

FUNCTIONAL SERVICING STUDY

PROPOSED SUBDIVISION

**ZAVARELLA & KULMATYCKY LANDS
PART OF LOT 31 & 32
CONCESSION 2**

**FORMER TOWNSHIP OF BRANTFORD
GEOGRAPHIC AREA OF PARIS
COUNTY OF BRANT**

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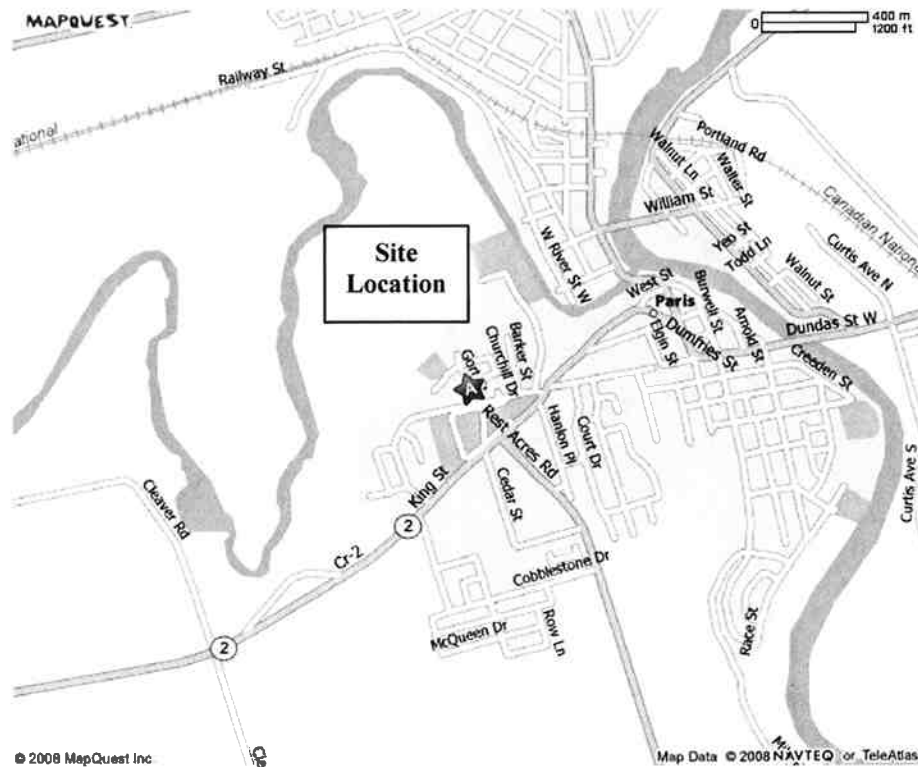
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1.0 INTRODUCTION

This Functional Servicing Study was prepared by J.H. Cohoon Engineering Limited, in support of an Area Plan Application by Steve Kulmatycky and Zavarella Construction for the proposed development of approximately 34.9 hectares (86.4 acres) of vacant land into a total of 369 lots comprised of 264 single family, 6 semi-detached, 90 medium density street townhouse units and 3 multiple density blocks. The projected total population is approximately **1,280 persons** or 52 people per developable hectare.

The lands, situated north of Dundas St. West, are legally referred to as Part of Lots 31 & 32, Concession 2, Former Township of Brantford, Geographic Area of Paris, County of Brant.

At the time of this report, it is anticipated that full municipal services will be installed. The following sections outline the servicing strategy to be employed for the development.



2.0 EXISTING SITE TOPOGRAPHY

The existing site is bordered by the Nith River along the west, north and east. The existing topography slopes out towards the river bank(s) around the perimeter of the property. Elevations vary from 269.0 along the south development limit to 234.0 at the north east site limit. There is a surface depression or "sinkhole" located on the north side of Dundas St. just south of the proposed cul-de-sac at the west limit of Street "A". The sinkhole (elev. 261.5) does not have a drainage outlet, however, the soils are highly permeable and surface runoff infiltrates quickly into the ground. The Kulmatycky lands situated north of Street "C" drain in a north-easterly direction to a low point near the existing wetland. Average slopes on the site generally range between 5%-15% with slopes of 3:1 and 4:1 also at some locations.

3.0 ROAD GEOMETRICS

The proposed road pattern for the development provides for three access points to Dundas St. West. The westerly access location (Extension of Street "C") will link up with Churchill Drive. The easterly access will be a connection to Barker St. The central access will be a northerly extension of Gort Avenue. A total of nine (9) public roads are proposed for this development, each with a 20.0 metre right-of-way. Preliminary road profiles were developed to provide for a minimum 2.4 metres of cover over the proposed storm sewer, 2.75m cover over the proposed sanitary sewer and 1.85m cover over the proposed watermain. The geometric design criteria used for this development conforms with County of Brant standards for local and minor collector roads as follows:

- Minimum K value (sag) = 12
- Minimum K value (crest) = 8
- Minimum Horizontal Radius = 80m
- Pavement Width = 9.2m
- Pavement Crossfall = 2%
- Minimum Grade = 0.50%
- Maximum Grade = 8.0%
- Intersection Angle = 70-90 degrees
- Minimum Asphalt Radius At Intersections = 9.0m
- Minimum Tangent Length Between Reverse Curves = 30m

4.0 PAVEMENT

A proposed pavement design for this development is outlined in the geotechnical investigation report prepared by Naylor Engineering Associates Ltd. dated August 2006. The recommended pavement component thicknesses based on pavement usage, frost susceptibility and strength of subgrade soils are as follows:

Pavement Component	Residential Streets
HL-4 Base Course Asphalt	55 mm
HL-3 Surface Course Asphalt	35 mm
Granular 'A' Base Course	150 mm
Granular 'B' Sub-base Course	300-450 mm

It is recommended that Granular 'B' sub-base and Granular 'A' base courses be compacted to 100% Standard Proctor Maximum Dry Density. Due to the good natural drainage characteristics of the granular subgrade soils, pavement subdrains will not be required.

Concrete curb and gutter shall be constructed as per OPSD 600.10 (narrow gutter mountable). Sidewalks, 1.4 metres in width, shall be provided in accordance with County Standards.

5.0 SANITARY SEWERS & APPURTENANCES

5.1 Design Flows

The total design flow rate from the proposed development using current County of Brant design criteria is as follows:

$1,280 \text{ persons} \times 450 \text{ litres/pers/day} / 86,400 \text{ sec} \times 3.6 \text{ Harmon Peaking Factor} + 0.2 \text{ L / Ha.s} \times 24.5 \text{ Ha.} = 29.0 \text{ litres/sec total design flow.}$

A 250mm diameter gravity sewer @ 0.40% grade would be required to convey this flow. In accordance with County of Brant Engineering Standards, the minimum sewer size will be 200mm diameter with 150mm being considered for top sections of sewer runs in order to attain minimum flows with reduced depth. The minimum cover to the crown of the sanitary sewer will be 2.4m. The minimum size of sanitary sewer lateral will be 100mm diameter. Manholes will be spaced maximum 100 metres.

5.2 Sanitary Outlets

There are two (2) existing sanitary sewer outlets in the vicinity of the proposed development. The first is the existing 300mm diameter sanitary sewer on King St. discharging to the sewage treatment plant via the Church St. trunk sanitary sewer system. The second is the existing siphon under the Nith River downstream of the existing footbridge below Laurel St. discharging to the Mechanic St. sewer and ultimately the Willow St. Pumping Station.

5.2.1 Church Street Trunk Sewer

The existing sanitary sewer elevation at King and Dundas St. is approximately 265.00 (T/C elev. 267.80m). The sewer invert at the lowest point in the proposed development is 233.30. Therefore a pumping station will be required to deliver 29.0 litres/sec @ 31.7m of head.

The location of the required sanitary pumping station will be influenced by the following considerations:

- pumping stations are typically situated at the lowest point in the development to facilitate gravity flow into the station. Therefore, the permanent station should be located on Gort Ave. in the Kulmatycky lands. A sanitary forcemain would be constructed on Gort Ave. southerly a distance of approximately 765m to Dundas St. W.
- the Public Works Department has indicated that the County would like to abandon the siphon under the Nith River due to ongoing maintenance problems, age and number of existing river crossings (3). There is an opportunity to situate the proposed pumping station outside the development limits in a location that would facilitate interception of the existing sanitary flows from the Victoria Street Subdivision at Laurel Street. This option would entail constructing the sanitary pumping station north of the Lion's Park swimming pool. A trunk sanitary sewer would be constructed down the embankment along the east side of the Kulmatycky lands to service the proposed development. A second trunk sanitary sewer would be constructed from the point of interception with the existing sanitary sewer at Laurel St. (approx. 225m north of Dundas St.) down Laurel Street to the proposed pumping station location. A sanitary forcemain would then be constructed from the pumping station location, up the Laurel Street hill to King Street. This option would involve cost sharing between the Developer and the County for the pumping station and forcemain in proportion of the existing flows to the overall flows. The County would also be required to install the gravity sanitary sewer on Laurel Street.

The most recent analysis provided by the County indicates that there are capacity deficiencies in certain sections of the Church/Ball/Race St. trunk sanitary sewers. A summary of the capacity deficiencies is provided as follows:

Street Name	Pipe No.	Diameter (mm)	Slope (%)	Design Flow (l/sec)	Capacity (l/sec)	Sewer Length (m)
Dundas St. W.	PRS0157	250	0.11	67.9	20	10.7
King Edward St.	PRS0152	300	0.30	66.2	53	107.1
King Edward St.	PRS0151	300	0.35	67.4	58	105.2
Church St.	PRS0150	300	0.50	68.2	68	23.8
Church St.	PRS0149	300	0.50	68.9	68	114.3
Church St.	PRS0148	300	0.50	69.3	68	112.8
Church St.	PRS0142	300	0.37	72.3	59	45.6

Church St.	PRS0141	300	0.52	72.6	70	99.1
Burwell St.	PRS0140	300	0.40	73.0	61	62.5
Ball St.	PRS0039	675	0.18	385.6	357	30.5
Ball St.	PRS0038	675	0.15	391.1	326	82.0
Ball St.	PRS0035	675	0.16	406.5	336	146.6
Ball St.	PRS0034	675	0.19	408.4	366	89.3
Ball St.	PRS0033	675	0.21	408.8	385	96.65

Note: The above figures include approximately 22 l/sec from the Grandville sewage pumping station. This flow is to be re-directed to the Mile Hill system once it is constructed.

The analysis was based on a theoretical per capita average daily flow rate of 450 l/pers.day. Flow monitoring in the Grandville sanitary sewer system and at the Paris Wastewater Treatment Plant indicate that actual flows are likely in the order of 270-350 l/pers.day. Secondly, as noted above, the construction of the Mile Hill trunk sanitary sewer / forcemain will allow the 22 l/sec from the Grandville Subdivision currently being discharged into the Church St. system to be re-directed. Once this has been done, there should be sufficient capacity in the existing system to accommodate the design flows from the Zavarella and Kulmatycky developments.

5.2.2 Nith River Siphon

The existing siphon invert is 222.76 metres on the west side, 221.896 on the east side and 200mm diameter (length = 55.5m slope 1.57%). Since the lowest sanitary sewer invert in the proposed development is 233.30 it is possible to gravity drain the sewer to the siphon and eliminate the need for a pumping station. This option would be more economical than the pumping station option. **The theoretical capacity of the siphon is approximately 40 litres per second. The required capacity is 29.0 litres per second for the new development plus 8.7 litres per second for the existing Victoria Survey residential for a total of 37.7 litres per second.**

5.2.3 Alternate Sanitary Servicing of Zavarella Lands

The County of Brant is presently reconstructing existing sanitary sewers in Victoria Survey and there is an opportunity to lower the existing invert at the north limit of Barker Street to elevation 263.130. Should the Kulmatycky development not proceed prior to or simultaneously with the Zavarella development, there is an opportunity to gravity drain sanitary sewage from Street A. This would allow about 40 units to develop in advance of the installation of the sewage pumping station.

5.3 Paris Wastewater Treatment Plant Capacity

5.3.1 Wastewater Design Criteria

The design criteria used in the theoretical analysis of existing and proposed infrastructure capacities is based on Ontario Ministry of the Environment Guidelines and County of Brant Engineering Standards. The average daily per capita flow rate presently employed by the County for residential flows is 450 litres/pers/day. This is the upper limit of the 225 to 450 litres/person/day range provided in the 1985 MOE Guidelines and is considered very conservative. Existing flow records measured at the County's Paris and St. George Wastewater Pollution Control Plants indicate a significant discrepancy between theoretical flows and actual flows with measured actual flows being as much as 50% lower than theoretical flows based on the County's design standardsⁱ. This indicates that the existing infrastructure is not being used efficiently. Other Ontario based municipalities have recognized this and have correspondingly adopted a lower per capita design flow rate of approximately 350 litres/person/day as noted in the following table;

Location	Per Capita Design Flow Rate (l/per/day)
City of Barrie	225
City of London	295
Regional Municipality of Niagara (City of Niagara Falls, Town of Fort Erie, City of St. Catharines, Town of Grimsby)	320
Regional Municipality of Waterloo (City of Kitchener, City of Cambridge, City of Waterloo, City of Guelph)	350
Halton Region	365
City of Ottawa	350
City of Kingston	350
City of Brantford	450
Haldimand County	450

Theoretical flows are a function of assumed per capita flow generation rates, contributing area and population density. Current County Standards stipulate a population density of 3.5 persons per single family residential unit. Recent census data and Official Plan numbers suggest that actual population density ranges between 2.5 and 2.8 persons per unitⁱⁱ. The Official Plan further stipulates the maximum number of units per hectare to be 19 for low density. This translates to approximately 53 persons per gross hectare. Although these numbers are appropriate for new developments, they do not reflect actual populations in existing residential areas. Census data again shows that the actual population density is approximately 38 persons per hectare (13 units per hectare).