

**School Sisters of Notre Dame
Development Traffic Impact Study
Supplement Number 2
Village of Elm Grove, Wisconsin**



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**School Sisters of Notre Dame
Development Traffic Impact Study
Supplemental Report Number 2
Elm Grove, Wisconsin**

Study Purpose

This Supplemental Report Number 2 has been prepared as an update to the September 23, 2020 Traffic Impact Study which involved a development plan for 266 apartments, 17 side-by-side duplexes and 100 senior housing units and the October 11, 2020 initial Supplemental Report that analyzed different access options that were identified through an extensive public involvement process related to the original Mandel Group planned residential development. The access options considered reducing development access to a single access road connection on Watertown Plank Road and to eliminate the existing SSND access road connection to Stephen Place. The initial Supplemental Report also analyzed a request to consider the installation of traffic signals at the access road SSND property connection on Watertown Plank Road.

After extensive conversations with neighbors and a series of public meetings, Mandel Group modified its development plan to provide single-family homes along Stephen Place, Red Barn Lane, and the southern portion of the SSND property.

This report provides a detailed analysis of future Year 2028 traffic impacts related to a revised SSND development plan that reduces the number of apartments located on the central SSND property to 240 with access to Watertown Plank Road limited to the existing SSND western driveway. The updated plan also includes 26 single family homes that would have driveway access to Stephen Place, Red Barn Lane and Green Meadow Place. The 11 single-family homes along Red Barn Lane and 15 single-family homes on the southern portion of campus replace the 17 side-by-side duplexes and 100 senior living units proposed in the original SSND development plan, respectively.

Based on traffic analysis findings reported in the September 23rd and October 16th traffic impact reports, this supplemental report focuses its analysis on the following three Year 2028 traffic scenario traffic operating conditions: 1) Background traffic without any new development on the School Sisters of Notre Dame property; 2) Background traffic with trips generated by the Mandel planned residential development; and 3) Background traffic with trips generated by the Mandel planned residential development plus trips also generated by multi-family development identified in the Village Downtown Corridor Master Plan. Year 2028 background traffic was analyzed since it provides a higher conservative traffic level on Watertown Plank Road compared to existing conditions.

It is noted that there is some redundancy in report traffic volume figures and intersection operation tables from the analysis materials in the September 23, 2020 Traffic Impact Study

and the October 11, 2020 Supplemental Report to provide the reader of this document a complete picture of the traffic impacts attributed to the updated SSND development plan.

Updated Mandel Development Plan

Figure 1 illustrates the updated Mandel Group Residential Development Plan for the SSND property.

Figure 1: Mandel Group Updated Residential Development Site Plan



As shown on Figure 1, the apartment component of the development is located adjacent to and includes the Maria and Notre Dame Halls consistent with the location of existing facilities housing SSND residents and offices. Figure 1 also shows 15 single family homes on the southern portion of the SSND property with access to Green Meadow Place in addition to 11 single family homes located along Stephen Place and Red Barn Lane.

Table 1 summarizes the peak hour trip generation for the updated development plan based on data published in the Institute of Transportation Engineers, *Trip Generation Manual, 10th edition*.

Table 1: Updated Mandel Residential Development Peak Hour Trip Generation

Land Use Component	No. of Units	ITE Code	Morning Peak Hour			Evening Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total
• Apartments								
○ Mid-rise	240	221	20	65	85	65	40	105
• Single Family								
○ Stephen/Red Barn	11	210	5	10	15	10	5	15
○ Green Meadow	15	210	5	10	15	10	5	15
Total	266		30	85	115	85	50	135

Source: Institute of Transportation Engineers Trip Generation Manual, 10th edition

Table 2 provides a comparison of trips generated by the original September 23, 2020 development plan to the updated number of trips identified in Table 1.

Table 2: Peak Hour Trip Comparison of Original and Updated Mandel Developments

Development Plan	No. of Units	Morning Peak Hour			Evening Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
○ September 23, 2020	400	40	105	145	110	70	180
○ January 11, 2021	266	30	85	115	85	50	135
Difference	-134	-10	-20	-30	-25	-20	-45

As shown on Table 2, the total number of development dwelling units is reduced by 134 units (-34%) with a resulting morning peak hour trip reduction of 30 trips (-21%) and 45 evening peak hour trips (-25%).

Trip Distribution

As noted in the previous Mandel residential development traffic studies submitted to the Village of Elm Grove, existing peak hour traffic count data collected at the Crescent Drive, Stephen Place and Longwood Avenue intersection approaches with Watertown Plank Road indicates approximately 60 percent of existing neighborhood traffic accessing Watertown Plank Road is oriented to/from the west.

Figures 2 and 3 show the distribution of peak hour trips generated by the updated Mandel Residential Development Plan. It is noted that the morning and evening peak hour trips associated with the single-family homes entering and exiting Stephen Place and Longwood Avenue intersections with Watertown Plank Road total 45 trips due to rounding to the nearest 5 vehicles compared to the 30 morning and evening single-family trip generation values shown

on Table 2. As shown on Figures 2 and 3, all apartment trips on the SSND property would use the existing SSND western property driveway on Watertown Plank Road. For the single-family home component of the SSND development, all trips with origins or destinations to/from the west are expected to use Stephen Place to access Watertown Plank Road. Single family home trips that have an origin or destination to/from the east generated by the 7 homes constructed along Red Barn Lane and the 15 homes constructed on the southern portion of the SSND property are expected to use Green Meadow Place and Longwood Avenue to access Watertown Plank Road.

Figure 2: Morning Peak Hour Updated Mandel Residential Development Trip Distribution

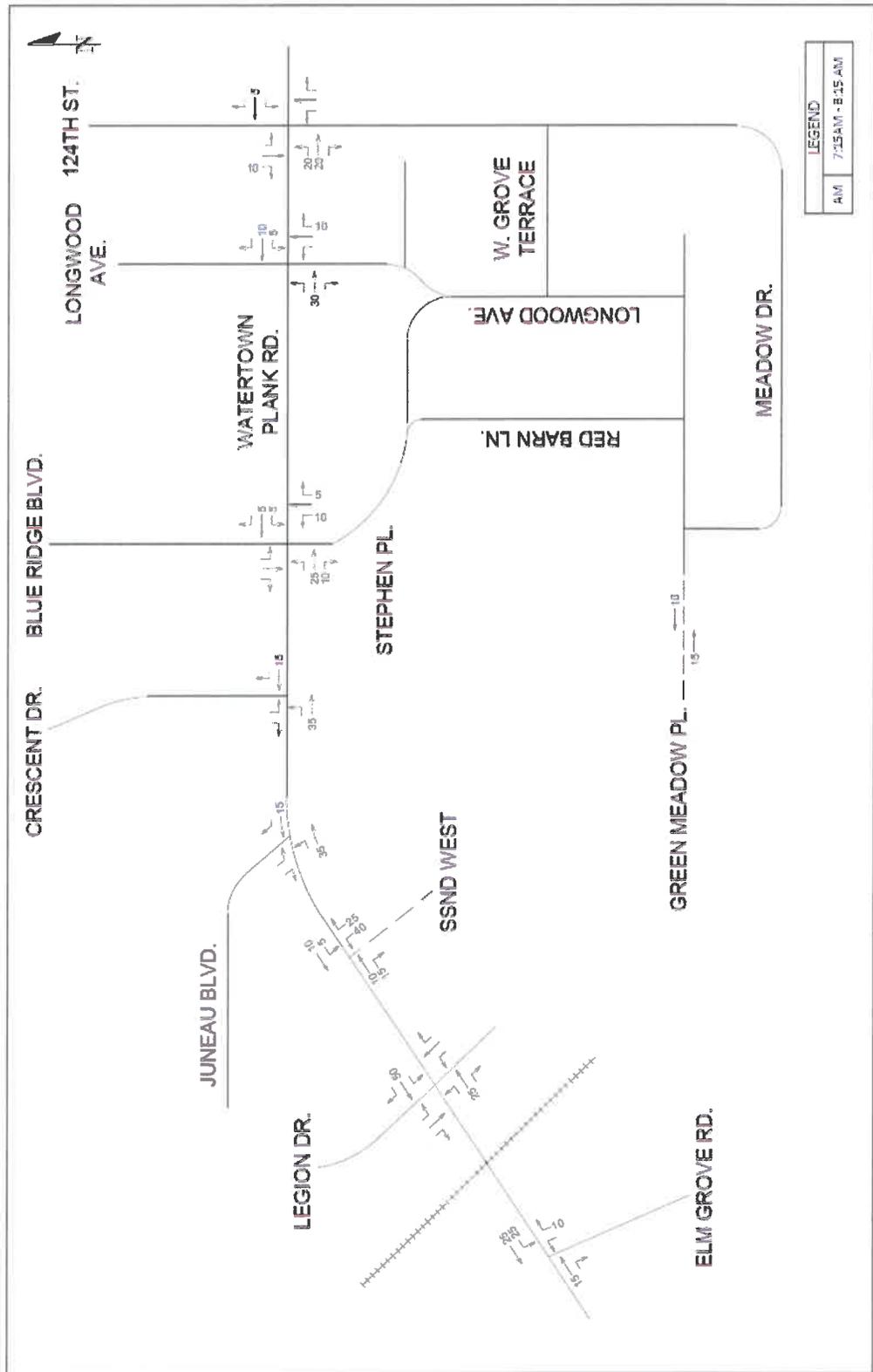
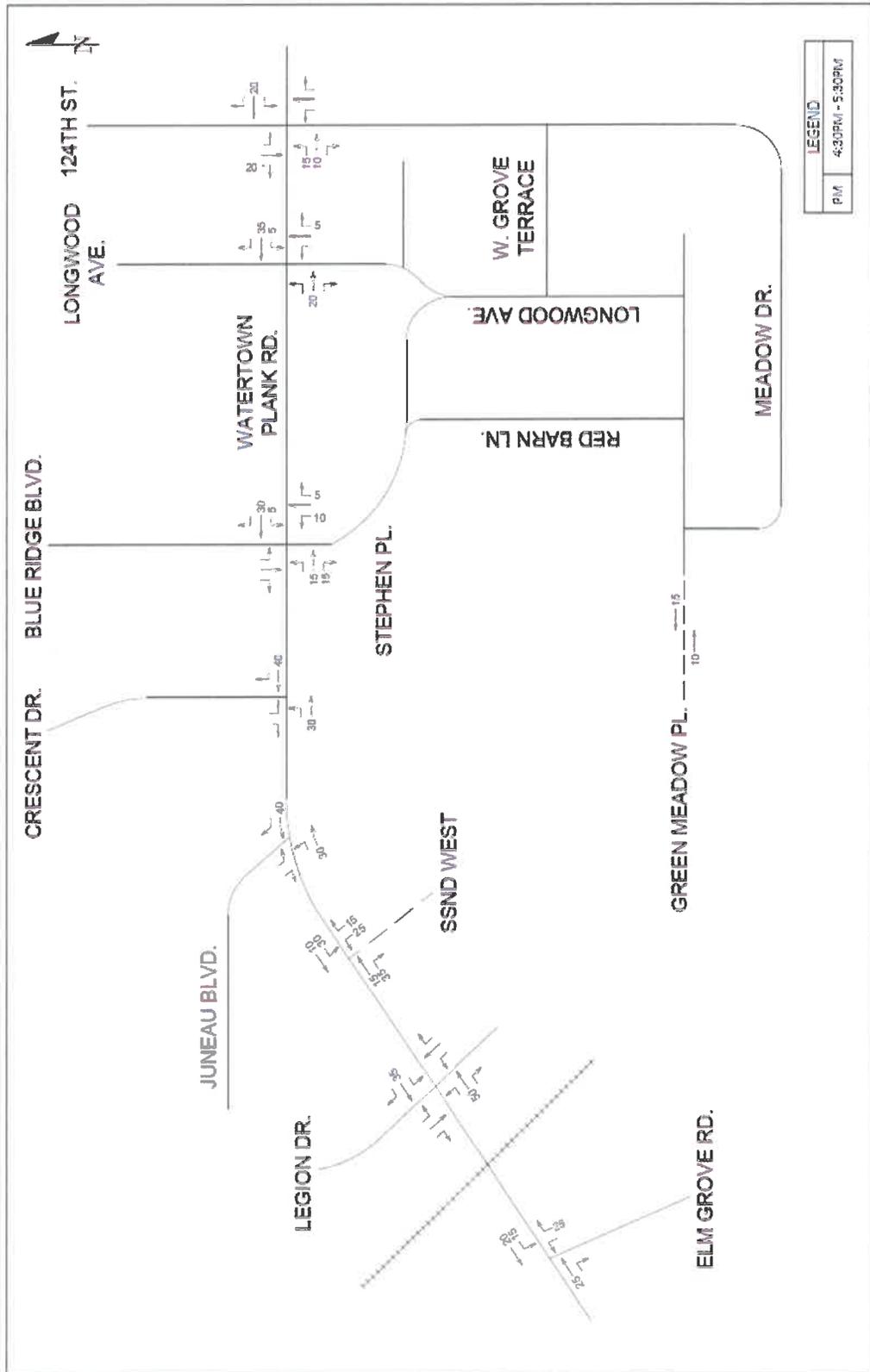


Figure 3: Evening Peak Hour Updated Mandel Residential Development Trip Distribution

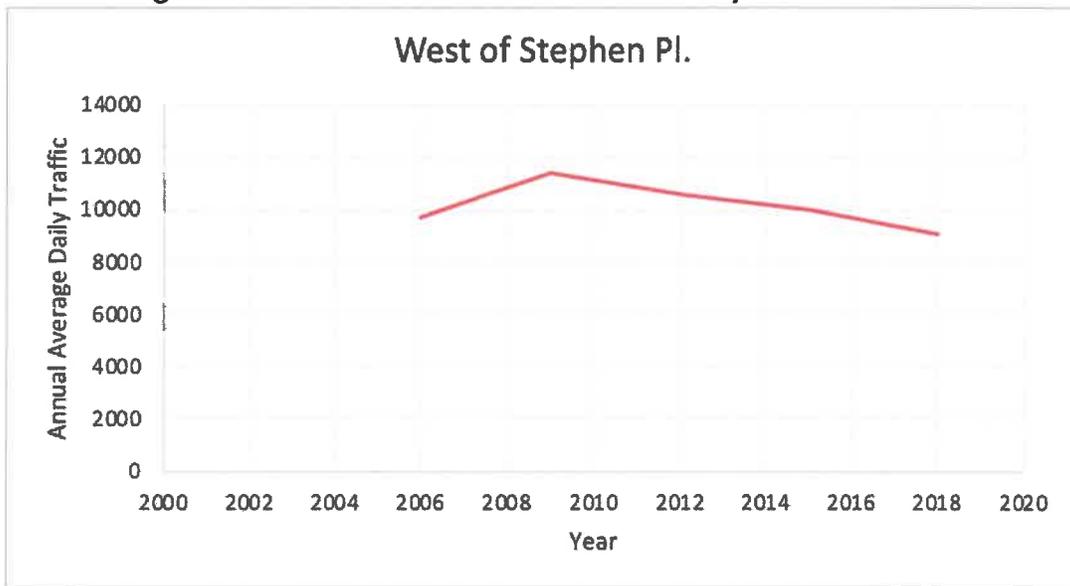


Year 2028 Traffic Analysis Scenarios

In conformance with WisDOT Traffic Impact Analysis Guidelines, Year 2028 traffic volumes are analyzed in this report to represent background traffic conditions 5-years after the updated Mandel Residential Development is planned to be fully constructed.

Year 2028 peak hour 'through' traffic volumes have been projected at an annual growth rate of 0.5 percent from 2019 peak hour 'through' traffic volume movement counts collected by Ayres Associates at the Watertown Plank Road study intersections in May of 2018. For reference purposes, Figure 4 illustrates historic weekday traffic volume patterns collected by the Wisconsin Department of Transportation (WisDOT) on the Watertown Plank Road segment between Stephen Place/Blue Ridge Boulevard and Crescent Drive.

Figure 4: Watertown Plank Road Historic Daily Traffic Volumes



Source: Wisconsin Department of Transportation

As shown on Figure 4, traffic volumes on Watertown Plank Road have remained relatively constant or slightly decreasing since 2006 with only a slight increase to 11,200 vpd in 2009 after which it steadily decreased to about 9,100 vpd. To be conservative, it was assumed, for this traffic impact analysis that 'Background' traffic volumes on Watertown Plank Road may increase at an annual growth rate of 0.5 percent.

Year 2028 Peak Hour Intersection Background Traffic

Figures 5 and 6 show the projected Year 2028 peak hour intersection 'Background' traffic movement volumes at the study intersections. Both figures include traffic count data collected at the Longwood Avenue intersection with Watertown Plank Road on Thursday, March 9, 2019. The early March counts are not considered to have been affected by the COVID 19 Pandemic.

The Longwood Avenue counts were not included in previous SSND analysis reports since they were not affected by SSND trips generated from the original development plan.

Figure 5: Year 2028 Morning Peak Hour Background Intersection Traffic Movements

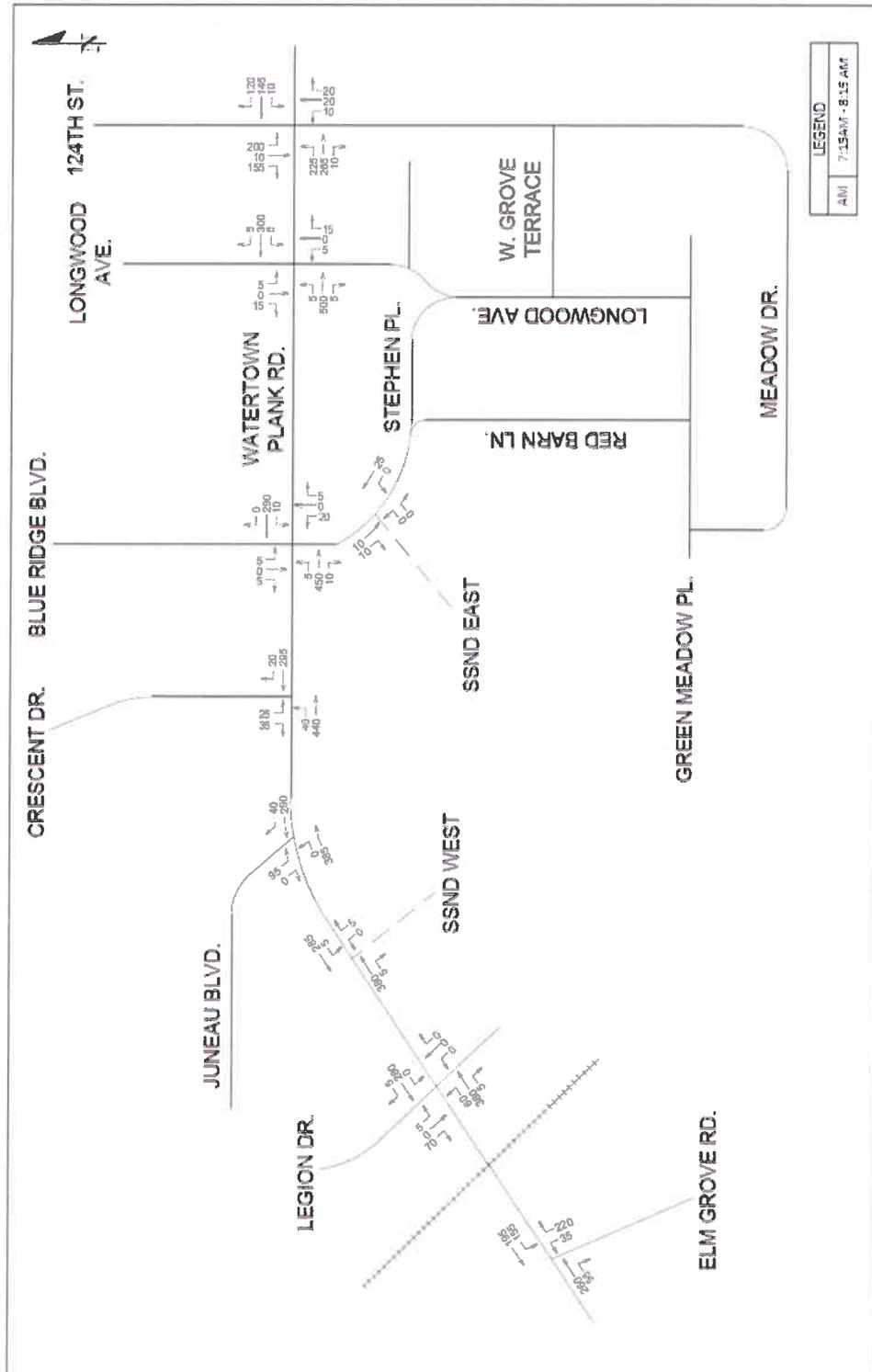


Figure 6: Year 2028 Evening Peak Hour Background Intersection Traffic Movements

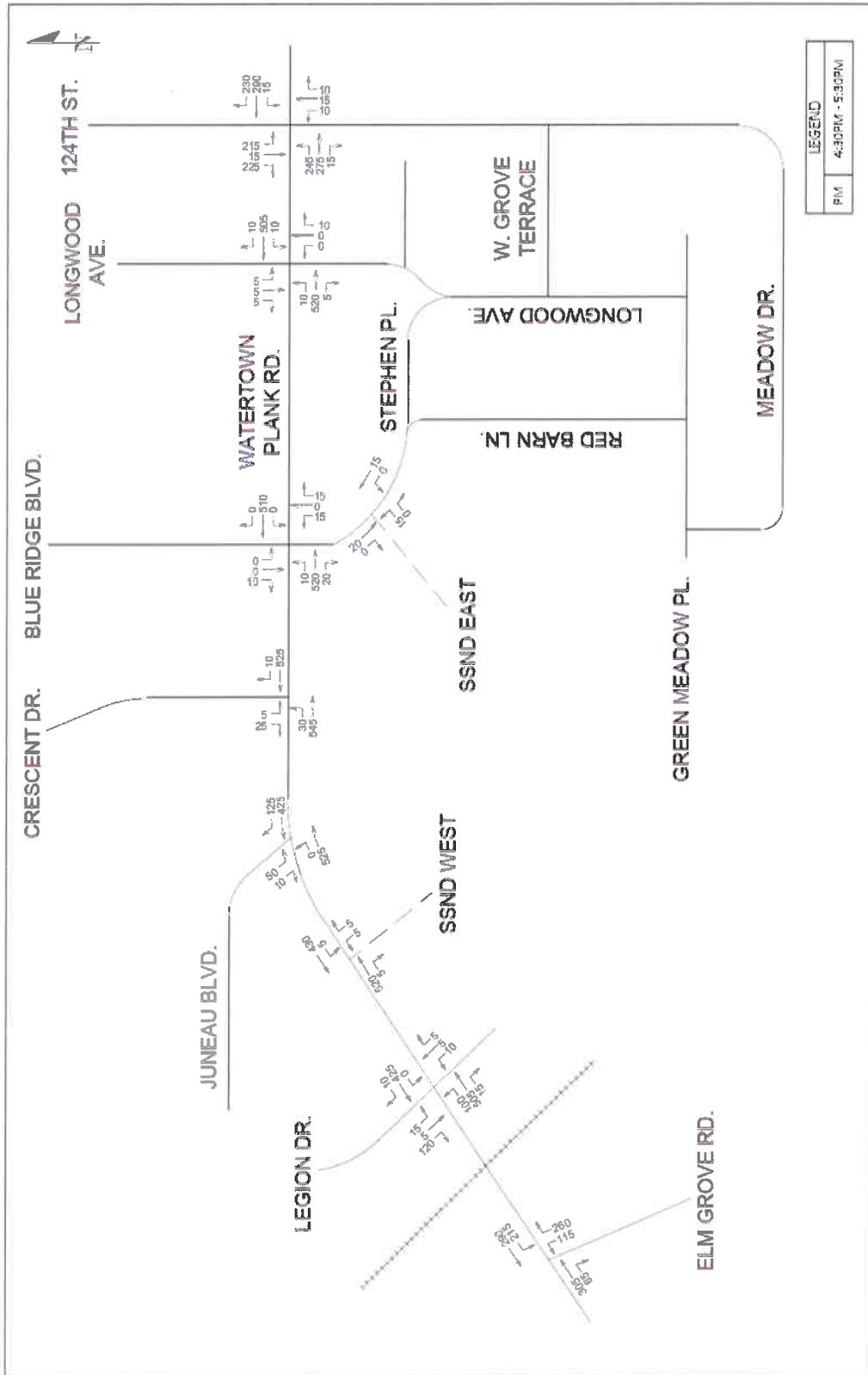
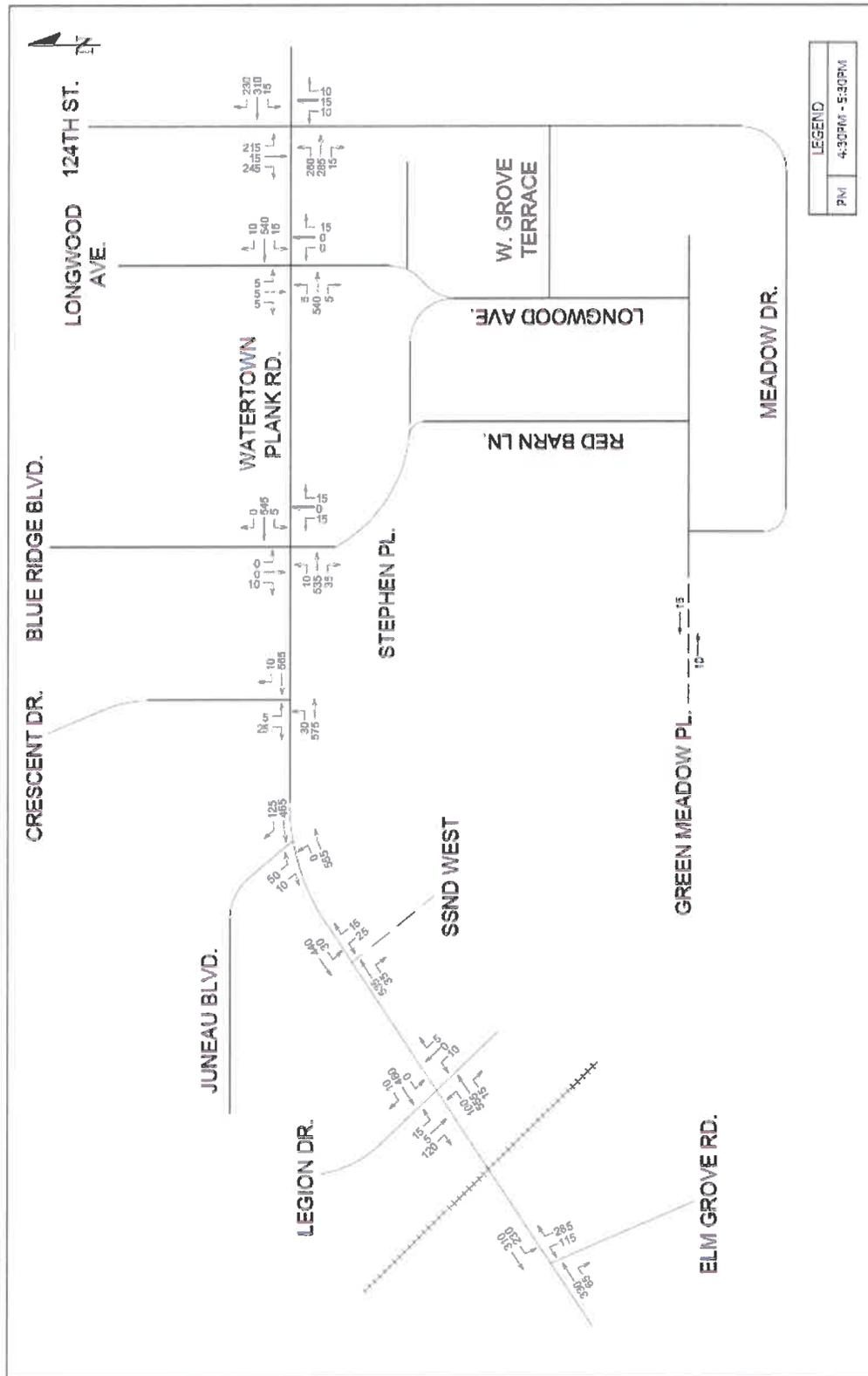


Figure 8: Year 2028 Evening Peak Hour Background Intersection Traffic Movements with Trips Generated by the Updated Mandel Residential Development Plan



Year 2028 Peak Hour Intersection Background Traffic with Updated Mandel Residential Development Plan and Village Downtown Corridor Master Plan Multi-Family Trips

In order to analyze year 2028 traffic impacts with trips generated by future residential it is necessary to quantify the number of trips that may be generated by the residential development identified in the Village Downtown Corridor Master Plan. On page 97 of the Village of Elm Grove Downtown Corridor Plan a total of 243 new residential multi-family dwelling units may be constructed. Table 10 provides a summary of the Master Plan number of new residential trips generated between the Legion Drive and Elm Grove Road intersections based on data published in the *ITE Trip Generation Manual*, 10th edition.

Table 3: Village Downtown Corridor Master Plan Residential Multi-Family Trip Generation

<u>Land Use</u>	<u>No. of Units</u>	<u>ITE Code</u>	<u>Morning Peak Hour</u>			<u>Evening Peak Hour</u>		
			<u>Total</u>	<u>Enter</u>	<u>Exit</u>	<u>Total</u>	<u>Enter</u>	<u>Exit</u>
• Mid-Rise Apartments	243	221	85	20	65	105	65	40

Source: Institute of Transportation Engineers Trip Generation Manual, 10th edition

Figures 9 and 10 show the distribution of Village Downtown Corridor Master Plan multi-family trips.

Figure 9: Distribution of Morning Peak Hour Trips Generated by Village Downtown Corridor Master Plan Multi-Family Development

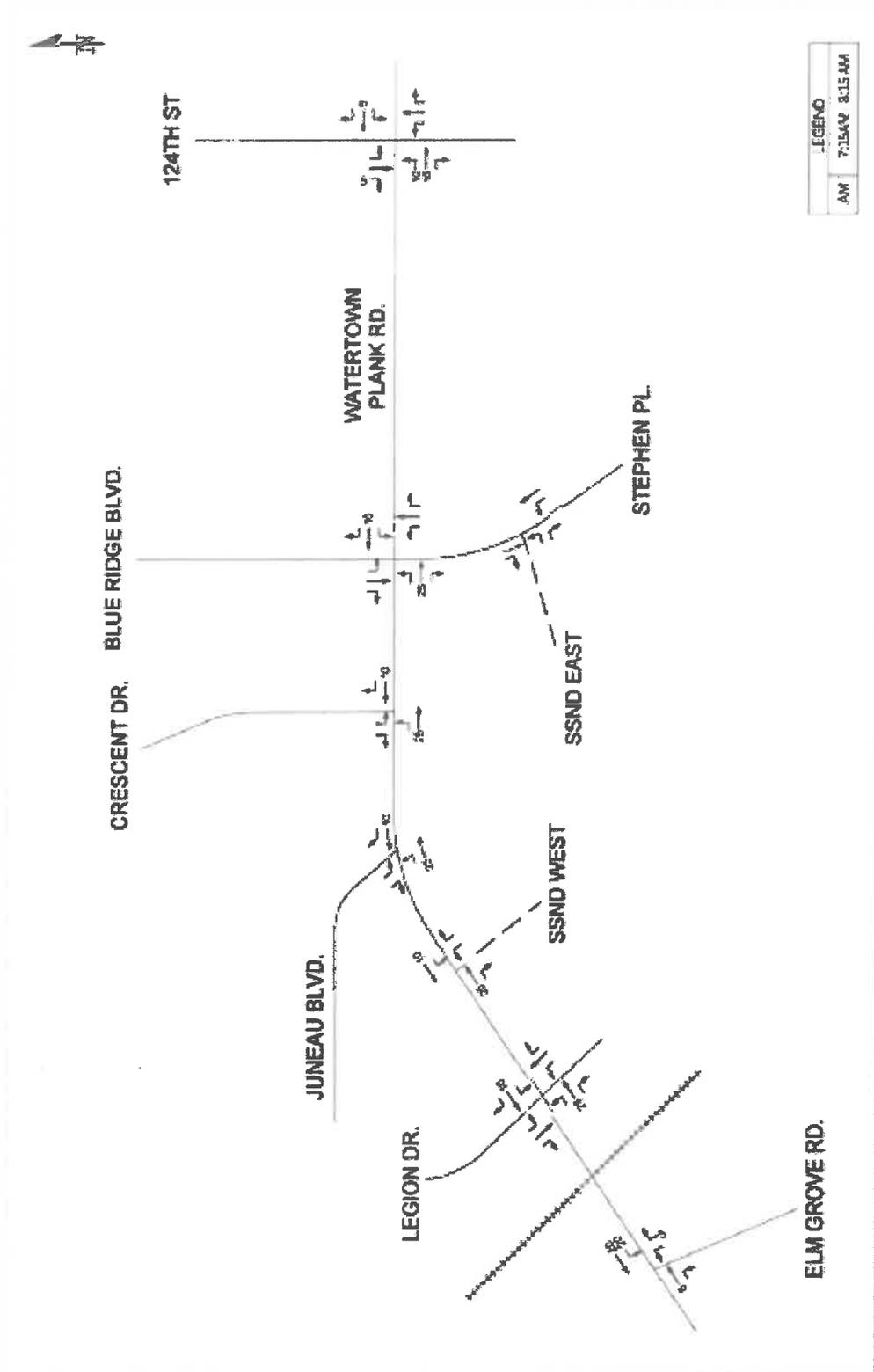
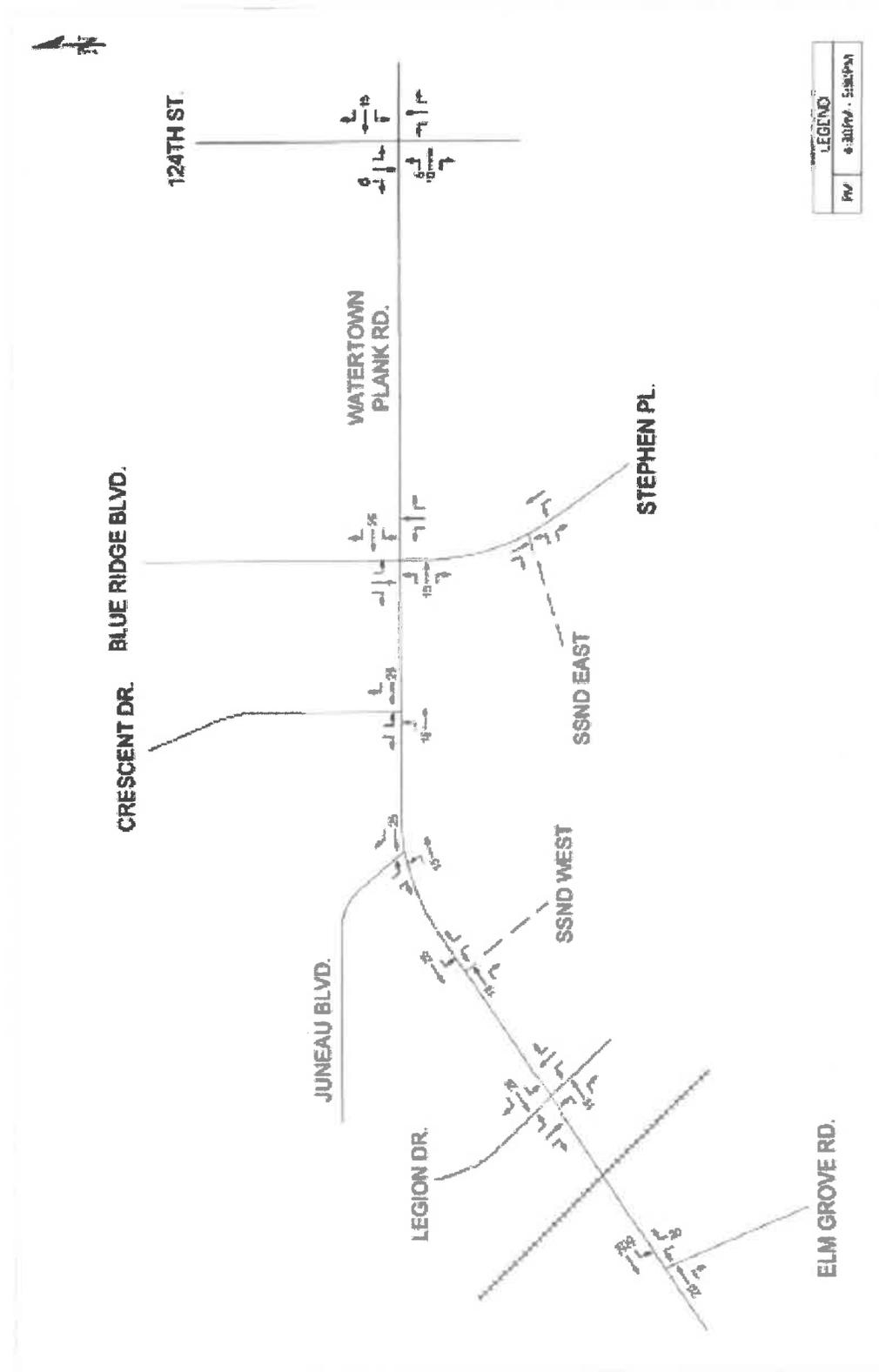


Figure 10: Distribution of Evening Peak Hour Trips Generated by Village Downtown Corridor Master Plan Multi-Family Development



Figures 11 and 12 show the projected year 2028 peak hour intersection 'Background' traffic volumes with the addition of trips generated by the updated SSND Residential Development Plan and the Village Downtown Corridor Master Plan Multi-Family Development.

Figure 11: Year 2028 Morning Peak Hour Background Intersection Traffic Movements with Trips Generated by the Updated Mandel Residential Development Plan and Village Downtown Corridor Master Plan Multi-Family Trips

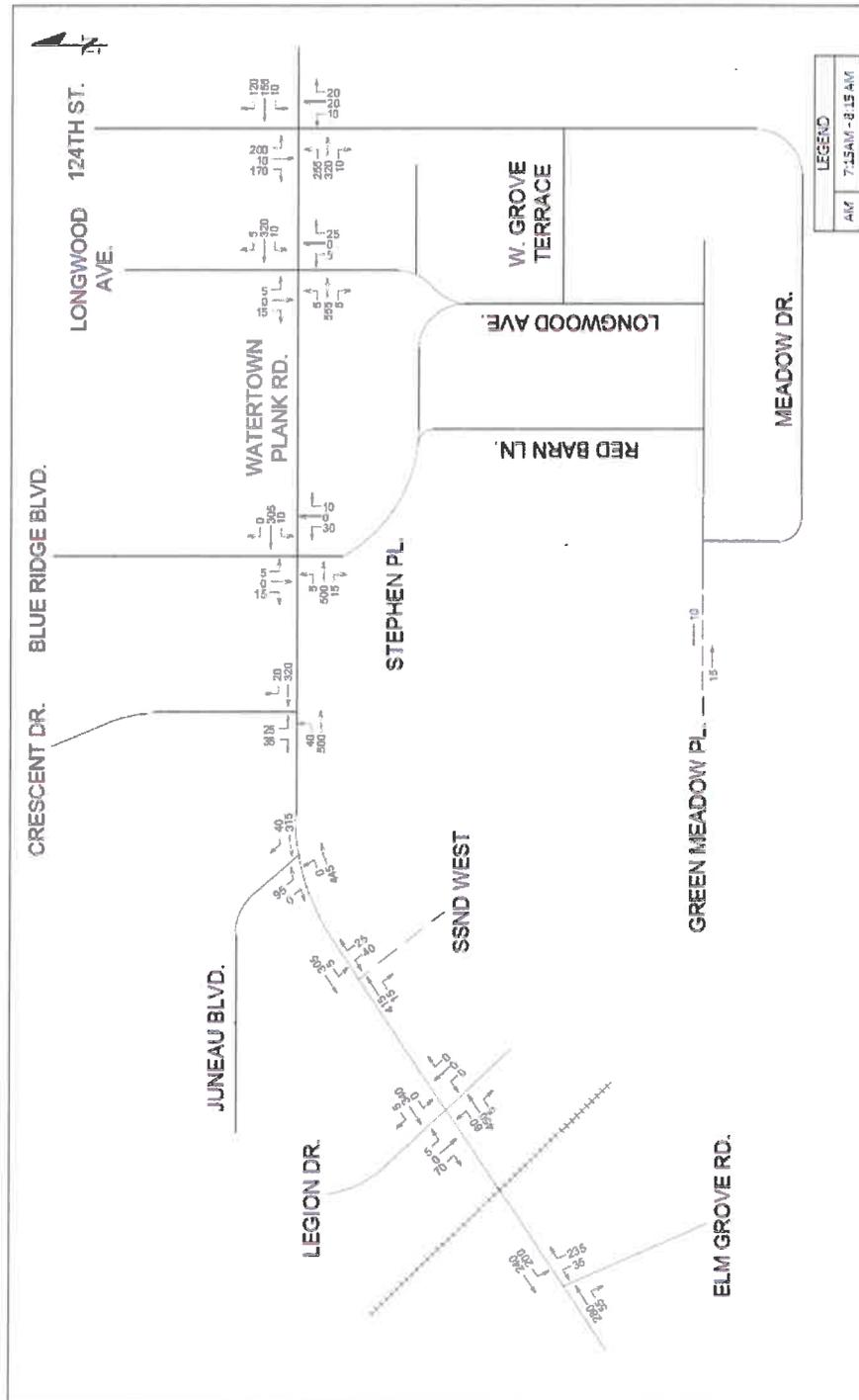
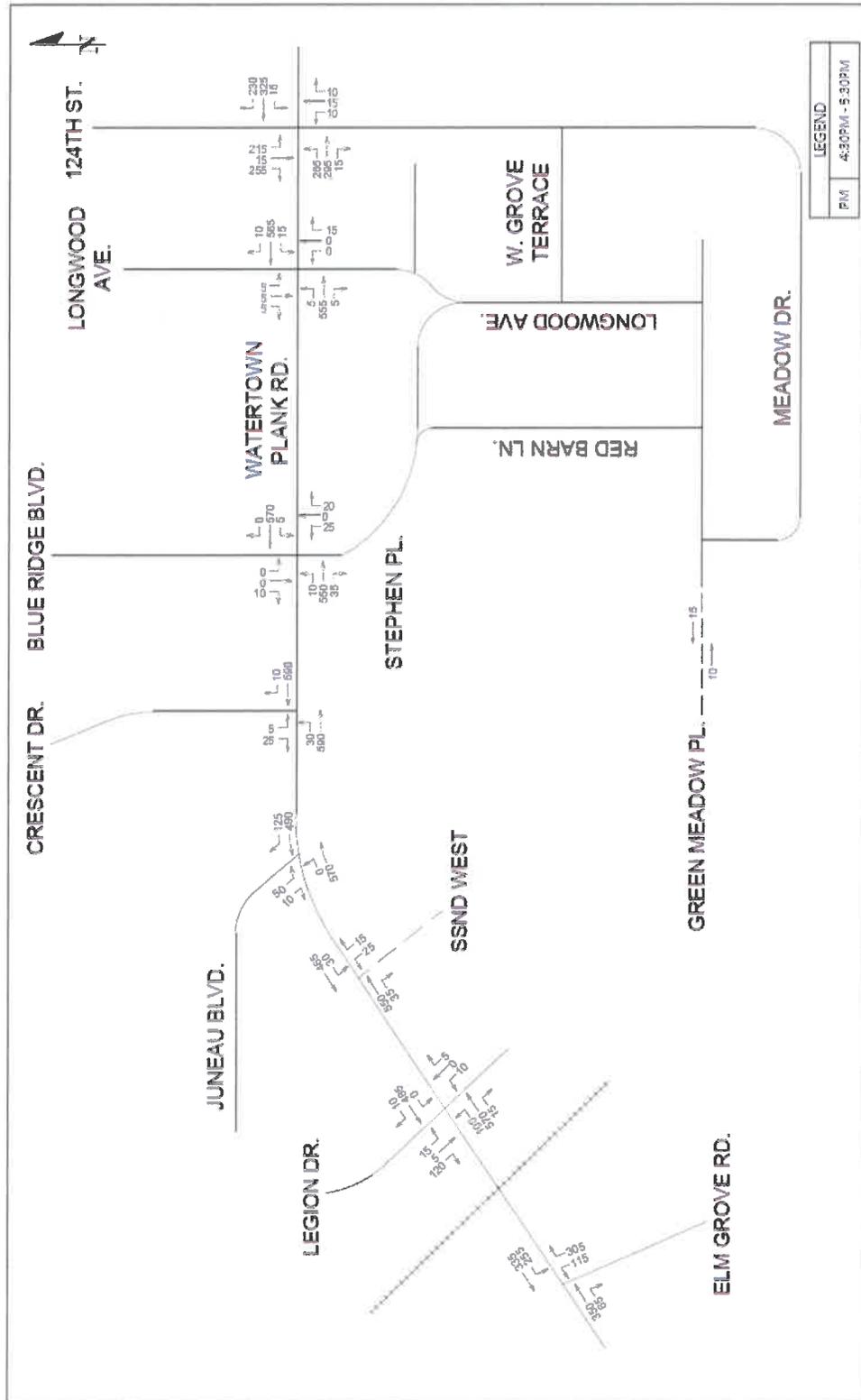


Figure 12: Year 2028 Evening Peak Hour Background Intersection Traffic Movements with Trips Generated by the Updated Mandel Residential Development Plan and Village Downtown Corridor Master Plan Multi-Family Trips



Intersection Operation

Year 2028 peak hour operation at each of the study intersections are evaluated under the following scenarios:

- Background Traffic Operation without Proposed Residential Development
- Background Traffic Operation with Proposed SSND Residential Development
- Background Traffic Operation with Proposed SSND Residential and Village Downtown Corridor Master Plan Multi-Family Developments

Intersection operation is nationally defined by Level of Service (LOS) categories. These LOS categories have been established by the National Academy of Sciences Transportation Research Board and have been adopted by Federal, state and local municipalities to analyze intersection operation. LOS is determined based on the average amount of delay experienced by each vehicle entering an intersection during a 1-hour study period and is categorized by grades of 'A' through 'F'. Level of Service (LOS) 'D', as defined in the *Highway Capacity Manual 6th Edition* (HCM), is normally used as the threshold for acceptable peak hour intersection operation in urban areas. Table 4 summarizes the different intersection LOS parameters.

Table 4: Intersection Level of Service Descriptions

Alpha LOS	Signalized (sec/veh)	Unsignalized Delay (sec/veh)	Description
A	≤ 10	≤ 10	No Congestion: Very few vehicles experience delay.
B	> 10 – 20	> 10 – 15	Minimal Congestion: Some vehicles experience delay but many pass through intersection without stopping.
C	> 20 – 35	> 15 – 25	Minor Congestion: Many vehicles experience delay but some travel through intersection without stopping.
D	> 35 – 55	> 25 – 35	Moderate Congestion: Most vehicles experience delay.
E	> 55 – 80	> 35 – 50	Severe Congestion: Most vehicles experience significant delay. Volumes nearing capacity.
F	> 80 Or V/C >1.0	> 50 Or V/C >1.0	Extreme Congestion: Nearly all vehicles experience significant delay. Volume may be higher than capacity. Potential gridlock.

Source: Transportation Research Board Highway Capacity Manual

The 95th percentile queue is also included as an additional performance measure in the following intersection operation summaries. The 95th percentile queue (sometimes referred to as the “maximum probable queue”) represents the distance away from the stop bar of an intersection at which 95% of all vehicle backups for a given traffic movement are expected to extend.

The following study Watertown Plank Road intersections are included in this analysis:

1. North 124th Street
2. Longwood Avenue
3. Stephen Place/Blue Ridge Boulevard
4. Crescent drive
5. Juneau Boulevard
6. Western SSND Access Road
7. Legion Drive
8. Elm Grove Road

Morning and evening peak hour operating conditions at each of the study intersections were analyzed with: 1) Projected Year 2028 ‘Background’ traffic movements; 2) ‘Background’ traffic and trips generated by the updated SSND Residential Development Plan; and 3) ‘Background’ traffic and trips generated by the updated SSND Residential Development Plan with the addition of trips generated by multi-family development in the Village Downtown Corridor Master Plan.

1. North 124th Street Intersection

Table 5 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 5: Year 2028 Peak Hour Operation at the North 124th Street Intersection with Watertown Plank Road

124th Street Traffic Operations															
Scenario	Control	MOE	Movement											OVERALL	
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT		SBR
2028 AM Background	Signal	LOS	A			C			C			C		C	B
		Delay (sec)	9.8			24.4			34.8			28.6		22.8	19.0
		Queue (ft)	125'			100'			75'			175'		100'	-
2028 PM Background	Signal	LOS	A			C			C			C		C	C
		Delay (sec)	9.5			28.3			33.7			32.4		25.9	22.0
		Queue (ft)	125'			200'			50'			200'		125'	-
			Movement											OVERALL	
2028 AM with SSND Development	Signal	LOS	B			C			C			C		C	B
		Delay (sec)	10.1			24.5			34.8			28.6		23.0	18.8
		Queue (ft)	125'			125'			75'			175'		100'	-
2028 PM with SSND Development	Signal	LOS	A			C			C			C		C	C
		Delay (sec)	9.6			29.0			33.8			32.6		26.7	22.3
		Queue (ft)	125'			200'			50'			200'		125'	-
			Movement											OVERALL	
2028 AM with SSND & Village Development	Signal	LOS	B			C			D			C		C	B
		Delay (sec)	10.2			24.3			35.5			29.1		23.3	18.8
		Queue (ft)	150'			125'			75'			200'		100'	-
2028 PM with SSND & Village Development	Signal	LOS	A			C			C			C		C	C
		Delay (sec)	9.7			29.7			33.9			33.0		27.4	22.8
		Queue (ft)	125'			225'			50'			200'		150'	-

As shown on Table 5, all Year 2028 traffic movements at the North 124th Street intersection with Watertown Plank Road are operating at LOS 'C' or better with and without trips generated by the updated Mandel Residential Development Plan. The addition of year 2028 trips generated by potential multi-family development included in the Village Downtown Corridor Master Plan is expected to change the northbound approach operation of North 124th Street from LOS 'C' to LOS 'D' with average delay per vehicle increasing from 34.8 seconds to 35.5 seconds. The threshold between LOS 'C' and LOS 'D' at signalized intersections is 35.0 seconds.

2. Longwood Avenue Intersection

Table 6 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 6: Year 2028 Peak Hour Operation at the Longwood Avenue Intersection with Watertown Plank Road

Longwood Avenue Traffic Operations															
Scenario	Control	MOE	Movement											OVERALL	
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT		SBR
2028 AM Background	Stop	LOS	A			A			B			B			A
		Delay (sec)	0.1			0.2			14.0			12.7			0.7
		Queue (ft)	25'			25'			25'			25'			-
2028 PM Background	Stop	LOS	A			A			B			C		A	
		Delay (sec)	0.3			0.3			12.0			23.1			0.7
		Queue (ft)	25'			25'			25'			25'			-
Movement															
2028 AM with SSND Development	Stop	LOS	A			A			B			B		A	
		Delay (sec)	0.1			0.4			14.1			13.3			0.9
		Queue (ft)	25'			25'			25'			25'			-
2028 PM with SSND Development	Stop	LOS	A			A			B			D		A	
		Delay (sec)	0.1			0.4			12.3			25.4			0.8
		Queue (ft)	25'			25'			25'			25'			-
Movement															
2028 AM with SSND & Village Development	Stop	LOS	A			A			B			B		A	
		Delay (sec)	0.1			0.4			14.5			13.6			0.9
		Queue (ft)	25'			25'			25'			25'			-
2028 PM with SSND & Village Development	Stop	LOS	A			A			B			D		A	
		Delay (sec)	0.1			0.4			12.5			27.3			0.8
		Queue (ft)	25'			25'			25'			25'			-

As shown on Table 6, all Year 2028 traffic movements at the Longwood Avenue intersection with Watertown Plank Road are expected to operate at LOS 'C' or better, except for the southbound approach of Longwood Avenue which is at LOS 'D' during the evening peak hour with trips generated by the updated Mandel Residential Development Plan or potential multi-family trips generated by the Village Downtown Corridor Master Plan. The southbound approach of Longwood Avenue average delay per vehicle changes from 23.1 seconds with background traffic conditions to 25.4 seconds and 27.3 seconds with the addition of updated Mandel residential traffic and with additional traffic generated by the Village Downtown Corridor Master Plan multi-family development. The threshold between LOS 'C' and LOS 'D' is 25.0 seconds per vehicle for stop sign controlled intersections.

3. Stephen Place/Blue Ridge Lane Intersection

Table 7 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 7: Year 2028 Peak Hour Operation at the Stephen Place/Blue Ridge Lane Intersection with Watertown Plank Road

Blue Ridge Boulevard/Stephen Place Traffic Operations															
Scenario	Control	MOE	Movement											OVERALL	
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT		SBR
2028 AM Background	Stop	LOS	A			A			C			B			A
		Delay (sec)	0.1			0.4			18.5			14.5			1.0
		Queue (ft)	25'			25'			25'			25'			-
2028 PM Background	Stop	LOS	A			A			C			B			A
		Delay (sec)	0.3			0.0			23.7			12.2			0.9
		Queue (ft)	25'			25'			25'			25'			-
			Movement											OVERALL	
2028 AM with SSND Development	Stop	LOS	A			A			C			B			A
		Delay (sec)	0.1			0.4			20.5			12.8			1.5
		Queue (ft)	25'			25'			25'			25'			-
2028 PM with SSND Development	Stop	LOS	A			A			D			B			A
		Delay (sec)	0.3			0.2			26.3			12.6			1.0
		Queue (ft)	25'			25'			25'			25'			-
			Movement											OVERALL	
2028 AM with SSND & Village Development	Stop	LOS	A			A			C			B			A
		Delay (sec)	0.1			0.4			21.6			13.2			1.5
		Queue (ft)	25'			25'			25'			25'			-
2028 PM with SSND & Village Development	Stop	LOS	A			A			D			B			A
		Delay (sec)	0.3			0.2			33.3			13.0			1.6
		Queue (ft)	25'			25'			25'			25'			-

As shown on Table 7, all Year 2028 traffic movements at the Stephen Place/Blue Ridge Lane intersection with Watertown Plank Road are expected to operate at LOS 'C' or better except for the northbound approach of Stephen Place which changes from LOS 'C' to LOS 'D' during the evening peak hour with trips generated by the updated Mandel Residential Development Plan or potential multi-family trips generated by the Village Downtown Corridor Master Plan. It is noted that during the evening peak hour on the northbound approach of Stephen Place average delay per vehicle without any new residential development is 23.7 seconds compared to average delay per vehicle with updated Mandel residential development trips which is 26.3 seconds. The threshold between LOS 'C' and LOS 'D' at stop sign controlled intersections is 25.0 seconds. 95th percent queues on the northbound approach of Stephen Place are expected to be 50 feet long under each of the three traffic analysis scenarios.

4. Crescent Drive Intersection

Table 8 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 8: Year 2028 Peak Hour Operation at the Crescent Drive Intersection with Watertown Plank Road

Crescent Drive Traffic Operations									
Scenario	Control	MOE	Movement						OVERALL
			EBL	EBT	WBT	WBR	SBL	SBR	
2028 AM Background	Stop	LOS	A		A		C		A
		Delay (sec)	1.2		0.0		16.5		1.8
		Queue (ft)	25'		0'		25'		–
2028 PM Background	Stop	LOS	A		A		C		A
		Delay (sec)	1.0		0.0		16.0		0.9
		Queue (ft)	25'		0'		25'		–
			Movement						OVERALL
			EBL	EBT	WBT	WBR	SBL	SBR	
2028 AM with SSND Development	Stop	LOS	A		A		C		A
		Delay (sec)	1.2		0.0		17.5		1.8
		Queue (ft)	25'		0'		25'		–
2028 PM with SSND Development	Stop	LOS	A		A		C		A
		Delay (sec)	1.0		0.0		17.1		0.9
		Queue (ft)	25'		0'		25'		–
			Movement						OVERALL
			EBL	EBT	WBT	WBR	SBL	SBR	
2028 AM with SSND & Village Development	Stop	LOS	A		A		C		A
		Delay (sec)	1.2		0.0		18.3		1.8
		Queue (ft)	25'		0'		25'		–
2028 PM with SSND & Village Development	Stop	LOS	A		A		C		A
		Delay (sec)	1.1		0.0		17.8		1.0
		Queue (ft)	25'		0'		25'		–

As shown on Table 8, all traffic movements at the Crescent Drive intersection with Watertown Plank Road are expected to operate at LOS 'C' or better with or without trips generated by the updated Mandel Residential Development Plan or potential multi-family development trips generated by the Village Downtown Corridor Master Plan.

5. Juneau Boulevard Intersection

Table 9 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 9: Year 2028 Peak Hour Operation at the Juneau Boulevard Intersection with Watertown Plank Road

Juneau Boulevard Traffic Operations									
Scenario	Control	MOE	Movement						OVERALL
			WBL	WBR	SBL	SBR	NEL	NER	
2028 AM Background	Stop	LOS	A		C		A		A
		Delay (sec)	0.0		19.9		0.0		2.3
		Queue (ft)	0'		50'		25'		—
2028 PM Background	Stop	LOS	A		D		A		A
		Delay (sec)	0.0		26.6		0.0		1.4
		Queue (ft)	0'		50'		25'		—
			Movement						OVERALL
			WBL	WBR	SBL	SBR	NEL	NER	
2028 AM with SSND Development	Stop	LOS	A		C		A		A
		Delay (sec)	0.0		21.8		0.0		2.4
		Queue (ft)	0'		50'		25'		—
2028 PM with SSND Development	Stop	LOS	A		D		A		A
		Delay (sec)	0.0		30.3		0.0		1.5
		Queue (ft)	0'		50'		25'		—
			Movement						OVERALL
			WBL	WBR	SBL	SBR	NEL	NER	
2028 AM with SSND & Village Development	Stop	LOS	A		C		A		A
		Delay (sec)	0.0		23.2		0.0		2.5
		Queue (ft)	0'		50'		25'		—
2028 PM with SSND & Village Development	Stop	LOS	A		D		A		A
		Delay (sec)	0.0		32.8		0.0		1.6
		Queue (ft)	0'		50'		25'		—

As shown on Table 9, all 'Background' traffic movements at the Juneau Boulevard intersection with Watertown Plank Road are expected to operate at LOS 'C' or better except for the southbound approach of Juneau Boulevard which is expected to operate at LOS 'D' during the evening peak hour. These LOS operating conditions do not change with or without trips generated by the updated Mandel Residential Development Plan or potential multi-family development trips generated by the Village Downtown Corridor Master Plan. It is noted that the southbound approach of Juneau Boulevard was reported to be operating at LOS 'C' during the evening peak hour but expected to increase by the year 2023 to LOS 'D' operation without any new residential development trips from the Mandel Residential Development Plan.

6. SSND Western Driveway Intersection

Table 10 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 10: Year 2028 Peak Hour Operation at the SSND Western Driveway Intersection with Watertown Plank Road

SSND West Driveway Traffic Operations									
Scenario	Control	MOE	Movement						OVERALL
			NWBL	NWBR	NEBT	NEBR	SWBL	SWBT	
2028 AM Background	Stop	LOS	B		A		A	A	
		Delay (sec)	10.3		0.0		0.2	0.1	
		Queue (ft)	25'		0'		25'	—	
2028 PM Background	Stop	LOS	C		A		A	A	
		Delay (sec)	16.1		0.0		0.2	0.2	
		Queue (ft)	25'		0'		25'	—	
			Movement						OVERALL
			NWBL	NWBR	NEBT	NEBR	SWBL	SWBT	
2028 AM with SSND Development	Stop	LOS	B		A		A	A	
		Delay (sec)	14.4		0.0		0.2	1.3	
		Queue (ft)	25'		0'		25'	—	
2028 PM with SSND Development	Stop	LOS	C		A		A	A	
		Delay (sec)	22.1		0.0		1.0	1.2	
		Queue (ft)	25'		0'		25'	—	
			Movement						OVERALL
			NWBL	NWBR	NEBT	NEBR	SWBL	SWBT	
2028 AM with SSND & Village Development	Stop	LOS	B		A		A	A	
		Delay (sec)	14.9		0.0		0.2	1.3	
		Queue (ft)	25'		0'		25'	—	
2028 PM with SSND & Village Development	Stop	LOS	C		A		A	A	
		Delay (sec)	23.7		0.0		1.0	1.3	
		Queue (ft)	25'		0'		25'	—	

As shown on Table 10, all traffic movements at the existing western SSND driveway intersection with Watertown Plank Road are expected to operate at LOS 'C' or better with or without trips generated by the updated Mandel Residential Development Plan or potential multi-family development trips generated by the Village Downtown Corridor Master Plan.

7. Legion Drive Intersection

Table 11 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 11: Year 2028 Peak Hour Operation at the Legion Drive Intersection with Watertown Plank Road

Legion Drive Traffic Operations														
Scenario	Control	MOE	Movement									OVERALL		
			SEBL	SEBT	SEBR	NWBL	NWBT	NWBR	NEBL	NEBT	NEBR		SWBL	SWBT
2028 AM Background	Signal	LOS	D	C	No Vehicles - Exited Driveway			E	B	C			B	C
		Delay (sec)	38.2	20.3				76.4	15.2	20.6			15.5	22.2
		Queue (ft)	25'	75'				100'	225'	200'			25'	—
2028 PM Background	Signal	LOS	D	C	C			F	B	C			B	C
		Delay (sec)	39.0	21.2	29.7			135.4	16.6	23.1			15.5	29.7
		Queue (ft)	50'	100'	50'			175'	300'	300'			25'	—
Movement														
2028 AM with SSND Development	Signal	LOS	D	C	No Vehicles - Exited Driveway			E	B	C			B	C
		Delay (sec)	38.2	20.3				76.4	16.2	22.0			15.5	22.7
		Queue (ft)	25'	75'				100'	250'	250'			25'	—
2028 PM with SSND Development	Signal	LOS	D	C	C			F	B	C			B	C
		Delay (sec)	39.0	21.2	29.6			135.4	17.7	24.3			15.5	29.9
		Queue (ft)	50'	100'	25'			175'	350'	325'			25'	—
Movement														
2028 AM with SSND & Village Development	Signal	LOS	D	C	No Vehicles - Exited Driveway			E	B	C			B	C
		Delay (sec)	38.2	20.3				76.4	16.7	22.3			15.5	23.0
		Queue (ft)	25'	75'				100'	275'	250'			25'	—
2028 PM with SSND & Village Development	Signal	LOS	D	C	C			F	B	C			B	C
		Delay (sec)	39.0	21.2	29.6			135.4	18.1	25.2			15.5	30.1
		Queue (ft)	50'	100'	25'			175'	375'	350'			25'	—

As shown on Table 11, all traffic movements at the Legion Drive intersection with Watertown Plank Road are expected to operate at LOS 'C' or better except for the LOS 'D' operation of the southeastbound left turn from Legion Drive to Watertown Plank Road, and the LOS 'E' operation during the morning peak hour and LOS 'F' operation during the evening peak hour of the northeastbound left turn from Watertown Plank Road to Legion Drive, with or without trips generated by the updated SSND Residential Development Plan or potential residential trips generated by the Village Downtown Corridor Master Plan.

An analysis was conducted to improve the unsatisfactory LOS 'E' and LOS 'F' operation of the Watertown Plank Road northeastbound left turn onto Legion Drive. The impact of a minor signal timing improvement at the intersection is summarized on Table 12.

Table 12: Year 2028 Improved Peak Hour Operation at the Legion Drive Intersection with Watertown Plank Road

Legion Drive Traffic Operations															
Scenario	Control	MOE	Movement									OVERALL			
			SEBL	SEBT	SEBR	NWBL	NWBT	NWBR	NEBL	NEBT	NEBR		SWBL	SWBT	SWBR
2028 AM Background	Signal	LOS	D	C		No Vehicles - Exited Driveway			D	B		C	B	C	
		Delay (sec)	38.2	20.3					44.2	15.2		25.0	18.5	21.4	
		Queue (ft)	25'	75'					100'	225'		225'	25'	—	
2028 PM Background	Signal	LOS	D	C		C			D	B		C	B	C	
		Delay (sec)	39.0	21.2		29.7			49.5	16.6		28.7	18.5	24.5	
		Queue (ft)	50'	100'		50'			125'	300'		325'	25'	—	
Movement															
			SEBL	SEBT	SEBR	NWBL	NWBT	NWBR	NEBL	NEBT	NEBR	SWBL	SWBT	SWBR	OVERALL
2028 AM with SSND Development	Signal	LOS	D	C		No Vehicles - Exited Driveway			D	B		C	B	C	
		Delay (sec)	38.2	20.3					44.2	16.2		26.9	18.5	22.4	
		Queue (ft)	25'	75'					100'	250'		275'	25'	—	
2028 PM with SSND Development	Signal	LOS	D	C		C			D	B		C	B	C	
		Delay (sec)	39.0	21.2		29.6			49.5	17.7		30.5	18.5	25.4	
		Queue (ft)	50'	100'		25'			125'	350'		375'	25'	—	
Movement															
			SEBL	SEBT	SEBR	NWBL	NWBT	NWBR	NEBL	NEBT	NEBR	SWBL	SWBT	SWBR	OVERALL
2028 AM with SSND & Village Development	Signal	LOS	D	C		No Vehicles - Exited Driveway			D	B		C	B	C	
		Delay (sec)	38.2	20.3					44.2	16.7		27.4	18.5	22.8	
		Queue (ft)	25'	75'					100'	275'		275'	25'	—	
2028 PM with SSND & Village Development	Signal	LOS	D	C		C			D	B		C	B	C	
		Delay (sec)	39.0	21.2		29.6			49.5	18.1		32.0	18.5	26.2	
		Queue (ft)	50'	100'		25'			125'	375'		400'	25'	—	

As shown on Table 12, the minor intersection traffic signal timing improvement should upgrade operation of the northeastbound left movement from LOS 'E' and LOS 'F' operation to LOS 'D' operation without negatively impacting the LOS 'D' operation identified for the southeastbound left turn from Legion Drive to Watertown Plank Road.

8. Elm Grove Road Intersection

Table 13 summarizes Year 2028 morning and evening peak hour operation at the study intersection for each of the three traffic analysis scenarios.

Table 13: Year 2028 Peak Hour Operation at the Elm Grove Road Intersection with Watertown Plank Road

Elm Grove Road Traffic Operations											
Scenario	Control	MOE	Movement							OVERALL	
			NBL	NBR		NEBT	NEBR		SWBL		SWBT
2028 AM Background	Signal	LOS	C	C		A	A		A	A	B
		Delay (sec)	20.0	23.4		9.0	7.3		10.0	8.5	11.9
		Queue (ft)	50'	125'		125'	25'		75'	100'	–
2028 PM Background	Signal	LOS	C	C		A	A		B	A	B
		Delay (sec)	21.6	23.4		9.1	7.3		11.1	9.0	12.7
		Queue (ft)	100'	125'		125'	25'		125'	125'	–
			Movement							OVERALL	
			NBL	NBR		NEBT	NEBR		SWBL	SWBT	
2028 AM with SSND Development	Signal	LOS	C	C		A	A		B	A	B
		Delay (sec)	20.0	23.6		9.2	7.3		10.8	8.7	12.1
		Queue (ft)	50'	125'		125'	25'		100'	100'	–
2028 PM with SSND Development	Signal	LOS	C	C		A	A		B	A	B
		Delay (sec)	21.6	23.9		9.4	7.3		11.9	9.2	13.1
		Queue (ft)	100'	150'		150'	25'		125'	125'	–
			Movement							OVERALL	
			NBL	NBR		NEBT	NEBR		SWBL	SWBT	
2028 AM with SSND & Village Development	Signal	LOS	C	C		A	A		B	A	B
		Delay (sec)	20.0	23.8		9.2	7.3		11.5	8.9	12.2
		Queue (ft)	50'	125'		125'	25'		125'	100'	–
2028 PM with SSND & Village Development	Signal	LOS	C	C		A	A		B	A	B
		Delay (sec)	21.6	24.4		9.6	7.3		13.2	9.5	13.4
		Queue (ft)	100'	150'		150'	25'		150'	150'	–

As shown on Table 13, all traffic movements at the Elm Grove Road intersection with Watertown Plank Road are expected to operate at LOS 'C' or better with or without trips generated by the updated Mandel Residential Development Plan or potential multi-family development trips generated by the Village Downtown Corridor Master Plan.

Conclusions

1. The updated Mandel Residential Development Plan reduces the total number of dwelling units in the original development plan by 34%. This reduction results in a morning peak hour trip reduction of 21% and an evening peak hour trip reduction of 25%.
2. All of the 240 apartments in the updated Mandel Residential Development Plan will use the existing western SSND roadway connection to access Watertown Plank Road. Of the 30 trips generated during the morning and evening by the 26 single-family homes, all 20 trips with an origin or destination to the west are expected to use Stephen Place to access Watertown Place with 10 trips using Longwood Avenue to access Watertown Plank Road.
3. All the study intersections are expected to continue to operate at acceptable level of service standards during the morning and evening peak hour in the Year 2028 with trips generated by the updated Mandel Residential Development Plan with or without trips generated by multi-family development identified in the Village Downtown Corridor Master Plan.
4. The northeastbound Legion Drive left turn from Watertown Plank Road operates at LOS 'E' during the morning peak hour and LOS 'F' during the evening peak hour in the Year 2028. This operating condition does not change with or without trips generated by the Mandel Residential Development Plan or trips generated by multi-family development identified in the Village Downtown Corridor Master Plan. This intersection movement operation can be improved to LOS 'D' operation during both the morning and evening peak hour with minor intersection traffic signal timing improvements that will not negatively affect operation of the other intersection traffic movements.

Additional Conclusions from Previous Mandel Traffic Impact Study and Supplemental Reports

5. SSND Driveway Intersection Traffic Signal Consideration
 - a. Installation of traffic signals at an intersection must satisfy national volume warrant criteria in the Manual on Traffic Control Devices. At least one of the 9 warrants must be satisfied, or research has shown they can create a traffic safety problem.
 - b. An analysis of year 2028 hourly traffic volumes on Watertown Plank Road and the SSND western driveway connection with traffic generated by the Mandel residential development indicates the intersection is not expected to satisfy any of the 9 traffic signal warrants.
6. St. Mary's School Pedestrian Safety
 - a. The only pedestrian collision with a motor vehicle occurred at the Elm Grove³ Road intersection between 2014 and 2019.
 - b. Table A summarizes the number of pedestrians counted at the Crescent Drive and Blue Ridge/Stephen Place intersections with Watertown Plank Road

Pedestrian Crossings								
Time/Approach leg crossed	Crescent				Blue Ridge/Stephen Pl			
	North	East	South	West	North	East	South	West
6-7am		2		4			1	
7-8am								
8-9am				1		2	2	6
3-4pm								
4-5pm						1	1	
5-6pm							1	

- c. There are no significant St. Mary’s School Pedestrian safety impacts related to traffic generated by the Updated Mandel Residential Development Plan.
- d. To enhance pedestrian safety, it is recommended to:
 - i. Modify the existing ‘In-street’ pavement yellow flashing warning lights to Rectangular Rapid Flashing Beacons at the Church Street and Elm Grove Street pedestrian crosswalks;
 - ii. Upgrade all crosswalk markings on Watertown Plank Road to ‘Continental’ design.

7. Train Crossing Delays

- a. The Wisconsin Southern/Soo Line crossing of Watertown Plank Road experiences approximately 32 trains a day that based on Ayres staff experience can typically last between 3 to 5 minutes.
- b. During peak hour traffic periods, the updated Mandel Residential Development can add approximately ½ to 1 car per minute to the queues attributed to trains crossing Watertown Plank Road.
- c. During off-peak traffic periods the updated Mandel development generates reduced traffic activity which minimizes its impact on train traffic queuing patterns.