



ACTIVE TRANSPORTATION PLAN UPDATE
CHITTENDEN COUNTY

DECEMBER 2022



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People using a sidewalk as part of a connected active transportation network.

INTRO

1.0

PLAN INTRODUCTION

Active transportation emphasizes the role of physically active forms of travel in improving community health. It reinforces that bicycling and walking are valid forms of transportation, not just forms of recreation, and it is a more inclusive term that reflects the use of mobility assistance devices, such as wheelchairs and scooters. It also implies a more comprehensive approach to the transportation system which recognizes the importance of accessing public transit for people using active modes. Active transportation also provides many community benefits, such as improved public health, economic development, quality of life, and environmental quality.

1.1

PURPOSE AND BACKGROUND

Plan Goal

The overall goal of this update to the Chittenden County Regional Planning Commission's (CCRPC) Active Transportation Plan (ATP) is to produce a region-wide Plan for existing and future bicycle and pedestrian facilities and programs that will serve as the active transportation element of the CCRPC's long-range [Metropolitan Transportation Plan](#) (MTP). Transportation infrastructure, policy, and regulations are constantly changing, along with best practices for planning and designing safe active transportation networks. Regular updates to the ATP help guarantee that countywide active transportation efforts remain relevant, respond to community priorities, continue to grow Chittenden County's walk/bike facilities, and foster a culture supportive of active transportation. As with the 2017 ATP, this updated ATP continues to support many of the goals of the ECOS Metropolitan Transportation Plan, which is the Regional Plan developed to protect Chittenden County's resources and guide its development. The ECOS Plan (Environment; Community; Opportunity; Sustainability) is the regional plan for Chittenden County and combines three plans into one: the Regional Plan, the Metropolitan Transportation Plan and the Comprehensive Economic Development Strategy.

Plan Continuity

CCRPC has a long history of planning for people walking and bicycling. This plan update builds upon previous plans and projects and ensures that ongoing active transportation initiatives are coordinated across the County to provide a cohesive and useful pedestrian and bicycle network. CCRPC last updated the Regional Bicycle/Pedestrian Plan in 2017. The previous Plan was completed in 2008, a third iteration of Regional Bike/Pedestrian planning that began in 1993.

Plan Structure

This summary report provides an overview of walking and bicycling conditions in Chittenden County, identifies gaps and barriers, and recommends infrastructure and program/policy improvements. A series of technical memoranda provide more detail for each plan element. They are available on the [CCRPC Regional Active Transportation Plan webpage](#) and linked throughout this document.

Technical Memoranda:

- Existing Conditions and Regional Network Analysis
 - » [Materials Review](#)
 - » [Equity Analysis](#)
 - » [Bicycle Network Analysis](#)
 - » [Trip Potential Analysis](#)
- Recommendations
 - » [Countywide Bicycle Network](#)
 - » [Project Prioritization](#)
 - » [Local Pedestrian Network](#)
 - » [Program and Policy Recommendations](#)



Students in Winooski enjoy an adaptive bike as part of Local Motion's Bike Smart program.

EXISTING CONDITIONS

2.0

MATERIALS REVIEW

The Project Team reviewed four key documents to draw from the important active transportation planning work already completed within the region, identify overlap in objectives, and determine what gaps remain to be filled through the CCRPC ATP update.

CCRPC ATP (2017)

CCRPC produced the [2017 ATP](#) as an update to the 2008 Regional Bicycle and Pedestrian Plan. The purpose of the ATP was to guide projects related to walking and biking in the county. The plan puts forward a strong vision for a connected regional network. Recommendations consist of proposed street segments and trails that merit high-comfort facilities for people walking and biking.

CCRPC ATP Evaluations

In 2021, the University of Vermont (UVM) Transportation Research Center (TRC) published [an evaluation of the 2017 ATP](#). The evaluation assessed the proposed network, other infrastructure recommendations, and non-infrastructure recommendations separately, and analyzed the implementation status of each recommendation, as well as the planning process. UVM then set out its own recommendations for implementing the remaining projects.

UVM found that progress on many of the recommendations was challenging to assess. The network recommendations lacked specific facility types. Other recommendations lacked clear end goals, making it difficult to determine if the recommendation was fully implemented or not. Many of the recommendations for implementing/updating the ATP are addressed in the 2022 ATP Update.

Transportation Improvement Program & Metropolitan Transportation Plan

The project team reviewed bicycle and pedestrian related projects in CCRPC's adopted [Transportation Improvement Program \(TIP\)](#) and [Metropolitan Transportation Plan \(MTP\)](#). These projects are slated to be funded and implemented in the coming years throughout the region. The current adopted TIP reflects projects funded through the 2025 fiscal year. The TIP is typically adopted annually and amended as needed. CCRPC adopted the most recent MTP in 2018 and is currently working on an updated version. The MTP includes short- and long-term strategies to consider for transportation improvements up to 20 years in the future. Complete lists of active transportation projects in the TIP and MTP are available in the [Materials Review Memorandum](#).

PUBLIC ENGAGEMENT

3.0 OVERVIEW

Historically, genuine and effective public engagement in transportation plans and projects has been difficult to achieve. In recent years, the industry has undergone a shift from simple public outreach, where the public is notified of decisions that have already been made, to more collaborative and empowering engagement strategies. CCRPC sought to emulate this approach in the development of the ATP Update using the strategies described below.

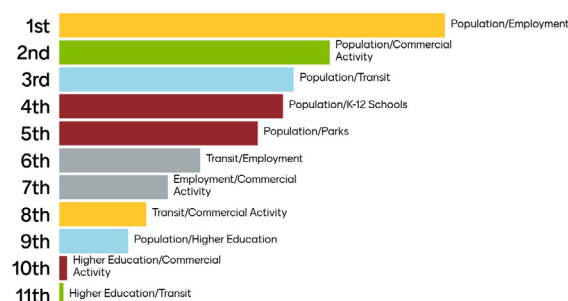
3.1 ADVISORY COMMITTEE

CCRPC convened an Advisory Committee to provide feedback and guidance on the development of the ATP update. Committee members included health, transit, and transportation professionals; state and local government representatives, and advocacy groups. The committee met three times over the course of the planning process. Additional notes, meeting presentations, and recordings are available on the CCRPC [Regional Active Transportation Plan webpage](#).

1st Meeting –March 24, 2022

The project team provided a high-level overview of the ATP process, including the purpose of the plan, the Advisory Committee's roles and responsibilities, and the project's scope and schedule. The project team also introduced two important components of the ATP – the Bicycle Network Analysis (BNA) and the Trip Potential Analysis (TPA). Committee members selected their preferred origin-destination pairs for the TPA. See the [Trip Potential Analysis Memo](#) for more detailed information.

What are the most important Origin-Destination pairs to consider for the trip potential analysis?



2nd Meeting – July, 14, 2022

The project team shared initial findings and results from the equity analysis, BNA, and TPA. Committee members reacted positively to the update; specifically, they appreciated that youth were included as a focus population in the equity analysis, and that the TPA highlighted walk/bike trip activity in low-vehicle access areas.

3rd Meeting – October 26, 2022

The project team presented the countywide bicycle network and local pedestrian recommendations and project prioritization results. Committee members offered suggestions for improving the bicycle facility selection guidance and questioned whether the network's goal is to attract new bicyclists or accommodate existing users. In response, CCRPC staff explained that a safer, more comfortable, and more connected network will both attract new users and better accommodate existing users.

3.2 LISTENING SESSIONS

CCRPC and the project team held six virtual listening sessions over the course of plan development to capture feedback from priority populations.

1st Listening Session – May 25, 2022

Older adults shared experiences with accessibility challenges, especially during winter weather, and aggressive motorist behavior at crosswalks. Participants were also concerned with bike lanes that don't provide enough protection from vehicle traffic and gaps in the bikeway network.

2nd Listening Session – June 4, 2022

Arabic speaking members of the community shared their desire for better maintenance of roads and sidewalks, challenges due to snow and ice, as well as the hilly topography, the need for safer and more connected bike facilities, and more lighting. Some also questioned whether communities with refugee populations are being under-prioritized by local maintenance departments.

3rd Listening Session – June 21, 2022

Mobility justice and racial equity advocates shared concerns about lack of bicycle accommodations at bus stops and on buses, lack of sidewalks around low-income housing and other priority destinations, financial barriers to accessing shared micromobility services, and lack of accessible pedestrian facilities and bathrooms.

4th Listening Session – June 27, 2022

Staff from the University of Vermont (UVM) expressed their desire for separated bicycle facilities, more bike parking closer to destinations, and the need for more affordable housing in urban areas and closer to employment centers. They also shared barriers to biking including high vehicle speeds, narrow bridges, lack of roadway shoulders and designated bicycle facilities, maintenance issues like potholes and faded pavement markings, and lack of facility connectivity.

5th Listening Session – June 27, 2022

Members of a local walk/bike committee voiced support for the new shared use path along a portion of VT Route 15 but expressed challenges at intersections, challenging walking conditions in winter due to ice, and need for better wayfinding and pavement marking maintenance.

6th Listening Session – June 30, 2022

Students from UVM talked about why they like using the Burlington Greenway: flat terrain with beautiful views, connects beaches, trails and playgrounds, and separation from vehicle traffic. They would like similar separated facilities connecting to other places outside of Burlington. Students commented on challenges including intersection crossings, lack of lighting, and vehicle speeds and volumes. They suggested more wayfinding signage and including times and/or distances to destinations for people walking and biking.

3.3

OTHER ENGAGEMENT EVENTS

On March 31, 2022 CCRPC and Local Motion co-hosted a virtual forum of Walk Bike Trails Committees from around the county. Twenty people representing 12 groups attended. This was an opportunity to make connections with each other, understand the needs of local groups, learn about their current efforts, and gather their perspectives to guide development of the ATP.

In addition to scheduled listening sessions, CCRPC staff also had informal conversations with community members in person. Visitors to a public park in Burlington in May 2022 commented that they like the Burlington Greenway because it is separated from traffic, noted that they put their bike on the bus to reach destinations further away, and would like more facilities and a more connected network throughout the county.

At a June 2022 pop-up bike repair event outside the public library in Winooski, people talked about how they like separated shared use paths and would like to see more paths and bike lanes, but there is a lack of connectivity. They also mentioned barriers including the bridge over the Winooski River, the traffic circulator in downtown Winooski, and said that snow and ice on sidewalks in winter is an issue.

In June 2022, some residents at an affordable housing complex in Colchester said they like the new separated path along VT Route 15 while others said they do not use it because of busy traffic on the roadway. There are children of varying ages in the neighborhood, some of whom can bike to places while others are too young to bike alone. Residents highlighted the need for more separated and protected facilities to get to destinations like school and work. They also pointed out the lack of bike parking at the affordable housing complex, the challenge of bike theft, and bikes parked outside that become unusable due to winter weather.

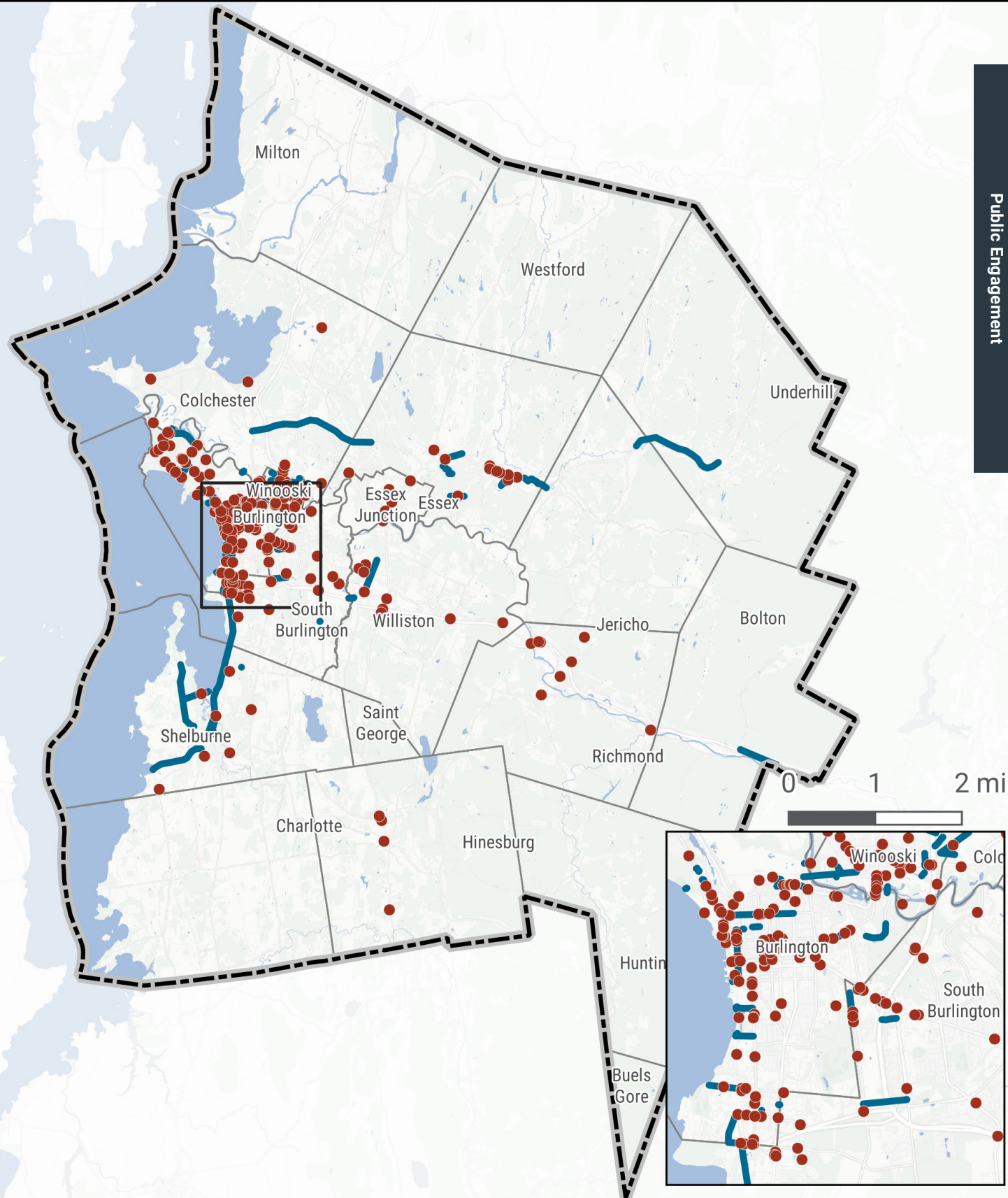
3.4 WEBMAP

During the planning process, CCRPC used a webmap to collect public feedback on routes that need improvement, specific project priorities, and locations of safety concerns for walking and bicycling. The project team used the webmap results to refine the network recommendations. The webmap was open from May 12 to July 8, 2022 and promoted using Front Porch Forum, CCRPC website and newsletter, transportation partner social media and newsletters, direct emails to individuals and organizations, and printed/translated fliers posted at bike shops, laundromats, public bulletin boards, and other locations. It captured more than 350 unique responses from the public on active transportation barriers and opportunities. Results are shown in **Figure 1**.

3.5 AN EQUITABLE APPROACH TO ENGAGEMENT

Decision-makers must listen to residents' priorities for better transit, accessible facilities, and expanded walking and biking options with an eagerness to address the community's self-identified needs. Proactive relationship building between decision-makers and community members is key to developing equitable and successful projects. When local agencies are able to marshal resources that help solve residents' problems, community members may eventually grow to value these relationships. This establishes trust and a willingness to collaborate on future projects.

A holistic approach often works best: framing bicycle and pedestrian infrastructure as a tool for economic development, improving public health, traffic safety, and other community priorities will be well-received by at least some community members. The community may also want different types of projects, or prefer them in different places, compared to what local agencies propose. For example, they might have different preferences for what makes a "safe" route in their community due to crime concerns rather than traffic speeds. Local knowledge and expertise should guide these decisions. This approach is especially valuable in under-resourced communities that have been excluded from planning projects in the past.

**Public Input Type**

- Existing Barrier
- Proposed Path

0 5 10 mi



Figure 1: Public Feedback Results

REGIONAL NETWORK ANALYSIS

4.0 OVERVIEW

The ATP includes a series of analyses that examine different components of the active transportation network, historic and contemporary transportation planning trends, and Chittenden County's demographics – the Equity Analysis, the Bicycle Network Analysis (BNA), and the Trip Potential Analysis (TPA).

4.1 EQUITY ANALYSIS

Introduction

Through the engagement process, CCRPC sought to listen to and learn from the most vulnerable travelers in the County. This included people walking and biking who are low-income, Black or other people of color, seniors and youth, and people with limited English proficiency. In assessing the regional network, it is critical to value community members' lived experiences as essential data, and the equity analysis builds upon stories and lessons shared during listening sessions and other engagement activities. It identifies disadvantaged populations, and assesses disparate impacts at the local level, such as historic transportation funding and the role of structural racism in shaping the transportation system.

Ensuring equity and embracing diversity are key principles in Chittenden County's planning processes. As the most populous county in the state of Vermont, it is home to a diverse cross-section of residents living in rural, suburban, and urban communities across the county. However, the County's planning efforts need to acknowledge the historical disparities in transportation, the economy, housing, and health, all of which affect residents' ability to thrive, and address the present-day inequities between these diverse communities. This section examines both historical and contemporary inequities within Chittenden County, compares local and national trends, and offers key takeaways about the disparities in income, transportation access and cost, environmental conditions, and more throughout the county.

Historical Inequities

In 1956 the first Federal-Aid Highway Act was passed to create the interstate system. This law, in concert with the 1949 Housing Act, led to widescale construction of highways through urban, Black communities to facilitate and support white flight throughout the 1950s-1970s. Displaced populations were relocated to massive public housing projects, notorious for their inhumane living conditions and poor construction. Such projects are less common in sparsely populated Vermont, but Burlington still features several public housing

projects from the era of urban renewal, notably Decker Towers, which is now reserved for seniors and people with disabilities. Urban renewal projects also removed existing neighborhoods, including Burlington's Little Italy, which was razed in the 1960s.

The history of transportation planning in Chittenden County plays a role in these disparities as well. As is the case with many communities, the county's urban core, centered in Burlington and Winooski, was separated from the suburban and rural population by the construction of I-89 in 1963, particularly the portion north of the I-189 spur. The I-189 spur itself extends into parts of South Burlington and Burlington, though originally there were plans to extend the spur along Lake Champlain that would have further isolated vulnerable populations in these communities. It should be noted that the current design of the Champlain Parkway project that is moving forward evolved to minimize impacts to vulnerable and underserved populations in the area.¹

The civil rights movement led to widespread calls for school integration, housing reform, and access to jobs for urban, Black communities nationwide. The passage of the Fair Housing Act in 1966 was intended to prevent discrimination in housing in response to the systemic inequities caused by redlining and other racist housing practices. The nationwide uprising of 1968, following the assassination of civil rights leader Martin Luther King, Jr., led to a renewed exodus of whites from cities and a decline in urban economies. While 71 percent of Chittenden County's residents lived in the dense urban core in 1940, half of the county's residents had settled on greenfield sprawl by 1996.² Nationwide, this migration climaxed in the 1970s, when more than two-thirds of large cities lost population³ and jobs, accelerating their financial crises.

Economic restructuring was also a factor that contributed to the fragmentation of the urban core, which in turn, motivated residents to move out of deteriorating urban areas and into newly built suburbs. Deindustrialization led to the decentralization of cities. The suburbs were viewed as a way for whites to escape urban blight, while people of color, low-income residents and the dependent elderly were unable to afford to move or/and experienced rampant racism in the suburban real estate process. Moreover, investments in mass motorization intensified the ease of white flight. At the same time, initiatives to expand transit were stymied by suburban racism.^{4 5}

Contemporary Inequities

Inequities from the past have contributed to present-day outcomes for disadvantaged groups in Chittenden County. County-wide, vulnerable populations experience disparate outcomes in environmental exposure, income, transportation and housing costs, police interactions, and more. Across a range of demographic groups, past inequities influence people's spatial distribution throughout the county. Conversely, where people live in turn impacts their access to services and essential needs.

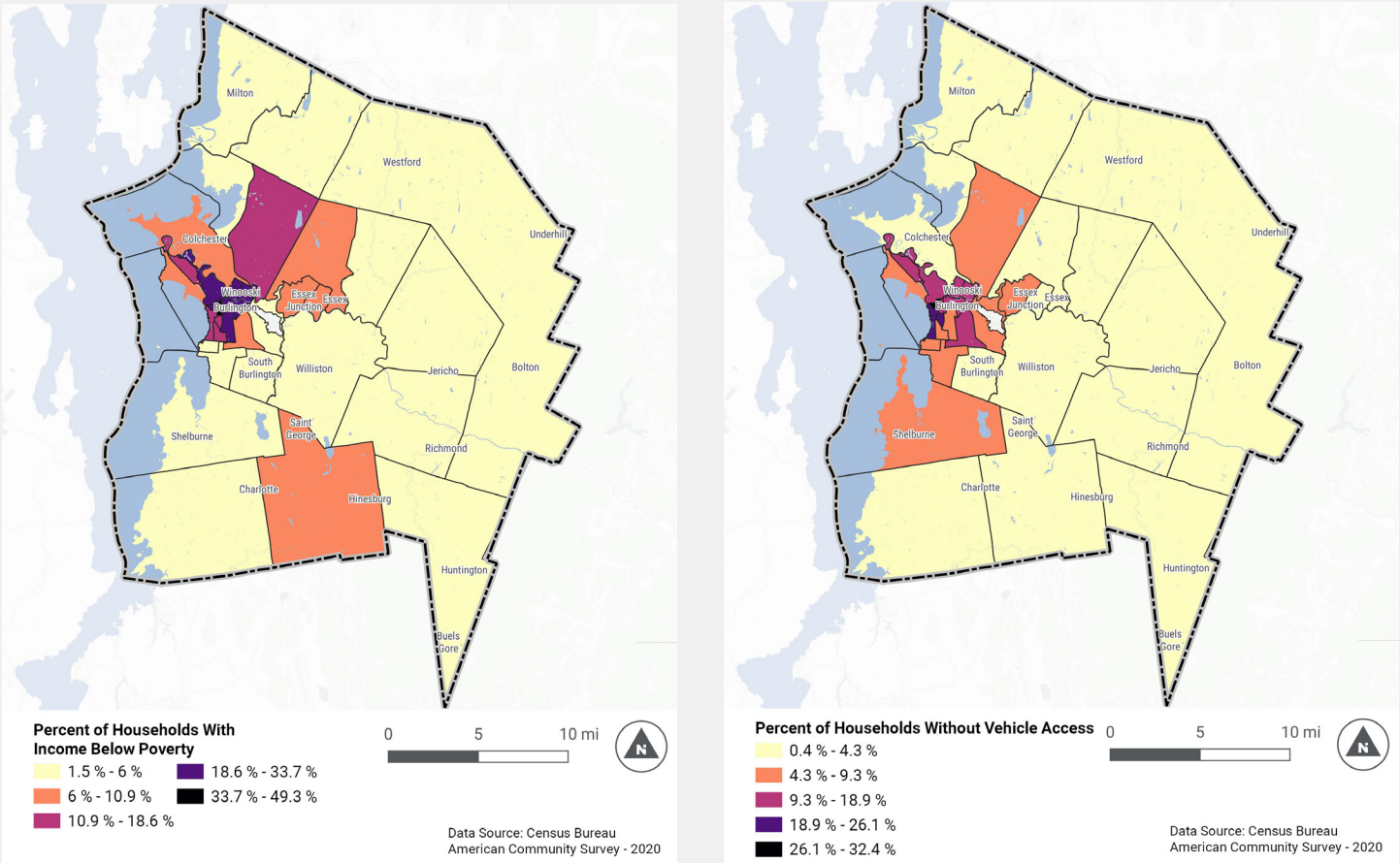
Past policy decisions have directly impacted the quality of life for certain disadvantaged groups. For example, the communities along I-89, particularly in Burlington, Winooski, South Burlington, and Colchester, are home to the highest concentrations of people of color, households below the poverty line, households without vehicle access, and residents with limited English proficiency in the county. Particulate matter exposure and asthma rates are also much higher in areas near the highway compared to the rest of the county, putting these vulnerable populations at greater risk.⁶

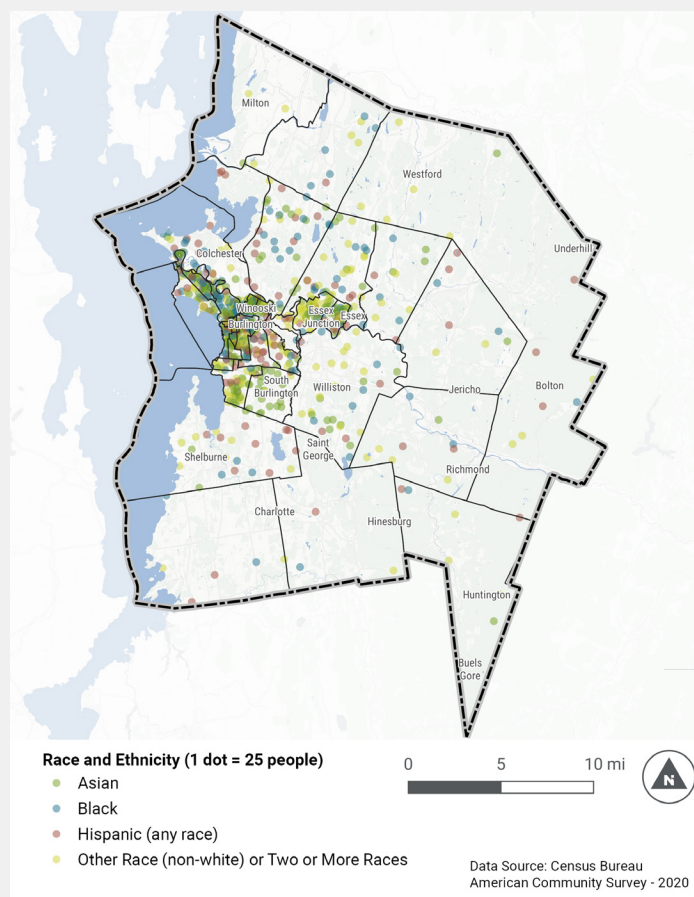
Across the county, transportation access is difficult for many. A family making the median income in Chittenden County is estimated to spend nearly half (49 percent) of their income on housing and transportation costs combined, above the 45 percent threshold to be considered cost burdened.⁷ Sixteen percent of Chittenden County households are considered severely cost burdened.⁸ About 8 percent of households have no access to vehicles despite much of the county’s development being geared towards automobile infrastructure.⁹

Disparities between racial and ethnic groups also exist in Chittenden County. While the median household income of \$76,806 is the highest in the state and 22 percent higher than the statewide median, Black households’ median income was less than half the County average at \$36,824.¹⁰ Chittenden County residents of color also experience different treatment in interactions with police, particularly during traffic stops. Compared to white drivers, Black drivers are about 3.5 times more likely to be searched and Hispanic drivers are about 3.9 times more likely to be searched during traffic stops. Black drivers are arrested about 70 percent more often than white drivers, while Hispanic drivers are about 90 percent more likely to be arrested during traffic stops.¹¹

These numbers are not uncommon, but they should be cause for alarm among decision-makers. Some municipalities and advocacy groups are taking steps to reduce inequities, but the County overall lacks a strong coordinated effort in addressing racial and ethnic disparities. Through its own organizational assessment, the CCRPC is currently exploring its potential role in providing a forum for regional collaboration to address inequities. **Figure 2** shows key demographic indicators for the entire county, based on census tracts. For an interpretation of the maps, discussion of additional equity indicators, and an overview of disparities in Burlington specifically, refer to the [Equity Analysis Memorandum](#).

Figure 2: Poverty, Race/Ethnicity, and Vehicle Access





Conclusion

Chittenden County's history diverged from many parts of the country in that it did not see massive demographic shifts in the second half of the 20th Century due to federal policies and structural racism. The County did, however, experience the impacts of urban renewal, housing and highway projects, and many disparities persist in the County today, especially for low-income residents of color and other underserved populations. There are strong opportunities for enhancing active transportation accommodations in those communities, and listening sessions with these groups indicate those improvements would be welcome.

These findings led to several additional equity-focused tasks as part of the ATP:

- The [Bicycle Network Analysis](#) (described below) examines network improvements in high need neighborhoods based on race, income, and vehicle access.
- The project prioritization process (described [here](#)) includes an equity factor that gives a higher score to bicycle network projects serving different types of equity needs (such as minority, low-income, and low-vehicle access census tracts) and larger numbers of high needs areas. The equity factor is weighted higher than any other factor to reflect its importance to CCRPC and the communities it serves.

BICYCLE NETWORK ANALYSIS (BNA)

The BNA examines existing bicycle network connectivity, as well as the impacts of potential improvements; these include systemic changes like building more low-stress routes in high need communities (such as minority, low-income, and low-vehicle access census tracts), as well as corridor-specific changes.

Network connectivity can be a difficult concept to describe, understand, and, crucially, to measure. While traditional methods of aggregating mileage of bike lanes or measuring “as-the-crow-flies” distances between destinations and bike facilities are easy to measure, they fail to capture the importance of having an interconnected network of low-stress bike routes connecting people to their destinations. BNA aims to capture the importance of the interconnectedness of bicycle routes by measuring access to destinations through four components:

1. Data Consolidation
2. Level of Traffic Stress
3. Connectivity Analysis
4. BNA Scores

Data Consolidation

The BNA draws from many datasets to accurately measure and visualize a bicycle network’s connectivity. Connectivity analysis requires a routable street network consisting of segments and intersections. The project team imported a routable network from [Open Street Map](#) (OSM), which is a crowdsourced geographic database of the world. The imported network contains all streets and paths where bicycle travel is allowed, as well as number of roadway lanes, speed limit, and bike facility information. We complemented OSM data with other CCRPC and Vermont Agency of Transportation (VTrans) datasets to fill data gaps.

Level of Traffic Stress

Level of Traffic Stress (LTS) is the stress a bicyclist experiences due to roadway and traffic conditions. LTS values can range from 1 to 4, with LTS 1 being the lowest stress and LTS 4 being the highest stress. LTS 1 and LTS 2 are generally considered low-stress, which is acceptable to the majority of the adult population. A segment’s LTS value depends on factors such as number of lanes, traffic volume, speed, presence of bike facility, parking lane, width of bike lanes, etc. In addition to the stress values for a segment, there can also be stress at intersection crossings, which varies depending on the number of crossing lanes, speed, volume, and traffic control device present at the intersection.

Using the LTS criteria, every segment in the network is assigned a stress level. In addition to the segment stress, crossing stress values are also assigned where appropriate. Generally speaking, higher crossing stress applies to smaller streets when they cross a larger road without any intersection control devices like signals, stop signs, or median crossing islands. **Figure 3** shows a map of all segments in the County classified by LTS values. Many of the busier roads in the area are high-stress – unless they have a bike facility along them – which leads to a disconnected network, since low-stress residential roads do not form longer continuous routes.

Connectivity Analysis

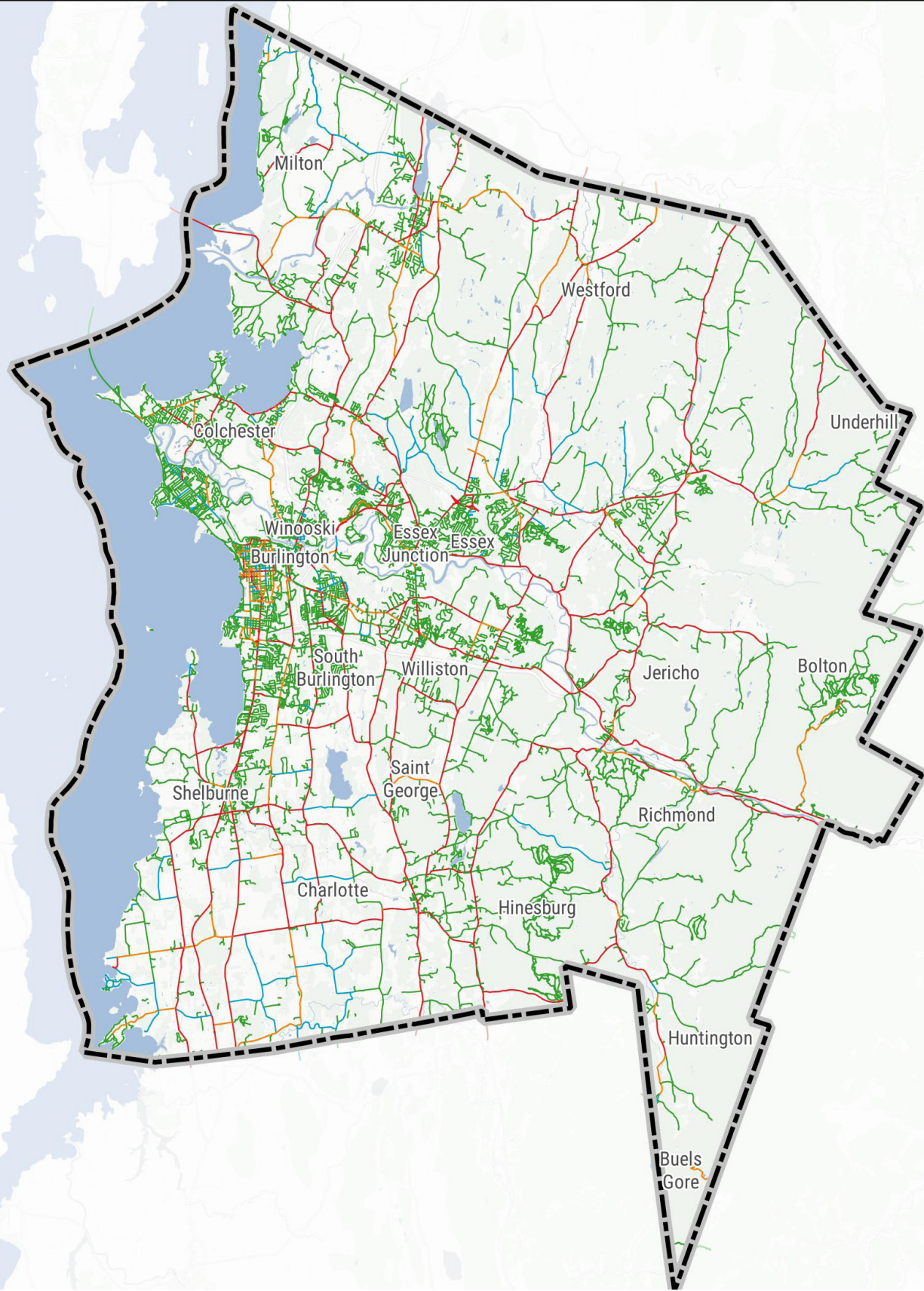
Connectivity analysis is done at a block-to-block level. For each census block, a shortest path is calculated both along the low-stress network (LTS 1-2) and overall network (LTS 1-4) within three miles. Travel along the low-stress network often requires longer distances than the overall network, which can be a barrier when the low-stress distance far exceeds the overall network distance. To account for this, a maximum detour of 25 percent is applied to low-stress routes when compared to overall network distance. BNA's routing algorithm takes into account both segment stress and crossing stress – a low-stress route is possible only if it does not require travel along any high-stress links or high-stress crossings. The output of this analysis is a list of census block pairs that are connected using either the low-stress links or all links.

BNA Scores

The project team calculated BNA scores for the baseline network and two network improvement scenarios. The baseline network consists of the current street and bikeway network. The two network improvement scenarios examine BNA scores when LTS values are reduced to become low-stress on certain parts of the network.

The final step of BNA is to assign a score to each block on a scale of 0 to 100 based on the destinations that can be reached using both low-stress and high-stress networks, with higher scores suggesting greater accessibility to destinations. Each census block is assigned a score for each individual type of destination and scores are aggregated based on weights assigned to that destination type. A full list of destinations and their weights is given in Appendix B of the [Bicycle Network Analysis Memorandum](#).

BNA results in **Figure 4** show the number of destinations reachable using high-stress and low-stress networks from each block. However, any block without high-stress network access to a given destination type automatically gets a score of zero for that destination type. This means that blocks with higher scores have more destinations nearby and those destinations are accessible by low-stress network. This measure is a useful way to combine the effect of both the low-stress network and proximity to destinations. As a result, destination-rich areas in and around Burlington get higher scores than the outlying areas.



Level of Traffic Stress

- 1
- 2
- 3
- 4

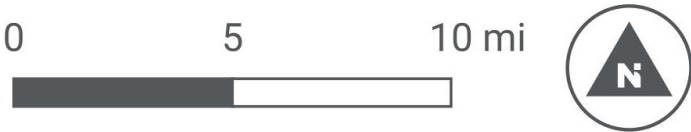
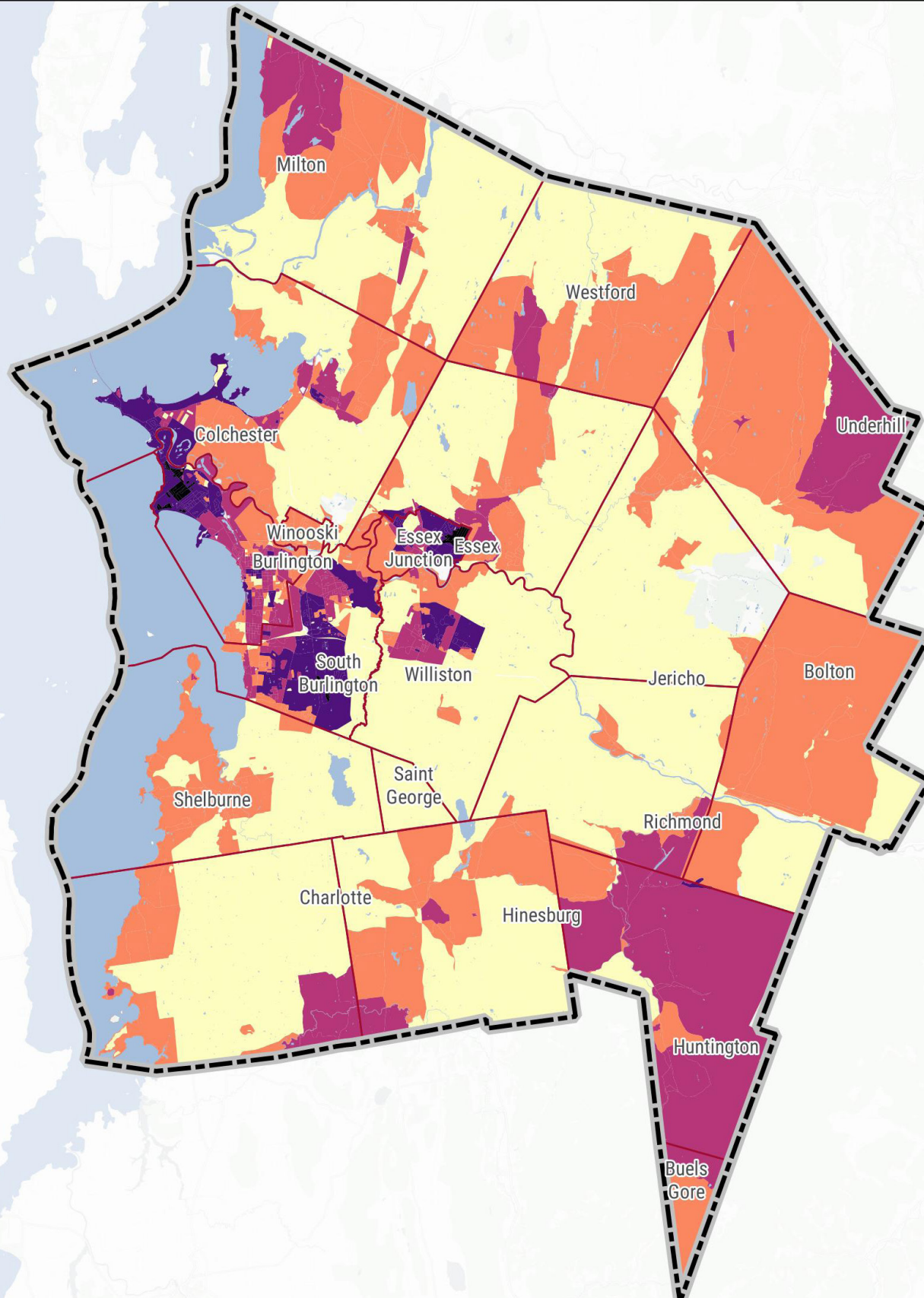


Figure 3: Level of Traffic Stress



Bicycle Network Analysis Score

- 0 - 10 (Lower Connectivity to Destinations)
- 10 - 25
- 25 - 40
- 40 - 60
- 60 - 100 (Greater Connectivity to Destinations)



Figure 4: Bicycle Network Analysis – Results

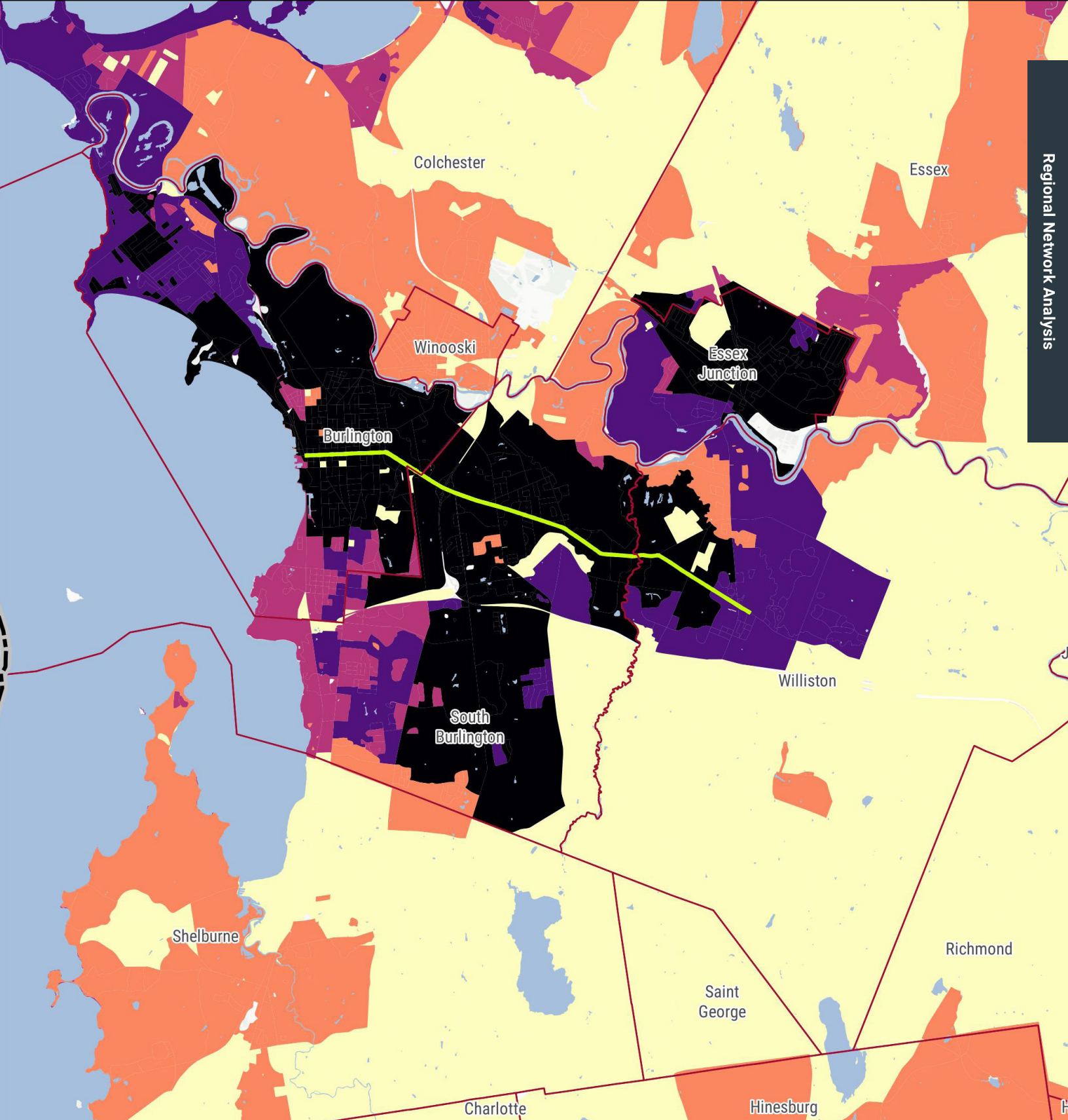
Scenario 1 – Route 2 Improvements

This scenario looks at improvements along the Route 2 corridor from the Lake Champlain waterfront in Burlington, continuing through South Burlington, and ending at Taft Corners in Williston. South Burlington received a RAISE grant to design and construct a separate walk/bike bridge over I-89 at Exit 14. This bridge will close a critical gap, and a scenario reducing LTS going both west and east to complement this project can help guide project development and additional improvements nearby. This corridor scenario also captures several other planned projects, including Burlington’s Conceptual Design of the Great Streets – Main Street project, South Burlington’s Williston Road Bike/Ped Improvements between Dorset and Midas Drive/White Street in draft FY23-26 TIP, and potential active transportation facilities on Williston’s Official Map. The scenario assumes that all the segments included (shown in purple below) are low-stress (LTS 1 or 2) and any high-stress crossings along those segments are also low-stress.

As expected, BNA scores for the Census Blocks immediately adjacent to Route 2 increased since those blocks now have low-stress access to the destinations along that corridor **(Figure 5)**. In addition, some blocks which are not immediately adjacent to Route 2, like those in the southern part of South Burlington, also saw improvement in BNA scores. This change indicates that network improvements along a given corridor can have a positive impact on locations away from the corridor as well.



Cycling the Burlington Greenway, which features quick build protection, wayfinding, and pavement markings.



BNA Score - Route 2 Scenario

- 0 - 10
- 10 - 25
- 25 - 40
- 40 - 60
- 60 - 100

Town Boundary

Route 2 Scenario Segments



Figure 5: Route 2 BNA Scenario – Input and Results

Scenario 2 – Equity Focused Improvements

This scenario looked at network improvements from an equity-centered perspective. Candidate segments were identified by first selecting all the high-stress segments in Environmental Justice (EJ) Census Tracts in the County that had more than 50 percent for at least one of these three equity indicators:

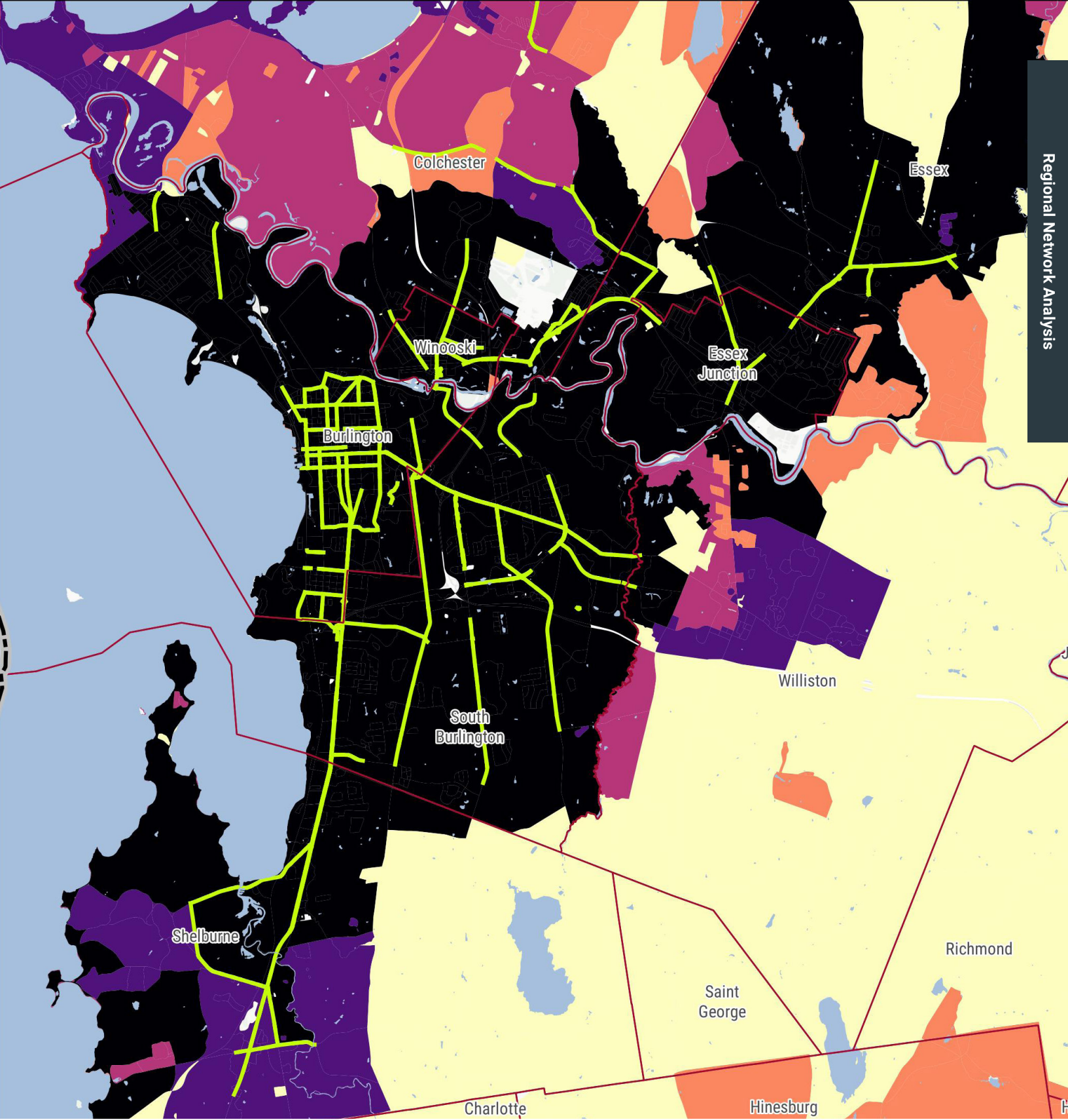
1. Percent of BIPOC population
2. Percentage of households without vehicle access
3. Percentage of households with income below poverty level

CCRPC staff then reviewed the candidate segments and flagged segments to be included or excluded in the equity scenario. Professional expertise, local knowledge, and previous planning efforts informed these decisions. The project team made some minor adjustments to the reviewed segments to fill gaps in the review process and to select a final shortlist of scenario segments.

Since this scenario consisted of improvements to many high-stress segments in EJ tracts, the BNA score improvement was very apparent in those tracts (**Figure 6**). Almost all of Burlington, South Burlington, Winooski, and Essex Junction received very high scores. Improvements do not extend too far beyond these scenario segments. This is likely due to higher stress on roads that connect to the scenario segments from outside of the EJ tracts. While this scenario included several network improvements that may not be possible to implement in a short time frame, these can be included in the County's long range planning efforts, as they have a large network benefit.



Local Motion's Bike Smart program provides all of the equipment and curriculum needed for kids to learn to bike safely.



BNA Score - EJ Scenario

- 0 - 10
- 10 - 25
- 25 - 40
- 40 - 60
- 60 - 100

- Town Boundary
- EJ Scenario Segments

Figure 6: EJ BNA Scenario – Input and Results

4.3

TRIP POTENTIAL ANALYSIS (TPA)

Introduction

Trip potential is an evaluation of factors that are likely to lead to higher levels of walking activity, bicycling activity and trail usage. The analysis is intended to highlight areas where the existing infrastructure already supports high numbers of people walking and biking or where such activity is currently low and improvements in infrastructure would be expected to increase it. Research has identified positive correlations between walking and biking activity and land use diversity, intersection density, population density, and destination density.

The ATP includes four trip potential analyses: one for bicyclists countywide, one for pedestrians countywide, and two for pedestrians in local jurisdictions (South Burlington and Milton). For each mode, CCRPC staff selected up to five unique trip types (origin-destination or O-D pairs). Because the O-D connections are modeled without regard for the underlying transportation network, the analysis identifies locations where trip activity could occur regardless of whether walk/bike facilities currently exist or not. This approach is useful for highlighting areas where new or improved connections would be expected to increase walking and biking activity.

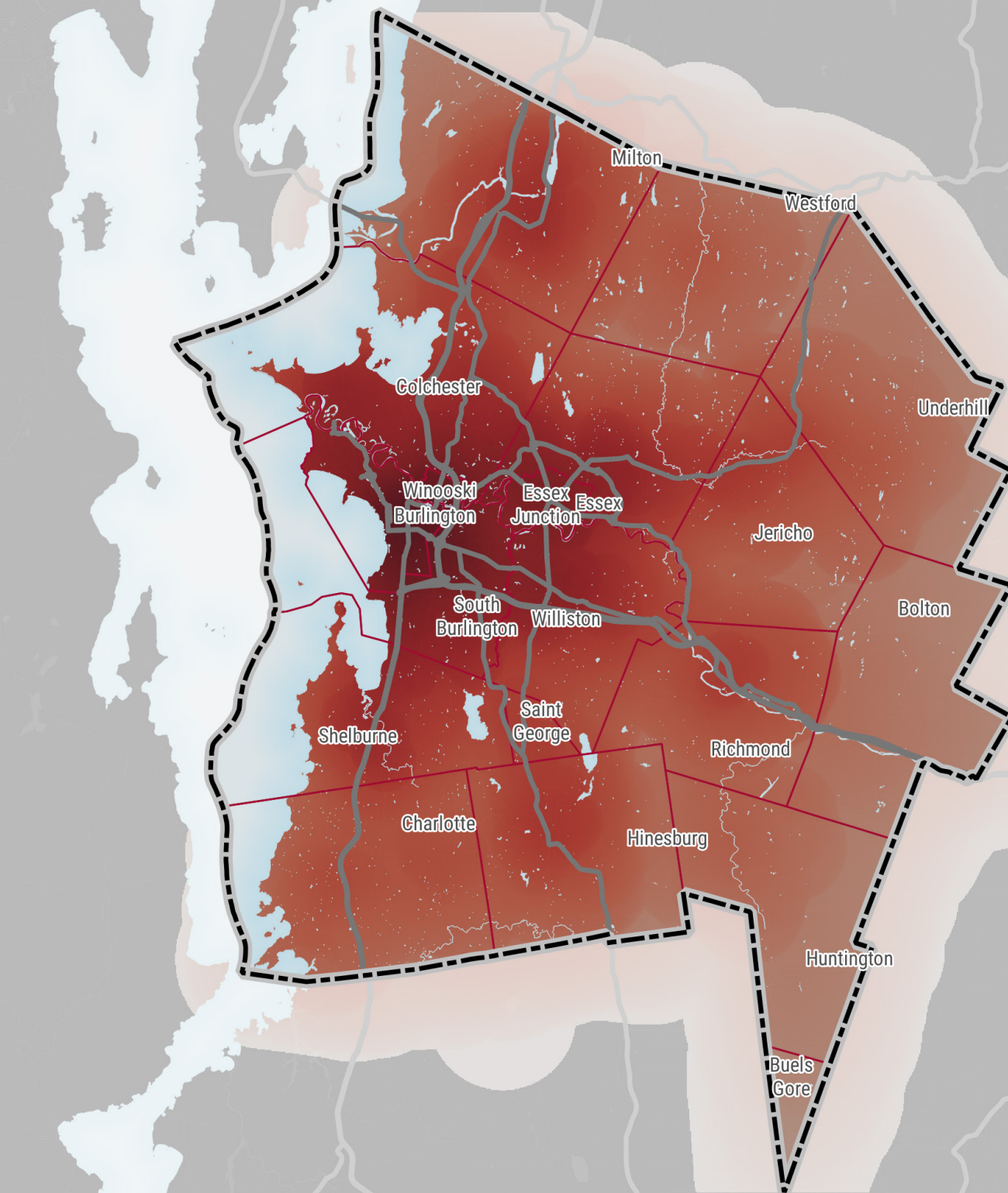
The following categories were included in O-D pairs:

- Commercial activity
- Employment
- K-12 Schools
- Parks
- Population
- Transit

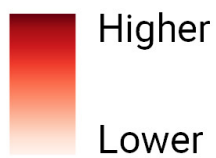
Trip Potential Index

The project team calculated an index for each type of origin-destination pairing. The index identifies features in the origin and destination datasets that are within walking or biking distance. The index draws a straight line connecting O-D pairs, applies a value to the connection, and uses a decay factor as distance from the straight line connection increases. Notably, this emphasizes the potential connection between origins and destinations, rather than simply highlighting destinations.

These values are then synthesized into an overall composite index using weights that indicate the relative importance of a trip type (**Figure 7 and Figure 8**). The [Trip Potential Analysis Memorandum](#) includes lists of origin-destination pairs for each mode (bicycling and walking) and mapped results for each origin-destination pair by mode.



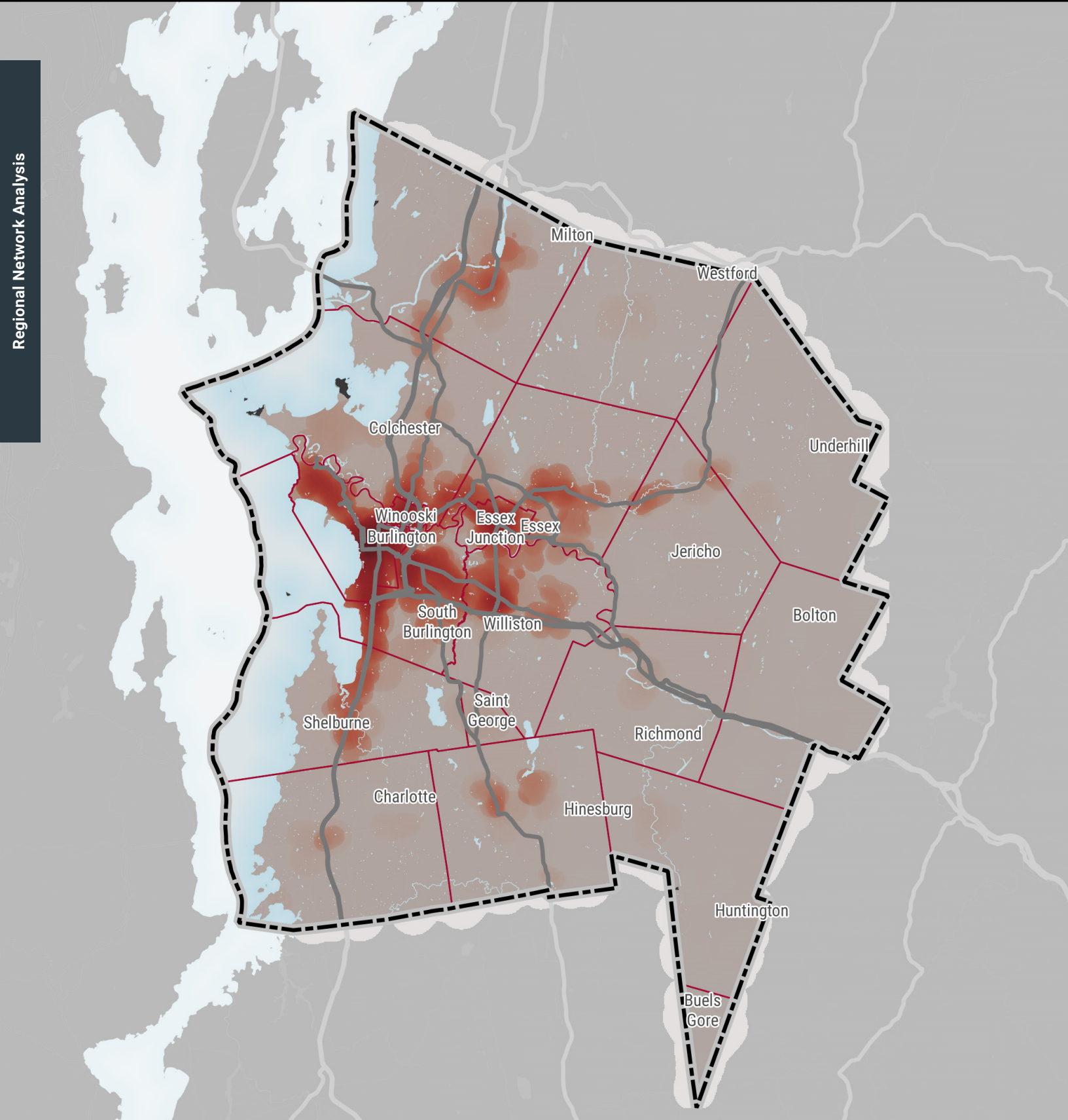
Bike Trip Potential Index



0 5 10 mi



Figure 7: Countywide Bicycle Trip Potential – Composite



Pedestrian Trip Potential Index

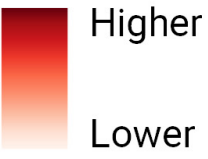


Figure 8: Countywide Pedestrian Trip Potential – Composite

4.4 UNPAVED TRAIL MAPPING

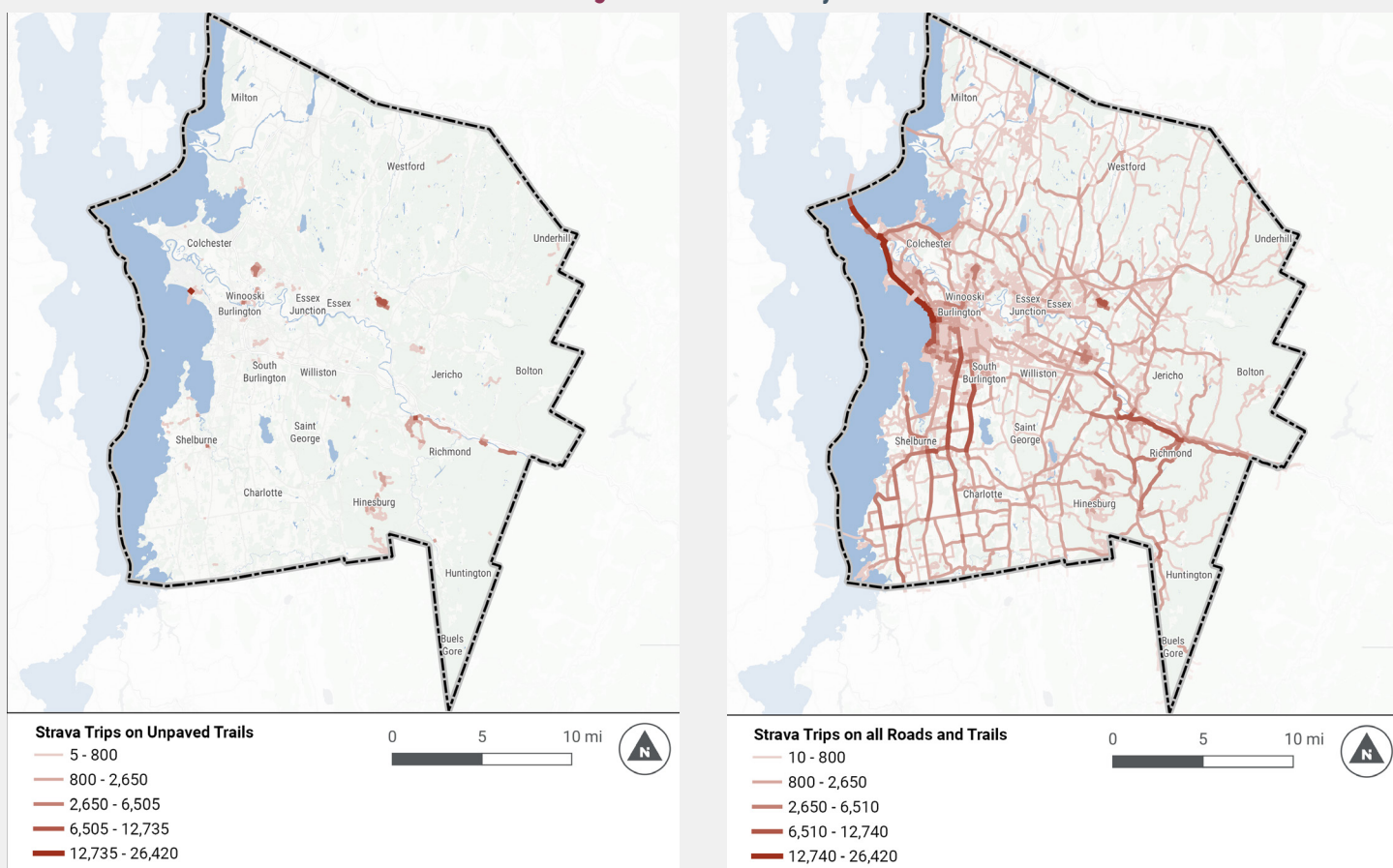
Unpaved trails are typically nature trails, mountain bike trails, and other dirt, gravel, or soft surface paths that are primarily used for recreation. Unpaved trails and roads provide an opportunity for gravel bicycling, one of the fastest growing sectors in bicycle sales.¹² This sport could encourage and support tourism and related economic development opportunities. Unpaved facilities are less desirable for transportation purposes due to winter maintenance and accessibility challenges. However, in some cases they may fill critical gaps in the active transportation network. They can also provide options for users in areas where on-road active transportation facilities are too circuitous, too expensive, or pose other challenges. Using online data tools, the project team examined a selection of unpaved trails to identify priority connections.

Figure 9 highlights the segments in the 2021 Strava dataset (symbolized by total volume in both directions) that are located within a 200-foot buffer of known unpaved trails. Key findings include:

- There seems to be significant activity on the Saxon Hill Trail network in Essex.
- Sunny Hollow Park in Colchester shows moderate use.
- There is less activity in Chittenden County Uplands and Parker River Shore Park outside Richmond, Hinesburg Town Forest, and Camels Hump State Park.

CCRPC can continue to work with local trail groups and users to identify other unpaved routes that could serve as connections in the regional network that are not identified in the Strava dataset, which is more recreation oriented.

Figure 9: Strava Activity



RECOMMENDATIONS

5.0

INTRODUCTION

Developing infrastructure and policy recommendations for the 2022 ATP was a joint effort between CCRPC staff, the project team, and the Advisory Committee. Bicycle and pedestrian network recommendations were based on findings from earlier analysis and research, including the Trip Potential Analysis and Bicycle Network Analysis, as well as presence of existing facilities, Transportation Improvement Program (TIP) and Metropolitan Transportation Plan (MTP) project locations, and important destination locations. CCRPC staff also conducted extensive outreach with local government and other key stakeholders as part of network development. That outreach led to an understanding of local active transportation needs and many of the proposed projects and ideas that are part of this plan.

Developing a plan that addresses both walking and bicycling can be challenging because of the different geographic scales of these modes. The proposed network focuses on accommodating bicycle travel. By nature, walking trips tend to be short distances within local communities, so developing a countywide pedestrian network is of limited utility. Walking trips are also difficult to plan for on a countywide level because they often involve local network and site-specific issues, such as first-last mile connections, ADA access to destinations, and the impact of local maintenance operations.

5.1

COUNTYWIDE BICYCLE NETWORK

Overview

The proposed countywide bicycle network includes about 200 miles of streets that would allow users of all ages and abilities to traverse the County on comfortable bicycle facilities. It includes routes along specific roadways and regional trails that create a logical and convenient network to improve connectivity across the County.

Figure 10 shows the proposed countywide bicycle network. The projects overlap with many of the high priority corridors identified in the 2017 Proposed Regional Active Transportation Network, further highlighting the need for active transportation upgrades on these streets. Existing off-street shared-use paths and trails were also included to highlight the high-comfort network connectivity that will be achieved once the network is implemented.

Public Input, Existing Bicycle Facilities, TIP, MTP, and Other Destinations

The project team refined bicycle network recommendations by examining desired and actual connections to other planned or existing facilities. Network recommendations connect to existing trails to ensure the recommendations lead to a connected network of comfortable facilities. For example, approximately half a mile of Harbor Road in Shelburne was added to the network to provide a connection between Shelburne Road and the Ti-Haul Trail. Other recommendations end at (i.e., connect to) existing trails, such as the northern terminus of the Spear Street recommendation in South Burlington and the West Lakeshore Drive and Prim Road recommendations in Colchester.

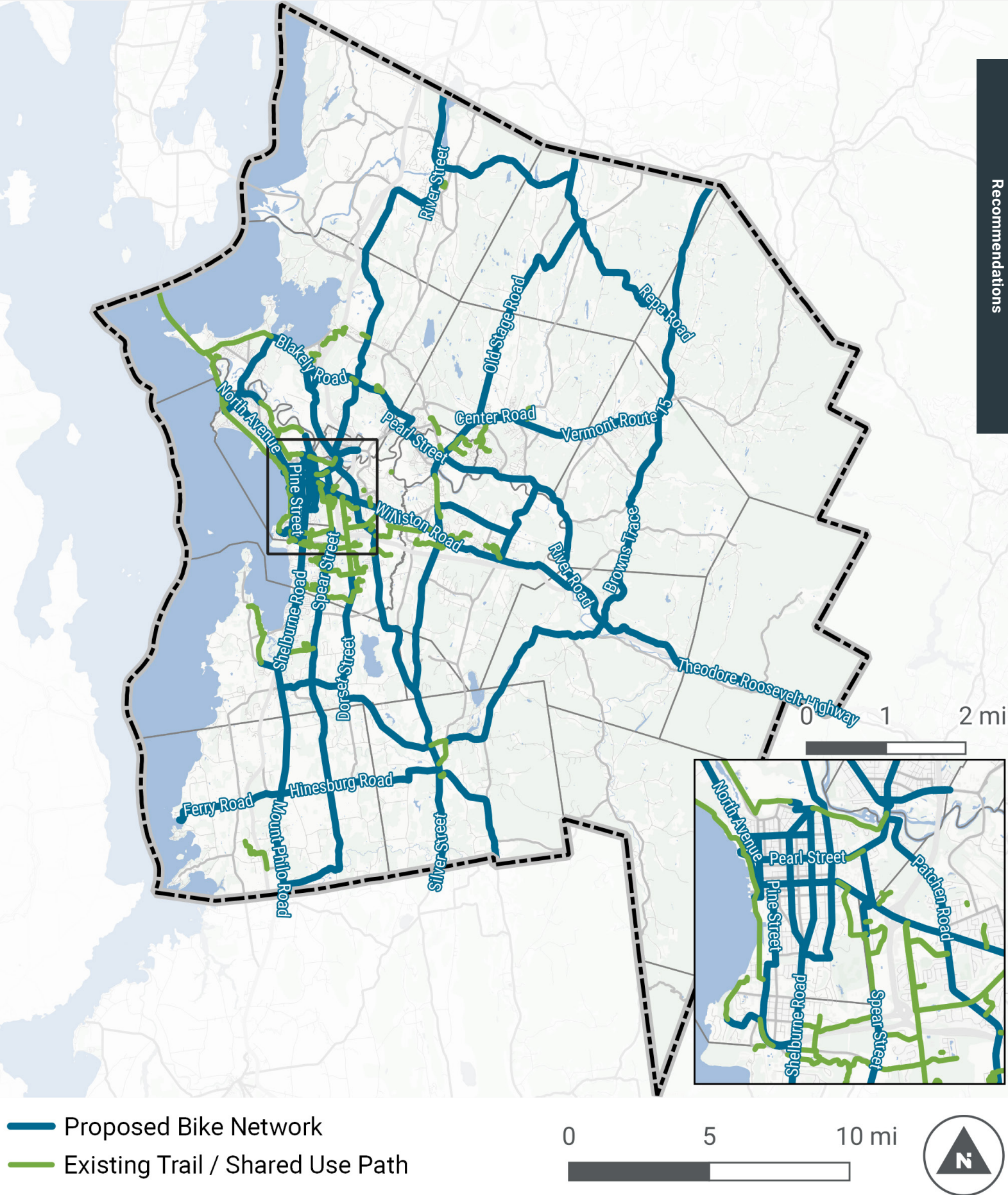


Figure 10: Countywide Bicycle Network

Public feedback indicated desires for connections to facilities like the Waterfront Park in Burlington, which are included at multiple points. Feedback also focused on the need for connectivity over the interstates separating Burlington from South Burlington, so multiple connections are included in the network.

Many of the network recommendations are in areas with projects planned in the TIP and MTP. While some of these projects already included active transportation elements, like the path along Williston Road in Williston and the path on Spear Street crossing I-189 in South Burlington, most of these projects are highway-related. They present opportunities to incorporate high-comfort bicycle and pedestrian facilities where they coincide with ATP network recommendations. In addition to routes connecting more rural towns with Burlington, such as the TIP project along Shelburne Road through Shelburne and South Burlington, many TIP projects make up the core bicycle network in Burlington itself, where the demand for bicycle facilities is highest.

Finally, the network is designed to accommodate connections to important destinations, particularly schools and future growth centers. For example, connections to the existing network near the University of Vermont are included along Main Street in Burlington and via Spear Street. Since the catchment area for Richmond schools include children in Jericho and Underhill, Browns Trace is included in the network to connect these towns. Similarly, since Hinesburg schools include students living in Shelburne, it was important to include the Shelburne Falls Road/Dorset Street/Irish Hill Road connection in the network in addition to connections to Charlotte, St. George, and Williston that were included due to high trip potential. The future growth center identified in the CCRPC Future Land Use Plan in Colchester is connected to nearby schools, residential areas, and commercial areas with network connections on Roosevelt Highway and Severance/Blakely Roads.

5.2

PROJECT LEVEL RECOMMENDATIONS

Project Identification

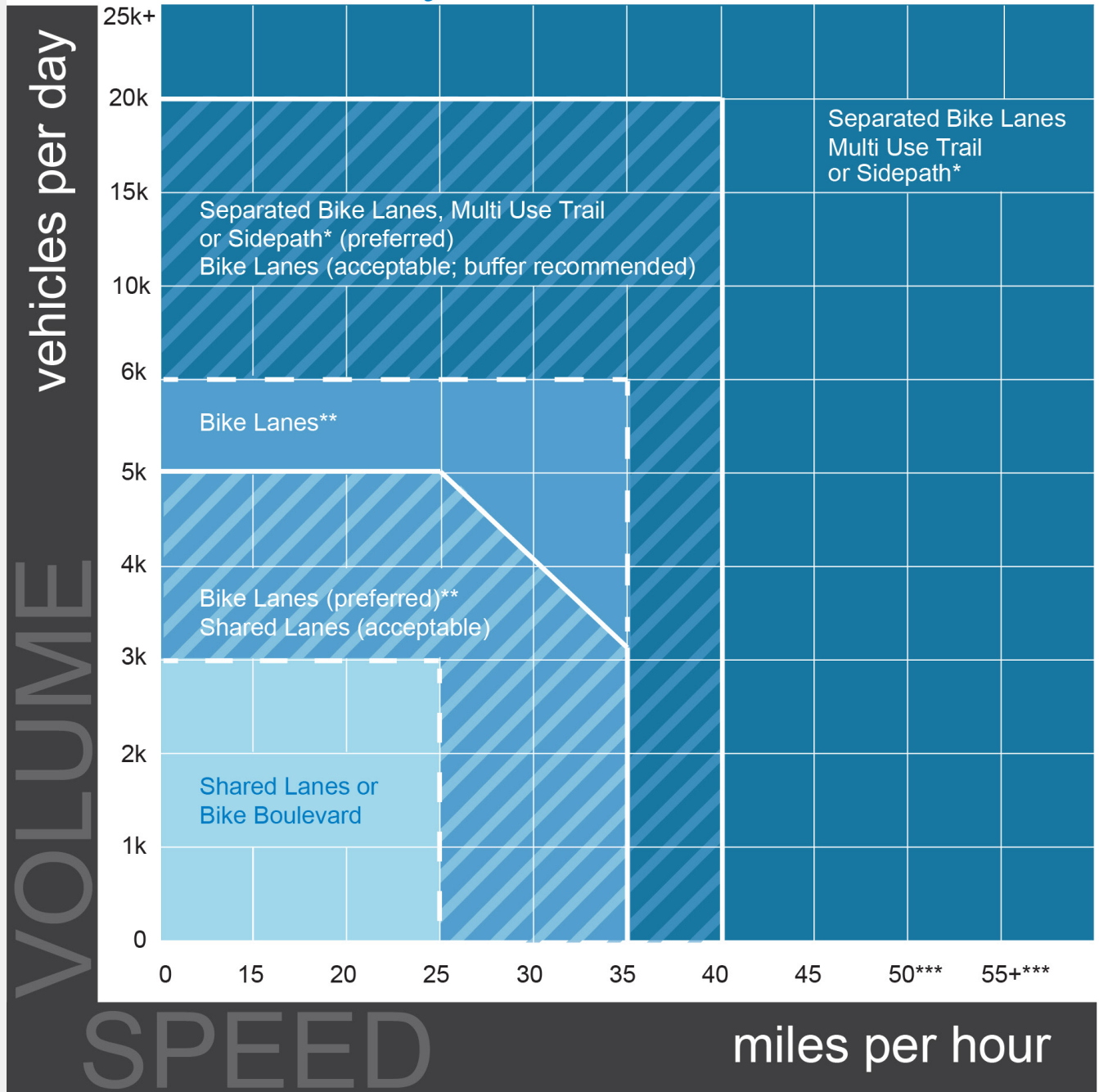
To facilitate project prioritization and implementation, the project team divided the network into 106 distinct projects based on road characteristics, existing bicycle facility limits, planned TIP project limits, and municipal boundaries. A complete list of projects and more information on project identification are available in the [Bicycle Network Recommendations Memorandum](#).

Facility Selection

Various methodologies can be used to select the appropriate bicycle facility based on roadway width, traffic volumes, speeds, and other considerations. **Figure 11** provides some guidance on how to select the appropriate facilities based on traffic volume and speed. These matrices include preferred and acceptable values for each facility type. Facility designers should use forecast traffic volumes if available. Additionally, designers should default to selecting the preferred facility when possible. For more information, refer to the FHWA's [Bikeway Selection Guide](#). Additional resources to consult during facility development are the FHWA's [Small Town and Rural Design Guide](#), AASHTO [Guide for the Development of Bicycle Facilities](#), and NACTO [Urban Bikeway Design Guide](#).

While CCRPC is providing resources and data for facility selection through this ATP update, it is beyond the scope of this plan to undertake comprehensive facility selection, which should instead be done as part of individual project scoping and development during plan implementation, in coordination with local agencies and project stakeholders.

Bicycle Accommodations-Urban



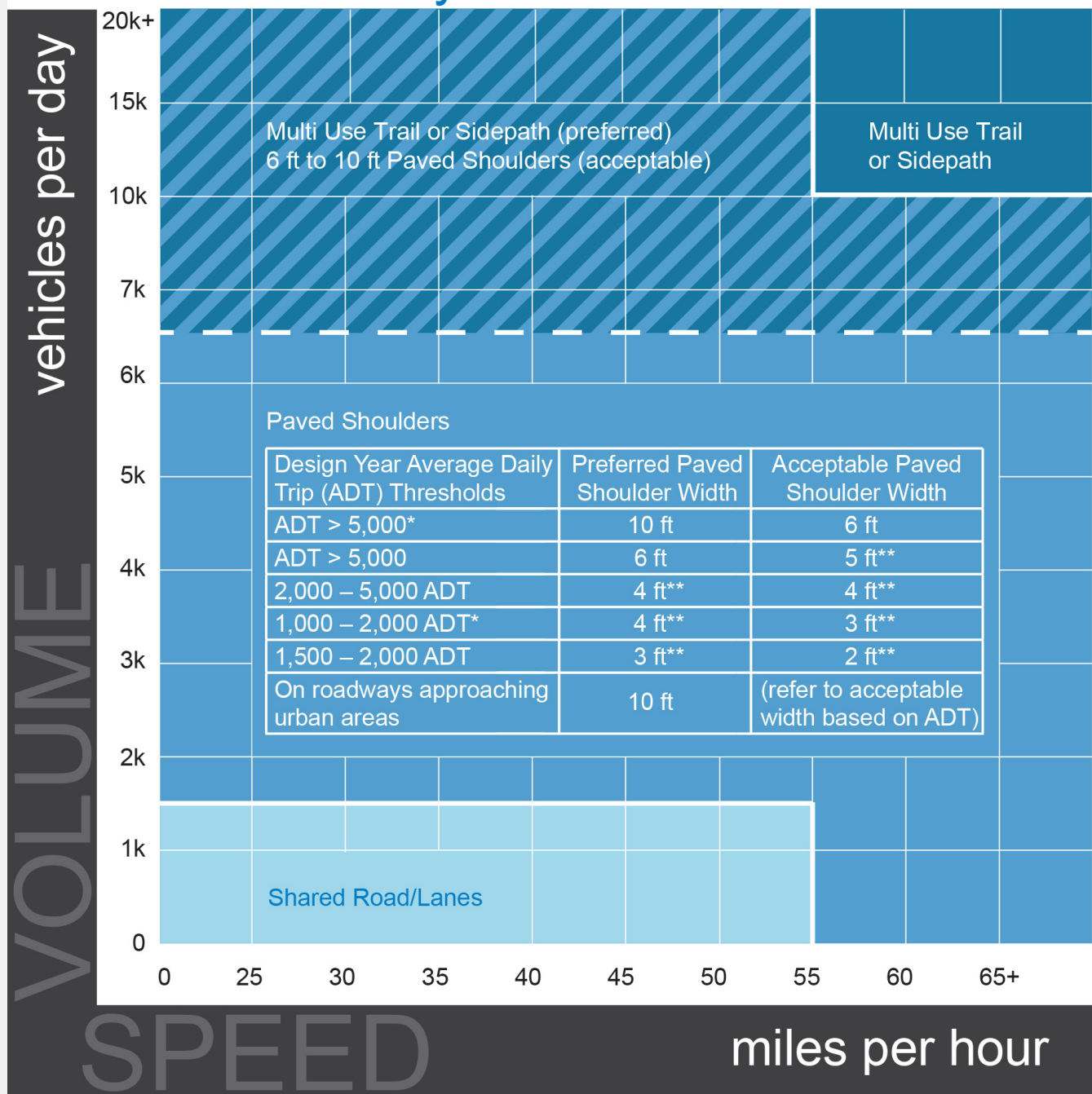
*To determine whether to provide a multi use trail/sidepath or separated bike lane, consider pedestrian and bicycle volumes or, in the absence of volume, consider land use.

**Advisory bike lanes may be an option where traffic volume < 4,000 ADT

***Speeds 50 mph or greater in urban areas are typically found in urban/rural transition areas.

Figure 11: Bicycle Facility Selection Guidance

Bicycle Accommodations-Rural



*On roadways where a higher level of bicycle traffic is expected (e.g., bike routes identified by cities, counties, RPAs, and MPOs, as well as official US Bicycle Routes and national trails).

**Paved width exclusive of rumble strips.

Figure 11: Bicycle Facility Selection Guidance



The temporary Burlington Greenway detour coordinated by Local Motion and Burlington Public Works provided a low-stress bike facility on Pine St. during the summer of 2020.

PROJECT PRIORITIZATION

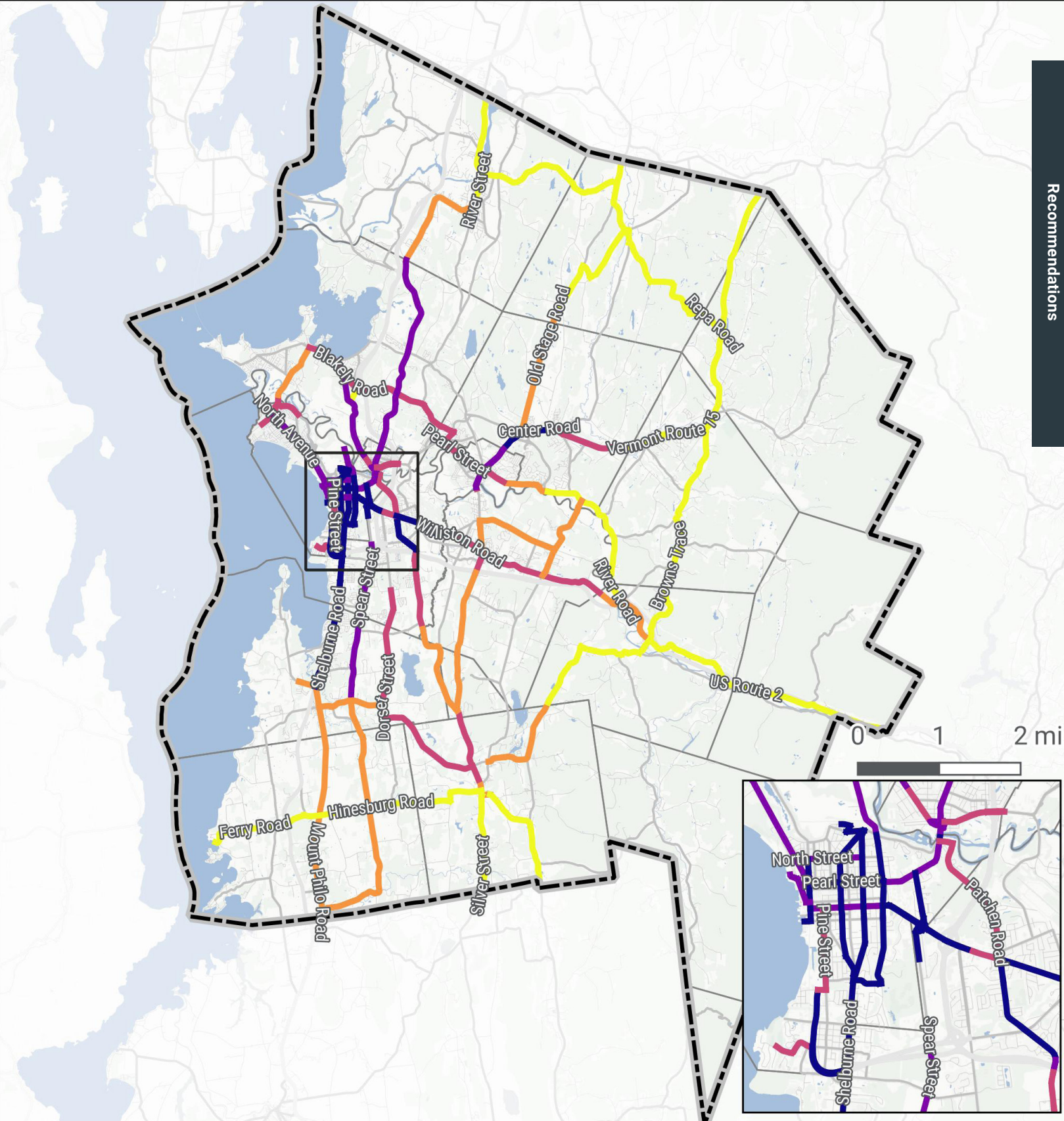
The project prioritization process established an order for funding and implementing projects based on a common set of criteria that stakeholders agreed upon. Agencies and communities have limited funding and resources, so it is important to prioritize projects that advance shared goals to the greatest degree. The process assigned a score to each of the proposed projects based on specific criteria:

- Equity
- Network Extension
- Safety – Speed
- Safety – AADT
- Demand
- Stakeholder Input

The objective of this analysis is to identify projects that rank higher within the prioritization framework so that investments may be focused and implemented accordingly. The final prioritization is calculated based on the individual scores and their factors. Where necessary, individual scores are rescaled to a same range of values to make them suitable for combining into a final score.

Figure 12 shows prioritization results. Projects near the more urbanized municipalities around Burlington have the highest prioritization scores. These projects tended to score better on Equity, Safety – AADT, and Demand metrics, while projects in more rural areas had higher scores on the Safety – Speed metric. Network Extension and Stakeholder Input scores were more evenly distributed throughout the county.

It was noted that projects may provide value to disadvantaged communities even if they do not fall within geographic EJ boundaries (for example, a project that connects an EJ community to a nearby job center). The project team will seek to identify such projects that were not captured by the equity prioritization factor. Data used in the prioritization process will be made available to municipalities to develop local active transportation networks that connect to the regional network. The table of prioritization factors and criteria are available in the [Project Prioritization Methodology and Results Memorandum](#).



Project Prioritization Scores

- 1 - 22 (Lowest Priority)
- 22 - 39
- 39 - 57
- 57 - 70
- 70 - 83 (Highest Priority)



Figure 12: Countywide Bicycle Network – Prioritization Scores

LOCAL PEDESTRIAN NETWORKS

While countywide pedestrian infrastructure recommendations are beyond the scope of this plan, detailed recommendations were developed for Milton and South Burlington. This section provides guidance on how to replicate this process for other communities in Chittenden County.

Inputs

The project team developed local recommendations based on results of the Trip Potential Analysis, Strava activity data, public input, and CCRPC's TIP and MTP project locations. The team also used publicly available aerial imagery and Google Street View to assess infrastructure conditions, identify gaps in the sidewalk network, and determine the need for upgraded and expanded pedestrian facilities. For agencies completing this process locally, CCRPC encourages site visits, in-person data collection, and engagement with local residents to identify gaps and barriers.

- ***Trip Potential Analysis***

The [Trip Potential Analysis Memorandum](#) describes results of the countywide pedestrian trip potential analysis, and the dataset is available for download [here](#).

- ***Strava Data***

Local pedestrian network recommendations also relied on GPS trace data from users of the Strava mobile app, which shows pedestrian activity throughout the county.

- ***Public Input***

The project team used webmap results to refine pedestrian recommendations. Agencies can [obtain webmap results here](#), or use a variety of other engagement methods to collect more localized feedback, such as pop-up events, listening sessions, social media, or intercept surveys.

- ***TIP and MTP Project Locations***

Once local agencies develop pedestrian networks with the above inputs, they can identify priority routes by examining overlap with TIP and MTP projects, many of which are slated for funding and implementation in the coming years.

Outputs

The pedestrian network recommendations for Milton and South Burlington include pedestrian facilities and traffic calming recommendations that would allow users of all ages and abilities to enjoy safer and more connected walking environments. The pedestrian recommendations also include spot improvements such as high visibility crosswalks, median islands, and rectangular rapid flashing beacons (RRFBs). Spot improvements focus on high-stress, high usage intersections where new pedestrian safety countermeasures could improve safety for vulnerable users (i.e., children, older adults, mobility impaired individuals) and/or where the existing facilities are not working optimally. Examples include crossings near schools or parks that are not stop controlled or have a standard crosswalk.

For more information on pedestrian planning, refer to the [Local Pedestrian Network Recommendations Memorandum](#).



Bike pavement markings and a quick-build curb extension seen on Burlington's Old North End Greenway on a fall day.

5.5 PROGRAM AND POLICY RECOMMENDATIONS

In addition to the infrastructure recommendations described previously, policy and programmatic strategies and actions should play an influential role in the future of active transportation in Chittenden County. The proposed network would significantly increase active transportation, but there are other opportunities for walking and bicycling in the county. Policy and program actions maintain and encourage active transportation, and pursuing them now will ensure a strong policy framework as the proposed network is constructed. The ATP includes 32 program and policy actions divided into five categories:

1. Equity – Increase equitable access to transportation networks.

Equity recommendations build the framework for all action steps. By removing barriers for those who need safe, reliable, and affordable transportation choices the most, the community can better meet the needs of all travelers. Prioritizing equity requires Chittenden County's agencies, municipalities, business interests, community groups and others to collaborate to advance a safe and convenient active transportation network for the county's most vulnerable and underserved populations. Focusing on encouragement, connectivity and economic development, mode shift, and maintenance recommendations will positively influence the equity action steps, and vice versa.

2. *Encouragement – Promote a culture of walking and bicycling.*

Many of the recommendations listed in this section are being led by partner agencies and other organizations including Local Motion and the Chittenden Area Transportation Management Association. It is important for CCRPC to continue supporting these organizations and identify emerging needs or gaps that the CCRPC can help to fill.

3. *Connectivity and Economic Development – Provide safe and comfortable active transportation routes to support access to jobs, training, education, and childcare.*

There is strong interest in connecting walking and biking investments to economic activity areas throughout Chittenden County. This section focuses on prioritizing transit and active transportation plans serving low-income communities to boost growth in those areas, supporting demonstration projects to promote infrastructure that connects to new developments, and adding more destinations within easy walking distance.

4. *Mode Shift – Make it easier for people to choose low-carbon transportation modes.*

Mode shift recommendations show how to make a significant shift towards bicycling and walking as sustainable transportation options. All of the recommendations in the plan will aim to increase bicycling and walking mode share, either through direct infrastructure investments or supportive programming. This section focuses on tracking the outcomes and progress that result from other policy/program recommendations and network development.

5. *Maintenance – Maintain a safe active transportation network throughout the winter by proactively managing walking and bicycling facilities before, during, and after winter precipitation.*

Winter maintenance is an important component of creating a comfortable environment for walking and bicycling year-round. This area of practice is unique, requiring specific legal, technical, and design considerations to operate successfully. This section provides recommendations related to planning, funding, agency coordination, and appropriate staffing and equipment needed to perform winter maintenance.

For a complete list of program and policy actions, refer to the [Program and Policy Recommendations Memorandum](#). It also identifies lead and support roles for the parties involved in implementation, as well as recommended timeframes for each action. With a comprehensive programmatic and policy approach, the Active Transportation Plan will help improve the cultural, regulatory, and political environment for walking and bicycling in Chittenden County.

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