FUNCTIONAL SERVICING REPORT

ARDAGH ROAD AND FERNDALE DRIVE

PROPOSED RESIDENTIAL DEVELOPMENT

CITY OF BARRIE

PROJECT 2018-4623 **JUNE 2019**

Revision	Description	Prepared		Checked	
		By	Date	By	Date
0.0	Original Report	M. Ventresca	June 2019	K. Shahbikian	June 2019

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1 INTRODUCTION

1.1 Study Objectives and Location

Schaeffers Consulting Engineers has been retained to provide a Functional Servicing Report for the property at the northwest corner of the intersection of Ardagh Road and Ferndale Drive South. The property is located at 224 Ardagh Road.

The subject site is bound by existing residential and an electrical building to the north, Ferndale Drive South to the east, Ardagh Road to the south, and a block zoned for a future fire station development to the west, as illustrated on **Figure** 1.1and **Figure** 1.2. The site is located within the jurisdiction of the NVCA; however, the site exists outside of the NVCA regulated areas.

The main objective of this report is to provide details regarding the water supply servicing, sanitary servicing, and stormwater management design for the subject site in accordance with the applicable design criteria and standards.

1.2 Proposed Development Plan

It is proposed to construct a residential development, consisting of thirty one (31) townhouse units and fifty (50) residential apartment units. It is proposed to have one access point from Ferndale Drive South and one access point from Ardagh Road as shown on **Figure** 1.2. The subject site is approximately 0.98 ha after the road widening and sight triangle blocks are conveyed to the city, refer to **Appendix A** for more information regarding the latest site plan by S&C Architects Inc.

1.3 Existing Site Conditions

The current land use is a mix of grassed open space, trees, a gravel stockpile, and a gravel parking lot. The existing gravel stockpile and existing trees will need to be removed for the development of the site. There is an existing electrical building on the site near the North-east corner. This existing building will be maintained in the post-development conditions.

A geotechnical investigation was completed by Soil Engineers Ltd. dated May 2018 and shows that the subsurface stratigraphy consisted of a topsoil layer over a discontinuous fill stratum which was in turn underlain by native deposits of sand, silt, and some silty clay.

The current existing ground has a significant fall towards North West. Under pre-development conditions, the majority of the site (the western portion) drains via sheet flow northbound towards an existing swale on the northern border of the site where it flows westerly. This topographic condition creates a challenge to provide a simple positive drainage solution. The proposed solution will be discussed further in Section 2.3.

Phil Gotfried

224 ARDAGH ROAD &
204 FERNDALE DRIVE SOUTH

LEGEND

SUBJECT LOCATION

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FIGURE 1.1
LOCATION PLAN

2018-4623	JUNE 2019	SCALE: N.T.S.

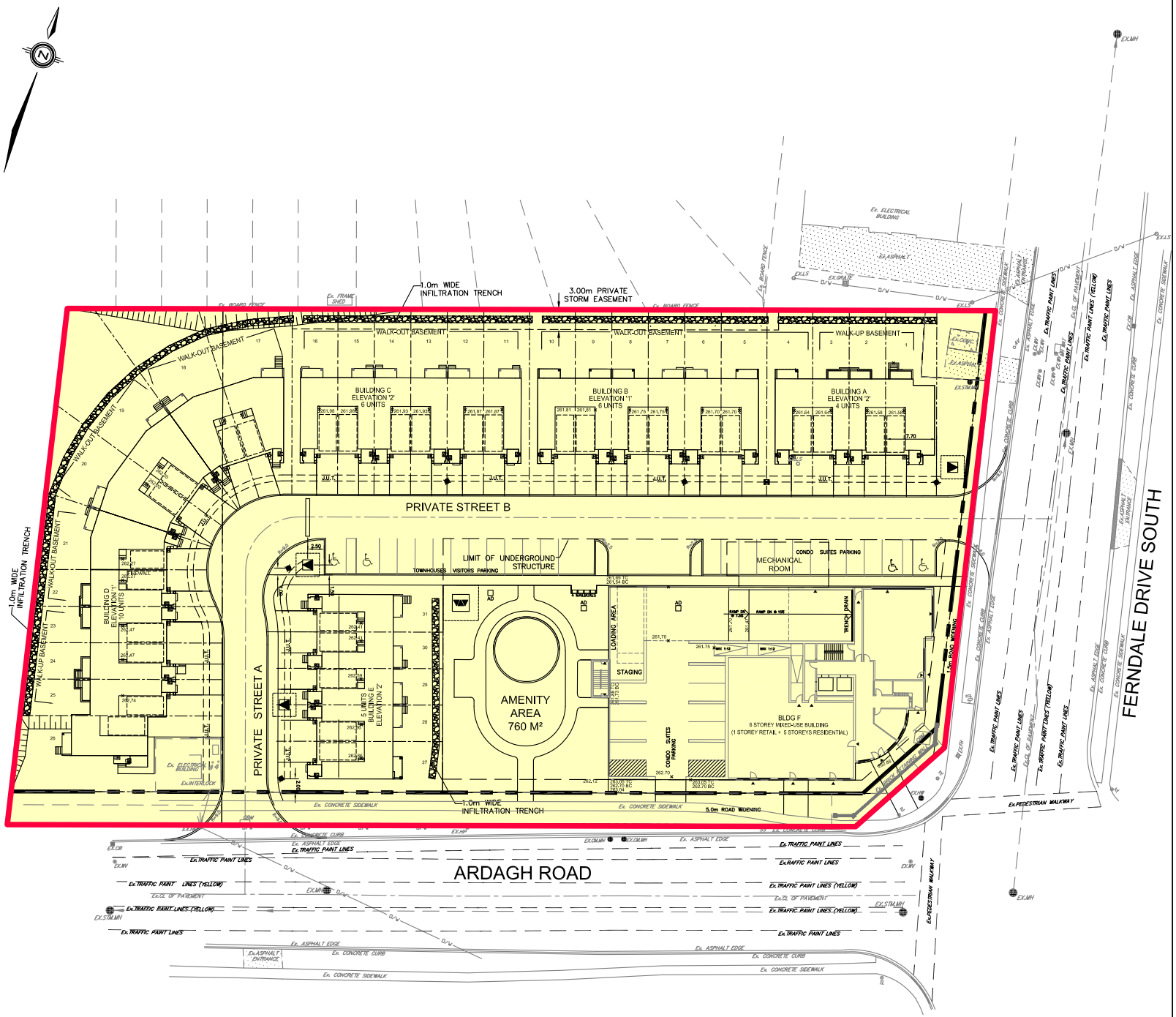

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FIGURE 1.2
DEVELOPMENT PLAN

2018-4623	JUNE 2019	SCALE: N.T.S.

2 STORMWATER MANAGEMENT

2.1 Existing Storm Infrastructure

There is an existing 600mmØ diameter storm sewer on Ardagh Road which drains westerly to an outfall just west of the subject site. Under pre-development conditions, the majority of the site (the western portion) drains via sheet flow northbound towards an existing swale on the northern border of the site where it flows westerly as shown in **Figure** 2.1**.**

There is an existing 300mmØ diameter storm sewer on Ferndale Drive South located north of the subject site; the eastern area of the subject site currently drains eastward towards Ferndale Drive South as shown in **Figure** 2.1.

2.2 Stormwater Design Criteria

As per the Ministry of the Environment Conservation and Park's (MECP, formerly referred to as the MOE) Stormwater Management Practices Planning and Design Manual (March 2003), the Nottawasaga Valley Stormwater Technical Guide (December 2013) and the City of Barrie's Design Criteria (December 2017), the following guidelines are used in the design of storm services and SWM infrastructure, described below:

- Storm sewers shall be designed to convey at least 5-year return frequency storm;
- Storm sewers shall be designed using Rational Formula:

  $Q = ciA/360$

  where Q is the flow rate in m^3/s;
  c is the runoff coefficient (dimensionless);
  i is rainfall intensity in mm/hr; and
  A is area in ha.
- Design storms should be derived from the City of Barrie Rainfall Intensity-Duration Frequency:

  $i = A/(t+B)^c$

  where i is rainfall intensity in mm/hr;
  t is time of concentration in minutes (minimum 10 minutes);
  A, B, & C are parameters determined from Barrie WPCC Station #6110557, adjusted for climate change, for the 100-year storm event, A=1426.4, B=5.27, and C=0.759;
- minimum pipe diameter for storm sewers is 300mmØ;

2.3 Proposed Stormwater Management Scheme

It is proposed to safely convey stormwater runoff to the existing storm sewer on Ferndale Drive South as shown in **Figure** 2.2. The site is proposed to drain generally eastwards towards Ferndale Drive South via the major flow route; the stormwater runoff is proposed to be captured within the storm sewer within the private street and discharged to the existing 300mmØ diameter storm sewer on Ferndale Drive South. There will be a second connection to Ardagh Road's existing 600mmØ storm sewer for the roof and rear yard drainage from the northern and western townhouse units. As discussed in Section 1.3 and Section 2.1, the RLCB along the North property line elevation will be low and these RLCBs cannot be connected to the existing sewer on Ferndale Drive. The proposed storm sewers will act as "superpipes" meaning they are to convey and attenuate the flows up to and including the 100-year storm event. The 100-year storm event will be fully captured within the subject site apart from a small ~0.026ha pervious area in the northwest of the subject site as seen in **Figure** 2.2.

2.4 Western System (Outlet to Ardagh Road)

2.4.1 Water Quantity Control – Ardagh Road

For the proposed outlet to Ardagh Road, the pre-development 5-year flow rate for the subject site area that currently drains westwards and discharges to the existing 600mmØ was taken as the allowable release rate to the receiving system, a flowrate of approximately 46.5 L/s, the drainage area is illustrated in **Figure** 2.2 for reference. Runoff to this receiving sewer will be controlled in the post-development condition to restrict the flow to the 5-year return period at predevelopment levels less the 100-year flow generated from the uncontrolled site area that is proposed to remain flowing westwards to outlet to the same receiving watercourse as the Ardagh sewer system. Detailed calculations regarding the pre-development flows are provided in **Appendix B** for reference.

A 100mmØ orifice tube will be used to control the outlet flowrate into the existing Ardagh Road 600mmØ sewer to the 5-year pre-development flowrate of 46.5 L/s (orifice outlet is designed to convey 36.2 L/s in the 100-year event). The required storage in the 100-year storm event under this scenario is ~27m^3; this volume is proposed to be met through the underground sewer system, mainly through two legs of 750mm storm sewers on the proposed private street. The superpipe system is designed to store the required 32.83m^3 with a 100-Year Water Level of 257.75masl. For a summary of the Quantity Control for the Western Stormwater Management system of the proposed site refer to **Table** 2-1 provided below, for further details refer to **Appendix B**.

Table 2-1: Ardagh Road Stormwater Management Quantity Control Summary

Condition	Return Period (Years)	Outlet	Tributary Area	Runoff Coefficient	Flow (L/s)	Controlled Peak Flow (L/s)	Volume Required (m^3)	Volume Provided (m^3)
Existing	5	Watercourse to the West	0.782	0.25	46.5	N/A	N/A	N/A
Proposed Uncontrolled	100	Watercourse to the West	0.026	0.25	3.2	N/A	N/A	N/A
Proposed Controlled	100	Existing 600mmØ on Ardagh Road	0.299	0.54	80.2	31.7	30	30.75

2.4.2 Water Quality Control – Ardagh Road

The proposed stormwater runoff to be conveyed to the Ardagh system is comprised solely of clean water from rooftop and rear yard tributary areas and therefore does not require quality control prior to out letting into the existing sewer system.

2.5 Eastern System (Outlet to Ferndale Drive South)

2.5.1 Water Quantity Control – Ferndale Drive South

For the proposed outlet to Ferndale Drive South storm sewer system, the 5-year flow rate for the subject site area reflected in the City of Barrie's approved storm drainage plan was taken as the allowable release rate [0.88ha with a runoff coefficient of 0.70] (refer to drawing #92128-4, included in **Appendix B** for more detail). The Ferndale Drive South system was designed to accept approximately 186.4 L/s from the subject site, therefore runoff to this receiving sewer will be controlled in the post-development condition to the flow to the 5-year return period in accordance with the tributary plan. Detailed calculations regarding the pre-development flows are provided in **Appendix B** for reference.

A 150mmØ orifice tube will be used to control the outlet flowrate into the existing Ferndale Drive South 300mmØ sewer to the minimum of the 5-year design flowrate of 186.4 L/s and the capacity of the proposed 300mmØ connecting to the existing sewer (~118L/s). Due to crossing constraints with the existing and proposed infrastructure the slope of the proposed 300mm storm sewer system on Ferndale Drive South could not contain a slope steeper than 1.5% yielding a conveyance capacity of

118 L/s, the proposed orifice outlet is designed to convey 82.6 L/s in the 100-year event. The required storage in the 100-year storm event under this scenario is ~119m^3; this volume is proposed to be met through the underground sewer system, mainly through the proposed 1800 x 1200mm box culvert on the proposed private road. The superpipe system is designed to store the required 119m^3 with a 100-Year Water Level of 261.18masl. For a summary of the Quantity Control for the Eastern Stormwater Management system of the proposed site refer to **Table** 2-2 below, for further details refer to **Appendix B**.

Table 2-2: Ardagh Road Stormwater Management Quantity Control Summary

Condition	Return Period (Years)	Outlet	Tributary Area	Runoff Coefficient	Flow (L/s)	Controlled Peak Flow (L/s)	Volume Required (m^3)	Volume Provided (m^3)
Approved Tributary Area	5	Existing 300mmØ on Ferndale Drive	0.88	0.70	186.4	N/A	N/A	N/A
Proposed Controlled Area	100	Existing 300mmØ on Ferndale Drive	0.67	0.79	265.3	85.6	115	116.64

2.5.2 Water Quality Control – Ferndale Drive South

A JF6-3-1 Jellyfish® unit has been proposed downstream of the control orifice. It has been designed to meet 80% TSS removal for 90% of the cumulative annual runoff, detailed calculations regarding this unit can be referenced in **Appendix B.** Furthermore, to meet the treatment train objective, CB shields will be added into each CBs.

2.6 Water Balance

The subject site is located within the Nottawasaga Valley (NVCA) Jurisdiction, in a Wellhead Protection Area (WHPA) of low stress quantity threat for both activities that take water without returning it and reduce recharge (WHPA-Q1 & Q2) and a vulnerability score of 2 for Quality indicating a 25-year time of travel for contaminants to reach the closest water well (WHPA-D). Due to the subject site's location in WHPA-Q1 & Q2, a pre-post development water balance of the annual infiltration volumes must be conducted to ensure that the post-development condition provides the same volumes as the pre-development condition. The annual infiltrated volume in the pre-development condition was determined to be 1,799m^3; the post-development condition revealed an infiltrated volume of 546m^3, therefore a deficit of 1,253m^3 must be mitigated by low impact

development measures (LIDs). In order to meet this deficit, topsoil amendment across the pervious areas of the site and infiltration trenches in the rear yards of the north and west townhouse blocks have been proposed on site. The post-development condition with these mitigation measures reveals an annual infiltration volume of 2,070m^3, exceeding the pre-development value and therefore satisfying the WHPA-Q1 & Q2 criteria. For further information regarding the pre-post water balance please refer to **Appendix B**.

As the subject site is located within WHPA-D, the policy to enact a Source Water Impact Assessment and Mitigation Plan (SWIAMP) will be triggered if the activities listed below are proposed to be occurring onsite as per the official South Georgian Bay Lake Simcoe Region's Source Protection Plan (July 2015).

a) petroleum-based fuels and or solvents;
b) pesticides, herbicides, fungicides or fertilizers;
c) construction equipment;
d) inorganic chemicals;
e) road salt and contaminants as identified by the Province;
f) the generation and storage of hazardous waste or liquid industrial waste, and waste disposal sites and facilities;
g) organic soil conditioning sites and the storage and application of agricultural and non-agricultural source organic materials; and,
h) snow storage and disposal facilities.

Please note that the activities listed above will not occur within the subject site. Therefore, as per policy, the project does not require a SWIAMP.

It should be noted that road salting/sanding will occur on site without the storage of these materials, the salting and general snow removal shall follow best management practices as identified in the Transportation Association of Canada (TAC) Synthesis of Best Management Practices for Salt and Snow, or through the use of a Smart-About-Salt (or equivalent) certified contractor. Snow storage even temporary shall only occur on paved surfaces, not on any pervious areas.

2.7 Erosion Control

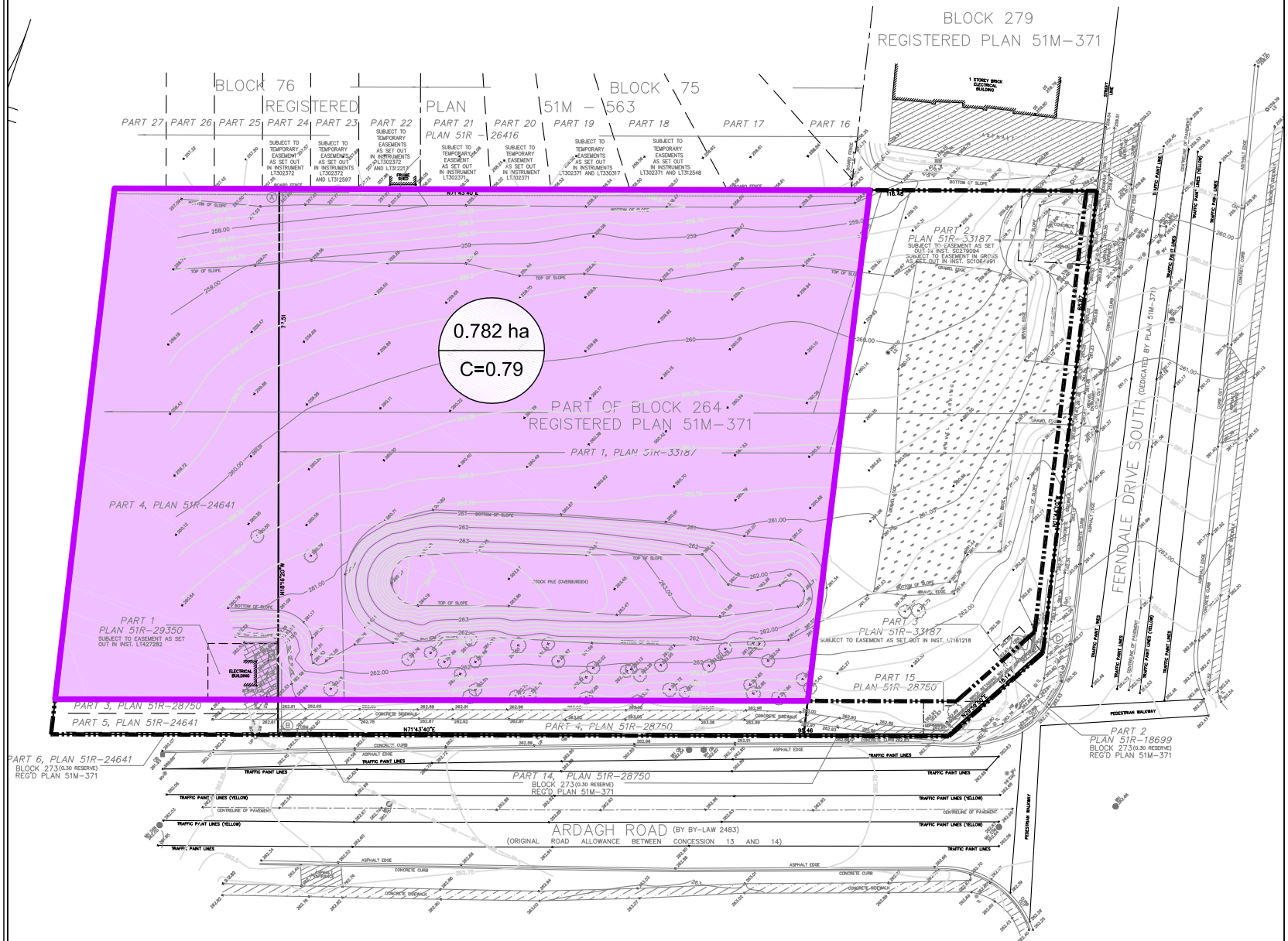
As per the NVCA's December 2013 Stormwater Technical Guide, the minimum erosion protection required for development is the retention of the first 5mm of rainfall on site. As recommended by the NVCA, this shall be achieved through the use of Low Impact Development Measures (LIDs); the volume to be retained shall be calculated by multiplying the 5mm rainfall depth over the entire site area. It is demonstrated through the water balance calculations provided in **Appendix B** that the by achieving an annual infiltration volume of 2,070m^3, the subject site will provide a 4.74mm retention

per rain event. Due to the development constraints of the subject site, it is our opinion that achieving the best efforts of 4.74mm is acceptable in this application.

2.8 Phosphorous Loading

As per Section 5.1.1 of the NVCA's Stormwater Technical Guide (December 2013), as a minimum, the NVCA requires a pre-post development phosphorous load balance, and it is preferred that the development achieve a 20% reduction from the pre-development phosphorous loading levels. The NVCA's phosphorous loading tool was used to calculate the annual mass load of phosphorous under the pre-development, post-development and post-development with Best Management Practices (BMPs) scenarios. Under the pre-development condition, the phosphorous loading on-site was determined to be 0.15kg/yr, under the post-development scenario, the phosphorous loading was calculated to be 0.37kg/yr, and therefore a mitigation of at least 0.22kg/yr is required on site. Two (2) different treatment train approaches are proposed for the west and east SWM systems respectively. The west system is proposed to have infiltration trenches, in accordance with the water balance discussion provided in *Section 2.6* above, and underground storage in accordance with *Section 2.4* above. This treatment train yields an overall phosphorous treatment of 70% as determined by the NVCA's loading tool (60% treatment from infiltration trenches, 25% treatment from underground storage). The eastern SWM system is proposed to have the same first two (2) steps in the treatment train; however there will be an additional phosphorous treatment unit in the form of the aforementioned Jellyfish unit in *Section 2.5.2* above. The Imbrium Jellyfish unit is ETV certified to have a phosphorous treatment efficiency of 59%; therefore in addition to the 70% overall treatment from the upstream measures, the overall treatment efficiency of this treatment train is 88%, note that some areas will be conveyed through the underground storage and jellyfish unit yielding an overall treatment efficiency of 69%. The analysis reveals that with the BMPs included, the phosphorous loading in the post-development condition is 0.11kg/yr, a 27% reduction of the pre-development phosphorous loading levels. The full input and output of this loading tool analysis can be found in **Appendix B** for reference.

Phil Gotfried



224 ARDAGH ROAD &
204 FERNDALE DRIVE SOUTH

LEGEND

SUBJECT LOCATION

EXISTING DRAINAGE

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FIGURE 2.1
PRE-DEVELOPMENT DRAINAGE

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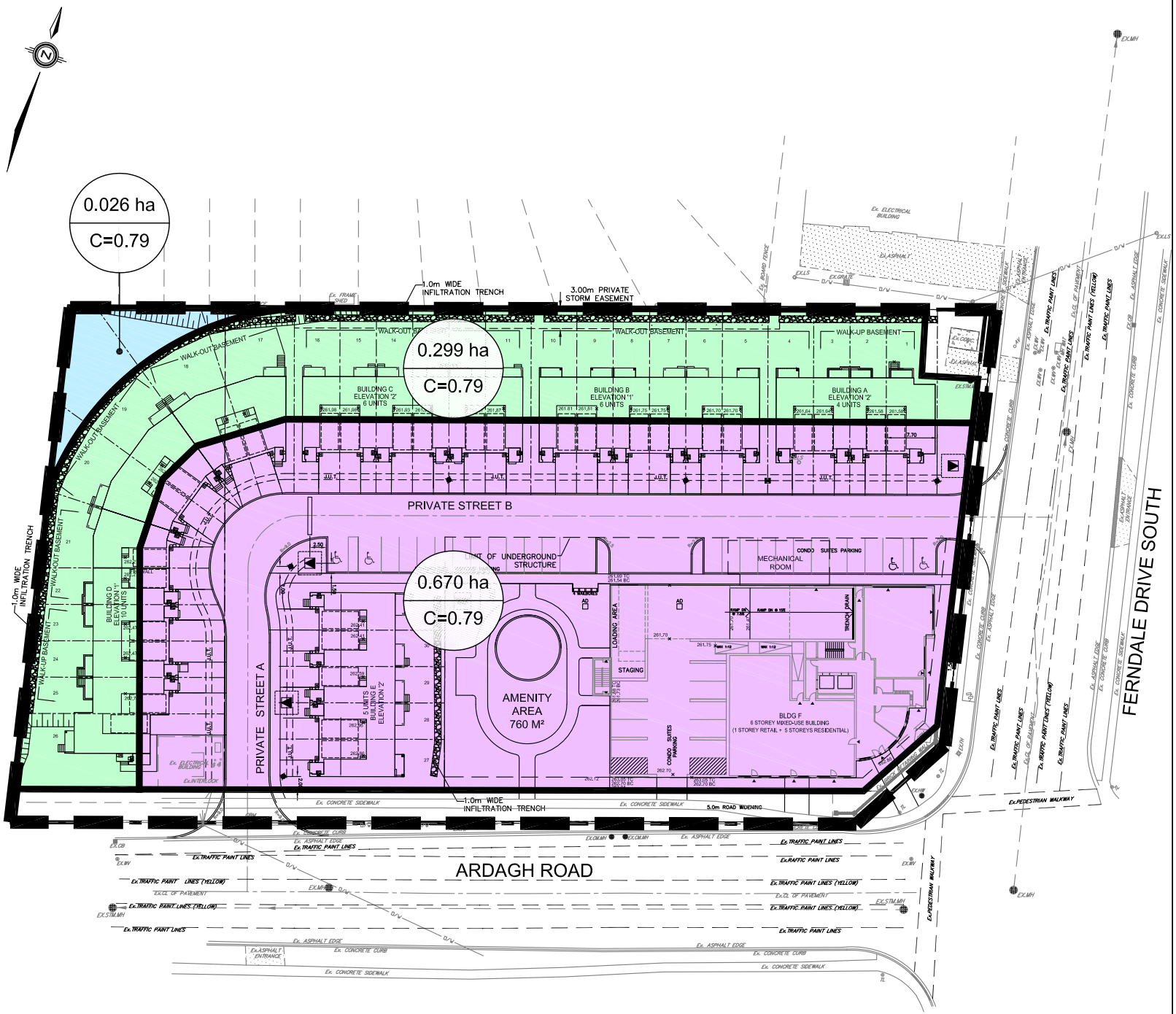

224 ARDAGH ROAD &
204 FERNDALE DRIVE SOUTH

LEGEND

- SUBJECT LOCATION
- WESTERN DRAINAGE AREA
- EASTERN DRAINAGE AREA
- UNCONTROLLED DRAINAGE AREA
- 0.670 ha / C=0.79 — DRAINAGE AREA IN HECTARES / RUNOFF COEFFICIENT

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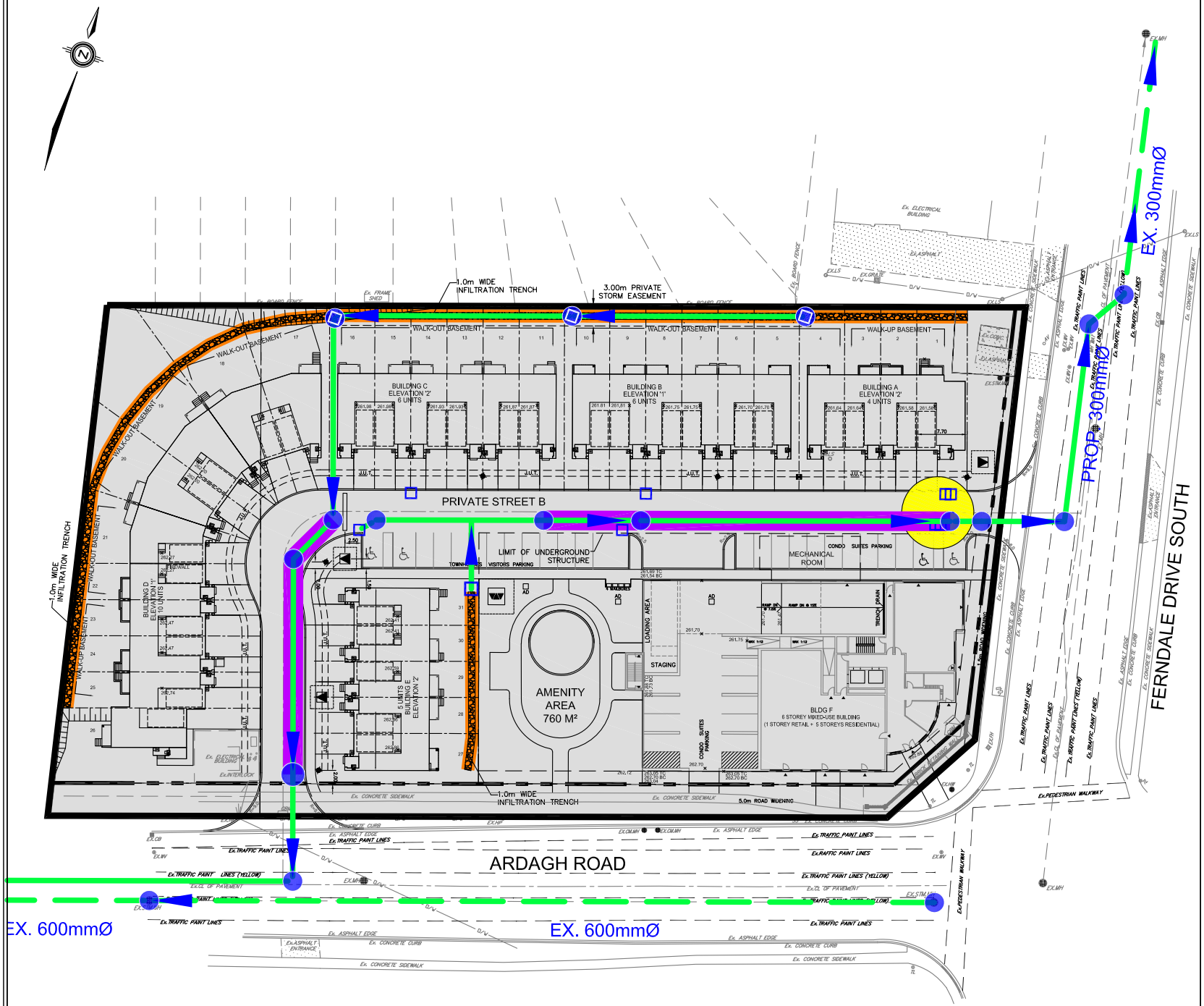
FIGURE 2.2
POST DEVELOPMENT DRAINAGE

2018-4623	JUNE 2019	SCALE: N.T.S.



224 ARDAGH ROAD &
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LEGEND

- SUBJECT LOCATION
- PROPOSED STORM SEWER
- PROPOSED SUPER PIPE
- EXISTING STORM SEWER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED INFILTRATION TRENCHES
- PROPOSED CAPTURE LOCATION

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FIGURE 2.3
PROPOSED STORM SERVICING

2018-4623	JUNE 2019	SCALE: N.T.S.

3 SANITARY SERVICING

3.1 Existing Sanitary Servicing

There is an existing 250mmØ diameter sanitary sewer on Ardagh Road and Ferndale Drive South. The Ardagh Road sanitary sewer ultimately connects to the Ferndale system at the intersection of the two streets.

3.2 Sanitary Design Criteria

As per the City of Barrie's Design Criteria for Sanitary Sewage Collection Systems, the following guidelines were used in the design calculations for the sanitary sewers:

- A daily domestic flow of 225 L/capita/day (excluding extraneous flows);
- A minimum average design flow rate of 28m^3/day/ha for commercial areas (excluding extraneous flows);
- An infiltration rate of 0.1 L/sec/ha;
- Peaking Factor: calculated based on Harmon Formula (where specific information is not known, a factor of two (2) may be used);
- Population Density of 3.13 persons/unit – Single Detached;
- Population Density of 2.34 persons/unit – Townhouses;
- Maximum velocity shall not be greater than 3.00 m/s with pipe flowing full; and
- Minimum velocity shall not be less than 0.60 m/s at actual flow.

3.3 Proposed Sanitary Servicing Plan

It is proposed to convey sanitary flows via a proposed 250mmØ diameter sanitary sewer along the Private Street 'B'. The proposed sewer is proposed to connect to the existing 250mmØ diameter sanitary sewer on Ferndale Drive South as shown on **Figure** 3-1.

Estimated sanitary demands are presented below in **Table** 3-1 and sanitary calculations are provided in **Appendix C**.

Table 3-1: Sanitary Servicing Loading

Land Use	Area (ha)	Average Demand (L/s)	K (Harmon Peaking Factor)	Infiltration (L/s)	Total Peak Flow (L/s)
Residential	0.99	0.50	4.00	0.99	2.12

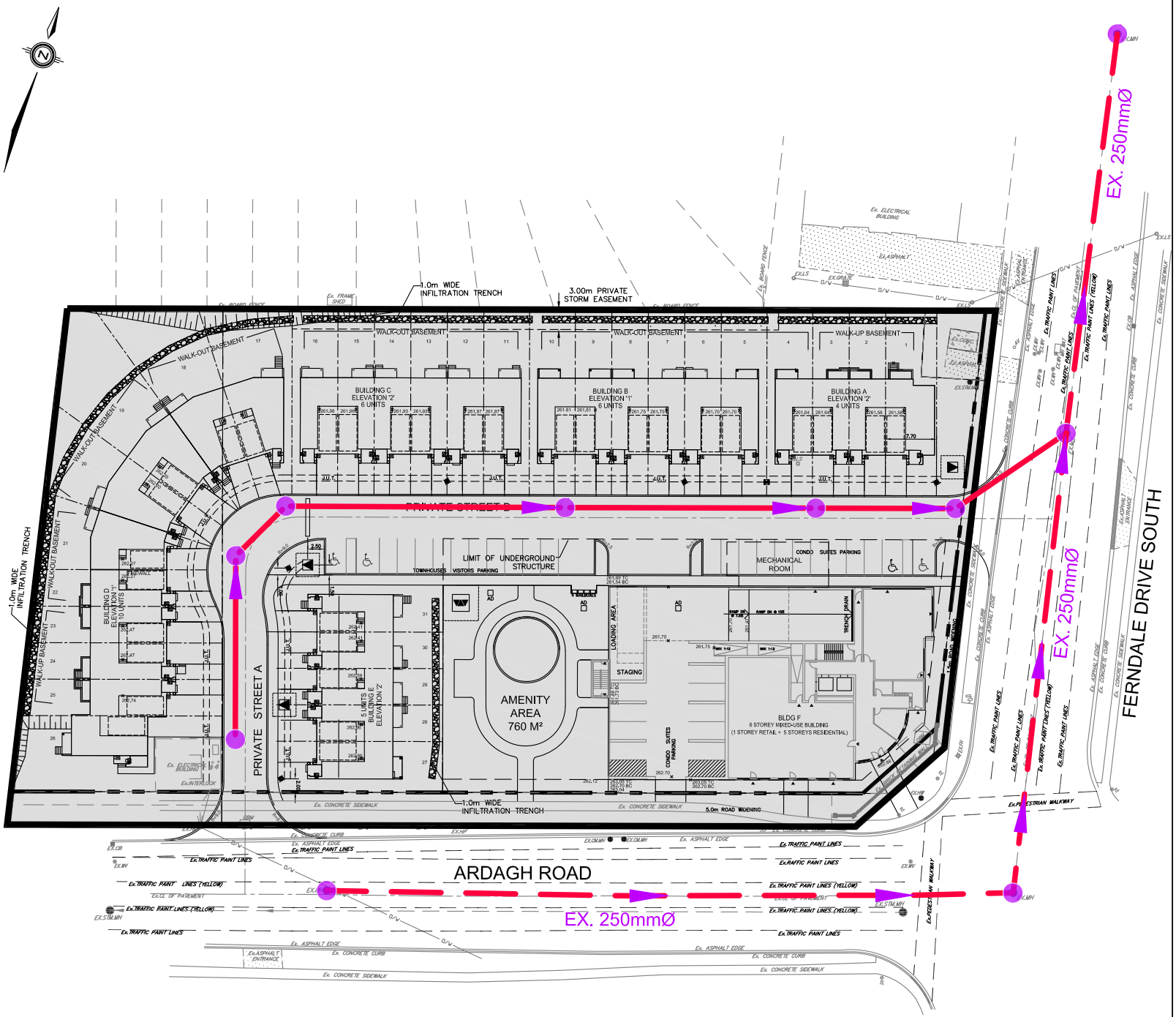
3.4 Sanitary Capacity Analysis

The approved City of Barrie design sanitary tributary plan (Drawing #92128-6) reveals that the existing infrastructure was sized to include the site as designated as a commercial development with an approximate flow of 0.66 L/s in accordance with the assumptions present in **Table** 3-2 below.

Table 3-2: Sanitary Servicing Allowance

Land Use	Area (ha)	Average Demand (L/s/ha)	K (Harmon Peaking Factor)	Infiltration (L/s)	Total Peak Flow (L/s)
Commercial	0.88	0.324	2.00	0.09	0.66

Therefore the subject site presents a net increase of 1.46L/s on the existing system, the proposed discharge location is to a 250mmØ sewer @ 5.26% slope with a capacity of 136.4L/s, therefore the 1.46L/s increase (~1.07%) is considered negligible.



224 ARDAGH ROAD &
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LEGEND

- SUBJECT LOCATION
- PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER

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FIGURE 3.1
PROPOSED SANITARY SERVICING

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4 WATER SUPPLY SERVICING

4.1 Existing Water Supply Servicing

In the vicinity of the subject site, there are watermains along Ardagh Road and Ferndale Drive South. Along Ardagh is an existing 300mmØ diameter watermain, along Ferndale Drive South, the existing watermain is 300mmØ south of Ardagh Road and 400mmØ north of Ardagh Road. There is an existing valve and reducer at the intersection of Ardagh and Ferndale Drive South. The subject site is located within Pressure District 3 North.

4.2 Water Supply Servicing Design Criteria

As per the City of Barrie's Watermain Transmission and Distribution Policies and Design Guidelines (December 2017), the following guidelines were used in the design calculations for the water supply:

- An average daily demand of 225 L/person/day (residential);
- Peaking factors based on MOECC Design Guidelines, for under 500-1000 population:
    - Maximum Day factor of 2.75, and
    - Maximum Hour factor of 4.13;
- A minimum pressure of 275 kPa (50 psi) under peak daily flow;
- A minimum pressure of 140 kPa (20 psi) during fire flow with maximum day flow;
- A maximum pressure of 690 kPa (90 psi) during static conditions;
- A minimum watermain diameter of 150 mm except for beyond the last hydrant in a cul-de-sac and for systems not designed to provide fire protection; and
- Population estimated by 2.34 persons/unit.

4.3 Proposed Water Supply Servicing Plan

It is proposed to connect the subject development via the 300mmØ watermain along Ardagh Road and the 400mmØ watermain along Ferndale Drive North as shown on **Figure** 4-1. The proposed connection will be 200mmØ diameter and will form a loop from which all units will connect for water supply servicing.

The expected domestic supply and fire flow demands are summarized in **Table** 4-1, with detailed calculations provided in **Appendix D**.

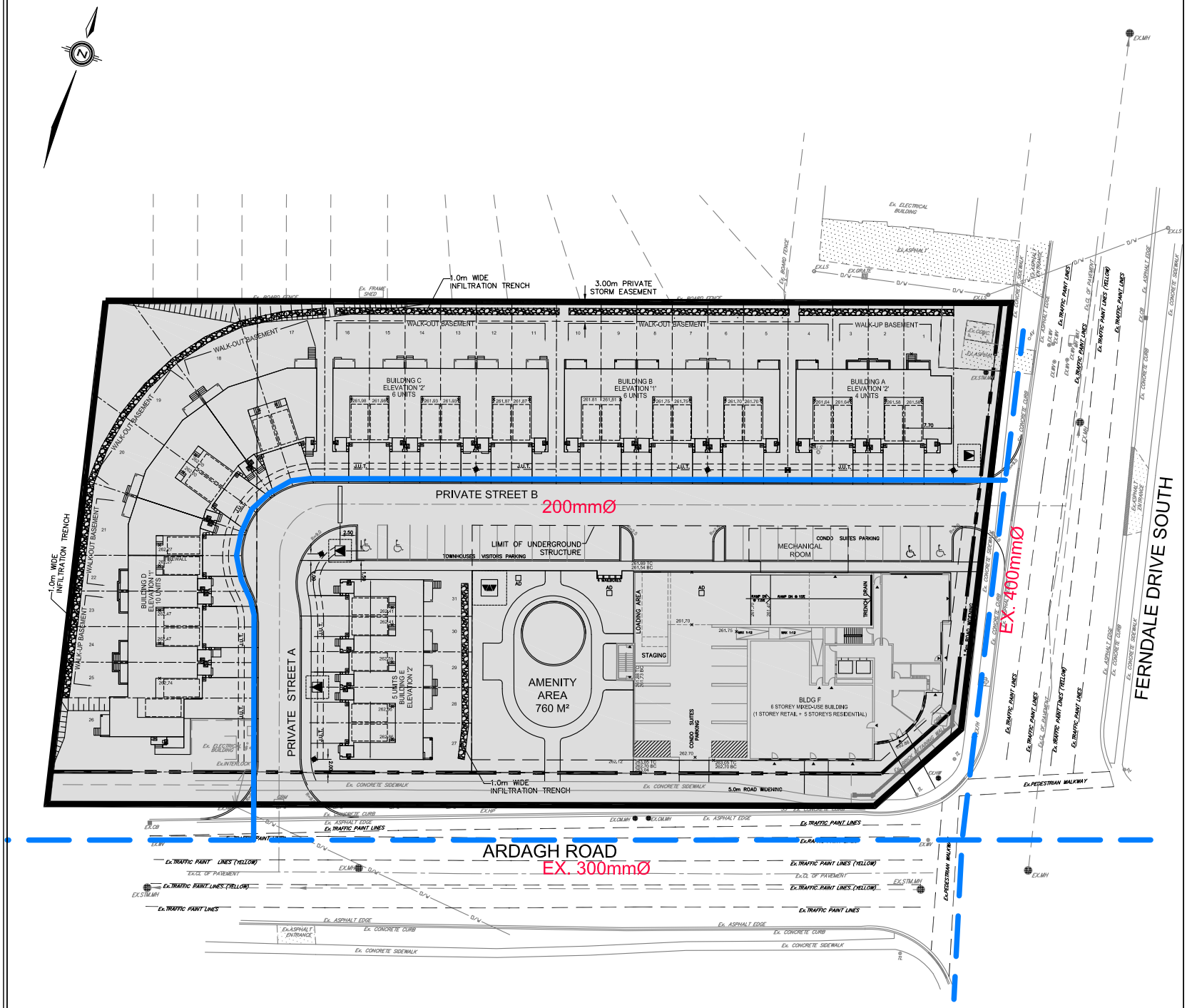
Table 4-1: Water Supply Demand Summary

Land Use	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hourly Demand (L/s)	Fire Flow (L/s)	Total Max Day + Fire Flow (L/s)
Total	0.50	**2.08**	**1.39**	166.67	**168.05**

The subject development exists outside of the hydraulic models as received from the City of Barrie. The subject site exists within Pressure Zone 3N. The Water Storage and Distribution Master Plan (2013) outlines the conditions for Ardagh Road in the vicinity of the subject site as follows:

- Maximum head of 308.0 m;
- Peak hour:
    - a minimum transient pressure between 20 and 40 psi
    - a maximum transient pressure between 60 and 80 psi
- Minimum hour:
    - a minimum transient pressure between 40 and 60 psi
    - a maximum transient pressure between 60 and 80 psi

Considering that the pressures stated above are transients, the minimum peak hour should tend towards 50 psi and the maximum minimum hour pressure should tend toward 60 psi. Based on this information, it is expected that the existing network should be able to provide servicing to the subject site; excerpts from the Master Plan document have been provided in **Appendix D** for reference. At the detailed design stage, a water system analysis shall be conducted to confirm that the existing system can provide adequate supply and required residual pressures. A hydrant flow test will be required to confirm existing pressures and system capacity boundary conditions for water analysis.



224 ARDAGH ROAD &
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LEGEND

- SUBJECT LOCATION
- PROPOSED WATERMAIN
- EXISTING WATERMAIN

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FIGURE 4.1
PROPOSED WATER SUPPLY SERVICING

2018-4623	JUNE 2019	SCALE: N.T.S.

5 SUMMARY

This Functional Servicing Report presents a municipal servicing scheme for the proposed mixed-use development at the northwest corner of the intersection between Ardagh Road and Ferndale Drive South in the City of Barrie.

The site is proposed to fully capture up to the 100-year storm event and convey the controlled stormwater flow to the existing 600mmØ and 300mm storm sewers on Ardagh Road and Ferndale Drive South respectively. Quantity control is proposed to be provided via orifice tubes and superpipe storage, quality control will be achieved for TSS and phosphorous loading as per the described treatment trains and the water balance and erosion criteria will be met via the use of infiltration trenches in the rear yards.

Sanitary servicing is proposed to be provided by the existing 250mmØ diameter sanitary sewer on Ferndale Drive South. The expected total peak sanitary flow for proposed development is 2.12 L/s, a net increase of the flow in the existing system of ~1% of the capacity of the receiving network, this load increase in considered negligible.

The site is located in Pressure Zone 3N. There is an existing 300mmØ diameter watermain on Ardagh Road and a 400mmØ diameter watermain on Ferndale Drive South. The site is proposed to connect to both of these watermains in a 200mmØ diameter watermain loop. The proposed residential development has a maximum day plus fire demand of 168.05 L/s. No water supply constraints are expected due to the findings of the Water Storage and Distribution Master Plan, however during the detailed design phase, a hydrant test shall be conducted to confirm these findings.

We trust that you will find the contents of this report satisfactory. Should you have any questions or comments, please do not hesitate to contact the undersigned.

Respectfully Submitted,

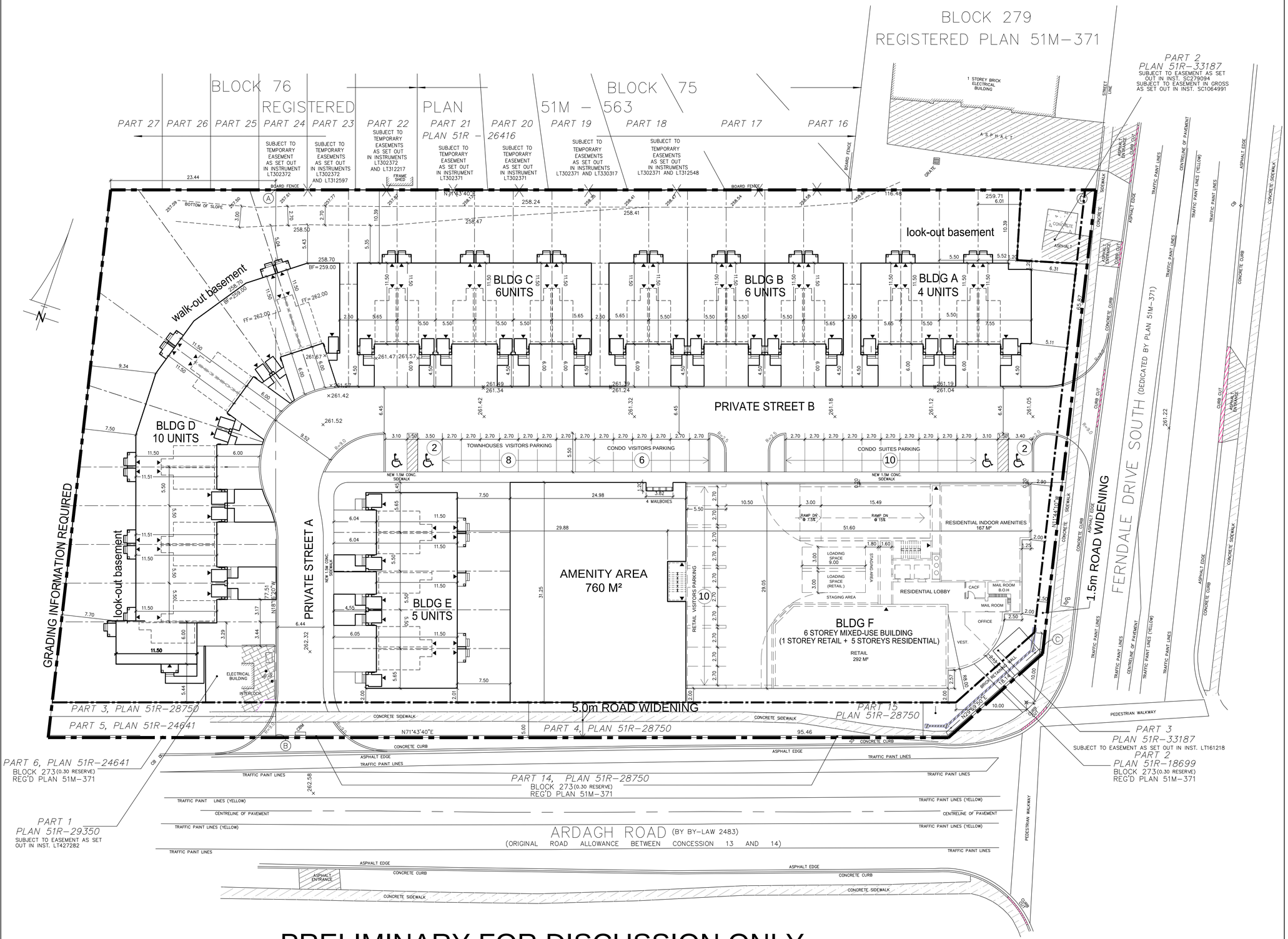
SCHAEFFER & ASSOCIATES LTD.

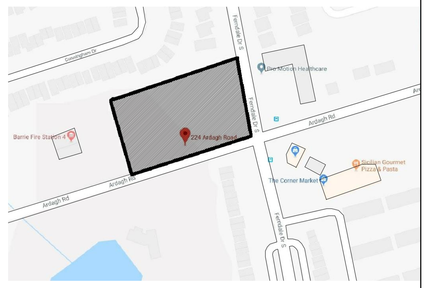
Michael Ventresca, M. Eng., E.I.T.
Water Resources Analyst

Koryun Shahbikian, LLM, M. Eng., P.Eng.
Partner

Appendix A

Site Plan





ZONING STANDARDS MATRIX

(STATS ONLY FOR SUBJECT LANDS)

LOT AREA= 10815.91 m² (1.08Ha, 2.67 Ac)
LOT NET AREA= 9848.48 m² (0.98Ha, 2.43 Ac)
(ROAD WIDENING EASEMENT AND SIGHT TRIANGLE AREA ARE NOT INCLUDED)
EXISTING EASEMENT NET AREA =179.99 m² (PART 1+2+3)

SITE STATISTICS :

6 STOREY MIXED-USE BUILDING (1 STOREY RETAIL + 5 STOREYS RESIDENTIAL) :
31 UNIT (3 STOREY TOWNHOUSES) GFA=(5630.31 M²)= (60604.2 Ft²)
6 STOREY MIXED-USE BUILDING (1 STOREY RETAIL + 5 STOREYS RESIDENTIAL) GFA=(7222.9 M²)- (77746.6 Ft²)

	REQUIRED (C4 ZONE)	PROVIDED
SETBACK REQUIREMENTS		
LOT FRONTAGE	15 m	65.87m
FRONTAGE/FLACKAGE SETBACK	6.0 m	2.0 m
INTERIOR SIDE YARD SETBACK	3.0 m	2.0 m
REAR YARD	7.0 m	10.39 m
LOT COVERAGE	50% MAX	37.0% (3651.60 m²)
LANDSCAPED AREA	35% (0.3 Ha)	38.0% (3747.55 m²)
PAVED AREA	-	25.0%(2449.33 m²)
DENSITY	53 UPNH	82.24 UPNH (50 APARTMENT+31 TOWNHOUSE)= 81 UNIT AS PER SITE NET AREA OF 9848.48 m²
AMENITY AREA	(12m²/UNIT) 972 m²	(760 +212 ROOF AMENITY)= 972 m²
BUILDING HEIGHT:	9.0 m	25.00 m

BUILDING BREAKDOWN

10 UNITS PER FLOOR (FLOORS 2 TO 6): 50 APARTMENT

TOWNHOUSES BREAKDOWN(3 STOREY): 31 TOWNHOUSE

PARKING

	REQUIRED	PROVIDED
TYPICAL PARKING SPACE (2.7x5.5)		
TOWNHOUSES 2/UNIT (2x31)	62 SPACES	62 SPACES
TOWNS VISITORS 0.25/UNIT (0.25x31)	8 SPACES	8 SPACES
RETAIL (1/30 m²) 292 m²/ 30	10 SPACES	10 SPACES
CONDO RESIDENTIAL :		
APARTMENT (1.5/ UNIT)50x1.5	75 SPACES	74 SPACES (1.48/ UNIT)
TOTAL	155 SPACES	154 SPACES

BARRIER FREE PARKING :

BARRIER FREE SPACES	5 SPACES (3-TYPE A + 2-TYPE B)
LOADING SPACE (3.0mX9.0m)	2 LOADING SPACES

UNDERGROUND PARKING GARAGE (1 FLOOR)

BASEMENT AREA	2637 M² /28384.4 Ft²
PARKING	58 +1 **BARRIER FREE PARKING**

SUBJECT LANDS
FUTURE DEVELOPMENT

No.	Description	Date	Rev.

S&C ARCHITECTS INC.
T:(416)848-0991 F:(416)860-6101
INFO@SCARCHITECTS.CA
60 RANDALL DRIVE SUITE 10
AJAX, ONTARIO L1S 6L3

Client
2596843 ONTARIO INC

Project Name
224 ARDAGH ROAD,
6 STOREY RESIDENTIAL / COMMERCIAL CONDOMINIUM AND
3 STOREY TOWNHOUSE DEVELOPMENT
CITY OF BARRIE

Sheet Title
SITE PLAN

Drawn by:	Checked by:	Date:
SA		Feb 26 2019

Scale: 1 : 250
Drawing No.: 1
Project No.: 2018-07

PRELIMINARY FOR DISCUSSION ONLY

Appendix B

Stormwater Management Calculations

Post Development Runoff Coefficient and Imperviousness Calculations

Project #: 4623

Date: 6/14/2019

Description	Area (m^2)	Area(ha)	Runoff Coeff	Imperv ious	A*R	A*Imp	Ximp	A*Ximp
Catchment ID: 200								
1. Controlled Area								
1.1 Western Drainage Area								
Grass	1673.9	0.17	0.25	0.07	0.04	0.01	0.07	0.01
Roof	1314.7	0.13	0.90	1.00	0.12	0.13	0.50	0.07
Sub total	**2,988.53**	**0.30**	**0.54**	**0.48**	**0.16**	**0.14**	**0.26**	**0.08**
1.2 Eastern Drainage Area								
Amenity Area	761.2	0.08	0.45	0.36	0.03	0.03	0.36	0.03
Building 'F'	1532.3	0.15	0.83	0.90	0.13	0.14	0.90	0.14
Grass	435.1	0.04	0.25	0.07	0.01	0.00	0.07	0.00
Roof	1266.7	0.13	0.90	1.00	0.11	0.13	0.50	0.06
Driveway	651.7	0.07	0.90	1.00	0.06	0.07	1.00	0.07
Patio	170.1	0.02	0.90	1.00	0.02	0.02	1.00	0.02
Road	1504.5	0.15	0.90	1.00	0.14	0.15	1.00	0.15
Sidewalk	282.6	0.03	0.90	1.00	0.03	0.03	1.00	0.03
Sub total	**6,604.20**	**0.66**	**0.79**	**0.84**	**0.52**	**0.56**	**0.75**	**0.49**
Total Controlled Area	**9,592.73**	**0.96**	**0.71**	**0.73**	**0.68**	**0.70**	**0.59**	**0.57**
2. Uncontrolled Area								
North West Corner of Uncontrolled Area	255.3	0.03	0.25	0.07	0.01	0.00	0.07	0.00
Sub total	**255.30**	**0.03**	**0.25**	**0.07**	**0.01**	**0.00**	**0.07**	**0.00**
Total Area	**9,848.03**	**0.98**	**0.70**	**0.71**	**0.69**	**0.70**	**0.58**	**0.57**

City of Barrie Design Criteria

Tributary Area Flowrate Calculation
To Ardagh Road

Job: **2018-4623**
Date May 2019

Return Period	Intensity (mm/hr)*		Flow (L/s)**
2yr	i = 678.085/(t+4.699^0.781)	65.1	35.3
5yr	**i =853.608/(t+4.699^0.766)**	**85.7**	**46.5**
10yr	i = 975.865/(t+4.699^0.760)	99.8	54.2
25yr	i = 1146.275/(t+4.922^0.757)	117.3	63.7
50yr	i = 1236.152/(t+4.699^0.751)	129.8	70.5
100yr	i = 1426.408/(t+5.273^0.759)	143.2	77.8

** Based on Tc = 18.3 minutes*

*** Based on C = 0.25, and A = 0.782 ha*

Uncontrolled Flowrate Calculation
To Western Fire Site

Job: **2018-4623**
Date May 2019

Return Period	Intensity (mm/hr)*		Flow (L/s)**
2yr	i = 678.085/(t+4.699^0.781)	83.1	1.5
5yr	i =853.608/(t+4.699^0.766)	108.9	1.9
10yr	i = 975.865/(t+4.699^0.760)	126.5	2.2
25yr	i = 1146.275/(t+4.922^0.757)	148.2	2.6
50yr	i = 1236.152/(t+4.699^0.751)	164.2	2.9
100yr	**= 1426.408/(t+5.273^0.759**	**180.2**	**3.2**

** Based on Tc = 10 minutes*

*** Based on C = 0.25, and A = 0.026 ha*

224 Ardagh Road

City of Barrie
Size Orifice - Western SWM System

Allowable Release Rate = 43.4 L/s

Orifice
DIA (mm)= **100**
COEFF = **0.80**

GRAVITY = 9.81 m/s^2
Orifice Inv.= 256.01 m

Effective Head m	Depth Water At CTL MH m	Qp m^3/s	TOTAL FLOW Qp m^3/s	ELEVATION of Water m
0.00	0.050	0.0000	0.0000	256.06
0.50	0.550	0.0197	0.0197	256.56
0.60	0.650	0.0216	0.0216	256.66
0.70	0.750	0.0233	0.0233	256.76
0.80	0.850	0.0249	0.0249	256.86
0.90	0.950	0.0264	0.0264	256.96
1.00	1.050	0.0278	0.0278	257.06
1.10	1.150	0.0292	0.0292	257.16
1.20	1.250	0.0305	0.0305	257.26
1.30	1.350	0.0317	0.0317	257.36
1.40	1.450	0.0329	0.0329	257.46
1.50	1.550	0.0341	0.0341	257.56
1.60	1.650	0.0352	0.0352	257.66
1.69	**1.740**	**0.0362**	**0.0362**	**257.75**
1.75	1.800	0.0368	0.0368	257.81
1.80	1.850	0.0373	0.0373	257.86
1.85	1.900	0.0379	0.0379	257.91

ORIFICE FLOW Q(m^3/s)= COEF*AREA*(2*GRAVITY*HEAD/K)^0.5
WEIR FLOW Q(m^3/s)= CLH^1.5 C=1.5

Schaeffers Consulting Engineers
Printed: 14-Jun-19

SWM Tank - Storage Volume Calculation

Schaeffers Consulting Engineers

Project: 224 Ardagh Road, City of Barrie

Modified Rational Method

Area (ha) =	0.2989
C =	0.54
Alowable Release Rate (L/s) =	43.36
Actual Release Rate (L/s) =	**36.2**

Private Laneway (m^2) =	0
5-Year Abstraction from Private Lanew	0.00

100 Year Storm

Design Storm =	City of Barrie	100-Year
A =		1426.408
B =		5.273
C =		0.759

	100 Year			Total	Maximum	Required
Time	Intensity	Total	Total	Runoff	Release	Storage
(min)	100 year	Runoff (not Roof)	Runoff	Volume	Volume	Volume
	(mm/hr)	(L/s)	(L/s)	(m^3)	(m^3)	(m^3)
10	180.15	80.22	80.22	48.13	21.72	26.41
20	122.92	54.73	54.73	65.68	43.44	22.24
30	95.44	42.50	42.50	76.49	65.16	11.33
40	78.97	35.16	35.16	84.39	86.88	0.00
50	67.87	30.22	30.22	90.66	108.60	0.00
60	59.82	26.64	26.64	95.89	130.32	0.00
70	53.69	23.91	23.91	100.40	152.04	0.00
80	48.84	21.75	21.75	104.38	173.76	0.00
90	44.90	19.99	19.99	107.95	195.48	0.00
100	41.62	18.53	18.53	111.19	217.20	0.00
110	38.85	17.30	17.30	114.17	238.92	0.00
120	36.47	16.24	16.24	116.93	260.64	0.00
130	34.41	15.32	15.32	119.50	282.36	0.00
140	32.59	14.51	14.51	121.91	304.08	0.00
150	30.99	13.80	13.80	124.18	325.80	0.00
160	29.55	13.16	13.16	126.33	347.52	0.00
170	28.27	12.59	12.59	128.37	369.24	0.00
180	27.10	12.07	12.07	130.32	390.96	0.00
190	26.04	11.59	11.59	132.18	412.68	0.00
200	25.07	11.16	11.16	133.96	434.40	0.00
210	24.18	10.77	10.77	135.67	456.12	0.00
220	23.36	10.40	10.40	137.32	477.84	0.00
230	22.61	10.07	10.07	138.90	499.56	0.00
260	20.64	9.19	9.19	143.35	564.72	0.00
290	19.03	8.47	8.47	147.40	629.88	0.00
320	17.68	7.87	7.87	151.13	695.04	0.00
380	15.55	6.92	6.92	157.83	825.36	0.00
				Required Storage (m^3):		**27.0**

HWL 257.75

Table 1.1: Underground Storage Summary

Storage in CBs	0.00 m3
Storage in MH	10.59 m3
Storage in Pipes	22.24 m3
Total Underground Storage	32.83 m3
Total Required Storage	27.00 m3

SCHAEFFERS
Consulting Engineers
6 Ronrose Drive, Concord,
Ontario L4K 4E8
Tel: (905) 738-6100
Fax: (905) 738-6875
design@schaeffers.com

CITY OF BARRIE

UNDERGROUND MANHOLE STORAGE

(100-YR. RAINFALL INTENSITY)

Designed By: MV
Checked By: MV
Date: June 14, 2019
File No.: 2018-4623

224 ARDAGH ROAD

MH ID	MH Size	Lowest Invert	Top of Grade	Is MH lower than HWL	Cross Sectional Flow Area	Volume
	[m]	[masl]	[masl]	F/P/N	[m^2]	[m^3]
5	1500	255.96	262.65	P	1.77	3.16
4	1500	256.17	261.90	P	1.77	2.79
3	1500	256.26	261.70	P	1.77	2.63
CBMH1	1200	256.98	257.75	F	1.13	0.87
CBMH2	1200	257.60	258.39	P	1.13	0.17
CBMH3	1200	256.90	258.50	P	1.13	0.96

---> Input Values
---> Calculated Values

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5 Boxwood Drive, Concord, Ontario L4K 4E3
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design@schaeffers.com
SCHAEFFER & ASSOCIATES LTD.

City of Barrie

UNDERGROUND PIPE STORAGE DESIGN SHEET
(100-YR. RAINFALL INTENSITY)

224 ARDAGH ROAD

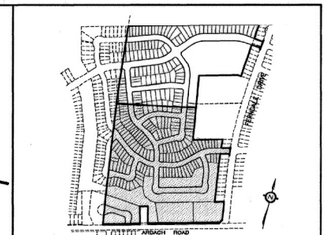
Designed By: MV
Checked By: MV
Date: June 14, 2019
File No.: 4569

Pipe	MH		Inverts		Size (Nominal Diameter Ø)	Length	Slope	Actual Diameter	Obverts		Is Pipe lower than HWL		Cross Sectional Flow Area		Volume		Volume
	From	To	U/S	D/S					U/S	D/S	U/S	D/S	U/S	D/S	Full/Partial both ends	Full/Partial one end	
			[masl]	[masl]	[mm]	[m]	[m/m]	[mm]	[masl]	[masl]	F/P/N	F/P/N	[m^2]	[m^2]			[m^3]
1	4	5	256.17	256.01	750	32.8	0.5%	762	256.93	256.77	F	F	0.456	0.46	14.96	0.00	14.96
2	3	4	256.26	256.22	750	8.5	0.5%	762	257.02	256.98	F	F	0.456	0.46	3.88	0.00	3.88
3	CBMH1	3	256.98	256.76	250	31.2	0.7%	254	257.23	257.01	F	F	0.051	0.05	1.58	0.00	1.58
4	CBMH2	CBMH1	257.25	256.98	250	36.0	0.7%	254	257.50	257.23	F	F	0.051	0.05	1.82	0.00	1.82
5	CBMH3	CBMH2	257.90	257.60	250	35.5	0.8%	254	258.15	257.85	N	P	0.000	0.00	0.00	0.00	0.00

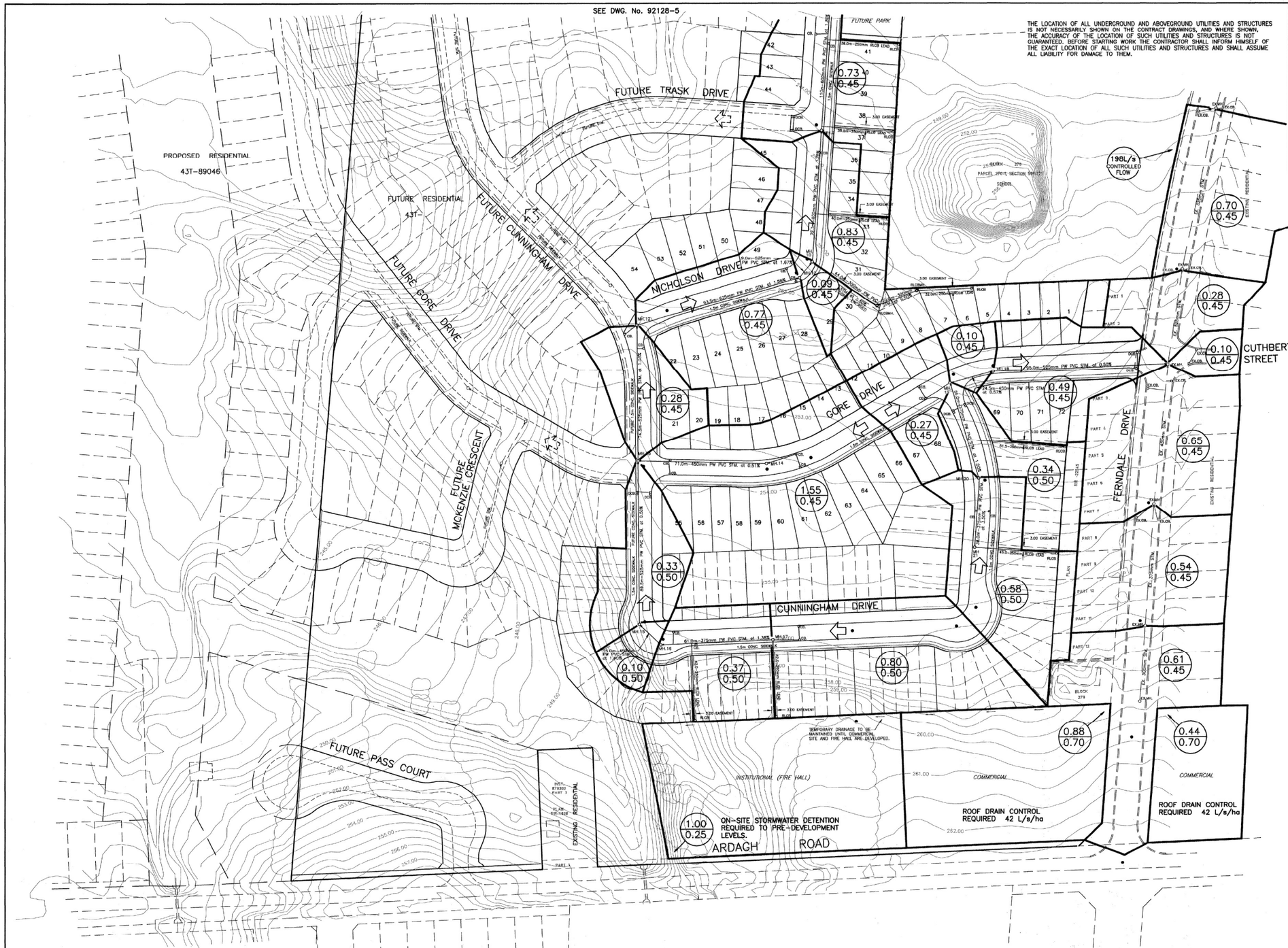
---> Input Values
---> Calculated Values

SEE DWG. No. 92128-5

THE LOCATION OF ALL UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE LOCATION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.



KEY PLAN



GENERAL NOTES

BENCH MARKS

No.	REVISIONS	DATE	BY
1.	SECOND SUBMISSION	OCT. 26/95	D.G.
2.	THIRD SUBMISSION	DEC. 19/95	D.G.
3.	MYLARS ISSUED TO CITY FOR SIGNING	JAN. 10/96	D.G.
4.	ISSUED FOR CONSTRUCTION	FEB. 1/96	D.G.
5.	RECORD DRAWINGS	JAN. 15/99	M.M.

BARRIE P.U.C.
APPROVED
DATE APRIL 15, 1996
DOUG SWITZER

CITY OF BARRIE
APPROVED
DATE APRIL 09, 1996
R.G. NEWLOVE
DIRECTOR OF MUNICIPAL WORKS

LICENSED PROFESSIONAL ENGINEER
D.A.GIUGOVAZ
PROVINCE OF ONTARIO

EMC GROUP LIMITED
Engineers Planners Project Managers
Concord Ontario (905) 738-3939

GAILCREST WEST PHASE 1

STORM DRAINAGE PLAN
PART 1

CITY of BARRIE
MUNICIPAL WORKS DEPARTMENT

DESIGN D.G./H.A.	SCALE HOR. 1:1000	VERT.
DRAWN J.M.M.	REVIEWED	DRAWING No. 92128-4
DATE MAY 1995	SHEET No.	

1999-050-005 99-50

Tributary Area Flowrate Calculation
To Ferndale Drive South

Job: **2018-4623**
Date May 2019

Return Period	Intensity (mm/hr)*		Flow (L/s)**
2yr	i = 678.085/(t+4.699^0.781)	83.1	142.2
5yr	**i =853.608/(t+4.699^0.766)**	**108.9**	**186.4**
10yr	i = 975.865/(t+4.699^0.760)	126.5	216.6
25yr	i = 1146.275/(t+4.922^0.757)	148.2	253.5
50yr	i = 1236.152/(t+4.699^0.751)	164.2	281.0
100yr	i = 1426.408/(t+5.273^0.759)	180.2	308.3

** Based on Tc = 10 minutes*

*** Based on C = 0.7, and A = 0.88 ha*

224 Ardagh Road

City of Barrie
Size Orifice - Eastern SWM System

Allowable Release Rate	118.00	L/s
Orifice		
DIA	150	mm
COEFF	0.80	
Gravity	9.81	m/s^2
Orifice Inv. El.	259.36	m

Effective Head m	Depth Water At CTL MH m	Qp m^3/s	TOTAL FLOW Qp m^3/s	ELEVATION of Water m
0.00	0.075	0.0000	0.0000	259.44
0.500	0.575	0.0443	0.0443	259.94
1.000	1.075	0.0626	0.0626	260.44
1.500	1.575	0.0767	0.0767	260.94
1.740	**1.815**	**0.0826**	**0.0826**	**261.18**
2.000	2.075	0.0886	0.0886	261.44
2.500	2.575	0.0990	0.0990	261.94

ORIFICE FLOW Q(m^3/s)= COEF*AREA*(2*GRAVITY*HEAD/K)^0.5
WEIR FLOW Q(m^3/s)= CLH^1.5 C=1.5

Schaeffers Consulting Engineers
Printed: 14-Jun-19

SWM Tank - Storage Volume Calculation

Schaeffers Consulting Engineers

Project: 224 Ardagh Road, City of Barrie

Modified Rational Method

Area (ha) =	0.6700
C =	0.79
Alowable Release Rate (L/s) =	118.00
Actual Release Rate (L/s) =	**82.6**

Private Laneway (m^2) =	0
5-Year Abstraction from Private Lanew	0.00

100 Year Storm

Design Storm =	City of Barrie	100-Year
A =		1426.408
B =		5.273
C =		0.759

	100 Year			Total	Maximum	Required
Time	Intensity	Total	Total	Runoff	Release	Storage
(min)	100 year	Runoff (not Roof)	Runoff	Volume	Volume	Volume
	(mm/hr)	(L/s)	(L/s)	(m^3)	(m^3)	(m^3)
10	180.15	265.32	265.32	159.19	49.56	109.63
20	122.92	181.03	181.03	217.23	99.12	118.11
30	95.44	140.56	140.56	253.00	148.68	104.32
40	78.97	116.30	116.30	279.12	198.24	80.88
50	67.87	99.95	99.95	299.86	247.80	52.06
60	59.82	88.10	88.10	317.16	297.36	19.80
70	53.69	79.07	79.07	332.08	346.92	0.00
80	48.84	71.92	71.92	345.24	396.48	0.00
90	44.90	66.12	66.12	357.04	446.04	0.00
100	41.62	61.29	61.29	367.77	495.60	0.00
110	38.85	57.22	57.22	377.62	545.16	0.00
120	36.47	53.71	53.71	386.74	594.72	0.00
130	34.41	50.67	50.67	395.25	644.28	0.00
140	32.59	48.00	48.00	403.22	693.84	0.00
150	30.99	45.64	45.64	410.74	743.40	0.00
160	29.55	43.53	43.53	417.85	792.96	0.00
170	28.27	41.63	41.63	424.60	842.52	0.00
180	27.10	39.91	39.91	431.04	892.08	0.00
190	26.04	38.35	38.35	437.19	941.64	0.00
200	25.07	36.92	36.92	443.08	991.20	0.00
210	24.18	35.61	35.61	448.74	1040.76	0.00
220	23.36	34.41	34.41	454.18	1090.32	0.00
230	22.61	33.29	33.29	459.43	1139.88	0.00
260	20.64	30.39	30.39	474.14	1288.56	0.00
290	19.03	28.02	28.02	487.54	1437.24	0.00
320	17.68	26.04	26.04	499.88	1585.92	0.00
380	15.55	22.90	22.90	522.03	1883.28	0.00
					Required Storage (m^3):	**119.0**

HWL 261.18

Table 1.1: Underground Storage Summary

Storage in CBs	0.00 m3
Storage in MH	7.26 m3
Storage in Pipes	112.37 m3
Total Underground Storage	119.63 m3
Total Required Storage	119.00 m3

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design@schaeffers.com

CITY OF BARRIE

UNDERGROUND MANHOLE STORAGE

(100-YR. RAINFALL INTENSITY)

224 ARDAGH ROAD

Designed By: MV
Checked By: MV
Date: June 14, 2019
File No.: 2018-4623

MH ID	MH Size	Lowest Invert	Top of Grade	Is MH lower than HWL	Cross Sectional Flow Area	Volume
	[m]	[masl]	[masl]	F/P/N	[m^2]	[m^3]
11	1200	259.31	261.04	F	1.13	1.96
10	1200	259.44	261.15	F	1.13	1.93
9	1200	259.62	261.30	P	1.13	1.76
8	1200	259.76	261.44	P	1.13	1.61

---> Input Values
---> Calculated Values

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City of Barrie

UNDERGROUND PIPE STORAGE DESIGN SHEET

(100-YR. RAINFALL INTENSITY)

224 ARDAGH ROAD

Designed By: MV
Checked By: MV
Date: June 14, 2019
File No.: 4569

Pipe	MH		Inverts		Size (Nominal Diameter Ø)	Length	Slope	Actual Diameter	Obverts		Volume		Volume
	From	To	U/S	D/S					U/S	D/S	Full/Partial both ends	Full/Partial one end	
			[masl]	[masl]	[mm]	[m]	[m/m]	[mm]	[masl]	[masl]			[m^3]
1	9	10	259.62	259.44	1800x900	72.0	0.25%	1402	261.02	260.84	111.15	0.00	111.15
2	8	9	259.76	259.67	300	16.7	0.56%	305	260.07	259.97	1.22	0.00	1.22

---> Input Values
---> Calculated Values

Project No: 4623 - 224 Ardagh Road - City of Barrie

TABLE 1: WATER BUDGET - PRE DEVELOPMENT
WATER BALANCE/WATER BUDGET ASSESSMENT

Catchment Designation	Site		
	Pervious Area	Impervious Area	Total
Area (m^2)	8922	926	9848
Pervious Area (m^2)	8922	0	8922
Impervious Area (m^2)	0	926	926
Infiltration Factors			
Topography Infiltration Factor (Rolling Land)*	0.2	N/A	
Soil Infiltration Factor (Silty to Sandy)*	0.3	N/A	
Land Cover Infiltration Factor (Cultivated Land)*	0.1	N/A	
MOE Infiltration Factor	0.6	N/A	
Inputs (per unit area)			
Precipitation (mm/year)**	933	933	**933**
Total Inputs (mm/year)	933	933	**933**
Outputs (mm/year)			
Precipitation Surplus	336	840	383
Net Surplus	336	840	383
Downspout Disconnection Retention	0	0	0
Evapotranspiration**	597	0	541
Roof Evapotranspiration	0	93	9
Rooftop Runoff Lawn Evaporation	0	0	0
Total Evapotranspiration	**597**	**93**	**550**
Infiltration	202	0	183
Rooftop Infiltration	0	0	0
Total Infiltration	**202**	**0**	**183**
Runoff Pervious Area	134	0	122
Runoff Impervious Area	0	840	79
Total Runoff	**134**	**840**	**201**
Total Outputs	**933**	**933**	933
Difference (Inputs - Outputs)	0	0	0
Input (Volumes - m^3/year)			
Precipitation	8324	864	9188
Total Inputs	**8324**	**864**	**9188**
Outputs (Volumes - m^3/year)			
Precipitation Surplus	2998	778	3775
Net Surplus	2998	778	3775
Downspout Disconnection Retention	0	0	0
Evapotranspiration	5326	0	5326
Roof Evapotranspiration	0	86	86
Rooftop Runoff Lawn Evaporation	0	0	0
Total Evapotranspiration	**5326**	**86**	**5413**
Infiltration	1799	0	1799
Rooftop Infiltration	0	0	0
Total Infiltration	**1799**	**0**	**1799**
Runoff Pervious Area	1199	0	1199
Runoff Impervious Area	0	778	778
Total Runoff	**1199**	**778**	**1977**
Total Outputs	**8324**	**864**	**9188**
Difference (Inputs - Outputs)	0	0	0

**Data based on MOE*

***Precipitation and Evapotranspiration data based on Environment Canada-Barrie WPCC Station (1978-2006)*

Project No: 4623 - 224 Ardagh Road - City of Barrie

TABLE 2: WATER BUDGET - POST-DEVELOPMENT WITHOUT MITIGATION
WATER BALANCE/WATER BUDGET ASSESSMENT

	Site					
Catchment Designation	**Residential Yards**	**Residential and Mixed Use Roofs**	**Patio + Impervious Amenity Area**	**Pervious Amenity Area**	**Roadway + Sidewalk + Driveway Area**	**Total**
Area (m^2)	2364	4114	589	343	2439	9848
Pervious Area (m^2)	2364	0	0	343	0	2707
Impervious Area (m^2)	0	4114	589	0	2439	7141
Infiltration Factors						
Topography Infiltration Factor (Rolling Land)*	0.2	N/A	N/A	0.2	N/A	
Soil Infiltration Factor (Silty to Sandy)*	0.3	N/A	N/A	0.3	N/A	
Land Cover Infiltration Factor (Residential Lawn)*	0.1	N/A	N/A	0.1	N/A	
MOE Infiltration Factor	**0.6**	**N/A**	**N/A**	**0.6**	**N/A**	
Inputs (per unit area)						
Precipitation (mm/year)**	933	933	933	933	933	933
Total Inputs (m^3/year)	933	933	933	933	933	933
Outputs (per unit area)						
Precipitation Surplus (mm/year)	336	840	840	336	840	701
Net Surplus (mm/year)	336	840	840	336	840	701
Downspout Disconnection Retention	0	0	0	0	0	0
Evapotranspiration (mm/year)	597	0	93	597	93	193
Roof Evapotranspiration (mm/year)	0	93	0	0	0	39
Rooftop Runoff Lawn Evaporation (mm/year)	0	0	0	0	0	0
Total Evapotranspiration (mm/yr)	**597**	**93**	**93**	**597**	**93**	**232**
Infiltration (mm/year)	202	0	0	202	0	55
Rooftop Infiltration (mm/year)	0	0	0	0	0	0
Mitigation (mm/year)	0	0	0	0	0	0
Total Infiltration (mm/year)	**202**	**0**	**0**	**202**	**0**	**55**
Runoff Pervious Area (mm/year)	134	0	0	134	0	37
Runoff Impervious Area (mm/year)	0	840	840	0	840	609
Total Runoff (mm/year)	**134**	**840**	**840**	**134**	**840**	**646**
Total Outputs (mm/year)	**933**	**933**	**933**	**933**	**933**	**933**
Difference (Inputs - Outputs)	0	0	0	0	0	0
Input Volumes						
Precipitation (m^3/year)	2206	3838	549	320	2275	**9188**
Total Inputs (m^3/year)	**2206**	**3838**	**549**	**320**	**2275**	**9188**
Outputs (Volumes)						
Precipitation Surplus (m^3/year)	794	3454	494	115	2048	6906
Net Surplus (m^3/year)	794	3454	494	115	2048	6906
Downspout Disconnection Retention (m^3/year)	0	0	0	0	0	0
Evapotranspiration (m^3/year)	1411	0	55	204	228	1898
Roof Evapotranspiration (m^3/year)	0	384	0	0	0	384
Rooftop Runoff Lawn Evaporation (m^3/year)	0	0	0	0	0	0
Total Evapotranspiration (m^3/year)	**1411**	**384**	**55**	**204**	**228**	**2282**
Infiltration (m^3/year)	477	0	0	69	0	546
Rooftop Infiltration (m^3/year)	0	0	0	0	0	0
Mitigation (m^3/year)	0	0	0	0	0	0
Total Infiltration (m^3/year)	**477**	**0**	**0**	**69**	**0**	**546**
Runoff Pervious Area (m^3/year)	318	0	0	46	0	364
Runoff Impervious Area (m^3/year)	0	3454	494	0	2048	5996
Total Runoff (m^3/year)	**318**	**3454**	**494**	**46**	**2048**	**6360**
Total Outputs (m^3/year)	**2206**	**3838**	**549**	**320**	**2275**	**9188**
Difference (Inputs - Outputs)	0	0	0	0	0	**0**

**Data based on MOE*

***Precipitation and Evapotranspiration data based on Environment Canada-Barrie WPCC Station (1978-2006)*

Project No: 4623 - 224 Ardagh Road - City of Barrie

TABLE 3: WATER BUDGET - POST-DEVELOPMENT WITH MITIGATION
WATER BALANCE/WATER BUDGET ASSESSMENT

	Site								
Catchment Designation	**Residential Yards**	**Residential Yards to Infiltration Trenches**	**Residential Rooftops**	**Residential Rooftops to Infiltration Trenches**	**Building F Impervious Area**	**Impervious Amenity Area**	**Pervious Amenity Area**	**Roadway + Patio + Sidewalk + Driveway Area**	**Total**
Area (m^2)	482	1883	1128	1454	1532	419	343	2609	9848
Pervious Area (m^2)	482	1883	0	0	0	0	343	0	2707
Impervious Area (m^2)	0	0	1128	1454	1532	419	0	2609	7141
Infiltration Factors									
Topography Infiltration Factor (Rolling Land)*	0.2	0.2	N/A	N/A	N/A	N/A	0.2	N/A	
Soil Infiltration Factor (Silty to Sandy Glacial Till)*	0.3	0.3	N/A	N/A	N/A	N/A	0.3	N/A	
Land Cover Infiltration Factor (Cultivated Land)*	0.1	0.1	N/A	N/A	N/A	N/A	0.1	N/A	
MOE Infiltration Factor	**0.6**	**0.6**	**N/A**	**N/A**	**N/A**	**N/A**	**0.6**	**N/A**	
Inputs (per unit area)									
Precipitation (mm/year)**	933	933	933	933	933	933	933	933	933
Total Inputs (m^3/year)	933	933	933	933	933	933	933	933	933
Outputs (per unit area)									
Precipitation Surplus (mm/year)	336	336	840	840	840	840	336	840	701
Net Surplus (mm/year)	336	336	840	840	840	840	336	840	701
Downspout Disconnection Retention	0	0	0	0	0	0	0	0	0
Evapotranspiration (mm/year)	597	597	0	93	93	93	597	93	221
Roof Evapotranspiration (mm/year)	0	0	93	0	0	0	0	0	11
Rooftop Runoff Lawn Evaporation (mm/year)	0	0	0	0	0	0	0	0	0
Total Evapotranspiration (mm/yr)	**597**	**597**	**93**	**93**	**93**	**93**	**597**	**93**	**232**
Infiltration (mm/year)	202	202	0	0	0	0	202	0	55
Rooftop Infiltration (mm/year)	0	0	0	0	0	0	0	0	0
Mitigation (Infiltration-Amended Topsoil) (mm/year)	60	60	0	0	0	0	60	0	17
Mitigation (Infiltration-Trenches) (mm/year)	0	74	0	840	0	0	0	0	138
Total Infiltration (mm/year)	**262**	**336**	**0**	**840**	**0**	**0**	**262**	**0**	**210**
Runoff Pervious Area (mm/year)	74	0	0	0	0	0	74	0	6
Runoff Impervious Area (mm/year)	0	0	840	0	840	840	0	840	485
Total Runoff (mm/year)	**74**	**0**	**840**	**0**	**840**	**840**	**74**	**840**	**491**
Total Outputs (mm/year)	**933**	**933**	**933**	**933**	**933**	**933**	**933**	**933**	**933**
Difference (Inputs - Outputs)	0	0	0	0	0	0	0	0	0
Input Volumes									
Precipitation (m^3/year)	449	1757	1052	1356	1430	391	320	2434	**9188**
Total Inputs (m^3/year)	**449**	**1757**	**1052**	**1356**	**1430**	**391**	**320**	**2434**	**9188**
Outputs (Volumes)									
Precipitation Surplus (m^3/year)	162	633	947	1221	1287	352	115	2191	6906
Net Surplus (m^3/year)	162	633	947	1221	1287	352	115	2191	6906
Downspout Disconnection Retention (m^3/year)	0	0	0	0	0	0	0	0	0
Evapotranspiration (m^3/year)	288	1124	0	136	143	39	204	243	2177
Roof Evapotranspiration (m^3/year)	0	0	105	0	0	0	0	0	105
Rooftop Runoff Lawn Evaporation (m^3/year)	0	0	0	0	0	0	0	0	0
Total Evapotranspiration (m^3/year)	**288**	**1124**	**105**	**136**	**143**	**39**	**204**	**243**	**2282**
Infiltration (m^3/year)	97	380	0	0	0	0	69	0	546
Rooftop Infiltration (m^3/year)	0	0	0	0	0	0	0	0	0
Mitigation (Infiltration-Amended Topsoil) (m^3/year)	29	114	0	0	0	0	21	0	164
Mitigation (Infiltration-Trenches) (m^3/year)	0	139	0	1221	0	0	0	0	1361
Total Infiltration (m^3/year)	**126**	**633**	**0**	**1221**	**0**	**0**	**90**	**0**	**2070**
Runoff Pervious Area (m^3/year)	36	0	0	0	0	0	25	0	61
Runoff Impervious Area (m^3/year)	0	0	947	0	1287	352	0	2191	4775
Total Runoff (m^3/year)	**36**	**0**	**947**	**0**	**1287**	**352**	**25**	**2191**	**4836**
Total Outputs (m^3/year)	**449**	**1757**	**1052**	**1356**	**1430**	**391**	**320**	**2434**	**9188**
Difference (Inputs - Outputs)	0	0	0	0	0	0	0	0	**0**

**Data based on MOE*

***Precipitation and Evapotranspiration data based on Environment Canada-Barrie WPCC Station (1978-2006)*

TABLE 4: WATER BUDGET -SUMMARY TABLE

Characteristics	Site				
	Pre-development	Post-development	Change (Pre to Post)	Post-development with	Change (pre to post with mitigation)
Inputs (Volumes)					
Precipitation (m^3/year)	9188	9188	0%	9188	0.0%
Total Inputs (m^3/year)	9188	9188	0%	9188	0.0%
Outputs (Volumes)					
Precipitation surplus (m^3/year)	3775	6906	83%	6906	83%
Net Surplus (m^3/year)	3775	6906	83%	6906	83%
Total Evapotranspiration (m^3/year)	5413	2282	-58%	2282	-58%
Total Infiltration (m^3/year)	1799	546	-70%	2070	15%
Total Runoff (m^3/year)	1977	6360	222%	4836	145%
Total Outputs (m^3/year)	9188	9188	0%	9188	0%

Total Infiltration req'd: **1253** **m^3/yr**
to match post to pre

Water Balance Mitigation Calculations

Pre Development Infiltration =	**1,799**	**m^3/y**
Post Development Infiltration without mitigation =	**546**	**m^3/y**
Post to Pre Deficit =	**1,253**	**m^3/y**
Mitigation Measures		
Topsoil Amendment =	**164**	**m^3/y**
Infiltration Trenches =	**1,361**	**m^3/y**
Mitgation Voulme Provided =	**1,524**	**m^3/y**
Deficit =	**-271**	**m^3/y**

In order to meet the annual pre-development infiltration deficit, the runoff from the site directed to infitlration trenches shall be equal to the annual deficit volume. Therefore,

Topsoil Amendment =

0.27 ha x Annual Precipitation Depth = 164 m^3/year

Required Annual Precpitation Depth to meet deficit = 60 mm/yr

Based on this analysis, it is concluded that precipitation events of depth less than or equal to *1.08 mm* will produce an annual amount of precipitation equal to 60 mm/yr

Infiltration Trenches =

0.33 ha x Annual Precipitation Depth = 1,361 m^3/year

Required Annual Precpitation Depth to meet deficit = 408 mm/yr

Based on this analysis, it is concluded that precipitation events of depth less than or equal to *10.18 mm* will produce an annual amount of precipitation equal to 408 mm/yr

The total required infiltration trench volume is 10.18 mm x 0.33 ha x 10 = 34.0 m^3

The analysis was performed on daily precipitation data collected from Barrie from 1978 to 2006 by Environment Canada. The data was then arranged into four categories for each year: Total Annual Depth of Precipitation from events less than or equal to 5mm, 10mm, 15mm and 20mm. This yearly data was then used to determine an average annual precipitation depth.

5mm Retention Volume Required

Area	0.98	ha
Depth	5	mm
$Volume_{event}$	49.2	m^3
$Volume_{annum}$	2,167	m^3

Current Event Retention Volume Provided

Area	0.98	ha
$Volume_{annum}$	2,070	m^3
$Depth_{annum}$	210.2	mm

Based on this analysis, it is concluded that precipitation events of depth less than or equal to **4.74 mm** will produce an annual amount of precipitation equal to 210.2 mm/yr

Job: 4623

Infiltration Sizing Calculations for Residential Lot Trenches

Jun-19

Required Infiltration System Footprint Area

Infiltration Volume =	1361	m^3	
Area =	3337	m^2	
Average Annual Precpitation =	408	mm	
Event Precpitation =	10.18	mm	
Infiltration Volume / Event =	**34**	m^3	
Drawdown Time =	48	hours	
Infiltration Rate =	15	mm/h	
Safety Factor =	2.5		
Design Infiltration Rate =	6.0	mm/h	MOE Eqn 4.3

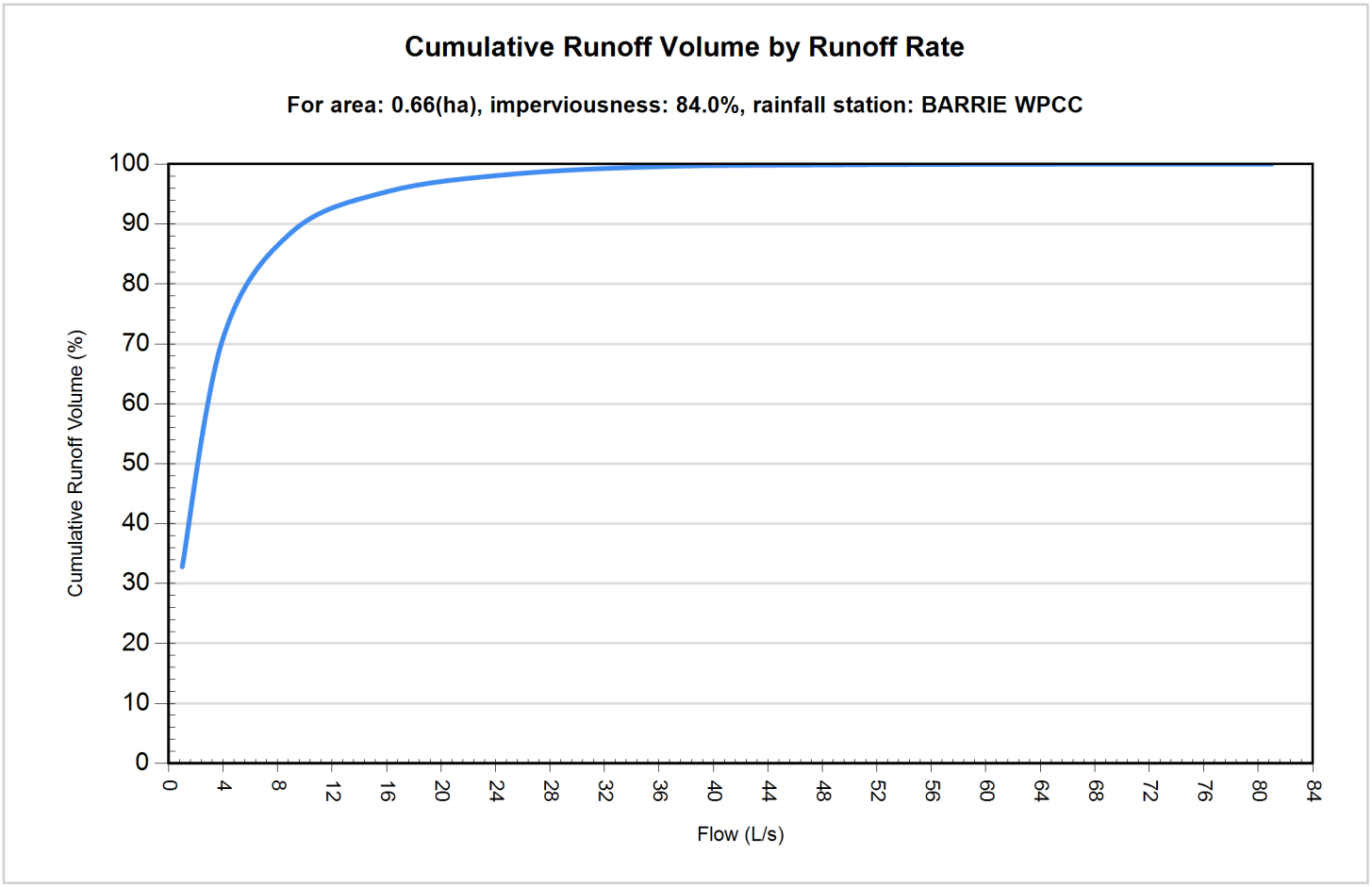
Proposed Infiltration Details - Trenches

Length =	5	m	
Width =	1	m	**(5m x 1m x 0.72 m)**
Minimum Required Storage Depth =	0.72	m	
Drawdown Time =	48	hours	
Number of Lots =	30		
Total Volume Retained =	**43.2**	m^3	

Therefore the proposed system has the required footprint area to drain within 48 hours and will provide a retention volume that exceeds the required volume for mitigation

* Soils with Satutrated Hydraulic Conductivity = $1(10^{-6})$ cm/s correlates to an infiltration rate of 15mm/h, and the minimum feasible infiltration rate is 12mm/hr. As per the Low Impact Development Design Manual (TRCA and CVC, 2010)

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	**Runoff Volume (m^3)**	**Volume Over (m^3)**	**Cumulative Runoff Volume (%)**
1	21309	43667	32.8
4	46129	18845	71.0
9	57546	7428	88.6
16	62014	2960	95.4
25	63862	1111	98.3
36	64694	280	99.6
49	64922	52	99.9
64	64964	9	100.0
81	64973	0	100.0



260 Eagle Street **Job: 4456**
PROJECT No. 2016-4456 **14-Jun-19**
Treatment Train TP Removal Summary

E = A + B – (AB/100); Where:
E = Overall Treatment Efficiency (%)
A = Upstream Treatment Efficiency
B = Downstream Treatment Efficiency
(NCDENR Stormwater BMP Manual, 2007)

Removal Efficiency 'A'* =	59	%	Jellyfish Unit
Removal Efficiency 'B'* =	25	%	Underground Storage
E =	**69**	**%**	**Overall Treatment Efficiency**

*Removal Efficiencies from LSRCA Guidelines, Appendix E P49, August 2013
**Removal Efficiencies fromTable 4.4.3 TRCA LID SWM Manual

Area through this treatment train option	0.6428	ha
Commercial	0.1875	ha
Transportation	0.1505	ha
Residential	0.3048	ha

260 Eagle Street **Job: 4456**
PROJECT No. 2016-4456 **14-Jun-19**
Treatment Train TP Removal Summary

E = A + B – (AB/100); Where:
E = Overall Treatment Efficiency (%)
A = Upstream Treatment Efficiency
B = Downstream Treatment Efficiency
(NCDENR Stormwater BMP Manual, 2007)

Removal Efficiency 'A'* =	60	%	Infiltration Trenches
Removal Efficiency 'B'* =	25	%	Underground Storage
E =	**70**	**%**	**Overall Treatment Efficiency**

Removal Efficiency 'A'* =	70	%	Calculated Above
Removal Efficiency 'B'* =	59	%	Jellyfish Unit
E =	**88**	**%**	**Overall Treatment Efficiency**

*Removal Efficiencies from LSRCA Guidelines, Appendix E P49, August 2013
**Removal Efficiencies fromTable 4.4.3 TRCA LID SWM Manual

Area through this treatment train option		0.3360 ha
	Residential (70%)	0.2988 ha
	Residential (88%)	0.0372 ha

Development Export Summary

Development :4623 - 226 Ardagh Road, Barrie, ON

Pre-Development Phosphorus Export

DEVELOPMENT : 4623 - 226 Ardagh Road, Barrie, ON

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Natural Heritage			
Turf/Sod	0.90	0.11	0.10
Natural Heritage Land use Class Total :	**0.90**		**0.10**
Urban			
Transportation	0.09	0.50	0.05
Urban Land use Class Total :	**0.09**		**0.05**
Development Total :	**0.99**		**0.15**

Cropland Site Sediment & Phosphorus Pre-Development Export

DEVELOPMENT : 4623 - 226 Ardagh Road, Barrie, ON

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)	R (rainfall / runoff for Lake Simcoe)
Surface Slope Gradient (%)	K (soil errodability factor)
Length of Slope (m)	NN (determined by slope)
Cropt Type Factor)	LS (slope length gradient factor)
Tillage Type Factor	C (crop management factor)
	P (prevention + capture)
	Soil Loss (kg/year)
	Phosphorus export (kg/ha/yr)
	Phosphorus load (kg/yr)

PRE Developed Area (ha) :

Phosphorus export (kg/ha/yr) :

Phosphorus load (kg/yr) :

Updated : Sept 2014

Post-Development Phosphorus Export

DEVELOPMENT : 4623 - 226 Ardagh Road, Barrie, ON

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Natural Heritage			
Turf/Sod	0.04	0.11	
Natural Heritage Land use Class Total :	**0.04**		
Urban			
Commercial	0.19	0.20	0.04
Residential	0.61	0.41	0.25
Transportation	0.15	0.50	0.08
Urban Land use Class Total :	**0.95**		**0.37**
Development Total :	**0.99**		**0.37**

Updated : Sept 2014

Cropland Site Sediment & Phosphorus Post-Development Export

DEVELOPMENT : 4623 - 226 Ardagh Road, Barrie, ON

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)	R (rainfall / runoff for Lake Simcoe)
Surface Slope Gradient (%)	K (soil errodability factor)
Length of Slope (m)	NN (determined by slope)
Cropt Type Factor)	LS (slope length gradient factor)
Tillage Type Factor	C (crop management factor)
	P (prevention + capture)
	Soil Loss (kg/year)
	Phosphorus export (kg/ha/yr)
	Phosphorus load (kg/yr)

PRE Developed Area (ha) :

Phosphorus export (kg/ha/yr) :

Phosphorus load (kg/yr) :

Updated : Sept 2014

Post Dev BMP

Area (ha)	Treated Area %	P coefficient	P coefficient	P Load Reduction (kg/yr)	Rationale
Best Management Practices (BMP) Applied (and Rationale)					
Residential					
0.30	100	0.41	70 %	0.09	Calculated using 60% from infiltration trenches and 25% from underground storage
User Entry					
Commercial					
0.19	100	0.20	69 %	0.03	Calculated using 25% from underground storage and 59% from Jellyfish unit
User Entry					
Transportation					
0.15	100	0.50	69 %	0.05	Calculated using 25% from underground storage and 59% from Jellyfish unit
User Entry					
Residential					
0.04	100	0.41	88 %	0.01	Calculated using 60% from infiltration trenches, 25% from underground storage and 59% from Jellyfish unit
User Entry					
Residential					
0.30	100	0.41	69 %	0.08	Calculated using 25% from underground storage and 59% from Jellyfish unit
User Entry					

Updated : Sept 2014

Development Area P and BMP Summary

Total PreDevelopment Area (ha):	0.99
PreDevelopment Area excluding Wetlands (ha):	0.99
Total PostDevelopment Area (ha):	0.99
Total Area treated by BMP's (ha):	0.98
Treated Area total:	0.98
Total PreDevelopment Load (kg/yr):	0.15
Total PostDevelopment Load (kg/yr):	0.37
Total P Load Reduction with BMP's (kg/yr):	0.26
Minimum P Load Reduction Required:	0.22
Total PostDevelopment Load with BMP's (kg/yr)	0.11

Conclusion : No Net Increase in P Load.

Updated : Sept 2014

Post Dev Construction

Appendix C

Sanitary Support Calculations & Documents

PROJECT NO.: 4623
PROJECT NAME: 224 ARDAGH ROAD
LOCATION: CITY OF BARRIE

SCHAEFFERS
CONSULTING ENGINEERS

SANITARY DEMAND CALCULATIONS

Site Area:	0.9848	ha
Infiltration Rate:	0.1000	L/ha/sec
Residential Generation Rate:	225	L/capita/day
Commercial Generation:	28	m3/ha/day

Summary of Average Residential Sanitary Generation Calculation

Tenure Type	Units	Unit Density (cap/unit)	Population	Sanitary Demand (L/cap/day)	Average Demand (L/s)
Residential building	50	2.34	117	225	0.305
Townhouses	31	2.34	73	225	0.190
Total			**190**		**0.495**

Summary of Sanitary Design Flow Calculation

Average Residential Demand (L/s)	Residential Population (persons)	Harmon's Peaking Factor (M)*	Commercial Demand (L/ha/s)	Commercial Area (ha)	Infiltration (L/ha/s)	Total Area (ha)	Total Peak Flow (L/s)
0.495	190	4.00	0.32	0.14	0.1000	0.98	**2.12**

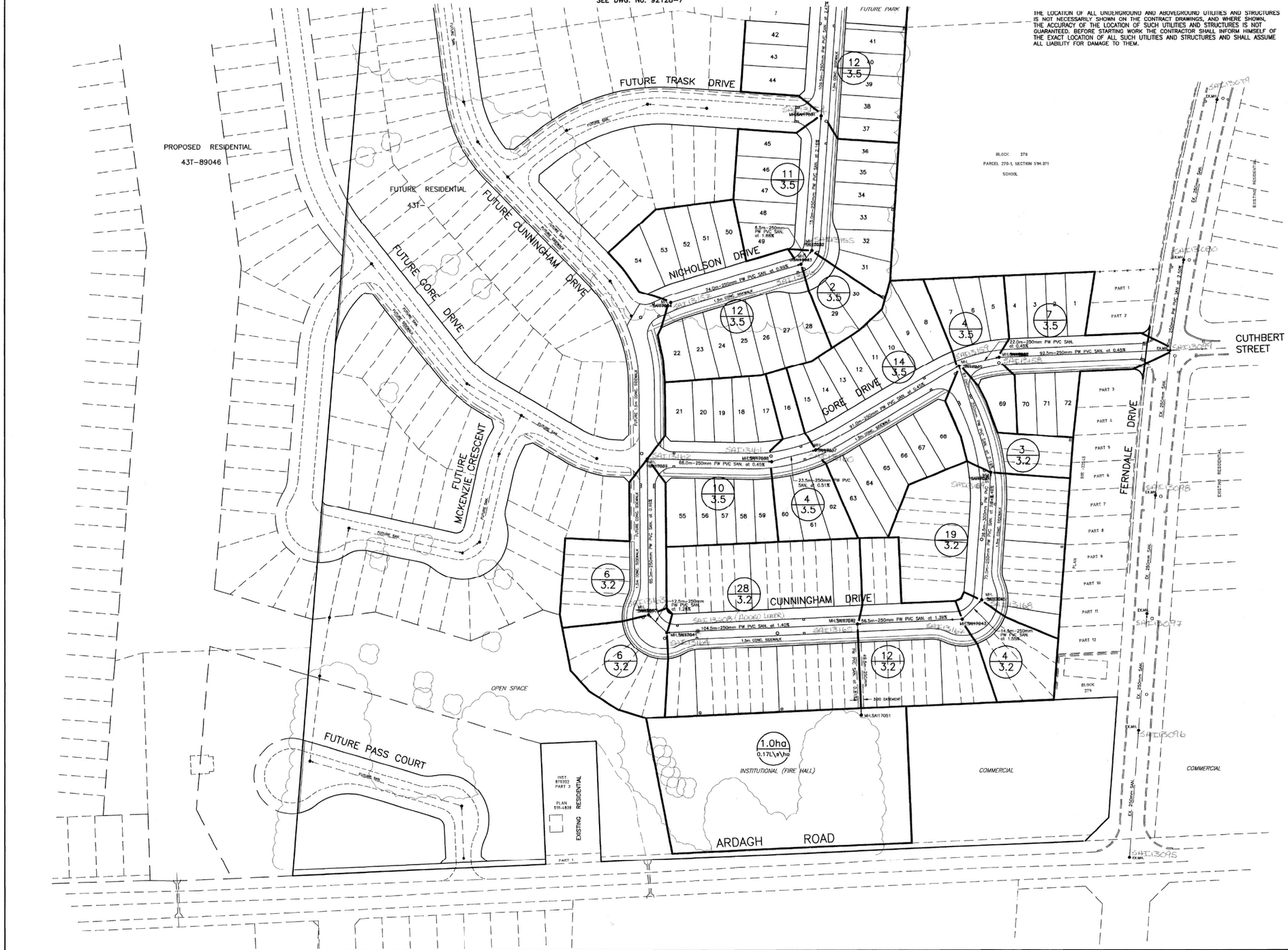
*Based on equivalent population method

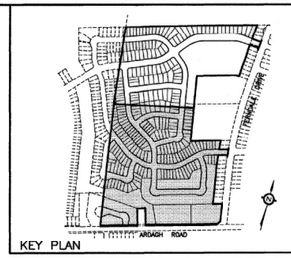
$M = 1 + 14/(4 + (P/1000)^{0.5})$

Printed 14-Jun-19

SEE DWG. No. 92128-7

THE LOCATION OF ALL UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE LOCATION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.





8/3.5 UNITS PERSON/UNIT

DRAINAGE AREA BOUNDARY

GENERAL NOTES

BENCH MARKS

No.	REVISIONS	DATE	BY
1.	SECOND SUBMISSION	OCT. 26/95	D.G.
2.	THIRD SUBMISSION	DEC. 19/95	D.G.
3.	MYLARS ISSUED TO CITY FOR SIGNING	JAN. 10/96	D.G.
4.	ISSUED FOR CONSTRUCTION	FEB. 1/96	D.G.
5.	RECORD DRAWINGS	JAN. 15/99	M.M.
6	SIMS NUMBERS REVISED	FEB 2/99	AET

BARRIE P.U.C.
APPROVED
DATE APRIL 15, 1996
DOUG SWITZER

CITY OF BARRIE
APPROVED
DATE APRIL 09, 1996
R.G. NEWLOVE
DIRECTOR OF MUNICIPAL WORKS

LICENSED PROFESSIONAL ENGINEER
D.A.GIUGOVAZ
PROVINCE OF ONTARIO

EMC GROUP LIMITED
Engineers Planners Project Managers
Concord Ontario (905) 738-3939

GAILCREST WEST PHASE 1

SANITARY DRAINAGE PLAN
PART 1

CITY of BARRIE
MUNICIPAL WORKS DEPARTMENT

DESIGN D.G./H.A.	SCALE HOR. 1:1000	VERT.
DRAWN J.M.M.	REVIEWED	DRAWING No. 92128-6
DATE MAY 1995	SHEET No.	

1999-050-007

99-50

Appendix D

Water Supply Support Calculations

Water Supply Calculation

Project No: 2018-4623
Project Name: 224 Ardagh Road
Municipality: City of Barrie

SCHAEFFERS
CONSULTING ENGINEERS

Minimum Fire Flow Demand:	8160	litres/minute	(Downtown Commercial)	136.00 litres/sec
FUS Fire Protection:	10000	litres/minute		166.67 litres/sec
Average Residential Daily Demand:	225	litres/capita/day		
Average Commercial Daily Demand	28.0	m3/day/ha		

Average Daily Demand

Land Use	Population	Area [m^3]	Average Day Demand (l/s)
Residential	190	0	**0.49**
Commercial	0	300	**0.01**

Max Daily Demand

Land Use	Population	Area [m^3]	Peaking Factor	Max Day Demand (L/s)
Residential	190	0	2.75	**1.36**
Commercial	0	300	2.75	**0.03**

Peak Hour Demand

Land Use	Population	Area [m^3]	Peaking Factor	Max Hour Demand (L/s)
Residential	190	0	4.13	**2.04**
Commercial	0	300	4.13	**0.04**

Max Day + Fire Flow

Land Use	Average Day Demand (L/s)	Max Hour Demand (L/s)	Max Day Demand (L/s)	Fire Flow (L/s)	Total Flow (L/s)
Total	0.50	**2.08**	**1.39**	166.67	**168.05**

As per City of Barrie Water Transmission and Distribution Policies and Design Guidelines
Commercial Water Supply Demand assumed to be equivalent to Sanitary Demand
Downtown commercial fire flow assumed for mid-rise residential in lieu of other criteria

Project: 224 Ardagh Road
Project No: 2018-4623
Municipality: City of Barrie

Tower 'A'

A = Type of Construction

Type of Construction:	C	Description
Wood Frame	1.5	(essentially all combustible)
Ordinary	1	(brick/masonry walls, combustible interior)
Non-Combustible	0.8	(unprotected metal structure, masonry/metal walls)
Fire-Resistive	0.6	(fully protected frame, roof, floors)

Construction Coefficient:	**0.8**	

B = Largest Floor

Area:	1077	square metres (of largest floor)

C = Height (storeys)

Height:	6	Storeys

D = Fire Flow (000's)

GFA	5,843	square metres
Construction Type	0.8	
Fire Flow	13,453	L/min.

-> Fire Flow	**13,000**	**L/min.**

E = Occupancy Factor

Fire Hazard of Contents	**Charge**
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Occupancy Factor	-15%	
Fire Flow	**11,050**	**L/min.**

F = Sprinkler Factor

Sprinkler System	**Charge**
n/a	0%
NFPA 13 System	-30%
Fully Supervised System	-50%

Sprinkler Factor:	-40%	incl 10% Standard Connection Size

G = Exposure Factor

Separation	**Charge**	
0 to 3 m	25%	
3.1 to 10 m	20%	
10.1 to 20 m	15%	1 side
20.1 to 30 m	10%	
30.1 to 45 m	5%	3 sides

Exposure Factor	30.00%	(no more than 75%)

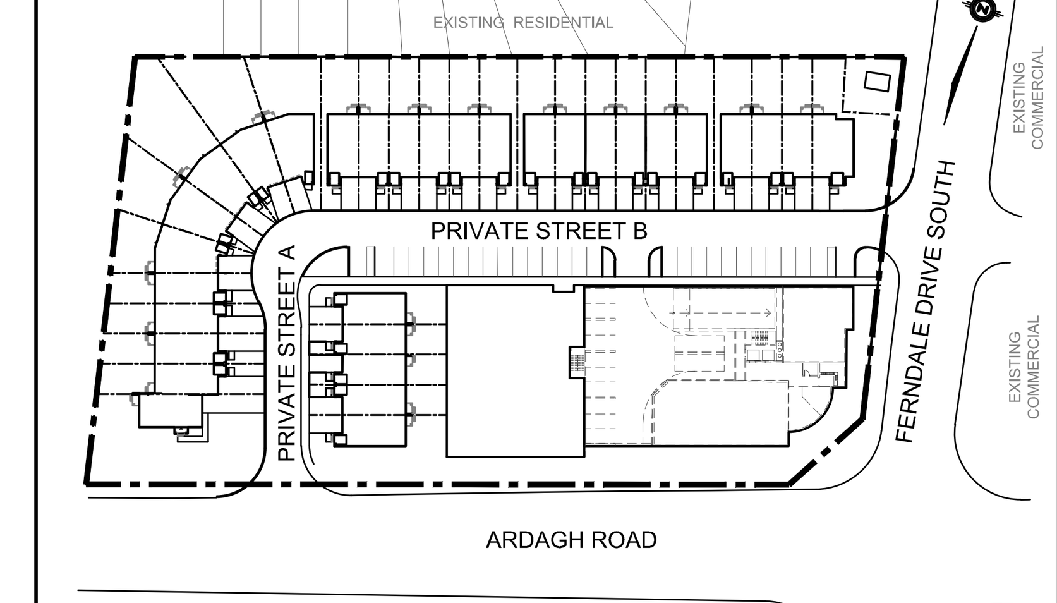
H - Net Fire Flow Required

	Charge
F + G Factors	-10%

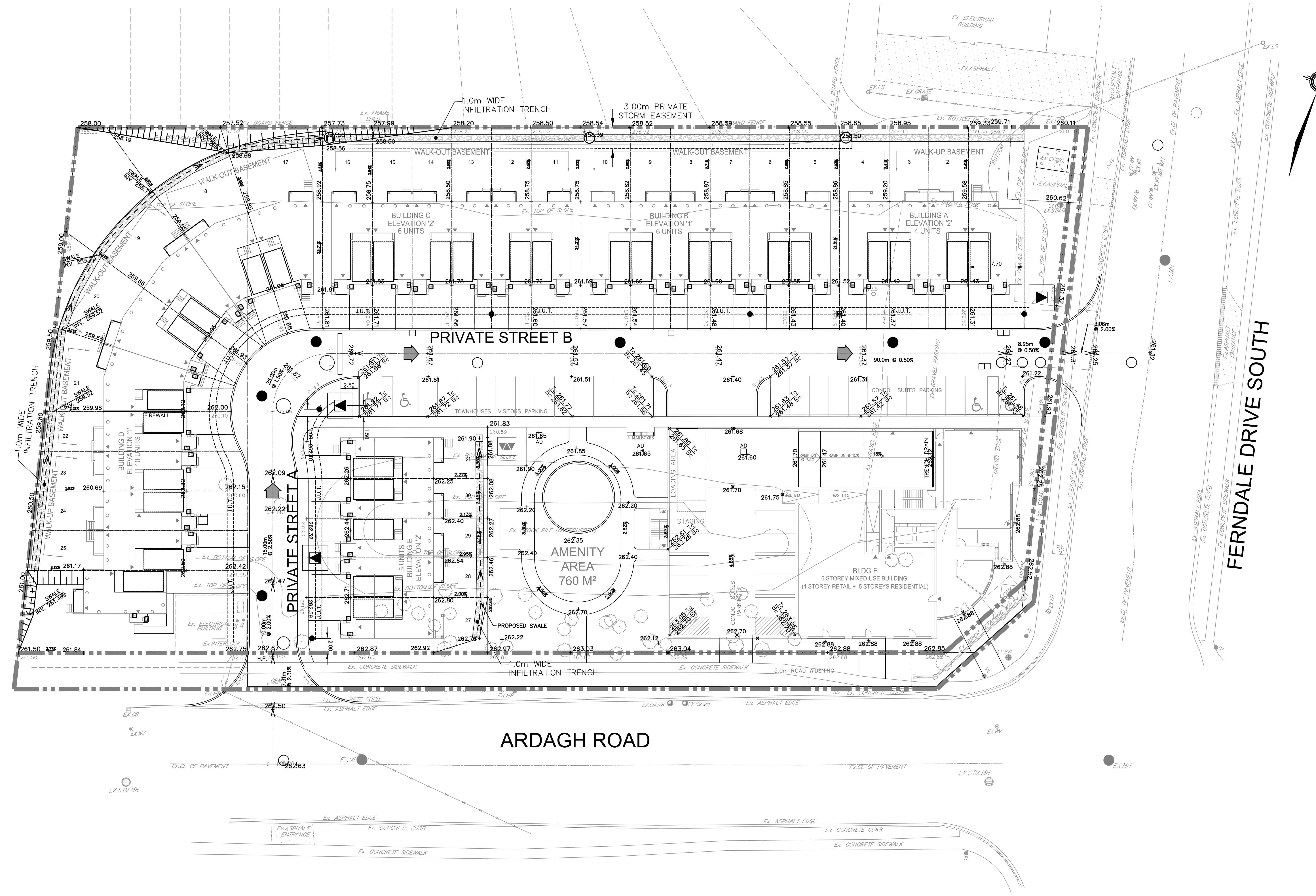
	9945	L/min.
Fire Flow:	10000	L/min.
	167	L/s
	2642	USGPM

Appendix E

Engineering Drawings



KEY PLAN
N.T.S.



NOTES:

1. FOR GENERAL NOTES REFER TO DWG GN-1.

LEGEND

- DENOTES VALVE AND CHAMBER
- DENOTES HYDRANT
- DENOTES SINGLE CATCHBASIN
- DENOTES DOUBLE CATCHBASIN
- DENOTES Ex. CATCHBASIN
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES EXISTING STORM MANHOLE
- 223.80 DENOTES PROPOSED ELEVATION
- DENOTES EXISTING ELEVATION
- DENOTES EXISTING CONTOUR
- DENOTES OVERLAND FLOW ROUTE
- DENOTES LIMIT OF SUBDIVISION

NO.	REVISIONS	DATE	APPROVED

SCHAEFFERS
CONSULTING ENGINEERS
SCHAEFFER & ASSOCIATES LTD.

6 Ronrose Drive, Concord,
Ontario L4K 4R3
Tel: (905) 738-6100
Fax: (905) 738-6875
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design@schaeffers.com

PROFESSIONAL ENGINEER
F. TCHOURKINE
DEC. 07, 2018
LICENSED
PROVINCE OF ONTARIO

CITY OF BARRIE
ACCEPTED
DATE. . . . .
DIRECTOR OF ENGINEERING

224 ARDAGH ROAD &
204 FERNDALE DRIVE SOUTH

GRADING PLAN

The City of
BARRIE
ENGINEERING DEPARTMENT

SCALE HOR. 1:300	VERT.	PROJECT NO. 4623
DESIGN F.T.	DRAWN T.K.	SHEET NO. GR-1
REVIEWED P.C.	DATE APRIL 2019	

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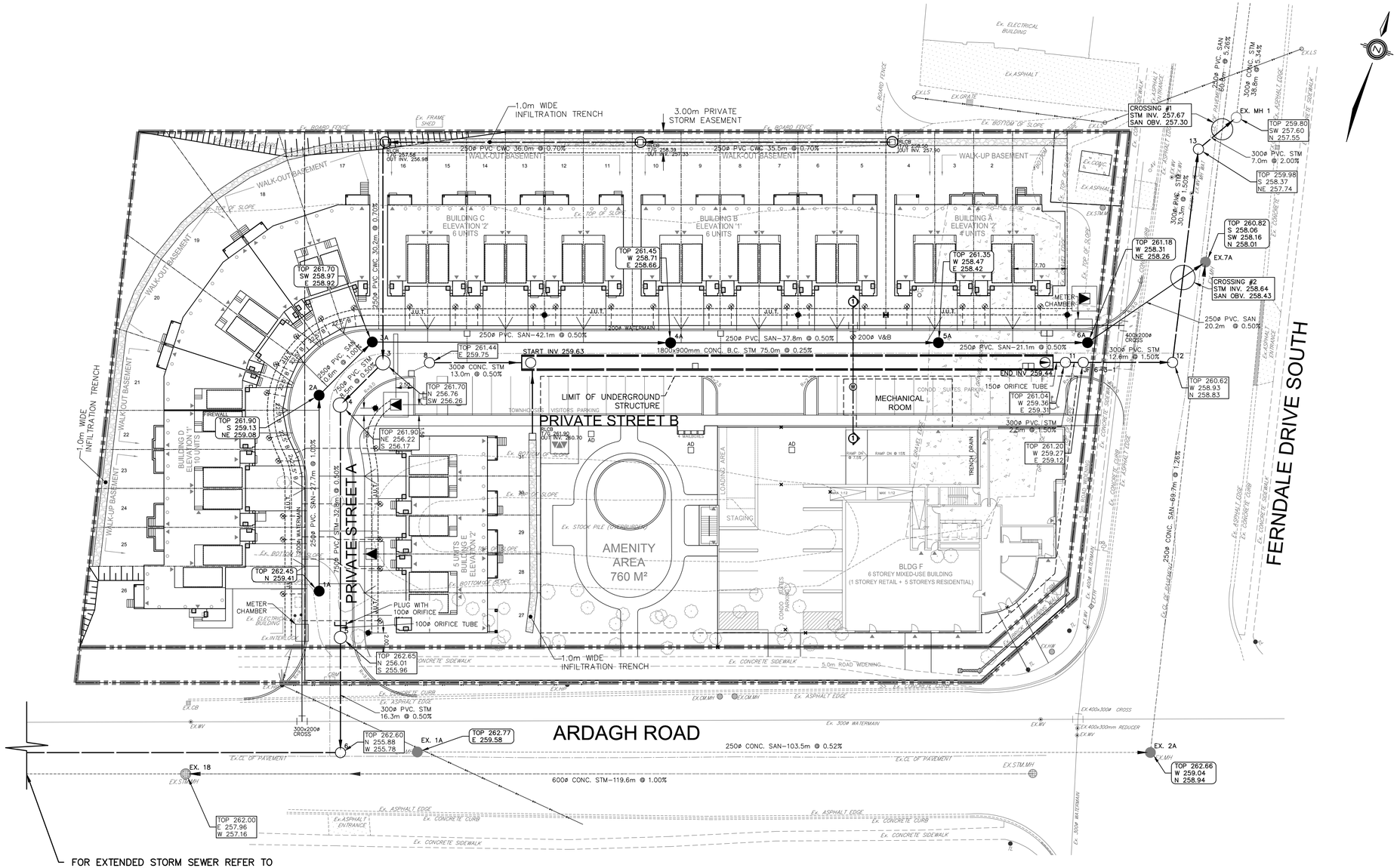

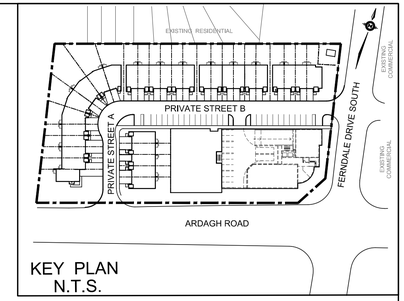

KEY PLAN
N.T.S.

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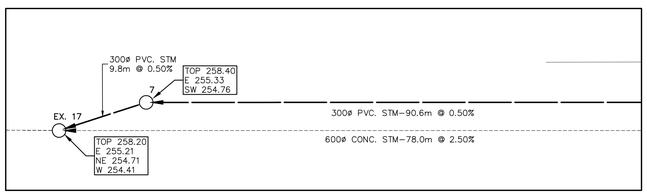
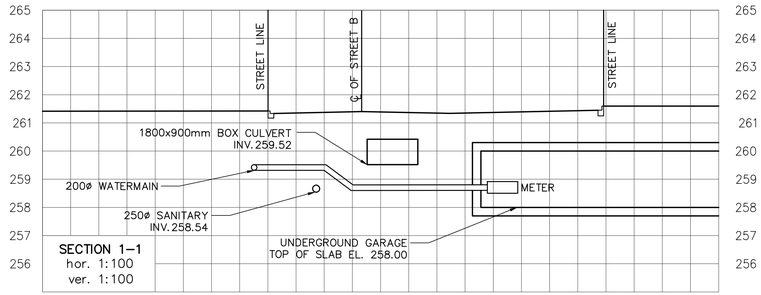
- DENOTES HYDRANT
- DENOTES SINGLE CATCHBASIN
- DENOTES DOUBLE CATCHBASIN
- DENOTES Ex. CATCHBASIN
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES EXISTING STORM MANHOLE
- DENOTES WATERMAIN
- DENOTES STORM SEWER
- DENOTES SANITARY SEWER
- DENOTES 1.2m HIGH CHAIN LINK FENCE
- DENOTES LIMIT OF SUBDIVISION
- TOP 260.70 W 259.00 — DENOTES PROPOSED TOP OF MH ELEVATION / DENOTES SANITARY INVERT ELEVATION
- TOP 260.70 W 259.00 — DENOTES PROPOSED TOP OF MH ELEVATION / DENOTES STORM INVERT ELEVATION



DETAIL 1
STORM SEWER EXTENSION
SCALE 1:300



SECTION 1–1
hor. 1:100
ver. 1:100

NO.	REVISIONS	DATE	APPROVED

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ACCEPTED
DATE. . . . . .
. . . . . .
DIRECTOR OF ENGINEERING

224 ARDAGH ROAD &
204 FERNDALE DRIVE SOUTH

SITE SERVICING PLAN

The City of BARRIE
ENGINEERING DEPARTMENT

SCALE HOR.	1:300	VERT.		PROJECT NO.	4623
DESIGN	F.T.	DRAWN	T.K.	SHEET NO.	SS-1
REVIEWED	P.C.	DATE	APRIL 2019		

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