



July 30, 2021

**To: Nathan Stencil, Stencil Group  
Scott Koester, Rebound Partners**

**From: Vernon Swing, PE**

**Re: 600 Greenvale Avenue Residential, Northfield, MN**

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Swing Traffic Solutions, LLC has conducted a traffic study for the 600 Greenvale Avenue residential development, also known as the Paulson Property in Northfield, Minnesota (see attachment Figure 1: Vicinity Map). The project is generally located across Lincoln Parkway from the Greenvale Elementary School and is bordered by Lincoln Parkway to the north and by Greenvale Avenue to the south. The project will include two distinct parts, Multi-family residential to the north and single family residential to the south. The Multifamily component will be accessed via a new driveway from Lincoln Parkway that will be located east of the existing bus and faculty access to the elementary school and to the west of the new east access to the elementary school. The single-family homes will be accessed via a new access road connecting with Greenvale Avenue and moving northward into the site. The proposed development will include 100 midrise apartment units on approximately 6.115 acres, and 28 single family homes on 4.796 acres (see attachment Figure 2: Concept Site Plan). This memorandum documents the existing conditions, the anticipated site generated traffic and its distribution, and reviews the traffic operations of the Build conditions at the following intersections:

- Greenvale Avenue and Lincoln Street
- Lincoln Street/Lincoln Parkway and Cannon Valley Drive
- Greenvale Avenue and Southern Access
- Lincoln Parkway and Greenvale Elementary Accesses (4)
- Lincoln Parkway/N Spring Street and Dresden Avenue
- N Spring Street and Greenvale Avenue
- Lincoln Parkway and St Olaf Avenue

#### **Existing Conditions**

The existing conditions of the roadways providing direct and indirect access to the proposed development of the 600 Greenvale residential development site in Northfield, MN were gathered during a site visit conducted in October of 2020. The field review revealed the following:

- Lincoln Street/Lincoln Parkway/N Spring Street - Signed for 30 mph, with one lane in each direction. These roadways connect to form a continuous loop with Greenvale Avenue just to the north of St. Olaf, and include bike lanes and pedestrian facilities. Except for the Greenvale Avenue intersections this route is free flowing with side street stop control. Lincoln Parkway

provides direct access to the Multi-Family residential, and indirect access to the Single Family homes via the intersections with Greenvale Avenue that lead to South Access.

- Greenvale Avenue – Signed for 30 mph, with one lane in each direction and runs in an east-west direction, and provides direct access to the single family portion of the development. The intersections with Lincoln Street and N Spring Street are all way stop controlled.

### **Data Collection**

The COVID-19 pandemic has resulted in large reductions in vehicle trips taken for work and otherwise. Therefore, in order determine the traffic utilizing the surrounding roadways a couple of methods were employed. Turning movement traffic counts were conducted during the week of October 5<sup>th</sup>, 2020 by Swing Traffic Solutions at the intersections of Greenvale Avenue with Lincoln Street and with N Spring Street in order to determine the trip distribution pattern in the area. These counts were adjusted up approximately 13 percent based on the MnDOT COVID traffic adjustment spreadsheet for the date the counts were collect to represent non-COVID conditions. However, these numbers are still significantly less than data collected for the 2019 study conducted for the proposed expansion of the Greenvale Elementary School. Therefore, for this analysis the 2019 counts from the School project were used. For information only, Figure 3 illustrates the traffic conditions for the AM and PM peak hours during COVID. Lastly, the historical daily traffic volumes on Highway 19 were reviewed to determine annual traffic growth patterns in the area indicating an annual rate of 2.6 percent.

The anticipated completion date for the site development and occupation is 2022 so this analysis considered the conditions in 2022 and adjusted the School traffic counts (2019) by the 2.6 annual percentage to reflect those conditions. (Note the 2022 No-Build assumes the completion of the Greenvale Elementary School expansion with full occupancy.) See Figure 4, 2022 No-Build Peak Hour Counts.

To quantify the impacts this development has on the surrounding roadway system, it is necessary to determine the trip generation potential of the proposed project and add the new trips back into the traffic passing the site, which will be addressed later in this study.

### **Intersection Capacity Analysis**

The operating conditions of transportation facilities, such as roadways, traffic signals, roundabouts and stop-controlled intersections, are evaluated based on the relationship of the theoretical capacity of a facility to the actual traffic volume on that facility. Various factors affect capacity including travel speed, roadway geometry, grade, number of travel lanes, and intersection control. The current standards for evaluating capacity and operating conditions are contained in the 6<sup>th</sup> Edition of Highway Capacity Manual, published by the Transportation Research Board. The procedures describe operating conditions in terms of driver delay represented as a Level of Service (LOS). Operations are given letter designations with "A" representing the best operating conditions and "F" representing the worst. Generally, level of service "C" represents the threshold for acceptable overall intersection operating conditions during a peak hour in the City of Northfield. The Chart below summarizes the level of service and delay criteria for signalized and unsignalized intersections.

LOS Designation	Signalized Intersection Average Delay/Vehicle (Sec.)	Unsignalized Intersection Average Delay/Vehicle (Sec.)
<b>A</b>	$\leq 10$	$\leq 10$
<b>B</b>	$> 10-20$	$> 10-15$
<b>C</b>	$> 20-35$	$> 15-25$
<b>D</b>	$> 35-55$	$> 25-35$
<b>E</b>	$> 55-80$	$> 35-50$
<b>F</b>	$> 80$	$> 50$

For side street stop-controlled intersections special emphasis is given to providing an estimate for the level of service of the minor approaches. Traffic operations at an unsignalized intersection with side street stop-control can be described two ways. First, consideration is given to the overall intersection level of service. This takes into account the total number of vehicles entering the intersection and the capability of the intersection to support these volumes. Second, it is important to consider the delay on the minor approaches, since the mainline does not have to stop. It is common for intersections with higher mainline traffic volumes to experience increased levels of delay and poor level of service on the side streets.

A final fundamental component of operational analyses is a study of vehicular queuing, or the line of vehicles waiting to pass through an intersection. An intersection can operate with an acceptable Level of Service, but if queues from the intersection extend back to block entrances to turn lanes or accesses to adjacent land uses, unsafe operating conditions could result. In this report, the Industry Design Standard 95th percentile queue length is used. The 95th Percentile Queue Length refers to that length of vehicle queue that has only a five-percent probability of occurring during an analysis hour.

A detailed intersection capacity analysis was conducted for the 2022 No-Build AM and PM peak conditions to establish a baseline for comparison with the Build conditions reflecting the completion of the project. The study intersections were analyzed using Synchro/Simtraffic software (Version 10). Result of the analysis are summarized in Table 1 and 2 for the AM and PM peaks, respectively.

**Table 1**  
**2022 No-Build AM Peak Operations**

Intersection	Level of Service and Delay (sec) <sup>1</sup>	Notes/95 <sup>th</sup> Percentile Queues <sup>2</sup>
Lincoln Street & Greenvale Ave	a/a (wb 7.8)	SB queue is forecast at 69 feet
Lincoln Street & Highland Ave	a/a (sb 5.8)	WB queue is forecast at 35 feet
Lincoln Pkwy & Cannon Valley Dr	a/a (sb 7.9)	SB queue is forecast at 98 feet
Lincoln Pkwy & West Elementary	a/a (eb 2.5)	EB queue is forecast at 10 feet
Lincoln Pky & Center Elementary	a/a (sb 6.7)	SB queue is forecast at 53 feet
Lincoln Pkwy & East Elementary	a/a (sb 6.0)	SB queue is forecast at 66 feet
Lincoln & New East Elementary	a/b (sb 12.0)	SB queue is forecast at 95 feet
Lincoln Parkway & Dresden Ave	a/b (sb 12.8)	SB queue is forecast at 111 feet
North Spring St & Greenvale Ave	a/a (sb 8.0)	SB queue is forecast at 83 feet
Lincoln Street & St Olaf Ave	a/a (sb 6.9)	WB queue is forecast at 67 feet

1. LOS and delay reported from SimTraffic. First letter represents intersection LOS, while second letter represents worst individual approach LOS.

2. 95<sup>th</sup> percentile queues are a result from an average of 10 SimTraffic simulations.

**Table 2**  
**2022 No-Build PM Peak Operations**

Intersection	Level of Service and Delay (sec) <sup>1</sup>	Notes/95 <sup>th</sup> Percentile Queues <sup>2</sup>
Lincoln Street & Greenvale Ave	a/a (wb 7.5)	NB queue is forecast at 65 feet
Lincoln Street & Highland Ave	a/a (eb 3.7)	WB queue is forecast at 31 feet
Lincoln Pkwy & Cannon Valley Dr	a/a (sb 7.5)	SB queue is forecast at 77 feet
Lincoln Pkwy & West Elementary	a/a (eb 4.1)	EB queue is forecast at 10 feet
Lincoln Pky & Center Elementary	a/a (sb 6.0)	SB queue is forecast at 42 feet
Lincoln Pkwy & East Elementary	a/a (sb 5.6)	SB queue is forecast at 57 feet
Lincoln & New East Elementary	a/a (sb 6.0)	SB queue is forecast at 49 feet
Lincoln Parkway & Dresden Ave	a/a (sb 7.0)	SB queue is forecast at 53 feet
North Spring St & Greenvale Ave	a/a (wb 8.4)	WB queue is forecast at 97 feet
Lincoln Street & St Olaf Ave	a/a (nb 8.6)	NB queue is forecast at 93 feet

1. LOS and delay reported from SimTraffic. First letter represents intersection LOS, while second letter represents worst individual approach LOS.
2. 95<sup>th</sup> percentile queues are a result from an average of 10 SimTraffic simulations.

The results in Tables 1 and 2 indicate the study area intersections are functioning at an overall LOS A with manageable traffic queues.

### **Proposed Development**

The proposed residential development will include a 100-unit midrise apartment building and 28 single family homes. Access to the multi-family apartment building will occur from a new driveway located approximately 150 feet east of the access to the existing Greenvale Elementary School faculty parking lot and approximately 180 west of the proposed new Elementary School access; while the access to the single family homes will occur via a new access road from Greenvale Avenue to the south. For the purposes of this study, it is assumed the development will be completed in 2021 and fully occupied in 2022. Therefore, 2022 was selected as the design year for study.

### **2022 Build Traffic Forecasts**

The number of vehicle trips generated by the proposed development have been estimated for the weekday daily, and AM and PM traffic peak hours using the data and methodologies contained in the 10<sup>th</sup> Edition of Trip Generation, published by the Institute of Transportation Engineers (ITE). Table 3 summarizes the trip generation estimates.

**Table 3**  
**Trip Generation**

Land Use	Land Use Code	Daily Traffic	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Midrise Multi-Family	221	544 Trips	9 Trips	27 Trips	27 Trips	17 Trips
Single Family	210	264 Trips	5 Trips	16 Trips	17 Trips	11 Trips
<b>TOTAL</b>		<b>808 Trips</b>	<b>57 Trips</b>		<b>72 Trips</b>	

As shown in Table 3, the site will generate 14 entering and 43 exiting trips during the morning traffic peak hour; and 44 entering and 28 exiting trips during the afternoon traffic peak hour. These trips have been distributed to the study area roadway network using the following distribution pattern and added

to the 2022 No-build scenarios resulting in the 2022 Build Peak Hour traffic scenarios (see attachment Figures 5 and 6 for the Trip Assignment and 2022 Build conditions):

- 20% to the northwest (including Greenvale Park Elementary) – assume all use the north access
- 10% to the northeast – assume all use the north access
- 35% to the southeast, Downtown, Carlton College, Middle and High Schools – assume 50% use the north access and 50% use the south access
- 35% to the southwest, St Olaf, and TH 19/I-35 – assume all use the south access

## 2022 Build Traffic Operations

To determine the traffic impacts associated with the proposed development, the traffic operations at the study area intersections has been reanalyzed to reflect the 2022 forecast Build traffic. (Note, the 2022 Build Scenario assumes completion of the Greenvale Elementary expansion.) Once again Synchro/Simtraffic Version 10 was used for the analysis. Tables 4 and 5 below summarize the results of the analysis.

**Table 4**  
**2022 Build AM Peak Operations**

Intersection	Level of Service and Delay (sec) <sup>1</sup>	Notes/95 <sup>th</sup> Percentile Queues <sup>2</sup>
Lincoln Street & Greenvale Ave	a/a (wb 7.8)	SB queue is forecast at 64 feet
Lincoln Street & Highland Ave	a/a (nb 4.6)	WB queue is forecast at 38 feet
Lincoln Pkwy & Cannon Valley Dr	a/a (sb 7.0)	SB queue is forecast at 82 feet
Lincoln Pkwy & West Elementary	a/a (eb 3.1)	EB queue is forecast at 24 feet
Lincoln Pky & Center Elementary	a/a (sb 6.7)	SB queue is forecast at 41 feet
Lincoln Pkwy & East Elementary	a/a (sb 6.2)	SB queue is forecast at 82 feet
Lincoln Parkway & North Access	a/a (nb 5.7)	NB queue is forecast at 42 feet
Lincoln & New East Elementary	a/b (sb 11.5)	SB queue is forecast at 88 feet
Lincoln Parkway & Dresden Ave	a/b (sb 11.0)	SB queue is forecast at 84 feet
North Spring St & Greenvale Ave	a/a (sb 8.3)	SB queue is forecast at 90 feet
Greenvale Ave & South Access	a/a (sb 4.7)	SB queue is forecast at 26 feet
Lincoln Street & St Olaf Ave	a/a (sb 7.4)	SB queue is forecast at 76 feet

1. LOS and delay reported from SimTraffic. First letter represents intersection LOS, while second letter represents worst individual approach LOS.
2. 95<sup>th</sup> percentile queues are a result from an average of 10 SimTraffic simulations

**Table 5**  
**2022 Build PM Peak Operations**

<b>Intersection</b>	<b>Level of Service and Delay (sec)<sup>1</sup></b>	<b>Notes/95<sup>th</sup> Percentile Queues<sup>2</sup></b>
Lincoln Street & Greenvale Ave	a/a (nb 7.4)	NB queue is forecast at 72 feet
Lincoln Street & Highland Ave	a/a (nb 4.0)	WB queue is forecast at 27 feet
Lincoln Pkwy & Cannon Valley Dr	a/a (sb 6.5)	SB queue is forecast at 60 feet
Lincoln Pkwy & West Elementary	a/a (eb 2.9)	No Queue per SimTraffic
Lincoln Pky & Center Elementary	a/a (sb 5.4)	SB queue is forecast at 30 feet
Lincoln Pkwy & East Elementary	a/a (sb 4.6)	SB queue is forecast at 46 feet
Lincoln Parkway & North Access	a/a (nb 6.2)	NB queue is forecast at 44 feet
Lincoln & New East Elementary	a/a (sb 6.3)	SB queue is forecast at 48 feet
Lincoln Parkway & Dresden Ave	a/a (sb 7.9)	SB queue is forecast at 63 feet
North Spring St & Greenvale Ave	a/a (wb 7.8)	WB queue is forecast at 84 feet
Greenvale Ave & South Access	a/a (sb 5.7)	SB queue is forecast at 32 feet
Lincoln Street & St Olaf Ave	a/a (nb 8.4)	NB queue is forecast at 83 feet

1. LOS and delay reported from SimTraffic. First letter represents intersection LOS, while second letter represents worst individual approach LOS.
2. 95<sup>th</sup> percentile queues are a result from an average of 10 SimTraffic simulations

The results in Tables 4 and 5 indicate the study area intersections will function at the same level service with or without the project with negligible change in delay, and the anticipate vehicle queue distance is expected to remain approximately the same.

### **Conclusions**

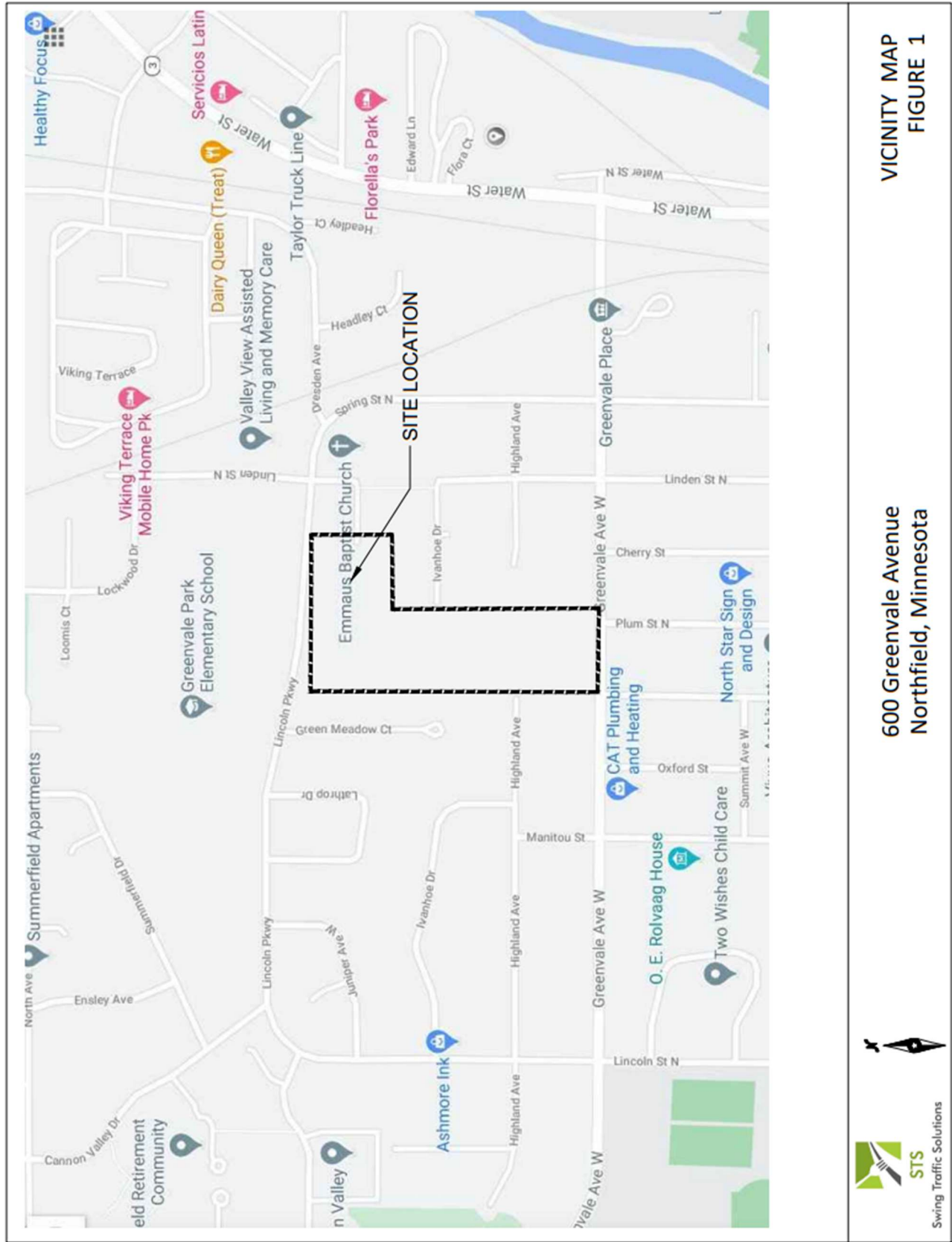
This study considered the development of 600 Greenvale Avenue including 100 apartment units and 28 single family homes in the City of Northfield. The proposed development will generate 57 new AM Peak hour trips and 72 new PM peak hour trips.

The traffic operations were modeled and reviewed using the methodology from the Highway Capacity Manual version 6, published by the Federal Highway Administration, as reported by Synchro/Simtraffic 10. The results indicate no change in study area operations in terms of Level of Service and manageable vehicle queues.

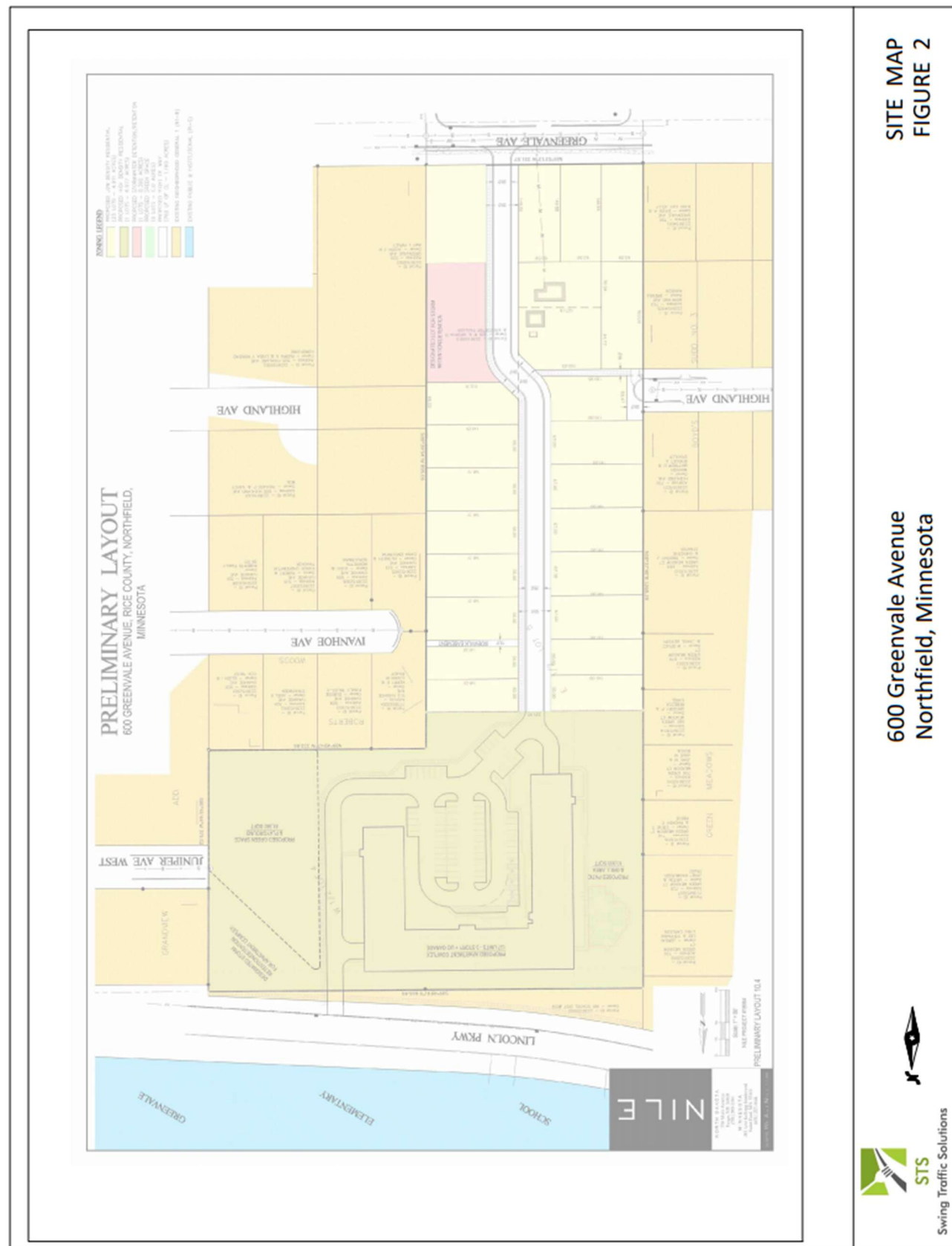
In conclusion, the proposed development has appropriate access to the site and to the surrounding roadway network. The addition of the proposed development is not anticipated to noticeably impact traffic operations in the area. In other words, the roadway network serving the proposed development will function well with the project.

Please contact Vernon Swing at [vswingtraffic@gmail.com](mailto:vswingtraffic@gmail.com) or 612-968-4142 with any questions.

**Attachment: Figures 1-6**







SITE MAP  
FIGURE 2

600 Greenvale Avenue  
Northfield, Minnesota





