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# Lake Avenue Reconstruction Project

## City of Fairmont, MN

### Corridor Study

**Submitted by:**

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# Certification

Corridor Study

for

Lake Avenue Reconstruction Project

City of Fairmont, MN  
West 4<sup>th</sup> Street to Park Street  
BMI Project No. F17.117990

September 16, 2019

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

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Date: September 18, 2019

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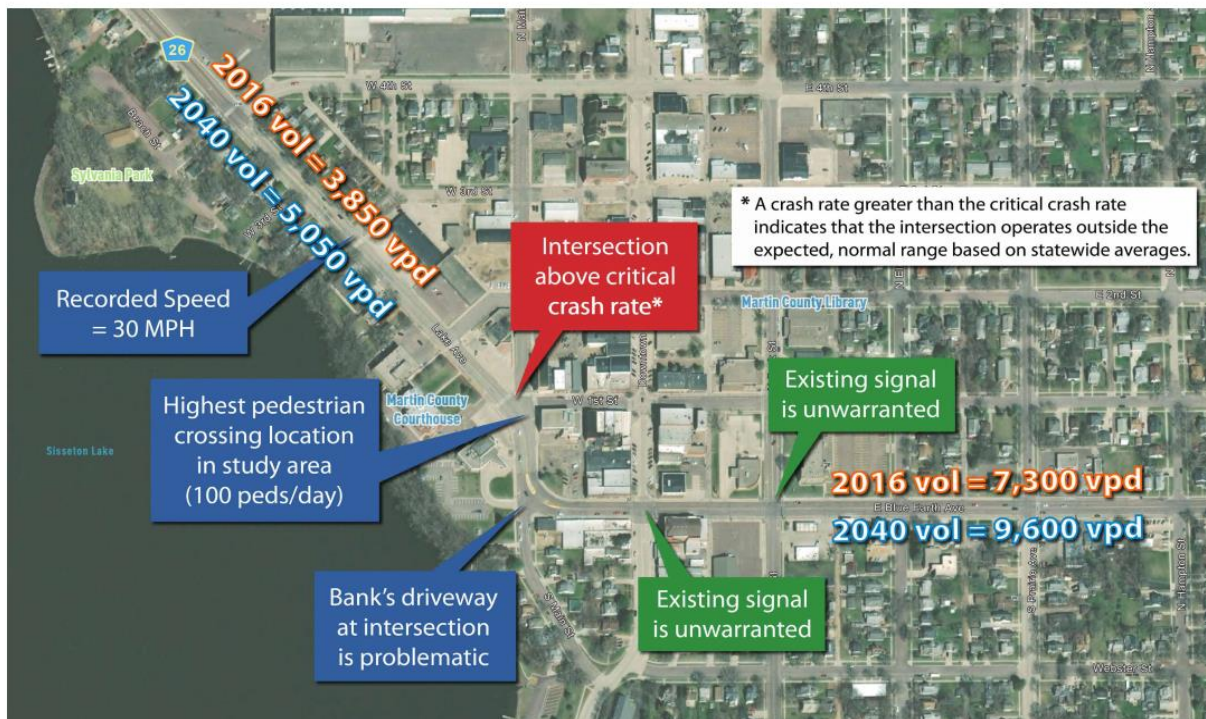
## I. Executive Summary

This study examined Lake Avenue/Blue Earth Avenue from West 4<sup>th</sup> Street to South Park Street. Based on MnDOT traffic data, this section of Lake Avenue/Blue Earth Avenue carried 3,850 vehicles per day near West 4<sup>th</sup> Street and 7,300 vehicles per day near Park Street in 2016. Lake Avenue/Blue Earth Avenue is a four-lane undivided roadway with 12-foot lanes and a speed limit of 30 mph through the project area.

The existing and future roadway needs were assessed from West 4<sup>th</sup> Street to Park Street. This analysis looked at the feasibility of a “road diet” on the corridor, signal warrants for the existing signals, geometric changes needed at problematic intersections, and pedestrian crossing needs. To ensure existing corridor needs were properly analyzed and to develop a future plan for the Park Street intersection, a larger study area was included with the traffic analysis which extended from West 4<sup>th</sup> Street to Park Street.

**Figure 1** presents a summary of the existing traffic information for this corridor.

Figure 1 - Summary of Existing Traffic Information



The existing conditions analysis showed that the Lake Avenue/Blue Earth Avenue corridor from West 4<sup>th</sup> Street to Park Street has no level of service or delay issues, as all intersections operate at LOS A. However, there are mobility, safety, and queuing issues along this corridor.



- The intersection of West 1<sup>st</sup> Street/North Main Street and Lake Avenue has a crash rate above the critical crash rate. This intersection has the highest number of pedestrians crossing at it and the existing crosswalks are wide leaving the pedestrian exposed to vehicle conflicts for a long period of time. In addition, both West 1<sup>st</sup> Street and North Main Street tie into Lake Avenue at odd grades and skews making it harder for vehicles to navigate through this intersection.
- The south leg of the intersection of South Main Street is one-way southbound at Blue Earth Avenue, this combined with the existing intersection skews and curves in this area make it difficult for drivers leaving the bank driveway to discern if Lake Avenue traffic will continue east to Blue Earth Avenue or south onto South Main Street. Additionally, one vehicle waiting to turn southbound in the westbound turn lane will often stick out into the westbound through lane as the turn lane storage is short at only 20’.
- The two signalized intersections of Downtown Plaza and Park Street have unwarranted signals and queuing issues in the northbound direction.

The proposed corridor improvements to address these mobility, safety, and queuing issues include a 4-lane to 3-lane “Road diet” along with the following intersection changes:

- a mini roundabout at Downtown Plaza and Blue Earth Avenue,
- a potential future mini roundabout at Park Street and Blue Earth Avenue,
- a realigned West 1<sup>st</sup>/North Main/Lake Avenue intersection with a median,
- a revised Profinium Bank Driveway further south of Lake Avenue/Blue Earth Avenue on South Main Street.

The results of the 2020 and 2040 Build Operations and Queuing analysis showed that with the reduction of lanes with the 3-lane configuration on Lake Avenue/Blue Earth Avenue and the intersection changes shown in the concept plan, the intersections along this corridor will continue to operate better than the No Build scenarios. All intersections will operate at LOS A with minimal delays.

Queues are improved in the Build scenarios for northbound Downtown Plaza and Park Street. The only potential problematic queuing area is with the short back to back left turns at the realigned West 1<sup>st</sup> Street/North Main Street and Lake Avenue intersection. The future queue results show that overall the anticipated queue can be accommodated for both left turn movements in the AM and PM peak but it could be close depending on the number of vehicles that arrive at a time to make these turns.

Based on the analysis documented in this report, the proposed concept plan improvements are recommended. The improvements, which include a 3-lane configuration on Lake Avenue/Blue Earth Avenue combined with intersection changes at key locations will improve operations, queuing, and safety along this corridor.

The proposed 3-lane configuration can handle up to 16,000 vehicles per day. The 2040 volumes on Lake Avenue are estimated at 5,050 vehicles and on Blue Earth at 9,600 vehicles per day.

4 to 3-lane conversions are estimated to improve safety by 29% for all crash types. Additionally, the space available with the lane reduction will be beneficial in the reconfiguration of the intersections and in addressing the existing grade and skew issues along this corridor.

These changes also addressed existing issues related to mobility and safety:

- South Main Street/West 1<sup>st</sup> Street above average critical crash rate
- A high number of pedestrians crossing at long crosswalks on Lake Avenue/West 1<sup>st</sup> Street
- Profinium Bank driveway/North Main Street problematic intersection configuration
- Unwarranted traffic signals at Downtown Plaza and Park Street

Additionally, these changes met the public preferences revealed throughout the public engagement process for:

- Improved safety
- Better walkability
- New pavement
- A bike facility

The projected cost for the modifications is \$4.7M. 25% of this cost is related to new watermain, sanitary sewer and storm sewer.

## **II. Introduction**

The City of Fairmont plans to reconstruct Lake Avenue/Blue Earth Avenue from SW 4<sup>th</sup> Street to Downtown Plaza in summer 2020. The poor pavement condition along this corridor prompted the need to reconstruct the corridor. As part of this work, the city wanted to address other issues along the corridor such as tight curves, challenging grades, complex intersections, aging signal infrastructure, lack of ADA compliance, a four-lane undivided roadway, and lack of separation of pedestrian facilities from moving traffic.

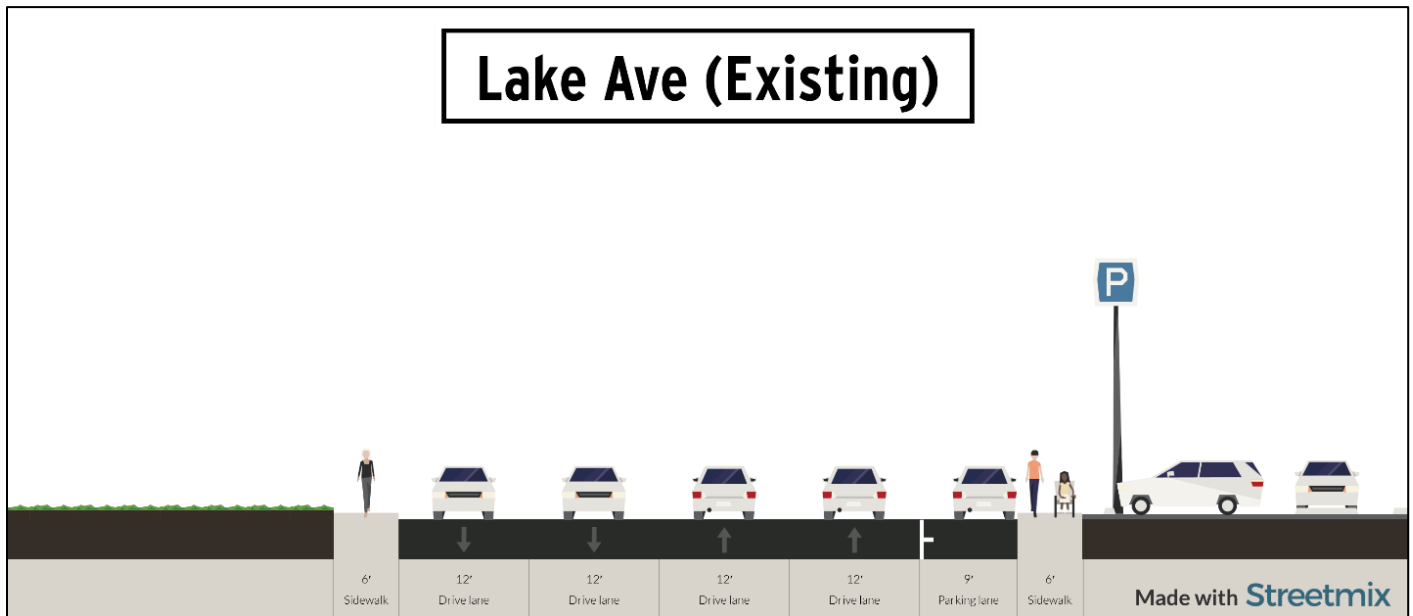
This study examined the existing and future traffic needs to accommodate vehicles, pedestrians and bicycles with this reconstruction project. To ensure existing corridor needs were properly analyzed and to develop a future plan for the Park Street intersection, a larger study area was included the traffic analysis. The study examined the area from West 4<sup>th</sup> Street to Park Street. This analysis looked at the feasibility of a “road diet” on the corridor, signal warrants for the existing signals, geometric changes needed at problematic intersections, and pedestrian crossing needs.

This study identified potential transportation issues and developed alternatives to mitigate these issues to provide a safe transportation facility for all modes.

### III. Existing Conditions Review

This study examined Lake Avenue/Blue Earth Avenue from West 4<sup>th</sup> Street to South Park Street. Based on MnDOT traffic data from 2016, this section of Lake Avenue/Blue Earth Avenue carried 3,850 vehicles per day at West 4<sup>th</sup> Street and 7,300 vehicles per day at Park Street. Lake Avenue/Blue Earth Avenue is a four-lane undivided roadway with 12-foot lanes and a speed limit of 30 mph through the project area. **Figure 2** shows a general roadway section.

Figure 2 - Existing Roadway Cross Section



Lake Avenue is part of a roadway system that runs parallel to I-90 for over 30 miles and connects communities like Sherburn, Welcome, Fairmont, Imogene, and Blue Earth as shown in **Figure 3**.

Figure 3 - Lake Avenue Corridor Location



**A. Traffic Counts**

The traffic analysis evaluated the six study intersections within the Lake Avenue corridor study area shown below in **Table 1**.

Table 1 - Study Intersections

#	Location	Control Type
1	West 4 <sup>th</sup> Street & Lake Avenue	Stop Controlled
2	West 2 <sup>nd</sup> Street & Lake Avenue	Stop Controlled
3	South Main St & Lake Ave/West 1 <sup>st</sup> Street	Stop Controlled
4	S Main St & Bank Parking/W Blue Earth Ave	Stop Controlled
5	Downtown Plaza & East Blue Earth Ave	Signal Controlled
6	South Park St & East Blue Earth Ave	Signal Controlled

The location of these study intersections along the corridor are shown in **Figure 4**.

Peak Hour Counts were collected March 5<sup>th</sup>-7<sup>th</sup>, 2019, at the study intersections. 13-hour turning movements were collected from 6:00 am to 7:00 pm. Peak hours were identified from the collected data as AM (7:30-8:30 a.m.) and PM (4:15-5:15 p.m.). The existing intersection traffic counts collected for the AM and PM peak hours are provided in the **Appendix**.

Annual Average Daily Traffic (AADT) volumes were attained from the Minnesota Department of Transportation (MnDOT).



Figure 4 - Study Area Limits and Study Intersections



## B. Roadway Characteristics

Lake Avenue/Blue Earth Avenue is a four-lane undivided roadway from West 3<sup>rd</sup> Street to the east city limits. West of West 3<sup>rd</sup> Street, Lake Avenue reduces to three lanes with one lane in each direction and a center two-way left turn lane. Lake Avenue/Blue Earth Avenue has a functional classification of major collector per MnDOT as shown in the functional classification map in **Figure 5**. It has a posted speed limit of 30 MPH with an advisory speed of 20 MPH around the curves at North Main Street and South Main Street. There is parallel parking present on the west/south side of Lake Avenue/Blue Earth Avenue for most of the study corridor. The 2016 ADT per MnDOT was 3,850 vehicles per day at West 4<sup>th</sup> Street and 7,300 vehicles per day at Park Street.

### West 4<sup>th</sup> Street at Lake Avenue

West 4<sup>th</sup> Street is a two-lane roadway with a functional classification of major collector. It has a speed limit of 30 MPH with parallel parking on both sides and is stop controlled at Lake Avenue. The northbound approach is a single-lane shared approach and the southbound approach has left-through and right lanes. There are left turn lanes eastbound and westbound on Lake Avenue at West 4<sup>th</sup> Street.

#### West 2<sup>nd</sup> Street at Lake Avenue

West 2<sup>nd</sup> Street is a two-lane roadway with a functional classification of local roadway. It has a speed limit of 30 MPH with parallel parking on both sides. It is stop controlled at Lake Avenue with a single-lane shared approach.

#### North Main Street/West 1<sup>st</sup> Street at Lake Avenue

North Main Street and West 1<sup>st</sup> Street are two-lane roadways with a functional classification of local roadway. They have a speed limit of 30 MPH with parallel parking on both sides. They are both stop controlled at Lake Avenue with single-lane shared approaches. This intersection has five-legs with the Martin County Courthouse driveway comprising the fifth leg. There is an eastbound right turn lane for the courthouse driveway and a northbound right turn lane for West 1<sup>st</sup> Street on Lake Avenue at this intersection. The existing intersection skews and Lake Avenue being higher elevation than North Main Street and West 1<sup>st</sup> Street make sight visibility of vehicles travelling on Lake Avenue challenging.

#### South Main Street/Profinium Bank Driveway at Blue Earth Avenue

As Lake Avenue bends to the east at South Main Street it becomes Blue Earth Avenue. South Main Street is a two-lane roadway with a functional classification of major collector. It has a speed limit of 30 MPH with parallel parking on both sides. This intersection has four-legs with the driveway to the Profinium Bank drive-thru and employee parking serving as the fourth leg. The bank driveway is stop controlled at Blue Earth with a single-lane shared approach. There is a southbound right turn lane and westbound left turn lane on Lake Avenue/Blue Earth Avenue at the intersection.

South Main Street is one-way southbound at this intersection, this combined with the existing intersection skews and curves in this area make it difficult for drivers leaving the bank driveway to discern if Lake Avenue traffic will continue east to Blue Earth Avenue or south onto South Main Street.

#### Downtown Plaza at Blue Earth Avenue

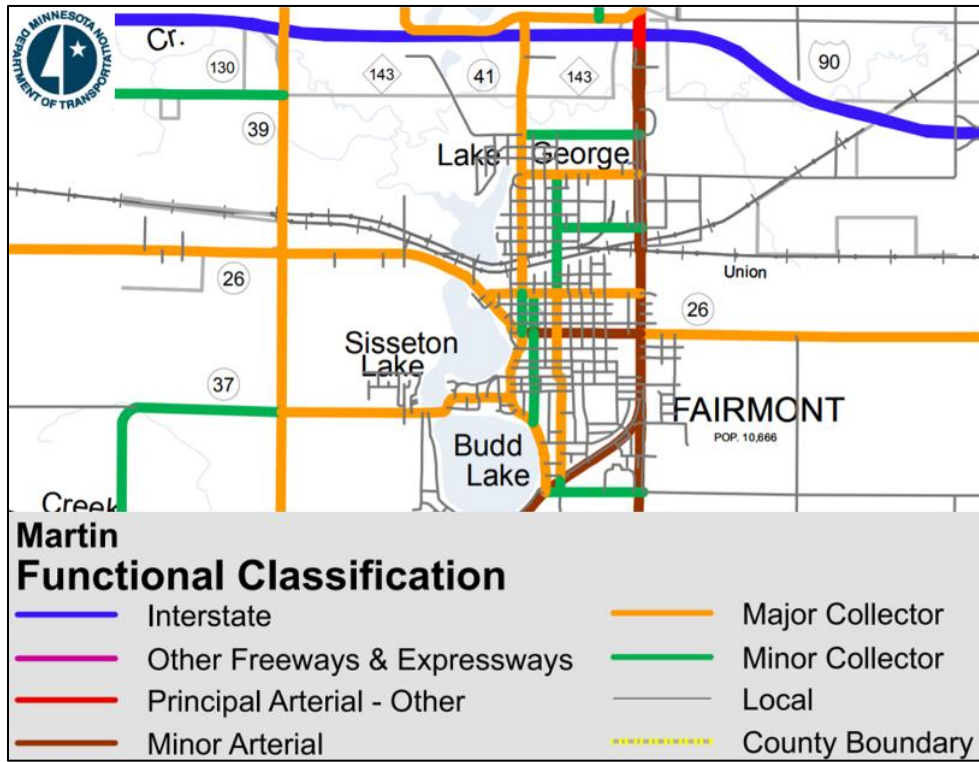
South of Blue Earth Avenue, Downtown Plaza is a two-lane, two-way roadway with a functional classification of major collector. It has a speed limit of 30 MPH with parallel parking on both sides and is signalized at Lake Avenue. The northbound approach has a left-through and right turn lane.

North of Blue Earth Avenue, Downtown Plaza is a one-lane, one-way northbound roadway with a functional classification of minor collector. It has a speed limit of 30 MPH with angle parking on both sides.

Park Street/Blue Earth Avenue

Park Street is a two-lane roadway with a functional classification of minor collector. Park Street has a speed limit of 30 MPH with parallel parking on the east side and is signalized at Lake Avenue. The northbound and southbound approaches have left-through and right turn lanes.

Figure 5 - MnDOT Functional Classification for Martin County



**C. Speed Characteristics**

Speed data was collected by the Fairmont Police Department in May 2019. The 85<sup>th</sup> percentile speed ranged from 28 to 30 MPH. This data shows that most of the vehicles are travelling at or below the posted speed limit of 30 MPH.

Table 2 - Speed Data

Location	85 <sup>th</sup> Percentile	10 MPH Pace	Existing Speed Limit (MPH)	% of Veh > Speed Limit
Lake & W 3 <sup>rd</sup> St. (EB)	30	21-30	30	0%
Blue Earth at Park St. (WB)	28	21-30	30	0%

#### **D. Roadside Development and Environment**

North of West 4<sup>th</sup> Street past the study area, the land use is industrial with a railroad company and iron manufacturing on the north side, while the south side has residential homes, Sylvania Park and The Marina Lodge.

South of West 4<sup>th</sup> Street to Park Street, Lake Avenue/Blue Earth Avenue is initially surrounded by residential land use, but transitions to commercial and retail in Downtown Fairmont. Downtown Plaza serves as the core commercial street within Downtown Fairmont. Lake Avenue from West 2<sup>nd</sup> Street to South Main Street also has Profinium Bank, the Martin County Courthouse, Human Services Center, and jail adjacent to it.

On the east end of the study area is a Casey's gas station, Salvation Army building, Presentation college and First Farmers & Merchants Bank. As Blue Earth continues further east, the area becomes primarily residential.

#### **E. Parking, Pedestrian, and Multi-modal Characteristics**

On-street parking is prevalent throughout the study area. Lake Avenue has parking on the west side from SW 4<sup>th</sup> Street to SW 1<sup>st</sup> Street. Blue Earth Avenue has two-hour parking on the south side from South Main Street to Park Street. Downtown Plaza has two-hour angle parking on both sides. Other downtown streets, such as West 1<sup>st</sup> Street and West 2<sup>nd</sup> Street also have parking spaces for limited hours.

Lake Avenue has an 8.5' sidewalk on both sides within the project area. Blue Earth Avenue has 7.5' wide sidewalk on the north side and 8.5' sidewalk on the south side. The sidewalk on South Main Street, south of Blue Earth, is currently 9.5'.

North Main Street and West 4<sup>th</sup> Street have an existing signed bike route. Lake Avenue north of West 4<sup>th</sup> Street has an off-street trail on the west side of the street.

#### **F. Pedestrian Volumes**

An analysis of pedestrian volumes was performed to better understand primary crossing locations and intersections where pedestrians congregate. The intent of this analysis was to ensure adequate pedestrian facilities are available at high-volume crossing locations and to determine whether additional measures can be implemented to improve upon existing conditions. Data collection efforts occurred in conjunction with the March 2019 13-hour vehicle turning movement counts. The pedestrian count data is shown in **Table 3**.

Pedestrian volumes are the highest at the intersection of Lake Avenue with North Main Street and West 1<sup>st</sup> Street with a total of 143 pedestrians crossing during the 13-hour count. The high volume of pedestrians is due to the movement of the people from the parking lot on North Main Street south towards the Human Services Center on West 1<sup>st</sup> Street or from the parking lot west towards the Martin County Courthouse. The stop control for North Main Street and West 1<sup>st</sup> Street provide an opportunity for pedestrians to cross those roadways, however, the current crossings on Lake Avenue and West 1<sup>st</sup> Street are uncontrolled and wide thus challenging to cross on foot.

Table 3: 13-Hour Pedestrian Volumes

13 - Hour Pedestrian Counts									
Intersection	Crossing				Total	Crossing Details			
	West Leg	East Leg	South Leg	North Leg		Existing		With Project	
						Crossing Type	Crossing Distance	Crossing Type	Crossing Distance
LAKE AVENUE & W 4TH STREET	0	3	1	5	9	X	50	X	50
LAKE AVENUE & W 2ND STREET	23	7	1	7	38	X	50	X	40
LAKE AVENUE & W 1ST STREET & N MAIN STREET	60	15	65	3	143	X	60	X	45
E BLUE EARTH AVENUE & S MAIN STREET	0	2	0	0	2	0	-	0	-
E BLUE EARTH AVENUE & DOWNTOWN PLAZA	3	25	13	6	47	S	60	R	40
E BLUE EARTH AVENUE & S PARK STREET	14	4	9	7	34	S	50	S	50

0 = No marked crossing  
 X = Unsignalized marked crossing

R = Roundabout  
 S = Signalized Crossing

The 2<sup>nd</sup> largest volume of pedestrians in the study area cross at Downtown Plaza. Most of these pedestrians are crossing between the Opera House and the retail businesses located north of the intersection. The traffic signal at this intersection helps to stop vehicles to allow a larger number of pedestrians to cross.

Currently, there are not any existing marked crossings at the Blue Earth Avenue and South Main Street intersection which is likely a contributing factor to the low the number of pedestrian crossings there.

**IV. Existing Traffic Operation Analysis**

Operations analysis of the existing AM and PM peak hours was conducted at the six study intersections to determine how traffic currently operates within the study area. A



level of service (LOS) analysis was completed to determine how well these intersections currently operate. The LOS results are based on average delay per vehicle as calculated by the 6<sup>th</sup> Edition of the Highway Capacity Manual (HCM). Control delay is the delay experienced by vehicles slowing down as they are approaching the intersection, the wait time at the intersection, and the time for the vehicle to speed up through the intersection and enter into the traffic stream. The average intersection control delay is a volume weighted average of delay experienced by all motorists entering the intersection on all intersection approaches. Intersections and each intersection approach are given a ranking from LOS A through LOS F. LOS A indicates the best traffic operation, with vehicles experiencing minimal delays. LOS A through D is generally perceived to be acceptable to drivers. LOS E indicates that an intersection is operating at, or very near, its capacity and that drivers experience considerable delays. LOS F indicates an intersection where demand exceeds capacity and drivers experience substantial delays.

#### A. Existing Level of Service

The LOS and its associated intersection delay for signalized and unsignalized intersections are presented in **Table 4**. The delay threshold for unsignalized intersections is lower for each LOS compared to signalized intersections, which accounts for the fact that people expect a higher level of service when at a stop-controlled intersection. A higher LOS (i.e. LOS D, E, and F) is indicative of elevated delay times compared to lower levels of service (i.e. LOS A, B, and C).

Table 4: Level of Service Criteria

	<i>Signalized Intersection</i>	<i>Unsignalized Intersection</i>
<i>LOS</i>	<b>Control Delay per Vehicle (sec.)</b>	<b>Control Delay per Vehicle (sec.)</b>
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	>20 and ≤ 35	>15 and ≤ 25
D	>35 and ≤ 55	>25 and ≤ 35
E	>55 and ≤ 80	>35 and ≤ 50
F	>80	>50



**Table 5**, below, provides the overall level of service, max approach queue, and if the max queue exceeds the available storage length at each of the study intersections during the AM and PM Peak hours. Peak hour factors were applied on a movement by movement basis to represent the delay experienced during the worst 15 minutes of each study peak hour. This evaluation is completed to establish the key intersections that require additional consideration. This includes determining whether the existing traffic control and intersection geometry sufficiently accommodates existing traffic conditions or if modifications should be made.

Table 5: Existing Traffic Operations

Intersection	Peak Hour	Intersection Delay (sec/veh)		Max Approach Queue			
				Direction	Average Queue (ft)	Max Queue (ft)	Exceeds Existing Turn Lane Storage?
W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	SBR	25	75	No
	PM	1	A	SBR	25	50	No
Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	0	A	SBL/R	25	50	No
	PM	0	A	SBL/R	25	50	No
N Main St & Lake Ave/W 1st St <i>Stop Controlled</i>	AM	2	A	SBL/T/R	25	75	No
	PM	2	A	SBL/T/R	50	100	No
S Main St & Bank Driveway/ Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	WBL	25	25	No
	PM	1	A	EBL/T/R	25	50	No
Downtown Plaza & Blue Earth Ave <i>Signal Controlled</i>	AM	7	A	NBL/T	50	100	Yes
	PM	9	A	WBL/T	75	125	No
S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	5	A	NBR	25	75	Yes
	PM	6	A	NBR	25	75	Yes

Overall, the corridor operates within acceptable level of service with all intersections operating with a level of service of A. The results of the above table indicate that there are no significant delay issues present throughout the corridor. It aids in determining the intersections or movements that may benefit from additional evaluation and potential changes in traffic control.

**B. Existing Queuing**

Queues (traffic backups) are a way to indicate how well traffic control and intersection configurations operate. Queues have been determined using peak hour volumes collected. The results obtained show acceptable queuing lengths throughout most of the corridor. There are two locations of concern:

- The northbound right turns at Park Street and Downtown Plaza at Blue Earth Avenue
  - Queues are exceeding the available storage which could lead to blocking of nearby driveways or parking stalls
  - Available storage is minimal at these locations, consider striping a minimum 100' northbound right turn storage bay at these locations if possible

**C. Intersection Warrant Analysis**

An evaluation was completed to check if the existing volumes still warrant the existing traffic signals at Downtown Plaza and Park Street. Minnesota Manual on Uniform Traffic Control Devices (MNMUTCD) methodology was utilized for this evaluation.

Traffic signal warrants have been developed as national guidelines to promote continuity of traffic control devices to ensure that traffic signals are installed at intersections that would benefit from their use. On Trunk Highways, Warrant 1: Eight-Hour Vehicular Volume is the primary factor in installing a traffic signal. Although Blue Earth Avenue is not a trunk highway, this same methodology was used.

Existing traffic signals are viewed slightly differently than presented directly in the MnMUTCD - lower volume thresholds than typical are used to justify retaining an existing traffic signal. The MnDOT Traffic Engineering Manual states that signals which do not meet 60% of the volume requirements for Warrant 1 (1A or 1B) are no longer justified traffic signals and should be removed. At these locations, volumes do not meet the 60% threshold for Warrant 1. See **Table 6**.

**Table 6 Existing Signal Retention Warrant Analysis**

Warrant	Downtown Plaza		Park Street	
	60%	80%	60%	80%
1A	5	0	7	1
1B	0	0	0	0

There are additional warrants the MnMUTCD states shall be included in a traffic signal study, listed below:

- Warrant 2: Four-Hour Vehicular Volume
- Warrant 3: Peak Hour
- Warrant 4: Pedestrian Volume
- Warrant 5: School Crossing
- Warrant 6: Coordinated Signal System
- Warrant 7: Crash Experience
- Warrant 8: Roadway Network
- Warrant 9: Intersection Near a Grade Crossing

None of the remaining warrants are met at these locations, with the exception of Warrant 7 at the 60% threshold at Park Street. It met the volume requirement, however, the second part of the warrant for the intersection having five or more reported crashes of types susceptible to correction by a traffic control signal, occurring within a 12-month period, was not met. There were only ten crashes total in a three-year period, or an average of 3.3 annually. The results of the signal warrant analysis are documented in the **Appendix**.

## V. Safety Review

An analysis of crashes and crash rates was completed to better understand existing safety conditions along the Lake Avenue/Blue Earth Avenue corridor at the study intersections. The results of this analysis are split into three measures including the crash rate, severity rate, and critical crash rate. The critical crash rate is utilized for the purposes of this evaluation as it provides a comparison of the study intersection to similar facilities. According to the Traffic Safety Fundamentals Handbook developed by MnDOT, the critical crash rate is the most accurate and statistically reliable method for identifying hazardous crash locations. It accounts for the design of the facility, type of intersection control, amount of exposure, and the random nature of crashes. An intersection is identified as being “unsafe” if the calculated crash rate is above the critical crash rate for the intersection.

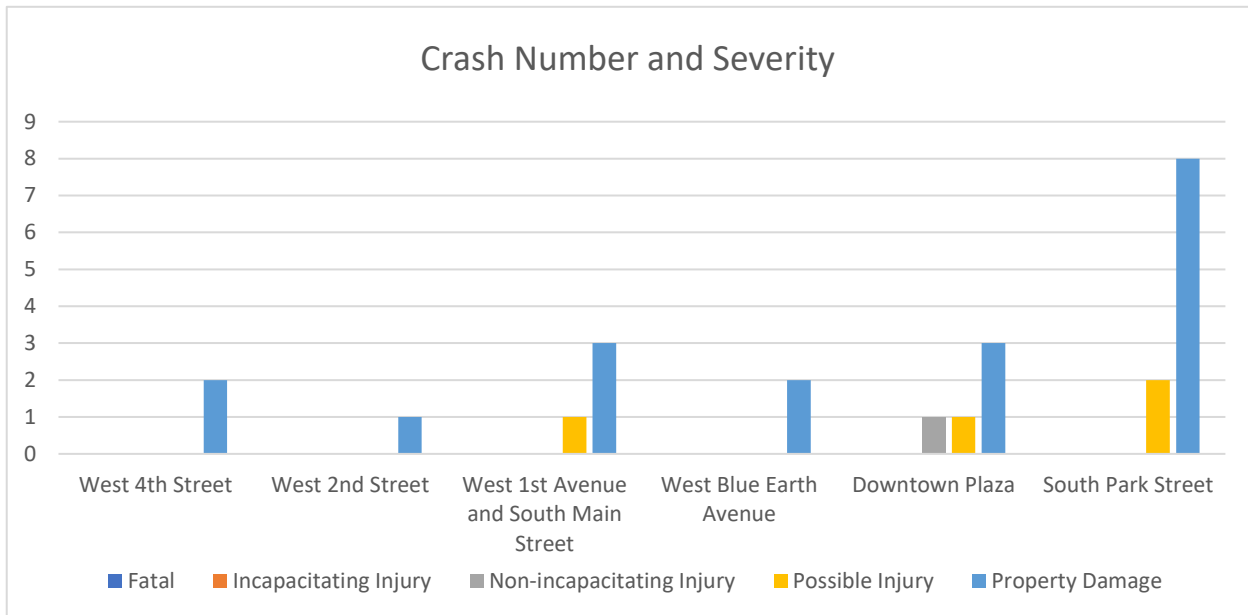
Crash data was obtained from MnDOT for a three-year time period between January 1, 2013 and December 31, 2015. This information is provided within the **Appendix** of this memorandum. No fatal or incapacitating crashes were documented over the three-year analysis period. One non-incapacitating occurred at Downtown Plaza and Blue Earth Avenue. The remaining intersection crashes involved possible injury or property damage only. **Table 7** provides more information about crash rates, crash severity rates and critical crash rates by intersection.

Table 7: Intersection Crash Frequency and Severity (2013-2015)

<b>Intersection Crash Rate</b>									
<u>Intersection</u>	<u>Traffic Control</u>	<u>Total Crashes</u>	<u>Crash Rate (per MEV)</u>	<u>Statewide Average</u>	<u>Severity Rate</u>	<u>Statewide Average</u>	<u>Crash Rate</u>	<u>//</u>	<u>Critical Crash Rate</u>
E BLUE EARTH AVENUE & S PARK STREET	Traffic Signal	10	1.2	0.52	0	0.44	1.2	<	1.23
E BLUE EARTH AVENUE & DOWNTOWN PLAZA	Traffic Signal	5	0.72	0.52	0	0.44	0.72	<	1.31
E BLUE EARTH AVENUE & BANK DWY/S MAIN STREET	Uncontrolled	2	0.39	0.14	0	0.16	0.39	<	0.66
LAKE AVENUE & W 1ST STREET & N MAIN STREET	Thru Stop	4	0.9	0.19	0	0.36	0.9	>	0.83
LAKE AVENUE & W 2ND STREET	Thru Stop	1	0.29	0.19	0	0.36	0.29	<	0.93
LAKE AVENUE & W 4TH STREET	Thru Stop	2	0.39	0.19	0	0.36	0.39	<	0.77

Average crash rates, severity rates, critical crash rates that were obtained from MnDOT using the most up-to-date version of the State Aid for Local Transportation (SALT) Intersection Green Sheets. These values are referenced in the Statewide Average columns for both crash and severity rates. **Figure 6** provides a comparison of study area intersection number of crashes by their severity. The intersection crash rates versus the statewide averages for the traffic control type present are included in **Table 7**. Crash rates were developed using the most recent AADT volumes available through MnDOT. 13-hour turning movement counts were adjusted to represent daily volumes where AADTs were not available.

Figure 6: Number of Crashes and Severity by Intersection



This analysis showed that one intersection in the study area, West 1<sup>st</sup> Street/North Main Street at Lake Avenue, has a crash rate above the critical crash rate. An elevated crash rate compared to the statewide average at the intersection of 1<sup>st</sup> Street with North Main Street at Lake Avenue means that it operates outside of the normal range of crashes expected at this type of intersection, but does not necessarily indicate that the conditions of the intersection are hazardous.

## VI. Proposed Improvements

The future build scenario analyzed the proposed project improvements. These improvements include several intersection changes and a “road diet” from West 4<sup>th</sup> Street to east of Downtown Plaza including a trail on the west side of Lake Avenue from West 4<sup>th</sup> Street to Blue Earth. Figure 8 presents the proposed “Build” typical cross section. This was the preferred street cross section from the public outreach that was conducted as part of this project planning. A summary of the responses to a public survey conducted for this project is provided in the **Appendix**.

### A. Road Diet

Four-lane undivided roadways are prevalent throughout Minnesota and the United States. They provide a significant capacity benefit for moving large volumes of through traffic through an area in constrained right-of-way situations. This design continues to be beneficial if the traffic is primarily through traffic or from one direction and the other direction has light traffic levels. The downside of the design is that as volumes get higher the left turning vehicles in one peak direction may be blocked by vehicles traveling the opposite direction

or the number of vehicles becomes high enough that any slowdown caused by a left turning vehicle begins to result in an unsafe situation as vehicles behind the left turning vehicle now have to swerve around them or stop.

As these issues arise, there may be a need to evaluate whether left turn lanes can be provided. One option is to convert the 4-lane roadway to a 3-lane road with a “road diet”. A “road diet” introduces a continuous two-way left turn lane along the roadway but reduces the number of through lanes to one in each direction. This results in a slight reduction in capacity but also results in a large increase in safety.

**a. Safety**

Studies show 4-lane to 3-lane conversions, “road diets”, are estimated to improve safety with an overall crash reduction of 29% for all crash types. The most significant reduction is opposing left turn crashes and rear end crashes by providing better sight lines for left turning traffic by creating a dedicated left turn lane and removing the turning vehicles from the through vehicle traffic stream. Opposing direction sideswipe and head-on crashes are generally reduced since the through traffic lanes are now separated by the two-way-left-turn-lane. Same direction sideswipe crashes are generally reduced since left turning vehicles now have a separate lane to wait for a gap in traffic and through traffic following behind a vehicle making a left turn does not have to swerve to get around a left turning vehicle. Additionally, right-angle and pedestrian crashes are generally reduced with the shorter crossing distances and the reduced number of through traffic lanes to watch is reduced from four to two.

**b. Operations**

It has been determined through multiple studies that a 4-lane to 3-lane “road diet” work well at volumes of 16,000 vehicles per day or less. The 2040 volumes on Lake Avenue are estimated at 5,050 vehicles and on Blue Earth at 9,600 vehicles per day. Well within the range of what a three-lane roadway can handle well. However, detailed analysis is needed to ascertain if the Lake Avenue/Blue Earth corridor would benefit from a road diet. The positive effects of the through lane reduction is that slower weaving maneuvers are reduced as all vehicles now use one lane and vehicle speeds are set by the slowest vehicle in front of them. Shorter delay results as the gaps in traffic do not have to be as large with fewer lanes to keep track of for shorter crossing distances.

The negative effects are delays are generally increased as vehicles cannot maneuver around the slower moving, turning, or slowing down vehicles.



Longer delays result as the mainline traffic volumes reduce the number of gaps with all through vehicles in one lane in each direction instead of two.

**c. Room for Multi-Modal Improvements**

A “road diet” in a corridor reduces the number of through lanes which can provide the opportunity to introduce facilities for non-motorized modes. Per the Fairmont 2017 Active Transportation Plan, Lake Avenue is proposed to have an off-street trail south of West 4<sup>th</sup> Street to tie into the existing trail and Blue Earth Avenue has a proposed signed bike route east of South Main Street. See **Figure 7**. The conversion of the corridor to three-lanes will allow room for a proposed trail on the west side of Lake Avenue to connect into the existing off-street trail at West 4<sup>th</sup> Street as shown in **Figure 8**.

Figure 7 - Excerpt from 2017 Fairmont Active Transportation Plan

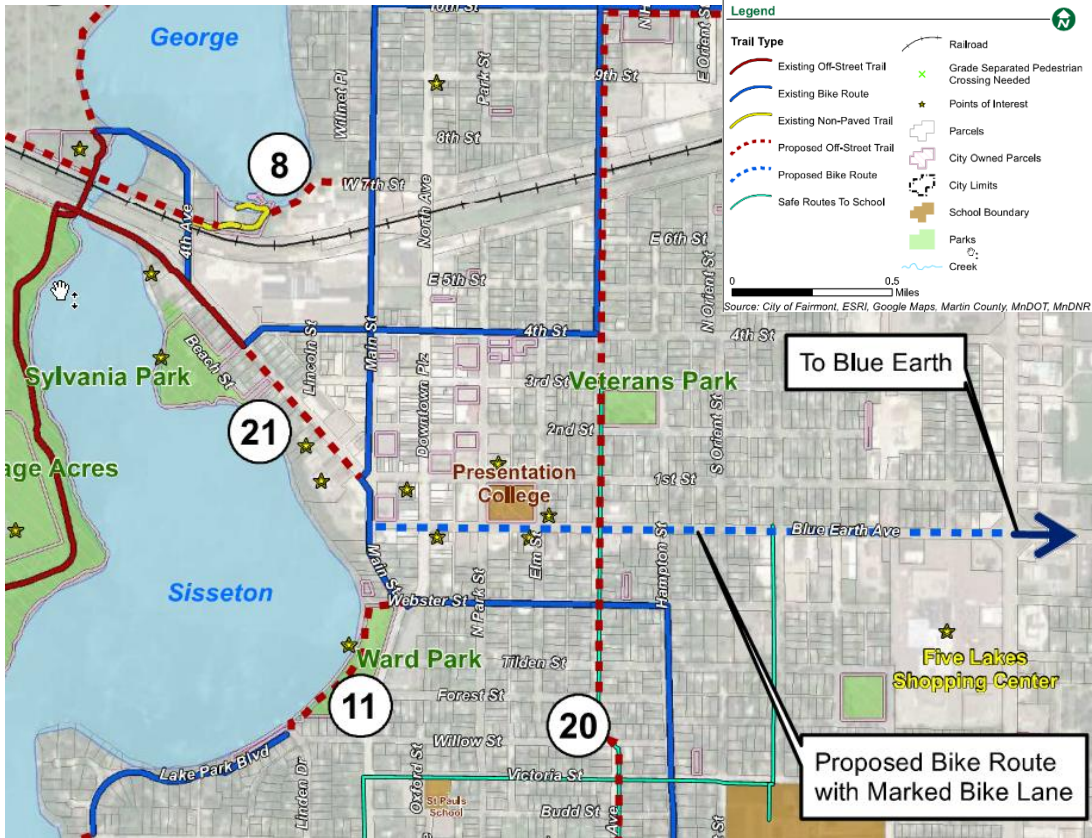
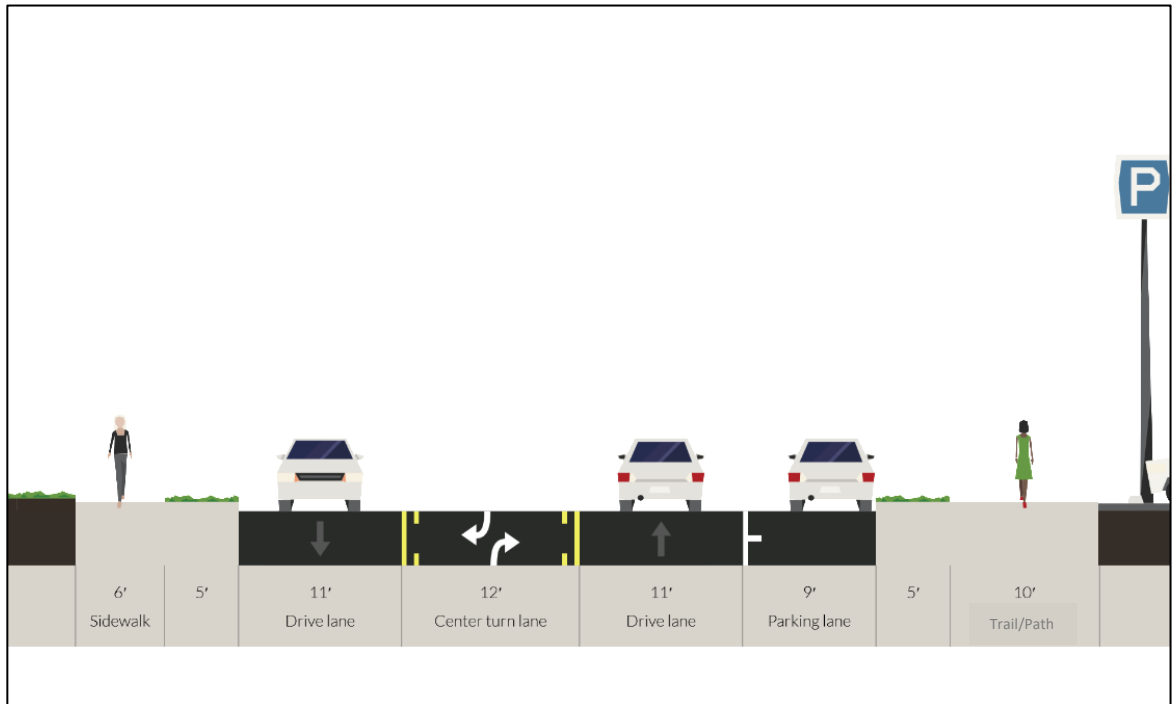


Figure 8 - Proposed "Build" Typical Street Cross Section

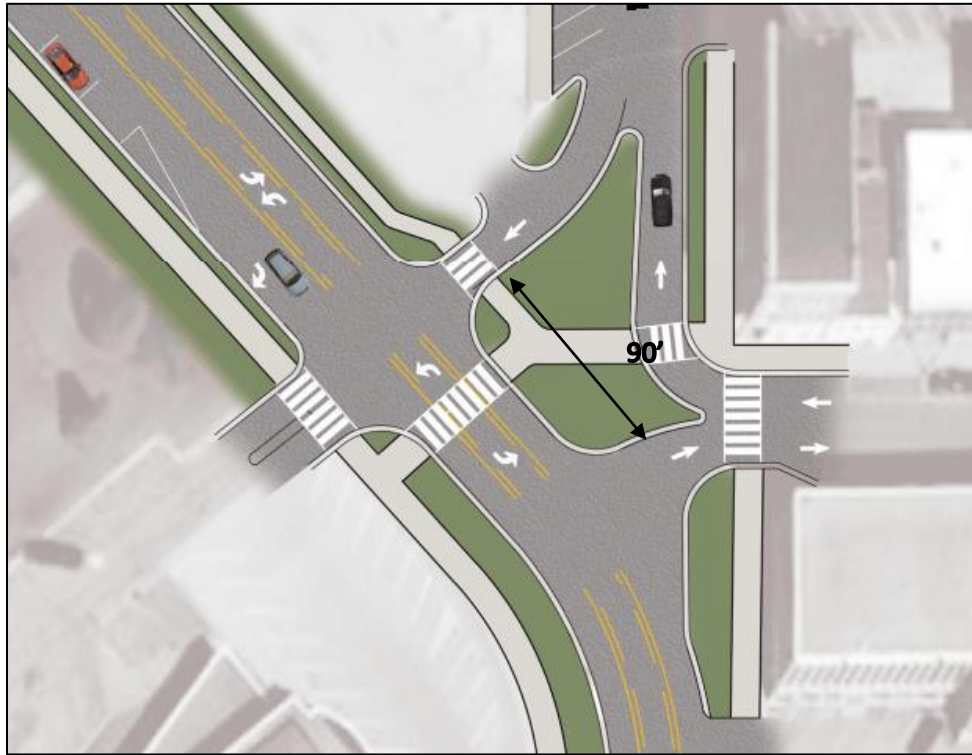


## B. Intersection Changes

The intersection changes include a mini roundabout at Downtown Plaza and Blue Earth Avenue, a realigned West 1<sup>st</sup>/North Main/Lake Avenue intersection with a median, a revised Profinium Bank Driveway further south of Lake Avenue/Blue Earth Avenue on South Main Street. **Figure 10** presents the proposed concept plan that depicts these proposed changes.

With the realigned West 1<sup>st</sup>/North Main/Lake Avenue the southbound left turn onto West 1<sup>st</sup> and the WB/NB Left turn into the County Courthouse Driveway are approximately 90' apart, leaving 45' of storage for each left turn movement. **Figure 9** shows the realigned intersection.

Figure 9 - Proposed West 1<sup>st</sup> Street/North Main Street/Lake Avenue Realignment



### C. Proposed Project Improvements Estimated Cost

A planning level cost estimate was prepared for the improvements shown in the proposed concept plan in accordance with the latest MnDOT bid items using actual bid costs received locally for past project work in the Fairmont area. The total project cost for the proposed improvements is estimated at \$4,746,000. Approximately 25% of this cost is for upgraded water main, sanitary sewer, and storm sewer. This estimate includes a 10% contingency and 18% for engineering and administration costs. A detailed cost estimate is provided in the **Appendix**.

Figure 10: Proposed Corridor Concept Plan



## VII. Future Traffic Operation Analysis

### A. Future Year Forecasts

Traffic volumes for the year 2040 were forecasted by applying a 1.3% annual growth rate to the existing 2019 traffic volumes. This growth rate was based on historical volume data collected from MnDOT and considers the highest vehicle volume that Lake Avenue/Blue Earth has ever carried. Applying this rate results in a daily traffic volume of 5,050 vehicle per day on Lake Avenue and 9,600 vehicles per day on Blue Earth Avenue by 2040.



## B. 2020 Operations

A comparison of the 2020 and 2020 Build Scenario level of service (LOS), delay, and queues follows in **Tables 8 and 9**. Overall, the corridor operates at acceptable levels with all intersections operating at LOS A. The results indicate that there are no significant traffic operation issues present throughout the corridor in 2020.

## C. 2020 Queuing

Queues (traffic backups) are a way to indicate how well certain types of traffic control and intersection configurations operate.

There are two locations of concern with the 2020 No Build:

- The northbound right turns at Downtown Plaza and the northbound through at Park Street
  - Queues are exceeding the available storage which could lead to blocking of nearby driveways

There are two locations of concern with the 2020 Build:

- With a roundabout at Downtown Plaza, the northbound queue reduces to 25 feet total or only one vehicle length.
- At Park Street the queue increases and exceeds the available storage which could lead to blocking of nearby driveways. The city should consider a mini roundabout at Park Street to reduce queuing at this intersection as part of a future project.
- At the realigned intersection of West 1<sup>st</sup>/North Main/Lake Avenue, the southbound left turn onto West 1<sup>st</sup> Street and the NB Left turn into the County Courthouse driveway are approximately 90' apart, leaving 45' of storage for each left turn movement. The queue for the southbound left turn is projected to be 50' in the PM Peak and the northbound left turn into the Courthouse driveway is projected to be 25'. With 90' of available storage and 75' of total queue, there is a chance that some queueing out of the available turn lane storage in this area could occur.



Table 8: 2020 No Build

Intersection	Peak Hour	Intersection Delay (sec/veh)		Max Approach Queue			
				Direction	Average Queue (ft)	Max Queue (ft)	Exceeds Existing Turn Lane Storage?
W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	SBR	25	75	No
	PM	1	A	SBR	25	50	No
Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	0	A	SBL/R	25	50	No
	PM	0	A	SBL/R	25	50	No
N Main St & Lake Ave/W 1st St <i>Stop Controlled</i>	AM	2	A	SBL/T/R	25	75	No
	PM	2	A	SBL/T/R	50	100	No
S Main St & Bank Driveway/ Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	WBL	25	25	No
	PM	1	A	EBL/T/R	25	50	No
Downtown Plaza & Blue Earth Ave <i>Signal Controlled</i>	AM	7	A	NBL/T	50	100	Yes
	PM	9	A	WBL/T	75	125	No
S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	5	A	NBR	25	75	Yes
	PM	6	A	NBR	25	75	Yes

Table 9: 2020 Build

Intersection	Peak Hour	Intersection Delay		Max Approach Queue			
				Direction	Average Queue (ft)	Max Queue (ft)	Exceeds Existing Turn Lane Storage?
W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	SBR	25	75	No
	PM	1	A	SBR	25	75	No
Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	1	A	SBL/R	50	75	No
	PM	1	A	SBL/R	50	75	No
Lake Ave/W 1st St <i>Stop Controlled</i>	AM	0	A	NBR	25	50	No
	PM	0	A	SBL	25	50	Yes
S Main St & Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	WBL	25	25	No
	PM	0	A	WBL	25	25	No
Downtown Plaza & Blue Earth Ave <i>Roundabout</i>	AM	5	A	WBL/T/R	25	25	No
	PM	5	A	WBL/T/R	25	25	No
S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	5	A	NBL/T	50	100	Yes
	PM	6	A	WBL/T	75	125	No
S Main St/Realigned Bank Driveway <i>Stop Controlled</i>	AM	0	A	-	-	-	No
	PM	1	A	EBR	25	50	No
Lake Ave/N Main St <i>Stop Controlled</i>	AM	1	A	WBL/T/R	50	75	No
	PM	1	A	WBL/T/R	50	75	No

Table 10: 2040 No Build

Intersection	Peak Hour	Intersection Delay		Max Approach Queue			
				Direction	Average Queue (ft)	Max Queue (ft)	Exceeds Existing Turn Lane Storage?
W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	SBR	50	75	No
	PM	1	A	SBR	50	75	No
Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	0	A	SBL/R	25	50	No
	PM	0	A	SBL/R	25	50	No
N Main St & Lake Ave/W 1st St <i>Stop Controlled</i>	AM	2	A	SBL/T/R	50	100	No
	PM	2	A	SBL/T/R	50	100	No
S Main St & Bank Driveway/ Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	WBL	25	25	No
	PM	2	A	EBL/T/R	25	75	No
Downtown Plaza & Blue Earth Ave <i>Signal Controlled</i>	AM	8	A	NBR	25	100	Yes
	PM	9	A	NBR	25	75	Yes
S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	6	A	NBR	25	50	Yes
	PM	7	A	NBR	25	75	Yes

Table 11: 2040 Build

Intersection	Peak Hour	Intersection Delay (1.)		Max Approach Queue			
				Direction	Average Queue (ft)	Max Queue (ft)	Exceeds Existing Turn Lane Storage?
W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	SBR	50	75	No
	PM	2	A	SBR	50	75	No
Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	2	A	SBL/R	50	75	No
	PM	2	A	SBL/R	50	75	No
Lake Ave/W 1st St <i>Stop Controlled</i>	AM	0	A	NBR	25	50	No
	PM	0	A	NBL	25	50	Yes
S Main St & Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	SBL	25	50	No
	PM	1	A	WBL	25	50	No
Downtown Plaza & Blue Earth Ave <i>Roundabout</i>	AM	6	A	WBL/T/R	25	25	No
	PM	6	A	WBL/T/R	50	50	No
S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	6	A	NBR	25	75	Yes
	PM	7	A	WBL	25	100	No
S Main St/Realigned Bank Driveway <i>Stop Controlled</i>	AM	0	A	-	-	-	No
	PM	1	A	EBR	25	75	No
Lake Ave/N Main St <i>Stop Controlled</i>	AM	1	A	WBL/T/R	50	75	No
	PM	1	A	WBL/T/R	50	75	No

#### **D. 2040 Operations**

The same traffic issues that exist in 2020 are expected to continue and slightly worsen, however, the corridor still operates within acceptable levels with all intersections operating at LOS A. The results of the following **Tables 10 and 11** indicate that there are no significant traffic issues present throughout the corridor with the planned improvements in place in 2040.

#### **E. 2040 Queuing**

As with the 2020 Build scenario, queuing improves at most intersections when the 2040 Build scenario is compared to the 2040 No Build scenario. The problematic queue locations in the 2020 Build and 2020 No Build are still present in 2040.

### **VIII. Design Considerations**

As the design moves forward from the preliminary concept phase the following items should be considered:

#### **A. Access**

There are numerous private and public accesses along the roadway corridor. An overview of the access locations and their spacing indicates that the three-lane section will provide advantages over the four-lane section. As the project moves into design, these access points should be modified to the extent possible with the reconstruction of the roadway to improve access and entry/exit from Lake Avenue/Blue Earth Avenue.

#### **B. Lane Width**

The *MnDOT Local State Aid Route Standards* provide minimum design standards for urban reconstruction projects without a designated on-road bicycle facility as shown in **Figure 11**. For ADT<10,000 vehicles/day, lane widths can be 10-11 feet with a curb reaction distance of 1-2 feet. Parking lanes should be 7-8'. The guidelines do suggest that in commercial or industrial areas, the minimum parking lane width is 8'. Given this, the proposed cross section meets the minimum design standard requirements for MnDOT State Aid.

The proposed cross section has a sidewalk/trail on each side separated by a 5' grass buffer. The lane widths proposed are a 9' parking lane, two 11' drive lanes and a 12' two-way left turn lane.

#### **C. Bike Facilities**

The Fairmont 2017 Active Transportation Plan called for a proposed off-street trail along Lake Avenue in the project area. A proposed future bike route is shown for Blue Earth Avenue. Consideration should be given on how to sign for the bike route on Blue Earth Avenue as part of this reconstruction project.

#### **D. Parking**

There is currently parallel parking provided on one side of Lake Avenue/Blue Earth Avenue. With the change to a three-lane section, the parking will be maintained.

More parking should be added where possible in the area near the Martin County Courthouse and Human Services Center as on-street parking demand in this area is high.

Additionally, throughout the corridor more on-street ADA spaces should be included with the final design, especially around the Opera House.

#### **E. Traffic Signal**

The Park Street signal is to remain for now. The existing traffic signal head alignment at the Park Street signal should be reviewed during the design phase to ensure proper head alignment with the roadway restriping that will be taking place to the west of this signal.

Although not part of the initial construction project, the signal at Park Street is unwarranted and should be considered for removal in the future. An initial look at the traffic operations results with a mini-roundabout show that a mini-roundabout would lessen queuing at this intersection and should be contemplated as the future traffic control for this intersection.

#### **F. Trucks**

Lake Avenue/Blue Earth Avenue has an average truck percentage of 2-3%. This is considered in line with a typical heavy vehicle percentage assumed for most roadways. This heavy vehicle percentage should be considered in the design.

Figure 11: MnDOT Minimum Design Standards for Urban Roads

8820.9936 LOCAL STATE-AID ROUTE STANDARDS, FINANCING <span style="float: right;">34</span>				
8820.9936 MINIMUM DESIGN STANDARDS, URBAN; NEW OR RECONSTRUCTION PROJECTS.				
New or reconstruction projects for urban roadways without a designated on-road bicycle facility must meet or exceed the minimum dimensions indicated in the following design chart.				
Projected Traffic Volume	Design Speed	Lane Width (a)	Curb Reaction Distance (c)	Parking Lane Width (e)
	mph	feet	feet	feet
ADT < 10,000	30-45	(b) 10-11	1-2 (d)	7-8
	50 or over	11-12	2	8-10
ADT ≥ 10,000	30-35	(b) 10-11	1-2 (d)	7-10
	40-45	11-12	1-4	7-10
	50 or over	11-12	2-4	Not allowed

Engineering judgment may be used to choose a lane-width dimension other than the widths indicated in the chart for roadways. Factors to consider include safety, speed, population/land use, benefit/cost analysis, traffic mix, peak hourly traffic, farm equipment, environmental impacts, terrain limitations, bicycle traffic, pedestrian traffic, other nonmotorized uses, functional classification, or other factors. Widths less than those indicated in the chart require a variance in accordance with parts 8820.3300 and 8820.3400.

(a) Twelve feet should be considered in industrial areas. One-way turn lanes must be at least ten feet wide, except 11 feet is required if the design speed is 50 mph or higher.

(b) Ten feet may be considered where truck or bus volumes are relatively low, rights-of-way are constrained, and design speeds are 35 mph or less. Eleven feet minimum is required on four-lane, undivided facilities.

(c) Curb reaction must be provided only where parking is not provided.

(d) The state-aid engineer may approve a zero-foot curb reaction distance where the cross-section is constrained, appropriate curb types are used, and drainage collection is adequate. The curb must be constructed without a gutter or monolithically with the adjacent traveled way.

(e) The roadway ADT and the vehicle mix must be considered when determining parking lane width. In commercial or industrial areas, the minimum parking lane width is eight feet.

## IX. Conclusions

The existing conditions analysis showed that the Lake Avenue/Blue Earth Avenue corridor from West 4<sup>th</sup> Street to Park Street has no level of service or delay issues, as all intersections operate at LOS A. However, there are mobility, safety, and queuing issues along this corridor.

- The intersection of West 1<sup>st</sup> Street/North Main Street and Lake Avenue has a crash rate above the critical crash rate. This intersection has the highest number of pedestrians crossing at it and the existing crosswalks are wide leaving the pedestrian exposed to vehicle conflicts for a long period of time. In addition, both West 1<sup>st</sup> Street and North Main Street tie into Lake Avenue at odd grades and skews making it harder for vehicles to navigate through this intersection.
- The south leg of the intersection of South Main Street is one-way southbound at Blue Earth Avenue, this combined with the existing intersection skews and curves in this area make it difficult for drivers leaving the bank driveway to discern if Lake Avenue traffic will continue east to Blue Earth Avenue or south onto South Main Street. Additionally, one vehicle waiting to turn southbound in the westbound turn lane will often stick out into the westbound through lane as the turn lane storage is short at only 20’.
- The two signalized intersections of Downtown Plaza and Park Street have unwarranted signals and queuing issues in the northbound direction.

The proposed corridor improvements to address these mobility, safety, and queuing issues include a 4-lane to 3-lane “Road diet” along with the following intersection changes:

- a mini roundabout at Downtown Plaza and Blue Earth Avenue,
- a potential future mini roundabout at Park Street and Blue Earth Avenue,
- a realigned West 1<sup>st</sup>/North Main/Lake Avenue intersection with a median,
- a revised Profinium Bank Driveway further south of Lake Avenue/Blue Earth Avenue on South Main Street.

The results of the 2020 and 2040 Build Operations and Queuing analysis show that with the reduction of lanes with the “road diet” on Lake Avenue/Blue Earth Avenue and the intersection changes shown in the concept plan, the intersections along this corridor will continue to operate better than the No Build scenarios. All intersections will operate at LOS A with minimal delays.

Queues are improved in the Build scenarios for northbound Downtown Plaza and Park Street. The only potential problem queuing area is with the short back to back left turns at the realigned West 1<sup>st</sup> Street/North Main Street and Lake Avenue intersection. The future queue results show that overall the anticipated queue can be accommodated for both left turn movements in the AM and PM peak but it could be close depending on the number of vehicles that arrive at a time to make these turns.



## X. Recommendations

Based on the analysis documented in this report, the proposed concept plan improvements are recommended. The improvements, which include a “road diet” on Lake Avenue/Blue Earth Avenue combined with intersection changes at key locations will improve operations, queuing, and safety along this corridor.

“Road diets” can handle up to 16,000 vehicles per day. The 2040 volumes on Lake Avenue are estimated at 5,050 vehicles and on Blue Earth at 9,600 vehicles per day. Well within the range of what a three-lane roadway can handle well.

Four to three lane conversions are estimated to improve safety with an overall crash reduction of 29% for all crash types. Additionally, the space available with the lane reduction will be beneficial in the reconfiguration of the intersections and in addressing the existing grade and skew issues along this corridor.

These changes addressed existing issues related to mobility, safety, and queuing along this corridor:

- South Main Street/West 1<sup>st</sup> Street above average critical crash rate
- A high number of pedestrians crossing at long crosswalks on Lake Avenue/West 1<sup>st</sup> Street
- Profinium Bank driveway/North Main Street problematic intersection configuration
- Unwarranted traffic signals at Downtown Plaza and Park Street

These changes also met the public preferences revealed through the public input survey for:

- Improved safety
- Better walkability
- New pavement
- A bike facility

# APPENDIX





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**Legend**

**Turning Movement Counts**

← AM (PM)

0 300 Feet

Source: MnDOT, MnDNR

Map Document: \\arcserver1\GIS\FAIR\1717960\ESRI\Map\17960\_2040\_NoBuild\_TMC\_11x17L.mxd | Date Saved: 9/16/2019 9:42:44 AM





Map Document: \\arcserver1\GIS\FAIR\F1717960\ESRI\Map117960\_2040\_Build\_TMC\_11x17L.mxd | Date Saved: 9/16/2019 9:43:38 AM



## SIGNAL WARRANTS ANALYSIS - Blue Earth and Downtown Plaza\_80%

LOCATION: Fairmont, MN

COUNTY: Martin

REF. POINT:   
 DATE: 3/5/2019   
 OPERATOR: JM

Speed	Approach Description	Lanes
30	Major App1: Blue Earth Ave	2
30	Major App3: Blue Earth Ave	2
30	Minor App2: Minor App4: Downtown Plaza	1

0.70 FACTOR USED?

No

POPULATION < 10,000?

No

EXISTING SIGNAL ?

Yes

THRESHOLDS 1A/1B:

480/720

120/60

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 1A/1B	MET SAME 1A/1B
0:00 - 1:00			0	/				/	/
1:00 - 2:00			0	/				/	/
2:00 - 3:00			0	/				/	/
3:00 - 4:00			0	/				/	/
4:00 - 5:00			0	/				/	/
5:00 - 6:00			0	/				/	/
6:00 - 7:00	24	92	116	/			39	/	/
7:00 - 8:00	87	171	258	/			157	X/X	/
8:00 - 9:00	99	170	269	/			105	/X	/
9:00 - 10:00	101	158	259	/			61	/X	/
10:00 - 11:00	105	167	272	/			62	/X	/
11:00 - 12:00	134	202	336	/			90	/X	/
12:00 - 13:00	146	265	411	/			102	/X	/
13:00 - 14:00	101	206	307	/			105	/X	/
14:00 - 15:00	105	210	315	/			73	/X	/
15:00 - 16:00	173	238	411	/			124	X/X	/
16:00 - 17:00	158	270	428	/			118	/X	/
17:00 - 18:00	165	221	386	/			92	/X	/
18:00 - 19:00	56	124	180	/			68	/X	/
19:00 - 20:00			0	/				/	/
20:00 - 21:00			0	/				/	/
21:00 - 22:00			0	/				/	/
22:00 - 23:00			0	/				/	/
23:00 - 24:00			0	/				/	/

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	3	8	Not satisfied

## SIGNAL WARRANTS ANALYSIS - Blue Earth and Downtown Plaza 60%

LOCATION: Fairmont, MN

COUNTY: Martin

REF. POINT:

DATE: 3/5/2019

OPERATOR: JM

Speed	Approach Description	Lanes
30	Major App1: Blue Earth Ave	2
30	Major App3: Blue Earth Ave	2
	Minor App2:	
30	Minor App4: Downtown Plaza	1

0.70 FACTOR USED?

Yes

POPULATION < 10,000?

Yes

EXISTING SIGNAL ?

Yes

THRESHOLDS 1A/1B:

335/503

83/41

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 1A/1B	MET SAME 1A/1B
0:00 - 1:00			0	/				/	/
1:00 - 2:00			0	/				/	/
2:00 - 3:00			0	/				/	/
3:00 - 4:00			0	/				/	/
4:00 - 5:00			0	/				/	/
5:00 - 6:00			0	/				/	/
6:00 - 7:00	24	92	116	/			39	/	/
7:00 - 8:00	87	171	258	/			157	X/X	/
8:00 - 9:00	99	170	269	/			105	X/X	/
9:00 - 10:00	101	158	259	/			61	/X	/
10:00 - 11:00	105	167	272	/			62	/X	/
11:00 - 12:00	134	202	336	X/			90	X/X	X/
12:00 - 13:00	146	265	411	X/			102	X/X	X/
13:00 - 14:00	101	206	307	/			105	X/X	/
14:00 - 15:00	105	210	315	/			73	/X	/
15:00 - 16:00	173	238	411	X/			124	X/X	X/
16:00 - 17:00	158	270	428	X/			118	X/X	X/
17:00 - 18:00	165	221	386	X/			92	X/X	X/
18:00 - 19:00	56	124	180	/			68	/X	/
19:00 - 20:00			0	/				/	/
20:00 - 21:00			0	/				/	/
21:00 - 22:00			0	/				/	/
22:00 - 23:00			0	/				/	/
23:00 - 24:00			0	/				/	/

Met (Hr)    Required (Hr)

Warrant 1A	5	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	8	8	Satisfied, check accident record

## SIGNAL WARRANTS ANALYSIS - Blue Earth and Park 80%

LOCATION: Fairmont, MN

COUNTY: Martin

REF. POINT:   
 DATE: 3/5/2019   
 OPERATOR: JM

Speed	Approach Description	Lanes
30	Major App1: Blue Earth Ave	2
30	Major App3: Blue Earth Ave	2
30	Minor App2:	
30	Minor App4: Park St	1

0.70 FACTOR USED?

No

POPULATION < 10,000?

No

EXISTING SIGNAL ?

Yes

THRESHOLDS 1A/1B:

480/720

120/60

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 1A/1B	MET SAME 1A/1B
0:00 - 1:00			0	/				/	/
1:00 - 2:00			0	/				/	/
2:00 - 3:00			0	/				/	/
3:00 - 4:00			0	/				/	/
4:00 - 5:00			0	/				/	/
5:00 - 6:00			0	/				/	/
6:00 - 7:00	51	83	134	/	27		9	/	/
7:00 - 8:00	151	181	332	/	56		43	/	/
8:00 - 9:00	145	191	336	/	53		56	/	/
9:00 - 10:00	130	177	307	/	27		53	/	/
10:00 - 11:00	134	189	323	/	34		85	/X	/
11:00 - 12:00	165	230	395	/	41		104	/X	/
12:00 - 13:00	181	270	451	/	50		122	X/X	/
13:00 - 14:00	140	230	370	/	50		105	/X	/
14:00 - 15:00	144	231	375	/	46		104	/X	/
15:00 - 16:00	210	253	463	/	43		107	/X	/
16:00 - 17:00	200	293	493	X/	47		120	X/X	X/
17:00 - 18:00	228	246	474	/	39		116	/X	/
18:00 - 19:00	82	146	228	/	29		53	/	/
19:00 - 20:00			0	/				/	/
20:00 - 21:00			0	/				/	/
21:00 - 22:00			0	/				/	/
22:00 - 23:00			0	/				/	/
23:00 - 24:00			0	/				/	/

	Met (Hr)	Required (Hr)	
Warrant 1A	1	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	0	8	Not satisfied

## SIGNAL WARRANTS ANALYSIS - Blue Earth and Park 60%

LOCATION: Fairmont, MN

COUNTY: Martin

REF. POINT:

DATE: 3/5/2019

OPERATOR: JM

Speed	Approach Description	Lanes
30	Major App1: Blue Earth Ave	2
30	Major App3: Blue Earth Ave	2
	Minor App2:	
30	Minor App4: Park St	1

0.70 FACTOR USED?

Yes

POPULATION < 10,000?

Yes

EXISTING SIGNAL ?

Yes

THRESHOLDS 1A/1B:

335/503

83/41

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 1A/1B	MET SAME 1A/1B
0:00 - 1:00			0	/				/	/
1:00 - 2:00			0	/				/	/
2:00 - 3:00			0	/				/	/
3:00 - 4:00			0	/				/	/
4:00 - 5:00			0	/				/	/
5:00 - 6:00			0	/				/	/
6:00 - 7:00	51	83	134	/	27		9	/	/
7:00 - 8:00	151	181	332	/	56		43	/X	/
8:00 - 9:00	145	191	336	X/	53		56	/X	/
9:00 - 10:00	130	177	307	/	27		53	/X	/
10:00 - 11:00	134	189	323	/	34		85	X/X	/
11:00 - 12:00	165	230	395	X/	41		104	X/X	X/
12:00 - 13:00	181	270	451	X/	50		122	X/X	X/
13:00 - 14:00	140	230	370	X/	50		105	X/X	X/
14:00 - 15:00	144	231	375	X/	46		104	X/X	X/
15:00 - 16:00	210	253	463	X/	43		107	X/X	X/
16:00 - 17:00	200	293	493	X/	47		120	X/X	X/
17:00 - 18:00	228	246	474	X/	39		116	X/X	X/
18:00 - 19:00	82	146	228	/	29		53	/X	/
19:00 - 20:00			0	/				/	/
20:00 - 21:00			0	/				/	/
21:00 - 22:00			0	/				/	/
22:00 - 23:00			0	/				/	/
23:00 - 24:00			0	/				/	/

	Met (Hr)	Required (Hr)	
Warrant 1A	7	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	9	8	Satisfied, check accident record

Table 1A: 2019 Existing Traffic Operations Analysis - Lake Ave Improvements

Intersection ID	Intersection	Peak Hour	Intersection Delay		Movement Delay (sec/veh)															Maximum Delay-LOS (2.)		Limiting Movement (3.)	Max Approach Queue											
					NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Direction	Average Queue (ft)	Max Queue (ft)															
1	W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	-	-	8	A	2	A	6	A	10	B	3	A	2	A	0	A	0	A	-	0	A	0	A	10	B	SBT	SBR	25	75	
		PM	1	A	12	B	6	A	4	A	6	A	9	A	3	A	2	A	0	A	0	A	2	A	1	A	0	A	12	B	NBL	SBR	25	50
4	Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	0	A	-	-	-	-	4	A	-	-	3	A	2	A	0	A	0	A	0	A	-	0	A	0	A	4	A	SBL	SBL/R	25	50	
		PM	0	A	-	-	-	-	5	A	-	-	3	A	2	A	0	A	0	A	0	A	-	0	A	0	A	5	A	SBL	SBL/R	25	50	
5	N Main St & Lake Ave/W 1st St <i>Stop Controlled</i>	AM	2	A	0	A	0	A	0	A	6	A	9	A	5	A	0	A	0	A	0	A	8	A	8	A	3	A	9	A	SBT	SBL/T/R	25	75
		PM	2	A	0	A	0	A	1	A	6	A	9	A	3	A	1	A	1	A	0	A	6	A	7	A	3	A	9	A	SBT	SBL/T/R	50	100
6	Main St & Bank Parking/Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	-	-	-	-	1	A	1	A	1	A	1	A	-	-	5	A	3	A	1	A	2	A	1	A	2	A	WBT	SBL	25	25
		PM	1	A	-	-	-	-	1	A	1	A	1	A	1	A	8	A	8	A	5	A	3	A	2	A	2	A	2	A	EBL	EBL/T/R	25	50
7	Downtown Plaza & Blue Earth Ave <i>Signal Controlled</i>	AM	7	A	6	A	6	A	2	A	-	-	-	-	11	B	8	A	3	A	12	B	11	B	4	A	12	B	WBL	NBL/T	50	100		
		PM	9	A	6	A	5	A	3	A	-	-	-	-	14	B	9	A	4	A	13	C	12	B	5	A	15	C	WBL	WBL/T	75	125		
8	S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	5	A	7	A	6	A	3	A	6	A	5	A	2	A	6	A	6	A	3	A	6	A	5	A	2	A	7	A	NBL	NBR	25	75
		PM	6	A	8	A	5	A	3	A	7	A	7	A	3	A	10	B	6	A	4	A	8	A	6	A	2	A	10	B	EBL	NBR	25	75

1. Delay in seconds per vehicle  
 2. Maximum delay and LOS on any approach and/or movement  
 3. Limiting Movement is the highest delay movement.



Table 1B: Peak Hour Queues By Movement - 2019 Existing Geometry

Intersection ID	Intersection	Peak Hour	Queue Lengths																																			
			EBL		EBL/T		EBL/T/R		EBT/R		WBL		WBL/T		WBL/T/R		WBT/R		NBL		NBL/T		NBL/T/R		NBR		SBL		SBL/R		SBL/T		SBL/T/R		SBR			
			Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max				
1	W 4th St & Lake Ave Stop Controlled	AM	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PM	25	50	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	Lake Ave & W 2nd St Stop Controlled	AM	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PM	-	-	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	N Main St & Lake Ave/W 1st St Stop Controlled	AM	-	-	-	0	25	-	-	-	-	-	-	-	25	50	-	-	-	25	25	0	25	-	-	-	-	-	-	-	-	-	-	25	75	-	-	
		PM	-	-	-	0	25	-	-	-	-	-	-	-	-	25	50	-	-	-	25	25	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	S Main St & Bank Parking/Blue Earth Ave Stop Controlled	AM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		PM	-	-	-	-	25	50	-	-	-	-	-	-	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	25	-	-	
7	Downtown Plaza & Blue Earth Ave Signal Controlled	AM	-	-	50	75	-	-	25	75	-	-	50	100	-	-	25	75	-	-	50	100	-	-	25	75	-	-	-	-	-	-	-	-	-	-	-	
		PM	-	-	50	100	-	-	25	75	-	-	75	125	-	-	50	100	-	-	50	100	-	-	25	75	-	-	-	-	-	-	-	-	-	-	-	-
8	S Park St & Blue Earth Ave Signal Controlled	AM	-	-	25	75	-	-	25	75	-	-	50	100	-	-	25	50	-	-	25	75	-	-	25	75	-	-	-	-	-	-	25	75	-	-	25	50
		PM	-	-	25	75	-	-	25	100	-	-	50	100	-	-	25	100	-	-	25	75	-	-	25	75	-	-	-	-	-	-	50	100	-	-	25	50



Table 2B: Peak Hour Queues By Movement - 2020 No Build Geometry

Intersection ID	Intersection	Peak Hour	Queue Lengths																																		
			EBL		EBL/T		EBL/T/R		EBT/R		WBL		WBL/T		WBL/T/R		WBT/R		NBL		NBL/T		NBL/T/R		NBR		SBL		SBL/R		SBL/T		SBL/T/R		SBR		
			Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max			
1	W 4th St & Lake Ave Stop Controlled	AM	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PM	25	50	-	-	-	-	-	-	25	25	-	-	-	-	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	50	
4	Lake Ave & W 2nd St Stop Controlled	AM	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PM	-	-	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	N Main St & Lake Ave/W 1st St Stop Controlled	AM	-	-	-	-	0	25	-	-	-	-	-	-	-	25	50	-	-	25	25	0	25	-	-	-	-	-	-	-	-	-	-	-	25	75	
		PM	-	-	-	-	0	25	-	-	-	-	-	-	-	-	25	50	-	-	25	25	0	25	-	-	-	-	-	-	-	-	-	-	50	100	
6	S Main St & Bank Parking/Blue Earth Ave Stop Controlled	AM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PM	-	-	-	-	25	50	-	-	-	-	-	-	-	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	50	
7	Downtown Plaza & Blue Earth Ave Signal Controlled	AM	-	-	50	75	-	-	25	75	-	-	50	100	-	-	25	75	-	-	50	100	-	-	25	75	-	-	-	-	-	-	-	-	-	-	
		PM	-	-	50	100	-	-	25	75	-	-	75	125	-	-	50	100	-	-	50	100	-	-	25	75	-	-	-	-	-	-	-	-	-	-	-
8	S Park St & Blue Earth Ave Signal Controlled	AM	-	-	25	75	-	-	25	75	-	-	50	100	-	-	25	50	-	-	25	75	-	-	25	75	-	-	-	-	-	-	-	-	25	50	
		PM	-	-	25	75	-	-	25	100	-	-	50	100	-	-	25	100	-	-	25	75	-	-	25	75	-	-	-	-	-	-	-	50	100	-	-

Table 4A: 2040 No Build Traffic Operations Analysis - Lake Ave Improvements

Intersection ID	Intersection	Peak Hour	Intersection Delay (1.)		Movement Delay (sec/veh)																		Maximum Delay-LOS (2.)		Limiting Movement (3.)	Max Approach Queue								
					NBL		NBT		NBR		SBL		SBT		SBR		EBL		EBT		EBR					WBL		WBT		WBR		Direction	Average Queue (ft)	Max Queue (ft)
1	W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	-	-	7	A	5	A	7	A	10	B	4	A	3	A	0	A	0	A	2	A	0	A	0	A	10	B	SBT	SBR	50	75
		PM	1	A	20	C	-	-	1	A	7	A	7	A	4	A	3	A	0	A	0	A	2	A	1	A	0	A	20	C	SBT	SBR	50	75
4	Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	0	A	-	-	-	-	8	A	-	-	3	A	3	A	0	A	0	A	-	-	0	A	0	A	8	A	SBL	SBL/R	25	50		
		PM	0	A	-	-	-	-	4	A	-	-	2	A	2	A	0	A	0	A	-	-	0	A	0	A	4	A	SBL	SBL/R	25	50		
5	N Main St & Lake Ave/W 1st St <i>Stop Controlled</i>	AM	2	A	0	A	0	A	1	A	7	A	11	B	8	A	2	A	0	A	0	A	6	A	9	A	3	A	11	B	SBT	SBL/T/R	50	100
		PM	2	A	1	A	0	A	1	A	6	A	11	B	5	A	1	A	1	A	0	A	8	A	7	A	3	A	11	B	SBT	SBL/T/R	50	100
6	Main St & Bank Parking/Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	-	-	-	-	1	A	1	A	1	A	-	-	-	-	-	-	-	2	A	2	A	2	A	2	A	WBT	WBL	25	25	
		PM	2	A	-	-	-	-	1	A	1	A	1	A	10	B	8	A	4	A	-	-	3	A	2	A	2	A	10	B	EBL	EBL/T/R	25	75
7	Downtown Plaza & Blue Earth Ave <i>Signal Controlled</i>	AM	8	A	7	A	7	A	3	A	-	-	-	-	11	B	9	A	2	A	13	B	11	B	4	A	13	B	WBL	NBR	25	100		
		PM	9	A	7	A	7	A	3	A	-	-	-	-	11	B	9	A	5	A	15	C	12	B	5	A	15	C	WBL	NBR	25	75		
8	S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	6	A	7	A	7	A	4	A	7	A	7	A	3	A	8	A	5	A	3	A	8	A	6	A	2	A	8	A	EBL	NBR	25	50
		PM	7	A	6	A	7	A	3	A	9	A	9	A	3	A	10	B	6	A	4	A	10	B	7	A	3	A	10	B	EBL	NBR	25	75

1. Delay in seconds per vehicle  
 2. Maximum delay and LOS on any approach and/or movement  
 3. Limiting Movement is the highest delay movement.



Table 3A: 2020 Build Traffic Operations Analysis - Lake Avenue Improvements

Intersection ID	Intersection	Peak Hour	Intersection Delay (s)		Movement Delay (sec/veh)															Maximum Delay-LOS (2.)		Limiting Movement	Max Approach Queue											
					NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Direction	Storage Queue	Max Queue (ft)															
1	W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	5	A	6	A	4	A	7	A	7	A	3	A	2	A	0	A	0	A	-	0	A	0	A	7	A	SBL	SBR	25	75	
		PM	1	A	6	A	5	A	3	A	6	A	8	A	3	A	2	A	0	A	0	A	2	A	0	A	0	A	8	A	SBT	SBR	25	75
4	Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	1	A	-	-	-	-	-	-	6	A	-	-	3	A	2	A	0	A	-	-	-	1	A	0	A	6	A	SBL	SBL/R	50	75	
		PM	1	A	-	-	-	-	-	-	5	A	-	-	3	A	2	A	0	A	-	-	-	1	A	0	A	5	A	SBL	SBL/R	50	75	
5	Lake Ave/W 1st St <i>Stop Controlled</i>	AM	0	A	0	A	0	A	0	A	2	A	-	-	-	-	-	-	1	A	0	A	-	-	-	-	1	A	EBT	EBR	25	50		
		PM	0	A	-	-	0	A	0	A	2	A	0	A	-	-	-	-	-	-	-	-	-	-	-	-	2	A	SBL	SBL	25	50		
6	S Main St & Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	-	-	-	-	-	-	0	A	-	-	-	-	-	-	-	-	-	-	1	A	0	A	1	A	WBL	WBL	25	25		
		PM	0	A	-	-	-	-	-	-	0	A	-	-	-	-	-	-	-	-	-	-	2	A	0	A	0	A	2	A	WBL	WBL	25	25
7	Downtown Plaza & Blue Earth Ave <i>Roundabout</i>	AM	5	A	-	-	5	A	-	-	-	-	-	-	-	3	A	-	-	-	-	-	5	A	-	-	5	A	WBL/R	WBL/T/R	25	25		
		PM	5	A	-	-	5	A	-	-	-	-	-	-	-	4	A	-	-	-	-	-	6	A	-	-	6	A	WBL/R	WBL/T/R	25	25		
8	S Park St & Blue Earth Ave <i>Stop Controlled</i>	AM	5	A	8	A	6	A	3	A	7	A	6	A	2	A	8	A	5	A	2	A	7	A	6	A	3	A	8	A	EBL	WBL/R	50	100
		PM	6	A	6	A	6	A	3	A	8	A	7	A	3	A	6	A	5	A	3	A	9	A	6	A	4	A	9	A	WBL	WBL/R	50	150
9	S Main St/Reassigned Bank Driveway <i>Stop Controlled</i>	AM	0	A	-	-	-	-	-	-	0	A	0	A	-	-	-	-	-	-	-	-	-	-	-	-	0	A	SBT	EBR	25	50		
		PM	1	A	-	-	-	-	-	-	0	A	0	A	-	-	-	-	-	-	-	-	3	A	-	-	3	A	EBR	EBR	25	50		
11	Lake Ave/N Main St <i>Stop Controlled</i>	AM	1	A	1	A	0	A	-	-	-	1	A	0	A	-	-	-	-	-	-	-	6	A	-	3	A	6	A	WBL	WBL/T/R	50	75	
		PM	1	A	1	A	0	A	-	-	0	A	0	A	6	A	-	-	3	A	5	A	-	3	A	-	3	A	6	A	EBL	WBL/T/R	50	75

1. Delay in seconds per vehicle  
 2. Maximum delay and LOS on any approach and/or movement  
 3. Limiting Movement is the highest delay movement.





Table 5A: 2040 Build Traffic Operations Analysis - Lake Avenue Improvements

Intersection ID	Intersection	Peak Hour	Intersection Delay (s)		Movement Delay (sec/veh)															Maximum Delay-LOS (2-)		ing Movement	Max Approach Queue											
					NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Direction	erage Queue	Max Queue (ft)															
1	W 4th St & Lake Ave <i>Stop Controlled</i>	AM	1	A	7	A	8	A	2	A	7	A	6	A	3	A	3	A	0	A	0	A	3	A	0	A	0	A	8	A	NBT	SBR	50	75
		PM	2	A	9	A	6	A	4	A	7	A	8	A	4	A	3	A	0	A	0	A	0	A	3	A	1	A	0	A	9	A	NBL	SBR
4	Lake Ave & W 2nd St <i>Stop Controlled</i>	AM	2	A	-	-	-	-	-	-	7	A	-	-	3	A	3	A	0	A	-	-	-	-	1	A	0	A	7	A	SBL	SBL/R	50	75
		PM	2	A	-	-	-	-	-	-	6	A	-	-	3	A	3	A	0	A	-	-	-	-	1	A	0	A	6	A	SBL	SBL/R	50	75
5	Lake Ave/W 1st St <i>Stop Controlled</i>	AM	0	A	0	A	0	A	1	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	A	EBT	EBR	25	50	
		PM	0	A	-	-	0	A	0	A	2	A	0	A	0	A	-	-	-	-	-	-	-	-	-	-	-	2	A	SBL	SBT	25	50	
6	S Main St & Blue Earth Ave <i>Stop Controlled</i>	AM	1	A	-	-	-	-	-	-	0	A	-	-	-	-	-	-	-	-	-	2	A	1	A	1	A	2	A	WBL	SBL	25	50	
		PM	1	A	-	-	-	-	-	-	0	A	-	-	-	-	-	-	-	-	-	4	A	0	A	1	A	4	A	WBL	WBL	25	50	
7	Downtown Plaza & Blue Earth Ave <i>Roundabout</i>	AM	6	A	-	-	6	A	-	-	-	-	-	-	4	A	-	-	-	-	6	A	-	-	6	A	6	A	WBL/R	WBL/T/R	25	25		
		PM	6	A	-	-	6	A	-	-	-	-	-	-	5	A	-	-	-	-	7	A	-	-	7	A	7	A	WBL/R	WBL/T/R	50	50		
8	S Park St & Blue Earth Ave <i>Signal Controlled</i>	AM	6	A	8	A	7	A	3	A	8	A	7	A	3	A	8	A	5	A	2	A	9	A	6	A	3	A	9	A	WBL	NBR	25	75
		PM	7	A	7	A	9	A	4	A	10	B	9	A	5	A	9	A	6	A	3	A	11	B	7	A	4	A	11	B	WBL	WBL	25	100
9	S Main St Reassigned Bank Driveway <i>Stop Controlled</i>	AM	0	A	-	-	-	-	-	-	0	A	0	A	-	-	-	-	-	-	-	-	-	-	-	-	-	0	A	SBT	EBR	25	50	
		PM	1	A	-	-	-	-	-	-	0	A	0	A	-	-	-	-	-	-	-	3	A	-	-	-	-	3	A	EBR	EBR	25	75	
11	Lake Ave/N Main St <i>Stop Controlled</i>	AM	1	A	2	A	0	A	-	-	1	A	0	A	-	-	-	-	-	-	8	A	-	-	4	A	8	A	WBL	WBL/T/R	50	75		
		PM	1	A	2	A	0	A	-	-	0	A	0	A	-	-	-	-	-	-	4	A	-	-	4	A	7	A	WBL	WBL/T/R	50	75		

1. Delay in seconds per vehicle  
 2. Maximum delay and LOS on any approach and/or movement  
 3. Limiting Movement is the highest delay movement.

Table SB: Peak Hour Queues By Movement - 2040 Build Geometry

Intersection ID	Intersection	Peak Hour	Queue Lengths																																							
			EBL		EBL/T/R		EBT/R		EBR		WBL		WBL/T/R		WBT/R		NBL		NBL/T		NBL/T/R		NBT		NBR		SBL		SBL/R		SBL/T		SBT		SBT/R		SBR					
			Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max						
1	W 4th St & Lake Ave Stop Controlled	AM	25	50	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	25	50	-	-	-	-	50	75
		PM	25	50	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	75		
4	Lake Ave & W 2nd St Stop Controlled	AM	25	50	-	-	-	-	-	-	-	-	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		PM	25	50	-	-	-	-	-	-	-	-	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5	Lake Ave/W 1st St Stop Controlled	AM	-	-	-	-	-	-	25	50	-	-	-	-	-	-	25	50	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		PM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	50	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	S Main St & Blue Earth Ave Stop Controlled	AM	-	-	-	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	0	25	
		PM	-	-	-	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	25	50	-	-	-	-	-	-	-	-	-	-	-	-	-	0	25	
7	Downtown Plaza & Blue Earth Ave Roundabout	AM	-	-	-	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		PM	-	-	25	25	-	-	-	-	-	50	50	-	-	-	-	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	S Park St & Blue Earth Ave Signal Controlled	AM	25	25	-	-	50	100	-	-	25	50	50	100	-	-	50	75	25	25	-	-	25	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	50	
		PM	25	25	-	-	50	125	-	-	25	100	-	-	75	150	-	-	25	75	-	-	25	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	50		
9	S Main St/Realigned Bank Driveway Stop Controlled	AM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		PM	-	-	-	-	-	-	25	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	25		
11	Lake Ave/N Main St Stop Controlled	AM	-	-	-	-	-	-	-	-	-	50	75	-	-	25	50	-	-	-	-	-	-	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PM	25	25	-	-	-	-	-	-	50	75	-	-	25	25	-	-	-	-	-	-	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

**PRELIMINARY ENGINEER'S ESTIMATE**

S.A.P. 123-111-010 (Lake Avenue/Main St/Blue Earth Avenue)

City of Fairmont, MN

BMI Project No.: F17.117990

H:\FAIR\F17117990\2\_Preliminary\A\_Calculations\2019-08-27 117990 Prelim Estimate.xlsx\ Prelim Est

ESTIMATED PORTION OF STORM SEWER ELIGIBLE FOR S.A.P. FUNDING 95%

September 16, 2019

**PRELIMINARY ENGINEER'S ESTIMATE**

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	S.A.P. 123-111-010		NON-PARTICIPATING		TOTAL PROJECT QUANTITY	S.A.P. 123-111-010		NON-PARTICIPATING			TOTAL PROJECT COST
				STREET	STORM	SANITARY	WATERMAIN		ROADWAY COST	STORM SEWER COST	STORM SEWER COST	SANITARY SEWER COST	WATERMAIN COST	
1	MOBILIZATION	LUMP SUM	\$194,000.00	0.69	0.10	0.08	0.13	1.00	\$133,860.00	\$18,430.00	\$970.00	\$15,520.00	\$25,220.00	\$194,000.00
2	CLEARING	TREE	\$500.00	4.00	1.00			5.00	\$2,000.00	\$475.00	\$25.00	\$0.00	\$0.00	\$2,500.00
3	GRUBBING	TREE	\$500.00	4.00	1.00			5.00	\$2,000.00	\$475.00	\$25.00	\$0.00	\$0.00	\$2,500.00
4	REMOVE WATERMAIN	LIN FT	\$5.00				2,600.00	2,600.00	\$0.00	\$0.00	\$0.00	\$0.00	\$13,000.00	\$13,000.00
5	REMOVE SEWER PIPE (STORM)	LIN FT	\$5.00		1,100.00			1,100.00	\$0.00	\$5,225.00	\$275.00	\$0.00	\$0.00	\$5,500.00
6	REMOVE SEWER PIPE (SANITARY)	LIN FT	\$7.00			2,000.00		2,000.00	\$0.00	\$0.00	\$0.00	\$14,000.00	\$0.00	\$14,000.00
7	REMOVE CURB & GUTTER	LIN FT	\$5.00	4,800.00				4,800.00	\$24,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$24,000.00
8	REMOVE SIGNAL LIGHT SYSTEM	LUMP SUM	\$5,000.00	1.00				1.00	\$5,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$5,000.00
9	REMOVE CONCRETE SIDEWALK/DRIVEWAY	SQ YD	\$15.00	3,700.00				3,700.00	\$55,500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$55,500.00
10	REMOVE CONCRETE/BITUMINOUS PAVEMENT	SQ YD	\$10.00	15,000.00				15,000.00	\$150,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$150,000.00
11	REMOVE MANHOLE OR CATCH BASIN	EACH	\$750.00		12.00	6.00	5.00	23.00	\$0.00	\$8,550.00	\$450.00	\$4,500.00	\$3,750.00	\$17,250.00
12	REMOVE GATE VALVE & BOX	EACH	\$500.00				4.00	4.00	\$0.00	\$0.00	\$0.00	\$0.00	\$2,000.00	\$2,000.00
13	REMOVE HYDRANT	EACH	\$750.00				4.00	4.00	\$0.00	\$0.00	\$0.00	\$0.00	\$3,000.00	\$3,000.00
14	COMMON EXCAVATION (EV) (P)	CU YD	\$15.00	11,000.00				11,000.00	\$165,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$165,000.00
15	SUBGRADE EXCAVATION (EV)	CU YD	\$14.00	500.00				500.00	\$7,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$7,000.00
16	STABILIZING AGGREGATE (CV)	CU YD	\$30.00	500.00				500.00	\$15,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$15,000.00
17	GEOTEXTILE FABRIC TYPE V	SQ YD	\$3.00	1,400.00				1,400.00	\$4,200.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4,200.00
18	AGGREGATE BASE CLASS 5 (16")	TON	\$30.00	11,500.00				11,500.00	\$345,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$345,000.00
19	BITUMINOUS WEARING COURSE MIX (4")	TON	\$85.00	2,600.00				2,600.00	\$221,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$221,000.00
20	BITUMINOUS NON-WEAR COURSE MIX (7")	TON	\$80.00	4,550.00				4,550.00	\$364,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$364,000.00
21	4" PERF PE PIPE DRAIN	LIN FT	\$13.00	5,100.00				5,100.00	\$66,300.00	\$0.00	\$0.00	\$0.00	\$0.00	\$66,300.00
22	DRAIN TILE REPAIR	LIN FT	\$50.00		20.00	20.00	20.00	60.00	\$0.00	\$950.00	\$50.00	\$1,000.00	\$1,000.00	\$3,000.00
23	12" STORM SEWER	LIN FT	\$75.00		600.00			600.00	\$0.00	\$42,750.00	\$2,250.00	\$0.00	\$0.00	\$45,000.00
24	15" STORM SEWER	LIN FT	\$80.00		390.00			390.00	\$0.00	\$29,640.00	\$1,560.00	\$0.00	\$0.00	\$31,200.00
25	18" STORM SEWER	LIN FT	\$85.00		380.00			380.00	\$0.00	\$30,685.00	\$1,615.00	\$0.00	\$0.00	\$32,300.00
26	21" STORM SEWER	LIN FT	\$90.00		190.00			190.00	\$0.00	\$16,245.00	\$855.00	\$0.00	\$0.00	\$17,100.00
27	42" STORM SEWER	LIN FT	\$180.00		300.00			300.00	\$0.00	\$51,300.00	\$2,700.00	\$0.00	\$0.00	\$54,000.00
28	STORM SEWER CATCH BASIN	EACH	\$3,000.00		20.00			20.00	\$0.00	\$57,000.00	\$3,000.00	\$0.00	\$0.00	\$60,000.00
29	STORM SEWER MANHOLE	EACH	\$6,000.00		10.00			10.00	\$0.00	\$57,000.00	\$3,000.00	\$0.00	\$0.00	\$60,000.00
30	STORMWATER TREATMENT	LUMP SUM	\$10,000.00		1.00			1.00	\$0.00	\$9,500.00	\$500.00	\$0.00	\$0.00	\$10,000.00
31	SANITARY SEWER BYPASS PUMPING	LUMP SUM	\$5,000.00			1.00		1.00	\$0.00	\$0.00	\$0.00	\$5,000.00	\$0.00	\$5,000.00
32	SANITARY SEWER MANHOLE	EACH	\$6,000.00			6.00		6.00	\$0.00	\$0.00	\$0.00	\$36,000.00	\$0.00	\$36,000.00
33	8" SANITARY SEWER	LIN FT	\$55.00			1200.00		1,200.00	\$0.00	\$0.00	\$0.00	\$66,000.00	\$0.00	\$66,000.00
34	10" SANITARY SEWER	LIN FT	\$60.00			140.00		140.00	\$0.00	\$0.00	\$0.00	\$8,400.00	\$0.00	\$8,400.00
35	15" SANITARY SEWER	LIN FT	\$80.00			600.00		600.00	\$0.00	\$0.00	\$0.00	\$48,000.00	\$0.00	\$48,000.00
36	SANITARY SERVICE	EACH	\$2,000.00			37.00		37.00	\$0.00	\$0.00	\$0.00	\$74,000.00	\$0.00	\$74,000.00
37	HYDRANT	EACH	\$6,500.00				5.00	5.00	\$0.00	\$0.00	\$0.00	\$0.00	\$32,500.00	\$32,500.00
38	WATER SERVICE	EACH	\$3,000.00				37.00	37.00	\$0.00	\$0.00	\$0.00	\$0.00	\$111,000.00	\$111,000.00
39	6" GATE VALVE & BOX	EACH	\$2,500.00				5.00	5.00	\$0.00	\$0.00	\$0.00	\$0.00	\$12,500.00	\$12,500.00
40	8" GATE VALVE & BOX	EACH	\$3,000.00				15.00	15.00	\$0.00	\$0.00	\$0.00	\$0.00	\$45,000.00	\$45,000.00
41	6" WATERMAIN DUCTILE IRON CL 52	LIN FT	\$75.00				200.00	200.00	\$0.00	\$0.00	\$0.00	\$0.00	\$15,000.00	\$15,000.00
42	8" PVC WATERMAIN	LIN FT	\$70.00				2,500.00	2,500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$175,000.00	\$175,000.00
43	WATERMAIN FITTINGS	POUND	\$15.00				1,050.00	1,050.00	\$0.00	\$0.00	\$0.00	\$0.00	\$15,750.00	\$15,750.00
44	CONCRETE WALK	SQ FT	\$10.00	35,000.00				35,000.00	\$350,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$350,000.00
45	CONCRETE CURB & GUTTER DESIGN B618	LIN FT	\$25.00	5,100.00				5,100.00	\$127,500.00	\$0.00	\$0.00	\$0.00	\$0.00	\$127,500.00
46	7" CONCRETE DRIVEWAY PAVEMENT	SQ YD	\$65.00	1,200.00				1,200.00	\$78,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$78,000.00
47	TRUNCATED DOMES	SQ FT	\$50.00	500.00				500.00	\$25,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$25,000.00
48	TURF ESTABLISHMENT	ACRE	\$3,500.00	2.00				2.00	\$7,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$7,000.00
49	STREET LIGHTING	LUMP SUM	\$150,000.00	1.00				1.00	\$150,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$150,000.00
50	TRAFFIC SIGNING	LUMP SUM	\$10,000.00	1.00				1.00	\$10,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$10,000.00
51	PAVEMENT MARKINGS (TEMP AND PERM)	LUMP SUM	\$50,000.00	1.00				1.00	\$50,000.00	\$0.00	\$0.00	\$0.00	\$0.00	\$50,000.00
52	TRAFFIC CONTROL	LUMP SUM	\$32,000.00	0.69	0.10	0.08	0.13	1.00	\$22,080.00	\$3,040.00	\$160.00	\$2,560.00	\$4,160.00	\$32,000.00
53	EROSION CONTROL	LUMP SUM	\$32,000.00	0.69	0.10	0.08	0.13	1.00	\$22,080.00	\$3,040.00	\$160.00	\$2,560.00	\$4,160.00	\$32,000.00
54	MISCELLANEOUS CONSTRUCTION	LUMP SUM	\$162,000.00	0.69	0.10	0.08	0.13	1.00	\$111,780.00	\$15,390.00	\$810.00	\$12,960.00	\$21,060.00	\$162,000.00
SUBTOTAL CONSTRUCTION COST									\$ 2,513,300.00	\$ 349,695.00	\$ 18,405.00	\$ 290,500.00	\$ 484,100.00	\$ 3,656,000.00
PROJECT CONTINGENCY 10%									\$ 251,330.00	\$ 35,000.00	\$ 2,000.00	\$ 29,050.00	\$ 48,410.00	\$ 366,000.00
ESTIMATED PROJECT COST									\$ 2,764,630.00	\$ 384,695.00	\$ 20,405.00	\$ 319,550.00	\$ 532,510.00	\$ 4,022,000.00
ENGINEERING AND ADMINISTRATION 18%									\$ 497,600.00	\$ 69,200.00	\$ 3,700.00	\$ 57,500.00	\$ 95,800.00	\$ 724,000.00
TOTAL PROJECT COST									\$ 3,261,900.00	\$ 453,895.00	\$ 24,105.00	\$ 377,000.00	\$ 627,900.00	\$ 4,746,000.00