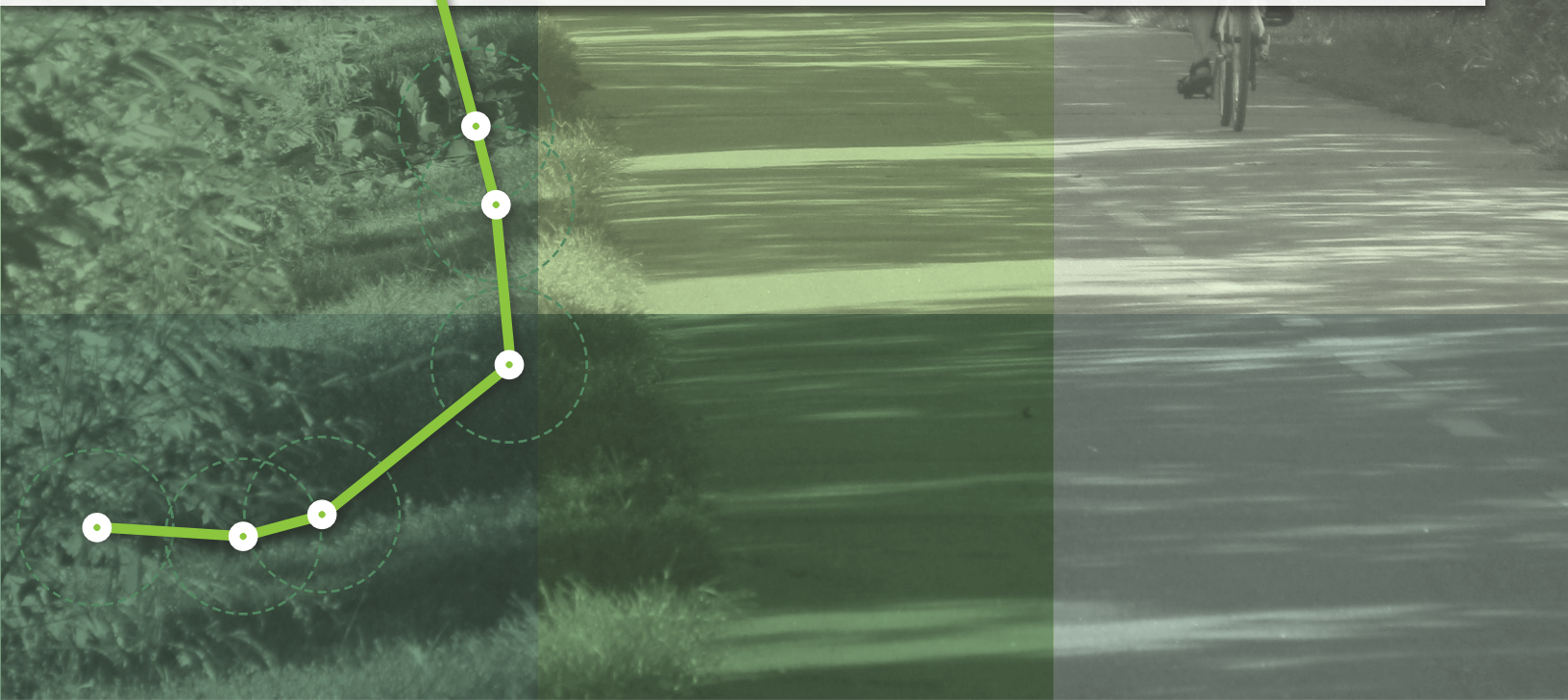


# SHADY OAK STATION

CITY OF HOPKINS + CITY OF MINNETONKA



SOUTHWEST CORRIDOR INVESTMENT FRAMEWORK  
TRANSITIONAL STATION AREA ACTION PLAN



## ABOUT THIS CHAPTER:

The Transitional Station Area Action Plans are the product of a Hennepin County led effort to help communities along the Southwest LRT corridor prepare for SW LRT's opening day in 2018 and beyond.

An individualized plan has been created for each of the 17 stations in the Southwest corridor, each plan comprising a chapter in the larger Southwest Corridor Investment Framework. The station area action plans suggest ways to build on local assets, enhance mobility, identify infrastructure needs, and capitalize on promising opportunities for development and redevelopment near each station.

Plan Components:

### INTRODUCTION 12-2

A brief overview of the station location and its surroundings

### WHERE ARE WE TODAY? 12-4

A description of existing conditions in the station area, including:

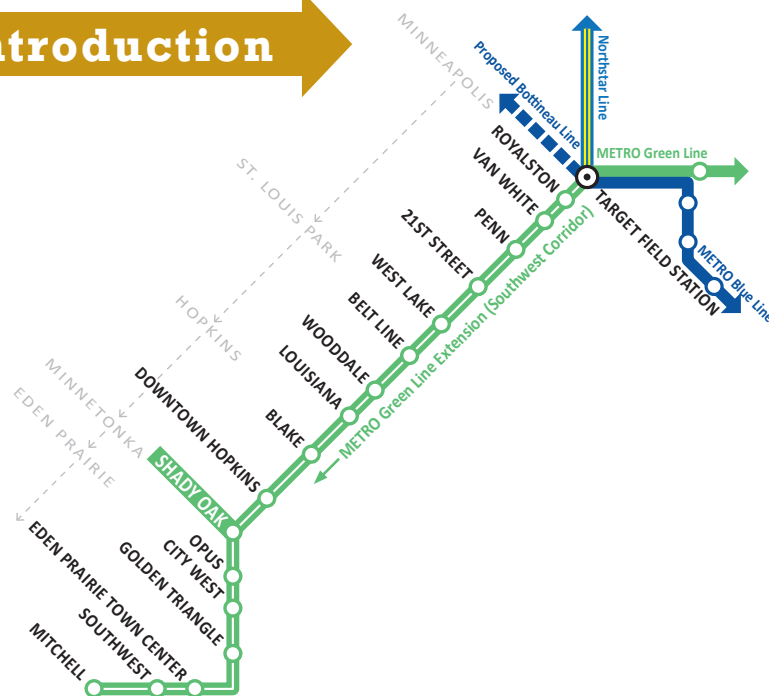
- » Land Use
- » Transit Connections
- » Access + Circulation Issues (Bike, Ped, and Auto)
- » Infrastructure Needs

### WHERE ARE WE GOING? 12-8

This section presents a number of recommendations for the station area in anticipation of opening day needs and the long-term TOD environment. This includes:

- » Access + Circulation Plan
- » Station Area Site Plan
- » Infrastructure Plan
- » Development Potential
- » Summary of Key Initiatives

## Introduction



### SHADY OAK STATION WITHIN THE CORRIDOR:

An important gateway to the Southwest Corridor that provides access to a mix of employment and residential areas as well as destinations along the Minnesota River Bluffs LRT Regional Trail.

**EMPLOYMENT** The Shady Oak station is the northernmost *Employment* station (see Place Types discussion beginning on p. 1-19) along a string of five employment focused stations which extend from Downtown Hopkins in the north to the Eden Prairie Town Center in the south. It is the most industrial among these stations and the closest to an urban center (Downtown Hopkins). As with many of the employment place types along the Southwest Corridor, the area today is not pedestrian-friendly, with a circuitous street network, large lot sizes, and buildings set back from the street. Furthermore, the lack of employee-serving amenities such as restaurants and daycares means that employees need to travel by car to access these services.

**NEIGHBORHOODS** The area contains a sizable residential component immediately to the north of Excelsior Boulevard, within walking distance to the station. For these residents, their primary access route will be along 17th Avenue.

**TRAIL CONNECTIONS** The Minnesota River Bluffs LRT Regional Trail, which links downtown Minneapolis to the western suburbs, passes through the middle of the station area. The trail, in addition to nearby Shady Oak Beach, will make the station an important trail and open space connection along the corridor.

**OTHER DESTINATIONS** Located at the northwest edge of the southwest LRT alignment, the station will be an important receiving point for park and ride commuters coming from the west along Highway 7, from the south along Shady Oak Road, and from the north along I-494. Given the station's employment focus and relatively central location along the corridor, Shady Oak station has also been identified as the preferred location for an operations and maintenance facility for LRT vehicles.

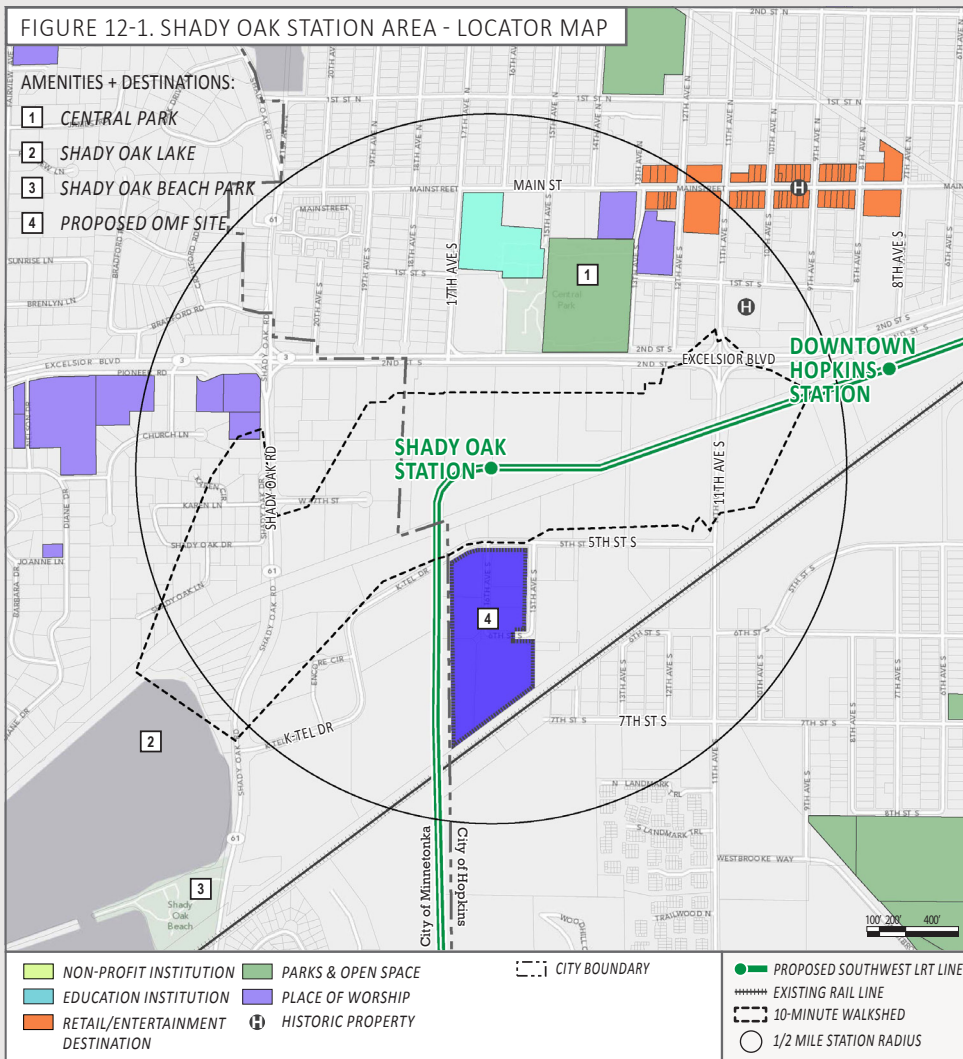
## Station Location

The Shady Oak station is located about a quarter-mile south of Excelsior Boulevard and about a quarter-mile east of Shady Oak Road. The proposed station platform is located in the middle of a large industrial area.

This station is challenged from a visibility and access perspective. Currently there is no public access to the station location. Access to this station will require land acquisition and a new roadway extension of 17th Avenue from Excelsior Boulevard to K-Tel Drive.

The Minnesota River Bluffs LRT Regional Trail runs alongside this station. Nearby destinations include Shady Oak Lake/Beach and Hopkins Pavilion.

The Shady Oak station is anticipated to serve local businesses and residents to the north of Excelsior Boulevard and west of Shady Oak Road, as well as Hopkins' Westbrooke neighborhood to the south of the station. The need to acquire parcels for station access presents the potential for redevelopment near the station.



NOTE: 10-minute walkshed approximates the area accessible within a 10-minute walk from the station platform using only the existing sidewalk/trail network. See Glossary for walkshed assumptions and methodology.

### SHADY OAK STATION AREA TODAY:



Minnesota River Bluffs LRT Regional Trail



Existing light industrial



Existing light industrial

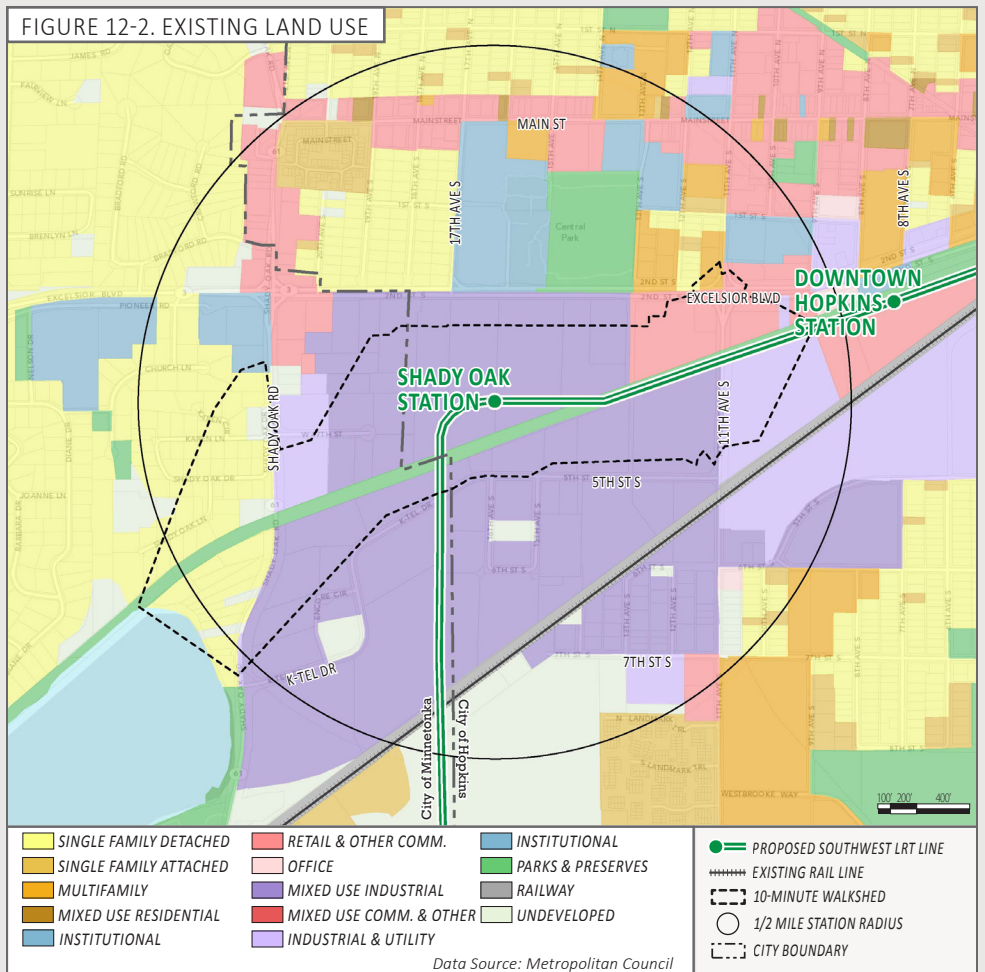
# Where Are We Today?

The following section describes the station area's **EXISTING CONDITIONS**, including the local context, land uses, transit and transportation systems, pedestrian and bicycle facilities, assets, destinations, and barriers to accessing the station. This analysis of current conditions presents key issues and opportunities in the station area and informs the recommendations for future station area improvements.

*NOTE: Existing conditions maps are based on data provided by Hennepin County and local municipalities. The data used to create each map is collected to varying degrees of accuracy and represents infrastructure and conditions at varying points in time. Actual conditions may vary slightly from what is shown.*

## Land Use

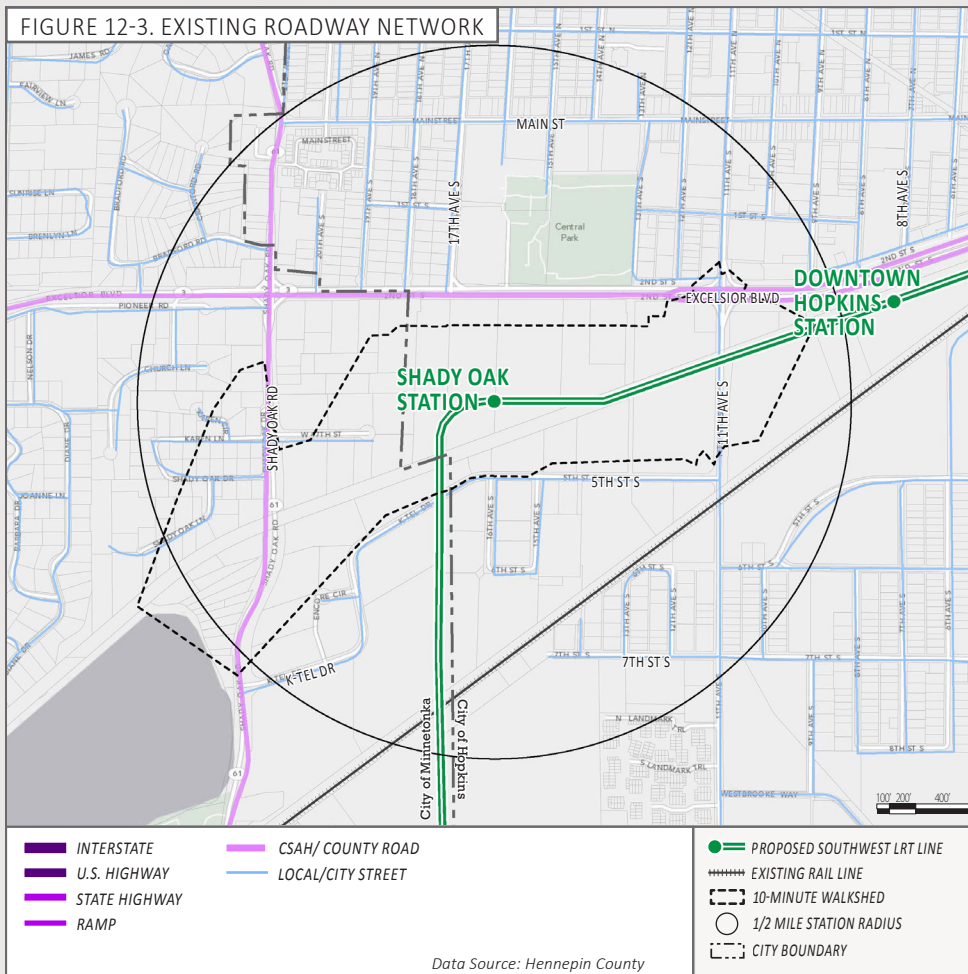
The surrounding land uses are predominantly industrial and commercial near the station, with a mix of residential and retail uses further from the station. The City of Hopkins Public Works Facility and Central Park are to the north of the station on Excelsior Boulevard. Mainstreet and its mix of retail and housing uses is located about a half-mile to the north and could be accessed along 17th Street. Shady Oak Lake is located about a half-mile from the station to the southwest, alongside Shady Oak Road.





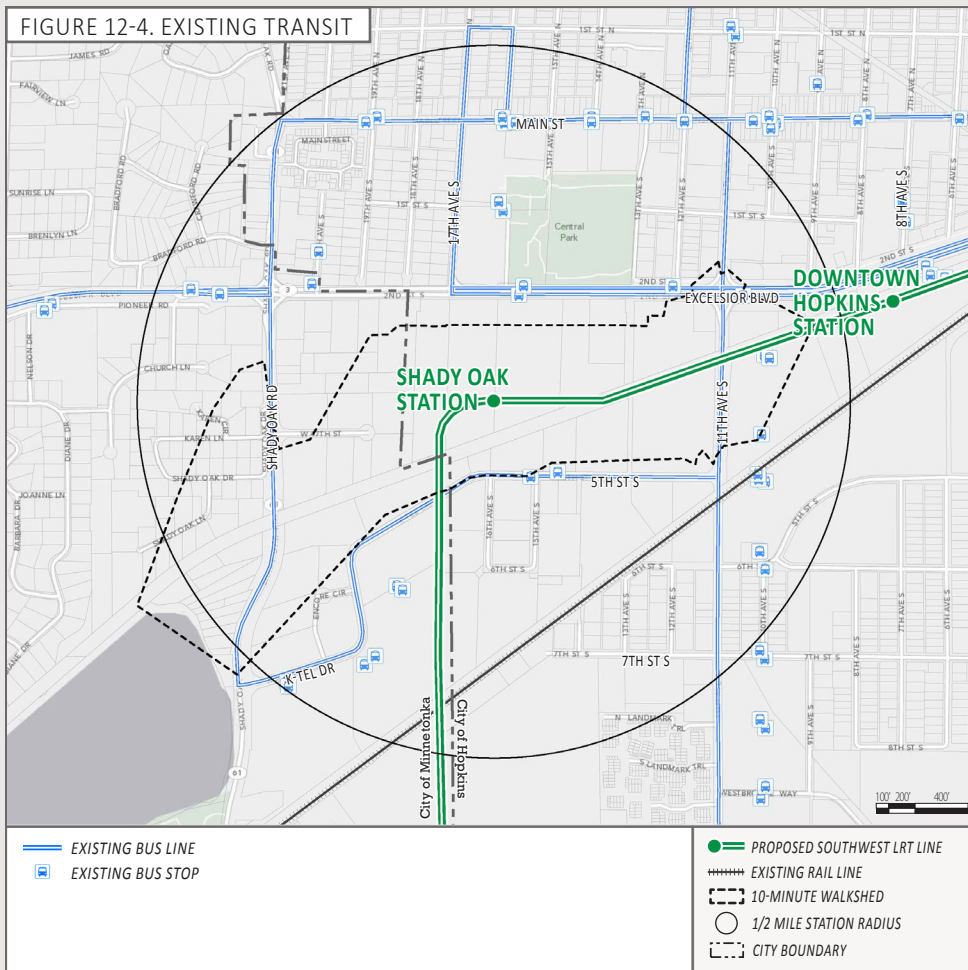
## Roadway Network

The roadway network near the Shady Oak Station is limited. The mostly industrial area is characterized by large block sizes and few roads. Currently, there is no roadway access to the proposed station location. Land acquisition will be required to extend 17th Avenue from Excelsior Boulevard south to the station and eventually further south to K-Tel Drive. Excelsior Boulevard, an important and busy east-west arterial, runs about a quarter-mile to the north of the station. Shady Oak Road, an important north-south arterial, runs about a quarter-mile to the west of the station.



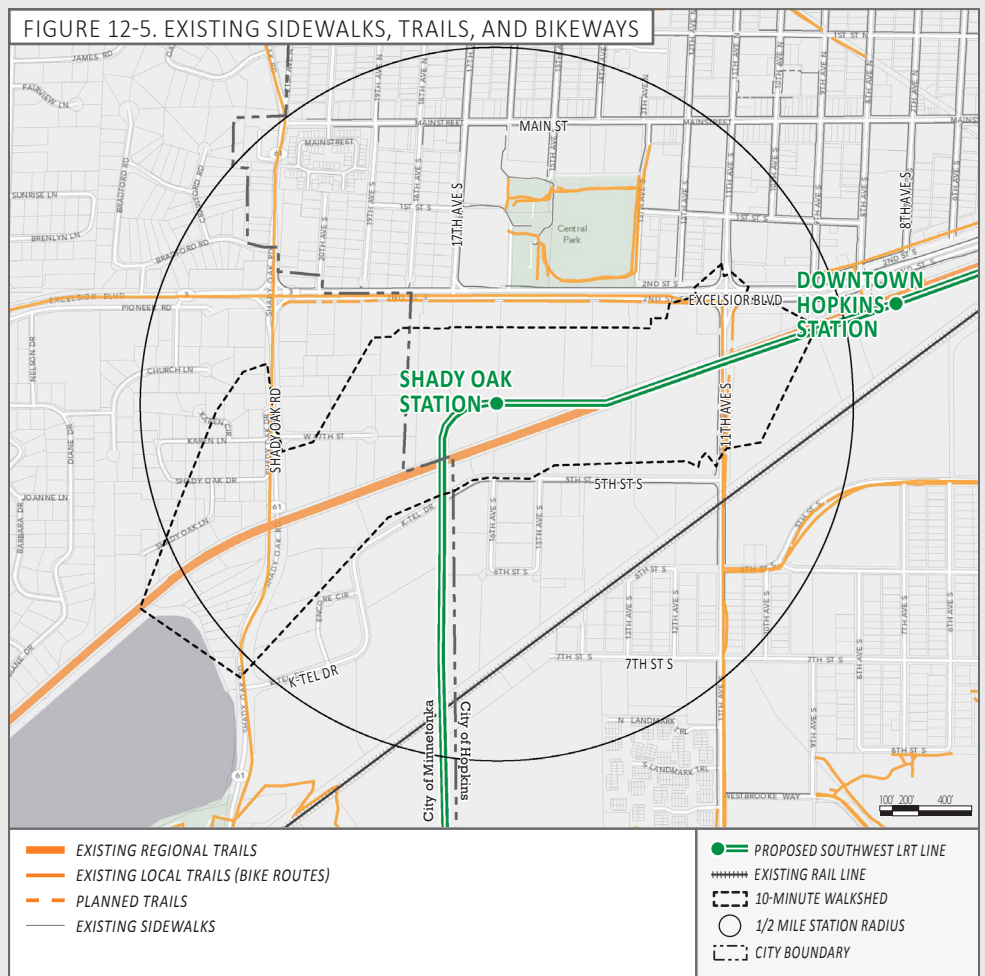
## Transit

Bus route #12 runs on Excelsior Boulevard, Shady Oak Road and 5th Street. The closest bus stops are located on 5th Street and Excelsior Boulevard.



## Sidewalk, Trails and Bikeways

The existing sidewalk system near the station is very limited. Large blocks sizes and a limited roadway network inhibit pedestrian access to the station. Sidewalk improvements alongside existing and new roads will be critical to provide better access to this station. The Minnesota River Bluffs LRT Regional Trail runs alongside the station platform and connects with other trails running along 11th Avenue and Shady Oak Road. These are important trail connections to surrounding residential neighborhoods.



## Existing Sanitary Sewer

Sanitary sewer infrastructure consists of a collection of gravity flow sewer mains, lift stations, and pressurized forcemains that transport sewage to a wastewater treatment plant (WWTP). An efficient collection system has the capacity to accommodate all of the existing land uses within its particular sewershed. Beyond capacity, the material and age of pipes within a system can also impact a system's effectiveness.

Sanitary sewer infrastructure within the project area is typically maintained by either by the City of Hopkins or the City of Minnetonka or by the Metropolitan Council Environmental Services (MCES) Division. MCES maintains a series of interceptor trunk sewers which collect sewage at key locations and convey sewage across community boundaries to regional WWTPs. Both the MCES Metro WWTP and MCES Blue Lake WWTP sewer sheds extend to the station area.

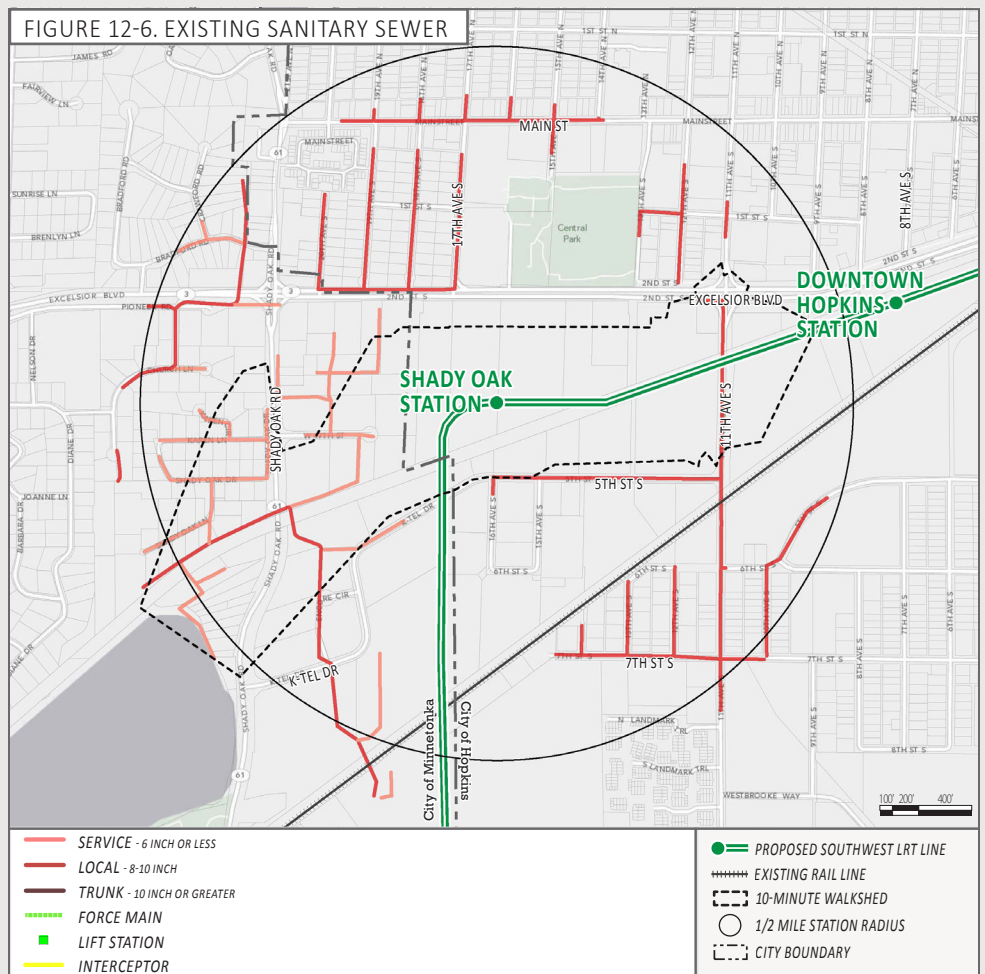
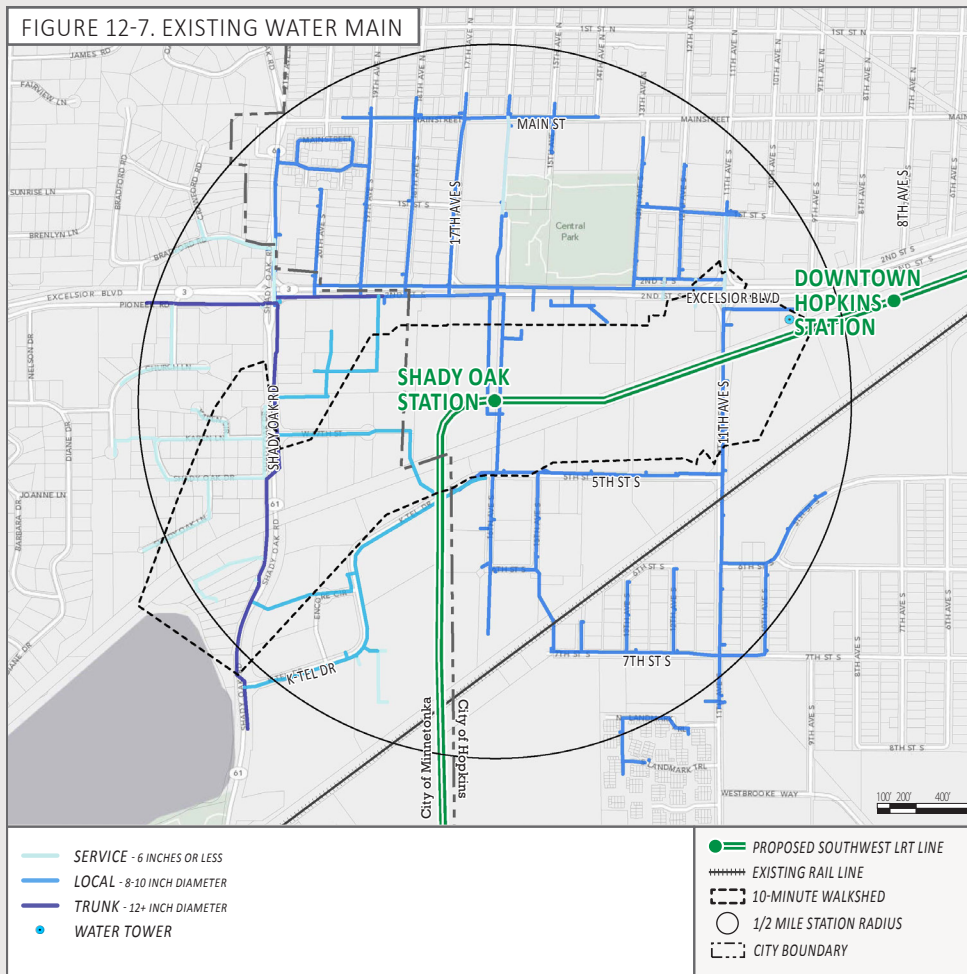




FIGURE 12-7. EXISTING WATER MAIN



## Existing Water Main

Water main distribution systems serve to supply potable water to individual properties and to support fire suppression throughout the community. A well-designed system can maintain adequate pressure to support demand of individual properties and provide high flow rates to fire hydrants/fire suppression systems in emergency situations. Because of the complexity of water distribution networks and the importance of pressure, flow, and water quality, City water system models are used to evaluate a system's adequacy. The material and age of the system's water mains can also be factors in system breaks, leaks, and pressure and flow degradations.

Water pressure and flow rates can be influenced by: the size of water main serving an area, proximity and elevation relative to a water tower, proximity to a trunk water main with high flow capacity, if the main creates a loop, the demand of adjacent land uses, and the condition of the main.

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## Where Are We Going?

The plans and diagrams on the following pages illustrate a range of recommendations for infrastructure improvements, station amenities, and potential redevelopment opportunities within the station area.

*The ACCESS AND CIRCULATION PLAN shown in Figure 12-8 provides a high level view of how future transit, automobile, bike, and pedestrian systems will connect to the station area and its surroundings.*

*Figure 12-9 illustrates the STATION AREA IMPROVEMENTS that will facilitate access to and from the station and catalyze redevelopment in the station area. This includes opening day and long-term station area improvements*

*Figure 12-10 focuses on OPENING DAY STATION AREA IMPROVEMENTS only. These recommendations represent the improvements necessary to enhance the efficient function of the transit station, roadways, pedestrian and bicycle connections, and transit connections on opening day in 2018.*

## Station Area Improvements

The discussion below outlines a range of future station area improvements. While some of the identified improvements may be constructed as part of the LRT project itself, other improvements must be funded, designed and constructed by other entities and will require coordination between the City, County, and Metro Transit as well as local stakeholder and community groups.

### ROADWAYS

#### Opening Day Improvements:

- » Focus on the extension of 17th Avenue from Excelsior Boulevard south to K-Tel Drive. This is seen as the lifeline to the station given that the station location is relatively isolated from current access and visibility today. 17th Avenue should be designed as a Complete Street, accommodating multiple modes of transportation (pedestrians, bicycles, vehicles).
- » Provide gateway monuments at Excelsior Boulevard and 17th Avenue to identify the LRT station and provide wayfinding to the station.

#### Long-Term Improvements:

- » Additional future roadways may include roads to the west of the station platform, between Shady Oak Road and 17th Avenue. Future roadways should be coordinated with and occur as redevelopment occurs on the southeast quadrant of Shady Oak Road and Excelsior Boulevard. This new road system will reduce block sizes, enhance connections to the station, and enhance redevelopment potential in the area. Transit-supportive uses should be promoted in the area.

### PEDESTRIAN CONNECTIONS

#### Opening Day Improvements:

- » Focus sidewalk and streetscape enhancements along 17th Avenue, Excelsior Boulevard, and K-Tel Drive.
- » Enhance the pedestrian crossings across Excelsior Boulevard, particularly at 17th Avenue.
- » Provide safe and convenient pedestrian connections to the Minnesota River Bluffs LRT Regional Trail. Realign the trail

along the north side of the station then follow 17th Avenue back to its existing alignment.

- » Design and construct 17th Avenue as a Complete Street with sidewalks, bike lanes, planting areas, lighting, seating, and signage.
- » Pave the regional trail to better serve bike riders and commuters, as well as connect residential neighborhoods and destinations with the LRT transit station.
- » Enhance pedestrian connections to Mainstreet through Central Park and along 13th Avenue South.
- » Provide pedestrian lighting along 17th Avenue, from Excelsior Boulevard to K-Tel Drive.

#### Long-Term Improvements:

- » Focus sidewalk and streetscape enhancements along 17th Avenue, Excelsior Boulevard, K-Tel Drive, 11th Avenue, and 5th Street.
- » Provide a pedestrian connection from the east of the station platform south to 5th Street.
- » Provide pedestrian connections when future roadways are developed between 17th Avenue and Shady Oak Road.

### BIKE CONNECTIONS

#### Opening Day Improvements:

- » Provide bike lanes in each direction on 17th Avenue between K-Tel Drive and north across Excelsior Boulevard.
- » Provide bike parking, lockers, pump station, and bike sharing facilities in a highly visible area near the station platform.
- » Provide bike connections to the regional trail.





Park and ride ramp wrapped with office uses



Station platform with shelter, signage, lighting, and seating

**Long-Term Improvements:**

- » Provide on-street bike facilities (lanes, routes, signage, etc.) on local streets to better connect the station to nearby neighborhoods, businesses, amenities, and destinations.

**TRANSIT CONNECTIONS**

**Opening Day Improvements:**

- » Provide safe and convenient access to bus stops along Excelsior Boulevard. This should be achieved with sidewalks connecting the station platform to Excelsior Boulevard along 17th Avenue and within the park and ride lot.
- » Provide pedestrian lighting along 17th Avenue, between the two different modes of transit (bus and LRT).

**PARK AND RIDE**

**Opening Day Improvements:**

- » A near-term surface parking lot has been identified along the east side of 17th Avenue south of Excelsior Boulevard. (note: mid- or long-term, structured parking should be considered on this site with associated redevelopment infill along 17th Avenue and Excelsior Boulevard).

**KISS AND RIDE**

- » Provide a kiss and ride pull out lane along the access road just north of the station platform.

**STATION AMENITIES (Beyond SW LRT Base Project Scope)**

**Opening Day Improvements:**

- » Wayfinding – visibility of the Shady Oak station is challenged. Include signage and wayfinding at the station area platform, the park and ride facility and along sidewalks and trails near the station. Include a gateway monument at Excelsior and 17th Avenue to orient transit users to the Shady Oak station location. Include wayfinding/public art along 17th Avenue.
- » Seating – provide comfortable and durable seating near the station platform, at the park and ride facility, and at nearby bus stop locations.

- » Lighting – provide adequate lighting for the safety of pedestrians, bicyclists, and motorists near the station platform, at the park and ride facility, at nearby bus stop locations, and near the kiss and ride dropoff.
- » Plaza – provide a public plaza area near the station platform and park and ride facility to provide transit users with a paved queue area to wait for LRT trains, gather, and move about the station area.
- » Bike Facilities – provide bicycle parking, lockers, pump station, and bike sharing facilities in a highly visible area near the station platform.
- » Public Art – provide public art in the station area. Utilize the roundabouts to include public art and wayfinding to the station.

**DEVELOPMENT POTENTIAL**

**Opening Day Improvements:**

- » Sites along both sides of the 17th Avenue extension represent opening day development potential. East of 17th Avenue, the park and ride ramp facility could be developed with a wrap of office or mixed-use development facing Excelsior Boulevard and 17th Avenue. This park and ride site represents an opportunity for joint development. Along the west side of 17th Avenue, sites located in Hopkins also could be developed by opening day.
- » Sites located at the intersection of Shady Oak Road and Excelsior Boulevard could be developed by opening day.

**Long-Term Improvements:**

- » See the “Development Potential” discussion on page 12-18 for more on long-term development opportunities.

**UTILITIES**

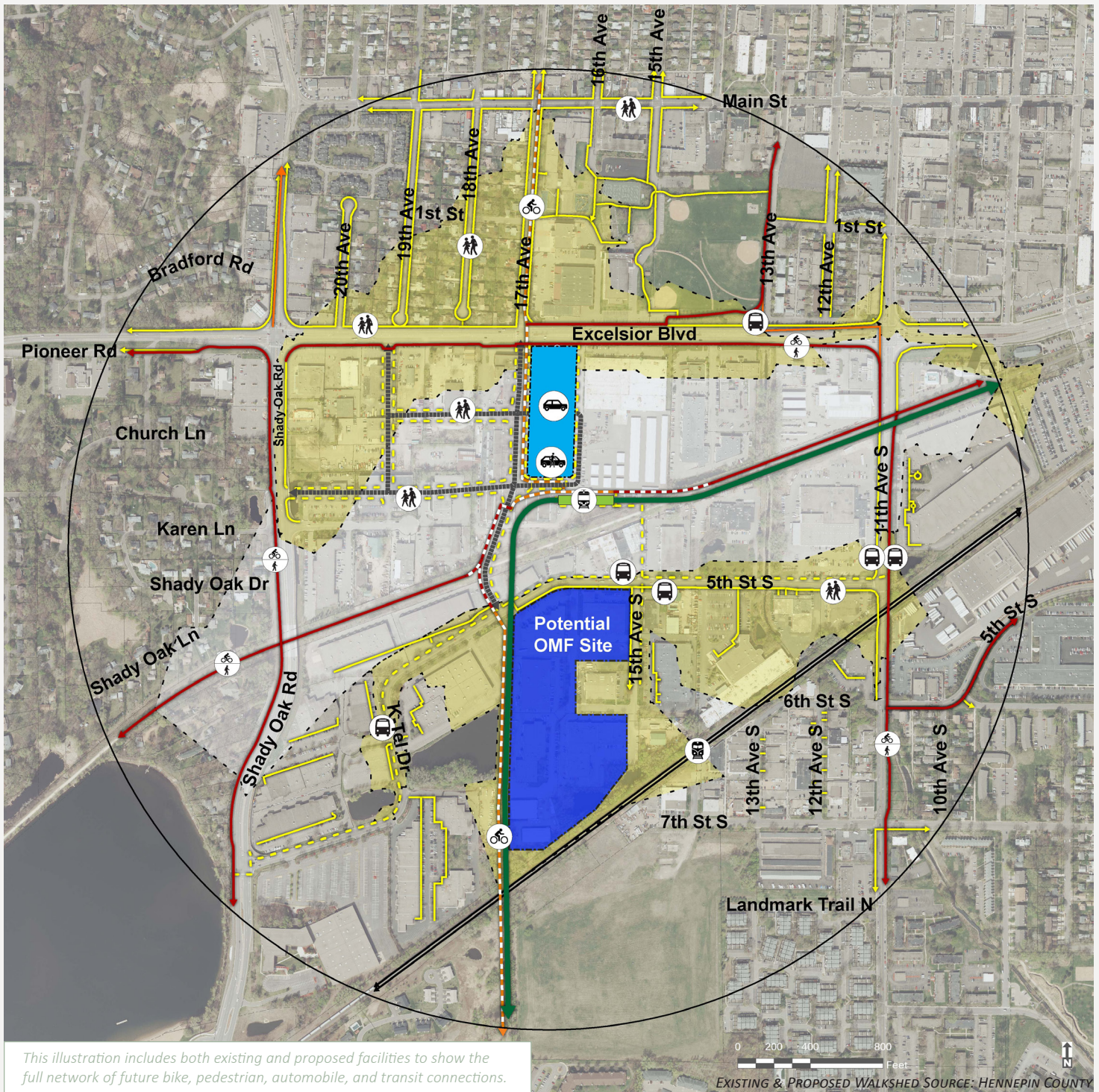
- » See the “Station Area Utility Plan” beginning on page 12-20 for all utility recommendations.



FIGURE 12-8. ACCESS + CIRCULATION PLAN

WHERE ARE WE GOING?

SHADY OAK



This illustration includes both existing and proposed facilities to show the full network of future bike, pedestrian, automobile, and transit connections.

0 200 400 800 Feet  
EXISTING & PROPOSED WALKSHED SOURCE: HENNEPIN COUNTY

- |  |               |  |                   |  |   |  |  |
|--|---------------|--|-------------------|--|---|--|--|
|  | LRT PLATFORM  |  | FREIGHT LINE      |  | EXISTING PEDESTRIAN CONNECTION            |  | PROPOSED(DASHED) PEDESTRIAN CONNECTION |
|  | LRT LINE      |  | NEW ROADWAY       |  | EXISTING BIKE CONNECTION                  |  | PROPOSED(DASHED) BIKE CONNECTION       |
|  | BUS STOP      |  | KISS AND RIDE     |  | EXISTING MULTI USE CONNECTION             |  | PROPOSED(DASHED) MULTI USE CONNECTION  |
|  | PARK AND RIDE |  | EXISTING WALKSHED |  | FUTURE WALKSHED (WITH TSAAP IMPROVEMENTS) |  |  |

NOTE: Existing walkshed approximates the area accessible within a 10-minute walk from the station platform using only the existing sidewalk/trail network. Future walkshed incorporates all proposed improvements to the sidewalk/trail network. Walksheds are based on GIS modeling and available sidewalk/trail information- and may not reflect exact on-the-ground conditions. See Glossary for detailed explanation of walkshed assumptions and methodology.



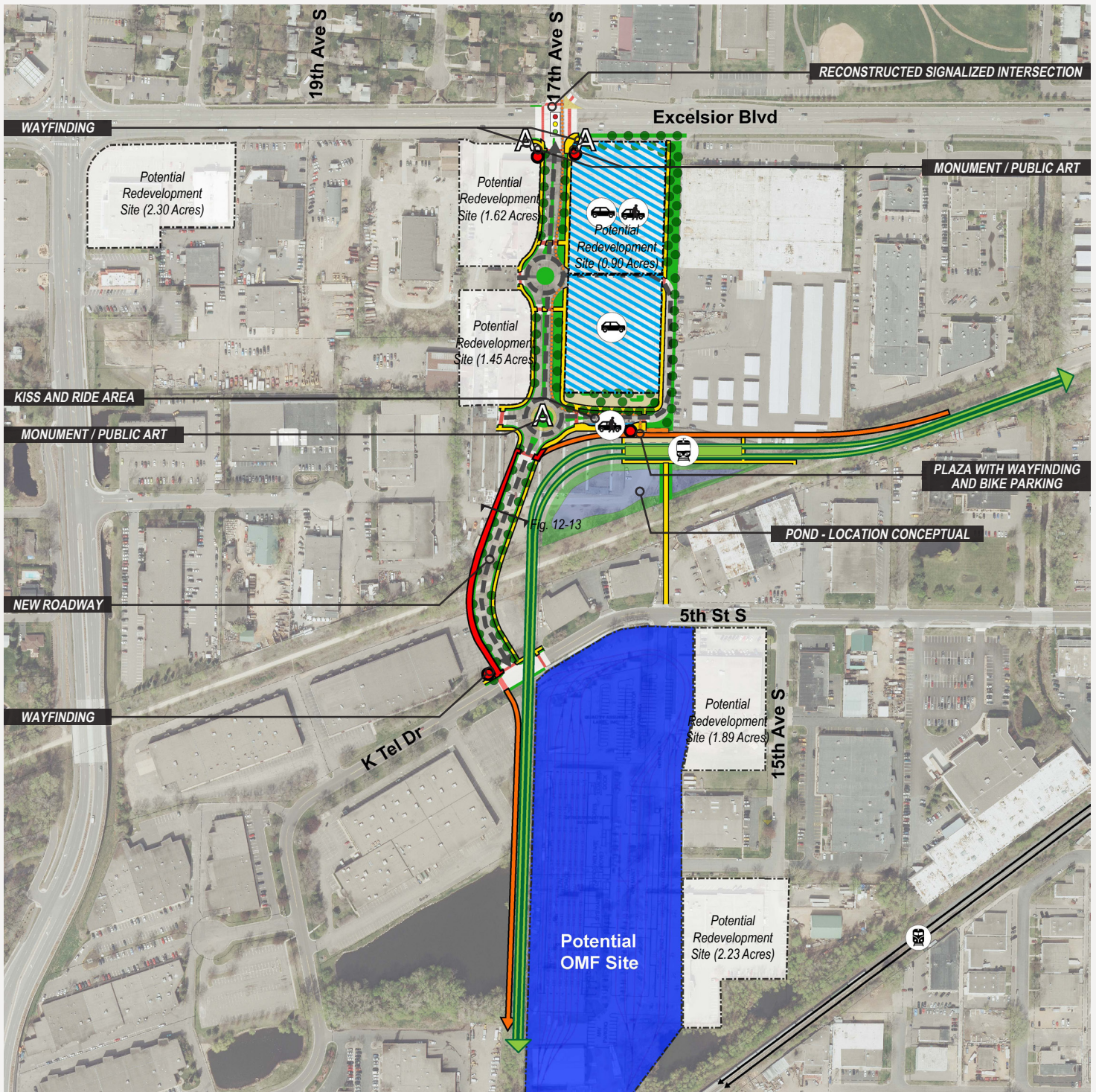




FIGURE 12-10. OPENING DAY STATION AREA IMPROVEMENTS

WHERE ARE WE GOING?

SHADY OAK



- |  |              |  |                                     |  |                                     |  |                            |
|--|--------------|--|-------------------------------------|--|-------------------------------------|--|----------------------------|
|  | LRT PLATFORM |  | NEW SIDEWALK / SIDEWALK IMPROVEMENT |  | NEW ROADWAY                         |  | BIKE PARKING               |
|  | FREIGHT LINE |  | ON STREET BIKE INFRASTRUCTURE       |  | STREETSCAPE                         |  | WAYFINDING                 |
|  | BUS STOP     |  | MULTI-USE PATH                      |  | PARK AND RIDE                       |  | PUBLIC ART OPPORTUNITY     |
|  | BUS SHELTER  |  | NEW CROSSING / CROSSING IMPROVEMENT |  | KISS AND RIDE                       |  | POTENTIAL DEVELOPMENT SITE |
|  |              |  | NEW SIGNALIZED INTERSECTION         |  | PLAZA SPACE / BUILDING SETBACK AREA |  |                            |



# Conceptual Street Sections

The street cross section illustrated below is conceptual and represents a potential future streetscape condition, addressing facilities for a variety of transportation modes, streetscape amenities, and the relationship between buildings and the street edge. Further design and engineering work will be required to ensure the streetscape is in compliance with City and/or County design standards and needs.

## 17TH AVENUE (SOUTH OF LRT STATION)

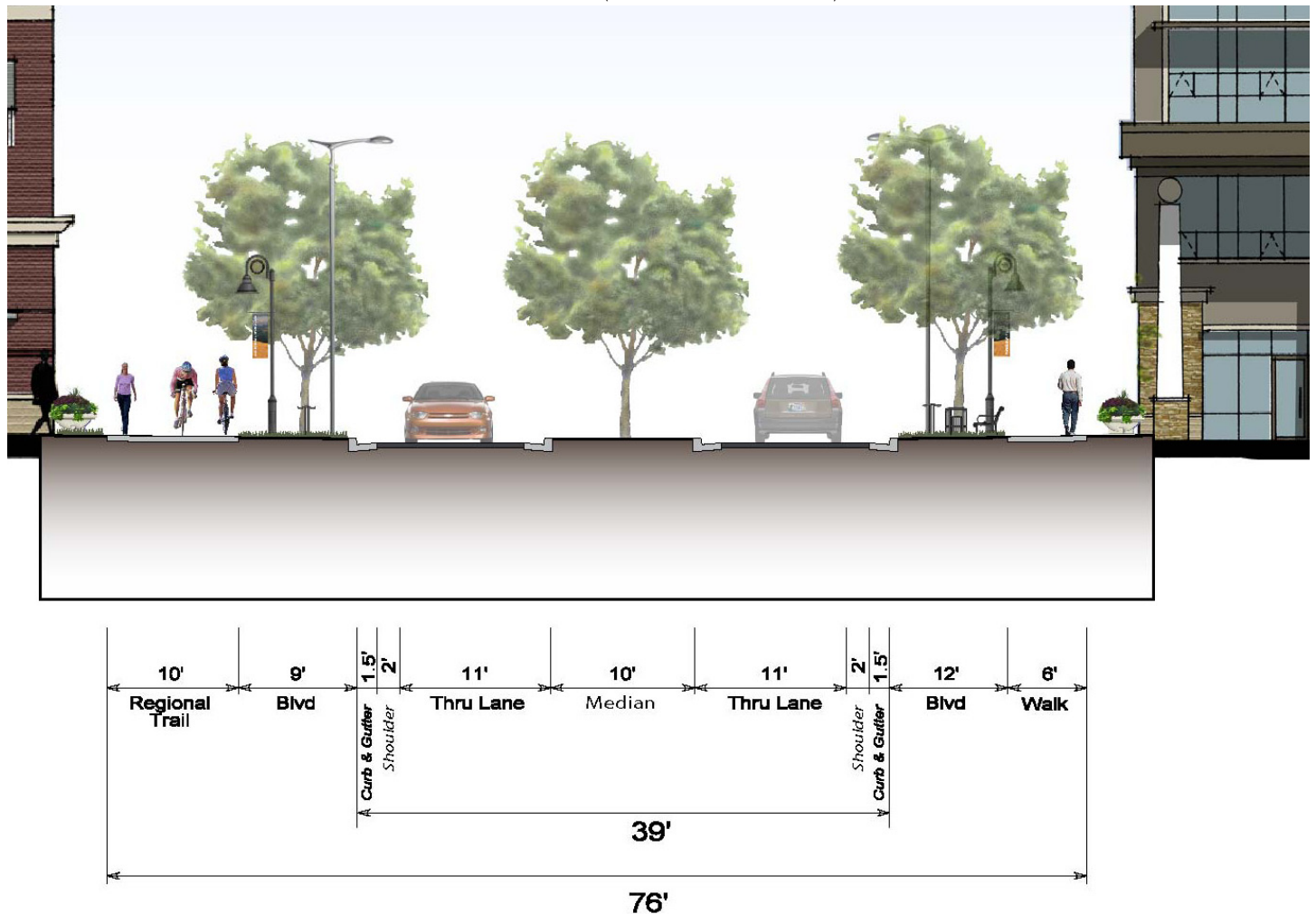
### Dimensional Criteria:

- » 76 feet Right-of-Way Width
- » 39 feet Pavement Width (2-way)
- » 20'-30' o/c Street Tree Spacing
- » 6'-0" Sidewalk Width
- » 10'-0" Trail Width

### Design Features:

- » Sidewalk (one side of street)
- » Trail (one side of street)
- » Street Trees/Plantings/Raingardens
- » Streetscape Furnishings (seating, planters, trash receptacles, bicycle racks)
- » Signage/Wayfinding
- » Street and Pedestrian Lighting
- » Public Art
- » Pedestrian-Friendly Crossings (markings, countdown traffic signals, ADA features)

FIGURE 12-11. CONCEPTUAL STREET SECTION - 17TH AVENUE (SOUTH OF LRT STATION)



# Conceptual Street Sections (Continued)

The street cross section illustrated below is conceptual and represents a potential future streetscape condition, addressing facilities for a variety of transportation modes, streetscape amenities, and the relationship between buildings and the street edge. Further design and engineering work will be required to ensure the streetscape is in compliance with City and/or County design standards and needs.

## 17TH AVENUE (NORTH OF LRT STATION)

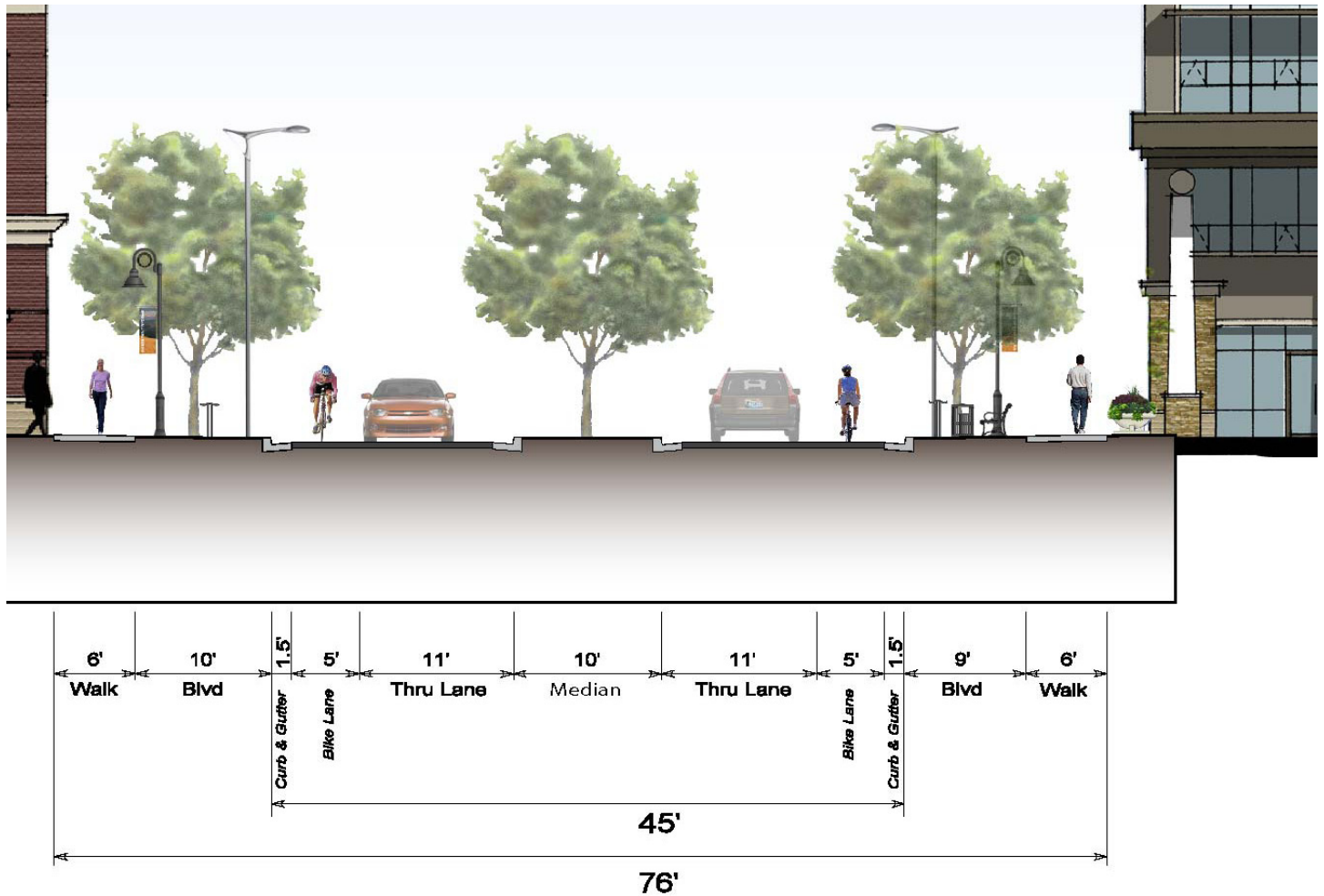
### Dimensional Criteria:

- » 76 feet Right-of-Way Width
- » 45 feet Pavement Width (2-way)
- » 20'-30' o/c Street Tree Spacing
- » 6'-0" Sidewalk Width

### Design Features:

- » Sidewalks
- » Trail (east side of street)
- » Bicycle Lanes 5'-0"
- » Street Trees/Plantings/Raingardens
- » Streetscape Furnishings (seating, planters, trash receptacles, bicycle racks)
- » Signage/Wayfinding
- » Street and Pedestrian Lighting
- » Public Art
- » Pedestrian-Friendly Crossings (markings, countdown traffic signals, ADA features)

FIGURE 12-12. CONCEPTUAL STREET SECTION - 17TH AVENUE (NORTH OF LRT STATION)





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# Opening Day Improvements

The following tables and diagrams outline the proposed improvements to be implemented in advance of SW LRT's opening day in 2018. Table 12-1 and Figure 12-14 show opening day improvements that are part of the SW LRT anticipated base project scope; these improvements will be part of the overall project cost for construction of the LRT line. Table 12-2 and Figure 12-15 include opening day improvements that are recommended as part of the Southwest Corridor Investment Framework and are beyond SW LRT's base project scope. Table 12-3 (also shown in Figure 12-15) includes locally requested "betterments"- or improvements that cities have requested to be included in the base project scope pending funding availability.

TABLE 12-1. SOUTHWEST LRT ANTICIPATED BASE PROJECT SCOPE - OPENING DAY STATION AREA IMPROVEMENTS

PLAN KEY	IMPROVEMENT	PROJECT LOCATION	WPROJECT NOTES
A	LRT Platform	South of Excelsior Blvd, north of 5th Street	Includes related LRT infrastructure
B	Park and Ride	North of station platform	500 stall surface lot
C	Kiss and Ride	North of station platform	Dropoff area
D	Roadways	New street- 17th Ave	From Excelsior Blvd to station platform, includes 2 roundabouts
E	Sidewalk/Trail	Along 17th Ave, Excelsior Blvd to LRT station	Sidewalk on both sides of street
F	Sidewalk/Trail	Excelsior Blvd- 16th to 18th Ave	Replace existing sidewalk on south side only
G	Sidewalk/Trail	LRT station to 11th Ave	Relocate regional trail and new surface
H	Intersection Enhancement	17th Ave and Excelsior Blvd	Reconstruct signalized intersection
I	Bike Facilities	Near station platform	Allowance for bike storage
J	Wayfinding	Station platform and 17th Ave/Excelsior Blvd	Allowance
K	Landscaping	17th Ave and park and ride lot	Allowance
L	Water*	Within project limits	Relocate existing water main
M	Utilities*	Within project limits	Adjustment of existing utilities
N	Stormwater management*	Within project limits	Allowance

Note: Anticipated Southwest LRT Base Project Scope as of December 2013 (subject to change)

\* Improvement not symbolized on opening day figures (exact location to be determined as part of the base project scope)

TABLE 12-2. SOUTHWEST CORRIDOR INVESTMENT FRAMEWORK (TSAAP) - OPENING DAY STATION AREA IMPROVEMENTS

PLAN KEY	IMPROVEMENT	PROJECT LOCATION	PROJECT NOTES	PRIORITY
1	Park and Ride	North of station platform	Enhanced planting areas/trees	Primary
2	Sidewalk/Trail	LRT station to K-Tel Drive	Multi-use trail along east side of 17th Ave	Primary
3	Sidewalk/Trail	LRT station to K-Tel Drive	Sidewalk along east side of 17th Ave	Primary
4	Intersection Enhancement	17th Ave and K-Tel Drive	New crosswalks	Primary
5	Bike Facilities	Near station platform	Bike parking, lockers, pump station and bike share facilities (beyond SPO improvements)	Primary
6	Wayfinding	Station platform, 17th Ave/Excelsior Blvd and 17th Ave/K-Tel Drive	Signage and wayfinding (beyond SPO improvements)	Primary
7	Stormwater management	17th Ave and park and ride lot	Green infrastructure (beyond SPO improvements)	Primary
8	Public Art	Along 17th Ave (at Excelsior Blvd and south roundabout)	Monument/art (beyond SPO improvements)	Primary
9	Public Plaza	South end of Park and Ride	Includes paving, seating, plantings, lighting, and signage (beyond SPO improvements)	
10	Sanitary Sewer	Along 17th Ave/varies	Construct 8-inch minimum sanitary sewer in conjunction with roadway construction	Primary
11	Water	Along 17th Ave (LRT station to just north of K-Tel Drive)	Construct 10-inch minimum water main in conjunction with roadway reconstruction/construction	Primary

TABLE 12-3. SOUTHWEST LRT LOCALLY REQUESTED BETTERMENTS - OPENING DAY STATION AREA IMPROVEMENTS

PLAN KEY	IMPROVEMENT	PROJECT LOCATION	PROJECT NOTES
<b>B1</b>	Roadways	New street- 17th Ave, from LRT station to K-Tel Drive	Includes roadway, sidewalk, bike lanes, tree plantings, streetscape furnishings, lighting and ped crossing improvements
<b>B2</b>	Streetscape	Along 17th Ave, between Excelsior Blvd and K-Tel Drive	Includes enhanced plantings, streetscape furnishings, lighting and ped crossing improvements (beyond SPO improvements)
<b>B3</b>	Sidewalk/Trail	K-Tel Drive south to Opus Station connection	Construct trail on west side of LRT tracks
<b>B4</b>	Park and Ride	North of Station Platform	Change from 500 surface spaces to 250 surface and 250 structured spaces



FIGURE 12-13. SOUTHWEST LRT ANTICIPATED BASE PROJECT SCOPE - OPENING DAY STATION AREA IMPROVEMENTS

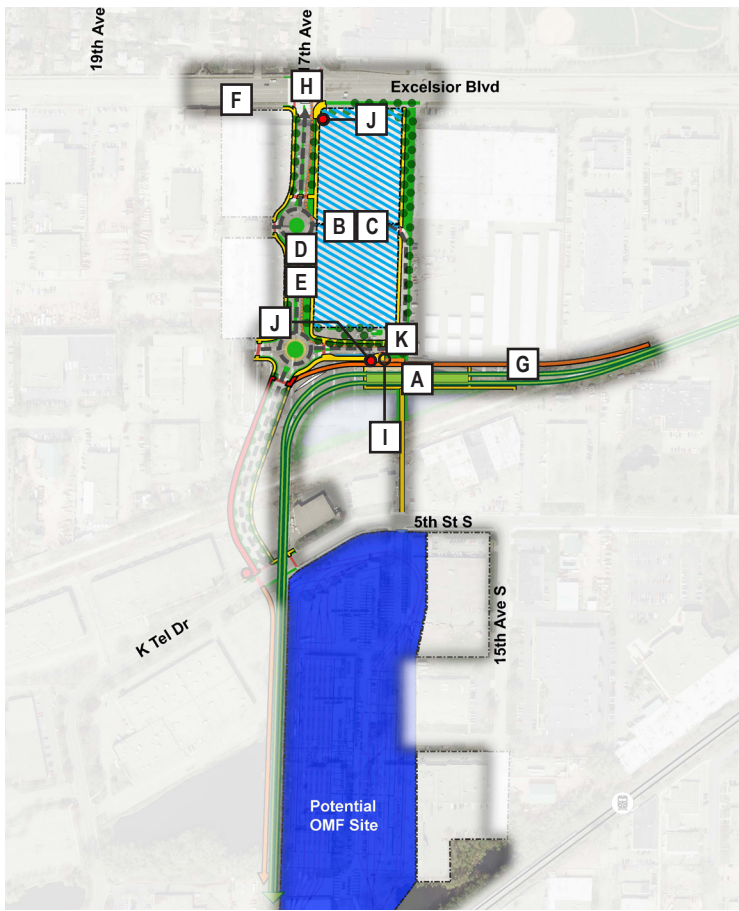
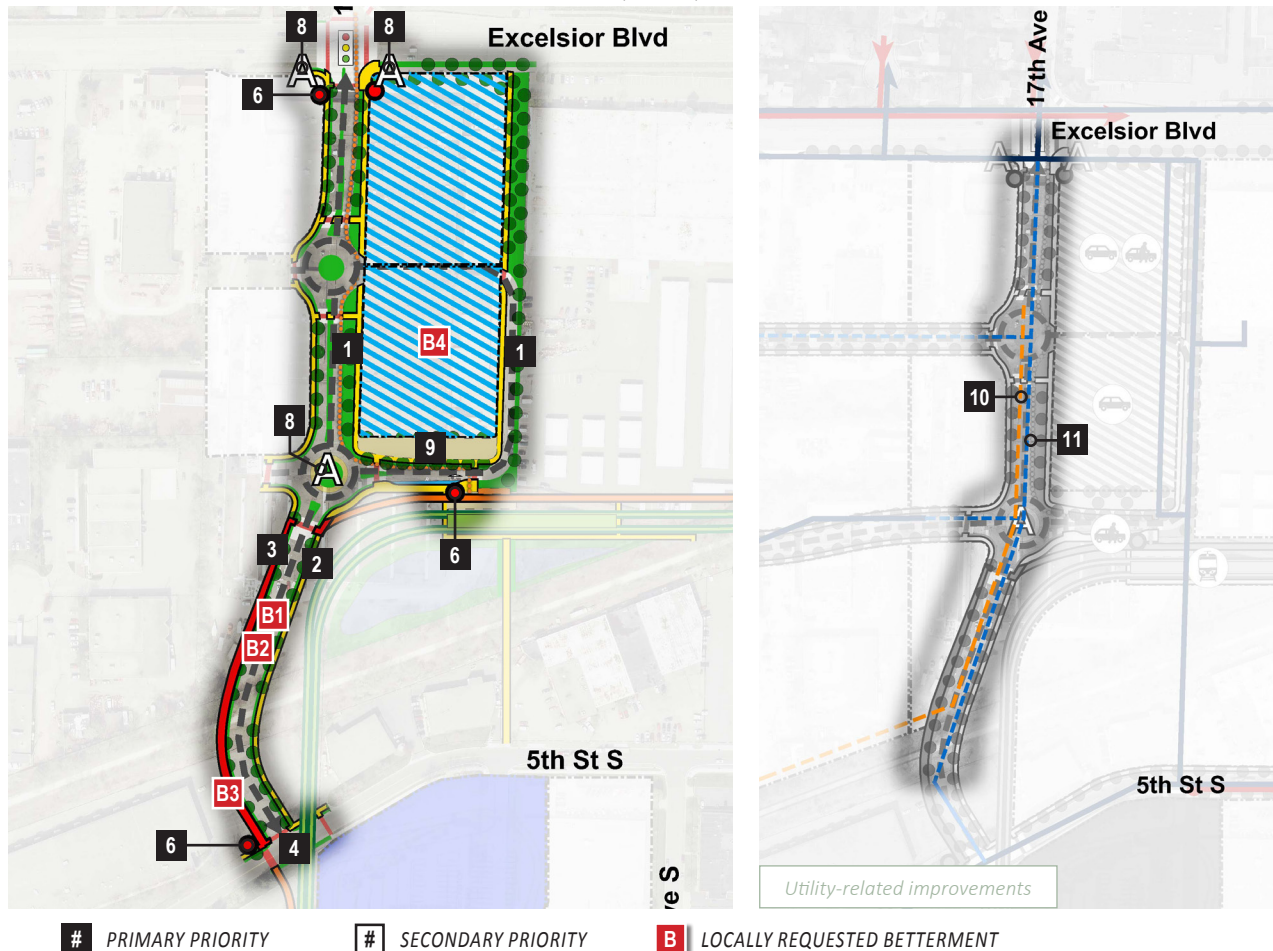


FIGURE 12-14. SW CORRIDOR INVESTMENT FRAMEWORK (TSAAP) - OPENING DAY STATION AREA IMPROVEMENTS + BETTERMENTS



# Development Potential

## OVERVIEW

The Shady Oak station area consists almost entirely of older, low-rise industrial properties. It has very few residents living within the 10-minute walk shed. Significant new connections need to be made to even access the station, as there is no public access to the proposed station platform location. Despite these obstacles, opportunities for redevelopment potential in the Shady Oak station area do exist.

Land acquisition necessary to extend 17th Avenue from Excelsior Boulevard to K-Tel Drive presents opportunities to redevelop properties along the new roadway. Other sites, northwest of the station location, along Excelsior Boulevard and Shady Oak Road, may also be ready for redevelopment in the short- to mid-term.

Key challenges that should be addressed to facilitate development potential include land uses, block sizes, limited station access and visibility, environmental cleanup, site preparation, and proximity of the Operations and Maintenance Facility (OMF) location.

## LAND USES

Higher density, commercial/retail, office, residential, and light industrial development are likely to occur near the Shady Oak station, with more commercial and residential uses expected west of 17th Avenue and more office/light industrial uses expected east of 17th Avenue and south of the station.

## PLANNING STRATEGIES

Several strategies should be addressed to facilitate future development in the station area. The large block sizes and lack of public station access create major challenges. Redevelopment should seek opportunities to introduce a finer grain of streets and block sizes to enhance station mobility and set up a framework for more compact, transit-oriented development. In the short-term, new sites opened up as a result of land acquisition necessary to extend 17th Avenue from Excelsior Boulevard to K-Tel Drive will trigger development interest near the station. A park and ride facility is expected along the east side of 17th Avenue, just north of the station platform. Consider joint development opportunities to create a park and ride ramp with a development wrapper facing Excelsior Boulevard and 17th Avenue.

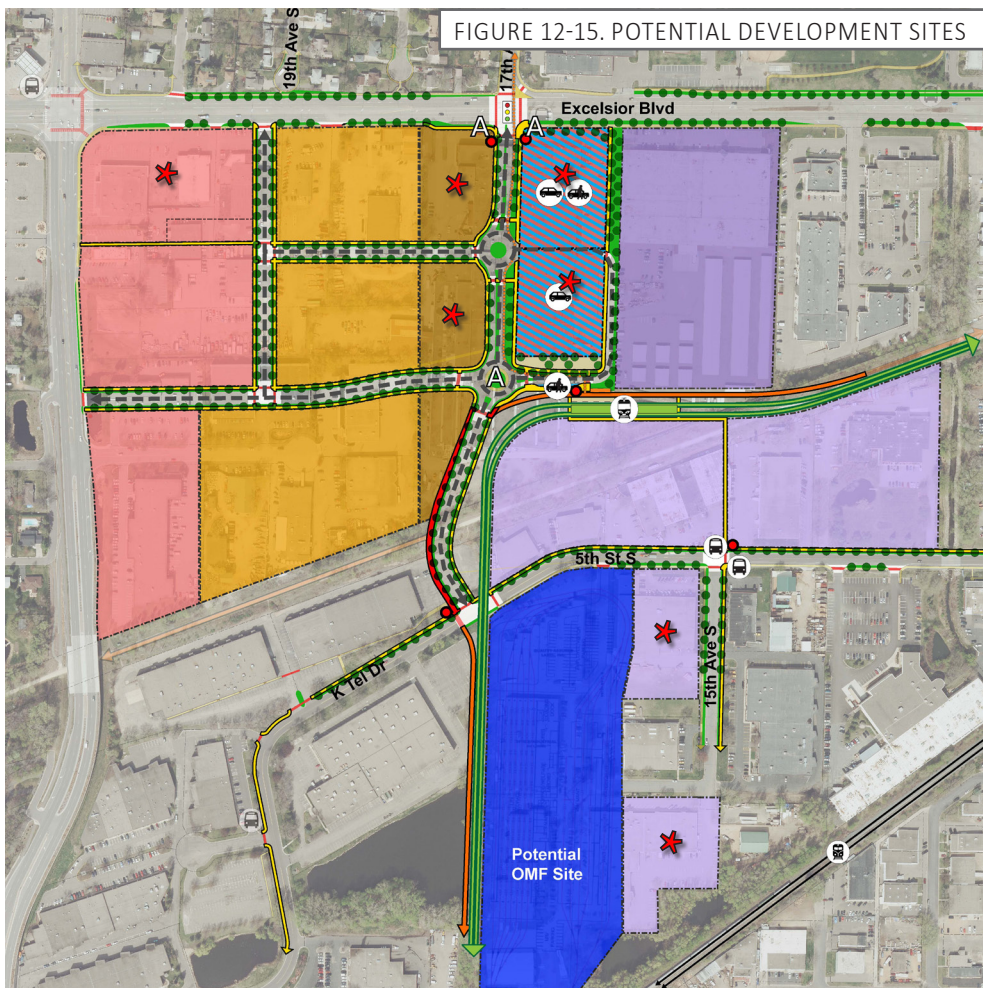


FIGURE 12-15. POTENTIAL DEVELOPMENT SITES

**FUTURE LAND USE:**

- MULTI-FAMILY
- RETAIL & OTHER COMMERCIAL
- MIXED-USE RESIDENTIAL
- MIXED-USE INDUSTRIAL
- \*
 OPENING DAY DEVELOPMENT POTENTIAL



# Key Considerations for Change and Development Over Time

The evolution of station area over time should focus on the establishment of a more walkable environment with an increase in amenities for area employees. Key considerations should include:

## BUILT FORM AND LAND USE

- » Introduce a greater mix of uses, encourage higher densities and provide active street level uses along 17th Avenue and 5th Street in order to support transit ridership and make it easier for employees to access food and other services without having to drive.
- » Design new buildings to enhance pedestrian access by orienting them towards the street and locating them as close to the street line as possible.
- » Design the OMF to contribute to the character and pedestrian-friendliness of the district by locating active uses such as office and cafeteria space along 5th Street where they can contribute to the animation and safety of the street.
- » Ensure that the design of the park and ride facility preserves opportunities for new development and incorporates active uses at street level that can animate the station area.
- » Locate and orient the new park and ride so that it establishes a strong visual connection between the station and Excelsior Boulevard to the north.

## PUBLIC REALM

- » Introduce a public plaza adjacent to the station to provide spill-out space for active uses facing the station and act as a receiving point for passengers walking to the station or transferring to the LRT by bus, bike, or car.
- » Restrict outdoor storage within the station area so that it does not detract from the image of the area or discourage new higher density employment uses.
- » Initiate intersection improvements at Excelsior Boulevard and 17th Avenue to improve safety for pedestrians walking between the station and Downtown Hopkins to the north.

## MOBILITY

- » Align new roads where they can help to support the creation of a walkable street and block pattern over time including an extension of 17th Avenue to K-Tel Drive and extension of 47th street east to the station.
- » Support pedestrians through the introduction of sidewalks on all streets within the station area, new crossings, and curb cuts for people in wheel chairs or other mobility devices.
- » Accommodate retail and short-term parking on-street or in shared parking facilities to minimize the construction of single-use parking areas.

- » Minimize the impact of parking and circulation on pedestrians by locating parking below grade or to the rear or side of new buildings, and consolidating access and service drives.
- » Limit vehicular access points along Excelsior Boulevard and Shady Oak Road.



More intense office/light industrial use



More intense office use



New commercial along Shady Oak Road

## Station Area Utility Plan

### OVERVIEW

The station area utility plan and strategies recommended below were developed by considering future transit-oriented development within the station area, as depicted by the Station Area Improvements plan (Figure 12-9). Hopkins and Minnetonka will need to apply these localized recommendations to their city wide systems to ensure that the potential development/redevelopment will not be limited by larger system constraints. Existing models or other methods can be used to check for system constraints in the station areas.

Hopkins and Minnetonka should also consider reviewing the condition of the existing utilities in the station development area. The station construction would provide Hopkins and Minnetonka an opportunity to address any utilities needing repairs. Once the larger system has been reviewed for system constraints, Hopkins and Minnetonka will be able to accurately plan for necessary utility improvements in their respective Capital Improvement Programs (CIPs). All utilities located beneath the proposed LRT rail or station platform should be encased prior to the construction of these facilities. The cost associated with encasing these facilities is assumed to be a project cost and is not included in potential improvements identified for the cities' CIPs.

### APPROACH

Utility improvement strategies are outlined in this report for the ultimate station area development (2030), as well as improvements which should be considered prior to opening day anticipated in 2018. Although recommendations are categorized in one of these two timeframes, Hopkins and Minnetonka should weigh the benefits of completing more or less of these improvements as land becomes available for future development. Hopkins and Minnetonka should take the utility analysis a level further and model future utilities in their city utility system models.

The proposed development and redevelopment areas were evaluated based on Metropolitan Commission Sewer Availability Charge (SAC) usage rates and estimated flows. Estimated flows for one possible development scenario in this area indicate that internal to the station area, no more than eight inch pipe are necessary to serve the mix of proposed and existing development. Each utility system should still be reviewed to identify capacity and demand constraints to the larger system associated with increase in flows from the proposed developments and existing developments in the area. Hopkins and Minnetonka should anticipate the construction of new municipal utilities in conjunction with new or realigned roadways.

### GENERAL RECOMMENDATIONS - SANITARY SEWER

Sanitary sewer recommendations for station area improvements include opportunities for Hopkins and Minnetonka to improve the existing sanitary sewer network, without necessarily replacing existing sanitary sewers. When recommendations for "improving" existing sanitary sewer are noted, Hopkins and Minnetonka should consider the level to which each specific sewer should be improved. Methods of improvement could include: lining the existing sewer, pipe joint repair, sewer manhole repair, relocation, and complete replacement.

The following items should be evaluated prior to opening day of the station, although action may not be required until necessary for development:

- » Televising existing sewer mains in the station area and proposed development area to determine the condition of the sewer mains, susceptibility for backups or other issues and evaluate for Infiltration and Inflow (I&I).
- » Locations of known I&I. If previous sewer televising records, city maintenance records, or an I&I study have shown problems, the cities should consider taking measures to address the problem.
- » The age and material of existing gravity and/or forcemain sanitary sewer in the identified station area. If the lines are older than the material's typical design life or materials which are susceptible to corrosion relative to soils in the area, the city should consider repairing, lining or replacing the mains.
- » Locations of known capacity constraints or areas where city sewer models indicate capacity issues. If there are known limitations, the city should further evaluate the benefit of increasing pipe sizes.
- » City sewer system models (existing and future). A review of these models with future development would assist Hopkins and Minnetonka in determining if sewers in the project area should be increased to meet existing or future city system needs.
- » Existing sewer pipes should be relocated or encased in areas where they cross or are immediately adjacent to the LRT line/station.



## GENERAL RECOMMENDATIONS - WATER MAIN

Water main recommendations for station area improvements also include opportunities for Hopkins and Minnetonka to improve the existing water system network. Creating loops in the network can help prevent stagnant water from accumulating along water main stubs, and creating loops of similar sized water main provides the cities a level of redundancy in their water networks. Redundancy helps reduce the impacts to the community during system repairs, and also helps stabilize the pressure in the network.

The following items should be evaluated prior to opening day of the station, although action may not be required until necessary for development:

- » The age and material of the existing mains in the identified station area. If the mains are older than the materials typical design life or materials which are susceptible to corrosion relative to soils in the area, the cities should consider replacing the main.
- » Locations of previous water main breaks. If water main breaks repeatedly occur in specific areas, the city should consider replacing or repairing the main.
- » Locations with known water pressure issues or areas where city models indicate low pressure. If there are known limitations (for either fire suppression or domestic uses), the cities should further evaluate the benefit of increasing main sizes.
- » Locations with known or potential water quality issues. If there are mains known to be affecting the water quality (color, taste, odor, etc.) of their system, Hopkins and Minnetonka should consider taking measures to address the problem affecting water quality.
- » City water system models (existing and future). A review of these models with future development would assist Hopkins and Minnetonka in determining if mains in the project area should be improved to meet existing or future city system needs based on demand constraints.
- » Existing water main pipes should be relocated or encased in areas where they cross or are immediately adjacent to the LRT line/station.

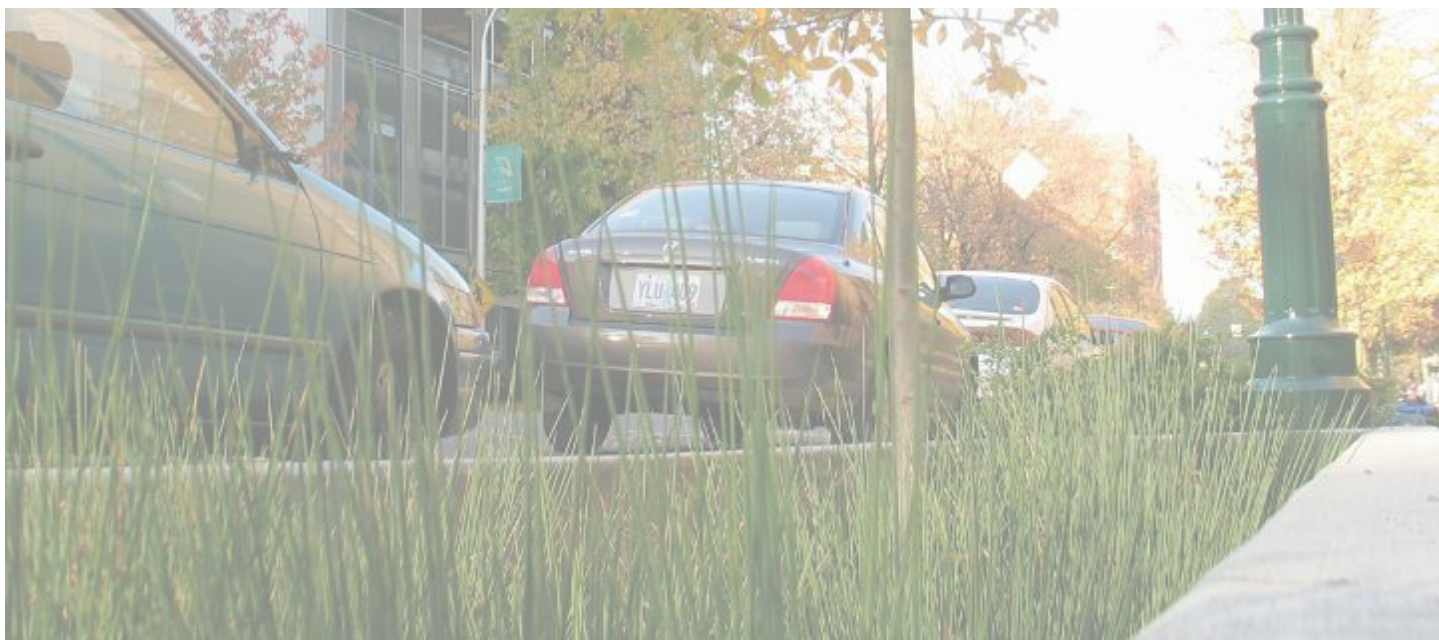
## GENERAL RECOMMENDATIONS – STORM SEWER

Local storm sewer improvements are recommended to be completed in conjunction with other improvements in the station area. Improvements which will likely require storm sewer modifications include: roadway realignments, roadway extensions, and pedestrian sidewalk/street scape improvements. Storm sewer improvements may consist of: storm sewer construction, manhole reconstruction, drain tile extensions, storm sewer relocation, and complete replacement. These local storm sewer improvements are included as part of the overall cost of roadway and streetscape improvements recommended in this plan. Where roadway/streetscape improvements are part of the Southwest LRT anticipated base project scope, associated storm sewer improvements are assumed to be a project cost. Hopkins and Minnetonka should also consider coordinating with the local watershed district and other agencies to review the condition of and capacity of existing trunk storm sewer systems serving more regional surface water needs.

## STORMWATER BEST MANAGEMENT PRACTICES

There are numerous stormwater best management practices (BMPs) that can be used to address stormwater quality and quantity. As part of this project, BMP guides were developed for four stations (Royalston, Blake, Shady Oak, and Mitchell) which exemplify the range of development intensity and character in the urbanized environment along the Southwest LRT Corridor. The recommendations and practices identified in each of the four BMP guides are applicable to various stations along the corridor.

The following section (starting on p. 12-24) includes a detailed stormwater analysis, stormwater management scenario, and BMP guide for Shady Oak station. These BMPs may also be applicable to the station areas at Opus and Golden Triangle. Cities should consider incorporating these practices where appropriate as development/redevelopment occurs.



## Station Area Utility Plan (Continued)

### STATION AREA UTILITY RECOMMENDATIONS

Utility recommendations (illustrated in Figure 12-17) are based on a localized analysis of proposed development. It is recommended that Hopkins and Minnetonka take this analysis a step further and review system constraints to the existing and future sanitary sewer and water main systems using existing sewer CAD or water CAD models, or other methods of modeling these systems.

#### *Opening Day Recommendations:*

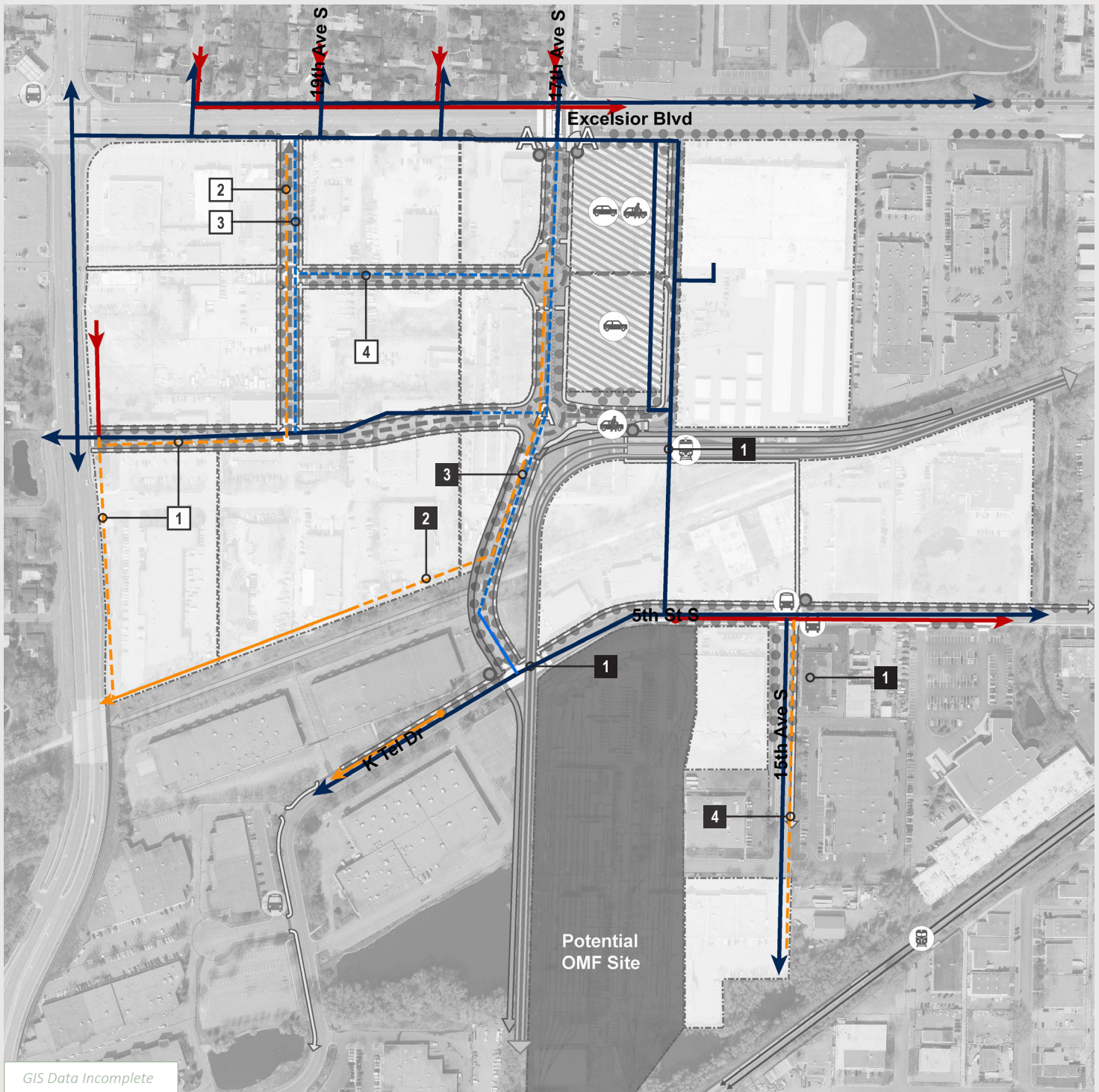
1. Encase existing water main crossing the LRT rail construction.
2. Extend 8-inch minimum sanitary sewer along trail corridor and extension of 17th Avenue S. in conjunction with roadway construction.
3. Construct 10-inch minimum water main in conjunction with reconstruction of 17th Avenue S.
4. Construct 8-inch minimum sanitary sewer in conjunction with reconstruction of 17th Avenue S.

#### *Long-Term Recommendations:*

1. Relocate existing sanitary sewer to promote transit-oriented development in conjunction with reconstruction of W. 47th Street.
2. Construct 8-inch minimum sanitary sewer in conjunction with construction of new street paralleling 17th Avenue S. Extension.
3. Construct 8-inch minimum water main in conjunction with construction of new street paralleling 17th Avenue S. Extension.
4. Construct 8-inch minimum water main in conjunction with construction of new street paralleling Excelsior Boulevard.



FIGURE 12-16. STATION AREA UTILITY PLAN



WHERE ARE WE GOING?

SHADY OAK

# OPENING DAY RECOMMENDATION

# LONG-TERM RECOMMENDATION

— EXISTING UTILITIES

- - - PROPOSED UTILITIES

— SERVICE SANITARY

— LOCAL SANITARY

— TRUNK SANITARY

— MCES SANITARY INTERCEPTOR

— SANITARY SEWER FORCEMAIN

■ LIFT STATION

— SERVICE WATER MAIN

— LOCAL WATER MAIN

— TRUNK WATER MAIN

● WATER TOWER

# Stormwater Management Recommendations

## INVENTORY

The Shady Oak station area is within Nine Mile Creek Watershed District. Station location lies about 1,600 feet west of the North Branch of Nine Mile Creek which ultimately flows to the Minnesota River. Station location is in the headwaters area of the North Fork. Nine Mile Creek is a State of Minnesota protected watercourse. The Watershed District has no proposed CIP projects within the station area or along the creek in areas near the station.

Nine Mile Creek is listed as impaired because of chloride levels as well as having impaired biota due to low fish Index of Biotic Integrity scores. A completed TMDL for chloride recommends a 62% reduction in chloride loading to the creek.

## CONSTRAINTS:

### *Impaired Waters*

Discharging within one mile of an impaired water may trigger additional Minnesota Pollution Control Agency NPDES (National Pollution Discharge Elimination System) requirements which require additional stormwater management. For impaired waters where a TMDL (Total Maximum Daily Load) has been approved, these requirements may increase further.

### *Floodplain*

The City of Hopkins participates in the National Flood Insurance Program.

Mapped FEMA floodplains exist along the creek, the majority of which are located immediately adjacent to the creek. For any developable areas within the floodplain, zoning requirements may limit development/redevelopment potential. In addition, there are numerous wetlands that create non-regulatory floodplain which must be considered during development/redevelopment near the station area.

### *Contamination*

Unspecified soil contamination may limit the use of some stormwater practices if remediation activities are not feasible. Three unpermitted dump sites are identified in the EIS.

### *Soils*

The majority of the soils in the 10-minute walk zone have been identified as hydrologic group A or B which typically allow for infiltration of stormwater. A portion of the soils are identified as Urban due to large amounts of previous development and fill.

### *Stormwater Management*

Key concept: decrease the “flashiness” of the creek and increase the amount of baseflow during dry periods. This may be accomplished by reducing peak stormwater discharges and volumes by encouraging retention and volume control. Increasing creek baseflow during dry periods will allow for improved aquatic life characteristics.

Nine Mile Creek Watershed District Rules: If a redevelopment project disturbs more than 50% of the existing impervious surface or the project will increase the imperviousness of the entire parcel by more than 50 percent, then the entire parcel is subject to the stormwater criteria below. Otherwise the criteria below only applies to the disturbed areas and additional impervious surface.

The watershed rules stipulate:

1. On-site retention of one inch of runoff from impervious surfaces;
2. Limit peak flow rates for the 2, 10, and 100-year rainfall events; and
3. Provide that all runoff from the 2.5-inch rainfall be routed through a treatment system capable of removing 60% phosphorus and 90% total suspended solids from the runoff.

## STORMWATER MANAGEMENT CALCULATION:

Total redevelopment area is approximately 90 acres. The 90 acres can be categorized into 3 groups; station improvements, ROW improvements, and individual site redevelopment. The following is the breakdown by area. Note this breakdown is highly variable depending on the timeline of ROW and individual site redevelopment.

- » Station improvements (park and ride, LRT platform, OMF Site) – 21 acres
- » ROW improvements – 11 acres
- » Individual site redevelopment – 58 acres

Based on Nine Mile Creek Watershed District Rules (March 2008) shown above, these areas will need to provide stormwater management to meet volume control, rate control, and pollutant removal requirements.

### *Volume Control*

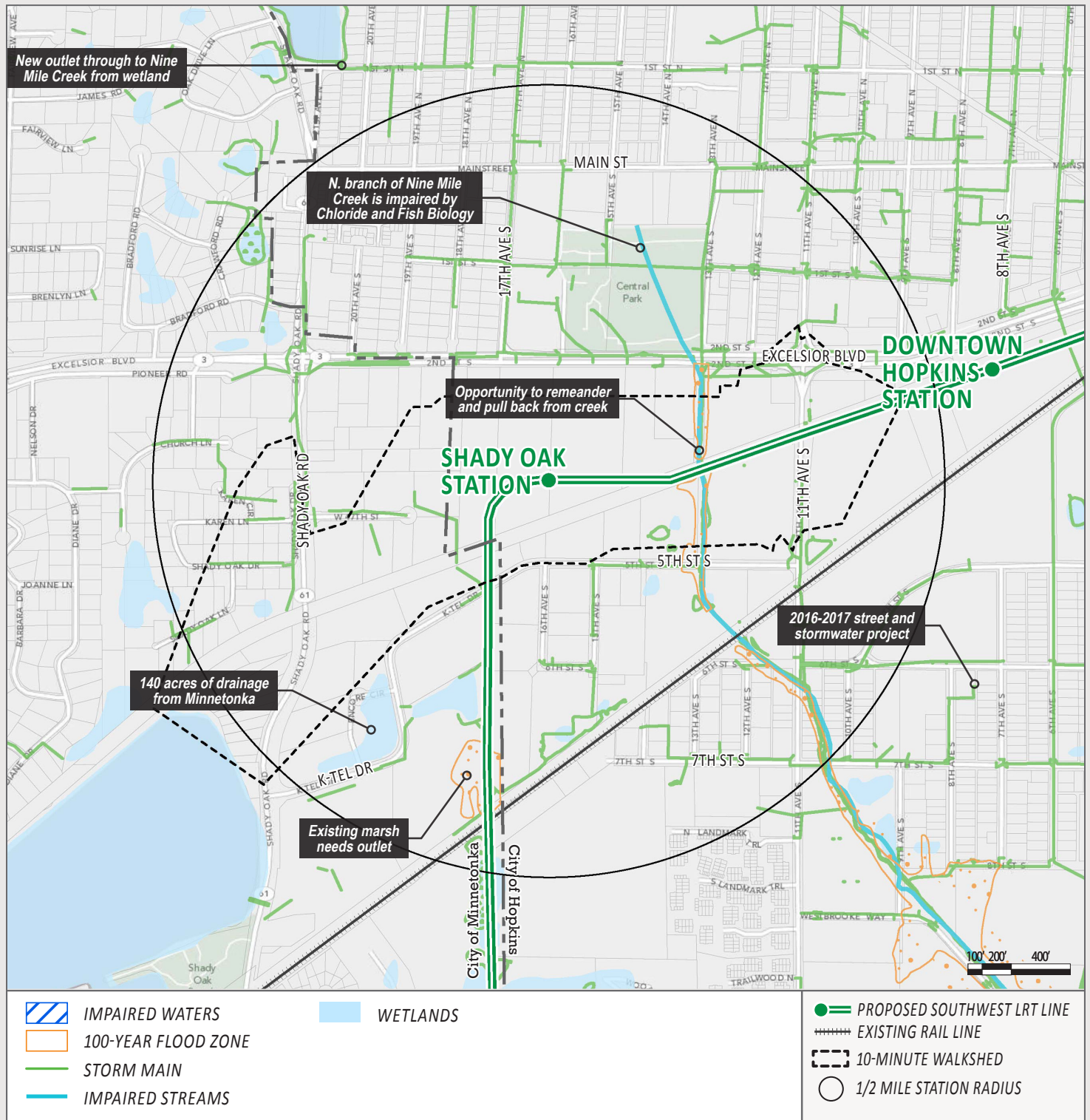
Volume control will need to be provided for the majority of the 90 acres estimated to redevelop. The one exception being, approximately 4 acres of ROW on 5th Street and 15th Avenue are anticipated to qualify as a linear project. Assuming there is less than one acre of new impervious, this area would qualify for exemption from the volume control requirement.

The following impervious coverages are assumed for the different types of redevelopment. These numbers are highly variable depending on the type and configuration of development that occurs.

- » Station improvements (park and ride, LRT platform, OMF Site) – 75% (15.7 acres)
- » ROW improvements – 55% (6.1 acres)
- » Individual site redevelopment – 65% (37.7 acres)



FIGURE 12-17. EXISTING STORMWATER



WHERE ARE WE GOING?

SHADY OAK

# Stormwater Management Recommendations (Continued)

Using the assumed impervious coverages, the following volume control is anticipated to be required:

$$15.7 \text{ acres} \times \frac{1 \text{ inch}}{12 \text{ in/ft}} + 6.1 \text{ acres} \times \frac{1 \text{ inch}}{12 \text{ in/ft}} + 37.7 \text{ acres} \times \frac{1 \text{ inch}}{12 \text{ in/ft}} = 5.0 \text{ Acre Feet}$$

### Pollutant Removal

Based on redevelopment of 90 acres, it is estimated that 60% reduction of total phosphorus would result in an annual reduction of 54 pounds of phosphorus. It is anticipated that the 60% total phosphorus removal and 90% total suspended solids removal for the 2.5 inch rainfall will be met through the combination of volume control best management practices and the pretreatment that will be utilized with these systems. Volume control is likely to be a viable option in most locations, however some areas may require contamination remediation if infiltration is desired for volume control. If remediation is not feasible the use of filtration may be needed to treat stormwater.

### Rate Control

Rate control is not anticipated to be a controlling requirement given the high amount of existing impervious coverage on redevelopment areas (approximately 90%) and the need to provide volume control and pollutant removal. As a result, proposed discharge rates are anticipated to be significantly less than existing discharge rates.

### EXAMPLE STORMWATER MANAGEMENT SCENARIO:

Figure 12-19 shows a possible stormwater management scenario for meeting the Nine Mile Creek Watershed District and MPCA NPDES redevelopment requirements. The scenario below has been developed to meet the stormwater volume control requirement of 5.0 acre feet and/or 54 pounds of phosphorus annually.

The following BMPs are considered in this scenario:

**Enhanced Media Filter:** Two locations for enhanced media filter are shown. One enhanced media filter would be on the 14 acre redevelopment site west of the proposed LRT platform and one on the 7 acre redevelopment site north of the proposed OMF site. It is anticipated that these two systems will be regional stormwater treatment facilities and treat approximately two

acre feet of stormwater runoff volume.

**Runnel Filter Pools:** One location to implement runnel filter pools is shown east of the park and ride area and extending along the north side of the trail. It is anticipated that this system will treat approximately half an acre foot of stormwater runoff volume.

**Landscape Filters:** Landscape filters are currently shown throughout the redeveloping area. These stormwater filters will be used to collect and treat stormwater prior to discharge downstream into additional stormwater facilities. These systems will be used primarily as pretreatment to the other best management practices.

**Underground Storage & Reuse:** A large detention structure is shown under the park and ride area. This area may be used to store, infiltrate, and irrigate landscape features. It is anticipated that this regional underground system will treat approximately two acre feet of stormwater runoff volume. Structure should be located to be compatible with future redevelopment.

**Permeable Pavement:** Permeable pavement is shown on the park and ride lot. It is possible that only the parking stalls would be pervious to reduce maintenance concerns. This BMP will reduce the impervious footprint by approximately 2 acres which will reduce the required stormwater treatment volume by approximately 0.2 acre feet.

**Green Roof:** A portion of the roof for the OMF Site is shown as a green roof. This will reduce the impervious footprint by up to 6 acres which will reduce the required stormwater treatment volume by approximately 0.4 acre feet.

Table 12-3 below summarizes the costs and stormwater management information related to each BMP shown in the example scenario. These numbers are highly variable based on conditions at the time of redevelopment, some of which include ultimate BMP location, size, elevation, soil type, contamination, development features, and other unknown conditions at this time. It is important to note that storm sewer to collect and convey stormwater is included in the cost estimate for street improvements and therefore is not included in the cost estimate below to avoid duplication.

TABLE 12-4. STORMWATER MANAGEMENT SCENARIO - COST SUMMARY

BEST MANAGEMENT PRACTICE (BMP)	DRAINAGE AREA (ACRES)	VOLUME RESTRICTION (AF)	ANNUAL TOTAL PHOSPHORUS REDUCTION (LBS)	SIZE OF BMP	COST OF BMP (\$/UNIT)	TOTAL COST (\$)
Enhanced Media Filter	44	2	31	6000 CY	\$75/CY	\$450,000
Runnel Filter Pools	10	0.5	4	1800 LF Runnel	\$100/LF	\$180,000
Landscape Filters	11	Pretreatment	4	200 Filter Boxes	\$1,000/Box	\$200,000
Underground Storage & Reuse	16	2	14	85,000 CF	\$10/CY	\$850,000
Permeable Pavement	3	0.2	3	10,000 SY	\$30/SY*	\$300,000
Green Roof	6	0.4	0	15,000 SY	\$25/SY**	\$375,000
<b>TOTAL</b>	-	<b>5.1</b>	<b>56</b>	-	-	<b>\$2,355,000</b>

\* More than standard parking lot section

\*\* Highly variable depending on increase in structural load capacity



FIGURE 12-18. STORMWATER MANAGEMENT SCENARIO



STORMWATER BEST MANAGEMENT PRACTICES:

- |   |                       |   |                               |
|---|-----------------------|---|-------------------------------|
|  | ENHANCED MEDIA FILTER |  | UNDERGROUND STORAGE AND REUSE |
|  | RUNNEL FILTER POOLS   |  | PERMEABLE PAVEMENT            |
|  | LANDSCAPE FILTERS     |  | GREEN ROOF                    |

WHERE ARE WE GOING?

SHADY OAK



## Stormwater Management Recommendations (Continued)

### ADDITIONAL OPPORTUNITIES:

- » Pull urban development back from the banks of Nine Mile Creek creating buffer areas or naturalized treatment areas. In addition, re-meander and naturalize the straightened portion of the creek.
- » Hopkins planned 2016 to 2017 street projects occur on the southeast fringe of the station impact area. In most cases where street reconstruction takes place, storm sewer facilities either need to be upgraded or updated.
- » A new outlet is needed for marsh along railroad. In addition, a new outlet for wetland outside the station impact area (to the northwest) must make it through to Nine Mile Creek.
- » The watershed district has a volume banking program which allows projects to exceed required volume reduction with the intent of using credits for future projects where volume reduction is not as easily obtained.
- » Redevelopment around the station area should emphasize BMPs for reducing chloride discharged to the creek. Individual properties should use de-icers sparingly and alternatives to de-icing should be considered with each development proposal.

## Stormwater Best Management Practices (BMP) Guide

The following section summarizes the key features and design considerations related to each of the stormwater best management practices recommended for the Shady Oak station area.

*NOTE: These BMPs may also be applicable to the station areas at Opus and Golden Triangle. Cities should consider incorporating these practices where appropriate as development/redevelopment occurs.*







### ENHANCED MEDIA FILTER

#### Features

- » Treatment provided by filtering stormwater
- » Enhanced treatment, to target dissolved pollutants, can be achieved by adding iron filings or spent lime to the filtration media
- » Allows for dissolved pollutant removal without infiltration (may be necessary in or near contaminated areas)

#### Design Considerations

- » Free draining system is necessary to achieve desired pollutant removal
- » Plant with vegetation that tolerates enhanced media
- » Regular maintenance will be needed to ensure functioning filter
- » Valves can be incorporated to verify system functionality



### RUNNEL FILTER POOLS

#### Features

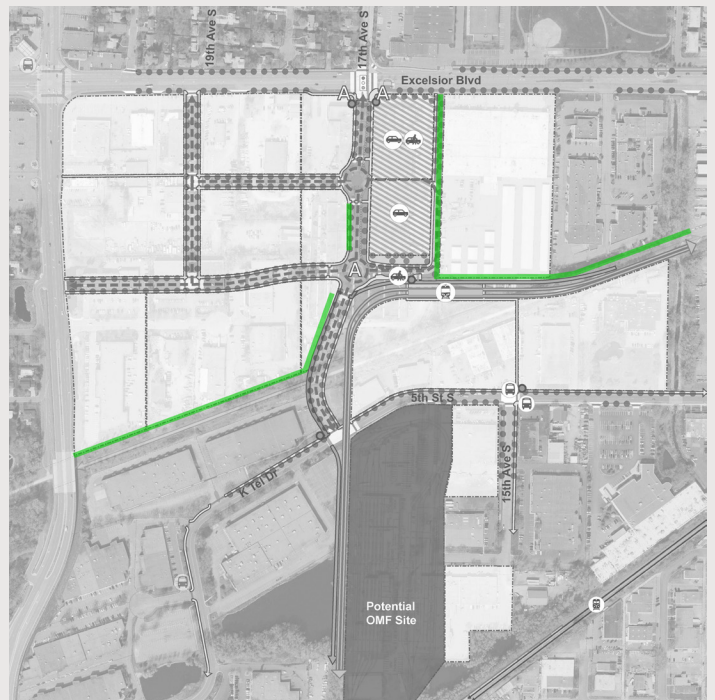
- » Treats stormwater as an amenity – does not hide stormwater underground
- » Collects and conveys stormwater while providing treatment – may reduce amount of storm sewer required
- » Retains stormwater to reduce peak flows
- » Can be constructed with any combination of rock, pavers, vegetation, etc.

#### Design Considerations

- » In-situ soils determine infiltration potential
- » Regular maintenance of filtration/infiltration areas will be needed
- » Can be connected to other stormwater BMPs (i.e. tree boxes, biofiltration cells)
- » Valves can be incorporated to verify system functionality



POSSIBLE AREAS FOR IMPLEMENTATION



POSSIBLE AREAS FOR IMPLEMENTATION





## UNDERGROUND STORAGE & REUSE

### Features:

- » Large detention capacity for reducing peak flows and providing treatment
- » Volume reduction by reusing stormwater to irrigate trees and green spaces
- » Can be used with or without reuse depending on irrigation demand
- » No land needed as storage is underground
- » Reduce potable water needed for washdown or in buildings (toilets)

### Design Considerations:

- » Green space to be irrigated should be in close proximity to storage reservoir
- » Size of green space will reflect treatment, the larger the green space the more treatment potential
- » Requires large underground volume free of utilities that is above groundwater and bedrock

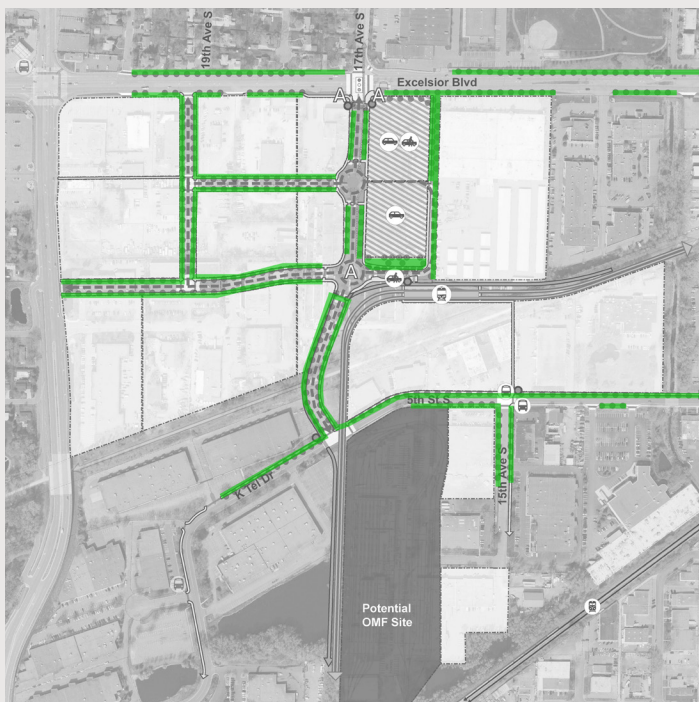
## LANDSCAPE FILTERS

### Features:

- » Volume control through infiltration and vegetative uptake
- » Treatment by filtration and infiltration
- » Detention capacity to reduce peak flow rates
- » Irrigation of aesthetic landscaping features
- » Minimal footprint

### Design Considerations:

- » In-situ soils determine infiltration potential
- » Periodic maintenance of underground filter system will be required to ensure performance



POSSIBLE AREAS FOR IMPLEMENTATION



POSSIBLE AREAS FOR IMPLEMENTATION





### PERMEABLE PAVEMENT

#### Features

- » Multiple types of permeable pavements; bituminous, concrete, and pavers
- » Provides volume control by reducing impervious surface
- » Treats stormwater using filtration and infiltration

#### Design Considerations

- » In-situ soils beneath pavement will control infiltration potential
- » Special vacuum truck required to maintain pavement surface
- » ADT criteria, low traffic preferred
- » Parking bumpouts as pervious area



### GREEN ROOFS

#### Features

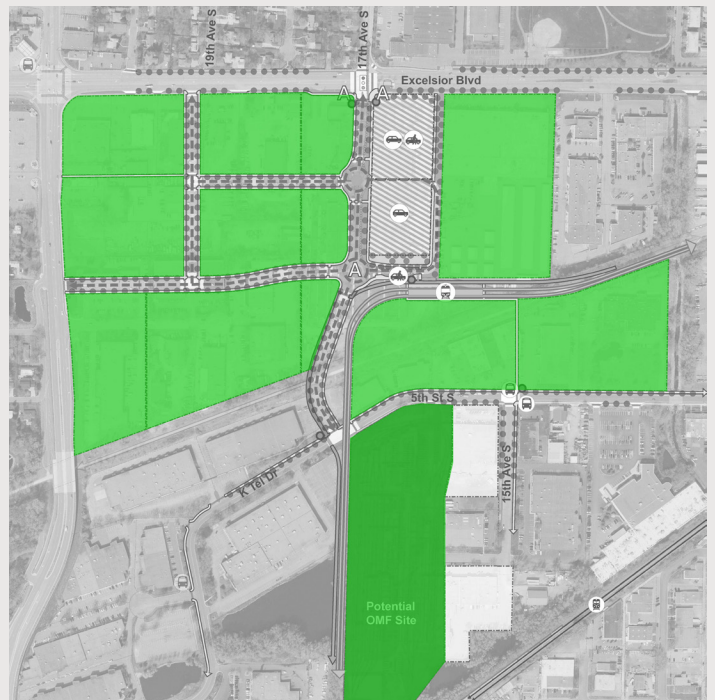
- » Treats stormwater through filtration and vegetative uptake
- » Reduces runoff rates by retaining stormwater in roof landscaping features
- » Reduces thermal stormwater impacts
- » No land is needed as roof is utilized

#### Design Considerations

- » Buildings may require additional structural design considerations
- » Vegetation will need to withstand direct sunlight all day
- » Supplemental irrigation may be needed
- » Only receives direct rainfall area, no additional tributary area unless pumping is incorporated



POSSIBLE AREAS FOR IMPLEMENTATION



POSSIBLE AREAS FOR IMPLEMENTATION

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