APPENDIX I

SR 503 Transportation Analysis

Final Report

SR 503 Milepost 52.23 to 53.92 Transportation Analysis

Prepared for:
Parametrix and WSDOT

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Chapter 1. Introduction

The primary purpose of this report is to identify enhancements along SR 503 by conducting a transportation analysis for the area between N Goerig Street and McCracken Road. The transportation analysis provides guidance to the City of Woodland and Washington State Department of Transportation (WSDOT) in implementing transportation improvements along the SR 503 corridor.

This study analyzes existing and future (2025) transportation conditions for SR 503 between N Goerig Street and McCracken Road. This roadway is located within the City of Woodland, Washington as shown in Figure 1, Study Area. This document describes design concepts and provides technical evaluation of transportation issues and impacts related to the corridor.

Report Organization

The report is organized into six chapters, the first being this Introduction and the remaining chapters include:

- **Chapter 2 Transportation Analysis Methodology** – establishes the standards and criteria as well as evaluation methods used to determine existing and future (2025) transportation conditions.
- **Chapter 3 Existing Conditions –** documents the current corridor transportation conditions.
- **Chapter 4 Future (2025) Conditions –** describes the future transportation conditions to determine potential transportation needs along SR 503.
- **Chapter 5 Future Improvement Evaluation** – presents an evaluation of improvement options for the SR 503 corridor.
- **Chapter 6 Summary and Conclusions** – describes the recommendations for the SR 503 corridor improvements.

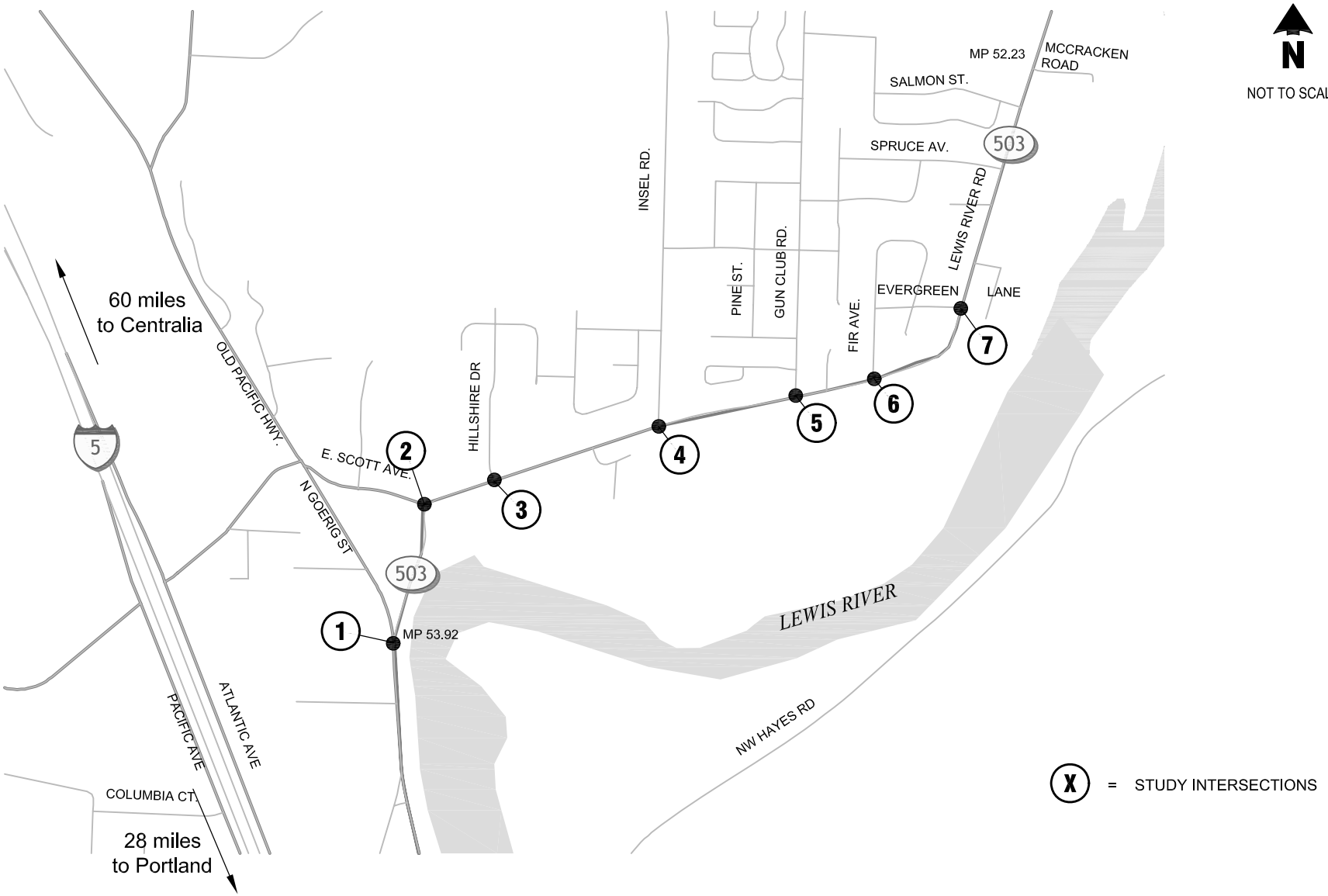

Figure 1
Study Area

SR 503 Milepost 52.23 to 53.92

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Chapter 2. Transportation Analysis Methodology

This section discusses the analysis methodology and data resources used to determine the existing conditions within the study area. The traffic operations analysis provides a quantitative method for evaluating and comparing existing and future transportation alternatives. Traffic operations were evaluated based upon the LOS (level of service) methodologies of the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2000). The HCM is a nationally recognized and locally accepted method of measuring traffic flow and congestion. Criteria range from LOS A, indicating free-flow conditions with minimal vehicle delays, to LOS F, indicating extreme congestion with significant vehicle delays.

LOS Criteria

Signalized intersection LOS is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically, LOS criteria are stated in terms of average delay per vehicle during a specified time period (for example, the PM peak hour). Vehicle delay is a complex measure based on many variables, including signal phasing (i.e., progression of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. Table 1 shows LOS criteria for signalized intersections, as described in HCM.

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	Description
A	≤10	Free Flow
B	>10 - 20	Stable Flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	>80	Forced flow (jammed)

Source: *Highway Capacity Manual,* Transportation Research Board, 2000.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop-controlled and two-way stop-controlled. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s). This is because the performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. For this reason, LOS for a two-way, stop-controlled intersection is defined in terms of its individual movements. With this in mind, total average vehicle delay (i.e., average delay of all movements) for a two-way, stop-controlled intersection should be viewed with discretion. Table 2 shows LOS criteria for unsignalized intersections (both all-way and two-way, stop-controlled).

All study intersections are currently unsignalized within the study area; therefore, the LOS criteria in Table 2 are used for the analysis of existing and future conditions within traffic control improvements.

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicles)
A	0 - 10
B	>10 - 15
C	>15 - 25
D	>25 - 35
E	>35 - 50
F	>50

Source: *Highway Capacity Manual*, Transportation Research Board, 2000.

LOS Standard

The City of Woodland's level of service standard is LOS D or better on state highways, major arterials, and minor arterials. Acceptable levels of traffic on collectors and local streets are established through street design standards.

Pursuant to the Growth Management Act (GMA) requirements, Cowlitz-Wahkiakum Council of Governments (CWCOG) and the Southwest Regional Transportation Planning Organization (SWRTPO) established levels of service standards for state highways within Cowlitz and Clark Counties. CWCOG/SWRTPO established LOS C for Highways of Statewide Significance (HSS) in rural areas. For non-HSS facilities, CWCOG/SWRTPO established LOS D for urban areas and LOS C for rural areas. Therefore, the City's LOS D standard would be consistent for SR 503 within the Urban Growth Area (UGA), with a LOS C standard outside the UGA. The study area along SR 503 between N Goerig Street and McCracken Road is within the City and the UGA; thus, the LOS D standard applies.

Data Sources

The existing roadway channelization and intersection configurations were obtained from previous traffic studies, work completed as part of the development of the City of Woodland traffic model, and verified using recent aerial photography as well as a field check based on data collected by Parametrix. All intersections are currently stop-controlled.

Intersection turning movement data were obtained from traffic counts conducted to support development of the City of Woodland traffic model and traffic studies conducted between 2003 and 2005. All traffic counts were conducted between 2003 and 2005. The counts were adjusted to be consistent with the 2007 conditions based on historical growth trends (see Traffic Volume section). The weekday PM peak hour typically has the highest overall traffic volumes in the community and thus provides a basis for identifying improvement needs for SR 503 between milepost 52.23 and 53.92.

Chapter 3. Existing Conditions

This section describes the existing conditions along the State Route (SR) 503 corridor including land use, environmental conditions, roadway operations, transit and non-motorized facilities, and safety issues. The existing conditions serve as a comparative baseline to measure potential improvements.

In general, SR 503, also known as Lewis River Road, is a rural minor arterial that extends from I-5 in Woodland, Washington to Mount St. Helens east of the City of Woodland. This roadway is not part of the national highway system. The study area runs from McCracken Road milepost 52.23 to N Goerig Street milepost 53.92 in City of Woodland, Cowlitz County. Within the study area this roadway is primarily oriented in the east-west direction with level terrain. WSDOT classifies the SR 503 access as a Class 4 Managed Access roadway which requires a designed posted speed limit of 35 to 40 miles per hour (mph) and spacing of intersecting streets a minimum of one-half mile. In addition, the private or public access connections allow one access point per parcel and require a minimum access spacing of 250 feet on the same side of the highway. Along SR 503, major intersections are spaced approximately 500 feet and private driveways, serving mostly residential uses, are located as close as 100 feet to intersections or other connections. The cross section on SR 503 within the study area is one lane in each direction. The posted speed limit is 30 to 35 mph. Sidewalks and bicycle lanes are not provided.

Land Use

Land uses along the SR 503 corridor are mainly residential with supporting uses such as schools, churches, and retail/restaurants. The roadway serves as a connection to low density residential, recreational and forest areas to the east of Woodland. As a result, a portion of the traffic is recreational vehicles and logging trucks coming to/from the forest areas east of the City.

Study Area

As discussed previously, the study focuses on SR 503 between N Goerig Street and McCracken Road. Figure 1 illustrates the study area. Based on available data, existing PM peak hour intersection operational analysis was conducted at the following unsignalized locations:

1. SR 503 (Lewis River Road)/N Goerig Street
2. SR 503 (Lewis River Road)/E Scott Avenue
3. SR 503 (Lewis River Road)/Hillshire Drive
4. SR 503 (Lewis River Road)/Insel Road
5. SR 503 (Lewis River Road)/Gun Club Road
6. SR 503 (Lewis River Road)/Fir Avenue
7. SR 503 (Lewis River Road)/Evergreen Lane

Roadway Characteristics

Channelization and traffic control study intersections along SR 503 within the study area are illustrated in Figure 2. A detailed description of major roadways within the study area is provided below.

State Route 503 (SR 503) provides regional access from I-5 to areas in east Cowlitz and Clark Counties, as well as parts of Skamania County. WSDOT classifies SR 503 in Woodland as a rural, minor arterial. Approximately one third of a mile east of I-5, SR 503 transitions from three lanes to two lanes. The east side of the road, between S Goerig Street and N Goerig Street, is paralleled by the Lewis River and a concrete dike wall. The west side of this section serves a mix of residential and commercial uses, many of which have direct access onto SR 503. Six-foot paved shoulders are typical on this section of the highway. East of I-5, where N Goerig Street intersects SR 503, the retaining wall located on the eastside of N Goerig Street limits sight distance as you approach this intersection from the south.

Continuing north and east from N Goerig Street, SR 503 continues as a two-lane highway, primarily providing connections to the growing residential areas within the northeast part of the City and to the Upper Lewis River recreational area. Immediately east of E Scott Avenue, residential lots have direct access on both sides of the highway. Further east, Insel Road and Gun Club Road intersect with SR 503. These collectors connect growing residential areas with the highway; however, several individual residential lots and local access streets also access SR 503, especially between Gun Club Road and Spruce Avenue. This section of SR 503 is posted at 35 mph and has 2- to 4-foot shoulders on both sides of the highway. The curve between Fir Street and Evergreen Lane is posted with a 25 mph advisory speed sign.

West of I-5, **Goerig Street** is a two-lane major arterial that connects the west side of Woodland with the I-5 freeway interchange (exit 21). Goerig Street has curb, gutter, and sidewalks on both sides of the street and a speed limit of 25 mph. Goerig Street connects Davidson Avenue and the Woodland downtown business district with SR 503.

The segment of **E Scott Avenue** between Old Pacific Highway and SR 503 is classified as a major arterial. The roadway has two lanes with a speed limit of 25 mph. An all-way stop is located at the intersection with Old Pacific Highway. Side street stop control is located at the SR 503 (Lewis River Road)/E Scott Avenue intersection. At this intersection, SR 503 creates an s-curve which limits sight distance as it approaches E Scott Avenue from the south. E Scott Avenue is considered a minor arterial west of Old Pacific Highway. It connects Old Pacific Highway and Atlantic Avenue on the east side of I-5. It is a two-lane, 25-mph roadway. The Atlantic Avenue/E Scott Avenue intersection provides direct access to northbound I-5.

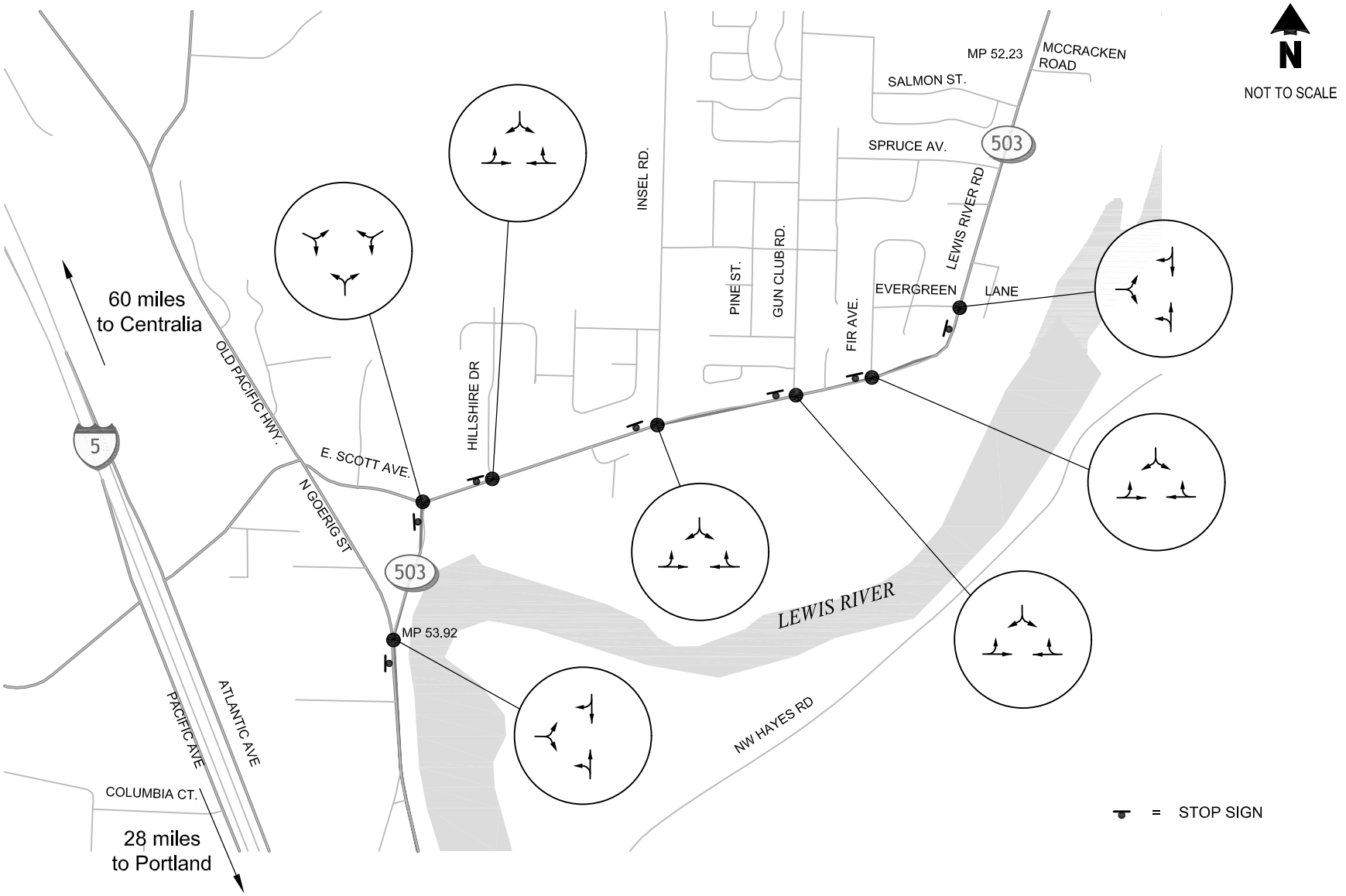

Figure 2

Existing (2007) Channelization and Traffic Control for Study Intersections

SR 503 Milepost 52.23 to 53.92

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Traffic Volumes

This section describes the existing traffic volumes at the study intersections which include locations most likely to be impacted by future SR 503 improvements.

Intersection Turning Movements

Weekday PM peak hour traffic volumes were collected and summarized for each study intersection. Intersection turning movement volumes were adjusted to reflect 2007 peak hour traffic volumes. Table 3 shows a comparison of historical and 2007 weekday PM peak hour turning movements at intersections in the vicinity of the study area.

Table 3. Comparison of Historical and 2007 Intersection Traffic Volumes

		Traffic Count		
Intersections	Count Year	Historical	2007	Annual Growth
W Scott Avenue/Pacific Avenue	2004	405	478	6%
E Scott Avenue/Atlantic Avenue	2004	309	366	6%
E Scott Avenue/Old Pacific Highway	2004	387	406	2%
SR 503 (Lewis River Road)/I-5 SB[1] on ramp	2004	2,018	2,115	2%
			Weighted Average	**3%**

Source: The Transpo Group and Parametrix, 2007.
1. SB = southbound

As shown in the table, the weighted average annual growth in the vicinity of the study area is about 3 percent per year. Based on the City's 2005 Transportation Plan, traffic growth in the eastern and northwestern areas of Woodland has increased between 2 to 4 percent annually. This is consistent with the US Census which shows a population growth in the City of Woodland of 3 to 4 percent per year. Therefore, as a conservative estimate of growth at the study intersections, an annual growth of 4 percent per year was assumed to adjust turning movements to 2007 conditions. Existing traffic volumes were rounded to the nearest five vehicles because weekday volumes fluctuate day-to-day. The 2007 PM peak hour traffic volumes are shown in Figure 3.

Heavy Vehicle Traffic

Intersection turning movement counts indicate that heavy vehicle are 5 percent or less of the total PM peak hour traffic volumes along SR 503. Based on field operations, a significant portion of the heavy vehicle traffic is recreational vehicles (RV).

Traffic Operations

Intersection LOS analysis was performed for the study intersections based on 2007 weekday PM peak hour conditions. Table 4 summarizes the LOS results, delay, volume to capacity (v/c) ratio, and worst movements at the study intersections for 2007. Detailed level of service worksheets are presented in Appendix A.

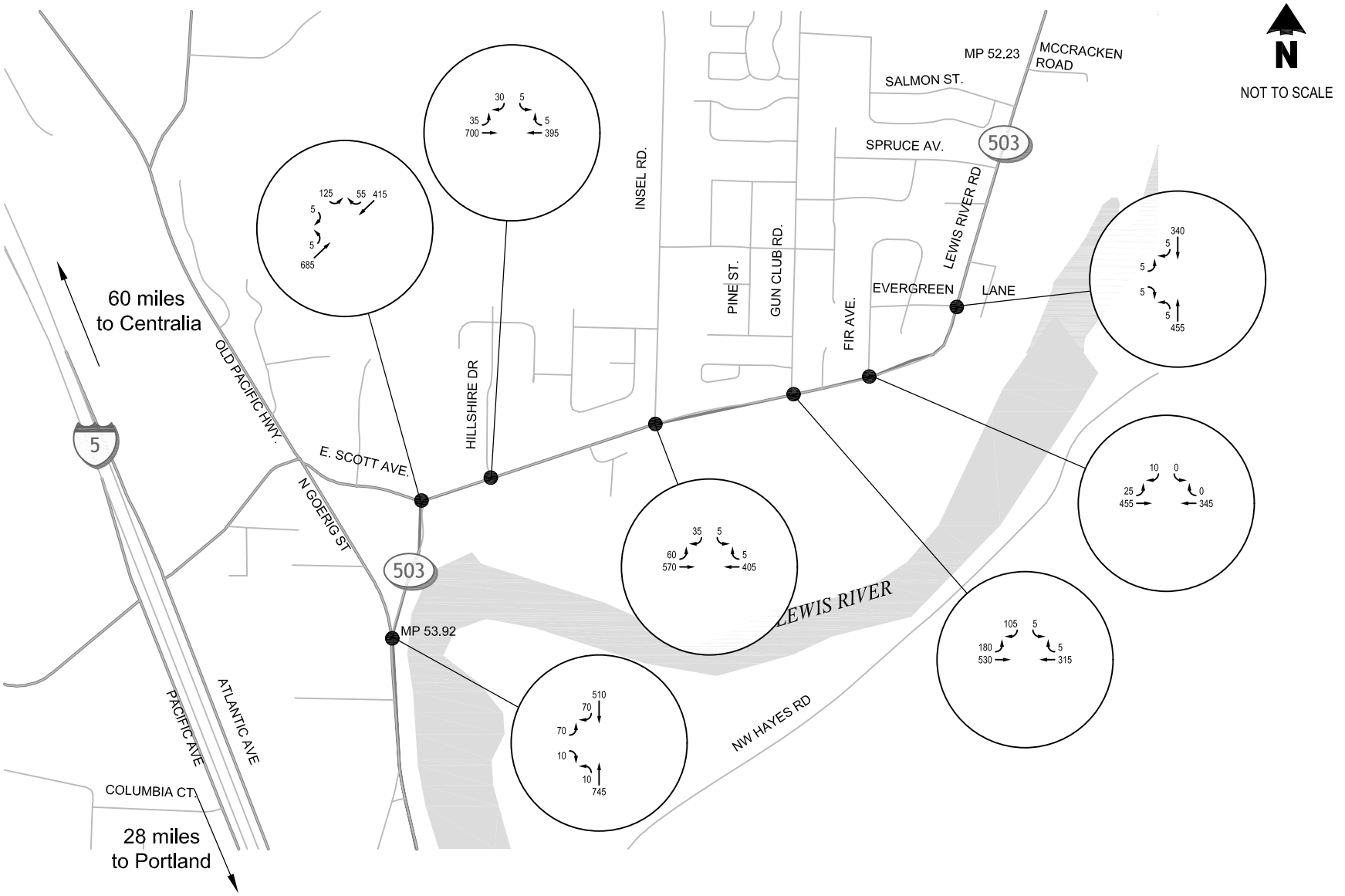

Figure 3

Existing (2007) PM Peak Hour Traffic Volumes

SR 503 Milepost 52.23 to 53.92

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Table 4. Existing (2007) PM Peak Hour Intersection Operations

Unsignalized Intersections	Worst Movement[1]	Delay[2]	LOS[3]
SR 503 (Lewis River Rd)/N Goerig Street	EB	48.9	E
SR 503 (Lewis River Rd)/E Scott Avenue	EB	55.2	F
SR 503 (Lewis River Rd)/Hillshire Drive	SB	13.7	B
SR 503 (Lewis River Rd)/Insel Road	SB	13.5	B
SR 503 (Lewis River Rd)/Gun Club Road	SB	12.2	B
SR 503 (Lewis River Rd)/Fir Avenue	SB	10.3	B
SR 503 (Lewis River Rd)/Evergreen Lane	EB	13.2	B

Source: The Transpo Group 2007.
1. Worst movement reported for unsignalized intersections. EB = eastbound and SB = southbound.
2. Average delay in seconds per vehicle.
3. Level of service, based on 2000 *Highway Capacity Manual* methodology.

As Table 4 shows, all of the intersections currently meet the City's LOS D standard during the weekday PM peak hour except the SR 503 (Lewis River Road)/N Goerig Street and SR 503 (Lewis River Road)/E Scott Avenue intersections.

The SR 503 (Lewis River Road)/N Goerig Street intersection operates at LOS E during the weekday PM peak hour and the SR 503 (Lewis River Road)/E Scott Avenue intersection operates at LOS F during the weekday PM peak hour. Improvements are planned at both of these intersections as part of WSDOT's SR 503 widening and channelization project (see Planned/Pending Improvements section in this report).

Traffic Safety

Historical accident data along SR 503 between N Goerig Street and McCracken Road were provided by WSDOT for the three-year period from 2004 to 2006 (the most recent data available). No fatal accidents were reported. In general, 60 percent of the accidents along this corridor were rear-end collisions. A majority of the accidents, 92 percent, occurred during the daylight hours with about 50 percent during the PM peak period. Summaries of reported accidents for roadways within the study area are provided in Tables 5 and 6.

Intersection Safety Analysis

Table 5 summarizes the accident history at intersections along SR 503. The majority of accidents at the intersections were rear-end collisions, according to WSDOT records. These types of collisions are typically caused by congestion: either frequent stop and go traffic during the peak hours or vehicles stopped along the roadway waiting to complete a left-turn. Rear-end collisions are also the predominate type at the intersection with the highest accident rate -- SR 503 (Lewis River Road)/Insel Road. Typically, intersections with collision rates greater than 1.0 collisions per million entering vehicles (MEV), or an average of more than ten accidents per year at signalized locations and more than five accidents per year at unsignalized locations are earmarked for continued evaluation and potential safety improvements. While Insel Road is outside this threshold, it is very close with four accidents per year and 0.94 accidents per million entering vehicles (MEV) which suggests that there is a possible safety concern.

Table 5. Accident History for Intersections (2004 – 2006)

Intersections	Average Accidents per Year	Daily Entering Vehicles[1]	Accidents per MEV[2]	Accident Majority Type
SR 503 (Lewis River Rd)/N Goerig Street	0.7	13,000	0.14	Rear-end
SR 503 (Lewis River Rd)/E Scott Avenue	0.7	13,000	0.14	Entering at angle
SR 503 (Lewis River Rd)/Hillshire Drive	2.0	12,620	0.43	Rear-end
SR 503 (Lewis River Rd)/River Rock Road	0.3	12,060	0.08	Rear-end
SR 503 (Lewis River Rd)/Insel Road	4.0	11,720	0.94	Rear-end
SR 503 (Lewis River Rd)/Gun Club Road	2.7	11,000	0.66	Rear-end
SR 503 (Lewis River Rd)/Fir Avenue	0.3	10,820	0.08	Rear-end
SR 503 (Lewis River Road)/Salmon Street	0.3	10,060	0.09	Fixed Object

Source: WSDOT and The Transpo Group, 2007.
1. Based on 2006 traffic volumes
2. Accidents per million entering vehicles (MEV).

Highway Safety Analysis

WSDOT applies a formula that takes into account the number and severity of accidents to define High Accident Corridors (HACs). According to WSDOT, there are no 2007-2009 Biennium HAC's or High Accident Locations (HALs) for SR 503 (milepost 52.23 to 53.95) from McCracken to N Goerig.

In addition to the HAC designation, a more detailed review of accidents along SR 503 was conducted. The results of the highway segment analysis are summarized in Table 6. The highway segments listed in Table 6 vary in length and traffic volume. To provide meaningful comparison, accidents along highway segments are typically analyzed in terms of accidents per million vehicle miles traveled (MVM). No universally accepted guideline exists for identifying hazards based on accident rates for highway segments alone; however, WSDOT publishes average accident rates by roadway classification. Table 6 lists the average accident rates for rural minor arterials, which is the classification of SR 503.

Table 6. Accident History for SR 503 Highway Segments (2004 - 2006)

Segment	Average Accidents per Year	Average Daily Vehicles	Accidents per MVM[1]	WSDOT Average Accident Rate[2]	Accident Type (Majority)
N Goerig Street to Gun Club Road	9.0	11,000	2.60	1.62	Rear-end
Gun Club Road to Salmon Street	3.7	13,000	1.59	1.62	Rear-end

Source: WSDOT and The Transpo Group, 2007.
1. Accidents per million entering vehicles (MEV).
2. Source is 2005 Annual State Highway Collision Data Summary (latest available); Rate for rural minor arterials.

The historical accident data obtained from WSDOT indicates that the N Goerig Street to Gun Club Road segment is above the average accident rate for state highways classified as rural, minor arterials similar to SR 503. Along both segments, congestion related rear-end accidents are the predominate type. Since there are no turn lanes along the study corridor, these rear-end accidents are likely due to drivers failing yield when vehicles are making left or right turns from the main road to side streets or driveways. It should also be noted that the segment between Gun Club Road and Salmon Street has a high rate of collisions with fixed objects focused particularly near the curve between the Fir Avenue and Evergreen Lane intersections. This suggests that motorists may struggle to safely negotiate this curve in the corridor.

Pedestrian and Bicycle Collisions

According to WSDOT records, only one accident along SR 503 from N Goerig Street to Salmon Street between 2004 and 2006 involved a bicyclist, and none involved a pedestrian. The bicycle accident

occurred near the SR 503 (Lewis River Road)/Gun Club Road intersection at mile post 53.04. No other pedestrian- or bicycle-related accidents were reported between 2004 and 2006. WSDOT has not currently identified any Pedestrian Accident Locations (PALs) along SR 503 in the Woodland study area.

Other Transportation Modes

The predominate mode of travel throughout the SR 503 corridor and the City of Woodland is currently automobile. This section discusses other modes including transit, pedestrian and bicycle facilities, airport facilities, rail, and port within the corridor and the City.

Transit Service

The City of Woodland and surrounding area are served by a limited amount of existing bus service. The Lower Columbia Community Action Program (CAP) provides a daily transportation service along I-5 from Longview to Salmon Creek including stops in Kalama, Woodland, LaCenter, and Ridgefield. The CAP commuter transit route is designed to connect these smaller communities, such as Woodland, with the larger transportation system in the Longview/Kelso or Vancouver urban areas. Currently, the service makes three complete loops from approximately 6:00 am and 6:00 pm on Monday through Friday. Woodland residents can access the route at the Visitor Center/Park-and-Ride facility near the I-5/SR 503 interchange. According to CAP, average transit pick-up/drop-off activity at the Park-and-Ride during 2007 was approximately 10 person-trips per day.

Pedestrian and Bicycle Facilities

The majority of formal pedestrian and bicycle facilities are located outside the study area along the SR 503 (Lewis River Road)/Goerig Street/Davidson Avenue corridor, especially west of I-5. Developments along Insel Road and Gun Club Roads have constructed sidewalks for pedestrian travel within the local neighborhood. Outside of these areas, pedestrians and bicyclists generally use the roadway shoulders, which are limited in width in many locations. When developing new subdivisions, the City requires dedication of right-of-way and construction of sidewalks. This results in a piecemeal pattern of sidewalks in the redeveloped areas.

Airport Facilities

The Woodland airport, though primarily used for recreation, is a notable part of the City's overall transportation system. It is owned and operated by the Washington State Aeronautics Commission, a division of WSDOT. The single airport runway, 1,965 feet long and approximately 25 feet wide, is only suitable for small aircraft.

The airport serves an assortment of uses: recreational flying, search and rescue, and medical emergency. When Mount St. Helens erupted, personnel and supplies were transported via the Woodland airport. Thus, it is important to maintain the airport services and access to and from the airport for the overall benefit it provides Woodland area residents.

Rail Facilities

Burlington Northern Sante-Fe Railroad (BNSF) owns and operates a major west coast railroad system through the City. The BNSF west coast system extends from California to Vancouver, BC. On the west side of Woodland, the rail system consists of a double-track mainline which runs on a north-south alignment through the study area. In addition to BNSF, Union Pacific (UP) also uses the system for freight hauling along the west coast while Amtrak uses the BNSF mainline for its passenger train operations. Currently, Amtrak does not offer passenger service stops in Woodland.

Davidson Avenue and W Scott Avenue cross the double-track mainline at-grade, and thus have railroad crossing signals and mechanical gates. Each crossing has pylons to discourage drivers from driving around closed gates.

Port Facilities

The Columbia River, located directly west of the City of Woodland, is a major source of marine transportation. Extensive amounts of materials are shipped through the Columbia-Snake River system annually. Major ports along the system facilitate rail and truck transportation of goods throughout the United States. Though the Woodland City limits do not extend west to the Columbia River, Cowlitz County has designated portions of the river shoreline for industrial use. The Port of Woodland has retained some of this land and intends to develop a transfer facility to handle marine freight activity.

Chapter 4. Future Conditions

This chapter discusses the future (2025) transportation conditions along SR 503 including planned improvements and traffic operations.

Planned/Pending Improvements

WSDOT has no planned improvements within the study area. Based on the City of Woodland's 2005 Transportation Plan and Cowlitz County's 2008 – 2013 Transportation Improvement Program (TIP), the following corridor-wide and intersection improvements are planned for SR 503 and the study area.

State Highway Improvements

SR 503 Widening and Channelization (projects S-3A to S-3E) – This series of projects would enhance safety and operations along SR 503 within the City. The existing corridor lacks adequate turn lanes and traffic controls to support continued residential growth in east Woodland. The information developed as part of the transportation analysis for the corridor would be used to define a specific cross-section for the highway. Likely improvements include left-turn lanes at intersections of SR 503 with collector roads including Hillshire Drive, Insel Road, and Gun Club Road. Traffic signals would also be considered at these intersections, when warranted per the Federal Highway Administration's *Manual on Uniform Traffic Control Devices* (MUTCD), 2003. Left-turn lanes also may be required at other local or collector streets between Fir Avenue and the City's north UGA limits. Addition of turn lanes and a traffic signal (or other traffic control, when warranted) also has been identified for the intersection of SR 503 at E Scott Avenue. Construction of a north-to-west left turn lane would facilitate potential restriction of some turns at SR 503 at N Goerig Street, just south of this intersection. Spot safety and drainage improvements also would be implemented. These may include guardrails, improved shoulders, signing, and/or illumination.

County Roadway Improvements

Based on the Cowlitz County TIP, there are no specific funded improvements planned within the study. The County does include annual safety improvements to improve the overall safety of the motoring public with placement of guardrail and correction of spot-safety locations; drainage improvements to address deficiencies in capacity and conditions; and sidewalk improvements to complete missing sidewalks within urban areas. In addition, funding is included to replace the Pacific Avenue Bridge with the potential for a new alignment to avoid conflicts with the existing railroad tunnel.

City Roadway Widening and Reconstruction Improvements

E Scott Avenue (project R-5) – The City plans to reconstruct this roadway between SR 503 and Old Pacific Highway. This roadway would be widened to include two travel lanes with paved shoulders for non-motorized uses. Signage would be provided to direct traffic via E Scott Avenue to the I-5 interchange at Pike Road.

City Intersections Improvements

As discussed previously, the SR 503 project would include improvements to intersections within the project limits. This would include SR 503 (Lewis River Road)/E Scott Avenue (project S-3D) and SR 503 (Lewis River Road)/N Goerig Street (project I-5) intersections. Improvements to the SR 503 (Lewis River Road)/E Scott Avenue intersection would enhance safety and operations. When the improved connection between SR 503 and Old Pacific Highway is completed via E Scott Avenue, then the

intersection of N Goerig Street/SR 503 (project I-5) can be restricted (or partially restricted) to reduce safety and operational issues.

Pedestrian and Bicycle Facilities

As part of the roadway improvements, pedestrian and bicycle facility enhancements are included. Sidewalks and bicycle lanes would be constructed as part of the SR 503 improvements.

Policies for Future Roadway Improvements

This section discusses the City of Woodland, Cowlitz County, and WSDOT policies and goals which pertain to future roadway improvements.

City Goals and Policies

The goals and policies that guide the City's implementation of transportation improvements are outlined in the City's 2005 Transportation Plan. The City's overall goal is to provide a convenient, safe, and efficient multi-modal transportation system that promotes the mobility of people and goods within and through the City. In support of this, the City has defined specific goals for modes including developing and improving the City's arterial and collector system to link residential, commercial, and industrial areas of the City with each other and with the regional highway system.

In addition to goals, the following policies help guide implementation of roadway improvements:

- *A LOS D or better is established for arterial state highways (SR 503), major arterials, and minor arterials. The levels of service shall be calculated according to the most recent Highway Capacity Manual or approved alternative method.*
- *Conduct periodic reviews and updates of the City's street design standards and development requirements to support cost effective implementation of arterial collector, and local streets and facilities for pedestrian and bicycle travel. The standard should require new developments, to provide a grid of collector and local roads to serve residential and commercial areas of the City to minimize the impact on adjacent arterials. New developments should provide fully-improved streets to provide access and circulation to support their increased traffic.*
- *Access to properties along state highways, and major and minor arterials should be consolidated whenever possible to maximize the capacity of the facilities and reduce potential safety conflicts. New accesses to state highways and major and minor arterials should be restricted, whenever practical. The City should work with WSDOT to adopt and implement standards for access permitting on state highways within the City boundaries as per Revised Code of Washington (RCW) 47.50.030.*
- *The City should work with WSDOT to provide signing and improvements to the arterial system to encourage use of the Dike Road interchange for travel between I-5 and SR 503.*
- *Local and collector street system improvement projects should include, where possible, provisions of curbs, storm drainage, sidewalks, street lights, and landscaped planting/utility strips, as well as adequate roadway widths and surfaces.*
- *Sidewalks and bicycle lanes should be included, where feasible, as part of identified improvements to SR 503 and other arterials within the UGA.*
- *Develop and sign a system of bicycle routes providing for travel within the City with connections to regional and major local destinations.*

County Goals and Policies

In November 2007, Cowlitz-Wahkiakum Council of Governments (CWCOG) published the 2008 – 2011 *Regional Transportation Improvement Program (TIP) for the Longview-Kelso-Rainer Metropolitan Planning Organization and the Southwest Washington Regional Transportation Planning Organization* CWCOG distributes roadway funding from the Statewide Transportation Program to rural and urban areas of Cowlitz County. Projects contained within the TIP come from transportation planning activities within the Regional Transportation Plan (RTP). The RTP develops regional transportation goals and policies for both short-term and long-term network improvements. The current RTP was published in June 2007 and covers the time period between 2007 and 2027.

State Goals and Policies

WSDOT's *Highway Design Manual* is a comprehensive guide to transportation design projects. Along with this document, WSDOT has developed the *2007-2026 Highway System Plan (HSP): High Benefit Low Cost* (December 2007) which identifies needs, prioritizes strategies for addressing needs, and determines performance measures based on five categories: preservation, safety, economic vitality, mobility, and environment quality and health. There are three tiers of investment with tier one being the low cost investments giving the high return and short delivery time. Investments along SR 503 are included in tier two which have moderate to high cost that deliver potential network benefits to both highways and local roads.

Travel Forecasting Methodology

This section documents future baseline (2025) PM peak hour traffic forecasts which provide the basis for evaluation of long term SR 503 transportation system needs and deficiencies. The following discusses the traffic forecasting process including expected future population and employment as well as future 2025 roadway network improvements.

Traffic volumes were forecasted for two scenarios:

1. **Comp Plan**: based on the existing adopted Woodland Comprehensive Land Use Plan which assumes an annualized population growth rate of 3.5 percent per year.
2. **Comp Plan Plus**: reflects more recent experience in community growth and assumes that population would grow by 4.5 percent per year from 2007 through the planning horizon year of 2025.

The purpose of the second scenario is to test what would be the transportation impacts and infrastructure requirements if the current trends in land development and population growth were to continue through the entire planning period. The Comp Plan Plus scenario is not intended to supersede or second guess the demographic analysis and land use recommendations that would come out of the pending update to the City's Comprehensive Plan. Rather, the analysis of this scenario is intended to inform and provide some direction to understanding the infrastructure implications of potential land use decisions.

Travel Demand Model

Traffic forecasts for the study intersections were developed using the travel demand model previously developed for the City of Woodland 2005 Transportation Plan Update. A multi-step process was undertaken to prepare future year traffic volume forecasts. This process relied on the travel demand model developed and maintained for the Woodland urban growth area by CWCOG. The future planning

horizon year was assumed to be 2025, consistent with regional transportation planning activities currently underway within the region.

The City's travel demand model was initially constructed in 1995 to support the development of the original City of Woodland Comprehensive Plan. It was used to evaluate the needed transportation system to support the anticipated land use targets documented in that Plan. Since 1995, several elements of the model have been updated to support both the 2004 Transportation Plan update and the Woodland Transportation Infrastructure Strategic Plan (TISP). The updated elements to support the Transportation Plan are more fully documented in a report entitled *Travel Demand Model Documentation, City of Woodland, 2004 Transportation Plan*, the Transpo Group, dated July 2005.

As part of this modeling effort, updates were made to the model to support the TISP process based on current information. These updates are described in the memorandum entitled "2007 Model Documentation – Methods of Forecasting Traffic Volumes for the *Woodland Transportation Strategic Infrastructure Plan*, Transpo Group, dated September 24, 2007. This memorandum is included in Appendix B in its entirety and portions are presented below.

2004 Comprehensive Plan Land Use/Socio-Economic Data

Land use and socio-economic data provide the foundation for estimating traffic growth associated with community development activities. This data was input into the travel demand model for each Transportation Analysis Zone (TAZ) within the study area. A TAZ represents a specific geographic area that contains relatively homogeneous land uses. A map of TAZs is included in Appendix B. Based on the nature and type of growth assumptions in each TAZ, future travel demand forecasts can be produced. Most of the forecasted traffic would travel to other TAZs within the study area using the future roadway system and replicating traffic patterns that can be observed in the field (e.g., travel from a residential area to an employment area). Some trips are also assumed to leave the study area to other destinations (such as the Longview/Kelso area and/or Clark County).

Existing and forecasted future land use data for the Woodland study area were originally prepared by City staff according to a series of land use categories (e.g., single- and multi-family housing types and various categories of employment). Tables 7 and 8 summarize the existing and future forecasted land use data by study area district (see Figure 4). These districts provide a concise summary of existing and potential future land use patterns within the study area.

Land use data for 2004 reflects existing conditions at the time the model was developed. The East City district is comprised of largely residential uses east of I-5. The Central City district includes mostly retail areas along I-5. The Northwest City district is dominated by industrial areas west of I-5. The southwest City district encompasses the traditional urban core of Woodland representing a mix of land uses.

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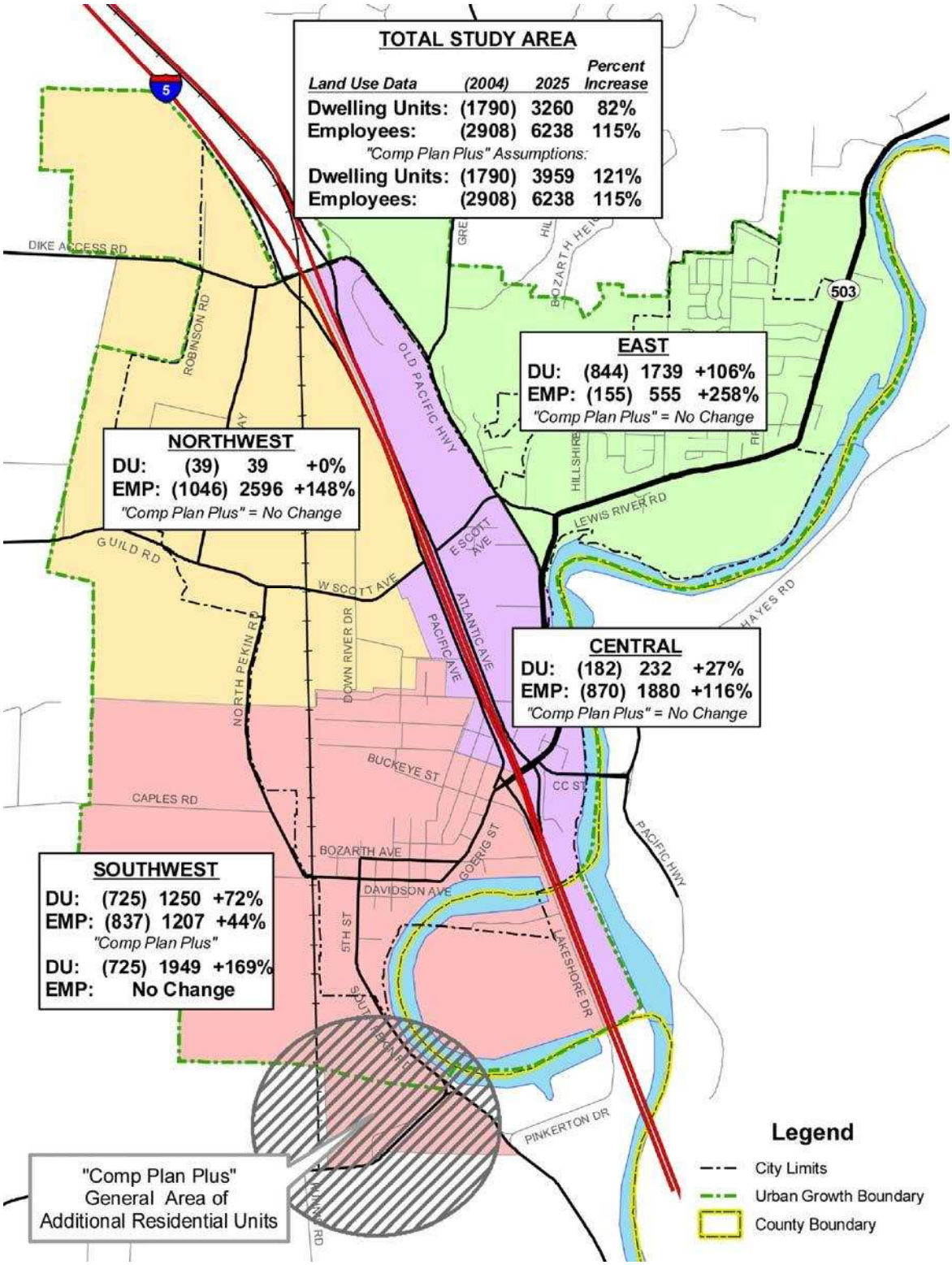

Figure 4

Study Area Growth Assumptions

SR 503 Milepost 52.23 to 53.92

The Transpo Group

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As shown in Table 7, the number of residential dwelling units (e.g., houses or apartments) in 2025 is forecast to be 82 percent higher than conditions in 2004. The largest increase is anticipated in the East City district where dwelling units (DUs) are expected to more than double. The southwest City District would also see a significant (72 percent) increase in dwelling units. Based on these forecasts, a majority (53 percent) of Woodland residents would live in the East City district by 2025.

Table 7. 2004 and 2025 Housing Forecasts

	Number of Dwelling Units			Weighting by District		
Study Area District	2004	2025	Percent Increase	2004	2025	Change in Weighting
1. East City	844	1,739	106%	47%	53%	+ 6%
2. Southwest City	725	1,250	72%	41%	38%	- 3%
3. Central City	182	232	27%	10%	7%	- 3%
4. Northwest City	39	39	0%	2%	2%	0%
Total	**1,790**	**3,260**	**82%**	**100%**	**100%**	

Source: City of Woodland, see also Figure 4.

As shown in Table 8, Woodland employment is forecast to more than double by 2025. While the largest percent increase in employment is in the East City district, employment in that district remains less than 10 percent of the City's total employment. The bulk of the employment growth would be in the Northwest City district with a 148 percent increase. The Southwest City district would also see an increase in employment, but overall employment activity is expected to shift to other areas of the City.

Table 8. 2004 and 2025 Employment Forecasts

	Number of Employees			Weighting by District		
Study Area District	2004	2025	Percent Increase	2004	2025	Change in Weighting
1. East City	155	555	258%	5%	9%	+ 4%
2. Southwest City	837	1,207	44%	29%	19%	- 10%
3. Central City	870	1,880	116%	30%	30%	0%
4. Northwest City	1,046	2,596	148%	36%	42%	+ 6%
Total	**2,908**	**6,238**	**115%**	**100%**	**100%**	

Source: City of Woodland, see also Figure 4.

Updated Land Use Assumptions

As part of the Woodland Transportation Strategic Infrastructure planning process, the land use growth assumptions from the 2005 Comprehensive Plan were reviewed and updated to be consistent with current information. CWCOG staff reviewed population growth and development patterns in and surrounding the Woodland Urban Growth Area (UGA). They concluded that growth may be higher than anticipated in the 2005 Woodland Comprehensive Plan. The 2005 Comprehensive Plan is based on an annual population growth rate of 3.5 percent. This growth rate is lower than the 4.5 percent annual growth rate between 1990 and 2000. Table 9 summarizes the population growth through 2025 based on the two growth rates.

Table 9. Population Projections By Year

Growth Rate Source	Growth Rate	2007 Population	2025 Population
2005 Comprehensive Plan	3.5%	4,960	9,087
Historical Trends (1990 to 2000)	4.5%	4,960	10,954
		Difference	***+1,867***

Source: Transpo Group *2007 Model Documentation – Methods of Forecasting Traffic Volumes for the Woodland Transportation Strategic Infrastructure Plan* Memorandum, September 24, 2007 & CWCOG, July 25, 2007

The CWCOG indicated that the higher growth rate would most likely result in additional residential units located south and west of the City's current UGA boundary (see Figure 4). Based on the current average of 2.67 persons per dwelling unit, as identified by CWCOG staff, the additional 1,867 persons would translate into 699 more dwelling units compared to the assumptions used in the 2005 Comprehensive Plan.

Based on the two growth rates, two land use scenarios were used in forecasting 2025 traffic volumes for use in the SR 503 transportation analysis. As discussed previously, the scenarios include "Comp Plan" based on the 2005 Comprehensive Plan land use. The second scenario, "Comp Plan Plus," adds 699 residential dwelling units to the original land use forecasts and assumes they are located south and west of the City. Growth in dwelling units and employment within the Woodland study area for both scenarios is illustrated in Figure 4.

Transportation Network

The Woodland travel demand model used for the 2005 Transportation Plan also includes assumptions about the existing transportation system including such factors as the location and connections available with the existing street and highway system, lane capacity, speeds and a variety of other factors. For the baseline 2025 model, existing roadway and intersection capacity parameters were adjusted to reflect likely improvements that would occur before the 2025 planning horizon year. For example, capacity for SR 503 was increased to reflect the planned widening from I-5 to the east City limits. Capacity for the Old Pacific Highway from Dike Access Road to E Scott Avenue was also increased to reflect roadway improvements such as turn lanes to provide access to adjacent properties expected to develop during the planning period. In addition, intersection capacity parameters were adjusted at the intersections of I-5 ramps with Dike Road and SR 503, Buckeye Street at Goerig Street, SR 503 at CC Street, SR 503 at Goerig Street, Old Pacific Highway at E Scott Avenue, and Old Pacific Highway at Green Mountain Road. All other capacity parameters remained constant with those that exist today.

No changes were made to this baseline network for this study. The development and evaluation of improvement alternatives relied on this baseline transportation network as a starting point. For each alternative, appropriate changes were made in the model network to reflect the unique characteristics of the alternative. These changes included new connections, changes to existing roadway capacity and/or speed parameters, or other modifications.

Traffic Volumes

This section discussion the future 2025 traffic volumes developed using the land use assumptions and forecasting process described previously. As noted, the updated 2025 Woodland travel demand model was used to forecast intersection turning movement traffic volumes for the weekday PM peak hour in the planning horizon year 2025. The forecast results show that there only small differences between the Comp Plan and Comp Plan Plus scenarios within the SR 503 corridor. Table 10 shows a comparison of 2025 Comp Plan and Comp Plan Plus traffic volumes.

Table 10. Comparison of Comp Plan and Comp Plan Plus Traffic Volumes

	2025 Traffic Volume			
Intersection	Comp Plan	Comp Plan Plus	Difference	Percent Difference
SR 503 (Lewis River Rd)/N Goerig Street	2,060	2,150	90	4%
SR 503 (Lewis River Rd)/E Scott Avenue	1,910	1,940	30	2%
SR 503 (Lewis River Rd)/Hillshire Drive	1,795	1,825	30	2%
SR 503 (Lewis River Rd)/Insel Road	1,645	1,680	35	2%
SR 503 (Lewis River Rd)/Gun Club Road	1,600	1,625	25	2%
SR 503 (Lewis River Rd)/Fir Avenue	1,235	1,250	15	1%
SR 503 (Lewis River Rd)/Evergreen Lane	1,215	1,230	15	1%

Source: The Transpo Group, 2007.

As shown in the table, traffic volumes for the Comp Plan and Comp Plan Plus are very similar with a percent difference in most cases of approximately 1 to 2 percent. Since the traffic volumes for both scenarios are similar and would result in similar traffic operations and future needed improvements, this analysis focuses on the Comp Plan Plus. Future (2025) PM peak hour intersection turning movements based on the Comp Plan Plus scenario are presented in Figure 5. Traffic volumes were rounded to the nearest five vehicles because weekday volumes fluctuate day-to-day. The turning movement volumes are not "raw" 2025 model volumes, but represent the 2025 model traffic volumes adjusted to reflect intersection level data calibration that was conducted using the procedures articulated in NCHRP Report 255[1].

Traffic Operations

This section includes an evaluation of the anticipated impact of community growth on the existing transportation system within the citywide study area. The analysis of future conditions builds on the existing transportation system results presented previously. The analysis identifies deficiencies expected to occur in the baseline transportation network as a result of the forecasted 2025 land use, population and employment growth. These transportation system needs and deficiencies combined with the public vision form the basis for the development of alternative strategies to improve the transportation system.

LOS Evaluation

PM peak hour intersection operations were evaluated at the study locations for future (2025) conditions based on the Comp Plan Plus projections. Table 11 provides a comparison of LOS results, delay, v/c ratio, and worst movements at the study intersections for existing (2007) and future 2025 conditions. Detailed level of service worksheets are presented in Appendix A.

1 NCHRP Report 255 entitled "Highway Traffic Data for Urbanized Area Project Planning and Design" was published in 1982 by the Transportation Research Board's National Cooperative Highway Research Program. It is an authoritative reference on the post-processing of travel demand model data output to develop future intersection level turning movement forecasts.

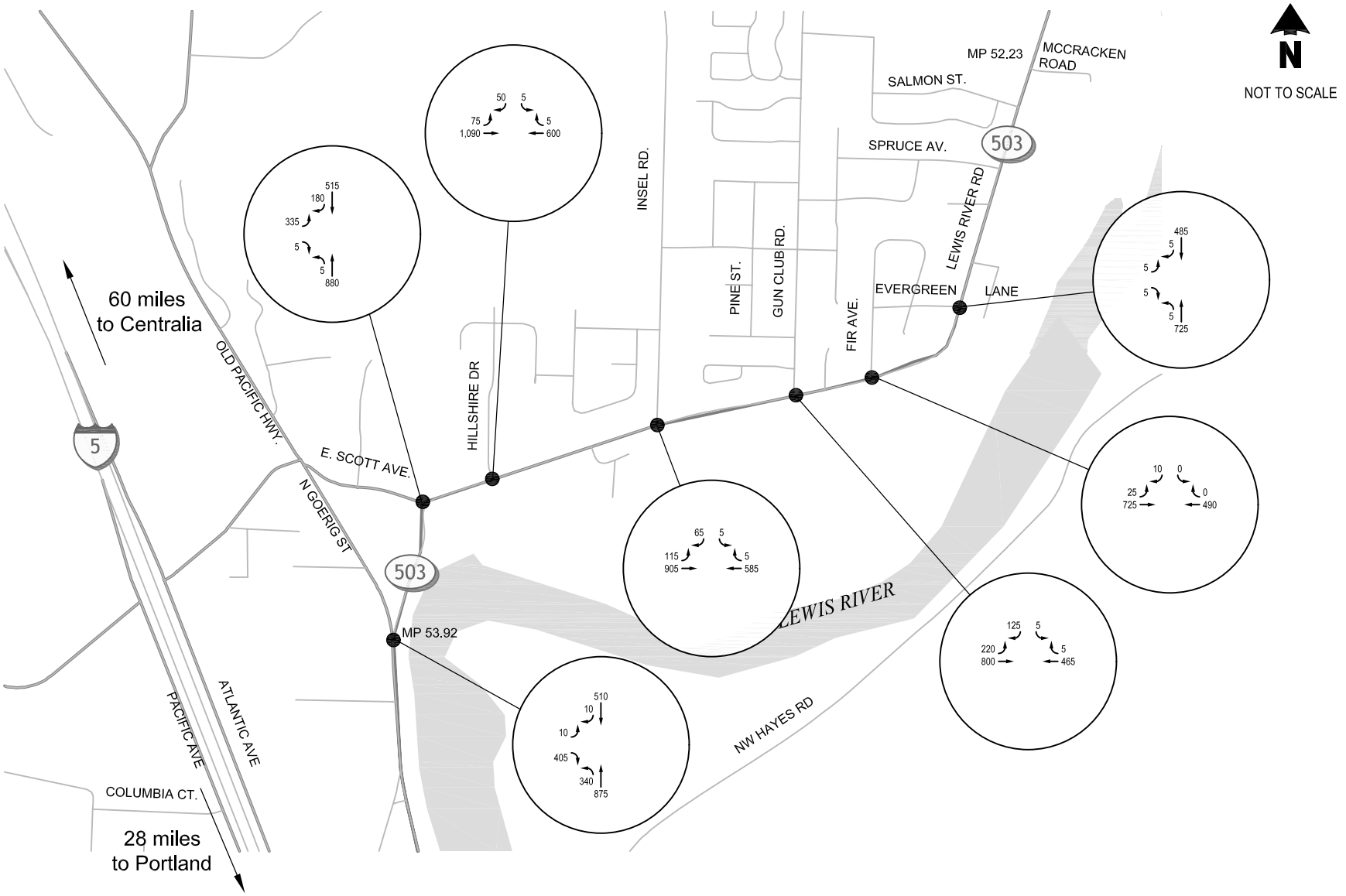

Figure 5

Future (2025) PM Peak Hour Traffic Volumes

SR 503 Milepost 52.23 to 53.92

The Transpo Group

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Table 11. Existing (2007) and Future (2025) PM Peak Hour Intersection Operations

Unsignalized Intersections	Worst Movement[1]	Existing Delay[2]	Existing LOS[3]	Future Delay[2]	Future LOS[3]
SR 503 (Lewis River Rd)/N Goerig Street	EB	48.9	E	>50	F
SR 503 (Lewis River Rd)/E Scott Avenue	EB	55.2	F	>50	F
SR 503 (Lewis River Rd)/Hillshire Drive	SB	13.7	B	21.6	C
SR 503 (Lewis River Rd)/Insel Road	SB	13.5	B	19.9	C
SR 503 (Lewis River Rd)/Gun Club Road	SB	12.2	B	15.8	C
SR 503 (Lewis River Rd)/Fir Avenue	SB	10.3	B	11.5	B
SR 503 (Lewis River Rd)/Evergreen Lane	EB	13.2	B	18.4	C

Source: The Transpo Group 2007.
1. Worst movement reported for unsignalized intersections. EB = eastbound and SB = southbound.
2. Average delay in seconds per vehicle.
3. Level of service, based on 2000 *Highway Capacity Manual* methodology.

As Table 11 shows, all of the intersections would meet the City's LOS D standard during the weekday PM peak hour in 2025 except the SR 503 (Lewis River Road)/N Goerig Street and SR 503 (Lewis River Road)/E Scott Avenue intersections. The SR 503 (Lewis River Road)/N Goerig Street intersection operations would degrade from LOS E in 2007 to LOS F by 2025 during the weekday PM peak hour. The SR 503 (Lewis River Road)/E Scott Avenue intersection would continue to operate at LOS F during the weekday PM peak hour in 2025. Improvements are planned at both these intersections per the City's Comprehensive Plan, SR 503 widening and channelization project (see Planned/Pending Improvements section). In addition, WSDOT has identified the need for an exclusive eastbound left-turn lane at the SR 503 (Lewis River Road)/E Scott Avenue intersection to address the sight distance issue for approaching vehicles.

Signal Warrant Analysis

MUTCD signal warrants were evaluated at both the SR 503 (Lewis River Road)/N Goerig Street and SR 503 (Lewis River Road)/E Scott Avenue intersections. Based on this analysis, both intersections would meet the criteria for the four-hour vehicular volume warrant. The signal warrant evaluation is provided in Appendix C.

Left-Turn Lane Warrant Analysis

The need for a left-turn lane and/or a two-way left-turn lane along SR 503 from Hillshire Drive to Evergreen Lane was evaluated based on WSDOT's Figure 910-8a Left-Turn Storage Guidelines (Two-Lane Unsignalized) from the Design Manual, May 2007. Table 12 summarizes the results of the left-turn lane warrant analysis.

Table 12. Left-turn Lane Warrant Analysis

Unsignalized intersection	Direction	Left-turn Lane Recommended by WSDOT
SR 503 (Lewis River Rd)/Hillshire Drive	EB	Yes
SR 503 (Lewis River Rd)/Insel Road	EB	Yes
SR 503 (Lewis River Rd)/Gun Club Road	EB	Yes
SR 503 (Lewis River Rd)/Fir Avenue	EB	Yes
SR 503 (Lewis River Rd)/Evergreen Lane	EB	No

Source: WSDOT and The Transpo Group, 2007.
Notes: EB = eastbound

As shown in Table 12, by 2025, all study intersections along SR 503 would meet WSDOT's standards for left-turn lanes except at Evergreen Lane.

Chapter 5. Future Improvements Evaluation

This section discusses the options evaluated to improve operating conditions along the SR 503 corridor, and the recommended improvements.

Improvement Options Considered

Analysis was conducted for the three options, outlined in Table 13, which were defined based on the analysis of traffic operations presented in Chapter 4 and recommendations provided in the City's 2005 Transportation Plan. Both individual intersection and overall SR 503 roadway improvements were evaluated. All options provide a two-way left-turn lane along SR 503 from Hillshire Drive to Fir Avenue. Intersection improvements considered include:

- **Option 1 –** Signalization of the SR 503 (Lewis River Road)/N Goerig Street and SR 503 (Lewis River Road)/E Scott Avenue intersections. Provide an exclusive eastbound left-turn lane at the E Scott Avenue intersection with SR 503.
- **Option 2 –** Signalization of the SR 503 (Lewis River Road)/N Goerig Street intersection and roundabout control at the SR 503 (Lewis River Road)/E Scott Avenue intersection.
- **Option 3 –** Restriction of the north-to-northwest left-turn at the SR 503 (Lewis River Road)/N Goerig Street intersection and roundabout control at the SR 503 (Lewis River Road)/E Scott Avenue intersection.

Table 13. Description of Options Analyzed for SR 503 Improvements

Option	Intersections Improvements			Roadway Improvements
	Signal Control	Restricted Movements	Roundabout Control	Two-Way Left-Turn Lane
1	SR 503 (Lewis River Rd)/N Goerig Street [1] SR 503 (Lewis River Rd)/E Scott Avenue [2]			SR 503 Hillshire Drive to Fir Avenue
2	SR 503 (Lewis River Rd)/N Goerig Street [1]		SR 503 (Lewis River Rd)/E Scott Avenue	SR 503 Hillshire Drive to Fir Avenue
3		SR 503 (Lewis River Rd)/N Goerig Street [3]	SR 503 (Lewis River Rd)/E Scott Avenue	SR 503 Hillshire Drive to Fir Avenue

Source: The Transpo Group, 2007.
1. N Goerig Street/SR 503 (Lewis River Rd) would have a northbound left-turn lane.
2. In addition to signal control, provide an exclusive eastbound left-turn lane.
3. Restrict the north-to-northwest left-turns. This movement would take place north of this intersection at the roundabout. This would allow this intersection to operate without a signal or any widening.

Traffic Operations

Level of service analysis was conducted at the SR 503 (Lewis River Road)/N Goerig Street and SR 503 (Lewis River Road)/E Scott Avenue intersections for each of the options described above. Table 14 shows the results of the analysis. Since future operations at the remaining study intersections would continue to be LOS D or better, and additional operational analysis was not conducted with the two-way left-turn lane improvement. Implementation of the two-way left-turn lane would enhance operations and improve safety.

Table 14. Future (2025) Level of Service Summary for SR 503 Improvement Options

Intersection	LOS[1]	Delay	V/C[2]
Option 1			
SR 503 (Lewis River Rd)/N Goerig Street[3]	B	13.8	0.65
SR 503 (Lewis River Rd)/E Scott Avenue	B	16.8	0.84
Option 2			
SR 503 (Lewis River Rd)/N Goerig Street[3]	B	13.8	0.65
SR 503 (Lewis River Rd)/E Scott Avenue[4]	D	45.9	NA
Option 3			
SR 503 (Lewis River Rd)/N Goerig Street[5]	E	36.2	EB
SR 503 (Lewis River Rd)/E Scott Avenue	F	155.7	NA

Source: The Transpo Group, 2007.
1. Level of service, based on 2000 *Highway Capacity Manual* methodology.
2. Volume-to-capacity ratio reported for signalized intersections. EB = Eastbound; NA = Not applicable to roundabouts.
3. Assumes protected-permitted phasing for the northbound left-turn.
4. Assumes a one-lane roundabout.
5. Restrict the north-to-northwest left-turns and assumes stop sign control on the eastbound approach.

As shown in the table, Option 1 would provide adequate intersection operations with future 2025 traffic projections. Option 2 would provide adequate intersection operations based on the overall intersection analysis; however, the southbound approach of the SR 503 (Lewis River Road)/E Scott Avenue intersection (controlled by a roundabout) would operate at LOS F and queues would extend for more than 1,600 feet. With Option 3, the eastbound approach of SR 503 (Lewis River Road)/N Goerig Street would operate at LOS E and the SR 503 (Lewis River Road)/E Scott Avenue intersection would operate at LOS F. Therefore, the best operations are anticipated with Option 1.

Since operations at the SR 503 (Lewis River Road)/E Scott Avenue intersection would likely be poor with roundabout control, two additional scenarios were developed for Option 3. These scenarios include:

- **Option 3b –** Signalization of the SR 503 (Lewis River Road)/E Scott Avenue and SR 503 (Lewis River Road)/N Goerig Street (restricted left-turn channelization is assumed) intersections. Provide an exclusive eastbound left-turn lane at the E Scott Avenue intersection with SR 503.
- **Option 3c –** Signalization of the SR 503 (Lewis River Road)/N Goerig Street intersection (restricted left-turn channelization is assumed) and Flying-T at SR 503 (Lewis River Road)/E Scott Avenue intersection. A Flying-T intersection would allow northbound traffic to flow freely without signal control unless there was a pedestrian crossing. Also, provide an exclusive eastbound left-turn lane at the E Scott Avenue intersection with SR 503.

Table 15 shows the results of the additional analysis.

Table 15. Level of Service Summary for Additional SR 503 Improvement Options

Intersection	2025 Future LOS[1]	Delay	V/C[2]
Option 3b			
SR 503 (Lewis River Rd)/N Goerig Street[3]	B	15.5	0.84
SR 503 (Lewis River Rd)/E Scott Avenue[4]	C	22.7	0.83
Option 3c			
SR 503 (Lewis River Rd)/N Goerig Street[3]	B	15.5	0.84
SR 503 (Lewis River Rd)/E Scott Avenue[4]	D	37.6	0.88

Source: The Transpo Group, 2007.
1. Level of service, based on 2000 *Highway Capacity Manual* methodology.
2. Volume-to-capacity ratio reported for signalized intersections.
3. Restrict the north-to-northwest left-turns and assumes stop-sign control on the eastbound approach.
4. Assumes additional northbound left-turns since N Goerig Street intersection would restrict left-turns. Provides a northbound left-turn lane with protected-permitted phasing, and southbound right-turn lane.

As shown in the table, operations would be improved with traffic signals at the SR 503 (Lewis River Road)/N Goerig Street intersection, and either a traffic signal or provision of a flying-T at the SR 503 (Lewis River Road)/E Scott Avenue intersection. Since Option 3b works slightly better i.e., operations are LOS C at the SR 503 (Lewis River Road)/E Scott Avenue intersection, additional consideration was given to this scenario.

Impact of Residential Development east on SR 503

There is potential for additional residential development on SR 503 east of the Urban Growth Area (UGA) which could increase traffic along SR 503. The City's traffic model showed that traffic volumes on SR 503 would increase by about 40 to 60 percent by 2025, or about 2 to 3 percent per year. An evaluation was conducted to determine if the proposed improvement options would continue to be sufficient if eastbound traffic increased due to potential additional development. The improvements were considered to be sufficient if the intersections met the LOS D standards. This evaluation showed that the maximum traffic increase the proposed improvements would support (and still maintain LOS D) would be approximately 0.1 to 0.5 percent increase per year in traffic or an increase of about 50 to 130 vehicles (for a maximum of about 1,150 to 1,200 vehicles) for the eastbound through movement; traffic increases beyond this level would require additional improvements along SR 503 to maintain LOS D.

It should be noted that the amount of traffic increase that would be accommodated varied for the improvement options. Option 1 would accommodate an increase of approximately 130 vehicles in the eastbound direction; however, with increases beyond this the southbound approach at the SR 503 (Lewis River Road)/Insel Road intersection would operate at LOS E and a traffic signal would be needed to provide operations that meet the LOS D standard. Option 3b would handle an increase of approximately 50 vehicles in the eastbound/northbound direction before northbound queues at the SR 503 (Lewis River Road)/N Goerig Street intersection spilled back into the SR 503 (Lewis River Road)/N Goerig Street intersection to the south (i.e., about 1,000 feet) impacting operations at this intersection. Therefore, volume increases beyond about 50 vehicles for Option 3b would require additional capacity such as a second northbound through lane. Table 16 shows a summary of the study intersection LOS for both options with the increased traffic volumes in the eastbound through direction.

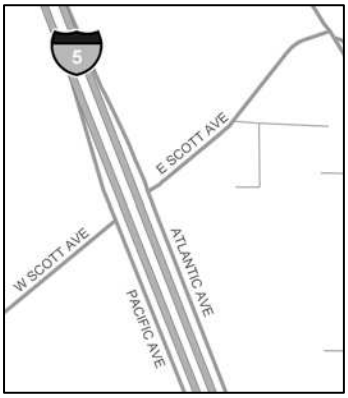
As shown in the table, intersection operations for both options would be similar and meet the LOS D standard. However, Option 1 would accommodate a greater increase in traffic than Option 3b.

Table 16. Future (2025) With Increased Traffic Volumes PM Peak Hour Intersection Operations

Intersection	Option 1[1]			Option 3b[2]		
	LOS[3]	Delay[4]	V/C[5] or WM[6]	LOS[3]	Delay[4]	V/C[5] or WM[6]
SR 503 (Lewis River Rd)/N Goerig Street	B	13.8	0.74	B	17.4	0.86
SR 503 (Lewis River Rd)/E Scott Avenue	C	21.5	0.90	C	23.7	0.86
SR 503 (Lewis River Rd)/Hillshire Drive	D	33.8	SB	D	25.7	SB
SR 503 (Lewis River Rd)/Insel Road	C	16.2	SB	C	15.9	SB
SR 503 (Lewis River Rd)/Gun Club Road	B	14.3	SB	B	14.1	SB
SR 503 (Lewis River Rd)/Fir Avenue	B	11.5	SB	B	11.5	SB
SR 503 (Lewis River Rd)/Evergreen Lane	C	17.1	EB	C	19.2	EB

Source: The Transpo Group 2007.
1. Traffic volumes were increased by approximately 130 vehicles for the eastbound through movement.
2. Traffic volumes were increased by approximately 50 vehicles for the eastbound through movement.
3. Level of service, based on 2000 *Highway Capacity Manual* methodology.
4. Average delay in seconds per vehicle. The average delay reported is the average of all movements for signalized intersections, and for the approach or turning movement experiencing the greatest delay at two-way stop-controlled intersections.
5. Volume-to-capacity ratio reported for signalized intersections.
6. Worst movement reported for two-way stop-controlled intersections.

Impact of Scott Avenue Crossing



Existing I-5 Scott Interchange

As shown in the photo to the right, no access is provided between East and West Scott Avenue at the I-5 interchange. Therefore, vehicles coming from I-5 southbound at the Scott Avenue off-ramp travel south on the Pacific Avenue frontage road to SR 503 to cross to the eastside of I-5. In addition, vehicles going to I-5 north from the westside would cross to the east at SR 503 and travel north on the Atlantic Avenue frontage road to the I-5 Scott Avenue northbound on-ramp. The Draft Woodland Transportation Infrastructure Strategic Plan recommends providing a connection at Scott Avenue and I-5 via an under-crossing of the freeway to facilitate travel to and from the east and west of I-5. Based on the City's travel demand model, with this new connection, a majority of the changes in travel patterns would occur along the Pacific Avenue and Atlantic Avenue corridors. There would be little to no change in travel patterns at the study intersections along SR 503 away from the I-5 interchange except at the SR 503 (Lewis River Road)/N Goerig Street intersection where traffic volumes would decrease by approximately 185 vehicles. This decrease in traffic volumes would decrease the delay per vehicle by a couple of seconds at the SR 503 (Lewis River Road)/N Goerig Street intersection for Option 1; however, the overall service level would remain LOS B. Option 3b assumes partial closure of the SR 503 (Lewis River Road)/ N Goerig Street intersection, this scenario is discussed below.

There would be changes in travel patterns at the SR 503 (Lewis River Road)/E Scott Avenue intersection with the provision of both the Scott Avenue partial interchange and either partial or full closure of the SR 503 (Lewis River Road)/N Goerig Street intersection. With a partial closure (i.e., restriction of the eastbound and northbound left-turn movements), the traffic volumes at the SR 503 (Lewis River Road)/E Scott Avenue intersection would increase by approximately 85 vehicles; with a full closure, traffic volumes would increase by approximately 185 vehicles. With the increase in traffic volumes and both full or partial closure of the SR 503 (Lewis River Road)/N Goerig Street intersection, SR 503 (Lewis River Road)/E Scott Avenue intersection operations under Option 3b would continue to be LOS B.

As discussed, construction of the Scott Avenue interchange would not alter the results and recommendations for SR 503. The remainder of this study is based on the Comp Plan Plus scenario discussed in Chapter 4 and does not assume the Scott Avenue crossing.

Cross-Section and Cost Estimate

Based on the operational analysis, Options 1 and 3b should be explored further since they provide the best operations. The improvements are illustrated in Appendix D including traffic control, extents of the two-way left-turn lane, and the lengths of proposed turn lanes. For both options, lighting can be assumed with a 35-foot height luminaire with 10-foot mast arms using 250W HPS light fixtures at 150-foot spacing on the west side of SR 503. Guardrail or barriers would need to be considered in locations where WSDOT clear zone is not met. The following provides a detailed description of the options:

Option 1

- Traffic signals at SR 503 (Lewis River Road)/N Goerig Street with protected/permitted phasing on the northbound approach (SR 503).
- Widening of SR 503 to provide a 300-foot northbound left-turn lane at N Goerig Street.
- Traffic signals at the SR 503 (Lewis River Road)/E Scott Avenue intersection.
- Widening of E Scott Avenue to provide a 300-foot eastbound left-turn lane at SR 503
- Provision of a two-way left-turn lane from west of Hillshire Drive to Evergreen Lane with median breaks every 500 to 1,000 feet to discourage passing. The breaks can include raised islands or taller reflectorized pylons for better nighttime visibility. The location of breaks should be based on locations that do not block driveway access.
- Roadway cross-section as shown in Table 17 and Appendix D.

Option 3

- Side-street stop controlled on the N Goerig Street approach of the SR 503 (Lewis River Road)/N Goerig Street intersection. Traffic signals should be considered in the future when traffic volumes warrant.
- Traffic signals at the SR 503 (Lewis River Road)/E Scott Avenue intersection
- Widening of SR 503 to provide a 250-foot northbound left-turn lane and 100-foot southbound right-turn lane at E Scott Avenue
- Widening of E Scott Avenue to provide a 300-foot eastbound left-turn lane at SR 503
- Provision of a two-way left-turn lane from west of Hillshire Drive to Evergreen Lane with median breaks every 500 to 1,000 feet to discourage passing. The breaks can include raised islands or taller reflectorized pylons for better nighttime visibility. The raised objects for the median breaks should be 2 feet from the edge of traveled way. The location of breaks should be based on locations that do not block driveway access.
- Roadway cross-section as shown in Table 17 and Appendix D.

Table 17. Roadway Cross-Section

Item[1]	Running Cross-Section Total (feet)
66-foot Cross-Section (45-foot Roadway)	
6-foot Sidewalk	6-feet
5-foot landscape area (for signing and lighting)	11-feet
0.5-foot curb	11.5-feet
4-foot shoulder	15.5-feet
11-foot Travel Lane	26.5-feet
14-foot Two-Way Left-turn Lane	40.5-feet
11-foot Travel Lane	51.5-feet
4-foot shoulder	55.5-feet
0.5-foot curb	56-feet
4-foot landscape area (for signing)[2]	60-feet
6-foot Sidewalk	**66-feet**
70-foot Cross-Section (49-foot Roadway)	
6-foot Sidewalk	6-feet
5-foot landscape area (for signing and lighting)	11-feet
0.5-foot curb	11.5-feet
5-foot shoulder	16.5-feet
12-foot Travel Lane	28.5-feet
14-foot Two-Way Left-turn Lane	42.5-feet
12-foot Travel Lane	54.5-feet
5-foot shoulder	59.5-feet
0.5-foot curb	60-feet
4-foot landscape area (for signing)[2]	64-feet
6-foot Sidewalk	**70-feet**

Source: The Transpo Group 2007.
1. Roadway items are listed as they appear in a roadway cross-section.
2. Guardrail or concrete barrier would need to be considered along segments of SR503 that do not meet WSDOT clears zone criteria.

Based on the recommended cross-section, cost estimates were prepared for both Options 1 and 3b. Appendix E provides detailed cost estimates for each improvement option. Table 18 provides a summary of the cost estimates for each option. The recommended two-way left-turn lane along SR 503 from Hillshire Road is the same for both options; therefore, costs of widening SR 503 are the same.

Table 18. SR 503 Improvements Cost Estimates

Location	Option 1	Option 3b
SR 503 Widening (from Hillshire Road East)	$5,700,000	$5,700,000
Intersection Improvements (from Hillshire Road West)	$4,700,000	$3,400,000
Total Cost	**$10,400,000**	**$9,100,000**

Source: Parametrix 2008.

As shown in Table 18, Option 1 would cost approximately $1.3 million more than Option 3b. This is due to the additional traffic signal required at SR 503 (Lewis River Road)/N Goerig Street intersection with Option 1. However, it should be noted that Option 1 would accommodate slightly more future growth than Option 3b (see impacts of residential development section above).

It is noted that the City currently has approximately $800,000 for the SR 503 project. Appendix E provides a cost estimate for minimum widening improvements along SR 503 between Hillshire Road and Gun Club Road. The cost estimate for this project is approximately $790,000. This project would be

constructed within the existing right-of-way, and it would allow for construction of more extensive improvements (e.g., Options 1 and 3b) in the future. Figures 12A and 12B in Appendix D show the proposed minimum widening cross-section.

Stormwater Treatment

As part of any widening improvements on SR 503, stormwater treatment would be incorporated into the design to meet state and federal water quality treatment guidelines. The extent and scope of this treatment would depend on the nature and extent of the improvements being constructed.

As an interim improvement measure, widening of SR 503 is proposed between Hillshire Road and Gun Club Road to accommodate a 14-foot two-way left turn lane, two 12-foot travel lanes and two 4-foot shoulders as shown in Figures 12A and 12B in Appendix D. Stormwater runoff would be collected in newly constructed open ditches and swales within the existing right-of-way. These improvements would also seek to utilize the existing stormwater system to the extent possible. These ditches and swales, whether new or existing, would be designed and/or modified to meet federal and state regulations relating to the treatment of stormwater for both quality and quantity.

Fully constructing the improvements on SR 503 as detailed in Options 1 and/or 3, will eliminate the roadside ditches and swales and instead will require the design of detention and treatment structures outside of the existing right-of-way. Curb and gutters will be constructed along SR 503 which will collect and direct the stormwater to these detention structures.

Environmental Review

This section identifies potential environmental impacts of the transportation improvement options including increased impervious surface areas, additional hazardous materials reconnaissance, and compliance with SEPA requirements. All options would need to be approved by the Department of Ecology (DOE) through a SEPA checklist.

To comply with stormwater management water quality and quantity standards for increased stormwater from increased impervious surfaces, the project would be required to adhere to the City of Woodland Critical Areas Ordinance requirements for location of stormwater facilities. These facilities cannot be located within wetlands, but are permittable within portions of wetland buffer areas (Woodland Municipal Code 15.08.400.L.4). Additionally, the project must obtain a Hydraulic Project Approval (HPA) from the Washington Department of Wildlife (WDFW), a joint 404/401 permit from the Corps and DOE, and a National Pollution Discharge Elimination System (NPDES) permit from the DOE.

The hazardous materials investigation completed for the Parametrix's *Final Existing Conditions Technical Memorandum* (August 2007) was limited to a regulatory database search for the potentially affected project areas. Because the regulatory databases may not include all hazardous materials sites, and may not provide highly accurate location information, a site reconnaissance of the right of way expansion areas and additional file review for hazardous materials sites is recommended for all improvement options.

Only one option is proposed for improvements to SR 503 from Hillshire Drive east to Evergreen Lane. The improvements would require widening SR 503 with right of way needs on both sides of the roadway for nearly the entire length of the improvement area, except where recent developments have already provided sidewalks and wider roadways, primarily on the north side of SR 503 between Insel Road and Gun Club Road. There are no National Wetlands Inventory (NWI) mapped or potential wetlands identified in the areas to be disturbed.

One identified hazardous materials site, Site 67 (see Appendix F Table 3-3 in the *Final Existing Conditions Technical Memorandum* August 2007), is located immediately south of SR 503 within the improvement area.

Although right of way is likely to be purchased from the identified hazardous materials site, at this time no further environmental investigation is required because the site does not have documented contamination.

There are two options for the proposed improvement area of SR 503 to the west of Hillshire Drive and south to Cherry Blossom Lane. Both options would likely have some direct impact on hazardous materials Site 31 (see Appendix F). This site has documented contamination, and would require a full Phase I Environmental Assessment in conformance with ASTM 1527-05 for purchase of any right of way. Option 1 requires the least right of way where the need is limited to the far southeast corner of the property, while Option 3b requires a sliver of right of way along nearly the full extent of the eastern property line along SR 503.

There are also NWI mapped wetlands identified between the Lewis River and SR 503. Neither option would have direct impacts to the identified wetlands, but construction may occur within a City of Woodland Critical Areas Ordinance wetland buffer area which may require a Critical Areas Permit. Wetland delineation may be required. In addition, there is a retaining wall along the edge of the roadway adjacent to the wetlands and the Lewis River. Roadway improvements would need to be limited such that no disturbance occurs to this wall.

The full extent of the area proposed for improvements to SR 503 is within or adjacent to the FEMA FIRM mapped 100-year floodplain. A Development Permit from the City of Woodland would be required for work within the 100-year floodplain.

Chapter 6. Summary and Conclusions

Table 19 provides a summary of the future improvements evaluation. Both options propose a two-way left-turn lane along SR 503 from Hillshire Road to Evergreen Lane. In addition, the options include:

- **Option 1 –** Signalization of the SR 503 (Lewis River Road)/N Goerig Street and SR 503 (Lewis River Road)/E Scott Avenue intersections.
- **Option 3b –** Signalization and restriction of the north-to-northwest left-turn at the SR 503 (Lewis River Road)/N Goerig Street intersection. Signalization of the SR 503 (Lewis River Road)/E Scott Avenue intersection.

As shown in Table 19, both options would meet the LOS D standard; however, Option 1 would accommodate more residential development if future growth increased beyond the 2025 projections. Option 1 would have less environmental impacts since less right-of-way is required but it would have a higher cost.

Table 19. SR 503 Improvements Cost Estimates

Location	Option 1			Option 3b		
Intersection Operations	**LOS[1]**	**Delay[2]**	**V/C[3]**	**LOS[1]**	**Delay[2]**	**V/C[3]**
SR 503 (Lewis River Rd)/N Goerig Street	B	13.8	0.65	B	15.5	0.84
SR 503 (Lewis River Rd)/E Scott Avenue	B	16.8	0.84	C	22.7	0.83
Additional Traffic Accommodated[4]	130 vehicles			50 vehicles		
Environmental Impacts	Least impact with limited right-of-way needs			More impact requiring additional right-of-way		
Estimated Cost	$11,500,000			$10,100,000		

Source: Parametrix 2008.
1. Level of service, based on 2000 *Highway Capacity Manual* methodology.
2. Average delay in seconds per vehicle. The average delay reported is the average of all movements for signalized intersections, and for the approach or turning movement experiencing the greatest delay at two-way stop-controlled intersections.
3. Volume-to-capacity ratio reported for signalized intersections.
4. Additional traffic accommodated refers to the growth beyond the 2025 Comp Plan Plus scenario that can be accommodated with the improvements.

It is likely that improvements to the intersections and roadways would be phased over time. Based on the evaluation presented in this transportation analysis report, the intersections are currently operating poorly and would continue to have poor operations in the future. Therefore, it is recommended the intersection improvements be implemented first. The priority, based on this evaluation, would be as follows:

1. SR 503 (Lewis River Road)/E Scott Avenue Intersection Improvements – This intersection has the poorest operations for both existing and future conditions.
2. SR 503 (Lewis River Road)/N Goerig Street Intersection Improvements
3. SR 503 Roadway Widening from Hillshire Road to Gun Club Road – This section of roadway has a higher frequency of accidents than the portion to the east.
4. SR 503 Roadway Widening from Gun Club Road East

In addition, with the City's current budget of $800,000, they could provide interim widening along SR 503 between Hillshire Road and Gun Club Road to accommodate some future growth in traffic. This minimum widening would be accommodated within the existing right-of-way, and it would allow for future improvements.