FUNCTIONAL SERVICING REPORT

VILLALAGO RESIDENCES INC.
PROPOSED RESIDENTIAL DEVELOPMENT

BOLTON SOUTH HILL DEVELOPMENT AREA
SOUTHEAST OF QUEENSGATE BLVD. AND HIGHWAY 50

TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

PROJECT NO. 16984

APRIL 2017

RAND ENGINEERING CORPORATION
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO L4W 5B8

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1.0 INTRODUCTION

RAND Engineering Corporation has been retained by Villalago Residences Inc. to complete a Functional Servicing Report (FSR) for the proposed residential development located within the Bolton South Hill Development Area in the Town of Caledon and Regional Municipality of Peel. The property encompasses a total area of 3.16 ha and is located on Part of Lot 5, Concession 7 and Blocks 118, 152-154, 165, 167, 178, 181 and 182 of the Registered Plan 43M-1251.

The proposed Draft Plan of Subdivision for the property was prepared by KLM Planning Partners Inc. on March 21, 2017. The development will consist of one hundred and nine (109) townhouse units, four (4) semi-detached units, and one (1) single detached unit. The development site plan for the property was prepared by One Riser Designs on March 17, 2017.

As shown in **Figure 1**, the Villalago property is located southeast of the intersection of 5th Sideroad and Highway 50 and is bounded by the Canadian Pacific Railway to the southwest and the existing South Hill Village residential subdivision to the east.

The development lies within the limits of the drainage area of the existing SWM Pond 4, located within the Rainbow Creek subwatershed. The facility was constructed in 1998 as part of the Gates of Bolton subdivision. The facility was designed to provide water quality and quantity control for approximately 100.2 ha contributing drainage area, including the subject property.

The purpose of this report is to provide stormwater, sanitary and water servicing requirements for the proposed Villalago development. The recommended grading and servicing plans have been prepared in accordance with the design criteria of the Town of Caledon, Toronto Region Conservation Authority (TRCA), and the Regional Municipality of Peel.

The information provided in this report is intended to assist the municipality and other regulatory agencies in their review of the draft plan application for the development.

LEGEND

PROPOSED DEVELOPMENT

VILLALAGO RESIDENCES INC.

FIGURE No. 1

NOT TO SCALE

LOCATION PLAN

TOWN OF CALEDON

PROJECT No. 16984

RAND ENGINEERING CORPORATION

R:\16\16984\Drawings & Figures\12 March 17, 2017\Figure 1_Location Plan.dwg Apr 04, 2017 - 4:18pm

2.0 BACKGROUND INFORMATION

The following is a list of the background studies and reference documents used in the preparation of this report;

- **Aquafor Beech Ltd.**, "*1113486 Ontario Limited – General Plan, Plan & Profiles, Storm Drainage Plans As Constructed Drawings No. 1, 2A, 6-9, 12 & 13*", 1997.

- **Aquafor Beech Ltd.**, "*Bolton South Hill – Drawing No. 1 - Pond 4 General Plan*", May 1995.

- **Aquafor Beech Ltd.,** *"Tormina Homes – Gates of Bolton – Phase III & IV – Stormwater Management Report"*(SWMR), *March 1998.*

- **Anton Kikas Ltd.,** *"Highway No. 50 Bolton/Brampton Trunk Sewer, Plan and Profiles", 1982.*

- **Exp Services Inc.**, "*Geotechnical Investigations Proposed Residential Development – Villalago Residences Inc. c/o Treasure Hill Homes – Landsbridge Street & Sideroad 5, Caledon, Ontario*", March 2016.

- **GGHACA**, *"Erosion and Sediment Control Guidelines for Urban Construction"*, December 2006.

- **Region of Peel**, "*Public Works, Design, Specifications & Procedures Manual*", September 2007.

- **Town of Caledon**, "*Development Standards, Policies and Guidelines*", January 2009.

- **Town of Caledon,** *"Village Villas and Tormina Homes – Storm Sewer Design Sheets – As Constructed Information"*, received from the Town in 2016.

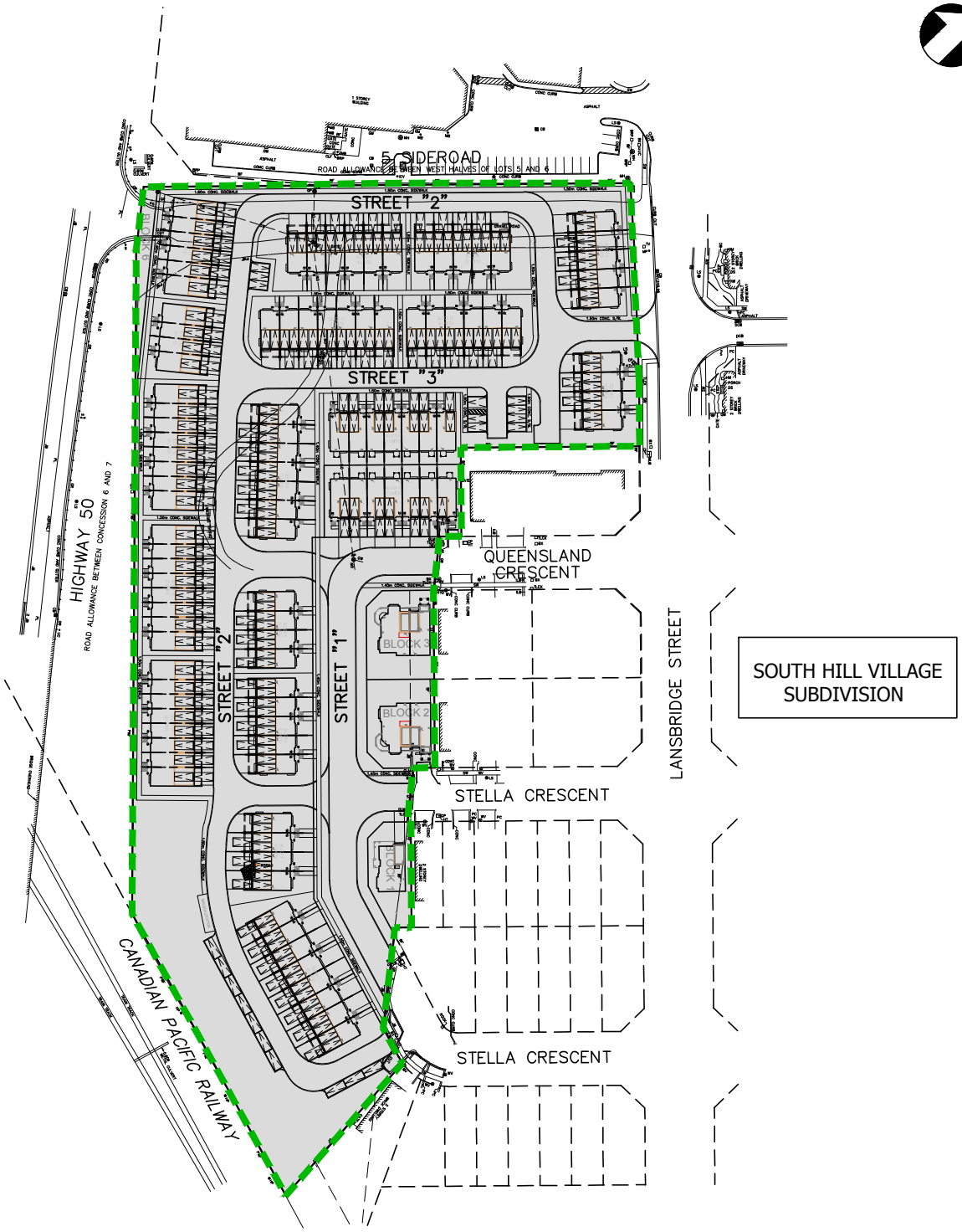
3.0 PROPOSED DEVELOPMENT

The general layout of the proposed 3.16 ha residential development is shown in **Figure 2**. The Draft Plan of Subdivision for the property was prepared by KLM Planning Partners Inc. on March 21, 2017, and is included in Appendix A. The site plan for the proposed development was prepared by One Riser Designs on March 17, 2017 and it consists of one hundred and nine (109) townhouse units, four (4) semi-detached units, and one (1) single detached unit. The site plan has been included in Appendix A.

Figure 2 shows that the proposed development will include a portion of the existing 5th Sideroad right-of-way to the north and a widening block for Highway 50 to the northwest.

Primary access to the development will be provided via Stella Crescent and Queensland Crescent from the adjacent South Hill Village residential subdivision (Registered Plan 43M-1251).

Stormwater quality, erosion and quantity control for the subject development will be provided within the existing SWM Pond 4 located approximately 150 m northeast of the intersection of the CP Rail line and Albion-Vaughan Road.



LEGEND

VILLALAGO PROPERTY

VILLALAGO RESIDENCES INC.

FIGURE No. 2

SCALE 1:2,000

TOWN OF CALEDON

DEVELOPMENT PLAN

PROJECT No. 16984

RAND ENGINEERING CORPORATION

R:\16\16984\Drawings & Figures\12 March 17, 2017\Figure 2_Development Plan.dwg Apr 04, 2017 - 4:19pm

4.0 EXISTING CONDITIONS

4.1 Topography and Drainage

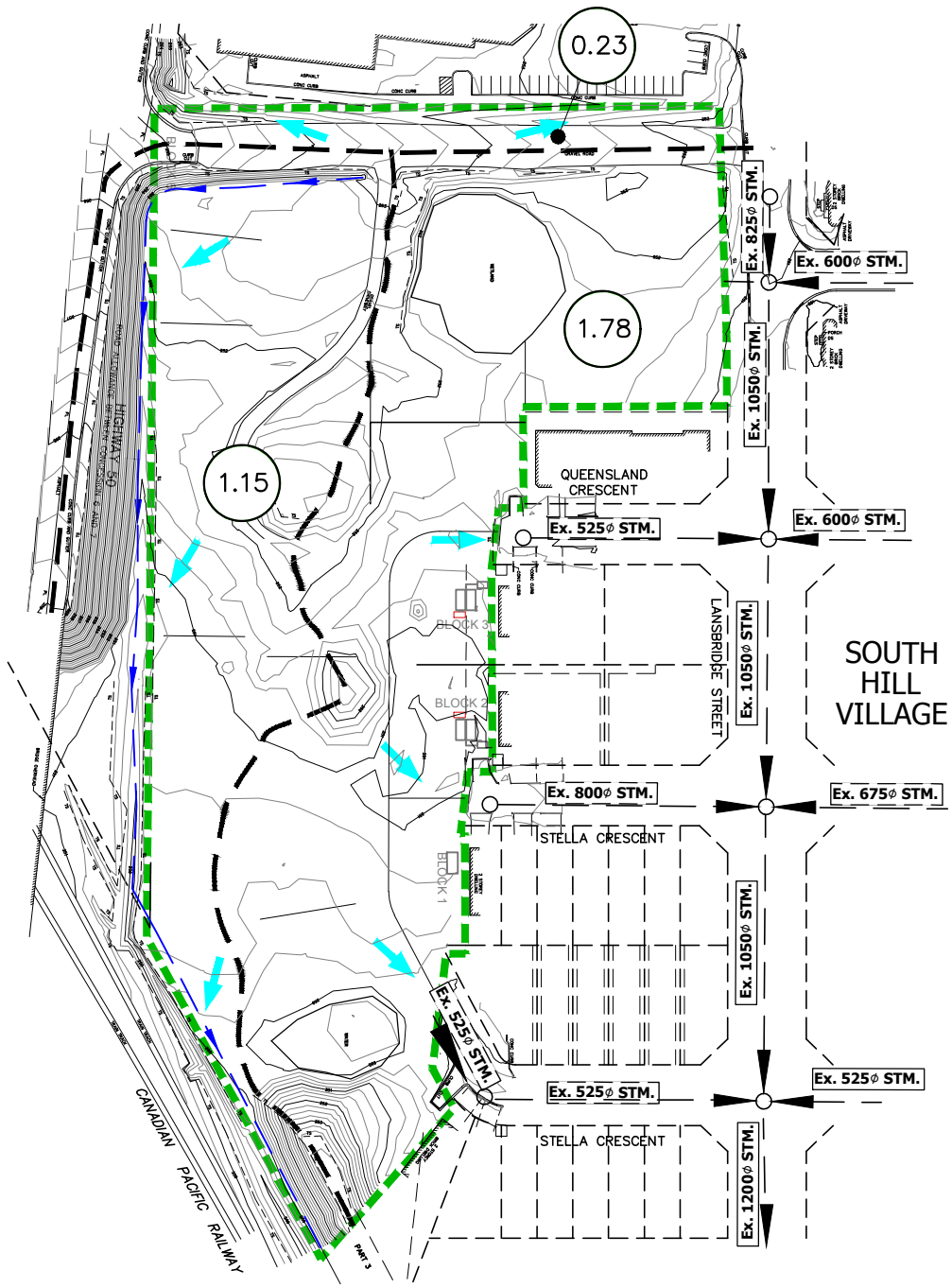
A review of the property's site conditions was carried out using topographic information and site inspection. Topographic information for the property and immediate surrounding area was obtained from the detailed survey plan completed by Holding Jones Vanderveen Inc. on February 3, 2017.

The property occupies a vacant parcel of land consisting of an open field with scattered trees in the north and central parts of the property. As shown in **Figure 3**, the ground surface is moderate in slope (0 to 6%) with the exception of an approximately 3 m high CPR berm in the southeast corner of the site. A review of the topographic conditions indicate that the majority of the property slopes easterly at an average gradient of 3% towards the existing South Hill Village subdivision. The topographic relief across the property is approximately 10 metres.

All drainage within the Villalago property and surrounding area is tributary to the existing drainage system of the Bolton South Hill Development Area. Stormwater management for the subject property is provided within the existing SWM Pond 4, located approximately 150 m northeast of the intersection of the CP Rail line and Albion-Vaughan Road. The Pond 4 outlets to Robinson Creek, a tributary to the Rainbow Creek subwatershed.

The drainage areas internal to the property have been discretized as follows (refer to **Figure 3**):

- 1.78 ha drains east to the existing storm sewer system of the South Hill Village subdivision towards Queensland Crescent and Stella Crescent;
- 1.15 ha drains south-west towards the ditch along the Canadian Pacific Railway and Highway 50.
- 0.23 ha drains north to the ditch along the 5th Sideroad right-of-way.



LEGEND

VILLALAGO PROPERTY

0.12 **DRAINAGE AREA (Ha)**

STORM DRAINAGE BOUNDARY

DRAINAGE DIRECTION

DITCH

VILLALAGO RESIDENCES INC.

FIGURE No. 3

SCALE 1:2,000

TOWN OF CALEDON

EXISTING CONDITIONS

PROJECT No. 16984

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R:\16\16984\Drawings & Figures\12 March 17, 2017\Figure 3_Existing Conditions.dwg Apr 04, 2017 - 4:22pm

4.2 Soils and Hydrogeology

A review of the property's subsurface site conditions was carried out using the geotechnical information for the property provided in the March 2016 *"Geotechnical Investigation"*, prepared by exp Services Inc.

The results of the investigation indicate that the soil stratigraphy of the site consists of 0.15m to 0.30m layer of topsoil over a stratum of fill extending to depths of approximately 0.7m to 2.2m, overlaying a native clayey silt till.

The groundwater was observed at approximately 0.2m below grade in the northern part of property (Borehole No. 1) and approximately 7.1m in the central part of property (Borehole No. 4). The near surface water level recorded in the northern part is likely associated with the wet sandy silt layer at that location.

5.0 STORMWATER MANAGEMENT PLAN

The storm drainage system for the development has been designed in accordance with the standards and requirements of the Town of Caledon and TRCA. The information pertaining to the water quality, erosion and quantity control from the site has been obtained from the 1998 "*Tormina Homes – Gates of Bolton – Phase III & IV – Stormwater Management Report*" prepared by Aquafor Beech.

5.1 Stormwater Management Criteria

The following storm drainage criteria have been adopted for the stormwater conveyance system within the proposed development:

- The minor drainage system within the proposed development should be designed for the 10-Year storm event using the Rational Method and the Town of Caledon's IDF curves.

- The major drainage system should be designed to convey flows from the 100-Year design storm. The major system should be contained within road allowances and designated easements.

- Runoff from roof leaders within residential lots should discharge to surface pre-cast splash pads and be directed towards pervious areas.

- Water quality, erosion and quantity control for the subject property will be provided within existing SWM Pond 4, located approximately 150 m northeast of the intersection of the CP Rail line and Albion-Vaughan Road. The SWM Pond 4 was designed to control runoff from the approximately 100.2 ha contributing drainage area, including the subject property.

5.2 Minor and Major Drainage Systems

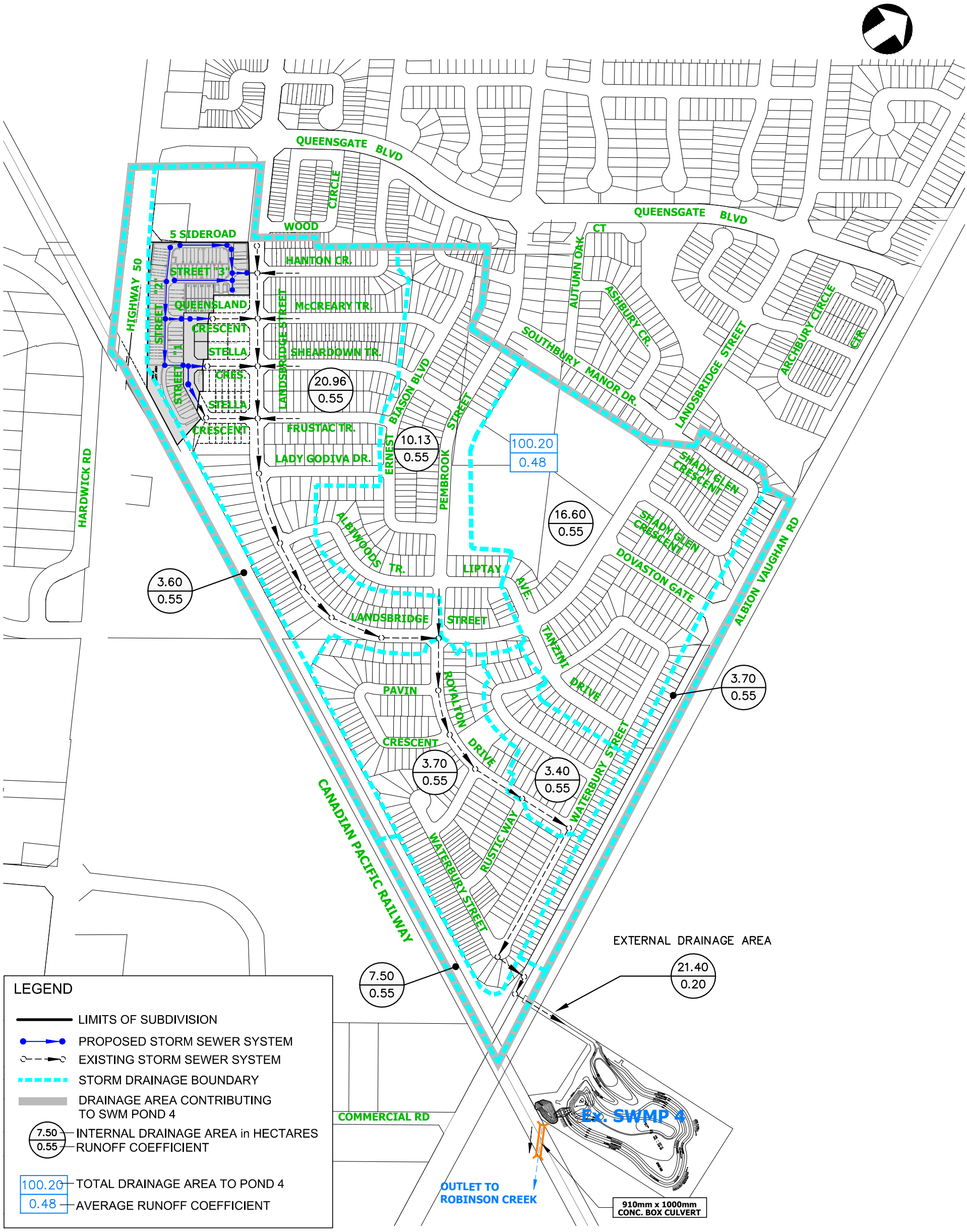
As shown in **Figure 4**, the drainage from the 3.16 ha Villalago development will be conveyed to the existing storm sewer system within the adjacent South Hill Village subdivision (Registered Plan 43M-1251). Post-development storm drainage from the subject property will be managed using a combination of minor (storm sewers) and major (overland) systems. The details of the drainage plan are shown on the **Preliminary Storm Drainage Plan** (Drawing No. 1), included in the back pocket of this report.

As shown on **Drawing No. 1**, the proposed storm sewer system from the Villalago development will be connected to the existing storm sewer system as follows;

- A proposed 525mm diameter storm sewer connection to the existing 525mm diameter pipe, following the removal of the existing storm plug, conveying flows to a 1050mm sewer on Landsbridge Street via storm MH 7.
- A proposed 450mm diameter storm sewer connection to the existing 525mm diameter storm sewer on Queensland Crescent via storm MH 11.
- A proposed 450mm diameter storm sewer connection to the existing 600mm diameter storm sewer on Stella Crescent via storm MH 16.
- A proposed 450mm diameter storm sewer connection to the existing 450mm diameter storm sewer on Stella Crescent, following the removal of the existing storm plug.

Hydrologic and hydraulic analysis has been conducted to confirm that there is sufficient capacity within the existing storm sewer system to convey flows from the proposed Villalago development. Based on the results of our analysis it has been concluded that the existing storm sewer system has sufficient capacity to convey the 10-year design flow from the subject development. It has been further determined that flows from the less frequent storm events up to and included the 100-year storm event will be conveyed by the combination of the storm sewer and road allowance to the

R:\16\16984\Drawings & Figures\12 March 17, 2017\Figure 4_Storm Servicing Plan (31-03-2017).dwg Apr 04, 2017 - 4:31pm



VILLALAGO RESIDENCES INC.

FIGURE No. 4

SCALE 1:6,000

TOWN OF CALEDON

STORM DRAINAGE PLAN

PROJECT No. 16984

RAND ENGINEERING CORPORATION

SWM Pond 4. The storm sewer design sheets for the Villalago development, and the downstream storm sewers tributary to SWM Pond 4, have been included in Appendix B.

Runoff exceeding the storm sewer's capacity for all storms up to and including the 100-Year design storm is directed towards the existing South Hill Village subdivision and subsequently to the existing SWM Pond 4.

The sizes and locations of storm sewers within the subject property will be verified at the time of detailed engineering design.

5.3 SWM Pond 4

The existing SWM Pond 4, located approximately 150 m northeast of the intersection of the CP Rail line and Albion-Vaughan Road, was designed to provide water quality, quantity, and erosion control for storms up to and including the 100-year storm flows from the approximately 100.20 ha contributing drainage area, including the 3.16 ha Villalago development. As shown in **Figure 3**, the pond lies within the Rainbow Creek subwatershed and drains to Robinson Creek via a 910 mm x 1000 mm concrete box culvert under the CP Rail line. The pond provides a maximum storage of approximately 36,200 m^3. The background information pertaining to the SWM Pond 4 is provided in Appendix C.

SWM Pond 4 was designed to accommodate the drainage from the subject development assuming an average runoff coefficient of 0.55. Considering the fact that the Villalago development consists of medium density residential units, the runoff coefficient has been revised from 0.55 to 0.75. Based on the calculations provided in **Table C.1** in Appendix C, it has been determined that the higher runoff coefficient within the subject development will increase the imperviousness within the total drainage area to Pond 4 by approximately 2.3%.

5.3.1 Water Quality Control

As per Table 3.2 from MOE Stormwater Management Planning and Design Manual (2003) the existing and proposed (i.e. with the Villilago development) catchment characteristics yield minimum required permanent storage volumes of 11,103 m^3 and 11,375 m^3, respectively. As shown in **Table C.2** in Appendix C, the impact of the proposed development on the permanent storage required within the pond is negligible.

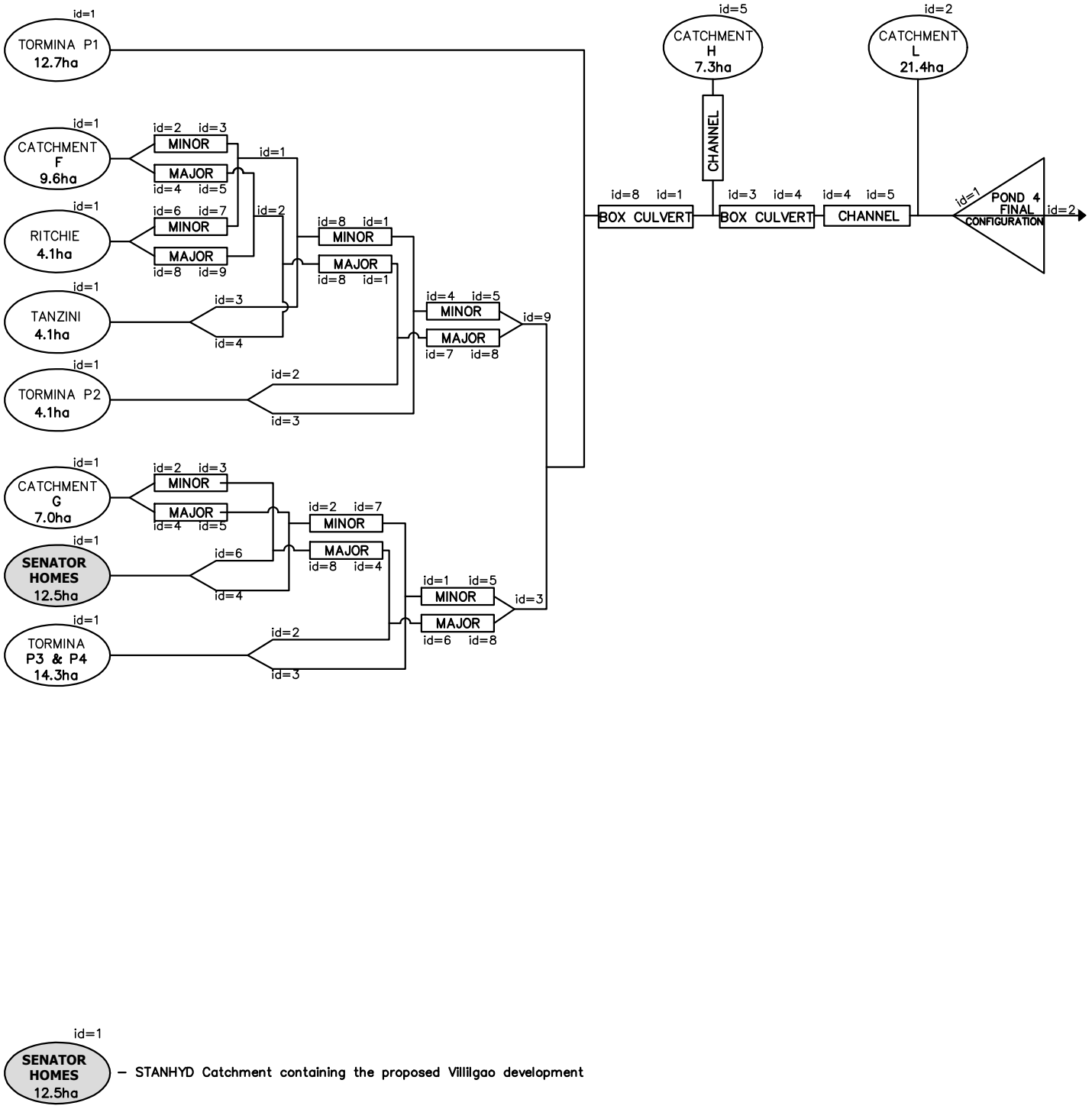
Based on the design information for SWM Pond 4, it has been determined that the facility provides approximately 19,500 m^3 of permanent storage. This volume exceeds the MOE requirements and is sufficient to provide water quality control for the entire contributing drainage area, including the Villalago development.

5.3.2 Water Quantity Control Volume

The impact of the Villalago development on the existing SWM Pond 4 capacity and water quantity control has been conducted using hydrologic computer model SWMHYMO.

The original design information and computer modelling (OTTHYMO) for the existing SWM Pond 4 has been obtained from the 1998 SWMR, prepared by Aquafor Beech Ltd. The existing OTTHYMO model has been translated to the SWMHYMO format and has been used to determine the impact of the 2.3% imperviousness increase in the contributing drainage area to SWM Pond 4. The OTTHYMO and updated SWMHYMO model input and summary files are included in Appendix D.

The hydrologic model is schematically illustrated on **Figure 5**. As highlighted in the schematic the Villilago development has been included within the Senator Homes subcatchment.



NOTE: Hydrologic schematic prepared based on the information obtained from the 1998 Tormina Homes – Gates of Bolton – Phase III & IV – Stormwater Management Report by Aquafor Beech.

VILLALAGO RESIDENCES INC.

FIGURE No. 5

N.T.S.

CITY OF CALEDON

HYDROLOGIC MODEL SCHEMATIC

PROJECT No. 16984

RAND ENGINEERING CORPORATION

R:\16\16984\Drawings & Figures\12 March 17, 2017\Figure 5_Hydrologic Model Schematic SWMP4.dwg Apr 04, 2017 - 4:23pm

Based on the comparison of the OTTHYMO and SWMHYMO model results it has been determined that the updated SWMHYMO model yielded approximately 2% less runoff volume, which is considered negligible.

The SWMHYMO model has been revised to reflect the 2.3% increase in the imperviousness of the contributing drainage area to Pond 4. The results of the hydrological modelling show that, based on the 2.3% increase in the imperviousness level, the water level in SWM Pond 4 under the 100-year storm event will increase approximately 0.01 m. The SWMHYMO model input and summary files are included in Appendix D.

The results of our hydrological analysis show that the Villilago development would practically have no impact on the functionality and operation of SWM Pond 4.

5.4 Erosion and Sediment Control

Erosion and sediment control measures to be implemented during and following construction will comply with the December 2006 *"Erosion and Sediment Control Guideline for Urban Construction"* prepared by the Greater Golden Horseshoe Area Conservation Authorities and recommendations from the Town of Caledon engineering staff. The details of the proposed erosion and sediment control works will be provided at the final design stage.

Prior to the initiation of grading or stripping of topsoil a Fill Permit Application will be submitted to the Town of Caledon. The permit will include an Erosion and Sediment Control Plan, illustrating the topsoil stockpile location and size and control measures in accordance with the Town's standards.

6.0 SANITARY SERVICING PLAN

The sanitary servicing plan for the Villalago development is shown schematically on **Figure 6**. Additional details of the sanitary sewer system are shown on the **Preliminary Servicing Plan** (Drawing No. 2), included in the Report's rear pocket.

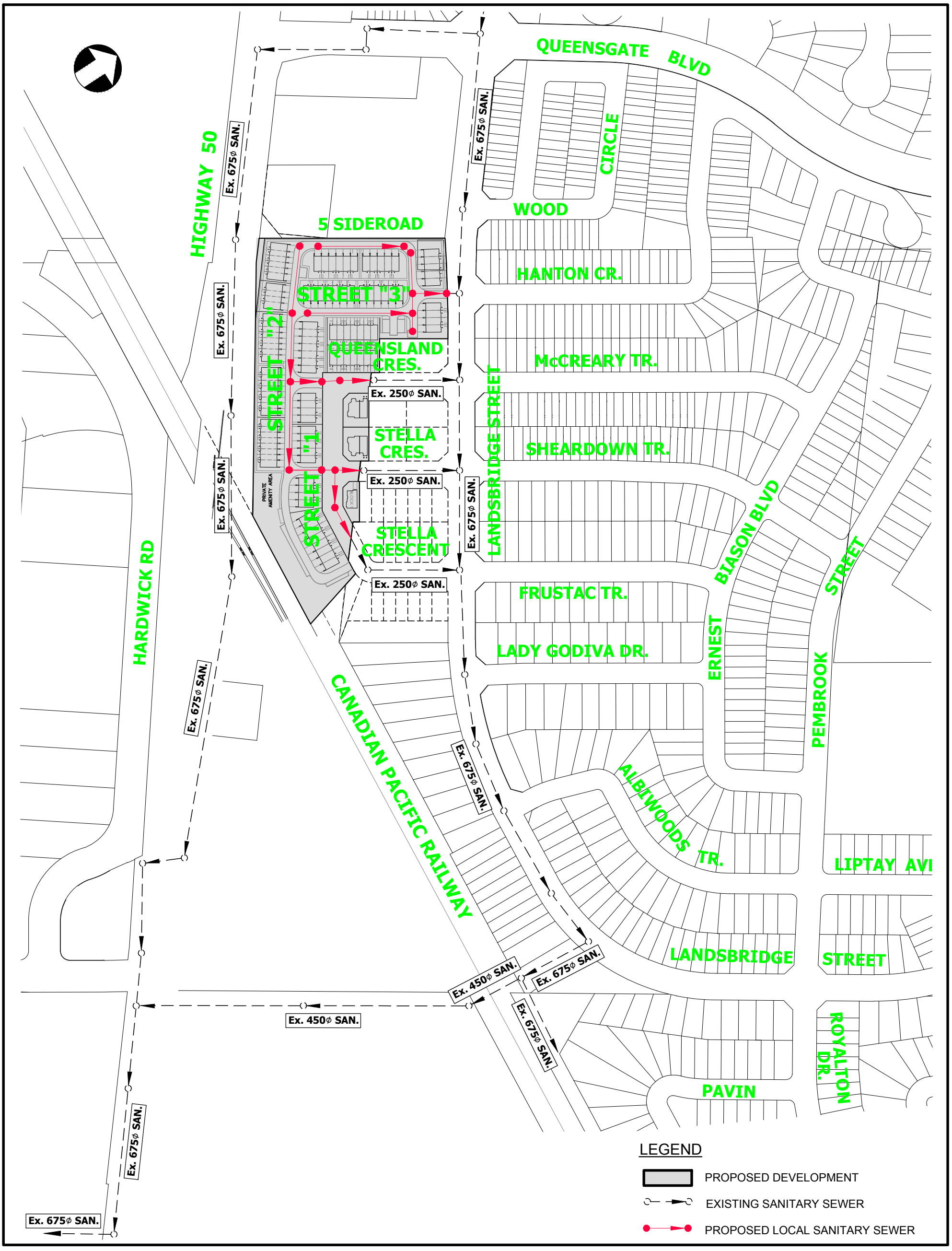
The sanitary servicing network within the proposed development will be designed as a conventional gravity system in accordance with the Region of Peel standards. The sizes and locations of sanitary sewers within the subject property will be verified at the time of detailed engineering design. Preliminary design calculations for the development are included in Appendix E.

As shown on **Drawing No. 2**, the sanitary flow from the subject property will be connected to the existing sanitary sewer system as follows;

- A proposed 250mm diameter sanitary sewer connection to the existing 250mm diameter sanitary sewer, following the removal of the existing sanitary plug, conveying flows to a 675mm diameter sewer on Landsbridge Street via sanitary MH 6A.
- A proposed 250mm diameter sanitary sewer connection to the existing 250mm diameter sanitary sewer on Queensland Crescent via sanitary MH 10A.
- A proposed 250mm diameter sanitary sewer connection to the existing 250mm diameter sanitary sewer on Stella Crescent via sanitary MH 15A.
- A proposed 250mm diameter sanitary sewer connection to the existing 250mm diameter sanitary sewer on Stella Crescent, following the removal of the existing sanitary plug.

The sanitary flows from the Villalago development will be conveyed via the existing 450mm diameter sewer located west of the CP Rail within an outlet to the 675mm diameter sanitary trunk sewer on Highway 50, as shown in **Figure 6**. Based on the Region of Peel requirements, it has been confirmed that the Villilago western property line does not encroach into the 3.0m limit to the outside diameter of the existing 675mm diameter sewer. It has been further confirmed that any proposed infrastructure within the Villilago development will not conflict with the zone of influence of the existing 675mm diameter sewer on Highway 50. The design details will be provided at the final design stage.

R:\16\16984\Drawings & Figures\12 March 17, 2017\Figure 6_Sanitary Servicing Plan.dwg Apr 04, 2017 - 4:30pm



VILLALAGO RESIDENCES INC.

FIGURE No. 6

SCALE 1:3,000

CITY OF CALEDON

SANITARY SERVICING PLAN

PROJECT No. 16984

RAND ENGINEERING CORPORATION

7.0 WATER DISTRIBUTION PLAN

The subject property will be serviced within Pressure Zone 6 of the Region of Peel's Lake Based Water Supply System. The layout of the network is outlined in the **Preliminary Servicing Plan** (Drawing No. 2), as provided in the Report's rear pocket. The proposed water distribution network is supported by the preliminary design calculations found in Appendix F.

As shown on **Drawing No. 2**, the proposed water servicing system from the Villalago development will be connected to the existing water servicing network as follows;

- A proposed 200mm diameter watermain connection to the existing 200mm diameter watermain, following the removal of the existing plug, conveying flows to a 300mm watermain on Landsbridge Street.
- A proposed 200mm diameter watermain connection to the existing 200mm diameter watermain on Queensland Crescent, following the removal of the existing water servicing plug.
- A proposed 200mm diameter watermain connection to the existing 200mm diameter watermain on Stella Crescent, following the removal of the existing water servicing plug.
- A proposed 200mm diameter watermain connection to the existing 150mm diameter watermain on Stella Crescent, following the removal of the existing plug. The watermain connection will require a reducer.

The sizes and locations of proposed watermains within the subject property will be verified at the time of detailed engineering design. The water distribution system for the proposed development will be designed in accordance with current Region of Peel standards.

As discussed with the Region of Peel, the existing 50mm water service connection to the abandoned property, located northwest of the Villilago property will be properly abandoned at the 300mm diameter watermain, located on the west side of Highway 50.

8.0 GRADING PLAN

A grading plan for the subject property has been prepared in conjunction with the preliminary storm and sanitary design for the subject development, and with consideration of the existing grading for the adjacent lands.

The site's grading has been designed to generally follow the existing topography and provide adequate cover for the underground services. As such, the majority of site drainage is directed south east towards the South Hill Village subdivision (Registered Plan 43M-1251).

The property's grading is outlined on the **Preliminary Grading Plan** (Drawing No. 3) provided in the Report's rear pocket. Additional grading design details for the development area in the vicinity of the Canadian Pacific Railway are provided on the enclosed **Drawing No. 4**.

9.0 CONCLUSIONS

Based on the findings of this study, it is concluded that:

1. A technical assessment of the municipal servicing requirements indicates that the development plan may be adequately serviced by the proposed storm drainage, sanitary and water distribution systems.

2. The existing SWM Pond 4, located southeast of the intersection of Albion Vaughn Road and the CPR rail line, has the sufficient capacity to accommodate the drainage from the proposed Villalago subdivision. The facility provides water quality, erosion and quantity control for the development.

3. A detailed Stormwater Management Implementation Report will be prepared in conjunction with the final engineering design.

This report is being submitted to the Town of Caledon and Regional Municipality of Peel in support of the Draft Plan Application for the Villalago subdivision.

Respectfully Submitted,

RAND Engineering Corporation

Doug Campbell, B. Eng., EIT

Piotr Szponar, P. Eng.

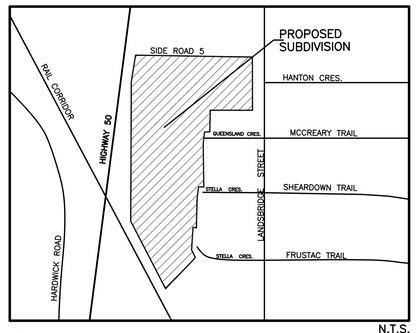
APPENDIX A. DRAFT PLAN OF SUBDIVISION AND SITE PLAN

Draft Plan of Subdivision, prepared by KLM Planning Limited on March 21, 2017
(1 Sheet)

Site Plan, prepared by One Riser Designs on March 17, 2017
(1 Sheet)

DRAFT PLAN OF SUBDIVISION OF PART OF LOT 5 AND PART OF THE ROAD ALLOWANCE BETWEEN WEST HALVES OF LOTS 5 AND 6 CONCESSION 7 AND BLOCKS 118, 152–154, 165, 167, 178, 181 and 182, REGISTERED PLAN 43M–1251 TOWN OF CALEDON (GEOGRAPHIC TOWNSHIP OF ALBION, COUNTY OF PEEL)

DRAFT PLAN T–



N.T.S.

KEY PLAN

SECTION 51, PLANNING ACT, ADDITIONAL INFORMATION

A. AS SHOWN ON DRAFT PLAN
B. AS SHOWN ON DRAFT PLAN
C. AS SHOWN ON DRAFT PLAN
D. SEE SCHEDULE OF LAND USE
E. AS SHOWN ON DRAFT PLAN
F. AS SHOWN ON DRAFT PLAN
G. AS SHOWN ON DRAFT PLAN
H. MUNICIPAL PIPED WATER AVAILABLE AT TIME OF DEVELOPMENT
I. CLAY–LOAM
J. AS SHOWN ON DRAFT PLAN
K. SANITARY AND STORM SEWERS, GARBAGE COLLECTION, FIRE PROTECTION
L. AS SHOWN ON DRAFT PLAN

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AS SHOWN ON THIS PLAN, AND THEIR RELATIONSHIP TO THE ADJACENT LAND ARE ACCURATELY AND CORRECTLY SHOWN.

HOLDING JONES VANDERVEEN INC.

DATE ----------, 2016

THOMAS R. REED
ONTARIO LAND SURVEYOR

OWNER'S CERTIFICATE

I AUTHORIZE KLM PLANNING PARTNERS INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE TOWN OF CALEDON FOR APPROVAL.

OWNER

VILLALAGO RESIDENCES INC.

C/O
TREASURE HILL
1681 LANGSTAFF ROAD
UNIT 1, VAUGHAN ONTARIO
L4K 5T3

NICHOLAS FIDEI
PRESIDENT

SCHEDULE OF LAND USE

TOTAL AREA OF LAND TO BE SUBDIVIDED = 3.155±Ha. (7.796±Acs)

	BLOCKS	LOTS	UNITS	±Ha.	±Acs.
DETACHED DWELLINGS					
LOT 1 MIN. LOT FRONTAGE=9.0m. MIN LOT AREA=300.00sq.m.		1	1	0.040	0.099
SEMI–DETACHED DWELLINGS					
LOTS 2 and 3 MIN. LOT FRONTAGE=9.0m. MIN LOT AREA=300.00sq.m.		2	4	0.117	0.289
TOWNHOUSE DWELLINGS					
BLOCK 4 MIN. UNIT FRONTAGE=5.55m.	1		7	0.099	0.245
CONDOMINIUM					
BLOCK 5	1		102	2.569	6.348
SUBTOTAL	2	3	114	2.825	6.981
BLOCK 6 – ROAD WIDENING	1			0.020	0.049
STREETS 17.0m. WIDE TOTAL LENGTH= 182.8m. AREA= 0.310±Ha.				0.310	0.766
TOTAL	3	3	114	3.155	7.796

NOTE – ELEVATIONS RELATED TO CANADIAN GEODETIC DATUM

PROJECT No. P-2658

SCALE 1:400 MARCH 21, 2017

(2658DES19) X-REF: (2658MAS6 & 2658TOPO)

DWG. No. - 17:2

KLM PLANNING PARTNERS INC.
64 JARDIN DRIVE - UNIT 1B, CONCORD ONTARIO L4K 3P3
TEL: (905)669-4055 FAX: (905)669-0097 design@klmplanning.com

Planning • Design • Development

TRUE NORTH

SITE STATS

5.55m SINGLE CAR -	14 UNITS
6.00m DOUBLE CAR -	61 UNITS
4.60m DOUBLE CAR -	34 UNITS
SEMI-DETACHED -	4 UNITS
SINGLE -	1 UNIT
TOTAL -	114 UNITS

9	REVISED AS PER COMMENTS	MAR.17/17	KA
8	ISSUED FOR CLIENT REVIEW	FEB.16/17	KA
7	ISSUED FOR SPA SUBMISSION 1	JUN. 6/16	KA
6	REVISED AS PER CLIENT COMMENTS	MAY 19/16	KA
5	REVISED AS PER COMMENTS	APR. 7/16	KA
4	REVISED AS PER COMMENTS	APR. 6/16	KA
3	REVISED AS PER COMMENTS	APR. 4/16	KA
2	REVISED AS PER COMMENTS	MAR. 24/16	KA
1	ISSUED FOR CLIENT REVIEW	MAR. 24/16	KA

REVISIONS

ONE RISER DESIGNS
20 RIVERMEDE ROAD, UNIT 101
CONCORD, ONTARIO, L4K 5N3
PHONE: (905) 669-2111
FAX: 1 (866) 602-1163
WWW.ONERISER.CA

Client: TREASURE HILL

Project: VILLALAGO RESIDENCES INC.

Sheet Title: SITEPLAN

Drawn By:	NL	Checked By:	
Project No:	16-33	Page:	A1.1
Scale:	1:400		

DRAFT FOR DISCUSSION ONLY

APPENDIX B. STORM SEWER DESIGN SHEETS

Storm Sewer Design Sheets
(2 Sheets)

APPENDIX C. SWM BACKGROUND INFORMATION

Table C.1: SWM Pond 4 Drainage Revision Impact Assessment (1 Sheet)

Table C.2: SWM Pond 4 Permanent Pool Impact Assessment

Table C.3: SWM Pond 4 Quantity Control Impact Assessment (1 Sheet)

Table C.4: Excerpts from "Tormina Homes – Gates of Bolton – Phase III & IV – Stormwater Management Report", prepared by Aquafor Beech in March 1998. (12 Sheets)

Table C.1: SWM Pond 4 Drainage Revision Impact Assessment (1 Sheet)

Table C.1: SWM Pond 4 - Drainage Revision Impact Assessment

Project No.: 16984
Date: 22-Mar-17
Prepared by: Doug Campbell

Existing Drainage Aquafor Beech, 1994				Proposed Drainage RAND, 2017		
Area (Ha)	Runoff Coefficent (C)	AxC		Area (Ha)	Runoff Coefficent (C)	AxC
3.7	0.55	2.04		3.7	0.55	2.04
16.6	0.55	9.13		16.6	0.55	9.13
3.4	0.55	1.87		3.4	0.55	1.87
7.5	0.55	4.13		7.5	0.55	4.13
10.13	0.55	5.57		10.13	0.55	5.57
3.6	0.55	1.98		3.6	0.55	1.98
17.8	0.55	9.79		17.8	0.55	9.79
3.16	**0.55**	**1.74**	**Villalago Development**	**3.16**	**0.75**	**2.37**
12.91	0.55	7.10		12.91	0.55	7.10
21.4	0.2	4.28		21.4	0.2	4.28
100.2	**0.475**	**47.62**	**Total**	**100.2**	**0.482**	**48.25**

Existing SWM Pond 4 Summary		
Drainage Area	100.2	ha
Imperviousness	39.3	%
Impervious Area	39.40	ha

Villalago Development Summary		
Aquafor Beech, 1994		
Drainage Area	3.16	ha
Imperviousness	50.0	%
Impervious Area	1.58	ha
RAND Engineering, 2017		
Drainage Area	3.16	ha
Imperviousness	78.6	%
Impervious Area	2.48	ha

Revised SWM Pond 4 Summary		
Drainage Area	100.2	ha
Imperviousness	40.2	%
Impervious Area	40.30	ha

Increase in imprevious area: 0.90 ha

Percent increase in total impervious area:

2.3%

Notes:
1. Imperviousness calculated using I = (C-0.2)/0.7 Where I = Imperviousness (%) and C = Runoff coefficent
2. SWM Pond 4 drainage area obtained from "Tormina Homes - Gates of Bolton - Phase III & IV - Stormwater Management Rpoert", prepared by Aquafor Beech in March 1998.

Table C.2: SWM Pond 4 Permanent Pool Impact Assessment
Table C.3: SWM Pond 4 Quantity Control Impact Assessment (1 Sheet)

Table C.2: Summary of
Permanent Pool Impact Assessment

Drainage Area	Minimum Required Volume[a] (m^3)	Existing Volume[b] (m^3)	Surplus Volume (m^3)
Existing	11,103	19,446	**8,344**
Proposed	11,304	19,446	**8,142**

Notes:
a - Minimum required volume as per Table 3.2 in the MOE Stormwater Management and Planning Design Manual (2003).
b - Existing permanent pool volume deliniated using the pond contours provided in the 1998 SWM Report prepared by Aquafor Beech.

Table C.3: SWM Pond 4 Quantity Control Impact Assessment

Design	Quantity Control Volume (m^3)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Existing Capacity[a]	13,240	16,600	18,760	21,500	23,420	25,460
Existing Model[b]	12,830	16,190	18,260	20,910	22,920	24,920
Proposed Model[c]	12,890	16,250	18,330	20,990	23,030	25,000
Net Increase	**60**	**60**	**70**	**80**	**110**	**80**

Notes:
a - Existing pond capacity obtained from stage storage curve within the 1998 SWM Report prepared by Aquafor Beech.
b - Maxiumum storage used in the OTTHYMO model included within the 1998 SWM Report prepared by Aquafor Beech.

Table C.4: Excerpts from *"Tormina Homes – Gates of Bolton – Phase III & IV – Stormwater Management Report",* prepared by Aquafor Beech in March 1998. (12 Sheets)

STORMWATER MANAGEMENT REPORT

GATES OF BOLTON - PHASE III & PHASE IV
DRAFT PLAN 21T-96004
TOWN OF CALEDON

M 1306

Report Prepared for:

TORMINA HOMES
562 Chrislea Road
WOODBRIDGE, Ontario
L4L 8K9

Prepared by:

AQUAFOR BEECH LIMITED
2 Marconi Court #14
Bolton, Ontario
L7E 1E5

March 1998 (R0)

Aquafor Reference: 67777

TABLE OF CONTENTS

QUEENSGATE BLVD

5 SIDEROAD TO BE CLOSED

SOUTHBURY MANOR

FUTURE SCHOOL

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TEMPORARY ACCESS ROAD

BLOCK 209 PARK

TANZINI DRIVE

PHASE TWO

EDGAR STREET

BLK 160 PARKETTE

ROYALTON DRIVE

PHASE ONE

HANTON CRES.

McCREARY TRAIL

SHEARDOWN TRAIL

RUSTIC TRAIL

ALDWOODS TRAIL

LADY GODIVA DRIVE

LANDSBRIDGE STREET

JAMESRIDGE STREET

PAWAN CRESCENT

STREET "A"

STREET "B"

STREET "C"

STREET "D"

EXISTING RESIDENTIAL

LIMITS OF PHASE 3 CONSTRUCTION (ROAD WORKS ONLY)

LIMITS OF PHASE 4 CONSTRUCTION

CANADIAN PACIFIC RAILWAY

EXTERNAL STORM DRAINAGE AREAS

GENERAL NOTES:

1. STORM SEWERS, SERVICES, AND APPURTENANCES, ROADWAYS, SIDEWALKS, WALKWAYS, STREETLIGHTS, ETC. SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE TOWN OF CALEDON
2. THE STANDARD SPECIFICATIONS AND DRAWINGS OF THE TOWN OF CALEDON AND THE REGION OF PEEL SHALL BE APPLICABLE TO ALL WORKS UNDER THEIR RESPECTIVE JURISDICTION. IN THE EVENT THAT THE STANDARD SPECIFICATIONS AND DRAWINGS OF THE TOWN OF CALEDON OR THE REGION OF PEEL DO NOT COVER A PARTICULAR ITEM SHOWN OR IMPLIED ON THE PROJECT DRAWINGS TO BE CONSTRUCTED AS PART OF THE WORKS THE STANDARD SPECIFICATIONS AND DRAWINGS OF THE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS SHALL APPLY.

STORM SEWERS

1. STORM SEWERS SHALL BE CONCRETE PIPED. PIPE SMALLER THAN 450mm DIA. SHALL BE CSA-A-231-M2R CONCRETE PIPE 450mm AND LARGER SHALL BE CSA-A-257-2 WITH RUBBER GASKETS CONFORMING TO CSA-A-257-S.
2. SEWER BEDDING SHALL BE AS PER OPSD-802.04, (CLASS B)
3. ALL TRENCHES ARE TO BACKFILLED WITH NATIVE MATERIAL AND COMPACTED TO AT LEAST 95% STD. PROCTOR DENSITY.
4. CATCHBASINS
   -FRAMES AND COVERS TO BE PER OPSD 400.02
   -SINGLE CATCHBASIN LEADS TO BE 250mm DIA.
   -DOUBLE CATCHBASIN LEADS SHALL BE 300mm DIA.
   -ALL CATCHBASINS SHALL HAVE SUMPS.
5. ALL MANHOLES AS PER ONTARIO PROVINCIAL STANDARDS. (SEE SEE CONSTRUCTION DETAIL DWGS. FOR LIST OF STD. DRAWINGS)

LEGEND

- DOUBLE CATCHBASIN
- SINGLE CATCHBASIN
- STORM MANHOLE
- SANITARY MANHOLE
- VALVE & BOX
- HYDRANT & VALVE
- PLUG & BLOW OFF

TOWN OF CALEDON

APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____

APPROVED BY: _____

J.P. HOOK, P.ENG.
Director of Engineering

No.	By	DATE	Revison	Chk'd
2	CRP	MAR 12/98	SECOND SUBMISSION	BB
1	BB	JAN 1998	FIRST SUBMISSION	

Client:

934169 ONTARIO LIMITED
GATES OF BOLTON PHASE 4

Municipality:

TOWN OF CALEDON

PART OF WEST HALF
LOT 5, CONCESSION 7
(Former Township of Albion)
TOWN OF CALEDON
REGION OF PEEL
DRAFT PLAN 21T-96004

Aquafor Beech Limited

2 MARCONI COURT, UNIT 14, BOLTON, ONTARIO L7E 1E5 (905) 857-5343

REGION FILE NO.: T-96004

FIGURE 2.2

STORM DRAINAGE AREA PLAN

File: 67777			
Drawn by: C.R.P.	Chk'd by:	Drawing No.	Sheet No.
Designed by: BB	Sheck by:	67777-A-1A	1A
Scale: 1 : 1000	Date: JAN. 1998		

3.0 STORMWATER MANAGEMENT

3.1 General

Stormwater management requirements for the subject site are outlined in the Master Drainage Plan Amendment for the Bolton South Hill Development Area (Aquafor Beech Limited, 1994). This site is situated in ***Area 3***, for which 1 central stormwater management facility is recommended for both water quantity and quality control (Pond 4). The Master Drainage Plan Amendment recommended that Pond 4 construction be staged or constructed to final configuration either prior to or in conjunction with future development in the upstream drainage area.

3.2 Major-Minor Drainage Systems

The minor system for the site is illustrated in Figure 2.2. The minor system consists of storm sewers ranging in size from 250mm to 1050mm in diameter, with grades varying from 0.50% to 4.80%. The minor system has been designed using the *Rational Method* to convey the 10-Year design flow without surcharge (Appendix A).

The major (overland) system consists of the road network and has been designed to convey excess runoff for flows up to the 100-Year return period design storm. The majority of the major system flows from the development will ultimately be conveyed via Landsbridge Street, Royalton Drive, and Waterbury Street which is located in the southeast corner of the Gates of Bolton (Phase I and Phase II) developments. The routed overland flow will then be conveyed via the box culvert under the Albion-Vaughan Road to the Pond 4 inlet channel and subsequently to Pond 4. Accordingly, the storm sewer system from Manhole 11 to the proposed box culvert

at the Albion-Vaughan Road has been designed to collect and convey the 100-Year design flow (see Figure 2.2).

The remaining undeveloped land within the Bolton South Hill Development Area (Area 3) will remain as unused agricultural fields until the final phases of development commence. Since the area upstream of the proposed development is already constructed, there will be no undeveloped lands draining to the site.

3.3 Drainage Outlet

The drainage outlet for runoff from the site will be Pond 4. The *minor* flows from the site will be conveyed via the storm sewer system and box culvert under the Albion-Vaughan Road and subsequently via an inlet channel to Pond 4. The *major* flows from the site will be conveyed via roadway to the box culvert under the Albion-Vaughan Road and subsequently via an inlet channel to Pond 4.

3.4 Runoff Control

Runoff control to address flood control and environmental design considerations will be provided by Pond 4. Consistent with the Master Drainage Plan Amendment, *Stage 3* construction of Pond 4 will be undertaken in conjunction with the Gates of Bolton (Phase III & Phase IV) subdivision.

The *Stage 3* pond configuration is shown in Figure 3.1 and provides water management requirements for Tormina Homes Gates of Bolton (Phase III & Phase IV), Ritchie Brothers subdivision, and Tanzini development. The previous *Stage 2* pond provided water management for Gates of Bolton (Phase II), South Hill Village, and Gates of Bolton (Phase I). A summary of the operational characteristics for the *Stage 3* pond is provided in Table 3.1. The stage-

TABLE 3.1
POND 4 OPERATIONAL CHARACTERISTICS - STAGE 3
BOLTON SOUTH HILL AREA

Design Storm	Rainfall Depth (mm)	Summary of Peak Flows (cms)			Live Storage Used (cu. m)	Maximum Pool Elevation (m)	Freeboard Available (m)
		Pre-Development	Post-Development 1 hr Design Storm	Post-Development 6 hr Design Storm			
	1hr storm (6hr storm)	*1hr storm (6hr storm)*	*inflow (outflow)*	*inflow (outflow)*			
25 mm	25.0 (25.0)	1.31 (1.31)	3.89 (0.11)	3.89 (0.11)	9,150	236.48	1.11
2-year	24.4 (35.9)	1.26 (1.63)	3.74 (0.10)	3.24 (0.57)	13,150	236.66	0.93
5-year	33.6 (47.9)	2.23 (2.65)	6.38 (0.64)	5.20 (1.63)	16,580	236.80	0.79
10-year	39.8 (55.7)	2.98 (3.39)	8.32 (1.43)	6.67 (2.50)	18,710	236.89	0.70
25-year	47.5 (65.6)	3.99 (4.41)	10.24 (2.74)	8.58 (3.75)	21,430	237.00	0.59
50-year	53.3 (73.1)	4.81 (5.20)	10.66 (4.01)	9.73 (4.79)	23,460	237.08	0.51
100-year	59.0 (80.3)	5.64 (6.00)	12.61 (5.22)	11.01 (5.89)	25,510	237.16	0.43

Notes:

1. *Rainfall depths are based on IDF data from the Toronto Bloor Street Meteorology Station.*
2. *Pre-development peak flows are at the C.P.R. Line east of the Albion-Vaughan Road (i.e., downstream of proposed Pond 4) and as reported in the Bolton South Hill Development Area M.D.P. Amendment. These flow estimates do not include any routing effects through the existing farm ponds.*
3. *Maximum pool elevation is based upon the proposed grading concept for Pond 4 and 6 hr duration design storm.*
4. *Available freeboard represents the difference between the perimeter berm crest (assumed @ elevation 237.59 metres) and maximum pool elevation.*
5. *Pond 4 - Stage 3 is designed to control flows generated by the 25 mm, 2 year, 5 year, 10 year, 25 year, 50 year, and 100 year design storms. The limits of the watershed boundary are shown in Figure 1.1 and include Gates of Bolton (Phase I)(Tormina Homes), Gates of Bolton (Phase II)(Tormina Homes), South Hill Village (Senator Homes), Gates of Bolton (Phase III & IV)(Tormina Homes), Ritchie Brothers Subdivision, and Tanzini development.*

storage-discharge relationship is shown in Table 3.2. A schematic for the hydrologic model is provided in Figure 3.2. Supporting INTERHYMO documentation is attached in Appendix A.

Stage 1 construction of Pond 4 was to include the following:

- inlet channel construction to final configuration;
- outlet structure construction to final configuration;
- excavation of the *Stage 1* pond to the lines and grades required to meet target pre development release rates as outlined in Table 3.1;
- access road construction to at least the northeast corner of the facility where topsoil and excavated material will be stockpiled; and
- temporary stabilization of all areas affected by construction activities.

Stage 2 construction of Pond 4 was to include the following:

- excavation of the *Stage 2* pond to the lines and grades required to meet target pre development release rates as outlined in Table 3.1; and
- temporary stabilization of all areas affected by construction activities.

Stage 3 construction of Pond 4 will consist of the following:

- completion of outstanding *Stage 1* and *Stage 2* pond construction works;
- excavation of the pond to final configuration (see Figure 3.1);
- final site grading;
- stabilization of all areas affected by construction activities; and

storage-discharge relationship is shown in Table 3.2. A schematic for the hydrologic model is provided in Figure 3.2. Supporting INTERHYMO documentation is attached in Appendix A.

Stage 1 construction of Pond 4 was to include the following:

- inlet channel construction to final configuration;
- outlet structure construction to final configuration;
- excavation of the *Stage 1* pond to the lines and grades required to meet target pre development release rates as outlined in Table 3.1;
- access road construction to at least the northeast corner of the facility where topsoil and excavated material will be stockpiled; and
- temporary stabilization of all areas affected by construction activities.

Stage 2 construction of Pond 4 was to include the following:

- excavation of the *Stage 2* pond to the lines and grades required to meet target pre development release rates as outlined in Table 3.1; and
- temporary stabilization of all areas affected by construction activities.

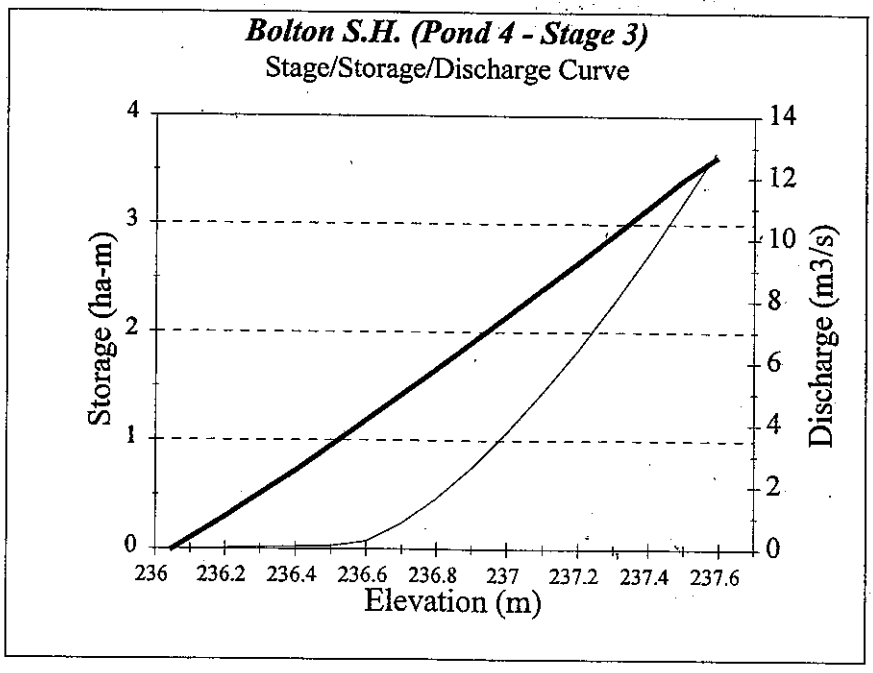
Stage 3 construction of Pond 4 will consist of the following:

- completion of outstanding *Stage 1* and *Stage 2* pond construction works;
- excavation of the pond to final configuration (see Figure 3.1);
- final site grading;
- stabilization of all areas affected by construction activities; and

TABLE 3.2
STAGE-STORAGE-DISCHARGE RELATIONSHIP
POND 4 - STAGE 3

Invert of Extended Outlet Control Structure (Orifice) (m)	236.05
Obvert of Extended Outlet Control Structure (Orifice) (m)	236.35
Elevation of Centre of Orifice (m)	236.2
Invert of Overflow Spillway (m)	236.55
Diameter of Orifice Plate Opening (m)	0.3
Basewidth of Spillway (m)	7
Sideslopes on Spillway (h:v)	4

Stage (m)	*Storage (ha-m)*	*Head on Orifice Centre (m)*	*Q Orifice (cms)*	*Head on Weir (m)*	*Q Weir (cms)*	*Q Total (cms)*
236.05	0.00	0.00	0.00	0.00	0.00	0.00
236.20	0.30	0.15	0.04	0.00	0.00	0.04
236.40	0.72	0.20	0.09	0.00	0.00	0.09
236.50	0.95	0.30	0.11	0.00	0.00	0.11
236.60	1.18	0.40	0.12	0.05	0.13	0.26
236.70	1.42	0.50	0.14	0.15	0.69	0.83
236.80	1.66	0.60	0.15	0.25	1.49	1.64
236.90	1.90	0.70	0.16	0.35	2.46	2.63
237.00	2.15	0.80	0.17	0.45	3.59	3.77
237.10	2.39	0.90	0.18	0.55	4.85	5.04
237.20	2.65	1.00	0.19	0.65	6.24	6.43
237.30	2.90	1.10	0.20	0.75	7.73	7.93
237.40	3.16	1.20	0.21	0.85	9.33	9.54
237.50	3.42	1.30	0.22	0.95	11.02	11.24
237.59	3.62	1.39	0.23	1.04	12.62	12.85



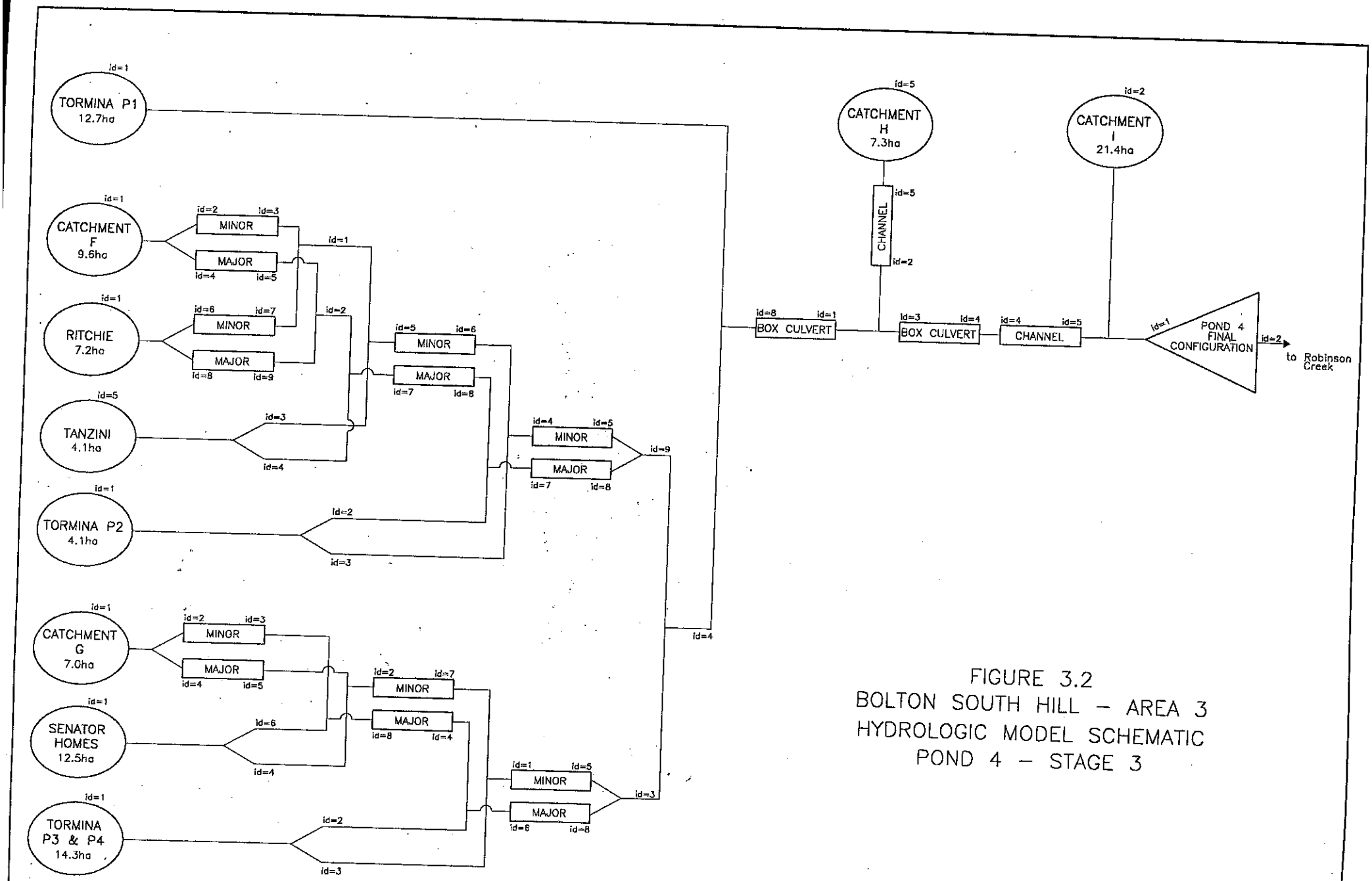


FIGURE 3.2
BOLTON SOUTH HILL – AREA 3
HYDROLOGIC MODEL SCHEMATIC
POND 4 – STAGE 3

- installation of wetland plantings and landscaping per Drawing 6567-A-8 (see Figure 3.3) during the planting season after grading of the stormwater management facility to final configuration.

3.5 Site Best Management Practices

The following *Best Management Practices* will be implemented for the subject site:

- roof down spouts will be directed to pervious lawn areas to promote infiltration;
- where applicable, grassed swales will be constructed along the rear lot lines; and
- an *Erosion and Sediment Control Plan* will be implemented to minimize release of sediment from the site during construction activities (see Section 3.7).

3.6 Storm Sewer Capacity Analysis

An analysis of storm sewer capacity was completed to identify any locations where the potential for surcharging may exist. The 100-year flow in the storm sewer system was determined by calculating the 100-year surface flow and the storm sewer inlet capacities. The 100-year surface flow was calculated with the Rational Method. Storm sewer inlet capacities were calculated using Ministry of Transportation Ontario (MTO) drainage charts consistent with the proposed type of catch basin inlets and sag depths. The pertinent MTO drainage charts can be found in Appendix B. The inlet capacities were subtracted from the surface flow to obtain a "net" surface flow available for discharge to the storm sewer inlets at subsequent downstream locations. The cumulative inlet capacity was carried down the system and checked against the sewer pipe capacity at each location. In this manner, the *surplus* pipe capacity was calculated. Pipes for which a negative *surplus* capacity was calculated were considered to have the potential for

surcharging. In such cases where the potential for surcharging was established, flow restrictors were recommended as a safety measure.

A flow restrictor is proposed for catchbasin 3 (CB3) located in the park northwest of Street "A". The recommended flow restrictor is an IPEX Type "A" inlet control device (ICD) (or equivalent) which limits the flow to 22 Litres/sec at the assumed operating head. The ICD is a tapered plug which is inserted in the lead from the catchbasin. This will ensure that the capacity of the downstream pipes will not be exceeded for the 100-year event. As shown in Table 3.3, the storm sewers will not surcharge during the 100-year event and, therefore, there is no risk of basement flooding to houses within the development.

3.7 Erosion and Sediment Control Plan

Outlined in Figure 3.4 is the *Erosion and Sediment Control Plan* for the site. Details are provided on this drawing of the following:

- locations of siltation fencing;
- access points for construction equipment (primary and secondary);
- measures to minimize construction equipment from tracking mud off-site;
- proposed topsoil stockpile location;
- siltation control measures for rear lot catchbasins; and
- siltation control measures for catchbasins within roadways.

APPENDIX D. SWMHYMO MODELLING FILES

Table D.1: SWM Pond 4 OTTHYMO vs. SWMHYMO Assessment (1 Sheet)

Table D.2: Input Data & Detailed Output of Aquafor Beech OTTHYMO Simulation Model

Table D.3: Input Data & Detailed Output of Existing Conditions SWMHYMO Simulation Model

Table D.4: Input Data & Detailed Output of Proposed Conditions SWMHYMO Simulation Model

(CD-ROM)

Table D.1: SWM Pond 4 OTTHYMO vs. SWMHYMO Assessment

OTTHYMO vs. SWMHYMO

Model	Quantity Control Volume (m^3)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
OTTHYMO	13,150	16,580	18,710	21,430	23,460	25,510
SWMHYMO	12,830	16,190	18,260	20,910	22,920	24,920
Percent Difference (%)	**-2.46**	**-2.38**	**-2.43**	**-2.46**	**-2.33**	**-2.34**

Notes:

The table above highlights the percent difference in the maximum storage used between the existing conditions OTTHYMO and SWMHYMO models during 6 hour design storms. The difference has been applied to the propsed SWMHYMO results shown in table B.2.

APPENDIX E. PRELIMINARY SANITARY SERVICING DESIGN CALCULATIONS

PROJECT: **VILLALAGO RESIDENCES INC.**
PROJECT #: **16984**

PRELIMINARY WASTEWATER DESIGN

Proposed Development:

Area =	3.16	ha
Townhouses =	109	units
Semi-Detached =	4	units
Single Detached =	1	unit

Assumption:
For calculation purposes, area is assumed to consist entirely of townhouses.

Density	Pop./Hectare	Pop.
Townhouses	175	553

Unit Sewage Flow = 302.8 L/cap-d

Q_{daily} = 167.45 m^3/d = 0.0019 m^3/s

Peak Dry Weather Flow using Harmon's Peaking Factor Formula, $M = 1 + 14 / (4 + P^{0.5})$
where P = population equivalent in '000's

M = 3.95

Q_{peak} = 661.42 m^3/d = 0.0077 m^3/s

Region specified flow for population < 1000 is 0.013 m^3/s

Since calculated Qpeak < Region specified flow,
Q for proposed development is **0.013 m^3/s**

APPENDIX F. PRELIMINARY WATER SERVICING DESIGN CALCULATIONS

PROJECT: **VILLALAGO RESIDENCES INC.**
PROJECT #: **16984**

PRELIMINARY WATER DEMAND DESIGN

Proposed Development:

Area =	3.16	ha
Townhouses =	109	units
Semi-Detached =	4	unit
Single Detached =	1	unit

Assumption:
For calculation purposes, area is assumed to consist entirely of townhouses.

Density	Pop./Hectare	Pop.
Townhouses	175	553

Typical Water Demand Criteria

Population Type	Unit	Avg. Consumption Rate	Max Day Factor	Peak Hour Factor
Residential	L/cap-d	280	2.0	3.0

Q_{daily} =	154.84 m^3/d	=	0.0018	m^3/s
$Q_{Max\ Day}$ =	309.68 m^3/d	=	0.0036	m^3/s
Q_{Peak} =	464.52 m^3/d	=	0.0054	m^3/s

The typical peak water demand flow rate is **0.0054 m^3/s**

Potential Short-Term Water Demand Criteria

Population Type	Unit	Avg. Consumption Rate	Max Day Factor	Peak Hour Factor
Residential	L/cap-d	409	2.0	3.0

Q_{daily} =	226.18 m^3/d	=	0.0026	m^3/s
$Q_{Max\ Day}$ =	452.35 m^3/d	=	0.0052	m^3/s
Q_{Peak} =	678.53 m^3/d	=	0.0079	m^3/s

The potential short-term water demand flow rate is **0.0079 m^3/s**

Fire Flow Demand

Fire Protection Demand	150 L/s	=	0.1500 m^3/s
$Q_{Max\ Day}$ =			0.0052 m^3/s
Total Fire Demand			**0.1552 m^3/s**