August 2025

UD22-097

Functional Servicing and Stormwater Management Report

Project: 20 Cairns Crescent, Huntsville
Client: 1000120857 Ontario Inc.

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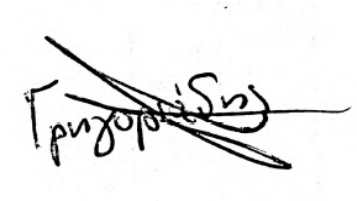

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Identification	Date	Description of issued and/or revision
FSR/SWM Report	August 02nd , 2024	Issued for CPP
FSR/SWM Report	August 18th, 2025	Issued for CPP

Statement of Conditions

This Report / Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner / Client, the Town of Huntsville and its affiliates (the "Intended User"). No one other than the Intended User has the right to use and rely on the Work without first obtaining the written authorization of Lithos Group Inc. and its Owner. Lithos Group Inc. expressly excludes liability to any party except the intended User for any use of, and/or reliance upon, the work.

Executive Summary

Lithos Group Inc. (Lithos) was retained by 1000120857 Ontario Inc. (the "Owner") to prepare a Functional Servicing and Stormwater Management (FSR-SWM) Report in support of CPP for a proposed residential development at 20 Crains Crescent (ON P1H 1Y3) in the Town of Huntsville (the "Town"). The following is a summary of our conclusions:

Storm Drainage

The site's stormwater discharge will be controlled for storm events ranging from the 2-year up to the 100-year flow to match the pre-development conditions. Post-development flows from the property, which will be directed towards the detention pond, must be controlled to meet the pre-development target flows for storm events up to the 100-year storm event. In order to attain the target flows and meet the Town's Wet Weather Flow Management Guidelines (WWFMG), quantity control will be utilized and up to 212.2 m^3 of on-site storage will be required. The stormwater management (SWM) system will be designed to provide enhanced level (Level 1) protection as specified by the Ministry of Environment, Conservation and Parks (MECP). Additional quality control measures will also be required by the MECP, will be provided by the proposed detention pond.

Sanitary Sewers

The proposed development will connect to the existing 200mm diameter sanitary sewer on Cairns Crescent, through a 150mm diameter sanitary sewer lateral connection, with a minimum grade of 2.00% (or equivalent pipe design). Under pre-development conditions, the site discharges approximately 0.61 L/s into the Town's sanitary sewer network. Under post-development conditions, the discharge is expected to increase to 5.93 L/s. Therefore, the net increase in sanitary flow resulting from the proposed development, is anticipated at approximately 5.32 L/s.

Water Supply

Water supply for the site will be provided by the existing 150mm diameter watermain on Cairns Crescent. It is anticipated that a total design flow of 153.55 L/s will be required to support the proposed development. In summary, the required design flow is the sum of 'the minimum fire suppression flow' and 'maximum daily demand' (150.00 + 3.55 = 153.55 L/s, 2434 USGPM).

Site Grading

The proposed grades will match current drainage pattern and will improve the existing drainage conditions to meet the Town's/Regional requirements. Grades will be maintained along the property line wherever feasible and overland flow will be directed towards the adjacent right-of-way (ROW).

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Appendices

1.0 Introduction

Lithos Group Inc. (Lithos) was retained by 1000120857 Ontario Inc. (the "Owner") to prepare a Functional Servicing and Stormwater Management (FSR-SWM) Report in support of CPP for a proposed residential development at 20 Cairns Crescent (ON P1H 1Y3), in the Town of Huntsville (the "Town").

The purpose of this report is to provide site-specific information for the Town's review with respect to infrastructure required to support the proposed development. More specifically, the report will present details on storm drainage, sanitary discharge and water supply.

We contacted the Town's engineering department to obtain existing information in preparation of this report. The following documents were available for our review:

- Plan and Profile drawings of Watermain on Cairns Crescent and Kitchen Road South, drawing No. 1989-105, dated October 30, 1989;
- Plan and Profile drawings of Sanitary Sewer System on Kitchen Road, Easement between Cairns Crescent and Kitchen Road South, and Cairns Crescent, drawing No. 535-414, drawing No. 535-415, drawing No. 535-416 and drawing No. 535-417, dated December, 1978;
- Plan and Profile drawing of Sanitary Sewer on Cairns Crescent – Kitchen Road South, drawing No. M5355, dated June, 1996;
- Plan and Profile drawing of Cairns Crescent Sanitary Sewer Extension, drawing No. 61210278, dated August 21, 2001;
- Site Plan and Site Statistics prepared by Options Architects, dated August 15, 2025; and,
- Topographic Survey prepared by Maughan Surveyors, a division of IBW Surveyors Ltd., dated February 03, 2023.

2.0 Site Description

The existing site is approximately 2.169 hectares of undeveloped land, located on the south side of Cairns Crescent, near Kitchen Road South, in the Town of Huntsville. The site area is bound by residential properties to the north, Kitchen Road South to the east, an apartment building to the west and Hollywood Drive to the south. Refer to **Figures 1** and **2** following this report, in **Appendix A** and **Appendix B**.

3.0 Site Proposal

The proposed site is approximately 2.169 hectares of residential land. The proposed building will consist of 176 residential units and will be serviced by one (1) level of underground parking. The total development will include approximately 12,467.37 m^2 of Gross Floor Area (GFA). Please refer to **Appendix B** for the proposed site plan and building site statistics.

4.0 Terms of Reference and Methodology

4.1. Terms of Reference

The following references and technical guidelines were consulted in the present study:

- Engineering Design Criteria and Standards Manual, District of Muskoka (2023);
- Ministry of Environment, Conservation and Park (MECP) Guidelines for the Design of Water Systems (2008);
- MECP Guidelines for the Design of Sanitary Sewage Systems (2008);
- MECP Stormwater Planning and Design Manual (2003);
- Fire Underwriters Survey (FUS) (2020); and,
- Ontario Building Code (2010).

4.2. Methodology: Stormwater Drainage and Management

This report provides a detailed Stormwater Management (SWM) review of the pre-development and post-development conditions, and comments on opportunities to reduce peak flows. This is illustrated on a proposed **"Site Servicing plan (SS-01)"**, submitted separately. Additional requirements set by the WWFMG will be discussed.

The proposed development will be designed to meet the Town's WWFMG and the standards of the Province of Ontario as set out in the Ministry of Environment, Conversation and Parks (MECP) 2003 Stormwater Management Planning and Design Manual (SWMPD). The following design criteria will be reviewed:

- Post-development peak flows for all storm events (2, 5, 10, 25, 50 and 100 year) from the site will be controlled to match pre-development conditions;
- A specified rainfall depth of 5mm is to be retained on-site, as required by the WWFMG; and,
- A safe overland flow will be provided for all flows in excess of the 100-year storm event.

4.3. Methodology: Sanitary Discharge

The sanitary sewage discharge from the site will be determined using sanitary sewer design sheets that incorporate the land use and building statistics as supplied by the design team. The calculated values provide peak sanitary flow discharge that considers infiltration.

The estimated sanitary discharge flows from the proposed site will be calculated based on the criteria shown in **Table 4-1**.

Table 4-1 – Sanitary Flows

Usage	Design Flow	Units	Population Equivalent
Residential	450	Litres / capita / day	Single Family = 15 ppha Semi-detached = 20 ppha Row dwellings = 40 ppha Apartments = 240 ppha

Based on the calculated peak flows, the adequacy of the existing infrastructure to support the proposed development will be discussed.

4.4. Methodology: Water Usage

The fire flow requirements were estimated using the method prescribed by the Fire Underwriters Survey (FUS). This method is based on the fire protected building floors, the type and combustibility of the structural frame and the separation distances with adjoining building units. The domestic water usage was calculated based on the Ministry of the Environment (MOE), Design Guidelines for Drinking – Water Systems (2008), outlined in **Table 4-2,** below.

Table 4-2 – Water Usage

Usage	Water Demand	Units
Residential	450	Litres / capita / day

5.0 Stormwater Management and Drainage

5.1. Existing Conditions

The existing site is approximately 2.169 hectares and it is currently occupied by undeveloped land. According to available records, the storm runoff from the existing site is gravity-driven towards Cairns Crescent and is captured by existing road ditches. Please refer to the topographic survey in **Appendix B**. Additionally, there is an external area situated directly behind the adjacent property, which drains towards the site and ultimately discharges into the aforementioned road ditches.

Due to the presence of landscaped areas covering the existing site, the run-off composite coefficient is estimated at 0.25. The input parameters, summarized in **Table 5-1**, are illustrated in the pre-development drainage area plan in **Figure DAP-1** in **Appendix C**.

Table 5-1 – Pre-development Input Parameters

Drainage Area	Drainage Area (ha)	Actual "C"	Design "C"	Tc (min.)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.25	10
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.25	10

Peak flows calculated for the existing conditions are shown in **Table 5-2** below. Detailed calculations are provided in **Appendix C**.

Table 5-2 – Target Peak Flows

Catchment	Peak Flow Rational Method (L/s)					
	2-year	5-year	10-year	25-year	50-year	100-year
A1 Pre (Towards Cairns Crescent)	110.4	141.9	165.7	195.0	213.8	231.5
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	37.0	47.5	55.5	65.3	71.6	77.6

As shown in **Table 5-2**, the post-development flows directed towards the detention pond area located in the north-west portion of the site will need to be controlled to match the pre – development conditions for all storm events up to the 100-year storm event. Detailed calculations can be found in **Appendix C**.

5.2. Stormwater Management

In order to meet the Town's Storm Design requirements, post-development flows should be controlled to the pre-development target flows, for all storm events up to the 100-year storm event, as established in **Section 5.1**.

The site consists of three (3) internal drainage areas:

1. A1 Post – Storm runoff from the rooftop, terraces, hardscaped and landscaped areas, controlled in the surface pond;
2. A2 Post – Uncontrolled runoff, directed towards Cairns Crescent;
3. EXT Area Post – Storm runoff from the external area, conveyed through the surface pond.

The post-development drainage areas and runoff coefficients are indicated on **Figure DAP-2**, in **Appendix C** and are summarized in **Table 5-3**.

Table 5-3 - Post-development Input Parameters

Drainage Area	Drainage Area (ha)	"C"	Tc (min.)
A1 Post (Rooftop/Terraces/Landscaped & Hardscaped Areas) - Controlled in surface pond	1.977	0.64	10
A2 Post (Uncontrolled Area) – Towards Cairns Crescent	0.192	0.44	10
EXT Area Post (External Area ultimately discharges towards Cairns Crescent) - Area to be conveyed through surface pond	0.727	0.25	10

The external drainage area, which previously discharged towards Cairns Crescent, will be effectively managed and conveyed through the proposed development. Storm runoff from the designated area will be collected by proposed catch basins and subsequently directed to the proposed detention pond. From there, the discharge will follow the pre-development major drainage pattern, ultimately reaching at Cairns Crescent.

5.2.1. Quantity Controls

As established in **Section 5.1** of this report, storm runoff from the proposed development will be controlled to match the pre-development conditions, for all storm events, up to the 100-year storm event.

Using the Town's intensity-duration-frequency (IDF) data, modified rational method calculations were undertaken to determine the maximum storage required during each storm event. Results for the 2, 5, 10, 25, 50 and 100-year storm events are summarized in **Table 5-4**, below. The detailed post-development quantity control calculations are provided in **Appendix C**.

Table 5-4 - Post-development Quantity Control as per Town Requirements

Storm Event	Target Flow (L/s)	Required Storage Volume (m^3)	Release Rate from EXT Area Post (L/s)	Uncontrolled Flow (L/s)	Maximum Controlled Site Release Rate (L/s)
2-year	147.4	105.4	37.0	17.4	93.0
5-year	189.4	133.0	47.5	22.3	119.6
10-year	221.2	155.6	55.5	26.1	139.6
25-year	260.3	182.4	65.3	30.7	164.3
50-year	285.4	198.5	71.6	33.7	180.1
100-year	309.1	212.2	77.6	36.5	195.1

As shown in **Table 5-4**, in order to control post-development flows, for all events to match pre-development conditions, a target flow of 309.1 L/s is to be satisfied. The maximum required storage volume is calculated at 212.2 m^3. The required on-site storage will be accommodated by the use of a detention pond area with a depth of 2.7 m, located at the north-west portion of the site. Detailed calculations supporting this design approach are available in **Appendix C**.

During a 100-year storm event, the maximum controlled site release rate, towards the right-of-way, is estimated at 195.1 L/s. The maximum controlled site release rate includes contributions from both the uncontrolled drainage area (**Drainage Area A2 Post**) and the external drainage area (**EXT Area Post**). Storm runoff from the external area will be conveyed through the detention pond and ultimately directed toward Cairns Crescent, maintaining the pre-development major drainage pattern. For storm events exceeding the 100-year design storm, the proposed stormwater management system is designed to safely overflow towards the adjacent right-of-way.

5.2.2. Quality Controls

Stormwater treatment must meet Enhanced Protection criteria as defined by the MECP 2003 SWMPD Manual, including a minimum 80% of total suspended solids removal (TSS).

Permanent Pool- Quality Control

According to **Table 3.2 Water Quality Storage Requirements based on Receiving Waters** of the MOE SWMP Manual Guidelines, dated March 2003, and taking into account that the ratio of impervious level is equal to 60%, a minimum 161.7 m^3/ha will be stored and infiltrated in order to achieve a minimum 80% of total suspended solids removal (TSS), while the volumetric quality control criteria are fulfilled. The required storage volume that will be required for the permanent pool has been calculated at 319.68 m^3.

Extended Detention quality control

Based on the MOE SWMP Guidelines for wet facilities, 40 m^3/ha is required for extended detention, resulting in an additional volume of 79.08 m^3 to be retained on-site. Therefore, the total required storage volume for quality control purposes is estimated at 398.76 m^3.

5.2.3. Proposed Detention Pond

As mentioned above, storm runoff from the rooftops, walkways, hardscaped and landscaped areas will be gravity-driven into the proposed detention pond through an internal storm sewer system. The proposed detention pond has been designed in accordance with the MOE SWMP Manual Guidelines, providing water quality erosion and quantity control.

Using the MOE SWMP Manual Guidelines, the minimum permanent pool volume has been calculated at 319.68 m^3. This volume is the minimum required permanent pool volume in the detention pond in order to provide Level 1 treatment for 60% impervious area as specified in Table 3.2 on MOE SWMP Manual Guidelines. Based on the detailed calculations provided in **Appendix C**, the proposed detention pond has been designed to provide a minimum of 398.76 m^3 for quality control purposes. In addition, the pond has been designed to accommodate above 664.21 m^3 for quantity control.

The following criteria have been met, ensuring public safety and proper functionality of the proposed detention pond:

- The maximum permanent pool depth has been calculated at 2.7 meters. As per MOE SWMP Manual Guidelines the permanent pool depth should be between 1 to 3 meters.
- The minimum length-to-width ratio of 3:1 has been maintained in the permanent detention pool providing a proper flow path and quality control. In addition, side slopes of 4:1 have been maintained in the extended detention portion of the pond as per MOE Guidelines.
- The proposed detention pond has been designed to include a sediment forebay to enhance stormwater quality through the removal of suspended pollutants. The forebay has a depth of 1.0m and a length-to-width ratio greater than 2:1. Both inlets to the detention pond have been located within the forebay to improve overall treatment performance.
- A minimum freeboard of 0.30 m above the maximum elevation has been included in the design.
- The emergency overflow spillway/weir has been included to safely convey peak flows from the 100-year event.

The total required storage volume for quality control is approximately 398.76 m^3. The detailed volume control calculations will be provided at a later stage.

5.2.4. Proposed site grading to the detention pond

According to the latest topographic survey, a combination of 3:1 and 4:1 slopes has been proposed along the northwest property limits, in order to meet the existing elevations. The proposed grading has been designed to provide major overland flow paths towards the proposed detention pond.

Refer to Site Grading and Site Servicing plans included in civil engineering drawings **"Site Grading Plan (SG-01)"** and **"Site Servicing Plan (SS-01)"**, respectively (submitted separately).

5.2.5. Water Balance

The Town's WWFMG requires 5 mm of onsite runoff from any rainfall event to be retained over the entirety of the site. A 5 mm of rainfall over the entire site equates to a required water balance volume of 108.47 m^3. Based on the initial abstraction values, the site will provide 58.67 m^3 of initial abstraction in post-development conditions. The remaining 49.80 m^3 will need to be stored and utilized within 72 hours.

In addition, the sediment forebay is designed to receive storm runoff and enhance pollutant removal, ensuring the water is considered clean. The proposed Wet Detention Pond has been designed to accommodate the Volumetric Quality as per MOE Guidelines. Taking into account that the proposed Pond is designed as a "Wet Pond" the respective volume will be infiltrated on-site ensuring that the infiltration target is fulfilled.

6.0 Sanitary Drainage System

6.1. Existing Sanitary Drainage System

The subject site is located on the south side of Cairns Crescent, as indicated by the topographic survey in **Appendix B**.

It is currently occupied by undeveloped land. According to available records, there are two (2) sanitary sewers abutting the subject property. More specifically:

- A 200mm to 350mm diameter sanitary sewer along Cairns Crescent flowing west;
- A 250mm diameter sanitary sewer along Kitchen Road South flowing north.

6.2. Existing Sanitary Flows

Given that the subject site ultimately discharges towards the existing sanitary network along Cairns Crescent, the total discharge flow was compared to the existing flow to quantify the net increase in the sanitary sewer. Using the design criteria outlined in **Section 4.3** and available site information, the existing sanitary discharge flow from the site is estimated at 0.61 L/s. For detailed calculations refer to the sanitary sewer design sheet in **Appendix D.**

6.3. Proposed Flows

According to the proposed development statistics, as well as the design criteria outlined in **Section 4.3**, the new building will discharge a total flow of 5.93 L/s (5.32 L/s of sanitary flow and 0.61 L/s of infiltration) into the Town's infrastructure.

The additional flow will be considered within the sanitary discharge rate, therefore, there is an increase in sanitary flow of approximately 5.32 L/s (5.928 L/s – 0.607 L/s). For detailed calculations refer to the sanitary sewer design sheet in **Appendix D**.

6.4. Proposed Sanitary Connection

The proposed development will connect to the existing 200mm diameter sanitary sewer on Cairns Crescent through a 150 mm diameter sanitary sewer connection at a minimum grade of 2.00% (or equivalent pipe design). Refer to engineering drawing **"Site Servicing Plan (SS-01)"** (submitted separately) for more details.

7.0 Water Supply System

7.1. Existing System

Based on plans provided by the Town, the existing watermain system consists of the following waterlines:

- A 150 mm diameter watermain along Cairns Crescent; and
- A 150 mm diameter watermain along Kitchen Road South.

7.2. Proposed Water Supply Requirements

The estimated water consumption was calculated based on the occupancy rates shown **on Table 4-2,** according to the Ministry of the Environment (MOE), Design Guidelines for Drinking – Water Systems (2008).

It is anticipated that an average consumption of approximately 1.29 L/s (111,456 L/day), a maximum daily consumption of 3.55 L/s (306,720 L/day) and a peak hourly demand of 5.33 L/s (19,188 L/hr) will be required to service this development with domestic water. Detailed calculations are found in **Appendix E**.

The fire flow requirements were estimated using the method prescribed by the Fire Underwriters Survey (FUS 2020) be undertaken to assess the minimum requirement for fire suppression. The fire flow calculations are normally conducted for the largest storey, by area, and for the two immediately adjacent storeys.

As a result to the above mentioned method, we have selected Levels 1, 2 and 3 which result the maximum fire flow requirement for this development (worst case scenario).

Table 7-1 below illustrates the input parameters used for the FUS 2020 calculations. According to our calculations, a minimum fire suppression flow of approximately 150.00 L/s (2378 USGPM) will be required. Refer to detailed calculations found in **Appendix E**.

Table 7-1 – Fire Flow Input Parameters

Parameter	Frame used for Building	Combustibility of Contents	Presence of Sprinklers	Separation Distance			
				North	East	West	South
Value according to FUS options	Non-Combustible Construction	Non-Combustible	Yes	10.1m-20m	10.1m-20m	>30m	>30m
Surcharge/reduction from base flow	0.8	25%	30%	15%	15%	0%	0%

In summary, the required design flow is the sum of 'the minimum fire suppression flow' and 'maximum daily demand' (150.00 + 3.55 = 153.55 L/s (2434 USGPM)).

7.3. Proposed Watermain Connections

The proposed development will be serviced by a 150mm diameter fire and a 100mm diameter domestic water service. The proposed water service will be connected to the existing 150mm diameter watermain on Cairns Crescent. For details refer to the engineering drawing "**Site Serving Plan (SS-01)"** (submitted separately).

8.0 Site Grading

8.1. Existing Grades

The existing site is approximately 2.169 hectares and it is occupied by undeveloped land. According to available records, the storm runoff from the existing site is gravity driven towards Cairns Crescent and is captured by existing road ditches. Please refer to the topographic survey in **Appendix B**. Additionally, there is an external area situated directly behind the adjacent property, which drains towards the site and eventually discharges into the aforementioned road ditches.

8.2. Proposed Grades

The proposed grades will improve the existing drainage conditions to meet the Town's requirements. Grades will be maintained along the property line wherever feasible and overland flow will be directed towards the adjacent right of ways (ROW).

9.0 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be designed and will include sediment fencing, a construction access driveway and temporary sediment control facilities where required. These measures will be designed and constructed in accordance with the Ministry of Transportation of Ontario (MTO) Drainage Management Manual (1997) and the Ministry of the Environment (MOE) Stormwater Management Planning and Design Manual (2003), as well as all applicable municipal and regional requirements. The detailed **"Erosion Control Plan (EC-01)"** will be approved by the Municipality and Region prior to any site alteration be undertaken. All reasonable measures will be taken to ensure sediment loading to the adjacent properties and storm sewers is minimized both during and following construction.

Proposed erosion and sediment control measures shall be inspected promptly after storm events and shall be repaired or replaced if/where damaged. In addition, it is advised that precipitation accumulated within site excavation during the duration of construction shall be dealt with as part of the short-term (construction) groundwater dewatering program.

Moreover, all waste material, including any hazardous contaminated excess soils, shall be removed and disposed of off-site by the Owner in accordance with Ministry of the Environment, Conservation and Parks regulations and all other applicable statutory requirements.

For further details refer to engineering drawing **"Erosion Control Plan (EC-01)"** (submitted separately).

10.0 Conclusions and Recommendations

Based on our investigations, we conclude the following:

Storm Drainage

The site's stormwater discharge will be controlled for storm events ranging from the 2-year up to the 100-year flow to the pre-development conditions. Post-development flows from the property, which will be directed towards the detention pond, must be controlled to meet the pre-development target flows for storm events up to the 100-year storm event. In order to attain the target flows and meet the Town's Wet Weather Flow Management Guidelines (WWFMG), quantity control will be utilized and up to 212.2 m^3 of on-site storage will be required. The stormwater management (SWM) system will be designed to provide enhanced level (Level 1) protection as specified by the Ministry of Environment, Conservation and Parks (MECP). Additional quality control measures will also be required by the MECP, will be provided by the proposed detention pond.

Sanitary Sewers

The proposed development will connect to the existing 200mm diameter sanitary sewer on Cairns Crescent, through a 150mm diameter sanitary sewer lateral connection, with a minimum grade of 2.00% (or equivalent pipe design). Under pre-development conditions, the site discharges approximately 0.61 L/s into the Town's sanitary sewer network. Under post-development conditions, the discharge is expected to increase to 5.93 L/s. Therefore, the net increase in sanitary flow resulting from the proposed development, is anticipated at approximately 5.32 L/s.

Water Supply

Water supply for the site will be provided by the existing 150mm diameter watermain on Cairns Crescent. It is anticipated that a total design flow of 153.55 L/s will be required to support the proposed development. In summary, the required design flow is the sum of 'the minimum fire suppression flow' and 'maximum daily demand' (150.00 + 3.55 = 153.55 L/s, 2434 USGPM).

Lithos

150 Bermondsey Road, North York, Ontario, M4A 1Y1

LOCATION PLAN
RESIDENTIAL USE DEVELOPMENT
20 CAIRNS CRESCENT
HUNTSVILLE, ONTARIO

DATE:	AUGUST 2025	PROJECT No:	UD22-097
SCALE:	N.T.S.	FIGURE No:	FIG 1

Lithos

150 Bermondsey Road, North York, Ontario, M4A 1Y1

AERIAL PLAN

RESIDENTIAL USE DEVELOPMENT
20 CAIRNS CRESCENT
HUNTSVILLE, ONTARIO

DATE:	AUGUST 2025	PROJECT No:	UD22-097
SCALE:	N.T.S.	FIGURE No:	FIG 2

Appendix A

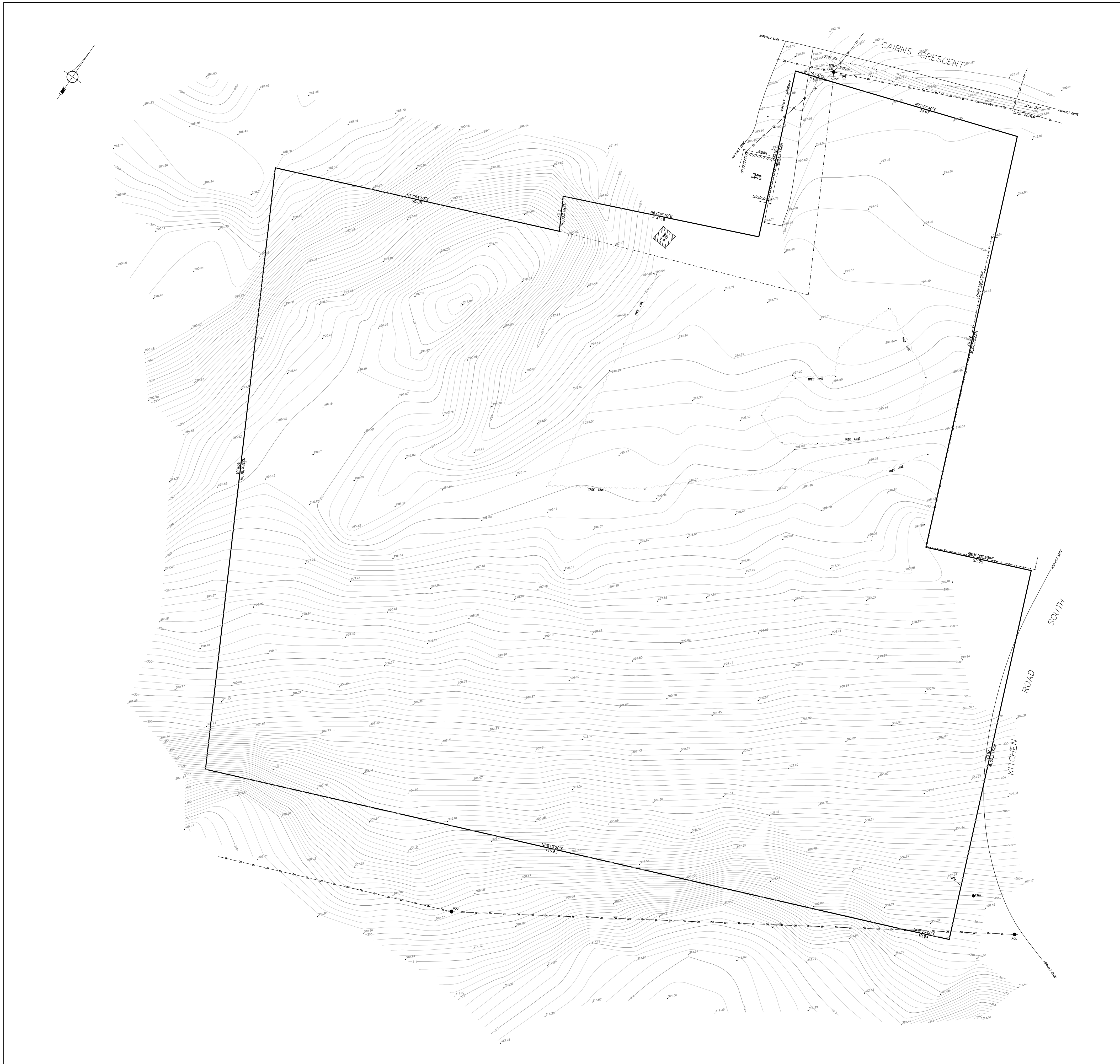
Site Photographs

North-West side of the property along Cairns Crescent facing South-East

North-East corner of the property along Cairns Crescent facing South-West

Appendix B

Background Information



KEY PLAN – NOT TO SCALE

IMAGERY

AERIAL IMAGERY SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY NOT DEPICT CURRENT FEATURES.

TOPOGRAPHIC BASE PLAN OF

20 CAIRNS CRESCENT
TOWN OF HUNTSVILLE

SCALE 1 : 250 METRES

0 1 2 3 4 5 10 20

COORDINATES

COORDINATE VALUES AND DIGITAL FILE ARE IN GRID SYSTEM, UTM ZONE 17 (81° WEST LONGITUDE), NAD83(CSRS)(2010). COMBINED SCALE FACTOR = 0.999793

CONTOURS

CONTOURS SHOWN HEREON ARE DRAWN AT 0.20 METRE INTERVALS.

ELEVATIONS

ELEVATIONS ARE GEODETIC AND REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD28) BY DIRECT MEASUREMENT TO A REAL TIME NETWORK.

CAUTION

THIS IS NOT A PLAN OF SURVEY AND SHALL NOT BE USED EXCEPT FOR THE PURPOSE INDICATED IN THE TITLE BLOCK. THE WORK AND DRAWINGS HEREIN WERE COMPLETED FOR THE EXCLUSIVE USE OF OUR CLIENT AND NO LIABILITY IS ASSUMED TO ANY THIRD PARTIES OR SUBSEQUENT OWNERS.

NOTE

PROPERTY DIMENSIONS SHOWN HEREON ARE IN ACCORDANCE WITH IBW SURVEYORS RECORDS. (PROJECT NUMBER A–039153)

DISTANCE NOTES – METRIC

DISTANCES ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999793.

LEGEND

- AN DENOTES ANCHOR POINT
- POA DENOTES ANCHOR POLE
- POU DENOTES UTILITY POLE
- TB DENOTES TERMINAL BOX
- -OH- DENOTES OVERHEAD UTILITY WIRES
- ×123.45 DENOTES SPOT ELEVATION

MAUGHAN SURVEYORS
A division of IBW Surveyors Ltd.

IBWSURVEYORS.COM | 1.800.667.0696

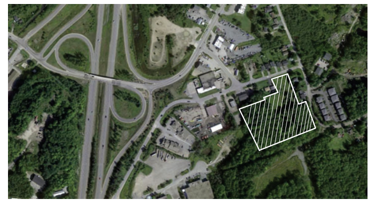
PARTY CHIEF: BP	DRAWN BY: AB	CHECKED BY: DC	PLOT DATE: FEB. 3, 2023
FILE NAME:			

20 CAIRNS CRESCENT, HUNTSVILLE

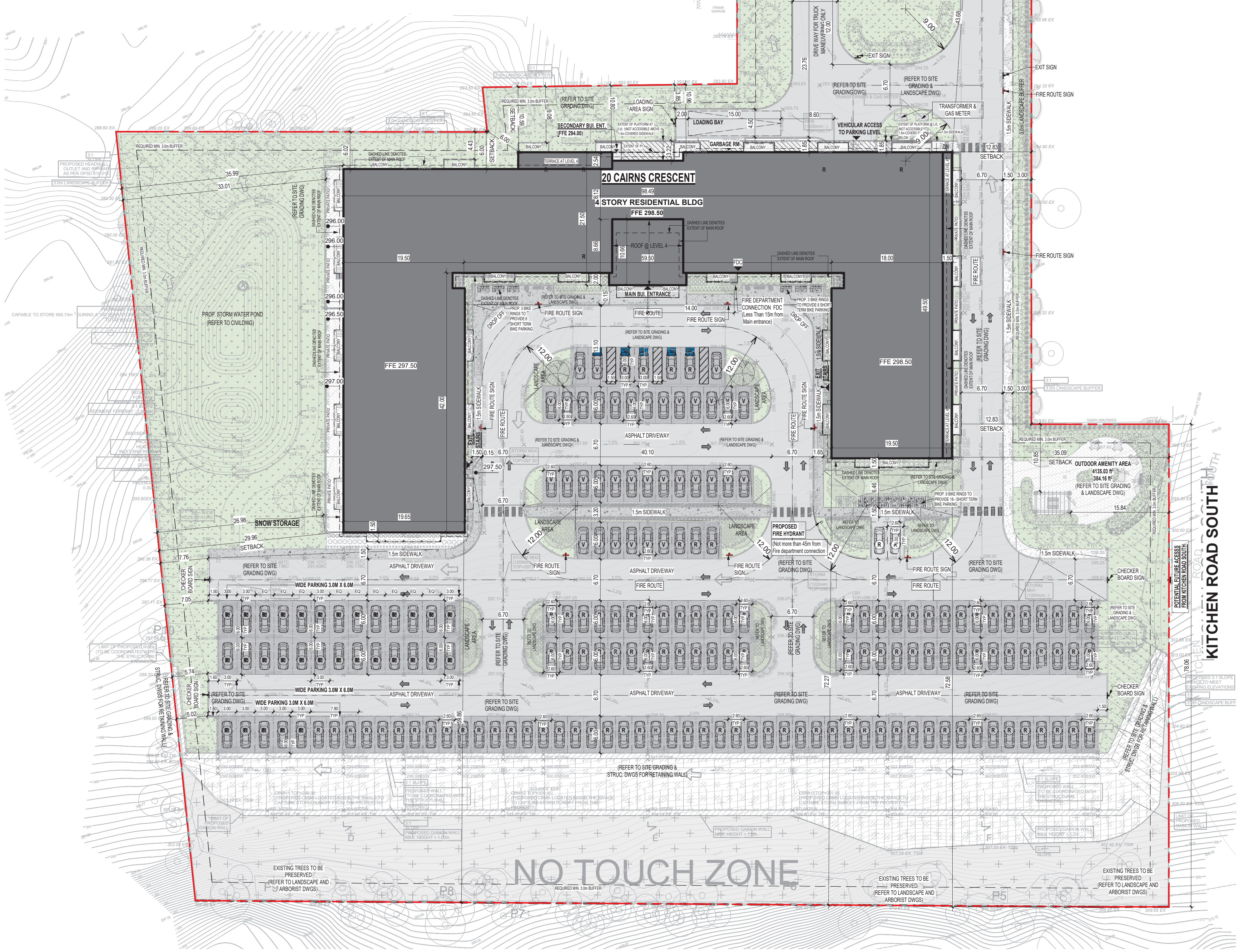
CITY OF HUNTSVILLE

THE INFORMATION FOR THIS SITE PLAN HAS OBTAINED FROM A COPY OF A SURVEY PLAN PREPARED BY MAUGHAN SURVEYORS. THE INFORMATION SHOWN HEREON, INCLUDING GRADES SHALL NOT BE USED FOR ANY LEGAL / ZONING / OR CONSTRUCTION PUROPOSE WITHOUT CONFIRMING THE ACCURACY THERE OF BY REFERENCE TO THE APPLICABLE SURVEY.

KEY PLAN - NTS



CONTEXT PLAN - NTS



1 SITE PLAN 1 : 350

SITE STATISTICS

- LOT AREA-		
Name	Area (Metric)	Area (Imperial)
20 Cairns Crescent	21693.20 m²	233504 ft²

GROSS FLOOR AREA - 4 STORY		
Level	Area	Area
LEVEL 1	3179.79 m²	34226.93 ft²
LEVEL 2	3136.51 m²	33761.16 ft²
LEVEL 3	3136.51 m²	33761.16 ft²
LEVEL 4	3014.56 m²	32448.45 ft²
Grand total	12467.37 m²	134197.69 ft²

NET SALABLE AREA - APARTMENT			
LEVEL	UNIT COUNT	SQ.M	SQ.FT
LEVEL 1	44	2,622.82 m²	28,232 ft²
LEVEL 2	44	2,613.22 m²	28,128 ft²
LEVEL 3	44	2,613.22 m²	28,128 ft²
LEVEL 4	44	2,501.61 m²	26,927 ft²
TOTAL	176	10,350.87 m²	111,416 ft²

PROPOSED RESIDENTIALUNIT MIX				
UNIT TYPE	UNIT COUNT	AREA		PERCENTAGE
		SQ.M	SQ.FT	
1 BED	121	6,450.10 m²	69,428 ft²	69%
1 BED+DEN	10	594.62 m²	6,400 ft²	6%
2 BED	14	852.37 m²	9,175 ft²	8%
2 BED+DEN	19	1,406.48 m²	15,139 ft²	11%
3 BED	12	1,047.29 m²	11,273 ft²	7%
TOTAL: 176	176	10,350.87 m²	111,416 ft²	100%

INDOOR AMENITY PROVIDED		
Level	SQ.M	SQ.FT
LEVEL 2	131.00 m²	1410.08 ft²
LEVEL 3	131.00 m²	1410.08 ft²
TOTAL	262.00 m²	2820.17 ft²

OUTDOOR AMENITY PROVIDED		
Level	SQ.M	SQ.FT
LEVEL 1	384.16 m²	4135.03 ft²
LEVEL 1	151.40 m²	1629.65 ft²
TOTAL	535.56 m²	5764.69 ft²

AMENITY AREA (OUTDOOR+INDOOR) PROVIDED	
SQ.M	SQ.FT
797.56 m²	8584.85 ft²

ZONING INFORMATION -COMMUNITY PLANNING PERMIT BY-LAW 2022-97 - R4		
ITEM NAME	ALLOWED / REQUIRED	PROPOSED
East Yard Setback		12.83 m
North Yard Setback		6.0 m
South Yard Setback		59.72 m
West Yard Setback		29.96 m
Building Height	11.0m	19.55m
Lot Coverage		15%
GFA		12467 sq.m
Density (FSI)		0.57
Total Residential Units Proposed		176
Total Parking Proposed	255	211(INCL. 7 B.F.)

PARKING STATISTICS - PARKING USE			
PARKING USE	REQUIRED		PROPOSED
	BY LAW 2022-97	TOWN COUNCIL (Endorsed reduced rate)	
RESIDENTIAL	220 (1.25 per unit)	176 (1 per unit)	176
VISITOR	35 (1 per 5 units)	35 (1 per 5 units)	35
TOTAL	255	211	211

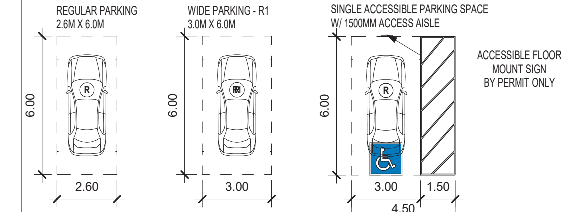
PARKING STATISTICS - WIDE & ACCCESSIBLE PARKING			
WIDE PARKING (3.0m x 6.0m)	51 (20% of required parking - 255)	42 (20% of required parking - 211)	42
ACCESSIBLE PARKING (4.5m x 6.0m)	7 (5 spaces plus 1 for each 50 beyond 150)	7 (5 spaces plus 1 for each 50 beyond 150)	07

NOTE: PARKING REQUIRMENTS FOLLOWING REQUIREMNTS OF COMMUNITY PLANNING PERMIT BY LAW 2022-97 (CONSOLIDATED MAY 22, 2024)

NOTE: MAJORITY OF PARKING SPACES AT P1 LEVEL CAN BE DESIGNATED FOR EV PARKING.

TOTAL PROPOSED BICYCLE PARKING		
PARKING TYPE	LOCATION	COUNT
SHORT TERM	SURFACE LEVEL	30 (0.17 per unit)
LONG TERM	P1 LEVEL	66 (0.375 per unit)
TOTAL		95 (0.53 per unit)

TYPICAL PROPOSED PARKING TYPES

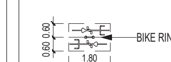


LEGEND FOR PARKING USE:

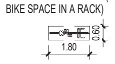
(R) (R1) RESIDENTIAL PARKING (V) VISITOR PARKING

TYP. PROPOSED BICYCLE PARKING TYPES

SHORT TERM:
HORIZONTAL POSITION AT FLOOR MOUNT BIKE RING
SIZE: 0.6m X 1.8m



LONG TERM:
HORIZONTAL POSITION AT STACKED BIKE RACK
SIZE: 0.6m X 1.8m x 1.2m(FOR EACH BIKE SPACE IN A RACK)



LEGEND

- PROPOSED PLANTING AREA (REFER TO LANDSCAPE DWG FOR DETAILS)
- PROPOSED SODDED AREA (REFER TO LANDSCAPE DWG FOR DETAILS)
- PROPOSED CONCRETE PAVING TYP. (REFER TO LANDSCAPE DWG FOR DETAILS)
- PROPOSED UNIT PAVING TYP. (REFER TO LANDSCAPE DWG FOR DETAILS)
- STOP BAR (SEE TRAFFIC SIGNAGE PLAN FOR DETAILS)
- TRAFFIC SIGN (SEE TRAFFIC SIGNAGE PLAN FOR DETAILS)
- FIRE ROUTE SIGN (SEE TRAFFIC SIGNAGE PLAN FOR DETAILS)

2 3D VIEW FROM SOUTH EAST

3 3D VIEW FROM NORTH EAST

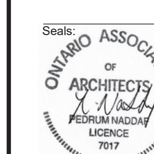
4 3D VIEW FROM NORTH WEST

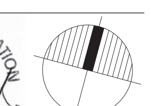
Options Architects
170 Sheppard Ave. East Unit # 101A
North York, ON, M2N 3A4
Tel: 437.703.2700

ID	DATE	ISSUE / REVISION	BY
1	2023-01-20	For Review	PN
2	2023-03-03	For Review	PN
3	2023-05-10	For Review & Coordination	PN
4	2023-06-16	For Review & Coordination	PN
5	2023-08-11	For Review & Coordination	PN
6	2023-08-23	For Site Plan Application	PN
7	2024-01-30	For Review & Coordination	PN
8	2024-07-17	For Review & Coordination	PN
9	2024-07-23	For Review & Coordination	PN
10	2024-08-02	For First Submission of Class 3 Major CPP	PN
11	2024-12-10	For Review	PN
12	2024-12-24	For Coordination	PN
13	2025-05-02	For Coordination	PN
14	2025-06-25	For Coordination	PN
15	2025-07-04	For Coordination	PN
16	2025-07-07	For Coordination	PN
17	2025-08-01	For Coordination	PN
18	2025-08-13	For Second Submission of Class 3 Major CPP	PN
19	2025-08-15	For Second Submission of Class 3 Major CPP-Revised	PN

Client:

Seals:





NORTH

Project:

RESIDENTIAL APARTMENT

20 CAIRNS CRESCENT, HUNTSVILLE

Sheet Title:

SITE PLAN

Drawn:	MH
Checked:	PN
Project No:	111-22
Date:	August, 2025
Scale:	As indicated

Sheet No: A1.01

P:\2022 - Projects\111 - 2022 - 20 Cairns Cresct. - Huntsville(Apartment only)\Drawings\Revit\25-08-15_#2 CPP re-submission.rvt
PLOT DATE: 2025-08-15 3:10:50 PM

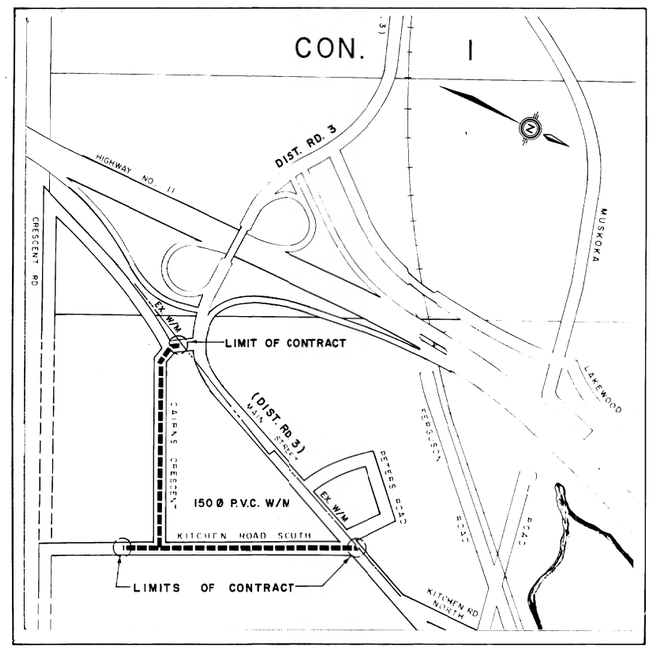
DISTRICT MUNICIPALITY OF MUSKOKA

PROPOSED WATERMAIN

CAIRNS CRESCENT AND KITCHEN ROAD SOUTH

TOWN OF HUNTSVILLE

SCALE 1 : 5000 KEY PLAN



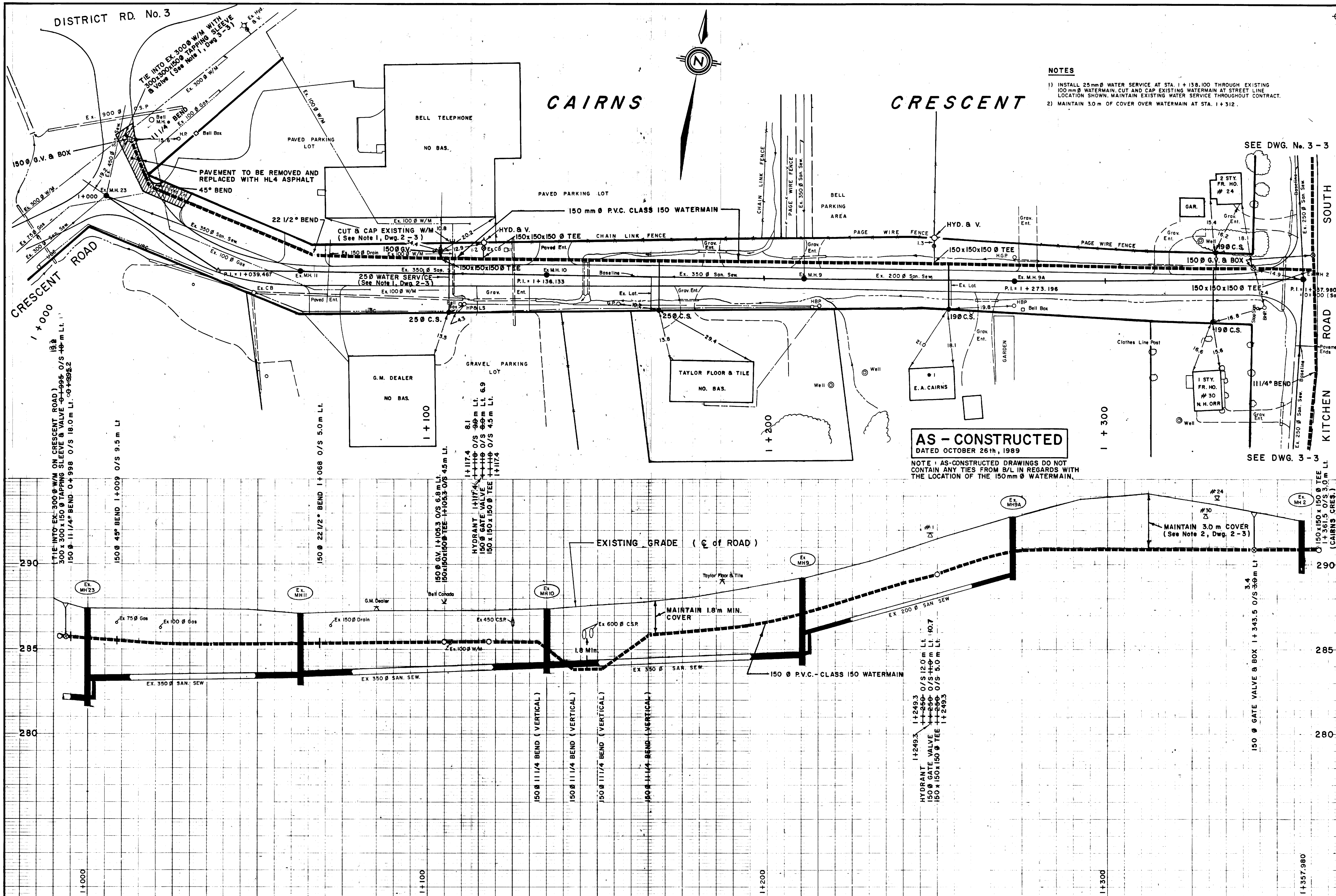
CONTRACT NO. 1989 - 105

A. J. WHITE P. ENG.

DISTRICT ENGINEER

DRAWING INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET, INDEX & KEY PLAN
2	CAIRNS CRESCENT WATERMAIN, FROM CRESCENT ROAD TO KITCHEN RD. SOUTH
3	SOUTH KITCHEN ROAD WATERMAIN, FROM CAIRNS CRESCENT TO DIST. RD. 3



DISTRICT MUNICIPALITY OF MUSKOKA

REGISTERED PROFESSIONAL ENGINEER — A. J. WHITE — PROVINCE OF ONTARIO — 28/Oct/89

NO.	DATE	REVISION	BY
2	OCT. 30/89	AS-CONSTRUCTED	K.H.
1	JUNE 7/89	ISSUED FOR TENDER	A.J.W.
0	OCT.20/88	ISSUED FOR APPROVAL	A.J.W.

DESIGNED: K. HAMMOND
DRAWN: R. LACROIX
CHECKED: D. DRUMMOND
APPROVED:
A. J. WHITE, DISTRICT ENGINEER
DATE: 28/Oct/89

PLAN AND PROFILE OF :

150 Ø P.V.C. WATERMAIN
CAIRNS CRESCENT
TOWN OF HUNTSVILLE

SCALE: Vert. 1 : 100; Horiz. 1 : 500
DATE: OCTOBER, 1988
CONTRACT: 1989 - 105
DRAWING NO. 2 of 3

AS - CONSTRUCTED
DATED OCTOBER 26th, 1989

NOTE : AS-CONSTRUCTED DRAWINGS DO NOT CONTAIN ANY TIES FROM B/L IN REGARDS WITH THE LOCATION OF THE 150 mm Ø WATERMAIN.

NOTE:
THE LOCATION OF UTILITIES SHOWN IS APPROXIMATE ONLY AND MAY NOT BE COMPLETE. THE EXACT LOCATION OF ALL UTILITIES SHALL BE DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL PROVE THE LOCATION OF UTILITIES AND SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE.

NOTES :
1) EXACT HORIZONTAL AND VERTICAL ALIGNMENT OF EXISTING WATERMAIN AT POINT OF CONNECTIONS TO BE DETERMINED IN THE FIELD.
2) WATER SERVICE LATERALS TO BE 20mm P.E. SERIES 160 AND INSTALLED USING OPEN CUT OR UNDERGROUND METHODS UNLESS NOTED OTHERWISE.
3) EXACT WATER SERVICE LATERAL LOCATIONS TO BE VERIFIED IN FIELD.
4) THRUST BLOCKING OR APPROVED JOINT RESTRAINERS ARE TO BE USED AT ALL BENDS, FITTINGS, AND HYDRANTS.
5) ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
6) MAINTAIN WATERMAIN VERTICAL ALIGNMENT AS SHOWN. ENSURE A MINIMUM GROUND COVER OF 1.8 METRES.
7) VERTICAL AND HORIZONTAL BENDS IN WATERMAIN CAN BE ACHIEVED BY DEFLECTIONS AT JOINTS AND RADIUS OF CURVATURE AS PER MANUFACTURERS SPECIFICATIONS UNLESS NOTED OTHERWISE.
8) WATERMAIN BEDDING SHALL BE CLASS 'B' THROUGHOUT UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
9) INSTALL COATED NO.12 GUAGE STRANDED TRACER WIRE ON ALL NON-METALLIC WATERMAIN.
10) CONTRACTOR TO RESTORE DRIVEWAYS AND DITCHWORK IN AREAS DISTURBED ALONG WATERMAIN ROUTE TO EQUAL OR BETTER CONDITION.
11) ALL NEW WATERMAINS MUST BE PRESSURE TESTED, CHLORINATED AND PIGGED WITH FOUR SWABS AS DIRECTED BY THE ENGINEER.

CAIRNS CRESCENT
KITCHEN ROAD SOUTH
MAIN STREET
(DIST RD. 3)
CAIRNS CRESCENT See Dwg. No. 2
NOTE : TIES TO APARTMENT BUILDINGS NOT DRAWN TO SCALE.
PRIVATELY OWNED RIGHT-OF-WAY
PERMANENT EASEMENT
NOTE : 1 STY. STONE HO. NOT TIED INTO ORIGINAL SURVEY.
NOTE : 1 STY. HO. NOT TIED IN AT TIME OF ORIGINAL SURVEY
NOTE : HIGHLANDER MOTEL NOT TIED INTO ORIGINAL SURVEY.
150 Ø G.V.
150x150x150mm Ø Tee
150 Ø G.V.& B.
PAVEMENT TO BE REMOVED AND REPLACED WITH H.L.-4 ASPHALT
150 Ø PVC-CLASS 150 WATERMAIN
150 x 150 x 150 Ø Tapping Sleeve and Valve (see note 11)
Hyd & V
CHAIN LINK FENCE
EXISTING GRADE (℄ of ROAD)
6m INSULATION

DISTRICT MUNICIPALITY OF MUSKOKA

A. J. WHITE — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — 28 Oct 88

NO.	DATE	REVISION	BY
2	OCT. 30/89	AS-CONSTRUCTED	K.H.
1	JUNE 6/89	ISSUED FOR TENDER	A.J.W.
0	OCT. 20/88	ISSUED FOR APPROVAL	A.J.W.

DESIGNED : K. HAMMOND
DRAWN : R. LACROIX
CHECKED : D. DRUMMOND
APPROVED :
A.J. WHITE, DISTRICT ENGINEER
DATE : 28/oct/88

PLAN AND PROFILE OF :
150 Ø P.V.C. WATERMAIN
KITCHEN ROAD SOUTH
TOWN OF HUNTSVILLE

SCALE Vert. 1 : 100
Horiz. 1 : 500
DATE : OCTOBER 1988
CONTRACT : 1989 - 105
DRAWING NO. 3 of 3

518

ACC H CONT'X'

LIST OF DRAWINGS

535 - 500 GENERAL PLAN
535 - 501 GENERAL PLAN (EXTENSIONS)

SEWERS

535 - 401 OLD HIGHWAY 11 B (WEST END)
535 - 402 MAIN STREET (HIGHWAY 11 B)
535 - 403 MAIN STREET (HIGHWAY 11 B)
535 - 409 JAMES STREET AND PETERS ROAD
535 - 414 KITCHEN ROAD SOUTH
535 - 415 KITCHEN ROAD SOUTH
535 - 416 EASEMENT BETWEEN CAIRNS CRESCENT AND KITCHEN ROAD SOUTH
535 - 417 CAIRNS CRESCENT
535 - 418 TRUNK EASEMENT
535 - 418 A TRUNK EASEMENT
535 - 433 DUFFERIN STREET (EXTENSION No. 1)
WEST STREET (EXTENSION No. 2)

DETAIL DRAWINGS

535 - 425 DETAILS
535 - 426 DETAILS

Ontario

ONTARIO MINISTRY OF THE ENVIRONMENT

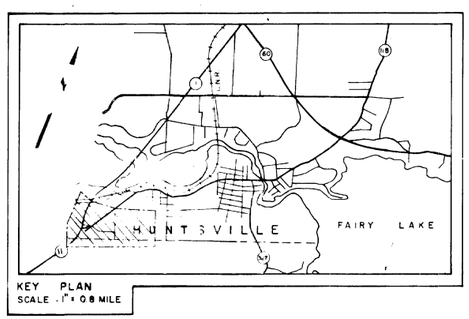
HONOURABLE GEORGE R. McCAGUE
MINISTER OF THE ENVIRONMENT

PROJECT № 1·0088

TOWN OF HUNTSVILLE

CONTRACT 'X'
SANITARY SEWER SYSTEM

1978

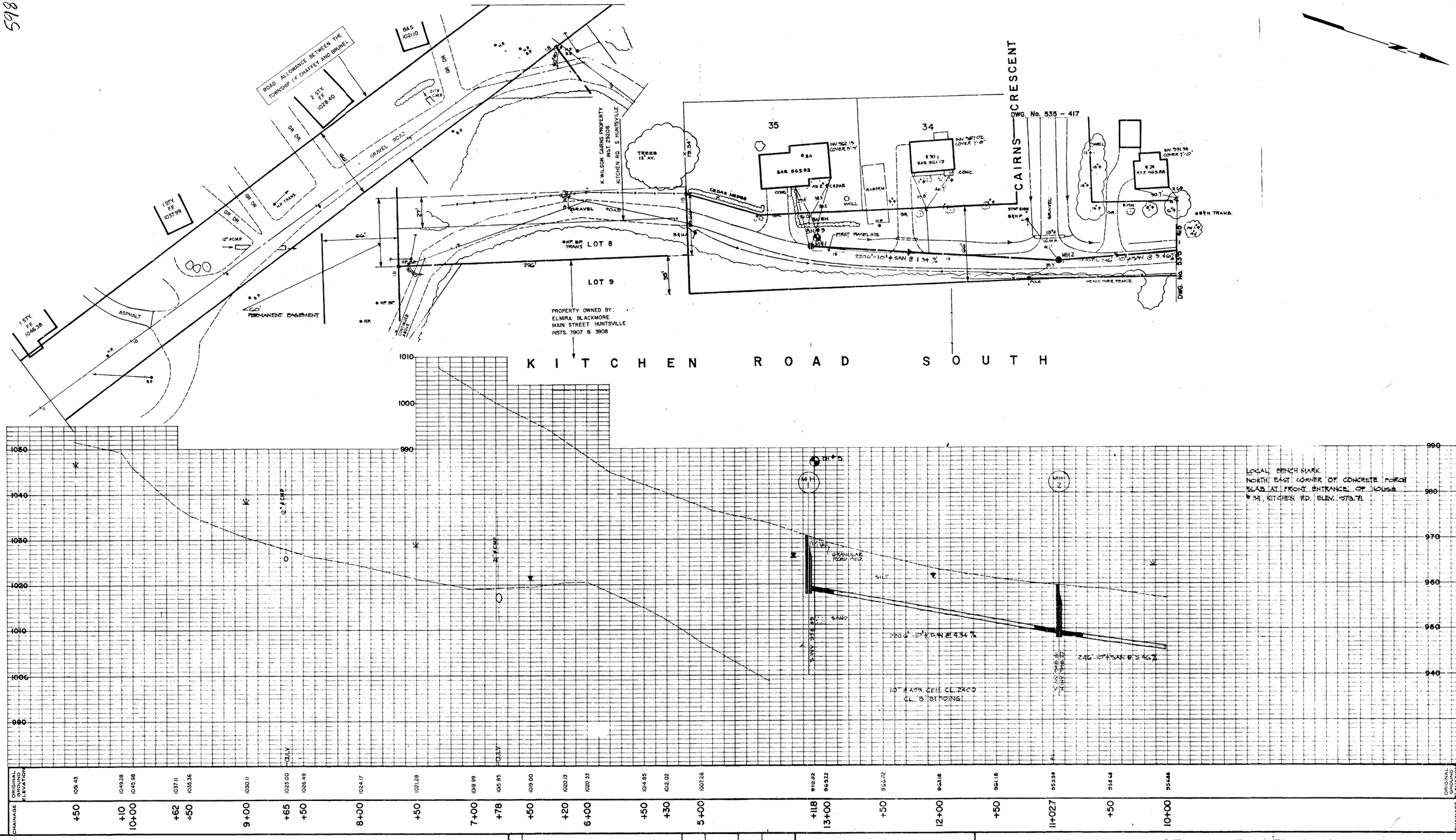


KEY PLAN
SCALE - 1" = 0.8 MILE

R.V. ANDERSON ASSOCIATES LIMITED
CONSULTING ENGINEERS & PLANNERS
TORONTO ONTARIO

ACC H CONT 'X'

598



ORIGINAL GROUND ELEVATION	1051.43	1049.28	1045.98	1037.11	1035.36	1030.11	1025.00	1026.49	1024.17	1021.28	1018.99	1015.85	1019.00	1020.13	1020.33	1014.85	1012.02	1007.26	970.02	964.22	964.02	962.16	961.16	953.98	956.45	956.66	ORIGINAL GROUND ELEVATION
CHAINAGE	+50	+10	10+00	+62	+50	9+00	+65	+50	8+00	+50	7+00	+78	+50	+20	6+00	+50	+30	5+00	+118	13+00	+50	12+00	+50	11+02.7	+50	10+00	CHAINAGE

NOTES

NO.	REVISION	BY	DATE	APP'D.	DATE
A	ISSUED FOR M.O.E. APPROVAL	D.L.	SEPT. '77		
B	ISSUED FOR CONSTRUCTION	D.L.	MAY '78		
C	AS CONSTRUCTED	P.K.	JUNE '79	JBM	Sept 79

REGISTERED PROFESSIONAL ENGINEER — CIVIL — R. C. HINDE — PROVINCE OF ONTARIO

MINISTRY OF THE ENVIRONMENT

PROJECT NO. 1-0088

SANITARY SEWER SYSTEM

R.V. ANDERSON ASSOCIATES LTD.
CONSULTING ENGINEERS AND PLANNERS
TORONTO WELLAND

CONTRACT 'X'

TOWN OF HUNTSVILLE

KITCHEN ROAD SOUTH

DESIGNED	D.L./B.B.	DATE JAN. '76	
CHECKED	R.C.H.	"	
DRAWN		"	

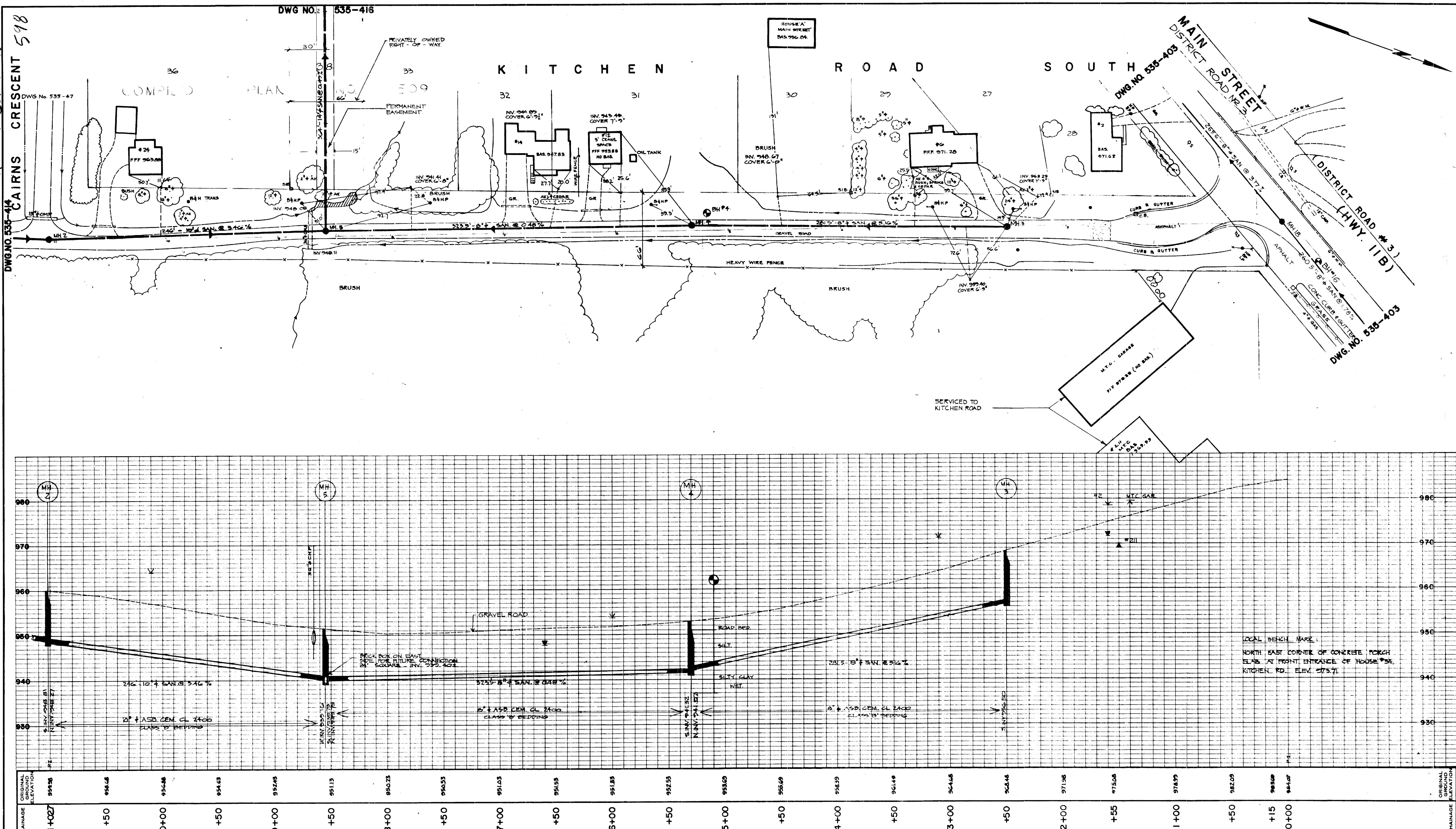
SCALE: HOR. 1" = 40' VERT. 1" = 10'

PROJECT DWG. NO. 535-414

ISSUE A B C

DRAWING NO.

400-3413 BRUNING 44-122 6-73 x



NOTES

NO.	REVISION	BY	DATE	APP'D.	DATE
A	ISSUED FOR M.O.E. APPROVAL	D.L.	SEPT/77		
B	ISSUED FOR CONSTRUCTION	D.L.	MAY/78		
C	AS CONSTRUCTED	P.K.	JUN 1/79	[illegible]	Sept 79

REGISTERED PROFESSIONAL ENGINEER — R. C. HINDE — PROVINCE OF ONTARIO

MINISTRY OF THE ENVIRONMENT

PROJECT NO. 1-0088

SANITARY SEWER SYSTEM

R.V. ANDERSON ASSOCIATES LTD.
CONSULTING ENGINEERS AND PLANNERS
TORONTO WELLAND

CONTRACT 'X'

TOWN OF HUNTSVILLE

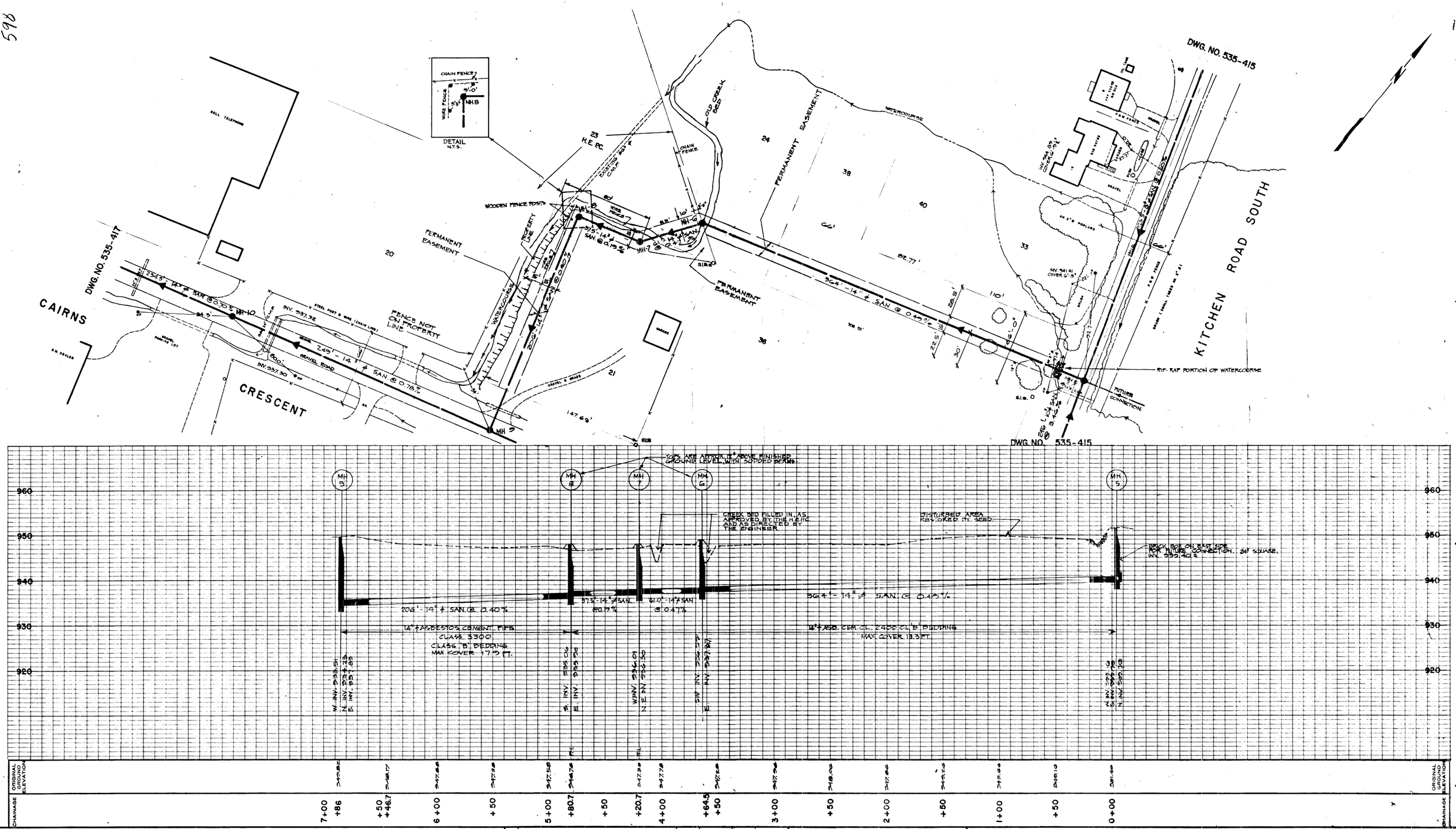
DESIGNED	D.L./B.B.	DATE JAN.1978	SCALE HOR. 1" = 40'	VERT. 1" = 10'	PROJECT DWG. NO. 535-415
CHECKED	R.C.H.	"			ISSUE A B C
DRAWN		"			

KITCHEN ROAD SOUTH

DRAWING NO.

400-34½ BRUNING 44-132 6-73

ACC H CONT 'X' 598



NOTES

NO.	REVISION	BY	DATE	APP'D.	DATE
A	ISSUED FOR M.O.E. APPROVAL	D.L.	SEPT/77		
B	ISSUED FOR CONSTRUCTION	D.L.	MAY/78		
C	AS CONSTRUCTED	F.K.	JUN/79	A.B.W.	Sept 79

R. C. HINDE — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

MINISTRY OF THE ENVIRONMENT

PROJECT NO. 1-0088

SANITARY SEWER SYSTEM

R.V. ANDERSON ASSOCIATES LTD.
CONSULTING ENGINEERS AND PLANNERS
TORONTO WELLAND

CONTRACT 'X'

TOWN OF HUNTSVILLE

		DATE
DESIGNED	B.B.	JAN. 1978
CHECKED	R.C.H.	"
DRAWN		

SCALE: HOR. 1" = 40' VERT. 1" = 10'

PROJECT DWG. NO. 535-416

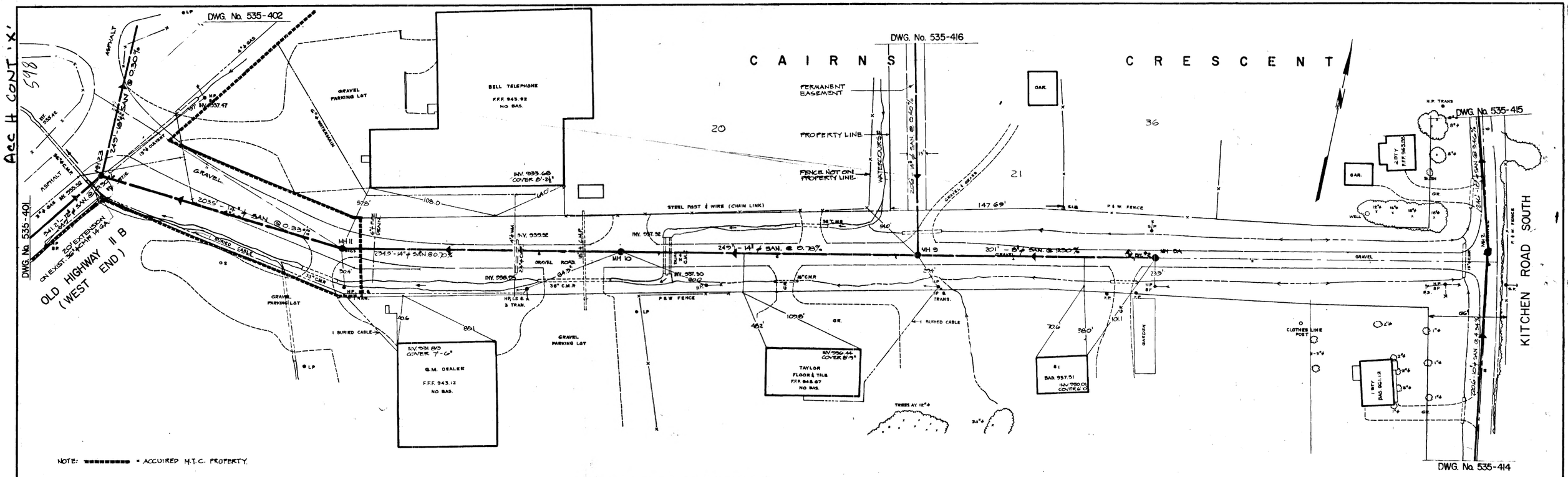
ISSUE A B

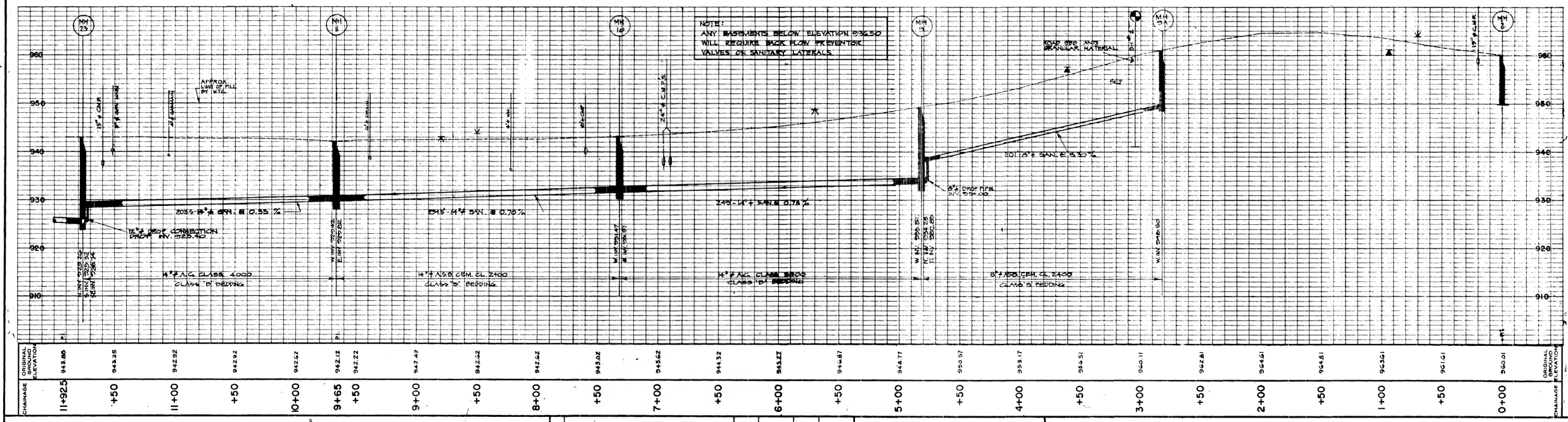
EASEMENT BETWEEN CAIRNS CRESCENT & KITCHEN ROAD SOUTH

DRAWING NO.

400-345½ BRUNING 44-132 6-73 x

ACC H CONT 'X'





NOTES

NO.	REVISION	BY	DATE	APP'D.	DATE
A	ISSUED FOR M.O.E. APPROVAL	D.L.	MAR. '77		
B	REVISED SEWER BETWEEN MH'S 11 AND 23 REVISED LOCATION OF MH 23	D.L.	MAY. '78		
C	ISSUED FOR CONSTRUCTION	D.L.	MAY '78		
D	AS CONSTRUCTED	F.K.	DEC. '78	RCH	Sept 79

R. C. HINDE — REGISTERED PROFESSIONAL ENGINEER — ONTARIO

MINISTRY OF THE ENVIRONMENT
PROJECT NO. 1-0088
SANITARY SEWER SYSTEM

R.V. ANDERSON ASSOCIATES LTD.
CONSULTING ENGINEERS AND PLANNERS
TORONTO WELLAND

CONTRACT 'X'
TOWN OF HUNTSVILLE

		DATE
DESIGNED	B.B.	JAN. 1976
CHECKED	R.C.H.	"
DRAWN		

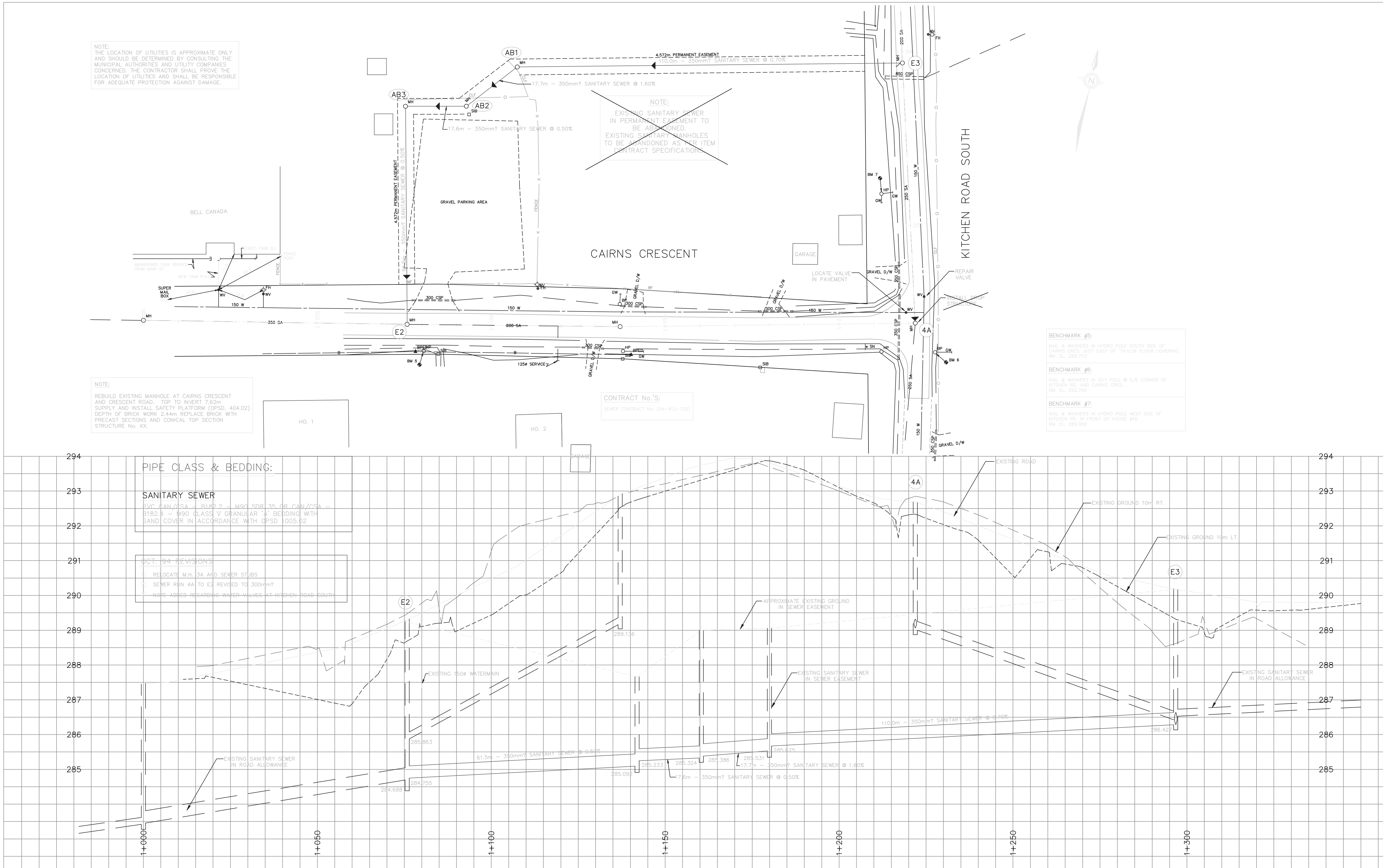
SCALE: HOR. 1" = 40' VERT. 1" = 10'

PROJECT DWG. NO. 535-417
ISSUE A B C

CAIRNS CRESCENT

DRAWING NO.

400-3693 BRUNING 44-132 6-73 x



4	JUNE 1996	"AS CONSTRUCTED"	F.B.
3	4 NOV. 1994	"ISSUED FOR CONSTRUCTION"	F.B.
2	OCT. 1994	REVISED AS NOTED	F.B.
1	SEPT. 1994	" ISSUED FOR TENDER "	F.B.

REGISTERED PROFESSIONAL ENGINEER
F. BURFORD
PROVINCE OF ONTARIO

CONTRACT FOR

CAIRNS CRES. – KITCHEN RD. SOUTH
SANITARY SEWER

TOWN OF HUNTSVILLE

DISTRICT MUNICIPALITY OF MUSKOKA
BOX 1720 – BRACEBRIDGE, ONTARIO – P0B 1C0

PLAN AND PROFILE

M5355
F.J.P. (ACAD – AdCADD)
F.B.
R.G.P.
SEPTEMBER 1994

1:500 1:50

3

GENERAL NOTES

1) All standards in accordance with current Ontario Provincial Standard Drawings (OPSD) and Ontario Provincial Standard Specifications (OPSS) unless otherwise noted.
2) All dimensions are in metres. Pipe sizes in millimetres unless otherwise noted.
3) Notify Bell Canada, ICG, Water and Sewer, Hydro and Cable Departments (where applicable) 72 hours prior to commencement for locates.
4) The Contractor shall coordinate the works with the Engineer who shall oversee the project on behalf of the owner.
5) All construction to be completed to the satisfaction of the Engineer.
6) All services and utilities to be supported as per OPSD-1007.01.
7) All trenching to be in accordance with the Occupational Health and Safety Act.
8) All traffic control and signage to be in accordance with M.T.O. requirements.
9) District of Muskoka Town of Huntsville and Engineer to be notified at least 72 hours prior to construction.
10) Wherever pipes are passing through uncompacted fill areas, the bedding trench shall be excavated to the undisturbed ground level and backfilled with Granular 'A' compacted to 95% standard proctor density or as otherwise shown on the drawings.
11) Maintain a minimum cover of 1.8m for watermains or as otherwise shown on the drawings.
12) Perform all blasting in accordance with the specification. Undertake pre-blast survey and provide copy to Engineer prior to commencement of blasting operations.
13) The location of underground and above ground utilities and structures shown on drawings is approximate only and may not be complete. The exact location of all utilities and structures shall be determined by consulting the Municipal authorities and Utilities companies concerned. The contractor shall prove the exact location of all utilities and structures before construction and shall be responsible for adequately protecting them against damage, assuming all liabilities for damage of such.
14) The Contractor must check and verify dimensions, obtain all utility locates, and obtain all required permits and licenses and verify existing service elevations before proceeding with any work.
15) Latest approved drawings to be used for construction and all discrepancies reported to the engineer.
16) Drawings are not to be scaled.
17) All materials to be used on this project shall be lead free.
18) Pipe length as labeled is measured horizontally along pipe centre line and may differ from baseline chainage where baseline is not parallel to pipe.
19) Utilize erosion and siltation controls as necessary during construction.
20) Ensure accessibility to existing residential driveways at all times.
21) Ensure adequate protection to all culverts.

APPLICABLE ONTARIO PROVINCIAL STANDARDS

102 Weighing of materials
120 General Specifications for the use of Explosives
127 Schedule of rental rates
206 Stripping of organic material, rough & fine grading
310 Asphaltic concrete hot mixed, hot laid and hot mix patching
314 Untreated granular subbase, base, surface, shoulder and stockpiling
407 The construction of manholes, catchbasins, ditch inlets and valve chambers
408 Adjusting or rebuilding manholes, catchbasins, ditch inlets and valve chambers
410 Pipe sewer construction by open cut method
421 Pipe culverts
501 Compacting
502 Weighing of materials
503 Site preparation
504 Preservation, protection and reconstruction of existing facilities
506 Dust suppressants
507 Restoration
514 Trenching, backfilling and compacting
515 Rock excavation for pipelines and structures in open cut
516 Excavating, backfilling and compacting for manholes, catchbasins, ditch inlets and valve chambers
517 Dewatering
518 Control of water
538 Shoring and bracing
539 Protection schemes
543 Traffic control signing
565 Protection of trees
570 Topsoil
571 Construction specifications for sodding
572 Construction specifications for seeding and mulching
701 Watermain Construction by open cut method.

SANITARY SEWERS NOTES

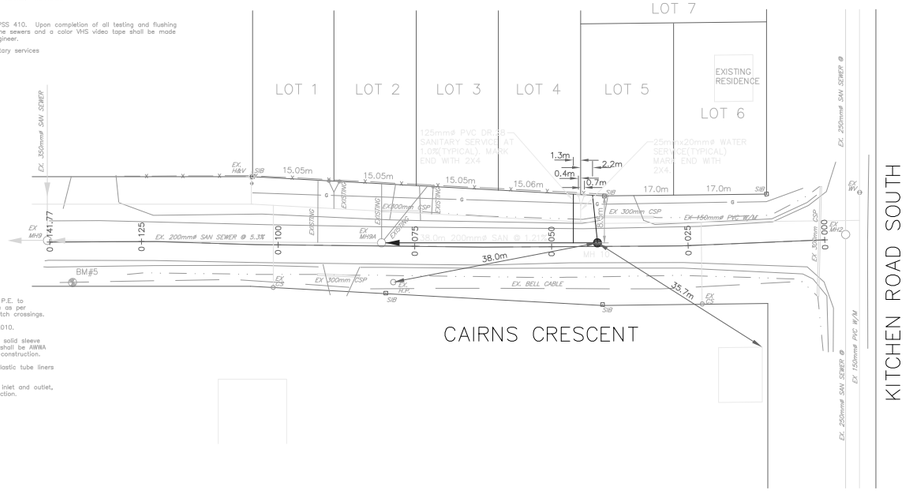
1. Sanitary sewer to be PVC DR35. Pipe embedment and backfill to be in accordance with OPSD.802.010 & 802.013. Pipe bedding to springline shall be granular A. Pipe cover shall be clean sand. Trench backfill shall be select, non organic, compactible native material.
2. All manholes to be minimum 1200mm dia. precast with aluminum rungs at 300mm centers per OPSD.701.010 Frames and Grates to be per OPSD 401.01 type 'A'.
3. All frames/lids for manholes shall be set using precast concrete adjustment units.
4. Sanitary services to be 125mm dia. PVC DR28 to OPSD 1006.02, marked with a 2x4 stake painted green extending from invert to 600mm above ground.
5. Provide frost straps on manholes per DMM 490.
6. Provide water tight pipe-to-manholes connectors in sanitary manholes.
7. All manholes to be benched per OPSD 701.021
8. Sanitary sewers to be tested in accordance with OPSS 410. Upon completion of all testing and flushing a video camera shall be passed through all mainline sewers and a color VHS video tape shall be made of the inspection and 2 copies supplied to the engineer.
9. Foundation drains are not to be connected to sanitary services

WATER SERVICE NOTES

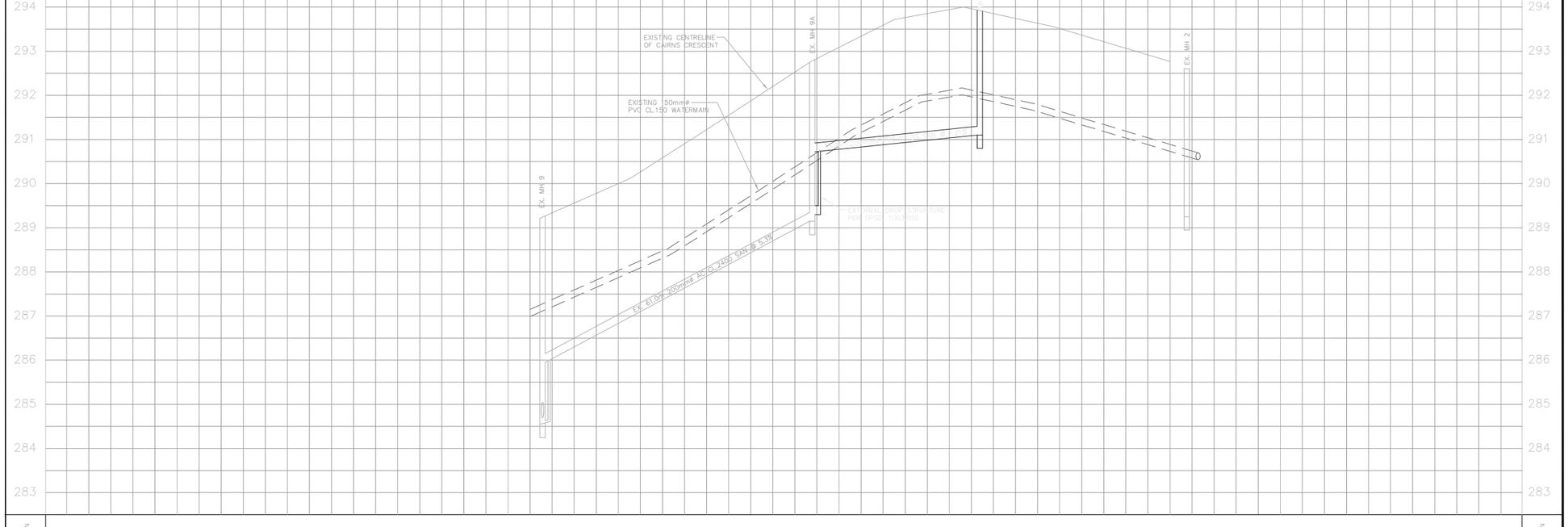
1. All water services to be 20mm dia. or 25mm dia.(CTS) series 160 P.E. to OPSD.-1104.01 unless otherwise noted. Double water services to be as per DMM 502.0 and 503.0. Provide 1.8m cover for water services at ditch crossings.
2. Water service bedding and cover shall be Granular 'A' to OPSD.802.010.
3. Connection to existing watermain shall be made with stainless steel solid sleeve service saddles, or approved equivalent. All corporation main stops shall be AWWA taper inlet thread and compression joint outlet of brass or bronze construction.
4. All polyethylene service pipe shall be fitted with stainless steel or plastic tube liners at each compression joint.
5. All curb stops shall be ball type curb stops with compression joint inlet and outlet, non-draining unless otherwise specified, of brass or bronze construction.

RESTORATION NOTES

1) Reinstate roads to previous condition or better.
2) Contractor to restore driveways and ditch work in areas disturbed by construction to equal or better conditions.
3) Minimum gravel driveway restoration to be 150mm, Granular 'A'. Asphalt Driveway restoration to be 50mm of HL3.
4) All grassed areas disturbed during construction shall be restored with 50mm topsoil and sodded or hydro mulched as per OPSS 507. Maintain until established.
5) All restoration work to be completed to the satisfaction of the Engineer.



KEYPLAN



NOTES

1. A GEOTECHNICAL INVESTIGATION OF EXISTING CONDITIONS HAS NOT BEEN CARRIED OUT PRIOR TO PROCEEDING WITH CONSTRUCTION, A GEOTECHNICAL CONSULTANT SHALL BE RETAINED TO VERIFY SUITABILITY OF SOILS FOR BEDDING PURPOSES.

BENCHMARK

BM#5
NAIL AND WASHERS IN HYDRO POLE SOUTH SIDE OF CAIRNS CRESCENT STATION 0+137 ELEVATION 289.703m.

NO.	YY.MM.DD	REVISION	BY
3	01.08.21	AS CONSTRUCTED	J.L.
2	01.06.20	REVISED SERVICE LOCATIONS ON LOT 3,4 & LOT 5 CHANGE PROPOSED PIPE GRADE	J.L.
1	00.10.26	REVISED LOT 1 SANITARY SERVICE AND ADDED WATERMAIN SERVICES	J.L.

D.E. BROUILLETTE

DESIGN BY:	Y.G.
DRAWN BY:	J.L.
CHECKED	DEB
DATE:	OCT. 2000
SCALE: HORIZ.:	1:500
VERT.:	1:50

6-4 DOMINION STREET, BRACEBRIDGE, ON, CANADA P1L 2A6 TEL:(705)645-8853 FAX:(705)645-7262 WWW.PINESTONE.COM

MARVIN CHANTLER

PROJECT
CAIRNS CRESCENT
SANITARY SEWER EXTENSION
TOWN OF HUNTSVILLE

PROJECT NO.	DRAWING NO.	REVISION
61210278	1 OF 1	1

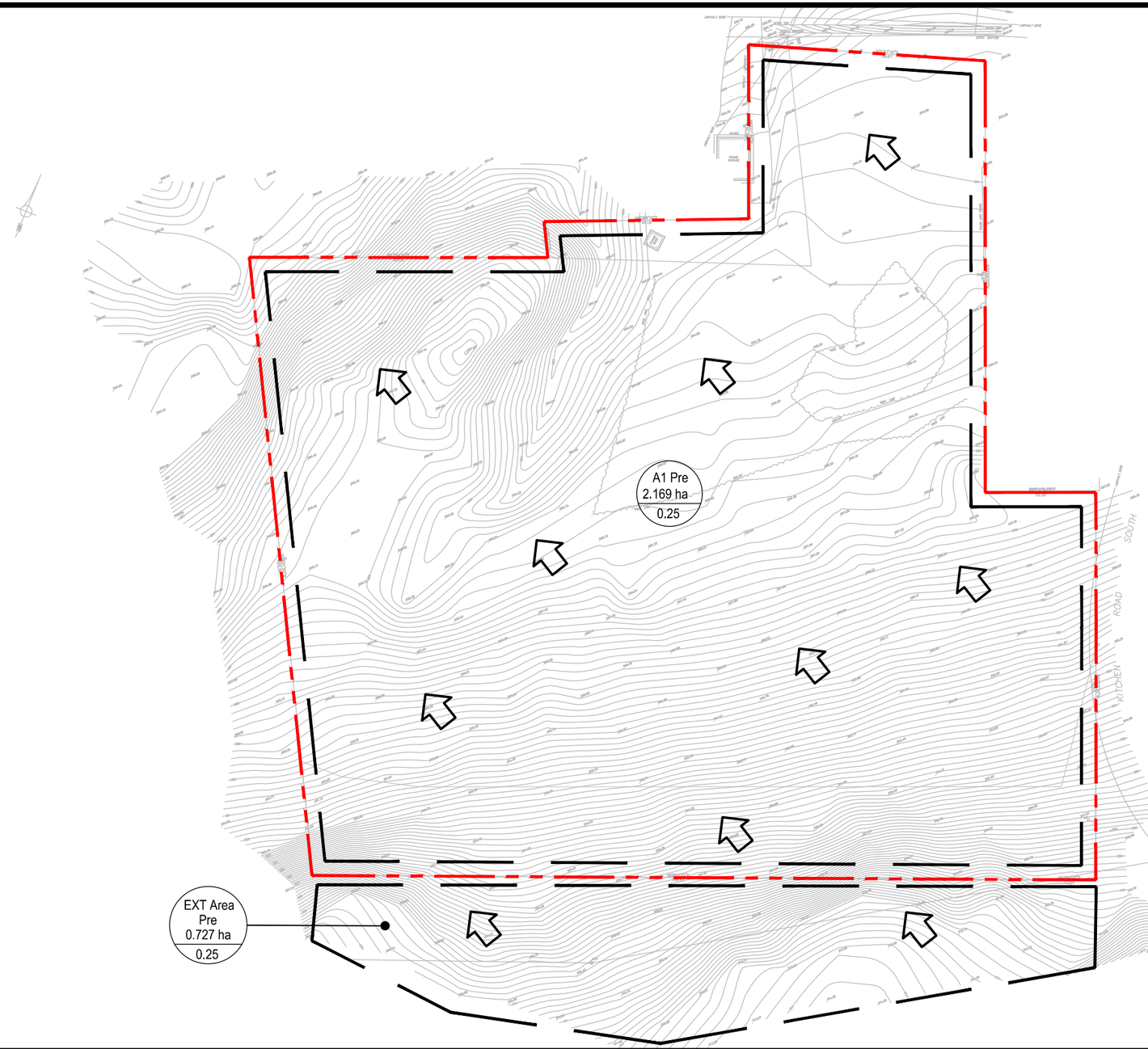
PINESTONE ENGINEERING LTD.
Consulting Engineers
6-4 Dominion Street
Bracebridge, ON P1L 2A6
T: (705) 645-8853
F: (705) 645-7262
E: pinestone@muskoka.com

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them.

Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Appendix C

Storm Analysis



RUN-OFF COEFFICIENTS			
DRAINAGE AREA	LAND USE	AREA (ha)	COEFFICIENT
A1 Pre (Towards Cairns Crescent)	LANDSCAPE	2.169	0.25
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	LANDSCAPE	0.727	0.25

LEGEND

A1 pre / 0.04 ha / 0.50 — STORM DRAINAGE AREA NUMBER; DRAINAGE AREA (ha); COMPOSITE RUNOFF COEFFICIENT

PRE-DEVELOPMENT STORM DRAINAGE AREA

PROPERTY LINE

OVERLAND FLOW ROUTE

Lithos
150 Bermondsey Road, Toronto, Ontario M4A 1Y1

PRE-DEVELOPMENT
DRAINAGE AREA PLAN
RESIDENTIAL USE DEVELOPMENT
20 CAIRNS CRESCENT
HUNTSVILLE, ONTARIO

DATE: AUGUST 2025 | PROJECT No: UD22-097

SCALE: N.T.S. | FIGURE No: DAP1

Lithos

Rational Method

Pre-Development Flow Calculation

20 Cairns Crescent
File No. UD22-097
Town of Huntsville
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	10
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	10
	2.896		

Formula: $I = a/(T+b)^c$

	a,c	Constants
	T	Time of concentration
	I	Rainfall intensity

Rational Method Calculation for the Town of Huntsville

Event 2-Year
a = 789.50
b = 7.83
c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.54	10	73.3	0.110	110.4
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.18	10	73.3	0.037	37.0
						Total =	**147.4**

Event 5-Year
a = 950.00
b = 6.75
c = 0.82

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.54	10	94.2	0.142	141.9
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.18	10	94.2	0.048	47.5
						Total =	**189.4**

Event 10-Year
a = 1221.00
b = 7.38
c = 0.84

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.54	10	110.0	0.166	165.7
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.18	10	110.0	0.055	55.5
						Total =	**221.2**

Event 25-Year
a = 1452.00
b = 7.3
c = 0.85

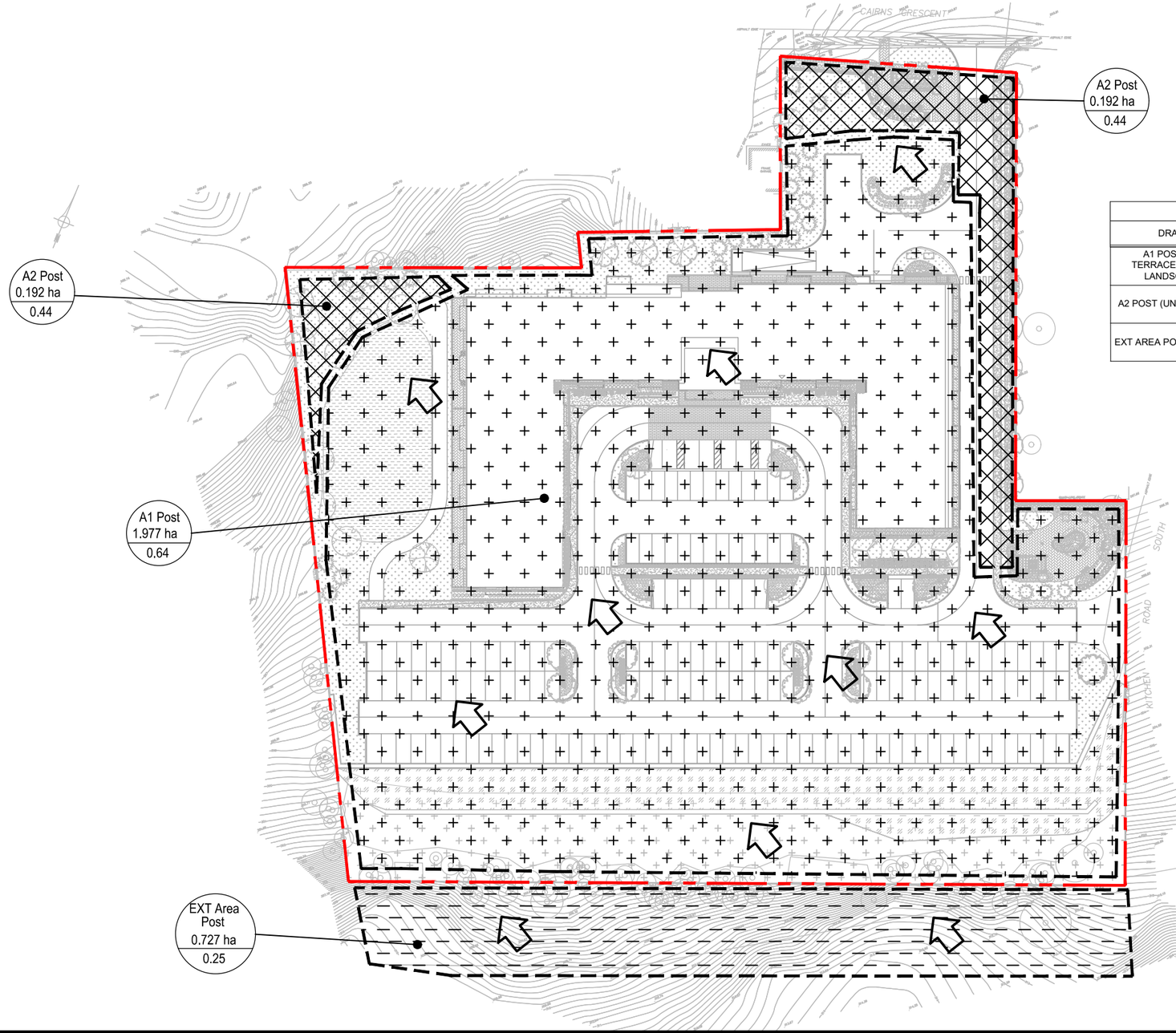
Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.54	10	129.5	0.195	195.0
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.18	10	129.5	0.065	65.3
						Total =	**260.3**

Event 50-Year
a = 1466.00
b = 6.55
c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.54	10	141.9	0.214	213.8
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.18	10	141.9	0.072	71.6
						Total =	**285.4**

Event 100-Year
a = 1499.00
b = 5.81
c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre (Towards Cairns Crescent)	2.169	0.25	0.54	10	153.7	0.232	231.5
EXT Area Pre (External Area ultimately discharges towards Cairns Crescent)	0.727	0.25	0.18	10	153.7	0.078	77.6
						Total =	**309.1**



RUN-OFF COEFFICIENTS					
DRAINAGE AREA	CONTROL	LAND USE	AREA (ha)	INITIAL COEFFICIENT	COMPOSITE COEFFICIENT
A1 POST (ROOFTOPS / TERRACES / HARDSCAPED/ LANDSCAPED AREAS)	CONTROLLED IN SURFACE POND	LANDSCAPE	0.790	0.25	0.64
		HARDSCAPE	1.187	0.90	
A2 POST (UNCONTROLLED AREA)	TOWARDS CAIRNS CRESCENT	LANDSCAPE	0.134	0.25	0.44
		HARDSCAPE	0.058	0.90	
EXT AREA POST (EXTERNAL AREA)	TO BE CONVEYED THROUGH SURFACE POND	LANDSCAPE	0.727	0.25	0.25

DRAINAGE AREA	LEGEND	AREA (ha)	TOTAL AREA (ha)
A1 POST		1.977	2.169
A2 POST		0.192	
EXT AREA POST		0.727	0.727

Lithos

150 Bermondsey Road, Toronto, Ontario M4A 1Y1

LEGEND

- A1 post / 0.04 ha / 0.50 — STORM DRAINAGE AREA NUMBER; DRAINAGE AREA (ha); COMPOSITE RUNOFF COEFFICIENT
- POST-DEVELOPMENT STORM DRAINAGE AREA
- PROPERTY LINE
- OVERLAND FLOW ROUTE

POST-DEVELOPMENT
DRAINAGE AREA PLAN
RESIDENTIAL USE DEVELOPMENT
20 CAIRNS CRESCENT
HUNTSVILLE, ONTARIO

DATE: AUGUST 2025	PROJECT No: UD22-097
SCALE: N.T.S.	FIGURE No: DAP2

Modified Rational Method - Two Year Storm

Site Flow and Storage Summary
20 Cairns Crescent
File No. UD22-097
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Drainage Area A1 Post

Rooftop / Terraces / Hardscape / Landscape Areas - Controlled in detention pond

Area (A1) =	**1.977**	ha
"C" =	**0.64**	
AC1 =	**1.266**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**257.8**	L/s

Drainage Area A2 Post

Uncontrolled Area - Towards Cairns Crescent

Area (A2) =	**0.192**	ha
"C" =	**0.44**	
AC2 =	**0.085**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**17.4**	L/s

EXT Area Post

External Area - To be conveyed through detention pond

Area (EXT) =	**0.727**	ha
"C" =	**0.25**	
ACEXT =	**0.182**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**37.0**	L/s

Total Site

2-yr Pre-Development Site Release Rate =	**147.4**	L/s
Maximum Controlled Site Release Rate =	**93.0**	L/s
Maximum Storage Required =	**105.4**	m^3

Detention Pond

Area =	832.95	m^2
Storage Capacity =	664.21	m^3

2 Year Design Storm

a=	789.50
b=	7.83
c=	0.83
I=	$I = a/(T+b)^c$

Tributary Area (A1)	ha	c
Landscape Area (A1)	**0.790**	0.25
Hardscape Area (A1)	1.187	0.90
Total	1.977	0.64

Tributary Area (A2)	ha	c
Landscape Area (A2)	**0.134**	0.25
Hardscape Area (A2)	0.058	0.90
Total	0.192	0.44

Tributary Area (EXT)	ha	c
Landscape Area (EXT)	**0.727**	0.25
Hardscape Area (EXT)	0.000	0.90
Total	0.727	0.25

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time	**Rainfall Intensity**	**Storm Runoff (A1 Post)**	**Runoff Volume (A1 Post)**	**Storm Runoff (A2 Post)**	**Runoff Volume (A2 Post)**	**Storm Runoff (EXT Post)**	**Runoff Volume (EXT Post)**	**Total Runoff towards detention pond**	**Released Volume**	**Storage Volume**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
10.0	73.3	0.258	154.66	0.017	10.44	0.037	22.19	154.66	55.83	98.83
15.0	59.8	0.210	189.19	0.014	12.77	0.030	27.15	189.19	83.74	105.45
20.0	50.8	0.179	214.23	0.012	14.46	0.026	30.74	214.23	111.65	102.57
25.0	44.3	0.156	233.66	0.011	15.77	0.022	33.53	233.66	139.56	94.09
30.0	39.4	0.139	249.44	0.009	16.83	0.020	35.79	249.44	167.48	81.97
35.0	35.6	0.125	262.69	0.008	17.73	0.018	37.70	262.69	195.39	67.30
40.0	32.5	0.114	274.08	0.008	18.49	0.016	39.33	274.08	223.30	50.77
45.0	29.9	0.105	284.05	0.007	19.17	0.015	40.76	284.05	251.22	32.84
50.0	27.8	0.098	292.93	0.007	19.77	0.014	42.03	292.93	279.13	13.80
55.0	25.9	0.091	300.91	0.006	20.31	0.013	43.18	300.91	307.04	0.00
60.0	24.3	0.086	308.17	0.006	20.80	0.012	44.22	308.17	334.95	0.00
65.0	23.0	0.081	314.83	0.005	21.24	0.012	45.18	314.83	362.87	0.00
70.0	21.7	0.076	320.97	0.005	21.66	0.011	46.06	320.97	390.78	0.00
75.0	20.6	0.073	326.68	0.005	22.04	0.010	46.88	326.68	418.69	0.00
80.0	19.7	0.069	332.01	0.005	22.40	0.010	47.64	332.01	446.61	0.00
85.0	18.8	0.066	337.01	0.004	22.74	0.009	48.36	337.01	474.52	0.00
90.0	18.0	0.063	341.72	0.004	23.06	0.009	49.04	341.72	502.43	0.00
95.0	17.3	0.061	346.17	0.004	23.36	0.009	49.68	346.17	530.34	0.00
100.0	16.6	0.058	350.39	0.004	23.64	0.008	50.28	350.39	558.26	0.00
105.0	16.0	0.056	354.41	0.004	23.92	0.008	50.86	354.41	586.17	0.00
110.0	15.4	0.054	358.24	0.004	24.17	0.008	51.41	358.24	614.08	0.00
115.0	14.9	0.052	361.90	0.004	24.42	0.008	51.93	361.90	642.00	0.00
120.0	14.4	0.051	365.41	0.003	24.66	0.007	52.44	365.41	669.91	0.00
125.0	14.0	0.049	368.77	0.003	24.88	0.007	52.92	368.77	697.82	0.00
130.0	13.6	0.048	372.01	0.003	25.10	0.007	53.38	372.01	725.73	0.00
135.0	13.2	0.046	375.12	0.003	25.31	0.007	53.83	375.12	753.65	0.00
140.0	12.8	0.045	378.13	0.003	25.52	0.006	54.26	378.13	781.56	0.00
145.0	12.5	0.044	381.03	0.003	25.71	0.006	54.68	381.03	809.47	0.00
150.0	12.1	0.043	383.84	0.003	25.90	0.006	55.08	383.84	837.39	0.00
155.0	11.8	0.042	386.56	0.003	26.09	0.006	55.47	386.56	865.30	0.00
160.0	11.5	0.041	389.20	0.003	26.26	0.006	55.85	389.20	893.21	0.00
165.0	11.3	0.040	391.75	0.003	26.44	0.006	56.22	391.75	921.13	0.00
170.0	11.0	0.039	394.24	0.003	26.60	0.006	56.57	394.24	949.04	0.00
175.0	10.7	0.038	396.66	0.003	26.77	0.005	56.92	396.66	976.95	0.00
180.0	10.5	0.037	399.01	0.002	26.93	0.005	57.26	399.01	1004.86	0.00

Modified Rational Method - Five Year Storm

Site Flow and Storage Summary
20 Cairns Crescent
File No. UD22-097
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Drainage Area A1 Post

Rooftop / Terraces / Hardscape / Landscape Areas - Controlled in detention pond

Area (A1) =	**1.977**	ha
"C" =	**0.64**	
AC1 =	**1.266**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**331.2**	L/s

Drainage Area A2 Post

Uncontrolled Area - Towards Cairns Crescent

Area (A2) =	**0.192**	ha
"C" =	**0.44**	
AC2 =	**0.085**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**22.3**	L/s

EXT Area Post

External Area - To be conveyed through detention pond

Area (EXT) =	**0.727**	ha
"C" =	**0.25**	
ACEXT =	**0.182**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**47.5**	L/s

Total Site

5-yr Pre-Development Site Release Rate =	**189.4**	L/s
Maximum Controlled Site Release Rate =	**119.6**	L/s
Maximum Storage Required =	**133.0**	m^3

Detention Pond

Area =	832.95	m^2
Storage Capacity =	664.21	m^3

5 Year Design Storm	
a=	950.00
b=	6.75
c=	0.82
I=	$I = a/(T+b)^c$

Tributary Area (A1)	**ha**	**c**
Landscape Area (A1)	**0.790**	0.25
Hardscape Area (A1)	1.187	0.90
Total	1.977	0.64

Tributary Area (A2)	**ha**	**c**
Landscape Area (A2)	**0.134**	0.25
Hardscape Area (A2)	0.058	0.90
Total	0.192	0.44

Tributary Area (EXT)	**ha**	**c**
Landscape Area (EXT)	**0.727**	0.25
Hardscape Area (EXT)	0.000	0.90
Total	0.727	0.25

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time	**Rainfall Intensity**	**Storm Runoff (A1 Post)**	**Runoff Volume (A1 Post)**	**Storm Runoff (A2 Post)**	**Runoff Volume (A2 Post)**	**Storm Runoff (EXT Post)**	**Runoff Volume (EXT Post)**	**Total Runoff towards detention pond**	**Released Volume**	**Storage Volume**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
10.0	94.2	0.331	198.72	0.022	13.41	0.048	28.52	198.72	71.73	126.99
15.0	76.0	0.267	240.61	0.018	16.24	0.038	34.53	240.61	107.60	133.01
20.0	64.2	0.226	270.75	0.015	18.27	0.032	38.85	270.75	143.46	127.28
25.0	55.8	0.196	294.07	0.013	19.84	0.028	42.20	294.07	179.33	114.74
30.0	49.5	0.174	313.00	0.012	21.12	0.025	44.92	313.00	215.20	97.81
35.0	44.5	0.157	328.90	0.011	22.19	0.022	47.20	328.90	251.06	77.84
40.0	40.6	0.143	342.59	0.010	23.12	0.020	49.16	342.59	286.93	55.66
45.0	37.4	0.131	354.60	0.009	23.93	0.019	50.89	354.60	322.79	31.81
50.0	34.6	0.122	365.30	0.008	24.65	0.017	52.42	365.30	358.66	6.64
55.0	32.3	0.114	374.95	0.008	25.30	0.016	53.81	374.95	394.53	0.00
60.0	30.3	0.107	383.74	0.007	25.90	0.015	55.07	383.74	430.39	0.00
65.0	28.6	0.100	391.81	0.007	26.44	0.014	56.22	391.81	466.26	0.00
70.0	27.0	0.095	399.27	0.006	26.94	0.014	57.30	399.27	502.13	0.00
75.0	25.7	0.090	406.22	0.006	27.41	0.013	58.29	406.22	537.99	0.00
80.0	24.5	0.086	412.71	0.006	27.85	0.012	59.22	412.71	573.86	0.00
85.0	23.4	0.082	418.81	0.006	28.26	0.012	60.10	418.81	609.72	0.00
90.0	22.4	0.079	424.57	0.005	28.65	0.011	60.93	424.57	645.59	0.00
95.0	21.5	0.075	430.01	0.005	29.02	0.011	61.71	430.01	681.46	0.00
100.0	20.6	0.073	435.19	0.005	29.37	0.010	62.45	435.19	717.32	0.00
105.0	19.9	0.070	440.11	0.005	29.70	0.010	63.16	440.11	753.19	0.00
110.0	19.2	0.067	444.82	0.005	30.02	0.010	63.83	444.82	789.05	0.00
115.0	18.5	0.065	449.31	0.004	30.32	0.009	64.48	449.31	824.92	0.00
120.0	17.9	0.063	453.63	0.004	30.61	0.009	65.10	453.63	860.79	0.00
125.0	17.4	0.061	457.77	0.004	30.89	0.009	65.69	457.77	896.65	0.00
130.0	16.8	0.059	461.76	0.004	31.16	0.008	66.26	461.76	932.52	0.00
135.0	16.3	0.057	465.61	0.004	31.42	0.008	66.81	465.61	968.38	0.00
140.0	15.9	0.056	469.32	0.004	31.67	0.008	67.35	469.32	1004.25	0.00
145.0	15.5	0.054	472.91	0.004	31.91	0.008	67.86	472.91	1040.12	0.00
150.0	15.1	0.053	476.39	0.004	32.15	0.008	68.36	476.39	1075.98	0.00
155.0	14.7	0.052	479.75	0.003	32.37	0.007	68.84	479.75	1111.85	0.00
160.0	14.3	0.050	483.02	0.003	32.59	0.007	69.31	483.02	1147.71	0.00
165.0	14.0	0.049	486.19	0.003	32.81	0.007	69.77	486.19	1183.58	0.00
170.0	13.6	0.048	489.27	0.003	33.02	0.007	70.21	489.27	1219.45	0.00
175.0	13.3	0.047	492.27	0.003	33.22	0.007	70.64	492.27	1255.31	0.00
180.0	13.0	0.046	495.19	0.003	33.42	0.007	71.06	495.19	1291.18	0.00

Modified Rational Method - Ten Year Storm

Site Flow and Storage Summary
20 Cairns Crescent
File No. UD22-097
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Drainage Area A1 Post

Rooftop / Terraces / Hardscape / Landscape Areas - Controlled in detention pond

Area (A1) =	**1.977**	ha
"C" =	**0.64**	
AC1 =	**1.266**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**386.7**	L/s

Drainage Area A2 Post

Uncontrolled Area - Towards Cairns Crescent

Area (A2) =	**0.192**	ha
"C" =	**0.44**	
AC2 =	**0.085**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**26.1**	L/s

EXT Area Post

External Area - To be conveyed through detention pond

Area (EXT) =	**0.727**	ha
"C" =	**0.25**	
ACEXT =	**0.182**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**55.5**	L/s

Total Site

10-yr Pre-Development Site Release Rate =	**221.2**	L/s
Maximum Controlled Site Release Rate =	**139.6**	L/s
Maximum Storage Required =	**155.6**	m^3

Detention Pond

Area =	832.95	m^2
Storage Capacity =	664.21	m^3

10 Year Design Storm

a=	1221.00
b=	7.38
c=	0.84
I=	$I = a/(T+b)^c$

Tributary Area (A1)	ha	c
Landscape Area (A1)	**0.790**	0.25
Hardscape Area (A1)	1.187	0.90
Total	1.977	0.64

Tributary Area (A2)	ha	c
Landscape Area (A2)	**0.134**	0.25
Hardscape Area (A2)	0.058	0.90
Total	0.192	0.44

Tributary Area (EXT)	ha	c
Landscape Area (EXT)	**0.727**	0.25
Hardscape Area (EXT)	0.000	0.90
Total	0.727	0.25

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time	**Rainfall Intensity**	**Storm Runoff (A1 Post)**	**Runoff Volume (A1 Post)**	**Storm Runoff (A2 Post)**	**Runoff Volume (A2 Post)**	**Storm Runoff (EXT Post)**	**Runoff Volume (EXT Post)**	**Total Runoff towards detention pond**	**Released Volume**	**Storage Volume**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
10.0	110.0	0.387	232.04	0.026	15.66	0.055	33.30	232.04	83.76	148.28
15.0	88.9	0.312	281.25	0.021	18.98	0.045	40.36	281.25	125.64	155.61
20.0	75.0	0.264	316.38	0.018	21.35	0.038	45.40	316.38	167.52	148.86
25.0	65.1	0.229	343.33	0.015	23.17	0.033	49.27	343.33	209.40	133.93
30.0	57.7	0.203	365.02	0.014	24.63	0.029	52.38	365.02	251.28	113.74
35.0	51.9	0.182	383.09	0.012	25.85	0.026	54.97	383.09	293.16	89.93
40.0	47.2	0.166	398.53	0.011	26.89	0.024	57.19	398.53	335.04	63.49
45.0	43.4	0.153	411.99	0.010	27.80	0.022	59.12	411.99	376.92	35.07
50.0	40.2	0.141	423.90	0.010	28.61	0.020	60.83	423.90	418.80	5.10
55.0	37.5	0.132	434.58	0.009	29.33	0.019	62.36	434.58	460.68	0.00
60.0	35.1	0.123	444.25	0.008	29.98	0.018	63.75	444.25	502.56	0.00
65.0	33.0	0.116	453.09	0.008	30.57	0.017	65.02	453.09	544.44	0.00
70.0	31.2	0.110	461.23	0.007	31.12	0.016	66.19	461.23	586.32	0.00
75.0	29.6	0.104	468.76	0.007	31.63	0.015	67.27	468.76	628.20	0.00
80.0	28.2	0.099	475.78	0.007	32.11	0.014	68.27	475.78	670.08	0.00
85.0	26.9	0.095	482.35	0.006	32.55	0.014	69.22	482.35	711.96	0.00
90.0	25.7	0.090	488.53	0.006	32.97	0.013	70.10	488.53	753.84	0.00
95.0	24.7	0.087	494.36	0.006	33.36	0.012	70.94	494.36	795.72	0.00
100.0	23.7	0.083	499.87	0.006	33.73	0.012	71.73	499.87	837.60	0.00
105.0	22.8	0.080	505.11	0.005	34.09	0.012	72.48	505.11	879.48	0.00
110.0	22.0	0.077	510.10	0.005	34.42	0.011	73.20	510.10	921.36	0.00
115.0	21.2	0.075	514.86	0.005	34.74	0.011	73.88	514.86	963.24	0.00
120.0	20.5	0.072	519.41	0.005	35.05	0.010	74.53	519.41	1005.12	0.00
125.0	19.9	0.070	523.77	0.005	35.34	0.010	75.16	523.77	1047.00	0.00
130.0	19.3	0.068	527.96	0.005	35.63	0.010	75.76	527.96	1088.88	0.00
135.0	18.7	0.066	531.99	0.004	35.90	0.009	76.34	531.99	1130.76	0.00
140.0	18.1	0.064	535.88	0.004	36.16	0.009	76.90	535.88	1172.64	0.00
145.0	17.6	0.062	539.62	0.004	36.41	0.009	77.44	539.62	1214.52	0.00
150.0	17.2	0.060	543.24	0.004	36.66	0.009	77.95	543.24	1256.40	0.00
155.0	16.7	0.059	546.74	0.004	36.89	0.008	78.46	546.74	1298.28	0.00
160.0	16.3	0.057	550.13	0.004	37.12	0.008	78.94	550.13	1340.16	0.00
165.0	15.9	0.056	553.42	0.004	37.35	0.008	79.42	553.42	1382.04	0.00
170.0	15.5	0.055	556.61	0.004	37.56	0.008	79.87	556.61	1423.92	0.00
175.0	15.2	0.053	559.71	0.004	37.77	0.008	80.32	559.71	1465.80	0.00
180.0	14.8	0.052	562.73	0.004	37.97	0.007	80.75	562.73	1507.68	0.00

Modified Rational Method - Twenty-Five Storm

Site Flow and Storage Summary
20 Cairns Crescent
File No. UD22-097
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Drainage Area A1 Post

Rooftop / Terraces / Hardscape / Landscape Areas - Controlled in detention pond

Area (A1) =	**1.977**	ha
"C" =	**0.64**	
AC1 =	**1.266**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**455.2**	L/s

Drainage Area A2 Post

Uncontrolled Area - Towards Cairns Crescent

Area (A2) =	**0.192**	ha
"C" =	**0.44**	
AC2 =	**0.085**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**30.7**	L/s

EXT Area Post

External Area - To be conveyed through detention pond

Area (EXT) =	**0.727**	ha
"C" =	**0.25**	
ACEXT =	**0.182**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**65.3**	L/s

Total Site

25-yr Pre-Development Site Release Rate =	**260.3**	L/s
Maximum Controlled Site Release Rate =	**164.3**	L/s
Maximum Storage Required =	**182.4**	m^3

Detention Pond

Area =	832.95	m^2
Storage Capacity =	664.21	m^3

25 Year Design Storm

a=	1452.00
b=	7.30
c=	0.85
I=	$I = a/(T+b)^c$

Tributary Area (A1)	**ha**	**c**
Landscape Area (A1)	**0.790**	0.25
Hardscape Area (A1)	**1.187**	0.90
Total	1.977	0.64

Tributary Area (A2)	**ha**	**c**
Landscape Area (A2)	**0.134**	0.25
Hardscape Area (A2)	0.058	0.90
Total	0.192	0.44

Tributary Area (EXT)	**ha**	**c**
Landscape Area (EXT)	**0.727**	0.25
Hardscape Area (EXT)	0.000	0.90
Total	0.727	0.25

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time	**Rainfall Intensity**	**Storm Runoff (A1 Post)**	**Runoff Volume (A1 Post)**	**Storm Runoff (A2 Post)**	**Runoff Volume (A2 Post)**	**Storm Runoff (EXT Post)**	**Runoff Volume (EXT Post)**	**Total Runoff towards detention pond**	**Released Volume**	**Storage Volume**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
10.0	129.5	0.455	273.10	0.031	18.43	0.065	39.19	273.10	98.58	174.52
15.0	104.4	0.367	330.30	0.025	22.29	0.053	47.40	330.30	147.87	182.43
20.0	87.9	0.309	370.97	0.021	25.03	0.044	53.23	370.97	197.16	173.82
25.0	76.2	0.268	402.08	0.018	27.13	0.038	57.70	402.08	246.45	155.64
30.0	67.5	0.237	427.06	0.016	28.82	0.034	61.28	427.06	295.74	131.33
35.0	60.6	0.213	447.83	0.014	30.22	0.031	64.26	447.83	345.03	102.80
40.0	55.2	0.194	465.54	0.013	31.41	0.028	66.80	465.54	394.32	71.22
45.0	50.7	0.178	480.95	0.012	32.46	0.026	69.02	480.95	443.61	37.35
50.0	46.9	0.165	494.58	0.011	33.37	0.024	70.97	494.58	492.90	1.68
55.0	43.7	0.154	506.78	0.010	34.20	0.022	72.72	506.78	542.19	0.00
60.0	40.9	0.144	517.82	0.010	34.94	0.021	74.31	517.82	591.48	0.00
65.0	38.5	0.135	527.89	0.009	35.62	0.019	75.75	527.89	640.77	0.00
70.0	36.4	0.128	537.16	0.009	36.25	0.018	77.08	537.16	690.06	0.00
75.0	34.5	0.121	545.74	0.008	36.83	0.017	78.31	545.74	739.35	0.00
80.0	32.8	0.115	553.72	0.008	37.37	0.017	79.46	553.72	788.63	0.00
85.0	31.3	0.110	561.19	0.007	37.87	0.016	80.53	561.19	837.92	0.00
90.0	29.9	0.105	568.20	0.007	38.34	0.015	81.54	568.20	887.21	0.00
95.0	28.7	0.101	574.82	0.007	38.79	0.014	82.49	574.82	936.50	0.00
100.0	27.5	0.097	581.07	0.007	39.21	0.014	83.38	581.07	985.79	0.00
105.0	26.5	0.093	587.01	0.006	39.61	0.013	84.24	587.01	1035.08	0.00
110.0	25.5	0.090	592.66	0.006	39.99	0.013	85.05	592.66	1084.37	0.00
115.0	24.7	0.087	598.05	0.006	40.36	0.012	85.82	598.05	1133.66	0.00
120.0	23.8	0.084	603.21	0.006	40.70	0.012	86.56	603.21	1182.95	0.00
125.0	23.1	0.081	608.15	0.005	41.04	0.012	87.27	608.15	1232.24	0.00
130.0	22.3	0.079	612.89	0.005	41.36	0.011	87.95	612.89	1281.53	0.00
135.0	21.7	0.076	617.44	0.005	41.67	0.011	88.60	617.44	1330.82	0.00
140.0	21.1	0.074	621.83	0.005	41.96	0.011	89.23	621.83	1380.11	0.00
145.0	20.5	0.072	626.06	0.005	42.25	0.010	89.84	626.06	1429.40	0.00
150.0	19.9	0.070	630.15	0.005	42.52	0.010	90.43	630.15	1478.69	0.00
155.0	19.4	0.068	634.11	0.005	42.79	0.010	90.99	634.11	1527.98	0.00
160.0	18.9	0.066	637.93	0.004	43.05	0.010	91.54	637.93	1577.27	0.00
165.0	18.4	0.065	641.64	0.004	43.30	0.009	92.08	641.64	1626.56	0.00
170.0	18.0	0.063	645.24	0.004	43.54	0.009	92.59	645.24	1675.85	0.00
175.0	17.6	0.062	648.74	0.004	43.78	0.009	93.09	648.74	1725.14	0.00
180.0	17.2	0.060	652.14	0.004	44.01	0.009	93.58	652.14	1774.43	0.00

Modified Rational Method - Fifty Year Storm

Site Flow and Storage Summary
20 Cairns Crescent
File No. UD22-097
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Drainage Area A1 Post

Rooftop / Terraces / Hardscape / Landscape Areas - Controlled in detention pond

Area (A1) =	**1.977**	ha
"C" =	**0.64**	
AC1 =	**1.266**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**499.1**	L/s

Drainage Area A2 Post

Uncontrolled Area - Towards Cairns Crescent

Area (A2) =	**0.192**	ha
"C" =	**0.44**	
AC2 =	**0.085**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**33.7**	L/s

EXT Area Post

External Area - To be conveyed through detention pond

Area (EXT) =	**0.727**	ha
"C" =	**0.25**	
ACEXT =	**0.182**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**71.6**	L/s

Total Site

50-yr Pre-Development Site Release Rate =	**285.4**	L/s
Maximum Controlled Site Release Rate =	**180.1**	L/s
Maximum Storage Required =	**198.5**	m^3

Detention Pond

Area =	832.95	m^2
Storage Capacity =	664.21	m^3

50 Year Design Storm

a=	1466.00
b=	6.55
c=	0.83
I=	$I = a/(T+b)^c$

Tributary Area (A1)	ha	C
Landscape Area (A1)	**0.790**	0.25
Hardscape Area (A1)	1.187	0.90
Total	1.977	0.64

Tributary Area (A2)	ha	C
Landscape Area (A2)	**0.134**	0.25
Hardscape Area (A2)	0.058	0.90
Total	0.192	0.44

Tributary Area (EXT)	ha	C
Landscape Area (EXT)	**0.727**	0.25
Hardscape Area (EXT)	0.000	0.90
Total	0.727	0.25

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time	**Rainfall Intensity**	**Storm Runoff (A1 Post)**	**Runoff Volume (A1 Post)**	**Storm Runoff (A2 Post)**	**Runoff Volume (A2 Post)**	**Storm Runoff (EXT Post)**	**Runoff Volume (EXT Post)**	**Total Runoff towards detention pond**	**Released Volume**	**Storage Volume**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
10.0	141.9	0.499	299.44	0.034	20.21	0.072	42.97	299.44	108.09	191.35
15.0	113.9	0.401	360.59	0.027	24.33	0.057	51.74	360.59	162.13	198.46
20.0	95.8	0.337	404.16	0.023	27.27	0.048	58.00	404.16	216.18	187.99
25.0	83.0	0.292	437.64	0.020	29.53	0.042	62.80	437.64	270.22	167.42
30.0	73.4	0.258	464.67	0.017	31.36	0.037	66.68	464.67	324.26	140.41
35.0	66.0	0.232	487.26	0.016	32.88	0.033	69.92	487.26	378.31	108.96
40.0	60.0	0.211	506.64	0.014	34.19	0.030	72.70	506.64	432.35	74.29
45.0	55.2	0.194	523.58	0.013	35.33	0.028	75.13	523.58	486.39	37.19
50.0	51.1	0.180	538.63	0.012	36.35	0.026	77.29	538.63	540.44	0.00
55.0	47.6	0.167	552.17	0.011	37.26	0.024	79.24	552.17	594.48	0.00
60.0	44.6	0.157	564.47	0.011	38.09	0.023	81.00	564.47	648.53	0.00
65.0	42.0	0.148	575.74	0.010	38.85	0.021	82.62	575.74	702.57	0.00
70.0	39.7	0.140	586.14	0.009	39.55	0.020	84.11	586.14	756.61	0.00
75.0	37.7	0.132	595.81	0.009	40.21	0.019	85.50	595.81	810.66	0.00
80.0	35.8	0.126	604.83	0.009	40.81	0.018	86.79	604.83	864.70	0.00
85.0	34.2	0.120	613.29	0.008	41.39	0.017	88.01	613.29	918.75	0.00
90.0	32.7	0.115	621.26	0.008	41.92	0.017	89.15	621.26	972.79	0.00
95.0	31.4	0.110	628.80	0.007	42.43	0.016	90.23	628.80	1026.83	0.00
100.0	30.1	0.106	635.95	0.007	42.91	0.015	91.26	635.95	1080.88	0.00
105.0	29.0	0.102	642.75	0.007	43.37	0.015	92.23	642.75	1134.92	0.00
110.0	28.0	0.098	649.24	0.007	43.81	0.014	93.16	649.24	1188.97	0.00
115.0	27.0	0.095	655.43	0.006	44.23	0.014	94.05	655.43	1243.01	0.00
120.0	26.1	0.092	661.37	0.006	44.63	0.013	94.91	661.37	1297.05	0.00
125.0	25.3	0.089	667.07	0.006	45.01	0.013	95.72	667.07	1351.10	0.00
130.0	24.5	0.086	672.56	0.006	45.38	0.012	96.51	672.56	1405.14	0.00
135.0	23.8	0.084	677.84	0.006	45.74	0.012	97.27	677.84	1459.18	0.00
140.0	23.1	0.081	682.93	0.005	46.08	0.012	98.00	682.93	1513.23	0.00
145.0	22.5	0.079	687.85	0.005	46.42	0.011	98.71	687.85	1567.27	0.00
150.0	21.9	0.077	692.61	0.005	46.74	0.011	99.39	692.61	1621.32	0.00
155.0	21.3	0.075	697.22	0.005	47.05	0.011	100.05	697.22	1675.36	0.00
160.0	20.8	0.073	701.69	0.005	47.35	0.010	100.69	701.69	1729.40	0.00
165.0	20.3	0.071	706.02	0.005	47.64	0.010	101.31	706.02	1783.45	0.00
170.0	19.8	0.070	710.24	0.005	47.93	0.010	101.92	710.24	1837.49	0.00
175.0	19.3	0.068	714.33	0.005	48.20	0.010	102.51	714.33	1891.54	0.00
180.0	18.9	0.067	718.32	0.004	48.47	0.010	103.08	718.32	1945.58	0.00

Modified Rational Method - Hundred Year Storm

Site Flow and Storage Summary
20 Cairns Crescent
File No. UD22-097
Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.
Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Drainage Area A1 Post

Rooftop / Terraces / Hardscape / Landscape Areas - Controlled in detention pond

Area (A1) =	**1.977**	ha
"C" =	**0.64**	
AC1 =	**1.266**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**540.4**	L/s

Drainage Area A2 Post

Uncontrolled Area - Towards Cairns Crescent

Area (A2) =	**0.192**	ha
"C" =	**0.44**	
AC2 =	**0.085**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**36.5**	L/s

EXT Area Post

External Area - To be conveyed through detention pond

Area (EXT) =	**0.727**	ha
"C" =	**0.25**	
ACEXT =	**0.182**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Release Rate =	**77.6**	L/s

Total Site

100-yr Pre-Development Site Release Rate =	**309.1**	L/s
Maximum Controlled Site Release Rate =	**195.1**	L/s
Maximum Storage Required =	**212.2**	m^3

Detention Pond

Area =	832.95	m^2
Storage Capacity =	664.21	m^3

100 Year Design Storm

a=	1499.00
b=	5.81
c=	0.83
I=	$I = a/(T+b)^c$

Tributary Area (A1)	ha	c
Landscape Area (A1)	**0.790**	0.25
Hardscape Area (A1)	1.187	0.90
Total	1.977	0.64

Tributary Area (A2)	ha	c
Landscape Area (A2)	**0.134**	0.25
Hardscape Area (A2)	0.058	0.90
Total	0.192	0.44

Tributary Area (EXT)	ha	c
Landscape Area (EXT)	**0.727**	0.25
Hardscape Area (EXT)	0.000	0.90
Total	0.727	0.25

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Time	**Rainfall Intensity**	**Storm Runoff (A1 Post)**	**Runoff Volume (A1 Post)**	**Storm Runoff (A2 Post)**	**Runoff Volume (A2 Post)**	**Storm Runoff (EXT Post)**	**Runoff Volume (EXT Post)**	**Total Runoff towards detention pond**	**Released Volume**	**Storage Volume**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
10.0	153.7	0.540	324.26	0.036	21.88	0.078	46.53	324.26	117.05	207.21
15.0	122.5	0.431	387.73	0.029	26.16	0.062	55.64	387.73	175.57	212.16
20.0	102.6	0.361	432.83	0.024	29.21	0.052	62.11	432.83	234.10	198.74
25.0	88.6	0.312	467.50	0.021	31.55	0.045	67.09	467.50	292.62	174.88
30.0	78.3	0.275	495.55	0.019	33.44	0.040	71.11	495.55	351.15	144.40
35.0	70.3	0.247	519.04	0.017	35.03	0.035	74.48	519.04	409.67	109.37
40.0	63.9	0.225	539.24	0.015	36.39	0.032	77.38	539.24	468.19	71.05
45.0	58.7	0.206	556.95	0.014	37.58	0.030	79.92	556.95	526.72	30.24
50.0	54.3	0.191	572.73	0.013	38.65	0.027	82.19	572.73	585.24	0.00
55.0	50.6	0.178	586.95	0.012	39.61	0.026	84.23	586.95	643.77	0.00
60.0	47.4	0.167	599.90	0.011	40.48	0.024	86.08	599.90	702.29	0.00
65.0	44.6	0.157	611.79	0.011	41.28	0.023	87.79	611.79	760.81	0.00
70.0	42.2	0.148	622.79	0.010	42.03	0.021	89.37	622.79	819.34	0.00
75.0	40.0	0.141	633.02	0.009	42.72	0.020	90.84	633.02	877.86	0.00
80.0	38.1	0.134	642.59	0.009	43.36	0.019	92.21	642.59	936.39	0.00
85.0	36.3	0.128	651.59	0.009	43.97	0.018	93.50	651.59	994.91	0.00
90.0	34.8	0.122	660.08	0.008	44.54	0.018	94.72	660.08	1053.44	0.00
95.0	33.3	0.117	668.11	0.008	45.08	0.017	95.87	668.11	1111.96	0.00
100.0	32.0	0.113	675.74	0.008	45.60	0.016	96.97	675.74	1170.48	0.00
105.0	30.8	0.108	683.01	0.007	46.09	0.016	98.01	683.01	1229.01	0.00
110.0	29.7	0.105	689.95	0.007	46.56	0.015	99.01	689.95	1287.53	0.00
115.0	28.7	0.101	696.59	0.007	47.01	0.014	99.96	696.59	1346.06	0.00
120.0	27.8	0.098	702.96	0.007	47.44	0.014	100.87	702.96	1404.58	0.00
125.0	26.9	0.095	709.08	0.006	47.85	0.014	101.75	709.08	1463.10	0.00
130.0	26.1	0.092	714.97	0.006	48.25	0.013	102.60	714.97	1521.63	0.00
135.0	25.3	0.089	720.65	0.006	48.63	0.013	103.41	720.65	1580.15	0.00
140.0	24.6	0.086	726.14	0.006	49.00	0.012	104.20	726.14	1638.68	0.00
145.0	23.9	0.084	731.44	0.006	49.36	0.012	104.96	731.44	1697.20	0.00
150.0	23.3	0.082	736.57	0.006	49.70	0.012	105.70	736.57	1755.73	0.00
155.0	22.7	0.080	741.55	0.005	50.04	0.011	106.41	741.55	1814.25	0.00
160.0	22.1	0.078	746.37	0.005	50.37	0.011	107.10	746.37	1872.77	0.00
165.0	21.6	0.076	751.06	0.005	50.68	0.011	107.78	751.06	1931.30	0.00
170.0	21.1	0.074	755.62	0.005	50.99	0.011	108.43	755.62	1989.82	0.00
175.0	20.6	0.072	760.05	0.005	51.29	0.010	109.07	760.05	2048.35	0.00
180.0	20.1	0.071	764.37	0.005	51.58	0.010	109.69	764.37	2106.87	0.00

Water Balance Calculations

20 Cairns Crescent

File No. UD22-097

Date: August 2025

Prepared By: Stergios Grigoriadis P.E., M.A.Sc.

Reviewed By: Anastasia Tzakopoulou P.E., M.A.Sc.

Contributing Drainage Area	21693.2	m^2
Rainfall depth to be retained	5.0	mm
Total rainfall volume at 5mm	**108.47**	m^3

Initial Abstraction Calculations

Surface	Area (m^2)	IA (mm)	Volume (m^3)	
Landscape	9244.4	5.0	46.22	m^3
Roof/Terraces/Asphalt	12448.8	1.0	12.45	m^3
Total	**21693.2**		**58.67**	m^3

Water Balance Required	**49.80**	**m^3**

DETENTION POND CALCULATION

Site Flow and Storage Summary
20 Cairns Crescent, Huntsville
File No. UD22-097
Date: August 2025

Prepared By: Riqina Vouxinou P.E., M.A.:
Reviewed By: Iraklis Nikoletos P.E., M.A.Sc.

Volumetric Quality Control		
Water Quality Requirements based on the Table 3.2 MOE Manual		
The proposed development will provide (level 1) protection of the total suspended solids. Total calculated impervious level of approximately 60%, which requires 161.7 m3/ha for permanent pool storage, and 40m3/ha for the extendend detention area.		
Drainage Area=	**1.977**	**ha**
Required Permanent Pool Size (Table 3.2 MOE Manual) - Quality Control=	**319.68**	**m^3**
Required Extendend Detention Size (Table 3.2 MOE Manual) - Quality Control=	**79.080**	**m^3**
Total Volumetric Quality control:	**398.76**	**m^3**

Required Volume for the detention Pond Based on the MOE Manual

Quality Control Permanent Pool				Quality Control & Quantity Control - Extended Detention			
	Elevation	Volume (m^3)	Footprint of the Detention Pond (m^2)		Elevation	Volume (m^3)	Footprint of the Detention Pond (m^2)
Bottom:	291.40	-	41.34				
0.05	291.45	1.14	47.10	1.80	293.20	349.89	466.60
0.10	291.50	2.42	53.14	1.85	293.25	373.68	484.97
0.15	291.55	3.86	59.46	1.90	293.30	398.39	503.55
0.20	291.60	5.46	66.04	1.95	293.35	424.04	522.36
0.25	291.65	7.23	72.90	2.00	293.40	450.63	541.39
0.30	291.70	9.17	80.04	2.05	293.45	478.18	560.65
0.35	291.75	11.30	87.46	2.10	293.50	506.70	580.12
0.40	291.80	13.61	95.14	2.15	293.55	536.20	599.82
0.45	291.85	16.12	103.10	2.20	293.60	566.69	619.74
0.50	291.90	18.84	111.33	2.25	293.65	598.18	639.88
0.55	291.95	21.76	119.85	2.30	293.70	630.68	660.25
0.60	292.00	24.89	128.63	2.35	293.75	664.21	680.83
0.65	292.05	28.26	137.68	Freeboard			
0.70	292.10	31.85	147.01	2.40	293.80	698.77	701.64
0.75	292.15	35.67	156.61	2.45	293.85	734.40	723.25
0.80	292.20	39.74	166.50	2.50	293.90	771.10	744.98
0.85	292.25	44.06	176.65	2.55	293.95	808.90	766.81
0.90	292.30	48.64	187.08	2.60	294.00	847.79	788.75
0.95	292.35	53.49	197.77	2.65	294.05	887.77	810.80
1.00	292.40	61.62	264.15	2.70	294.10	927.75	832.95
1.05	292.45	75.11	275.52				
1.10	292.50	89.17	287.02				
1.15	292.55	103.81	298.66				
1.20	292.60	119.04	310.42				
1.25	292.65	134.86	322.32				
1.30	292.70	151.27	334.34				
1.35	292.75	168.30	346.50				
1.40	292.80	185.93	358.79				
1.45	292.85	204.18	371.20				
1.50	292.90	223.05	383.75				
1.55	292.95	242.56	396.43				
1.60	293.00	262.70	409.24				
1.65	293.05	283.48	422.19				
1.70	293.10	304.92	435.26				
1.75	293.15	327.01	448.46				

Summary Requirements for the Detention Pond

Required Pool Size (Quantity and Quality Control)=	**212.20+398.76**	**610.92**	**m^3**
Provided Pool Size=		**664.21**	**m^3**

Lithos

Rational Method

Flow Calculation for Public Ditch

20 Cairns Crescent
File No. UD22-097
Town of Huntsville
Date: August 2025

Prepared by: Rigina Vouxinou, P.E., M.A.Sc
Reviewed by: Iraklis Nikoletos, Ph.D.

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
Drainage Area - Public Ditch	0.192	0.44	10

Formula: $I = a/(T+b)^c$

a,b,c	Constants
T	Time of concentration
I	Rainfall intensity

$Q=2.78 \times A \times C \times I$

Type	Area (ha)	"C"
Landscaped	0.134	0.25
Hardscaped	0.058	0.90
Total Area (A1 pre)	0.192	0.44

Rational Method Calculation

Event 2 yr IDF Data Set Town of Huntsville
a = 789.50 b = 7.83 c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Ditch	0.192	0.44	0.08	10	72.3	0.017	17.0

Event 5 yr IDF Data Set Town of Huntsville
a = 950.00 b = 6.75 c = 0.82

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Ditch	0.192	0.44	0.08	10	94.2	0.022	22.1

Event 10 yr IDF Data Set Town of Huntsville
a = 1221.00 b = 7.38 c = 0.84

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Ditch	0.192	0.44	0.08	10	110.9	0.026	26.0

Event 25 yr IDF Data Set Town of Huntsville
a = 1452.00 b = 7.30 c = 0.85

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Ditch	0.192	0.44	0.08	10	128.7	0.030	30.2

Event 50 yr IDF Data Set Town of Huntsville
a = 1466.00 b = 6.55 c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Ditch	0.192	0.44	0.08	10	142.7	0.033	33.5

Event 100 yr IDF Data Set Town of Huntsville
a = 1499.00 b = 5.81 c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Ditch	0.192	0.44	0.08	10	151.6	0.036	35.6

Lithos

Rational Method

Flow Calculation for Public Culvert

20 Cairns Crescent
File No. UD22-097
Town of Huntsville
Date: August 2025

Prepared by: Rigina Vouxinou, P.E., M.A.Sc
Reviewed by: Iraklis Nikoletos, Ph.D.

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
Drainage Area - Public Culvert	0.085	0.50	10

Formula: $I = a/(T+b)^c$

a,b,c	Constants
T	Time of concentration
I	Rainfall intensity

$Q=2.78 \times A \times C \times I$

Type	Area (ha)	"C"
Landscaped	0.057	0.30
Hardscaped	0.028	0.90
Total Area (A1 pre)	0.085	0.50

Rational Method Calculation

Event 2 yr IDF Data Set Town of Huntsville
a = 789.50 b = 7.83 c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Culvert	0.085	0.50	0.04	10	72.3	0.008	8.5

Event 5 yr IDF Data Set Town of Huntsville
a = 950.00 b = 6.75 c = 0.82

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Culvert	0.085	0.50	0.04	10	94.2	0.011	11.1

Event 10 yr IDF Data Set Town of Huntsville
a = 1221.00 b = 7.38 c = 0.84

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Culvert	0.085	0.50	0.04	10	110.9	0.013	13.0

Event 25 yr IDF Data Set Town of Huntsville
a = 1452.00 b = 7.30 c = 0.85

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Culvert	0.085	0.50	0.04	10	128.7	0.015	15.1

Event 50 yr IDF Data Set Town of Huntsville
a = 1466.00 b = 6.55 c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Culvert	0.085	0.50	0.04	10	142.7	0.017	16.8

Event 100 yr IDF Data Set Town of Huntsville
a = 1499.00 b = 5.81 c = 0.83

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
Drainage Area - Public Culvert	0.085	0.50	0.04	10	151.6	0.018	17.8

Lithos

Public Ditch conveyance calculations

20 Cairns Crescent, Town of Huntsville
File No. UD22-097
Date: August 2025
Prepared By: Rigina Vouxinou, P.E., M.A.Sc.
Reviewed by: Iraklis Nikoletos, Ph.D.

n (manning's factor for grass swale) =	0.04	
I (Slope) =	0.029	
Q (2-year event, Tc=10min) =	17.0	lt/s
Q (5-year event, Tc=10min) =	22.1	lt/s
Q (10-year event, Tc=10min) =	26.0	lt/s
Q (25-year event, Tc=10min) =	30.2	lt/s
Q (50-year event, Tc=10min) =	33.5	lt/s
Q (100-year event, Tc=10min) =	35.6	lt/s
b=	0	m
z_1=	5.1	
z_2=	3	

Relationships for Trapezoidal Shape - Open Channel Flow

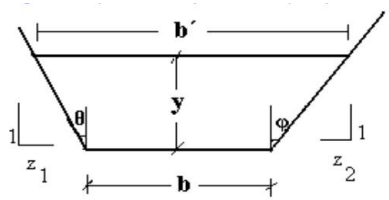
b'=Larger Base	$b' = b + y(z_1 + z_2)$
P=Wetted Perimeter	$P = b + y(\sqrt{1+z_1^2} + \sqrt{1+z_2^2})$
A=Wetted Area	$A = yb + \frac{(b'-b)}{2}y$

Manning's Equations for Open Channel Flow

$$Q = \frac{1}{n} A R_h^{2/3} I^{1/2} = \frac{1}{n} \frac{A^{5/3}}{P^{2/3}} I^{1/2}$$

$$V = \frac{1}{n} R_h^{2/3} I^{1/2} = \frac{1}{n} \frac{A^{2/3}}{P^{2/3}} I^{1/2}$$

$$R_h = \frac{A}{P}$$



Note: For the minimum slope, 2.90%, within the swale the full flow capacity is minimized. Therefore it is enough to prove that the swale is able to convey the 100 year storm flow for the 2.90% slope.

	Q (lt/s)	Q (m^3/s)	I (%)	P(m)	A(m2)	b'	$A^{5/3}$	$P^{2/3}$	$A^{5/3}/P^{2/3}$	$Qn/I^{1/2}$	y(m)	Swale Capacity Calculations				Check
												$P(y_{max})$	$A(y_{max})$	$A^{5/3}/P^{2/3}$	Q (for y_{max}) (m^3/s)	
Public Ditch (2-year event, Tc=10min)	17.0	0.0170	0.029	0.75	0.032	0.725	0.003	0.824	0.0040	0.0040	**0.090**					OK
Public Ditch (5-year event, Tc=10min)	22.1	0.0221	0.029	0.83	0.040	0.802	0.005	0.881	0.0052	0.0052	**0.099**					OK
Public Ditch (10-year event, Tc=10min)	26.0	0.0260	0.029	0.88	0.045	0.851	0.006	0.917	0.0061	0.0061	**0.105**					OK
Public Ditch (25-year event, Tc=10min)	30.2	0.0302	0.029	0.93	0.050	0.899	0.007	0.951	0.0071	0.0071	**0.111**	4.88	0.36	0.065	**0.275**	OK
Public Ditch (50-year event, Tc=10min)	33.5	0.0335	0.029	0.97	0.054	0.936	0.008	0.977	0.0079	0.0079	**0.116**					OK
Public Ditch (100-year event, Tc=10min)	35.6	0.0356	0.029	0.99	0.056	0.956	0.008	0.991	0.0084	0.0084	**0.118**					OK

Lithos

Public Culvert Calculations

20 Cairns Crescent, Town of Huntsville
File No. UD22-097
Date: August 2025
Prepared By: Rigina Vouxinou, P.E., M.A.Sc.
Reviewed by: Iraklis Nikoletos, Ph.D.

n (manning's factor for culvert) =	0.013	
I (Slope) =	0.02	
Q (2-year event, Tc=10min) =	8.5	lt/s
Q (5-year event, Tc=10min) =	11.1	lt/s
Q (10-year event, Tc=10min) =	13.0	lt/s
Q (25-year event, Tc=10min) =	15.1	lt/s
Q (50-year event, Tc=10min) =	16.8	lt/s
Q (100-year event, Tc=10min) =	17.8	lt/s

Relationships for circular storm sewer

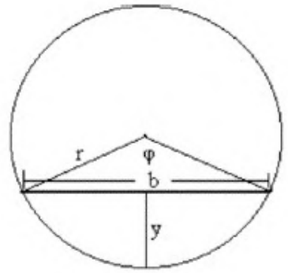
b=Top Width	$b = 2\sqrt{y(2r-y)} = 2r\sin\frac{\varphi}{2}$
P=Wetted Perimeter	$P = \varphi r$
A=Wetted Area	$A = \left(\frac{Pr}{2} - \frac{b(r-y)}{2}\right) = (\varphi - \sin\varphi)\frac{r^2}{2}$

Manning's Equations for Open Channel Flow

$$Q = \frac{1}{n} A R_h^{2/3} I^{1/2} = \frac{1}{n}\frac{A^{5/3}}{P^{2/3}} I^{1/2}$$

$$V = \frac{1}{n} R_h^{2/3} I^{1/2} = \frac{1}{n}\frac{A^{2/3}}{P^{2/3}} I^{1/2}$$

$$R_h = \frac{A}{P}$$



	Q (lt/s)	Q (m^3/s)	I (%)	P(m)	A(m2)	b	$A^{5/3}$	$P^{2/3}$	$A^{5/3}/P^{2/3}$	$Qn/I^{1/2}$	y(m)	Culvert Capacity Calculations				Check
												$P(y_{max})$	$A(y_{max})$	I (%)	Q (for y_{max}) (m^3/s)	
Culvert 1 (2-year event, Tc=16min)	8.5	0.0085	2.00%	0.289	0.008	0.269	0.000	0.437	0.001	0.001	**0.045**	0.35	0.01	0.020	**0.018**	OK
Culvert 1 (5-year event, Tc=16min)	11.1	0.0111	2.00%	0.309	0.010	0.285	0.000	0.457	0.001	0.001	**0.051**					OK
Culvert 1 (10-year event, Tc=16min)	13.0	0.0130	2.00%	0.322	0.011	0.295	0.001	0.469	0.001	0.001	**0.055**					OK
Culvert 1 (25-year event, Tc=16min)	15.1	0.0151	2.00%	0.337	0.013	0.306	0.001	0.484	0.001	0.001	**0.060**					OK
Culvert 1 (50-year event, Tc=16min)	16.8	0.0168	2.00%	0.344	0.013	0.311	0.001	0.491	0.002	0.002	**0.063**					OK
Culvert 1 (100-year event, Tc=16min)	17.8	0.0178	2.00%	0.350	0.014	0.316	0.001	0.497	0.002	0.002	**0.065**					OK

STORM SEWER DESIGN

Whitby

20 Cairns Crescent
Town of Huntsville

Sewer Segment	FROM	TO	A area (ha)	R runoff coeff.	SUM AxR	I 100-YR (mm/hr)	Q (100-YR) (m3/s)	Q (100-YR) (L/s)	STORM SEWER DESIGN INFORMATION size (mm)	slope (%)	length (m)	Q full (m^3/s)	Q full (L/s)	V full (m/s)	TIME SECT. (min.)	CUM. (min.)	capacity (%)	GROUND ELEVATION (m)	UPPER INVERT (m)	UPPER OBVERT (m)	LOWER INVERT (m)	LOWER OBVERT (m)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = (6) x (7)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
															Initial TC=	10.00						
#1	STORM MH1	STORM MH2	0.214	0.69	0.1477	153.7	0.0630	63.04	450	1.20	34.7	0.312	312.32	1.964	0.29	10.29	20.2%	298.75	296.38	296.83	295.96	296.41
#2	STORM MH2	STORM MH3	0.445	0.77	0.3427	151.4	0.1441	144.08	450	1.00	45.6	0.285	285.11	1.793	0.42	10.72	50.5%	298.02	295.86	296.31	295.40	295.85
#3	STORM MH 4	STORM MH3	0.123	0.89	0.1095	153.7	0.0467	46.74	300	1.00	17.8	0.097	96.70	1.368	0.22	10.22	48.3%	297.30	295.28	295.58	295.10	295.40
#4	STORM MH3	STORM MH5	0.568	0.79	0.4487	152.0	0.1894	189.44	450	2.50	41.6	0.451	450.79	2.834	0.24	10.46	42.0%	297.05	295.00	295.45	293.96	294.41
#5	CBMH3	CBMH2	0.117	0.27	0.0316	153.7	0.0135	13.49	300	2.50	45.6	0.153	152.90	2.163	0.35	10.35	8.8%	301.85	299.95	300.25	298.81	299.11
#6	CBMH2	CBMH1	0.227	0.27	0.0613	150.9	0.0257	25.70	300	2.00	37.0	0.137	136.76	1.935	0.32	10.67	18.8%	300.45	298.78	299.08	298.04	298.34
#7	CBMH1	STORM MH5	0.376	0.27	0.1015	148.5	0.0419	41.89	300	2.70	29.3	0.159	158.90	2.248	0.22	10.89	26.4%	299.30	294.87	295.17	294.08	294.38
#8	STORM MH5	DETENTION POND	1.231	0.64	0.7878	150.1	0.3285	328.48	525	2.00	20.9	0.608	608.20	2.810	0.12	10.59	54.0%	295.65	293.57	294.10	293.15	293.68
#9	STORM MH9	STORM MH8	0.148	0.51	0.0755	153.7	0.0322	32.23	300	0.50	37.7	0.068	68.38	0.967	0.65	10.65	47.1%	293.77	292.15	292.45	291.96	292.26
#10	STORM MH8	STORM MH7	0.197	0.46	0.0906	148.7	0.0374	37.43	300	0.50	37.7	0.068	68.38	0.967	0.65	11.30	54.7%	294.30	291.93	292.23	291.74	292.04
#11	STORM MH7	STORM MH6	0.197	0.46	0.0906	144.0	0.0363	36.25	300	0.50	30.1	0.068	68.38	0.967	0.52	11.82	53.0%	294.30	291.68	291.98	291.53	291.83
#12	STORM MH6	DETENTION POND	0.197	0.46	0.0906	140.5	0.0354	35.37	300	0.50	14.2	0.068	68.38	0.967	0.24	12.06	51.7%	294.15	291.47	291.77	291.40	291.70

NOTES:
1. The above calculations assume storm flow from the proposed site for the 100-year storm event.
2. This calculation assumes that the proposed development will be connected to the proposed detention pond.
3. Roughness coefficient n = 0.013

Appendix D

Sanitary Data Analysis

SANITARY SEWER DESIGN SHEET

20 Cairns Crescent

TOWN OF HUNTSVILLE

LOCATION	RESIDENTIAL				FLOW					SEWER DESIGN							
	SECTION AREA (ha.)	RESIDENTIAL USE AREA (ha.)	NUMBER OF UNITS Apartments	SECTION POP. (persons)	TOTAL ACCUM. POP. (persons)	AVERAGE RESIDENTIAL FLOW '@' 450 L/c/d (L/s)	HARMON PEAKING FACTOR	RES. PEAK FLOW (L/s)	TOTAL ACCUM. AREA (ha.)	INFILT. @ 0.28 L/s/ha. (L/s)	TOTAL SANITARY FLOW (L/s)	TOTAL DESIGN FLOW (L/s)	PIPE LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	FULL FLOW CAPACITY n = 0.013 (L/sec)	% of DESIG CAPACITY (%)
Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Existing Condition																	
Undeveloped land	2.169	0	0	0	0	0.00	4.50	0.00	2.169	0.607	0.000	**0.61**					
Proposed Condition																	
Residential use	2.169	1.035	176	248	248	1.29	4.11	5.32	2.169	0.607	5.321	**5.93**					
Population Density = 240 persons/ha **Residential Flow Rate - 450 litres/capita/day** **Commercial Flow Rate - 28 m^3/hactares/day** **Infiltration - 0.28 L/ha** **Peaking Factor = 1 + [14 / (4 + $P^{0.5}$)], P=Population in thousands** **Site Area (ha): 2.169**											**Total Sanitary Net Flow**	**5.32**					

Lithos

Prepared by: Stergios Grigoriadis, P.E., M.A.Sc.
Reviewed by: Anastasia Tzakopoulou, P.E., M.A.Sc.
Date: August 2025

Project: 20 Cairns Crescent
Project: UD22-097
Town of Huntsville

Sheet 1 OF 1

Appendix E

Water Data Analysis

WATER DEMAND

20 Cairns Crescent
File No: UD22-097
Date: August 2025
Prepared by: Stergios Grigoriadis, P.E., M.A.Sc.
Reviewed by: Anastasia Tzakopoulou, P.Eng., M.A.Sc.

Fire Flow Calculation

1 $F = 220\ C\ (A)^{1/2}$

Where F= Fire flow in Lpm
C= construction type coefficient
= 0.8 Non-combustible Construction
A = total floor area in sq.m.

		Area Applied
Level 1=	3179.8 m^2	25%
Level 2=	3136.5 m^2	100%
Level 3=	3136.5 m^2	25%
=	4,716 sq.m.	

Note: The levels indicated, reference the floors with the largest areas (refer to building stats)

F = 12,085.94 L/min *F(No.1) = 220C√A*
F = 12,000 L/min *F(No.1) Round to nearest 1000 l/min*

2 Occupancy Reduction
25% reduction for non-combustible occupancy
F = 9000 L/min *F(No.2) = F(No.1) x occupancy reduction/charge(%)*

3 Sprinkler Reduction
30% Reduction for NFPA Sprinkler System
F = 6300 l/min *F(No.3) = F(No.2) x sprinkler reduction(%)*

4 Separation Charge

15%	North	10.1m to 20m
15%	East	10.1m to 20m
0%	South	> 30 m
0%	West	> 30 m
30%	Total Separation Charge	

F = 2,700.00 L/min *F (No.4) = F(No.2) x separation charge(%)*

F = 9,000.00 L/min *F (tot) = F(No.3) + F(No.4)*

F = 9,000 L/min *F(tot) Round to nearest 1000 l/min*
150.00 L/s
F = 2378 US GPM

Domestic Flow Calculations

Population = 248 Persons (from sanitary design sheet for Residential)
Average Day Demand = 450 L/cap/day 1 US Gallon=3.785 L
Residential Flow= 1.29 L/s

Retail/Commercial Area= 0.000 m^2 (from sanitary design sheet for Commercial)
Average Day Demand= 2.8 $L/m^2/day$
Retail/Commercial Flow= - L/s 1 US GPM=15.852L/s

Total Flow= 1.29 L/s
= 20.13 US GPM

Max. Daily Demand Peaking Factor = 2.75 (For residential)
Max. Daily Demand = 3.55 L/s = 56 US GPM

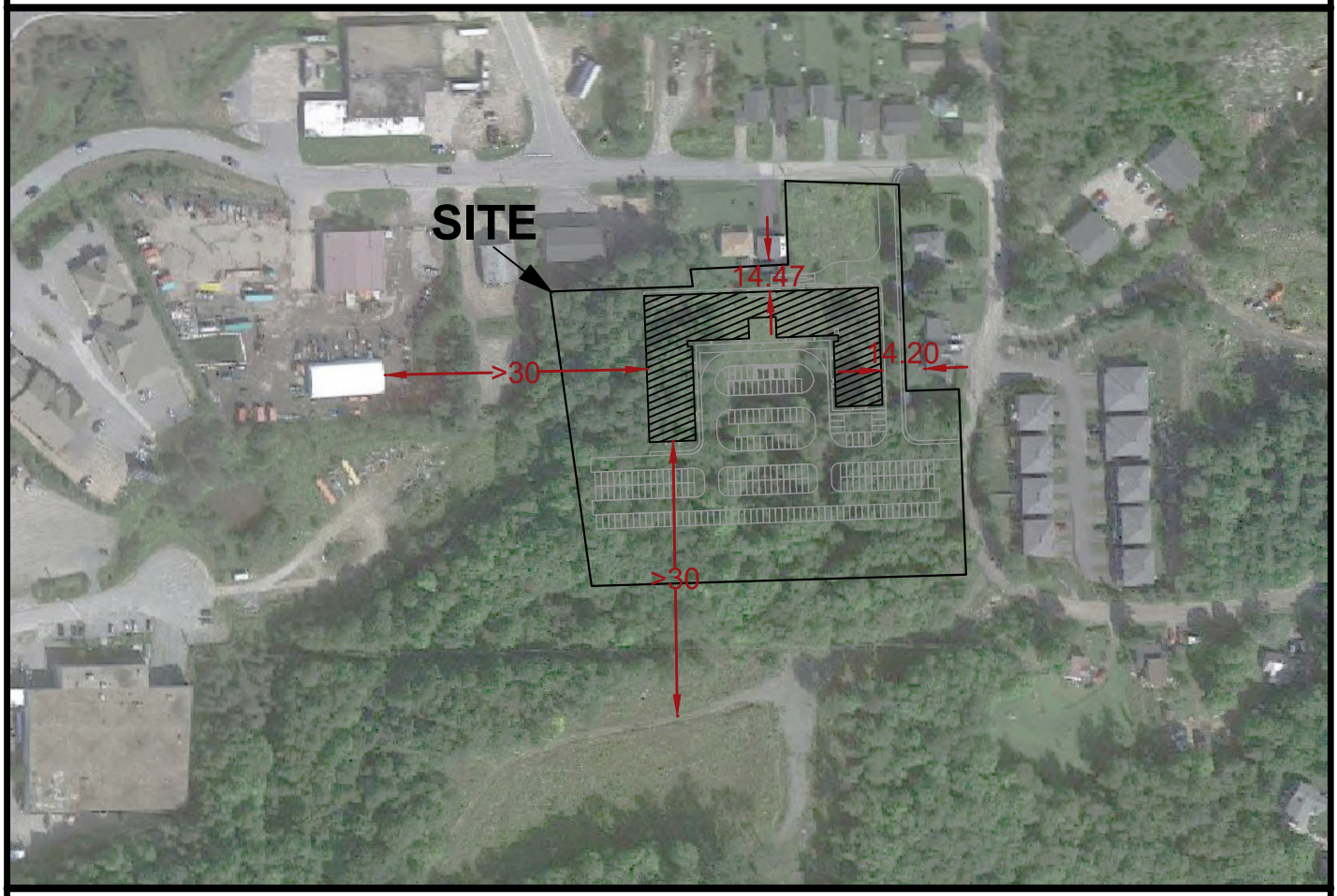
or

Max. Hourly Demand Peaking Factor = 4.13
Max. Hourly Demand = 5.33 L/s = 85 US GPM

Max Daily Demand = 3.55 L/s
Fire Flow = 150.00 L/s

Required 'Design' Flow = 153.55 L/s
2434 US GPM

Note: Required 'Design' Flow is the maximum of either:
1) Fire Flow + Maximum Daily Demand
2) Maximum Hourly Demand



Lithos

150 Bermondsey Road, North York, Ontario, M4A 1Y1

SEPARATION DISTANCES
RESIDENTIAL USE DEVELOPMENT
20 CAIRNS CRESCENT
HUNTSVILLE, ONTARIO

DATE:	AUGUST 2025	PROJECT No:	UD22-097
SCALE:	N.T.S.	FIGURE No:	FIG 3