

NORTHVILLE DOWNS TRAFFIC IMPACT STUDY

NORTHVILLE, MICHIGAN

DECEMBER 14, 2021

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PREPARED BY:



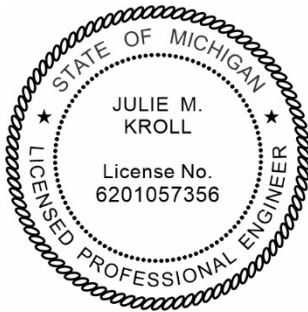
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Agency Review	Date	Comments
City/OHM	12/30/21	Provided in Review letter
City/OHM	1/13/22	Provided in Review letter
City/OHM	1/26/22	Provided in Review letter

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EXECUTIVE SUMMARY

This report presents the results of a Traffic Impact Study (TIS) for the proposed development in the City of Northville, Michigan. The project site is located generally in the northeast quadrant of the Center Street and Hines Drive/Seven Mile Road intersection on the property that is currently occupied by Northville Downs, as shown on **Figure E1**. The proposed development includes the construction of mixed-use, with various residential unit types and commercial. The development includes site access to Cady Street, Griswold Street, Beal Street, Fairbrook Street, and Center Street.

FIGURE E1: SITE LOCATION



The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and information published by the Institute of Transportation Engineers (ITE). In addition, the City of Northville and their traffic engineering consultant OHM and planning consultant Carlisle Wortman provided input regarding the scope of work included herein. The study includes the evaluation of study roadway network based upon pre-COVID operations.

BACKGROUND DATA

- Traffic volume data was collected at the study intersections by F&V subconsultants Traffic Data Collection Inc. (TDC) on May 15, 2018, and October 18, 2018, and by Gewalt Hamilton Associates, Inc (GHA) on October 19, 2021, during the weekday AM (7:00 AM-9:00 AM) and PM (4:00 PM-6:00 PM) peak periods.
- The analysis includes the evaluation of 28 off-site intersections in the City of Northville adjacent to the project site and six (6) new site driveway intersections for a total of 34 study intersection.
- An annual 0.2% background growth was determined from SEMCOG data to calculate the projected implicit background traffic growth to the site buildout year in 2028.
- In addition to background growth, the following developments were identified by the City of Northville to include as background traffic: Cady Project – 6-unit condominium (South side of Cady Street, east of Center Street), 355 E. Cady St. - 3-story mixed-use building; first floor Retail, office above, 455 E. Cady St “Hanger Building”- office space, and Foundry Flask – 78 Multi-Family Units, corner store specialty market.

TRIP GENERATION

The proposed development includes single family, attached housing, multi-family units and commercial uses. The following ITE Trip Generation Manual land uses were determined to be the best fit for the proposed development.

Single-Family Detached Housing (LUC 210)

- A single-family detached housing site includes any single-family detached home on an individual lot.

Single-Family Attached Housing (LUC 215)

- Single-family attached housing includes any single-family housing unit that shares a wall with an adjoining dwelling unit, whether the walls are for living space, a vehicle garage, or storage space. Includes duplexes and townhouses/rowhouses, joined side-by-side in a row and each with an outside entrance.

Mid-Rise Multi-Family Home (LUC 221)

- Mid-rise multifamily housing includes apartments and condominiums located in a building that has between four and 10 floors of living space. Access to individual dwelling units is through an outside building entrance, a lobby, elevator, and a set of hallways.

Strip Retail Plaza <40k SF (LUC 822)

- A strip retail plaza is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. Each study site in this land use has less than 40,000 square feet of gross leasable area (GLA).

The number of AM and PM peak hour vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 11th Edition*.

Table E1: Trip Generation Summary

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Single-Family Detached Housing	210	39	DU	424	8	24	32	26	15	41
Single-Family Attached Housing	215	259	DU	1,923	40	89	129	86	65	151
Multi-Family Home (Mid-Rise)	221	174	DU	784	15	50	65	41	27	68
Total Trips				3,131	63	163	226	153	107	260
<i>Internal Capture</i>				190	1	2	3	14	5	19
New Trips				2,941	62	161	223	139	102	241
Strip Retail Plaza (<40k SF)	822	17,374	SF	963	25	16	41	58	57	115
<i>Internal Capture</i>				190	2	1	3	5	14	19
<i>Pass-By (34%)</i>				327	8	5	13	16	16	32
New Trips				446	15	10	25	37	27	64
Total Trips				4,094	88	179	267	211	164	375
<i>Total Internal Capture</i>				380	3	3	6	19	19	38
<i>Total Pass-By</i>				327	8	5	13	16	16	32
Total New Trips				3,387	77	171	248	176	129	305

SITE TRIP DISTRIBUTION

- The vehicular trips that would be generated by the proposed development were assigned to the study roads based on existing peak hour traffic patterns in the adjacent roadway network and the methodologies published by ITE.
- The global trip generation is based on trips in the AM going from the residential development exiting the study network and returning to the study network in the PM. The vehicular traffic volumes were distributed to the roadway network according to the global traffic distribution.
- The proposed development plan has multiple site access points to the adjacent roadway network; therefore, the impact of the development is dispersed throughout the area study intersections.

OPERATIONAL ANALYSIS SUMMARY

- The recommended improvements identified for existing and background conditions were found to mitigate the future intersection delays at the study intersections with the additional of the site generated traffic volumes.
- No additional mitigation measures were identified with the additional site generated traffic in the Future conditions.
- The results of this analysis concludes that the majority of intersections within the City of Northville will experience a negligible increase in traffic volumes associated with the Northville Downs development. Additionally, alternatives for mitigating existing delays are recommended which will also support the projected increases in traffic volumes generated by the proposed development. Furthermore, the recommendations included herein are consistent with the recommendations identified by the City's Mobility Task Force.

Table E2: Analysis and Mitigation Summary

Intersection		Existing Conditions Recommendation	Background Conditions Recommendation	Future Conditions Recommendations
2	Randolph Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
8	Main Street & Hutton Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
9	Main Street & Griswold Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
12	Cady Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
21	Fairbrook Street & Center Street	<i>n/a</i>	<i>n/a</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
22	Seven Mile Road & Wing Street / St. Lawrence	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
23	Seven Mile Road & Sheldon Avenue / Center Street	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout
24	Seven Mile & Hines Drive	<i>n/a</i>	<i>n/a</i>	<i>Delays on the NB approach are due to impacts/queue lengths extending from Seven Mile Road & Sheldon Avenue / Center Street intersection.</i>
26/ 27	Northville Road & N. Seven Mile Road	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.
28	Northville Road & S. Seven Mile Road	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
32	Center Street & Beal St. (Proposed)	<i>n/a</i>	<i>n/a</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>

* Details of the proposed signal timing optimization are included in Appendix F

FIGURE E2: INTERSECTION MITIGATION SUMMARY



1 INTRODUCTION

This report presents the results of a Traffic Impact Study (TIS) for the proposed development in the City of Northville, Michigan. The project site is located adjacent to the south side of Cady Street, between Center Street and Griswold Street on the property that was previously occupied by Northville Downs as shown on **Figure 1**. The proposed development includes the construction of mixed-use commercial and multi-family residential units. The City has required a Traffic Impact Study (TIS) for the project as part of the site plan approval process.

FIGURE 1: SITE LOCATION



The scope of this study was developed based on Fleis & VandenBrink’s (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and information published by the Institute of Transportation Engineers (ITE). In addition, the City of Northville and their traffic engineering consultant OHM and planning consultant Carlisle Wortman provided input regarding the scope of work included herein.

The study analyses were completed using Synchro/SimTraffic (Version 11) and Rodel traffic analysis software. Sources of data for this study include traffic counts conducted by F&V subconsultants Traffic Data Collection, Inc. (TDC) and Gewalt Hamilton Associates (GHA), City of Northville, Wayne County Department of Public Services (WCDPS), and ITE. All background information is provided in **Appendix A**.

The study will include the evaluation of pre-COVID operations in Northville, assuming all roadway open and pre-COVID traffic volumes grown to 2021.

Baseline Operations (Pre-COVID)	
Section 3	
Existing Conditions	Pre-COVID 2018 traffic volumes grown to 2021
Section 4	
Background Conditions	Baseline + Growth Rate + Background Developments
Section 6	
Site Traffic Volumes	Site Generated Traffic
Section 7	
Future Conditions	Background Conditions + Site Generated Traffic

2 BACKGROUND DATA

2.1 STUDY ROADWAY NETWORK

Vehicle transportation for the proposed development is provided via Center Street, Cady Street, and Beal Street. Regional transportation is provided via I-96, I-275, and M-14; with access to these routes within 5 miles of the project site location. The lane use and traffic control at the study intersections are shown on **Figure 2** and the study roadways are further described below. For the purposes of this study, all minor streets and driveways are assumed to have an operating speed of 25 miles per hour (mph).



Center Street / Sheldon Avenue

- Functional Classification: Other Principal Arterial
- Runs in the north and south directions, generally adjacent to the west side of the project site.
- North of Hines Drive/7 Mile Road: Center Street, Average Annual Daily Traffic (AADT) volume of 14,175 vehicles per day (SEMCOG 2018), under the jurisdiction of the City of Northville.
- South of Hines Drive/7 Mile Road: Regional Name Sheldon Road and is under the jurisdiction of WCDPS.
- North of Cady: 25 mph, on-street parking
- South of Cady Street: 35 mph, bike lanes
- The roadway is a typical two-lane cross-section, with one lane in each direction.
- At the intersection with Hines Drive/7 Mile Road, the roadway is striped as a single shared lane for northbound and southbound traffic. However, vehicles on the northbound and southbound approaches utilize the available pavement width as a short left-turn lane and a shared through/right-turn lane.



Northville Road

- Functional Classification: Minor Arterial.
- Under the jurisdiction of WCDPS
- Runs in the north and south directions, generally east side of the project site.
- Average Annual Daily Traffic (AADT) volume of 17,000 vehicles per day (MDOT 2019),
- Speed Limit varies 25 mph to 40 mph
- North of 7 Mile Road: Four-lane cross-section with two lanes in each direction
- South of 7 Mile Road: Two-lane cross section with one lane each direction.
- Undivided south of 7 Mile Road (south)
- Median divided at 7 Mile Road (north)



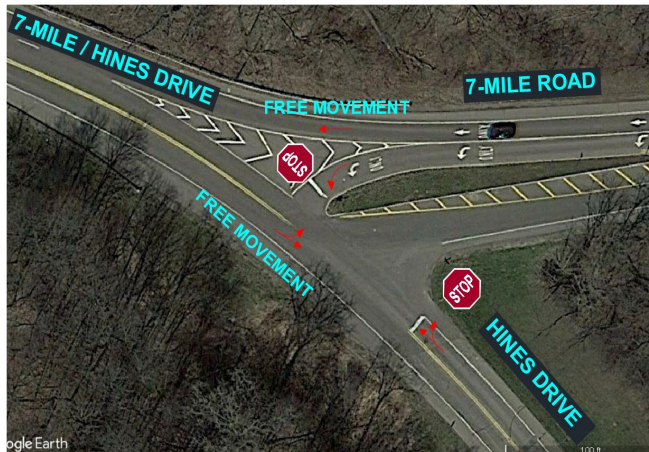
Main Street

- Functional Classification: Minor Arterial
- Runs in the east and west directions, north of the project site.
- Average Annual Daily Traffic (AADT) volume of 8,175 vehicles per day (SEMCOG 2018), under the jurisdiction of the City of Northville.
- South of 7 Mile Road: Regional name is Northville Road and is under the jurisdiction of WCDPS.
- Speed Limit 25 mph
- On-street parking provided on both sides of the roadway.
- The roadway is a typical two-lane cross-section, with one lane in each direction.
- On-street parking typically ends prior to an intersection, in order to provide short (25-50 ft typical) right-turn lanes at the intersections..
- The section of roadway east of Griswold Street becomes S. Main Street; for the purposes of this study S. Main Street is labeled Northville Road, specifically at the intersection with Beal Street.



7 Mile Road

- Functional Classification: Minor Arterial.
- Under the jurisdiction of WCDPS
- Runs in the east and west directions, adjacent to the south side of the project site..
- Average Annual Daily Traffic (AADT) volume of 8,155 vehicles per day (SEMCOG 2019),
- Speed Limit 35 mph
- The study section of 7 Mile Road is split at Northville Road for the purposes of this study: West of Northville Road referred to as N. 7 Mile Road , East of Northville Road referred to as S. 7 Mile Road
- The study section of roadway (N. 7 Mile Road) is a typical two-lane cross-section, with one lane in each direction. However, there is intermittent right-/left-turn auxiliary lane.



Edward N. Hines Drive

- Functional Classification: Other Principal Arterial.
- Under the jurisdiction of WCDPS
- Runs in the east/southeast and west/northwest directions south side of the project site..
- South of 7 Mile Road Average Annual Daily Traffic (AADT) volume of 3,800 vehicles per day (MDOT 2019),
- Speed Limit 35 mph to 40 mph
- The roadway is a typical two-lane cross-section with one lane in each direction.
- The adjacent exhibit further depicts the unique intersection geometry and operations of the Edward N. Hines Drive and 7 Mile Road intersection.



Cady Street

- Functional Classification: Local Road
- Under the jurisdiction of City of Northville
- Runs in the east and west directions, adjacent to the north side of the project site..
- Speed Limit 25 mph
- The roadway has a typical two-lane cross-section with one lane in each direction and has on-street parking on both sides of the road between Hutton Street and Griswold Street.



Griswold Street

- North of Main Street under the jurisdiction of WCDPS north of Main Street and a Minor Arterial functional classification:
- South of Main Street under the jurisdiction of the City of Northville and a Local Road functional classification:
- Runs in the north and south directions, generally east of the project site.
- Average Annual Daily Traffic (AADT) volume of 7,500 vehicles per day (MDOT 2019)
- Speed Limit 35 mph
- Two-lane cross-section with one lane in each direction
- On-street parking south of Main Street adjacent to the west side of the road



Hutton Street

- Functional Classification: Local Road
- Under the jurisdiction of the City of Northville :
- Runs in the north and south directions, generally north of the project site.
- Speed Limit 25 mph
- Two-lane cross-section with one lane in each direction
- On-street parking north of Main Street on both sides of the roadway.



Wing Street

- Functional Classification: Local Road
- Under the jurisdiction of the City of Northville :
- Runs in the north and south directions, west of the project site.
- Parrell route to Center Street between Randolph St. and 7 Mile Road.
- Speed Limit 25 mph
- Two-lane cross-section with one lane in each direction
- On-street parking on both sides of the roadway (with a few exceptions along the roadway)



Randolph Street

- Functional Classification: Major Collector
- Under the jurisdiction of City of Northville
- Runs in the east and west directions, north of the project site.
- Average Annual Daily Traffic (AADT) volume of 4,120 vehicles per day (SEMCOG 2019)
- Speed Limit 25 mph
- The roadway has a typical two-lane cross-section with one lane in each direction



Dunlap Street

- Functional Classification: Local Road
- Under the jurisdiction of City of Northville
- Runs in the east and west directions, north of the project site.
- Speed Limit 25 mph
- The roadway has a typical two-lane cross-section with one lane in each direction



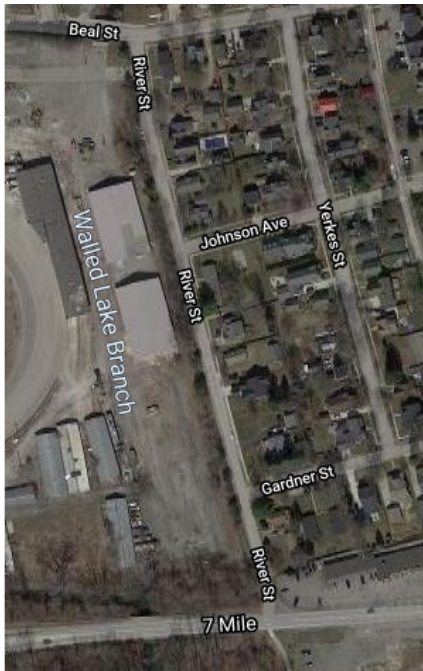
Fairbrook Street

- Functional Classification: Local Road
- Under the jurisdiction of City of Northville
- Runs in the east and west directions, west of the project site.
- Speed Limit 25 mph
- The roadway has a typical two-lane cross-section with one lane in each direction and has on-street parking on both sides of the roadway.



Beal Street

- Functional Classification: Local Road
- Under the jurisdiction of City of Northville
- Runs in the east and west directions, adjacent to the west side of the project site.
- Speed Limit 25 mph
- The roadway has a typical two-lane cross-section with one lane in each direction



River Street

- Functional Classification: Local Road
- Under the jurisdiction of the City of Northville :
- Runs in the north and south directions, adjacent to the east side of the project site.
- Speed Limit 25 mph
- Two-lane cross-section with one lane in each direction

2.2 TRAFFIC VOLUME DATA

Traffic volume data was collected at the study intersections by F&V subconsultants, Traffic Data Collection Inc. (TDC) on May 15, 2018, and October 18, 2018, and by Gewalt Hamilton Associates, Inc (GHA) on October 19, 2021, during the weekday AM (7:00 AM-9:00 AM) and PM (4:00 PM-6:00 PM) peak periods. The data collection performed is summarized below and the raw traffic volume data are included in **Appendix A**.

The data collection was intentionally performed on a day with no live events at the Northville Downs racetrack to avoid any additional traffic generated by the peak existing operations. During collection of the manual intersection turning movement counts, pedestrian data and commercial truck percentages were recorded and used in the traffic analysis. Peak Hour Factors (PHFs) were also calculated for each study intersection approach.

Data Collection May 15, 2018 (TDC) October 19, 2021 (GHA)	Data Collection October 1, 2018 (TDC) October 19, 2021 (GHA)	Data Collection October 19, 2021 (GHA)
<ul style="list-style-type: none"> • Main Street & Center Street • Main Street & Hutton Street • Main Street & Griswold Street • Main Street & Cady Street • Cady Street & Center Street • Cady Street & Hutton Street • Cady Street & Church Street • Cady Street & Griswold Street • Beal Street & Griswold Street • Beal Street & River Street • Seven Mile Road & First Street / Fairbrook • Fairbrook Street & Center Street • Seven Mile Road & Sheldon Avenue / Center Street • Seven Mile Road & Hines Drive • Seven Mile Road & River Street 	<ul style="list-style-type: none"> • Beal Street & Northville Road • SB Northville Road & N. Seven Mile Road • NB Northville Road & N. Seven Mile Road • Northville Road & S. Seven Mile Road 	<ul style="list-style-type: none"> • Randolph Street & Wing Street • Randolph Street & Center Street • Dunlap Street & Wing Street • Center Street & Dunlap Street • Dunlap Street & Hutton Street • Main Street & Wing Street • Cady Street & Wing Street • Fairbrook Street & Wing Street • Seven Mile Road & Wing Street / St. Lawrence Blvd

3 EXISTING CONDITIONS ANALYSIS (2021)

Existing Baseline Operations (Pre-COVID)	
Existing Conditions	<ul style="list-style-type: none"> • Pre-COVID 2018 traffic volumes grown to 2021 • Pre-COVID intersection operations

The existing conditions analysis performed an evaluation of the pre-COVID intersection operations and the 2018 data collection grown to 2021. The existing AM and PM peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro (Version 11) traffic analysis software.

There are several study intersections where the traffic control used are not supported by the HCM 6th Edition analysis methodology; therefore, HCM2000 and SimTraffic simulation delays were determined to be more appropriate for use at these intersections. All remaining study intersections and driveways were analyzed using the HCM 6th Edition methodology. These intersections are summarized below:

- *Griswold Street & Beal Street*: The two-way stop control on the eastbound and southbound approaches at the T-intersection is not supported by the HCM. Therefore, SimTraffic delays were utilized.
- *Seven Mile Road & First Street/Fairbrook*: The stop control for southbound First Street and westbound Fairbrook Street is not supported by the HCM. Therefore, SimTraffic delays were utilized.
- *Seven Mile Road & Hines Drive*: The stop control for northbound Hines Drive and the westbound left-turn movement for Seven Mile Road is not supported by the HCM. Therefore, SimTraffic delays were utilized.
- *Northville Road & N. Seven Mile Road*: The yield control at the median crossover at the intersection is not supported by HCM 6th edition. Therefore, HCM 2000 analysis was utilized.

Descriptions of LOS “A” through “F” as defined in the HCM are provided in **Appendix B** for signalized and unsignalized intersections. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions.

3.1 EXISTING OPERATIONS

The traffic volumes for this analysis utilized the existing 2018 (Pre-COVID) turning movement counts collected at the study intersections. A background growth rate of 0.2% provided by SEMCOG was applied to the 2018 traffic counts to calculate the baseline 2021 traffic volumes. There are several intersections which were added into the scope of work for this study, and therefore did not have 2018 traffic volume data. In order to evaluate these intersections under the Pre-COVID conditions the traffic volumes were adjusted and balanced with the adjacent roadway network considering the reductions in traffic volumes due to COVID and the redistribution of traffic associated with the current downtown street closures on Center Street and Main Street. The peak hour volumes for each intersection were utilized and the volumes were balanced upward through the study network. At locations where access is provided between study intersections, “dummy” intersections were used to account for sink and source volumes, and through volumes were carried along the main study roadways. The results of the existing conditions analysis were based on the lane use and traffic control shown on **Figure 2 in Appendix A** and the traffic volumes shown on **Figure 3 in Appendix B**.

Additional Study Intersections Collected October 2021
<ul style="list-style-type: none"> • Randolph Street & Wing Street • Randolph Street & Center Street • Dunlap Street & Wing Street • Center Street & Dunlap Street • Dunlap Street & Hutton Street • Main Street & Wing Street • Cady Street & Wing Street • Fairbrook Street & Wing Street • Seven Mile Road & Wing Street / St. Lawrence Blvd

The results of the existing conditions analysis summarized in **Table 3.1** and are presented in **Appendix B**. The results of the existing conditions analysis indicate that all study intersection approaches and movements currently operate acceptably at a LOS D or better, with the exception of those highlighted.

Table 3.1: Existing Conditions Analysis Summary

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1 Randolph Street & Wing Street	Stop (Minor)	EB	Free			
		WBL	7.8	A	8.2	A
		NB	11.9	B	18.9	C
2 Randolph Street & Center Street	Stop (Minor)	EB	39.5	E	265.4	F
		WB	34.3	D	154.6	F
		NBL	9.3	A	9.3	A
		SBL	8.5	A	9.0	A
3 Dunlap Street & Wing Street	Stop (All-Way)	EB	8.6	A	9.7	A
		WB	9.0	A	12.1	B
		NB	8.5	A	11.4	B
		SB	8.9	A	10.3	B
		Overall	8.8	A	11.2	B
4 Center Street & Dunlap Street	Signalized	EBL	21.4	C	25.1	C
		EBTR	18.7	B	19.2	B
		WBL	19.1	B	17.4	B
		WBTR	19.7	B	20.3	C
		NBL	1.6	A	3.5	A
		NBTR	1.3	A	2.0	A
		SBL	6.3	A	5.9	A
		SBTR	8.0	A	10.1	B
Overall	7.6	A	9.3	A		
5 Dunlap Street & Hutton Street	Stop (Minor)	EBL	7.6	A	8.1	A
		WB	Free			
		SB	10.6	B	13.8	B
6 Main Street & Wing Street	Stop (All-Way)	EB	10.0	A	10.9	B
		WB	8.9	A	9.9	A
		NB	8.9	A	11.3	B
		SB	9.9	A	10.3	B
		Overall	9.6	A	10.7	B
7 Main Street & Center Street	Signalized	EB	20.0	B	20.1	C
		WB	19.2	B	19.7	B
		NB	9.8	A	10.0	B
		SB	1.1	A	1.8	A
		Overall	9.6	A	10.1	B
8 Main Street & Hutton Street	Signalized	EBTL	0.3	A	0.3	A
		EBR	0.0	A	0.0	A
		WBTL	12.7	B	7.6	A
		WBR	13.5	B	9.2	A
		NB	17.2	B	19.1	B
		SBTL	21.3	C	70.2	E
		SBR	16.5	B	16.5	B
		Overall	12.6	B	22.1	C

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
9 Main Street & Griswold Street	Signalized	EBTL	12.0	B	24.1	C
		EBTR	10.1	B	17.8	B
		WBTL	10.1	B	11.8	B
		WBTR	10.5	B	12.5	B
		NB	15.3	B	16.4	B
		SB	17.0	B	32.3	C
		Overall	12.9	B	20.2	C
10 Main Street & Cady Street	Stop (Minor)	EB	Free			
		WBL	7.9	A	8.6	A
		NB	9.7	A	13.3	B
11 Cady Street & Wing Street	Stop (All-Way)	EB	8.5	A	8.9	A
		WB	8.0	A	8.6	A
		NB	8.1	A	9.3	A
		SB	8.9	B	9.4	A
		Overall	8.5	A	9.1	A
12 Cady Street & Center Street	Stop (Minor)	EB	19.5	C	37.7	E
		WB	44.9	E	132.3	F
		NBL	8.4	A	9.2	A
		SBL	9.0	A	8.9	A
13 Cady Street & Hutton Street	Stop (Minor)	EBL	7.8	A	7.6	A
		WB	Free			
		SB	11.5	B	10.2	B
14 Cady Street & Church Street	Stop (Minor)	EB	Free			
		WB	Free			
		SB	10.3	B	9.9	A
15 Cady Street & Griswold Street	Stop (Minor)	EB	11.0	B	13.9	B
		WB	9.5	A	11.0	B
		NBL	7.4	A	7.6	A
		SBL	7.3	A	7.4	A
16 Beal Street & Griswold Street	Stop (EB & SB)	EB	0.0*	A	0.0*	A
		WB	Free			
		SB	0.0**	A	3.9**	A
17 Beal Street & River Street	Stop (Minor)	EB	Free			
		WBL	7.3	A	7.4	A
		NB	9.1	A	9.8	A
18 Beal Street & Northville Road	Stop (Minor)	EB	10.5	B	12.6	B
		NBL	8.0	A	8.6	A
		SB	Free			
19 Seven Mile Road & First Street / Fairbrook Street	Stop (Minor)	EBL	1.7**	A	6.7**	A
		WB	Free			
		SB	10.0**	B	27.9**	D
		SW	6.8**	A	12.1**	B

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
20 Fairbrook Street & Wing Street	Stop (All-Way)	EB	7.5	A	8.1	A
		WB	6.8	A	7.9	A
		NB	7.5	A	8.5	A
		SB	7.5	A	8.3	A
		Overall	7.4	A	8.2	A
21 Fairbrook Street & Center Street	Stop (Minor)	EB	22.6	C	23.2	C
		NBL	8.5	A	10.1	B
		SB	Free			
22 Seven Mile Road & Wing Street / St. Lawrence Blvd	Stop (Minor)	EBL	7.7	A	9.2	A
		WBL	8.8	A	8.4	A
		NB	15.3	C	22.3	C
		SB	17.4	C	39.4	E
23 Seven Mile Road & Sheldon Avenue / Center Street	Signalized	EBL	20.6	C	33.1	C
		EBTR	33.3	C	26.7	C
		WBL	37.6	D	39.4	D
		WBT	18.3	B	27.8	C
		WBR	17.4	B	18.4	B
		NBL	19.9	B	40.0	D
		NBTR	21.6	C	27.5	C
		SBL	33.3	C	43.0	D
		SBTR	15.4	B	21.7	C
Overall	23.6	C	27.1	C		
24 Seven Mile Road & Hines Drive	Stop (NB Hines & WBL 7 Mile)	WBL	13.1**	B	22.4**	C
		WBR	Free			
		NB	17.0**	C	31.1**	D
		SBL	4.7**	A	4.0**	A
25 Seven Mile Road & River Street	Stop (Minor)	EBL	7.7	A	8.7	A
		WB	Free			
		SB	11.0	B	13.7	B
26 SB Northville Road & N. Seven Mile Road	Stop/Yield (Minor)	EBT	11.5	B	14.4	B
		EBR	12.2	B	13.7	B
		WB	13.9	B	69.2	F
		SB	Free			
27 NB Northville Road & N. Seven Mile Road	Yield (Minor)	EBL	14.5	B	32.2	D
		NBTL	4.9	A	5.9	A
		NBT	Free			
28 Northville Road & S. Seven Mile Road	Signalized	WBL	21.5	C	22.3	C
		WBR	9.9	A	15.3	B
		NBT	40.0	D	129.2	F
		NBTR	58.8	E	131.7	F
		SBL	57.4	E	44.1	D
		SBT	11.3	B	12.2	B
		Overall	37.1	D	58.7	E

3.1.1 Signal Warrant Analyses

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements, signal warrant analyses were performed at the following intersections to determine if a traffic signal is warranted and recommended to mitigate existing delays.

- Center Street & Randolph Street
- Center Street & Cady Street
- Northville Road & 7-Mile Road

The signal warrant analysis was conducted in accordance with the requirements outlined in the Michigan Manual of Uniform Traffic Control Devices (MMUTCD). The existing traffic volumes at the study intersections of Center Street & Randolph Street, Center Street & Cady Street, and Northville Road & 7-Mile Road were utilized to evaluate the MMUTCD warranting criteria. F&V only collected 4-hour turning movement count data at the study intersections, with the exception of the Northville Road & 7-Mile Road intersection; therefore, if the Warrants for 1A or 1B are not met for all 4 hours of evaluation, higher volumes are not expected during the off-peak hours, indicating the full Warrant 1A and/or 1B would not be met.

Warrant 1 (8-Hour Vehicular Volume)

According to the MMUTCD, Warrant 1, Condition A is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. Condition B is intended for application where Condition A is not satisfied and where the traffic volume on the major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. It is intended that Warrant 1 be treated as a single warrant, where Warrant 1 is satisfied if either Conditions A or B are met. Additionally, in applying each condition, the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Warrant 2 (4-Hour Vehicular Volume)

The Four-Hour signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The need for a traffic signal shall be considered if, for each of any four hours of an average day, the approach volumes fall above the applicable curve on Figure 4C-1.

Warrant 3 (Peak-Hour Vehicular Volume)

The Peak Hour signal warrant conditions is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. The need for a signal shall be considered if on any hour of an average day, the approach volumes fall above the applicable curve on Figure 4C-3.

Warrant 4 (Pedestrian Volumes)

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. The need for a traffic signal shall be considered if, for each of any four hours of an average day, the vehicular and pedestrian volumes fall above the applicable curve on Figure 4C-5 **OR** if on any hour of an average day, the vehicular and pedestrian volumes fall above the applicable curve on Figure 4C-7.

Warrant 5 (School Crossing)

The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word "schoolchildren" includes elementary through high school students. None of the study intersections evaluated are within close proximity to a school; therefore, this warrant is not applicable.

Warrant 6 (Coordinated Signal System)

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles. The study intersections evaluated are not part of a coordinated network focused on platooning and progression of vehicles, encouraging throughput; therefore, this warrant is not applicable.

Warrant 7 (Crash Experience)

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. The need for a signal shall be considered if five or more reported crashes of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash **AND** Warrant 1A and/or Warrant 1B are met to 80 percent of the required volumes.

Warrant 8 (Roadway Network)

Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network. The need for a traffic signal shall be considered at location of two or more major routes, in addition to volume criteria. The study intersections evaluated each contain at least one minor route; therefore, this warrant is not applicable.

Warrant 9 (Intersection Near a Grade Crossing)

The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal. None of the study intersections evaluated are within close proximity to a grade crossing; therefore, this warrant is not applicable.

Table 3.2: Existing Signal Warrant Analysis Summary

Study Intersection		Center Street & Randolph Street	Center Street & Cady Street	Northville Road & 7-Mile Road
Warrant 1: Eight Hour		NO	NO	YES
<i>Condition A</i>	<i>Hours Met</i>	1	0	8
	<i>Warrant Met</i>	NO	NO	YES
<i>Condition B</i>	<i>Hours Met</i>	1	2	5
	<i>Warrant Met</i>	NO	NO	NO
Warrant 2: Four-Hour	<i>Hours Met</i>	1	1	7
	<i>Warrant Met</i>	NO	NO	YES
Warrant 3: Peak-Hour	<i>Hours Met</i>	0	0	3
	<i>Warrant Met</i>	NO	NO	YES
Warrant 4: Pedestrian Volume	<i>Hours Met</i>	0	0	0
	<i>Warrant Met</i>	NO	NO	NO
Warrant 5: School Crossing		N/A	N/A	N/A
Warrant 6: Coordinated Signal System		N/A	N/A	N/A
Warrant 7: Crash Experience	<i>Crashes</i>	4	4	4
	<i>Warrant Met</i>	NO	NO	NO
Warrant 8: Roadway Network		N/A	N/A	N/A
Warrant 9: Intersection Near Grade Crossing		N/A	N/A	N/A

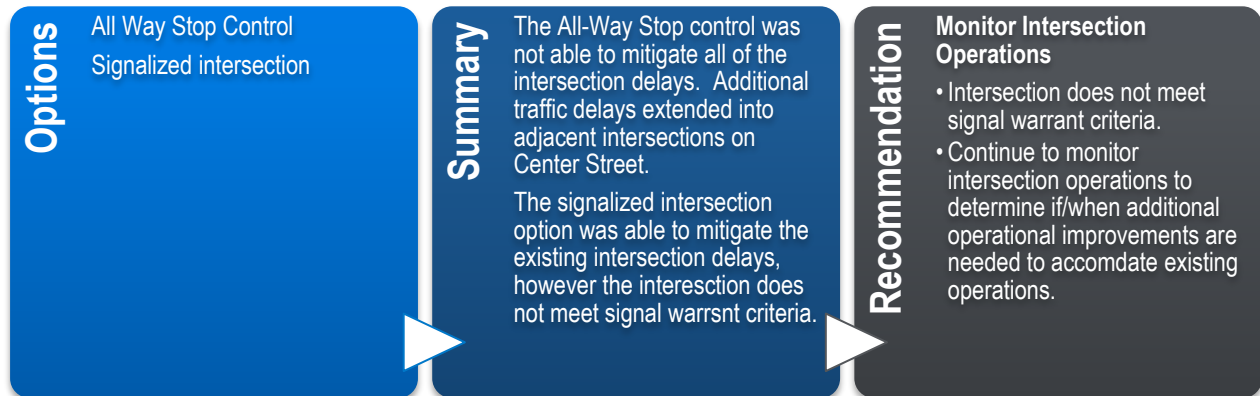
The results of the existing conditions signal warrant analyses shows that signal is warranted at the following intersection:

- Northville Road & 7-Mile Road meets Warrant 1A, 2, and 3.

The analysis shows that the Center Street & Randolph Street and Center Street & Cady Street do not meet the signal warrants. Therefore, these intersections should be monitored to determine if/when signals or additional traffic control is warranted or recommended.

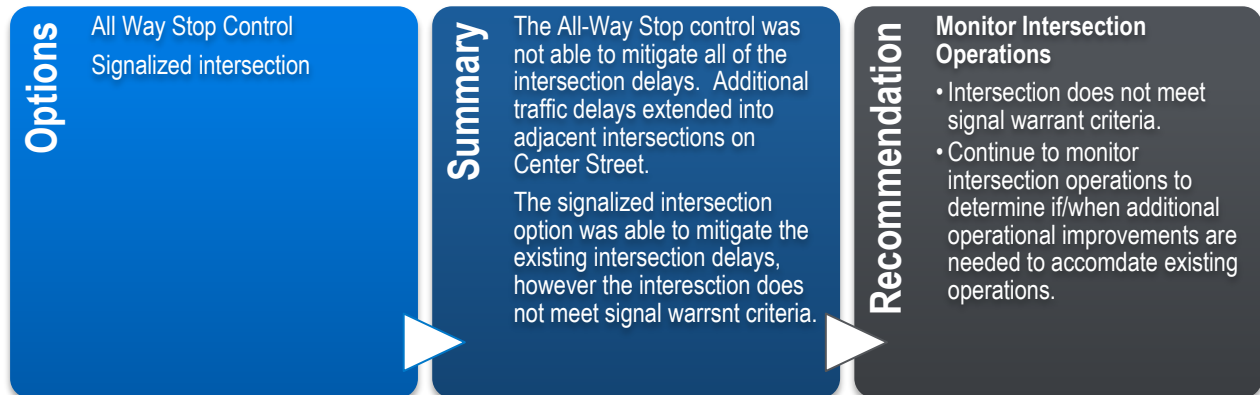
3.1.2 Center Street and Randolph Street

Mitigation measures were identified at this intersection in order to address the intersection delays and vehicle queueing as summarized below.



3.1.3 Center Street and Cady Street

Mitigation measures were identified at this intersection in order to address the intersection delays and vehicle queueing as summarized below.



3.1.4 Northville Road (S. Main Street) and N. Seven Mile Road

Several mitigation measures were identified at this intersection in order to address the intersection delays and vehicle queueing identified. These alternatives are summarized below.

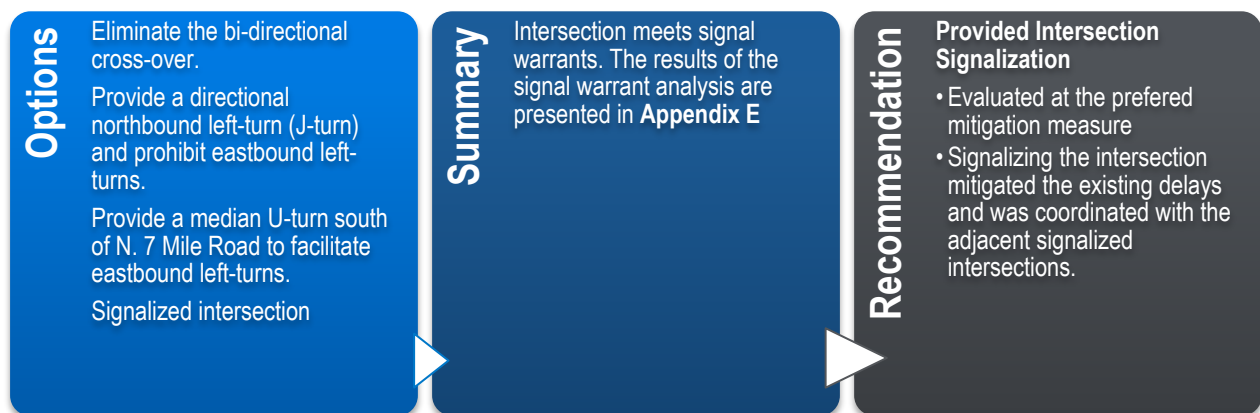


Table 3.3: Existing Conditions with Mitigation Analysis Summary

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
8 Main Street & Hutton Street	Signalized	EBTL	No Change		20.6	C
		EBR			17.8	B
		WBTL			17.0	B
		WBR			23.4	C
		NB			8.6	A
		SBTL			11.2	B
		SBR			8.3	A
		Overall			17.5	B
9 Main Street & Griswold Street	Signalized	EBTL	No Change		32.8	C
		EBTR			22.4	C
		WBTL			17.5	B
		WBTR			19.2	B
		NB			11.2	B
		SB			17.5	B
		Overall			19.0	B
26 SB Northville Road & N. Seven Mile Road	Signalized	EBL	24.6	C	37.0	D
		EBR	15.5	B	16.6	B
		NBL	6.8	A	4.9	A
		NBT	0.2	A	0.2	A
		SB	24.2	C	25.0	C
		Overall	12.7	B	11.8	B
28 Northville Road & S. Seven Mile Road	Signalized	WBL	34.9	C	33.2	C
		WBR	13.0	B	22.6	C
		NBT	29.0	C	41.9	D
		NBTR	34.1	C	43.2	D
		SBL	35.3	D	32.7	C
		SBT	14.0	B	4.2	A
		Overall	28.5	C	29.3	C

3.1.5 Sheldon Avenue/Center Street and Seven Mile Road/Hines Drive

The LOS at this intersection showed acceptable intersection delays; however, review of the Sim Traffic simulations showed long vehicles queues for several movements. Therefore, mitigation measures were investigated at this intersection in order to address the vehicle queuing and subsequent intersection delays. The mitigation measures options evaluated are summarized below and the results of the operations for each option in **Table 3.4**.

Option 1: Signalization Improvements

- Upgrade to a fully actuated, 2-phase traffic signal.
- Restripe the NB approach to provide a left-turn lane Note: length would be limited by existing geometric constraints of the bridge.
- Restripe the SB approach to provide an exclusive left-turn lane.
- Impacts to existing bike lane on Center Street, ~350 feet storage length required at intersection

Option 2: Bridge Replacement

- Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 300- ft of storage length.
- Restripe the SB approach to provide an exclusive left-turn lane.
- Impacts to existing bike lane on Center Street, ~350 feet storage length required at intersection.

Option 2A: Signal Improvements + Bridge Replacement

Option 3: Roundabout

- Additional ROW required, in order to accommodate a roundabout.
- Potential wetland mitigation may be needed.
- Grading west of the intersection
- Will require special design consideration for pedestrians and bicycles.

Option 3A: Roundabout + Bridge Replacement

Summary

- The results of the analysis showed that increasing the left-turn storage (Option 2) provided the highest reduction in vehicle queueing.
- However, the construction of a roundabout (Option 3) may also be considered to reduce delays and improve vehicle queueing
- Option 1 (Signal upgrade) is expected to provide minimal improvement over existing conditions, unless installed in conjunction with Option 2; therefore, Option 1 is not recommended for this intersection.

Table 3.4: Center St. and Seven Mile Rd. Intersection Mitigation Summary (Existing)

Peak Period	Approach	Existing Conditions				Option 1 Signalization Improvements				Option 2 Bridge Replacement				Option 3 Roundabout			
		Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)
AM	EBL	20.6	C	25	60	23.3	C	30	144	20.6	C	26	84	8.4	A	180	372
	EBTR	33.3	C	163	266	50.4	D	223	371	33.3	C	197	340				
	WBL	37.6	D	20	51	28.6	C	21	43	37.6	D	21	52	4.7	A	27	60
	WBT	18.3	B	47	94	27.5	C	66	117	18.3	B	50	106				
	WBR	17.4	B	13	40	23.2	C	13	35	17.4	B	16	47				
	NBL	19.9	B	27	63	21.0	C	27	61	19.9	B	22	59	11.5	B	1653	3147
	NBT	21.6	C	257	451	50.3	D	415	781	18.6	B	224	414				
	NBR									11.3	B	30	85				
	SBL	33.3	C	57	121	28.4	C	38	72	28.1	C	52	107	5.2	A	78	164
	SBTR	15.4	B	113	202	27.8	C	145	258	15.4	B	123	207				
Overall	23.6	C	N/A	N/A	40.3	D	N/A	N/A	22.3	C	N/A	N/A	8.1	A	N/A	N/A	
PM	EBL	33.1	C	26	68	31.7	C	16	44	33.1	C	26	65	10.3	B	192	454
	EBTR	26.7	C	150	243	54.6	D	227	363	26.7	C	144	237				
	WBL	39.4	D	83	188	36.8	D	107	261	39.4	D	92	216	8.6	A	599	785
	WBT	27.8	C	186	292	52.4	D	249	401	27.8	C	206	354				
	WBR	18.4	B	65	174	27.5	C	88	252	18.4	B	76	241				
	NBL	40.0	D	50	75	28.0	C	47	73	40.0	D	171	374	15.9	C	5631	12659
	NBT	27.5	C	2844	5931	54.4	D	2631	4614	20.6	C	304	531				
	NBR									11.6	B	33	85				
	SBL	43.0	D	77	184	29.1	C	81	243	31.8	C	74	179	13.6	B	519	531
	SBTR	21.7	C	223	354	37.3	D	323	509	21.7	C	239	375				
Overall	27.1	C	N/A	N/A	46.0	D	N/A	N/A	24.6	C	N/A	N/A	12.3	B	N/A	N/A	

3.2 EXISTING CONDITIONS ANALYSIS SUMMARY

The results of the existing conditions analysis provides the following mitigation measures for consideration to improve the existing baseline operations (pre-COVID).

Table 3.5: Existing Conditions Mitigation Summary

Intersection		Recommendation
2	Randolph Street & Center Street	<i>Continue to monitor intersection operations</i>
8	Main Street & Hutton Street	Signal Timing Optimization Recommended
9	Main Street & Griswold Street	Signal Timing Optimization Recommended
12	Cady Street & Center Street	<i>Continue to monitor intersection operations</i>
22	Seven Mile Road & Wing Street / St. Lawrence	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
23	Seven Mile Road & Sheldon Avenue / Center Street	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout
26/27	Northville Road & N. Seven Mile Road	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.
28	Northville Road & S. Seven Mile Road	Signal Timing Optimization Recommended

* Details of the proposed signal timing optimization are included in Appendix F

4 BACKGROUND CONDITIONS ANALYSIS (2028)

The proposed development is expected to have an opening day in 2024 with the first dwelling units occupied, with a full buildout of the site in 2028. Therefore, the background conditions analysis evaluated the projected operations in 2028 **without the proposed development**.

Background Baseline Operations (Pre-COVID)	
Background Conditions	<ul style="list-style-type: none"> Existing Baseline Traffic Volume + Growth Rate to 2028 Background Developments Pre-COVID intersection operations

A background growth was determined to calculate the projected implicit background traffic growth to the site buildout year in 2028. Population and employment data were used in order to determine the applicable growth rate for the existing traffic volumes to the project build-out year of 2028. The SEMCOG community profile for the City of Northville was reviewed and showed an average annual growth rate of 0.20% population growth and a 0.07% employment growth from 2020 to 2045. Therefore, an annual growth rate of 0.20% per year was applied to the existing baseline traffic volumes.

In addition to background growth, it is important to account for traffic that will be generated by approved and/or proposed developments within the vicinity of the study area that have yet to be constructed or are currently under construction. The following developments were identified by the City of Northville:

- Cady Project – 6-unit condominium (South side of Cady Street, east of Center Street)
- 355 E. Cady St. - 3-story mixed-use building; first floor retail, office above
- 455 E. Cady St “Hanger Building”- office space
- Foundry Flask – 78 Multi-Family Units, corner store specialty market

The number of AM and PM peak hour vehicle trips that would be generated by these proposed developments were forecast based on data published by ITE in the *Trip Generation Manual, 10th Edition*¹ and the *ITE Trip Generation Handbook, 3rd Edition*. The trip distribution that was determined for the proposed Northville Downs development was used to distribute the trip projections for these developments.

4.1 BACKGROUND OPERATIONS

The traffic volumes for this analysis utilized the baseline 2021 traffic volumes shown on Figure 3. A 0.2% annual background growth rate was applied to these traffic volumes and the trips generated by the adjacent developments were added into the study network to calculate the background conditions traffic volumes. The results of the background conditions analysis were based on the lane use and traffic control shown on **Figure 2** the traffic volumes shown on **Figure 4 in Appendix C**.

The results of the background conditions analysis are summarized in **Table 4.1** and are presented in **Appendix C**. The results of the analysis indicate that all study intersection approaches and movements are expected to operate similar to background conditions with the following delays, highlighted in **Table 4.1**.

Table 4.1: Background Conditions Analysis Summary

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
1 Randolph Street & Wing Street	Stop (Minor)	EB	Free			
		WBL	7.8	A	8.3	A
		NB	12.0	B	19.9	C
2 Randolph Street & Center Street	Stop (Minor)	EB	42.6	E	308.9	F
		WB	36.4	E	188.3	F
		NBL	9.3	A	9.4	A
		SBL	8.6	A	9.1	A

¹The ITE Trip Generation 11th edition was published in October 2021. The trip generation analysis performed for these land uses was performed before the release of this publication, therefore the 10th Edition data was utilized for these developments

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
3 Dunlap Street & Wing Street	Stop (All-Way)	EB	8.6	A	9.9	A
		WB	9.1	A	12.6	B
		NB	8.6	A	11.8	B
		SB	8.9	A	10.5	B
		Overall	8.8	A	11.6	B
4 Center Street & Dunlap Street	Signalized	EBL	21.6	C	25.9	C
		EBTR	18.8	B	19.4	B
		WBL	19.1	B	17.5	B
		WBTR	19.9	B	20.9	C
		NBL	1.6	A	3.6	A
		NBTR	1.3	A	2.1	A
		SBL	6.4	A	6.0	A
		SBTR	8.0	A	10.2	B
Overall	7.7	A	9.6	A		
5 Dunlap Street & Hutton Street	Stop (Minor)	EBL	7.6	A	8.2	A
		WB	Free			
		SB	10.8	B	14.4	B
6 Main Street & Wing Street	Stop (All-Way)	EB	10.1	B	11.3	B
		WB	9.0	A	10.2	B
		NB	9.0	A	11.6	B
		SB	10.0	B	10.7	B
		Overall	9.7	A	11.0	B
7 Main Street & Center Street	Signalized	EB	20.2	B	20.5	C
		WB	19.4	B	20.8	C
		NB	9.9	A	10.1	B
		SB	1.1	A	1.9	A
		Overall	9.8	A	10.6	B
8 Main Street & Hutton Street	Signalized	EBTL	0.3	A	0.3	A
		EBR	0.0	A	0.0	A
		WBTL	12.8	B	4.6	A
		WBR	13.7	B	5.9	A
		NB	17.2	B	19.1	B
		SBTL	21.6	C	86.3	F
		SBR	16.5	B	16.5	B
Overall	12.7	B	24.0	C		
9 Main Street & Griswold Street	Signalized	EBTL	12.1	B	25.0	C
		EBTR	10.2	B	18.3	B
		WBTL	10.2	B	12.1	B
		WBTR	10.5	B	12.9	B
		NB	15.6	B	17.5	B
		SB	17.2	B	44.9	D
		Overall	13.1	B	24.1	C
10 Main Street & Cady Street	Stop (Minor)	EB	Free			
		WBL	7.9	A	8.9	A
		NB	10.0	B	20.3	C

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
11 Cady Street & Wing Street	Stop (All-Way)	EB	8.5	A	8.9	A
		WB	8.1	A	8.7	A
		NB	8.2	A	9.4	A
		SB	8.9	B	9.5	A
		Overall	8.6	A	9.2	A
12 Cady Street & Center Street	Stop (Minor)	EB	19.9	C	41.3	E
		WB	48.7	E	184.1	F
		NBL	8.4	A	9.2	A
		SBL	9.1	A	9.0	A
13 Cady Street & Hutton Street	Stop (Minor)	EBL	7.8	A	7.6	A
		WB	Free			
		SB	11.6	B	10.3	B
14 Cady Street & Church Street	Stop (Minor)	EB	Free			
		WB	Free			
		SB	10.4	B	10.0	B
15 Cady Street & Griswold Street	Stop (Minor)	EB	11.7	B	16.1	C
		WB	9.1	A	11.2	B
		NBL	7.4	A	7.6	A
		SBL	7.3	A	7.5	A
16 Beal Street & Griswold Street	Stop (EB & SB)	EB	0.0*	A	0.0*	A
		WB	Free			
		SB	3.8**	A	3.9**	A
17 Beal Street & River Street	Stop (Minor)	EB	Free			
		WBL	7.3	A	7.5	A
		NB	9.1	A	9.9	A
18 Beal Street & Northville Road	Stop (Minor)	EB	10.6	B	13.0	B
		NBL	8.1	A	8.7	A
		SB	Free			
19 Seven Mile Road & First Street / Fairbrook Street	Stop (Minor)	EBL	1.5**	A	11.2**	B
		WB	Free			
		SB	12.7**	B	29.4**	D
		SW	10.2**	B	13.2**	B
20 Fairbrook Street & Wing Street	Stop (All-Way)	EB	7.5	A	8.1	A
		WB	6.8	A	7.9	A
		NB	7.5	A	8.5	A
		SB	7.5	A	8.3	A
		Overall	7.4	A	8.2	A
21 Fairbrook Street & Center Street	Stop (Minor)	EB	23.2	C	24.3	C
		NBL	8.5	A	10.2	B
		SB	Free			
22 Seven Mile Road & Wing Street / St. Lawrence Blvd	Stop (Minor)	EBL	7.8	A	9.3	A
		WBL	8.9	A	8.4	A
		NB	15.5	C	22.5	C
		SB	17.9	C	41.9	E

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
23 Seven Mile Road & Sheldon Avenue / Center Street	Signalized	EBL	20.7	C	33.5	C
		EBTR	34.1	C	27.0	C
		WBL	38.3	D	40.5	D
		WBT	18.3	B	28.1	C
		WBR	17.4	B	18.5	B
		NBL	20.2	C	43.0	D
		NBTR	22.2	C	28.9	C
		SBL	34.8	C	45.8	D
		SBTR	15.6	B	22.4	C
		Overall	24.2	C	28.0	C
24 Seven Mile Road & Hines Drive	Stop (NB Hines & WBL 7 Mile)	WBL	14.7**	B	22.0**	C
		WBR	Free			
		NB	17.2**	C	33.3**	D
		SBL	4.9**	A	4.0**	A
25 Seven Mile Road & River Street	Stop (Minor)	EBL	7.7	A	8.8	A
		WB	Free			
		SB	11.0	B	13.8	B
26 SB Northville Road & N. Seven Mile Road	Stop/Yield (Minor)	EBT	11.7	B	15.1	C
		EBR	12.4	B	14.3	B
		WB	14.2	B	91.3	F
		SB	Free			
27 NB Northville Road & N. Seven Mile Road	Yield (Minor)	EBL	14.8	B	33.8	D
		NBTL	4.8	A	5.9	A
		NBT	Free			
28 Northville Road & S. Seven Mile Road	Signalized	WBL	21.6	C	22.5	C
		WBR	10.0	B	16.0	B
		NBT	41.7	D	142.7	F
		NBTR	60.7	E	144.8	F
		SBL	62.7	E	49.3	D
		SBT	11.3	B	12.3	B
		Overall	39.0	D	63.9	E

4.1.1 Signal Warrant Analyses

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements, signal warrant analyses were performed at the following intersections to determine if a traffic signal is warranted and recommended to mitigate background condition delays.

- Center Street & Randolph Street
- Center Street & Cady Street
- Northville Road & 7-Mile Road

The results of the existing conditions signal warrant analyses are summarized in Table 4.2 and shows that signal is warranted at the following intersection:

- Northville Road & 7-Mile Road meets Warrant 1A, 2, and 3.

The analysis shows that the Center Street & Randolph Street and Center Street & Cady Street do not meet the signal warrants. Therefore, these intersections should be monitored to determine if/when signals or additional traffic control is warranted or recommended.

Table 4.2: Background Signal Warrant Analysis Summary

Study Intersection		Center Street &	Center Street	Northville Road &
Warrant 1: Eight Hour		NO	NO	YES
Condition A	Hours Met	1	0	8
	Warrant Met	NO	NO	YES
Condition B	Hours Met	1	3	5
	Warrant Met	NO	NO	NO
Warrant 2: Four-Hour	Hours Met	1	3	7
	Warrant Met	NO	NO	YES
Warrant 3: Peak-Hour	Hours Met	0	0	3
	Warrant Met	NO	NO	YES
Warrant 4: Pedestrian Volume	Hours Met	0	0	0
	Warrant Met	NO	NO	NO

4.2 BACKGROUND CONDITIONS ANALYSIS SUMMARY

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements in the background conditions, the mitigation measures evaluated in the existing conditions analyses were investigated in addition to mitigation measures identified as necessary to accommodate the additional projected background traffic volumes. The recommended mitigation measures are summarized in **Table 4.3** and the results of the analysis with the recommendations is summarized in **Tables 4.4 and 4.5**.

Table 4.3: Background Intersection Mitigation Summary

Intersection		Existing Conditions Recommendation	Background Conditions Recommendation
2	Randolph Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
8	Main Street & Hutton Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
9	Main Street & Griswold Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
12	Cady Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
22	Seven Mile Road & Wing Street / St. Lawrence	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
23	Seven Mile Road & Sheldon Avenue / Center Street	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout
26/ 27	Northville Road & N. Seven Mile Road	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.
28	Northville Road & S. Seven Mile Road	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended

* Details of the proposed signal timing optimization are included in Appendix F

Table 4.4: Background Conditions with Mitigation Analysis Summary

Intersection	Control	Approach	AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS
8 Main Street & Hutton Street	Signalized	EBTL	No Change		20.9	C
		EBR			17.8	B
		WBTL			17.4	B
		WBR			25.1	C
		NB			8.6	A
		SBTL			11.5	B
		SBR			8.3	A
		Overall			18.2	B
9 Main Street & Griswold Street	Signalized	EBTL	No Change		35.1	D
		EBTR			23.1	C
		WBTL			18.2	B
		WBTR			20.1	C
		NB			11.8	B
		SB			19.4	B
		Overall			20.0	C
		26 SB Northville Road & N. Seven Mile Road			Signalized	EBL
EBR	14.8		B	13.7		B
NBL	3.3		A	9.8		A
NBT	0.1		A	0.3		A
SB	25.4		C	31.8		C
Overall	12.6		B	14.1		B
28 Northville Road & S. Seven Mile Road	Signalized	WBL	35.2	D	33.5	C
		WBR	13.2	B	23.9	C
		NBT	29.6	C	44.5	D
		NBTR	34.5	C	45.8	D
		SBL	32.9	C	30.3	C
		SBT	10.2	B	0.2	A
		Overall	27.6	C	29.4	C

Table 4.5: Center St. and Seven Mile Rd. Intersection Mitigation Summary (Background)

Peak Period	Approach	Existing Conditions				Option 1 Signalization Improvements				Option 2 Bridge Replacement				Option 3 Roundabout			
		Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)
AM	EBL	20.7	C	23	59	23.8	C	23	52	20.7	C	19	45	8.7	A	212	407
	EBTR	34.1	C	184	301	52.9	D	207	331	34.1	C	174	289				
	WBL	38.3	D	23	57	29.4	C	23	54	38.3	D	21	56	4.7	A	33	62
	WBT	18.3	B	49	108	28.1	C	65	119	18.3	B	51	105				
	WBR	17.4	B	15	42	23.6	C	14	37	17.4	B	11	34				
	NBL	20.2	B	27	62	21.4	C	28	64	20.2	C	25	62	12.5	B	2004	3555
	NBT	22.2	C	282	505	53.9	D	416	653	19.0	B	218	406				
	NBR									11.3	B	33	68				
	SBL	34.8	C	62	135	30.1	C	46	79	29.1	C	57	130	5.2	A	100	228
	SBTR	15.6	B	127	212	28.4	C	177	278	15.6	B	124	204				
Overall	24.2	C	N/A	N/A	42.4	D	N/A	N/A	22.6	C	N/A	N/A	8.6	A	N/A	N/A	
PM	EBL	33.5	C	21	61	32.0	C	24	92	33.5	C	24	64	10.8	B	61	165
	EBTR	27.0	C	151	245	55.9	E	222	355	27.0	C	160	263				
	WBL	40.5	D	77	175	38.2	D	102	251	40.5	D	116	255	9.1	A	262	713
	WBT	28.1	C	180	296	53.7	D	236	372	28.1	C	277	504				
	WBR	18.5	B	64	180	27.7	C	84	221	18.5	B	143	422				
	NBL	43.0	D	51	73	30.9	C	48	74	43.0	D	144	288	18.0	C	4507	8002
	NBT	28.9	C	3384	6126	59.7	E	3472	6322	21.2	C	306	515				
	NBR									11.6	B	38	93				
	SBL	45.8	D	81	187	30.9	C	102	279	33.0	C	87	215	14.9	B	517	535
	SBTR	22.4	C	222	346	39.5	D	374	568	22.4	C	245	387				
Overall	28.0	C	N/A	N/A	48.6	D	N/A	N/A	25.2	C	N/A	N/A	13.5	B	N/A	N/A	

5 SITE TRIP GENERATION

The number of AM and PM peak hour vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 11th Edition*. The proposed development includes single family, attached housing, multi-family units and commercial uses. The following ITE Trip Generation Manual land uses were determined to be the best fit for the proposed development.

Single-Family Detached Housing (LUC 210)

- A single-family detached housing site includes any single-family detached home on an individual lot.

Single-Family Attached Housing (LUC 215)

- Single-family attached housing includes any single-family housing unit that shares a wall with an adjoining dwelling unit, whether the walls are for living space, a vehicle garage, or storage space. Includes duplexes and townhouses/rowhouses, joined side-by-side in a row and each with an outside entrance.

Mid-Rise Multi-Family Home (LUC 221)

- Mid-rise multifamily housing includes apartments and condominiums located in a building that has between four and 10 floors of living space. Access to individual dwelling units is through an outside building entrance, a lobby, elevator, and a set of hallways.

Strip Retail Plaza <40k SF (LUC 822)

- A strip retail plaza is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. Each study site in this land use has less than 40,000 square feet of gross leasable area (GLA).

Internal trip capture is the portion of trips generated by a mixed-used development that would begin and end within the development; resulting in no additional trips added to the adjacent road network. The internal trip capture spreadsheet for the proposed development is provided in **Appendix A**. Additionally, a portion of the site-generated commercial trips are already present on the adjacent road network and are interrupted to visit the site. These trips are known as “pass-by” trips and result in turning movements at the site driveways, but do not increase traffic volumes on the adjacent road network. The percentage of pass-by trips was determined based on the rates published by in ITE Trip Generation, 11th Edition.

Table 5.1: Trip Generation Summary

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Single-Family Detached Housing	210	39	DU	424	8	24	32	26	15	41
Single-Family Attached Housing	215	259	DU	1,923	40	89	129	86	65	151
Multi-Family Home (Mid-Rise)	221	174	DU	784	15	50	65	41	27	68
Total Trips				3,131	63	163	226	153	107	260
Internal Capture				190	1	2	3	14	5	19
New Trips				2,941	62	161	223	139	102	241
Strip Retail Plaza (<40k SF)	822	17,374	SF	963	25	16	41	58	57	115
Internal Capture				190	2	1	3	5	14	19
Pass-By (34%)				327	8	5	13	16	16	32
New Trips				446	15	10	25	37	27	64
Total Trips				4,094	88	179	267	211	164	375
Total Internal Capture				380	3	3	6	19	19	38
Total Pass-By				327	8	5	13	16	16	32
Total New Trips				3,387	77	171	248	176	129	305

6 SITE TRIP DISTRIBUTION

The vehicular trips that would be generated by the proposed development were assigned to the study roads based on existing peak hour traffic patterns in the adjacent roadway network and the methodologies published by ITE.

The adjacent street traffic volumes were used to develop the global traffic distribution. To determine trips distribution for residential developments using the adjacent street traffic it is assumed that the trips in the AM are home-to-work based trips, and in the PM are work-to-home based trips. Therefore, the global trip generation is based on trips in the AM going from the residential development exiting the study network and returning to the study network in the PM. The ITE trip distribution methodology assumes that new trips will return to their direction of origin, while pass-by trips enter and exit the development in their original direction of travel. The global site trip distributions used in the analysis are summarized in **Table 6.1**.

Table 6.1: Site Generated Traffic Distribution

New Trips					
Residential		To/From	Via	Commercial	
AM	PM			AM	PM
15%	9%	North	Center Street	13%	13%
2%	2%		Hutton Street	2%	2%
11%	9%		Griswold Street	7%	11%
16%	16%	South	Sheldon Avenue	18%	16%
5%	6%		Hines Drive	3%	5%
14%	16%		Northville Road	16%	15%
19%	18%	East	7-Mile Road	13%	15%
5%	7%	West	Randolph Street	7%	6%
2%	2%		Dunlap Street	2%	2%
2%	4%		Main Street	5%	2%
2%	2%		Cady Street	2%	1%
7%	9%		Seven Mile Road	12%	12%
100%	100%	Total		100%	100%
Commercial Pass-by Trips					
From / To		Via		AM	PM
North to South		Center Street		43%	40%
South to North		Center Street		30%	36%
East to West		Cady Street		13%	13%
West to East		Cady Street		14%	11%
Total				100%	100%

The vehicular traffic volumes shown in **Table 5.1** were distributed to the roadway network according to the global traffic distribution shown in **Table 6.1**. The proposed development plan has multiple site access points to the adjacent roadway network; therefore, the impact of the development is dispersed throughout the area study intersections.

7 FUTURE CONDITIONS (2028)

The future conditions analysis evaluated the projected operations in 2028 *with the proposed development*.

Future Baseline Operations (Pre-COVID)	
Future Conditions	<ul style="list-style-type: none"> Existing Baseline Traffic Volume + Growth Rate to 2028 Background Developments Pre-COVID intersection operations Site Generated Traffic

The traffic volumes for this analysis utilized the site generated traffic volumes shown on Figure 5 which were added to the background 2028 traffic volumes shown on Figure 4 to calculate the future traffic volumes shown on Figure 6. The results of the future conditions analysis were based on the lane use and traffic control shown on Figure 2 the traffic volumes shown on Figure 6 in Appendix D.

7.1 FUTURE OPERATIONS

The results of the future conditions analysis are summarized in Table 7.1 and are presented in Appendix D. The results of the analysis indicate that all study intersection approaches and movements are expected to operate similar to background conditions with the following delays, highlighted in Table 7.1.

Table 7.1: Future Conditions Analysis Summary

Intersection	Control	Approach	Background Conditions				Future Conditions				Difference			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1 Randolph Street & Wing Street	Stop (Minor)	EB	Free				Free				Free			
		WBL	7.8	A	8.3	A	7.8	A	8.3	A	0.0	-	0.0	-
		NB	12.0	B	19.9	C	12.2	B	21.0	C	0.2	-	1.1	-
2 Randolph Street & Center Street	Stop (Minor)	EB	42.6	E	308.9	F	48.3	E	367.5	F	5.7	-	58.6	-
		WB	36.4	E	188.3	F	39.7	E	257.3	F	3.3	-	69.0	-
		NBL	9.3	A	9.4	A	9.4	A	9.5	A	0.1	-	0.1	-
		SBL	8.6	A	9.1	A	8.6	A	9.2	A	0.0	-	0.1	-
3 Dunlap Street & Wing Street	Stop (All-Way)	EB	8.6	A	9.9	A	8.7	A	10.1	B	0.1	-	0.2	A→B
		WB	9.1	A	12.6	B	9.2	A	13.0	B	0.1	-	0.4	-
		NB	8.6	A	11.8	B	8.7	A	12.0	B	0.1	-	0.2	-
		SB	8.9	A	10.5	B	9.0	A	10.7	B	0.1	-	0.2	-
		Overall	8.8	A	11.6	B	8.9	A	11.8	B	0.1	-	0.2	-
4 Center Street & Dunlap Street	Signalized	EBL	21.6	C	25.9	C	22.1	C	26.4	C	0.5	-	0.5	-
		EBTR	18.8	B	19.4	B	18.9	B	19.5	B	0.1	-	0.1	-
		WBL	19.1	B	17.5	B	19.2	B	17.6	B	0.1	-	0.1	-
		WBTR	19.9	B	20.9	C	20.4	C	21.5	C	0.5	B→C	0.6	-
		NBL	1.6	A	3.6	A	1.7	A	4.0	A	0.1	-	0.4	-
		NBTR	1.3	A	2.1	A	1.4	A	2.2	A	0.1	-	0.1	-
		SBL	6.4	A	6.0	A	6.6	A	6.3	A	0.2	-	0.3	-
		SBTR	8.0	A	10.2	B	8.2	A	10.6	B	0.2	-	0.4	-
		Overall	7.7	A	9.6	A	7.9	A	9.9	A	0.2	-	0.3	-

Intersection	Control	Approach	Background Conditions				Future Conditions				Difference			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
5 Dunlap Street & Hutton Street	Stop (Minor)	EBL	7.6	A	8.2	A	7.7	A	8.2	A	0.1	-	0.0	-
		WB	Free				Free				Free			
		SB	10.8	B	14.4	B	11.0	B	15.0	C	0.2	-	0.6	B→C
6 Main Street & Wing Street	Stop (All-Way)	EB	10.1	B	11.3	B	10.2	B	11.6	B	0.1	-	0.3	-
		WB	9.0	A	10.2	B	9.1	A	10.4	B	0.1	-	0.2	-
		NB	9.0	A	11.6	B	9.0	A	11.8	B	0.0	-	0.2	-
		SB	10.0	B	10.7	B	10.1	B	10.8	B	0.1	-	0.1	-
		Overall	9.7	A	11.0	B	9.8	A	11.2	B	0.1	-	0.2	-
7 Main Street & Center Street	Signalized	EB	20.2	B	20.5	C	20.2	B	20.7	C	0.0	-	0.2	-
		WB	19.4	B	20.8	C	19.5	B	21.0	C	0.1	-	0.2	-
		NB	9.9	A	10.1	B	10.2	B	10.4	B	0.3	A→B	0.3	-
		SB	1.1	A	1.9	A	1.2	A	2.0	A	0.1	-	0.1	-
		Overall	9.8	A	10.6	B	9.9	A	10.7	B	0.1	-	0.1	-
8 Main Street & Hutton Street	Signalized	EBTL	0.3	A	0.3	A	0.3	A	0.3	A	0.0	-	0.0	-
		EBR	0.0	A	0.0	A	0.0	A	0.1	A	0.0	-	0.1	-
		WBTL	12.8	B	4.6	A	12.8	B	4.6	A	0.0	-	0.0	-
		WBR	13.7	B	5.9	A	13.7	B	5.9	A	0.0	-	0.0	-
		NB	17.2	B	19.1	B	17.6	B	19.8	B	0.4	-	0.7	-
		SBTL	21.6	C	86.3	F	21.8	C	106.8	F	0.2	-	20.5	-
		SBR	16.5	B	16.5	B	16.5	B	16.5	B	0.0	-	0.0	-
		Overall	12.7	B	24.0	C	12.9	B	29.7	C	0.2	-	5.7	-
9 Main Street & Griswold Street	Signalized	EBTL	12.1	B	25.0	C	12.1	B	25.1	C	0.0	-	0.1	-
		EBTR	10.2	B	18.3	B	10.2	B	18.3	B	0.0	-	0.0	-
		WBTL	10.2	B	12.1	B	10.2	B	12.1	B	0.0	-	0.0	-
		WBTR	10.5	B	12.9	B	10.5	B	12.9	B	0.0	-	0.0	-
		NB	15.6	B	17.5	B	15.9	B	17.8	B	0.3	-	0.3	-
		SB	17.2	B	44.9	D	17.3	B	51.9	D	0.1	-	7.0	-
		Overall	13.1	B	24.1	C	13.2	B	26.3	C	0.1	-	2.2	-
10 Main Street & Cady Street	Stop (Minor)	EB	Free				Free				Free			
		WBL	7.9	A	8.9	A	7.9	A	8.9	A	0.0	-	0.0	-
		NB	10.0	B	20.3	C	10.0	B	20.3	C	0.0	-	0.0	-
11 Cady Street & Wing Street	Stop (All-Way)	EB	8.5	A	8.9	A	8.5	A	9.0	A	0.0	-	0.1	-
		WB	8.1	A	8.7	A	8.1	A	8.7	A	0.0	-	0.0	-
		NB	8.2	A	9.4	A	8.2	A	9.4	A	0.0	-	0.0	-
		SB	8.9	B	9.5	A	8.9	B	9.5	A	0.0	-	0.0	-
		Overall	8.6	A	9.2	A	8.6	A	9.2	A	0.0	-	0.0	-

Intersection	Control	Approach	Background Conditions				Future Conditions				Difference				
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
12	Cady Street & Center Street	Stop (Minor)	EB	19.9	C	41.3	E	21.6	C	47.7	E	1.7	-	6.4	-
			WB	48.7	E	184.1	F	58.4	F	258.2	F	9.7	E→F	74.1	-
			NBL	8.4	A	9.2	A	8.4	A	9.3	A	0.0	-	0.1	-
			SBL	9.1	A	9.0	A	9.2	A	9.1	A	0.1	-	0.1	-
13	Cady Street & Hutton Street / N. Site Drive	Stop (Minor)	EBL	7.8	A	7.6	A	7.8	A	7.6	A	0.0	-	0.0	-
			WBL	Free				7.6	A	7.5	A	N/A			
			NB	Free				12.1	B	11.8	B	N/A			
			SB	11.6	B	10.3	B	12.9	B	11.9	B	1.3	-	1.6	-
14	Cady Street & Church Street	Stop (Minor)	EB	Free				Free				Free			
			WB	Free				Free				Free			
			SB	10.4	B	10.0	B	10.5	B	10.0	B	0.1	-	0.0	-
15	Cady Street & Griswold Street	Stop (Minor)	EB	11.7	B	16.1	C	12.2	B	17.3	C	0.5	-	1.2	-
			WB	9.1	A	11.2	B	9.1	A	11.4	B	0.0	-	0.2	-
			NBL	7.4	A	7.6	A	7.4	A	7.6	A	0.0	-	0.0	-
			SBL	7.3	A	7.5	A	7.3	A	7.5	A	0.0	-	0.0	-
16	Beal Street & Griswold Street	Stop (EB & SB)	EB	0.0*	A	0.0*	A	4.9**	A	4.8**	A	4.9**	-	4.8**	-
			WB	Free				Free				Free			
			SB	3.8**	A	3.9**	A	4.1**	A	4.2**	A	0.3**	-	0.3**	-
17	Beal Street & River Street	Stop (Minor)	EB	Free				Free				Free			
			WBL	7.3	A	7.5	A	7.5	A	7.6	A	0.2	-	0.1	-
			NB	9.1	A	9.9	A	9.7	A	10.7	B	0.6	-	0.8	A→B
18	Beal Street & Northville Road	Stop (Minor)	EB	10.6	B	13.0	B	10.7	B	13.3	B	0.1	-	0.3	-
			NBL	8.1	A	8.7	A	8.1	A	8.9	A	0.0	-	0.2	-
			SB	Free				Free				Free			
19	Seven Mile Road & First Street / Fairbrook	Stop (Minor)	EBL	1.5**	A	11.2**	B	1.8**	A	3.6**	A	0.3**	-	-7.6 **	B→A
			WB	Free				Free				Free			
			SB	12.7**	B	29.4**	D	14.5**	B	29.6**	D	1.8**	-	0.2**	-
			SW	10.2**	B	13.2**	B	6.4**	A	11.8**	B	-3.8**	B→A	-1.4**	-
20	Fairbrook Street & Wing Street	Stop (All-Way)	EB	7.5	A	8.1	A	7.5	A	8.3	A	0.0	-	0.2	-
			WB	6.8	A	7.9	A	7.0	A	8.1	A	0.2	-	0.2	-
			NB	7.5	A	8.5	A	7.6	A	8.6	A	0.1	-	0.1	-
			SB	7.5	A	8.3	A	7.6	A	8.4	A	0.1	-	0.1	-
			Overall	7.4	A	8.2	A	7.5	A	8.4	A	0.1	-	0.2	-
21	Fairbrook Street & Center Street	Stop (Minor)	EB	23.2	C	24.3	C	33.6	D	133.2	F	10.4	C→D	108.9	C→F
			WB	Free				37.3	E	134.8	F	N/A			
			NBL	8.5	A	10.2	B	8.6	A	10.3	B	0.1	-	0.1	-
			SBL	Free	0.0	0.0	0.0	9.4	A	9.5	A	N/A			

Intersection	Control	Approach	Background Conditions				Future Conditions				Difference				
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
22	Seven Mile Road & Wing Street / St. Lawrence Blvd	Stop (Minor)	EBL	7.8	A	9.3	A	7.8	A	9.3	A	0.0	-	0.0	-
			WBL	8.9	A	8.4	A	8.9	A	8.4	A	0.0	-	0.0	-
			NB	15.5	C	22.5	C	15.6	C	22.9	C	0.1	-	0.4	-
			SB	17.9	C	41.9	E	18.4	C	44.4	E	0.5	-	2.5	-
23	Seven Mile Road & Sheldon Avenue / Center Street	Signalized	EBL	20.7	C	33.5	C	20.8	C	33.8	C	0.1	-	0.3	-
			EBTR	34.1	C	27.0	C	34.3	C	27.1	C	0.2	-	0.1	-
			WBL	38.3	D	40.5	D	38.4	D	40.9	D	0.1	-	0.4	-
			WBT	18.3	B	28.1	C	18.3	B	28.4	C	0.0	-	0.3	-
			WBR	17.4	B	18.5	B	17.6	B	19.0	B	0.2	-	0.5	-
			NBL	20.2	C	43.0	D	21.5	C	47.4	D	1.3	-	4.4	-
			NBTR	22.2	C	28.9	C	22.9	C	32.0	C	0.7	-	3.1	-
			SBL	34.8	C	45.8	D	38.3	D	53.7	D	3.5	C→D	7.9	-
			SBTR	15.6	B	22.4	C	16.2	B	23.7	C	0.6	-	1.3	-
Overall	24.2	C	28.0	C	24.6	C	29.5	C	0.4	-	1.5	-			
24	Seven Mile Road & Hines Drive	Stop (NB Hines & WBL 7 Mile)	WBL	14.7**	B	22.0**	C	20.2**	C	21.8**	C	5.5**	B→C	-0.2**	-
			WBR	Free				Free				Free			
			NB	17.2**	C	33.3**	D	18.5**	C	49.8**	E	1.3**	-	16.5**	D→E
			SBL	4.9**	A	4.0**	A	5.1**	A	4.0**	A	0.2**	-	0.0**	-
25	Seven Mile Road & River Street	Stop (Minor)	EBL	7.7	A	8.8	A	7.8	A	8.9	A	0.1	-	0.1	-
			WB	Free				Free				Free			
			SB	11.0	B	13.8	B	12.0	B	15.7	C	1.0	-	1.9	B→C
26	SB Northville Road & N. Seven Mile Road	Stop/Yield (Minor)	EBT	11.7	B	15.1	C	12.1	B	15.6	C	0.4	-	0.5	-
			EBR	12.4	B	14.3	B	13.2	B	15.0	C	0.8	-	0.7	B→C
			WB	14.2	B	91.3	F	15.4	C	135.0	F	1.2	B→C	43.7	-
			SB	Free				Free				Free			
27	NB Northville Road & N. Seven Mile Road	Yield (Minor)	EBL	14.8	B	33.8	D	15.5	C	41.0	E	0.7	B→C	0.0	D→E
			NBTL	4.8	A	5.9	A	4.9	A	6.0	A	0.1	-	0.0	-
			NBT	Free				Free				Free			
28	Northville Road & S. Seven Mile Road	Signalized	WBL	21.6	C	22.5	C	21.6	C	22.5	C	0.0	-	0.0	-
			WBR	10.0	B	16.0	B	10.2	B	16.9	B	0.2	-	0.9	-
			NBT	41.7	D	142.7	F	43.6	D	157.3	F	1.9	-	14.6	-
			NBTR	60.7	E	144.8	F	60.7	E	158.9	F	0.0	-	14.1	-
			SBL	62.7	E	49.3	D	82.4	F	56.4	E	19.7	E→F	7.1	D→E
			SBT	11.3	B	12.3	B	11.4	B	12.4	B	0.1	-	0.1	-
			Overall	39.0	D	63.9	E	44.3	D	69.7	E	5.3	-	5.8	-

* Indicates no vehicle volume present ** Indicates SimTraffic delay was utilized

7.1.1 Signal Warrant Analyses

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements, signal warrant analyses were performed at the following intersections to determine if a traffic signal is warranted and recommended to mitigate background condition delays.

- Center Street & Randolph Street
- Center Street & Cady Street
- Northville Road & 7-Mile Road

Table 7.2: Future Signal Warrant Analysis Summary

Future		Center Street & Randolph Street	Center Street & Cady Street	Northville Road & 7-Mile Road
Warrant 1: Eight Hour		NO	NO	YES
<i>Condition A</i>	<i>Hours Met</i>	2	0	8
	<i>Warrant Met</i>	NO	NO	YES
<i>Condition B</i>	<i>Hours Met</i>	2	3	5
	<i>Warrant Met</i>	NO	NO	NO
Warrant 2: Four-Hour	<i>Hours Met</i>	2	3	7
	<i>Warrant Met</i>	NO	NO	YES
Warrant 3: Peak-Hour	<i>Hours Met</i>	0	0	3
	<i>Warrant Met</i>	NO	NO	YES
Warrant 4: Pedestrian Volume	<i>Hours Met</i>	0	0	0
	<i>Warrant Met</i>	NO	NO	NO

The results of the existing conditions signal warrant analyses shows that signal is warranted at the following intersection:

- Northville Road & 7-Mile Road meets Warrant 1A, 2, and 3.

The analysis shows that the Center Street & Randolph Street and Center Street & Cady Street do not meet the signal warrants. Therefore, these intersections should be monitored to determine if/when signals or additional traffic control is warranted or recommended.

7.2 FUTURE CONDITIONS ANALYSIS SUMMARY

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements in the future conditions, the mitigation measures evaluated in the existing and background conditions analyses were investigated in addition to mitigation measures identified as necessary to accommodate the projected site traffic volumes. The recommended mitigation measures are summarized in **Table 7.3** and the results of the analysis with the recommendations is summarized in **Table 7.3**. A comparison between the results of background and future traffic condition analysis is provided in **Appendix F**. Additionally, a figure is provided in **Appendix F** depicting the proportional impact of trip generation at the study intersections of concern.

Table 7.3: Future Intersection Mitigation Summary

Intersection		Existing Conditions Recommendation	Background Conditions Recommendation	Future Conditions Recommendations
2	Randolph Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
8	Main Street & Hutton Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
9	Main Street & Griswold Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
12	Cady Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
21	Fairbrook Street & Center Street	<i>n/a</i>	<i>n/a</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
22	Seven Mile Road & Wing Street / St. Lawrence	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
23	Seven Mile Road & Sheldon Avenue / Center Street	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout
24	Seven Mile & Hines Drive	<i>n/a</i>	<i>n/a</i>	<i>Delays on the NB approach are due to impacts/queue lengths extending from Seven Mile Road & Sheldon Avenue / Center Street intersection.</i>
26/ 27	Northville Road & N. Seven Mile Road	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.
28	Northville Road & S. Seven Mile Road	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
32	Center Street & Beal St. (Proposed)	<i>n/a</i>	<i>n/a</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>

* Details of the proposed signal timing optimization are included in Appendix F

Table 7.4: Future Conditions with Mitigation Analysis Summary

Intersection	Control	Approach	AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
8	Main Street & Hutton Street	Signalized	EBTL	No Change	20.9	C	No Change		No Change		No Change				
			EBR		18.0	B									
			WBTL		17.4	B									
			WBR		25.1	C									
			NB		8.7	A									
			SBTL		11.8	B									
			SBR		8.3	A									
			Overall		18.0	B									
9	Main Street & Griswold Street	Signalized	EBTL	No Change	35.3	D	No Change		15.6	B	No Change		15.6	B	
			EBTR		23.1	C			15.3	B			15.3	B	
			WBTL		18.2	B			16.7	B			16.7	B	
			WBTR		20.1	C			18.7	B			18.7	B	
			NB		12.0	B			12.2	B			11.7	B	
			SB		20.4	C			17.3	B			15.8	B	
			Overall		20.3	C			16.0	B			15.6	B	
			26		SB Northville Road & N. Seven Mile Road	Signalized			EBL	32.7			C	37.1	D
EBR	16.0	B		16.9			B	13.9	B	16.8	B	13.9	B	16.8	B
NBL	3.2	A		5.7			A	3.2	A	5.7	A	3.2	A	5.7	A
NBT	0.1	A		0.3			A	0.1	A	0.2	A	0.1	A	0.2	A
SB	25.0	C		26.4			C	25.0	C	25.8	C	25.0	C	25.8	C
Overall	13.0	B		12.4			B	12.0	B	12.6	B	12.0	B	12.6	B
28	Northville Road & S. Seven Mile Road	Signalized	WBL	35.2	D	33.5	C	35.2	D	42.4	D	35.2	D	42.4	D
			WBR	13.4	B	26.0	C	12.9	B	24.7	C	12.9	B	24.7	C
			NBT	30.1	C	47.7	D	33.7	C	42.7	D	33.7	C	42.7	D
			NBTR	34.5	C	49.0	D	36.7	D	44.1	D	36.7	D	44.1	D
			SBL	35.4	D	40.4	D	30.7	C	34.7	C	30.7	C	34.7	C
			SBT	10.3	B	4.3	A	10.3	B	4.2	A	10.3	B	4.2	A
			Overall	28.1	C	33.0	C	28.1	C	31.6	C	28.1	C	31.6	C

Table 7.5: Center St. and Seven Mile Rd. Intersection Mitigation Summary (Future)

Peak Period	Approach	Existing Conditions				Option 1 Signalization Improvements				Option 2 Bridge Replacement				Option 3 Roundabout			
		Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)	Delay (s/veh)	LOS	Avg. (ft)	95th % (ft)
AM	EBL	20.8	C	22	50	23.9	C	24	54	20.8	C	26	84	9.3	A	219	435
	EBTR	34.3	C	191	306	53.6	D	209	365	34.3	C	195	327				
	WBL	38.4	D	21	52	29.6	C	20	46	38.4	D	21	53	5.1	A	35	78
	WBT	18.3	B	49	99	28.3	C	52	117	18.3	B	49	102				
	WBR	17.6	B	17	47	23.8	C	14	38	17.6	B	14	44				
	NBL	21.5	B	27	63	22.1	C	18	43	21.5	C	19	48	13.8	B	2174	3787
	NBT	22.9	C	301	527	54.9	D	466	831	19.4	B	225	421				
	NBR									11.3	B	33	88				
	SBL	38.3	D	81	161	33.7	C	61	108	31.4	C	64	129	5.6	A	144	308
	SBTR	16.2	B	127	235	29.8	C	144	234	16.2	B	135	229				
	Overall	24.6	C	N/A	N/A	43.0	D	N/A	N/A	23.0	C	N/A	N/A	9.2	A	N/A	N/A
PM	EBL	33.8	C	21	50	31.6	C	25	95	33.8	C	37	94	11.4	B	112	271
	EBTR	27.1	C	150	237	54.1	D	213	331	27.1	C	158	267				
	WBL	40.9	D	80	182	37.4	D	90	235	40.9	D	110	239	10.7	B	422	774
	WBT	28.4	C	193	308	52.3	D	252	420	28.4	C	216	387				
	WBR	19.0	B	65	182	27.7	C	121	318	19.0	B	100	293				
	NBL	47.4	D	53	73	36.7	D	46	73	47.4	D	219	479	22.2	C	5215	9441
	NBT	32.0	C	3986	7609	72.9	F	3639	6264	22.4	C	361	650				
	NBR									11.6	B	44	99				
	SBL	53.7	D	94	207	33.7	C	109	294	36.4	D	113	250	17.1	C	444	744
	SBTR	23.7	C	250	407	45.0	D	355	557	23.7	C	241	381				
	Overall	29.5	C	N/A	N/A	53.1	D	N/A	N/A	26.1	C	N/A	N/A	15.8	C	N/A	N/A

8 CONCLUSIONS

- The recommended improvements identified for existing and background conditions were found to mitigate the future intersection delays at the study intersections with the additional of the site generated traffic volumes.
- No additional mitigation measures were identified with the additional site generated traffic in the Future conditions.
- The results of this analysis concludes that the majority of intersections within the City of Northville will experience a negligible increase in traffic volumes associated with the Northville Downs development. Additionally, alternatives for mitigating existing delays are recommended which will also support the projected increases in traffic volumes generated by the proposed development. Furthermore, the recommendations included herein are consistent with the recommendations identified by the City's Mobility Task Force.

Table 8.1: Analysis and Mitigation Summary

Intersection		Existing Conditions Recommendation	Background Conditions Recommendation	Future Conditions Recommendations
2	Randolph Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
8	Main Street & Hutton Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
9	Main Street & Griswold Street	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
12	Cady Street & Center Street	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>	<i>Continue to monitor intersection operations</i>
21	Fairbrook Street & Center Street	<i>n/a</i>	<i>n/a</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
22	Seven Mile Road & Wing Street / St. Lawrence	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>
23	Seven Mile Road & Sheldon Avenue / Center Street	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout	Option 2/2A: Replace bridge/culvert across the Johnson Creek to provide a NB left-turn lane with 500-ft of storage length. AND/OR Option 3/3A: Roundabout
24	Seven Mile & Hines Drive	<i>n/a</i>	<i>n/a</i>	<i>Delays on the NB approach are due to impacts/queue lengths extending from Seven Mile Road & Sheldon Avenue / Center Street intersection.</i>
26/ 27	Northville Road & N. Seven Mile Road	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.	Signal Recommended Delays for WB Stop control approach, northbound left-turn sight distance limitations.
28	Northville Road & S. Seven Mile Road	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended	Signal Timing Optimization Recommended
32	Center Street & Beal St. (Proposed)	<i>n/a</i>	<i>n/a</i>	<i>A review of network simulations indicates acceptable operations. Queue lengths were minimal and vehicles were able to find gaps in traffic.</i>

* Details of the proposed signal timing optimization are included in Appendix F

FIGURE 8: INTERSECTION MITIGATION SUMMARY

