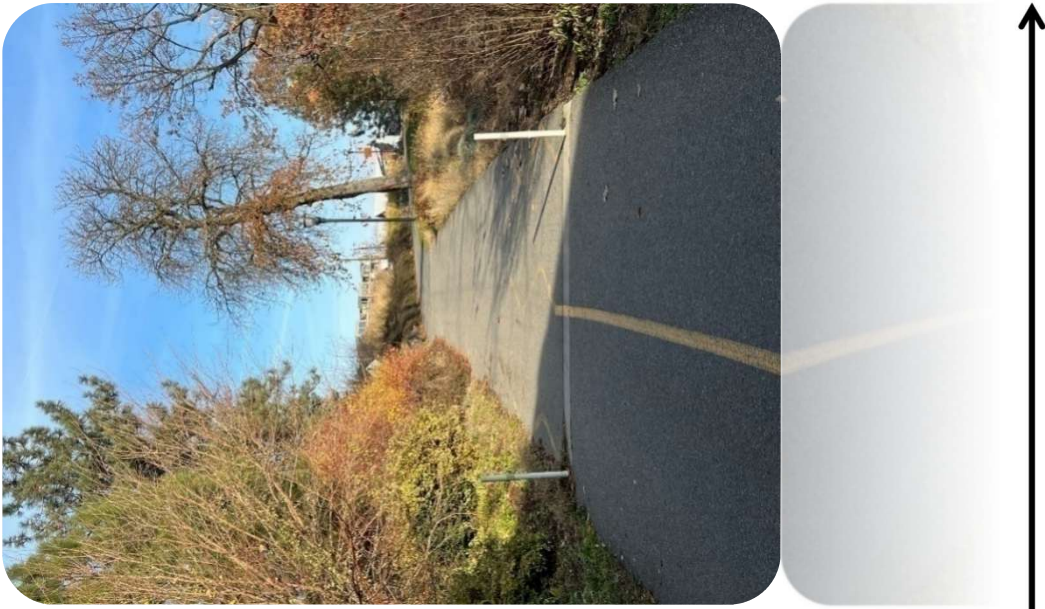


CHAPTER 5

MULTIMODAL

DISCUSSION

73 of 235



Chapter 5

This section summarizes the multimodal review. Presented are a discussion of bike, pedestrian, and transit conditions within the City with recommendations for improvement.

5.1 ACTIVE TRANSPORTATION

The goals and policies presented with Section 2 strongly focus on improving active mobility and transit networks via application of bike lanes, shared use paths, trails, separated sidewalks, and transit connections. Multimodal solutions offer a cost-effective option to single-occupancy vehicle use. They are key to helping cities like Medical Lake promote small-town values, improve health, and improve livability.

SIDEWALK

Research provided with *Economic and Health Benefits of Walking, Hiking, and Bicycling on Recreational Trails in Washington* (Washington Recreation and Conservation, 2019) found the presence of sidewalk is the chief factor in determining a person's willingness to walk. There is a lack of continuity regarding sidewalk along arterials and collectors. This can be detrimental to active mobility in the City. The lack of sidewalk is a theme in the older, developed areas of the County overall, and not just Medical Lake. Past agency standards did not consistently require sidewalks, so they were not provided on many streets, historically.

The *Pedestrian Safety Guide and Countermeasure Selection* guide of the Federal Highway Administration (FHWA) shows the types of sidewalks needed in varied transportation and land use settings. Guidance is shown with **Table 5.1** below.

Roadway Classification and Land Use	Sidewalk/Walkway
Rural Highways (< 400 ADT)	Shoulders preferred, with minimum of 0.9 m (3 ft).
Rural Highways (400 to 2,000 ADT)	1.5-m (5-ft) shoulders preferred, minimum of 1.2 m (4 ft) required.
Rural/suburban Highway (ADT > 2,000 and less than 1 dwelling unit (d.u.) / .4 hectares (ha) [1 d.u. / acre])	Sidewalks or side paths preferred. Minimum of 1.8-m (6-ft) shoulders required.
Suburban Highway (1 to 4 d.u. / .4 ha [1 to 4 d.u. / acre])	Sidewalks on both sides required.
Major Arterial (residential)	Sidewalks on both sides required.
Urban Collector and Minor Arterial (residential)	Sidewalks on both sides required.
Urban Local Street (residential – less than 1 d.u. / .4 ha [1 d.u. / acre])	Sidewalks on both sides preferred. Minimum of 1.5-m (5-ft) shoulders required.
Urban Local Street (residential – 1 to 4 d.u. / .4 ha [1 to 4 d.u. / acre])	Both sides preferred.
Local Street (residential – more than 4 d.u. / .4 ha [4 d.u. / acre])	Sidewalks on both sides required.
All Commercial Urban Streets	Sidewalks on both sides required.
All Streets in Industrial Areas	Sidewalks on both sides preferred. Minimum of 1.5-m (5-ft) shoulders required.

Table 5.1. FHWA Sidewalk Needs by Roadway Type

Any arterial or collector is recommended by the FHWA as needing sidewalks along both sides of urban and suburban streets in Medical Lake. Share-use paths or separated sidewalk are recommended on roads with greater than 2,000 ADT, sidewalks or wide shoulders are supportable on roads with less than 2,000 ADT.

Exhibit 5.1 shows existing sidewalk sections within Medical Lake. As shown, sidewalk is aligned along one or both sides of streets within more newly developed areas, and in districts City officials have made a priority for pedestrian circulation. Older street segments tend to lack sidewalk, the function of historical design standards from a time when sidewalk was not a priority along low volume roads.

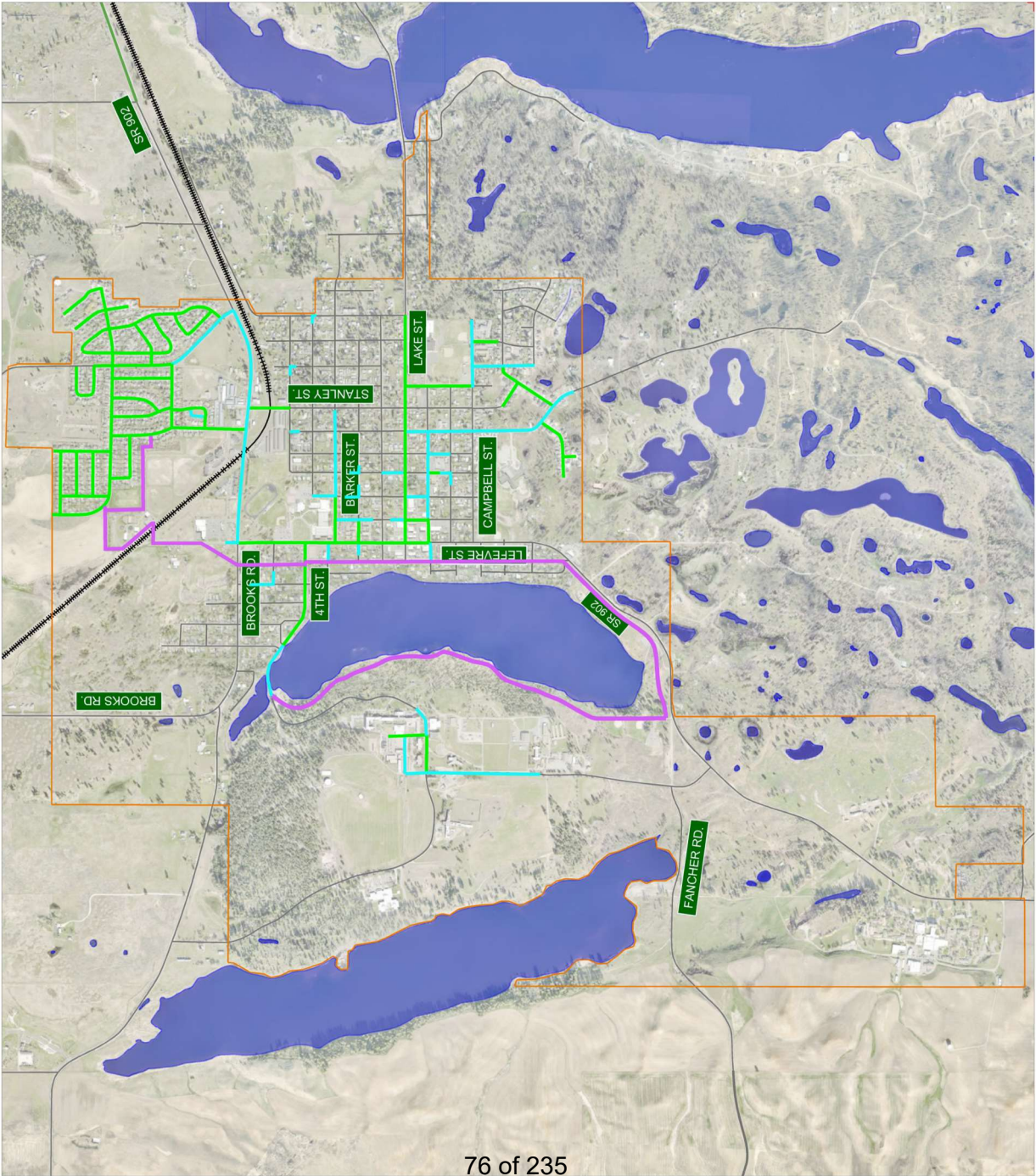
This Transportation Master Plan confirms the need to extend sidewalks or paths along city streets. Planning,

design, and construction should be prioritized for classified streets (arterials and collectors), higher volume local streets, and local streets that provide pedestrian and bike connections to City services like schools, retail, businesses, etc. Also, streets that support travel between functionally classified roads.

The decision between sidewalk or pathways should consider whether the route would also serve cyclists, precipitating the need for a shared use path on at least one side of the road. With this premise, a summary of the streets that should be considered a priority for sidewalks are noted below. This

should be reviewed in coordination with the pathway versus bike lane discussion shown with the following section.

- Arterials
 - Lefevre Street (SR 902),
 - Sidewalk Infill Both Sides, SR 902 to Jefferson St
- Collectors
 - Brooks Road
 - Sidewalk North Side, San Salvador to Lefevre
 - Howard Street
 - Sidewalk both sides, Brooks to 4th Street
 - Jefferson Street
 - Sidewalk infill both Sides, 4th St to Lake
 - Stanley Street South
 - Sidewalk both Sides, Percival to Campbell
 - San Salvador Street
 - No Sidewalk Recommended, Rural Section
 - Barker Street
 - Sidewalk both Sides, Washington to Stanley
 - Lake Street
 - Sidewalk Both Sides, Sherman to Freeman
 - Campbell Street.
 - Sidewalk both sides, Lefevre to Stanley
- Priority Locals and Future Collectors
 - Jefferson Street
 - Sidewalk both sides, Brooks to Lefevre



LEGEND	
	CITY URBAN BOUNDARY
	WASHINGTON EASTERN RAIL
	SIDEWALK BOTH SIDES
	SIDEWALK ONE SIDE
	SHARED USE PATHWAY



Exhibit

5.1

EXISTING SIDEWALK FACILITIES

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON

- Barker Street
 - Sidewalk south side, Washington to Stanley
 - Sidewalk both sides, Stanley to Sherman
- Sherman Street/Henderson Street
 - Sidewalk both sides, Lake to SR 902
- Graham Road
 - Sidewalk west side, Kathy Lee to SR 902

PATHWAYS AND BIKEWAYS

Exhibit 5.2 shows the dedicated bicycle network of Medical Lake. The bike network is comprised of shared use pathways, dedicated bike lanes, and routes where shared interaction of bicycles and vehicles has been assigned.

The success of a pathway system is typically in the number of people observed using the pathways, trails, and bike lanes on a regular basis, and in all seasons. The reasons for this are not only that it links neighborhoods to destinations, but also pathways and bike lanes protect pedestrians and bicycles from moving vehicles.

Research from FHWA confirms that separated paths, either standalone or alongside major roads, are what encourage bicycle activity. **Exhibit 5.3** shows bicyclists affirm a 51 to 56% comfort factor with a shared use path, trail, or side path. The level of comfort of cyclists reduces with proximity to vehicles; buffered bike lanes and typical on-street bike lanes result in a 5 to 9% comfort level. Shared vehicle lanes and shoulder cycling precipitate a 4% to 7% comfort level.

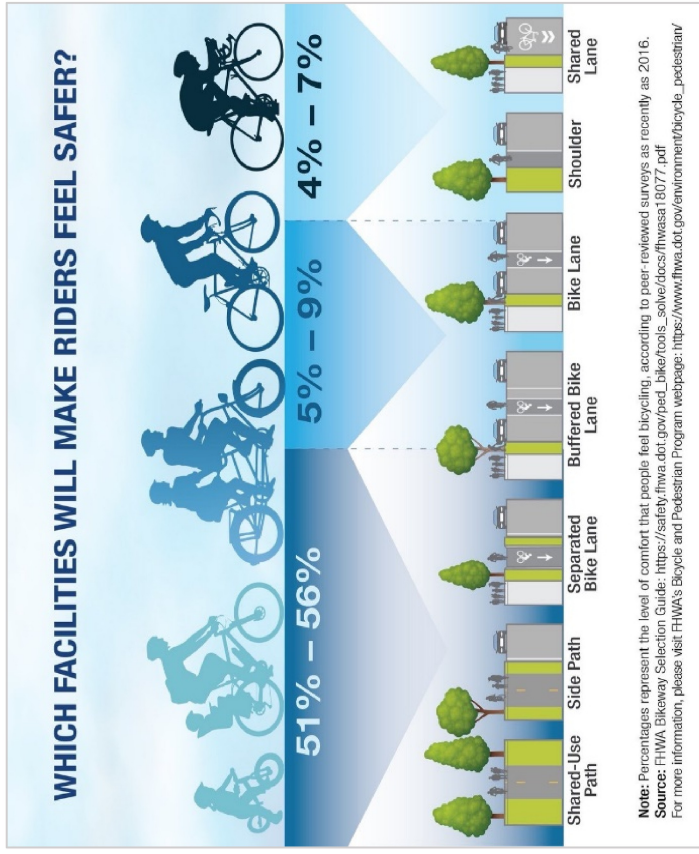
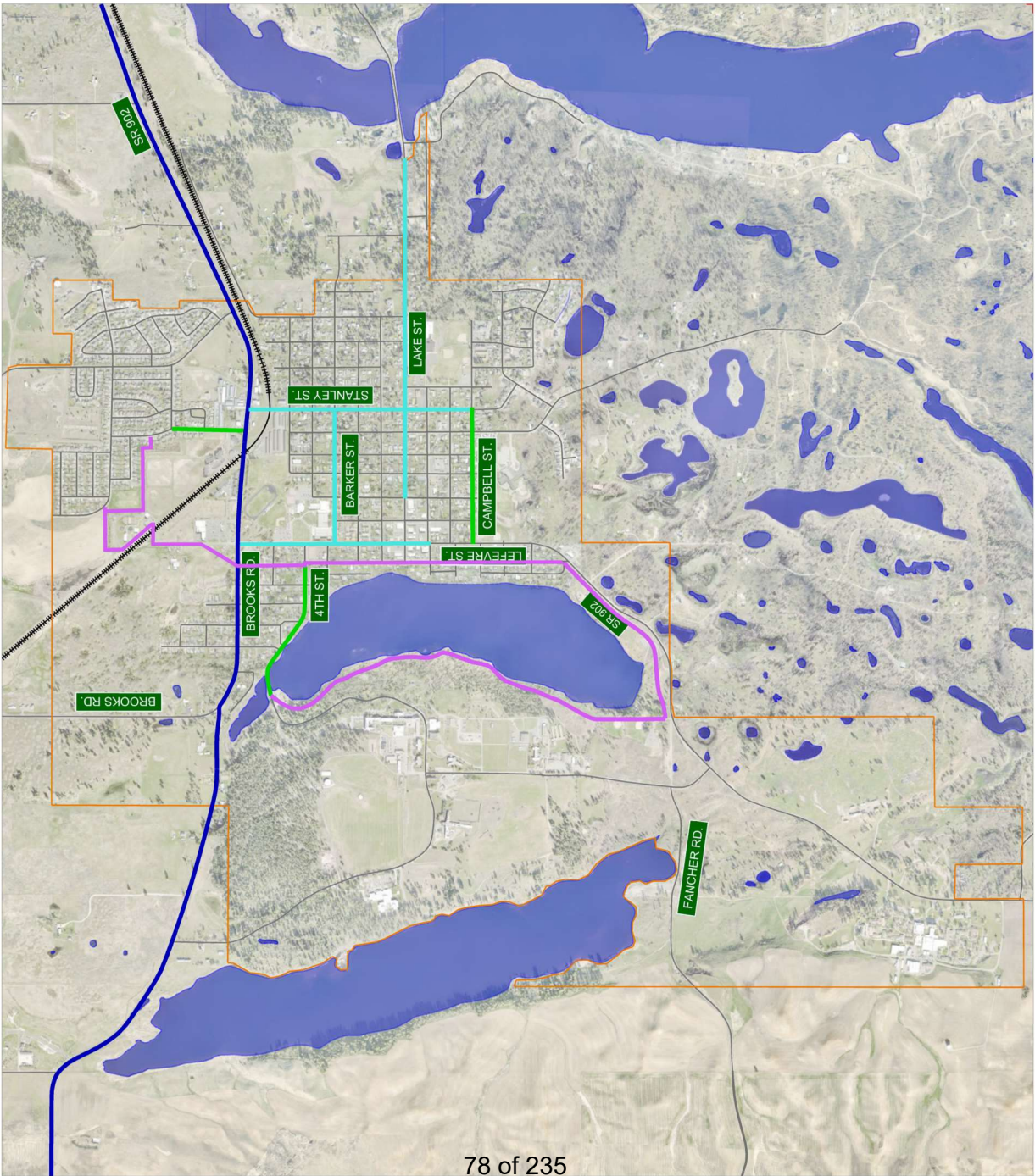


Exhibit 5.2. FHWA Safe Facilities Results

The conclusion is that, while providing bike lanes or shared lanes does encourage some use, the separation of cyclists from traffic using buffered or separated bicycle lanes or pathways is what will optimally encourage bicycling within the community.



LEGEND

	CITY URBAN BOUNDARY
	WASHINGTON EASTERN RAIL
	SHARED ROADWAY
	BIKE LANES
	BIKE LANE, ONE SIDE
	SHARED USE PATHWAY

Exhibit
5.3

EXISTING BICYCLE FACILITIES

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON



For this reason, the active element of this Transportation Plan recommends buffered bike lanes or off-street shared-use pathways, trails, and side paths along major routes to link people to their destinations. Buffered bike lanes refer to the use of street parking to separate bikes from moving vehicles. The Bikeway Selection Guide (FHWA, 2019) offers direction on the selection of bicycle facilities when considering volume and speed conditions. **Exhibit 5.4** (next page) for Medical Lake streets. A street with a posted speed limit of 35 mph and higher and/or with traffic volumes of 7,000 or higher should be planned as a separated facility. Per this guidance, SR 902 should be developed with a shared use path, side path, or separated bike lane to address the needs of cyclists.

Bike lanes in streets are supported with speed limits between 25 and 35 mph, and with traffic volumes between 3,000 and 7,000 vehicles per day. However, given the comfort level of cyclists with on-street facilities, attempts should be made to separate or buffer these facilities, as much as possible.

Below thresholds of 3,000 trips per day, a street is a candidate for a shared lane per the matrix below. However, a shared lane is not an optimal solution per the cyclist comfort level discussions provided prior. For streets with reduced volumes, in-street bike lanes would be a more optimal solution compared with in-lane sharing.

Several sidewalk routes noted prior could be enhanced for bicycle improvements, new or revised facilities provided with or in-lieu of sidewalk.

A summary of bicycle improvement considerations is below. These would be provided as a part of complete street improvements highlighted subsequently.

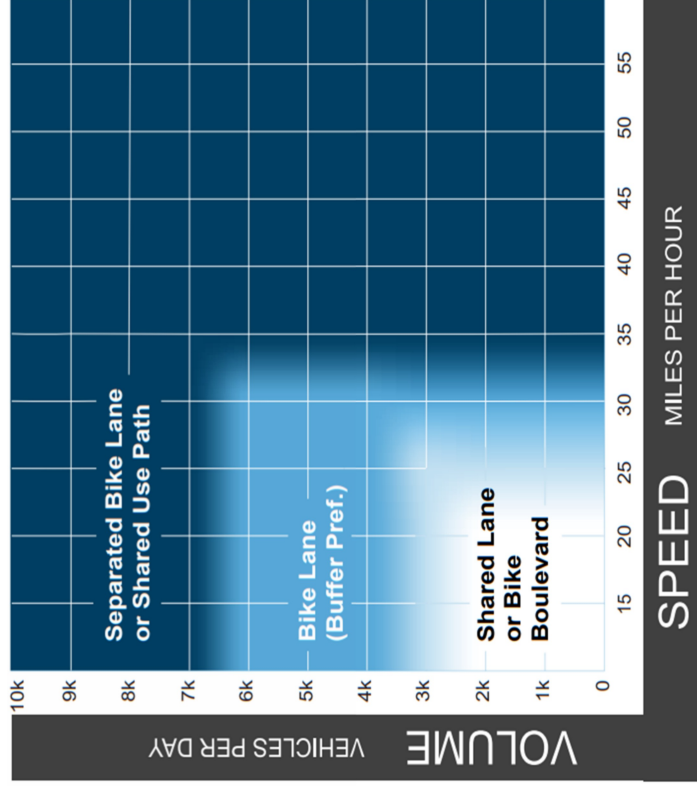


Exhibit 5.4. FHWA Facility Selection Matrix

- Arterials
 - Lefevre Street (SR 902)
 - Bike lanes, Hancock to Jefferson.
 - SR 902
 - Shared-use path south side, Lefevre to Graham.

- Collectors
 - Brooks Road
 - Pathway south side, San Salvador to Lefevre
 - Howard Street
 - Bike lanes, Brooks to 4th Street
 - Jefferson Street
 - Bike lanes (both sides), 4th St to Lake 4th Street,
 - Pathway south side, North Trailhead to Jefferson
 - Barker Street
 - Bike lanes, Stanley to Sherman
 - Lake Street
 - Bike lanes, Sherman to Freeman
 - Campbell Street
 - Bike lanes, Lefevre to Stanley
- Priority Locals and Future Collectors
 - Jefferson Street
 - Bike lanes both sides, Brooks to Lefevre
 - 4th Street
 - Pathway south side, North Trail Head to Jefferson
 - Barker Street
 - Path or Bike Lanes, Stanley to Sherman
 - Sherman Street/Henderson Street
 - Bike lanes or pathway, Lake to SR 902
 - Stanley Street North
 - Bike lanes, Tara Lee to SR 902

- Graham Road
 - Bike lanes or Path, City Limit to SR 902

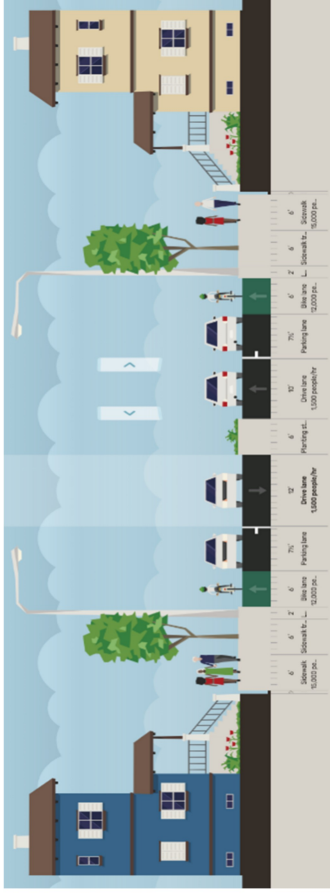


Exhibit 5.5. Sample Complete Street Cross Section w/Parking Lanes as Buffers from Bike Lanes

As indicated, streets in core residential areas, pathways and bike lanes are recommended to include buffered areas to protect pedestrians and cyclists. This includes landscaped area projection for sidewalk and pathways, or a parking lane aligned between the bike and vehicle through lanes. From a practical standpoint, the recommendation is a complete street like what the City leaders completed with TIB for Lefevre Street. This recommendation is reinforced in capacity discussions. **Exhibit 5.5** provides an example of a complete street section for highlighted roadways in Medical Lake.

CROSSINGS

There are several crossings throughout the City; the emphasis of this section is on highlighting any improvements that may be needed for junctions between two classified roadways, or a classified roadway with a major local street. Lastly, primary routes to/from Medical Lake schools were examined to determine whether crossing improvements may promote student safety at key intersections.

Potential crossing treatments were reviewed in coordination with *A Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* (FHWA, 2018). This provides guidance on treatment options given variables of speed and daily vehicle volume data. The guidance is shown with **Exhibit 5.6** (right).

To be clear, this is a guide, and this Transportation Master Plan follows FHWA advisements for most intersections. However, there were key locations where enhanced treatments were recommended. As justification, the FHWA guide was based largely on analysis of larger metropolitan areas; areas where drivers and pedestrians are accustomed to wider streets with higher travel demands. The citizens from Medical Lake will have different perceptions of roadway geometry and traffic volumes; criteria should be tempered situationally to be of relevance to this community. This is true especially of the higher volume roads, SR 902 and Lefevre Street.

Roadway Configuration	Posted Speed Limit and AADT									
	Vehicle AADT <9,000					Vehicle AADT 9,000–15,000				
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	Vehicle AADT >15,000
2 lanes (1 lane in each direction)	1 2 4 5 6	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9	1 5 6 7 9
3 lanes with raised median (1 lane in each direction)	1 2 3 4 5	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9	1 3 5 4 5 7 9
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	1 2 3 4 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9	1 3 5 6 7 9
4+ lanes with raised median (2 or more lanes in each direction)	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9	1 3 5 8 9
4+ lanes w/o raised median (2 or more lanes in each direction)	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9	1 3 5 6 8 9

Given the set of conditions in a cell,

Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.

● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs

2 Raised crosswalk

3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line

4 In-Street Pedestrian Crossing sign

5 Curb extension

6 Pedestrian refuge island

7 Rectangular Rapid-Flashing Beacon (RRFB)**

8 Road Diet

9 Pedestrian Hybrid Beacon (PHB)**

Exhibit 5.6. FHWA Crossing Treatment Matrix

Based on the preamble, a summary of the recommended treatments for key intersections is summarized as follows:

Install or update with high visibility markings, install lighting, and provide advanced signs:

- Brooks Road / San Salvador Street
- Barker Street / Lefevre Street

- Howard Street / Brooks Road
- Howard Street / 4th Street
- Jefferson Street / 4th Street
- Lefevre Street / 4th Street
- Lefevre Street / Barker Street
- Stanley Street / Barker Street
- Sherman Street / Barker Street
- Jefferson Street / Lake Street
- Lefevre Street / Lake Street
- Sherman Street / Lake Street
- Lefevre Street / Campbell Street
- Stanley Street / Campbell Street

Install or update with high visibility markings, install lighting, provide advanced signs, and install pedestrian-actuated rapid rectangular flashing beacon (RRFB):

- Lefevre Street / Brooks Road / SR 902
- Stanley Street South / SR 902
- Stanley Street South / Lake Street

The last three intersections noted above are also candidates for intersection improvements, as described with the future condition's discussion. The installation of RRFBs would occur as an interim improvement until the City determines elevated intersection improvements are required.

5.2 CITY TRANSIT

Spokane Transit Authority (STA) operates the Medical Lake public bus system. Route 62 “Medical Lake” operates on an hourly rotation during weekdays between 5:30 AM and 11:30 PM. The route also operates hourly from 6:00 AM and 11:00 PM on Saturdays, and hourly on Sundays between 7:00 AM and 8:30 PM.

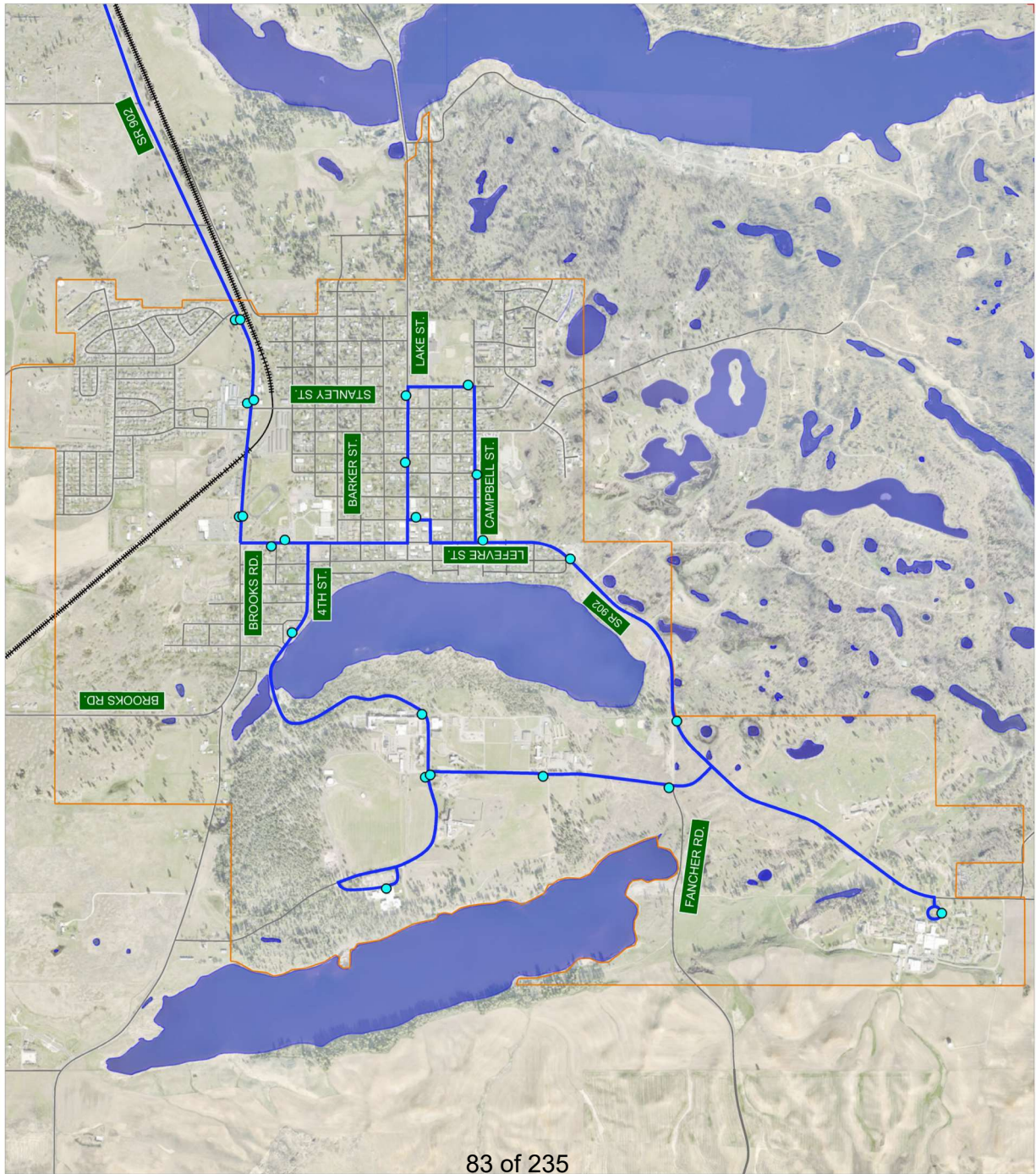
The Annual Route and Passenger Facilities Performance Report - 2024 Data (STA, 2024)* provides metrics regarding use of STA in Medical Lake. Key metrics are as follows:

Route 62: Medical Lake

- Annual Ridership – 47,062 passengers
- Average Weekday Ridership – 147.2 passengers
- Peak Boardings - 3 PM, 19 passengers
- Peak Location, Medical Lake Center (54 in/out)

STA provides paratransit service comparable to fixed-route service. Origins and destinations must be in a three-quarter mile radius of a fixed route. This means many areas of the City are served by paratransit.

The route operates between Medical Lake and the West Plains Transit Center, where connections to Airway Heights, Cheney, Spokane, and other areas of Spokane County can be achieved. A route map is shown with **Exhibit 5.7**, highlighting notable stops.



LEGEND	
	CITY URBAN BOUNDARY
	WASHINGTON EASTERN RAIL
	STA ROUTE 62 STOP
	STA ROUTE 62

Exhibit
5.7

STA BUS SERVICE AND STOPS

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON



RECOMMENDATIONS

STA services are provided in response to ridership demands, as determined by leadership. City of Medical Lake leaders can make route addition or change requests of the agency, but the decision is up to STA.

With that said, in line with multimodal goals of Medical Lake, City leaders can encourage STA ridership. The provision of facilities that help augment the access and convenience of public bus stops is a large factor. For instance, the extension of sidewalk, paths, and bike lanes is a key strategy. Additional ideas include, but are not limited to, the following actions:

- ◆ Amenities such as bike racks and shelters,
- ◆ Improving the lighting around the facilities,
- ◆ Improving the visibility of transit stops,
- ◆ Adding security cameras/surveillance systems,
- ◆ Education and promotion (benefits of transit),
- ◆ Preferred vehicle parking at stops, and
- ◆ Discounted passed or service subsidies.

Many solutions above require capital investment by the City to affect multimodal changes. For that reason, they are identified as long-term solutions with the proposed City TIP presented with Chapter 6.0.

Transportation Oriented Development

Transit-oriented developments (TODs) are a transportation demand management strategy that could be considered

by City leaders for Medical Lake. A TOD is a land use area, supported by policy, which maximizes the use of property in suburban or urban environment to promote walking, biking, and transit activities. Employment, recreation, and residential land uses are promoted in a focused area, which also has clear/direct access to Spokane Transit. A TOD reduces reliance on single occupancy vehicles, promoting healthy lifestyles, as active mobility can occur between land uses. Also, transit ridership increases as occupants can more easily access buses with commuters to/from the region.

STA leaders are working to initiate the first TOD developments along key corridors, like Division Street and Sprague Avenue within Spokane and Spokane Valley, respectively. However, there is opportunity to advance to a TOD center in Medical Lake. This has strong synergies with the multimodal vision of City leaders and offers many benefits for the community.

The benefits of a TOD center for the City of Medical Lake:

- ◆ Mobility and Access.
 - A range of travel choices are promoted beyond personal vehicles, including transit, walking, biking, and often micro-mobility.
 - Service, employment, and residential centers are within convenient/near walking, biking, and transit proximities, diminishing reliance on personal autos.
 - To that end, a TOD can reduce/eliminate need for an automobile.

- The TOD can reduce travel demand, as measured in diminished vehicle miles of travel (VMT).
- ◆ Land Use and Economics.
 - Private development can be stimulated, helping to promote works centers and access to service and retail services.
 - Apartments and townhomes are normally a key feature of a TOD, providing diverse and affordable housing options.
 - Costs for auto fuel and maintenance are eased, allowing citizens economic benefit.
 - Reduces road preservation costs for agencies due to reduction of vehicle friction.
- ◆ Sociability and Quality of Life.
 - Walking, biking, and micro-mobility are important accessibility features of a TOD, promoting health.
 - Harmful vehicle emissions are reduced, improving and reducing environmental impact.
 - Social interactions are improved on transit and within service and retail hubs of TOD's.
 - Aesthetics like street art, landscaping, decorative lights, and parks are often developed within TOD's, augmenting appeal and a sense of community.
 - Historical or cultural centers can be a focal point of the TOD, enhancing community pride.

- Enhancing pride in one's community can increase cooperation and stewardship.

The TOD should be considered as a multimodal strategy for Medical Lake. As noted, this travel demand management strategy will help promote land use, economic, and quality of life benefits, as well as positive mobility and environmental outcomes.

Given STA Route 62 covers many areas within Medical Lake, there are several options the City can consider for a TOD. The downtown area and Harvest Food areas are two examples of deployment areas, though more examples do exist.

5.3 MEDICAL LAKE SCHOOL DISTRICT

Medical Lake school district has two elementary schools, a middle school, and a high school that services a geographic area extending from just north of U.S. Highway 2 to the north, I-90 to the south, Pine Street and Maple Street to the west, and Craig Road to the east. The District serves the City, areas of Spokane County, and Fairchild Air Force Base.

The District provides bus services to students located outside of an approximate mile circumference of the schools. There are three schools located in City limits, an elementary school located in and servicing Fairchild. **Exhibit 5.8** (next page) shows the limits of the school district.

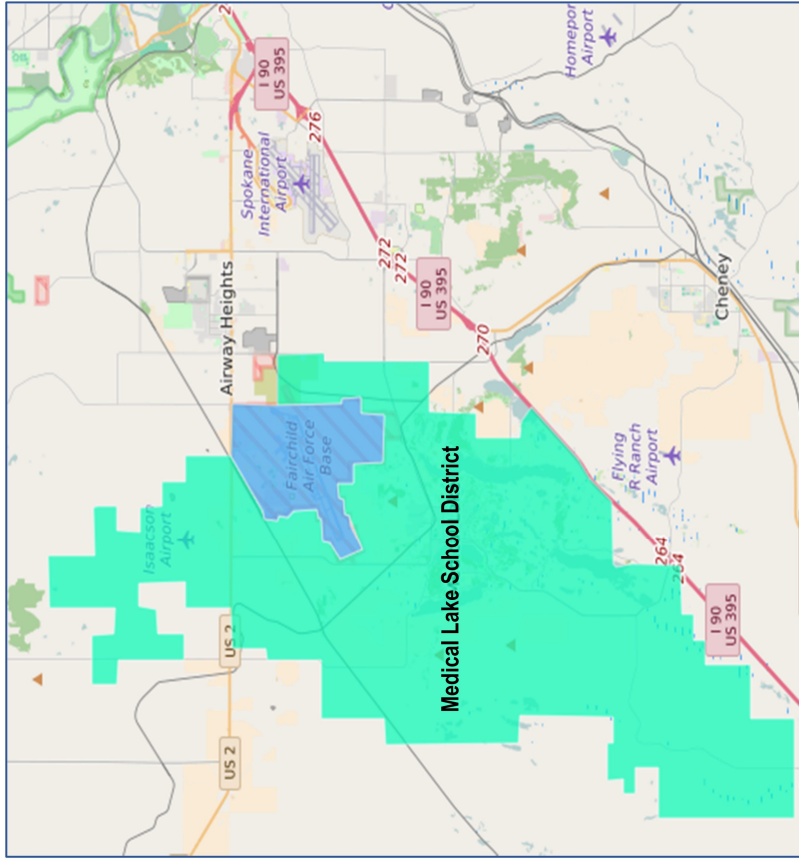


Exhibit 5.8. Medical Lake School District (Green)

(Source: Zipdatamaps.com)

Lighting and visibility improvements may be considered for areas that may support the recurrent pickup and drop of students. However, many areas are outside of City control given they are in Spokane County or Fairchild Air Force Base authority. The City can coordinate with MLS D leadership and

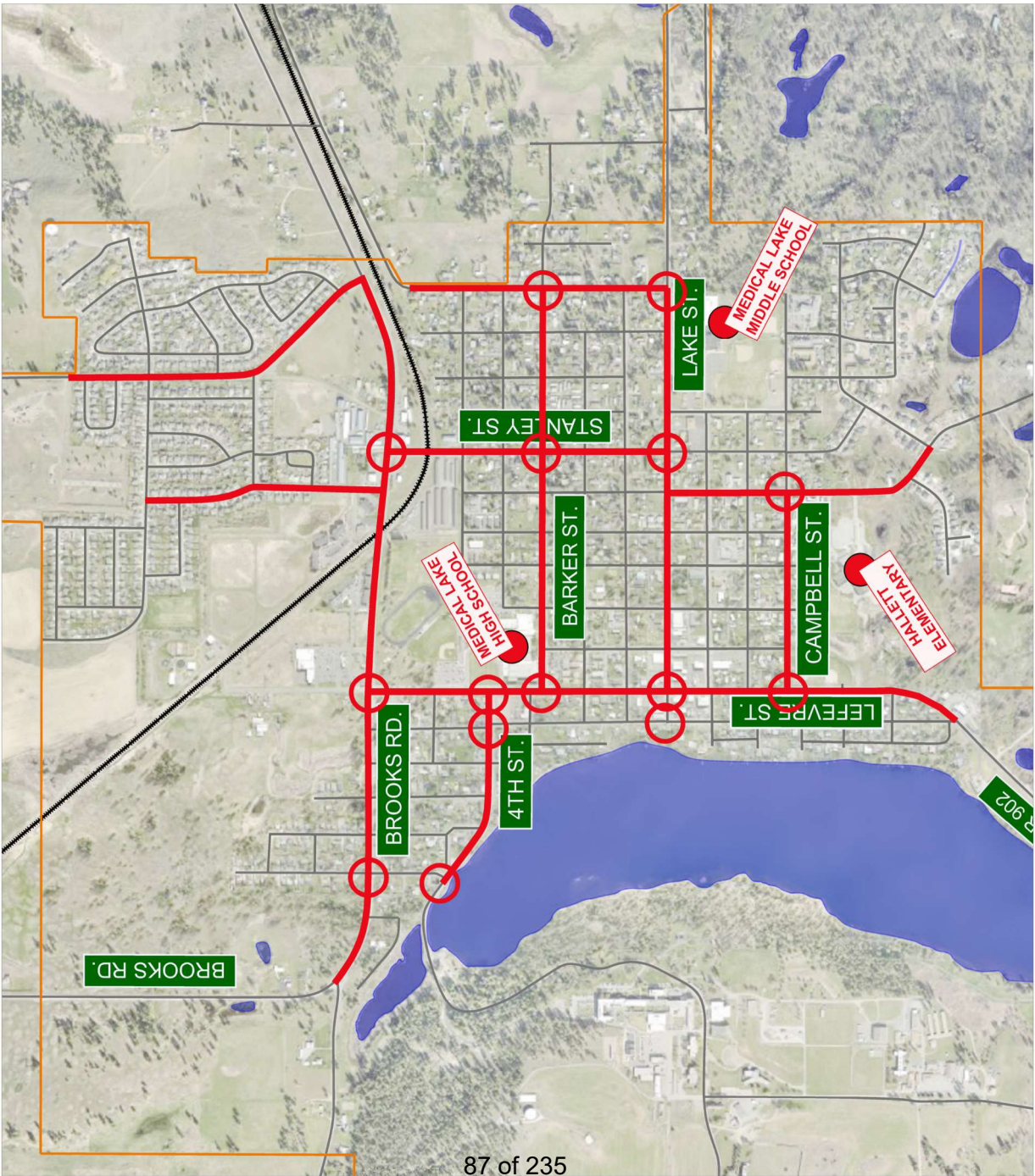
affected agencies for changes, strategies, or improvements outside of Medical Lake.

However, as indicated prior, there are students that walk to school within Medical Lake. There is a lack of sidewalk and bicycle accommodation along many routes for walking and bicycling students.

A Safe Routes to Schools analysis was provided to help confirm routes, many of them noted prior, for priority implementation of active mobility and safety improvements. The criteria for these routes were:

- The route has application for serving a large residential area of Medical Lake.
- The route provides duplication in supporting active movements for all citizens in Medical Lake (broader investment implications).
- The route captures students for up to an approaching mile of schools, this captures most routes in the City.

The results of this review are shown with **Exhibit 5.9**. This map shows roadways and intersections of emphasis for the safe mobility of students between schools and neighborhoods. There is much duplicity in this and prior multimodal analyses, this affirms the investments can be made to serve complete purposes for the community.



LEGEND	
	CITY URBAN BOUNDARY
	WASHINGTON EASTERN RAIL
	SCHOOL LOCATION
	SAFE SCHOOLS ROUTE
	SAFE SCHOOLS CROSSING

Exhibit
5.9

SAFE ROUTE ROADS AND
INTERSECTIONS

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON





CHAPTER 6

TRANSPORTATION IMPROVEMENT PROGRAM

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Chapter 6

Chapter 6 summarizes the improvements recommended for the Transportation Master Plan. Short-term strategies and projects would be included in the 6-Year City Transportation Improvement Program (TIP). Long-Term projects would be those moved into the TIP for implementation over time. All of these projects could be included in the Capital Improvement Element of the Medical Lake Comprehensive Plan, which is currently being updated.

6.1 TIP COST ESTIMATES

Planning level construction costs were developed to support the development of the TIP. Costs are provided to help City officials plan for, secure, and allocate capital for right-of-way acquisition, design, and construction. Unit pricing was based on the recent bid estimates of projects in the region; the City of Spokane and the City of Airway Heights were primary examples used in material costs. The bid forms from agencies are typically downloadable from websites, or as available from past project work.

Materials include the cost of construction. Markups were applied to material costs for Washington taxes (9%); traffic control (3%); mobilization (7%); survey, design, permitting, bid documents, and administration (15%); construction survey and construction engineering (16%). This calculates to a 50% total markup on material/construction costs.

Short Term: Lake Street / Stanley Street

Option 1. Cross traffic (MUTCD W2-1) and street name (W16-8P) signs on Lake Street in advance of Stanley Street, two breakaway signs with poles and bases.

Material & Construction	\$1,800
Project Markups	\$900

Option 1. Project Estimate

\$2,700

Option 2. Stop signs (MUTCD R1-1) to convert to an all-way stop. Advanced "stop ahead" signs (MUTCD W3-1) used to notify approaching drivers of the all-way stop.

Material & Construction	\$3,760
Project Markups	\$1,885

Option 2. Project Estimate

\$5,645

Option 3. Solar-powered stop signs (MUTCD R1-1) to convert to an all-way stop. Advanced "stop ahead" signs (MUTCD W3-1) used to notify approaching drivers of the all-way stop.

Material & Construction	\$16,585
Project Markups	\$8,300

Option 3. Project Estimate

\$24,885

Short Term: SR 902 & Stanley Street North

Option 1. Reflective markers on a 1-foot interval for length of right-turn lane line (150-feet), improving lane visibility.

Material & Construction	\$2,250
Project Markups	\$1,135

Option 1. Project Estimate

\$3,385

Option 2. Driveway pushed 15 feet west, width reduced by 5-feet, and terminus pushed east 10-feet, prior to ADA ramp. This allows taper length to increase from 30 to 60 feet.

Material & Construction	\$87,380
Project Markups	\$43,650

Option 2: Project Estimate **\$131,030**

Short Term: SR 902 & Lefevre Street

Option 1: Stop signs (MUTCD R1-1) to convert to an all-way stop. Advanced “stop ahead” signs (MUTCD W3-1) used to notify approaching drivers of the all-way stop.

Material & Construction	\$3,315
Project Markups	\$1,565

Option 1. Project Estimate **\$4,700**

Option 2. Solar-powered stop signs (MUTCD R1-1) to convert to an all-way stop. Advanced “stop ahead” signs (MUTCD W3-1) used to notify approaching drivers of the all-way stop.

Material & Construction	\$16,585
Project Markups	\$5,640

Option 2. Project Estimate **\$22,225**

Short Term: Roadway Public Works Design Standards

Develop Public Works standards that provide guidance on the design of multimodal streets within Medical Lake.

Option 1. Project Estimate **\$10,000**

Short Term: Intersection Crossing Improvements

Section 5.1 recommends the improvement of 14 crossings in Medical Lake with high visibility markings, lighting, and signs.

In addition, three intersections were recommended with an RRFB set in addition to these measures. The City does not have the capital to provide all improvements at once unless a safety grant is obtained. As such, installation of 5-basic and 1-RRFB crossing is assumed every 6-years to address identified locations, 18-years needed to address all intersections.

The assumption for a basic location is two sets of signs assumed for main-line: two pedestrian crossing (W11-2) with diagonal arrow (W-16-7PL/R) signs. In addition, there would be two sets of signs with the pedestrian crossing (W11-2) and ahead signs (W16-P). All signs would have breakaway posts. Continental striping would be used on all approaches (4-crossings), and a streetlight is assumed for one corner with a candle strong enough to light the entire intersection.

Assumptions are the same at enhanced locations, just with the addition of an RRFB set to face traffic on the major street.

Material & Construction	\$17,110
Project Markups	\$8,560

Base Crossing Project Estimate **\$25,670**

Material & Construction	\$76,760
Project Markups	\$38,385

Base Crossing Project Estimate **\$115,145**

Short Term: SR 902 Complete Street, Lefevre to Graham

Widening includes the addition of a center lane with curb, gutter, and separated pathway south side [sidewalk, cu. The assumption adds 12-feet of pavement widening south from

the existing, southerly lane line. A 1.5-foot curb and gutter section would be provided, then a 6-foot separation to a 10-foot shared-use pathway extending 3,600-feet from Lefevre Street to Graham Road. Note there are cross-section widths that are moderately below typical WSDOT and AASHTO recommendations. This is to avoid the foundations of transmission power line poles located about 33-feet south of the southerly lane line.

Per County GIS, right-of-way is available to support widening. However, there is a BNSF rail line crossing of SR 902 about 300-feet west of North Stanley Street. The provision of a path on the south side of SR 902 would promote need for crossings. Long term, these would occur with roundabouts at Lefevre, Stanley Street, and Graham. In the interim, RFRB's could be deployed with advanced crossings notification signs.

Material & Construction	\$3,198,915
Project Markups	\$1,599,415
Project Estimate	\$4,798,330

Short Term: Lefevre Complete Street, Hancock to Jefferson

Per County GIS, there is an approximate 73-foot right-of-way from Hancock Street to California Street, narrowing to 63-feet for the remainder of the corridor to Jefferson Street. To minimize the need for property acquisition, a 73-foot cross section was used for to 1,550-feet starting at Hancock Street and then 63-feet for the remainder to Jefferson Street, about 650-feet. The difference between the two cross sections is the provision of parking lanes on both sides of the street.

The Hancock Street to California Street section includes 12-foot through lanes, and 8-foot parking lanes which protect 5-foot bike lanes. The project assumes widening from outside lane lines, no reconstruction. There would be 1.5-foot curb and gutter sections, the gutter pan providing an additional foot to the bike lanes on each side of the street. Lastly, 10-foot sidewalk would be aligned on each side of the road. Again, the 8-foot parking lanes would drop from California Street to Jefferson Street. Yet, bicycle protection is needed, so the parking lanes would narrow to a hatched 3-foot buffer area to separate through lanes from vehicle lanes.

A bicycle crossing would be located at Jefferson Street so path users located on the west side of Lefevre Street, south of this intersection, could access the northbound bike lane.

Material & Construction	\$2,544,805
Project Markups	\$1,272,420
Project Estimate	\$3,817,225

6.2 MEDICAL LAKE TIP

The 6-Year City of Medical Lake Transportation Improvement Program recommended for Medical Lake is summarized by following **Table 6.1**. Shown is the recommended project with a brief description, the action, and the project construction cost estimate. Where improvement options were presented, the least expensive project was selected for initial installation. In addition, the complete street projects were identified with phases given the time it takes to advance large projects.

Table 6.1. Medical Lake 6-Year TIP

Target Year and Project Year 2026	Project Type	Project Cost
Lake / Stanley: Install Cross-Traffic Signs	Design & Construction	\$2,700
SR 902 / Stanley N.: Install Reflective Markers	Design & Construction	\$3,385
SR 902 / Lefevre: Convert to All-Way Stop	Design & Construction	\$4,700
Basic Crossing Installation	Design & Construction	\$25,670
Year 2026 TIP Total		\$36,455
Year 2027		
Roadway Public Works Design Standards	Planning	\$10,000
SR 902 Complete Street; Multimodal Street	Planning & TIB Grant	\$32,000
RREB Crossing Installation	Design & Construction	\$115,145
Year 2027 TIP Total		\$157,145
Year 2028		
SR 902 Complete Street; Multimodal Street	Design, Permits, & Plans	\$447,850
Basic Crossing Installation	Design & Construction	\$25,670
Year 2028 TIP Total		\$473,520
Year 2029		
SR 902 Complete Street; Multimodal Street	Construction	\$4,318,490
Lefevre Complete Street; Multimodal Street	Planning & TIB Grant	\$25,445
Basic Crossing Installation	Design & Construction	\$25,670
Year 2029 TIP Total		\$4,369,605
Year 2030		
Lefevre Complete Street; Multimodal Street	Design, Permits, & Plans	\$356,275
Basic Crossing Installation	Design & Construction	\$25,670
Year 2030 TIP Total		\$381,945
Year 2031		
Lefevre Complete Street; Multimodal Street	Construction	\$3,435,505
Basic Crossing Installation	Design & Construction	\$25,670
Year 2031 TIP Total		\$3,461,175

6.3 LONG-RANGE PROJECTS

Again, the strategy presented by this Transportation Master Plan is to advance multimodal facilities through the provision of widening with active facilities and/or complete street upgrades for City arterials, collectors, and major local streets. Improvements were identified for several streets in Medical Lake. A loose priority is inferred in Section 4.3. These projects would include some variation of sidewalk, buffered bike lanes, shared-use paths, parking, lighting, crossing, widening, and/or sign improvements.

Construction costs do change with time, as do the priorities of agencies and funding agents. As such, the detailed cost of long-range projects were not estimated for this Plan. However, some level of understanding is needed for to help with City planning functions. Thus, a range of project costs were developed based on the costs estimated from the TIP; the SR 902 and Lefevre Street projects. The result is a planning, design, and construction cost estimate range of \$1,300 to \$1,700 per linear road foot; \$7,000,000 to \$9,000,000 per mile. This does align with FHWA's year 2020 "Status of the Nation's Highways, Bridges, and Transit", which provides urban lane-mile costs for roads (planning level costs), when factoring in inflation (<https://www.fhwa.dot.gov/policy/23cpr/>).

These ranges were then applied to the priorities from Section 4.3 to give cost ranges to the City, for planning functions. For instance, a complete street has been recommended as a

priority for Lake Street, Sherman Street to Freeman Drive. This is measured at a horizontal distance of about 2,650-feet per Google Earth. Thus, a cost range of \$3.445 to \$4.505 million would be estimated for the project.

Again, this is just a tool provided as a resource for planning purposes until the next TIP update is provided, with refined construction costs provided by the City Engineer. All of the road improvements planning costs suggested below include a degree of widening with active mobility improvements.

The priority improvements for functionally classified roadways with cost ranges are as follows, these would be targeted for construction by year 2050 following TIP project construction:

- ◆ Lake Street, Sherman to Freeman (2,650 ft)
Cost Range: \$3.445 to \$4.505 million
- ◆ Jefferson Street, W 4th St to Lake (1,450 ft)
Cost Range: \$1.885 to \$2.465 million
- ◆ W. 4th Street, North Trailhead to Jefferson (2,120 ft)
Cost Range: \$2.756 to \$3.604 million
- ◆ Howard Street, Brooks to W. 4th St (610 ft)
Cost Range: \$0.793 to \$1.037 million
- ◆ Brooks Road, San Salvador to Lefevre (2,520 ft)
Cost Range: \$3.276 to \$4.284 million
- ◆ Stanley Street, Percival to Campbell (2,780 ft)
Cost Range: \$3.614 to \$4.726 million
- ◆ Barker Street, Lefevre to Stanley (2,000 ft)
Cost Range: \$2.600 to \$3.400 million

- ◆ Campbell Street, Lefevre to Stanley (2,000 ft)
Cost Range: \$2.600 to \$3.400 million

To be clear, these are the priority projects for the City over the next 25 years. They do not address all City multimodal needs; just those important to commutes and safety. The assumption is this plan would be updated in 5 to 10-years, the TIP and long-range list would be updated with revised project priorities provided with time.

There were local streets identified for improvements, some as a function of proposed functional class upgrades noted subsequently. These are widening with active improvement or complete street projects developed following 25-year projects, summarized below with preliminary project costs.

- Jefferson Street, Brooks to Lefevre (3,370 feet)
Cost Range: \$4.381 to \$5.729 million
- Barker Street, Stanley to Sherman (1,360 feet)
Cost Range: \$1.768 to \$2.312 million
- Sherman/Henderson, SR 902 to Lake (3,965 feet)
Cost Range: \$5.155 to \$6.741 million
- Stanley Street North, Tara Lee to SR 902 (2,000 ft)
Cost Range: \$2.600 to \$3.400 million
- Graham Road, City Limits to SR 902 (3,685 feet)
Cost Range: \$4.791 to \$6.265 million

Roundabout Intersections

Similarly, planning level construction cost estimates were also provided for roundabouts proposed at SR 902 with Lefevre

Street, South Stanley Street, and Graham Road; and for Stanley Street and Lake Street. Again, as this is a long-range review, a detailed cost estimate was developed for a typical single-lane roundabout for the City.

The design for this roundabout was modeled after Wellesley and A Street in the City of Spokane. This roundabout has an inscribed diameter of 125-feet, which is sufficient for school buses, city buses, and WB-50 trucks. A mountable center island is provided to accommodate WB-67 vehicles. Wider sidewalk was assumed in the roundabout for pedestrian and bike activities, with typical sidewalk in the approach. Bike lanes lead to transitions at the edges of the roundabout to the wide sidewalk. Landscaped buffers would be provided.

The footprint was assessed at locations mentioned, minor rights-of-way may be needed for intersection corners, which has been factored into costs. The roundabout assumes spitter islands with refuge. A resulting total cost estimate of **\$2 million** can be assumed per each of the SR 902 roundabouts. Scaling down, an estimate of **\$1.6 million** can be assumed for Stanley Street / Lake Street.

Exhibit 6.1 shows the type of roundabout that would be envisioned for these intersections, Wellesley Avenue and A Street in Spokane.

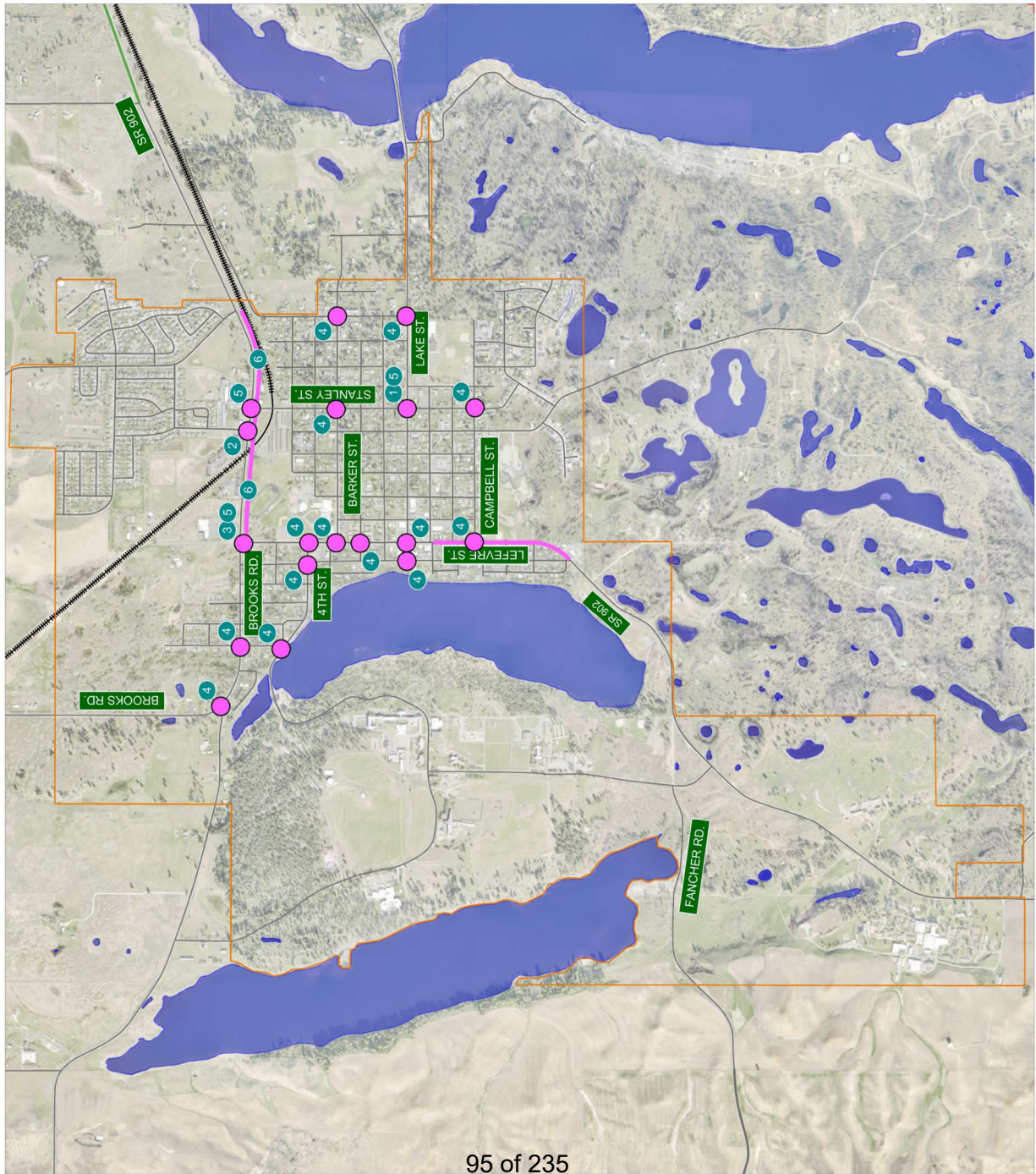
These are street projects that assume the road and sidewalk improvements discussed prior. Also highlighted are the



Exhibit 6.1. Wellesley Avenue & A Street Roundabout

bicycle recommendations emphasized for complete streets and intersections targeted for enhancement.

Improvement maps were created to help show the limits of the road and intersection projects discussed for the TIP and long-range plans. **Exhibit 6.2** shows 6-year improvements. **Exhibit 6.3** shows short-term improvements targeted for 6 to 20 years. Finally, **Exhibit 6.4** shows the longer-term projects anticipated for development after 20-years, as well as general alignments for growth areas (discussed Section 6.5).



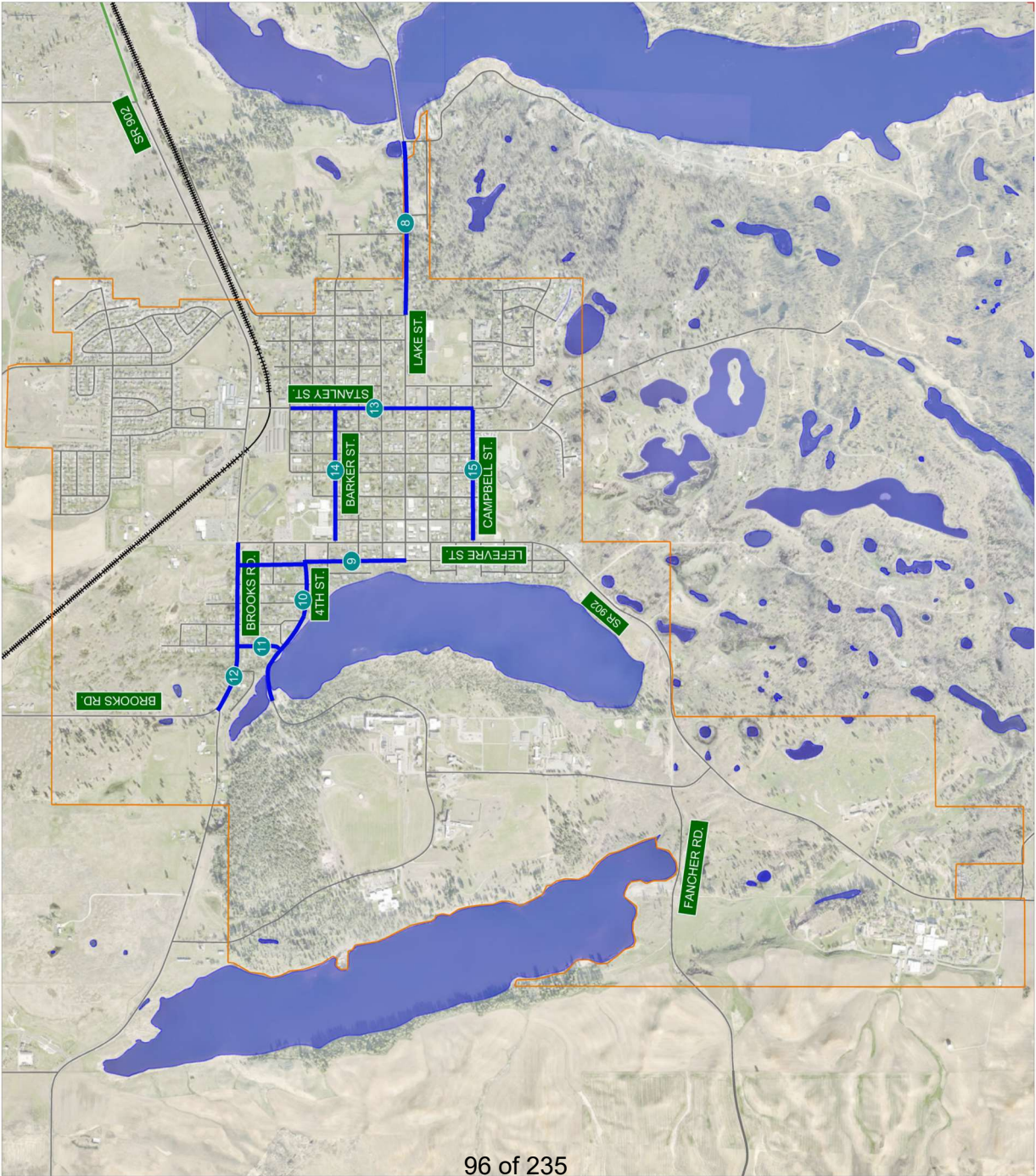
LEGEND	
	6 YEAR IMPROVEMENTS
	6 YR INTERSECTION PROJECT

Summary of Proposed Improvements:

1. Lake/Stanley: Install Cross-Traffic Signs
2. SR 902/Stanley North: Install Reflective Markers
3. SR 902/Lefevre: Convert to All-Way Stop
4. High Viability Crossing Improvements/Upgrades
5. RRFB Crossing Improvement w/Signs and Stripes
6. SR 902 Complete Street; Widening, Curb, Gutter, and Path
7. Lefevre Complete Street; Curb, Gutter, Sidewalk, and Direction Bike Lanes

Exhibit	PROPOSED IMPROVEMENTS SHORT-TERM, 6-YEAR
6.2	CITY OF MEDICAL LAKE TRANSPORTATION MASTER PLAN MEDICAL LAKE, WASHINGTON

N.T.S.



LEGEND

	6 - 20 YEAR ROAD PROJECTS
	6 - 20 YR INTERSECTION PROJ

Summary of Proposed Improvements:

- 8. Lake St, Sidewalk and Bike Lanes, Sherman to Freeman
- 9. Jefferson, Sidewalk and Bike Lane (Both), 4th St to Lake St
- 10. 4th St, Pathway South Side, North Trail Head to Jefferson
- 11. Howard, Sidewalk and Bike Lanes, Brooks to 4th St
- 12. Brooks, Sidewalk and Pathway, San Salvador to Lefevre
- 13. Stanley, Sidewalk, Percival to Campbell
- 14. Barker St, Sidewalk and Bike Lanes, Lefevre to Stanley
- 15. Campbell St, Sidewalk and Bike Lanes, Lefevre to Stanley

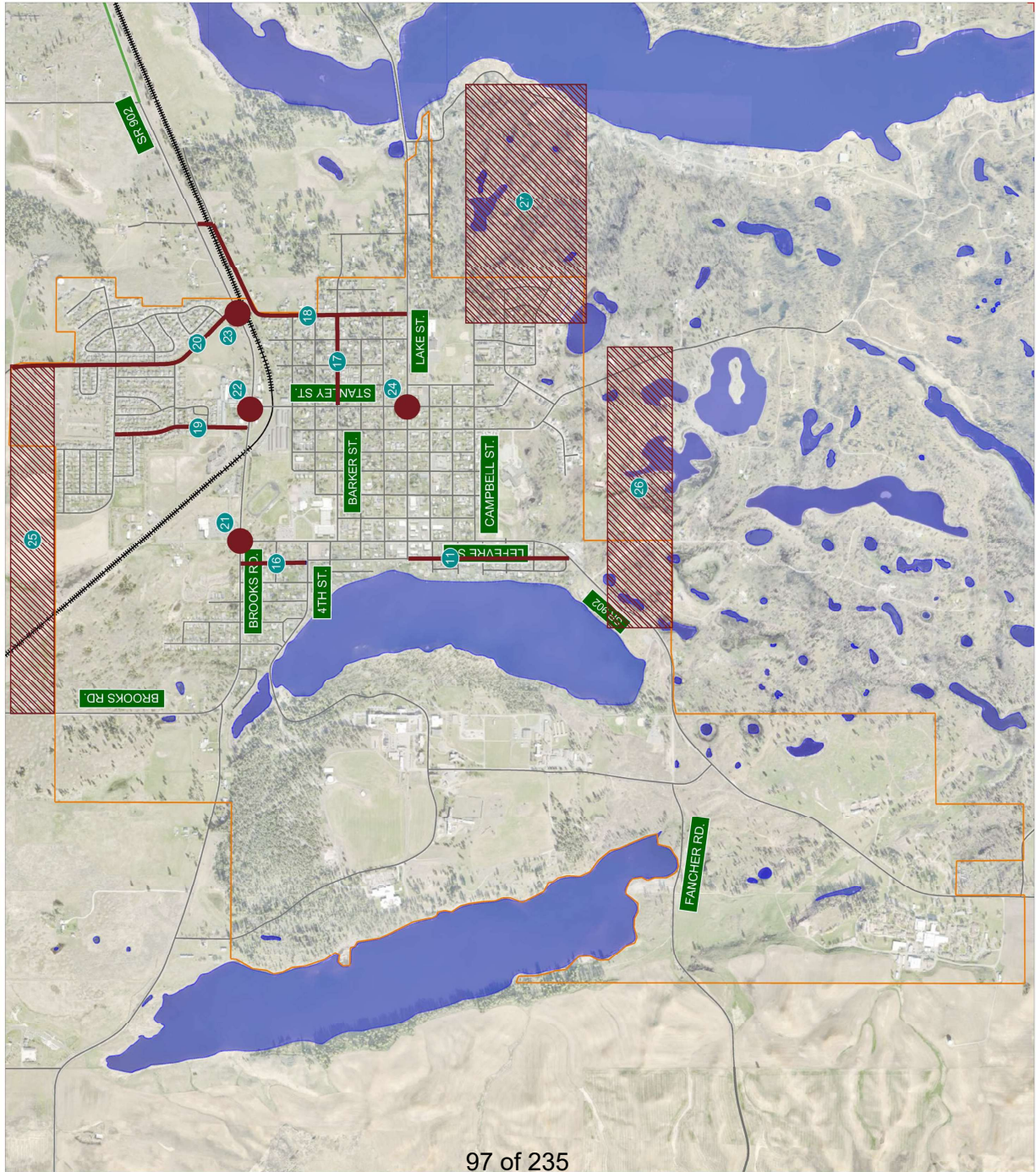
Exhibit
6.3

PROPOSED IMPROVEMENTS
MID-TERM, 6 - 20 YEAR

N.T.S.



CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON





LEGEND

20 PLUS YR ROAD PROJECTS

20 PLUS YR INTERSECTION PR

Summary of Proposed Improvements:

- 16. Jefferson St, Bike Lanes, Brooks to Lefevre
- 17. Barker St, Bike Lanes, Stanley to Sherman
- 18. Sherman/Henderson, Bike Lanes, SR 902 to Lake
- 19. Stanley, Bike Lanes, Tara Lee to SR 902
- 20. Graham, Bike Lanes or Path, City Limit to SR 902
- 21. Lefevre Street/SR 902 Roundabout
- 22. Stanley Street South/SR 902 Roundabout
- 23. Stanley Street/Lake Street Roundabout
- 24. Lefevre Street/SR 902 Roundabout
- 25. North Collector, Shoulders Road and Share Use Path, Brooks to Graham
- 26. South Collector, Shouldered Road and Shared Use Path, SR 902 to Hallet Road/Medical Lake Road
- 27. East Collector, Shouldered Road and Shared Use Path, Hallet Road/Medical Lake Road to Freeman Street

Exhibit

6.4

PROPOSED IMPROVEMENTS
LONG-TERM, 20-PLUS YEAR

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON

97 of 235

6.4 FUNCTIONAL CLASSIFICATION REVISIONS

As indicated, streets are classified to understand how each serves local, regional, and State mobility. For instance, a principal or minor arterial serves regional needs, moving high levels of traffic between smaller communities or areas of a large city. Conversely, a local street is intended to access residential or small commercial areas. A collector directs local trips from these residential areas to arterials or highways.

There distinctions between roadway classes are based on factors such as use and intent. As it pertains to Medical Lake, several streets have been identified throughout this Plan for increased multimodal use within Medical Lake within intention of access more expansive residential areas. To that end, this report recommends the City consider petitioning (applying to) WSDOT to elevate the classification of select roads and roadway segments to collectors.

Reclassifications can be proposed as either major or minor collectors, depending on the preference of City officials. Reclassifying roads will help the City achieve three primary measures for future development:

1. A higher and better, complete street design standard would therefore become applicable.
2. When accepted by WSDOT, the roads become eligible for grant funding support (local roads are not typically eligible for grant funds from Federal and State agencies).

3. A network is established that development must adhere to when extending frontage and mitigating improvements as a function of entitlement processes.

Exhibit 6.5 shows and lists the proposed collector designation revisions for Medical Lake.

6.5 GROWTH AREA ROADWAY ALIGNMENTS

City officials requested a review of possible road alignments to help move traffic within targeted growth areas of the City. Two of these are the north and east UGA expansion areas. The third is a developing district in south Medical Lake. The purpose was establishing alignments between established roadways to and through these areas.

A very preliminary review was performed, considering factors like topography, minimizing the number of owners that would be impacted by ROW/property, and attempting to minimize alignment through wetlands and sensitive areas. The general limits of these long-term future/possible, collectors are as follows, summarized with a basic design consideration:

- North UGA Collector
 - Two lanes, wide shoulders and a shared-use path, Brooks Road to Graham Road.
- South Development Area Collector
 - Two lanes, wide shoulders and a shared-use path, SR 902 to Hallett Road/Medical Lake Road.

- East UGA Collector
 - Two lanes with wide shoulders and a shared-use path, Hallet/Medical Lake Road to Freeman Street

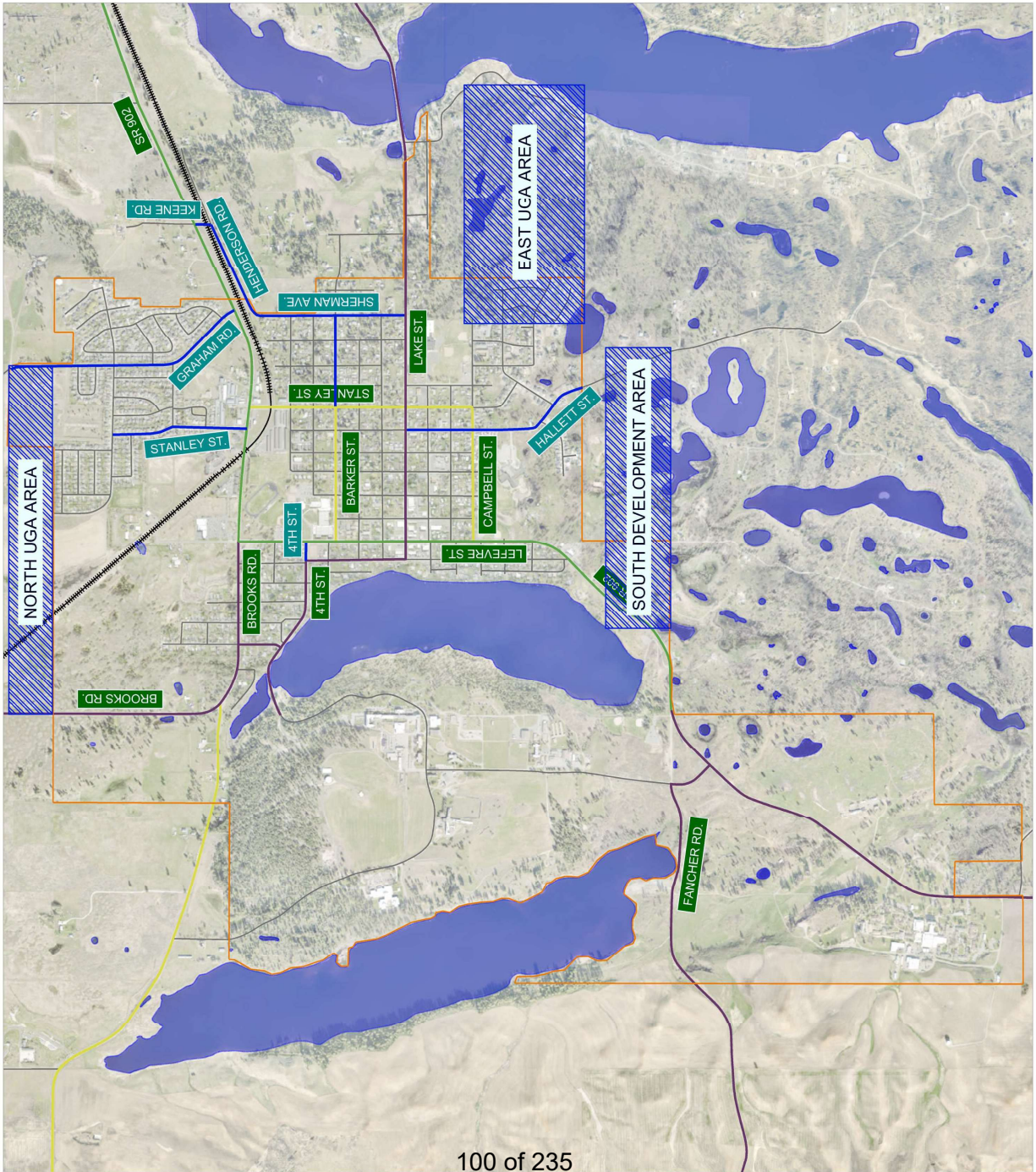
6.6 INFLATION

Inflation has been neglected to this point. The construction costs shown in Table 6.1 are conservative (high-end), so inflation was not addressed, the same with the long-range planning estimates. With that said, inflation is a very real issue for agencies to understand and reflect in project costs.

The recommendation is that any future update to the TIP or this Plan factor inflation, accounting for increasing prices. Per resources such as WSDOT's historical pricing index pages (unit bid history webpage) and Engineering News Record (<https://www.enr.com/>) inflation tables, a 2.8% inflation factor has been occurring within more recent histories. To ensure conservative results, a 3% annual adjustment should be used to estimate future costs.

Per the prior example, a cost range of \$3.445 to \$4.505 million was estimated to provide a complete street along Lake Street, Sherman Street to Freeman Drive. If a year 2036 cost estimate were to be developed, a 3% compounding of 10-years would be applied for a total adjustment factor of 1.344. This would be applied against former costs to develop a revised range of \$4.63 to \$6.055 million for year 2036. For convenience, an inflation adjustment summary is as follows:

2027 = 1.03	2035 = 1.305	2043 = 1.653
2028 = 1.061	2036 = 1.344	2044 = 1.702
2029 = 1.093	2037 = 1.384	2045 = 1.754
2030 = 1.126	2038 = 1.426	2046 = 1.806
2031 = 1.159	2039 = 1.469	2047 = 1.860
2032 = 1.194	2040 = 1.513	2048 = 1.916
2033 = 1.230	2041 = 1.558	2049 = 1.974
2034 = 1.267	2042 = 1.605	2050 = 2.033



LEGEND	
	PRINCIPAL ARTERIAL
	MINOR ARTERIAL
	MAJOR COLLECTOR
	MINOR COLLECTOR
	LOCAL STREET
	CITY URBAN BOUNDARY
	WASHINGTON EASTERN RAIL
	FUTURE COLLECTOR
	FUTURE COLLECTOR AREA

- Proposed Revision to Major or Minor Collector
- Hallett Street, Lake Street to City Limit
 - Stanley Street, Tara Lee Avenue to SR 902
 - Graham Road, Tara Lee Avenue to SR 902
 - Sherman Avenue, Henderson Rd to Lake St
 - Henderson Rd, Sherman Ave to Keene Rd
 - Keene Road, Henderson Road to SR 902
 - 4th Street, Jefferson Street to Leffevre Street
 - Barker Street, Stanley St to Sherman Ave

Exhibit

6.5

PROPOSED FUNCTIONAL CLASSIFICATIONS

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON





LEGEND

	ALIGNMENT OPTION # 1
	ALIGNMENT OPTION # 2



Exhibit 6.6

PROPOSED ROAD ALIGNMENTS NORTH UGA AREA

CITY OF MEDICAL LAKE
TRANSPORTATION MASTER PLAN
MEDICAL LAKE, WASHINGTON



LEGEND					
	ALIGNMENT OPTION # 1		ALIGNMENT OPTION # 3		ALIGNMENT OPTION # 5
	ALIGNMENT OPTION # 2		ALIGNMENT OPTION # 4		



Appendix A:

Glossary of Terms

This section of the Technical Appendix provides a glossary of terms.

- Access point - An intersection, driveway, or opening on a roadway that provides access to a land use or facility.
- All-way stop-controlled - An intersection with stop signs located on all approaches.
- Arterial - (General Definition) A signalized street that primarily serves through traffic and secondarily provides access to abutting properties.
- Average daily traffic (ADT) - The average 24-hour traffic volume at a given location on a roadway.
- Capacity - The number of vehicles or persons that can be accommodated on a roadway, roadway section, or at an intersection over a specified period. Capacity is also a term used to define limits for transit, pedestrian, and bicycle facilities. Concept typically expressed as vehicles per hour, vehicles per day, or persons per hour or per day.
- Collector street - (General Definition) A surface street providing land access and traffic circulation within residential, commercial, and industrial areas.
- Cycle - A complete sequence of cycle indicators.
- Cycle length - The total time for a signal to complete one cycle.
- Delay - The additional travel time experienced by a driver, passenger, or pedestrian.
- Demand - The number of users desiring service on a highway system or street over a specified time. Concept typically expressed as vehicles per hour, vehicles per day, or persons per hour or per day.
- Departing sight distance - The length of road required for a vehicle to turn from a stopped position at an intersection (or driveway) and accelerate to travel speed.
- Design Hour - The peak hour of traffic volumes/conditions; typically used in traffic studies, design analyses, and design. Typically recognized as the 85th percentile hours and often one of the peak/commute hours.
- Downstream - The direction of traffic flow.
- Functional class - A transportation facility defined by the traffic service it provides.
- Growth factor - A percentage increase applied to current traffic demands or counts to estimate future demands/volumes.
- Intersection Control Analysis - An intersection control analysis (ICA) is a traffic/transportation study used to recommend geometric and traffic control improvements for an intersection or intersections.
- Level of Service - The standard used to evaluate traffic operating conditions of the transportation system. This is a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric

features, traffic interruptions, delays, and freedom to maneuver. Operating conditions are categorized as LOS A through LOS “F.” LOS A generally represents the most favorable driving conditions and LOS F represents the least favorable conditions.

- Mainline - The primary through roadway as distinct from ramps, auxiliary lanes, and collector-distributor roads.
 - Major Street - The street not controlled by stop signs at a two-way stop-controlled intersection.
 - Minor arterial - (General Definition) A functional category of a street allowing trips of moderate length within a small geographical area.
 - Operational analysis - A use of capacity analysis to determine the level of service on an existing or projected facility, with known projected traffic, roadway, and control conditions.
 - Peak Generator Hour - The single hour (or hours) in a day during which trip generation for a development or land use is highest.
 - Peak hour - A single hour (or hours) in a day during which the maximum traffic volume occurs on a given facility (roadway, intersection, etc.). Typically, the peak hour is known as the “rush” hour that occurs during the AM or PM work commutes of the typical weekday. The absolute peak hour of the day can also be referred to as the design hour.
 - Peak Generator Hour - The peak hourly volume generated by a particular development or land use. In the context of traffic reports, the generator hour can occur in the morning and afternoon, described as AM and PM peak generator hours, respectively.
 - Peak hour factor - The hourly volume during the maximum-volume hour of the day divided by the peak 15-minute flow rate within the peak hour; a measure of traffic demand fluctuation within the peak hour.
 - Principal Arterial - (General Definition) A major surface street with relatively long trips between major points, and with through-trips entering, leaving, and passing through the urban area.
 - Queue - A line of vehicles, bicycles, or persons waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue. Slower moving vehicles or people joining the rear of the queue are usually considered a part of the queue.
 - Roadside obstruction - An object or barrier along a roadside or median that affects traffic flow, whether continuous (e.g., a retaining wall) or not continuous (e.g., light supports or a bridge abutment).
 - Road characteristic - A geometric characteristic of a street or highway, including the type of facility, number and width of lanes, shoulder widths and lateral clearances, design speed, and horizontal and vertical alignment.
-

- Roundabout - An unsignalized intersection with a circulatory roadway around a central island with all entering vehicles yielding to the circulating traffic.
- Shoulder - A portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, emergency use, and lateral support of the subbase, base, and surface courses.
- Stopping sight distance - The length of road needed for a moving vehicle to come to a complete stop prior to an obstruction sighted on the road.
- Traffic conditions - A characteristic of traffic flow, including distribution of vehicle types in the traffic stream, directional distribution of traffic, lane use distribution of traffic, and type of driver population on a given facility.
- Travel speed - The average speed, in miles per hour, of traffic computed as the length of the roadway segment divided by the average travel time of the vehicles traversing the segment.
- Travel time - The average time spent by vehicles traversing a highway segment, including control delay, in seconds per vehicle or minutes per vehicle.
- Trip Distribution and Assignment - The predicted travel patterns of vehicle trips as they approach and depart a land use. Distribution refers to the travel pattern, usually defined in percentages or fractions, and assignment refers to vehicle trip ends.
- Traffic forecast - The predicted traffic volume of the analysis horizon year or period. Most typically predicted for the weekday, AM peak hour, PM peak hour, or AM or PM peak generator hours of the typical weekday.
- Traffic impact analysis - A traffic impact analysis (TIA) is an engineering and planning study that forecasts the potential traffic and transportation impacts of a proposed development on an area, neighborhood, or community. Reports can also be referred to as a traffic impact study (TIS).
- Trip generation - The number of vehicle trips generated by a development or land use. Most typically predicted for the weekday, AM peak hour, PM peak hour, or AM or PM peak generator hours of the typical weekday.
- Two-way left-turn lane - A lane in the median area that extends continuously along a street or highway and is marked to provide a deceleration and storage area, out of the through-traffic stream, for vehicles traveling in either direction to use in marking left turns at intersections and driveways.
- Two-way stop-controlled - The type of traffic control at an intersection where drivers on the minor street or drivers turning left from the major street wait for a gap in the major street traffic to complete a maneuver. Typically, the minor approaches are stop-controlled.
- Unsignalized intersection - An intersection not controlled by traffic signals.

- Upstream - The direction from which traffic is flowing.
 - Volume - The number of persons or vehicles passing a point on a lane, roadway, or other traffic-way during some time interval, often one hour, expressed in vehicles, bicycles, or persons per hour.
 - Volume-to-capacity ratio - The ratio of flow rate to capacity for a transportation facility.
 - Walkway - A facility provided for pedestrian movement and segregated from vehicle traffic by a curb or provided for on a separate right-of-way.
-

Appendix B:

HCM Methodology

All intersections capacity conditions were analyzed using the methodologies presented in the latest (7th) edition of the *Highway Capacity Manual* (HCM) updated in 2022. The concept of level of service (LOS) uses qualitative measures that characterize operational conditions within the traffic stream. The individual levels of service are described by factors that include speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations A through F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions; a description of each LOS grade is provided as follows:

LOS A represents uninterrupted travel operations. A roadway operating at LOS B may also be over-engineered, where resources could have been allocated to higher priority areas.

LOS B represents reasonably free-flow travel operations, unaffected by the presence of other vehicles. A roadway operating at LOS A may be over-engineered, where resources could have been allocated to higher priority areas.

LOS C represents stable travel operations and average speeds remain at or near free-flow conditions. This is an ideal LOS, requiring drivers to be vigilant for safety and representing appropriate infrastructure investment.

LOS D represents travel operations that are acceptable but are approaching instability. Speeds decrease and the roadway investment is serving an appropriate number of users.

LOS E represents travel operations that are unacceptable to the city. Traffic is unstable and flow, speed, and maneuverability are limited. LOS E may be mitigated with improvements that include traffic control measures, signal timing adjustments, or capacity improvements.

LOS F represents travel operations that are forced flow or breakdown conditions in queued traffic. Stop-and-go travel with long delays exists as vehicles shuffle through queues. Like LOS E, these conditions must be mitigated.

Levels of service for intersections are defined within ranges of average control delay experienced per vehicle, the number of seconds a vehicle can expect to wait due to the presence of a traffic control device. Signalized LOS is the function of control delay experienced by all vehicles at the intersection, as is LOS for an all-way stop. However, LOS for an unsignalized one or two-way stop to another road is the function of control delay experienced within the worse, stopped approach or approach movement. **Table 5** lists LOS criteria for signalized and unsignalized intersections (all or partial stops).

The LOS (capacity) analysis was developed using Synchro software, version 12.0. Synchro 12.0 software calculates the LOS per HCM 7th edition methodology. The 7th edition HCM documents the signalized LOS calculation methodology which considers lane geometry,

Table 5. Intersection LOS Criteria

Level of Service	Control Delay (sec/veh)	
	Signalized	Unsignalized
A	≤ 10	≤ 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80 (or $v/c > 1$)	> 50 (or $v/c > 1$)

Source: Exhibits 19-8, 20-2, 21-8, and 22-8, *Highway Capacity Manual, 7th Edition (2022)*

traffic volumes and cycle length/phasing to compute LOS. Synchro analysis worksheets report individual movement delay/LOS and overall delay/LOS for signalized intersections; unsignalized intersection worksheets report the worst-case delay/LOS and the average overall intersection delay.

Appendix C:

Summary Collision Data

Appendix D:
Summary LOS Worksheets

Intersection												
Int Delay, s/veh	6.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔	↔		↔	
Traffic Vol, veh/h	19	142	50	85	80	5	53	27	135	8	32	17
Future Vol, veh/h	19	142	50	85	80	5	53	27	135	8	32	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	150	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	154	54	92	87	5	58	29	147	9	35	18
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	92	0	0	209	0	0	512	500	182	485	524	90
Stage 1	-	-	-	-	-	-	223	223	-	274	274	-
Stage 2	-	-	-	-	-	-	289	277	-	210	250	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1502	-	-	1362	-	-	472	473	861	493	458	968
Stage 1	-	-	-	-	-	-	780	719	-	732	683	-
Stage 2	-	-	-	-	-	-	719	681	-	792	700	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1502	-	-	1362	-	-	391	432	861	350	418	968
Mov Cap-2 Maneuver	-	-	-	-	-	-	391	432	-	350	418	-
Stage 1	-	-	-	-	-	-	767	708	-	679	634	-
Stage 2	-	-	-	-	-	-	619	632	-	620	689	-
Approach	EB			WB			NB			SB		
HCM Ctrl Dly, s/v	0.67			3.92			12.38			13.45		
HCM LOS							B			B		
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1			
Capacity (veh/h)	404	861	154	-	-	890	-	-	488			
HCM Lane V/C Ratio	0.215	0.17	0.014	-	-	0.068	-	-	0.127			
HCM Ctrl Dly (s/v)	16.3	10	7.4	0	-	7.8	0	-	13.5			
HCM Lane LOS	C	B	A	A	-	A	A	-	B			
HCM 95th %tile Q(veh)	0.8	0.6	0	-	-	0.2	-	-	0.4			

Intersection						
Int Delay, s/veh	1.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	46	239	156	57	18	14
Future Vol, veh/h	46	239	156	57	18	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	260	170	62	20	15
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	232	0	-	0	529	170
Stage 1	-	-	-	-	170	-
Stage 2	-	-	-	-	360	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1336	-	-	-	510	874
Stage 1	-	-	-	-	860	-
Stage 2	-	-	-	-	706	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1336	-	-	-	488	874
Mov Cap-2 Maneuver	-	-	-	-	488	-
Stage 1	-	-	-	-	823	-
Stage 2	-	-	-	-	706	-
Approach	EB	WB		SB		
HCM Ctrl Dly, s/v	1.26	0		11.32		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	291	-	-	-	605	
HCM Lane V/C Ratio	0.037	-	-	-	0.058	
HCM Ctrl Dly (s/v)	7.8	0	-	-	11.3	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	

Intersection						
Int Delay, s/veh	3.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	22	35	59	182	31	51
Future Vol, veh/h	22	35	59	182	31	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	38	64	198	34	55
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	62	0	369	43
Stage 1	-	-	-	-	43	-
Stage 2	-	-	-	-	326	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1541	-	631	1027
Stage 1	-	-	-	-	980	-
Stage 2	-	-	-	-	731	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1541	-	602	1027
Mov Cap-2 Maneuver	-	-	-	-	602	-
Stage 1	-	-	-	-	980	-
Stage 2	-	-	-	-	697	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		1.82		9.99	
HCM LOS	A					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	811	-	-	441	-	
HCM Lane V/C Ratio	0.11	-	-	0.042	-	
HCM Ctrl Dly (s/v)	10	-	-	7.4	0	
HCM Lane LOS	A	-	-	A	A	
HCM 95th %tile Q(veh)	0.4	-	-	0.1	-	

Intersection						
Int Delay, s/veh	1.6					
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	48	278	255	81	36	19
Future Vol, veh/h	48	278	255	81	36	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	52	302	277	88	39	21
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	365	0	-	0	728	321
Stage 1	-	-	-	-	321	-
Stage 2	-	-	-	-	407	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1193	-	-	-	391	720
Stage 1	-	-	-	-	735	-
Stage 2	-	-	-	-	672	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1193	-	-	-	370	720
Mov Cap-2 Maneuver	-	-	-	-	370	-
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	672	-
Approach	EB	WB		SE		
HCM Ctrl Dly, s/v	1.2	0		14.35		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1	
Capacity (veh/h)	265	-	-	-	445	
HCM Lane V/C Ratio	0.044	-	-	-	0.134	
HCM Ctrl Dly (s/v)	8.2	0	-	-	14.3	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0.1	-	-	-	0.5	

HCM 7th TWSC

1: Lefevre Street/N Lefevre Street & W Brooks Road/SR 902

Year 2050 PM Peak Hour

Intersection												
Int Delay, s/veh	9.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕	↕		↕	
Traffic Vol, veh/h	25	190	70	135	115	5	80	35	195	10	45	20
Future Vol, veh/h	25	190	70	135	115	5	80	35	195	10	45	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	150	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	27	207	76	147	125	5	87	38	212	11	49	22
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	130	0	0	283	0	0	742	723	245	701	758	128
Stage 1	-	-	-	-	-	-	299	299	-	421	421	-
Stage 2	-	-	-	-	-	-	443	424	-	280	337	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1455	-	-	1280	-	-	332	353	794	353	336	922
Stage 1	-	-	-	-	-	-	710	666	-	610	589	-
Stage 2	-	-	-	-	-	-	594	587	-	727	641	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1455	-	-	1280	-	-	236	302	794	198	288	922
Mov Cap-2 Maneuver	-	-	-	-	-	-	236	302	-	198	288	-
Stage 1	-	-	-	-	-	-	694	651	-	535	516	-
Stage 2	-	-	-	-	-	-	460	514	-	490	627	-
Approach	EB			WB			NB			SB		
HCM Ctrl Dly, s/v	0.66			4.33			19.04			19.55		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1			
Capacity (veh/h)	253	794	150	-	-	945	-	-	328			
HCM Lane V/C Ratio	0.494	0.267	0.019	-	-	0.115	-	-	0.248			
HCM Ctrl Dly (s/v)	32.4	11.2	7.5	0	-	8.2	0	-	19.6			
HCM Lane LOS	D	B	A	A	-	A	A	-	C			
HCM 95th %tile Q(veh)	2.5	1.1	0.1	-	-	0.4	-	-	1			

HCM 7th TWSC
2: SR 902 & Stanley Street North

Year 2050 PM Peak Hour

Intersection						
Int Delay, s/veh	2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	75	320	225	95	35	30
Future Vol, veh/h	75	320	225	95	35	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	82	348	245	103	38	33
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	348	0	-	0	755	245
Stage 1	-	-	-	-	245	-
Stage 2	-	-	-	-	511	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1211	-	-	-	376	794
Stage 1	-	-	-	-	796	-
Stage 2	-	-	-	-	602	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1211	-	-	-	345	794
Mov Cap-2 Maneuver	-	-	-	-	345	-
Stage 1	-	-	-	-	730	-
Stage 2	-	-	-	-	602	-
Approach	EB	WB		SB		
HCM Ctrl Dly, s/v	1.55	0		14.09		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	342	-	-	-	467	
HCM Lane V/C Ratio	0.067	-	-	-	0.151	
HCM Ctrl Dly (s/v)	8.2	0	-	-	14.1	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0.2	-	-	-	0.5	

Synchro 12 Report

HCM 7th TWSC
3: Stanley Street South & SR 902

Year 2050 PM Peak Hour

Intersection						
Int Delay, s/veh	3.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	270	85	140	275	45	75
Future Vol, veh/h	270	85	140	275	45	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	293	92	152	299	49	82
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	386	0	943	340
Stage 1	-	-	-	-	340	-
Stage 2	-	-	-	-	603	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1173	-	291	703
Stage 1	-	-	-	-	721	-
Stage 2	-	-	-	-	546	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1173	-	246	703
Mov Cap-2 Maneuver	-	-	-	-	246	-
Stage 1	-	-	-	-	721	-
Stage 2	-	-	-	-	461	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		2.88		17.63	
HCM LOS	C					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	414	-	-	607	-	
HCM Lane V/C Ratio	0.315	-	-	0.13	-	
HCM Ctrl Dly (s/v)	17.6	-	-	8.5	0	
HCM Lane LOS	C	-	-	A	A	
HCM 95th %tile Q(veh)	1.3	-	-	0.4	-	

Intersection						
Int Delay, s/veh	2.9					
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	70	400	405	135	65	30
Future Vol, veh/h	70	400	405	135	65	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	76	435	440	147	71	33
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	587	0	-	0	1101	514
Stage 1	-	-	-	-	514	-
Stage 2	-	-	-	-	587	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	988	-	-	-	235	561
Stage 1	-	-	-	-	601	-
Stage 2	-	-	-	-	556	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	988	-	-	-	211	561
Mov Cap-2 Maneuver	-	-	-	-	211	-
Stage 1	-	-	-	-	540	-
Stage 2	-	-	-	-	556	-
Approach	EB	WB		SE		
HCM Ctrl Dly, s/v	1.33	0		27.32		
HCM LOS				D		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1	
Capacity (veh/h)	268	-	-	-	263	
HCM Lane V/C Ratio	0.077	-	-	-	0.393	
HCM Ctrl Dly (s/v)	8.9	0	-	-	27.3	
HCM Lane LOS	A	A	-	-	D	
HCM 95th %tile Q(veh)	0.2	-	-	-	1.8	

HCM 7th TWSC

1: Lefevre Street/N Lefevre Street & W Brooks Road/SR 902

Full Build PM Peak Hour

Intersection												
Int Delay, s/veh	25.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔	↔		↔	
Traffic Vol, veh/h	25	205	80	250	130	10	80	40	285	15	55	20
Future Vol, veh/h	25	205	80	250	130	10	80	40	285	15	55	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Yield	-	-	None
Storage Length	-	-	-	-	-	-	-	-	150	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	27	223	87	272	141	11	87	43	310	16	60	22
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	152	0	0	310	0	0	1035	1016	266	989	1054	147
Stage 1	-	-	-	-	-	-	321	321	-	690	690	-
Stage 2	-	-	-	-	-	-	715	696	-	299	364	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1429	-	-	1251	-	-	210	238	772	226	226	900
Stage 1	-	-	-	-	-	-	691	652	-	435	446	-
Stage 2	-	-	-	-	-	-	422	443	-	710	624	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1429	-	-	1251	-	-	108	177	772	81	168	900
Mov Cap-2 Maneuver	-	-	-	-	-	-	108	177	-	81	168	-
Stage 1	-	-	-	-	-	-	675	637	-	332	340	-
Stage 2	-	-	-	-	-	-	259	338	-	387	609	-
Approach	EB			WB			NB			SB		
HCM Ctrl Dly, s/v	0.61			5.56			57.18			52.42		
HCM LOS							F			F		
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1			
Capacity (veh/h)	124	772	137	-	-	1138	-	-	168			
HCM Lane V/C Ratio	1.05	0.401	0.019	-	-	0.217	-	-	0.581			
HCM Ctrl Dly (s/v)	162.7	12.7	7.6	0	-	8.7	0	-	52.4			
HCM Lane LOS	F	B	A	A	-	A	A	-	F			
HCM 95th %tile Q(veh)	7.4	1.9	0.1	-	-	0.8	-	-	3.1			

Intersection						
Int Delay, s/veh	2.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	65	440	345	140	55	45
Future Vol, veh/h	65	440	345	140	55	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	160	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	71	478	375	152	60	49
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	527	0	-	0	995	375
Stage 1	-	-	-	-	375	-
Stage 2	-	-	-	-	620	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1040	-	-	-	272	671
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	537	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1040	-	-	-	246	671
Mov Cap-2 Maneuver	-	-	-	-	246	-
Stage 1	-	-	-	-	631	-
Stage 2	-	-	-	-	537	-
Approach	EB	WB		SB		
HCM Ctrl Dly, s/v	1.12	0		20.19		
HCM LOS				C		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	232	-	-	-	345	
HCM Lane V/C Ratio	0.068	-	-	-	0.315	
HCM Ctrl Dly (s/v)	8.7	0	-	-	20.2	
HCM Lane LOS	A	A	-	-	C	
HCM 95th %tile Q(veh)	0.2	-	-	-	1.3	

HCM 7th TWSC
3: Stanley Street South & SR 902

Full Build PM Peak Hour

Intersection						
Int Delay, s/veh	16.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	380	115	250	425	65	105
Future Vol, veh/h	380	115	250	425	65	105
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	413	125	272	462	71	114
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	538	0	1481	476
Stage 1	-	-	-	-	476	-
Stage 2	-	-	-	-	1005	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1030	-	138	589
Stage 1	-	-	-	-	625	-
Stage 2	-	-	-	-	354	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1030	-	89	589
Mov Cap-2 Maneuver	-	-	-	-	89	-
Stage 1	-	-	-	-	625	-
Stage 2	-	-	-	-	228	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		3.61		113.77	
HCM LOS	F					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	187	-	-	667	-	
HCM Lane V/C Ratio	0.987	-	-	0.264	-	
HCM Ctrl Dly (s/v)	113.8	-	-	9.7	0	
HCM Lane LOS	F	-	-	A	A	
HCM 95th %tile Q(veh)	8.2	-	-	1.1	-	

Synchro 12 Report

Intersection						
Int Delay, s/veh	33.7					
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	105	515	630	200	110	65
Future Vol, veh/h	105	515	630	200	110	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	114	560	685	217	120	71

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	902	0	0	1582	793
Stage 1	-	-	-	793	-
Stage 2	-	-	-	788	-
Critical Hdwy	4.12	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	3.518	3.318
Pot Cap-1 Maneuver	753	-	-	120	388
Stage 1	-	-	-	445	-
Stage 2	-	-	-	448	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	753	-	-	~ 93	388
Mov Cap-2 Maneuver	-	-	-	~ 93	-
Stage 1	-	-	-	347	-
Stage 2	-	-	-	448	-

Approach	EB	WB	SE
HCM Ctrl Dly, s/v	1.8	0	\$ 306.75
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SELn1
Capacity (veh/h)	305	-	-	-	130
HCM Lane V/C Ratio	0.151	-	-	-	1.462
HCM Ctrl Dly (s/v)	10.6	0	-	-	\$ 306.7
HCM Lane LOS	B	A	-	-	F
HCM 95th %tile Q(veh)	0.5	-	-	-	13

Notes	
~: Volume exceeds capacity	\$: Delay exceeds 300s
+: Computation Not Defined	*: All major volume in platoon