BOTTINEAU LRT / METRO BLUE LINE EXTENSION BICYCLE STUDY

Final Draft

February 2016

NELSON
NYGAARD

Table of Contents

Table of Figures

1 INTRODUCTION

PURPOSE OF THIS STUDY

The METRO Blue Line extension (Bottineau LRT) will bring light rail transit (LRT) to the northwest area of the Twin Cities. With Minneapolis and Brooklyn Park at either end, the 13-mile corridor passes through north Minneapolis and the cities of Golden Valley, Robbinsdale, and Crystal. This extension of the METRO Blue Line (Hiawatha) will connect to the METRO Green (Central and Southwest) Line and Northstar Commuter Rail at Target Field Station in Minneapolis. Up to 11 stations are proposed on the Bottineau LRT line, which is expected to provide approximately 27,000 rides a day by 2030.

The purpose of this study is to assist LRT and station area planners and engineers at Hennepin County, the Metropolitan Council, and cities along the line in ensuring that the Bottineau Transitway is optimally accessible to bicyclists of all ages and abilities traveling to, from, across, and along the Bottineau Transitway, including bicycle parking and other end-of-trip facilities in the station area. High quality bicycle connections will maximize LRT ridership in a cost effective and efficient manner. They will also allow corridor residents, many of whom experience health disparities including higher rates of obesity and type 2 diabetes, to incorporate physical activity into routine daily life by accessing the transitway using active transportation (walking and biking).

Hennepin County did not conduct bicycle studies for the Hiawatha (Blue Line) or Central (Green Line) LRT projects, which were the region's first LRT lines, opening in 2004 and 2014, respectively. These two LRT lines are frequently used by bicyclists. Hennepin County and partner agencies are interested in even further promoting potential connections between non-motorized transportation and transit in order to improve accessibility and mobility throughout the region. To that end, Hennepin County undertook bike studies in conjunction with the Southwest and Bottineau LRT lines, which are currently scheduled for completion in 2020 and 2021, respectively.

Hennepin County's decision to create a bicycle plan for the Bottineau LRT / METRO Blue Line extension reflects the agency's commitment to support station access throughout the County. This multi-jurisdictional plan proposes prioritizing investments that improve station access by bicycle and encourage bicycling along low stress routes that parallel the corridor for transportation and recreation.

This study was completed as an early part of engineering in close consultation with other LRT planning efforts, including the Brooklyn Park Bicycle and Pedestrian Plan. It includes review of county-generated demand projections, bike parking needs, network assessment within three miles of stations and circulation analysis at LRT stations. The Study complements station area planning already underway focused on ½ mile around each station and will be coordinated with that work.

VISION STATEMENT

Biking is a pleasant, comfortable, safe, and convenient option for traveling to, from, across, and along the METRO Blue Line Extension Light Rail Transit (LRT). High quality bicycle connections and parking in this corridor provide opportunities for physical activity, help residents and visitors access more destinations, institutions, and businesses, and increase LRT ridership.

STRATEGIES

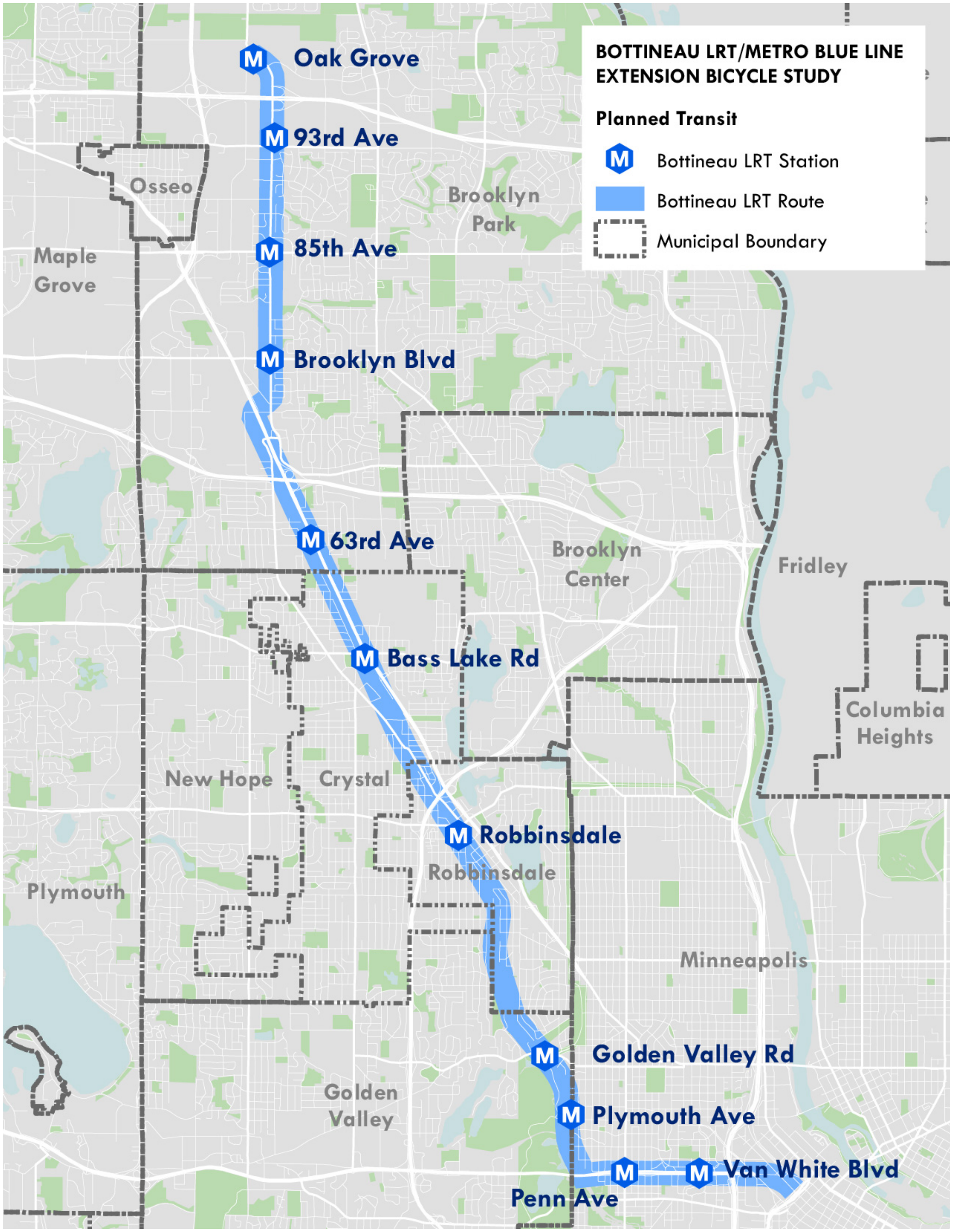
The study proposes the following strategies for connecting neighborhoods to LRT by bike:

- Leveraging light rail transit investments
- Ensuring ample, high quality bicycle parking
- Connecting neighborhoods to LRT stations with trails and/or on-street facilities
- Exploring options for bike share service at stations
- Including wayfinding between stations, trails, and other destinations
- Eliminating barriers, such as network gaps and hazardous intersections
- Identifying options for a parallel corridor-length low-stress bikeway
- Incorporate community input from related studies (station area planning, bike/pedestrian planning), and continue to engage underserved and underrepresented communities in the implementation of this study in order to ensure that all populations receive benefits from bicycling investments.

STUDY AREA

The Bottineau LRT/METRO Blue Line Extension Bicycle Study covers bicycle transportation related to the LRT corridor shown in Figure 1.

Figure 1 Bottineau LRT Corridor



2 BICYCLE NETWORK

BIKESHED METHODOLOGY

This section summarizes how bikesheds were developed for the Bottineau LRT / METRO Blue Line Extension Bicycle Study to symbolize the area easily accessible by bicycle from planned transit stations. The “first and last mile” connections to transit within the bikeshed are critically important to extend the reach and increase the ridership on transit.

While the Federal Transit Administration defines a bikeshed as a 3-mile radius around a transit station, this approach does not account for variations in road network connectivity and other barriers that can limit the area accessible on bicycle. To understand the bicycle accessibility of planned METRO Blue Line Extension (LRT) stations, a bikeshed analysis was conducted, including on street connectivity, topography, and energy consumption factors. The methodology is based on the approach developed by Hiroyuki Iseki and Matthew Tingstrom.[1]

Methodology

This bikeshed analysis used Geographic Information System (GIS) software to analyze bicycle access at each of the 11 planned METRO Blue Line LRT station areas. Existing road and trail infrastructure data was collected from municipalities in Hennepin County. Road and trail data was updated to reflect existing conditions and changes since the GIS files were developed.

A digital elevation model of Hennepin County from the U.S. Geological Survey’s National Map website was used to provide topographical data. Elevation data was joined with the street and trail network to calculate the slope of each segment, traveling in each direction. After collecting and updating the data, GIS software was used to create bikeshed areas around transit stations based on the energy required to bicycle on streets of varying slope and to stop at various types of intersections.

Calculating the Energy Consumption of Bicycling on Streets with Slope

This analysis uses a version of the “steady-speed power equation” to estimate the total energy a bicycle user needs to traverse a street segment, without differentiating for type of road or bicycle facility. The equation uses the calculated slope and assumes general values for the mass of the rider, wind speed, drag, and rolling resistance, as shown in Figure 2. While the speed of bicyclists may vary, a constant velocity is necessary to calculate the watts of energy consumed per street segment using the following equation:

$$W_{rider} = [K_A * (V + V_W)^2 + m * g (s + C_R)] * V$$

[1] Iseki, Hiroyuki, and Matthew Tingstrom. 2014. "A new approach for bikeshed analysis with consideration of topography, street connectivity, and energy consumption". *Computers, Environment and Urban Systems*. 48 (3): 166-177.

Figure 2 Values of Variables and Coefficients Used in Bikeshed Analysis

Variables and Coefficients	Description	Assumed Value
W_{rider}	Energy consumed in watts by person bicycling	To be calculated
K_A	Drag factor	0.245
V	Velocity	4 m/s (8.9mph)
V_W	Wind velocity	0
m	Mass of the rider	80 kg (176 lbs)
g	Acceleration of gravity	9.807 m/s^2
S	Slope	Calculated in GIS
C_R	Tire rolling resistance coefficient	0.004

Calculating the Energy Consumption of Bicycling Through Intersections

In addition to the energy required to traverse street segments, this analysis incorporates intersection impedance: the energy cost of making left and right turns, as well as traveling straight through intersections. The energy costs of making each of these movements on a network of local and arterial streets are based on the energy required to start and stop. Some intersection movements, such as a bicycle user making a left turn onto an arterial from a local street, are assumed to use more energy than other movements, like making a right turn to a local street or crossing a local street. For purposes of intersection impedance, trails are assumed to be local streets. The methodology does not account for the impact that on-street bicycle facilities and signals may have on time delay and energy consumption at an intersection.

Applying Energy Consumption to Bikesheds

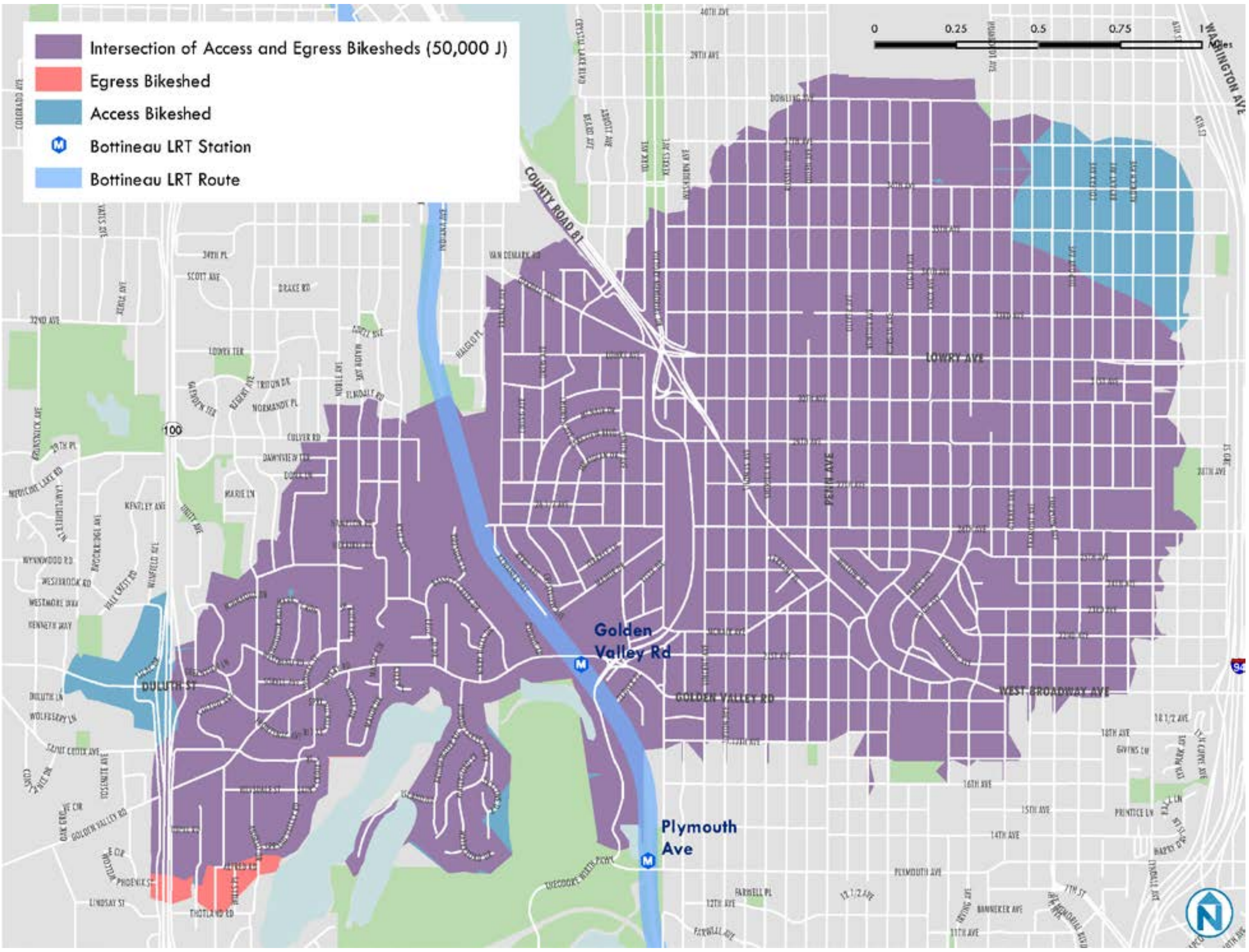
Using the energy consumption for traversing street segments and crossing intersections, the bikeshed is calculated for a maximum energy expenditure of 50,000 joules, equivalent to bicycling 7.08 kilometers (4.4 miles) on flat terrain with no intersections. This threshold energy expenditure, based on the Iseki and Tingstrom approach, is considered reasonable to capture most potential bicycle trips to transit because the equivalent distance on flat terrain (4.4 miles) is approximately equal to the average distance of bicycle trips found in a study of bicycle users in Portland, Oregon.[2] A majority of bicycle trips recorded in the study were shorter than the average distance. While some people will expend more energy to bicycle to transit, using this distance as the threshold for analysis provides a realistic bikeshed to focus plans for connecting a range of bicycle users with LRT stations.

As this analysis uses the relative slope of street segments to calculate energy consumption, unique bikesheds are produced for bicycle access towards a station and bicycle egress away from a station. For example, elevation changes in the area northeast of the planned Golden Valley station result in an access bikeshed and an egress bikeshed that do not align. The access bikeshed extends further from the station site because bicycling downhill to the station uses less energy than bicycling uphill away from it. For each station, access and egress bikesheds were intersected to generate a single bikeshed representing the common area in which bicycle users could travel both to and from a single station using up to 50,000 joules of energy. Areas where the access and egress bikesheds for a single station do not overlap are excluded from the station area bikeshed, as shown in Figure 3. While station spacing and flat terrain allows people in some areas to access as many as four stations without exerting more than 50,000 joules,

[2] Dill, Jennifer, and John Gliebe. 2008. *Understanding and measuring bicycling behavior: a focus on travel time and route choice.* [Portland, Or.]: Oregon Transportation Research and Education Consortium.

this analysis assumes that people will travel to and from the station that requires the least amount of energy expenditure.

Figure 3 Examples of Access and Egress Bikesheds



TYPES OF BICYCLE FACILITIES

The existing and proposed bicycle network is composed of a range of facilities. The predominant bike facilities are summarized in Figure 4, based on the Hennepin County 2040 Bicycle Transportation Plan, which contains further information on design and application.

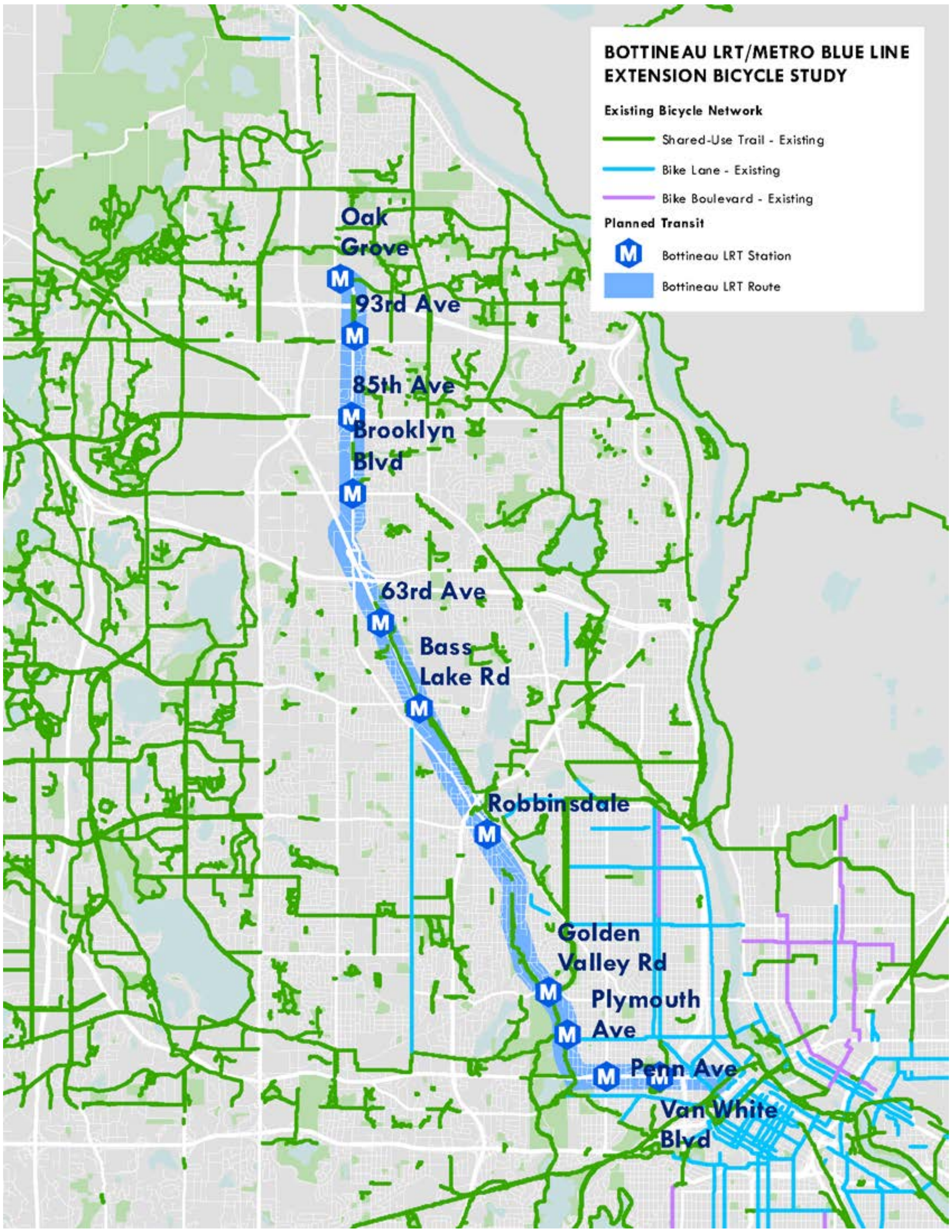
Figure 4 Types of Bicycle Facilities

Facility	Characteristics	Image
Trail	▪ Paved multi-use trails provide a shared space for bicycling, walking and other non-motorized uses. ▪ Some multi-use trail facilities provide designated lanes for bicycles and pedestrians, especially where there are higher volumes. ▪ Can be located along streets to increase bikeway comfort where traffic speeds or volumes are high. ▪ Can be located outside of the street right-of-way along abandoned or active rail corridors, waterways or through parks.	
Cycle Track	▪ A protected one-way or two-way bikeway separated from adjacent motor vehicle travel lanes by a curb. ▪ Typically include operational features to address conflicts at intersections, such as traffic signal phases exclusively for people biking.	
Bike Lane	▪ Bike lanes provide dedicated space for bicycling alongside motor vehicle traffic. ▪ Bike lanes can be a low-cost option when adequate right-of-way is available, and often can be incorporated into roadway repaving or restriping projects.	
Buffered Bike Lane	▪ Buffered bike lanes enhance traditional bike lanes with additional striped or buffered space between people biking and motor vehicles. ▪ A buffer can be incorporated to the right of the bicycle lane, protecting people biking from the door zone of parked vehicles, to the left of the bicycle lane, protecting people biking from motor vehicles, or both. ▪ Buffered bike lanes can be a low-cost retrofit as part of paving or restriping.	
Bike Boulevard	▪ A bicycle boulevard is typically suited for a local low-speed, low-volume street. ▪ Biking is prioritized by turning stops signs to prioritize bike movements, giving bicycles the right of way, and using traffic calming (i.e., bump outs or traffic circles), vehicle diverters, enhanced signage for bicycling and other means. ▪ Bike boulevards are intended to improve safety and comfort, and provide an alternative to higher speed roadways that may be intimidating to some bicycle users.	

EXISTING AND PROPOSED BICYCLE NETWORK

The existing bicycle network around the Bottineau LRT corridor is centered on a robust system of trails, both on- and off-street, that is augmented by on-street bike lanes on major roadways, and signed bike routes on lower traffic streets. This network predominantly serves recreational bicycle users due to gaps between destinations, and areas of population and job density. East and west bicycle routes are particularly lacking throughout the corridor, while north and south routes are infrequent and disconnected north of Robbinsdale. Figure 5 presents an overview of the existing bicycle network.

Figure 5 Existing Bicycle Network



The proposed bicycle network is intended to eliminate gaps in the existing bicycle network and provide access between LRT stations and surrounding neighborhoods and destinations within the bikesheds. The technical analysis, combined with stakeholder input, related LRT corridor studies (station area planning, bike/pedestrian planning), and bicycle facilities planned by individual cities and Hennepin County resulted in the proposed bicycle network, illustrated in Figure 6. Existing and Proposed facilities within each station's bikeshed are provided in Figures 7 through 16.

Figure 6 Proposed Bicycle Network

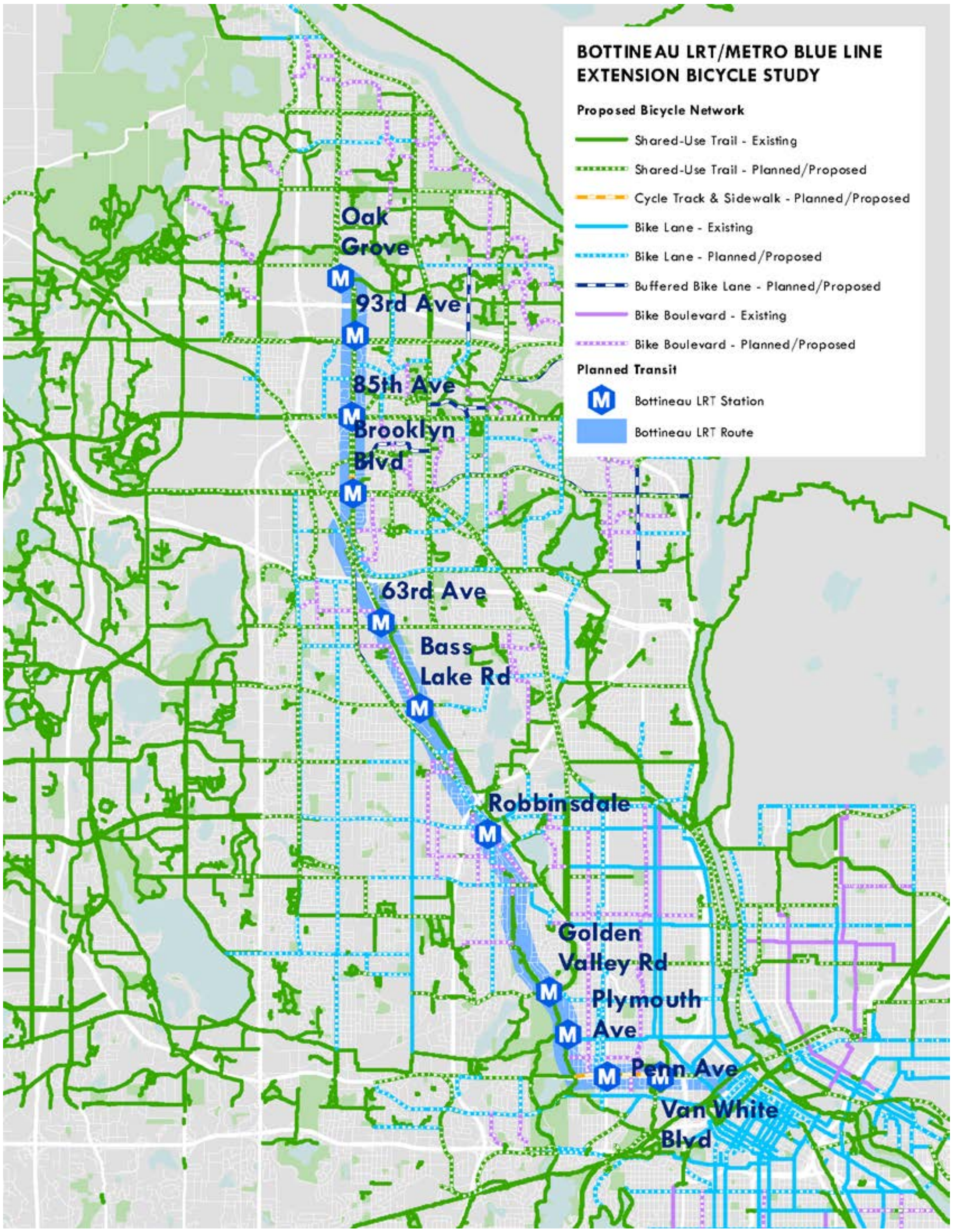


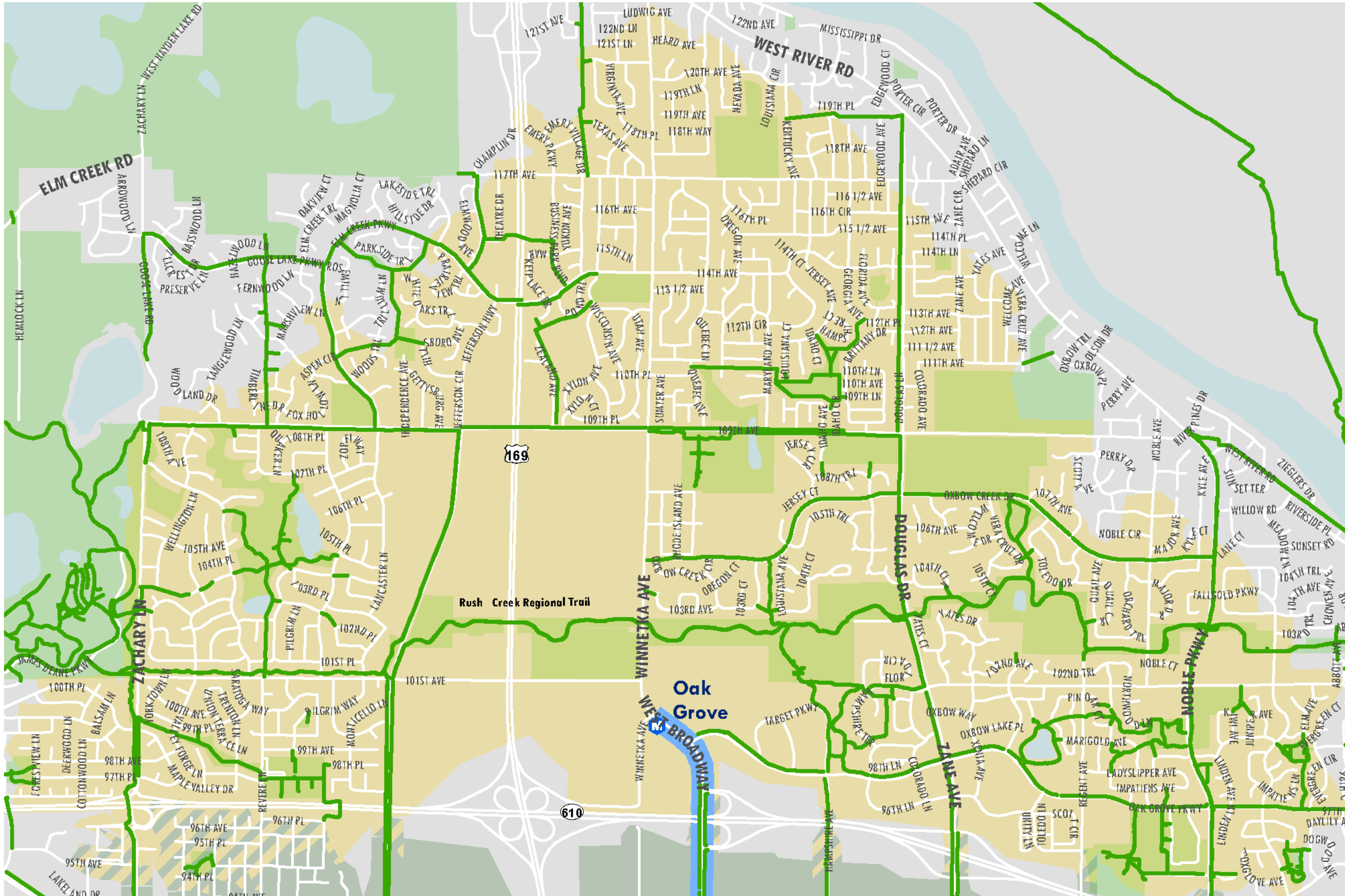
Figure 7 Existing Bicycle Network – Oak Grove Bikeshed

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Existing Bicycle Network
- Shared-Use Trail - Existing
- Bike Lane - Existing
- Bike Boulevard - Existing

Planned Transit
- Bottineau LRT Station
- Bottineau LRT Route

Station Area Bikeshed
- 93rd Ave
- 93rd Ave - Oak Grove
- Oak Grove



0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Figure 8 Proposed Bicycle Network – Oak Grove Bikeshed

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Proposed Bicycle Network
- Shared-Use Trail - Existing
- Shared-Use Trail - Planned by City/County
- Shared-Use Trail - Proposed by this Study
- Cycle Track & Sidewalk - Proposed by this Study
- Bike Lane - Existing
- Bike Lane - Planned by City/County
- Bike Lane - Proposed by this Study
- Buffered Bike Lane - Proposed by this Study
- Bike Boulevard - Existing
- Bike Boulevard - Planned by City/County
- Bike Boulevard - Proposed by this Study
- Regional Trail Corridor

Planned Transit
- Bottineau LRT Station
- Bottineau LRT Route

Station Area Bikeshed
- 93rd Ave
- 93rd Ave - Oak Grove
- Oak Grove

0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

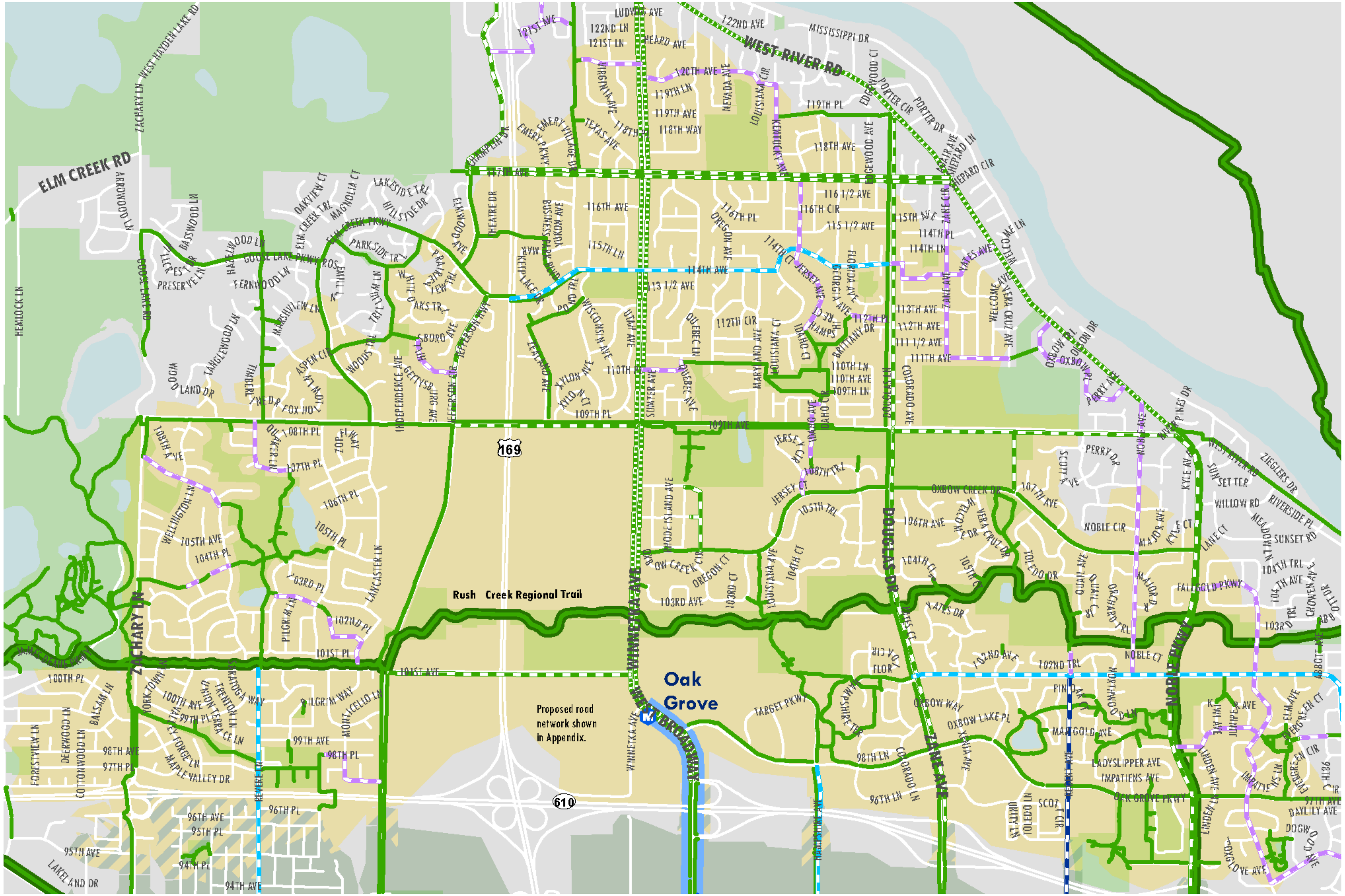


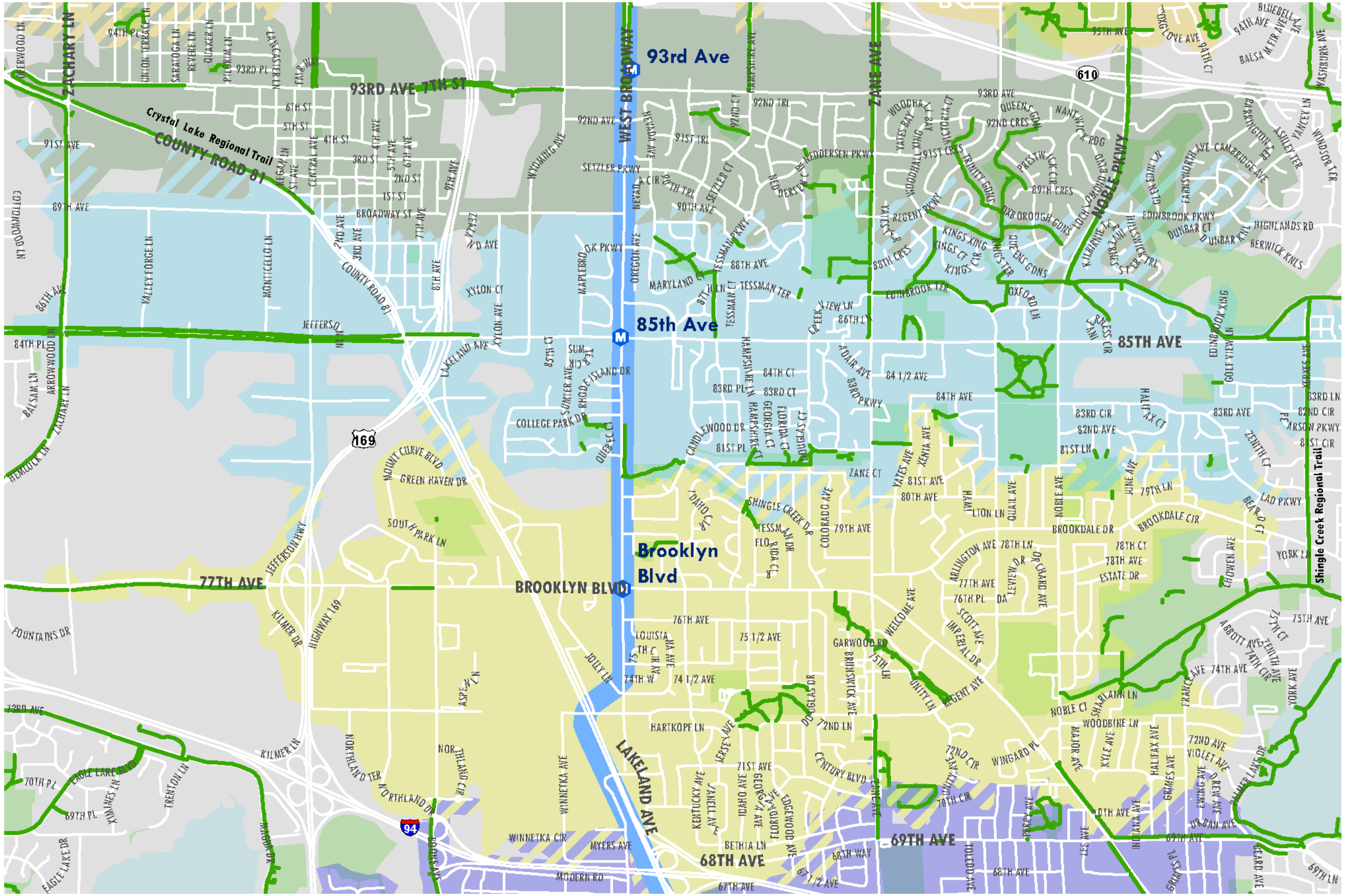
Figure 9 Existing Bicycle Network – 93rd Ave, 85th Ave, Brooklyn Blvd Bikesheds

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Existing Bicycle Network
- Shared-Use Trail - Existing
- Bike Lane - Existing
- Bike Boulevard - Existing

Planned Transit
- Bottineau LRT Station
- Bottineau LRT Route

Station Area Bikeshed
- 63rd Ave
- 63rd Ave - Brooklyn Blvd
- 85th Ave
- 85th Ave - 93rd Ave
- 93rd Ave
- 93rd Ave - Oak Grove
- Oak Grove
- Brooklyn Blvd
- Brooklyn Blvd - 85th Ave



0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Figure 10 Proposed Bicycle Network – 93rd Ave, 85th Ave, Brooklyn Blvd Bikesheds

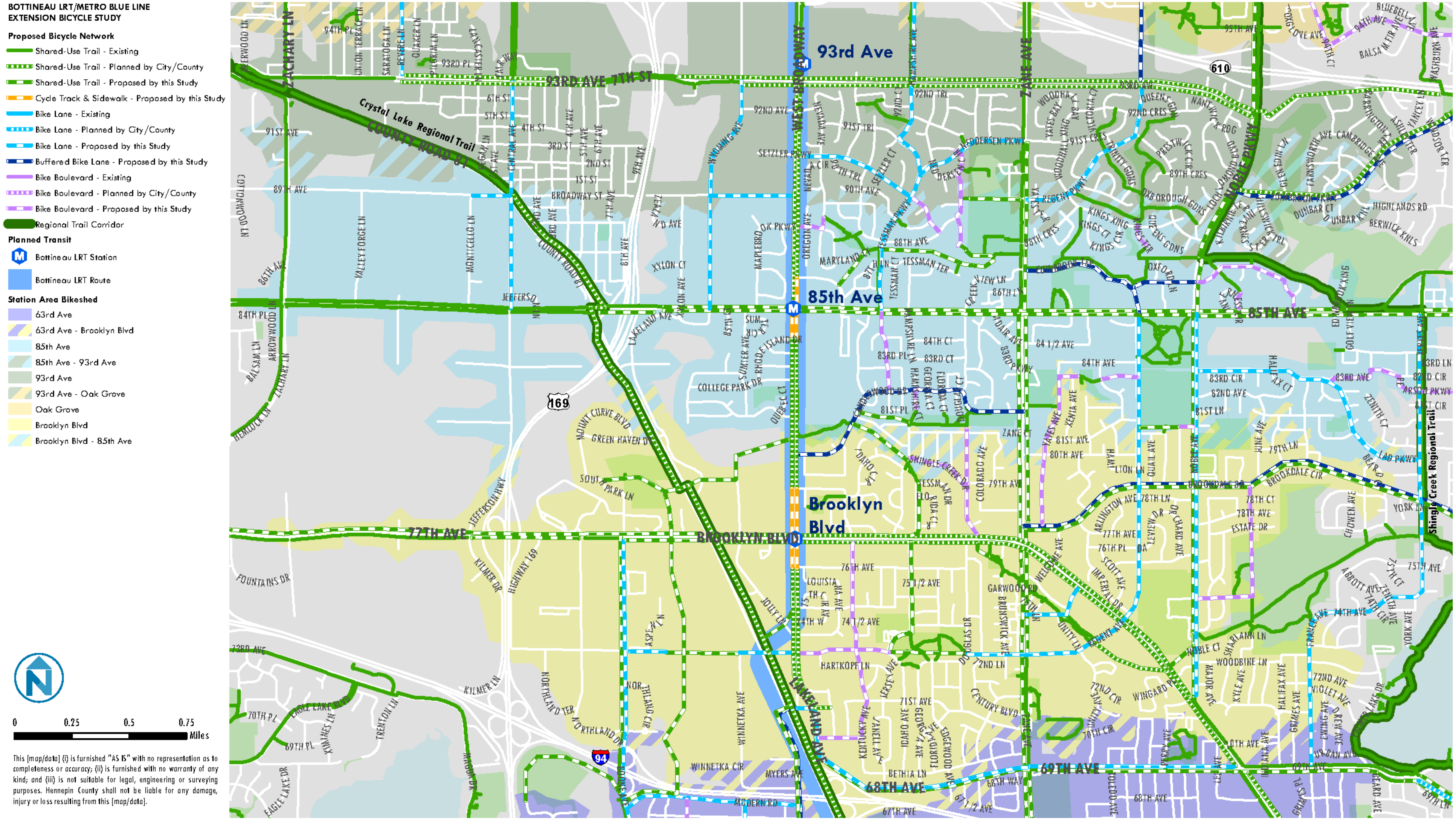


Figure 11 Existing Bicycle Network – 63rd Ave, Bass Lake Rd Bikesheds

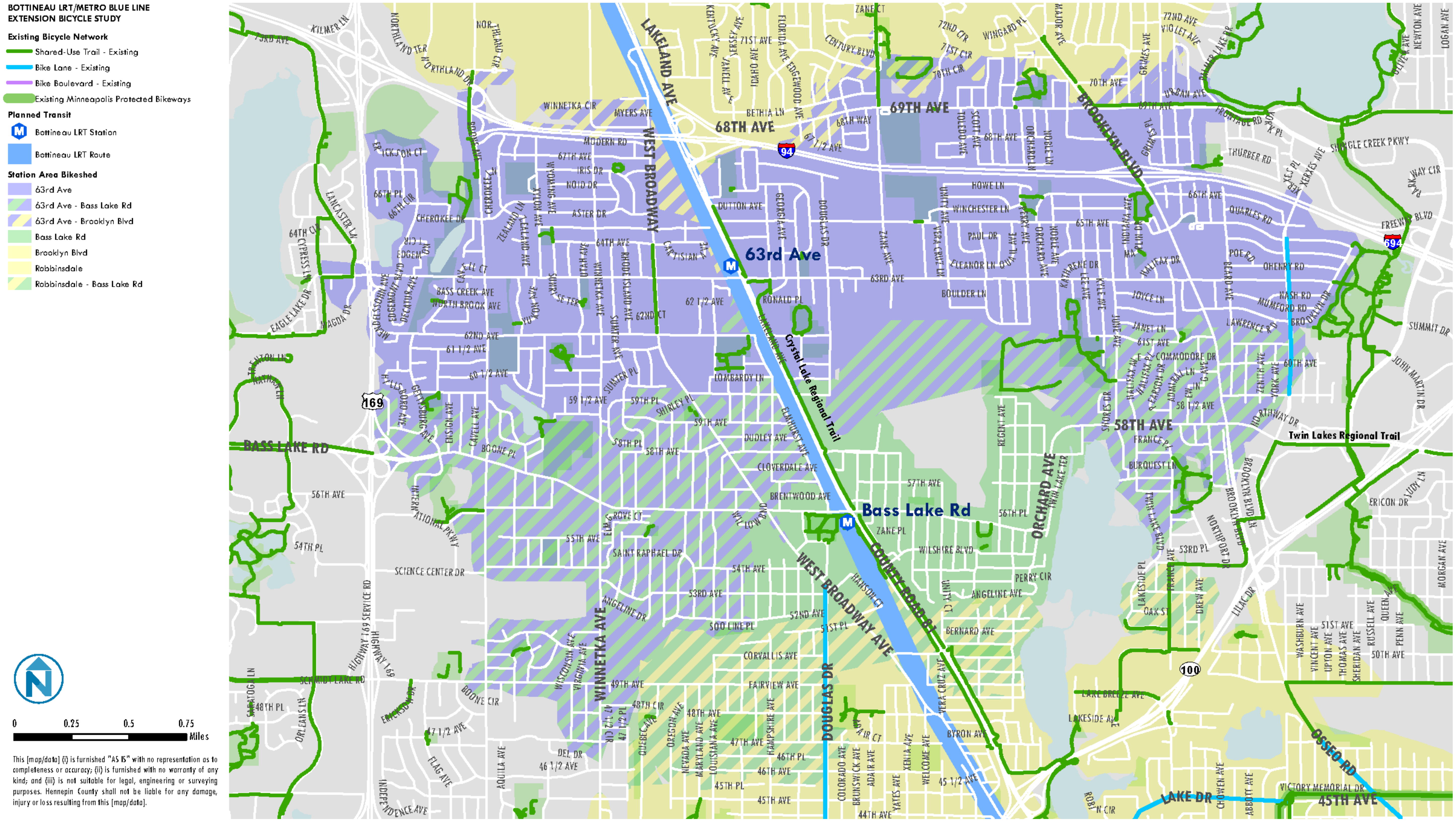


Figure 12 Proposed Bicycle Network – 63rd Ave, Bass Lake Rd Bikesheds

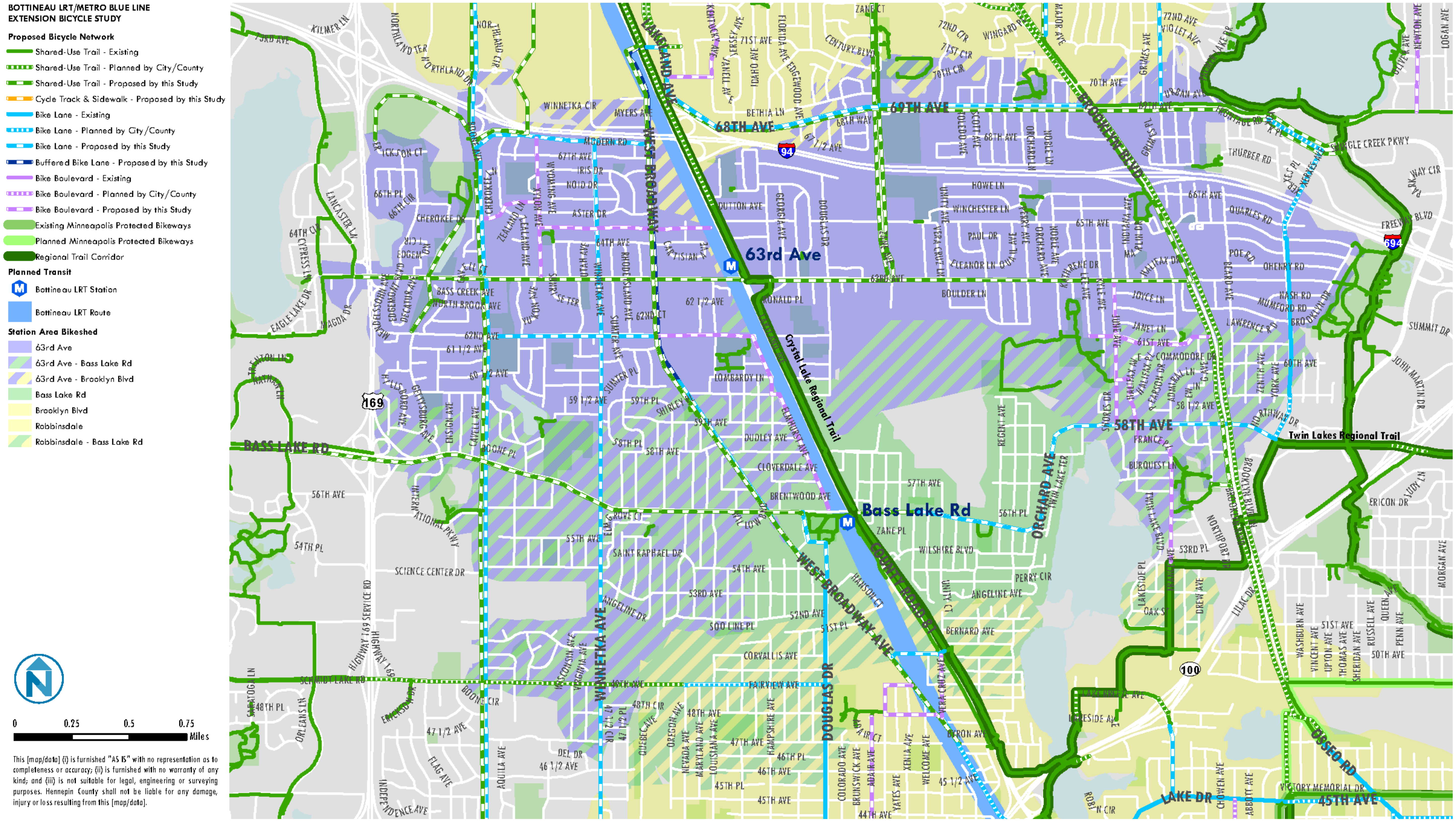


Figure 13 Existing Bicycle Network – Robbinsdale Bikeshed

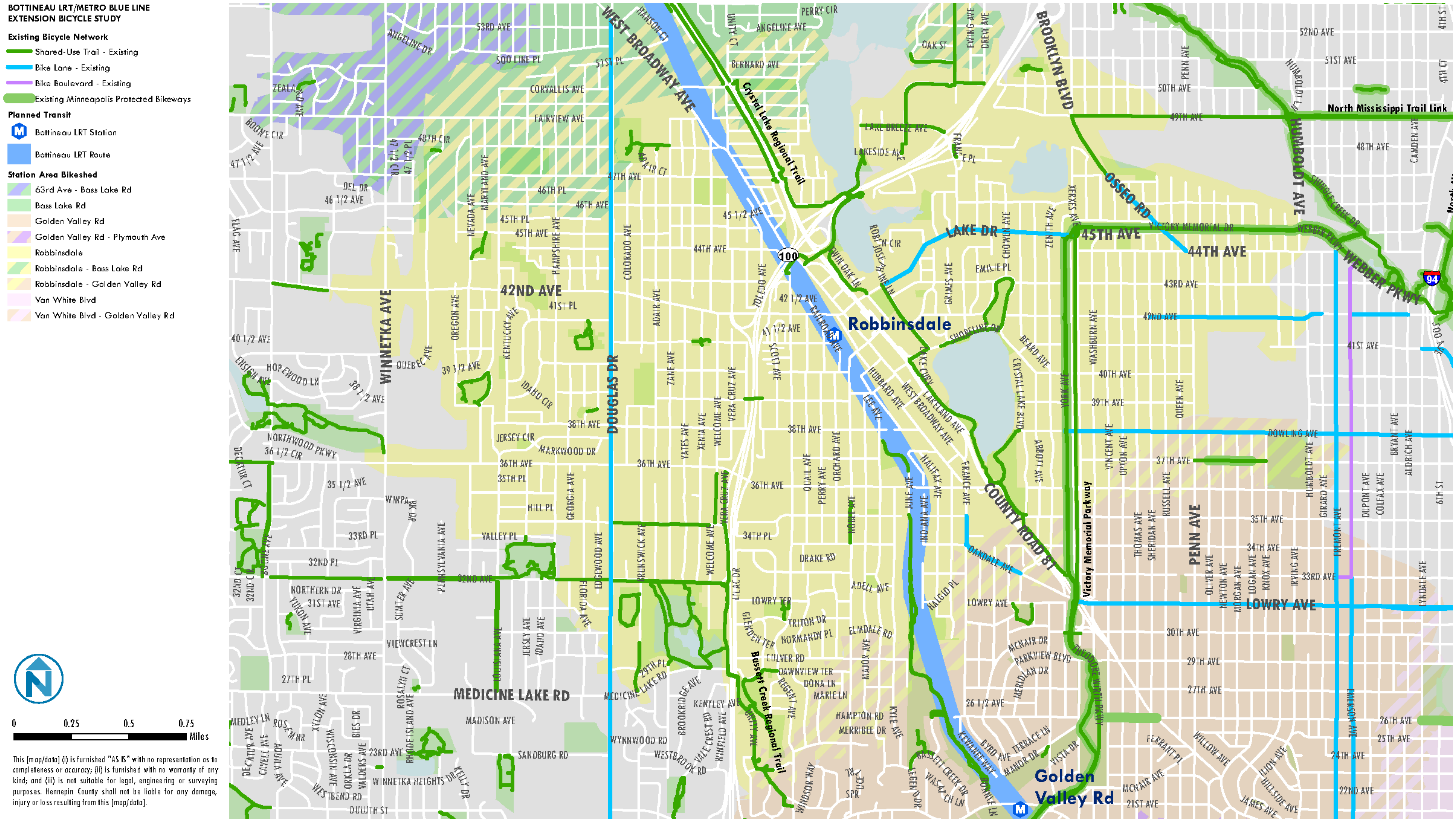
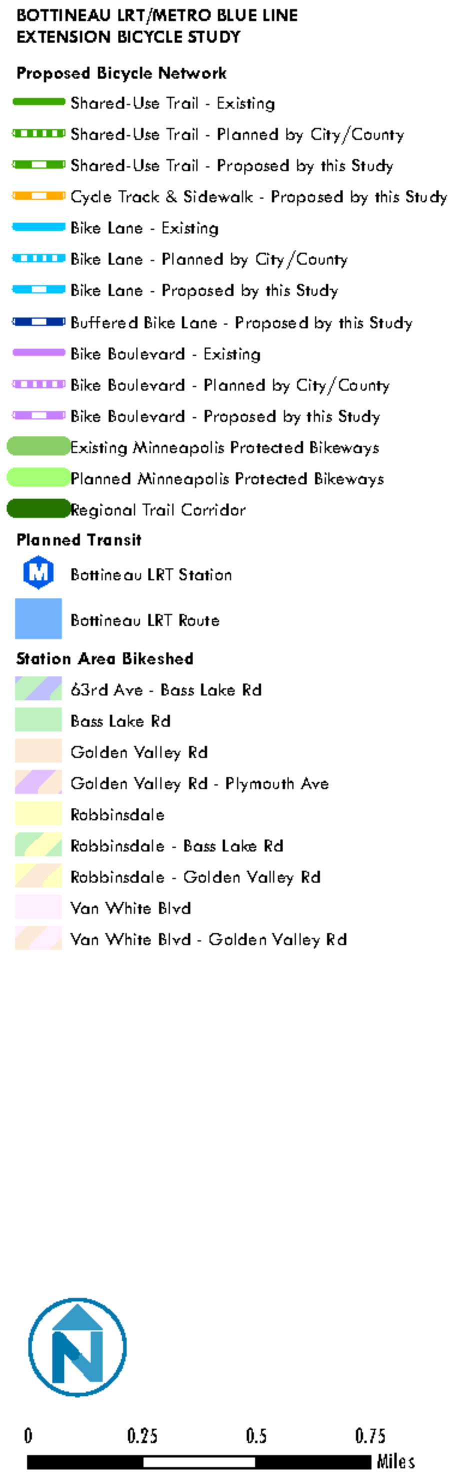


Figure 14 Proposed Bicycle Network – Robbinsdale Bikeshed



This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

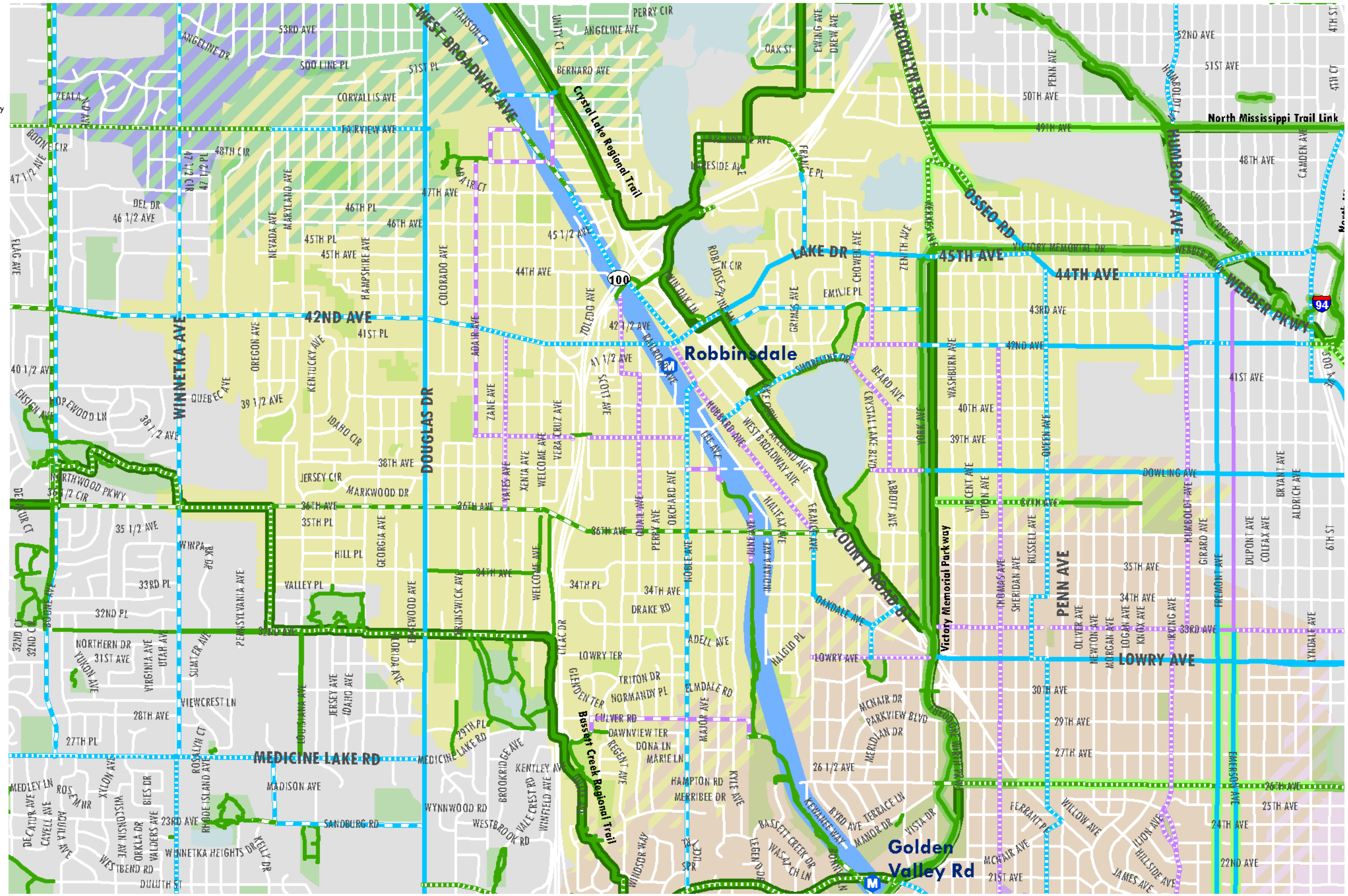


Figure 15 Existing Bicycle Network – Golden Valley Rd, Plymouth Ave, Penn Ave, Van White Blvd Bikesheds

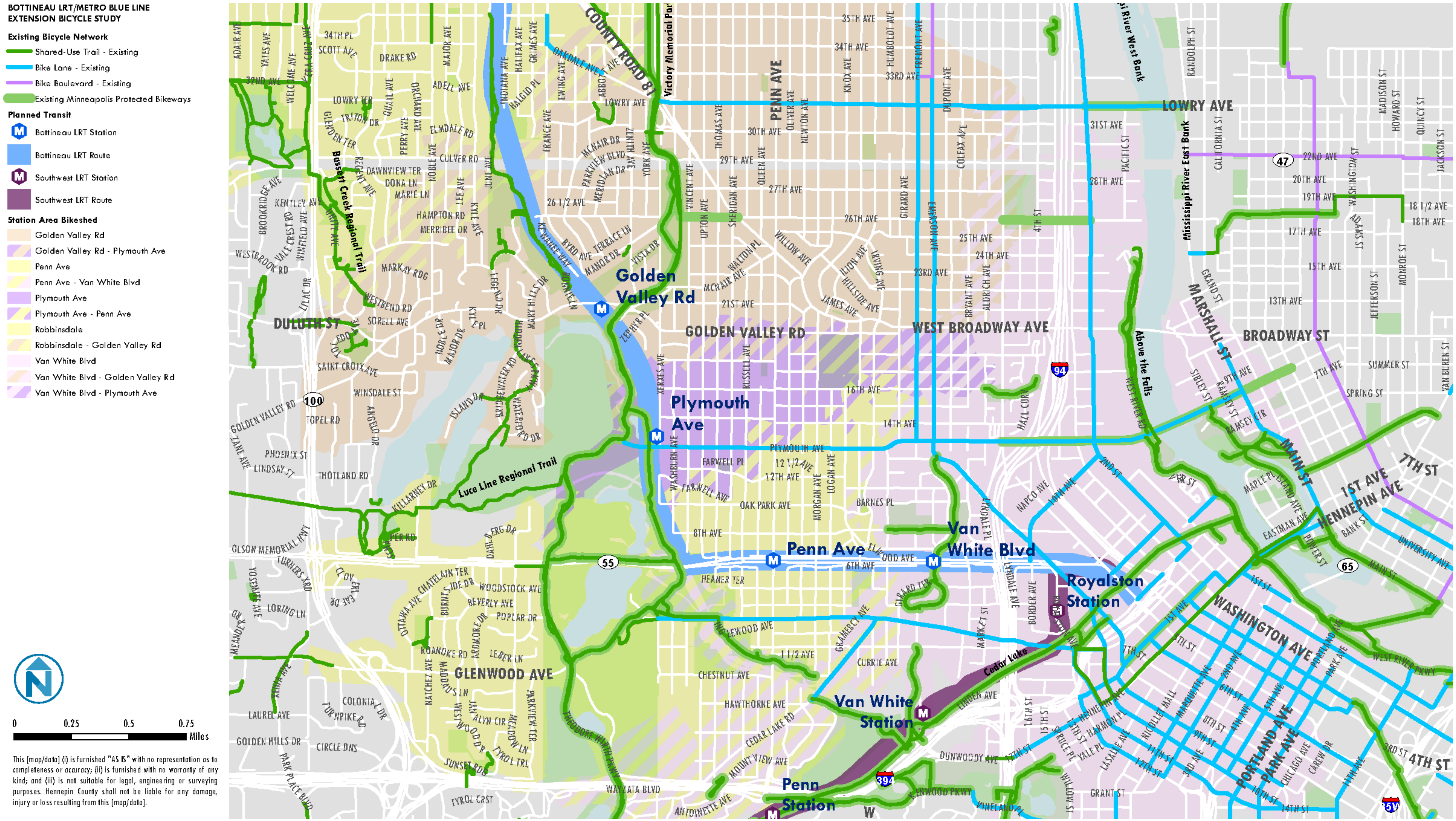
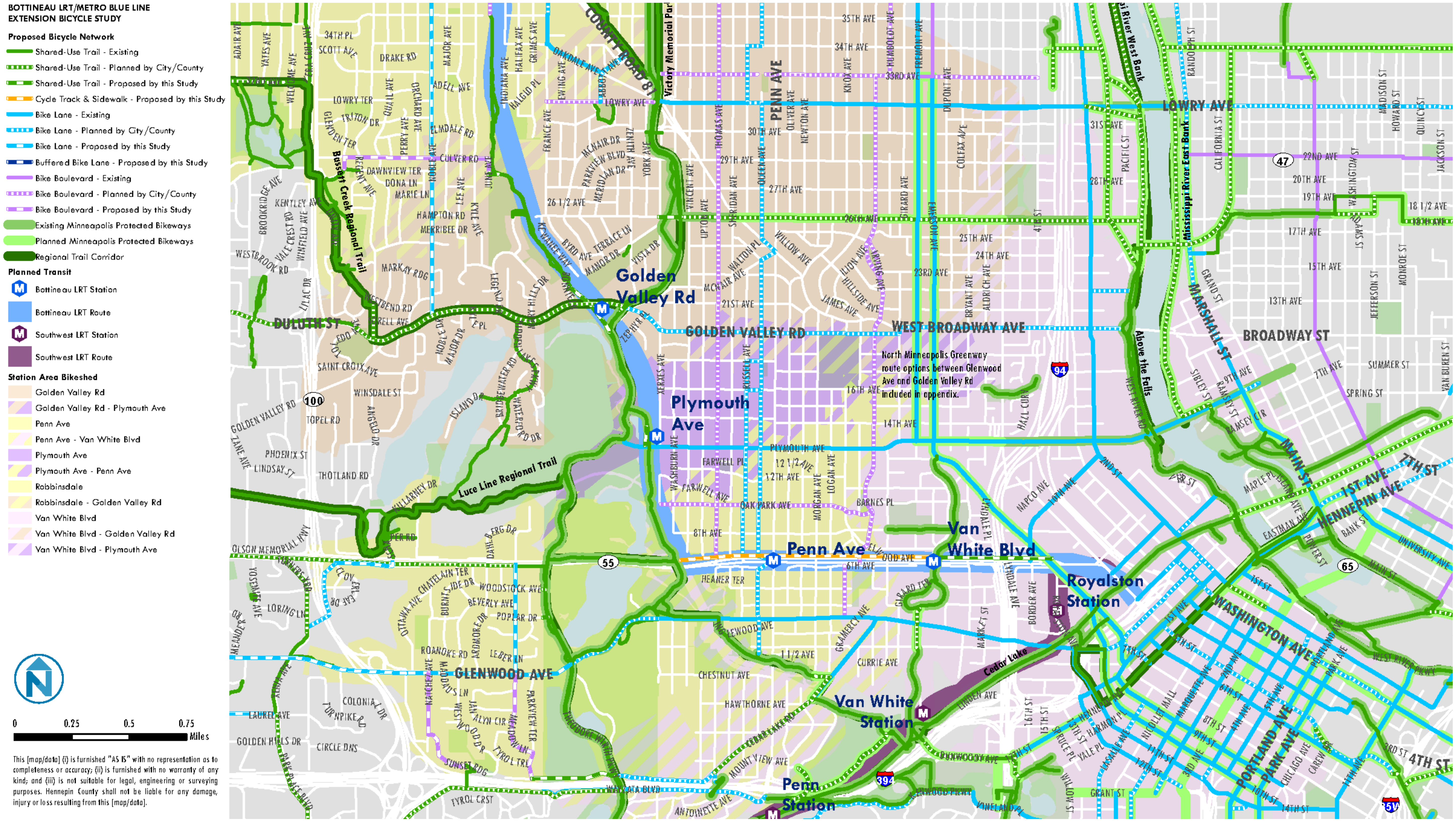


Figure 16 Proposed Bicycle Network – Golden Valley Rd, Plymouth Ave, Penn Ave, Van White Blvd Bikesheds



KEY LOCATION: OLSON MEMORIAL HIGHWAY

This memo provides recommendations for implementing separate facilities for people walking and people bicycling on the north side of Olson Memorial Highway. The concept of a two-way bicycle path with a separate sidewalk for people walking has multiple advantages over a shared use path:

- Separate facilities will minimize conflicts between bicyclists and pedestrians, creating a safer and more comfortable street environment.
- The sidewalk corridor, including the frontage zone and throughway zone, ensures that building entrances do not open directly into the path of people bicycling.
- New development along Olson Memorial Highway should provide active street frontages. A separate sidewalk will support new land uses (commercial, residential, and mixed use) by providing the space for people and potential customers to pass by and to stop at businesses.

Recommendations

Figure 17 through Figure 20 below illustrate: a) conceptual cross-sections of the north side of Olson Memorial Highway at Penn Avenue and James Avenue; and b) a conceptual route that connects the bike path between Van White Memorial Highway and North 7th Street, east of the I-94 overpass.

The proposed sidewalk along the north side of Olson Memorial Highway is 6-feet wide, with a two-way 10-foot wide bicycle path, which is physically separated from motor vehicle travel lanes by a buffer that may vary between 10 feet and 12 feet in width to accommodate snow storage, BRT stops, streetscaping, and lighting. While 10 feet is desired for snow storage, a wider buffer may be desirable at BRT stops. Considerations and recommendations for these concepts as listed below are called out on the illustrations:

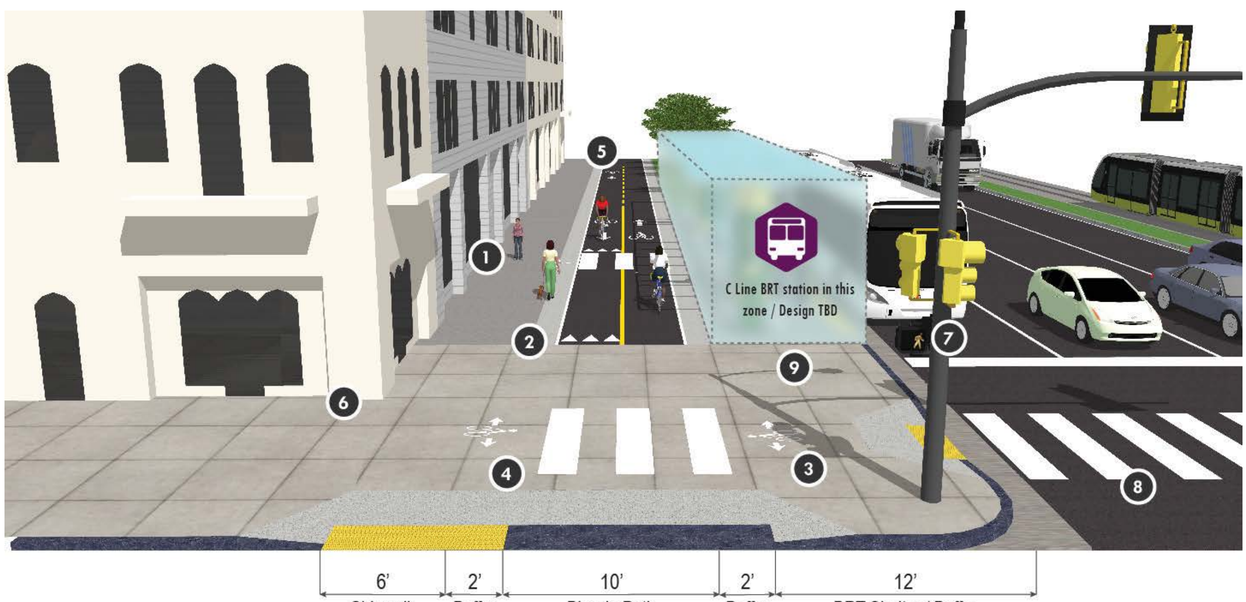
1. Mark crosswalks on the bike path between the BRT stop and the sidewalk to indicate to both pedestrians and bicyclists where to cross, concentrate pedestrian activity in the marked location, and decrease potential conflicts. Crosswalks must be visible to motorists, especially at night. Contrast markings, such as a black border around light markings, may be used to enhance visibility to enhance contrast with the road surface.
2. Methods to support the path crossing include a speed table on the bike path and/or advanced yield markings for bicyclists as well as bicycle crossing markings to alert pedestrians.
3. At corners, utilize distinctive pavement treatments and yield markings to highlight the shared space and emphasize bicyclists' responsibility to yield to pedestrians.
4. A crosswalk can be marked where the bicycle path crosses the desire line of pedestrians north and south along Penn Avenue, James Avenue, and other north-south streets. The crosswalk tells bicyclists to yield to pedestrians while the bicycle pavement markings help alert pedestrians.
5. The bike path and sidewalk can be delineated with design elements such as a raised curb, varied surface materials, or other small buffers.
6. The buffer on the north side of the sidewalk varies in dimensions and use. At Penn Avenue and James Avenue, existing buildings are currently set back at least 70 feet, while existing sidewalks, service roads, and structures are in closer proximity along the corridor. In general, the dimensions used in these concepts are best practice for the safety and comfort of users. However, there is flexibility within these concepts to work around various constraints.
7. Pedestrian signal heads should include adequate time to fully cross the street. Pedestrian-clearance intervals should meet the walking speed standards in the MUTCD (3.5 feet per second) at a minimum. A walking speed of less than 3.5 feet per second should be considered in these clearance intervals at locations where pedestrians who may need more time routinely cross, such as the elderly or those in wheelchairs.

8. Intersection crossing markings should be included for bicyclists at any existing bicycle path across Olson Memorial Highway.
9. The buffer between the bicycle path and motor vehicle travel lanes is recommended to be a minimum of 10 feet wide for snow storage, lighting, and landscaping, although there are pinch points where this may not be achieved.

Olson Memorial Highway at Penn Avenue

At Penn Avenue there is a proposed BRT stop on the north side of Olson, in addition to the median LRT station. In this concept, the bicycle path remains behind the bus stop in order to minimize conflicts between path users and passengers boarding and alighting from the bus. A separate sidewalk facility provides more comfortable space for people walking and accessing potential mixed-use development on the north side of Olson. The shared space at the corner could be treated with alternative pavement treatments to delineate the path of travel for through bicycle riders. Additional examples for designing bike paths at bus stops are included in the following section.

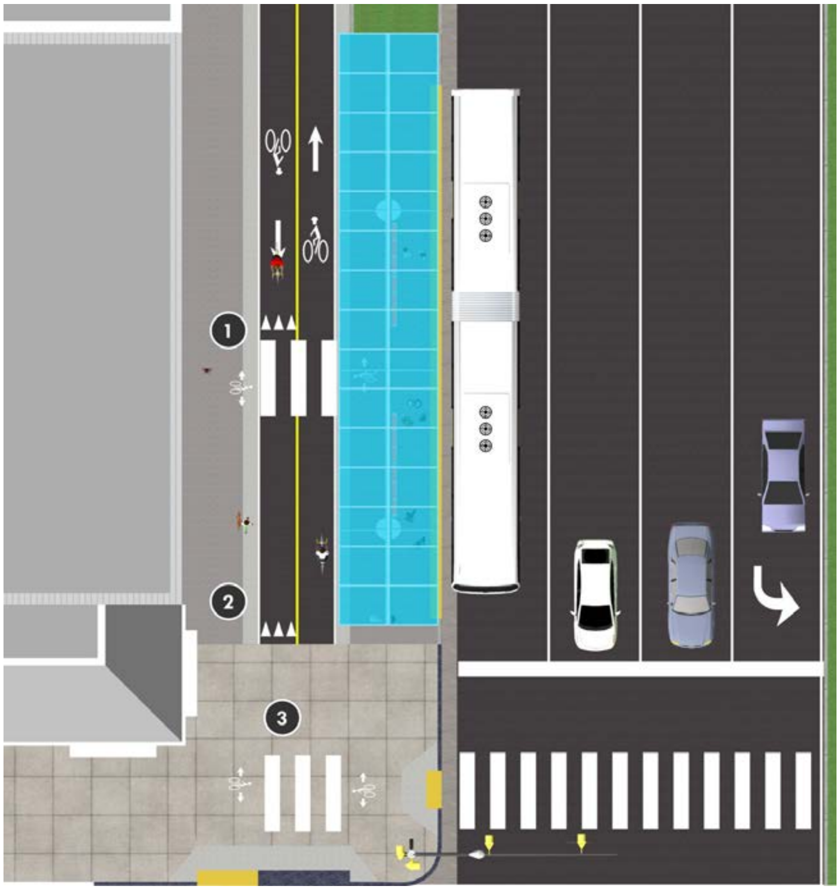
Figure 17 Proposed Configuration of Olson Memorial Highway (North Side) at Penn Avenue



Olson Memorial Highway (North Side) at Penn Avenue

Note: Buildings illustrated are not planned, but included to show potential relationship between proposed sidewalk facility and possible future development along Olson Memorial Highway.

Figure 18 Plan View Sketch of Olson Memorial Highway (North Side) at Penn Avenue



Olson Memorial Highway at James Avenue

There is no proposed LRT station or BRT stop on Olson Memorial Highway at James Avenue. In this concept, the bicycle path is separated from motor vehicle travel lanes by a buffer. The shared space at the corner could be treated with alternative pavement treatments to delineate the path of travel for through bicycle riders.

Figure 19 Proposed Configuration of Olson Memorial Highway (North Side) at James Avenue

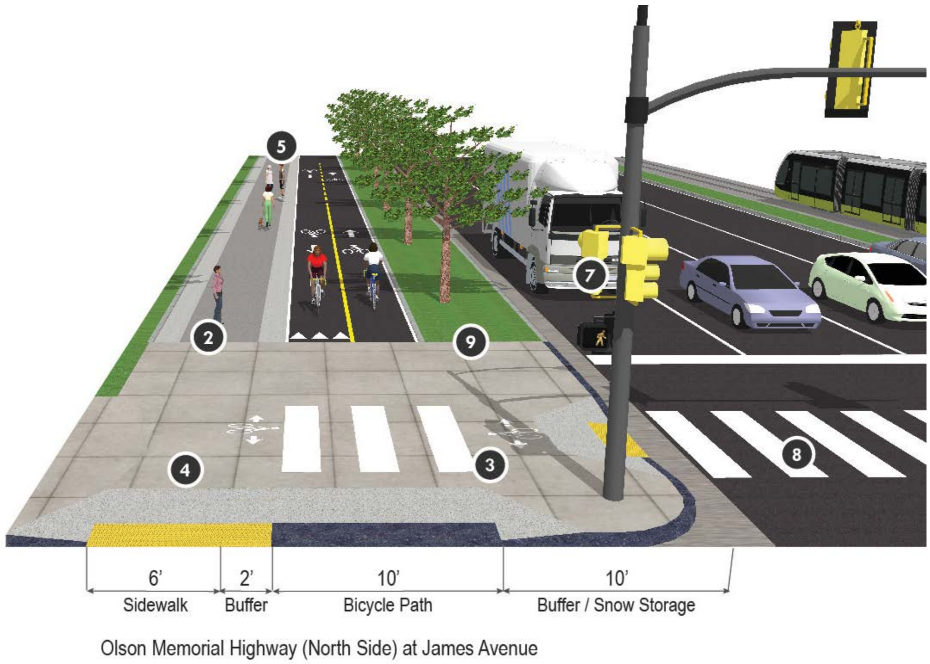
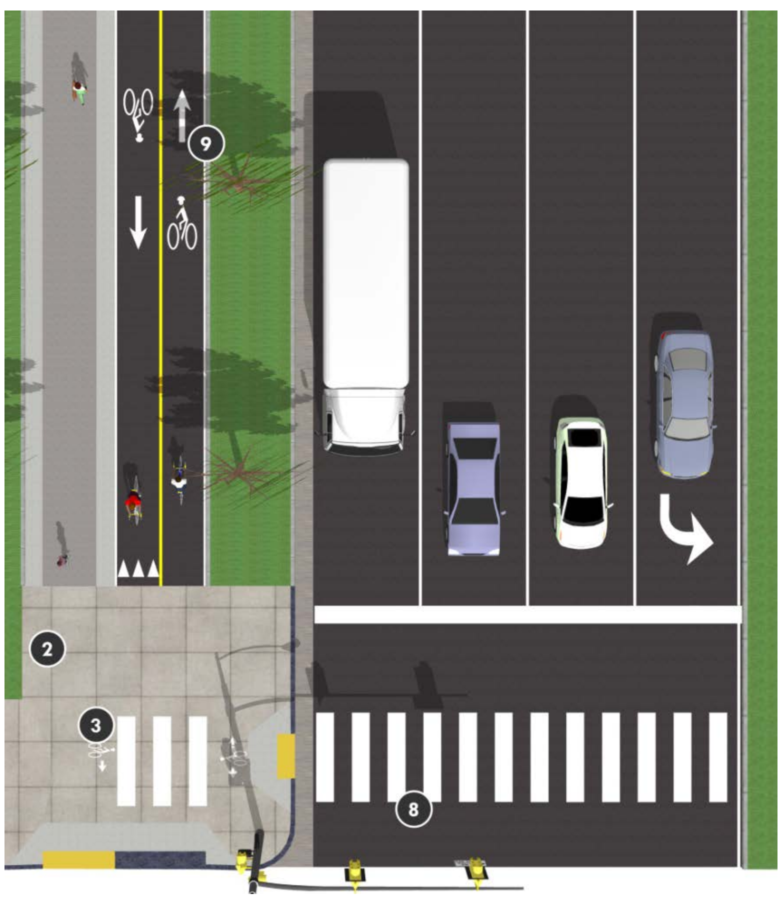


Figure 20 Plan View Sketch of Olson Memorial Highway (North Side) at James Avenue



Olson Memorial Highway across the I-94 Bridge

Between Van White Memorial Highway and the I-94 bridge there is insufficient space to continue the bicycle path and sidewalk treatment proposed above in the existing right of way. Installing a bicycle path and separate sidewalk would require using private property or reducing the buffer on the street side, both actions that could require removal of existing trees. The I-94 bridge also does not possess sufficient space to provide separate facilities for bicycling and walking at this time.

For opening day of the light rail, the proposed concept shown in Figure 21 provides a shared use path on the north side of Olson Memorial Highway between Van White Memorial Highway and the I-94 bridge. Although below current construction standards, the most practical option to connect the path across the bridge is to create a two-way shared use path using the existing sidewalk. As this section of shared use path will be between 8 and 9 feet wide, future bridge work should include a replacement to standard dimensions. Bicycle users may also choose to use the trail on Van White Memorial Boulevard to connect to the bicycle lanes on Glenwood Avenue as an alternate connection across I-94.

In the future, the replacement of the I-94 bridge should include a 6-foot wide sidewalk along the north side with a two-way 10-foot wide bicycle path, as shown in Figure 22. Physical separation between the bicycle path and vehicle travel lanes may be provided using buffer space or a vertical barrier with sufficient clearance.

Figure 21 Proposed Olson Memorial Highway Bicycle Route across the I-94 Bridge for Opening Day

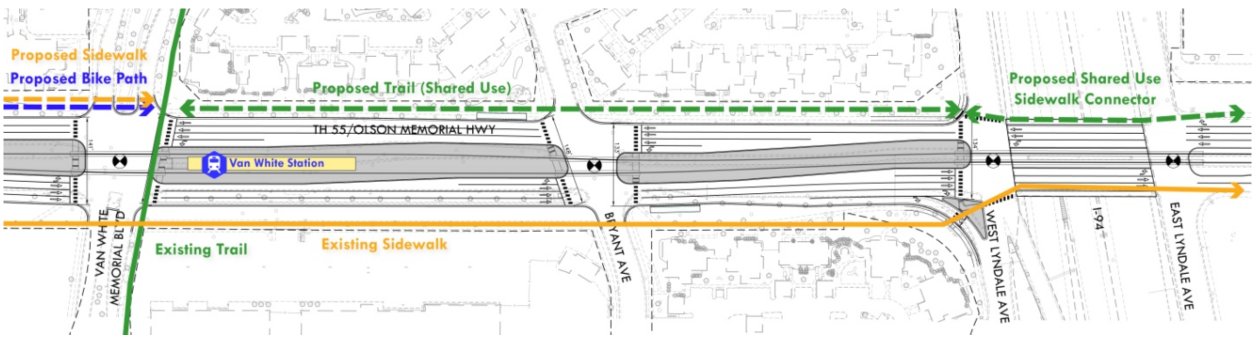
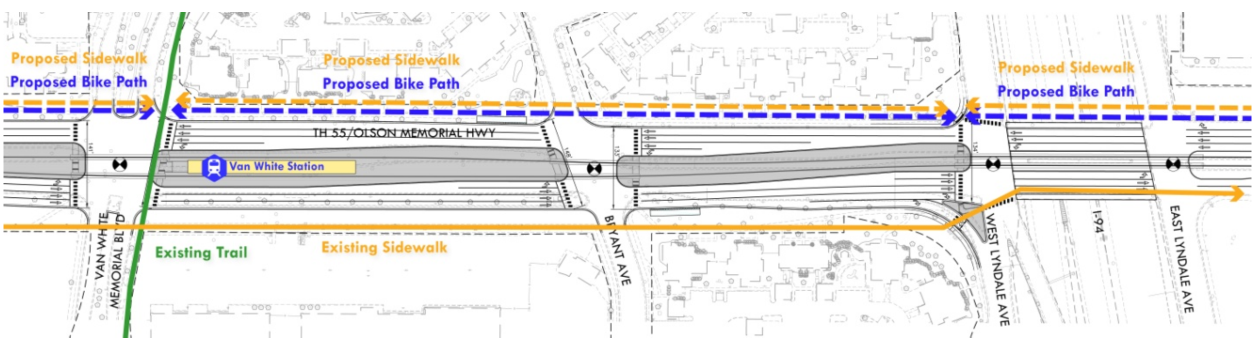


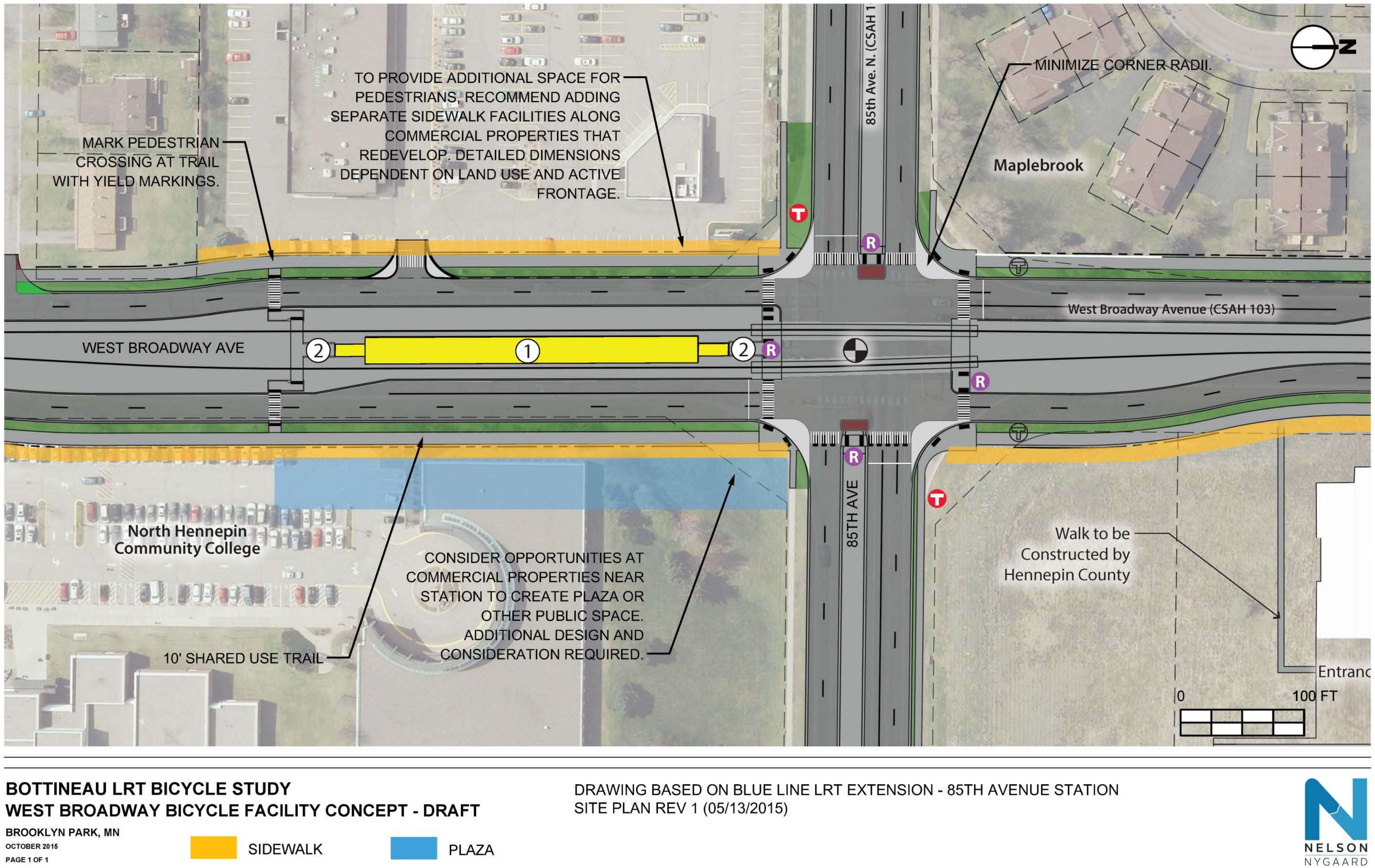
Figure 22 Proposed Olson Memorial Highway Bicycle Route across I-94 Bridge with Future Bridge Reconstruction



KEY LOCATION: WEST BROADWAY

Figure 23 presents a proposed concept for LRT stations on West Broadway, including Brooklyn Boulevard, 85th Avenue, and 93rd Avenue. A trail facility is planned for both sides of West Broadway. To provide additional space for pedestrians near transit stations, separate sidewalk facilities along commercial properties can be added during redevelopment. Specific dimensions are dependent on the land use and active frontage of redeveloped properties. In additional, commercial properties near transit stations should be considered as potential opportunities to create plazas or other public space.

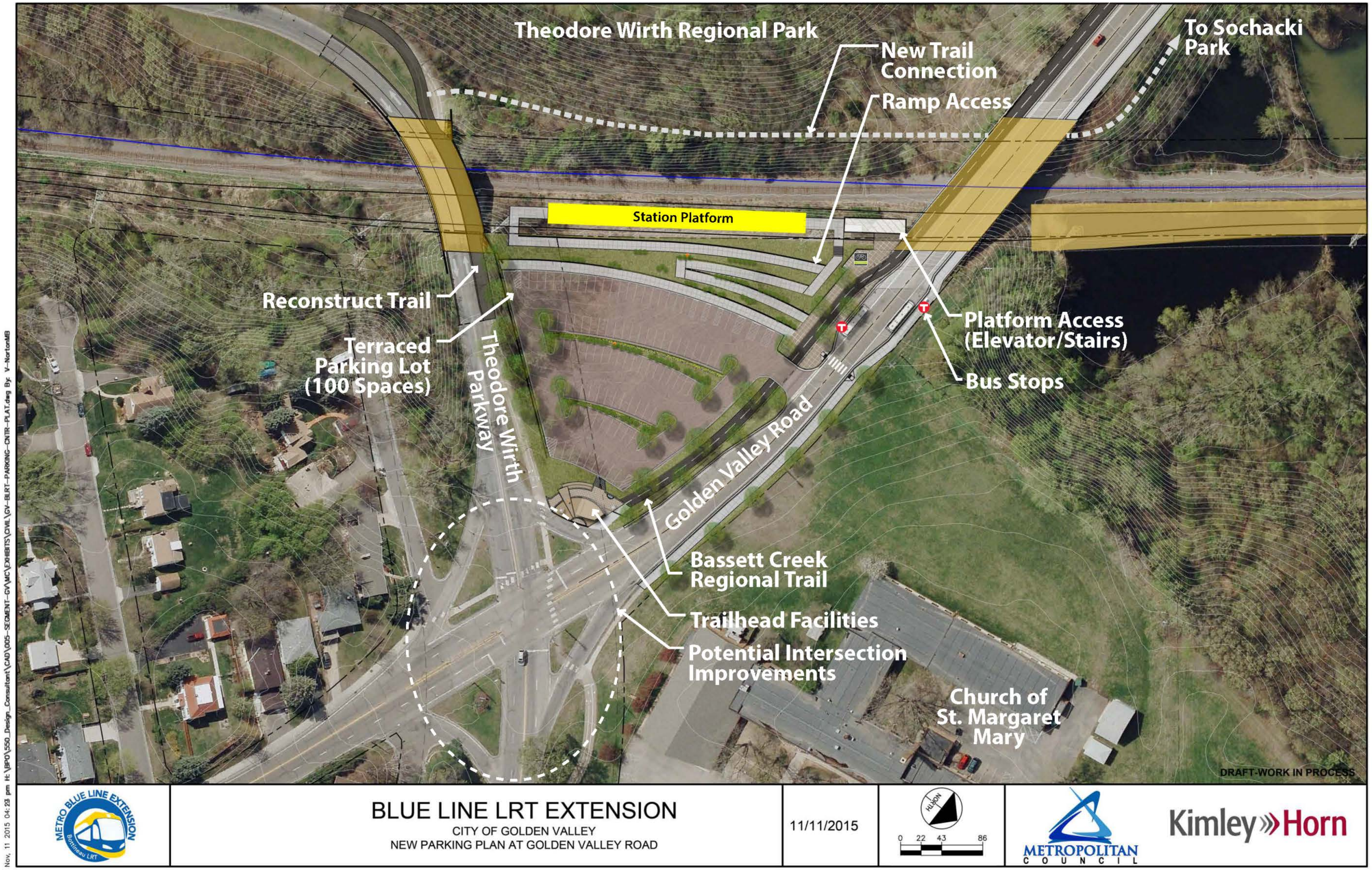
Figure 23 West Broadway Bicycle Facility Concept



KEY LOCATION: GOLDEN VALLEY STATION BICYCLE ACCESS

Figure 24 presents the Bottineau Project Office proposed concept for parking facilities at the Golden Valley Road station. If parking facilities are not included in the final plan, a path is recommended to connect the station platform with trails on Golden Valley Road and Theodore Wirth Parkway. In addition, by making the ADA-accessible elevator large enough to accommodate bicycles and including a bike rail to roll bicycles in the stairwell, station access will be improved. As the owner of the property, the Minneapolis Park Board should be involved with design, placement, and maintenance of facilities.

Figure 24 Golden Valley Road Station Bicycle Access



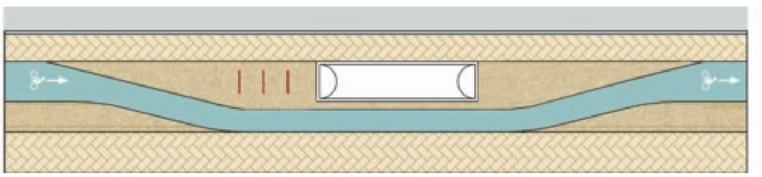
STRATEGIES FOR BICYCLE PATHS IN HIGH-ACTIVITY PEDESTRIAN AREAS

Pathways through high-activity pedestrian areas near transit stops should be designed to minimize conflict between users. In addition to the recommendations for signal phasing, pavement markings, and buffers described for the Olson Highway concepts, the following design solutions can be considered to minimize conflicts between users.

Slow Path Users Approaching Station

Slight chicanes and pinch points can be used to slow path users in advance of the station area, which can be designed to function as a shared space for low-speed bicyclist and pedestrian use. The diagram below shows a slight chicane to slow path users passing behind a transit stop.

Figure 25 Bicycle Path Passing Behind Transit Stop



Path Widening at Transit Stop

Increasing the width of the bike path around a transit stop provides path users and transit users more space to safely navigate around each other, as seen in the example below of a bicycle path passing a bus stop in Changzhou, China.

Figure 26 Wider Bicycle Path at Transit Stop

Path Widening at Intersection

The path can also be widened at intersection crossings where queuing results in crowding at the edge of the roadway. Widening the path can increase crossing capacity and help reduce conflicts between path users, as well as pedestrians crossing perpendicularly to access the BRT or LRT stops.

Raised Crossings

Raised crosswalks (speed tables) ramp the roadway to the elevation of the sidewalk so that vehicles or bicycles are slowed in advance of a pedestrian crossing. Raised crosswalks are typically utilized at high volume pedestrian crossings or at locations that have demonstrated a significant safety risk. Truncated domes or other surface markings should be placed at the edges of the raised section to alert pedestrians with visual impairments of the sidewalk edge. Figure 27**.** shows an example of a two-way cycle track in Seattle that passes over a raised crossing to give bicyclists warning and slow their approach. Figure 28 shows a raised crosswalk across the Hudson River Greenway at an office building in New York City. In-pavement lights begin flashing when nearby motion sensors detect the approach of bicyclists or other people using the greenway.

Figure 27 Two-way cycle track with raised crossing behind a bus stop (Seattle, WA)

Figure 28 Raised crosswalk across bike path with motion-activated flashing lights (New York, NY)

Guide Bus Passengers to Marked Crossings

Fencing can be used behind a transit stop to guide passengers exiting the bus to cross a bike path at a marked crosswalk or preferred location, without reducing access to the station. Examples of this strategy are shown above and below where simple fencing or bollards encourage crossing at specific locations rather than anywhere along the length of the bus stop.

Figure 29 Cycle track and bus stop (Warsaw, Poland)

Signal Synchronization

Prioritize the movement of path users through station areas prior to the arrival of a light rail train or BRT to reduce conflicts. If bicyclists are passing the station as the light rail train or bus is approaching, passengers will be mainly waiting on the platform, rather than crossing the path. This can be accomplished by using leading bicycle intervals or separate bicycle phasing that prioritizes the movement of the bicycles at adjacent signalized intersections.

FUNDING OPPORTUNITIES

Once a community has decided to improve biking options, it needs the resources to do so. Various funding sources and programs are available to fund the implementation of the proposed bicycle network in Hennepin County. The following table presents funding opportunities that may be available to eliminate gaps and build out the bicycle network.

Figure 30 Potential Funding Opportunities

Funding Source	Description	Opportunities
Federal Funding	Large trails or trail networks with a transportation purpose can compete for TIGER grant awards. Additional significant federal funding sources include TAP, STP and CMAQ. Depending upon the location and purpose, trails can also be funded by HUD CDBG funds, USDA rural development programs, or EPA funding.	▪ Trail projects in urban areas have traditionally been funded at a minimum of $10,000,000 and rural trails of lower project costs are considered for TIGER funding.
State of Minnesota	Programs include: ▪ Corridor Investment Management Strategy ▪ Parks and Trails Fund ▪ State Bonds	▪ Trails ▪ Bike Lanes ▪ Sidewalks ▪ Crossings
Metropolitan Council	The Livable Communities Demonstration Account is intended to fund local and regional projections that link housing, jobs, and other destinations through transportation networks.	▪ Trails ▪ Bike Lanes
Hennepin County	Programs include: ▪ Complete Streets Cost Participation Policy ▪ Capital Improvement Program ▪ Transit Oriented Development Grant ▪ Roadside Enhancement Partnership Program	▪ Trails ▪ Bike Lanes ▪ Sidewalks
National Center for Safe Routes	Safe Routes to School grants provides funding for bicycle and pedestrian facilities along routes to schools	▪ Trails ▪ Bike Lanes ▪ Sidewalks
Public/Private Partnerships	Public/private partnerships are agreements between public and private partners that can benefit from the same improvements. They have been used in several places around the country to provide end-of-trip facilities at public transit stations in exchange for operational revenue from the facilities.	▪ Streets ▪ Sidewalks ▪ Bike lanes ▪ Trails ▪ Transit
Private Organization and Corporate Donors	Donations from private organizations and corporations can be accepted by many municipalities for capital projects. Private developers and institutions in the LRT service area may be willing to fund projects that help improve the safety and convenience of accessing, their facilities, in addition to improving their desirability	▪ Trails ▪ Sidewalks ▪ Bike Lanes ▪ Bike Parking

3 LOW STRESS ROUTE

In addition to traveling to and from LRT stations, bicycle users may need to travel between stations to access the unique businesses, services, and opportunities in each station area. The low stress route helps facilitate these trips along the LRT corridor for people to bicycle either one way or both ways, and use the LRT as part of a trip. The following is a proposed concept for a "low stress" bicycle route that connects all station areas along the Bottineau LRT line.

Some LRT corridors, such as the METRO Blue Line (Hiawatha Line) in Minneapolis, have multi-use trails running parallel to the LRT. Due to limited right of way in the freight corridor, a rail trail is not feasible for the Bottineau LRT. This chapter proposes several concepts for corridor long routes that are "low stress" for people biking along the corridor, but not necessarily accessing stations. These routes would be designed with a high level of protection, including trails, cycle tracks, and improvements at intersections, so that people who are not comfortable riding in the street with automobile traffic would be comfortable with this corridor long route. To improve the level of comfort and safety for trail users, design treatments are proposed for specific road crossings and connections, in addition to prototypical treatments for other crossings along the route. Wayfinding strategies are also proposed to guide trail users along the route and to nearby destinations.

PROPOSED LOW STRESS ROUTE

Figure 31 Proposed Low Stress Route

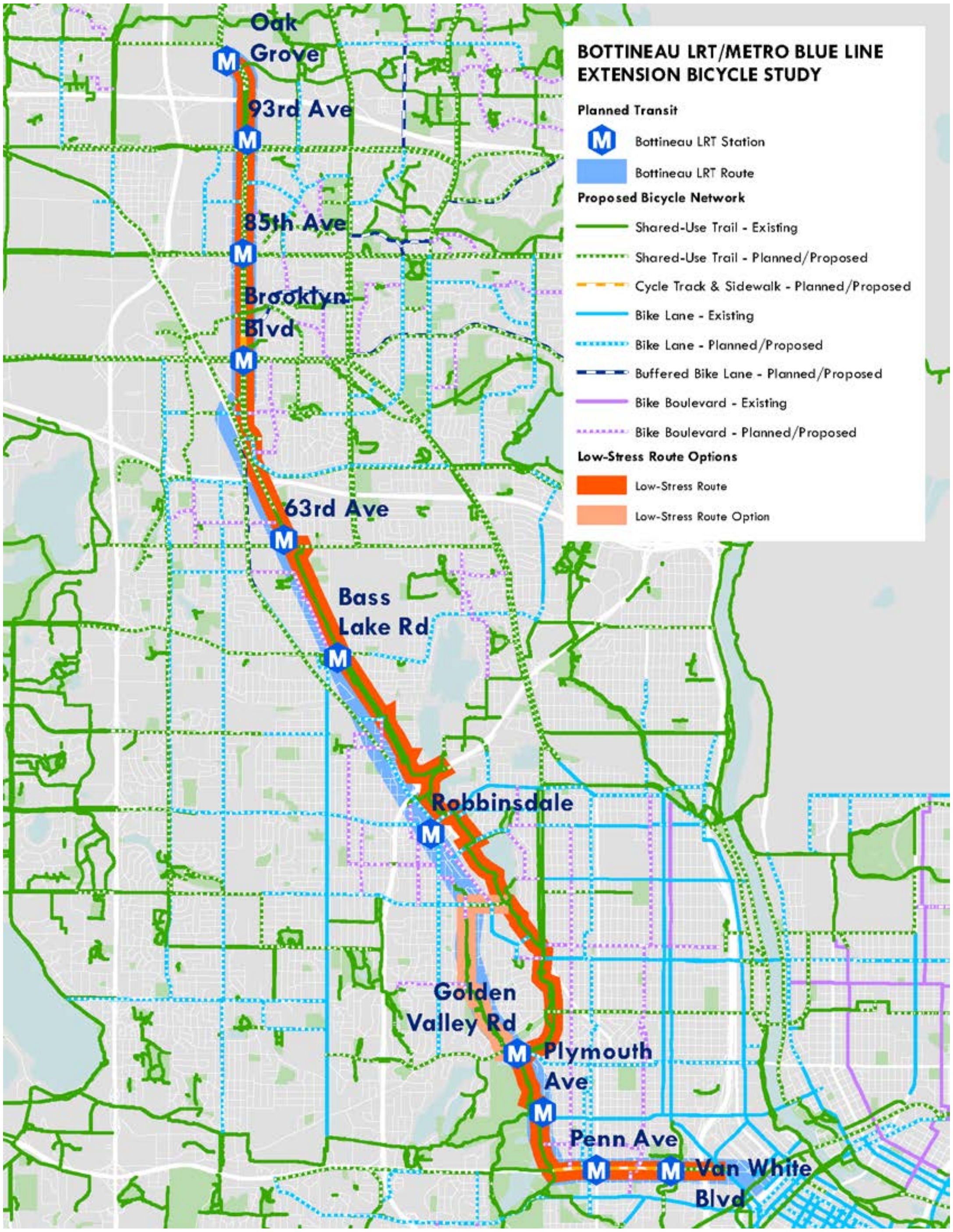


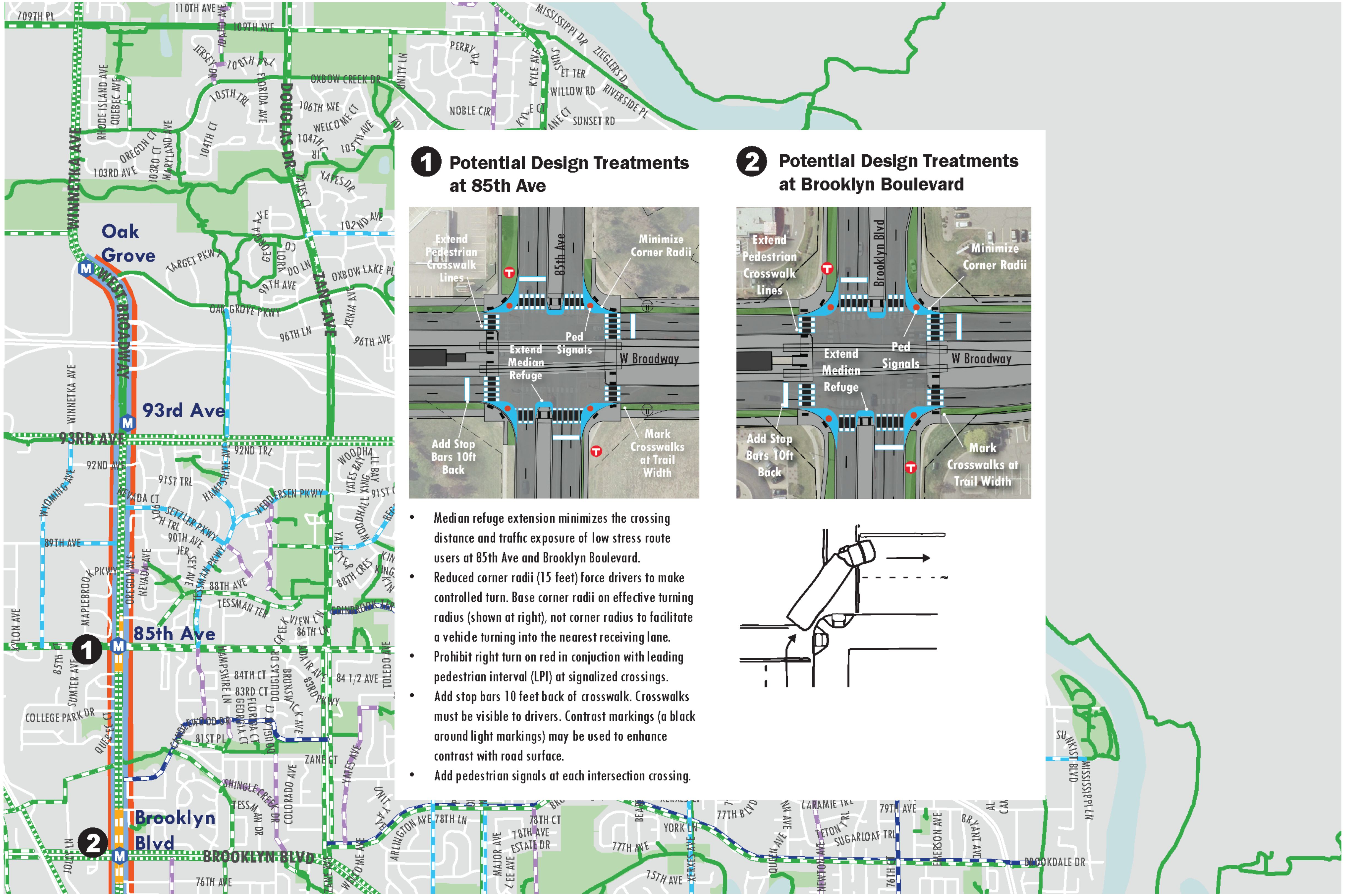
Figure 32 Low Stress Route Map (Oak Grove, 93rd Ave, 85th Ave, Brooklyn Blvd)

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit
- Bottineau LRT Station
- Bottineau LRT Route

Proposed Bicycle Network
- Shared-Use Trail - Existing
- Shared-Use Trail - Planned by City/County
- Shared-Use Trail - Proposed by this Study
- Cycle Track & Sidewalk - Proposed by this Study
- Bike Lane - Existing
- Bike Lane - Planned by City/County
- Bike Lane - Proposed by this Study
- Buffered Bike Lane - Proposed by this Study
- Bike Boulevard - Existing
- Bike Boulevard - Planned by City/County
- Bike Boulevard - Proposed by this Study

Segment
- Low-Stress Route
- Low-Stress Route Option



- Median refuge extension minimizes the crossing distance and traffic exposure of low stress route users at 85th Ave and Brooklyn Boulevard.
- Reduced corner radii (15 feet) force drivers to make controlled turn. Base corner radii on effective turning radius (shown at right), not corner radius to facilitate a vehicle turning into the nearest receiving lane.
- Prohibit right turn on red in conjuction with leading pedestrian interval (LPI) at signalized crossings.
- Add stop bars 10 feet back of crosswalk. Crosswalks must be visible to drivers. Contrast markings (a black around light markings) may be used to enhance contrast with road surface.
- Add pedestrian signals at each intersection crossing.

0 0.3 0.6 0.9 Miles

Figure 33 Low Stress Route Map (Brooklyn Blvd, 63rd Ave, Bass Lake Rd)

Alignment	
A	- Travels at-grade along LRT overpass. - Provides direct route between West Broadway trail and Crystal Lake Regional Trail beneath LRT overpass. - Requires additional lighting along LRT overpass and signage to guide users on either end.
B	- Continues West Broadway trail along west side of street. - Requires at-grade LRT crossing.

- Median refuge extensions minimize crossing and traffic exposure.
- Add raised crosswalks, and traffic and pedestrian signals on slip lanes to hold drivers while trail users cross.
- Reduced corner radii on slip lanes force drivers to make controlled turn.
- Prohibit right turn on red in conjuction with leading pedestrian interval (LPI) at signalized crossings.
- Crosswalks must be visible to drivers. Contrast markings (a black border around light markings) may be used to enhance contrast.

Figure 34 Low Stress Route Map (Brooklyn Blvd, 63rd Ave, Bass Lake Rd)

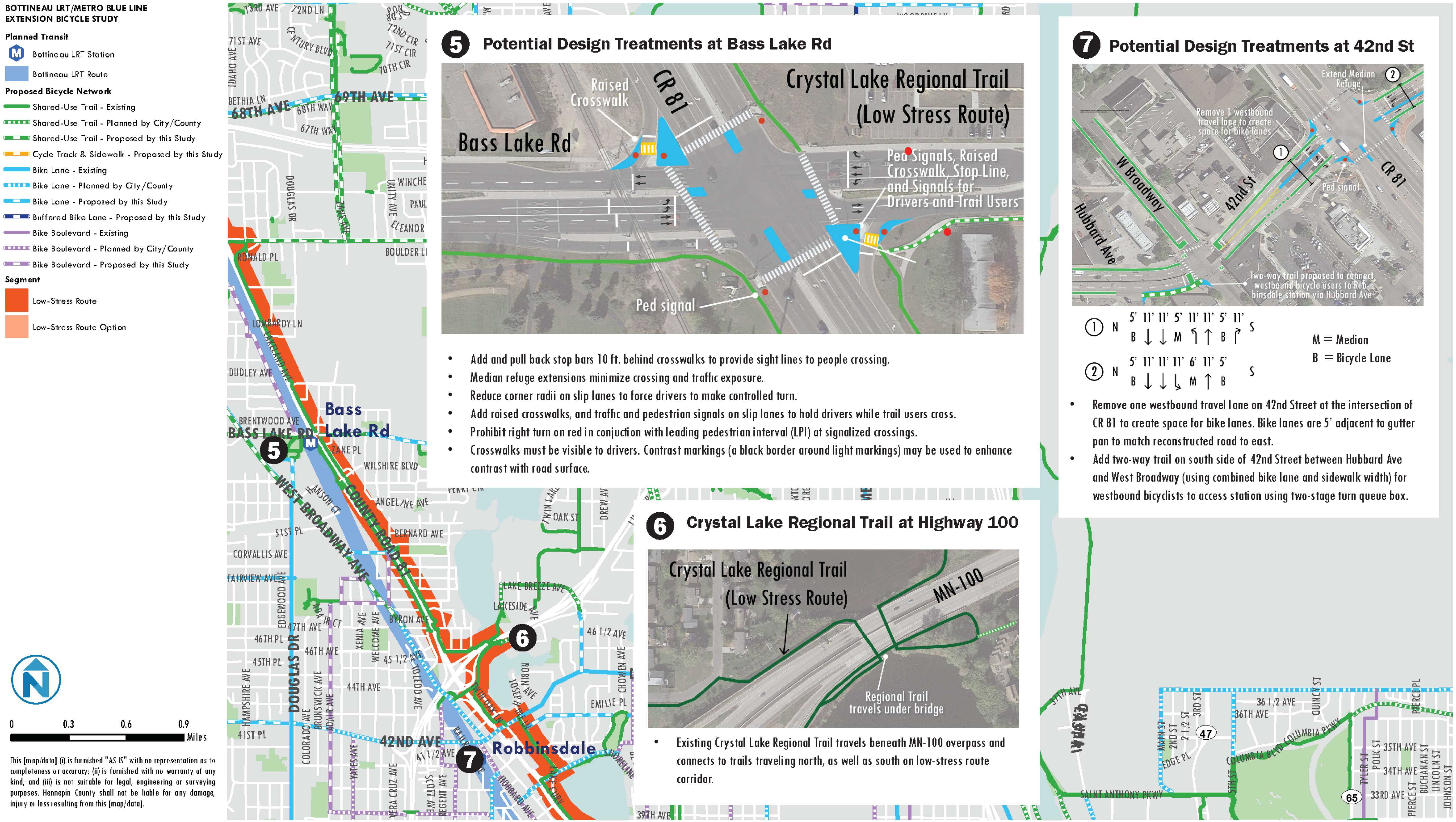


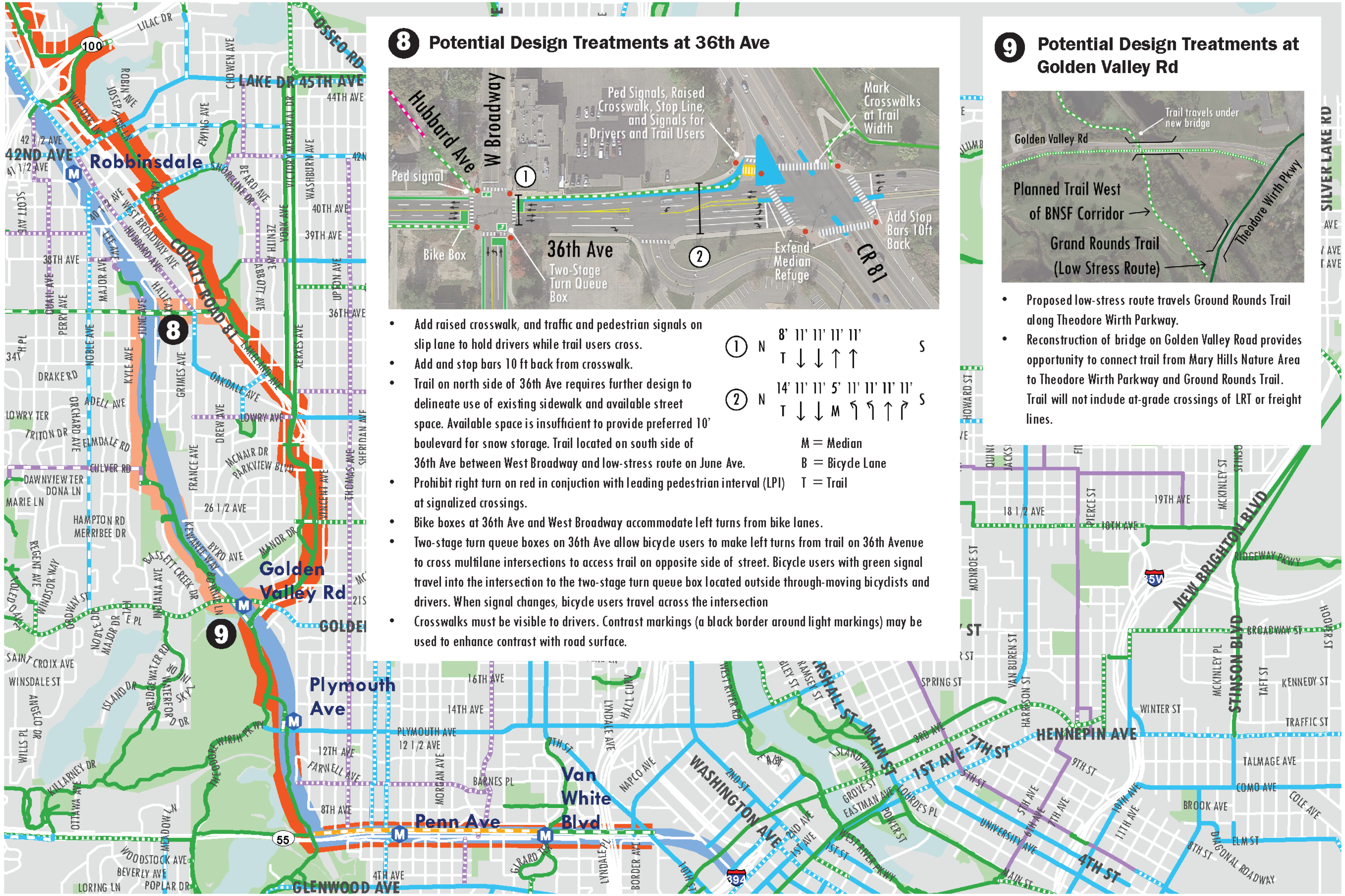
Figure 35 Low Stress Route Map (Robbinsdale, Golden Valley Rd, Plymouth Ave, Penn Ave, Van White Blvd)

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit
- Bottineau LRT Station
- Bottineau LRT Route

Proposed Bicycle Network
- Shared-Use Trail - Existing
- Shared-Use Trail - Planned by City/County
- Shared-Use Trail - Proposed by this Study
- Cycle Track & Sidewalk - Proposed by this Study
- Bike Lane - Existing
- Bike Lane - Planned by City/County
- Bike Lane - Proposed by this Study
- Buffered Bike Lane - Proposed by this Study
- Bike Boulevard - Existing
- Bike Boulevard - Planned by City/County
- Bike Boulevard - Proposed by this Study

Segment
- Low-Stress Route
- Low-Stress Route Option



0 0.3 0.6 0.9 Miles

PROTOTYPICAL CROSSING TREATMENTS

The completeness of the low-stress route corridor with safe, comfortable, and convenient crossings for people walking and bicycling is a basic requirement. The following memo focuses on prototypical crossing treatments for the proposed low stress route. In general, crossings are categorized as:

- Major intersection crossing (4+ lanes)
- Minor intersection crossing (2 lanes)
- Major mid-block crossing (4+ lanes)
- Minor mid-block crossing (2 lanes)
- Driveway crossing
- Other/Complex crossing (requires further design)

General Principles

- Make crossings as short as possible. Crosswalks must be visible to drivers, especially at night. Contrast markings, such as a black border around light markings, may be used to enhance contrast with the road surface. Add stop bars in advance of crosswalks to increase the distance between vehicles and people crossing the street.
- Ensure clear sight lines and distance are provided at crossings.
- Improve visibility for trail users and road users at crossings by designating clear space, and removing or avoiding obstructions to sight lines.
- At signalized crossings, increase the amount of crossing time for pedestrians.
- Consider leading pedestrian intervals to hold vehicles until trail users have started crossing.
- Intersections between trail and roadway should be designed at a right angle.
- Include sufficient lighting to illuminate crossing for drivers and trail users.

Major Intersection Crossing

Existing Characteristics

- 4 or more travel lanes
- Intersection is controlled by traffic signal
- Trail is located parallel to a road

Design Recommendation

- Install curb extensions in shoulder or parking lanes to decrease crossing distance if space is available.
- Install an ADA accessible median refuge if space is available. If space is not available, install narrow median or bollard to control vehicle turning movements.
- If ADA accessible median refuge is installed, and longest leg of crossing is two lanes, create raised trail crossing.
- Install signal heads for bicycle and pedestrian trail crossing and phase. Prohibit right turn on red across the trail.
- Warning signs may be used on the street and trail to indicate the presence of a crossing in advance.

- Reduce the speed of road users using traffic calming.
- Reduce corner radii to 15 feet to force drivers to make controlled turns. Base corner radii on effective turning radius, not corner radius to facilitate a vehicle turning into the nearest receiving lane. Drivers typically turn into far lane to maintain speed.

Minor Intersection Crossing

Existing Characteristics

- 2 travel lanes
- Intersection controlled by stop sign or signal
- Trail is located parallel to a road

Design Recommendation

- Trail users assumed to have priority over road users at crossing.
- Trail crossing is raised.
- Install curb extensions in shoulder or parking lanes to decrease crossing distance if space is available.
- Install an ADA accessible median refuge if space is available. If space is not available, install narrow median or bollard to control vehicle turning movements.
- At a stop-controlled intersection, trail users have priority and do not stop. Raised trail crossing includes yield markings for road users and trail users on crossing approach.
- At a signal-controlled intersection, install signal heads for bicycle and pedestrian trail crossing phase. Prohibit right turn on red across the trail.
- Warning signs may be used on the street and trail to indicate the presence of a crossing in advance.
- Reduce the speed of road users using traffic calming.
- Reduce corner radii to 15 feet to force drivers to make controlled turns. Base corner radii on effective turning radius, not corner radius to facilitate a vehicle turning into the nearest receiving lane. Drivers typically turn into far lane to maintain speed.

Major Mid-Block Crossing

Existing Characteristics

- 4 or more travel lanes
- Trail does not cross at an intersection

Design Recommendation

- Install curb extensions in shoulder or parking lanes to decrease crossing distance if space is available.
- Install an ADA accessible median refuge if space is available.
- If ADA accessible median refuge is installed, and longest leg of crossing is two lanes, create raised trail crossing and consider traffic signal.
- If ADA accessible median refuge is not installed, add traffic signal and signal heads for bicycle and pedestrian trail crossing.

- Warning signs may be used on the street and trail to indicate the presence of a crossing in advance.
- Reduce the speed of road users using traffic calming.

Minor Mid-Block Crossing

Existing Characteristics

- 2 travel lanes
- Trail does not cross at an intersection

Design Recommendation

- Trail users assumed to have priority over road users at crossing.
- Trail crossing is raised.
- Install curb extensions in shoulder or parking lanes to decrease crossing distance if space is available.
- Install an ADA accessible median refuge if space is available. If space is not available, install narrow median or bollard to control vehicle turning movements.
- If ADA accessible median is installed, use stop sign or signal to control road users.
- At a stop-controlled crossing, trail users have priority and do not stop. Raised trail crossing includes yield markings for road users and trail users on crossing approach.
- At a signal-controlled crossing, install signal heads for bicycle and pedestrian trail crossing and phase. Prohibit right turn on red across the trail.
- Warning signs may be used on the street and trail to indicate the presence of a crossing in advance.
- Use traffic calming to reduce the speed of road users.

Driveway Crossing

Existing Characteristics

- 1+ driveway lanes crossing trail to provide access to the street
- Trail crosses driveway parallel to the street
- Driveway is controlled by a stop-sign. Signal-controlled driveway should be considered as an intersection.

Design Recommendation

- Trail users assumed to have priority over road users at crossing.
- Trail crossing is raised. Driveway ramps are located outside of the trail crossing and do not affect trail users.
- Reduce corner radii to 15 feet, or less, to force drivers to make controlled turns. Base corner radii on effective turning radius, not corner radius to facilitate a vehicle turning into the nearest receiving lane. Drivers typically turn into far lane to maintain speed.
- Consolidate driveway crossings as much as possible.
- Block large vehicles from using driveway crossings on trail if possible and alternative driveways exist that do not create undue conflicts.

- Trail users have priority and do not stop.

Other/Complex Crossings

Existing Characteristics

- Intersection is irregular, including acute- and obtuse-angled intersections, 5+ legs, slip lanes or islands.
- Crossing is more complex than prototypical design recommendations can address.
- Complex crossings and connections may be included in existing studies, such as Crystal Lake Regional Trail Phase 2.

Design Recommendation

- Further design required.

WAYFINDING

A wayfinding system for the proposed low stress bicycle route, or any route in the proposed bicycle network, helps residents and visitors navigate by providing cues at key decision points. Wayfinding signage serves to:

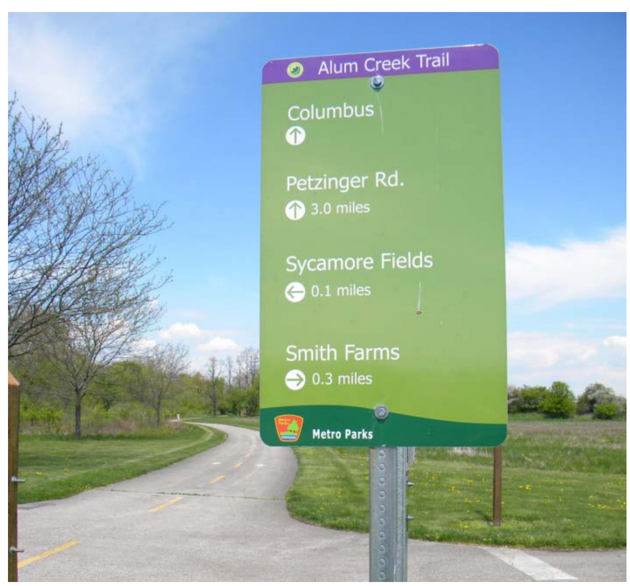
- Direct people to and along the route.
- Direct people to places of interest.
- Provide a visual cue to drivers.

By indicating the best bike routes to get to the destinations they want to access, and even communicating the distance or time to get there, wayfinding signage helps people use the designated bicycle facilities and experience the most comfortable crossings of major roadways. In addition to wayfinding guidance, the Crystal Lake Regional Trail Master Plan includes guidelines for kiosks and structures that provide maps and information about the entire trail, as well as Three Rivers' Regional Park and Trail System.

Figure 36 Confirmation Sign in Indianapolis, IN

Figure 37 Turn Sign in Savannah, GA

Figure 38 Decision Sign in Colombus, OH



Types of Wayfinding Signs

There are three general types of wayfinding signs:

Confirmation Signs

Confirmation signs indicate to bicyclists that they are on a designated bike route, which could include trails, bike lanes, or bike boulevards. Confirmation signs also make drivers away of the route. Destinations and the distance or time to destinations may be included, however arrows should not be used.

Confirmations signs should be placed:

- Every .25-1 mile on off-street bike facilities.
- Every 2-3 blocks on on-street bike facilities, except when a decision sign or turn sign is used.
- After turns to confirm that bicycle riders and trail users are on the correct route.

Turn Signs

Turn signs indicate where a bike route turns from one street onto another street, and can be supplemented with pavement markings. Turn signs should include destinations and arrows.

Turn signs should be placed:

- On the near-side of intersections before a bike route turns.

Decision Signs

Decision signs indicate the junction of two or more bike routes, and inform bicycle riders which routes access priority destinations. Decision signs should include destinations and arrows. Destinations and the distance or time to destinations should be included. 12 mph is the standard for estimating travel time for utilitarian bicyclists.

Decision signs should be placed:

- On the near-side of intersections where a bike route intersects another bike route.
- Along a bike route to indicate a destination nearby. The sign should be placed in advance of the point one must make a turn towards the destination.

4 BICYCLE FACILITIES AT STATIONS

Secure bicycle parking is an important end of trip facility that increases security from theft and physical damage while people access destinations or park to use transit. This section provides overall bike parking recommendations along the Bottineau LRT corridor as well as specific recommendations for each LRT station. Bicycle parking needs are estimated as a range, based on assumed low, medium, and high-level bicycle mode shares. A description of the methodology for developing these estimates is included below.

In addition, other opportunities to increase the number of residents, employees, and visitors using bicycles for trips to, from, and around transit stations are included. These include opportunities for higher-level bicycle facilities, such as changing rooms, showers, bike shops, bike share, bike rental, or other programs.

GENERAL BICYCLE PARKING RECOMMENDATIONS

Lack of secure bicycle parking is a chief obstacle to bicycling. People will often not bicycle somewhere or commute via bicycle if they think there is a reasonable chance their bicycle will not be there when they return. The Southwest Light Rail Transit Bicycle Facility Assessment conducted an online survey asking respondents how frequently they would bicycle to LRT stations, as well as how they would feel about locking their bicycle at the station. Survey respondents displayed a preference for indoor, secure parking and covered bike parking. Among respondents who are unlikely to park their bicycle at the station, 43% indicated a need to use their bicycle on both ends of their LRT trip, while 37% indicated that their bicycle is too valuable or would not feel safe locked at a station.

It is important that bicycle parking is conveniently located and designed to allow users to properly secure a bicycle. Effective bicycle racks provide direct contact between the bicycle frame and the rack at two points for stability such as those shown below.

Primary Types of Bicycle Parking Facilities

There are three major types of bicycle parking facilities: racks, lockers and shelters. Several key considerations influence which types are acceptable and most desirable at various locations:

- Length of time bicycles will be parked.
- Frequency of vandalism, theft and other crime in the area; presence of other security measures, either active (security guard) or passive (visible from transit platform, office windows nearby).
- Demand for parking.
- Availability of funds for installation and maintenance.

Short-term Parking

Short-term bicycle parking is typically provided and desired in the public right-of-way, and is publicly accessible. This type of parking is most often accommodated by u-racks provided singly, in clusters of two or three, or in a public bike corral.

Unsheltered Racks

Bicycle racks are the most abundant type of parking facility and generally the least expensive to install. Spatially, they are the most efficient and can accommodate the greatest number of bicycles. There are many different styles and forms of racks. The most effective racks:

- **Accommodate locking both wheels.** Older styles of racks that only hold one wheel, such as the "toaster rack," are not effective – people must remove a wheel to lock it or risk having it stolen.
- **Are immovable.** Racks should not be able to be lifted, dragged, or removed from the site. They should be firmly secured or permanently installed into a site (i.e. placed into the pavement).
- **Support the bicycle while locked.** The rack design should hold the bicycle upright while locked, without it falling or being able to be knocked over. It should also be oriented to allow sufficient access when locking the bicycle, with clearance between the rack and parked cars, buildings, or pedestrians.

Figure 39 shows a simple U-rack that can securely hold two bicycles (one on each side of the rack), while Figure 40 shows a common but undesirable wave-type of bicycle rack. Both wheels are not easily locked and bicycles can also easily fall over while locked. Some other racks have moving parts – these are also not recommended, because of high maintenance costs and increased potential for physical harm to bicycles and bicycle riders.

Figure 39 Standard U-Rack (Recommended)

Figure 40 Wave Rack (Not Recommended)

Sheltered Racks

Figure 41 Large Bike Parking Shelter

Covered racks and bicycle shelters require more space than racks and have higher installation and maintenance costs, but promote year round cycling and provide a significantly higher level of security, especially if someone is present to watch the bicycles. Shelters generally consist of rows of bicycle racks protected underneath a structure that is either fully or partially enclosed, as shown in Figure 41. Multiple configurations may be used to accommodate high demand at certain stations, while providing convenient locations and utilizing available space. Shelter can be cost- and space-efficient by locating racks inside a parking structure, as shown in Figure 48, or beneath a building overhang or awning, as opposed to a new bicycle-specific standalone structure. As respondents to the bike parking survey for the Southwest Light Rail Transit Bicycle Facility Assessment prefer sheltered racks over regular racks, it is recommended that all short-term bicycle parking is sheltered, although feasibility to do so may be restricted by factors such as cost and space.

Long-Term Parking

Long-term parking is typically fully enclosed, secured and sheltered storage intended to accommodate a personal bicycle for a period of several hours or days. It may require pre-arranged authorization to access (for example via a code, card or key). Long-term parking is generally necessary at places of work or residence. Typical means of providing for long-term bicycle parking include bicycle lockers or bicycle cages, sheds or rooms. Similar to sheltered racks, long-term parking can be provided at less cost by locating facilities inside existing or planned structures, such as parking structures and building awnings. At stations with high demand for bike parking, facilities may be divided among more than one location in order to better utilize available space conveniently located to the station platform.

Bicycle Lockers

Bicycle lockers provide a high level of security for long-term parking; however they require more space than bike cages and typically restrict access to one user. As a result, bicycle lockers are not well utilized when individuals do not consistently use the single lockers they have reserved. Due to the limited space available for fulfilling bike parking demands at each LRT station, lockers are not an effective bike parking strategy at Bottineau LRT stations.

Racks inside a Cage or Room

A higher-security variation on basic racks is a bike cage that restricts access solely to the bicycle's owner. The cage can be fitted with a gate and electronic pass card access to provide unsupervised parking. When there is a high demand for parking, several small cages provide more security than one larger one can, as they reduce the number of people who have access to each room. Parking inside an enclosed cage or room, as shown in Figure 42 to Figure 45 is more secure, but the downside of both is that bicyclists must have a key or know a code prior to using the parking facilities, which is a barrier to incidental use. As respondents to the bike parking survey for the Southwest Light Rail Transit Bicycle Facility Assessment prefer secure bike parking, it is recommended that long-term bicycle parking be provided in a secure cage or room.

Figure 42 Trimet Bike & Ride in Parking Structure

74 secure bke parking spaces are provided inside a parking structure at the SE Park Ave Trimet Station in Portland, Oregon. 26 additional sheltered short-term spaces are located near the platform.

Source: Trimet

Figure 43 Secure Bike Room in Private Development

A 54-space Bike & Ride secure parking facility is located inside a private development by the Orenco/NW 231st Ave MAX Station in Hillsboro, Oregon.

Source: Trimet

Figure 44 Free-standing Bike Cage

At the SE Tacoma/Johnson Creek MAX Station in Portland, Oregon, 72 bike parking spaces are provided in a secure, free-standing Bike & Ride facility. 22 additional sheltered short-term spaces are located near the platform.

Source: Trimet

Figure 45 Beaverton, OR Transit Center Bike & Ride

The Beaverton Transit Center provides 76 long-term parkin spaces in a secure structure, and 24 sheltered spaces underneath the awning, for bike users to access MAX LRT service.

Source: Trimet

Additional Facilities and Equipment

Bicycle repair stations are recommended at each station. These stands include an air pump and basic tools attached to a bicycle stand for users to perform repairs, shown in Figure 46.

Vending machines with small parts for bicycle repairs and accessories, such as lights and bells, should be considered for stations with higher bike parking demand.

As the Bottineau LRT stations are typically a midpoint for bicycle users, not their final destination, the stations are not very desirable locations for changing rooms or showers. These types of facilities may be a better fit at specific employment destinations, such as businesses around Oak Grove Parkway, or as part of potential bicycle stations near the Robbinsdale station.

Placement

To encourage maximum use, and for them to be accessible and convenient for bicyclists, parking facilities should be placed in well-traveled, central locations, as close as possible to a LRT station entrance. A maximum of 100 feet between bike parking facilities and a station entrance is ideal, but may not be possible at all stations, in which case the distance should be minimized. They should be easy to find and access, but also designed to fit in with the surrounding area and not obstruct the movement of pedestrians or other vehicles. To avoid conflicts, bike parking should not be placed on station platforms. As shown in Figure 42 to Figure 45, bike parking at transit stations can be provided in multiple convenient locations when spatial constraints or opportunities do not allow for one location.

Figure 46 Bike Repair Station

Figure 47 Bike Parts Vending Machine

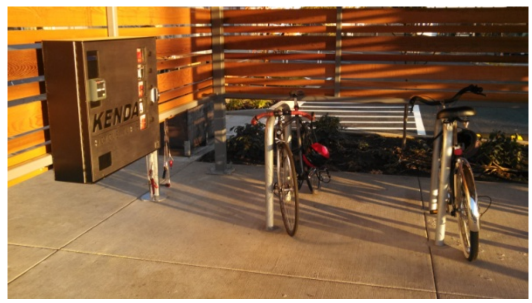


Figure 48 Bike Corral in Parking Ramp

The following criteria will assist in the proper location of bicycle parking facilities:

- **Visibility and security:** Place parking facilities in highly visible locations to discourage theft and vandalism. Locate parking within view of passers-by, retail activity or station platform. Explore opportunities to take advantage of any security personnel at the station or nearby. Consider installing a security camera if other measures do not appear sufficient to deter theft and vandalism.
- **Access:** Facilities should be convenient to building entrances and street access without obstructing the flow of pedestrian or auto traffic. Locate bike parking as close as possible to a LRT station entrance, but no more than 100 feet away. Through placement and signage, bike parking should be easily visible to or located by first-time users. Avoid locations that require bicyclists to carry their bicycles up and down stairs, through narrow passages, or across other surfaces they cannot ride on. Locating bicycle parking near to corners improves visibility, access to curb ramps, and accessibility to more block frontages. Parking should be located far enough away from the corner to avoid conflicting with curb ramps or sight lines. Bicycle parking works well in curb extensions or bike corrals that extend the pedestrian environment into the parking lane, freeing up space on the sidewalk for circulation or other amenities. Bicycle parking can be incorporated into car parking facilities to provide shelter for unsecured, short-term bike parking, as shown in Figure 48. Additionally, parking structures can provide space for a secure bike parking cage, as shown in Figure 42. In both scenarios, the bike parking should be located in close proximity to the station entrance. Safe and convenient connections should be provided between bike parking in a

garage and routes that people biking and walking will use for access from the station and station area.

- **Lighting:** Parking facilities should be placed in well-lit areas. A bright light illuminating the parking area, perhaps motion sensitive, is a deterrent theft and vandalism and increases people's sense of personal safety.

Maintenance

Bike parking areas must be maintained like any portion of the station. Vandalized and abandoned bicycles send a clear message to current and potential cyclists that their bicycle would not be safe parked at a LRT station. Removing these bicycles regularly conveys to thieves and passengers that the parking is being taken care of. Keeping bicycle facilities in good repair also maximizes the number of bicycles that can be stored at each station. Bike parking must also be kept clear after a snow event. Avoid snow storage that prevents the use of bicycle racks, or avoid placing racks in areas that are used for snow storage, such as certain medians along the side of the road.

BIKE PARKING DEMAND ESTIMATE

The bikesheds developed earlier in the Bottineau LRT / METRO Blue Line Extension Bicycle Study (see chapter 2) were used to estimate the amount of bike parking demand for each of the planned Bottineau LRT stations. The methodology for determining demand was based on the Bottineau Project Office (Metropolitan Council)'s estimated 2040 Bottineau LRT boardings by station. The steps are as follows:

1. Combine stations into segments based on station character (Figure 49). For example, the Van White Boulevard and Penn Ave stations were considered one segment because they are both located on Olson Memorial Highway and have similar land use patterns.

Figure 49 Total 2040 LRT Boardings by Segment and Station

Segment	Station	2040 Estimated Daily Boardings		2040 Estimated Daily Boardings per Segment
		Total	Walk Access	
Residential Minneapolis	Van White	650	400	1,650
	Penn Ave	1,000	450	
Park Adjacent Minneapolis	Plymouth	250	200	1,150
	Golden Valley	900	350	
City Center	Robbinsdale	3550	650	3,550
Suburban	Bass Lake Road	1,650	550	7,950
	63rd Avenue	1,350	400	
	Brooklyn Blvd	2,400	400	
	85th Avenue	2,200	1,000	
	93rd Avenue	350	250	
Mixed Use Job Center	Oak Grove Parkway	2,350	700	2,350

2. Develop a high, medium, and low bicycle mode share estimate based on existing census data and regional bicycle mode share goals. As information about bike-to-transit mode share for other regions is limited, assumptions are made based on the goals published by Hennepin County and the City of Minneapolis. The Hennepin County 2040 Bicycle Transportation Plan includes a goal

of doubling the mode share of bicycling to work in the county from 1.8% to 3.6% by 2040, while the Minneapolis Climate Action Plan aims to achieve a goal of 15% bicycling mode share by 2025. Figure 50 describes the rationale for each low, medium, and high bike-to-transit mode share.

Figure 50 Bicycle Mode Share Estimates by Segment

Segment Name	Stations	Bicycle Mode Share to Transit Estimate	Rationale
Residential Minneapolis	▪ Van White ▪ Penn Ave	2014 ACS bicycle mode share: 4.6%	
		Low estimate - 5%	2014 mode share rounded up
		Medium estimate - 10%	Splits the difference between low and high estimate
		High estimate - 15%	Based on Minneapolis 2025 Climate Action Plan goal
Park adjacent residential	▪ Plymouth Ave ▪ Golden Valley Road	2014 ACS bicycle mode share: 4.6% in Minneapolis; 2013 ACS bicycle mode share: 0.3% in Golden Valley; 3% arrived at Wirth via bike per 2008 parks survey	
		Low estimate - 5%	Minneapolis and park access mode share rounded up
		Medium estimate - 6.5%	Splits the difference between low and high estimate
		High estimate - 8%	Half of Minneapolis 2025 Climate Action Plan goal, rounded up
City center	▪ Robbinsdale	2013 ACS bicycle mode share: 0.7% Robbinsdale bike plan does not establish mode share goal; Hennepin County 2040 bicycle transportation plan indicates 3.6% mode share goal for 2040	
		Low estimate - 1%	2013 mode share rounded up
		Medium estimate - 3%	Splits the difference between low and high estimate
		High estimate - 5%	Based on Hennepin County's bike plan 2040 goal, rounded up to 5% for good bikeability and walkability in Robbinsdale
Suburban	▪ Bass Lake Road ▪ 63rd Ave ▪ Brooklyn Blvd ▪ 85th Ave ▪ 93rd Ave	2013 ACS bicycle mode share: 0.2%	
		Low estimate - 1%	Rounding up 2010 mode share for error in very low existing mode share
		Medium estimate - 2.3%	Splits the difference between low and high estimate
		High estimate - 3.6%	Based on Hennepin County 2040 county wide commute mode split goal
Mixed use-Job center	▪ Oak Grove Pkwy	2013 ACS bicycle mode share: 0.2%	
		Low estimate 1%	2013 mode share rounded up
		Medium estimate - 3%	Splits the difference between low and high estimate
		High estimate - 5%	Based on Hennepin County's bike plan 2040 goal, increased to 5% because concentration of jobs, retail, and housing is planned

3. Apply the mode share estimates to each segment to yield a low, medium, and high bike ridership estimate for each station, as shown in Figure 51.
4. Based on results of a survey completed for the Southwest Light Rail Transit Bicycle Facility Assessment, it is assumed that 25% of people who bike to a station will take their bicycle on the

train. The estimate of bike parking needed, shown in Figure 51, is based on 75% of the estimated bike ridership using parking for each segment.

Figure 51 Estimated Bike Parking Needs by Segment

Segment	Bike Mode Share Estimate		Bike Ridership	Carry on Percentage	Bike Parking Needed
Residential Minneapolis	Low	5%	83	25%	62
	Medium	10%	165		124
	High	15%	248		186
Park Adjacent Residential	Low	5%	58	25%	43
	Medium	6.5%	75		56
	High	8%	92		69
City Center	Low	1%	36	25%	27
	Medium	3%	107		80
	High	5%	178		133
Suburban	Low	1%	80	25%	60
	Medium	2.3%	183		137
	High	3.6%	286		215
Mixed Use Job Center	Low	1%	24	25%	18
	Medium	3%	71		53
	High	5%	118		88

5. Calculate the current 2010 population of the bike shed for each station based on U.S. Census data (for bike sheds, see Chapter 2). Estimate 2040 bike shed population by applying a city level growth factor to each bike shed (city level growth factors were derived from 2010 existing population and 2040 population forecasts in Thrive MSP 2040; for the Golden Valley Road and Plymouth stations, growth factors from Minneapolis and Golden Valley were averaged). The second column in Figure 52 shows estimated 2040 bikeshed population.
6. A qualitative multiplier was used to adjust the estimated populations of the bikesheds to account for other factors that could impact bike parking, as shown in Figure 52. The total amount of bike parking recommended for a given segment remained the same, but, adjusting the estimated population of these stations allows for a realistic distribution of bike parking within a segment
    a. Robbinsdale increased for high potential for bicycling due to land uses and population density.
    b. Bass Lake Road decreased due to suburban land uses.
    c. 63rd Avenue decreased due to vehicular park and ride.
    d. Brooklyn Boulevard decreased due to suburban land uses and low development potential as indicated by market study.
    e. 85th Avenue increased due to school and library.
    f. 93rd Avenue decreased due to low density.

Bike parking demand for each segment was divided among the individual stations proportionately to the estimated 2040 population of each bikeshed (Figure 52).

Figure 52 Bikeshed Population Ratios with Overlapping Bikesheds

Station	2040 Bikeshed Population	Qualitative Multiplier	Effective Population	Bikeshed Population Ratio
Van White	38,178	1	38,178	0.69
Penn Ave	16,907	1	16,907	0.31
Plymouth	6,885	1	6,885	0.16
Golden Valley	35,688	1	35,688	0.84
Robbinsdale	48,327	1.2	57,992	1.00
Bass Lake Road	17,624	0.8	14,099	0.10
63rd Avenue	52,296	0.8	41,837	0.29
Brooklyn Blvd	40,923	0.8	32,739	0.23
85th Avenue	32,597	1.2	39,116	0.27
93rd Avenue	19,442	0.8	15,553	0.11
Oak Grove Pkwy	42,248	1	42,248	1.00

7. Figure 53 summarizes the low, medium, and high bike parking demand estimates by station including the overlapping bikeshed areas. These calculations were performed based on the unique bikesheds for each station and an even divide of overlapping bikeshed areas as there is no way to be certain which station bicyclists in overlapping areas will choose to bike to.

Figure 53 Bike Parking Demand by Station Bikesheds

Station	Low Parking Estimate	Medium Parking Estimate	High Parking Estimate
Van White*	22	43	64
Penn Ave	19	38	57
Plymouth	7	9	11
Golden Valley	36	47	58
Robbinsdale	27	80	133
Bass Lake Road	6	13	21
63rd Avenue	17	40	63
Brooklyn Blvd	14	31	49
85th Avenue	16	37	59
93rd Avenue	6	15	23
Oak Grove Pkwy	18	53	88

* Note: Estimates at the Van White station were cut in half after calculations were complete because of the station's proximity to downtown Minneapolis. If people are traveling to downtown Minneapolis from this station area, some are likely to bike the 1-2 miles to downtown rather than parking at the station, which will reduce the number of bike parking spots needed at this station.

BIKE PARKING RECOMMENDATIONS

To accommodate future bike demand, square footage should be identified at each station to serve the high parking estimate, based on the highest mode share assumptions. Some bike parking should be located in the immediate vicinity of station platforms, but in many cases bike parking demand will be accommodated in a number of locations and may be owned and operated by different partners. For example, long-term bike parking may be located in parking ramps or on nearby public or private property. Although some public bike parking is needed, some of the demand may be accommodated by private employers or businesses. A variety of public, private, and non-profit entities will need to work together to meet the total bike parking needs.

For opening day of the Bottineau LRT, the minimum amount of bike parking implemented should serve the low demand estimate, most closely reflecting existing mode share. Bicycle parking needs should be reassessed in the future as the station area changes, and bicycle users respond to the implementation of transit, bicycle network improvements, and other land use changes.

Estimated bike parking space requirements shown in Figure 56 are based on the highest estimated bike parking demand. Long-term bike parking will not include bike lockers, as they are expensive, spatially inefficient, and being phased out by Metro Transit. Bike cages or secure bike rooms, depending on available space and structures, are appropriate for long-term parking.

Estimated space requirements for short-term bike parking are based on bicycle parking guidelines in the Hennepin County 2040 Bicycle Transportation Bicycle Plan, as shown in Figure 54. This layout was used to assume an estimated 24 square feet per bike rack. Space requirements for long-term bike parking are assumed based on typical vendor specs. Many vendors provide racks with similar specifications; specific vendors or models of U-racks are not identified. Figure 55 illustrates a typical bicycle cage, accommodating 28 racks, which measures 21.6 feet by 17.6 feet. Similar bicycle cages require approximately 13 square feet per rack, and can accommodate as many as 80 racks per cage.

Figure 54 Estimated Space Requirements for Short-term Bike Parking

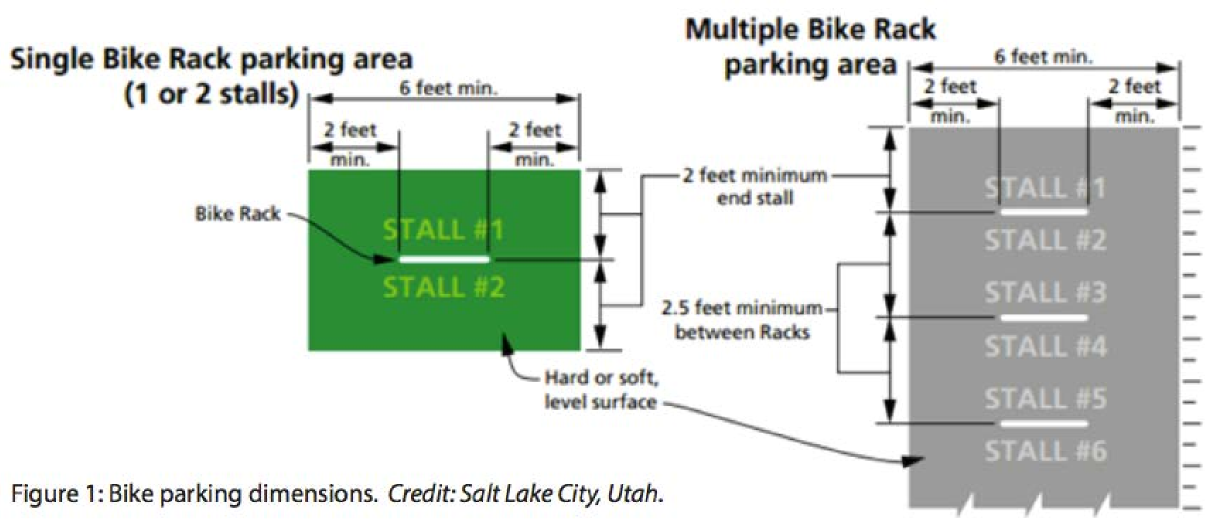


Figure 1: Bike parking dimensions. *Credit: Salt Lake City, Utah.*

Figure 55 Velodome Guardian Double Bike Shelter

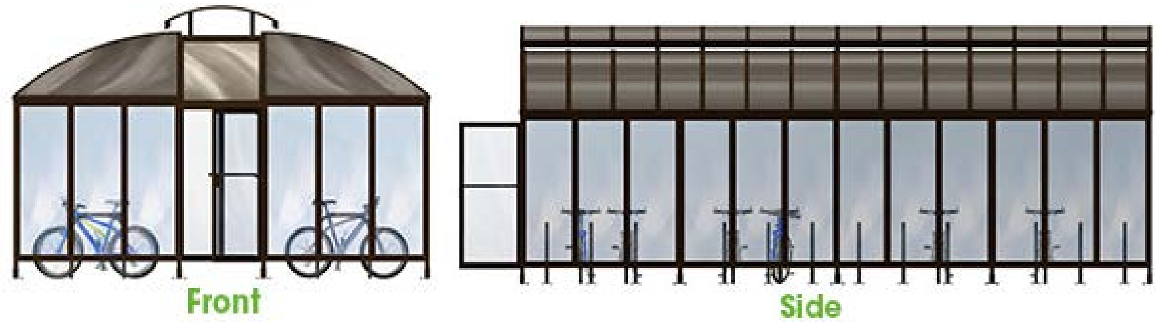


Figure 56 Recommended Bike Parking Type and Space Requirements

Station	Total Parking (High)	Long-term (60%)	Short-term (40%)	Cage Capacity Needed	Number of Covered Racks (Capacity: 2)	Total Square Footage
Van White	64	39	26	38	13	811
Penn Ave	57	34	23	34	11	777
Plymouth	11	7	4	7	2	247
Golden Valley	58	35	23	35	12	781
Robbinsdale	133	80	53	80	27	1,635
Bass Lake Road	21	13	8	13	4	330
63rd Avenue	63	38	25	38	13	804
Brooklyn Blvd	49	29	20	29	10	739
85th Avenue	59	35	23	35	12	785
93rd Avenue	23	14	9	14	5	341
Oak Grove Pkwy	88	53	35	53	18	1,173

For comparison purposes, Figure 57 and Figure 58 present the space requirements for the medium and low bike parking demand estimates.

Figure 57 Bike Parking Type and Space Requirements for Medium Demand Estimate

Station	Total Parking (Medium)	Long-term (60%)	Short Term (40%)	Cage Capacity Needed	Number of Covered Racks (Capacity: 2)	Total Square Footage
Van White	43	26	17	26	9	586
Penn Ave	38	23	15	23	8	562
Plymouth	9	5	4	5	2	237
Golden Valley	47	28	19	28	9	606
Robbinsdale	80	48	32	48	16	1,010
Bass Lake Road	13	8	5	8	3	258
63rd Avenue	40	24	16	24	8	572
Brooklyn Blvd	31	19	13	19	6	432
85th Avenue	37	22	15	22	7	560
93rd Avenue	15	9	6	9	3	265
Oak Grove Pkwy	53	32	21	32	11	757

Figure 58 Bike Parking Type and Space Requirements for Low Demand Estimate

Station	Total Parking (Low)	Long-term (60%)	Short-term (40%)	Cage Capacity Needed	Number of Covered Racks (Capacity: 2)	Total Square Footage
Van White	22	13	9	13	4	335
Penn Ave	19	11	8	11	4	285
Plymouth	7	4	3	4	1	227
Golden Valley	36	22	14	22	7	554
Robbinsdale	27	16	11	16	5	357
Bass Lake Road	6	4	2	4	1	222
63rd Avenue	17	10	7	10	3	277
Brooklyn Blvd	14	8	5	8	3	259
85th Avenue	16	10	7	10	3	272
93rd Avenue	6	4	3	4	1	225
Oak Grove Pkwy	18	11	7	11	4	278

Estimated Bike Parking Costs

The following table shows estimated costs for providing bike parking at each station. Short-term parking costs are assumed to be $200 for installation of a rack, while additional shelter costs can range from $0, if shelter can be provided by an existing structure, to $30,000 or more, for higher-quality new construction. Long-term parking costs are assumed to be $1,000 per space, which fits with the range of costs provided by parking manufacturers. Similarly, costs for long-term parking can vary depending on the quality, discount associated with purchasing and installing multiple units, as well as the need to pour a concrete pad to support a structure. Additional costs of long-term parking include access-control software and security systems.

Figure 59 Recommended Bike Parking Type and Space Requirements for High Demand Estimate

Station	Short-Term Parking (Racks)	Long-Term Parking (Spaces)	Short-term Parking Cost	Long-term Parking Cost	Total Cost
Van White	13	38	$5,200	$38,000	$40,600
Penn Ave	11	34	$2,400	$35,000	$37,400
Plymouth	2	7	$600	$7,000	$7,600
Golden Valley	12	35	$2,400	$35,000	$37,400
Robbinsdale	27	80	$5,400	$80,000	$85,400
Bass Lake Road	4	13	$1,000	$13,000	$14,000
63rd Avenue	13	38	$2,600	$38,000	$40,600
Brooklyn Blvd	10	29	$2,000	$30,000	$32,000
85th Avenue	12	35	$2,400	$36,000	$38,400
93rd Avenue	5	14	$1,000	$14,000	$15,000
Oak Grove Pkwy	18	53	$3,600	$53,000	$56,600
Total	127	376	$26,000	$397,000	$405,000

ADDITIONAL OPPORTUNITIES TO INCREASE BICYCLE RIDERSHIP

In addition to providing the proposed bicycle network within the Bottineau LRT station bikesheds and parking at stations, there may be other opportunities to increase bicycle ridership in the station areas.

- **Bicycle sharing –** A fleet of publicly owned bicycles is available on demand at some transit stations and nearby destinations for short first and last mile trips in Minneapolis. The Van White and Penn Avenue Stations are currently within the Nice Ride service area, while the Plymouth and Golden Valley stations are near the edge. These are the most likely stations to locate a bike sharing station. Other Bottineau LRT station areas with a mix of origin and destination points require further consideration of a bike share expansion, satellite system, or work-place bike share system in a station area such as Oak Grove Parkway. Dockless bikeshare systems, such as those operated in multiple cities by Social Bicycles, provide a lower cost opportunity to implement a small-scale bikeshare system. For more information about bicycle sharing options, please see the Appendix.
- **Bicycle rental –** Bicycle rental can be provided in the form of an automated bikeshare system, standalone rental-focused businesses, or commonly as a service of bicycle shops. A bicycle shop providing rental services located adjacent to a station would be desirable to serve bike-to-transit users, other bicycle users, and visitors.

5 BICYCLE NETWORK PROJECT PRIORITIZATION

This section provides a prioritized list of proposed bicycle facilities within each of the municipalities covered by the bikesheds developed for the Bottineau LRT / Metro Blue Line Extension Bicycle Study. Municipalities are included that do not lie along the Bottineau LRT corridor as the bikesheds extend beyond the corridor.

IDENTIFYING PROJECTS FOR PRIORITIZATION

For the purposes of the prioritization process, the proposed network needs to be divided into distinct projects. The following approach was used to define projects.

- Include facilities that are planned by city or county or park agencies, or proposed by this study.
- Exclude projects that do not touch a bikeshed. In some areas of limited network connectivity, a facility outside of the bikeshed is included as a critical link to close a small gap that would otherwise be left in the proposed network.
- All facilities proposed on a street or corridor will be considered one project (e.g., bike lanes and a trail proposed for one street).
- Projects will be split by municipality regardless of who is responsible for the roadway or right of way.
- Proposed facilities that fill gaps in a network corridor will be considered one project, rather than separate projects.
- Proposed facilities of the same or different types will be grouped as one project if the facilities are dependent on each other to fully close a gap in the network or reach a destination.

PRIORITIZATION CRITERIA

Projects identified in the study are ranked and prioritized corridor-wide and by municipality using the criteria in Figure 60. The criteria prioritize projects that create direct connections to proposed LRT stations, improve corridors with a history of bicycle crashes, and connect to jobs, residents, and zero-car households.

Proximity to LRT station was calculated using a spatial join. The number of bicycle crashes per mile was calculated by count of crashes along the project corridor. Data on zero car households was collected from the 2013 Census block group level within a 500-foot buffer of project corridors. Similarly, data on residents was collected from the 2010 Census block level and jobs data was collected from the 2013 Census Longitudinal Employer-Household Dynamics (LEHD) program dataset within a 500-foot buffer of projects. To normalize projects of varying distance, the number of residents and jobs was calculated per project mile.

The specific metric scores for each project are calculated relative to all projects, not in absolute terms. The data for each metric is aggregated into percentile terms ranging from 0 (lowest) to 10 (highest) among all projects, signifying the relative standing of each project in the LRT corridor.

Figure 60 Prioritization Criteria

Criteria	Notes	Value	Weighting
Is the project located close to an LRT station?	Proximity to LRT station point in GIS	Projects ranked in comparison to each other on a scale of 0 to 10	30%
Does the project create a direct connection to an LRT station?	Connection to an LRT station	Yes = 15 No = 0	15%
Does the project address a known safety concern?	Bicycles crashes per mile	Projects ranked in comparison to each other on a scale of 0 to 10	15%
How many zero car households does the project serve?	Assigned zero car households to each project based on adjacent blocks	Projects ranked in comparison to each other on a scale of 0 to 10	15%
How many employees and residents does the project serve?	Assigned jobs to each project based on LEHD data points; assigned population to each project based on adjacent blocks	Projects ranked on a scale of 0 to 10 based on employment and residential density (jobs + population per mile)	15%
Does the project directly serve schools and libraries?	Known schools and libraries per mile	Projects ranked in comparison to each other on a scale of 0 to 10	5%
Does the project improve connections to the regional trail network and the Metropolitan Council's regional bicycle transportation network?	Proximity to trail or bicycle transportation network segment in GIS	Projects ranked in comparison to each other on a scale of 0 to 10	5%

PRIORITIZED PROJECTS BY MUNICIPALITY

The following pages illustrate prioritized project maps and prioritization scores for projects in the 90th percentile for each municipality. Projects are uniquely colored to illustrate proposed project limits. Information regarding facility type is described in the Proposed Bicycle Network figures. Complete prioritized project maps and scores for all municipalities, and a complete table of the overall project ranks follows in the Appendix C.

Champlin

Figure 61 Champlin Project Priority Map

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

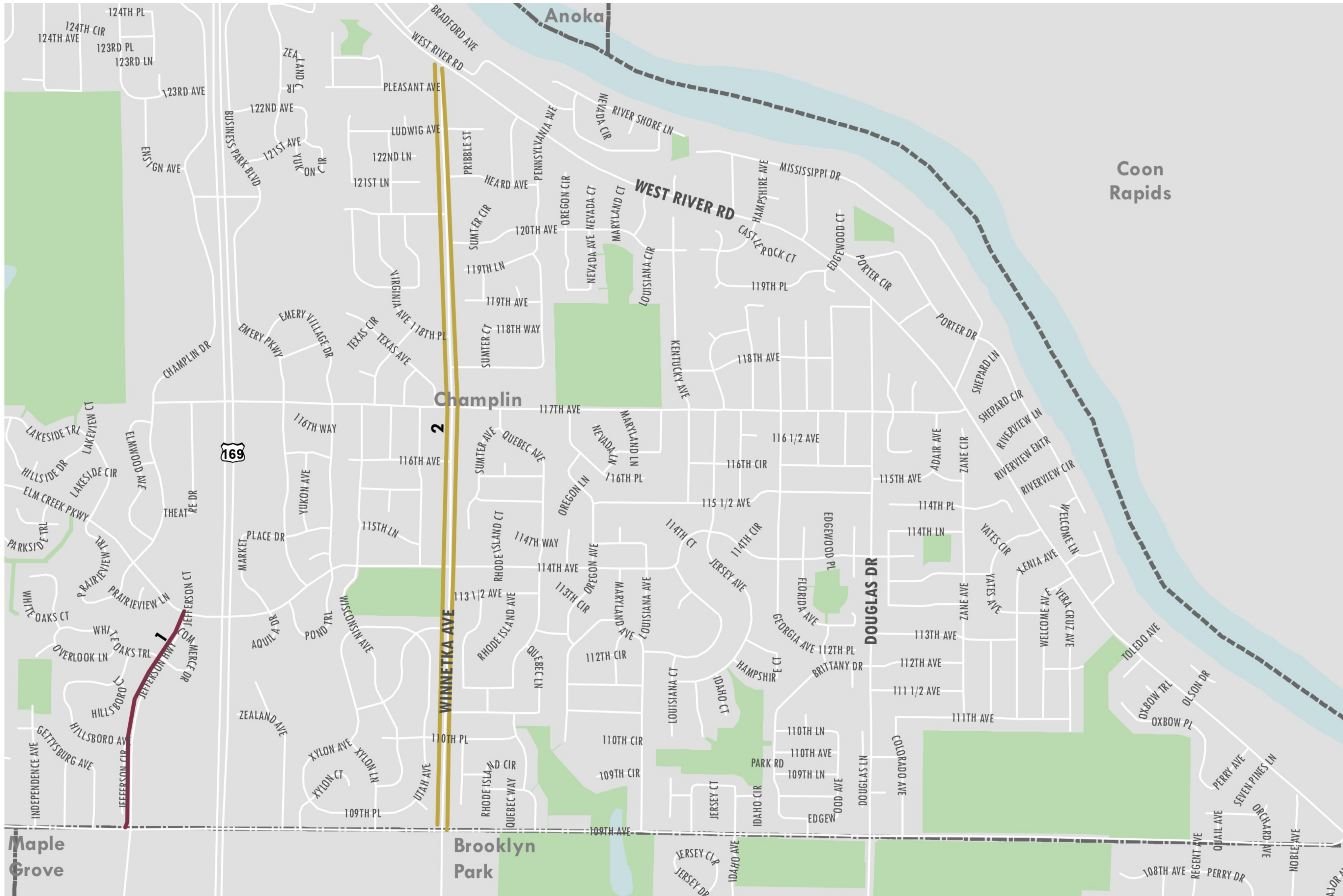
Planned Transit

Bottineau LRT Station

Municipal Boundary

Proposed Project

 # Local Rank



0 0.15 0.3 0.45 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 62 Champlin Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	199	Champlin	Jefferson Hwy	8.10	11.64	0	1.40	9.98	0.00	0.65	31.76
2	129	Champlin	Douglas Dr	7.02	10.79	0	5.22	4.31	0.00	0.58	27.91

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Brooklyn Park

Figure 63 Brooklyn Park Project Priority Map (North)

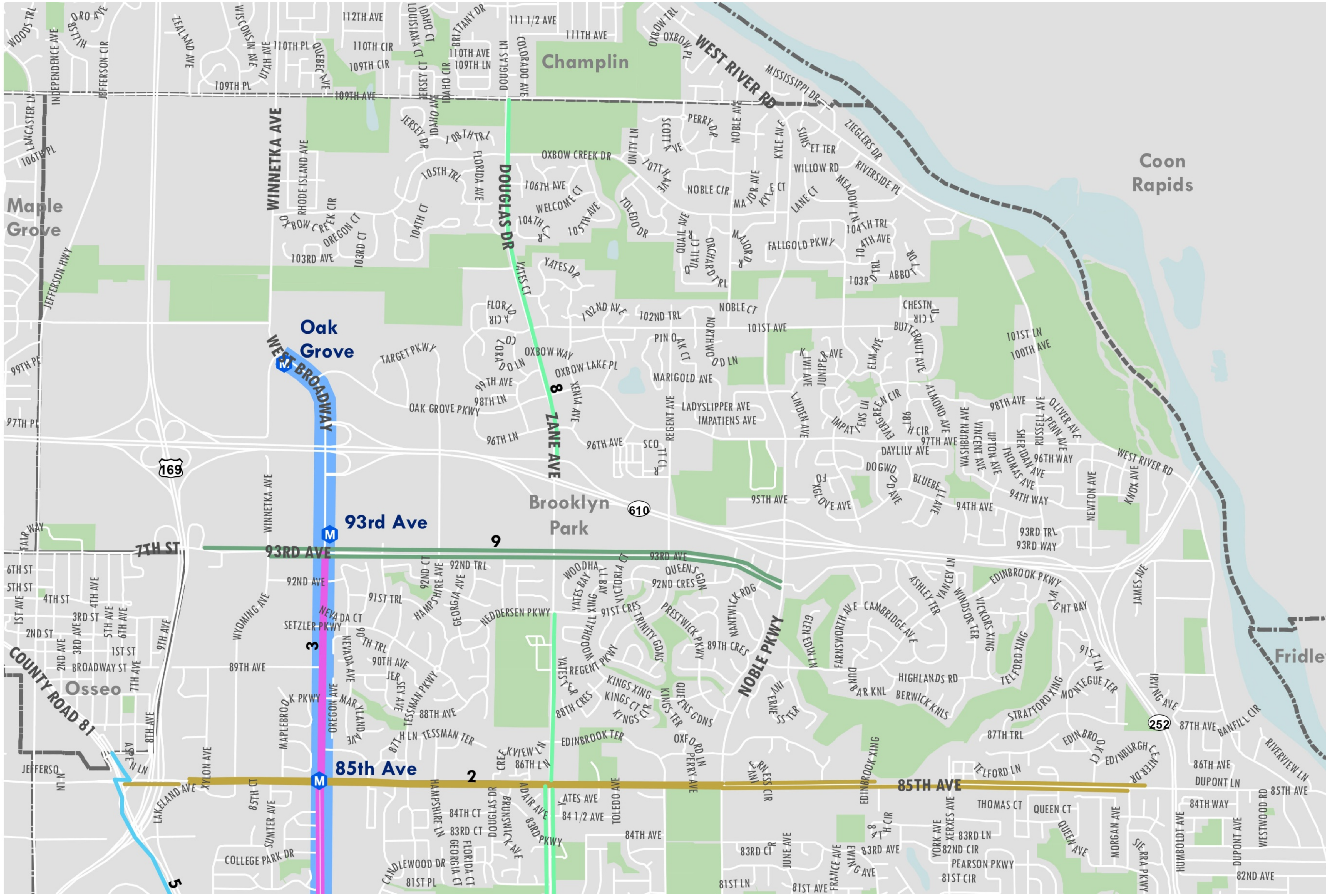
BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

- Bottineau LRT Station
- Bottineau LRT Route
- Municipal Boundary

Proposed Project

 # Local Rank

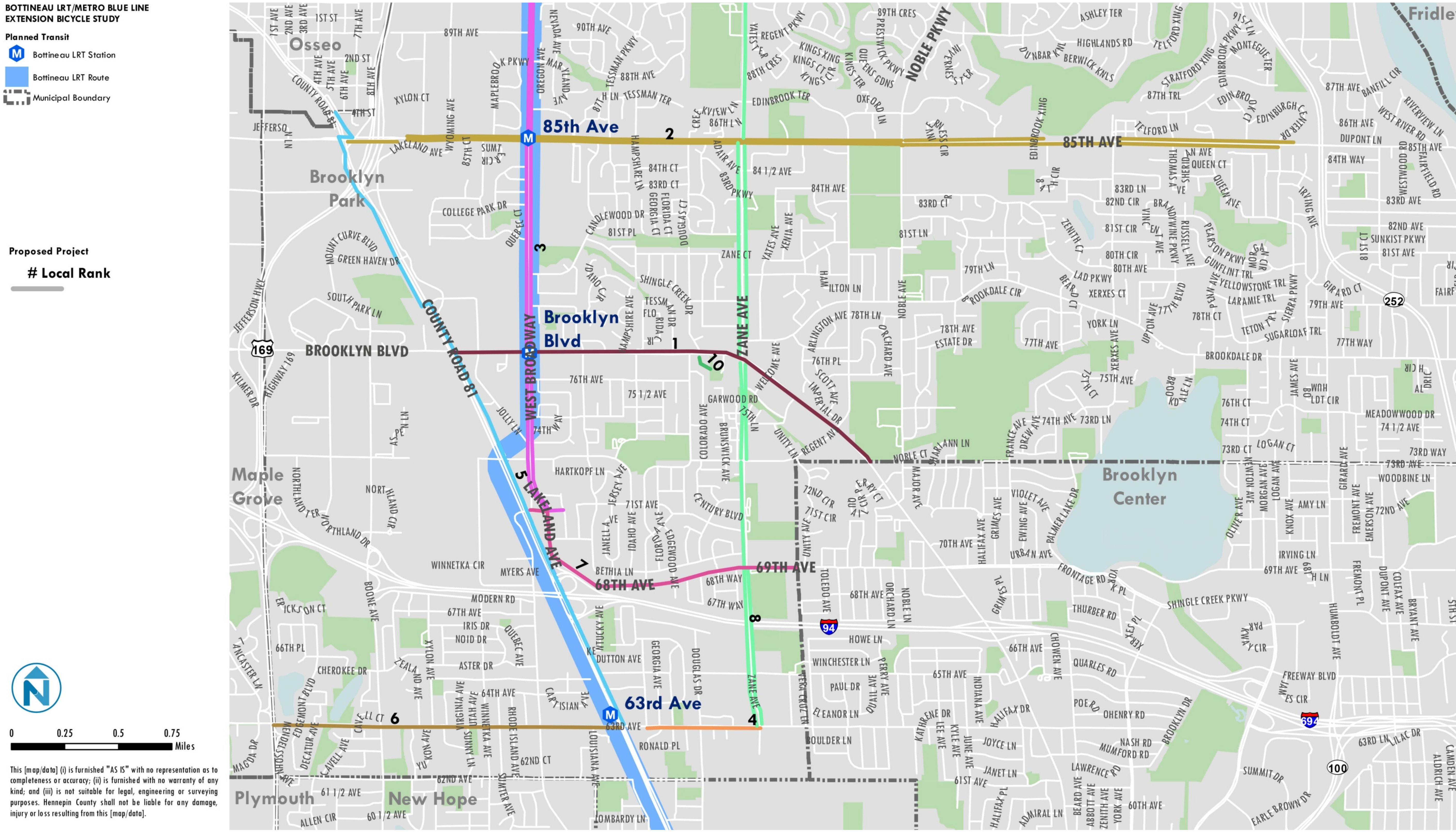


0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 64 Brooklyn Park Project Priority Map (South)



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 65 Brooklyn Park Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	304	Brooklyn Park	Brooklyn Blvd	29.70	12.68	15	12.45	7.55	4.05	5.00	86.42
2	70	Brooklyn Park	85th Ave	29.58	8.79	15	13.16	1.46	3.76	5.00	76.74
3	82	Brooklyn Park	West Broadway	29.79	9.87	15	11.16	1.07	3.78	5.00	75.66
4	77	Brooklyn Park	63rd Ave	27.54	13.11	15	7.11	7.71	0.00	3.37	73.84
5	48	Brooklyn Park	Crystal Lake Regional Trail	28.83	8.57	15	12.72	2.64	0.00	5.00	72.76
6	75	Brooklyn Park	63rd Ave	28.50	9.33	15	12.35	3.66	0.00	2.85	71.68
7	311	Brooklyn Park	68th Ave	21.93	12.03	0	13.70	5.72	3.87	5.00	62.24
8	128	Brooklyn Park	Zane Ave to Douglas Dr	20.94	11.00	0	14.94	5.28	3.90	5.00	61.06
9	164	Brooklyn Park	93rd Ave	28.41	8.03	15	3.39	0.65	0.00	5.00	60.47
10	266	Brooklyn Park	Shingle Creek Dr South	18.03	13.86	0	11.00	13.16	0.00	0.20	56.24

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Brooklyn Center

Figure 66 Brooklyn Center Project Priority Map

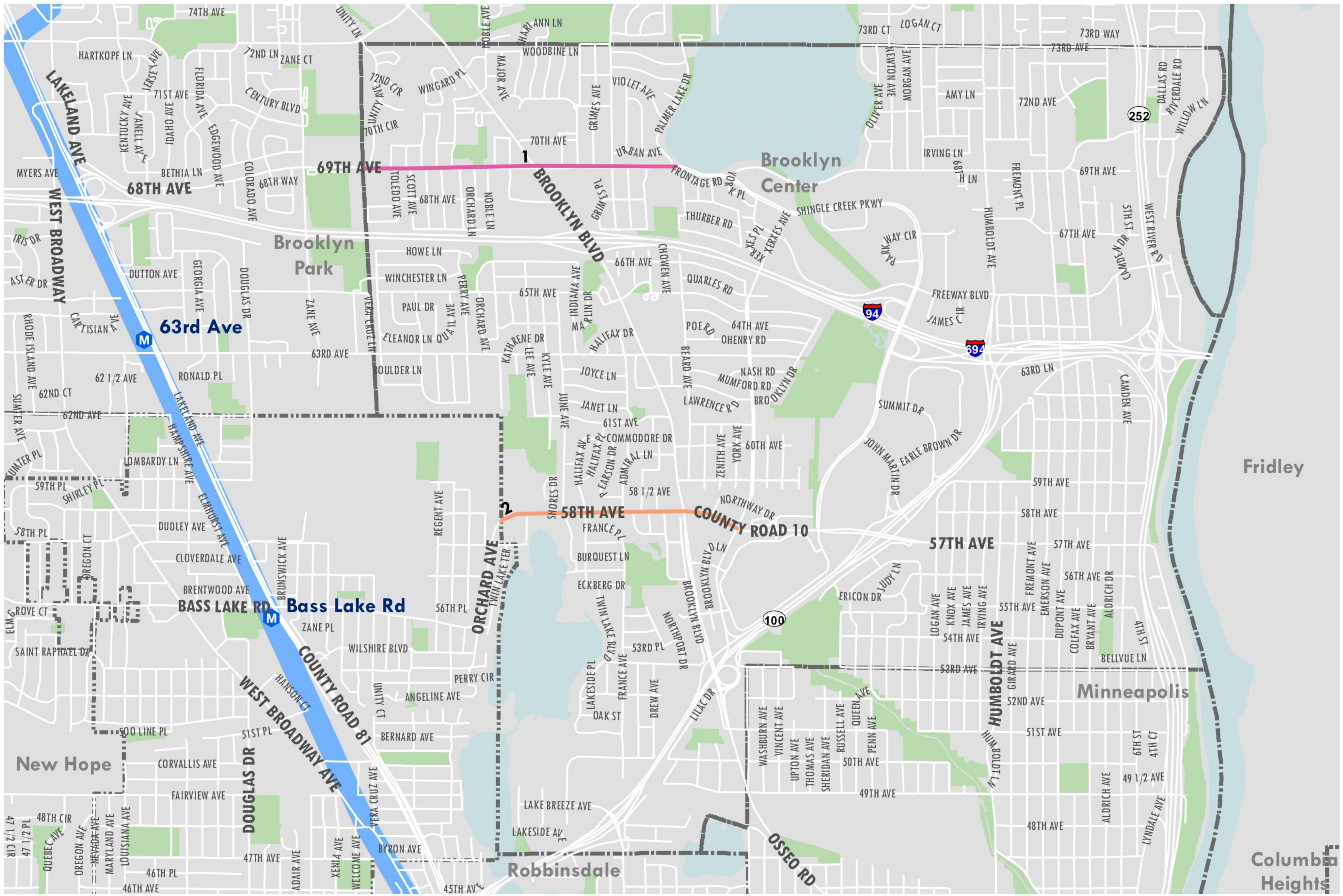
BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

- Bottineau LRT Station
- Bottineau LRT Route
- Municipal Boundary

Proposed Project

 # Local Rank



0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

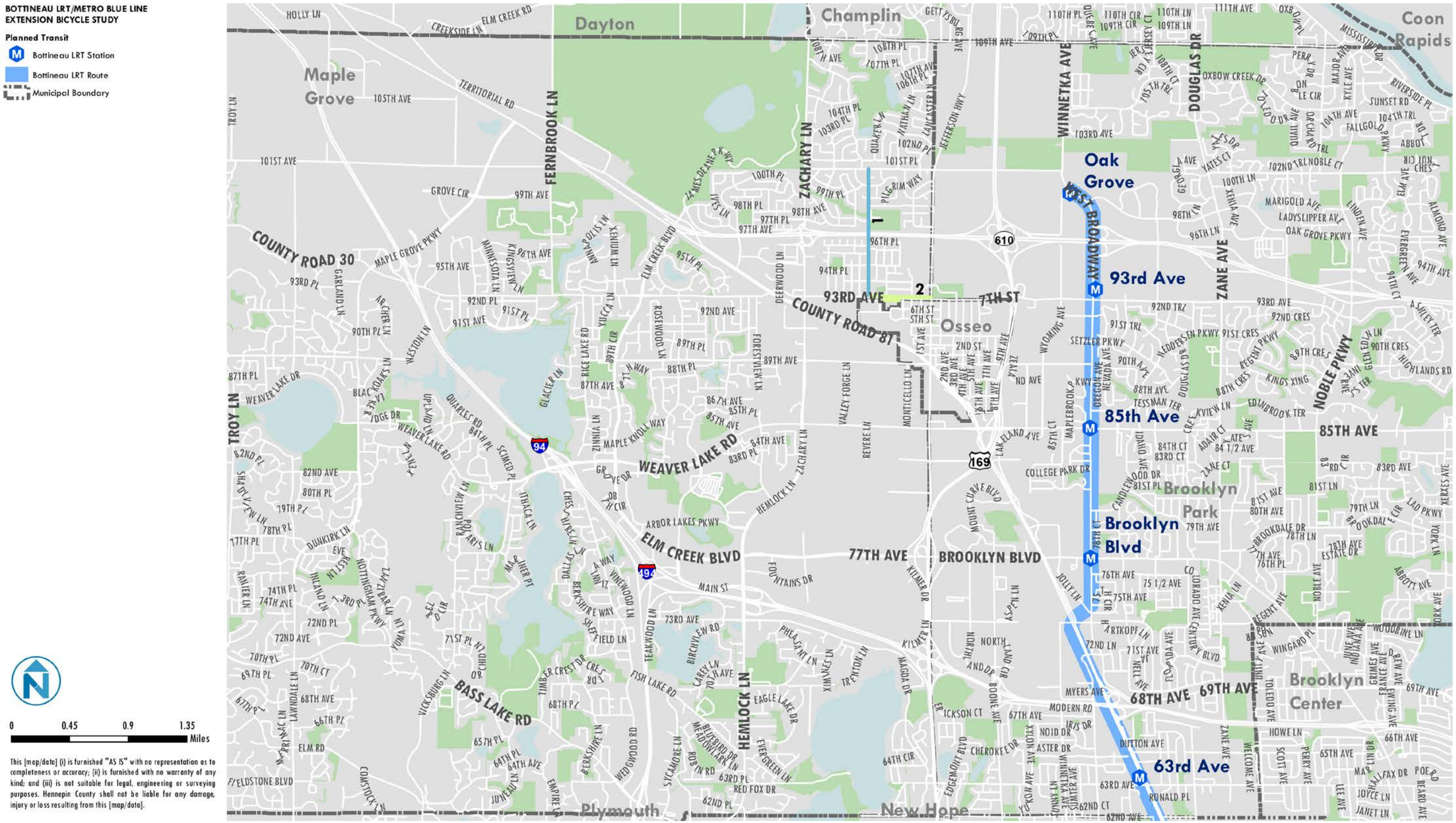
Figure 67 Brooklyn Center Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	310	Brooklyn Center	69th Ave	12.33	12.30	0	12.57	7.38	3.99	5.00	53.57
2	110	Brooklyn Center	59th Ave	14.70	13.92	0	10.95	7.61	0.00	3.06	50.24

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Maple Grove

Figure 68 Maple Grove Project Priority Map



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 69 Maple Grove Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	133	Maple Grove	Revere Ln	6.72	9.06	0	6.36	2.54	4.44	2.92	32.03
2	167	Maple Grove	93rd Ave	9.93	0.00	0	8.30	3.08	4.62	1.82	27.74

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

New Hope

Figure 70 New Hope Project Priority Map

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

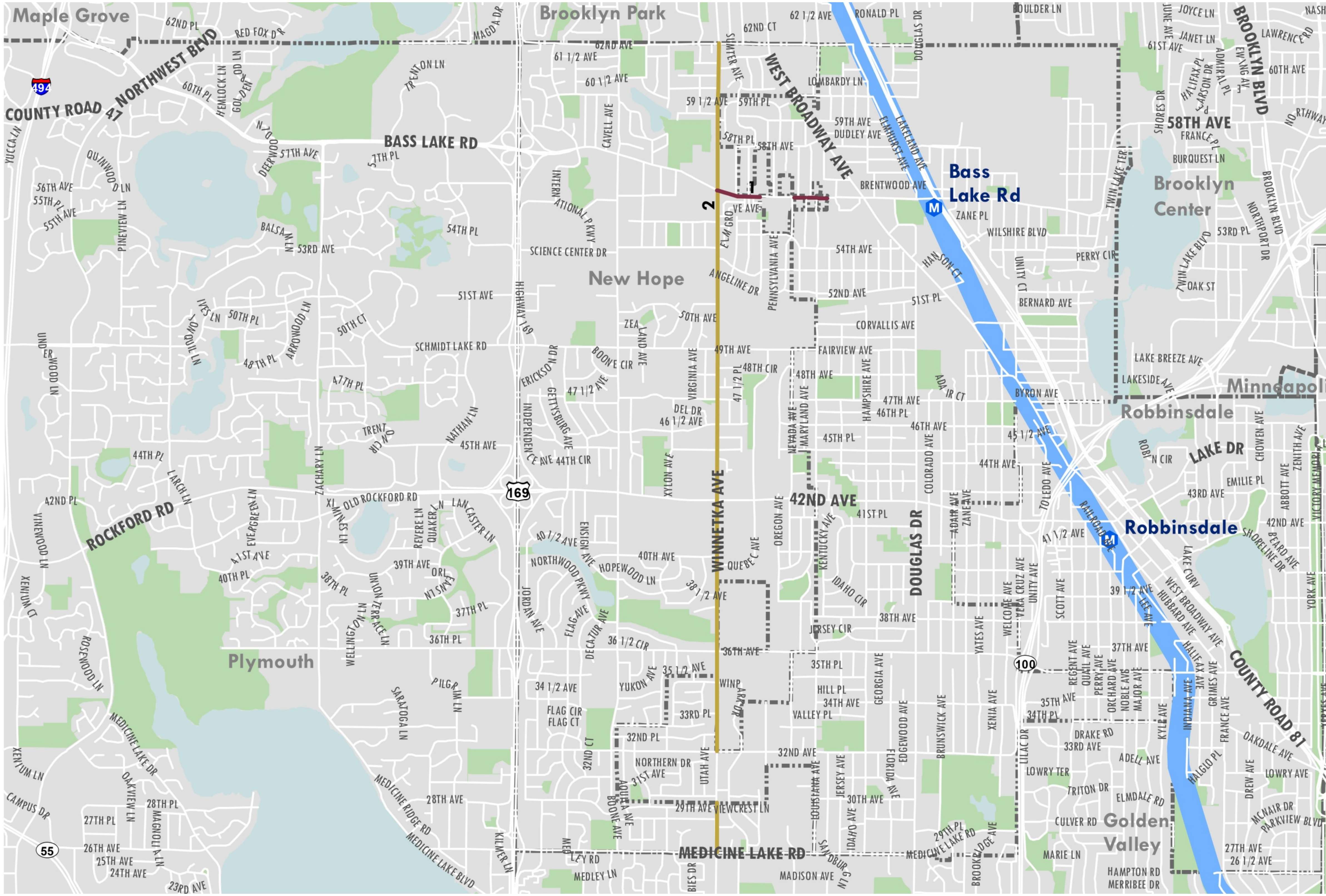
Planned Transit

- Bottineau LRT Station
- Bottineau LRT Route
- Municipal Boundary

Proposed Project

 # Local Rank

0 0.3 0.6 0.9 Miles



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 71 New Hope Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	115	New Hope	Bass Lake Rd	23.01	14.13	0	11.81	12.99	4.55	1.07	67.55
2	79	New Hope	Winnetka Ave	21.39	11.16	0	14.40	8.15	4.84	5.00	64.93

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Osseo

Figure 72 Osseo Project Priority Map

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

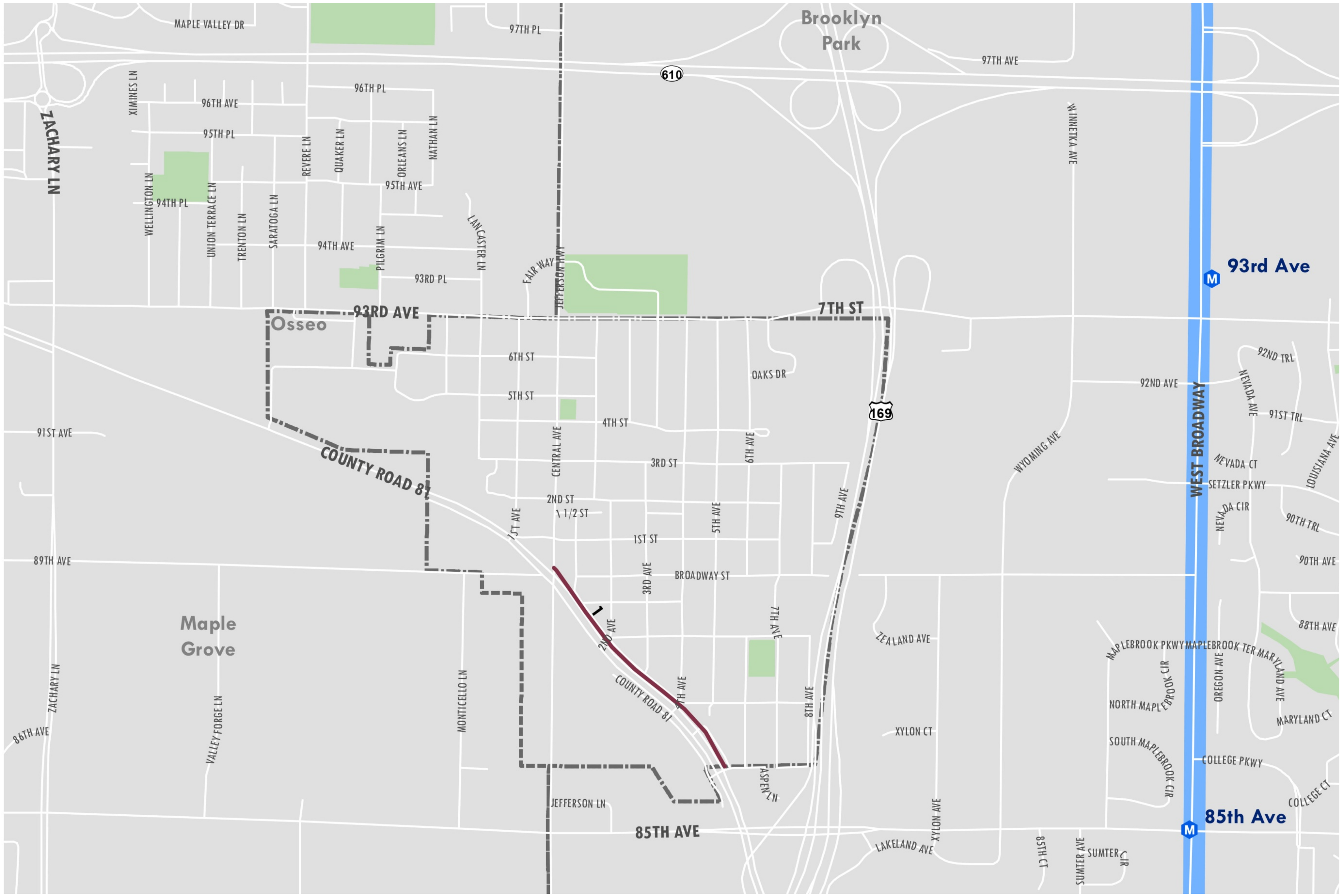
Bottineau LRT Station

Bottineau LRT Route

Municipal Boundary

Proposed Project

 # Local Rank



0 0.1 0.2 0.3 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 73 Osseo Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	49	Osseo	Crystal Lake Regional Trail	15.78	10.85	0	11.60	7.01	4.14	5.00	54.36

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Robbinsdale

Figure 74 Robbinsdale Project Priority Map

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

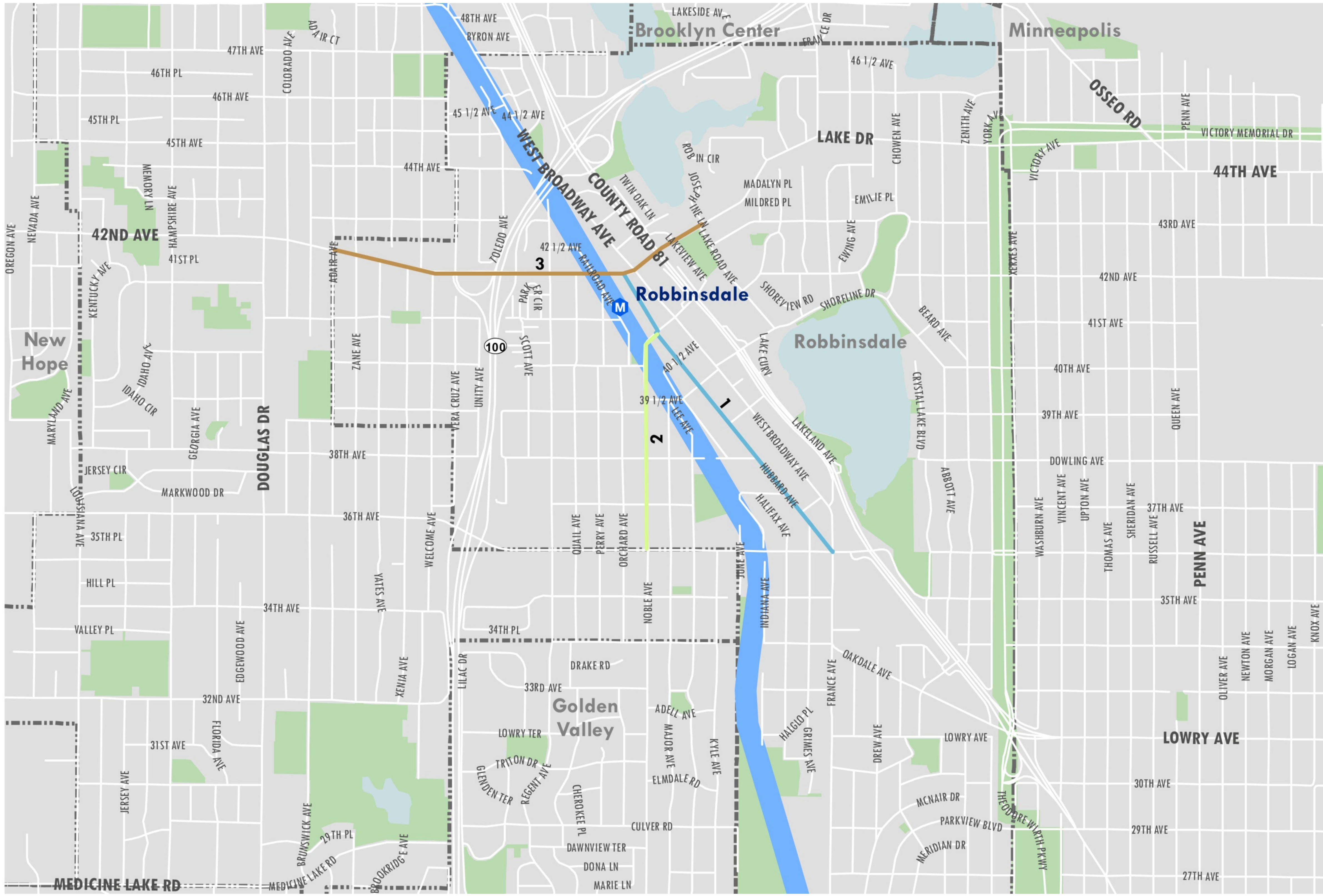
Bottineau LRT Station

Bottineau LRT Route

Municipal Boundary

Proposed Project

Local Rank



0 0.15 0.3 0.45 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 75 Robbinsdale Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	64	Robbinsdale	Hubbard Ave	28.62	9.17	15	14.67	10.68	4.60	2.45	85.19
2	98	Robbinsdale	Noble Ave	27.87	11.22	15	13.38	10.46	4.30	2.09	84.31
3	97	Robbinsdale	42nd Ave	28.29	11.81	15	13.53	7.82	0.00	5.00	81.44

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Plymouth

Figure 76 Plymouth Project Priority Map

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

Bottineau LRT Station

Bottineau LRT Route

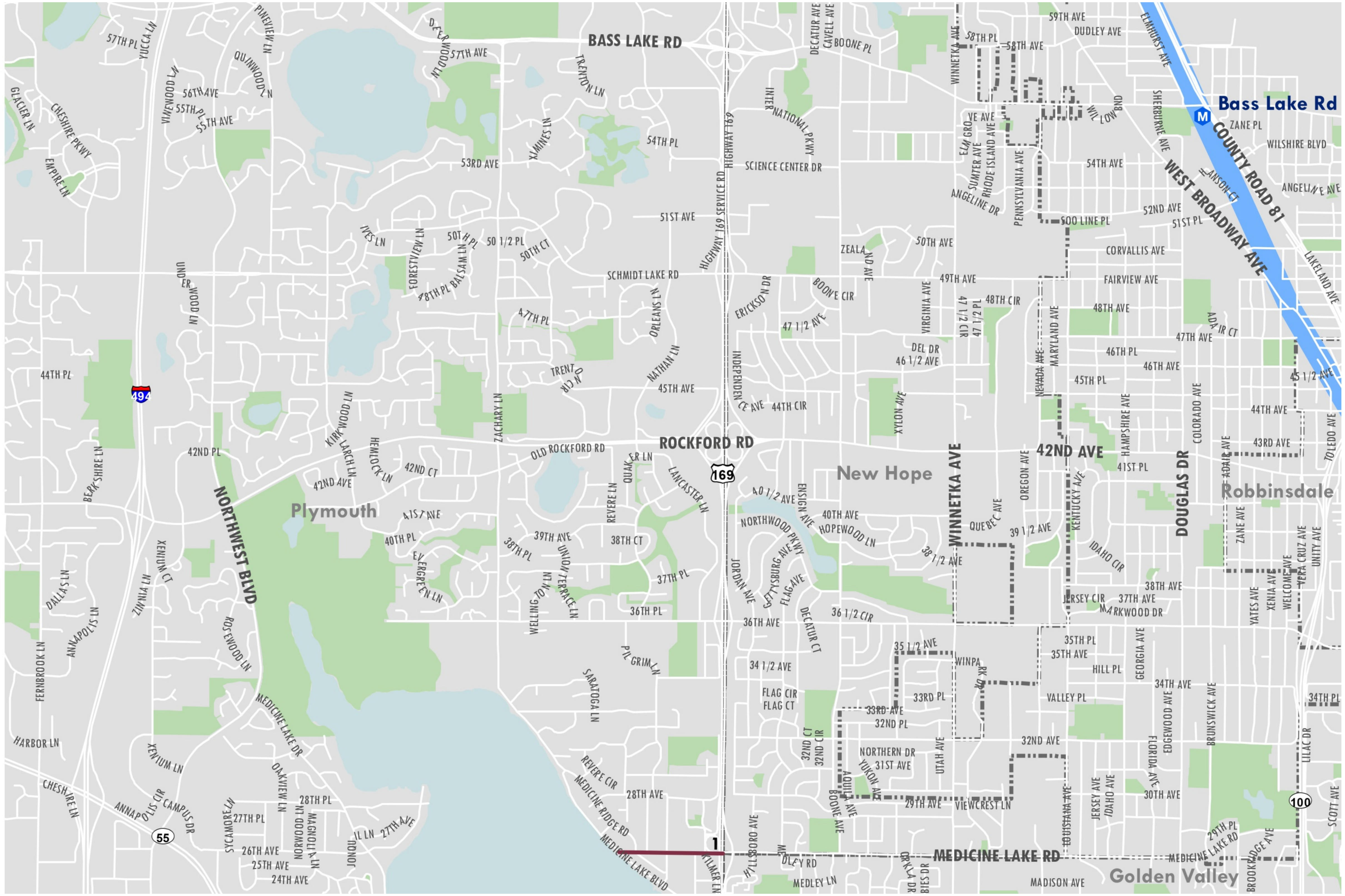
Municipal Boundary

Proposed Project

 # Local Rank

0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 77 Plymouth Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	240	Plymouth	26th Ave	0.00	10.46	0	5.28	7.44	0.00	5.00	28.18

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Saint Louis Park

Figure 78 Saint Louis Park Project Priority Map

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

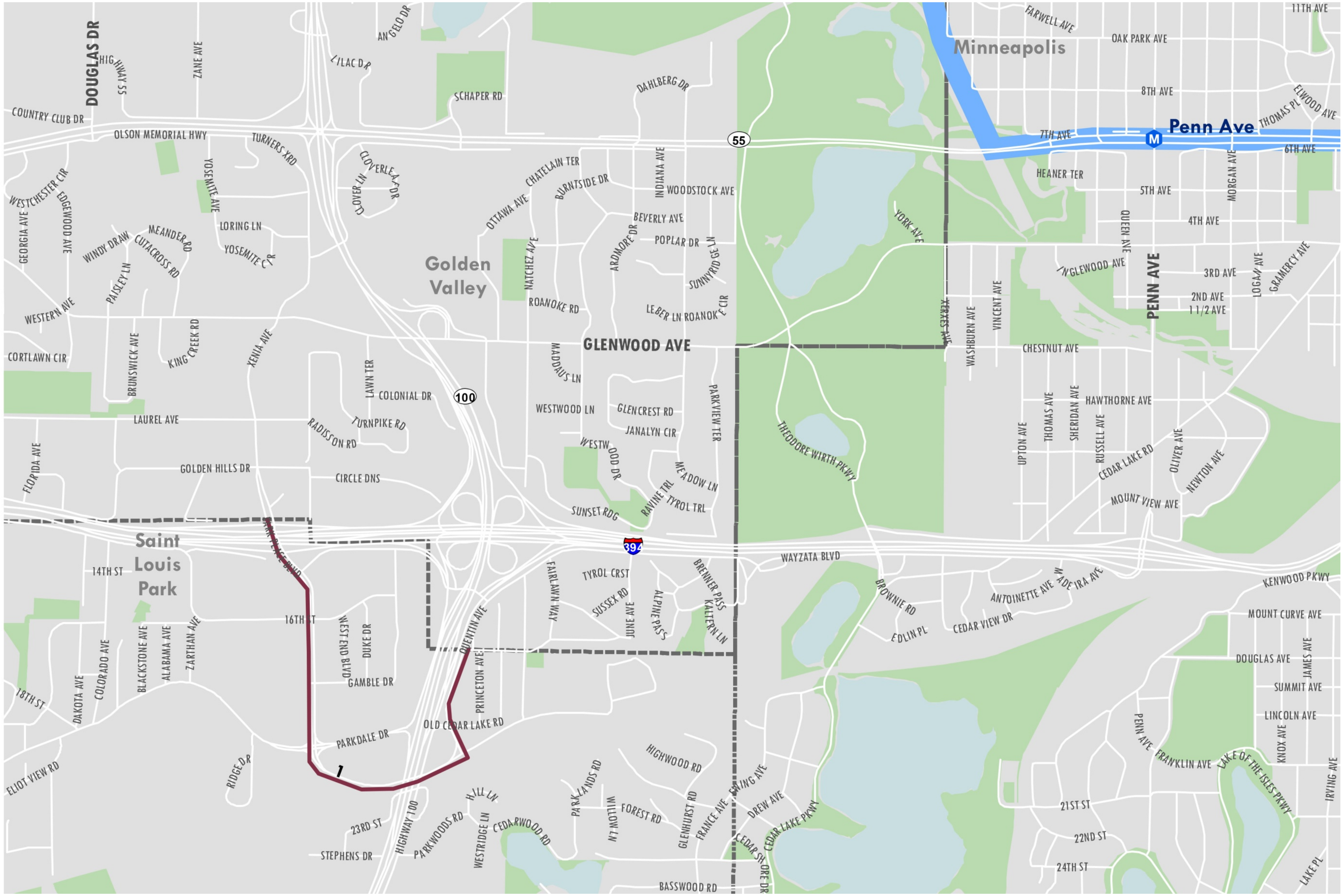
- Bottineau LRT Station
- Bottineau LRT Route
- Municipal Boundary

Proposed Project

 # Local Rank

0 0.15 0.3 0.45 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 79 Saint Louis Park Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	253	Saint Louis Park	Park Pl Blvd to Quentin Ave	1.95	10.58	0	9.17	13.26	0.00	3.39	38.34

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Minneapolis

Figure 80 Minneapolis Project Priority Map (North)

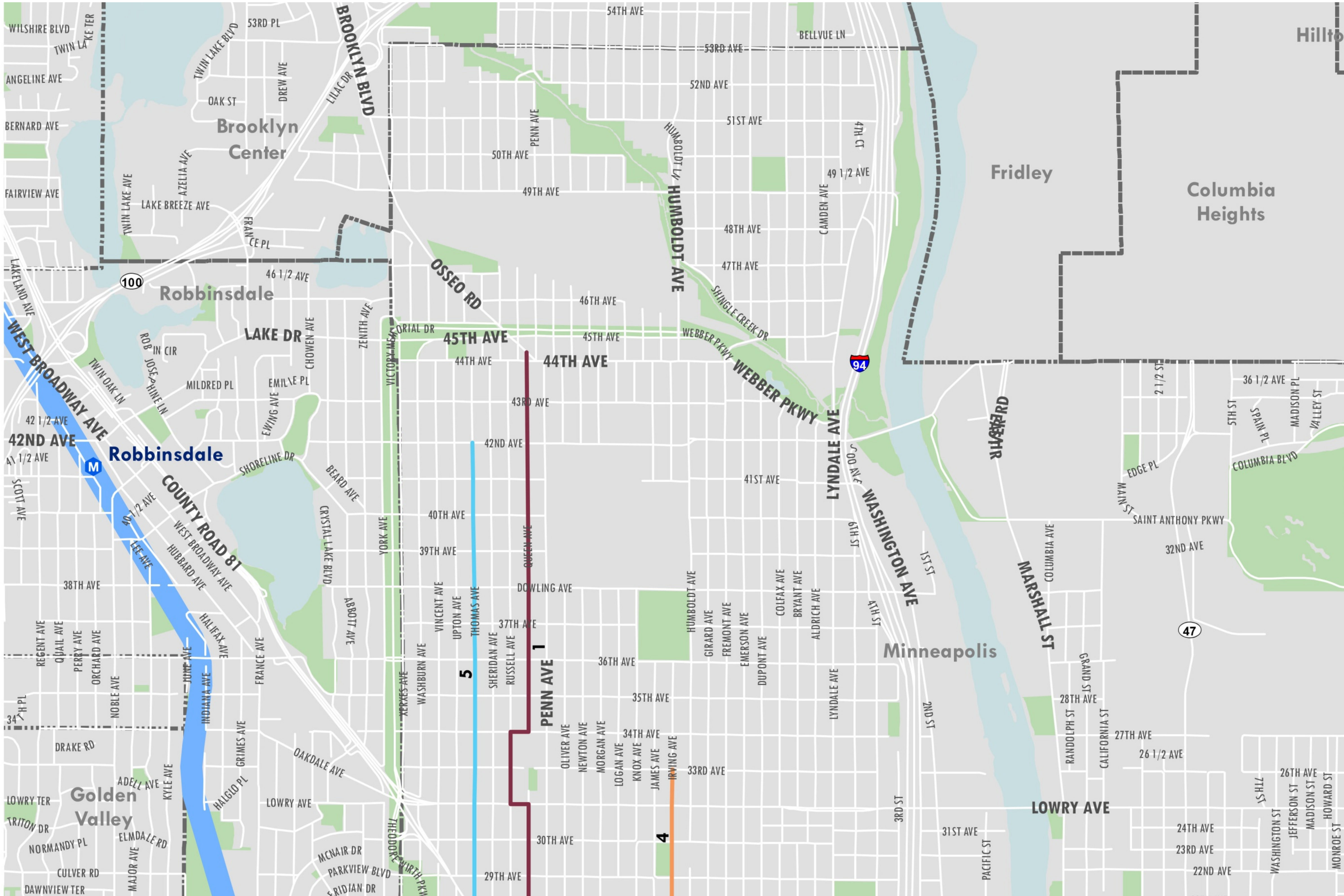
BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

- Bottineau LRT Station
- Bottineau LRT Route
- Municipal Boundary

Proposed Project

 # Local Rank



0 0.2 0.4 0.6 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 81 Minneapolis Project Priority Map (South)

BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

Bottineau LRT Station

Bottineau LRT Route

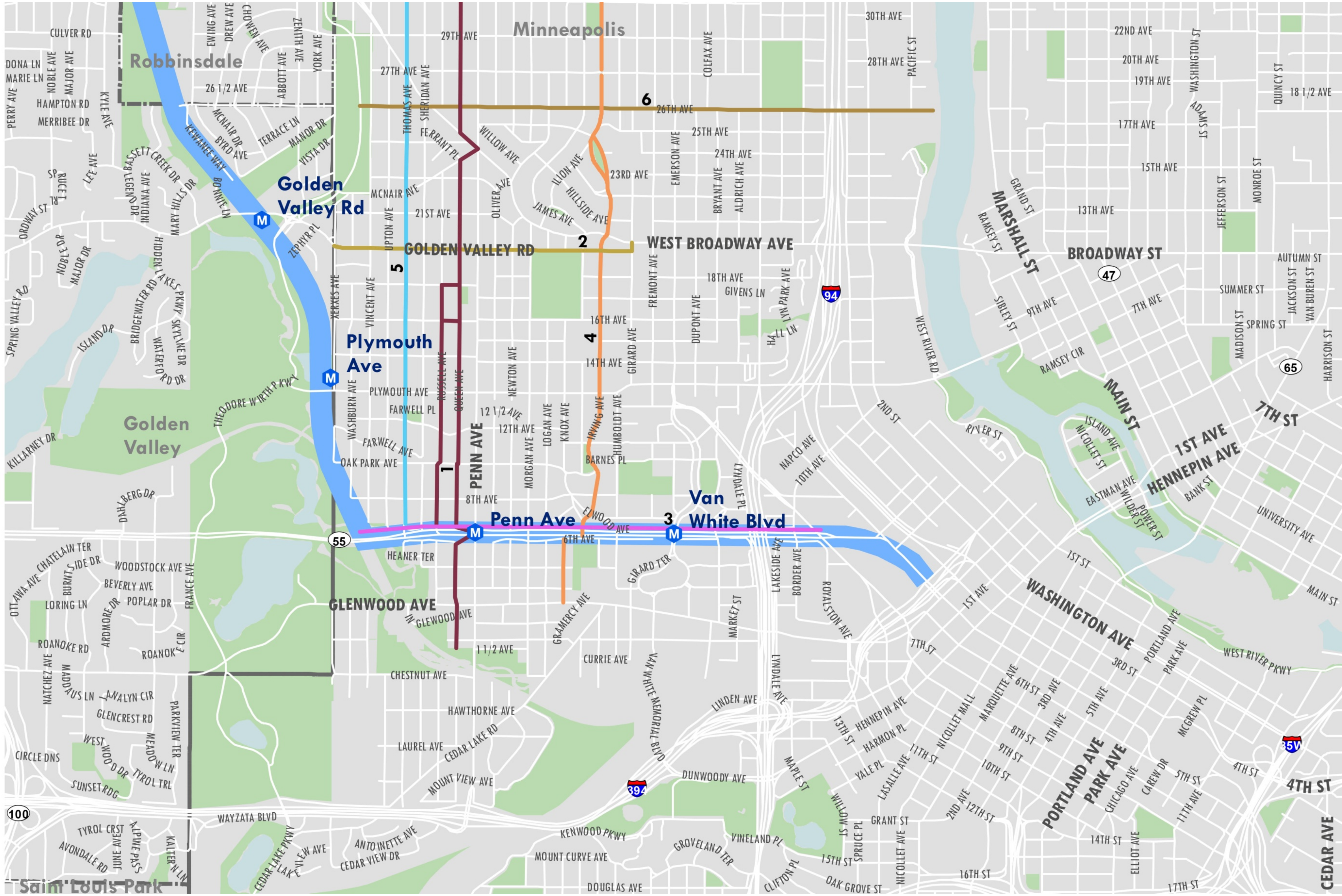
Municipal Boundary

Proposed Project

 # Local Rank

0 0.2 0.4 0.6 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

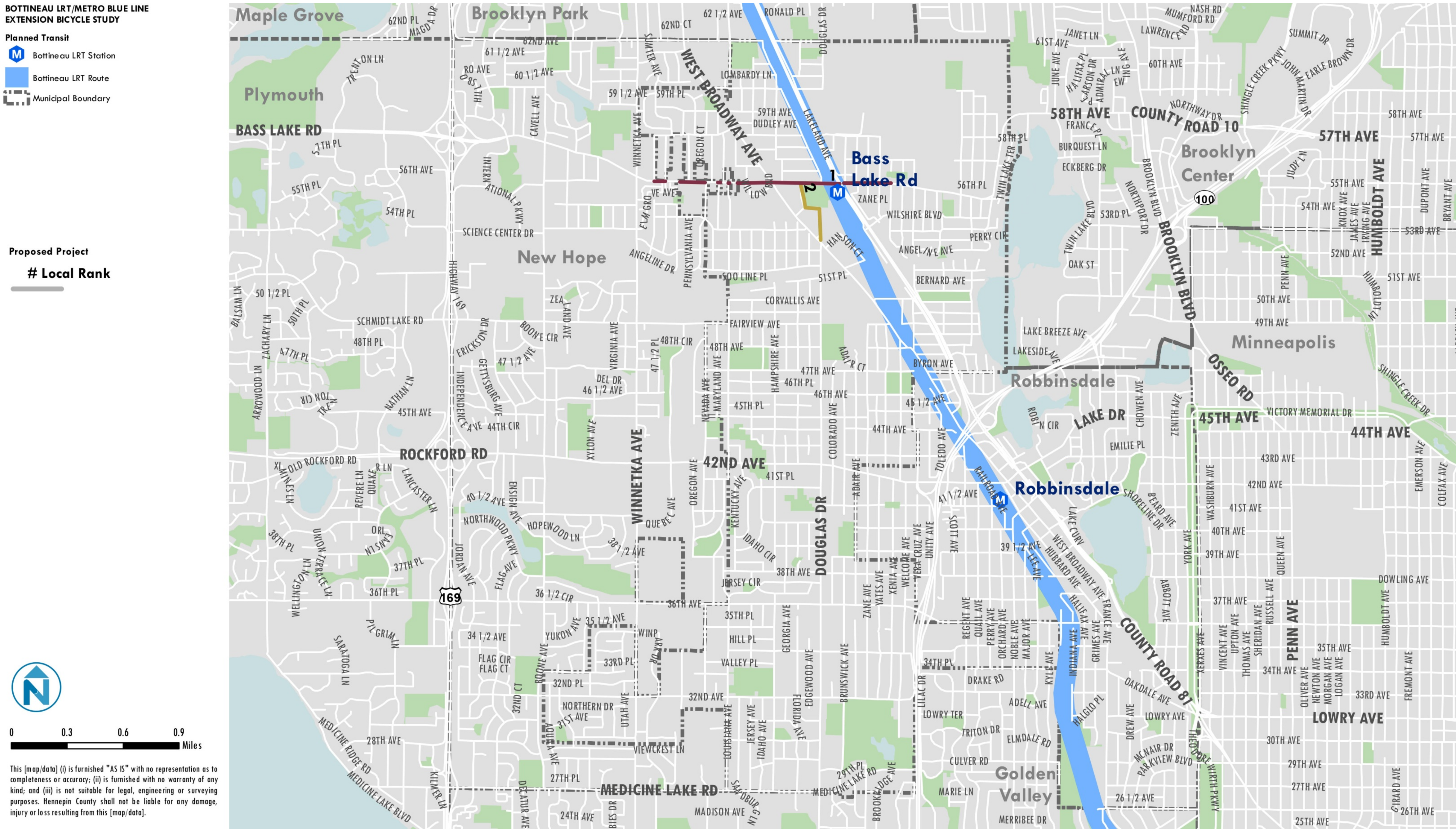
Figure 82 Minneapolis Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	52	Minneapolis	Queen Ave and Russell Ave	30.00	9.50	15	14.88	9.54	3.96	5.00	87.87
2	27	Minneapolis	Golden Valley Rd Bikeway	26.46	13.49	15	13.05	10.95	4.03	5.00	87.97
3	56	Minneapolis	Olson Memorial Highway	29.16	12.41	0	14.61	11.00	4.39	5.00	76.56
4	23	Minneapolis	Irving Ave N Bike Blvd	25.92	10.68	0	14.84	10.25	4.50	5.00	71.18
5	31	Minneapolis	Thomas Ave N Bike Blvd	26.79	9.38	0	14.51	10.85	3.85	5.00	70.36
6	5	Minneapolis	26th Ave N	23.10	12.18	0	14.57	9.23	4.28	5.00	68.35

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Crystal

Figure 83 Crystal Project Priority Map



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 84 Crystal Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	340	Crystal	Bass Lake Rd to Orchard Ave	28.71	14.40	15	12.08	11.60	4.06	3.24	89.08
2	330	Crystal	Sherburne Ave to Douglas Dr	27.63	13.59	0	9.87	12.18	0.00	2.11	65.38

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Golden Valley

Figure 85 Golden Valley Project Priority Map

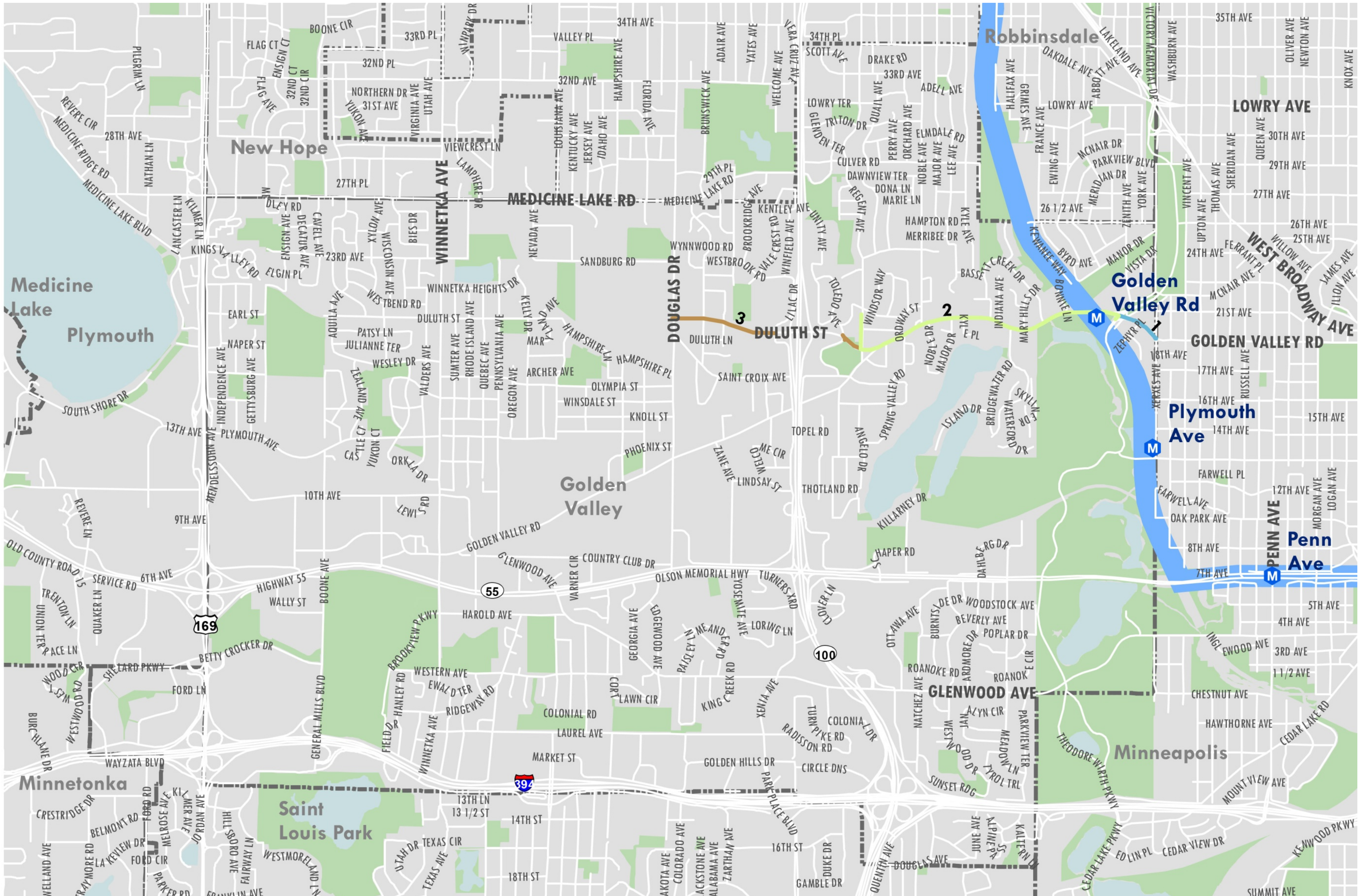
BOTTINEAU LRT/METRO BLUE LINE EXTENSION BICYCLE STUDY

Planned Transit

- Bottineau LRT Station
- Bottineau LRT Route
- Municipal Boundary

Proposed Project

 # Local Rank



0 0.25 0.5 0.75 Miles

This [map/data] (i) is furnished "AS IS" with no representation as to completeness or accuracy; (ii) is furnished with no warranty of any kind; and (iii) is not suitable for legal, engineering or surveying purposes. Hennepin County shall not be liable for any damage, injury or loss resulting from this [map/data].

Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

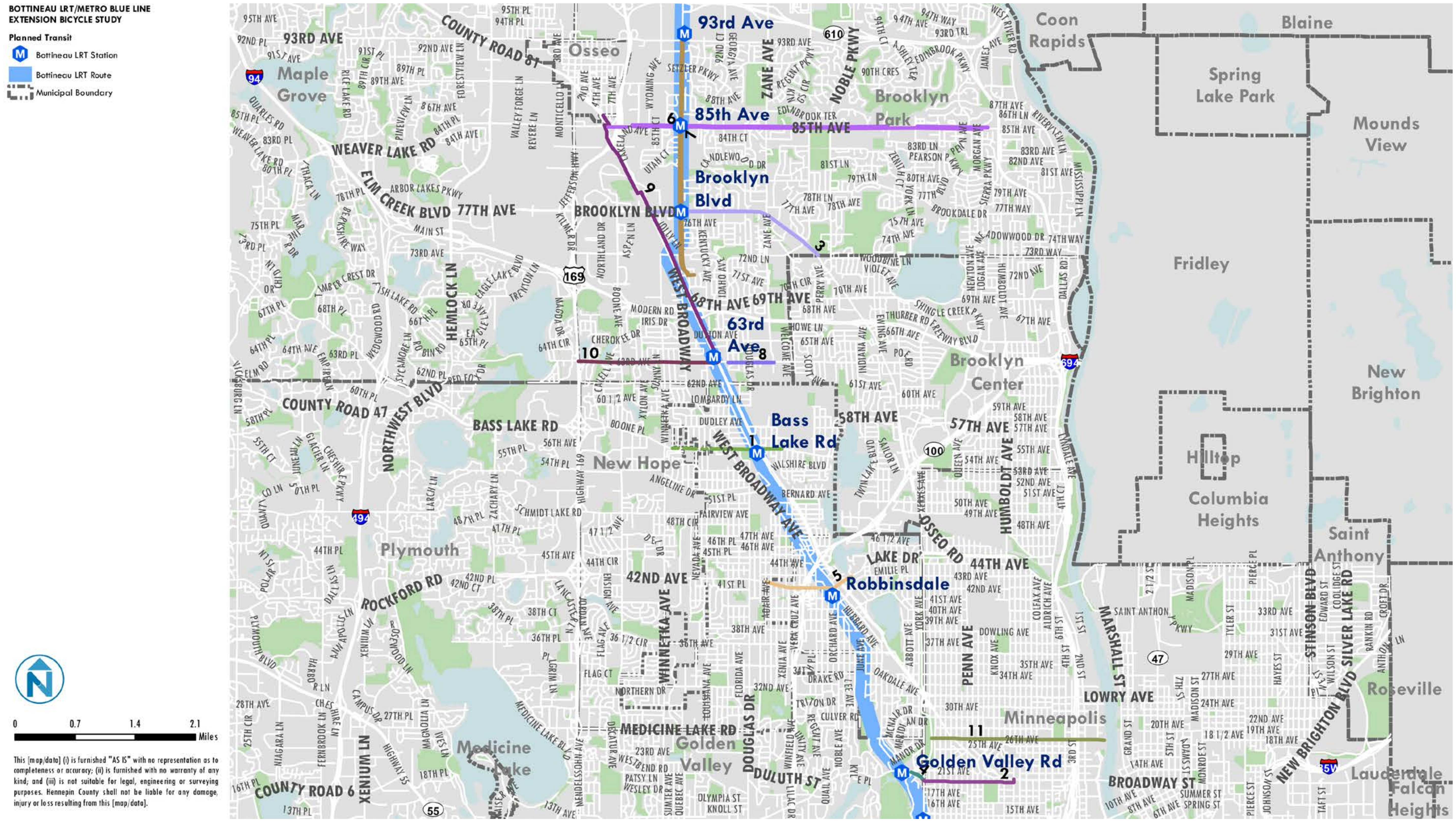
Figure 86 Golden Valley Project Prioritization Score

Local Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	26	Golden Valley	Golden Valley Rd Bikeway	28.08	14.67	15	5.76	9.33	4.80	3.82	81.46
2	300	Golden Valley	Bassett Creek Regional Trail	29.04	11.76	15	0.00	1.02	3.94	5.00	65.76
3	250	Golden Valley	Duluth St	14.37	12.62	0	9.60	12.84	4.35	5.00	58.78

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

Hennepin County Facilities

Figure 87 Hennepin County Facilities Project Priority Map



Projects are uniquely colored to illustrate project limits only, and do not symbolize additional information.

Figure 88 Hennepin County Project Prioritization Score

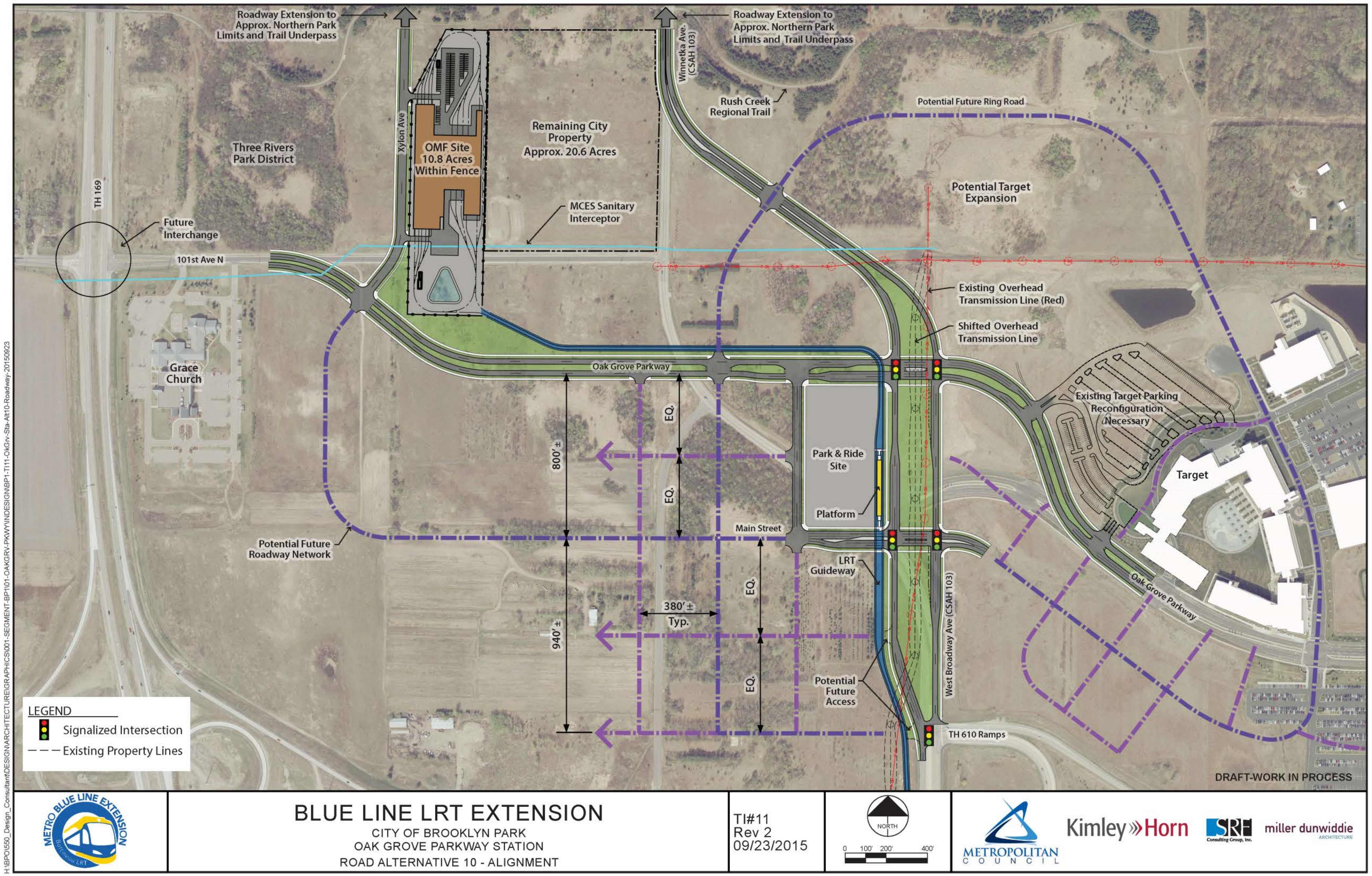
Hennepin County Rank	Project Number	Municipality	Project Location	LRT Station Distance Score	Crashes per Mile Score	LRT Station Connection Score	Zero Car Households Score	Population and Jobs Served per Mile Score	Schools and Libraries Score	Trail Connections Score	Total Score
1	340	Crystal	Bass Lake Rd to Orchard Ave	28.71	14.40	15	12.08	11.60	4.06	3.24	89.08
2	27	Minneapolis	Golden Valley Rd Bikeway	26.46	13.49	15	13.05	10.95	4.03	5.00	87.97
3	304	Brooklyn Park	Brooklyn Blvd	29.70	12.68	15	12.45	7.55	4.05	5.00	86.42
4	26	Golden Valley	Golden Valley Rd Bikeway	28.08	14.67	15	5.76	9.33	4.80	3.82	81.46
5	97	Robbinsdale	42nd Ave	28.29	11.81	15	13.53	7.82	0.00	5.00	81.44
6	70	Brooklyn Park	85th Ave	29.58	8.79	15	13.16	1.46	3.76	5.00	76.74
7	82	Brooklyn Park	West Broadway	29.79	9.87	15	11.16	1.07	3.78	5.00	75.66
8	77	Brooklyn Park	63rd Ave	27.54	13.11	15	7.11	7.71	0.00	3.37	73.84
9	48	Brooklyn Park	Crystal Lake Regional Trail	28.83	8.57	15	12.72	2.64	0.00	5.00	72.76
10	75	Brooklyn Park	63rd Ave	28.50	9.33	15	12.35	3.66	0.00	2.85	71.68
11	5	Minneapolis	26th Ave N	23.10	12.18	0	14.57	9.23	4.28	5.00	68.35

Note: Values represent scores for each prioritization criteria. See Figure 60 for scoring details.

6 APPENDIX

APPENDIX A: OAK GROVE STATION AREA PROPOSED ROAD NETWORK

Figure 89 Oak Grove Station Area Proposed Road Network



APPENDIX B: NORTH MINNEAPOLIS GREENWAY ROUTE ALTERNATIVES

Figure 90 North Minneapolis Greenway Route Alternatives

APPENDIX C: COMPLETE BICYCLE NETWORK PROJECT PRIORITIZATION

APPENDIX D: SOUTHWEST LRT – LITERATURE REVIEW OF BIKESHARE PROGRAM MODELS