



August 23, 2018

Steven Wright, President
WrightHaven Homes Limited
11 Spencer Drive
Elora, ON · N0B 1S0

**Re: Transportation Assessment
 Inverhaugh Residential Project**

Dear Steve,

This Transportation Assessment has been prepared in support of a proposed residential Draft Plan of Subdivision on Sideroad 4 in Inverhaugh west of Fourth Line. As part of the application, the Township of Centre Wellington has asked that a scoped assessment be undertaken to consider traffic operations at the new road connection of Street A to Sideroad 4.

This Transportation Assessment considers the potential traffic generation of the proposal and traffic operations at the intersection along with a review of the available sight distance and the need for auxiliary turn lanes on Sideroad 4.

The Proposal

The Draft Plan of Subdivision proposes 40 single detached residential units on two new streets within the site. Access to the subdivision would be provided at a new intersection between Street A and Sideroad 4. A walkway and emergency access is planned to JM Quarrie Drive, but is not intended to provide regular vehicular access to the subdivision.

Existing Traffic Conditions

Sideroad 4 is a two-lane rural road in the vicinity of the site. The speed limit is 50 kph along the site frontage; further west, however, it transitions to 80 kph just east of the site boundary and continues further east.

The Township of Centre Wellington regularly collects traffic data on their roads and was able to provide 2018 data along Sideroad 4 west of Fourth Line in a location that appears to be just east of the easterly boundary of the subject site. The data collected includes eastbound and westbound traffic volumes in 15-minute increments along with travel speed data by direction. The 2018 data was collected over two weekdays – Tuesday and Wednesday, May 8th and 9th during a time when school was in session. The data is summarized in the tables below.

Table 1: 2018 Traffic Volume Data - Sideroad 4

Date	Peak Hour	Direction		
		Eastbound	Westbound	Total
Tuesday, May 8	AM (7:30-8:30)	64	78	142
	PM (4:45-5:45)	81	83	164
Wednesday, May 9	AM (7:15-8:15)	70	88	158
	PM (5:00-6:00)	102	91	193
Chosen	AM	70	88	158
	PM	102	91	193

Table 2: 2018 Traffic Speed Data

Date	85 th Percentile Speeds (kph)	
	Eastbound	Westbound
Tuesday, May 8	80	89
Wednesday, May 9	80	89
Chosen Design Speed	90	

The peak hour data chosen for analysis purposes is the data from Wednesday, May 9th, the higher of the two days. In addition, the speed data suggests a design speed of 90 kph is appropriate given 85th percentile speeds of 89 in the westbound direction. It is likely that traffic speeds are lower at the location of the proposed intersection further west where the speed limit is lower, however, the 90 kph design speed is conservative in this case.

Future Traffic Volumes at Site Driveways

Future background traffic along Sideroad 4 was estimated by increasing traffic by 10 percent to reflect a simple two percent per year growth rate over five years. Two percent per year is a typical suburban growth rate. The resulting traffic volumes are shown in the table below.

Table 3: 2023 Future Background Traffic Forecast - Sideroad 4

Peak Hour	Direction		
	Eastbound	Westbound	Total
AM	77	97	174
PM	112	100	212

Site traffic was estimated based on information in the Institute of Transportation Engineers Trip Generation Manual (10th Edition) as outlined in the table below.



Table 4: Site Traffic Generation

Land Use	Peak Hour	Description	In	Out	Total
Single-Family Detached Housing (land use code 210)	AM of adjacent street traffic	Rate (trips/unit)	0.19	0.55	0.74
		Trips (40 units)	8	22	30
	PM of adjacent street traffic	Rate (trips/unit)	0.62	0.37	0.99
		Trips (40 units)	25	15	40

The site is expected to generate 30 and 40 trips in the weekday morning and afternoon peak hours, respectively. Site traffic was assigned to Sideroad 4 based on the split of eastbound and westbound traffic flows in the peak hours to determine site traffic volumes at the new intersection. Future traffic was determined by adding the site traffic to the future background traffic. Site traffic and future total traffic are illustrated in Figures 1 and 2 below.

Figure 1: Site Traffic

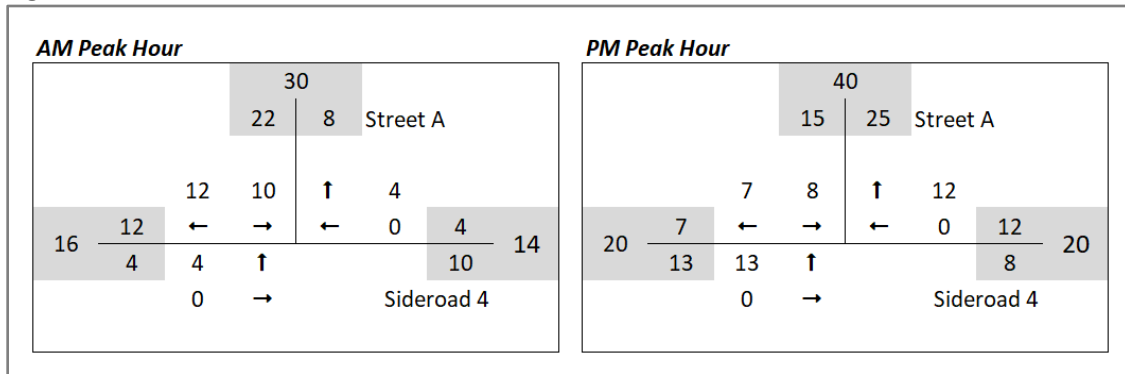
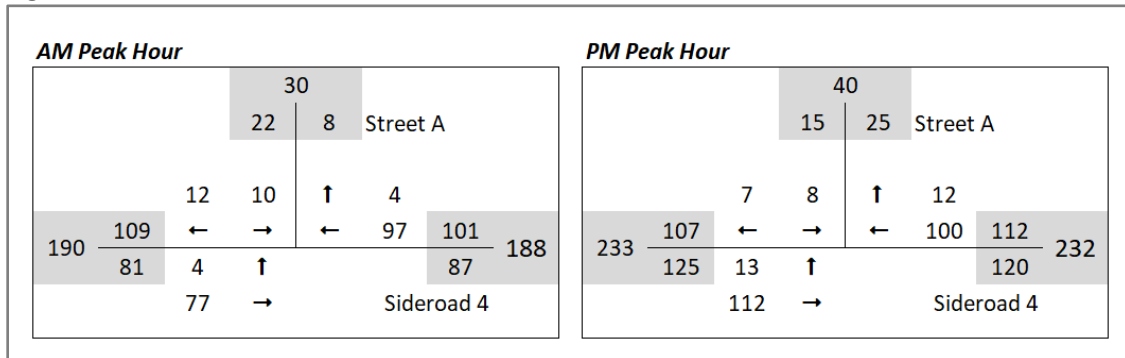


Figure 2: Future Total Traffic



Eastbound Left Turn Lane Warrant

The Township asked us to consider whether an eastbound left turn lane is warranted along Sideroad 4 at the proposed new intersection of Street A.



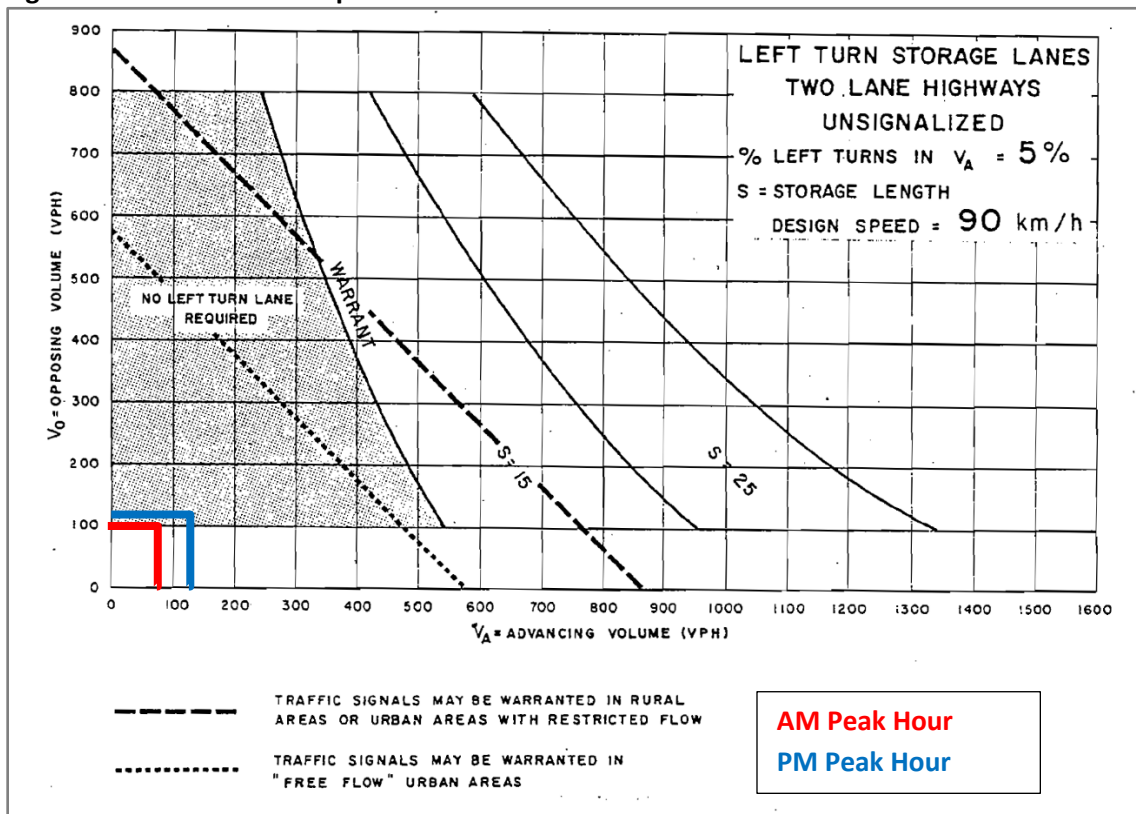
Left turn lanes can provide additional capacity at intersections and improve the level of service of the roadway where they are needed. The Ontario Ministry of Transportation (MTO) in their Geometric Design Standards for Ontario Highways Manual states that:

When the number of left turning vehicles at intersections is such that it creates a hazard and reduces capacity, consideration should be given to the provision of a separate left turn lane design.

The MTO Geometric Design Standards for Ontario Highways Manual provides warrant graphs in Section E.A.1 for left turn lanes at unsignalized intersections along two-lane roads. The appropriate graph is chosen based on the design speed of the main road and the percentage of left turns in the approach volume. In this case, a design speed of 90 kph was chosen based on a review of the 85th percentile speeds in the area. In the future, the left turn volume from Sideroad 4 to Street A is expected to be just under five (5) percent of the eastbound approach volume in both the morning and afternoon peak hours.

The warrant graph is shown below in Figure 3 with both the approach and opposing volumes illustrated in red for the morning peak hour and in blue for the afternoon peak hour. The data indicates that a left turn lane on Sideroad 4 to street A is not warranted.

Figure 3: MTO Warrant Graph for EB Left Turn Lane on Sideroad 4



Given the low volume of right turning traffic from Sideroad 4 to Street A (four in the morning peak hour and 12 in the afternoon peak hour), a westbound right turn lane will not be needed at the new intersection either.

Sight Distance Assessment

A sight distance assessment is undertaken for new intersections to be sure that a minimum sight distance is available for turning traffic to see conflicting oncoming traffic so that the driver can determine there is a large enough gap to make their turn.

In the case of the proposed new intersection with Sideroad 4, drivers wanting to turn left onto Street A, or either left or right out from Street A onto Sideroad 4, need to be able to see approaching westbound Sideroad 4 traffic. Drivers wanting to turn left from Street A would also need to be able to see approaching eastbound traffic on Sideroad 4.

The Transportation Association of Canada (TAC) in their Geometric Design Guide for Canadian Roads provides guidance in Chapter 9 – Intersections, for designing new intersections with appropriate sight distance. Table 9.9.4 provides design intersection sight distance for a left turn from stop – for a design speed of 90 kph, the sight distance is 190 metres. Table 9.9.6 provides design intersection sight distance for a right turn from stop – for a design speed of 90 kph, the sight distance is 165 metres. Both of these conditions cover the sight distance requirements for all turning movements.

Additionally, the County of Wellington has an Entrance Policy that requires a certain amount of sight distance from new access connections based on the posted speed limit on County roads. The minimum sight distance for a posted speed of 50 kph is 135 metres measured from a driver's eye height of 1.05 metres to an object height of 1.3 metres. For a posted speed of 80 kph, the minimum sight distance increases to 200 metres.

Sight distance from the proposed new intersection were measured in the field in July 2018 to determine how much sight distance is available both of eastbound and westbound oncoming traffic. Visibility of traffic is good and drivers can see over 400 metres in both directions from the location of the new intersection. The available sight distance is more that twice both the recommended TAC design sight distance and the requirement in the County's Entrance Policy as outlined in Table 5 below, suggesting that there is adequate sight distance at the proposed intersection.



Table 5: Sight Distance Assessment – Proposed Street A Intersection with Sideroad 4

Description	Speed	TAC Design	County Minimum	Available	Assessment
Sight distance for left turn from stop (eastbound traffic)	90 kph (design)	190	-	400+ metres	✓ Requirement met
	50 kph (posted)	-	135		
	80 kph (posted)	-	200		
Sight distance for right turn from stop (westbound traffic)	90 kph (design)	165	-	400+ metres	✓ Requirement met
	50 kph (posted)	-	135		
	80 kph (posted)	-	200		

Traffic Operations Assessment

An assessment of the intersection operations under future total traffic conditions was undertaken using Synchro 9. Single lane approaches on all three legs of the intersection were included in the assessment. The intersection operations are summarized in the table below with detailed analysis worksheets attached.

Table 6: Operations Analysis - Sideroad 4/Street A Intersection

Peak Hour	Measure of Effectiveness	Approach	
		Eastbound	Southbound
AM	Level of Service	A	A
	Delay (seconds)	0.4	9.3
	Volume/capacity	-	0.03
	95 th percentile Q (m)	0.1	0.6
PM	Level of Service	A	A
	Delay (seconds)	0.8	9.6
	Volume/capacity	0.01	0.02
	95 th percentile Q (m)	0.2	0.5

The operations analysis indicates that the new intersection will operate well under future total traffic conditions with a single lane on each approach.



Summary and Conclusion

As requested, this transportation assessment considered the needs of a new proposed subdivision in Inverhaugh and concludes the following.

- The site is expected to generate 30 and 40 trips in the weekday morning and afternoon peak hours, respectively.
- An eastbound left turn lane from Sideroad 4 to Street A is not warranted.
- A westbound right turn lane from Sideroad 4 to Street A is not needed.
- There is adequate sight distance of both eastbound and westbound traffic at the new proposed intersection of Street A and Sideroad 4.
- The new intersection will operate well under future total traffic conditions with a single lane on each approach.

If you have any questions about the analysis presented in this letter, please contact me to discuss.

Sincerely,



Julia Salvini, MEng, PEng
President

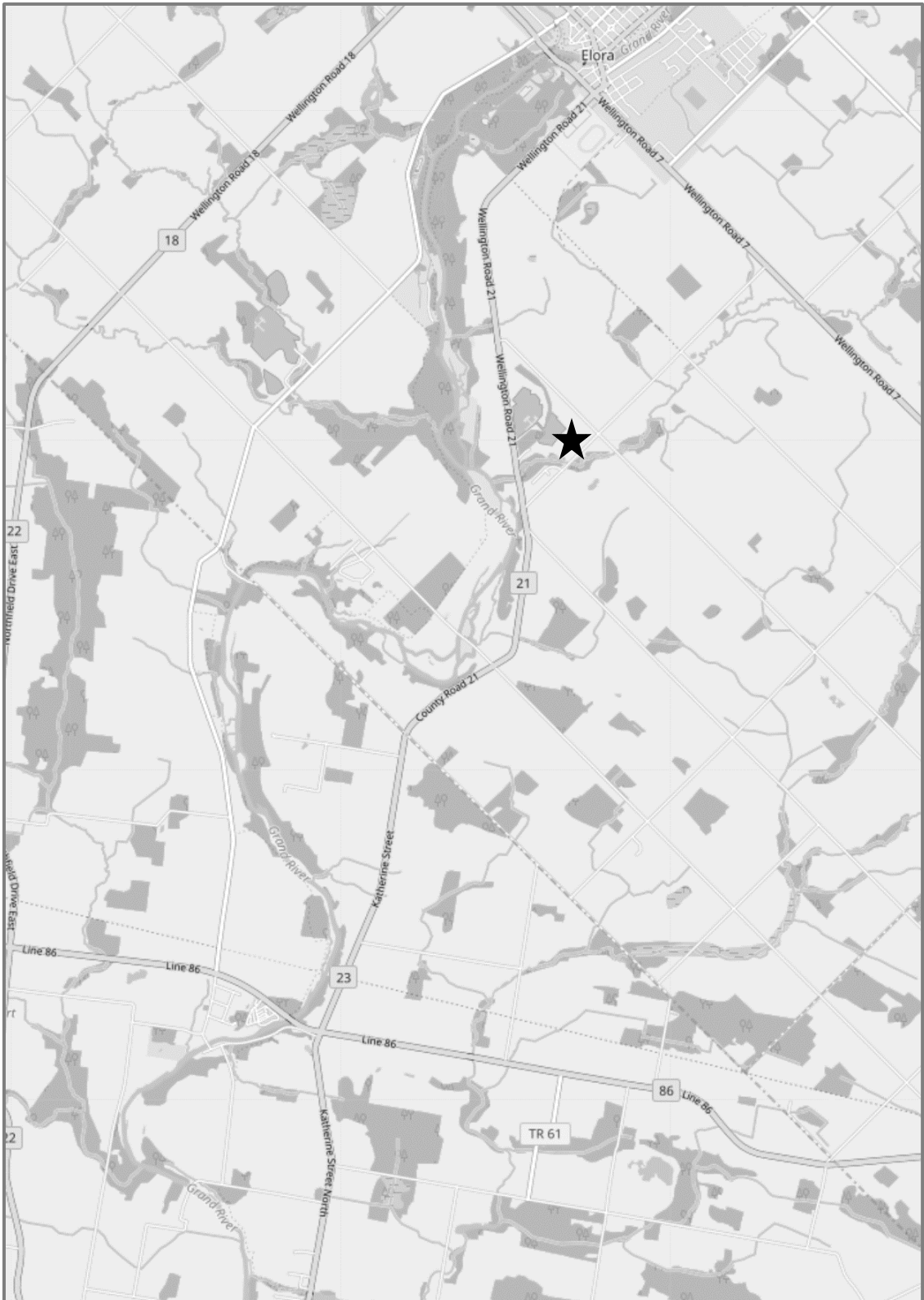
Cc: Katherine McLaughlin, Thomasfield Homes
Astrid Clos, Astrid J. Clos Planning Consultants

Attach: Site Location Plan
Draft Plan of Subdivision
Synchro Analysis Worksheets



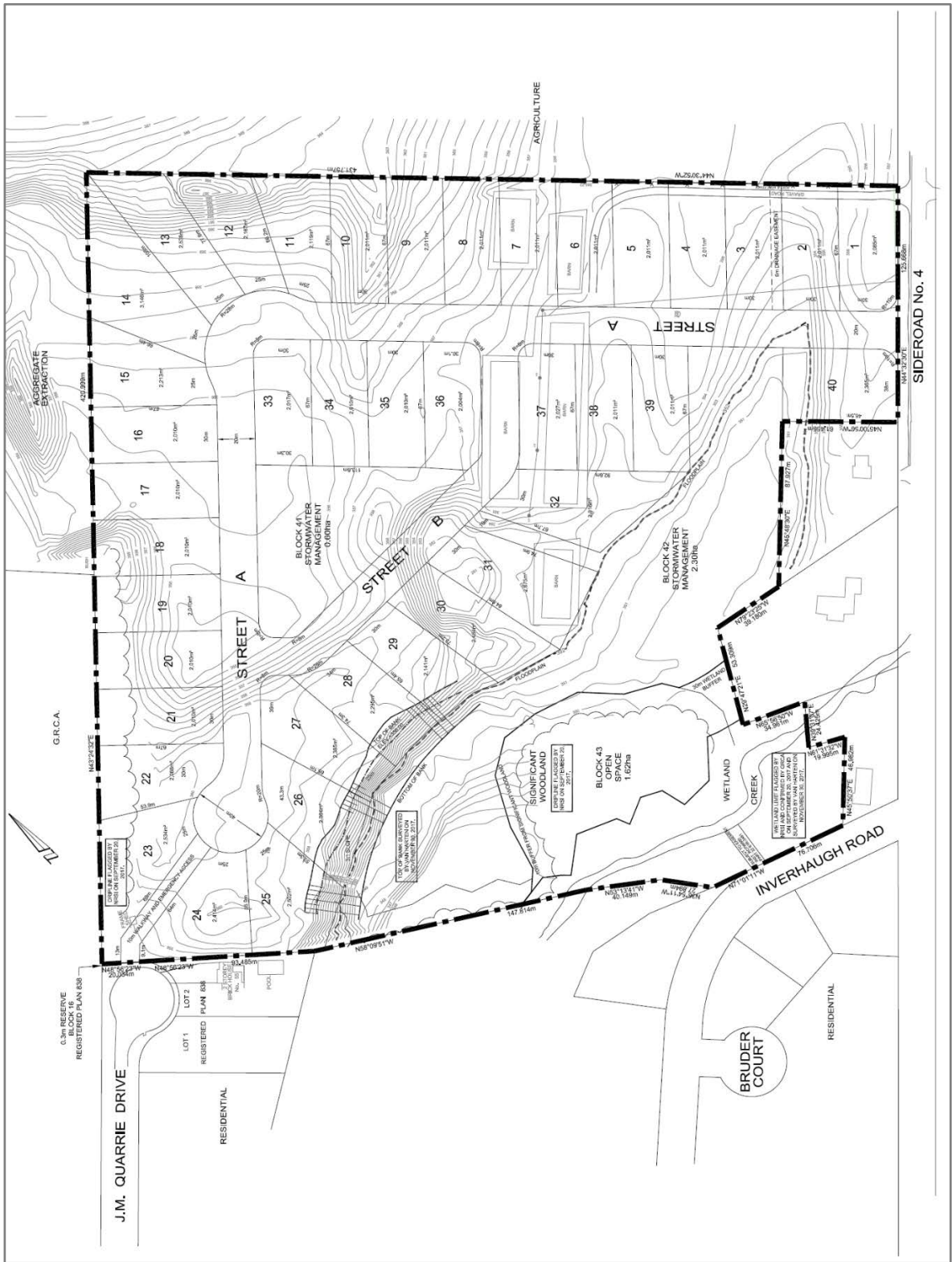
Attachments





Site Location Plan

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Draft Plan of Subdivision

Source: Astrid J. Clos Planning Consultants

HCM Unsignalized Intersection Capacity Analysis

3: Sideroad 4 & Street A

08/21/2018



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↶		↶	
Traffic Volume (veh/h)	4	77	97	4	10	12
Future Volume (Veh/h)	4	77	97	4	10	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	84	105	4	11	13
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	109				199	107
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	109				199	107
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1481				788	947
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	88	109	24			
Volume Left	4	0	11			
Volume Right	0	4	13			
cSH	1481	1700	867			
Volume to Capacity	0.00	0.06	0.03			
Queue Length 95th (m)	0.1	0.0	0.6			
Control Delay (s)	0.4	0.0	9.3			
Lane LOS	A		A			
Approach Delay (s)	0.4	0.0	9.3			
Approach LOS			A			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization		17.3%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Sideroad 4 & Street A

08/21/2018



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↙	↘
Traffic Volume (veh/h)	13	112	100	12	8	7
Future Volume (Veh/h)	13	112	100	12	8	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	122	109	13	9	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	122				266	116
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122				266	116
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	99
cM capacity (veh/h)	1465				717	937
Direction, Lane #						
	EB 1	WB 1	SB 1			
Volume Total	136	122	17			
Volume Left	14	0	9			
Volume Right	0	13	8			
cSH	1465	1700	806			
Volume to Capacity	0.01	0.07	0.02			
Queue Length 95th (m)	0.2	0.0	0.5			
Control Delay (s)	0.8	0.0	9.6			
Lane LOS	A		A			
Approach Delay (s)	0.8	0.0	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			23.3%		ICU Level of Service	A
Analysis Period (min)			15			