WILSON-FORD SURVEYING & ENGINEERING

Functional Servicing Report

Bradley Street Plan of Subdivision

Part of Lot 227 Con 2 SWTSR
Geographic Village of Dundalk
Township of Southgate
County of Grey

Prepared for:

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Executive Summary

Wilson-Ford Surveying & Engineering was retained by White Rose Park to complete a Functional Servicing Report (FSR) of the property located at the end of Bradley Street within the former Village of Dundalk, hereafter referred to as the 'Site'. The purpose of this FSR was to:

- evaluate the effects of the proposed change in land use, i.e. Plan of Subdivision on the existing municipal servicing infrastructure and watercourses;
- to determine if necessary improvements are required to the existing municipal servicing infrastructure to support the change in land use, and
- to determine possible mitigation measures to minimise any potential negative impacts to said infrastructure and watercourses.

The work was completed in accordance with established municipal engineering design principles, applicable guidelines (e.g., Ministry of the Environment), regulations and by-laws, and infrastructure information available from the Township of Southgate.

In brief, the FSR has concluded that the Site can be serviced by existing municipal infrastructure (watermains, sanitary sewers, municipal drain) adjacent to the property.

1 Introduction

1.1 Background

Wilson-Ford Surveying & Engineering was retained by White Rose Park to complete a Functional Servicing Report (FSR) to assess the servicing requirements relating to the proposed Plan of Subdivision at the end of Bradley Street. This report will provide the conceptual framework for water distribution, sanitary sewage and storm drainage for the development of the Site prior to detailed design being undertaken.

The Site will be serviced by existing local municipal sewers and watermains at Bradley Street, which adjoins the Site. Service connections will be extended into the proposed Site.

1.2 Site Description

The subject property is an approximate 8.6 ha undeveloped Parcel located at the very north end of the existing Bradley Street comprised of vacant lands and bush, of which 4.65 ha comprises the land to be developed and the balance of ~ 4 ha remaining a wetland/wildlife habitat at tis time[1]. The Site is bounded to the south by an existing residential subdivision (Plans 401 and 852); to the east and north by agricultural lands, and to the west by a Plan of Subdivision currently being constructed (16M-55). Bradley Street is a year-round municipally maintained road.

The Site has a sloping topography with the highest elevation at the northerly end of the vacant lands sloping toward the southeast and southwest at an average slope of 1.8%. The average elevation is 523.0 m along the north boundary and 520.0 m along the south boundary.

The overburden onsite is expected to consist *mainly of a loam textured till*[2] *(Listowel Loam)* with few boulders and relatively stone free for the upper 0.6 m. Additionally, the Listowel Series is characterised by being imperfectly draining. A review of the local water wells[3] verified the presence of loam and sand to varying depths (refer to p. 27).

The Site is legally described as Part of Lot 227 Concession 2 SWTSR within the Geographic Village of Dundalk, Township of Southgate, County of Grey. As shown in Figure 2 (Appendix 1) the Site is also referred to as PIN 37267-0082 (LT) and 37267-0426 (LT) and shown on Reference Plan 16R-11006 as Parts 1 and 2.

[1] According to the Planners retained by White Rose, ie Cuesta Planning Consultants Inc.
[2] Soil Survey of Grey County, Ontario; Report No. 17 of the Ontario Soil Survey; Hoffman, DW, Matthews, BC and Wicklund, RE
[3] Map Well records, MOECC

1.3 Proposed Development

The proposed site development will see the regrading of the currently vacant lands to allow for the construction of a multi-use residential Plan of Subdivision with access from Bradley Street.

As shown in Figure 1 below the subject property is outlined in blue.

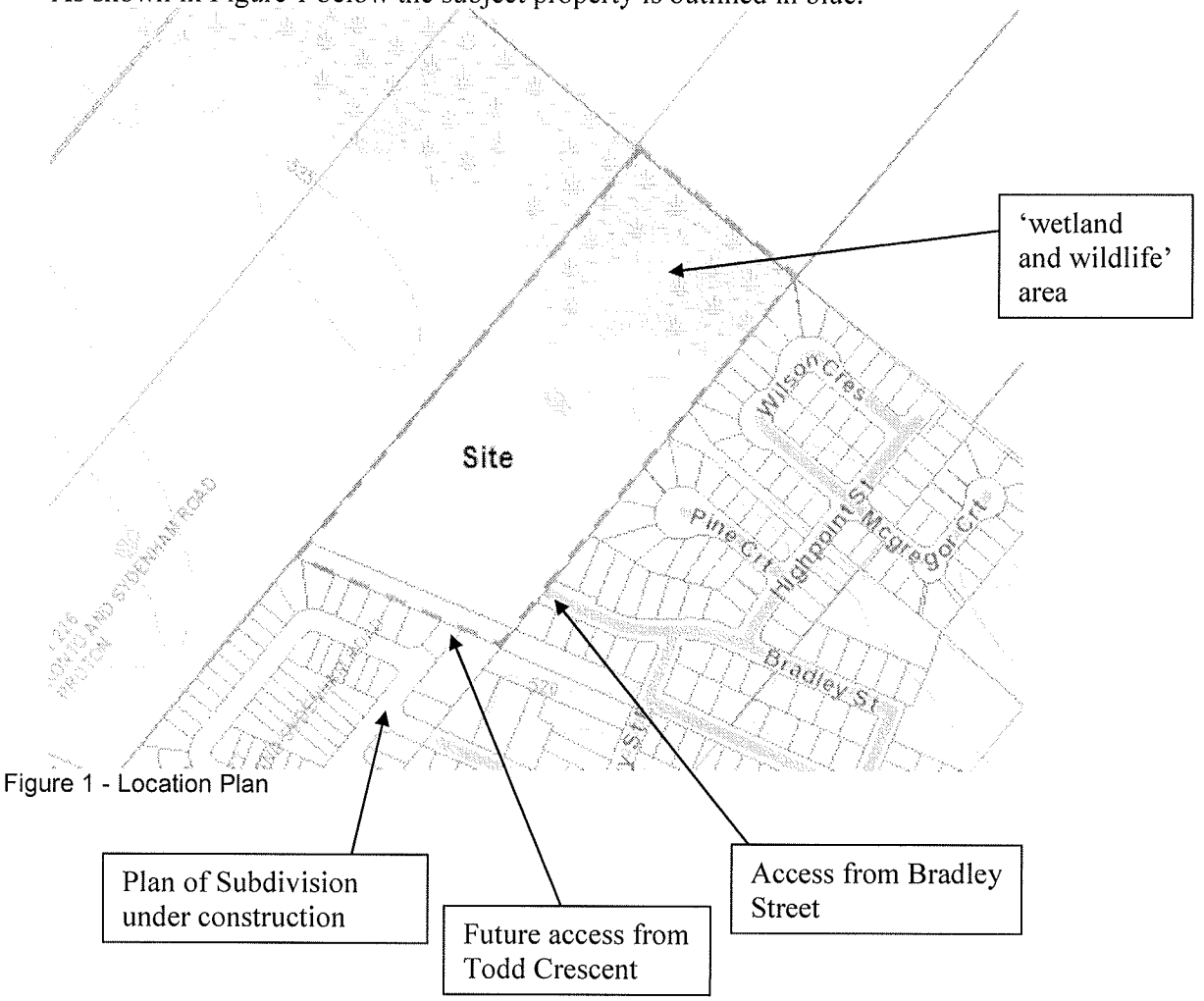


Figure 1 - Location Plan

2 Sanitary Servicing

2.1 Existing Sanitary Infrastructure

The proposed outlet for wastewater will be the existing sanitary sewer at Bradley Street, and more specifically the existing sanitary manhole located in the center of the turning circle located at the end of Bradley Street. Within said manhole there is a singular outlet sewer concrete in material and 250 mm in diameter discharging to the south toward Grey Street. A review of the outlet sewer from the Bradley Street manhole (MH1) is shown below in Table 1.

Sewer segment	**Dia** (mm)	**Slope** (%)	**Length** (m)	**Sewer Capacity** (L/sec)	**Proposed flow from Site** (L/sec)
MH1 to MH2	250	0.50	64	43.9	6.53

Table 1 - summary of sanitary infrastructure conditions

The proposed flow from the Site was developed in Table 2 below for a combination of: 57 single-family residential dwellings; 28 townhouse units and 17 seniors' detached dwellings. The total estimated anticipated sanitary flow from the development will be 6.53 L/sec, which represents ~ 15 % of the existing sewer capacity.

2.2 Sanitary Demands

Sanitary sewers will be designed based on an average daily flow of 450 L/cap[4]; a peaking factor proportional to the design population, and a peak extraneous flow of 0.25 L/Ha*sec. Table 2 below summarises the utilised design criteria and resultant total peak flow that will be generated from the Plan of Subdivision of 0.96 L/sec.

Criteria	**Input**	**Resultant**
Site area	4.55 ha	
Proposed lots (EDU)	57 singles; 28 towns; 17 seniors	
Population[5]	2.5 p/EDU (singles & towns); 1.5 p/EDU (seniors)	238.0 pers[6]
Sewage generation	450 L/cap/day	
Average day Demand	450 L/cap/d * 238.0 pers	1.24 L/sec
Harmon Peaking factor	4.347	
Infiltration Allowance	0.25 L/sec/ha	
Peak sanitary flow	(1.24*4.347) + (0.25*4.55)	6.53 L/sec

Table 2 - sanitary sewage flow

[4] Design Guidelines for Sewage Works, 2008; Ministry of Environment

2.3 Proposed Sanitary Servicing

All sanitary sewers are proposed to be 200 mm diameter PVC pipe with sufficient minimum cleansing velocity of 0.6 m/s.

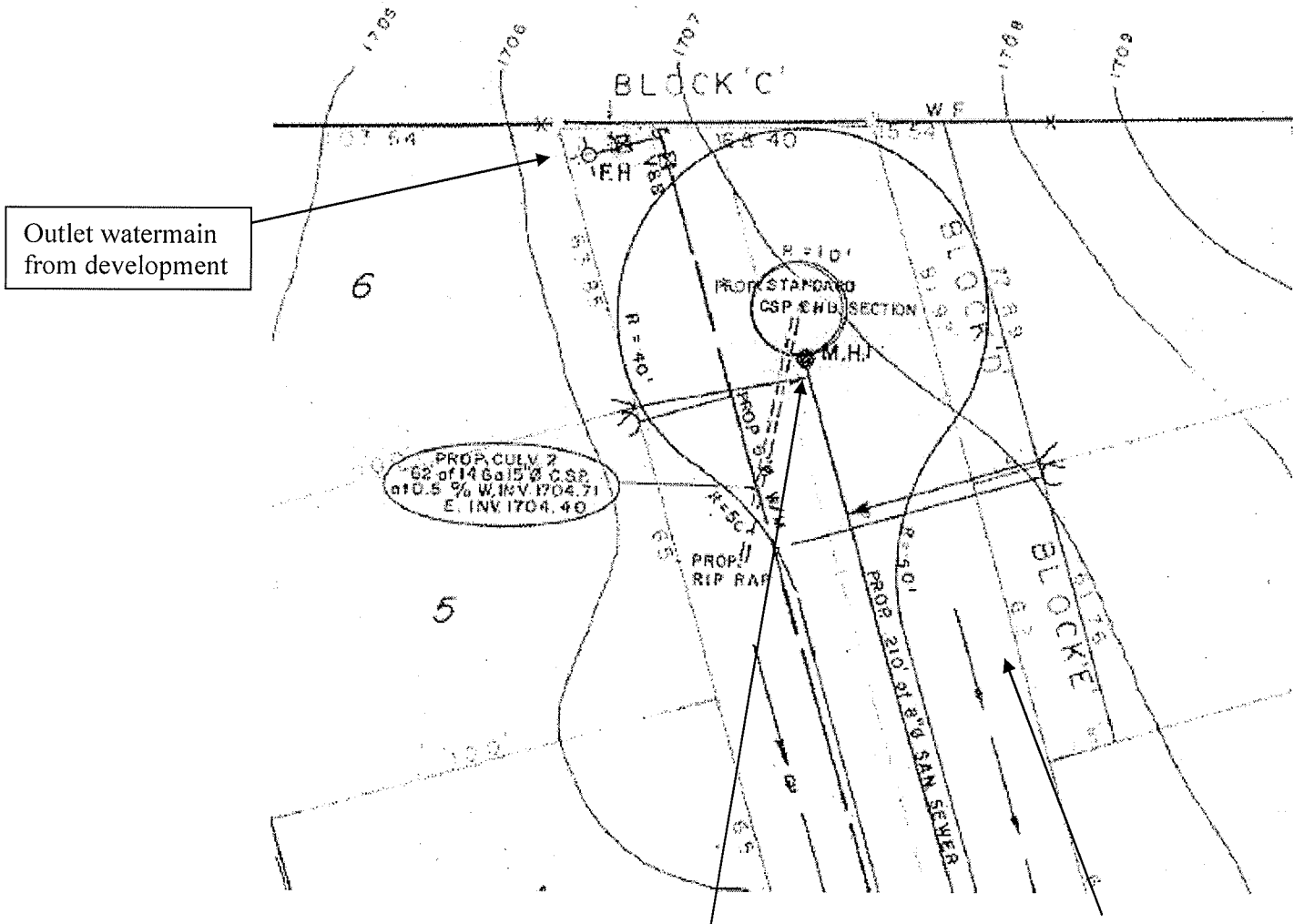


Figure 2 - as-built of Bradley Street[7]

[7] From engineering plans provided by Township of Southgate staff

3 Water Servicing Network

3.1 Existing Conditions

The existing municipal water distribution system around the Site consists of a 150 mm diameter watermain along Bradley Street, where it is dead-ended. The closest existing fire hydrant is located at the end of Bradley Street. Based on flow testing obtained for the existing watermain, the system had a static pressure of 72 psi (496 kPa) and a residual pressure of 15 psi (103 kPa) at a flow rate of 650 usgpm (41.0 L/sec). Refer to Appendix 6 for hydrant flow data.
It is the intent of the design to loop or connect the watermain between Bradley Street and Todd Crescent, currently under construction, which should improve the residual pressures.

[Note – the Township of Southgate are currently in the EA process to build a water tower, which will improve local water pressures]

3.2 Design Criteria

The water distribution system will be designed in accordance to Ministry of Environment guidelines[8] which state that the drinking water system *should be designed* to satisfy the greater of the following:

- Maximum day demand plus fire flow, or
- Peak hour demand.

The maximum day demand and peak hour demand are based on the anticipated water consumption from the development and the fire flow is based on the type of development (see below).

3.3 Domestic Water Demands

The domestic water demand for the development was estimated at 450 L/cap/day[2] . Table 3 below summarises the domestic water demand requirements for the Average day, Maximum Day and Peak Hour demand scenarios derived from Table 3-3 of reference 2 above for systems serving fewer than 500 people. Similar to the sanitary requirements, water usage was based on a population density of 2.5 pers/EDU for singles and towns, and 1.5 pers/EDU for seniors detached dwellings.

[8] Design Guidelines for Drinking-Water Systems, 2008; Ministry of Environment

Criteria	Input	Resultant
Proposed lots (EDU)	57 singles; 28 towns; 17 seniors	
Population[3]	2.5 p/EDU (singles & towns); 1.5 p/EDU (seniors)	238.0 pers
Consumption	450 L/cap/day	
Average day Demand	450 L/cap/day * 238 pers	1.24 L/sec
Maximum day Factor	3.6	
Peak Hour Factor	5.4	
Maximum Day Demand	(3.6*1.24)	4.46 L/sec
Peak Hour Demand	(5.4*1.24)	6.69 L/sec

Table 3 - domestic water demands

3.4 Fire Flow Demands

Fire flow demands for developments are governed by a number of guidelines and criteria, such as the *Water Supply for Public Fire Protection (Fire Underwriters Survey (FUS), 1999), Ontario Building Code (OBC) and AWWA Manual of Water Supply Practices M31 – Distribution System Requirements for Fire Protection.*

The fire flows are dependent upon several factors including the type of construction materials (e.g. wood frame v. masonry or brick), building height, and density of development (i.e. separation). For this development the fire flow requirements at a single-family home (one or two storey), comprised either of wood frame, brick or masonry and separated by 10.1 to 30 m is shown in Table 4 below.

Occupancy	**Fire Flow Required** (L/min)	**Duration** (hr)
One family and two-family dwellings not exceeding 2 storeys in height	3000	1.25

Table 4 - Fire Flow requirements

The watermain within the Plan of Subdivision is required to maintain a minimum residual pressure of 20 psi (138 kPa) when subject to maximum day + Fire Flow demands and a residual system pressure of 40 psi (275 kPa) under normal operating conditions. From Tables 3 and 4 above the value of maximum day + Fire Flow demands = 54.5 L/sec. When this demand, i.e. 54.5 L/sec (864 usgpm) is compared to the fire flow tests, the calculated (extrapolated) residual pressure is < 20 psi (138 kPa) which does not currently meet the minimum required 20 psi (138 kPa).

Because the watermain is currently dead-ended at Bradley Street, but will be looped to connect to the new watermain from Todd Crescent no meaningful pressure tests can yet be derived from this segment.

3.5 Fire Protection

It is anticipated that at least one new fire hydrant will be installed within the Plan of Subdivision cognisant that there is an existing hydrant approximately 5 m from the proposed development boundary at Bradley Street

4 Stormwater Management - preliminary

A Stormwater Management (swm) Report will be required for this development of which some calculations have been included within Appendix 4 and Table 6. Within said calculations the stormwater quantity generated has been estimated under which this Site will demonstrate compliance with the Municipal (Township of Southgate), and Ministry of Environment (MOECC) guidelines.

In general, the Site defined as the developable portion of the overall lands, is split into two drainage areas. One area, the west area, will drain toward the southwest portion of the Site near the existing Bradley Road while the other area entitled the east area will drain toward the existing municipal drain at the southeast area of the Site.

It is anticipated that the west area will drain into the existing storm water facility which services the east portion of the new subdivision located immediately adjacent to the Site. This will require an amendment to the existing MOECC Approval, and is being facilitated by others, ie WMI & Associates Limited under separate cover.

The level of protection with respect to the downstream watercourses and existing aquatic habitats has been specified as 'normal' from the Conservation Authority (Grand River C.A.), which is defined as providing a long-term average removal of 70% of the suspended solids within the newly generated storm water volumes.

4.1 Existing Conditions

There are two existing storm water outlets adjacent to the Site. One outlet is an open watercourse located to the southeast of the proposed developable area of the Site east of Lot 25 on R.P. 401 and west of Lot 7 on R.P. 852 discharging toward Highpoint Street. A second outlet is the recently established storm water facility located to the southwest of the Site south of Todd Crescent.
From a review of the prevailing topography there are no external lands that will drain onto the Site. A combination of new storm sewers and swales throughout the development will provide an outlet for post-development conditions to either of the previously specified outlets.

4.2 Minor Storm Drainage System

An onsite minor storm drainage system, consisting of a series of new storm sewers will be designed to convey storm water from storms up to and inclusive of a 1:10 year storm event exceeding the suggested Municipal guidelines.

The pre-development condition of the site is primarily an agricultural field. The post-development condition will change to a more residential environment with landscaped lawns, hard top driveways and hard top roadways.

No onsite stormwater controls have been incorporated to restrict flows to the new storm sewer system.

4.3 Major Storm Drainage System

The major storm system is a conveyance system for flows in excess of the minor system flows designed for a 1:100 year storm event.

For this development, the grading design will be prepared such that the surface grades of roads and landscaped areas will direct surface drainage to approved outlets, such as the infiltration basin located at the southeast corner of the Site.

4.4 Approvals

New storm sewers and appurtenances, e.g. catchbasins, manholes and storm water management facilities will be subject to local municipal Approval, Conservation Authority and Ministry of Environment (MOECC).

Additionally, permanent swm facilities may be required to be located on lands that the proponent will provide easements thereon for municipal maintenance

4.5 Native Soil

Prior to discussing how water generated from various storm events will affect the Site through a synthetic rainfall distribution, an understanding of the insitu soil is helpful.

From a review of various soils maps, and textbooks e.g. Soil Survey of Grey County (Soil Survey Report No. 17) an appreciation of the local soil described as 'Listowel silt loam' is described. More specifically that the soil type was developed from limestone till defined as *unsorted material deposited directly by glacial ice and showing no stratification*[9] . Listowel silt loam soils were developed on medium textured till resulting in imperfect, i.e. not good and not poor characterised by low surface runoff but slow internal drainage. In our opinion, these soils could be classified as a hydrologic soil group classification 'B'.

In summary, the Site would appear to be underlain by a soils group which will impede the downward movement of water and confirms that a Hydrologic Soil Group classification of 'B' is appropriate.

[9] https://www.britannica.com/science/till

4.6 Hydrologic Modelling

4.6.1 Method of Analysis

Modelling for all storm events was completed using computer (HydroCad ver. 10) software with a 24-hour NRCS (National Resources Conservation Service) type II design storm using Ministry of Transportation IDF coefficients specifically for the Bradley Street development area (lat: 44.17350 deg, long: -80.39755 deg).

Runoff coefficient's that were utilised in this analysis, for a Hydrologic Soils Group classification of 'B' included:

Cover Type	Runoff Curve Number
Residential district with lots approximately 1/8 acre in size or less	85 (Group B)
Fallow grassland with good (>75% ground cover) hydrologic condition	61 (Group B)

Table 5 - runoff coefficients

Overall there is a net increase in the runoff coefficient as shown in Table 2 below. In other words, more water should run off the overall site in a post-development scenario than what currently occurs.

Watershed contributing Area (ha)	Overall coefficient of runoff, CN
West, Pre-development watershed, A = 3.00	61
West, Post-development watershed, A = 3.00	85
East, pre-development watershed, A = 1.65	61
East, post-development watershed, A = 1.65	85

Table 6 - overall runoff coefficient

The runoff coefficients in Table 3 above were further modified by a frequency factor. in other words, less water to account for antecedent precipitation conditions as follows:

Storm Interval (yrs)	Factor
25	1.1
50	1.2
100	1.25

Table 7 - frequency factors

Time of concentration for the sub-catchment areas was evaluated using a sheet flow runoff pro forma template, with a minimum practical time of concentration of no less than 5 minutes.

Initial abstraction (Ia) coefficients, representing the interception, infiltration and surface depression storage of rainfall are illustrated in Table 4 below:

Land Cover	Ia
Impervious	2 mm
Pervious lawns	5 mm

Table 8 - Ia coefficients

Modelling of the site resulted in the following schematic drawings with applicable sub-catchment areas, in both a pre-development scenario (Figure 4), and post-development scenario as shown in Figure 5.

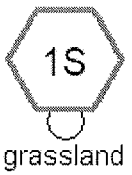


Figure 3 - sub-catchment area (pre-development)

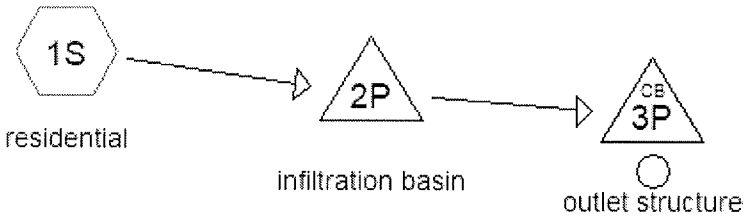


Figure 4 - sub-catchment area and connecting links (post-development)

The infiltration basin shown in Figure 5 will most likely consist of an oil/grit separator followed by an aggregate filled infiltration basin, similar to a sand filter for suspended solids polishing, which in turn will discharge into a concrete outlet structure for final discharge to the open municipal drain.

4.7 Proposed Storm Water Controls

With respect to quality of storm water, it is possible that a combination of stormwater management practices might be implemented to provide TSS attenuation for this development, which is not required at this site.

In a treatment train approach to solutions, beginning at the lot level expanding to the conveyance system then to the end-of-pipe possible restoration measures might include the following practices:

Treatment train level	examples
Lot level	Roof leader discharge to soakaway pits; Reduced lot grading; Reduced driveway grading; Bioretention basins
Conveyance	Grass swales; Vegetated filter strips; Open ditches
end-of-pipe	Infiltration basins; Filters;

Table 9 - stormwater management practices

In summary the salient features of the storm water design for the east area are as follows:

- Minor system flows will enter the storm water facility through an oil/grit separator;
- Major system flows will enter the storm water facility overland directly into the infiltration basin;
- To provide a protection level of 'normal' as specified within the Ministry guidelines[10] the required storage volume within the proposed infiltration basin is 23 cu m to which 40.5 cu m have been allotted;
- A concrete structure at the end of the infiltration basin will allow for monitoring, further particulate polishing through filters prior to discharge to the existing municipal drain;
- The existing municipal drain, estimating it as ~ 5 m in width and 0.6 m in depth has a capacity more than sufficient to drain the post development Site conditions at storm frequencies up to and including the 1:100 storm event, and
- All rainfall events have been based on the very localised Bradley Street area as provided by the Ministry of Transportation and modelled using a synthetic rainfall distribution of 24-hour NRCS (National Resources Conservation Service) type II design storm.

A more detailed storm water design is to follow in the Stormwater Report that will accompany the application for Approval to the Ministry of Environment.

[10] Stormwater Management Planning and Design Manual, March 2003

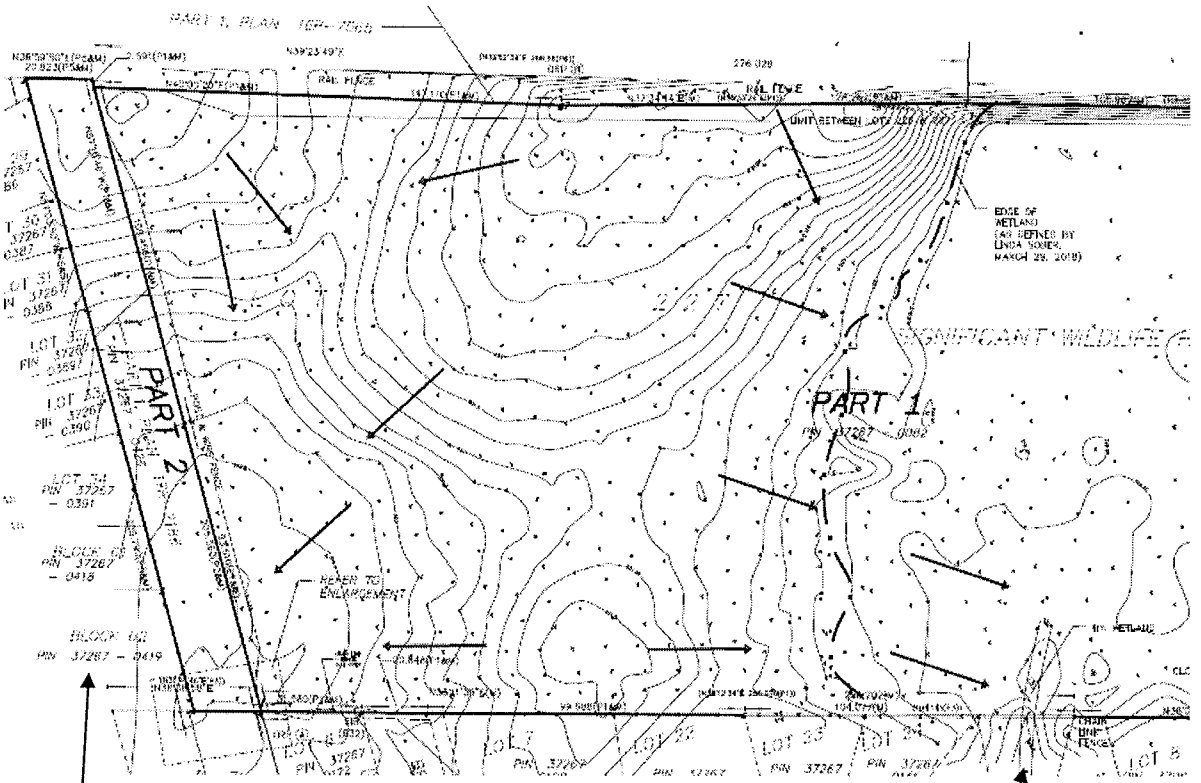


Figure 5 – an illustration of the Site topography

As illustrated in Figure 5 above the two outlets to the newly generated stormwater volumes are shown in the southwest and southeast corners of the Site.

5 Sediment and Erosion Controls

Erosion and sediment controls shall meet the requirements of the most recent version of the MOE Stormwater Management Planning and Design Manual[4] at the time of construction.

Sediment and erosion controls will be implemented both during construction of applicable infrastructure and during lot development. These measures will include:

- Installation of silt control fencing at strategic locations around the perimeter of the site;
- Maintaining sediment and control structures in good repair including periodic cleaning s required) until such time that the Town approved their removal;
- During individual construction of homes within the development, silt barriers to be constructed, as appropriate to prevent eroding of materials into roadside drainage system. Sedimentation control to be in the form of siltation fences and/or shallow excavated sediment traps (moats) placed in the direction of flow from the construction site.

6 Conclusion

6.1 Water Distribution

The proposed development will be serviced from a looping of the existing 150 mm diameter watermain currently dead-ended at the end of Bradley Street to the new 150 mm diameter watermain along Todd Crescent. Through a combination of piping and existing fire hydrants both the maximum daily demand and fire flow consumption will be satisfied. Fire hydrant flow tests are included as Appendix 6. Domestic and fire flow calculations for the proposed development are included under Item 3.

6.2 Sanitary Sewage

Sanitary sewage generated from this development will be conveyed to the existing sewer along Bradley Street, and more specifically to the manhole in the center of the turning circle. It is estimated at the current proposed scale of the Plan of Subdivision, i.e. 57 singles, 28 towns and 17 seniors' dwellings that the post-development peak sanitary flow to be approximately 6.53 L/sec from the Site.

6.3 Storm Sewage

Minor storm drainage for the proposed development will be conveyed to the curb and gutter along the new roads and major storm flows will be directed away from the proposed residential dwellings toward the southeast corner of the Site. The required storage volume to satisfy the level of protection criteria has been met through the implementation of an infiltration basin.

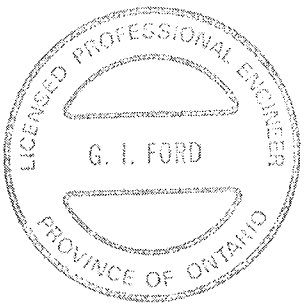
7 Limitation of Liability

The information in this report is based partly on information provided by others and visual observations identified herein. This type of limited investigation is designed to provide information to support an overall Plan of Subdivision application. Sampling and analysis of soils, groundwater, and other media was not carried out as part of the investigation.

It should also be noted that current environmental guidelines and regulations are subject to change, and such changes, when put into effect, could alter the conclusions and recommendations noted throughout this report.

Wilson-Ford Surveying & Engineering

Greg Ford, P. Eng. (civil), OLS



Appendix 1

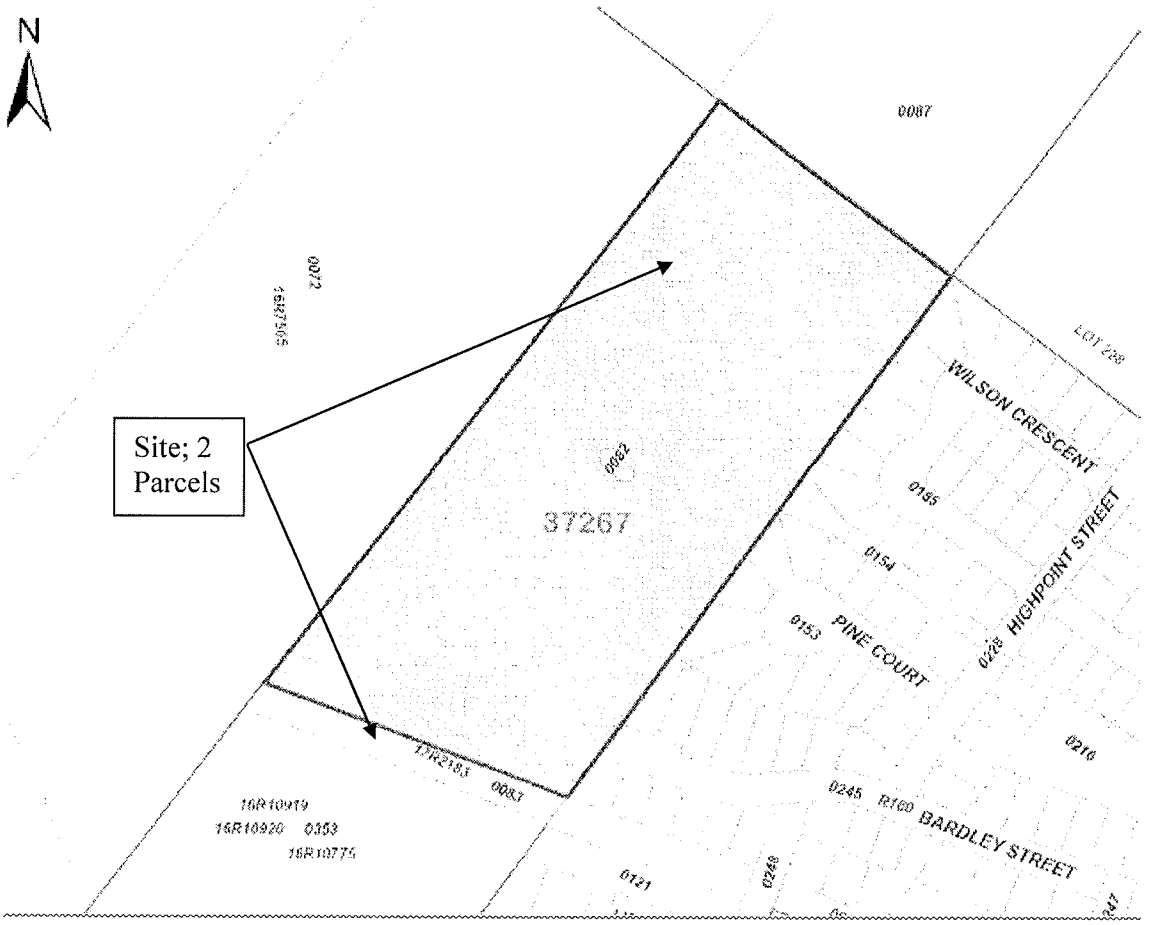


Figure 6 - Block map of Site courtesy of LRO records

Appendix 2

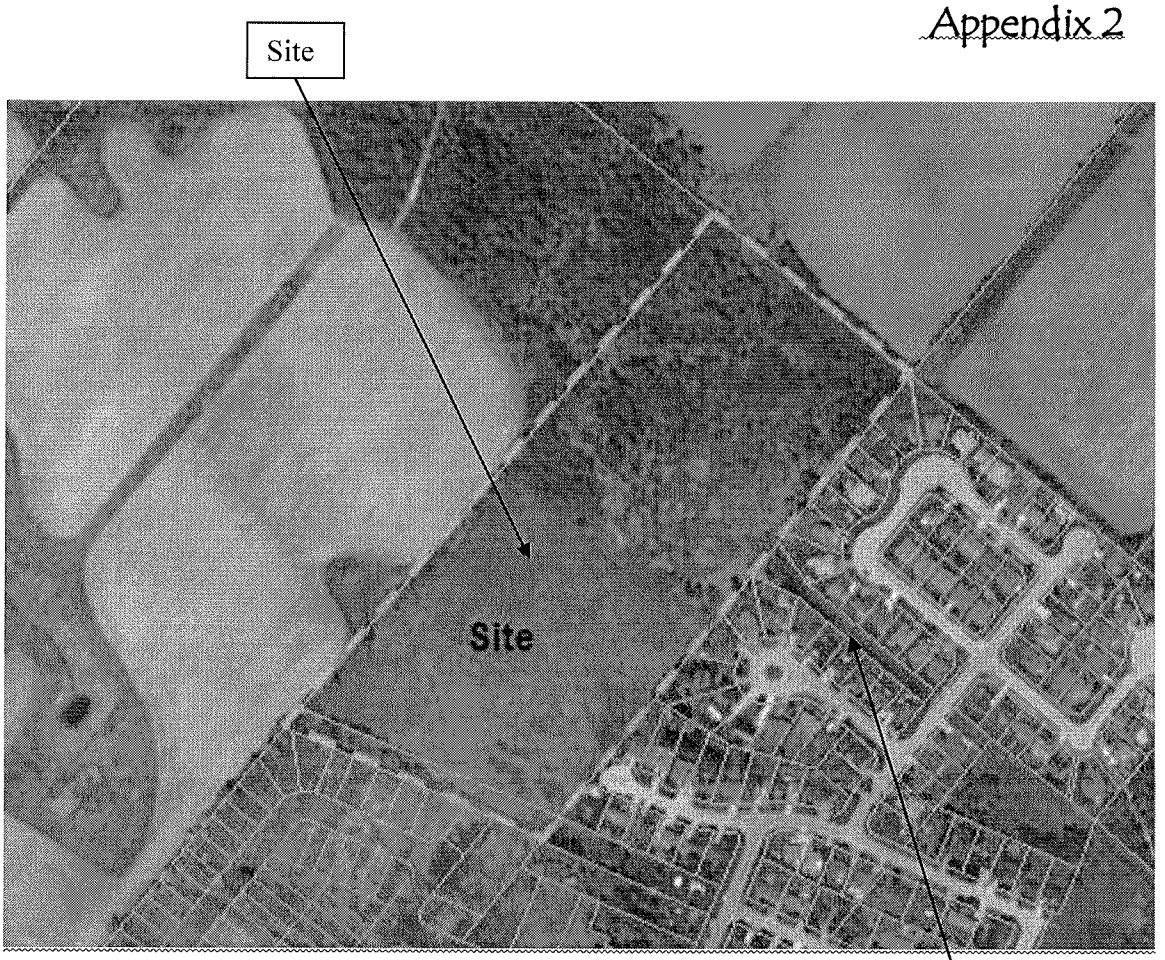


Figure 7 – aerial view of proposed Plan of Subdivision (courtesy of MNRF).

Appendix 3 – Reference Plan

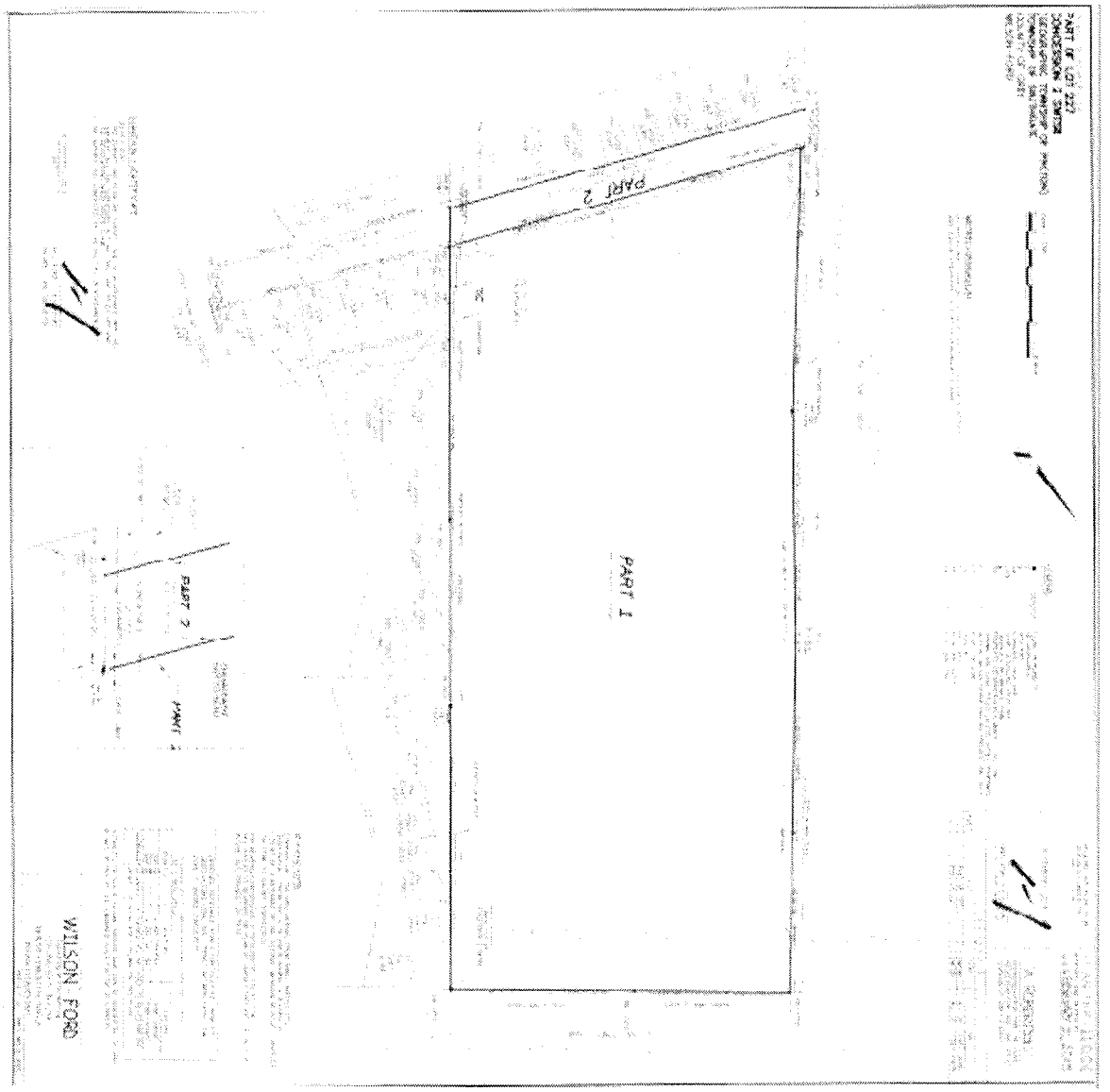


Figure 8 - Reference Plan of Site

Appendix 4 – Site Topography

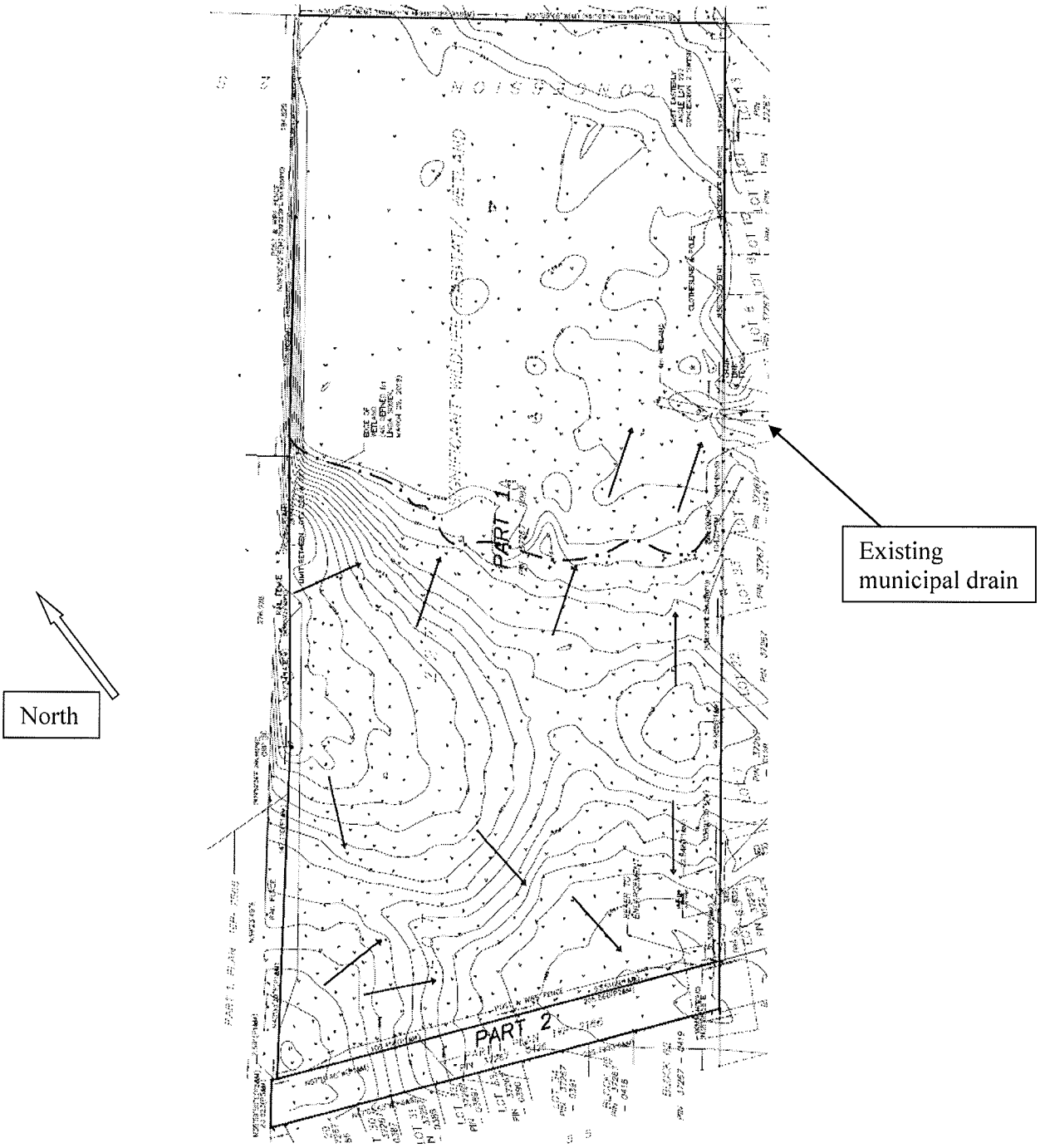


Figure 9 - contour plan of Site

Appendix 5 – Site Geology

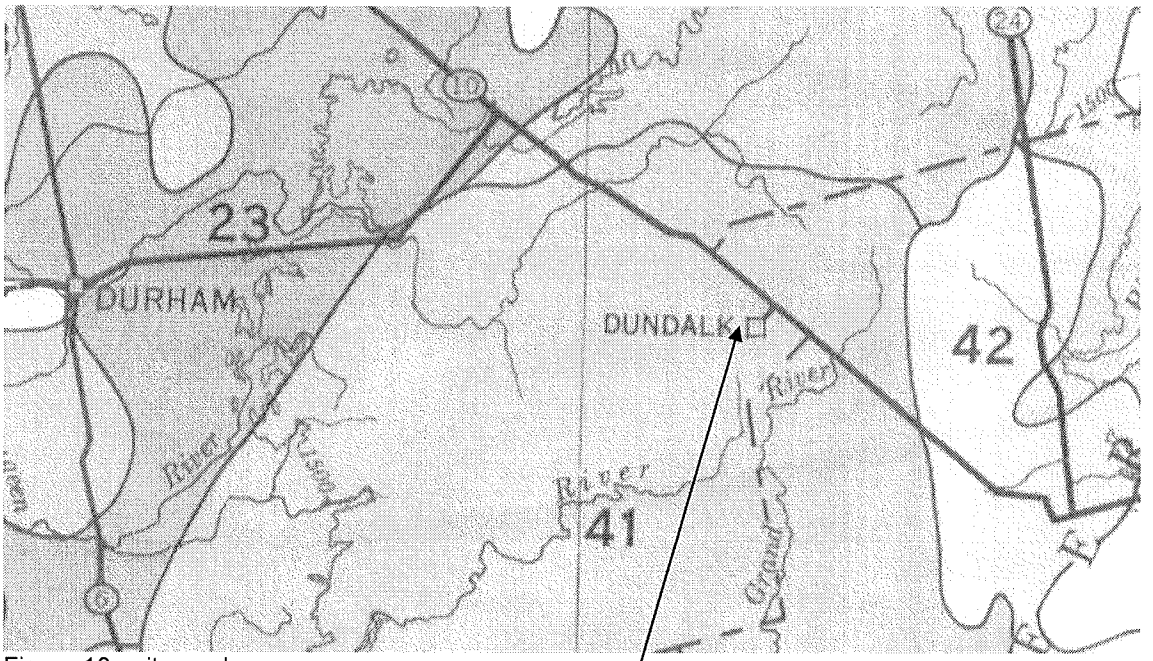


Figure 10 - site geology

From a review of the Soil Survey manual for the area [11] and the geology map[12] the dominant soil type in the Dundalk area is a loam developed from limestone till ("*Listowel silt loam*"). Characteristics include a medium-texture with imperfect drainage and relatively stone free.

[11] Soil Survey of Grey County by JE Gillespie and NR Richards; January 1954; Report No. 17 of the Ontario Soil Survey

[12] Soil Associations of Southern Ontario compiled drawn and published by the Soil Research Institute, Research Branch, Canada Department of Agriculture; 1960

Appendix 6 – Fire Hydrant Flow Testing

Fire Hydrant Flow Testing

Location	Residual Hydrant #	Flow Hydrant #	Static Reading Before	Static Reading During	Residual Hydrant Flow GPM	Residual Hydrant PSI	Calcualte Flow at 20 PSI GPM	Assigned Colour	Date Tested
Eco Parkway	78	79	78	26	750	20	796	Orange	10/10/2017
Eco Parkway	72	73	88	40	850	25	1026	Green	10/10/2017
Ida St N	66	67	82	24	750	20	778	Orange	10/10/2017
Hanbury and Bell Circle	27	28	78	22	700	18	713	Orange	10/10/2017
Ida St S	29	30	80	40	650	15	809	Orange	10/10/2017
Ida St N and Glen Elg St	33	34	78	22	590	12.5	601	Orange	10/10/2017
McDowell St & Braemoe St	64	63	69	34	750	20	899	Orange	10/10/2017
Artemesia St N	42	41	72	34	750	20	889	Orange	11/10/2017
Osprey St N	47	46	72	28	700	17.5	766	Orange	11/10/2017
Bradley St N	50	51	72	28	650	15	711	Orange	11/10/2017

Figure 11- fire hydrant pressures

As shown in Figure 11 above the static pressure at the closest existing fire hydrant to the new development was measured as 15 psi. It is anticipated that upon looping the watermain from Bradley Street North, which is currently dead-ended, to the new watermain from Todd Crescent that the static pressure will increase to be equal to or greater than the required pressure of 20 psi.

Appendix 7 – Water Well Records

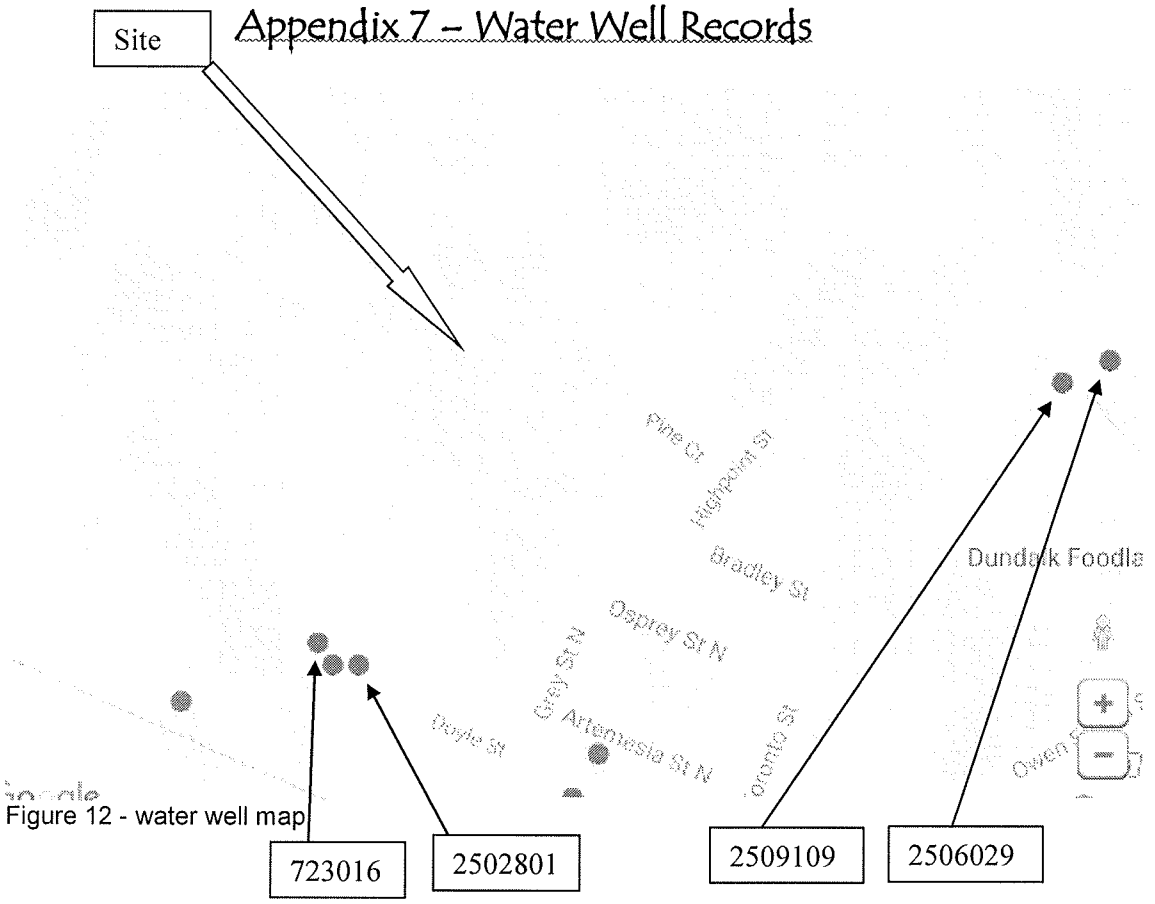


Figure 12 - water well map

Well ID #	Date of Completion	Overburden strata:	
723016	Dec 13/14	0 – 20 ft: sand w/gravel	
2502801	Mar 7/69	0 – 3 ft: loam	3 – 20 ft: clay w/sand
2509109	Sep 15/87	0 – 1 ft: topsoil	1 – 53 ft: clay, stones & some gravel
2506029	Apr 15/77	1 – 27 ft: sandy clay, gravel	

Table 10 - overburden strata

As illustrated in Table 10, courtesy of the Ministry of the Environment, the overburden typifies the 'imperfect' drainage discussed earlier exemplified by competing pockets of sand with gravel and sandy clay.