Tribute (Brookdale) Limited

Tribute 1101A, 1105 and 1163 Kingston Road

Stormwater Management Report (Brookdale)

January 24, 2025   Second Submission

wsp

Tribute 1101A, 1105 and 1163 Kingston Road 1101A, 1105 and 1163 Kingston Road Stormwater Management Report (Brookdale)

Tribute (Brookdale) Limited

Official Plan Amendment (OPA), and Zoning By-Law
Amendment (ZBA)
Second Submission

Project No.: 221-12931-00
Date: January 24, 2025

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FORUTH ISSUE

Prepared by	Reviewed by	Approved by

Tribute 1101A, 1105 and 1163 Kingston Road
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Tribute (Brookdale) Limited

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S i g n a t u r e s

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B   Stormwater Management Calculations

C   Hydrologic Model Output

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1 INTRODUCTION

1.1 Scope

WSP Canada Inc. (WSP) has been retained by Tribute (Brookdale) Limited (the 'Client') to prepare a stormwater management (SWM) report to support the Official Plan Amendment (OPA), and Zoning By-Law Amendment (ZBA) for the proposed development located north of Highway 401, west of Liverpool Road and east of Dixie Road in the City of Pickering in the Regional Municipality of Durham. This SWM report will examine the potential water balance, erosion, sediment control, water quality, and water quantity impacts of the proposed development and summarizes how each parameter will be addressed in accordance with the City of Pickering Stormwater Management Design Guidelines dated July 2019 and the Toronto and Region Conservation (TRCA) Stormwater Management Criteria dated August 2012.

The site has an area of 7.75 ha and shall be developed in five separate phases. As such, this report has been organized into five independent sections discussing the design approach and requirements for each of the phases separately. A separate section discusses all phases and the total site area.

1.2 Site Location

The Site is located at 1101A, 1105 and 1163 Kingston Road, bounded by Kingston Road to the north, Highway 401 to the south, Dixie Road to the west and undeveloped lands and Walnut Lane to the east. The Site is located within Toronto and Region Conservation Authority (TRCA) Lake Ontario Waterfront Watershed area and may be subject to TRCA SWM guidelines and requirements. The location of the proposed development is shown in **Figure 1-1**.
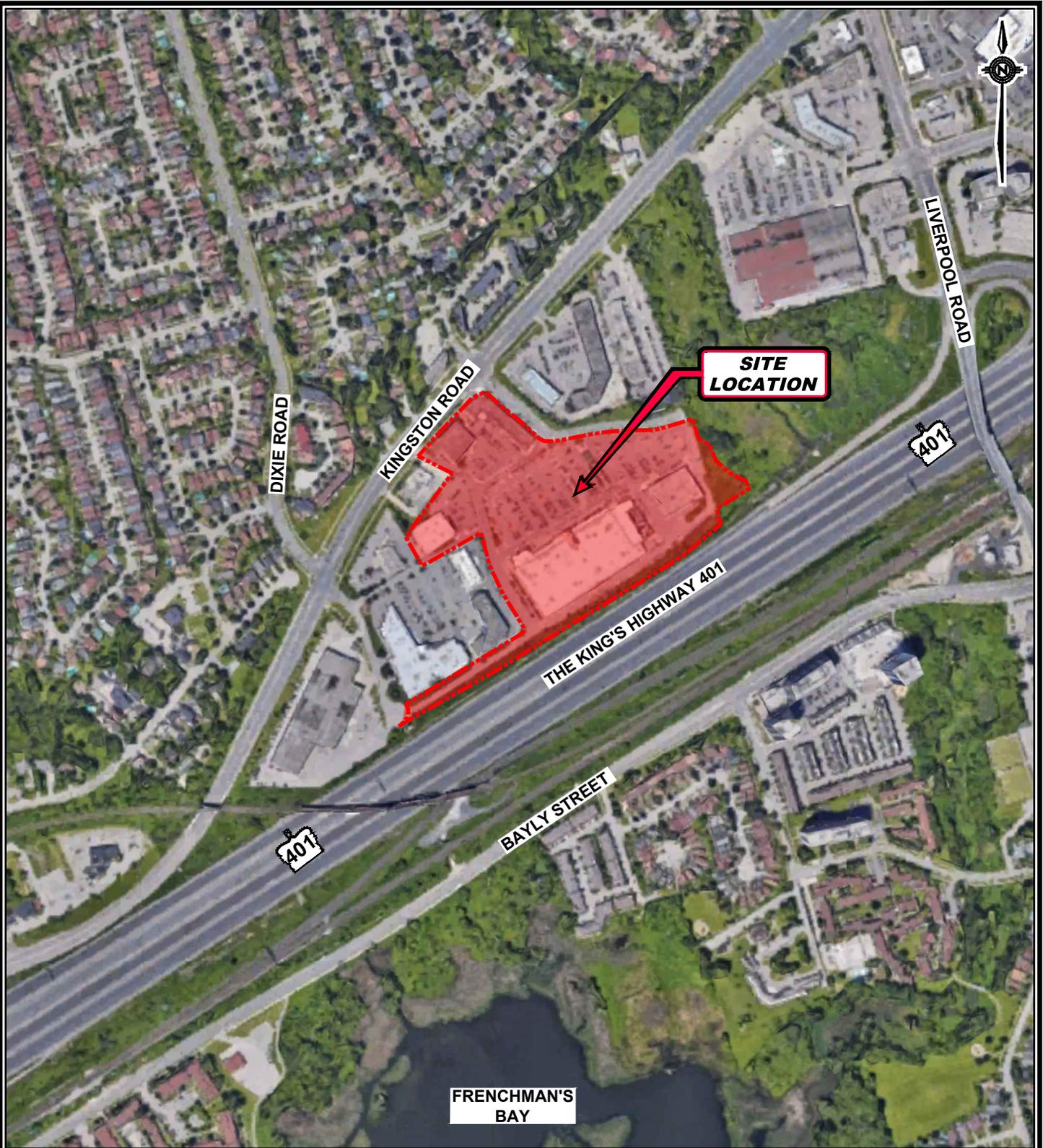
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@2023 Google - Map Canada

SITE LOCATION

DIXIE ROAD

KINGSTON ROAD

LIVERPOOL ROAD

THE KING'S HIGHWAY 401

401

401

BAYLY STREET

FRENCHMAN'S BAY

CLIENT			
TRIBUTE (BROOKDALE) LIMITED			

TITLE	
1105 - 1163 KINGSTON ROAD **CITY OF PICKERING** **SITE LOCATION**	

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Date	**Proj. No.**	
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Scale	**Figure No.**	**Gr.No.**
N.T.S.	**1.1**	00

1.3 Stormwater Management Plan Objectives

The objectives of the stormwater management plan are as follows:

— Determine site specific stormwater management requirements to ensure that the proposals are in conformance with the City of Pickering Stormwater Management Design Guidelines and TRCA Stormwater Management Criteria.

— Evaluate various stormwater management practices that meet the requirements of the City and recommend a preferred strategy.

— Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and preliminary sizing of the proposed stormwater management facilities.

1.4 Design Criteria

The City of Pickering issued the Stormwater Management Design Guidelines in July 2019 to provide direction on the management of rainfall and runoff inside the City's Jurisdiction. Similarly, the TRCA issued the Stormwater Management Criteria in August 2012 to provide guidance regarding the planning and design of stormwater management facilities located within their jurisdiction.

As each of the development phases has an area of less than 5 ha, they are subject to the same design criteria and general requirements. A summary of the stormwater management criteria applicable to each of the development phases are as follows:

1.4.1 Erosion Control

For areas that are less than 5 ha, the City's guideline requires minimum erosion control requirements as follows:

— Extended detention of the 4-hour, 25 mm Chicago distribution rainfall event for a minimum of 24 hours, or

— Runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5 mm of rainfall depth across all impervious surfaces.

1.4.2 Water Balance

The Site is located within a Low Volume Groundwater Recharge Area (LGRA). Due to its location, the City's and TRCA's guidelines do not explicitly state any requirements for water balance. Based on consultation with the City's review engineer, retention of the

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5 mm rainfall through application of green roofs and infiltration (with 72 hour drawdown time) is targeted for the site to satisfy the water balance criterion.

1.4.3   Water Quality

The City's and TRCA's guidelines require the development to provide water quality measures that are designed to provide Enhanced (Level 1) level of protection as defined in the 2003 Stormwater Management Planning and Design Manual prepared by the Ontario Ministry of the Environment, now Ministry of the Environment, Conservation and Parks (MECP).

1.4.4   Water Quantity

As mentioned previously, the Site is located within the Lake Ontario Waterfront watershed however runoff from each of the development blocks is discharged to the municipal storm sewer and as such subject to the City of Pickering design requirements.

Based on consultation with the City's review engineer on June 28th 2023, each development block is required to control all flows from the 2-year to 100-year to predevelopment levels with a maximum runoff coefficient of 0.5. If the background documents show there are existing SWM controls for the development blocks, the lesser of the two flow rates shall be the governing allowable flow rate for each of the development blocks.

1.5 Rainfall Information

The rainfall intensity for the site was calculated using the following equation as stated in Section 6.2.4 of the City of Pickering Stormwater Management Design Guidelines:

$$I = \frac{A}{(t_c + B)^C}$$

Where:

I = Rainfall intensity in mm/hr

T_c = Time of concentration in minutes

A, B and C = Constant parameters as stated in "Table 12 – Pickering IDF Parameters: in the City of Pickering Stormwater Management Design Guidelines".

The parameters are summarized in **Table 1-1**.

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Table 1-1:   Intensity Duration Frequency (I.D.F.) Parameters used by the City of Pickering

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863

Source: City of Pickering Stormwater Management Design Guidelines (July 2019)

1.6 Allowable Flow Rate

The development in the existing conditions has a total area of 7.75 ha with 7.54 draining to Frenchman's Bay and 0.21 ha draining to Pine Creek. The proposed development has a total area of 7.75 ha and includes two main drainage areas with 7.62 ha draining to Frenchman's Bay and 0.125 ha draining to Pine Creek via overland flow. The drainage area towards Pine Creek decreases in the proposed conditions and therefore SWM mitigation is not required. In this study, the SWM mitigations are proposed for the drainage area toward the Frenchman's Bay via the 900mm Culvert under the Go Transit and C.N.R tracks.

As noted in **Section 1.4.4**, the lesser of the City's quantity control criterion and the existing flows govern the allowable flow rate for the site.

Based on the City's quantity control criterion, all flows from the 2-year to 100-year storm events should be controlled to the existing levels, estimated with a maximum runoff coefficient of 0.50. As the City's minor storm system is sized to convey up to the 5-year event, the allowable flow for the site area of 7.54 ha in existing conditions to Frenchman's Bay shall be estimated based on the 5-year event. **Table 1-2** shows the estimated flows from the site for all storm events up to and including the 100-year event, calculated with a runoff coefficient of 0.5.

Table 1-2:   Allowable Flow Rate - City's Design Standards

Parameter	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Intensity (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.7
Runoff Coefficient	0.50	0.50	0.50	0.55	0.60	0.63
Flow* (m³/s)	812.9	**1114.1**	1320.8	1736.2	2119.9	2445.6

*Flow values are calculated using a site area of 7.54 ha and a runoff coefficient of 0.5 to Frenchman's Bay via 900mm Culvert under the Go Transit and C.N.R tracks.

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Upon review of the existing report, titled Stormwater Management Report - Proposed Commercial Development for Brookdale Centres Inc. by A.M. Candaras Associates Inc. issued in January 2015 (A.M., 2015), it is understood that flow from the entire Amerlea Industrial 5 Development (13.19 ha), which includes the site boundary, discharges south through a 1.83 m x 1.83 m box culvert under Highway 401. Discharge from this box culvert is directed to a 900 mm culvert which runs under the GO Transit and CNR Tracks. Therefore, flow from the entire Amerlea Industrial 5 Development is restricted to the capacity of the 900 mm culvert which is 1.61 m^3/s. A copy of A.M, 2015 is provided under **Appendix A**. Existing conditions of the site is shown in **Figure 1-2**.
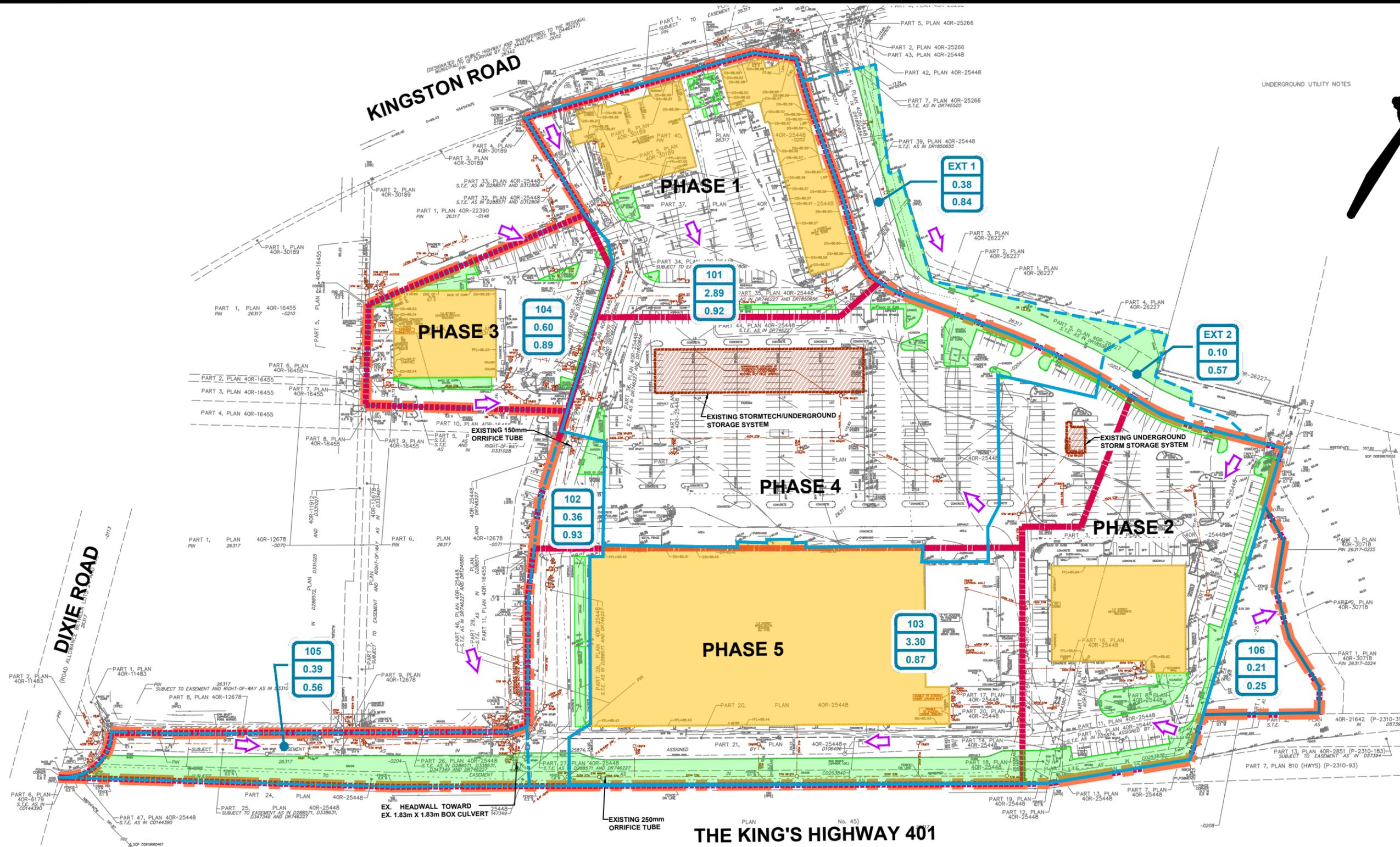
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Project No. 221-12931-00
Tribute (Brookdale) Limited

KINGSTON ROAD

CITY OF PICKERING

PHASE 1

EXT 1
0.38
0.84

101
2.89
0.92

104
0.60
0.89

PHASE 3

EXT 2
0.10
0.57

EXISTING STORMTECH/UNDERGROUND
STORAGE SYSTEM

EXISTING UNDERGROUND
STORM STORAGE SYSTEM

EXISTING 150mm
ORRIFICE TUBE

PHASE 4

102
0.36
0.93

PHASE 2

103
3.30
0.87

DIXIE ROAD

105
0.39
0.56

PHASE 5

106
0.21
0.25

EX. HEADWALL TOWARD
EX. 1.83m X 1.83m BOX CULVERT

EXISTING 250mm
ORRIFICE TUBE

THE KING'S HIGHWAY 401

LEGEND

- ▬▬▬ PROJECT BOUNDARY
- ▬▬▬ SUB-CATCHMENT BOUNDARY
- ▬ ▬ ▬ EXTERNAL SUB-CATCHMENT BOUNDARY
- ▬ ▬ ▬ UNCONTROLLED SUB-CATCHMENT BOUNDARY
- ▪▪▪▪▪ FUTURE PHASE BOUNDARY

211
0.49
0.52

- SUB-CATCHMENT ID
- DRAINAGE AREA (ha)
- AVERAGE RUNOFF COEFFICIENT

- ▨ EXISTING ROOF AREA
- ▨ EXISTING LANDSCAPE AREA
- ▨ EXISTING UNDERGROUND STORM STORAGE SYSTEM
- ⇨ OVERLAND FLOW ROUTE

0 10 20 30 40 50   100m

CLIENT	**TRIBUTE (BROOKDALE) LIMITED**
TITLE	**1105 - 1163 KINGSTON ROAD** **CITY OF PICKERING** **ALL PHASES** **EXISTING CONDITIONS**

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According to A.M., 2015, under the existing conditions, runoff storage for a portion of the site (7.03 ha), identified as catchments 101,102 ,103, EXT 1 and EXT 2 is provided via surface ponding, pipe storage, rooftop storage and flow controls and two underground storage systems. Flow control to the 900 mm culvert is provided by two orifice tubes, 150 mm and 250 mm at existing MH10 and MH18, respectively. Based on the limited information provided in A.M., 2015, flow from the entire site, catchments 101 to 105, EXT 1 and EXT 2, is estimated and summarized in **Table 1-3**. The current proposed development contains additional area including catchment 104 and 105, the 2-year flows from these catchments are added to the allowable flow rate according to A.M., 2015 100-year flow equation. In post development conditions, external catchment EXT 1 and EXT 2 will drain toward pine creek through Walnut Lane. Detailed calculations are provided in **Appendix B**.

Table 1-3: Allowable Flow Rate - Existing SWM System

Catchment ID	Area (ha)	Runoff Coefficient (2-Yr)	100-Year Flow (L/s)*	2-Year Flow (L/s)
101	2.89	0.92	-	
102	0.36	0.93	-	
103	3.30	0.87	-	
EXT 1	0.38	0.84	-	
EXT 2	0.10	0.57	-	
Sum of Above	**7.03**	**0.88**	**550.0**	
104	0.60	0.89		**68.3**
105	0.39	0.56		**44.1**
Total	**8.02**	**0.87**	**662.6**	

*Based on analysis provided in A.M., 2015 to Frenchman's Bay via 900mm Culvert under the Go Transit and C.N.R tracks

Therefore, based on the existing SWM system in place, the allowable flow rate for the site is estimated at 662.6 L/s. As the flow rate set by City criteria is 1114.1L/s and the flow rate set by existing SWM systems is 662.6 L/s, the governing allowable flow rate for the site is 662.6 L/s as it is more conservative. Detailed calculations of the allowable flow rate are provided under **Appendix B**. The allowable flow rate for all development phases was pro-rated based on phase boundaries and the SWM system under the proposed conditions. In the proposed conditions, an area of 0.70 ha in Phase 5 will flow uncontrolled, the allowable release rate for the controlled portion of the site is pro-rated to account for the uncontrolled flow. A summary of the pro-rated allowable flow rate for each phase is presented in **Table 1-4**.

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Tribute (Brookdale) Limited

Table 1-4:   Allowable Flow Rate for the Site – Pro-rated for all Phases

Phase	Control	Area (ha)	Allowable Flow Rate (L/s)
1	Controlled	1.13	65.4
2A	Controlled	1.12	64.5
2B	Controlled	0.15	8.7
3	Controlled	0.60	34.5
4	Controlled	2.16	124.9
5	Controlled	1.75	101.8
Total Controlled	**-**	**6.92**	**399.8**
5	Uncontrolled	**0.70**	**262.8**
Total	**-**	**7.62**	**662.6**

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2   PHASE 1 DEVELOPMENT BLOCK

2.1   Phase 1 Pre-Development Condition

Phase 1 has an area of approximately 1.13 ha. Under existing conditions, the Phase 1 area consists of two impervious roofs, at grade parking areas and some landscaping. Runoff from the Phase 1 area is collected via catch basins and internal storm sewers and directed to MH10 where a 150 mm orifice tube controls discharge from the area. Runoff storage for the Phase 1 boundary consists of surface ponding, pipe storage, rooftop storage and an underground storage tank that is located south of the Phase 1 boundary (in Phase 4 area). According to A.M., 2015, it is understood that the Phase 1 boundary does not directly discharge to the underground storage located in Phase 4 but runoff backflows into the underground storage after being restricted by the 150 mm orifice tube.

There is an external area of 0.38 ha (EXT 1) with a runoff coefficient of 0.84 located east of Phase 1, runoff from which flows to Phase 1. EXT 1 is part of a separate development application for Walnut Lane and as such flows from this area shall be controlled by the storm servicing proposed for Walnut Lane. The site plan application for Walnut Lane has been submitted by WSP on August 10, 2023, under a separate cover. The existing condition of Phase 1 is shown in **Figure 1-2**.

2.2   Phase 1 Post Development Condition

2.2.1   General

Under the post development conditions, Phase 1 consists of catchment 200 and catchment 201. Catchment 200, with an area of 0.93 ha shall be developed into building structures that are connected via the underground garage, at-grade impervious areas and landscaping. Catchment 201, with an area of 0.20 ha shall be constructed into a public right-of-way (ROW). An area breakdown for the proposed development in Phase 1 is provided below in **Table 2-1**. Detailed calculations can be found in **Appendix B.**

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Table 2-1:   Phase 1 Proposed Land-Use

Land-Use	Area (m²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping/Park	699	0.25	7%
Intensive Green Roof	900	0.50	43%
Extensive Green Roof	2,151	0.50	43%
Impervious at Grade	4,316	0.95	100%
Impervious Roof	3,248	0.95	100%
Total	**11,315**	**0.79**	**79%**

Phase 1 shall be developed in the first stage of the development plan. During Phase 1 construction, the interim condition, Phases 2, 3, and 5 shall remain unchanged and continue to discharge at the existing rate. A portion of the superpipe that controls Phase 1 shall be built on the public ROW that is part of Phase 4. The 150 mm orifice tube located south of MH10 shall be left in place to control flow for the existing tank located in the Phase 4 area.

The entire Phase 1 will be serviced by one underground storm cistern in catchment 200 and a super pipe that runs from catchment 201 through catchment 208 which is part of Phase 4. Please refer to civil drawings for more details. Runoff from Phase 1 shall be collected via internal catch basins and storm sewers and directed to the Phase 1 cistern and super pipe.

Please refer to **Figure 2-1** for details of the post-development conditions and land-uses.
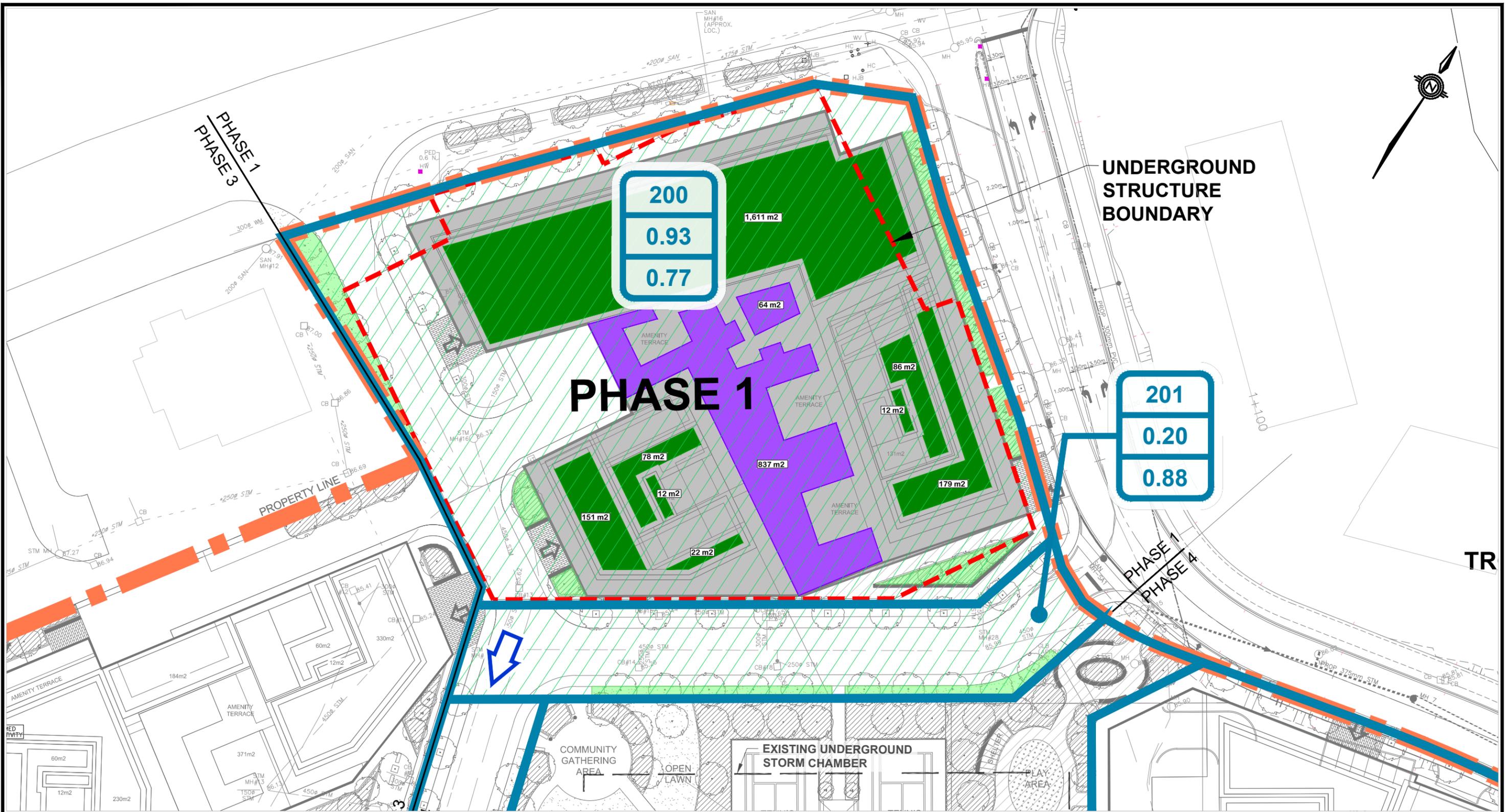
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Catchment data boxes:

200
0.93
0.77

201
0.20
0.88

PHASE 1

UNDERGROUND STRUCTURE BOUNDARY

Green roof area labels: 1,611 m2, 64 m2, 86 m2, 12 m2, 78 m2, 837 m2, 1?1 m2, 12 m2, 151 m2, 179 m2, 22 m2

AMENITY TERRACE

PHASE 1 / PHASE 3

PHASE 1 / PHASE 4

PROPERTY LINE

COMMUNITY GATHERING AREA

OPEN LAWN

EXISTING UNDERGROUND STORM CHAMBER

SHELTER

PLAY AREA

TR

LEGEND

- ▬ ▬ PROJECT BOUNDARY
- ▬▬ CATCHMENT BOUNDARY
- ····· UNCONTROLLED CATCHMENT BOUNDARY
- ▬ ▬ UNDERGROUND STRUCTURE BOUNDARY
- ⇨ OVERLAND FLOW ROUTE

211	— CATCHMENT ID
0.49	— DRAINAGE AREA (ha)
0.52	— AVERAGE RUNOFF COEFFICIENT

- PROPOSED LANDSCAPE AREA
- PHASE 1
- EXTENSIVE GREEN ROOF
- INTENSIVE GREEN ROOF
- IMPERVIOUS ROOF

Scale: 0 10 20 30 40 50m

CLIENT
TRIBUTE (BROOKDALE) LIMITED

TITLE
**1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
PHASE 1**

PROPOSED CONDITIONS

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Scale	AS SHOWN	Figure No.	2.1	Gr.No.

FIGURE 3.dwg Fig 2.1 PH 1 C:\Users\stlouism\DC\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-12931 - 1105-1163 Kingston Road\SWM\FIGURES\ Jan 15, 2025 - 9:47am

2.2.2 Erosion Control

As mentioned in **Section 1.4.1**, erosion control for Phase 1 (1.13 ha in total area) can be provided by retention of the first 5 mm of rainfall from each storm event. The volume shall be retained within the Phase 1 area. Further detail on retention of the 5 mm event is provided in **Section 2.2.3.** Temporary erosion and sediment control during construction shall be planned and carried out during the construction of Phase 1. A detailed Erosion and Sediment Control Plan (ESC) shall be provided under the Functional Servicing Report (FSR).

2.2.3 Water Balance

As noted in **Section 1.4.2**, retention of the 5 mm rainfall through green roof and infiltration shall be provided to satisfy the water balance criterion.

Table 2-2 summarizes the 5 mm water balance calculations for Phase 1 catchment 200. Roadways (catchment 201) are not required to meet water balance and are excluded from the analysis. As shown in the table, a total volume of 28.98 m^3 must be retained on site through infiltration or implementation of green roofs.

Table 2-2: Phase 1 Water Balance Calculation

Surface Type	Area (m²)	Initial Abstraction (m)	Volume Abstracted (m³)	5 mm Volume (m³)	Water Balance (WB) (m³)
Soft Landscaping/Park	503	0.005	2.51	2.51	0.00
Intensive Green Roof	900	0.005	4.50	4.50	0.00
Extensive Green Roof	2,151	0.005	10.76	10.76	0.00
Impervious at Grade	2,548	0.000	0.00	12.74	12.74
Impervious Roof	3,248	0.000	0.00	16.24	16.24
Total	**9,350**	**-**	**17.77**	**46.75**	28.98

Due to the limited space for infiltration and the limited roof space for excess green roof, it is assumed that the intensive green roof portions have a total initial abstraction of 40 mm. The soil depth of the intensive green roof is greater than 1m, therefore a 40mm abstraction is reasonable. This provides an additional water balance volume of 31.5 m^3 and results in a net surplus water balance of 2.5 m^3 for Phase 1. No infiltration trench is proposed for Phase 1 due to the extent of the underground parking lot. **Table 2-3** summarizes the additional water balance volume provided and the total net water balance for Phase 1. Detailed calculations of the water balance calculations can be found in **Appendix B.**

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Table 2-3:   Additional Water Balance Provided in Phase 1

Catchment ID	5mm WB Volume	Intensive Green Roof Area (m²)	Total Initial Abstraction (m)	Volume Abstracted by Intensive Green Roof (m³)*	Volume Abstracted by Infiltration Trench (m³)	Net Water Balance (m³)
200	28.98	900	0.04	31.5	-	-2.5

*This volume has been reduced by the 5mm water balance amount, thus, it does not double count the 5mm water balance volume

2.2.4   Water Quality

As mentioned in **Section 1.4.3**, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (TSS). An Imbrium Jellyfish filter is proposed to provide 80% TSS removal for runoff from the impervious areas including the roof within the Phase 1 boundary. As landscaped areas are free from sediment generating activities, runoff shall leave these areas effectively unchanged and clean.

Water quality for the ROW shall be addressed by an existing Oil Grit Separator (OGS) unit located in the Phase 5 boundary, providing 50% TSS removal for catchment 200, as filter units are not accepted for roadways. Further details will be provided during detailed design.

Details of the Jellyfish sizing and specifications shall be provided as part of the submission for Site Plan Application.

2.2.5   Water Quantity

As stated in **Section 1.6**, the post-development flows from the Phase 1 boundary shall be controlled to 65.4 L/s for all storms up to and including the 100-year storm event. The Phase 1 area is divided into two catchments of 200 and 201, as shown in **Figure 2-1**. Runoff from catchment 200 is directed to an underground cistern with an area of 260 m² and a height of 2 m. Runoff from catchment 201 is directed to a 60 m superpipe with a diameter of 975 mm. The superpipe also receives the controlled outflow from the cistern in catchment 200. The flow will be controlled by flow control devices such as pumps, weirs, orifice plates or a combination of these measures. The detailed design of the flow control devices will be provided in future submissions. For modelling purposes, a 75mm orifice plate has been assumed for the cistern and a 150mm orifice tube has been assumed for the superpipe.

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A HydroCAD model was created for Phase 1 and was used to simulate the hydrologic response for Phase 1 under proposed development conditions and to determine the required detention volume for quantity control.

A summary of the modelling results for Phase 1 with respect to storage utilization is provided in **Table 2-4**.

Table 2-5 provides a summary of all flows from Phase 1 for all storm events up to and including the 100-year event. Full HydroCAD modelling output is provided in **Appendix C**.

Table 2-4:   Summary of the Storage Utilization for Phase 1

Return Period	Phase 1 Cistern	Phase 1 Cistern	Phase 1 Superpipe	Phase 1 Superpipe
	Utilized Storage (m³/ 520 m³)	Peak Water Elevation (m)	Utilized Storage (m³/ 44.8 m³)	Peak Water Elevation (m)
2	157.5	0.606	10.2	0.271
5	220.2	0.847	15.6	0.371
10	260.8	1.003	19.6	0.440
25	345.9	1.330	28.4	0.590
50	427.9	1.646	34.6	0.703
100	500.0	1.923	39.7	0.809

Table 2-5:   Summary of all Flows from Phase 1 Area

Return Period	Flow from Phase 1 Cistern (L/s)	Flow from Phase 1 Superpipe (L/s)	Total Flow from Phase 1 (L/s)*	Phase 1 Allowable Flow (L/s)
2	9.29	28.43	28.43	65.4
5	11.09	34.90	34.90	65.4
10	12.11	38.77	38.77	65.4
25	14.02	46.06	46.06	65.4
50	15.63	50.85	50.85	65.4
100	16.93	54.98	54.98	65.4

*Flow from the entire Phase 1 area is not an arithmetic sum of flows from the cistern and the superpipe, but it is iteratively determined, the superpipe takes in flows from the cistern.

Therefore, the modelling results demonstrate that the overall peak flow rate from Phase 1 shall be controlled to below the allowable pro-rated flow rate for Phase 1, 65.4 L/s, for all storms up to and including the 100-year storm event. Additionally, the

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modelling results demonstrates that the utilized storage for the 100-year storm event for the Phase 1 cistern and Phase 1 superpipe are less than the storage volumes provided in the cistern and superpipe proposed for Phase 1.

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2.3 Phase 1 Design Conclusion

The key points with respect to the design criteria for Phase 1 of the development are summarized below.

Erosion Control

Retention of the 5 mm rainfall within the Phase 1 area shall satisfy the erosion control criterion for Phase 1. Temporary erosion and sediment control shall be provided during construction.

Water Balance

An assumed 40mm minimum initial abstraction for the intensive green roof provides the required water balance volume in combination with extensive green roof areas.

Water Quality

An Imbrium Jellyfish filter sized for Phase 1 is proposed to provide 80% TSS removal on the annual average loading basis. An existing OGS on site will provide 50% TSS removal for the ROW.

Water Quantity

A 520 m³ underground cistern and a 44.8 m³ superpipe equipped with flow controls are proposed to provide quantity control for the Phase 1 area and control all flows from Phase 1 to below the allowable flow rate for Phase 1 of the development.

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3 PHASE 2 DEVELOPMENT BLOCK

3.1 Phase 2 Pre-Development Condition

Phase 2 is split into Phase 2A and Phase 2B, the two combined have a total area of approximately 1.27 ha. There is an area of 0.125 ha (titled as Catchment 106 in the existing condition, and Catchment 213 in the proposed condition) on the east side of Phase 2 which is undeveloped in the existing condition. This area discharges to Pine Creek via overland flow under the existing condition and is located within the 10 m buffer for the 100-year floodline for Pine Creek. This area decreases under post development conditions from 0.21 ha to 0.125 ha, however the area will continue to discharge to Pine Creek via overland flow. There is also an external area of approximately 0.1 ha (EXT 2) located north of the Phase 2 boundary from which runoff flows to the Phase 2 area. Similar to EXT 1, the EXT 2 area shall be developed as part of a separate development package proposed for Walnut Lane which will be completed prior to this development. The future Walnut Lane Road will not be contributing flows to Phase 2 under the post development conditions.

Under the existing condition, the Phase 2 area consists of an impervious roof, at grade parking areas and some landscaping. Runoff from the Phase 2 area, with the exception of catchment 106 (catchment 213 replaces catchment 106 in the proposed condition), is collected via catch basins and internal storm sewers and directed to MH18 where flow control is provided by a 250 mm orifice tube. Runoff storage for the Phase 2 boundary consists of surface ponding, pipe storage, rooftop storage and a small underground storage that is located within the Phase 4 boundary. Based on the limited information provided in A.M., 2015, it is understood that, while some areas within the Phase 2 boundary directly discharge to the small underground storage, the majority of the Phase 2 boundary does not directly discharge to the underground storage system but runoff backflows into the underground storage after being restricted by the 250 mm orifice tube at MH18. The 250 mm orifice tube at MH18 also provides flow control to runoff from Phase 5 but has no impact on flows from the Phase 4 area. The existing condition of Phase 2 is shown in **Figure 1-2.**

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3.2 Phase 2 Post Development Condition

3.2.1 General

Under the post development condition, Phase 2 consists of catchment 202 as Phase 2A and catchment 203 as Phase 2B. Phase 2A, with an area of 1.12 ha shall be developed into a building structure, an underground garage, at-grade impervious areas and landscaping. A public ROW, Phase 2B, with an area of 0.15 ha shall be constructed as part of the Phase 2 development at the northwest corner of Phase 2 boundary. Catchment 213 (0.125 ha) will be functioning as a park area with a multi-use path (MUP) and will decrease in size in comparison to existing conditions, it will continue discharging via overland flow to Pine Creek. An area breakdown for the proposed development in Phase 2 is provided in **Table 3-1**. Please refer to for details of the post-development conditions and land-uses. Detailed calculations can be found in **Appendix B.**

Table 3-1:   Phase 2 Proposed Land-Use

Land-Use	Area (m²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping/Park	1,773	0.25	7%
Intensive Green Roof	2,290	0.50	43%
Extensive Green Roof	964	0.50	43%
Impervious at Grade	3,077	0.95	100%
Impervious Roof	3,065	0.95	100%
Phase 2A – Catchment 202	**11,169**	**0.71**	**73%**
Soft Landscaping/Park	208	0.25	7%
Intensive Green Roof	-	0.50	43%
Extensive Green Roof	-	0.50	43%
Impervious at Grade	1,301	0.95	100%
Impervious Roof	-	0.95	100%
Phase 2B – Catchment 203	**1,508**	**0.85**	**93%**
Total Catchment 202/203	**12,677**	**0.73**	**71%**
Soft Landscaping/Park	670	0.25	7%
Intensive Green Roof	0	0.50	43%
Extensive Green Roof	0	1.50	100%
Impervious at Grade	576	0.95	100%
Impervious Roof	0	0.95	100%
Catchment 213	**1,246**	**0.57**	**53%**

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Phase 2 shall be developed during the second stage of the development plan. During Phase 2 construction, the interim condition, only the ROW in Phase 4 will be redeveloped to include a superpipe that will service Phase 2B.The existing Home Depot and associated parking will not yet be redeveloped and shall remain unchanged and continue to discharge at the existing rate. The 250 mm orifice tube located at MH18 shall be removed to prevent flows backing up into the proposed building, however as the majority of the runoff storage in the existing condition for future Phase 4 (the existing Home Depot) is provided as rooftop storage and flow controls, removal of the 250 mm orifice tube should not create a major impact for the runoff from this area. Detailed analysis of the existing SWM system shall be carried out at the Site Plan stage and should it reveal that flows from the Phase 4 area are impacted in the interim condition of Phase 2, mitigation measures such as temporary runoff storage shall be proposed to manage the impacts during the interim condition.

Phase 2A, catchment 202, will be serviced by one underground storm cistern. Runoff from 202 area shall be collected via internal catch basins and storm sewers and directed to the Phase 2A cistern. This cistern will outlet to the existing storm network that runs along the south side of the site prior to discharging to the box culvert.

Phase 2B, catchment 203, the public ROW within Phase 2 shall be serviced with a superpipe that is built in the Phase 4 area. In the interim conditions, for the Phase 2 stage of the development, the superpipe will provide quantity control for Phase 2B. In the ultimate conditions, the superpipe will be retrofitted with flow control devices to provide quantity control for additional tributary areas. Further details are available in the Functional Servicing Report prepared by WSP. This superpipe will outlet to the existing storm network that runs along the west side of the site prior to discharging at the headwall and eventually flowing to the box culvert.

Catchment 213 shall continue to discharge to Pine Creek via overland flow, similar to the existing condition.

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PHASE 2B

| 203 |
| 0.15 |
| 0.85 |

PHASE 2A

| 202 |
| 1.12 |
| 0.71 |

| 213 |
| 0.12 |
| 0.57 |

UNDERGROUND STRUCTURE BOUNDARY

PHASE 2 INFILTRATION PIT
REQUIRED FOOTPRINT = 160 m²
DEPTH OF STONE = 0.74 m

TRCA FLOODLINE

EXISTING UNDERGROUND STORM CHAMBER

COMMUNITY GATHERING AREA

OPEN LAWN

TENNIS

PUBLIC R.O.W.

PHASE 4 / PHASE 2

PHASE 4 / PHASE 5

PHASE 5 / PHASE 2

EX. STM MH 19

EX. STM MH 23

KING'S HIGHWAY 401

0   10   20   30   40   50m

LEGEND

	PROJECT BOUNDARY
	CATCHMENT BOUNDARY
	UNCONTROLLED CATCHMENT BOUNDARY
	UNDERGROUND STRUCTURE BOUNDARY
	OVERLAND FLOW ROUTE

211	CATCHMENT ID
0.49	DRAINAGE AREA (ha)
0.52	AVERAGE RUNOFF COEFFICIENT

	PROPOSED LANDSCAPE AREA
	PHASE 2
	EXTENSIVE GREEN ROOF
	INTENSIVE GREEN ROOF
	IMPERVIOUS ROOF

CLIENT

TRIBUTE (BROOKDALE) LIMITED

TITLE

**1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
PHASE 2**

PROPOSED CONDITIONS

wsp

150 Commerce Valley Dr. West, Thornhill, ON Canada L3T 0A1
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Checked	I.S.	Drawn	AutoCAD/M.ST.L.
Date	JANUARY 2025	Proj. No.	221−12931−00
Scale	AS SHOWN	Figure No.	3.1	Gr.No.

FIGURE 3.dwg Fig 3.1 PH 2 C:\Users\slouism\DC\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-12931 - 1105-1163 Kingston Road\SWM\FIGURES\ Jan 15, 2025 - 9:46am

3.2.2   Erosion Control

As mentioned in **Section 1.4.1**, erosion control for Phase 2 (1.27 ha in area excluding catchment 213) can be provided by retention of the first 5 mm rainfall of each storm event. The volume shall be retained within the Phase 2 area. Further detail on retention of the 5 mm event is provided in **Section 3.2.3.**

Temporary erosion and sediment control during construction shall be planned and carried out during the construction of Phase 2. A detailed Erosion and Sediment Control Plan (ESC) shall be provided under the Functional Servicing Report (FSR).

Catchment 213 shall continue to discharge to Pine Creek at rates less than existing rates under the proposed condition. As such, long-term erosion control is not required for catchment 213.

3.2.3   Water Balance

As noted in **Section 1.4.2**, retention of the 5 mm rainfall through green roofs and infiltration shall be provided to satisfy the water balance criterion. As well, the Site is located within a Low Volume Groundwater Recharge Area (LGRA). Therefore, there are no site-specific water balance requirements for the site. However, based on the City of Pickering's request for private lands the 5 mm on site infiltration within the 72-hour drawdown time is required.

The infiltration rate has been calculated using Hydraulic Conductivity data from the site per Preliminary Hydrological Investigation, exp., 2023. A measured hydraulic conductivity of between 7.9*10^-7 and 1.1 * 10^-4 m/s was observed. The lowest value has been used as it is more conservative. Accordingly, an infiltration gallery with the respective area and depth 160 m^2 and 0.74 m and drawdown time of 48 hours will be proposed in catchment 213. The first 5 mm of rainfall will be captured from the roof area in catchment 202 and will be conveyed to the underground infiltration galleries.

The ground water level is reported as 4.19 mbgs (meters below ground surface) in BH/MW4 on June 6, 2023, in Preliminary Hydrological Investigation, exp., 2023 which is attached in **Appendix D**. The clearance from the groundwater level by considering 0.6 m cover on top the infiltration gallery is roughly 1.34 m which meets the minimum clearance requirement. The infiltration gallery is sized to provide an infiltration volume of 47.36 m^3.

Table 3-2 summarizes the water balance calculations for Phase 2A. Phase 2B is a public ROW and water balance targets are not required for roadways. As shown in the table, a total water balance volume of 30.71 m^3 shall be retained on site through infiltration or implementation of green roofs.

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Table 3-2: Phase 2A Water Balance Calculation

Surface Type	Area (m²)	Initial Abstraction (m)	Volume Abstracted (m³)	5 mm Volume (m³)	Water Balance (WB) (m³)
Soft Landscaping	1,773	0.005	8.87	8.87	0.00
Intensive Green Roof	2,290	0.005	11.45	11.45	0.00
Extensive Green Roof	964	0.005	4.82	4.82	0.00
Impervious at Grade	3,077	0.000	0.00	15.38	15.38
Impervious at Roof	3,065	0.000	0.00	15.33	15.33
Total	**11,169**	**-**	**25.14**	**55.85**	**30.71**

Due to the limited roof space for excess green roof, it is assumed that the intensive green roof portion has a total initial abstraction of 40 mm. The design volume of 47.4 m³ provided in the infiltration gallery also provides additional water balance volume, it is expected to infiltrate in approximately 48 hours. Detailed calculations are provided under **Appendix B**. **Table 3-3** provides details on the net water balance for catchment 202 and the water balance volume for catchment 213. There is a surplus of 96.80 m³ due to the assumption for the intensive green roof the infiltration trenches proposed for catchment 202.

Table 3-3: Additional Water Balance Provided – Phase 2

Catchment ID	5mm WB Volume	Intensive Green Roof Area (m²)	Total Initial Abstraction (m)	Volume Abstracted by Intensive Green Roof (m³)*	Volume Abstracted by Infiltration Trench (m³)	Net Water Balance (m³)
202	30.71	2290	0.040	80.15	47.36	-96.80
213	2.88	-	-	-	-	2.88

*This volume has been reduced by the 5mm water balance amount, thus, it does not double count the 5mm water balance volume

The surplus allows for water balance targets to be met for catchment 213 , the total water balance volume surplus across the site will be explained in further detail in **Section 7.1.2.**

3.2.4 Water Quality

As mentioned in **Section 1.4.3**, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (TSS). An Imbrium Jellyfish filter is proposed to provide 80% TSS removal for runoff from the impervious at grade areas including

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roof areas within catchment 202 of Phase 2 boundary. Water quality shall be addressed by an existing OGS located in the Phase 5 boundary, providing 50% TSS removal, for catchment 203, the public ROW, as filter units are not accepted for roadways. As soft landscaping areas are free from sediment generating activities, runoff shall leave these areas effectively unchanged and clean.

Details of the Jellyfish sizing and specifications shall be provided as part of the submission for Site Plan Application.

Catchment 213 shall function as a park, consisting of pervious surfaces and a multi-use path and as such it shall be free of sediment generating activities. Therefore, no water quality measures are required for this area.

3.2.5   Water Quantity

The Phase 2 area is divided into two catchments, Phase 2A and Phase 2B, and catchment 213 as shown in **Figure 3.1**.

3.2.5.1 Phase 2A Water Quantity Control

As stated in **Section 1.6**, the post-development flows from the Phase 2A boundary (catchment 202) shall be controlled to 64.5 L/s. Runoff from catchment 202 is directed to an underground cistern with an area of 220 m^2 and a height of 2 m (provides volume of 440 m^3). The detailed design of the flow control devices will be provided in future submissions. For modelling purposes, a 150mm orifice plate has been assumed for the cistern.

A HydroCAD model was created and was used to simulate the hydrologic response for Phase 2A under proposed development conditions and to determine the required detention volume for quantity control.

A summary of the modelling results for Phase 2A with respect to storage utilization is provided in **Table 3-4**. **Table 3-5** provides a summary of all flows from Phase 2A for all storm events up to and including the 100-year event. Full HydroCAD modelling output is provided in **Appendix C**.

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Table 3-4:   Summary of the Storage Utilization for Phase 2A

Return Period	Phase 2A Cistern Utilized Storage (m³/ 440 m³)	Phase 2A Cistern Peak Water Elevation (m)
2	112.6	0.512
5	161.1	0.732
10	193.8	0.881
25	262.9	1.195
50	328.6	1.494
100	385.0	1.750

Table 3-5:   Summary of all Flows from Phase 2A Area

Return Period	Total Flow from Phase 2A (L/s)*	Phase 2A Allowable Flow (L/s)
2	32.59	64.5
5	39.99	64.5
10	44.27	64.5
25	52.19	64.5
50	58.73	64.5
100	63.82	64.5

Therefore, the modelling results demonstrate that the overall peak flow rate shall be controlled to below the allowable flow rate for Phase 2A, 64.5 L/s, for all storms up to and including the 100-year storm event. Additionally, the modelling results demonstrates that the utilized storage for the 100-year storm event for the Phase 2A cistern are less than the storage volumes provided in the cistern proposed for Phase 2A.

3.2.5.2 Phase 2B Water Quantity Control

As stated in **Section 1.6**, the post-development flows from the Phase 2B boundary (catchment 203) shall be controlled to 8.7 L/s. Runoff from catchment 203 consists of a public ROW and shall be directed to a 240 m superpipe with a diameter of 1,200 mm that will be built in the Phase 4 ROW during the Phase 2 development stage. In the ultimate conditions, this superpipe will also service Phase 4 and its tributary drainage areas. The flow will be controlled by flow control devices such as pumps, weirs, orifice plates or a combination of these measures. The detailed design of the flow control devices will be provided in future submissions.

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No additional quantity control measures will be in place within catchment 203. The allowable release rate will be met in the ultimate conditions, this will be further detailed in **Section 5.2.5**

3.2.5.3 Catchment 213 Quantity Control

Catchment 213 shall continue to discharge via over land flow to Pine Creek at flow rates less than the existing flow rates as seen below in **Table 3-6.** Catchment 106 flowing to Pine Creek in the existing conditions is 0.21 ha, part of the catchment is developed and controlled through catchment 202, the remaining area of 0.125 ha is developed as catchment 213. Thus, in the proposed conditions, the area flowing to Pine Creek is less than what it was in the existing conditions and therefore, no quantity control measures are required for catchment 213. See **Appendix B** for calculation details.

Table 3-6:   Summary of Flows to Pine Creek

Return Period	Flow from Proposed 213 (L/s)	Flow from Existing 106 (L/s)
2	15.4	22.3
5	21.1	30.6
10	25.1	36.2
25	32.9	47.6
50	40.2	58.2
100	46.4	67.1

3.3 Phase 2 Design Conclusion

The key points with respect to the design criteria for Phase 2 of the development are summarized below.

Erosion Control

Retention of the 5 mm rainfall within the Phase 2 area shall satisfy the erosion control criterion. Catchment 213 shall continue to discharge to Pine Creek at lower rates than the existing rates due to a decrease in the area and does not require long term erosion control. Temporary erosion and sediment control shall be provided during construction.

Water Balance

With the assumption of 40mm initial abstraction through the intensive green roof and the infiltration proposed through the infiltration galleries, there is a net surplus of water balance that can compensate for the water balance volume required by catchment 213 and future catchments.

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Water Quality

An Imbrium Jellyfish filter sized for Phase 2A catchment 202 (private block) is proposed to provide 80% TSS removal on the annual average loading basis. An existing oil grit separator will provide 50% TSS removal for Phase 2B catchment 203 which consists of a public ROW. Water quality measure is not required for catchment 213, park area, as it is free of sediment generating activities.

Water Quantity

A 440 m³ underground cistern equipped with flow control is proposed to provide quantity control for Phase 2A catchment 202. All flows from Phase 2A shall be controlled to below the allowable flow rate for Phase 2A of the development. Phase 2B, catchment 203, the public ROW will be serviced by a superpipe that will be built during the stage for Phase 2 development but in the ultimate conditions it will also service other tributary drainage areas. The Phase 2B flows will be met through the superpipe in the ultimate conditions and further details are presented in **Section 5.2.5**. Catchment 213 shall continue to discharge to Pine Creek via overland flow at rates lower than the existing rates.

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4 PHASE 3 DEVELOPMENT BLOCK

4.1 Phase 3 Pre-Development Condition

Phase 3 of the development has an area of approximately 0.60 ha. Under the existing conditions, the Phase 3 area consists of at grade parking areas and minimal landscaping surrounding a building. The existing runoff storage for the Phase 3 boundary consists of pipe storage as a part of catchment 104 which is explained in **Section 1.6**. Runoff from the existing area is collected via catch basins and internal storm sewers and directed to the underground storage located east of Phase 3 in Phase 4 and ultimately to the existing MH10 where flow control is provided by a 150 mm orifice tube. According to A.M., 2015, it is understood that that the Phase 3 boundary does not directly discharge to the underground storage located in Phase 4 but runoff backflows into the underground storage after being restricted by the 150mm orifice tube. The existing condition of Phase 3 is shown in **Figure 1.2** and the proposed condition of Phase 3 is shown in **Figure 4.1.**

4.2 Phase 3 Post Development Condition

4.2.1 General

The 0.60 ha proposed development will consist of redeveloping the existing at grade parking area, the building and the landscaped area. This phase is delineated as Catchment 204 and includes a proposed building with underground parking and some at grade landscaped areas. The 100-year flow from each catchment will be captured via catch basins, roof area and will be conveyed to an underground cistern. The 100-year flow will be controlled to allowable release rates explained in **Section 1.6.** Erosion, sediment control, and quality control for Phase 3 will be achieved as explained in the following sections.

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PHASE 3

204
0.60
0.79

PROPERTY LINE

PUBLIC R.O.W.

PHASE 3

PHASE 4

COMMUNITY GATHERING AREA

OPEN LAWN

OPEN LAWN

837m2

79m2

12m2

29m2

206 m2
231 m2
60 m2
12 m2
184 m2
61 m2
12 m2
333 m2
376 m2

LEGEND

	PROJECT BOUNDARY
	CATCHMENT BOUNDARY
	UNCONTROLLED CATCHMENT BOUNDARY
	UNDERGROUND STRUCTURE BOUNDARY
	OVERLAND FLOW ROUTE

211 — CATCHMENT ID
0.49 — DRAINAGE AREA (ha)
0.52 — AVERAGE RUNOFF COEFFICIENT

	PROPOSED LANDSCAPE AREA
	PHASE 3
	EXTENSIVE GREEN ROOF
	INTENSIVE GREEN ROOF
	IMPERVIOUS ROOF

0   10   20   30   40   50m

FIGURE 3.dwg Fig 4.1 PH 3 C:\Users\stlouism\DC\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-12931 - 1105-1163 Kingston Road\SWM\FIGURES\ Jan 15, 2025 - 9:49am

An area breakdown for the proposed development under final condition is provided below in **Table 4-1.** Detailed calculations can be found in **Appendix B.**

Table 4-1:   Phase 3 Proposed Land-Use Area Breakdown

Land-Use	Area (m²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping	437	0.25	7%
Intensive Green Roof	576	0.50	43%
Extensive Green Roof	888	0.50	43%
Impervious at Grade	2,450	0.95	100%
Impervious Roof	1,617	0.95	100%
Phase Total	**5,968**	**0.79**	**84%**

4.2.2   Erosion Control

Erosion control for this development will be provided by runoff reduction from the site through infiltration of a minimum 5 mm rainfall depth across all impervious surfaces. The infiltration of 5 mm will be achieved by proposed initial abstraction assumptions through the intensive green roof explained in the following **Section 5.2.3.**

4.2.3   Water Balance

As noted in **Section 1.4.2**, retention of the 5mm rainfall through green roof and infiltration shall be provided to satisfy the water balance criterion.

Table 4-2 outlines the water balance volume required to retain the runoff from a 5 mm storm on site for Phase 3. Detailed water balance calculations can be found in **Appendix B** of this report.

Table 4-2:   Phase 3 Water Balance Calculation

Surface Type	Area (m²)	Initial Abstraction (m)	Volume Abstracted (m³)	5 mm Volume (m³)	Water Balance (WB) (m³)
Soft Landscaping	437	0.005	2.18	2.18	0.00
Intensive Green Roof	576	0.005	2.88	2.88	0.00
Extensive Green Roof	888	0.005	4.44	4.44	0.00
Impervious at Grade	2,450	0.000	0.00	12.25	12.25
Impervious Roof	1,617	0.000	0.00	8.09	8.09
Total	**5,968**	**-**	**9.50**	**29.84**	**20.34**

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There is limited space for infiltration and limited roof space for excess green roof. It is assumed that the intensive green roof portion has a total initial abstraction of 40 mm. This provides an additional water balance volume of 20.16 m^3. No infiltration trench is proposed for Phase 3 due to the extent of the underground parking lot. **Table 4-3** summarizes the additional water balance volume provided and the total net water balance for Phase 3.

Table 4-3:   Additional Water Balance Provided in Phase 3

Catchment ID	5mm WB Volume	Intensive Green Roof Area (m^2)	Total Initial Abstraction (m)	Volume Abstracted by Intensive Green Roof (m^3)*	Volume Abstracted by Infiltration Trench (m^3)	Net Water Balance (m^3)
204	20.34	576	0.04	20.16	-	0.18

*This volume has been reduced by the 5mm water balance amount, thus, it does not double count the 5mm water balance volume

There is a net deficit in water balance of 0.18 m^3. However, there is a surplus water balance volume from earlier phases of the site that can compensate for the deficit in Phase 3, further details are presented in **Section 7.1.2.** Detailed calculations of the water balance calculations can be found in **Appendix B.**

4.2.4   Water Quality

As mentioned in **Section 1.4.3**, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (T.S.S.).

An Imbrium Jellyfish is proposed to achieve the full 80% TSS removal for runoff from the at-grade impervious areas and roof runoff. Soft landscaped areas are considered clean areas as they are free from sediment generating activities and runoff shall leave these areas effectively unchanged and clean.

Details of the Jellyfish unit sizing and specifications shall be provided as part of the submission for Site Plan Application (SPA).

4.2.5   Water Quantity

As stated in **Section 1.4.4**, the post-development flows from the site shall be attenuated to the allowable flow, for all storms up to and including the 100-year storm event. As mentioned in **Section 5.2.1,** Phase 3 is labelled as one catchment, catchment 204. The 100-year flow from the catchment will be controlled by an underground cistern with a volume of 280 m^3 (140 m^2 x 2 m) located in the underground parking structure. The flow

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will be controlled by flow control devices such as pumps, weirs, orifice plates or a combination of these measures. The detailed design of the flow control devices will be provided in future submissions. For the purposes of this submission a 100 mm orifice plate is assumed.

A HydroCAD model is used to simulate the hydrologic response of the site under proposed development conditions and to determine the required detention volume for quantity control using the Rational Method and City of Pickering IDF curve explained in **Section 1.6.** The runoff coefficient adjustment factors have been applied based on the City of Pickering SWM design guideline.

A summary of the modelling results for the proposed underground cistern is provided in **Table 4-4 .** A comparison of post-development to pre-development flows is shown in **Table 4-5.** Full HydroCAD modelling output is provided in **Appendix C**.

Table 4-4:   Summary of the Storage Utilization for Phase 3

Return Period	Catchment 204 Cistern	
	Utilized Storage (m^3/ 280 m^3)	Peak Water Elevation (m)
2	73.90	0.528
5	105.7	0.755
10	126.9	0.906
25	172.2	1.230
50	215.2	1.537
100	253.4	1.810

Table 4-5:   Summary of Modelling Results Compared to Allowable for Phase 3

Return Period	204 Development Release Rate (L/s)	Total Allowable Release Rate, Q_P (L/s)
2	15.15	34.5
5	18.40	34.5
10	20.28	34.5
25	23.81	34.5
50	26.73	34.5
100	29.08	34.5

Therefore, the modelling results demonstrate that the overall peak flow rate from the entire site will be below the allowable release rates for all storms up to and including the

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100-year storm event. Additionally, the modelling results demonstrates that the 100-year storm event uses a maximum storage volume which are below the underground cistern designed storm volume.

4.3 Phase 3 Design Conclusion

Erosion Control

Erosion control for this phase will be provided by runoff reduction from the site through infiltration of a minimum 5 mm rainfall depth across all impervious surfaces. More details will be provided at the detailed design stage. Temporary erosion and sediment controls measures will be implemented during construction.

Water Balance

An assumption of 40mm of initial abstraction for the intensive green roof provides additional water balance volume for Phase 3. An infiltration gallery is not feasible for Phase 3 due to the extent of the underground parking. Surplus water balance from earlier phases will offset the shortfall in Phase 3.

Water Quality

An Imbrium Jellyfish filter sized for Phase 3 is proposed to provide 80% TSS removal on the annual average loading basis.

Water Quantity

An underground cistern with a volume of 280 m^3 is proposed for volume and flow control for Phase 3. Post-development flows, including the expected flows from the development, have been controlled to below the allowable release rate for the site.

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5 PHASE 4 DEVELOPMENT BLOCK

5.1 Phase 4 Pre-Development Condition

Phase 4 of the development has an area of approximately 2.16 ha. Under the existing conditions, the Phase 4 area consists of at grade parking areas and minimal landscaping. The existing runoff storage for the Phase 4 boundary consists of two underground storage systems, surface ponding and pipe storage as a part of catchment 101 which is explained in **Section 1.6**. Runoff from the existing area is collected via catch basins and internal storm sewers and directed to the larger of the two underground storages and ultimately to existing MH10 where flow control is provided by a 150 mm orifice tube. The existing condition of Phase 4 is shown in **Figure 1.2.**

5.2 Phase 4 Post Development Condition

5.2.1 General

Phase 4 is 2.16 ha, the proposed boundary for Phase 4 will consist of redeveloping the existing at grade parking area, and a public right-of-way (ROW). This phase is split into four drainage catchments (i.e., 205, 206, 207 and 208). Catchment 205 includes a proposed commercial / residential building. Catchment 206 includes a park area with MUPs, tennis courts and open lawn areas. Catchment 207 and 208 are public ROWs. The 100-year flow from each catchment will be captured via catch basins, roof area and will be conveyed to the underground cistern and superpipes.

In the interim condition of Phase 4, the existing area of Home Depot, and landscapes south and southwest of Phase 4 will remain without any changes. The existing SWM measurement for these areas will remain unchanged except for the 250 mm existing orifice tube located at the existing storm MH18. Although, the existing 250 mm orifice tube will be removed in Phase 2 to convey the controlled flow from Phase 2 freely without any backflow into the system, the interim flow under the interim condition will remain under the allowable release rates. The detail of the flows and any required temporary SWM mitigation for interim condition will be provided as part of the detailed design.

The phases in the proposed conditions will be built in stages starting with Phase 1 and ending with Phase 5. Phase 4 will need to account for its own tributary drainage areas along with the flows from Phase 1, Phase 3 and Phase 2B. Thus, the Phase 4 allowable

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release rate is the sum of the pro-rated allowable release rates from Phase 1, Phase 2B, Phase 3 and Phase 4 as seen in **Section 1.6**.

The 100-year flow for Phase 4 will be controlled to the allowable release rate of 233.5 L/s as seen in **Table 5-1** below.

Table 5-1:   Phase 4 Allowable Release Rate

Phase ID	Pro-Rated Allowable Release Rates (L/s)
Phase 1	65.4
Phase 2B	8.7
Phase 3	34.5
Phase 4	124.9
Total Allowable Release Rate Phase 4	**233.5**

A storm cistern is proposed to be located in the building in catchment 205. It will release to the proposed superpipe in the public ROW (i.e., catchment 207), which will have been built during the stage 2 development (Phase 2). A subsurface storage system is proposed for the park area (i.e., catchment 206). This storage will also release to the superpipe located in catchment 207.

The superpipe that will have been built during stage 1 development (Phase 1) will be extended in the fourth development stage for Phase 4 to account for the additional tributary drainage area consisting of catchment 208.

The controlled flow from Phase 4 will drain to the existing 600 mm storm sewer located west of the existing Home Depot building. For more details refer to the Functional Servicing Report by WSP dated October 2023 under a separate cover.

An area breakdown for the proposed development under the Phase 4 condition is provided below in **Table 5-2.** Please refer to **Figure 5-1** for details of the post-development conditions and land-uses. Detailed calculations can be found in **Appendix B.**

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Table 5-2: Phase 4 Proposed Land-Use Area Breakdown

Land-Use	Area (m²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping / Park	5,997	0.25	7%
Intensive Green Roof	2,641	0.50	43%
Extensive Green Roof	733	0.50	43%
Impervious at Grade	9,836	0.95	100%
Impervious Roof	2,416	0.95	100%
Phase Total	**21,623**	**0.69**	**65%**

Erosion, sediment control, and quality control for Phase 4 will be achieved as explained in the following sections.

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TRCA FLOODLINE

PHASE 4

| 206 |
| 0.88 |
| 0.55 |

| 205 |
| 0.70 |
| 0.71 |

| 207 |
| 0.44 |
| 0.85 |

| 208 |
| 0.14 |
| 0.88 |

PUBLIC R.O.W.

PUBLIC R.O.W.

PHASE 3 / PHASE 4

PHASE 1 / PHASE 4

PHASE 4 / PHASE 2

PHASE 3 / PHASE 5

PHASE 4 / PHASE 5

EXISTING UNDERGROUND STORM CHAMBER

COMMUNITY GATHERING AREA

PROPERTY LINE

EX. STM MH 10
EX. STM MH 9
EX. STM MH 8
EX. STM MH 7

LEGEND

▬ ▬ ▬	PROJECT BOUNDARY
▬▬▬	CATCHMENT BOUNDARY
▪▪▪▪	UNCONTROLLED CATCHMENT BOUNDARY
▬ ▬ ▬	UNDERGROUND STRUCTURE BOUNDARY
⟶	OVERLAND FLOW ROUTE

211	CATCHMENT ID
0.49	DRAINAGE AREA (ha)
0.52	AVERAGE RUNOFF COEFFICIENT

(light green)	PROPOSED LANDSCAPE AREA
(hatched)	PHASE 4
(dark green)	EXTENSIVE GREEN ROOF
(purple)	INTENSIVE GREEN ROOF
(grey)	IMPERVIOUS ROOF

0 10 20 30 40 50m

CLIENT

TRIBUTE (BROOKDALE) LIMITED

TITLE

**1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
PHASE 4**

PROPOSED CONDITIONS

FIGURE 3.dwg Fig 5.1 PH 4 C:\Users\stlouism\DC\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-12931 - 1105-1163 Kingston Road\SWM\FIGURES\ Jan 15, 2025 - 9:50am

5.2.2 Erosion Control

Erosion control for this development will be provided by runoff reduction from the site through infiltration of a minimum 5 mm rainfall depth across all impervious surfaces. The infiltration of 5 mm will be achieved by proposed assumptions for intensive green roof and net water balance surplus volumes explained in the following section.

5.2.3 Water Balance

As noted in **Section 1.4.2**, retention of the 5mm rainfall through green roof and infiltration shall be provided to satisfy the water balance criterion.

Table 5-3 outlines the water balance volume required to retain the runoff from a 5 mm storm on site for Phase 4 catchment 205 and catchment 206. As catchments 207 and 208 are public ROWs, water balance criteria does not need to be met for roadways. Detailed water balance calculations can be found in **Appendix B** of this report.

Table 5-3:   Phase 4 Water Balance Calculation

Surface Type	Area (m²)	Initial Abstraction (m)	Volume Abstracted (m³)	5 mm Volume (m³)	Water Balance (m³)
Soft Landscaping / Park	230	0.005	1.15	1.15	0.00
Intensive Green Roof	2,641	0.005	13.21	13.21	0.00
Extensive Green Roof	733	0.005	3.67	3.67	0.00
Impervious at Grade	1,000	0.000	0.00	5.00	5.00
Impervious Roof	2,416	0.000	0.00	12.08	12.08
Total Catchment 205	**7,020**		**18.02**	**35.10**	**17.08**
Soft Landscaping / Park	5,028	0.005	25.14	25.14	0.00
Intensive Green Roof	-	0.005	0.00	0.00	0.00
Extensive Green Roof	-	0.005	0.00	0.00	0.00
Impervious at Grade	3,811	0.000	0.00	19.06	19.06
Impervious Roof	-	0.000	0.00	0.00	0.00
Total Catchment 206	**8,839**		**25.14**	**44.20**	**19.06**

Due to the limited space for infiltration and the limited roof space for excess green roof, it is assumed that the intensive green roof portion has a total initial abstraction of 40 mm. No infiltration trench is proposed for Phase 4 due to the extent of the underground parking lot. **Table 5-4** summarizes the additional water balance volume provided and the total net water balance for Phase 4. Detailed calculations of the water balance calculations can be found in **Appendix B.**

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Table 5-4:   Additional Water Balance Provided in Phase 4

Catchment ID	5mm WB Volume	Intensive Green Roof Area (m²)	Total Initial Abstraction (m)	Volume Abstracted by Intensive Green Roof (m³)*	Volume Abstracted by Infiltration Trench (m³)	Net Water Balance (m³)
205	17.08	2641	0.040	92.44	0.00	-75.36
206	19.06	0	0.000		0.00	19.06

*This volume has been reduced by the 5mm water balance amount, thus, it does not double count the 5mm water balance volume

There is a surplus of water balance from catchment 205 of 75.36 m³. Catchment 206, the park area, does not allow for any infiltration nor does it have any intensive green roof areas, thus, there is a net deficit water balance of 19.06 m³. However, the surplus provided by the earlier phase in catchment 205 along with the surplus of water balance volume across the site compensates for the deficit, further details are presented in **Section 7.1.2,** it details the total water balance volume across the site. Detailed calculations of the water balance calculations can be found in **Appendix B.**

5.2.4   Water Quality

As mentioned in **Section 1.4.3**, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (T.S.S.).

The individual Residential / Commercial block will have their own filter-based water treatment units, an area expected to achieve the full 80% TSS removal, this will include runoff from impervious at grade areas and roof areas. Soft landscaped areas are considered clean and will not be included in sizing the unit as they are not sediment generating surfaces.

Since the TRCA only credits a maximum 50% TSS removal rate for conventional OGS units; should filter-based units not be permitted in the municipal right-of-way as part of detailed design, evaluation of a treatment train approach will be considered for the public right-of-way roads and public spaces. Treatment train may include: bioretention areas, extended tree pits in the right-of-way boulevards, and stormwater curb extensions will be proposed within the roads and public spaces.

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5.2.5   Water Quantity

As mentioned in **Section 5.2.1,** Phase 4 is divided into four catchments (i.e., 205, 206, 207 and 208), the 100-year flow from the catchments will be controlled with volume provided by underground cistern and superpipes. The post-development flows from the site shall be attenuated to the allowable flow shown in **Table 5-1** of 233.5 L/s**,** for all storms up to and including the 100-year storm event.

The runoff from catchment 205 will be controlled by an underground cistern with a volume of 340 m^3 (170 m^2 x 2 m) located in the underground parking structure. The runoff from catchments 206 will be controlled by a subsurface storage system with a volume of 280 m^3 (140 m^2 x 2 m).

Catchment 207 will be controlled by providing a superpipe volume of 271.4 m^3 (1200mm at 240 m long). This superpipe will have been built during the Phase 2 development stage. As mentioned in **Section 3.2.5.2**, Phase 2B will be controlled by the superpipe, the allowable release rate for Phase 2B is considered in the sum of the pro-rated allowable release rate that Phase 4 controls (as stated in **Table 5-1**). This superpipe in catchment 207 takes in flows from Phase 2B, from catchment 207, from the cistern in catchment 205, and from the subsurface storage tank in catchment 206. It has been sized accordingly in order to provide quantity control for the tributary drainage areas and meet the total allowable release rate for Phase 4.

Accordingly, catchment 208 will include a superpipe with a volume of 44.8 m^3 (975mm at 60 m long). This superpipe takes in flows from Phase 1, Phase 3 and from catchment 208. The flow will be controlled by flow control devices such as pumps, weirs, orifice plates or a combination of these measures. The detailed design of the flow control devices will be provided in future submissions. For the modelling purposes of this submission, a 75 mm orifice plate is assumed for the storage tank in Catchment 205, a 100 mm orifice tube is assumed for the storage tank in Catchment 206, a 200 mm orifice tube is assumed for the superpipe in Catchment 207, and a 200 mm orifice tube is assumed for the superpipe in Catchment 208.

A HydroCAD model is used to simulate the hydrologic response of the site under proposed development conditions and to determine the required detention volume for quantity control using the Rational Method and City of Pickering IDF curve explained in **Section 1.6.** The runoff coefficient adjustment factors have been applied based on the City of Pickering SWM design guideline.

A summary of the modelling results for the proposed underground cistern and superpipes are provided in **Table 5-5** and **Table 5-6.** A comparison of post-development

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to pre-development flows is shown in **Table 5-7.** Full HydroCAD modelling output is provided in **Appendix C**.

Table 5-5:   Summary of the Storage Utilization for Phase 4

Return Period	Catchment 205 Cistern		Catchment 206 Subsurface Storage	
	Utilized Storage (m^3/ 340 m^3)	Peak Water Elevation (m)	Utilized Storage (m^3/ 280 m^3)	Peak Water Elevation (m)
2	96.5	0.568	69.6	0.497
5	136.2	0.801	100.2	0.716
10	162.2	0.954	120.6	0.862
25	217.9	1.282	162.2	0.954
50	269.5	1.585	205.7	1.469
100	317.3	1.866	243.7	1.741

Table 5-6:   Summary of the Storage Utilization for Phase 4

Return Period	Catchment 207 Superpipe		Catchment 208 Superpipe	
	Utilized Storage (m^3/ 271.4 m^3)	Peak Water Elevation (m)	Utilized Storage (m^3/ 44.8 m^3)	Peak Water Elevation (m)
2	58.0	0.320	12.0	0.305
5	84.9	0.421	17.7	0.406
10	103.5	0.487	21.7	0.476
25	144.6	0.631	30.4	0.626
50	178.7	0.751	36.7	0.744
100	204.4	0.846	41.8	0.859

Table 5-7:   Summary of Modelling Results Compared to Allowable for Phase 4

Return Period	207 Release Rate (L/s)	208 Release Rate (L/s)	Total Phase 4 Release Rate* (L/s)	Total Allowable Release Rate, Q_P (L/s)
2	53.46	51.67	104.07	233.5
5	64.63	63.14	126.75	233.5
10	71.02	69.96	139.93	233.5
25	83.14	82.78	164.78	233.5
50	92.07	91.54	182.25	233.5
100	98.53	99.42	196.28	233.5

*Flow from entire Phase 4 is not an arithmetic sum of flows from all catchments, but it is iteratively determined.

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Therefore, the modelling results demonstrate that the overall peak flow rate from the entire site will be below the allowable release rates for all storms up to and including the 100-year storm event. Additionally, the modelling results demonstrates that the 100-year storm event uses a maximum storage volume which are below the underground cistern and superpipes' designed storm volume for final and interim conditions.

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5.3 Phase 4 Design Conclusion

Erosion Control

Erosion control for this phase will be provided by runoff reduction from the site through infiltration of a minimum 5 mm rainfall depth across all impervious surfaces. More details will be provided at the detailed design stage. Temporary erosion and sediment controls measures will be implemented during construction.

Water Balance

An assumption of 40mm of initial abstraction for the intensive green roof provides additional water balance volume for Phase 4. An infiltration gallery is not feasible for Phase 4 due to the extent of the underground parking. Surplus water balance from earlier phases will offset the shortfall in Phase 4.

Water Quality

The individual Residential / Commercial block will have its own filter-based water treatment units. Treatment train approach along with the OGS units will be considered for the right-of-way roads and public space.

Water Quantity

Phase 4 includes a commercial / residential block, public roads and park. Accordingly, an underground cistern with a volume of 300 m^3 (for commercial / residential block), 200 m^3 (for the park) and 1200 mm and 975 mm superpipes (for public ROWs) are proposed respectively. Post-development flows, including the expected flows from the development, have been controlled to below the allowable release rate for the site for both the interim and final conditions.

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6 PHASE 5 DEVELOPMENT BLOCK

6.1 Phase 5 Pre-Development Condition

Phase 5 of the development has an area of approximately 2.46 ha. Under the existing condition, the Phase 5 area consists of a Home Depot building, and roads with minimal landscaping. The runoff storage for the existing Phase 5 boundary consists of roof top control, surface ponding and pipe storage as a part of catchment 103 and uncontrolled runoff as part of catchment 102 and catchment 105 which is explained in **Section 1.6**. Runoff from the existing area is collected via catch basins and internal storm sewers and directed to the underground storage in Phase 4 and ultimately to existing MH18 where flow control is provided by a 250 mm orifice tube. The existing uncontrolled runoff from catchment 102 is collected by double catch basins draining to the existing 1.83 m x 1.83 m box culvert and eventually to the existing 900 mm culvert under the GO Transit and CNR tracks southwest of the subject site. The existing condition of Phase 5 is shown in **Figure 1.2.**

6.2 Phase 5 Post Development Condition

6.2.1 General

The 2.46 ha proposed development is shown **Figure 6-1**, it will consist of redeveloping the existing Home Depot building and surrounding roads. This phase is split into four drainage catchments (i.e., 209, 210, 211 and 212). Catchment 209 includes the proposed residential building. Catchments 210, 211 and 212 include private roads respectively. The 100-year flow from each catchment will be captured via catch basins and roof area drains and will be conveyed to the underground cistern and superpipes. The 100-year flow from catchment 209 and catchment 210 will be controlled to allowable release rates explained in **Section 1.6.** The 100-year flow from the private roads (i.e., catchment 211 and 212) will be captured by existing and proposed single and double catch basins and will drain to the existing 1.83 m x 1.83 m box culvert uncontrolled via the existing and proposed storm sewers. Erosion sediment control and quality control for Phase 5 will be achieved as explained in the following sections.

The storm cistern in the building (i.e., catchment 209) will be connected to the existing storm MH19, south of the subject site. The private road (i.e., catchment 210) will be controlled by the cistern in catchment 209. The runoff from private roads (i.e., catchment 211 and 212) will be conveyed via the proposed 750 mm pipe and existing

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525 mm to 900 mm storm sewers uncontrolled to the existing 1.83 m x 1.83 m box culvert. As mentioned in **Section 1.6**, the controlled and uncontrolled runoff from the subject site will drain to the existing 900 mm culvert under the GO Transit and CNR tracks. For more details refer to the Functional Servicing Report by WSP dated October 2023 under separate cover.

An area breakdown for the proposed development under final condition is provided below in **Table 6-1.** Please refer to for details of the post-development conditions and land-uses. Detailed calculations can be found in **Appendix B.**

Table 6-1:   Phase 5 Proposed Land-Use Area Breakdown

Land-Use	Area (m²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping / Park	4,815	0.25	7%
Intensive Green Roof	4,818	0.50	43%
Extensive Green Roof	1,777	0.50	43%
Impervious at Grade	8,271	0.95	100%
Impervious Roof	4,961	0.95	100%
Site Total	24,641	0.69	67%

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DIXIE ROAD

THE KING'S HIGHWAY 401

PUBLIC R.O.W.

PUBLIC R.O.W.

PHASE 3
PHASE 4

PHASE 3
PHASE 5

PHASE 4
PHASE 5

PHASE 5

EX. STM MH 10
EX. STM MH 9
EX. STM MH 8
EX. STM MH 7
EX. STM MH 6
EX. 600 Ø STM
EX. 675 Ø STM
EX. HEADWALL TOWARD 1.83m X 1.83Mm BOX CULVERT
PROPERTY LINE
PROPERTY LINE
EX. STM MH 18
EX. STM MH 18
EX. STM MH 47 OGS
EX. STM MH 19
EX. STM MH 23
PHASE 5
PHASE 2

| 210 |
| 0.12 |
| 0.76 |

| 209 |
| 1.64 |
| 0.74 |

| 212 |
| 0.47 |
| 0.64 |

| 211 |
| 0.23 |
| 0.45 |

LEGEND

▬▬▬	PROJECT BOUNDARY	
▬▬▬	CATCHMENT BOUNDARY	
▪▪▪▪	UNCONTROLLED CATCHMENT BOUNDARY	
▬ ▬ ▬	UNDERGROUND STRUCTURE BOUNDARY	
▬▬▬	ROOF BOUNDARY	
⇨	OVERLAND FLOW ROUTE	

211	CATCHMENT ID
0.49	DRAINAGE AREA (ha)
0.52	AVERAGE RUNOFF COEFFICIENT

(light green)	PROPOSED LANDSCAPE AREA
(hatched)	PHASE 5
(dark green)	EXTENSIVE GREEN ROOF
(purple)	INTENSIVE GREEN ROOF
(gray)	IMPERVIOUS ROOF

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TITLE
1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
PHASE 5
PROPOSED CONDITIONS

0 10 20 30 40 50m

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Checked	Drawn
I.S.	AutoCAD/M.ST.L.
Date	Proj. No.
JANUARY 2025	221-12931-00
Scale	Figure No.
AS SHOWN	**6.1**	Gr.No.

FIGURE 3.dwg Fig 6.1 PH 5 C:\Users\stlouism\DC\ACCDocs\WSP Canada projects (AMER)\LDO\Files\221-12931 - 1105-1163 Kingston Road\SWM\FIGURES\ Jan 15, 2025 - 9:52am

6.2.2   Erosion Control

Erosion control for this development will be provided by runoff reduction from the site through infiltration of a minimum 5 mm rainfall depth across all impervious surfaces. The infiltration of 5 mm will be achieved by proposed assumptions for intensive green roof areas explained in the following **Section 6.2.3**.

6.2.3   Water Balance

As noted in **Section 1.4.2**, retention of the 5mm rainfall through green roof and infiltration shall be provided to satisfy the water balance criterion.

Table 6-2 outlines the water balance volume required to retain the runoff from a 5 mm storm on site for Phase 5 catchment 209 and the uncontrolled catchments 211, 212. ROWs (catchment 210) do not require water balance targets. Detailed water balance calculations can be found in **Appendix B** of this report.

Table 6-2:   Phase 5 Water Balance Calculation

Surface Type	Area (m²)	Initial Abstraction (m)	Volume Abstracted (m³)	5 mm Volume (m³)	Water Balance (WB) (m³)
Soft Landscaping	733	0.005	3.67	3.67	0.00
Intensive Green Roof	4,818	0.005	24.09	24.09	0.00
Extensive Green Roof	1,777	0.005	8.89	8.89	0.00
Impervious at Grade	4,118	0.000	0.00	20.59	20.59
Impervious Roof	4,961	0.000	0.00	24.80	24.80
Total Catchment 209	**16,407**		**36.64**	**82.03**	**45.39**
Soft Landscaping	1,649	0.005	8.25	8.25	0.00
Intensive Green Roof	-	0.005	0.00	0.00	0.00
Extensive Green Roof	-	0.005	0.00	0.00	0.00
Impervious at Grade	678	0.000	0.00	3.39	3.39
Impervious Roof	-	0.000	0.00	0.00	0.00
Total Catchment 211	**2,328**		**8.25**	**11.64**	**3.39**
Soft Landscaping	2,100	0.005	10.50	10.50	0.00
Intensive Green Roof	-	0.005	0.00	0.00	0.00
Extensive Green Roof	-	0.005	0.00	0.00	0.00
Impervious at Grade	2,599	0.000	0.00	13.00	13.00
Impervious Roof	-	0.000	0.00	0.00	0.00
Total Catchment 212	**4,700**		**10.50**	**23.50**	**13.00**

Due to the limited space for infiltration and the limited roof space for excess green roof, it is assumed that the intensive green roof portion has a total initial abstraction of

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40 mm. No infiltration trench is proposed for Phase 5 due to the extent of the underground parking lot. **Table 6-3** summarizes the additional water balance volume provided and the total net water balance for Phase 4.

Table 6-3: **Additional Water Balance Provided in Phase 5**

Catchment ID	5mm WB Volume	Intensive Green Roof Area (m²)	Total Initial Abstraction (m)	Volume Abstracted by Intensive Green Roof (m³)*	Volume Abstracted by Infiltration Trench (m³)	Net Water Balance (m³)
209	45.39	4818	0.040	168.63	0.00	-123.24
211	3.39	0	0.000	0.00	0.00	3.39
212	13.00	0	0.000	0.00	0.00	13.00

*This volume has been reduced by the 5mm water balance amount, thus, it does not double count the 5mm water balance volume

There is a surplus of water balance from catchment 209 of 123.24 m³. This surplus along with the surplus of water balance volume across the site compensates for the uncontrolled catchments, further details are presented in **Section 7.1.2** which details the total water balance volume across the site. Detailed calculations of the water balance calculations can be found in **Appendix B.**

6.2.4   Water Quality

As mentioned in **Section 1.4.3**, Enhanced Level of protection is required for the proposed development. The target is to treat 90% of the annual runoff volume and remove 80% of the total suspended solids (T.S.S.).

The individual Residential / Commercial block will have their own filter-based water treatment units, an area expected to achieve the full 80% TSS removal, this will include runoff from impervious at grade areas and roof areas. Soft landscaped areas are considered clean and will not be included in sizing the unit as they are not sediment generating surfaces.

Since the TRCA only credits a maximum 50% TSS removal rate for conventional OGS units; should filter-based units not be permitted in the municipal right-of-way as part of detailed design, evaluation of a treatment train approach will be considered for the public right-of-way roads and public spaces. Treatment train may include: bioretention areas, extended tree pits in the right-of-way boulevards, and stormwater curb extensions will be proposed within the roads and public spaces.

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6.2.5 Water Quantity

As stated in **Section 1.4.4**, the post-development flows from the site shall be attenuated to the allowable flow, for all storms up to and including the 100-year storm event. As mentioned in **Section 6.2.1**, Phase 5 is divided into four catchments (i.e., 209, 210, 211 and 212), the 100-year flow from the catchments (i.e., 209 and 210) will be controlled with volume provided by underground cistern. The 100-year flow from the uncontrolled catchments (i.e., 211 and 212) will be discharged uncontrolled. The runoff from Catchment 209 will be controlled by an underground cistern with a volume of 680 m^3 (340 m^2 x 2 m) located in the underground parking structure. The cistern overcontrols for catchment 210. The flow will be controlled by flow control devices such as pumps, weirs, orifice plates or combination of. The detailed design of the flow control devices will be provided in the detailed design stage. For the purpose of modelling for this submission, a 150 mm orifice tube is assumed for the storage tank.

The HydroCAD model is used to simulate the hydrologic response of the site under proposed development conditions and to determine the required detention volume for quantity control using the Rational Method and City of Pickering IDF curve explained in **Section 1.6.** The runoff coefficient adjustment factor has been applied based on the City of Pickering SWM design guideline.

A summary of the modelling results for the proposed underground cistern in Catchment 210 is provided below in **Table 6-4**. A comparison of post-development to pre-development flows is shown in **Table 6-5.** Full HydroCAD modelling output is provided in **Appendix C**.

Table 6-4:   Summary of the Storage Utilization for Phase 5

Return Period	Catchment 208 Cistern	
	Utilized Storage (m³/ 680 m³)	Peak Water Elevation (m)
2	198.7	0.584
5	283.8	0.835
10	340.5	1.002
25	459.0	1.350
50	577.7	1.699
100	675.0	1.985

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Table 6-5:   Summary of Modelling Results Compared to Allowable for Phase 5

Return Period	209, 210 Development Release Rate (L/s)	Total Controlled 209, 210 Allowable Release Rate, Q_P (L/s)	211, 212 Uncontrolled Release Rate (L/s)
2	45.81	101.5	85.86
5	55.94	101.5	117.67
10	61.78	101.5	139.51
25	72.47	101.5	183.09
50	81.8	101.5	222.17
100	88.72	101.5	259.19

*Flow from entire Phase 5 is not an arithmetic sum of flows from all catchments, but it is iteratively determined.

Therefore, the modelling results demonstrate that the overall peak flow rate from the controlled portion of the Phase 5 site will be below the allowable release rates for all storms up to and including the 100-year storm event. **Section 7.1.4** will detail the total release rate from the site and will account for the uncontrolled release rates from Phase 5. Additionally, the modelling results demonstrates that the 100-year storm event uses a maximum storage volume which are below the underground cisterns designed storm volume for final conditions.

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6.3 Phase 5 Design Conclusion

Erosion Control

Erosion control for Phase 5 will be provided by runoff reduction from the site through infiltration of a minimum of 5 mm rainfall depth across all impervious surfaces. More details will be provided at the detailed design stage. Temporary erosion and sediment controls measures will be implemented during construction.

Water Balance

An assumption of 40mm of initial abstraction for the intensive green roof provides additional water balance volume for Phase 5. An infiltration gallery is not feasible for Phase 5 due to the extent of the underground parking. Surplus water balance from earlier phases will offset the shortfall in Phase 5.

Water Quality

The individual Residential block will have its own filter-based water treatment units. Treatment train approach along with the OGS units will be considered for the right-of-way roads and public space.

Water Quantity

Phase 5 includes a residential block, controlled and uncontrolled private roads. Accordingly, an underground cistern with a volume of 680 m^3 (for commercial / residential block and overcontrol controlled private road) The remaining private roads will drain uncontrolled. The post-development flows for the controlled portion have been controlled to below the allowable release rate for the Phase 5 controlled allowable release rate for the final conditions.

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7   ALL PHASES 1-5

7.1   General

Phase 1 through 5 of the proposed development has a total area of 7.75 ha. The entirety of the phase is shown in **Figure 7-1** below. As discussed in **Section 1.6**, the site's discharge point is towards Frenchman's Bay via the 900mm Culvert under the Go Transit and C.N.R tracks. The total area flowing to this discharge point is 7.62 ha, it excludes the 0.125 ha (catchment 213) flowing towards Pine Creek. The following sections discuss the total SWM mitigation strategies provided for the 7.62 ha site discharging towards Frenchman's Bay.

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LEGEND

▬ ▬ ▬	PROJECT BOUNDARY
▬▬▬	CATCHMENT BOUNDARY
▬ ▬ ▬	UNCONTROLLED CATCHMENT BOUNDARY
▬ ▬ ▬	UNDERGROUND STRUCTURE BOUNDARY
⇨	OVERLAND FLOW ROUTE

211	CATCHMENT ID
0.49	DRAINAGE AREA (ha)
0.52	AVERAGE RUNOFF COEFFICIENT

▨ PHASE 1	
▨ PHASE 2	▨ PROPOSED LANDSCAPE AREA
▨ PHASE 3	▨ EXTENSIVE GREEN ROOF
▨ PHASE 4	▨ INTENSIVE GREEN ROOF
▨ PHASE 5	▨ IMPERVIOUS ROOF

Catchment labels shown on plan:

- 200 / 0.93 / 0.77 (PHASE 1)
- 201 / 0.20 / 0.88
- 204 / 0.60 / 0.79 (PHASE 3)
- 206 / 0.88 / 0.55
- 205 / 0.70 / 0.71
- 203 / 0.15 / 0.85 (PHASE 2B)
- 208 / 0.14 / 0.88
- 207 / 0.44 / 0.85
- 202 / 1.12 / 0.71 (PHASE 2A)
- 210 / 0.12 / 0.76
- 209 / 1.64 / 0.74 (PHASE 5)
- 213 / 0.12 / 0.57
- 212 / 0.47 / 0.64
- 211 / 0.23 / 0.45

Map labels: DIXIE ROAD, THE KING'S HIGHWAY 401, TRCA FLOODLINE, UNDERGROUND STRUCTURE BOUNDARY, PUBLIC R.O.W., EXISTING UNDERGROUND STORM CHAMBER

0 10 20 30 40 50 — 100m

CLIENT
TRIBUTE (BROOKDALE) LIMITED

TITLE
1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
ALL PHASES

PROPOSED CONDITIONS

Checked	Drawn
I.S.	AutoCAD/M.ST.L.
Date	Proj. No.
JANUARY 2025	221-12931-00
Scale	Figure No. 7.1	Gr.No.
AS SHOWN	

7.1.1 Erosion Control

Erosion control is provided for each phase through the minimum on-site retention of at least 5mm as per the requirements set by the City of Pickering.

7.1.2 Water Balance

As discussed in **Section 1.4.2**, based on consultation with the City of Pickering review engineer, retention of the 5mm rainfall through application of green roofs and infiltration is targeted for the site. Due to the extent of the underground parking for each phase, infiltration is proposed only for Phase 2. Thus, the SWM strategy was revised to propose an assumption for the intensive green roof area to have a total abstraction of 40mm in order to meet water balance targets.

The following **Table 7-1** summarizes the net water balance for the entire site. Roadways are not included in the total net water balance volume as they are not required to meet water balance targets.

Table 7-1:   Net Water Balance Volume - All Phases

Phase ID	Catchment ID	5mm WB Volume	Additional WB Volume Provided Through Intensive Green Roof (m³)	Additional WB Volume Provided Through Infiltration Trench (m³)	Net WB Volume (m³)
PH1	200	29.0	31.5	0.0	-2.5
PH2	202	30.7	80.2	47.4	-96.8
PH2	213 - Uncontrolled	2.9	0.0	0.0	2.9
PH3	204	20.3	20.2	0.0	0.2
PH4	205	17.1	92.4	0.0	-75.4
PH4	206	19.1	0.0	0.0	19.1
PH5	209	45.4	168.6	0.0	-123.2
PH5	211 - Uncontrolled	3.4	0.0	0.0	3.4
PH5	212 - Uncontrolled	13.0	0.0	0.0	13.0
Total Controlled WB Net Volume (m³)					-278.7
Total Uncontrolled WB Net Volume (m³)					19.3
Total WB Net Volume (m³)					-259.4

A negative net water balance volume indicates a surplus of water balance volume, this surplus is used throughout the site to compensate for uncontrolled areas and for phases that do not meet the water balance targets. The site provides a total surplus water balance volume of 259.4 m³ after compensating for the uncontrolled areas.

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7.1.3 Water Quality

Each phase of the proposed development targets 80% TSS removal from all runoff from impervious at-grade areas and roofs. Runoff from landscaped areas are considered clean. Filter-based water treatment units will be sized during the SPA submission. For roadways, should filter-units not be permitted as part of SPA, evaluation of the treatment train approach will be considered.

7.1.4 Water Quantity

As stated in **Section 1.4.4**, the post-development flows from the site shall be attenuated to the allowable flow, for all storms up to and including the 100-year storm event. The allowable flow to Frenchmans Bay is 662.6 L/s.

The following **Table 7-2** summarizes the flows the flows from each phase including the uncontrolled flows and the total flow from the proposed development. Phase 4 accounts for flows from Phase 1, Phase 3 and Phase 2B.

Table 7-2:   Summary of Total Site Release Rates

Return Period	Phase 2A Release Rate (L/s)	Phase 4 Release Rate (Accounts for Phase 1, 2B, and 3) (L/s)	Phase 5 Release Rate (L/s)	Phase 5 Uncontrolled Release Rate (L/s)	Total Development Release Rate* (L/s)	Total Allowable Release Rate, Q_P (L/s)
2	32.59	104.07	45.81	85.86	224.11	662.6
5	39.99	126.75	55.94	117.67	280.09	662.6
10	44.27	139.93	61.78	139.51	316.03	662.6
25	52.19	164.78	72.47	183.09	383.73	662.6
50	58.73	182.25	81.8	222.17	440.67	662.6
100	63.82	196.28	88.72	259.19	490.27	662.6

Therefore, the modelling results demonstrate that the overall peak flow rate form the entire development will be below the allowable release rate for all storms up to and including the 100-year storm event.

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8   CONCLUSIONS

A Stormwater Management report has been prepared in support of the Official Plan Amendment (OPA), and Zoning By-Law Amendment (ZBA) for the development of Brookdale at 1101A, 1105 and 1163 Kingston Road in the City of Pickering, based on the City of Pickering Stormwater Management Design Guidelines dated July 2019.

— **Water Balance:** Each phase of the development is to address the water balance criterion separately and independently by retaining all runoff from the 5 mm rainfall. The accepted retention practices are infiltration and implementation of green roofs. It is assumed that the intensive green roof provides a total abstraction of 40mm, this assumption along with the proposed infiltration gallery allows for a surplus in water balance volume across the site.

— **Water Quality:** All runoff from impervious at-grade surfaces and roof areas within each phase shall be treated by an appropriately sized filtered water quality unit, Jellyfish Filters, for 80% TSS removal. Runoff from landscaping areas is considered clean as these areas are free from runoff generating activities. There is an existing OGS unit on site that can provide treatment for the proposed ROWs. A treatment train approach will be investigated for detailed design.

— **Erosion Control:** The minimum on-site retention of at least 5 mm will be achieved as per requirements by the City of Pickering. Temporary erosion and sediment control plans shall be implemented during construction.

— **Water Quantity:** The use of controlled discharge for each phase boundary will ensure that the peak offsite discharge rate to municipal storm sewers shall be below the allowable flow rate defined according to the City of Pickering's design requirements, for all storms up to and including the 100-year event.

The report has demonstrated that the proposed SWM strategy will address stormwater management related impacts from this development and meet the intent of the City of Pickering's Stormwater Management Design Guidelines.

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APPENDIX

A

Existing Stormwater Management Report
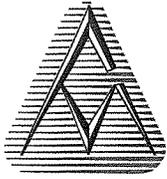
a.m. candaras associates inc.

consulting engineers

STORMWATER MANAGEMENT REPORT
PROPOSED COMMERCIAL DEVELOPMENT
FOR
BROOKDALE CENTRES INC.
1105 KINGSTON ROAD
PICKERING, ONTARIO

Revised January, 2015

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8551 Weston Road, Suite 203
Woodbridge, Ontario
L4L 9R4

Project #0589

1.0   INTRODUCTION

This report presents the stormwater management analysis for the proposed Commercial Development at 1105 Kingston Road, just east of Dixie Road. The site is part of the Amberlea Industrial 5 overall development. It is proposed to utilize the existing storm service connections along with on site controls, to limit the flows as per the stormwater management report prepared by Johnson Sustronk Weinstein & Associates (JSW) June 1988. The Amberlea Industrial 5 site drains south through a 1.83 x 1.83 m box culvert under Hwy # 401. The discharge from the box culvert on the south side of Hwy # 401 is drained by an existing 900 mm diameter culvert which runs under the Go Transit and C.N.R. tracks. This 900 mm diameter culvert will be the restricting factor for the entire development, with a capacity of $1.61 m^3/s$ as stated in the JSW report. Also, the maximum capacity of a 900mm diameter sewer is $1.8 m^3/s$, therefore the $1.61 m^3/s$ will be used as the maximum allowable discharge. (See reference from Town of Bradford Design Criteria enclosed)

2.0   DESIGN CRITERIA

(a) Maximum allowable stormwater discharge to be limited to the 900 mm diameter culvert capacity of $1.61 m^3/s$ for the entire Amerlea Industrial 5 development which includes the proposed commercial site at 1105 Kingston Road.

(b) On site detention must be provided for the 100 year storm.

(c) Stormwater quality controls are to provide Level 1 protection, 80% TSS removal.

3.0   ALLOWABLE PEAK DISCHARGE

As discussed in Section 1, the allowable peak discharge is to be limited to the 900 mm diameter culvert on the south side of Hwy # 401. To determine the allowable discharge from the proposed commercial development at 1105 Kingston Road, Plan SWM-2 (enclosed) prepared by JSW will be used along with the June 1988 stormwater management report for the entire Amberlea Industrial 5 area. The 100 year discharge flows to the 900 mm diameter culvert are as follows:

(a) Area C $\quad$ = 4.06 ha, to be limited to 0.077 m³/s / ha

$\quad\quad \therefore Q_C$ $\quad$ = 4.06 ha x 0.077 m³/s /ha

$\quad\quad\quad\quad\quad$ = 0.313 m³/s

(b) Area B $\quad$ = 1.29 ha $\quad\quad$ C = 0.51 (as per JSW Stormwater Management Report)

$\quad\quad i_{100}$ $\quad$ = $\frac{1770}{(t+4)^{0.82}}$, where T= 10min

$\quad\quad\quad\quad\quad$ = $\frac{1770}{(10+4)^{0.82}}$ $\quad$ = 203.3mm/hr

$\quad\quad Q_B$ $\quad$ = C AIN

$\quad\quad\quad\quad\quad$ = (0.51) (1.29ha) (203.3mm/hr) (2.778)

$\quad\quad\quad\quad\quad$ = 371.6 l/s (0.372 m³/s)

(c) Area A $\quad$ = 0.51ha $\quad\quad$ C= 0.61 (As per JSW Stormwater Management Report)

$\quad\quad i_{100}$ $\quad$ = 203.3mm/hr based on T=10 min

$\quad\quad Q_A$ $\quad$ = (0.61) (0.51 ha) (203.3mm/hr) (2.778)

$\quad\quad\quad\quad\quad$ = 175.7 l/s (0.176 m³/s)

(d) Areas G   = 1.19 - 0.5ha (within proposed development)

               = 0.69 ha

      H   = 0.46 ha

      C   = 0.25, increase to 0.31 for 100 year runoff calculation.

$$\text{i}_{100}= 203.3 \text{ mm/hr, based on } T=10 \text{ min}$$

$$Q_{G\&H} = (0.31)\,(1.15\text{ha})\,(203.3\text{ mm/hr})\,(2.778)$$

$$= 201.3 \text{ l/s } (0.201 \text{ m}^3/\text{s})$$

Total 100 year discharge from areas A, B, C, G&H based on SWM-2 Plan is:

$$Q_{100} \quad = (0.313 + 0.372 + 0.176 + 0.201) \text{ m}^3/\text{s}$$

$$= 1.06 \text{m}^3/\text{s}$$

Therefore, allowable peak discharge from the proposed commercial development at 1105 Kingston Road is as follows:

$$Q_{\text{ALLOWABLE}} = 1.61 \text{ m}^3/\text{s} - 1.06 \text{ m}^3/\text{s}$$

$$= 0.55 \text{m}^3/\text{s}$$

4.0   SITE DESCRIPTION

The proposed commercial development will be utilizing the existing storm connections to discharge the allowable runoff of 0.55 m³/s as shown in Figure 1.

a) Drainage area A = 3.27ha, connection to existing 600mm storm sewer.

Roof (Bldg's C, D, E)	= 0.41ha
Paved	= 2.70ha
Landscaped (*assume 5% of total area)	= 0.16ha
Total	3.27ha

b) Drainage area B = 3.37ha, connection to existing 525mm storm sewer.

Roof (Bldg's Home Depot, B)	= 1.33ha
Paved	= 1.87ha
Landscaped (*assume 5% of total area) =	0.17
Total	3.37ha

The allowable discharge rate 0.55 m³/s for both areas A and B will be pro-rated as follows:

Site A = 3.27ha

$$Q_{ALLOWABLE} = \frac{(3.27)}{(3.27+3.37)} \times 0.55 \text{ m}^3/\text{s}$$
$$= 0.27 \text{ m}^3/\text{s}$$

Site B = 3.37ha

$$Q_{ALLOWABLE} = 0.55 \text{ m}^3/\text{s} - 0.27 \text{m}^3/\text{s}$$
$$= 0.28 \text{ m}^3/\text{s}$$

PROPOSED COMMERCIAL
DEVELOPMENT FOR
BROOKDALE CENTRES INC.

1105 KINGSTON ROAD, PICKERING

PROPOSED DRAINAGE AREAS

FIGURE 1

SEPTEMBER 27/07
SCALE: N.T.S

a.m. candaras associates inc.
consulting engineers
8551 Weston rd. suite 203
Woodbridge ont. L4L 9R4
905-850-8020 Fax 905-850-8099
Email: civil@amcai.com
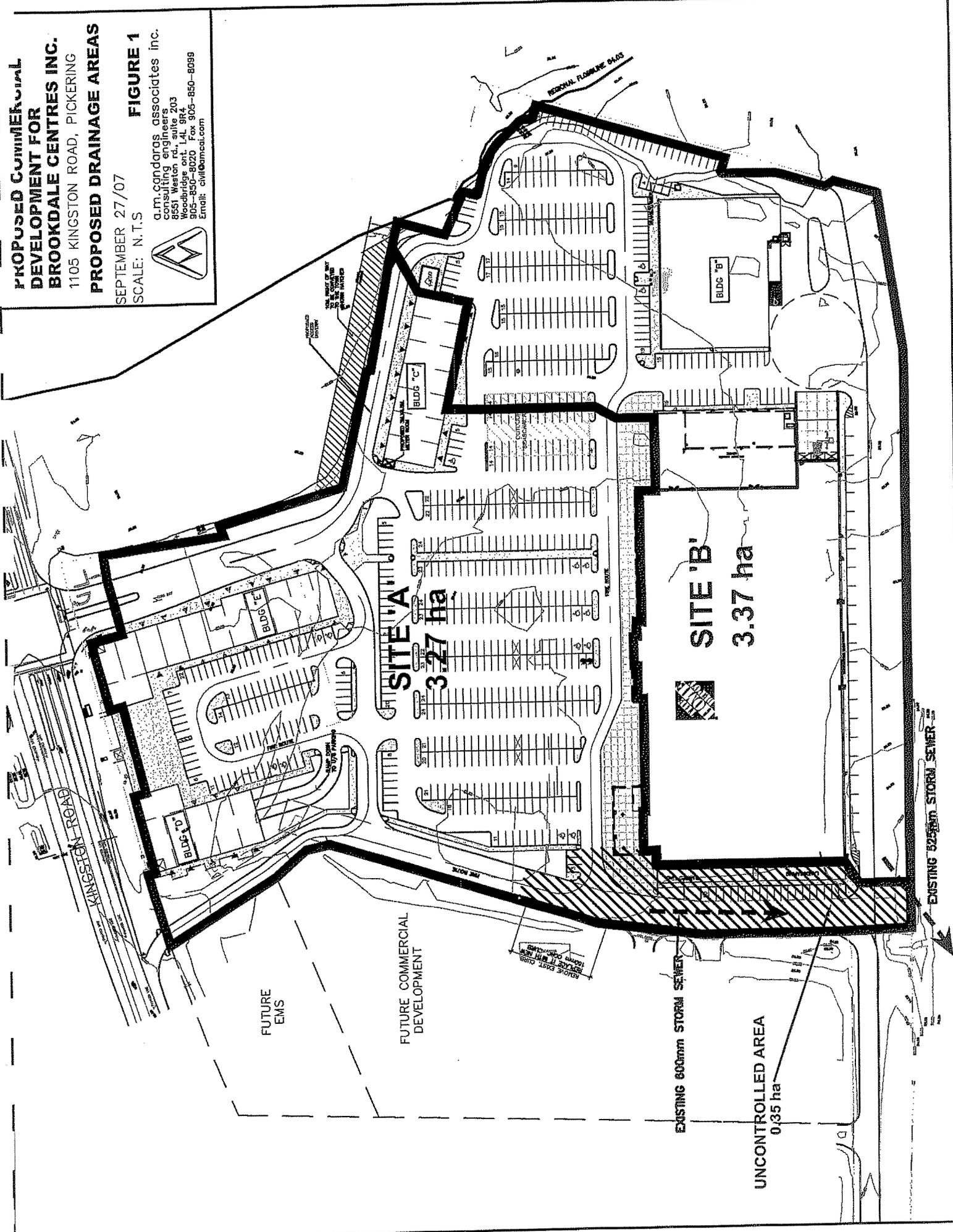
SITE 'A'
3.27 ha

SITE 'B'
3.37 ha

BLDG "C"

BLDG "E"

BLDG "D"

BLDG "B"

KINGSTON ROAD

FUTURE EMS

FUTURE COMMERCIAL
DEVELOPMENT

UNCONTROLLED AREA
0.35 ha

EXISTING 600mm STORM SEWER

EXISTING 525mm STORM SEWER

REGIONAL FLOWLINE 94.03

5.0   PRE-DEVELPOMENT RUNOFF

Based on the allowable runoff determined in Section 3 as 0.55 m³/s, the following pre-development rates for the 2,5 and 100 year storm event have been calculated to demonstrate that the post development rate of 0.55 m³/s is less than the pre-development rate.

- Pre-Development Areas, based on JSW SWM-2 plan enclosed.

Area	B	=	1.21ha	@	C= 0.51
Area	F	=	1.04ha	@	C=0.71
Area	E	=	1.36ha	@	C=0.51
Area	D	=	0.72ha	@	C=0.71
Area	G	=	0.50ha	@	C=0.25

(within development area)

EX Building	=	1.15ha	@	C=0.9

$$\therefore \quad CA = [(0.25)(0.50) + (0.71)(1.76) + (0.51)(2.57) + (0.9)(1.15)]$$
$$= 3.7$$

Based on City of Pickering rainfall intensity curves;

$$i_{2yr} = \frac{647.7}{(t+4)^{0.784}} \qquad t = 10min$$

$$= \frac{647.7}{(10+4)^{0.784}} \qquad = 81.8mm/hr$$

$$i_{5yr} = \frac{2464}{t+16} \qquad t = 10min$$

$$= \frac{2464}{10+16} \qquad = 94.8mm/hr$$

$$i_{100yr} = \frac{1770}{(t+4)^{0.82}} \qquad t = 10min$$

$$= \frac{1770}{(10+4)^{0.82}} \qquad = 203.3mm/hr$$

- Pre-Development flows are as follows:

2yr   Q = CAIN
            = (3.7) (81.8mm/hr) (2.778)
            = 841 l/s (0.84m³/s)   > 0.55m³/s allowable runoff

5yr   Q = CAIN
            = (3.7) (94.8mm/hr) (2.778)
            = 974 l/s (0.97m³/s)   > 0.55m³/s allowable runoff

100yr Q = CAIN
            = (3.7) (203.3mm/hr) (2.778)
            = 2090 l/s (2.09 m³/s)   > 0.55 m³/s allowable runoff

6.0   ROOF TOP CONTROLS

The roof areas will be flat and will be equipped with Zurn-Z-105–ERC control flow roof drains as follows:

SITE A

Bldg	Area (m²)	No. of Notches	Notch Area	Flow (1)	Total flow
C	1258.63	3	419.5	93 l/m	4.65 l/s
D	1025.00	3	341.7	93 l/m	4.65 l/s
E	1791.55	5	358.3	93 l/m	7.75 l/s
					Q_R=17.1 l/s (0.02 m³/s)

(1) Based on manufacturer's design table at a 102mm depth.

SITE B

Bldg	Area (m²)	No. Of Notches	Notch Area (m²)	Flow (1) Per Notch	Total Flow
Home Depot	10881.84	28	388.6	93 l/m	43.4 l/s
B	2382	6	397	93 l/m	9.3 l/s
					Q_R= 52.7 l/s (0.05m³/s)

(1) Based on manufacturer's design table at a 102mm depth

MTO does not consider rooftop control structures to be permanent in nature, therefore the City of Pickering has stated that the site plan agreement will ensure that these rooftop controls will remain in place and be regularly maintained to be effective. In the event that the rooftop controls are removed, the orifice pipe along with the restrictor pipes for each building roof outlet will control the site below the pre-development rates.

7.0 DETENTION VOLUME CALCULATIONS

A) Site A = 3.27ha, connection to existing 600mm storm sewer. A portion of Site A (0.35ha) along the west side of the proposed Home Depot will discharge off site uncontrolled.

$\therefore Q_{Uncontrolled} = $ CAIN, where C = 0.85

$= (0.85)(0.35ha)(203.3mm/hr)(2.778)$ A $= 0.35ha(0.315ha\ paved)$
$(0.0035\ Landscaped)$

$= 168.0\ l/s\ (0.17m^3/s)$ i_{100} $= 203.3\ mm/hr$
Based on T $= 10min$

Allowable Runoff Site A $= 0.27m^3/s$
Uncontrolled Run off Site A $= 0.17m^3/s$
Roof Discharge Site A $= 0.02m^3/s$

$\therefore$ Allowable discharge from paved and landscaped Area:
$Q_s = 0.27\ m^3/s - (0.17 + 0.02)\ m^3/s$
$= 0.08\ m^3/s$

100 yr. Storage Required = 1,113.0 m³, as calculated in Table 1 and based on the rational formula hydrograph.

B) Site B = 3.37ha, connection to existing 525mm storm sewer.

Allowable runoff Site B = 0.28 m³/s
Roof Discharge Site B = 0.05 m³/s

$\therefore$ Allowable discharge from paved and landscaped areas:

$Q_s = 0.28\ m^3/s - 0.05\ m^3/s$
$= 0.23\ m^3/s$

100 year storage required = 555.0 m³, as calculated in Table 2 and based on the rational formula hydrograph.

Note: The 100yr storm hydrograph is based on the City of Pickering 100yr IDF curve, with the 4hr Chicago Storm (see SWM HYMO Output File for Details enclosed.)

TABLE 1:   100 YR STORM RUNOFF COMPUTATIONS FOR SITE A, PAVED AND LANDSCAPED AREAS

Time Period (min)	Intensity (mm /hr)	Runoff (l/s)	(1)Storage (m^3)	(2)Storage (m^3)
35-40	11	0.07	-	-
40-45	14	0.09	3.0	6.0
45-50	19	0.13	15.0	18.0
50-55	30	0.20	36.0	39.0
55-60	76	0.51	129.0	132.0
60-65	292	1.96	564.0	567.0
65-70	101	0.68	180.0	183.0
70-75	52	0.35	81.0	84.0
75-80	35	0.23	45.0	48.0
80-85	26	0.17	27.0	30.0
85-90	21	0.14	18.0	21.0
90-95	18	0.12	12.0	15.0
95-100	14	0.09	3.0	6.0
100-105	11	0.07	-	-
			1,113.0	1149.0

Paved   = 2.40ha   @   C = 0.99
Landscaped   = 0.13ha   @   C = 0.31

CAN   = [(2.40 x 0.99) + (0.13 x 0.31)] (2.778)
               = 6.7

Storage (m^3)   = (Runoff – Allowable Outflow) x 5min x 60sec

(1) Allowable Outflow = 0.08 m^3/s
(2) Allowable Outflow = 0.07 m^3/s with 150mm Orifice Tube.

TABLE 2:   100 YR STORM RUNOFF COMPUTATIONS FOR SITE B, PAVED AND LANDSCAPED AREAS

Time Period (min)	Intensity (mm /hr)	Runoff (m³/s)	Storage (m³)
35-40	11	0.06	-
40-45	14	0.07	-
45-50	19	0.10	-
50-55	30	0.16	-
55-60	76	0.40	51.0
60-65	292	1.55	396.0
65-70	101	0.54	93.0
70-75	52	0.28	15.0
75-80	35	0.19	-
80-85	26	0.14	-
85-90	21	0.11	-
90-95	18	0.10	-
95-100	14	0.07	-
100-105	11	0.06	-
			555.0

Net Paved   = 1.87ha @ C = 0.99
Landscaped   = 0.17ha @ C = 0.31

CAN   = [(1.87x0.99) + (0.17 x 0.31)] (2.778)
                            = 5.3
Storage (m³)   = (Runoff – Allowable Outflow) x 5min x 60sec

Allowable Outflow   = 0.23 m³/s

8.0   AVAILABLE DETENTION VOLUME

A) Site A

Based on a high water level of 85.10, the available detention volume is as follows:

Surface Storage

DCB # 1&2	= 400.0 m³
CB#23	= 5.3 m³
DCB # 3	= 121.5 m³
	526.8 m³

Pipe Storage

338.5m – 450mm dia	= 53.8 m³
50m – 375mm dia	= 5.5 m³
47m – 300mm dia	= 3.3 m³
44m – 200mm dia	= 1.4 m³
29.5m – 250mm dia	= 1.5 m³
	65.5 m³

Stormtech Chambers: (Model SC-310)

A total of 643 SC-310 stormtech chambers @ 0.877 m³ per chamber will be required with an available storage volume 563.9 m³.

Preliminary layout of the model SC-310 stormtech chambers are shown on plan G2 and specifications enclosed in Appendix A.

∴ Total Storage provided
= 526.8 m³ (Surface Storage)
+ 65.5 m³ (Pipe Storage)
+ 563.9 m³ (Stormtech Chambers)
1,156.2 m³ > 1,149.0 m³ (required based on 150mm orifice)

B) Site B

Based on a high water level of 85.05, the available detention volume is as follows:

Surface Storage

CB # 12&13	= 118.0
CB # 14	= 54.5
CBMH #12,	= 170.0
DCB#21, DCBMH # 15	= 55.2
CB # 22	= 33.8
	431.5 m³

Pipe Storage

187m – 525mm dia	= 40.5 m³
182m – 450mm dia	= 29.0 m³
13m - 300mm dia	= 0.9 m³
193.5m – 250mm dia	= 9.5 m³
17m - 200mm dia	= 0.5 m³
	80.4

Stormtech Chamber: (Model SC-740)

A total of 21 SC-740 stormtech chambers @ 2.12 m³ per chamber will be required with an available storage volume of 44.5 m³.

Preliminary layout of the model SC -740 stormtech chambers are shown on plan G2 and specifications enclosed in Appendix A.

∴ Total Storage provided
   = 431.5 m³ (surface storage)
   + 80.4 m³ (pipe storage)
   + 44.5 m³ (stormtech chambers)
      556.4 m³ > 555.0 m³ (required)

9.0 OUTLET CONTROLS

A) Site A

To limit the discharge to :

Q_A = 0.27 m³/s − 0.17 m³/s (uncontrolled flow)
         = 0.10 m³/s

Sizing of orifice pipe is as follows :

Q $= CA \sqrt{2gh}$
Q   = 0.13 m³/s
H   = HWL − Inv. of orifice
H   = 85.10 − 83.14
     = 1.96 m

A $= \dfrac{Q}{C\sqrt{2gh}}$

$$= \dfrac{0.10}{0.8\sqrt{2 \times 9.81 \times 1.96}}$$

= 0.02016 m²

D $= \sqrt{\dfrac{4xA}{\pi}} = \sqrt{\dfrac{4 \times (0.02016)}{\pi}} = 0.160\text{m}$

∴ Use 150 mm prefabricated eccentric reducer as detailed on Plan G2

$Q = CA \sqrt{2gh}$
    $= (0.8)(0.0177) \sqrt{2 \times 9.81 \times 1.56}$
    = 0.09 m³/s

$A = \dfrac{\pi d^2}{4} = \pi \dfrac{(.15)^2}{4} = 0.0177\text{m}^2$

B) Site B

To limit the discharge to :

$$Q_A = 0.28 \text{ m}^3/\text{s}$$

Sizing of the orifice pipe is as follows :

$$A = \frac{Q}{C\sqrt{2gh}}$$

$$Q = 0.28 \text{ m}^3/\text{s}$$

$$H = \text{HWL} - \text{Inv. Of orifice}$$

$$= 85.05 - 82.10$$

$$= 2.95 \text{ m}$$

$$A = \frac{0.28}{0.8\sqrt{2 \times 9.81 \times 2.95}} = 0.0460 \text{ m}^2$$

$$D = \sqrt{\frac{4 \times A}{\pi}} = \sqrt{\frac{4 \times (0.0460)}{\pi}} = 0.242 \text{ m}$$

∴ Use 250 mm prefabricated eccentric reducer as detailed on Plan G2

$$Q = CA\sqrt{2gh} \qquad\qquad A = \frac{\pi (.25)2}{4} = 0.0491 \text{ m}^2$$
$$= (0.8)(0.491)\sqrt{2 \times 9.81 \times 2.95}$$
$$= 0.30 \text{ m}^3/\text{s}$$

∴ Total discharge off site = 0.30 + 0.09+ 0.17 = 0.56 m³/s (allowable 0.55m³/s)

10.0 STORMWATER QUALITY

Stormwater quality treatment for the proposed commercial development will be based on M.O.E Level 1 protection with 80% annual TSS removal, as well as capturing and treating a minimum of 90% runoff volume. Three treatment units will be provided on site as shown in Figure 2, and plan G2 with sizing as follows:

A) <u>Treatment Unit #1</u>

$$\text{Tributary Impervious Area} = 3.27 \text{ ha} \times 90\% \text{ (imperviousness)}$$
$$= 2.94 \text{ ha}$$

Based on Contech Stormwater Solutions Inc. Sizing Estimates, a VortSentry model VS70 will be required.

B) <u>Treatment Unit # 2</u>

$$\text{Tributary Impervious Area} = 3.37 \text{ ha} \times 90\% \text{ (imperviousness)}$$
$$= 3.03 \text{ ha}$$

Based on Contech Stormwater Solutions Inc. Sizing Estimates, a VortSentry model VS70 will be required.

Note: (1) See attached VortSentry sizing in Appendix B.
(2)Manufacture to confirm that location and sizing meets their specifications, and that certification will be provided upon installation as per City of Pickering requirement.

Prepared by,
a.m. candaras associates inc.
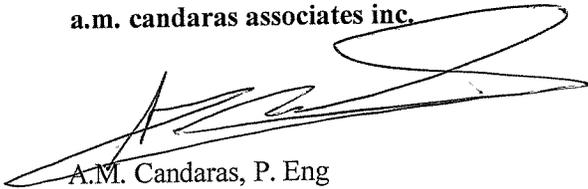
A.M. Candaras, P. Eng
Consulting Engineer

DEVELOPMENT FOR
BROOKDALE CENTRES INC.
1105 KINGSTON ROAD, PICKERING

STORMCEPTOR
DRAINAGE AREAS

FIGURE 2

OCTOBER 26/07
SCALE: N.T.S

a.m.candaras associates inc.
consulting engineers
8551 Weston rd., suite 203
Woodbridge ont. L4L 9R4
905-850-8020   Fax 905-850-8099
Email: civil@amcai.com

3.37 ha — DRAINAGE AREA (ha)
90% — IMPERVIOUSNESS (%)
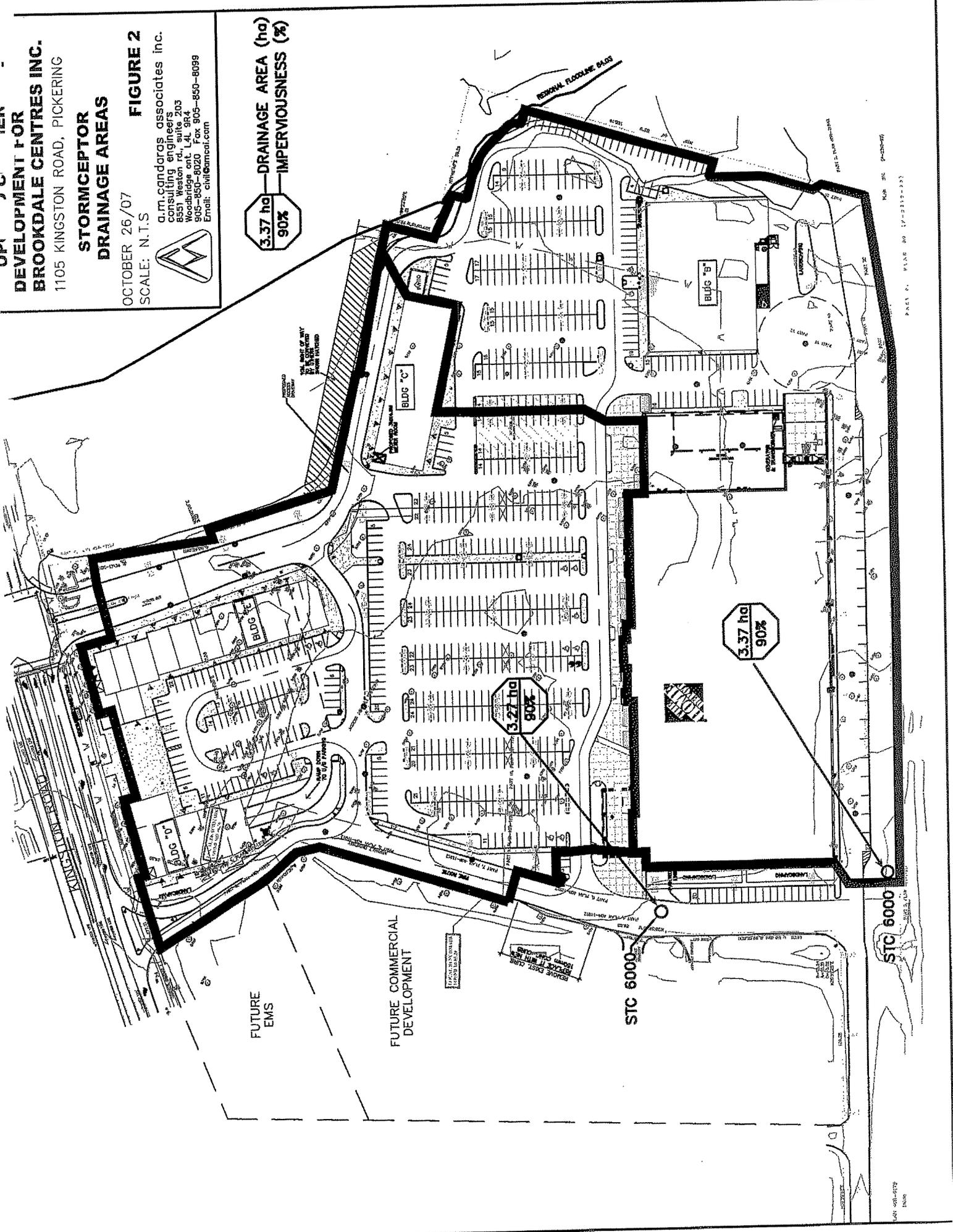
APPENDIX A

STORMTECH SPECIFICATIONS

StormTech®

Detention · Retention · Recharge

Subsurface Stormwater Management℠

Design Manual

StormTech® Chamber Systems for Stormwater Management

2.0 Product Information

Figure 1

StormTech SC-740 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	51.0" x 30.0" x 85.4"
Chamber Storage	45.9 ft³
Minimum Installed Storage*	74.9 ft³
Weight	74 lbs

ACCEPTS 4" SCH 40 PIPE
FOR OPTIONAL
INSPECTION PORT

90.7"

85.4" INSTALLED

30.0"

51.0"

Figure 2

StormTech SC-310 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	34.0" x 16.0" x 85.4"
Chamber Storage	14.7 ft³
Minimum Installed Storage*	31.0 ft³
Weight	37 lbs

ACCEPTS 4" SCH 40 PIPE
FOR OPTIONAL
INSPECTION PORT

90.7"

85.4" INSTALLED

16.0"

34.0"

*This assumes a minimum of 6-inches of stone below, above and between chamber rows and 40% stone porosity.

2.5 STORMTECH CHAMBERS

StormTech's chamber systems have unique features to improve site optimization and reduce product waste. The SC-740 and SC-310 chambers can be cut at the job site in approximately 6.5-inch increments to shorten a row's length. Designing and constructing chamber rows around site obstacles is easily accomplished by including specific cutting instructions or a well placed "cut to fit" note on the design plans. The last chamber of a row can be cut in any of its corrugation's valleys. An end cap placed into the trimmed corrugation's crest completes the row. The trimmed-off piece of a StormTech chamber may then be used to start the next row. See **Figure 3**.

To assist the contractor, StormTech's chambers are molded with simple assembly instructions and arrows that indicate the direction in which to build rows. Rows are formed by overlapping the next chamber's "Start End" corrugation with the previously laid chamber's end corrugation. Two people can safely and efficiently form rows of chambers without complicated connectors, special tools or heavy equipment.
Product Specifications: 2.2, 2.4, 2.9 and 3.2

2.6 STORMTECH END CAPS

The StormTech end cap has features which make the chamber system simple to design, easy to build and more versatile than other products. StormTech end caps can be easily secured within any corrugation's crest. A molded-in handle makes attaching the end cap a one-person operation. Tools or fasteners are not required.

StormTech end caps are required at each end of a chamber row to prevent stone intrusion (two per row). The SC-740 end cap will accept up to a 25-inch maximum outside diameter inlet pipe. The SC-310 end cap will accept up to a 12-inch inlet pipe. To aid contractors, inlet pipe cutting guides and a blade-starting slot are molded into the end caps. See **Figure 4**.
Product Specifications: 3.1, 3.2, 3.3 and 3.4

Figure 3
Distance Between Corrugations (not to scale)

SC-310 chamber

Figure 4
Chamber End Caps (not to scale)

SC-740 end cap

12.0 Detail Drawings

Figure 13
Plan View Detail – StormTech SC-740 Chamber (not to scale)

- PAVEMENT
- PAVEMENT SUB-BASE
- COMPACTED FILL PER STORMTECH'S TABLE OF ACCEPTABLE FILL MATERIALS*
- AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE
- 6" MIN. DEPTH OF 3/4 - 2-INCH WASHED, CRUSHED, ANGULAR STONE BACKFILL
- 3/4 - 2-INCH WASHED, CRUSHED, ANGULAR STONE BENEATH AND AROUND CHAMBER BED. DEPTH TO BE DETERMINED BY DESIGN ENGINEER*

- AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE
- SC-740 END CAP
- SC-740 CHAMBER

Figure 14
Typical Cross Section Detail – StormTech SC-740 Chamber (not to scale)

- SC-740 END CAP
- SC-740 CHAMBER
- 3/4 - 2-INCH WASHED, CRUSHED, ANGULAR STONE
- AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE ALL AROUND STONE

- GRANULAR WELL GRADED SOIL/AGGREGATE MIXTURES, <35% FINES. COMPACT IN 6" LIFTS TO 95% PROCTOR DENSITY. SEE THE TABLE OF ACCEPTABLE FILL MATERIALS IN STORMTECH'S DESIGN MANUAL, INSTALLATION MANUAL, OR WWW.STORMTECH.COM.

- PAVEMENT

FOR UNPAVED INSTALLATION WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24 INCHES

- 18" MIN.
- 96" MAX.
- 6" MIN.
- 30"

- DEPTH OF STONE TO BE DETERMINED BY DESIGN ENGINEER*

- DESIGN ENGINEER IS RESPONSIBLE FOR ENSURING SUITABILITY OF SUBGRADE SOILS*

- 6" MIN.
- 51"
- 12" MIN. TYP.

*See Section 4 of this Design Manual.

Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

Figure 15
Inlet and Outlet Detail – StormTech SC-740 Chamber (not to scale)

GRANULAR WELL GRADED SOIL/AGGREGATE MIXTURES,
<35% FINES. COMPACT IN 6" LIFTS TO 95% PROCTOR DENSITY.
SEE THE TABLE OF ACCEPTABLE FILL MATERIALS IN
STORMTECH'S DESIGN MANUAL, INSTALLATION MANUAL,
OR WWW.STORMTECH.COM.

PAVEMENT

CONTROL STRUCTURE PER DESIGN

AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE

CATCH BASIN
OR
MANHOLE

A

18"
MIN.

96"
MAX.

24" MIN.
SUMP

OUTLET PIPING

3/4 - 2 INCH WASHED, CRUSHED,
ANGULAR STONE. DEPTH OF
STONE TO BE DETERMINED BY
DESIGN ENGINEER*

OUTLET

DESIGN ENGINEER IS
RESPONSIBLE FOR
ENSURING THE SUITIBILITY
OF SUBGRADE SOILS*

SC-740 CHAMBER

SC-740 ENDCAP

A. FOR UNPAVED INSTALLATION
WHERE RUTTING MAY OCCUR,
INCREASE COVER TO 24 INCHES

See Section 4 of this Design Manual.

AASHTO M288 CLASS 2
NON-WOVEN GEOTEXTILE

Figure 16
StormTech Isolator Row (not to scale)

12" MIN ID 25" MAX OD PIPE
SET 1.5" FROM BOTTOM
OF CHAMBER

INSPECTION PORT
LOCATION PER
ENGINEER'S DRAWING

COVER ENTIRE ROW WITH AASHTO M288
CLASS 2 NON-WOVEN GEOTEXTILE
SC-740 — 8' WIDE STRIP
SC-310 — 5' WIDE STRIP

STORMTECH
ENDCAP

CATCH
BASIN
OR
MANHOLE

2FT MIN.
SUMP

WOVEN GEOTEXTILE THAT MEETS AASHTO M288 CLASS 1
REQUIREMENTS, BETWEEN STONE BASE AND CHAMBERS
SC-740 — 5'-6' WIDE STRIP
SC-310 — 4' WIDE STRIP

Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

APPENDIX B

VORTSENTRY SIZING

Provided by Jennifer Knowles on November 20, 2007

Brookdale Centres Inc, Pickering, ON
Stormwater Treatment System Design Summary

Information provided by contractor (Direct Underground Ltd):

- WQS #1
  - Drainage area = 3.27 hectares
  - Runoff coefficient = 0.9
  - Pipe size = 600 mm
- WQS #2
  - Drainage area = 3.37 hectares
  - Runoff coefficient = 0.9
  - Pipe size = 525 mm

- Sediment removal efficiency required = 80%
- Sediment particle gradation = 150 microns (MOE)

Sizing Summary:

The VortSentry® Stormwater Treatment System is a hydrodynamic separator designed to enhance gravitational separation of floating and settleable materials from stormwater flows. Stormwater flows enter the unit tangentially to the treatment chamber, which promotes a gentle swirling motion. As stormwater circles the treatment chamber, pollutants migrate toward the center of the unit where velocities are the lowest. Sediments accumulate in the bottom of the treatment chamber, while floating debris, oil and grease form a floating layer trapped in front of the treatment chamber baffle.

For this project the VortSentry was designed to remove approximately 80% of an average particle size of 110 microns based on historical rainfall data. For this site CONTECH Stormwater Solutions Inc. recommends the following:

System Designation	VortSentry Model	80% Treatment Capacity (l/s)	Sediment Storage Capacity (cubic meters)	Oil Spill Capacity (liters)
WQS #1	VS70	76.5	3.3	2660
WQS #2	VS70	76.5	3.3	2660

We have supplied project specific efficiency and flow calculations for your use and review.

Maintenance:

As any stormwater best management practice, the VortSentry system requires regular inspection and maintenance to ensure optimal performance. Maintenance frequency will be driven by site conditions. Quarterly visual inspections are recommended, at which time the accumulation of pollutants can be determined. On average, the VortSentry system requires annual removal of accumulated pollutants.

Thank you for the opportunity to present this information to you and your client.

VortSentry® Estimated Net Annual Solids Load Reduction
Based on an Average Particle Size of 110 Microns
BROOKDALE CENTRES INC
PICKERING, ON
Model VS70
System WQS #1

CONTECH®
STORMWATER
SOLUTIONS.

Design Ratio[1] =	$\dfrac{3.27 \text{ ha} \times 0.9}{7.54 \text{ m3}}$	= 0.027

Rainfall Intensity mm/hr	Flow Rate l/s	Operating Rate[2] cfs/ft^{3}	% Total Rainfall Depth[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.5	4.05	0.00053	8.5%	98.0%	8.4%
1.0	8.11	0.00106	11.1%	96.9%	10.8%
1.5	12.16	0.00159	9.4%	95.8%	9.1%
2.0	16.22	0.00213	7.4%	94.7%	7.0%
3.0	24.32	0.00319	12.4%	92.5%	11.5%
4.0	32.43	0.00425	9.3%	89.6%	8.3%
5.0	40.54	0.00531	7.3%	85.9%	6.3%
6.0	48.65	0.00638	6.0%	84.0%	5.1%
7.0	56.76	0.00744	5.8%	82.4%	4.8%
8.0	64.86	0.00850	3.2%	81.6%	2.6%
9.0	72.97	0.00956	1.9%	80.8%	1.6%
10.0	81.08	0.01063	4.2%	80.0%	3.4%
11.0	89.19	0.01169	2.2%	75.7%	1.7%
12.0	97.30	0.01275	1.6%	71.3%	1.1%
15.0	121.62	0.01594	2.6%	57.6%	1.5%
20.0	162.16	0.02126	1.3%	49.8%	0.6%
25.0	202.70	0.02657	1.2%	28.2%	0.3%
30.0	243.24	0.03188	0.4%	23.8%	0.1%

Predicted Net Annual Load Removal Efficiency = 81.0%
Predicted Percent of Runoff Volume Treated = 92.9%

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
2 - Operating Rate (cfs/ft^{3}) = Rainfall Intensity ("/hr) x Design Ratio
3 - Based on 10 years of rainfall data from Canadian Station 6158350 Pearson Airport, Toronto, ON
4 - Removal efficiencies are based on Contech Stormwater Solutions laboratory verified removal of OK-110, a commercially available silica gradation with a mean particle size of 110 microns, containing particles ranging from 53-150 microns.

Calculated by: JAK	Date: 11/20/07	Checked by:	Date:

VortSentry® Stage Discharge Calculations
BROOKDALE CENTRES INC
PICKERING, ON
Model VS70
System WQS #1

CONTECH
STORMWATER
SOLUTIONS

Treatment Chamber Outlet Orifice		Flow Partition Weir	
Orifice Area (m²) =	0.060	Crest El. (m) =	0.46
Discharge Coefficient =	308	Weir Crest Length (m) =	0.51
		Discharge Coefficient =	1895

Head (m)	Elevation (m)	Treatment Flow (l/s)	Bypass Flow Rate (l/s)	Total Flow Rate (l/s)
0.05	82.74	6	0	6
0.10	82.79	17	0	17
0.15	82.84	28	0	28
0.20	82.89	40	0	40
0.25	82.94	45	0	45
0.30	82.99	54	0	54
0.35	83.04	59	0	59
0.40	83.09	68	0	68
0.45	83.14	74	0	74
0.50	83.19	79	3	82
0.55	83.24	85	25	110
0.60	83.29	91	45	136
0.65	83.34	93	71	164
0.70	83.39	96	102	198
0.75	83.44	102	144	246
0.80	83.49	108	181	289
0.85	83.54	110	218	328

Calculated by: JAK	Date: 11/20/2007	Checked By:	Date:
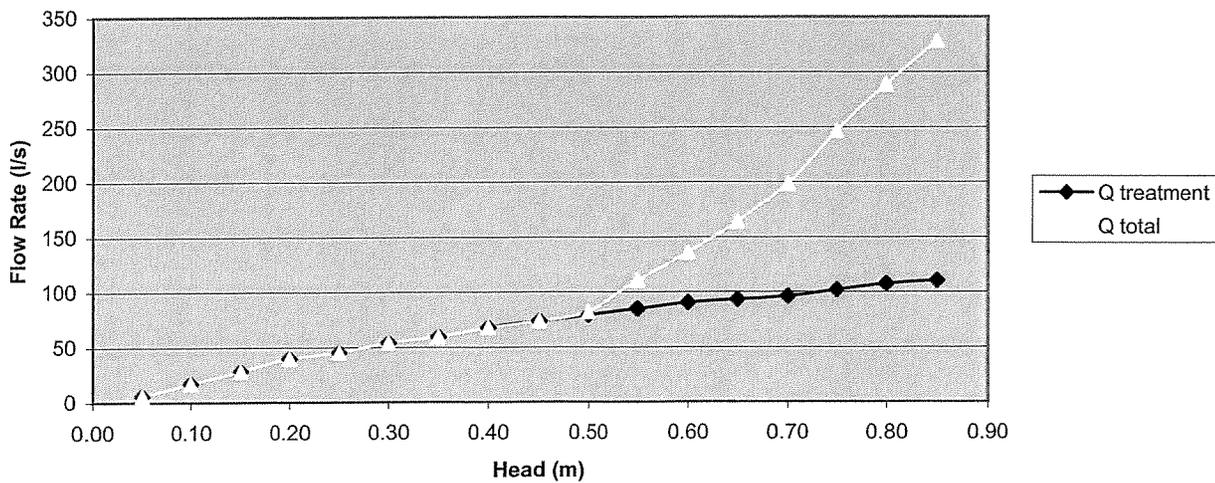
Stage Discharge

VortSentry® Estimated Net Annual Solids Load Reduction
Based on an Average Particle Size of 110 Microns
BROOKDALE CENTRES INC
PICKERING, ON
Model VS70
System WQS #2

C⊛NTECH®
STORMWATER
SOLUTIONS.

Design Ratio[1] = $\dfrac{3.37\ ha\ \times\ 0.9}{7.54\ m3}$ = 0.028

Rainfall Intensity mm/hr	Flow Rate l/s	Operating Rate[2] cfs/ft^{3}	% Total Rainfall Depth[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.5	4.18	0.00055	8.5%	96.9%	8.3%
1.0	8.36	0.00110	11.1%	95.8%	10.7%
1.5	12.54	0.00164	9.4%	94.7%	8.9%
2.0	16.72	0.00219	7.4%	93.6%	6.9%
3.0	25.08	0.00329	12.4%	91.4%	11.3%
4.0	33.44	0.00438	9.3%	89.6%	8.3%
5.0	41.79	0.00548	7.3%	85.9%	6.3%
6.0	50.15	0.00657	6.0%	83.2%	5.0%
7.0	58.51	0.00767	5.8%	82.4%	4.8%
8.0	66.87	0.00877	3.2%	81.6%	2.6%
9.0	75.23	0.00986	1.9%	80.8%	1.6%
10.0	83.59	0.01096	4.1%	80.0%	3.3%
11.0	91.95	0.01205	2.2%	71.3%	1.6%
12.0	100.31	0.01315	1.6%	67.0%	1.1%
15.0	125.38	0.01643	2.6%	57.6%	1.5%
20.0	167.18	0.02191	1.2%	44.6%	0.5%
25.0	208.97	0.02739	1.2%	27.8%	0.3%
30.0	250.77	0.03287	0.4%	22.2%	0.1%

Predicted Net Annual Load Removal Efficiency =   80.0%
Predicted Percent of Runoff Volume Treated =   92.7%

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry Treatment Volume
    = The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
2 - Operating Rate (cfs/ft^{3}) = Rainfall Intensity ("/hr) x Design Ratio
3 - Based on 10 years of rainfall data from Canadian Station 6158350 Pearson Airport, Toronto, ON
4 - Removal efficiencies are based on Contech Stormwater Solutions laboratory verified removal of OK-110, a commercially available silica gradation with a mean particle size of 110 microns, containing particles ranging from 53-150 microns.

Calculated by: JAK	Date: 11/20/07	Checked by:	Date:

VortSentry® Stage Discharge Calculations
BROOKDALE CENTRES INC
PICKERING, ON
Model VS70
System WQS #2

Treatment Chamber Outlet Orifice		Flow Partition Weir	
Orifice Area (m^2) =	0.060	Crest El. (m) =	0.46
Discharge Coefficient =	308	Weir Crest Length (m) =	0.51
		Discharge Coefficient =	1895

Head (m)	Elevation (m)	Treatment Flow (l/s)	Bypass Flow Rate (l/s)	Total Flow Rate (l/s)
0.05	82.09	6	0	6
0.10	82.14	17	0	17
0.15	82.19	28	0	28
0.20	82.24	40	0	40
0.25	82.29	45	0	45
0.30	82.34	54	0	54
0.35	82.39	59	0	59
0.40	82.44	68	0	68
0.45	82.49	74	0	74
0.50	82.54	79	3	82
0.55	82.59	85	25	110
0.60	82.64	91	45	136
0.65	82.69	93	71	164
0.70	82.74	96	102	198
0.75	82.79	102	144	246
0.80	82.84	108	181	289
0.85	82.89	110	218	328

Calculated by: JAK	Date: 11/20/2007	Checked By:	Date:

Stage Discharge

FOR INFORMATIONAL PURPOSES ONLY - NOT INTENDED FOR CONSTRUCTION

LEFT SIDE VIEW

3" [76]
TYP

VARIES

Ø2'-6" [762]
MAX (TYP)
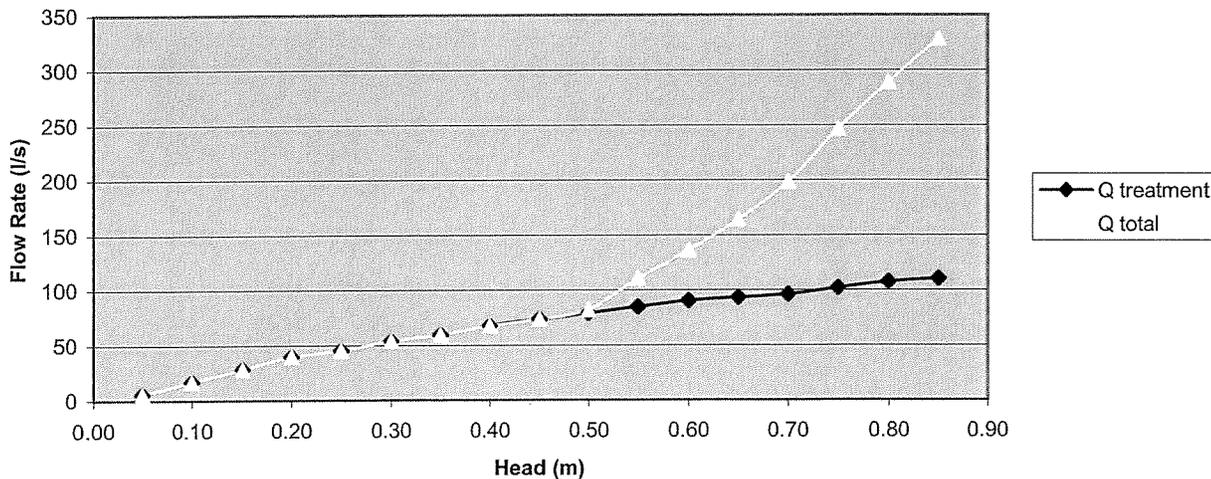
THE VORTSENTRY SECTION SHALL BE STENCILED
WITH THE CONTECH STORMWATER SOLUTIONS
NAME AND LOGO. PIPE OPENINGS SHALL BE
STENCILED "INLET" OR "OUTLET" AS APPROPRIATE

ELEVATION VIEW

ALTERNATE UNITS [ ] ARE IN
MILLIMETERS UNLESS NOTED OTHERWISE

18'-8" [5688]
(VARIES)

3'-10" [1167]
MIN

4'-0" [1219]
(VARIES)

6'-0" [1829]
TYP

4'-1" [1245]
(VARIES)

3'-6" [1067]

Ø8'-4" [2540]

PLAN VIEW

4'-1" [1245] SQUARE
TYP INLET/OUTLET

Ø2'-0" [610]

Ø7'-0" [2134]

9'-10" [2997] TYP
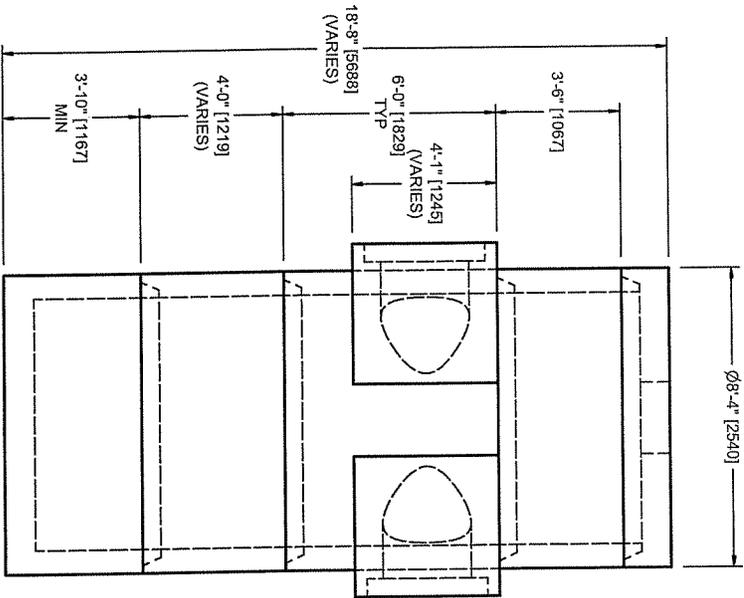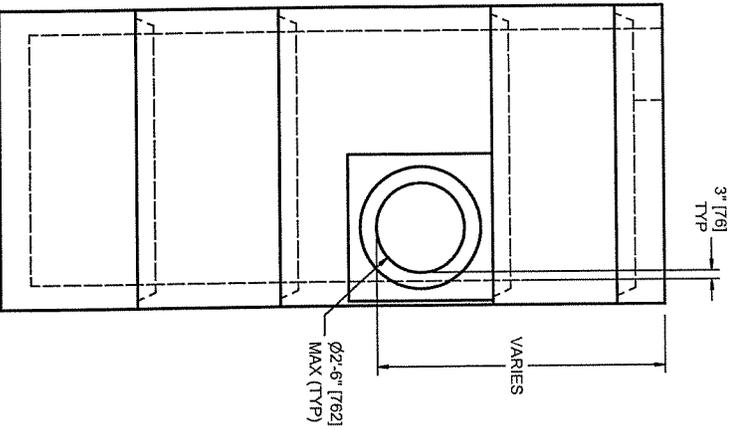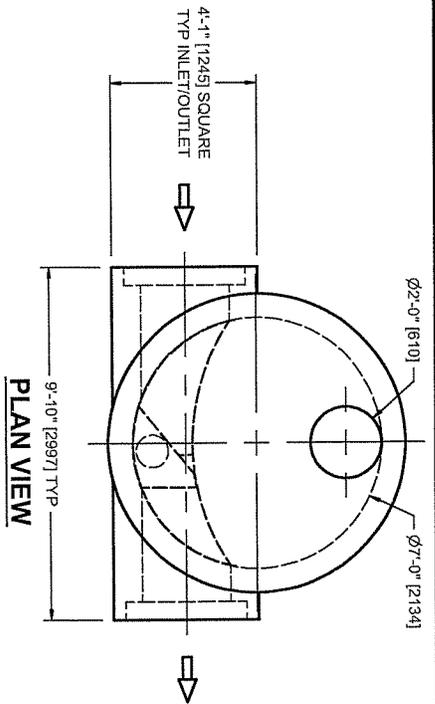
NOTES:

1. STORMWATER TREATMENT SYSTEM (SWTS) SHALL BE DESIGNED TO
MEET PERFORMANCE GOALS BASED ON FULL SCALE LABORATORY
PERFORMANCE DATA

2. SWTS SHALL BE DESIGNED TO RETAIN FLOATABLES AND TRAPPED
SEDIMENT AT FLOW RATES UP TO AND INCLUDING PEAK TREATMENT
CAPACITY

3. SWTS INVERTS IN AND OUT SHALL BE AT THE SAME ELEVATION

4. SWTS SHALL NOT BE COMPROMISED BY EFFECTS OF DOWNSTREAM
TAILWATER

5. SWTS SHALL HAVE NO INTERNAL COMPONENTS THAT OBSTRUCT
MAINTENANCE ACCESS

6. PIPE ORIENTATION MAY VARY; SEE SITE PLAN FOR SIZE AND LOCATION

7. PURCHASER SHALL NOT BE RESPONSIBLE FOR ASSEMBLY OF INTERNAL
COMPONENTS

8. (1) MANHOLE FRAME AND COVER SUPPLIED WITH SYSTEM, NOT
INSTALLED

9. PURCHASER TO PREPARE EXCAVATION AND PROVIDE LIFTING
EQUIPMENT

10. VORTSENTRY BY CONTECH STORMWATER SOLUTIONS; PORTLAND, OR
(800) 548-4667; SCARBOROUGH, ME (877) 907-8676; LINTHICUM, MD (866)
740-3318

ASSEMBLY VIEW

TOP SLAB

VS SECTION

RISER 1

RISER 2

BASE SECTION
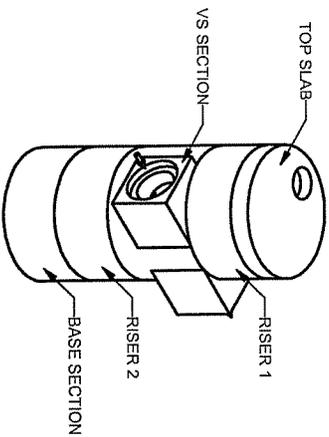
US PATENT No. 6,991,114

STANDARD DETAIL
STORMWATER TREATMENT SYSTEM
VORTSENTRY® VS70

SCALE: NONE	
DRAWN: JBS	
CHECKED: NDG	
FILE NAME: STDVS70	
DATE: 9/25/06	

STD

APPENDIX C

REFERENCED DOCUMENTS

0589.Swm-Jan.2015.docx

Run-off coefficients used for the post-development condition were:

Area	C
A	0.610
B	0.510
C	0.900
D	0.710
E	0.510
F	0.710
G	0.25
H	0.25
Existing Building	0.900
Bpre	0.900

Note: Bpre is an area unchanged from the pre-development condition.

* Reference from JSW Stormwater Management report, June 1988

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS (LBS.)	TOTAL ROOF SLOPE											
			DEAD-LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	104.5 (23)	4	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	77.5 (17)	16	86.5 (3.4)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	7.1 (15.6)	68 (15)	29	76 (3.0)	82 (18)	26	91.5 (3.6)	102.5 (22.5)	18	114.5 (4.5)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	40	81.5 (3.2)	86.5 (19)	34	96.5 (3.8)	107 (23.5)	24	119.5 (4.7)	132 (29)	20	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.3	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	14	71 (2.8)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	70.5 (15.5)	22	78.5 (3.1)	86.5 (19)	15	96.5 (3.8)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	91 (20)	21	101.5 (4.0)	109 (24)	17	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	66 (14.5)	7	73.5 (2.9)	82 (18)	4.5	91.5 (3.6)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	19	73.5 (2.9)	77.5 (17)	16	86.5 (3.4)	93 (20.5)	11	104 (4.1)	111.5 (24.5)	9	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	84 (18.5)	26	94 (3.7)	100 (22)	18	112 (4.4)	120.5 (26.5)	14	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	86.5 (19)	34	96.5 (3.8)	104.5 (23)	24	117 (4.6)	127.5 (28)	20	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	70.5 (15.5)	7.5	78.5 (3.1)	84 (18.5)	4.5	94 (3.7)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	19	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	26	127 (5.0)	129.5 (28.5)	20	145 (5.7)
Charlottetown, P.E.I.	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	57 (12.5)	8	63.5 (2.5)	68 (15)	3.8	76 (3.0)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	100 (22)	7.5	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	31	84 (3.3)	86.5 (19)	26	96.5 (3.8)	102.5 (22.5)	18	114.5 (4.5)	113.5 (25)	13	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	42	94 (3.7)	97.5 (21.5)	37	106.5 (4.2)	111.5 (24.5)	26	124.5 (4.9)	125 (27.5)	20	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	7.5	56 (2.2)	61.5 (13.5)	7	68.5 (2.7)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	70.5 (15.5)	15	78.5 (3.1)	88.5 (19.5)	10	99 (3.9)	109 (24)	8	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	27	66 (2.6)	72.5 (16)	23	81.5 (3.2)	93 (20.5)	16	104 (4.1)	113.5 (25)	13	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	36	68.5 (2.7)	77.5 (17)	31	86.5 (3.4)	95.5 (21)	22	106.5 (4.2)	120.5 (26.5)	19	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	8	58.5 (2.3)	63.5 (14)	7	71 (2.8)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	70.5 (15.5)	15	78.5 (3.1)	84 (18.5)	10	94 (3.7)	104.5 (23)	8	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	72.5 (16)	23	81.5 (3.2)	86.5 (19)	15	96.5 (3.8)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	37	76 (3.0)	77.5 (17)	31	86.5 (3.4)	88.5 (19.5)	20	99 (3.9)	109 (24)	17	122 (4.8)
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	54.5 (12)	6	61 (2.4)	72.5 (16)	4	81.5 (3.2)	79.5 (17.5)	3.3	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	68 (15)	14	76 (3.0)	86.5 (19)	10	96.5 (3.8)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	77.5 (17)	24	86.5 (3.4)	100 (22)	17	112 (4.4)	109 (24)	12	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	40	89 (3.5)	82 (18)	32	91.5 (3.6)	104.5 (23)	24	117 (4.6)	118 (26)	18	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	8	43 (1.7)	57 (12.5)	6	63.5 (2.5)	66 (14.5)	3.8	73.5 (2.9)	77.5 (17)	2.8	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	18	61 (2.4)	68 (15)	14.5	76 (3.0)	82 (18)	9	91.5 (3.6)	95.5 (21)	7	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	91 (20)	16	101.5 (4.0)	104.5 (23)	12	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	82 (18)	32	91.5 (3.6)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5.0)

Economical Roof Drainage Installations

381 (15")	
316 (12,1/2")	
172 (6,3/4")	
25 (0")MIN. AS SPECIFIED	
102 (4")MAX.	
133 (5,1/4")	

INSULATION

DECK

50, 75, 100
(2"), (3"), (4")
THREADED, CAULK, MJ
CONNECTIONS AVAILABLE.

305 (12")

PART   DESCRIPTION

1 — POLY-DOME
2 — CONTROL FLO WEIR WITH INTEGRAL CLAMP COLLAR AND GRAVEL GUARD
3 — E-EXTENSION WITH GASKET (WHEN SPECIFIED)
4 — ROOFING MEMBRANE (BY OTHERS)
5 — R-ROOF SUMP RECEIVER (WHEN SPECIFIED)
6 — C-UNDERDECK CLAMP (WHEN SPECIFIED)
7 — BODY

Z-105-5-ERC "Control-Flo" Dura-Coated Cast Iron Body, Aluminum Parabolic Weir With Integral Clamping Collar And Gravel Guard, Poly Dome. Extension, Roof Sump Receiver, Under Deck Clamp, Aluminum Dome Available When Specified.

2 YEAR STORM

$$i = \frac{647.7}{(t + 4)^{0.784}}$$

Curve data points: 115.68, 81.81, 64.39, 53.62, 46.22, 40.80, 36.64, 33.34, 30.64, 28.39, 26.49, 24.85

Y-axis: RAINFALL INTENSITY – MILLIMETRES PER HOUR

X-axis: TIME OF CONCENTRATION – MINUTES

Mins.	i	Mins.	i	Mins.	i	Mins.	i	Mins.	i
0–5	115.7	16	61.9	27	43.9	38	34.6	49	28.8
6	106.5	17	59.5	28	42.8	39	33.9	50	28.4
7	98.8	18	57.4	29	41.8	40	33.3	51	28
8	92.3	19	55.4	30	40.8	41	32.8	52	27.6
9	86.7	20	53.6	31	39.9	42	32.2	53	27.2
10	81.8	21	51.9	32	39	43	31.7	54	26.8
11	77.5	22	50.4	33	38.2	44	31.1	55	26.5
12	73.7	23	48.9	34	37.4	45	30.6	56	26.1
13	70.3	24	47.5	35	36.6	46	30.2	57	25.8
14	67.2	25	46.2	36	35.9	47	29.7	58	25.5
15	64.4	26	45	37	35.2	48	29.2	59	25.2

City of Pickering   Planning & Development Department

DRAWN J.McMULLEN	RAINFALL INTENSITY CURVE FOR	REVISION NO.
APPROVED R. STARR	DESIGN OF STORM SEWERS	DATE
DATE OCTOBER 2003		P–501

BASED ON YARNELL'S 5 YEAR STORM

$$i = \frac{2464}{t + 16}$$

TIME OF CONCENTRATION — MINUTES

RAINFALL INTENSITY — MILLIMETRES PER HOUR

Mins.	i	Mins.	i	Mins.	i	Mins.	i	Mins.	i
0–5	117.3	16	77.0	27	57.3	38	45.6	49	37.9
6	112.0	17	74.7	28	56.0	39	44.8	50	37.3
7	107.1	18	72.5	29	54.8	40	44.0	51	36.8
8	102.7	19	70.4	30	53.6	41	43.2	52	36.2
9	98.6	20	68.4	31	52.4	42	42.5	53	35.7
10	94.8	21	66.6	32	51.3	43	41.8	54	35.2
11	91.3	22	64.8	33	50.3	44	41.1	55	34.7
12	88.0	23	63.2	34	49.3	45	40.4	56	34.2
13	85.0	24	61.6	35	48.3	46	39.7	57	33.8
14	82.1	25	60.1	36	47.4	47	39.1	58	33.3
15	79.5	26	58.7	37	46.5	48	38.5	59	32.9

City of Pickering		Planning & Development Department	
DRAWN P. NEUMAN	RAINFALL INTENSITY CURVE FOR DESIGN OF STORM SEWERS	REVISION NO.	
APPROVED S. A. VOKES		DATE	
DATE JANUARY 1993		P-502	

Mins.	i	Mins.	i	Mins.	i	Mins.	i	Mins.	i
0–5	292.1	16	151.7	27	105.9	38	82.6	49	68.2
6	267.9	17	145.8	28	103.2	39	81.0	50	67.2
7	247.8	18	140.3	29	100.6	40	79.5	51	66.2
8	230.7	19	135.3	30	98.2	41	78.0	52	65.2
9	216.0	20	130.7	31	95.9	42	76.6	53	64.3
10	203.3	21	126.4	32	93.7	43	75.3	54	63.4
11	192.1	22	122.4	33	91.6	44	74.0	55	62.5
12	182.1	23	118.6	34	89.7	45	72.8	56	61.6
13	173.4	24	115.2	35	87.8	46	71.6	57	60.8
14	165.4	25	111.9	36	86.0	47	70.4	58	60.0
15	158.3	26	108.8	37	84.2	48	69.3	59	59.2

100 YEAR STORM

$$i = \frac{1770}{(t + 4)^{0.82}}$$

RAINFALL INTENSITY – MILLIMETRES PER HOUR

TIME OF CONCENTRATION – MINUTES

(curve labels: 292.1, 203.3, 158.3, 130.7, 111.9, 98.2, 87.8, 79.5, 72.8, 67.2, 62.5, 58.5)

```
SSSSS   W       W   M       M   H   H   Y   Y   M       M   OOO         999     999
S       W       W   MM     MM   H   H    Y Y    MM     MM  O   O      9   9   9   9   9   Ver. 4.02
SSSSS   W       W   M M   M M   HHHHH     Y     M M   M M  O   O    ##  9   9   9999  9   July 1999
    S    W  W  W    M  M M  M   H   H     Y     M  M M  M  O   O        9   9      9  9   # 3813174
SSSSS     W   W     M   M   M   H   H     Y     M   M   M   OOO         999     999
```

StormWater Management Hydrologic Model

```
*******************************************************
********   A single event and continuous hydrologic simulation model   ********
********   based on the principles of HYMO and its successors          ********
********                    SWMHYMO Ver/4.02                           ********
********                  OTTHYMO-83 and OTTHYMO-89.                    ********
********  Distributed by:  J.F. Sabourin and Associates Inc.           ********
********                   Ottawa, Ontario: (613) 727-5199             ********
********                   Gatineau, Quebec: (819) 243-6858            ********
********                   E-Mail: swmhymo@jfsa.Com                    ********
*******************************************************
+++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++  Licensed user: a.m. candaras associates inc.        +++++++
++++++                 Woodbridge          SERIAL#:3813174  +++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++

********   +++++++ PROGRAM ARRAY DIMENSIONS +++++++   ********
********   Maximum value for ID numbers :        10  ********
********   Max. number of rainfall points:    15000  ********
********   Max. number of flow points   :    15000  ********
*******************************************************

***************   D E T A I L E D   O U T P U T   ***************
*   DATE: 2007-09-28     TIME: 16:19:52     RUN COUNTER: 000061   *
*****************************************************************
* Input  filename: N:\otthymo\GENERA~1\BLOORS-1.DAT   *
* Output filename: N:\otthymo\GENERA~1\BLOORS-1.out   *
* Summary filename: N:\otthymo\GENERA~1\BLOORS-1.sum  *
* User comments:                                      *
* 1:                                                  *
* 2:                                                  *
* 3:                                                  *
*****************************************************************
```

```
001:0001-----------------------------------------
* CREATION OF 4HOUR STORM HYETOGRAPHS FOR TORONTO,
* BLOOR STREET STATION
*************************************************

|START      | Project  dir.: N:\otthymo\GENERA~1\BLOORS-1\
            | Rainfall dir.: N:\otthymo\GENERA~1\BLOORS-1\
TZERO =  .00 hrs on    0
METOUT= 2 (output = METRIC)
NRUN = 001
NSTORM= 0

001:0002-----------------------------------------
```

*5 minute Time Steps
```
***********************************
*100yr STORM, 4HR HYETOGRAPH
***********************************
```

```
| CHICAGO STORM   |          IDF curve parameters: A=1770.000
| Ptotal= 78.04 mm |                                B=   4.000
                                                    C=    .820
```

used in: INTENSITY = A / (t + B)^C

Duration of storm   = 4.00 hrs
Storm time step   = 5.00 min
Time to peak ratio   =   .33

| TIME | RAIN | TIME | RAIN | TIME | RAIN | TIME | RAIN |
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.08	4.035	1.08	19.246	2.08	11.859	3.08	5.445
.17	4.291	1.17	30.539	2.17	10.735	3.17	5.224
.25	4.586	1.25	76.878	2.25	9.818	3.25	5.022
.33	4.929	1.33	292.075	2.33	9.054	3.33	4.836
.42	5.334	1.42	101.415	2.42	8.408	3.42	4.665
.50	5.821	1.50	52.341	2.50	7.854	3.50	4.506
.58	6.416	1.58	34.908	2.58	7.374	3.58	4.359
.67	7.164	1.67	26.170	2.67	6.953	3.67	4.222
.75	8.131	1.75	20.966	2.75	6.582	3.75	4.095
.83	9.436	1.83	17.526	2.83	6.251	3.83	3.975
.92	11.297	1.92	15.087	2.92	5.954	3.92	3.863
1.00	14.177	2.00	13.268	3.00	5.687	4.00	3.758

```
-------------------------------------------------
001:0003-----------------------------------------
                  FINISH
-------------------------------------------------
***********************************************
WARNINGS / ERRORS / NOTES
***********************************************

Simulation ended on 2007-09-28      at 16:19:52
=================================================
```

SECTION C - STORM DRAINAGE AND STORMWATER MANAGEMENT

C3.02   MINOR DRAINAGE SYSTEM DESIGN (Cont'd)

Table 5: Allowable Storm Sewer Capacities and Gradients

Diameter (mm)	Q max (m^3/s)	Slope min (%)	Slope critical (%)	Slope max (%)
300	0.12	0.43	1.34	8.4
375	0.20	0.32	1.25	6.3
450	0.32	0.30	1.17	4.9
525	0.47	0.30	1.12	4.0
600	0.66	0.30	1.07	3.4
675	0.88	0.30	1.03	2.9
750	1.1	0.30	0.99	2.5
825	1.5	0.30	0.96	2.2
900	1.8	0.30	0.93	2.0
975	2.2	0.30	0.91	1.8
1,050	2.7	0.30	0.89	1.6
1,200	3.7	0.30	0.85	1.3
1,350	5.0	0.30	0.81	1.1
1,500	6.5	0.30	0.79	0.99
1,650	8.2	0.30	0.76	0.87
1,800	10	0.30	0.74	0.77
1,950	12	0.30	0.72	0.70
2,100	14	0.30	0.70	0.63
2,250	16	0.30	0.69	0.58
2,400	19	0.30	0.67	0.53
2,700	24	0.30	0.65	0.45
3,000	29	0.30	0.62	0.39

Based on the following criteria:

	Velocity min	Velocity max	Slope min	
	0.90 m/s	**4.0 m/s**	**0.30 %**	

StormTech®

Detention · Retention · Recharge

Subsurface Stormwater Management℠

Design Manual

StormTech® Chamber Systems for Stormwater Management

2.0 Product Information

Figure 1
StormTech SC-740 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	51.0" x 30.0" x 85.4"
Chamber Storage	45.9 ft³
Minimum Installed Storage*	74.9 ft³
Weight	74 lbs

ACCEPTS 4" SCH 40 PIPE
FOR OPTIONAL
INSPECTION PORT

90.7"

85.4" INSTALLED

30.0"

51.0"

Figure 2
StormTech SC-310 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	34.0" x 16.0" x 85.4"
Chamber Storage	14.7 ft³
Minimum Installed Storage*	31.0 ft³
Weight	37 lbs

ACCEPTS 4" SCH 40 PIPE
FOR OPTIONAL
INSPECTION PORT

90.7"

85.4" INSTALLED

16.0"

34.0"

*This assumes a minimum of 6-inches of stone below, above and between chamber rows and 40% stone porosity.

2.5 STORMTECH CHAMBERS

StormTech's chamber systems have unique features to improve site optimization and reduce product waste. The SC-740 and SC-310 chambers can be cut at the job site in approximately 6.5-inch increments to shorten a row's length. Designing and constructing chamber rows around site obstacles is easily accomplished by including specific cutting instructions or a well placed "cut to fit" note on the design plans. The last chamber of a row can be cut in any of its corrugation's valleys. An end cap placed into the trimmed corrugation's crest completes the row. The trimmed-off piece of a StormTech chamber may then be used to start the next row. See **Figure 3**.

To assist the contractor, StormTech's chambers are molded with simple assembly instructions and arrows that indicate the direction in which to build rows. Rows are formed by overlapping the next chamber's "Start End" corrugation with the previously laid chamber's end corrugation. Two people can safely and efficiently form rows of chambers without complicated connectors, special tools or heavy equipment.
Product Specifications: 2.2, 2.4, 2.9 and 3.2

2.6 STORMTECH END CAPS

The StormTech end cap has features which make the chamber system simple to design, easy to build and more versatile than other products. StormTech end caps can be easily secured within any corrugation's crest. A molded-in handle makes attaching the end cap a one-person operation. Tools or fasteners are not required.

StormTech end caps are required at each end of a chamber row to prevent stone intrusion (two per row). The SC-740 end cap will accept up to a 25-inch maximum outside diameter inlet pipe. The SC-310 end cap will accept up to a 12-inch inlet pipe. To aid contractors, inlet pipe cutting guides and a blade-starting slot are molded into the end caps. See **Figure 4**.
Product Specifications: 3.1, 3.2, 3.3 and 3.4

Figure 3
Distance Between Corrugations (not to scale)

SC-310 chamber

Figure 4
Chamber End Caps (not to scale)

SC-740 end cap

Figure 13

Plan View Detail – StormTech SC-740 Chamber (not to scale)

PAVEMENT

PAVEMENT SUB-BASE

COMPACTED FILL PER STORMTECH'S TABLE OF ACCEPTABLE FILL MATERIALS*

AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE

6" MIN. DEPTH OF ³/₄ - 2-INCH WASHED, CRUSHED, ANGULAR STONE BACKFILL

³/₄ - 2-INCH WASHED, CRUSHED, ANGULAR STONE BENEATH AND AROUND CHAMBER BED. DEPTH TO BE DETERMINED BY DESIGN ENGINEER*

AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE

SC-740 CHAMBER

SC-740 END CAP

Figure 14

Typical Cross Section Detail – StormTech SC-740 Chamber (not to scale)

SC-740 END CAP

SC-740 CHAMBER

³/₄ - 2-INCH WASHED, CRUSHED, ANGULAR STONE

AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE ALL AROUND STONE

GRANULAR WELL GRADED SOIL/AGGREGATE MIXTURES, <35% FINES. COMPACT IN 6" LIFTS TO 95% PROCTOR DENSITY. SEE THE TABLE OF ACCEPTABLE FILL MATERIALS IN STORMTECH'S DESIGN MANUAL, INSTALLATION MANUAL, OR WWW.STORMTECH.COM.

PAVEMENT

FOR UNPAVED INSTALLATION WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24 INCHES

18" MIN.   96" MAX.

6" MIN.

30"

DEPTH OF STONE TO BE DETERMINED BY DESIGN ENGINEER*

DESIGN ENGINEER IS RESPONSIBLE FOR ENSURING SUITABILITY OF SUBGRADE SOILS*

6" MIN.   51"   12" MIN. TYP.

*See Section 4 of this Design Manual.

Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

Figure 15
Inlet and Outlet Detail – StormTech SC-740 Chamber (not to scale)

PAVEMENT

GRANULAR WELL GRADED SOIL/AGGREGATE MIXTURES,
<35% FINES. COMPACT IN 6" LIFTS TO 95% PROCTOR DENSITY.
SEE THE TABLE OF ACCEPTABLE FILL MATERIALS IN
STORMTECH'S DESIGN MANUAL, INSTALLATION MANUAL,
OR WWW.STORMTECH.COM.

CONTROL STRUCTURE PER DESIGN

AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE

CATCH BASIN
OR
MANHOLE

A

18"
MIN.

96"
MAX.

24" MIN.
SUMP

OUTLET PIPING

3/4 - 2 INCH WASHED, CRUSHED,
ANGULAR STONE. DEPTH OF
STONE TO BE DETERMINED BY
DESIGN ENGINEER*

OUTLET

DESIGN ENGINEER IS
RESPONSIBLE FOR
ENSURING THE SUITIBILITY
OF SUBGRADE SOILS*

SC-740 CHAMBER

SC-740 ENDCAP

A. FOR UNPAVED INSTALLATION
WHERE RUTTING MAY OCCUR,
INCREASE COVER TO 24 INCHES

*See Section 4 of this Design Manual.

AASHTO M288 CLASS 2
NON-WOVEN GEOTEXTILE

Figure 16
StormTech Isolator Row (not to scale)

12" MIN ID 25" MAX OD PIPE
SET 1.5" FROM BOTTOM
OF CHAMBER

INSPECTION PORT
LOCATION PER
ENGINEER'S DRAWING

COVER ENTIRE ROW WITH AASHTO M288
CLASS 2 NON-WOVEN GEOTEXTILE
SC-740 — 8' WIDE STRIP
SC-310 — 5' WIDE STRIP

STORMTECH
ENDCAP

CATCH
BASIN
OR
MANHOLE

2FT MIN.
SUMP

WOVEN GEOTEXTILE THAT MEETS AASHTO M288 CLASS 1
REQUIREMENTS, BETWEEN STONE BASE AND CHAMBERS
SC-740 — 5'-6' WIDE STRIP
SC-310 — 4' WIDE STRIP

Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

Run-off coefficients used for the post-development condition were:

Area	C
A	0.610
B	0.510
C	0.900
D	0.710
E	0.510
F	0.710
G	0.25
H	0.25
Existing Building	0.900
Bpre	0.900

Note: Bpre is an area unchanged from the pre-development condition.

* Reference from JSW Stormwater Management report, June 1988

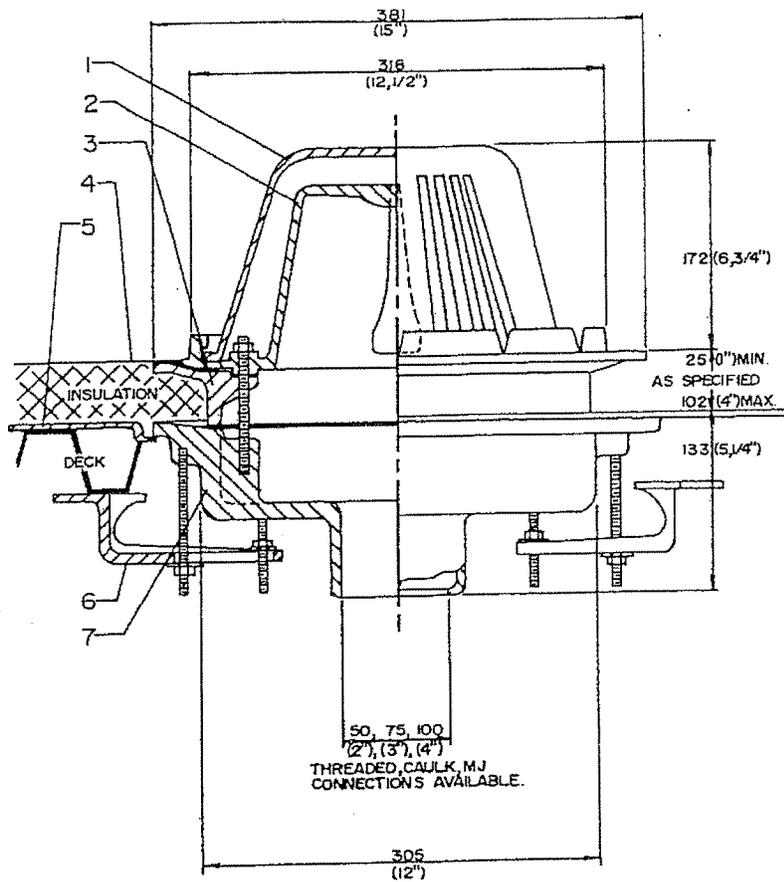| LOCATION | SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING | ROOF LOAD FACTOR KGS (LBS.) | TOTAL ROOF SLOPE | | | | | | | | | | | |
| | | | DEAD-LEVEL | | | 51mm (2") RISE | | | 102mm (4") RISE | | | 152mm (6") RISE | | |
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	104.5 (23)	4	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	77.5 (17)	16	86.5 (3.4)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	7.1 (15.6)	68 (15)	29	76 (3.0)	82 (18)	26	91.5 (3.6)	102.5 (22.5)	18	114.5 (4.5)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	40	81.5 (3.2)	86.5 (19)	34	96.5 (3.8)	107 (23.5)	24	119.5 (4.7)	132 (29)	20	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.3	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	14	71 (2.8)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	70.5 (15.5)	22	78.5 (3.1)	86.5 (19)	15	96.5 (3.8)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	91 (20)	21	101.5 (4.0)	109 (24)	17	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	66 (14.5)	7	73.5 (2.9)	82 (18)	4.5	91.5 (3.6)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	19	73.5 (2.9)	77.5 (17)	16	86.5 (3.4)	93 (20.5)	11	104 (4.1)	111.5 (24.5)	9	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	84 (18.5)	26	94 (3.7)	100 (22)	18	112 (4.4)	120.5 (26.5)	14	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	86.5 (19)	34	96.5 (3.8)	104.5 (23)	24	117 (4.6)	127.5 (28)	20	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	70.5 (15.5)	7.5	78.5 (3.1)	84 (18.5)	4.5	94 (3.7)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	18	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	26	127 (5.0)	129.5 (28.5)	20	145 (5.7)
Charlottetown, P.E.I.	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	57 (12.5)	6	63.5 (2.5)	68 (15)	3.8	76 (3.0)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	100 (22)	7.5	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	31	84 (3.3)	86.5 (19)	26	96.5 (3.8)	102.5 (22.5)	18	114.5 (4.5)	113.5 (25)	13	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	42	94 (3.7)	97.5 (21.5)	37	106.5 (4.2)	111.5 (24.5)	26	124.5 (4.9)	125 (27.5)	20	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	7.5	56 (2.2)	61.5 (13.5)	7	68.5 (2.7)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	70.5 (15.5)	15	78.5 (3.1)	88.5 (19.5)	10	99 (3.9)	109 (24)	8	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	27	66 (2.6)	72.5 (16)	23	81.5 (3.2)	93 (20.5)	16	104 (4.1)	113.5 (25)	13	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	38	68.5 (2.7)	77.5 (17)	31	86.5 (3.4)	95.5 (21)	22	106.5 (4.2)	120.5 (26.5)	19	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	8	58.5 (2.3)	63.5 (14)	7	71 (2.8)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	70.5 (15.5)	15	78.5 (3.1)	84 (18.5)	10	94 (3.7)	104.5 (23)	12	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	72.5 (16)	23	81.5 (3.2)	86.5 (19)	15	96.5 (3.8)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	37	76 (3.0)	77.5 (17)	31	86.5 (3.4)	88.5 (19.5)	20	99 (3.9)	109 (24)	17	122 (4.8)
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	54.5 (12)	6	61 (2.4)	72.5 (16)	4	81.5 (3.2)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	68 (15)	14	76 (3.0)	86.5 (19)	10	96.5 (3.8)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	77.5 (17)	24	86.5 (3.4)	100 (22)	17	112 (4.4)	109 (24)	12	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	40	89 (3.5)	82 (18)	32	91.5 (3.6)	104.5 (23)	24	117 (4.6)	118 (26)	18	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	8	43 (1.7)	57 (12.5)	6	63.5 (2.5)	66 (14.5)	3.8	73.5 (2.9)	77.5 (17)	2.8	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	68 (15)	14.5	76 (3.0)	82 (18)	9	91.5 (3.6)	95.5 (21)	7	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	91 (20)	16	101.5 (4.0)	104.5 (23)	12	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	82 (18)	32	91.5 (3.6)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5.0)

Economical Roof Drainage Installations

SPECIFICATION DATA


```
        381
        (15")
       318
      (12,1/2")

172(6,3/4")

INSULATION

DECK                    25.0")MIN.
                        AS SPECIFIED
                        102(4")MAX.

                        133(5,1/4")

50, 75, 100
(2"),(3"),(4")
THREADED,CAULK,MJ
CONNECTIONS AVAILABLE.

        305
        (12")
```

PART   DESCRIPTION

1 — POLY-DOME
2 — CONTROL FLO WEIR WITH INTEGRAL CLAMP COLLAR AND
     GRAVEL GUARD
3 — E-EXTENSION WITH GASKET (WHEN SPECIFIED)
4 — ROOFING MEMBRANE(BY OTHERS)
5 — R-ROOF SUMP RECEIVER(WHEN SPECIFIED)
6 — C-UNDERDECK CLAMP(WHEN SPECIFIED)
7 — BODY

Z-105-5-ERC "Control-Flo" Dura-Coated Cast Iron Body,
Aluminum Parabolic Weir With Integral Clamping Collar
And Gravel Guard, Poly Dome. Extension, Roof Sump
Receiver, Under Deck Clamp, Aluminum Dome Available
When Specified.

2 YEAR STORM

$$i = \frac{647.7}{(t + 4)^{0.784}}$$

Chart: RAINFALL INTENSITY – MILLIMETRES PER HOUR (y-axis) vs TIME OF CONCENTRATION – MINUTES (x-axis)

Curve values: 115.68, 81.81, 64.39, 53.62, 46.22, 40.80, 36.64, 33.34, 30.64, 28.39, 26.49, 24.85

Mins.	i	Mins.	i	Mins.	i	Mins.	i	Mins.	i
0–5	115.7	16	61.9	27	43.9	38	34.6	49	28.8
6	106.5	17	59.5	28	42.8	39	33.9	50	28.4
7	98.8	18	57.4	29	41.8	40	33.3	51	28
8	92.3	19	55.4	30	40.8	41	32.8	52	27.6
9	86.7	20	53.6	31	39.9	42	32.2	53	27.2
10	81.8	21	51.9	32	39	43	31.7	54	26.8
11	77.5	22	50.4	33	38.2	44	31.1	55	26.5
12	73.7	23	48.9	34	37.4	45	30.6	56	26.1
13	70.3	24	47.5	35	36.6	46	30.2	57	25.8
14	67.2	25	46.2	36	35.9	47	29.7	58	25.5
15	64.4	26	45	37	35.2	48	29.2	59	25.2

City of Pickering — Planning & Development Department

DRAWN J.McMULLEN	RAINFALL INTENSITY CURVE FOR	REVISION NO.
APPROVED R. STARR	DESIGN OF STORM SEWERS	DATE
DATE OCTOBER 2003		P-501

RAINFALL INTENSITY – MILLIMETRES PER HOUR

TIME OF CONCENTRATION – MINUTES

BASED ON YARNELL'S 5 YEAR STORM

$$i = \frac{2464}{t + 16}$$

Mins.	i	Mins.	i	Mins.	i	Mins.	i	Mins.	i
0–5	117.3	16	77.0	27	57.3	38	45.6	49	37.9
6	112.0	17	74.7	28	56.0	39	44.8	50	37.3
7	107.1	18	72.5	29	54.8	40	44.0	51	36.8
8	102.7	19	70.4	30	53.6	41	43.2	52	36.2
9	98.6	20	68.4	31	52.4	42	42.5	53	35.7
10	94.8	21	66.6	32	51.3	43	41.8	54	35.2
11	91.3	22	64.8	33	50.3	44	41.1	55	34.7
12	88.0	23	63.2	34	49.3	45	40.4	56	34.2
13	85.0	24	61.6	35	48.3	46	39.7	57	33.8
14	82.1	25	60.1	36	47.4	47	39.1	58	33.3
15	79.5	26	58.7	37	46.5	48	38.5	59	32.9

City of Pickering		Planning & Development Department	
DRAWN P. NEUMAN	RAINFALL INTENSITY CURVE FOR	REVISION NO.	
APPROVED S. A. VOKES	DESIGN OF STORM SEWERS	DATE	
DATE JANUARY 1993		P–502	

Mins.	i	Mins.	i	Mins.	i	Mins.	i	Mins.	i
0–5	292.1	16	151.7	27	105.9	38	82.6	49	68.2
6	267.9	17	145.8	28	103.2	39	81.0	50	67.2
7	247.8	18	140.3	29	100.6	40	79.5	51	66.2
8	230.7	19	135.3	30	98.2	41	78.0	52	65.2
9	216.0	20	130.7	31	95.9	42	76.6	53	64.3
10	203.3	21	126.4	32	93.7	43	75.3	54	63.4
11	192.1	22	122.4	33	91.6	44	74.0	55	62.5
12	182.1	23	118.6	34	89.7	45	72.8	56	61.6
13	173.4	24	115.2	35	87.8	46	71.6	57	60.8
14	165.4	25	111.9	36	86.0	47	70.4	58	60.0
15	158.3	26	108.8	37	84.2	48	69.3	59	59.2

100 YEAR STORM

$$i = \frac{1770}{(t + 4)^{0.82}}$$

RAINFALL INTENSITY – MILLIMETRES PER HOUR

TIME OF CONCENTRATION – MINUTES

City of Pickering

Planning & Development Department

DRAWN J. McMULLEN	
APPROVED R. STARR	RAINFALL INTENSITY CURVE FOR
DATE OCTOBER 2003	DESIGN OF STORM SEWERS

REVISION NO.

DATE

P–504

```
SSSSS   W     W   M     M   H   H   Y   Y   M   M   OOO         999    999
S       W     W   MM   MM   H   H    Y Y    MM MM   O   O     9     9  9     9
SSSSS   W     W   M M M M   HHHHH     Y     M M M   O   O  ##    9999  9999  Ver. 4.02
    S   W  W  W   M  M  M   H   H     Y     M   M   O   O        9999  9999  July 1999
SSSSS   W  W  W   M     M   H   H     Y     M   M   OOO              9     9  # 3813174
        W W   W   M     M   H   H     Y     M   M            999    999
```

StormWater Management HYdrologic Model

```
*********************************************************************
*******         SWMHYMO-99 Ver/4.02 ***********************************
*******   A single event and continuous hydrologic simulation model   *********
*******       based on the principles of HYMO and its successors      *********
*******                OTTHYMO-83 and OTTHYMO-89.                      *********
*******  Distributed by:  J.F. Sabourin and Associates Inc.           *********
*******                   Ottawa, Ontario: (613) 727-5199             *********
*******                   Gatineau, Quebec: (819) 243-6858            *********
*******                   E-Mail: swmhymo@jfsa.Com                     *********
*********************************************************************
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++  Licensed user: a.m. candaras associates inc.                 ++++++++
+++++++               Woodbridge           SERIAL#:3813174            ++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
**********************************************************************
*******     ++++++ PROGRAM ARRAY DIMENSIONS ++++++                    *********
*******        Maximum value for ID numbers :      10                 *********
*******        Max. number of rainfall points:   15000               *********
*******        Max. number of flow points    :   15000               *********
**********************************************************************

************************   D E T A I L E D   O U T P U T   *********************
*     DATE: 2007-09-28     TIME: 16:19:52     RUN COUNTER: 000061     *
*********************************************************************************
* Input  filename: N:\otthymo\GENERA~1\BLOORS~1\BLOORS~1.DAT      *
* Output filename: N:\otthymo\GENERA~1\BLOORS~1\BLOORS~1.out      *
* Summary filename: N:\otthymo\GENERA~1\BLOORS~1\BLOORS~1.sum     *
* User comments:                                                  *
* 1:                                                              *
* 2:                                                              *
* 3:                                                              *
*********************************************************************************
```

```
001:0001--------------------------------------------------------------------
* CREATION OF 4HOUR STORM HYETOGRAPHS FOR TORONTO,
* BLOOR STREET STATION
*********************************************************************
| START       | Project dir.: N:\otthymo\GENERA~1\BLOORS~1\
             -------- Rainfall dir.: N:\otthymo\GENERA~1\BLOORS~1\

  TZERO =   .00 hrs on      0
  METOUT=    2 (output = METRIC)
  NRUN = 001
  NSTORM= 0
----------------------------------------------------------------------------
001:0002--------------------------------------------------------------------
```

*5 minute Time Steps
```
*********************************
*100yr STORM, 4HR HYETOGRAPH
*********************************
-------------------------        IDF curve parameters:  A=1770.000
| CHICAGO STORM    |                                    B=    4.000
| Ptotal= 78.04 mm |                                    C=     .820
-------------------------

            used in:    INTENSITY = A / (t + B)^C

                        Duration of storm     =   4.00 hrs
                        Storm time step        =   5.00 min
                        Time to peak ratio     =    .33
```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.08	4.035	1.08	19.246	2.08	11.859	3.08	5.445
.17	4.291	1.17	30.539	2.17	10.735	3.17	5.224
.25	4.586	1.25	76.878	2.25	9.818	3.25	5.022
.33	4.929	1.33	292.075	2.33	9.054	3.33	4.836
.42	5.334	1.42	101.415	2.42	8.408	3.42	4.665
.50	5.821	1.50	52.341	2.50	7.854	3.50	4.506
.58	6.416	1.58	34.908	2.58	7.374	3.58	4.359
.67	7.164	1.67	26.170	2.67	6.953	3.67	4.222
.75	8.131	1.75	20.966	2.75	6.582	3.75	4.095
.83	9.436	1.83	17.526	2.83	6.251	3.83	3.975
.92	11.297	1.92	15.087	2.92	5.954	3.92	3.863
1.00	14.177	2.00	13.268	3.00	5.687	4.00	3.758

```
------------------------------------------------------------
001:0003-----
         FINISH
------------------------------------------------------------
*********************************************************************
    WARNINGS / ERRORS / NOTES

    Simulation ended on 2007-09-28          at 16:19:52
=================================================================
```

SECTION C - STORM DRAINAGE AND STORMWATER MANAGEMENT

C3.02   MINOR DRAINAGE SYSTEM DESIGN (Cont'd)

Table 5: Allowable Storm Sewer Capacities and Gradients

Diameter (mm)	Q max (m³/s)	Slope min (%)	Slope critical (%)	Slope max (%)
300	0.12	0.43	1.34	8.4
375	0.20	0.32	1.25	6.3
450	0.32	0.30	1.17	4.9
525	0.47	0.30	1.12	4.0
600	0.66	0.30	1.07	3.4
675	0.88	0.30	1.03	2.9
750	1.1	0.30	0.99	2.5
825	1.5	0.30	0.96	2.2
900	1.8	0.30	0.93	2.0
975	2.2	0.30	0.91	1.8
1,050	2.7	0.30	0.89	1.6
1,200	3.7	0.30	0.85	1.3
1,350	5.0	0.30	0.81	1.1
1,500	6.5	0.30	0.79	0.99
1,650	8.2	0.30	0.76	0.87
1,800	10	0.30	0.74	0.77
1,950	12	0.30	0.72	0.70
2,100	14	0.30	0.70	0.63
2,250	16	0.30	0.69	0.58
2,400	19	0.30	0.67	0.53
2,700	24	0.30	0.65	0.45
3,000	29	0.30	0.62	0.39

Based on the following criteria:

	Velocity min	Velocity max	Slope min	
	0.90 m/s	**4.0 m/s**	**0.30 %**	

APPENDIX

B

Stormwater Management Calculations

	Project	**1105-1163 Kingston Road**	No.		**221-12931**	
WSP	By	**M.N.**	Date	**2025-01-24**		Page
	Checked	**I.S.**	Date	**2025-01-24**		1

Subject	**SWM Design Criteria**

0.0 SWM Design Criteria

0.1 Jurisdictions

1   City of Pickering
2   Regional Municipality of Durham
3   Ministry of Environment, Conservation and Parks (MECP)
4   Toronto and Region Conservation Authority (TRCA)
     a. Subwatershed - Pine Creek

0.2 SWM Design Criteria

0.2.1 Water Quality

Provide an Enhance Level of Protection or 80% TSS removal, as per MOECC SWMPDM (2003)

0.2.2 Water Balance

Based on the correspondences with City, 5mm on site retention and infiltration with a 72 hour drawdown time is required for the private lands. It is expected that best efforts will be taken to provide of the site and to use S.W.M. facilities that reduce runoff volumes, which will result in reduced loading of pollutants.

0.2.3 Erosion Control

Provide extended detention of runoff from 25 mm rainfall event and release within a minimum 24 hour period. Erosion control measures are required to limit erosion at the outfall locations. Or
Runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5mm of rainfall depth across all impervious surfaces.

0.2.4 Quantity Control

1) The post-development peak flow rates generated from the City's IDF Curves for 2 to 100-year storm events shall be controlled to pre-development levels for 2-year storm with maximum runoff coefficient 0.5
2) Allowable flow rates based on the existing storm system explained in the SWM report, proposed commercial development for Brookdale Centers Inc, 1105 Kingston Road, by a.m. candaras associates inc., 2015

	Project	**1105-1163 Kingston Road**	No.	**221-12931**	
WSP	By	**M.N.**	Date	**2025-01-24**	Page
	Checked	**I.S.**	Date	**2025-01-24**	**2**

Subject	
SWM Parameters	

1.0 Design Rainfall Event

1.1 Design Storm

IDF Curve   *City of Pickering*
1 hour AES   *TRCA*

In general, the SCS design storm should be used for determining the hydrographs for undeveloped watersheds and for checking detention storages required for quantity control.
The Chicago design storms should be used for determining hydrographs in urban areas and also for checking detention storage. In many cases, the consultant will be required to run both sets of design storms to make sure that the more stringent is used for each individual element of the drainage system.

1.2 IDF Curves

Source of IDF:

The City of Pickering Accepted IDF Data

Equation:

$$I = \frac{A}{(t + B)^c}$$

Where,   I = Rainfall Intensity (mm/hr)
t = Time of Concentration (minutes)
A, B, C = Constant Values for Storms with Various Return Period.

Return Period (Years)	A	B	C	Pickering		
				Rainfall Amount (mm)		**Intensity (mm/hr)**
				1 Hour AES	**24 hour**	**10 min**
2	715.1	5.26	0.815	11.8	0.1	77.6
5	1082.9	6.01	0.837	0.1	0.1	106.3
10	1314.0	6.03	0.845	0.1	0.1	126.0
25	1581.7	6.01	0.848	0.1	0.1	150.6
50	1828.0	6.19	0.856	0.1	0.1	168.6
100	2096.4	6.49	0.863	0.1	0.1	186.7

Note:
1) The minimum initial time of concentration is to be 10 minutes

2.0 Soil Information

2.1 SCS Curve Number

Site Location	Kingston Road & Walnut Lane Road	
Soil Symbol:	Brsl	
Soil Type,(PH1,PH3, PH4):	Sandy Loam/Sandy Silt Til	Soil Survey Report #23 - Soil Map of Ontario County (National Soil DataBase, NSDB), Preliminary Hydrogeological Investogation, exp, 2023
Soil Symbol:	BL	Soil Survey Report #23 - Soil Map of Ontario County
Soil Type:	Bottom Land	(National Soil DataBase, NSDB)
Land Use:	Paved/Grass	
Hydrologic Soil Group (HSG)	B	(Design Chart 1.08, MTO Drainage Manual, 1997)
SCS Curve Number, CN (II)	98	(Table 8.7.3, Paved area,water resources engineering, Larry Mays, 2010)
SCS Curve Number, CN (III)	99	Equation 8.7.2, water resources engineering, Larry Mays, 2010
Soil Storage, S	2.2	S=(25400/CN(III))-254
Initial Abstraction, IA (mm)	0.4	CN<=70, IA=0.075S, CN>70<=80, IA=0.1S, CN>80<=90, IA=0.15S, CN>90, IA=0.2S
SCS Curve Number, CN (II)	79	(Table 8.7.3, Park Area, Lawn, water resources engineering, Larry Mays, 2010)
SCS Curve Number, CN (III)	89.6	Equation 8.7.2, water resources engineering, Larry Mays, 2010
Soil Storage, S	29.4	S=(25400/CN(III))-254
Initial Abstraction, IA (mm)	4.4	CN<=70, IA=0.075S, CN>70<=80, IA=0.1S, CN>80<=90, IA=0.15S, CN>90, IA=0.2S

Soil Survey Report #23 - Soil Map of Ontario (National Soil DataBase, NSDB)
https://sis.agr.gc.ca/cansis/publications/surveys/on/on23/index.html

For less frequent storms an Antecedent Precipiation Factor (Ca) should be used and Rational Formula to be modified accordingly to: Q (Flow) = A (Area) x C (Runoff Coefficient) x Ca (Antecedent Precipiation Factor) x I (Rainfall Intensity)

Storm	Ca
1 to 10 year storm	1.00
25 year storm	1.10
50 year storm	1.20
100 year storm	1.25
Product of 'Ca x C' should not exceed 1.00	

As per City of Pickering Stormwater Management Design Guidelines (July 2019) Section 6.2.3.

Pre-Development Conditions Overall within Property Limit

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	8163	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	45921	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	21308	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**75392**	**0.87**	0.87	0.87	0.96	1.00	1.00

Pre-Development Conditions Overall Including External Area

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	9272	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	49577	0.87	0.87	0.87	0.96	1.00	1.00
Impervious Roof	21308	0.00	0.00	0.00	0.00	0.00	0.00
Total Area	**80156**	**0.56**	0.56	0.56	0.61	0.67	0.70

Pre-Development Conditions - 101

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	1424	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	24185	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	3277	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**28886**	**0.92**	0.92	0.92	1.00	1.00	1.00

Pre-Development Conditions - 102

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	127	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	181	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	3277	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**3585**	**0.92**	0.92	0.92	1.00	1.00	1.00

Pre-Development Conditions -103

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	3920	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	15936	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	13161	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**33017**	**0.87**	0.87	0.87	0.95	1.00	1.00

WSP

Stormwater Management Calculations	**Project:**	**1105-1163 Kingston Road**	**No.:** **221-12931**
Existing Area Takeoff and Runoff Coefficient Adjustment Calculations- to Frenchmans Bay	**By:** **M.N.**		**Page:**
	Checked: **I.S.**	**Date:** **2025-01-24**	**5**

Pre-Development Conditions - 104

Land Use	Area (m^2)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	540	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	3877	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	1592	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**6009**	**0.89**	0.92	0.92	1.00	1.00	1.00

Pre-Development Conditions -105

Land Use	Area (m^2)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	2152	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	1742	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**3895**	**0.56**	0.56	0.56	0.62	0.68	0.70

External Areas - EX1

Land Use	Area (m^2)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	588	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	3222	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**3810**	**0.84**	0.84	0.84	0.93	1.00	1.00

External Areas - EX2

Land Use	Area (m^2)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping	520	0.25	0.25	0.25	0.28	0.30	0.31
Impervious at Grade	434	0.95	0.95	0.95	1.00	1.00	1.00
Impervious Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**954**	**0.57**	0.57	0.57	0.63	0.68	0.71

Pre-Development Conditions -106

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping-to Pine Creek	2069	0.25	0.25	0.25	0.28	0.30	0.31
Total Area	**2069**	**0.25**	0.25	0.25	0.28	0.30	0.31

For less frequent storms an Antecedent Precipitation Factor (Ca) should be used and Rational Formula to be modified accordingly to: Q (Flow) = A (Area) x C (Runoff Coefficient) x Ca (Antecedent Precipitation Factor) x I (Rainfall Intensity)

Storm	Ca
1 to 10 year storm	1.00
25 year storm	1.10
50 year storm	1.20
100 year storm	1.25
Product of 'Ca x C' should not exceed 1.00	

As per City of Pickering Stormwater Management Design Guidelines (July 2019) Section 6.2.3.

Post-Development Conditions Overall

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	13929	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	11225	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	6513	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	29250	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	15306	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**76224**	**0.72**	0.72	0.72	0.79	0.86	0.90

Post-Development Conditions - 200

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	503	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	900	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	2151	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	2548	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	3248	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**9350**	**0.77**	0.77	0.77	0.84	0.92	0.96

Post-Development Conditions - 201

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	197	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1768	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**1965**	**0.88**	0.88	0.88	0.97	1.00	1.00

Post-Development Conditions - 202

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	1773	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	2290	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	964	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	3077	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	3065	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**11169**	**0.71**	0.71	0.71	0.78	0.85	0.88

Post-Development Conditions - 203

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	208	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1301	0.95	0.00	0.00	0.00	0.00	0.00
Impervious at Roof	0	0.95	5.00	5.00	1.00	1.00	1.00
Total Area	**1508**	**0.85**	0.85	0.85	0.94	1.00	1.00

Post-Development Conditions -204

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	437	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	576	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	888	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	2450	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	1617	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**5968**	**0.79**	0.79	0.79	0.87	0.95	0.99

Post-Development Conditions -205

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	230	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	2641	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	733	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1000	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	2416	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**7020**	**0.71**	0.71	0.71	0.78	0.85	0.89

Post-Development Conditions -206

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	5028	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	3811	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**8839**	**0.55**	0.55	0.55	0.61	0.66	0.69

Post-Development Conditions -207

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	607	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	3780	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**4387**	**0.85**	0.85	0.85	0.94	1.00	1.00

Post-Development Conditions -208

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	132	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1244	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**1376**	**0.88**	0.88	0.88	0.97	1.00	1.00

Post-Development Conditions -209

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	733	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	4818	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	1777	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	4118	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	4961	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**16407**	**0.74**	0.74	0.74	0.81	0.89	0.92

Post-Development Conditions -210

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	332	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	875	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**1207**	**0.76**	0.76	0.76	0.83	0.91	0.95

Post-Development Conditions -211

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	1649	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	678	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**2328**	**0.45**	0.45	0.45	0.50	0.54	0.57

Post-Development Conditions -212

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	2100	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	2599	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**4700**	**0.64**	0.64	0.64	0.70	0.76	0.80

Post-Development Conditions -213

Land Use	Area (m²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	670	0.25	0.25	0.25	0.28	0.30	0.31
Intensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Extensive Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	576	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	0	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	**1247**	**0.57**	0.57	0.57	0.63	0.69	0.72

Calculation of existing runoff rate is undertaken using the Rational Method: Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
Ca = Runoff coefficient adjustment factor (-)
C = Runoff coefficient (-)
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Project Area, Total   **7.54**   hectares
Runoff Coef, C   0.50

$$I = \frac{A}{(t + B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)
I = Rainfall intensity (mm/hour)
t = Time of concentration (minutes)

Return Period (Years)	2	5	10	25	50	100
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863
T (mins) *	10	10	10	10	10	10
I (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.7
Adjusted C** (-)	0.50	0.50	0.50	0.55	0.60	0.63
Q (L/s)	812.9	**1114.1**	1320.8	1736.2	2119.9	2445.6

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

**Note: as per City's request the maximum runoff coefficient to be considered as 0.5

Calculation of existing runoff rate is undertaken using the Rational Method: Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
Ca = Runoff coefficient adjustment factor (-)
C = Runoff coefficient (-)
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Project Area, Total   **0.21**   hectares
Runoff Coef, C   0.50

$$I = \frac{A}{(t + B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)
I = Rainfall intensity (mm/hour)
t = Time of concentration (minutes)

Return Period (Years)	2	5	10	25	50	100
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863
T (mins) *	10	10	10	10	10	10
I (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.7
Adjusted C** (-)	0.50	0.50	0.50	0.55	0.60	0.63
Q (L/s)	22.3	30.6	36.2	47.6	58.2	67.1

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

**Note: as per City's request the maximum runoff coefficient to be considered as 0.5

Allowable flow rates based on the SWM report, proposed commercial development for Brookdale Centers Inc, 1105 Kingston Road, by a.m. candaras associates inc., 2015=   550.00   **L/s**

Calculation of existing additional runoff flow rate from subcatchment 104, and 105 using the Rational Method: **Q = 2.78 CaCIA**

Where: Q = Peak flow rate (litres/second)
Ca = Runoff coefficient adjustment factor (-), refer to page 4
C = Runoff coefficient (-)
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Catchment ID	Additional Area(ha)
104	0.60
105	0.39

$$I = \frac{A}{(t + B)^c}$$

Where: A, B and C = Parameters defined in Table P-501, P-502, P504 of City of Pickering Planning and Development Department Guidelines (January 1993)
I = Rainfall intensity (mm/hour)
t = Time of concentration (minutes)

Return Period (Years)	2	5	100
A	647.7	2464	1770
B	4	16	4
C	0.784	1	0.82
T (mins) *	10	10	10
I (mm/hr)	81.8	94.8	203.3
Adjusted C**(-)	0.50	0.50	0.63
Q_Total (L/s)_104	68.3	79.2	212.3
Q_Total (L/s)_105	44.3	51.3	137.6

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations
**Maximum Runoff C, 0.5 per City of Pickering request
Allowable flow rate from the proposed development (L/s)=   662.6

Calculation of proposed uncontrolled runoff rate from subcatchment 211, and 212 using the Rational Method: **Q = 2.78 CaCIA**

Catchment ID	Uncontrolled Area(ha)
211	0.23
212	0.47

$$I = \frac{A}{(t + B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)

I = Rainfall intensity (mm/hour)

t = Time of concentration (minutes)

Return Period (Years)	2	5	10	25	50	100
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863
T (mins) *	10	10	10	10	10	10
I (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.69
Adjusted C (-)**	0.45	0.45	0.45	0.50	0.54	0.57
Adjusted C(-)**	0.64	0.64	0.64	0.70	0.76	0.80
Q_211 (L/s)	22.8	31.2	37.0	48.7	59.4	68.57
Q_212 (L/s)	64.6	88.5	104.9	137.9	168.4	194.3

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

** Refer to page 4 to 6 regarding the adjustment factors

Allowable flow rate from the controlled site area (L/s)=   399.79

Phase	Catchment ID		Area (ha)	Pro-rated Allowable Flow Rates (L/s)	
PH1	Controlled	200	0.935	54.0	65.4
		201	0.196	11.4	
PH2A		202	1.117	64.5	64.5
PH2B		203	0.151	8.7	8.7
PH3		204	0.597	34.5	34.5
PH4		205	0.702	40.6	124.9
		206	0.884	51.1	
		207	0.439	25.3	
		208	0.138	7.9	
PH5		209	1.641	94.8	101.8
		210	0.121	7.0	
Total Controlled			**6.92**	**399.8**	399.8
PH5	Uncontrolled	211	0.23	68.6	262.8
		212	0.47	194.3	
Total			**7.62**	**662.6**	662.6

The phases in the proposed conditions will be built in stages starting with Phase 1 and ending with Phase 5. Thus, each phase built after the former needs to take into account the flows from the built phases. This results in the following allowable release rates for the site:

PHASE ID	Allowable Flow Rates (L/s)	Notes
Phase 1	65.4	Takes in flows from 200 and 201
Phase 2A	64.5	Takes in flows from 202
Phase 2B	8.7	Takes in flows from 203
Phase 3	34.5	Takes in flows from 204
Phase 4	233.5	Takes in flows from 200, 201, 203, 204, 205, 206, 207, and 208. The total allowable flow rate is the sum of the pro-rated value from PH4, PH1, Ph2B and PH3.
Phase 5	101.8	Takes in flows from 209, 210
Phase 5 Uncontrolled	262.8	Takes in flows from 211, 212
Total Flow to Frenchmans Bay	662.6	

Calculation of proposed runoff flow rate from the site area using the Rational Method: **Q = 2.78 CaCIA**

Where: Q = Peak flow rate (litres/second)
Ca = Runoff coefficient adjustment factor (-), refer to page 10
C = Runoff coefficient (-)-Refer to Page 10
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

$$I = \frac{A}{(t + B)^c}$$

Where: A, B and C = Parameters defined in Table 12 of City of Pickering Stormwater Management Design Guidelines (July 2019)

I = Rainfall intensity (mm/hour)
t = Time of concentration (minutes)

Catchment 213,   **0.12**   hectares
Runoff Coef, C   0.57

Uncontrolled Flow Rates from 212 to Pine Creek

Return Period (Years)	2	5	10	25	50	100
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863
T (mins) *	10	10	10	10	10	10
I (mm/hr)	77.6	106.3	126.0	150.6	168.6	186.7
Adjusted C (-)**	0.57	0.57	0.57	0.63	0.69	0.72
Q_213 (L/s)	15.4	21.1	25.1	32.9	40.2	46.4

*Note: For a small site (<2.0ha), a time of concentration of 10 minutes was assumed for the calculations

** Refer to page 10 regarding the adjustment factors

The post development of catchment 213 (future pop area) is smaller than the pre-development condition area. No SWM is required accordingly.

The Infiltration rate has been calculated using Hydraulic Conductivity data from the site per Preliminary Hydrological Investigation, exp., 2023
A measured hydraulic conductivity of between 7.9*10^-7 and 1.1 * 10^-4 m/s was observed. The lower value has been used as it is more conservative.

Using the Ontario Building Code Table C1, the Infiltration rate is interpolated to be 13 mm/hour

Table C1: Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (centimetres/second)	Percolation Time, T (minutes/centimetre)	Infiltration Rate, 1/T (millimetres/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Phase 2 - Trench 1+ Trench 2
The following calculation determines the drawdown time for the Phase 2 (Catchment 202) infiltration trench system, the inflow area assumes the entirety of the impervious roof area in catchment 202

Inflow Area (Impervious Roof Area)	3065.00	m²
5 mm event volume	55.8	m³
Initial Abstraction	25.1	m³
5mm event runoff	30.7	m³

Infiltration drawdown time is solved with the following equation:

$$T = \frac{n}{q} * \frac{A}{P} * \ln\left(\frac{d + \frac{A}{P}}{\frac{A}{P}}\right)$$

Where
T= Time to Drain (hours)
n=void ratio of soil
A=Area of infiltration system (m²)
d=depth of water (m)
q=Infiltration rate of soil (m/h)
P=perimeter length of base of infiltration system (m)

For this site:

n=	0.4	
A=	160	m²
Minimum d=	0.48	m
Design d=	0.74	m
q=	0.01	m/h
P=	97	
Safety Factor=	2.5	
T=	47.6	h
Impervious Area/Footpri	19	between 5:1 to 20:1
Design Volume	47.36	m³

Therefore the infiltration pit will fully drain in 47.6 hours. This is within the 72 hour window required for full drawdown.

Phase	Catchment ID	Surface Type	Area (m²)	IA (m)	Volume Abstracted (m³)	5mm Volume (m³)	Water Balance (m³)
PH1	200	Soft Landscaping/Park	503	0.005	2.51	2.51	0.00
		Intensive Green Roof	900	0.005	4.50	4.50	0.00
		Extensive Green Roof	2,151	0.005	10.76	10.76	0.00
		Impervious at Grade	2,548	0.000	0.00	12.74	12.74
		Impervious at Roof	3,248	0.000	0.00	16.24	16.24
		Area:	9,350	-	17.77	46.75	28.98
	201 Public Road	Soft Landscaping/Park	197	0.005	0.98	0.98	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	1,768	0.000	0.00	8.84	8.84
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	1,965	-	0.98	9.82	8.84
PH2	202 Phase 2A	Soft Landscaping/Park	1,773	0.005	8.87	8.87	0.00
		Intensive Green Roof	2,290	0.005	11.45	11.45	0.00
		Extensive Green Roof	964	0.005	4.82	4.82	0.00
		Impervious at Grade	3,077	0.000	0.00	15.38	15.38
		Impervious at Roof	3,065	0.000	0.00	15.33	15.33
		Area:	11,169	-	25.14	55.85	30.71
	203 Public Road Phase 2B	Soft Landscaping/Park	208	0.005	1.04	1.04	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	1,301	0.000	0.00	6.50	6.50
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	1,508	-	1.04	7.54	6.50
	213	Soft Landscaping/Park	670	0.005	3.35	3.35	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	576	0.000	0.00	2.88	2.88
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	1,247	-	3.35	6.23	2.88
PH3	204	Soft Landscaping/Park	437	0.005	2.18	2.18	0.00
		Intensive Green Roof	576	0.005	2.88	2.88	0.00
		Extensive Green Roof	888	0.005	4.44	4.44	0.00
		Impervious at Grade	2,450	0.000	0.00	12.25	12.25
		Impervious at Roof	1,617	0.000	0.00	8.09	8.09
		Area:	5,968	-	9.50	29.84	20.34
PH4	205	Soft Landscaping/Park	230	0.005	1.15	1.15	0.00
		Intensive Green Roof	2,641	0.005	13.21	13.21	0.00
		Extensive Green Roof	733	0.005	3.67	3.67	0.00
		Impervious at Grade	1,000	0.000	0.00	5.00	5.00
		Impervious at Roof	2,416	0.000	0.00	12.08	12.08
		Area:	7,020	-	18.02	35.10	17.08
	206 Park	Soft Landscaping/Park	5,028	0.005	25.14	25.14	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	3,811	0.000	0.00	19.06	19.06
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	8,839	-	25.14	44.20	19.06
	207 Public Road	Soft Landscaping/Park	607	0.005	3.03	3.03	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	3,780	0.000	0.00	18.90	18.90
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	4,387		3.03	21.94	18.90
	208 Public Road	Soft Landscaping/Park	132	0.005	0.66	0.66	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	1,244	0.000	0.00	6.22	6.22
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	1,376		0.66	6.88	6.22

PH5	209	Soft Landscaping/Park	733	0.005	3.67	3.67	0.00
		Intensive Green Roof	4,818	0.005	24.09	24.09	0.00
		Extensive Green Roof	1,777	0.005	8.89	8.89	0.00
		Impervious at Grade	4,118	0.000	0.00	20.59	20.59
		Impervious at Roof	4,961	0.000	0.00	24.80	24.80
		Area:	**16,407**		**36.64**	**82.03**	**45.39**
	210 Private Road	Soft Landscaping/Park	332	0.005	1.66	1.66	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	875	0.000	0.00	4.38	4.38
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	**1,207**		**1.66**	**6.03**	**4.38**
	211	Soft Landscaping/Park	1,649	0.005	8.25	8.25	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	678	0.000	0.00	3.39	3.39
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	**2,328**		**8.25**	**11.64**	**3.39**
	212	Soft Landscaping/Park	2,100	0.005	10.50	10.50	0.00
		Intensive Green Roof	-	0.005	0.00	0.00	0.00
		Extensive Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	2,599	0.000	0.00	13.00	13.00
		Impervious at Roof	-	0.000	0.00	0.00	0.00
		Area:	**4,700**		**10.50**	**23.50**	**13.00**
	Total Catchment Area:		**77,470**		**161.69**	**387.35**	**225.66**

Initial Abstractions (IA) levels of 40mm are assumed for the intensive green roof areas:

Phase	Catchment ID	5mm WB Volume	Intensive Green Roof Area (m²)	Total IA Provided (m)	Additional WB Volume Provided Through Intensive Green Roof (m³)	Additional WB Volume Provided Through Infiltration Trench (m³)	Net WB (m³)
PH1	200	28.98	900	0.040	31.50	0.00	-2.52
PH1	201 - Public Road	8.84	0	0.000	0.00	0.00	8.84
PH2A	202	30.71	2,290	0.040	80.15	47.36	-96.80
PH2B	203 - Public Road	6.50	0	0.000	0.00	0.00	6.50
PH2	213 - Uncontrolled	2.88	0	0.000	0.00	0.00	2.88
PH3	204	20.34	576	0.040	20.16	0.00	0.18
PH4	205	17.08	2641	0.040	92.44	0.00	-75.36
PH4	206 -Park	19.06	0	0.000	0.00	0.00	19.06
PH4	207 - Public Road	18.90	0	0.000	0.00	0.00	18.90
PH4	208 - Public Road	6.22	0	0.000	0.00	0.00	6.22
PH5	209	45.39	4818	0.040	168.63	0.00	-123.24
PH5	210 - Private Road	4.38	0	0.000	0.00	0.00	4.38
PH5	211 - Uncontrolled	3.39	0	0.000	0.00	0.00	3.39
PH5	212 - Uncontrolled	13.00	0	0.000	0.00	0.00	13.00
Total Controlled WB Net Volume (m³)							**-278.68**
Total Uncontrolled WB Net Volume (m³)							**19.27**
Total WB Net Volume (m³)							**-259.41**

Note: Roadways are not required to meet water balance and are excluded from the Total WB Net Volume summation

The site provides overcontrol through the intensive green roof initial abstraction assumption and the infiltration trenches provided in Phase 2, the total surplus water balance provided is: **259**   m³
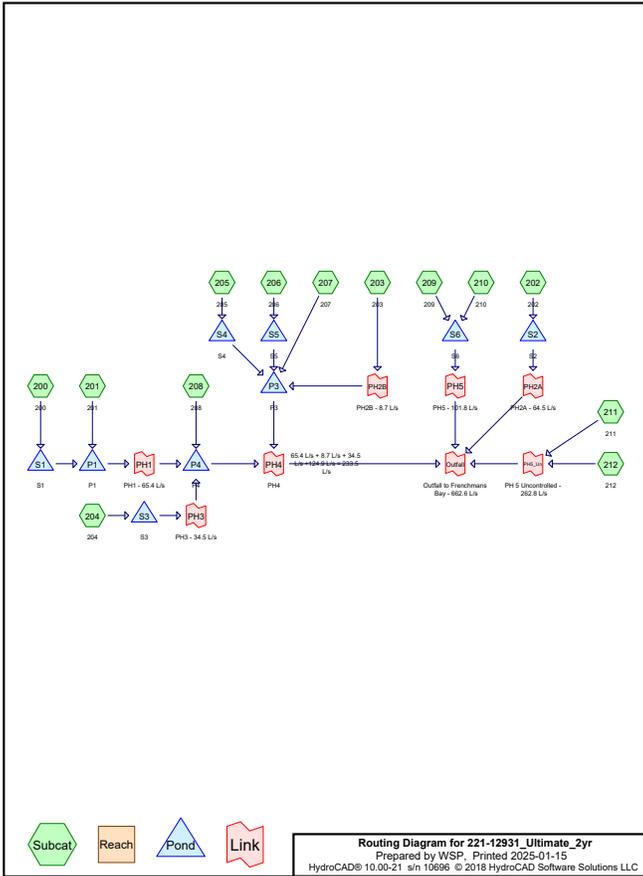
APPENDIX

C

Hydrologic Model Output

Routing Diagram for 221-12931_Ultimate_2yr
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Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.9350	0.77	(200)
0.3341	0.88	(201, 208)
1.8189	0.71	(202, 205)
0.5895	0.85	(203, 207)
0.5968	0.79	(204)
0.8839	0.55	(206)
1.6407	0.74	(209)
0.1207	0.76	(210)
0.2328	0.45	(211)
0.4700	0.64	(212)
7.6224	**0.72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.6224	Other	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
7.6224		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	7.6224	7.6224		200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
0.0000	**0.0000**	**0.0000**	**0.0000**	**7.6224**	**7.6224**	**TOTAL AREA**	

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Time span=0.00-10.00 hrs, dt=0.01 hrs, 1001 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment200: 200	Runoff Area=0.9350 ha 0.00% Impervious Runoff Depth=13 mm Tc=0.0 min C=0.77 Runoff=0.11004 m³/s 0.123 Ml
Subcatchment201: 201	Runoff Area=0.1965 ha 0.00% Impervious Runoff Depth=15 mm Tc=10.0 min C=0.88 Runoff=0.02643 m³/s 0.029 Ml
Subcatchment202: 202	Runoff Area=1.1169 ha 0.00% Impervious Runoff Depth=12 mm Tc=10.0 min C=0.71 Runoff=0.12120 m³/s 0.131 Ml
Subcatchment203: 203	Runoff Area=0.1508 ha 0.00% Impervious Runoff Depth=14 mm Tc=0.0 min C=0.85 Runoff=0.01959 m³/s 0.022 Ml
Subcatchment204: 204	Runoff Area=0.5968 ha 0.00% Impervious Runoff Depth=13 mm Tc=10.0 min C=0.79 Runoff=0.07206 m³/s 0.078 Ml
Subcatchment205: 205	Runoff Area=0.7020 ha 0.00% Impervious Runoff Depth=12 mm Tc=10.0 min C=0.71 Runoff=0.07618 m³/s 0.082 Ml
Subcatchment206: 206	Runoff Area=0.8839 ha 0.00% Impervious Runoff Depth=9 mm Tc=10.0 min C=0.55 Runoff=0.07430 m³/s 0.080 Ml
Subcatchment207: 207	Runoff Area=0.4387 ha 0.00% Impervious Runoff Depth=14 mm Tc=10.0 min C=0.85 Runoff=0.05699 m³/s 0.062 Ml
Subcatchment208: 208	Runoff Area=0.1376 ha 0.00% Impervious Runoff Depth=15 mm Tc=10.0 min C=0.88 Runoff=0.01851 m³/s 0.020 Ml
Subcatchment209: 209	Runoff Area=1.6407 ha 0.00% Impervious Runoff Depth=12 mm Tc=10.0 min C=0.74 Runoff=0.18556 m³/s 0.200 Ml
Subcatchment210: 210	Runoff Area=0.1207 ha 0.00% Impervious Runoff Depth=13 mm Tc=10.0 min C=0.76 Runoff=0.01402 m³/s 0.015 Ml
Subcatchment211: 211	Runoff Area=0.2328 ha 0.00% Impervious Runoff Depth=7 mm Tc=10.0 min C=0.45 Runoff=0.01601 m³/s 0.017 Ml
Subcatchment212: 212	Runoff Area=0.4700 ha 0.00% Impervious Runoff Depth=11 mm Tc=10.0 min C=0.64 Runoff=0.04597 m³/s 0.050 Ml
Pond P1: P1	Peak Elev=0.267 m Storage=9.9 m³ Inflow=0.03443 m³/s 0.146 Ml Outflow=0.02809 m³/s 0.146 Ml
Pond P3: P3	Peak Elev=0.307 m Storage=54.9 m³ Inflow=0.09909 m³/s 0.245 Ml Outflow=0.05195 m³/s 0.244 Ml
Pond P4: P4	Peak Elev=10.305 m Storage=12.0 m³ Inflow=0.05810 m³/s 0.244 Ml Outflow=0.05167 m³/s 0.244 Ml

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Pond S1: S1	Peak Elev=10.451 m Storage=117.3 m³ Inflow=0.11004 m³/s 0.123 Ml Outflow=0.00793 m³/s 0.118 Ml
Pond S2: S2	Peak Elev=0.467 m Storage=102.8 m³ Inflow=0.12120 m³/s 0.131 Ml Outflow=0.03089 m³/s 0.130 Ml
Pond S3: S3	Peak Elev=10.461 m Storage=64.5 m³ Inflow=0.07206 m³/s 0.078 Ml Outflow=0.01405 m³/s 0.078 Ml
Pond S4: S4	Peak Elev=10.439 m Storage=74.7 m³ Inflow=0.07618 m³/s 0.082 Ml Outflow=0.00782 m³/s 0.081 Ml
Pond S5: S5	Peak Elev=10.452 m Storage=63.2 m³ Inflow=0.07430 m³/s 0.080 Ml Outflow=0.01808 m³/s 0.080 Ml
Pond S6: S6	Peak Elev=0.518 m Storage=176.2 m³ Inflow=0.19958 m³/s 0.216 Ml Outflow=0.04274 m³/s 0.214 Ml
Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s	Inflow=0.22411 m³/s 0.899 Ml Primary=0.22411 m³/s 0.899 Ml
Link PH1: PH1 - 65.4 L/s	Inflow=0.02809 m³/s 0.146 Ml Primary=0.02809 m³/s 0.146 Ml
Link PH2A: PH2A - 64.5 L/s	Inflow=0.03089 m³/s 0.130 Ml Primary=0.03089 m³/s 0.130 Ml
Link PH2B: PH2B - 8.7 L/s	Inflow=0.01959 m³/s 0.022 Ml Primary=0.01959 m³/s 0.022 Ml
Link PH3: PH3 - 34.5 L/s	Inflow=0.01405 m³/s 0.078 Ml Primary=0.01405 m³/s 0.078 Ml
Link PH4: PH4	Inflow=0.10358 m³/s 0.488 Ml Primary=0.10358 m³/s 0.488 Ml
Link PH5: PH5 - 101.8 L/s	Inflow=0.04274 m³/s 0.214 Ml Primary=0.04274 m³/s 0.214 Ml
Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s	Inflow=0.06199 m³/s 0.067 Ml Primary=0.06199 m³/s 0.067 Ml

Total Runoff Area = 7.6224 ha   Runoff Volume = 0.908 Ml   Average Runoff Depth = 12 mm
100.00% Pervious = 7.6224 ha   0.00% Impervious = 0.0000 ha

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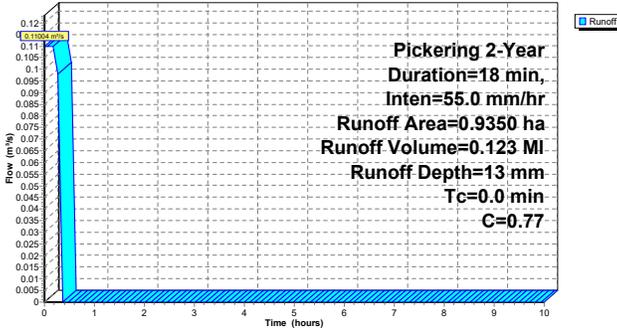### Summary for Subcatchment 200: 200

Runoff   =   0.11004 m³/s @   0.00 hrs, Volume=   0.123 Ml, Depth=   13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.9350	0.77	
0.9350		100.00% Pervious Area

Subcatchment 200: 200

**Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.9350 ha
Runoff Volume=0.123 Ml
Runoff Depth=13 mm
Tc=0.0 min
C=0.77**

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Subcatchment 201: 201

Runoff   =   0.02643 m³/s @   0.17 hrs, Volume=   0.029 Ml, Depth=   15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.1965	0.88	
0.1965		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 201: 201

**Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.1965 ha
Runoff Volume=0.029 Ml
Runoff Depth=15 mm
Tc=10.0 min
C=0.88**

Summary for Subcatchment 202: 202

Runoff   =   0.12120 m³/s @   0.17 hrs, Volume=   0.131 Ml, Depth=   12 mm
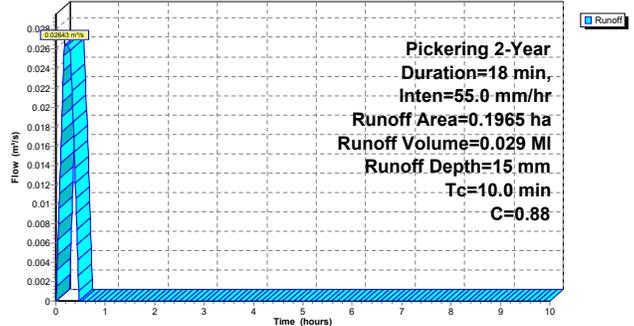
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
1.1169	0.71	
1.1169		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 202: 202
Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=1.1169 ha
Runoff Volume=0.131 Ml
Runoff Depth=12 mm
Tc=10.0 min
C=0.71

Summary for Subcatchment 203: 203

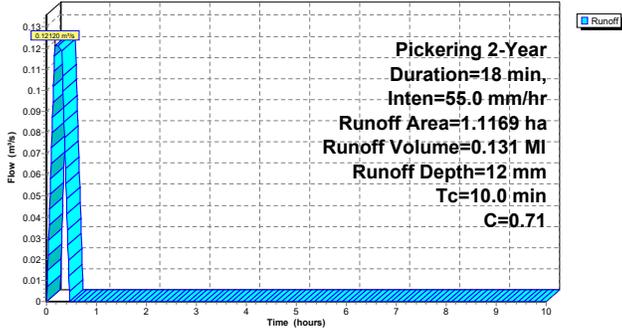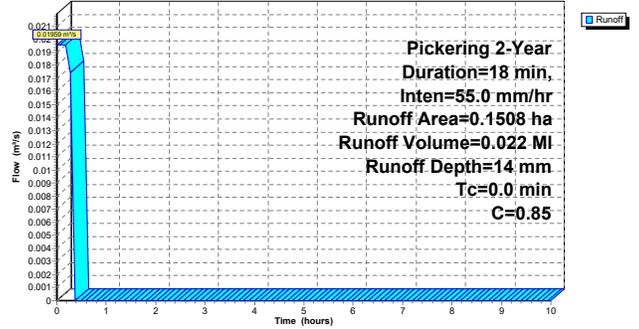Runoff   =   0.01959 m³/s @   0.00 hrs, Volume=   0.022 Ml, Depth=   14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.1508	0.85	
0.1508		100.00% Pervious Area

Subcatchment 203: 203
Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.1508 ha
Runoff Volume=0.022 Ml
Runoff Depth=14 mm
Tc=0.0 min
C=0.85

Summary for Subcatchment 204: 204

Runoff   =   0.07206 m³/s @   0.17 hrs, Volume=   0.078 Ml, Depth=   13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.5968	0.79	
0.5968		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 204: 204
Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.5968 ha
Runoff Volume=0.078 Ml
Runoff Depth=13 mm
Tc=10.0 min
C=0.79

Summary for Subcatchment 205: 205

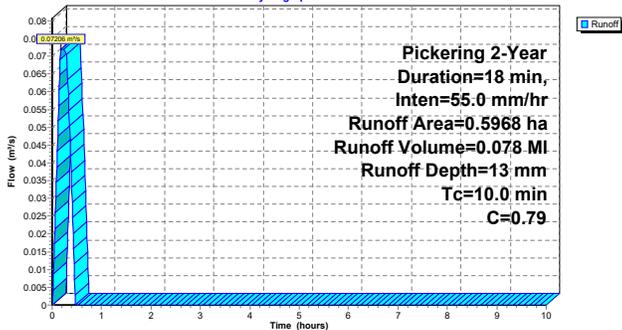Runoff   =   0.07618 m³/s @   0.17 hrs, Volume=   0.082 Ml, Depth=   12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.7020	0.71	
0.7020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 205: 205
Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.7020 ha
Runoff Volume=0.082 Ml
Runoff Depth=12 mm
Tc=10.0 min
C=0.71

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Summary for Subcatchment 206: 206

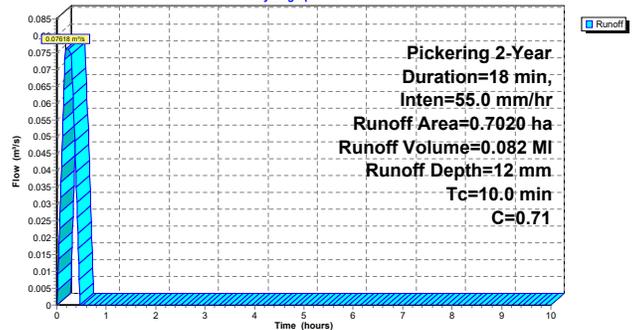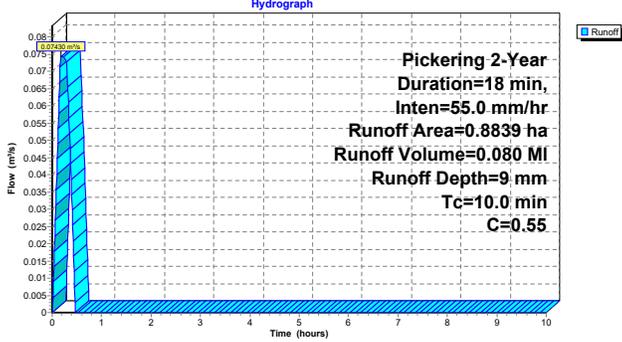Runoff = 0.07430 m³/s @ 0.17 hrs, Volume= 0.080 Ml, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.8839	0.55	
0.8839		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 206: 206

Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.8839 ha
Runoff Volume=0.080 Ml
Runoff Depth=9 mm
Tc=10.0 min
C=0.55

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Subcatchment 207: 207

Runoff = 0.05699 m³/s @ 0.17 hrs, Volume= 0.062 Ml, Depth= 14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.4387	0.85	
0.4387		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 207: 207

Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.4387 ha
Runoff Volume=0.062 Ml
Runoff Depth=14 mm
Tc=10.0 min
C=0.85

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
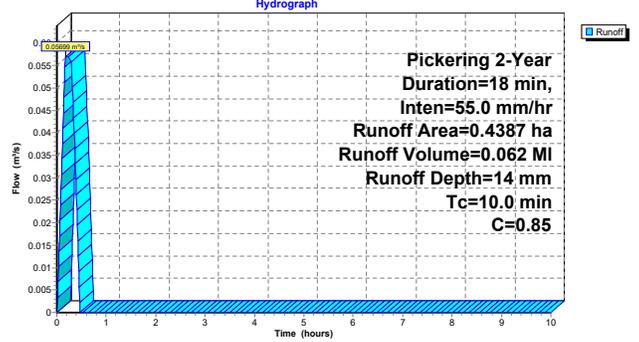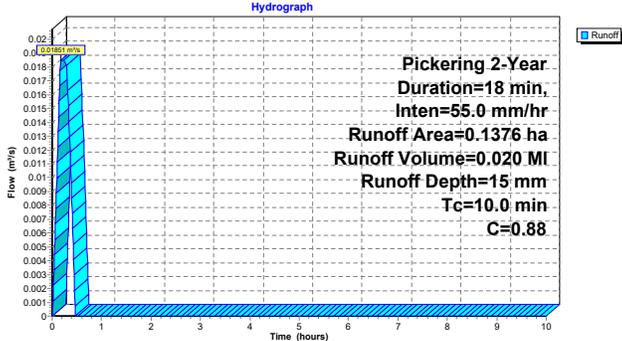Printed 2025-01-15
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Summary for Subcatchment 208: 208

Runoff = 0.01851 m³/s @ 0.17 hrs, Volume= 0.020 Ml, Depth= 15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.1376	0.88	
0.1376		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 208: 208

Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.1376 ha
Runoff Volume=0.020 Ml
Runoff Depth=15 mm
Tc=10.0 min
C=0.88

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
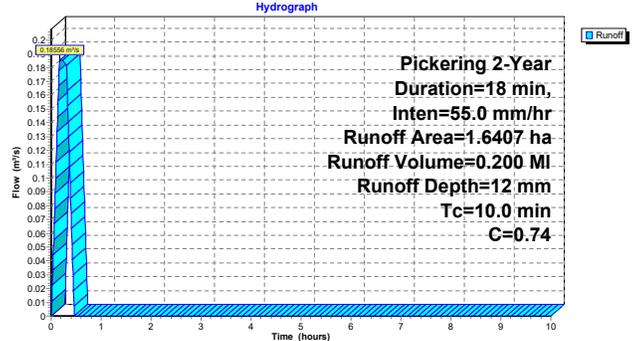Printed 2025-01-15
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Summary for Subcatchment 209: 209

Runoff = 0.18556 m³/s @ 0.17 hrs, Volume= 0.200 Ml, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
1.6407	0.74	
1.6407		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 209: 209

Hydrograph

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=1.6407 ha
Runoff Volume=0.200 Ml
Runoff Depth=12 mm
Tc=10.0 min
C=0.74
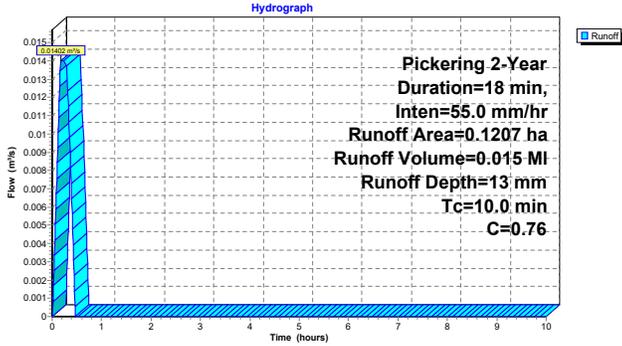
Summary for Subcatchment 210: 210

Runoff   =   0.01402 m³/s @   0.17 hrs, Volume=   0.015 Ml, Depth=   13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.1207	0.76	
0.1207		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 210: 210

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.1207 ha
Runoff Volume=0.015 Ml
Runoff Depth=13 mm
Tc=10.0 min
C=0.76
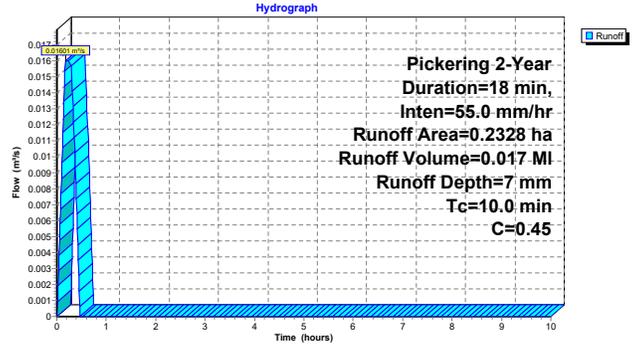
Summary for Subcatchment 211: 211

Runoff   =   0.01601 m³/s @   0.17 hrs, Volume=   0.017 Ml, Depth=   7 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.2328	0.45	
0.2328		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 211: 211

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.2328 ha
Runoff Volume=0.017 Ml
Runoff Depth=7 mm
Tc=10.0 min
C=0.45
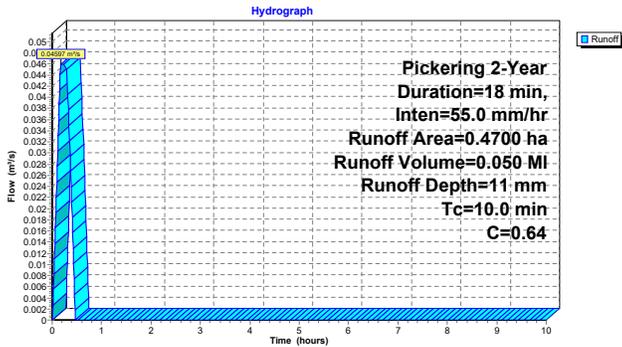
Summary for Subcatchment 212: 212

Runoff   =   0.04597 m³/s @   0.17 hrs, Volume=   0.050 Ml, Depth=   11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr

Area (ha)	C	Description
0.4700	0.64	
0.4700		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 212: 212

Pickering 2-Year
Duration=18 min,
Inten=55.0 mm/hr
Runoff Area=0.4700 ha
Runoff Volume=0.050 Ml
Runoff Depth=11 mm
Tc=10.0 min
C=0.64

Summary for Pond P1: P1

Inflow Area =   1.1315 ha,   0.00% Impervious, Inflow Depth >   13 mm   for 2-Year event
Inflow   =   0.03443 m³/s @   0.30 hrs, Volume=   0.146 Ml
Outflow   =   0.02809 m³/s @   0.34 hrs, Volume=   0.146 Ml, Atten= 18%, Lag= 2.6 min
Primary   =   0.02809 m³/s @   0.34 hrs, Volume=   0.146 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.267 m @ 0.34 hrs Surf.Area= 52.1 m² Storage= 9.9 m³
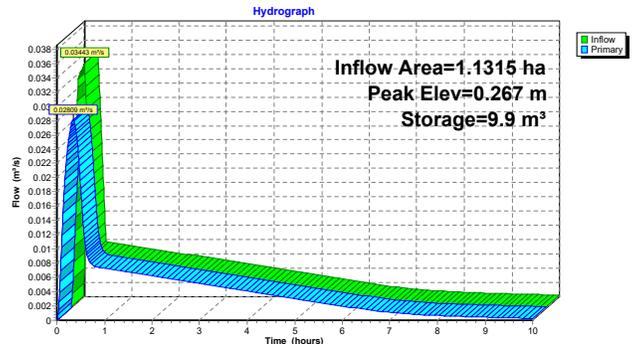
Plug-Flow detention time= 4.7 min calculated for 0.146 Ml (100% of inflow)
Center-of-Mass det. time= 4.3 min (147.9 - 143.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.02809 m³/s @ 0.34 hrs HW=0.267 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02809 m³/s @ 1.59 m/s)

Pond P1: P1

Inflow Area=1.1315 ha
Peak Elev=0.267 m
Storage=9.9 m³

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Pond P3: P3

Inflow Area =   2.1754 ha,   0.00% Impervious, Inflow Depth >   11 mm   for 2-Year event
Inflow   =   0.09909 m³/s @   0.30 hrs, Volume=   0.245 Ml
Outflow   =   0.05195 m³/s @   0.39 hrs, Volume=   0.244 Ml, Atten= 48%, Lag= 5.4 min
Primary   =   0.05195 m³/s @   0.39 hrs, Volume=   0.244 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.307 m @ 0.39 hrs Surf.Area= 251.4 m² Storage= 54.9 m³

Plug-Flow detention time= 16.3 min calculated for 0.244 Ml (100% of inflow)
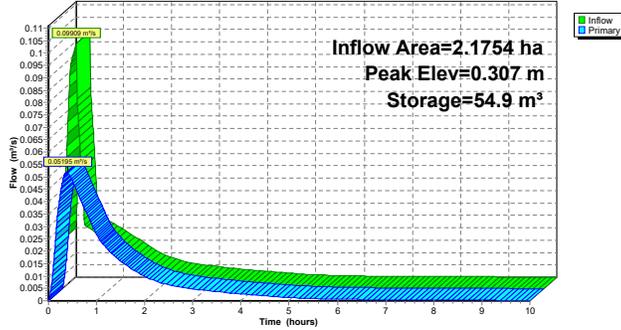Center-of-Mass det. time= 15.0 min (84.1 - 69.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	271.4 m³	**1,200 mm Round Pipe Storage** L= 240.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.05195 m³/s @ 0.39 hrs HW=0.307 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05195 m³/s @ 1.65 m/s)

Pond P3: P3

Inflow Area=2.1754 ha
Peak Elev=0.307 m
Storage=54.9 m³

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Pond P4: P4

Inflow Area =   1.8659 ha,   0.00% Impervious, Inflow Depth >   13 mm   for 2-Year event
Inflow   =   0.05810 m³/s @   0.30 hrs, Volume=   0.244 Ml
Outflow   =   0.05167 m³/s @   0.37 hrs, Volume=   0.244 Ml, Atten= 11%, Lag= 4.4 min
Primary   =   0.05167 m³/s @   0.37 hrs, Volume=   0.244 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.305 m @ 0.37 hrs Surf.Area= 54.3 m² Storage= 12.0 m³

Plug-Flow detention time= 3.5 min calculated for 0.244 Ml (100% of inflow)
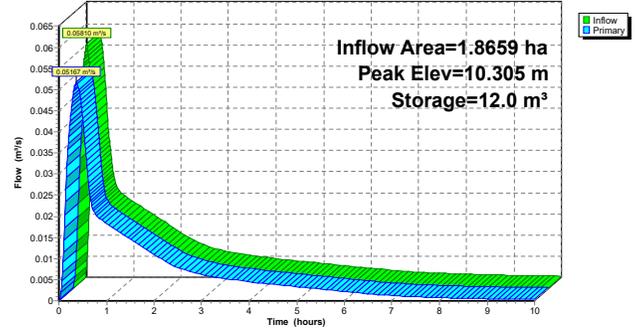Center-of-Mass det. time= 3.3 min (118.1 - 114.9)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.05166 m³/s @ 0.37 hrs HW=10.305 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05166 m³/s @ 1.64 m/s)

Pond P4: P4

Inflow Area=1.8659 ha
Peak Elev=10.305 m
Storage=12.0 m³

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Pond S1: S1

Inflow Area =   0.9350 ha,   0.00% Impervious, Inflow Depth =   13 mm   for 2-Year event
Inflow   =   0.11004 m³/s @   0.00 hrs, Volume=   0.123 Ml
Outflow   =   0.00793 m³/s @   0.31 hrs, Volume=   0.118 Ml, Atten= 93%, Lag= 18.8 min
Primary   =   0.00793 m³/s @   0.31 hrs, Volume=   0.118 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.451 m @ 0.31 hrs Surf.Area= 260.0 m² Storage= 117.3 m³

Plug-Flow detention time= 169.4 min calculated for 0.116 Ml (94% of inflow)
Center-of-Mass det. time= 166.0 min (175.0 - 9.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	520.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	260.0	0.0	0.0
12.000	260.0	520.0	520.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.00792 m³/s @ 0.31 hrs HW=10.450 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.00792 m³/s @ 1.79 m/s)

Pond S1: S1
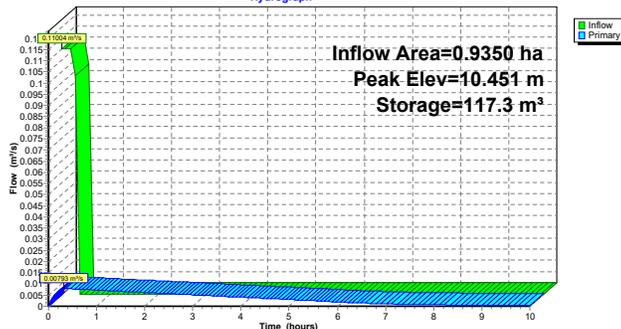
Inflow Area=0.9350 ha
Peak Elev=10.451 m
Storage=117.3 m³

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Summary for Pond S2: S2

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth =   12 mm   for 2-Year event
Inflow   =   0.12120 m³/s @   0.17 hrs, Volume=   0.131 Ml
Outflow   =   0.03089 m³/s @   0.42 hrs, Volume=   0.130 Ml, Atten= 75%, Lag= 15.3 min
Primary   =   0.03089 m³/s @   0.42 hrs, Volume=   0.130 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.467 m @ 0.42 hrs Surf.Area= 220.0 m² Storage= 102.8 m³

Plug-Flow detention time= 53.2 min calculated for 0.130 Ml (99% of inflow)
Center-of-Mass det. time= 53.1 min (67.1 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	440.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	220.0	0.0	0.0
2.000	220.0	440.0	440.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.03089 m³/s @ 0.42 hrs HW=0.467 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.03089 m³/s @ 1.75 m/s)

Pond S2: S2
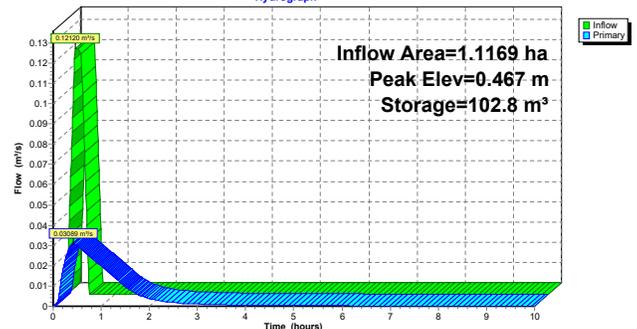
Inflow Area=1.1169 ha
Peak Elev=0.467 m
Storage=102.8 m³

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Summary for Pond S3: S3

Inflow Area =   0.5968 ha,   0.00% Impervious, Inflow Depth =   13 mm   for 2-Year event
Inflow   =   0.07206 m³/s @   0.17 hrs, Volume=   0.078 Ml
Outflow   =   0.01405 m³/s @   0.43 hrs, Volume=   0.078 Ml, Atten= 80%, Lag= 15.9 min
Primary   =   0.01405 m³/s @   0.43 hrs, Volume=   0.078 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.461 m @ 0.43 hrs Surf.Area= 140.0 m² Storage= 64.5 m³

Plug-Flow detention time= 64.7 min calculated for 0.078 Ml (100% of inflow)
Center-of-Mass det. time= 64.7 min (78.7 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	140.0	0.0	0.0
12.000	140.0	280.0	280.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01405 m³/s @ 0.43 hrs HW=10.461 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01405 m³/s @ 1.79 m/s)

Pond S3: S3

Hydrograph
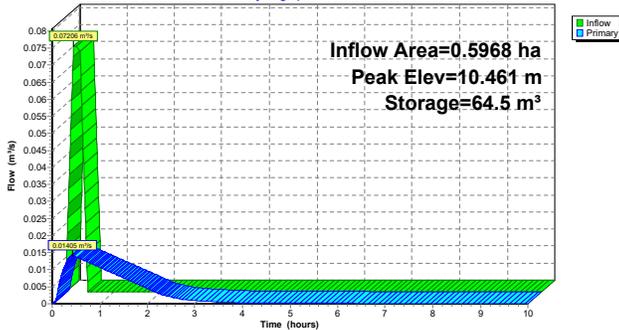
Inflow Area=0.5968 ha
Peak Elev=10.461 m
Storage=64.5 m³

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Summary for Pond S4: S4

Inflow Area =   0.7020 ha,   0.00% Impervious, Inflow Depth =   12 mm   for 2-Year event
Inflow   =   0.07618 m³/s @   0.17 hrs, Volume=   0.082 Ml
Outflow   =   0.00782 m³/s @   0.45 hrs, Volume=   0.081 Ml, Atten= 90%, Lag= 16.8 min
Primary   =   0.00782 m³/s @   0.45 hrs, Volume=   0.081 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.439 m @ 0.45 hrs Surf.Area= 170.0 m² Storage= 74.7 m³

Plug-Flow detention time= 117.6 min calculated for 0.081 Ml (98% of inflow)
Center-of-Mass det. time= 117.8 min (131.8 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	340.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	170.0	0.0	0.0
12.000	170.0	340.0	340.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.00782 m³/s @ 0.45 hrs HW=10.439 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.00782 m³/s @ 1.77 m/s)

Pond S4: S4

Hydrograph

Inflow Area=0.7020 ha
Peak Elev=10.439 m
Storage=74.7 m³

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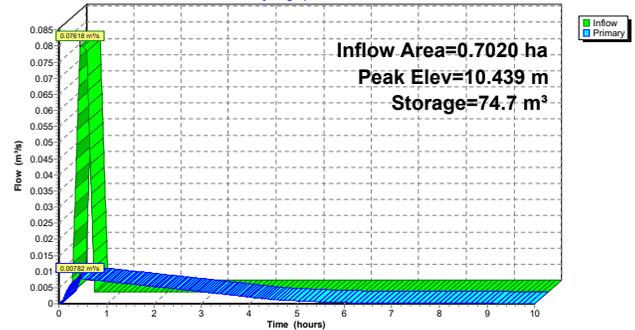
Summary for Pond S5: S5

Inflow Area =   0.8839 ha,   0.00% Impervious, Inflow Depth =   9 mm   for 2-Year event
Inflow   =   0.07430 m³/s @   0.17 hrs, Volume=   0.080 Ml
Outflow   =   0.01808 m³/s @   0.43 hrs, Volume=   0.080 Ml, Atten= 76%, Lag= 15.4 min
Primary   =   0.01808 m³/s @   0.43 hrs, Volume=   0.080 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.452 m @ 0.43 hrs Surf.Area= 140.0 m² Storage= 63.2 m³

Plug-Flow detention time= 50.1 min calculated for 0.080 Ml (100% of inflow)
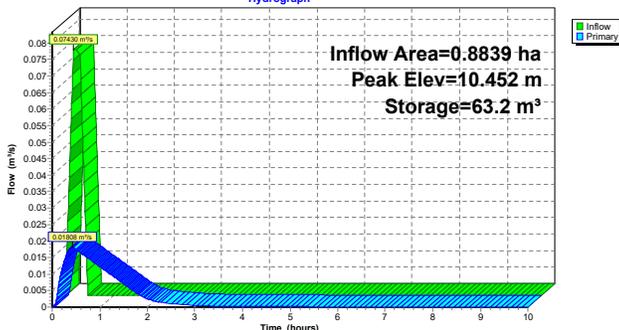Center-of-Mass det. time= 50.6 min (64.6 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**1.00 mW x 140.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.01808 m³/s @ 0.43 hrs HW=10.452 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01808 m³/s @ 2.30 m/s)

Pond S5: S5

Hydrograph

Inflow Area=0.8839 ha
Peak Elev=10.452 m
Storage=63.2 m³

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Summary for Pond S6: S6

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth =   12 mm   for 2-Year event
Inflow   =   0.19958 m³/s @   0.17 hrs, Volume=   0.216 Ml
Outflow   =   0.04274 m³/s @   0.43 hrs, Volume=   0.214 Ml, Atten= 79%, Lag= 15.7 min
Primary   =   0.04274 m³/s @   0.43 hrs, Volume=   0.214 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.518 m @ 0.43 hrs Surf.Area= 340.0 m² Storage= 176.2 m³

Plug-Flow detention time= 61.5 min calculated for 0.214 Ml (99% of inflow)
Center-of-Mass det. time= 61.9 min (75.9 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	680.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	340.0	0.0	0.0
2.000	340.0	680.0	680.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.04274 m³/s @ 0.43 hrs HW=0.518 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.04274 m³/s @ 2.42 m/s)

Pond S6: S6

Hydrograph
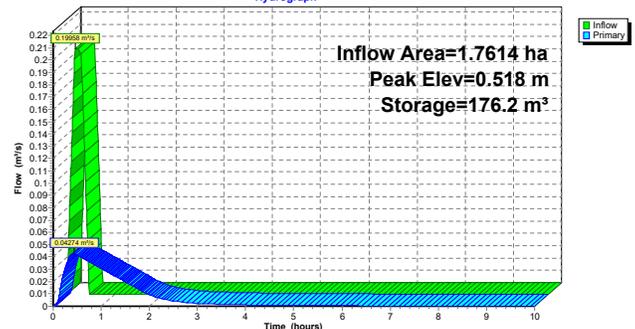
Inflow Area=1.7614 ha
Peak Elev=0.518 m
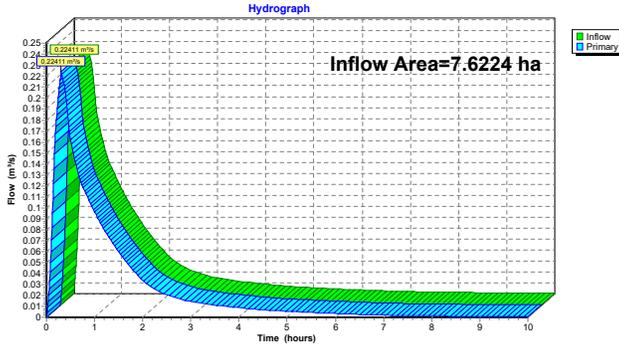Storage=176.2 m³

Summary for Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area =   7.6224 ha,   0.00% Impervious, Inflow Depth >   12 mm   for 2-Year event
Inflow   =   0.22411 m³/s @   0.30 hrs, Volume=   0.899 Ml
Primary   =   0.22411 m³/s @   0.30 hrs, Volume=   0.899 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

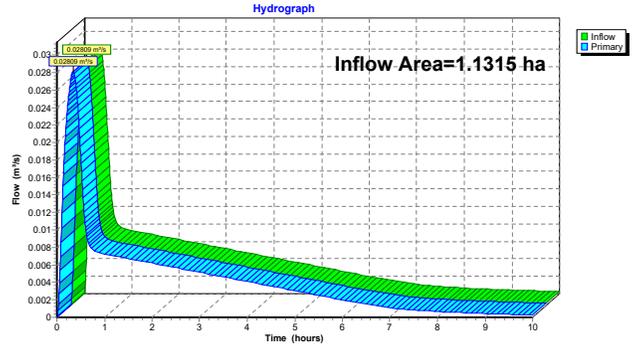**Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s**

Summary for Link PH1: PH1 - 65.4 L/s

Inflow Area =   1.1315 ha,   0.00% Impervious, Inflow Depth >   13 mm   for 2-Year event
Inflow   =   0.02809 m³/s @   0.34 hrs, Volume=   0.146 Ml
Primary   =   0.02809 m³/s @   0.34 hrs, Volume=   0.146 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
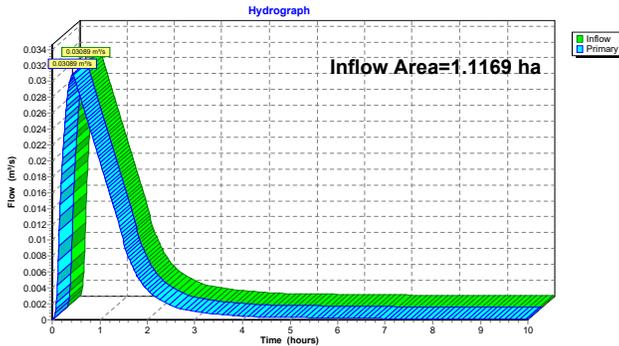
Link PH1: PH1 - 65.4 L/s

Summary for Link PH2A: PH2A - 64.5 L/s

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth >   12 mm   for 2-Year event
Inflow   =   0.03089 m³/s @   0.42 hrs, Volume=   0.130 Ml
Primary   =   0.03089 m³/s @   0.42 hrs, Volume=   0.130 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
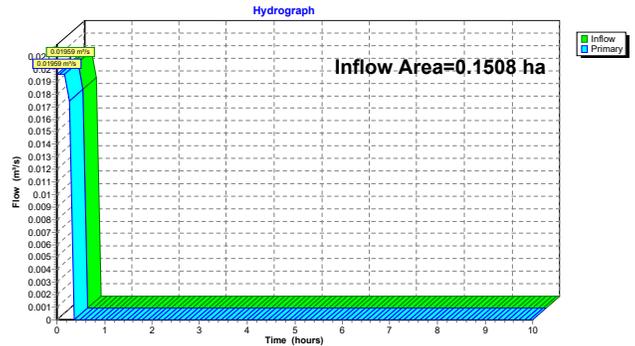
Link PH2A: PH2A - 64.5 L/s

Summary for Link PH2B: PH2B - 8.7 L/s

Inflow Area =   0.1508 ha,   0.00% Impervious, Inflow Depth =   14 mm   for 2-Year event
Inflow   =   0.01959 m³/s @   0.00 hrs, Volume=   0.022 Ml
Primary   =   0.01959 m³/s @   0.00 hrs, Volume=   0.022 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
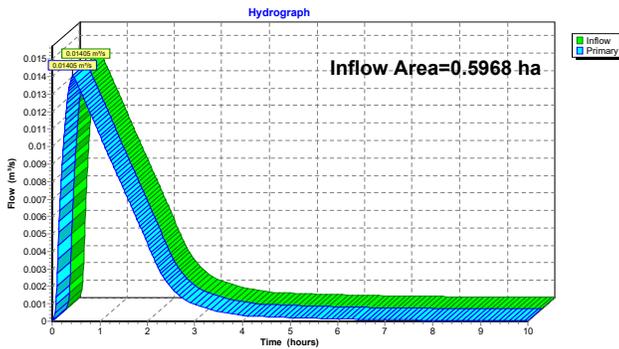
Link PH2B: PH2B - 8.7 L/s

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Summary for Link PH3: PH3 - 34.5 L/s

Inflow Area =   0.5968 ha,   0.00% Impervious, Inflow Depth >   13 mm   for 2-Year event
Inflow   =   0.01405 m³/s @   0.43 hrs, Volume=   0.078 Ml
Primary   =   0.01405 m³/s @   0.43 hrs, Volume=   0.078 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
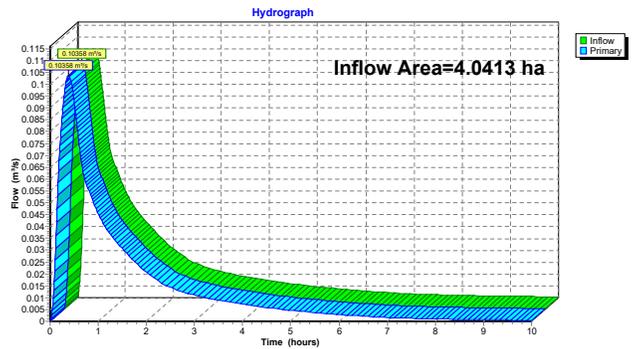
Link PH3: PH3 - 34.5 L/s

Inflow Area=0.5968 ha

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Link PH4: PH4

Inflow Area =   4.0413 ha,   0.00% Impervious, Inflow Depth >   12 mm   for 2-Year event
Inflow   =   0.10358 m³/s @   0.38 hrs, Volume=   0.488 Ml
Primary   =   0.10358 m³/s @   0.38 hrs, Volume=   0.488 Ml, Atten= 0%, Lag= 0.0 min

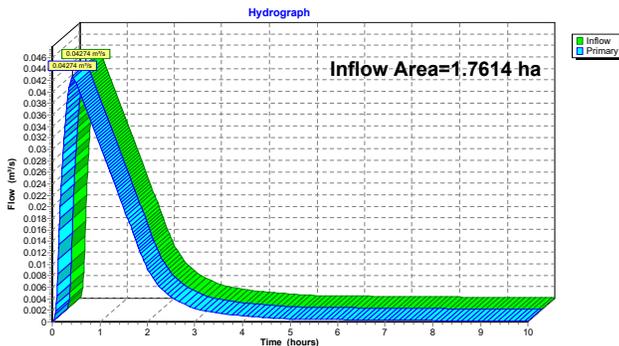Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

Inflow Area=4.0413 ha

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Link PH5: PH5 - 101.8 L/s

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth >   12 mm   for 2-Year event
Inflow   =   0.04274 m³/s @   0.43 hrs, Volume=   0.214 Ml
Primary   =   0.04274 m³/s @   0.43 hrs, Volume=   0.214 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
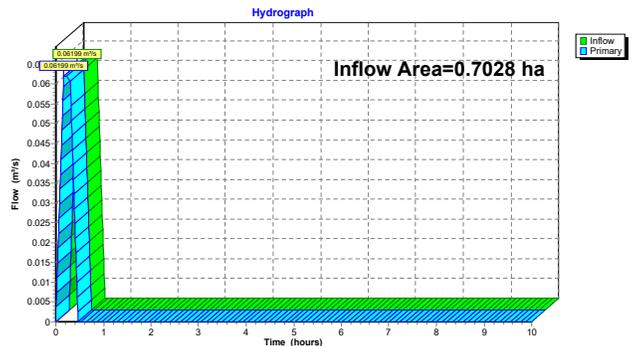
Link PH5: PH5 - 101.8 L/s

Inflow Area=1.7614 ha

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Pickering 2-Year Duration=18 min, Inten=55.0 mm/hr
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Summary for Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area =   0.7028 ha,   0.00% Impervious, Inflow Depth =   10 mm   for 2-Year event
Inflow   =   0.06199 m³/s @   0.17 hrs, Volume=   0.067 Ml
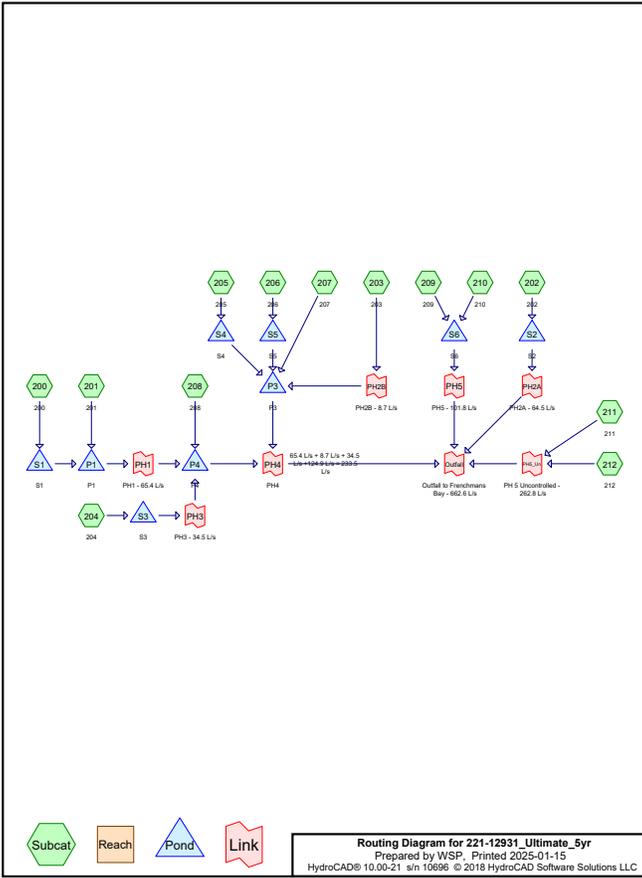Primary   =   0.06199 m³/s @   0.17 hrs, Volume=   0.067 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area=0.7028 ha

Routing Diagram for 221-12931_Ultimate_5yr
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Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.9350	0.77	(200)
0.3341	0.88	(201, 208)
1.8189	0.71	(202, 205)
0.5895	0.85	(203, 207)
0.5968	0.79	(204)
0.8839	0.55	(206)
1.6407	0.74	(209)
0.1207	0.76	(210)
0.2328	0.45	(211)
0.4700	0.64	(212)
7.6224	**0.72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.6224	Other	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
7.6224		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	7.6224	7.6224		200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
0.0000	**0.0000**	**0.0000**	**0.0000**	**7.6224**	**7.6224**	**TOTAL AREA**	

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Time span=0.00-10.00 hrs, dt=0.01 hrs, 1001 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment200: 200   Runoff Area=0.9350 ha 0.00% Impervious Runoff Depth=18 mm
Tc=0.0 min C=0.77 Runoff=0.15144 m³/s 0.169 Ml

Subcatchment201: 201   Runoff Area=0.1965 ha 0.00% Impervious Runoff Depth=20 mm
Tc=10.0 min C=0.88 Runoff=0.03637 m³/s 0.039 Ml

Subcatchment202: 202   Runoff Area=1.1169 ha 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.71 Runoff=0.16681 m³/s 0.180 Ml

Subcatchment203: 203   Runoff Area=0.1508 ha 0.00% Impervious Runoff Depth=20 mm
Tc=0.0 min C=0.85 Runoff=0.02696 m³/s 0.030 Ml

Subcatchment204: 204   Runoff Area=0.5968 ha 0.00% Impervious Runoff Depth=18 mm
Tc=10.0 min C=0.79 Runoff=0.09917 m³/s 0.107 Ml

Subcatchment205: 205   Runoff Area=0.7020 ha 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.71 Runoff=0.10484 m³/s 0.113 Ml

Subcatchment206: 206   Runoff Area=0.8839 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.55 Runoff=0.10226 m³/s 0.110 Ml

Subcatchment207: 207   Runoff Area=0.4387 ha 0.00% Impervious Runoff Depth=19 mm
Tc=10.0 min C=0.85 Runoff=0.07844 m³/s 0.085 Ml

Subcatchment208: 208   Runoff Area=0.1376 ha 0.00% Impervious Runoff Depth=20 mm
Tc=10.0 min C=0.88 Runoff=0.02547 m³/s 0.028 Ml

Subcatchment209: 209   Runoff Area=1.6407 ha 0.00% Impervious Runoff Depth=17 mm
Tc=10.0 min C=0.74 Runoff=0.25539 m³/s 0.276 Ml

Subcatchment210: 210   Runoff Area=0.1207 ha 0.00% Impervious Runoff Depth=17 mm
Tc=10.0 min C=0.76 Runoff=0.01930 m³/s 0.021 Ml

Subcatchment211: 211   Runoff Area=0.2328 ha 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.45 Runoff=0.02204 m³/s 0.024 Ml

Subcatchment212: 212   Runoff Area=0.4700 ha 0.00% Impervious Runoff Depth=15 mm
Tc=10.0 min C=0.64 Runoff=0.06327 m³/s 0.068 Ml

Pond P1: P1   Peak Elev=0.368 m Storage=15.5 m³ Inflow=0.04595 m³/s 0.201 Ml
Outflow=0.03473 m³/s 0.201 Ml

Pond P3: P3   Peak Elev=0.400 m Storage=79.1 m³ Inflow=0.13251 m³/s 0.337 Ml
Outflow=0.06245 m³/s 0.336 Ml

Pond P4: P4   Peak Elev=10.406 m Storage=17.6 m³ Inflow=0.07374 m³/s 0.335 Ml
Outflow=0.06307 m³/s 0.335 Ml

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Pond S1: S1   Peak Elev=10.624 m Storage=162.4 m³ Inflow=0.15144 m³/s 0.169 Ml
Outflow=0.00944 m³/s 0.162 Ml

Pond S2: S2   Peak Elev=0.658 m Storage=144.8 m³ Inflow=0.16681 m³/s 0.180 Ml
Outflow=0.03766 m³/s 0.179 Ml

Pond S3: S3   Peak Elev=10.648 m Storage=90.7 m³ Inflow=0.09917 m³/s 0.107 Ml
Outflow=0.01694 m³/s 0.107 Ml

Pond S4: S4   Peak Elev=10.612 m Storage=104.0 m³ Inflow=0.10484 m³/s 0.113 Ml
Outflow=0.00934 m³/s 0.111 Ml

Pond S5: S5   Peak Elev=10.638 m Storage=89.3 m³ Inflow=0.10226 m³/s 0.110 Ml
Outflow=0.02188 m³/s 0.110 Ml

Pond S6: S6   Peak Elev=0.728 m Storage=247.5 m³ Inflow=0.27469 m³/s 0.297 Ml
Outflow=0.05186 m³/s 0.295 Ml

Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s   Inflow=0.28090 m³/s 1.238 Ml
Primary=0.28090 m³/s 1.238 Ml

Link PH1: PH1 - 65.4 L/s   Inflow=0.03473 m³/s 0.201 Ml
Primary=0.03473 m³/s 0.201 Ml

Link PH2A: PH2A - 64.5 L/s   Inflow=0.03766 m³/s 0.179 Ml
Primary=0.03766 m³/s 0.179 Ml

Link PH2B: PH2B - 8.7 L/s   Inflow=0.02696 m³/s 0.030 Ml
Primary=0.02696 m³/s 0.030 Ml

Link PH3: PH3 - 34.5 L/s   Inflow=0.01694 m³/s 0.107 Ml
Primary=0.01694 m³/s 0.107 Ml

Link PH4: PH4   Inflow=0.12549 m³/s 0.672 Ml
Primary=0.12549 m³/s 0.672 Ml

Link PH5: PH5 - 101.8 L/s   Inflow=0.05186 m³/s 0.295 Ml
Primary=0.05186 m³/s 0.295 Ml

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s   Inflow=0.08531 m³/s 0.092 Ml
Primary=0.08531 m³/s 0.092 Ml

Total Runoff Area = 7.6224 ha   Runoff Volume = 1.250 Ml   Average Runoff Depth = 16 mm
100.00% Pervious = 7.6224 ha   0.00% Impervious = 0.0000 ha

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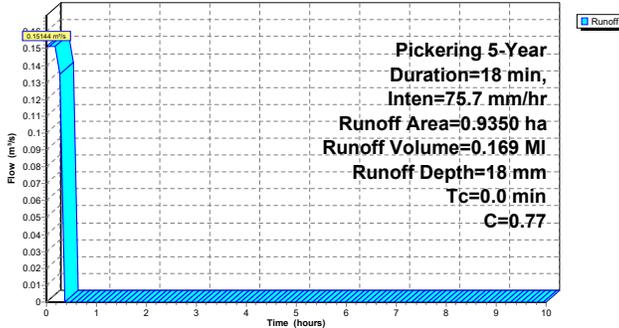**Summary for Subcatchment 200: 200**

Runoff   =   0.15144 m³/s @   0.00 hrs, Volume=   0.169 Ml, Depth=   18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.9350	0.77	
0.9350		100.00% Pervious Area

Subcatchment 200: 200

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.9350 ha
Runoff Volume=0.169 Ml
Runoff Depth=18 mm
Tc=0.0 min
C=0.77

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Subcatchment 201: 201

Runoff   =   0.03637 m³/s @   0.17 hrs, Volume=   0.039 Ml, Depth=   20 mm
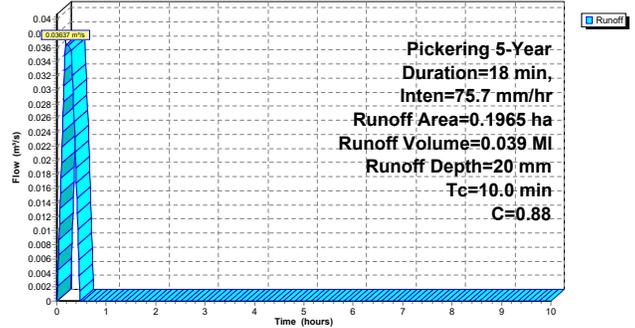
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.1965	0.88	
0.1965		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 201: 201

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.1965 ha
Runoff Volume=0.039 Ml
Runoff Depth=20 mm
Tc=10.0 min
C=0.88

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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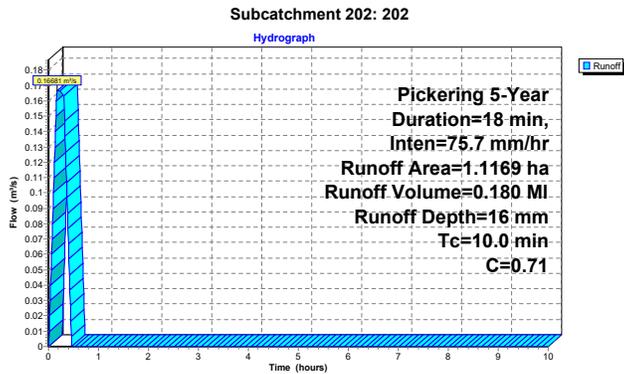### Summary for Subcatchment 202: 202

Runoff = 0.16681 m³/s @ 0.17 hrs, Volume= 0.180 Ml, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
1.1169	0.71	
1.1169		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 202: 202

Hydrograph

Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr Runoff Area=1.1169 ha Runoff Volume=0.180 Ml Runoff Depth=16 mm Tc=10.0 min C=0.71

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
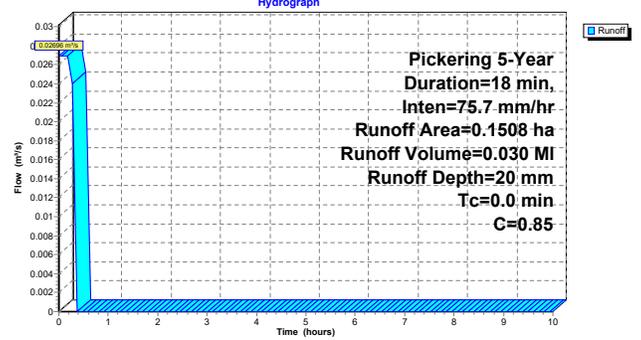Printed 2025-01-15
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Summary for Subcatchment 203: 203

Runoff = 0.02696 m³/s @ 0.00 hrs, Volume= 0.030 Ml, Depth= 20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.1508	0.85	
0.1508		100.00% Pervious Area

Subcatchment 203: 203

Hydrograph

Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr Runoff Area=0.1508 ha Runoff Volume=0.030 Ml Runoff Depth=20 mm Tc=0.0 min C=0.85

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
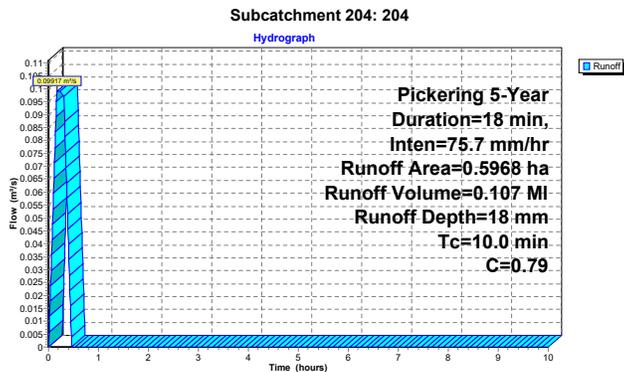Printed 2025-01-15
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Summary for Subcatchment 204: 204

Runoff = 0.09917 m³/s @ 0.17 hrs, Volume= 0.107 Ml, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.5968	0.79	
0.5968		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 204: 204

Hydrograph

Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr Runoff Area=0.5968 ha Runoff Volume=0.107 Ml Runoff Depth=18 mm Tc=10.0 min C=0.79

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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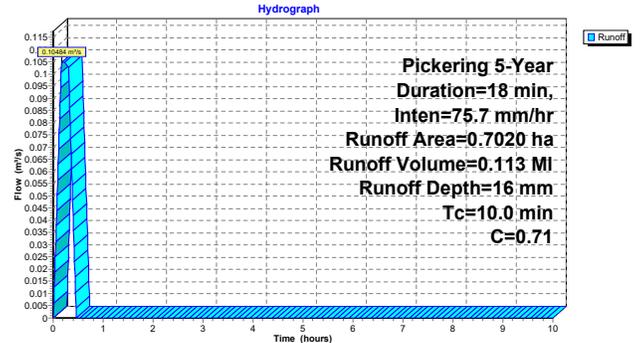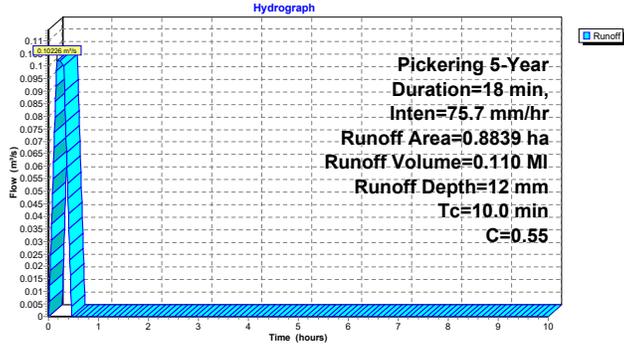Page 12

Summary for Subcatchment 205: 205

Runoff = 0.10484 m³/s @ 0.17 hrs, Volume= 0.113 Ml, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.7020	0.71	
0.7020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 205: 205

Hydrograph

Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr Runoff Area=0.7020 ha Runoff Volume=0.113 Ml Runoff Depth=16 mm Tc=10.0 min C=0.71

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Subcatchment 206: 206

Runoff   =   0.10226 m³/s @   0.17 hrs, Volume=   0.110 Ml, Depth=   12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.8839	0.55	
0.8839		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 206: 206

Hydrograph

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.8839 ha
Runoff Volume=0.110 Ml
Runoff Depth=12 mm
Tc=10.0 min
C=0.55

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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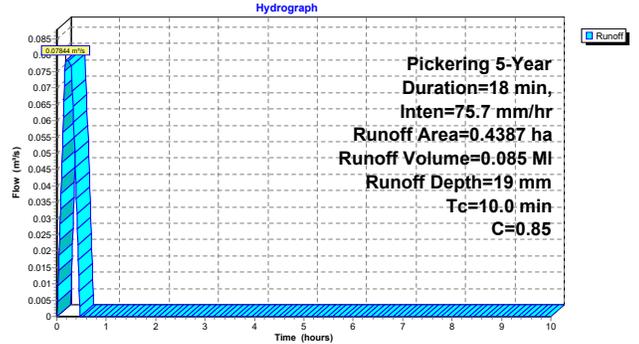### Summary for Subcatchment 207: 207

Runoff   =   0.07844 m³/s @   0.17 hrs, Volume=   0.085 Ml, Depth=   19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.4387	0.85	
0.4387		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 207: 207

Hydrograph

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.4387 ha
Runoff Volume=0.085 Ml
Runoff Depth=19 mm
Tc=10.0 min
C=0.85

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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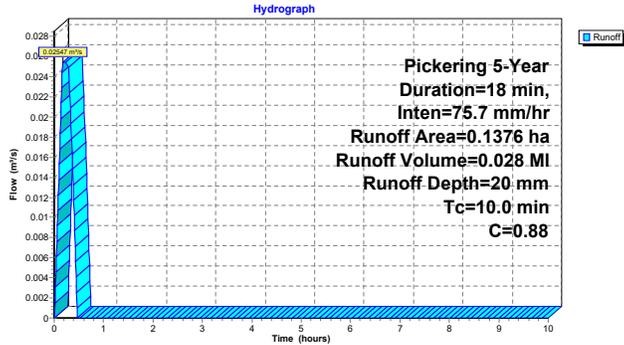### Summary for Subcatchment 208: 208

Runoff   =   0.02547 m³/s @   0.17 hrs, Volume=   0.028 Ml, Depth=   20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.1376	0.88	
0.1376		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 208: 208

Hydrograph

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.1376 ha
Runoff Volume=0.028 Ml
Runoff Depth=20 mm
Tc=10.0 min
C=0.88

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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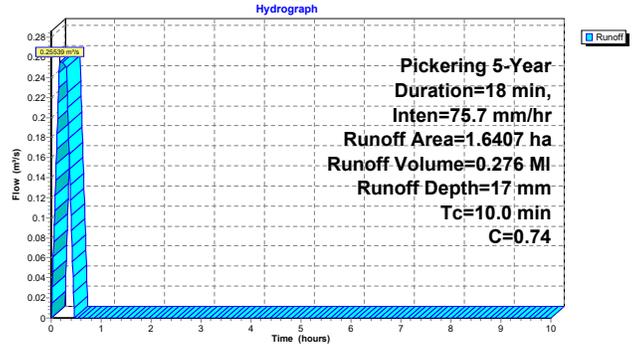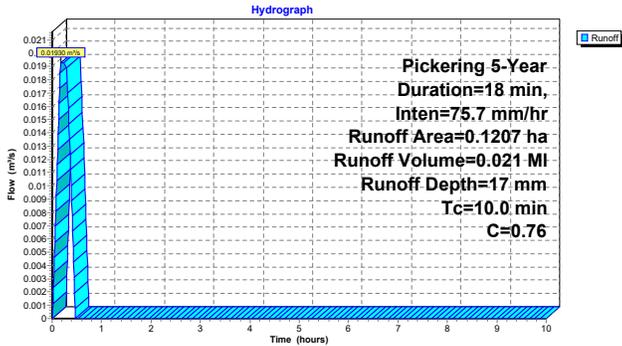### Summary for Subcatchment 209: 209

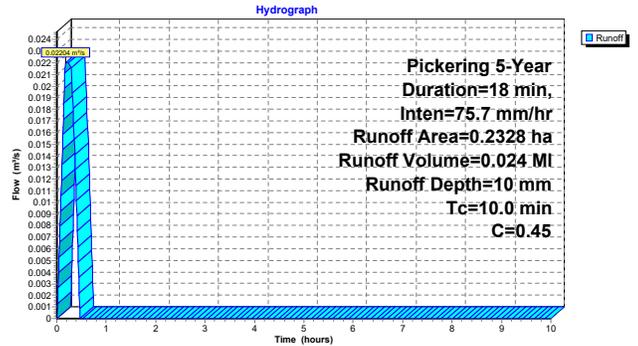Runoff   =   0.25539 m³/s @   0.17 hrs, Volume=   0.276 Ml, Depth=   17 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
1.6407	0.74	
1.6407		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 209: 209

Hydrograph

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=1.6407 ha
Runoff Volume=0.276 Ml
Runoff Depth=17 mm
Tc=10.0 min
C=0.74

Summary for Subcatchment 210: 210

Runoff = 0.01930 m³/s @ 0.17 hrs, Volume=   0.021 Ml, Depth= 17 mm
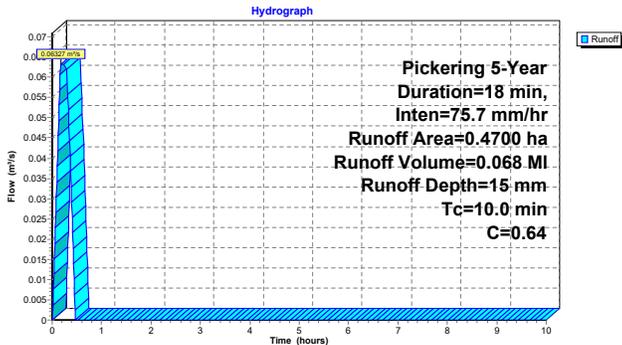
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.1207	0.76	
0.1207		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 210: 210

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.1207 ha
Runoff Volume=0.021 Ml
Runoff Depth=17 mm
Tc=10.0 min
C=0.76

Summary for Subcatchment 211: 211

Runoff = 0.02204 m³/s @ 0.17 hrs, Volume=   0.024 Ml, Depth= 10 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.2328	0.45	
0.2328		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 211: 211

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.2328 ha
Runoff Volume=0.024 Ml
Runoff Depth=10 mm
Tc=10.0 min
C=0.45

Summary for Subcatchment 212: 212

Runoff = 0.06327 m³/s @ 0.17 hrs, Volume=   0.068 Ml, Depth= 15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr

Area (ha)	C	Description
0.4700	0.64	
0.4700		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 212: 212

Pickering 5-Year
Duration=18 min,
Inten=75.7 mm/hr
Runoff Area=0.4700 ha
Runoff Volume=0.068 Ml
Runoff Depth=15 mm
Tc=10.0 min
C=0.64

Summary for Pond P1: P1

Inflow Area =   1.1315 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 5-Year event
Inflow   =   0.04595 m³/s @   0.30 hrs, Volume=   0.201 Ml
Outflow   =   0.03473 m³/s @   0.35 hrs, Volume=   0.201 Ml, Atten= 24%, Lag= 3.3 min
Primary   =   0.03473 m³/s @   0.35 hrs, Volume=   0.201 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
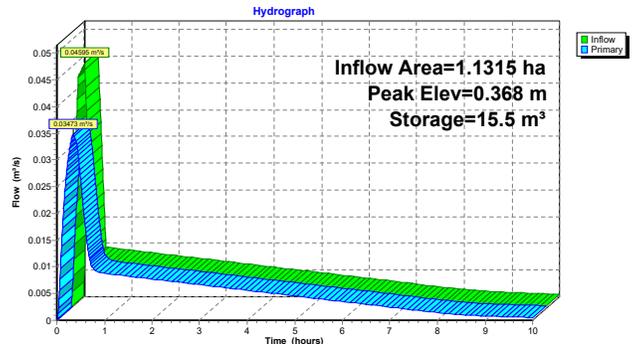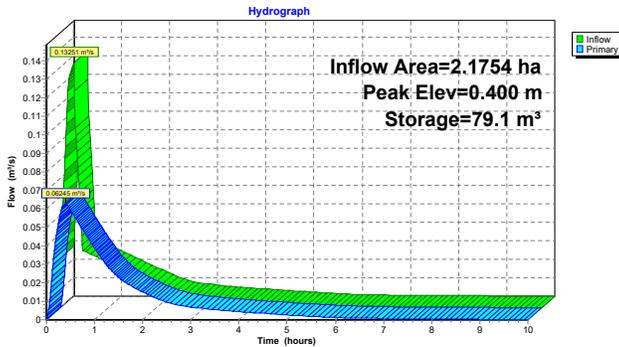Peak Elev= 0.368 m @ 0.35 hrs Surf.Area= 56.7 m² Storage= 15.5 m³

Plug-Flow detention time= 4.8 min calculated for 0.201 Ml (100% of inflow)
Center-of-Mass det. time= 4.4 min (165.2 - 160.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	44.8 m³	**975 mm Round Pipe Storage**
			L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.03473 m³/s @ 0.35 hrs HW=0.368 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.03473 m³/s @ 1.97 m/s)

Pond P1: P1

Inflow Area=1.1315 ha
Peak Elev=0.368 m
Storage=15.5 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond P3: P3

Inflow Area =   2.1754 ha,   0.00% Impervious, Inflow Depth >   15 mm   for 5-Year event
Inflow   =   0.13251 m³/s @   0.30 hrs, Volume=   0.337 Ml
Outflow   =   0.06245 m³/s @   0.40 hrs, Volume=   0.336 Ml, Atten= 53%, Lag= 6.0 min
Primary   =   0.06245 m³/s @   0.40 hrs, Volume=   0.336 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.400 m @ 0.40 hrs Surf.Area= 271.5 m² Storage= 79.1 m³

Plug-Flow detention time= 17.3 min calculated for 0.335 Ml (100% of inflow)
Center-of-Mass det. time= 16.0 min (91.1 - 75.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	271.4 m³	**1,200 mm Round Pipe Storage** L= 240.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.06245 m³/s @ 0.40 hrs HW=0.400 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06245 m³/s @ 1.99 m/s)

Pond P3: P3

Inflow Area=2.1754 ha
Peak Elev=0.400 m
Storage=79.1 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond P4: P4

Inflow Area =   1.8659 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 5-Year event
Inflow   =   0.07374 m³/s @   0.30 hrs, Volume=   0.335 Ml
Outflow   =   0.06307 m³/s @   0.39 hrs, Volume=   0.335 Ml, Atten= 14%, Lag= 5.2 min
Primary   =   0.06307 m³/s @   0.39 hrs, Volume=   0.335 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
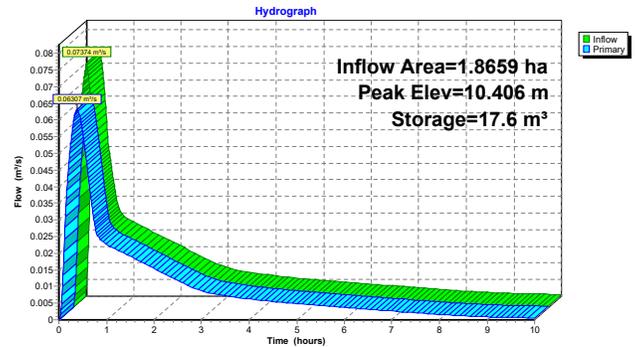Peak Elev= 10.406 m @ 0.39 hrs Surf.Area= 57.7 m² Storage= 17.6 m³

Plug-Flow detention time= 3.6 min calculated for 0.335 Ml (100% of inflow)
Center-of-Mass det. time= 3.3 min (130.4 - 127.1)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.06306 m³/s @ 0.39 hrs HW=10.405 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06306 m³/s @ 2.01 m/s)

Pond P4: P4

Inflow Area=1.8659 ha
Peak Elev=10.406 m
Storage=17.6 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond S1: S1

Inflow Area =   0.9350 ha,   0.00% Impervious, Inflow Depth =   18 mm   for 5-Year event
Inflow   =   0.15144 m³/s @   0.00 hrs, Volume=   0.169 Ml
Outflow   =   0.00944 m³/s @   0.31 hrs, Volume=   0.162 Ml, Atten= 94%, Lag= 18.8 min
Primary   =   0.00944 m³/s @   0.31 hrs, Volume=   0.162 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.624 m @ 0.31 hrs Surf.Area= 260.0 m² Storage= 162.4 m³

Plug-Flow detention time= 190.8 min calculated for 0.159 Ml (94% of inflow)
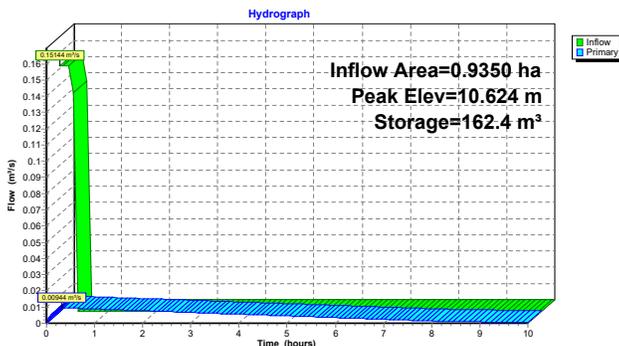Center-of-Mass det. time= 187.4 min (196.4 - 9.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	520.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	260.0	0.0	0.0
12.000	260.0	520.0	520.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.00943 m³/s @ 0.31 hrs HW=10.623 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.00943 m³/s @ 2.14 m/s)

Pond S1: S1

Inflow Area=0.9350 ha
Peak Elev=10.624 m
Storage=162.4 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond S2: S2

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth =   16 mm   for 5-Year event
Inflow   =   0.16681 m³/s @   0.17 hrs, Volume=   0.180 Ml
Outflow   =   0.03766 m³/s @   0.43 hrs, Volume=   0.179 Ml, Atten= 77%, Lag= 15.5 min
Primary   =   0.03766 m³/s @   0.43 hrs, Volume=   0.179 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.658 m @ 0.43 hrs Surf.Area= 220.0 m² Storage= 144.8 m³

Plug-Flow detention time= 55.5 min calculated for 0.179 Ml (100% of inflow)
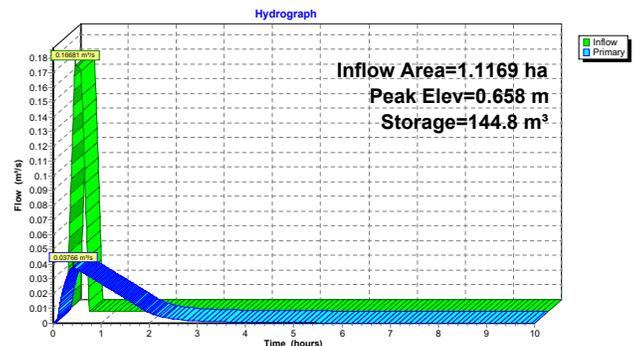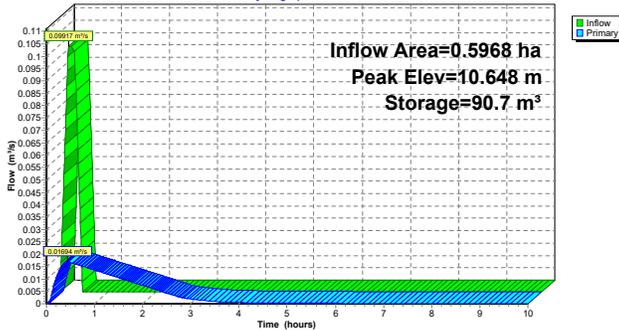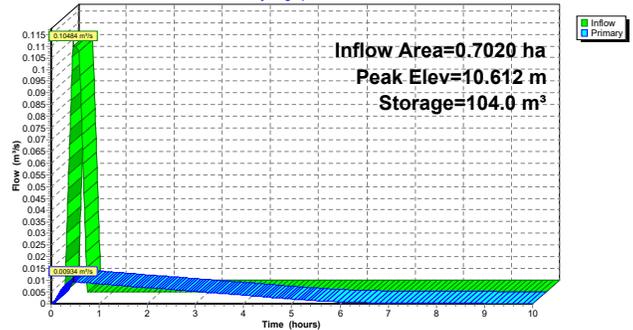Center-of-Mass det. time= 55.5 min (69.5 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	440.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	220.0	0.0	0.0
2.000	220.0	440.0	440.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.03766 m³/s @ 0.43 hrs HW=0.658 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.03766 m³/s @ 2.13 m/s)

Pond S2: S2

Inflow Area=1.1169 ha
Peak Elev=0.658 m
Storage=144.8 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond S3: S3

Inflow Area = 0.5968 ha, 0.00% Impervious, Inflow Depth = 18 mm for 5-Year event
Inflow = 0.09917 m³/s @ 0.17 hrs, Volume= 0.107 Ml
Outflow = 0.01694 m³/s @ 0.44 hrs, Volume= 0.107 Ml, Atten= 83%, Lag= 16.1 min
Primary = 0.01694 m³/s @ 0.44 hrs, Volume= 0.107 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.648 m @ 0.44 hrs Surf.Area= 140.0 m² Storage= 90.7 m³

Plug-Flow detention time= 69.9 min calculated for 0.107 Ml (100% of inflow)
Center-of-Mass det. time= 70.3 min (84.3 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	140.0	0.0	0.0
12.000	140.0	280.0	280.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01694 m³/s @ 0.44 hrs HW=10.648 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01694 m³/s @ 2.16 m/s)

Pond S3: S3
Hydrograph

Inflow Area=0.5968 ha
Peak Elev=10.648 m
Storage=90.7 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond S4: S4

Inflow Area = 0.7020 ha, 0.00% Impervious, Inflow Depth = 16 mm for 5-Year event
Inflow = 0.10484 m³/s @ 0.17 hrs, Volume= 0.113 Ml
Outflow = 0.00934 m³/s @ 0.45 hrs, Volume= 0.111 Ml, Atten= 91%, Lag= 16.9 min
Primary = 0.00934 m³/s @ 0.45 hrs, Volume= 0.111 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.612 m @ 0.45 hrs Surf.Area= 170.0 m² Storage= 104.0 m³

Plug-Flow detention time= 131.4 min calculated for 0.111 Ml (98% of inflow)
Center-of-Mass det. time= 131.7 min (145.7 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	340.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	170.0	0.0	0.0
12.000	170.0	340.0	340.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.00934 m³/s @ 0.45 hrs HW=10.612 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.00934 m³/s @ 2.11 m/s)

Pond S4: S4
Hydrograph

Inflow Area=0.7020 ha
Peak Elev=10.612 m
Storage=104.0 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond S5: S5

Inflow Area = 0.8839 ha, 0.00% Impervious, Inflow Depth = 12 mm for 5-Year event
Inflow = 0.10226 m³/s @ 0.17 hrs, Volume= 0.110 Ml
Outflow = 0.02188 m³/s @ 0.43 hrs, Volume= 0.110 Ml, Atten= 79%, Lag= 15.7 min
Primary = 0.02188 m³/s @ 0.43 hrs, Volume= 0.110 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.638 m @ 0.43 hrs Surf.Area= 140.0 m² Storage= 89.3 m³

Plug-Flow detention time= 54.9 min calculated for 0.110 Ml (100% of inflow)
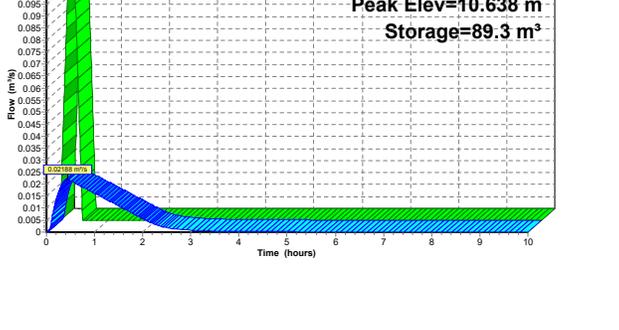Center-of-Mass det. time= 54.9 min (68.9 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**1.00 mW x 140.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.02187 m³/s @ 0.43 hrs HW=10.638 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02187 m³/s @ 2.79 m/s)

Pond S5: S5
Hydrograph

Inflow Area=0.8839 ha
Peak Elev=10.638 m
Storage=89.3 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
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Summary for Pond S6: S6

Inflow Area = 1.7614 ha, 0.00% Impervious, Inflow Depth = 17 mm for 5-Year event
Inflow = 0.27469 m³/s @ 0.17 hrs, Volume= 0.297 Ml
Outflow = 0.05186 m³/s @ 0.44 hrs, Volume= 0.295 Ml, Atten= 81%, Lag= 15.9 min
Primary = 0.05186 m³/s @ 0.44 hrs, Volume= 0.295 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.728 m @ 0.44 hrs Surf.Area= 340.0 m² Storage= 247.5 m³

Plug-Flow detention time= 65.2 min calculated for 0.294 Ml (99% of inflow)
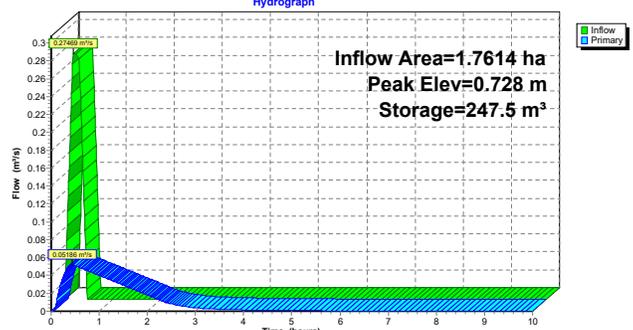Center-of-Mass det. time= 65.6 min (79.6 - 14.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	680.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	340.0	0.0	0.0
2.000	340.0	680.0	680.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.05185 m³/s @ 0.44 hrs HW=0.728 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05185 m³/s @ 2.93 m/s)

Pond S6: S6
Hydrograph

Inflow Area=1.7614 ha
Peak Elev=0.728 m
Storage=247.5 m³

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Pickering 5-Year Duration=18 min, Inten=75.7 mm/hr
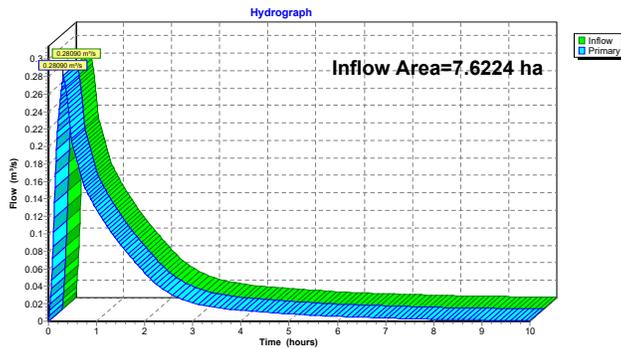Printed 2025-01-15
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Summary for Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area =   7.6224 ha,   0.00% Impervious, Inflow Depth >   16 mm   for 5-Year event
Inflow   =   0.28090 m³/s @   0.30 hrs, Volume=   1.238 Ml
Primary   =   0.28090 m³/s @   0.30 hrs, Volume=   1.238 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area=7.6224 ha

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Summary for Link PH1: PH1 - 65.4 L/s

Inflow Area =   1.1315 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 5-Year event
Inflow   =   0.03473 m³/s @   0.35 hrs, Volume=   0.201 Ml
Primary   =   0.03473 m³/s @   0.35 hrs, Volume=   0.201 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1 - 65.4 L/s

Inflow Area=1.1315 ha

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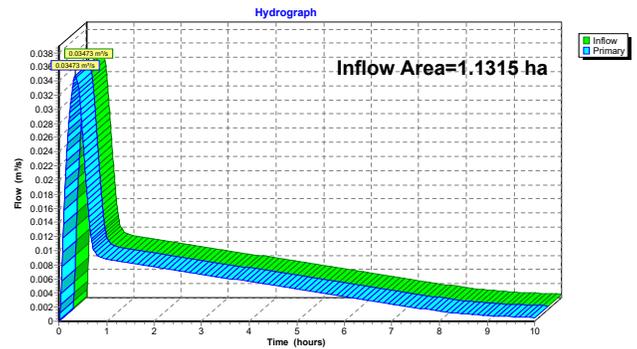
Summary for Link PH2A: PH2A - 64.5 L/s

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth >   16 mm   for 5-Year event
Inflow   =   0.03766 m³/s @   0.43 hrs, Volume=   0.179 Ml
Primary   =   0.03766 m³/s @   0.43 hrs, Volume=   0.179 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2A: PH2A - 64.5 L/s

Inflow Area=1.1169 ha

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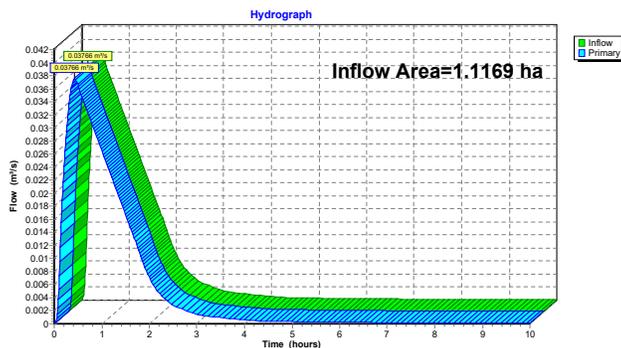
Summary for Link PH2B: PH2B - 8.7 L/s

Inflow Area =   0.1508 ha,   0.00% Impervious, Inflow Depth =   20 mm   for 5-Year event
Inflow   =   0.02696 m³/s @   0.00 hrs, Volume=   0.030 Ml
Primary   =   0.02696 m³/s @   0.00 hrs, Volume=   0.030 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2B: PH2B - 8.7 L/s

Inflow Area=0.1508 ha
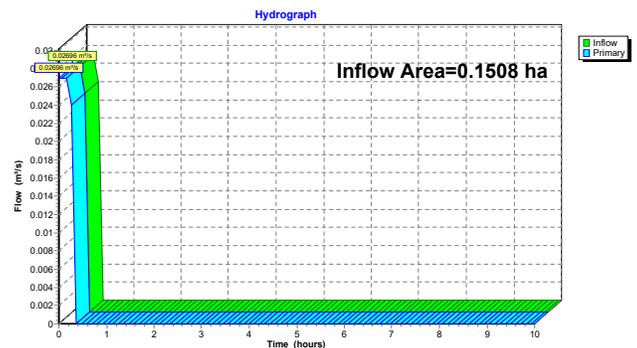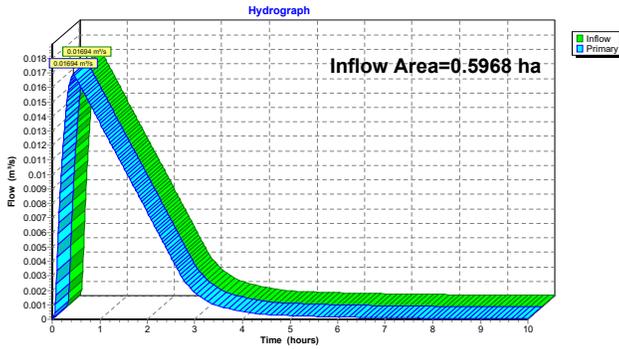
Summary for Link PH3: PH3 - 34.5 L/s

Inflow Area =   0.5968 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 5-Year event
Inflow   =   0.01694 m³/s @   0.44 hrs, Volume=   0.107 Ml
Primary   =   0.01694 m³/s @   0.44 hrs, Volume=   0.107 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
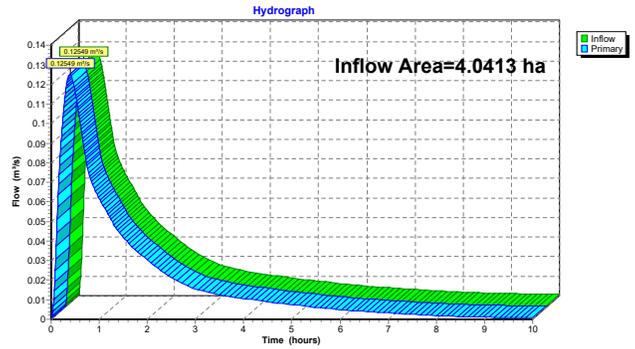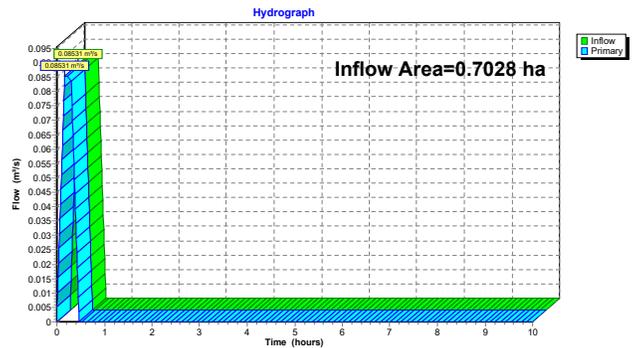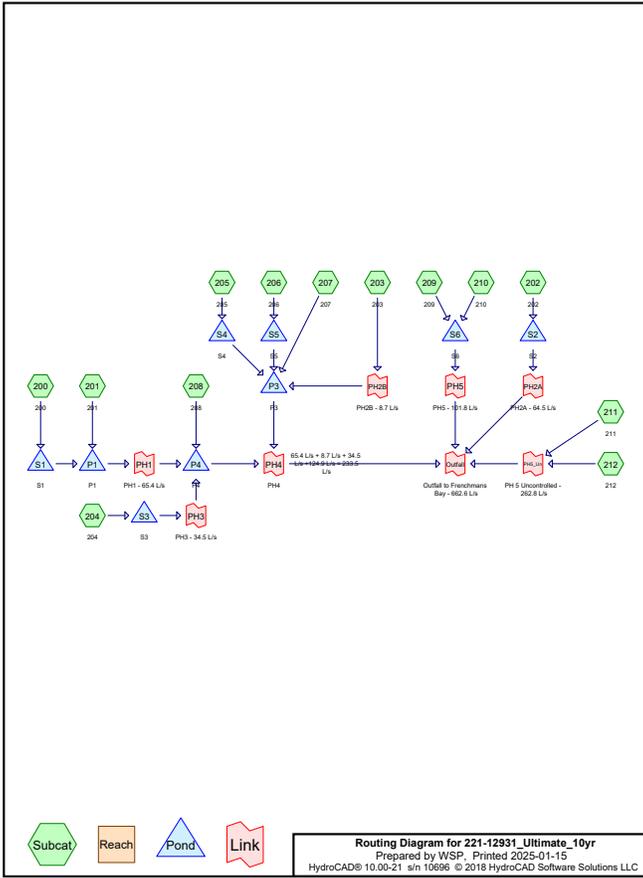
Link PH3: PH3 - 34.5 L/s
Hydrograph

Inflow Area=0.5968 ha

Summary for Link PH4: PH4

Inflow Area =   4.0413 ha,   0.00% Impervious, Inflow Depth >   17 mm   for 5-Year event
Inflow   =   0.12549 m³/s @   0.39 hrs, Volume=   0.672 Ml
Primary   =   0.12549 m³/s @   0.39 hrs, Volume=   0.672 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4
Hydrograph

Inflow Area=4.0413 ha

Summary for Link PH5: PH5 - 101.8 L/s

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth >   17 mm   for 5-Year event
Inflow   =   0.05186 m³/s @   0.44 hrs, Volume=   0.295 Ml
Primary   =   0.05186 m³/s @   0.44 hrs, Volume=   0.295 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5: PH5 - 101.8 L/s
Hydrograph

Inflow Area=1.7614 ha
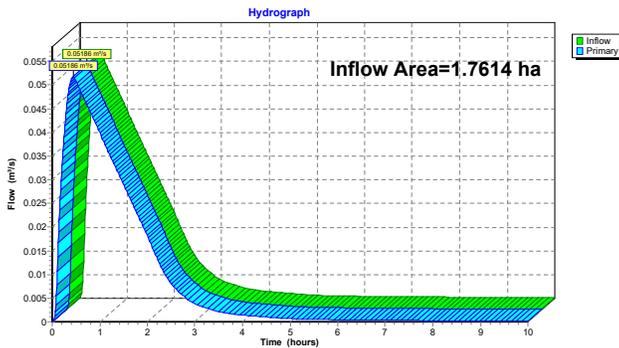
Summary for Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area =   0.7028 ha,   0.00% Impervious, Inflow Depth =   13 mm   for 5-Year event
Inflow   =   0.08531 m³/s @   0.17 hrs, Volume=   0.092 Ml
Primary   =   0.08531 m³/s @   0.17 hrs, Volume=   0.092 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s
Hydrograph

Inflow Area=0.7028 ha

Routing Diagram for 221-12931_Ultimate_10yr
Prepared by WSP, Printed 2025-01-15
HydroCAD® 10.00-21 s/n 10696 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.9350	0.77	(200)
0.3341	0.88	(201, 208)
1.8189	0.71	(202, 205)
0.5895	0.85	(203, 207)
0.5968	0.79	(204)
0.8839	0.55	(206)
1.6407	0.74	(209)
0.1207	0.76	(210)
0.2328	0.45	(211)
0.4700	0.64	(212)
7.6224	**0.72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.6224	Other	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
7.6224		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	7.6224	7.6224		200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
0.0000	**0.0000**	**0.0000**	**0.0000**	**7.6224**	**7.6224**	**TOTAL AREA**	

Time span=0.00-10.00 hrs, dt=0.01 hrs, 1001 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment200: 200 Runoff Area=0.9350 ha 0.00% Impervious Runoff Depth=20 mm
Tc=0.0 min C=0.77 Runoff=0.20038 m³/s 0.188 Ml

Subcatchment201: 201 Runoff Area=0.1965 ha 0.00% Impervious Runoff Depth=22 mm
Tc=10.0 min C=0.88 Runoff=0.04813 m³/s 0.043 Ml

Subcatchment202: 202 Runoff Area=1.1169 ha 0.00% Impervious Runoff Depth=18 mm
Tc=10.0 min C=0.71 Runoff=0.22071 m³/s 0.199 Ml

Subcatchment203: 203 Runoff Area=0.1508 ha 0.00% Impervious Runoff Depth=22 mm
Tc=0.0 min C=0.85 Runoff=0.03568 m³/s 0.033 Ml

Subcatchment204: 204 Runoff Area=0.5968 ha 0.00% Impervious Runoff Depth=20 mm
Tc=10.0 min C=0.79 Runoff=0.13122 m³/s 0.118 Ml

Subcatchment205: 205 Runoff Area=0.7020 ha 0.00% Impervious Runoff Depth=18 mm
Tc=10.0 min C=0.71 Runoff=0.13872 m³/s 0.125 Ml

Subcatchment206: 206 Runoff Area=0.8839 ha 0.00% Impervious Runoff Depth=14 mm
Tc=10.0 min C=0.55 Runoff=0.13531 m³/s 0.122 Ml

Subcatchment207: 207 Runoff Area=0.4387 ha 0.00% Impervious Runoff Depth=21 mm
Tc=10.0 min C=0.85 Runoff=0.10379 m³/s 0.093 Ml

Subcatchment208: 208 Runoff Area=0.1376 ha 0.00% Impervious Runoff Depth=22 mm
Tc=10.0 min C=0.88 Runoff=0.03370 m³/s 0.030 Ml

Subcatchment209: 209 Runoff Area=1.6407 ha 0.00% Impervious Runoff Depth=19 mm
Tc=10.0 min C=0.74 Runoff=0.33792 m³/s 0.304 Ml

Subcatchment210: 210 Runoff Area=0.1207 ha 0.00% Impervious Runoff Depth=19 mm
Tc=10.0 min C=0.76 Runoff=0.02553 m³/s 0.023 Ml

Subcatchment211: 211 Runoff Area=0.2328 ha 0.00% Impervious Runoff Depth=11 mm
Tc=10.0 min C=0.45 Runoff=0.02916 m³/s 0.026 Ml

Subcatchment212: 212 Runoff Area=0.4700 ha 0.00% Impervious Runoff Depth=16 mm
Tc=10.0 min C=0.64 Runoff=0.08372 m³/s 0.075 Ml

Pond P1: P1 Peak Elev=0.440 m Storage=19.6 m³ Inflow=0.05833 m³/s 0.223 Ml
Outflow=0.03877 m³/s 0.223 Ml

Pond P3: P3 Peak Elev=0.445 m Storage=91.5 m³ Inflow=0.16718 m³/s 0.371 Ml
Outflow=0.06698 m³/s 0.371 Ml

Pond P4: P4 Peak Elev=10.466 m Storage=21.1 m³ Inflow=0.08509 m³/s 0.371 Ml
Outflow=0.06900 m³/s 0.371 Ml

Pond S1: S1 Peak Elev=10.699 m Storage=181.7 m³ Inflow=0.20038 m³/s 0.188 Ml
Outflow=0.01003 m³/s 0.180 Ml

Pond S2: S2 Peak Elev=0.748 m Storage=164.5 m³ Inflow=0.22071 m³/s 0.199 Ml
Outflow=0.04045 m³/s 0.198 Ml

Pond S3: S3 Peak Elev=10.731 m Storage=102.4 m³ Inflow=0.13122 m³/s 0.118 Ml
Outflow=0.01809 m³/s 0.118 Ml

Pond S4: S4 Peak Elev=10.683 m Storage=116.1 m³ Inflow=0.13872 m³/s 0.125 Ml
Outflow=0.00990 m³/s 0.123 Ml

Pond S5: S5 Peak Elev=10.725 m Storage=101.5 m³ Inflow=0.13531 m³/s 0.122 Ml
Outflow=0.02344 m³/s 0.122 Ml

Pond S6: S6 Peak Elev=0.823 m Storage=279.8 m³ Inflow=0.36345 m³/s 0.327 Ml
Outflow=0.05551 m³/s 0.325 Ml

Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s Inflow=0.31603 m³/s 1.366 Ml
Primary=0.31603 m³/s 1.366 Ml

Link PH1: PH1 - 65.4 L/s Inflow=0.03877 m³/s 0.223 Ml
Primary=0.03877 m³/s 0.223 Ml

Link PH2A: PH2A - 64.5 L/s Inflow=0.04045 m³/s 0.198 Ml
Primary=0.04045 m³/s 0.198 Ml

Link PH2B: PH2B - 8.7 L/s Inflow=0.03568 m³/s 0.033 Ml
Primary=0.03568 m³/s 0.033 Ml

Link PH3: PH3 - 34.5 L/s Inflow=0.01809 m³/s 0.118 Ml
Primary=0.01809 m³/s 0.118 Ml

Link PH4: PH4 Inflow=0.13596 m³/s 0.742 Ml
Primary=0.13596 m³/s 0.742 Ml

Link PH5: PH5 - 101.8 L/s Inflow=0.05551 m³/s 0.325 Ml
Primary=0.05551 m³/s 0.325 Ml

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s Inflow=0.11288 m³/s 0.102 Ml
Primary=0.11288 m³/s 0.102 Ml

Total Runoff Area = 7.6224 ha   Runoff Volume = 1.380 Ml   Average Runoff Depth = 18 mm
100.00% Pervious = 7.6224 ha   0.00% Impervious = 0.0000 ha
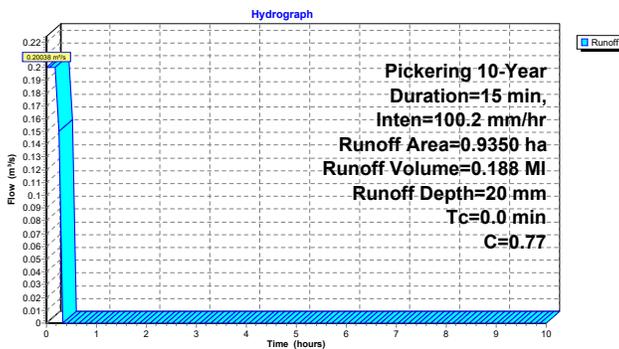

Summary for Subcatchment 200: 200

Runoff   =   0.20038 m³/s @   0.00 hrs, Volume=   0.188 Ml, Depth=   20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.9350	0.77	
0.9350		100.00% Pervious Area

Subcatchment 200: 200

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.9350 ha
Runoff Volume=0.188 Ml
Runoff Depth=20 mm
Tc=0.0 min
C=0.77

Summary for Subcatchment 201: 201
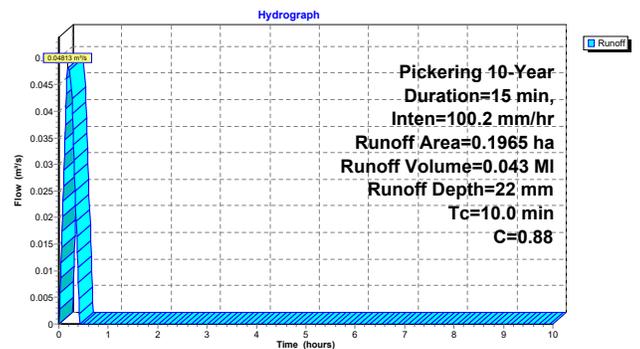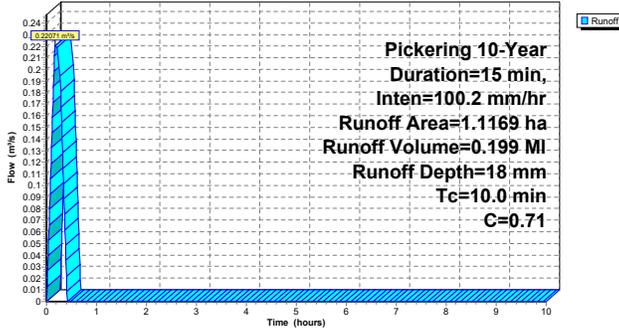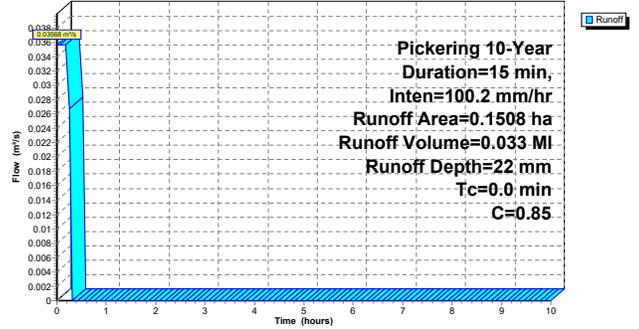
Runoff   =   0.04813 m³/s @   0.17 hrs, Volume=   0.043 Ml, Depth=   22 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.1965	0.88	
0.1965		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 201: 201

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.1965 ha
Runoff Volume=0.043 Ml
Runoff Depth=22 mm
Tc=10.0 min
C=0.88

Summary for Subcatchment 202: 202

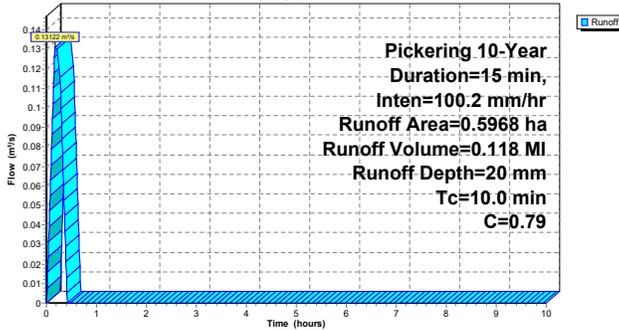Runoff   =   0.22071 m³/s @   0.17 hrs, Volume=   0.199 Ml, Depth=   18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
1.1169	0.71	
1.1169		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 202: 202

Summary for Subcatchment 203: 203

Runoff   =   0.03568 m³/s @   0.00 hrs, Volume=   0.033 Ml, Depth=   22 mm
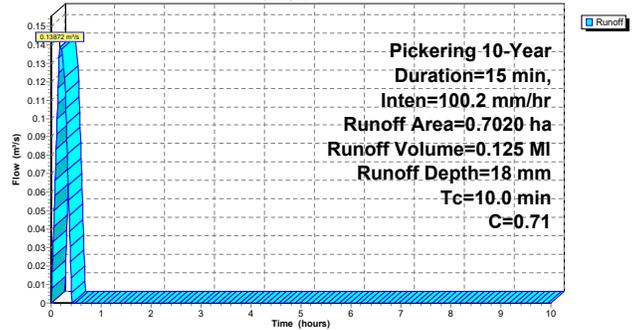
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.1508	0.85	
0.1508		100.00% Pervious Area

Subcatchment 203: 203

Summary for Subcatchment 204: 204

Runoff   =   0.13122 m³/s @   0.17 hrs, Volume=   0.118 Ml, Depth=   20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.5968	0.79	
0.5968		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 204: 204

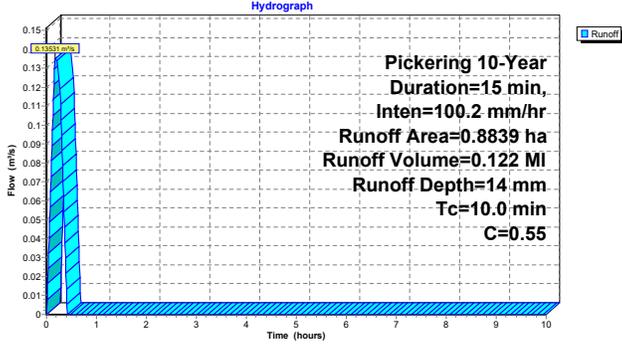### Summary for Subcatchment 205: 205

Runoff   =   0.13872 m³/s @   0.17 hrs, Volume=   0.125 Ml, Depth=   18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.7020	0.71	
0.7020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 205: 205

Summary for Subcatchment 206: 206
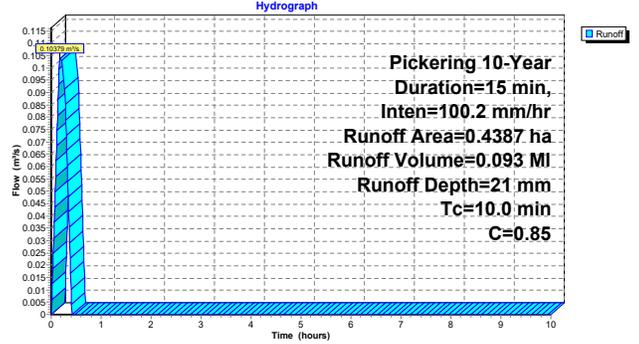
Runoff = 0.13531 m³/s @ 0.17 hrs, Volume= 0.122 Ml, Depth= 14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.8839	0.55	
0.8839		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 206: 206

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.8839 ha
Runoff Volume=0.122 Ml
Runoff Depth=14 mm
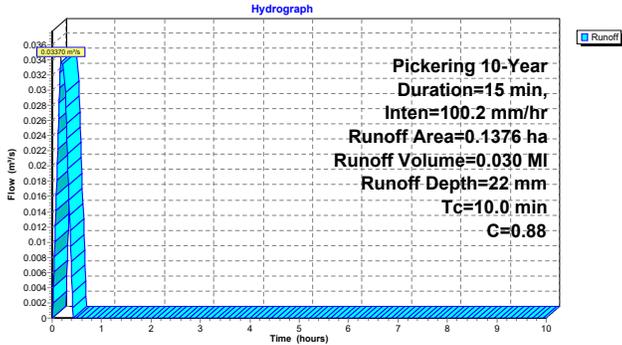Tc=10.0 min
C=0.55

Summary for Subcatchment 207: 207

Runoff = 0.10379 m³/s @ 0.17 hrs, Volume= 0.093 Ml, Depth= 21 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.4387	0.85	
0.4387		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 207: 207

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.4387 ha
Runoff Volume=0.093 Ml
Runoff Depth=21 mm
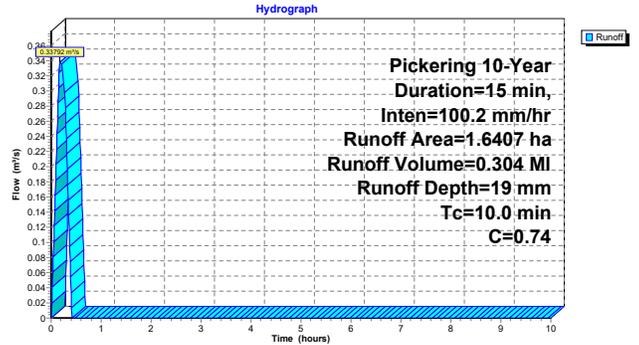Tc=10.0 min
C=0.85

Summary for Subcatchment 208: 208

Runoff = 0.03370 m³/s @ 0.17 hrs, Volume= 0.030 Ml, Depth= 22 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.1376	0.88	
0.1376		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 208: 208

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.1376 ha
Runoff Volume=0.030 Ml
Runoff Depth=22 mm
Tc=10.0 min
C=0.88

Summary for Subcatchment 209: 209

Runoff = 0.33792 m³/s @ 0.17 hrs, Volume= 0.304 Ml, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
1.6407	0.74	
1.6407		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 209: 209

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=1.6407 ha
Runoff Volume=0.304 Ml
Runoff Depth=19 mm
Tc=10.0 min
C=0.74

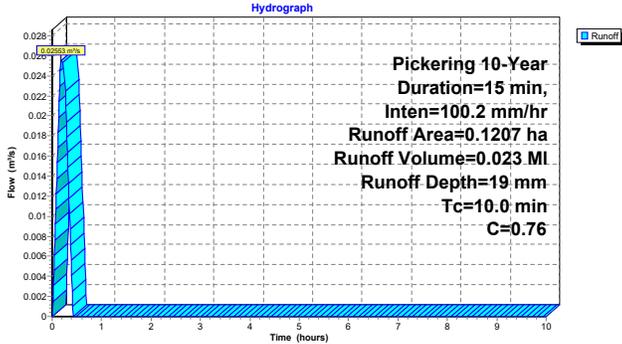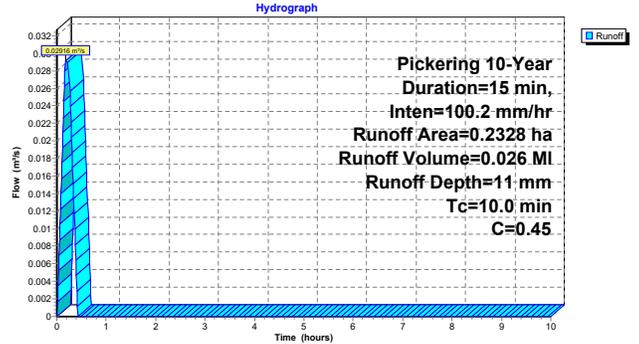### Summary for Subcatchment 210: 210

Runoff   =   0.02553 m³/s @   0.17 hrs, Volume=   0.023 Ml, Depth=   19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.1207	0.76	
0.1207		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 210: 210

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.1207 ha
Runoff Volume=0.023 Ml
Runoff Depth=19 mm
Tc=10.0 min
C=0.76

Summary for Subcatchment 211: 211

Runoff   =   0.02916 m³/s @   0.17 hrs, Volume=   0.026 Ml, Depth=   11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.2328	0.45	
0.2328		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 211: 211

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.2328 ha
Runoff Volume=0.026 Ml
Runoff Depth=11 mm
Tc=10.0 min
C=0.45

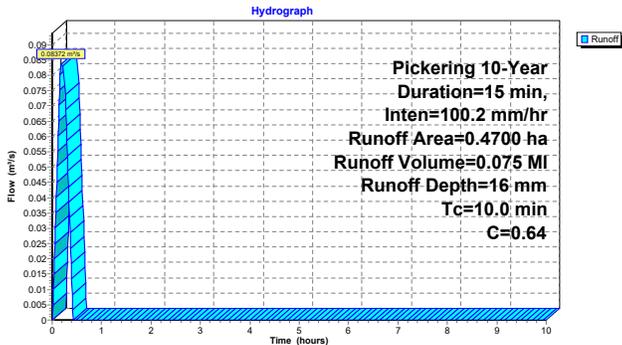### Summary for Subcatchment 212: 212

Runoff   =   0.08372 m³/s @   0.17 hrs, Volume=   0.075 Ml, Depth=   16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr

Area (ha)	C	Description
0.4700	0.64	
0.4700		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 212: 212

Pickering 10-Year
Duration=15 min,
Inten=100.2 mm/hr
Runoff Area=0.4700 ha
Runoff Volume=0.075 Ml
Runoff Depth=16 mm
Tc=10.0 min
C=0.64

Summary for Pond P1: P1

Inflow Area =   1.1315 ha,   0.00% Impervious, Inflow Depth >   20 mm   for 10-Year event
Inflow   =   0.05833 m³/s @   0.25 hrs, Volume=   0.223 Ml
Outflow   =   0.03877 m³/s @   0.32 hrs, Volume=   0.223 Ml, Atten= 34%, Lag= 4.3 min
Primary   =   0.03877 m³/s @   0.32 hrs, Volume=   0.223 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.440 m @ 0.32 hrs Surf.Area= 58.2 m² Storage= 19.6 m³

Plug-Flow detention time= 5.0 min calculated for 0.222 Ml (100% of inflow)
Center-of-Mass det. time= 4.4 min (170.5 - 166.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.03876 m³/s @ 0.32 hrs HW=0.440 m   (Free Discharge)
↳**1=Orifice/Grate** (Orifice Controls 0.03876 m³/s @ 2.19 m/s)

Pond P1: P1

Inflow Area=1.1315 ha
Peak Elev=0.440 m
Storage=19.6 m³
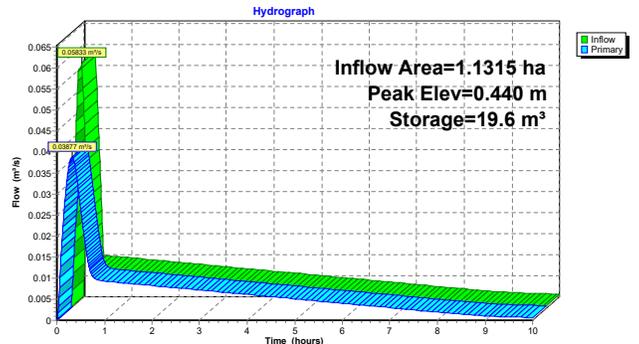
Summary for Pond P3: P3

Inflow Area =   2.1754 ha,   0.00% Impervious, Inflow Depth >   17 mm   for 10-Year event
Inflow   =   0.16718 m³/s @   0.25 hrs, Volume=   0.371 Ml
Outflow   =   0.06698 m³/s @   0.36 hrs, Volume=   0.371 Ml, Atten= 60%, Lag= 6.7 min
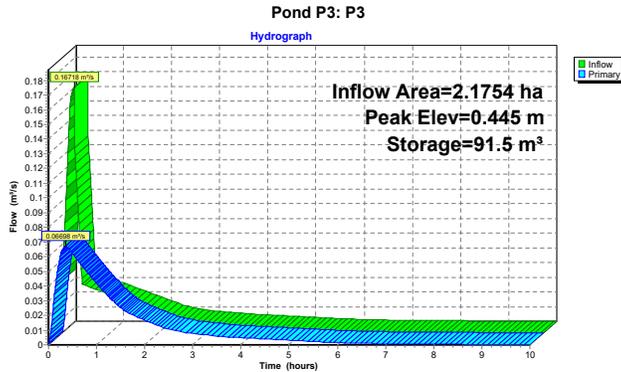Primary   =   0.06698 m³/s @   0.36 hrs, Volume=   0.371 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.445 m @ 0.36 hrs Surf.Area= 278.2 m² Storage= 91.5 m³

Plug-Flow detention time= 18.0 min calculated for 0.370 Ml (100% of inflow)
Center-of-Mass det. time= 16.5 min (92.6 - 76.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	271.4 m³	**1,200 mm Round Pipe Storage** L= 240.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.06697 m³/s @ 0.36 hrs HW=0.444 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06697 m³/s @ 2.13 m/s)

Pond P3: P3

Inflow Area=2.1754 ha
Peak Elev=0.445 m
Storage=91.5 m³

Summary for Pond P4: P4

Inflow Area =   1.8659 ha,   0.00% Impervious, Inflow Depth >   20 mm   for 10-Year event
Inflow   =   0.08509 m³/s @   0.25 hrs, Volume=   0.371 Ml
Outflow   =   0.06900 m³/s @   0.35 hrs, Volume=   0.371 Ml, Atten= 19%, Lag= 6.1 min
Primary   =   0.06900 m³/s @   0.35 hrs, Volume=   0.371 Ml
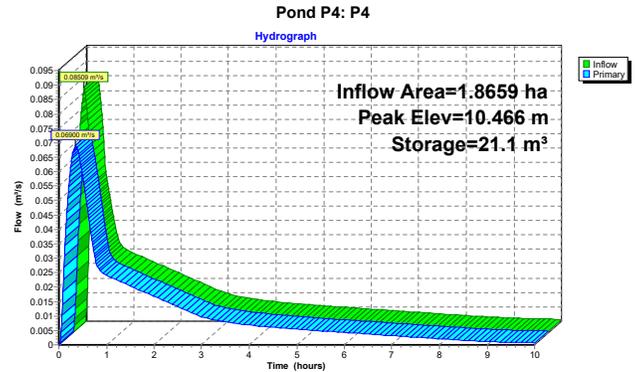
Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.466 m @ 0.35 hrs Surf.Area= 58.4 m² Storage= 21.1 m³

Plug-Flow detention time= 3.6 min calculated for 0.371 Ml (100% of inflow)
Center-of-Mass det. time= 3.3 min (133.9 - 130.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.06899 m³/s @ 0.35 hrs HW=10.466 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06899 m³/s @ 2.20 m/s)

Pond P4: P4

Inflow Area=1.8659 ha
Peak Elev=10.466 m
Storage=21.1 m³

Summary for Pond S1: S1

Inflow Area =   0.9350 ha,   0.00% Impervious, Inflow Depth =   20 mm   for 10-Year event
Inflow   =   0.20038 m³/s @   0.00 hrs, Volume=   0.188 Ml
Outflow   =   0.01003 m³/s @   0.26 hrs, Volume=   0.180 Ml, Atten= 95%, Lag= 15.8 min
Primary   =   0.01003 m³/s @   0.26 hrs, Volume=   0.180 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.699 m @ 0.26 hrs Surf.Area= 260.0 m² Storage= 181.7 m³

Plug-Flow detention time= 199.7 min calculated for 0.176 Ml (94% of inflow)
Center-of-Mass det. time= 195.6 min (203.1 - 7.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	520.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	260.0	0.0	0.0
12.000	260.0	520.0	520.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01001 m³/s @ 0.26 hrs HW=10.697 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01001 m³/s @ 2.27 m/s)
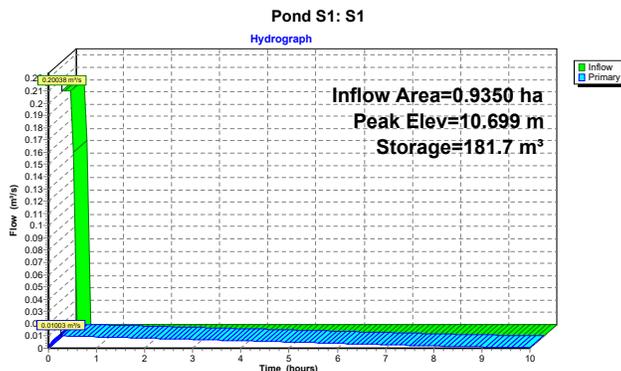
Pond S1: S1

Inflow Area=0.9350 ha
Peak Elev=10.699 m
Storage=181.7 m³

Summary for Pond S2: S2

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth =   18 mm   for 10-Year event
Inflow   =   0.22071 m³/s @   0.17 hrs, Volume=   0.199 Ml
Outflow   =   0.04045 m³/s @   0.39 hrs, Volume=   0.198 Ml, Atten= 82%, Lag= 13.0 min
Primary   =   0.04045 m³/s @   0.39 hrs, Volume=   0.198 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.748 m @ 0.39 hrs Surf.Area= 220.0 m² Storage= 164.5 m³
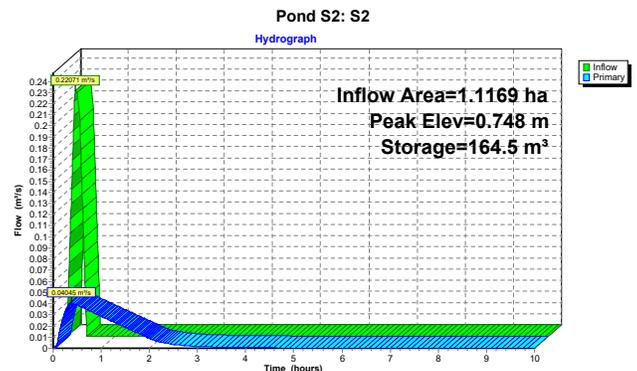
Plug-Flow detention time= 56.4 min calculated for 0.198 Ml (100% of inflow)
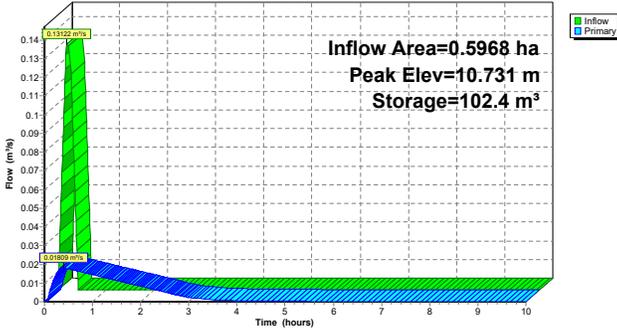Center-of-Mass det. time= 56.9 min (69.4 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	440.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	220.0	0.0	0.0
2.000	220.0	440.0	440.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.04044 m³/s @ 0.39 hrs HW=0.748 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.04044 m³/s @ 2.29 m/s)

Pond S2: S2

Inflow Area=1.1169 ha
Peak Elev=0.748 m
Storage=164.5 m³

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Summary for Pond S3: S3

Inflow Area =	0.5968 ha,	0.00% Impervious, Inflow Depth = 20 mm for 10-Year event	
Inflow =	0.13122 m³/s @	0.17 hrs, Volume=	0.118 Ml
Outflow =	0.01809 m³/s @	0.39 hrs, Volume=	0.118 Ml, Atten= 86%, Lag= 13.4 min
Primary =	0.01809 m³/s @	0.39 hrs, Volume=	0.118 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.731 m @ 0.39 hrs Surf.Area= 140.0 m² Storage= 102.4 m³

Plug-Flow detention time= 72.4 min calculated for 0.118 Ml (100% of inflow)
Center-of-Mass det. time= 72.9 min (85.4 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	140.0	0.0	0.0
12.000	140.0	280.0	280.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01809 m³/s @ 0.39 hrs HW=10.731 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01809 m³/s @ 2.30 m/s)

Pond S3: S3
Hydrograph

Inflow Area=0.5968 ha
Peak Elev=10.731 m
Storage=102.4 m³

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Summary for Pond S4: S4

Inflow Area =	0.7020 ha,	0.00% Impervious, Inflow Depth = 18 mm for 10-Year event	
Inflow =	0.13872 m³/s @	0.17 hrs, Volume=	0.125 Ml
Outflow =	0.00990 m³/s @	0.40 hrs, Volume=	0.123 Ml, Atten= 93%, Lag= 14.1 min
Primary =	0.00990 m³/s @	0.40 hrs, Volume=	0.123 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.683 m @ 0.40 hrs Surf.Area= 170.0 m² Storage= 116.1 m³

Plug-Flow detention time= 137.2 min calculated for 0.123 Ml (98% of inflow)
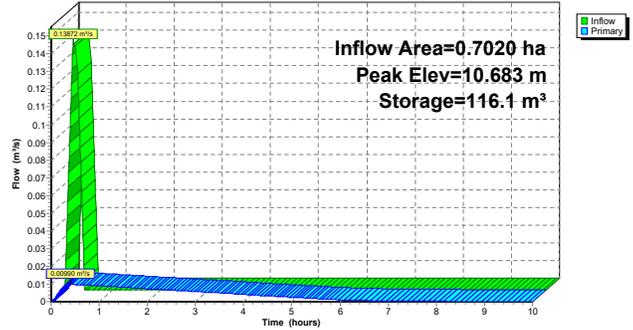Center-of-Mass det. time= 137.1 min (149.6 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	340.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	170.0	0.0	0.0
12.000	170.0	340.0	340.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.00990 m³/s @ 0.40 hrs HW=10.683 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.00990 m³/s @ 2.24 m/s)

Pond S4: S4
Hydrograph

Inflow Area=0.7020 ha
Peak Elev=10.683 m
Storage=116.1 m³

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Summary for Pond S5: S5

Inflow Area =	0.8839 ha,	0.00% Impervious, Inflow Depth = 14 mm for 10-Year event	
Inflow =	0.13531 m³/s @	0.17 hrs, Volume=	0.122 Ml
Outflow =	0.02344 m³/s @	0.39 hrs, Volume=	0.122 Ml, Atten= 83%, Lag= 13.1 min
Primary =	0.02344 m³/s @	0.39 hrs, Volume=	0.122 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
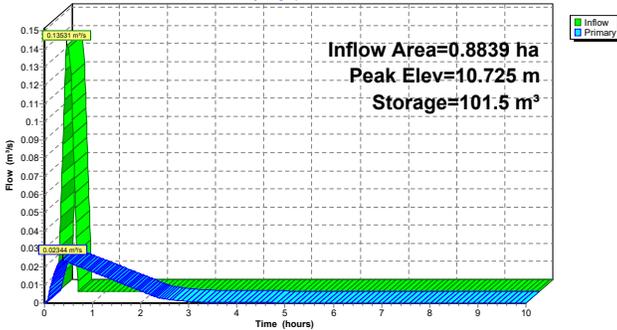Peak Elev= 10.725 m @ 0.39 hrs Surf.Area= 140.0 m² Storage= 101.5 m³

Plug-Flow detention time= 56.4 min calculated for 0.122 Ml (100% of inflow)
Center-of-Mass det. time= 56.9 min (69.4 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**1.00 mW x 140.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.02343 m³/s @ 0.39 hrs HW=10.725 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02343 m³/s @ 2.98 m/s)

Pond S5: S5
Hydrograph

Inflow Area=0.8839 ha
Peak Elev=10.725 m
Storage=101.5 m³

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Summary for Pond S6: S6

Inflow Area =	1.7614 ha,	0.00% Impervious, Inflow Depth = 19 mm for 10-Year event	
Inflow =	0.36345 m³/s @	0.17 hrs, Volume=	0.327 Ml
Outflow =	0.05551 m³/s @	0.39 hrs, Volume=	0.325 Ml, Atten= 85%, Lag= 13.3 min
Primary =	0.05551 m³/s @	0.39 hrs, Volume=	0.325 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
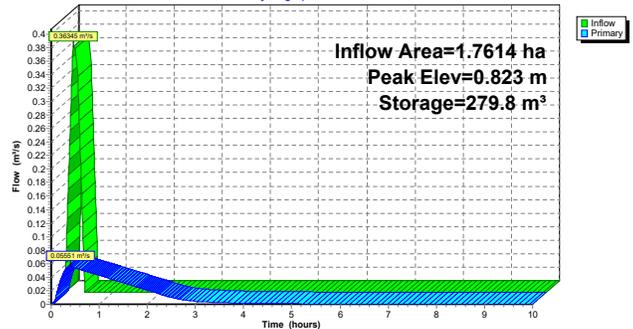Peak Elev= 0.823 m @ 0.39 hrs Surf.Area= 340.0 m² Storage= 279.8 m³

Plug-Flow detention time= 67.1 min calculated for 0.325 Ml (99% of inflow)
Center-of-Mass det. time= 67.6 min (80.1 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	680.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	340.0	0.0	0.0
2.000	340.0	680.0	680.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.05551 m³/s @ 0.39 hrs HW=0.823 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05551 m³/s @ 3.14 m/s)

Pond S6: S6
Hydrograph

Inflow Area=1.7614 ha
Peak Elev=0.823 m
Storage=279.8 m³

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Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr
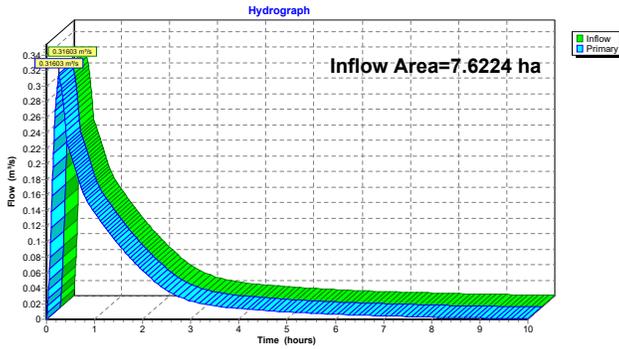Printed 2025-01-15
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Summary for Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area =   7.6224 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 10-Year event
Inflow   =   0.31603 m³/s @   0.25 hrs, Volume=   1.366 Ml
Primary   =   0.31603 m³/s @   0.25 hrs, Volume=   1.366 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

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Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr
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Summary for Link PH1: PH1 - 65.4 L/s

Inflow Area =   1.1315 ha,   0.00% Impervious, Inflow Depth >   20 mm   for 10-Year event
Inflow   =   0.03877 m³/s @   0.32 hrs, Volume=   0.223 Ml
Primary   =   0.03877 m³/s @   0.32 hrs, Volume=   0.223 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1 - 65.4 L/s

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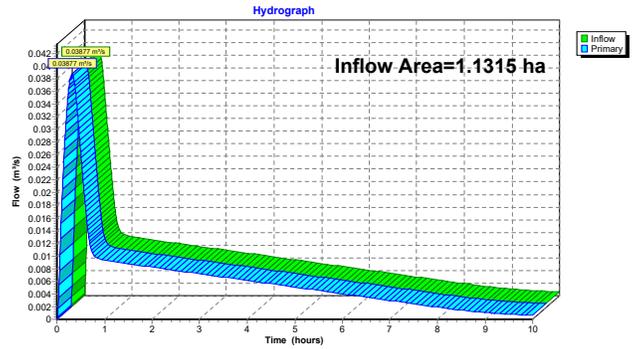
Summary for Link PH2A: PH2A - 64.5 L/s

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 10-Year event
Inflow   =   0.04045 m³/s @   0.39 hrs, Volume=   0.198 Ml
Primary   =   0.04045 m³/s @   0.39 hrs, Volume=   0.198 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
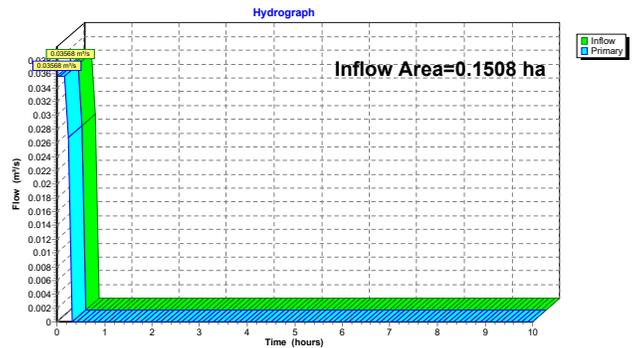
Link PH2A: PH2A - 64.5 L/s

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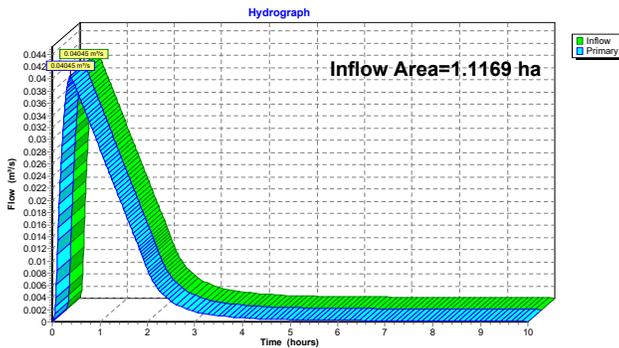
Summary for Link PH2B: PH2B - 8.7 L/s

Inflow Area =   0.1508 ha,   0.00% Impervious, Inflow Depth =   22 mm   for 10-Year event
Inflow   =   0.03568 m³/s @   0.00 hrs, Volume=   0.033 Ml
Primary   =   0.03568 m³/s @   0.00 hrs, Volume=   0.033 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
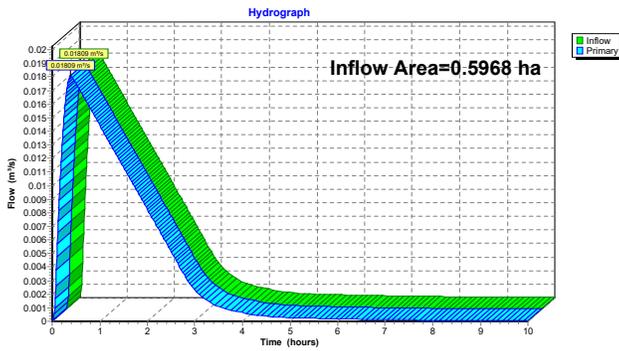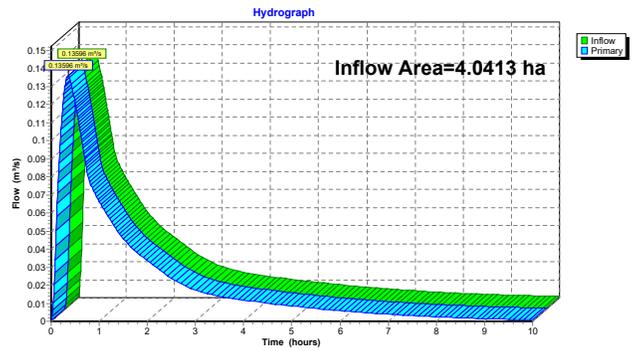
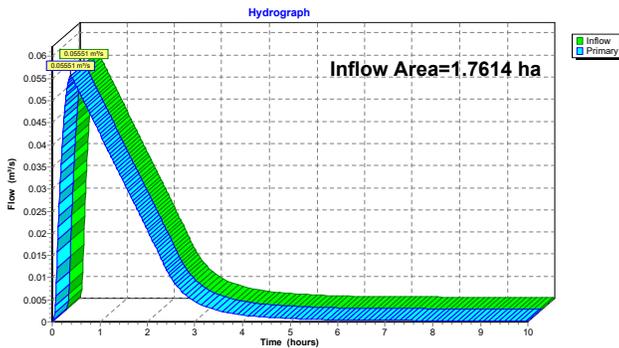**Link PH2B: PH2B - 8.7 L/s**

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Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr
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Summary for Link PH3: PH3 - 34.5 L/s

Inflow Area =   0.5968 ha,   0.00% Impervious, Inflow Depth >   20 mm   for 10-Year event
Inflow   =   0.01809 m³/s @   0.39 hrs, Volume=   0.118 Ml
Primary   =   0.01809 m³/s @   0.39 hrs, Volume=   0.118 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3 - 34.5 L/s

Inflow Area=0.5968 ha

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Summary for Link PH4: PH4

Inflow Area =   4.0413 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 10-Year event
Inflow   =   0.13596 m³/s @   0.36 hrs, Volume=   0.742 Ml
Primary   =   0.13596 m³/s @   0.36 hrs, Volume=   0.742 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

Inflow Area=4.0413 ha

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Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr
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Summary for Link PH5: PH5 - 101.8 L/s

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth >   18 mm   for 10-Year event
Inflow   =   0.05551 m³/s @   0.39 hrs, Volume=   0.325 Ml
Primary   =   0.05551 m³/s @   0.39 hrs, Volume=   0.325 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
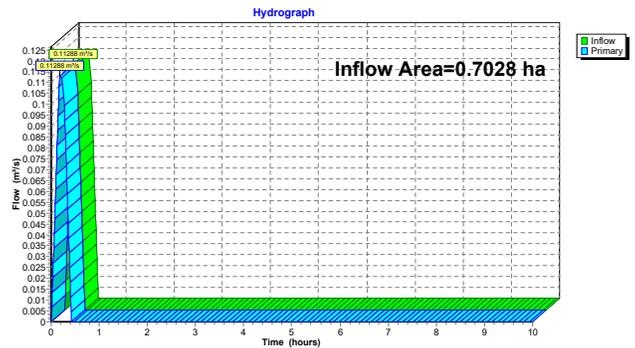
Link PH5: PH5 - 101.8 L/s

Inflow Area=1.7614 ha

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Pickering 10-Year Duration=15 min, Inten=100.2 mm/hr
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Summary for Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area =   0.7028 ha,   0.00% Impervious, Inflow Depth =   14 mm   for 10-Year event
Inflow   =   0.11288 m³/s @   0.17 hrs, Volume=   0.102 Ml
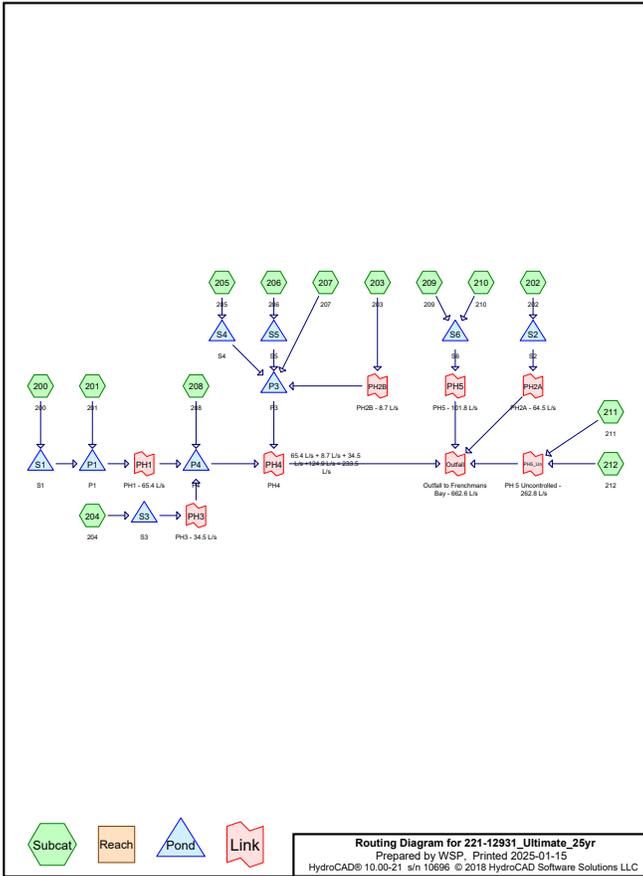Primary   =   0.11288 m³/s @   0.17 hrs, Volume=   0.102 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area=0.7028 ha

Routing Diagram for 221-12931_Ultimate_25yr
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Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.9350	0.84	(200)
0.3341	0.97	(201, 208)
1.8189	0.78	(202, 205)
0.5895	0.94	(203, 207)
0.5968	0.87	(204)
0.8839	0.61	(206)
1.6407	0.81	(209)
0.1207	0.83	(210)
0.2328	0.50	(211)
0.4700	0.70	(212)
7.6224	**0.79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.6224	Other	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
7.6224		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	7.6224	7.6224		200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
0.0000	**0.0000**	**0.0000**	**0.0000**	**7.6224**	**7.6224**	**TOTAL AREA**	

Time span=0.00-10.00 hrs, dt=0.01 hrs, 1001 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment200: 200	Runoff Area=0.9350 ha 0.00% Impervious Runoff Depth=26 mm
	Tc=0.0 min C=0.84 Runoff=0.26095 m³/s 0.244 Ml
Subcatchment201: 201	Runoff Area=0.1965 ha 100.00% Impervious Runoff Depth=29 mm
	Tc=10.0 min C=0.97 Runoff=0.06333 m³/s 0.057 Ml
Subcatchment202: 202	Runoff Area=1.1169 ha 0.00% Impervious Runoff Depth=23 mm
	Tc=10.0 min C=0.78 Runoff=0.28945 m³/s 0.261 Ml
Subcatchment203: 203	Runoff Area=0.1508 ha 0.00% Impervious Runoff Depth=29 mm
	Tc=0.0 min C=0.94 Runoff=0.04710 m³/s 0.044 Ml
Subcatchment204: 204	Runoff Area=0.5968 ha 0.00% Impervious Runoff Depth=26 mm
	Tc=10.0 min C=0.87 Runoff=0.17251 m³/s 0.155 Ml
Subcatchment205: 205	Runoff Area=0.7020 ha 0.00% Impervious Runoff Depth=23 mm
	Tc=10.0 min C=0.78 Runoff=0.18193 m³/s 0.164 Ml
Subcatchment206: 206	Runoff Area=0.8839 ha 0.00% Impervious Runoff Depth=18 mm
	Tc=10.0 min C=0.61 Runoff=0.17914 m³/s 0.161 Ml
Subcatchment207: 207	Runoff Area=0.4387 ha 0.00% Impervious Runoff Depth=28 mm
	Tc=10.0 min C=0.94 Runoff=0.13701 m³/s 0.123 Ml
Subcatchment208: 208	Runoff Area=0.1376 ha 100.00% Impervious Runoff Depth=29 mm
	Tc=10.0 min C=0.97 Runoff=0.04435 m³/s 0.040 Ml
Subcatchment209: 209	Runoff Area=1.6407 ha 0.00% Impervious Runoff Depth=24 mm
	Tc=10.0 min C=0.81 Runoff=0.44155 m³/s 0.397 Ml
Subcatchment210: 210	Runoff Area=0.1207 ha 0.00% Impervious Runoff Depth=25 mm
	Tc=10.0 min C=0.83 Runoff=0.03328 m³/s 0.030 Ml
Subcatchment211: 211	Runoff Area=0.2328 ha 0.00% Impervious Runoff Depth=15 mm
	Tc=10.0 min C=0.50 Runoff=0.03867 m³/s 0.035 Ml
Subcatchment212: 212	Runoff Area=0.4700 ha 0.00% Impervious Runoff Depth=21 mm
	Tc=10.0 min C=0.70 Runoff=0.10931 m³/s 0.098 Ml
Pond P1: P1	Peak Elev=0.588 m Storage=28.2 m³ Inflow=0.07513 m³/s 0.289 Ml
	Outflow=0.04597 m³/s 0.288 Ml
Pond P3: P3	Peak Elev=0.564 m Storage=125.5 m³ Inflow=0.21648 m³/s 0.490 Ml
	Outflow=0.07776 m³/s 0.489 Ml
Pond P4: P4	Peak Elev=10.604 m Storage=29.2 m³ Inflow=0.10440 m³/s 0.483 Ml
	Outflow=0.08103 m³/s 0.482 Ml

Pond S1: S1	Peak Elev=10.913 m Storage=237.5 m³ Inflow=0.26095 m³/s 0.244 Ml
	Outflow=0.01154 m³/s 0.232 Ml
Pond S2: S2	Peak Elev=0.999 m Storage=219.7 m³ Inflow=0.28945 m³/s 0.261 Ml
	Outflow=0.04739 m³/s 0.260 Ml
Pond S3: S3	Peak Elev=10.976 m Storage=136.6 m³ Inflow=0.17251 m³/s 0.155 Ml
	Outflow=0.02109 m³/s 0.155 Ml
Pond S4: S4	Peak Elev=10.902 m Storage=153.4 m³ Inflow=0.18193 m³/s 0.164 Ml
	Outflow=0.01147 m³/s 0.161 Ml
Pond S5: S5	Peak Elev=10.979 m Storage=137.0 m³ Inflow=0.17914 m³/s 0.161 Ml
	Outflow=0.02749 m³/s 0.161 Ml
Pond S6: S6	Peak Elev=1.092 m Storage=371.1 m³ Inflow=0.47483 m³/s 0.427 Ml
	Outflow=0.06471 m³/s 0.425 Ml
Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s	Inflow=0.38373 m³/s 1.790 Ml
	Primary=0.38373 m³/s 1.790 Ml
Link PH1: PH1 - 65.4 L/s	Inflow=0.04597 m³/s 0.288 Ml
	Primary=0.04597 m³/s 0.288 Ml
Link PH2A: PH2A - 64.5 L/s	Inflow=0.04739 m³/s 0.260 Ml
	Primary=0.04739 m³/s 0.260 Ml
Link PH2B: PH2B - 8.7 L/s	Inflow=0.04710 m³/s 0.044 Ml
	Primary=0.04710 m³/s 0.044 Ml
Link PH3: PH3 - 34.5 L/s	Inflow=0.02109 m³/s 0.155 Ml
	Primary=0.02109 m³/s 0.155 Ml
Link PH4: PH4	Inflow=0.15877 m³/s 0.972 Ml
	Primary=0.15877 m³/s 0.972 Ml
Link PH5: PH5 - 101.8 L/s	Inflow=0.06471 m³/s 0.425 Ml
	Primary=0.06471 m³/s 0.425 Ml
Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s	Inflow=0.14798 m³/s 0.133 Ml
	Primary=0.14798 m³/s 0.133 Ml

Total Runoff Area = 7.6224 ha   Runoff Volume = 1.810 Ml   Average Runoff Depth = 24 mm
**95.62% Pervious = 7.2883 ha   4.38% Impervious = 0.3341 ha**

Summary for Subcatchment 200: 200

Runoff   =   0.26095 m³/s @   0.00 hrs, Volume=   0.244 Ml, Depth=   26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.9350	0.84	
0.9350		100.00% Pervious Area

Subcatchment 200: 200

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.9350 ha
Runoff Volume=0.244 Ml
Runoff Depth=26 mm
Tc=0.0 min
C=0.84
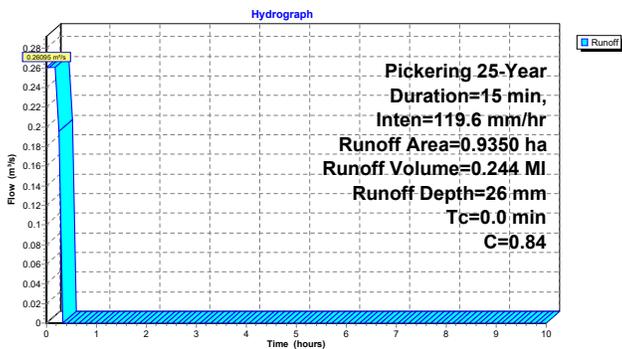
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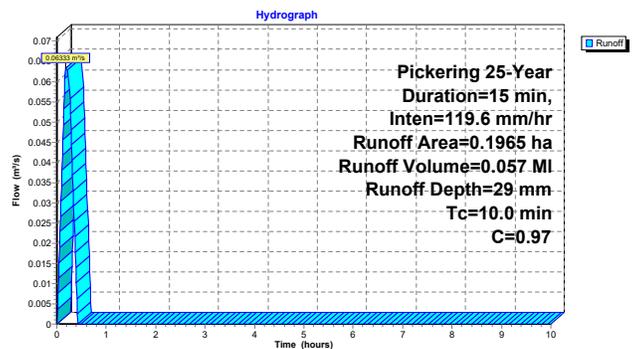
Runoff   =   0.06333 m³/s @   0.17 hrs, Volume=   0.057 Ml, Depth=   29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.1965	0.97	
0.1965		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 201: 201

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.1965 ha
Runoff Volume=0.057 Ml
Runoff Depth=29 mm
Tc=10.0 min
C=0.97

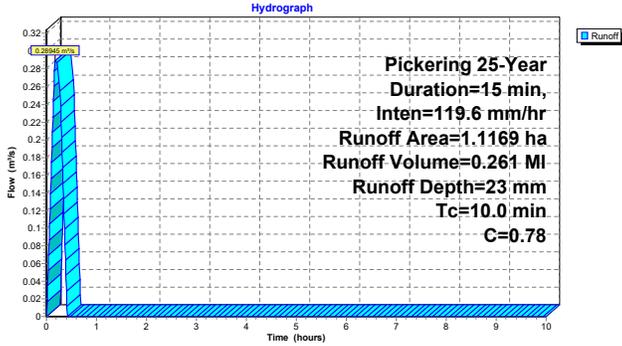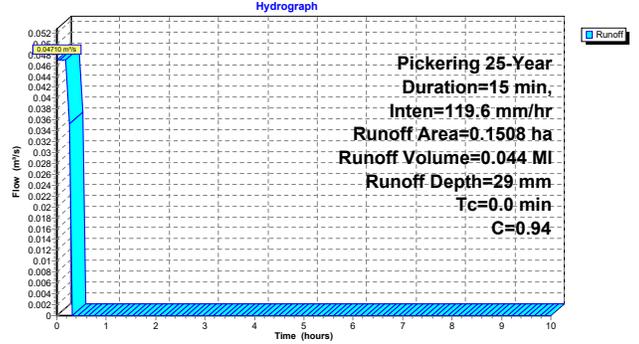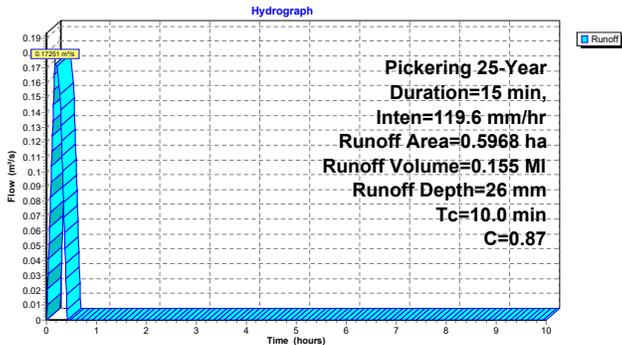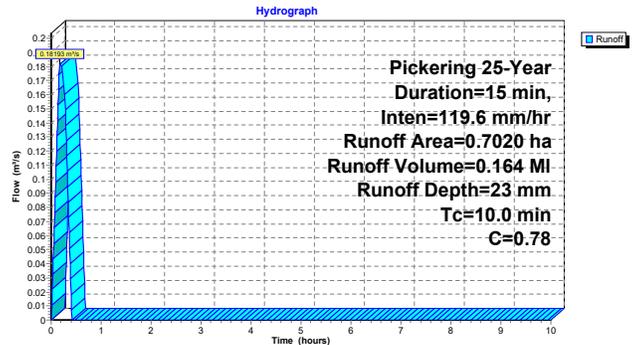### Summary for Subcatchment 202: 202

Runoff   =   0.28945 m³/s @   0.17 hrs, Volume=   0.261 Ml, Depth=   23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
1.1169	0.78	
1.1169		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 202: 202

Hydrograph

Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr Runoff Area=1.1169 ha Runoff Volume=0.261 Ml Runoff Depth=23 mm Tc=10.0 min C=0.78

Summary for Subcatchment 203: 203

Runoff   =   0.04710 m³/s @   0.00 hrs, Volume=   0.044 Ml, Depth=   29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.1508	0.94	
0.1508		100.00% Pervious Area

Subcatchment 203: 203

Hydrograph

Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr Runoff Area=0.1508 ha Runoff Volume=0.044 Ml Runoff Depth=29 mm Tc=0.0 min C=0.94

Summary for Subcatchment 204: 204

Runoff   =   0.17251 m³/s @   0.17 hrs, Volume=   0.155 Ml, Depth=   26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.5968	0.87	
0.5968		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 204: 204

Hydrograph

Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr Runoff Area=0.5968 ha Runoff Volume=0.155 Ml Runoff Depth=26 mm Tc=10.0 min C=0.87

Summary for Subcatchment 205: 205

Runoff   =   0.18193 m³/s @   0.17 hrs, Volume=   0.164 Ml, Depth=   23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.7020	0.78	
0.7020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 205: 205

Hydrograph

Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr Runoff Area=0.7020 ha Runoff Volume=0.164 Ml Runoff Depth=23 mm Tc=10.0 min C=0.78
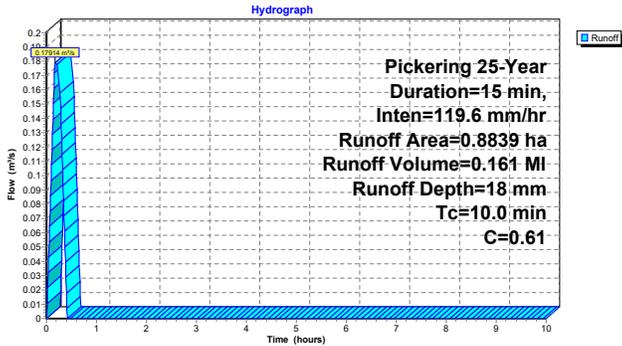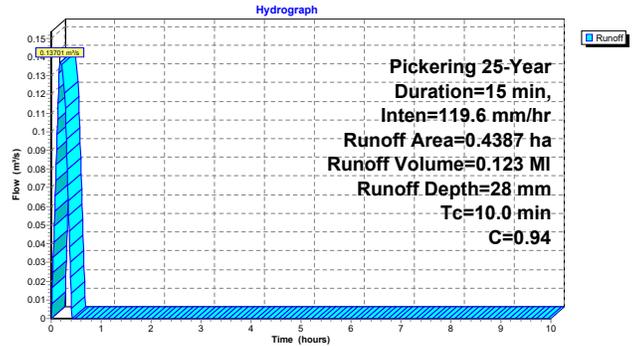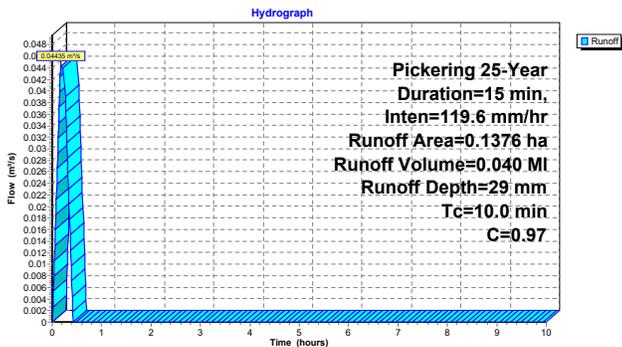
Summary for Subcatchment 206: 206

Runoff = 0.17914 m³/s @ 0.17 hrs, Volume= 0.161 Ml, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.8839	0.61	
0.8839		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 206: 206

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.8839 ha
Runoff Volume=0.161 Ml
Runoff Depth=18 mm
Tc=10.0 min
C=0.61

Summary for Subcatchment 207: 207

Runoff = 0.13701 m³/s @ 0.17 hrs, Volume= 0.123 Ml, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.4387	0.94	
0.4387		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 207: 207

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.4387 ha
Runoff Volume=0.123 Ml
Runoff Depth=28 mm
Tc=10.0 min
C=0.94

Summary for Subcatchment 208: 208

Runoff = 0.04435 m³/s @ 0.17 hrs, Volume= 0.040 Ml, Depth= 29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.1376	0.97	
0.1376		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 208: 208

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.1376 ha
Runoff Volume=0.040 Ml
Runoff Depth=29 mm
Tc=10.0 min
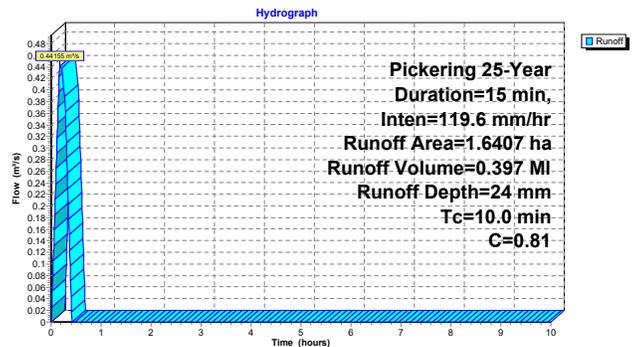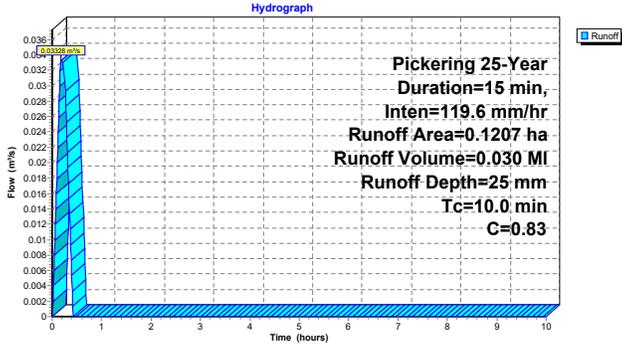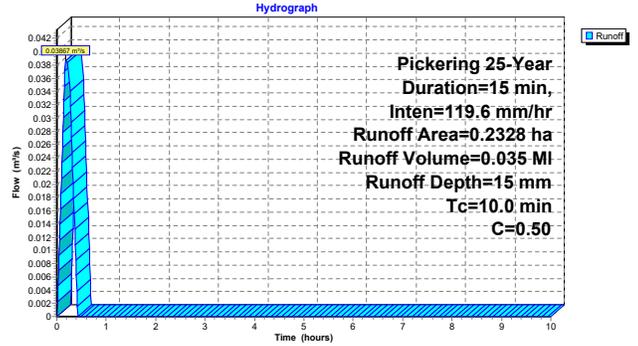C=0.97

Summary for Subcatchment 209: 209

Runoff = 0.44155 m³/s @ 0.17 hrs, Volume= 0.397 Ml, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
1.6407	0.81	
1.6407		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 209: 209

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=1.6407 ha
Runoff Volume=0.397 Ml
Runoff Depth=24 mm
Tc=10.0 min
C=0.81

221-12931_Ultimate_25yr
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
Prepared by WSP
Printed 2025-01-15
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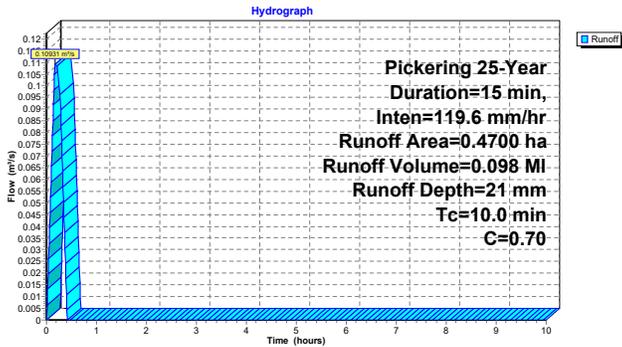
Summary for Subcatchment 210: 210

Runoff   =   0.03328 m³/s @   0.17 hrs, Volume=   0.030 Ml, Depth=   25 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.1207	0.83	
0.1207		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 210: 210

Hydrograph

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.1207 ha
Runoff Volume=0.030 Ml
Runoff Depth=25 mm
Tc=10.0 min
C=0.83

221-12931_Ultimate_25yr
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
Prepared by WSP
Printed 2025-01-15
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Summary for Subcatchment 211: 211

Runoff   =   0.03867 m³/s @   0.17 hrs, Volume=   0.035 Ml, Depth=   15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.2328	0.50	
0.2328		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 211: 211

Hydrograph

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.2328 ha
Runoff Volume=0.035 Ml
Runoff Depth=15 mm
Tc=10.0 min
C=0.50

221-12931_Ultimate_25yr
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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Summary for Subcatchment 212: 212

Runoff   =   0.10931 m³/s @   0.17 hrs, Volume=   0.098 Ml, Depth=   21 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr

Area (ha)	C	Description
0.4700	0.70	
0.4700		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 212: 212

Hydrograph

Pickering 25-Year
Duration=15 min,
Inten=119.6 mm/hr
Runoff Area=0.4700 ha
Runoff Volume=0.098 Ml
Runoff Depth=21 mm
Tc=10.0 min
C=0.70

221-12931_Ultimate_25yr
Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
Prepared by WSP
Printed 2025-01-15
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Summary for Pond P1: P1

Inflow Area =   1.1315 ha, 17.37% Impervious, Inflow Depth >   26 mm   for 25-Year event
Inflow   =   0.07513 m³/s @   0.25 hrs, Volume=   0.289 Ml
Outflow   =   0.04597 m³/s @   0.33 hrs, Volume=   0.288 Ml, Atten= 39%, Lag= 4.8 min
Primary   =   0.04597 m³/s @   0.33 hrs, Volume=   0.288 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.588 m @ 0.33 hrs Surf.Area= 57.2 m² Storage= 28.2 m³
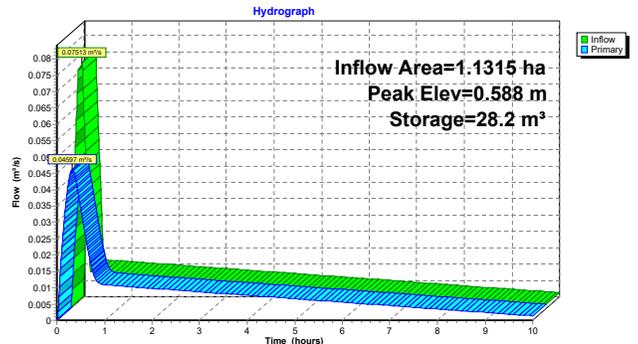
Plug-Flow detention time= 5.2 min calculated for 0.288 Ml (100% of inflow)
Center-of-Mass det. time= 4.5 min (186.0 - 181.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.04596 m³/s @ 0.33 hrs HW=0.588 m   (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.04596 m³/s @ 2.60 m/s)

Pond P1: P1

Hydrograph

Inflow Area=1.1315 ha
Peak Elev=0.588 m
Storage=28.2 m³

Summary for Pond P3: P3

Inflow Area =   2.1754 ha,   0.00% Impervious, Inflow Depth >   23 mm for 25-Year event
Inflow   =   0.21648 m³/s @   0.25 hrs, Volume=   0.490 Ml
Outflow   =   0.07776 m³/s @   0.37 hrs, Volume=   0.489 Ml, Atten= 64%, Lag= 7.2 min
Primary   =   0.07776 m³/s @   0.37 hrs, Volume=   0.489 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.564 m @ 0.37 hrs Surf.Area= 287.5 m² Storage= 125.5 m³

Plug-Flow detention time= 19.5 min calculated for 0.488 Ml (100% of inflow)
Center-of-Mass det. time= 18.1 min (101.1 - 83.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	271.4 m³	**1,200 mm Round Pipe Storage** L= 240.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.07776 m³/s @ 0.37 hrs HW=0.564 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.07776 m³/s @ 2.48 m/s)

Pond P3: P3

Inflow Area=2.1754 ha
Peak Elev=0.564 m
Storage=125.5 m³
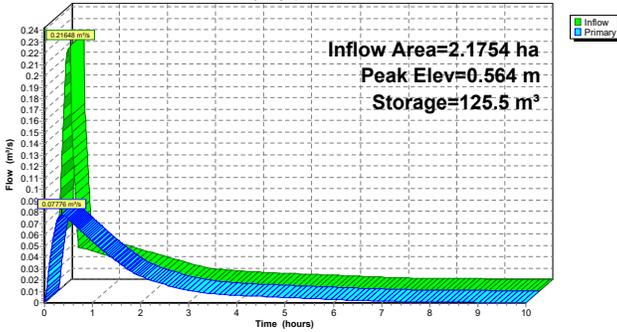
Summary for Pond P4: P4

Inflow Area =   1.8659 ha, 17.91% Impervious, Inflow Depth >   26 mm for 25-Year event
Inflow   =   0.10440 m³/s @   0.25 hrs, Volume=   0.483 Ml
Outflow   =   0.08103 m³/s @   0.36 hrs, Volume=   0.482 Ml, Atten= 22%, Lag= 6.6 min
Primary   =   0.08103 m³/s @   0.36 hrs, Volume=   0.482 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.604 m @ 0.36 hrs Surf.Area= 56.8 m² Storage= 29.2 m³

Plug-Flow detention time= 3.8 min calculated for 0.482 Ml (100% of inflow)
Center-of-Mass det. time= 3.4 min (145.1 - 141.7)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.08102 m³/s @ 0.36 hrs HW=10.604 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.08102 m³/s @ 2.58 m/s)

Pond P4: P4
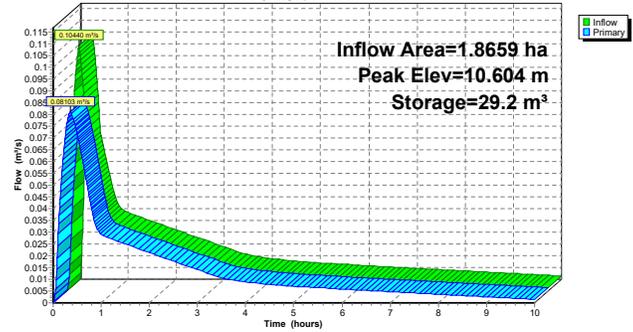
Inflow Area=1.8659 ha
Peak Elev=10.604 m
Storage=29.2 m³

Summary for Pond S1: S1

Inflow Area =   0.9350 ha,   0.00% Impervious, Inflow Depth =   26 mm for 25-Year event
Inflow   =   0.26095 m³/s @   0.00 hrs, Volume=   0.244 Ml
Outflow   =   0.01154 m³/s @   0.26 hrs, Volume=   0.232 Ml, Atten= 96%, Lag= 15.8 min
Primary   =   0.01154 m³/s @   0.26 hrs, Volume=   0.232 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.913 m @ 0.26 hrs Surf.Area= 260.0 m² Storage= 237.5 m³

Plug-Flow detention time= 220.5 min calculated for 0.227 Ml (93% of inflow)
Center-of-Mass det. time= 215.5 min (223.0 - 7.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	520.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	260.0	0.0	0.0
12.000	260.0	520.0	520.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01152 m³/s @ 0.26 hrs HW=10.911 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01152 m³/s @ 2.61 m/s)

Pond S1: S1
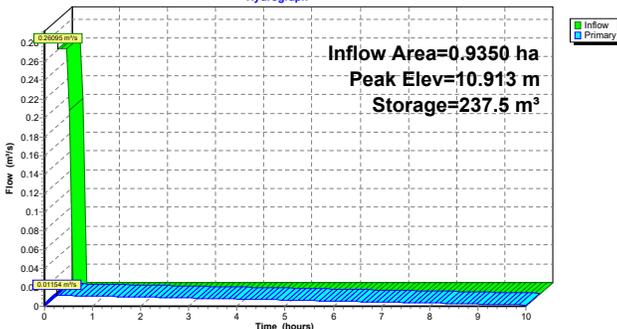
Inflow Area=0.9350 ha
Peak Elev=10.913 m
Storage=237.5 m³

Summary for Pond S2: S2

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth =   23 mm for 25-Year event
Inflow   =   0.28945 m³/s @   0.17 hrs, Volume=   0.261 Ml
Outflow   =   0.04739 m³/s @   0.39 hrs, Volume=   0.260 Ml, Atten= 84%, Lag= 13.2 min
Primary   =   0.04739 m³/s @   0.39 hrs, Volume=   0.260 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.999 m @ 0.39 hrs Surf.Area= 220.0 m² Storage= 219.7 m³

Plug-Flow detention time= 60.7 min calculated for 0.259 Ml (100% of inflow)
Center-of-Mass det. time= 61.1 min (73.7 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	440.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	220.0	0.0	0.0
2.000	220.0	440.0	440.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.04739 m³/s @ 0.39 hrs HW=0.998 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.04739 m³/s @ 2.68 m/s)

Pond S2: S2
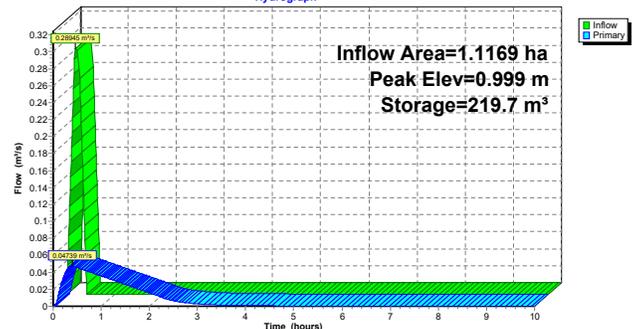
Inflow Area=1.1169 ha
Peak Elev=0.999 m
Storage=219.7 m³

Summary for Pond S3: S3

Inflow Area =   0.5968 ha,   0.00% Impervious, Inflow Depth =   26 mm   for 25-Year event
Inflow   =   0.17251 m³/s @   0.17 hrs, Volume=   0.155 Ml
Outflow   =   0.02109 m³/s @   0.40 hrs, Volume=   0.155 Ml, Atten= 88%, Lag= 13.6 min
Primary   =   0.02109 m³/s @   0.40 hrs, Volume=   0.155 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.976 m @ 0.40 hrs Surf.Area= 140.0 m² Storage= 136.6 m³

Plug-Flow detention time= 80.3 min calculated for 0.155 Ml (100% of inflow)
Center-of-Mass det. time= 80.2 min (92.7 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	140.0	0.0	0.0
12.000	140.0	280.0	280.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.02109 m³/s @ 0.40 hrs HW=10.976 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02109 m³/s @ 2.68 m/s)

Pond S3: S3
Hydrograph
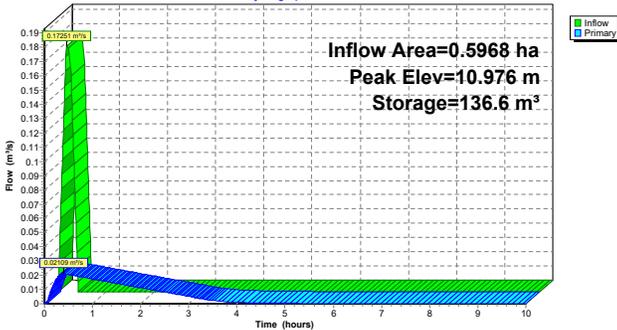
Inflow Area=0.5968 ha
Peak Elev=10.976 m
Storage=136.6 m³

Summary for Pond S4: S4

Inflow Area =   0.7020 ha,   0.00% Impervious, Inflow Depth =   23 mm   for 25-Year event
Inflow   =   0.18193 m³/s @   0.17 hrs, Volume=   0.164 Ml
Outflow   =   0.01147 m³/s @   0.41 hrs, Volume=   0.161 Ml, Atten= 94%, Lag= 14.2 min
Primary   =   0.01147 m³/s @   0.41 hrs, Volume=   0.161 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.902 m @ 0.41 hrs Surf.Area= 170.0 m² Storage= 153.4 m³

Plug-Flow detention time= 153.2 min calculated for 0.161 Ml (98% of inflow)
Center-of-Mass det. time= 153.0 min (165.5 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	340.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	170.0	0.0	0.0
12.000	170.0	340.0	340.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01146 m³/s @ 0.41 hrs HW=10.902 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01146 m³/s @ 2.59 m/s)

Pond S4: S4
Hydrograph

Inflow Area=0.7020 ha
Peak Elev=10.902 m
Storage=153.4 m³
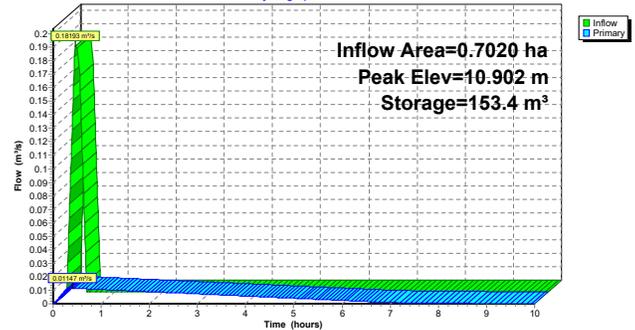
Summary for Pond S5: S5

Inflow Area =   0.8839 ha,   0.00% Impervious, Inflow Depth =   18 mm   for 25-Year event
Inflow   =   0.17914 m³/s @   0.17 hrs, Volume=   0.161 Ml
Outflow   =   0.02749 m³/s @   0.39 hrs, Volume=   0.161 Ml, Atten= 85%, Lag= 13.3 min
Primary   =   0.02749 m³/s @   0.39 hrs, Volume=   0.161 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.979 m @ 0.39 hrs Surf.Area= 140.0 m² Storage= 137.0 m³

Plug-Flow detention time= 62.3 min calculated for 0.161 Ml (100% of inflow)
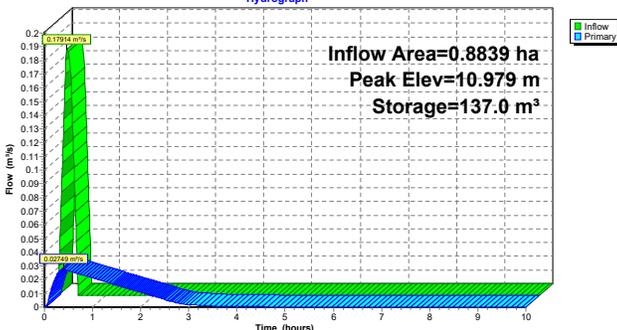Center-of-Mass det. time= 62.8 min (75.3 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**1.00 mW x 140.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.02749 m³/s @ 0.39 hrs HW=10.979 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02749 m³/s @ 3.50 m/s)

Pond S5: S5
Hydrograph

Inflow Area=0.8839 ha
Peak Elev=10.979 m
Storage=137.0 m³

Summary for Pond S6: S6

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth =   24 mm   for 25-Year event
Inflow   =   0.47483 m³/s @   0.17 hrs, Volume=   0.427 Ml
Outflow   =   0.06471 m³/s @   0.39 hrs, Volume=   0.425 Ml, Atten= 86%, Lag= 13.4 min
Primary   =   0.06471 m³/s @   0.39 hrs, Volume=   0.425 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 1.092 m @ 0.39 hrs Surf.Area= 340.0 m² Storage= 371.1 m³

Plug-Flow detention time= 72.8 min calculated for 0.425 Ml (99% of inflow)
Center-of-Mass det. time= 73.2 min (85.7 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	680.0 m³	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	340.0	0.0	0.0
2.000	340.0	680.0	680.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.06470 m³/s @ 0.39 hrs HW=1.091 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06470 m³/s @ 3.66 m/s)

Pond S6: S6
Hydrograph

Inflow Area=1.7614 ha
Peak Elev=1.092 m
Storage=371.1 m³

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
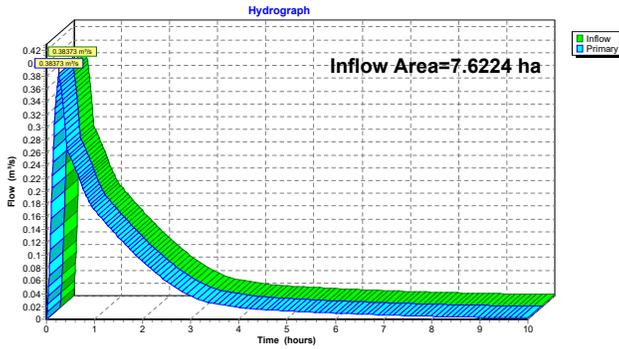Printed 2025-01-15
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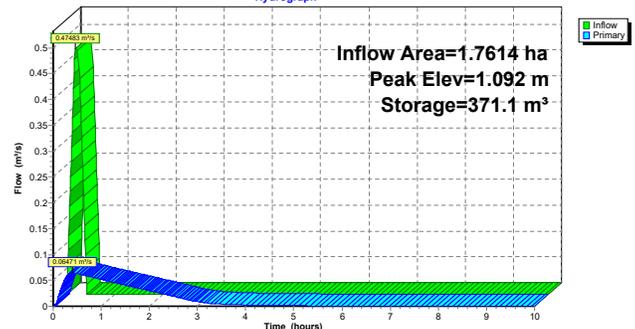
Summary for Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area =   7.6224 ha,   4.38% Impervious, Inflow Depth >   23 mm   for 25-Year event
Inflow   =   0.38373 m³/s @   0.25 hrs, Volume=   1.790 Ml
Primary   =   0.38373 m³/s @   0.25 hrs, Volume=   1.790 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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Summary for Link PH1: PH1 - 65.4 L/s

Inflow Area =   1.1315 ha, 17.37% Impervious, Inflow Depth >   25 mm   for 25-Year event
Inflow   =   0.04597 m³/s @   0.33 hrs, Volume=   0.288 Ml
Primary   =   0.04597 m³/s @   0.33 hrs, Volume=   0.288 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1 - 65.4 L/s

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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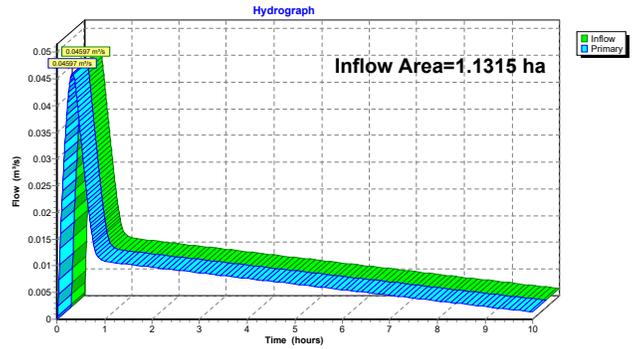
Summary for Link PH2A: PH2A - 64.5 L/s

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth >   23 mm   for 25-Year event
Inflow   =   0.04739 m³/s @   0.39 hrs, Volume=   0.260 Ml
Primary   =   0.04739 m³/s @   0.39 hrs, Volume=   0.260 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
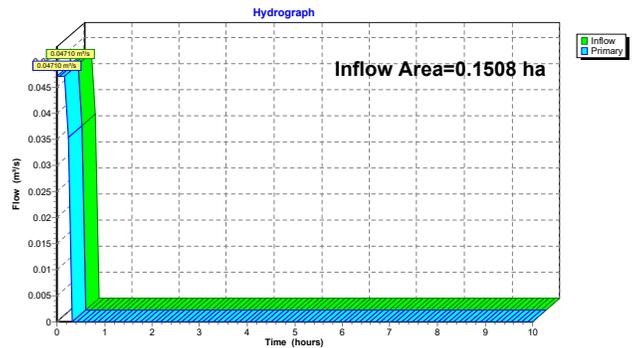
Link PH2A: PH2A - 64.5 L/s

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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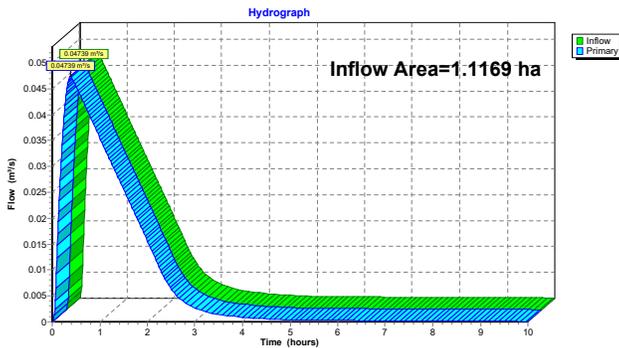
Summary for Link PH2B: PH2B - 8.7 L/s

Inflow Area =   0.1508 ha,   0.00% Impervious, Inflow Depth =   29 mm   for 25-Year event
Inflow   =   0.04710 m³/s @   0.00 hrs, Volume=   0.044 Ml
Primary   =   0.04710 m³/s @   0.00 hrs, Volume=   0.044 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
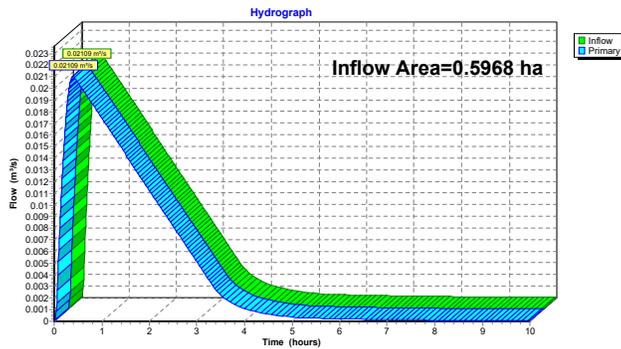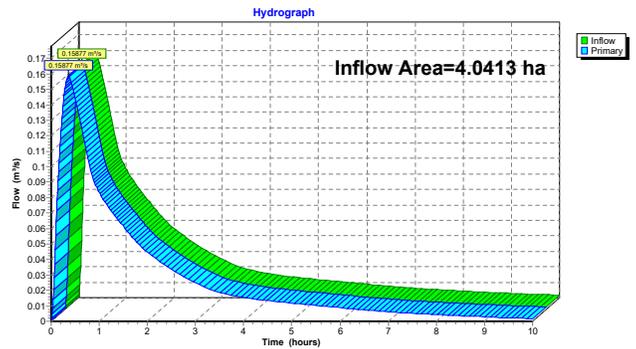
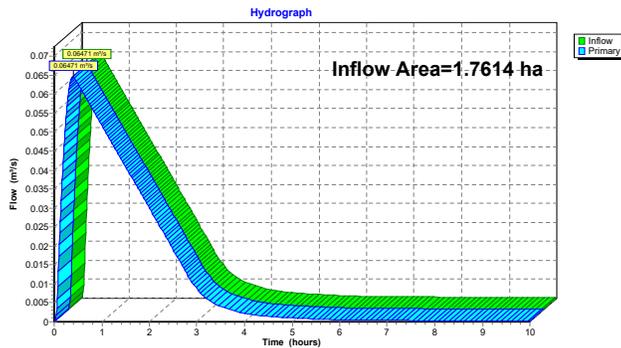**Link PH2B: PH2B - 8.7 L/s**

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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Summary for Link PH3: PH3 - 34.5 L/s

Inflow Area =   0.5968 ha,   0.00% Impervious, Inflow Depth >   26 mm   for 25-Year event
Inflow   =   0.02109 m³/s @   0.40 hrs, Volume=   0.155 Ml
Primary   =   0.02109 m³/s @   0.40 hrs, Volume=   0.155 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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Summary for Link PH4: PH4

Inflow Area =   4.0413 ha,   8.27% Impervious, Inflow Depth >   24 mm   for 25-Year event
Inflow   =   0.15877 m³/s @   0.36 hrs, Volume=   0.972 Ml
Primary   =   0.15877 m³/s @   0.36 hrs, Volume=   0.972 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
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Summary for Link PH5: PH5 - 101.8 L/s

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth >   24 mm   for 25-Year event
Inflow   =   0.06471 m³/s @   0.39 hrs, Volume=   0.425 Ml
Primary   =   0.06471 m³/s @   0.39 hrs, Volume=   0.425 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

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Pickering 25-Year Duration=15 min, Inten=119.6 mm/hr
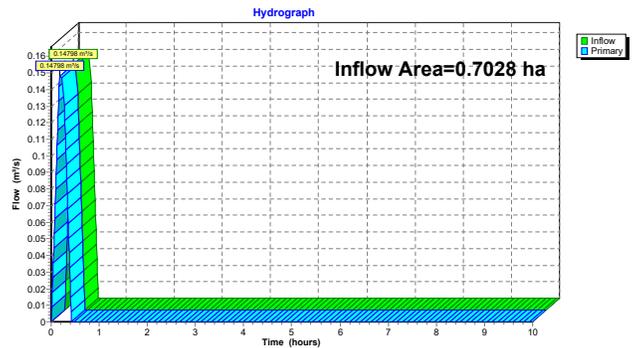Printed 2025-01-15
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Summary for Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area =   0.7028 ha,   0.00% Impervious, Inflow Depth =   19 mm   for 25-Year event
Inflow   =   0.14798 m³/s @   0.17 hrs, Volume=   0.133 Ml
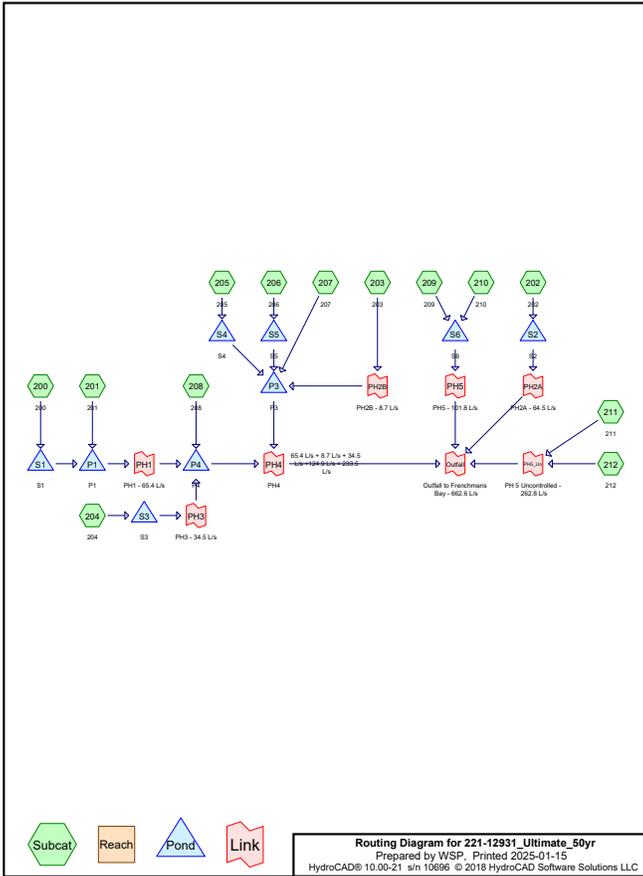Primary   =   0.14798 m³/s @   0.17 hrs, Volume=   0.133 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Routing Diagram for 221-12931_Ultimate_50yr
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Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.9350	0.92	(200)
0.9236	1.00	(201, 203, 207, 208)
1.8189	0.85	(202, 205)
0.5968	0.95	(204)
0.8839	0.66	(206)
1.6407	0.89	(209)
0.1207	0.91	(210)
0.2328	0.54	(211)
0.4700	0.76	(212)
7.6224	**0.86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.6224	Other	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
7.6224		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	7.6224	7.6224		200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
0.0000	**0.0000**	**0.0000**	**0.0000**	**7.6224**	**7.6224**	**TOTAL AREA**	

Time span=0.00-10.00 hrs, dt=0.01 hrs, 1001 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment200: 200	Runoff Area=0.9350 ha 0.00% Impervious Runoff Depth=29 mm
	Tc=0.0 min C=0.92 Runoff=0.36458 m³/s 0.276 Ml
Subcatchment201: 201	Runoff Area=0.1965 ha 100.00% Impervious Runoff Depth=31 mm
	Tc=10.0 min C=1.00 Runoff=0.08328 m³/s 0.060 Ml
Subcatchment202: 202	Runoff Area=1.1169 ha 0.00% Impervious Runoff Depth=26 mm
	Tc=10.0 min C=0.85 Runoff=0.40237 m³/s 0.290 Ml
Subcatchment203: 203	Runoff Area=0.1508 ha 100.00% Impervious Runoff Depth=32 mm
	Tc=0.0 min C=1.00 Runoff=0.06391 m³/s 0.048 Ml
Subcatchment204: 204	Runoff Area=0.5968 ha 100.00% Impervious Runoff Depth=29 mm
	Tc=10.0 min C=0.95 Runoff=0.24030 m³/s 0.173 Ml
Subcatchment205: 205	Runoff Area=0.7020 ha 0.00% Impervious Runoff Depth=26 mm
	Tc=10.0 min C=0.85 Runoff=0.25290 m³/s 0.182 Ml
Subcatchment206: 206	Runoff Area=0.8839 ha 0.00% Impervious Runoff Depth=20 mm
	Tc=10.0 min C=0.66 Runoff=0.24725 m³/s 0.178 Ml
Subcatchment207: 207	Runoff Area=0.4387 ha 100.00% Impervious Runoff Depth=31 mm
	Tc=10.0 min C=1.00 Runoff=0.18594 m³/s 0.134 Ml
Subcatchment208: 208	Runoff Area=0.1376 ha 100.00% Impervious Runoff Depth=31 mm
	Tc=10.0 min C=1.00 Runoff=0.05832 m³/s 0.042 Ml
Subcatchment209: 209	Runoff Area=1.6407 ha 0.00% Impervious Runoff Depth=27 mm
	Tc=10.0 min C=0.89 Runoff=0.61889 m³/s 0.446 Ml
Subcatchment210: 210	Runoff Area=0.1207 ha 0.00% Impervious Runoff Depth=28 mm
	Tc=10.0 min C=0.91 Runoff=0.04655 m³/s 0.034 Ml
Subcatchment211: 211	Runoff Area=0.2328 ha 0.00% Impervious Runoff Depth=16 mm
	Tc=10.0 min C=0.54 Runoff=0.05328 m³/s 0.038 Ml
Subcatchment212: 212	Runoff Area=0.4700 ha 0.00% Impervious Runoff Depth=23 mm
	Tc=10.0 min C=0.76 Runoff=0.15139 m³/s 0.109 Ml
Pond P1: P1	Peak Elev=0.674 m Storage=33.0 m³ Inflow=0.09596 m³/s 0.319 Ml
	Outflow=0.04967 m³/s 0.318 Ml
Pond P3: P3	Peak Elev=0.622 m Storage=142.0 m³ Inflow=0.28196 m³/s 0.539 Ml
	Outflow=0.08244 m³/s 0.539 Ml
Pond P4: P4	Peak Elev=10.671 m Storage=32.9 m³ Inflow=0.11895 m³/s 0.533 Ml
	Outflow=0.08619 m³/s 0.532 Ml

Pond S1: S1	Peak Elev=11.036 m Storage=269.4 m³ Inflow=0.36458 m³/s 0.276 Ml
	Outflow=0.01232 m³/s 0.259 Ml
Pond S2: S2	Peak Elev=1.140 m Storage=250.9 m³ Inflow=0.40237 m³/s 0.290 Ml
	Outflow=0.05090 m³/s 0.289 Ml
Pond S3: S3	Peak Elev=11.110 m Storage=155.4 m³ Inflow=0.24030 m³/s 0.173 Ml
	Outflow=0.02256 m³/s 0.173 Ml
Pond S4: S4	Peak Elev=11.014 m Storage=172.4 m³ Inflow=0.25290 m³/s 0.182 Ml
	Outflow=0.01218 m³/s 0.179 Ml
Pond S5: S5	Peak Elev=11.108 m Storage=155.2 m³ Inflow=0.24725 m³/s 0.178 Ml
	Outflow=0.02935 m³/s 0.178 Ml
Pond S6: S6	Peak Elev=1.252 m Storage=425.6 m³ Inflow=0.66545 m³/s 0.479 Ml
	Outflow=0.06962 m³/s 0.477 Ml
Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s	Inflow=0.44067 m³/s 1.984 Ml
	Primary=0.44067 m³/s 1.984 Ml
Link PH1: PH1 - 65.4 L/s	Inflow=0.04967 m³/s 0.318 Ml
	Primary=0.04967 m³/s 0.318 Ml
Link PH2A: PH2A - 64.5 L/s	Inflow=0.05090 m³/s 0.289 Ml
	Primary=0.05090 m³/s 0.289 Ml
Link PH2B: PH2B - 8.7 L/s	Inflow=0.06391 m³/s 0.048 Ml
	Primary=0.06391 m³/s 0.048 Ml
Link PH3: PH3 - 34.5 L/s	Inflow=0.02256 m³/s 0.173 Ml
	Primary=0.02256 m³/s 0.173 Ml
Link PH4: PH4	Inflow=0.16862 m³/s 1.071 Ml
	Primary=0.16862 m³/s 1.071 Ml
Link PH5: PH5 - 101.8 L/s	Inflow=0.06962 m³/s 0.477 Ml
	Primary=0.06962 m³/s 0.477 Ml
Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s	Inflow=0.20468 m³/s 0.147 Ml
	Primary=0.20468 m³/s 0.147 Ml

Total Runoff Area = 7.6224 ha   Runoff Volume = 2.009 Ml   Average Runoff Depth = 26 mm
80.05% Pervious = 6.1020 ha   19.95% Impervious = 1.5204 ha
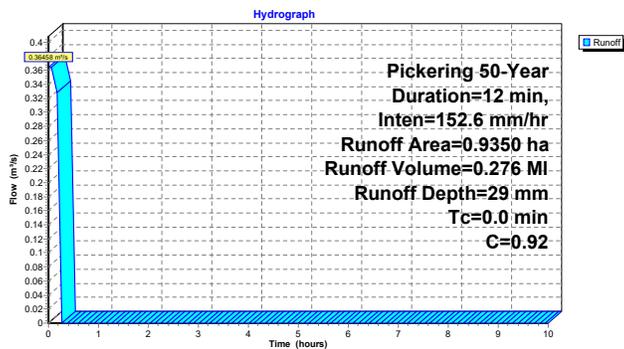

Summary for Subcatchment 200: 200

Runoff   =   0.36458 m³/s @   0.00 hrs, Volume=   0.276 Ml, Depth=   29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.9350	0.92	
0.9350		100.00% Pervious Area

Subcatchment 200: 200

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.9350 ha
Runoff Volume=0.276 Ml
Runoff Depth=29 mm
Tc=0.0 min
C=0.92

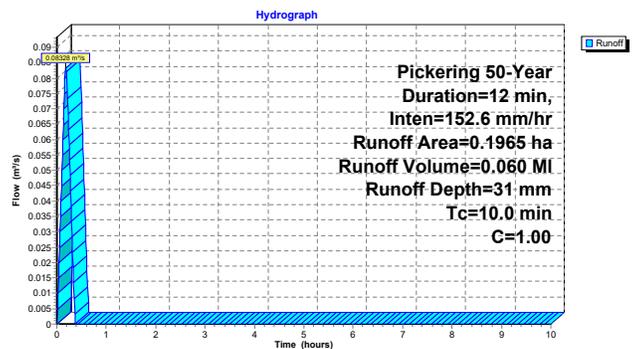**Summary for Subcatchment 201: 201**

Runoff   =   0.08328 m³/s @   0.17 hrs, Volume=   0.060 Ml, Depth=   31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.1965	1.00	
0.1965		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 201: 201

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.1965 ha
Runoff Volume=0.060 Ml
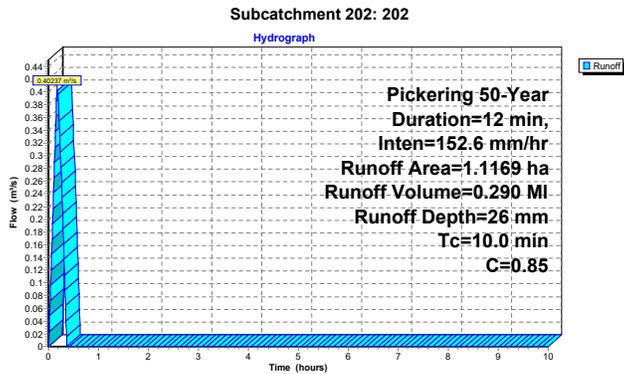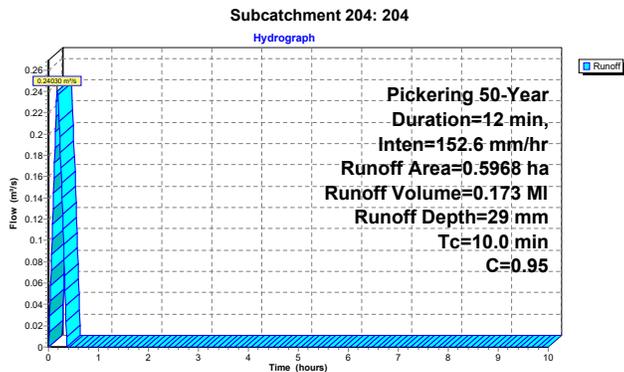Runoff Depth=31 mm
Tc=10.0 min
C=1.00

Summary for Subcatchment 202: 202

Runoff   =   0.40237 m³/s @   0.17 hrs, Volume=   0.290 Ml, Depth=   26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
1.1169	0.85	
1.1169		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 202: 202

Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr Runoff Area=1.1169 ha Runoff Volume=0.290 Ml Runoff Depth=26 mm Tc=10.0 min C=0.85

Summary for Subcatchment 203: 203

Runoff   =   0.06391 m³/s @   0.00 hrs, Volume=   0.048 Ml, Depth=   32 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.1508	1.00	
0.1508		100.00% Impervious Area

Subcatchment 203: 203

Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr Runoff Area=0.1508 ha Runoff Volume=0.048 Ml Runoff Depth=32 mm Tc=0.0 min C=1.00
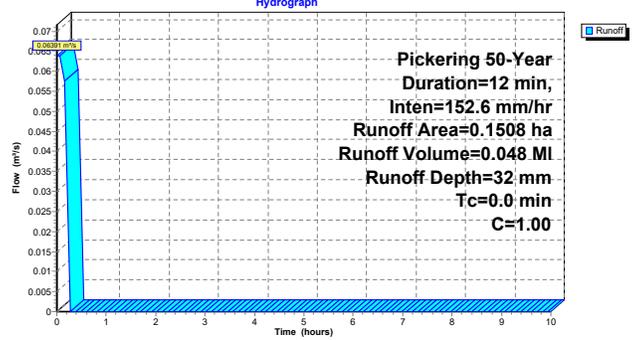
Summary for Subcatchment 204: 204

Runoff   =   0.24030 m³/s @   0.17 hrs, Volume=   0.173 Ml, Depth=   29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.5968	0.95	
0.5968		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 204: 204

Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr Runoff Area=0.5968 ha Runoff Volume=0.173 Ml Runoff Depth=29 mm Tc=10.0 min C=0.95

Summary for Subcatchment 205: 205

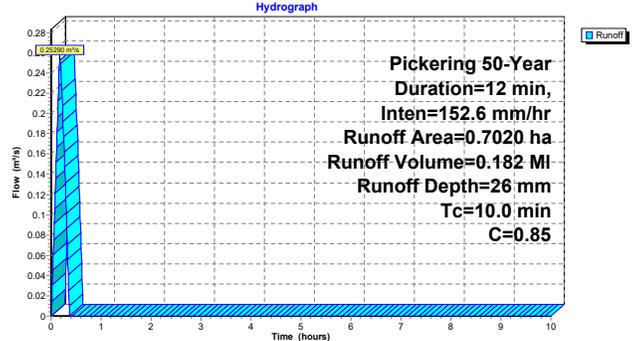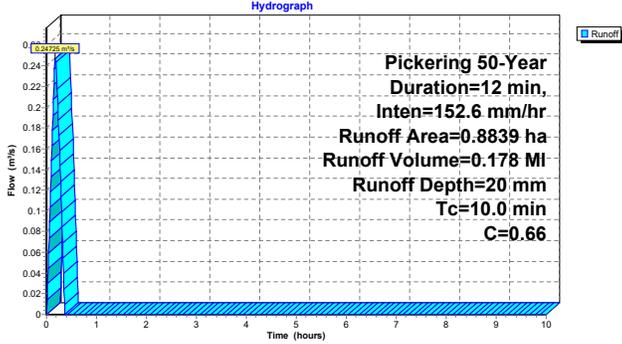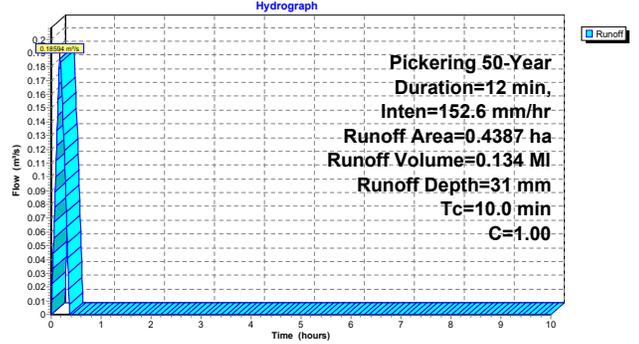Runoff   =   0.25290 m³/s @   0.17 hrs, Volume=   0.182 Ml, Depth=   26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.7020	0.85	
0.7020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 205: 205

Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr Runoff Area=0.7020 ha Runoff Volume=0.182 Ml Runoff Depth=26 mm Tc=10.0 min C=0.85
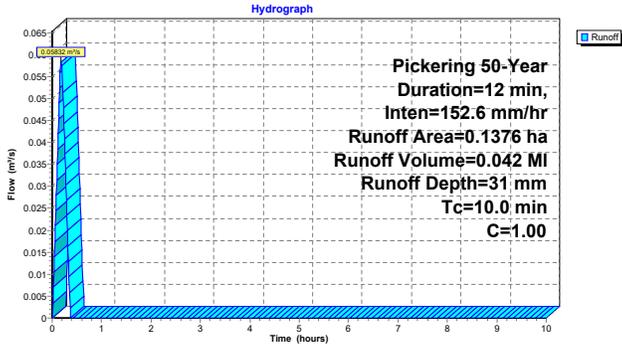
Summary for Subcatchment 206: 206

Runoff　=　0.24725 m³/s @　0.17 hrs, Volume=　　0.178 Ml, Depth=　20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.8839	0.66	
0.8839		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 206: 206

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.8839 ha
Runoff Volume=0.178 Ml
Runoff Depth=20 mm
Tc=10.0 min
C=0.66

Summary for Subcatchment 207: 207

Runoff　=　0.18594 m³/s @　0.17 hrs, Volume=　　0.134 Ml, Depth=　31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.4387	1.00	
0.4387		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 207: 207

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.4387 ha
Runoff Volume=0.134 Ml
Runoff Depth=31 mm
Tc=10.0 min
C=1.00

Summary for Subcatchment 208: 208

Runoff　=　0.05832 m³/s @　0.17 hrs, Volume=　　0.042 Ml, Depth=　31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.1376	1.00	
0.1376		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 208: 208

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.1376 ha
Runoff Volume=0.042 Ml
Runoff Depth=31 mm
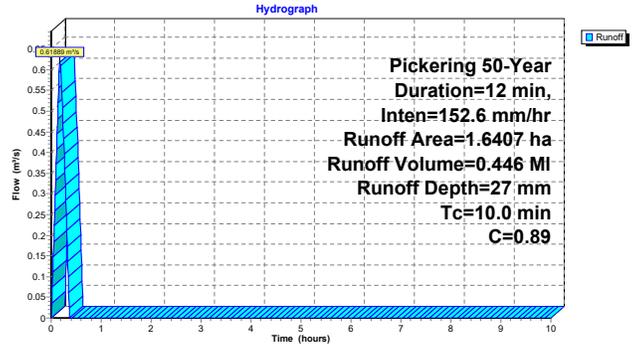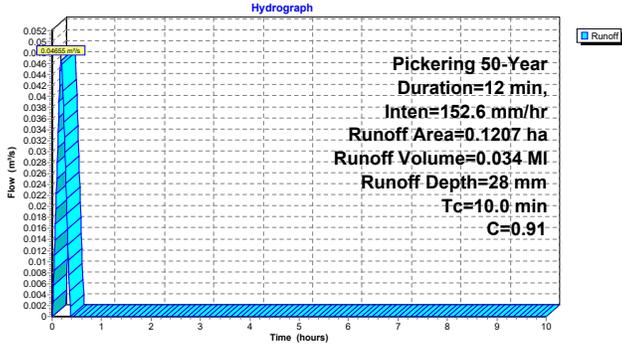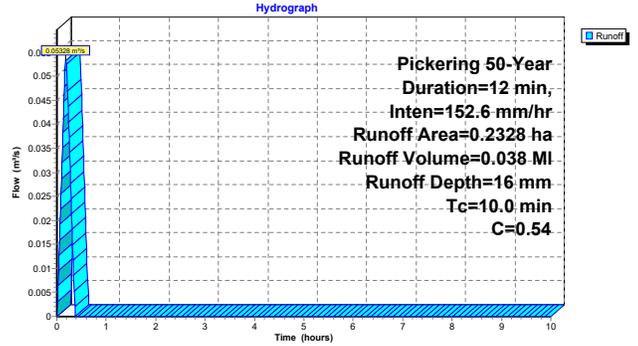Tc=10.0 min
C=1.00

Summary for Subcatchment 209: 209

Runoff　=　0.61889 m³/s @　0.17 hrs, Volume=　　0.446 Ml, Depth=　27 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
1.6407	0.89	
1.6407		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 209: 209

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=1.6407 ha
Runoff Volume=0.446 Ml
Runoff Depth=27 mm
Tc=10.0 min
C=0.89

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Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr
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Page 17
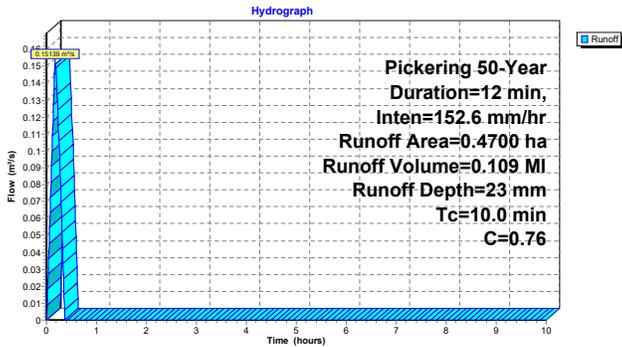
Summary for Subcatchment 210: 210

Runoff   =   0.04655 m³/s @   0.17 hrs, Volume=   0.034 Ml, Depth=   28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.1207	0.91	
0.1207		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 210: 210

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.1207 ha
Runoff Volume=0.034 Ml
Runoff Depth=28 mm
Tc=10.0 min
C=0.91

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HydroCAD® 10.00-21 s/n 10696 © 2018 HydroCAD Software Solutions LLC

Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr
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Summary for Subcatchment 211: 211

Runoff   =   0.05328 m³/s @   0.17 hrs, Volume=   0.038 Ml, Depth=   16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.2328	0.54	
0.2328		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 211: 211

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.2328 ha
Runoff Volume=0.038 Ml
Runoff Depth=16 mm
Tc=10.0 min
C=0.54

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Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr
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Summary for Subcatchment 212: 212

Runoff   =   0.15139 m³/s @   0.17 hrs, Volume=   0.109 Ml, Depth=   23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr

Area (ha)	C	Description
0.4700	0.76	
0.4700		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 212: 212

Pickering 50-Year
Duration=12 min,
Inten=152.6 mm/hr
Runoff Area=0.4700 ha
Runoff Volume=0.109 Ml
Runoff Depth=23 mm
Tc=10.0 min
C=0.76

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Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr
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Summary for Pond P1: P1

Inflow Area =	1.1315 ha, 17.37% Impervious, Inflow Depth >	28 mm	for 50-Year event
Inflow =	0.09596 m³/s @ 0.20 hrs, Volume=	0.319 Ml	
Outflow =	0.04967 m³/s @ 0.29 hrs, Volume=	0.318 Ml,	Atten= 48%, Lag= 5.8 min
Primary =	0.04967 m³/s @ 0.29 hrs, Volume=	0.318 Ml	

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.674 m @ 0.29 hrs Surf.Area= 54.1 m² Storage= 33.0 m³

Plug-Flow detention time= 5.3 min calculated for 0.318 Ml (100% of inflow)
Center-of-Mass det. time= 4.4 min (193.6 - 189.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.04966 m³/s @ 0.29 hrs HW=0.674 m   (Free Discharge)
↖**1=Orifice/Grate** (Orifice Controls 0.04966 m³/s @ 2.81 m/s)

Pond P1: P1

Inflow Area=1.1315 ha
Peak Elev=0.674 m
Storage=33.0 m³
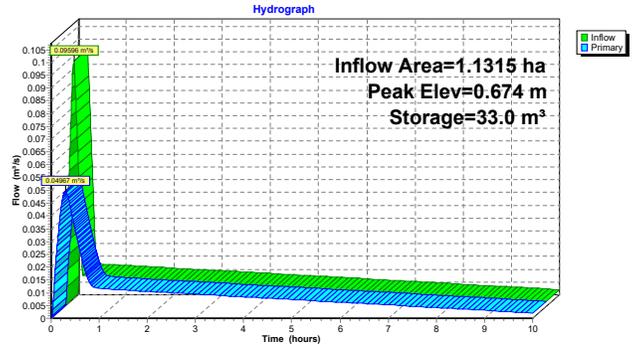
Summary for Pond P3: P3

Inflow Area =   2.1754 ha, 27.10% Impervious, Inflow Depth >   25 mm   for 50-Year event
Inflow   =   0.28196 m³/s @   0.20 hrs, Volume=   0.539 Ml
Outflow   =   0.08244 m³/s @   0.33 hrs, Volume=   0.539 Ml, Atten= 71%, Lag= 7.8 min
Primary   =   0.08244 m³/s @   0.33 hrs, Volume=   0.539 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.622 m @ 0.33 hrs Surf.Area= 287.8 m² Storage= 142.0 m³

Plug-Flow detention time= 20.3 min calculated for 0.537 Ml (100% of inflow)
Center-of-Mass det. time= 18.7 min (104.2 - 85.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	271.4 m³	**1,200 mm Round Pipe Storage** L= 240.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.08244 m³/s @ 0.33 hrs HW=0.622 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.08244 m³/s @ 2.62 m/s)

Pond P3: P3
Hydrograph

Inflow Area=2.1754 ha
Peak Elev=0.622 m
Storage=142.0 m³
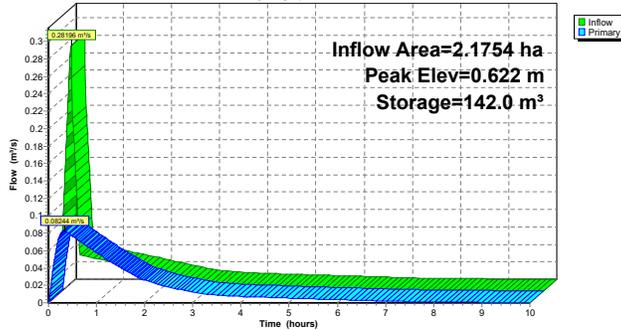
Summary for Pond P4: P4

Inflow Area =   1.8659 ha, 49.89% Impervious, Inflow Depth >   29 mm   for 50-Year event
Inflow   =   0.11895 m³/s @   0.20 hrs, Volume=   0.533 Ml
Outflow   =   0.08619 m³/s @   0.32 hrs, Volume=   0.532 Ml, Atten= 28%, Lag= 7.4 min
Primary   =   0.08619 m³/s @   0.32 hrs, Volume=   0.532 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.671 m @ 0.32 hrs Surf.Area= 54.2 m² Storage= 32.9 m³

Plug-Flow detention time= 3.8 min calculated for 0.532 Ml (100% of inflow)
Center-of-Mass det. time= 3.3 min (150.6 - 147.2)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.08617 m³/s @ 0.32 hrs HW=10.670 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.08617 m³/s @ 2.74 m/s)

Pond P4: P4
Hydrograph
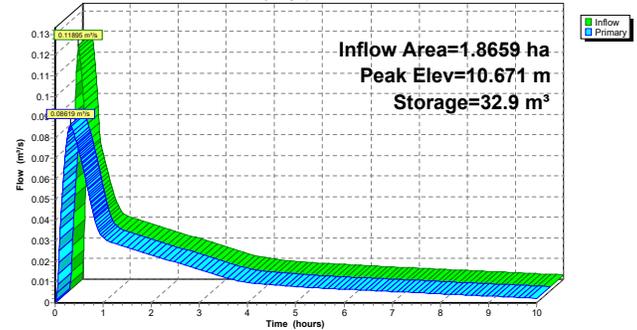
Inflow Area=1.8659 ha
Peak Elev=10.671 m
Storage=32.9 m³

Summary for Pond S1: S1

Inflow Area =   0.9350 ha, 0.00% Impervious, Inflow Depth =   29 mm   for 50-Year event
Inflow   =   0.36458 m³/s @   0.00 hrs, Volume=   0.276 Ml
Outflow   =   0.01232 m³/s @   0.21 hrs, Volume=   0.259 Ml, Atten= 97%, Lag= 12.6 min
Primary   =   0.01232 m³/s @   0.21 hrs, Volume=   0.259 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.036 m @ 0.21 hrs Surf.Area= 260.0 m² Storage= 269.4 m³

Plug-Flow detention time= 230.4 min calculated for 0.252 Ml (91% of inflow)
Center-of-Mass det. time= 224.4 min (230.4 - 6.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	520.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	260.0	0.0	0.0
12.000	260.0	520.0	520.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01232 m³/s @ 0.21 hrs HW=11.036 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01232 m³/s @ 2.79 m/s)

Pond S1: S1
Hydrograph
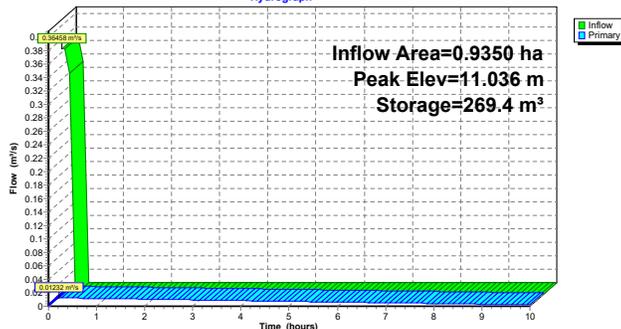
Inflow Area=0.9350 ha
Peak Elev=11.036 m
Storage=269.4 m³

Summary for Pond S2: S2

Inflow Area =   1.1169 ha, 0.00% Impervious, Inflow Depth =   26 mm   for 50-Year event
Inflow   =   0.40237 m³/s @   0.17 hrs, Volume=   0.290 Ml
Outflow   =   0.05090 m³/s @   0.35 hrs, Volume=   0.289 Ml, Atten= 87%, Lag= 10.5 min
Primary   =   0.05090 m³/s @   0.35 hrs, Volume=   0.289 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 1.140 m @ 0.35 hrs Surf.Area= 220.0 m² Storage= 250.9 m³

Plug-Flow detention time= 63.1 min calculated for 0.289 Ml (100% of inflow)
Center-of-Mass det. time= 63.5 min (74.5 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	440.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	220.0	0.0	0.0
2.000	220.0	440.0	440.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.05089 m³/s @ 0.35 hrs HW=1.140 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05089 m³/s @ 2.88 m/s)

Pond S2: S2
Hydrograph
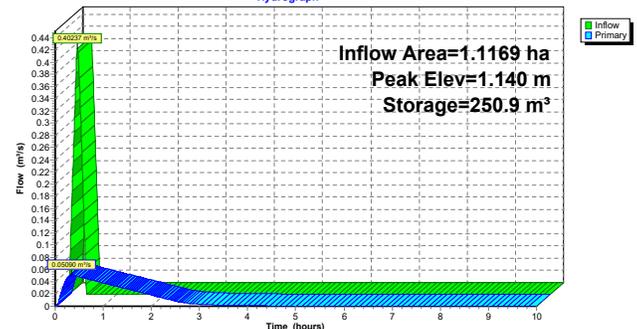
Inflow Area=1.1169 ha
Peak Elev=1.140 m
Storage=250.9 m³

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Summary for Pond S3: S3

Inflow Area =   0.5968 ha,100.00% Impervious, Inflow Depth =   29 mm   for 50-Year event
Inflow   =   0.24030 m³/s @   0.17 hrs, Volume=   0.173 Ml
Outflow   =   0.02256 m³/s @   0.35 hrs, Volume=   0.173 Ml, Atten= 91%, Lag= 10.9 min
Primary   =   0.02256 m³/s @   0.35 hrs, Volume=   0.173 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.110 m @ 0.35 hrs Surf.Area= 140.0 m² Storage= 155.4 m³

Plug-Flow detention time= 83.5 min calculated for 0.172 Ml (100% of inflow)
Center-of-Mass det. time= 84.0 min (95.0 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	140.0	0.0	0.0
12.000	140.0	280.0	280.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.02256 m³/s @ 0.35 hrs HW=11.110 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02256 m³/s @ 2.87 m/s)

Pond S3: S3
Hydrograph
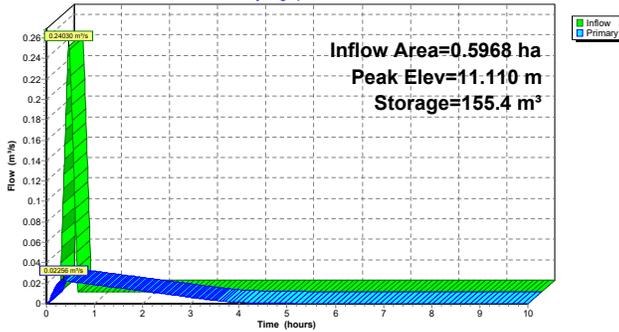
Inflow Area=0.5968 ha
Peak Elev=11.110 m
Storage=155.4 m³

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Summary for Pond S4: S4

Inflow Area =   0.7020 ha,   0.00% Impervious, Inflow Depth =   26 mm   for 50-Year event
Inflow   =   0.25290 m³/s @   0.17 hrs, Volume=   0.182 Ml
Outflow   =   0.01218 m³/s @   0.36 hrs, Volume=   0.179 Ml, Atten= 95%, Lag= 11.4 min
Primary   =   0.01218 m³/s @   0.36 hrs, Volume=   0.179 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.014 m @ 0.36 hrs Surf.Area= 170.0 m² Storage= 172.4 m³

Plug-Flow detention time= 160.2 min calculated for 0.179 Ml (98% of inflow)
Center-of-Mass det. time= 160.5 min (171.5 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	340.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	170.0	0.0	0.0
12.000	170.0	340.0	340.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01218 m³/s @ 0.36 hrs HW=11.014 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01218 m³/s @ 2.76 m/s)

Pond S4: S4
Hydrograph

Inflow Area=0.7020 ha
Peak Elev=11.014 m
Storage=172.4 m³

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Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr
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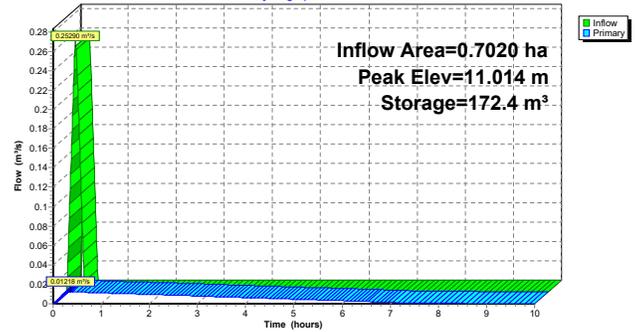
Summary for Pond S5: S5

Inflow Area =   0.8839 ha,   0.00% Impervious, Inflow Depth =   20 mm   for 50-Year event
Inflow   =   0.24725 m³/s @   0.17 hrs, Volume=   0.178 Ml
Outflow   =   0.02935 m³/s @   0.35 hrs, Volume=   0.178 Ml, Atten= 88%, Lag= 10.6 min
Primary   =   0.02935 m³/s @   0.35 hrs, Volume=   0.178 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.108 m @ 0.35 hrs Surf.Area= 140.0 m² Storage= 155.2 m³

Plug-Flow detention time= 65.5 min calculated for 0.178 Ml (100% of inflow)
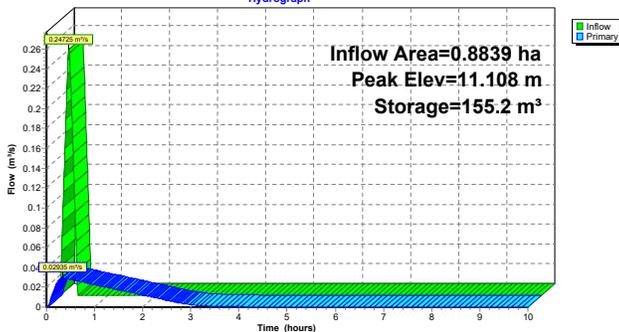Center-of-Mass det. time= 65.5 min (76.5 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**1.00 mW x 140.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.02934 m³/s @ 0.35 hrs HW=11.108 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02934 m³/s @ 3.74 m/s)

Pond S5: S5
Hydrograph

Inflow Area=0.8839 ha
Peak Elev=11.108 m
Storage=155.2 m³

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Summary for Pond S6: S6

Inflow Area =   1.7614 ha,   0.00% Impervious, Inflow Depth =   27 mm   for 50-Year event
Inflow   =   0.66545 m³/s @   0.17 hrs, Volume=   0.479 Ml
Outflow   =   0.06962 m³/s @   0.35 hrs, Volume=   0.477 Ml, Atten= 90%, Lag= 10.8 min
Primary   =   0.06962 m³/s @   0.35 hrs, Volume=   0.477 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 1.252 m @ 0.35 hrs Surf.Area= 340.0 m² Storage= 425.6 m³

Plug-Flow detention time= 76.5 min calculated for 0.477 Ml (100% of inflow)
Center-of-Mass det. time= 76.4 min (87.4 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	680.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	340.0	0.0	0.0
2.000	340.0	680.0	680.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.06962 m³/s @ 0.35 hrs HW=1.251 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06962 m³/s @ 3.94 m/s)

Pond S6: S6
Hydrograph

Inflow Area=1.7614 ha
Peak Elev=1.252 m
Storage=425.6 m³

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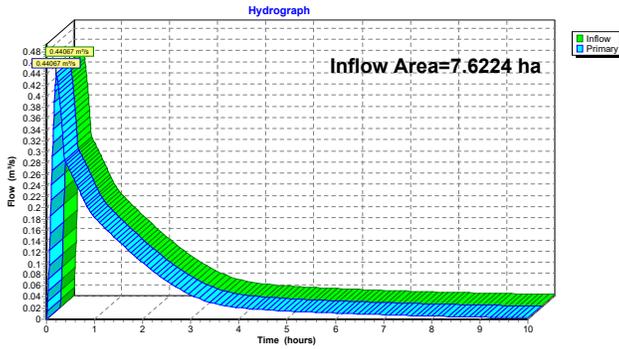*Pickering 50-Year Duration=12 min, Inten=152.6 mm/hr*
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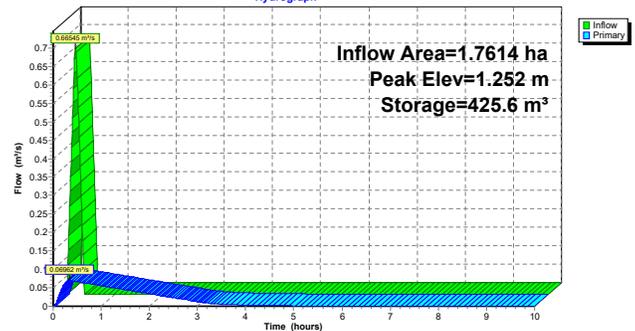
Summary for Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area = 7.6224 ha, 19.95% Impervious, Inflow Depth > 26 mm for 50-Year event
Inflow = 0.44067 m³/s @ 0.20 hrs, Volume= 1.984 Ml
Primary = 0.44067 m³/s @ 0.20 hrs, Volume= 1.984 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area=7.6224 ha

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Summary for Link PH1: PH1 - 65.4 L/s

Inflow Area = 1.1315 ha, 17.37% Impervious, Inflow Depth > 28 mm for 50-Year event
Inflow = 0.04967 m³/s @ 0.29 hrs, Volume= 0.318 Ml
Primary = 0.04967 m³/s @ 0.29 hrs, Volume= 0.318 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1 - 65.4 L/s

Inflow Area=1.1315 ha

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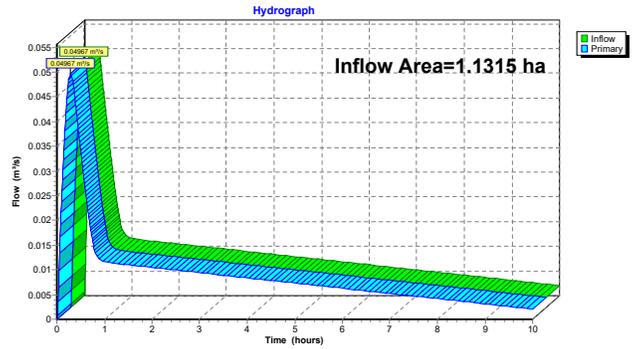
Summary for Link PH2A: PH2A - 64.5 L/s

Inflow Area = 1.1169 ha, 0.00% Impervious, Inflow Depth > 26 mm for 50-Year event
Inflow = 0.05090 m³/s @ 0.35 hrs, Volume= 0.289 Ml
Primary = 0.05090 m³/s @ 0.35 hrs, Volume= 0.289 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2A: PH2A - 64.5 L/s

Inflow Area=1.1169 ha

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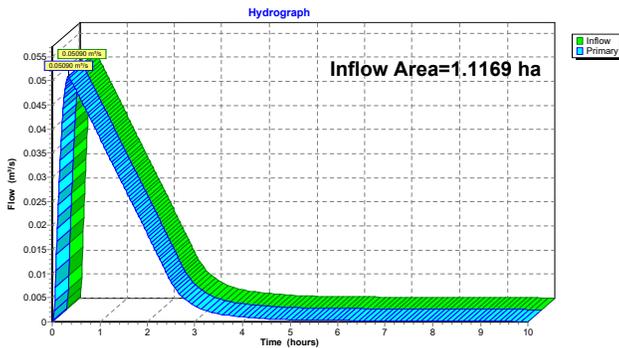
Summary for Link PH2B: PH2B - 8.7 L/s

Inflow Area = 0.1508 ha,100.00% Impervious, Inflow Depth = 32 mm for 50-Year event
Inflow = 0.06391 m³/s @ 0.00 hrs, Volume= 0.048 Ml
Primary = 0.06391 m³/s @ 0.00 hrs, Volume= 0.048 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
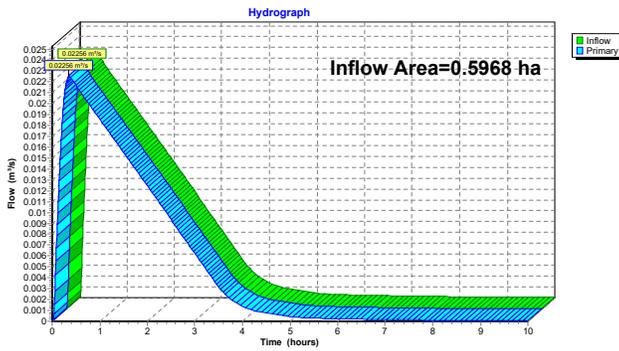
Link PH2B: PH2B - 8.7 L/s

Inflow Area=0.1508 ha
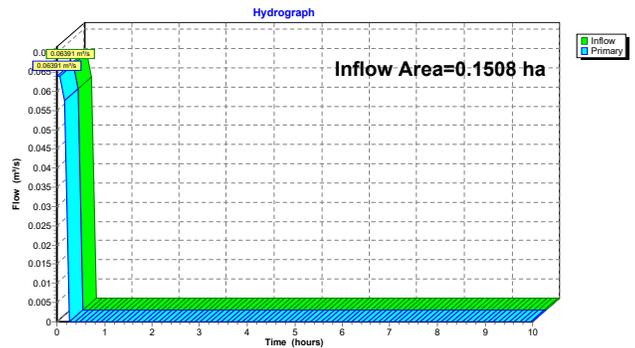
Summary for Link PH3: PH3 - 34.5 L/s

Inflow Area =   0.5968 ha,100.00% Impervious, Inflow Depth >   29 mm for 50-Year event
Inflow   =   0.02256 m³/s @   0.35 hrs, Volume=   0.173 Ml
Primary =   0.02256 m³/s @   0.35 hrs, Volume=   0.173 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
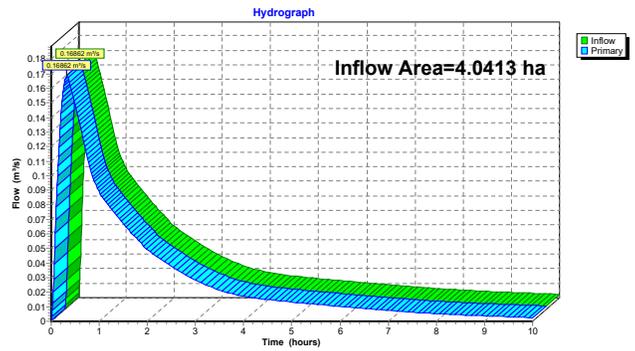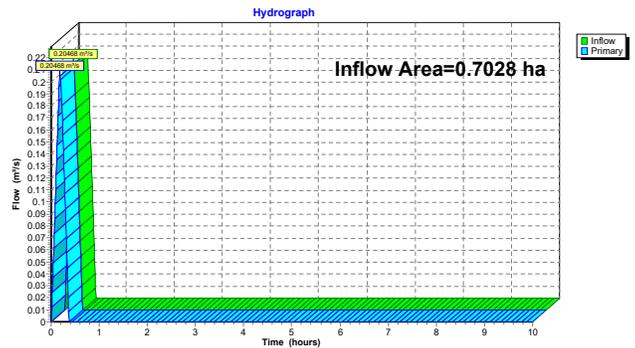
Link PH3: PH3 - 34.5 L/s

Inflow Area=0.5968 ha

Summary for Link PH4: PH4

Inflow Area =   4.0413 ha, 37.62% Impervious, Inflow Depth >   27 mm for 50-Year event
Inflow   =   0.16862 m³/s @   0.33 hrs, Volume=   1.071 Ml
Primary =   0.16862 m³/s @   0.33 hrs, Volume=   1.071 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

Inflow Area=4.0413 ha

Summary for Link PH5: PH5 - 101.8 L/s

Inflow Area =   1.7614 ha, 0.00% Impervious, Inflow Depth >   27 mm for 50-Year event
Inflow   =   0.06962 m³/s @   0.35 hrs, Volume=   0.477 Ml
Primary =   0.06962 m³/s @   0.35 hrs, Volume=   0.477 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5: PH5 - 101.8 L/s

Inflow Area=1.7614 ha
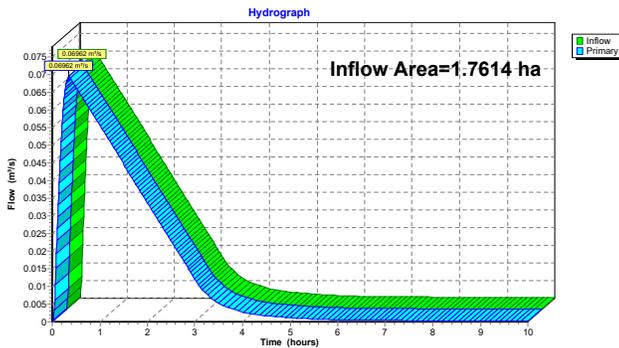
Summary for Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area =   0.7028 ha, 0.00% Impervious, Inflow Depth =   21 mm for 50-Year event
Inflow   =   0.20468 m³/s @   0.17 hrs, Volume=   0.147 Ml
Primary =   0.20468 m³/s @   0.17 hrs, Volume=   0.147 Ml, Atten= 0%, Lag= 0.0 min
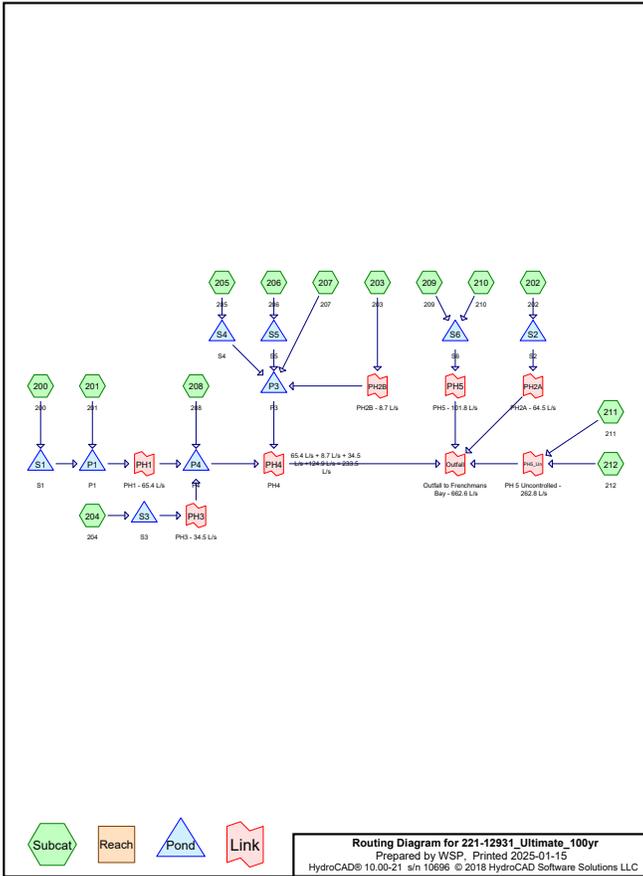
Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area=0.7028 ha

Routing Diagram for 221-12931_Ultimate_100yr
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Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.9350	0.96	(200)
0.9236	1.00	(201, 203, 207, 208)
1.1169	0.88	(202)
0.5968	0.99	(204)
0.7020	0.89	(205)
0.8839	0.69	(206)
1.6407	0.92	(209)
0.1207	0.95	(210)
0.2328	0.57	(211)
0.4700	0.80	(212)
7.6224	**0.89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.6224	Other	200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
7.6224		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	7.6224	7.6224		200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212
0.0000	**0.0000**	**0.0000**	**0.0000**	**7.6224**	**7.6224**	**TOTAL AREA**	

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Time span=0.00-10.00 hrs, dt=0.01 hrs, 1001 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment200: 200	Runoff Area=0.9350 ha 100.00% Impervious Runoff Depth=34 mm Tc=0.0 min C=0.96 Runoff=0.42169 m³/s 0.319 Ml
Subcatchment201: 201	Runoff Area=0.1965 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.09232 m³/s 0.066 Ml
Subcatchment202: 202	Runoff Area=1.1169 ha 0.00% Impervious Runoff Depth=30 mm Tc=10.0 min C=0.88 Runoff=0.46175 m³/s 0.332 Ml
Subcatchment203: 203	Runoff Area=0.1508 ha 100.00% Impervious Runoff Depth=36 mm Tc=0.0 min C=1.00 Runoff=0.07085 m³/s 0.054 Ml
Subcatchment204: 204	Runoff Area=0.5968 ha 100.00% Impervious Runoff Depth=33 mm Tc=10.0 min C=0.99 Runoff=0.27757 m³/s 0.200 Ml
Subcatchment205: 205	Runoff Area=0.7020 ha 0.00% Impervious Runoff Depth=30 mm Tc=10.0 min C=0.89 Runoff=0.29352 m³/s 0.211 Ml
Subcatchment206: 206	Runoff Area=0.8839 ha 0.00% Impervious Runoff Depth=23 mm Tc=10.0 min C=0.69 Runoff=0.28653 m³/s 0.206 Ml
Subcatchment207: 207	Runoff Area=0.4387 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.20610 m³/s 0.148 Ml
Subcatchment208: 208	Runoff Area=0.1376 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.06464 m³/s 0.047 Ml
Subcatchment209: 209	Runoff Area=1.6407 ha 0.00% Impervious Runoff Depth=31 mm Tc=10.0 min C=0.92 Runoff=0.70913 m³/s 0.511 Ml
Subcatchment210: 210	Runoff Area=0.1207 ha 100.00% Impervious Runoff Depth=32 mm Tc=10.0 min C=0.95 Runoff=0.05387 m³/s 0.039 Ml
Subcatchment211: 211	Runoff Area=0.2328 ha 0.00% Impervious Runoff Depth=19 mm Tc=10.0 min C=0.57 Runoff=0.06234 m³/s 0.045 Ml
Subcatchment212: 212	Runoff Area=0.4700 ha 0.00% Impervious Runoff Depth=27 mm Tc=10.0 min C=0.80 Runoff=0.17664 m³/s 0.127 Ml
Pond P1: P1	Peak Elev=0.765 m Storage=37.7 m³ Inflow=0.10601 m³/s 0.360 Ml Outflow=0.05332 m³/s 0.359 Ml
Pond P3: P3	Peak Elev=0.685 m Storage=160.1 m³ Inflow=0.31175 m³/s 0.616 Ml Outflow=0.08726 m³/s 0.615 Ml
Pond P4: P4	Peak Elev=10.754 m Storage=37.2 m³ Inflow=0.12931 m³/s 0.605 Ml Outflow=0.09227 m³/s 0.604 Ml

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Pond S1: S1	Peak Elev=11.200 m Storage=312.0 m³ Inflow=0.42169 m³/s 0.319 Ml Outflow=0.01329 m³/s 0.294 Ml
Pond S2: S2	Peak Elev=1.319 m Storage=290.1 m³ Inflow=0.46175 m³/s 0.332 Ml Outflow=0.05500 m³/s 0.332 Ml
Pond S3: S3	Peak Elev=11.290 m Storage=180.6 m³ Inflow=0.27757 m³/s 0.200 Ml Outflow=0.02441 m³/s 0.199 Ml
Pond S4: S4	Peak Elev=11.181 m Storage=200.8 m³ Inflow=0.29352 m³/s 0.211 Ml Outflow=0.01318 m³/s 0.208 Ml
Pond S5: S5	Peak Elev=11.295 m Storage=181.3 m³ Inflow=0.28653 m³/s 0.206 Ml Outflow=0.03183 m³/s 0.206 Ml
Pond S6: S6	Peak Elev=1.444 m Storage=491.1 m³ Inflow=0.76300 m³/s 0.549 Ml Outflow=0.07511 m³/s 0.547 Ml
Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s	Inflow=0.49027 m³/s 2.270 Ml Primary=0.49027 m³/s 2.270 Ml
Link PH1: PH1 - 65.4 L/s	Inflow=0.05332 m³/s 0.359 Ml Primary=0.05332 m³/s 0.359 Ml
Link PH2A: PH2A - 64.5 L/s	Inflow=0.05500 m³/s 0.332 Ml Primary=0.05500 m³/s 0.332 Ml
Link PH2B: PH2B - 8.7 L/s	Inflow=0.07085 m³/s 0.054 Ml Primary=0.07085 m³/s 0.054 Ml
Link PH3: PH3 - 34.5 L/s	Inflow=0.02441 m³/s 0.199 Ml Primary=0.02441 m³/s 0.199 Ml
Link PH4: PH4	Inflow=0.17952 m³/s 1.220 Ml Primary=0.17952 m³/s 1.220 Ml
Link PH5: PH5 - 101.8 L/s	Inflow=0.07511 m³/s 0.547 Ml Primary=0.07511 m³/s 0.547 Ml
Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s	Inflow=0.23898 m³/s 0.172 Ml Primary=0.23898 m³/s 0.172 Ml

Total Runoff Area = 7.6224 ha   Runoff Volume = 2.305 Ml   Average Runoff Depth = 30 mm
66.20% Pervious = 5.0463 ha   33.80% Impervious = 2.5761 ha

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Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr
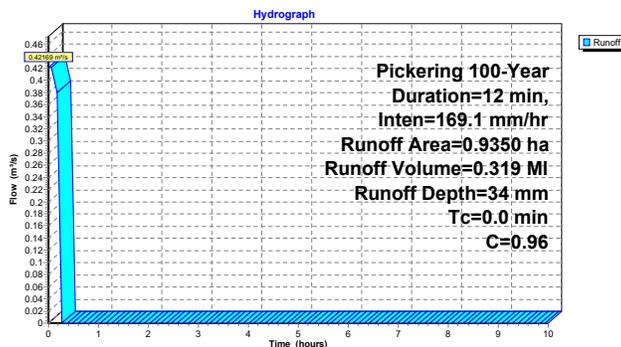Printed 2025-01-15
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Summary for Subcatchment 200: 200

Runoff   =   0.42169 m³/s @   0.00 hrs, Volume=   0.319 Ml, Depth=   34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.9350	0.96	
0.9350		100.00% Impervious Area

Subcatchment 200: 200

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.9350 ha
Runoff Volume=0.319 Ml
Runoff Depth=34 mm
Tc=0.0 min
C=0.96

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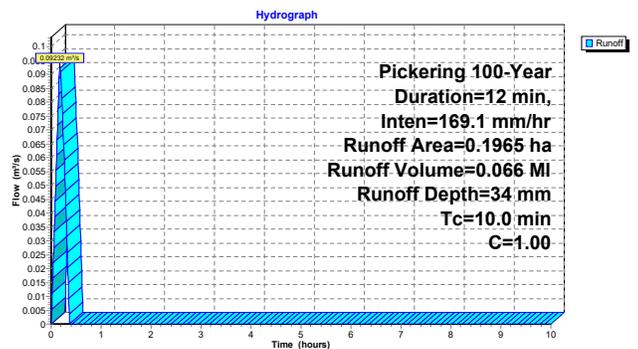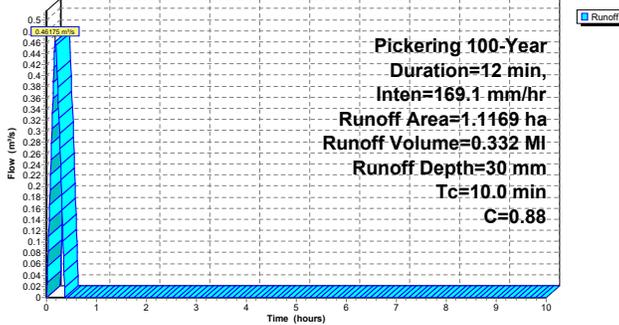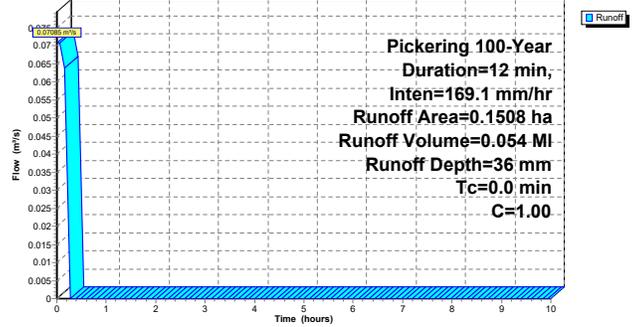**Summary for Subcatchment 201: 201**

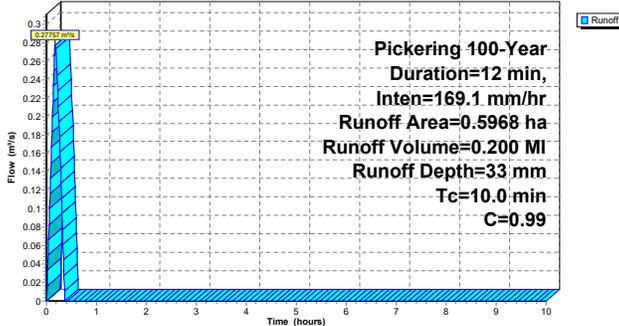Runoff   =   0.09232 m³/s @   0.17 hrs, Volume=   0.066 Ml, Depth=   34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.1965	1.00	
0.1965		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 201: 201

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.1965 ha
Runoff Volume=0.066 Ml
Runoff Depth=34 mm
Tc=10.0 min
C=1.00

Summary for Subcatchment 202: 202

Runoff   =   0.46175 m³/s @   0.17 hrs, Volume=   0.332 Ml, Depth=   30 mm
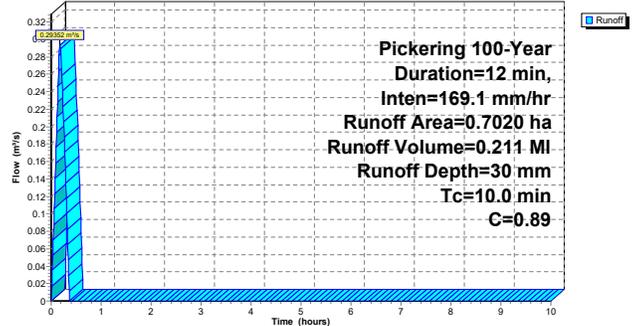
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
1.1169	0.88	
1.1169		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 202: 202

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=1.1169 ha
Runoff Volume=0.332 Ml
Runoff Depth=30 mm
Tc=10.0 min
C=0.88

Summary for Subcatchment 203: 203

Runoff   =   0.07085 m³/s @   0.00 hrs, Volume=   0.054 Ml, Depth=   36 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.1508	1.00	
0.1508		100.00% Impervious Area

Subcatchment 203: 203

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.1508 ha
Runoff Volume=0.054 Ml
Runoff Depth=36 mm
Tc=0.0 min
C=1.00

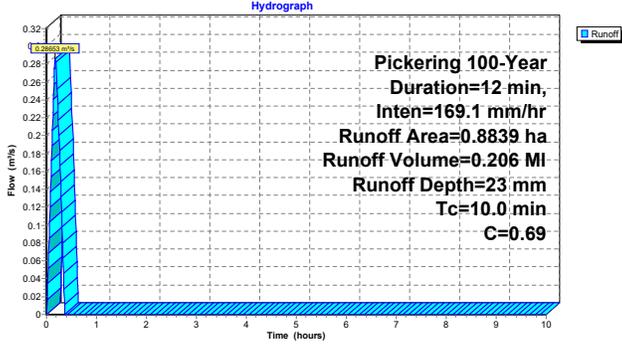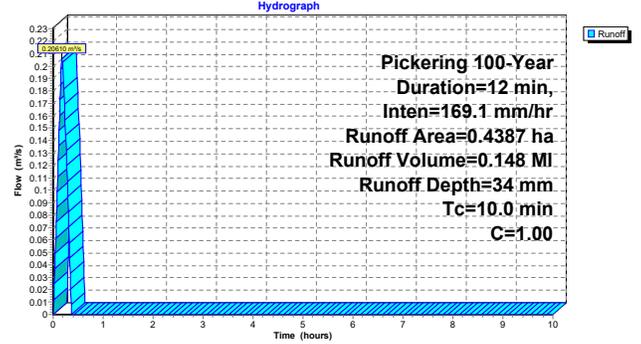### Summary for Subcatchment 204: 204

Runoff   =   0.27757 m³/s @   0.17 hrs, Volume=   0.200 Ml, Depth=   33 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.5968	0.99	
0.5968		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 204: 204

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.5968 ha
Runoff Volume=0.200 Ml
Runoff Depth=33 mm
Tc=10.0 min
C=0.99

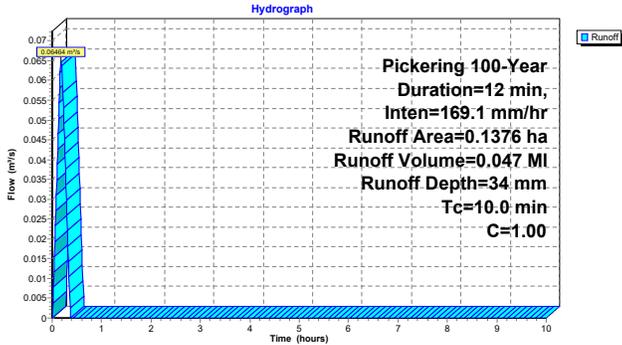### Summary for Subcatchment 205: 205

Runoff   =   0.29352 m³/s @   0.17 hrs, Volume=   0.211 Ml, Depth=   30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.7020	0.89	
0.7020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 205: 205

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.7020 ha
Runoff Volume=0.211 Ml
Runoff Depth=30 mm
Tc=10.0 min
C=0.89

Summary for Subcatchment 206: 206

Runoff   =   0.28653 m³/s @   0.17 hrs, Volume=   0.206 Ml, Depth=   23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.8839	0.69	
0.8839		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 206: 206

Hydrograph

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.8839 ha
Runoff Volume=0.206 Ml
Runoff Depth=23 mm
Tc=10.0 min
C=0.69

Summary for Subcatchment 207: 207

Runoff   =   0.20610 m³/s @   0.17 hrs, Volume=   0.148 Ml, Depth=   34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.4387	1.00	
0.4387		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 207: 207

Hydrograph

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.4387 ha
Runoff Volume=0.148 Ml
Runoff Depth=34 mm
Tc=10.0 min
C=1.00

Summary for Subcatchment 208: 208

Runoff   =   0.06464 m³/s @   0.17 hrs, Volume=   0.047 Ml, Depth=   34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.1376	1.00	
0.1376		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 208: 208

Hydrograph

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.1376 ha
Runoff Volume=0.047 Ml
Runoff Depth=34 mm
Tc=10.0 min
C=1.00

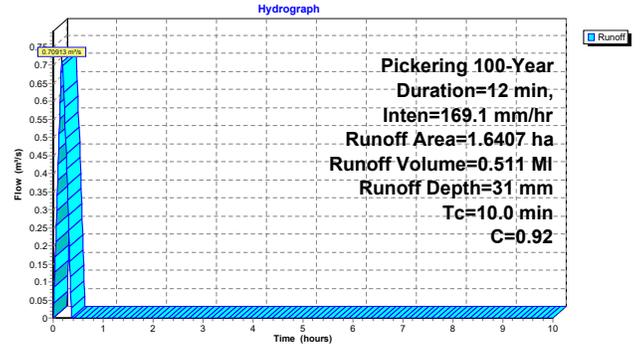### Summary for Subcatchment 209: 209

Runoff   =   0.70913 m³/s @   0.17 hrs, Volume=   0.511 Ml, Depth=   31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
1.6407	0.92	
1.6407		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 209: 209

Hydrograph

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=1.6407 ha
Runoff Volume=0.511 Ml
Runoff Depth=31 mm
Tc=10.0 min
C=0.92

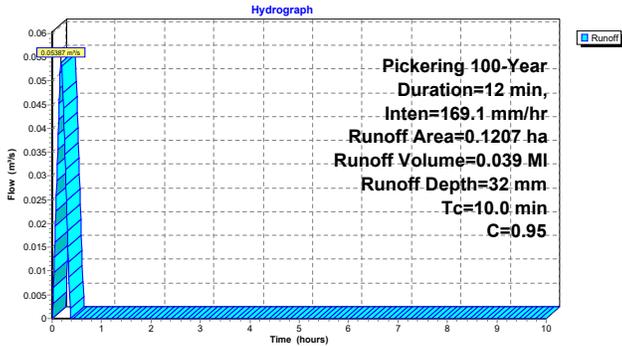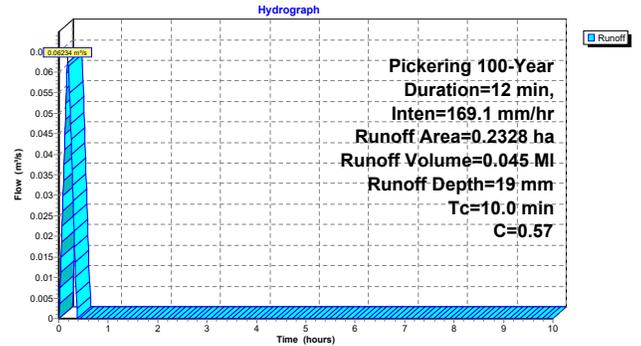### Summary for Subcatchment 210: 210

Runoff   =   0.05387 m³/s @   0.17 hrs, Volume=   0.039 Ml, Depth=   32 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.1207	0.95	
0.1207		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 210: 210

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.1207 ha
Runoff Volume=0.039 Ml
Runoff Depth=32 mm
Tc=10.0 min
C=0.95

Summary for Subcatchment 211: 211

Runoff   =   0.06234 m³/s @   0.17 hrs, Volume=   0.045 Ml, Depth=   19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.2328	0.57	
0.2328		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 211: 211

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.2328 ha
Runoff Volume=0.045 Ml
Runoff Depth=19 mm
Tc=10.0 min
C=0.57

Summary for Subcatchment 212: 212

Runoff   =   0.17664 m³/s @   0.17 hrs, Volume=   0.127 Ml, Depth=   27 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 100-Year Duration=12 min, Inten=169.1 mm/hr

Area (ha)	C	Description
0.4700	0.80	
0.4700		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 212: 212

Pickering 100-Year
Duration=12 min,
Inten=169.1 mm/hr
Runoff Area=0.4700 ha
Runoff Volume=0.127 Ml
Runoff Depth=27 mm
Tc=10.0 min
C=0.80
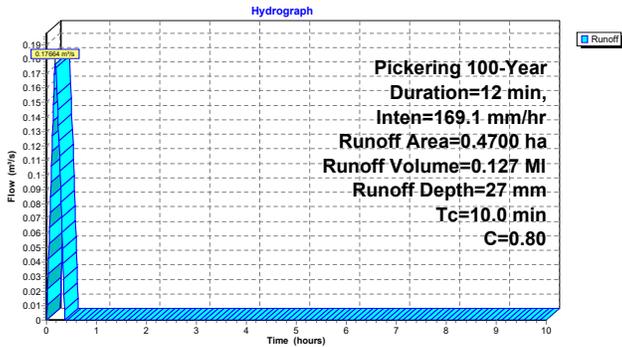
Summary for Pond P1: P1

Inflow Area =	1.1315 ha,100.00% Impervious, Inflow Depth >	32 mm	for 100-Year event
Inflow =	0.10601 m³/s @ 0.20 hrs, Volume=	0.360 Ml	
Outflow =	0.05332 m³/s @ 0.29 hrs, Volume=	0.359 Ml,	Atten= 50%, Lag= 5.9 min
Primary =	0.05332 m³/s @ 0.29 hrs, Volume=	0.359 Ml	

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.765 m @ 0.29 hrs Surf.Area= 48.1 m² Storage= 37.7 m³

Plug-Flow detention time= 5.3 min calculated for 0.359 Ml (100% of inflow)
Center-of-Mass det. time= 4.3 min (201.2 - 196.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.05331 m³/s @ 0.29 hrs HW=0.765 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05331 m³/s @ 3.02 m/s)

Pond P1: P1

Inflow Area=1.1315 ha
Peak Elev=0.765 m
Storage=37.7 m³
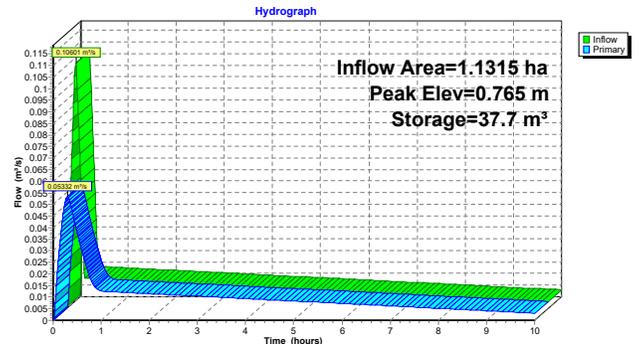
Summary for Pond P3: P3

Inflow Area =   2.1754 ha, 27.10% Impervious, Inflow Depth >   28 mm for 100-Year event
Inflow   =   0.31175 m³/s @   0.20 hrs, Volume=   0.616 Ml
Outflow   =   0.08726 m³/s @   0.33 hrs, Volume=   0.615 Ml, Atten= 72%, Lag= 7.9 min
Primary   =   0.08726 m³/s @   0.33 hrs, Volume=   0.615 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 0.685 m @ 0.33 hrs Surf.Area= 285.1 m² Storage= 160.1 m³

Plug-Flow detention time= 21.1 min calculated for 0.614 Ml (100% of inflow)
Center-of-Mass det. time= 19.4 min (111.1 - 91.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	271.4 m³	**1,200 mm Round Pipe Storage** L= 240.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.08725 m³/s @ 0.33 hrs HW=0.685 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.08725 m³/s @ 2.78 m/s)

Pond P3: P3

Inflow Area=2.1754 ha
Peak Elev=0.685 m
Storage=160.1 m³
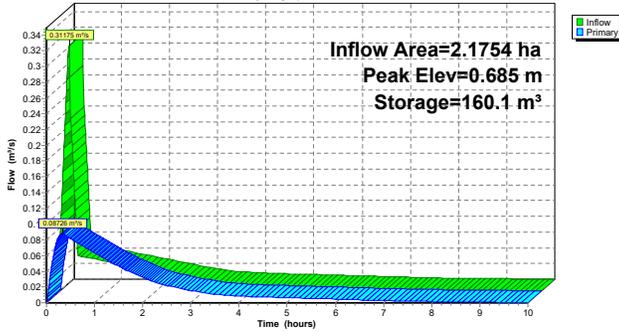
Summary for Pond P4: P4

Inflow Area =   1.8659 ha,100.00% Impervious, Inflow Depth >   32 mm for 100-Year event
Inflow   =   0.12931 m³/s @   0.20 hrs, Volume=   0.605 Ml
Outflow   =   0.09227 m³/s @   0.33 hrs, Volume=   0.604 Ml, Atten= 29%, Lag= 7.5 min
Primary   =   0.09227 m³/s @   0.33 hrs, Volume=   0.604 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 10.754 m @ 0.33 hrs Surf.Area= 49.0 m² Storage= 37.2 m³

Plug-Flow detention time= 3.9 min calculated for 0.604 Ml (100% of inflow)
Center-of-Mass det. time= 3.3 min (156.6 - 153.3)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	44.8 m³	**975 mm Round Pipe Storage** L= 60.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**200 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.09225 m³/s @ 0.33 hrs HW=10.754 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.09225 m³/s @ 2.94 m/s)

Pond P4: P4

Inflow Area=1.8659 ha
Peak Elev=10.754 m
Storage=37.2 m³
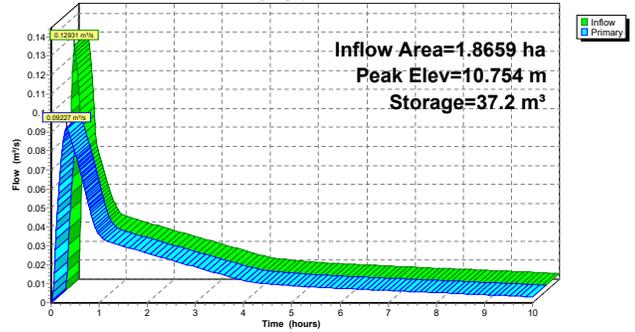
Summary for Pond S1: S1

Inflow Area =   0.9350 ha,100.00% Impervious, Inflow Depth =   34 mm for 100-Year event
Inflow   =   0.42169 m³/s @   0.00 hrs, Volume=   0.319 Ml
Outflow   =   0.01329 m³/s @   0.21 hrs, Volume=   0.294 Ml, Atten= 97%, Lag= 12.6 min
Primary   =   0.01329 m³/s @   0.21 hrs, Volume=   0.294 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.200 m @ 0.21 hrs Surf.Area= 260.0 m² Storage= 312.0 m³

Plug-Flow detention time= 239.7 min calculated for 0.286 Ml (90% of inflow)
Center-of-Mass det. time= 233.0 min (239.0 - 6.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	520.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	260.0	0.0	0.0
12.000	260.0	520.0	520.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01329 m³/s @ 0.21 hrs HW=11.200 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01329 m³/s @ 3.01 m/s)

Pond S1: S1
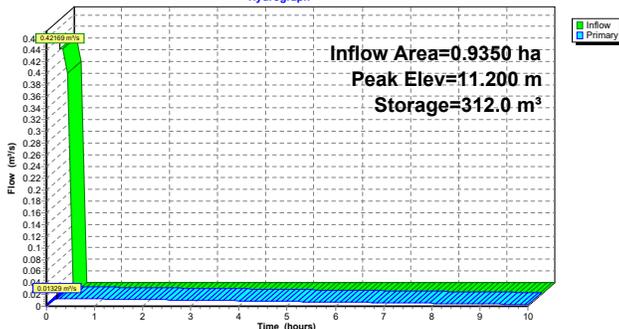
Inflow Area=0.9350 ha
Peak Elev=11.200 m
Storage=312.0 m³

Summary for Pond S2: S2

Inflow Area =   1.1169 ha, 0.00% Impervious, Inflow Depth =   30 mm for 100-Year event
Inflow   =   0.46175 m³/s @   0.17 hrs, Volume=   0.332 Ml
Outflow   =   0.05500 m³/s @   0.35 hrs, Volume=   0.332 Ml, Atten= 88%, Lag= 10.6 min
Primary   =   0.05500 m³/s @   0.35 hrs, Volume=   0.332 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 1.319 m @ 0.35 hrs Surf.Area= 220.0 m² Storage= 290.1 m³

Plug-Flow detention time= 66.6 min calculated for 0.332 Ml (100% of inflow)
Center-of-Mass det. time= 66.6 min (77.6 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	440.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	220.0	0.0	0.0
2.000	220.0	440.0	440.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.05498 m³/s @ 0.35 hrs HW=1.318 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05498 m³/s @ 3.11 m/s)

Pond S2: S2
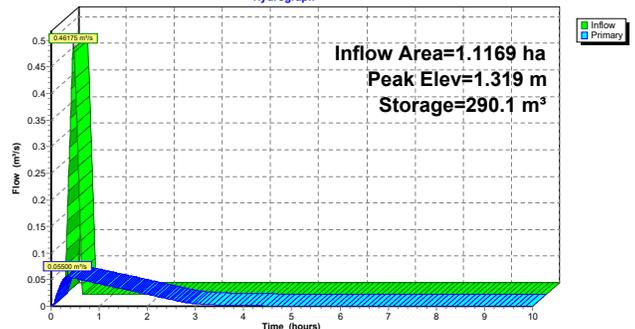
Inflow Area=1.1169 ha
Peak Elev=1.319 m
Storage=290.1 m³

Summary for Pond S3: S3

Inflow Area =   0.5968 ha,100.00% Impervious, Inflow Depth =   33 mm   for 100-Year event
Inflow   =   0.27757 m³/s @   0.17 hrs, Volume=   0.200 Ml
Outflow   =   0.02441 m³/s @   0.35 hrs, Volume=   0.199 Ml, Atten= 91%, Lag= 10.9 min
Primary   =   0.02441 m³/s @   0.35 hrs, Volume=   0.199 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.290 m @ 0.35 hrs   Surf.Area= 140.0 m²   Storage= 180.6 m³

Plug-Flow detention time= 89.0 min calculated for 0.199 Ml (100% of inflow)
Center-of-Mass det. time= 89.0 min (100.0 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	140.0	0.0	0.0
12.000	140.0	280.0	280.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.02441 m³/s @ 0.35 hrs HW=11.290 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.02441 m³/s @ 3.11 m/s)

Pond S3: S3
Hydrograph
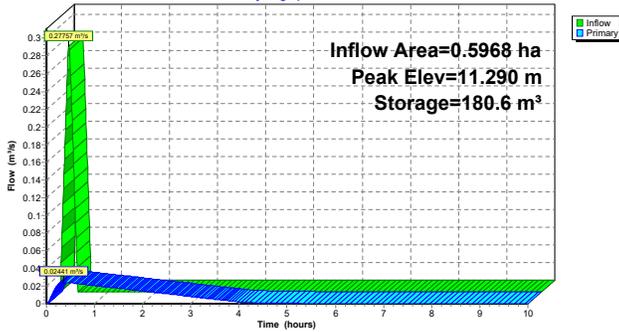
Inflow Area=0.5968 ha
Peak Elev=11.290 m
Storage=180.6 m³

Summary for Pond S4: S4

Inflow Area =   0.7020 ha, 0.00% Impervious, Inflow Depth =   30 mm   for 100-Year event
Inflow   =   0.29352 m³/s @   0.17 hrs, Volume=   0.211 Ml
Outflow   =   0.01318 m³/s @   0.36 hrs, Volume=   0.208 Ml, Atten= 96%, Lag= 11.4 min
Primary   =   0.01318 m³/s @   0.36 hrs, Volume=   0.208 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.181 m @ 0.36 hrs   Surf.Area= 170.0 m²   Storage= 200.8 m³

Plug-Flow detention time= 171.0 min calculated for 0.208 Ml (98% of inflow)
Center-of-Mass det. time= 171.2 min (182.2 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	340.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
10.000	170.0	0.0	0.0
12.000	170.0	340.0	340.0

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**75 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.01318 m³/s @ 0.36 hrs HW=11.181 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.01318 m³/s @ 2.98 m/s)

Pond S4: S4
Hydrograph

Inflow Area=0.7020 ha
Peak Elev=11.181 m
Storage=200.8 m³
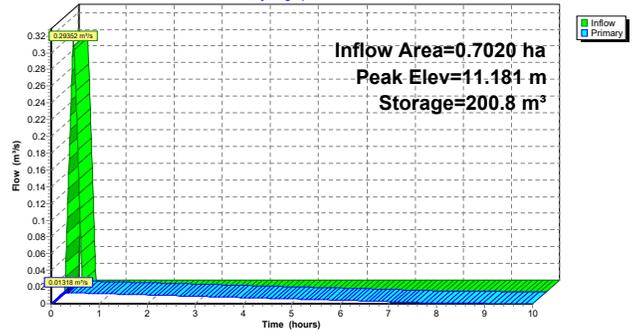
Summary for Pond S5: S5

Inflow Area =   0.8839 ha, 0.00% Impervious, Inflow Depth =   23 mm   for 100-Year event
Inflow   =   0.28653 m³/s @   0.17 hrs, Volume=   0.206 Ml
Outflow   =   0.03183 m³/s @   0.35 hrs, Volume=   0.206 Ml, Atten= 89%, Lag= 10.7 min
Primary   =   0.03183 m³/s @   0.35 hrs, Volume=   0.206 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 11.295 m @ 0.35 hrs   Surf.Area= 140.0 m²   Storage= 181.3 m³

Plug-Flow detention time= 69.5 min calculated for 0.206 Ml (100% of inflow)
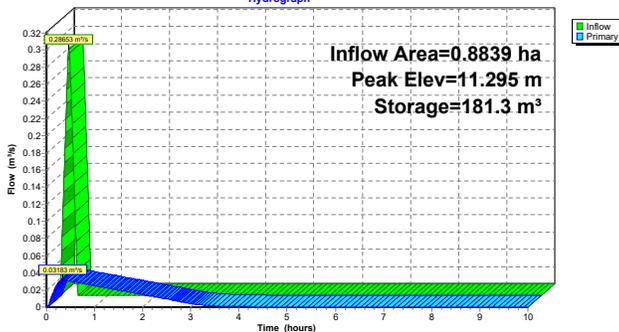Center-of-Mass det. time= 69.5 min (80.5 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	10.000 m	280.0 m³	**1.00 mW x 140.00 mL x 2.00 mH Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	10.000 m	**100 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.03183 m³/s @ 0.35 hrs HW=11.295 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.03183 m³/s @ 4.05 m/s)

Pond S5: S5
Hydrograph

Inflow Area=0.8839 ha
Peak Elev=11.295 m
Storage=181.3 m³

Summary for Pond S6: S6

Inflow Area =   1.7614 ha, 6.85% Impervious, Inflow Depth =   31 mm   for 100-Year event
Inflow   =   0.76300 m³/s @   0.17 hrs, Volume=   0.549 Ml
Outflow   =   0.07511 m³/s @   0.35 hrs, Volume=   0.547 Ml, Atten= 90%, Lag= 10.8 min
Primary   =   0.07511 m³/s @   0.35 hrs, Volume=   0.547 Ml

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Peak Elev= 1.444 m @ 0.35 hrs   Surf.Area= 340.0 m²   Storage= 491.1 m³

Plug-Flow detention time= 80.4 min calculated for 0.547 Ml (100% of inflow)
Center-of-Mass det. time= 80.3 min (91.4 - 11.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	680.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	340.0	0.0	0.0
2.000	340.0	680.0	680.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	**150 mm Vert. Orifice/Grate** C= 0.820

Primary OutFlow Max=0.07511 m³/s @ 0.35 hrs HW=1.444 m   (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.07511 m³/s @ 4.25 m/s)

Pond S6: S6
Hydrograph

Inflow Area=1.7614 ha
Peak Elev=1.444 m
Storage=491.1 m³
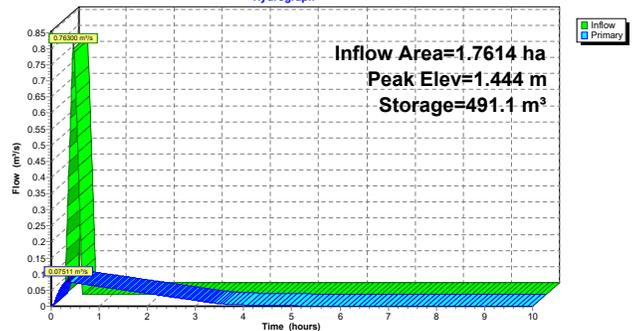
Summary for Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s

Inflow Area =   7.6224 ha, 33.80% Impervious, Inflow Depth >   30 mm   for 100-Year event
Inflow   =   0.49027 m³/s @   0.20 hrs, Volume=   2.270 Ml
Primary   =   0.49027 m³/s @   0.20 hrs, Volume=   2.270 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
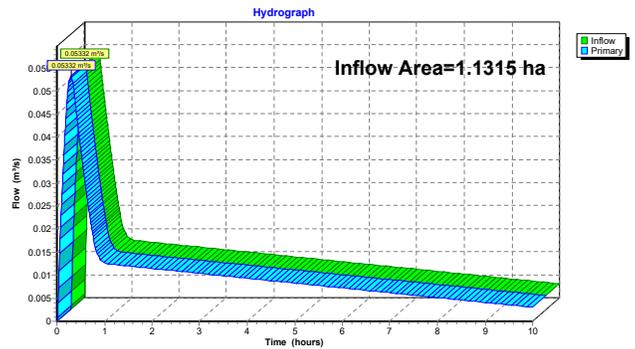
Link Outfall: Outfall to Frenchmans Bay - 662.6 L/s
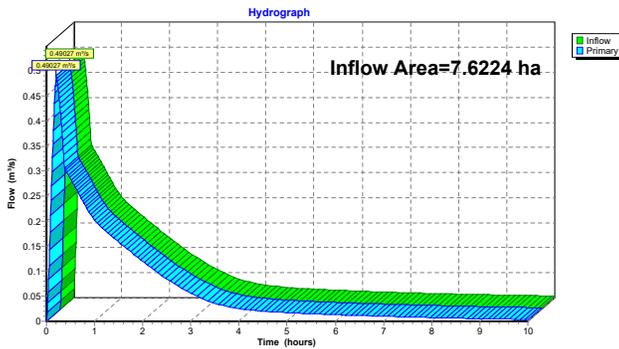
Summary for Link PH1: PH1 - 65.4 L/s

Inflow Area =   1.1315 ha,100.00% Impervious, Inflow Depth >   32 mm   for 100-Year event
Inflow   =   0.05332 m³/s @   0.29 hrs, Volume=   0.359 Ml
Primary   =   0.05332 m³/s @   0.29 hrs, Volume=   0.359 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1 - 65.4 L/s

Summary for Link PH2A: PH2A - 64.5 L/s

Inflow Area =   1.1169 ha,   0.00% Impervious, Inflow Depth >   30 mm   for 100-Year event
Inflow   =   0.05500 m³/s @   0.35 hrs, Volume=   0.332 Ml
Primary   =   0.05500 m³/s @   0.35 hrs, Volume=   0.332 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
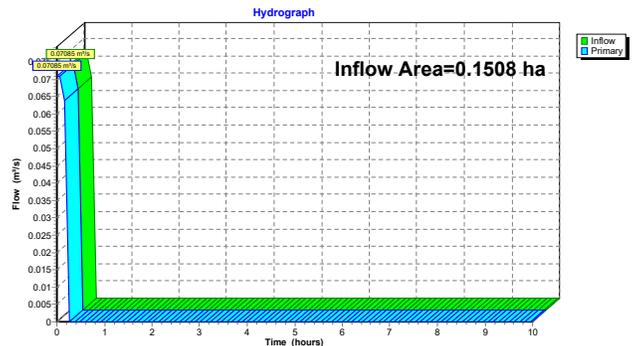
Link PH2A: PH2A - 64.5 L/s
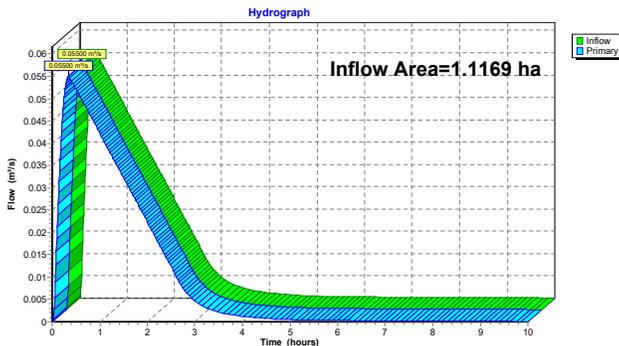
Summary for Link PH2B: PH2B - 8.7 L/s

Inflow Area =   0.1508 ha,100.00% Impervious, Inflow Depth =   36 mm   for 100-Year event
Inflow   =   0.07085 m³/s @   0.00 hrs, Volume=   0.054 Ml
Primary   =   0.07085 m³/s @   0.00 hrs, Volume=   0.054 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
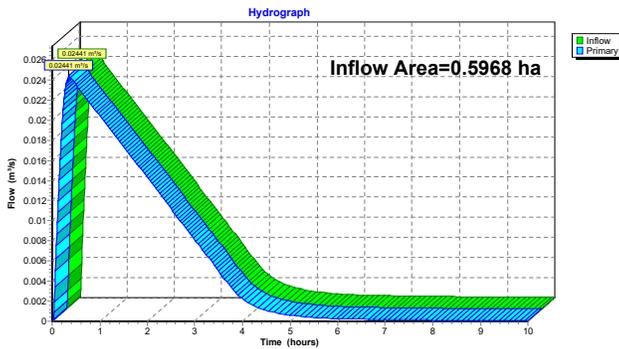
Link PH2B: PH2B - 8.7 L/s

Summary for Link PH3: PH3 - 34.5 L/s

Inflow Area =   0.5968 ha,100.00% Impervious, Inflow Depth >   33 mm   for 100-Year event
Inflow   =   0.02441 m³/s @   0.35 hrs, Volume=   0.199 Ml
Primary   =   0.02441 m³/s @   0.35 hrs, Volume=   0.199 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
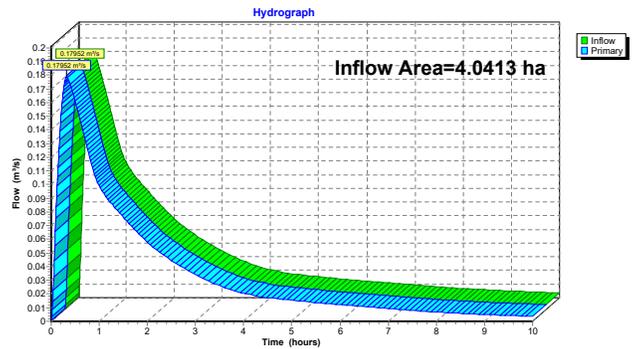
Link PH3: PH3 - 34.5 L/s
Hydrograph

Inflow Area=0.5968 ha

Summary for Link PH4: PH4

Inflow Area =   4.0413 ha, 60.76% Impervious, Inflow Depth >   30 mm   for 100-Year event
Inflow   =   0.17952 m³/s @   0.33 hrs, Volume=   1.220 Ml
Primary   =   0.17952 m³/s @   0.33 hrs, Volume=   1.220 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4
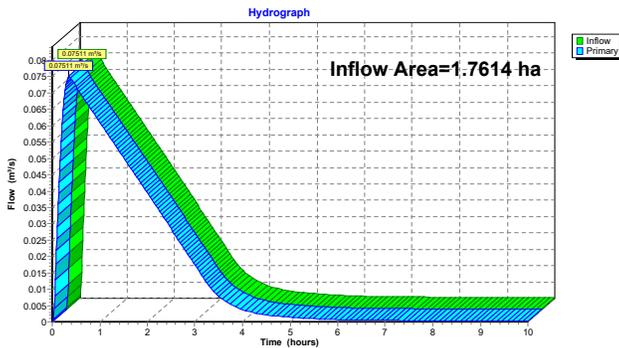Hydrograph

Inflow Area=4.0413 ha

Summary for Link PH5: PH5 - 101.8 L/s

Inflow Area =   1.7614 ha,   6.85% Impervious, Inflow Depth >   31 mm   for 100-Year event
Inflow   =   0.07511 m³/s @   0.35 hrs, Volume=   0.547 Ml
Primary   =   0.07511 m³/s @   0.35 hrs, Volume=   0.547 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5: PH5 - 101.8 L/s
Hydrograph

Inflow Area=1.7614 ha

Summary for Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s

Inflow Area =   0.7028 ha,   0.00% Impervious, Inflow Depth =   24 mm   for 100-Year event
Inflow   =   0.23898 m³/s @   0.17 hrs, Volume=   0.172 Ml
Primary   =   0.23898 m³/s @   0.17 hrs, Volume=   0.172 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH5_Un: PH 5 Uncontrolled - 262.8 L/s
Hydrograph

Inflow Area=0.7028 ha
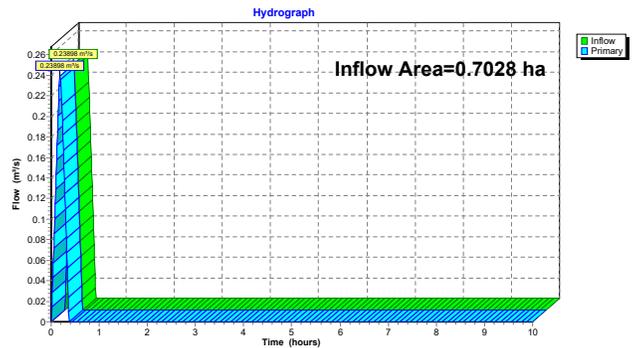
APPENDIX

D

Hydrogeological Investigation, exp, 2023

Table 3-1: Summary of Measured Groundwater Elevations

Monitoring Well ID	Ground Surface Elevation (masl)	Approximate Full Well Depth (mbgs)	Depth	31-May-23	6-Jun-23
BH/MW1	85.79	16.55	mbgs	3.42	3.37
			masl	82.37	82.42
BH/MW2S	86.38	12.27	mbgs	2.97	2.91
			masl	83.41	83.47
BH/MW2D	86.38	18.47	mbgs	3.83	3.98
			masl	82.55	82.40
BH/MW3S	85.08	11.41	mbgs	2.10	4.04
			masl	82.98	81.04
BH/MW3D	85.08	17.88	mbgs	4.04	4.04
			masl	81.04	81.04
BH/MW4	85.41	16.32	mbgs	3.97	4.19
			masl	81.44	81.22
BH/MW5S	84.89	10.78	mbgs	2.67	2.62
			masl	82.22	82.27
BH/MW5D	84.89	13.88	mbgs	2.54	2.61
			masl	82.35	82.28
BH/MW6	85.30	18.82	mbgs	3.11	6.79
			masl	82.19	78.51*I
BH/MW7	85.12	18.28	mbgs	3.10	3.59
			masl	82.02	81.53

*not static
mbgs - meters below ground surface
masl - meters above sea level

exp.

Two (2) maps were created for the Site to show groundwater contours of the intermediate and deep water-bearing zones (Figures 6 A and 6 B). Accordingly, the groundwater flow directions in the intermediate and deep zones are interpreted to be southeast of the Site, towards Pine Creek, respectively.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions. This may also affect the direction and rate of flow. It is recommended to conduct seasonal groundwater level measurements to provide more information on seasonal groundwater level fluctuations.

3.3 Hydraulic Conductivity Testing

Nine (9) Single Well Response Tests (SWRT's) were completed on monitoring wells BH/MW1, BH/MW2S, BH/MW2D, BH/MW3S, BH/MW3D, BH/MW4, BH/MW5S, BH/MW5D and BH/MW7 on June 6, 2023. The tests were completed to estimate the saturated hydraulic conductivity (K) of the soils at the well screen depths utilizing data loggers, preprogramed to take measurement on time in half second intervals.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT and constant rate test data as per Hvorslev's solution included in the Aqtesolv Pro. V.4.5 software package. The semi-log plots for normalized drawdown versus time are included in Appendix C.

A summary of the hydraulic conductivities (K-values) estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well ID	Measured Well Depth (mbgs)	Screened Interval (mbgs)	Formation Screened	Estimated Hydraulic Conductivity (m/s)
BH/MW1	16.55	13.55-16.55	Silty Sand Till/Clayey Silt	2.6E-05
BH/MW2S	12.27	9.27-12.27	Sandy Silt Till/Silty Sand Till	8.5E-06
BH/MW2D	18.47	15.47–18.47	Sandy Silt Till	9.1E-05
BH/MW3S	11.41	8.41-11.41	Silty Sand Till	9.6E-05
BH/MW3D	17.88	14.88-17.88	Silty Sand Till	1.1E-04
BH/MW4	16.32	13.32-16.32	Sandy Silt Till	7.9E-07
BH/MW5S	10.78	7.78-10.78	Coarse Sand	4.4E-05
BH/MW5D	13.88	10.88-13.88	Coarse Sand/Sand and Gravel	2.3E-05
BH/MW7	18.28	15.28-18.28	Sandy Silt Till	8.9E-06
			Highest Estimated K Value	1.1E-04
			Geometric Mean of Estimated K Values	3.4E-05
			Arithmetic Mean of Estimated K Values	5.1E-05

exp.

BH/MW 2D
82.40

BH/MW 3D
81.04

BH/MW 1
82.42

BH/MW 7
81.53

BH/MW 4
81.22

BH/MW 5D
82.28

Glen Eden Ct

Kingston Rd

Dixie Rd

Dudberry Ct

Bayly St

401

22

N

SCALE:

0 30 60 90 120 150
m

LEGEND:

◉ BOREHOLE / MONITORING WELL (EXP, 2023)

XX.XX GROUNDWATER ELEVATION (m asl) AS MEASURED ON JUNE 6, 2023

—— GROUNDWATER CONTOUR

➤ GROUNDWATER FLOW DIRECTION

▭ APPROXIMATE SITE BOUNDARY

DEEP GROUNDWATER
CONTOUR PLAN

FIGURE:
6B

HYDROGEOLOGICAL INVESTIGATION
1101A AND 1105 KINGSTON ROAD
PICKERING, ONTARIO

exp.

DRAWN BY:
AC

CHECKED BY:
AN

PROJECT NUMBER: GTR-22015419-B0   DATE: JULY 2023