C.C. Tatham & Associates Ltd.
Consulting Engineers

STONEBROOK RESIDENTIAL DEVELOPMENT PHASE III

Municipality of Grey Highlands (Markdale)

Functional Servicing Report

prepared by:

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prepared for

Stonebrook Developments Markdale III Ltd.

July 17, 2018

CCTA File 117168

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APPENDICES

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1 Introduction

C.C. Tatham & Associates Ltd. (CCTA) was retained by Stonebrook Developments Markdale III Ltd. to prepare a Functional Servicing Report in support of a proposed residential development in the Community of Markdale, within the Municipality of Grey Highlands (Municipality).

This servicing report summarizes the engineering review completed to date and provides a guide to establishing the servicing requirements associated with the development. More specifically, the requirements address the following:

- water supply for domestic and fire-fighting purposes;
- sanitary sewage servicing;
- stormwater management;
- transportation needs; and
- utility distribution (hydro, telephone, cable TV and gas).

2 Background

2.1 Guidelines and Background Documents

This report was prepared in recognition of the design guidelines/criteria, and recommendations provided in the following publications:

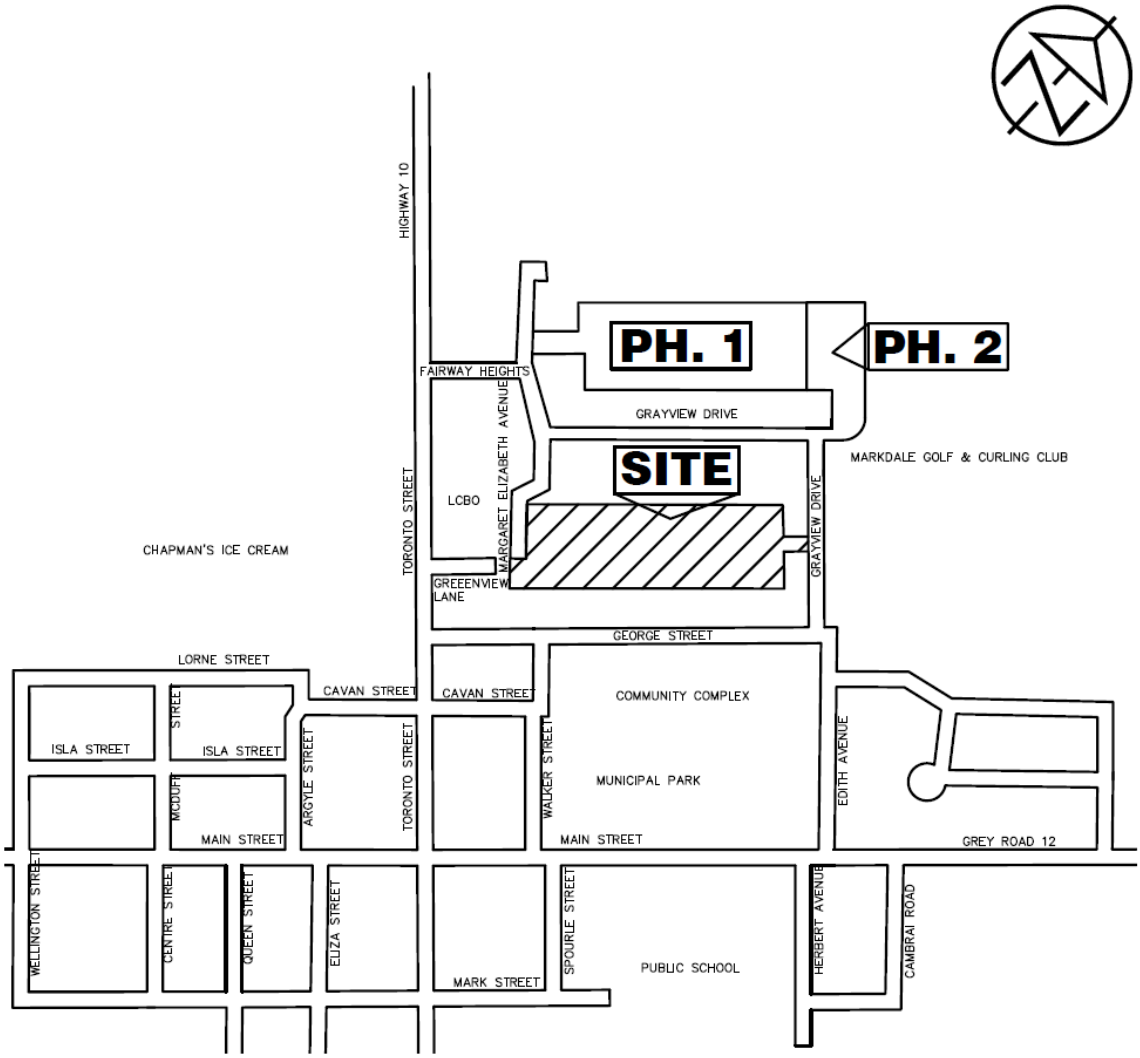
- *Water Supply For Public Fire Protection.* Fire Underwriters Survey (1999);
- *Stormwater Management Planning and Design Manual.* Ministry of the Environment (March 2003);
- *Design Guidelines for Drinking-Water Systems.* Ministry of the Environment (2008);
- *Design Guidelines for Sewage Works.* Ministry of the Environment (2008);
- *Municipality of Grey Highlands Development Standards.* (August 25, 2014);
- *105 Margaret Elizabeth Avenue Residential Development Functional Servicing Report.* C.C. Tatham & Associates Ltd. (February 2017);
- *2016 Annual Report, Operation and Maintenance, Markdale Wastewater Treatment Plant.* WSP Canada Inc. (March 2017);
- *Geotechnical Investigation Proposed Stonebrook Development – Part 2 Margaret Elizabeth Avenue Markdale, Ontario For Stonebrook Development.* Peto MacCallum Ltd. (December 2017);
- *Stonebrook, Phase 2 (Markdale) – Residential Development Functional Servicing Letter*. C.C. Tatham & Associates Ltd. (December 22, 2017);
- *Markdale Water Supply, O.Reg. 170/03, 2017 Annual Summary Report.* WSP Canada Inc. (February 2018);
- *Stonebrook Developments (Markdale) Stormwater Management Facility Block Sizing Requirement Letter.* C.C. Tatham & Associates Ltd. (February 27, 2018); and
- *Stonebrook Phase 3 (Markdale), Municipality of Grey Highlands Traffic Brief Letter*. C.C. Tatham & Associates Ltd. (July 9, 2018).

2.2 Site Location and Access

The Site consists of approximately 2.62 hectares of undeveloped land located approximately 450 metres north of the intersection of Grey Road 12 (Main Street) and Highway 10 (Toronto Street) within the Community of Markdale. The legal description of the site refers to Part of Lot 98 and Part of Lot 99, Concession 1, northeast of the Toronto and Sydenham Road, Municipality of Grey Highlands, County of Grey. The municipal address for the site is 30 Grayview Drive.

Access to the proposed development will be from the southwest utilizing the unopened Margaret Elizabeth Avenue/ Greenview Lane right-of-way (ROW) and from the northeast from Grayview Drive. The site location is shown in Figure 1, below, in context of the area roads and Phases I and II of the development

Figure 1: Site Location



2.3 Existing Land Use & Site Conditions

The site is a vacant lot cleared of trees with no buildings on site. The topography of the site resembles a bowl, with a low spot in the middle of the site near the northwest property line. The majority of drainage from the site ponds in this location with no discernible drainage outlet.

2.4 Surrounding Land Uses

The site is bounded to the northwest, southeast, and northeast by residential development. To the southwest, the site is bounded by an OPP Station and residential development.

2.5 Site Geology

A geotechnical investigation for the subject property was completed by Peto MacCallum Ltd. in November 2017. The investigation included 7 boreholes to an average depth of 5.0 metres. Per the investigation, the soils can generally be described as consisting of 0.2 to 0.3 metres of topsoil underlain by sandy silt till. Traces of gravel, cobbles and sand were also noted. Groundwater was found in 3 of the 7 boreholes at depths of 2.3 to 2.9 metres. These boreholes were located at the southwest corner of the site.

The details of the geotechnical investigation and geotechnical recommendations are provided in Peto MacCallum's report titled *Proposed Stonebrook Development – Part 2 Margaret Elizabeth Avenue Markdale, Ontario for Stonebrook Developments*. A copy of this report will be submitted to the Municipality as a part of the Draft Plan Approval submittal package.

3 Proposed Development

3.1 Land Use

Development of the site will consist of 54 townhouse (multi-attached) residential units grouped in 8 blocks. The proposed layout is illustrated on drawing CSD-1 in Appendix A.

3.2 Servicing

The townhouse units will front onto a 20 metre urban right-of-way complete with municipal services in accordance with the Municipality's development standards. The conceptual servicing arrangement is shown on drawing CSD-1 whereas additional details of how the site will be serviced are provided in the following chapters.

4 Water Network

4.1 Water Demands

The proposed water demands for the development have been calculated based on *MOE Design Guidelines for Drinking-Water Systems*, *Municipality of Grey Highlands Development Standards,* and the Fire Underwriter Survey document *Water Supply For Public Fire Protection.* The estimated water demands under various conditions are summarized below:

- Design Population 119 people
- Average Day Demand (ADD) 53.6 m^3/d (0.62 L/s)
- Maximum Day Demand (MDD) 133.9 m^3/d (1.55 L/s)
- Peak Hour Demand (PHD) 2.32 L/s
- Fire Flow 83.33 L/s for 1.75 hours
- Maximum Day Demand Plus Fire Flow 84.88 L/s

Supporting calculations are provided in Appendix B.

4.2 Water Supply

Potable water will be supplied from the existing municipal water treatment and distribution system. According to the *2017 Annual Summary Report for the Markdale Water Supply* the water treatment system has approximately 3,485 m^3/day of uncommitted hydraulic reserve capacity. The Maximum Daily Demand for the development will be 134 m^3/d, which represents approximately 4% of this uncommitted capacity. Therefore, there is sufficient capacity within the existing infrastructure to service the proposed development.

4.3 Water Distribution

The site will be serviced by a new 150 mm diameter PVC watermain on Street C that will be connected to the existing 150 mm diameter watermain on Margaret Elizabeth Avenue and on Grayview Drive (at the terminal end of the Stonebrook Phase II watermain). An existing 200 mm diameter trunk watermain along Highway 10 (Toronto Street) supplies water to this area of Markdale and is pressurized from the existing water tower located approximately 1 km southeast of the site.

A desk top analysis was completed to confirm the proposed 150 mm diameter watermain will be able to supply sufficient water to the fire hydrant located at 1+740 Street C, the furthest hydrant from both connection points, under maximum day plus fire flow conditions. The analysis confirmed the water

main could supply 84.9 L/s to the fire hydrant with a pressure loss of approximately 62 kPa (9 psi). Assuming the existing water distribution system operates at a minimum pressure of 275 kPa (40 psi), per MOECC requirements, the available pressure at the fire hydrant under maximum day plus fire flow conditions will be approximately 213 kPa (31 psi) which exceeds the minimum pressure of 140 kPa (20 psi) required by MOECC. Supporting calculations are enclosed in Appendix B.

A preliminary water distribution servicing concept is illustrated on drawing CSD-1 in Appendix A.

5 Sanitary Sewer Network

5.1 Sewage Flow

The proposed sewage demands for the development have been calculated based on the previously noted water demands and are influenced by the *MOE Design Guidelines for Sewage Works (2008)* and the municipal development standards. The estimated sewage flow under various conditions are summarized below:

- Design Population 119 residents
- Average Day Flow 53.6 m^3/d (0.62 L/s)
- Maximum Day Flow 133.9 m^3/d (1.55 L/s)
- Peak Flow 278.21 m^3/d (3.22 L/s)

Supporting calculations are enclosed in Appendix B.

5.2 Wastewater Treatment Plant Capacity

According to the *2016 Annual Report, Operation and Maintenance, Markdale Wastewater Treatment Plant*, the wastewater treatment plant (WWTP) has approximately 143 m^3/day of uncommitted hydraulic reserve capacity, which does not account for sewage generated by Stonebrook Phases I and II. The total maximum day sewage flow from the Stonebrook Development will be approximately 304 m^3/day – 170 m^3/day from Phases I and II and 134 m^3/day from Phase III.

It is understood that the WWTP has been recently upgraded to provide the physical capacity to treat sewage generated by all 3 phases of the Stonebrook Development and that the Municipality has applied to MOECC for approval to increase the approved rated capacity of the plant. It is further understood Phase III of the development may not proceed until the increased rated capacity has been approved.

In 2011, a sewage pumping station (SPS) was constructed at the north bend of Grayview Drive to service existing and future developments in the area. Through discussions with Municipal staff, we understand Stonebrook Phase I, II and III lands are located within the SPS catchment area and both the SPS and downstream sewer network have sufficient capacity to service the proposed development.

5.3 Sewage Collection System

The development will be serviced by a new 200 mm diameter sewer extending from existing sanitary manhole MH157 immediately upstream of the SPS along Grayview Drive and Street C. As the existing sanitary sewer on Grayview Drive between Street C and MH 157 is not deep enough to service Phase III, it must be replaced with a deeper sewer.

The estimated peak sewage flow from Phase III, including sewage and extraneous flows, is 3.22 L/s. The combined peak sewage flow from Stonebrook Phase III and downstream existing development on Grayview Drive is 3.6 L/s. The proposed sanitary sewer is designed with a minimum slope of 0.4% in accordance with MOECC design criteria. The full flow capacity of a sewer at 0.4% is approximately 22 L/s which exceeds the capacity required for existing and proposed development.

Supporting calculations are enclosed in Appendix B. The conceptual sewer design is shown on drawing CSD-1 in Appendix A.

6 Stormwater Management

6.1 Stormwater Management Highlights

A *Stormwater Management Facility Block Sizing Requirement* letter was prepared by C.C. Tatham & Associates Ltd. dated February 27, 2018 and is included in Appendix C. This letter outlines the proposed stormwater management plan (SWM) and hydrology for the site, key findings are as follows:

- The stormwater management plan developed for the subject lands is in accordance with the criteria set forth by the Municipality's development standards and the *Ministry of the Environment Stormwater Management Planning and Design Manual*.
- When implemented, the stormwater management plan will allow the development of Phases I, II, and III of the Stonebrook Development (Markdale) without negatively impacting the local drainage systems.
- Water quality control to an enhanced level, with 80% total suspended solids removal, will be provided through the use of a conventional end-of-pipe facility (stormwater management pond) complete with a sediment forebay.
- Water quantity control will be provided such that post-development peak flow rates for storm events ranging from 2-year to 100-year storms will be equal to or less than pre-development peak flow rates.
- As Phase III lands do not have a direct connection to the stormwater management pond, the 100 - year peak flow will be conveyed to the facility underground via the proposed sewer system.

6.2 Siltation and Erosion Control

Siltation and erosion control will be implemented for all construction activities, including topsoil stripping, material stockpiling, road construction and grading operations. The necessary sediment control measures will be identified during detailed design and will address the following requirements:

1. Where necessary, heavy duty silt fence will be erected around the perimeter of the site before any grading operations commence to control sediment movement.
2. A construction vehicle access, consisting of a stone mud mat, will be constructed and maintained to reduce the off-site tracking of material.
3. Catch basins and inlet structures will be fitted with catch basin sediment traps during construction activities, and cleaned out as required and prior to assumption of the works.
4. Straw bale flow checks will be installed within the ditches/swales.

7 Traffic Impact

7.1 Traffic Brief

A *Traffic Brief* letter was prepared by C.C. Tatham & Associates Ltd. dated July 9, 2018 and is included in Appendix D. This letter outlines the proposed site conditions and analyses the feasibility of growth in the development area from a transportation perspective.

7.2 Road Network

The area road system under consideration includes Toronto Street (Highway 10), Main Street East (Grey Road 12), Fairway Heights, Margaret Elizabeth Avenue, Grayview Drive and Edith Avenue. All roads in the study area have a 50 km/h speed limit. As stated in the *Stonebrook Phase III Traffic* Brief, the main arterial roads, Toronto Street and Main Street, are currently operating at a capacity of 58% and 28% respectively which provides ample room to accommodate additional traffic.

7.3 Phase III Traffic

As with the Phase I and II trip estimates, the vehicle trips generated by the proposed development have been determined based on the development size and the trip generation rates for the low-rise residential condo/townhouse (1-2 floors) land use (ITE code 231). In consideration of 54 townhouse units, the site is expected to generate 36 trips during the AM peak hour and 42 trips during the PM peak hour. Due to the limited size of the development, the road network will continue to operate well below capacity and can readily accommodate the additional traffic volume.

7.4 Sight Line Analysis

MTO geometric design standards specify a minimum stopping sight distance of 85 metres for a design speed of 60 km/h (posted 50 km/h + 10 km/h) which provides an adequate stopping distance for a motorist avoiding a stationary hazard. The available sight lines to/from the northwest along Margaret Elizabeth Avenue are approximately 105 metres. With respect to Grayview Drive, the sight lines from the northwest are approximately 100 metres, whereas to/from the southeast the sight lines are approximately 110 metres. Thus, the available sight lines along Grayview Drive at the proposed site access points satisfy the MTO minimum stopping sight distance criterion for a design speed of 60 km/h.

8 Utility Network

8.1 Existing Utilities

All aboveground existing utility features including hydro poles and pedestals were located during the topographic survey and are identified on drawing CSD-1.

8.2 Hydro

Hydro One has been contacted and confirmed they have existing infrastructure along Margaret Elizabeth Avenue and Grayview Drive, in addition to proposed works that will service Stonebrook Developments Phases I and II. Their Distribution and Planning Department has not confirmed whether a single phase or three-phase connection is required to service Phase III; however there is a three-phase connection point at the Margaret Elizabeth Avenue and Grayview Drive intersection.

8.3 Cable TV and Internet

Eastlink Cable confirmed they can provide cable TV and internet service to Phase III with Fibre To The Home (FTTH) infrastructure.

8.4 Gas

Union Gas confirmed that their existing infrastructure along Margaret Elizabeth Avenue has capacity to service Stonebrook Phases I and II. They have yet to confirm if they have capacity for Phase III. Union Gas does not reserve load on their system, so capacity is to be re-confirmed prior to construction. Union Gas is currently reviewing the development for their infrastructure.

8.5 Telephone

Bell has been previously contacted for Phases I and II of the development. Fibre services have been proposed and Phase III will be serviced similarly as Bell no longer provides new developments with existing copper based services and therefore servicing would be offered utilizing FTTH.

8.6 Connection Strategies

Detailed connection strategies with all utility companies will be formalized at the appropriate time. However, it would appear that there would be no issue in providing all utility servicing to this development.

9 Conclusions

Based on the preceding analyses, the proposed development can be appropriately serviced by the required infrastructure. Specifically, the proposed servicing strategy includes:

- An internal water distribution system constructed and connected to the existing watermain on Margaret Elizabeth Avenue will supply the needs of the development. The watermain will be looped into the existing watermain on Grayview Drive, past the northeast access of the subject property.
- An internal sanitary sewer will convey sewage from the site via gravity to the existing sewage pumping station on Grayview Drive which has sufficient capacity to service the development. The rated capacity of the existing wastewater treatment plant has been recently increased; final MOECC approval is expected which in turn will accommodate the Phase III flows.
- An internal storm sewer system will collect and convey surface water runoff from the proposed development. Runoff will be discharged to a communal stormwater management pond situated off site on agricultural lands to the northwest of Stonebrook Phase I. The SWM facility will provide enhanced level quality control and control post development peak flows to pre-development levels.
- Given the limited traffic volumes to be generated by the Phase III development, and in consideration of the excess reserve capacity on the study area road network, the increase in traffic volumes will not have any appreciable impacts on the adjacent road system.
- Hydro, telephone, cable and gas service are readily available and no issues regarding connections are expected.

Additional details with respect to the various servicing components will be provided at the final design. stage.

Professional Engineers Ontario
Limited Licensee
Name: E. M. WATKIN
Number: 100078771
Category: CIVIL: Sewers, Water Mains, Municipal Road
Limitations:
This licence is subject to the limitations as detailed on the certificate.
Association of Professional Engineers of Ontario
JULY 17, 2018

Authored by: Brian Gregatti, B.Eng., E.I.T.
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Appendix A:
Concept Site Development Plan

Appendix B:
Design Calculations

C.C. Tatham & Associates Ltd. Consulting Engineers — Collingwood Bracebridge Orillia Barrie Ottawa	Project:	Markdale Residential Development	Date:	27-Jun-18
	File No.:	117168	Designed:	BAG
	Subject:	Water Distribution Calculations	Checked	AO/EMW

WATER SUPPLY

1.1 Residential Design Flows

Condominium Block (Units)	=	54					(Per Draft Plan submitted by Georgian Planning Solutions)
Population per Unit	=	2.2					(Per Markdale Water Supply, O.Rg. 170/03 2017 Annual Summary Report)
Population	=	54	x	2.20	=	119	
Average daily per capita flow	=	450	L/cap/day				(Per Municipality of Grey Highlands Development Standards)
Average Daily Flow	=	119	x	450	/1000		
	=	53.6	m^3/day				
	=	0.62	L/s				

Design Factors

Residential Population	=	119					
Residential Max. Day Factor	=	2.50					(Per MOE Design Guidelines - 2008)
Residential Peak Hour Factor	=	3.75					

Design Flows

Max. Daily Flow	=	0.62	x	2.50			
	=	1.55	L/s	(133.9	m^3/day)		
Peak Hour Flow	=	0.62	x	3.75			
	=	2.32	L/s				
Fire Flow	=	83.30	L/s				(Fire Underwriters Survey - 1999, see fire flow calculations in Appendix B)
Max. Day plus Fire	=	1.55	+	83.3			
	=	84.85	L/s	(7,331	m^3/day)		

1.2 Sanitary Design Flow (Per MOE Design Guidelines - 2008)

Proposed Development

No. Units	=	54	
Population Density	=	2.20	People / Unit
Population	=	119	People / Unit
Per Capita Flow	=	450	L/person/day
Average Flow	=	53.55 m^3/day	0.62 L/s
Maximum Day Factor	=	2.50	
Maximum Day Flow	=	133.88 m^3/day	1.55 L/s
Peaking Factor (Harmon)	=	4.22	
Peak Sewage Flow	=	2.62	
Development Area	=	2.62	ha
Extraneous Flows (0.23 L/s/ha)	=	0.60	L/s
Peak Flow (Peak Sewage and Extraneous Flow)	=	3.22	L/s

Existing and Proposed Development

No. Units	=	5	
Population Density	=	2.20	People / Unit
Existing Population	=	11	People
Proposed Population	=	119	People
Total Population	=	130	People
Per Capita Flow	=	450	L/person/day
Average Flow	=	0.68	L/s
Peaking Factor (Harmon)	=	4.21	
Peak Sewage Flow	=	2.85	
Ex. Development Area	=	0.71	ha
Prop. Development Area	=	2.62	ha
Total Development Area	=	3.33	ha
Extraneous Flows (0.23 L/s/ha)	=	0.77	L/s
Peak Flow (Peak Sewage and Extraneous Flow)	=	3.62	L/s

Stonebrook Phase III (Markdale)
117168

Assess Available Fire Flow to FH located at Station 1+740 Street C

Maximum Day + Fire Flow Demand		84.9	L/s
W/M Details			
Size	0.150 m (Nom)	0.155	m (ID)
Area		0.019	m^2
Roughness Coefficient		100	
Assess W/M From Grayview Drive to Fire Hydrant			
W/M Elev. At Connection Point		420.8	m
FH Discharge Elev.		420.6	m
Dist. from Connection to FH		150.0	m
Flow from connection to FH		37.77	L/s
		0.038	m^3/s
Velocity from connection to FH		2.00	m/s
Static Head Losses (h_s)		-0.2	m
Friction Head Losses (h_f)		6.6	m
Total Dynamic Head		6.4	m
		9.0	PSI
		62.3	KPa

Hazen-Williams Formula

$$h_f = \frac{(10.7 * Q^{1.85} * L)}{(C^{1.85} * D^{4.87})}$$

Assess W/M From Margaret Elizabeth Avenue Drive to Fire Hydrant			
W/M Elev. At Connection Point		425.1	m
FH Discharge Elev.		420.6	m
Dist. from Connection to FH		165.0	m
Flow from connection to FH		47.13	L/s
		0.047	m^3/s
Velocity from connection to FH		1.25	m/s
Static Head Losses (h_s)		-4.5	m
Friction Head Losses (h_f)		10.9	m
Total Dynamic Head		6.4	m
		9.0	PSI
		62.3	KPa

Combined flow from either end of the proposed water main will meet MDF + Fire Flow demand with < 10 PSI pressure loss which is acceptable.

C.C.Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie

Project:	Stonebrook (Markdale) Phase 3	Date:	July 5, 2018
File No.:	117168	Designed:	BAG
Subject:	Fire Flow Calculations	Checked	EMW
Revisions:			

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
1	Frame Use for Construction of Unit	Framing Material							
		Coefficient related to type of construction (C)	Wood Frame	1.5	Ordinary Construction	1	-	N/A	
			Ordinary Construction	1					
			Non-combustible construction	0.8					
			Fire resistive construction (< 2 hrs)	0.7					
			Fire resistive construction (> 2 hrs)	0.6					
2	Type of Housing (if Tow House, enter number of units per TH block)	Floor Space Area							
		Type of Housing	Single Family				Units	N/A	
			Townhouse / Apartment- inform # of units	8 (firewall every 2 units)		2			
			Other (Comm. Ind., etc)						
2.1	Number of Storeys	Number of Floors / Storeys in the unit (do not include basement)				2	Storeys	N/A	
3	Floor Area	Total Floor Area (A) - for all storeys excluding basement				100	m^2	N/A	
		Measurement Unis	Square Feet (ft2)		Square metres	400			
			Square Metres (m^2)	1					
			Hectares (ha)						
4	Required Fire Flow	Required Fire Flows without Reductions or Increases per FUS): (FF= 220 x C x $A^{0.5}$)					L/min	4,000	
5	Factors Affecting Burning	Reductions / Increases Due to Factors Affecting Burning							
5.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited Combustible	-0.15	N/A	0	(600)
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
5.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete automatic sprinkler protection	-0.3	None	0.0	N/A	0	-
			None	0					
5.3	Separation Distance Between Units	Exposure distance between units	North Side	34.00	5	0.55	m	0	1,870
			East Side	6.00	20				
			South Side	39.00	5				
			West Side	0.00	25				
Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:								0	5,000
6	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:						0	83
		Required Duration of Fire Flow of 5,000 L/min (hrs):						1.75	
		Required volume for Fire Flow of 5,000 L/min (m^3):						525	

Notes:
- assumed ordinary construction, ie. Wood frame with non-combustable exterior walls like brick/masonary.
- assumed a firewall between every two units (based on intial plans for Phase 1).
- assumed no internal fire suppression systems.
- Dwellings are considered a low hazard occupancy. As such, their contents was considered to be limited combustible.
- assumed an average floor area of 100 m^2.

Appendix C:
Stonebrook Developments (Markdale) Stormwater Management Facility Block Sizing Requirement Letter

C.C. Tatham & Associates Ltd.
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February 27, 2018

via e-mail (paul@stonebrookdevelopments.com)
CCTA File 117168

Paul Bonwick
Stonebrook Developments
1-120 Jevlan Drive
Vaughan, ON L4L 8G3

Re: Stonebrook Developments (Markdale)
Stormwater Management Facility Block Sizing Requirement

Dear Paul:

This letter and its enclosed documents outline the proposed stormwater management facility (SWMF) to determine the required SWM block size for the proposed Stonebrook Development (Markdale). This SWMF has been sized to provide quality and quantity control for a drainage area encompassing the proposed Stonebrook Development (Markdale) Phases 1 to 3, as well as the adjacent future development lands owned by the golf course that are tributary to the Proposed SWMF under a developed condition.

As agreed between all parties, the proposed SWMF is to be located on an adjacent property west of Stonebrook Development (Markdale) Phase 1 and 2 lands known as the golf course lands. The SWMF will outlet to a watercourse known as Tributary to the Rocky Saugeen River. The location of the facility in terms of proximity to the watercourse and setbacks was previously resolved with the SVCA as part of the Phase 1 submission and has been respected for this analysis. Water quality control will be provided in the form of 80% TSS removal and water quantity control will be provided by matching post development flows to pre development levels for the 2 through 100 year design storm by detaining stormwater runoff in the pond and releasing it at controlled rates via an engineered outlet structure.

Existing Conditions

Under existing conditions, an area of approximately 25.3 ha drains to the location of the proposed SWMF. This area is primarily agricultural land as well as the vacant Stonebrook Development (Markdale) Phases 1 and 2 lands, some existing residential lands, and a portion of the Markdale Golf and Curling Club. Under existing conditions, Stonebrook Development (Markdale) Phase 3 lands and its surrounding existing residential areas, approximately 5.7 ha, drain to a low point on the Phase 3 lands with no outlet. While some of these lands could potentially contribute flows in major storm

events, these areas were assumed to drain internally for modeling and flow target purposes to be conservative. The existing condition drainage areas are illustrated on Drawing DP-1 for reference.

A visual OTTHYMO hydrologic model was created to determine pre-development peak flows to the proposed SWMF location and the results are summarized in the table below. A detailed OTTHYMO output file is included attached to this letter.

Table 1: Pre-Development Peak Flow Summary

Storm Event	Peak Flow Rate (m^3/s) To the Proposed SWMF	
	6 hr SCS Design Storm	4 hr Chicago Design Storm
25 mm	0.193	
2-year	0.381	0.394
5-year	0.669	0.725
10-year	0.899	0.976
25-year	1.223	1.332
50-year	1.480	1.638
100-year	1.753	1.932
Regional Hazel Storm	2.680	

Proposed Conditions

Under proposed conditions, the proposed Stonebrook Phases 1 and 2 areas (3.81 ha) and the adjacent golf course lands slated for future development (17.7 ha) were modelled as draining to the SWMF. As well, the areas that drained to the low point on Stonebrook Development (Markdale) Phase 3 lands will be directed to the proposed SWMF. This makes the proposed drainage area to the SWMF 31.0 ha with a calculated overall imperviousness of 50% as nearly all vacant land draining to the SWMF is proposed to be developed in the future. Note that an imperviousness of 50% was assigned to the golf course lands which represents a similar development density to Stonebrook Phases 1-3. These areas are depicted on Drawing DP-2 for reference.

The proposed SWMF features a top of pond contour footprint of 9,425 m^2 at an elevation of 413.00 masl. The side slopes of the pond are 5:1 (H:V) with the bottom at an elevation of 410.00 masl; the permanent pool is at an elevation of 411.00 masl. The outlet structure features:

- a 150 mm low flow orifice with in invert elevation of 411.00 masl;
- a ditch inlet catchbasin with a rim elevation of 411.60 masl; and

- an emergency weir spillway with a sill elevation of 412.50 masl.

The outlet pipe is sized at 675 mm diameter and acts as a hydraulic control when the water level is between 412.10 masl and 412.50 masl. A pond design layout is illustrated in Drawing PND-1 included with this report.

Below is a table summarizing the proposed condition peak flows from the SWMF to the Tributary to the Rocky Saugeen River. A detailed OTTHYMO output has been included with this letter.

Table 2: Pre-Development Peak Flow Summary

Storm Event	Peak Flow Rate (m^3/s) To the Proposed SWMF	
	6 hr SCS Design Storm	4 hr Chicago Design Storm
25 mm	0.053 (0.193)	
2-year	0.110 (0.381)	0.069 (0.394)
5-year	0.583 (0.669)	0.407 (0.725)
10-year	0.891 (0.899)	0.707 (0.976)
25-year	1.170 (1.223)	1.076 (1.332)
50-year	1.264 (1.480)	1.197 (1.638)
100-year	1.355 (1.753)	1.355 (1.932)
Regional Hazel Storm	3.809 (2.680)	

The above table shows that the proposed SWMF will match or reduce peak flows to pre development levels to the Tributary to the Rocky Saugeen River.

Water Quality

As per the MOE SWM Guide (2003) the pond requires 4,220 m^3 of permanent pool volume for Enhanced level treatment based on a tributary percent impervious of 50% and a drainage area of 31.0 ha; 5200 m3 has been provided. As for extended detention, the greater of 40 m^3 /ha or the runoff volume of the 25 mm storm event must be provided; this corresponds to 1240 m^3 and 3410 m^3 respectively; 3,850 m^3 of extended detention storage has been provided.

The preceding water quality measures will ensure Enhanced level treatment of storm runoff to the pond achieving 80% TSS removal. Detailed SWMF water quality calculations can be seen attached to this letter.

Conclusions

The above summary of the proposed SWMF shows that all quality and quantity control requirements for the Stonebrook Development (Markdale) Phases 1 to 3, as well as for development of the golf course lands, can be achieved by the proposed wet pond SWMF. We have prepared the attached Drawing PND-1 to illustrate the pond design concept and propose that a SWMF block be established with an area of 1.89 ha (4.67 ac). This size is adequate to service the developments when considering the existing grades of the golf course lands. Its size could be reduced in the future depending on final developed grade of the golf course lands.

Yours truly,
C.C. Tatham & Associates Ltd.

Andrew Overholt, B.E.Sc., EIT
Intern Engineer
AO:rlh

Dan Hurley B.A.Sc., P.Eng. LEED AP
Vice President,
Manager – Water Resources Engineering

copy: Rob Adams, Municipality of Grey Highlands
Jeff Akitt, C.C. Tatham & Associates Ltd.

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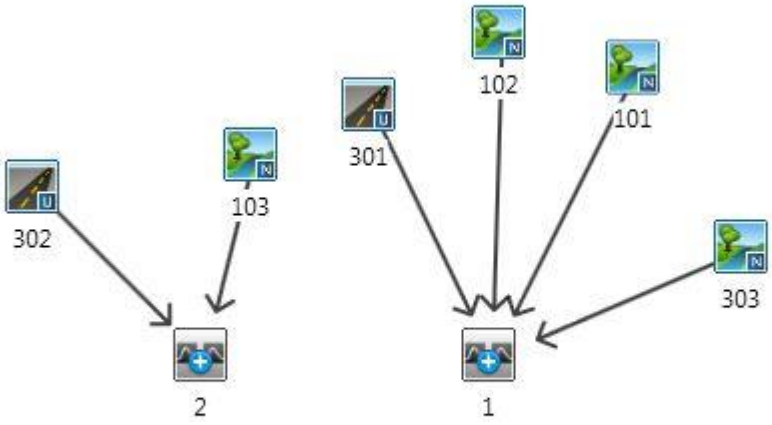
Existing Conditions OTTHYMO Model Schematic



Appendix D:
Stonebrook Phase 3 (Markdale), Municipality of Grey Highlands
Traffic Brief Letter

C.C. Tatham & Associates Ltd.
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July 9, 2018

via email (paul@stonebrookdevelopments.com)
CCTA File 117168

Paul Bonwick
Stonebrook Developments
1-120 Jevlan Drive
Vaughan, ON L4L 8G3

Re: Stonebrook Phase 3 (Markdale), Municipality of Grey Highlands
Traffic Brief

Dear Paul:

As requested, we have reviewed the proposed Stonebrook Phase 3 residential development from a transportation perspective, addressing site access, site traffic volumes, and the potential impacts to the adjacent road system. Our comments are set out in this letter report as follows.

Site Location & Statistics

The development site is located at 30 Grayview Drive within the Community of Markdale in the Municipality of the Grey Highlands (as illustrated in Figure 1). The overall property has a total area of approximately 2.62 hectares (6.47 acres).

Existing Conditions

Road Network

The area road system under consideration includes Toronto Street (Highway 10), Main Street East (Grey Road 12), Fairway Heights, Margaret Elizabeth Avenue, Grayview Drive and Edith Avenue.

Toronto Street (Highway 10) is a provincial highway with a 2-lane urban cross section (i.e. curb and gutter) and a posted speed limit of 50 km/h. Through the community of Markdale, Toronto Street is under a connecting link agreement with the Municipality, and thus the Municipality has effective jurisdiction of most matters pertaining to it. As an arterial road and connecting link, Toronto Street has a theoretical planning capacity of 900 to 1,100 vphpl. The lower threshold of 900 vphpl has been employed in consideration of the built-up area of Markdale and the impacts of such on through capacity.

Main Street East (Grey Road 12) is a County road with an urban cross section within the immediate study area, oriented east-west. As a County road, Main Street East serves an arterial function and provides 1 travel lane per direction plus on-street parking on both sides. As an arterial road, Main Street East has an assumed planning capacity of 800 vphpl. A posted speed limit of 50 km/h is present throughout the study area.

Fairway Heights, Margaret Elizabeth Avenue, Grayview Drive and Edith Avenue are all local roads, providing one lane of travel in each direction. Fairway Heights and Edith Avenue have curb and gutter on both sides and a sidewalk on one side, while Grayview Drive has asphalt gutters and no sidewalk. Margaret Elizabeth Avenue has no curb, gutter or sidewalks. As local roads, the speed limits on each are 50 km/h. A lower capacity of 400 vphpl has been assumed, reflective of the primary function of local roads to serve the abutting land uses.

Traffic Volumes

The existing traffic volumes on Toronto Street and Main Street East are based on the 2018 traffic volumes provided in the *Markdale Tim Hortons Transportation Impact Study*[1], which in turn are based on a 2016 turning movement count conducted at the intersection of Toronto Street with Main Street, adjusted by a background growth rate of 2% per annum to reflect 2018 conditions, and further adjusted by a seasonal factor of 34% to reflect peak summer conditions.

The 2018 summer traffic volumes are illustrated in Figure 2.

As previously noted, Toronto Street has an assumed lane capacity of 900 vehicles per hour, whereas Main Street has an assumed lane capacity of 800 vehicles per hour. In consideration of the 2018 peak hour directional peak hour volumes, Toronto Street is operating at 58% of capacity or less, while Main Street East is operating at 28% of capacity or less Thus, the study area road network is currently operating well below capacity.

Traffic volumes on the local road network have not been explicitly considered, recognizing that the local roads serve limited residential development. Based on site investigations, there are approximately 42 detached residential units and 20 apartment units served by the local road network. The trip generation associated with the existing level of development is nominal in relation to the available capacity of the local roads (400 vphpl). Recognizing that Fairway Heights, Margaret Elizabeth Avenue, Grayview Drive and Edith Avenue do not serve through traffic (i.e. all traffic is local to the developments served by the noted roads), they are all considered to be operating with excess reserve capacity.

[1] *Markdale Tim Hortons Transportation Impact Study*. C.C. Tatham & Associates. April 2018.

Stonebrook Phase 3

Development Plan

The proposed development will consist of 54 townhouse units with access provided via Margaret Elizabeth Avenue and Grayview Drive. The Margaret Elizabeth Avenue access will be located approximated 60 metres southeast of the intersection of Margaret Elizabeth Avenue with Grayview Drive; whereas the Grayview Drive access will be located approximately 110 metres northwest of the intersection of Grayview Drive with George Street. It is further noted that the proposed plan includes the future connection of Margaret Elizabeth Avenue to Greenview Lane. The site access on Margaret Elizabeth Avenue would be located at the street elbow connecting the two roads.

A site plan is provided in Figure 3.

Site Generated Trips

The number of vehicle trips to be generated by the proposed development has been determined based on type of use, development size, and trip generation rates for the *low-rise residential condo/townhouse (1-2 floors) land-use* (ITE code 231) as per the *ITE Trip Generation Manual*[2] *9th Edition*. It is noted that the *ITE Trip Generation Manual, 10th Edition*[3] has consolidated several residential land-uses under the new land-use description *multifamily housing - low-rise* (ITE code 220). However, the consolidated trip rates provided in the 10th Edition are less conservative than the 9th Edition trip rates. As such, the trip rates published in the 9th Edition manual have been applied.

The associated trip rates and trip estimates are provided in Table 1.

Table 1: Trip Generation

Land Use	rate/ estimate	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
townhouse	units	0.17	0.50	0.67	0.45	0.33	0.78
	54 units	9	27	36	24	18	42

As indicated, the site is expected to generate 36 trips during the AM peak hour and 42 trips during the PM peak hour.

It is noted that the trip generation associated with the Stonebrook Phase 3 development is not significant. When further considering the direction split (ie. inbound and outbound) coupled with the distribution and

[2] *ITE Trip Generation Manual, 9th Edition*. Institute of Transportation Engineers, 2012.

[3] *ITE Trip Generation Manual, 10th Edition*. Institute of Transportation Engineers, 2017.

assignment of the site generated trips to the area road network, the peak directional peak hour trips added to the network will be nominal (no more than 10 to 15 vehicles per hour per direction).

Traffic Operations Assessment

As previously noted, Toronto Street is currently operating at 58% of capacity or less during peak hour conditions, whereas Main Street is operating at 28% of capacity or less. Given the excess reserve capacity on the adjacent road network, and further considering the nominal volumes to be generated by the subject development, the study area road network will continue to operate well below capacity and can readily accommodate the additional volumes associated with the proposed development.

Likewise, the internal local road network will also accommodate the proposed development with no appreciable impacts to the road network operations, given the limited development (and hence volumes) that currently exist.

Sight Lines Analysis

Sight Distance Requirement

Based on MTO geometric design standards, the minimum stopping sight distance for a design speed of 60 km/h (posted 50 km/h + 10 km/h) is 85 metres. This provides sufficient distance for an approaching motorist to observe a stationary hazard in the road (i.e. a vehicle stopped on Grayview Drive waiting to turn onto the proposed development road) and bring their vehicle to a complete stop prior to the hazard.

Available Sight Lines

As previously noted (and illustrated in the site plan), the site access on Margaret Elizabeth Avenue is located on the outside radius of the proposed street elbow connecting Margaret Elizabeth Avenue with Greenview Lane. The sight lines to/from the northwest along Margaret Elizabeth Avenue are approximately 105 metres, thus satisfying the MTO minimum stopping sight distance of 85 metres. The sight lines to/from the southwest along Greenview Lane cannot be determined at this time, recognizing that the connection to Greenview Lane has not been constructed. Regardless, it is expected that the proposed road network will be designed and constructed to maximize the sight lines to/from the southwest along Greenview Lane.

With respect to the access on Grayview Drive, the sight lines to/from the northwest along Grayview Drive are approximately 100 metres, whereas to/from the southeast the sight line are approximately 110 metres. Thus the available sight lines along Grayview Drive at the proposed site access satisfy the MTO minimum stopping sight distance for a design speed of 60 km/h.

Sight Line Assessment

In consideration of the above, the available sight lines at the proposed site accesses are appropriate.

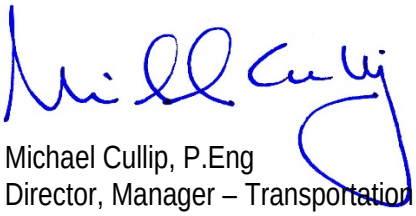
Summary

Given the limited traffic volumes to be generated by the proposed development, and in consideration of the excess reserve capacity on the study area road network, the increase in traffic volumes associated with the proposed development will not have any appreciable impacts on the adjacent road system.

The sight distances at the proposed access points were also reviewed in consideration of the MTO minimum stopping sight distance requirements for a design speed 60 km/h. The available sight lines are considered acceptable in all instances and thus no improvements are recommended to address the sight distances.

Should you have any questions or comments regarding the findings above, please do not hesitate to contact us.

Yours truly,
C.C. Tatham & Associates Ltd.



David Perks, M.Sc, PTP
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DP:dp

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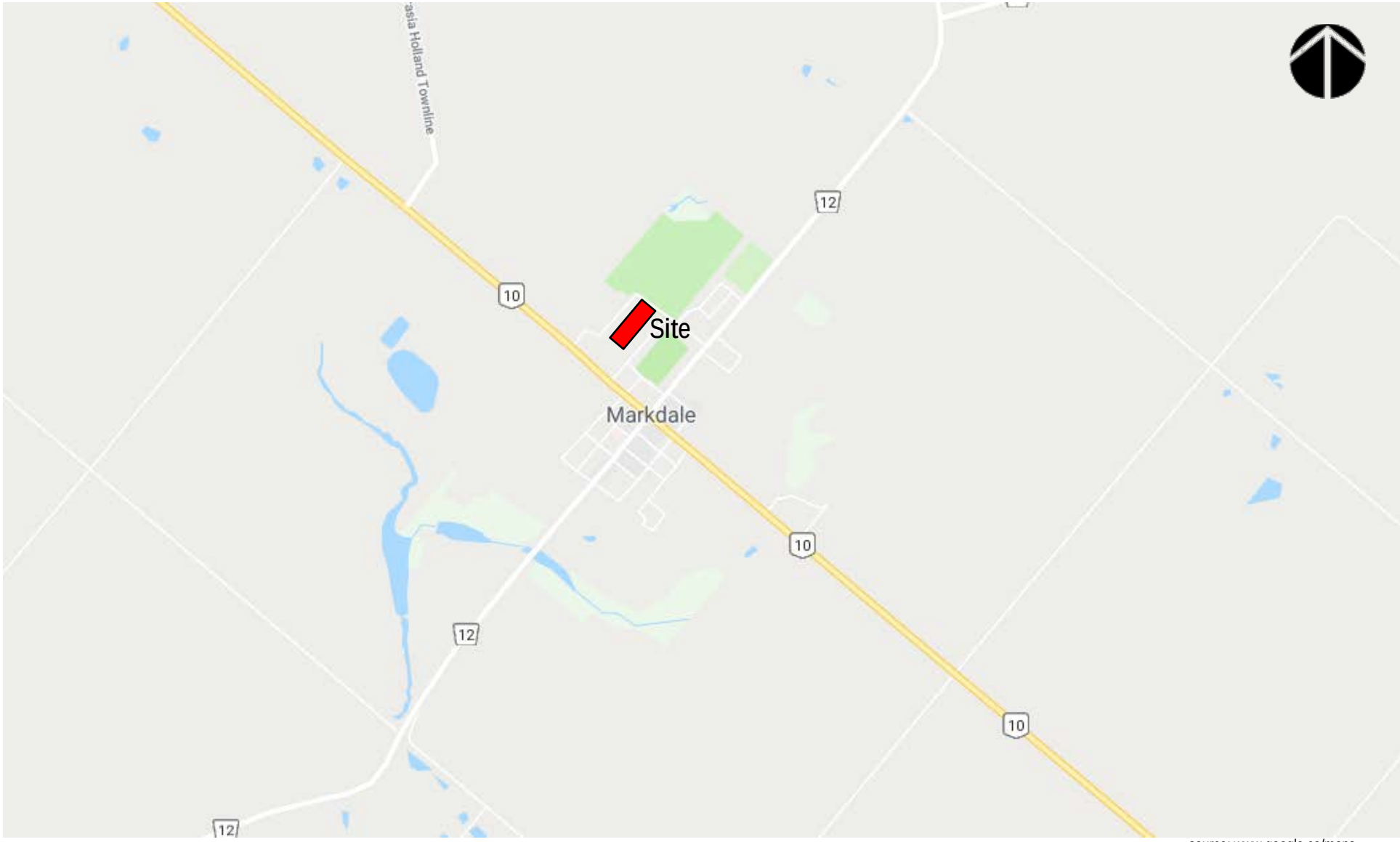

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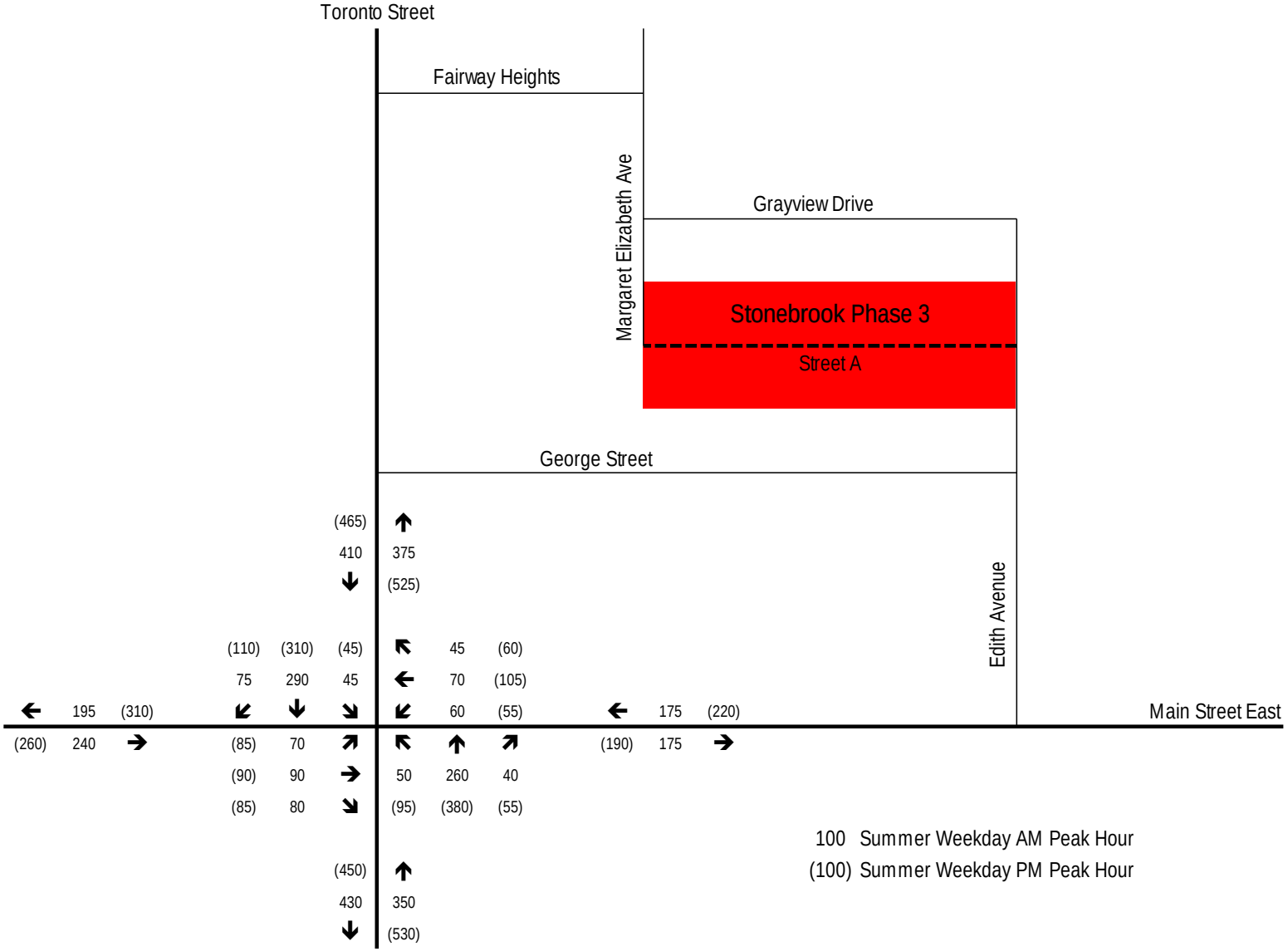
C.C.Tatham & Associates Ltd.
Consulting Engineers

Stonebrook Phase 3 Residential Development, Traffic Brief

Site Location

Figure

1



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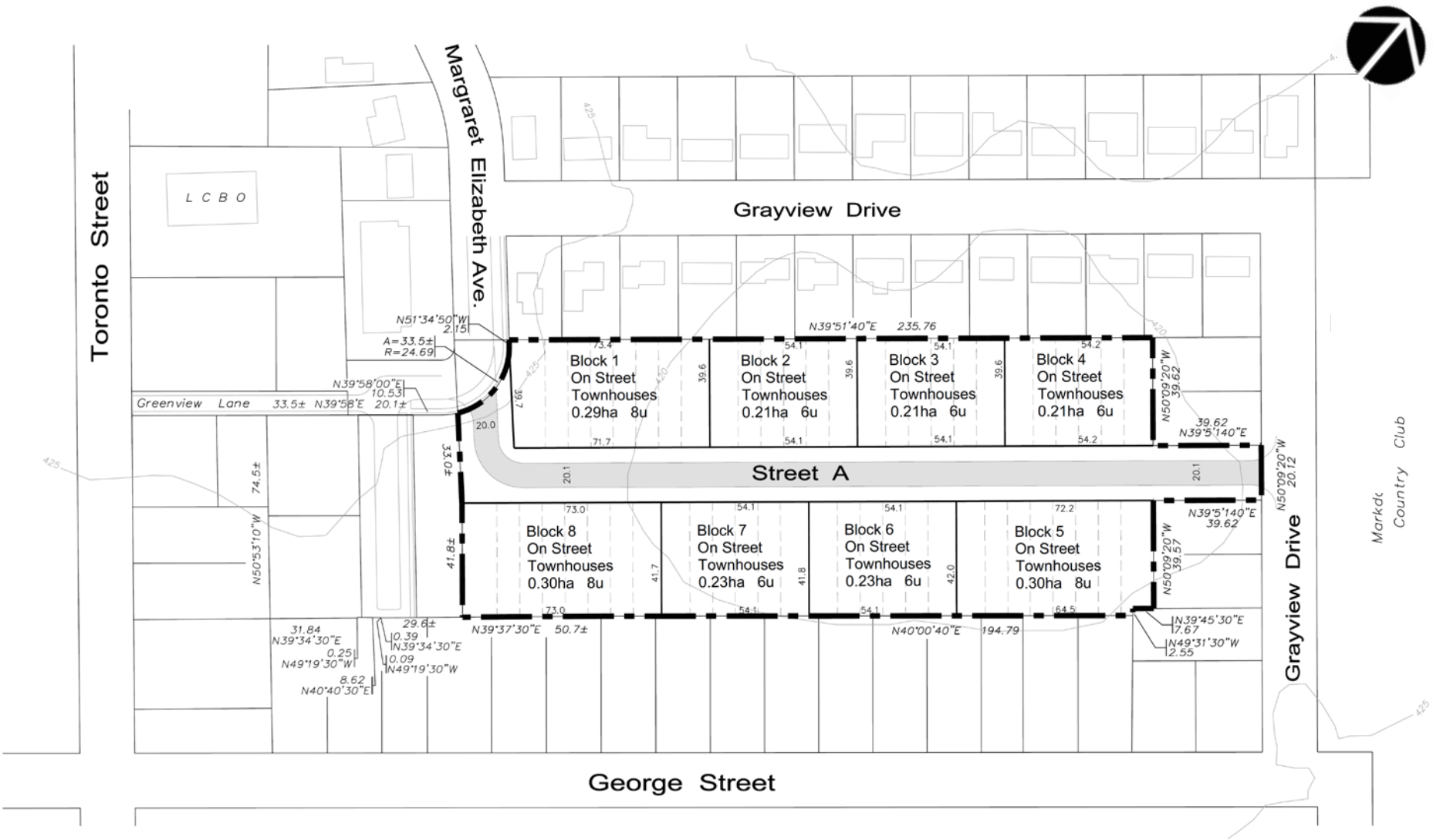
Stonebrook Phase 3 Residential Development, Traffic Brief

2018 Traffic Volumes - Summer

Figure 2



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Stonebrook Phase 3 Residential Development, Traffic Brief

Site Plan

Figure 3