MILWAUKEE NORTH SOUTH Transit Enhancement

VOLUME 5

TIER 2 EVALUATION

Milwaukee County **North-South** Transit Enhancement Study

Southeastern Wisconsin **Regional Planning Commission**

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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 340

MILWAUKEE NORTH SOUTH Transit Enhancement

MILWAUKEE COUNTY NORTH-SOUTH TRANSIT ENHANCEMENT STUDY

VOLUME 5: TIER 2 EVALUATION

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The preparation of this publication was financed in part through planning funds provided by the Federal Highway and Federal Transit Administrations of the U.S. Department of Transportation and the Wisconsin Department of Transportation. The contents of this report do not necessarily reflect the official views or policy of these agencies.

U.S. Department of Transportation
Federal Highway Administration
Federal Transit Administration

December 2022

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INTRODUCTION 1

The Southeastern Wisconsin Regional Planning Commission has undertaken a feasibility study at the request of Milwaukee County to consider transit alternatives along and near 27th Street. Enhanced transit service would reduce travel times, increase frequency, add amenities, and potentially expand the existing Milwaukee County Transit System's (MCTS) PurpleLine service area to better serve the high proportion of transit dependent populations in this area and attract new riders.

1.1 OVERVIEW

This study uses an incremental evaluation process, described in the following three steps, which will progress to the final phase of the analysis and result in a recommended alternative.

- The first step (Tier 1 Evaluation) defines the alternatives to be evaluated and recommended, including the transit technology and the identification of alignment options. This evaluation step results in the elimination of some of the alternatives considered and is the subject of this report.

- The second step (Tier 2 Evaluation—this document) will further assess the alternative alignments defined in step one and identify potential station locations along the alignments, using the evaluation criteria outlined below. This evaluation step may also result in the elimination of some of the alternatives considered.

- The third step (Tier 3 Evaluation) builds upon any alternative still under consideration after the second step. Any remaining alternative will be evaluated against federal criteria for transit projects to determine if refinements should be made.

At the conclusion of the third step of the evaluation process, a recommended route alternative will be finalized and included in a letter to the Federal Transit Administration (FTA) requesting to enter project development. If approved, Milwaukee County will enter the next phase of this project, which will include design and engineering as well as additional public involvement The next phase will help to further refine the route alignment, location of dedicated lanes, and detailed station siting.

The Tier 1 Evaluation for this study recommended bus rapid transit (BRT) as the best fit for an enhanced transit technology in this corridor at this time and narrowed down route segment options under consideration to those shown in Map 1.1.

This document presents the Tier 2 Evaluation for this study, providing the information related to the alternatives under consideration and the various analyses used to evaluate the alternatives against one another and the no-build alternative to identify which option(s) would best meet the project Purpose and Need Statement, which is described in detail in Volume 3 of this study.

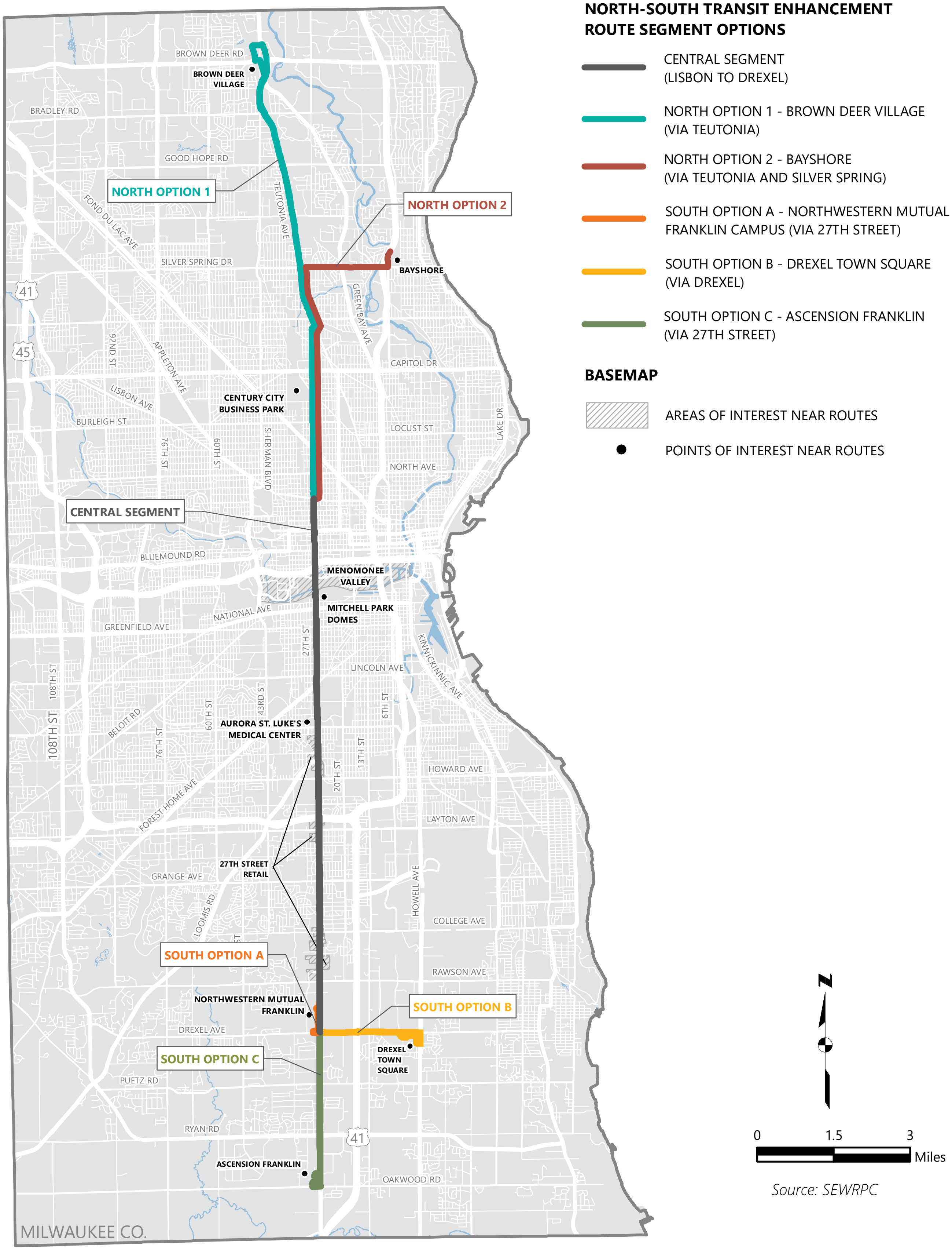
The results of this stage in the study are organized as follows: Chapter 2 will provide a detailed definition of alternatives under consideration and Chapters 3 through 8 provide detailed information about evaluations completed to further refine the alternatives, including methodology, data sources, and results of the evaluations. The evaluations are grouped into six topics, outlined below by chapter:

- Chapter 3: Station Area Analysis

- Chapter 4: Transportation System Impacts Evaluation

- Chapter 5: Ridership Forecasts

Map 1.1
Route Segment Options



Source: SEWRPC

- Chapter 6: Environmental Impacts Evaluation
- Chapter 7: Capital Costs
- Chapter 8: Operating and Maintenance Costs

Chapter 9 of this document will provide a summary of the evaluation of alternatives and identify the route option and configuration as the recommended alternative.

DETAILED DEFINITION OF ALTERNATIVES 2

2.1 OVERVIEW

This chapter describes the key physical and service elements of the transit alternatives that advanced through the Tier 1 Evaluation of the Milwaukee County North-South Transit Enhancement Study and will be evaluated throughout this Tier 2 Evaluation. The BRT alternatives are summarized below and described in detail in the following sections of this chapter.

2.2 ROUTE ALTERNATIVES

The following segment options are under consideration for the Tier 2 Evaluation of this study:

- North Option 1 (Original Brown Deer Village via Teutonia Avenue)
- North Option 2 (Bayshore via Silver Spring Drive)
- Central Segment (27th Street from Drexel Avenue to Silver Spring Drive)
- South Option A (Northwestern Mutual Franklin Campus)
- South Option B (Drexel Town Square via Drexel Avenue)
- South Option C (Ascension Franklin via S. 27th Street)

The South Option A and South Option B route segment options differ slightly from what was recommended at the completion of the Tier 1 Evaluation. After a closer review of planned development and discussion with key project stakeholders, these routes were modified to run along planned extensions of Northwestern Mutual Way and Ikea Way near the existing Ikea furniture store to better serve the mixed-use development planned in the area and potentially spur additional transit-oriented development. Map 2.1 provides a detailed view of these changes. The updated route segment options are shown in Map 2.2.

This Tier 2 Evaluation will identify a combination of the central segment with one of the north segment options and one of the south segment options to create the following full route alternatives to be evaluated against one another throughout this evaluation:

- North Option 1 to South Option A
- North Option 1 to South Option B
- North Option 1 to South Option C
- North Option 2 to South Option A
- North Option 2 to South Option B
- North Option 2 to South Option C

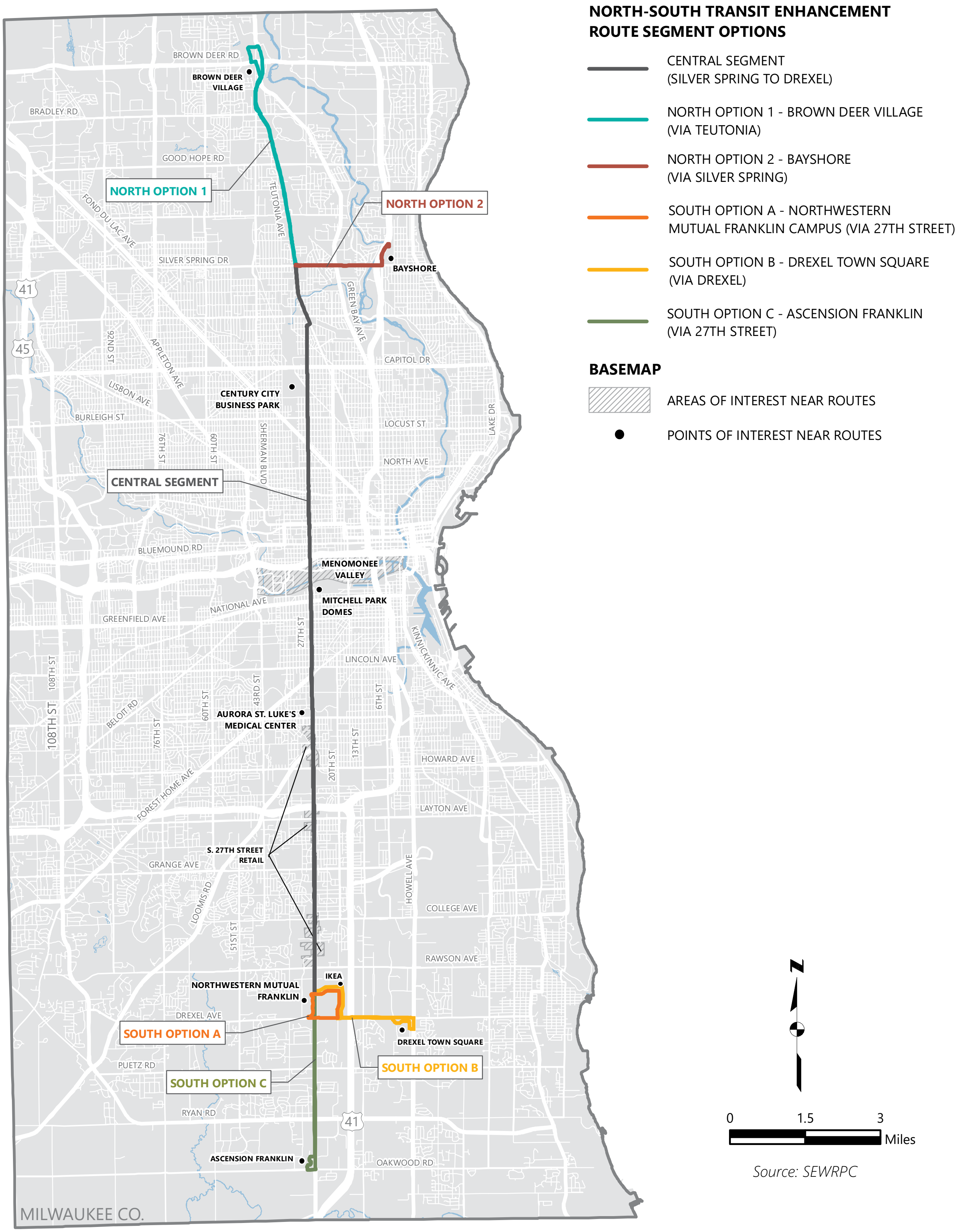
The alternatives considered are in addition to a no-build or existing transit service option. MCTS' PurpleLine serves as the no-build base from which the build alternatives will be compared. The no-build alternative is shown in Map 2.3. This Tier 2 Evaluation will result in the recommendation of one or more of the alternatives listed above to be carried forward and further refined, if necessary, in the Tier 3 evaluation.

Map 2.1
Updated Alignment for South Option A and South Option B

Source: SEWRPC

As recommended in the Tier 1 Evaluation, if North Option 1 and South Option C are ranked favorably in these evaluations, they will be further evaluated as part of an open BRT model that would be paired with North Option 2 and South Option B, respectively. An open BRT system would provide periodic service to the multiple destinations in the corridor by allowing buses to continue off the end of the primary BRT route.

Map 2.2
Route Segment Options



Source: SEWRPC

Map 2.3
No Build Route Alternative

Source: SEWRPC and MCTS

2.3 ROADWAY CONFIGURATIONS

In addition to the route alternatives under consideration, a variety of roadway configurations will be considered throughout different portions of the route segments. The following BRT route running types will be evaluated as appropriate throughout the Tier 2 Evaluation:

- BRT in Mixed Traffic
- BRT in Dedicated Center Lane
- BRT in Dedicated Curb or Right-side Lane

For fixed-guideway BRT, which is the kind of BRT that meets the purpose and need for this study, at least 50 percent of the chosen route alternative should include a dedicated transit lane.

Tables 2.1 through 2.6 describe which BRT running types and lane conversion options are possible along various portions of the BRT route alternatives based on existing roadway configurations and width. BRT is expected to be implemented in this corridor with little to no changes in the curb-to-curb width of the roadway; therefore, running types and lane conversion options under consideration for each route segment are based on whether it would be possible to have a 12-foot dedicated transit lane while maintaining at least one 11-foot travel lane in each direction. Therefore, if the existing roadway includes only one travel lane in each direction and there is no additional space available from either a parking lane or wide-shoulder, only BRT in mixed traffic is being considered for that segment. If the existing roadway includes a median, which could provide space for BRT stations, as well as at least two travel lanes in each direction, a parking lane, or a wide shoulder that could be converted to a travel lane, a dedicated center transit lane is possible.

Appendix A includes maps and typical section diagrams for each segment of the corridor, which describe running type and lane conversion options in more detail. Although at least 50 percent of the route is recommended to include a dedicated transit lane, all route segment options will be evaluated for BRT in mixed traffic among any other options available.[1] Roadway configuration options will be evaluated further by analyzing potential benefits and impacts to transit travel times, traffic, parking, ridership, and cost and this study is expected to result in high-level recommendations for roadway configuration(s) (i.e., the approximate locations of dedicated lanes). The more detailed analysis conducted during the engineering and design phases of this study will provide more specific roadway configurations.

2.4 KEY PHYISCAL AND SERVICE ELEMENTS

For the purposes of this Tier 2 Evaluation, the alternatives are described based on the categories below under the no-build alternative and proposed BRT service, with differences noted between the route alternatives and running types under consideration.

- Service plan
- Station/stop spacing
- Station/stop facilities
- Transit vehicles
- Technology and service information systems
- Identity and branding
- Maintenance facilities

[1] *To meet the Federal Transit Administration's (FTA) definition of fixed guideway BRT—which would allow the project to be eligible for various FTA funding programs—over 50 percent of the route must operate in a separated right-of-way dedicated for transit use during peak periods.*

Table 2.1
BRT Running Type and Lane Conversion Options: North Option 1

Road	Extents	BRT Running Type			Lane Conversion Option(s)
		Mixed Traffic	Dedicated Center Lane	Dedicated Outside Lane	
N. Deerbrook Trail	N. Green Bay Road to W. Brown Deer Road	X			None
W. Brown Deer Road	N. Deerbrook Trail to N. Deerwood Drive	X			None
N. Deerwood Drive	N. Brown Deer Road to Ruth Place	X			None
Ruth Place	N. Deerwood Drive to N. Green Bay Road	X			None
N. Green Bay Road	N. Deerbrook Trail to N. Teutonia Avenue	X	X	X	Wide Shoulder or Travel Lane
N. Teutonia Avenue	N. Green Bay Road to N. Sherman Boulevard	X	X	X	Parking Lane or Travel Lane
N. Teutonia Avenue	N. Sherman Boulevard to W. Woodale Avenue	X			None
N. Teutonia Avenue	W. Woodale Avenue to W. Good Hope Road	X	X	X	Parking Lane or Travel Lane
N. Teutonia Avenue	W. Good Hope Road to W. Mill Road	X	X	X	Parking and Bike Lanes or Travel Lane
N. Teutonia Avenue	W. Mill Road to W. Silver Spring Drive	X		X	Parking and Bike Lanes or Travel Lane

Source: SEWRPC

Table 2.2
BRT Running Type and Lane Conversion Options: North Option 2

Road	Extents	BRT Running Type			Lane Conversion Option(s)
		Mixed Traffic	Dedicated Center Lane	Dedicated Outside Lane	
W. Silver Spring Drive	N. Teutonia Avenue to N. Port Washington Road	X	X	X	Travel Lane
N. Port Washington Road	W. Silver Spring Drive to W. Carrigan Drive	X	X	X	Travel Lane

Source: SEWRPC

Table 2.3
BRT Running Type and Lane Conversion Options: Central Segment

Road	Extents	BRT Running Type			Lane Conversion Option(s)
		Mixed Traffic	Dedicated Center Lane	Dedicated Curb Lane	
N. Teutonia Avenue	W. Silver Spring Drive to W. Custer Avenue	X		X	Parking or Travel Lane
N. Teutonia Avenue	W. Custer Avenue to W. Cornell Street	X		X	Travel Lane
W. Cornell Street	N. Teutonia Avenue to N. 27th Street	X			None
N. 27th Street	W. Cornell Street to W. Hope Avenue	X		X	Parking Lane
N. 27th Street	W. Hope Avenue to W. Capitol Drive	X		X	Travel Lane
N. 27th Street	W. Capitol Drive to W. Meinecke Avenue	X		X	Parking and Bike Lanes
N. 27th Street	W. Meinecke Avenue to W. Garfield Avenue	X		X	Travel Lane
N. 27th Street	W. Garfield Avenue to W. Lisbon Avenue	X		X	Parking and Bike Lanes
N. 27th Street	W. Lisbon Avenue to W. State Street	X		X	Parking and Bike Lane or Travel Lane
N. 27th Street	W. State Street to W. Wisconsin Avenue	X		X	Parking and Bike Lane
N. 27th Street	W. Wisconsin Avenue to W. St. Paul Avenue	X		X	Travel Lane
N. 27th Street/S. Layton Boulevard	W. St. Paul Avenue to W. Pierce Street	X	X	X	Travel Lane
S. Layton Boulevard	W. Pierce Street to W. National Avenue	X	X	X	Travel Lane
S. Layton Boulevard	W. National Avenue to W. Lincoln Avenue	X	X	X	Parking and Travel Lanes
S. 27th Street	W. Lincoln Avenue to W. Oklahoma Avenue	X	X	X	Parking Lane or Travel Lane
S. 27th Street	W. Oklahoma Avenue to W. Cold Spring Road	X	X	X	Travel Lane
S. 27th Street	W. Cold Spring Road to W. Layton Avenue	X	X	X	Travel Lane
S. 27th Street	W. Layton Avenue to W. College Avenue	X	X	X	Travel Lane
S. 27th Street	W. College Avenue to W. Sycamore Street	X	X	X	Travel Lane
S. 27th Street	W. Sycamore Street to Northwestern Mutual Way	X	X	X	Travel Lane

Source: SEWRPC

Table 2.4
BRT Running Type and Lane Conversion Options: South Option A

Road	Extents	BRT Running Type			Lane Conversion Option(s)
		Mixed Traffic	Dedicated Center Lane	Dedicated Curb Lane	
(Future) Northwestern Mutual Way	S. 27th Street to S. Ikea Way	X			None
S. Ikea Way (Incl. Future Extension)	(Future) Northwestern Mutual Way to W. Drexel Avenue	X			None
W. Drexel Avenue	S. Ikea Way to Northwestern Mutual Way	X			None
Northwestern Mutual Way (Private)	W. Drexel Avenue to S. 27th Street	X			None

Source: SEWRPC

Table 2.5
BRT Running Type and Lane Conversion Options: South Option B

Road	Extents	BRT Running Type			Lane Conversion Option(s)
		Mixed Traffic	Dedicated Center Lane	Dedicated Curb Lane	
(Future) Northwestern Mutual Way	S. 27th Street to S. Ikea Way	X			None
S. Ikea Way (Incl. Future Extension)	(Future) Northwestern Mutual Way to W. Drexel Avenue	X			None
W. Drexel Avenue	S. Ikea Way to Northwestern Mutual Way	X			None
Northwestern Mutual Way (Private)	W. Drexel Avenue to S. 27th Street	X			None

Source: SEWRPC

Table 2.6
BRT Running Type and Lane Conversion Options: South Option C

Road	Extents	BRT Running Type			Lane Conversion Option(s)
		Mixed Traffic	Dedicated Center Lane	Dedicated Curb Lane	
S. 27th Street	Northwestern Mutual Way to W. Oakwood Road	X	X	X	Wide Shoulder or Travel Lane
W. Oakwood Road	S. 27th Street to W. Wheaton Way	X			None
W. Wheaton Way (Private)	W. Oakwood Road to S. 27th Street	X			None

Source: SEWRPC

2.5 THE NO-BUILD ALTERNATIVE

Service Plan

The existing MCTS PurpleLine serves as the no-build alternative and assumes no changes to the existing service plan. Currently the PurpleLine operates from Bayshore in the City of Glendale to Ikea in the City of Oak Creek in mixed-traffic and runs primarily along 27th Street. The existing route is approximately 18 miles long. Map 2.2 shows the existing PurpleLine route. Additional service characteristics are described below.

Service Times

Service times, defined as the start of the first trip and end of the last trip, for the existing PurpleLine are listed below:

- Weekdays: 3:42 a.m. to 1:54 a.m.
- Saturdays: 4:31 a.m. to 1:44 a.m.
- Sundays: 4:41 a.m. to 1:17 a.m.

Headways

The approximate headways, or the amount of time between transit vehicle arrivals at a stop, for the existing PurpleLine are listed below.

- Weekdays
  - Peak (6:00 a.m. to 7:00 p.m.): 12 minutes
  - Off-peak (all other service times): 25 minutes
- Saturdays:
  - Peak (6:00 a.m. to 7:00 p.m.): 14 minutes
  - Off-peak (all other service times): 25 minutes
- Sundays:
  - Peak (11:00 a.m. to 6:00 p.m.): 15 minutes
  - Off-peak (all other service times): 20 minutes

Service Requirements

Service requirements—including the number of vehicles needed to operate the service and annual revenue hours—will be used to develop capital and operating cost estimates and compare the no-build alternative and the BRT alternatives. In 2021, the PurpleLine required the use of 14 buses daily and ran for approximately 81,000 annual revenue hours.

Stop Facilities

The existing PurpleLine has 148 stops total (73 each trip one-way plus a layover), with station pairs spaced approximately 0.25 miles apart. Most stops along the route consist of a bus stop pad and route sign, with some stops including a basic transit shelter. Figure 2.1 shows an image of an existing PurpleLine bus stop located near the intersection of N. 27th Street and W. Hope Avenue (just north of Capitol Drive) in the City of Milwaukee.

Figure 2.1
Existing PurpleLine Bus Stop

Source: SEWRPC Staff

Transit Vehicles
The transit vehicles that are used on the existing PurpleLine are 40-ft low-floor city buses with clean diesel engines. Older vehicles would be replaced in compliance with guidance from the Federal Transit Administration (FTA) as funding is available.

Bikes on Buses
Buses on the existing PurpleLine route have a two-bike rack installed on the front bumper and a third bike can be brought on board, per MCTS policy, if the front bumper bike racks are full.

Technology and Service Information Systems
Existing technology and customer information systems that support the existing PurpleLine include:

- Umo WisGo App: MCTS' mobile app allows users to trip plan, purchase e-tickets, and track their bus in real-time. Service updates and promotions are also shared on the app. The app is available for phones that use Android and iOS operating systems.

- WisGo Card: The Wis-Go smartcard is a physical fare card that riders can use to pay fares. It can be purchased and reloaded online or at more than 150 locations across Milwaukee County.

- Trip Planner and Real-Time Bus Tracker: In addition to the trip planner and bus tracker on the WisGo app, a trip planner and real-time bus tracker is also available on the MCTS website and a trip planner is available on Google Maps.

The no-build alternative assumes no modifications to these systems.

Identity and Branding
The no-build alternative will not include any changes to the existing identity or branding of the PurpleLine.

Maintenance Facility
This study assumes no changes to the existing maintenance facility for the no-build alternative.

2.6 PROPOSED BRT SERVICE

Regardless of the route alternative and roadway configurations that are recommended in this study, many of the characteristics of the proposed BRT service are the same, and either match or closely align with Milwaukee County's East-West BRT route that is under construction during the writing of this report. Where applicable, differences related to route and roadway configuration will be identified below.

Service Plan
Regardless of the route alternative(s) or roadway configurations recommended in this evaluation, the service plans would be similar to one another. If an open BRT model—which would provide periodic service to multiple destinations in the corridor—is recommended in this Tier 2 Evaluation, more detailed service plans will be included in the Tier 3 Evaluation of this study.

Service Times
Approximate service times, defined as the start of the first trip and end of the last trip, for the recommended BRT service are listed below:

- Weekdays: 3:30 a.m. to 2:00 a.m.

- Saturdays: 4:30 a.m. to 1:30 a.m.

- Sundays: 4:30 a.m. to 1:00 a.m.

Headways

The approximate headways, or the amount of time between transit vehicle arrivals at a stop, as proposed, would vary from 10 to 30 minutes on weekdays, and 15 to 25 minutes on weekends. Table 2.7 shows a breakdown of the approximate headways and service times for the proposed BRT operating plan that will be used for the evaluation of all route alternatives and roadway configurations.

Table 2.7
Proposed BRT Service Headways and Service Times

	Service Times[a] and Headways (Minutes)						
Day	Early AM	AM Peak	Midday	PM Peak	Early Evening	Evening	Late Evening
Weekdays	20		10		15	20	30
Saturday	20			15		20	30
Sunday	*No Service*	20		15		20	30

Note: Actual headways may be adjusted during future phases of this effort to improve service efficiencies.

[a] *Service times are defined as follows:*

Early AM: 3:30 a.m. to 6:00 a.m. on weekdays, 4:30 a.m. to 6:00 a.m. on weekends
AM Peak: 6:00 a.m. to 9:00 a.m.
Midday: 9:00 a.m. to 3:00 p.m.
PM Peak: 3:00 p.m. to 6:00 p.m.
Early Evening: 6:00 p.m. to 8:00 p.m.
Evening: 8:00 p.m. to 11:00 p.m.
Late Evening: 11:00 p.m. to 2:00 a.m. on weekdays, 11:00 p.m. to 1:30 a.m. on Saturdays, and 11:00 p.m. to 1:00 a.m. on Sundays

Source: SEWRPC

Service Requirements

Just as with the no-build alternative, service requirements for the proposed BRT service—including the number of vehicles needed to operate the service and platform hours—will be used to develop capital and operating cost estimates to compare alternatives. Table 2.8 shows the estimated service requirements for the proposed BRT service based on route alternative. The length of dedicated lanes in the corridor and the use of transit signal priority or queue jump signals would reduce travel time and, therefore, could reduce both the number of required vehicles and the projected annual revenue bus-hours. Battery electric buses are planned to be used on this service—more details are provided further in this chapter—which are expected to have some impacts on service requirements. Specifically, the estimate shown in Table 2.8 for the number of peak vehicles required for the service was increased by 40 percent to account for estimated maximum run times of 13-hours per bus, before buses are required to return to the maintenance garage for plug-in charging. These estimates could be refined in future phase of this project as more is known about vehicle charging needs.

Table 2.8
Proposed BRT Service Requirements

	Proposed BRT Route Alternative					
Service Characteristic	N1 to SA	N1 to SB	N1 to SC	N2 to SA	N2 to SB	N2 to SC
Peak Vehicles[a]	22	24	22	12	22	21
Spare Vehicles (20%)	5	5	5	4	5	5
Total Buses	27	29	27	24	27	26
Annual Platform Hours[b]	94,591	103,369	97,271	86,553	93,357	91,818
Annual Revenue Miles	1,415,235	1,525,735	1,559,498	1,245,358	1,350,004	1,411,803

[a] *Estimate peak vehicles for all BRT route alternatives were increased by 40 percent to account for estimated maximum battery charge of 13 hours per bus before buses are required to return to the maintenance garage for plug-in charging.*

[b] *Annual platform hours = revenue hours (in service and layover time) + deadhead hours to/from the maintenance garage*

Source: SEWRPC

Station Facilities

Enhanced stations along the proposed BRT service, regardless of the route alternative recommended, would include features that are intended to both improve the experience of transit users and reduce travel times by shortening the dwell time—the amount of time the transit vehicle spends stopped at stations to load and unload passengers. Stations are expected to incorporate features that are typical for BRT service, which include:

- Raised platforms to allow for easy boarding for all passengers, particularly for individuals who use mobility devices or who may have trouble using stairs
- ADA-accessible ramps to allow all passengers to access the platforms
- Ticket vending machines (TVMs) and off-board fare validation readers at all stations—allowing for full off-board fare collection and all-door boarding at busy stations (riders would either scan their fare card, mobile ticket, paper ticket purchased at the ticket vending machines, or use a contactless payment method to validate fares before boarding)
- High quality shelters with seating, transparent wall panels, and a roof or canopy to provide transparency and protection from the weather—shelter sizes could be varied based on demand at each station location
- Lighting
- Security cameras
- Sidewalk snowmelt systems, which heat the affected surface by circulating warm fluid in pipes below the surface of the stations to prevent the buildup of ice and snow when such conditions are present
- Real-time signs (RTS) showing bus arrival information so passengers know exactly when the bus is expected to arrive
- Route and schedule information
- Trash and recycling receptacles
- Branding to distinguish the service from regular fixed-route transit service
- Materials that are easy to clean, repair, refurbish, and difficult to vandalize

Stations are expected to match or closely match stations that, as of the writing of this report, are under construction on Milwaukee County's East-West BRT route. A rendering of one of these stations is shown in Figure 2.2.

Figure 2.2
Rendering of Example Milwaukee County BRT Station

Source: HNTB

Stations are expected to be similar along the various roadway configurations under consideration; however, in segments where a center-running configuration were to be recommended, a single, larger station situated in the median may be used to serve passengers traveling in both directions of the route.

Adding bikeshare stations or bicycle amenities such as lockers or racks near BRT stations, or including space and options for future utility connections for bikeshare stations, should be considered as detailed station siting and design is completed. Co-locating these stations could benefit both transit ridership and bikeshare/

bicycle usership by making multimodal transfers easier and expanding access to both services. Where appropriate, stations and bikeshare stations could share utility connections—potentially offering cost savings for both service providers.

Stations are expected to be located one-quarter to one mile apart and at intersections with other transit routes to allow for easy transfers. More details about proposed station locations are included in Chapter 3 of this report.

Transit Vehicles

The proposed BRT service is expected to use 40-foot battery electric buses (BEBs) with overhead chargers located at the end points of the route (in-route charging) and plug-in chargers located at the maintenance garage (depot charging) where buses will be parked when not in service. Vehicles are expected to match or be similar to the electric buses that will be used on the East-West BRT route. These vehicles have a capacity of 38-41 people seated, 68-82 with standees, and an upper range of 290 miles before needing a charge (based on a battery capacity of 564 kWh, and optimal power demands and operating conditions). Electric buses also have largely silent operation and zero tailpipe emissions.

If the recommended route alternative includes any segments with dedicated center-running lanes, buses will be equipped with right- and left-side doors. Otherwise, doors will only be necessary on the right side of the vehicle.

Bikes on Buses

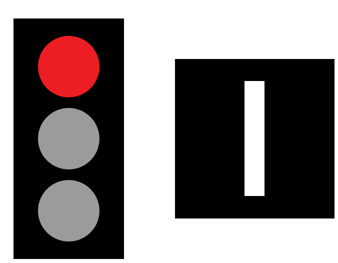
The proposed BRT vehicles will likely have the same two-bike rack installed on the front bumper of the bus that are on existing buses and that are also planned for the East-West BRT service. If the rack is full, a third bike could be brought on board, per MCTS policy, although no interior bike storage is expected to be included.

Technology and Service Information Systems

In addition to taking advantage of the existing technology and service information systems provided by MCTS, such as the mobile app and fare card, the web-based trip planner, and the web-based real-time bus tracker, BRT service would provide additional technology to improve travel times, reliability, and customer experience. Specifically, the Tier 2 Evaluation assumes that the proposed BRT service will include the following features:

- RTS showing bus arrival information signs at each stop, to notify passengers exactly when the bus will arrive
- TVMs and off-board fare validation readers at all stations
- Traffic signal priority (TSP), which is a system that allows buses to communicate with traffic signals to lengthen a green light or shorten a red light to reduce waiting time at traffic signals
- Transit queue-jump signals (shown in Figure 2.3), which are separate signals that apply only to the transit vehicle and allow buses to get a head start into traffic and avoid merging into long lines of vehicles waiting at an intersection—these could be used at intersections, in locations where the roadway configuration transitions from a dedicated lane (either curb-running or center-running) to a mixed-traffic configuration, or in locations where the bus needs to cross over to or from a center-running configuration to a curb-running configuration.

Figure 2.3
Diagram of a Queue Jump Signal



The queue jump signal illustrated on the right side of this diagram indicates a bus is allowed to move into the intersection while other traffic must continue to wait at a red light.

Source: SEWRPC Staff

Identity and Branding

Stations, vehicles, signage, and other public-facing information regarding the proposed BRT service would include unique branding to distinguish it from traditional fixed-route bus service provided by MCTS. Branding is expected to have similar characteristics to the East-West BRT but would be specific to this route. Details about the identity and branding of the proposed BRT service would be developed in future phases of project development but likely include the use of a unique route name, branded bus wraps, color schemes, and a logo. Unique identity and branding are expected to be included regardless of the route alternative and roadway configuration that is recommended in this study.

Maintenance Facility

Proposed BRT vehicles are expected to be maintained at existing MCTS facilities. MCTS has three maintenance locations: two operating garages, one on S. Kinnickinnic Avenue and W. Mitchell Street and at N. 35th Street and W. Fond du Lac Avenue; and a third facility for major repairs located at W. Fond du Lac Avenue and W. Vine Street. Additional equipment may need to be purchased to maintain the expanded fleet of electric vehicles.

2.7 PROPOSED CHANGES TO OTHER ROUTES

Introduction of the proposed BRT service in the corridor provides opportunities to modify service on other MCTS routes that serve this corridor and make adjustments to expand access to the investment. Potential service changes have been assumed in this study for purposes of estimating ridership and costs. Actual service modifications will require further analysis and public input. Service changes vary based on route alternative and are summarized in Table 2.9 and described in more detail below.

Table 2.9
Changes to Other Routes by Route Alternative

Route Alternative	Future Route 27 Option 1 *(Bayshore to Loomis)*	Future Route 27 Option 2 *(Green Bay Road to Loomis)*	Truncate Existing Route 12	Extend Existing Route 80
North Option 1 to South Option A	X		X	X
North Option 1 to South Option B	X		X	X
North Option 1 to South Option C	X		X	X
North Option 2 to South Option A		X		
North Option 2 to South Option B		X		
North Option 2 to South Option C		X		

Source: SEWRPC

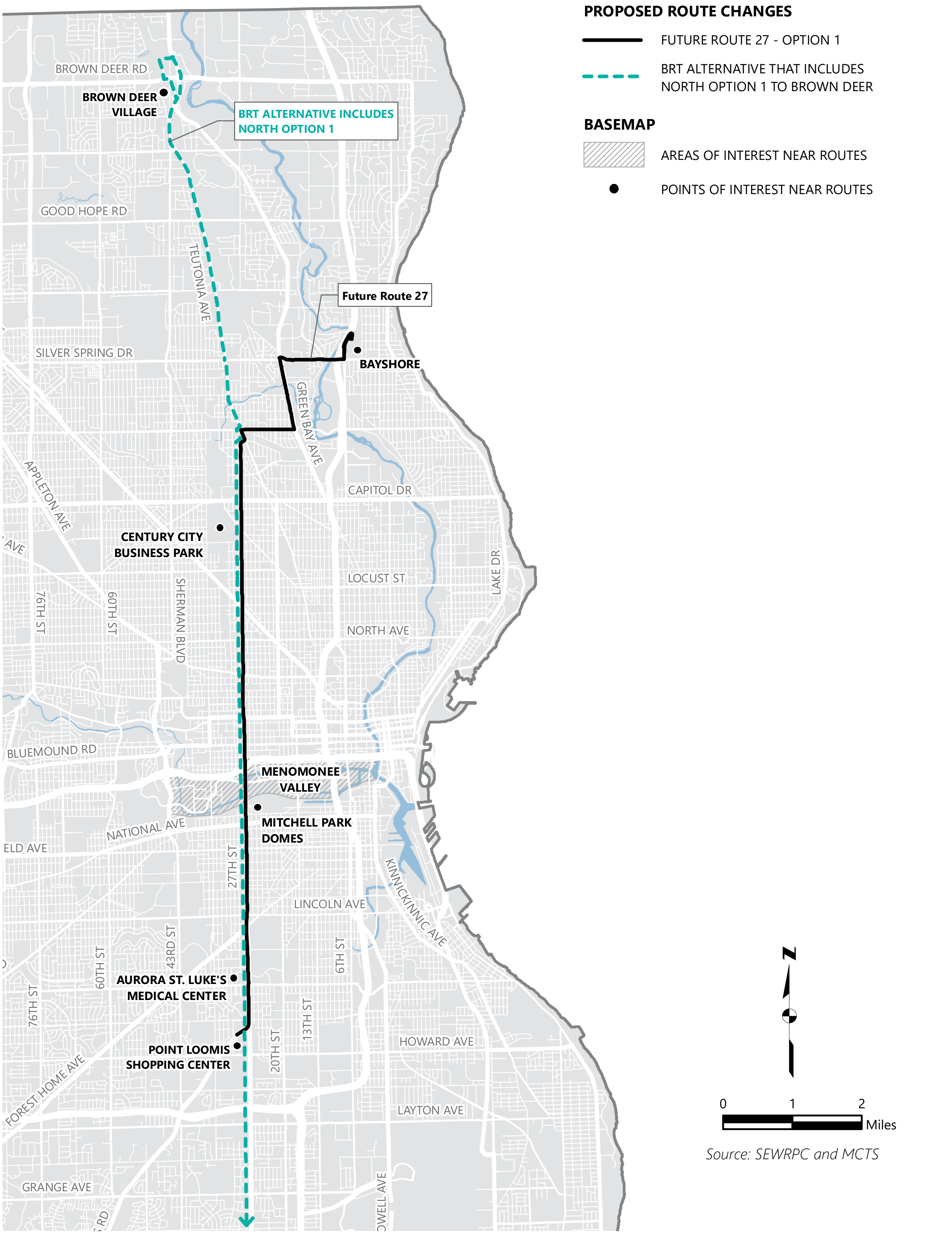
Future Route 27

If the proposed BRT service is recommended at the conclusion of this study, for any of the route alternatives and roadway configurations under consideration, it would replace the existing PurpleLine route. It is expected that a fixed-route bus service would be maintained in the core segment of the corridor to serve many of the existing PurpleLine route stops at a reduced service frequency. Two variations of the route are being considered and will be described as future Route 27, in reference to the name of the route that served this corridor through 2018.

If a route alternative that includes North Option 1 to Brown Deer is implemented, future Route 27 would follow a similar pattern, but instead of terminating near the intersection of W. Hampton Avenue and N. Green Bay Avenue, it would continue north on N. Green Bay Avenue, turn east onto W. Silver Spring Drive, and then turn north onto N. Port Washington Road, terminating at Bayshore—following a pattern similar to the existing PurpleLine on the northern portion of the corridor. This route variation is shown in Map 2.4.

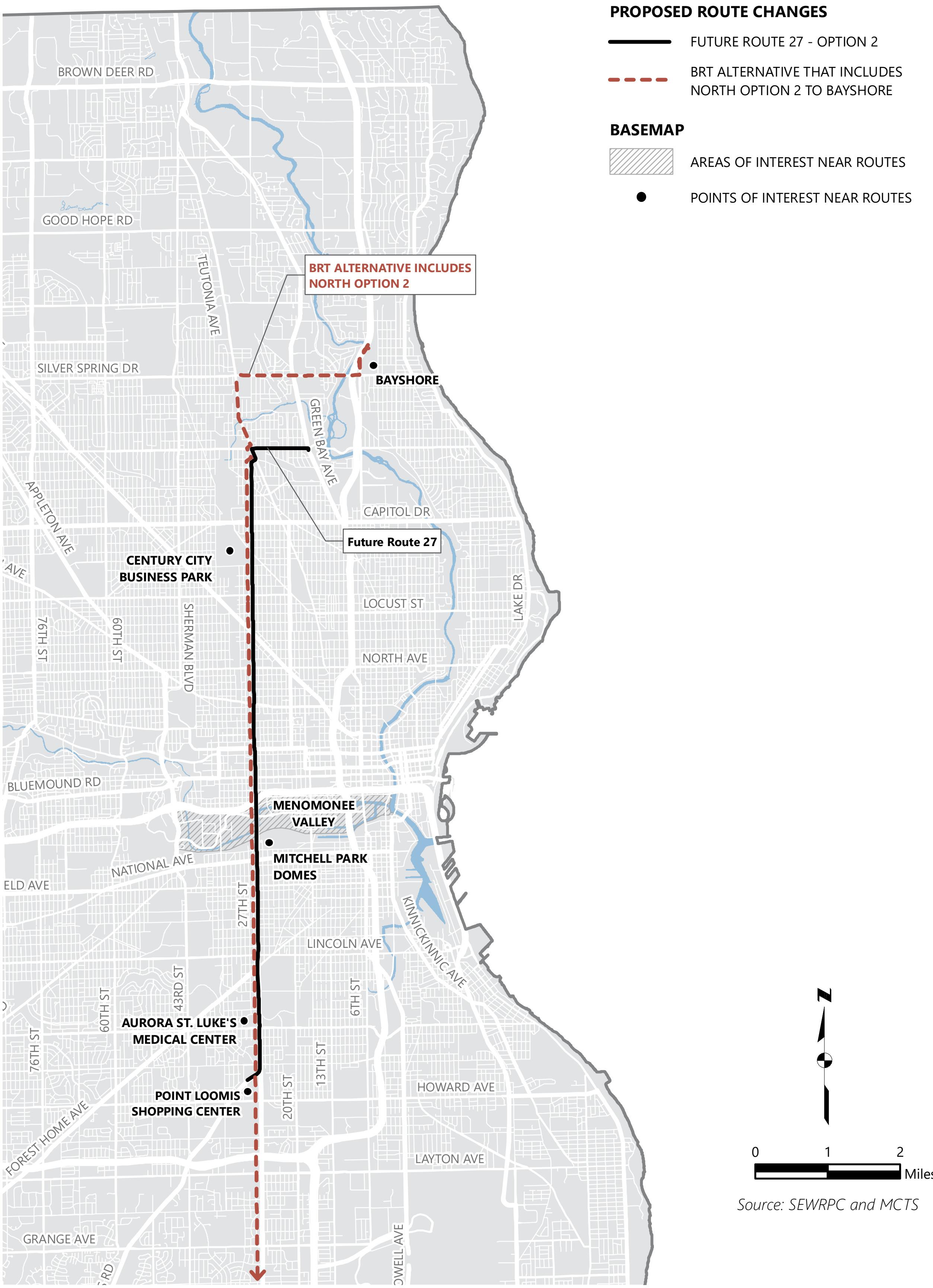
If a route alternative that includes North Option 2 to Bayshore is implemented in the corridor, future Route 27 would serve the corridor along 27th Street from W. Loomis Road to W. Cornell Street, continuing north onto N. Teutonia Avenue, then turning east onto W. Hampton Avenue, before terminating near the intersection of W. Hampton Avenue and N. Green Bay Avenue. This route variation is shown in Map 2.5.

Map 2.4
Future Route 27 – Option 1



Source: SEWRPC and MCTS

Map 2.5
Future Route 27 – Option 2



Source: SEWRPC and MCTS

The goal of future Route 27 would be to provide service to existing stops for riders for whom longer walking distances to and from the more widely spaced BRT station locations would be difficult. Where appropriate, future Route 27 would be able to utilize BRT stations and dedicated transit lanes located along the route.

Route 12

The existing Route 12 provides service from downtown Milwaukee to W. Brown Deer Road—running along N. 12th Street, N. Teutonia Avenue, and N. Green Bay Road with weekday service every 15 to 30 minutes and weekend service every 20 to 30 minutes. If the recommended route alternative includes North Option 1 to Brown Deer, the segment that runs along N. Teutonia Avenue from W. Cornell Street to the Marketplace of Brown Deer (just north of W. Brown Deer Road), would be duplicated by this service. Therefore, this route would be truncated at W. Hampton Avenue, providing service from downtown Milwaukee along N. 12th Street and N. Teutonia Avenue to W. Hampton Avenue, turning east onto W. Hampton Avenue and terminating at the intersection of W. Hampton Avenue and N. Green Bay Avenue. Proposed changes to Route 12 are shown in Map 2.6. This route configuration would allow riders of Route 12 to transfer to the proposed BRT line at the intersection of N. Teutonia Avenue and W. Hampton Avenue to continue to Brown Deer or other destinations along the proposed BRT route while avoiding duplication of service on the segment north of W. Hampton Avenue. Headways on Route 12 would be expected to remain the same, although the schedule could be adjusted to better align with a transfer to the BRT service.

Route 80

The existing Route 80 provides service between the City of Oak Creek (the existing southern terminus is near S. Howell Avenue and E. Puetz Road) to the City of Glendale (the existing northern terminus is located at the Glendale Industrial Park near N. Green Bay Avenue and W. Silver Spring Drive) running primarily along S. 6th Street with stops at Mitchell International Airport. If the recommended route alternative includes North Option 1 to Brown Deer, the northern terminus of Route 80 will be extended along N. Green Bay Avenue and then west along W. Good Hope Road to connect with the BRT service at the intersection of N. Teutonia Avenue and W. Good Hope Road. Headways would be expected to remain the same, although the schedule could be adjusted to better align with a transfer to the BRT service. Proposed changes to Route 80 are shown in Map 2.7.

East-West Connection in Southern Milwaukee County

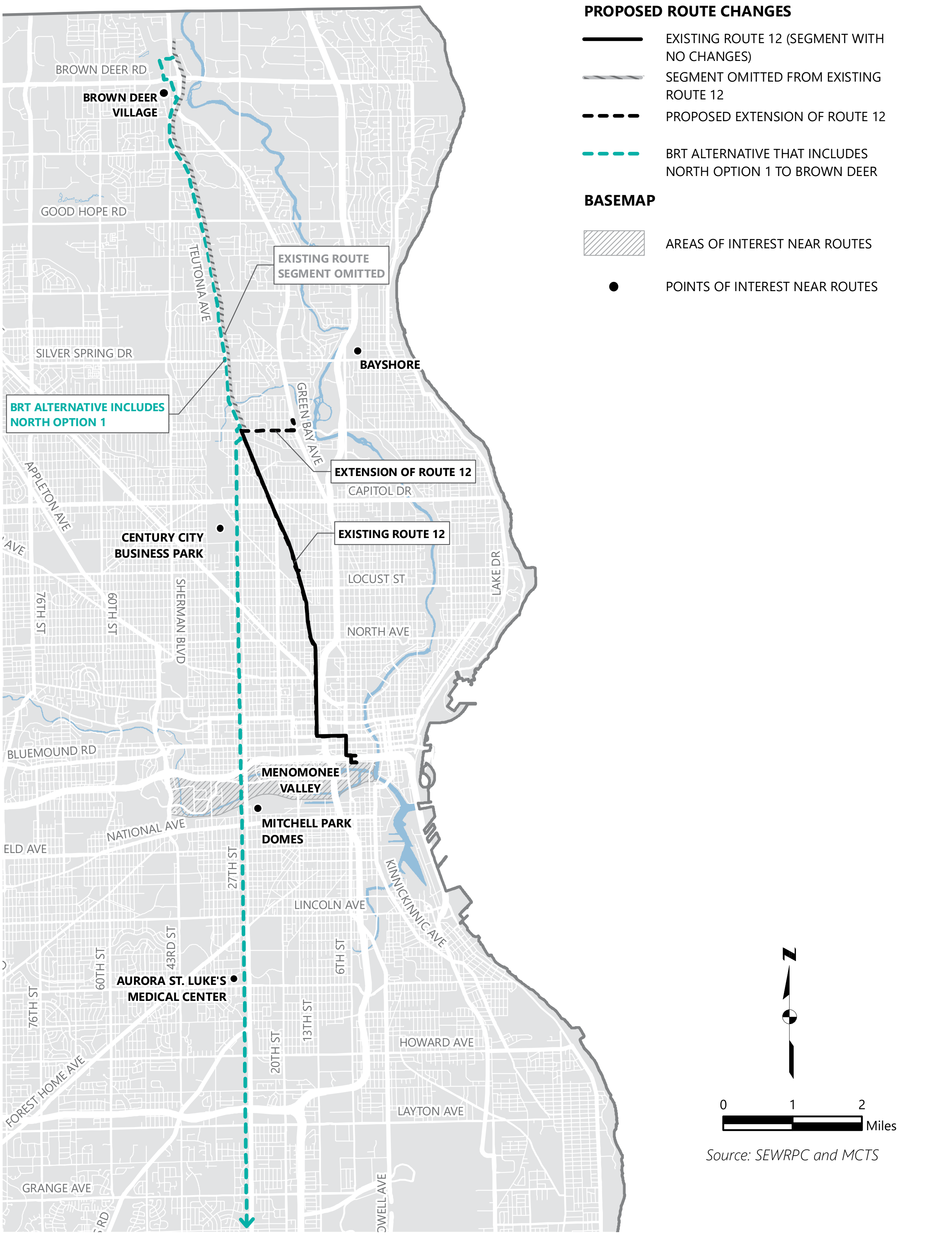
If the recommended alternative does not include South Option B, an east-west connection could be considered in the future to facilitate transfers from Route 80 and the proposed BRT service if funding were to become available. This could be done through the extension of Route 80 to the west, or the introduction of a new route along W. Drexel Avenue.

2.8 DETAILED EVALUATION CRITERIA

The remaining chapters of this Tier 2 Evaluation will focus on analyzing the detailed alternatives described in this chapter against the evaluation criteria shown in Table 2.10. These criteria are linked to the project goals and objectives, which are described in more detail in the Purpose and Need document (Volume 3) of this study.

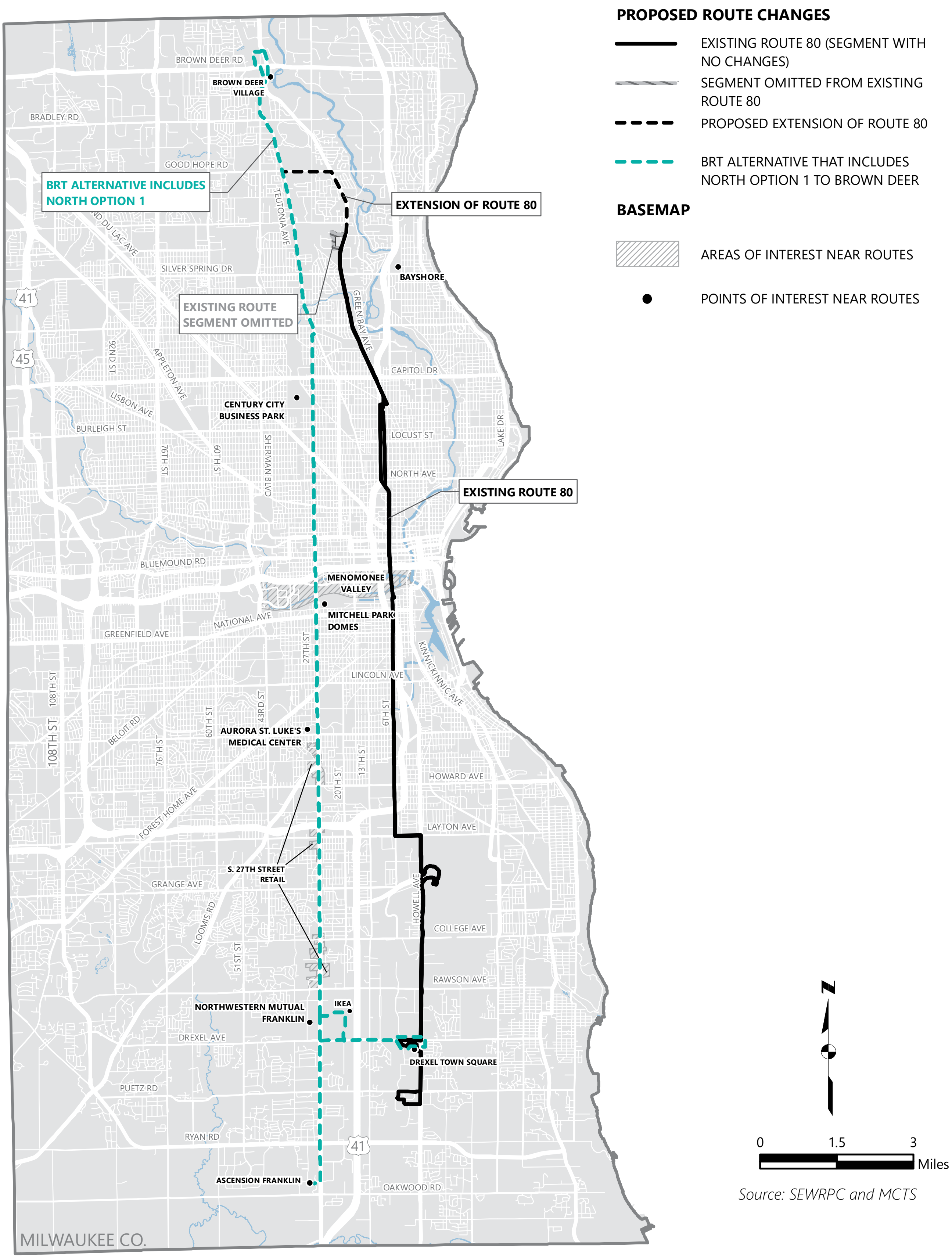
The complete results of these evaluations are summarized in the final chapter of this volume.

Map 2.6
Changes to Route 12



Source: SEWRPC and MCTS

Map 2.7
Changes to Route 80



Source: SEWRPC and MCTS

Table 2.10
Detailed Evaluation Criteria

Project Goal	Detailed Evaluation Criteria
Provide underserved residents in the corridor with an improved, efficient, and convenient transportation option. *(Refer to needs 1, 2, 3, 4)*	• Ridership • Transit Travel Times
Improve access for underserved neighborhoods. *(Refer to needs 2, 3, 4)*	• Demographics • Employment • Ridership
Provide transit that is a viable, attractive alternative to driving. (*Refer to need 1)*	• Ridership • Transit Travel Times • Capital, Operating, and Maintenance Costs • Cost Effectiveness
Manage travel demand in the corridor. (*Refer to needs 4, 5, 6)*	• Parking Impacts • Potential Right-Of-Way Impacts • Bicycle and Pedestrian Impacts
Develop a recommended alternative that will be supported by the community and that is financially sustainable within the expected transit funding. *(Refer to needs 1, 6)*	• Capital, Operating and Maintenance Costs • Cost Effectiveness • Community Support
Deliver an environmentally sustainable transportation option. *(Refer to needs 4, 6)*	• Land Use • Environmental Impacts and Benefits • Bicycle and Pedestrian Impacts

Source: SEWRPC

STATION AREA ANALYSIS 3

3.1 OVERVIEW

This chapter documents the analysis of potential station areas along the route alternatives under consideration. Station area analysis is used to evaluate both the individual station locations and the route alternatives under consideration. Four categories of evaluation are included in this analysis:

1. Station Area Population and Employment Totals
2. Population + Employment Density Scores
3. Equitable Access to the Transit Investment
4. Development Potential

For this study, station locations are generalized at intersections and a station area is defined as the half-mile radius around each intersection. The process of detailed siting of stations will occur during the future engineering and design phases of this project. Station locations represent areas where station pairs—a station in each direction—would be located, except in the cases of a center-running configuration (where a single station in the median could serve both directions) or some of the route termini locations (where only one station would be needed). The half-mile radius used for the analysis is consistent with federal evaluation standards and generally reflects the distance that could be covered in a 10-minute walk (an industry standard for the distance the average person is willing to walk to access high-quality transit). Station locations under consideration are shown in Map 3.1 and listed in Table 3.1. Additional details regarding the alternatives under consideration can be found in Chapter 2.

Identifying Station Locations

Several factors were considered to identify potential station locations, including:

- Boardings and alightings at existing PurpleLine bus stops
- Intersections with other major streets or existing transit routes (to accommodate passenger transfers)
- Proximity to other potential stations—station spacing averaging approximately one-half mile over the length of the corridor in keeping with best practices for BRT service
- The locations of major destinations such as employment, shopping, and medical centers
- The existence of pedestrian infrastructure including continuous sidewalks, curb ramps, and pedestrian crossings
- Existing and projected population and employment density
- Options for locating a battery electric bus charger at potential route termini and providing restrooms for drivers during charging and layovers
- The potential for future development

In addition, due to the flexible nature of BRT and infrastructure needs related to charging and restrooms, stations could be added or relocated in the future to accommodate changes in development.

Map 3.1
Route Segment Options and Station Locations

Table 3.1
Station Location by Route Option

Station Location	North Option 1	North Option 2	Central Segment	South Option A	South Option B	South Option C
Marketplace of Brown Deer[a]	X					
Original Brown Deer Village[a]	X					
Teutonia & Bradley	X					
Teutonia & Good Hope	X					
Teutonia & Green Tree	X					
Teutonia & Florist	X					
Silver Spring & Crestwood		X				
Silver Spring & Private (at Pick N' Save)		X				
Bayshore[a]		X				
Teutonia & Silver Spring			X			
Teutonia & Villard			X			
Teutonia & Hampton			X			
27th & Atkinson			X			
27th & Capitol			X			
27th & Hopkins			X			
27th & Burleigh			X			
27th & Center/Fond Du Lac			X			
27th & North			X			
27th & Lisbon			X			
27th & Vliet			X			
27th & Highland			X			
27th & Wisconsin			X			
27th & St. Paul			X			
Layton & National			X			
Layton & Greenfield			X			
Layton & Burnham			X			
Layton & Lincoln/Forest Home			X			
27th & Oklahoma			X			
27th & Ohio (at Walmart)			X			
27th & North of Howard			X			
27th & Coldspring/Bolivar			X			
27th & Layton			X			
27th & Edgerton			X			
27th & Grange			X			
27th & Ramsey			X			
27th & College			X			
27th & Sycamore (at Walmart)			X			
27th & Northwestern Mutual Way					X	X
Northwestern Mutual Way & Ikea Way[b]				X	X	
Northwestern Mutual[a]				X		
Drexel & 13th					X	
Drexel Town Square[a]					X	
27th & Ryan						X
Ascension Franklin*						X

[a] *Station location does not include station pairs or stations in both directions.*

[b] *Station pair for South Option A, but a single station for South Option B.*

Source: SEWRPC

At this time, a station on the 27th Street viaduct over the Menomonee Valley is not included due to the existing low boardings and alightings, and the walking distance between a station located where the viaduct crosses Canal Street and the distance from jobs and other destinations in the Menomonee Valley. A station in this location could be considered in the future.

Equitable Development

Local and regional plans recommend relatively dense, mixed-use development and redevelopment along much of the corridor that accommodates bicyclists and pedestrians and that both supports and is supported by transit. The addition of BRT service along this corridor may encourage additional development beyond what may otherwise occur due to the improved access it will provide.

Private investment along the route would benefit the surrounding community by providing access to more housing options and additional destinations along the route, as well as filling in vacant or underutilized sites that can negatively affect property values. However, it will be important that local governments ensure that any development and redevelopment efforts bolstered by this project benefit existing residents and businesses and that displacement due to an increase in property values is prevented. The City of Milwaukee's Moving Milwaukee Forward Effort provides a neighborhood framework for catalyzing equitable transit-oriented development (TOD) through the future expansion of the Milwaukee Streetcar system to the Bronzeville and Walker's Point neighborhoods.[2] The plans that have resulted from this effort include a set of strategies that could be applied to the 27th Street corridor in conjunction with future phases of this project.

3.2 STATION AREA POPULATION AND EMPLOYMENT TOTALS

Population and employment estimates around stations are important for understanding how many people have access to the transit enhancement and how many jobs will be accessible via the transit enhancement. The following section outlines the method for measuring the total population and jobs within the half-mile radius of each station using estimates for 2020 and 2045, followed by the evaluation and results by complete route alternative.

Methodology

Employment and population totals are measured within one-half mile radius of each station location and organized by route segment option. The methodology for measuring these totals is described below:

- Population and employment data at the Traffic Analysis Zone (TAZ)[3] geography is clipped to one-half mile radius around each station using geographic information system (GIS) software.

- Per Federal Transit Administration (FTA) guidance, estimates are created by calculating the pro-rated amount of area of a given TAZ that falls within the half-mile radius. For example, if 60 percent of the area of a TAZ falls within one-half mile radius of a station, it is assumed that 60 percent of the population and employment of that TAZ are also within the half-mile radius.

- Population and employment totals per route-mile are also reported and calculated by dividing total population and employment by the number of route-miles on each route alternative or route segment option.

Data sources used in this analysis include estimated existing (2020) and forecasted future (2045) population and employment estimates were developed using the Commission's population and employment model at the TAZ level.

Evaluation

A summary of population and employment that would be served by stations along each complete route alternative is provided in Table 3.2 to understand how the route alternatives compare to one another, including population and employment per mile to adjust for the varying length among the alternatives. Then, the results for each individual station are provided by route segment in Tables 3.3 through 3.8 to display how well each station and segment serves the study corridor.

[2] Equitable Growth through Transit Oriented Development: A Neighborhood Plan for Historic Dr. Martin Luther King Jr. Drive (FINAL REPORT) *and* Equitable Growth through Transit Oriented Development: A Neighborhood Plan for Walker's Point (FINAL REPORT). *city.milwaukee.gov/DCD/Planning/PlansStudies/Plans/MovingMKEForward.*

[3] *TAZs are the geographical unit most used in transportation planning models. Most TAZs used in this analysis are quarter sections, although in less densely populated areas, quarter sections have been combined to form TAZs.*

Table 3.2
Population and Employment: Summary Results by Route Alternative

Route Alternative	Route Length (miles)	2020 Population	2020 Population Per Mile	2045 Population	2045 Population Per Mile	Percent Change in Population	2020 Employment	2020 Employment Per Mile	2045 Employment	2045 Employment Per Mile	Percent Change in Employment
North Option 1 to South Option A	20.46	119,800	5,855	119,900	5,860	0.1	54,900	2,683	56,500	2,760	2.9
North Option 1 to South Option B	22.09	122,500	5,545	122,900	5,560	0.3	58,100	2,630	59,800	2,710	2.9
North Option 1 to South Option C	22.99	121,000	5,263	121,100	5,270	0.1	56,600	2,462	58,300	2,540	3.0
North Option 2 to South Option A	17.98	116,200	6,463	116,500	6,480	0.3	51,700	2,875	53,700	2,990	3.9
North Option 2 to South Option B	19.61	118,900	6,063	119,400	6,090	0.4	54,800	2,794	57,000	2,910	4.0
North Option 2 to South Option C	20.51	117,400	5,724	117,700	5,740	0.3	53,400	2,604	55,500	2,710	3.9

Source: SEWRPC

The North Option 2 to South Option A alternative would serve the highest number of people and jobs per mile followed by the North Option 2 to South Option B alternative. Alternatives that include North Option 1—the longer of the two northern segment options—would serve a higher number of total people and jobs. All alternatives are expected to have similar levels of change in population and job density between 2020 and 2045.

It should be noted that some additional population and/or job growth is likely in some areas of the study corridor that are not reflected in the Commission's population and employment model. Specifically, the areas surrounding the Original Brown Deer Village, Bayshore, the 30th Street Corridor (near W. Capitol Drive and W. Hopkins Street), N. 27th Street and W. Wisconsin Avenue, Northwestern Mutual and Ikea, and W. Drexel Avenue and 13th Street are expected to see a more significant growth in population and jobs based on current development activities in those areas.

Tables 3.3 and 3.4 provide population and employment information for the north route segments under consideration. The average number of people and jobs served by stations along North Option 2 is higher than North Option 1. Both population and jobs are expected to increase slightly along North Option 2 and decrease slightly along North Option 1.

Table 3.3
Population and Employment: North Option 1 Stations

Station Location	2020 Population	2045 Population	Percent Change in Population	2020 Employment	2045 Employment	Percent Change in Employment
Marketplace of Brown Deer	1,270	1,260	-0.8	4,200	4,220	0.5
Original Brown Deer Village	780	760	-2.6	2,990	2,960	-1.0
Teutonia & Bradley	1,420	1,410	-0.7	430	440	2.3
Teutonia & Good Hope	2,870	2,810	-2.1	1,580	1,520	-3.8
Teutonia & Green Tree	2,550	2,490	-2.4	2,800	2,670	-4.6
Teutonia & Florist	3,520	3,500	-0.6	2,360	2,270	-3.8
Average	2,070	2,040	-1.4	2,390	2,350	-1.7

Source: SEWRPC

Table 3.4
Population and Employment: North Option 2 Stations

Station Location	2020 Population	2045 Population	Percent Change in Population	2020 Employment	2045 Employment	Percent Change in Employment
Silver Spring & Crestwood	3,290	3,340	1.5	2,470	2,540	2.8
Silver Spring & Private	1,980	2,020	2.0	2,840	2,890	1.8
Bayshore	3,020	3,020	0.0	4,140	4,200	1.4
Average	2,770	2,790	0.7	3,150	3,210	1.9

Source: SEWRPC

Table 3.5 provides population and employment information for the Central Segment. Stations along this segment would serve a higher average number of total people and jobs when compared to other route segment options.

Table 3.5
Population and Employment: Central Segment Stations

Station Location	2020 Population	2045 Population	Percent Change in Population	2020 Employment	2045 Employment	Percent Change in Employment
Teutonia & Silver Spring	5,050	5,020	-0.6	1,660	1,740	4.8
Teutonia & Villard	4,810	4,770	-0.8	1,710	1,750	2.3
Teutonia & Hampton	5,440	5,340	-1.8	1,550	1,610	3.9
27th & Atkinson	5,280	5,190	-1.7	2,760	2,810	1.8
27th & Capitol	5,490	5,390	-1.8	3,000	3,150	5.0
27th & Hopkins	6,670	6,530	-2.1	1,710	1,920	12.3
27th & Burleigh	7,620	7,660	0.5	1,670	1,820	9.0
27th & Center/Fond Du Lac	6,920	7,030	1.6	2,560	2,710	5.9
27th & North	6,510	6,630	1.8	2,320	2,450	5.6
27th & Lisbon	3,650	3,630	-0.5	1,770	1,800	1.7
27th & Vliet	9,920	10,200	2.8	2,900	3,060	5.5
27th & Highland	10,990	11,310	2.9	4,280	4,570	6.8
27th & Wisconsin	9,220	9,460	2.6	4,960	5,330	7.5
27th & St. Paul	980	980	0.0	630	650	3.2
Layton & National	11,550	11,420	-1.1	2,490	2,560	2.8
Layton & Greenfield	15,990	15,780	-1.3	2,800	2,880	2.9
Layton & Burnham	15,550	15,340	-1.4	2,640	2,730	3.4
Layton & Lincoln/ Forest Home	9,700	9,530	-1.8	1,820	1,890	3.8
27th & Oklahoma	3,490	3,460	-0.9	8,390	8,550	1.9
27th & Ohio (at Walmart)	5,150	5,080	-1.4	4,340	4,430	2.1
27th & North of Howard	5,190	5,150	-0.8	1,920	1,960	2.1
27th & Coldspring/Bolivar	2,800	2,830	1.1	1,300	1,330	2.3
27th & Layton	3,650	3,630	-0.5	1,770	1,800	1.7
27th & Edgerton	3,790	3,820	0.8	1,600	1,620	1.3
27th & Grange	4,230	4,220	-0.2	1,530	1,600	4.6
27th & Ramsey	4,360	4,300	-1.4	1,520	1,580	3.9
27th & College	3,860	3,800	-1.6	1,680	1,710	1.8
27th & Sycamore (at Walmart)	2,350	2,370	0.9	1,920	1,980	3.1
Average	6,440	6,420	-0.3	2,470	2,570	4.0

Source: SEWRPC

Tables 3.6 through 3.8 provide population and job information for the southern route options under consideration. All of these route options are expected to experience a significant increase in both population and jobs by 2045 due to the availability of open land and plans for development in these areas. Stations on the South Option A segment would serve the lowest average number of people and jobs while South Option B and C would serve similar, but higher numbers.

Table 3.6
Population and Employment: South Option A Segment Stations

Station Location	2020 Population	2045 Population	Percent Change in Population	2020 Employment	2045 Employment	Percent Change in Employment
NW Mutual Way & Ikea Way	210	460	119.0	250	340	36.0
Northwestern Mutual	840	1,060	26.2	870	950	9.2
Average	530	760	43.4	560	640	14.3

Source: SEWRPC

Table 3.7
Population and Employment: South Option B Segment Stations

Station Location	2020 Population	2045 Population	Percent Change in Population	2020 Employment	2045 Employment	Percent Change in Employment
NW Mutual Way & Ikea Way	210	460	119.0	250	340	36.0
Drexel & 13th	900	1,140	26.7	1,080	1,160	7.4
Drexel Town Square	2,110	2,260	7.1	2,440	2,530	3.7
Average	1,070	1,280	19.6	1,260	1,340	6.3

Source: SEWRPC

Table 3.8
Population and Employment: South Option C Segment Stations

Station Location	2020 Population	2045 Population	Percent Change in Population	2020 Employment	2045 Employment	Percent Change in Employment
27th & NW Mutual Way	710	940	32.4	850	920	8.2
27th & Ryan	1,200	1,270	5.8	1,410	1,460	3.5
Ascension Franklin	1,200	1,400	16.7	1,650	1,750	6.1
Average	1,040	1,210	16.3	1,300	1,380	6.2

Source: SEWRPC

Summary of Evaluation Results

Table 3.9 provides the route alternative evaluation results for station area population and employment totals based on averages for 2020 and 2045. For total population served per mile, North Option 2 to South Option A and North Option 2 to South Option B are rated green, with the highest number of people per mile served by these alternatives; North Option 1 to South Option A and North Option 2 to South Option C are rated yellow, with the next highest number of people served per mile; and North Option 1 to South Option B and North Option 1 to South Option C are rated as red, as the alternatives that would serve the fewest number of people per mile.

Table 3.9
Route Alternative Evaluation Results: Population and Employment Totals

Route Alternative	Total Population Served per Mile	Total Employment Served per Mile
North Option 1 to South Option A	●	●
North Option 1 to South Option B	●	●
North Option 1 to South Option C	●	●
North Option 2 to South Option A	●	●
North Option 2 to South Option B	●	●
North Option 2 to South Option C	●	●

Source: SEWRPC

For total employment served per mile, as shown in Table 3.2, both the North Option 2 to South Option A alternative and the North Option 2 to South Option B alternative are rated green as they would serve a similar, relatively high number of jobs per mile; the North Option 1 to South Option A, North Option 1 to South Option B, and North Option 2 to South Option C alternatives are rated as yellow as they would serve similar numbers of jobs per mile—all around 2,700; and North Option 1 to South Option C tis rated as red as it would provide service to the fewest number of jobs per mile among all the alternatives.

3.3 POPULATION + EMPLOYMENT DENSITY SCORES

The density of people and destinations within walking distance of stations is a key factor in the efficiency and viability of transit. For this evaluation, minimum thresholds for population and employment density are used to create a combined score indicating levels of density that support transit. The combined scores identify areas that may not meet minimum density thresholds for either population or employment density independently, but the combined densities are supportive of transit. This measure will be referred to as a Population + Employment Score and was used to evaluate which route segment options would best support bus rapid transit.

Methodology

Research from the Transit Cooperative Research Program (TCRP) provides guidance regarding minimum population and job density thresholds that support different levels of transit service based on national data.[4] These thresholds represent a baseline for where transit will most likely be successful and don't include factors such as the rate of car ownership or general walkability, which are also likely to support transit ridership.

Based on TCRP research, minimum thresholds of 3 dwelling units per gross acre and 4 jobs per gross acre are needed to support fixed-route transit service, and minimum thresholds of 4.8 dwelling units per gross acre and 6 jobs per gross acre are needed to support rapid transit such as BRT. Generally, this minimum threshold should be continuous throughout the length of the corridor for transit service to be viable. However, if a service passes through areas of lower density, the end points need to have relatively higher density levels to justify the additional travel times.

The Population + Employment Density Score combines both population and employment density and equalizes them on a weighted scoring scale. A score of 100 is the minimum score expected to support fixed route transit and a score of 150 is the minimum score expected to support rapid transit service. The scores are mapped underlaying polygons showing station areas. A visual evaluation of the maps provides a comparison of route segment options.

Data sources used for this analysis include existing (2020) and forecasted future (2045) population and employment estimates that were developed using the Commission's population and employment model at the TAZ level.

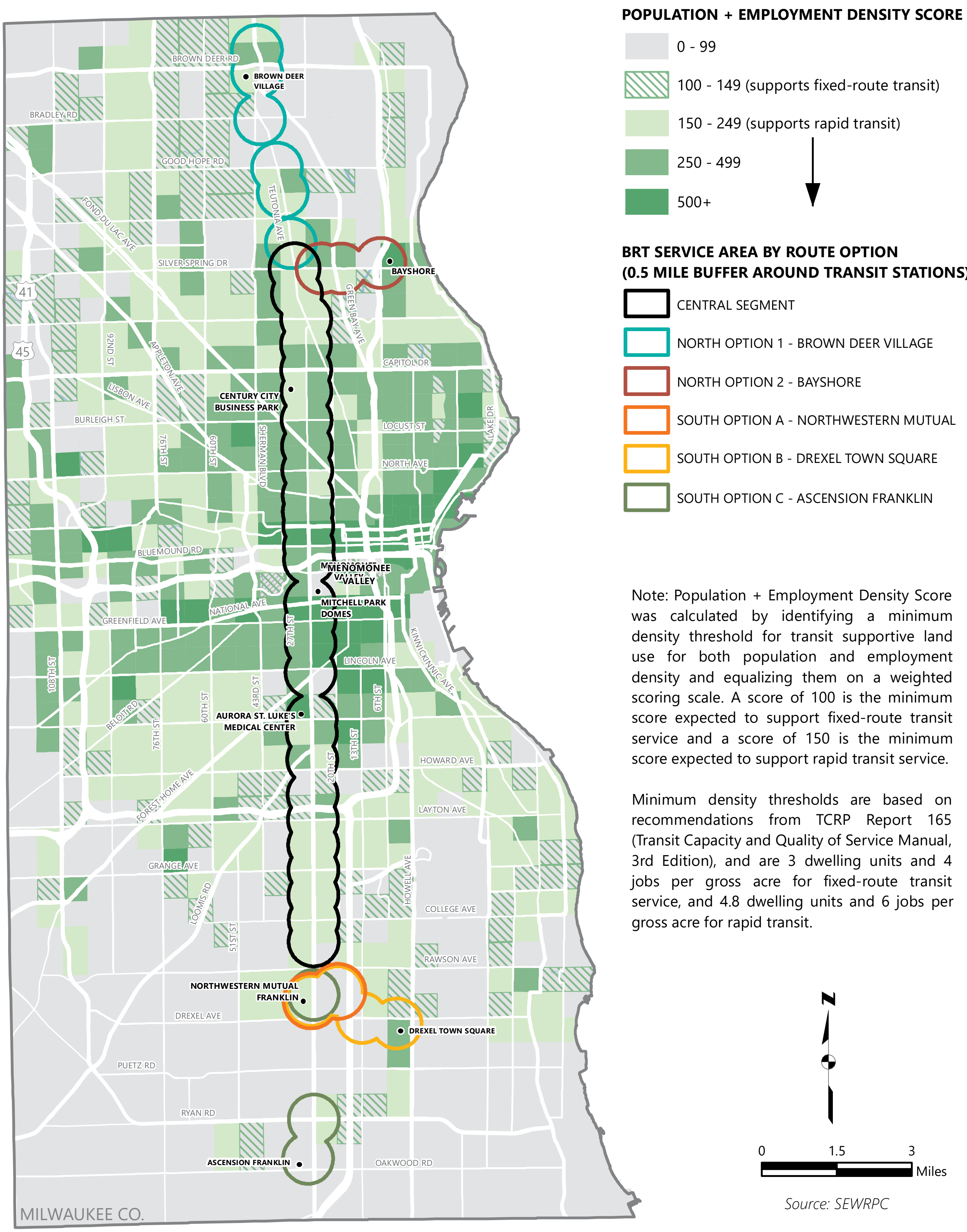
Evaluation

Map 3.2 shows the Population + Employment Density Scores for Milwaukee County in 2020 and Map 3.3 shows the same map for 2045 with the station areas around each route segment option also shown.

North Option 1 has several areas below the density thresholds to adequately support rapid transit, although there are areas above the threshold near the Market Place of Brown Deer, the Original Brown Deer Village, and the areas south of Good Hope Road. North Option 2 shows several areas with higher scores along Silver Spring Drive and at Bayshore.

[4] *National Academies of Sciences, Engineering, and Medicine. 2013.* Transit Capacity and Quality of Service Manual, Third Edition. *Washington, DC: The National Academies Press. doi.org/10.17226/24766.*

Map 3.2
Population + Employment Density Score: Estimated 2020

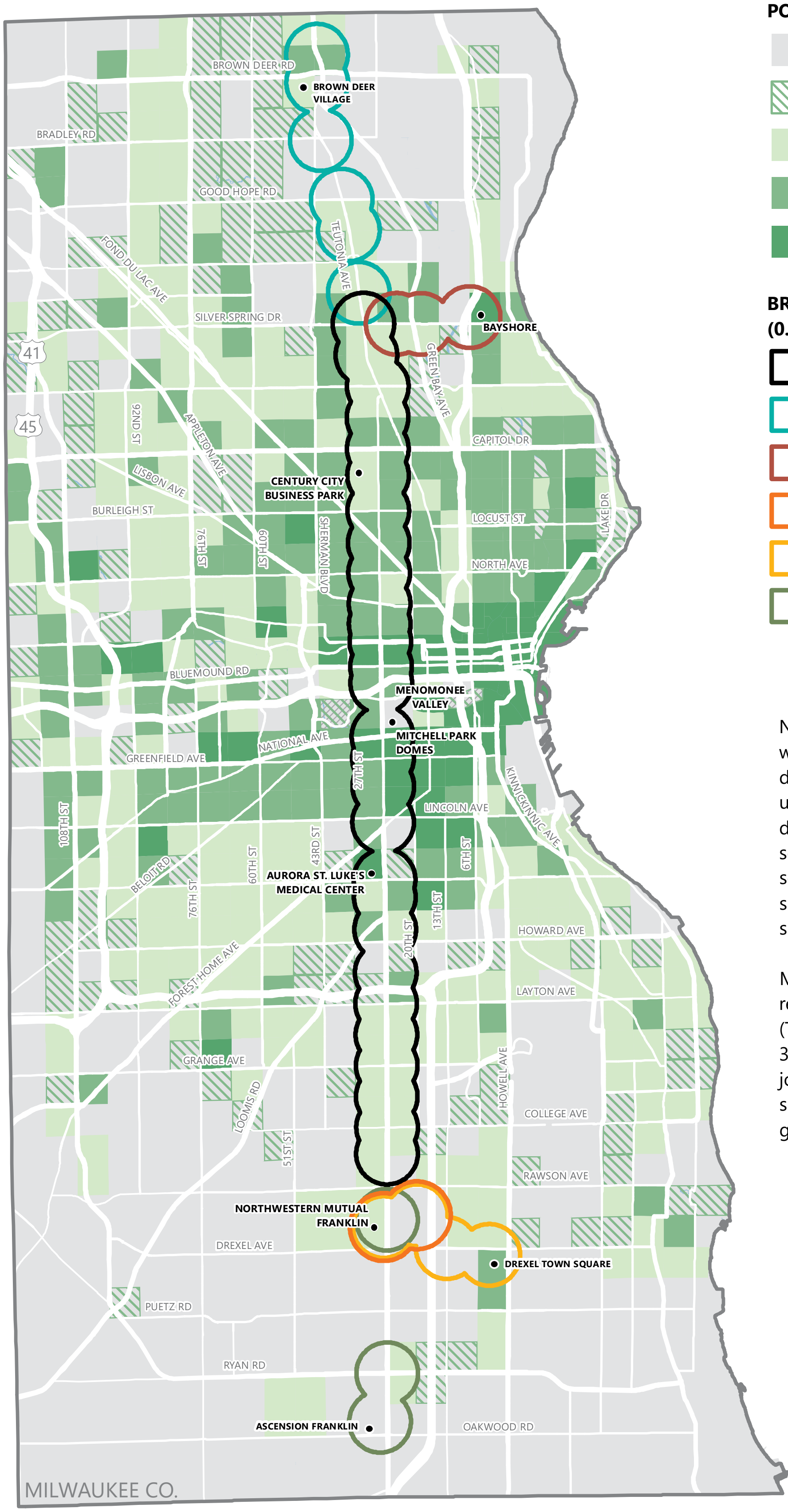


Note: Population + Employment Density Score was calculated by identifying a minimum density threshold for transit supportive land use for both population and employment density and equalizing them on a weighted scoring scale. A score of 100 is the minimum score expected to support fixed-route transit service and a score of 150 is the minimum score expected to support rapid transit service.

Minimum density thresholds are based on recommendations from TCRP Report 165 (Transit Capacity and Quality of Service Manual, 3rd Edition), and are 3 dwelling units and 4 jobs per gross acre for fixed-route transit service, and 4.8 dwelling units and 6 jobs per gross acre for rapid transit.

Source: SEWRPC

Map 3.3
Population + Employment Density Score: Estimated 2045



POPULATION + EMPLOYMENT DENSITY SCORE

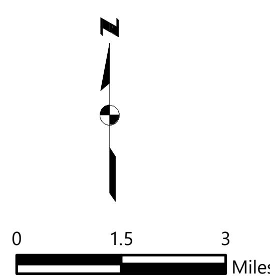
- 0 - 99
- 100 - 149 (supports fixed-route transit)
- 150 - 249 (supports rapid transit)
- 250 - 499
- 500+

BRT SERVICE AREA BY ROUTE OPTION (0.5 MILE BUFFER AROUND TRANSIT STATIONS)

- CENTRAL SEGMENT
- NORTH OPTION 1 - BROWN DEER VILLAGE
- NORTH OPTION 2 - BAYSHORE
- SOUTH OPTION A - NORTHWESTERN MUTUAL
- SOUTH OPTION B - DREXEL TOWN SQUARE
- SOUTH OPTION C - ASCENSION FRANKLIN

Note: Population + Employment Density Score was calculated by identifying a minimum density threshold for transit supportive land use for both population and employment density and equalizing them on a weighted scoring scale. A score of 100 is the minimum score expected to support fixed-route transit service and a score of 150 is the minimum score expected to support rapid transit service.

Minimum density thresholds are based on recommendations from TCRP Report 165 (Transit Capacity and Quality of Service Manual, 3rd Edition), and are 3 dwelling units and 4 jobs per gross acre for fixed-route transit service, and 4.8 dwelling units and 6 jobs per gross acre for rapid transit.



Source: SEWRPC

Summary of Evaluation Results

Table 3.10 provides the results for the Population + Employment Density Scores evaluation by route alternative. The North Option 2 to South Option A and North Option 2 to South Option B alternatives are both rated green, as they are the alternatives that would serve areas with scores consistently above 150—supportive of rapid transit. The North Option 1 to South Option A and North Option 1 to South Option B alternatives are both rated yellow, as they would serve areas largely made up of scores above 150, with the exception being the larger gap in transit-supportive densities along the North Option 1 segment. The North Option 1 to South Option C and North Option 2 to South Option C alternatives are both rated as red, as their service areas include larger swaths of land with scores below 100, meaning there is likely not enough density in either jobs or population (in 2020 or 2045) to support rapid transit.

Table 3.10
Route Alternative Evaluation Results: Population + Employment Density Scores

Route Alternative	Population + Employment Density Scores
North Option 1 to South Option A	🟡
North Option 1 to South Option B	🟡
North Option 1 to South Option C	🔴
North Option 2 to South Option A	🟢
North Option 2 to South Option B	🟢
North Option 2 to South Option C	🔴

Source: SEWRPC

3.4 EQUITABLE ACCESS TO THE TRANSIT INVESTMENT

A primary aspect of the Purpose and Need Statement for this study is to improve access for populations that are currently underserved by most transportation network investments—which favor car travel. These populations include families in poverty, people of color, households without a car, and people with disabilities, all of whom are more likely to rely on transit than families not in poverty, white non-Hispanic people, households with a car, and people without a disability. This evaluation also must be completed in accordance with federal laws and regulations including the Title VI of the 1964 Civil Rights Act (Title VI) and Executive Order (EO) 12898. This chapter identifies the number and percent of these population groups within 0.5 miles of potential station locations in an effort to understand how this project would improve access for these population groups and whether any station locations or route alternatives provide more or less benefit to these population groups.

Regulatory Framework

The Federal Transit Administration (FTA) provides two key documents to encourage compliance with Environmental Justice and Title VI requirements: Circular 4703.1 Environmental Justice Policy Guidance for Federal Transit Administration and Circular 4702.1B Title VI Requirements and Guidelines for Federal Transit Administration Recipients. The two circulars provide methods to fulfill the key goals of federal environmental justice policies:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations

- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process

- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

Title VI prohibits discrimination on the ground of race, color, or national origin. Title VI imposes a statutory obligation on FTA recipients to: (1) ensure that the level and quality of public transportation service is provided equitably without regard to race, color, or national origin; (2) promote full and fair participation in public transportation decision-making without regard to race, color, or national origin; and (3) ensure meaningful access to transit-related programs and activities by persons with limited English proficiency (LEP). A separate Title VI analysis will be prepared for this study in a subsequent phase.

EO 12898 requires each federal agency "to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." Subsequent guidance further defines environmental justice by requiring that "each federal agency shall analyze the environmental effects, including human health, economic, and social effects, of federal actions including effects on minority and low-income communities, when such analysis is required by the National Environmental Policy Act (NEPA)." Guidance also directs each federal agency to "provide opportunities for community input in the NEPA process, identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial documents, and notices."

This phase of the study does not require a NEPA-level analysis of environmental justice; however, in full compliance with Title VI and EO 12898, all efforts are being made to identify and document any adverse effects to protected populations and to ensure full and fair participation by affected communities.

Due to the high proportion of minority and low-income populations in this corridor who depend on transit at higher rates than non-minority and non-low-income populations, special attention must be paid to ensuring the complete and timely consideration of improving transit in this corridor to fulfill the third key goal of the federal environmental justice policies—to prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

Methodology

The total population and total number of households were calculated to determine population by race and ethnicity, the percent of families in poverty, households without a car, and people with disabilities within one-half mile of each station and within one-half mile of each alignment, given the industry standard that people are willing to walk approximately one-half mile to access enhanced transit. The methodology for measuring totals and percentages is described below:

- Population by race and ethnicity data from the 2020 Census was joined with a Census Block Group GIS shapefile, and data representing households without a car, families in poverty, and people with disabilities from the 2015-2019 American Community Survey was joined with a Census Tract GIS shapefile. Half-mile buffers were created around each station location for each alternative. Station buffers were also merged to analyze all populations that would be served by each route segment alternative and avoid double counting people residing in overlapping station buffers.

- The total population, total number of families, and total number of households within one-half mile of each station were calculated for each data source.

- Population by race and ethnicity was calculated as well as the percentage of the population living in poverty, households without a car, and people with disabilities.

    - The population by race and ethnicity was categorized by people of color (defined as "minority" in guidance documents) and people who are White alone, non-Hispanic. People of color includes following race and ethnic groups from the data set and represented the highest proportions in the corridor: Black/African American, American Indian and Alaska Native, Asian and Pacific Islander, other races or two or more races, and Hispanic/Latino.

    - Families in poverty were identified as families living below the federal poverty level as defined by the U.S. Census Bureau.

- The percentage of each group was determined by dividing the population, number of families, or number of households by the total population, total families, or total households.

- Per FTA guidance, these estimates were created by assigning population totals to each station area based on the pro-rated amount of area that falls within the half-mile circle around the station.

Data from the 2020 U.S. Census and the U.S. Census Bureau American Community Survey 2015-2019 were used to complete this evaluation.

Evaluation of Population by Race and Ethnicity Near Station Locations

Table 3.11 shows the population by race and ethnicity by route alternative, combining the half-mile buffer around each station location into a service area for each route. All route alternatives would serve populations with a high proportion of people of color with a range of 3,950 to 4,750 per mile.

Table 3.12 shows the composition of the population by race and ethnicity around North Option 1 stations. All stations on this route segment option serve a population that is majority people of color, with stations further north—Marketplace of Brown Deer, Original Brown Deer Village, and Teutonia & Bradley—serving a higher proportion of white people when compared to three stations further south on this route option—Teutonia & Good Hope, Teutonia & Green Tree, and Teutonia & Florist. People of color that would be served by these stations are predominantly Black/African American.

Table 3.13 shows the composition of the population by race and ethnicity around North Option 2 stations. Stations at Silver Spring & Crestwood and Silver Spring & Private on this route serve a population that is majority people of color—primarily Black/African American. The station at Bayshore would serve a majority white population.

Table 3.14 shows the composition of the population by race and ethnicity around Central Segment stations. Nearly 80 percent of the stations on this route option would serve a population that is majority people of color; however, the composition of the population by race and ethnicity changes throughout different portions of the segment. Specifically, stations north of the Menomonee Valley would serve a population that is predominately Black/African American, and stations south of the Menomonee Valley would serve a population that is predominantly Hispanic/Latino. It should also be noted that stations at 27th & North, 27th & Lisbon, and 27th & Highland serve a population that is 10 to 25 percent Asian and Pacific Islander, which is significantly higher than other station areas in the corridor.

Table 3.15 shows the composition of the population by race and ethnicity around South Option A stations. Stations on this route segment would serve 24 to 32 percent people of color, although as an area with minimal existing development, the total number of people served is low.

Table 3.16 shows the composition of the population by race and ethnicity around South Option B stations. The four potential stations along this segment serve a population that is made up of 24 to 32 percent people of color with a similar proportion of each racial and ethnic population group around each station.

Table 3.17 shows the composition of the population by race and ethnicity around South Option C stations. The three potential stations along this segment serve a population that is made up of 18 to 32 percent people of color, also with a similar proportion of each racial and ethnic population group around each station. Evaluation of Families in Poverty, Households Without a Car, and People with Disabilities Near Station Locations.

Table 3.11
Population by Race and Ethnicity: Summary Results by Route Alternative

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Route Alternative	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Per Mile	Number	Per Mile	**Total Population**
North Option 1 to South Option A	44,600	39.0	560	0.5	7,400	6.5	4,100	3.6	33,700	29.5	90,400	4,420	23,900	1,170	114,300
North Option 1 to South Option B	44,700	38.4	570	0.5	7,600	6.5	4,200	3.6	34,000	29.2	91,000	4,120	25,500	1,150	116,500
North Option 1 to South Option C	44,600	38.7	560	0.5	7,600	6.6	4,100	3.6	33,800	29.6	90,700	3,950	24,600	1,070	115,300
North Option 2 to South Option A	40,500	37.2	550	0.5	7,000	6.1	3,800	3.3	33,500	29.3	85,400	4,750	23,500	1,310	108,900
North Option 2 to South Option B	40,600	36.5	560	0.5	7,200	6.3	3,900	3.4	33,700	29.5	86,000	4,390	25,200	1,290	111,200
North Option 2 to South Option C	40,500	36.9	550	0.5	7,200	6.3	3,800	3.3	33,500	29.3	85,700	4,180	24,200	1,180	109,900

Source: U.S. Bureau of the Census (2020) and SEWRPC

Table 3.12
Population by Race and Ethnicity: North Option 1 Stations

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Station Location	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	**Total Population**
Marketplace of Brown Deer	960	44.4	--	--	100	4.6	100	4.6	100	4.6	1,250	57.9	910	42.1	2,160
Original Brown Deer Village	640	38.3	--	--	90	5.4	80	4.8	110	6.6	920	55.1	750	44.9	1,670
Teutonia & Bradley	860	44.1	5	0.3	110	5.6	100	5.1	110	5.6	1,180	60.5	770	39.5	1,950
Teutonia & Good Hope	1,130	59.8	5	0.3	120	6.3	100	5.3	110	5.8	1,460	77.2	430	22.8	1,890
Teutonia & Green Tree	1,660	60.6	5	0.2	170	6.2	130	4.7	130	4.7	2,090	76.3	660	24.1	2,740
Teutonia & Florist	2,010	69.1	5	0.2	60	2.1	140	4.8	170	5.8	2,370	81.4	530	18.2	2,910

Source: U.S. Bureau of the Census (2020) and SEWRPC

Table 3.13
Population by Race and Ethnicity: North Option 2 Stations

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Station Location	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	**Total Population**
Silver Spring & Crestwood	1,210	46.2	5	0.2	50	1.9	140	5.3	170	6.5	1,570	59.9	1,050	40.1	2,620
Silver Spring & Private	970	41.5	5	0.2	50	2.1	130	5.6	160	6.8	1,300	55.6	1,030	44.0	2,340
Bayshore	290	12.3	5	0.2	90	3.8	100	4.3	110	4.7	590	25.1	1,760	74.9	2,350

Source: U.S. Bureau of the Census (2020) and SEWRPC

Table 3.14
Population by Race and Ethnicity: Central Segment Stations

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Station Location	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	**Total Population**
Teutonia & Silver Spring	2,930	74.6	0	--	60	1.5	160	4.1	200	5.1	3,360	85.5	580	14.8	3,930
Teutonia & Villard	3,230	83.2	10	0.3	40	1.0	150	3.9	160	4.1	3,590	92.5	290	7.5	3,880
Teutonia & Hampton	4,500	89.5	20	0.4	30	0.6	170	3.4	200	4.0	4,910	97.6	120	2.4	5,030
27th & Atkinson	4,470	90.3	10	0.2	20	0.4	180	3.6	170	3.4	4,850	98.0	100	2.0	4,950
27th & Capitol	4,540	92.1	10	0.2	20	0.4	170	3.4	120	2.4	4,850	98.4	80	1.6	4,930
27th & Hopkins	5,310	92.0	10	0.2	30	0.5	180	3.1	150	2.6	5,690	98.6	80	1.4	5,770
27th & Burleigh	5,820	90.0	20	0.3	40	0.6	230	3.6	260	4.0	6,360	98.3	110	1.7	6,470
27th & Center/ Fond Du Lac	5,180	86.6	10	0.2	120	2.0	220	3.7	290	4.8	5,820	97.3	160	2.7	5,980
27th & North	3,990	74.0	10	0.2	700	13.0	220	4.1	330	6.1	5,240	97.2	150	2.8	5,390
27th & Lisbon	4,270	60.0	30	0.4	1,740	24.4	290	4.1	560	7.9	6,880	96.6	240	3.4	7,120
27th & Vliet	5,240	60.9	40	0.5	1,580	18.4	360	4.2	710	8.2	7,930	92.1	670	7.8	8,610
27th & Highland	5,910	58.2	70	0.7	990	9.7	460	4.5	1,090	10.7	8,520	83.9	1,640	16.1	10,160
27th & Wisconsin	5,000	52.9	80	0.8	510	5.4	460	4.9	1,300	13.7	7,330	77.5	2,120	22.4	9,460
27th & St. Paul	3,180	51.5	50	0.8	300	4.9	320	5.2	1,030	16.7	4,870	78.8	1,310	21.2	6,180
Layton & National	1,000	10.0	80	0.8	420	4.2	290	2.9	6,760	67.8	8,550	85.8	1,420	14.2	9,970
Layton & Greenfield	1,250	8.1	120	0.8	640	4.1	400	2.6	10,950	71.0	13,360	86.6	2,070	13.4	15,430
Layton & Burnham	770	5.2	100	0.7	510	3.4	330	2.2	11,220	75.3	12,930	86.7	1,980	13.3	14,910
Layton & Lincoln/ Forest Home	390	3.9	60	0.6	250	2.5	210	2.1	7,660	76.9	8,560	85.9	1,400	14.1	9,960
27th & Oklahoma	340	8.3	20	0.5	410	10.0	120	2.9	2,210	53.6	3,110	75.5	1,020	24.8	4,120
27th & Ohio (at Walmart)	560	10.7	30	0.6	680	13.1	170	3.3	2,440	46.8	3,870	74.3	1,340	25.7	5,210
27th & North of Howard	570	9.6	30	0.5	800	13.4	210	3.5	2,360	39.7	3,960	66.6	1,980	33.3	5,950
27th & Coldspring/ Bolivar	300	10.2	20	0.7	330	11.3	110	3.8	810	27.6	1,560	53.2	1,370	46.8	2,930
27th & Layton	260	7.0	30	0.8	490	13.2	160	4.3	920	24.8	1,850	49.9	1,860	50.1	3,710
27th & Edgerton	90	2.3	20	0.5	500	13.0	150	3.9	690	17.9	1,440	37.3	2,420	62.7	3,860
27th & Grange	150	3.7	30	0.7	440	10.8	120	2.9	730	17.9	1,460	35.9	2,610	64.1	4,070
27th & Ramsey	180	4.4	30	0.7	390	9.5	170	4.1	800	19.5	1,580	38.4	2,530	61.6	4,110
27th & College	130	4.1	20	0.6	270	8.6	130	4.1	540	17.1	1,090	34.6	2,060	65.4	3,150
27th & Sycamore (at Walmart)	80	3.4	20	0.9	200	8.5	80	3.4	360	15.4	730	31.2	1,600	68.4	2,340

Source: U.S. Bureau of the Census (2020) and SEWRPC

Table 3.15
Population by Race and Ethnicity: South Option A Stations

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Station Location	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Total Population
NW Mutual Way & Ikea Way	20	8.0	0	--	20	8.0	10	4.0	30	12.0	80	32.0	160	64.0	250
Northwestern Mutual	20	2.2	0	--	90	9.8	30	3.3	80	8.7	220	23.9	690	75.0	920

Source: U.S. Bureau of the Census (2020) and SEWRPC

Table 3.16
Population by Race and Ethnicity: South Option B Stations

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Station Location	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Total Population
27th & NW Mutual Way	20	2.5	0	--	80	9.9	30	3.7	70	8.6	200	24.7	600	74.1	810
NW Mutual Way & Ikea Way	20	8.0	0	--	20	8.0	10	4.0	30	12.0	80	32.0	160	64.0	250
Drexel & 13th	40	4.6	10	1.1	70	8.0	30	3.4	80	9.2	240	27.6	640	73.6	870
Drexel Town Square	120	6.9	10	0.6	140	8.1	80	4.6	190	11.0	530	30.6	1,200	69.4	1,730

Source: U.S. Bureau of the Census (2020) and SEWRPC

Table 3.17
Population by Race and Ethnicity: South Option C Stations

	People of Color												White Alone, Non-Hispanic		
	Black/African American		American Indian and Alaska Native		Asian and Pacific Islander		Other Race, Two or More Races		Hispanic/Latino		Total People of Color				
Station Location	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Total Population
27th & NW Mutual Way	20	2.5	0	--	80	9.9	30	3.7	70	8.6	200	24.7	600	74.1	810
27th & Ryan	30	2.7	0	--	190	17.1	40	3.6	90	8.1	350	31.5	760	68.5	1,110
Ascension Franklin	10	5.9	0	--	10	5.9	10	5.9	10	5.9	30	17.6	140	82.4	170

Source: U.S. Bureau of the Census (2020) and SEWRPC

Evaluation of Families in Poverty, Households Without a Car, and People with Disabilities Near Station Locations

Table 3.18 shows the households without a car, families in poverty, and people with disabilities by route alternative, combining the half-mile buffer around each station location into a service area for each route. All route alternatives would serve populations with a range of people per mile in each of these population groups with 410 to 510 households without a car, 280 to 350 families in poverty, and 730 to 890 people with disabilities. These populations represent those that are more likely to depend on transit for their primary source of transportation.

Table 3.18
Households Without a Car, Families in Poverty, and People with Disabilities: Summary Results by Route Alternative

	Households Without a Car			Families in Poverty			People with Disabilities		
Route Alternative	Total Households	Households Without a Car	Per Mile	Total Families	Families in Poverty	Per Mile	Total Population	People with Disabilities	Per Mile
North Option 1 to South Option A	41,660	9,400	460	24,060	6,410	310	112,500	16,740	820
North Option 1 to South Option B	42,480	9,410	430	24,580	6,430	290	114,470	16,960	770
North Option 1 to South Option C	41,980	9,420	410	24,280	6,410	280	113,370	16,810	730
North Option 2 to South Option A	39,330	9,110	510	22,850	6,220	350	107,360	16,090	890
North Option 2 to South Option B	40,150	9,130	470	23,370	6,240	320	109,330	16,310	830
North Option 2 to South Option C	39,650	9,140	450	23,080	6,220	300	108,230	16,160	790

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Table 3.19 shows the number and proportion of households without a car, families in poverty and people with disabilities that would be served by North Option 1 stations. Stations along this segment would serve populations made up of 8 to 20 percent of households without a car, 10 to 32 percent of families in poverty, and 11 to 13 percent of people with disabilities.

Table 3.19
Households Without a Car, Families in Poverty, and People with Disabilities: North Option 1 Stations

	Households Without a Car			Families in Poverty			People with Disabilities		
Station Location	Total Households	Households Without a Car	Percent of Total	Total Families	Families in Poverty	Percent of Total	Total Population	People with Disabilities	Percent of Total
Marketplace of Brown Deer	790	100	12.7	440	50	11.4	1,760	230	13.1
Original Brown Deer Village	740	90	12.2	410	40	9.8	1,650	210	12.7
Teutonia & Bradley	890	110	12.4	500	60	12.0	2,020	260	12.9
Teutonia & Good Hope	820	80	9.8	510	70	13.7	2,040	220	10.8
Teutonia & Green Tree	870	70	8.0	530	70	13.2	2,150	230	10.7
Teutonia & Florist	1,370	270	19.7	750	240	32.0	3,430	390	11.4

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Table 3.20 shows the number and proportion of households without a car, families in poverty and people with disabilities that would be served by North Option 2 stations. Stations at Silver Spring & Crestwood and Silver Spring & Private (near a Pick N' Save grocery store), would serve populations with relatively high proportions of households without a car and families in poverty while the station at Bayshore serves a population made up of less than half the percentage of those population groups. The percent of people with disabilities ranges from 9 to 13 percent among the three stations.

Table 3.20
Households Without a Car, Families in Poverty, and People with Disabilities: North Option 2 Stations

	Households Without a Car			Families in Poverty			People with Disabilities		
Station Location	Total Households	Households Without a Car	Percent of Total	Total Families	Families in Poverty	Percent of Total	Total Population	People with Disabilities	Percent of Total
Silver Spring & Crestwood	970	200	20.6	570	130	22.8	2,480	320	12.9
Silver Spring & Private	860	170	19.8	530	110	20.8	2,250	300	13.3
Bayshore	920	80	8.7	620	50	8.1	2,340	210	9.0

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Table 3.21 shows the number and proportion of households without a car, families in poverty, and people with disabilities that would be served by the central route segment. Most stations along this route option serve a proportion of people in these groups that is significantly higher than those stations along the north and south route segments, and the averages in Milwaukee County. Stations at 27th & Highland, 27th & Wisconsin, and 27th & St. Paul serve areas with more than one-third of households without a car and nearly half of families in poverty. Stations further south on the Central Segment generally serve populations with lower proportions of households without a car, families in poverty, and people with disabilities.

Table 3.21
Households Without a Car, Families in Poverty, and People with Disabilities: Central Segment Stations

	Households Without a Car			Families in Poverty			People with Disabilities		
Station Location	Total Households	Households Without a Car	Percent of Total	Total Families	Families in Poverty	Percent of Total	Total Population	People with Disabilities	Percent of Total
Teutonia & Silver Spring	1,680	440	26.2	860	260	30.2	4,040	510	12.6
Teutonia & Villard	1,720	520	30.2	920	250	27.2	4,350	600	13.8
Teutonia & Hampton	1,950	500	25.6	1,130	300	26.5	5,150	770	15.0
27th & Atkinson	2,350	580	24.7	1,450	390	26.9	6,180	1,050	17.0
27th & Capitol	2,230	610	27.4	1,370	370	27.0	6,220	1,070	17.2
27th & Hopkins	2,150	650	30.2	1,310	440	33.6	6,340	1,150	18.1
27th & Burleigh	2,240	730	32.6	1,310	590	45.0	6,660	1,260	18.9
27th & Center/ Fond Du Lac	1,970	650	33.0	1,110	490	44.1	5,720	1,130	19.8
27th & North	1,780	540	30.3	1,120	430	38.4	5,670	940	16.6
27th & Lisbon	2,160	540	25.0	1,330	530	39.8	6,870	930	13.5
27th & Vliet	3,260	1,100	33.7	1,510	680	45.0	8,210	1,320	16.1
27th & Highland	4,550	1,880	41.3	1,570	770	49.0	9,740	1,680	17.2
27th & Wisconsin	4,370	1,830	41.9	1,310	620	47.3	9,000	1,490	16.6
27th & St. Paul	2,760	1,070	38.8	880	410	46.6	6,020	910	15.1
Layton & National	3,250	900	27.7	1,880	620	33.0	9,670	1,440	14.9
Layton & Greenfield	4,620	1,000	21.6	2,970	920	31.0	14,280	1,970	13.8
Layton & Burnham	4,390	660	15.0	3,210	1,000	31.2	14,450	1,800	12.5
Layton & Lincoln/ Forest Home	3,110	340	10.9	2,430	690	28.4	10,910	1,130	10.4
27th & Oklahoma	1,850	360	19.5	1,170	160	13.7	4,890	830	17.0
27th & Ohio (at Walmart)	1,980	370	18.7	1,250	180	14.4	5,140	910	17.7
27th & North of Howard	1,910	250	13.1	1,210	140	11.6	5,050	790	15.6
27th & Coldspring/ Bolivar	1,450	230	15.9	740	120	16.2	3,300	530	16.1
27th & Layton	1,610	200	12.4	930	120	12.9	3,840	650	16.9
27th & Edgerton	1,530	120	7.8	960	60	6.3	3,710	690	18.6
27th & Grange	1,330	120	9.0	840	80	9.5	3,240	550	17.0
27th & Ramsey	990	80	8.1	670	70	10.4	2,560	380	14.8
27th & College	630	20	3.2	420	20	4.8	1,620	210	13.0
27th & Sycamore (at Walmart)	470	30	6.4	270	10	3.7	1,090	120	11.0

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Table 3.22 shows the number and proportion of households without a car, families in poverty, and people with disabilities that would be served along South Option A. Stations on this segment would serve a relatively low number and proportion of people in these population groups.

Table 3.22
Households Without a Car, Families in Poverty, and People with Disabilities: South Option A Stations

	Households Without a Car			Families in Poverty			People with Disabilities		
Station Location	Total Households	Households Without a Car	Percent of Total	Total Families	Families in Poverty	Percent of Total	Total Population	People with Disabilities	Percent of Total
NWM Way & Ikea Way	360	20	5.6	200	10	5.0	790	90	11.4
Northwestern Mutual	480	30	6.3	280	10	3.6	1,130	120	10.6

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Table 3.23 shows the number and proportion of households without a car, families in poverty, and people with disabilities that would be served along South Option B to Drexel Town Square. This segment would also serve a relatively low number and proportion of people in these population groups, with the population around these stations ranging from 2 to 7 percent of households without a car, approximately 3 to 5 percent of families in poverty, and approximately 10 to 12 percent of people with disabilities.

Table 3.23
Households Without a Car, Families in Poverty, and People with Disabilities: South Option B Stations

	Households Without a Car			Families in Poverty			People with Disabilities		
Station Location	Total Households	Households Without a Car	Percent of Total	Total Families	Families in Poverty	Percent of Total	Total Population	People with Disabilities	Percent of Total
27th & NW Mutual Way	460	30	6.5	260	10	3.8	1,060	110	10.4
NWM Way & Ikea Way	360	20	5.6	200	10	5.0	790	90	11.4
Drexel & 13th	470	10	2.1	290	10	3.4	1,120	120	10.7
Drexel Town Square	500	10	2.0	320	10	3.1	1,210	140	11.6

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Table 3.24 shows the number and proportion of households without a car, families in poverty, and people with disabilities that would be served along South Option C to the Ascension Hospital campus in Franklin. Stations along this route would serve a low number and proportion of people in these population groups with 0 to 9 percent of households without a car, 0 to 4 percent of families in poverty, and 9 to 10 percent of people with disabilities.

Table 3.24
Households Without a Car, Families in Poverty, and People with Disabilities: South Option C Stations

	Households Without a Car			Families in Poverty			People with Disabilities		
Station Location	Total Households	Households Without a Car	Percent of Total	Total Families	Families in Poverty	Percent of Total	Total Population	People with Disabilities	Percent of Total
27th & NW Mutual Way	460	30	6.5	260	10	3.8	1,060	110	10.4
27th & Ryan	470	40	8.5	290	10	3.4	1,160	110	9.5
Ascension Franklin	130	0	--	100	0	--	350	30	8.6

Source: U.S. Bureau of the Census American Community Survey (2015-2019) and SEWRPC

Summary of Evaluation Results

Table 3.25 provides the results of the Equitable Access to the Transit Investment evaluation. All route alternatives would serve populations with significant portions of people of color, low-income families, households without a car, and people with disabilities. However, routes that include North Option 1 would serve populations with slightly higher proportions of these population groups and, therefore, are rated as green. Remaining route alternatives are rated as yellow.

Table 3.25
Route Alternative Evaluation Results: Equitable Access to the Transit Investment

Route Alternative	Equitable Access to the Transit Investment
North Option 1 to South Option A	🟢
North Option 1 to South Option B	🟢
North Option 1 to South Option C	🟢
North Option 2 to South Option A	🟡
North Option 2 to South Option B	🟡
North Option 2 to South Option C	🟡

Source: SEWRPC

3.5 DEVELOPMENT POTENTIAL

The fourth criterion of evaluation for the station area analysis is the ability for the transit investment to foster development around station areas that is consistent with adopted planning, land uses, and development opportunities. This evaluation criterion is consistent with criteria used by the Federal Transit Administration (FTA) when rating potential projects for funding eligibility. The following section will provide an overview of the methodology, summarize the analysis by route segment option, and provide results of the evaluation by route alternative. Appendix B includes more details behind the evaluation including a description of the existing land use, planning and policy guidance, transportation connectivity, and development opportunities around each station location with maps to provide context.

Methodology

To evaluate development potential around station areas, four topics were evaluated for the area within a one-half mile buffer of approximate future station locations as shown in Map 3.1:

1. **Existing Land Use**
   A qualitative analysis was completed using maps from the 2015 Regional Land Use Inventory, existing building footprints, and orthophotos to develop a high-level description of existing land use in the station areas.

2. **Planning and Policy Guidance**
   An inventory of any local plans that apply to the station area are listed and were reviewed as part of identifying development opportunities.

3. **Transportation Connectivity**
   A list of the transit routes that intersect each station location was developed to help identify areas with higher amounts of transportation connectivity.

4. **Development Opportunities**
   The potential for development in a proposed station area was evaluated using the factors described below:

   a. <u>Planning and policy support</u>
      Local and regional plans and local zoning ordinances were reviewed to provide insight into the community's desired development strategies and identify plans for redevelopment or opportunities for higher-density residential, commercial, or mixed-use development in proposed station areas.

   b. <u>Local knowledge regarding existing or projected future demand</u>
      Existing and projected future development trends that indicate growth and development potential in the area were evaluated around each potential station location.

   c. <u>Presence of underutilized opportunity sites</u>
      Each station area was reviewed for sites that are underdeveloped or underutilized and that could be suited for future transit supportive development.

Data used for this analysis includes SEWRPC's 2015 Regional Land Use Survey and orthophotos; plans and land use data from the Village of Brown Deer, City of Glendale, City of Milwaukee, City of Greenfield, City of Franklin, and City of Oak Creek; land use data from Milwaukee County; VISION 2050; Google Maps; and local knowledge.

Evaluation

Below is a summary of development potential by route segment option. A detailed evaluation by station area is included in Appendix B.

North Option 1

Station areas along North Option 1 provide minimal to moderate opportunities for development and redevelopment. Most station areas are largely comprised of single-family residential neighborhoods and auto-oriented commercial land uses. Select development and infill opportunities appear to exist near station locations at Marketplace of Brown Deer, N. Teutonia Avenue and W. Bradley Road, and near N. Teutonia Avenue and W. Florist Avenue. The station area surrounding the Original Brown Deer Village area is currently undergoing a large amount of mixed-use and walkable development and re-development, which could be further bolstered by enhanced transit in the area and would likely support ridership. Remaining station locations along this segment are either built out or comprised of parks, having limited opportunity for development.

North Option 2

Station areas along North Option 2 also provide minimal to moderate opportunities for development and redevelopment with the proposed station at Bayshore providing the primary potential for development along this route segment option. Enhanced transit in the area could support recent and on-going growth of commercial development in this area and could help fill in vacancies in the existing development by providing faster, more convenient access to both customers and employees.

Central Segment

Station areas along the central segment route option provide minimal to high opportunities for development and redevelopment. As the longest segment with 31 possible station locations, there is a diversity of existing land uses and development opportunities along the central segment. Land surrounding most station locations along this segment is well developed; however, many station areas offer opportunities to fill in vacant or underutilized lots with uses that would both support and be supported by enhanced transit.

One area with greater development potential are stations near the 30th Street Industrial Corridor, which include stations at N. 27th and W. Capitol Drive, W. Hopkins Street, and W. Burleigh Street. Proximity to BRT service in this area would add an additional layer of incentive for large employers to locate in the area in addition to the comprehensive business attraction and retention efforts being led by the City of Milwaukee, the 30th Street Industrial Corridor Corp (nicknamed "The Corridor"), and other partners.

Station areas along N. 27th Street and W. North Avenue, W. Lisbon Avenue, W. Vliet Street, and W. Highland Boulevard provide opportunities for infill development of additional housing or small commercial development on vacant lots.

Large surface parking lots surrounding big-box and strip retail development on the southern end of the segment—including station areas between S. 27th Street and W. Ohio Avenue, W. Howard Avenue, and W. Coldspring Road—provide opportunities for the development of outlots to increase density and improve walkability in the area.

Further south in this segment, lower density development with more open land provides opportunities for additional mixed-use development that would be bolstered by access to BRT service and that align with local comprehensive plans.

South Option A

Station areas along this route segment option have a high level of development potential with large amounts of open land and active plans for development. The station area at the intersection of the planned extension of Northwestern Mutual Way and Ikea Way includes large areas of land that are being actively pursued for multifamily housing, entertainment, and retail development by private landowners and the City of Oak Creek as of the writing of this report. A BRT station supported by walkable access to these developments would provide an opportunity for transit-supportive development that is consistent with VISION 2050 and local plans. The station area surrounding Northwestern Mutual is largely developed, however BRT would provide more transportation options for current and future employees.

South Option B

The South Option B route segment also has a high level of development potential as it shares the station area surrounding the intersection of Northwestern Mutual Way and Ikea Way with South Option A, with the same opportunities for development. The station at W. Drexel Avenue and S. 13th Street would connect to the new and ongoing development of housing and commercial uses in this area, with the potential to support these developments further with access to BRT service. The station area at Drexel Town Square is largely built out; therefore, limited development opportunities exist. Enhanced transit would support the businesses in this area by providing fast and convenient access to customers and employees.

South Option C

Station areas along South Option C provide a high level of opportunity for development. Open land on the west side of S. 27th Street, which is in the City of Franklin, is planned for a mixed-use commercial district that includes retail, commercial, office, and residential uses. Land on the east side of S. 27th Street, which is within the City of Oak Creek, is planned for mixed use, multifamily, commercial, industrial, and business park uses with several areas included as “flexible overlay,” meaning the City should remain open to considering additional land uses that best respond to future market conditions and the vision and goals of the City’s comprehensive plan. Although current development activity along this segment is lower when compared to South Options A and B, enhanced transit along this segment could encourage development by providing quick and convenient access to and from jobs and other destinations along the corridor. To be compatible with transit use, future development should follow density guidelines described in Section 3.3 of this chapter, which is based on research from the Transit Cooperative Research Program (TCRP) and include sidewalks and safe pedestrian crossings.

Summary of Evaluation Results

Based on an evaluation of the factors described above for each potential station area along the route segment options, each station was given a rating of red, green, or yellow corresponding to whether each route alternative is generally expected to have minimal, moderate, or high opportunities for development, respectively. All route alternatives are rated green as they are expected to have high opportunities for development, with all three southern segment options providing improved transit accessibility to a significant amount of open land that is planned for mixed use development and the remainder of the route segments providing improved transit accessibility to available land with at least moderate development potential for infill redevelopment that could be spurred by a transit investment in the area. This summary is provided in Table 3.26.

Table 3.26
Summary of Station Area Development Potential

Route Alternative	Development Potential
North Option 1 to South Option A	🟢
North Option 1 to South Option B	🟢
North Option 1 to South Option C	🟡
North Option 2 to South Option A	🟢
North Option 2 to South Option B	🟢
North Option 2 to South Option C	🟡

Source: SEWRPC

3.6 CONCLUSIONS

Table 3.27 provides a summary of the results of all evaluations for route alternatives under the station area analysis. Based on the results of the evaluations outlined in this chapter, North Option 2 to South Option A and North Option 2 to South Option B are rated as the most favorable with regard to station area characteristics with the strongest existing and future station area population and employment totals, consistently high Population + Employment Density Scores, equitable access to the transit investment, and areas with the most development potential.

Table 3.27
Route Alternative Evaluation Results: Station Area Analysis

Route Alternative	Existing and Projected Future Station Area Population	Existing and Projected Future Station Area Employment	Population + Employment Density Scores	Equitable Access to the Transit Investment	Development Potential	Summary
North Option 1 to South Option A	🟡	🟡	🟡	🟢	🟢	🟡
North Option 1 to South Option B	🔴	🟡	🟡	🟢	🟢	🟡
North Option 1 to South Option C	🔴	🔴	🔴	🟢	🟡	🔴
North Option 2 to South Option A	🟢	🟢	🟢	🟡	🟢	🟢
North Option 2 to South Option B	🟢	🟢	🟢	🟡	🟢	🟢
North Option 2 to South Option C	🟡	🟡	🔴	🟡	🟡	🔴

Source: SEWRPC

TRANSPORTATION SYSTEM EVALUATION 4

4.1 OVERVIEW

This chapter describes the potential impacts that the proposed BRT service would have on other areas of the transportation system and makes recommendations for dedicated transit lanes and other roadway configuration options based on those impacts. Specifically, this chapter evaluates the expected impacts on the roadway right-of-way, on-street parking, traffic, and bicycle and pedestrian accommodations and makes recommendations for lane conversion options, BRT running type, vertical separation elements, queue-jump signals, and changes to bike facilities in the corridor. Estimates for travel times by route alternative are also included in this chapter and rated comparatively. Based on the expected impacts and resulting recommendations, the route alternatives are rated in comparison to one another at the conclusion of this chapter.

4.2 RIGHT-OF-WAY IMPACTS

With respect to this study, right-of-way is defined as the publicly-owned land that contains the transportation system elements—including roads, traffic lights, stations, and bicycle and pedestrian accommodations—along the BRT route alternatives. Any increase in right-of-way width resulting from implementation of the BRT project would have the potential to impact adjacent landowners and increase the cost of the project. None of the route alternatives are expected to require expanding right-of-way. This section presents the analysis of expected BRT public right-of-way impacts for each route alternative.

Methodology

If impacts to the existing public right-of-way were expected, they would be determined by identifying locations along the study corridor where BRT infrastructure would be constructed outside the existing or planned right-of-way. However, as any modifications necessary to accommodate the proposed BRT service—specifically, dedicated transit lanes or stations—will be constructed within the existing right-of-way, no impacts are expected. Dedicated transit lanes will be incorporated within the existing curb-to-curb width of the roadway, and any alterations will be limited to re-striping or adding surface-level treatments. While stations may require some modifications to the median or sidewalk and terrace area, they are expected to be constructed within the existing right-of-way.

Evaluation

Based on the assumptions listed above, no changes to the existing right-of-way width are expected with the proposed BRT service.

Summary of Results

Table 4.1 provides the results for the right-of-way impacts evaluation by route alternative. As described, no changes to the existing right-of-way width are expected for any of the route alternatives; therefore, all alternatives are rated as green.

Table 4.1
Route Alternative Evaluation Results: Right-of-Way Impacts

Route Alternative	Right-of-Way Impacts
North Option 1 to South Option A	●
North Option 1 to South Option B	●
North Option 1 to South Option C	●
North Option 2 to South Option A	●
North Option 2 to South Option B	●
North Option 2 to South Option C	●

Source: SEWRPC

4.3 ON-STREET PARKING IMPACTS

With respect to this study, on-street parking impacts are defined as the conversion of on-street unrestricted and restricted parking spaces and on-street loading zones to either a dedicated transit lane or general-purpose traffic lane (depending on BRT running type), to make space for the addition of a dedicated transit lane. The addition of dedicated transit lanes would improve BRT service by reducing travel times and increasing on-time performance. However, the loss of on-street parking potentially would negatively impact residents and businesses along the corridor. This section presents an analysis of expected on-street parking impacts for each route alternative.

Methodology

Impacts to existing on-street parking are determined by first inventorying—through the use of Google Maps and on-site surveys—the existing on-street unrestricted and restricted parking spaces and on-street loading zones located along each route segment option. This inventory includes a breakdown of on-street parking by residential and commercial use. Corridor segments where the proposed BRT service could benefit from the conversion of on-street parking to a dedicated transit lane are then identified, taking into consideration the available right-of-way width, the number of existing traffic lanes, nearby available parking, and the length of the roadway segments with on-street parking. In this corridor, non-arterial streets at or near route termini are not recommended for dedicated lanes since they tend to be narrower with much lower volumes and therefore dedicated lanes in these locations would not substantially benefit the operation of the service. The perceived difficulty in converting on-street parking is then estimated, taking into account observations of the existing usage of on-street parking and the availability of nearby parking alternatives. The total on-street parking impacts for each route segment option are then determined. Finally, an overall assessment of the on-street parking impacts for each potential route and roadway configuration is provided.

Evaluation

Tables 4.2 through 4.7 provide an inventory of existing on-street parking spaces for each of the route segment options in the study corridor, with a perceived level of difficulty to convert parking lanes listed where applicable. Segments where parking exists, but other limitations in the roadway configuration or characteristics would prevent parking from being converted to a dedicated transit lane were not rated. Details are provided in the "notes" section of each table. Segments were rated as having a low level of difficulty to convert parking in locations where it appeared to be considerably underutilized and where alternative parking options existed nearby. Segments were rated as having a medium level of difficulty to convert parking where it appeared to be moderately utilized or mostly utilized during off-peak hours (typical in residential areas). Segments were rated as having a high level of difficulty to convert parking in locations where it appeared to be highly utilized throughout the day, where limited alternative parking options exist, or where it appeared to be vital to the function of nearby businesses.

Based on roadway configuration and the expected level of difficulty, parking segments recommended to be converted are shown in Table 4.8 and are located only along North Option 1 and the Central Segment.

It should be noted that most parking that would be impacted would be expected to have a low level of difficulty to convert since it appears to be underutilized and in locations where alternative parking options exist nearby. However, two segments along N. 27th Street and one segment along S. Layton Boulevard would be expected to have a medium level of difficulty and are recommended to be converted. The W. Cornell Street to W. Hope Street and W. Capitol Drive to W. Meinecke Avenue segments consist primarily of residential parking and appear to be heavily utilized on nights and weekends, although some alternative parking options appear to be available nearby. The S. Layton Boulevard segment from W. Pierce Street to W. Lincoln Avenue has some parking areas on the east side of the street that are well utilized by a church and multi-family housing with limited off-street parking options and other parking areas that are utilized in the day, overnight and on weekends. Additional public engagement to determine the impacts of converting these parking areas and to help identify parking alternatives should be considered in future phases of this project.

Table 4.2
Existing On-Street Parking and Perceived Difficulty of Converting On-Street Parking to Dedicated Transit Lanes: North Option 1

Road Segment	Extents	Travel Direction	Total On-Street Parking LZ (feet)	Total On-Street Parking URP (parking spaces)	Total On-Street Parking RP (parking spaces)	Total On-Street Parking URP + RP (parking spaces)	Residential On-Street Parking LZ (feet)	Residential On-Street Parking URP + RP (parking spaces)	Commercial On-Street Parking LZ (feet)	Commercial On-Street Parking URP + RP (parking spaces)	Level of Difficulty	Notes
N. Deerbrook Trail	N. Green Bay Road to W. Brown Deer Road	West/South East/North	0 0	37 51	0 0	37 51	0 0	0 0	0 0	37 51	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
W. Brown Deer Road	N. Deerbrook Trail to N. Deerwood Drive	East West	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Roadway segment has no existing parking lanes.
N. Deerwood Drive	W. Brown Deer Road to Ruth Place	South North	0 0	50 6	0 0	50 6	0 0	13 0	0 0	37 6	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
Ruth Place	N. Deerwood Drive to N. Green Bay Road	West East	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
N. Green Bay Road	N. Deerwood Trail to N. Teutonia Avenue	South North	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Roadway segment has no existing parking lanes.
N. Teutonia Avenue	N. Green Bay Road to N. Sherman Boulevard	South North	0 0	0 0	103 87	130 87	0 0	103 42	0 0	0 45	Low	Parking lanes appears to be underutilized in this segment. Adjacent commercial areas have on-site parking.
N. Teutonia Avenue	N. Sherman Boulevard to W. Woodale Avenue	South North	0 0	0 0	12 51	12 51	0 0	5 0	0 0	7 51	--	Right-of-way does not have space to accommodate both travel lanes and dedicated transit lanes.
N. Teutonia Avenue	W. Woodale Avenue to Good Hope Road	South North	0 0	70 16	61 86	131 102	0 0	39 0	0 0	92 102	Low	Parking lanes appear to be underutilized in this segment. Adjacent commercial areas have on-site parking.
N. Teutonia Avenue	Good Hope Road to W. Mill Road	South North	0 0	45 106	0 0	45 106	0 0	11 0	0 0	34 106	Low	Parking lanes appear to be underutilized in this segment. Adjacent commercial areas have on-site parking.
N. Teutonia Avenue	W. Mill Road to W. Silver Spring Drive	South North	0 0	174 151	12 0	186 151	0 0	63 20	0 0	123 131	Low	Parking lanes appear to be underutilized in this segment. Adjacent commercial areas have on-site parking.
		Total	0	706	412	1,145	0	296	0	822	--	--

Note: URP = Unrestricted Parking. Unrestricted parking areas generally allow parking most of the time, except on snow routes, during snow emergencies or other emergencies, and construction zones. Some unrestricted parking areas do require parking permits for overnight parking. RP = Restricted Parking. Restricted parking areas generally include time-limited parking, paid metered parking spots, restricted alternative side parking in winter, bus stop locations, and time of day parking restrictions. LZ = Loading Zone. Loading Zones include temporary, time-restricted parking areas and permanent no parking areas. Length of on-street parking space is assumed to be 20 feet.

Source: SEWRPC

Table 4.3
Existing On-Street Parking and Perceived Difficulty of Converting On-Street Parking to Dedicated Transit Lanes: North Option 2

Road Segment	Extents	Travel Direction	Total On-Street Parking				Residential On-Street Parking		Commercial On-Street Parking		Level of Difficulty	Notes
			LZ (feet)	URP (parking spaces)	RP (parking spaces)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)		
W. Silver Spring Drive	N. Teutonia Avenue to N. Port Washington Road	West/South	0	26	9	35	0	15	0	20	--	Inconsistent availability of a parking lane in this segment. Would not be suitable for conversion to a transit lane.
		East/North	38	62	0	62	38	60	0	2		
N. Port Washington Road	W. Silver Spring Drive to W. Carrigan Drive	East	0	0	0	0	0	0	0	0	--	Roadway segment has no existing parking lanes.
		West	0	0	0	0	0	0	0	0		
		Total	38	88	9	97	38	75	0	22	--	--

Note: URP = Unrestricted Parking. Unrestricted parking areas generally allow parking most of the time, except on snow routes, during snow emergencies or other emergencies, and construction zones. Some unrestricted parking areas do require parking permits for overnight parking. RP = Restricted Parking. Restricted parking areas generally include time-limited parking, paid metered parking spots, restricted alternative side parking in winter, bus stop locations, and time of day parking restrictions. LZ = Loading Zone. Loading Zones include temporary, time-restricted parking areas and permanent no parking areas. Length of on-street parking space is assumed to be 20 feet.

Source: SEWRPC

Table 4.4
Existing On-Street Parking and Perceived Difficulty of Converting On-Street Parking to Dedicated Transit Lanes: Central Segment

Road Segment	Extents	Travel Direction	Total On-Street Parking				Residential On-Street Parking		Commercial On-Street Parking		Level of Difficulty	Notes
			LZ (feet)	URP (parking spaces)	RP (parking spaces)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)		
N. Teutonia Avenue	W. Silver Spring Drive to W. Custer Avenue	South North	0 0	50 26	0 17	50 43	0 0	21 0	0 0	29 43	--	Existing parking lanes are not wide enough for conversion to dedicated transit lanes.
N. Teutonia Avenue	W. Custer Avenue to W. Cornell Street	South North	0 0	64 60	19 0	83 60	0 0	47 35	0 0	36 25	--	Existing parking lanes are not wide enough for conversion to dedicated transit lanes.
W. Cornell Street	N. Teutonia Avenue to N. 27th Street	South North	0 0	0 4	0 0	0 4	0 0	0 4	0 0	0 0	--	Roadway segment right-of-way cannot accommodate dedicated transit lanes.
N. 27th Street	W. Cornell Street to W. Hope Avenue	South North	32 0	89 62	19 54	108 116	32 0	105 103	0 0	3 13	Medium	Parking in this primarily residential segment appears to be utilized in the evenings, at night, and on weekends. Engagement with residents should be completed in a future phase of the study.
N. 27th Street	W. Hope Avenue to W. Capitol Drive	South North	0 0	0 0	29 24	29 24	0 0	0 0	0 0	29 24	Low	The southbound side of this segment has a designated parking lane that appears to have low utilization. The northbound side of this segment has restricted parking that appears to be moderately used with neighboring properties having designated off-street parking available.
N. 27th Street	W. Capitol Drive to W. Meinecke Avenue	South North	69 0	292 288	11 17	303 305	0 0	259 222	69 0	44 83	Medium	Parking in this primarily residential segment appears to be utilized in the evenings, at night, and on weekends. Engagement with residents should be completed in a future phase of the study.
N. 27th Street	W. Meinecke Avenue to W. Garfield Avenue	South North	0 0	0 0	0 4	0 4	0 0	0 0	0 0	0 4	--	Transit service would not benefit from conversion of short parking lane segment.
N. 27th Street	W. Garfield Avenue to W. Lisbon Avenue	South North	0 0	73 64	2 0	75 64	0 0	56 41	0 0	19 23	Low	Parking in this segment appears to have low utilization with several vacant/underutilized parcels and residential properties that have designated off-street parking. Engagement with residents should be completed in a future phase of the study.
N. 27th Street	W. Lisbon Avenue to W. State Street	South North	0 244	113 76	0 0	113 76	0 0	109 61	0 244	4 15	Low	Parking in this segment appears to have low utilization with several vacant/underutilized parcels and residential and commercial properties that have designated off-street parking. Engagement with residents should be completed in a future phase of the study.
N. 27th Street	W. State Street to W. Wisconsin Avenue	South North	0 41	2 12	48 12	50 24	0 0	2 12	0 41	48 12	High	Parking along this segment appears to have relatively high utilization and serves businesses that do not appear to have designated off-street parking. Engagement with residents, commercial property owners, and businesses should be completed in a future phase of the study.
N. 27th Street	W. Wisconsin Avenue to W. St. Paul Avenue	South North	0 0	3 2	15 23	18 25	0 0	0 7	0 0	18 18	Low	Roadway segment largely consists of two travel lanes in each direction during peak travel periods, with some restricted parking allowed in travel lanes during off-peak travel periods. Adjacent commercial properties appear to have designated off-street parking.

Table continued on next page.

Table 4.4 (Continued)

Road Segment	Extents	Travel Direction	Total On-Street Parking LZ (feet)	Total On-Street Parking URP (parking spaces)	Total On-Street Parking RP (parking spaces)	Total On-Street Parking URP + RP (parking spaces)	Residential On-Street Parking LZ (feet)	Residential On-Street Parking URP + RP (parking spaces)	Commercial On-Street Parking LZ (feet)	Commercial On-Street Parking URP + RP (parking spaces)	Level of Difficulty	Notes
N. 27th Street/S. Layton Boulevard	W. St. Paul Avenue to W. Pierce Street	South North	0 0	20 0	0 0	20 0	0 0	20 0	0 0	0 0	--	Roadway segment largely has no existing parking lanes. The southbound side of this segment between W. Evergreen Ln. and W. Pierce St. has a designated parking lane that appears to have low utilization.
S. Layton Boulevard	W. Pierce Street to W. National Avenue	South North	0 30	12 5	0 13	12 18	0 30	0 9	0 0	12 9	Medium	Parking along the southbound segment appears to be underutilized and serves commercial properties with designated off-street parking. Parking along the northbound segment appears to be well utilized and largely serves a church and multi-family housing with limited off-street parking. Engagement with residents should be completed in a future phase of the study.
S. Layton Boulevard	W. National Avenue to W. Lincoln Avenue	South North	43 223	232 219	6 4	238 223	43 34	204 193	0 189	34 30	Medium	Parking in this primarily residential segment appears to be utilized in the evenings, at night, and on weekends. Loading zones are also prevalent on the northbound side of the street. Engagement with residents should be completed in a future phase of the study.
27th Street	W. Lincoln Avenue to W. Oklahoma Avenue	South North	0 0	70 91	16 10	86 101	0 0	25 14	0 0	61 87	Low	Limited parking in this area appears to be underutilized with a few exceptions (Maynard Steel Casting). Properties along this segment appear to have designated off-street parking
27th Street	W. Oklahoma Avenue to Northwestern Mutual Way	South North	39 0	0 0	21 26	21 26	0 0	0 0	39 0	21 26	High	Commercial parking between W. Oklahoma Ave. and W. Ohio Ave. appears to be well-utilized, particularly in front of businesses with no off-street parking available. No on-street parking is available south of W. Ohio Ave. to Northwestern Mutual Way.
		Total	721	1,929	390	2,319	139	1,549	582	770	--	--

Note: URP = Unrestricted Parking. Unrestricted parking areas generally allow parking most of the time, except on snow routes, during snow emergencies or other emergencies, and construction zones. Some unrestricted parking areas do require parking permits for overnight parking. RP = Restricted Parking. Restricted parking areas generally include time-limited parking, paid metered parking spots, restricted alternative side parking in winter, bus stop locations, and time of day parking restrictions. LZ = Loading Zone. Loading Zones include temporary, time-restricted parking areas and permanent no parking areas. Length of on-street parking space is assumed to be 20 feet.

Source: SEWRPC

Table 4.5
Existing On-Street Parking and Perceived Difficulty of Converting On-Street Parking to Dedicated Transit Lanes: South Option A

			Total On-Street Parking				Residential On-Street Parking		Commercial On-Street Parking			
Road Segment	**Extents**	**Travel Direction**	LZ (feet)	URP (parking spaces)	RP (parking spaces)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	**Level of Difficulty**	**Notes**
(Future) Northwestern Mutual Way	S. 27th Street to S. Ikea Way (including future extension)	East West	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
S. Ikea Way (including future extension)	(Future) Northwestern Mutual Way to W. Drexel Avenue	South North	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
W. Drexel Avenue	S. Ikea Way to Northwestern Mutual Way (private)	East West	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Roadway segment has no existing parking lanes.
Northwestern Mutual Way (private)	W. Drexel Avenue to S. 27th Street	South North	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
		Total	0	0	0	0	0	0	0	0	--	--

Note: URP = Unrestricted Parking. Unrestricted parking areas generally allow parking most of the time, except on snow routes, during snow emergencies or other emergencies, and construction zones. Some unrestricted parking areas do require parking permits for overnight parking. RP = Restricted Parking. Restricted parking areas generally include time-limited parking, paid metered parking spots, restricted alternative side parking in winter, bus stop locations, and time of day parking restrictions. LZ = Loading Zone. Loading Zones include temporary, time-restricted parking areas and permanent no parking areas. Length of on-street parking space is assumed to be 20 feet.

Source: SEWRPC

Table 4.6
Existing On-Street Parking and Perceived Difficulty of Converting On-Street Parking to Dedicated Transit Lanes: South Option B

Road Segment	Extents	Travel Direction	Total On-Street Parking				Residential On-Street Parking		Commercial On-Street Parking		Level of Difficulty	Notes
			LZ (feet)	URP (parking spaces)	RP (parking spaces)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)		
(Future) Northwestern Mutual Way	S. 27th St. to S. Ikea Way (including future extension)	East West	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
S. Ikea Way (including future extension)	(Future) Northwestern Mutual Way to W. Drexel Avenue	South North	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
W. Drexel Avenue	S. Ikea Way to S. Howell Avenue	East West	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Roadway segment has no existing parking lanes.
W. Town Square Way	W. Drexel Avenue to S. Howell Avenue	East West	0 0	0 0	14 11	14 11	0 0	0 0	0 0	14 11	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
		Total	0	0	25	25	0	0	0	25	--	--

Note: URP = Unrestricted Parking. Unrestricted parking areas generally allow parking most of the time, except on snow routes, during snow emergencies or other emergencies, and construction zones. Some unrestricted parking areas do require parking permits for overnight parking. RP = Restricted Parking. Restricted parking areas generally include time-limited parking, paid metered parking spots, restricted alternative side parking in winter, bus stop locations, and time of day parking restrictions. LZ = Loading Zone. Loading Zones include temporary, time-restricted parking areas and permanent no parking areas. Length of on-street parking space is assumed to be 20 feet.

Source: SEWRPC

Table 4.7
Existing On-Street Parking and Perceived Difficulty of Converting On-Street Parking to Dedicated Transit Lanes: South Option C

			Total On-Street Parking				Residential On-Street Parking		Commercial On-Street Parking			
Road Segment	Extents	Travel Direction	LZ (feet)	URP (parking spaces)	RP (parking spaces)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	LZ (feet)	URP + RP (parking spaces)	Level of Difficulty	Notes
S. 27th Street	Northwestern Mutual Way. to W. Wheaton Way (private)	South North	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Roadway segment has no existing parking lanes.
W. Oakwood Road	S. 27th Street to W. Wheaton Way.	East West	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Roadway segment has no existing parking lanes.
W. Wheaton Way (private)	W. Oakwood Road to S. 27th Street	South North	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	--	Dedicated transit lanes are not recommended on non-arterial streets in this corridor.
		Total	0	0	0	0	0	0	0	0	--	--

Note: URP = Unrestricted Parking. Unrestricted parking areas generally allow parking most of the time, except on snow routes, during snow emergencies or other emergencies, and construction zones. Some unrestricted parking areas do require parking permits for overnight parking. RP = Restricted Parking. Restricted parking areas generally include time-limited parking, paid metered parking spots, restricted alternative side parking in winter, bus stop locations, and time of day parking restrictions. LZ = Loading Zone. Loading Zones include temporary, time-restricted parking areas and permanent no parking areas. Length of on-street parking space is assumed to be 20 feet.

Source: SEWRPC

Table 4.8
Road Segments Recommended for Parking Lane Conversion

Route Segment Option	Road	Extents	Parking Impacts			Level of Difficulty	Other Lane Conversion Option(s)
			Residential Spaces	Commercial Spaces	Total Spaces		
North Option 1	N. Teutonia Avenue	N. Green Bay Road to N. Sherman Boulevard	145	45	190	Low	Travel Lane
	N. Teutonia Avenue	W. Woodale Avenue to Good Hope Road	39	194	233	Low	Travel Lane
	N. Teutonia Avenue	Good Hope Road to W. Mill Road	11	140	151	Low	Travel Lane
	N. Teutonia Avenue	W. Mill Road to W. Silver Spring Drive	83	254	337	Low	Travel Lane
North Option 2	None	--	--	--	--	--	--
Central Segment	N. 27th Street	W. Cornell Street to W. Hope Avenue	208	16	224	Medium	None
	N. 27th Street	W. Capitol Drive to W. Meinecke Avenue	481	127	608	Medium	None
	N. 27th Street	W. Garfield Avenue to W. Lisbon Avenue	97	42	139	Low	None
	S. Layton Boulevard	W. National Avenue to W. Lincoln Avenue	397	64	461	Medium	None[a]
	S. 27th Street	W. Lincoln Avenue to W. Oklahoma Avenue	39	195	234	Low	None
South Option A	None	--	--	--	--	--	--
South Option B	None	--	--	--	--	--	--
South Option C	None	--	--	--	--	--	--

[a] *Segment would require conversion of both travel and parking lanes to provide sufficient width for a dedicated travel lane.*

Source: SEWRPC

Summary of Results

Table 4.9 summarizes the impacts to parking by route alternative. Route segments that include North Option 1 would experience a slightly higher impact to parking if the recommended segments of parking lanes were converted for a dedicated transit lane with approximately 74 percent of the parking along those route alternatives being removed. Approximately 69 percent of the existing on-street parking along other route segments would be removed. For all routes, more residential parking than commercial parking would be impacted.

Table 4.9
Impacts to Parking by Route Alternative

Route Alternative	Number of Parking Spaces Impacted[a]	Percent Residential	Percent Commercial	Total Parking Spaces	Percent of Total Parking Impacted
North Option 1 to South Option A	2,577	58	42	3,464	74
North Option 1 to South Option B	2,577	58	42	3,489	74
North Option 1 to South Option C	2,577	58	42	3,464	74
North Option 2 to South Option A	1,666	73	27	2,416	69
North Option 2 to South Option B	1,666	73	27	2,441	68
North Option 2 to South Option C	1,666	73	27	2,416	69

[a] *Some parking spaces may be preserved depending on the final siting of the BRT stations. In addition, some new parking spaces could be gained if the existing bus stops are removed from parking restricted areas or are combined with the BRT stations.*

Source: SEWRPC

Table 4.10 provides the results of the on-street parking impacts evaluation. Since a higher percentage of parking would be impacted on route alternatives that include North Option 1, those are rated as yellow. The remaining route alternatives are rated as green.

Table 4.10
Route Alternative Evaluation Results: On-Street Parking Impacts

Route Alternative	On-Street Parking Impacts
North Option 1 to South Option A	🟡
North Option 1 to South Option B	🟡
North Option 1 to South Option C	🟡
North Option 2 to South Option A	🟢
North Option 2 to South Option B	🟢
North Option 2 to South Option C	🟢

Source: SEWRPC

4.4 TRAFFIC IMPACTS

Expected impacts to traffic are primarily related to the proposed conversion of travel lanes to dedicated transit lanes in select segments. Tables 2.1 through 2.6 in Chapter 2 provide an overview of running type and lane conversion options for each route segment option in the study corridor. An evaluation of existing traffic and projected traffic in areas where converting a traffic lane is possible was completed to better understand the impact of lane conversion, make recommendations for dedicated transit lanes, and compare route alternatives. This section outlines that evaluation process, provides a summary of the results, and rates route alternatives based on the results of the evaluation.

Methodology

To analyze the expected impacts of converting a travel lane to a dedicated transit lane, SEWRPC's Regional Travel Demand Model was used to evaluate existing and forecast traffic operations in the study corridor after converting any segments where it would be possible to convert a travel lane to a dedicated transit lane. Traffic operations are measured using a grading system called Level of Service (LOS), which rates how a roadway is performing in terms of traffic congestion. The grading system uses A (no congestion) through F (extreme congestion) to describe how traffic is flowing and the roadway is operating. Table 4.11 shows the characteristics of each LOS grade.

Traffic forecasts were completed for 2025 and 2045. Segments were identified as having a low, medium, or high level of difficulty to convert a travel lane to a dedicated transit lane based on the forecasted LOS after a travel lane was converted. The worst hourly LOS during a 24-hour day was generally used to identify difficulty level, although engineering judgement was also incorporated into the evaluation and based on the length and the number of hours per day a given segment is expected to experience congestion. Generally,

Table 4.11
Surface Arterial Traffic Level of Service Definitions

Level of Traffic Congestion	Level of Service	Average Speed	Operating Conditions
None	A and B	70 to 100 percent of free-flow speed	Ability to maneuver within traffic stream is unimpeded. Control delay at signalized intersections is minimal.
None	C	50 to 100 percent of free-flow speed	Restricted ability to maneuver and change lanes at mid-block locations.
Moderate	D	40 to 50 percent of free-flow speed	Restricted ability to maneuver and change lanes. Small increases in flow lead to substantial increases in delay and decreases in travel speed.
Severe	E	33 to 40 percent of free-flow speed	Significant restrictions on lane changes. Traffic flow approaches instability.
Extreme	F	25 to 33 percent of free-flow speed	Flow at extremely low speeds. Intersection congestion with high delays, high volumes, and extensive queuing.

Source: SEWRPC

levels of difficulty correspond to the LOS expected in the segment with low difficulty assumed for segments where LOS C or higher was forecasted, medium difficulty assumed for segments that included LOS D, and high difficulty assumed for segments that included LOS E or F, except for segments where LOS E and F occur for a short duration during the 24-hour period. Those segments are identified as having medium difficulty to convert a travel lane to a dedicated transit lane.

Transit Signal Priority

In addition to evaluating the potential traffic impacts of converting a travel lane to a dedicated transit lane, an analysis was also completed to understand the possible impacts that implementing transit signal prioritization (TSP) would have on transit travel times and LOS. Utilizing TSP for the proposed BRT service would modify traffic signal timing when transit vehicles are present either conditionally (when transit service is running behind schedule) or unconditionally (for all arriving transit vehicles). When used unconditionally, TSP can be used to improve travel times and allow transit to run consistently on a more aggressive timetable. When used conditionally, it can help to improve reliability—especially on corridors with varying congestion and long signal cycles.

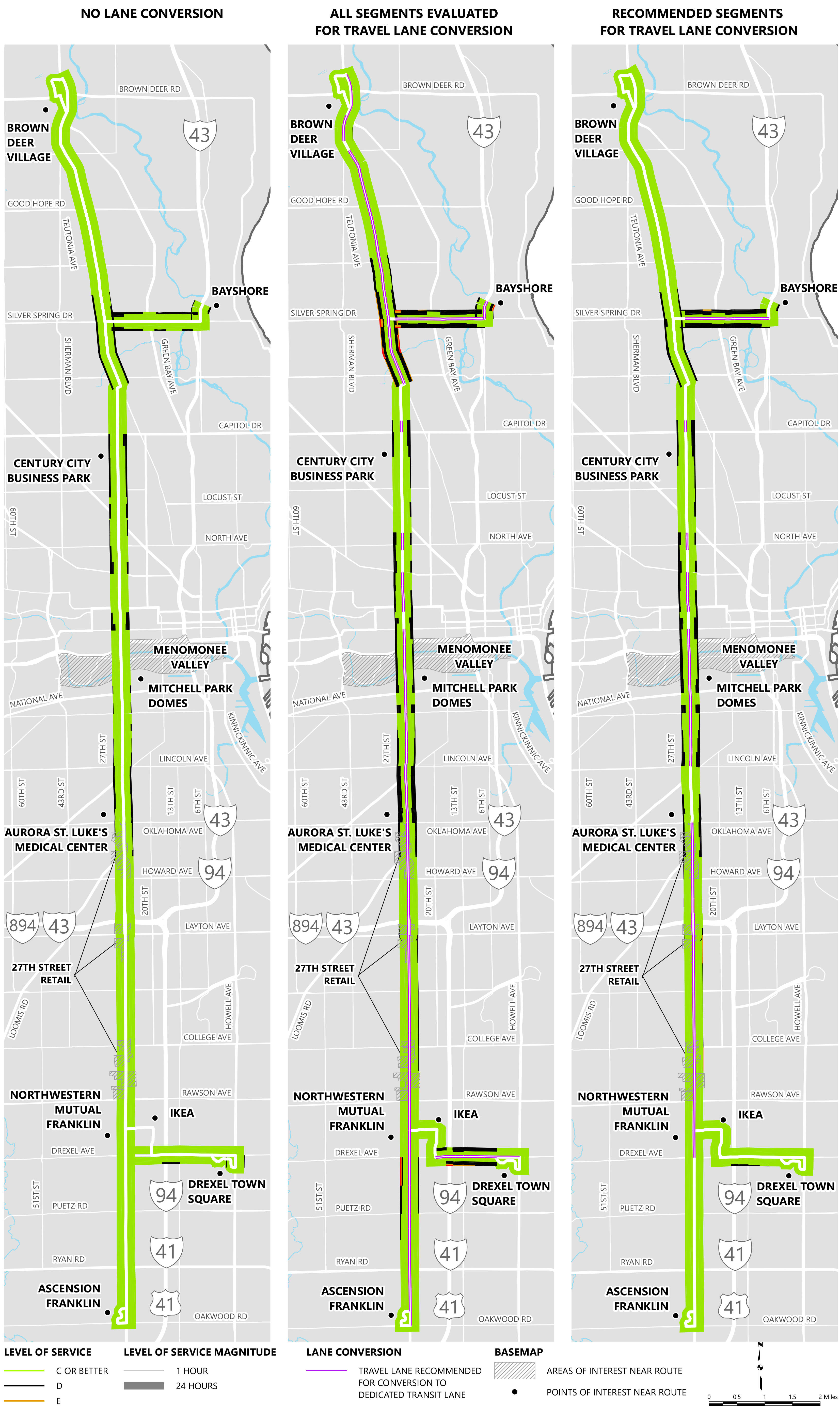
A microsimulation model was developed using PTV Vissim to conduct an intersection-level analysis on a segment in the core of the study corridor on 27th Street/Layton Boulevard between W. Lisbon Avenue and W. Greenfield Avenue. Consistent with implementations throughout the United States, the microsimulation model utilized a conditional implementation for TSP, and was only triggered if BRT is operating more than 30 seconds or more behind schedule. This segment was analyzed because it has the greatest density of signals and best opportunities for TSP and the estimated time saving from this corridor could be used to estimate time savings for other segments of the BRT route. When applied in this segment, the modeling indicated that there would be at best a modest improvement in travel times for the BRT. LOS at the intersections would also only be moderately impacted. Due to the very modest impact of TSP in this corridor, it was not studied in any other segments. However, TSP assumed under this analysis used generalized assumptions about station locations that were not optimized to take advantage of TSP. Once station siting occurs in the next phase of the project, additional intersection traffic analysis would likely provide additional TSP time savings, especially if the stations are located on the far side of the intersection or spaced away from the intersection. More details about the analysis, including the resulting travel time estimates, are included as Appendix C to this report.

TSP should still be considered at the next stage of study and design when route alignments, station sites, and more detailed schedules are finalized, to ensure schedule reliability for consistent on-time performance.

Evaluation

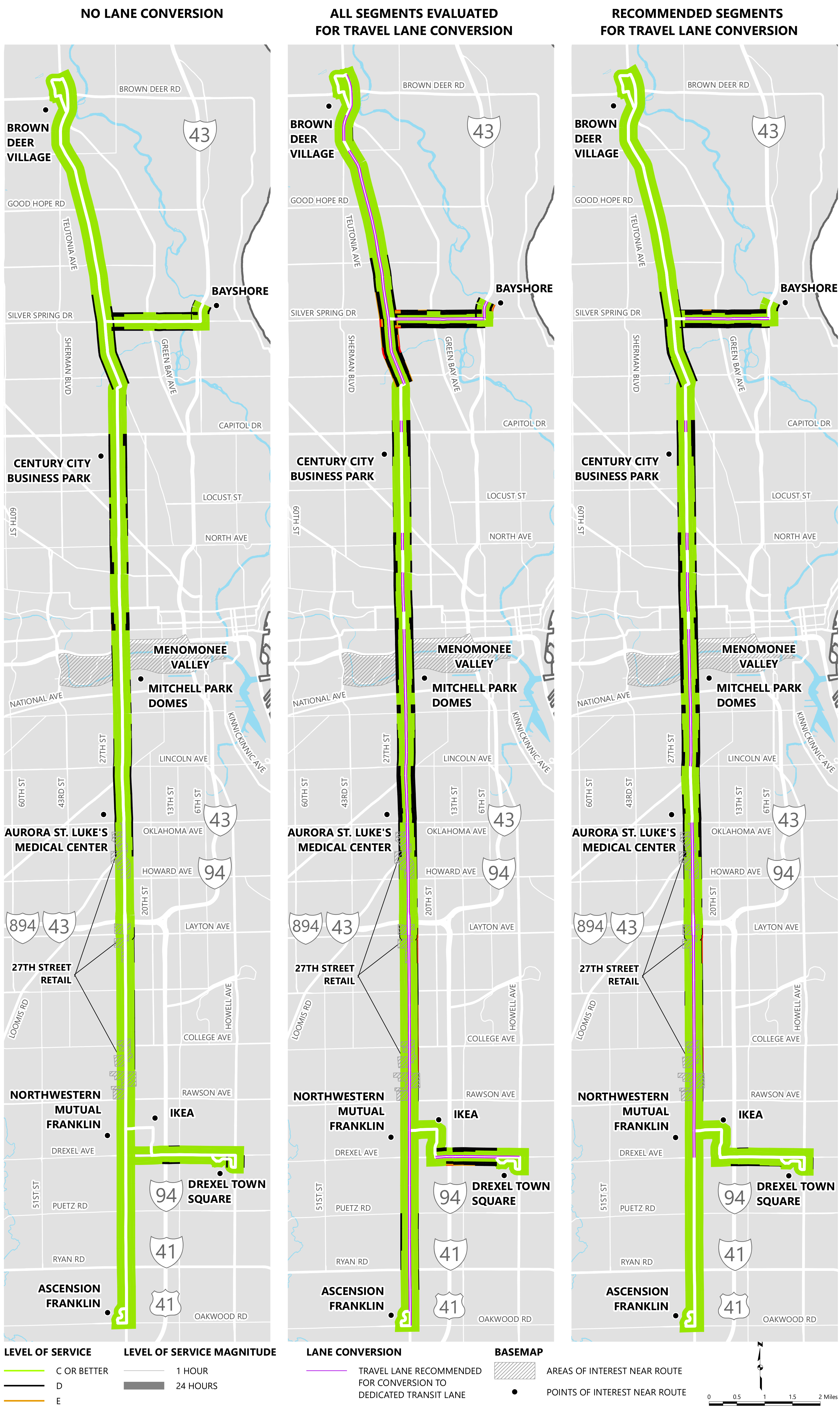
Maps 4.1 and 4.2 show the LOS expected on weekdays in 2025 and 2045 using line widths to signify the time a given LOS occurs during a 24-hour travel period for three scenarios: if no lanes were converted to dedicated transit lanes, if all segments under consideration for travel lane conversion were converted to dedicated transit lanes, and if only those recommended for conversion were converted to dedicated lanes.

Map 4.1
Level of Service in Study Corridor over a 24-hour Weekday: 2025



Source: SEWRPC

Map 4.2
Level of Service in Study Corridor over a 24-hour Weekday: 2045



Source: SEWRPC

Tables 4.12 through 4.17 show the worst hourly LOS expected during a 24-hour period for each segment where converting a travel lane was considered, with the corresponding level of difficulty for each route segment option.

Table 4.18 lists the segments that are recommended for converting a travel lane to a dedicated transit lane based on the results of the lane conversion LOS analysis, expected level of difficulty, and other lane conversion options available including parking, bike lanes and wide shoulders.

Table 4.12
Forecast Level of Service and Expected Level of Difficulty to Convert Travel Lane: North Option 1

Road	Extents	Travel Lane Conversion Possible?		Worst Hourly Forecast Level of Service		Level of Difficulty	Other Lane Conversion Options(s)
		YES	NO	2025	2045		
N. Deerbrook Trail	N. Green Bay Road to W. Brown Deer Road		X	--	--	--	None
W. Brown Deer Road	N. Deerbrook Trail to N. Deerwood Drive		X	--	--	--	None
N. Deerwood Drive	N. Brown Deer Road to Ruth Place		X	--	--	--	None
Ruth Place	N. Deerwood Drive to N. Green Bay Road		X	--	--	--	None
N. Green Bay Road	N. Deerbrook Trail to N. Teutonia Avenue	X		C	C	Low	Wide shoulder
N. Teutonia Avenue	N. Green Bay Road to N. Sherman Boulevard	X		D	D	Low	Parking Lane
N. Teutonia Avenue	N. Sherman Boulevard to W. Woodale Avenue		X	--	--	--	None
N. Teutonia Avenue	W. Woodale Avenue to W. Good Hope Road	X		C	C	Low	Parking Lane
N. Teutonia Avenue	W. Good Hope Road to W. Mill Road	X		D	D	Medium	Parking and Bike Lanes
N. Teutonia Avenue	W. Mill Road to W. Silver Spring Drive	X		E	E	High	Parking and Bike Lanes

Source: SEWRPC

Table 4.13
Forecast Level of Service and Expected Level of Difficulty to Convert Travel Lane: North Option 2

Road	Extents	Travel Lane Conversion Possible?		Worst Hourly Forecast Level of Service		Level of Difficulty	Other Lane Conversion Options(s)
		YES	NO	2025	2045		
W. Silver Spring Drive	N. Teutonia Avenue to N. Port Washington Road	X		E	F	Medium[a]	None
N. Port Washington Road	W. Silver Spring Drive to W. Corrigan Drive	X		F	F	High	None

[a] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS D, except for a very short segment between N. Bridgewood Lane and N. Milwaukee River Parkway in the westbound direction that is expected to perform at LOS E, and another very short segment at the ramp from W. Silver Spring Drive onto N. Teutonia Avenue.*

Source: SEWRPC

Table 4.14
Forecast Level of Service and Expected Level of Difficulty to Convert Travel Lane: Central Segment

Road	Extents	Travel Lane Conversion Possible?		Worst Hourly Forecast Level of Service		Level of Difficulty	Other Lane Conversion Options(s)
		YES	NO	2025	2045		
N. Teutonia Avenue	W. Silver Spring Drive to W. Custer Avenue	X		F	F	**High**	Parking Lane
N. Teutonia Avenue	W. Custer Avenue to W. Cornell Street	X		F	F	**High**	None
W. Cornell Street	N. Teutonia Avenue to N. 27th Street		X	--	--	--	None
N. 27th Street	W. Cornell Street to W. Hope Avenue		X	--	--	--	Parking Lane
N. 27th Street	W. Hope Avenue to W. Capitol Drive	X		D	D	**Medium**	Parking Lane
N. 27th Street	W. Capitol Drive to W. Meinecke Avenue		X	--	--	--	Parking and Bike Lanes
N. 27th Street	W. Meinecke Avenue to W. Garfield Avenue	X		E	E	**Medium**[a]	None
N. 27th Street	W. Garfield Avenue to W. Lisbon Avenue		X	--	--	--	Parking and Bike Lanes
N. 27th Street	W. Lisbon Avenue to W. State Street	X		D	D	**Medium**	Parking and Bike Lanes
N. 27th Street	W. State Street to W. Wisconsin Avenue		X	--	--	--	Parking and Bike Lanes
N. 27th Street	W. Wisconsin Avenue to W. St. Paul Avenue	X		D	D	**Medium**	None
N. 27th Street/S. Layton Boulevard	W. St. Paul Avenue to W. Pierce Street	X		D	D	**Medium**	None
S. Layton Boulevard	W. Pierce Street to W. National Avenue	X		E	E	**Medium**[b]	None
S. Layton Boulevard	W. National Avenue to W. Lincoln Avenue	X		F	F	**Medium**[c]	None[d]
S. 27th Street	W. Lincoln Avenue to W. Oklahoma Avenue	X		D	D	**Medium**	Parking Lane
S. 27th Street	W. Oklahoma Avenue to W. Cold Spring Road	X		D	D	**Medium**	None
S. 27th Street	W. Cold Spring Road to W. Layton Avenue	X		D	F	**Medium**[e]	None
S. 27th Street	W. Layton Avenue to W. College Avenue	X		E	F	**Medium**[f]	None
S. 27th Street	W. College Avenue to W. Sycamore Street	X		E	F	**Medium**[g]	None
S. 27th Street	W. Sycamore Street to Northwestern Mutual Way	X		C	D	**Low**	None

[a] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS D, except for a very short segment between W. Meinecke Avenue and W. North Avenue in the southbound direction that is expected to perform at LOS E.*

[b] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS D, except for a very short segment between W. Pierce Street and W. National Avenue in the southbound direction that is expected to perform at LOS E.*

[c] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS D, except for a very short segment between W. Mitchell Street and W. Lapham Street in the northbound direction that is expected to perform at LOS F.*

[d] *Segment would require conversion of both travel and parking lanes to provide sufficient width for a dedicated travel lane.*

[e] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS C, except for a very short time where segments between and W. Cold Spring Road and W. Layton Avenue in the northbound direction that is expected to perform at LOS F.*

[f] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS C, except for a very short time where segments between and W. Layton Avenue and W. College Avenue in the northbound direction that is expected to perform at LOS E and F.*

[g] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS C, except for a very short time where segments between and W. College Avenue and W. Sycamore Street in the northbound direction that is expected to perform at LOS E and F.*

Source: SEWRPC

Table 4.15
Forecast Level of Service and Expected Level of Difficulty to Convert Travel Lane: South Option A

Road	Extents	Travel Lane Conversion Possible?		Worst Hourly Forecast Level of Service		Level of Difficulty	Other Lane Conversion Options(s)
		YES	NO	2025	2045		
(Future) Northwestern Mutual Way	S. 27th Street to S. Ikea Way		X	--	--	--	None
S. Ikea Way (including future extension)	(Future) Northwestern Mutual Way to W. Drexel Avenue		X	--	--	--	None
W. Drexel Avenue	S. Ikea Way to Northwestern Mutual Way		X	--	--	--	None
Northwestern Mutual Way (Private)	W. Drexel Avenue to S. 27th Street		X	--	--	--	None

Source: SEWRPC

Table 4.16
Forecast Level of Service and Expected Level of Difficulty to Convert Travel Lane: South Option B

Road	Extents	Travel Lane Conversion Possible?		Worst Hourly Forecast Level of Service		Level of Difficulty	Other Lane Conversion Options(s)
		YES	NO	2025	2045		
(Future) Northwestern Mutual Way	S. 27th Street to S. Ikea Way		X	--	--	--	None
S. Ikea Way (including future extension)	(Future) Northwestern Mutual Way to W. Drexel Avenue		X	--	--	--	None
W. Drexel Avenue	S. Ikea Way to S. Howell Avenue	X		F	F	Medium[a]	None
W. Town Square Way	W. Drexel Avenue to S. Howell Avenue		X	--	--	--	None

[a] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS D, except for a short segment near the ramps to and from I-94 in the eastbound direction that is expected to perform at LOS E and F.*

Source: SEWRPC

Table 4.17
Forecast Level of Service and Expected Level of Difficulty to Convert Travel Lane: South Option C

Road	Extents	Travel Lane Conversion Possible?		Worst Hourly Forecast Level of Service		Level of Difficulty	Other Lane Conversion Options(s)
		YES	NO	2025	2045		
S. 27th Street	W. Drexel Avenue to W. Oakwood Road	X		F	D	Medium[a]	Wide Shoulder
W. Oakwood Road	S. 27th Street to W. Wheaton Way		X	-	-	-	None
W. Wheaton Way (Private)	W. Oakwood Road to S. 27th Street		X	-	-	-	None

[a] *The level of difficulty expected to convert the travel lane on this segment is listed as medium because most of this segment is expected to perform at LOS D, except for a short segment on S. 27th Street in the southbound direction south of W. Drexel Avenue that is expected to perform at LOS F.*

Source: SEWRPC

Table 4.18
Road Segments Recommended for Travel Lane Conversion on all Route Segment Options (Both Travel Directions)

Route Segment Option	Road	Extents	Approximate Length in Miles (Inbound and Outbound)	Level of Difficulty	Other Lane Conversion Option(s)
North Option 1	None	--	--	--	--
North Option 2	W. Silver Spring Drive	S. 27th Street to N. Port Washington Road	3.0	Medium	None
Central Segment	N. 27th Street	W. Hope Avenue to W. Capitol Drive	0.4	Medium	None
	N. 27th Street	W. Meinecke Avenue to W. Garfield Avenue	0.6	Medium	None
	N. 27th Street	W. Lisbon Avenue to W. State Street	1.4	Medium	Parking and Bike Lanes
	N. 27th Street	W. Wisconsin Avenue to W. St. Paul Avenue	0.5	Medium	None
	N. 27th Street/S. Layton Boulevard	W. St. Paul Avenue to W. Pierce Street	1.5	Medium	None
	S. Layton Boulevard	W. Pierce Street to W. National Avenue	0.3	Medium	None
	S. Layton Boulevard	W. National Avenue to W. Lincoln Avenue	2.6	Medium	None[a]
	S. 27th Street	W. Oklahoma Avenue to W. Cold Spring Road	3.0	Medium	None
	S. 27th Street	W. Cold Spring Road to W. Sycamore Street	7.3	Medium	None
	S. 27th Street	W. Sycamore Street to Northwestern Mutual Way	2.2	Low	None
South Option A	None	--	--	--	--
South Option B	None	--	--	--	--
South Option C	S. 27th Street	W. Drexel Avenue to W. Oakwood Road	5.8	Medium	Wide Shoulder

[a] *Segment would require conversion of both travel and parking lanes to provide sufficient width for a dedicated travel lane.*

Source: SEWRPC

Summary of Results

Table 4.19 shows the total length of travel lanes recommended to be converted for a dedicated transit lane by route alternative. While this evaluation considers impacts to existing travel lanes negatively, a reduction in general purpose travel lanes can improve safety in locations where reckless driving is a concern by slowing traffic, often with minimal impacts to level of service.

Table 4.20 provides the results of the evaluation, rating each route alternative either red, yellow, or green corresponding to whether the expected impacts to general travel lanes would be high, moderate, or low when compared among all the route alternatives. Route alternatives that include North Option 1 are rated as green as fewer miles of travel lanes would be impacted. Route alternatives that include North Option 2 are rated as yellow since they would have more travel lane miles converted, although all the travel lanes converted are expected to have low to medium levels of difficulty to convert.

Table 4.19
Total Length of Travel Lanes Converted by Route Alternative

Route Alternative	Length of Travel Lane (Linear Miles)
North Option 1 to South Option A	17.9
North Option 1 to South Option B	17.9
North Option 1 to South Option C	18.8
North Option 2 to South Option A	20.9
North Option 2 to South Option B	20.9
North Option 2 to South Option C	21.8

Source: SEWRPC

Table 4.20
Route Alternative Evaluation Results: Traffic Impacts

Route Alternative	Traffic Impacts
North Option 1 to South Option A	●
North Option 1 to South Option B	●
North Option 1 to South Option C	●
North Option 2 to South Option A	●
North Option 2 to South Option B	●
North Option 2 to South Option C	●

Source: SEWRPC

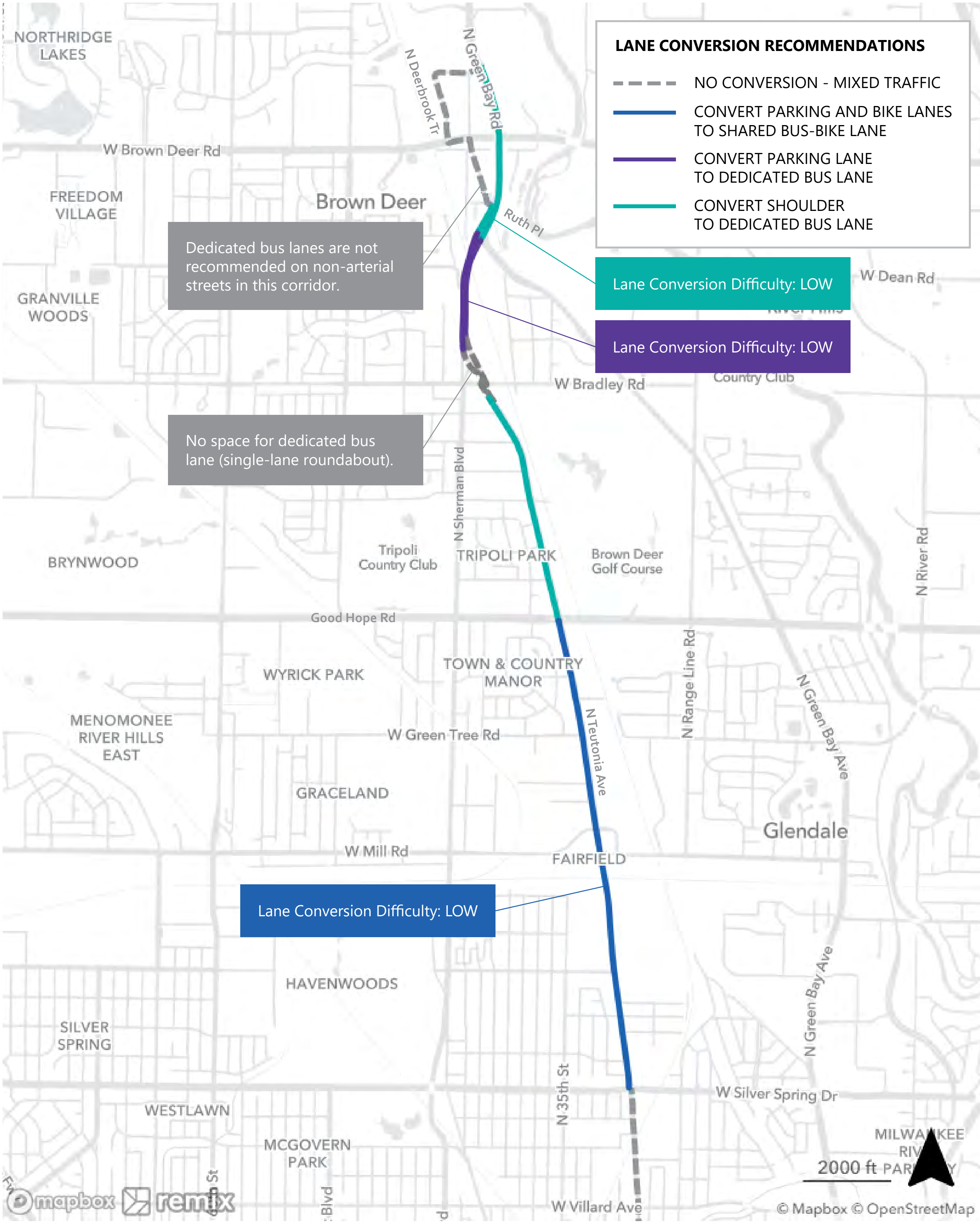
4.5 RECOMMENDED ROADWAY CONFIGURATIONS

The evaluations for impacts to the existing transportation system described in this chapter are used, in large part, to understand the locations where a dedicated transit lane would be most feasible by providing a recommendation for lane conversion. In addition to lane conversion options, recommendations for roadway configurations will also outline where the various BRT running types (mixed traffic, dedicated center lane, and dedicated outside lane) are feasible. Finally, recommendations for roadway configurations will also identify intersections where queue jump signals should be considered based on the locations of dedicated transit lanes. These recommendations should be seen as preliminary and will need to be further refined in future phases of this study, including through additional public and stakeholder engagement. Evaluations comparing route alternatives based on the percent of dedicated transit lanes and running type are included in the following section.

Methodology

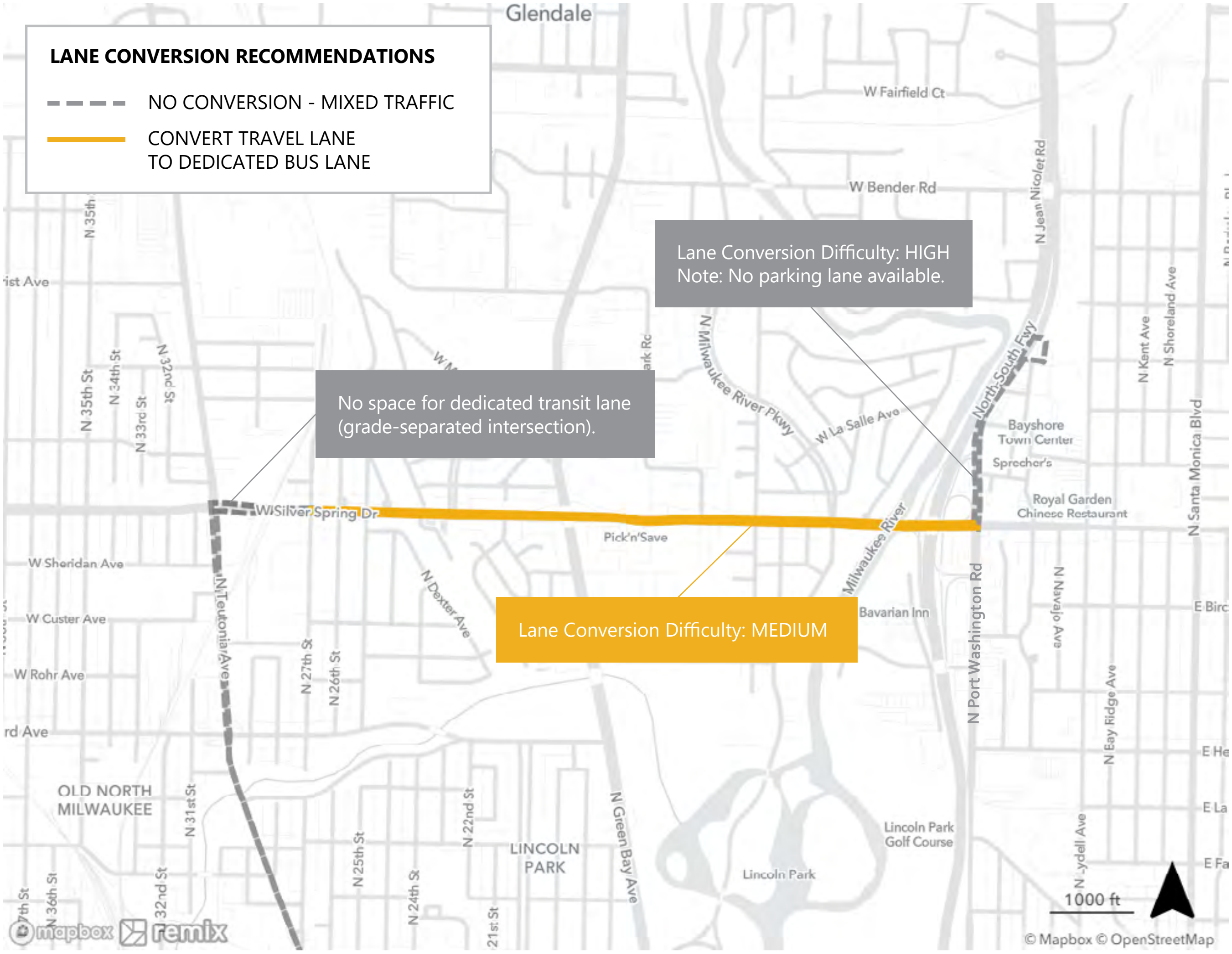
Maps 4.3 through 4.10 show recommendations for lane conversion by route segment option—combining results from the on-street parking impacts and traffic impacts evaluations. In locations where a wide shoulder exists, the shoulder is prioritized for conversion to a dedicated transit lane over a parking or travel lane. Travel lanes that were rated as having low to medium difficulty to convert to a dedicated transit lane in the traffic impacts evaluation were prioritized for conversion. Then parking lanes and/or parking and bike lanes are recommended for conversion to a dedicated lane on segments that were rated as having low to medium difficulty to convert to a dedicated transit lane in the parking impacts evaluation. On segments where converting both the parking and bike lanes are necessary, a shared bus-bike lane is recommended. Finally, in segments where either there were no lane conversion options due to limited space, or impacts to parking or travel would be too high, mixed traffic is recommended.

Map 4.3
Lane Conversion Recommendations: North Option 1



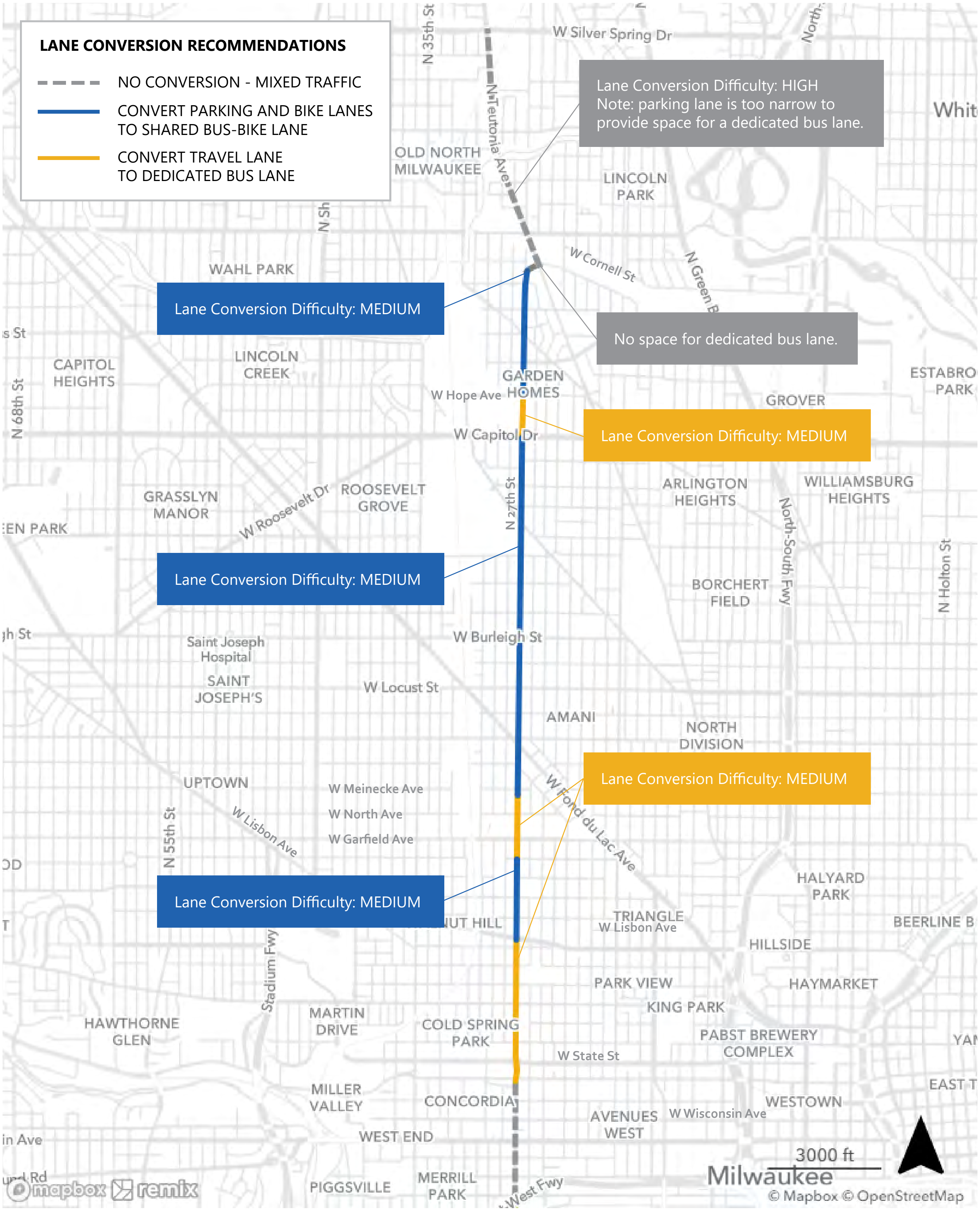
Source: SEWRPC

Map 4.4
Lane Conversion Recommendations: North Option 2



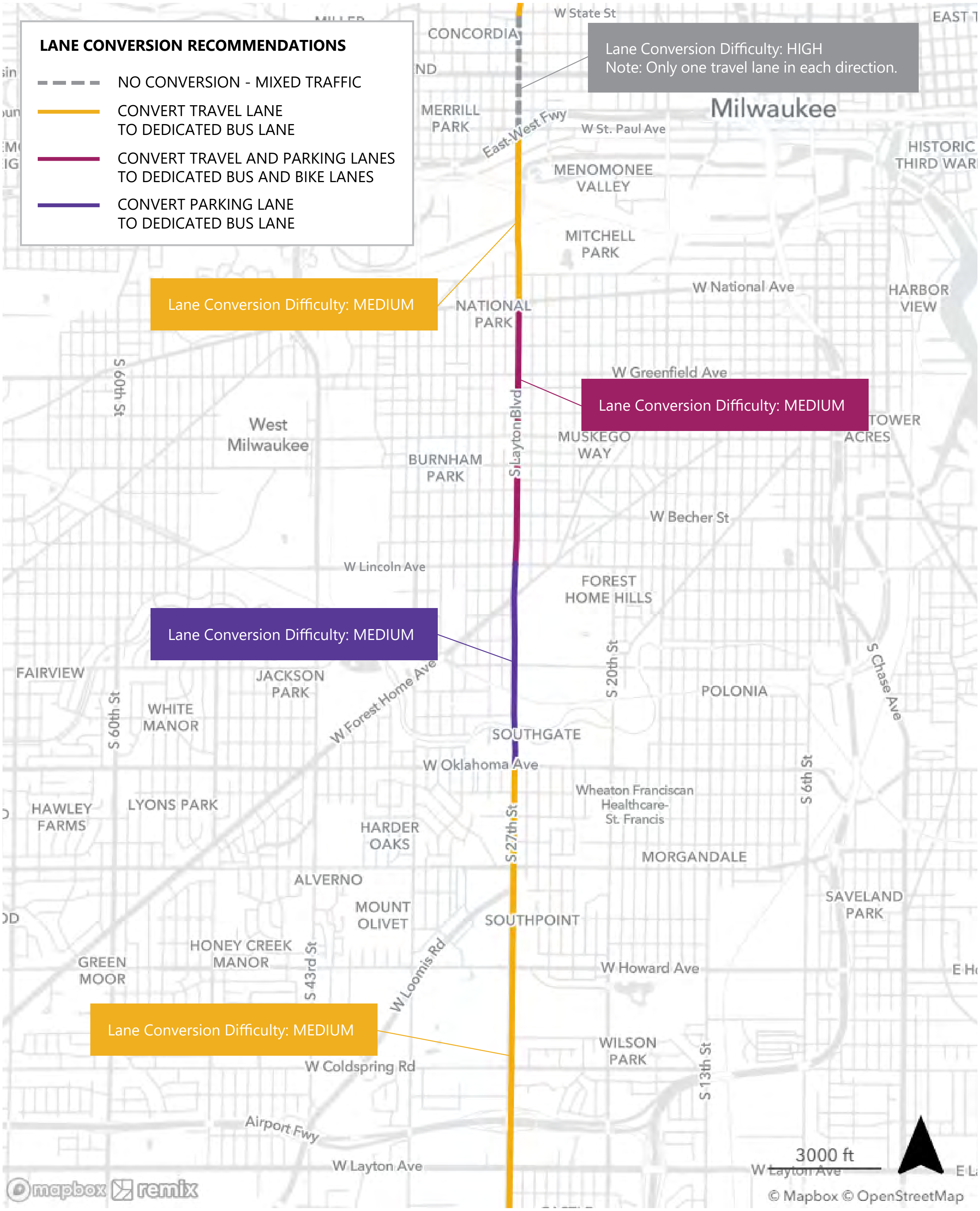
Source: SEWRPC

Map 4.5
Lane Conversion Recommendations: Central Segment from W. Silver Spring Drive to W. State Street



Source: SEWRPC

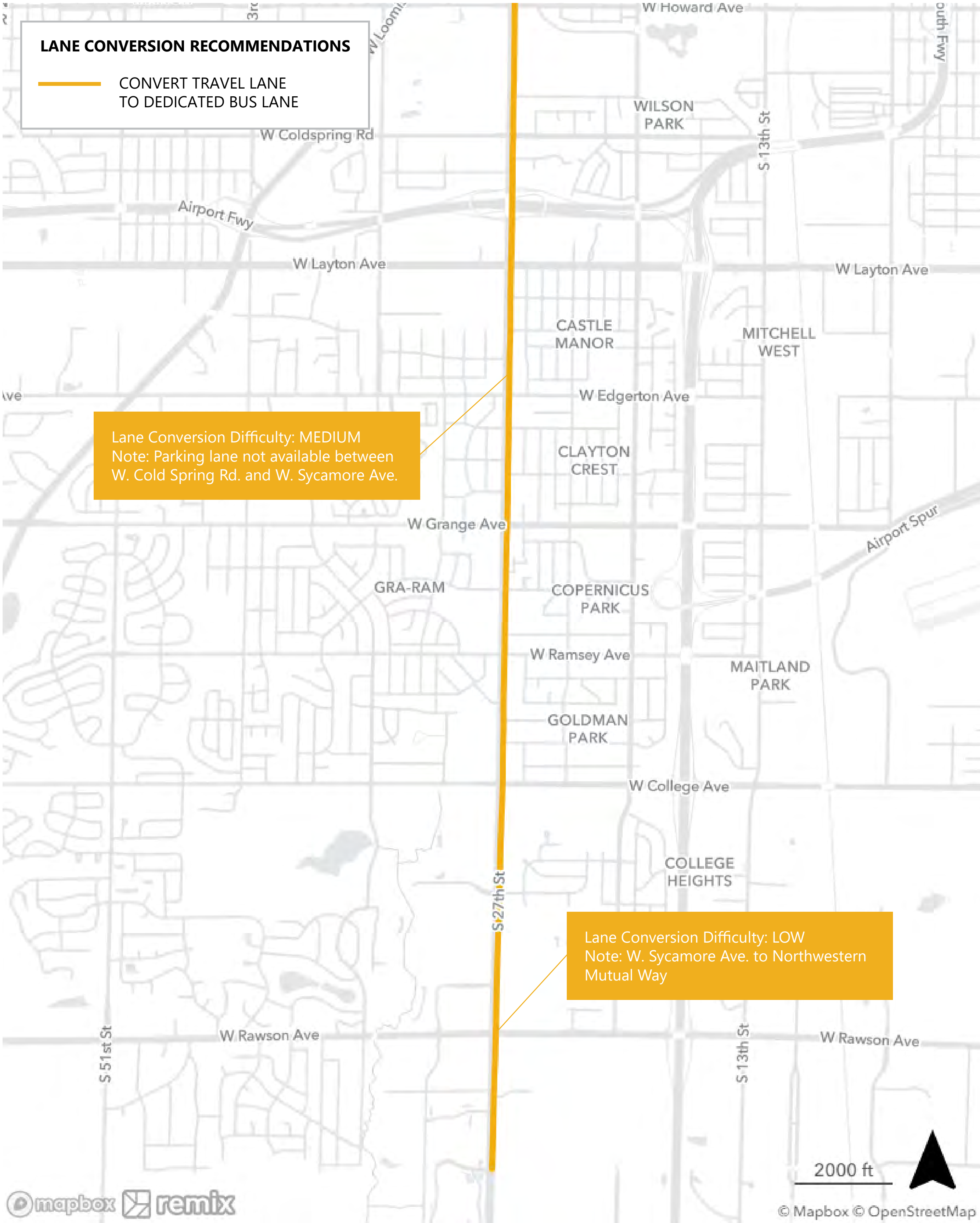
Map 4.6
Lane Conversion Recommendations: Central Segment from W. State Street to W. Cold Spring Road



Source: SEWRPC

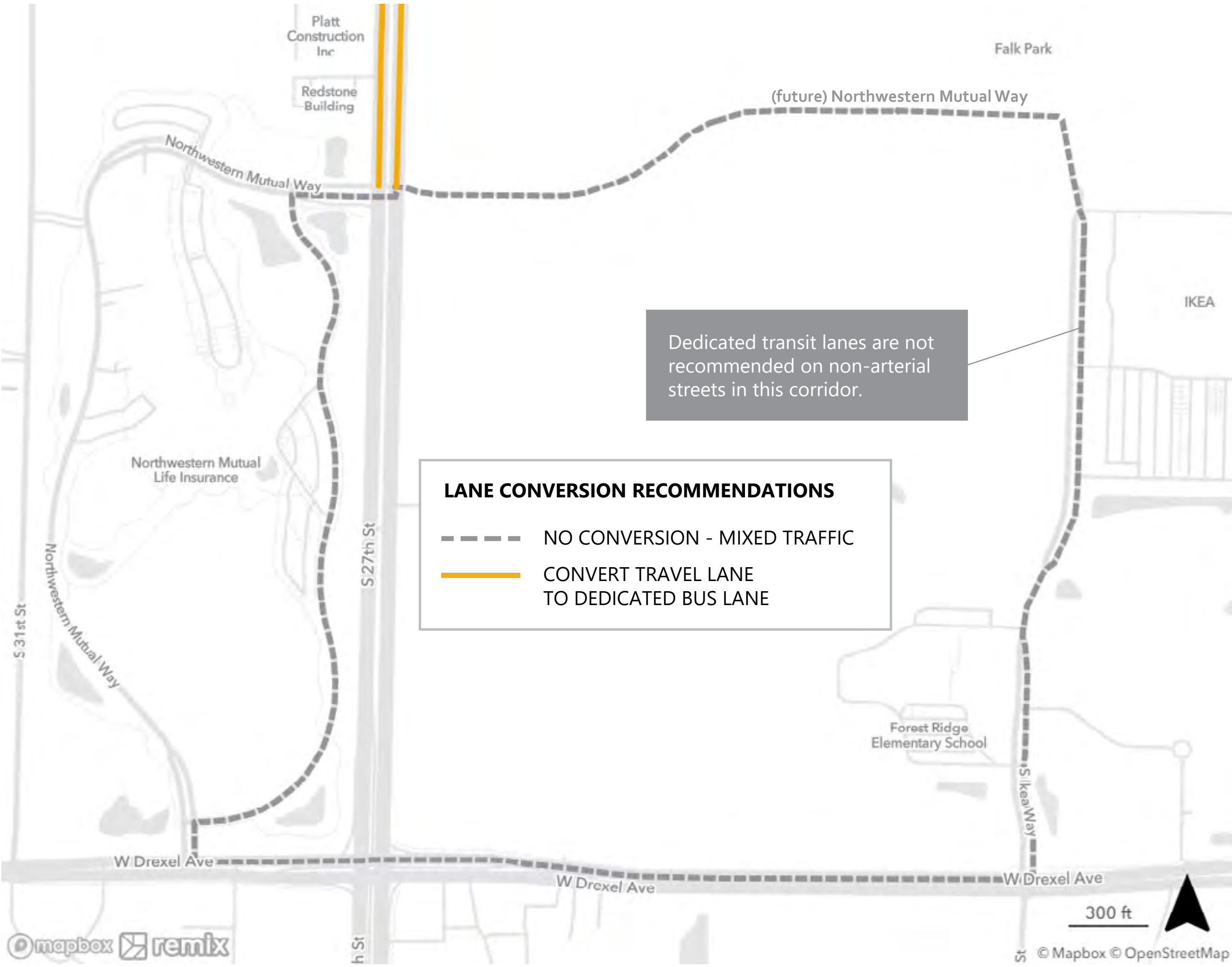
Map 4.7

Lane Conversion Recommendations: Central Segment from W. Cold Spring Road to Northwestern Mutual Way



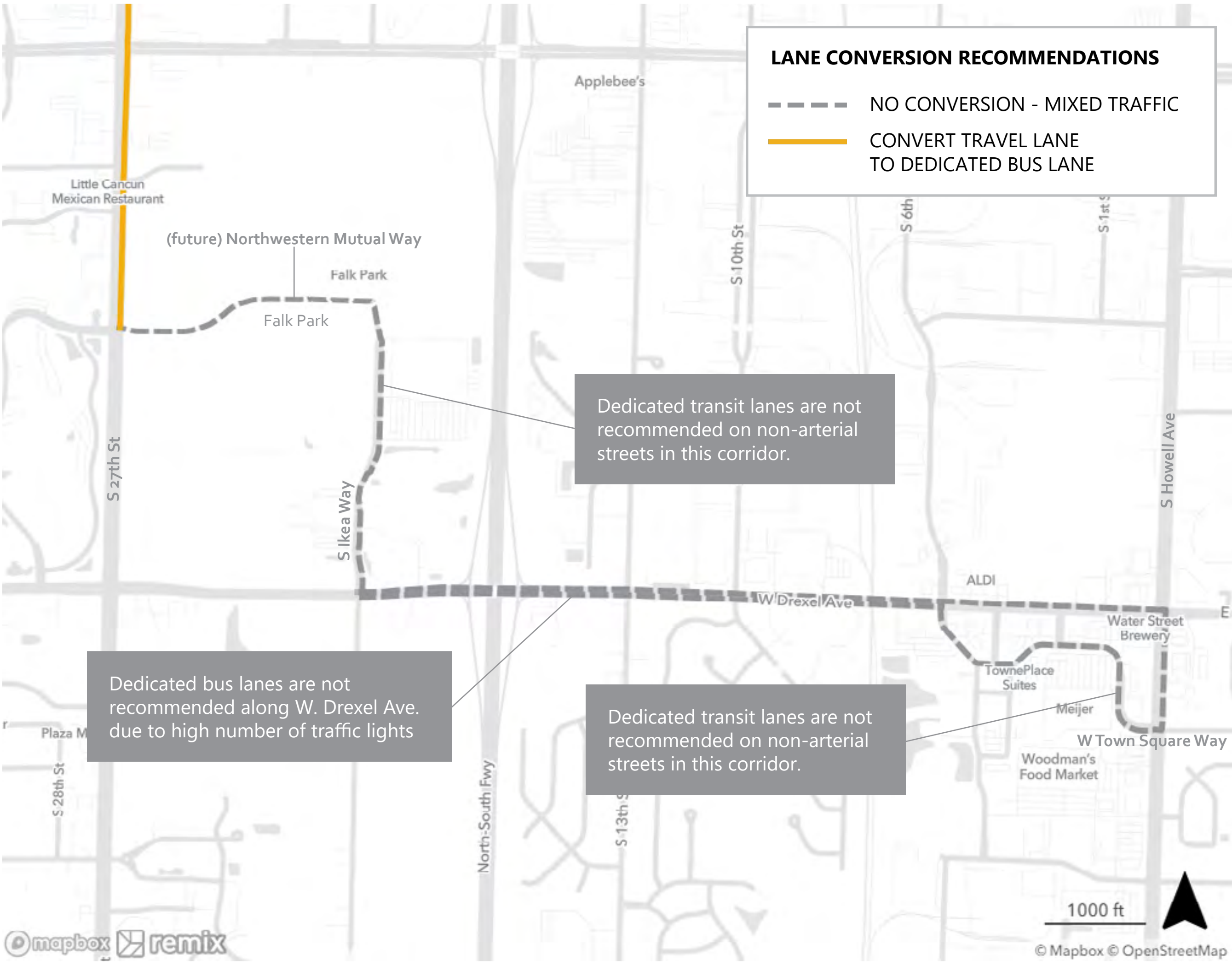
Source: SEWRPC

Map 4.8
Lane Conversion Recommendations: South Option A



Source: SEWRPC

Map 4.9
Lane Conversion Recommendations: South Option B



Source: SEWRPC

Map 4.10
Lane Conversion Recommendations: South Option C

Source: SEWRPC

Summary of Results

Based on recommendations for lane conversion, Map 4.11 (page 80) shows the locations where dedicated transit lanes are recommended on all segment options. Table 4.21 reports the length and percent of route-miles recommended for dedicated lanes by route alternative.

Table 4.21
Length of Dedicated Transit Lanes by Route Alternative

Route Alternative	Miles of Dedicated Transit Lanes (Inbound & Outbound)	Total Route Length (Inbound & Outbound)	Percent of Route with Dedicated Transit Lane
North Option 1 to South Option A	33.0	40.8	81
North Option 1 to South Option B	33.0	44.1	75
North Option 1 to South Option C	39.9	45.9	87
North Option 2 to South Option A	28.4	35.9	79
North Option 2 to South Option B	28.4	39.2	72
North Option 2 to South Option C	35.3	41.0	86

Source: SEWRPC

Table 4.22 rates route alternatives based on the percent of the route that would operate in dedicated lanes. North Option 1 to South Option A, North Option 1 to South Option C, North Option 2 to South Option A, and North Option 2 to South Option C are rated as green with over 75 percent of the route with dedicated lanes. The remaining routes are rated as yellow with slightly lower proportions of dedicated lanes, although all route alternatives are recommended to operate in well over 50 percent dedicated transit lanes, which is the minimum required for fixed-guideway BRT.

Table 4.22
Route Alternative Evaluation Results: Percent of Route Operating in Dedicated Transit Lanes

Route Alternative	Percent of Route Operating in Dedicated Transit Lanes
North Option 1 to South Option A	●
North Option 1 to South Option B	●
North Option 1 to South Option C	●
North Option 2 to South Option A	●
North Option 2 to South Option B	●
North Option 2 to South Option C	●

Source: SEWRPC

Other Roadway Configuration Options

Although not included in the route alternatives evaluation, this study makes recommendations for other roadway configuration options that can improve transit service quality. Recommendations for running type, vertical separation elements, and transit queue-jump signals are provided for all route segment options in this section.

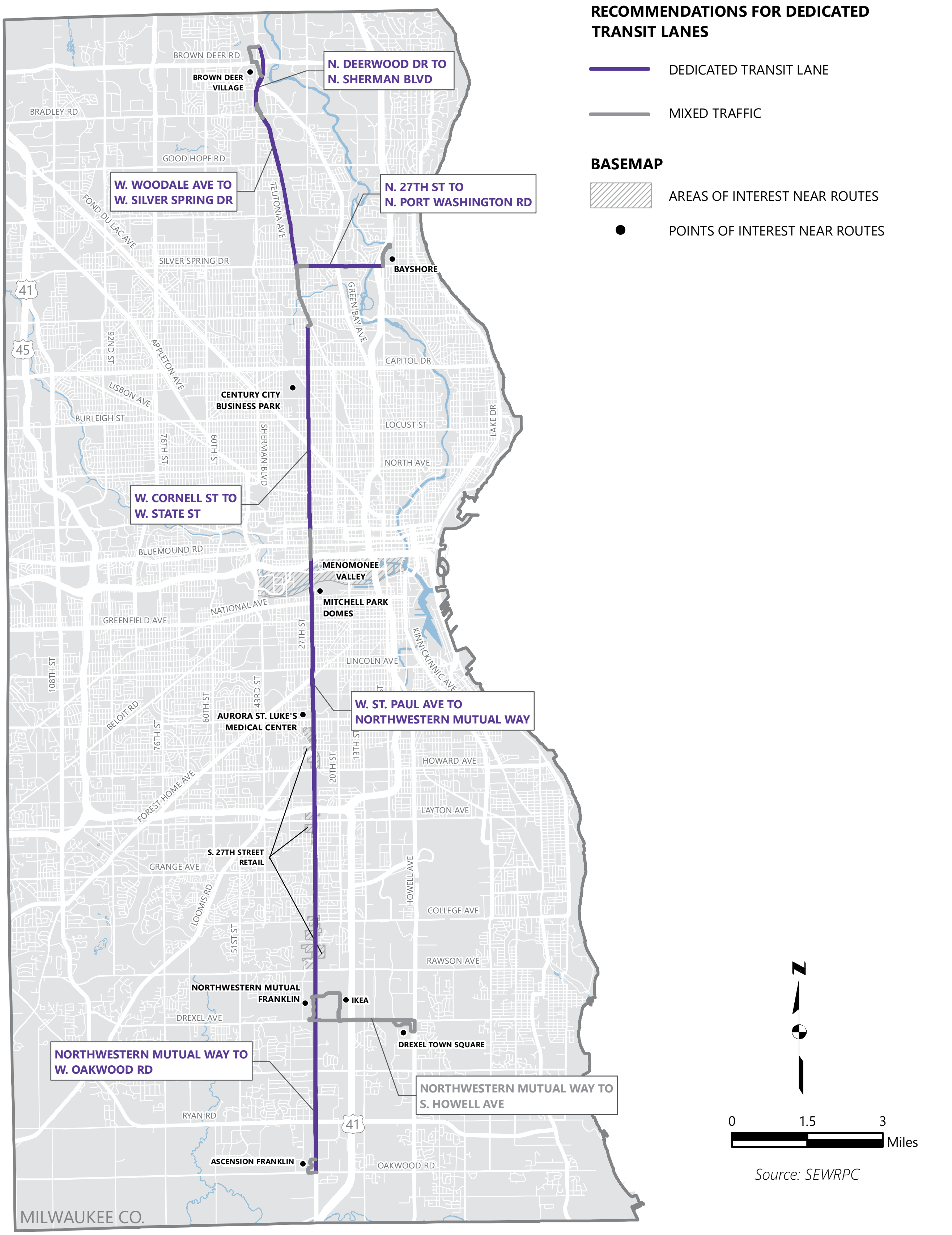
Running Type

Running type options considered for this study include mixed traffic, a dedicated center-running transit lane, and a dedicated outside-running transit lane. Tables 2.1 through 2.6 in Chapter 2 outline where each of these running types is considered and Appendix A provides proposed typical sections of these options in more detail. If the existing roadway includes a median, which could provide space for BRT stations, as well as at least two travel lanes in each direction, a parking lane, or a wide shoulder that could be converted to a dedicated transit lane, a dedicated center lane is possible.

Map 4.12 shows recommendations for running type. Regardless of running type, dedicated transit lanes can provide significant travel time and reliability improvements by limiting delays due to congestion and other variations in traffic. Outside-running transit lanes—which can be curbside or offset from a parking lane—allow riders to board directly from the curb and are generally recommended in locations where a center-running transit lane is not possible.[5] In cases where outside-running lanes are offset from a parking lane, bulb-outs can be used to accommodate stations (shown in Figure 4.1) or island stations (shown in Figure 4.2) can be used and improve reliability and speed.

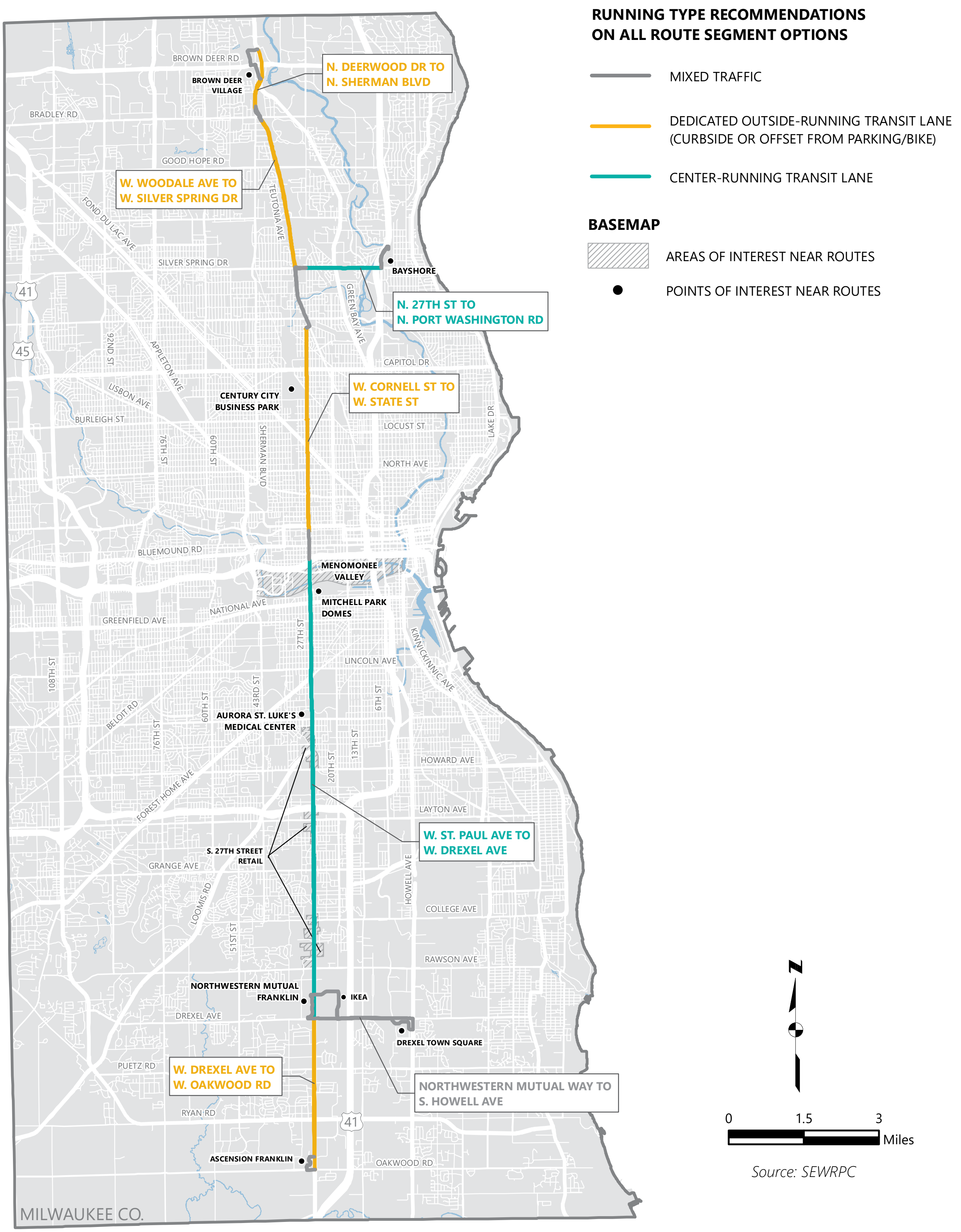
[5] NACTO, Transit Street Design Guide, "Offset Transit Lane" and "Curbside Transit Lane." *nacto.org/publication/transit-street-design-guide/transit-lanes-transitways*.

Map 4.11
Dedicated Transit Lane Recommendations on All Route Segment Options



Source: SEWRPC

Map 4.12
Running Type Recommendations on All Route Segment Options



Source: SEWRPC

Figure 4.1
Curb Bulb-Out Used to Accommodate Transit Station

Source: MCTS

Figure 4.2
Side-Boarding Island Station

Source: Green Lanes Project via NACTO

Figure 4.3
Median Station

Source: Metropolitan Planning Council

Where feasible, center-running transit lanes are preferred as they further reduce delays due to congestion and variations in traffic by minimizing conflict with parked and right-turning vehicles and typically are interrupted by many fewer access points than outside-running lanes due to left turn restrictions. In this corridor, medians already provide significant access management as well as a location for stations to be sited. In some cases, inbound and outbound stations could be combined into one larger station in a median if a center-running transit lane is used. In addition to the benefits that the proposed BRT service would experience because of center-running transit lanes, general traffic flow would be less impacted and pedestrian crossing distances for passengers narrowed.[6] Figure 4.3 shows a rendering of a station in the median from a BRT study in Chicago. In locations where physical separation elements are needed to prevent incursions on the dedicated transit lane, they would be more effective in a center-running lane due to the reduction of required access points to allow general traffic to access or cross through the transit lane.

Vertical Separation Elements

Data and public feedback collected during this study pointed to concerns about reckless driving and pedestrian safety along portions of the corridor (more detail provided in the Purpose and Need and Public Involvement Summary documents). Vertical separation elements between dedicated transit lanes and general purpose travel lanes help prevent incursions by non-transit vehicles into the transit lane, improving performance of the proposed BRT service while preventing reckless driving and reducing traffic speeds where applied.[7]

The appropriateness of different separation treatments depends on the available roadway width, the level or expected level of compliance, traffic conditions, access points, cost, and operations and maintenance needs (including snow removal and storm water management). Additional analysis and public engagement in future phases of this project will refine details about the location and treatment types for separation

[6] NACTO, Transit Street Design Guide, "Center Transit Lane." *nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/transit-lanes/center-transit-lane.*

[7] *NACTO, Transit Street Design Guide,* Separation Elements.

elements, but for the purpose of evaluating the feasibility and estimating the cost of including transit lane separation elements, segments where reckless driving concerns were identified are recommended for this treatment. Recommended segments are shown in Map 4.13 (page 84) and are those included in the Pedestrian High Injury Network from the City of Milwaukee Pedestrian Plan along the Central Segment option, as well as the portion recommended for dedicated lanes along W. Silver Spring Drive in the City of Glendale along the North Option 2 route segment.

Figure 4.4 shows examples of treatment options that could be considered for the corridor. As appropriate, multiple treatment options could be used depending on the needs of the segment and whether softer or more aggressive treatments are needed to adequately maintain the integrity of the transit lane. Examples, listed in order from more aggressive to less aggressive treatments, include a pre-cast or cast-in-place curb with bollards, planters or planting strips, bollards, low concrete domes or "armadillo" shaped elements, mountable curbs, and rumble strips. In addition to vertical separation elements, red or terra cotta colored pavement could be considered on all dedicated lanes in the corridor to help visually distinguish it from general use travel lanes and help improve compliance.[8]

Queue-Jump Signals

Transit queue-jump signals, introduced in Chapter 2, are separate signals that apply only to the transit vehicle allowing it to get a head start into traffic and avoid merging into long lines of vehicles waiting at an intersection. Queue-jump signals can be used at signalized intersections, in locations where the roadway configuration transitions from a dedicated transit lane (either outside-running or center-running) to a mixed-traffic configuration, in locations where the bus needs to cross over to or from a dedicated center-running transit lane to a dedicated outside-running transit lane. For all route alternatives, queue-jump signals are considered for implementation at each signalized intersection.

Figure 4.4
Vertical Separation Element Treatment Option Examples

Cast-in-Place Curb with Bollards

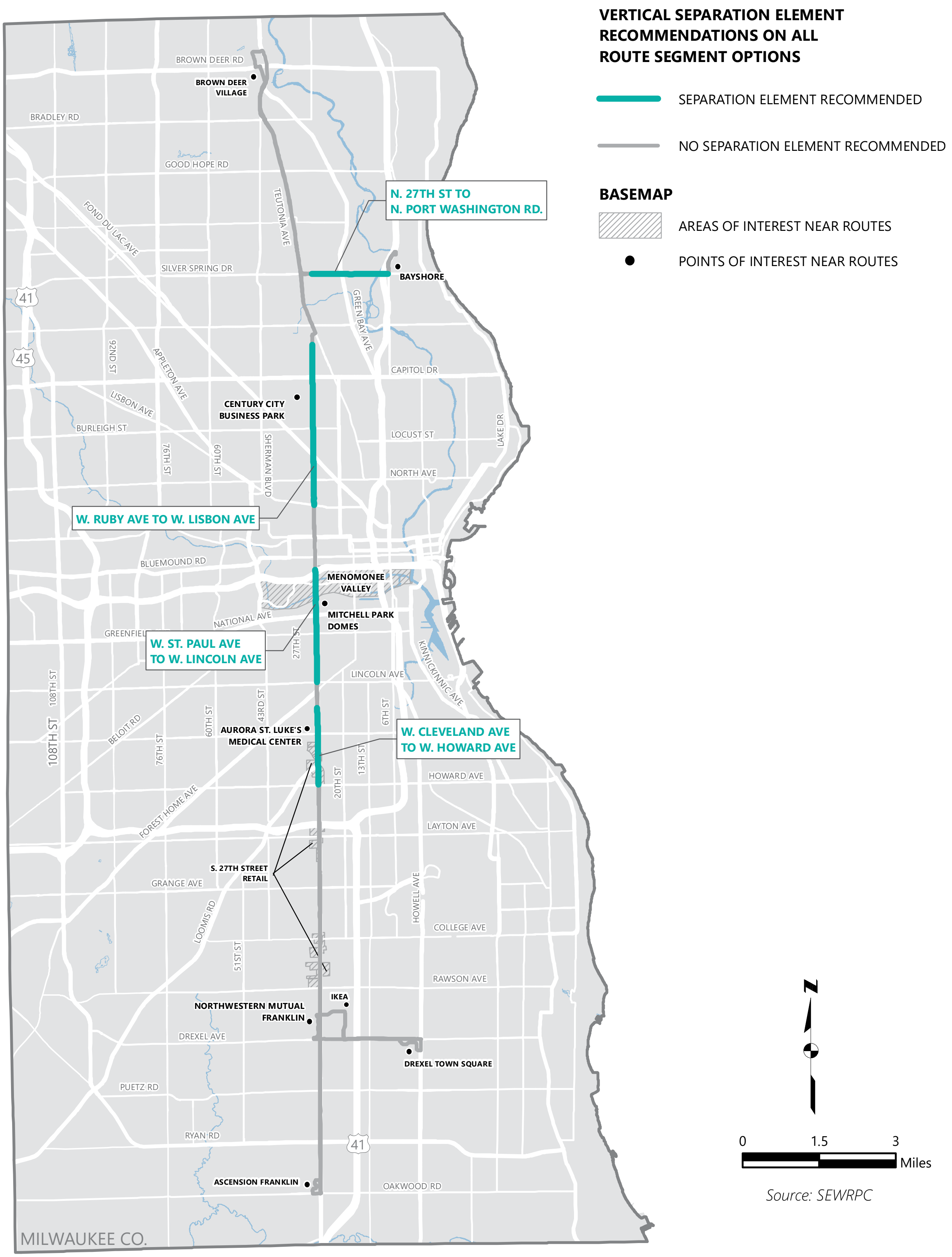
Source: Washington County, modified by BikePortland

Flexible Bollards

Source: David Meyer via Streetsblog NYC

[8] *NACTO, Transit Street Design Guide,* Pavement Markings and Colors, *nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/lane-elements/pavement-markings-color.*

Map 4.13
Segments Recommended for Vertical Separation Elements



Source: SEWRPC

4.6 BICYCLE AND PEDESTRIAN IMPACTS

With respect to this study, bicycle impacts are defined as the conversion of existing on-street dedicated bike lanes to dedicated transit lanes, or to shared bus-bike lanes. The creation of dedicated transit or traffic lanes, or shared bus-bike lanes, would improve BRT service by reducing travel times and increasing on-time performance. However, the loss of dedicated on-street bike lanes has the potential to negatively impact bicyclists. In some locations, changes in roadway configuration may present an opportunity to provide a new bike lane where one does not currently exist—positively impacting the availability of dedicated bike lanes in the corridor.

Pedestrian impacts are defined as changes to existing sidewalks, pedestrian crossings, or multi-use paths resulting from the implementation of the BRT service. While the construction of stations may require modifications to existing pedestrian facilities, safe and ADA-compliant access to and from stations will be required and, in some cases, sidewalks and safe crossing elements will need to be added to safely accommodate access to and from stations.

Methodology

Impacts to existing on-street bicycle facilities are determined by first inventorying—through the use of Google Maps and on-site surveys—the existing on-street bicycle lanes and enhanced bicycle facilities and the existing sidewalks and multi-use paths located along the study corridor. Corridor segments where a proposed dedicated transit lane would require the conversion of dedicated bike lanes to shared bus-bike lanes, or locations where roadway configurations would provide space for a new dedicated bike lane, are identified, taking into consideration the available right-of-way width, the number of existing traffic lanes, and the length of the roadway segments with on-street bicycle facilities. Based on these factors, recommendations for changes to bike facilities are made.

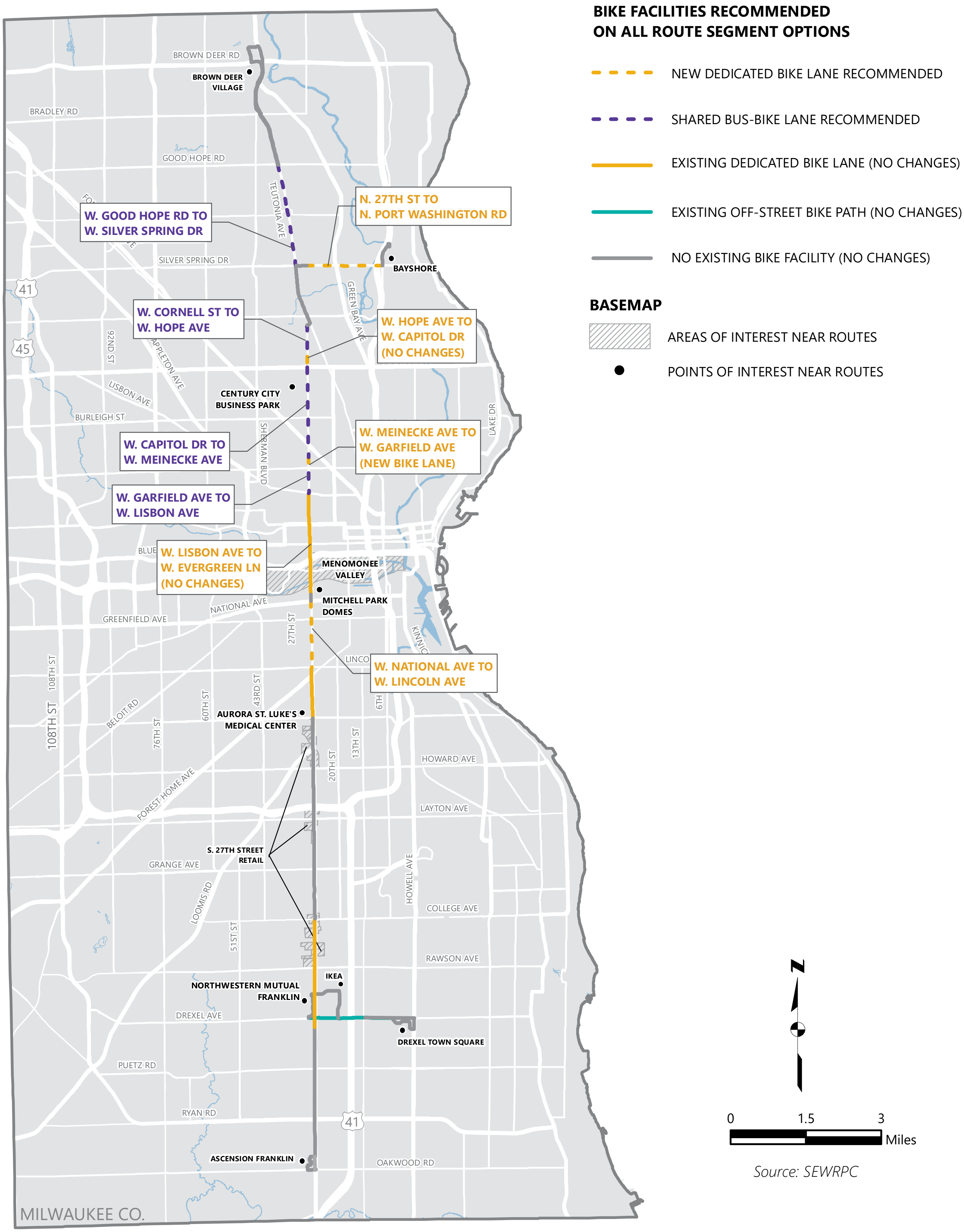
It is expected that implementation of the BRT service will not significantly impact pedestrian facilities. When station locations are further refined in future phases of the project, pedestrian infrastructure, including crossing treatments, should be added or modified to provide safe and ADA-compliant access to and from the stations. Any new or modified pedestrian infrastructure would be constructed within the existing right-of-way. At this time, the extent of impacts to pedestrian facilities is not known and therefore not included in this evaluation.

Evaluation

Based on the existing roadway configurations and recommendations for lane conversions described previously in this chapter, recommended changes to bike facilities are shown in Map 4.14. Table 4.23 shows the length of bike facilities impacted with one column representing the miles of dedicated bike lanes that are recommended to be converted to a shared bus-bike lane to accommodate the proposed BRT service, and another column representing the miles of new dedicated bike lanes that could potentially be added due to other changes in roadway configuration. Changes to bike facilities are limited to North Option 1, North Option 2, and the Central Segment. There are no segments where a bike facility would be eliminated where one currently exists.

With the introduction of shared bus-bike lanes to the corridor, both public and driver education should be considered to help bus drivers and bicyclists understand how to use the shared lane correctly. This could be done through additional signage, targeted media outreach, coordination with bicycle advocacy groups, and driver training.

Map 4.14
Recommended Changes to Bike Facilities



Source: SEWRPC

Table 4.23
Length of Dedicated Bike Lanes by Route Alternative

Route Alternative	Miles of Dedicated Bike Lanes Converted to Shared Bus-Bike Lanes	Miles of New Dedicated Bike Lanes
North Option 1 to South Option A	10.3	3.7
North Option 1 to South Option B	10.3	3.7
North Option 1 to South Option C	10.3	3.7
North Option 2 to South Option A	6.2	6.7
North Option 2 to South Option B	6.2	6.7
North Option 2 to South Option C	6.2	6.7

Source: SEWRPC

Summary of Results

Table 4.24 provides the results for the impacts to bike facilities evaluation by route alternative. Route alternatives that include North Option 2 are rated as green since fewer miles of dedicated bike lanes would be converted to shared bus-bike lanes and more miles of new dedicated bike lanes could be added on those route alternatives. Other route alternatives are rated as yellow with slightly more miles of dedicated bike lanes impacted and fewer new dedicated bike lanes expected to be added.

Table 4.24
Route Alternative Evaluation Results: Impacts to Bike Facilities

Route Alternative	Impacts to Bike Facilities
North Option 1 to South Option A	🟡
North Option 1 to South Option B	🟡
North Option 1 to South Option C	🟡
North Option 2 to South Option A	🟢
North Option 2 to South Option B	🟢
North Option 2 to South Option C	🟢

Source: SEWRPC

4.7 TRANSIT TRAVEL TIMES

Based on the estimated level of service and recommendations for dedicated transit lanes, transit travel times are provided in the following section and rated by route alternative.

Methodology

SEWRPC's Regional Travel Demand Model is used to estimate transit travel times by route alternative. The estimates are developed by first forecasting travel times between each proposed station location (including additional time for the vehicle to decelerate and accelerate and using the free flow travel time if the segment is recommended to have a dedicated transit lane) and adding a 30-second dwell time for each station location. Delays from congestion in segments where the vehicle would travel in mixed traffic and traffic signals are included in the estimate. Estimates are calculated for the morning (AM) peak, the afternoon (PM) peak, and off-peak travel times for 2025 and 2045. The AM peak period is from 6:00 a.m. to 9:00 a.m. and the PM peak is from 3:00 p.m. to 6:00 p.m. Off-peak travel times represent a free-flow condition which would be most common in the early mornings, late evenings, and on weekends.

Evaluation

Total travel time by route alternative and time of day for 2025 and 2045 are shown in Table 4.25. Travel times are expected to increase slightly between 2025 and 2045 due to the modest increases in vehicle miles traveled (and resulting congestion) expected in the corridor. Travel times for the existing PurpleLine (no-build) are expected to remain the same through 2045 since the forecast congestion speeds are higher than maximum travel speeds on the route.

Average travel speeds for all proposed BRT route alternatives are expected to be higher than the no-build alternative and range from between 5 percent (during off-peak times) to 30 percent faster than existing service. The build alternative that is most similar to the no-build in length is North Option 2 to South Option A, which is estimated to operate at anywhere from 7 to 17 minutes faster roundtrip than the existing PurpleLine. Estimated travel time improvements are a result of several factors, including fewer stops, dedicated transit lanes, and shorter dwell times. Further reductions in travel times that may result from the implementation of center-running transit lanes and queue-jump signals. Reliability improvements from vertical separation elements and conditionally applied TSP are not considered in these estimates.

Table 4.25
Estimated Travel Times by Route Alternative: 2025 and 2045

	AM Peak		PM Peak		Off-Peak	
	Roundtrip Travel Time in Minutes		Roundtrip Travel Time in Minutes		Roundtrip Travel Time in Minutes	
Route Alternative	2025	2045	2025	2045	2025	2045
North Option 1 to South Option A	137.4	137.9	136.3	136.7	134.9	134.9
North Option 1 to South Option B	148.9	149.5	147.9	148.2	146.4	146.4
North Option 1 to South Option C	145.1	145.7	144.1	144.4	142.6	142.6
North Option 2 to South Option A	125.2	125.7	124.1	124.4	122.5	122.5
North Option 2 to South Option B	135.2	135.7	134.1	134.4	132.5	132.5
North Option 2 to South Option C	130.4	130.9	129.3	129.6	127.7	127.7
No-Build (Existing PurpleLine)[a]	142.0		141.0		129.0	

[a] *Travel times for the existing PurpleLine (no-build) are expected to remain the same through 2045 since the forecast congestion speeds are higher than maximum travel speeds on the route.*

Source: SEWRPC

Summary of Results

Table 4.26 provides the results for the transit travel time evaluation by route alternative. North Option 1 to South Option A, North Option 1 to South Option C, and North Option 2 to South Option C are all rated as green and North Option 1 to South Option B, North Option 2 to South Option A, and North Option 2 to South Option B are all rated as yellow, with expected lower travel speeds during PM peak travel periods.

Table 4.26
Route Alternative Evaluation Results: Transit Travel Times

Route Alternative	Right-of-Way Impacts
North Option 1 to South Option A	●
North Option 1 to South Option B	●
North Option 1 to South Option C	●
North Option 2 to South Option A	●
North Option 2 to South Option B	●
North Option 2 to South Option C	●

Source: SEWRPC

4.8 CONCLUSIONS

Table 4.27 provides a summary of the results of all evaluations for route alternatives under the transportation system impacts evaluation. Based on the results of the evaluations outlined in this chapter, North Option 1 to South Option A, North Option 1 to South Option C, North Option 2 to South Option A, and North Option 2 to South Option C are rated as the most favorable with regard to transportation system impacts with minimal negative impacts expected and a high proportion of dedicated lanes and faster estimated transit travel times when compared to other route alternatives. The remaining alternatives are rated as yellow with slightly more yellow ratings, although significant impacts to other transportation systems are not expected with any of the route alternatives.

Table 4.27
Route Alternative Evaluation Results: Transportation System Impacts

Route Alternative	Right-of-Way Impacts	On-Street Parking Impacts	Traffic Impacts	Dedicated Transit Lanes	Impacts to Bike Facilities	Transit Travel Times	Summary
North Option 1 to South Option A	🟢	🟡	🟢	🟢	🟡	🟢	🟢
North Option 1 to South Option B	🟢	🟡	🟢	🟡	🟡	🟡	🟡
North Option 1 to South Option C	🟢	🟡	🟢	🟢	🟡	🟢	🟢
North Option 2 to South Option A	🟢	🟢	🟡	🟢	🟢	🟡	🟢
North Option 2 to South Option B	🟢	🟢	🟡	🟡	🟢	🟡	🟡
North Option 2 to South Option C	🟢	🟢	🟡	🟢	🟢	🟢	🟢

Source: SEWRPC

RIDERSHIP FORECASTS 5

5.1 OVERVIEW

This chapter describes the methodology and results of the ridership forecasts for the BRT route alternatives and the no-build alternative under consideration, the details of which are described in Chapter 2 of this report.

5.2 METHODOLOGY

Ridership forecasts for the six BRT alternatives and the no-build alternative were developed using the Federal Transit Administration (FTA) travel demand forecasting tool: Simplified Trips-on-Project Software (STOPS). STOPS is a limited implementation of the conventional four step model.

For this analysis, trip and origin-destination travel patterns are derived from 2006-10 American Community Survey (ACS) data from the U.S. Census. It also uses General Transit Feed Specification (GTFS) transit schedule data to replace the traditional coded transit network. Version 2.5 of STOPS was obtained from FTA for use in this project.

Additional data used for this analysis include forecasted future population and employment estimates for 2025 and 2045, which were developed using SEWRPC's population and employment model and future year transit maps, schedule, and travel time information developed by SEWRPC and MCTS using Remix, a public transit planning software, and SEWRPC's travel demand model. GTFS data for the existing transit system was provided by MCTS. Base ridership data was provided by MCTS and is described in more detail below. Settings for the STOPS analysis were taken from the calibration done for the East-West BRT study to ensure consistency between the studies. The STOPS model calibrates the output ridership based on actual route ridership data MCTS provided to SEWRPC. The "Fixed Guideway" factor was set to 0.3, which is a standard for BRT lines with at least 50 percent dedicated lanes, representing the advantage over a standard bus route running in mixed traffic.

This analysis considers that the proposed BRT service could be implemented in 2025, and that the service would have a life span of at least 20 years; therefore, forecasts were developed for 2025 and 2045. Transit schedule data is based on the proposed service plans described in Chapter 2 and the estimated travel times provided in Chapter 4 for the BRT route alternatives with no changes made to the existing PurpleLine service plan for the no-build alternative. The analysis also assumes that changes to other routes as described in Chapter 2 are implemented for the proposed BRT route alternatives and that the East-West BRT service, which is under construction during the writing of this report, is in service replacing the existing GoldLine for all alternatives.

Base Ridership Data

This study was conducted during a time of significant fluctuation in transit ridership, making forecasting future ridership using base ridership a difficult task for this study and others like it across the country. In 2020, the COVID-19 pandemic caused a sharp decline in transit ridership that has not fully recovered more than two years later. Since it is difficult to predict what travel behavior will look like in the coming years due to factors that include the ongoing pandemic, an expected permanent shift toward more remote work, and varying fuel prices, this study uses two different years of base ridership data—pre-pandemic 2019 ridership and the more recent and significantly lower 2021 ridership—to develop a range of estimated future ridership. Ridership on MCTS for April and May 2022 increased by approximately 20 percent over the previous year, indicating what may be the start of a ridership recovery but also likely partially due to rising gasoline prices.

5.3 EVALUATION

Tables 5.1 through 5.4 provide the following ridership forecast information for all BRT route alternatives and the no-build alternative 2025 and 2045 as a range:

- Average daily weekday boardings on each route alternative (Table 5.1)
- Average daily weekday system boardings for each route alternative (Table 5.2)
- New riders (Table 5.3)
- Vehicle miles of travel (VMT) saved (Table 5.4)

All forecasts are provided as a range using 2021 ridership data as a base for the low end of the range and 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future.

Average Daily Weekday Boardings

As shown in Table 5.1, average daily weekday boardings are expected to be significantly higher for all of the BRT route alternatives when compared to the no-build alternative with North Option 2 to South Option A expected to result in the highest average daily weekday boardings by one-way route miles in 2025 and 2045.

Table 5.1
Forecast Range of Average Daily Weekday Boardings: 2025 and 2045

Route Alternative	One-way Route Miles	Total Boardings		Boardings by Route Mile		Percent Change[a]	
		2025	2045	2025	2045	2025	2045
North Option 1 to South Option A	20.5	5,800-11,800	5,800-11,700	280-570	280-570	38-57	38-56
North Option 1 to South Option B	22.1	5,800-11,700	5,800-11,700	260-530	260-530	28-44	28-44
North Option 1 to South Option C	23.0	6,600-12,300	6,600-12,300	290-530	290-540	40-46	41-46
North Option 2 to South Option A	18.0	5,400-10,500	5,400-10,600	300-580	300-590	47-59	47-60
North Option 2 to South Option B	19.6	5,400-10,600	5,400-10,600	280-540	280-540	36-47	36-48
North Option 2 to South Option C	20.5	6,000-10,800	6,100-10,900	290-530	300-530	44-44	45-45
No-Build (Existing PurpleLine)	18.0	3,700-6,600	3,700-6,600	200-370	200-370	--	--

Note: Forecasts are provided as a range, using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future.

[a] *Percent change represents the difference between the forecast boardings for the BRT route alternatives and the no-build alternative by one-way route mile.*

Source: SEWRPC

Total System Boardings

Table 5.2 provides forecasts for total system boardings comparing ridership on the entire the MCTS system if it were to include each of the BRT route alternatives or the no-build alternative, with the implementation of all route alternatives expected to result in a net increase in ridership for the system. North Option 1 to South Option C is expected to result in the greatest overall increase in transit ridership for the system and North Option 2 to South Option A is expected to result in the greatest increase in system boardings by one-way route mile of investment for both 2025 and 2045.

Table 5.2
Forecast Total System Average Daily Weekday Boardings: 2025 and 2045

Route Alternative	One-way Route Miles	Total System Boardings		Increase in System Boardings per Route Mile of Investment	
		2025	2045	2025	2045
North Option 1 to South Option A	20.5	56,600-115,200	57,300-116,200	2,800-5,600	2,800-5,700
North Option 1 to South Option B	22.1	56,600-115,100	57,200-116,100	2,600-5,200	2,600-5,300
North Option 1 to South Option C	23.0	58,000-116,400	58,800-117,500	2,500-5,100	2,600-5,100
North Option 2 to South Option A	18.0	55,900-113,800	56,500-114,800	3,100-6,300	3,100-6,400
North Option 2 to South Option B	19.6	56,000-114,000	56,700-115,100	2,900-5,800	2,900-5,900
North Option 2 to South Option C	20.5	56,800-114,300	57,500-115,400	2,800-5,600	2,800-5,600
No-Build (Existing PurpleLine)	18.0	54,100-110,000	54,700-110,400	--	--

Note: Forecasts are provided as a range—using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future.

Source: SEWRPC

New Riders

Table 5.3 provides forecasts for the number of average weekday new riders, also referred to as incremental new riders, expected for each BRT route alternative when compared to the no-build alternative, with the proposed BRT service expected to attract anywhere from approximately 1,800 to 7,000 new riders. North Option 1 to South Option C is expected to result in the greatest number of new riders by one-way route mile, which is due in large part to serving areas not currently served by the PurpleLine.

Table 5.3
Forecast Average Weekday New Riders: 2025 and 2045

Route Alternative	One-way Route Miles	New Riders		New Riders per Mile	
		2025	2045	2025	2045
North Option 1 to South Option A	20.5	2,500-5,200	2,500-5,900	120-250	120-290
North Option 1 to South Option B	22.1	2,500-5,100	2,500-5,700	110-230	110-260
North Option 1 to South Option C	23.0	3,900-6,300	4,100-7,100	170-270	180-310
North Option 2 to South Option A	18.0	1,800-3,700	1,800-4,400	100-210	100-240
North Option 2 to South Option B	19.6	2,000-4,000	2,000-4,700	100-200	100-240
North Option 2 to South Option C	20.5	2,700-4,200	2,800-5,000	130-210	140-240
No-Build (Existing PurpleLine)	18.0	--	--	--	--

Note: Forecasts are provided as a range—using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future.

Source: SEWRPC

VMT Savings

Table 5.4 provides forecasts for average weekday VMT savings. This metric is used to understand the amount of automobile travel savings that would be experienced as a result of new riders utilizing the proposed BRT service instead of driving. The VMT estimates were produced using the person miles traveled estimate from the STOPS model and applying a factor of 1.2 to account for average automobile occupancy. North Option 1 to South Option C is expected to result in the highest VMT savings per one-way route mile of investment.

Table 5.4
Forecast Average Weekday Automobile VMT Savings: 2025 and 2045

Route Alternative	One-way Route Miles	VMT Saved		VMT Saved per Route Mile	
		2025	2045	2025	2045
North Option 1 to South Option A	20.5	6,800-14,400	6,900-14,600	330-700	340-710
North Option 1 to South Option B	22.1	7,600-15,700	7,700-15,900	340-710	350-720
North Option 1 to South Option C	23.0	12,300-19,700	12,700-20,200	530-860	550-880
North Option 2 to South Option A	18.0	4,400-9,300	4,500-9,500	240-520	250-530
North Option 2 to South Option B	19.6	6,400-12,700	6,500-13,000	330-650	330-660
North Option 2 to South Option C	20.5	8,200-12,000	8,500-12,500	400-580	410-610
No-Build (Existing PurpleLine)	18.0	--	--	--	--

Note: Forecasts are provided as a range—using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future.

Source: SEWRPC

5.4 SUMMARY OF RESULTS

Table 5.5 provides a summary of the results of all evaluations for route alternatives for the ridership forecasts analysis. Based on the results of the evaluations outlined in this chapter, North Option 1 to South Option A, North Option 1 to South Option C, North Option 2 to South Option A, and North Option 2 to South Option C are rated as green as they are generally expected to result in greater increases in boardings, new riders, and/or VMT savings per one-way route mile of investment. The remaining route alternatives are rated as yellow with lower increases in these metrics generally expected.

Table 5.5
Route Alternative Evaluation Results: Ridership Forecasts

Route Alternative	Average Daily Weekday Boardings	Increase in System Boardings	New Riders	VMT Saved	Summary
North Option 1 to South Option A	🟢	🟡	🟢	🟢	🟢
North Option 1 to South Option B	🟡	🟡	🟡	🟡	🟡
North Option 1 to South Option C	🟢	🟢	🟢	🟢	🟢
North Option 2 to South Option A	🟢	🟢	🟡	🟡	🟢
North Option 2 to South Option B	🟡	🟡	🟡	🟡	🟡
North Option 2 to South Option C	🟡	🟡	🟢	🟢	🟢

Source: SEWRPC

ENVIRONMENTAL IMPACTS 6

6.1 OVERVIEW

In this chapter, BRT route alternatives are evaluated based on the expected environmental impacts of changes to vehicle miles traveled (VMT) using the Federal Transit Administration's (FTA) methodology for Small Starts projects, and the potential impacts to historic and cultural resources. As previously shown in the Tier 1 Evaluation, the BRT route alternatives that remain under consideration would not directly impact nearby parks, waterways, or natural areas. As part of the updated alignment for the North Option 2 to South Option route alternative, Falk Park would be adjacent to the extension of Northwestern Mutual Way, east of S. 27th Street, in Oak Creek.

6.2 AIR QUALITY, GREENHOUSE GASES, ENERGY USAGE, AND SAFETY

The following section evaluates the BRT route alternatives based on expected impacts to air quality, greenhouse gases, energy usage, and safety using the FTA methodology for Small Starts projects, which uses changes to VMT to estimate these impacts. Small Starts guidance includes safety as an environmental benefit.

The proposed BRT service is expected to result in a reduction of automobile VMT due to increased ridership, a reduction in VMT for diesel buses due to the elimination of the PurpleLine and changes to other routes, and an increase in VMT for electric buses that will be used on the service. These combined changes would result in a net decrease in VMT for each route alternative with greater decreases expected for route alternatives that include North Option 1, which are expected to result in more new riders (see Chapter 5) and are generally longer, and smaller decreases are expected for route alternatives that include North Option 2.

Table 6.1 shows a range of estimated changes in annual VMT for autos and a static VMT value in 2025 and 2045 for diesel and electric buses by route alternative. Automobile VMT and, subsequently, net changes to annual VMT are a function of ridership estimates and are provided as a range using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future, as described in Chapter 5. Bus VMT is not shown as a range because it is not expected to change within the estimated range of ridership. See Chapter 5 for more detailed information regarding ridership forecasts.

Table 6.1
Estimated Changes to Annual Vehicle Miles Traveled (VMT) by Vehicle Type and Route Alternative: 2025 and 2045

Vehicle Type and Year		Route Alternative					
		North Option 1 to South Option A	North Option 1 to South Option B	North Option 1 to South Option C	North Option 2 to South Option A	North Option 2 to South Option B	North Option 2 to South Option C
Automobile	2025	-4,913,000 to -2,331,000	-5,347,200 to -2,604,700	-6,710,000 to -4,202,300	-3,165,000 to -1,501,800	-4,336,700 to -2,180,700	-4,076,400 to -2,793,400
	2045	-4,990,500 to -2,361,700	-5,428,200 to -2,631,400	-6,900,400 to -4,339,200	-3,235,500 to -1,524,600	-4,416,500 to -2,202,300	-4,253,700 to -2,913,600
Bus – Diesel	2025	-771,800	-771,800	-771,800	-692,200	-692,200	-692,200
	2045	-771,800	-771,800	-771,800	-692,200	-692,200	-692,200
Bus – Electric	2025	770,700	883,100	944,700	599,800	703,700	773,800
	2045	770,700	883,100	944,700	599,800	703,700	773,800
Net Changes to Annual VMT	2025	-4,914,100 to -2,332,100	-5,235,900 to -2,493,400	-6,537,100 to -4,029,400	-3,257,400 to -1,594,200	-4,325,200 to -2,169,200	-3,994,800 to -2,711,800
	2045	-4,991,600 to -2,362,800	-5,316,900 to -2,520,100	-6,727,500 to -4,166,300	-3,327,900 to -1,617,000	-4,405,000 to -2,190,800	-4,172,100 to -2,832,000

Note: Automobile VMT and, subsequently, net changes to annual VMT are a function of ridership estimates and are provided as a range, using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future. Bus VMT is not shown as a range because it is not expected to change within the estimated range of ridership.

Source: SEWRPC

Methodology

The FTA Small Starts reporting tool[9] uses a conversion factor to estimate changes in regional air quality pollutants, greenhouse gas emissions, energy usage, and injuries and fatalities based on changes in VMT. These estimates are also provided as a range to account for the range of net changes in VMT used in this analysis. Regional air quality pollutants include carbon monoxide (CO), mono-nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulate matter ($PM_{2.5}$). Table 6.2 lists each of the conversion factors by vehicle type. Changes in VMT are estimated using ridership forecasts developed using FTA's STOPS model (described in Chapter 5), and SEWRPC's regional travel demand model. The current vehicle occupancy average of 1.2 people per vehicle is used for this analysis.

Table 6.2
FTA Factors Applied to Air Pollutants, Greenhouse Gas Emissions, Energy Usage, and Safety Changes by Vehicle Type: 2025 and 2045

FTA Factors Applied		Year	Vehicle Type		
			Automobile	Bus – Diesel	Bus - Electric
Air Pollutants (grams/VMT)	CO	2025	16.77	5.83	6.45
		2045	10.26	2.89	5.04
	NO_X	2025	0.91	8.67	5.83
		2045	0.20	1.14	3.98
	VOCs	2025	0.60	0.73	0.12
		2045	0.21	0.16	0.10
	$PM_{2.5}$	2025	0.01	0.48	0.39
		2045	0.01	0.03	0.03
Greenhouse Gases (CO_2e/VMT)		2025	532	3,319	2,934
		2045	397	2,721	2,303
Energy Use (Btu/VMT)		2025	7,559	41,436	--[a]
		2045	5,633	33,978	--[a]
Safety (per million VMT)	Fatal Crashes	2025	0.013	0.004	0.004
		2045	0.013	0.004	0.004
	Injuries	2025	0.195	1.824	1.458
		2045	0.195	1.824	1.458

[a] *The FTA Small Starts Reporting Template does not provide an energy use conversion for electric buses.*

Source: FTA Small Starts Reporting Templates, 5/14/2021

[9] *www.transit.dot.gov/funding/grant-programs/capital-investments/small-starts-reporting-instructions.*

Air Quality and Energy Usage

Expected net changes in CO, NO_X, VOCs, and $PM_{2.5}$ are shown in Table 6.3 and net changes in greenhouse gases (CO_2e), and energy usage are shown in Table 6.4 for each BRT route alternative when compared to the no-build. For all the BRT route alternatives, reductions in CO, VOCs, CO_2e, and energy usage are expected in both 2025 and 2045 with larger reductions expected in 2025.

Nitrogen oxides and $PM_{2.5}$ are expected to be reduced in 2025 but increase in 2045 for all BRT route alternatives when compared to the no-build. This is because emissions generated by automobiles are expected to see more significant reductions over the next two decades as the vehicle fleet turns over and newer cleaner vehicles replace older vehicles. Electric vehicles already produce significantly lower emissions, and some of the emissions are tied to power generation, which is expected to experience emissions reductions at a slower rate of decline than fossil-fueled vehicles. This results in a net increase in these two emissions.

Table 6.3
Net Changes in Air Pollutants: 2025 and 2045

Route Alternatives	Air Pollutants (kg)							
	CO		NO_X		VOCs		$PM_{2.5}$	
	2025	2045	2025	2045	2025	2045	2025	2045
North Option 1 to South Option A	-81,920 to -38,620	-49,550 to -22,580	-6,670 to -4,320	1,190 to 1,720	-3,420 to -1,870	-1,090 to -540	-130 to -100	160 to 180
North Option 1 to South Option B	-88,480 to -42,480	-53,470 to -24,780	-6,410 to -3,910	1,550 to 2,110	-3,670 to -2,020	1,180 to -590	-90 to -60	190 to 210
North Option 1 to South Option C	-110,930 to -68,880	-68,270 to -41,990	-7,290 to -5,010	1,500 to 2,010	-4,480 to -2,970	-1,480 to -940	-80 to -60	190 to 220
North Option 2 to South Option A	-53,240 to -25,350	-32,170 to -14,620	-5,380 to -3,870	950 to 1,290	-2,330 to -1,330	-730 to -370	-140 to -120	130 to 140
North Option 2 to South Option B	-72,220 to -36,070	-43,770 to -21,050	-5,850 to -3,880	1,130 to 1,570	-3,020 to -1,730	-970 to -500	-110 to -90	150 to 170
North Option 2 to South Option C	-67,410 to -45,890	-41,740 to -27,990	-5,200 to -4,030	1,440 to 1,710	-2,860 to -2,090	-930 to -650	-80 to -70	170 to 180

Source: SEWRPC

Table 6.4
Net Changes in Greenhouse Gases and Energy Usage: 2025 and 2045

Route Alternatives	Greenhouse Gases (metric tons)		Energy Usage (Million Btu)	
	2025	2045	2025	2045
North Option 1 to South Option A	-2,910 to -1,540	-2,310 to -1,260	-69,100 to -49,600	-54,300 to -39,500
North Option 1 to South Option B	-2,820 to -1,360	-1,110 to -2,220	-72,400 to -51,700	-56,800 to -41,000
North Option 1 to South Option C	-3,360 to -2,030	-1,650 to -2,660	-82,700 to -63,700	-65,100 to -50,700
North Option 2 to South Option A	-2,220 to -1,340	-1,110 to -1,790	-52,600 to -40,000	-41,700 to -32,100
North Option 2 to South Option B	-2,540 to -1,390	-1,140 to -2,020	-61,500 to -45,200	-48,400 to -35,900
North Option 2 to South Option C	-2,220 to -1,510	-1,260 to -1,790	-59,500 to -49,800	-47,500 to -39,900

Source: SEWRPC

Traffic Safety
Shown in Table 6.5, small reductions in injuries and fatalities are expected as a result of the net reduction in VMT. As noted above, ridership and VMT have been forecast using a range because of the recent variations in transit ridership due to the COVID-19 pandemic, and therefore, the net changes to injuries and fatalities are also shown as a range. It is expected that additional reductions in injuries and fatalities—not quantified in Table 6.5—may occur due to reduced excessive automobile travel speeds in the portions of the corridor proposed for physically-separated bus lanes. These reductions could be expected to be similar across all alternatives.

Table 6.5
Net Changes in Injuries and Fatalities: 2025 and 2045

	Injuries		Fatalities	
Route Alternatives	2025	2045	2025	2045
North Option 1 to South Option A	-1.24 to -0.03	-1.26 to -0.03	-0.06 to -0.03	-0.06 to -0.03
North Option 1 to South Option B	-1.16 to -0.03	-1.18 to -0.03	-0.07 to -0.03	-0.07 to -0.03
North Option 1 to South Option C	-1.34 to -0.05	-1.38 to -0.06	-0.09 to -0.05	-0.09 to -0.06
North Option 2 to South Option A	-1.01 to -0.02	-1.02 to -0.02	-0.04 to -0.02	-0.04 to -0.02
North Option 2 to South Option B	-1.08 to -0.03	-1.10 to -0.03	-0.06 to -0.03	-0.06 to -0.03
North Option 2 to South Option C	-0.93 to -0.04	-0.96 to -0.04	-0.05 to -0.04	-0.05 to -0.04

Source: SEWRPC

Summary of Results
Table 6.6 provides the results of the regional air quality pollutant, greenhouse gases, energy usage, and safety evaluations, which are a function of expected changes to VMT. Route alternatives rated as green, which are estimated to result in greater net reductions in VMT, are expected to result in greater net benefits as it relates to these metrics and those rated as yellow are expected to provide smaller net benefits when compared to the no-build alternative.

Table 6.6
Route Alternative Evaluation Results: Air Pollutants, Greenhouse Gas, Energy Usage and Safety

Route Alternative	Air Pollutants	Greenhouse Gases	Energy Usage	Safety	Summary
North Option 1 to South Option A	🟢	🟢	🟢	🟢	🟢
North Option 1 to South Option B	🟢	🟢	🟢	🟢	🟢
North Option 1 to South Option C	🟢	🟢	🟢	🟢	🟢
North Option 2 to South Option A	🟡	🟡	🟡	🟡	🟡
North Option 2 to South Option B	🟡	🟡	🟡	🟡	🟡
North Option 2 to South Option C	🟡	🟡	🟡	🟡	🟡

Source: SEWRPC

6.3 HISTORIC AND CULTURAL RESOURCES

Historic and cultural resources are structures, historic districts, artifacts, and burial sites that represent the heritage of the United States. A description and the number of inventoried historical and cultural resources located within the service area of the BRT route alternatives are provided in the following sections.

Methodology
Historic properties are those buildings, structures, and objects that are eligible for and listed on the National Register of Historic Places (NRHP), the Wisconsin Historic Preservation Database, or have local historic preservation designation. Generally, structures are determined to be historic if they are considered significant regarding architecture, archeology, engineering, or culture. Historic districts are those neighborhoods or areas with clusters of historic properties or that signify a historic event within the same geographic area.

Cultural resources are defined as those that depict past human activity, including burial sites, marked and unmarked cemeteries, and cultural sites that may include artifacts, sites, structures, landscapes, and objects.

Historic and cultural information has been determined using data from the National Register of Historic Places (NRHP), the Wisconsin Historical Society and local historic preservation entities. Other historic and cultural resources may be present in the area, but not yet inventoried in the databases.

Evaluation

With the physical disturbance expected to occur only in the curb-to-curb area of the roadway for the construction of the BRT service along all of the route alternatives, the effect on these resources is expected to be minimal. However, during the environmental phase of the project, consultation with the Wisconsin State Historic Preservation Office (SHPO) will take place and an area of potential effect (APE) will be determined based on the recommended alternative and any changes that may be determined during the design phase of the project. Historic and cultural sites within the APE will be evaluated for impacts and documented according to Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA).

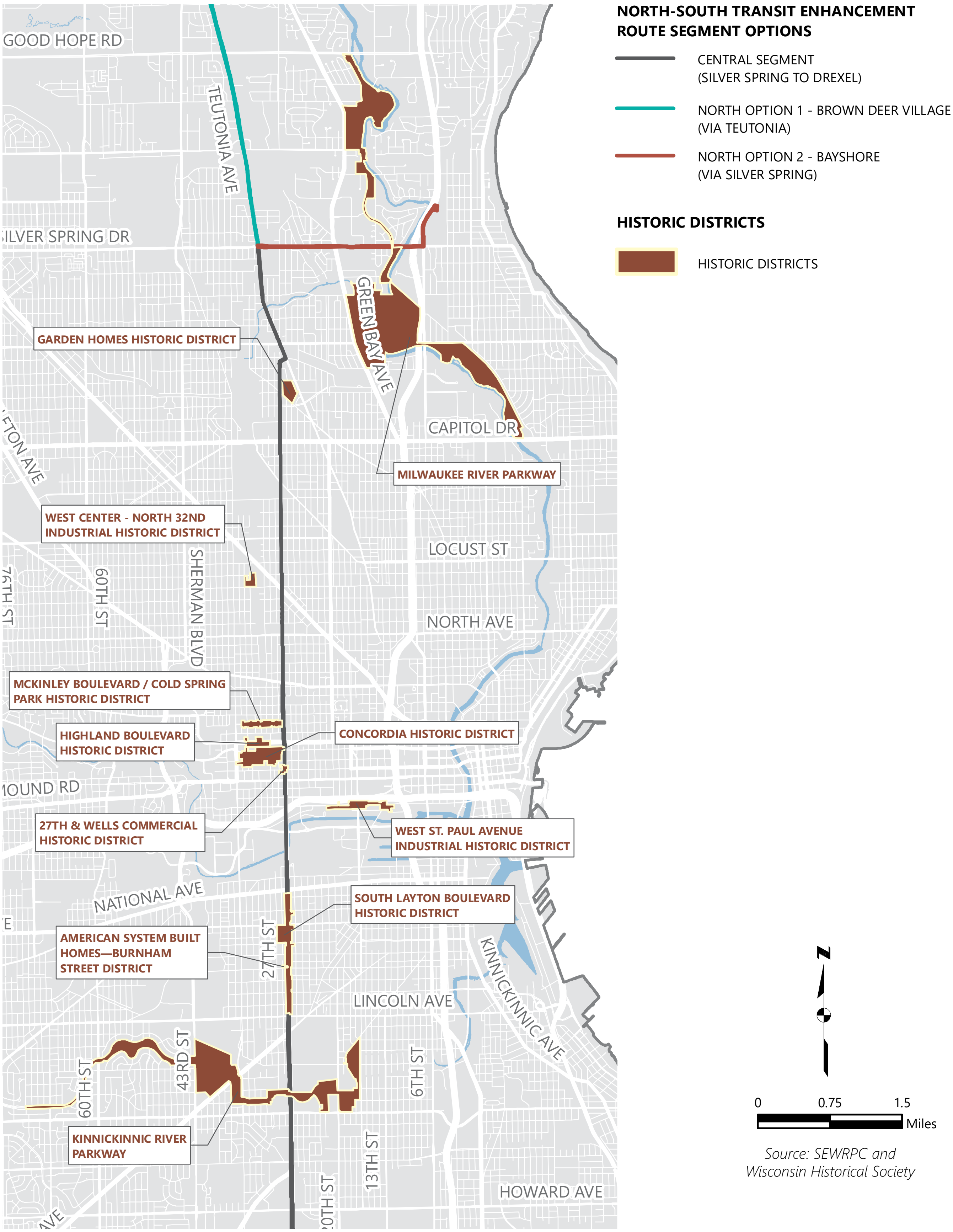
An inventory of historical and cultural resources present within a half mile of each of the remaining alternatives is listed in Table 6.7. Map 6.1 shows the historic districts that are present within a half mile of the route alternatives.

Table 6.7
Historic and Cultural Properties

Route Alternative	Historic Properties (Architecture and Historic Inventory)	Cultural Resources (Archaeological Site Inventory)
North Option 1 to South Option A	3,059	40
North Option 1 to South Option B	3,072	44
North Option 1 to South Option C	3,074	49
North Option 2 to South Option A	3,639	33
North Option 2 to South Option B	3,652	37
North Option 2 to South Option C	3,654	42

Source: Wisconsin Historical Society and SEWRPC

Map 6.1
Historic Districts Within the Study Area



Source: SEWRPC and Wisconsin Historical Society

Summary of Results

Table 6.8 shows the results of the impacts to historic and cultural resources evaluation. There are historic districts, historic properties, and cultural resources present near the BRT route alternatives, however, since the construction activities will not disturb these resources, all are rated with a green dot. However, a final determination of any visual, noise or other impacts to these resources will be performed during the environmental and design phase of the project in accordance with Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA).

Table 6.8
Route Alternative Evaluation Results: Impacts to Historic and Cultural Resources

Route Alternative	Historic Districts	Historic Properties	Cultural Resources	Summary
North Option 1 to South Option A	🟢	🟢	🟢	🟢
North Option 1 to South Option B	🟢	🟢	🟢	🟢
North Option 1 to South Option C	🟢	🟢	🟢	🟢
North Option 2 to South Option A	🟢	🟢	🟢	🟢
North Option 2 to South Option B	🟢	🟢	🟢	🟢
North Option 2 to South Option C	🟢	🟢	🟢	🟢

Source: SEWRPC

6.4 CONCLUSIONS

Table 6.9 summarizes the conclusions of the environmental impacts evaluation. Because BRT route alternatives that include Route Option 1 are expected to result in a greater net decrease in VMT, and in turn, result in greater improvements to air quality, lower energy usage, and greater reductions in injuries and fatalities, those route alternatives are rated as green. The remaining route alternatives are rated as yellow, as they would still be expected to result in a net benefit to the environment, but to a slightly lesser degree.

Table 6.9
Route Alternative Evaluation Results: Environmental Impacts

Route Alternative	Air Pollutants, Greenhouse Gas, Energy Usage and Safety	Historic & Cultural Resources	Summary
North Option 1 to South Option A	🟢	🟢	🟢
North Option 1 to South Option B	🟢	🟢	🟢
North Option 1 to South Option C	🟢	🟢	🟢
North Option 2 to South Option A	🟡	🟢	🟡
North Option 2 to South Option B	🟡	🟢	🟡
North Option 2 to South Option C	🟡	🟢	🟡

Source: SEWRPC

CAPITAL COSTS 7

7.1 OVERVIEW

In this chapter, the costs required to build the proposed BRT service are detailed and analyzed for the each of the BRT route alternatives. The details of each of the route alternatives are described in Chapter 2, Detailed Definition of Alternatives. The features of the BRT service, information, limitations, and methodology used to determine the route alternative capital cost estimates are described in the sections below. For the purpose of estimating costs for this project, no additional capital costs are attributed to the no-build alternative.

7.2 CAPITAL COSTS

Capital costs are those construction and purchasing costs associated with each of the proposed BRT service route alternatives under consideration. The cost estimates, required to apply for the FTA's capital investment grant program, provided in this chapter also include professional services costs for the environmental documentation, transit roadway design, and station design. In addition, a thirty percent contingency has been added to the cost estimates, which is appropriate at this early stage. The capital cost estimates for this feasibility study are not intended be a detailed, final cost estimate, but rather they provide a high-level, magnitude of cost comparison for the route alternatives appropriate for the level of planning undertaken in this study. Where noted, higher line-item costs were used to ensure the cost estimate would cover the project options. During the next phases of the project, a more accurate line item-based cost estimate can be developed when more detailed environmental and engineering information is available.

Methodology

FTA has developed a breakdown of costs for capital projects pursuing FTA funds called standard cost categories (SCC) and a workbook that uses the cost categories to develop transit project capital cost estimates. Table 7.1 lists the main cost categories, the typical items for each cost category, a description of the category and sub-category costs, some specific cost items for this project, and the method used to calculate each cost item.

The FTA SCC workbook provides a calculation for each cost item to determine cost estimates for each of the route alternatives. The value for each cost item was derived from estimated and actual costs from the Milwaukee East-West BRT project, under construction as of the writing of this report, and the Wisconsin Department of Transportation's (WisDOT) construction average unit price list[10] and are calculated using the more expensive options for curb-protected lanes (center-running) and buses with opening doors on both sides that are required for the center-running recommended segments. The cost estimates were also compared to construction costs for other BRT projects in Pittsburgh, Cleveland, and Boston by checking each project's cost categories using FTA's Capital Cost Database.[11]

In addition, each cost item was inflated using published inflation rates based on the Engineering News-Record (ENR) magazine's construction cost index (CCI). The ENR CCI was then used to calculate an inflation factor of seven percent to estimate 2021 costs based on the 2019 East-West BRT cost items. An average annual inflation rate of approximately four percent was used to estimate costs for the years 2022 through 2026. The anticipated year that each item would be purchased or constructed was estimated, and the costs were then inflated to reflect the year of expenditure.

[10] *wisconsindot.gov/hccidocs/contracting-info/average-unit-price.pdf.*

[11] *www.transit.dot.gov/capital-cost-database.*

Table 7.1
FTA's Standard Cost Categories

Category Number	Cost Items	Description of Costs Covered
10	Guideway and Track Elements	Roadway configuration (using existing curb-to-curb roadway) where the transit vehicles operate, calculated by length
20	Stations, Stops, Terminals, Intermodal Facilities	Stations, platforms, passenger amenities, including one restroom, calculated by number of items
30	Support Facilities: Yards, Shops, Administration Buildings	Transit maintenance and storage facilities. There are no costs attributed to additions or upgrades to maintenance facilities for this project
40	Sitework and Special Conditions	Construction, demolition, and earthwork that is not included in stations and support facilities, such as curb and bollard transit lane delineation included along high pedestrian crash segments, utility costs, roadway construction beyond what is covered in guideway and track elements, and street scaping/landscaping, calculated by length
50	Systems	Traffic signal infrastructure, communications, central systems control, calculated by length, and next bus automated signage, ticket vending, and ticket validators, calculated by number of units
60	Right-of-Way, Land, Existing Improvements	Includes expected land purchase or easements required for the roadway, stations, or parking areas, calculated by length
70	Vehicles	Buses and spare parts for electric, dual door, forty-foot buses and two on-route fast bus chargers, calculated by number of items
80	Professional Services (applies to categories 10 – 50)	Environmental analysis and documentation, design of roadway configuration, supporting infrastructure and stations, construction administration and management, legal document costs, pre-construction surveys, inspection and testing, and construction startup costs (calculated as a percentage of infrastructure costs)
90	Unallocated Contingency (applies to categories 10 – 80)	Percentage added for unanticipated future costs and escalation. This cost estimate includes a contingency of thirty percent
100	Finance Charges	Costs related to financing the project. A financial plan for the project has not been developed at this time, but will be determined in later phases of the project, therefore, no finance charges have been included in the cost estimates

Source: FTA and SEWRPC

Estimating Capital Costs for BRT Alternatives
As mentioned above, FTA's SCC workbook was used for the route alternative cost estimates using cost categories, and each cost category is calculated based on segment length or item quantity, and unit cost. Table 7.2 shows the variable length and number of units for each of the route alternatives.

Table 7.2
Cost Calculation Quantities by Route Alternative

Route Variables	North Option 1 to South Option A	North Option 1 to South Option B	North Option 1 to South Option C	North Option 2 to South Option A	North Option 2 to South Option B	North Option 2 to South Option C
Route Length (one-way, miles)	20.40	22.05	22.95	17.95	19.60	20.50
Exclusive transit lanes (one-way, miles)	16.5	16.5	19.95	14.20	14.20	17.60
Length of center-running curb-protected lanes (one way, miles)[a]	6.5	6.5	6.5	7.86	7.86	7.86
Stations (bi-directional)	68	73	71	63	68	66
Number of buses[b]	27	29	27	24	27	26

[a] *Cost for center-running curb-protected lanes was used for cost estimating since it is the most expensive option. Outside-running curb-protected lanes will also be included with recommendations for outside-running BRT segments.*

[b] *The cost for buses with dual doors, left- and right-opening doors, are required for center-running BRT segments and, therefore, are included in the cost estimate since they represent the most expensive option, a cost increase of approximately 10 percent.*

Source: SEWRPC

As described in Table 7.1, the following cost categories were calculated by the one-way route length: (10) Guideway and Track Elements, including costs based on the length of dedicated transit lanes and mixed traffic lanes for each alternative, (40) Sitework and Special Conditions, except a flat fee was used for anticipated additional utility costs, (50) Systems, except a line item for the fare collection system and equipment used unit costs since recent purchase data was available from the East-West BRT project, and (60) Right-of-Way, Land and Existing Improvements, although a value of $500,000 in 2021 dollars was used to cover the cost for obtaining easements for each route alternative based on easement costs for the East-West BRT project. The cost categories that are based on unit costs include: (20) Stations, Stops, and Terminals, including a restroom that may be required at each end of all route alternatives, and (70) Vehicles. Costs for (80) Professional Services are estimated by multiplying a percentage (19.4 percent) to the construction subtotal (categories 10 – 50).

The (10) Guideway and Track Elements cost estimates were prepared for each of the alternatives based on the recommended lengths of dedicated transit lanes and mixed traffic lanes. However, specific consideration as to whether dedicated outside-running transit lanes or dedicated center-running transit lanes are used is not included in the cost estimate. The costs that would vary based on whether dedicated center- or outside-running transit lanes include the number of stations—dedicated center-running BRT systems may reduce station costs by sharing stations in some areas, but those details will be determined in later phases of the project—and the addition of vertical separation elements, which provide a physical barrier between the transit lane and general-purpose travel lanes.

For this cost estimate, vertical separation elements are defined as a raised concrete curb with 36-inch-high bollards every six feet; however, other treatment options may be considered in future phases of this project. Vertical separation elements are recommended in parts of the study corridor that have been identified as having a prevalence of reckless driving and pedestrian crashes—more details, including specific segments recommended for this treatment, are provided in Chapter 4. The length of vertical separation elements would vary based on whether dedicated center-running transit lanes or dedicated outside-running lanes are present. Dedicated outside-running transit lanes would require more curb openings to accommodate driveways and right turns, whereas vertical separation elements along a dedicated center-running transit lane would be more continuous, with gaps needed only for median openings and intersections that would require cross traffic usage. The cost for the vertical separation elements were calculated for a dedicated center-running transit lane to provide a more conservative cost estimate.

The East-West BRT project's forty-foot electric buses were used as the base vehicle cost. However, vehicles with dual-side doors would be required if a dedicated center-running transit lane with stations in the median is used on portions of the proposed BRT service. To account for this possibility, an extra 10 percent was added to base cost of the East-West BRT vehicles. The estimated number of buses that would be needed for each route alternative, listed in Table 7.2, was calculated based on anticipated electric charging requirements for the buses, although once in use on the East-West BRT corridor, charging and usage efficiencies may be realized for a reduction in the number of buses required for this corridor.

Capital Cost Estimates

Table 7.3 provides the estimated total cost and cost by category for each route alternative, inflated to the year of expenditure and including the applied contingency of 30 percent (standard cost category 90). These estimated costs were developed using cost data from the East-West BRT project, the WisDOT construction pricing data, and the previous costs items as described in the Methodology section above.

Table 7.3
Cost Estimates by Route Alternative in Year of Expenditure

Standard Cost Categories	North Option 1 to South Option A ($)	North Option 1 to South Option B ($)	North Option 1 to South Option C ($)	North Option 2 to South Option A ($)	North Option 2 to South Option B ($)	North Option 2 to South Option C ($)
10	4,526,900	4,777,400	5,212,900	3,955,600	4,206,200	4,637,300
20	9,093,200	9,720,600	9,469,600	8,465,800	9,093,200	8,842,200
30	0	0	0	0	0	0
40	42,204,000	45,278,500	47,600,200	38,268,500	41,343,000	43,032,800
50	12,809,800	13,858,400	13,851,700	11,869,800	12,924,900	12,924,600
60	584,000	584,000	584,000	584,000	584,000	584,000
70	44,370,600	47,570,800	44,370,600	39,570,300	44,370,600	42,770,500
80	12,364,400	13,273,400	13,731,200	11,248,200	12,158,200	12,505,000
90	37,785,800	40,519,000	40,446,100	34,188,600	37,404,000	37,588,900
100	0	0	0	0	0	0
Total Estimate[a]	163,738,600	175,582,100	175,266,300	148,150,700	162,084,100	162,885,400

[a] *Rounded to nearest $100.*

Source: SEWRPC

Summary of Cost Estimates

Table 7.4 provides a summary with a rating for all route alternative capital cost estimates using green, yellow, and red dots to signify the magnitude of cost. Based on the results of the evaluations outlined in this chapter, North Option 2 to South Option A is rated as green as the least expensive route alternative. North Option 1 to South Option A, North Option 2 to South Option B, and North Option 2 to South Option C have relatively similar capital cost impacts that are all a moderate amount higher than the least expensive alternative and, therefore, are rated as yellow. North Option 1 to South Option B and North Option 1 to South Option C are rated as red as they are the most expensive route alternatives.

Table 7.4
Summary of Capital Cost Estimates for Route Alternatives

Route Alternatives	Capital Costs
North Option 1 to South Option A	
North Option 1 to South Option B	
North Option 1 to South Option C	
North Option 2 to South Option A	
North Option 2 to South Option B	
North Option 2 to South Option C	

Source: SEWRPC

OPERATING AND MAINTENANCE COSTS 8

8.1 OVERVIEW

In this chapter, proposed BRT route alternatives are evaluated based on the estimated operating and maintenance (O&M) costs, including any changes to other MCTS routes that would be made with the implementation of the proposed BRT route alternatives. Changes to the other transit routes are described in Section 2.6, "Proposed Changes to Other Routes," of Chapter 2. The information and methodology used to estimate O&M costs, the O&M cost estimates, and route alternative evaluation are provided in the following sections.

8.2 OPERATING AND MAINTENANCE COSTS

Operating costs for the proposed BRT service route alternatives are those derived from labor, including the time required to pull the electric buses in and out of service and layover time, benefits, insurance, security and fare enforcement, tires, and utility costs required to run the electric buses, stations, and bus chargers. The electricity operational costs of the BRT service include those for overhead charging at each end of the route, plug-in charging at the maintenance garage, and electricity costs at the BRT stations.

Maintenance costs include those associated with maintaining the electric buses, electric bus chargers, stations, station platforms, bus ticketing and fare validation machines, and the automated electric bus arrival signage. In addition, O&M costs for a restroom for bus operators is included, as it is expected that a restroom will be needed at the terminus of the southern BRT route options.

Operation and maintenance costs for proposed changes to other routes, which would be made if the proposed BRT service was implemented, are also included in this analysis to provide an estimate of the total cost impact on the MCTS annual operating budget. Operating costs for these routes include labor, benefits, insurance, security, utilities, tires, and oil and fuel used for the buses that would operate on the other routes. Maintenance costs for these routes include those required to maintain clean diesel buses and bus stops.

Methodology

The O&M costs for the BRT and underlying local service are estimated by multiplying the cost per operating hour and the number of platform hours required for the service. Platform hours are a combination of revenue hours (which include service and layover time), plus deadhead hours (which include the time it takes for buses to travel to and from the maintenance garage). In this evaluation, the O&M costs do not specifically account for possible variations in BRT running types. The O&M costs are based on platform hours which may change slightly depending on what lengths of the route are running in mixed-traffic, a dedicated center lane, or a dedicated outside lane, and the deadhead hours may change to account for the number of buses required to maintain headways and service schedule. Chapter 4 provides recommendations for running types for each segment option.

Estimating Operating and Maintenance Costs for BRT Alternatives

MCTS determined the BRT service operating cost per hour to be $120.19 in 2022 dollars by reviewing the annual operations and maintenance budget and applying a percentage for the total O&M costs that would be used for BRT-specific services, including those for the East-West BRT service, which is expected to start service in Spring 2023 with costs similar to the proposed BRT service in this corridor. To estimate BRT operating costs for an expected start of service in 2027, MCTS applied a two percent inflation rate per year, which reflects expected changes in materials, labor rates, and benefit costs, including the rising health insurance cost trends, which resulted in an estimated BRT service operating cost per hour in 2027 of $132.70.

Estimating Operating and Maintenance Costs for Changes to Other Routes

The O&M costs for other transit routes that would be modified with the implementation of the proposed BRT service were determined to estimate the cost impacts of these changes. These routes are expected to use the same vehicles that are used today on local fixed route transit service. The operating cost per hour for these routes is $120.39 in 2022 and, with an applied two percent per year inflation rate, is expected to be $132.92 in 2027. As with the BRT O&M costs, MCTS determined this operating cost per hour based on a percentage of the overall MCTS O&M annual budget.

Additional Operating and Maintenance Costs

The bus operator restrooms are not included in the BRT O&M costs per hour, so they are included as a separate O&M cost item. For the purposes of the cost estimates, a restroom is included at the northern and southern ends of all proposed BRT route alternatives. A similar, operator-only restroom is included in the East-West BRT service with a cost of $620 per month to operate and maintain in 2022. That cost was inflated by two percent per year for an O&M cost of $1114.64 per month or $13,376, and rounded to $13,400, per year in 2027 for each restroom.

BRT Cost Estimates

Table 8.1 shows the estimated O&M costs for each of the proposed BRT route alternatives and the no-build alternative (the existing MCTS PurpleLine). These costs are calculated by multiplying the operating costs per hour in 2027 dollars by the platform hours and adding the estimated O&M cost for two operator restrooms. The no-build alterative has the least expensive annual O&M cost at $10,757,700, followed by North Option 2 to South Option A at $11,512,400. The proposed BRT alternative with most expensive O&M costs is North Option 1 to South Option B at $13,743,900.

Table 8.1
Estimated Operating and Maintenance Costs by Route Alternative: 2027

	Proposed BRT Routes Alternatives						
Operating and Maintenance Costs (O&M)	North Option 1 to South Option A	North Option 1 to South Option B	North Option 1 to South Option C	North Option 2 to South Option A	North Option 2 to South Option B	North Option 2 to South Option C	**No-Build Alternative**
Operating Costs per Hour[a] ($)	132.70	132.70	132.70	132.70	132.70	132.70	132.92
Platform Hours	94,591	103,369	97,271	86,553	93,357	91,818	80,934
Annual Operating and Maintenance Cost ($)	12,552,200	13,717,100	12,907,900	11,485,600	12,388,500	12,184,200	10,757,700
Annual O&M Costs for Two Bus Operator Restrooms[b] ($)	26,800	26,800	26,800	26,800	26,800	26,800	N/A
Total O&M Costs ($, rounded to nearest $100)	12,579,000	13,743,900	12,934,700	11,512,400	12,415,300	12,211,000	10,757,700

[a] *MCTS operating costs per hour include wages, fringe benefits, advertising, other outside services, maintenance services, security services, consultants, materials and supplies, bus parts, postage and printed forms, utilities, purchased transportation, insurance and recoveries, travel and meetings, dues, licenses and subs, other miscellaneous, bond interest, tire leasing and depreciation.*

[b] *Milwaukee County provided monthly operations and maintenance costs for the existing operator-exclusive restrooms as $620/month per restroom in 2022, and the operational and maintenance cost inflation factor of 2 percent per year has been applied for a cost of $1114.64 per month or $13375.68, rounded to $13,400 per year in 2027.*

Source: MCTS and SEWRPC

Cost Estimates for Changes to Other Routes

The O&M costs for planned changes to other routes are provided in Tables 8.2 and Table 8.3. These costs will be used to determine the net O&M costs for each route alternative given that changes made to other routes will have impacts on Milwaukee County's future overall operating budget if the proposed BRT service is implemented.

Table 8.2 shows the cost estimates for the changes to other routes for BRT route alternatives that include North Option 1—including the removal of the existing PurpleLine route, the addition of future Route 27 from Bayshore to W. Loomis Road, truncating Route 12 to avoid the duplication of transit service along N. Teutonia Avenue, and the extension of Route 80 to expand access to the BRT route. Table 8.3 shows the cost estimates for BRT route alternatives that include North Option 2—including the removal of the existing PurpleLine route and the addition of future Route 27 from N. Green Bay Road to Loomis Road. These changes are described in more detail in Chapter 2. These O&M costs were calculated using the 2027 operating cost per hour for fixed route transit service ($132.92) and multiplied by the platform hours that will be required after changes are made to each route. The net O&M costs for each route alternative were estimated by subtracting the existing O&M cost from the proposed future O&M cost with service changes.

As Table 8.2 shows, changes to other routes related to the BRT route alternatives that include North Option 1 would result in an estimated O&M cost savings of $7,833,900 per year. As Table 8.3 shows, changes to other routes related to the BRT route alternatives that include North Option 2 would result in an O&M cost savings of $7,484,700 per year.

Table 8.2
Operating and Maintenance (O&M) Costs for Proposed Changes to Other Routes for BRT Route Alternatives that Include North Option 1: 2027

Changes to Other Routes	Operating Cost per hour ($)	Existing Platform Hours	Existing O&M Cost ($)	Proposed Platform Hours	O&M Cost with Proposed Changes ($)	O&M Cost Difference ($)
Add Route 27 – Option 1	132.92	0	0	24,629	3,273,700	3,273,700
Truncate Route 12	132.92	39,037	5,188,800	30,018	3,990,000	-1,198,800
Extend Route 80	132.92	60,515	8,043,700	66,902	8,892,600	848,900
Remove PurpleLine	132.92	80,934	10,757,700	0	0	-10,757,700
Net Cost Changes ($, rounded to nearest $100)						-7,833,900

Source: MCTS and SEWRPC

Table 8.3
Operating and Maintenance (O&M) Costs for Proposed Changes to Other Routes for BRT Route Alternatives that Include North Option 2: 2027

Changes to Other Routes	Operating Cost per hour ($)	Existing Platform Hours	Existing Operating Cost ($)	Proposed Platform Hours	O&M Cost with Proposed Changes ($)	O&M Cost Difference ($)
Add Route 27 – Option 2	132.92	0	0	24,624	3,273,000	3,273,000
Remove PurpleLine	132.92	80,934	10,757,700	0	0	-10,757,700
Net Cost Changes ($, rounded to nearest $100)						-7,484,700

Source: MCTS and SEWRPC

Evaluation of Total Operations and Maintenance Costs for Route Alternatives

Table 8.4 shows the net total O&M cost estimates for each route alternative, which is calculated by combining the cost estimates for each proposed BRT route alternatives with the cost estimates for proposed changes to other routes. The annual O&M costs range from the least expensive, North Option 2 to South Option A at $4,027,700 to the most expensive, North Option 1 to South Option B at $5,910,000.

Table 8.4
Net Total Operating and Maintenance Costs by BRT Route Alternative: 2027

Operating and Maintenance Costs (O&M)	North Option 1 to South Option A ($)	North Option 1 to South Option B ($)	North Option 1 to South Option C ($)	North Option 2 to South Option A ($)	North Option 2 to South Option B ($)	North Option 2 to South Option C ($)
Proposed BRT Service	12,579,000	13,743,900	12,934,700	11,512,400	12,415,300	12,211,000
Changes to Other Routes	-7,833,900	-7,833,900	-7,833,900	-7,484,700	-7,484,700	-7,484,700
Total ($, rounded to nearest $100)	4,745,100	5,910,000	5,100,800	4,027,700	4,930,600	4,726,300

Source: MCTS and SEWRPC

Summary of Evaluation Results

Based on the O&M costs provided above, a rating for each proposed BRT route alternative is provided in Table 8.5. The rating system uses green, yellow, or red dots to signify whether each proposed BRT route alternative would have a minimal, moderate, or high impact on the MCTS operating budget. North Option 1 to South Option A, North Option 2 to South Option A and North Option 2 to South Option C alternatives are rated with a green dot since their annual O&M costs are lower and would have a minimal impact on the MCTS O&M budget. North Option 1 to South Option C and North Option 2 to South Option B are rated with a yellow dot since their annual O&M costs would have a moderate impact, and North Option 1 to South Option B would have the highest impact on the MCTS O&M budget.

Table 8.5
Summary of Annual Operating and Maintenance (O&M) Costs for BRT and Underlying Transit Services

Route Alternative	Annual O&M Cost
North Option 1 to South Option A	🟢
North Option 1 to South Option B	🔴
North Option 1 to South Option C	🟡
North Option 2 to South Option A	🟢
North Option 2 to South Option B	🟡
North Option 2 to South Option C	🟢

Source: SEWRPC

SUMMARY AND RECOMMENDATIONS 9

9.1 OVERVIEW

This chapter summarizes the evaluations presented throughout this report and the resulting recommendations that will be carried forward to the Tier 3 Evaluation. This Tier 2 Evaluation was intended to further assess the alternatives defined in the Tier 1 Evaluation in order to refine the number of BRT route alternatives under consideration, and, as appropriate, recommend roadway alignment options and potential station locations that will be further refined in the next phase of study. As a result of the evaluations described throughout this report, North Option 2 to South Option A will move forward as the recommended alternative for BRT service in this corridor. The route with proposed station areas is shown in Map 9.1. Detailed station locations will be identified in a future phase of this project.

9.2 SUMMARY OF EVALUATIONS

Table 9.1 shows the results of the route alternatives evaluations described throughout this report, with North Option 2 to South Option A resulting in the highest rating among all alternatives. This route alternative is most similar to the current PurpleLine route and is the most cost-effective alternative—providing access to the highest number of people and jobs per route-mile of investment.

Specifically, the station area analysis showed that this route alternative will provide access to nearly 6,500 people and 3,000 jobs per route-mile, and that population and employment densities are consistently high enough along the route to support enhanced transit. This route alternative would also serve the highest number of people of color, households without a car, families in poverty, and people with disabilities per mile—population groups that are more likely to depend on transit.

If the recommended roadway configurations, including locations for dedicated transit lanes, running types, and vertical separation elements are implemented, this alternative would result in lower impacts to parking, traffic, and bikes (including the potential to add 6.7 miles of dedicated bike lanes) among the BRT route alternatives under consideration. With dedicated transit lanes recommended along 79 percent of the route, initial estimates show that travel times on this route would be between 8 to 18 minutes faster than the existing PurpleLine depending on time of day.

Ridership forecasts estimate that this route alternative will result in 45 to 60 percent higher boardings per route mile when compared to the existing PurpleLine with between 5,400 to 10,500 riders on an average weekday, including up to 3,700 new riders.

The environmental evaluation estimated that implementing BRT service along any of the route alternatives would result in a net reduction in VMT, reducing air pollutants, energy usage, and traffic-related injuries and fatalities and that no impacts to historical or cultural resources are known at this time. However, the expected environmental benefits for the recommended alternative are the lowest among all route alternatives since this route would yield the lowest net reduction in VMT.

Finally, this route alternative has the lowest capital and operating cost estimates of all route alternatives, with an estimated capital cost of approximately $148 million and estimated annual operating and maintenance costs of $11.5 million.

Map 9.1
Recommended Route Alternative and Potential Station Locations

Table 9.1
Route Alternative Evaluation Results

Route Alternative	Station Area Analysis	Transportation System Impacts	Ridership Forecasts	Environmental Impacts	Capital Costs	Operating and Maintenance Costs	Summary
North Option 1 to South Option A	🟡	🟢	🟢	🟢	🟡	🟢	🟡
North Option 1 to South Option B	🟡	🟡	🟡	🟢	🔴	🔴	🔴
North Option 1 to South Option C	🔴	🟢	🟢	🟢	🔴	🟡	🔴
North Option 2 to South Option A	🟢	🟢	🟢	🟡	🟢	🟢	🟢
North Option 2 to South Option B	🟢	🟡	🟡	🟡	🟡	🟡	🟡
North Option 2 to South Option C	🔴	🟢	🟢	🟡	🟢	🟢	🟡

Source: SEWRPC

9.3 RECOMMENDED ROADWAY CONFIGURATIONS

Roadway configurations for the recommended alternative are described below and shown in Map 9.2. Roadway configuration options are evaluated for all route alternatives and described in more detail in Chapter 4 of this report.

Dedicated transit lanes significantly improve travel time and reliability of BRT service and are recommended along much of the route. Mixed traffic is only recommended along segments where dedicated transit lanes are not possible due to limited roadway width or where converting a traffic or parking lane would be highly difficult due to the expected impacts to traffic, businesses, or residents. More details about expected impacts are provided in Chapter 4 of this report.

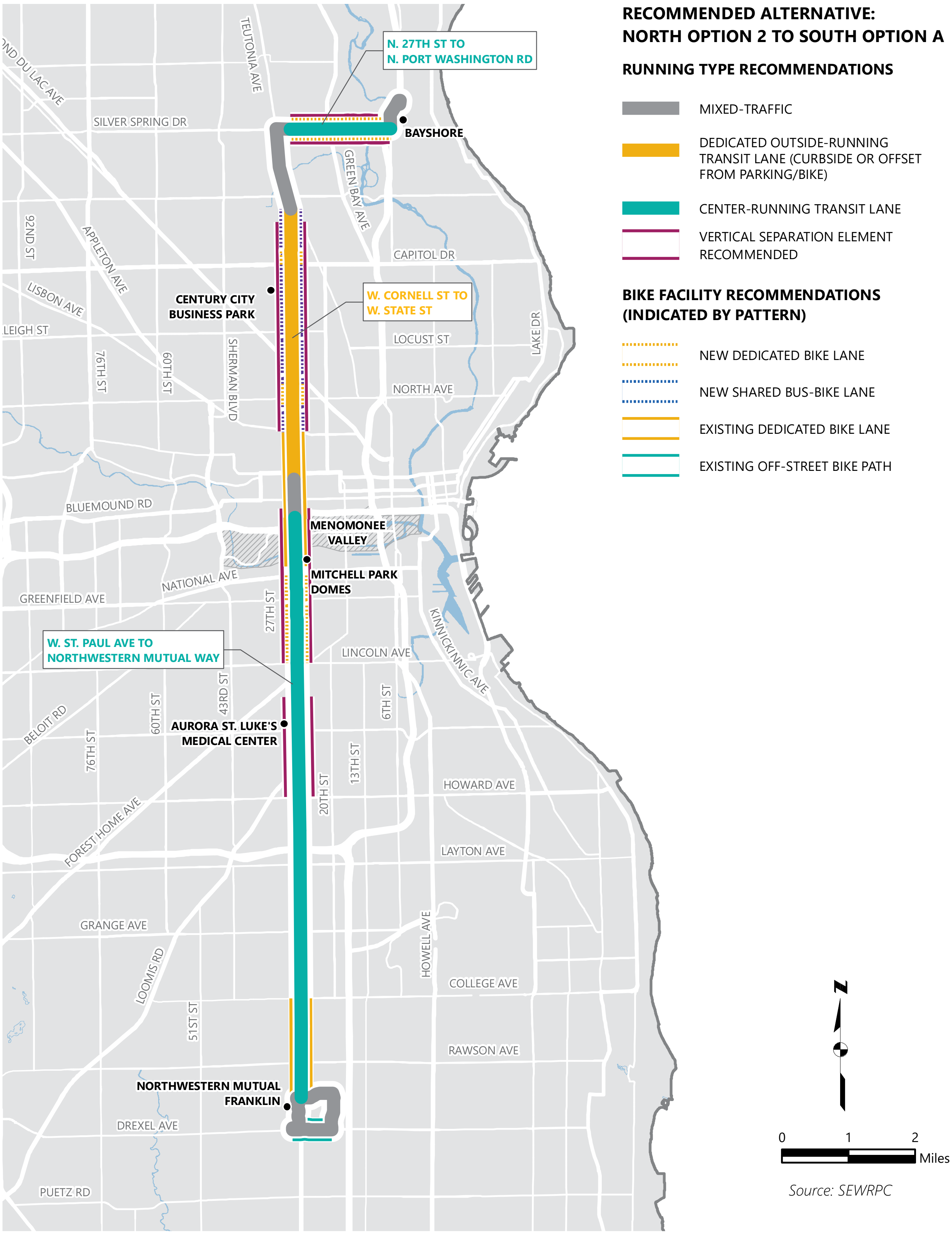
Center-running transit lanes were prioritized over side-running transit lanes and were recommended on segments with wide medians where a station could be placed. Center-running lanes further improve travel time, reliability, and pedestrian safety, and provide cost-savings by allowing for the implementation of a station serving both directions in some circumstances.

In segments where reckless driving is a particular concern, vertical separation elements along dedicated transit lanes are recommended to prevent incursion by non-transit vehicles.

Finally, the conversion of some bike lanes to shared bus-bike lanes will be necessary to provide space for dedicated transit lanes, and in some cases, the addition of new dedicated bike lanes is possible due to other changes in roadway configuration.

The recommendations described in this report will be evaluated and refined, if necessary, in the Tier 3 Evaluation of this study. In later phases of the project, environmental review, preliminary engineering and design, more detailed information, mapping, and surveys will be conducted and considered for further refinements to the recommendations, resulting in a preferred alternative prior to completing design and engineering, followed by construction.

Map 9.2
Recommended Roadway Configurations



Source: SEWRPC

APPENDICES

APPENDIX A
DETAILED ROADWAY CONFIGURATION OPTIONS

OVERVIEW

This appendix provides a detailed visual description of the roadway configuration and lane conversion options possible for BRT service in this corridor, which are initially outlined in Chapter 2. Typical sections of the existing roadway and any re-configuration options under consideration are provided for each distinct roadway segment and organized by BRT route segment option. Dimensions shown on typical sections are approximate and widths may vary along each segment with some sections including turn lanes and other differences that are not shown on the typical section diagrams. Proposed typical sections will need to be refined in future design and engineering phases of the project. A simple reference map for each segment is also shown.

Dedicated transit lanes on proposed typical sections are generally shown in red. According to the National Association of City Transportation Officials (NACTO) Transit Street Design Guide, red or terra cotta colored pavement helps visually distinguish a dedicated transit lane from general use travel lanes and implementation in different contexts can help improve compliance, which supports the performance of the route.[12] Physical separation elements can also be used to create a more significant barrier between general use travel lanes and dedicated transit lanes. These elements are not shown in proposed typical sections; however, examples of treatment options are provided in Chapter 4 with some recommendations related to where they should be considered (primarily in areas where reckless driving is a concern). Pavement markings and colors as well as any physical separation elements will need to be considered further during the design and engineering phase of the project. The typical sections included in this appendix identify shared bus-bike lanes only where an existing dedicated bike lane would be replaced by the shared bus-bike lane. Although not specified in the potential typical sections, several additional segments of dedicated transit lanes could accommodate bicycles where there isn't room for a separate dedicated bike lane (see Chapter 4 for more details).

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[12] NACTO, *Transit Street Design Guide, "Pavement Markings and Colors," nacto.org/publication/transit-street-design-guide/transit-lanes-transitways/lane-elements/pavement-markings-color.*

NORTH OPTION 1

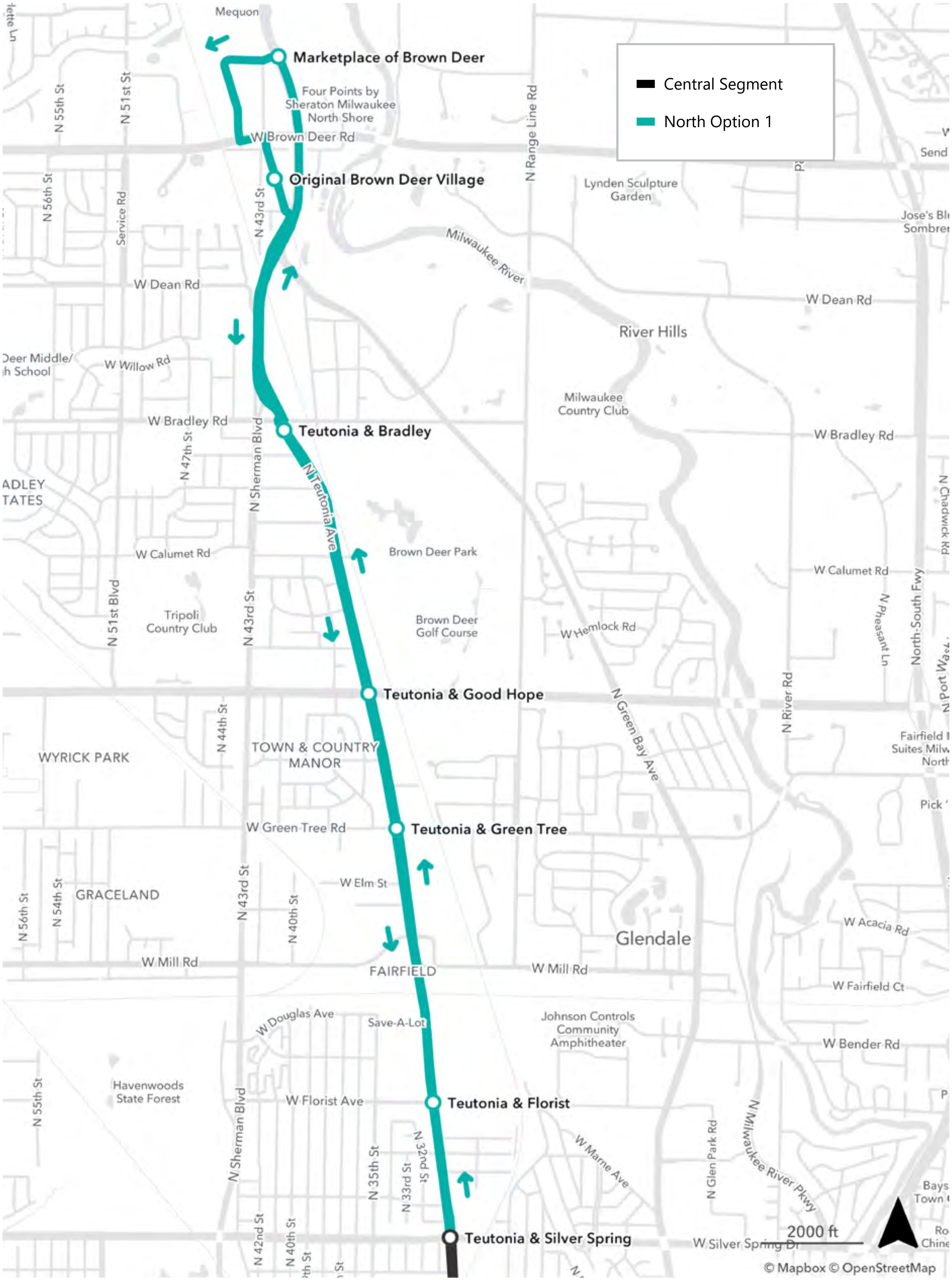
Reference Map

Map A.1 shows a map of the North Option 1 route segment, which extends from the intersection of N. Teutonia Avenue and W. Silver Spring Drive along N. Teutonia Avenue to the Market Place of Brown Deer shopping center. Generalized proposed station locations are also shown.

Typical Sections

Figures A.1 through A.10 show existing and proposed typical sections for roadway segments along the North Option 1 route segment. A more detailed reference map is also included for each segment.

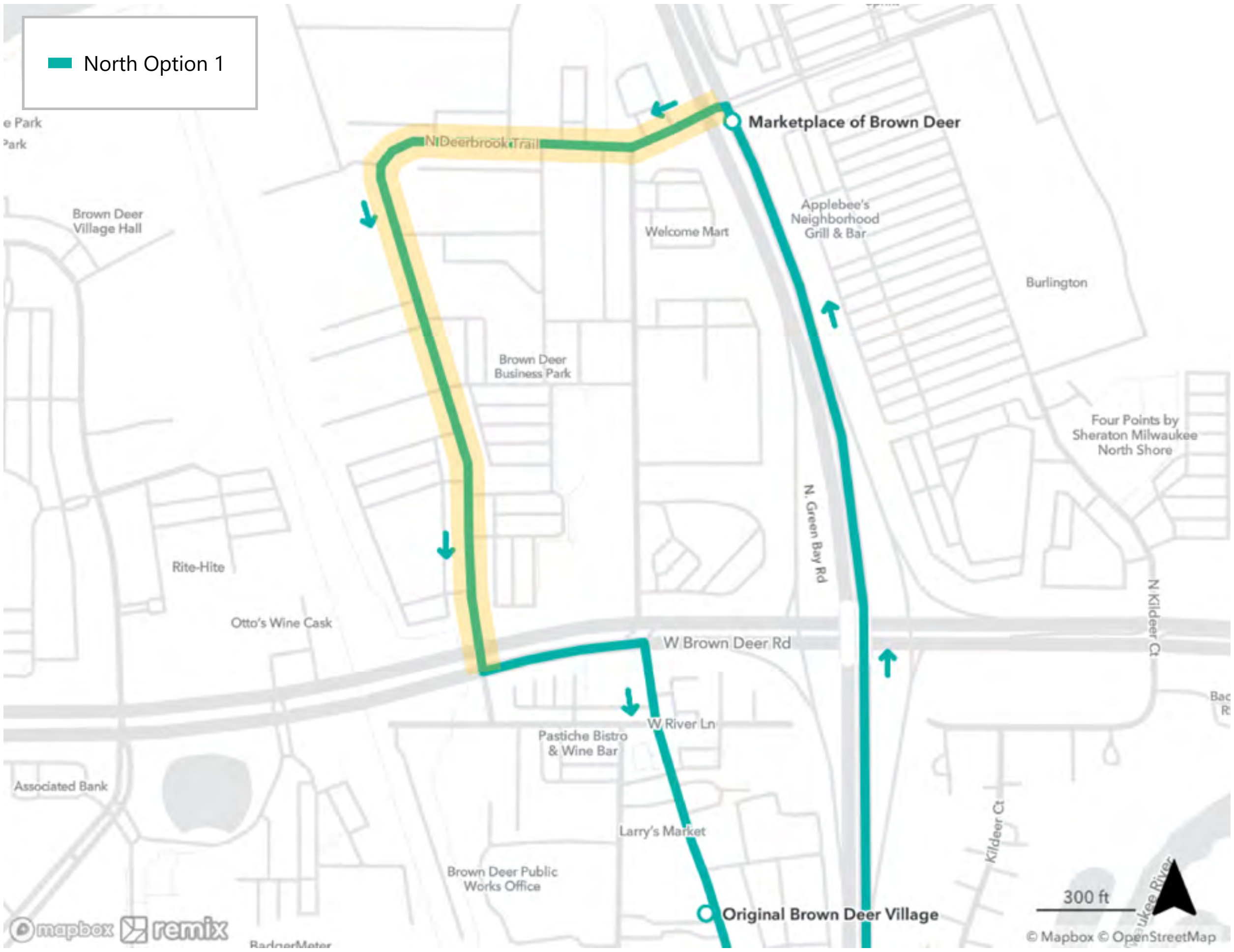
Map A.1
North Option 1



Source: SEWRPC

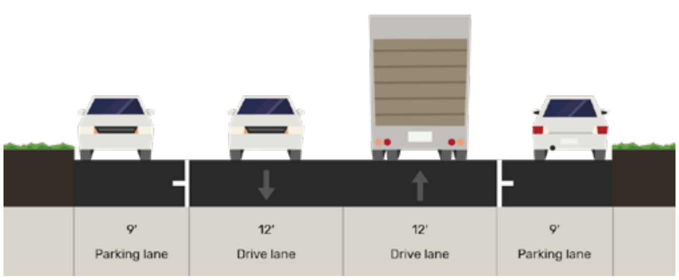
Figure A.1
N. Deerbrook Trail from N. Green Bay Road to W. Brown Deer Road

Reference Map



Source: SEWRPC

Existing Typical Section

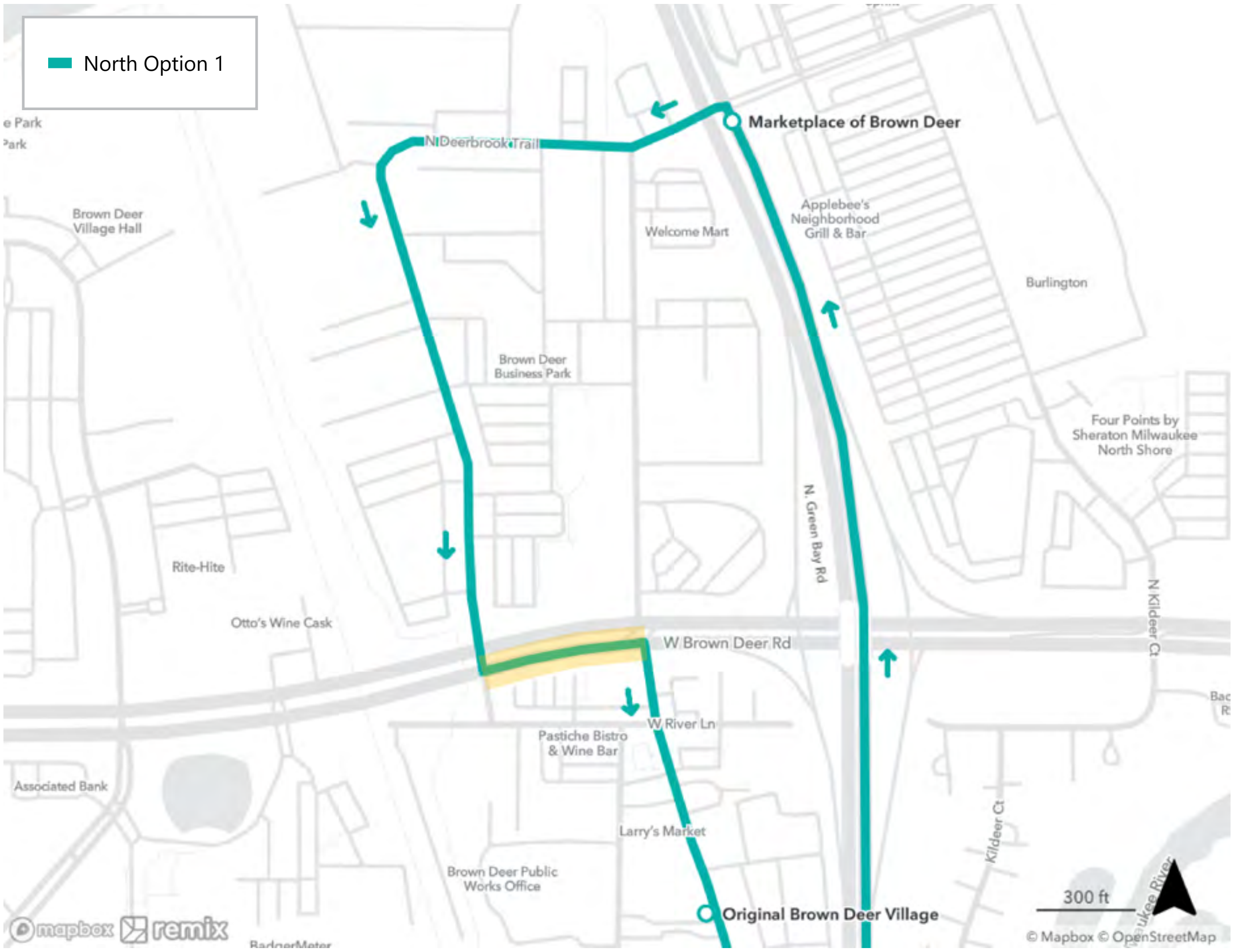


Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

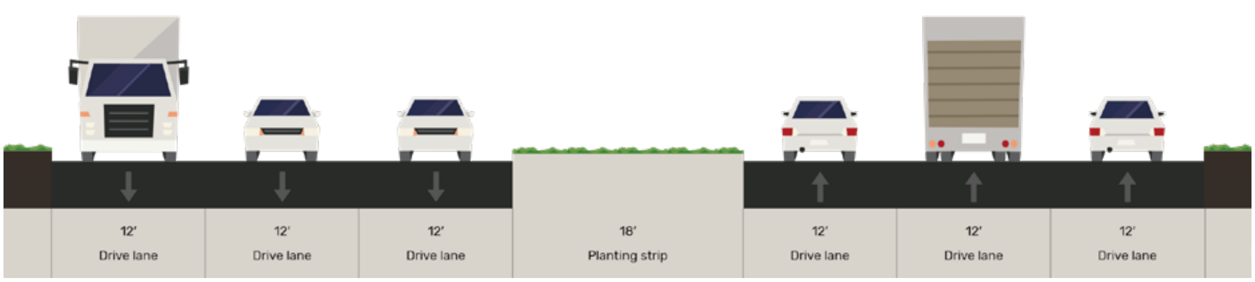
Figure A.2
W. Brown Deer Road from N. Deerbrook Trail to N. Deerwood Drive

Reference Map



Source: SEWRPC

Existing Typical Section

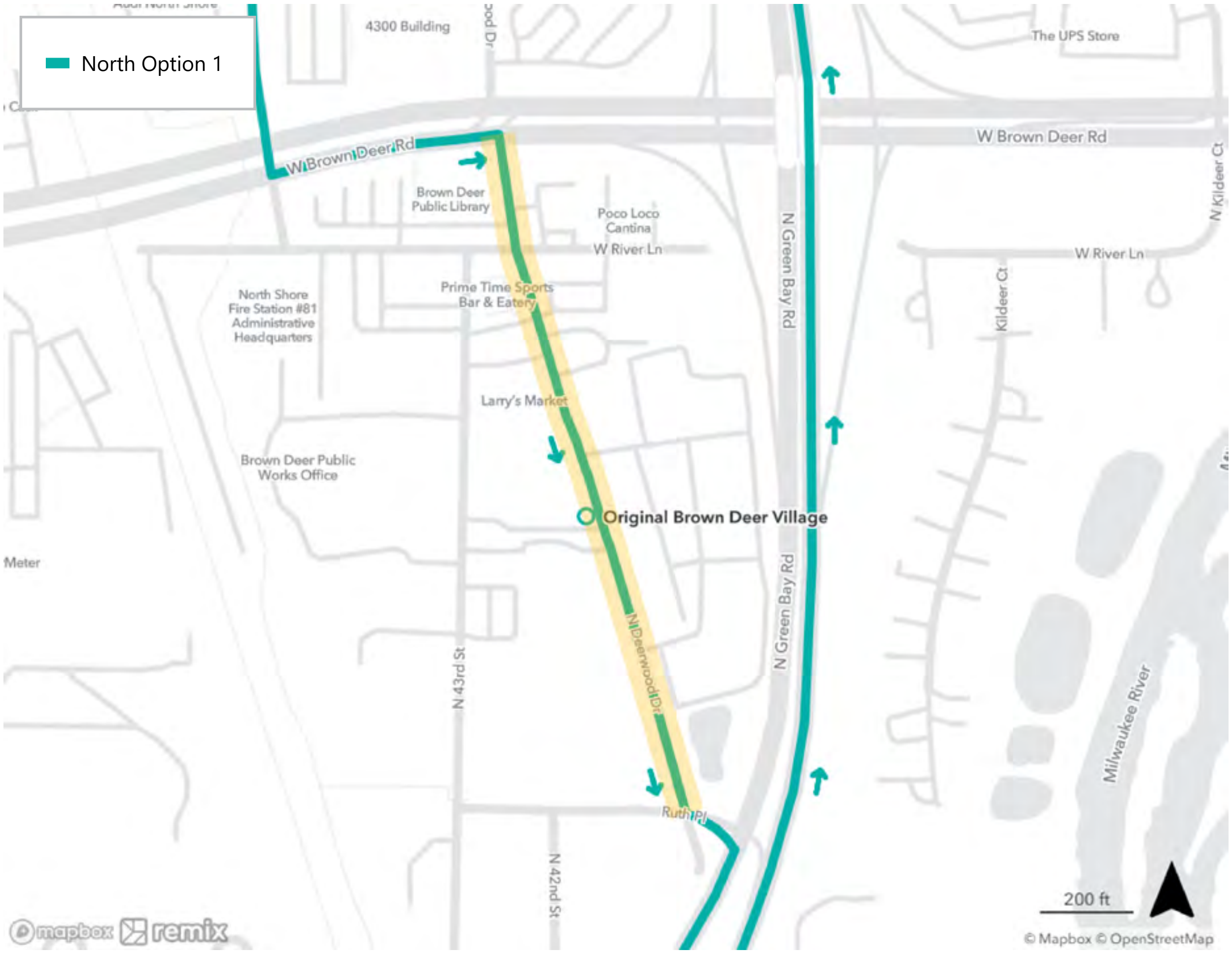


Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

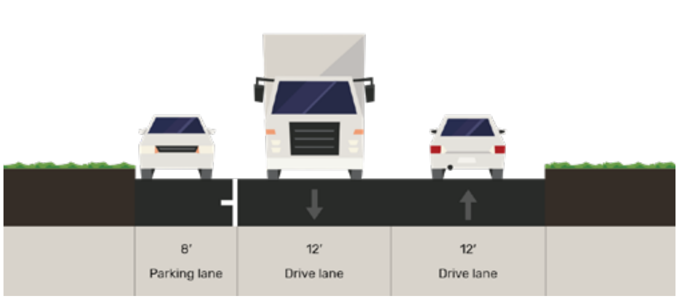
Figure A.3
N. Deerwood Drive from N. Brown Deer Road to Ruth Place

Reference Map



Source: SEWRPC

Existing Typical Section

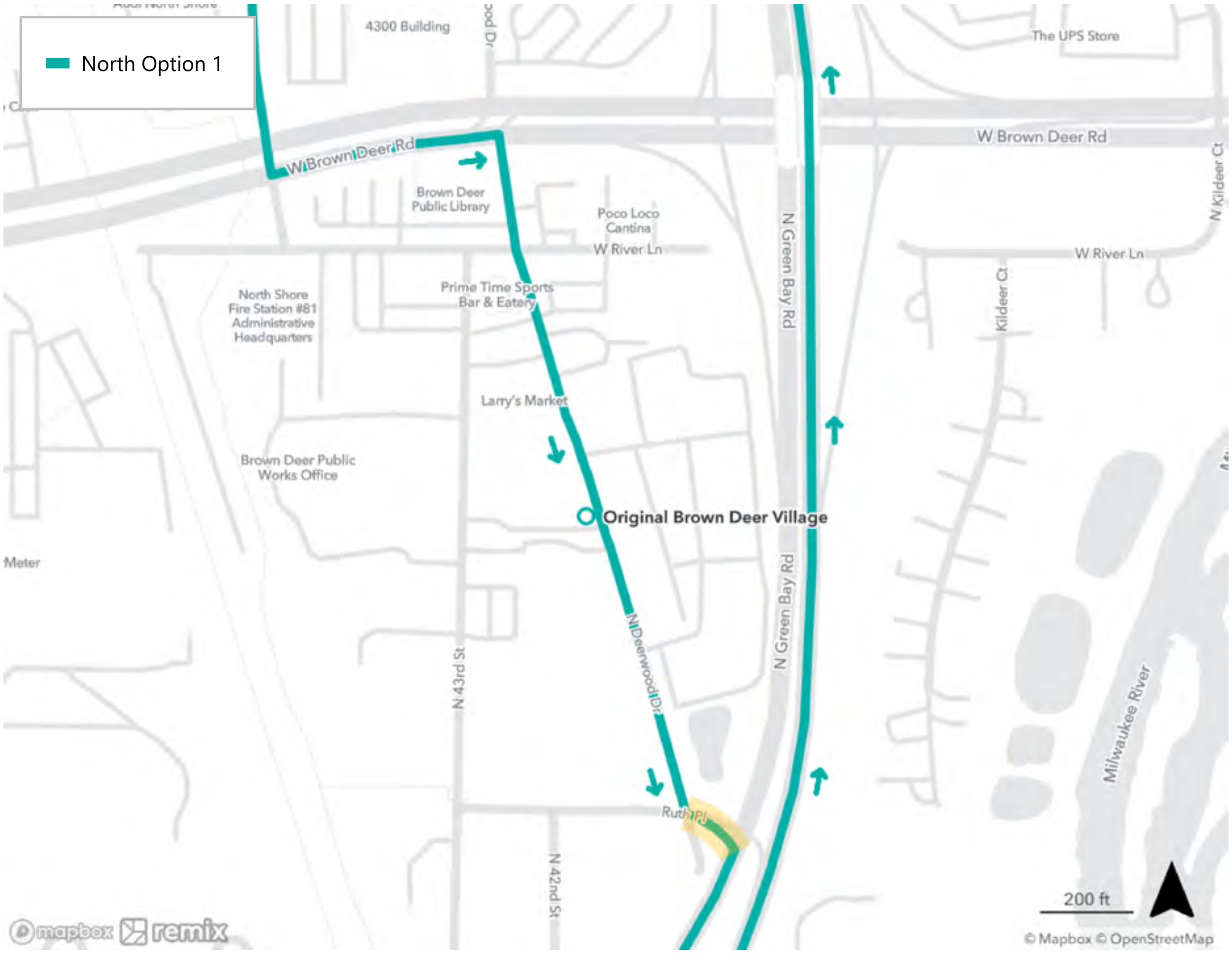


Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

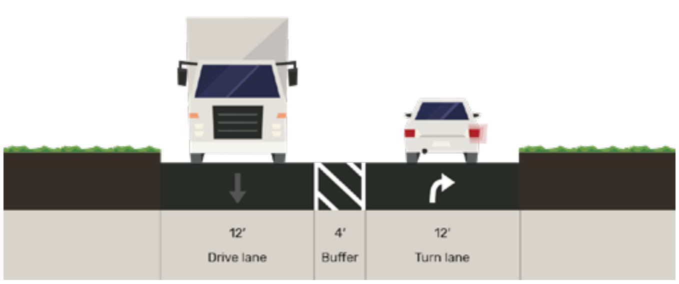
Figure A.4
Ruth Place from N. Deerwood Drive to N. Green Bay Road

Reference Map



Source: SEWRPC

Existing Typical Section

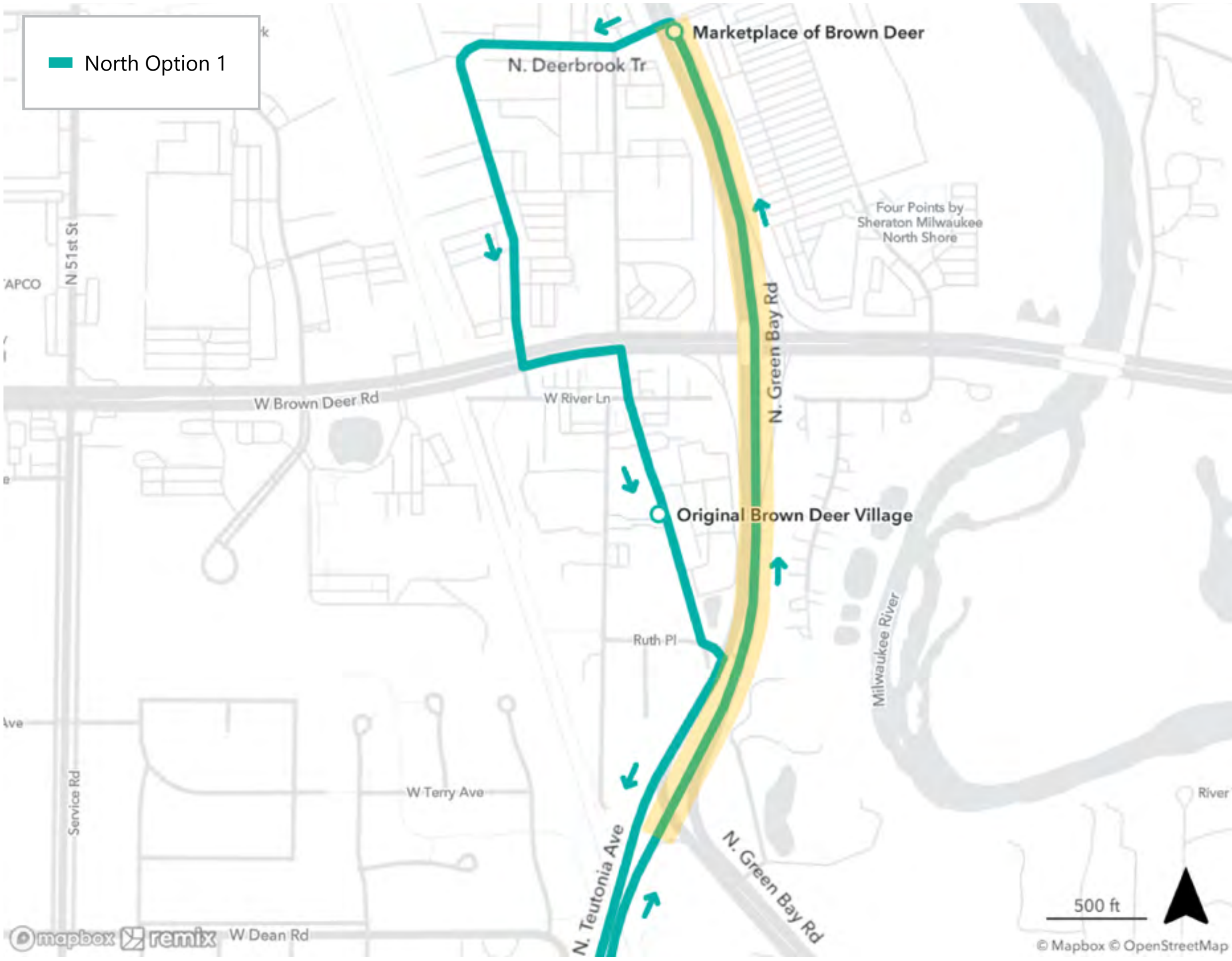


Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.5
N. Green Bay Road from N. Deerbrook Trail to N. Teutonia Avenue

Reference Map



Source: SEWRPC

Existing Typical Section

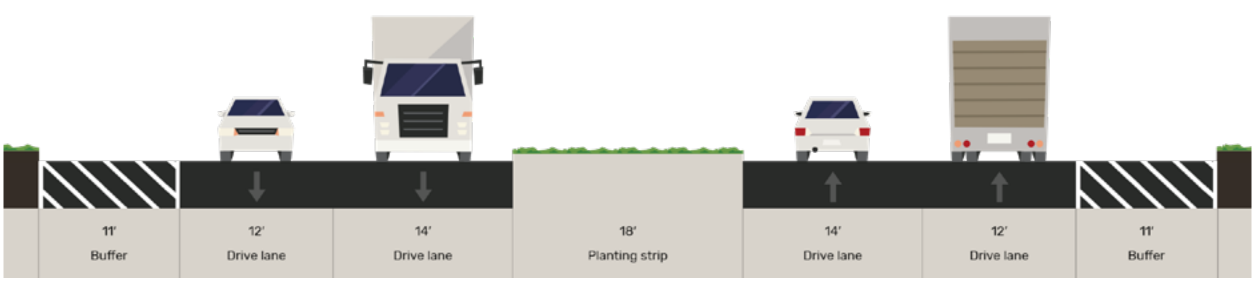


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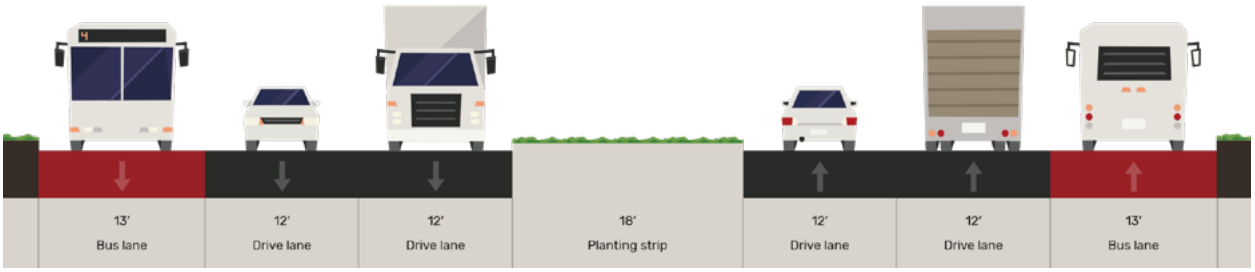
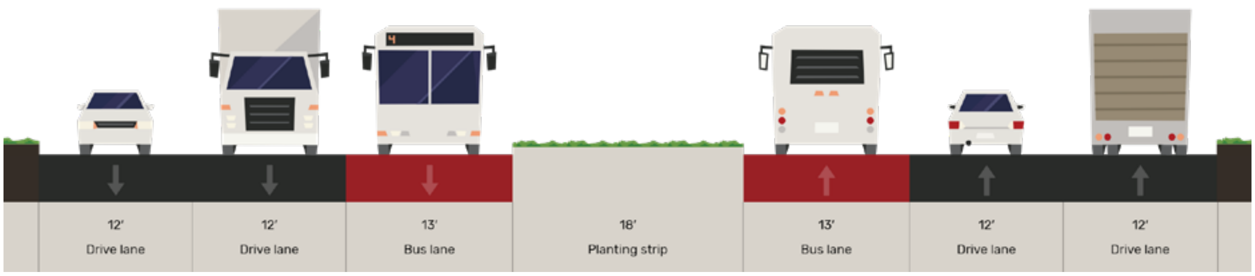
Figure A.5 (Continued)

Proposed Typical Section – Option 1: Convert Shoulder to Dedicated Transit Lane

Dedicated Outside Lane

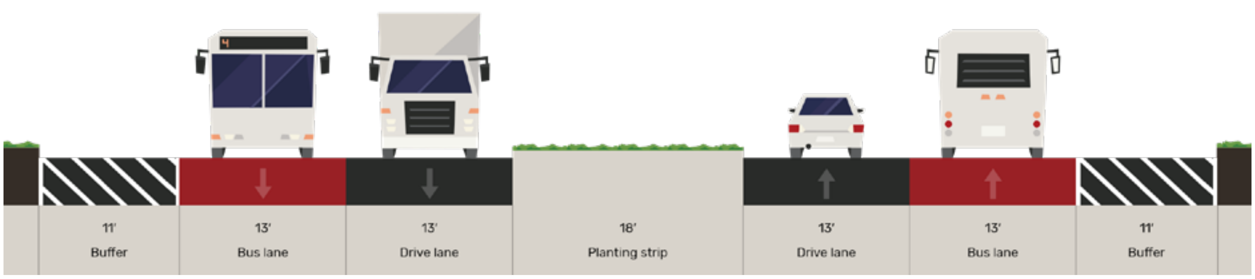


Dedicated Center Lane

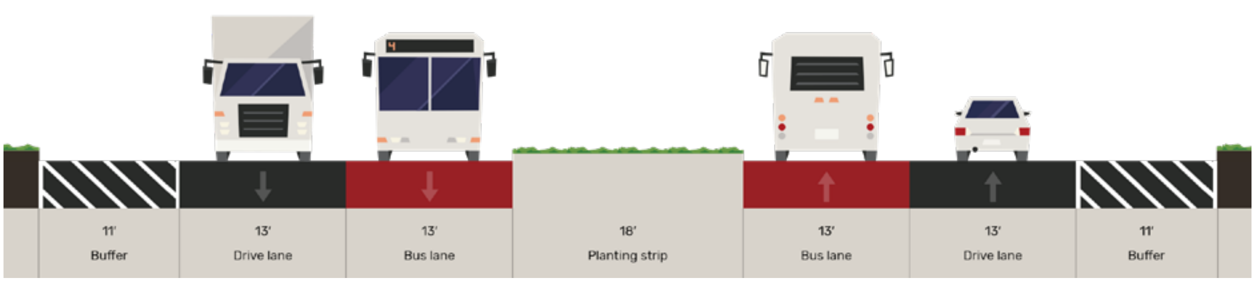


Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.6
N. Teutonia Avenue from N. Green Bay Road to N. Sherman Boulevard

Reference Map

Source: SEWRPC

Existing Typical Section

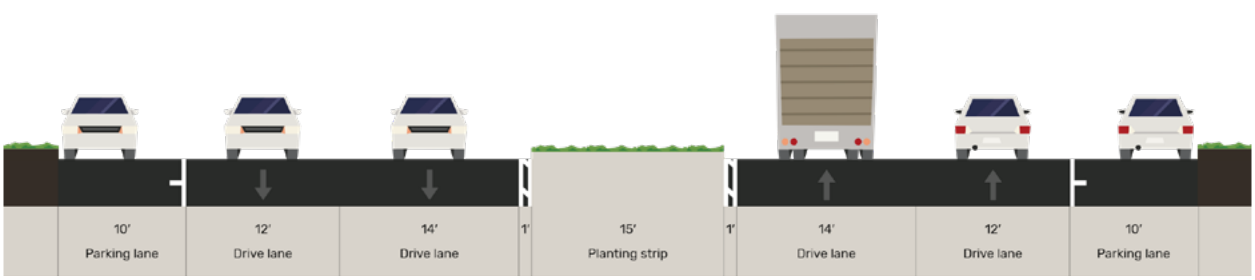
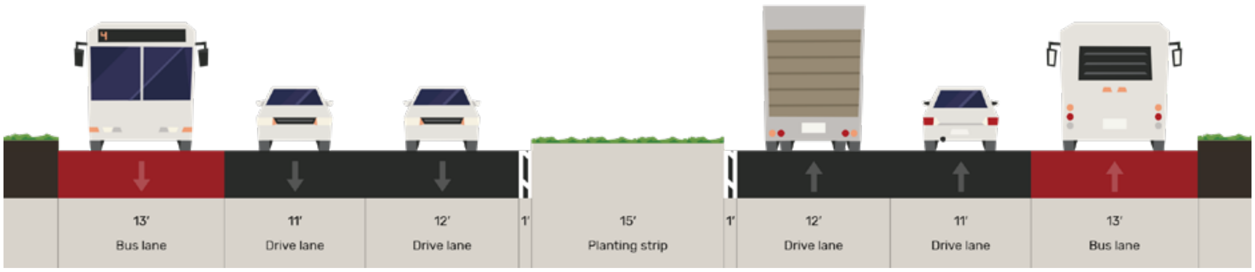


Figure continued on next page.

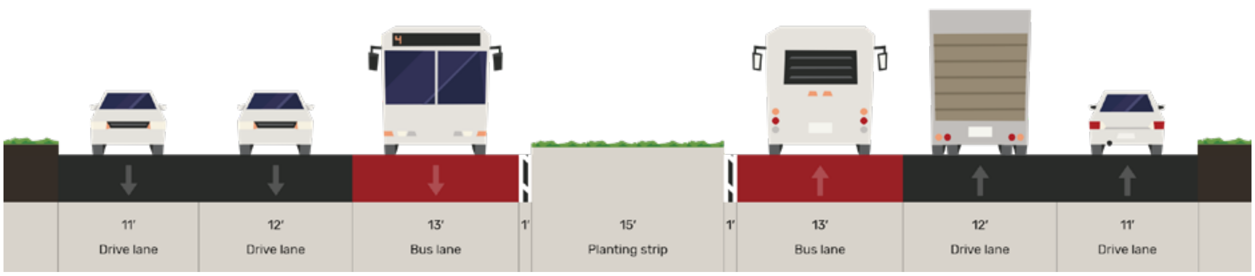
Figure A.6 (Continued)

Proposed Typical Section – Option 1: Convert Parking Lane to Dedicated Transit Lane

Dedicated Outside Lane

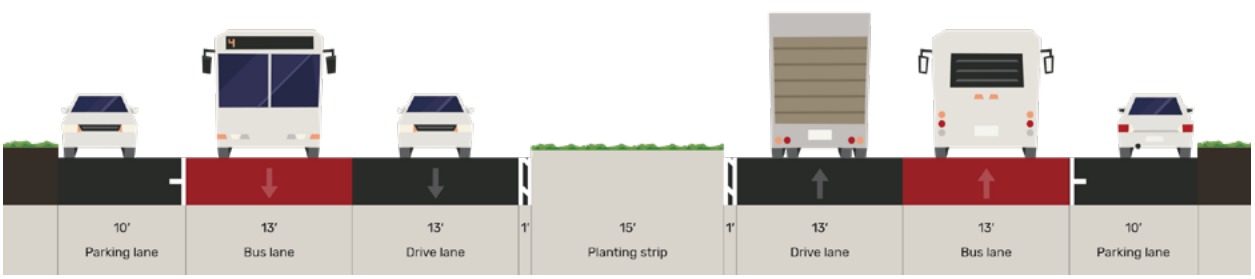


Dedicated Center Lane

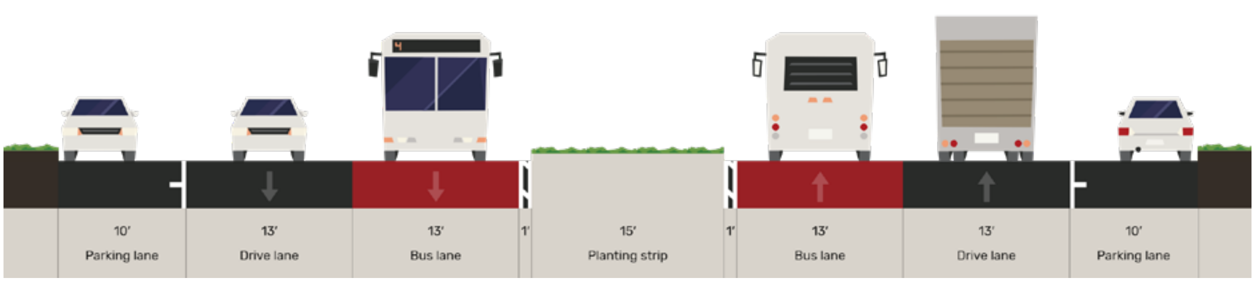


Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane



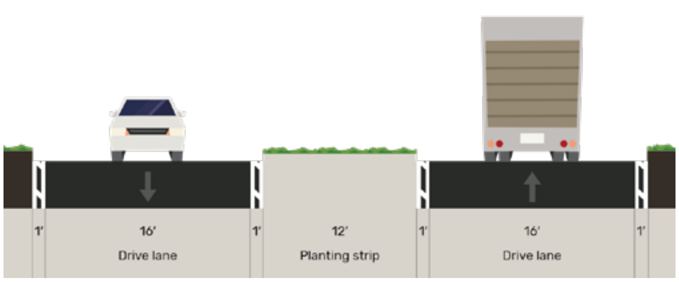
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.7
N. Teutonia Avenue from N. Sherman Boulevard to W. Woodale Avenue

Reference Map

Source: SEWRPC

Existing Typical Section



Note: Roadway widths along this segment vary; however, it includes a roundabout and relevant approaches with one drive lane in each direction. Therefore, no changes in roadway configuration are being considered for this segment.

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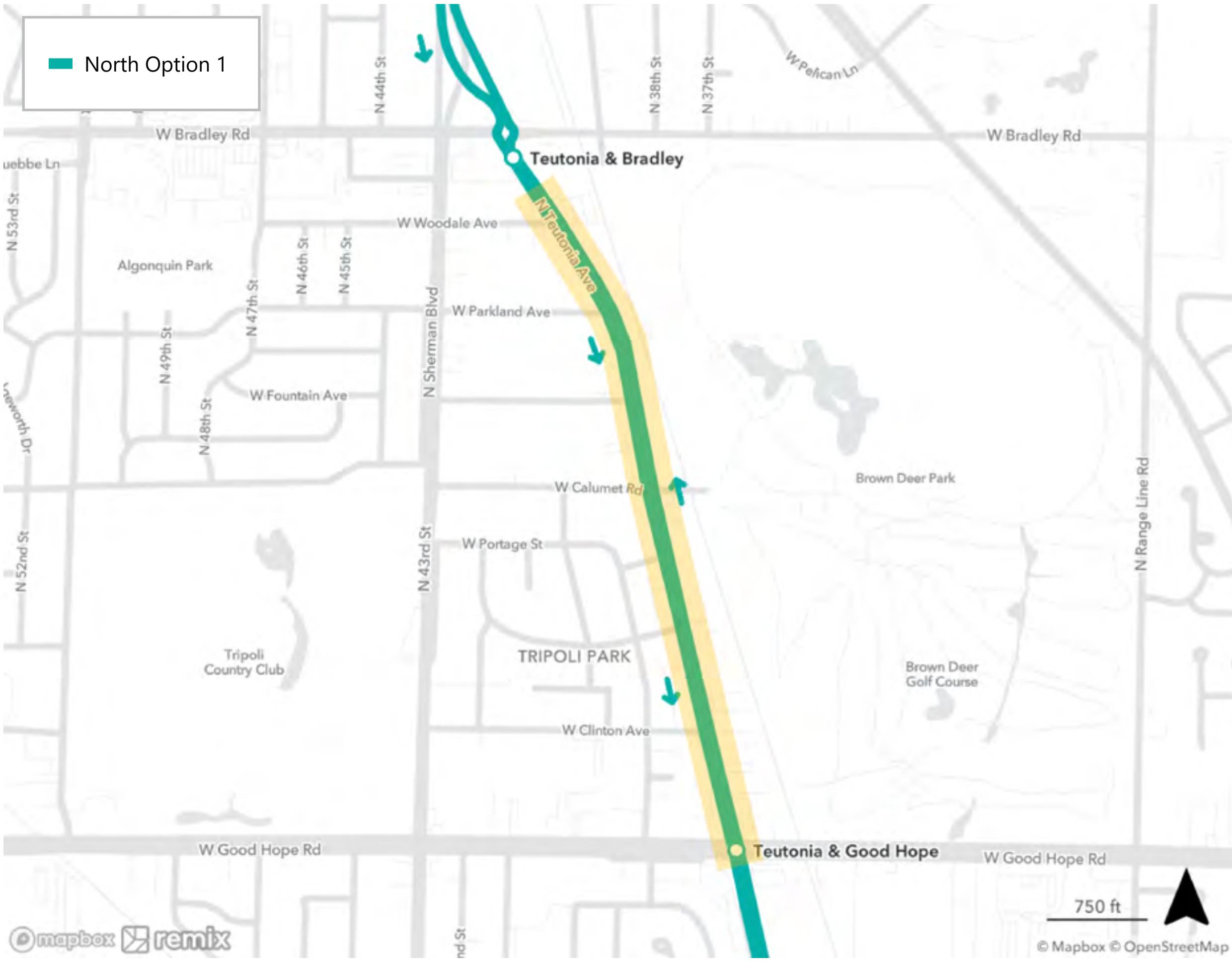
Figure A.8
N. Teutonia Avenue from W. Woodale Avenue to W. Good Hope Road

Reference Map



Source: SEWRPC

Existing Typical Section

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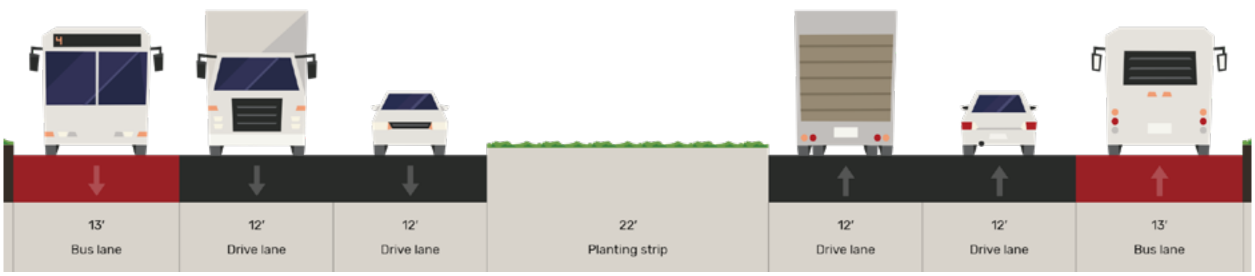
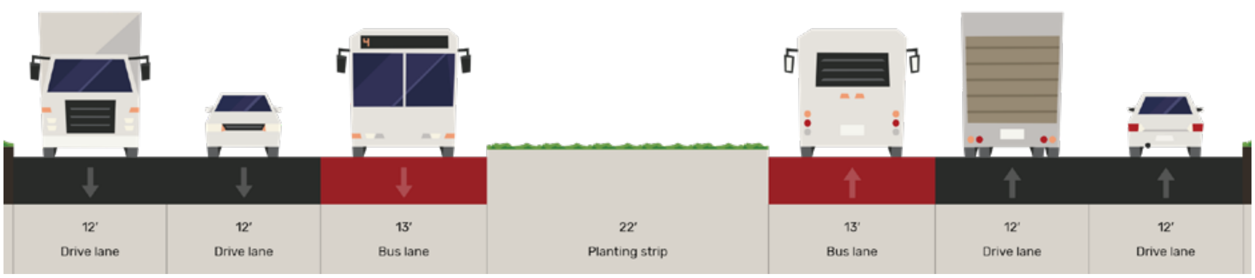
Figure A.8 (Continued)

Proposed Typical Section – Option 1: Convert Parking Lane to Dedicated Transit Lane

Dedicated Outside Lane



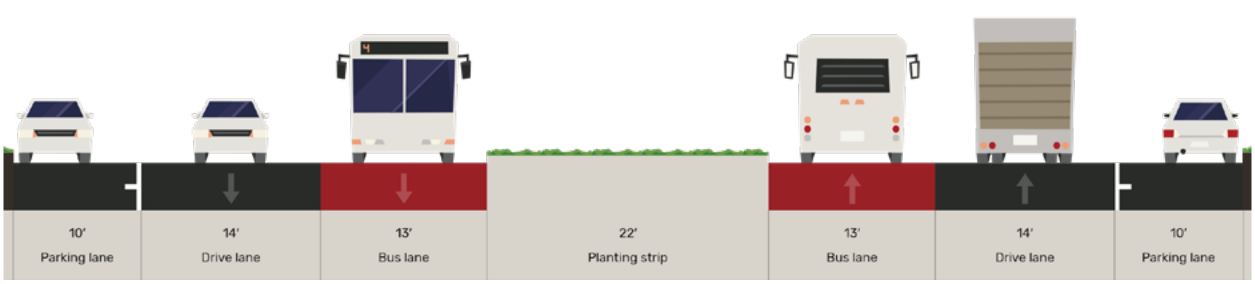
Dedicated Center Lane



Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane

Dedicated Center Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.9
N. Teutonia Avenue from W. Good Hope Road to W. Mill Road

Reference Map

Source: SEWRPC

Existing Typical Section

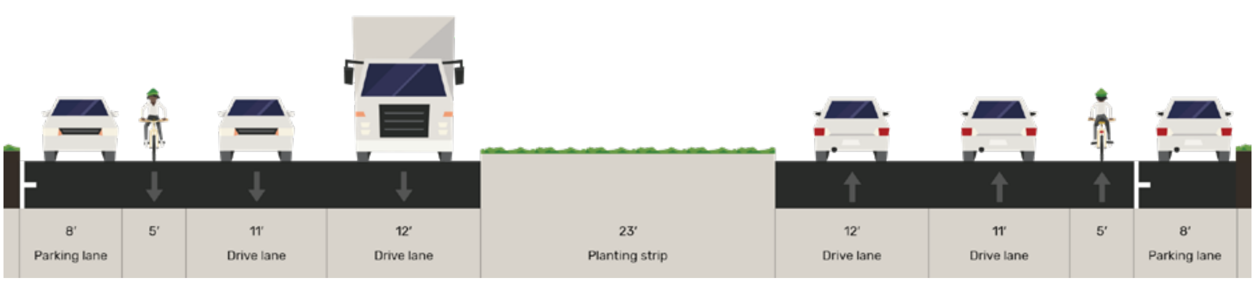


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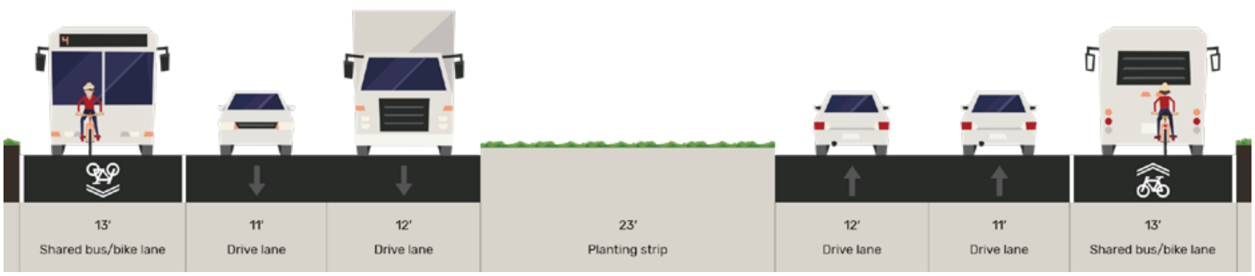
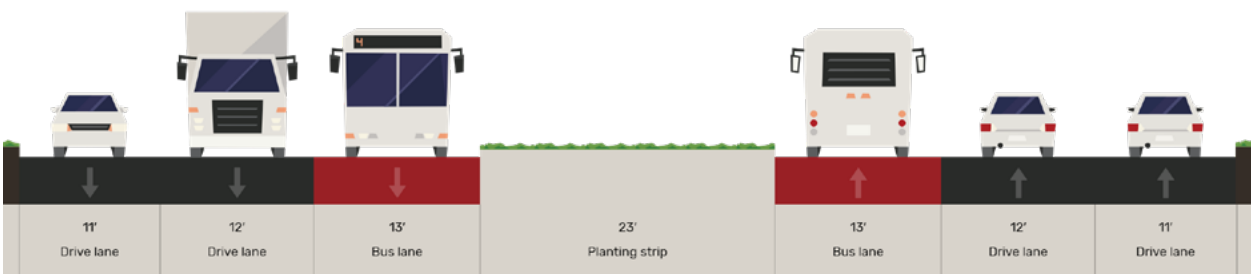
Figure A.9 (Continued)

Proposed Typical Section – Option 1: Convert Parking and Bike Lane to Shared Bus-Bike Lane

Dedicated Outside Lane

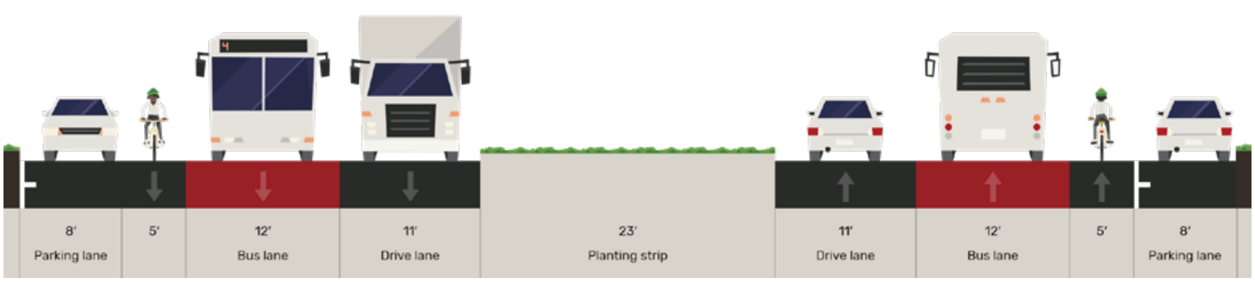


Dedicated Center Lane*

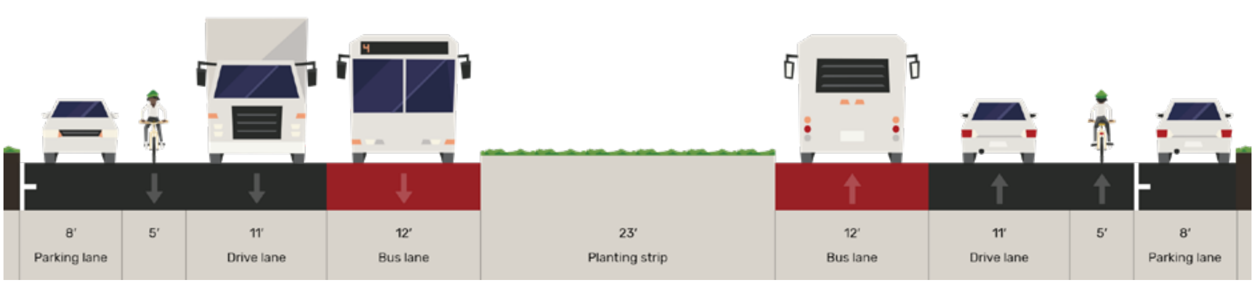


Proposed Typical Section - Option 2: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane



* A shared bus-bike lane is not recommended for a center-running configuration.

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Figure A.10
N. Teutonia Avenue from W. Mill Road to W. Silver Spring Drive

Reference Map

Source: SEWRPC

Existing Typical Section

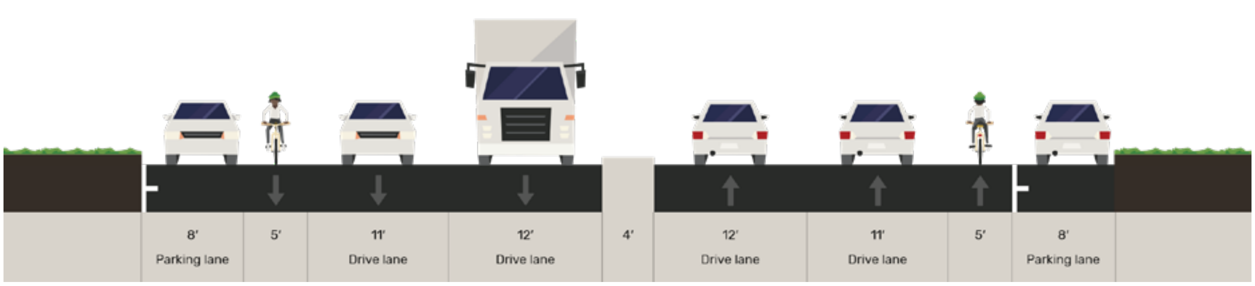

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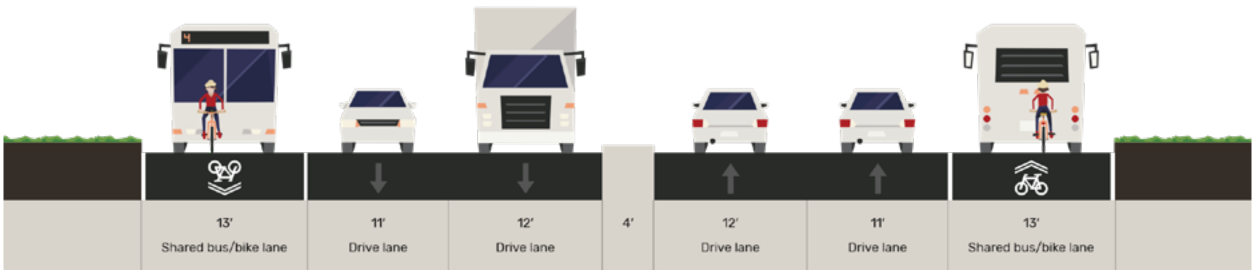
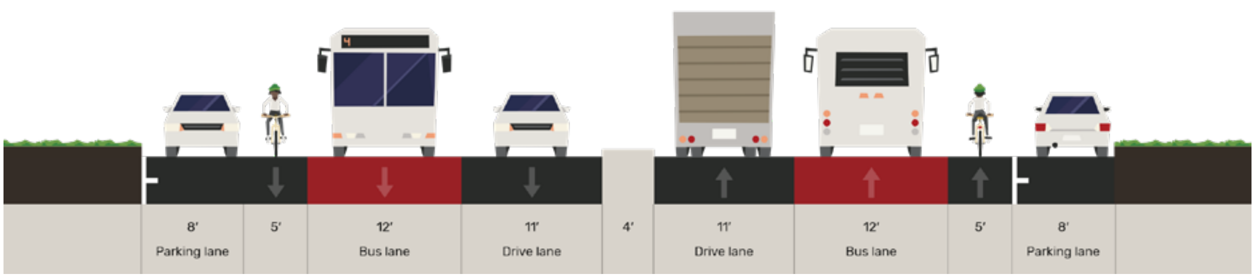
Figure A.10 (Continued)

Proposed Typical Section – Option 1: Convert Parking and Bike Lane to Shared Bus-Bike Lane



Proposed Typical Section - Option 2: Convert Travel Lane to Dedicated Transit Lane



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NORTH OPTION 2

Reference Map

Map A.2 shows a map of the North Option 2 route segment, which extends from the intersection of N. Teutonia Avenue and W. Silver Spring Drive along W. Silver Spring Drive to Bayshore. Generalized proposed station locations are also shown.

Typical Sections

Figures A.11 and A.12 show existing and proposed typical sections for roadway segments along the North Option 2 route segment. A more detailed reference map is also included for each segment.

Map A.2
North Option 2

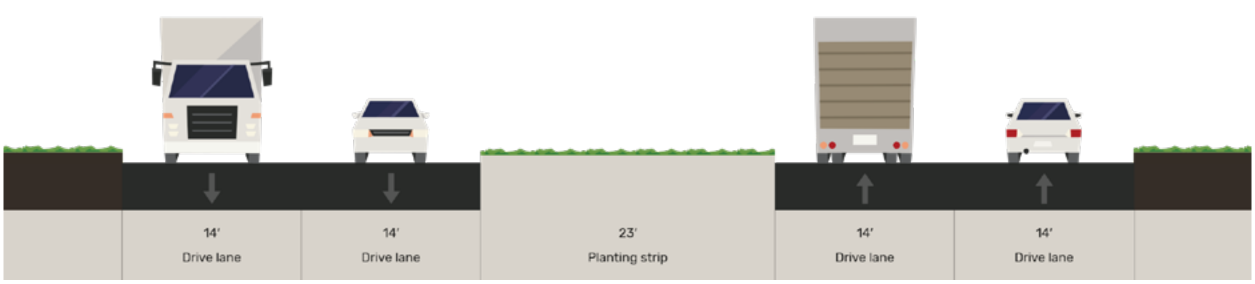
Source: SEWRPC

Figure A.11
W. Silver Spring Drive from N. Teutonia Avenue to N. Port Washington Road

Reference Map

Source: SEWRPC

Existing Typical Section*



* Roadway widths along this segment vary with parking lanes in short segments in addition to two travel lanes in each direction. The options shown below—converting one travel lane to a dedicated transit lane and narrowing the second travel lane to make space for a dedicated bike lane—appear to be feasible along the length of the segment but space for a dedicated bike lane will need to be verified in the design and engineering phase of this effort if recommended.

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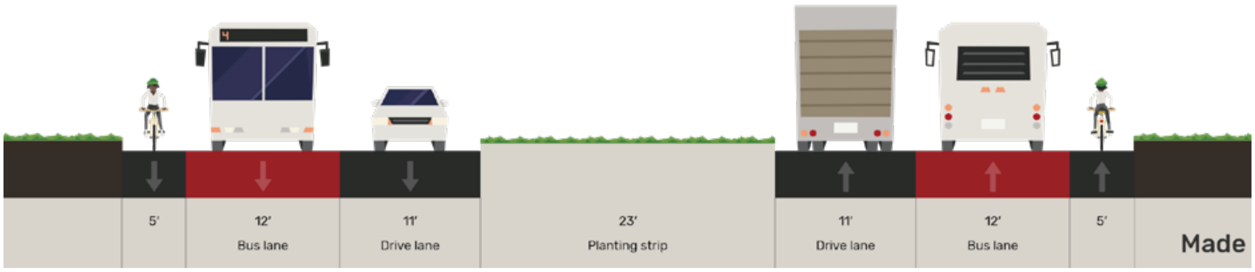
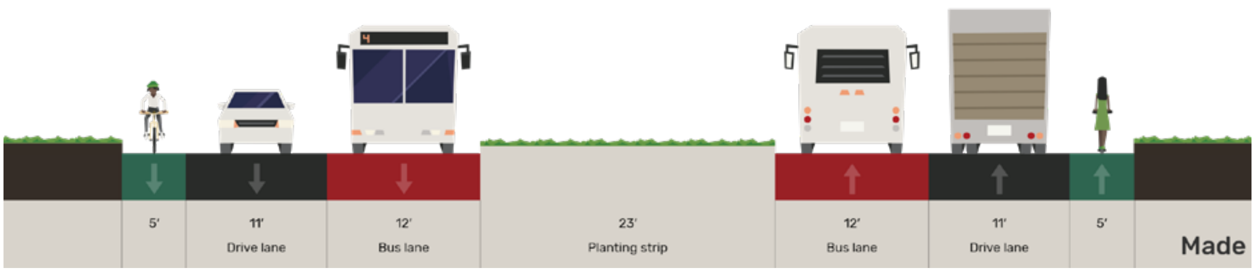
Figure A.11 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane and Add Dedicated Bike Lane

Dedicated Outside Lane



Dedicated Center Lane



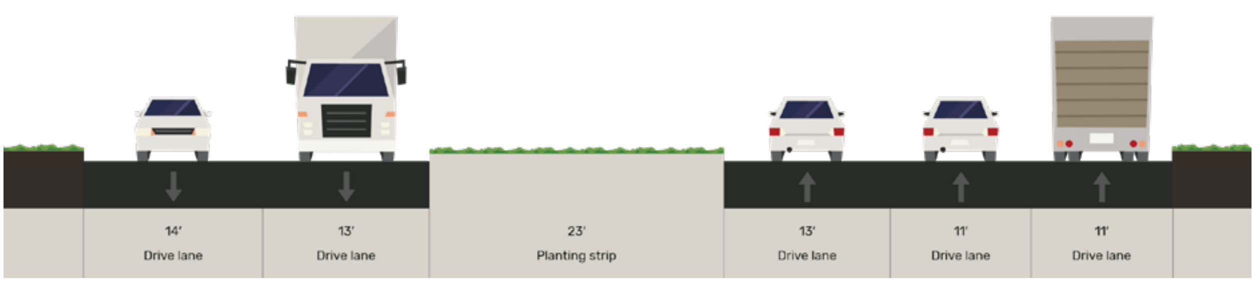
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.12
N. Port Washington Road from W. Silver Spring Drive to W. Corrigan Drive

Reference Map

Source: SEWRPC

Existing Typical Section*



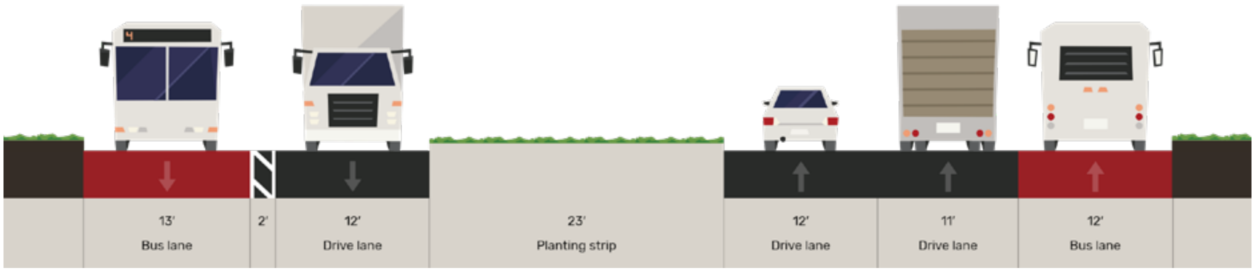
* Roadway widths along this segment vary with turn lanes in several areas in addition to the thru lanes shown in the existing typical section. The options shown below appear to be feasible along the length of the segment, but lane widths will need to be verified in the design and engineering phase of this effort if recommended.

Figure continued on next page.

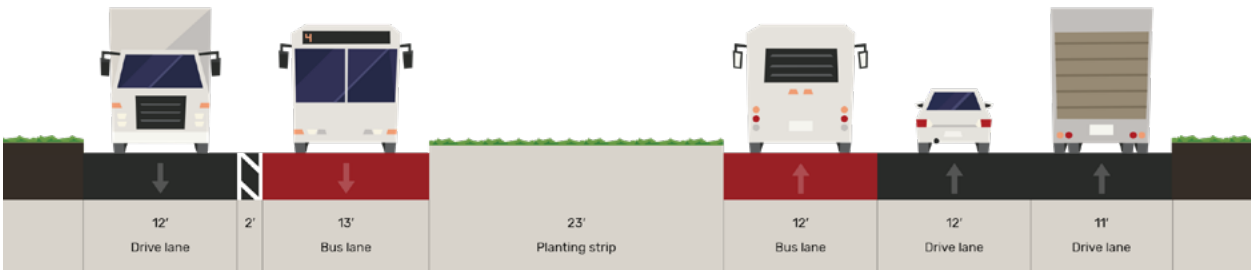
Figure A.12 (Continued)

Proposed Typical Section - Option 1: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

CENTRAL SEGMENT

Reference Map

Maps A.3 through A.8 show the Central Segment, which extends from the intersection of W. Drexel Avenue and S. 27th Street along 27th Street and N. Teutonia Avenue to the intersection of N. Teutonia Avenue and W. Silver Spring Drive. Generalized proposed station locations are also shown.

Typical Sections

Figures A.13 through A.32 show existing and proposed typical sections for roadway segments along the Central Segment. A more detailed reference map is also included for each segment.

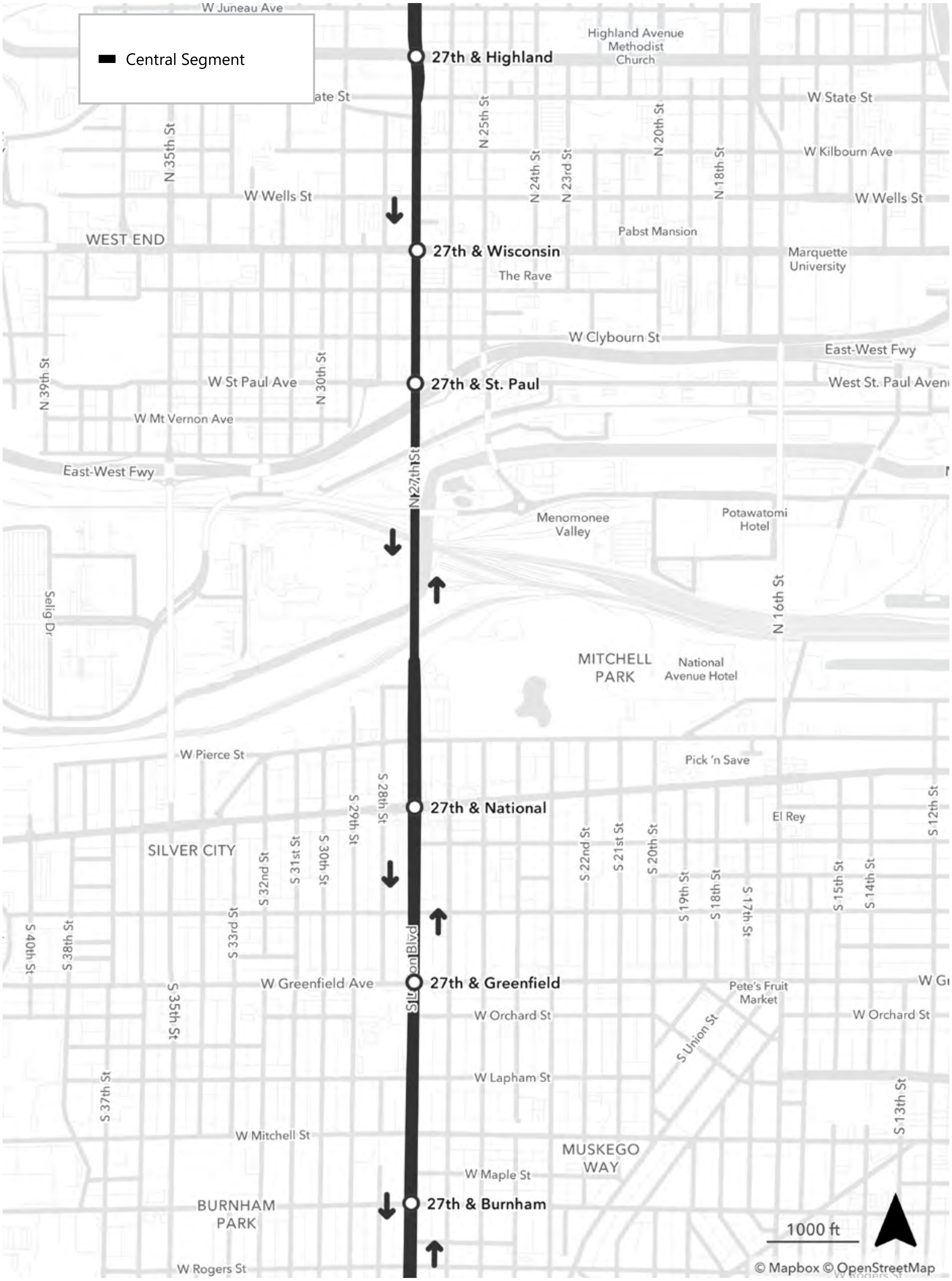
Map A.3
Central Segment from W. Silver Spring Drive to W. Hopkins Street

Source: SEWRPC

Map A.4
Central Segment from W. Hopkins Street to W. Highland Boulevard

Source: SEWRPC

Map A.5
Central Segment from W. Highland Boulevard to W. Burnham Street



Source: SEWRPC

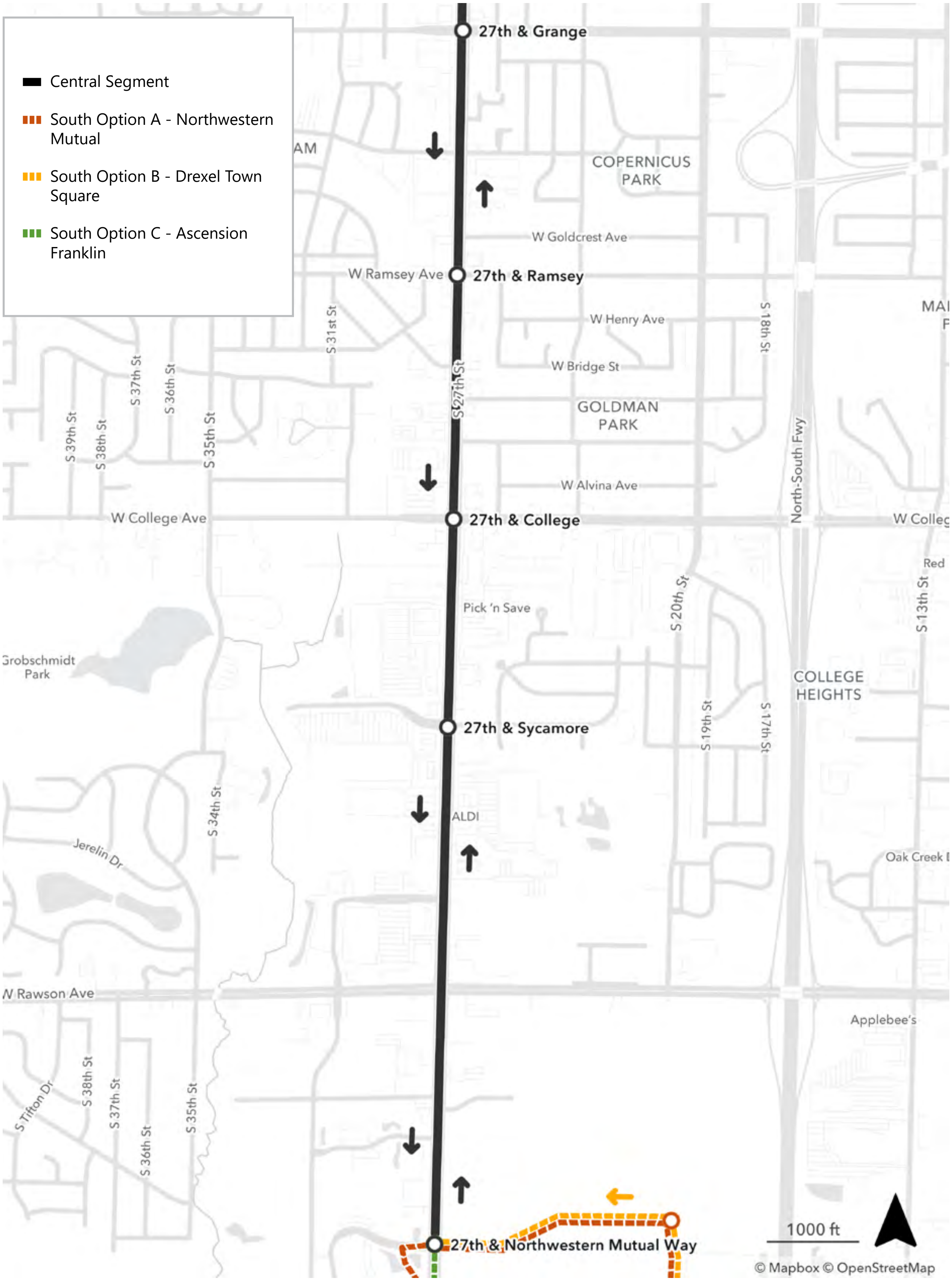
Map A.6
Central Segment from W. Burnham Street to W. Howard Avenue

Source: SEWRPC

Map A.7
Central Segment from W. Howard Avenue to W. Grange Avenue

Source: SEWRPC

Map A.8
Central Segment from W. Grange Avenue to Northwestern Mutual Way



Source: SEWRPC

Figure A.13
N. Teutonia Avenue from W. Silver Spring Drive to W. Custer Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

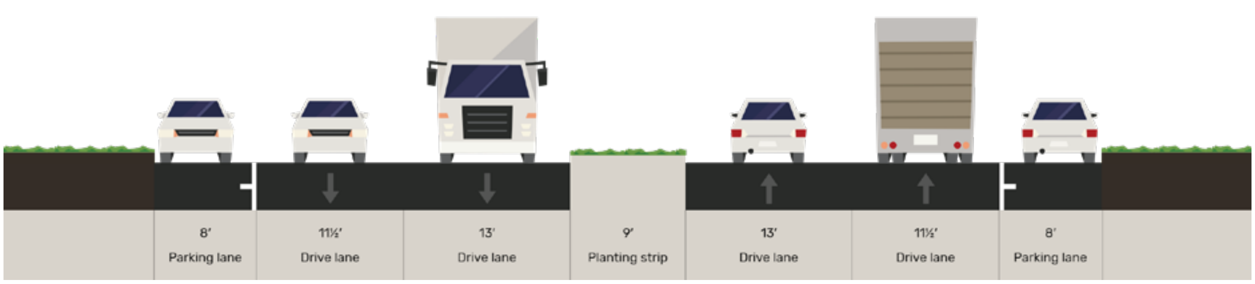


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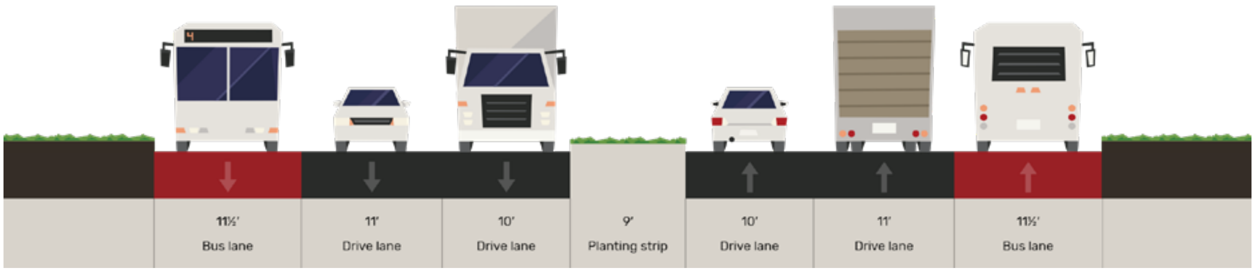
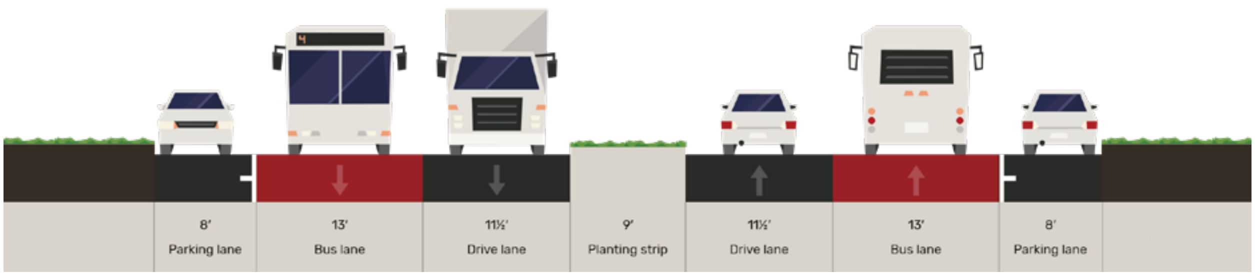
Figure A.13 (Continued)

Proposed Typical Section – Option 1: Convert Parking Lane to Dedicated Transit Lane*



Proposed Typical Section - Option 2: Convert Travel Lane to Dedicated Transit Lane



* Preferred width for a BRT lane is 12 feet; however, 11-foot minimums can be considered if necessary. Converting a parking lane and narrowing travel lanes to minimum accepted widths would allow for an 11.5-foot lane along this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.14
N. Teutonia Avenue from W. Custer Avenue to W. Cornell Street

Reference Map

Source: SEWRPC

Existing Typical Section

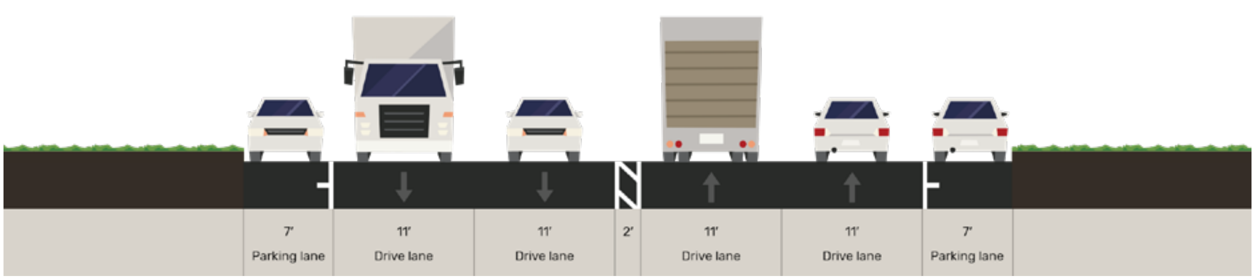
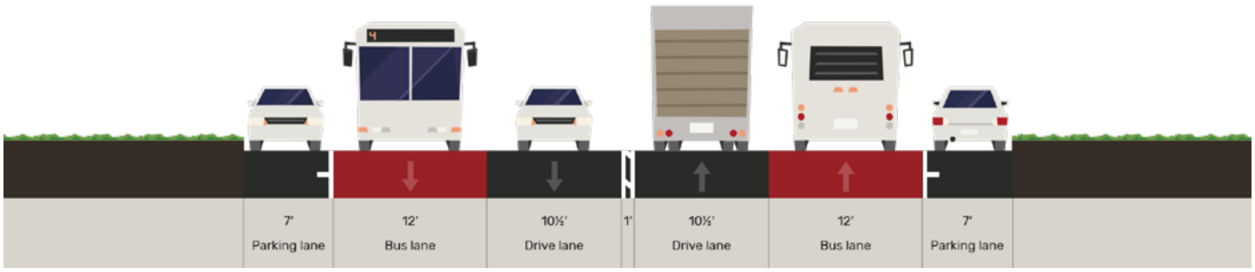


Figure continued on next page.

Figure A.14 (Continued)

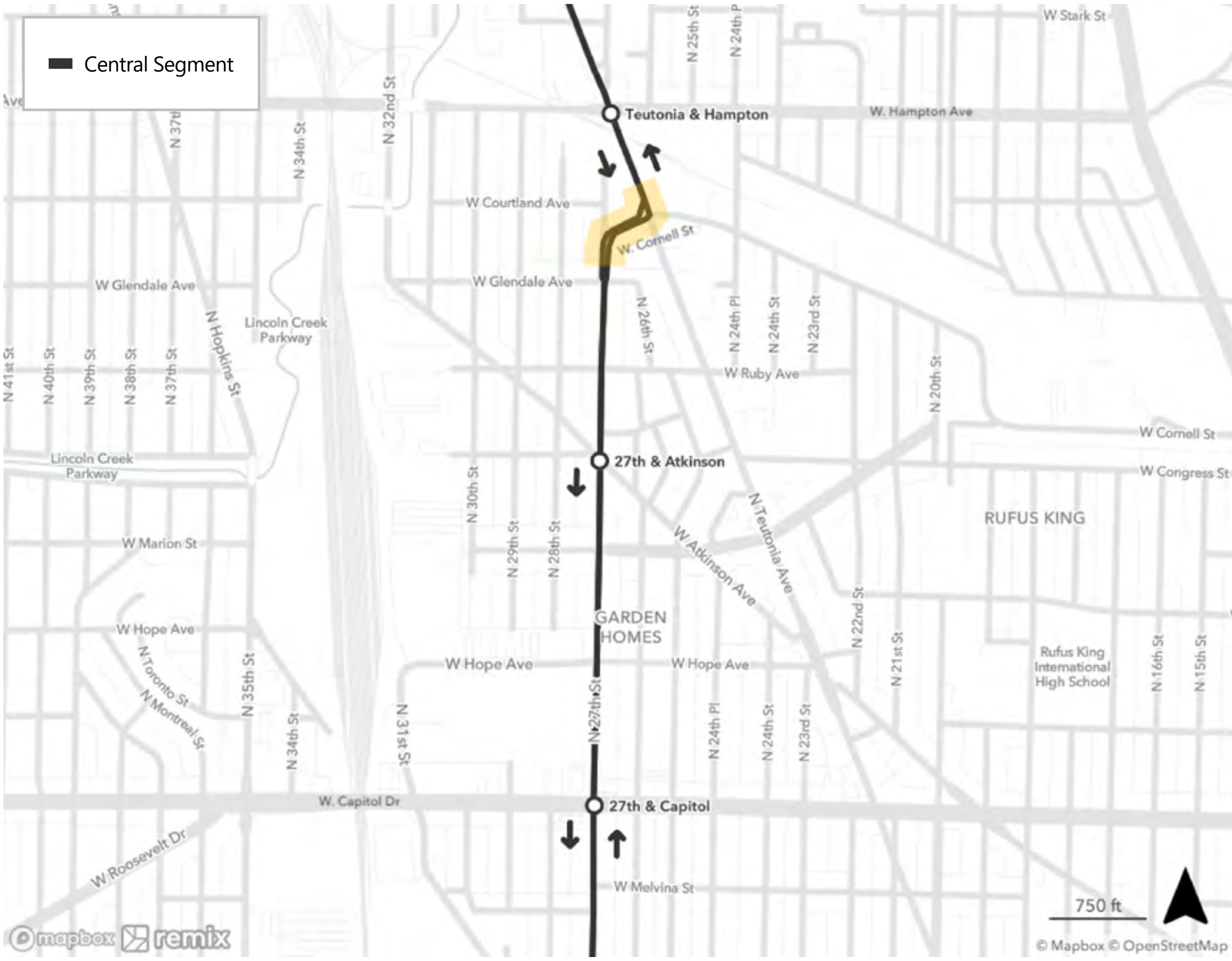
Proposed Typical Section - Option 1: Convert Travel Lane to Dedicated Transit Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

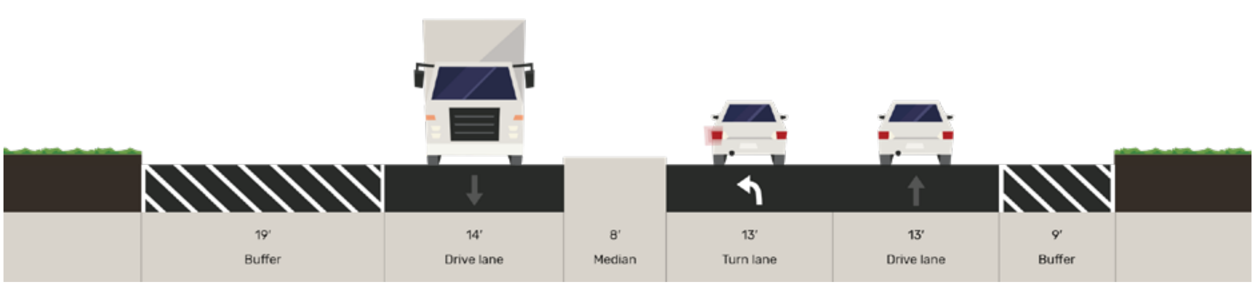
Figure A.15
W. Cornell Street from N. Teutonia Avenue to N. 27th Street

Reference Map



Source: SEWRPC

Existing Typical Section*



* This segment is less than one-tenth of a mile long. Although some space may be available for a dedicated transit lane, BRT service would not benefit from providing a dedicated lane on this short of a segment; therefore, no changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.16
N. 27th Street from W. Cornell Street to W. Hope Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

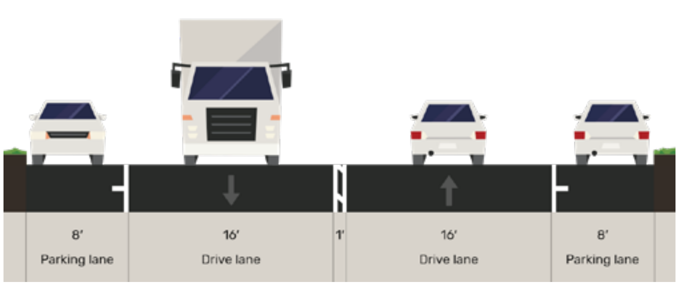


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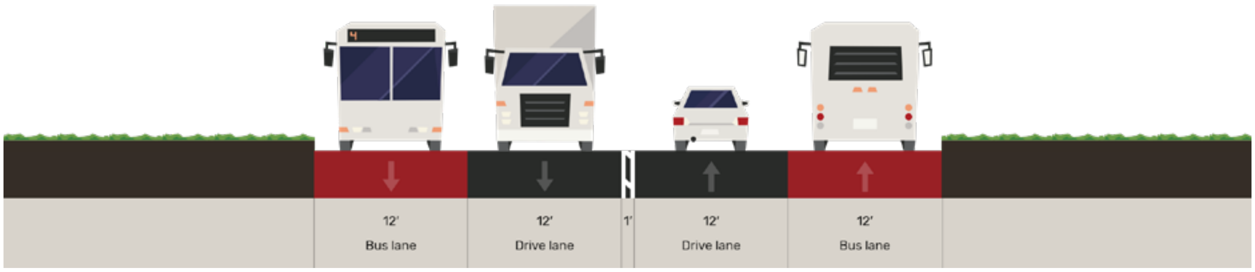
Figure A.16 (Continued)

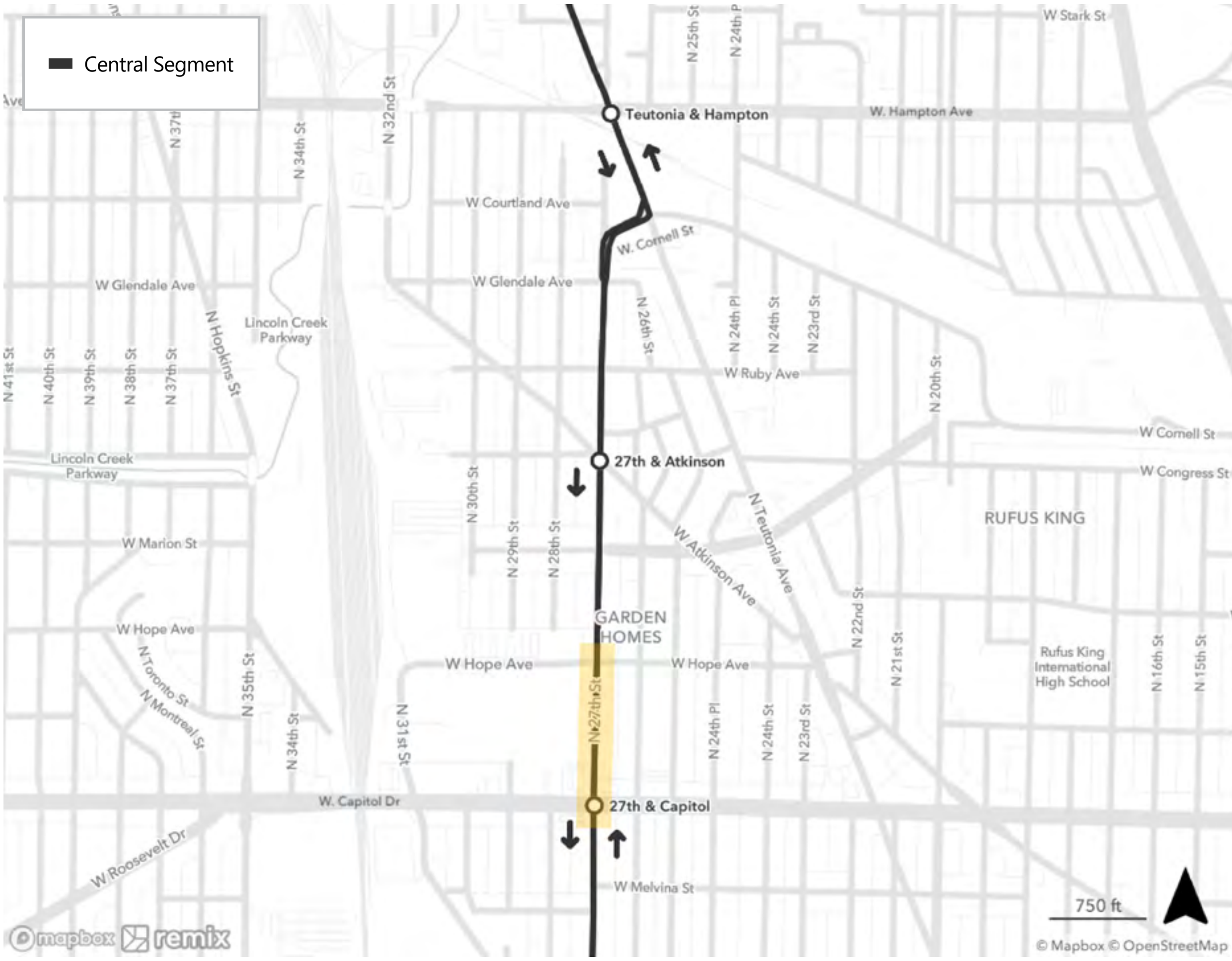
Proposed Typical Section – Option 1: Convert Parking Lane to Dedicated Transit Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.17
N. 27th Street from W. Hope Avenue to W. Capitol Drive

Reference Map



Source: SEWRPC

Existing Typical Section

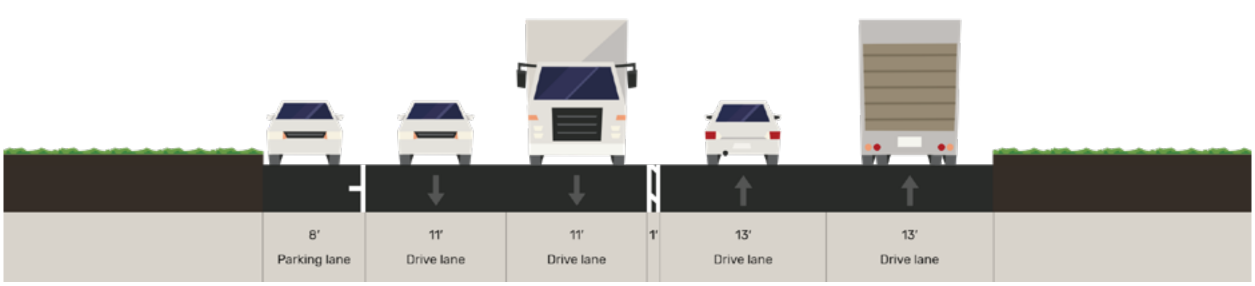


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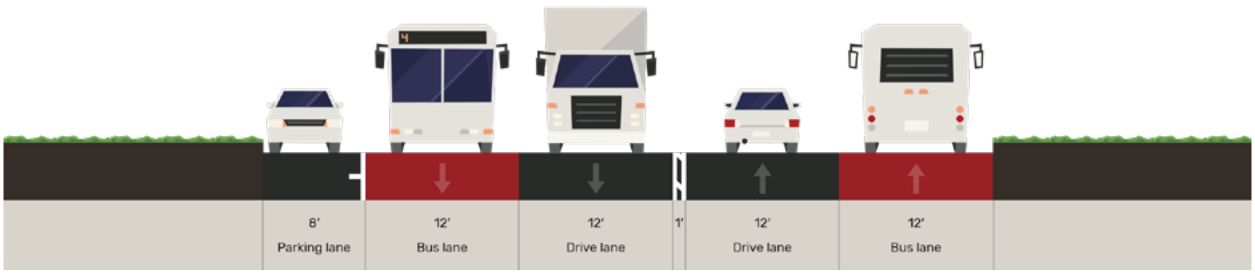
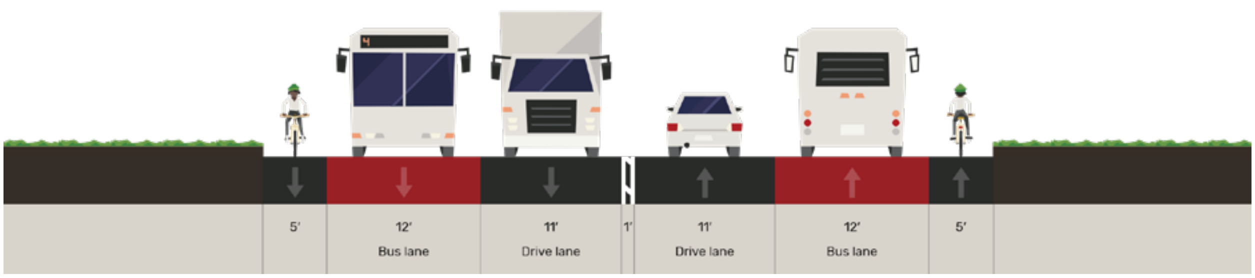
Figure A.17 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane



Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane and Convert Parking Lane to Bike Lanes*



* Wide travel lanes and the southbound parking lane that appears to be underutilized could be converted to narrower travel lanes and dedicated bike lanes which would improve multimodal options and calm traffic.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.18
N. 27th Street from W. Capitol Drive to W. Meinecke Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

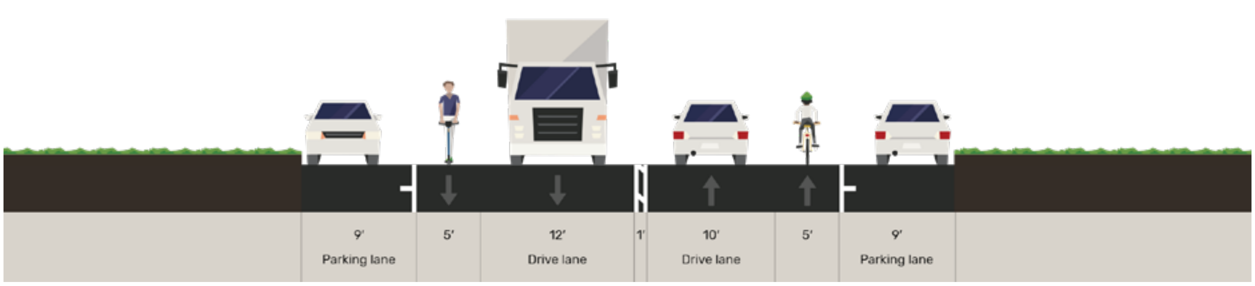


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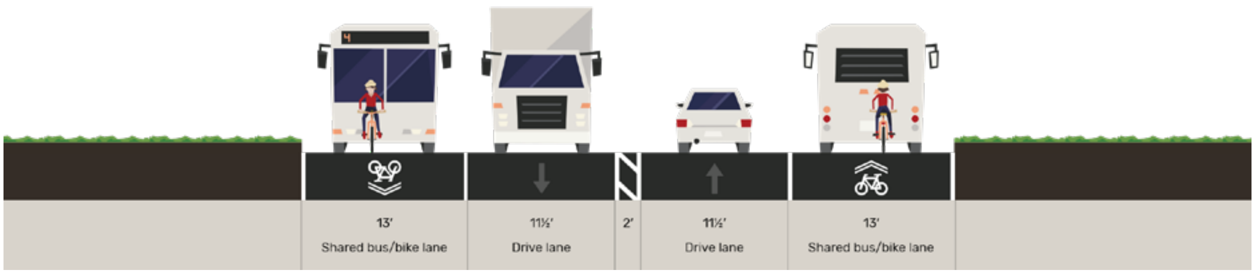
Figure A.18 (Continued)

Proposed Typical Section – Option 1: Convert Parking and Bike Lane to Shared Bus-Bike Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.19
N. 27th Street from W. Meinecke Avenue to W. Garfield Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

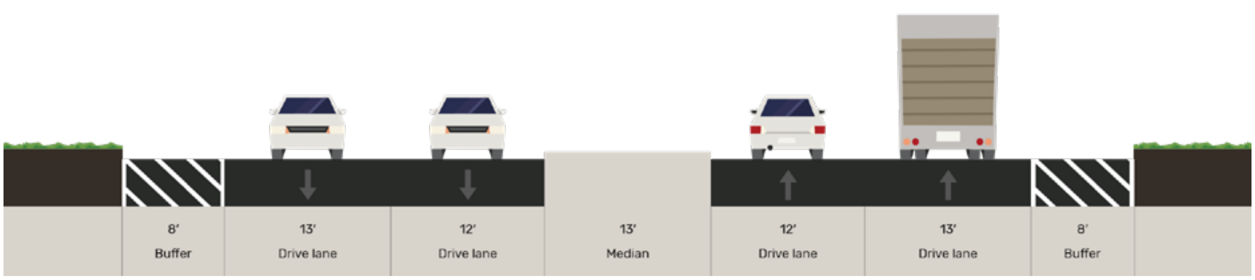


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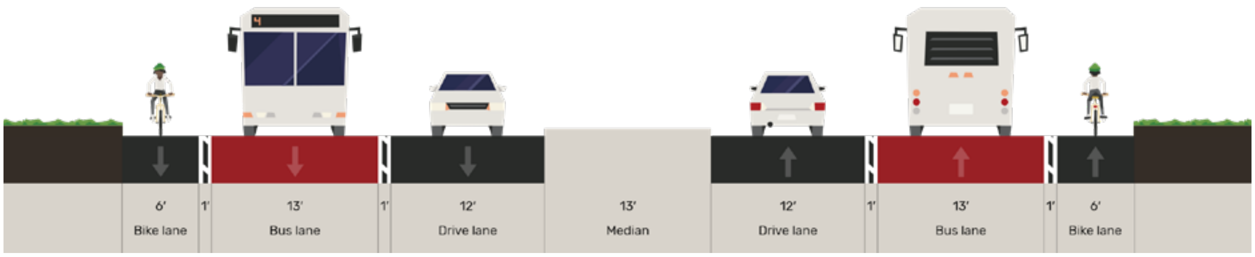
Figure A.19 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane and Shoulder to Bike Lane and Transit Lane Buffer*



* Option includes proposal to convert the shoulder to a dedicated bike lane to provide a continuous bike facility along the corridor and calm traffic.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.20
N. 27th Street from W. Garfield Avenue to W. Lisbon Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

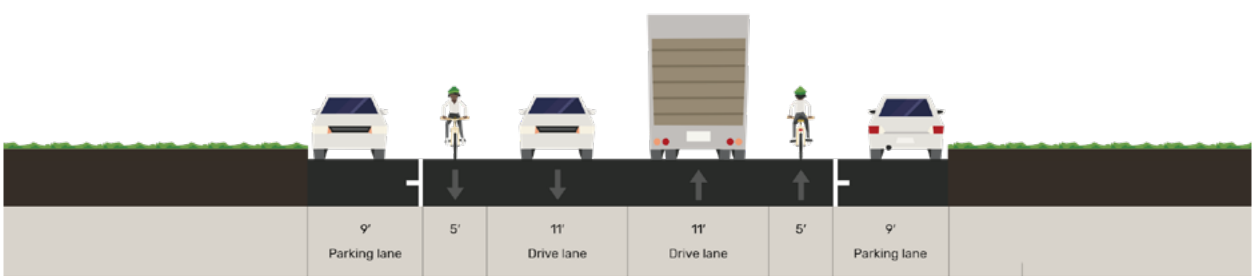


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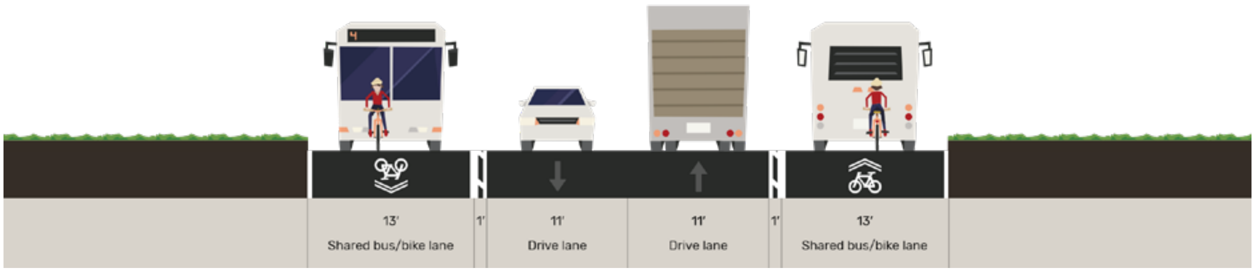
Figure A.20 (Continued)

Proposed Typical Section – Option 1: Convert Parking and Bike Lane to Shared Bus-Bike Lane with Buffer



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.21
N. 27th Street from W. Lisbon Avenue to W. State Street

Reference Map

Source: SEWRPC

Existing Typical Section

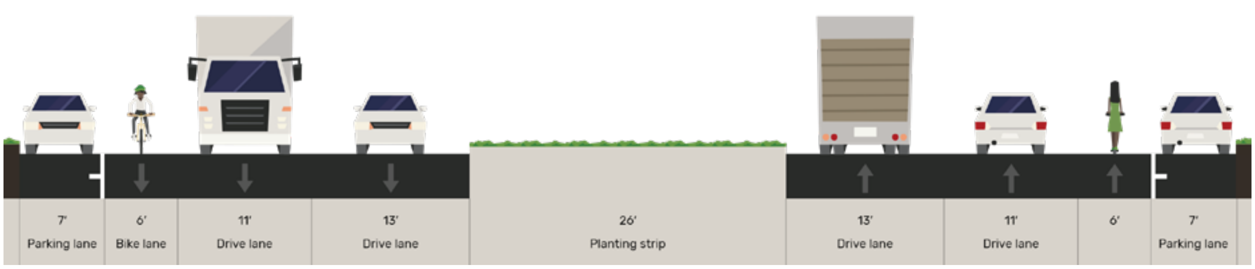


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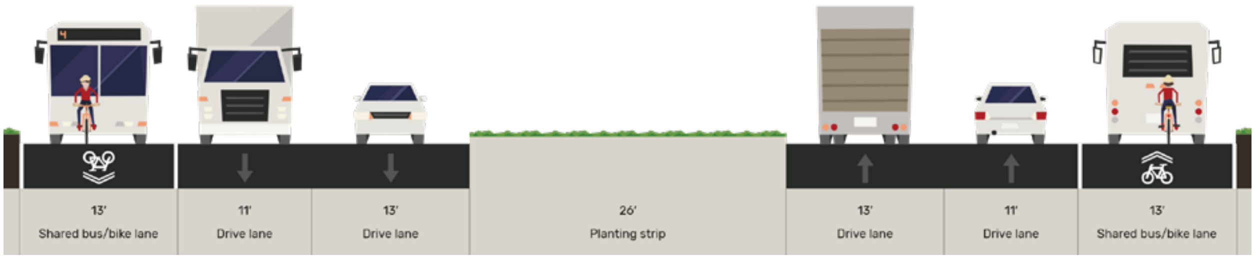
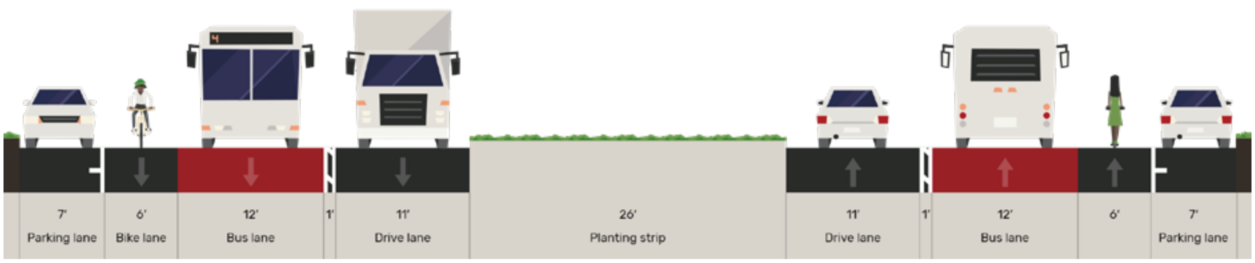
Figure A.21 (Continued)

Proposed Typical Section – Option 1: Convert Parking and Bike Lane to Shared Bus-Bike Lane



Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane with Buffer



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.22
N. 27th Street from W. State Street to W. Wisconsin Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

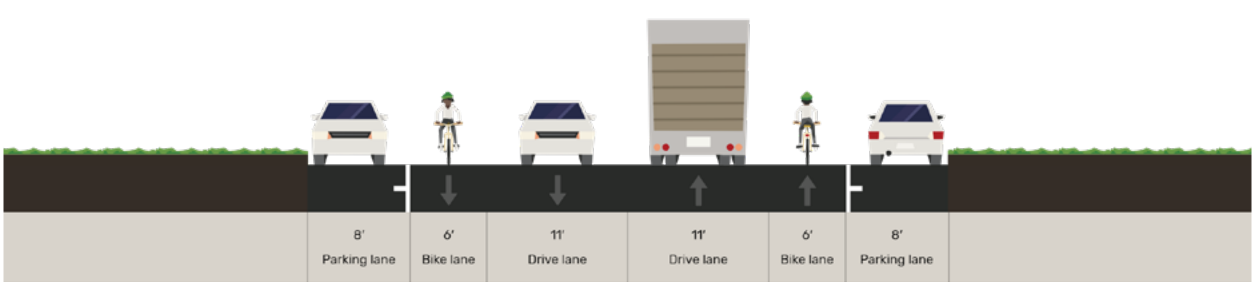


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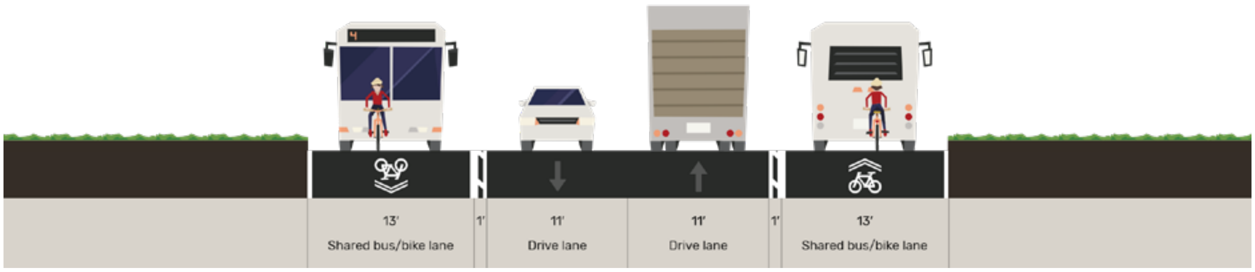
Figure A.22 (Continued)

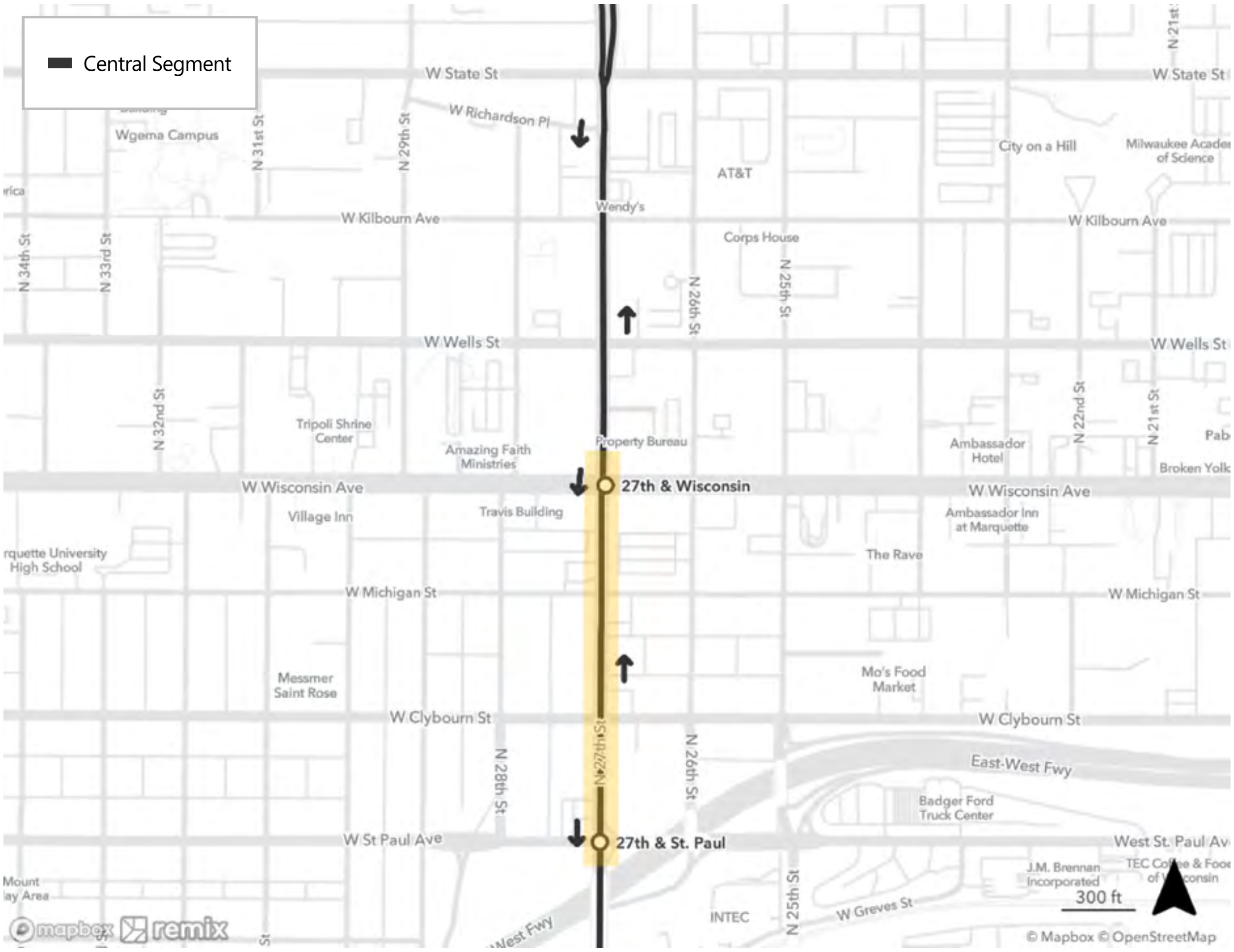
Proposed Typical Section – Option 1: Convert Parking and Bike Lane to Shared Bus-Bike Lane with Buffer



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.23
N. 27th Street from W. Wisconsin Avenue to W. St. Paul Avenue

Reference Map



Source: SEWRPC

Existing Typical Section

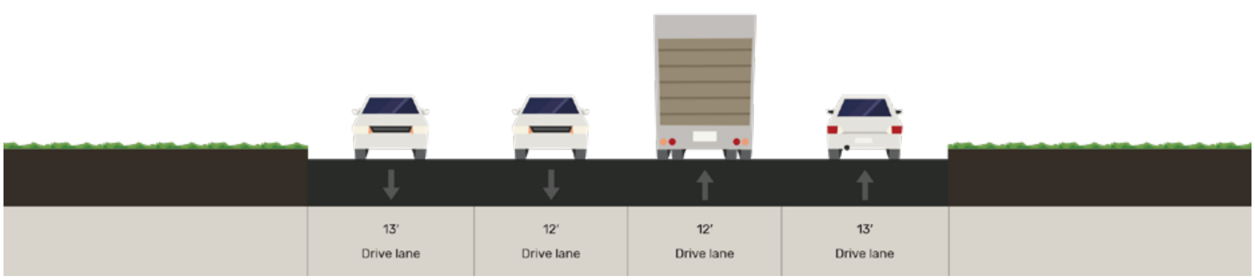


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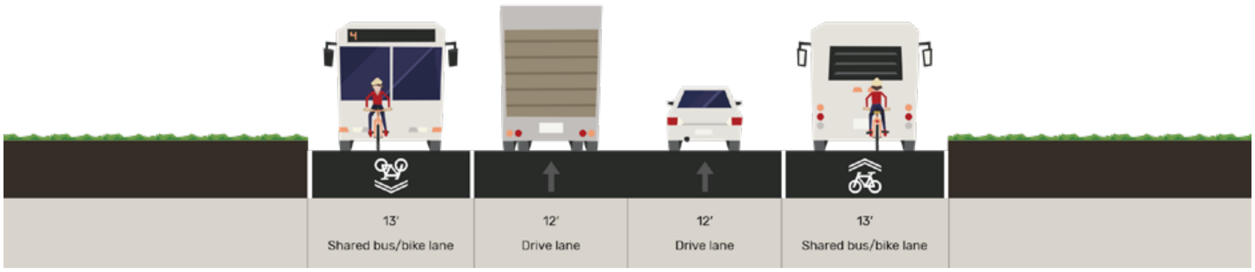
Figure A.23 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Shared Bus-Bike Lane*

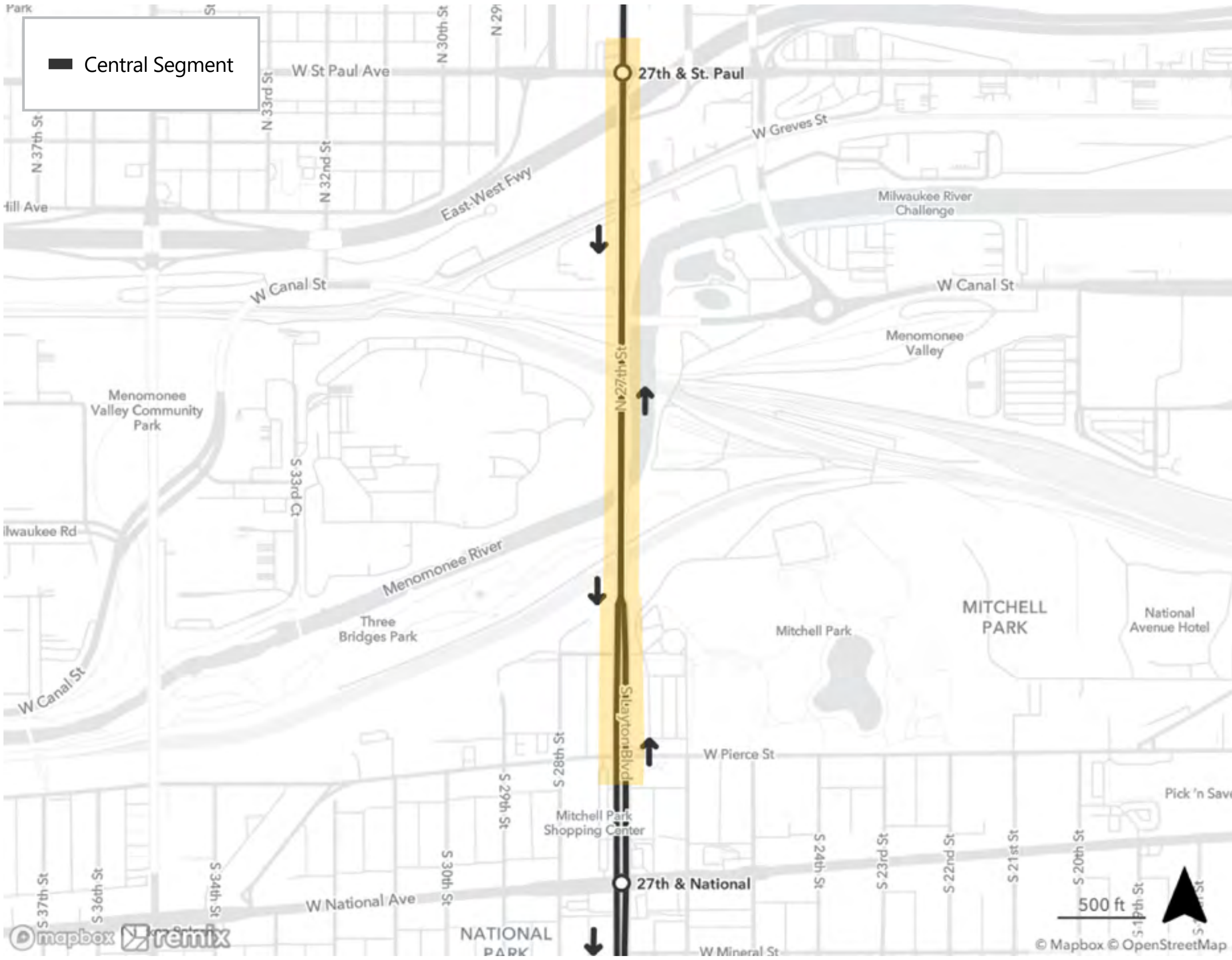


* Option includes shared bus-bike lanes to provide a continuous bike facility along the corridor.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.24
N. 27th Street/S. Layton Boulevard from W. St. Paul Avenue to W. Pierce Street (Viaduct over the Menomonee Valley)

Reference Map



Source: SEWRPC

Existing Typical Section

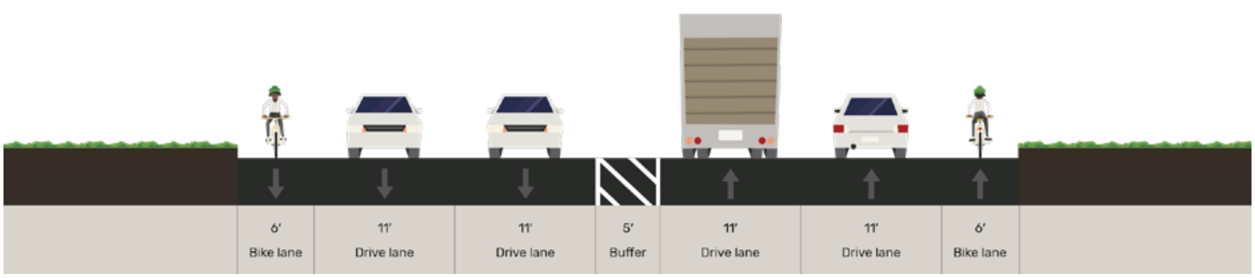


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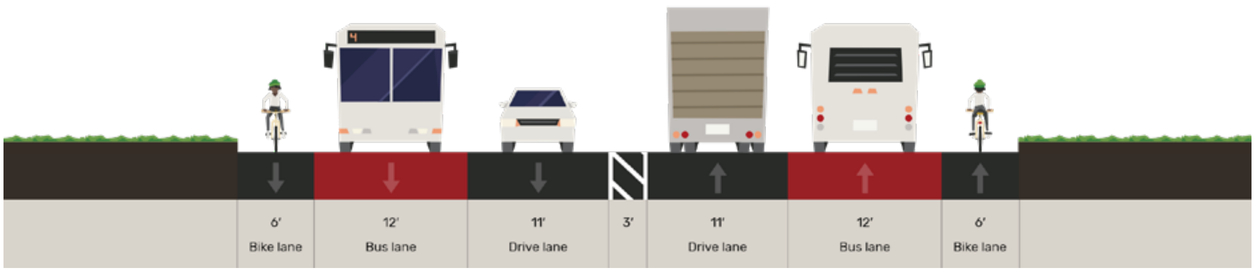
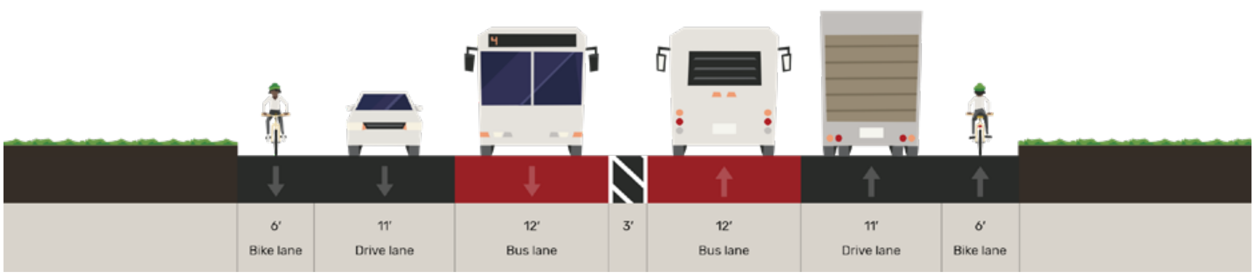
Figure A.24 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane*

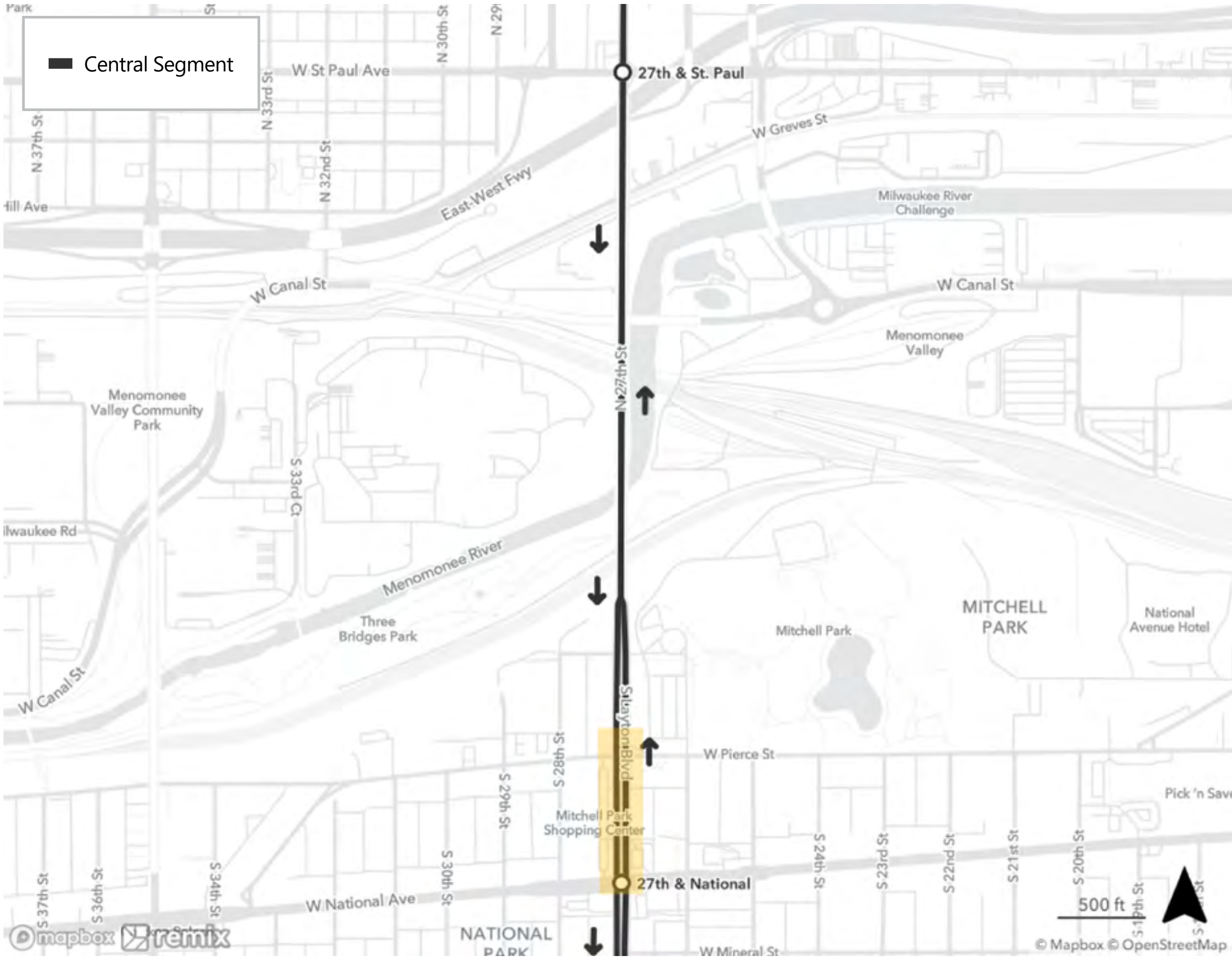


* Although there is not a median present, a center-running configuration is possible since there are no stations proposed in this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.25
S. Layton Boulevard from W. Pierce Street to W. National Avenue

Reference Map



Source: SEWRPC

Existing Typical Section

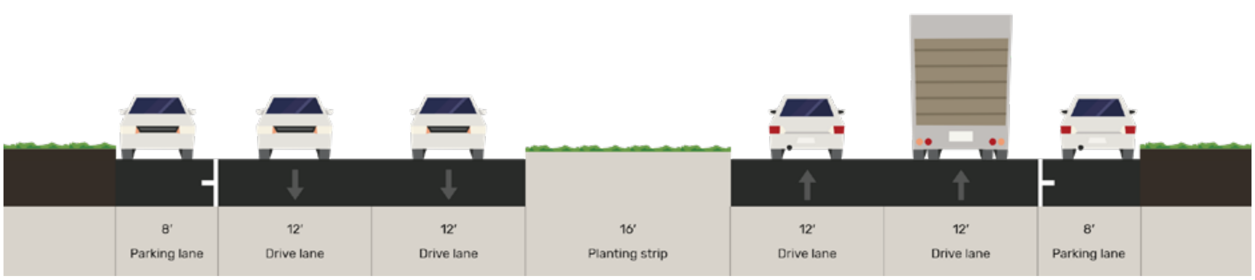


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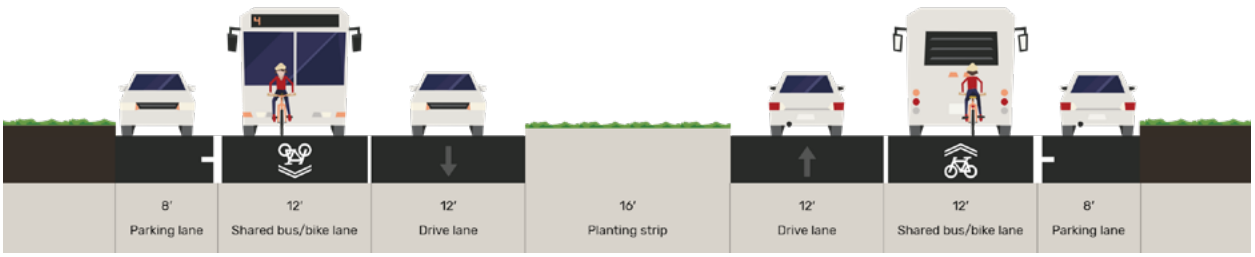
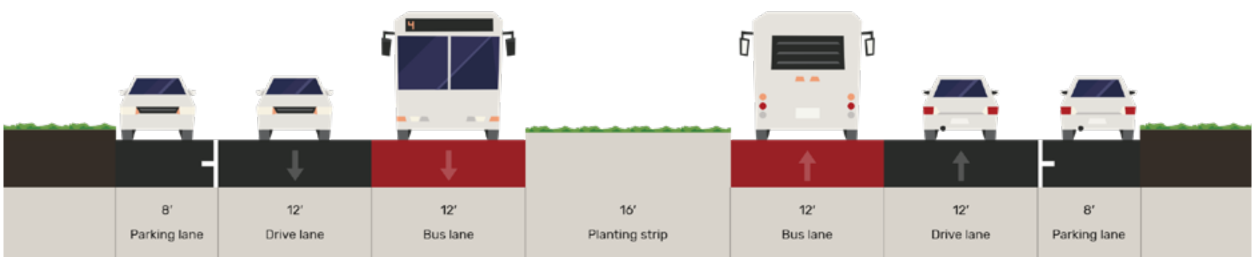
Figure A.25 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Shared Bus-Bike Lane

Dedicated Outside Lane*



Dedicated Center Lane**



* Option includes shared bus-bike lanes to provide a continuous bike facility along the corridor.

** One parking lane could be converted to a bike lane if desired along this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.26
S. Layton Boulevard from W. National Avenue to W. Lincoln Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

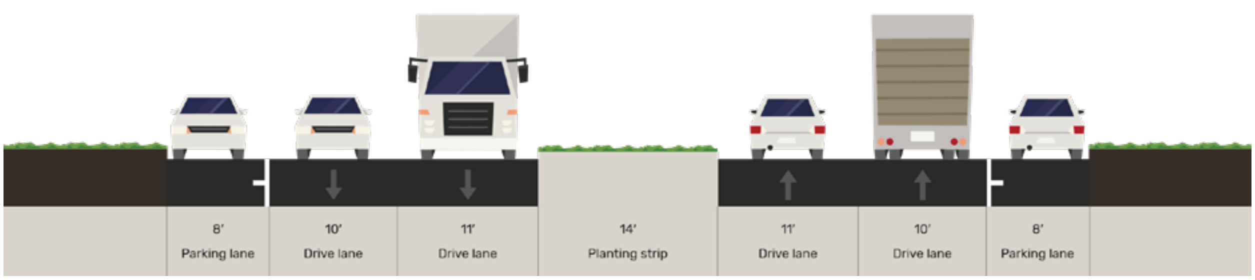


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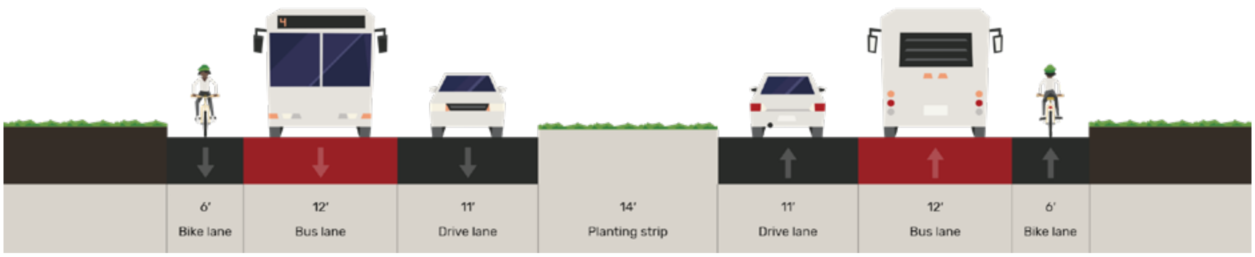
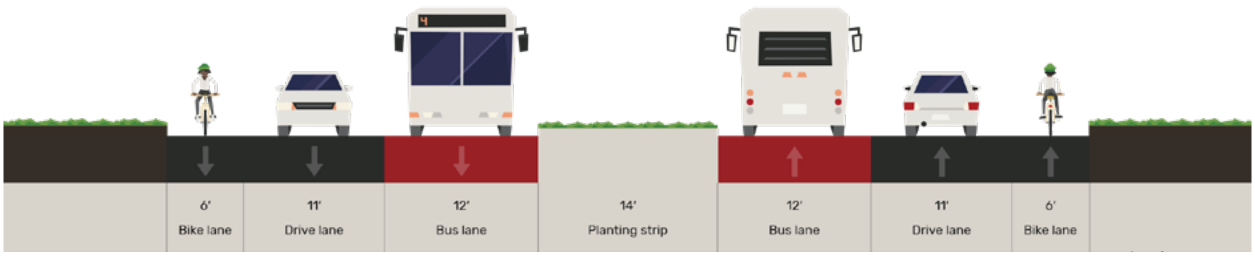
Figure A.26 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane and Parking Lane to Dedicated Transit Lane and Bike Lane

Dedicated Outside Lane



Dedicated Center Lane



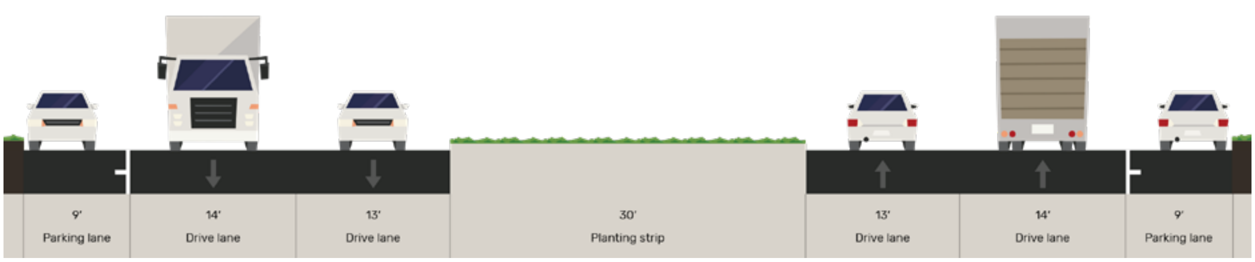
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.27
S. 27th Street from W. Lincoln Avenue to W. Ohio Avenue

Reference Map

Source: SEWRPC

Existing Typical Section*



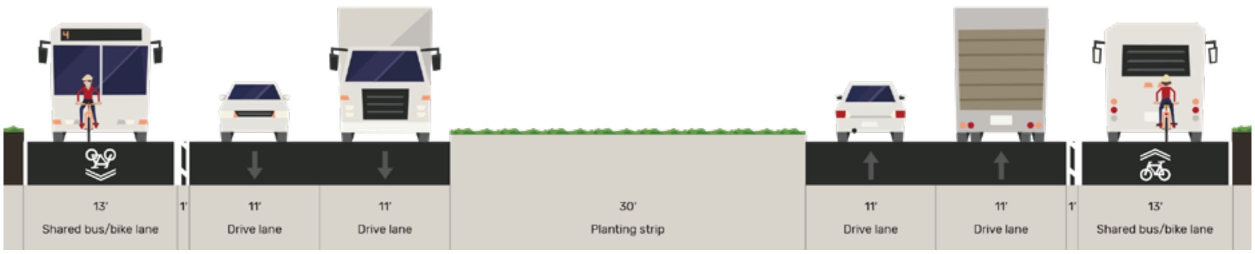
* Some portions of this segment include bike lanes with narrower travel and parking lanes.

Figure continued on next page.

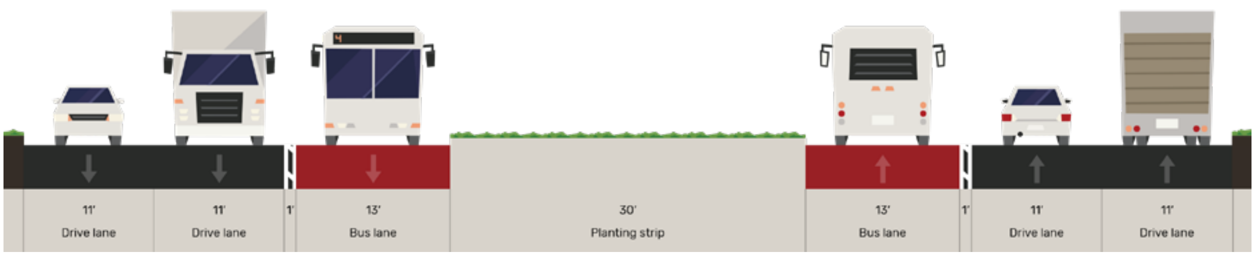
Figure A.27 (Continued)

Proposed Typical Section – Option 1: Convert Parking Lane to Shared Bus-Bike Lane with Buffer (Outside-running) or Dedicated Transit Lane (Center-running)

Dedicated Outside Lane

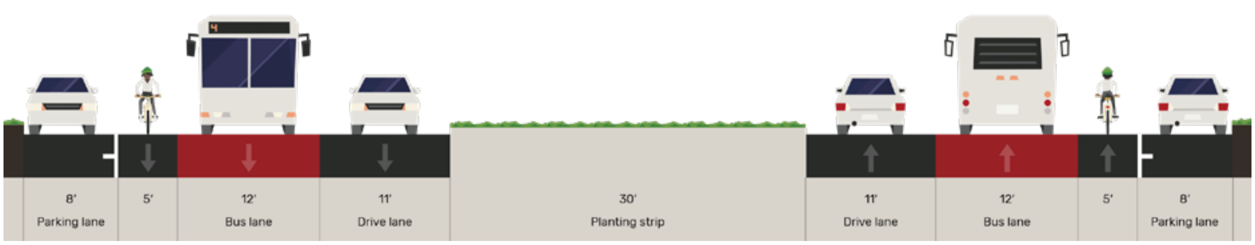


Dedicated Center Lane**

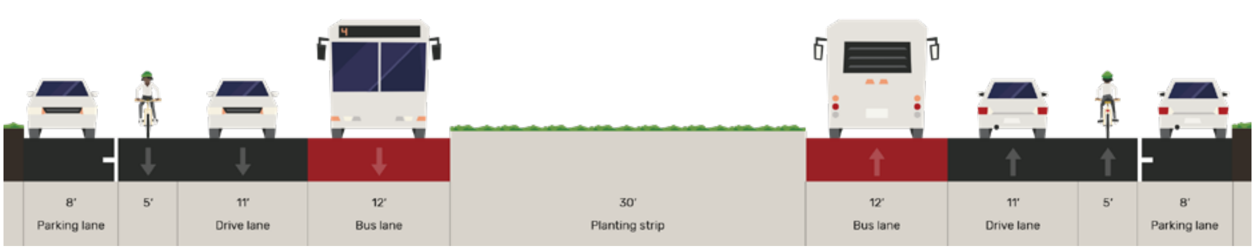


Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane and Continuous Bike Lane

Dedicated Outside Lane



Dedicated Center Lane



** A shared bus-bike lane is not recommended for a center-running configuration.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.28
S. 27th Street from W. Ohio Avenue to W. Cold Spring Road

Reference Map

Source: SEWRPC

Existing Typical Section

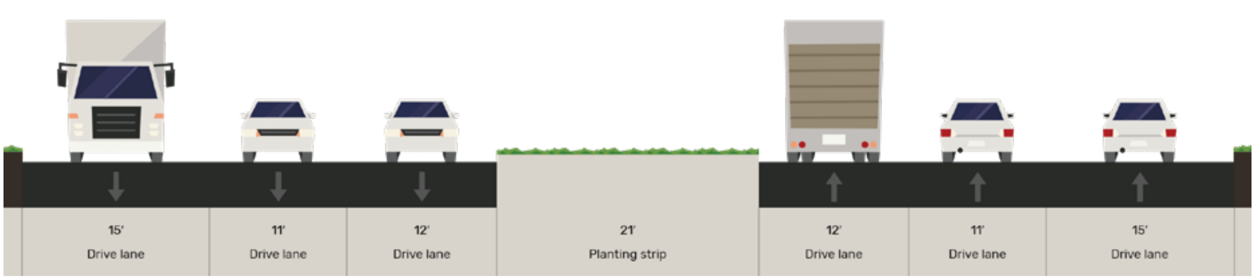


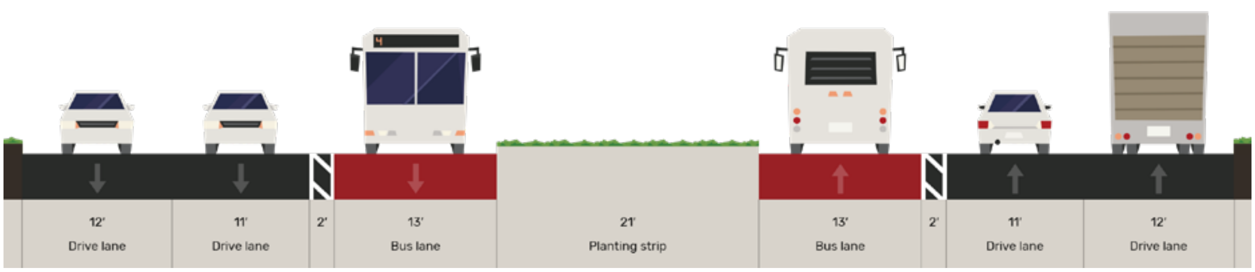
Figure continued on next page.

Figure A.28 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Shared Bus-Bike Lane (Outside-running) or Dedicated Transit Lane (Center-running) with Buffer

Dedicated Outside Lane*

Dedicated Center Lane**



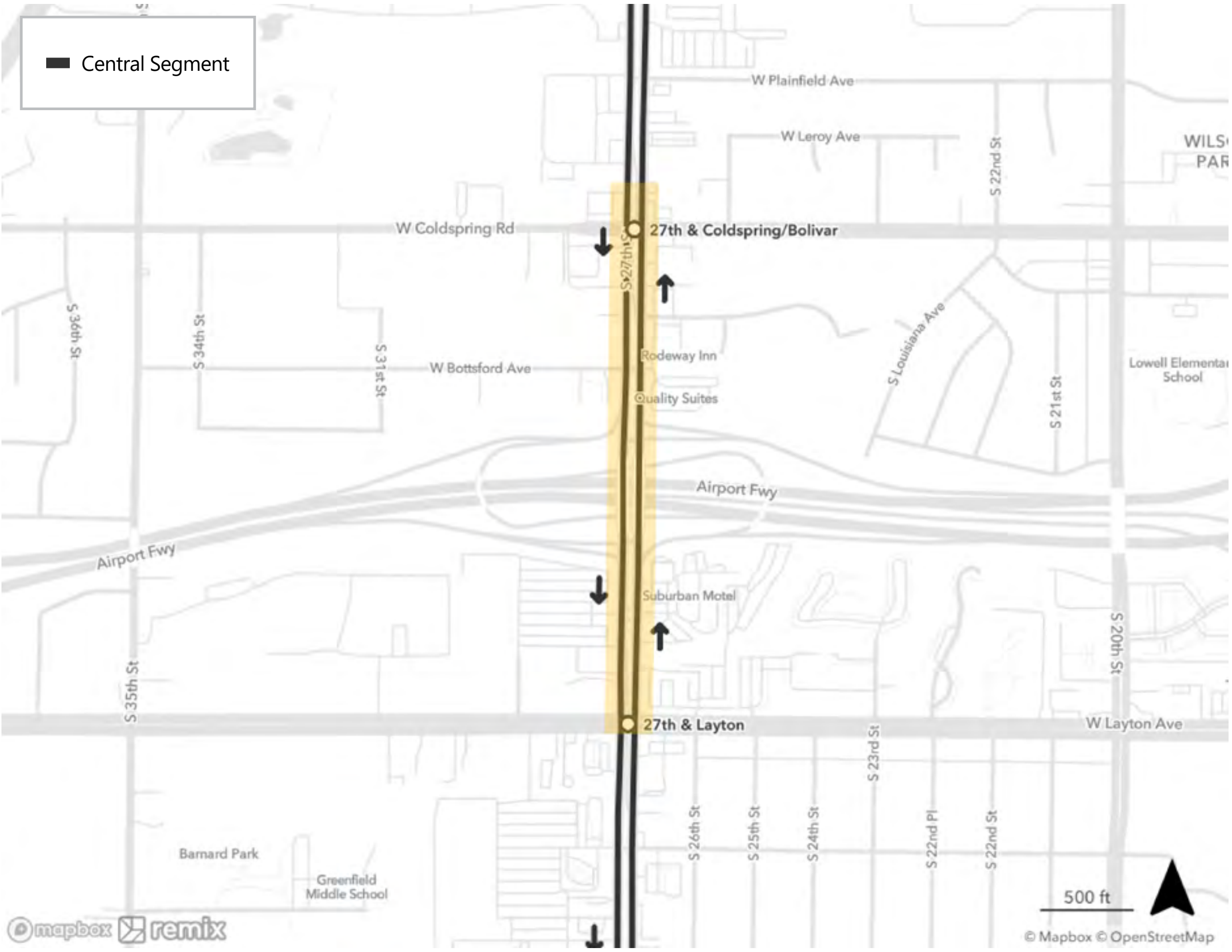
* Option includes shared bus-bike lanes to provide a continuous bike facility along the corridor.

** A shared bus-bike lane is not recommended for a center-running configuration.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.29
S. 27th Street from W. Cold Spring Road to W. Layton Avenue

Reference Map



Source: SEWRPC

Existing Typical Section

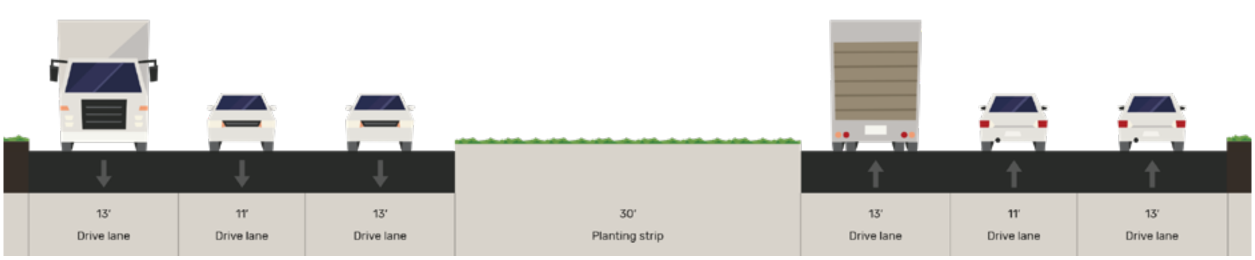


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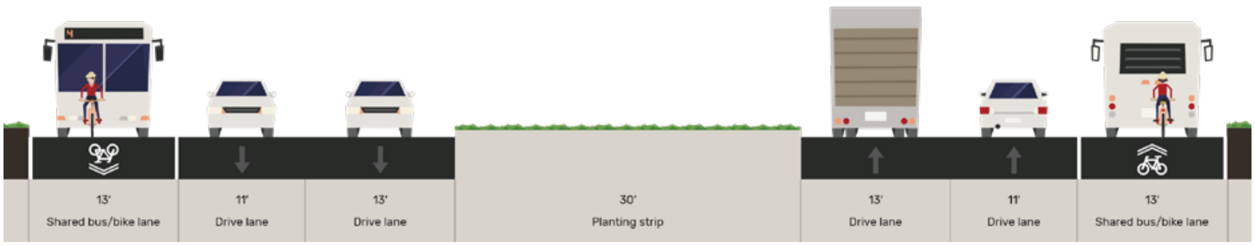
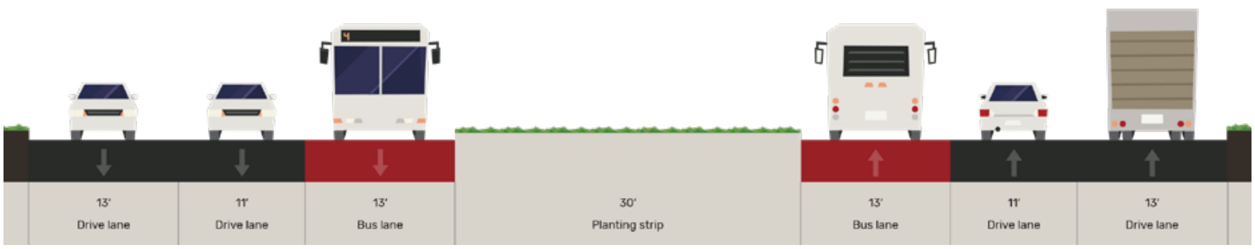
Figure A.29 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Shared Bus-Bike Lane (Outside-running) or Dedicated Transit Lane (Center-running)

Dedicated Outside Lane*



Dedicated Center Lane**



* Option includes shared bus-bike lanes to provide a continuous bike facility along the corridor.

** A shared bus-bike lane is not recommended for a center-running configuration.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.30
S. 27th Street from W. Layton Avenue to W. College Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

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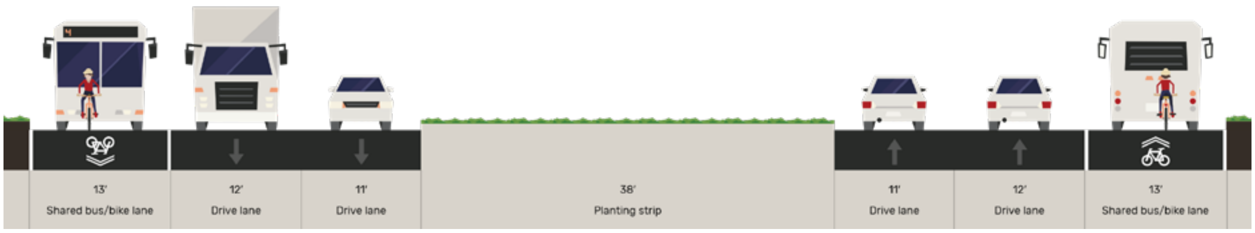
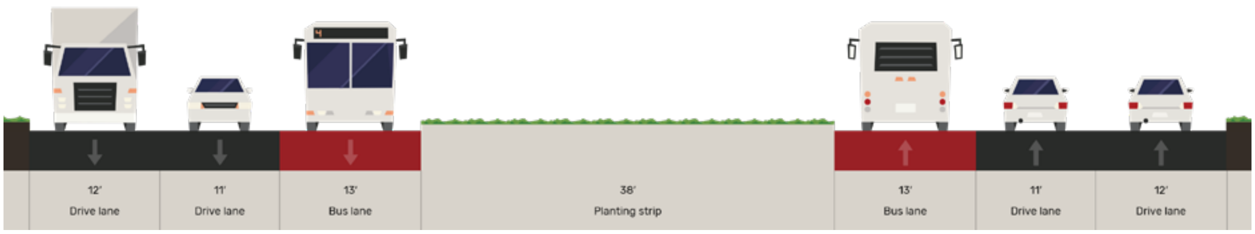
Figure A.30 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Shared Bus-Bike Lane (Outside-running) or Dedicated Transit Lane (Center-running)

Dedicated Outside Lane*



Dedicated Center Lane**



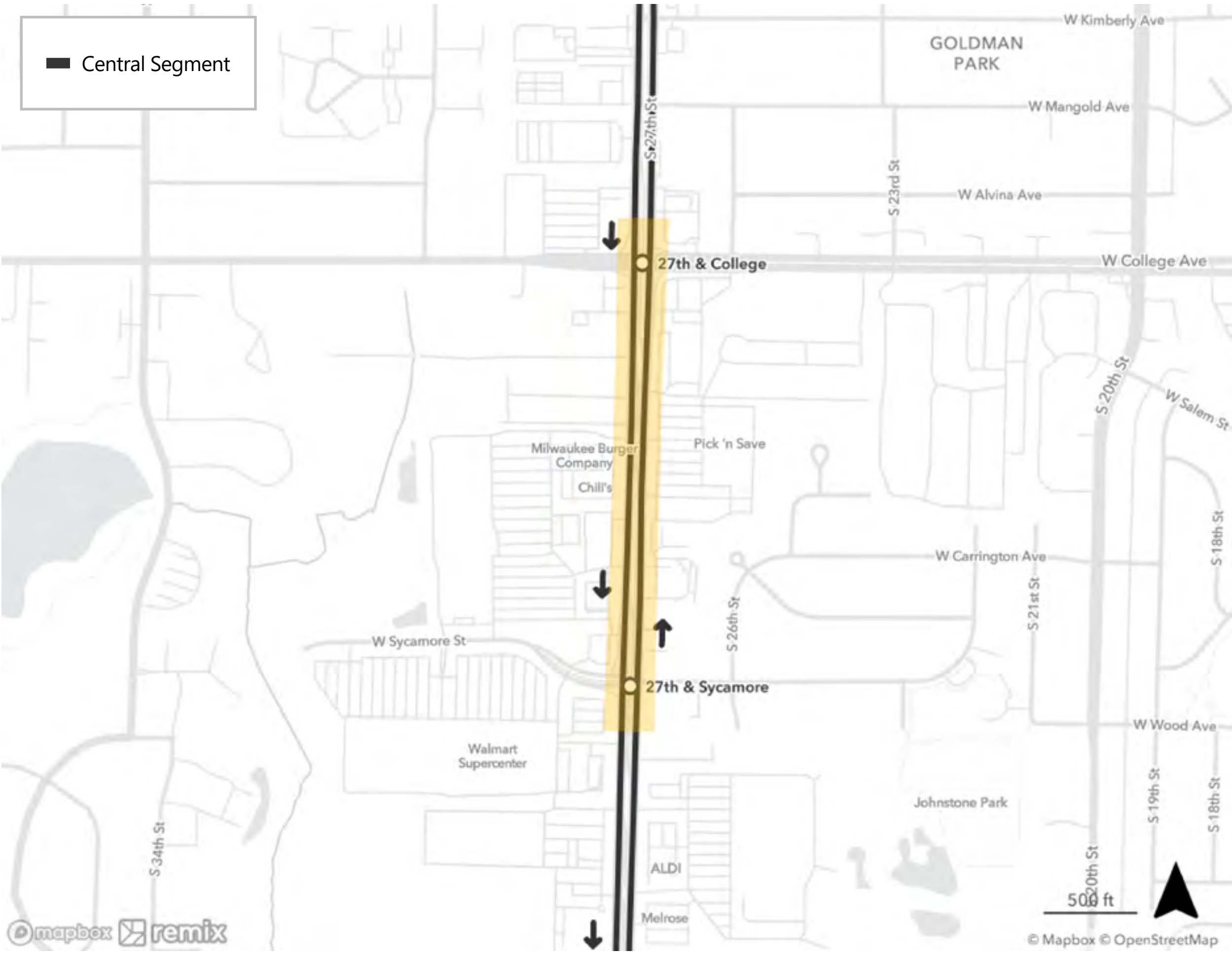
* Option includes shared bus-bike lanes to provide a continuous bike facility along the corridor.

** A shared bus-bike lane is not recommended for a center-running configuration.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.31
S. 27th Street from W. College Avenue to W. Sycamore Street

Reference Map



Source: SEWRPC

Existing Typical Section

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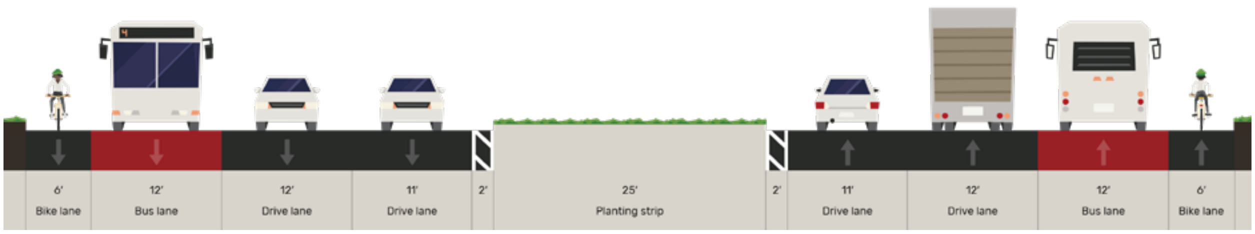
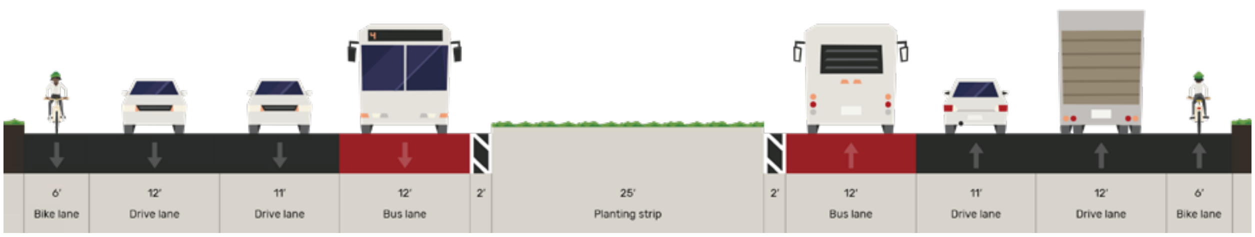
Figure A.31 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.32
S. 27th Street from W. Sycamore Street to Northwestern Mutual Way

Reference Map

Source: SEWRPC

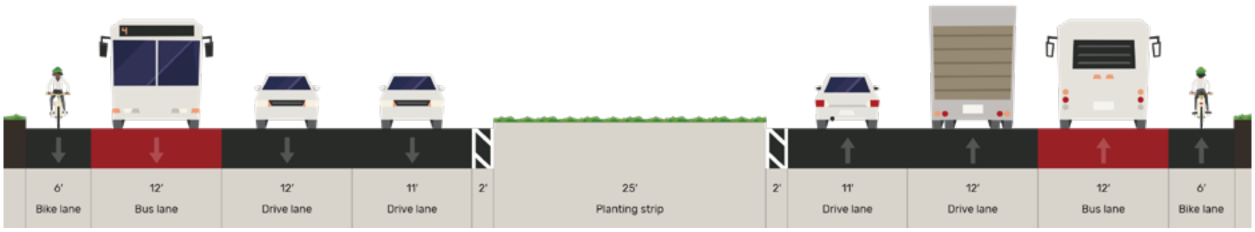
Existing Typical Section

Figure continued on next page.

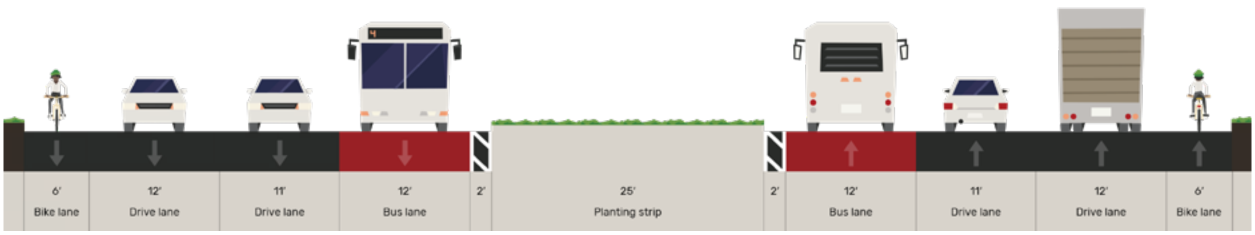
Figure A.32 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane



Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

SOUTH OPTION A

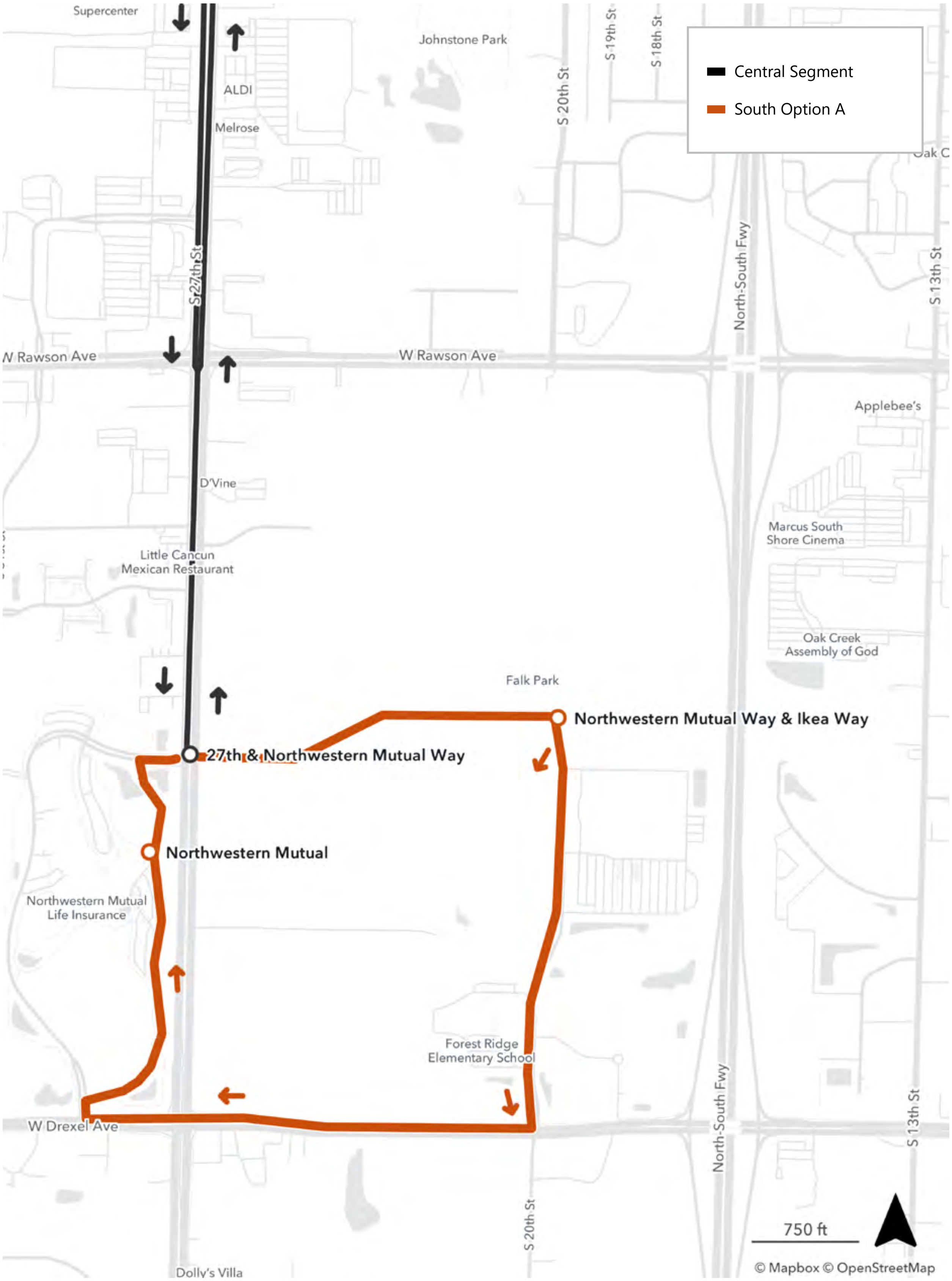
Reference Map

Map A.9 shows the South Option A route segment, which extends east from the intersection of S. 27th Street and Northwestern Mutual Way along a future extension of Northwestern Mutual Way, turns south along the existing and future extension of Ikea Way, then turns west along W. Drexel Avenue, before turning back north along Northwestern Mutual Way to connect back to S. 27th Street. The location of the future extensions of Northwestern Mutual Way and Ikea Way shown on the map are approximate locations and may change as those roadways are designed and constructed. Generalized proposed station locations are also shown.

Typical Sections

Figures A.33 through A.36 show existing and proposed typical sections for roadway segments along the South Option A route segment. A more detailed reference map is also included for each segment.

Map A.9
South Option A



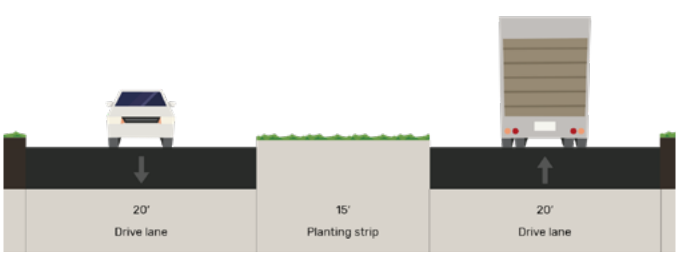
Source: SEWRPC

Figure A.33
(Future) Northwestern Mutual Way from S. 27th Street to S. Ikea Way

Reference Map

Source: SEWRPC

Existing Typical Section



Note: This typical section is an estimate based on the existing cross section on nearby S. Ikea Way. The actual typical section for this future segment of Northwestern Mutual Way may differ. No changes in roadway configuration are expected to be considered for this segment.

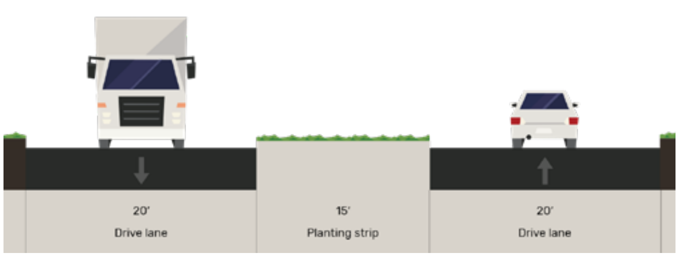
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.34
S. Ikea Way (Including Future Extension) from (Future) Northwestern Mutual Way to W. Drexel Avenue

Reference Map

Source: SEWRPC

Existing Typical Section



Note: The expected typical section of the future extension of S. Ikea Way is expected to match the existing typical section of S. Ikea Way that is already built out, although the actual characteristics of the future extension may differ. No changes in roadway configuration are expected to be considered for this segment.

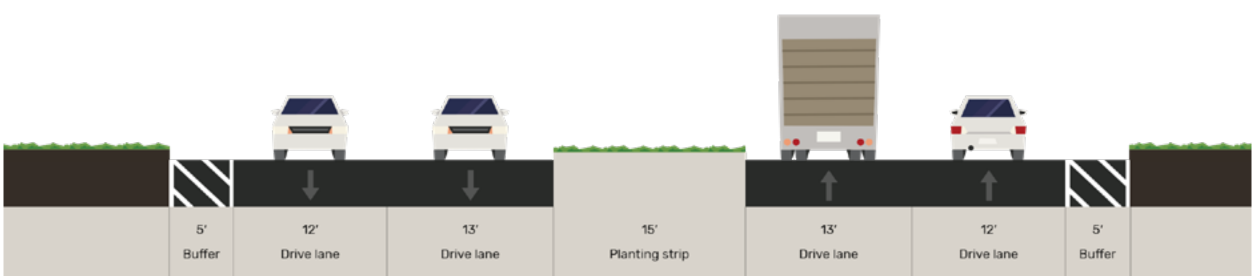
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.35
W. Drexel Avenue from S. Ikea Way to Northwestern Mutual Way

Reference Map

Source: SEWRPC

Existing Typical Section



Note: No changes in roadway configuration are being considered for this segment for alternatives that include South Option A due to the short length of the segment.

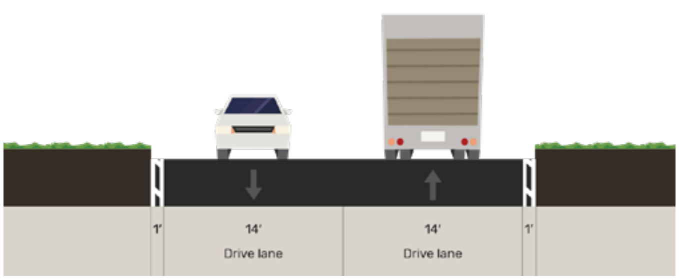
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.36
Northwestern Mutual Way (Private) from W. Drexel Avenue to S. 27th Street

Reference Map

Source: SEWRPC

Existing Typical Section



Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

SOUTH OPTION B

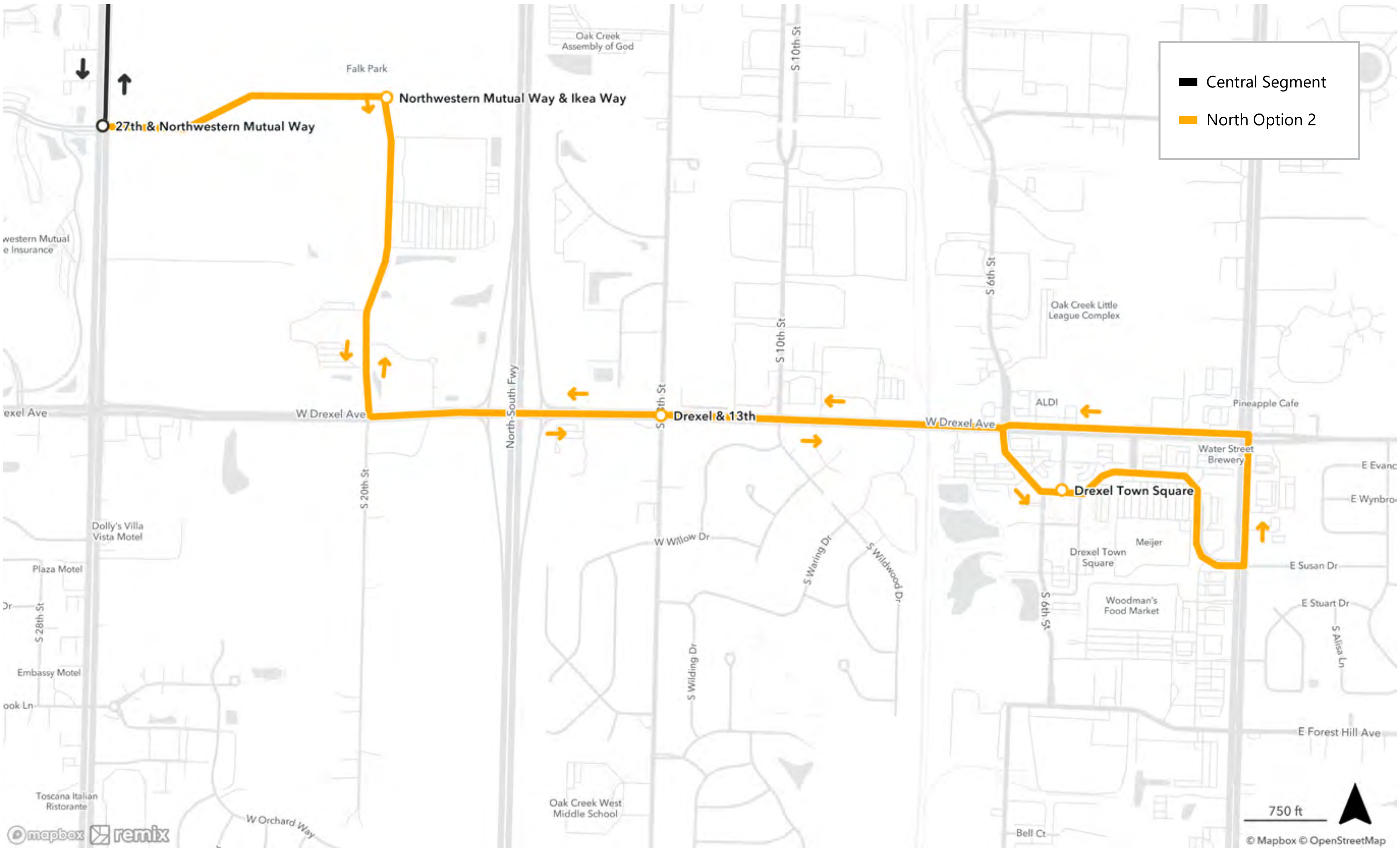
Reference Map

Map A.10 shows the South Option B route segment, which extends east from the intersection of S. 27th Street and Northwestern Mutual Way along a future extension of Northwestern Mutual Way, turns south along the existing and future extension of Ikea Way, turns east along W. Drexel Avenue, turns south onto S. 6th Street/W. Town Square Way (which travels through the Drexel Town Square development), turns north onto S. Howell Avenue, and then turns back west along W. Drexel Avenue for the return trip. Similar to South Option A, the location of the future extensions of Northwestern Mutual Way and Ikea Way shown on the map are approximate locations and may change as those roadways are designed and constructed. Generalized proposed station locations are also shown on the map.

Typical Sections

Figures A.37 through A.40 show existing and proposed typical sections for roadway segments along the South Option B route segment. A more detailed reference map is also included for each segment.

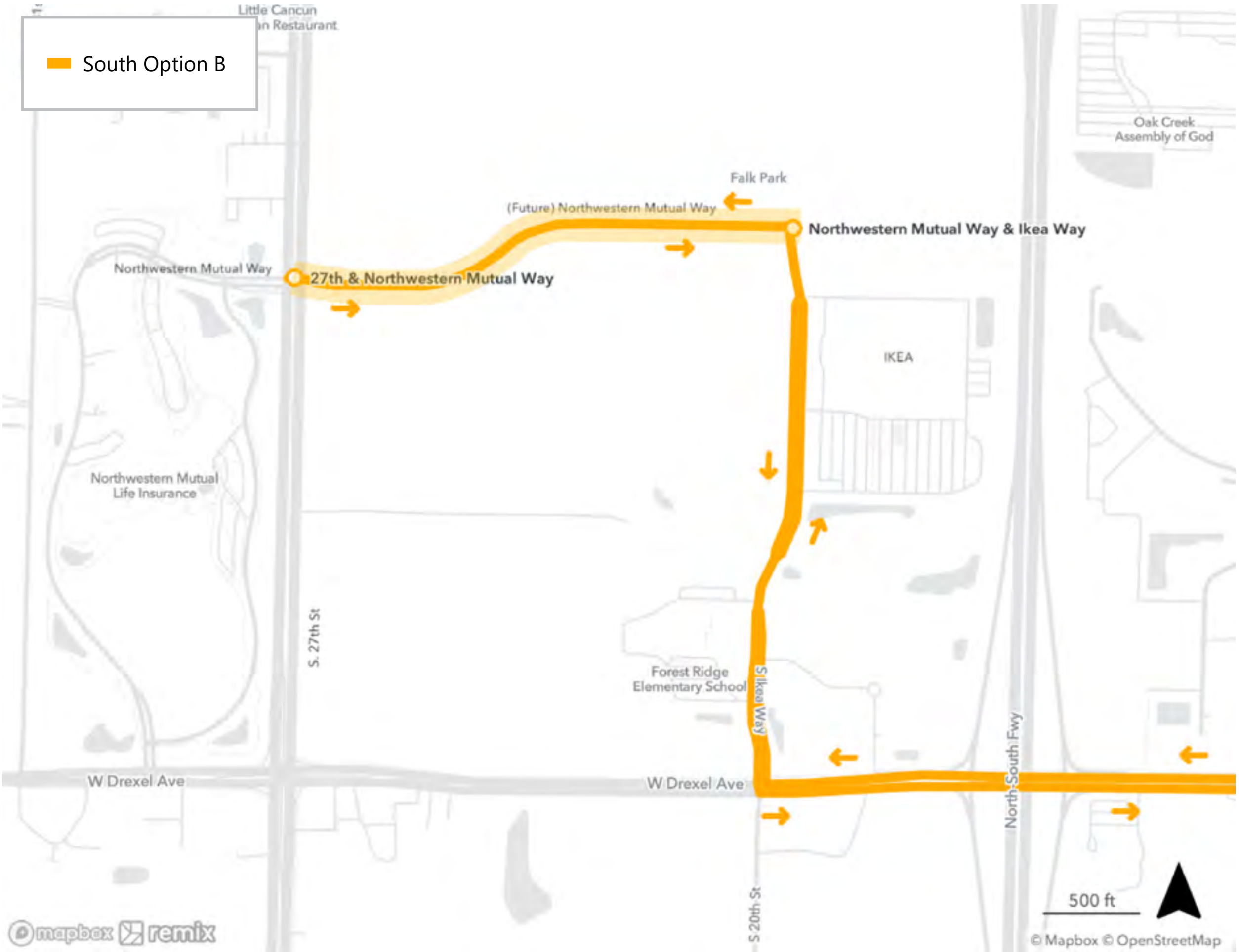
Map A.10
South Option B



Source: SEWRPC

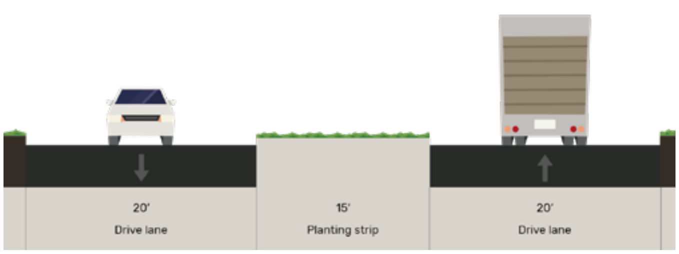
Figure A.37
(Future) Northwestern Mutual Way from S. 27th Street to S. Ikea Way

Reference Map



Source: SEWRPC

Existing Typical Section



Note: This typical section is an estimate based on the existing cross section on nearby S. Ikea Way. The actual typical section for this future segment of Northwestern Mutual Way may differ. No changes in roadway configuration are expected to be considered for this segment.

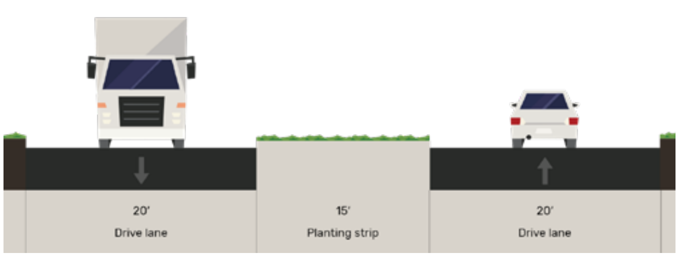
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.38
S. Ikea Way (Including Future Extension) from (Future) Northwestern Mutual Way to W. Drexel Avenue

Reference Map

Source: SEWRPC

Existing Typical Section

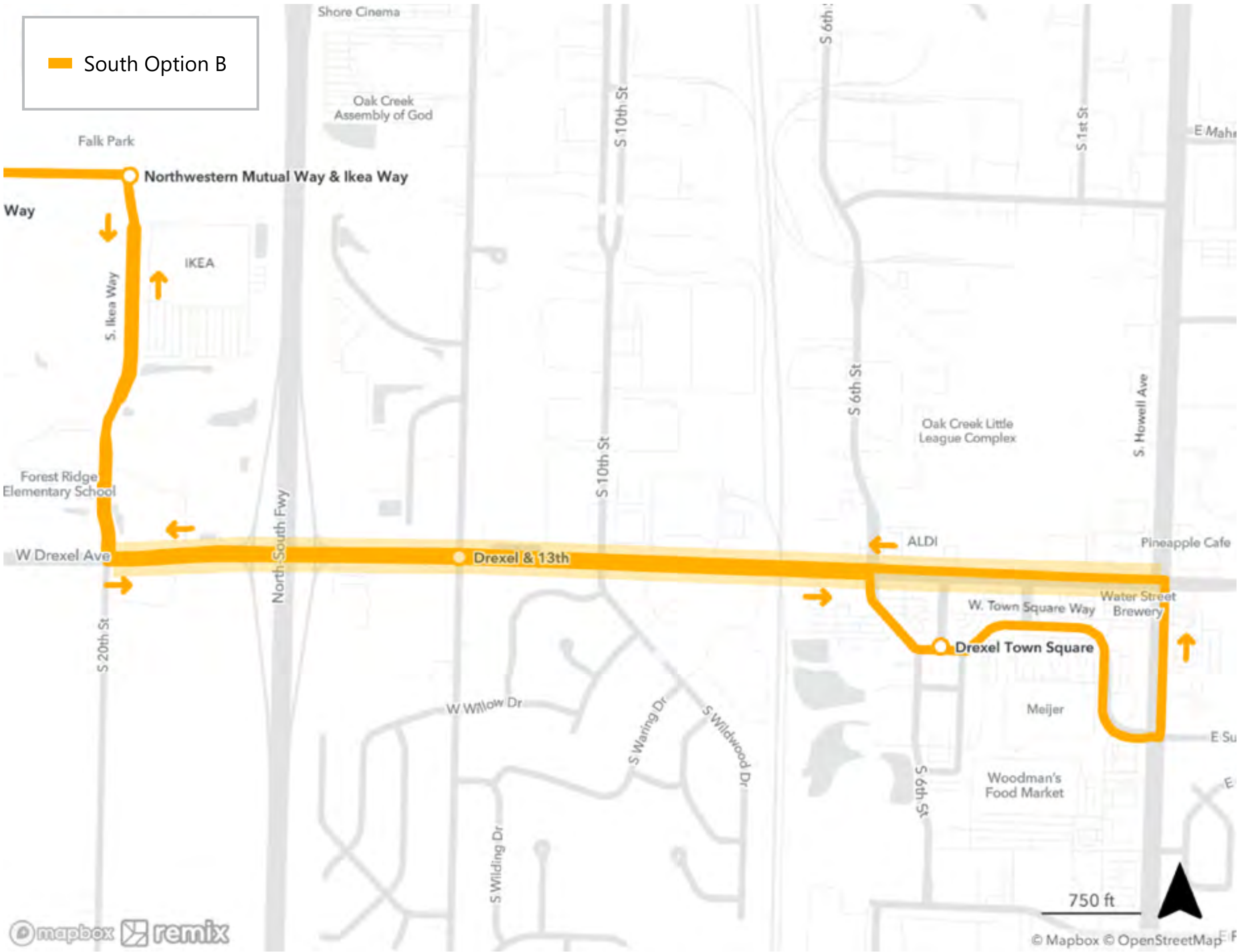


Note: The expected typical section of the future extension of S. Ikea Way is expected to match the existing typical section of S. Ikea Way that is already built out, although the actual characteristics of the future extension may differ. No changes in roadway configuration are expected to be considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

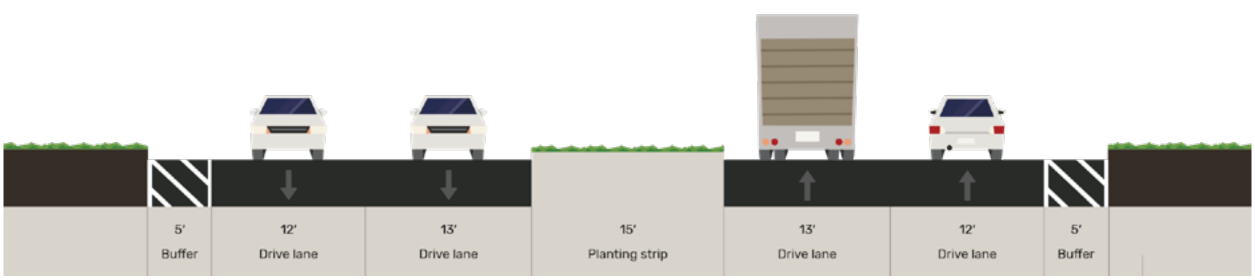
Figure A.39
W. Drexel Avenue from S. Ikea Way to S. Howell Avenue

Reference Map



Source: SEWRPC

Existing Typical Section*



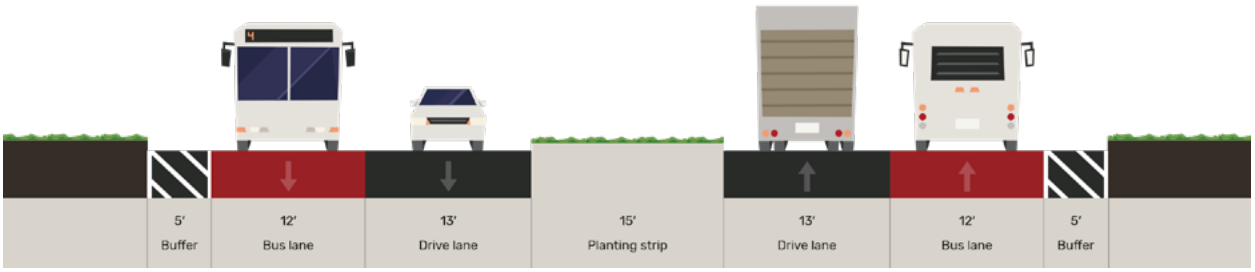
* A 10-foot multi-use path exists along the north side of W. Drexel Avenue between S. 27th Street and S. 13th Street.

Figure continued on next page.

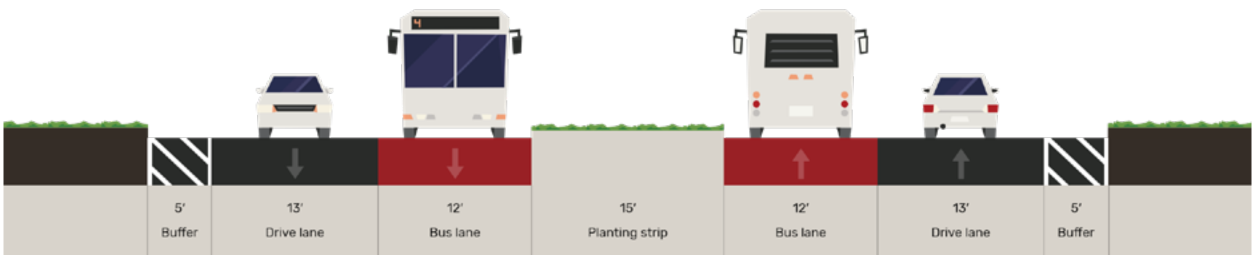
Figure A.39 (Continued)

Proposed Typical Section – Option 1: Convert Travel Lane to Dedicated Transit Lane (Dedicated Outside Lane)

Dedicated Outside Lane



Dedicated Center Lane



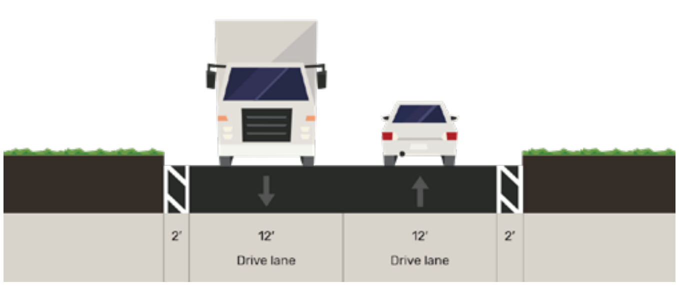
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.40
W. Town Square Way from W. Drexel Avenue to S. Howell Avenue

Reference Map

Source: SEWRPC

Existing Typical Section



Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

SOUTH OPTION C

Reference Map

Map A.11 shows the South Option C route segment, which extends south from the intersection of S. 27th Street and Northwestern Mutual Way along S. 27th Street to W. Oakwood Road, turns west onto W. Oakwood Road, turns north onto W. Wheaton Way, before connecting back to S. 27th Street and turning north for the return trip. Generalized proposed station locations are also shown on the map.

Typical Sections

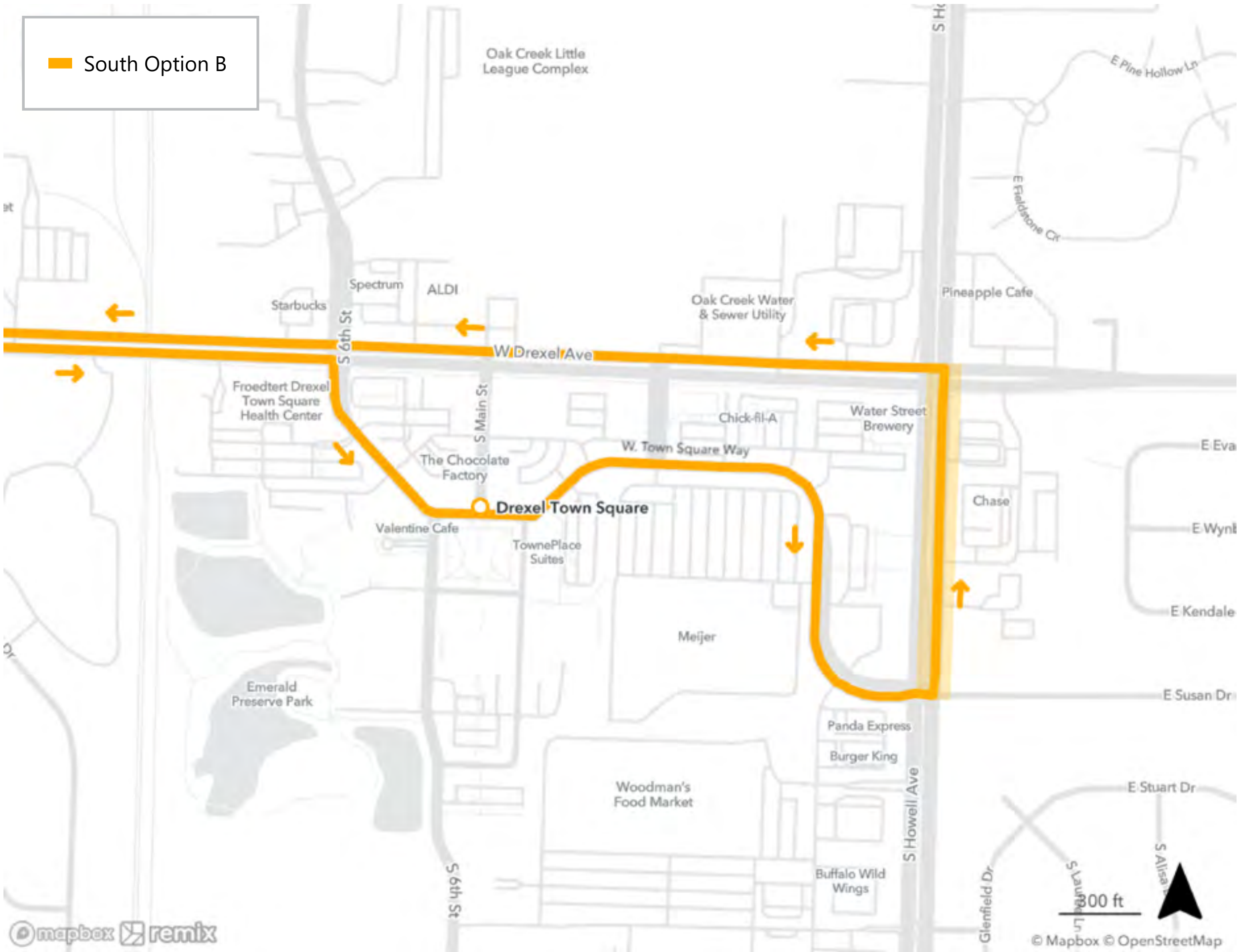
Figures A.41 through A.43 show existing and proposed typical sections for roadway segments along the South Option C route segment. A more detailed reference map is also included for each segment.

Map A.11
South Option C

Source: SEWRPC

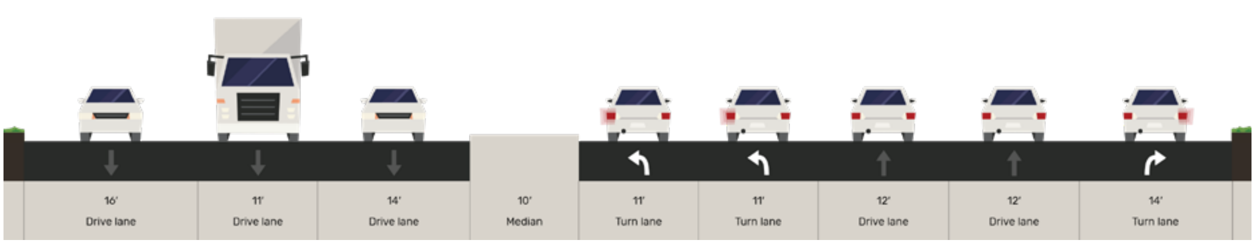
Figure A.41
S. Howell Avenue from W. Town Square Way to W. Drexel Avenue

Reference Map



Source: SEWRPC

Existing Typical Section*



Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.42
S. 27th Street from Northwestern Mutual Way to W. Oakwood Road

Reference Map

Source: SEWRPC

Existing Typical Section

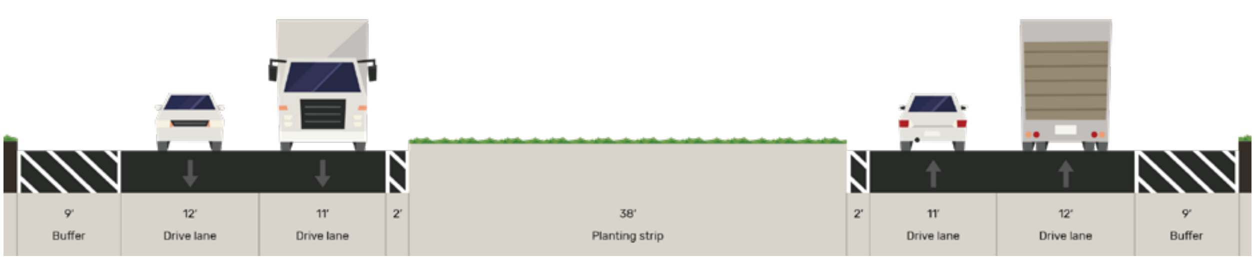
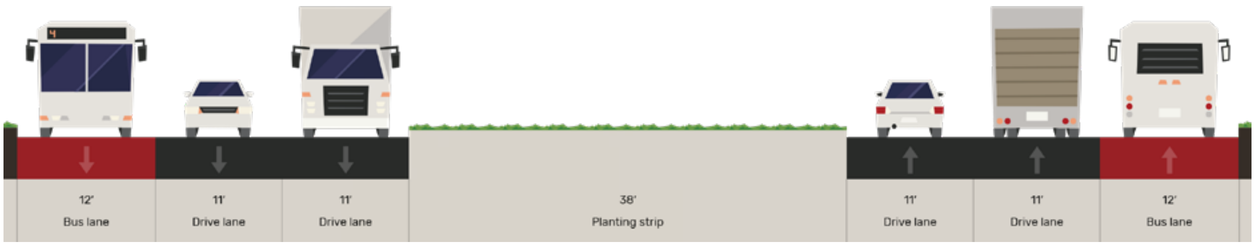


Figure continued on next page.

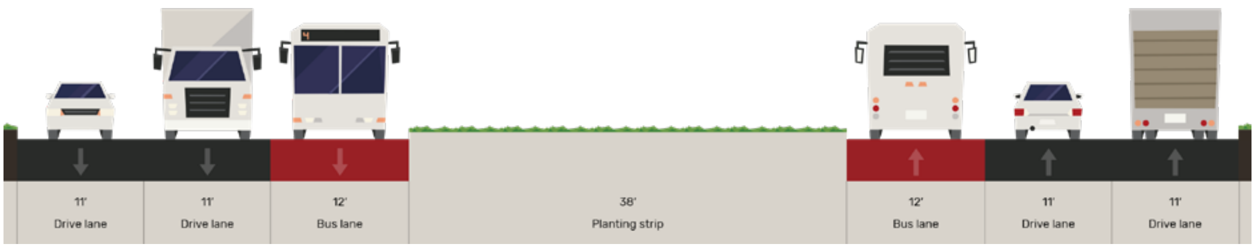
Figure A.42 (Continued)

Proposed Typical Section – Option 1: Convert Shoulder to Dedicated Transit Lane

Dedicated Outside Lane

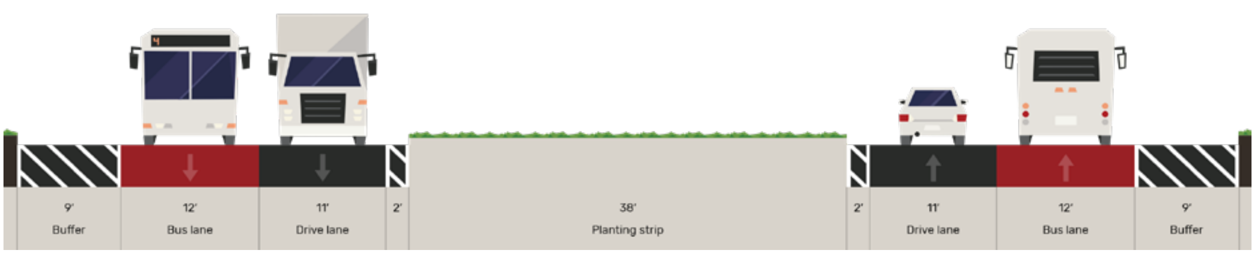


Dedicated Center Lane



Proposed Typical Section – Option 2: Convert Travel Lane to Dedicated Transit Lane

Dedicated Outside Lane



Dedicated Center Lane

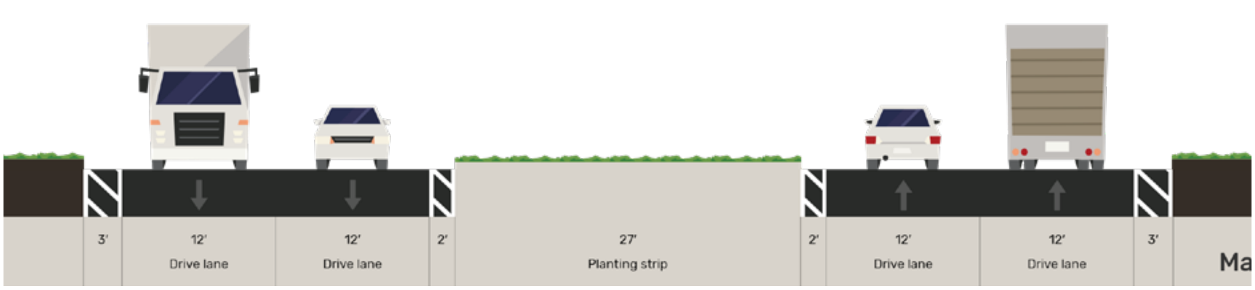
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.43
W. Oakwood Road from S. 27th Street to W. Wheaton Way

Reference Map

Source: SEWRPC

Existing Typical Section



Note: No changes in roadway configuration are being considered for this segment.

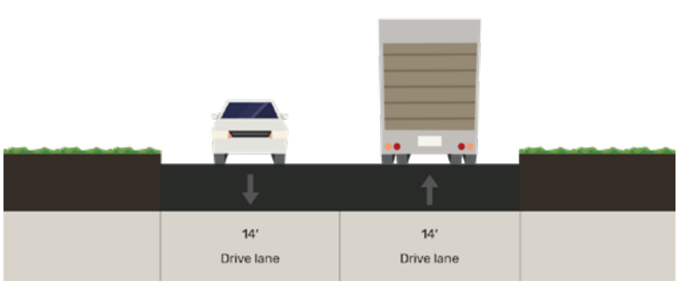
Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

Figure A.44
W. Wheaton Way (Private) from W. Oakwood Road to S. 27th Street

Reference Map

Source: SEWRPC

Existing Typical Section



Note: No changes in roadway configuration are being considered for this segment.

Source: Image created using Streetmix and adapted under Creative Commons license BY-SA 4.0 and SEWRPC

APPENDIX B

EVALUATION OF STATION AREA DEVELOPMENT OPPORTUNITIES

The development characteristics of each proposed station area is described in this appendix, categorized under the topics of existing land use, planning and policy guidance, transit connections, and development opportunities. Each station area is also labeled with the potential BRT route segment option(s) that it would be located along. Future phases of this effort may include more detailed analysis of development opportunities including more detailed maps. Maps included in this appendix use Open StreetMap basemaps to provide context about the land use surrounding each station location. Open StreetMap is free, crowdsourced data made available under the Open Database License; and therefore, may contain some inaccuracies.

MARKETPLACE OF BROWN DEER - NORTH OPTION 1

Existing Land Use

The convergence and intersection of W. Brown Deer Road, N. Green Bay Road, and N. Teutonia Avenue provides regional access to a large concentration of commercial and manufacturing uses. The commercial uses vary, including office buildings, shopping centers and big box retailers, hotels, and stand-alone businesses such as fast-food restaurants, automobile services and car dealerships. Northeast of the intersection of W. Brown Deer and N. Green Bay Roads lies the Marketplace of Brown Deer shopping center and an aquatic and medical center, and northwest is a business park. To the north are low-rise apartment complexes and low-density single-family houses.

Planning and Policy Guidance

Village of Brown Deer Comprehensive Plan 2030 (2009)

Transit Connections

MCTS Routes 12 and 88.

Development Opportunities

Village plans have considered the potential to reimagine the Marketplace of Brown Deer area. The expanse of surface parking and age of the strip center buildings may lead to mixed-use redevelopment similar to the evolution of Bayshore to the southeast in Glendale.

Map B.1
Marketplace of Brown Deer Station Area

Source: SEWRPC

ORIGINAL BROWN DEER VILLAGE - NORTH OPTION 1

Existing Land Use

Development along N. Deerwood Drive south of W. Brown Deer Road has a historic hamlet layout with retail shops in individual buildings that formed the original Brown Deer Village. This area is undergoing reconfiguration and infill with new townhouse-style and multi-story, multifamily apartment buildings. There is existing walkable access to a collection of shops and restaurants and a small church building. A public library fronts on Brown Deer Road. A couple dozen single-family houses at medium densities are located to the south between N. 43rd Street and N. Deerwood Drive. The Oak Leaf Trail, a multi-use path, runs along a railroad and power utility corridor and there is a pedestrian connection to the trail in this area. A factory and the office headquarters of Badger Meter is located west of the tracks south of W. Brown Deer Road. Brown Deer Village Hall police and public works department buildings are located north of W. Brown Deer Road and west of the railroad tracks, where a large financial services office and corporate office are also located.

Planning and Policy Guidance

Village of Brown Deer Comprehensive Plan 2030 (2009)

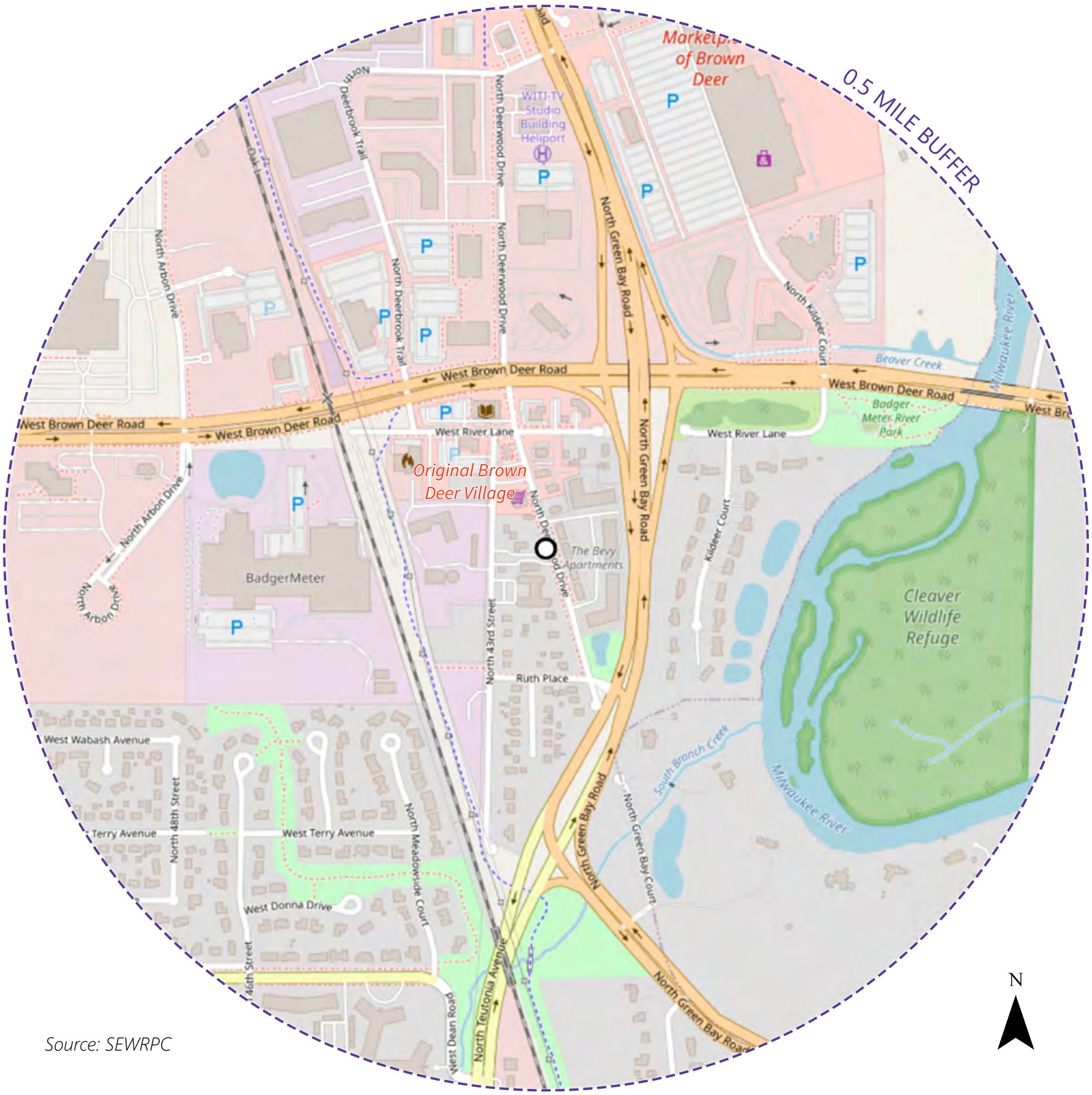
Transit Connections

Near MCTS Routes 12 and 88.

Development Opportunities

The Original Village will continue to evolve following trends evident with the recent redevelopment and infill projects creating new multifamily units with a mixture of small office and retail development where space is available. This could be further bolstered by the addition of enhanced transit in the area.

Map B.2
Original Brown Deer Village Station Area



Source: SEWRPC

TEUTONIA & BRADLEY - NORTH OPTION 1

Existing Land Use

A relatively new roundabout controls traffic flow at N. Teutonia Avenue and W. Bradley Road. East on W. Bradley Road, a self-storage warehouse to the south sits opposite a chocolate wholesale distribution center, both along a railroad corridor. Brown Deer Park and Golf Course, a green space over 300 acres, is located past the railroad tracks to the south adjacent to a lower density single-family residential area. West of the roundabout at N. Sherman Boulevard, the Bradley Crossing development includes new, three-story affordable apartment buildings, senior assisted living apartments with a small bank, medical offices, and personal service business including a barber and fitness center. The development is a suburban/urban hybrid that creates a walkable place with commercial buildings set up on the street and parking hidden to the rear. Post-World War II residential development is located to the south on both sides of N. Sherman Boulevard in a variety of Cape Cod and Ranch style houses, some on very deep lots. The area also includes a pedestrian connection to the Oak Leaf Trail.

Planning and Policy Guidance

Village of Brown Deer Comprehensive Plan 2030 (2009)

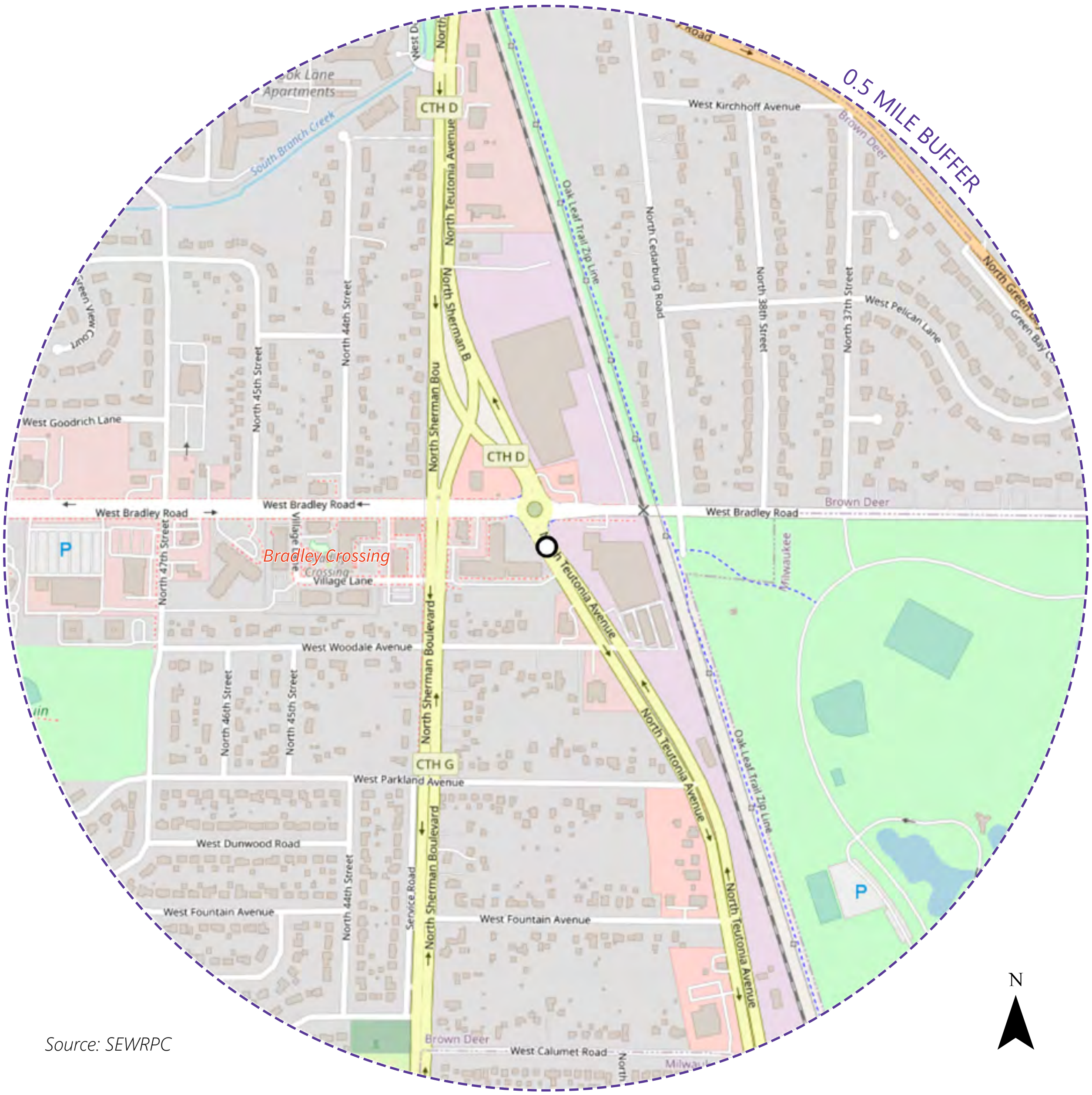
Transit Connections

MCTS Route 12.

Development Opportunities

The success of the Bradley Crossing development sets an example for continued mixed-use redevelopment; however, the area is built out which may limit opportunities for future development. The self-storage and manufacturing/warehouses at the southeast corner of Bradley and Teutonia along the railroad tracks provide the most potential for redevelopment in this station area. City policy supports a transition from manufacturing to mixed-use in this area. Additional infill may be possible on sites west of N. 47th Street.

Map B.3
Teutonia and Bradley Station Area



Source: SEWRPC

TEUTONIA & GOOD HOPE - NORTH OPTION 1

Existing Land Use

North Teutonia Avenue runs parallel to the railroad corridor at Good Hope Road, and the distance between the road and railroad tracks widens north to south from 300 feet to 500 feet. The space in-between is lined with commercial and industrial uses along the east side of N. Teutonia Avenue. Multifamily residential uses front on the west side of N. Teutonia Avenue, north of W. Good Hope Road in a variety of small apartment styles. A collection of fast-food restaurants is on the corners of the intersection along with a drug store. Two-story apartment buildings face both sides of W. Good Hope Road, and lower density single-family subdivisions are located to the interior.

An automotive supplier manufacturing plant (STRATTEC Security) is located to the east of the railroad tracks south of Good Hope Road, opposite the southern boundary of Brown Deer Park. Further east is a medical clinic and an office building. There is a low-density single-family residential area to the south. The area also includes a pedestrian connection to the Oak Leaf Trail.

Planning and Policy Guidance

City of Milwaukee Northwest Side Area Plan (2008)

Transit Connections

MCTS Route 12 and 35.

Development Opportunities

This area is built out, but there may be some potential for future site redevelopment.

Map B.4
Teutonia and Good Hope Station Area

Source: SEWRPC

TEUTONIA & GREEN TREE - NORTH OPTION 1

Existing Land Use

The pattern of industrial and commercial uses between the railroad tracks and N. Teutonia Avenue continues south of W. Good Hope Road to W. Green Tree Road. A large area of multifamily residential uses, including affordable housing at the N. Teutonia Avenue apartment complex, are found on the west side of N. Teutonia Avenue and to the west along W. Green Tree Road. There is a gas station on one corner of the intersection and two vacant sites. West Green Tree Road does not cross the railroad tracks. To the south is a large area of industrial and commercial land uses, with a variety of businesses including lawn and garden equipment, used appliances, moving and warehousing, and other businesses in small buildings. An automobile salvage yard is located where two railroad corridors cross, one of the older corridors without track. The Milwaukee Safety Academy is located south of the intersection in a modern building where police cadets are trained.

Planning and Policy Guidance

City of Milwaukee Northwest Side Area Plan (2008)

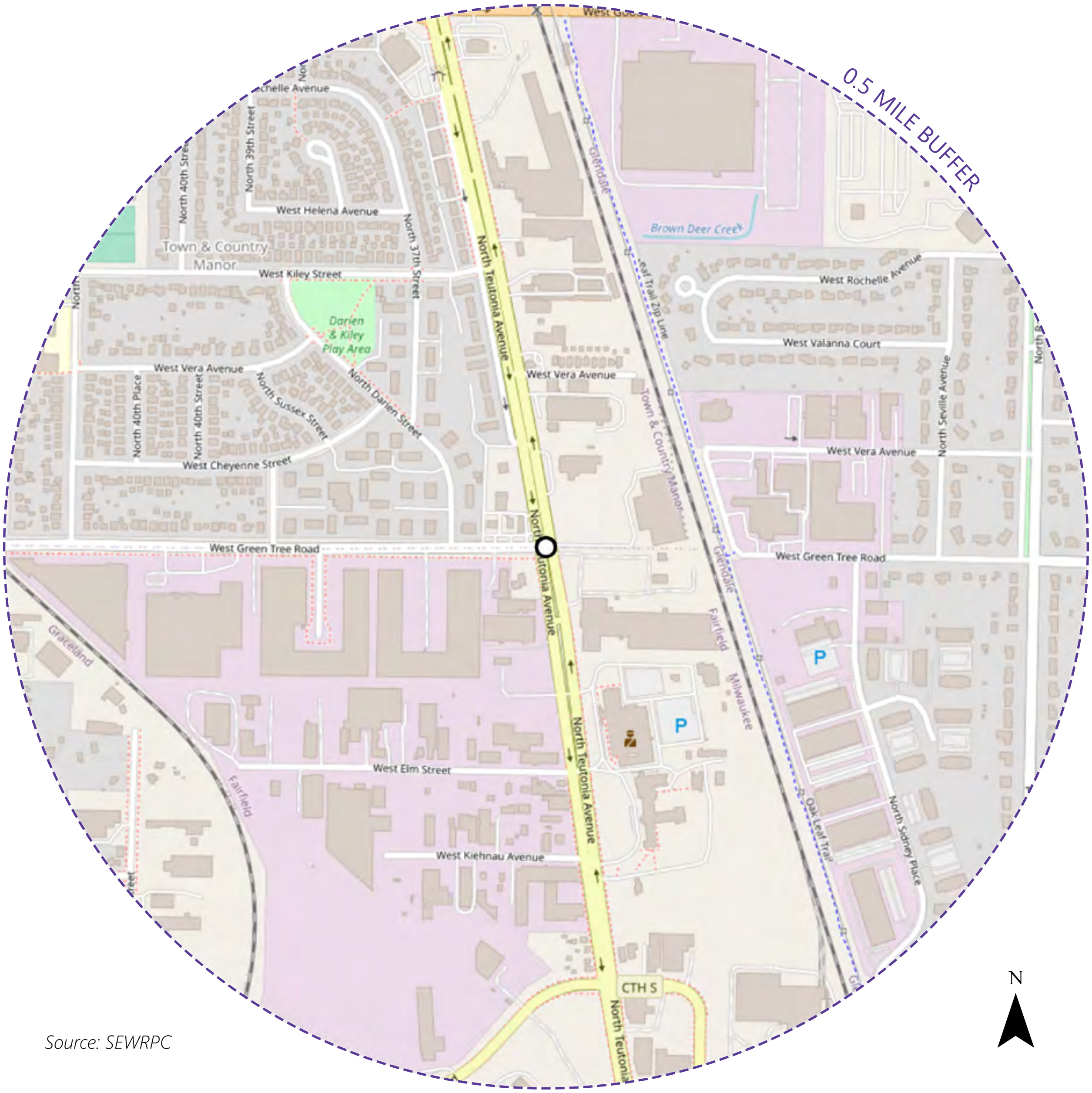
Transit Connections

MCTS Route 12.

Development Opportunities

This area is built out, including relatively dense multifamily residential and small shop industrial uses. Assembly of sites would be difficult, presenting few opportunities.

Map B.5
Teutonia and Green Tree Station Area



Source: SEWRPC

TEUTONIA & FLORIST - NORTH OPTION 1

Existing Land Use

West Florist Avenue bisects a large residential area between N. Sherman Boulevard and N. Teutonia Avenue, terminating at the entrance to the MilliporeSigma manufacturing plant next to the railroad corridor. This large factory complex produces biomedical supplies and equipment.

The Silver Mill Shopping Center extends north along the west side of N. Teutonia Avenue for a quarter mile, the main building is set back 450 feet from N. Teutonia Avenue creating a substantial surface parking lot. The mall includes a Wisconsin Department of Motor Vehicles office and a variety of goods and services, including clothes and musical instrument stores, beauty and hair salons, a grocery store and take-out food restaurant. A similar mix of businesses is found in the North Bay Shopping Mall closer to W. Florist Avenue, where a gas station occupies the northwest corner.

A U.S. Post Office is located on the southwest corner next to the Thurston Woods Public School, an elementary school in the Milwaukee Public Schools system. The Thurston Woods residential areas are a dense mix of single-family and two-family houses in a wide variety of styles set on blocks that extend for 1800 feet south of W. Florist Avenue.

Planning and Policy Guidance

City of Milwaukee Northwest Side Area Plan (2008)

Transit Connections

MCTS Routes 12 and 19.

Development Opportunities

The Silver Mill Shopping Center was identified as a Catalytic Project site in the 2008 City plan, including two concepts for improvement. If the market strengthens this property, it presents a very large opportunity for infill and redevelopment to the north of the proposed station location.

Map B.6
Teutonia and Florist Station Area

Source: SEWRPC

BAYSHORE – NORTH OPTION 2

Existing Land Use

Bayshore is an open-air shopping destination that has undergone a series of reinventions since opening in the 1950s. The current development emphasizes an urban-style shopping experience with storefronts set on sidewalks. Stores include fashion retail, franchise eateries, and big box stores including Target and Kohls. Offices and apartments are also part of the development and are located above the shops and parking garages. The density is high, which contrasts with the low-density single-family residential areas to the east. Commercial and institutional uses, including Dominican High School and St. Monica Catholic Church, continue along both sides of W. Silver Spring Drive, in small buildings set in a walkable streetscape. These businesses serve the residential areas to the north and south, and east along Lake Michigan.

Planning and Policy Guidance

City of Glendale Comprehensive Master Plan 2040 (2020)

Transit Connections

MCTS routes 14, 63, 68, the existing PurpleLine, and the GreenLine.

Development Opportunities

Bayshore has undergone recent redevelopment and repositioning that added multifamily units, new restaurants, and retail. Despite recent growth, vacancies in the existing development represent opportunities for additional commercial tenants to fill this developed space. A connection to enhanced transit like BRT service would support access to this development for both customers and employees, which could encourage lower vacancy rates and support new and long-time businesses within this development. The commercial and institutional uses east on W. Silver Spring Drive are stable and so are the residential areas.

Map B.7
Bayshore Station Area

Source: SEWRPC

SILVER SPRING & PRIVATE (AT PICK ʻN SAVE) – NORTH OPTION 2

Existing Land Use

The intersection of W. Silver Spring Drive and N. Green Bay Road, which is directly west of the proposed station location, is a grade separated intersection with on- and off-ramps. The land to the east of these ramps is used for a large grocery store to the south and a car dealership to the north. Four more large car dealerships are located further east of a power utility corridor, which is also used for the Oak Leaf Trail. While these uses are oriented to access via automobile, they are also large employers with the potential for transit riders. A veterinary clinic and a health care clinic are located east of the car dealerships, and a single-family residential area is along the Milwaukee River.

The 250-acre Glendale Industrial Park and North American headquarters of Johnson Controls, a major global building systems corporation, is located along the Oak Leaf Trail, a half-mile to the northwest of the proposed station location. The Oak Leaf Trail and can be directly accessed from either side of W. Silver Spring at this station location.

Planning and Policy Guidance

City of Glendale Comprehensive Master Plan 2040 (2020)

Transit Connections

MCTS route 63 and the existing PurpleLine.

Development Opportunities

The grouping of major car dealerships makes this area a regional destination for car sales. While this land is relatively open, a change in land use is unlikely.

Map B.8
Silver Spring and Private (at Pick N' Save) Station Area

Source: SEWRPC

SILVER SPRING & CRESTWOOD - NORTH OPTION 2

Existing Land Use

North Crestwood Boulevard provides access to a single-family residential area in the City of Glendale. The small lots create a relatively dense area, but also with mature trees and some yards backing up to an electric power utility corridor that cuts through the neighborhood from south to north. There is an animal hospital directly east of N. Crestwood Boulevard and a senior apartment building facing W. Silver Spring Drive to the west. A small cluster of medical clinics and a pharmacy are located to the west of the apartment building. A string of duplexes is located along N. Long Island Drive south of W. Silver Spring Drive in the City of Milwaukee. This residential area also includes small post-war houses.

Planning and Policy Guidance

City of Glendale Comprehensive Master Plan 2040 (2020)

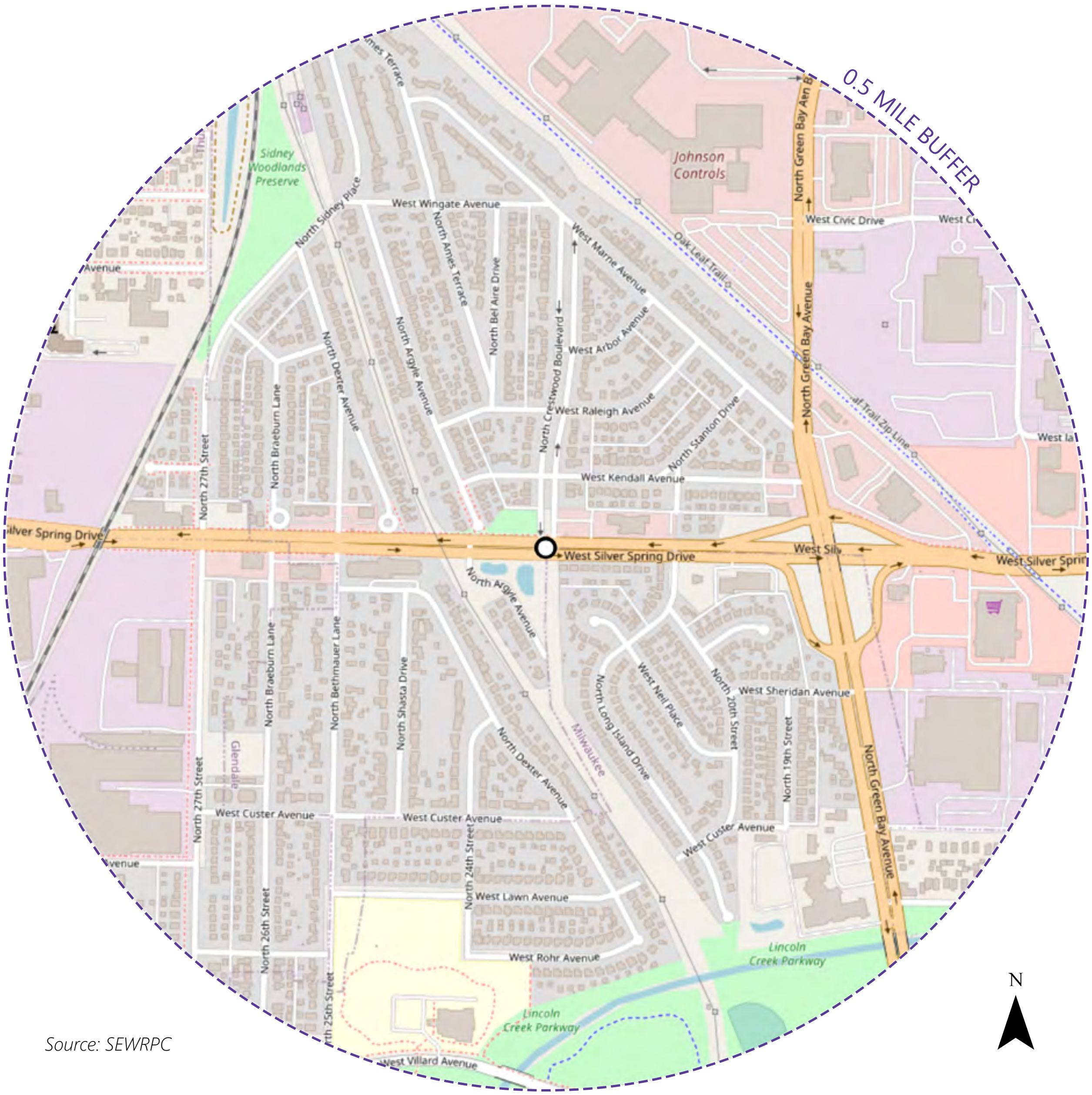
Transit Connections

MCTS Route 63.

Development Opportunities

Stable residential neighborhoods present few opportunities for new development. Sites along W. Silver Spring Drive are also limited, and recent projects such as the senior living apartments, leave few development opportunities.

Map B.9
Silver Spring and Crestwood Station Area



Source: SEWRPC

TEUTONIA & SILVER SPRING – CENTRAL SEGMENT

Existing Land Use

West Silver Spring Drive is a major four-lane east-west arterial on Milwaukee's north side. The intersection with N. Teutonia Avenue is grade separated with two-lane ramps in each direction creating a very large intersection that is challenging for pedestrians with long distances between safe crossing locations. For this reason, a BRT station would likely be sited in a location outside of the intersection that would provide safe access for pedestrians. The land use pattern is also influenced by a railroad corridor that crosses N. Teutonia Avenue at a diagonal just south of W. Silver Spring Drive. There are industrial uses along the railroad corridor to the east of N. Teutonia Avenue, and again further south, past Milwaukee County's Smith Park which provides a green space for the residential areas. The industrial use on the northeast corner of the intersection is open, bulk material processing, creating a large site with only a few buildings. A childcare and learning center is located on the northwest corner. A three-story apartment building is on the southwest corner, with this multifamily use continuing south along N. Teutonia Avenue. A heating supply plant and distributor is located opposite these apartments next to the railroad tracks.

Planning and Policy Guidance

City of Milwaukee Near North Side Area Comprehensive Plan (2009)
City of Milwaukee Northwest Side Area Comprehensive Plan (2008)

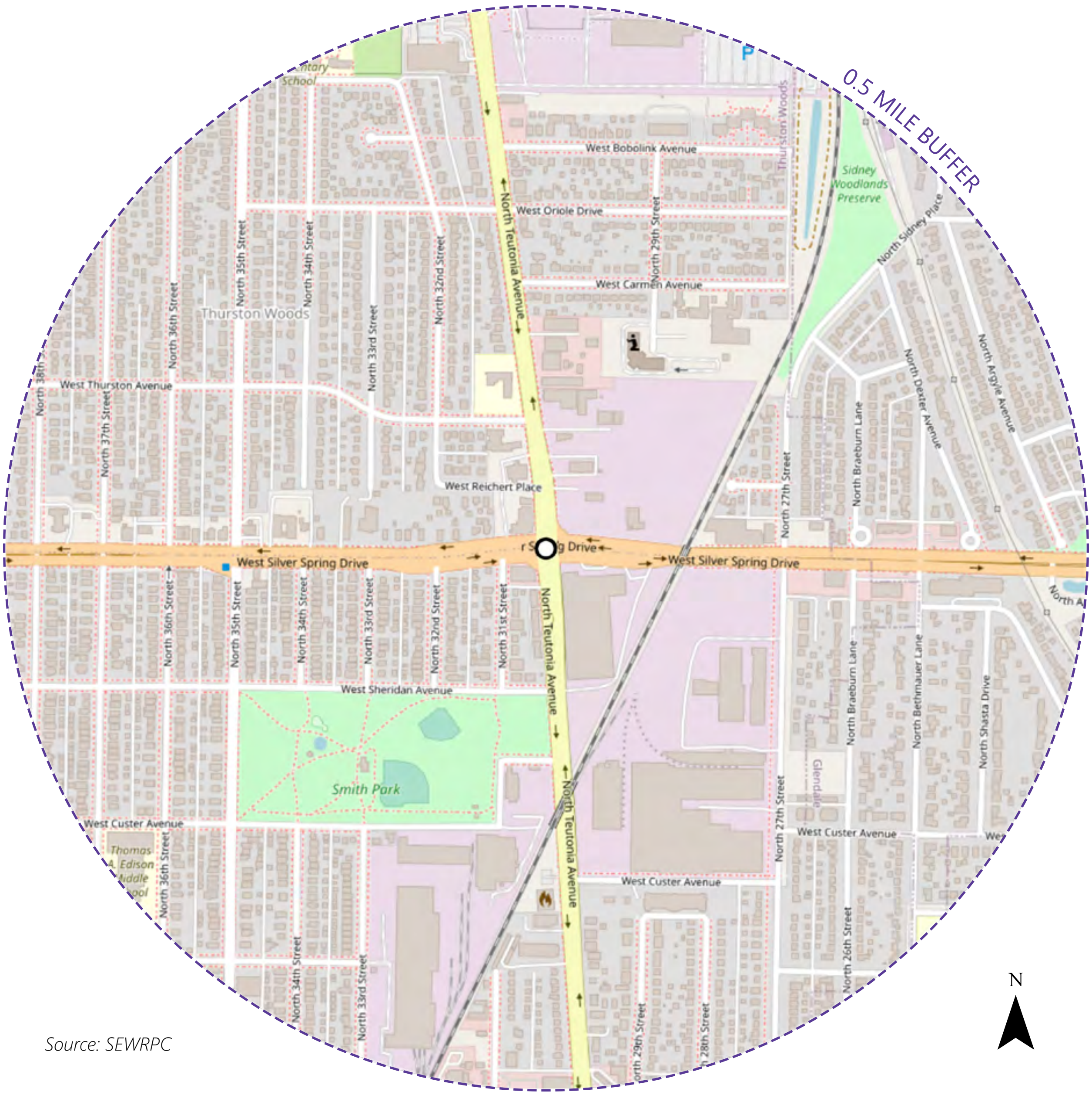
Transit Connections

MCTS Routes 12, 19, and 63.

Development Opportunities

Industrial uses along the railroad corridor seem stable and the grade separated intersection does not lend itself to pedestrian-friendly redevelopment. Converting W. Silver Spring Drive and N. Teutonia Avenue intersection to an at-grade intersection could provide redevelopment opportunities and improve connectivity and access to the stations.

Map B.10
Teutonia and Silver Spring Station Area



Source: SEWRPC

TEUTONIA & VILLARD – CENTRAL SEGMENT

Existing Land Use

The development pattern becomes more urban moving further south along the central segment option at W. Villard Avenue. A newer drug store has been developed on the northwest corner, which fronts the sidewalk with parking adjacent to the building. A gas station is located on the northeast corner and a fast-food restaurant on the southwest corner. Three blocks to the west is a walkable node of small storefront buildings anchored by the relatively new Villard Street branch of the Milwaukee Public Library that is part of a mixed-use building that also includes the Villard Square Apartments at 34th Street. Additionally, a multi-family mixed-use building at N. 37th Street and W. Villard Avenue was completed in 2021. The Connecting the Corridor Strategic Action Plan also recommends significant pedestrian and bicycle improvements along Villard Avenue.

Planning and Policy Guidance

City of Milwaukee Near North Side Area Comprehensive Plan (2009)
City of Milwaukee Connecting the Corridor Strategic Action Plan (2020)

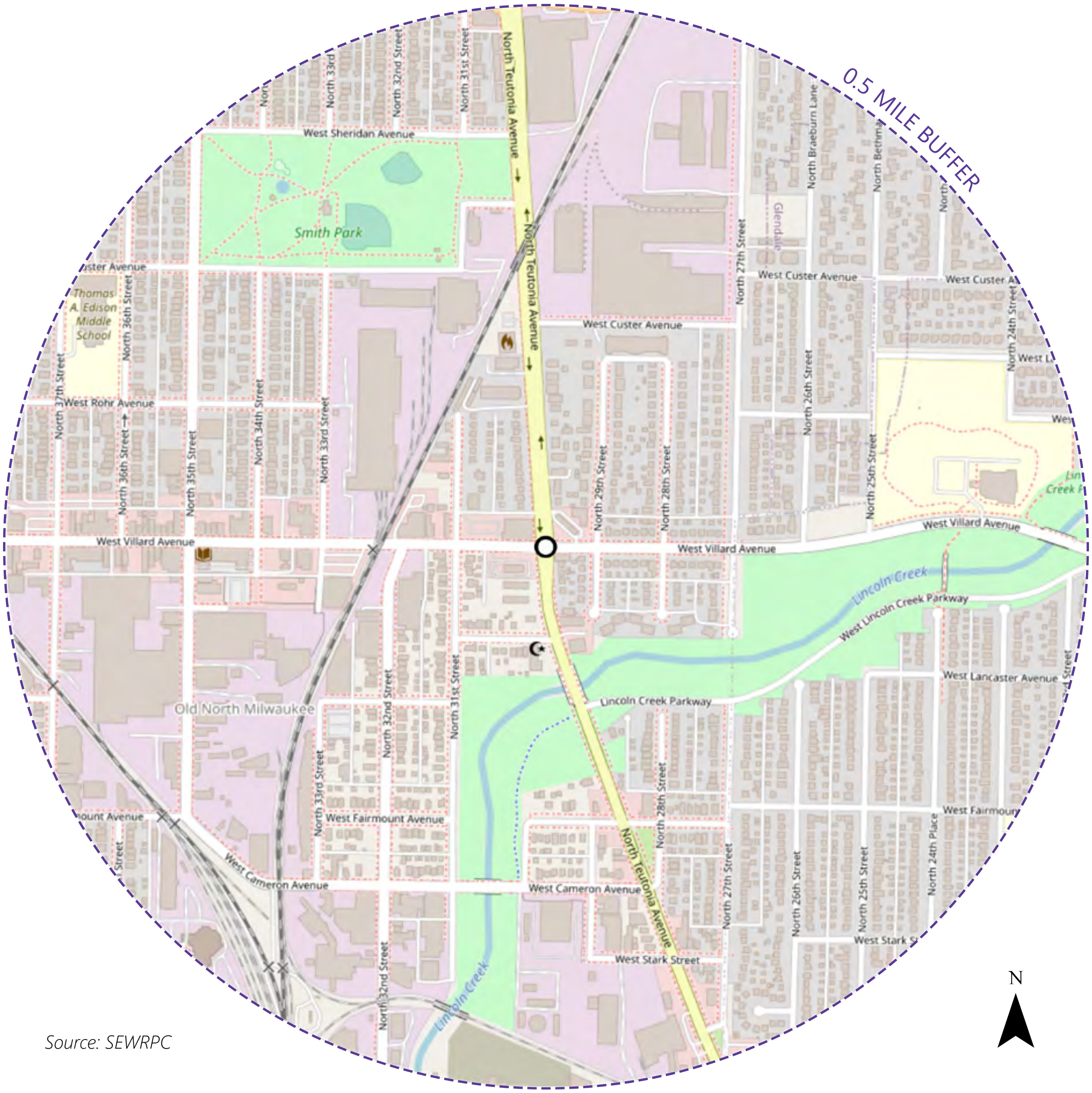
Transit Connections

MCTS routes 12 and 58.

Development Opportunities

The condition of newer commercial properties at the intersection of N. Teutonia Avenue and W. Villard Avenue limits new opportunities. Older single story commercial structures and scattered vacant lots and buildings along W. Villard Avenue, between N. 31st Street and N. 34th Street, offer good potential for redevelopment.

Map B.11
Teutonia and Villard Station Area



Source: SEWRPC

TEUTONIA & HAMPTON – CENTRAL SEGMENT

Existing Land Use

West Hampton Avenue and N. Teutonia Avenue represent the north and east boundary of the 30th Street Industrial Corridor as defined by the City of Milwaukee. A portion of the Beerline railroad corridor that is still intact at this location is adjacent to heavy industrial, manufacturing, and warehousing uses. At the intersection, a gas station, a bulk oil storage facility, and automobile parts store are on the corners north of W. Hampton Avenue, with a laundry and car wash further north on N. Teutonia Avenue. A lead works factory is located on the southwest corner and an oil lubricants factory to the northwest behind the gas station. East of N. Teutonia Avenue, the grid of streets is interrupted by an old railroad corridor (with no track) lined by metal working, roofing, salvage, and freight operations. The segment of the former rail corridor from N. 20th to 24th Streets will have a trail by 2025, part of the extension of the Beerline Trail. West Cornell Street, the local street opposite these industrial uses, loops across N. Teutonia Avenue to connect to N. 27th Street, which is interrupted by the lead works. Along W. Hampton Avenue east of the intersection, a wedge of land with vacant land and a trucking operation is located on the south side and residential uses are found on the north side. This residential area is a mix of one- and two-unit houses and a large three-story apartment building and townhouse apartments called New Hampton Gardens at N. 24th Street and W. Hampton Avenue. A mix of small apartments, houses, and churches line N. Teutonia Avenue south of W. Cornell Street.

Planning and Policy Guidance

City of Milwaukee Near North Side Area Comprehensive Plan (2009)
City of Milwaukee Connecting the Corridor Strategic Action Plan (2020)
30th Street Corridor Economic Development Master Plan (2011)

Transit Connections

MCTS routes 11, 12, and the existing PurpleLine.

Development Opportunities

There is a vacant lot on the southeast corner of N. Teutonia Avenue and W. Hampton Avenue zoned for commercial uses. The mix of heavy industrial uses and older residential areas present few opportunities for new development. However, the development of the Beerline Trail will likely extend through this area in the future and create bike and pedestrian connections to the area.

Map B.12
Teutonia and Hampton Station Area

Source: SEWRPC

27TH & ATKINSON – CENTRAL SEGMENT

Existing Land Use

The intersection, where W. Atkinson Avenue crosses N. 27th Street at an angle diagonal to the grid, is a neighborhood commercial node serving the surrounding residential areas, which are a mix of one- and two-unit houses and small- and medium-sized apartment buildings. The commercial node consists of urban-style storefront buildings, with second and third level apartments, built out to the sidewalk without off-street parking. A mix of businesses includes small groceries and restaurants, barber shops, and mobile phone shops. Three short blocks to the west lies a corridor of industrial uses that is stretched along a railroad yard at the northern part of the 30th Street industrial corridor.

Planning and Policy Guidance

City of Milwaukee Near North Side Area Comprehensive Plan (2009)
City of Milwaukee Connecting the Corridor Strategic Action Plan (2020)
30th Street Corridor Economic Development Master Plan (2011)

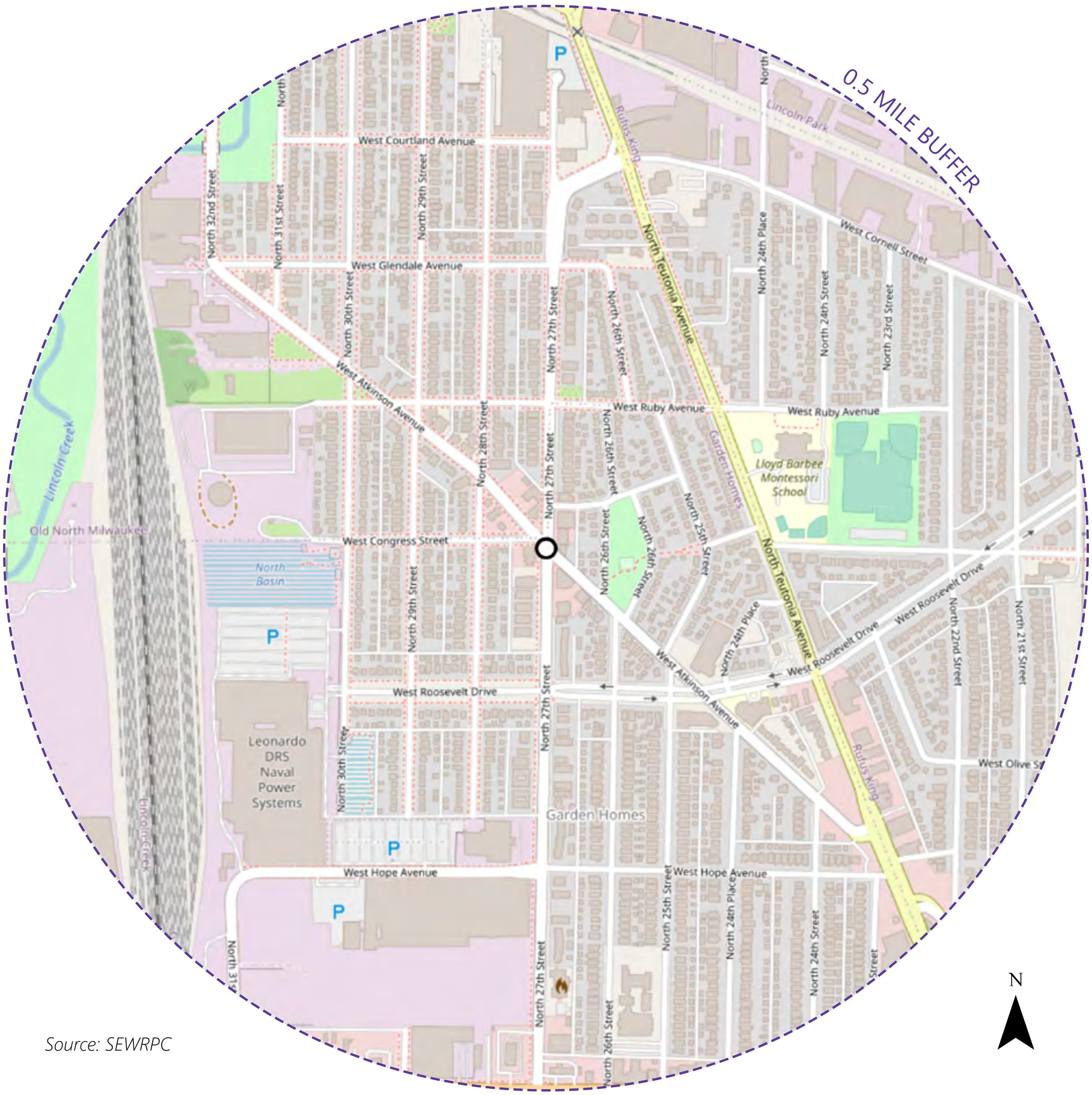
Transit Connections

MCTS route 19 and the existing Purple Line.

Development Opportunities

There are a small number of vacant lots in the vicinity of the intersection that could provide an opportunity for development, but no large sites for infill or redevelopment.

Map B.13
27th and Atkinson Station Area



Source: SEWRPC

27TH & CAPITOL – CENTRAL SEGMENT

Existing Land Use

West Capitol Drive is a six-lane east-west arterial on the city's north side that is a major commercial corridor serving the surrounding neighborhoods and regional customers. The intersection of N. 27th Street and W. Capitol Drive is one of most utilized transfer points in the MCTS system. Six blocks east of 27th Street, the intersections of Capitol Drive and two diagonal roadways, N. Teutonia Avenue and W. Atkinson Avenue, create a large commercial area. Development along W. Capitol Drive includes retail, restaurant, automobile service businesses, and a multifamily residential area with a variety of apartment types. At N. 27th Street and W. Capitol Drive there are fast-food restaurants on two corners and gas stations on the other two corners. While the overall use favors vehicular access, the streetscape design pays attention to pedestrian safety and transit rider comfort around existing bus stops, including bus shelters, widened sidewalks, and enhanced crosswalks.

The station area is adjacent to the 30th Street Industrial Corridor, which is the focus of a major redevelopment effort by the City of Milwaukee in partnership with the 30th Street Industrial Corridor Corp (nicknamed "The Corridor") and several other groups. The 30th Street rail corridor runs north-south through the core of these redevelopment sites. The area is home to a mix of business sizes and types, as well as large swaths of vacant and underutilized parcels. The 30th Street Industrial Corridor encompasses approximately 880 acres, of which 518 acres is zoned industrial. The site was previously home to large manufacturing firms including AO Smith. Plans for a multi-use path along the 30th Street Rail Corridor would provide enhanced bicycle and pedestrian connections throughout the area. A recommendation for commuter rail along the 30th Street Rail Corridor is also included in VISION 2050—SEWRPC's long-range regional land use and transportation plan—which would provide additional transportation connectivity in the area. More details about commuter rail in this corridor can be found in Appendix A of Volume 4 of this study, the Tier 1 Evaluation.

Directly surrounding the intersection of N. 27th Street and W. Capitol Drive, an 8-acre site is cleared just north of a fast-food restaurant, with a newer warehousing structure to the north. The eight-story Century City Towers office building—the tallest structure in the area—is located one block north of Capitol Drive. Warehousing and high-tech industrial uses are also located in this quadrant, which are all part of 30th Street Industrial Corridor. On the east side of N. 27th Street, north of W. Capitol Drive, there is a daycare center and a fire station just north of the intersection, followed by a mix of medium density housing types, including newer townhouses and small apartment buildings. To the south of W. Capitol Drive is a predominantly single-family residential area with a mix of bungalows and Craftsman-style houses, many of them duplexes.

Planning and Policy Guidance

City of Milwaukee Near North Side Area Comprehensive Plan (2010)
City of Milwaukee Connecting the Corridor Strategic Action Plan (2020)
30th Street Industrial Corridor Corporation, 2018-2020 Strategic Implementation Plan
30th Street Corridor Economic Development Master Plan (2011)

Transit Connections

MCTS RedLine and the existing PurpleLine.

Development Opportunities

This station area represents one of the key redevelopment and infill opportunities along the corridor, with many development and redevelopment efforts already complete and in progress with strong planning and policy support from the City of Milwaukee and partners that include The Corridor, Northwest Side Community Development Corporation, and the Milwaukee 7 Regional Economic Development Partnership. Introducing enhanced transit to this area could further incentivize development in the area by providing current and future employers faster and more convenient access for employees.

Map B.14
27th and Capitol Station Area

Source: SEWRPC

27TH & HOPKINS – CENTRAL SEGMENT

Existing Land Use

The area surrounding the intersection of N. 27th Street and W. Hopkins Street is also adjacent to the 30th Street Industrial Corridor. It is a boundary to the Century City Business Park, which is currently home to multiple private companies and a City of Milwaukee Department of Public Works facility. These entities employ more than 500 people and offer jobs at all skill levels. The City of Milwaukee is actively working with its partners to recruit new businesses to the aera and fill 65 acres of available land for manufacturing and job intensive uses. In addition, there are a number of City-owned vacant sites that were historically associated with parking lots. There is approximately 10 acres of vacant land east of West Hopkins Street that is available for new development. The largest vacant parcel is located along the east side of North 27th Street between West Hopkins Street and West Townsend Street. Residential uses are found on the surrounding blocks.

To the south of Townsend on both sides of the tracks are large automobile salvage and recycling facilities.

Planning and Policy Guidance

City of Milwaukee Near North Side Area Comprehensive Plan (2010)
City of Milwaukee Connecting the Corridor Strategic Action Plan (2020)
30th Street Industrial Corridor Corporation, 2018-2020 Strategic Implementation Plan
30th Street Corridor Economic Development Master Plan (2011)

Transit Connections

MCTS route 34 and the existing PurpleLine.

Development Opportunities

A BRT station in this area would provide access to the 30th Street Industrial Corridor, representing another key opportunity area for development and redevelopment along the route that could both support and be supported by enhanced transit in the area. Additionally, vacant land is also available east of N. 27th Street in this area—providing additional opportunities for infill and redevelopment.

Map B.15
27th and Hopkins Station Area

Source: SEWRPC

27TH & BURLEIGH – CENTRAL SEGMENT

Existing Land Use

The intersection at N. 27th Street and W. Burleigh Street is located within the 30th Street Industrial Corridor, which includes many smaller sites, many with existing industrial businesses. There is a concentration of metal and wood recycling, auto repair, and furniture-making businesses, faced by residential uses on the east side of 30th street. Directly surrounding the intersection is a small neighborhood commercial node with storefront buildings on three of the corners and a gas station on the fourth. Businesses include a convenience store, mobile phone store, and a barber shop. The blocks around the intersection are residential, with a higher number of vacant lots and houses than areas to the north. The Fond du Lac Operating Station, a bus garage owned by the Milwaukee County Transit System, is located to the west of the rail corridor at Locust Street between the proposed BRT stations at W. Burleigh Street and W. Center Street.

Planning and Policy Guidance

City of Milwaukee Fond du Lac and North Area Plan (2021)
City of Milwaukee Near North Side Area Comprehensive Plan (2009)
City of Milwaukee Connecting the Corridor Strategic Action Plan (2020)
30th Street Corridor Economic Development Master Plan (2011)

Transit Connections

MCTS route 66 and the existing PurpleLine.

Development Opportunities

There are numerous vacant residential lots in the area that are seeing some infill with new housing, and other existing houses are being renovated. There are also several vacant Industrial sites that could be redeveloped, including the former Geiser Potato Chip factory complex at 3033 W. Burleigh Street. Areas to the north and south of W. Burleigh Street west of N. 27th Street are in a Federally qualified Opportunity Zone with several residential sites that could be consolidated for larger and denser residential buildings as proposed by the City of Milwaukee Area Plan. Areas to the west of N. 27th Street are seeing increased activity in residential rehabilitation, driven by local community organizations such as the Dominican Center.

Map B.16
27th and Burleigh Station Area

Source: SEWRPC

27TH & CENTER/FOND DU LAC – CENTRAL SEGMENT

Existing Land Use

A major new mixed-use retail and apartment development, called Fond du Lac Center, wraps around the corner from N. 27th Street to W. Center Street to W. Fond du Lac Avenue. Storefronts are on the ground level of this mixed-use building along W. Fond du Lac Avenue, with two residential floors above. The building anchors one part of another complex intersection. W. Fond du Lac Avenue is a commercial street and one of the major arterials on Milwaukee's northwest side. The land use mix is also complex, including the Wisconsin Black Historical Society Museum on W. Center Street at N. 27th Street, the Center Street Branch of the Milwaukee Public Library, and a green space on a triangle of land at W. Center Street and N. 27th Street. Along W. Fond du Lac Avenue, there are a wide variety of uses, mostly commercial retail and service businesses, but also older houses and vacant lots and buildings. Churches are mixed into residential blocks. The Clark Street Public School occupies a block between W. 28th and W. 29th Streets south of W. Center Street. The industrial corridor continues along the railroad corridor, including the Master Lock factory at N. 31st Street and W. Center Street. Master Lock is the largest employer in the 30th Street Industrial Corridor and employs approximately 400 people at this location.

Planning and Policy Guidance

City of Milwaukee Fond du Lac and North Area Plan (2021)
30th Street Corridor Economic Development Master Plan (2011)

Transit Connections

MCTS routes 22, 81, the BlueLine, and the existing PurpleLine.

Development Opportunities

Recent redevelopment and reuse projects in the area indicate a strengthening real estate market, for example, a project under construction, branded as the Community Within the Corridor, will reuse former Cream City brick manufacturing buildings for community and commercial space and 197 units of affordable housing. This project on W. Center Street just west of the tracks at N. 30th Street, is the largest investment of private capital in Wisconsin history for an affordable housing project, with the project totaling $66 million in private and public funds. Additional conversions of former industrial buildings to other land uses can be expected in the future. There is also large amount of vacant or underused land along the W. Center Street corridor, west of N. 27th Street, that is owned by the City of Milwaukee and could be developed with mixed-use or multi-family buildings in the future.

Map B.17
27th and Center/Fond Du Lac Station Area

Source: SEWRPC

27TH & NORTH – CENTRAL SEGMENT

Existing Land Use

Newer developments with setbacks, landscaping, and wrap-around parking are found on three of the corners at W. North Avenue. One of these buildings is a metal stamping factory (Capitol Stampings), which fills most of the block on the northwest corner of N. 27th Street and W. North Avenue. Capitol Stampings is one of the largest manufacturers in the area and employs about 150 people. On the opposite corner are two single-story structures with flexible space utilized for offices and service businesses, including Employ Milwaukee. Employ Milwaukee is Milwaukee County's workforce development board and serves hundreds of people at this location through job training, business support, and a variety of other services. A large adult day care center, the St. Ann Center for Intergenerational Care, is located between N. 24th Street and N. 25th Street. The Fondy Farmers Market and Park is a seasonal farmers market located near W. North Avenue and W. Fond du Lac Avenue. A modern drug store with a parking lot sits on the southwest corner of W. North Avenue and N. 27th Street, however the rest of the south side of W. North Avenue has older urban-style buildings with a variety of uses including restaurants, small shops, taverns, and churches. WE Energies operates their North Side Services Center which employs more than 50 people near N. 31st Street and W. North Avenue.

Other land along the tracks provides green open space, including Cream City Farms. The historic Garfield Park building, a four-story Cream City brick building south of W. North Avenue, west of the tracks, has been converted to loft apartments. The red brick Richardsonian Romanesque massing of the Starms Early Childhood Center stands out from vacant lots one block south of W. North Avenue. The larger Starms Discovery Learning is a newer school that occupies two blocks to the east of N. 27th Street. Residential blocks are a mix of vacant lots, older single-family, and two-family houses, and newer house construction filling in lots. Some land that is currently zoned industrial could transition to residential in the future.

Planning and Policy Guidance

City of Milwaukee Fond du Lac and North Area Plan (2021)
30th Street Corridor Economic Development Master Plan (2011)

Transit Connections

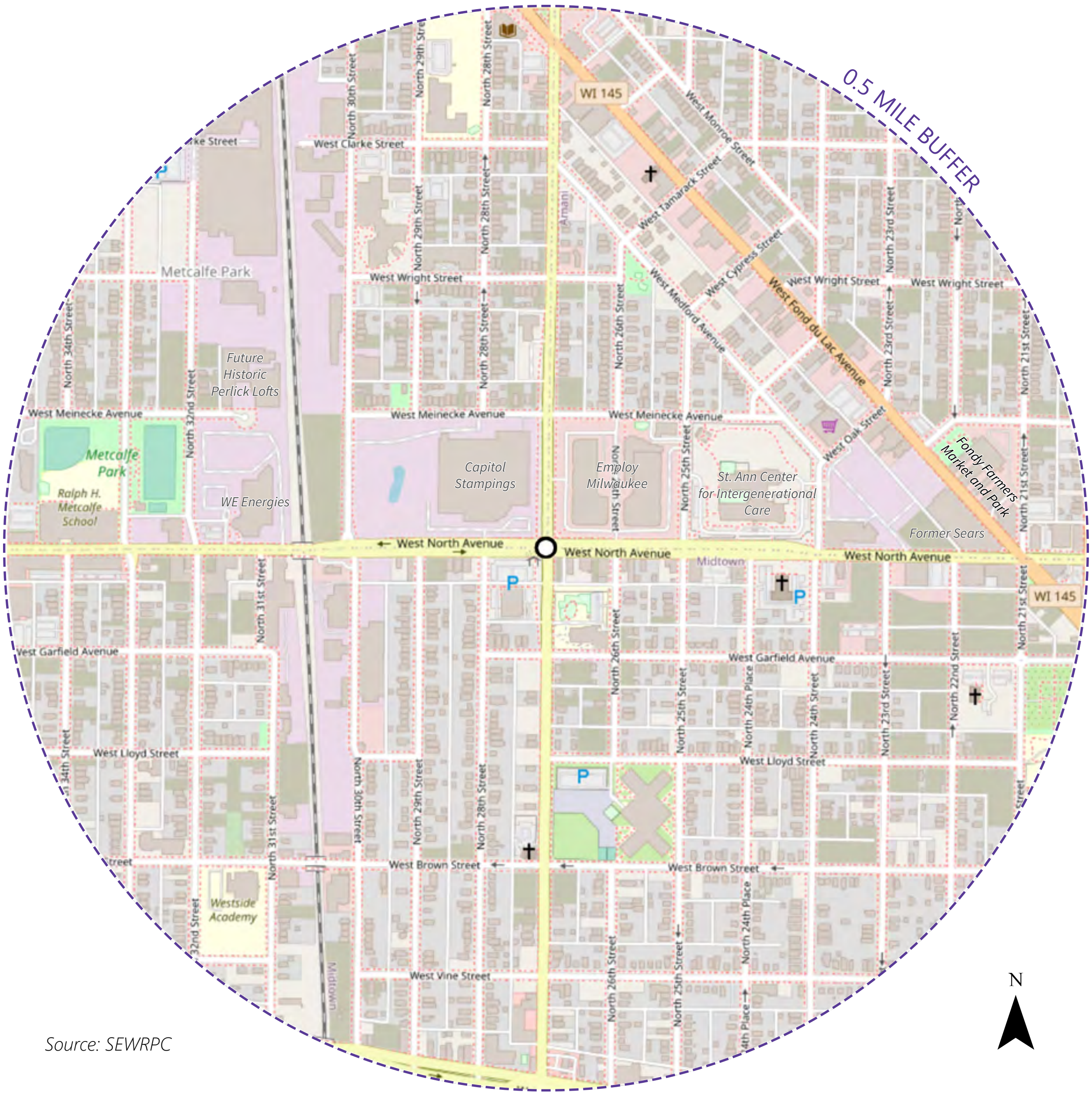
MCTS route 21 and the existing PurpleLine.

Development Opportunities

There are vacant sites along the south side of W. North Avenue in the immediate station area.

A project under construction just south of Master Lock and north of W. North Avenue shows the trend to reuse long vacant manufacturing buildings. The Historic Perlick Lofts project at 3100 W. Meinecke Avenue will create 80 loft style apartment units, including 66 affordable units. A multi-use open space planned for the northwest corner of N. 30th Street and W. North Avenue would provide a training facility for Milwaukee Area Technical College and WE Energies as well as a public gathering space. A hotel and convention center is planned for the former Sears Department Store at Fond du Lac and North Avenue. And multiple City blocks of vacant land south of North Avenue and east of N. 24th Street are planned for redevelopment with medium density residential and other uses. Portions of N. 27th Street north and south of North Avenue have vacant city-owned land and buildings that may be appropriate for redevelopment as multi-family housing.

Map B.18
27th and North Station Area



Source: SEWRPC

27TH & LISBON – CENTRAL SEGMENT

Existing Land Use

The intersection of N. 27th Street and W. Lisbon Avenue is primarily given over to the movement of vehicles, where the four-lane W. Lisbon Avenue is divided with turn lanes and medians, and where N. 27th Street expands from two to four lanes divided by landscaped medians. The land along the west side of N. 27th Street from W. North Avenue south to W. Vliet Street and W. Juneau Avenue is cleared and landscaped up to the alley to create a linear open space. The median treatment is similar to Layton Boulevard to the south. The green space expands east into Tiefenthaler Park, an eleven-acre Milwaukee County park with open playfield, basketball courts, and a wading pool. There are no commercial uses between W. Lisbon Avenue and W. Vliet Street in this segment of N. 27th Street, but houses do face the street on the west side up to the open space.

The north side of W. Lisbon Avenue at N. 27th Street retains a small number of retail uses, including a gas station on one corner and a hair salon in a small brick building on the other. A convenience store, a handful of older houses, abandoned commercial buildings, and vacant lots are located at W. ~~North~~ Lisbon Avenue and N. 27th Street. Next to the hair salon, the new, three-story Lisbon Terrace Apartment building wraps around the corner from W. Lisbon Avenue to N. 28th Street.

Planning and Policy Guidance

City of Milwaukee Fond du Lac and North Area Plan (2021)
30th Street Corridor Economic Development Master Plan (2011)

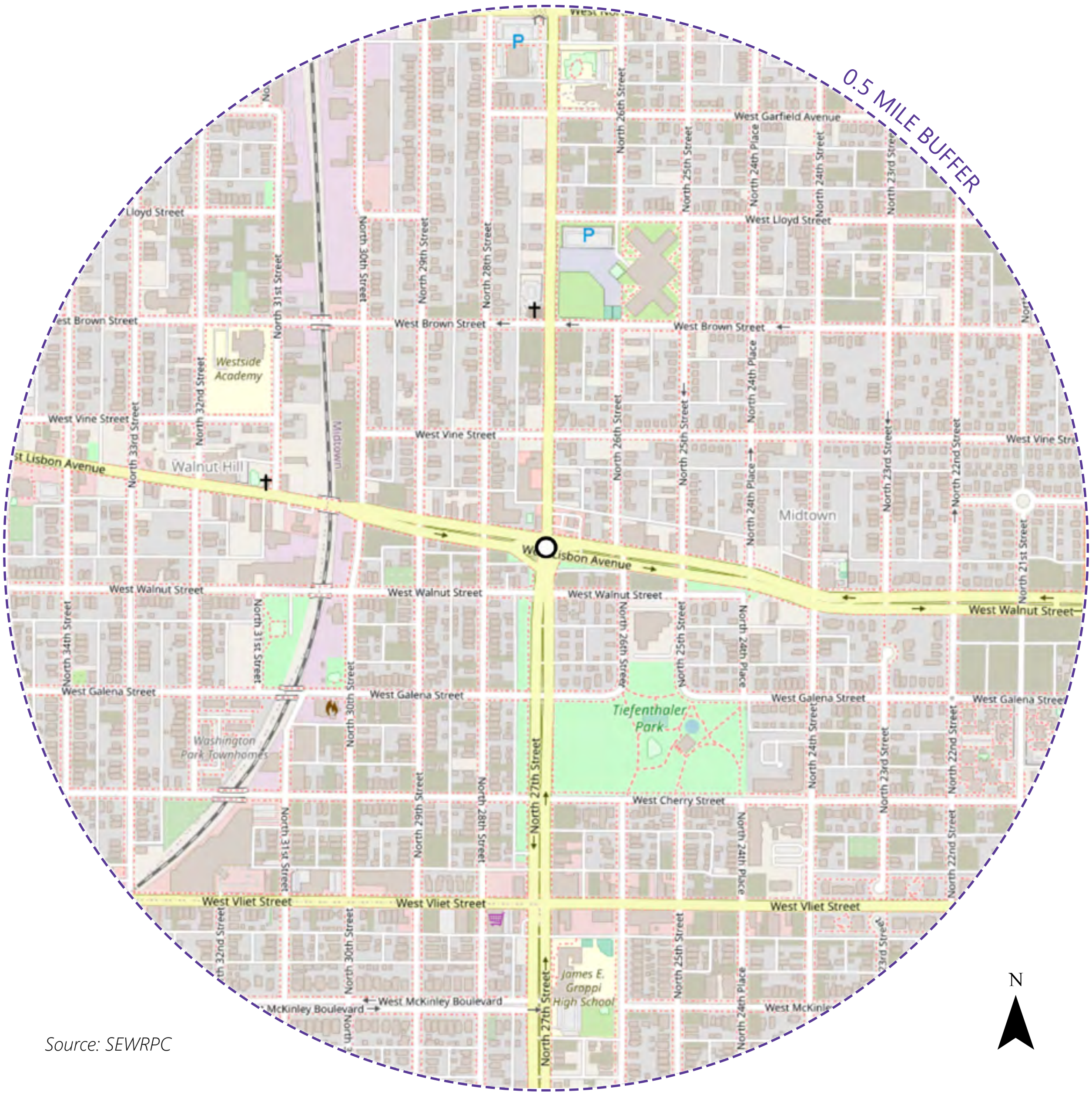
Transit Connections

MCTS route 57 and the existing PurpleLine.

Development Opportunities

Many vacant lots are available for new single-family and townhouse development in the area. Several large sites are also available fronting on W. Lisbon Avenue, including the southeast corner of the intersection with N. 27th Street. Both Lisbon Avenue and 27th Street transition to standard 66-feet-wide urban right-of-way soon after passing through the intersection. A future reconstruction of these street segments could vacate some of the 54 feet of excess right-of-way that was taken during the urban renewal period. This would serve to reconnect the area and allow for the development of several large multi-family buildings with hundreds of new housing units near the intersection of Lisbon Avenue. Without these changes to narrow the streets and repair the traditional pattern of blocks and parcels, the size and shape of the vacant parcels south of Lisbon Avenue and west of N. 27th Street are much less conducive for development.

Map B.19
27th and Lisbon Station Area



Source: SEWRPC

27TH & VLIET – CENTRAL SEGMENT

Existing Land Use

The east side of the intersection of N. 27th Street and W. Vliet Street has storefronts in attractive two-story brick buildings with architectural details. There are two furniture stores, a restaurant and sandwich shop, and coin laundry. Other businesses in this neighborhood commercial node include barber shops and small grocery stores. The WVCY television studio and transmission tower are located on the northwest corner in a building with stone facade typical of old banks.

James Groppi High School is on the block immediately south of W. Vliet Street, its brick facade welcoming students in an area with many vacant lots and dilapidated homes. Newly constructed housing is replacing commercial uses along W. Vliet Street to the west of N. 27th Street in single-family units, while some mid-20th-century and newer multifamily complexes are found to the east. A community care center is located along the railroad tracks that curve to the west away from N. 30th Street. Vacant sites are being filled in with new townhouse developments west of the tracks.

Planning and Policy Guidance

City of Milwaukee Near West Side Comprehensive Plan (2004, 2009)
City of Milwaukee Fond du Lac and North Area Plan (2021)
30th Street Corridor Economic Development Master Plan (2011)

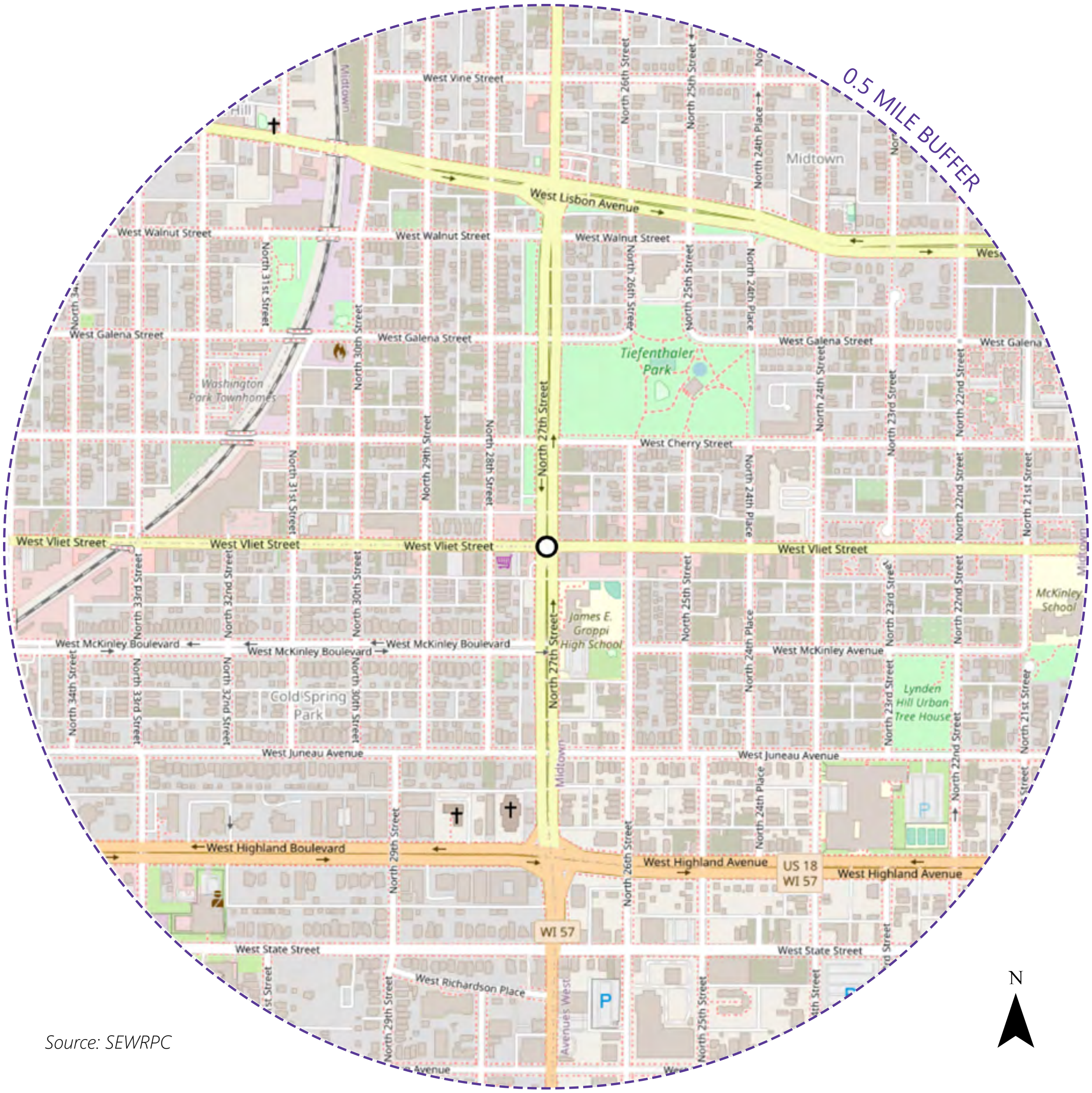
Transit Connections

MCTS route 33 and the existing PurpleLine.

Development Opportunities

West Vliet Street has vacant lots available for new development, with new single-family houses just west of N. 27th Street indicating a change away from commercial uses. Many vacant lots are available for new, single-family and townhouse development in the area.

Map B.20
27th and Vliet Station Area



Source: SEWRPC

27TH & HIGHLAND – CENTRAL SEGMENT

Existing Land Use

West Highland Boulevard represents the southern boundary of the 30th Street Industrial Corridor and is also USH 18 in a four-lane section with landscaped medians. Its intersection with N. 27th Street was recently reconstructed with slip-lane right turns on all four corners and left turn lanes. The slip lanes create triangular islands which are utilized as bus stops with shelters. A large four-story mid-20th century apartment building stretches along the south side of W. Highland Boulevard. On the north side of W. Highland Boulevard stands the landmark St. Luke Emanuel Baptist Church and apartment buildings in a variety of styles and different eras, creating a dense concentration of units within blocks of the intersection and proposed station location. The Milwaukee High School of the Arts is three blocks east at N. 24th Street and W. Highland Boulevard. While W. Highland Boulevard is one of the widest roads in this area, it does not have many commercial uses, instead higher density residential use is dominant.

Planning and Policy Guidance

City of Milwaukee Near West Side Comprehensive Plan (2004, 2009)
City of Milwaukee North 27th Street Corridor Strategy (2018)
30th Street Corridor Economic Development Master Plan (2011)

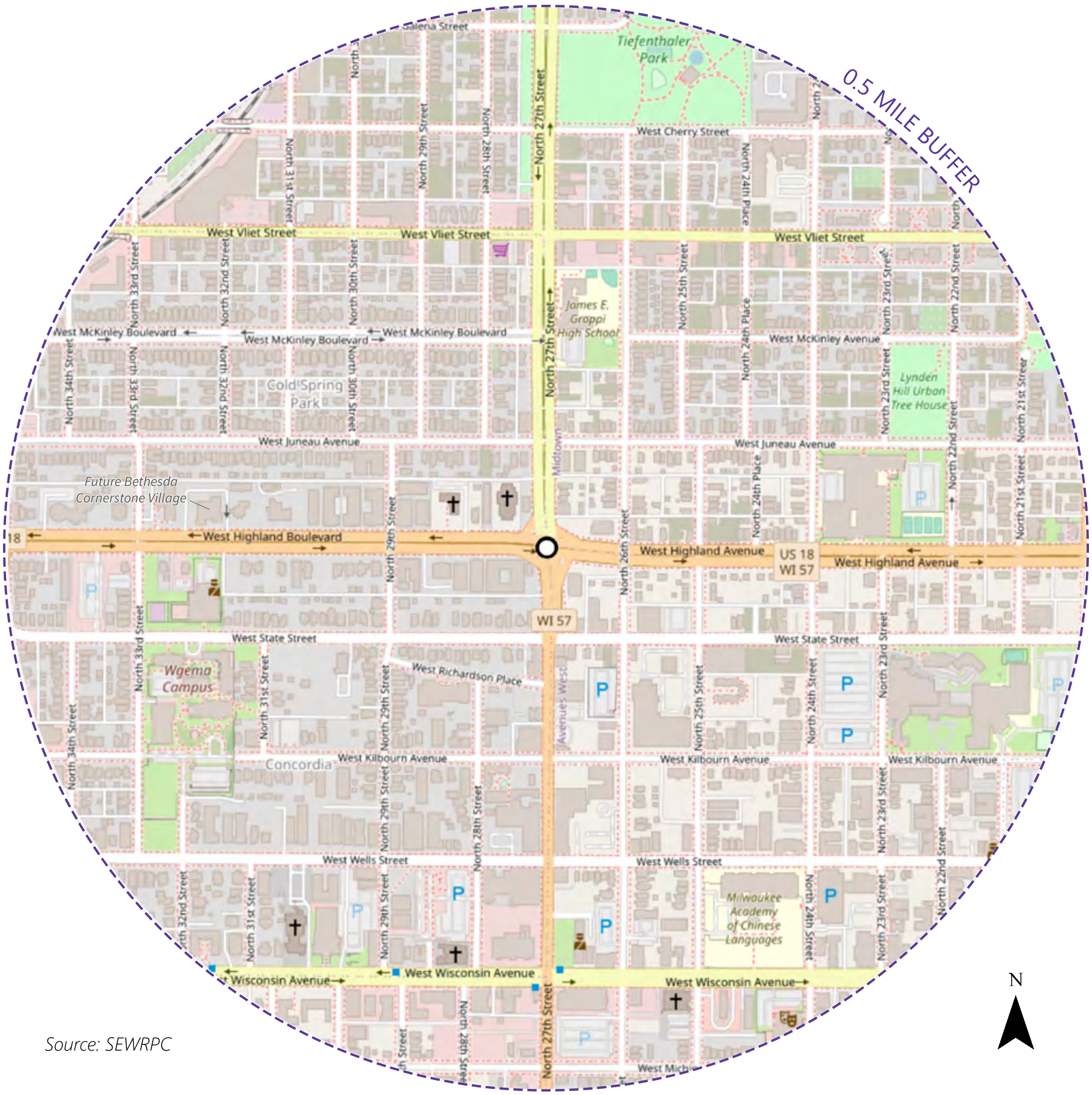
Transit Connections

MCTS route 31 and the existing PurpleLine.

Development Opportunities

The Bethesda Cornerstone Village project at 3200 W. Highland Boulevard will require demolishing a health clinic to construct 68 units of new housing, with 62 affordable units.

Map B.21
27th and Highland Station Area



Source: SEWRPC

27TH & WISCONSIN – CENTRAL SEGMENT

Existing Land Use

North 27th Street and W. Wisconsin Avenue is a station location on the East West BRT line (under construction) and is an area of market-driven transition. Even before service begins on either the East-West BRT line or this proposed North-South service, the area serves as a transit hub and supports a high number of existing transit boardings and transfers that would only be expected to grow with the introduction of BRT service. The southwest corner of the intersection is vacant lots and vacant buildings. A state office that houses a social service agency is located on the southeast corner. On the northside of W. Wisconsin Avenue, an old school is vacant, but plans are under development for its reuse, and across N. 27th Street, the corner lot has been cleared. Behind the school is a former hospital/office building connected to two buildings with storefronts. Large surface parking lots that served these uses are located between the buildings and across the way on N. 28th Street. The corner of N. 27th Street and W. Wells Street exhibits a fine collection of historic Milwaukee architecture, with handsome brick facades and cornice details. Restaurants, fashion, and beauty salon businesses operate out of these storefronts. The urban sidewalk and enclosure the buildings provide creates a comfortable pedestrian environment.

Near West Side Partners, a Milwaukee neighborhood improvement group, is leading several redevelopment efforts near the intersection of N. 27th Street and Wells Street. The effort includes purchasing and improving several small buildings for retail or other commercial redevelopment and the redevelopment of a larger building into a community center called Concordia 27, which has already received $5 million in support from the State of Wisconsin. The Concordia 27 development will include 30 affordable housing units for seniors and families; community gathering space; commercial spaces for non-profits; a commercial, demonstration, and incubator kitchen; daily affordable meals for more than 1,000 residents; and school meals for more than 15,000 low-income students at 106 schools in Milwaukee, Waukesha, Racine, and Kenosha.

To the east of N. 27th Street, on W. Wisconsin Avenue, a hotel is four blocks east, and other examples of Art Deco styling are found on older, elevator apartment buildings. The well-known Rave/Eagles Club concert venue is three blocks east of N. 27th Street. A public school occupies a block with a large green lawn along W. Wisconsin Avenue at N. 25th Street. The residential use in the area is primarily multifamily, either in apartment buildings or older two- and three-story houses that have been divided into multiple units. There are also numerous vacant lots where houses used to stand.

Planning and Policy Guidance

City of Milwaukee Near West Side Comprehensive Plan (2004, 2009)
City of Milwaukee North 27th Street Corridor Strategy (2018)

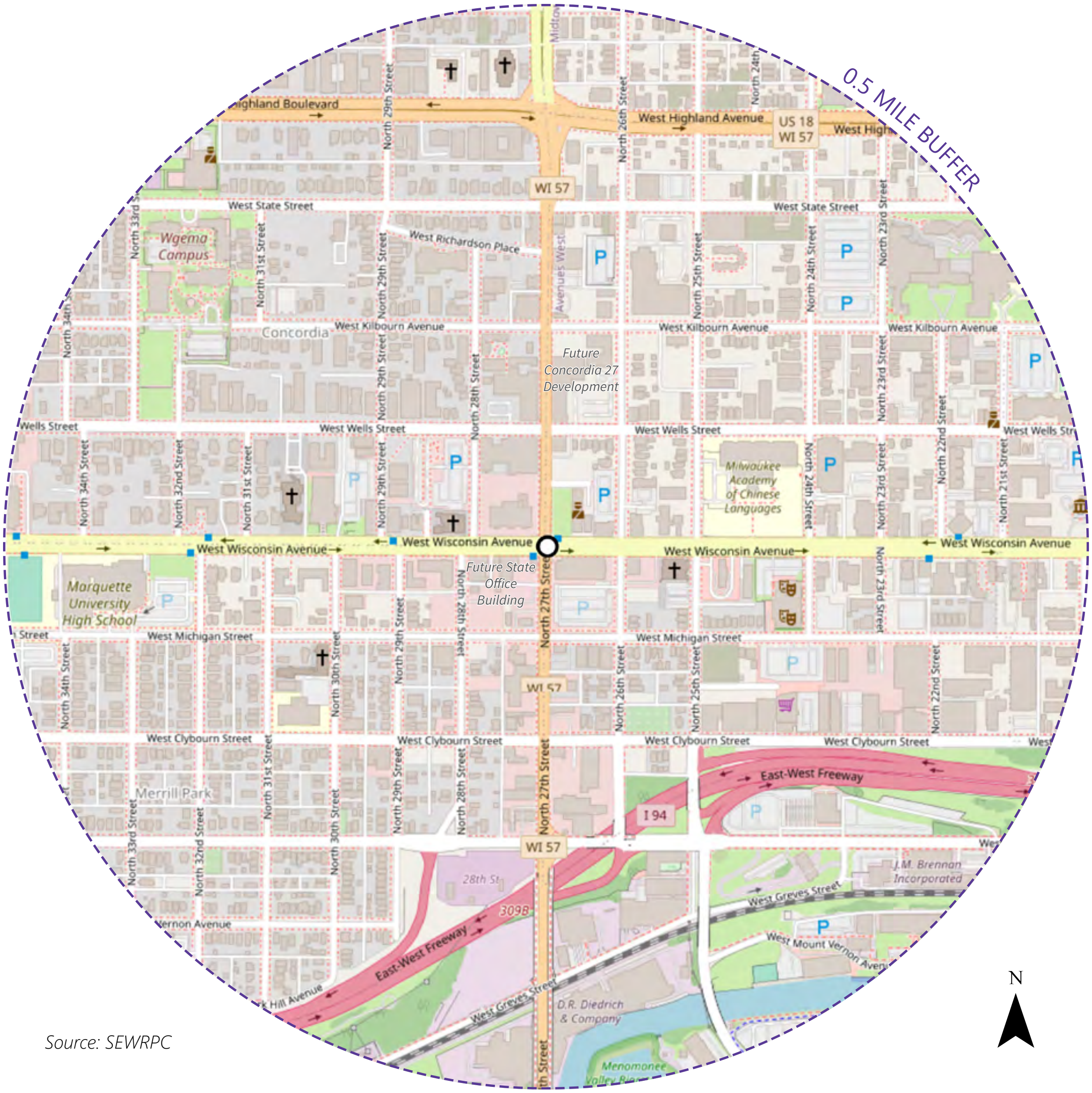
Transit Connections

MCTS route 30, the East-West BRT (expected to open to service in 2023), and the existing PurpleLine.

Development Opportunities

At present, land is being assembled for redevelopment, which accounts for some of the vacancy. For example, the whole block to the southwest of the intersection of W. Wisconsin Avenue and N. 27th Street is under single ownership and is planned for a State of Wisconsin office building. The former public school on the northwest corner is planned for reuse as a hotel. And the former hospital, the storefront building at W. Wells Street, and the large parking lot on N. 28th Street are all under the same ownership, with planning underway for reuse and infill. The intersection of the East West BRT and this proposed BRT service on N. 27th Street will make this area one of the most accessible by transit in the city and provide a great opportunity to support new and ongoing development. Planning for transit-oriented development along the East West corridor is under way. Attention will be given to the potential to create a transit hub that facilitates transfers between transit lines at N. 27th Street and W. Wisconsin Avenue.

Map B.22
27th and Wisconsin Station Area



Source: SEWRPC

27TH & ST. PAUL – CENTRAL SEGMENT

Existing Land Use

Transportation infrastructure is the dominant land use at N. 27th Street and W. St. Paul Avenue, in a transition area from north Milwaukee to the Menomonee Valley. IH 94 passes beneath the 27th Street Viaduct on the southside of the intersection. The four-lane W. St. Paul Avenue becomes the northern rim of the Menomonee Valley overlooking and providing access to the industrial heart of the city. The viaduct is an imposing structure that allows traffic to fly over railroad tracks and yards, shipping canals, and industrial plants in the valley below. On the southwest corner of the intersection, there is a large power substation. The northwest corner is a gas station with convenient access to expressway on- and off- ramps. To the north on 27th Street to W. Clybourn Street, there is a mix of business including a veterinary clinic, tire store, auto repair, law offices, and vacant lots and buildings. There are blocks of residential uses to the west of the intersection.

Planning and Policy Guidance

City of Milwaukee Near West Side Comprehensive Plan (2004, 2009)
City of Milwaukee North 27th Street Corridor Strategy (2018)

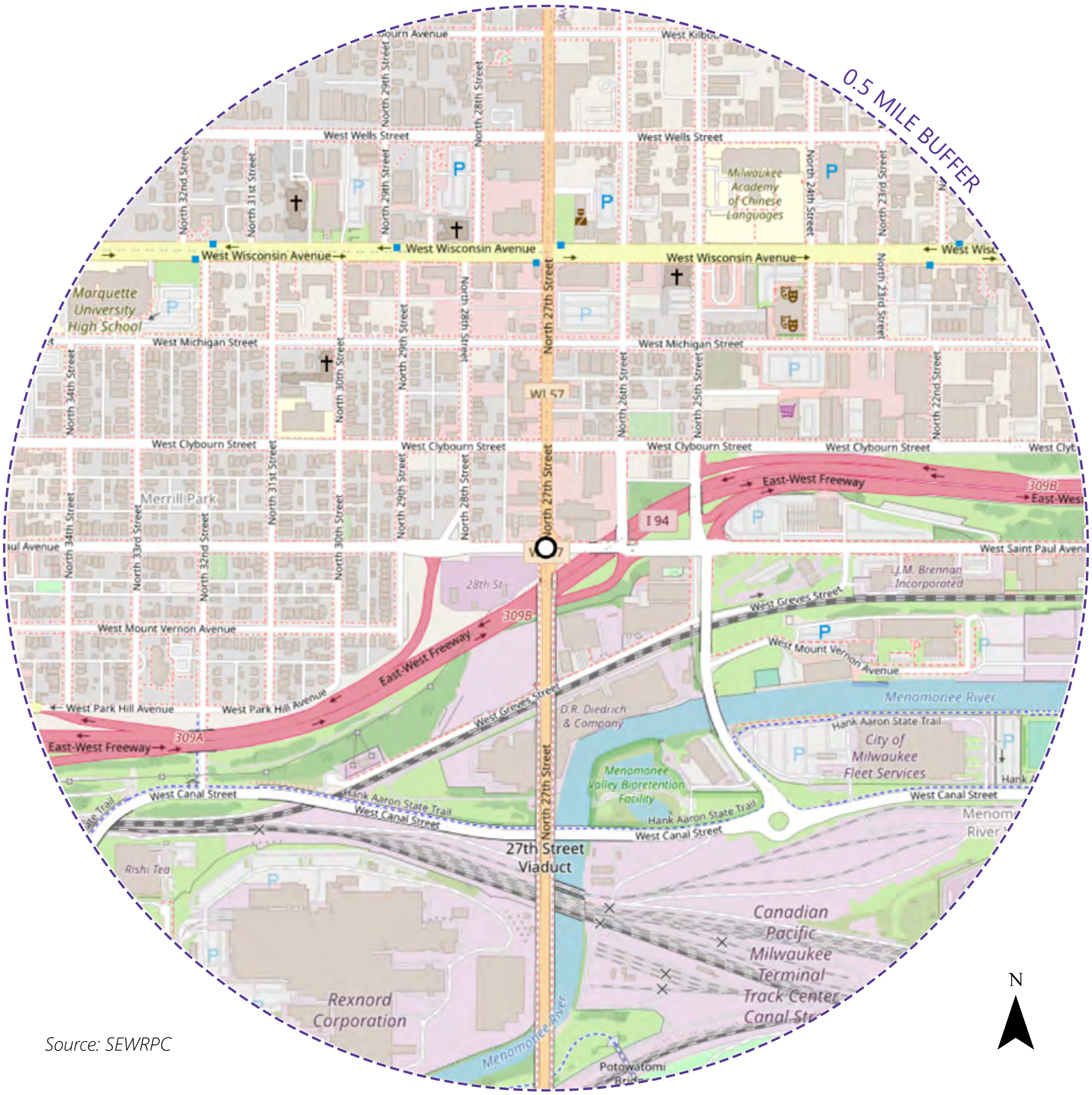
Transit Connections

MCTS existing PurpleLine.

Development Opportunities

Vacant property is available for infill within the potential station area. Some of the current industrial properties may transition to residential in the future.

Map B.23
27th and St. Paul Station Area



Source: SEWRPC

LAYTON & NATIONAL – CENTRAL SEGMENT

Existing Land Use

West National Avenue is the first key arterial south of the Menomonee Valley at S. Layton Boulevard and it is a major commercial corridor serving the surrounding neighborhoods and regional markets. On the northwest corner of S. Layton Boulevard and W. National Avenue, there is a block-long strip shopping center with a large parking lot along the street. This single-story building has a mix of restaurants, thrift shops, dentist, and furniture shops. Across S. Layton Boulevard there is a gas station at the corner, and immediately east of the gas station is an eleven-story cylindrical senior housing apartment building, by far the tallest structure in the area and providing higher residential density very close to the proposed BRT station.

A small brick building with a phone shop holds the sidewalk on the southeast corner, stylistically connected to the drugstore with a parking lot on the site. A bus shelter is located on the sidewalk next to this store. A newer bank building on the southwest corner also accommodates bus patrons with an alcove and bench built into the building facade. A quick transition to residential uses happens to the west of the intersection, with a mix of single- and two-unit houses and a few small brick apartment buildings. The side streets are mostly residential with churches. The houses are all two and three stories on narrow urban lots with alleys, creating a high density of units. Many of these older 'Victorian' or 'Queen Anne' style balloon frame houses were originally constructed as duplexes, or with smaller rental units.

Planning and Policy Guidance

City of Milwaukee Near South Side Area Comprehensive Plan (2009)

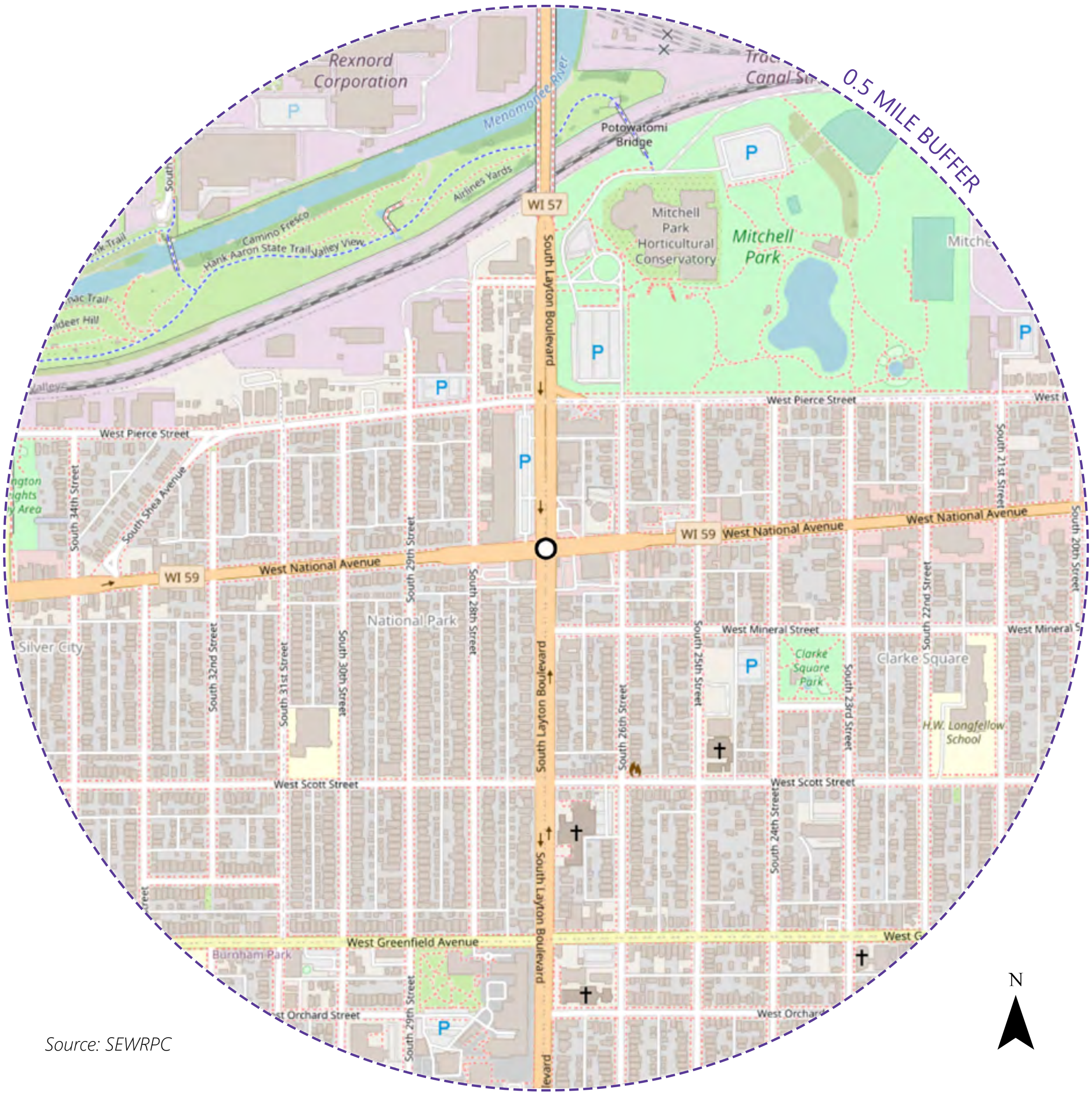
Transit Connections

MCTS route 18 and the existing PurpleLine.

Development Opportunities

There are no obvious sites for new development in the area, but in the long term, the strip shopping center to the northwest of the potential station location could become a redevelopment opportunity.

Map B.24
Layton and National Station Area



Source: SEWRPC

LAYTON & GREENFIELD – CENTRAL SEGMENT

Existing Land Use

South Layton Boulevard has four lanes and a landscaped median with mature trees and large houses facing the street. At the intersection with W. Greenfield Avenue there are small scale commercial uses in older structures, which stretch down W. Greenfield Avenue to the east, while the land use is more residential to the west. This area is dominated by large religious institutions, including the massive St. Joseph's Church with clock tower spire and the Notre Dame School of Milwaukee next door. Across the boulevard and wrapping around the southwest corner of W. Greenfield Avenue is a complex of institutional and church buildings including the School Sisters of St. Francis, the St. Joseph Center hospice, Sacred Heart church and community care. This group of buildings is mostly Cream City brick and three or four stories. A newer independent and assisted senior living complex mimics the older architecture on W. Greenfield Avenue. Single story and one-and-a-half story bungalows line the north side of W. Greenfield Avenue west of the intersection. Urban density residential uses are found on the surrounding side streets.

Planning and Policy Guidance

City of Milwaukee Near South Side Area Comprehensive Plan (2009)

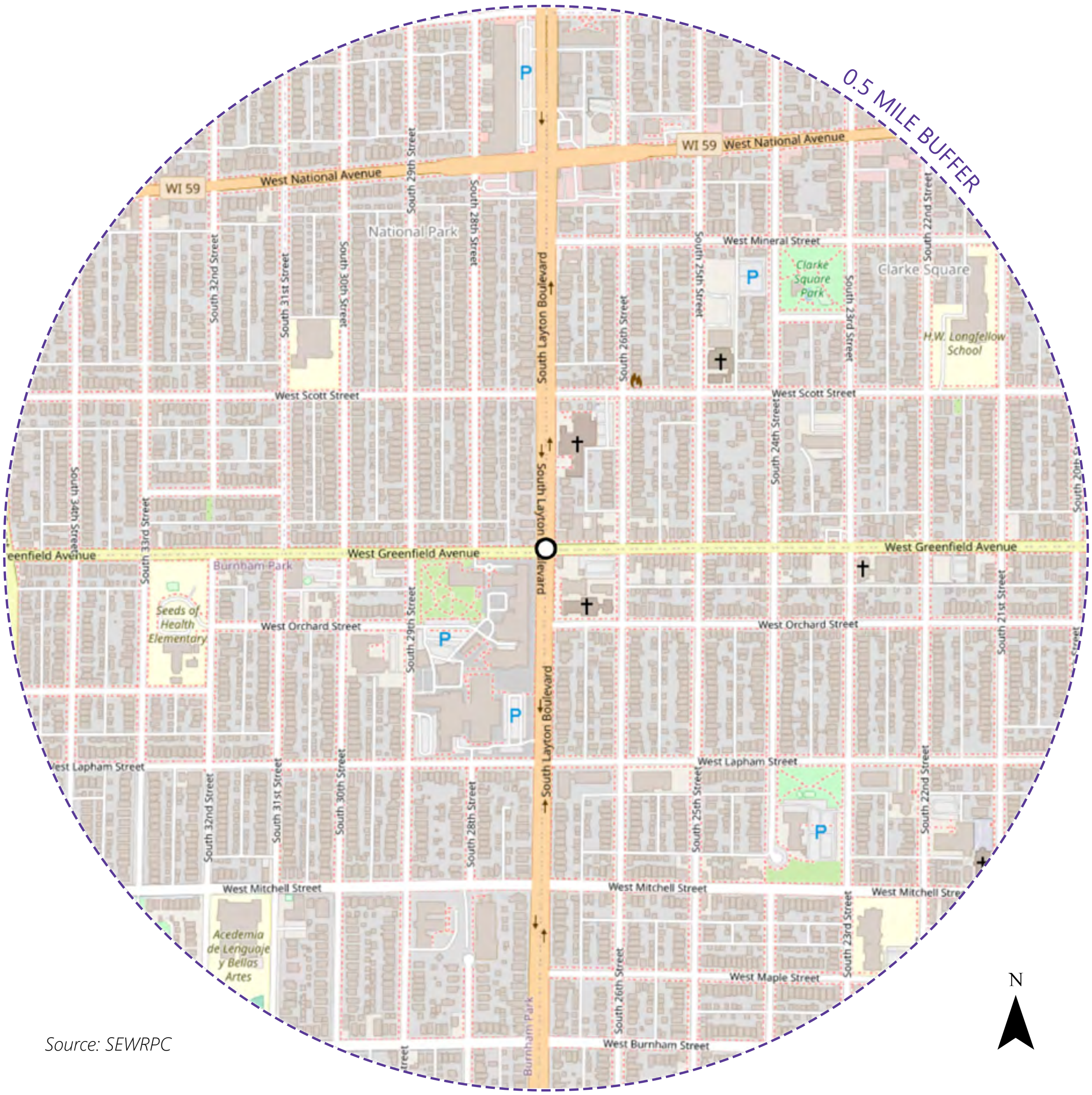
Transit Connections

MCTS route 56 and the existing PurpleLine.

Development Opportunities

The area is a dense built out urban neighborhood without any obvious sites for new development.

Map B.25
Layton and Greenfield Station Area



Source: SEWRPC

LAYTON & BURNHAM – CENTRAL SEGMENT

Existing Land Use

The land use along S. Layton Boulevard and W. Burnham Street is almost entirely residential in this area. A few small shops are located to the east on W. Burnham Street at S. 25th Street, and automobile sales and repairs to the west at S. 29th Street. A more substantial commercial area with automobile sales and services and restaurants is further west at N. 31st Street. A few commercial and institutional uses are found to the north along W. Mitchell Street, including two schools and two health service clinics. The residential area is primarily comprised of houses with single or multiple units in an urban density.

Planning and Policy Guidance

City of Milwaukee Near South Side Area Comprehensive Plan (2009)

Transit Connections

MCTS route 54 and the existing PurpleLine.

Development Opportunities

The area is a dense, built-out urban neighborhood without any obvious sites for new development.

Map B.26
Layton and Burnham Station Area

Source: SEWRPC

LAYTON & LINCOLN/FOREST HOME – CENTRAL SEGMENT

Existing Land Use

S. Layton Boulevard at W. Lincoln Avenue widens to accommodate turn lanes. The buildings on the east side of the intersection are set up on the sidewalk, with small businesses including a convenience store and furniture store. The bigger commercial area is two and half blocks to the east of the intersection of W. Forest Home Avenue and W. Lincoln Avenue. Forest Home is the name of the large cemetery which lies east of S. Layton Boulevard, from W. Forest Home Avenue south to the Union Pacific Railroad corridor on the north side of the Kinnickinnic River. The cemetery extends east to S. 20th Street. A second cemetery, Pilgrims Rest Cemetery, is located to the west of S. Layton Boulevard, between S. 31st and S. 33rd Streets. W. Lincoln Avenue to the west of S. Layton Avenue is a mix of houses and small commercial buildings, with restaurants, a gas station, and barber shop. The stone massing of St. Raphael church rises above the avenue at S. 31st Street. Residential blocks are relatively dense single- and two-family houses on narrow lots.

Planning and Policy Guidance

City of Milwaukee Near South Side Area Comprehensive Plan (2009)

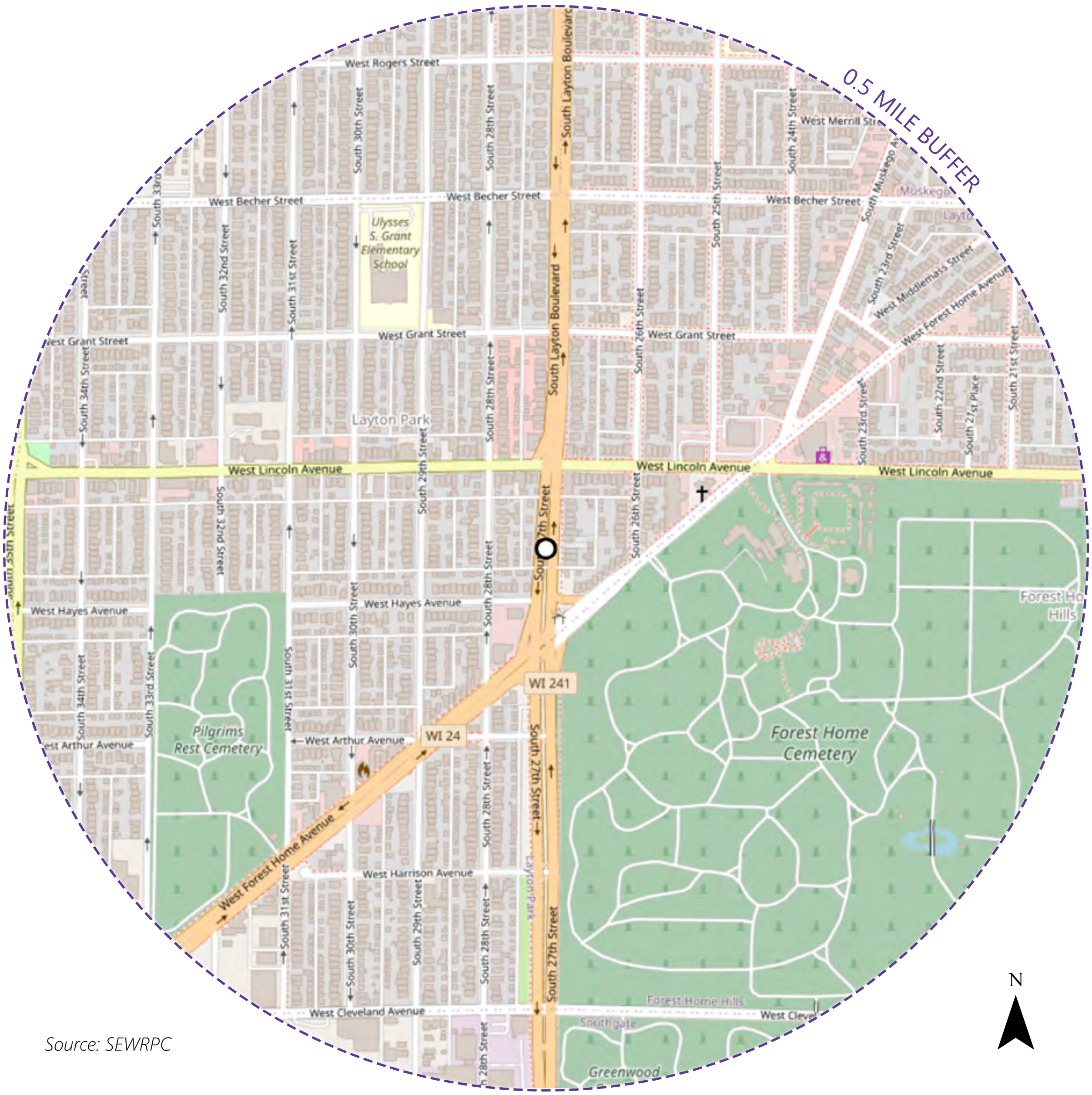
Transit Connections

MCTS routes 14, 53, and the existing PurpleLine.

Development Opportunities

The area is a dense, built-out urban neighborhood without any obvious sites for new development.

Map B.27
Layton and Lincoln/Forest Home Station Area



Source: SEWRPC

27TH & OKLAHOMA (AURORA ST. LUKE'S MEDICAL CENTER) – CENTRAL SEGMENT

Existing Land Use

South of the Kinnickinnic River, the land use pattern in the corridor enters the post-war era of urban expansion. The commercial and institutional uses are located on much bigger sites than in the older parts of the city, and the housing stock is smaller, frequently in a Cape Cod style single story with a half story gable, but still on narrow lots. Mixed on the same blocks are square houses with hipped roofs that can be one unit, a duplex, or fourplex configurations. However, single-unit houses are far more prevalent than in neighborhoods to the north in the older parts of the city.

S. 27th Street becomes a six-lane divided highway with medians. The intersection with W. Oklahoma Avenue is a very wide suburban-style crossing, with W. Oklahoma Avenue also being six lanes with turn lanes. All of the land to the northwest to the Kinnickinnic River Parkway is the Aurora St. Luke's Medical Center. This huge medical complex includes a hospital and two multistory medical office buildings, and a parking garage. It is a major employer in the area. To the east, Pulaski High School also exhibits the new suburban style high school that is separated from the residential neighborhoods and set on a large site that extends to S. 22nd Street. Leon's Custard is a classic drive-up restaurant on S. 27th Street south of W. Oklahoma Avenue with a car parking lot. A wide variety of franchise restaurants serve the medical center staff and patrons, while a block of small commercial buildings fronts the sidewalk along the east side of S. 27th Street, with on-street parking part of the day. Businesses include loans and check cashing, tattoo, mobile phones, and takeout restaurants. While the street design is car-oriented at this point, the South 27th Street Action Plan calls for a more pedestrian-oriented environment.

Planning and Policy Guidance

City of Milwaukee Southwest Side Area Comprehensive Plan (2009)
South 27th Street Strategic Action Plan (2017)

Transit Connections

MCTS route 51 and the existing PurpleLine.

Development Opportunities

The hospital and public school north of W. Oklahoma Avenue are not susceptible to change, but they do generate a need for transit access. The businesses that support the hospital on the south side of W. Oklahoma Avenue are also unlikely to be redeveloped in the short term.

Map B.28
27th and Oklahoma Station Area

Source: SEWRPC

27TH & OHIO (AT WALMART) – CENTRAL SEGMENT

Existing Land Use

The site of the first suburban style shopping center in the Milwaukee metro area, called Southgate when it opened in 1951, is now a Walmart on S. 27th Street at W. Ohio Avenue. The Southgate cinema remains at the north end of a huge expanse of surface parking. Part of the original mall remains at the south end of the site, with a shoe store and fitness center. A drug store and coffee shop are set nearer to S. 27th Street in the current outlot shopping center configuration.

Post-war planning and zoning separated commercial uses from residential areas, and as a result, the land use pattern becomes more obvious and less complex with commercial uses all along the main S. 27th Street corridor, and residential areas to the west and east. A thin corridor of industrial and logistics uses are located to the east along an old railroad spur.

Instead of being mixed with single-family and duplexes on neighborhood streets, multifamily units are separated on large sites and constructed as apartment complexes. The Southlawn apartments found east of Layton at S. 25th to S. 22nd Streets are a precursor to the garden apartment, with four units with party walls in a long house building. These apartments have off-street parking lots behind the units, and the street grid does not connect. While the street design is car-oriented at this point, the South 27th Street Action Plan calls for a more pedestrian-oriented environment.

Planning and Policy Guidance

City of Milwaukee Southwest Side Area Comprehensive Plan (2009)
South 27th Street Strategic Action Plan (2017)

Transit Connections

MCTS existing PurpleLine.

Development Opportunities

The Southwest Side plan identifies the large surface parking lots on the west side of S. 27th Street by the cinema and the Walmart as potential infill areas. Long term, redevelopment of Southlawn may provide opportunity.

Map B.29
27th and Ohio Station Area

Source: SEWRPC

27TH & NORTH OF HOWARD – CENTRAL SEGMENT

Existing Land Use

The City of Greenfield's eastern boundary is along S. 27th Street from W. Howard Avenue south to W. Grange Avenue. Land use at W. Howard Avenue repeats the pattern found south of W. Oklahoma Avenue, including two large shopping centers to the west of S. 27th Street and popular franchise businesses set in parking lots to the east. There are sidewalks and landscaping and bus shelters, however the scale of development is geared to access via automobiles, making for lengthy walks. The 27th Street Strategic Action Plan sets recommendations for creating a more walkable pedestrian-oriented site. Residential blocks are primarily single-family houses. Garden apartments, organized around surface parking lots, are north of Howard, while the south side is the Arlington Park cemetery. Four-unit apartment buildings line W. Loomis Road along with scattered highway commercial uses. More four-unit buildings line W. Howard Avenue east of S. 27th Street. The street grid does not connect to S. 27th Street from the residential area to the east. South of W. Howard Avenue, the land use on the east side of S. 27th Street is retail including a large car dealership. Wilson Park, a Milwaukee County park, is located to the east of this commercial area, home to the Wilson Ice Arena.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southwest Side Area Comprehensive Plan (2009)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

Transit Connections

MCTS existing PurpleLine.

Development Opportunities

The South 27th Street Strategic Action Plan explored redevelopment concepts for sites immediately north of the proposed station location at W. Howard Avenue, including for the Wildenberg Hotel, an abandoned historic mansion owned by the City of Milwaukee. The City has sought proposals for reuse of the mansion and infill of the surrounding land. Concepts have included apartments and townhouses.

Map B.30
27th and North of Howard Station Area

Source: SEWRPC

27TH & COLD SPRING/BOLIVAR – CENTRAL SEGMENT

Existing Land Use

Highway commercial uses line S. 27th Street north and south of W. Cold Spring Road and W. Bolivar Avenue, between a powerline corridor and IH 41/43/894 just 1000 feet to the south. The commercial uses are typical for an interstate interchange, including two hotels, car dealers, a car wash, and fast-food restaurants. The street pattern of the residential development in the area is no longer a grid, and while the single-family houses are similar in size to the post war areas to the north, some of the yards are very deep, lowering the overall density. There are plans to develop the South Powerline Trail just to the north of the intersection.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

Transit Connections

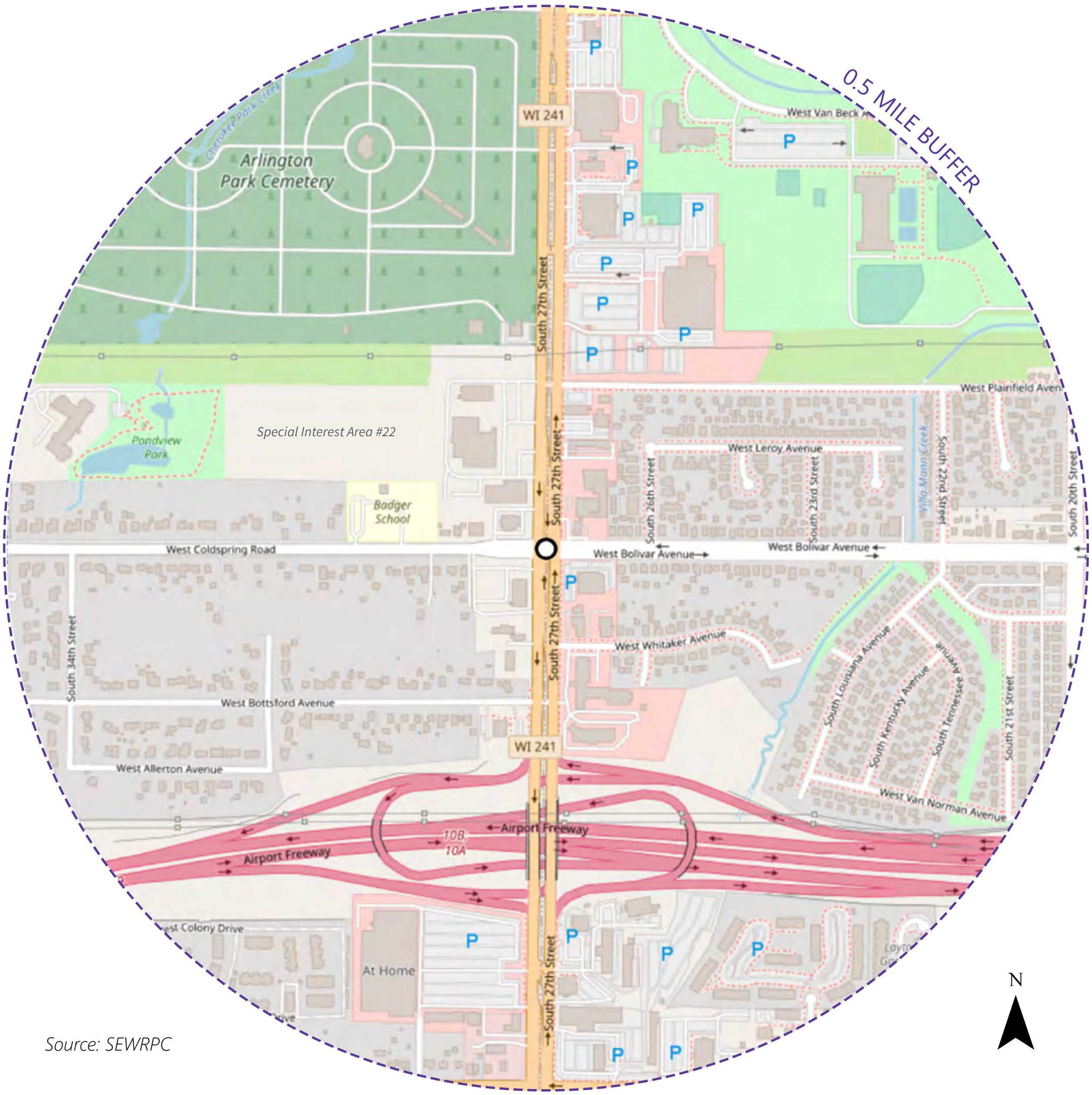
MCTS existing PurpleLine.

Development Opportunities

- The City of Greenfield Comprehensive Plan identifies 'Special Interest Areas', including Special Interest Area #22, S. 27th Street and W. Cold Spring Road, an undeveloped 22-acre area to the northwest of 27th and Cold Spring Road, between Pondview Park and commercial fronting on S. 27th Street. Eleven acres were rezoned as planned unit development, with a recommendation for mixed-use development including multifamily residential.

- Southwest of the intersection, there are a few vacant parcels that could provide development opportunities.

Map B.31
27th and Cold Spring/Bolivar Station Area



Source: SEWRPC

27TH & LAYTON – CENTRAL SEGMENT

Existing Land Use

The area south of the IH 41/43/894, also known as the Airport Freeway, to W. Layton Avenue is developed with large apartment complexes on sites bordering the expressway, and single-family houses lining W. Layton Avenue to the west of S. 27th Street. East of S. 27th Street there are four-unit apartment buildings on the north side of W. Layton Avenue and single- and two-family houses on the south side. At the intersection, there is a car dealership that stretches almost two blocks to the east and gas stations on both sides of W. Layton Avenue on the west side of S. 27th Street. A drug store occupies the southeast corner. The land use on the west side of S. 27th Street is commercial with businesses including a grocery supermarket set back over 600 feet from the road and a large surface parking lot with outlots near the road that are occupied by fast-food drive-thru restaurants, a bank, and an oil change service center. To the west of S. 27th Street and south of W. Layton Avenue is the City of Greenfield where the residential lots are noticeably larger and density lower than in the areas east of S. 27th Street in the City of Milwaukee. The grid of streets in this part of Milwaukee is regular and the lots are relatively narrow with mainly single-story, single-unit ranch-style houses.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

Transit Connections

MCTS route 55 and the existing PurpleLine.

Development Opportunities

The City of Greenfield Comprehensive Plan identifies 'Special Interest Areas' or SIA in the corridor, including:

- Special Interest Area #24, former Target Store, south of W. Layton Avenue, currently a big box grocery store. The City calls this a significant opportunity to encourage dense mixed-use redevelopment with multifamily residential up to five stories, professional offices, and boutique shopping.

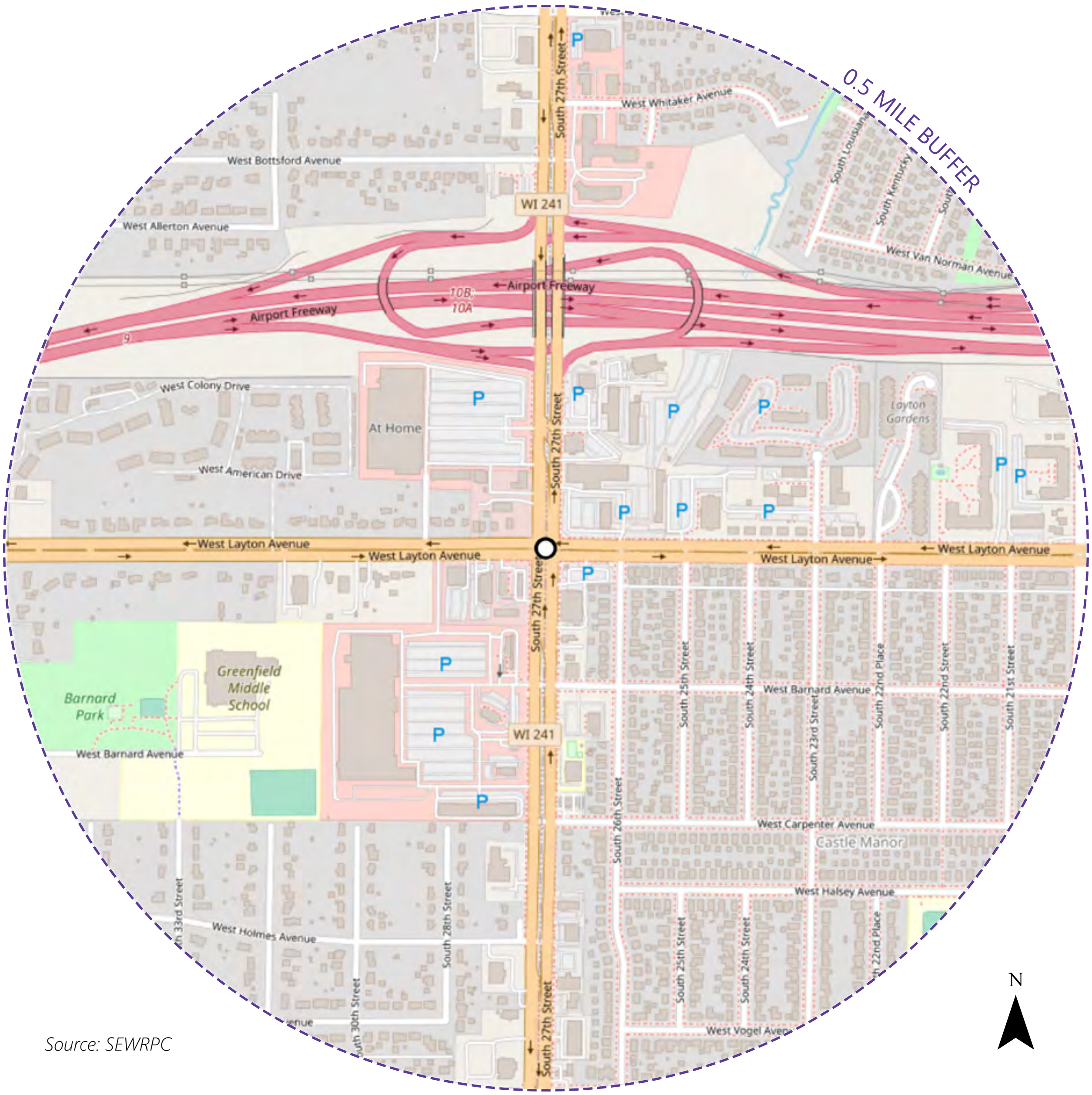
- Special Interest Area #23, W. Layton Avenue between S. 27th and S. 35th Streets, is a 40-acre area of single-family residential that the City envisions as a gateway to Greenfield, that should be redeveloped to multi-story office and entertainment and hospitality uses at S. 27th Street. The intersection of W. Layton Avenue and S. 35th Street is identified as an ideal location for neighborhood-serving commercial uses. A mix of residential uses is recommended along W. Layton Avenue between these commercial nodes.

The South 27th Street Strategic Action Plan explored redevelopment concepts for two sites immediately north of the proposed station location, including:

- Northwest corner of W. Layton Avenue and S. 27th Street, currently a gas station, a bank, single-family residential, and small retail and office spaces. These are re-imagined as a neighborhood center, with a coffee shop, bank, apartments, retail, and a conference center.

- S. 27th Street, between W. Layton Avenue and the IH 41/43/894 interchange, currently includes a vacant restaurant, a motel, and a health clinic. The redevelopment concept envisions a mixed-used medical and retail center.

Map B.32
27th and Layton Station Area



Source: SEWRPC

27TH & EDGERTON – CENTRAL SEGMENT

Existing Land Use

Highway commercial uses continue along both sides of S. 27th Street at W. Edgerton Avenue, including a gas station and restaurant on the northside corners and a post office and bank south of W. Edgerton Avenue. The roadway and intersection are very wide. The residential pattern to the east of S. 27th Street in Milwaukee remains the same, with single-family houses at a medium density. Unlike areas to the north, this single unit is no longer mixed with duplexes or small apartments, except for the first block to the east of the commercial strip, which are duplexes.

West of S. 27th Street in Greenfield there are both low-density single-family streets without sidewalks and a large area of mixed density residential that includes garden apartment complexes organized around parking lots and detached single-family houses set on small loop roads without sidewalks. All of the commercial businesses serving these neighborhoods are located on S. 27th Street, as the residential areas are exclusively residential.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

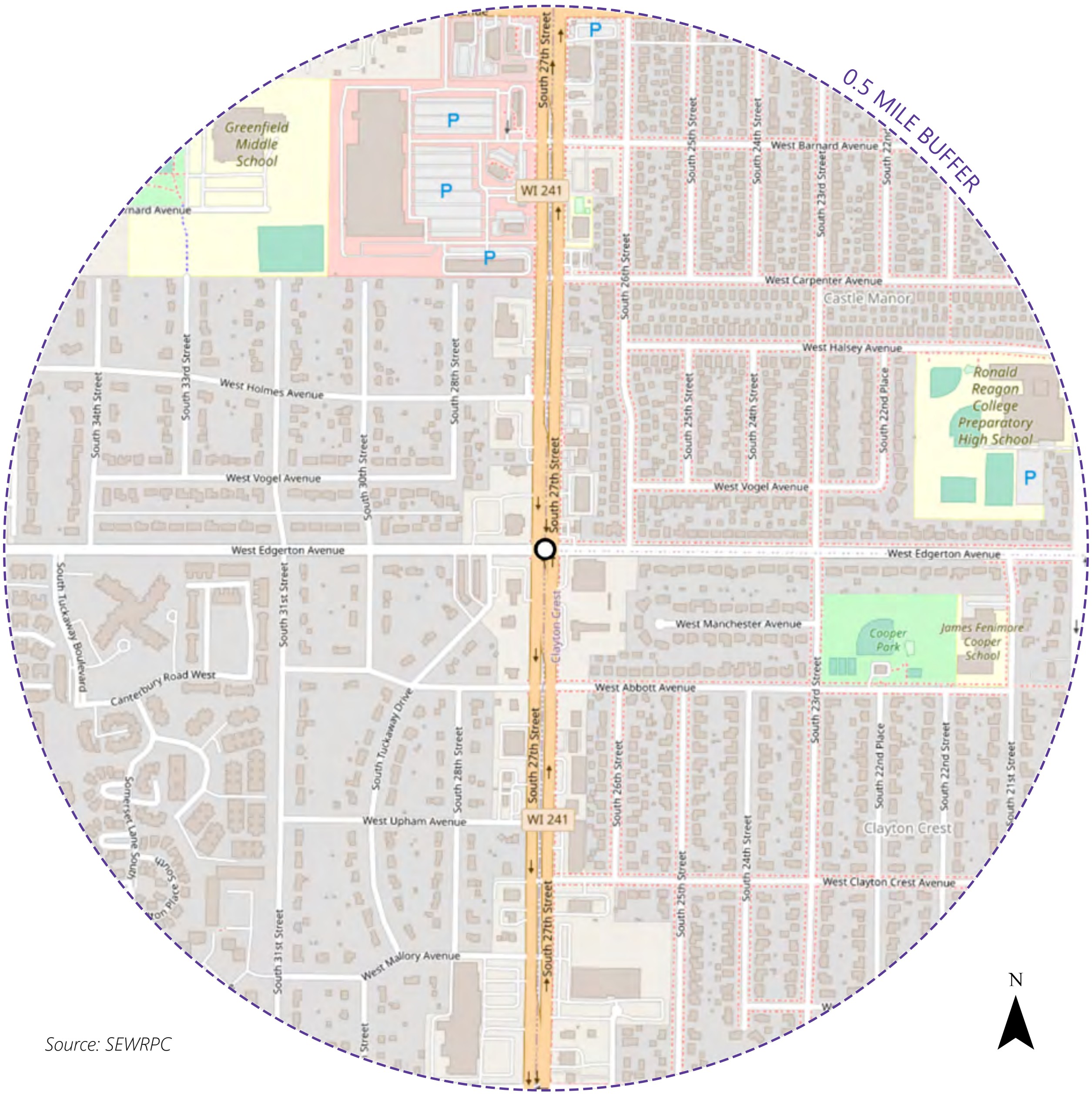
Transit Connections

MCTS route 55 and the existing PurpleLine.

Development Opportunities

Currently the land use along S. 27th Street at the W. Edgerton Avenue intersection seems stable. Small parcel redevelopment may become possible as businesses turn over.

Map B.33
27th and Edgerton Station Area



Source: SEWRPC

27TH & GRANGE – CENTRAL SEGMENT

Existing Land Use

There are car dealerships on both sides of S. 27th Street south of W. Grange Avenue. The intersection itself is very wide, given the medians on W. Grange Avenue, and long left turn lanes on S. 27th Street divided by concrete barriers. There is a strip shopping center on the west side of S. 27th Street leading south to W. Parnell Avenue, where two very large car dealerships fill all of the land on both sides of 27th Street.

Medium-density attached condominiums, duplexes, and four unit and other apartment buildings lead from W. Parnell Avenue into residential areas to the west and east, providing a transition to single-family residential areas with increasingly large lot sizes. St. Charles Borromeo church and school is located south of W. Grange Avenue in an area of the City of Milwaukee west of S. 27th Street, while Copernicus Park provides an amenity to the residential area to the east.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

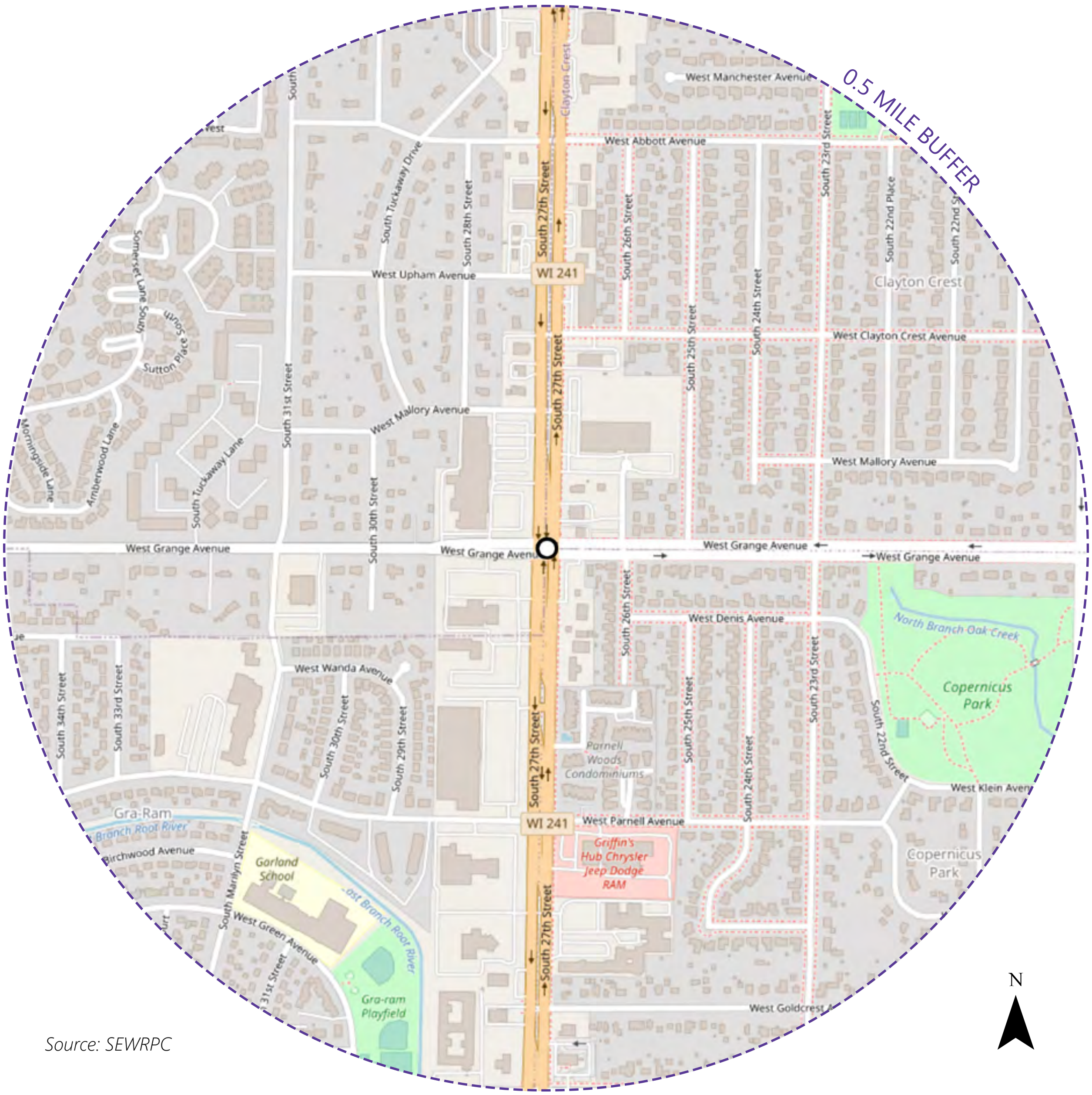
Transit Connections

MCTS existing PurpleLine.

Development Opportunities

Land use at the intersection of S. 27th Street and W. Grange Avenue is stable, without obvious sites for infill or redevelopment.

Map B.34
27th and Grange Station Area



Source: SEWRPC

27TH & RAMSEY – CENTRAL SEGMENT

Existing Land Use

The west side of S. 27th Street from W. Ramsey Avenue to W. College Avenue lies within the City of Greenfield. The commercial area south of W. Ramsey Avenue to W. Kimberly Avenue has relatively shallow and narrow lots compared to the rest of the corridor, with a mix of service and retail businesses, churches, even some residential facing S. 27th Street. The parcels on the west side deepen south to W. College Avenue, where two car dealerships fill the area. The southern city limit of the City of Milwaukee is W. College Avenue and the residential areas to the east of S. 27th Street are single-family on various lots sizes.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

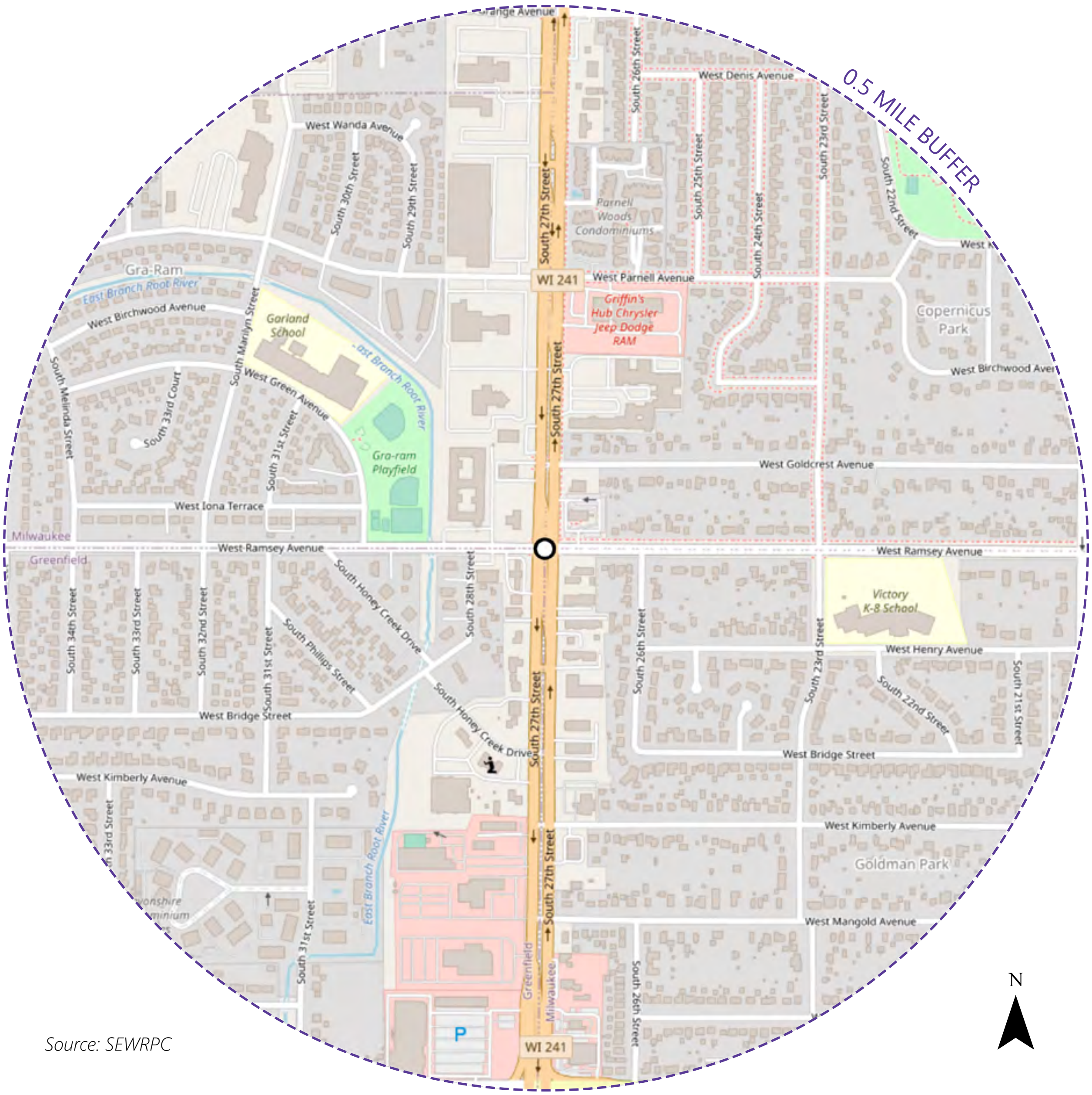
Transit Connections

MCTS existing PurpleLine.

Development Opportunities

Land use at the intersection of S. 27th Street and W. Ramsey Avenue is stable, without obvious sites for infill or redevelopment.

Map B.35
27th and Ramsey Station Area



Source: SEWRPC

27TH & COLLEGE – CENTRAL SEGMENT

Existing Land Use

The northern boundary of the City of Franklin is set at the southwest corner of S. 27th Street and W. College Avenue, and a portion of the City of Oak Creek is on the southeast corner. Highway commercial uses line both sides of S. 27th Street. Two mobile home parks extend along east west drives on both sides of S. 27th Street south of W. College Avenue. Big box retail centers straddle the roadway, with a home improvement store to the west and a grocery to the east, with outlot fast-food restaurants against the roadway. Wetland and wooded areas are located west of the commercial lands in the City of Franklin, with apartment complexes located along S. 35th Street. Manufactured housing, single-family houses, and an apartment complex are located east of S. 27th Street.

Planning and Policy Guidance

City of Greenfield Comprehensive Plan (2020)
City of Franklin 2025 Comprehensive Master Plan (2009)
City of Oak Creek Comprehensive Plan (2020)
City of Milwaukee South 27th Street Strategic Action Plan (2017)
City of Milwaukee Southeast Side Comprehensive Area Plan (2008)

Transit Connections

MCTS route 20 and the existing PurpleLine.

Development Opportunities

- The City of Greenfield Comprehensive Plan identifies the northwest corner of S. 27th Street and W. College Avenue as an infill site with mixed-uses envisioned.

- The City of Franklin plan also identifies several sites along S. 27th Street as areas for infill and redevelopment with a focus on housing.

Map B.36
27th and College Station Area

Source: SEWRPC

27TH & SYCAMORE (AT WALMART) – CENTRAL SEGMENT

Existing Land Use

A commercial area is located near the intersection of S. 27th Street and W. Sycamore Avenue with a number of big box retailers, including three home improvement stores and a supercenter store. Wetlands and creeks run behind these commercial areas to the east and west, including near Milwaukee County's Johnstone Park. This may limit the amount of residential uses on open land to the south of W. Sycamore Avenue.

Planning and Policy Guidance

City of Franklin 2025 Comprehensive Master Plan (2009)
City of Oak Creek Comprehensive Plan (2020)

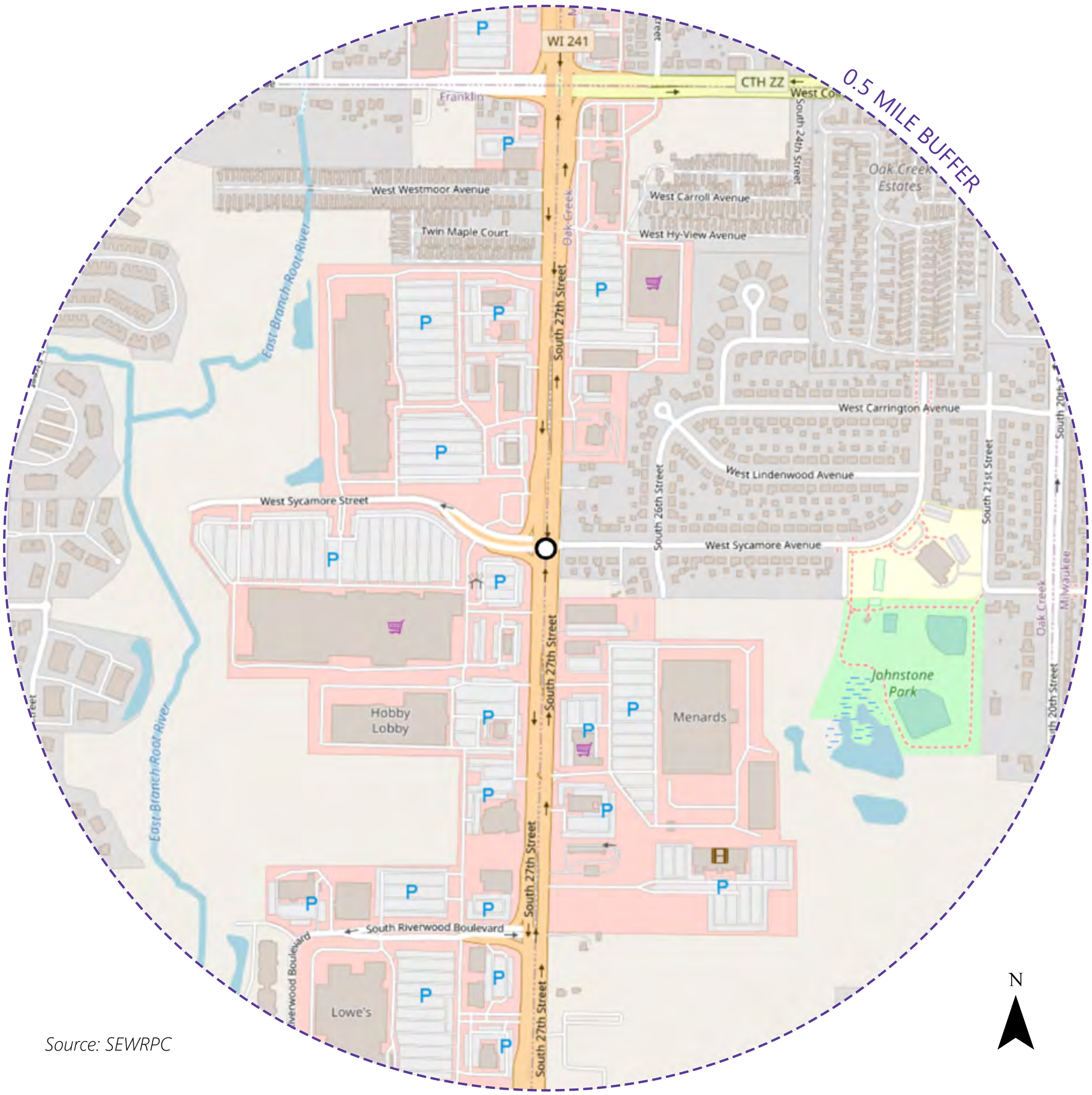
Transit Connections

MCTS route 20 and the existing PurpleLine.

Development Opportunities

Despite the existence of wetlands and creeks, opportunities for infill development may exist on open land in the area south of W. Sycamore Avenue.

Map B.37
27th and Sycamore Station Area



Source: SEWRPC

NORTHWESTERN MUTUAL WAY & IKEA WAY – SOUTH OPTION A AND B

Existing Land Use

A big box furniture store, Ikea, is located on a site surrounded by open land next to IH 94. Hospitality and other commercial uses are under construction nearby.

Planning and Policy Guidance

City of Franklin 2025 Comprehensive Master Plan (2009)
City of Oak Creek Comprehensive Plan (2020)

Transit Connections

No existing transit routes serve this location.

Development Opportunities

The City of Oak Creek identifies the following areas as development opportunities:

- 27th Street Mixed Use, the area is adjacent to the new Forest Ridge Elementary School and Ikea. The City has been working with Northwestern Mutual, the owners of the open lands in this area, to develop this area with a range of housing types and supporting commercial uses including office development. In January 2022, a mixed-use development, including nightlife and entertainment, was proposed for this area.

Map B.38
Northwestern Mutual Way and Ikea Way Station Area

Source: SEWRPC

27TH AND NORTHWESTERN MUTUAL – SOUTH OPTION A AND B

Existing Land Use

A large corporate office site is located on hundreds of acres surrounded by open countryside on the west side of 27th Street, in an area that remained undeveloped while the edge of urbanization continued to the south. A new apartment complex is under construction to the north. Agricultural fields, woods, and wetlands are located to the east.

Planning and Policy Guidance

City of Franklin 2025 Comprehensive Master Plan (2009)
City of Oak Creek Comprehensive Plan (2020)

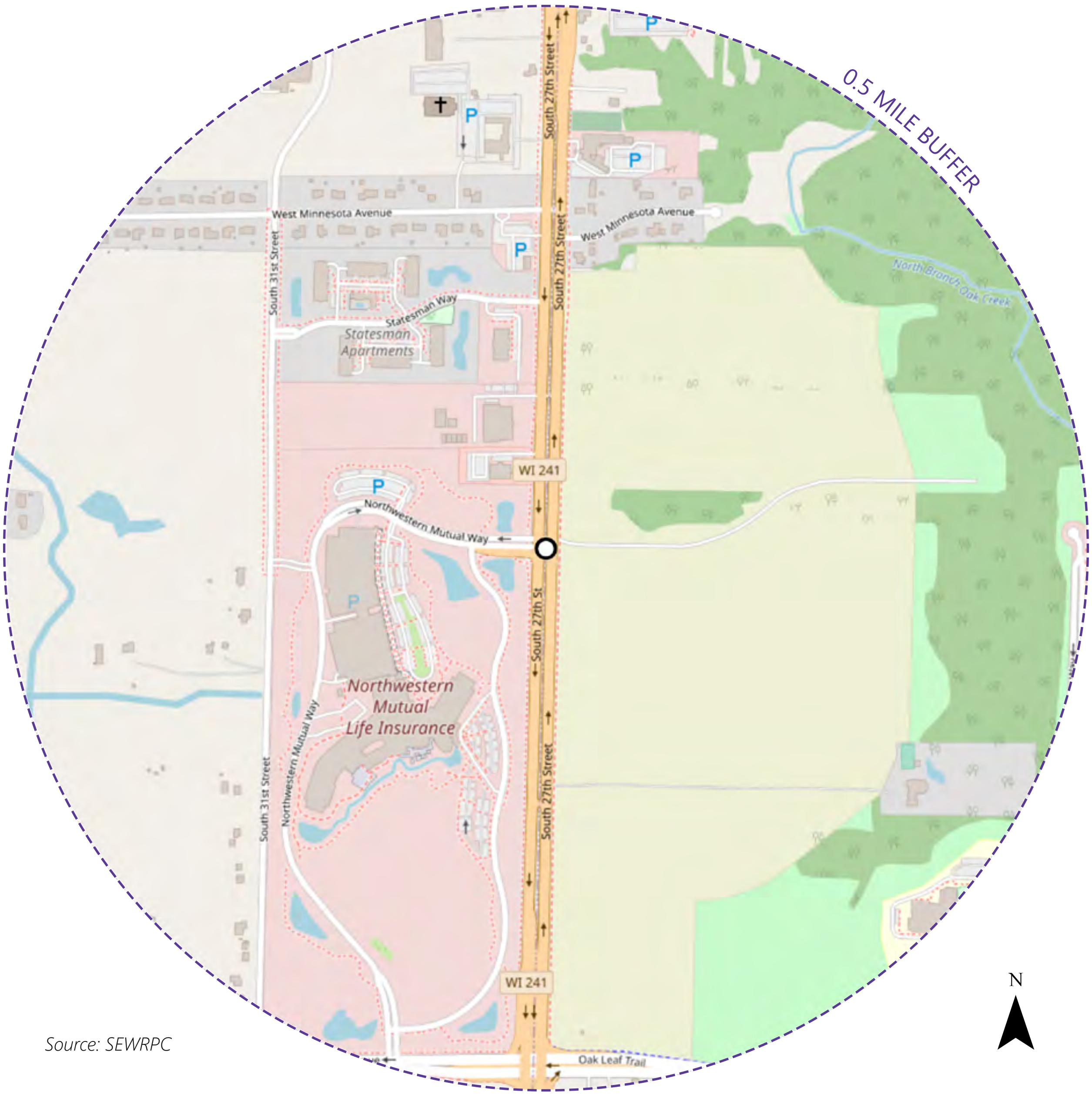
Transit Connections

MCTS existing PurpleLine.

Development Opportunities

This area has open land that is planned for new construction. New apartment buildings are being developed to the north of S. 27th Street and Northwestern Mutual Way, and large areas of open land are also planned for development to the east of 27th Street with the extension of Northwestern Mutual Way to the east side of S. 27th Street. In January 2022, a mixed-use development, including nightlife and entertainment, was proposed for this area. At some point in the future, further expansion of the Northwestern Mutual corporate office site may occur.

Map B.39
27th and Northwestern Mutual Station Area



Source: SEWRPC

DREXEL & 13TH – SOUTH OPTION B

Existing Land Use

South 13th Street at W. Drexel Avenue is an area in transition from rural lands along IH 94 to new development of institutional uses such as churches, big box retail, as well as additions to existing residential uses, such as a luxury apartment complex, and an indoor sports complex. South of W. Drexel Avenue are older subdivisions of single-family ranch-style houses on a variety of lot sizes, at a relatively low density. Further east, an area of medium-density, two-story garden apartments is located south of W. Drexel Avenue. To the north of W. Drexel Avenue, there are single-family houses on the east side of S. 13th Street, and new development, under construction, on the west side. Behind these houses is an area with light- and heavy-industrial and logistic uses, some with rail spurs to the rail line. These industrial uses continue to S. Howell Avenue. Greenspace around small creeks includes the Oak Creek Little League Complex.

Planning and Policy Guidance

City of Oak Creek Comprehensive Plan (2020)

Transit Connections

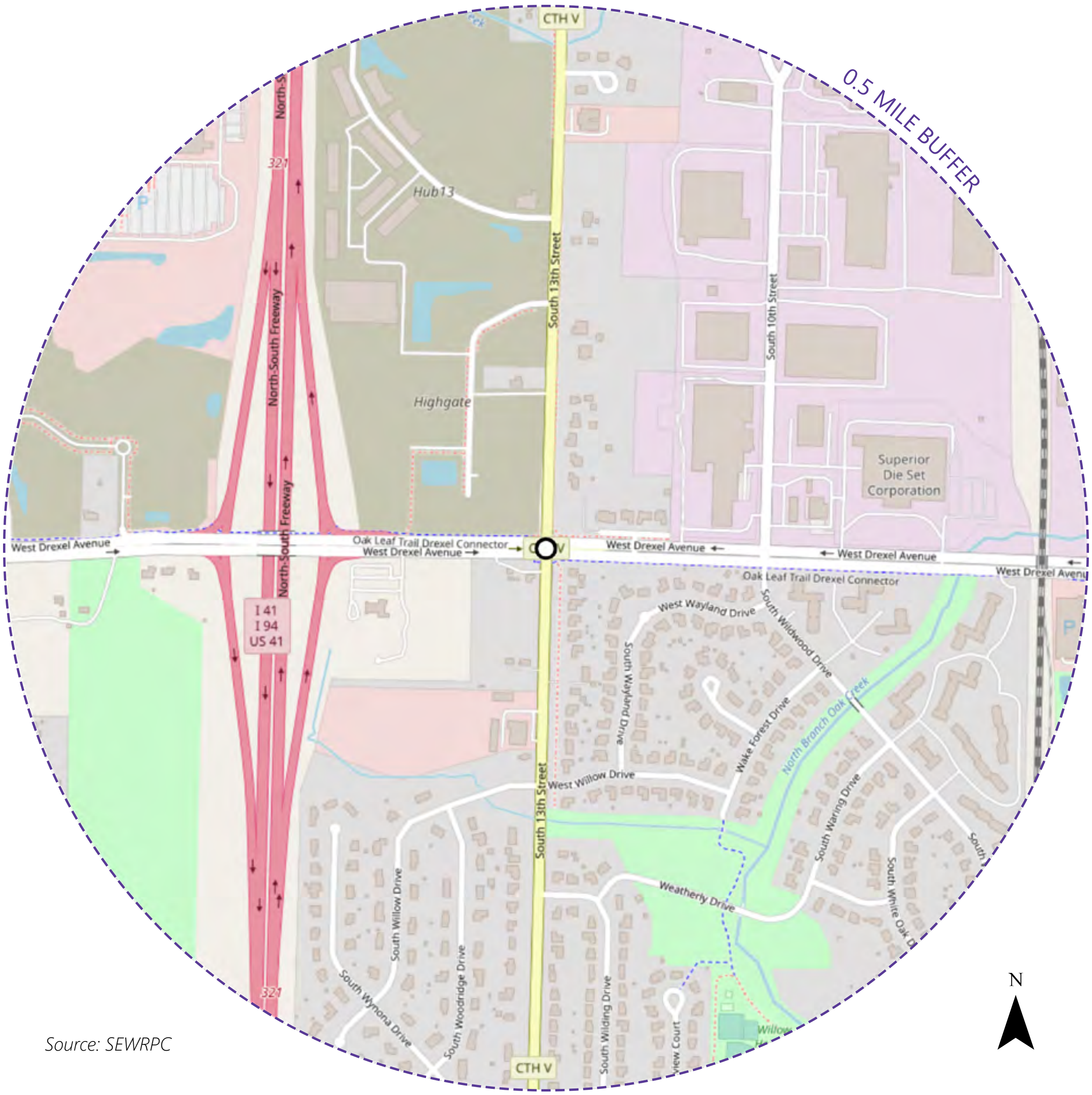
No existing transit routes directly serve this location, but the PurpleLine provides service at S. Ikea Way and Route 80 runs to W. Drexel Avenue and S. 6th Street

Development Opportunities

The City of Oak Creek identifies the following areas as development opportunities:

- 27th Street Corridor Commercial area, at the intersection of S. 27th Street and W. Drexel Avenue, is a major gateway to Oak Creek and Drexel Town Square. The City envisions redevelopment of this area with more intense commercial uses to improve the value and appearance of lands adjacent to the intersection.

Map B.40
Drexel and 13th Station Area



Source: SEWRPC

SOUTH OPTION B: DREXEL TOWN SQUARE

Existing Land Use

Drexel Town Square is located south of W. Drexel Avenue between the Canadian Pacific Railroad tracks and S. Howell Avenue. It is a relatively new mixed-use town center styled development next to two big box grocery stores. The urban design concept is centered on a town square greenspace with the Oak Creek Public Library and City Hall on the south side of the square. This traditional 'Main Street' style development surrounds the square with a hotel on one side and apartment buildings on the other two sides of the square. These apartment developments incorporate restaurant space at the ground level, with cafe seating on wide sidewalks. The S. Main Street entrance from W. Drexel Avenue includes storefront space for small shops and services including a nail salon. The residential component is on the second, third and fourth level of these mixed-use structures. There is a stand-alone medical center fronting on W. Drexel Avenue and to the east of S. Main Street. Some outlot fast-food restaurants and businesses wrap around both grocery stores along S. Howell Avenue. Emerald Preserve Park provides open space along the railroad tracks. The development creates density in a walkable urban form.

Planning and Policy Guidance

City of Oak Creek Comprehensive Plan (2020)

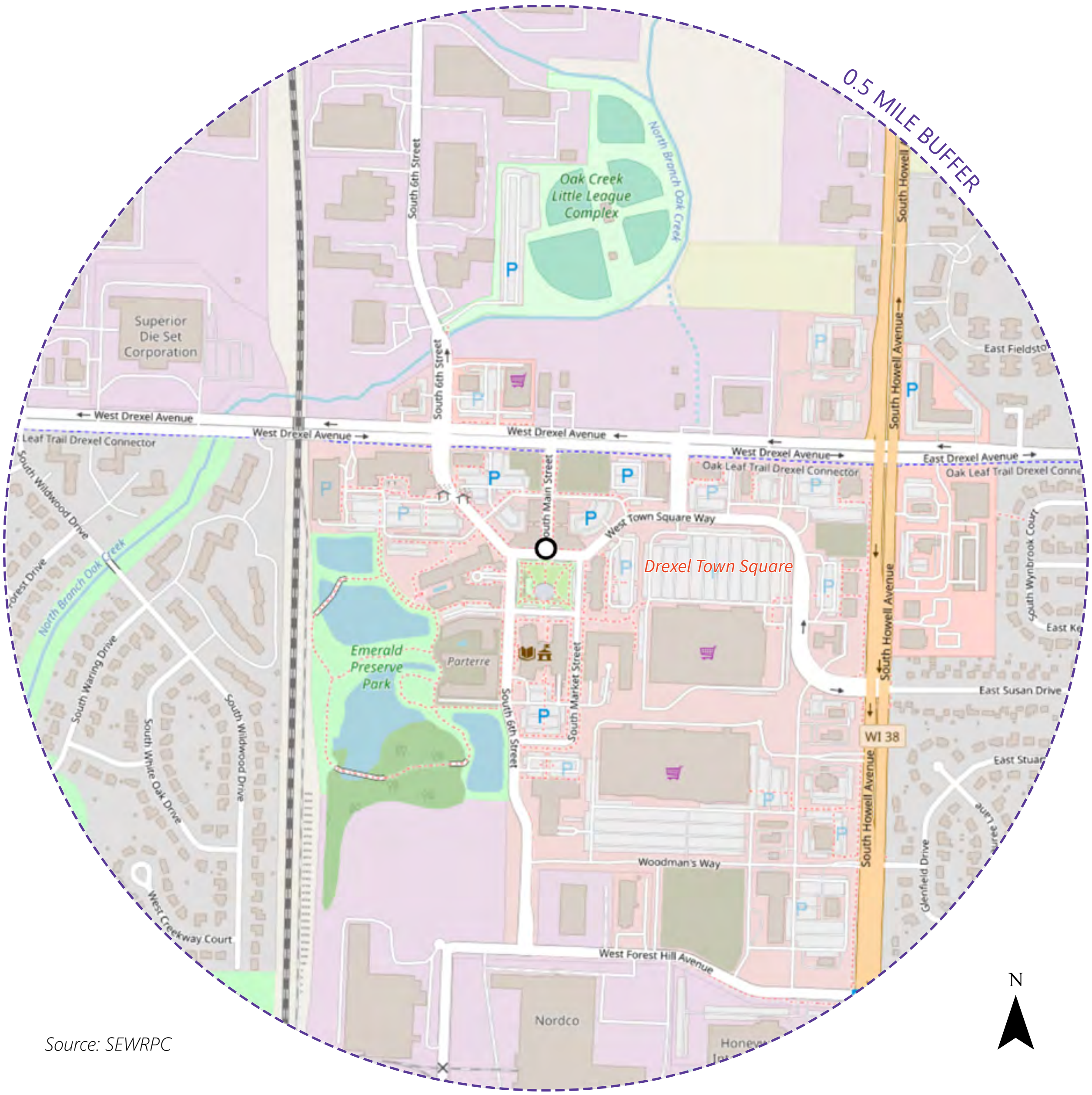
Transit Connections

MCTS route 80.

Development Opportunities

This area is largely built out; therefore, limited development opportunities exist. Enhanced transit would support the businesses in the area by providing fast and convenient access for customers and employees.

Map B.41
Drexel Town Square Station Area



Source: SEWRPC

27TH & RYAN – SOUTH OPTION C

Existing Land Use

W. Ryan Road has a major interchange with IH 94 and as such has a pattern of highway commercial uses that serve the trucking industry, including major truck stops and a truck dealer, which are located between S. 27th Street and IH 94. At the intersection of S. 27th Street and W. Ryan Road there are widely spaced businesses including a drug store, a veterinary hospital, car wash, fast food, and small hotel. Low-density, single-family residential uses are located to the northwest and a large apartment complex to the northeast.

Planning and Policy Guidance

City of Franklin 2025 Comprehensive Master Plan (2009)
City of Oak Creek Comprehensive Plan (2020)

Transit Connections

No existing transit routes serve this location.

Development Opportunities

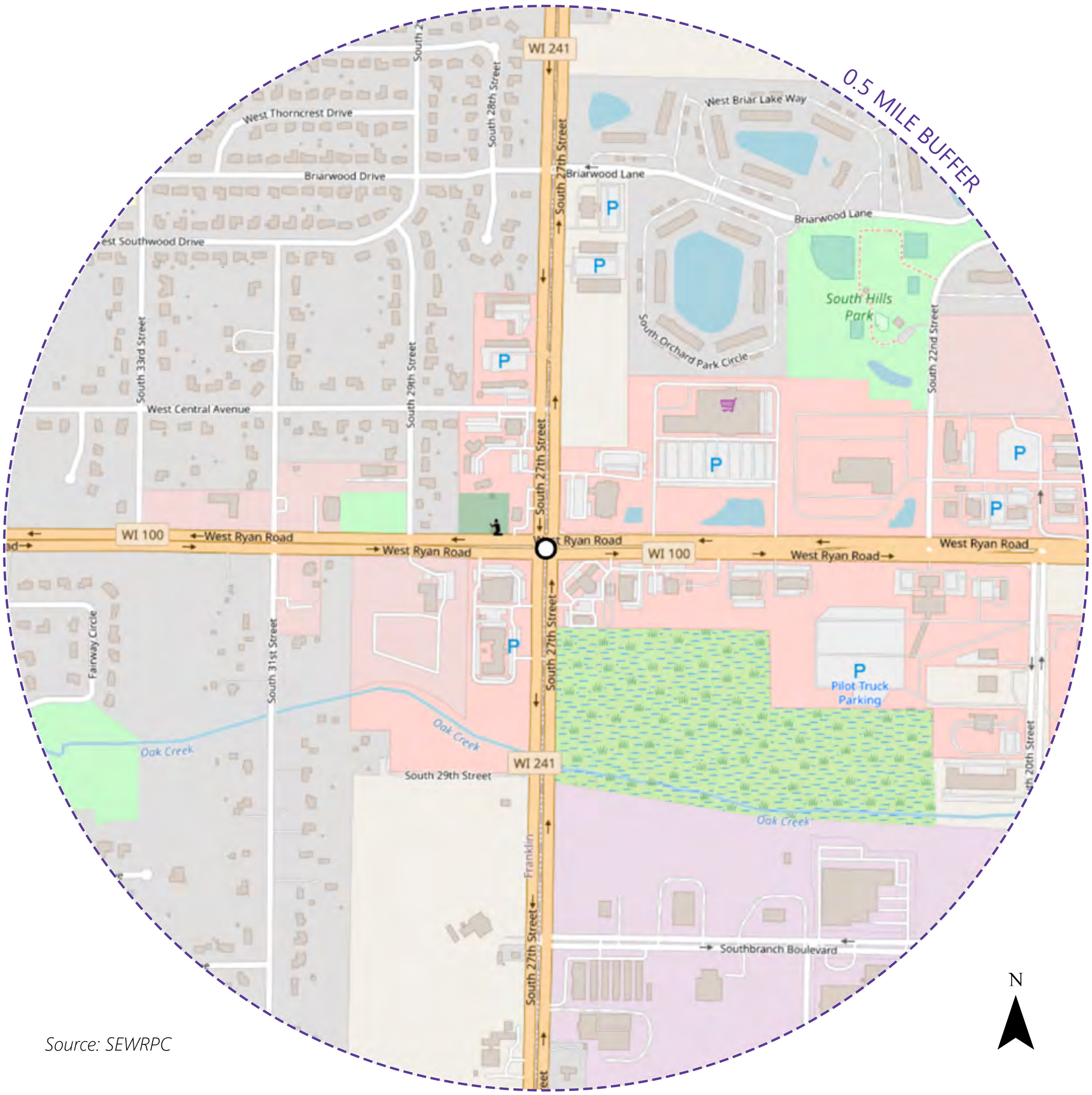
The City of Oak Creek identifies the following areas as development opportunities:

- Currently agricultural and single-family residential areas near S. 27th Street and W. Oakwood Road are envisioned as a future business park (27th Street Business Park).

The City of Franklin identifies the following areas as development opportunities.

- More commercial and mixed-use development is encouraged along 27th Street at W. Drexel Avenue.

Map B.42
27th and Ryan Station Area



Source: SEWRPC

ASCENSION FRANKLIN – SOUTH OPTION C

Existing Land Use

The Ascension Franklin hospital complex is located in the northwest corner of the intersection of W. Oakwood Road and S. 27th Street, at the current southern edge of urbanization in the Milwaukee metropolitan area. Agricultural uses are operating on lands in the area, with scattered exurban residential subdivisions.

Planning and Policy Guidance

City of Franklin 2025 Comprehensive Master Plan (2009)
City of Oak Creek Comprehensive Plan (2020)

Transit Connections

No existing transit routes serve this location.

Development Opportunities

The City of Oak Creek identifies the following areas as development opportunities:

- 27th Street and West Oakwood Road, including on vacant land and through potential redevelopment of older single-family residential areas.

- Current agricultural land near the newly constructed Elm Road interchange is envisioned to be redeveloped as the 27th Street Business Park South.

The City of Franklin's plan recommends that single-family attached housing development and business park uses for the area.

Map B.43
Ascension Franklin Station Area

Source: SEWRPC

APPENDIX C

MICROSIMULATION ANALYSIS

OVERVIEW

This appendix summarizes the Southeastern Wisconsin Regional Planning Commission's (SEWRPC) efforts in forecasting potential transit travel time and intersection level of service (LOS) impacts associated with the implementation of transit signal priority (TSP) and the conversion of traffic lanes to exclusive transit bus lanes along the study alignment. This forecasting analysis was conducted using a microsimulation model implemented with PTV Vissim. As the 27th Street corridor under consideration includes more than 50 signalized intersections, a representative subsegment of the corridor was selected to identify the potential impacts on traffic and transit operational speeds. As such SEWRPC focused on the segment of 27th Street/Layton Boulevard between Lisbon Avenue/Walnut Street and Greenfield Avenue that includes 15 signalized intersections. Figure C.1 shows the location of the segment and the intersections analyzed.

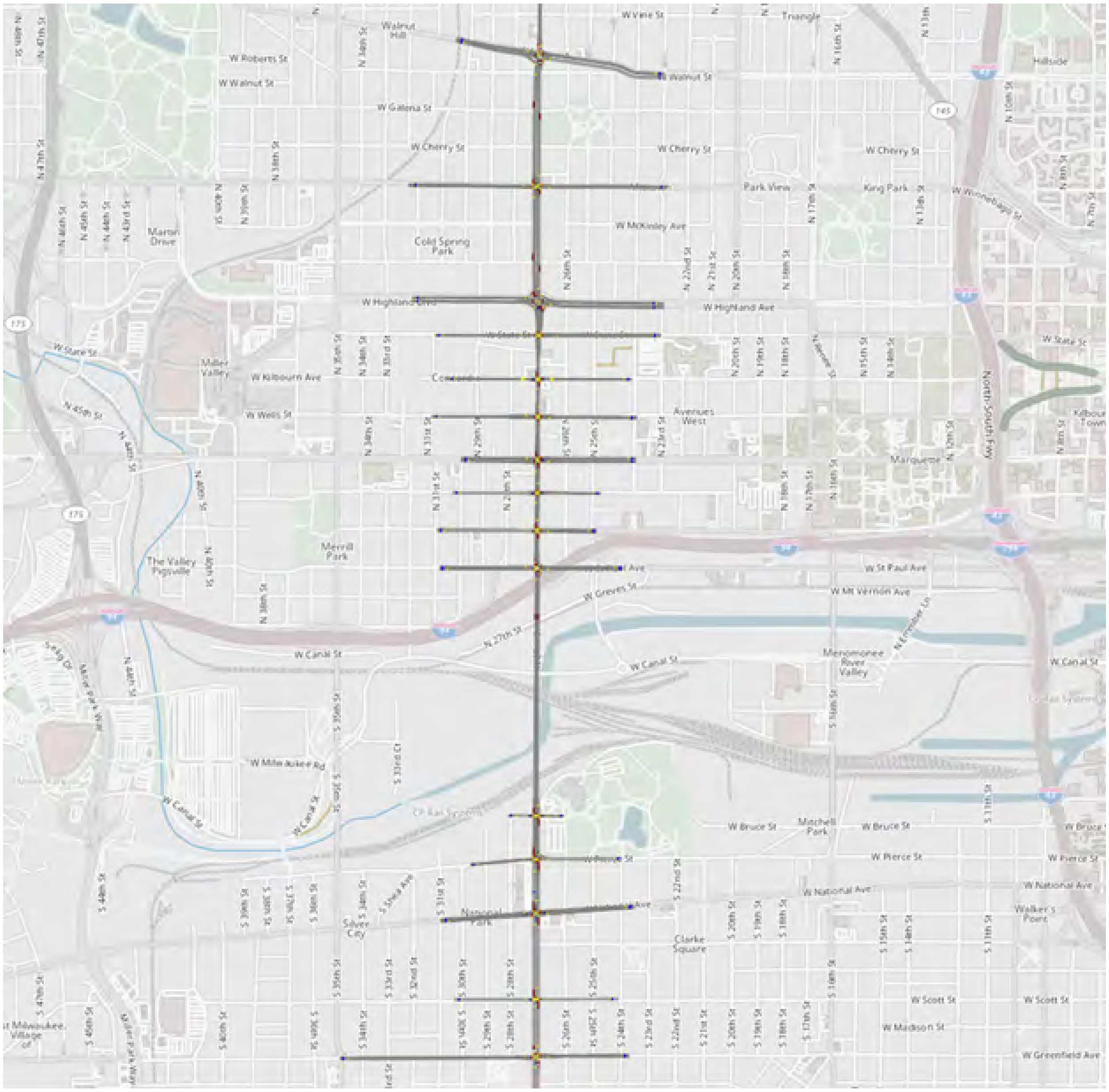
This appendix first presents the efforts undertaken to calibrate and validate the microsimulation model to the base year 2019 data. Next, the results of the scenario analysis of travel lane conversion and TSP are presented for each of the analysis years (2025 and 2045). The last section of the appendix presents the conclusions based on the microsimulation analysis.

BASE YEAR 2019 VISSIM MODEL CALIBRATION AND VALIDATION

Initial model development processes must be completed before model calibration and validation processes can begin. The initial model development processes include network coding, including coding of signal timing plan data, determining input traffic volumes, and establishing analysis period, number of simulation runs, etc.

Calibration and validation of the microsimulation model were conducted as outlined in Chapter 16, Section 20 of the Wisconsin Department of Transportation's (WisDOT) Traffic Engineering, Operations & Safety Manual. Calibration of a microsimulation traffic model requires adjustments to the selected input parameters within the model, usually related to driver behavior and vehicle characteristics, such that the model

Figure C.1
Project Corridor Location



Source: SEWRPC

represents field conditions. Model validation, on the other hand, is an independent process after calibration in which the model outputs are compared against benchmark field data, such as traffic volumes, travel speeds and times, queue lengths, time gap distribution, etc. Calibration and validation form an iterative process. After calibration, the model is run, and model results are compared against field data to check whether the model performance meets the validation targets. If validation thresholds are not satisfied, additional model calibration is carried out. This iterative process continues until validation thresholds are met.

Network Coding

Microsimulation traffic models require transportation (vehicular/transit/pedestrian/bicycle) facilities, including traffic control devices, to be coded in detail and their physical geometries coded to scale. This study focused on vehicular traffic at signalized intersections. Traffic lane configuration, traffic control device, and transit bus stop facilities were coded using aerial imagery and Google Street View.

Traffic Signal Timing Plan Data

Actual traffic signal timing plan data were encoded into the model for all signalized intersections on the study corridor based on information obtained from the City of Milwaukee, Milwaukee County, and WisDOT.

Analysis Period

It was found, based on 2019 hourly traffic count data, that the study corridor carried higher traffic volumes during the PM peak hour compared to the AM peak hour. Since the study was focused on identifying the upper end of expected time savings associated with implementing TSP, the PM peak hour (4:30 p.m. – 5:30 p.m.) was therefore selected as the model analysis period. An additional warm-up period of 15 minutes was used in this analysis based on the average PM peak-hour travel time of about 10 minutes measured in the field on the study corridor. A warm-up period allows traffic to load onto the network and helps the model reach a traffic condition expected in the field at the start of an analysis period. In addition, a cool-down period of 30 minutes was used in this analysis. A cool-down period allows vehicles loaded during the analysis period to complete their trips.

Traffic Volume Data

Microsimulation models typically utilize vehicular travel information in the form of Origin-Destination (OD) trip tables. OD tables for the corridor were estimated using an iterative processing technique known as Origin-Destination Matrix Estimation (ODME). In ODME, a seed table is adjusted iteratively until the volumes assigned match a set of target mainline and turning movement volumes. The seed table in this analysis was derived from SEWRPC's 5th Generation travel demand model. The traffic volume targets were established based on WisDOT triennial traffic count data. The following are the major inputs provided to the ODME process:

- *Seed OD tables*: SEWRPC's fifth generation travel demand models were used to extract the base year 2019 PM peak-hour seed OD tables.

- *Target link volumes*: Year 2019 PM peak-hour directional count volumes at locations on the analyzed segment, including cross streets, obtained from WisDOT triennial coverage count datasets. Latest prior year count volume data were used if 2019 count volume data were not available.

- *Target turn volumes*: Year 2019 turn movement count volumes obtained from WisDOT turn movement count datasets (found available only at the intersection of 27th Street & St. Paul Avenue).

The output from the ODME process is the adjusted seed OD tables (that result in highway assignments close to the target volumes) and are referred to in this appendix as ODME estimated trip tables, which after minor adjustments based on engineering judgment were the traffic volume data input to the Vissim microsimulation model. Two percent of traffic volumes were considered heavy vehicles (WisDOT defaults). However, heavy vehicles were prohibited from entering link segments that had truck restriction in place based on the information obtained from the City of Milwaukee.

Model Runs

Real-world traffic varies considerably over a day and from day to day. To mimic this variability, microsimulation models utilize stochastic variables that determine the release pattern of vehicles (how many and when) and the distribution of driver characteristics (behavior, speed, etc.) for each model run. The stochasticity (randomness) is obtained by using pseudo-random number generator, which is an algorithm within the modeling package. It requires a seed to initiate the underlying algorithm; two microsimulation model runs with the same seed yield identical results.

Typically, a scenario is run multiple times and the model results associated with that scenario is the average results of multiple runs. In this analysis, 10 simulation runs were used for base year 2019 scenario as well as for all future-year scenario runs. Each of 10 simulation runs (per scenario) utilized 10 distinct seed values as recommended in the WisDOT modeling guide.

Model Calibration

A range of input parameters are available to calibrate a Vissim model. A list of these parameters, along with recommended ranges, is provided in Chapter 16, Section 20 of the WisDOT Traffic Engineering, Operations & Safety Manual.

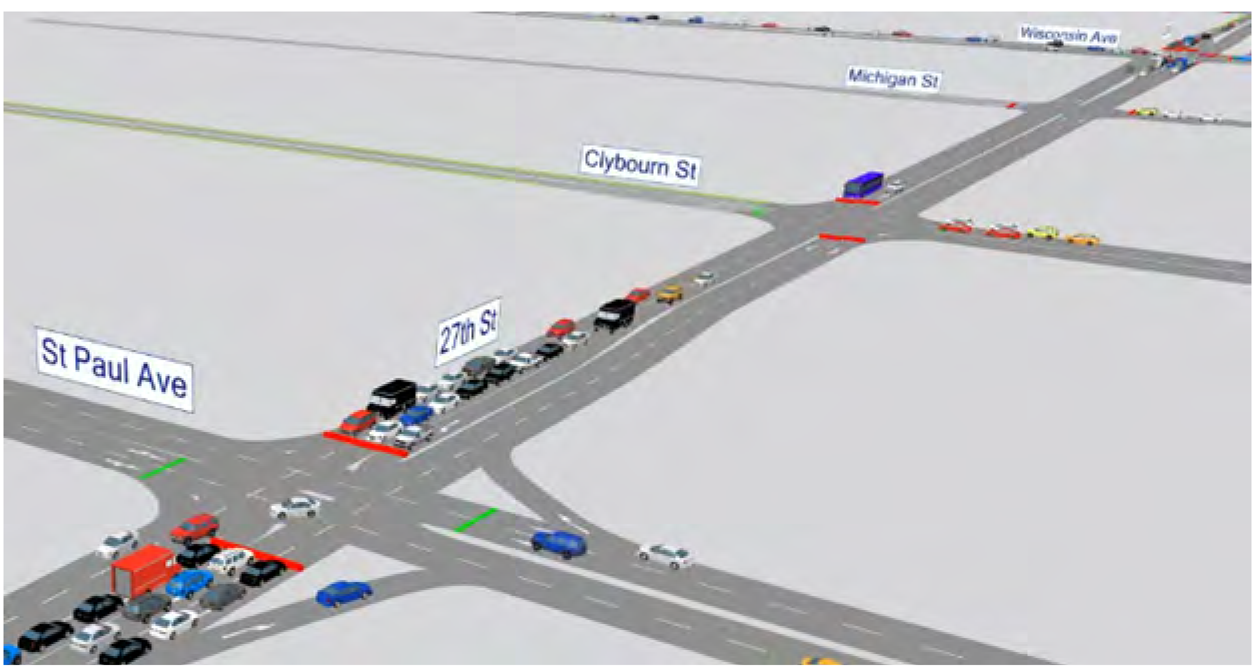
The input calibration parameters are broadly classified into two groups – global parameters and local parameters. The global parameters include simulation settings (simulation resolution, simulation speed, etc.), traffic settings (vehicle/pedestrian compositions), and base settings (vehicle fleet, vehicle/pedestrian types/classes, vehicle characteristics/functions/distributions, such as maximum/desired acceleration/deceleration, etc.). The local parameters include driving behavior (car following, lane change, lateral) and driver behavior at signal control. The WisDOT has prepared a set of defaults for these input parameters that simulate the traffic and vehicle characteristics specific to Wisconsin and have made them available on the WisDOT website (Vehicle Defaults for Vissim 2020 Version 1.2 (INPX file)). Given the range of input parameters, multiple parameter combinations may exist to calibrate a specific modeling condition in Vissim. The WisDOT advises that the model be calibrated by adjusting the global parameters first and then, only if necessary, adjusting the local parameters.

The Vissim model developed for this analysis incorporated WisDOT default calibration parameters applicable for arterial highways (as opposed to the freeways). The speed distribution inputs selected from WisDOT defaults were those corresponding to the posted speed limits on the study segments. Car-following model parameter was the only local calibration parameter that was changed in this analysis as Wiedemann 74 car-following model for car-following behavior on arterial highways was used with the following parameter values:

- Average standstill distance: 3.28 feet
- Additive part of safety distance: 1.00
- Multiplicative part of safety distance: 2.00

Average standstill distance defines the average desired distance between two stopped cars. Additive part of safety distance is used for the computation of the desired safety distance. Higher values of these parameters result in larger distances between cars and lower capacity. Multiplicative part of safety distance is also used for the computation of the desired safety distance; higher values result in greater standard deviation (greater spread) of the distribution of safety distance. The values of these parameters used in this analysis are on the lower end of the range of recommended values and were found appropriate in this study located in a large urban area to simulate closely spaced vehicles on a signalized corridor in low-speed condition. Figure C.2 provides a snapshot of the street level visualization of a microsimulation run used in this analysis.

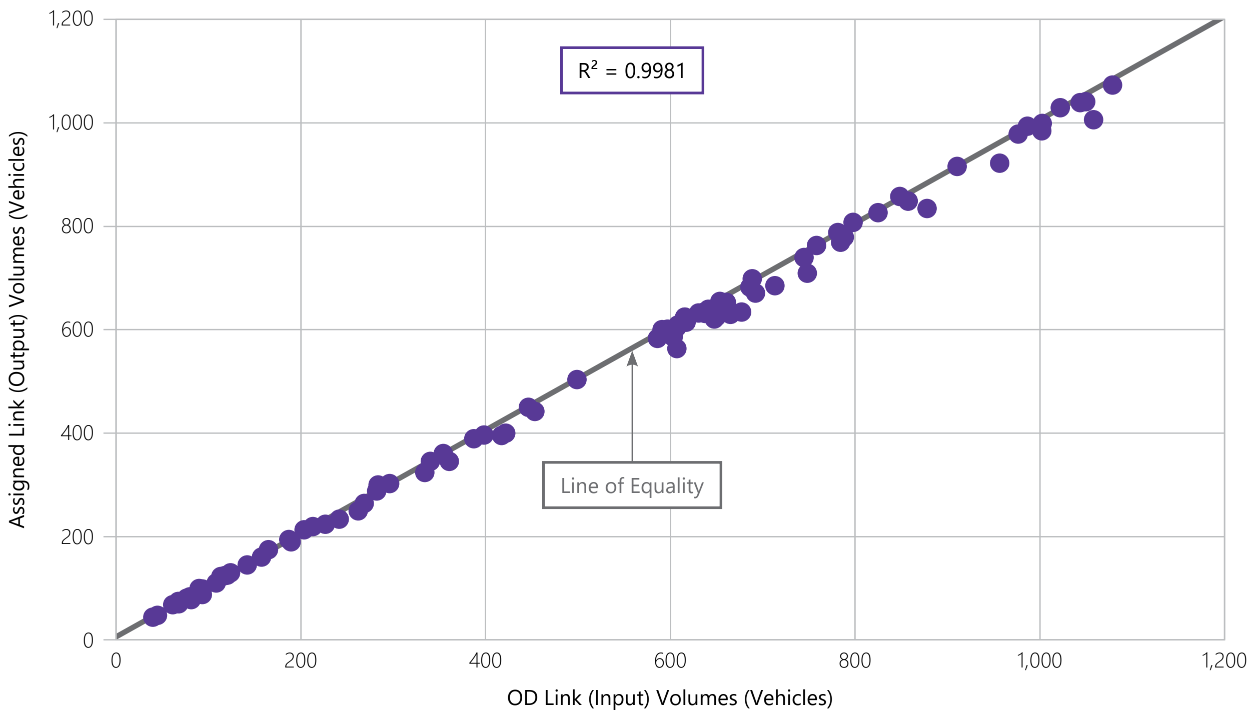
Figure C.2
A Snapshot of Vissim Microsimulation Model



Source: SEWRPC

In microsimulation models, as in the real world, roadway physical space places a hard cap on its capacity. If traffic demand input (OD tables in this study) exceeds network capacity, not all of the vehicles will get assigned to the network, as some vehicles (blocked vehicles) will be unable to enter the network at their desired time due to downstream vehicle queues. Figure C.3 compares the PM peak-hour input OD volumes through link assignment not constrained by network capacity to the capacity-constrained Vissim link volumes assigned during the PM peak-hour analysis period. A figure like this is essentially a way to check whether all input vehicles were able to travel to their intended destinations (indicated by a high R-square value) and helps detect the presence of blocked vehicles, unreleased vehicles (vehicles that were able to enter the network but not exit) and stalled/stuck vehicles. In this study, the stalled/stuck vehicles were not allowed to diffuse (disappear) from the network. The figure also helps identify other issues related to model calibration, warm up and cool down periods, and model evaluation setups. In such situations, the capacity-constrained assigned volumes, when plotted as in Figure C.3, will fall below the 45-degree line of equality (with a lower R-square value).

Figure C.3
Comparison Between the PM Peak-Hour OD Link (Input) Volumes and Assigned Link (Output) Volumes

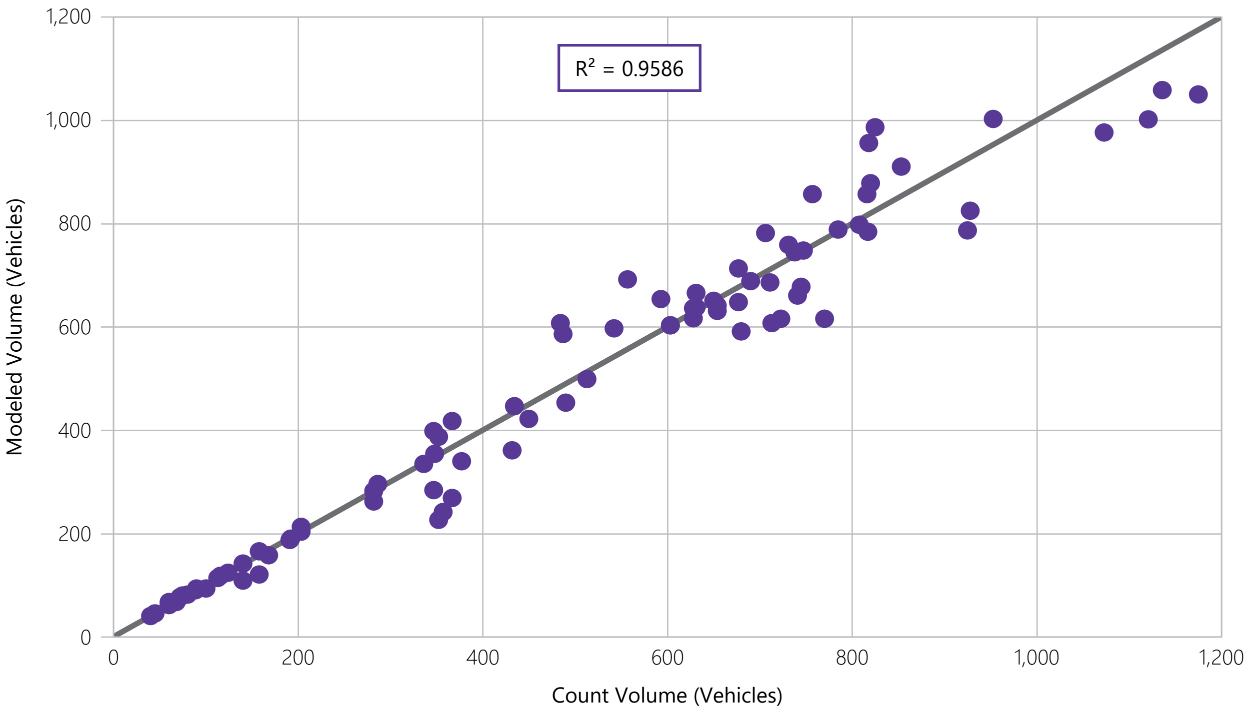


Source: SEWRPC

Model Validation

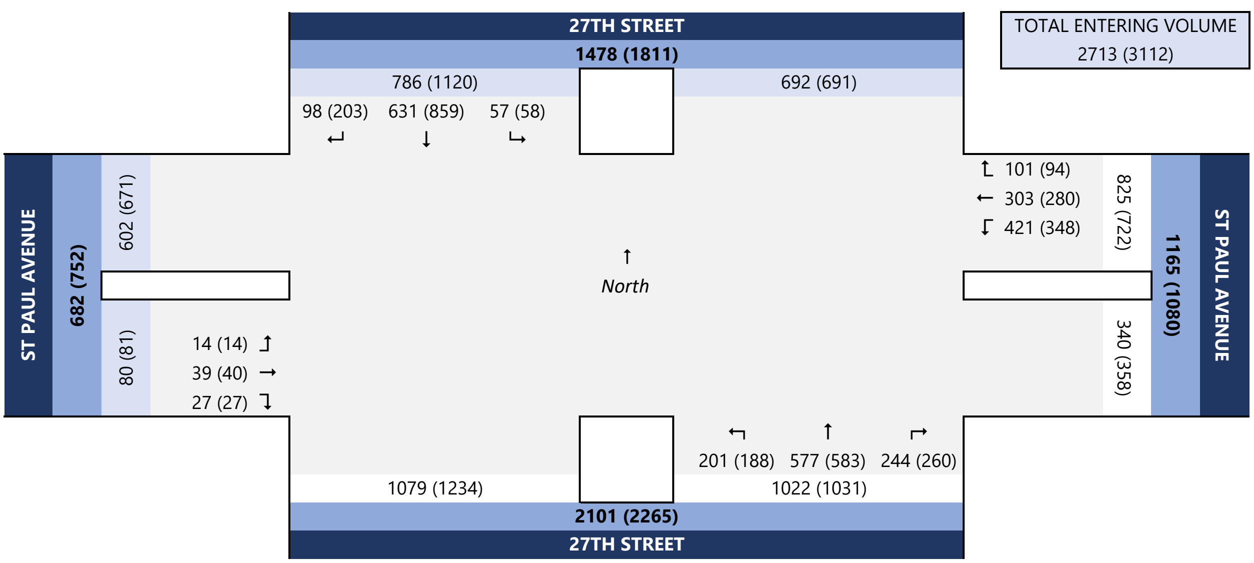
The base year 2019 Vissim model was validated for OD trip tables used in the analysis, turn movement volumes at count locations, travel time, travel speed, and traffic volume. Figure C.4 shows the comparison between target PM peak-hour directional link volumes (count volumes) and modeled PM peak-hour directional link volumes resulting from the assignment of ODME estimated trip tables. Figure C.5 shows the modeled PM peak-hour turn movement volumes compared to turn movement count volumes at the intersection of St. Paul Avenue and 27th Street. These figures show the validity of ODME estimated trip tables to model base year 2019 traffic volumes.

Figure C.4
Comparison Between 2019 PM Peak-Hour Count Volumes (Target Volumes) and Modeled Volumes Obtained Through ODME Process



Source: SEWRPC

Figure C.5
2019 PM Peak-Hour Modeled Turn Movement Volumes Compared to Turn Movement Counts



Note: xxx = 2019 PM peak-hour modeled turn movement volume; (xxx) = 2019 PM peak-hour (4:00-5:00 pm) turn movement count.

Source: Wisconsin Department of Transportation and SEWRPC

Table C.1 shows the base year 2019 PM peak-hour modeled travel times and travel speeds compared to the peak-hour travel times and travel speeds obtained from the 2019 National Performance Management Research Data Set (NPMRDS). The table shows the northbound modeled peak-hour travel times are within a minute and travel speeds within one mph compared to NPMRDS data; however, the modeled southbound travel time on the whole corridor is about 1.5 minutes longer and the travel speed about 3.5 mph slower than shown in the NPMRDS data. Field measurements of travel times carried out by the Commission staff found that the PM peak-hour southbound travel times on the study corridor to be significantly longer (by 3 minutes on an average on the whole corridor) compared to the travel times obtained from NPMRDS data. Table C.2 shows the NPMRDS, and modeled PM peak-hour travel times compared to the travel times measured in the field. Table C.3 shows the 2019 PM peak-hour modeled transit bus (PurpleLine) travel times compared to the travel times obtained from the Milwaukee County Transit System (MCTS) bus schedule. The modeled transit bus travel times are found to be within 2 minutes of the travel times estimated from bus schedule.

Table C.1
2019 PM Peak-Hour Modeled Travel Time and Speed Compared to Travel Time and Speed Obtained from 2019 NPMRDS

	Distance	Travel Time (Minutes)			Travel Speed (mph)		
Direction	**(Miles)**	NPMRDS	Modeled	Difference	NPMRDS	Modeled	Difference
NB – Whole Corridor	2.5	7.7	8.3	0.6	19.5	18.3	-1.2
NB – Greenfield to St. Paul	1.2	3.2	3.4	0.2	23.0	22.0	-1.0
NB – St. Paul to Lisbon	1.3	4.5	4.8	0.3	17.1	16.1	-1.0
SB – Whole Corridor	2.5	7.2	8.6	1.4	21.0	17.6	-3.4
SB – Lisbon to St. Paul	1.3	4.4	5.1	0.7	17.6	15.3	-2.3
SB – St. Paul to Greenfield	1.2	2.8	3.4	0.6	26.2	21.2	-5.0

Source: NPMRDS and SEWRPC

Table C.2
The NPMRDS and Modeled Peak-Hour Travel Times Compared to the Field Measured Travel Times

		Travel Time (Minutes)								
		Measured at Field								
		Measurement 1[a]							Difference[c]	
Direction	**Distance (Miles)**	Run 1	Run 2	Run 3	Average	Measurement 2[b]	NPMRDS	Modeled	NPMRDS	Modeled
NB – Whole Corridor	2.5	7.9	8.5	8.8	8.4	8.6	7.7	8.3	-0.7	-0.1
NB – Greenfield to St. Paul	1.2	3.2	3.5	3.2	3.3	2.8	3.2	3.4	-0.1	0.1
NB – St. Paul to Lisbon	1.3	4.7	5.0	5.6	5.1	5.8	4.5	4.8	-0.6	-0.3
SB – Whole Corridor	2.5	9.5	9.9	11.8	10.4	--[d]	7.2	8.6	-3.2	-1.8
SB – Lisbon to St. Paul	1.3	5.0	5.6	8.8	6.5	--	4.4	5.1	-2.1	-1.4
SB – St. Paul to Greenfield	1.2	4.5	4.4	3.0	4.0	6.3	2.8	3.4	-1.2	-0.6

[a] *Travel times measured at field on Wednesday February 09, 2022, between 4:30-5:30 pm.*

[b] *Travel times measured at field in 2016 between 4:30-5:30 pm.*

[c] *Difference compared to Average of Field Measurement 1.*

[d] *Not measured due to construction delay.*

Source: SEWRPC

Table C.3
2019 PM Peak-Hour Modeled Transit Bus Travel Time Compared to Travel Time Obtained from MCTS Bus Schedule

Direction	Distance (Miles)	Travel Time (Minutes)		
		PurpleLine[a] Transit Bus	Modeled	Difference
NB – Whole Corridor	2.5	14.0	15.0	1.0
NB – Greenfield to St. Paul	1.2	5.0	6.5	1.5
NB – St. Paul to Lisbon	1.3	9.0	8.4	-0.6
SB – Whole Corridor	2.5	14.0	15.8	1.8
SB – Lisbon to St. Paul	1.3	9.0	9.3	0.3
SB – St. Paul to Greenfield	1.2	5.0	6.4	1.4

[a] *Travel time estimated from MCTS bus schedule.*

Source: MCTS and SEWRPC

SCENARIO ANALYSIS

The major goal of scenario analysis was to quantify the impacts of converting travel lanes to exclusive transit bus lanes and TSP implementation on corridor travel times and intersection LOS. TSP is a common method of providing preferential signal timing for transit at an intersection. TSP aims to improve the reliability of transit by reducing delay at intersections, thereby reducing average running time. TSP can improve LOS for vehicles operating in the direction of transit but could also impair LOS on the cross streets. TSP operates by shifting green time from cross streets to the street where transit is operating, however priority is not preemption. If the signal controller determines that the cross street is already at its minimum time, no action will be taken. This occurs more frequently in controllers with shorter cycle lengths or longer pedestrian clearance times, either of which determines the minimum red time. Similarly, TSP could be used in a fashion where it is activated conditionally to only prioritize transit that is sufficiently late.

TSP implementation generally involves exclusive bus lanes and lights, protected turns, and/or green extension and red truncation. Green extension refers to the amount of time a green signal will be extended to allow transit to cross an intersection. Red truncation (also known as early green) refers to the amount of time a red signal will be truncated after receiving a call from transit. Green extension provides greater time savings (by allowing a red phase to be skipped altogether), but only if transit approaches the intersection at the end of a green signal. Alternatively, red truncation allows for small time savings (equaling truncation time), but in a more consistent manner as the probability of approaching a signal at red phase (thus activating red truncation) is considerably higher than the probability of approaching a signal near the end of green phase (activating green extension). Green extension and red truncation are usually used in conjunction to provide greater and consistent time savings at signalized intersections.

The impacts of TSP in this study were modeled by coding additional TSP setups in the network and by appending TSP variables, values, and thresholds to the base year 2019 signal timing parameters. Green extension and red truncation both were modeled but only one would be activated in a signal cycle depending on the phase when a TSP call was received. Additionally, the TSP was conservatively assumed to activate conditionally (being triggered only if the transit vehicle was behind schedule by at least 30 seconds as determined based on the difference between desired transit operating speed and actual simulated speed).

Scenarios

The base year 2019 calibrated and validated Vissim model was utilized to analyze three different scenarios in each of the analysis years 2025 and 2045. The following are the scenarios analyzed:

- **No Build:** No exclusive travel lanes and no TSP provided for transit bus
- **Build without TSP:** Exclusive travel lanes on the segments where conversion of travel lanes is recommended without TSP provided for transit bus
- **Build with TSP:** Exclusive travel lanes on the segments where conversion of travel lanes is recommended with TSP at all signalized intersections provided for transit bus

The traffic volume data for the analysis years 2025/2045 were determined by estimating change in 2025/2045 trips compared to the base year 2019 trips obtained from the Commission travel demand models. The forecast change in trips was then added to the base year 2019 ODME estimated trip tables to obtain the traffic volume input for 2025/2045 Vissim microsimulation models. As in the case of base year 2019, two percent of traffic volumes were considered heavy vehicles. Truck restrictions that exist in the base year were assumed to continue into 2025/2045.

The signal timing plan data input for the scenario analysis remained the same as for the base year 2019. The difference between the base year 2019 and 2025/2045 No-Build scenarios was the growth in traffic volumes in 2025/2045. The difference between 2025/2045 No-Build and Build without TSP scenarios was the conversion of travel lanes to transit bus-only lanes where recommended. Non-transit vehicles were prohibited from traveling on transit bus-only lanes. The difference between 2025/2045 Build without TSP and Build with TSP scenarios was the implementation of TSP at signalized intersections.

Model Results

The paragraphs that follow present the model results in terms of simulated travel times and LOS under various scenarios. The travel times and the LOS simulated under the base year 2019 are also presented.

Travel Time

The northbound and southbound travel times on the whole corridor, as well as the segment between Greenfield Avenue and St. Paul Avenue and the segment between St. Paul Avenue and Lisbon Avenue/ Walnut Street, are shown for overall traffic in Table C.4 and for transit buses in Table C.5 under different scenarios. In general, travel times increased as congestion built up resulting from some growth in traffic expected in the areas surrounding the analyzed corridor. Conversion of travel lanes to exclusive bus lanes affected travel times as expected; negatively (up to one minute longer) for overall roadway traffic and positively (up to 3 minutes shorter) for transit. However, the conditional implementation of TSP included in this analysis was found to have minimal impact on typical travel times, resulting in a time saving of less than one minute for transit. There are likely travel time reliability benefits (which would appear when the vehicle is more dramatically behind schedule) that are not captured within this analysis.

Level of Service

The forecast level of service is presented in Figure C.6. In general, the modeled overall intersection LOS is C or better under different scenarios, except for the intersections at Greenfield Avenue (LOS E for Build scenarios) and Wisconsin Avenue (LOS D for all 2025 and 2045 scenarios). The specific turn movement LOS at intersections is generally D or better. However, some turn movements have been forecast to be failing (LOS F), the most prominent of which are the turn movements from Greenfield Avenue and the eastbound movements at State Street. The eastbound left at National Avenue and the westbound left at Wisconsin Avenue have also been modeled to be operating under LOS F.

CONCLUSION

This appendix summarized SEWRPC's efforts in conducting an intersection-level analysis using the PTV Vissim microsimulation tool on a segment in the core of the study corridor on 27th Street/Layton Boulevard between Lisbon Avenue/Walnut Street and Greenfield Avenue. The major objectives of the analysis were to quantify the impacts of TSP and travel lane conversion to exclusive transit bus lanes on the corridor travel times and the intersection LOS. As expected, the conversion of travel lanes to exclusive transit bus lanes was found to affect travel times negatively for overall roadway traffic and positively for transit buses. However, the implementation of TSP was found to have little effect on travel times, given the conditional application of TSP assumed under this analysis, and the need to make generalized assumptions about station locations that were not optimized to take advantage of TSP.

The majority of the intersections were found to operate under overall intersection LOS C or better, and intersection turn movements under LOS D or better. However, a couple of intersections and some turn movements were forecast to be operating under LOS E or worse. Further study involving optimization of signal timing on the study corridor as well as on adjacent corridors with turn movement count data at all signalized intersections is necessary to better model intersection turn movements and estimate a more precise intersection operating environment.

Table C.4
Modeled PM Peak-Hour Travel Speed on the Study Corridor

	Travel Time (Minutes)																												
	Base Year	No Build		Build (Without TSP)		Build (with TSP)																							
						Average Travel Time												Change in Average Travel Time											
						10 Second Extension/Truncation[a]						15 Second Extension/Truncation						10 Second Extension/Truncation						15 Second Extension/Truncation					
						18 mph[b]		20 mph		22 mph		18 mph		20 mph		22 mph		18 mph		20 mph		22 mph		18 mph		20 mph		22 mph	
Direction	2019	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045
NB – Whole Corridor	8.4	8.6	8.7	9.6	9.5	9.5	9.4	9.5	9.4	9.5	9.5	9.5	9.4	9.5	9.4	9.5	9.4	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
NB – Greenfield to St. Paul	3.4	3.4	3.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.5	4.6	4.6	4.6	4.5	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
NB – St. Paul to Lisbon	4.9	5.0	5.1	5.1	5.1	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
SB – Whole Corridor	8.8	8.8	9.1	8.9	9.1	8.8	9.1	8.8	9.1	8.8	9.0	8.8	9.0	8.8	9.1	8.8	9.1	-0.1	0.0	-0.1	0.0	-0.1	0.0	-0.1	-0.1	-0.1	0.0	-0.1	0.0
SB – Lisbon to St. Paul	5.2	5.2	5.5	5.3	5.6	5.3	5.5	5.2	5.5	5.3	5.5	5.3	5.5	5.2	5.5	5.2	5.5	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0
SB – St. Paul to Greenfield	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[a] *Extension if TSP requires current green at an intersection to extend, truncation if TSP requires current red at an intersection to truncate early.*

[b] *Desired transit operating speed.*

Source: SEWRPC

Table C.5
Modeled PM Peak-Hour Travel Speed of Transit Bus on the Study Corridor

	Travel Time (Minutes)																												
						Build (with TSP)																							
						Average Travel Time												Change in Average Travel Time											
						10 Second Extension/Truncation[a]						15 Second Extension/Truncation						10 Second Extension/Truncation						15 Second Extension/Truncation					
	Base Year	No Build		Build (Without TSP)		18 mph[b]		20 mph		22 mph		18 mph		20 mph		22 mph		18 mph		20 mph		22 mph		18 mph		20 mph		22 mph	
Direction	2019	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045
NB – Whole Corridor	15.3	15.0	15.3	13.4	13.5	12.8	13.0	12.7	12.9	12.7	12.9	12.8	13.0	12.7	12.9	12.7	12.9	-0.6	-0.5	-0.7	-0.6	-0.7	-0.6	-0.6	-0.5	-0.7	-0.6	-0.7	-0.6
NB – Greenfield to St. Paul	6.6	6.7	6.7	4.9	4.9	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NB – St. Paul to Lisbon	8.6	8.4	8.6	8.5	8.6	7.9	8.1	7.9	8.0	7.8	8.0	7.9	8.1	7.9	8.0	7.8	8.0	-0.5	-0.5	-0.6	-0.5	-0.6	-0.5	-0.5	-0.5	-0.6	-0.5	-0.6	-0.5
SB – Whole Corridor	16.1	16.2	16.4	13.8	13.8	13.3	13.3	13.3	13.2	13.3	13.2	13.3	13.3	13.3	13.2	13.3	13.2	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.6	-0.6	-0.6	-0.5
SB – Lisbon to St. Paul	9.5	9.6	9.8	8.2	8.1	7.6	7.7	7.6	7.7	7.6	7.7	7.6	7.7	7.6	7.7	7.6	7.7	-0.5	-0.4	-0.6	-0.4	-0.5	-0.4	-0.5	-0.5	-0.6	-0.4	-0.5	-0.4
SB – St. Paul to Greenfield	6.5	6.5	6.6	5.7	5.7	5.8	5.7	5.7	5.6	5.7	5.6	5.8	5.7	5.7	5.6	5.7	5.6	0.1	0.0	0.0	-0.1	0.0	0.0	0.1	0.0	0.0	-0.1	0.0	-0.1

[a] *Extension if TSP requires current green at an intersection to extend, truncation if TSP requires current red at an intersection to truncate early.*

[b] *Desired transit operating speed.*

Source: SEWRPC

Figure C.6
Modeled Intersection and Turn Movement Level of Service

	Scenario
1	Base Year 2019
2	2025 No Build
3	2045 No Build
4	2025 Build without TSP
5	2045 Build without TSP
6	2025 Build with TSP
7	2045 Build with TSP

27th St / Lisbon Ave/Walnut St

Scenario	Intersection LOS	North approach ↲	North approach ↓	North approach ↳	East approach ↰	East approach ←	East approach ↲	West approach ↱	West approach →	West approach ↳	South approach ↰	South approach ↑	South approach ↱
1	B	A	B	B	A	B	C	C	B	A	B	A	B
2	B	A	B	B	A	B	C	C	B	A	B	A	B
3	B	A	B	B	A	B	C	C	B	A	B	A	B
4	B	B	C	B	A	B	C	B	B	A	B	B	B
5	B	B	C	C	A	B	C	B	B	A	C	B	B
6	B	B	B	C	A	B	C	B	B	A	B	B	B
7	B	B	C	C	A	B	C	B	B	A	B	B	B

27th St / Vliet St

Scenario	Intersection LOS	North approach ↲	North approach ↓	North approach ↳	East approach ↰	East approach ←	East approach ↲	West approach ↱	West approach →	West approach ↳	South approach ↰	South approach ↑	South approach ↱
1	B	A	A	B	A	B	C	C	B	A	B	B	A
2	B	A	A	B	A	B	C	C	B	A	B	B	A
3	B	A	A	B	A	B	C	C	B	A	C	B	A
4	B	A	B	C	B	B	C	C	B	B	C	B	B
5	B	A	B	C	B	B	C	C	B	B	C	B	B
6	B	A	B	C	B	C	C	D	C	B	C	B	B
7	B	A	B	C	B	C	C	C	C	B	C	B	B

27th St / Highland Blvd

Scenario	Intersection LOS	North approach ↲	North approach ↓	North approach ↳	East approach ↰	East approach ←	East approach ↲	West approach ↱	West approach →	West approach ↳	South approach ↰	South approach ↑	South approach ↱
1	C	A	B	B	A	C	D	D	C	A	B	B	A
2	C	A	B	B	A	C	D	D	C	A	B	B	A
3	C	A	B	B	A	C	D	D	C	A	B	B	A
4	C	A	B	C	B	C	D	D	C	A	B	C	A
5	C	A	B	C	A	C	D	D	C	A	B	C	A
6	C	A	B	C	A	C	D	D	C	A	B	C	A
7	C	A	B	C	A	C	D	D	C	A	B	C	A

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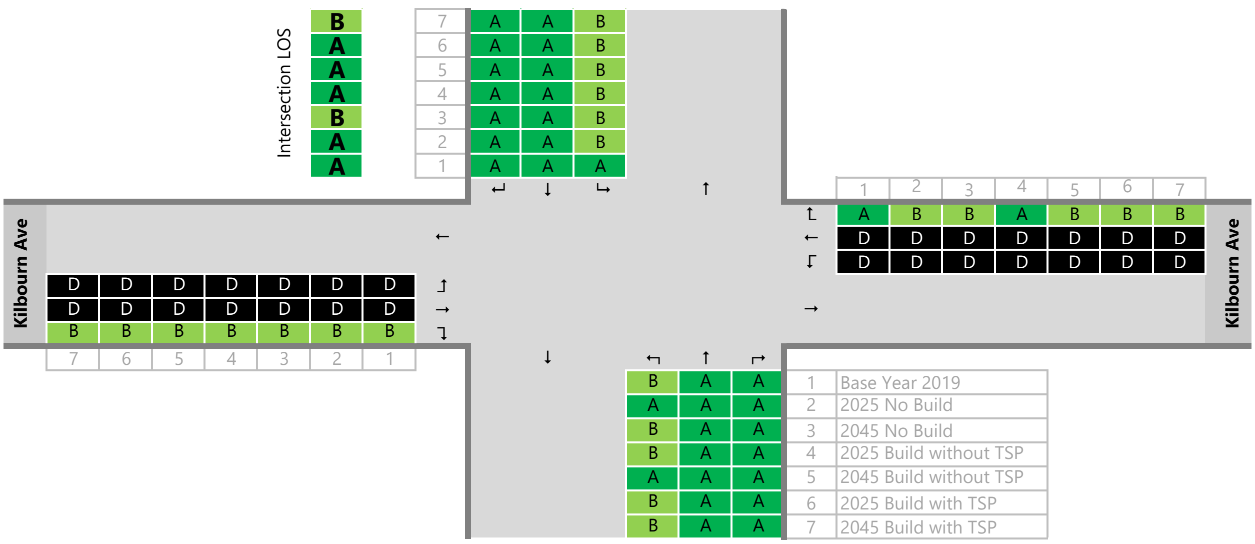
Figure C.6 (Continued)



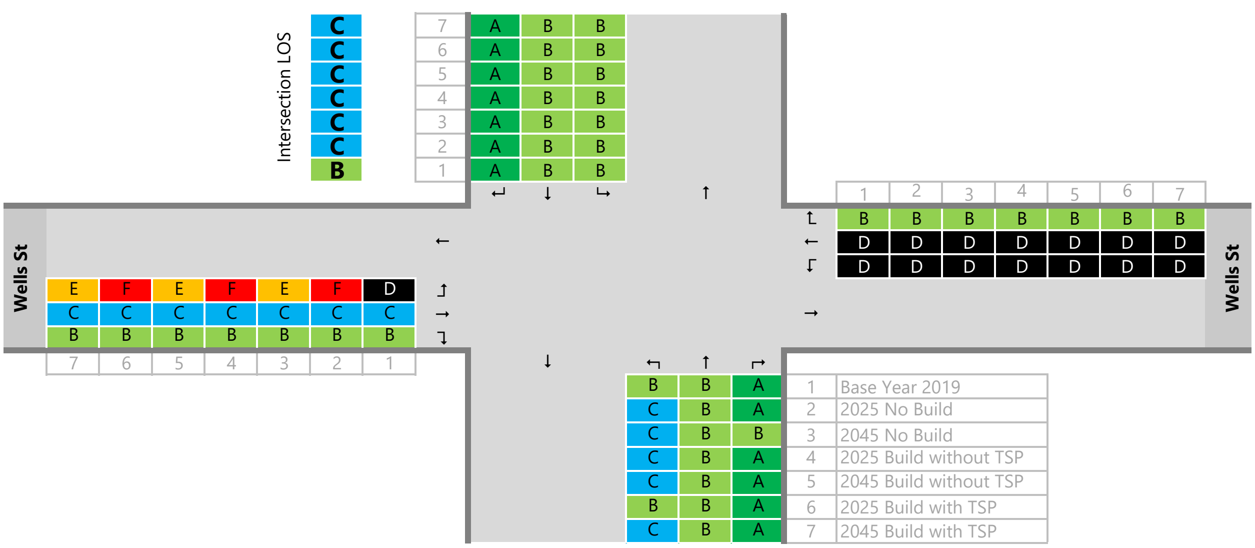


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Figure C.6 (Continued)

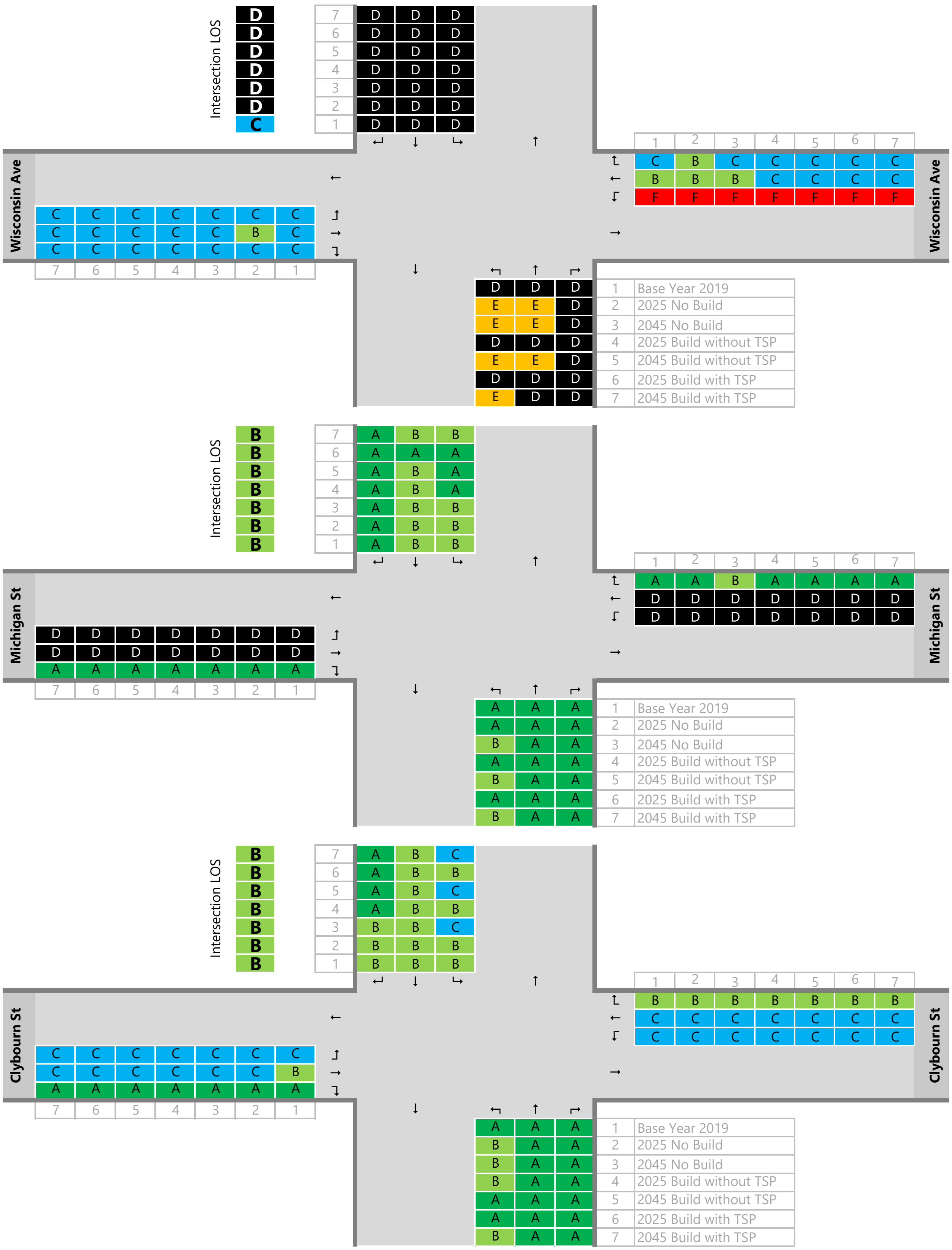

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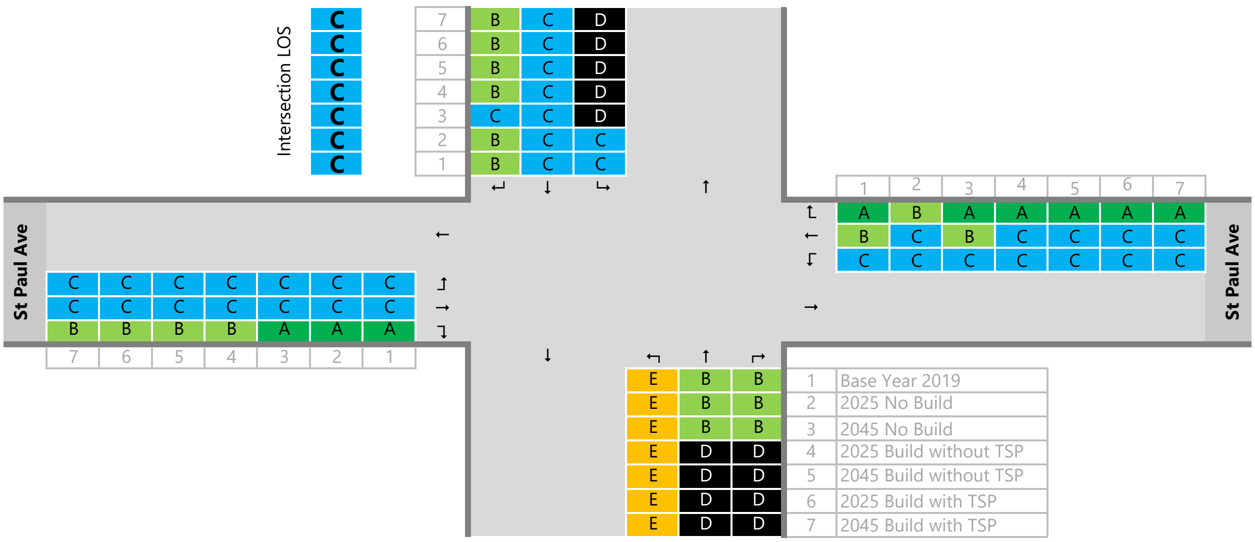
Figure C.6 (Continued)



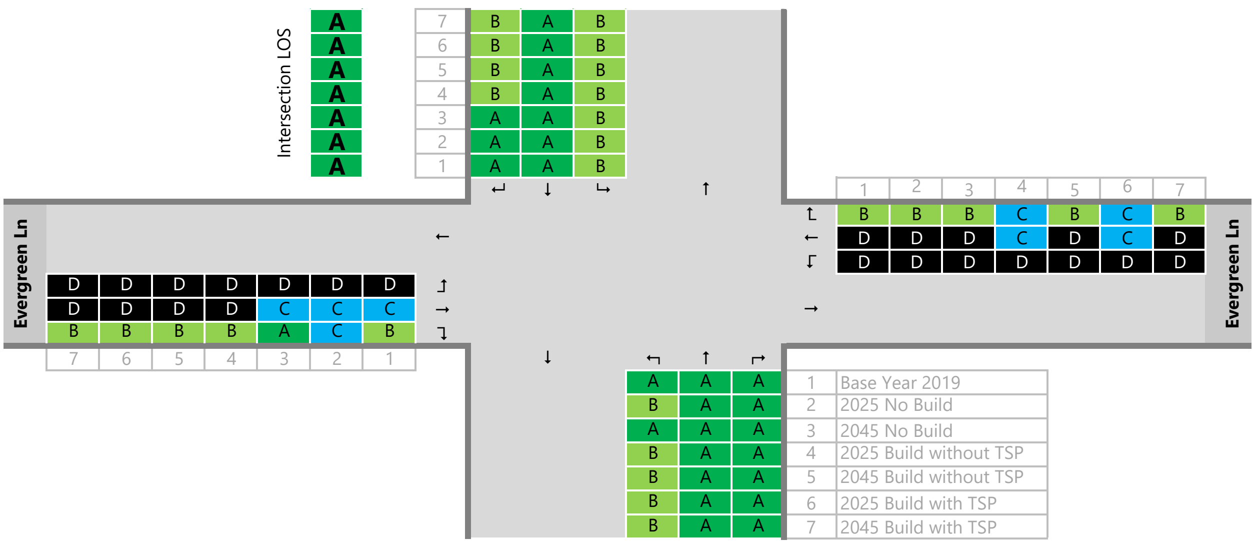


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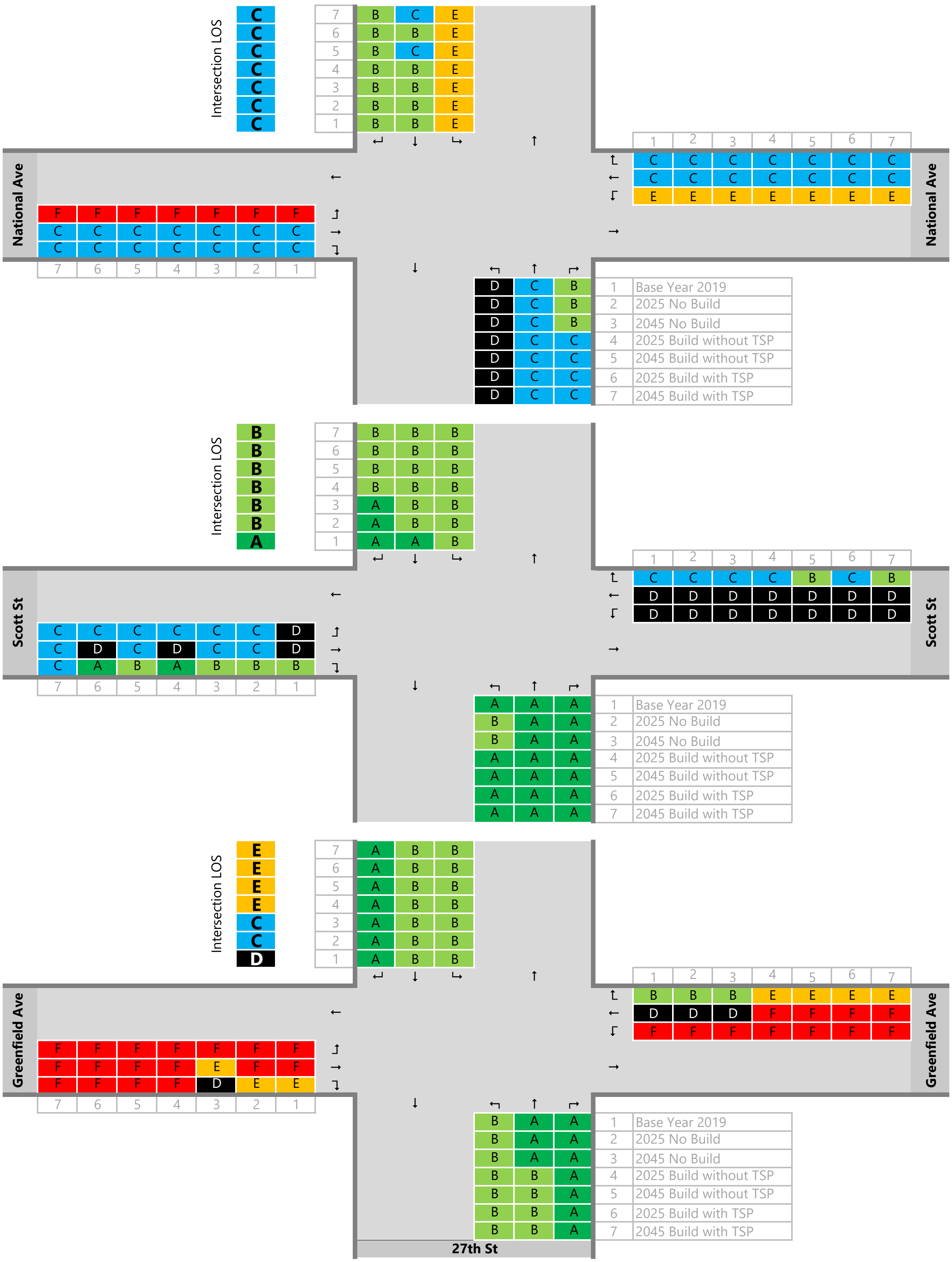
Figure C.6 (Continued)



Note: a) Assumes 10 sec extension if TSP requires current green at an intersection to extend, or 10 sec truncation if TSP requires current red at an intersection to truncate early, b) Assumes 18 mph desired transit operating speed.

Source: SEWRPC

Prepared for:

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