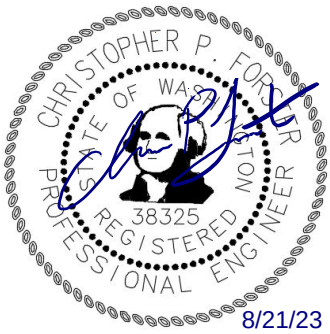
TECHNICAL MEMORANDUM

DATE: August 21, 2023

TO: Jesse Hannahs, PE / Jesse Birchman, PE, PTOE
City of Marysville, WA

FROM: Spenser Haynie / Chris Forster, PE
TENW

SUBJECT: Limited Traffic Impact Analysis
Chick-fil-A Soper Hill Road – Marysville, WA
TENW Project No. 2023-197



8/21/23

This technical memorandum documents the limited traffic impact analysis (TIA) completed for the proposed *Chick-fil-A Soper Hill Road* project and is based on scoping discussions with the City of Marysville. This traffic assessment includes a project description, trip generation estimate, project peak hour trip distribution and assignment, drive-through queuing analysis, and estimation of impact fees.

Project Description

The proposed *Chick-fil-A Soper Hill Road* site is located on the northeast corner of 87th Ave NE and Soper Hill Road in Marysville, WA, as shown in the Attachment A Vicinity Map. The project proposal includes a 5,773 square foot (SF) Chick-fil-A fast-food restaurant with drive-through on a pad site within the White Barn Development that is currently vacant. Vehicular access to the adjacent public streets is proposed via two driveways (one on Soper Hill Road and one on 87th Ave NE shared with other uses within the White Barn Development). A preliminary site plan is shown in Attachment B.

Project Trip Generation

The net new weekday daily, AM and PM peak hour trip generation estimates for the proposed project were based on methodology documented in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 11th Edition for Land Use Code (LUC) 934 (Fast Food Restaurant with Drive-Thru). Adjustments to the trip generation estimates were made to account for pass-by trips, which are trips that are made by vehicles that are already on the adjacent streets and make intermediate stops at a commercial use on route to a primary destination (i.e., on the way from work to home). The pass-by reduction is based on studies documented in the appendices of the ITE *Trip Generation Manual*, 11th Edition. It should be noted that the trip generation estimates do not account for the potential internal capture between the proposed Chick-fil-A and other uses on the White Barn Development site. Therefore, these trip generation estimates may be conservative. Table 1 summarizes the net new weekday trip generation with detailed trip generation calculations provided in Attachment C.

Table 1
Trip Generation Summary

	Net New Trips Generated		
Weekday Time Period	In	Out	Total
Daily	641	641	1,282
AM Peak Hour	66	63	129
PM Peak Hour	44	42	86

Project Trip Distribution and Assignment

The distribution of weekday daily and peak hour project-generated trips was estimated based on trip distribution patterns documented in the TIA prepared for the White Barn Development (dated February 2021) and traffic model distribution figures as provided by the City of Marysville.

The estimated distribution percentages were used to assign the weekday daily and peak hour project trips generated by the *Chick-fil-A Soper Hill Road* project to the adjacent street network. In accordance with the *Snohomish County Traffic Worksheet and Traffic Study Requirements for Developments in the City of Marysville*, project trip impacts at Snohomish County key intersections were identified. Weekday daily and peak hour trip distribution and assignment figures were prepared consistent with these guidelines and are included in Attachment D.

Drive-Through Queuing

A drive-through queuing analysis was conducted for the proposed drive-through lanes including a summary of the proposed drive-through lane storage capacity and an estimate of the 95th percentile queues based on service time information provided by Chick-fil-A.

Drive-Through Operations and Storage

Based on the current site plan, the proposed *Chick-fil-A Soper Hill Road* project includes two (2) drive-through lanes with approximately 1,015 total feet of queuing storage (41 vehicles) from the pick-up window to the entrance of the drive-through lanes.

Drive-Through Queue Analysis

A drive-through queuing analysis was conducted to estimate future queuing in the drive-through with the proposed *Chick-fil-A Soper Hill Road* project. The queue analysis was based on standard queue theory equations that relate the rate of vehicle arrivals to the rate of vehicle departures (service time), which are both based on a Poisson distribution (M/M/s) queue regime).

Queue analysis is based on the fact that a queue will form when vehicles arrive at a faster rate than they can be served. The key inputs in the model are (1) the arrival rate of vehicles during the peak hour, and (2) the service rate of the drive-through. The use of the Poisson distribution assumes arrival times are independent of each other and that the arrival time of one vehicle has no impact on the arrival time of the next vehicle, which is a reasonable assumption at a fast-food drive-through window where vehicle arrival rates fluctuate through the peak hour. The model also assumes that departure rates can vary (some customers take longer to order).

To estimate future queues in the proposed drive-through lanes, the queuing formula based on the M/M/s queuing regime was used. The M/M/s queuing regime assumes random (exponentially distributed) arrivals and departures and uses average arrival and departure rates.

Arrival Rate

The arrival rate at the drive-through was based on the forecasted future PM peak hour project trip generation and information provided by Chick-Fil-A related to drive-through usage. Based on data provided by Chick-fil-A, approximately 65 percent of arriving customers during the PM peak hour are estimated to utilize the drive-through. During the weekday PM peak hour, 99 vehicles (gross project trip generation) are estimated to enter the *Chick-fil-A Soper Hill Road* site. Assuming 65 percent of the vehicles would use the drive-through, this would result in 64 vehicles in the drive-through lane.

Departure Rate

The average service (departure) rate was based on information provided by Chick-fil-A. Per Chick-fil-A, on average, it takes approximately 60 seconds per vehicle at the order window and 30 seconds per vehicle at the pay/pick-up window. It should be noted that the average service time does not include queue "move-up" time, or the time it takes for the next vehicle in line to move forward. With the assumption of 5 seconds for "move-up" time, the average service rate would be conservatively estimated at *65 seconds* (60 seconds per vehicle for ordering + 5 seconds move-up time) at the order point and *35 seconds* (30 seconds per vehicle at each of the pay/pick-up window + 5 seconds move-up time) at the pay/pick-up window. Based on this information, the order point is the critical component of the drive-through operations and the cause for potential queuing. Therefore, the queuing analysis described next is for the queuing at the order point.

Drive-Through Queue Estimate

Queues were calculated at the order point based on the estimated drive-through volumes during the weekday PM peak hour and the average service (departure) rate as provided by Chick-fil-A. Based on 64 entering vehicles during the PM peak hour, a service rate of 65 seconds per vehicle, and two (2) order points, a 95th percentile queue of 5 vehicles is estimated at the order point. The 95th percentile queue of 5 vehicles would be accommodated within the drive-through lane storage provided (approximately 20 vehicles measured from the order point to the drive-through entrance). The detailed queue calculations are shown in Appendix E.

Mitigation

The following summarizes the measures proposed to mitigate the transportation impacts of the proposed *Chick-fil-A Soper Hill Road* project.

City of Marysville

The City of Marysville requires payment of transportation impact fees to help fund planned roadway improvements throughout the City. The City of Marysville's currently adopted transportation impact fee rate is $2,220 per PM peak hour trip. The proposed *Chick-fil-A Soper Hill Road* project is estimated to generate 86 net new PM peak hour trips. As a result, the estimated City of Marysville transportation impact fee is $190,920 ($2,220 x 86 PM peak hour trips). Actual impact fees will be calculated by the City based on the proposed land uses and trip generation rates in effect at the time of building permit issuance.

Additionally, based on the interlocal agreement between City of Marysville and the City of Lake Stevens, the City of Marysville is collecting fees to fund improvements to Soper Hill Road between SR 9 and 83rd Avenue NE. The City of Marysville is currently collecting an impact fee of $1,700 per PM peak hour trip impacting the new 87th Ave NE/Soper Hill Road roundabout. Based on the horizon year weekday PM peak hour trip distribution and assignment shown in Attachment D, the proposed *Chick-fil-A Soper Hill Road* project is anticipated to send 29 trips through the 87th Ave NE/Soper Hill Road roundabout resulting in an impact fee of $49,300 ($1,700 x 29 PM peak hour trips).

Snohomish County

The project is also subject to the requirements of an Interlocal Agreement between the City of Marysville and Snohomish County. Pursuant to this agreement, the project is required to evaluate potential impact fees to fund improvements in nearby unincorporated areas of Snohomish County. TENW reviewed the interlocal agreement requirements and based on the location of the nearest roadway improvements identified in the Snohomish County *Transportation Needs Report* (Appendix D), no impact fee projects are anticipated to be

impacted by at least 3 directional peak hour trips. Therefore, we believe that no impact fees will be due to Snohomish County. The Snohomish County Traffic Worksheet and Traffic Mitigation Offer forms will be submitted separately.

If you have any questions regarding the information presented in this limited Traffic Impact Analysis (TIA), please contact me at (206) 390-7253 or spenser@tenw.com.

cc: Steve Schwartz – Chick-fil-A, Inc
Stef Escamilla – 4G Development & Consulting

Attachments:
A. Project Site Vicinity
B. Preliminary Site Plan
C. Trip Generation Calculations
D. Weekday Project Trip Distribution and Assignment
E. Drive-Through Queuing Analysis

ATTACHMENT A

Vicinity Map

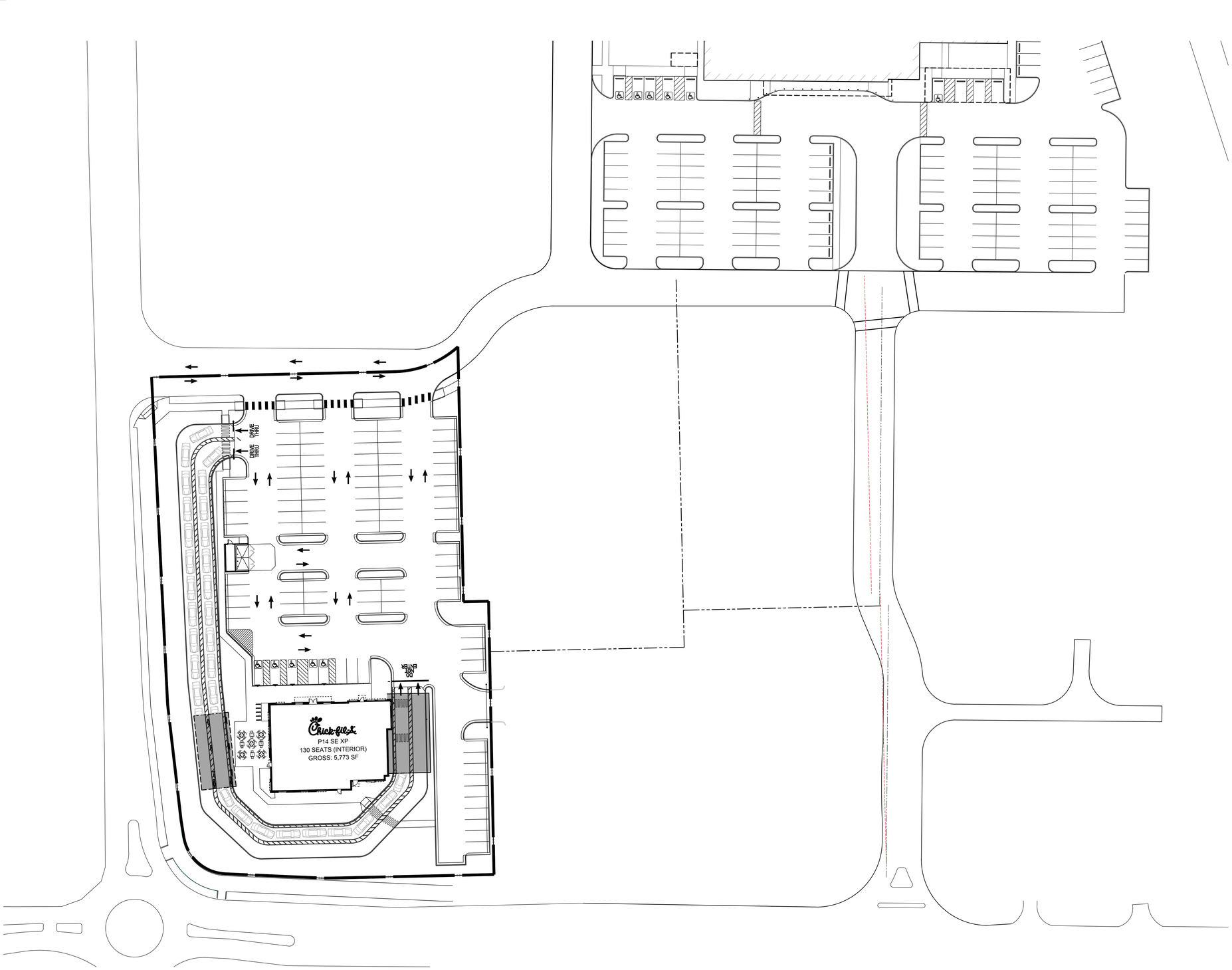
Attachment A: Project Site Vicinity Map

N

NOT TO SCALE

ATTACHMENT B

Preliminary Site Plan



PROJECT DATA:

SITE AREA:	
GROSS:	2.08 AC
	90,528 SF
BUILDING FOOTPRINT:	5,028 SF
BUILDING USE:	
COVERAGE:	
GROSS:	6%
NET:	6%
PARKING REQUIRED:	
RESTAURANT	30 STALLS
TOTAL	30 STALLS
PARKING PROVIDED:	
AUTO:	106 STALLS
	@21.08/1000 SF
REQ. ACCESSIBLE	*5 STALLS*
DT STACK:	49 CARS
OP CANOPY	11TH CAR AT INNER LANE

DEVELOPMENT STANDARDS:

ZONING:	CB-WR	1
MAX. HEIGHT:	55 FT	
BUILDING SETBACKS:		
FRONT:	0 FT	2
SIDE:	0 FT	3
REAR:	0 FT	3
LANDSCAPE SETBACKS:		
FRONT:		5
SIDE:		4
REAR:		4
LANDSCAPE REQ.:	15%	6
OFF-STREET PARKING:		
STANDARD:	8.5X18	9
COMPACT:	TBD	
COMPACT %:	TBD	
DRIVE AISLE:	22 FT	
FIRE LANE:	26 FT	
OVERHANG:	2 FT	
REQ. PARKING RATIO BY USE:		
RESTAURANT:		8
DRIVE-THROUGH:	1/75 SF	7

NOTES:

1 Community Business - Whiskey Ridge Subarea Plan

2 Subject to sight distance review at driveways and street intersections.

3 A 25-foot setback is required on property lines adjoining residentially designated property.

4 20 ft L1 landscaping buffer between commercial use and property designated single-family by the Marysville comprehensive plan.
10 ft L2 landscaping buffer between commercial use and property designated multiple-family by the Marysville comprehensive plan.

5 Required landscaping setbacks for developments on the north side of Soper Hill Road are 25 ft from the edge of sidewalk.
If the drive-through lane is abutting a street: (a) 10 ft setback required from a public right-of-way or private access road. The setback area shall be landscaped to the L3 standard; see Chapter 22C.120 MMC, Landscaping and Screening.
(b) 15 ft setback required from a public arterial right-of-way. The setback area shall be landscaped to the L3 standard; see Chapter 22C.120 MMC, Landscaping and Screening. (Ord. 2852 § 10 (Exh. A), 2011).

6 Maximum impervious surface: 85%

7 A stacking lane shall be an area measuring a minimum of 8'-6' wide by 20 feet deep. For each service lane of a drive-through restaurant, a minimum of 7 stacking spaces shall be provided. For high volume drive-through restaurants up to 12 stacking spaces may be required.

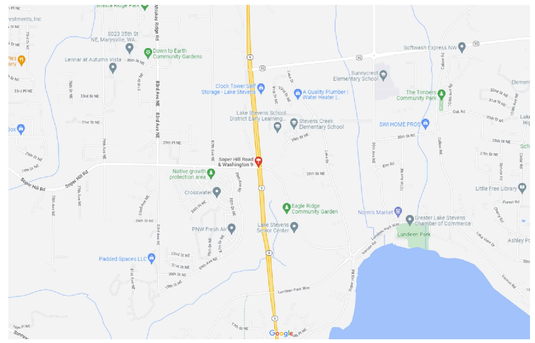
8 If < 4,000 SF, 1 per 200 SF gross floor area; if > 4,000 SF, 20 plus 1 per 100 SF gross floor area over 4,000 SF

9 Bicycle parking facilities shall be provided for any new use which requires 20 or more automobile parking spaces. The number of required bicycle parking spaces shall be 5% of the number of required off-street auto parking spaces. When any covered automobile parking is provided, all bicycle parking shall be covered.

This conceptual design is based upon a preliminary review of entitlement requirements and on unverified and possibly incomplete site and/or building information, and is intended merely to assist in exploring how the project might be developed.

Stormwater Management Design:
AVERAGE REGIONAL REQUIRED PROVIDED

Boundary Source:
GIS MAP & AERIAL IMAGE



1" =30'

0 15 30 60 150

NORTH

scheme: PSP10

Conceptual Site Plan

Soper Hill Rd & SR 9,
Marysville, WA 98258

WARE MALCOMB

SEA22-0053-00
01.11.2023

SHEET
PSP10

ATTACHMENT C

Trip Generation Calculations

Chick-fil-A Soper Hill Rd
Marysville, WA

DAILY

Land Use	Size[1]	ITE LUC[2]	Directional Split In	Directional Split Out	Trip Rate or Equation Total	Trips Generated In	Trips Generated Out	Trips Generated Total
Proposed Use								
Fast-Food Rest. With Drive-Thru	5,773 GFA	934	50%	50%	467.48	1,349	1,350	2,699
Pass-by Trips[3,4]	*53%*					-708	-709	-1,417
						641	641	1,282
					New Weekday Daily Trips Generated =	**641**	**641**	**1,282**

AM PEAK HOUR

Land Use	Size[1]	ITE LUC[2]	Directional Split In	Directional Split Out	Trip Rate or Equation Total	Trips Generated In	Trips Generated Out	Trips Generated Total
Proposed Use								
Fast-Food Rest. With Drive-Thru	5,773 GFA	934	51%	49%	44.61	132	126	258
Pass-by Trips[3]	*50%*					-66	-63	-129
						66	63	129
					New AM Peak Hour Trips Generated =	**66**	**63**	**129**

PM PEAK HOUR

Land Use	Size[1]	ITE LUC[2]	Directional Split In	Directional Split Out	Trip Rate or Equation Total	Trips Generated In	Trips Generated Out	Trips Generated Total
Proposed Use								
Fast-Food Rest. With Drive-Thru	5,773 GFA	934	52%	48%	33.03	99	92	191
Pass-by Trips[3]	*55%*					-55	-50	-105
						44	42	86
					New PM Peak Hour Trips Generated =	**44**	**42**	**86**

Notes:

[1] GFA = Gross Floor Area.

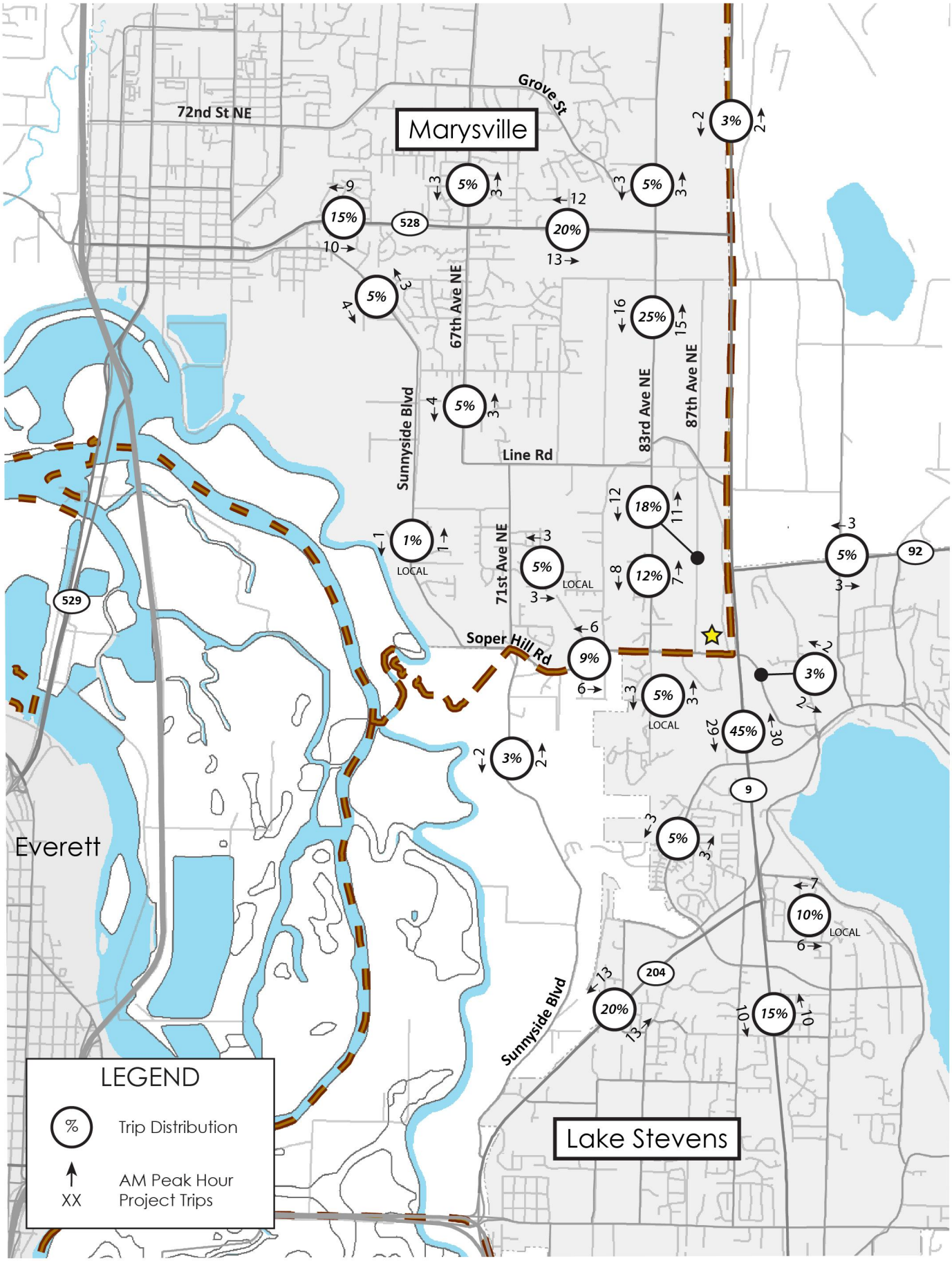
[2] Institute of Transportation Engineers, *Trip Generation* Manual, 11th Edition, 2021.

[3] Pass-by trips determined based on appendices included in the ITE Trip Generation Manual, 11th Edition.

[4] Pass-by percentage for daily based on the average of the AM and PM peak hours.

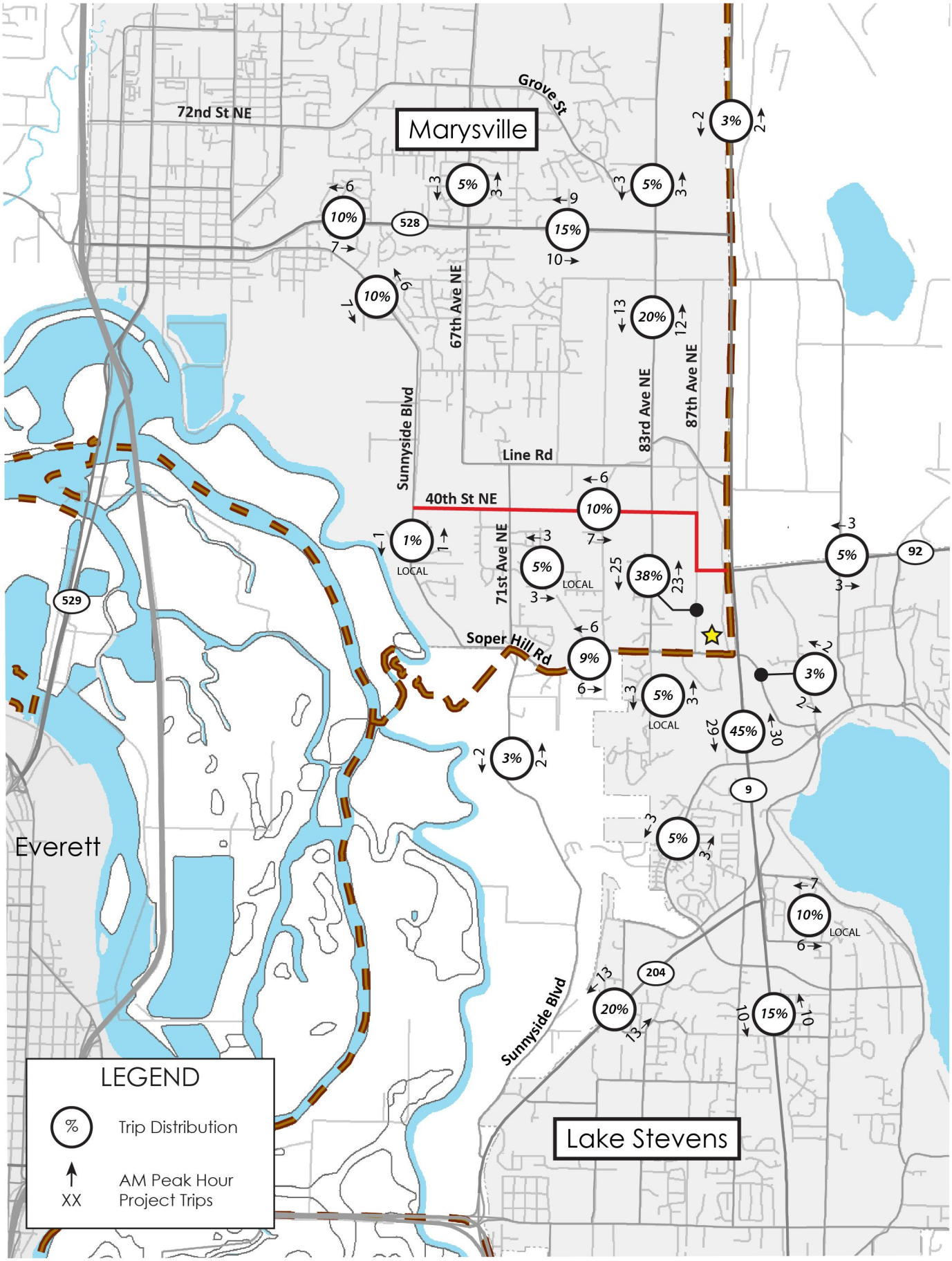
ATTACHMENT D

Weekday Project Trip Distribution and Assignment



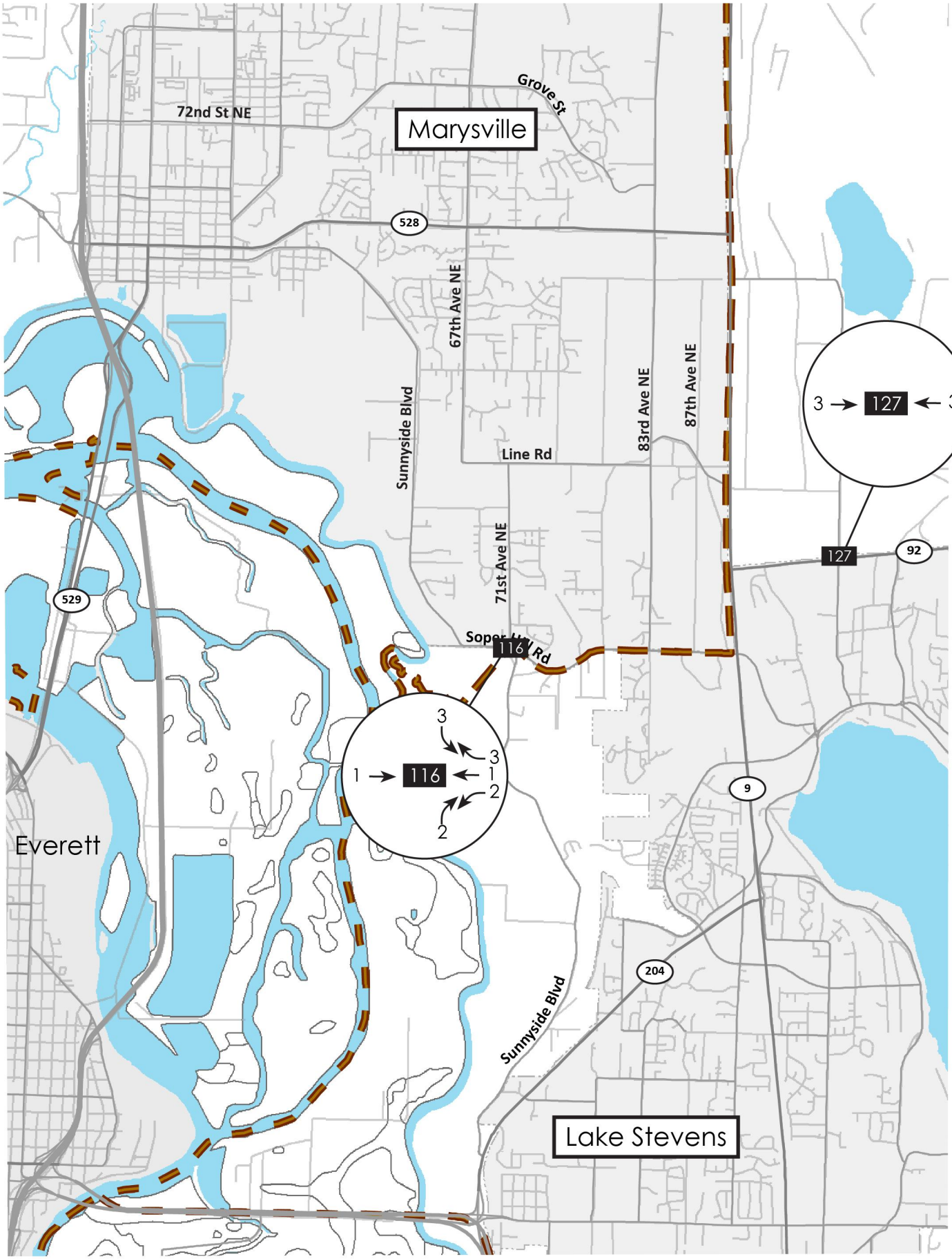
Attachment D1: AM Peak Hour Project Trip Distribution and Assignment (Year of Opening)

N
NOT TO SCALE



Attachment D2: AM Peak Hour Project Trip Distribution and Assignment (Horizon Year)

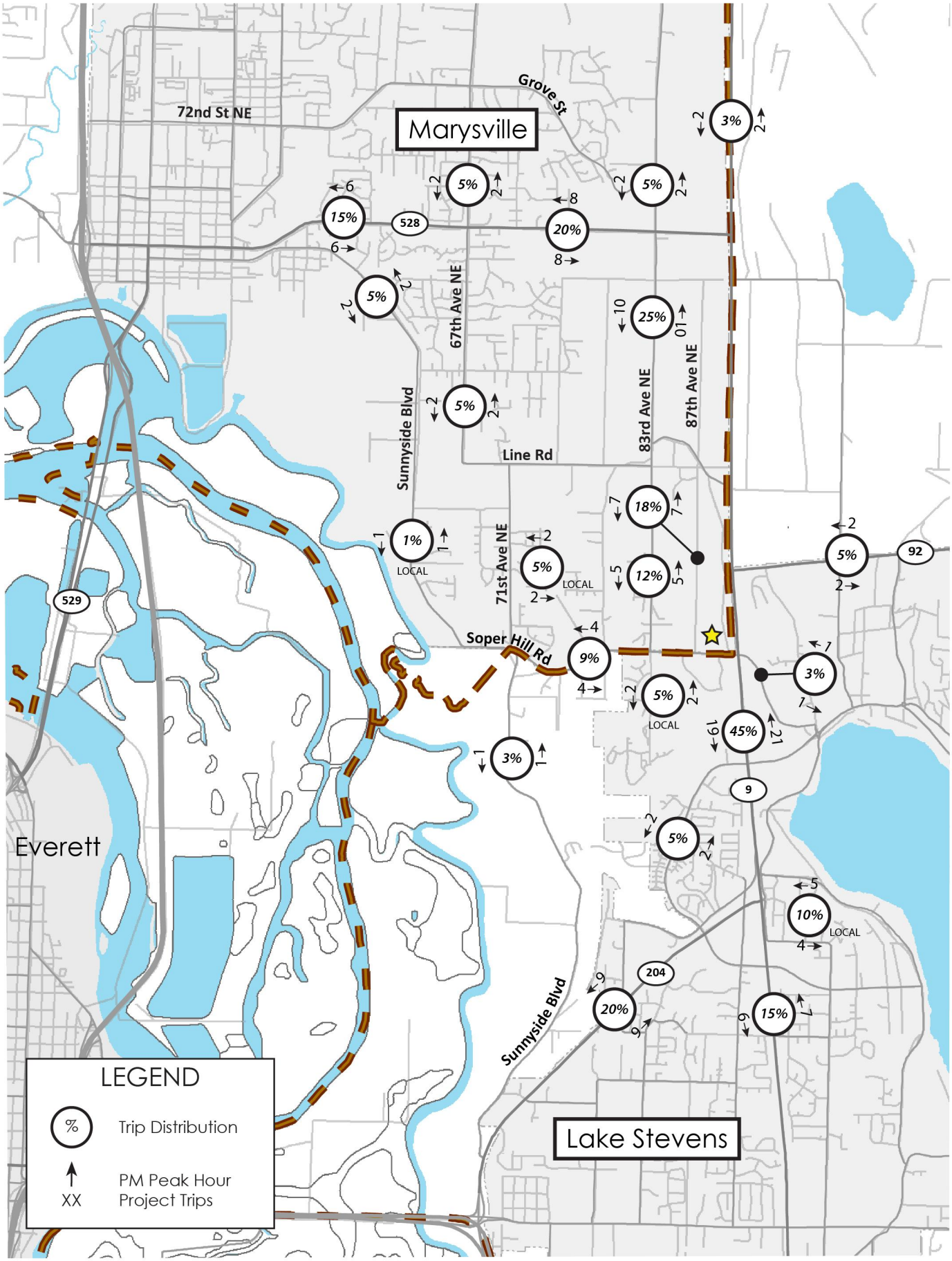
N
NOT TO SCALE



Attachment D3: AM Peak Hour Project Trip Assignment at Snohomish County Key Intersections

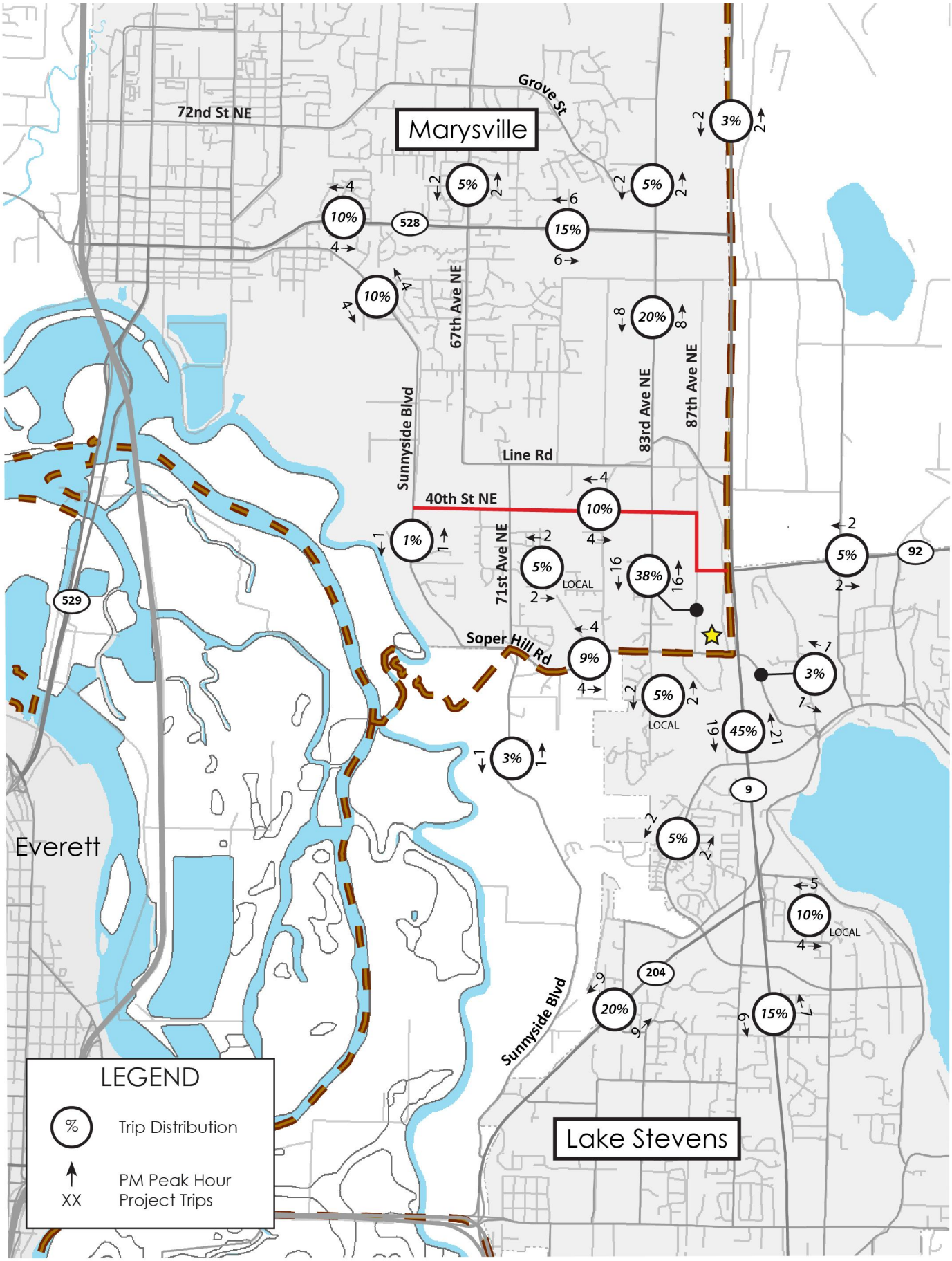
N

NOT TO SCALE



Attachment D4: PM Peak Hour Project Trip Distribution and Assignment (Year of Opening)

N
NOT TO SCALE

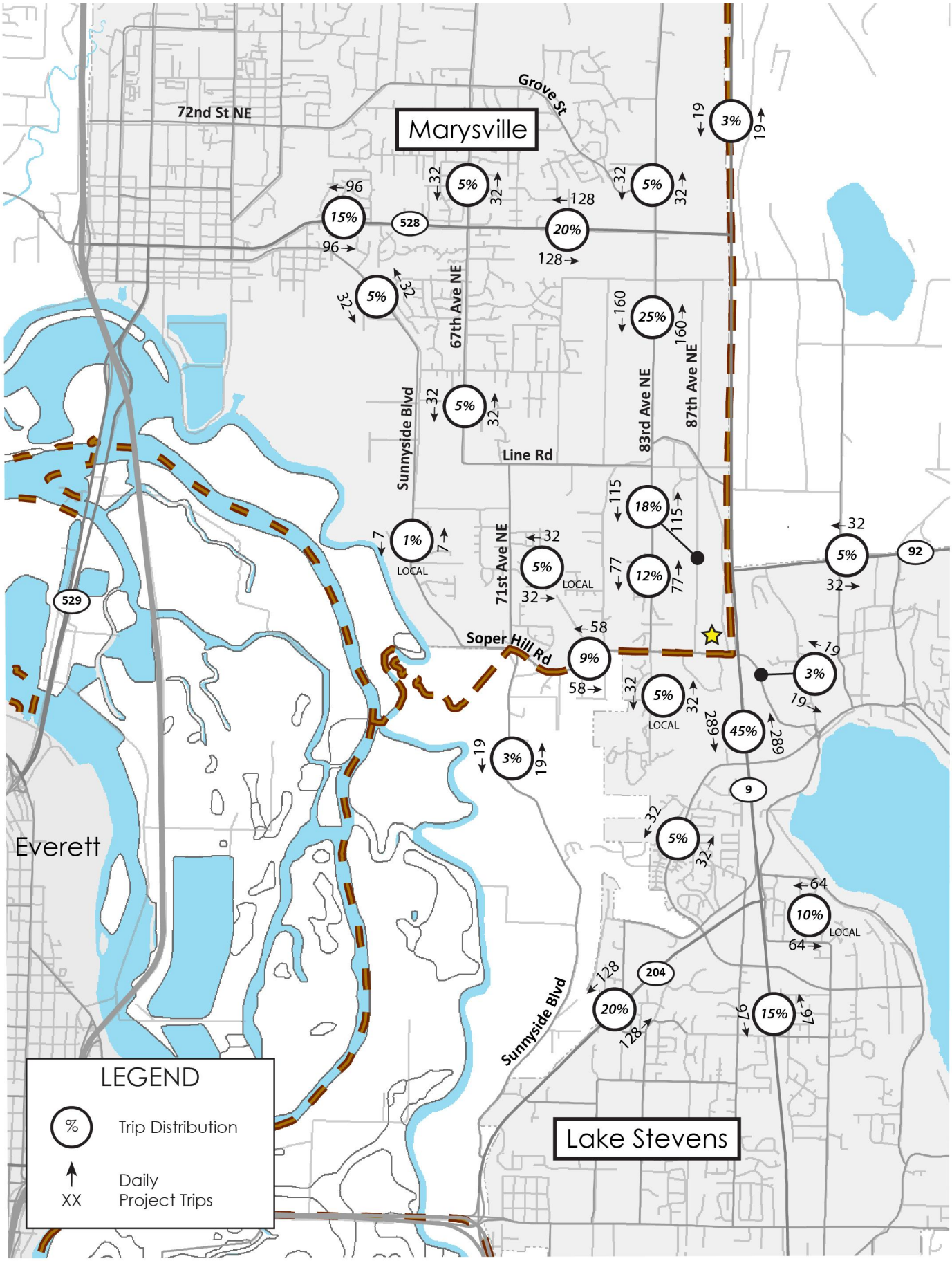


Attachment D5: PM Peak Hour Project Trip Distribution and Assignment (Horizon Year)

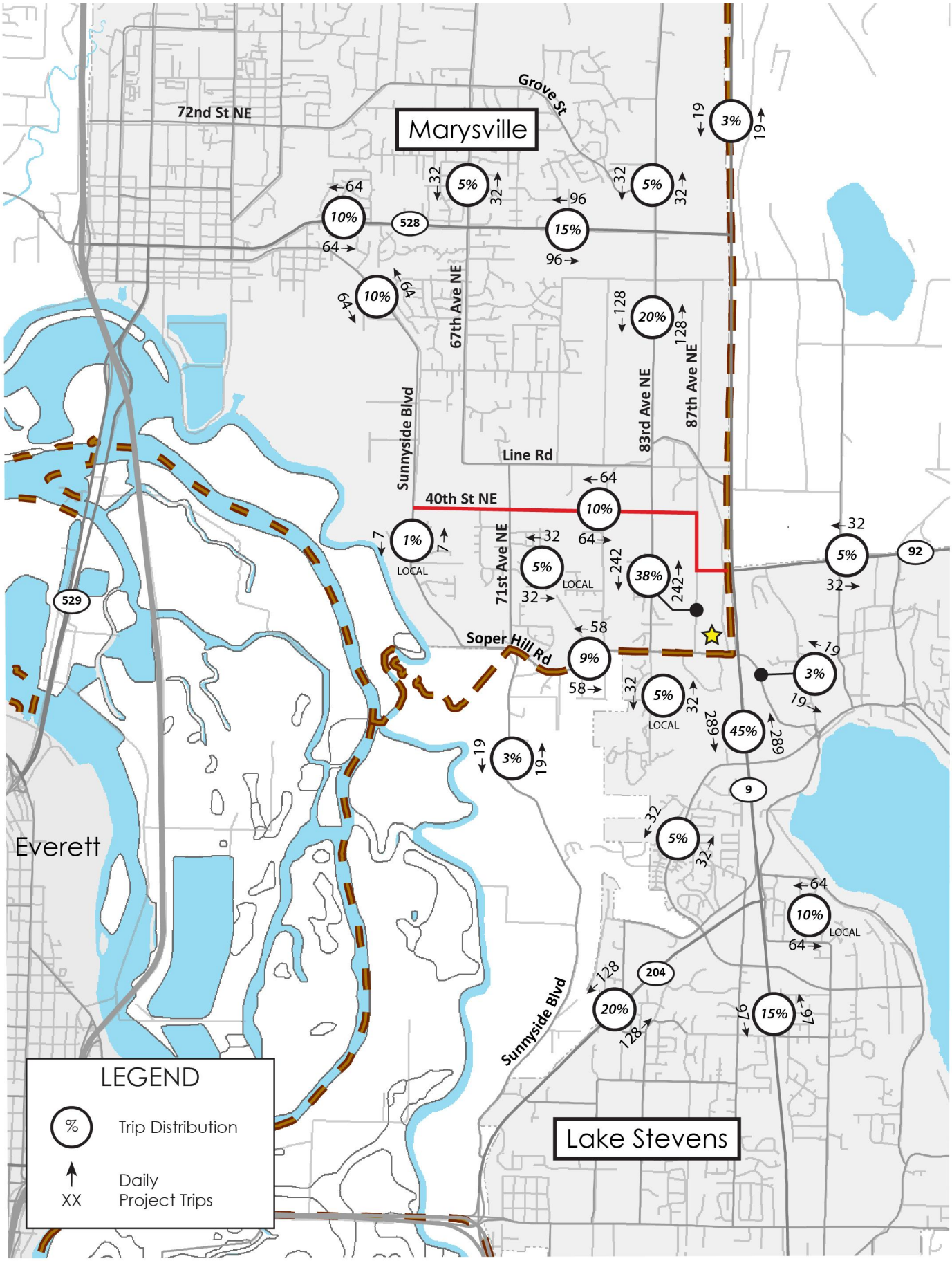
Attachment D6: PM Peak Hour Project Trip Assignment at Snohomish County Key Intersections

N

NOT TO SCALE



Attachment D7: Daily Project Trip Distribution and Assignment (Year of Opening)



Attachment D8: Daily Project Trip Distribution and Assignment
Horizon Year)

N
NOT TO SCALE

ATTACHMENT E

Drive-Through Queuing Analysis

Chick-fil-A Soper Hill Rd
Weekday PM Peak Hour Queue Estimate
M/M/s Queuing Model

Entering Vehicles 99
% Drive-Through 65%

Order Point

Arrival Rate (λ)
64 veh/hr
0.0178 veh/sec

Departure Rate (μ)
65.0 sec
0.0154 veh/sec

Inputs:
λ = 0.0178
μ = 0.0154
s = 2

Outputs:
ρ = 0.57778

L = 1.7 veh
L_q = 0.6 veh

W = 97.57228
W_q = 32.57228

Probability Calcs: n	P_n	Prob <= n Vehicles	Vehicles (n)
0	0.26760563	26.8%	0
1	0.30923318	57.7%	1
2	0.17866806	75.6%	2
3	0.10323043	85.9%	3
4	0.05964425	91.8%	4
5	0.03446112	**95.3%**	**5**
6	0.01991087	97.3%	6
7	0.01150406	98.4%	7
8	0.00664679	99.1%	8
9	0.00384037	99.5%	9
10	0.00221888	99.7%	10
11	0.00128202	99.8%	11
12	0.00074072	99.9%	12
13	0.00042797	99.9%	13
14	0.00024727	100.0%	14
15	0.00014287	100.0%	15
16	0.00008255	100.0%	16
17	0.00004769	100.0%	17
18	0.00002756	100.0%	18
19	0.00001592	100.0%	19
20	0.00000920	100.0%	20

Legend:

λ =	mean arrival rate
μ =	mean service rate
s =	# of servers
ρ =	traffic intensity
L =	**expected number of customers in system**
L_q =	expected number of customers in the queue
W =	expected waiting time of customer in system
W_q =	expected waiting time of customer in queue
P_0 =	probability of 0 cars in the system
Pn =	probability of n cars in the system