound Interchange 43 (Winter Street/ Third Avenue): Extend On-Ramp Acceleration Lane	●	●	◐	◐	●	Advance
V-13	Route 20 at Summer Street: Install Dedicated Turn Lanes on Summer Street	●	○	◐	○	◐	Discard
V-14	Route 20 at Summer Street: Signalize Intersection	●	◐	◐	◐	●	Advance
V-15	Route 128/I-95 Northbound Interchange 39 (I-90/ Route 30): Extend Second Lane of C-D Road	●	●	◐	◐	●	Advance
V-16	Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Consolidate Service Plaza Ramps	◐	◐	◐	◐	●	Discard
V-17	Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Modify C-D Road and Service Plaza Access	●	◐	◐	◐	●	Advance
V-18	Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close Off-Ramp to Route 16 Eastbound	◐	◐	◐	◐	●	Advance
V-19	Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress	◐	◐	◐	◐	●	Advance
V-20	Route 128/I-95 Northbound Interchange 37 (Route 16): Close On-Ramp from Route 16 Westbound	●	●	◐	◐	●	Advance
V-21	Route 16 at Route 128/I-95 Northbound Ramps and Quinobequin Road: Install Roundabout(s)	◐	○	◐	○	○	Discard
V-22	Route 16 at Quinobequin Road: Close Wales Street	○	◐	◐	◐	○	Discard

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

● - Benefit ◐ - Neutral ○ - Impact

Table 4-2 Vehicular Transportation Alternatives Screening (continued)

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
V-23	Route 16 at Quinobequin Road: Install Dedicated Eastbound Right-Turn Lane	●	◐	◐	○	○	Discard
V-24	Route 16 at Quinobequin Road: Extend Westbound Left-Turn Lane	●	◐	◐	◐	●	Immediate Action
V-25	Route 16 at Quinobequin Road: Extend Southbound Two-Lane Approach on Quinobequin Road	●	◐	◐	◐	●	Immediate Action
V-26	Convert a General-Purpose Lane on Route 128/I-95 to Managed Lane	◐	◐	○	◐	◐	Advance
V-27	Widen Route 128/I-95 to Accommodate Managed Lane	●	◐	○	○	○	Discard
V-28	Consider Connected/ Autonomous Vehicle Technology	●	◐	◐	●	●	Advance
V-29	Consider Transportation Systems Management and Operations Strategies	●	◐	◐	●	●	Advance
V-30	Consider Dynamic tolling on I-90	◐	○	○	◐	◐	Discard
V-31	Build upon Outcomes of Shared Travel Network Study	●	●	◐	●	●	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

● - Benefit ◐ - Neutral ○ - Impact

Two of the alternatives are recommended as immediate actions, **Alternatives V-24 and V-25,** and more information is provided at the end of this chapter. As shown above, the remaining Vehicular alternatives were screened against the established study goals and objectives and 19 are recommended to advance for further study. The following 10 Vehicular alternatives are recommended to be discarded for the following reasons:

» **Alternatives V-6, V-7, and V-8** are recommended to be discarded as these alternatives would result in significant impacts to the wetlands adjacent to the Cambridge Reservoir and not provide a significant operational and/or safety benefit. Additionally, other alternatives can be pursued at Interchange 43 (Winter Street) that help to improve traffic operations and safety without significant impacts to environmental resources.

- **Alternative V-13** is recommended to be discarded as providing dedicated turn lanes on Summer Street would require widening resulting in impacts to adjacent properties while not providing significant lasting benefits.
- **Alternative V-16** is recommended to be discarded as combining the service plaza off-ramp directly with the Interchange 38-37B (Grove Street/ Route 16 westbound) off-ramp could create a safety issue as vehicles would not have adequate distance to safely reduce vehicle speeds when entering the service plaza.
- **Alternative V-21** is recommended to be discarded as converting the intersections to roundabout control would result in poor traffic operations and significant queues. Both the existing and future traffic volumes are too high (over 3,500 vehicles entering the intersection) to sufficiently be accommodated in a single lane roundabout. A multilane roundabout would likely require roadway widening resulting in impacts to adjacent properties.
- **Alternative V-22** is recommended to be discarded as closing Wales Street would eliminate a connection between Newton and Wellesley, impact parcel access, and result in redirecting vehicles to other nearby roadways.
- **Alternative V-23** is recommended to be discarded as adding a dedicated eastbound right-turn lane would require widening the roadway towards the Charles River likely resulting in environmental impacts.
- **Alternative V-27** is recommended to be discarded as widening Route 128/I-95 for new managed lanes would require significant infrastructure improvements and would continue to focus substantial investments on improving driver accommodations at the expense of improvements that would better encourage a shift away from single-occupancy vehicles.
- **Alternative V-30** is recommended to be discarded as increased tolling on I-90 may encourage drivers to divert to local roadways and increased tolling for those who cannot change their travel patterns may unfairly impact low-income commuters.

Transit

Transit alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on increasing transit frequency, reliability, and connectivity in the service area. In this category, 12 alternatives were developed (Figure 4-2) and screened (Table 4-3):

- **Alternative T-1: Provide Additional Transit Service in Northern Portion of Study Area** – Evaluate the feasibility of providing additional transit service in Waltham and Lexington. Existing service in the northern portion of the study area focuses mainly on connecting to Alewife Station and the Fitchburg Line and does not easily accommodate travel to other destinations.
- **Alternative T-2: Relocate MBTA Route 76 Marrett Road opp. Wilson Road Inbound Bus Stop** – The inbound bus stop of Marrett Road at Wilson Road does not have a sidewalk. Move the bus stop east of Elena Road (approximately 250 feet) immediately next to the existing crosswalk where the sidewalk starts on the south side of Marrett Road. Additionally, restripe the existing crosswalk. ***This alternative was implemented by MBTA in late 2022, after the list of alternatives had been developed.***

» **Alternative T-3: Extend Sidewalk for MBTA Route 61 Bus Stop on Smith Street South of Trapelo Road** – The sidewalk on the west side of Smith Street currently ends approximately 50 feet north of the bus stop. Extend the sidewalk south to the bus stop to provide passengers a place to wait for the bus and other connections.

» **Alternative T-4: Extend Shuttle Network in West Waltham** – Add supplemental shuttle service west of Route 128/I-95 to capture existing and planned development in West Waltham.

» **Alternative T-5: Create Fitchburg Line Multimodal Hub** – Create a new multimodal hub along the Fitchburg Line in the vicinity of Jones Road/ Green Street in Waltham, likely as a relocation of the existing Kendall Green station, with improved connections to Route 128/I-95.

» **Alternative T-6: Consider Transit Connection between West Waltham and Worcester Line/Green Line** – Add supplemental transit service between transit stations in Newton and commercial hubs in West Waltham.

» **Alternative T-7: Consider Green Line Extension Along Route 128/I-95 Corridor** – Extend the Green Line north from Riverside Station with center or side running service along the Route 128/I-95 corridor.

» **Alternative T-8: Provide Increased East-West Bus Service** – Provide additional east-west bus service in the study area municipalities to improve access to employment centers along Route 128/I-95. The additional bus service could be provided by a private shuttle operator or local transit agencies.

MBTA Commuter Rail Train


MBTA Green Line Train

» **Alternative T-9: Implement Managed Lane: Bus on Shoulder** – Repurpose the shoulder on Route 128/I-95 as a bus lane. The lane could be for the entire study area or for targeted locations in connection with proposed bus service (i.e., between one or two interchanges that serve shuttles/MBTA routes).

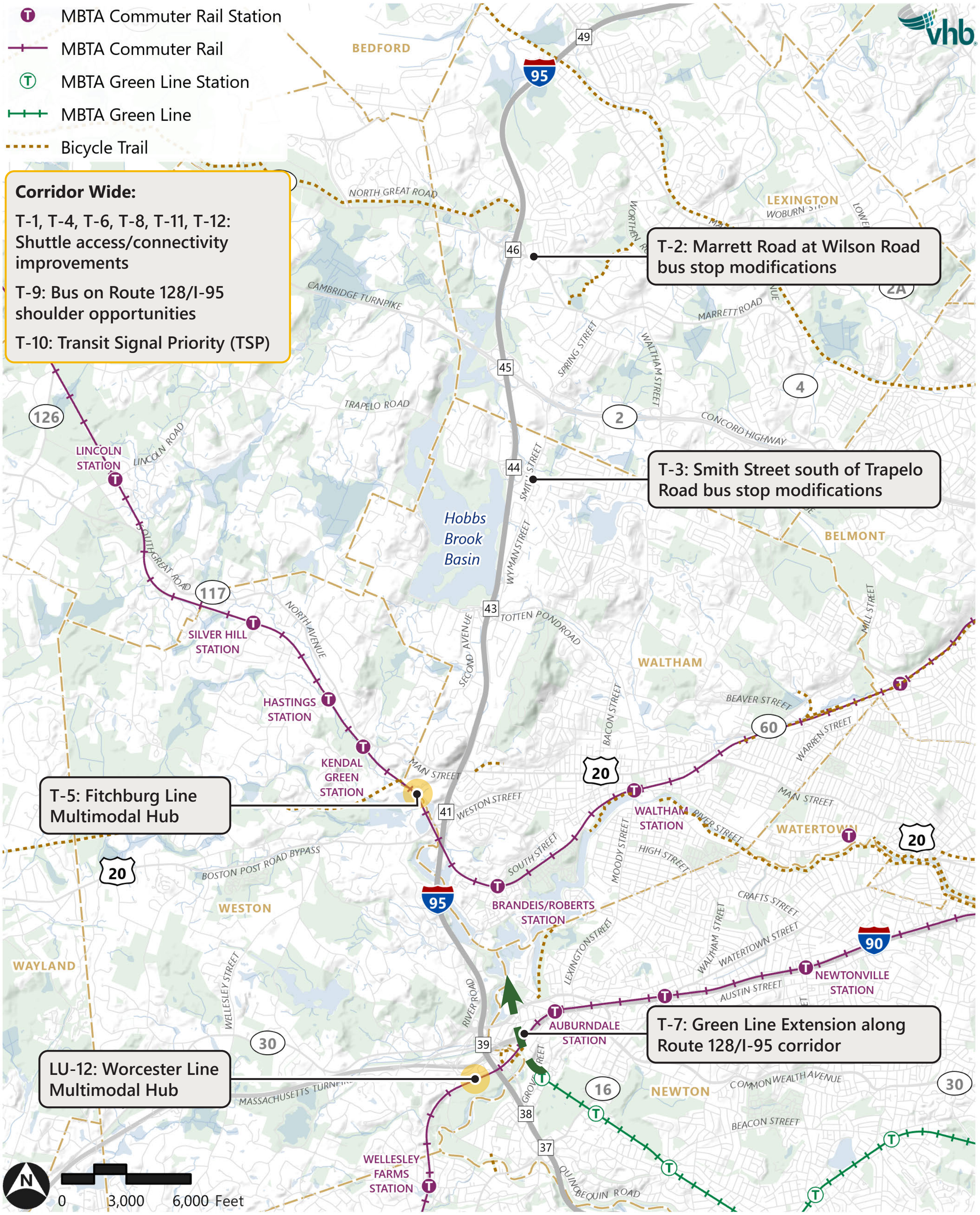
» **Alternative T-10: Install Transit Signal Priority** – Install Transit Signal Priority (TSP) at up to 12 signalized study area intersections with expected future MBTA bus service[55].

55 Future MBTA bus service and routes based on Bus Network Redesign revised bus network map released in November 2022.

- **Alternative T-11: Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks** – Increase the frequency of existing transit services in the study area (such as those operated by the MBTA, Lexpress, and the Route 128 Business Council) outside traditional weekday morning and weekday evening peak periods.
- **Alternative T-12: Expand Shuttle Access for All Passengers** – Establish partnerships between transit operators, business communities, and municipalities to allow residents access to all shuttles and increase marketing to non-members to inform the public of this transit option.

MBTA Route 70 Bus Stop at Marketplace Drive, Waltham

Figure 4-2: Transit Alternatives



Source: MassGIS, MassDOT

Table 4-3 Transit Alternatives Screening

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
T-1	Provide Additional Transit Service in Northern Portion of Study Area	●	●	●	●	◐	Advance
T-2	Relocate MBTA Route 76 Marrett Road opposite Wilson Road Inbound Bus Stop	●	◐	●	◐	◐	Immediate Action
T-3	Extend Sidewalk for MBTA Route 61 Bus Stop on Smith St South of Trapelo Road	●	◐	●	◐	◐	Immediate Action
T-4	Extend Shuttle Network in West Waltham	●	●	◐	●	◐	Advance
T-5	Create Fitchburg Line Multimodal Hub	●	●	●	◐	◐	Advance
T-6	Consider Transit Connection between West Waltham and Worcester Line/Green Line	●	●	◐	●	◐	Advance [1]
T-7	Consider Green Line Extension Along Route 128/I-95 Corridor	◐	●	◐	○	○	Discard
T-8	Consider Increased East-West Bus Service	●	●	◐	●	◐	Advance
T-9	Implement Managed Lane: Bus on Shoulder	●	●	◐	●	◐	Advance [2]
T-10	Install Transit Signal Priority	●	◐	●	◐	◐	Advance
T-11	Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks	●	●	●	●	◐	Advance
T-12	Expand Shuttle Access for All Passengers	●	●	●	●	◐	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

1 – Advance for shuttle service only

2 – Advance in key areas to support shuttle service

● - Benefit ◐ - Neutral ○ - Impact

Two of the alternatives are recommended as immediate actions, **Alternatives T-2 and T-3,** and more information is provided at the end of this chapter. As shown above, the remaining Transit alternatives were screened against the established study goals and objectives and nine are recommended to advance for further study. **Alternative T-7** is recommended to be discarded because of the significant cost and environmental impacts of extending the Green Line, combined with anticipated impacts to existing Green Line service.

Active Transportation

Active Transportation alternatives primarily include infrastructure improvements that focus on supporting multimodal mobility and connectivity. In this category, 10 alternatives were developed (Figure 4-3) and screened (Table 4-4):

- **Alternative AT-1: Improve North-South Bicycle Connections along Route 128/I-95** – Provide enhanced north-south bicycle accommodations on routes paralleling Route 128/I-95 within the study area to create a continuous bicycle network.
- **Alternative AT-2: Improve East-West Bicycle Connections across Route 128/I-95** – Provide enhanced bicycle accommodations on east-west roadways crossing Route 128/ I-95, including Trapelo Road and Route 16.
- **Alternative AT-3: Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95** – Provide enhanced north-south bicycle accommodations within Lexington and Waltham generally along the Waltham Street/ Lexington Street corridor.
- **Alternative AT-4: Improve East-West Bicycle Connections within Waltham** – Provide enhanced east-west bicycle accommodations within Waltham, including on Totten Pond Road and on connecting roadways between South Street and the Charles River Greenway, linking destinations on the west side of Waltham, such as Brandeis University and downtown Waltham to points east. These connections could compliment the planned MCRT extension. Main Street is a primary existing east-west bicycle route through Waltham and is a 2010-2019 HSIP high-crash bicycle cluster between Francis Street and Elm Street.


MCRT, Weston

- **Alternative AT-5: Construct Lower Falls Shared Use Path** – Construct a shared use path through the Lower Falls neighborhood of Newton, providing an off-road connection between the Riverside MBTA station and Wellesley. Determine the preferred alignment either on the former railroad ROW, preferred by the City of Newton, or along the southern edge of the Leo J. Martin Golf Course. Utilize the old railroad bridges over Route 128/I-95 and the northbound C-D Road to connect to Riverside.

- **Alternative AT-6: Improve Trapelo Road at Route 128/I-95 Southbound Off-Ramp: Restripe Crosswalks** – Restripe crosswalks across the Trapelo Road eastbound approach and the Route 128/I-95 southbound off-ramp approach as the paint is faded.
- **Alternative AT-7: Improve Trapelo Road at Smith Street: Install Crosswalk Across Eastbound Approach** – Add a crosswalk across the eastbound approach of the intersection to facilitate safe pedestrian crossings. Crosswalks are currently provided on three of the four intersection approaches.
- **Alternative AT-8: Improve Route 16 at Route 128/I-95 Northbound Ramps: Install Crosswalks across Route 16 with Flashing Beacons or Signal** – Install crosswalks across Route 16 to provide safe crossings for pedestrians. Consider treatments to enhance the crosswalk and improve safety, such as a signal (if warranted) or flashing beacons.
- **Alternative AT-9: Improve Route 16 at Route 128/I-95 Northbound Ramps and Quinobequin Road: Restripe Crosswalks** – Restripe crosswalks at the intersections of Route 16 at Route 128/I-95 Northbound Ramps and Route 16 at Route 128/I-95 Southbound Ramps/Quinobequin Road as the paint is faded.
- **Alternative AT-10: Expand Public Bike Share Program** – Expand upon the Bluebikes system in place throughout Greater Boston. Start with an initial expansion in Waltham and expand throughout the rest of the study area in subsequent phases. Only Newton is currently included in Bluebikes system of the five study area municipalities.


Bluebikes Station, Newton

While outside the study area, additional north-south bicycle connections could be explored to further improve regional mobility, particularly in Lincoln, with a grade-separated crossing of Route 2 and enhanced bicycle accommodations along Page Road and Winter Street. This alternative is outside the scope of this study and therefore not evaluated further but could be explored by others and could complement Alternative GT-1: Consider Two-Way Winter Street between Waltham and Lincoln.

Figure 4-3: Active Transportation Alternatives

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

- Existing Bluebikes Station
- Potential Bluebikes Station
- MBTA Commuter Rail Station
- MBTA Commuter Rail
- MBTA Green Line Station
- MBTA Green Line
- Paved Path
- Bike Lane
- Planned - Paved Path
- Planned - Separated Bike Lane
- Bicycle Connection Alternatives

Key:

AT-1: Improve north-south bicycle connections along Route 128/I-95

AT-2: Improve east-west bicycle connections across Route 128/I-95

AT-3: Improve north-south bicycle connections within Lexington and Waltham east of Route 128/I-95

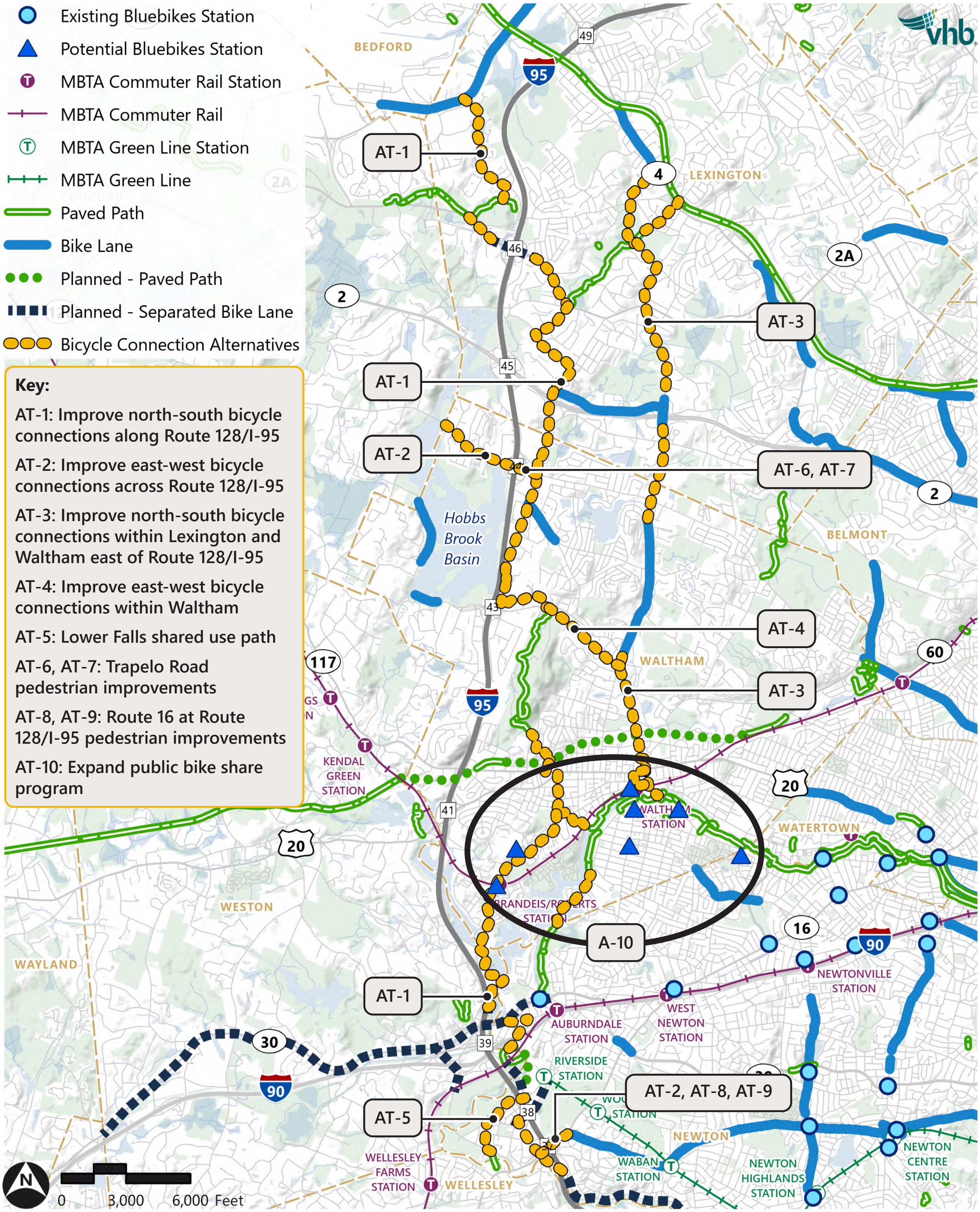
AT-4: Improve east-west bicycle connections within Waltham

AT-5: Lower Falls shared use path

AT-6, AT-7: Trapelo Road pedestrian improvements

AT-8, AT-9: Route 16 at Route 128/I-95 pedestrian improvements

AT-10: Expand public bike share program



Source: MassGIS, MassDOT, MAPC

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 4 Figures Indesign\Chapter 4 Figures.indd

Table 4-4 Active Transportation Alternatives Screening

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
AT-1	Improve North-South Bicycle Connections along Route 128/I-95	●	●	●	●	●	Advance
AT-2	Improve East-West Bicycle Connections across Route 128/I-95	●	●	●	●	●	Advance
AT-3	Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95	●	●	●	●	●	Advance
AT-4	Improve East-West Bicycle Connections within Waltham	●	●	●	●	●	Advance
AT-5	Construct Lower Falls Shared Use Path	●	●	●	●	●	Advance
AT-6	Improve Trapelo Road at Route 128/I-95 Southbound Off-Ramp: Restripe Crosswalks	●	◐	◐	◐	◐	Immediate Action
AT-7	Improve Trapelo Road at Smith Street: Install Crosswalk Across Eastbound Approach	●	◐	◐	◐	●	Immediate Action
AT-8	Improve Route 16 at Route 128/I-95 Northbound Ramps: Install Crosswalks across Route 16 with Flashing Beacons or Signal	●	◐	◐	◐	◐	Discard
AT-9	Improve Route 16 at Route 128/I-95 Northbound Ramps and Quinobequin Road: Restripe Crosswalks	●	◐	◐	◐	◐	Immediate Action
AT-10	Expand Public Bike Share Program	●	●	●	●	●	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

● - Benefit ◐ - Neutral ○ - Impact

Three of the alternatives are recommended as immediate actions, **Alternatives AT-6, AT-7, and AT-9,**and more information is provided at the end of this chapter. As shown above, the remaining Active Transportation alternatives were screened against the established study goals and objectives and six are recommended to advance for further study. **Alternative AT-8** is recommended to be discarded as there is minimal demand to cross Route 16 at this location and existing pedestrian crossings are currently provided at the signalized intersections with Beacon Street to the east and Quinobequin Road to the west. In addition, this alternative can be integrated with intersection improvements proposed in **Alternative V-20.**

Safety

Safety alternatives include infrastructure improvements that focus on mitigating existing identified safety deficiencies in the study area. In this category, six alternatives were developed and screened (Table 4-5). In addition to the process outlined above, decisions to advance alternatives under this category were considered against the recent Road Safety Audits conducted along the corridor.

- **Alternative S-1: Route 128/I-95 Corridor Wide Guardrail Review** – Review guardrail location and quality along the Route 128/I-95 corridor within the study area for compliance with current standards. Of note is vehicles parked along Route 128/I-95 southbound at an existing guardrail break to access the Cambridge Reservoir, presenting a safety concern.
- **Alternative S-2: Route 16 at Quinobequin Road: Install Advance Signage and Lane Designation Markings** – As recommended in the Road Safety Audit for this location, install advance signage and lane markings to reduce driver confusion, especially for the westbound and southbound approaches.
- **Alternative S-3: Route 16 at Beacon Street: Install "No Turn on Red" Signage for Beacon Street North-westbound Approach** – As recommended in the Road Safety Audit for this location, install "No Turn on Red" signs for the Beacon Street north-westbound approach to limit conflicts between pedestrians and turning vehicles.
- **Alternative S-4: Route 16 at Quinobequin Road: Install Flashing Yellow Arrows** – As recommended in the Road Safety Audit for this location, install flashing yellow arrows for the westbound left-turn phase and the northbound left-turn phase to enforce that turning vehicles must yield to oncoming traffic.
- **Alternative S-5: Advanced Congestion Warning to Mitigate Risk for Large Vehicle Crash Potential** – MassDOT's Risk based Network Screening tool identified Route 128/I-95 within the study area as a risk site for large vehicle crashes. Consider opportunities to reduce risk of large vehicle crashes along Route 128/I-95 utilizing technology.
- **Alternative S-6: Review Speed Data on Study Area Roadways** – Evaluate speeds on non-interstate roadways, including arterials, collectors, and local roadways under MassDOT and local jurisdiction, to determine if there's a need for speed management treatments. Refer to MassDOT's Safe Speed: Roadway Treatment Technical Toolkit available for municipalities to determine applicable speed management roadway treatments where necessary.

Table 4-5 Safety Transportation Alternatives Screening

		Benefits & Impacts to Goals & Objectives					
ID	Alternative	Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
S-1	Route 128/I-95 Corridor Wide Guardrail Review	●	◐	◐	◐	◐	Discard [1]
S-2	Route 16 at Quinobequin Road: Install Advance Signage and Lane Markings for Lane Designations	●	◐	◐	◐	◐	Immediate Action
S-3	Route 16 at Beacon Street: Install "No Turn on Red" Signage for Beacon Street North-westbound Approach	●	◐	◐	◐	◐	Immediate Action
S-4	Route 16 at Quinobequin Road: Install Flashing Yellow Arrows	●	◐	◐	◐	◐	Immediate Action
S-5	Advanced Congestion Warning to Mitigate Risk for Large Vehicle Crash Potential	●	◐	◐	●	●	Discard [1]
S-6	Review Speed Data on Study Area Roadway	●	◐	◐	◐	●	Immediate Action

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

1 - Discard as stand-alone improvements for evaluation in this study.

● - Benefit ◐ - Neutral ○ - Impact

Four of the alternatives are recommended as immediate actions, **Alternatives S-2, S-3, S-4, and S-6,** and more information is provided at the end of this chapter. The remaining two Safety alternatives were screened against the established study goals and objectives, and neither are recommended to advance for further study. **Alternatives S-1 and S-5** are recommended to be discarded as stand-alone improvements, however, could be incorporated into future projects along the corridor, as appropriate. **Alternative S-1** could also be considered as a maintenance project. **Alternative S-5** would best be suited as part of a more comprehensive integration of technology solutions along Route 128/I-95 presented as **Alternative V-29**.

General Transportation

General Transportation alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on supporting multimodal mobility and accessibility for all modes of transportation. In this category, nine alternatives were developed and screened (Table 4-6):

» **Alternative GT-1: Consider Two-Way Winter Street between Waltham and Lincoln** – Provide a two-way connection for transit, pedestrians/bicyclists, and/or vehicles on Winter Street between Waltham and Lincoln where it is currently one-way westbound for all traffic.

» **Alternative GT-2: Consider New Connection over Route 128/I-95 South of Winter Street** – Consider a new east-west multimodal connection (pedestrians/bicyclists, vehicle, and/or transit) over Route 128/I-95 in Waltham between Bear Hill Road/Second Avenue and Third Avenue.

» **Alternative GT-3: Route 128/I-95 Corridor Wide: Consider the Need for Sound Barriers** – Consider the need for sound barriers along Route 128/I-95 within the study area and review MassDOT's Type II Priority List for sound barriers.

» **Alternative GT-4: Route 128/I-95 Corridor Wide: Improve Drainage** – Review the drainage along the Route 128/I-95 mainline for opportunities to improve and/or address existing issues.

» **Alternative GT-5: Route 128/I-95 Corridor Wide: Improve Shoulders** – Review shoulder widths along the Route 128/I-95 corridor within the study area to identify locations that are sub-standard and present opportunities to improve by shifting sign structures and/or light poles into the median.

» **Alternative GT-6: Improve Station Access and Connectivity** – As existing transit stations are upgraded and new stations are designed within the study area, ensure compliance with applicable Americans with Disabilities Act (ADA) standards for all users and improve pedestrian and bicycle connectivity, access, and amenities at stations.

» **Alternative GT-7: Develop Regional TDM Plan** – Develop and encourage implementation of enhanced TDM policies appropriate for the study area through a regional, coordinated approach to encourage mode shift, building upon the current TDM formula for developers provided in the City of Newton as appropriate.

» **Alternative GT-8: Install Electric Vehicle Infrastructure (Public)** – Work within MassDOT's EV Infrastructure Deployment Plan to identify opportunities to install electric vehicle infrastructure on publicly owned property and ROW within the study area.

» **Alternative GT-9: Install Electric Vehicle Infrastructure (Private)** – Promote the installation of electric vehicle charging infrastructure on privately-owned properties with a focus on multi-family residential developments and workplace and commercial destination settings. Build awareness among private property owners and major tenants of available incentive programs.

Electric Vehicle Charging Station at the Service Plaza, Lexington

Table 4-6 General Transportation Alternatives Screening

ID	Alternative	Benefits & Impacts to Goals & Objectives: Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
GT-1	Consider Two-Way Winter Street between Waltham and Lincoln	◐	●	◐	◐	●	Advance [1]
GT-2	Consider New Connection over Route 128/I-95 South of Winter Street	●	◐	◐	◐	○	Discard
GT-3	Route 128/I-95 Corridor Wide: Consider the Need for Sound Barriers	◐	◐	●	●	●	Discard [2]
GT-4	Route 128/I-95 Corridor Wide: Improve Drainage	●	◐	◐	◐	●	Discard [2]
GT-5	Route 128/I-95 Corridor Wide: Improve Shoulders	●	◐	◐	◐	●	Discard [2]
GT-6	Improve Station Access and Connectivity	●	●	●	●	●	Advance
GT-7	Develop Regional TDM Plan	●	●	●	●	●	Advance
GT-8	Install Electric Vehicle Infrastructure - Public	●	●	◐	●	●	Advance
GT-9	Install Electric Vehicle Infrastructure - Private	●	●	◐	●	●	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.
1 – Advance for two-way transit, pedestrian, and/or bicycle traffic only.
2 – Discard as stand-alone improvements for evaluation in this study.

● - Benefit ◐ - Neutral ○ - Impact

The nine General Transportation alternatives were screened against the established study goals and objectives and five of the nine are recommended to advance for further study. Four alternatives were discarded from further consideration:

» **Alternative GT-2** is recommended to be discarded because the anticipated demand for a new connection over Route 128/I-95 south of Winter Street would not justify the investment based on existing and planned/proposed land uses on either side of the interstate.

» **Alternative GT-3** is discarded as a stand-alone action. MassDOT's Type II Priority List identifies the following locations in the study area as "to be studied": Route 128/I-95/DeForest Road;

I-90/Charles Street; I-90/Central/Auburn Street. MassDOT's Type II Noise Abatement program examines the priority list locations to determine the feasibility and reasonableness of future Type II barriers.

- **Alternatives GT-4 and GT-5** are recommended to be discarded as stand-alone improvements as they are better suited to be considered as part of corridor maintenance projects administered through MassDOT District offices.

Environmental

Environmental alternatives include a combination of policy-based initiatives and infrastructure improvements that focus on improving existing environmental conditions and increasing climate resilience in the study area for the future. In this category, four alternatives were developed and screened (Table 4-7):

- **Alternative E-1: Improve Hobbs Brook Reservoir Water Quality** – Identify and implement measures to improve water quality in Hobbs Brook and its tributaries based on notable exceptions to meeting Class A Massachusetts Surface Water Quality Standards (e.g., chloride impairment). Water quality concerns can be identified through the City of Cambridge Water Department's Source Water Quality Monitoring Program, an ongoing study to assess source water quality in Cambridge reservoirs and associated tributaries.
- **Alternative E-2: Reduce Amount of Impervious Area and Increase Vegetative Cover** – Identify opportunities to reduce impervious areas within the study area, particularly those within floodplains. The reduction of impervious surfaces reduces the potential for localized flooding, as water is allowed to seep into the ground as opposed to into storm sewers and local waterways. Simultaneously increasing vegetative cover has the co-benefit of mitigating the urban heat island effect.
- **Alternative E-3: Provide Flood Storage and Stormwater Treatment Areas** – Identify properties within the 100-year and 500-year floodplains that could best serve the purpose of flood storage and stormwater treatment and explore ways to ensure their preservation for such purposes. The preservation of suitable properties for flood storage and stormwater treatment could not only protect local life and property, but also serve to enhance local water quality and wildlife habitat.
- **Alternative E-4: Limit Development within Flood Prone Areas** – Review local ordinances and bylaws to ensure that they do not allow inappropriate development within the 100-year floodplain or areas with exposure to inland flood risk. Encourage longer-term safeguards by restricting development within the 500-year floodplain, as appropriate. Coordinating local ordinances and bylaws to limit development in flood prone areas would protect against the potential future loss of life and property.

Table 4-7 Environmental Alternatives Screening

ID	Alternative	Benefits & Impacts to Goals & Objectives: Improve Access, Safety, and Mobility for All	Support Strategic Land Use and Economic Vitality	Advance Social Equity Throughout	Contribute Environmental and Health Benefits	Develop Recommendations with Lasting Benefits	Next Step
E-1	Improve Hobbs Brook Reservoir Water Quality	◐	●	●	●	●	Advance
E-2	Reduce Amount of Impervious Area and Increase Vegetative Cover	●	●	●	●	●	Advance
E-3	Provide Flood Storage and Stormwater Treatment Areas	●	●	●	●	●	Advance
E-4	Limit Development within Flood-Prone Areas	●	●	●	●	●	Advance

Note: Using Harvey Balls and colors to convey relative performance against goals and objectives.

● - Benefit ◐ - Neutral ○ - Impact

The four Environmental alternatives were screened against the established study goals and objectives and all four are recommended to advance for further study.

Immediate Recommendations – 0 to 1 Year

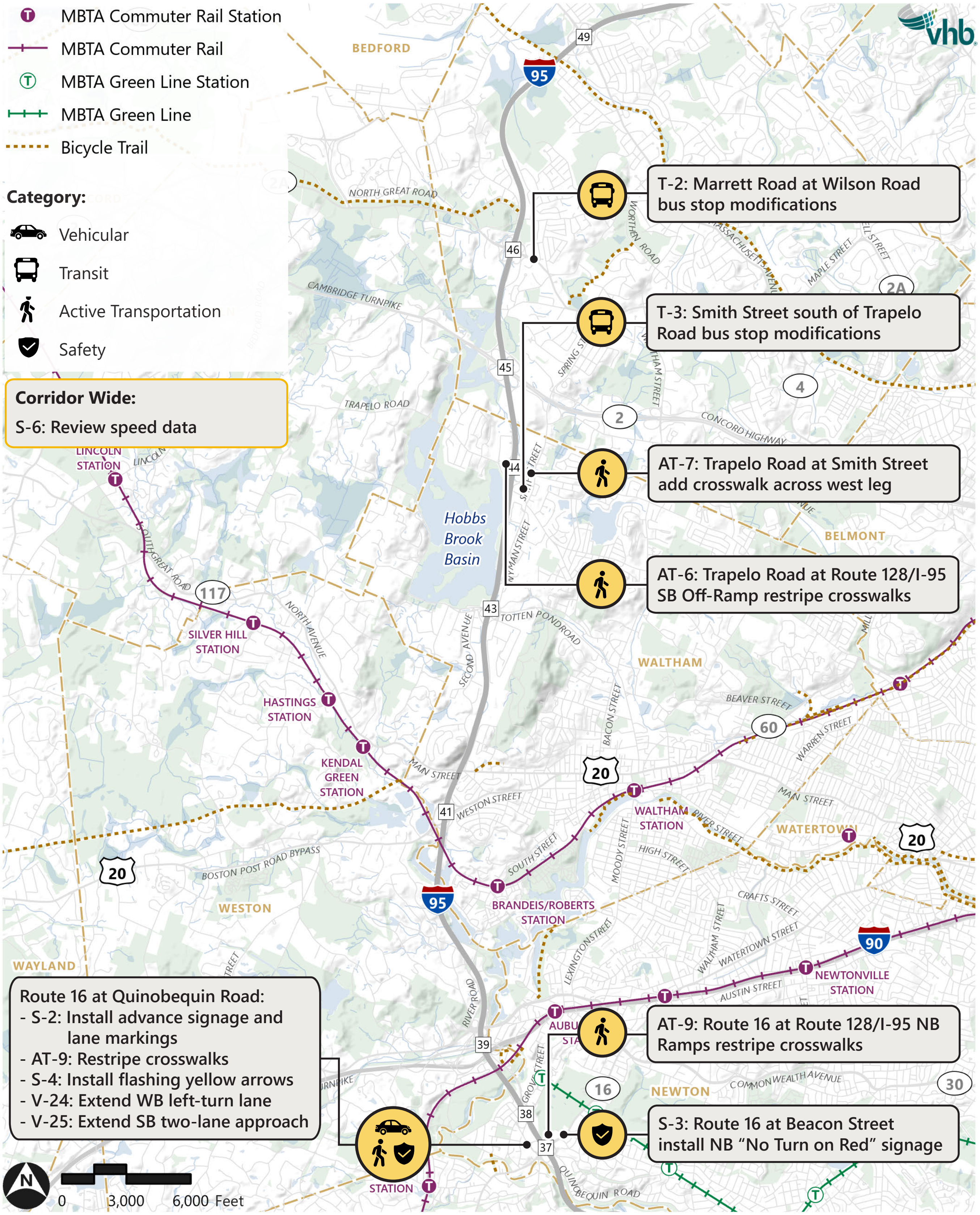
A series of improvements were identified for immediate implementation by MassDOT, the MBTA, and/or study area municipalities (Figure 4-4). These **11 immediate-term actions** address existing safety/operational deficiencies or advance some aspects of longer-term improvement projects. For the most part, these improvements can be completed within one year and include low-cost options that do not require environmental permitting, prolonged design or approvals, or extensive community vetting. Next steps in advancing these recommendations include coordination with responsible parties and evaluating the potential for each action to be addressed as part of mitigation item for private developments.

ID	Alternative	Responsible Parties	Next Steps
V-24	Route 16 at Quinobequin Road: Extend Westbound Left-Turn Lane	MassDOT	Coordination with MassDOT intersection improvement project[1]. Assessment of turn lane feasibility and advancement to design and construction.
V-25	Route 16 at Quinobequin Road: Extend Southbound Two-Lane Approach on Quinobequin Road	MassDOT	Coordination with MassDOT intersection improvement project[1]. Assessment of lane extension feasibility and advancement to design and construction.
T-2	Relocate MBTA Route 76 Marrett Road opposite Wilson Road Inbound Bus Stop	MassDOT, MBTA	This project was completed by the MBTA in late 2022.
T-3	Extend Sidewalk for MBTA Route 61 Bus Stop on Smith Street South of Trapelo Road	City of Waltham, MBTA	Municipal assessment of sidewalk feasibility and advancement to design and construction.
AT-6	Trapelo Road at Route 128/I-95 Southbound Off-Ramp: Restripe Crosswalks	MassDOT	Inclusion of crosswalk restriping in annual maintenance operating budget.
AT-7	Trapelo Road at Smith Street: Install Crosswalk Across Eastbound Approach	MassDOT	Assessment of crosswalk feasibility and advancement to design and construction.
AT-9	Route 16 at Route 128/I-95 Northbound Ramps and Quinobequin Road: Restripe Crosswalks	MassDOT, DCR	Coordination with MassDOT intersection improvement project[1]. Inclusion of crosswalk restriping in annual maintenance operating budget.

S-2	Route 16 at Quinobequin Road: Install Advance Signage and Lane Markings for Lane Designations	MassDOT, DCR	Coordination with MassDOT intersection improvement project[1]. Advancement to design and construction.
S-3	Route 16 at Beacon Street: Install "No Turn on Red" Signage for North-westbound Approach	City of Newton	Evaluation of right-turn-on-red installation to traffic operations. Installation of signage as part of annual maintenance operating budget.
S-4	Route 16 at Quinobequin Road: Install Flashing Yellow Arrows	MassDOT	Coordination with MassDOT intersection improvement project[1]. Assessment of feasibility and advancement to design and construction.
S-6	Review Speed Data on Study Area Roadways	MassDOT, Study Area Municipalities	Evaluation of speeds on study area roadways and review of MassDOT Roadway Treatment Technical Toolkit to determine applicable speed management treatments.

1 MassDOT has initiated a project to construct intersection improvements at the intersection of Route 16 at Quinobequin Road, which will include pedestrian and bicycle signal and crossing improvements (MassDOT Project 612613). As of Winter 2023, the project is still in the design stages and no official design plans have been released.

Figure 4-4: Immediate Recommendations



Source: MassGIS, MassDOT

5

Alternatives Analysis

This chapter discusses the evaluation of the alternatives that have been advanced beyond preliminary screening.

Chapter 4 presented a preliminary, 'fatal-flaw' screening of the alternatives that were identified as having the potential to address land use and transportation system issues and opportunities along the corridor. The options carried forward from the initial fatal-flaw screening were further refined, and this chapter presents more detailed assessments and evaluations of each option carried forward. The surviving options were evaluated within the established categories:

1. Land Use/Economic Development
2. Transportation
    a) Vehicular
    b) Transit
    c) Active Transportation
    d) Safety
    e) General Transportation
3. Environmental

Alternatives Analysis Summary

- In total, **54 alternatives** were analyzed
- Alternatives organized around five fundamental themes:
    - Improve Regional Mobility
    - Expand Transportation Choice
    - Align Policies with Mobility Goals
    - Plan for the Future
    - Address Congestion & Improve Safety
- Evaluation of each alternative included assessing and scoring the relative benefits and impacts against the project goals.
- **39 alternatives** are advanced as recommendations of this study.
- Cut sheets with additional information for each alternative are provided in Appendix A.

Throughout the course of the study and through engagement with the Working Group and the public, it became apparent that there were a series of desired outcomes for the corridor. Considering this, the study team further organized alternatives around five fundamental themes:

» Improve Regional Mobility

» Expand Transportation Choice

» Align Policies with Mobility Goals
» Plan for the Future
» Address Congestion & Improve Safety

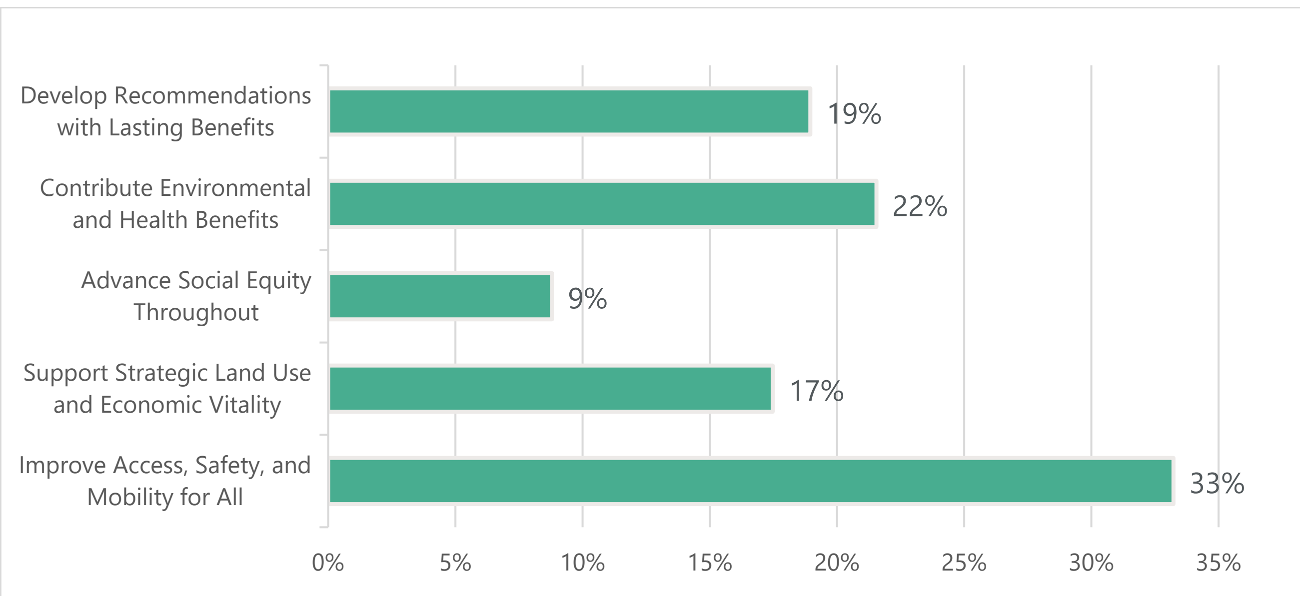
Establishing these themes was a critical step to help frame the analysis. Alternatives were then assessed based on the evaluation criteria relevant to goals it aims to achieve. A discussion of potential alternatives within each theme is presented in the following sections.

Alternatives Scoring

To evaluate alternatives, we applied weights to the five study goals. The weighted study goals were used as a decision support mechanism to rate each proposed alternative and help guide phasing and prioritization recommendations.

To determine the weights, we collected feedback from the Working Group and the public. The resulting weights are shown in Figure 5-1. The 'mobility' goal was weighted the highest, followed by 'contributing environmental and health benefits.'

Figure 5-1 Study Area Goal Weighting



Source: Working Group and Public Informational Meeting Feedback

As presented in Chapter 1, *Study Process and Framework,* a series of evaluation criteria has been established under each study goal. Using a combination of quantitative and qualitative assessments, the study team rated how alternatives performed against each evaluation criteria using a rubric of -3 to +3. Individual ratings were averaged within each study goal and a weighted index was calculated whereby all goal scores sum to a maximum possible value of 100. Scores should be used for relative comparison purposes among alternatives only. There are a series of trade-offs for each alternative making a score of 100 highly unlikely. The recommendations in this study will be most effective when implemented together, maximizing the positive impacts of each alternative.

Evaluation Methods

Alternative ratings were established using a combination of quantitative and qualitative assessments. Each alternative was reviewed qualitatively for impacts/benefits to land use/economic development; impacts to the environment; effects on social equity; and level of potential for lasting benefits. Effects on factors linked to local public health outcomes were informed based on the existing conditions statistical assessment presented previously in Chapter 2, *Existing Conditions*.

Quantitative methods for evaluating study goals include:

- **Vehicular Alternatives:** The alternatives and concepts presented are conceptual and would need to be further refined through design development in coordination with the appropriate permitting agencies if implemented. Supporting evaluations and detailed analyses, such as an intersection control evaluation (ICE) and/or function design report (FDR) are expected to be completed during the design development phase.
  - **Operations:** Intersection capacity analysis using Highway Capacity Manual (HCM) methodology with Synchro and SIDRA software. Highway capacity analysis (segment, merge/diverge, weave) using Highway Capacity Manual (HCM) methodology.
  - **Safety:** Assessment of potential effects on crash frequency and number of crashes. Where possible, quantitative resources were used to support the assessment including crash prediction models from MassDOT[56] and the Highway Safety Manual (HSM)[57] and crash modification factors (CMFs) in the MassDOT preferred CMF list[58], the FHWA CMF Clearinghouse[59], and principles of the Safe System Approach (SSA)[60].
  - **Geometric Review:** Evaluation of potential constraints, constructability review, and consideration of current MassDOT design standards.
- **Transit Alternatives:** Analyses for transit alternatives reviewed potential increase in transit mode share based on output from the CTPS travel demand model.
- **Active Transportation:** Evaluation of the appropriate level of accommodation based on the roadway and anticipated user characteristics, considering geometric constraints and current MassDOT design standards.

In addition, preliminary order-of-magnitude conceptual cost estimates have been developed. These estimates are in 2022 dollars, include life-cycle operating costs where applicable, and it's assumed

56 MassDOT crash prediction spreadsheet tools are available here: https://www.mass.gov/service-details/highway-safety-improvement-program.

57 HSM spreadsheet tools are available here: https://www.highwaysafetymanual.org/Pages/Tools.aspx.

58 MassDOT's CMF list is available in the MassDOT spreadsheet tools linked in footnote 1.

59 The FHWA CMF Clearinghouse lists and rates published CMFs: https://www.cmfclearinghouse.org/.

60 https://safety.fhwa.dot.gov/zerodeaths/docs/FHWA_SafeSystem_Brochure_V9_508_200717.pdf.

there are no productivity constraints associated with the COVID-19 pandemic. These estimates do not include any required right-of-way acquisitions, hazardous materials mitigation, or utility relocation.

The following sections discuss the alternatives within each theme and provide a summary evaluation matrix, ordered from best- to worst-performing. The evaluation matrix also indicates which alternatives are recommended to be advanced (all or in part), discarded, or monitored for further evaluation. The recommendations are not solely based on scoring but rather consider feedback from the Working Group, public and other stakeholders. In addition, the recommendations consider factors that could limit the implementation of the alternative, such as local and state laws and regulations and environmental factors. Therefore, some alternatives that are advanced may end up having lower scores than those that are discarded.

A detailed alternatives analysis matrix, including all of the evaluation criteria, and technical memoranda documenting the alternatives analysis process are included in Appendices C and E.

Improve Regional Mobility

Providing more reliable and robust multimodal access between the region and the Study Area are critical components to accommodating land use growth and protecting the adjacent neighborhoods from cut-through traffic. Alternatives targeted in this theme are multimodal, acknowledging that we cannot build our way out of vehicular congestion and must focus on expanding options for travelers. Alternatives that seek to improve regional mobility are presented in Figure 5-2 and include:

» **Alternative LU-12:** Identify Opportunities at Route 128/I-95 & I-90 Interchange

» **Alternative V-26:** Convert a General-Purpose Lane on Route 128/I-95 to Managed Lane

» **Alternative V-31:** Build upon Outcomes of Shared Travel Network Study

» **Alternative T-5:** Create Fitchburg Line Multimodal Hub

Connecting Route 128/I-95 to the Region

Focusing investments on multimodal solutions to better connect the Route 128/I-95 study area to the region is imperative to address congestion, decrease emissions, and protect adjacent neighborhoods:

- The study area needs to import workers at a rate of over 7:1 to fill available jobs[61], straining the regional transportation network.
- No significant transit or active transportation investments are planned, leaving limited multimodal choices.
- By 2040, it is estimated that 84 percent of study area trips will be made by a passenger vehicle[62] which will continue to exacerbate congestion.

61 U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

62 CTPS Statewide Travel Demand Model; 2040 weekday morning and evening peak period person trips in study area municipalities.

- **Alternative T-9:** Implement Managed Lane: Bus on Shoulder
- **Alternative T-11:** Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks
- **Alternative AT-10:** Expand Public Bike Share Program

Table 5-1 below presents a summary evaluation matrix, ordered from best to worst performing. Alternatives in this subset scored the highest across all themes and many of these options not only achieve mobility goals of the study, but also contribute to other goals of supporting strategic land use, advancing social equity, and contributing to environmental and health benefits.

More details on each alternative, including context, description, benefits/impacts, order-of magnitude cost estimates, and recommendations are provided in alternative cut-sheets.

Alternative T-5: Create Fitchburg Line Multimodal Hub

Existing Newton Bluebikes Station

Key Alternative: Fitchburg Line Multimodal Hub

The Fitchburg Line Multimodal Hub is an alternative of particular note as it received the highest score during the alternatives analysis. This alternative represents a major capital investment on behalf of MassDOT and the MBTA. The transportation hub would replace the existing Kendal Green Station and be relocated east in the vicinity of Jones Road/Green Street. This hub would provide a central connection point between major roadways of Route 20, Route 128/I-95, the Commuter Rail Fitchburg Line, and the planned future continuation of the Mass Central Rail Trail. The Fitchburg Line Multimodal hub would provide robust connections to job centers in Waltham, provide new connections to transit services, encourage commuter mode shift, enhance connectivity between the study area municipalities and Boston, and present an opportunity for potential new transit-oriented development adjacent to the hub.

Table 5-1 Improve Regional Mobility Alternatives Analysis Summary

ID	Alternative	Total Weighted Score [1]	Recommendation [2]
T-5	Create Fitchburg Line Multimodal Hub	**54.67**	Advance
LU-12	Identify Opportunities at Route 128/I-95 & I-90 Interchange	**45.35**	Advance [3]
AT-10	Expand Public Bike Share Program	**31.55**	Advance
T-11	Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks	**30.01**	Advance
V-31	Build upon Outcomes of Shared Travel Network Study	**21.05**	Discard as Standalone Alternative
T-9	Implement Managed Lane: Bus on Shoulder	**18.53**	Monitor [4]
V-26	Convert a General-Purpose Lane on Route 128/ I-95 to Managed Lane	**14.79**	Monitor [5]

1 – Based on maximum score of 100. Sum of individual study goal scores multiplied by weighted factor for each goal.

2 – Recommendations are not solely based on scoring but also consider feedback from the Working Group, public, and other stakeholders and therefore some alternatives that are advanced may end up having lower scores than those that are discarded.

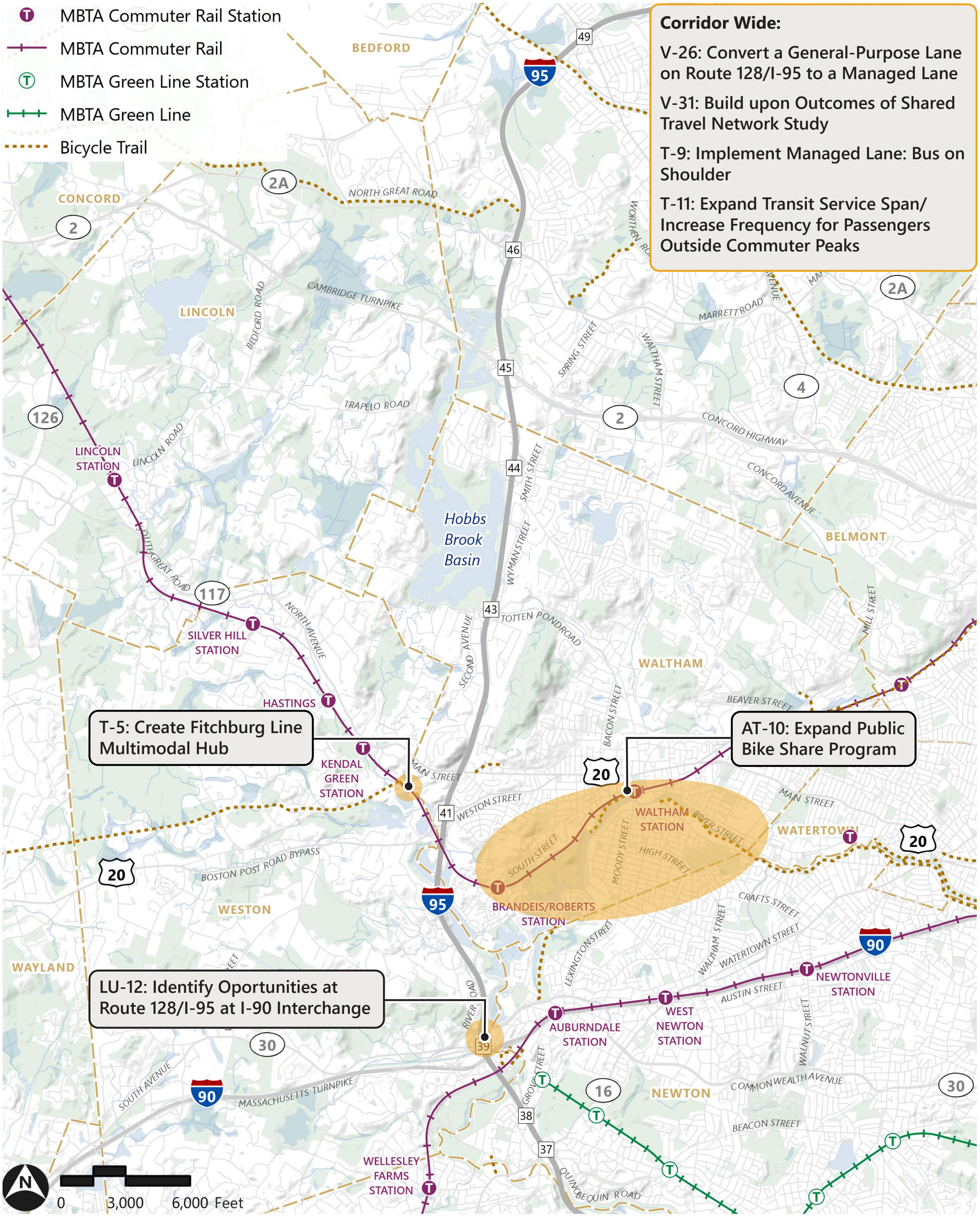
3 – Further review feasibility of uses at this site and consider necessary supportive transportation elements including vehicle access/egress.

4 – Not recommended to be advanced currently as there are no proposed MBTA bus routes or existing Route 128 Business Council shuttle routes that travel on Route 128/I-95. If a new route is to be proposed along the Route 128/I-95 corridor, the use of the shoulder for bus travel should be evaluated for the segments where the bus route would travel.

5 – Continue to monitor feasibility and priority based on MassDOT's broader managed lane initiatives.

Figure 5-2: Improve Regional Mobility Alternatives

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

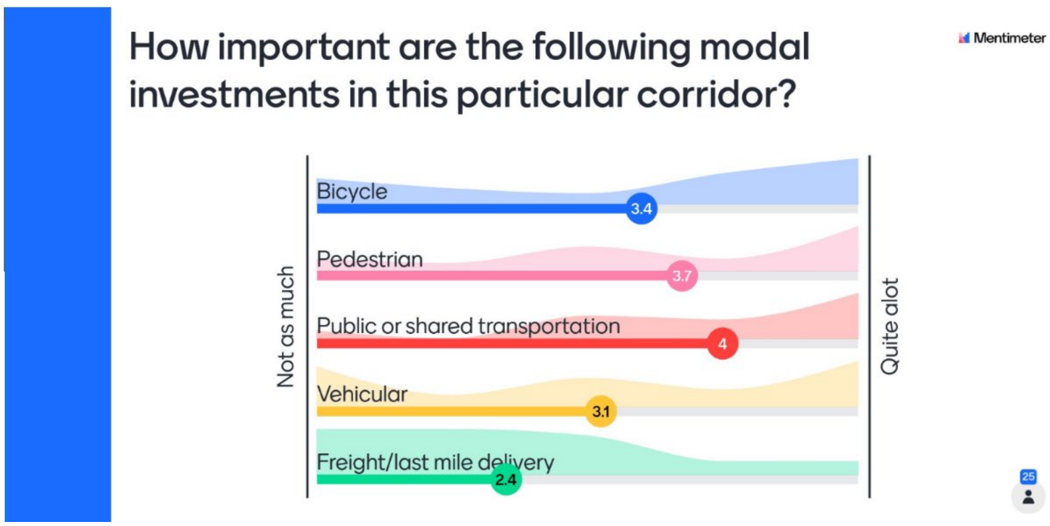


Source: MassGIS, MassDOT

Enhance Transportation Choice

Expanding and diversifying multimodal options from, to, and within the Study Area will help the corridor realize its full potential as an economic engine for the region and protect nearby neighborhoods from unintended traffic impacts from this growth. Currently, the Study Area is hampered by a lack of quality multimodal connections, limiting the potential for mode share shifts for all trip types to more sustainable modes like transit, bicycling, and walking. Feedback at the second Public Informational Meeting underscored the desire to invest in transit and active transportation options ahead of vehicular infrastructure (Figure 5-3).

Figure 5-3 Route 128/I-95 Investment Priorities



Source: Public Informational Meeting #2 Poll Results

Alternatives that seek to diversify transportation options to, from, and within the Study Area are presented in Figure 5-4 and include:

- **Alternative T-1:** Provide Additional Transit Service in Northern Portion of Study Area
- **Alternative T-4:** Extend Shuttle Network in West Waltham
- **Alternative T-6:** Consider Transit Connection between West Waltham and Worcester Line/Green Line
- **Alternative T-8:** Consider Increased East-West Bus Service
- **Alternative T-10:** Install Transit Signal Priority
- **Alternative T-12:** Expand Shuttle Access for All Passengers

Route 128 Business Council Shuttles

- » **Alternative AT-1:** Improve North-South Bicycle Connections along Route 128/I-95
- » **Alternative AT-2:** Improve East-West Bicycle Connections across Route 128/I-95
- » **Alternative AT-3:** Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95
- » **Alternative AT-4:** Improve East-West Bicycle Connections within Waltham
- » **Alternative AT-5:** Construct Lower Falls Shared Use Path
- » **Alternative GT-1:** Consider Two-Way Winter Street between Waltham and Lincoln
- » **Alternative GT-6:** Improve Station Access and Connectivity

Example Active Transportation Alternative Cross-Section

Table 5-2 below presents a summary evaluation matrix, ordered from best-to worst-performing. The alternatives targeted at enhancing transportation choice scored well against the study evaluation criteria, and all are suggested to advance as recommendations.

More details on each alternative, including context, description, benefits/impacts, order-of magnitude cost estimates, and recommendations are provided in the alternative cut-sheets in Appendix A.

While outside the study area, additional north-south bicycle connections could be explored to further improve regional mobility, particularly in Lincoln, with a grade-separated crossing of Route 2 and enhanced bicycle accommodations along Page Road and Winter Street. This alternative is outside the scope of this study and therefore not evaluated further but could be explored by others and could complement Alternative GT-1: Consider Two-Way Winter Street between Waltham and Lincoln.

Table 5-2 Enhance Transportation Choice Alternatives Analysis Summary

ID	Alternative	Total Weighted Score [1]	Recommendation [2]
AT-5	Construct Lower Falls Shared Use Path	**40.71**	Advance
T-1	Provide Additional Transit Service in Northern Portion of Study Area	**31.39**	Advance
AT-4	Improve East-West Bicycle Connections within Waltham	**29.68**	Advance
T-12	Expand Shuttle Access for All Passengers	**29.57**	Advance [3]
T-8	Consider Increased East-West Bus Service	**29.33**	Discard
T-6	Consider Transit Connection between West Waltham and Worcester Line/Green Line	**27.58**	Monitor [4]
GT-6	Improve Station Access and Connectivity	**26.15**	Advance
AT-2	Improve East-West Bicycle Connections across Route 128/I-95	**24.21**	Advance
AT-3	Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95	**24.21**	Advance
AT-1	Improve North-South Bicycle Connections along Route 128/I-95	**23.88**	Advance
T-4	Extend Shuttle Network in West Waltham	**22.45**	Advance
GT-1	Consider Two-Way Winter Street between Waltham and Lincoln	**17.95**	Advance in Part [5]
T-10	Install Transit Signal Priority	**16.51**	Monitor [6]

1 – Based on maximum score of 100. Sum of individual study goal scores multiplied by weighted factor for each goal.

2 – Recommendations are not solely based on scoring but also consider feedback from the Working Group, public, and other stakeholders and therefore some alternatives that are advanced may end up having lower scores than those that are discarded.

3 – As most Route 128 Business Council shuttles currently allow public access, this alternative should focus on increasing marketing to non-members to inform the public of the existing transit options.

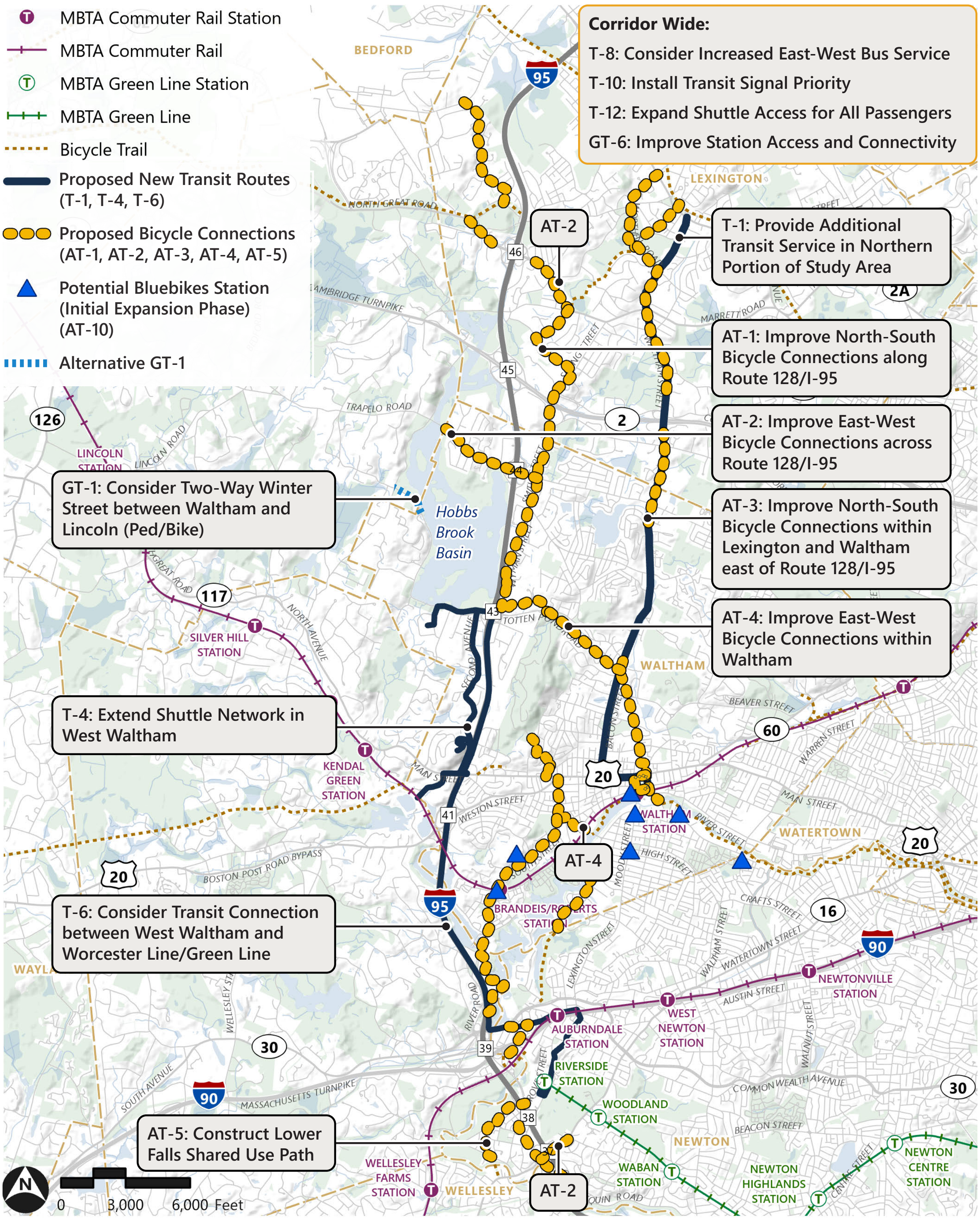
4 – Monitor to determine if market demand for this connection grows in the future.

5 – Advance for pedestrian/bicycle accommodations only based on stormwater regulations on expanding roadway pavement in proximity to the Cambridge Reservoir.

6 – Coordinate with MBTA's ongoing Bus Network Redesign to determine final bus routings and station locations. Monitor traffic delays and implement at intersections with significant delay.

Figure 5-4: Enhance Transportation Choice Alternatives

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, MAPC

*Alternate Segments are shown in two colors to distinguish between the segments

Align Policies with Mobility Goals

Land Use & Transportation Relationship

- Based on market analysis, Route 128/I-95 development is oversubscribed to lab, office, and retail, leaving the corridor vulnerable to shifts in real estate market demand
- It also puts more strain on traffic, exacerbates greenhouse gas emissions, and has a negative impact on public health.
- Policy changes can help to address these conditions and align them with larger mobility goals and infrastructure investments.

The connection between homogeneous land use on the Route 128/I-95 corridor and resulting transportation demands has been highlighted throughout this study. Left unchecked, the continued uniform growth of office/lab space will further overwhelm the Study Area's transportation infrastructure and leave the corridor vulnerable to economic fluctuations in the face of changing market demands. It is critical to align land use policies with mobility goals and targeted investments. Supportive policies can work to promote sustainable communities and enhance the economic and social well-being of people throughout the study area. The policies presented below seek to diversify land uses, improve transportation choice, enhance access to jobs, open space, and other destinations, as well as promote positive effects on the surrounding community. Implementation of such policies would require collaboration among state, regional, and municipal partners.

» **Alternative LU-1:** Conduct Market Analysis

» **Alternative LU-2:** Implement Resident and Small Business Protection

» **Alternative LU-3:** Remove or Revise Parking Minimums

» **Alternative LU-5:** Improve Open Space Network

» **Alternative LU-6:** Improve Public Gathering Spaces

» **Alternative LU-7:** Improve Multimodal Network near Cambridge Reservoir

» **Alternative LU-8:** Encourage Workforce and Affordable Housing

» **Alternative LU-9:** Encourage Mixed-Use Development

» **Alternative LU-10:** Encourage Transit Oriented Development (TOD)

» **Alternative GT-7:** Develop Regional TDM Plan

Example TOD – Riverside Station Redevelopment
Source: Riverside Station Redevelopment Supplemental Draft Environmental Impact Report

Table 5-3 below presents a summary evaluation matrix, ordered from best to worst performing. The policy-focused alternative scores varied, with LU10: Encourage TOD, LU-9: Encourage Mixed-Use Development, and LU-8: Encourage Workforce and Affordable Housing each ranking among the highest overall across all themes. One of the alternatives will be discarded based on the analysis and resulting scoring.

More details on each alternative, including context, description, benefits/impacts, order-of magnitude cost estimates, and recommendations are provided in alternative cut-sheets.

Table 5-3 Align Policies with Mobility Goals Alternatives Analysis Summary

ID	Alternative	Total Weighted Score [1]	Recommendation [2]
LU-10	Encourage TOD	**42.11**	Advance in Part [3]
LU-9	Encourage Mixed-Use Development	**39.93**	Advance
LU-8	Encourage Workforce and Affordable Housing	**37.30**	Advance
LU-3	Remove or Revise Parking Minimums	**25.89**	Advance
LU-6	Improve Public Gathering Spaces	**20.68**	Advance
LU-7	Improve Multimodal Network near Cambridge Reservoir	**17.32**	Advance in Part [4]
LU-5	Improve Open Space Network	**16.93**	Discard [5]
GT-7	Develop Regional TDM Plan	**15.22**	Advance
LU-2	Implement Resident and Small Business Protection	**12.70**	Advance
LU-1	Conduct Market Analysis	**0.55**	Advance [6]

1 – Based on maximum score of 100. Sum of individual study goal scores multiplied by weighted factor for each goal.

2 – Recommendations are not solely based on scoring but also consider feedback from the Working Group, public, and other stakeholders and therefore some alternatives that are advanced may end up having lower scores than those that are discarded.

3 – Advance for TOD along the Fitchburg Line and monitor for potential TOD opportunities along the Worcester Line.

4 – Advance segments on MassDOT/municipal owned roadways only.

5 – Current open space policies are sufficient.

6 – In order to remain economically strong, it may be beneficial to perform updated market analysis on an annual basis to track trends and anticipate changes in demand.

Plan for the Future

How we live, work, and play is rapidly transforming. While predicting the future is difficult, one thing is certain: change is the only constant. And with change comes opportunity to harness the power of advancing technology to help make Route 128/I-95 and the municipalities it travels through more sustainable, more resilient, and more equitable. Future-focused alternatives for the Study Area seek to leverage emerging technologies, support renewable energy, and address sustainability and resiliency challenges:

» **Alternative LU-4:** Implement Solar Energy Program Expansion

» **Alternative V-28:** Consider Connected/ Autonomous Vehicle Technology

» **Alternative V-29:** Consider Transportation Systems Management and Operations Strategies

» **Alternative GT-8:** Install Electric Vehicle Infrastructure - Public

» **Alternative GT-9:** Install Electric Vehicle Infrastructure - Private

» **Alternative E-1:** Improve Hobbs Brook Reservoir Water Quality

» **Alternative E-2:** Reduce Amount of Impervious Area and Increase Vegetative Cover

» **Alternative E-3:** Provide Flood Storage and Stormwater Treatment Areas

» **Alternative E-4:** Limit Development within Flood-Prone Areas

Table 5-4 below presents a summary evaluation matrix, ordered from best to worst performing. While the alternatives in this category scored in the middle of the pack, they include initiatives that will set the corridor up for a more sustainable future and are all suggested to advance as study recommendations.

More details on each alternative, including context, description, benefits/impacts, order-of magnitude cost estimates, and recommendations are provided in alternative cut-sheets.

Table 5-4 Plan for the Future Alternatives Analysis Summary

ID	Alternative	Total Weighted Score [1]	Recommendation [2]
V-29	Consider Transportation Systems Management and Operations Strategies	**26.95**	Advance [3]
V-28	Consider Connected/ Autonomous Vehicle Tech.	**23.56**	Monitor [4]
E-2	Reduce Amount of Impervious Area and Increase Vegetative Cover	**22.51**	Advance
E-3	Provide Flood Storage and Stormwater Treatment Areas	**17.44**	Advance
GT-8	Install Electric Vehicle Infrastructure - Public	**13.61**	Advance
E-1	Improve Hobbs Brook Reservoir Water Quality	**12.78**	Advance
E-4	Limit Development within Flood-Prone Areas	**9.20**	Advance
LU-4	Implement Solar Energy Program Expansion	**7.77**	Advance [5]
GT-9	Install Electric Vehicle Infrastructure - Private	**7.09**	Advance

1 – Based on maximum score of 100. Sum of individual study goal scores multiplied by weighted factor for each goal.

2 – Recommendations are not solely based on scoring but also consider feedback from the Working Group, public, and other stakeholders and therefore some alternatives that are advanced may end up having lower scores than those that are discarded.

3 – Consider implementing a pilot study of TSMO strategies on the Route 128/I-95 corridor, in coordination with broader MassDOT TSMO efforts.

4 – Continue to monitor advancing connected/autonomous vehicle technology and MassDOT priorities for potential implementation of applications along the Route 128/I-95 corridor.

5 – Prioritize deforested or paved sites and eliminate existing wooded and parkland sites from consideration.

Address Congestion & Improve Safety

While we can't build our way out of vehicular congestion, we acknowledge the need to support vehicular traffic (including freight, delivery, and service) within and through the study area. A series of physical vehicular infrastructure investments focused on addressing local and regional congestion, reliability, and safety issues were developed and evaluated, as presented in Figure 5-5. These physical improvements incorporate enhancement or expansion of pedestrian and bicycle accommodations where appropriate. Alternatives in this category include:

- **Alternative V-1:** Increase Truck Parking at Lexington Service Plaza
- **Alternative V-2:** Route 128/I-95 Northbound between Interchanges 44 (Trapelo Road) and 46 (Route 2A): Construct New C-D Road
- **Alternative V-3:** Route 128/I-95 Southbound at Interchange 45 (Route 2): Construct New C-D Road
- **Alternative V-4:** Route 128/I-95 Northbound Interchange 45 (Route 2): Two-Lane Off-Ramp to Route 2 Eastbound
- **Alternative V-5:** Trapelo Road at Route 128/I-95 Ramps: Improve Intersections

Alternative V-5: Trapelo Road at Route 128/I-95 Ramps: Improve Intersections

- **Alternative V-9:** Route 128/I-95 Southbound Interchange 43 (Winter Street): Reconstruct Winter Street and Southbound Off-Ramp
- **Alternative V-10:** Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Two Lane Off-Ramp
- **Alternative V-11:** Route 128/I-95 Southbound Interchange 43 (Winter Street): Modify Winter Street Eastbound

» **Alternative V-12:** Route 128/I-95 Northbound Interchange 43 (Winter Street/ Third Avenue): Extend On-Ramp Acceleration Lane
» **Alternative V-14:** Route 20 at Summer Street: Signalize Intersection
» **Alternative V-15:** Route 128/I-95 Northbound Interchange 39 (I-90/ Route 30): Extend Second Lane of C-D Road
» **Alternative V-17:** Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Modify C-D Road and Service Plaza Access
» **Alternative V-18:** Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close Off-Ramp to Route 16 Eastbound
» **Alternative V-19:** Route 128/I-95 Southbound Interchange 37B/38 (Route 16/ Grove Street): Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress
» **Alternative V-20:** Route 128/I-95 Northbound Interchange 37 (Route 16): Close On-Ramp from Route 16 Westbound

Alternative V-20: Route 128/I-95 Northbound Interchange 37: Close On-Ramp from Route 16 Westbound

Table 5-5 below presents a summary evaluation matrix, ordered from best to worst performing. These alternatives scored in the mid to low end due to their primarily vehicular focused nature and resulting limited benefits when considered across all study goals. Four of the alternatives are recommended to be discarded based on the analysis results and, to a lesser degree, resulting scoring.

More details on each alternative, including context, description, benefits/impacts, order-of magnitude cost estimates, and recommendations are provided in alternative cut-sheets.

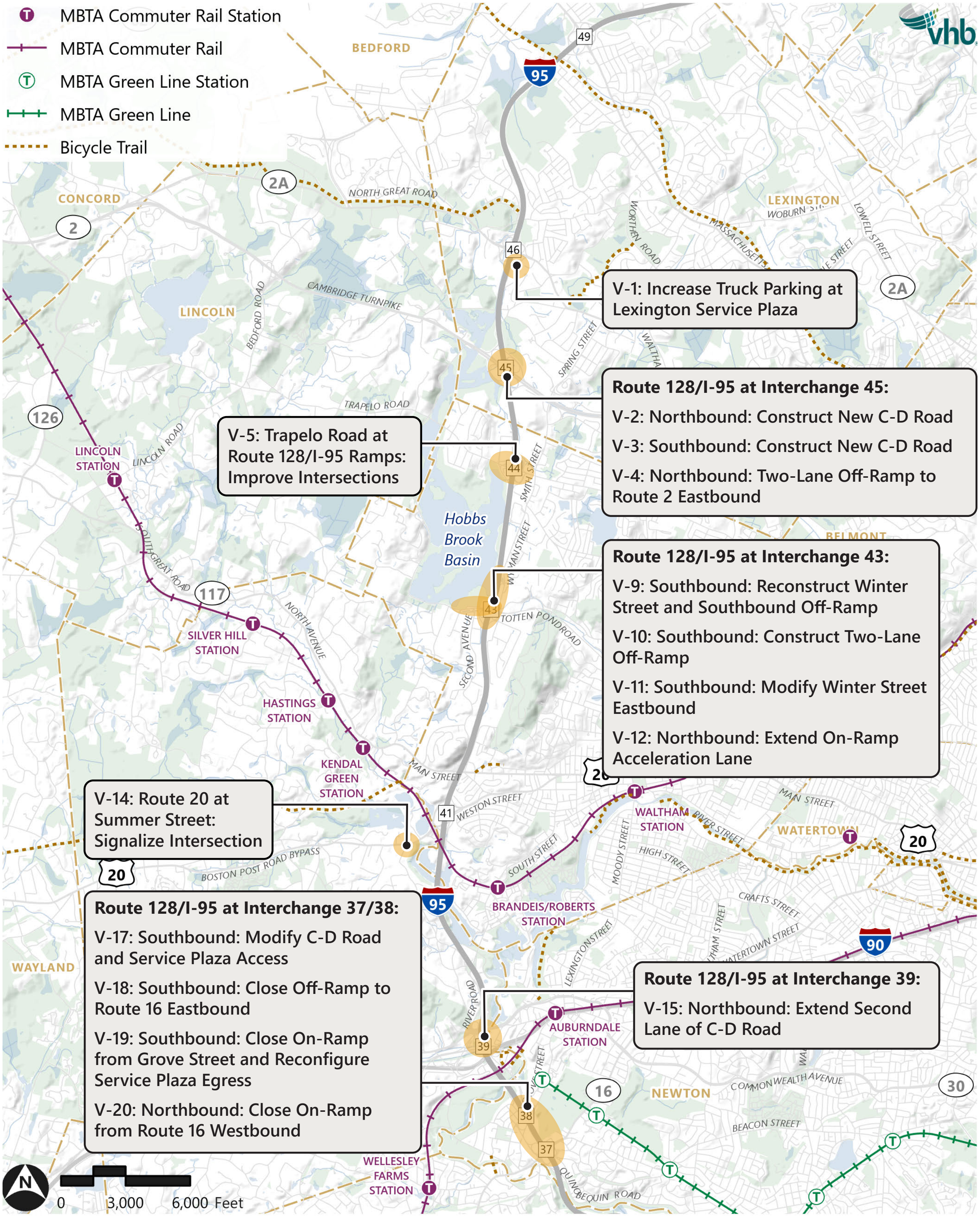
Table 5-5 Address Congestion & Improve Safety Alternatives Analysis Summary

ID	Alternative	Total Weighted Score [1]	Recommendation [2]
V-5	Trapelo Road at Route 128/I-95 Ramps: Improve Intersection	**24.29**	Advance in Part [3]
V-20	Route 128/I-95 Northbound Interchange 37: Close On-Ramp from Route 16 Westbound	**20.06**	Advance
V-3	Route 128/I-95 Southbound at Interchange 45: Construct New C-D Road	**15.55**	Advance
V-10	Route 128/I-95 Southbound Interchange 43: Construct Two Lane Off-Ramp	**14.70**	Advance
V-19	Route 128/I-95 SB Interchange 37B/38: Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress	**13.60**	Advance for Further Study [4]
V-17	Route 128/I-95 Southbound Interchange 37/38: Modify C-D Road and Service Plaza Access	**12.73**	Advance for Further Study [4]
V-18	Route 128/I-95 Southbound Interchange 37/38: Close Off-Ramp to Route 16 Eastbound	**11.54**	Advance for Further Study [4]
V-14	Route 20 at Summer Street: Signalize Intersection	**10.69**	Discard
V-15	Route 128/I-95 Northbound Interchange 39: Extend Second Lane of C-D Road	**10.21**	Advance
V-1	Increase Truck Parking at Lexington Service Plaza	**8.47**	Advance
V-4	Route 128/I-95 Northbound Interchange 45: Two-Lane Off-Ramp to Route 2 Eastbound	**6.83**	Discard
V-12	Route 128/I-95 Northbound Interchange 43: Extend On-Ramp Acceleration Lane	**5.33**	Advance
V-9	Route 128/I-95 Southbound Interchange 43: Reconstruct Winter Street and Southbound Off-Ramp	**4.72**	Discard
V-2	Route 128/I-95 Northbound between Interchanges 44 and 46: Construct New C-D Road	**-2.34**	Advance in Part [5]
V-11	Route 128/I-95 Southbound Interchange 43: Modify Winter Street Eastbound	**-8.79**	Discard

1 – Based on maximum score of 100. Sum of individual study goal scores multiplied by weighted factor for each goal.
2 – Recommendations are not solely based on scoring but also consider feedback from the Working Group, public, and other stakeholders and therefore some alternatives that are advanced may end up having lower scores than those that are discarded.
3 – Advance roundabout at northbound ramps only.
4 - Based on coordination with MassDOT, it is recommended that a focused planning and design effort be initiated to address the unique and complex challenges of this location in detail with the goal of establishing a preferred design that safely accommodating all users.
5 – Discard C-D Road alternative and advance as auxiliary lane between Trapelo Road on-ramp and Exit 45A (Route 2 eastbound) off-ramp.

Figure 5-5: Address Congestion & Improve Safety Alternatives

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

6

Recommendations

This chapter presents an implementation plan for the study recommendations.

Chapters 4 and 5 developed, screened, and analyzed potential land use, transportation, and mobility improvements for the Route 128/I-95 corridor. This alternatives analysis was then considered against the input we heard from study area stakeholders, including the Working Group, the corridor municipalities, MassDOT, the MBTA, and the public, and culminates in the series of recommended improvement projects that are presented in this chapter in the form of an implementation plan.

Overview

In response to the corridor's land use and transportation infrastructure needs identified through the study process, we recommend a comprehensive set of actions that include items for the short, medium, and long terms. Immediate recommendations with a timeframe of under one year were presented in Chapter 4, and primarily consist of low-scale improvements like pavement markings and signage, bus stop relocations, traffic signal enhancements, and crosswalk installations.

It should be acknowledged that the study recommendations represent significant financial commitments. The advancement of the recommendations developed as part of this study will require prioritization by and coordination among local municipalities, state departments, and other stakeholders. Besides prioritization, identification of potential funding sources and availability to leverage funding could alter priorities.

Implementation Plan Elements

The implementation plan includes project cost estimates; project timeframe; key and adjacent stakeholders; potential funding sources; and next steps. These elements are described below.

Conceptual Cost Estimates

Conceptual cost estimates have been developed for each of the proposed recommendations[63]. Further details on the specific costs for each recommendation are referenced in the alternative cut-sheets in Appendix A and information on the development of the cost estimates for each recommendation are presented in a memorandum in Appendix E.

Based on the conceptual cost estimates, each recommendation has been summarized into one of the following ranges:

» **Low-Cost ($):** Conceptual cost estimated to be under $1 million

» **Medium-Cost ($$):** Conceptual cost estimated between $1 million and $5 million

» **High-Cost ($$$):** Conceptual cost estimated to be over $5 million

Key Stakeholders

The implementation plan identifies a Key Stakeholder for each project. The Key Stakeholder is the agency that will be responsible for leading the permitting, design, funding, and implementation of each specific project. While other parties may be involved in the development of a project, having one single organization that leads project implementation is critical to driving recommendations forward. Key Stakeholders that have been identified in this study include the study area municipalities, MassDOT, MBTA, the Route 128 Business Council, and other participating agencies.

Implementation Timeframe

An implementation timeframe has been established for each recommendation. The timeframe is estimated based on the time required to implement similar projects recently completed or currently underway in Massachusetts and include:

» **Short-Term (1 to 5 years):** Relatively low cost and uncomplicated design with minimal to no permitting required.

» **Medium-Term (5 to 10 years):** Higher cost and more intensive design with potentially some permitting required.

» **Long-Term (over 10 years):** High cost and substantial design with moderate to extensive permitting required.

Potential Funding Sources

Although not an exhaustive list, possible funding sources are identified for each recommended alternative. Funding sources were chosen based on the anticipated size, scope, and cost of a particular project, but it is assumed the key stakeholder will consider a variety of municipal, state,

63 The estimates were developed to represent preliminary order-of-magnitude conceptual implementation costs and life-cycle operating costs (where applicable), in 2023 dollars and do not include any engineering/design costs, right-of-way acquisitions, hazardous materials mitigation, or utility relocation.

and/or federal funding assistance for each recommendation, and some recommendations may be eligible for multiple funding sources. The key stakeholder will also be responsible for identifying potential new funding opportunities as they arise, either through MassDOT or the United States Department of Transportation (U.S. DOT).

Municipal and private developer funds can come from a variety of sources and were not specifically delineated for the purposes of the Recommended Action Plan. In addition, some recommendations may be able to be funded through an organization's annual operating budget and may not require a dedicated funding source.

» **State Transportation Improvement Plan Funding:** Each Metropolitan Planning Organization (MPO) within the state has a rolling, five-year capital funding program. Eligible transportation projects can receive federal and state roadway funding if the project is selected by the MPO. Selection is based on an evaluation and prioritization of all eligible projects and includes municipal and public feedback. The Boston Region MPO has identified the following six investment programs that focus on specific types of projects that help the MPO achieve its goals and objectives for the transportation system:

  - **Complete Streets:** Projects that modernize roadways to improve safety and mobility for all users.
  - **Intersection Improvements:** Projects to modernize intersection geometry and signalization to improve safety and mobility.
  - **Bicycle Network and Pedestrian Connections:** Projects to expand bicycle and pedestrian networks to improve safe access to transit, schools, employment centers, and shopping destinations.
  - **Major Infrastructure:** Projects that enhance major arterials for all users and modernize or expand transit systems to increase capacity. Projects in this program cost more than $50 million; are on major roadways; or add new connections to or extend the rail or fixed guideway transit network or the bus rapid transit network.
  - **Community Connections:** Includes a variety of project types, including first- and last-mile solutions and other small, nontraditional transportation projects to enhance mobility and improve air quality.
  - **Transit Modernization:** Projects that modernize transit infrastructure and promote the enhanced ridership, accessibility, or resiliency of transit services.

  Additional information on this funding source can be found at https://www.ctps.org/tip.

» **MassDOT Chapter 90 Funding:** The state currently provides reimbursement funding for projects that create or extend the life of capital facilities under Section 34 of Massachusetts General Law (MGL) Chapter 90. Within all applicable allowances, municipalities have discretion on how the funding can be used. The funding amount allocated is based on the municipality's accepted road miles, population, and employment. It should be noted that Chapter 90 funding may also be used discretionally by a municipality to cover project design costs. Additional information on this funding source can be found at https://www.mass.gov/chapter-90-program.

- **MassDOT Complete Streets Funding:** The state currently offers dedicated construction funding to eligible communities to implement Complete Streets infrastructure elements. A 'complete street' is one that provides safe and accessible options for all travel modes (walking, biking, transit, and vehicles) for people of all ages and abilities. To be eligible for funding, a municipality must have a MassDOT approved Complete Streets policy and prioritization plan. Additional information on this funding source can be found at https://www.mass.gov/complete-streets-funding-program.
- **MassDOT Highway Safety Improvement Program:** MassDOT provides funding for projects that aim to reduce traffic fatalities and serious injuries on public roadways. Eligible programs include any strategy, activity, or project that corrects or improves a hazardous road location or features or addresses a highway safety problem. Additional information on this funding source can be found at: https://www.mass.gov/service-details/highway-safety-improvement-program.
- **MassDOT Shared Street and Spaces Grant Program:** MassDOT provides a dedicated funding program to support quick-launch improvements to public health, safe mobility, and strengthened commerce. The program provides funding to municipalities and public transit authorities to quickly implement improvements to plazas, sidewalks, curbs, streets, bus stops, parking areas, and other public spaces. The program first launched in summer 2020 in response to the COVID-19 pandemic. Additional information on this funding source can be found at https://www.mass.gov/shared-streets-and-spaces-grant-program.
- **MassDOT Interstate Maintenance and Related Work Funding:** MassDOT provides regular funding for interstate maintenance and related work for roadways around the Commonwealth, This program can include funding for roadway resurfacing, paving, pavement marking installation, bridge repair, and other regular maintenance measures. Some of the lower-cost recommendations in this study could utilize this funding source without requiring a separate grant or program.
- **Federal Grants:** There are several grants and programs administered at the federal level that may also be applicable to provide support for some of the recommendations. Application for federal grant programs occur through a coordinated process within MassDOT. In particular, the U.S. DOT and the Federal Highway Administration offer several discretionary grants programs to support local and state land use and transportation projects, including:
  - Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Discretionary Grants
  - Strengthening Mobility and Revolutionizing Transportation (SMART) Grants Program
  - National Electric Vehicle Infrastructure (NEVI) Formula Program Funding
  - Multimodal Project Discretionary Grant (MPDG) Opportunity
  - Building Resilient Infrastructure and Communities (BRIC) Program
  - Bipartisan Infrastructure Law Grant Programs

In addition to the funding sources described above, the following programs and grants may also be applicable for certain recommendations:

» MassDOT State Planning and Research Work Program
» MassDEP Massachusetts Electric Vehicle Incentive Program (MassEVIP) Grant Programs
» Massachusetts Department of Housing and Community Development (DHCD) Housing Choice Grants
» Municipal Vulnerability Preparedness Programs administered by the Executive Office of Energy and Environmental Affairs (EOEEA)
» Urban and Community Forestry Challenge Grants administered by DCR
» MassTrails Grant Programs administered by MassDOT, DCR, and the EOEEA
» MassWorks Infrastructure Programs administered by the Executive Office of Housing and Economic Development
» Boston Region MPO Unified Planning Work Program
» Metropolitan Area Planning Council (MAPC) Accelerating Climate Resiliency Grant Program
» MassDevelopment Site Readiness Program
» MassDevelopment Underutilized Properties Program
» Massachusetts Growth Capital Corporation Grant Programs
» Partnership with local university research programs

Next Steps

For the recommendations to be implemented, each of the projects will need to follow a multi-step process at the municipal or state agency level. The project development process as defined by MassDOT for infrastructure projects on facilities owned by MassDOT or that may be funded through MassDOT is shown below. Depending on the project, some of the early steps may have already been completed either as part of this study or in other studies.

Step 1: Planning Studies → **Step 2:** Environmental Study → **Step 3:** Funding Process → **Step 4:** Final Design → **Step 5:** Implementation

» **Step 1 – Planning Studies:** The first step of project development is a comprehensive evaluation in a planning study, including a review of existing and expected future transportation issues. This study generally completes Step 1.
» **Step 2 – Environmental Study:** Most projects will need to go through the permitting process in an environmental study. This may include a review through the Massachusetts Environmental Policy Act as well as a review through the local permitting process. Projects that do not result in infrastructure changes may not need to go through the full environmental review process.

» **Step 3 – Funding Process:** Once a project has been completed the preliminary design, the project champion needs to identify funding for the project. A list of potential funding sources is included in the previous section.

» **Step 4 – Final Design:** With funding in place, the next phase of project development is the final design. During this phase, the final layout of the project and the design details will be determined.

» **Step 5 – Implementation:** In the final phase, the project will be constructed.

Complex recommendations require more in-depth design, permitting, and environmental documentation. These initial steps could begin in the immediate or short-term. In addition, when recommendations overlap with each other or with already-announced projects by local and state authorities, coordination will be required between projects.

Focus Area: Route 128/I-95 Southbound at Exit 37/38 and Newton Service Plaza

As noted in Chapter 5, several alternatives were evaluated at the Route 128/I-95 southbound interchanges with Exit 37 (Grove Street), Exit 38 (Route 16), and the Newton Service Plaza. These alternatives were targeted at addressing operational and safety challenges related to multiple, closely spaced ramps and lack of multimodal connections to the service plaza. There has been significant and sustained interest in improving these conditions throughout the study outreach process. While the alternatives evaluated in this study have some notable benefits, especially to active transportation connections, none fully address the complicated nature of this area.

Based on coordination with MassDOT, we recommend that a focused planning and design effort be initiated to address the unique and complex challenges of these locations in detail with the goal of establishing a preferred design that safely accommodates all users. Alternatives evaluated in this study, and the supporting analysis, can be used as a starting point for this future effort.

Implementation Plan

The study recommendations are presented below, organized around the fundamental themes presented in Chapter 5, Alternatives Analysis:

» Improve Regional Mobility

» Expand Transportation Choice

» Align Policies with Mobility Goals

» Plan for the Future

» Address Congestion & Improve Safety

Tables 6-1 through 6-5 present recommendations included in each theme, ordered from short-term to long-term actions. Corridor wide improvements are included in Figure 6-1 and the locations of the improvement projects are presented in Figure 6-2.

Figure 6-1 Corridor Wide Recommended Improvement Projects

Short-Term:
T-12: Expand Shuttle Access for All Passengers
LU-8: Encourage Workforce and Affordable Housing
LU-2: Implement Resident and Small Business Protection
LU-3: Remove or Revise Parking Minimums
LU-6: Improve Public Gathering Spaces
GT-7: Develop Regional TDM Plan
E-2: Reduce Amount of Impervious Area and Increase Vegetative Cover
LU-4: Implement Solar Energy Program Expansion
GT-8 & GT-9 Install Electric Vehicle Infrastructure

Medium-Term:
AT-10: Expand Public Bike Share Program
LU-1: Conduct Market Analysis
V-29: Consider TSMO Strategies

Long-Term:
T-11: Expand Transit Service Span/Increase Frequency
GT-6: Improve Station Access and Connectivity
LU-9: Encourage Mixed-Use Development
E-4: Limit Development within Flood-Prone Areas
E-3: Provide Floor Storage and Stormwater Treatment Area

Table 6-1 Implementation Plan (Improve Regional Mobility)

			Cost / Funding		Implementation Timeframe (Years)												Parties Involved												
					Short-Term					Medium-Term					Long-Term		Facilitating Organizations											
ID	Alternative	Jurisdiction	Cost (Range)[1]	Possible Funding Source(s)	1	2	3	4	5	6	7	8	9	10	10+	Key Stakeholders	MassDOT	FHWA	DCR	MBTA	128 BC	Lexpress	Lexington	Lincoln	Newton	Waltham	Weston	Next Steps
AT-10	Expand Public Bike Share Program	Individual Cities/Towns	$	› Developer Mitigation Contributions › Shared Streets & Spaces Grant Program › Community Connections Program	■	■	■	■	■	■	■	■	■	■		Individual Cities/ Towns							X	X	X	X	X	› Interested municipalities to consider further evaluation of priority locations
LU-12	Identify Opportunities at Route 128/I-95 & I-90 Interchange	MassDOT	$	› MassDev Site Readiness Program › MassDev Underutilized Properties Program	■	■	■	■	■	■	■	■	■	■	■	MassDOT	X										X	› Assess existing roadway conditions to determine suitability for supporting individual uses › Identify preferred use and establish a site development plan
T-5	Create Fitchburg Line Multimodal Hub	MBTA, Weston, & Waltham	$$$	› Transit Modernization Program › Major Infrastructure Program › Federal Transit Grants						■	■	■	■	■	■	MBTA	X		X	X						X	X	› Advance to design › Determine permitting requirements
T-11	Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks	MBTA & Lexpress	$$$	› Transit Modernization Program › Federal Transit Grants › Local Operating Budget						■	■	■	■	■	■	MBTA / Lexpress				X		X						› Develop updated service plan

1 - n/a not applicable, $ Less than $1 million, $$ $1 to $5 million, $$$ Greater than $5 million

Table 6-2 Implementation Plan (Expand Transportation Choice)

ID	Alternative	Jurisdiction	Cost / Funding: Cost (Range)[1]	Cost / Funding: Possible Funding Source(s)	Short-Term: 1	2	3	4	5	Medium-Term: 6	7	8	9	10	Long-Term: 10+	Key Stakeholders	Parties Involved – Facilitating Organizations: MassDOT	FHWA	DCR	MBTA	128 BC	Lexpress	Lexington	Lincoln	Newton	Waltham	Weston	Next Steps
AT-4	Improve East-West Bicycle Connections within Waltham	Waltham	$	› Complete Streets Funding › Community Connections Program › Bike Network/Ped. Connections Program › Shared Streets & Spaces Grant Program	■	■	■									Waltham										X		› Advance to design › Coordination with municipal complete streets and ped/ bike plans › Determine permitting requirements
T-12	Expand Shuttle Access for All Passengers	128 Business Council	$	› Developer Mitigation Contributions	■	■	■									128 Business Council					X							› Initiate targeted marketing campaign to non-member businesses and their employees
AT-5	Construct Lower Falls Shared Use Path	Newton, MassDOT, & DCR	$	› MassTrails Grants › Bike Network/Ped. Connections Program	■	■	■	■	■							DCR	X		X						X			› Advance design and permitting of previously identified recommendations
AT-2	Improve East-West Bicycle Connections across Route 128/I-95	Newton, Waltham, Lexington, & MassDOT	$	› Complete Streets Funding › Community Connections Program › Bike Network/Ped. Connections Program › Shared Streets & Spaces Grant Program	■	■	■	■	■							MassDOT & Individual Cities/ Towns	X						X		X	X		› Advance to design › Coordination with municipal complete streets and ped/ bike plans › Determine permitting requirements
AT-3	Improve North-South Bike Connections within Lexington and Waltham east of Route 128/I-95	Waltham & Lexington	$	› Complete Streets Funding › Community Connections Program › Bike Network/Ped. Connections Program › Shared Streets & Spaces Grant Program	■	■	■	■	■							Waltham & Lexington							X			X		› Advance to design › Coordination with municipal complete streets and ped/ bike plans › Determine permitting requirements
AT-1	Improve North-South Bicycle Connections along Route 128/I-95	Individual Cities/ Towns & MassDOT	$$	› Complete Streets Funding › Community Connections Program › Bike Network/Ped. Connections Program › Shared Streets & Spaces Grant Program	■	■	■	■	■	■	■					Individual Cities/ Towns	X						X	X	X	X	X	› Advance to design › Coordination with municipal complete streets and ped/ bike plans › Determine permitting requirements › Explore north-south connections west of Route 128/I-95
T-4	Extend Shuttle Network in West Waltham	128 Business Council	$$$	› Transit Modernization Program › Federal Transit Grants › Developer Mitigation Contributions			■	■	■	■	■	■				128 Business Council					X					X		› Identify preferred routing and service plan
GT-1	Consider Two-Way Winter Street (Pedestrian/Bicycle)	Waltham & Lincoln	$	› Complete Streets Funding › Community Connections Program › Bike Network/Ped. Connections Program › Shared Streets & Spaces Grant Program				■	■	■	■					Waltham & Lincoln								X		X		› Advance to design › Coordination with Cambridge Reservoir › Coordination with municipal complete streets and ped/ bike plans › Determine permitting requirements
T-1	Provide Additional Transit Service in Northern Portion of Study Area	Lexpress	$$$	› Transit Modernization Program › Federal Transit Grants › Developer Mitigation Contributions				■	■	■	■	■				Lexpress	X					X	X			X		› Evaluate potential for Lexpress to operate this service through new funding sources › Identify preferred routing and service plan
GT-6	Improve Station Access and Connectivity	MBTA, & Individual Cities/Towns	n/a	› MBTA Annual Operating Budget › Transit Modernization Program › Shared Street & Spaces Grant Program						■	■	■	■	■	■	MBTA				X				X	X	X	X	› Implement station access and connectivity improvements as part of future station reconstruction projects

1 - n/a not applicable, $ Less than $1 million, $$ $1 to $5 million, $$$ Greater than $5 million

Table 6-3 Implementation Plan (Align Policies with Mobility Goals)

ID	Alternative	Jurisdiction	Cost / Funding: Cost (Range)[1]	Cost / Funding: Possible Funding Source(s)	Implementation Timeframe (Years): Short-Term 1	2	3	4	5	Medium-Term 6	7	8	9	10	Long-Term 10+	Key Stakeholders	Parties Involved – Facilitating Organizations: MassDOT	FHWA	DCR	MBTA	128 BC	Lexpress	Lexington	Lincoln	Newton	Waltham	Weston	Next Steps
LU-8	Encourage Workforce and Affordable Housing	Individual Cities/ Towns	$	› DHCD Housing Choice Grants	■	■										Individual Cities/ Towns							X	X	X	X	X	› Prepare Housing Production Plans to establish goals › Reform zoning in each municipality to reduce or eliminate single-family zoning
LU-2	Implement Resident and Small Business Protection	Individual Cities/ Towns	$	› Mass Growth Capital Corp. Grant Programs	■	■										Individual Cities/ Towns							X	X	X	X	X	› Establish programs to strengthen and support existing small businesses (especially WMBE's)
LU-3	Remove or Revise Parking Minimums	Individual Cities/ Towns	$$	› Local Operating Budget › University Research Partners	■	■										Individual Cities/ Towns							X	X	X	X	X	› Conduct parking studies to evaluate shared/off-site parking solutions › Engage the community in planning › Perform rezoning to reduce parking requirements
LU-6	Improve Public Gathering Spaces	Individual Cities/ Towns	$	› Local Operating Budget › University Research Partners	■	■	■									Individual Cities/ Towns							X	X	X	X	X	› Perform a planning study to identify candidate locations for high-impact public gathering spaces, with a focus on visibility, district branding, and placemaking
LU-7	Improve Multimodal Network near Cambridge Reservoir	Waltham & Lincoln	$	› Massworks Infrastructure Grants	■	■	■	■	■	■	■	■	■	■		Waltham and Lincoln	X							X		X		› Assess existing conditions for potential ped/bike accommodations › Conduct a review of the environmental constraints and permitting requirements › Design and construct infrastructure
LU-1	Conduct Market Analysis	Individual Cities/ Towns	$	› Local Operating Budget › University Research Partners	■	■	■	■	■	■	■	■	■	■		Individual Cities/ Towns							X	X	X	X	X	› Perform updated market analyses on an annual basis
LU-10	Encourage Transit-Oriented Development	Waltham, Weston, MBTA, & MassDOT	$	› MBTA Annual Operating Budget	■	■	■	■	■	■	■	■	■	■	■	MBTA	X		X	X						X	X	› Conduct environmental constraints review › Perform TOD feasibility/market analysis › Design/construct new station infrastructure
LU-9	Encourage Mixed-Use Development	Individual Cities/ Towns	$	› Local Operating Budget › University Research Partners	■	■	■	■	■	■	■	■	■	■	■	Individual Cities/ Towns							X	X	X	X	X	› Identify/define priority districts › Reform zoning to allow and incentivize mixed-use development by right in relevant districts
GT-7	Develop Regional TDM Plan	Study-area wide	$	› Unified Planning Work Program		■	■									Boston Region MPO					X		X	X	X	X	X	› Leverage recommendations of recent Boston Region MPO TDM efforts

1 - n/a not applicable, $ Less than $1 million, $$ $1 to $5 million, $$$ Greater than $5 million

Table 6-4 Implementation Plan (Plan for the Future)

			Cost / Funding		Implementation Timeframe (Years)												Parties Involved											
					Short-Term					Medium-Term					Long-Term		Facilitating Organizations											
ID	Alternative	Jurisdiction	Cost (Range)[1]	Possible Funding Source(s)	1	2	3	4	5	6	7	8	9	10	10+	Key Stakeholders	MassDOT	FHWA	DCR	MBTA	128 BC	Lexpress	Lexington	Lincoln	Newton	Waltham	Weston	Next Steps
E-2	Reduce Amount of Impervious Area and Increase Vegetative Cover	Study-area wide	n/a	n/a	■	■										Individual Cities/ Towns							X	X	X	X	X	› Municipal review of local land use controls and permitting › Reform zoning to reduce impervious areas & increase vegetative cover › Build awareness among property owners
LU-4	Implement Solar Energy Program Expansion	Individual Cities/ Towns	$$	› MassDev Site Readiness Program › Private Developer Partners	■	■	■									Individual Cities/ Towns							X	X	X	X	X	› Review existing conditions › Assess potential power output › Select one or more sites and establish a development plan
GT-8	Install Electric Vehicle Infrastructure - Public	Study-area wide	$$	› NEVI Formula Program Funding › Federal Discretionary Grant Programs	■	■	■	■								MassDOT & Individual Cities/ Towns	X						X	X	X	X	X	› Work within MassDOT's EV Infrastructure Deployment Plan › Cities/towns seek discretionary grant funding › Continue to track technology changes
GT-9	Install Electric Vehicle Infrastructure - Private	Study-area wide	$$	› Developer Mitigation Contributions › MassDEP MassEVIP Grant Program	■	■	■	■								Individual Cities/ Towns							X	X	X	X	X	› Build awareness among property owners › Municipal review of local land use controls and permitting and inspection processes
E-4	Limit Development within Flood-Prone Areas	Study-area wide	n/a	n/a	■	■	■	■	■	■	■	■	■	■	■	Individual Cities/ Towns							X	X	X	X	X	› Map flood prone areas / municipal review of local land use controls and permitting › Reform zoning and building codes to limit development in flood prone areas › Build awareness among property owners › Review & update land use controls/permitting
V-29	Consider Transportation Systems Management and Operations Strategies	MassDOT	n/a	› Federal Grant Programs › State Planning and Research Work Program				■	■	■	■	■	■	■		MassDOT	X	X										› Incorporate potential pilot of TSMO strategies on this corridor
E-3	Provide Flood Storage and Stormwater Treatment Areas	Study-area wide	$	› Municipal Vulnerability Preparedness Program › Building Resilient Inf. and Comm Program › Accelerating Climate Resiliency Grant Program › Urban & Comm Forestry Challenge Grants						■	■	■	■	■	■	Individual Cities/ Towns	X		X				X	X	X	X	X	› Map flood prone areas and evaluate potential sites for suitability › Advance to design & plan for maint. › Continuously review opportunities for additional flood storage/ treatment areas
E-1	Improve Hobbs Brook Reservoir Water Quality	MassDOT, Waltham, Lexington, & Lincoln	$	n/a						■	■	■	■	■	■	MassDOT	X		X				X	X		X		› Improve quality, density, & width of vegetated buffers › Reform zoning to reduce impervious areas & increase vegetative cover

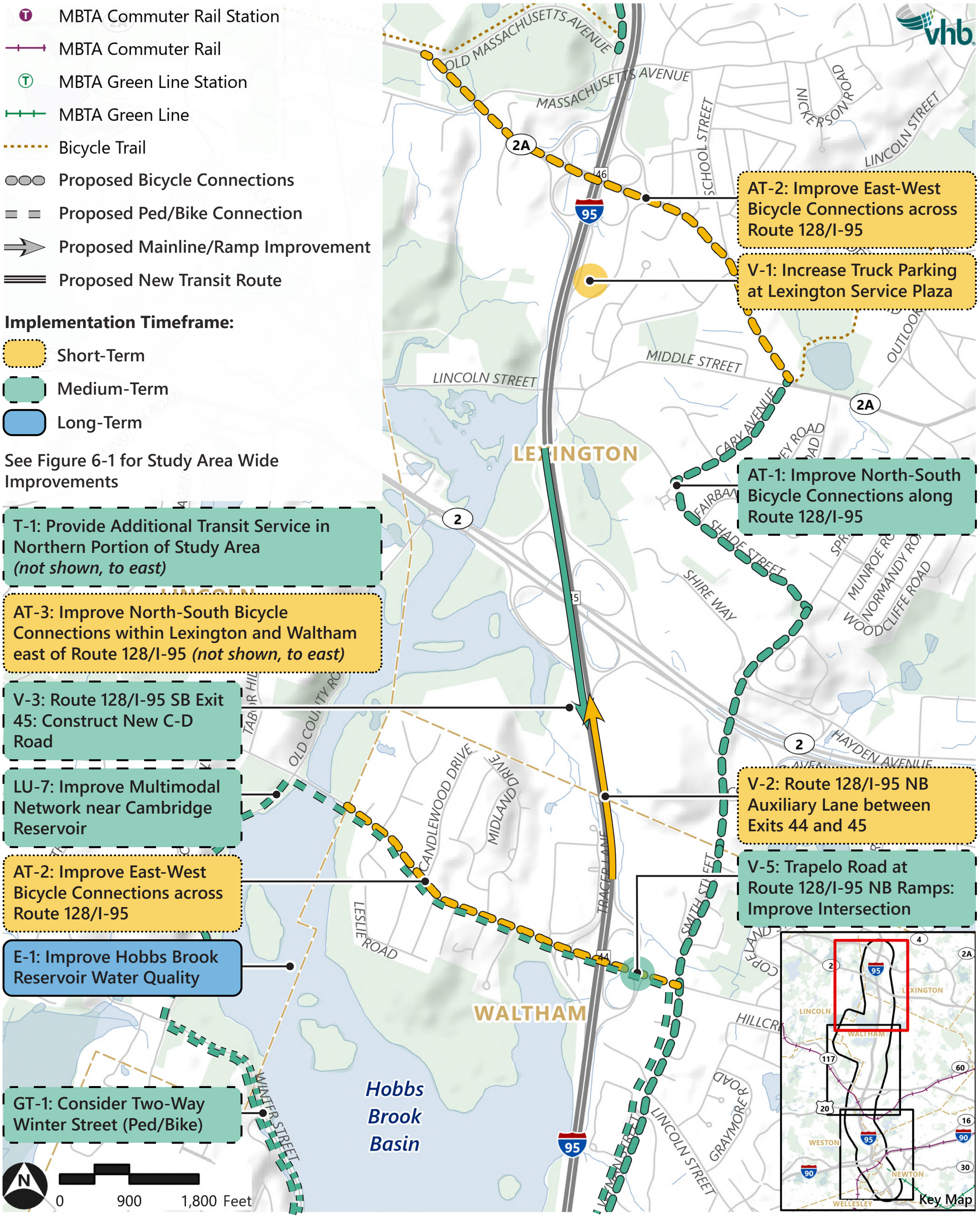
1 - n/a not applicable, $ Less than $1 million, $$ $1 to $5 million, $$$ Greater than $5 million

Table 6-5 Implementation Plan (Address Congestion & Improve Safety)

			Cost / Funding		Implementation Timeframe (Years)												Parties Involved											
					Short-Term			Medium-Term					Long-Term				Facilitating Organizations											
ID	Alternative	Jurisdiction	Cost (Range)[1]	Possible Funding Source(s)	1	2	3	4	5	6	7	8	9	10	10+	Key Stakeholders	MassDOT	FHWA	DCR	MBTA	128 BC	Lexpress	Lexington	Lincoln	Newton	Waltham	Weston	Next Steps
V-1	Increase Truck Parking at Lexington Service Plaza	MassDOT	$$	› Interstate Maintenance and Related Work Funding	■	■	■									MassDOT	X											› Advance to design › Determine permitting requirements
V-2	Route 128/I-95 NB between Exit 44 and 45: Auxiliary Lane	MassDOT	SS	› Interstate Maintenance and Related Work Funding	■	■	■									MassDOT	X	X										› Advance to design › Determine permitting requirements
V-10	Route 128/I-95 SB Exit 43: Construct Two Lane Off-Ramp	MassDOT	$	› Interstate Maintenance and Related Work Funding		■	■	■	■							MassDOT	X	X								X		› Advance to design › Coordinate with Cambridge Reservoir › Determine permitting requirements
V-12	Route 128/I-95 Northbound Exit 43: Extend On-Ramp Acceleration Lane	MassDOT	$	› Interstate Maintenance and Related Work Funding		■	■	■	■							MassDOT	X	X										› Advance to design › Coordinate with Cambridge Reservoir › Determine permitting requirements
V-17, 18, 19	Route 128/I-95 SB Exit 37/38: Planning and Design	MassDOT	$	› State Planning and Research Work Program			■	■	■							MassDOT	X	X	X						X			› Continue to advance planning and preliminary design of improvements to Exit 37/38 and Newton Service Plaza › Identify additional project stakeholders
V-5	Trapelo Road at Route 128/I-95 Ramps: Improve Intersections	MassDOT	$$	› Highway Safety Improvement Program › Intersection Improvements Program				■	■	■	■	■				MassDOT	X	X										› Advance to design › Determine permitting requirements
V-20	Route 128/I-95 NB Exit 37: Close On-Ramp from Route 16 WB	MassDOT	$	› Highway Safety Improvement Program › Intersection Improvements Program				■	■	■	■	■				MassDOT	X	X							X			› Advance to design › Determine permitting requirements
V-3	Route 128/I-95 SB at Exit 45: Construct New C-D Road	MassDOT	$$$	› Highway Safety Improvement Program › Major Infrastructure Program				■	■	■	■	■	■			MassDOT	X	X										› Advance to design › Coordinate with Cambridge Reservoir › Determine permitting requirements
V-15	Route 128/I-95 Northbound Exit 39: Extend Second Lane of C-D Road	MassDOT	$	› Interstate Maintenance and Related Work Funding					■	■						MassDOT	X	X										› Coordination with MassDOT Projects #110980 and #606783 › Advance to design › Determine permitting requirements › Possible coordination with MWRA

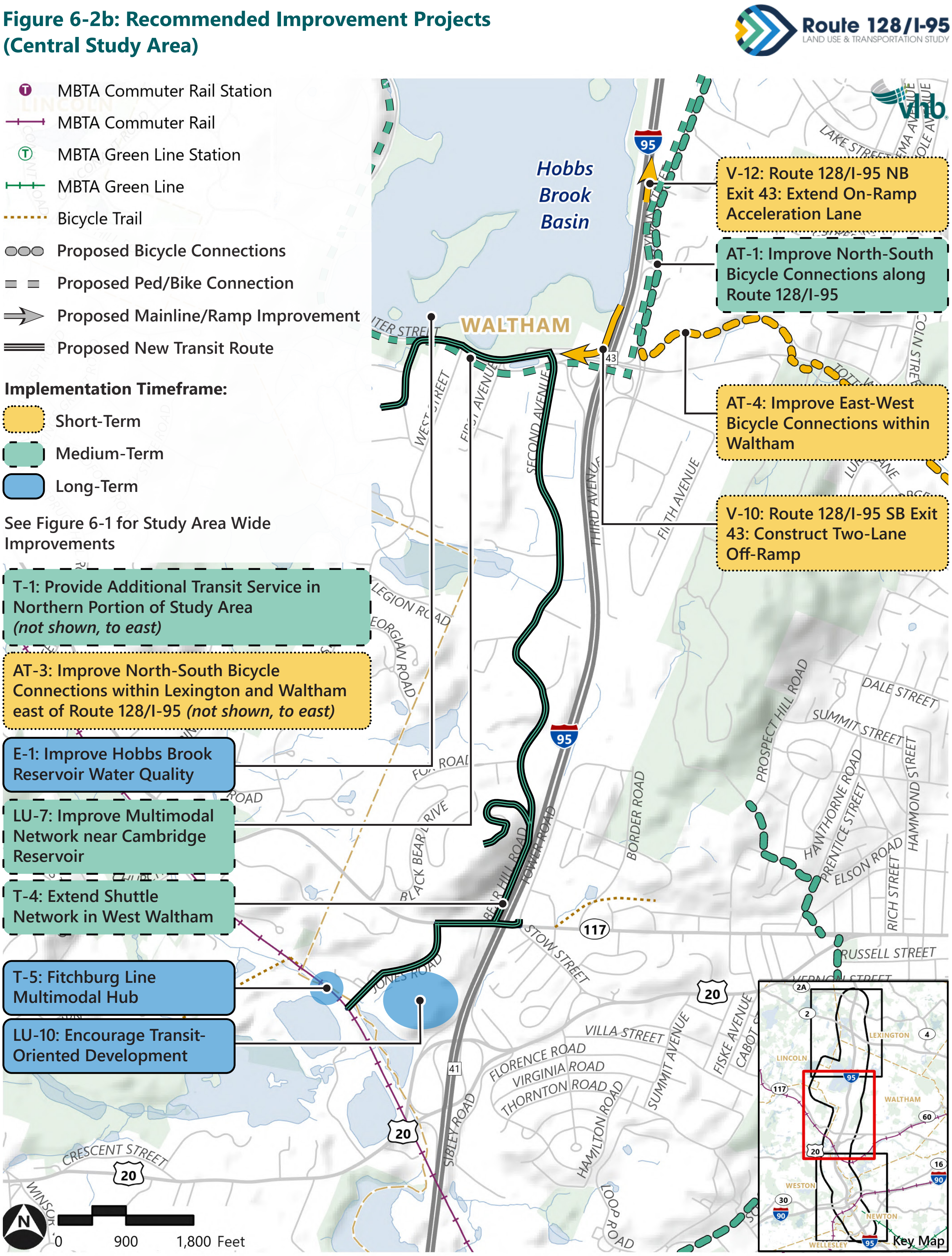
1 - n/a not applicable, $ Less than $1 million, $$ $1 to $5 million, $$$ Greater than $5 million

Figure 6-2a: Recommended Improvement Projects (Northern Study Area)



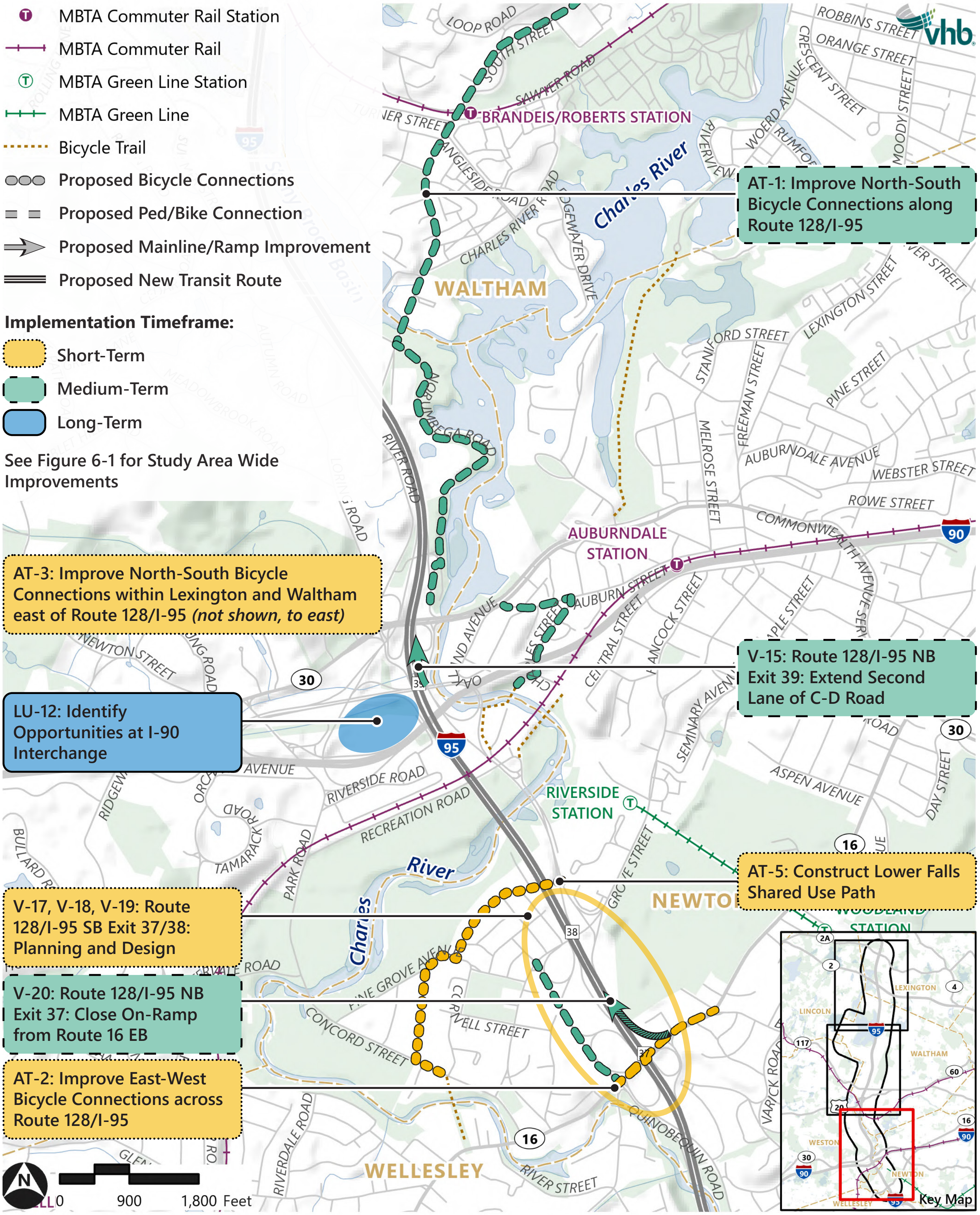
Source: MassGIS

Figure 6-2b: Recommended Improvement Projects (Central Study Area)



Source: MassGIS

Figure 6-2c: Recommended Improvement Projects (Southern Study Area)



Source: MassGIS

Appendix A: Alternative Cut-Sheets

Land Use/Economic Development Alternative Cut-Sheets

The following land use/economic development alternatives were advanced beyond the initial screening in Chapter 4, *Alternatives Development*, and have been further analyzed and evaluated as outlined in Chapter 5, *Alternatives Analysis*:

» Alternative LU-1: Conduct Market Analysis
» Alternative LU-2: Implement Resident and Small Business Protection
» Alternative LU-3: Remove or Revise Parking Minimums
» Alternative LU-4: Implement Solar Energy Program Expansion
» Alternative LU-5: Improve Open Space Network
» Alternative LU-6: Improve Public Gathering Spaces
» Alternative LU-7: Improve Cambridge Reservoir Access
» Alternative LU-8: Encourage Workforce and Affordable Housing
» Alternative LU-9: Encourage Mixed-Use Development
» Alternative LU-10: Encourage Transit Oriented Development (TOD)
» Alternative LU-12: Identify Opportunities at Route 128/I-95 at I-90 Interchange

LU-1: Conduct Market Analysis

Context

In order to remain economically strong, the Study Area needs to be more flexible in the face of changing market demands. It is anticipated that there will be a slowdown in the production of office space, and possibly lab space as well, prompting a greater need for other uses along the corridor such as multifamily housing.

Description

A market analysis helps understand the study area's potential to capture new residential, commercial, and industrial business opportunities. Our research led to four key takeaways of current conditions.

1. Suburban office markets (like those in the Study Area) recovered from the pandemic faster than urban submarkets (like downtown Boston).
2. In recent years, the Study Area has continued to absorb demand for lab space, making it one of Metro Boston's premiere lab destinations. The Study Area has a very strong reputation among leading R&D / life sciences employers, which may be its greatest asset for continued economic development.
3. Rising interest rates and increasing construction costs could pose challenges for new development.
4. The limited construction of new dwelling units, particularly multifamily dwelling units, is constraining the economic health of the Study Area. Development is currently oversubscribed to lab, office, and retail. This makes the corridor less resilient in the face of dramatic changes in how people live, work, learn, and play.

Benefits/Impacts

» Preparation of a market analysis on a regular basis would determine the demand and supply of desired development types, which can then be used to inform local development policies.

Recommendation

Out of a maximum score of 100, this alternative received a score of 0.55. While this alternative scored lowly, the Study Team sees benefits to understanding development trends and how that may inform local policies. As such, this alternative is recommended to be **advanced**. In addition, this alternative could be expanded to nearby municipalities such as Wellesley or Needham to have a better understanding of regional market conditions.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

LU-2: Implement Resident and Small Business Protection

Context

Protection against resident and small business displacement in the study area largely centers on strategies for protecting and expanding affordable housing opportunities. The Town of Lexington includes strategies for protecting and supporting small businesses, in addition to community engagement for developing affordable housing strategies. The Regional Housing Services Office (RHSO)[1]. is an example of a regional strategy throughout the study area, including Weston, Lincoln, and Lexington. The municipalities lack distinct strategies for addressing the needs and protection of historically underserved residents in local environmental justice populations.

Description

» Ahead of proposals for development/ redevelopment within the study area, implement strategies that protect against local resident and small business displacement.

» The focus of these strategies should be on environmental justice populations.

» To understand the efficacy of current policies, collect data and report out on what programs and strategies are working best to achieve goals of resident and small business protection.

Benefits/Impacts

» Preserve housing affordability.

» Encourage new affordable housing.

» Meaningful community engagement that identifies and works to address local environmental justice population needs.

Recommendation

Out of a maximum score of 100, this alternative received a score of 12.70. This alternative is recommended to be **advanced** to establish programs within each municipality to strengthen and support existing small businesses located along the corridor, specifically regarding minority- and women-owned businesses.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

[1] Regional Housing Services Office. (2022). *About RHSO*. About RHSO | Regional Housing Services Office (rhsohousing.org)

LU-3: Remove or Revise Parking Minimums

Context

Municipalities in the study area all operate on minimum parking factors with very few instances of flexibility based on development context. Only Newton and Lexington have reductions in residential parking requirements based on multi-unit or low-income unit contexts. Some of the towns have high office requirements as a baseline with reductions for some districts or property/development sizes. However, none of these allow for fewer than 3 spaces per 1,000 square feet (sf). In addition, 2018 data from three existing office sites in Waltham indicate that parking demand was less than 2.5 spaces per 1,000 sf[2]. Research shows that reducing parking requirements can encourage more affordable development due to how parking costs tend to be passed on to buyers and renters in the form of higher rents or housing costs[3].

Description

» Revise parking minimums and shared parking policies within local zoning ordinances and bylaws to ensure they do not encourage an automobile-centric transportation network.

» Conduct parking studies for the municipalities in the study area to evaluate opportunities for shared/offsite parking solutions and revisions to parking standards, particularly regarding shifts in office use.

» Engage the public to solicit support for reduced parking requirements.

» Perform re-zoning in each municipality to reduce the parking requirements.

Next steps to advance this alternative include:

» Study opportunities for shared/offsite parking solutions and revisions to parking standards, particularly about shifts in office use.

» Engage the public to solicit support for reduced parking requirements.

» Perform re-zoning in each municipality to reduce the parking requirements.

» Build upon Newton’s current effort to reduce or eliminate parking minimums in their village center district zoning.

2 City Point Parking Analysis, Waltham, Massachusetts; Prepared for Boston Properties by VHB; November 1, 2018.

3 Gabbe and Pierce, "Hidden Costs and Deadweight Losses: Bundled Parking and Residential Rents in the Metropolitan United States". (2017). Link.

Cutter and DeWoody, "Parking Externalities in Commercial Real Estate" (2010). Link.

Shoup, "The High Cost of Minimum Parking Requirements" (2014). Link.

Benefits/Impacts

- Limiting parking and allowing for shared parking in mixed-use developments can encourage use of public transit and active modes of transportation.
- Potentially reduce costs on business and renters.
- Land freed up from the local parking inventory could potentially be dedicated to community needs or additional non-paved open space, reducing heat islands.

Recommendation

Out of a maximum score of 100, this alternative received a score of 25.89. This alternative is recommended to be **advanced** as it could result is less unused parking being constructed which would provide additional space for other uses and could encourage use of public transit and active modes of transportation.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

LU-4: Implement Solar Energy Program Expansion

Context

The Commonwealth has a goal of achieving net-zero emissions by 2050 and a 50 percent reduction by 2030. There is potential to support this goal by expanding MassDOT's Solar Energy Program and identifying and utilizing opportunity sites within the Study Area.

Description

An online assessment of the Route 128/I-95 study area was conducted to identify potentially suitable locations for solar farms within the corridor. The assessment identified parcels that are located at least partially within the study area, include a minimum of five acres of land, and are mostly if not entirely vacant. Based on this assessment, 11 potentially suitable parcels for future solar farm use were identified, as shown in the attached figure. It should be noted that the identified parcels are under municipal or private ownership.

Based on the identified sites, the following next steps could be completed:

- Evaluate the feasibility of constructing solar farms at each location.
- Coordinate with individual property owner(s) to understand their plans for each parcel and discuss potential use as a solar farm.
- Conduct an expanded review of existing conditions at each candidate site, including topography, peak sunlight conditions, and potential environmental constraints.
- Assess the potential power output for each candidate site based on available land acreage and peak sunlight.
- Select one or more sites and establish a development plan.

In addition, the potential to add solar capacity at existing sites that are already developed should also be considered, such as the installation of photovoltaic canopies over parking lots at service plazas.

Benefits/Impacts

- Support the Commonwealth's goal of achieving net-zero emissions by 2050.
- Some identified sites include wooded areas and/or parkland which provide meaningful health and other intrinsic benefits. These sites are less desirable for the construction of solar farms and should be eliminated from further consideration.

Recommendation

Out of a maximum score of 100, this alternative received a score of 7.77. This alternative is recommended to be **advanced** as it supports the study goals of contributing environmental and health benefits. Of the 11 potentially suitable sites identified, deforested, or paved sites should be prioritized and existing wooded and parkland sites should be eliminated from consideration.

Conceptual Cost Range

$$

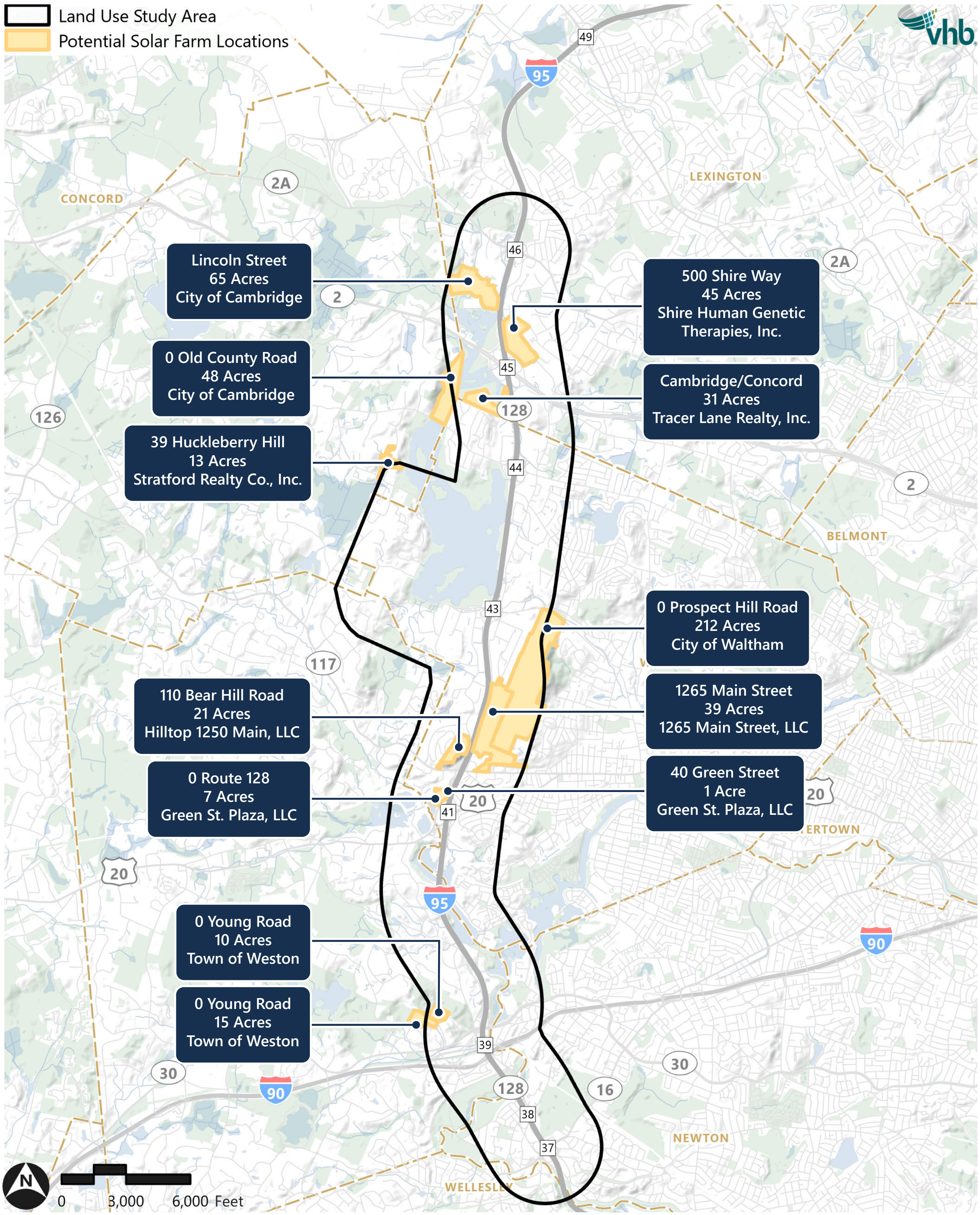
n/a not applicable

$ Less than $1 million

$$ $1 to $5 million

$$$ Greater than $5 million

Alternative LU-4: Implement Solar Energy Program Expansion - Potential Solar Farm Locations



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

LU-5: Improve Open Space Network

Context

Promoting open space within the study area is important to balance development opportunities with preserving environmental and natural features.

Four of the five study area communities currently have active Open Space and Recreation Plans, with Lincoln in the process of updating their plan. A review of the current plans identified the following five goals that overlapped between the different studies:

» Maintain and preserve open space and recreational facilities.

» Enhance management/oversight of open space and recreational facilities.

» Improve the accessibility of open space and recreational facilities.

» Promote public use of open space and recreational facilities.

» Expand connectivity between open space and recreational facilities and active transportation infrastructure, important resources, and areas that lack these facilities.

Description

Study and improve, as necessary, the accessibility of open spaces within the study area, particularly from an equity perspective. This assessment should consider criteria such as walking distance, route safety, available amenities, and quality (e.g., maintenance and general appearance).

Benefits/Impacts

» Preserve/expand open space within the study area.

» Contribute environmental and health benefits.

Recommendation

Out of a maximum score of 100, this alternative received a score of 16.93. This alternative is recommended to be **discarded** as a review of the existing Open Space and Recreation Plans for the study area communities indicates that current policies are sufficient to preserve and improve the open space network.

Conceptual Cost Range

n/a [1]

1 - Study Area municipalities currently have or are in the process of updating an Open Space and Recreation Plan.

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

LU-6: Improve Public Gathering Spaces

Context

Promoting public gathering spaces within the study area is important to balance development opportunities with the desire to increase social connectivity and the health and well-being of each community.

A review of the local zoning ordinances and bylaws for the study area communities indicates that most municipalities within the study area have provisions for the support and development of new community gathering spaces on public or privately owned land. The Town of Lincoln and the Town of Weston do not include specified requirements in their zoning bylaws.

Description

Perform a planning study to identify candidate locations for high-impact public gathering spaces, with a focus on visibility, district branding, and placemaking within the Study Area. Recommendations of this study could consider:

» New community gathering spaces, such as plazas, gardens, neighborhood parks, etc., on both publicly owned and privately owned lands.

» Connection of gathering spaces with each other to the greatest extent practicable (e.g., trails to plazas).

Benefits/Impacts

» Provide areas for public activities, social connectivity, and increased foot traffic that could support commercial activity/small businesses.

» Enhance community health and well-being.

» Augment the visual character of a community.

Recommendation

Out of a maximum score of 100, this alternative received a score of 20.68. This alternative is recommended to be **advanced** as it achieves the study goals of supporting strategic land use and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

LU-7: Improve Multimodal Network near Cambridge Reservoir

Context

Public access to the Cambridge Reservoir (Hobbs Brook Reservoir) is prohibited. However, there is an opportunity to create a multimodal recreation pathway loop along existing roadways that could provide views of the Cambridge Reservoir, while respecting existing use limitations and stormwater regulations.

Description

This alternative considers opportunities to improve public access around and enjoyment of the Cambridge Reservoir within current use limits[4], including:

» Create a continuous five-mile recreational loop surrounding the reservoir connecting Winter Street, Old County Road, Trapelo Road, and Wyman Street (seen in the attached figure):
   - Currently, only 1.6 miles of the potential route features sidewalks.
   - The creation of 3.4 miles of new sidewalk and the addition of bike lanes and/or shared lane markings would be required to create a safe and functional recreational loop.
   - It should be noted that portions of this loop are included in Alternatives AT-1, AT-2, and GT-1.

Next steps to develop this recreation loop would include:

» Assess existing roadway conditions along the proposed five-mile recreational loop to determine the suitability for introducing new bicycle and pedestrian infrastructure, including roadway width, traffic conditions, potential engineering challenges, topography, utilities, etc.

» Conduct a review of the reservoir's environmental constraints and stormwater regulations to determine potential permitting requirements associated with existing natural resources.

» Design and construct infrastructure (i.e., sidewalks, bike lanes, signage, and wayfinding.

Benefits/Impacts

» Create a shared amenity for residents/employees in the area, promoting physical activity, social connections, and respite from the urban environment.

» Connect gaps between the existing bicycle and pedestrian infrastructure.

[4] Initially, this alternative also considered trails/connections to Cambridge Reservoir. However, based on conversations with the City of Cambridge Water Department when the Cambridge Reservoir was created in the 1800's public access was prohibited and remains prohibited to this day. Therefore, this portion of the alternative was discarded from further consideration.

Recommendation

Out of a maximum score of 100, this alternative received a score of 17.32. This alternative is recommended to be **advanced for segments on MassDOT/municipal owned roadways only** to improve recreational accommodations.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative LU-7: Improve Multimodal Network near Cambridge Reservoir - Proposed Recreational Loop

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

LU-8: Encourage Workforce and Affordable Housing

Context

Directly along the Route 128/I-95 corridor, rental housing is sparse, as is multifamily housing and affordable housing in general. The municipalities of the study area can take steps to allow and incentivize multifamily development within the corridor.

A review of the zoning ordinances and bylaws for the study area municipalities indicate that each municipality in the study area addresses affordable housing differently, with only Waltham and Newton containing multi-resident districts where multifamily housing development is allowed either by-right or via Special Permit.

Description

» Identify opportunities for the study area to supply affordable and workforce housing for each level of low-income households (i.e., households earning less than 50% Area Median Income (AMI), households earning between 50% and 80% AMI, and households earning between 80% and 100% AMI).

» Each municipality should prepare a Housing Production Plan to establish goals and an implementation matrix (currently, only Weston has an active Housing Production Plan).

» Reform zoning in each municipality to reduce or eliminate single-family zoning.

» Coordinate with the multifamily zoning requirement for MBTA communities that was enacted as part of the economic development bill in January 2021.

Benefits/Impacts

» Help to address local, regional, and statewide housing needs.

» Help to make the corridor more resilient in the face of a rapidly changing real estate market.

» Supports job creation and retention.

» Shortens commutes and potentially reduces vehicle trips.

Recommendation

Out of a maximum score of 100, this alternative received a score of 37.30. This alternative is recommended to be **advanced** as it achieves the study goals of supporting strategic land use and economic vitality and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

LU-9: Encourage Mixed-Use Development

Context

Zoning regulations through the study area are generally amenable to single-use development patterns instead of mixed-use. In municipalities where mixed-use development is allowed, there are constraints to new development, including special permitting requirements in Newton and limited opportunity for mixed commercial and residential development in Waltham.

Description

» Explore strategies that encourage mixed-use development within the study area, such as:
  - Financial and regulatory incentives (e.g., tax abatements, density bonuses);
  - Strategic infill development;
  - Removal of regulatory barriers in local zoning ordinances/bylaws; and
  - Adoption of form-based codes.

Next steps to advance this alternative include:

» Identify and delineate districts within the study area that would most benefit from mixed-use development.

» Reform zoning in each municipality to allow and incentivize mixed-use development by right in relevant districts.

Benefits/Impacts

» Provide residential units closer to workplaces, which can shorten commutes and potentially reduce the number of vehicles on the roadway.

» Help to address local, regional, and statewide housing needs.

» Help to make the corridor more resilient in the face of a rapidly changing real estate market.

Recommendation

Out of a maximum score of 100, this alternative received a score of 39.93. This alternative is recommended to be **advanced** as it achieves the study goals of supporting strategic land use and economic vitality and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

LU-10: Encourage Transit Oriented Development (TOD)

Context

Designated zoning districts for TOD are limited within the study area, with just one such district located in Newton. Although Waltham does not have a designated TOD district, its Riverfront zoning district has regulations that are supportive of it.

The MBTA's Fitchburg and Worcester Commuter Rail lines traverse the Study Area and offer the potential for TOD. In addition, the Worcester Line is in proximity to Riverside Station of the MBTA Green Line D Branch. MassDOT, the MBTA, the City of Waltham, and the Town of Weston should put consideration into the potential for facilitating TOD along these lines with the introduction of potential new stations along each line.

Description

The project team examined the study area to identify locations along the two commuter rail lines that traverse the study area (the Fitchburg Line and the Worcester Line) that would be best suited for TOD. Two sites were identified on each line and vacant or underutilized parcels nearby with strong potential to support mixed-use residential and/or commercial development were identified:

» TOD Site 1 (Fitchburg Line)
  - Potential site for a new station and new development identified southeast of the MBTA's existing Kendal Green Station[5].
  - Two sites nearby were identified with development opportunities of 23 acres and 16 acres, respectively.
  - Given the proximity to existing clusters of life science and research facilities, each of these sites would be ideal for mixed-use laboratory and/or commercial development.

» TOD Site 2 (Worcester Line)
  - Potential site for new development identified directly south of the Route 128/I-95 at I-90 interchange. The site is located along the MBTA Worcester Commuter Rail Line and in proximity to Riverside Station of the MBTA Green Line D Branch.
  - As an illustrative example, a 20-acre portion of the public 18-hole Leo J. Martin Memorial Golf Course could potentially be considered for TOD. However, additional sites should be evaluated if this alternative is advanced.

A map of the two TOD site locations along the Fitchburg Line and the Worcester Line and potential development opportunities at each of the sites are provided in the attached figures.

[5] A new station at this location aligns with the MBTA Rail Vision study, which proposed to replace Kendal Green Station with a new "I-95" urban rail station with direct connection to I-95, close Hastings and Silver Hill stations, and serve the new station with high frequency urban rail.

Next steps to encourage TOD include the following:

- Conduct a review of environmental constraints at the two opportunity sites to determine potential permitting requirements associated with existing natural resources.
- Perform TOD feasibility and market analysis.
- Based on the outcomes of the above, design and construct new station infrastructure to support TOD and enhanced connectivity surrounding the two opportunity sites.

Benefits/Impacts

TOD supports many of this study's goals, objectives, and other actions, including:

- Promoting economic development
- Increasing mixed use developments and sustainable developments
- Adding to the local affordable housing supply
- Supporting alternative modes of transportation
- Promoting social equity

Additional options for TOD Site 2 (Worcester Line) should be considered as the illustrative example included in this study would displace an existing use.

Recommendation

Out of a maximum score of 100, this alternative received a score of 42.11. This alternative is recommended to be **advanced for TOD Site 1 (Fitchburg Line)** as it achieves the study goals of supporting strategic land use and economic vitality, advancing social equity, and improving access and mobility for all. TOD Site 2 (Worcester Line) should be monitored for potential future development opportunities.

Conceptual Cost Range

$\$\$\$^1$

1 – Cost estimate does not include design or construction of new station infrastructure

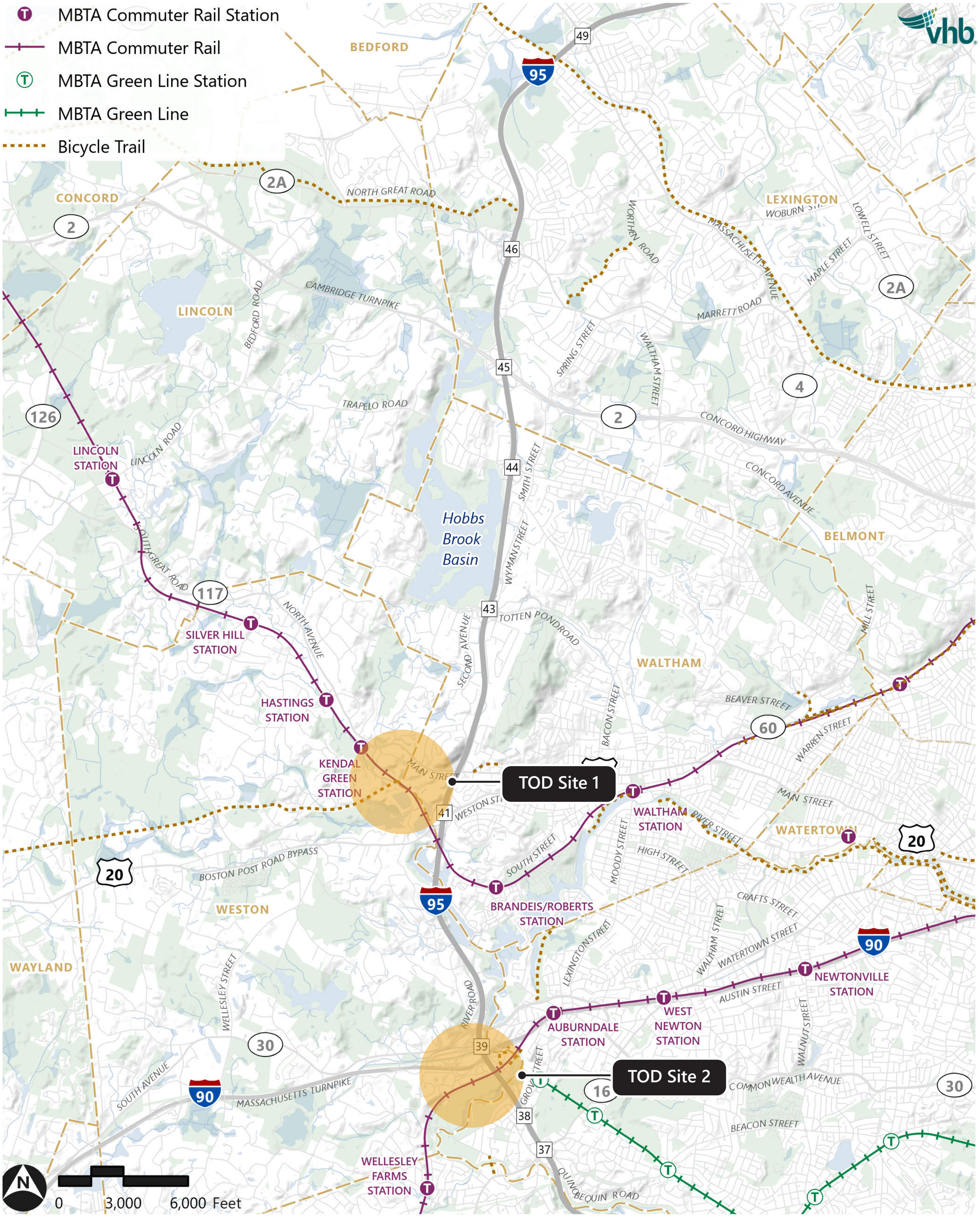
n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative LU-10: Encourage Transit Oriented Development (TOD) - TOD Site Locations



Source: MassGIS, MassDOT

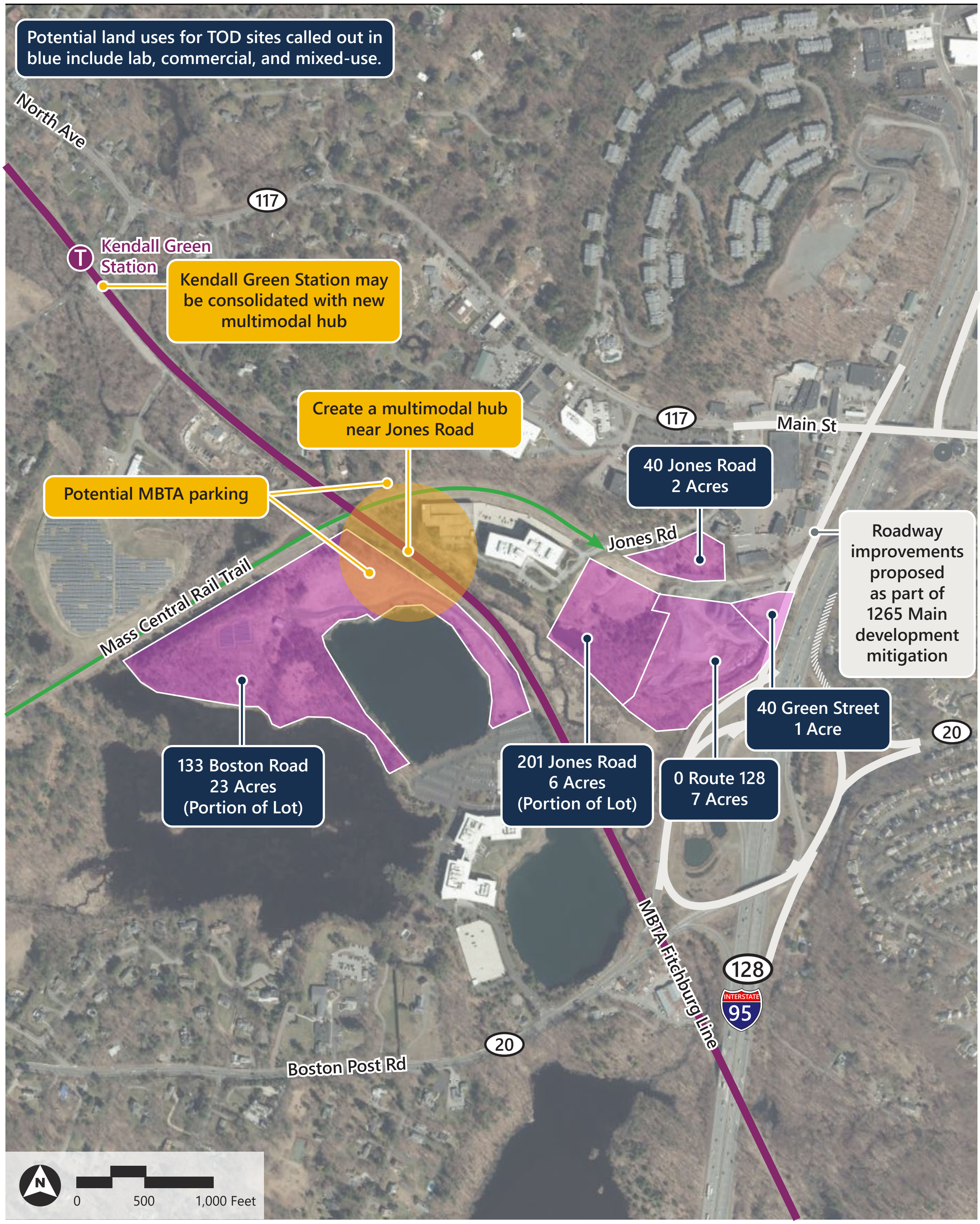
Alternative LU-10: Encourage Transit Oriented Development (TOD) - TOD Site 1 (Existing Conditions)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

Alternative LU-10: Encourage Transit Oriented Development (TOD) - TOD Site 1 (Development Opportunities)



Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

Alternative LU-10: Encourage Transit Oriented Development (TOD) - TOD Site 2 (Existing Conditions)

Source: MassGIS

Alternative LU-10: Encourage Transit Oriented Development (TOD) - TOD Site 2 (Development Opportunities)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

LU-12: Identify Opportunities at Route 128/I-95 at I-90 Interchange

Context

With the elimination of toll booths along I-90, there is underutilized land owned by MassDOT at the Route 128/I-95 at I-90 interchange that could potentially be repurposed. Although the interchange site would not be amenable to most real estate markets, it is an ideal site for industrial and transportation-related uses. MassDOT, who owns this property, should explore options for leveraging the availability of this space to support transportation and/or economic development goals.

Description

Opportunities within the existing Route 128/I-95 at I-90 interchange to foster economic development were identified. Due to the site's proximity to highways, it would not be amenable to the development of residential, retail, or institutional land uses, but the vacant land could likely be best leveraged through:

» Construction of a park and ride lot with over 300 parking spaces, including a dedicated bus pick-up/drop-off facility, for workers on Route 128/I-95, commuter carpooling to points west, and/or travelers to Logan Airport; or

» Construction of a private sector industrial/warehouse development (up to 180,000 sf).

A map of the potential development area at the Route 128/I-95 at I-90 interchange and high-level concepts of two potential development opportunities are provided in the attached figures.

Other potential uses considered include a park and ride, a regional EV charging and maintenance facility, and/or a truck-only layover/rest-stop which could leverage its position inside of these ramps to support freight mobility and replace or complement the existing stops located off Weston's local roadways.

Any redevelopment of the site within the interchange would be enhanced by a multimodal hub on the Worcester Line. The Worcester Line travels directly south of interchange and laboratory space under construction on Riverside Road. A new station at or in the vicinity of this location would enhance redevelopment opportunities and could provide a central transportation hub that could capture drivers on both Route 128/I-95 and I-90.

It should be noted that there are several proposed state-sponsored projects in the vicinity of the interchange that need to be considered when evaluating the feasibility of leveraging the vacant land:

» MassDOT is currently in the planning stages to rehabilitate and replace several bridges at the Route 128/I-95 at I-90 interchange which could result in changes to the roadway network (Project Number 606783).
» MWRA is in discussion regarding leasing land in the vicinity of this interchange for enabling an upcoming project.

Next steps to leverage development opportunities at the interchange include the following:

» Assess existing roadway conditions to determine the suitability for supporting various uses within the identified site.
» Identify a preferred use and necessary supportive transportation elements.
» Establish a site development plan for the preferred use and prepare a Request for Proposal (RFP) to solicit developer participation.

Benefits/Impacts

» Create jobs and foster economic development.
» Provide a ground-lease revenue source for MassDOT and strengthen Weston's tax base.
» Multimodal hub and/or park-and-ride options could encourage a reduction in single occupancy vehicle trips.
» A regional EV charging and maintenance facility would help support the commonwealth's goal of achieving net-zero emissions by 2050 and a 50 percent reduction by 2030.

Recommendation

Out of a maximum score of 100, this alternative received a score of 45.35. This alternative is recommended to be **advanced** as it achieves the study goals of supporting strategic land use and economic vitality, advancing social equity, and improving access and mobility for all. Before any concepts are developed at this location, the feasibility of redeveloping this site should be confirmed based on potential access/egress connections with nearby roadways.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative LU-12: Identify Opportunities at Route 128/I-95 at I-90 Interchange - Interchange Site (Existing Conditions)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

Alternative LU-12: Identify Opportunities at Route 128/I-95 at I-90 Interchange - Interchange Site (Alternative 1)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

Alternative LU-12: Identify Opportunities at Route 128/I-95 at I-90 Interchange - Interchange Site (Alternative 2)

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\whb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Land Use Figures.indd

Transportation: Vehicular Alternative Cut-Sheets

The following vehicular alternatives were advanced beyond the initial screening in Chapter 4, *Alternatives Development*, and have been further analyzed and evaluated as outlined in Chapter 5, *Alternatives Analysis*:

» Alternative V-1: Increase Truck Parking at Lexington Service Plaza

» Alternative V-2: Route 128/I-95 Northbound between Interchanges 44 (Trapelo Road) and 46 (Route 2A): Construct New C-D Road

» Alternative V-3: Route 128/I-95 Southbound at Interchange 45 (Route 2): Construct New C-D Road

» Alternative V-4: Route 128/I-95 Northbound Interchange 45 (Route 2): Two-Lane Off-Ramp to Route 2 Eastbound

» Alternative V-5: Trapelo Road at Route 128/I-95 Ramps: Improve Intersections

» Alternative V-9: Route 128/I-95 Southbound Interchange 43 (Winter Street): Reconstruct Winter Street and Southbound Off-Ramp

» Alternative V-10: Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Two Lane Off-Ramp

» Alternative V-11: Route 128/I-95 Southbound Interchange 43 (Winter Street): Modify Winter Street Eastbound

» Alternative V-12: Route 128/I-95 Northbound Interchange 43 (Winter Street/ Third Avenue): Extend On-Ramp Acceleration Lane

» Alternative V-14: Route 20 at Summer Street: Signalize Intersection

» Alternative V-15: Route 128/I-95 Northbound Interchange 39 (I-90/Route 30): Extend Second Lane of C-D Road

» Alternative V-17: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Modify C-D Road and Service Plaza Access

» Alternative V-18: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close Off-Ramp to Route 16 Eastbound

» Alternative V-19: Route 128/I-95 Southbound Interchange 37B/38 (Route 16/ Grove Street): Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress

» Alternative V-20: Route 128/I-95 Northbound Interchange 37 (Route 16): Close On-Ramp from Route 16 Westbound

» Alternative V-26: Convert a General-Purpose Lane on Route 128/I-95 to Managed Lane

» Alternative V-28: Consider Connected/ Autonomous Vehicle Technology

» Alternative V-29: Consider Transportation Systems Management and Operations Strategies

» Alternative V-31: Build upon Outcomes of Shared Travel Network Study

V-1: Increase Truck Parking at Lexington Service Plaza

Context

There is currently insufficient truck parking at the Lexington Service Plaza. Tractor trailers are frequently observed to park in non-designated parking spaces, such as on the shoulders of the service plaza access roadways. In addition, there is a small surface parking lot on the south side of the service plaza that is under-utilized and could potentially be repurposed.

Description

A review of the service plaza indicates that approximately 10 additional truck parking spaces could be added on the east side of the service plaza in a wooded area behind the service plaza building. The following conditions are noted:

- Minimal grading issues.
- No major obstructions would need to be relocated.
- Spaces would be angled spaces that require truck drivers to back in.

A concept of the increased truck parking at the Lexington Service Plaza with truck turning diagrams is provided in the attached figure.

A review of the small surface parking lot on the south side of the service plaza indicates that the construction of truck parking may not be feasible due to the amount of space needed for trucks to turn into and out of the parking area.

Benefits/Impacts

- Would provide additional truck parking spaces for truck drivers.
- Would improve safety and circulation through the service plaza by not having tractor trailers park on the shoulder of the access roadways.

Recommendation

Out of a maximum score of 100, this alternative received a score of 8.47. This alternative is recommended to be **advanced** as it will improve safety and circulation through the service plaza by providing additional dedicated truck parking spaces with minimal construction costs.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative V-1: Increase Truck Parking at Lexington Service Plaza

Source: VHB

V-2: Route 128/I-95 Northbound between Interchanges 44 (Trapelo Road) and 46 (Route 2A): Construct New C-D Road

Context

The weaving movement on Route 128/I-95 northbound at Exit 45 (Route 2) presents an operational and safety issue with vehicles entering from Route 2 eastbound conflicting with vehicles exiting to Route 2 westbound. The Route 2 overpass was reconstructed in the mid-2010s to include additional right-of-way to accommodate a potential Collector-Distributor (C-D) Road.

Description

Due to the proximity of upstream and downstream interchanges, it is likely that a C-D Road constructed at Interchange 45 (Route 2) would extend to include either Interchange 44 (Trapelo Road) or Interchange 46 (Route 2A) as well. Two different concepts were evaluated:

» Beginning south of Interchange 45 (Route 2) and ending north of Interchange 46 (Route 2A).

» Beginning south of Interchange 44 (Trapelo Road) and ending north of Interchange 45 (Route 2).

A map illustrating the location of this alternative is provided in the attached figure. Both concepts would result in all on- and off-ramps occurring on the C-D Road with no impacts to the number of lanes on the Route 128/I-95 northbound mainline.

Benefits/Impacts

» Improved capacity operations for the merge, diverge, and weaving segments at the interchange due to the separating of interchange traffic from through traffic.

» Anticipated small reduction in total estimated number of crashes.

» While the freeway operations would be improved on the mainline, the high volumes entering and exiting at the Route 2 interchange would result in poor operations on the C-D Road with the demand greater than the capacity for the C-D Road concept between Trapelo Road and Route 2.

Recommendation

Out of a maximum score of 100, the initial alternative received a score of -2.34 and is recommended to be discarded due to the poor operations on the C-D Road and the lack of other benefits. However, a revised alternative of an auxiliary lane between Exit 44 (Trapelo Road) and Exit 45 (Route 2) has been considered, as described below, and is recommended to be **advanced**.

Alternative Revision

Based on coordination with MassDOT, there is the potential to realize some operational and safety benefits by constructing an auxiliary lane between Exit 44 (Trapelo Road) and Exit 45 (Route 2), instead of a C-D Road. This revised alternative includes a continuous lane between the Trapelo Road on-ramp and the Exit 45A (Route 2 eastbound) off-ramp, increasing the distance for drivers to change lanes without the operational challenges noted above.

Conceptual Cost Range [1]

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

1 – Cost is based on the Alternative Revision (auxiliary lane only between Exits 44 and 45)

Alternative V-2: Route 128/I-95 Northbound between Interchanges 44 and 46: Construct New C-D Road

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

V-3: Route 128/I-95 Southbound at Interchange 45 (Route 2): Construct New C-D Road

Context

The weaving movement on Route 128/I-95 southbound at Exit 45 (Route 2) presents an operational and safety issue with vehicles entering from Route 2 westbound conflicting with vehicles exiting to Route 2 eastbound. The Route 2 overpass was reconstructed in the mid-2010s to include additional right-of-way to accommodate a potential C-D Road.

Description

» New Collector-Distributor (C-D) Road on Route 128/I-95 southbound starting north of the Exit 45B off-ramp to Route 2 westbound and extending south of the on-ramp from Route 2 eastbound.

» All on- and off-ramps for the Route 2 interchange will occur on the C-D Road.

» No impact to the number of lanes on the Route 128/I-95 southbound mainline.

An illustration of Alternative V-3 is provided in the attached figure.

Benefits/Impacts

» Improved capacity operations for the merge, diverge, and weaving segments at the interchange due to the separating of interchange traffic from through traffic[6].

» While weaving segment will operate with a lower vehicular density, the segment is still expected to operate with poor results (Level of Service F).

» Anticipated small reduction in total estimated number of crashes.

» Further geometric review required to ensure a potential design would adhere to current MassDOT standards with respect to interchange spacing and weaving distances.

Recommendation

Out of a maximum score of 100, this alternative received a score of 15.55. This alternative is recommended to be **advanced** as it is expected to improve vehicular operations and safety by separating the interchange merge, diverge, and weave movements from the mainline through traffic.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

[6] It should be noted that this alternative of a C-D Road in the southbound direction of Route 128/I-95 is expected to handle the anticipated traffic volumes more efficiently than the discarded Alternative V-2 of a potential C-D Road in the northbound direction.

Alternative V-3: Route 128/I-95 Southbound at Interchange 45: Construct New C-D Road

Source: VHB

V-4: Route 128/I-95 Northbound Interchange 45 (Route 2): Two-Lane Off-Ramp to Route 2 Eastbound

Context

The diverge movement for the Route 128/I-95 northbound Interchange 45A off-ramp to Route 2 eastbound is expected to operate at level of service (LOS) F under future conditions. The off-ramp is not adjacent to wetlands or other significant constraints, presenting an opportunity to expand the off-ramp from one lane to two lanes to accommodate the anticipated demand.

Description

» Expand the Route 128/I-95 northbound Interchange 45A off-ramp to Route 2 eastbound from one lane to two lanes.

» Modify the Route 2 eastbound mainline from three lanes to two lanes to accommodate two receiving lanes from Route 128/I-95 northbound.

» This alternative would likely involve the construction of a retaining wall southeast of the off-ramp to accommodate the expanded roadway.

A map illustrating the location of this alternative is provided in the attached figure.

Benefits/Impacts

» Slightly improves operations for the diverge movement at the Exit 45A off-ramp but would still result in an LOS F during the weekday evening peak hour.

Recommendation

Out of a maximum score of 100, this alternative received a score of 6.83. This alternative is recommended to be **discarded** as it will not result in significant improvements in operations within the study area and would likely have constructability challenges due to grading issues southeast of the off-ramp.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative V-4: Route 128/I-95 Northbound Interchange 45: Two-Lane Off-Ramp to Route 2 EB

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

V-5: Trapelo Road at Route 128/I-95 Ramps: Improve Intersections

Context

The existing intersections of Trapelo Road at the Route 128/I-95 northbound ramps and Trapelo Road at the Route 128/I-95 southbound ramps/Data Drive have operational issues and do not provide sufficient pedestrian and bicycle accommodations.

Description

This alternative looked at several alternatives to improve the intersections:

» **Trapelo Road at the Route 128/I-95 Northbound Ramps:** Two-lane roundabout and elimination of two of the four interchange ramps (on-ramp from Trapelo Road eastbound and off-ramp to Trapelo Road westbound). This alternative includes a shared-use path around the roundabout for pedestrians and bicyclists and could be accommodated within the existing right-of-way.

» **Trapelo Road at the Route 128/I-95 Southbound Ramps/Data Drive:**

- Option1: Signalization was considered; however, a signal is not warranted at this intersection based on existing and future traffic volume warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD)[7].
- Option 2: A roundabout was considered; however, it could not be accommodated within the existing right-of-way. Further, a roundabout would likely need to have six approaches due to the proximity of nearby driveways, creating confusion for drivers and requiring a larger roadway diameter.

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

The following benefits are for the concept of a two-lane roundabout at the intersection of Trapelo Road at the Route 128/I-95 northbound ramps:

» Eliminates a weaving segment on the Route 128/I-95 mainline by removing two of the four ramps serving this interchange.

» Improves operations and queues for traffic on the off-ramp approaching Trapelo Road.

» Allows for dedicated pedestrian and bicycle accommodations and eliminates the existing conflict points where pedestrians and bicyclists need to cross the on-ramps and off-ramps.

» Reduces vehicle speeds for vehicles on Trapelo Road and vehicles exiting the interstate.

» Expected to produce a significant reduction in crash frequency.

[7] Manual on Uniform Traffic Control Devices (MUTCD); 2009 Edition with Revision Numbers 1, 2, and 3, dated July 2022; U.S. Department of Transportation Federal Highway Administration.

Based on the identified issues for the Trapelo Road at the Route 128/I-95 southbound ramps/Data Drive concepts, these alternatives were not advanced.

Recommendation

Out of a maximum score of 100, this alternative received a score of 24.29. A roundabout at the intersection of Trapelo Road at the Route 128/I-95 northbound ramps is recommended to be **advanced**. The concept will improve safety, enhance pedestrian and bicycle accommodations, provide acceptable levels of operations, and does not have any critical flaws from a constructability standpoint. The concepts at the intersection of Trapelo Road at the Route 128/I-95 southbound ramps/Data Drive are not recommended to be progressed as they do not meet current design standards.

Conceptual Cost Range

**$$**$

n/a not applicable

**$**$$ Less than $1 million

**$$**$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-5: Trapelo Road at Route 128/I-95 Ramps: Improve Intersections

Source: VHB

V-9: Route 128/I-95 Southbound Interchange 43 (Winter Street): Reconstruct Winter Street and Southbound Off-Ramp

Context

The existing intersection network along Winter Street between 1st Avenue and the Route 128/I-95 southbound ramps is congested, operates poorly, does not provide sufficient pedestrian and bicycle accommodations, and confuses drivers. The City of Waltham Transportation Master Plan[8] included a concept to reconstruct this roadway network that serves as the basis of this alternative but has not progressed beyond the concept stage as of the publication of this study.

Description

» Reconstruct Winter Street to remove the "goose pond" and add a jug handle from Route 128/I-95 southbound and Winter Street westbound for access to 2nd Avenue.

» Remove the two one-way segments of Winter Street and have a single roadway that allows two-way travel.

» Relocate the Bertucci's parcel driveway to signal with 1st Avenue.

An illustration of this alternative based on the concept presented in the Waltham Transportation Master Plan is provided in the attached figure.

Benefits/Impacts

» Provides some operational improvements, but still expected to result in intersections with overall poor operations (LOS F).

» Provides an opportunity to improve pedestrian and bicycle accommodations.

» Likely to result in a slight reduction in crash frequency.

Recommendation

Out of a maximum score of 100, this alternative received a score of 4.72. This alternative is recommended to be **discarded** as the level of investment needed to implement this alternative would not result in a significant improvement in intersection operations and congestion.

Conceptual Cost Range

$$$

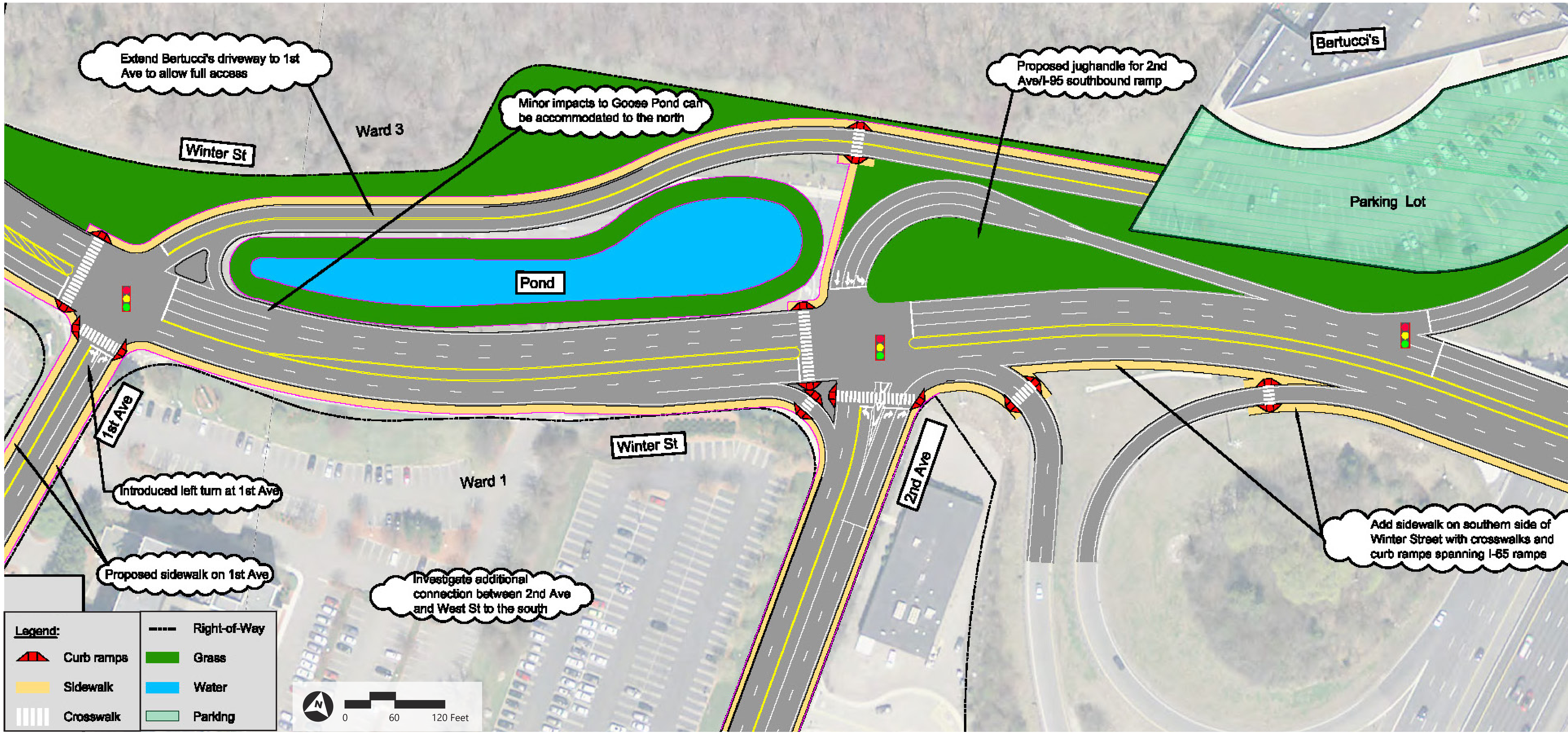
n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

8 City of Waltham Transportation Master Plan; prepared by McMahon Associates; January 2017.

Alternative V-9: Existing Geometry

Source: Nearmap Imagery.

Alternative V-9: Route 128/I-95 Southbound Interchange 43: Reconstruct Winter Street and Southbound Off-Ramp



Note: For Route 128/I-95 alternative, three eastbound lanes were modeled due to additional anticipated traffic growth in area.

Source: McMahon, City of Waltham Transportation Master Plan, 2016

V-10: Route 128/I-95 Southbound Interchange 43 (Winter Street): Construct Two Lane Off-Ramp

Context

The single lane off-ramp from Route 128/I-95 southbound to Winter Street at Interchange 43 is expected to experience poor operations in the future with queues of over 1,500 feet.

Description

» Expand the off-ramp from Route 128/I-95 southbound to Winter Street at Interchange 43 from one lane to two lanes approaching the signalized ramp termini at Winter Street.

» Maintain one lane departing the mainline and open up to two lanes approaching Winter Street.

» Install queue detection on the Route 128/I-95 southbound off-ramp to ensure that the queues from the new traffic signal do not impact mainline operations.

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

» Improves the operations at the signalized intersection at Winter Street and 2nd Avenue from overall LOS F to overall LOS C with queues reduced by approximately 600 feet.

» Minimal constructability issues as will occur fully within the right of way.

Recommendation

Out of a maximum score of 100, this alternative received a score of 14.70. This alternative is recommended to be **advanced** as it will improve vehicle operations and travel times while having minimal impacts on the other study area goals.

Conceptual Cost Range

**$**$$

n/a not applicable

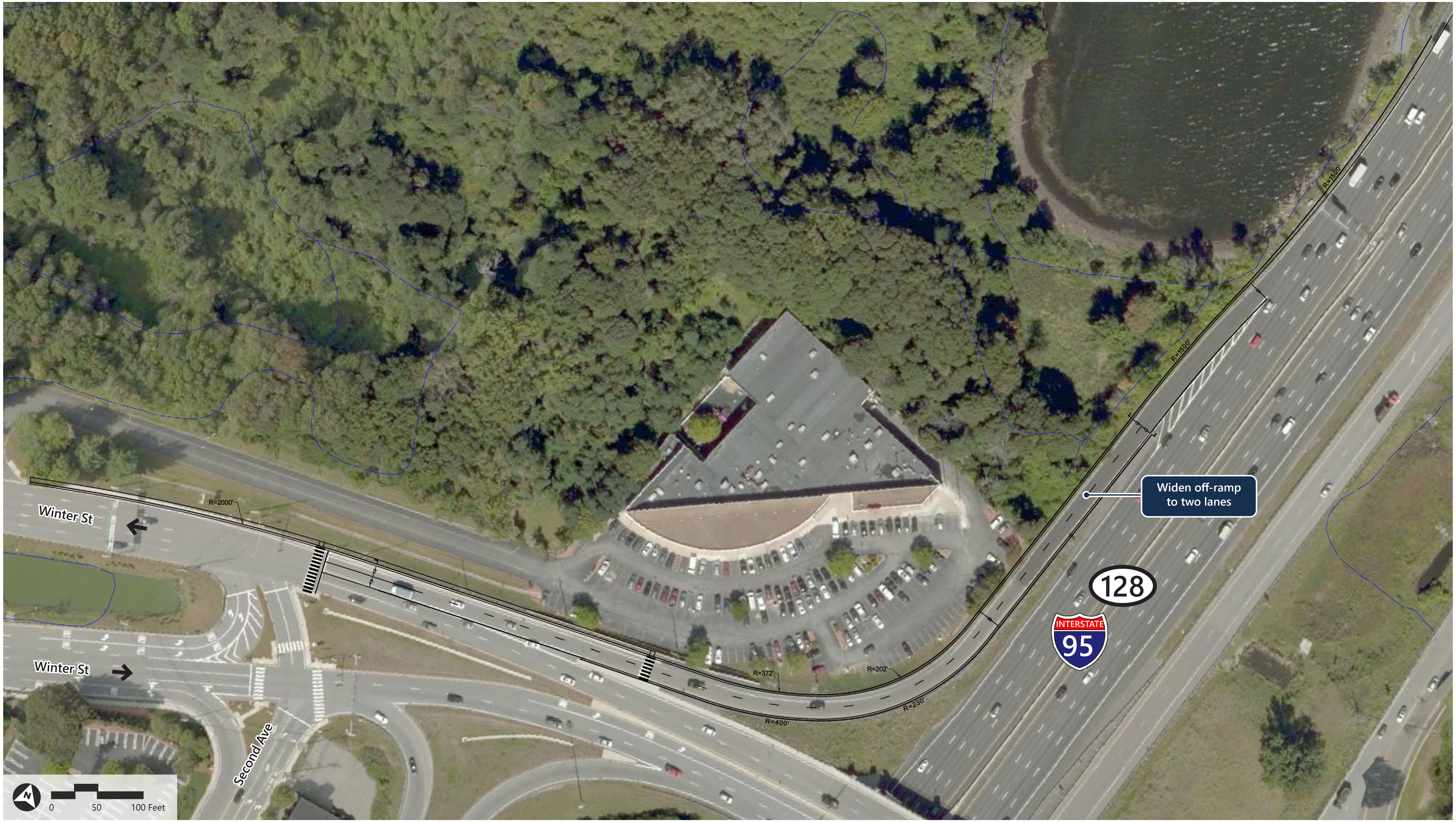
**$**$$ Less than $1 million

**$$**$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-10: Route 128/I-95 Southbound Interchange 43: Construct Two Lane Off-Ramp

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: VHB

V-11: Route 128/I-95 Southbound Interchange 43 (Winter Street): Modify Winter Street Eastbound

Context

The existing intersection network along Winter Street between 1st Avenue and the Route 128/I-95 southbound ramp is congested, operates poorly, does not provide sufficient pedestrian and bicycle accommodations, and confuses drivers. The City of Waltham has reviewed preliminary concepts in the past to improve operations in this area.

Description

» Simplify the intersections of Winter Street eastbound and westbound with 2nd Avenue by eliminating turning movements onto Winter Street westbound from the south.

» Creates a new signalized intersection east of 2nd Avenue for U-turns from Winter Street eastbound onto Winter Street westbound.

» Requires modifications to the Route 128/I-95 southbound off-ramp which includes providing a two-lane off-ramp (as proposed in Alternative V-10).

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

» Leverages previous concepts for roadway designs that have been reviewed by the City of Waltham.

» Slightly improves operations at the intersection of Winter Street eastbound at 2nd Avenue.

» The new signalized intersection permitting U-turns from Winter Street eastbound to Winter Street westbound would operate poorly (LOS F).

Recommendation

Out of a maximum score of 100, this alternative received a score of -8.79. This alternative is recommended to be **discarded** as the alternative is expected to degrade overall vehicle operations and does not notably progress the other study goals.

Conceptual Cost Range

$$$

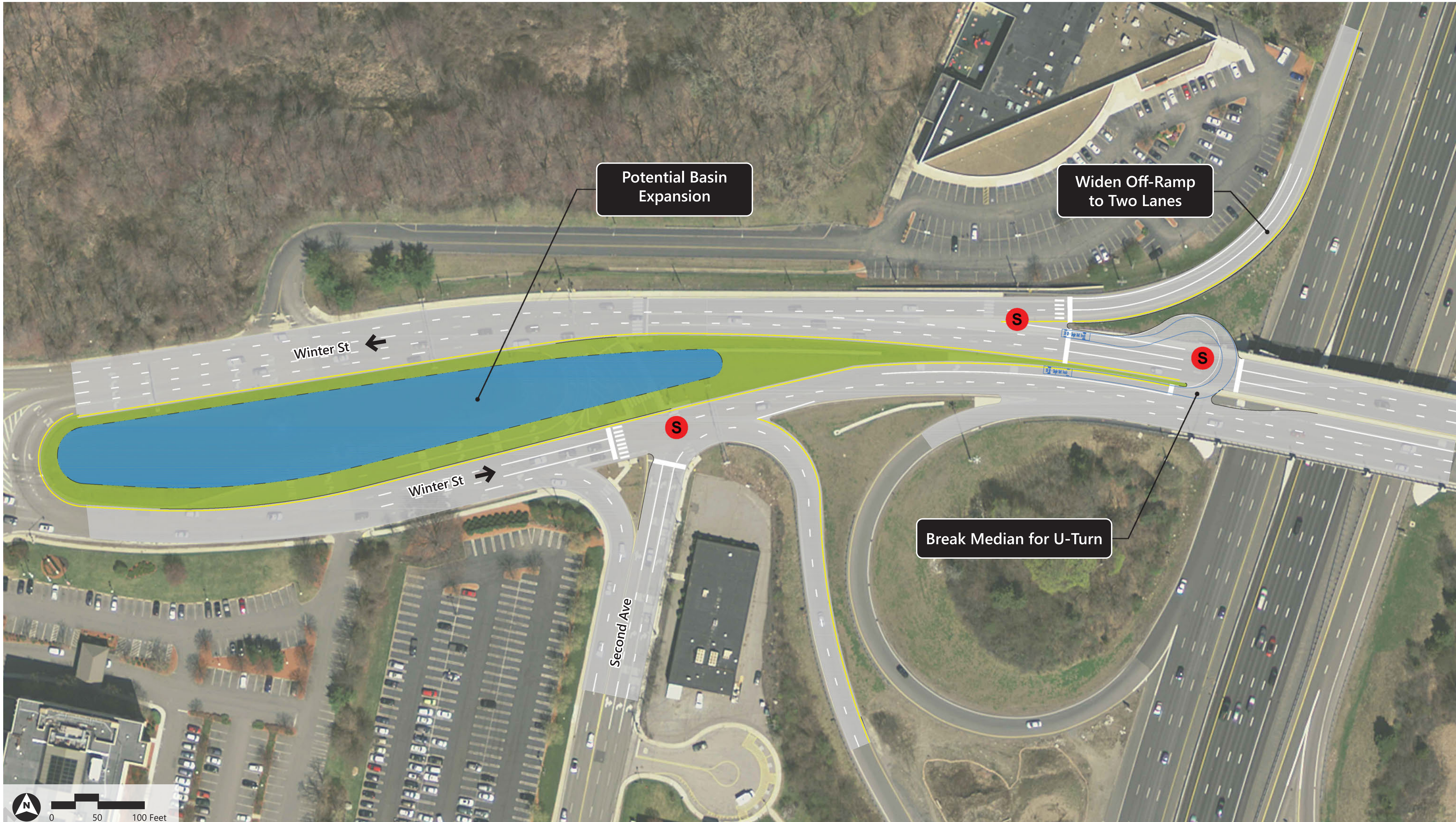
n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-11: Route 128/I-95 Southbound Interchange 43: Modify Winter Street Eastbound



Source: VHB, City of Waltham Transportation Master Plan, 2016

V-12: Route 128/I-95 Northbound Interchange 43 (Winter Street/ Third Avenue): Extend On-Ramp Acceleration Lane

Context

The existing acceleration lane for the Route 128/I-95 northbound on-ramp from Winter Street / Wyman Street is currently substandard in length and radius. Mainline capacity is effectively reduced as vehicles avoid the rightmost lane as to not conflict with on-ramp traffic.

Description

An illustration of Alternative V-12 is provided in the attached figure. As shown, the alternative would extend the acceleration lane from 600 feet to approximately 1,000 feet, meeting current design standards.

Benefits/Impacts

» The merge segment will operate with a slightly lower density.

» Additional length in the acceleration lane will provide increased distance for drivers to merge into the mainline.

Recommendation

Out of a maximum score of 100, this alternative received a score of 5.33. While this alternative did not score highly across all goals, it is recommended to be **advanced** as a short-term, low-cost option that will slightly improve operations with a relatively minor investment.

Conceptual Cost Range

$$$

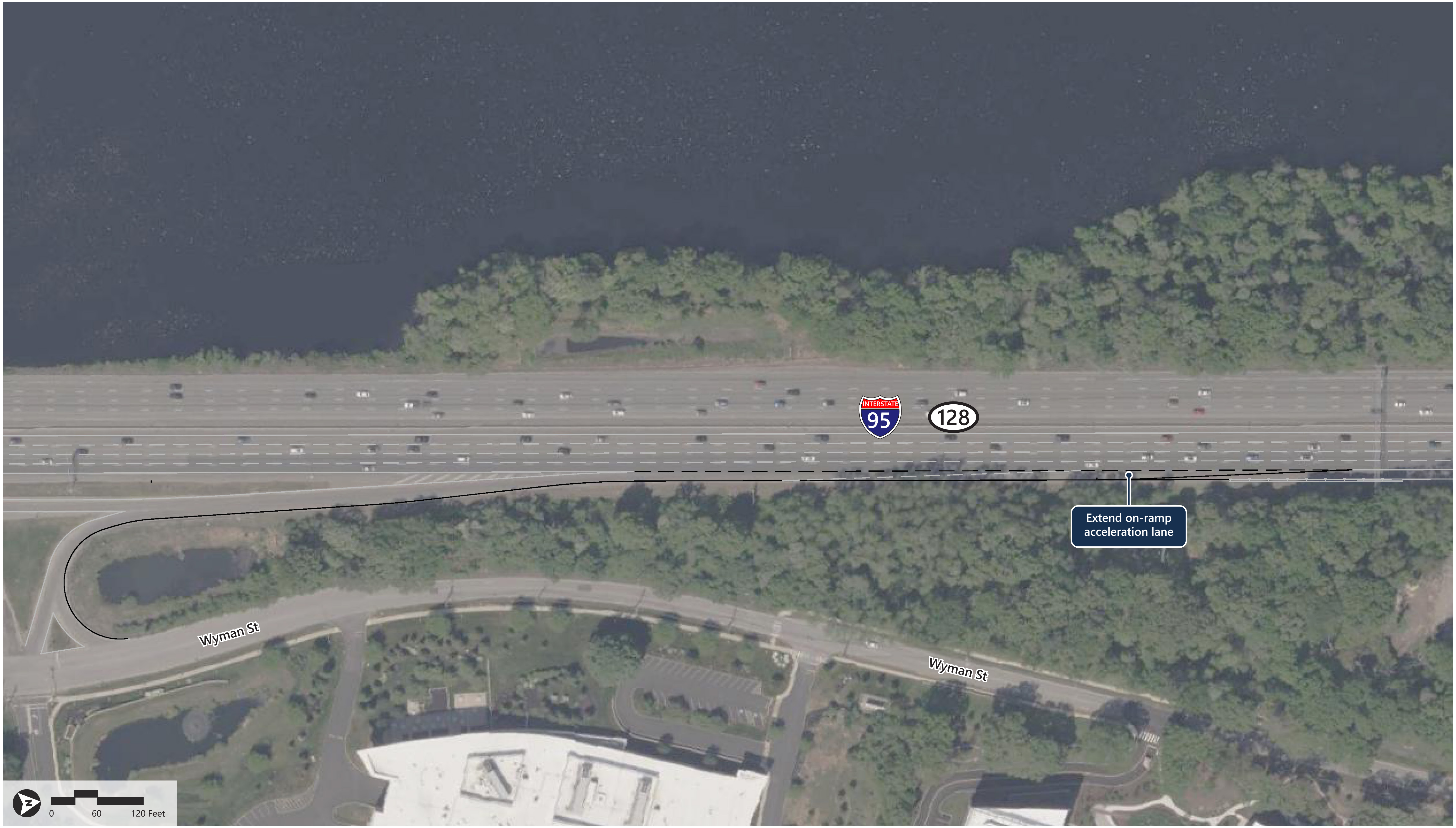
n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-12: Route 128/I-95 Northbound Interchange 43: Extend On-Ramp Acceleration Lane



Source: VHB

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

V-14: Route 20 at Summer Street: Signalize Intersection

Context

The Summer Street approach to Route 20 operates over capacity with queues of over 500 feet.

Description

A traffic signal at the intersection of Route 20 at Summer Street would improve traffic operations for vehicles on the Summer Street approach. To determine if a traffic signal is warranted, a traffic signal warrant analysis was conducted based on methodology outlined in the MUTCD using the existing and future intersection traffic volumes. Based on the analysis, a traffic signal is **not warranted** at this intersection based on existing and future volumes.

A roundabout was not considered at this location as it would have environmental impacts and require property takings beyond the existing right-of-way.

Benefits/Impacts

» If the intersection warranted a signal, installing a traffic signal would improve operations on the Summer Street approach.

» Could result in additional cut-through traffic on Summer Street as drivers avoid congestion on Route 128/I-95.

Recommendation

Out of a maximum score of 100, this alternative received a score of 10.69. This alternative is recommended to be **discarded** as the intersection does not meet a signal warrant. Traffic volumes should be monitored and re-evaluated in the future to determine if installation of a traffic signal is warranted at that time.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

V-15: Route 128/I-95 Northbound Interchange 39 (I-90/ Route 30): Extend Second Lane of C-D Road

Context

An upcoming MassDOT project will remove the existing on-ramp from Route 30 eastbound to the Route 128/I-95 Northbound C-D Road. The C-D Road currently has a lane drop prior to the merge that will be eliminated. With the on-ramp removed, there is an opportunity to extend the second lane on the C-D Road.

Description

Extend the two-lane section on Route 128/I-95 northbound C-D Road from I-90/Grove Street/ Route 30 to provide approximately 1,000 additional feet of merging distance for vehicles coming from the on-ramp from I-90. An illustration of this alternative is provided in the attached figure.

Incorporating this alternative into one of the multiple active design projects in this area could be considered. These projects include the Route 30 bridge rehabilitation over the Charles River (MassDOT Project 110980) and the I-90/I-95 bridge replacement and rehabilitation (MassDOT Project 606783).

Benefits/Impacts

» Provide additional space for vehicles to merge from two lanes to one lane on the Route 128/I-95 Northbound C-D Road.

» Leverage the closure of the on-ramp from Route 30 eastbound to improve traffic flow on the Route 128/I-95 Northbound C-D Road and the on-ramp from I-90 to reduce congestion on I-90 eastbound and westbound at the interchange.

Recommendation

Out of a maximum score of 100, this alternative received a score of 10.21. This alternative is recommended to be **advanced** as a short-term, low-cost option that will slightly improve operations with a relatively minor investment.

Conceptual Cost Range

**$**$$

n/a not applicable

**$**$$ Less than $1 million

**$$**$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-15: Route 128/I-95 Northbound Interchange 39: Extend Second Lane of C-D Road

Source: VHB

V-17: Route 128/I-95 SB Interchange 37/38 (Route 16/ Grove Street): Modify C-D Road and Service Plaza Access

Context

The on- and off-ramps to/from the Newton Service Plaza on Route 128/I-95 southbound are inadequate and do not meet current MassDOT standards for acceleration and deceleration lengths. In addition, this segment of Route 128/I-95 southbound has six on- or off-ramps in less than 2/3 of a mile, creating confusion for drivers and presenting many different conflict points.

Description

» Close the existing off-ramp and on-ramp to/from the Newton Service Plaza.

» Reconfigure circulation of the service plaza to provide full access from the west from Quinobequin Road via a new unsignalized driveway.

» Reconfigure the existing merge of the Interchange 37B off-ramp to Route 16 westbound at Quinobequin Road to a stop-controlled intersection with the off-ramp under stop control and Quinobequin Road under free-flow conditions to prevent a weave condition on Quinobequin Road between the off-ramp and the new service plaza driveway.

» Construct a shared use path along Quinobequin Road with a crosswalk across the roadway for pedestrians and bicyclists to access the service plaza.

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

» Provides pedestrian and bicycle access to the service plaza and connects proposed active transportation accommodations on Grove Street to the north with proposed accommodations on Quinobequin Road to the south of Route 16.

» Reduces the number of conflict points on the Route 128/I-95 southbound mainline.

» Diverge and merge movements for the existing ramps would slightly degrade.

» The Interchange 37B off-ramp under STOP-control would operate with significant delays with the queue likely backing up onto the mainline.

Recommendation

Out of a maximum score of 100, this alternative received a score of 12.73. While this alternative has some notable benefits, especially to active transportation connections, it does not fully address the complicated nature of this area. Based on coordination with MassDOT, it is recommended that a **focused planning and design effort be initiated** to address the unique and complex challenges of this location in detail with the goal of establishing a preferred design that safely accommodating all users. This alternative (as well as Alternatives V-18 and V-19) and the supporting analysis can be used as a starting point for this future effort.

Conceptual Cost Range

$$

n/a not applicable

$ Less than $1 million

$$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-17: Route 128/I-95 Southbound Interchange 37/38: Modify C-D Road and Service Plaza Access

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

V-18: Route 128/I-95 Southbound Interchange 37/38 (Route 16/ Grove Street): Close Off-Ramp to Route 16 Eastbound

Context

The on- and off-ramps to/from the Newton Service Plaza on Route 128/I-95 southbound are inadequate and do not meet current MassDOT standards for acceleration and deceleration lengths. In addition, this segment of Route 128/I-95 southbound has six on- or off-ramps in less than 2/3 of a mile, creating confusion for drivers and presenting many different conflict points.

Description

» Close the Interchange 37A off-ramp to Route 16 eastbound and divert traffic to the Interchange 37B off-ramp.

» To accommodate diverted traffic, expand the southbound approach of Quinobequin Road at Route 16 to provide a second left-turn lane and modify the traffic signal timing/phasing to facilitate additional left-turning movements from Quinobequin Road southbound to Route 16 eastbound. In addition, provide pedestrian accommodations that do not currently exist at this intersection.

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

» Eliminates the weaving conflict on the Route 128/I-95 southbound mainline between the Grove Street/Route 16 westbound on-ramp and the Interchange 37A off-ramp to Route 16 eastbound.

» Reduces driver confusion by eliminating an off-ramp and consolidating all Route 16 traffic to a single off-ramp.

» Improves pedestrian accommodations at the signalized intersection of Route 16 at Quinobequin Road.

» Improves operations on the Route 128/I-95 southbound mainline.

» Redistributes vehicle traffic through an HSIP high crash location (the intersection of Route 16 at Quinobequin Road) from right-turning movements to left-turning movements.

» The signalized intersection of Route 16 at Quinobequin Road would operate at LOS F during both the weekday morning and weekday evening peak hours due to additional left-turning traffic demand through the intersection.

Recommendation

Out of a maximum score of 100, this alternative received a score of 11.54. While this alternative has some notable benefits, it does not fully address the complicated nature of this area. Based on coordination with MassDOT, it is recommended that a **focused planning and design effort be initiated** to address the unique and complex challenges of this location in detail with the goal of establishing a preferred design that safely accommodating all users. This alternative (as well as Alternatives V-17 and V-19) and the supporting analysis can be used as a starting point for this future effort.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-18: Route 128/I-95 Southbound Interchange 37/38: Close Off-Ramp to Route 16 Eastbound

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

V-19: Route 128/I-95 Southbound Interchange 37B/38 (Route 16/ Grove Street): Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress

Context

The on- and off-ramps to/from the Newton Service Plaza on Route 128/I-95 southbound are inadequate and do not meet current MassDOT standards for acceleration and deceleration lengths. In addition, this segment of Route 128/I-95 southbound has six on- or off-ramps in less than 2/3 of a mile, creating confusion for drivers and presenting many different conflict points. This alternative focuses on reconfiguring just the egress from the Newton Service Plaza while Alternative V-17 examines on reconfiguring both the access and egress to/from the Newton Service Plaza.

Description

» Eliminate the on-ramp from the Newton Service Plaza onto Route 128/I-95 southbound and reconfigure the service plaza egress to merge onto the on-ramp from Route 16 westbound.

» Close access from Grove Street to the Route 128/I-95 southbound on-ramp, diverting traffic to the on-ramp from Quinobequin Road/Route 16 eastbound.

» Expand the southbound approach of Quinobequin Road at Route 16 to provide a second through lane and modify the traffic signal timing/phasing to accommodate the additional traffic. In addition, provide pedestrian accommodations that do not currently exist at this intersection.

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

» Eliminates a merge point and improves operations on the Route 128/I-95 southbound mainline by closing the on-ramp from the service plaza.

» Improves pedestrian accommodations at the intersection of Route 16 at Quinobequin Road.

» Adds vehicle traffic through an HSIP high crash location (the intersection of Route 16 at Quinobequin Road).

» The signalized intersection of Route 16 at Quinobequin Road would operate at LOS F during both the weekday morning and weekday evening peak hours due to additional traffic demand through the intersection.

Recommendation

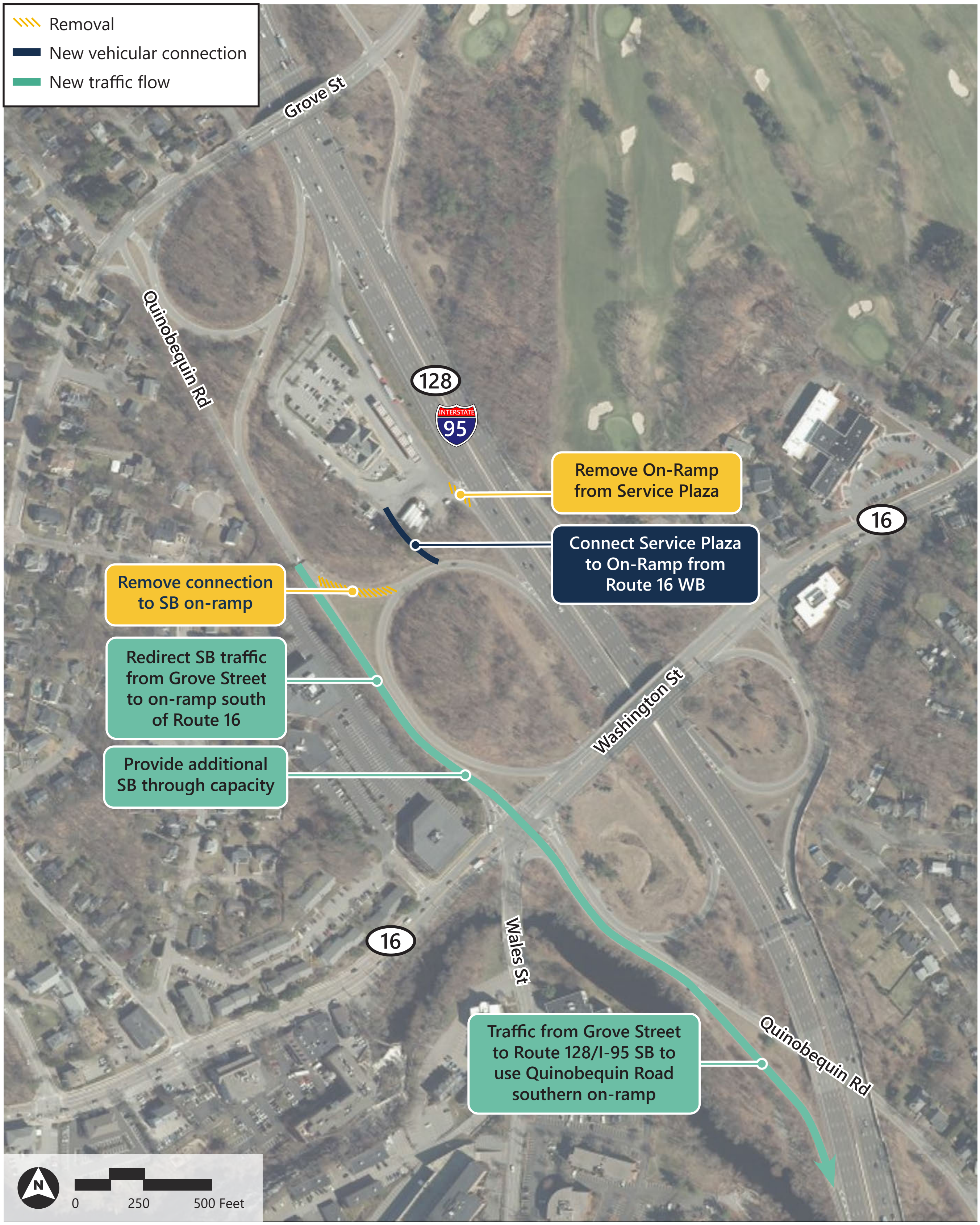
Out of a maximum score of 100, this alternative received a score of 13.60. While this alternative has some notable benefits, it does not fully address the complicated nature of this area. Based on coordination with MassDOT, it is recommended that a **focused planning and design effort be initiated** to address the unique and complex challenges of this location in detail with the goal of establishing a preferred design that safely accommodating all users. This alternative (as well as Alternatives V-17 and V-18) and the supporting analysis, can be used as a starting point for this future effort

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative V-19: Route 128/I-95 Southbound Interchange 37B/38: Close On-Ramp from Grove Street and Reconfigure Service Plaza Egress



Source: MassGIS

V-20: Route 128/I-95 Northbound Interchange 37 (Route 16): Close On-Ramp from Route 16 Westbound

Context

Under existing conditions, the Route 16 westbound on-ramp and the Interchange 38 off-ramp to Grove Street create a weave segment on the Route 128/I-95 northbound mainline with approximately 600 feet between the ramps. In addition, the Interchange 37 off-ramp to Route 16 intersects under stop control with the left-turning movement operating over capacity at LOS F.

Description

» Close the on-ramp from Route 16 westbound to Route 128/I-95 northbound eliminating the short weaving segment on the mainline.

» Construct a three-way signalized intersection for Route 16 at the Route 128/I-95 northbound ramps with left-turns allowed from Route 16 westbound onto the on-ramp.

» Install queue detection on the Route 128/I-95 northbound off-ramp to ensure that the queues from the new traffic signal do not impact mainline operations.

» Modify the acceleration lane for the existing on-ramp from Route 16 eastbound to extend into the deceleration lane for the Grove Street off-ramp, creating a new, longer weave that is more than twice as long as the existing weave.

An illustration of this alternative is provided in the attached figure.

Benefits/Impacts

» Eliminate a conflict point on the Route 128/I-95 mainline and create a weave segment that is more than twice as long as the existing weave.

» Improve operations for the Interchange 37 off-ramp to Route 16 with the new signalized intersection operating at a generally acceptable level of service.

» Provide a potential for improved pedestrian and bicycle accommodations including the installation of a new crosswalk at the new traffic signal.

» Potential to reconfigure Belmore Park as a fourth leg to the signalized intersection from the north.

Recommendation

Out of a maximum score of 100, this alternative received a score of 20.06. This alternative is recommended to be **advanced** as it will eliminate a conflict point on the Route 128/I-95 northbound mainline and result in reasonable operations at the new signalized location that provides the potential for enhanced pedestrian accommodations.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative V-20: Route 128/I-95 Northbound Interchange 37: Close On-Ramp from Route 16 Westbound

Route 128/I-95 LAND USE & TRANSPORTATION STUDY

Source: VHB

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

V-26: Convert a General-Purpose Lane on Route 128/I-95 to Managed Lane

Context

Overall, the Route 128/I-95 corridor through the study area experiences congestion throughout the day. MassDOT recently published the Managed Lanes Screening Study[9] that looked at the feasibility of converting a general-purpose lane into an express lane or HOV lane and determined that it would likely be feasible on the segment of Route 128/I-95 within the corridor.

Description

This alternative considers converting one general-purpose lane in each direction on Route 128/I-95 into a managed lane:

» Convert the leftmost lane along the corridor to an express lane with a buffer to separate the general-purpose lane from the managed lane. The buffer should be four feet wide (with two feet minimum) and include flex post separation, as outlined in the MassDOT Managed Lanes Screening Study.

» Based on a review of vehicle origin-destination patterns along the corridor, an express lane would be recommended between Route 16 and Route 2A, with a potential mixing zone south of Route 20 to provide access in the middle of the corridor. As noted in Chapter 2, *Existing Conditions*, approximately 25 to 30 percent of all travelers on Route 128/I-95 travel on the interstate through the entire study area, potential users of an express lane.

» Implementation may require widening of up to four bridges and replacement of up to four additional bridges, as outlined in the MassDOT Managed Lanes Screening Study (2020).

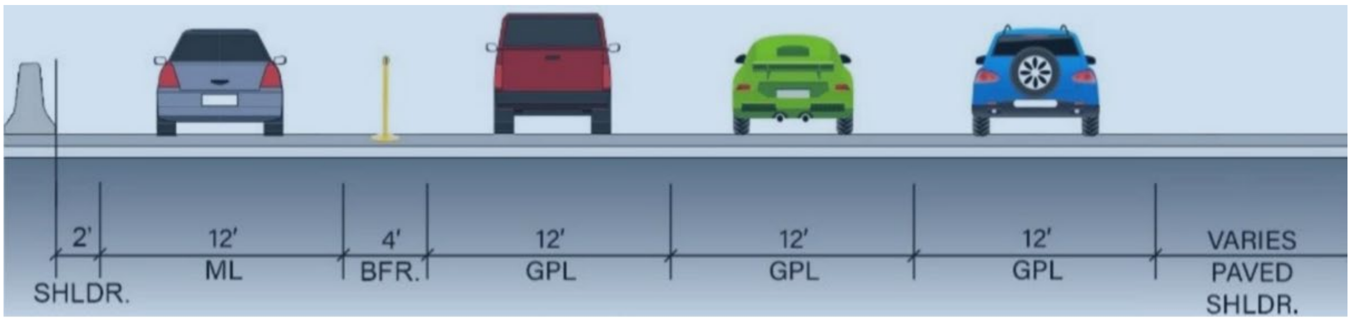
» Other managed lane types were considered, including:
  - High-Occupancy Vehicle (HOV) Lane – Based on a review of traffic volume composition along the Route 128/I-95 mainline, an HOV managed lane is not recommended as the existing and projected future share of HOVs on Route 128/I-95 within the study area is only between seven and ten percent[10]. Unless a significant mode shift to HOV is achieved, reducing the corridor to three General-Purpose Lanes would worsen congestion, mobility, and emissions.
  - High-Occupancy Toll (HOT) Lane – Based on current corridor congestion, required infrastructure costs, and transportation equity considerations, an HOT lane is not recommended.

9 Congestion in the Commonwealth: Managed Lanes Screening Study; MassDOT; 2020.

10 Existing 2016 and Future 2040 HOV percentages based on CTPS statewide travel demand model.

A cross-section of one direction of the interstate with three general-purpose lanes and a managed lane based on the MassDOT Managed Lanes Screening Study is provided in the figure below and a map illustrating the potential limits of the managed lanes is provided in the attached figure.

AlternativeV-26: Route 128/I-95 Potential Cross-Section Per Direction with Managed Lane



Source: Congestion in the Commonwealth: Managed Lanes Screening Study; MassDOT; 2020

Benefits/Impacts

- Provide minor travel time improvements for vehicles in the express lane.
- Provide improved operations for buses and emergency vehicles that travel in the express lane.
- Reduces friction within the express lane limits while increasing friction at the entry and exit points.

Recommendation

Conceptual Cost Range

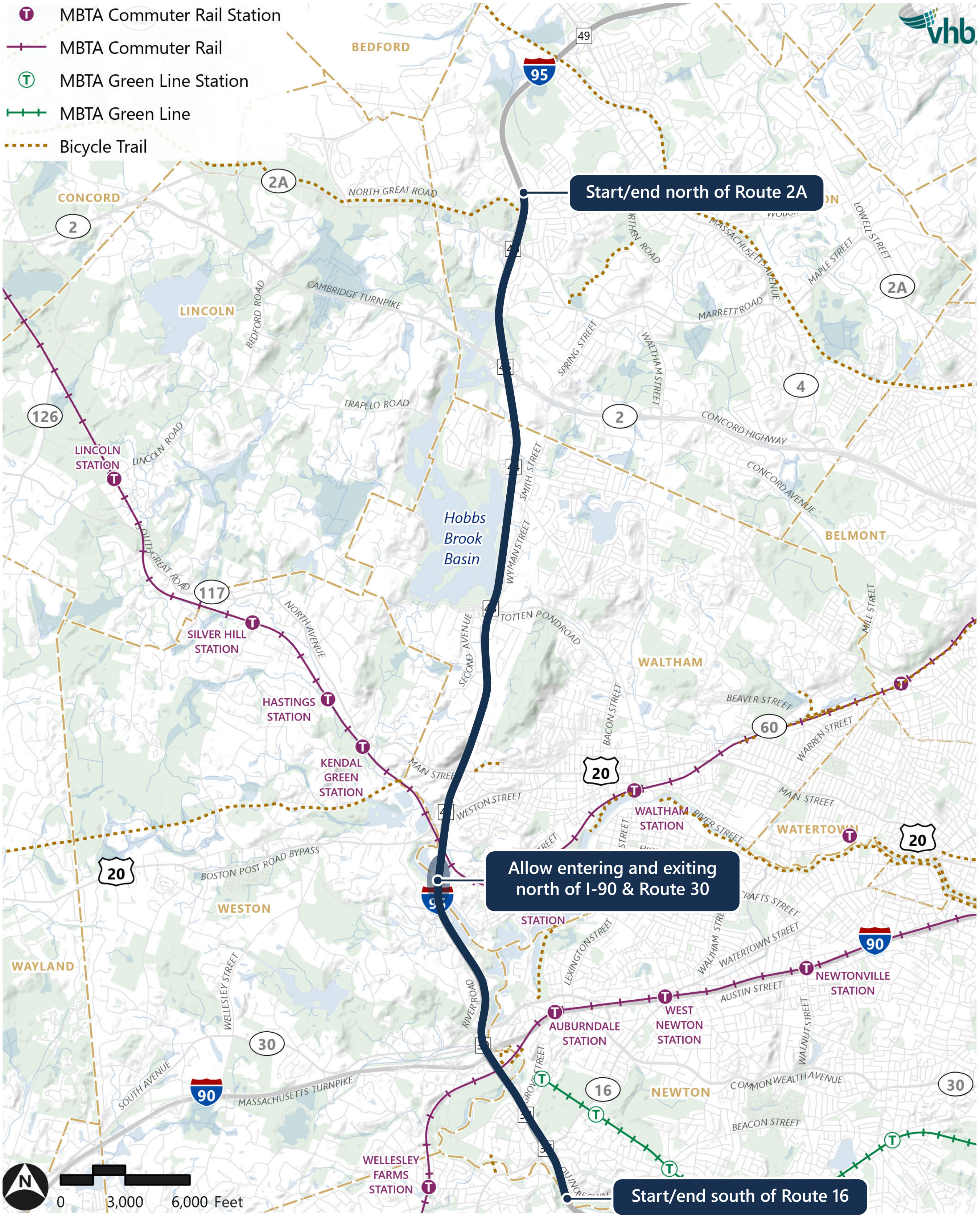
$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Out of a maximum score of 100, this alternative received a score of 14.79. This alternative is recommended to be **monitored** for future feasibility as MassDOT continues to evaluate its managed lane strategy on roadways across Massachusetts. At this time, it is likely that other alternatives can more efficiently be leveraged to achieve the study area goals with a lower implementation cost. Traffic volumes and operations should be monitored to determine if the conversion of a general-purpose lane to a managed lane would be beneficial in the future in coordination with broader MassDOT managed lane initiatives.

Alternative V-26: Conversion of General-Purpose Lane to Managed Lane

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

V-28: Consider Connected/ Autonomous Vehicle Technology

Context

According to the United States Department of Transportation[11],

> *Automated vehicles are those in which at least some aspect of a safety-critical control function (e.g., steering, throttle, or braking) occurs without direct driver input. Automated vehicles may be autonomous (i.e., use only vehicle sensors) or may be connected (i.e., use communications systems such as connected vehicle technology, in which cars and roadside infrastructure communicate wirelessly). Connectivity is an important input to realizing the full potential benefits and broad-scale implementation of automated vehicles.*

As vehicle and roadside infrastructure technology continues to advance, there will be opportunities to leverage these technologies to improve safety, enhance reliability, mitigate congestion, and reduce vehicle emissions.

Description

- Evaluate opportunities to enable future vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications along the Route 128/I-95 corridor.

Benefits/Impacts

- Prepares to leverage emerging technology to support transportation needs in the study area.
- Long-term projected benefits of adoption/implementation of these technologies include improved safety, enhanced reliability, congestion mitigation, and reduced vehicle emissions.
- Expected congestion relief associated with connected vehicles may have limited benefits on interstate systems.

[11] https://www.its.dot.gov/automated_vehicle/index.htm

Recommendation

Out of a maximum score of 100, this alternative received a score of 23.56. This alternative is recommended to be **monitored** as connected and autonomous vehicle technology progresses and MassDOT prioritizes potential implementation of applications throughout the roadway network.

Conceptual Cost Range

n/a [1]

1 – To be included as part of larger initiative.

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

V-29: Consider Transportation Systems Management and Operations Strategies

Context

According to the Federal Highway Administration (FHWA), Transportation Systems Management and Operations (TSMO) is an "integrated set of strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system."[12] Implementation of TSMO strategies can work to improve safety, enhance reliability, mitigate congestion, and reduce vehicle emissions.

The approach to TSMO program planning has evolved over the last decade through efforts of the FHWA, the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board (TRB). Numerous State DOTs and MPOs have developed both strategic and program plans for TSMO. The *Congestion in the Commonwealth Report*[13] included a roadmap as to how MassDOT does and can use TSMO concepts to mitigate the various causes of congestion in the Commonwealth. MassDOT is currently building from these previous efforts and leveraging lessons learned to advance its efforts around TSMO to tailor a program specific to minimize the congestion issues within the Commonwealth.

Description

- Consider deploying TSMO strategies on the Route 128/I-95 corridor, potentially as a pilot study, including incident detection monitoring and integrated multimodal traveler information.
- Leverage MassDOT's recent engagement of a consultant to develop a TSMO Strategic Plan and promote this corridor as a priority corridor.

Benefits/Impacts

- Prepares to leverage technology to support transportation needs in the study area.
- Long-term projected benefits of adoption/implementation of these technologies include improved safety, enhanced reliability, congestion mitigation, and reduced vehicle emissions.

[12] https://ops.fhwa.dot.gov/tsmo/#q1

[13] Congestion in the Commonwealth https://www.mass.gov/service-details/congestion-in-the-commonwealth

Recommendation

Out of a maximum score of 100, this alternative received a score of 26.95. This alternative is recommended to be **advanced** with consideration given to a pilot study of potential TSMO strategies along the Route 128/I-95 corridor by MassDOT, with a focus on incident detection monitoring and integrated multimodal traveler information.

Conceptual Cost Range

n/a [1]

1 – To be included as part of larger initiative.

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

V-31: Build upon Outcomes of Shared Travel Network Study

Context

MassDOT recently released a Shared Travel Network Study[14] which assesses the potential for new or enhanced services to connect origins and destinations in Greater Boston via physical and operational improvements on roadways. A component of the study involved considering how trips can be routed through a park-and-ride facility along the Route 128/I-95 or I-495 belts to a destination hub outside of the urban core (i.e., along or between those beltways). The study also considered trips that can be routed through park-and-ride facilities inside of the suburban core. The study discusses components of shared travel networks and identifies opportunities to expand and formalize shared travel network opportunities.

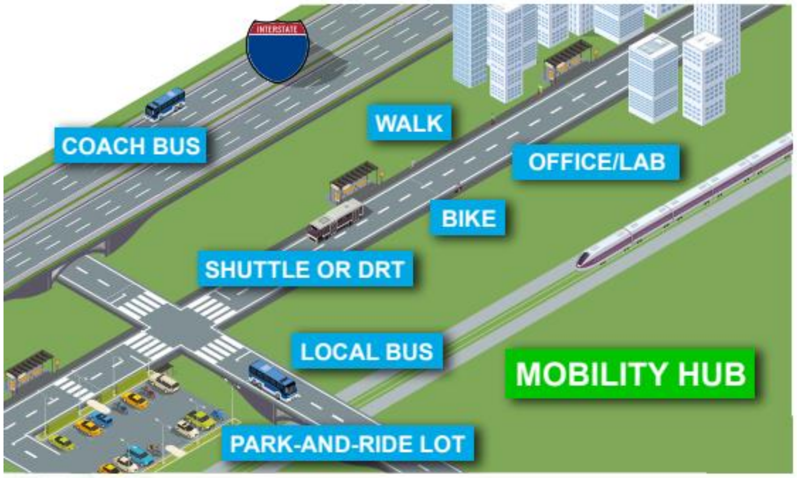
There are no existing MassDOT park-and-ride lots within the Route 128/I-95 study area. The Shared Travel Network Study does not present specific recommendations to improve the shared travel network along this corridor but does include components of an ideal shared travel network that could be considered.

Description

Consider components of an ideal shared travel network (as shown in the figure below), particularly where future Transit-Oriented Development (TOD) and/or mobility enhancements are being considered along the Fitchburg Line (Alternatives LU-10 and T-5) and Worcester Line (Alternatives LU-10 and LU-12). Potential components include additional park and ride facilities and a regional microtransit network. Elements of a shared travel network could potentially be utilized to support upcoming construction projects that will impact traffic operations in the region.

[14] Shared Travel Network Study; MassDOT; May 2022.

Ideal Shared Travel Network



Source: Shared Travel Network Study

Benefits/Impacts

» Increase opportunities to shift from single-occupant vehicles (SOV) to more sustainable modes.

Recommendation

Out of a maximum score of 100, this alternative received a score of 21.05. This alternative is recommended to be **discarded as a standalone option**. Components of an ideal shared travel network can be incorporated where future TOD and/or mobility enhancements are being considered along the Fitchburg Line (Alternatives LU-10 and T-5) and Worcester Line (Alternatives LU-10 and LU-12). They could also support upcoming construction projects that will impact traffic operations in the region.

Conceptual Cost Range

n/a [1]

1 – To be incorporated into other alternatives

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Transportation: Transit Alternative Cut-Sheets

The following transit alternatives were advanced beyond the initial screening in Chapter 4, *Alternatives Development*, and have been further analyzed and evaluated as outlined in Chapter 5, *Alternatives Analysis*:

- Alternative T-1: Provide Additional Transit Service in Northern Portion of Study Area
- Alternative T-4: Extend Shuttle Network in West Waltham
- Alternative T-5: Create Fitchburg Line Multimodal Hub
- Alternative T-6: Consider Transit Connection between West Waltham and Worcester Line/Green Line
- Alternative T-8: Consider Increased East-West Bus Service
- Alternative T-9: Implement Managed Lane: Bus on Shoulder
- Alternative T-10: Install Transit Signal Priority
- Alternative T-11: Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks
- Alternative T-12: Expand Shuttle Access for All Passengers

T-1: Provide Additional Transit Service in Northern Portion of Study Area

Context

Existing service in the northern portion of the study area focuses mainly on connecting to Alewife Station and the Fitchburg Line. There are limited opportunities to travel via transit to other destinations within and beyond the study area, including job clusters in Waltham.

Description

This alternative evaluates the feasibility of providing additional transit service in Waltham and Lexington. Specifically, one new transit route was evaluated:

» Travelling between Depot Square in Lexington Center and Downtown Waltham via Waltham Street and Lexington Street.

» With additional funding resources, this service could be operated by Lexpress, the local bus service for the Town of Lexington, or potentially a new provider.

» Would provide direction service between destinations in Lexington and Waltham and would provide a single transfer to the following additional routes and destinations:
  - All other Lexpress services at Depot Square in Lexington Center providing service to most of the Town of Lexington.
  - MBTA Bus Routes 54, 56, 61, and 70 providing service to West Waltham, Belmont, Newton, Watertown, and Allston.
  - Route 128 Business Council shuttles providing service to West Waltham and Alewife.

A map of this new transit route is provided in the attached figure.

Benefits/Impacts

» Creates a new transit connection between Lexington and Waltham enhancing connectivity between the two communities.

» Increases access to job centers in Waltham via non-vehicle modes of travel.

» May encourage commuters to shift modes.

» Improves transit connectivity to existing and future bus routes.

To determine the ridership potential of a new transit service in the northern portion of the study area, a capture shed analysis was conducted. The analysis indicates that this new service could achieve a ridership between 15 and 40 passengers during the peak hour. Details on the capture shed analysis is included in Appendix E.

Recommendation

Out of a maximum score of 100, this alternative received a score of 31.39. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses and contributing to environmental and health benefits.

Conceptual Cost Range

$$$

n/a not applicable

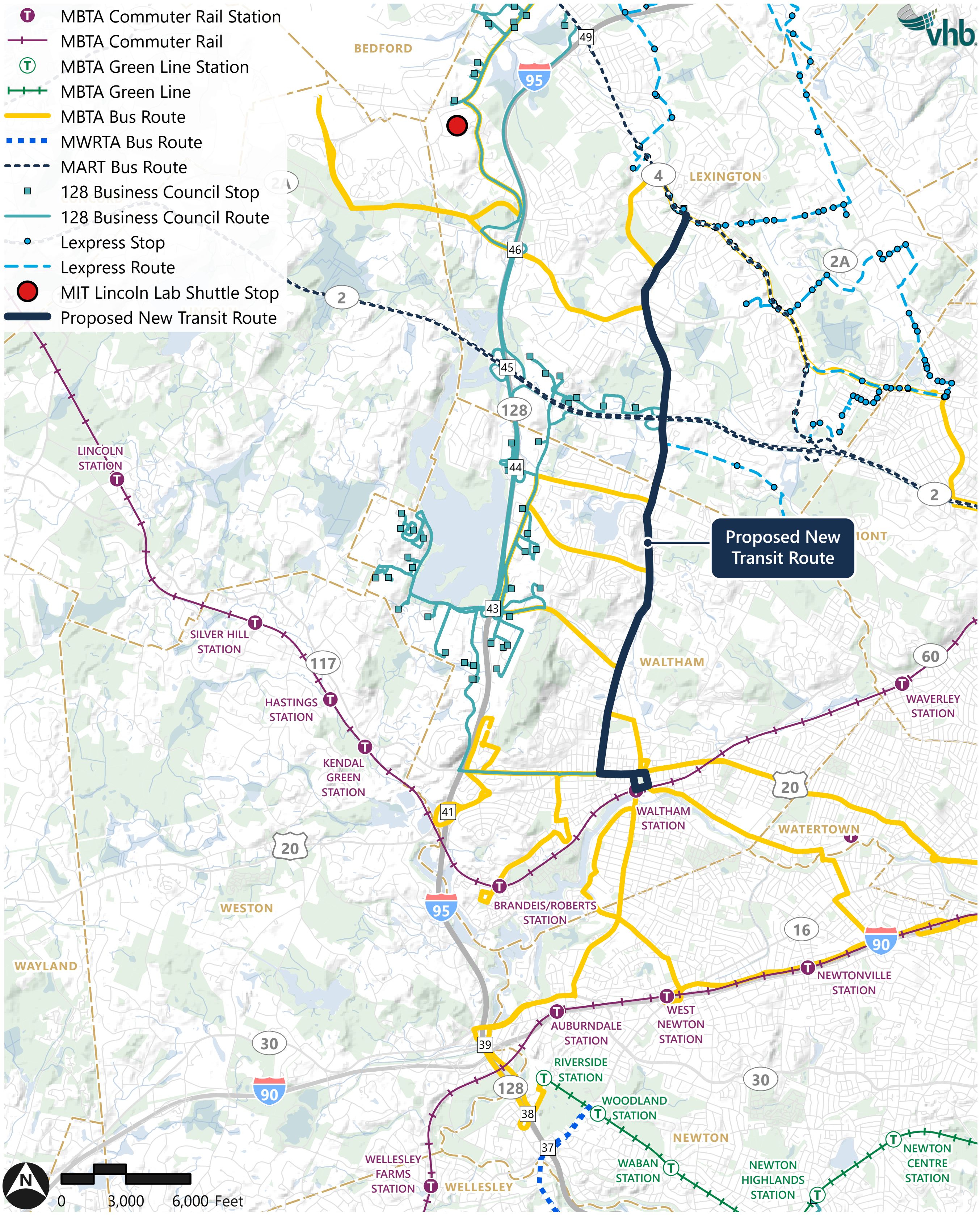
$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative T-1: Provide Additional Transit Service in Northern Portion of Study Area

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

T-4: Extend Shuttle Network in West Waltham

Context

Existing transit in the study area mostly serves the east side of Route 128/I-95. Currently, there is just one route operating along Winter Street west of Route 128/I-95. The revised draft of the MBTA's Bus Network Redesign includes a revision to Route 61 that would travel west of Route 128/I-95 via Bear Hill Road to connect the North Waltham residential areas and commercial along the corridor.

Description

This alternative recommends adding supplemental shuttle service west of Route 128/I-95 to capture existing and planned development:

- A potential route has been identified that would travel along Bear Hill Road between Main Street and Winter Street.
- This route would connect several existing and proposed commercial and residential developments in West Waltham.
- Would also provide a connection to a potential multimodal hub on the Fitchburg Line (see Alternative T-5).
- Likely would be operated by a non-MBTA operator, such as the 128 Business Council.

A map of the potential routing of an extended shuttle network is provided in the attached figure.

Benefits/Impacts

- Would achieve maximum effectiveness if completed in coordination with Alternative T-5: Create Fitchburg Line Multimodal Hub
- Could see increased ridership connectivity if completed with other alternatives that provide cross connections to other routes/services
- Provides service to developments that are currently underserved by transit accommodations
- Increases access to job centers in Waltham via non-private vehicle modes of travel
- May encourage commuters to shift modes

Recommendation

Out of a maximum score of 100, this alternative received a score of 22.45. While this alternative is recommended to be **advanced**, it will achieve the greatest benefits when paired with Alternative T-5: Create Fitchburg Multimodal Hub. If implemented together, the multimodal hub and expanded shuttle network in West Waltham will greatly support the study goals of supporting mobility for all uses, advancing equity, and contributing to environmental and health benefits.

Conceptual Cost Range

$$$

n/a not applicable

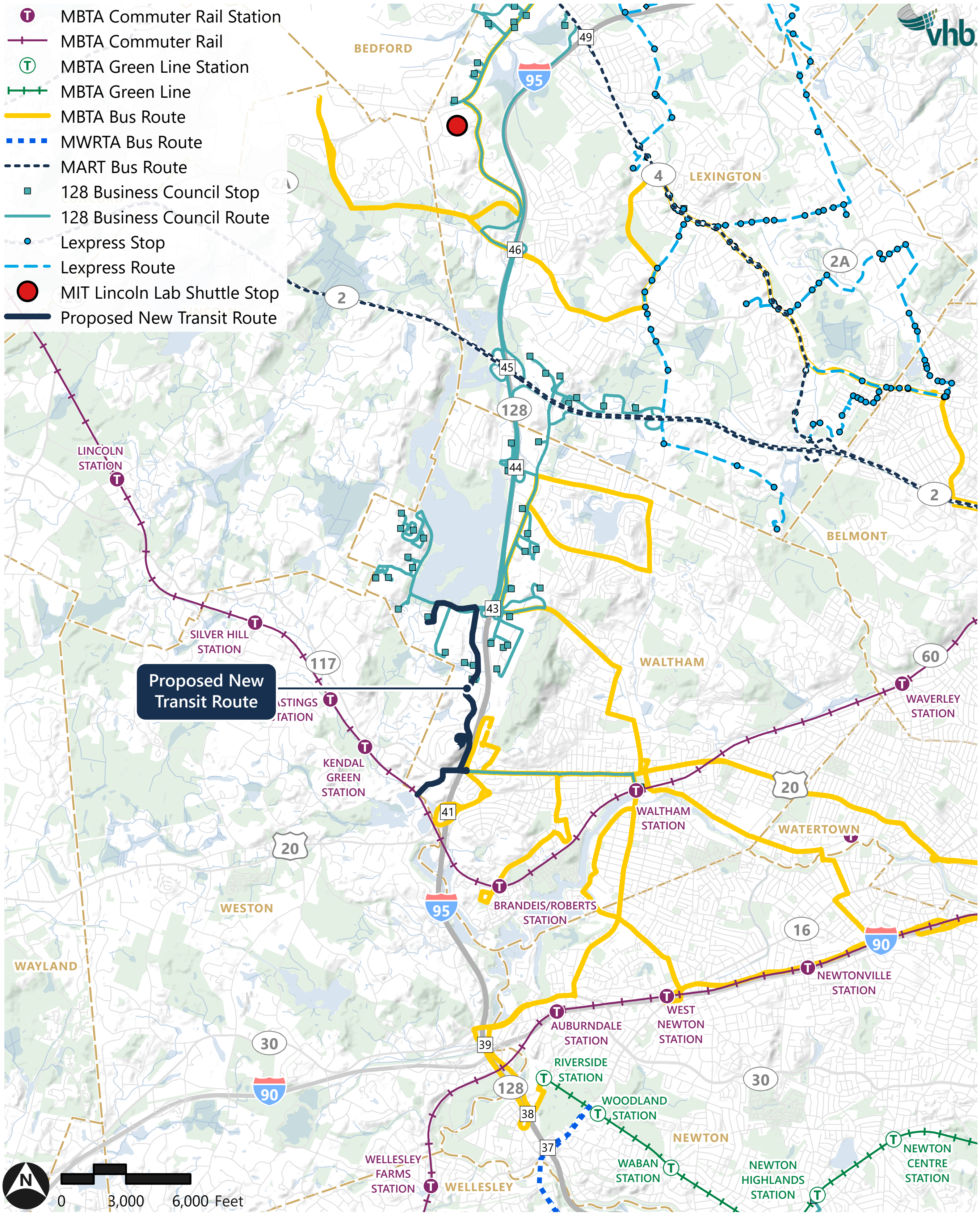
$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative T-4: Extend Shuttle Network in West Waltham

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

T-5: Create Fitchburg Line Multimodal Hub

Context

While the Fitchburg Line travels near the many commercial developments in West Waltham, the current stations lack robust multimodal connections, limiting the potential to accommodate transit trips to commercial development in the area. The concept of a new multimodal hub has been considered previously, including in the 2011 MAPC Route 128/I-95 Central Corridor Plan and the 2020 MBTA Rail Vision study.

Description

» A multimodal hub would replace the existing Kendal Green Station and be relocated to the east in the vicinity of Jones Road/Green Street with a new connection to Route 20 and Route 128/I-95.

» The shift in station location would allow for additional space to incorporate multimodal connections.

» Would likely include parking and first-mile/last-mile connection to nearby land uses in Waltham and Weston.

» If located at a new station near Jones Road/Green Street, would include a direct connection to the planned continuation of the Mass Central Rail Trail (MCRT).

» Could be incorporated with new transit-oriented development (see Alternative LU-10).

A map of the potential multimodal hub location near Jones Road/Green Street is provided in the attached figure.

Benefits/Impacts

» Provides a more direct and robust transit connection to job centers in Waltham from communities to the east and west along the Fitchburg Line (such as Fitchburg, Leominster, Ayer, Littleton, Concord, and other communities along the Route 2 corridor).

» Provides an option into downtown Boston for residents of the study area municipalities.

» May encourages commuters to shift modes.

» Improves the transit network by providing new connections to existing transit services.

» Provides an opportunity for transit-oriented development.

» Enhances multimodal connections through the study area with direct access to the MCRT.

» Improves transit service between the study area and Boston, which accounts for over eight percent of all daily study area trips (as presented in Chapter 2, *Existing Conditions*).

As noted, the multimodal hub would replace the existing Kendal Green Station and therefore riders at that station are anticipated to use the new station. It is also expected that some riders that currently utilize the Brandeis/Roberts and Waltham stations may shift to the new multimodal station location. In addition, new riders would be generated by the multimodal station and its connections, and a capture shed analysis was conducted to quantify those. The analysis indicates that a station on the Fitchburg Line with multimodal connections could achieve a ridership between 15 and 40 new passengers during the peak hour. Details on the capture shed analysis is included in Appendix E.

Recommendation

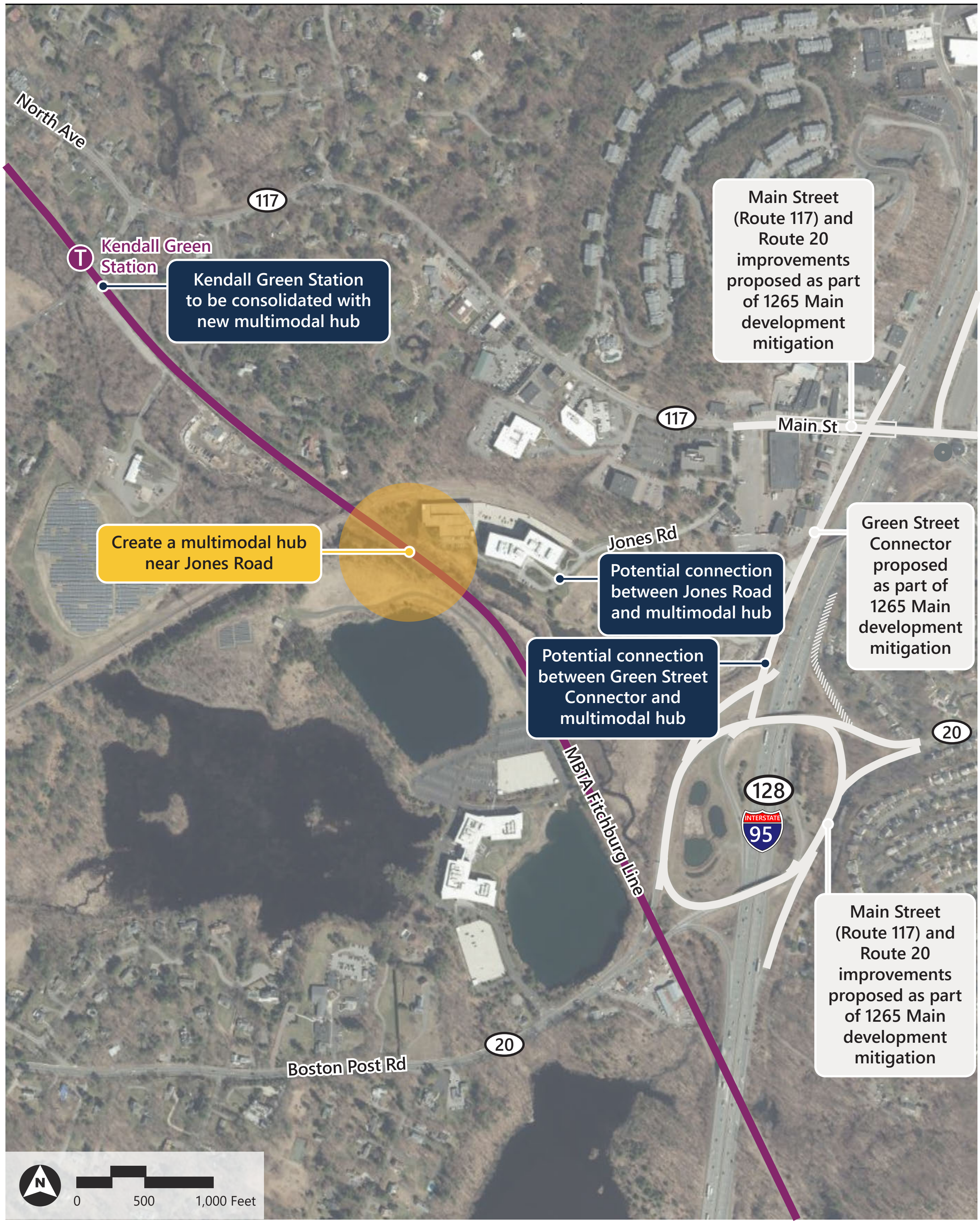
Out of a maximum score of 100, this alternative received a score of 54.67, the highest of all alternatives. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses, contributing to environmental and health benefits, supporting land use strategies, and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative T-5: Create Fitchburg Line Multimodal Hub



Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

T-6: Consider Transit Connection between West Waltham and Worcester Line/Green Line

Context

There is currently no transit connection between the commercial developments in West Waltham and nearby stations on the Worcester Line and Green Line. Existing private shuttles focus on connections to other transit hubs such as Alewife and Waltham Center. The revised draft of the MBTA's Bus Network Redesign includes Route 53 that would connect the 1265 Main development in West Waltham to Brandeis/Roberts station on the Fitchburg Line and Woodland Station of the Green Line and Routes 56 and 58 that would connect the 1265 Main development in West Waltham to Waltham Center on the Fitchburg Line and West Newton and Newtonville stations on the Worcester Line.

Description

This alternative recommends adding supplemental transit service between transit stations in Newton and commercial hubs in West Waltham:

- A potential route would connect the Green Line Riverside station, Worcester Line Auburndale station, and Winter Street in West Waltham via Route 128/I-95.
- This route would connect several existing and proposed commercial and residential developments in West Waltham with existing transit services in Newton.
- This route could be operated by the MBTA or by a shuttle operator, such as the 128 Business Council.
- This route could potentially incorporate bus-on-shoulder operations on Route 128/I-95, as outlined in Alternative T-9.

A map of the potential routing of a transit connection between West Waltham and the Worcester Line and Green Line is provided in the attached figure. While this route is like that proposed in the MBTA's Bus Network Redesign, this proposal extends further north to capture development west of Route 128/I-95.

Benefits/Impacts

- Creates a new transit connection between Newton and Waltham enhancing connectivity between the two communities.
- Increases access to job centers in Waltham via transit by connecting to the Green Line and Worcester Line.
- May encourage commuters to shift modes.
- Improves the transit network by providing new connections to existing transit services.

To determine the ridership potential of a new transit connection between West Waltham and the Worcester Line and Green Line, a capture shed analysis was conducted. The analysis indicates that this new service could achieve a ridership between 15 and 45 passengers during the peak hour. Details on the capture shed analysis is included in Appendix E.

Recommendation

Out of a maximum score of 100, this alternative received a score of 27.58. This alternative is recommended to be **monitored** for increased market demand. If the demand for this connection grows, it may help to achieve the study goals of supporting mobility for all uses and supporting land use strategies.

Conceptual Cost Range

$$$

n/a not applicable

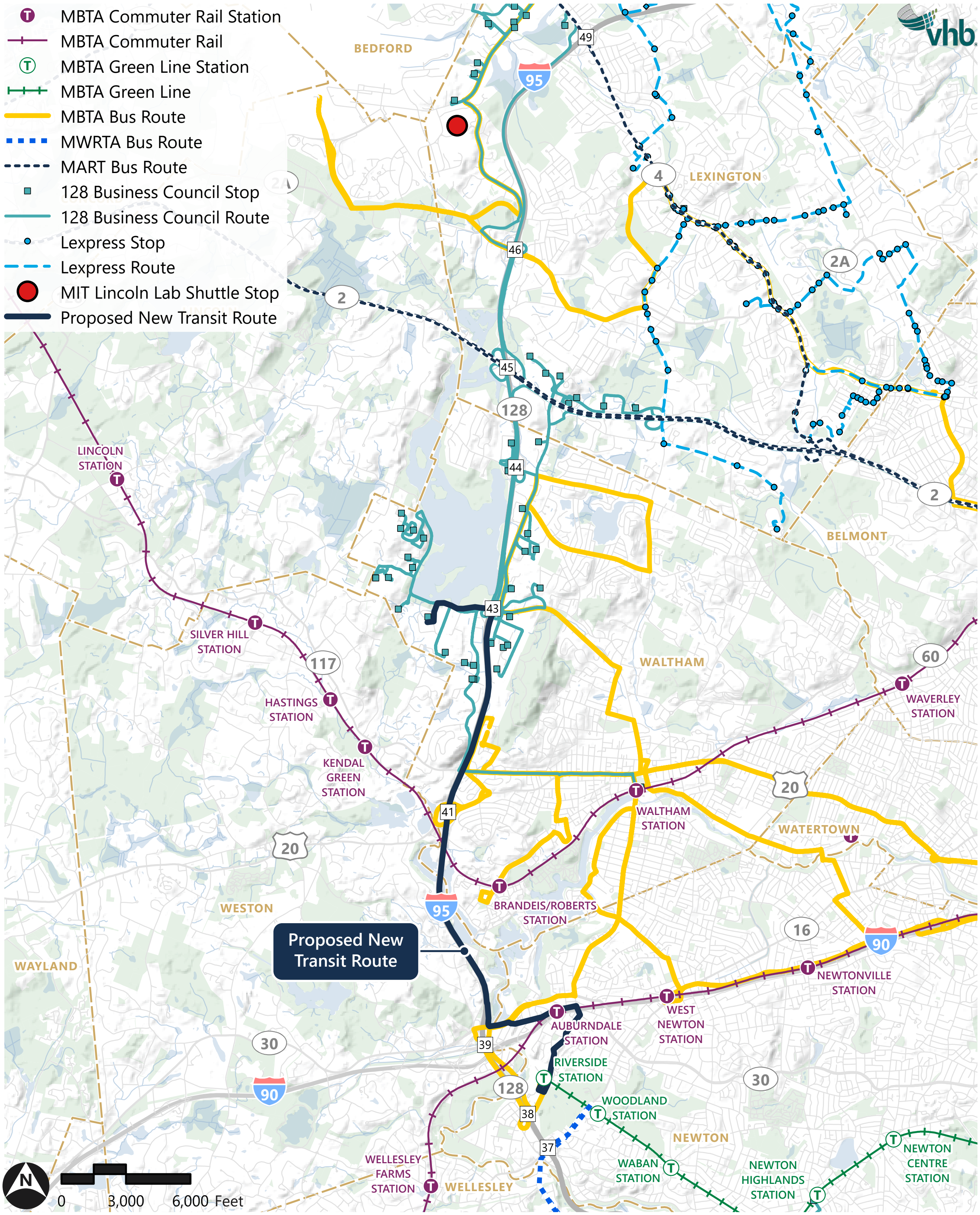
$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative T-6: Consider Transit Connection between West Waltham and Worcester Line/Green Line

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

T-8: Consider Increased East-West Bus Service

Context

Existing east-west service in the study area is currently provided on MBTA buses and Route 128 Business Council shuttles that have limited frequency and focus mostly on the peak commuting periods. The Route 128 Business Council shuttles serve many of the major employers in West Waltham, connecting to other transit services in Waltham and Alewife station. With modifications, these shuttles could extend to future proposed employment sites.

Description

» Provide additional east-west bus service operated by a private shuttle service or local transit agency in study area municipalities to improve access to planned/proposed employment centers along Route 128/I-95.

» Additional east-west connections could be provided by modifying existing Route 128 Business Council shuttles connecting to Alewife (A North, A South, B, C, D) to provide more convenient transfers to the Lexpress Route A2 and MBTA Route 61 (See Alternative T-1).

Benefits/Impacts

» Improves transit frequency by providing additional service.

» Could make transit use more attractive by providing more route options and times.

» Provides more affordable alternatives to driving and connect Environmental Justice (EJ) communities along the corridor.

» Fare integration would need to be explored for transfers among services.

» Transfers to 128 Business Council shuttles would fundamentally change the current operations. A revenue reverse-direction trip would add 15-25% to the total round-trip cycle time according to 128 Business Council estimates. This would result in higher operating costs due to longer shifts and may require additional vehicles.

» Expanded service hours require additional funding for operations. In some cases, heavier-duty vehicles designed for up to 18 hours of daily service may need to replace existing vehicle fleet. Existing services that are either funded locally or through membership models would need outside resources if their operations were to change.

Recommendation

Out of a maximum score of 100, this alternative received a score of 29.33. This alternative is recommended to be **discarded** as it would require substantial structural changes to existing services.

Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

T-9: Implement Managed Lane: Bus on Shoulder

Context

With the current lane configuration on Route 128/I-95, any buses travel in the general-purpose lanes and experience the congestion. MassDOT completed Phase II of the Bus on Shoulder (BOS) Screening Study in November 2022. The study evaluated locations to expand a cost-effective BOS program to improve bus reliability and decrease travel times and determined that BOS would likely be feasible on the segment of Route 128/I-95 within the study area. It should be noted that there are no bus routes under the proposed MBTA Bus Network Redesign network or the existing Route 128 Business Council shuttle network that utilize Route 128/I-95 within the study area.

Description

» Repurpose existing Route 128/I-95 shoulder as bus lane within the study area.

» Lane designation change could be for entire study area or for targeted locations in connection with proposed bus service (i.e. between one or two interchanges that serve shuttles/MBTA routes).

» An option could be to allow buses to travel on the shoulder only when the speed of vehicles on the roadway is less than 35 miles per hour, like MassDOT's I-93 bus on shoulder pilot that started in 2021.

Benefits/Impacts

» Could serve as a pilot corridor to implement the findings of the Phase II BOS Screening Study.

» Would improve travel times for buses if the MBTA and/or Route 128 Business Council was to introduce a new route that traveled on Route 128/I-95.

» Would introduce friction between buses and general traffic at ramps and start/end points of bus on shoulder lane designation.

Recommendation

Out of a maximum score of 100, this alternative received a score of 18.53. This alternative is recommended to be **monitored** for potential implementation at a future date if/when there is sufficient bus service on the corridor to benefit from a bus on shoulder lane designation. As currently proposed, there are no future MBTA bus routes or existing Route 128 Business Council shuttle routes that travel on Route 128/I-95. If a new route is to be proposed along the Route 128/I-95 corridor, the use of the shoulder for bus travel should be evaluated.

Conceptual Cost Range

$$

n/a not applicable
$ Less than $1 million
$$ $1 to $5 million
$$$ Greater than $5 million

T-10: Install Transit Signal Priority

Context

Transit Signal Priority (TSP) is a tool that can extend green time or shorten the red time when buses approach signalized intersections to improve transit reliability and travel time. TSP can either run conditionally for buses that are behind schedule or for all arriving transit. TSP is not currently installed or planned at any of the signalized study area intersections that buses travel through today.

Description

Consider installing TSP at all signalized intersections within the study area that buses are expected to travel through in the future (shown in the attached figure), including:

- Route 30 at Route 128/I-95 Southbound Ramps/ River Road (Weston)
- Route 30 at Route 128/I-95 Northbound Ramps (Weston)
- Route 117 at Bear Hill Road/ Green Street (Waltham)
- Route 117 at Tower Road (Waltham)
- Route 117 at Border Road (Waltham)
- Winter Street at First Avenue (Waltham)
- Winter Street at Second Avenue (Waltham)
- Winter Street at Wyman Street (Waltham)
- Wyman Street at Route 128/I-95 Northbound Ramps (Waltham)
- Trapelo Road at Smith Street (Waltham)
- Route 2A at Forbes Road (Lexington)
- Route 2A at Massachusetts Avenue (Lexington)

Once the MBTA’s Bus Network Redesign is finalized, a review of existing and future bus stop locations in relation to signalized intersections and proximity to other bus stops should be reviewed. Since the benefit of TSP is affected primarily by bus stop location and route frequency, the analysis should consider potential adjustments to maximize system effectiveness.

Benefits/Impacts

- Improves transit reliability and travel time.
- Minimal impacts to non-transit traffic operations are anticipated.

Recommendation

Out of a maximum score of 100, this alternative received a score of 16.51. This alternative is recommended to be **monitored** in coordination with MBTA's ongoing Bus Network Redesign to determine final bus routing, headways and stop locations. Intersection delays should also be monitored to prioritize potential TSP locations.

Conceptual Cost Range

$$$

n/a not applicable

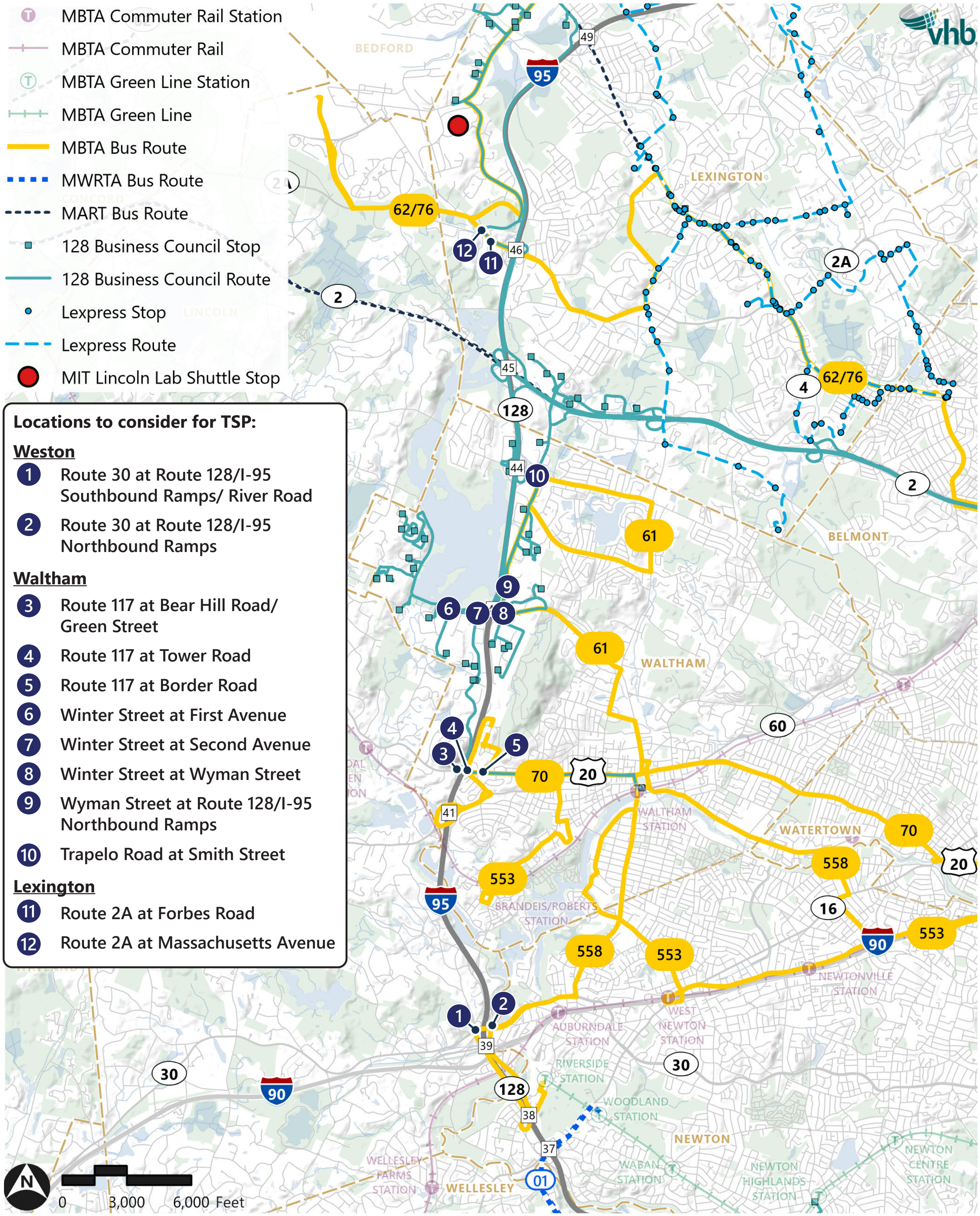
$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative T-10: Install Transit Signal Priority

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

T-11: Expand Transit Service Span/Increase Frequency for Passengers Outside Commuter Peaks

Context

Transit service within the study area is focused on the weekday morning and evening peak period commuting times. Service during the midday, in the late evenings, and on weekends is more limited, restricting the ability for people to use transit for non-traditional commuting patterns.

It should be noted that all day bi-directional service on the Fitchburg and Worcester Lines with at least hourly service was implemented in 2021 as an initial phase of the MBTA's Rail Transformation project. Higher frequency urban rail service is planned for Kendal Green and Brandeis stations in the next three years once a new turn track is built (which is partially funded in the current Capital Investment Plan).

Description

» Increase the frequency of existing transit services in the study area (such as those operated by the MBTA, Lexpress, and the Route 128 Business Council) outside traditional weekday morning and weekday evening peak periods.

» Extend the hours of operations on existing transit services on the weekends and in the late evening on weekdays.

» Consider potential funding opportunities to support 128 Business Council in offering expanded service hours.

Benefits/Impacts

» Improves transit frequency for existing transit routes.

» Offers alternatives to driving for individuals who commute outside of the AM and PM peak commute hours

» Advances social equity by providing additional transit service outside of typical commuter windows.

» Increased ridership may result from increased frequency; however, the increased operating costs may not be commensurate with ridership increases.

Recommendation

Out of a maximum score of 100, this alternative received a score of 30.01. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting strategic land use and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

T-12: Expand Shuttle Access for All Passengers

Context

Most Route 128 Business Council shuttles allow non-member riders. However, non-members must pay a higher fare, generally double the member fare. As transportation modes centered around employers and residential buildings, the shuttles only make stops at the transit station (e.g., Waltham, Alewife) or the employer/residential destination; shuttles do not make intermediate stops for transfers to other services or at major corridors.

Description

Establish partnerships between transit operators, business communities, and municipalities to allow all residents access to all shuttles. Increase marketing to non-members to inform the public of this transit option.

Benefits/Impacts

» Advances social equity by providing additional transit opportunities for all members of the community.

» More efficiently leverages existing private shuttle services that travel through the study area for access to land uses and other transit services.

» Increased awareness of affordable transit options.

Recommendation

Out of a maximum score of 100, this alternative received a score of 29.57. This alternative is recommended to be **advanced** as it will help to achieve the study goal of advancing social equity and does not require any infrastructure changes.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Transportation: Active Transportation Alternative Cut-Sheets

The following active transportation alternatives were advanced beyond the initial screening in Chapter 4, *Alternatives Development*, and have been further analyzed and evaluated as outlined in Chapter 5, *Alternatives Analysis*:

» Alternative AT-1: Improve North-South Bicycle Connections along Route 128/I-95

» Alternative AT-2: Improve East-West Bicycle Connections across Route 128/I-95

» Alternative AT-3: Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95

» Alternative AT-4: Improve East-West Bicycle Connections within Waltham

» Alternative AT-5: Construct Lower Falls Shared Use Path

» Alternative AT-10: Expand Public Bike Share Program

AT-1: Improve North-South Bicycle Connections along Route 128/I-95

Context

The study area has few bicycle accommodations in the north-south direction that parallel Route 128/I-95, making bicycle travel difficult. In addition, the existing accommodations are not continuous and do not provide a fully connected bicycle network.

Description

Move towards creating a continuous network of bicycle accommodations paralleling Route 128/I-95 in the study area between Lexington and Newton by:

» Installing/improving bicycle accommodations (separated where possible) on surface streets paralleling Route 128/I-95.

» Providing different levels of bicycle accommodations based on the characteristics of each roadway.

» At Quinobequin Road, tying into proposed roadway improvement concept presented in Alternative V-17.

A map of the specific roadways with proposed bicycle accommodations for Alternative AT-1 is provided in the attached figure, and cross-sections of typical sections on Cary Avenue, Wyman Street, and South Street are provided in the figures below as examples of potential bicycle accommodations in the study area.

Benefits/Impacts

» Provides enhanced bicycle accommodations with separation from motor vehicles where possible.

» Improves safety for bicyclists.

» May encourage travelers to shift modes for short trips.

» Advances social equity by improving accommodations for those without access to a vehicle.

» Potential topographical issues with steep grades on certain roadways.

Recommendation

Out of a maximum score of 100, this alternative received a score of 23.88. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

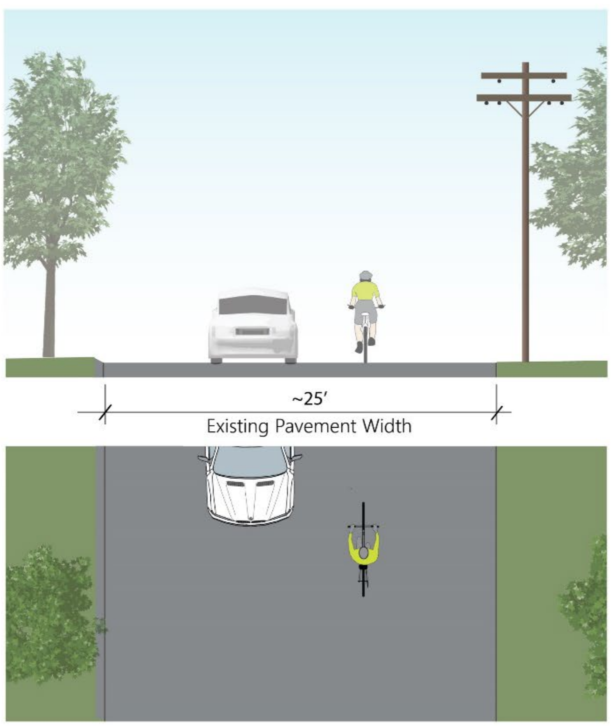
$$$ Less than $1 million

$$$ $1 to $5 million

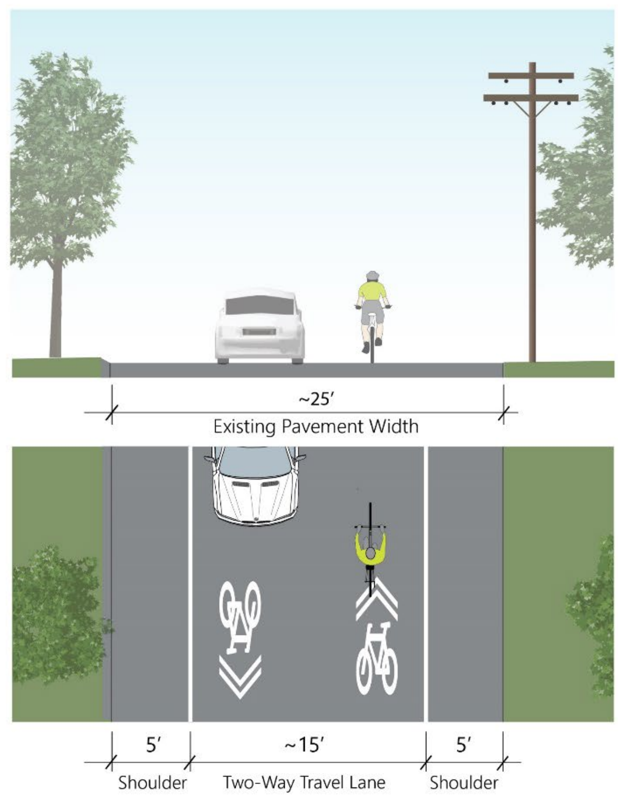
$$$ Greater than $5 million

Cary Avenue (facing north/east) – Existing and Proposed Cross-Sections

Existing Configuration

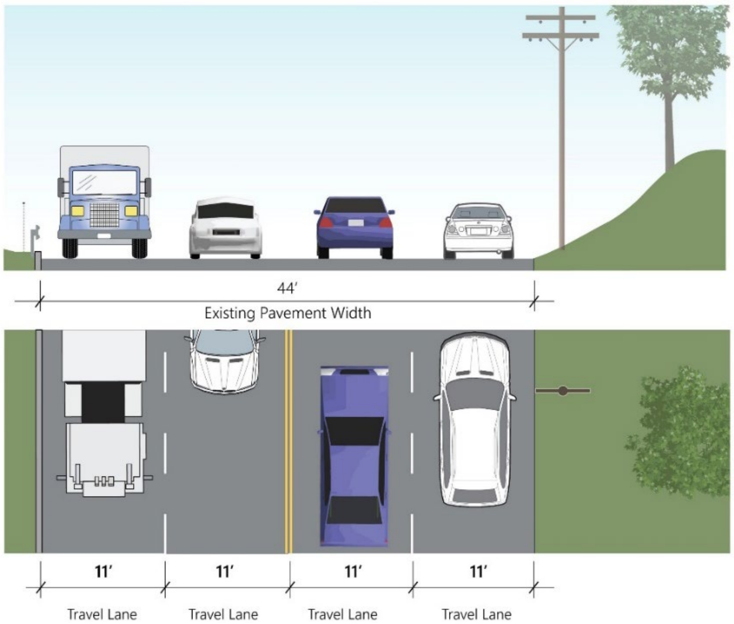


Proposed Configuration

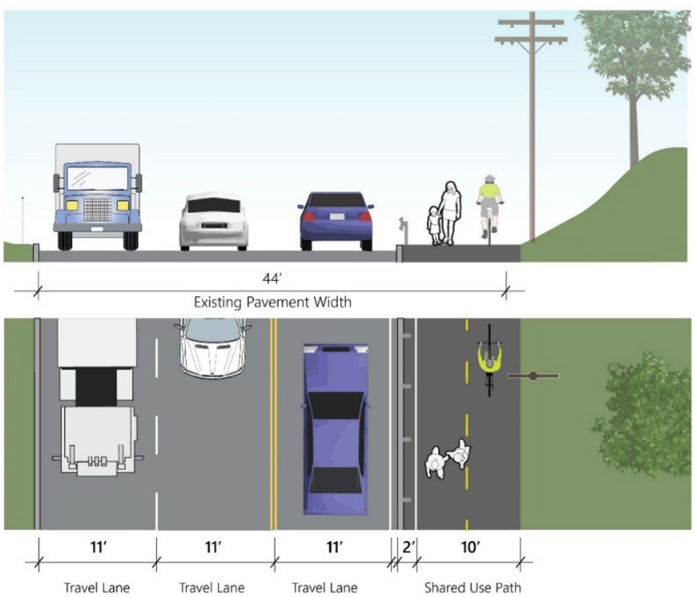


Wyman Street (facing north) – Existing and Proposed Cross-Sections

Existing Conditions



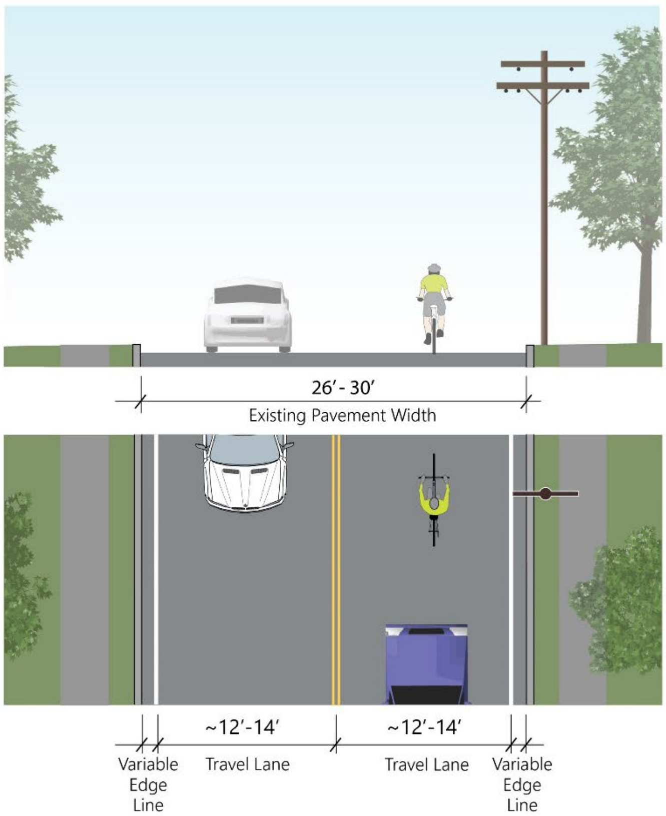
Proposed Configuration



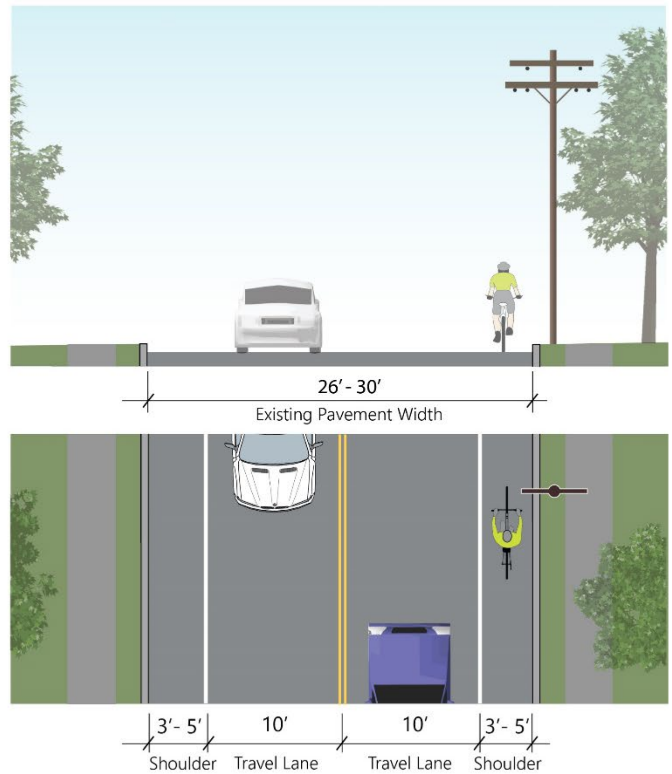
Note: A preliminary operational assessment of this alternative was conducted and determined it was feasible based on existing and projected future queues, as discussed in the *Active Transportation Alternative Analysis* memorandum in Appendix E. A more detailed operational analysis is recommended if this alternative is advanced.

South Street (facing north/east) – Existing and Proposed Cross-Sections

Existing Conditions

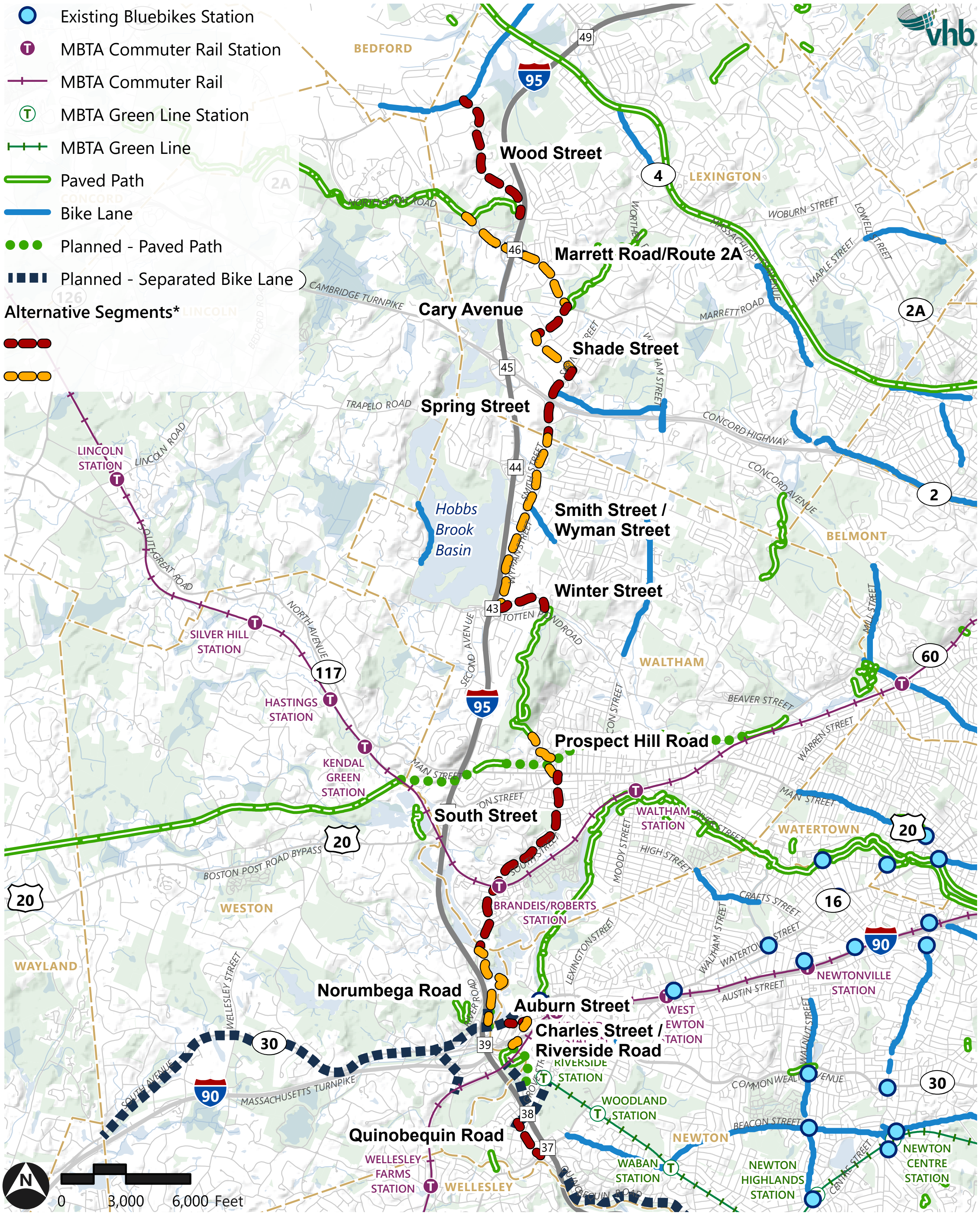


Proposed Configuration



Alternative AT-1: Improve North-South Bicycle Connections along Route/I-95

Route 128/I-95 LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, MAPC

*Alternate Segments are shown in two colors to distinguish between the segments

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation Figures (11-1-2022)\Transportation Figures (04-06-2023).aprx (adomogala,

AT-2: Improve East-West Bicycle Connections across Route 128/I-95

Context

The study area has few bicycle accommodations in the east-west direction that cross Route 128/I-95, creating a barrier for bicycle travel. While planned roadway improvements will include dedicated bicycle accommodations on some Route 128/I-95 crossings (such as Grove Street, Route 30, and Route 117), there will still be several east-west roadways without sufficient bicycle facilities.

Description

Move towards creating a continuous network of bicycle accommodations across Route 128/I-95 in the study area to improve connectivity by:

- Installing/improving bicycle accommodations (separated where possible) on surface streets crossing Route 128/I-95, including Route 2A, Trapelo Road, and Route 16.
- Providing different levels of bicycle accommodations based on the characteristics of each roadway.
- At Trapelo Road, tying into proposed roundabout concept presented in Alternative V-5.

A map of the specific roadways with proposed bicycle accommodations for Alternative AT-2 is provided in the attached figure.

Benefits/Impacts

- Provides enhanced bicycle accommodations with separation from motor vehicles where possible.
- Improves safety for bicyclists.
- May encourage travelers to shift modes for short trips.
- Advances social equity by improving accommodations for those without access to a vehicle.

Recommendation

Out of a maximum score of 100, this alternative received a score of 24.21. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses and advancing social equity.

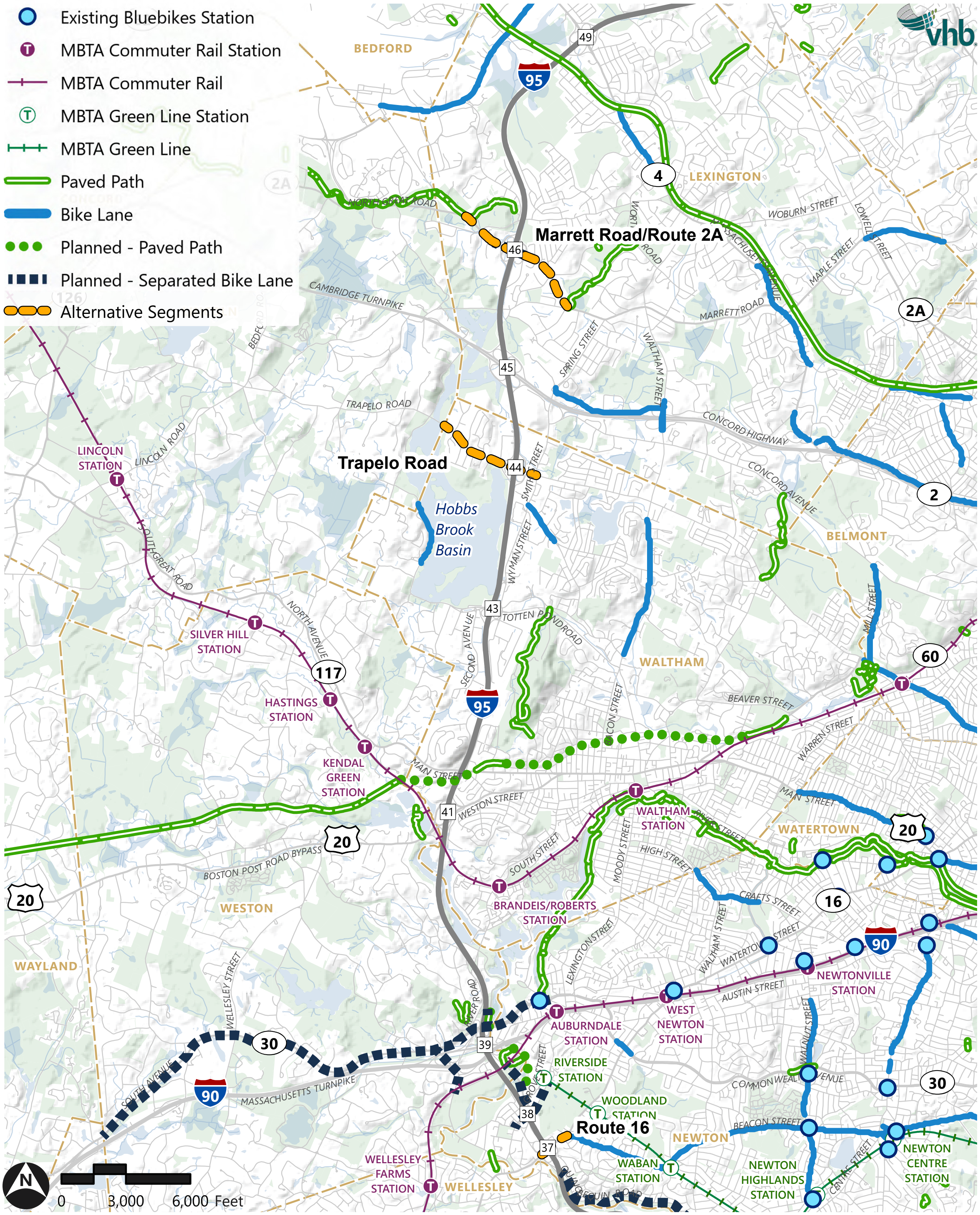
Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative AT-2: Improve East-West Bicycle Connections across Route/I-95

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, MAPC

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation Figures (11-1-2022)\Transportation Figures (04-06-2023).aprx (adomogala).

AT-3: Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95

Context

Local bicycle accommodations in the north-south direction through Lexington and Waltham are disconnected, requiring bicyclists to travel on roadways without dedicated bicycle accommodations.

Description

Build towards a continuous network of local bicycle accommodations in the north-south direction in Lexington and Waltham by:

» Installing/improving bicycle accommodations (separated where possible) on north-south roadways in Lexington and Waltham generally following the Waltham Street / Lexington Street corridor.

» Providing different levels of bicycle accommodations based on the characteristics of each roadway.

» Developing bicycle accommodations through Waltham Center to encourage bicycling within and through the center of Waltham.

A map of the specific roadways with proposed bicycle accommodations for Alternative AT-3 is provided in an attached figure and a cross-section of the proposed typical cross-section on Beacon Street is provided in the figure below as an example of potential bicycle accommodations. In addition, a diagram of potential bicycle connections through Waltham Center is provided in an attached figure.

Benefits/Impacts

» Provides enhanced bicycle accommodations with separation from motor vehicles where possible.

» Improves safety for bicyclists.

» May encourage travelers to shift modes for short trips.

» Advances social equity by improving accommodations for those without access to a vehicle.

Recommendation

Out of a maximum score of 100, this alternative received a score of 24.21. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

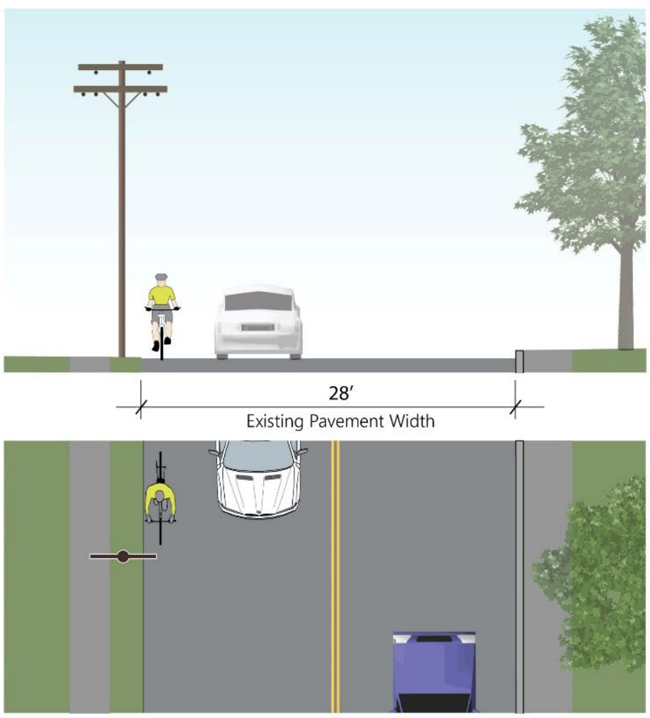
$$$ Less than $1 million

$$$ $1 to $5 million

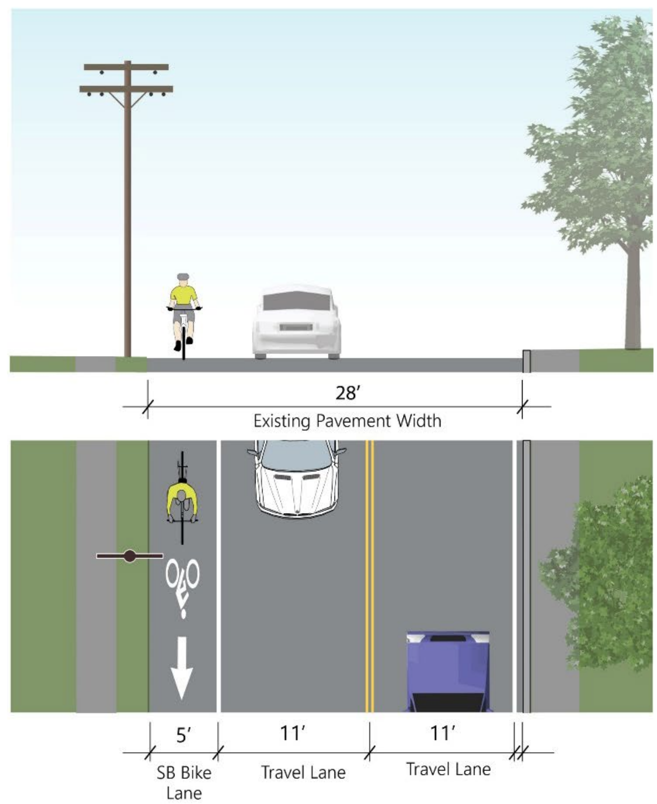
$$$ Greater than $5 million

Bacon Street (facing north) – Existing and Proposed Cross-Sections

Existing Configuration

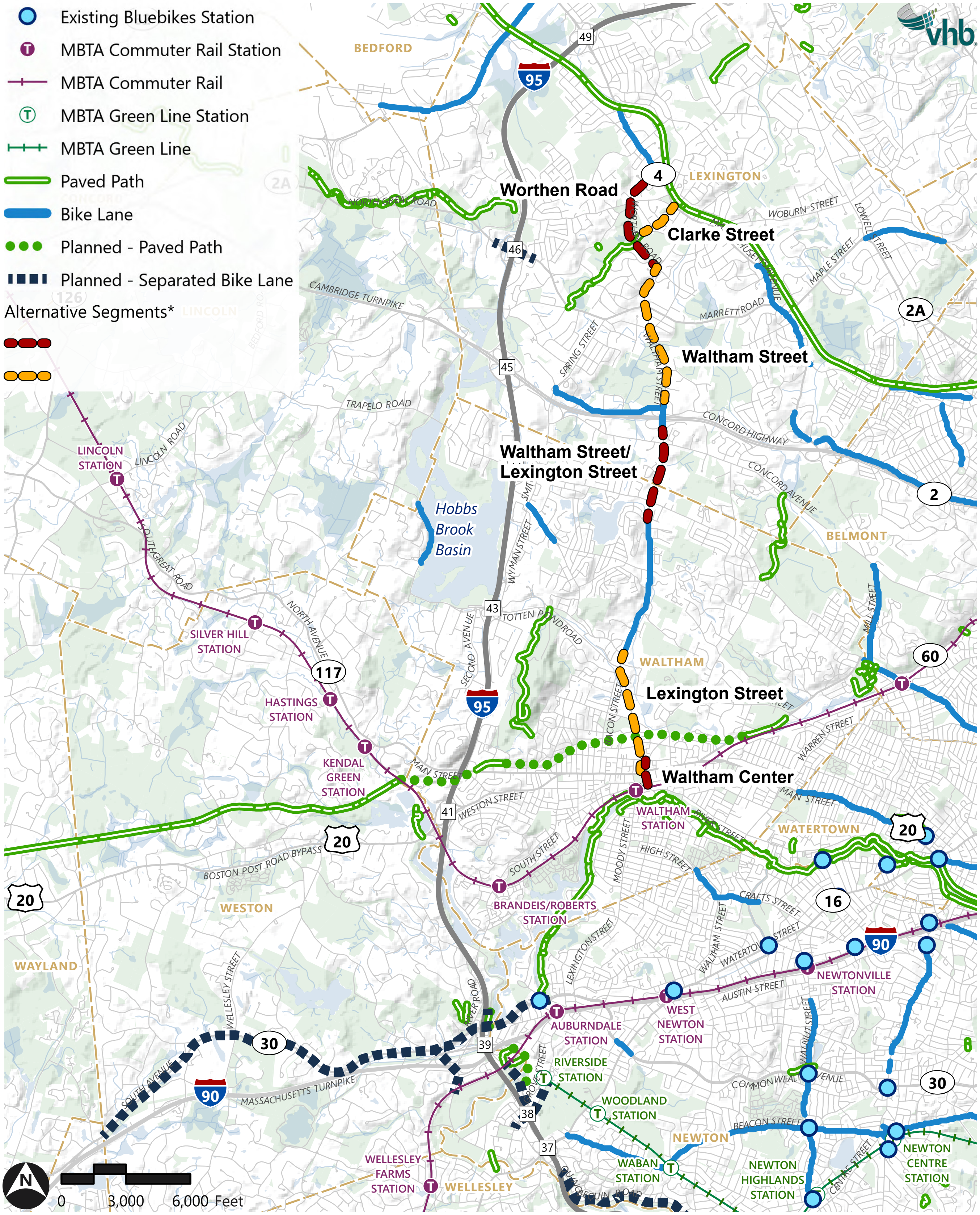


Proposed Configuration



Alternative AT-3: Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95

Route 128/I-95
LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, MAPC

*Alternate Segments are shown in two colors to distinguish between the segments

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation Figures (11-1-2022)\Transportation Figures (04-06-2023).aprx (adomogala,

Alternative AT-3: Improve North-South Bicycle Connections within Lexington and Waltham east of Route 128/I-95 - Waltham Center Connections

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

AT-4: Improve East-West Bicycle Connections within Waltham

Context

Local bicycle accommodations in the east-west direction through Waltham are disconnected, creating a piece-meal bicycle network that required bicyclists to travel on roadways without dedicated bicycle accommodations.

Description

Build towards a continuous network of local bicycle accommodations in the east-west direction in Waltham by:

» Installing/improving bicycle accommodations (separated where possible) on east-west roadways in Waltham, including Totten Pond Road, Winter Street, and a connection between South Street and the Charles River Greenway.

» Providing different levels of bicycle accommodations based on the characteristics of each roadway.

A map of the specific roadways with proposed bicycle accommodations for Alternative AT-4 is provided in the attached figure, and a cross-section of the proposed typical cross-section on Highland Street is provided in the figure below as an example of potential bicycle accommodations in the study area.

Benefits/Impacts

» Provides enhanced bicycle accommodations with separation from motor vehicles where possible.

» Improves safety for bicyclists.

» May encourage travelers to shift modes for short trips.

» Advances social equity by improving accommodations for those without access to a vehicle.

Recommendation

Out of a maximum score of 100, this alternative received a score of 29.68. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses and advancing social equity.

Conceptual Cost Range

$$$

n/a not applicable

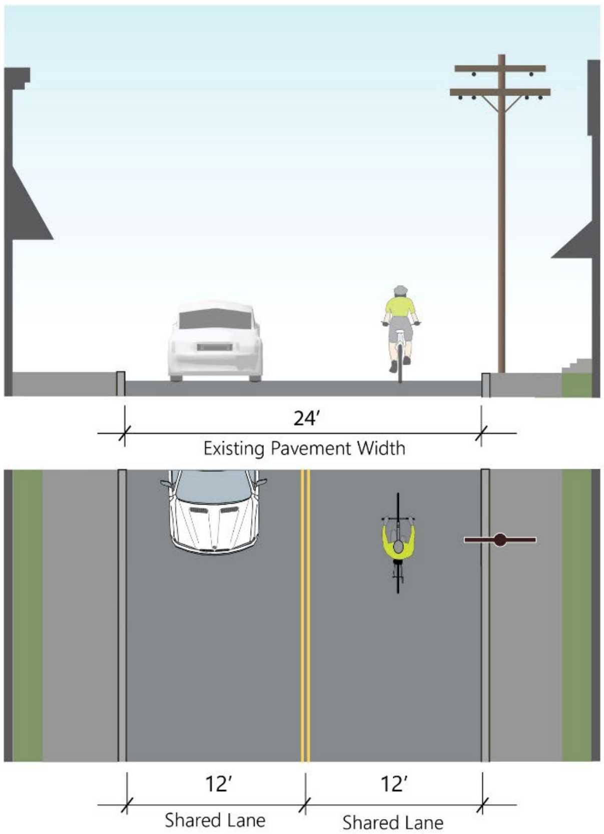
$$$ Less than $1 million

$$$ $1 to $5 million

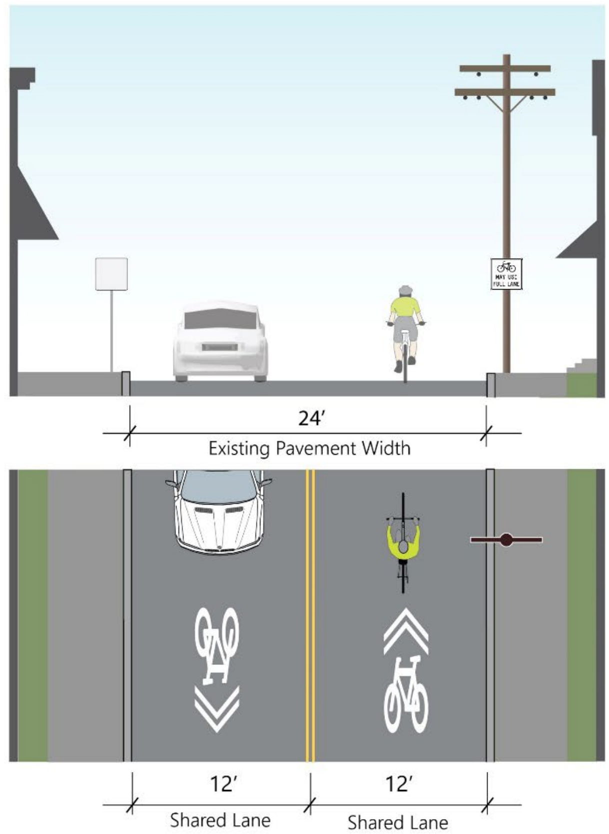
$$$ Greater than $5 million

Highland Street (facing north) – Existing and Proposed Cross-Sections

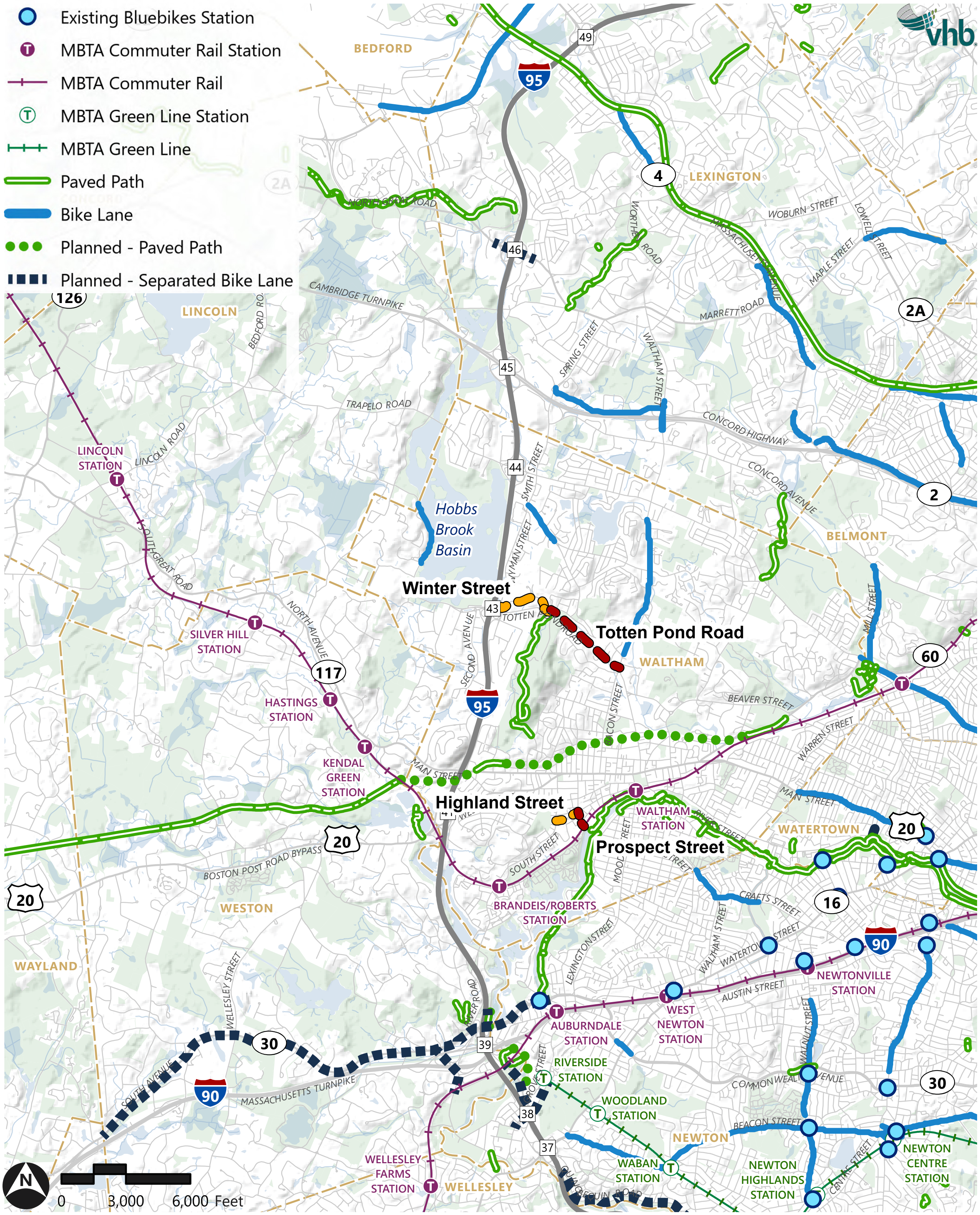
Existing Configuration



Proposed Configuration



Alternative AT-4: Improve East-West Bicycle Connections within Waltham



Source: MassGIS, MassDOT, MAPC

*Alternate Segments are shown in two colors to distinguish between the segments

Path: \\vhb.com\gis\proj\Wat-TS\15403.00 MassDOT-OTP-128\Project\Transportation Figures (11-1-2022)\Transportation Figures (04-06-2023).aprx (adomogala,

AT-5: Construct Lower Falls Shared Use Path

Context

There is no clear bicycle connection between the Riverside MBTA station and neighborhoods in Newton Lower Falls and Wellesley. A former railroad right-of-way (ROW and rehabilitation of two former railroad bridges present an opportunity to create a shared-use path and complete this connection. This alternative builds on the feasibility study completed by the Department of Conservation and Recreation (DCR) in 2020[15].

Description

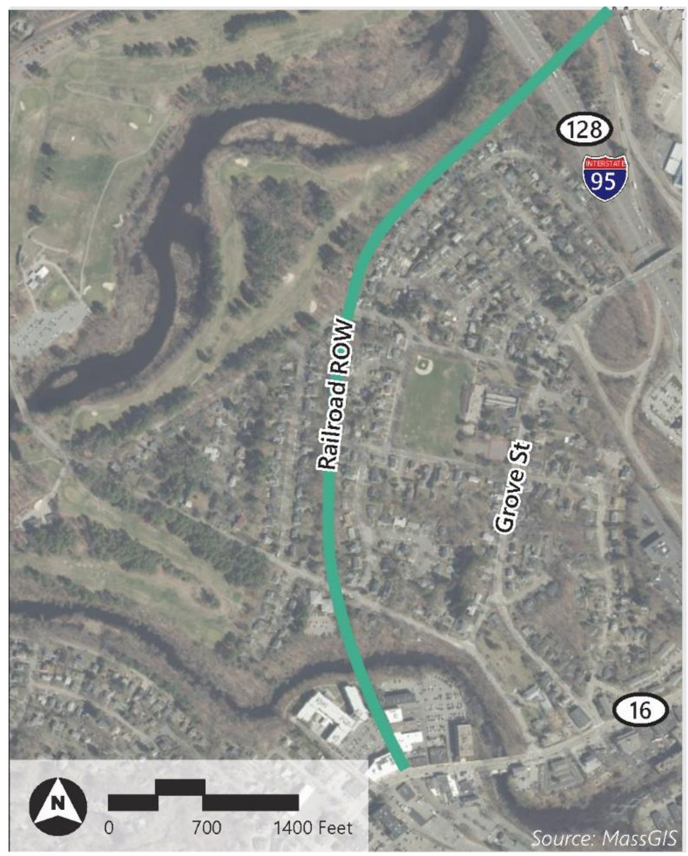
» Construct a shared use path through the Lower Falls neighborhood of Newton, providing an off-road connection between the Riverside MBTA station and Wellesley.

» Consider alignment options, including former railroad ROW, preferred by the City of Newton, or along the edge of the Leo J. Martin Golf Course.

» Utilize the old railroad bridges over Route 128/I-95 and the northbound C-D Road to connect to the Riverside MBTA station and the proposed bicycle accommodations along the Charles River north of Riverside.

A map of the potential location of the Lower Falls shared-use path is provided in the figure below.

Alternative AT-5: Construct Lower Falls Shared Use Path



15 Lower Falls Shared-Use Trail Feasibility Study, Leo J. Martin Golf Course to Quinobequin Road; Prepared for Massachusetts Department of Conservation and Recreation; November 2020

Benefits/Impacts

» Provides a bicycle and pedestrian accommodation fully separated from motor vehicles between Wellesley and the Riverside MBTA station.

» Builds upon previously conducted studies and infrastructure work related with the Riverside MBTA station redevelopment.

» Improves safety for bicyclists.

» May encourage travelers to shift modes for short trips.

Recommendation

Out of a maximum score of 100, this alternative received a score of 40.71. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses and contributing to environmental and health benefits.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

AT-10: Expand Public Bike Share Program

Context

Newton is the only study area municipality that participates in Bluebikes, the bike share program for Metro Boston spanning 13 municipalities. There are currently 15 Bluebikes stations in Newton, with the station closest to the study area located in Auburndale village.

Expanding the bike share system throughout the study area would provide an opportunity to encourage more people to bike and could serve as a "last-mile" solution for commuters to connect between transit stations and workplaces or residences. In addition, expanding the bike share program requires little initial infrastructure investment, beyond the installation of the physical stations (which usually consist of approximately 50-foot-long docking locations for at least 10 bicycles).

Description

- Expand the Bluebikes bike share system into other study area municipalities beyond Newton.
- Start with an initial expansion of seven bike share stations in Waltham, as to be successful new Bluebikes stations should be placed within a five-to-seven-minute bike ride of existing stations.
- Expand the Bluebikes bike share system throughout the rest of the study area municipalities in subsequent phases.
- Review opportunities for potential "Park and Pedal" facilities to complement new bikeshare stations.

A map of the potential bike share stations to be included in the first phase of a Bluebikes expansion into the study area is provided in the attached figure.

Benefits/Impacts

- Provides access to a new mode of transportation (bicycle) for those that don't own a bicycle.
- Creates a potential last-mile connection solution for transit riders.
- Improves equity when subsidies are provided to encourage bicycle riding among populations that wouldn't normally ride a bicycle.

Recommendation

Out of a maximum score of 100, this alternative received a score of 31.55. This alternative is recommended to be **advanced** as it will help to achieve the study goals of supporting mobility for all uses, advancing equity, and contributing to environmental and health benefits.

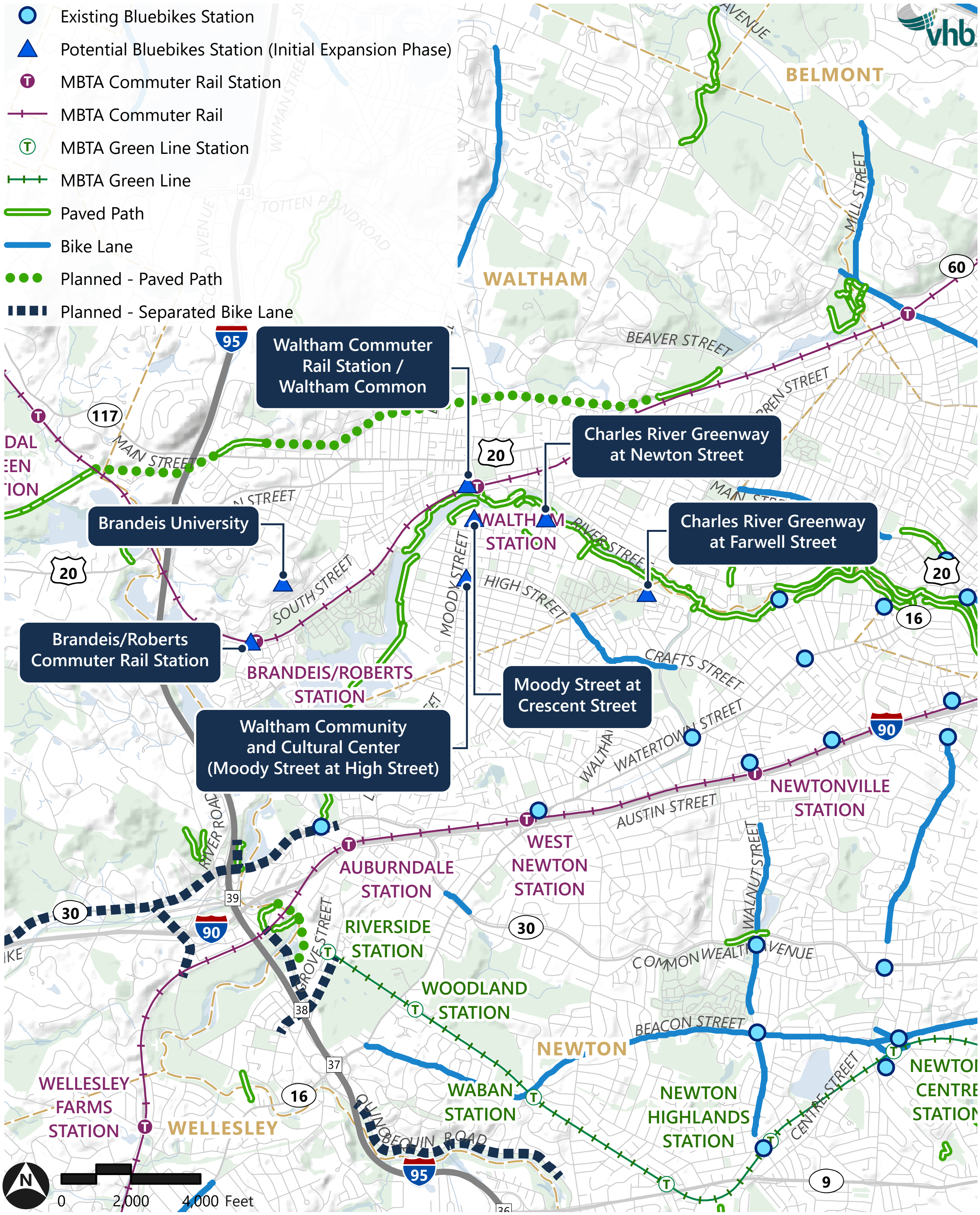
Conceptual Cost Range

$$$

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Alternative AT-10: Expand Public Bike Share Program

Route 128/I-95 LAND USE & TRANSPORTATION STUDY



Source: MassGIS, MassDOT, MAPC

\\vhb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

Transportation: General Transportation Alternative Cut-Sheets

The following general transportation alternatives were advanced beyond the initial screening in Chapter 4, *Alternatives Development*, and have been further analyzed and evaluated as outlined in Chapter 5, *Alternatives Analysis*:

- Alternative GT-1: Consider Two-Way Winter Street between Waltham and Lincoln
- Alternative GT-6: Improve Station Access and Connectivity
- Alternative GT-7: Develop Regional TDM Plan
- Alternative GT-8: Install Electric Vehicle Infrastructure - Public
- Alternative GT-9: Install Electric Vehicle Infrastructure - Private

GT-1: Consider Two-Way Winter Street between Waltham and Lincoln

Context

Winter Street is currently one-way westbound from Waltham Woods towards Lincoln (except for emergency vehicles), limiting mobility for vehicles, transit, pedestrians, and bicyclists from Lincoln into Waltham. There are currently no sidewalks or bicycle facilities.

Based on the initial screening conducted in Chapter 4, evaluation of two-way vehicular traffic was discarded. The revised alternative considers a two-way connection for transit, pedestrians, and bicyclists only.

Description

» Provide a two-way connection for transit vehicles on Winter Street between Waltham and Lincoln.

» Construct active transportation infrastructure to provide a two-way connection for pedestrians and bicyclists on Winter Street between Waltham and Lincoln.

A map of the proposed section of Winter Street that is currently one-way and could become two-way for transit and/or pedestrians and bicyclists is provided in the attached figure.

Benefits/Impacts

» Would provide new pedestrian and bicycle accommodations connecting West Waltham with residential areas of Lincoln.

» Improves safety for pedestrians and bicyclists.

» Could allow for revised shuttle routing to avoid congestion.

» Could impact the Cambridge Reservoir public drinking water supply if the roadway pavement is expanded to the north/east and a new stormwater facility is required[16]

[16] New stormwater facilities are prohibited in water supply protection zones (400 feet from the reservoir and 200 feet from water supply tributaries) by the Massachusetts Wetlands Protection Act Regulations (310 CRM 10).

Recommendation

Out of a maximum score of 100, this alternative received a score of 17.95. This alternative is recommended to be **advanced for pedestrian and bicycle access only**. Providing two-way bicycle and pedestrian access would improve the active transportation network between Waltham and Lincoln. The benefits of two-way travel on Winter Street for existing transit are limited and would likely require expanding the width of pavement on Winter Street, potentially impacting the Cambridge Reservoir public drinking water supply.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

Alternative GT-1: Consider Two-Way Winter Street between Waltham and Lincoln

Route 128/I-95
LAND USE & TRANSPORTATION STUDY

Source: MassGIS

\\whb\gbl\proj\Wat-TS\15403.00 MassDOT-OTP-128\4_Working\6_Graphics\Report Figures\Chapter 5 Figures\Chapter 5_Alternatives Figures.indd

GT-6: Improve Station Access and Connectivity

Context

Access and connectivity for all passengers from existing and future transit stations to the area's multimodal network are critical to providing safe, accessible connections and maximizing mobility options.

Description

As existing transit stations are upgraded and new stations are designed within the study area, incorporate the following considerations:

- Review and comply with applicable Americans with Disabilities Act (ADA) standards at the station.
- Evaluate pedestrian and bicycle desire lines and improve network connectivity in the vicinity of the station, working with adjacent landowners to remove barriers such as fences that restrict access.
- Review bike parking capacity and demand at each transit station and improve as needed.
- Improve roadway and intersection crossings for pedestrians and bicyclists near stations to ensure crossings are safe and accessible.

Benefits/Impacts

- Improves access, connectivity, and accessibility to transit stations for all users.

Recommendation

Out of a maximum score of 100, this alternative received a score of 26.15. This alternative is recommended to be **advanced** as it will help to advance social equity by making transit stations more accessible for all users.

Conceptual Cost Range

n/a [1]

1 – To be incorporated into larger projects/ studies

n/a not applicable

$ Less than $1 million

$$ $1 to $5 million

$$$ Greater than $5 million

GT-7: Develop Regional TDM Plan

Context

Existing Transportation Demand Management (TDM) plans in the study area are generally associated with specific developments and in some cases, a specific section of the municipality. While the study area municipalities each have various guidelines/requirements for development and implementation of TDM plans, there is no regional TDM plan that is applicable and coordinated across communities.

Description

» Develop and encourage implementation of enhanced TDM policies appropriate for the study area through a regional, coordinated approach to encourage mode shift, building upon the current TDM formula for developers provided in the City of Newton as appropriate.

» Identify a champion, such as the Boston Region MPO, to lead the development of a regional TDM plan, considering the characteristics of all study area communities.

» Consider opening private TDM programs to all members of the public.

» Revisit existing TDM policy thresholds for large/medium size employers

Benefits/Impacts

» Encourage mode shifts by implementing policies and measures to encourage a shift from single occupancy vehicle (SOV) trips

» Increase social equity by providing consistent TDM measures for all businesses, residents, and workers in the study area

Recommendation

Out of a maximum score of 100, this alternative received a score of 15.22. This alternative is recommended to be **advanced** as it will help to promote mode shifts away from private vehicles and will require minimal, if any, physical infrastructure changes.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

GT-8: Install Electric Vehicle Infrastructure - Public

Context

MassDOT recently completed an Electric Vehicle (EV) Infrastructure Deployment Plan (Deployment Plan) as required by the Infrastructure Investment and Jobs Act's National Electric Vehicle Infrastructure (NEVI) Formula Program[17]. MassDOT's NEVI Plan describes the Commonwealth's approach for investing NEVI Formula Program funds to build a network of DC Fast Charge (Level 3) infrastructure on Alternative Fuel Corridors in Massachusetts. Based on an evaluation of demand and equity along the AFC's, the Deployment Plan ranked Route 128/I-95 seventh out of 15 corridors in terms of priority for EV charging infrastructure deployment. Note that NEVI formula funding is only applicable to publicly accessible Level 3 charging infrastructure, and does not address existing demand for slower, Level 1 or Level 2 charging. In addition to NEVI Formula Program funds, the Infrastructure Investment and Jobs Act also offers the Discretionary Grant Program for Charging and Fueling Infrastructure. This Discretionary Grant Program will provide funding for EV charging infrastructure deployment along Alternative Fuel Corridors as well as within communities. Guidelines for the Discretionary Grant Program are forthcoming.

Description

» Work within MassDOT's EV Infrastructure Deployment Plan to identify opportunities on publicly-owned property and ROW along Route 128/I-95 within the study area.

» Coordinate with the communities within the Study Area to plan for the release of Discretionary Grant Program funding.

» Consider how the cost of electricity will be addressed (e.g. free for users, charged by the minute, charged by the amount of power, etc.)

Benefits/Impacts

» Support the shift from gasoline-powered vehicles to EVs and the Commonwealth's goal of eliminating the sale of gasoline-powered vehicles by 2035.

» Support reduced greenhouse gas emissions and improved air quality.

» Leverage federal funding that is available to support the expansion of EV infrastructure.

» Enable greater EV adoption within environmental justice communities.

[17] https://www.mass.gov/service-details/deployment-plan-for-massachusetts

Recommendation

Out of a maximum score of 100, this alternative received a score of 13.61. This alternative is recommended to be **advanced** as it will help to achieve the study goals of reducing greenhouse gas emissions and improving air quality. This alternative can also be introduced incrementally with electric vehicle infrastructure included as part of larger public infrastructure upgrades and not as individual stand-alone projects.

Conceptual Cost Range

$$

n/a not applicable

$ Less than $1 million

$$ $1 to $5 million

$$$ Greater than $5 million

GT-9: Install Electric Vehicle Infrastructure - Private

Context

In addition to electric vehicle (EV) infrastructure on public land, charging stations on private land, such as at workplace and commercial destinations, can also support EV adoption. The Massachusetts Department of Environmental Protection (MassDEP) has several Electric Vehicle Incentive Program (MassEVIP) grants aimed at making electric vehicles and EV charging stations more widely available across Massachusetts, including the MassEVIP Workplace and Fleet Charging Program[18], MassEVIP Public Access Charging Program[19], MassEVIP Multi-Unit Dwelling (MUD) and Educational Campus Charging Program[20], and MassEVIP DC Fast Charging Program[21]. Opportunities exist to leverage these grant opportunities and other funding mechanisms (such as federal and utility-based incentives) to install Level 2 and Level 3 (DC Fast Charge) EV charging infrastructure on privately owned land and to incorporate new electric vehicle infrastructure in new developments.

Description

- Promote the installation of EV charging infrastructure on privately-owned properties with a focus on multi-family residential developments and workplace and commercial destination settings. Build awareness among private property owners and major tenants of available incentive programs.
- Work with the communities within the study area to ensure local land use controls (e.g., zoning ordinances and building codes) are supportive of EV charging infrastructure installations, as well as to provide expedited permitting and inspection processes.

Benefits/Impacts

- Support the shift from gasoline-powered vehicles to EVs and the Commonwealth's goal of eliminating the sale of gasoline-powered vehicles by 2035.
- Support reduced greenhouse gas emissions and improved air quality.
- Leverage available federal, state, and utility-based funding that is available to support the expansion of EV infrastructure.

[18] https://www.mass.gov/how-to/apply-for-massevip-workplace-fleet-charging-incentives

[19] https://www.mass.gov/how-to/apply-for-massevip-public-access-charging-incentives

[20] https://www.mass.gov/how-to/apply-for-massevip-multi-unit-dwelling-educational-campus-charging-incentives

[21] https://www.mass.gov/how-to/apply-for-massevip-direct-current-fast-charging-incentives

Recommendation

Out of a maximum score of 100, this alternative received a score of 7.09. This alternative is recommended to be **advanced** as it will help to achieve the study goals of improving greenhouse gas emissions reducing air quality. This alternative can also be introduced incrementally with electric vehicle infrastructure included as part of new development or redevelopment projects and not as individual stand-alone projects.

Conceptual Cost Range

$$

n/a not applicable

$ Less than $1 million

$$ $1 to $5 million

$$$ Greater than $5 million

Environmental Alternative Cut-Sheets

Of the environmental alternatives presented in the initial screening in Chapter 4, *Alternatives Development*, all four were advanced and have been further analyzed and evaluated as outlined in Chapter 5, *Alternatives Analysis*:

- Alternative E-1: Improve Hobbs Brook Reservoir Water Quality
- Alternative E-2: Reduce Amount of Impervious Area and Increase Vegetative Cover
- Alternative E-3: Provide Flood Storage and Stormwater Treatment Areas
- Alternative E-4: Limit Development within Flood-Prone Areas

E-1: Improve Cambridge (Hobbs Brook) Reservoir Water Quality

Context

An opportunity exists to improve the water quality of Hobbs Brook Reservoir, which is adjacent to Route 128/I-95 within the northern portion of the study area.

Description

» Identify and implement measures to improve water quality in Hobbs Brook Reservoir and its tributaries based on notable exceptions to meeting Class A Massachusetts Surface Water Quality Standards (e.g., chloride impairment). The primary source of chloride comes from deicing chemicals applied to nearby roadways and parking areas.

» Water quality concerns can be identified through the City of Cambridge Water Department's Source Water Quality Monitoring Program, an ongoing study to assess source water quality in Cambridge reservoirs and associated tributaries.

Benefits/Impacts

» The natural environment would benefit by reducing water quality stressors on plants, fish, and wildlife in and around the reservoir.

» The human environment would benefit through improved drinking water quality.

» Improving water quality at the Hobbs Brook Reservoir could have minor climate-related benefits by addressing eutrophication to reduce eutrophication-driven methane.

Recommendation

Out of a maximum score of 100, this alternative received a score of 12.78. This alternative is recommended to be **advanced** as it will help to advance the study goal of contributing environmental and health benefits.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

E-2: Reduce Amount of Impervious Area and Increase Vegetative Cover

Context

The study area contains much impervious areas, due to the many surface parking lots and roadways serving the development along the corridor.

Description

» Identify opportunities to reduce impervious areas within the study area, particularly those within floodplains.

Benefits/Impacts

» The reduction of impervious surfaces reduces the potential for localized flooding, as water is allowed to naturally infiltrate into the ground as opposed to into storm sewers and local waterways.

» Removing pavement within 100 feet of wetlands or 200 feet of a perennial stream will enhance natural habitat in the sensitive wetland buffer zone and/or riverfront area.

» Simultaneously increasing vegetative cover has the co-benefit of mitigating the urban heat island effect.

Recommendation

Out of a maximum score of 100, this alternative received a score of 22.51. This alternative is recommended to be **advanced** as it will help to advance the study goal of contributing environmental and health benefits.

Conceptual Cost Range

n/a [1]

1 – Minimal cost to enact policy that limits impervious areas in new developments

n/a not applicable
$ Less than $1 million
$$ $1 to $5 million
$$$ Greater than $5 million

E-3: Provide Flood Storage and Stormwater Treatment Areas

Context

An opportunity exists to enhance or provide areas for flood storage and stormwater treatment.

Description

» Identify properties within the 100-year and 500-year floodplains that could best serve the purpose of flood storage and stormwater treatment and explore ways to ensure their preservation for such purposes.

Benefits/Impacts

» The creation and/or preservation of flood storage and stormwater treatment areas on suitable properties could have multiple climate-related benefits, including mitigating local flooding and the urban heat island effect.

» Flood storage and stormwater treatment areas could improve water quality and enhance habitat.

Recommendation

Out of a maximum score of 100, this alternative received a score of 17.44. This alternative is recommended to be **advanced** as it will help to advance the study goal of contributing environmental and health benefits.

Conceptual Cost Range

$$$

n/a not applicable

$$$ Less than $1 million

$$$ $1 to $5 million

$$$ Greater than $5 million

E-4: Limit Development within Flood-Prone Areas

Context

Existing flooding may intensify because of climate change, which would likely impact development that occurs within flood-prone areas.

Description

» Review local ordinances and bylaws, such as zoning, to ensure that they do not allow inappropriate development within the 100-year floodplain or areas with exposure to inland flood risk.

» Encourage longer-term safeguards by restricting development within the 500-year floodplain, as appropriate.

Benefits/Impacts

» Coordinating local ordinances and bylaws to limit development in flood prone areas would protect against the potential future loss of life and property due to flooding.

» Limiting new development within floodplains would provide the opportunity to increase vegetated cover and habitat, which could also provide for improved water quality.

Recommendation

Out of a maximum score of 100, this alternative received a score of 9.20. This alternative is recommended to be **advanced** as it will help to advance the study goal of contributing environmental and health benefits.

Conceptual Cost Range

n/a [1]

1 – Minimal cost to enact policy that limits development within flood-prone areas.

n/a not applicable
$$$ Less than $1 million
$$$ $1 to $5 million
$$$ Greater than $5 million

Appendix B: Supplemental Tables and Graphics

Provided upon Request

Roadways and Intersections

» Intersection Lane Use and Control
» Existing Traffic Volumes and LOS on Route 128/I-95 – AM Peak Hour
» Existing Traffic Volumes and LOS on Route 128/I-95 – PM Peak Hour
» Existing Vehicle Volume Networks and LOS – AM Peak Hour
» Existing Vehicle Volume Networks and LOS – PM Peak Hour
» 2040 Future Traffic Volumes and LOS on Route 128/I-95 – AM Peak Hour
» 2040 Future Traffic Volumes and LOS on Route 128/I-95 – PM Peak Hour
» 2040 Future Vehicle Volume Networks and LOS – AM Peak Hour
» 2040 Future Vehicle Volume Networks and LOS – PM Peak Hour

Environmental

» Designated Properties and Properties within Designated Historic Districts
» MHC – Inventoried and Designated Properties
» Summary of MassDEP Disposal Sites
» Oil and Hazardous Materials

Appendix C: Report Appendix

Provided upon Request

Study Process and Framework

- Working Group Member List
- Public Involvement Plan
- Working Group/ Public Meeting Notes
- Draft Report Public Comments

Existing Conditions

- Route 128/I-95 Origin-Destination Streetlight Data

Future Conditions and Issues, Opportunities, Constraints

- Planned Roadway Infrastructure Improvement Concept Plans

Alternatives Development

- Vehicular Alternatives Preliminary Sketches

Alternatives Analysis

- Alternatives Analysis Evaluation Matrix

Appendix D: Existing and Future Conditions Supplemental Memorandums

Provided upon Request

- Background Relevant Planning Documents Memorandum
- Existing Conditions Public Health Methodology and Detailed Results Memorandum
- Existing Conditions Traffic Data Adjustment Methodology Memorandum
- Existing Conditions Roadway and Intersection Crash Data Memorandum
- 2040 Future Volume Development Methodology Memorandum
- Traffic Capacity Operations Summary Existing and Future Conditions Memorandum

Appendix E: Alternatives Analysis Supplemental Memorandums

Provided upon Request

Alternatives Process

» Alternatives Analysis Scoring Summary Memorandum

Improve Access, Safety, and Mobility for All

» Active Transportation Alternatives Analysis Summary Memorandum
» Transit Alternatives Analysis Summary Memorandum
» Traffic Capacity Operations Alternatives Analysis Summary Memorandum
» Safety Review Alternatives Analysis Summary Memorandum
» Highway Design Review Summary Memorandum

Support Strategic Land Use and Economic Vitality

» Land Use/Economic Development Alternatives Analysis Summary Memorandum

Advance Social Equity Throughout

» Environmental Justice Alternatives Analysis Summary Memorandum

Contribute Environmental and Health Benefits

» Environmental Review Alternatives Analysis Summary Memorandum

» Public Health Alternatives Analysis Summary Memorandum

Develop Recommendations with Lasting Benefits

» Cost Estimate Alternatives Analysis Summary Memorandum