

Tribute (Brookdale) Limited

Tribute 1101A, 1105 and 1163 Kingston Road

Stormwater Management Report (Brookdale)

October 27, 2023

First Submission





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

Tribute (Brookdale) Limited

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

Project No.: 221-12931-00

Date: October 27, 2023

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- A** Existing Stormwater Management Report
- B** Stormwater Management Calculations
- C** Hydrologic Model Output
- D** Hydrogeological Investigation, exp, 2023

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 four separate phases, involving development of four independent phases, with the areas for each phase ranging from 1.40 ha to 2.46 ha. As such, this report has been organized into four independent sections discussing the design approach and requirements for each of the phases, separately.

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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CLIENT

TRIBUTE (BROOKDALE) LIMITED

TITLE

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CITY OF PICKERING
SITE LOCATION**



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Date	OCTOBER 2023	Proj. No.	221-12931-00
Scale	N.T.S.	Figure No.	1.1
		Gr.No.	00

FIGURE 1.dwg Fig 1 C:\Users\CAPP078249\Documents\WSP Canada\projects (AMER)\LD\O\Files\221-12931 - 1105-1163 Kingston Road(SWM\FIGURES) Oct. 26, 2023 - 5:33pm

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 phase 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

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**.

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 proposed development has an area of 7.75 ha and includes two main drainage areas with 7.54 ha draining to Frenchman’s Bay and 0.21 ha draining to Pine Creek via overland flow. The drainage area toward Pine Creek will remain unchanged with respect to surface properties 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 0.5. 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 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* (m ³ /s)	812.9	<u>1114.1</u>	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 .

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, discharged 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 m³/s. A copy of A.M, 2015 is provided under **Appendix A**. Existing condition of the site is shown in **Figure 1.2**.

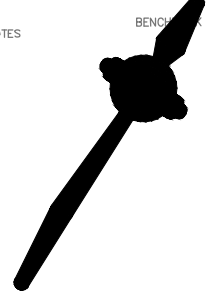
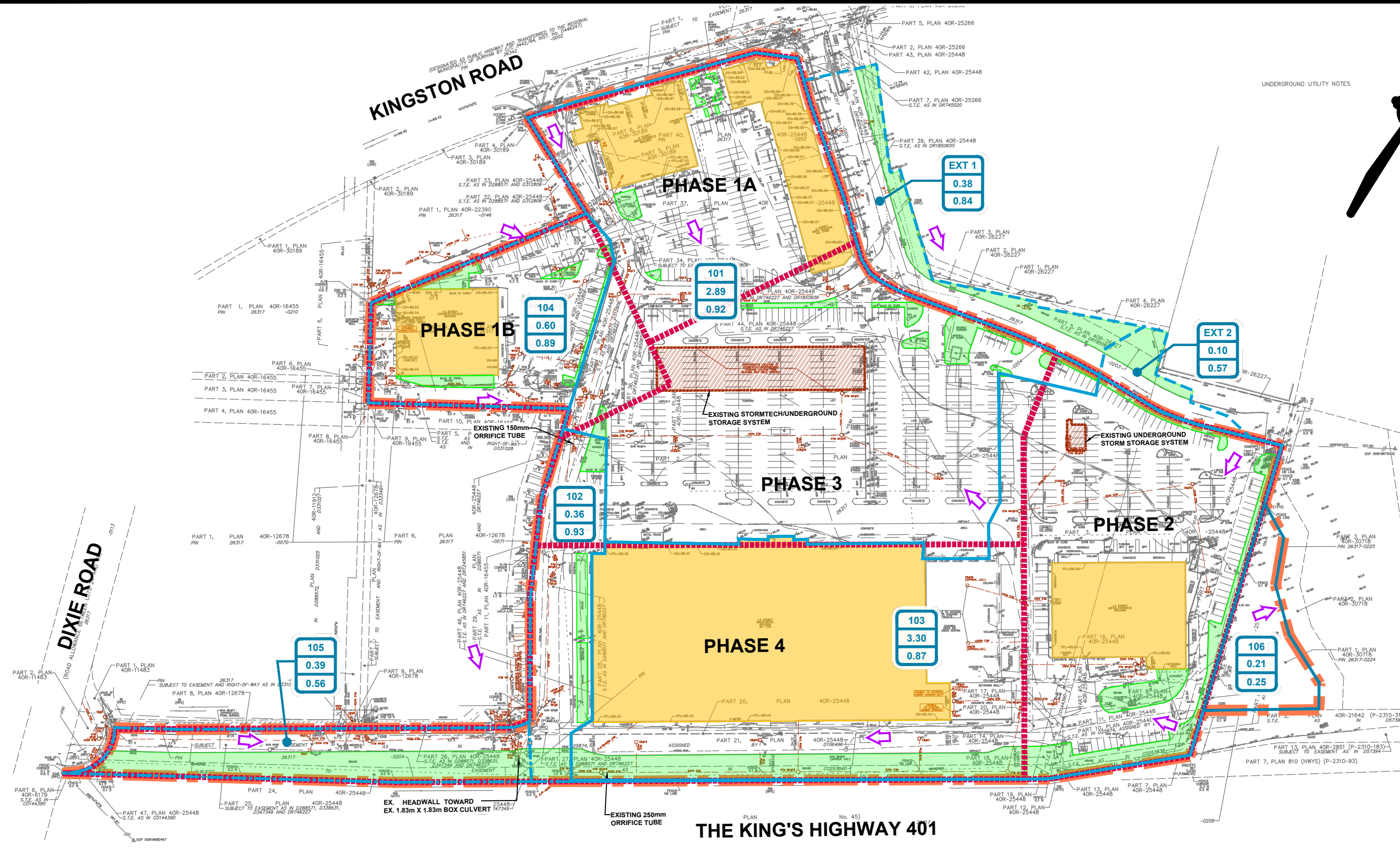


FIGURE 2.dwg Fig 1.1 ALL PHASE C:\Users\CAPP078249\Documents\WSP Canada projects (AMER)\LD\Files\221-12931 - 1105-1163 Kingston Road\SWMF\GURES) Oct 26, 2023 - 5:53pm

LEGEND

- PROJECT BOUNDARY
- SUB-CATCHMENT BOUNDARY
- EXTERNAL SUB-CATCHMENT BOUNDARY
- UNCONTROLLED SUB-CATCHMENT BOUNDARY
- FUTURE PHASE BOUNDARY
- SUB-CATCHMENT ID
- DRAINAGE AREA (ha)
- AVERAGE RUNOFF COEFFICIENT
- EXISTING ROOF AREA
- EXISTING LANDSCAPE AREA
- EXISTING UNDERGROUND STORM STORAGE SYSTEM
- OVERLAND FLOW ROUTE

Scale: 0 10 20 30 40 50 100m

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**1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
ALL PHASES
EXISTING CONDITIONS**

WSP

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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 which are added to allowable flow rate according to A.M., 2015 100-year flow equation. In post development condition 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)*
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	212.3
105	0.39	0.56	137.6
Total	8.02	0.87	<u>899.9</u>

*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, allowable flow rate for the site is estimated at 899.9 L/s. As the flow rate set by City criteria is 1114.1L/s, the existing flows for the site 899.9 L/s is governing the allowable flow rate for the site.

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. A summary of the pro-rated allowable flow rate for each phase is presented in **Table 1-4**. Detailed calculations are provided in **Appendix B**.

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

Phase	Area (ha)	Allowable Flow Rate (L/s)
1	1.77	171.3
2	1.40	136.0
3	1.91	185.2
4	2.46	407.5
Total	7.54	899.9

2 PHASE 1 DEVELOPMENT BLOCK

2.1 Phase 1 Pre-Development Condition

Phase 1 has an area of approximately 1.77 ha. Under existing condition, the Phase 1 area consists of three impervious roofs, at grade parking areas and some landscaping with a weighted runoff coefficient of 0.89. Runoff from the Phase 1 area is collected via catchbasins 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 3 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 3 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 2.1**.

2.2 Phase 1 Post Development Condition

2.2.1 General

Under the post development condition Phase 1 (1.77 ha, catchments 201 and 202) shall be developed into two building structures that are connected via the underground garage, at grade impervious areas and landscaping. An area breakdown for the proposed development in Phase 1 is provided in **Table 2-1**. Please refer to **Figure 2.1** for details of the post-development conditions and land-uses. Detailed calculations can be found in **Appendix B**.

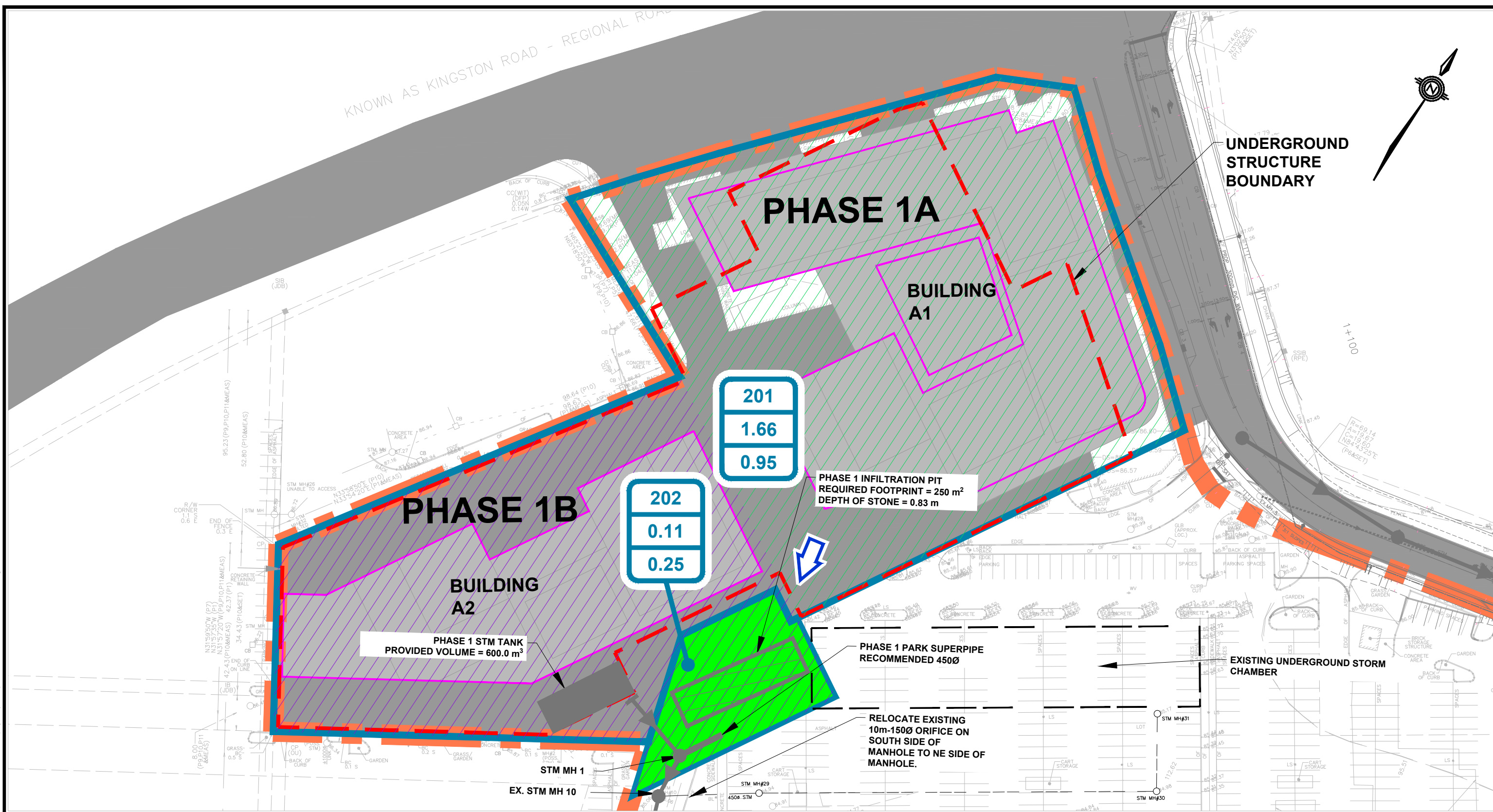
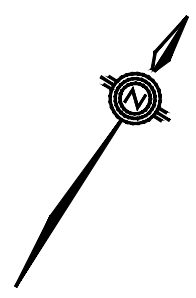
Table 2-1: Phase 1 Proposed Land-Use

Land-Use	Area (m²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping	1061	0.25	7
At-Grade Impervious	8,131	0.95	100
Impervious Roof	8,459	0.95	100
Total	17,651	0.92	96

Phase 1 shall be developed in the first stage of the development plan. During Phase 1 construction, the interim condition, Phases 2 - 4 shall remain unchanged and continue to discharge at the existing rate. The 150 mm orifice tube located south of MH10 shall be relocated to the east side of MH10 to provide flow control from the existing at grade parking area.

The entire Phase 1, Phase 1A and Phase 1B, will be serviced by one underground storm cistern and a super pipe. Runoff from Phase 1 shall be collected via internal catchbasins and storm sewers and directed to the Phase 1 cistern and super pipe.

KNOWN AS KINGSTON ROAD - REGIONAL ROAD



201
1.66
0.95

202
0.11
0.25

FIGURE 3.dwg Fig 2.1 PH 1A1B C:\Users\CAPP078249\Documents\WSP Canada projects (AMER)\LD\Files\221-12931 - 1105-1163 Kingston Road(SW\FIGURES) Oct 13, 2023 - 10:24am

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- UNCONTROLLED SUB-CATCHMENT BOUNDARY
- UNDERGROUND STRUCTURE BOUNDARY
- ROOF BOUNDARY
- PROPOSED LANDSCAPE AREA
- PHASE 1A
- PHASE 1B
- OVERLAND FLOW ROUTE
- SUB-CATCHMENT ID
- DRAINAGE AREA (ha)
- AVERAGE RUNOFF COEFFICIENT

0 10 20 30 40 50m

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PROPOSED CONDITIONS**

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2.2.2 Erosion Control

As mentioned in **Section 1.4.1**, erosion control for Phase 1 (1.77 ha in area) can be provided by retention of the first 5 mm of rainfall from each storm event. For Phase 1, a 5 mm rainfall generates a runoff volume of 83 m³. This 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 water balance calculations for Phase 1. As shown in the table, a total volume of 83 m³ shall be retained on site through infiltration or implementation of green roofs. As green roofs will be implemented in the design for future submissions and as part of the Site Plan Application, as a conservative measure, it is assumed that the entire water balance volume is to be infiltrated.

Table 2-2: Phase 1 Water Balance Calculation

Surface Type	Area (m ²)	Initial Abstraction (m)	Volume Abstracted (m ³)	5 mm Volume (m ³)	Water Balance (m ³)
Soft Landscaping/Park	1,061	0.005	5.31	5.31	0.00
Green Roof	-	0.005	0.00	0.00	0.00
Impervious at Grade	8,131	0.000	0.00	40.65	40.65
Impervious at Roof	8,459	0.000	0.00	42.30	42.30
Total	17,651	-	5.31	88.26	82.95

An infiltration gallery with an area of approximately 250 m² and depth of 0.83 m is proposed to provide infiltration of 83 m³, Phase 1 water balance volume. The preliminary location of the Phase 1 Infiltration Gallery is in the park area located southwest of the Phase 1 boundary, as shown in **Figure 2.1**. The infiltration volume is expected to infiltrate in approximately 58 hours. Detailed calculations are provided under **Appendix B**.

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 at grade areas within the Phase 1 boundary. As rooftops and 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.

2.2.5 Water Quantity

As stated in **Section 1.6**, the post-development flows from the Phase 1 boundary shall be controlled to 171.3 L/s for all storms up to and including the 100-year storm event. The Phase 1 area is divided into two subcatchments of 201 and 202, as shown in **Figure 2.1**. Runoff from subcatchment 201 is directed to an underground cistern with an area of 300 m² and a height of 2 m. Runoff from subcatchment 202 is directed to a 40 m superpipe with a diameter of 450 mm. 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.

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 2-3**.

Table 2-4 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 2-3: Summary of the Storage Utilization for Phase 1

	Phase 1 Cistern	Phase 1 Cistern	Phase 1 Superpipe	Phase 1 Superpipe
Return Period	Utilized Storage (m³/ 600 m³)	Peak Water Elevation (m)	Utilized Storage (m³/ 6.4 m³)	Peak Water Elevation (m)
2	195.8	0.65	1.1	0.10
5	278.6	0.93	1.9	0.15
10	335.5	1.12	2.4	0.18
25	423.7	1.41	3.9	0.26
50	480.0	1.60	5.0	0.33
100	521.0	1.74	6.1	0.41

Table 2-4: 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	82.8	3.0	85.4	171.3
5	101.3	3.9	105.0	171.3
10	112.3	4.5	116.5	171.3
25	127.5	5.6	132.9	171.3
50	136.4	6.4	142.5	171.3
100	142.4	7.2	149.3	171.3

*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.

Therefore, the modelling results demonstrate that the overall peak flow rate from Phase 1 shall be controlled to below the allowable flow rate for Phase 1, 171.3 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 1 cistern and Phase 1 superpipe are less than the storage volumes provided in the cistern and superpipe proposed for Phase 1.

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 83m³ infiltration gallery located in Phase 1 is proposed to provide infiltration of the entire water balance volume for Phase 1.

Water Quality

An Imbrium Jellyfish filter sized for Phase 1 is proposed to provide 80% TSS removal on the annual average loading basis.

Water Quantity

A 600m³ underground cistern and a 6.4m³ 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.

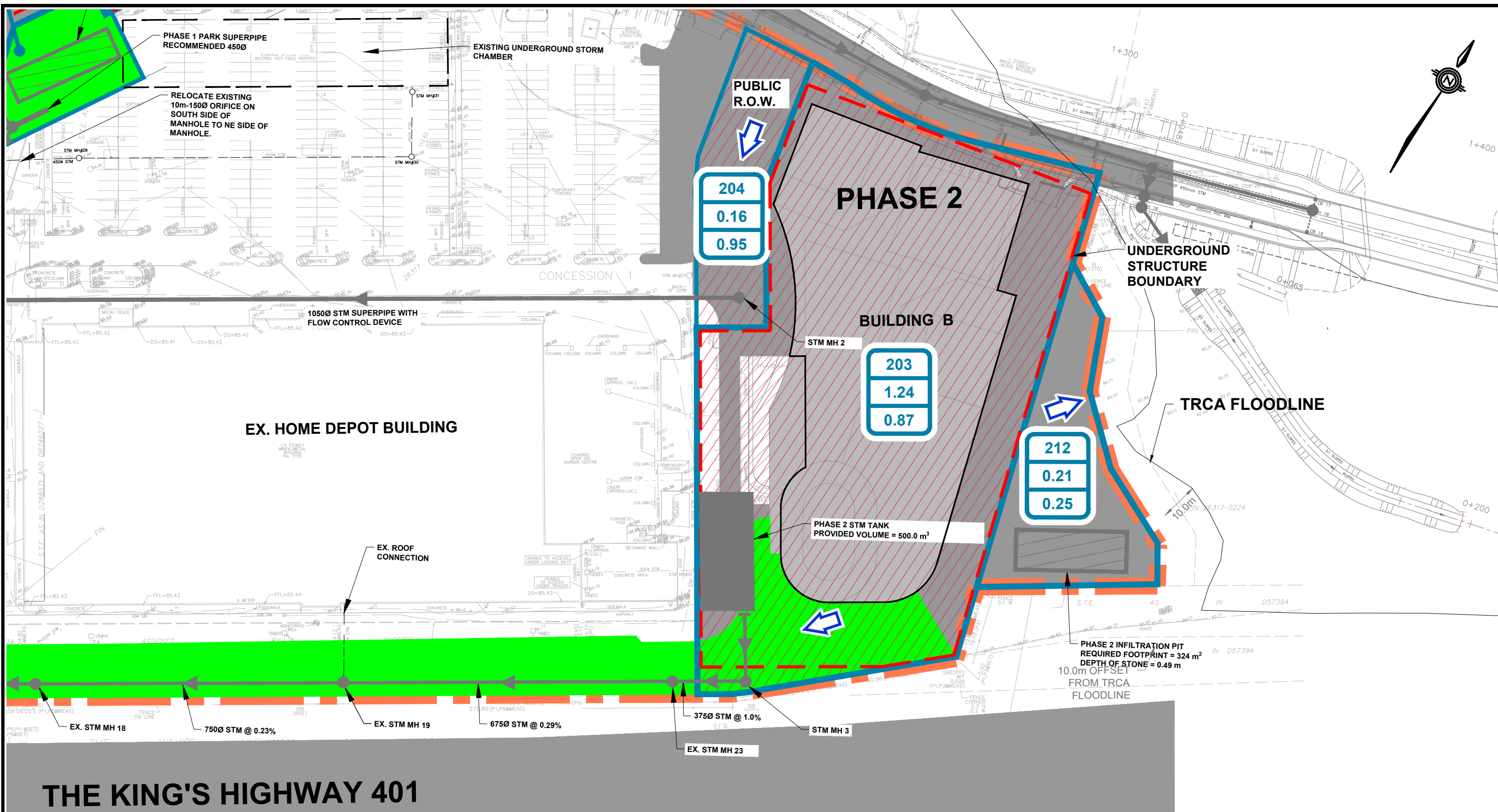
3 PHASE 2 DEVELOPMENT BLOCK

3.1 Phase 2 Pre-Development Condition

Phase 2 has an area of approximately 1.61 ha. There is an area of 0.21 ha (titled as Catchment 106 in the existing condition, and Catchment 212 in the proposed condition) on the east side of Phase 2 which is currently undeveloped. 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 shall remain primarily unchanged under post development conditions, and 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.

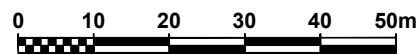
Under the existing condition, the Phase 2 area consists of an impervious roof, at grade parking areas and some landscaping with an existing weighted runoff coefficient of 0.79. Runoff from the Phase 2 area, with the exception of catchment 106 (catchment 212 replaces catchment 106 in the proposed condition), is collected via catchbasins 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 2 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 4 but has no impact on flows from the Phase 3 area. The existing condition of Phase 2 is shown in **Figure 1.2**.

FIGURE 3.dwg Fig 3.1 PH 2 C:\Users\CAAPP078249\OneDrive\WSP Canada projects (AMER)\DOFiles\221-12931 - 1105-1163 Kingston Road\SWM\FIGURES\ Oct 27, 2023 - 3:43pm



LEGEND

- PROJECT BOUNDARY
- SUB-CATCHMENT BOUNDARY
- UNCONTROLLED SUB-CATCHMENT BOUNDARY
- UNDERGROUND STRUCTURE BOUNDARY
- ROOF BOUNDARY
- SUB-CATCHMENT ID
- DRAINAGE AREA (ha)
- AVERAGE RUNOFF COEFFICIENT
- PROPOSED LANDSCAPE AREA
- PHASE 2
- OVERLAND FLOW ROUTE



CLIENT

TRIBUTE (BROOKDALE) LIMITED

TITLE

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



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3.2 Phase 2 Post Development Condition

3.2.1 General

Under the post development condition Phase 2 (1.24 ha, catchments 203) shall be developed into a building structure, an underground garage, at grade impervious areas and landscaping. A public right of way, catchment 204, with an area of 0.16 ha shall be constructed as part of the Phase 2 development at the northwest corner of Phase 2 boundary. Catchment 212 (0.21 ha) will be functioning as a park and primarily remain unchanged, 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 **Figure 3.1** 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 (m ²)	Runoff Coefficient (2 - 10 Yr)	% Impervious
Soft Landscaping	1,511	0.25	7
Park - Catchment 212	2,069	0.25	7
At-Grade Impervious	6,031	0.95	100
Impervious Roof	6,475	0.95	100
Total	16,086	0.79	90

Phase 2 shall be developed during the second stage of the development plan. The existing underground storage shall be removed as part of the development plan for Phase 2. During Phase 2 construction, the interim condition, the areas of future Phase 3 and Phase 4 (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.

Subcatchment 203 within Phase 2 will be serviced by one underground storm cistern. Runoff from 203 area shall be collected via internal catchbasins and storm sewers and

directed to the Phase 2 cistern. Subcatchment 204, the public right of way, within Phase 2 shall be serviced with a superpipe which shall also provide runoff control for subcatchment 204 area. Subcatchment 212 shall remain unchanged with respect to drainage and discharge to Pine Creek via overland flow, similar to the existing condition.

3.2.2 Erosion Control

As mentioned in **Section 1.4.1**, erosion control for Phase 2 (1.40 ha in area excluding catchment 212) can be provided by retention of the first 5 mm rainfall of each storm event. For Phase 2, a 5 mm rainfall generates a runoff volume of 63 m³. This 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).

Subcatchment 212 shall continue to discharge to Pine Creek at the existing rates as the area will remain entirely pervious under the proposed condition. As such, long-term erosion control is not required for subcatchment 212.

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.

Table 3-2 summarizes the water balance calculations for Phase 2. As shown in the table, a total volume of 63 m³ shall be retained on site through infiltration or implementation of green roofs. As green roofs will be implemented in the design for future submissions and as part of the Site Plan Application, as a conservative measure, it is assumed that the entire water balance volume is to be infiltrated.

Table 3-2: Phase 2 Water Balance Calculation

Surface Type	Area (m ²)	Initial Abstraction (m)	Volume Abstracted (m ³)	5 mm Volume (m ³)	Water Balance (m ³)
Soft Landscaping/Park	1,511	0.005	7.55	7.55	0.00
Green Roof	-	0.005	0.00	0.00	0.00
Impervious at Grade	6,031	0.000	0.00	30.15	30.15
Impervious at Roof	6,475	0.000	0.00	32.37	32.37
Total	14,016		7.55	70.08	62.53

An infiltration gallery with an area of approximately 324 m² and depth of 0.49 m is proposed for infiltration of the Phase 2 water balance volume. The preliminary location of the Phase 2 Infiltration Gallery is in the park area, subcatchment 212, as shown in **Figure 3-1**. The water balance volume of 63.5 m³ provided in the infiltration gallery is

expected to infiltrate in approximately 36 hours. Detailed calculations are provided under **Appendix B**.

As subcatchment 212 shall remain pervious under the proposed condition providing initial abstraction of 5 mm, additional water balance measures are not required for this subcatchment.

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 within subcatchment 203 of Phase 2 boundary. Water quality shall be addressed by an Oil Grit Separator, providing 50% TSS removal, for subcatchment 204, the public right of way, as filter units are not accepted for public right of ways. As rooftops and 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.

Subcatchment 212 shall function as a park entirely consisting of pervious surfaces 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

As stated in **Section 1.6**, the post-development flows from the Phase 2 boundary shall be controlled to 133.0 L/s for all storms up to and including the 100-year storm event. The Phase 2 area is divided into two subcatchments of 203 and 204, as shown in **Figure 3.1**. Runoff from subcatchment 203 is directed to an underground cistern with an area of 224 m² and a height of 2 m. Runoff from subcatchment 204 which consists of a public right-of-way (ROW) shall be directed to a 70 m superpipe with a diameter of 1,040 mm. 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.

Flows from subcatchment 212 will continue to discharge, unchanged in quantity, via overland flow to Pine Creek.

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

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

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

	Phase 2 Cistern	Phase 2 Cistern	Phase 2 Superpipe	Phase 2 Superpipe
Return Period	Utilized Storage (m ³ / 500 m ³)	Peak Water Elevation (m)	Utilized Storage (m ³ / 60.6 m ³)	Peak Water Elevation (m)
2	163.0	0.65	18.7	0.37
5	229.2	0.92	27.3	0.48
10	274.9	1.10	33.1	0.56
25	342.8	1.37	41.9	0.69
50	387.2	1.55	47.6	0.77
100	416.8	1.67	51.4	0.83

Subcatchment 212 shall continue to discharge via over land flow to Pine Creek at existing flow rates. Therefore, no quantity control measures are required for subcatchment 212.

Table 3-4: Summary of all Flows from Phase 2 Area

Return Period	Flow from Phase 2 Cistern (L/s)	Flow from Phase 2 Superpipe (L/s)	Total Flow from Phase 2 (L/s)*	Phase 2 Allowable Flow (L/s)
2	47.6	6.7	54.3	136.0
5	57.5	7.8	65.3	136.0
10	63.4	8.5	71.9	136.0
25	71.3	9.5	80.7	136.0
50	76.0	10.0	86.1	136.0
100	79.0	10.5	89.5	136.0

*Flow from entire Phase 2 is not an arithmetic sum of flows from the cistern and the superpipe, but it is iteratively determined.

Therefore, the modelling results demonstrate that the overall peak flow rate shall be controlled to below the allowable flow rate for Phase 2, 136.0 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 2 cistern and Phase 2 superpipe are less than the storage volumes provided in the cistern and superpipe proposed for Phase 2.

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 for Subcatchment 212 shall remain pervious and continue to discharge at the existing rates and does not require long term erosion control.

Temporary erosion and sediment control shall be provided during construction.

Water Balance

A 62m³ infiltration gallery located in Phase 2 is proposed to provide infiltration of the entire water balance volume for subcatchment 203 and 204. Subcatchment 212 consists entirely of pervious surfaces providing an initial abstraction of 5 mm and does not require additional water balance measures.

Water Quality

An Imbrium Jellyfish filter sized for Subcatchment 203 (private block) is proposed to provide 80% TSS removal on the annual average loading basis. An oil grit separator, providing 50% TSS removal, is proposed for Subcatchment 204 which consists of a public right of way, Water quality measure is not required for subcatchment 212, park area, as it is free of sediment generating activities.

Water Quantity

A 500m³ underground cistern and a 60.6m³ superpipe equipped with flow controls are proposed to provide quantity control for subcatchment 203 and 204, respectively. All flows from Phase 2 shall be controlled to below the allowable flow rate for Phase 2 of the development. Subcatchment 212 shall continue to discharge to Pine Creek via overland flow at the existing rates.

4 PHASE 3 DEVELOPMENT BLOCK

4.1 Phase 3 Pre-Development Condition

Phase 3 of the development has an area of approximately 1.91 ha. Under the existing condition, the Phase 3 area consists of at grade parking areas and minimal landscaping. The existing runoff storage for the Phase 3 boundary consists of the underground storage system, 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 catchbasins and internal storm sewers and directed to the underground storage and ultimately to existing MH10 where flow control is provided by a 150 mm orifice tube. The existing condition of Phase 3 is shown in **Figure 4.1**.

4.2 Phase 3 Post Development Condition

4.2.1 General

The 1.91 ha proposed development will consist of redeveloping the existing at grade parking area, and a public right-of-way (ROW). This phase is split into three drainage catchments (i.e., 205, 206 and 207). Catchment 205 includes a proposed commercial / residential building C1 and C2 with 27 stories. Catchment 206 and 207 includes a 20 m right-of-way and public park respectively. The 100-year flow from each catchment will be captured via catchbasins, roof area and will be conveyed to the underground cistern and superpipes. 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.

In the Interim condition of Phase 3, the existing area of Home Depot, the public road, and landscapes south and southwest of Phase 3 will remain without any changes. The existing SWM measurement for these areas will remain unchanged except for 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.

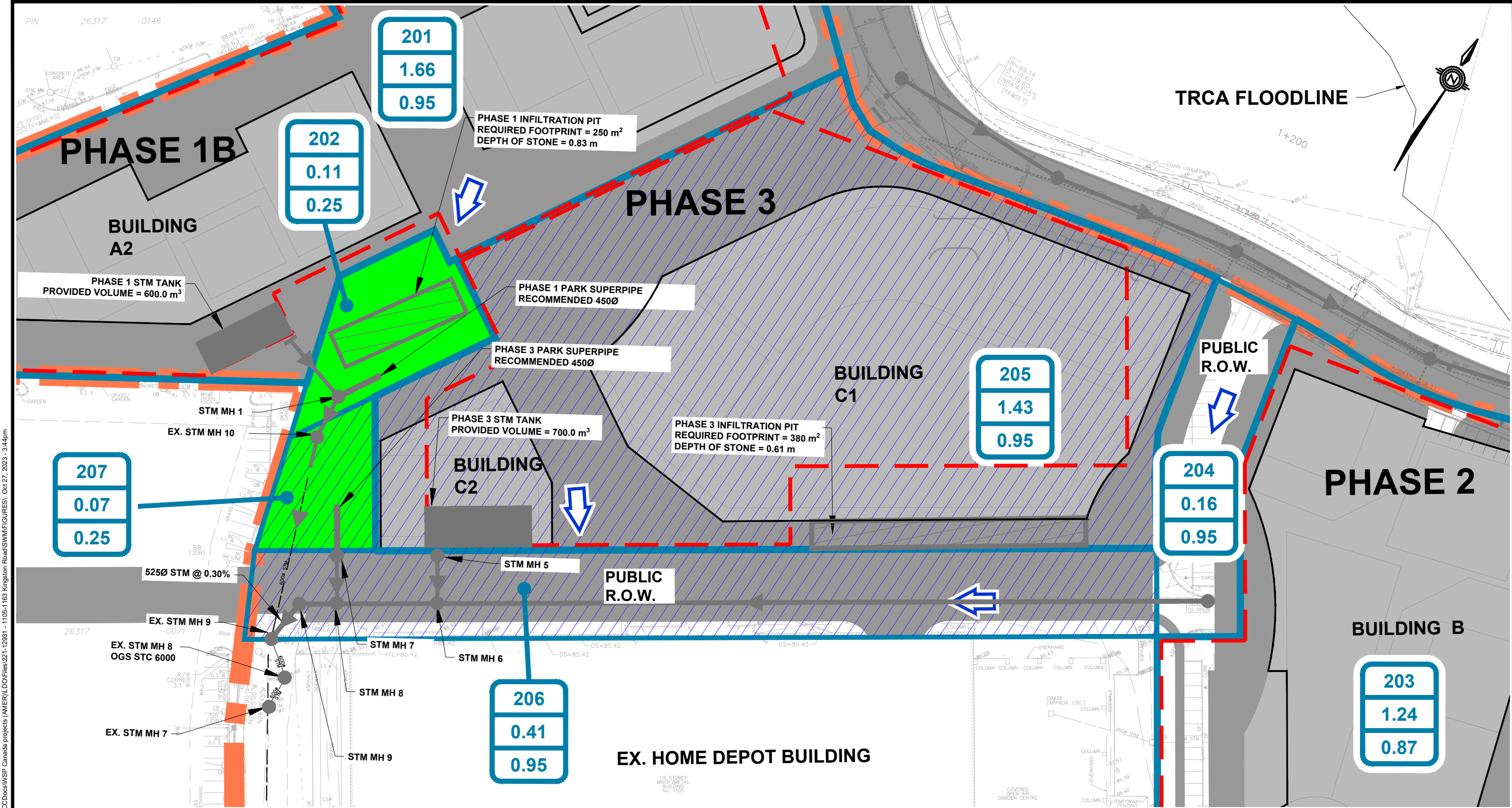


FIGURE 3.dwg Fig 4.1 PH 3 C:\Users\CAAPP078249\OneDrive\Projects\AMER\DOFiles\221-12931-1105-1163 Kingston Road\SWM\FIGURES\ Oct 27, 2023 - 3:44pm

LEGEND

- PROJECT BOUNDARY
- SUB-CATCHMENT BOUNDARY
- UNCONTROLLED SUB-CATCHMENT BOUNDARY
- UNDERGROUND STRUCTURE BOUNDARY
- ROOF BOUNDARY
- PROPOSED LANDSCAPE AREA
- PHASE 3
- OVERLAND FLOW ROUTE

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

10 20 30 40 50m

CLIENT
TRIBUTE (BROOKDALE) LIMITED

TITLE
**1105 - 1163 KINGSTON ROAD
CITY OF PICKERING
PHASE 3
PROPOSED CONDITIONS**

WSP

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Checked	I.S.	Drawn	AutoCAD/M.ST.L.
Date	OCTOBER 2023	Proj. No.	221-12931-00
Scale	AS SHOWN	Figure No.	4.1
		Gr.No.	

The storm cistern in building C1 and C2 (i.e., catchment 205) will be connected to the proposed storm MH6, via proposed control MH5 south of building C2. The proposed superpipe in public right-of-way (i.e., catchment 206) will be connected to proposed storm MH9, via proposed control MH8 west of the public right-of-way. The proposed superpipe in the park area (i.e., catchment 207) will be connected to the proposed control MH8 via proposed control MH7, south of the park area. The controlled flow from Phase 3 will drain to the existing 600 mm storm sewer located at west of the existing Home Depot building. 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 4-1**. Please refer to **Figure 4.1** for details of the post-development conditions and land-uses. Detailed calculations can be found in **Appendix B**.

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

Land-Use	Area (m ²)	TIMP (%)
Soft Landscaping / Park	685.41	7%
Green Roof	0.00*	43%
Impervious at Grade	9659.08	100%
Impervious at Roof	8739.85	100%
Site Total	19084.34	97%

*Green roof areas will be proposed at a later design stage

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 infiltration galleries explained in the following **Section 4.2.3**.

4.2.3 Water Balance

As noted in **Section 1.4.2**, 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 of 380 m² and 0.61 m and drawdown time of 43 hours will be proposed southeast of Phase 3. The first 5 mm of rainfall will be captured from the roof area of building C1 and will be conveyed to the underground infiltration galleries.

The ground water level is reported as 2.54 mbgs in BH/MW5D on May 31, 2023, in Preliminary Hydrological Investigation, exp., 2023. The clearance from the groundwater level by considering 0.6 m cover on top the infiltration gallery is roughly 1.30 m which meets the minimum clearance requirement. The infiltration gallery is sized to provide an infiltration volume of 93 m³.

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. Refer to **Appendix D** for Preliminary Hydrological Investigation, exp., 2023.

Table 4-2: Phase 3 Water Balance Calculation

Surface Type	Area (m ²)	Initial Abstraction (m)	Volume Abstracted (m ³)	5 mm Volume (m ³)	Water Balance (m ³)
Soft Landscaping / Park	685.41	0.005	3.4	3.4	0.0
Green Roof	0.00	0.005	0.0	0.00	0.0
Impervious at Grade	9659.08	0.000	0.0	48.3	48.3
Impervious at Roof	8739.85	0.000	0.0	43.7	43.7
Total	19084.34		3.4	95.4	92.0

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.).

The individual Residential / Commercial block will have their own filter-based water treatment units, an area expected to achieve the full 80% TSS removal. Roof runoff is considered clean provided it does not mix with at-grade runoff prior to collection in SWM storage volumes.

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.

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 4.2.1**, Phase 3 is divided into three catchments (i.e., 205, 206 and 207), the 100-year flow from the catchments will be controlled with volume provided by underground cistern and superpipes. The runoff from catchment 205 will be controlled by an underground cistern with a volume of 700 m³ (350 m² x 2 m) located in the underground parking structure. The runoff from catchments 206 and 207 will be controlled by providing volume of 1050 mm and 450 mm superpipes. 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.

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 4-3**, and **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 4-3: Summary of the Storage Utilization for Phase 3

Return Period	Catchment 205 Cistern	
	Utilized Storage (m ³ / 700 m ³)	Peak Water Elevation (m)
2	173.1	0.49
5	244.0	0.70
10	293.0	0.84
25	368.7	1.05
50	417.1	1.19
100	452.1	1.29

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

Return Period	Catchment 206 Superpipe		Catchment 207 Superpipe	
	Utilized Storage (m ³ / 173.20 m ³)	Peak Water Elevation (m)	Utilized Storage (m ³ / 4.0 m ³)	Peak Water Elevation (m)
2	43.6	0.31	0.4	0.07
5	64.1	0.42	0.6	0.10
10	78.1	0.49	0.9	0.12
25	100.3	0.59	1.5	0.18
50	114.2	0.66	2.1	0.23
100	124.7	0.71	2.7	0.29

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

Return Period	205 Development Release Rate (L/s)	206 Development Release Rate (L/s)	207 Development Release Rate (L/s)	Total Development Release Rate* (L/s)	Total Allowable Release Rate, Q _P (L/s)
2	69.9	23.0	2.1	95.0	185.2
5	86.0	27.5	2.9	116.4	185.2
10	95.6	30.1	3.4	129.1	185.2
25	108.7	33.7	4.5	146.9	185.2
50	116.3	35.9	5.2	157.4	185.2
100	121.5	37.4	5.9	164.9	185.2

*Flow from entire Phase 3 is not an arithmetic sum of flows from all subcatchments, but it is iteratively determined.

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.

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

The proposed site is in an area of LGRA. Based on the City of Pickering's request, 5 mm on site infiltration within the 72-hour drawdown time is required for the private lands. Accordingly, a 93m³ infiltration gallery with the area and depth of 380 m² and 0.61 m with drawdown time of 43 hours will be proposed southeast of the Phase 3.

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.

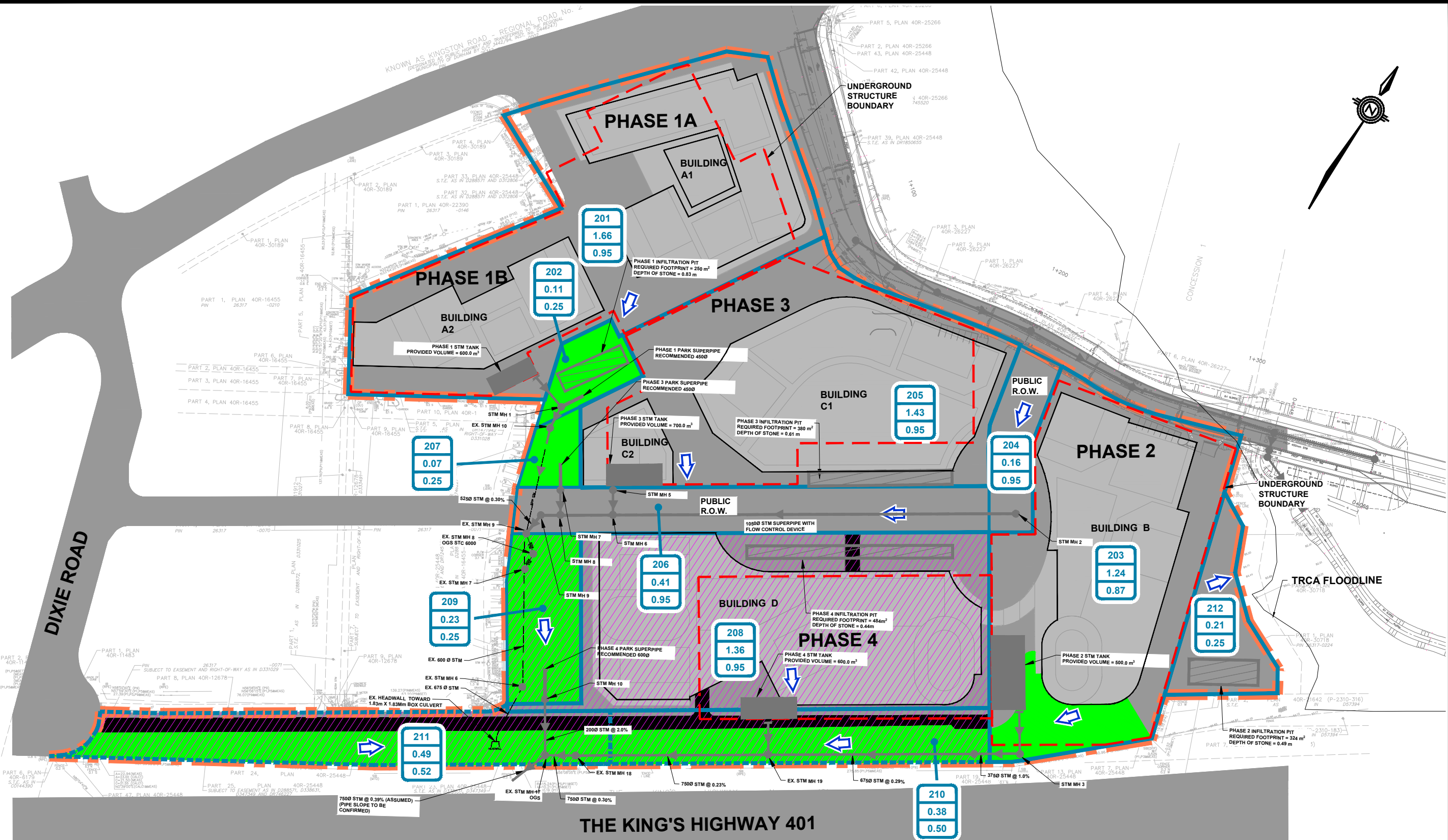
Water Quantity

Phase 3 includes a commercial / residential block, public road and park. Accordingly, an underground cistern with a volume of 700 m³ (for commercial / residential block) and 1050 mm and 450 mm superpipes (for public road and park) 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.

5 PHASE 4 DEVELOPMENT BLOCK

5.1 Phase 4 Pre-Development Condition

Phase 4 of the development has an area of approximately 2.46 ha. Under the existing condition, the Phase 4 area consists of a Home Depot building, and roads with minimal landscaping. The runoff storage for the existing Phase 4 boundary consists of an underground storage system, roof top control, surface ponding and pipe storage as a part of catchment 103 and uncontrolled runoff as part of catchment 102 which is explained in **Section 1.6**. Runoff from the existing area is collected via catchbasins and internal storm sewers and directed to the underground storage 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 catchbasins 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 4 is shown in **Figure 5.1**.



5.2 Phase 4 Post Development Condition

5.2.1 General

The 2.46 ha proposed development will consist of redeveloping the existing Home Depot building and roads. This phase is split into four drainage catchments (i.e., 208, 209, 210, and 211). Catchment 208 includes the proposed residential building D with 33-stories. Catchment 209 includes the public park, and Catchments 210 and 211 include private roads respectively. The 100-year flow from each catchment will be captured via catchbasins and roof area drains and will be conveyed to the underground cistern and superpipes. The 100-year flow from building D and park area (i.e., catchment 208 and 209) will be controlled to allowable release rates explained in **Section 1.6**. The 100-year flow from private roads (i.e., catchment 210 and 211) will be captured by existing and proposed single and double catchbasins 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 4 will be achieved as explained in the following sections.

The storm cistern in Building D (i.e., catchment 208) will be connected to the existing storm MH19, south of the subject site. The proposed superpipe in the park area (i.e., catchment 209) will be connected to the existing storm MH17 via proposed control MH10 south of the park area. The runoff from private roads (i.e., catchment 210 and 211) will be conveyed via the proposed 750 mm pipe and existing 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 5-1**. Please refer to **Figure 5.1** for details of the post-development conditions and land-uses. Detailed calculations can be found in **Appendix B**.

Table 5-1: Phase 4 Proposed Land-Use Area Breakdown

Land-Use	Area (m ²)	TIMP (%)
Soft Landscaping / Park	7761.83	7%
Green Roof	0.00	43%
Impervious at Grade	7178.99	100%
Impervious at Roof	9699.28	100%
Site Total	24640.10	71%

* Green roof areas will be proposed at a later design stage

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 infiltration galleries explained in the following **Section 5.2.3**.

5.2.3 Water Balance

As noted in **Section 1.4.2**, the Site is located within a LGRA. Therefore, there are no site-specific water balance requirements for the site. However, based on the City of Pickering's request 5 mm of on site infiltration within the 72-hour drawdown time is required for the private lands.

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 area and depth of 484 m² and 0.44 m will be proposed northeast of Phase 4. The infiltration gallery is sized to provide an infiltration volume of 85 m³ with a drawdown time of 32 hours. The first 5 mm of rainfall will be captured from the roof area of building D and will be conveyed to the underground infiltration galleries.

The ground water level is reported as 2.54 mbgs in BH/MW5D on May 31, 2023, in Preliminary Hydrological Investigation, exp., 2023. The clearance from the groundwater level by considering 0.6 m cover on top the infiltration gallery is roughly 1.50 m which meets the minimum clearance requirement.

Table 5-2, outlines the water balance volume required to retain the runoff from a 5 mm storm on site for Phase 4. Detailed water balance calculations can be found in **Appendix B** of this report. Refer to **Appendix D** for Preliminary Hydrological Investigation, exp., 2023.

Table 5-2: Phase 4 Water Balance Calculation

Surface Type	Area (m ²)	Initial Abstraction (m)	Volume Abstracted (m ³)	5 mm Volume (m ³)	Water Balance (m ³)
Soft Landscaping / Park	7,762	0.005	38.8	38.8	0.00
Green Roof	-	0.005	0.0	0.00	0.00
Impervious at Grade	7,179	0.000	0.0	35.9	35.8
Impervious at Roof	9,699	0.000	0.0	48.5	48.5
Total	24,640		38.8	123.2	84.3

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 block will have their own filter-based water treatment units, and area expected to achieve the full 80% TSS removal. Roof runoff is considered clean provided it does not mix with at-grade runoff prior to collection in SWM storage volumes. Since the TRCA only credits a maximum 50% TSS removal rate for conventional OGS units; should filter-based units not be permitted in the right-of-way as part of detailed design, evaluation of a treatment train approach will be considered for the 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.

5.2.5 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 4 is divided into four catchments (i.e., 208, 209, 210 and 211), the 100-year flow from the catchments (i.e., 208 and 209) will be controlled with volume provided by underground cistern and superpipes. The 100-year flow from the uncontrolled catchments (i.e., 210 and 211) will be drained uncontrolled. The runoff from Catchment 208 will be controlled by an underground cistern with a volume of 600 m³ (300 m² x 2 m) located in the underground parking structure. The runoff from Catchment 209 will be controlled by providing volume of 600 mm superpipes. 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.

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 and superpipes are provided in **Table 5-3**. A comparison of post-development to pre-development flows is shown in **Table 5-4**. Full HydroCAD modelling output is provided in **Appendix C**.

Table 5-3: Summary of the Storage Utilization for Phase 4

Return Period	Catchment 208 Cistern		Catchment 209 Superpipe	
	Utilized Storage (m ³ / 600 m ³)	Peak Water Elevation (m)	Utilized Storage (m ³ / 18.4 m ³)	Peak Water Elevation (m)
2	185.3	0.62	1.9	0.10
5	258.7	0.86	2.7	0.12
10	309.6	1.03	3.2	0.14
25	384.1	1.28	5.1	0.19
50	433.3	1.45	6.6	0.23
100	465.0	1.55	8.6	0.29

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

Return Period	208, 209 Development Release Rate (L/s)	210, 211 Uncontrolled Development Rate (L/s)	Total Development Rate* (L/s)	Total Allowable Release Rate, Q _P (L/s)
2	53.1	84.2	137.3	407.5
5	65.6	115.3	180.9	407.5
10	73.0	136.7	209.7	407.5
25	84.8	179.7	264.5	407.5
50	91.9	219.4	311.3	407.5
100	97.6	253.1	350.7	407.5

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

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 conditions.

5.3 Phase 4 Design Conclusion

Erosion Control

Erosion control for Phase 4 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

The proposed site is in an area of LGRA. Based on the City of Pickering's request for 5 mm on site infiltration within the 72-hour drawdown time for the private lands is required. Accordingly, an 85m³ infiltration gallery with the area and depth of 484 m² and 0.44 m with a drawdown time of 32 hours will be proposed northeast of Phase 4.

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 4 includes a residential block, private roads and a public park. Accordingly, an underground cistern with a volume of 600 m³ (for commercial / residential block) and 600 mm superpipes (park) are proposed respectively. The private roads will drain uncontrolled. The post-development flows, including the expected flows from the development, have been controlled to below the allowable release rate for the site for the final conditions.

6 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. For support of the OPA, and ZBA infiltration galleries within in each of the phases are sized and proposed to provide infiltration of the water balance volume for each phase.
- **Water Quality:** All runoff from impervious at-grade surfaces within each phase shall be treated by an appropriately sized filtered water quality unit, Jellyfish Filters, for 80% TSS removal. Runoff from rooftops and landscaping areas is considered clean as these areas are free from runoff generating activities.
- **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.

5 BIBLIOGRAPHY

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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

**a.m candaras associates inc.
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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 1.61m³/s as stated in the JSW report. Also, the maximum capacity of a 900mm diameter sewer is 1.8 m³/s, therefore the 1.61m³/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 m³/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:

$$\begin{aligned} \text{(a) Area C} &= 4.06 \text{ ha, to be limited to } 0.077 \text{ m}^3/\text{s} / \text{ha} \\ \therefore Q_C &= 4.06 \text{ ha} \times 0.077 \text{ m}^3/\text{s} / \text{ha} \\ &= 0.313 \text{ m}^3/\text{s} \end{aligned}$$

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

$$\begin{aligned} i_{100} &= \frac{1770}{(t+4)^{0.82}}, \text{ where } T = 10 \text{ min} \\ &= \frac{1770}{(10+4)^{0.82}} = 203.3 \text{ mm/hr} \end{aligned}$$

$$\begin{aligned} Q_B &= C A I N \\ &= (0.51) (1.29 \text{ ha}) (203.3 \text{ mm/hr}) (2.778) \\ &= 371.6 \text{ l/s (0.372 m}^3/\text{s)} \end{aligned}$$

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

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

$$\begin{aligned} Q_A &= (0.61) (0.51 \text{ ha}) (203.3 \text{ mm/hr}) (2.778) \\ &= 175.7 \text{ l/s (0.176 m}^3/\text{s)} \end{aligned}$$

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

$$= 0.69 \text{ ha}$$

$$H = 0.46 \text{ ha}$$

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

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

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

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

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

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

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

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)	= <u>0.16ha</u>
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) =	<u>0.17</u>
Total	3.37ha

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

$$\begin{aligned} \text{Site A} = 3.27\text{ha} \quad Q_{\text{ALLOWABLE}} &= \frac{(3.27)}{(3.27+3.37)} \times 0.55 \text{ m}^3/\text{s} \\ &= 0.27 \text{ m}^3/\text{s} \end{aligned}$$

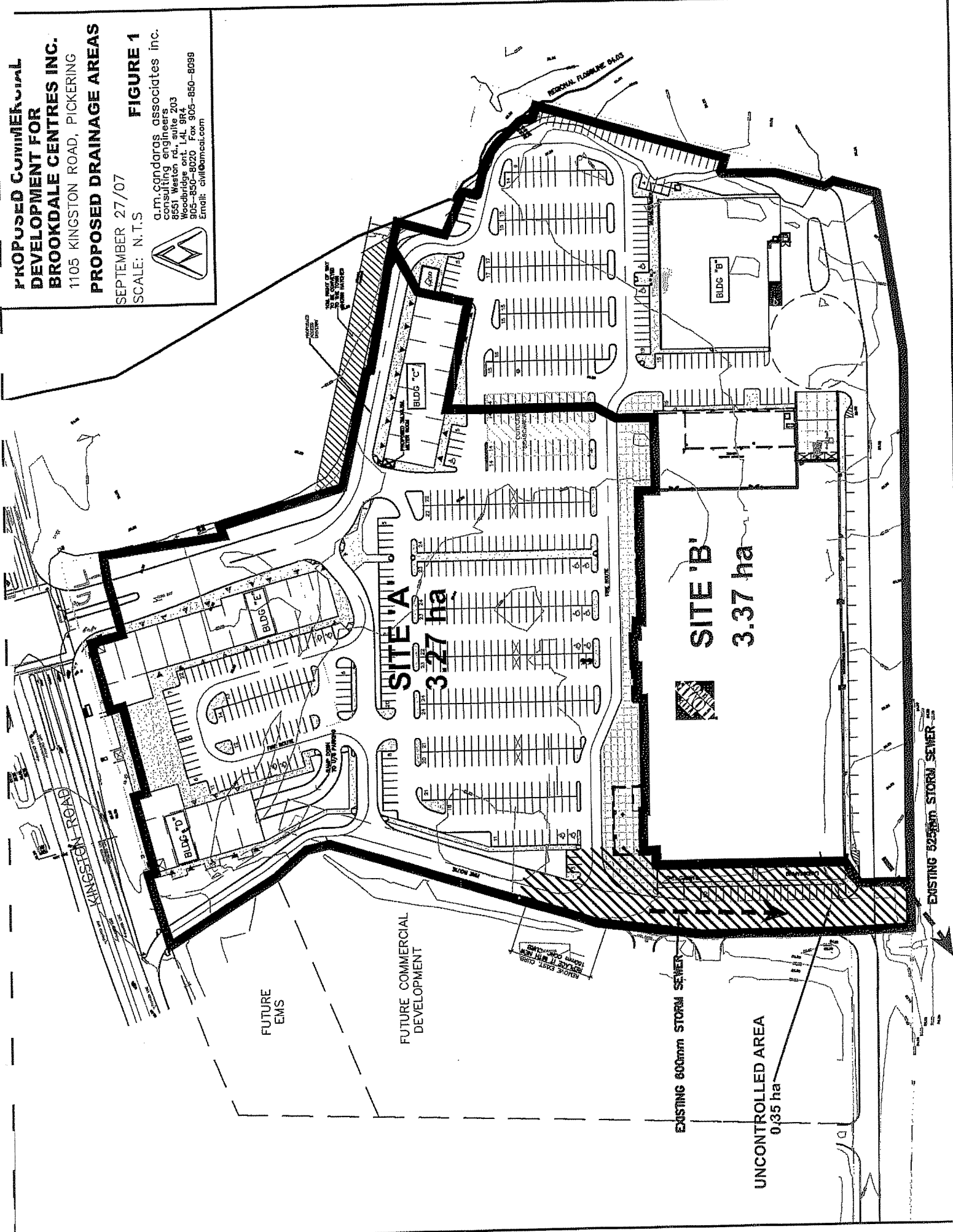
$$\begin{aligned} \text{Site B} = 3.37\text{ha} \quad Q_{\text{ALLOWABLE}} &= 0.55 \text{ m}^3/\text{s} - 0.27\text{m}^3/\text{s} \\ &= 0.28 \text{ m}^3/\text{s} \end{aligned}$$

**PROPOSED COMMERCIAL
DEVELOPMENT FOR
BROOKDALE CENTRES INC.**
1105 KINGSTON ROAD, PICKERING
PROPOSED DRAINAGE AREAS

SEPTEMBER 27/07
SCALE: N.T.S



FIGURE 1
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5.0 PRE-DEVELOPMENT 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

$$\begin{aligned} \therefore CA &= [(0.25)(0.50) + (0.71)(1.76) + (0.51)(2.57) + (0.9)(1.15)] \\ &= 3.7 \end{aligned}$$

Based on City of Pickering rainfall intensity curves;

$$\begin{aligned} i_{2yr} &= \frac{647.7}{(t+4)^{0.784}} & t &= 10\text{min} \\ &= \frac{647.7}{(10+4)^{0.784}} & &= 81.8\text{mm/hr} \end{aligned}$$

$$\begin{aligned} i_{5yr} &= \frac{2464}{t+16} & t &= 10\text{min} \\ &= \frac{2464}{10+16} & &= 94.8\text{mm/hr} \end{aligned}$$

$$\begin{aligned} i_{100yr} &= \frac{1770}{(t+4)^{0.82}} & t &= 10\text{min} \\ &= \frac{1770}{(10+4)^{0.82}} & &= 203.3\text{mm/hr} \end{aligned}$$

- Pre-Development flows are as follows:

2yr $Q = CAIN$
 $= (3.7) (81.8\text{mm/hr}) (2.778)$
 $= 841 \text{ l/s } (0.84\text{m}^3/\text{s}) > 0.55\text{m}^3/\text{s} \text{ allowable runoff}$

5yr $Q = CAIN$
 $= (3.7) (94.8\text{mm/hr}) (2.778)$
 $= 974 \text{ l/s } (0.97\text{m}^3/\text{s}) > 0.55\text{m}^3/\text{s} \text{ allowable runoff}$

100yr $Q = CAIN$
 $= (3.7) (203.3\text{mm/hr}) (2.778)$
 $= 2090 \text{ l/s } (2.09 \text{ m}^3/\text{s}) > 0.55 \text{ m}^3/\text{s} \text{ allowable runoff}$

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 (m ²)	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
					QR=17.1 l/s (0.02 m ³ /s)

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

SITE B

Bldg	Area (m ²)	No. Of Notches	Notch Area (m ²)	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 (0.05m ³ /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.

$$\begin{aligned} \therefore Q_{\text{Uncontrolled}} &= CAIN, \quad \text{where } C = 0.85 \\ &= (0.85)(0.35\text{ha})(203.3\text{mm/hr})(2.778) \quad A \quad = 0.35\text{ha}(0.315\text{ha paved}) \\ & \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad (0.0035 \text{ Landscaped}) \\ &= 168.0 \text{ l/s } (0.17\text{m}^3/\text{s}) \quad t_{100} = 203.3 \text{ mm/hr} \\ & \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{Based on T} = 10\text{min} \end{aligned}$$

$$\text{Allowable Runoff Site A} = 0.27\text{m}^3/\text{s}$$

$$\text{Uncontrolled Run off Site A} = 0.17\text{m}^3/\text{s}$$

$$\text{Roof Discharge Site A} = 0.02\text{m}^3/\text{s}$$

\therefore Allowable discharge from paved and landscaped Area:

$$\begin{aligned} Q_s &= 0.27 \text{ m}^3/\text{s} - (0.17 + 0.02) \text{ m}^3/\text{s} \\ &= 0.08 \text{ m}^3/\text{s} \end{aligned}$$

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.

$$\text{Allowable runoff Site B} = 0.28 \text{ m}^3/\text{s}$$

$$\text{Roof Discharge Site B} = 0.05 \text{ m}^3/\text{s}$$

\therefore Allowable discharge from paved and landscaped areas:

$$\begin{aligned} Q_s &= 0.28 \text{ m}^3/\text{s} - 0.05 \text{ m}^3/\text{s} \\ &= 0.23 \text{ m}^3/\text{s} \end{aligned}$$

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 (m³) = (Runoff – Allowable Outflow) x 5min x 60sec

(1) Allowable Outflow = 0.08 m³/s

(2) Allowable Outflow = 0.07 m³/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 (m ³ /s)	Storage (m ³)
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

$$\begin{aligned} \text{DCB \# 1\&2} &= 400.0 \text{ m}^3 \\ \text{CB\#23} &= 5.3 \text{ m}^3 \\ \text{DCB \# 3} &= \frac{121.5 \text{ m}^3}{526.8 \text{ m}^3} \end{aligned}$$

Pipe Storage

$$\begin{aligned} 338.5\text{m} - 450\text{mm dia} &= 53.8 \text{ m}^3 \\ 50\text{m} - 375\text{mm dia} &= 5.5 \text{ m}^3 \\ 47\text{m} - 300\text{mm dia} &= 3.3 \text{ m}^3 \\ 44\text{m} - 200\text{mm dia} &= 1.4 \text{ m}^3 \\ 29.5\text{m} - 250\text{mm dia} &= \frac{1.5 \text{ m}^3}{65.5 \text{ m}^3} \end{aligned}$$

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.

$$\begin{aligned} \therefore \text{Total Storage provided} &= 526.8 \text{ m}^3 \text{ (Surface Storage)} \\ &+ 65.5 \text{ m}^3 \text{ (Pipe Storage)} \\ &+ \frac{563.9 \text{ m}^3}{1,156.2 \text{ m}^3} \text{ (Stormtech Chambers)} \\ &1,156.2 \text{ m}^3 > 1,149.0 \text{ m}^3 \text{ (required based on 150mm orifice)} \end{aligned}$$

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	= <u>33.8</u>
	431.5 m ³

Pipe Storage

187m – 525mm dia	= 40.5 m ³
182m – 450mm dia	= 29.0 m ³
13m - 300mm dia	= 0.9 m ³
193.5m – 250mm dia	= 9.5 m ³
17m - 200mm dia	= <u>0.5 m³</u>
	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 m ³ (surface storage)
	+ 80.4 m ³ (pipe storage)
	+ <u>44.5 m³</u> (stormtech chambers)
	556.4 m ³ > 555.0 m ³ (required)

9.0 OUTLET CONTROLS

A) Site A

To limit the discharge to :

$$\begin{aligned}Q_A &= 0.27 \text{ m}^3/\text{s} - 0.17 \text{ m}^3/\text{s} \text{ (uncontrolled flow)} \\ &= 0.10 \text{ m}^3/\text{s}\end{aligned}$$

Sizing of orifice pipe is as follows :

$$\begin{aligned}Q &= CA \sqrt{2gh} \\ Q &= 0.13 \text{ m}^3/\text{s} \\ H &= \text{HWL} - \text{Inv. of orifice} \\ H &= 85.10 - 83.14 \\ &= 1.96 \text{ m}\end{aligned}$$

$$\begin{aligned}A &= \frac{Q}{C\sqrt{2gh}} \\ &= \frac{0.10}{0.8\sqrt{2 \times 9.81 \times 1.96}} \\ &= 0.02016 \text{ m}^2\end{aligned}$$

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

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

$$\begin{aligned}Q &= CA \sqrt{2gh} \\ &= (0.8)(0.0177) \sqrt{2 \times 9.81 \times 1.56} \\ &= 0.09 \text{ m}^3/\text{s}\end{aligned}$$

$$A = \frac{\pi d^2}{4} = \pi \frac{(0.15)^2}{4} = 0.0177 \text{ m}^2$$

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

$$\begin{aligned} Q &= CA \sqrt{2gh} \\ &= (0.8)(0.491) \sqrt{2 \times 9.81 \times 2.95} \\ &= 0.30 \text{ m}^3/\text{s} \end{aligned}$$

$$A = \frac{\pi (.25)^2}{4} = 0.0491 \text{ m}^2$$

∴ 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) Treatment Unit #1

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

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

B) Treatment Unit # 2

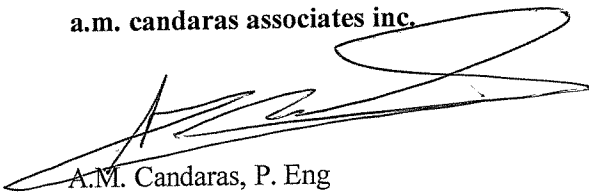
$$\begin{aligned}\text{Tributary Impervious Area} &= 3.37 \text{ ha} \times 90\% \text{ (imperviousness)} \\ &= 3.03 \text{ ha}\end{aligned}$$

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

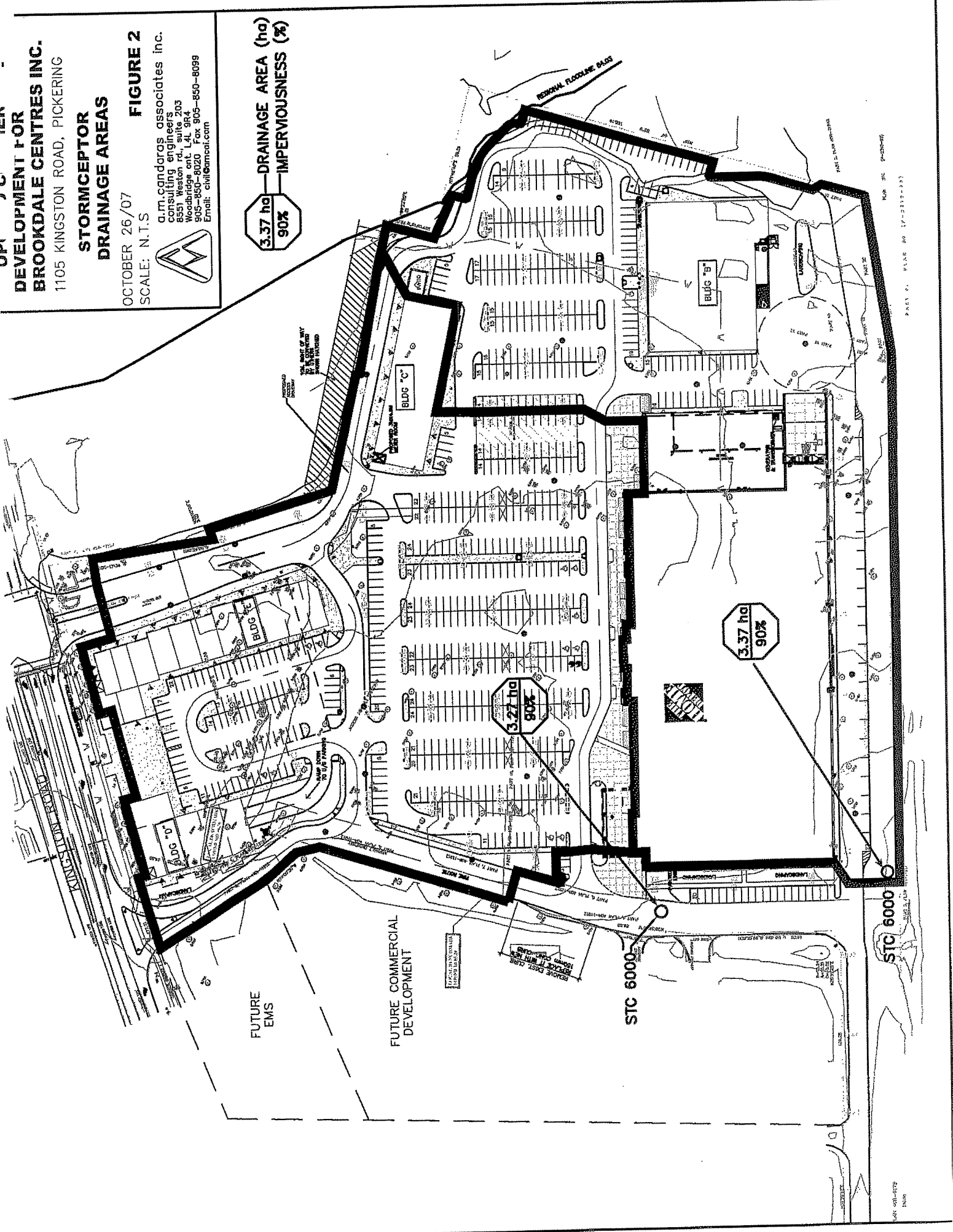


DEVELOPMENT FOR
BROOKDALE CENTRES INC.
 1105 KINGSTON ROAD, PICKERING
**STORMCEPTOR
 DRAINAGE AREAS**
 OCTOBER 26/07
 SCALE: N.T.S.



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

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



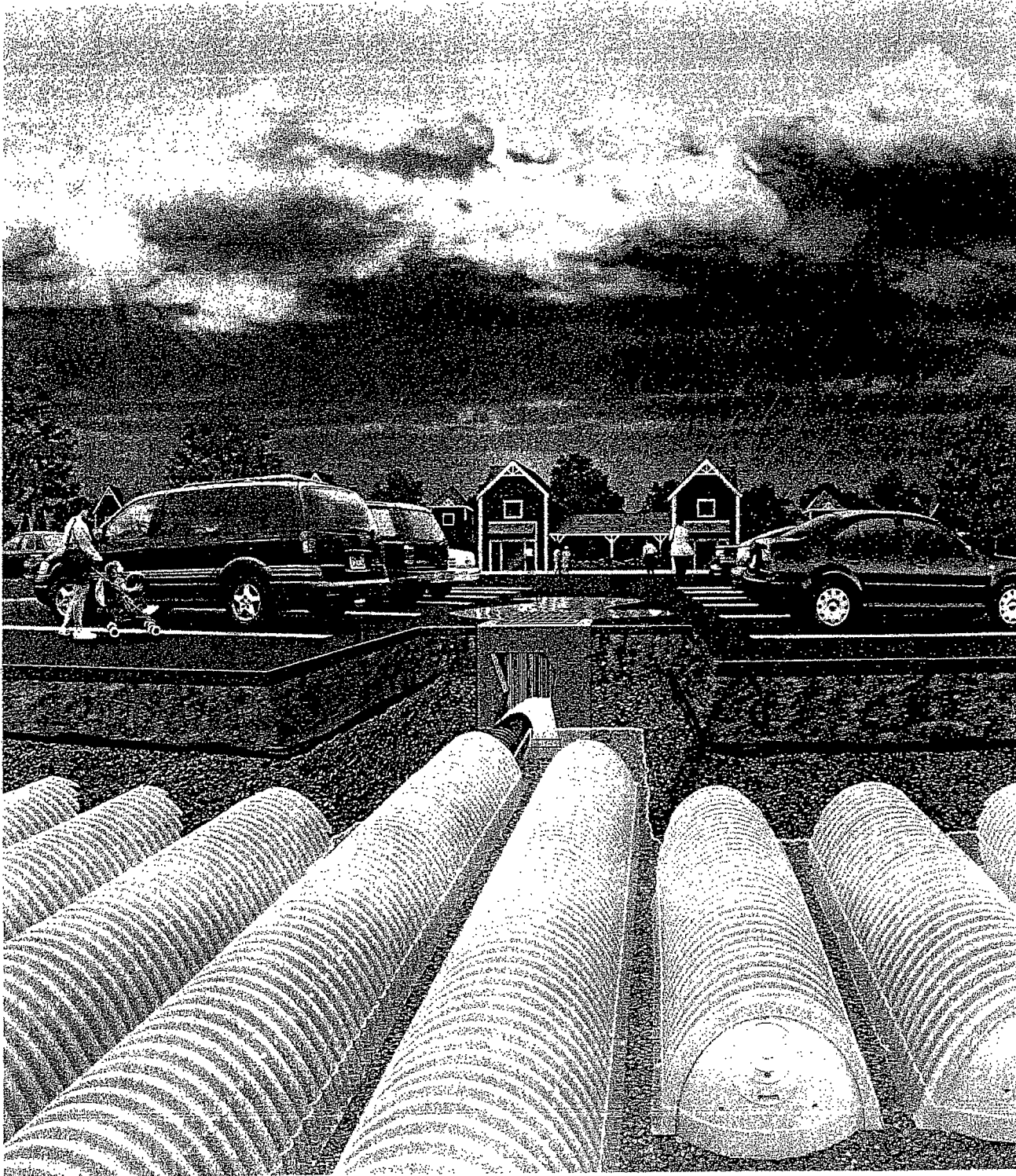
PART 2, PLAN NO. 19-2312-131
 MGR 316 (4-20-07)

STC 6000

UNIT 101-102
 10/07

APPENDIX A
STORMTECH SPECIFICATIONS


StormTech[®]
Detention • Retention • Recharge
Subsurface Stormwater ManagementSM



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 ft ³
Minimum Installed Storage*	74.9 ft ³
Weight	74 lbs

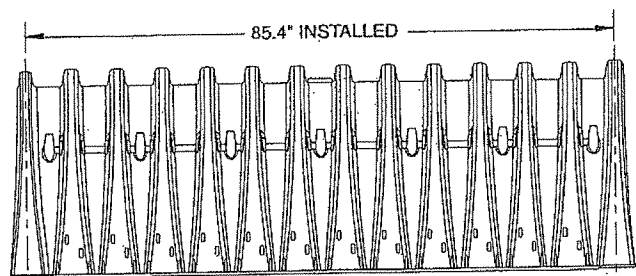
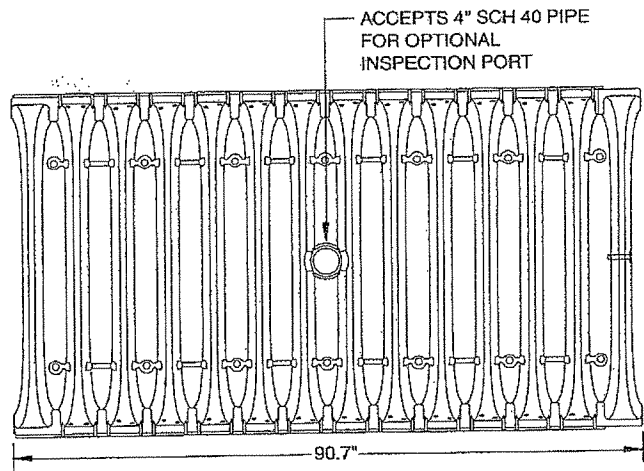
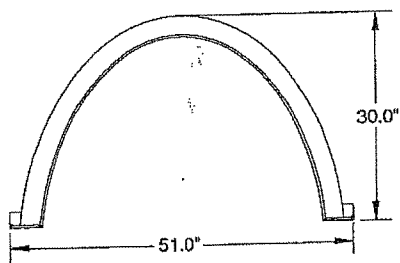
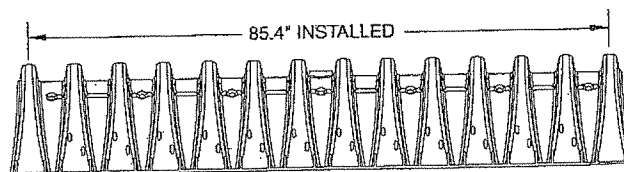
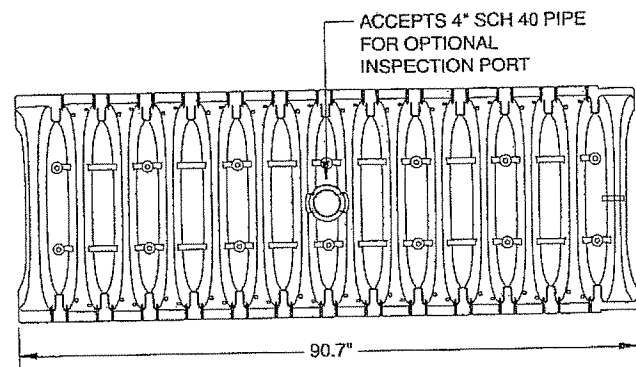
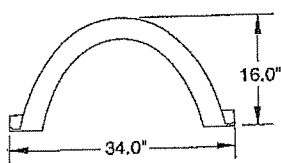


Figure 2
StormTech SC-310 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	34.0" x 16.0" x 85.4"
Chamber Storage	14.7 ft ³
Minimum Installed Storage*	31.0 ft ³
Weight	37 lbs



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

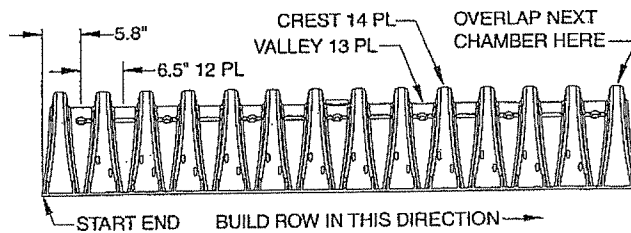
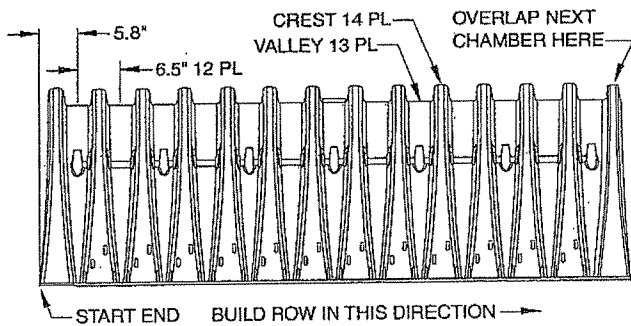
2.5 STORMTECH CHAMBERS

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

Figure 3
Distance Between Corrugations (not to scale)



SC-310 chamber

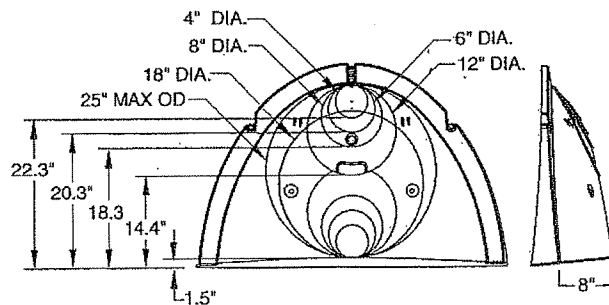
2.6 STORMTECH END CAPS

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.

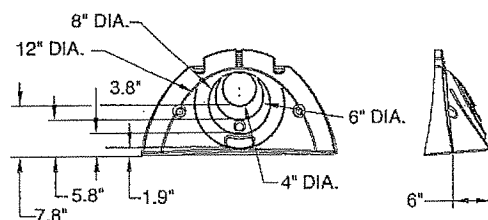
StormTech end caps are required at each end of a chamber row to prevent stone intrusion (two per row). The SC-740 end cap will accept up to a 25-inch maximum outside diameter inlet pipe. The SC-310 end cap will accept up to a 12-inch inlet pipe. To aid contractors, inlet pipe cutting guides and a blade-starting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

Product Specifications: 3.1, 3.2, 3.3 and 3.4

Figure 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)

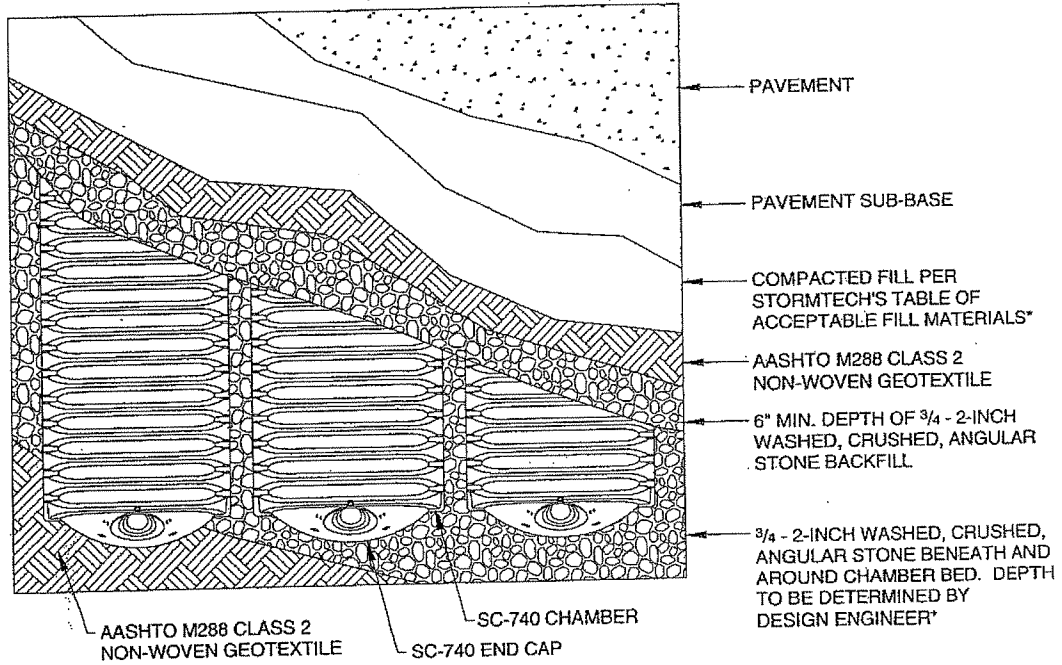
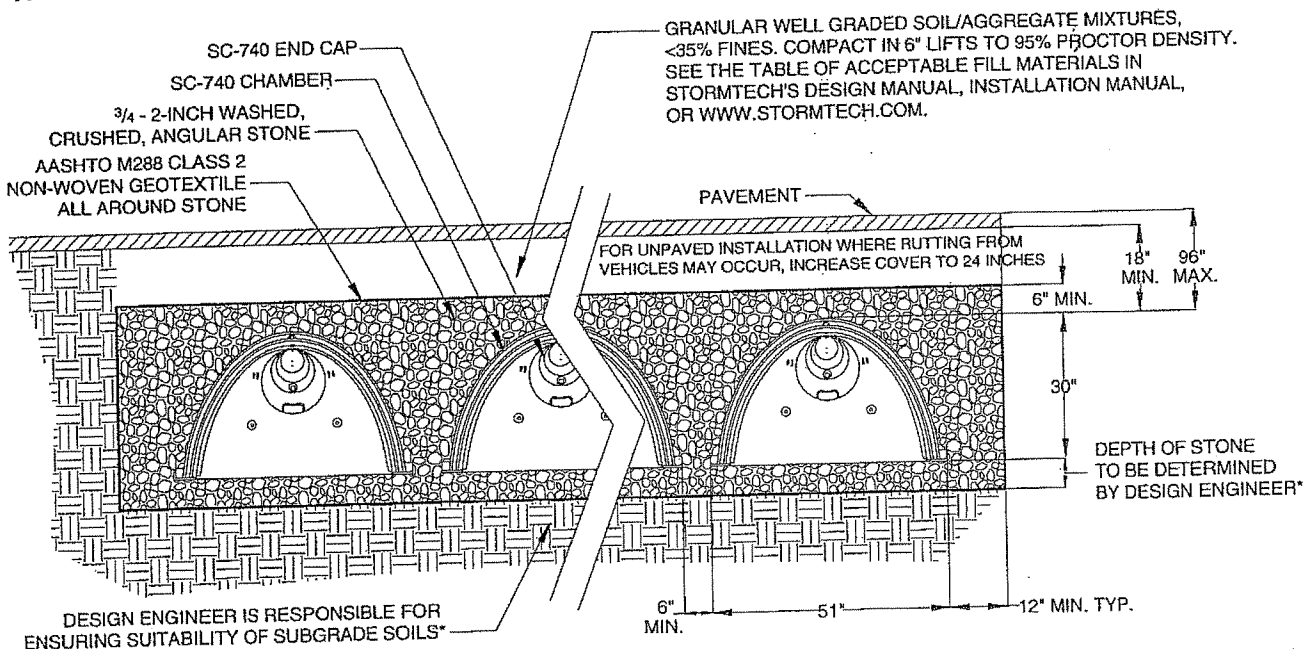


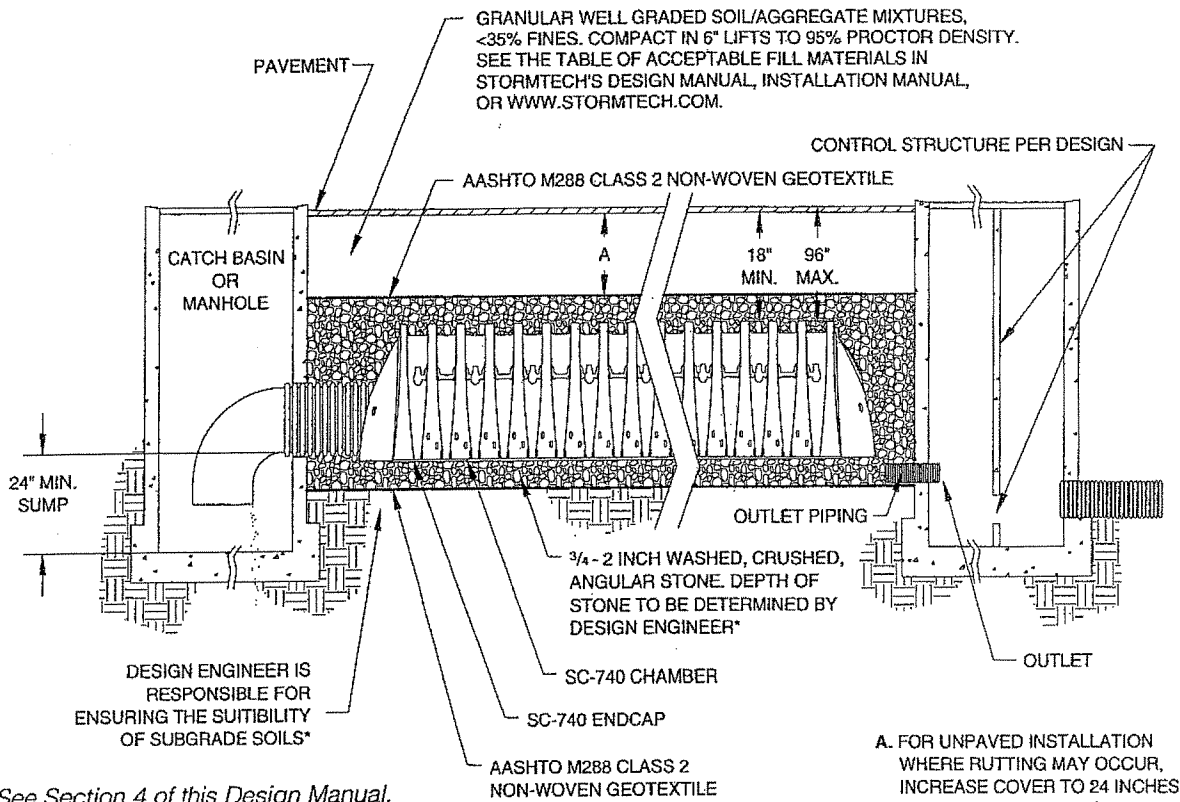
Figure 14
Typical Cross Section Detail – StormTech SC-740 Chamber (not to scale)



*See Section 4 of this Design Manual.

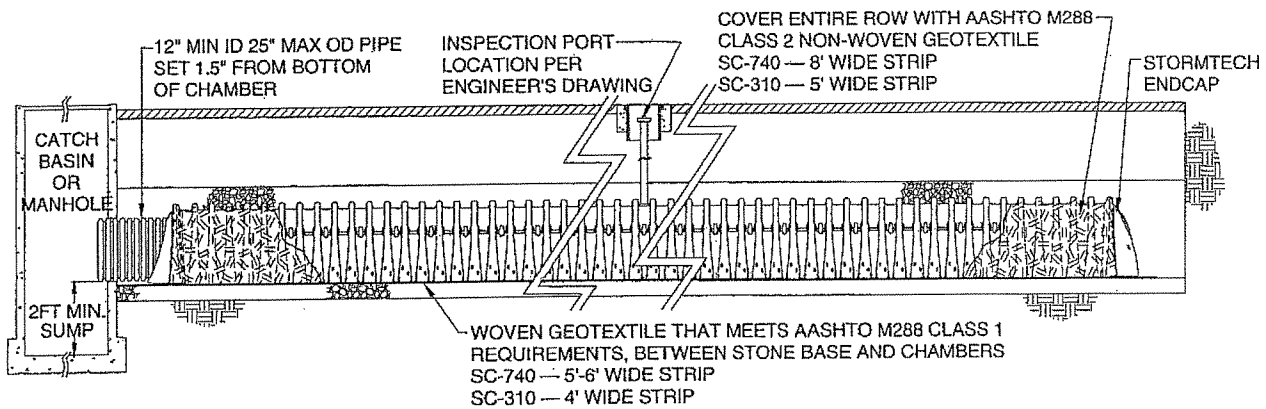
Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

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



*See Section 4 of this Design Manual.

Figure 16
StormTech Isolator Row (not to scale)



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

APPENDIX B
VORTSENTRY SIZING

Sizing Estimate

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)

Operating 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 with 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**

Design Ratio¹ = $\frac{3.27 \text{ ha} \times 0.9}{7.54 \text{ m}^3}$ = 0.027

<u>Rainfall Intensity</u> mm/hr	<u>Flow Rate</u> l/s	<u>Operating Rate</u> ² cfs/ft ³	<u>% Total Rainfall</u> Depth ³	<u>Rmvl. Effcy</u> ⁴ (%)	<u>Rel. Effcy</u> (%)
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/ft³) = 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



Treatment Chamber Outlet Orifice

Orifice Area (m²) = 0.060
Discharge Coefficient = 308

Flow Partition Weir

Crest El. (m) = 0.46
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

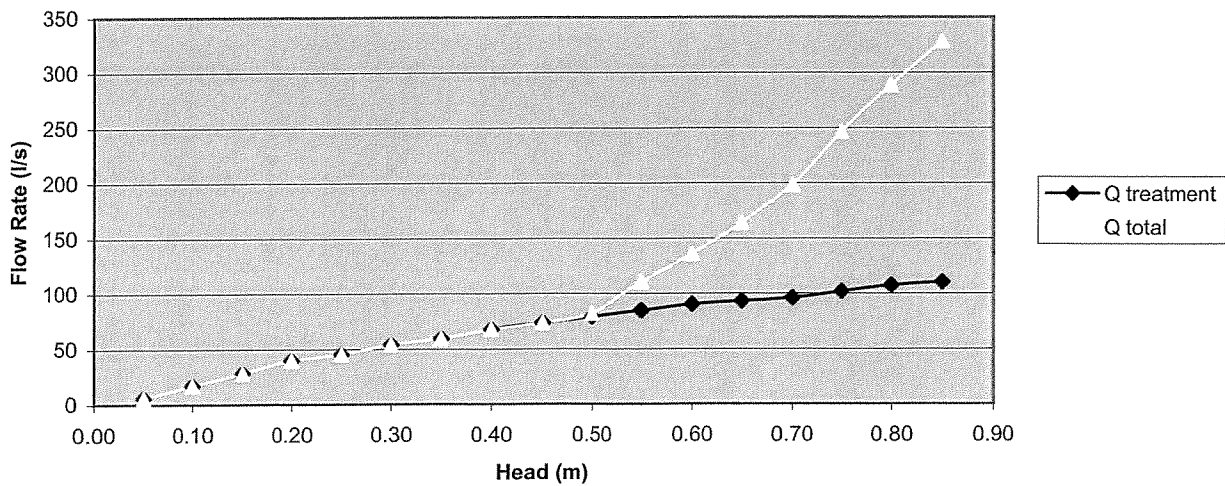
Calculated by: JAK

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

Design Ratio¹ = $\frac{3.37 \text{ ha} \times 0.9}{7.54 \text{ m}^3}$ = 0.028

<u>Rainfall Intensity</u> mm/hr	<u>Flow Rate</u> l/s	<u>Operating Rate</u> ² cfs/ft ³	<u>% Total Rainfall</u> Depth ³	<u>Rmvl. Effcy</u> ⁴ (%)	<u>Rel. Effcy</u> (%)
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/ft³) = 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

Orifice Area (m²) = 0.060
 Discharge Coefficient = 308

Flow Partition Weir

Crest El. (m) = 0.46
 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

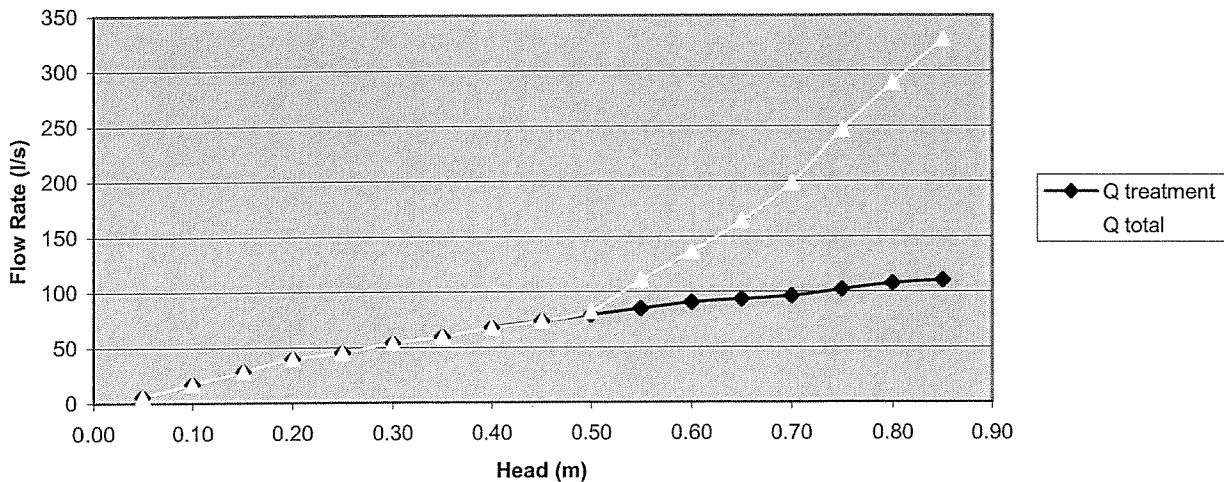
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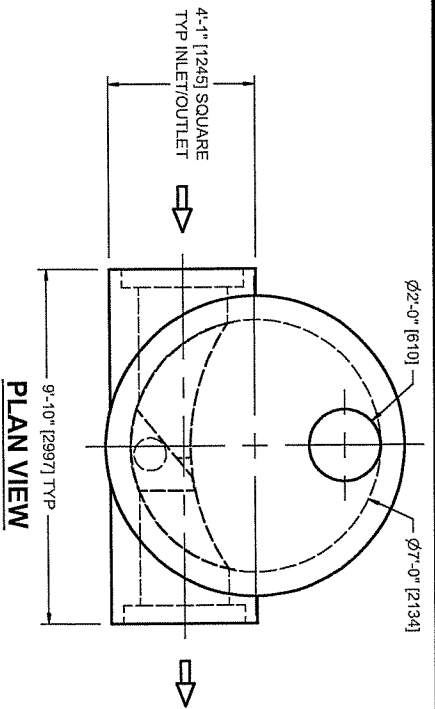
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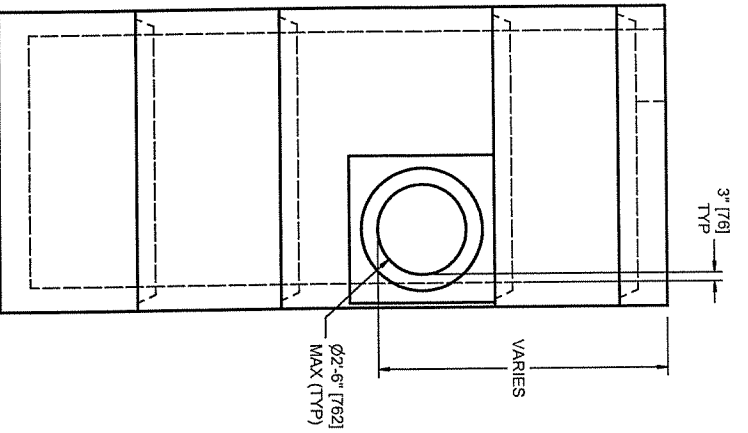
Stage Discharge



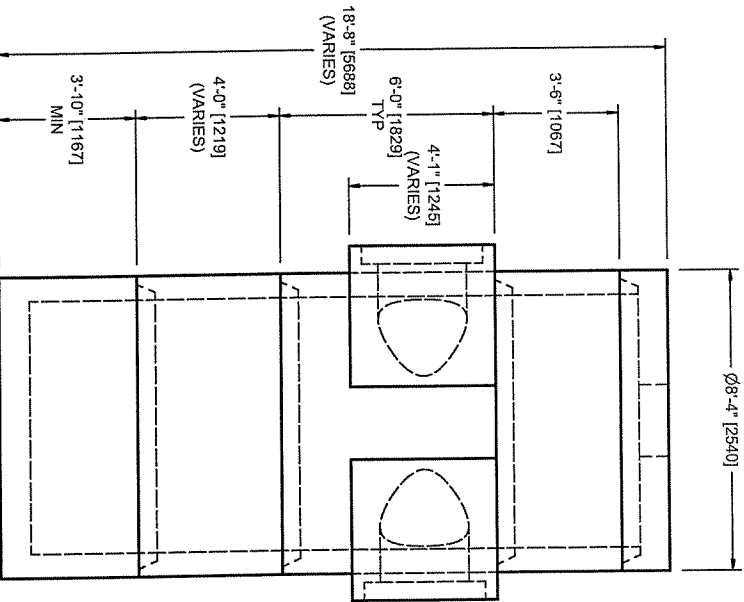
THE VORTSENTRY SECTION SHALL BE STENCILED WITH THE CONTECH STORMWATER SOLUTIONS NAME AND LOGO. PIPE OPENINGS SHALL BE STENCILED "INLET" OR "OUTLET" AS APPROPRIATE



PLAN VIEW



LEFT SIDE VIEW



ELEVATION VIEW

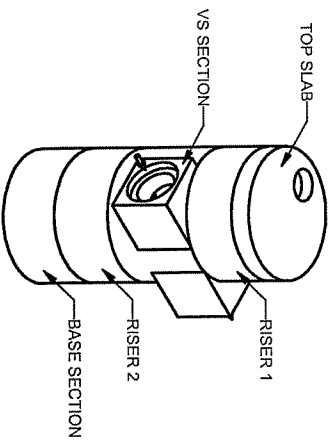
ALTERNATE UNITS [] ARE IN MILLIMETERS UNLESS NOTED OTHERWISE

FOR INFORMATIONAL PURPOSES ONLY - NOT INTENDED FOR CONSTRUCTION

This CADD file is for the purpose of specifying stormwater treatment equipment to be furnished by CONTECH Stormwater Solutions and may only be transferred to other documents exactly as provided by CONTECH Stormwater Solutions. Title block information, excluding the CONTECH Stormwater Solutions logo and the VortSentry Stormwater Treatment System designation and patent number, may be deleted if necessary. Revisions to any part of this CADD file without prior coordination with CONTECH Stormwater Solutions shall be considered unauthorized use of proprietary information.

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

STANDARD DETAIL
STORMWATER TREATMENT SYSTEM
VORTSENTRY® VS70 US PATENT No. 6,991,114

STD



SCALE:	NONE
DRAWN:	JBS
CHECKED:	NDG
FILE NAME:	STDVST0
DATE:	9/25/06

contechstormwater.com

APPENDIX C
REFERENCED DOCUMENTS

0589.Swm-Jan.2015.docx

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

<u>Area</u>	<u>C</u>
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

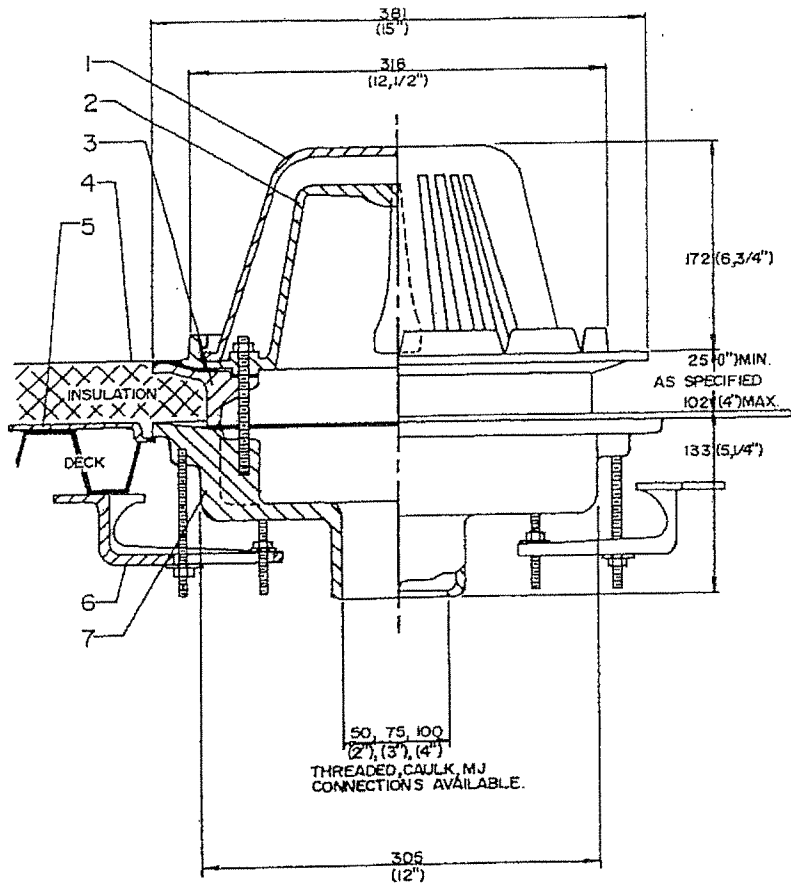
Note: Bpre is an area unchanged from the pre-development condition.

* Reference from JSW Stormwater Management report, June 1988

LOCATION	SQUARE METRE (SQ. FT.)	ROOF LOAD FACTOR (K.G.S. (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 (15.8)	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)	16	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)	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	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)	28	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)	6	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)				

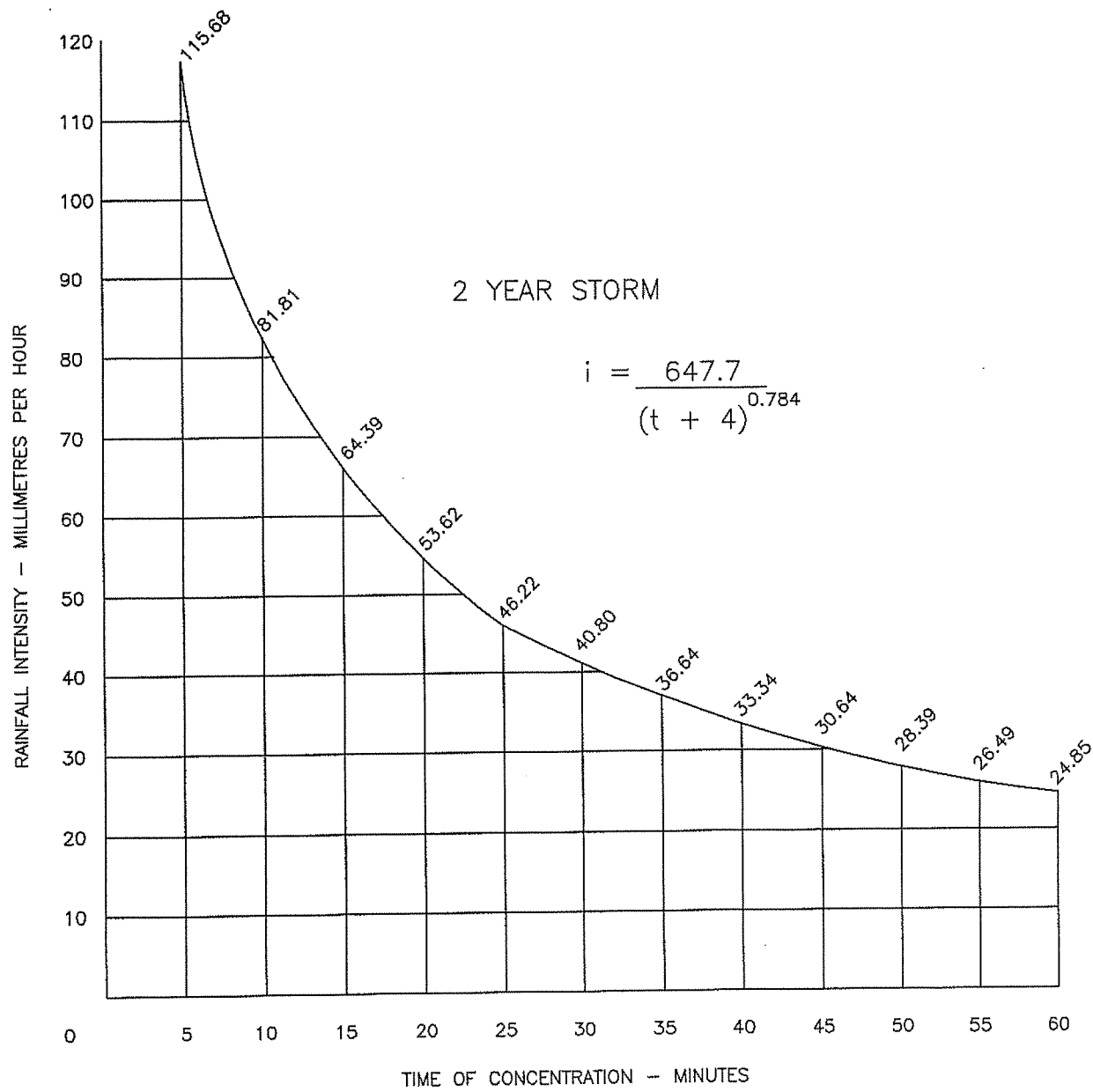
Economical Roof Drainage Installations

SPECIFICATION DATA



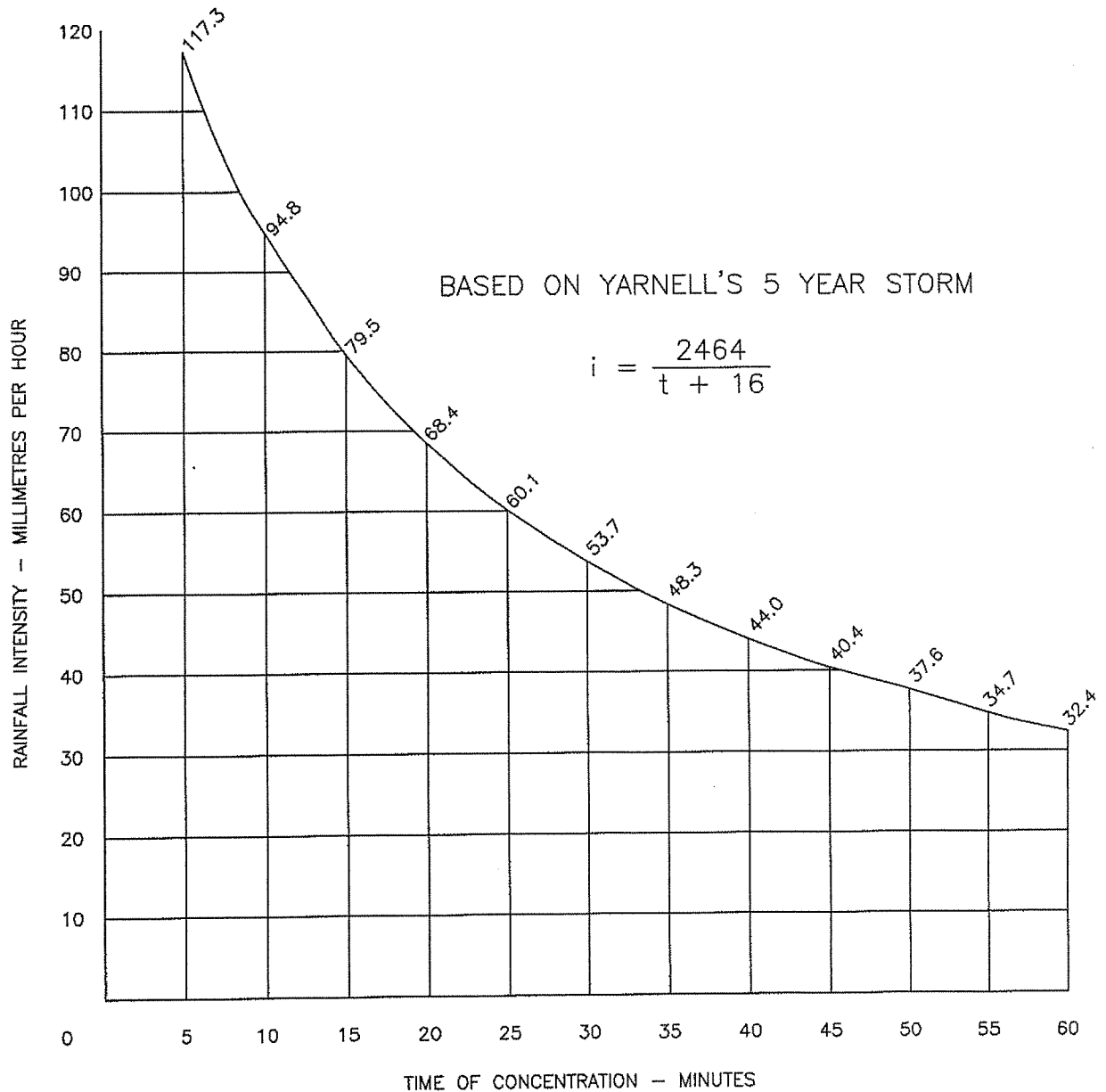
<u>PART</u>	<u>DESCRIPTION</u>
1	POLY-DOME
2	CONTROL FLO WEIR WITH INTEGRAL CLAMP COLLAR AND GRAVEL GUARD
3	E-EXTENSION WITH GASKET (WHEN SPECIFIED)
4	ROOFING MEMBRANE (BY OTHERS)
5	R-ROOF SUMP RECEIVER (WHEN SPECIFIED)
6	C-UNDERDECK CLAMP (WHEN SPECIFIED)
7	BODY

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.



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

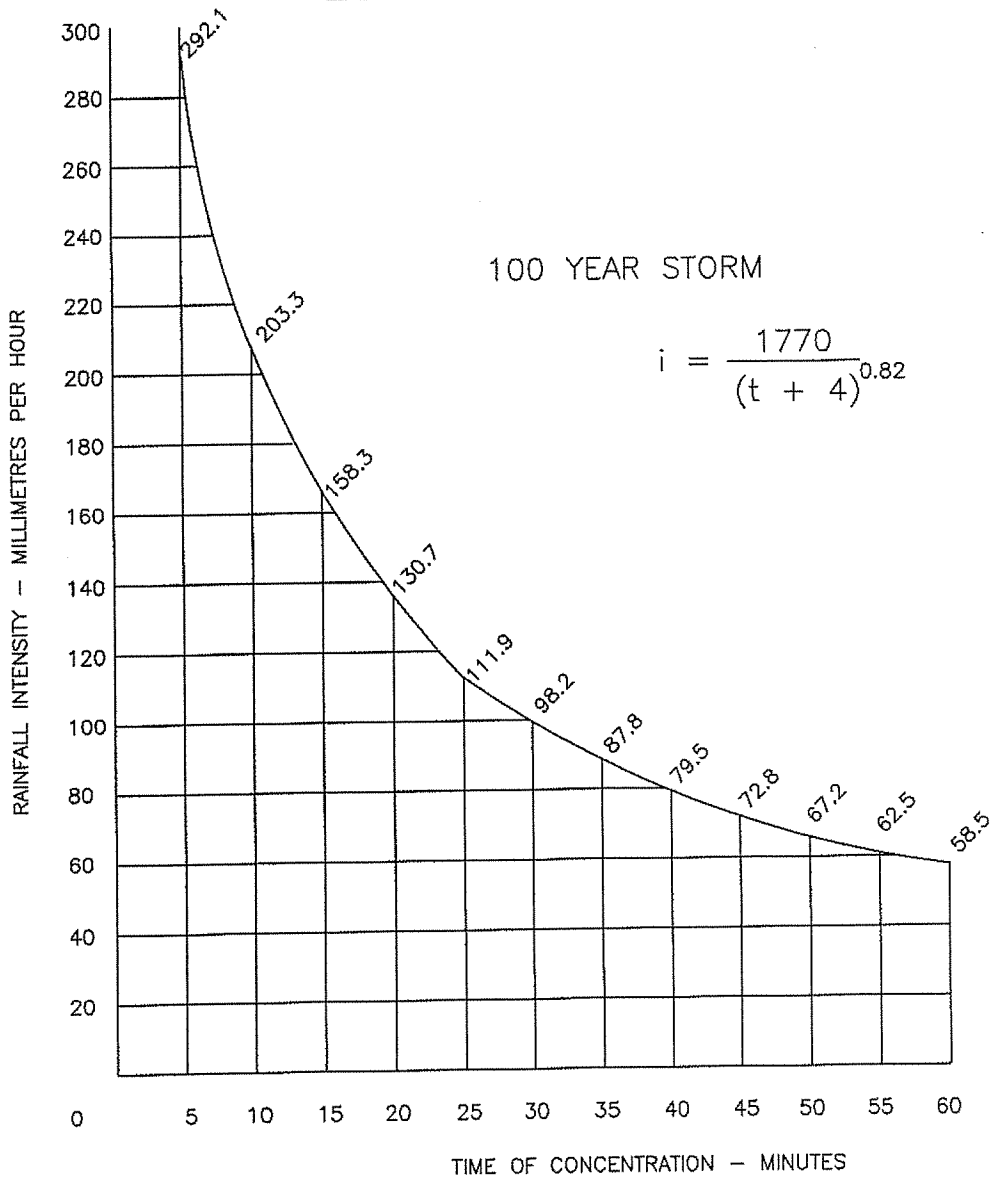
City of Pickering		Planning & Development Department	
DRAWN J. McMULLEN	<h2 style="margin: 0;">RAINFALL INTENSITY CURVE FOR DESIGN OF STORM SEWERS</h2>		REVISION NO.
APPROVED R. STARR			DATE
DATE OCTOBER 2003			P-501



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



City of Pickering		Planning & Development Department	
DRAWN J. McMULLEN	RAINFALL INTENSITY CURVE FOR DESIGN OF STORM SEWERS		REVISION NO. DATE
APPROVED R. STARR			P-504
DATE OCTOBER 2003			

*5 minute Time Steps

*100yr STORM, 4HR HYETOGRAPH

IDF curve parameters: A=1770.000
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
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.08	4.035	1.08	19.246	2.08	11.859
.17	4.291	1.17	30.539	2.17	10.735
.25	4.586	1.25	76.878	2.25	9.818
.33	4.929	1.33	292.075	2.33	9.054
.42	5.334	1.42	101.415	2.42	8.408
.50	5.821	1.50	52.341	2.50	7.854
.58	6.416	1.58	34.908	2.58	7.374
.67	7.164	1.67	26.170	2.67	6.953
.75	8.131	1.75	20.966	2.75	6.582
.83	9.436	1.83	17.526	2.83	6.251
.92	11.297	1.92	15.087	2.92	5.954
1.00	14.177	2.00	13.268	3.00	5.687

CHICAGO STORM
Ptotal= 78.04 mm

StormWater Management Hydrologic Model
999 999

***** SWHYMO-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: swbymo@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\GENERAL-1\BLOORS-1\BLOORS-1.DAT *****
***** Output filename: N:\otthymo\GENERAL-1\BLOORS-1\BLOORS-1.out *****
***** Summary filename: N:\otthymo\GENERAL-1\BLOORS-1\BLOORS-1.sum *****
***** User comments: *****
* 1: *****
* 2: *****
* 3: *****

001:0001-

* CREATION OF 4 HOUR STORM HYETOGRAPHS FOR TORONTO,
* BLOOR STREET STATION

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

001:0002

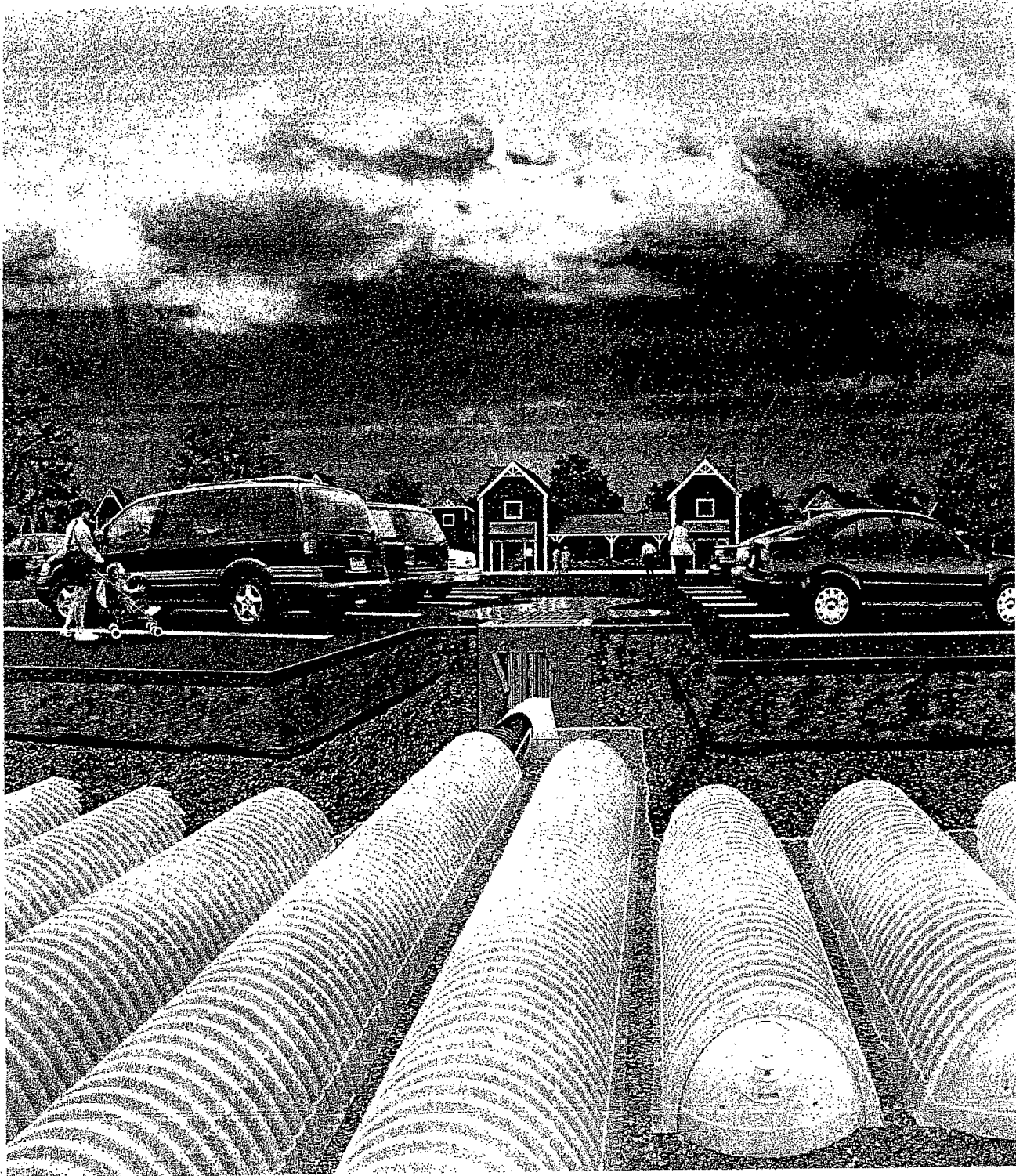
001:0003
FINISH

***** 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 %	



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 ft ³
Minimum Installed Storage*	74.9 ft ³
Weight	74 lbs

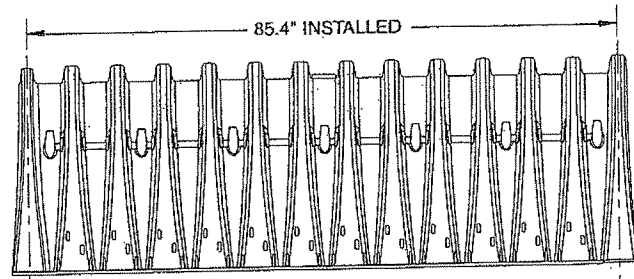
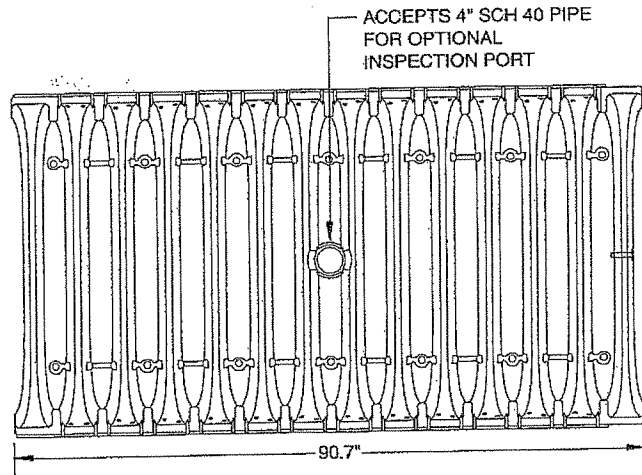
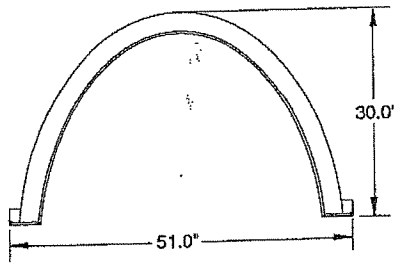
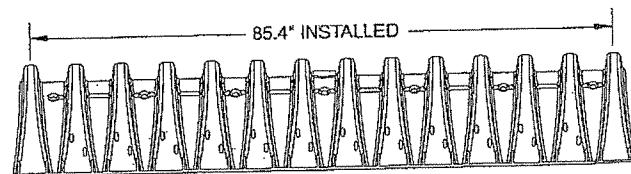
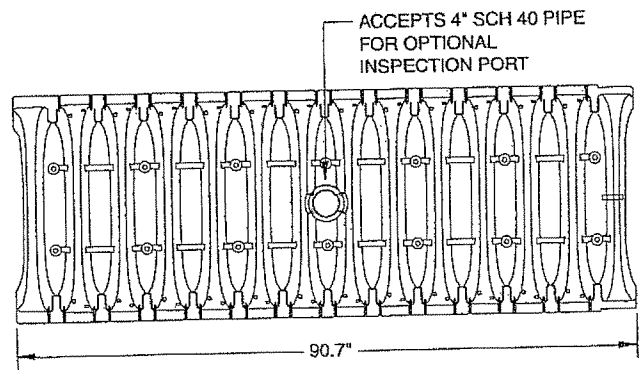
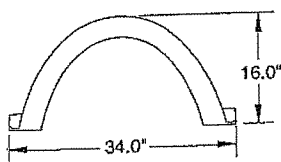


Figure 2
StormTech SC-310 Chamber (not to scale)

Nominal Chamber Specifications

Size (W x H x Installed L)	34.0" x 16.0" x 85.4"
Chamber Storage	14.7 ft ³
Minimum Installed Storage*	31.0 ft ³
Weight	37 lbs



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

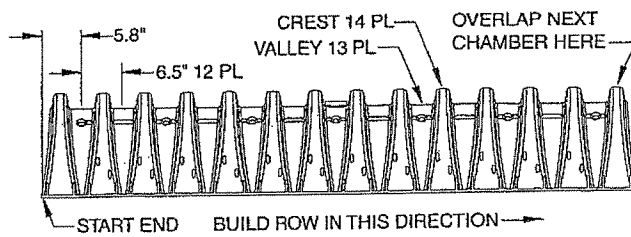
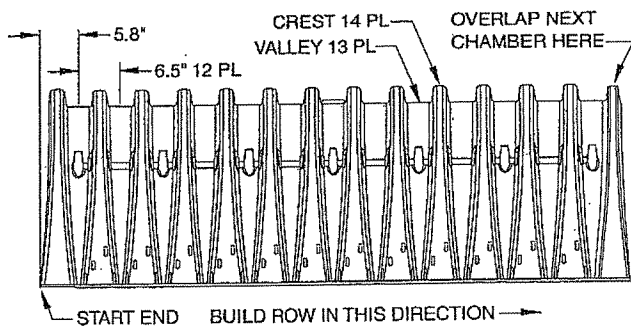
2.5 STORMTECH CHAMBERS

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

Figure 3
Distance Between Corrugations (not to scale)



SC-310 chamber

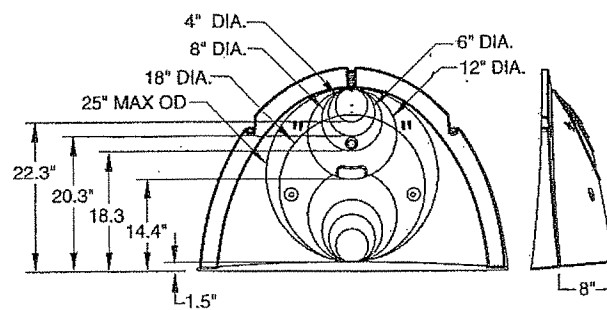
2.6 STORMTECH END CAPS

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.

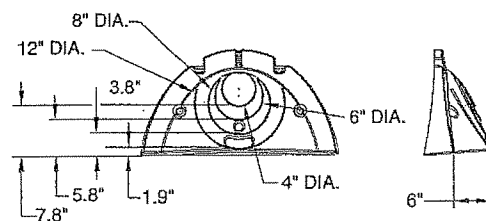
StormTech end caps are required at each end of a chamber row to prevent stone intrusion (two per row). The SC-740 end cap will accept up to a 25-inch maximum outside diameter inlet pipe. The SC-310 end cap will accept up to a 12-inch inlet pipe. To aid contractors, inlet pipe cutting guides and a blade-starting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

Product Specifications: 3.1, 3.2, 3.3 and 3.4

Figure 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)

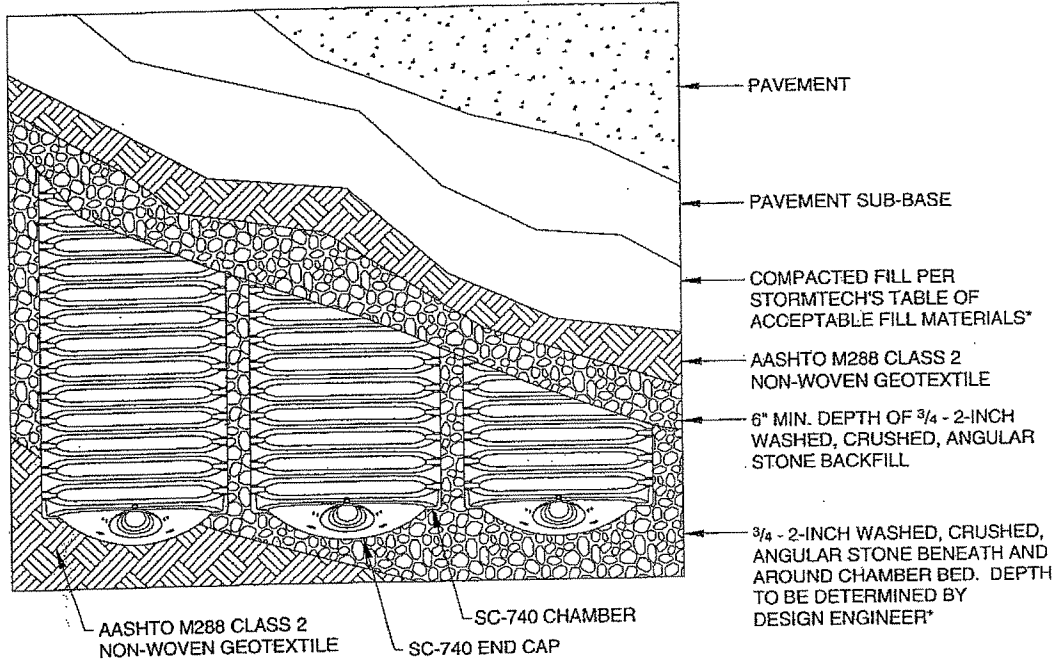
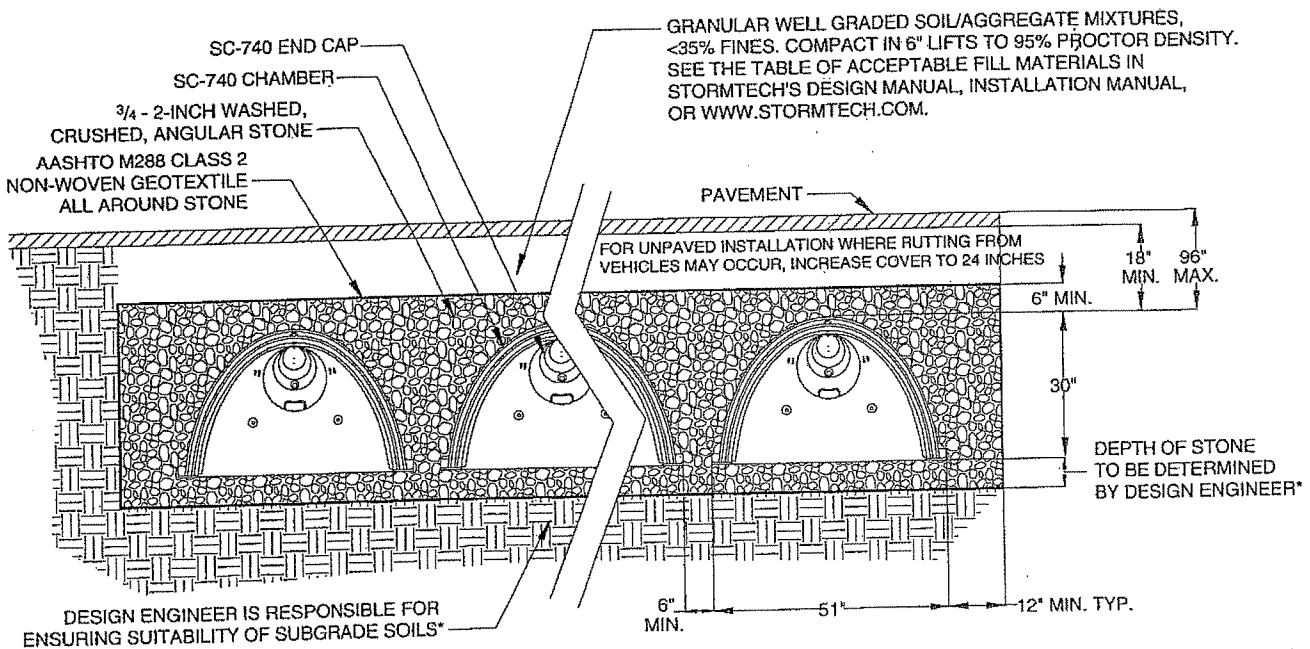


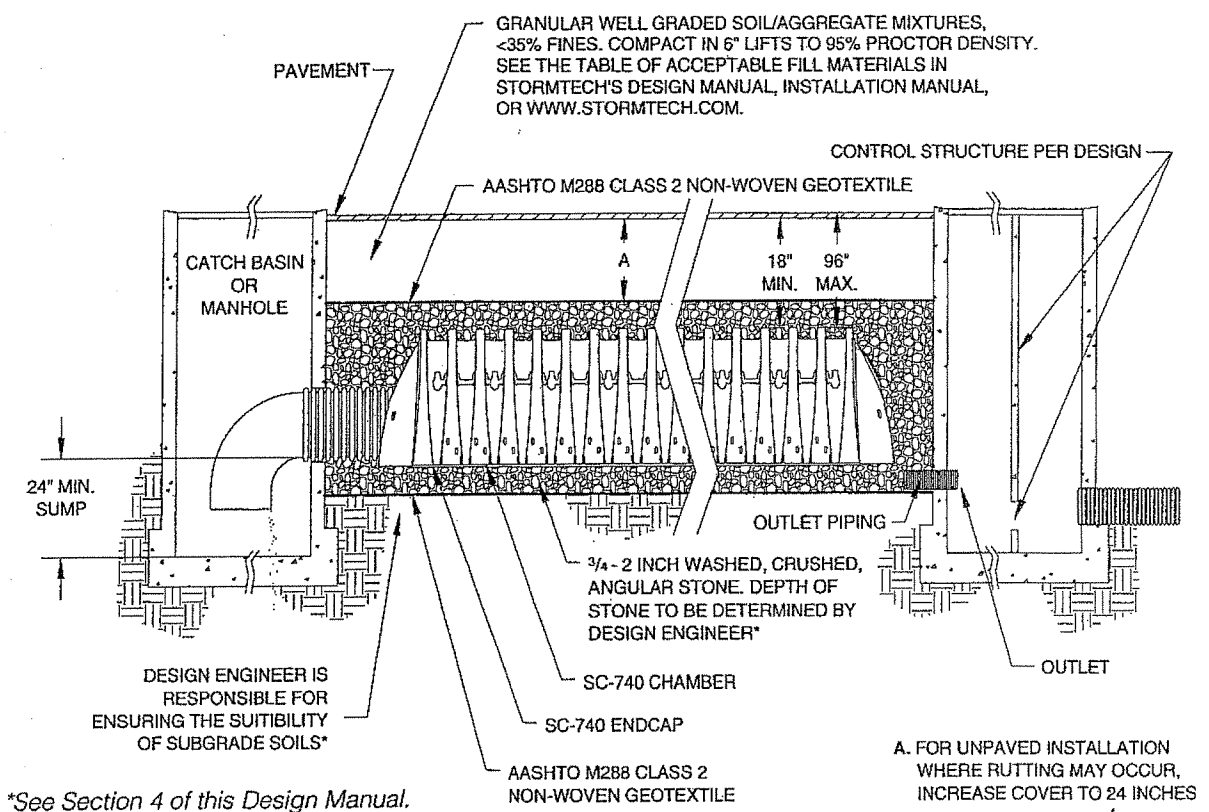
Figure 14
Typical Cross Section Detail – StormTech SC-740 Chamber (not to scale)



*See Section 4 of this Design Manual.

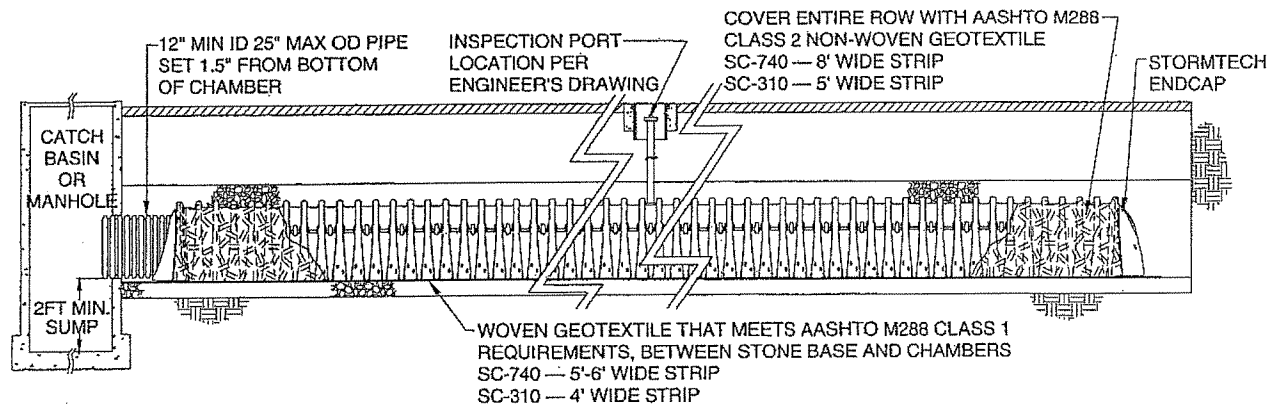
Detail drawings available in AutoCad Rev. 14 format at www.stormtech.com.

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



*See Section 4 of this Design Manual.

Figure 16
StormTech Isolator Row (not to scale)



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

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

<u>Area</u>	<u>C</u>
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

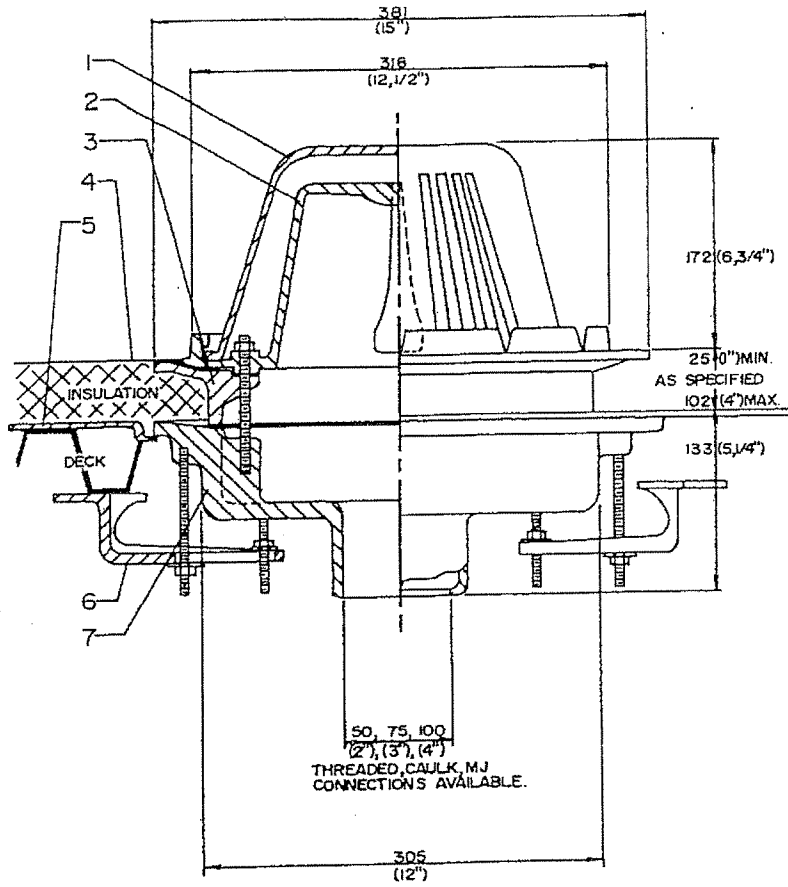
Note: Bpre is an area unchanged from the pre-development condition.

* Reference from JSW Stormwater Management report, June 1988

LOCATION	SQUARE METRE (SQUARE FOOT)	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 (3.9)	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)	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	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)	7	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)	6.8 (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)

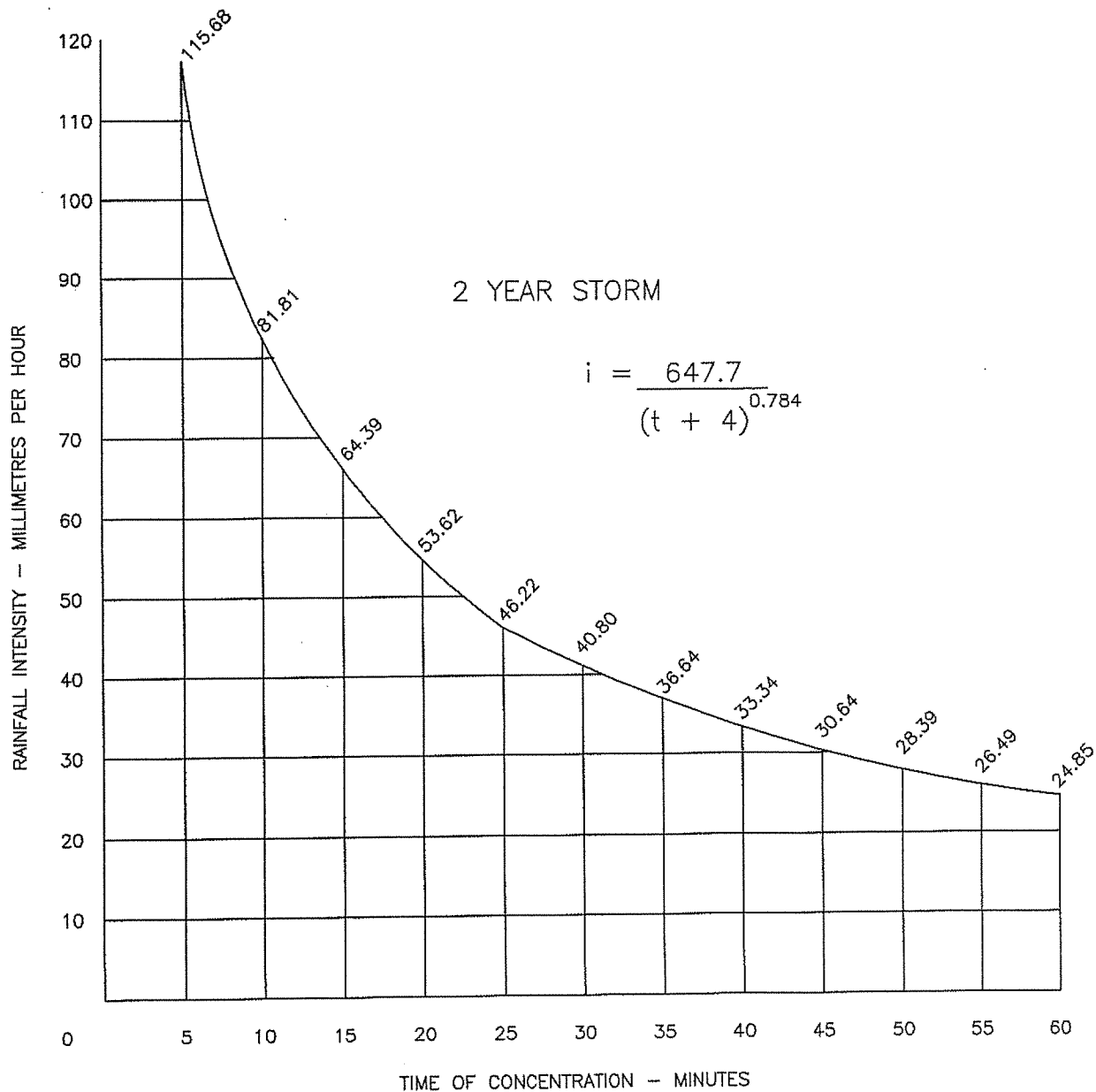
Economical Roof Drainage Installations

SPECIFICATION DATA



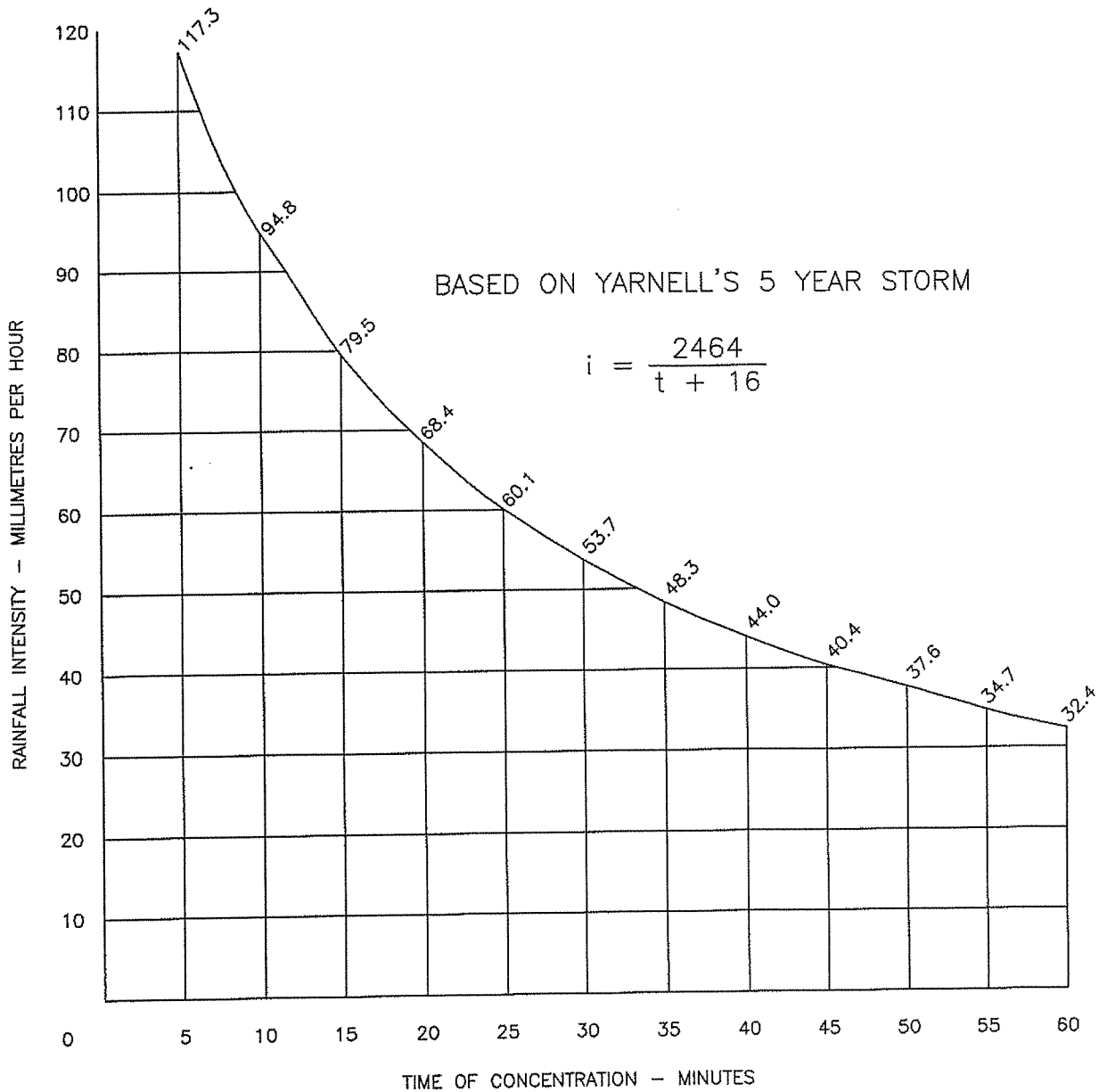
<u>PART</u>	<u>DESCRIPTION</u>
1	POLY-DOME
2	CONTROL FLO WEIR WITH INTEGRAL CLAMP COLLAR AND GRAVEL GUARD
3	E-EXTENSION WITH GASKET (WHEN SPECIFIED)
4	ROOFING MEMBRANE (BY OTHERS)
5	R-ROOF SUMP RECEIVER (WHEN SPECIFIED)
6	C-UNDERDECK CLAMP (WHEN SPECIFIED)
7	BODY

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.



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

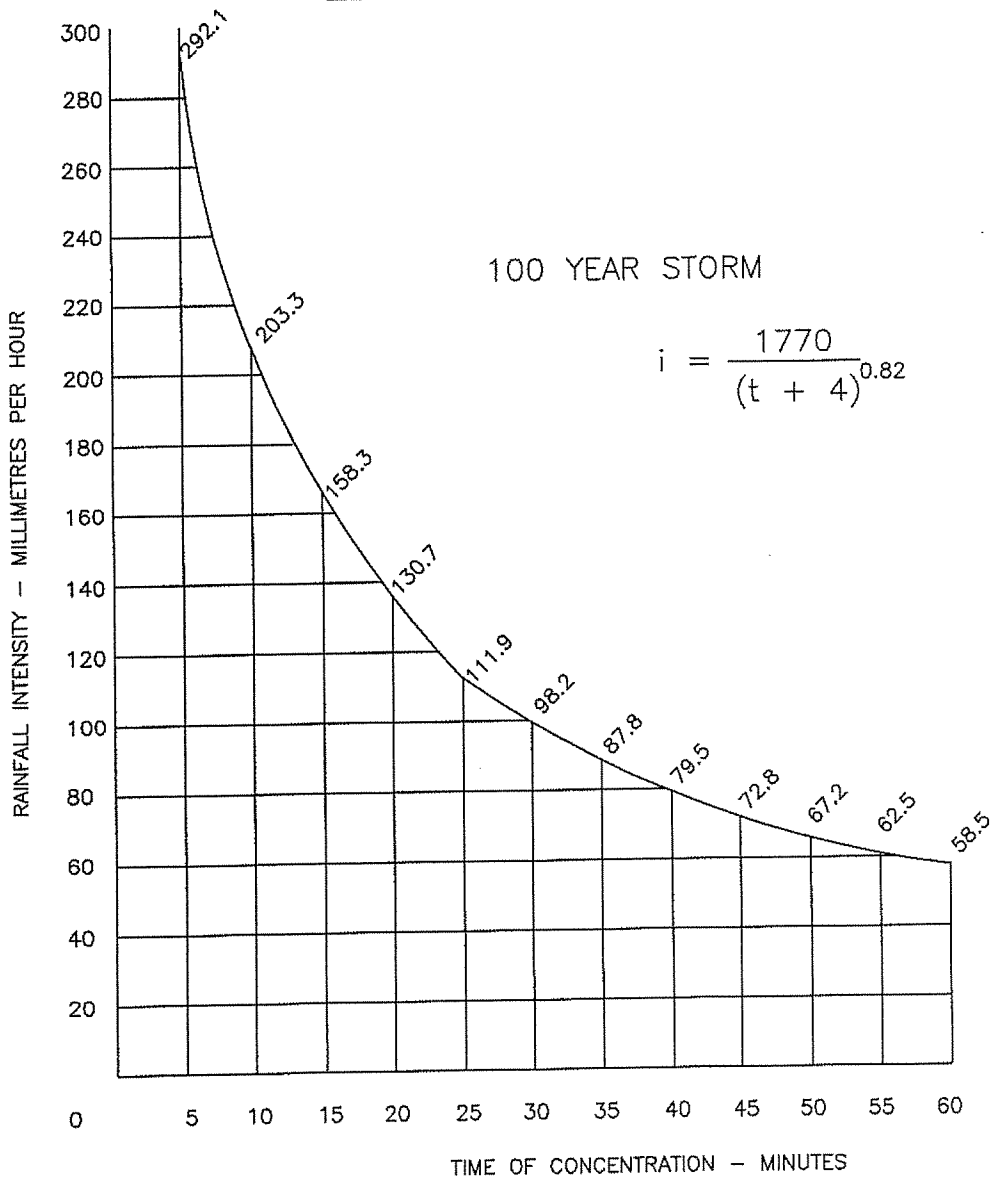
City of Pickering		Planning & Development Department	
DRAWN J.McMULLEN	<h2 style="margin: 0;">RAINFALL INTENSITY CURVE FOR DESIGN OF STORM SEWERS</h2>		REVISION NO.
APPROVED R. STARR			DATE
DATE OCTOBER 2003			P-501



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	<h2 style="margin: 0;">RAINFALL INTENSITY CURVE FOR DESIGN OF STORM SEWERS</h2>	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



City of Pickering		Planning & Development Department	
DRAWN J. McMULLEN	<h2 style="margin: 0;">RAINFALL INTENSITY CURVE FOR DESIGN OF STORM SEWERS</h2>		REVISION NO. <hr/> DATE <hr/> P-504
APPROVED R. STARR			
DATE OCTOBER 2003			

*5 minute Time Steps

*100yr STORM, 4HR HYETOGRAPH

IDF curve parameters: A=1770.000
B= 4.000
C= .820
used in: INTENSITY = A / (t + B)^C

CHICAGO STORM
| Ptotal= 76.04 mm |

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

TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.08	4.035	1.08	19.246	2.08	11.859
.17	4.291	1.17	30.539	2.17	10.735
.25	4.586	1.25	76.878	2.25	9.818
.33	4.929	1.33	292.075	2.33	9.054
.42	5.334	1.42	101.415	2.42	8.408
.50	5.821	1.50	52.341	2.50	7.854
.58	6.416	1.58	34.908	2.58	7.374
.67	7.164	1.67	26.170	2.67	6.953
.75	8.131	1.75	20.966	2.75	6.582
.83	9.436	1.83	17.526	2.83	6.251
.92	11.297	1.92	15.087	2.92	5.954
1.00	14.177	2.00	13.268	3.00	5.687

001:0003

FINISH

***** WARNINGS / ERRORS / NOTES *****

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

SSSS W W M M H H Y Y M M O O O 999 999
S W W M M H H Y Y M M M M O O 9 9 9 9
SSSS W W M M H H H H Y Y M M M O O # 9 9 9 9 Ver. 4.02
S W W M M H H Y Y M M M O O 9999 9999 July 1999
SSSS W W M M H H Y Y M M M O O 9 9 9 9
StormWater Management Hydrologic Model 999 999 # 3813174

***** SWHYMO-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: swhymo@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\GENERAL\BLOORS-1\BLOORS-1.DAT *****
***** Output filename: N:\otthymo\GENERAL\BLOORS-1\BLOORS-1.out *****
***** Summary filename: N:\otthymo\GENERAL\BLOORS-1\BLOORS-1.sum *****
***** User comments: *****
* 1: *****
* 2: *****
* 3: *****

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

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

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 %	

APPENDIX

B

Stormwater Management Calculations

	Project	1105-1163 Kingston Road	No.	221-12931	Page 1
	By	P.P.	Date	2023-10-27	
	Checked	I.S.	Date	2023-10-27	
Subject	SWM Design Criteria				
<p>0.0 SWM Design Criteria</p> <p>0.1 Jurisdictions</p> <ol style="list-style-type: none"> 1 City of Pickering 2 Regional Municipality of Durham 3 Ministry of Environment, Conservation and Parks (MECP) 4 Toronto and Region Conservation Authority (TRCA) <ol style="list-style-type: none"> a. Subwatershed - Pine Creek <p>0.2 SWM Design Criteria</p> <p>0.2.1 Water Quality Provide an Enhance Level of Protection or 80% TSS removal, as per MOECC SWMPDM (2003)</p> <p>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.</p> <p>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.</p> <p>0.2.4 Quantity Control</p> <ol style="list-style-type: none"> 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 5-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	Page 2
	By	P.P.	Date	2023-10-27	
	Checked	I.S.	Date	2023-10-27	

Subject: SWM Parameters

1.0 Design Rainfall Event

1.1 Design Storm

IDF Curve
1 hour AES

City of Pickering
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

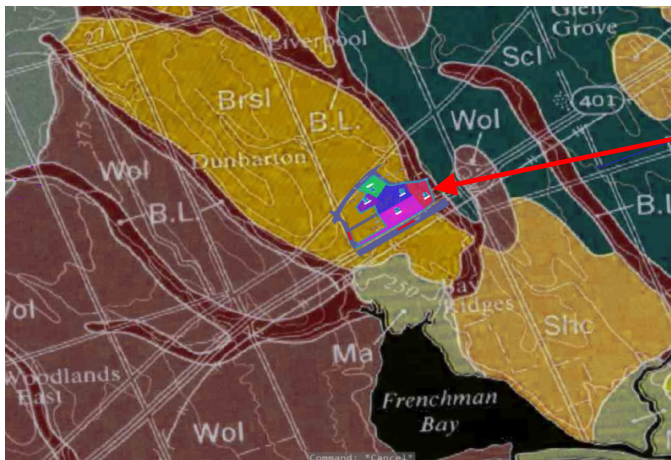
	Project	1105-1163 Kingston Road	No.	221-12931	Page 3
	By	P.P.	Date	2023-10-27	
	Checked	I.S.	Date	2023-10-27	

Subject: **SWM Parameters**

2.0 Soil Information

2.1 SCS Curve Number

Site Location	Kingston Road & Walnut Lane Road	
Soil Symbol:	Brsl	Soil Survey Report #23 - Soil Map of Ontario County (National Soil DataBase, NSDB), Preliminary Hydrogeological Investigation, exp, 2023
Soil Type,(PH1,PH3, PH4):	Sandy Loam/Sandy Silt Til	
Soil Symbol:	BL	Soil Survey Report #23 - Soil Map of Ontario County (National Soil DataBase, NSDB)
Soil Type:	Bottom Land	
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	$CN \leq 70, IA=0.075S, CN > 70 \leq 80, IA=0.1S, CN > 80 \leq 90, IA=0.15S, CN > 90, IA=0.2S$
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	$CN \leq 70, IA=0.075S, CN > 70 \leq 80, IA=0.1S, CN > 80 \leq 90, IA=0.15S, CN > 90, IA=0.2S$



Site Location

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



Stormwater Management Calculations Existing Area Takeoff and Runoff Coefficient Adjustment Calculations- to Frenchmans Bay	Project: 1105-1163 Kingston Road	No.: 221-12931
	By: P.P. Checked: I.S.	Date: 2023-10-27
		Page: 4

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

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 (m ²)	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 (m ²)	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 (m ²)	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 (m ²)	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 (m ²)	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



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



Stormwater Management Calculations

Project: 1105-1163 Kingston Road

No.: 221-12931

Existing Area Takeoff and Runoff
Coefficient Adjustment Calculations- to
Pine Creek

By: P.P.

Date: 2023-10-27

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Checked: I.S.

Pre-Development Conditions -106

Land Use	Area (m ²)	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: $Q \text{ (Flow)} = A \text{ (Area)} \times C \text{ (Runoff Coefficient)} \times Ca \text{ (Antecedent Precipitation Factor)} \times I \text{ (Rainfall Intensity)}$

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 (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	11019	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	30999	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	33373	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	75392	0.85	0.85	0.85	0.93	1.00	1.00

Post-Development Conditions - 201

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	0	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	8131	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	8459	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	16590	0.95	0.95	0.95	1.00	1.00	1.00

Post-Development Conditions -202

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	1061	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	0	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	1061	0.25	0.25	0.25	0.28	0.30	0.31

Post-Development Conditions - 203

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	1511	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	4458	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	6475	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	12444	0.87	0.95	0.95	1.00	1.00	1.00



Post-Development Conditions -204

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	0	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1572	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	1572	0.95	0.95	0.95	1.00	1.00	1.00

Post-Development Conditions -205

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	0	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	5562	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	8740	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	14302	0.95	0.95	0.95	1.00	1.00	1.00

Post-Development Conditions -206

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	0	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	4097	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	4097	0.95	0.95	0.95	1.00	1.00	1.00

Post-Development Conditions -207

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	685	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	0	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	685	0.25	0.25	0.25	0.28	0.30	0.31

Post-Development Conditions -208

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	0	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	3880	0.95	0.95	0.95	1.00	1.00	1.00
Impervious at Roof	9699	0.95	0.95	0.95	1.00	1.00	1.00
Total Area	13580	0.95	0.95	0.95	1.00	1.00	1.00



Stormwater Management Calculations

Project: 1105-1163 Kingston Road

No.: 221-12931

Proposed Area Takeoff and Runoff
Coefficient Adjustment Calculations- to
Frenchmans Bay

By: P.P.

Date: 2023-10-27

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Checked: I.S.

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Post-Development Conditions -209

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	2333	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	0	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	2333	0.25	0.25	0.25	0.28	0.30	0.31

Post-Development Conditions -210

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	2432	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1369	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	3801	0.50	0.50	0.50	0.55	0.60	0.63

Post-Development Conditions -211

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	2997	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	1930	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	4926	0.52	0.52	0.52	0.58	0.63	0.66



Stormwater Management Calculations
Proposed Area Takeoff and Runoff
Coefficient Adjustment Calculations- to
Pine Creek

Project: 1105-1163 Kingston Road
By: P.P.
Checked: I.S.

No.: 221-12931
Date: 2023-10-27

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Post-Development Conditions -212

Land Use	Area (m ²)	Runoff Coefficients C, Return Period (Years)					
		2	5	10	25	50	100
Soft Landscaping/Park	2069	0.25	0.25	0.25	0.28	0.30	0.31
Green Roof	0	0.50	0.50	0.50	0.55	0.60	0.63
Impervious at Grade	0	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	2069	0.25	0.25	0.25	0.28	0.30	0.31



Calculation of existing runoff rate is undertaken using the Rational Method:

$$Q = 2.78 \text{ CaCIA}$$

- 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
Total Area	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



Stormwater Management Calculations	Project: 1105-1163 Kingston Road	No.: 221-12931
Allowable Flow Rate-All Phases to Frenchmans Bay	By: P.P.	Date: 2023-10-27
	Checked: I.S.	

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 103, and 104 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)= 899.9



Stormwater Management Calculations	Project: 1105-1163 Kingston Road	No.: 221-12931
Allowable Flow Rate-All Phases to Frenchmans Bay	By: P.P.	Date: 2023-10-27
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Calculation of proposed uncontrolled runoff rate from subcatchment 210, and 211 using the Rational Method:

Q = 2.78 CaCIA

Catchment ID	Uncontrolled Area(ha)
210	0.38
211	0.49

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

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 (-)**	0.50	0.50	0.50	0.55	0.60	0.63
Adjusted C(-)**	0.52	0.52	0.52	0.58	0.63	0.66
Q_210 (L/s)	41.2	56.4	66.9	87.9	107.3	123.82
Q_211 (L/s)	43.0	58.9	69.8	91.8	112.1	129.3

*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)=

646.77

Phase	Catchment ID	Area (ha)	Pro-rated Allowable Flow Rates (L/s)
PH1	Controlled	201	161.0
		202	10.3
PH2	Controlled	203	120.7
		204	15.3
PH3	Controlled	205	138.8
		206	39.7
PH4	Controlled	207	6.6
		208	131.7
PH4	Uncontrolled	209	22.6
		210	123.8
Total Controlled		6.67	646.8
Total		7.54	899.9



Stormwater Management Calculations 100-YR-Post Development Release Rates, Required Volumes-All Phases- To Frenchmans Bay	Project: 1105-1163 Kingston Road	No.: 221-12931
	By: P.P.	Date: 2023-10-27
	Checked: I.s.	Page: 14

Calculation of proposed runoff flow rate from the site area using the Rational Method, HydroCAD results, refer to Appendix C for details:

Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
 Ca = Runoff coefficient adjustment factor (-), refer to page7 to 10
 C = Runoff coefficient (-), refer to page 7 to 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)

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

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

100-YR Required Volume per HydroCAD Results- Refer to Appendix C for more Details

Phase	Catchment ID	Area (ha)	Release Rates (L/s)-100 yr	Allowable Flow Rates (L/s)	Minimum Required Volume (m ³)*	Provided Volume (m ³)	Peak Elevation (m)	
PH1	Controlled	201	1.66	142.4	161.0	521.0	600.0	1.74
		202	0.11	7.2	10.3	6.1	6.4	0.41
PH2		203	1.24	79.0	120.7	416.8	500.0	1.67
		204	0.16	10.5	15.3	51.4	60.6	0.83
PH3		205	1.43	121.5	138.8	452.1	700.0	1.29
		206	0.41	37.4	39.7	124.7	173.2	0.71
		207	0.07	5.9	6.6	2.7	4.0	0.29
PH4		208	1.36	76.1	131.7	465.0	600.0	1.55
		209	0.23	21.5	22.6	8.6	18.4	0.29
Total Controlled to City's Storm Sewer		6.67	501.5	646.8	2048.4	2662.6	-	
PH4	Uncontrolled	210	0.38	123.8	123.8	-	-	-
		211	0.49	129.3	129.3	-	-	-
Total Uncontrolled to City's Storm Sewer		0.87	253.1	253.1	-	-	-	
Total to City's Storm Sewer		7.54	754.5	899.9	-	-	-	

*The depth of the underground storage tank is assumed 2m for subcatchment 201, 203, 205, and 208

The underground storage tanks will be equipped with pumps.

The following minimum super pipes have been recommended:

- 1- Catchment 202: super pipe 450mm L:40m
- 2- Catchment 204: super pipe 1050mm L:70m
- 3- Catchment 206: super pipe 1050mm L:200m
- 4- Catchment 207: super pipe 450mm L:25m
- 5- Catchment 209: super pipe 600mm L: 65m

Super pipes will be equipped with flow control devices such as orifice plates, weirs or both inside the control MHs.

The design of the flow control devices will be provided in detail design stage



Stormwater Management Calculations 50-YR Post Development Release Rates, Required Volumes-All Phases- To Frenchmans Bay	Project:	1105-1163 Kingston Road	No.:	221-12931
	By:	P.P.	Date:	2023-10-27
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Calculation of proposed runoff flow rate from the site area using the Rational Method, HydroCAD results, refer to Appendix C for details:

Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
 Ca = Runoff coefficient adjustment factor (-), refer to page7 to 10
 C = Runoff coefficient (-), refer to page 7 to 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)

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

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

50-YR Required Volume per HydroCAD Results- Refer to Appendix C for more Details

Phase	Catchment ID	Area (ha)	Release Rates (L/s)-50 yr	Allowable Flow Rates (L/s)	Minimum Required Volume (m ³)*	Provided Volume (m ³)	Peak Elevation (m)
PH1	Controlled	201	136.3	161.0	480.0	600.0	1.60
		202	6.4	10.3	5.0	6.4	0.33
PH2		203	76.0	120.7	387.2	500.0	1.55
		204	10.0	15.3	47.6	60.6	0.77
PH3		205	116.3	138.8	417.1	700.0	1.19
		206	35.9	39.7	114.2	173.2	0.66
		207	5.2	6.6	2.1	4.0	0.23
PH4		208	73.3	131.7	433.3	600.0	1.45
		209	18.7	22.6	6.6	18.4	0.23
Total Controlled to City's Storm Sewer		6.67	478.0	646.8	1893.1	2662.6	-
PH4	Uncontrolled	210	107.3	123.8	-	-	-
		211	112.1	129.3	-	-	-
Total Uncontrolled to City's Storm Sewer		0.87	219.4	253.1	-	-	-
Total to City's Storm Sewer		7.54	697.4	899.9	-	-	-

*The depth of the underground storage tank is assumed 2m for subcatchment 201, 203, 205, and 208
 The underground storage tanks will be equipped with pumps.

The following minimum super pipes have been recommended:

- 1- Catchment 202: super pipe 450mm L:40m
- 2- Catchment 204: super pipe 1050mm L:70m
- 3- Catchment 206: super pipe 1050mm L:200m
- 4- Catchment 207: super pipe 450mm L:25m
- 5- Catchment 209: super pipe 600mm L: 65m

Super pipes will be equipped with flow control devices such as orifice plates, weirs or both inside the control MHs.

The design of the flow control devices will be provided in detail design stage



Stormwater Management Calculations 25-YR Post Development Release Rates, Required Volumes-All Phases- To Frenchmans Bay	Project:	1105-1163 Kingston Road	No.:	221-12931
	By:	P.P.	Date:	2023-10-27
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Calculation of proposed runoff flow rate from the site area using the Rational Method, HydroCAD results, refer to Appendix C for details:

Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
 Ca = Runoff coefficient adjustment factor (-), refer to page7 to 10
 C = Runoff coefficient (-), refer to page 7 to 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)

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

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

25-YR Required Volume per HydroCAD Results- Refer to Appendix C for more Details

Phase	Catchment ID	Area (ha)	Release Rates (L/s)-25 yr	Allowable Flow Rates (L/s)	Minimum Required Volume (m ³)*	Provided Volume (m ³)	Peak Elevation (m)	
PH1	Controlled	201	1.66	127.5	161.0	423.7	600.0	1.41
		202	0.11	5.6	10.3	3.9	6.4	0.26
PH2		203	1.24	71.3	120.7	342.8	500.0	1.37
PH3		204	0.16	9.5	15.3	41.9	60.6	0.69
		205	1.43	108.7	138.8	368.7	700.0	1.05
		206	0.41	33.7	39.7	100.3	173.2	0.59
		207	0.07	4.5	6.6	1.5	4.0	0.18
PH4		208	1.36	68.7	131.7	384.1	600.0	1.28
		209	0.23	16.1	22.6	5.1	18.4	0.19
Total Controlled to City's Storm Sewer		6.67	445.6	646.8	1672.0	2662.6	-	
PH4	Uncontrolled	210	0.38	87.9	123.8	-	-	-
		211	0.49	91.8	129.3	-	-	-
Total Uncontrolled to City's Storm Sewer		0.87	179.7	253.1	-	-	-	
Total to City's Storm Sewer		7.54	625.3	899.9	-	-	-	

*The depth of the underground storage tank is assumed 2m for subcatchment 201, 203, 205, and 208
 The underground storage tanks will be equipped with pumps.

The following minimum super pipes have been recommended:

- 1- Catchment 202: super pipe 450mm L:40m
- 2- Catchment 204: super pipe 1050mm L:70m
- 3- Catchment 206: super pipe 1050mm L:200m
- 4- Catchment 207: super pipe 450mm L:25m
- 5- Catchment 209: super pipe 600mm L: 65m

Super pipes will be equipped with flow control devices such as orifice plates, weirs or both inside the control MHs.

The design of the flow control devices will be provided in detail design stage



Stormwater Management Calculations 10-YR Post Development Release Rates, Required Volumes-All Phases- To Frenchmans Bay	Project:	1105-1163 Kingston Road	No.:	221-12931
	By:	P.P.	Date:	2023-10-27
	Checked:	I.s.	Page:	17

Calculation of proposed runoff flow rate from the site area using the Rational Method, HydroCAD results, refer to Appendix C for details:

Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
 Ca = Runoff coefficient adjustment factor (-), refer to page7 to 10
 C = Runoff coefficient (-), refer to page 7 to 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)

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

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

10-YR Required Volume per HydroCAD Results- Refer to Appendix C for more Details

Phase	Catchment ID	Area (ha)	Release Rates (L/s)-10 yr	Allowable Flow Rates (L/s)	Minimum Required Volume (m ³)*	Provided Volume (m ³)	Peak Elevation (m)
PH1	Controlled	201	112.3	161.0	335.5	600.0	1.12
		202	4.5	10.3	2.4	6.4	0.18
PH2		203	63.4	120.7	274.9	500.0	1.10
		204	8.5	15.3	33.1	60.6	0.56
PH3		205	95.6	138.8	293.0	700.0	0.84
		206	30.1	39.7	78.1	173.2	0.49
		207	3.4	6.6	0.9	4.0	0.12
PH4		208	61.3	131.7	309.6	600.0	1.03
		209	11.8	22.6	3.2	18.4	0.14
Total Controlled to City's Storm Sewer		6.67	390.7	646.8	1330.7	2662.6	-
PH4	Uncontrolled	210	66.9	123.8	-	-	-
		211	69.8	129.3	-	-	-
Total Uncontrolled to City's Storm Sewer		0.87	136.7	253.1	-	-	-
Total to City's Storm Sewer		7.54	527.4	899.9	-	-	-

*The depth of the underground storage tank is assumed 2m for subcatchment 201, 203, 205, and 208
 The underground storage tanks will be equipped with pumps.

The following minimum super pipes have been recommended:

- 1- Catchment 202: super pipe 450mm L:40m
- 2- Catchment 204: super pipe 1050mm L:70m
- 3- Catchment 206: super pipe 1050mm L:200m
- 4- Catchment 207: super pipe 450mm L:25m
- 5- Catchment 209: super pipe 600mm L: 65m

Super pipes will be equipped with flow control devices such as orifice plates, weirs or both inside the control MHs.

The design of the flow control devices will be provided in detail design stage



Stormwater Management Calculations 5-YR Post Development Release Rates, Required Volumes-All Phases- To Frenchmans Bay	Project:	1105-1163 Kingston Road	No.:	221-12931
	By:	P.P.	Date:	2023-10-27
	Checked:	I.s.	Page:	18

Calculation of proposed runoff flow rate from the site area using the Rational Method, HydroCAD results, refer to Appendix C for details:

Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
 Ca = Runoff coefficient adjustment factor (-), refer to page7 to 10
 C = Runoff coefficient (-), refer to page 7 to 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)

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

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

5-YR Required Volume per HydroCAD Results- Refer to Appendix C for more Details

Phase	Catchment ID	Area (ha)	Release Rates (L/s)-5 yr	Allowable Flow Rates (L/s)	Minimum Required Volume (m ³)*	Provided Volume (m ³)	Peak Elevation (m)	
PH1	Controlled	201	1.66	101.3	161.0	27.6	600.0	0.93
		202	0.11	3.9	10.3	1.9	6.4	0.15
PH2		203	1.24	57.5	120.7	229.2	500.0	0.92
		204	0.16	7.8	15.3	27.3	60.6	0.48
PH3		205	1.43	86.0	138.8	244.0	700.0	0.70
		206	0.41	27.5	39.7	64.1	173.2	0.42
		207	0.07	2.9	6.6	0.6	4.0	0.10
PH4		208	1.36	55.6	131.7	258.7	600.0	0.86
		209	0.23	10.0	22.6	2.7	18.4	0.12
Total Controlled to City's Storm Sewer		6.67	352.5	646.8	856.1	2662.6	-	
PH4	Uncontrolled	210	0.38	56.4	123.8	-	-	-
		211	0.49	58.9	129.3	-	-	-
Total Uncontrolled to City's Storm Sewer		0.87	115.3	253.1	-	-	-	
Total to City's Storm Sewer		7.54	467.8	899.9	-	-	-	

*The depth of the underground storage tank is assumed 2m for subcatchment 201, 203, 205, and 208
 The underground storage tanks will be equipped with pumps.

The following minimum super pipes have been recommended:

- 1- Catchment 202: super pipe 450mm L:40m
- 2- Catchment 204: super pipe 1050mm L:70m
- 3- Catchment 206: super pipe 1050mm L:200m
- 4- Catchment 207: super pipe 450mm L:25m
- 5- Catchment 209: super pipe 600mm L: 65m

Super pipes will be equipped with flow control devices such as orifice plates, weirs or both inside the control MHs.

The design of the flow control devices will be provided in detail design stage



Stormwater Management Calculations 2-YR Post Development Release Rates, Required Volumes-All Phases- To Frenchmans Bay	Project:	1105-1163 Kingston Road	No.:	221-12931
	By:	P.P.	Date:	2023-10-27
	Checked:	I.s.		Page: 19

Calculation of proposed runoff flow rate from the site area using the Rational Method, HydroCAD results, refer to Appendix C for details:

Q = 2.78 CaCIA

Where: Q = Peak flow rate (litres/second)
 Ca = Runoff coefficient adjustment factor (-), refer to page7 to 10
 C = Runoff coefficient (-), refer to page 7 to 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)

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

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

2-YR Required Volume per HydroCAD Results- Refer to Appendix C for more Details

Phase	Catchment ID	Area (ha)	Release Rates (L/s)-2 yr	Allowable Flow Rates (L/s)	Minimum Required Volume (m ³)*	Provided Volume (m ³)	Peak Elevation (m)
PH1	Controlled	201	82.8	161.0	195.8	600.0	0.65
		202	3.0	10.3	1.1	6.4	0.10
PH2		203	47.6	120.7	163.0	500.0	0.65
PH3		204	6.7	15.3	18.7	60.6	0.37
		205	69.9	138.8	173.1	700.0	0.49
		206	23.0	39.7	43.6	173.2	0.31
PH4		207	2.1	6.6	0.4	4.0	0.07
		208	46.1	131.7	185.3	600.0	0.62
		209	7.0	22.6	1.9	18.4	0.10
Total Controlled to City's Storm Sewer		6.67	288.0	646.8	782.9	2662.6	-
PH4	Uncontrolled	210	41.2	123.8	-	-	-
		211	43.0	129.3	-	-	-
Total Uncontrolled to City's Storm Sewer		0.87	84.1	253.1	-	-	-
Total to City's Storm Sewer		7.54	372.2	899.9	-	-	-

*The depth of the underground storage tank is assumed 2m for subcatchment 201, 203, 205, and 208
 The underground storage tanks will be equipped with pumps.

The following minimum super pipes have been recommended:

- 1- Catchment 202: super pipe 450mm L:40m
- 2- Catchment 204: super pipe 1050mm L:70m
- 3- Catchment 206: super pipe 1050mm L:200m
- 4- Catchment 207: super pipe 450mm L:25m
- 5- Catchment 209: super pipe 600mm L: 65m

Super pipes will be equipped with flow control devices such as orifice plates, weirs or both inside the control MHs.

The design of the flow control devices will be provided in detail design stage



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 212, **0.21** hectares
 Runoff Coef, C 0.25

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 (-)**	0.25	0.25	0.25	0.28	0.30	0.31
Q_212 (L/s)	11.2	15.3	18.1	23.8	29.1	33.6

*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 pre and post development of catchment 212 (future pop area) will remain the same. No SWM is required accordingly.



Stormwater Management Calculations

Project: 1105-1163 Kingston Road (Brookdale Subdivision)

No.: 221-12931

Water Balance

By: P.P

Date: 2023-10-27

Checked: IS

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Phase	Catchment ID	Surface Type	Area (m ²)	IA (m)	Volume Abstracted (m ³)	5mm Volume (m ³)	Water Balance (m ³)
PH1	201	Soft Landscaping/Park	-	0.005	0.00	0.00	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	8,131	0.000	0.00	40.65	40.65
		Impervious at Roof	8,459	0.000	0.00	42.30	42.30
	Area:		16,590	-	0.00	82.95	82.95
	202 Park	Soft Landscaping/Park	1,061	0.005	5.31	5.31	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	-	0.000	0.00	0.00	0.00
Impervious at Roof		-	0.000	0.00	0.00	0.00	
Area:		1,061		5.31	5.31	0.00	
PH2	203	Soft Landscaping/Park	1,511	0.005	7.55	7.55	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	4,458	0.000	0.00	22.29	22.29
		Impervious at Roof	6,475	0.000	0.00	32.37	32.37
	Area:		12,444		7.55	62.22	54.66
	204 Public Road	Soft Landscaping/Park	-	0.005	0.00	0.00	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	1,572	0.000	0.00	7.86	7.86
Impervious at Roof		-	0.000	0.00	0.00	0.00	
Area:		1,572		0.00	7.86	7.86	
PH3	205	Soft Landscaping/Park	-	0.005	0.00	0.00	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	5,562	0.000	0.00	27.81	27.81
		Impervious at Roof	8,740	0.000	0.00	43.70	43.70
	Area:		14,302		0.00	71.51	71.51
	206 Public Road	Soft Landscaping/Park	-	0.005	0.00	0.00	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	4,097	0.000	0.00	20.48	20.48
		Impervious at Roof	-	0.000	0.00	0.00	0.00
	Area:		4,097		0.00	20.48	20.48
	207 Park	Soft Landscaping/Park	685	0.005	3.43	3.43	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
Impervious at Grade		-	0.000	0.00	0.00	0.00	
Impervious at Roof		-	0.000	0.00	0.00	0.00	
Area:		685		3.43	3.43	0.00	
PH4	208	Soft Landscaping/Park	-	0.005	0.00	0.00	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	3,880	0.000	0.00	19.40	19.40
		Impervious at Roof	9,699	0.000	0.00	48.50	48.50
	Area:		13,580		0.00	67.90	67.90
	209 Park	Soft Landscaping/Park	2,333	0.005	11.66	11.66	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	-	0.000	0.00	0.00	0.00
		Impervious at Roof	-	0.000	0.00	0.00	0.00
	Area:		2,333		11.66	11.66	0.00
	210	Soft Landscaping/Park	2,432	0.005	12.16	12.16	0.00
		Green Roof	-	0.005	0.00	0.00	0.00
		Impervious at Grade	1,369	0.000	0.00	6.84	6.84
		Impervious at Roof	-	0.000	0.00	0.00	0.00
	Area:		3,801		12.16	19.01	6.84
	211	Soft Landscaping/Park	2,997	0.005	14.98	14.98	0.00
Green Roof		-	0.005	0.00	0.00	0.00	
Impervious at Grade		1,930	0.000	0.00	9.65	9.65	
Impervious at Roof		-	0.000	0.00	0.00	0.00	
Area:		4,926		14.98	24.63	9.65	
Total Catchment Area:			75,392		55.10	376.96	321.86



Project:	1105-1163 Kingston Road	No.:	221-12931
By:	P.P.	Date:	2023-10-27
Checked:	I.S.	Checked:	I.S.
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Subject: Stormwater Management Calculations - Infiltration Pit Drawdown Time-Phase 1

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.

Phase1

The following calculation determines the drawdown time for the Phase 1 (catchment 201 & 202) infiltration pit system

Inflow Area (Roof Area Phase 1B/ Building A2)	3169.02	m ²
5 mm event volume	88.3	m ³
Initial Abstraction	5.3	m ³
5mm event runoff	83.0	m ³

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=	250 m ²
d=	0.83 m
q=	0.01 m/h
P=	77 m
Safety Factor=	2.5
T=	57.5 h
Impervious Area/Footprint surface area	13 between 5:1 to 20:1

Therefore the infiltration pit will fully drain in 57.5 hours. This is within the 72 hour window required for full drawdown.

The ratio of impervious drainage area to footprint surface area of the practice should be between 5:1 and 20. (LID, SWM Planning and Design Guide, 2010)



Subject: Stormwater Management Calculations - Infiltration Pit Drawdown Time- Phase 2

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.

Phase2

The following calculation determines the drawdown time for the Phase 2 (catchment 203 & 204) infiltration pit system

Inflow Area (Roof Area)	6474.55	m ²
5 mm event volume	70.1	m ³
Initial Abstraction	7.6	m ³
5mm event runoff	62.5	m ³

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=	324 m ²
d=	0.49 m
q=	0.01 m/h
P=	82
Safety Factor=	2.5
T=	36.0 h
Impervious Area/Footprint surface area	20 between 5:1 to 20:1

Therefore the infiltration pit will fully drain in 36.0 hours. This is within the 72 hour window required for full drawdown.



Subject: Stormwater Management Calculations - Infiltration Pit Drawdown Time- Phase 3

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.

Phase3

The following calculation determines the drawdown time for the Phase 3 (catchment 205, 206 & 207) infiltration pit system

Inflow Area (Roof Area/Building C1))	7577.34	m ²
5 mm event volume	95.4	m ³
Initial Abstraction	3.4	m ³
5mm event runoff	92.0	m ³

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=	380 m ²
d=	0.61 m
q=	0.01 m/h
P=	136
Safety Factor=	2.5
T=	42.9 h
Impervious Area/Footprint surface area	20 between 5:1 to 20:1

Therefore the infiltration pit will fully drain in 42.9 hours. This is within the 72 hour window required for full drawdown.



Subject: Stormwater Management Calculations - Infiltration Pit Drawdown Time- Phase 4

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.

Phase4

The following calculation determines the drawdown time for the Phase 4 (catchment 208, 209, 210 & 211) infiltration pit system

Inflow Area (Roof Area)	9699.28	m ²
5 mm event volume	123.2	m ³
Initial Abstraction	38.8	m ³
5mm event runoff	84.4	m ³

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=	484 m ²
d=	0.44 m
q=	0.01 m/h
P=	189
Safety Factor=	2.5
T=	31.6 h
Impervious Area/Footprint surface area	20 between 5:1 to 20:1

Therefore the infiltration pit will fully drain in 31.6 hours. This is within the 72 hour window required for full drawdown.

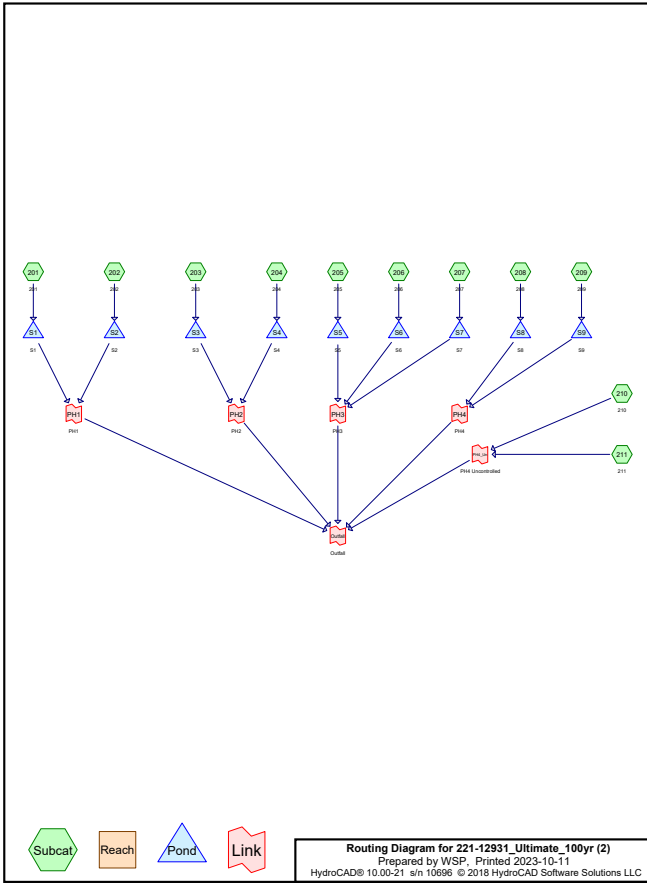
APPENDIX

C

Hydrologic Model Output

Area Listing (selected nodes)

Area (hectares)	C	Description (subcatchment-numbers)
6.2585	1.00	(201, 203, 204, 205, 206, 208)
0.4079	0.31	(202, 207, 209)
0.3801	0.63	(210)
0.4926	0.66	(211)
7.5391	0.92	TOTAL AREA



Soil Listing (selected nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.5391	Other	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
7.5391		TOTAL AREA

Ground Covers (selected 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	7.5391	7.5391		201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
0.0000	0.0000	0.0000	0.0000	7.5391	7.5391	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

Subcatchment201: 201	Runoff Area=1.6590 ha 100.00% Impervious Runoff Depth=40 mm Tc=10.0 min C=1.00 Runoff=0.61151 m³/s 0.660 MI
Subcatchment202: 202	Runoff Area=0.1061 ha 0.00% Impervious Runoff Depth=12 mm Tc=10.0 min C=0.31 Runoff=0.01212 m³/s 0.013 MI
Subcatchment203: 203	Runoff Area=1.2444 ha 100.00% Impervious Runoff Depth=40 mm Tc=10.0 min C=1.00 Runoff=0.45869 m³/s 0.495 MI
Subcatchment204: 204	Runoff Area=0.1572 ha 100.00% Impervious Runoff Depth=40 mm Tc=10.0 min C=1.00 Runoff=0.05794 m³/s 0.063 MI
Subcatchment205: 205	Runoff Area=1.4302 ha 100.00% Impervious Runoff Depth=40 mm Tc=10.0 min C=1.00 Runoff=0.52717 m³/s 0.569 MI
Subcatchment206: 206	Runoff Area=0.4097 ha 100.00% Impervious Runoff Depth=40 mm Tc=10.0 min C=1.00 Runoff=0.15102 m³/s 0.163 MI
Subcatchment207: 207	Runoff Area=0.0685 ha 0.00% Impervious Runoff Depth=12 mm Tc=10.0 min C=0.31 Runoff=0.00783 m³/s 0.008 MI
Subcatchment208: 208	Runoff Area=1.3580 ha 100.00% Impervious Runoff Depth=40 mm Tc=10.0 min C=1.00 Runoff=0.50056 m³/s 0.541 MI
Subcatchment209: 209	Runoff Area=0.2333 ha 0.00% Impervious Runoff Depth=12 mm Tc=10.0 min C=0.31 Runoff=0.02666 m³/s 0.029 MI
Subcatchment210: 210	Runoff Area=0.3801 ha 0.00% Impervious Runoff Depth=25 mm Tc=10.0 min C=0.63 Runoff=0.08827 m³/s 0.095 MI
Subcatchment211: 211	Runoff Area=0.4926 ha 0.00% Impervious Runoff Depth=26 mm Tc=10.0 min C=0.66 Runoff=0.11984 m³/s 0.129 MI
Pond S1: S1	Peak Elev=1.737 m Storage=521.0 m³ Inflow=0.61151 m³/s 0.660 MI Outflow=0.14241 m³/s 0.660 MI
Pond S2: S2	Peak Elev=0.414 m Storage=6.1 m³ Inflow=0.01212 m³/s 0.013 MI Outflow=0.00721 m³/s 0.013 MI
Pond S3: S3	Peak Elev=1.667 m Storage=416.8 m³ Inflow=0.45869 m³/s 0.495 MI Outflow=0.07901 m³/s 0.494 MI
Pond S4: S4	Peak Elev=0.830 m Storage=51.4 m³ Inflow=0.05794 m³/s 0.063 MI Outflow=0.01046 m³/s 0.063 MI
Pond S5: S5	Peak Elev=1.292 m Storage=452.1 m³ Inflow=0.52717 m³/s 0.569 MI Outflow=0.12153 m³/s 0.568 MI

Pond S6: S6	Peak Elev=0.710 m Storage=124.7 m³ Inflow=0.15102 m³/s 0.163 MI Outflow=0.03743 m³/s 0.163 MI
Pond S7: S7	Peak Elev=0.290 m Storage=2.7 m³ Inflow=0.00783 m³/s 0.008 MI Outflow=0.00590 m³/s 0.008 MI
Pond S8: S8	Peak Elev=1.550 m Storage=465.0 m³ Inflow=0.50056 m³/s 0.541 MI Outflow=0.07605 m³/s 0.539 MI
Pond S9: S9	Peak Elev=0.285 m Storage=8.6 m³ Inflow=0.02666 m³/s 0.029 MI Outflow=0.02152 m³/s 0.029 MI
Link Outfall: Outfall	Inflow=0.65153 m³/s 2.761 MI Primary=0.65153 m³/s 2.761 MI
Link PH1: PH1	Inflow=0.14928 m³/s 0.673 MI Primary=0.14928 m³/s 0.673 MI
Link PH2: PH2	Inflow=0.08947 m³/s 0.557 MI Primary=0.08947 m³/s 0.557 MI
Link PH3: PH3	Inflow=0.16428 m³/s 0.739 MI Primary=0.16428 m³/s 0.739 MI
Link PH4: PH4	Inflow=0.09515 m³/s 0.568 MI Primary=0.09515 m³/s 0.568 MI
Link PH4_Un: PH4 Uncontrolled	Inflow=0.20810 m³/s 0.225 MI Primary=0.20810 m³/s 0.225 MI

Total Runoff Area = 7.5391 ha Runoff Volume = 2.767 MI Average Runoff Depth = 37 mm
16.99% Pervious = 1.2806 ha 83.01% Impervious = 6.2585 ha

Summary for Subcatchment 201: 201

Runoff = 0.61151 m³/s @ 0.17 hrs, Volume= 0.660 MI, Depth= 40 mm

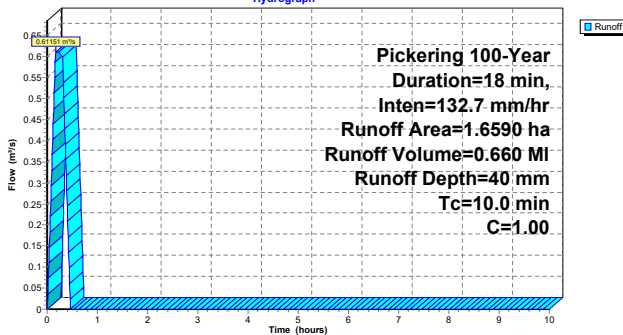
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span=0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 100-Year Duration=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
1.6590	1.00	
1.6590		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

Hydrograph



Summary for Subcatchment 202: 202

Runoff = 0.01212 m³/s @ 0.17 hrs, Volume= 0.013 MI, Depth= 12 mm

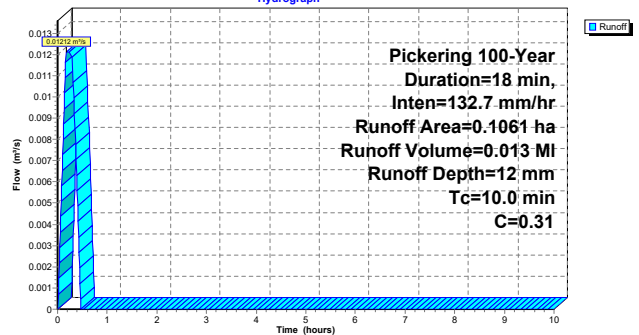
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span=0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 100-Year Duration=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.1061	0.31	
0.1061		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



Summary for Subcatchment 203: 203

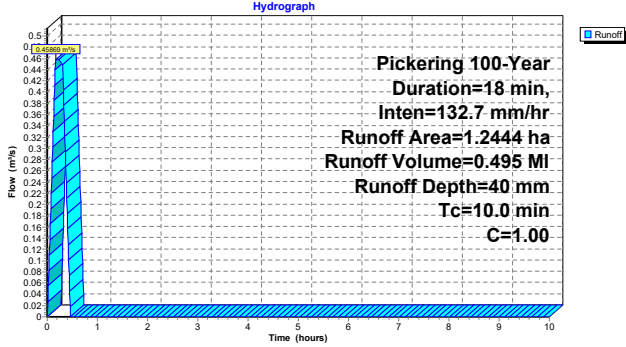
Runoff = 0.45869 m³/s @ 0.17 hrs, Volume= 0.495 MI, Depth= 40 mm

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=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
1.2444	1.00	
1.2444	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 203: 203



Summary for Subcatchment 204: 204

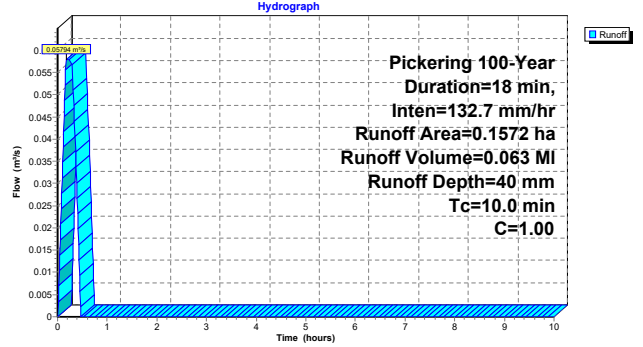
Runoff = 0.05794 m³/s @ 0.17 hrs, Volume= 0.063 MI, Depth= 40 mm

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=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.1572	1.00	
0.1572	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 204: 204



Summary for Subcatchment 205: 205

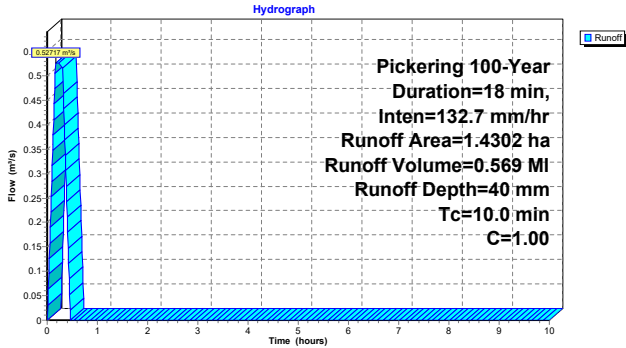
Runoff = 0.52717 m³/s @ 0.17 hrs, Volume= 0.569 MI, Depth= 40 mm

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=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
1.4302	1.00	
1.4302	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 205: 205



Summary for Subcatchment 206: 206

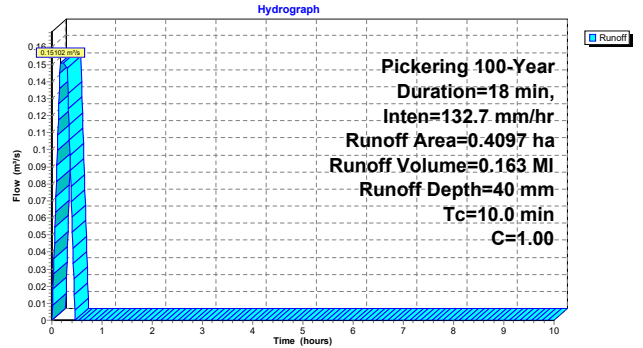
Runoff = 0.15102 m³/s @ 0.17 hrs, Volume= 0.163 MI, Depth= 40 mm

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=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.4097	1.00	
0.4097	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 206: 206



Summary for Subcatchment 207: 207

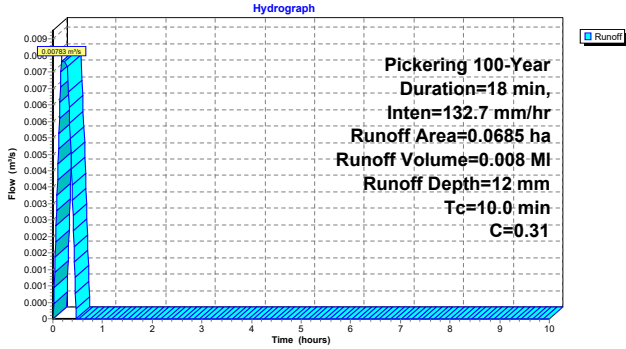
Runoff = 0.00783 m³/s @ 0.17 hrs, Volume= 0.008 MI, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 100-Year Duration=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.0685	0.31	
0.0685		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 207: 207



Summary for Subcatchment 208: 208

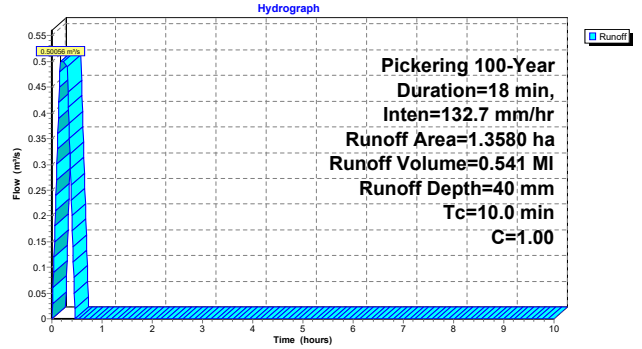
Runoff = 0.50056 m³/s @ 0.17 hrs, Volume= 0.541 MI, Depth= 40 mm

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=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
1.3580	1.00	
1.3580		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 208: 208



Summary for Subcatchment 209: 209

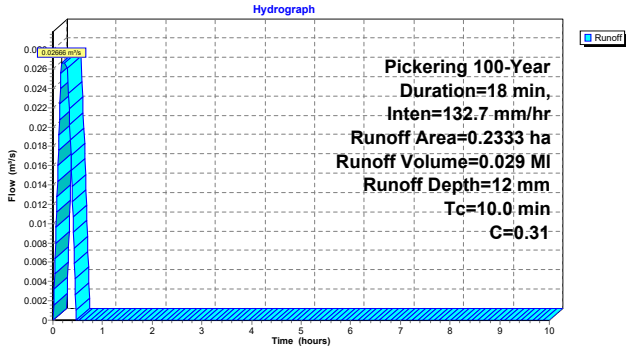
Runoff = 0.02666 m³/s @ 0.17 hrs, Volume= 0.029 MI, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 100-Year Duration=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.2333	0.31	
0.2333		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 209: 209



Summary for Subcatchment 210: 210

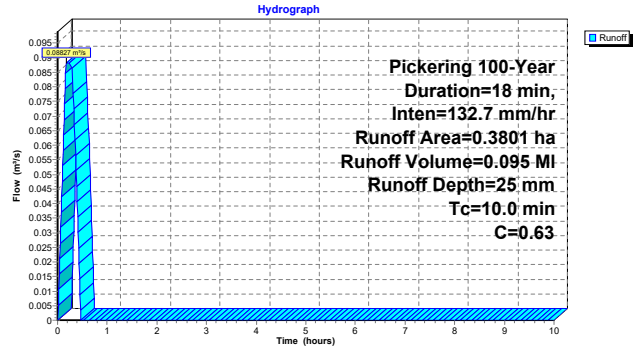
Runoff = 0.08827 m³/s @ 0.17 hrs, Volume= 0.095 MI, Depth= 25 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 100-Year Duration=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.3801	0.63	
0.3801		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 210: 210



Summary for Subcatchment 211: 211

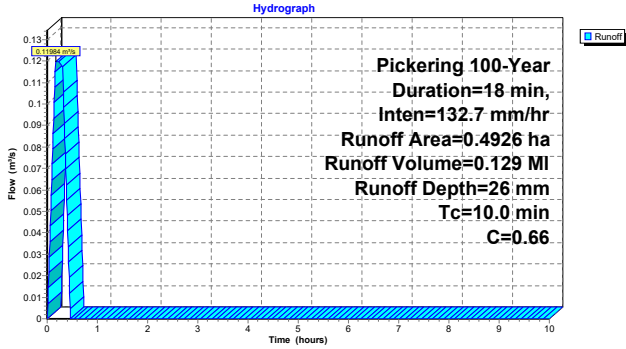
Runoff = 0.11984 m³/s @ 0.17 hrs, Volume= 0.129 MI, Depth= 26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 100-Year Duration=18 min, Inten=132.7 mm/hr

Area (ha)	C	Description
0.4926	0.66	
0.4926		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



Summary for Pond S1: S1

Inflow Area = 1.6590 ha, 100.00% Impervious, Inflow Depth = 40 mm for 100-Year event
 Inflow = 0.61151 m³/s @ 0.17 hrs, Volume= 0.660 MI
 Outflow = 0.14241 m³/s @ 0.43 hrs, Volume= 0.660 MI, Atten= 77%, Lag= 15.5 min
 Primary = 0.14241 m³/s @ 0.43 hrs, Volume= 0.660 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.737 m @ 0.43 hrs Surf.Area= 300.0 m² Storage= 521.0 m³

Plug-Flow detention time= 47.1 min calculated for 0.659 MI (100% of inflow)
 Center-of-Mass det. time= 47.5 min (61.5 - 14.0)

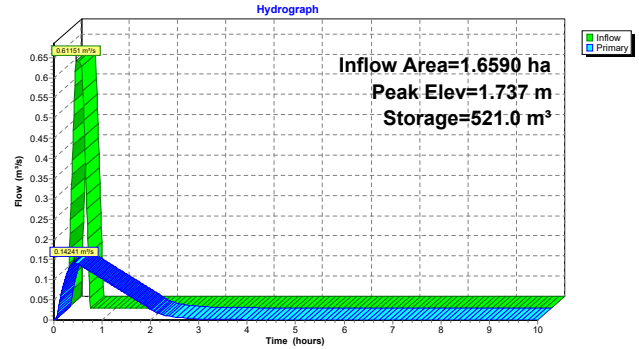
Volume #1	Invert	Avail. Storage	Storage Description
	0.000 m	600.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device #1	Routing	Invert	Outlet Devices	C
	Primary	0.000 m	200 mm Vert. Orifice/Grate	0.800

Primary OutFlow Max=0.14240 m³/s @ 0.43 hrs HW=1.736 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.14240 m³/s @ 4.53 m/s)

Pond S1: S1



Summary for Pond S2: S2

Inflow Area = 0.1061 ha, 0.00% Impervious, Inflow Depth = 12 mm for 100-Year event
 Inflow = 0.01212 m³/s @ 0.17 hrs, Volume= 0.013 MI
 Outflow = 0.00721 m³/s @ 0.37 hrs, Volume= 0.013 MI, Atten= 41%, Lag= 11.9 min
 Primary = 0.00721 m³/s @ 0.37 hrs, Volume= 0.013 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.414 m @ 0.37 hrs Surf.Area= 9.7 m² Storage= 6.1 m³

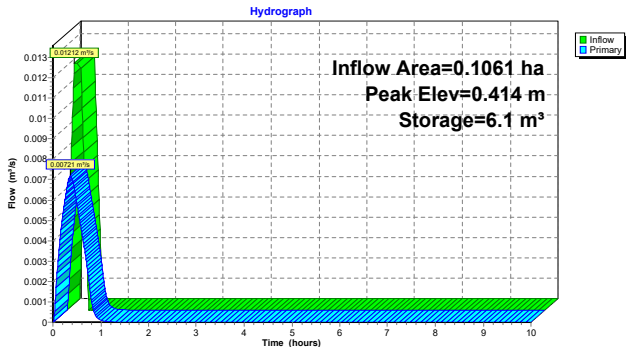
Plug-Flow detention time= 10.9 min calculated for 0.013 MI (100% of inflow)
 Center-of-Mass det. time= 10.9 min (24.9 - 14.0)

Volume #1	Invert	Avail. Storage	Storage Description
	0.000 m	6.4 m³	450 mm Round Pipe Storage L= 40.00 m

Device #1	Routing	Invert	Outlet Devices	C
	Primary	0.000 m	75 mm Vert. Orifice/Grate	0.600

Primary OutFlow Max=0.00720 m³/s @ 0.37 hrs HW=0.414 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00720 m³/s @ 1.63 m/s)

Pond S2: S2



Summary for Pond S3: S3

Inflow Area = 1.2444 ha, 100.00% Impervious, Inflow Depth = 40 mm for 100-Year event
 Inflow = 0.45869 m³/s @ 0.17 hrs, Volume= 0.495 MI
 Outflow = 0.07901 m³/s @ 0.44 hrs, Volume= 0.494 MI, Atten= 83%, Lag= 16.1 min
 Primary = 0.07901 m³/s @ 0.44 hrs, Volume= 0.494 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.667 m @ 0.44 hrs Surf.Area= 250.0 m² Storage= 416.8 m³

Plug-Flow detention time= 65.5 min calculated for 0.494 MI (100% of inflow)
 Center-of-Mass det. time= 65.4 min (79.5 - 14.0)

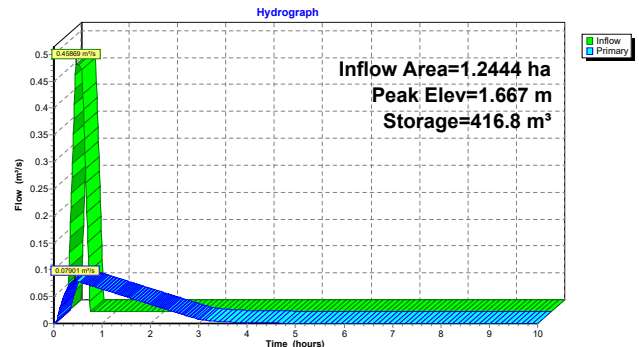
Volume #1	Invert	Avail. Storage	Storage Description
	0.000 m	500.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	250.0	0.0	0.0
2.000	250.0	500.0	500.0

Device #1	Routing	Invert	Outlet Devices	C
	Primary	0.000 m	150 mm Vert. Orifice/Grate	0.800

Primary OutFlow Max=0.07900 m³/s @ 0.44 hrs HW=1.667 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.07900 m³/s @ 4.47 m/s)

Pond S3: S3



Summary for Pond S4: S4

Inflow Area = 0.1572 ha, 100.00% Impervious, Inflow Depth = 40 mm for 100-Year event
 Inflow = 0.05794 m³/s @ 0.17 hrs, Volume= 0.063 MI
 Outflow = 0.01046 m³/s @ 0.44 hrs, Volume= 0.063 MI, Atten= 82%, Lag= 16.0 min
 Primary = 0.01046 m³/s @ 0.44 hrs, Volume= 0.063 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.830 m @ 0.44 hrs Surf.Area= 59.8 m² Storage= 51.4 m³

Plug-Flow detention time= 55.1 min calculated for 0.063 MI (100% of inflow)
 Center-of-Mass det. time= 54.9 min (68.9 - 14.0)

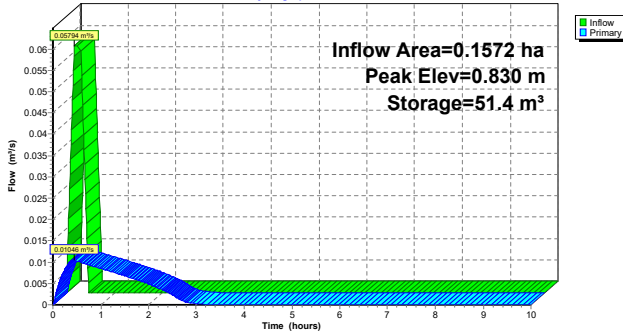
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	60.6 m³	1,050 mm Round Pipe Storage L= 70.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.01045 m³/s @ 0.44 hrs HW=0.830 m (Free Discharge)
 ↳1=Orifice/Grate (Orifice Controls 0.01045 m³/s @ 2.37 m/s)

Pond S4: S4

Hydrograph



Summary for Pond S5: S5

Inflow Area = 1.4302 ha, 100.00% Impervious, Inflow Depth = 40 mm for 100-Year event
 Inflow = 0.52717 m³/s @ 0.17 hrs, Volume= 0.569 MI
 Outflow = 0.12153 m³/s @ 0.43 hrs, Volume= 0.568 MI, Atten= 77%, Lag= 15.5 min
 Primary = 0.12153 m³/s @ 0.43 hrs, Volume= 0.568 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.292 m @ 0.43 hrs Surf.Area= 350.0 m² Storage= 452.1 m³

Plug-Flow detention time= 49.7 min calculated for 0.567 MI (100% of inflow)
 Center-of-Mass det. time= 50.1 min (64.1 - 14.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	700.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

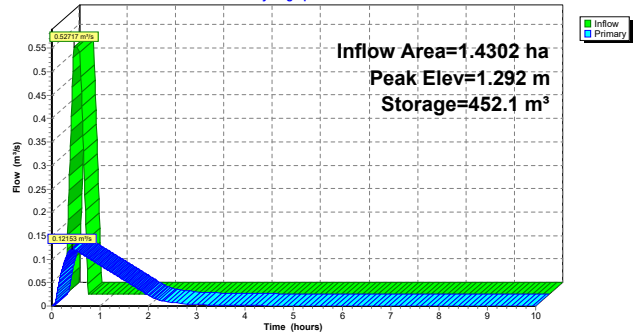
Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	350.0	0.0	0.0
2.000	350.0	700.0	700.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.12152 m³/s @ 0.43 hrs HW=1.292 m (Free Discharge)
 ↳1=Orifice/Grate (Orifice Controls 0.12152 m³/s @ 3.87 m/s)

Pond S5: S5

Hydrograph



Summary for Pond S6: S6

Inflow Area = 0.4097 ha, 100.00% Impervious, Inflow Depth = 40 mm for 100-Year event
 Inflow = 0.15102 m³/s @ 0.17 hrs, Volume= 0.163 MI
 Outflow = 0.03743 m³/s @ 0.43 hrs, Volume= 0.163 MI, Atten= 75%, Lag= 15.3 min
 Primary = 0.03743 m³/s @ 0.43 hrs, Volume= 0.163 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.710 m @ 0.43 hrs Surf.Area= 196.5 m² Storage= 124.7 m³

Plug-Flow detention time= 39.0 min calculated for 0.163 MI (100% of inflow)
 Center-of-Mass det. time= 39.2 min (53.2 - 14.0)

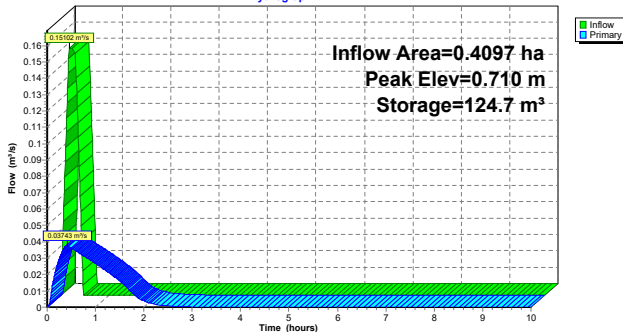
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	173.2 m³	1,050 mm Round Pipe Storage L= 200.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.03743 m³/s @ 0.43 hrs HW=0.710 m (Free Discharge)
 ↳1=Orifice/Grate (Orifice Controls 0.03743 m³/s @ 2.12 m/s)

Pond S6: S6

Hydrograph



Summary for Pond S7: S7

Inflow Area = 0.0685 ha, 0.00% Impervious, Inflow Depth = 12 mm for 100-Year event
 Inflow = 0.00783 m³/s @ 0.17 hrs, Volume= 0.008 MI
 Outflow = 0.00590 m³/s @ 0.34 hrs, Volume= 0.008 MI, Atten= 25%, Lag= 10.3 min
 Primary = 0.00590 m³/s @ 0.34 hrs, Volume= 0.008 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.290 m @ 0.34 hrs Surf.Area= 10.8 m² Storage= 2.7 m³

Plug-Flow detention time= 6.0 min calculated for 0.008 MI (100% of inflow)
 Center-of-Mass det. time= 6.0 min (20.0 - 14.0)

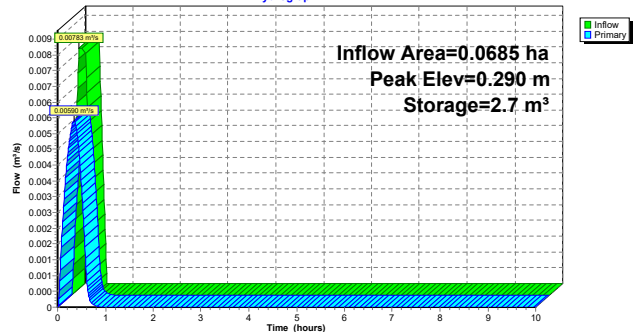
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	4.0 m³	450 mm Round Pipe Storage L= 25.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00590 m³/s @ 0.34 hrs HW=0.290 m (Free Discharge)
 ↳1=Orifice/Grate (Orifice Controls 0.00590 m³/s @ 1.34 m/s)

Pond S7: S7

Hydrograph



Summary for Pond S8: S8

Inflow Area = 1.3580 ha, 100.00% Impervious, Inflow Depth = 40 mm for 100-Year event
 Inflow = 0.50056 m³/s @ 0.17 hrs, Volume= 0.541 MI
 Outflow = 0.07605 m³/s @ 0.44 hrs, Volume= 0.539 MI, Atten= 85%, Lag= 16.3 min
 Primary = 0.07605 m³/s @ 0.44 hrs, Volume= 0.539 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.550 m @ 0.44 hrs Surf.Area= 300.0 m² Storage= 465.0 m³

Plug-Flow detention time= 75.5 min calculated for 0.539 MI (100% of inflow)
 Center-of-Mass det. time= 75.4 min (89.4 - 14.0)

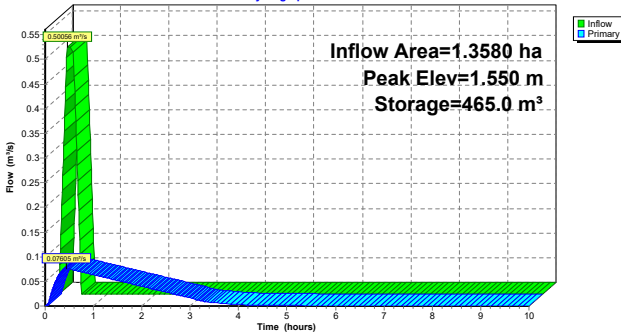
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.07605 m³/s @ 0.44 hrs HW=1.550 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.07605 m³/s @ 4.30 m/s)

Pond S8: S8

Hydrograph



Summary for Pond S9: S9

Inflow Area = 0.2333 ha, 0.00% Impervious, Inflow Depth = 12 mm for 100-Year event
 Inflow = 0.02666 m³/s @ 0.17 hrs, Volume= 0.029 MI
 Outflow = 0.02152 m³/s @ 0.33 hrs, Volume= 0.029 MI, Atten= 19%, Lag= 9.7 min
 Primary = 0.02152 m³/s @ 0.33 hrs, Volume= 0.029 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.285 m @ 0.33 hrs Surf.Area= 39.0 m² Storage= 8.6 m³

Plug-Flow detention time= 5.7 min calculated for 0.029 MI (100% of inflow)
 Center-of-Mass det. time= 5.8 min (19.8 - 14.0)

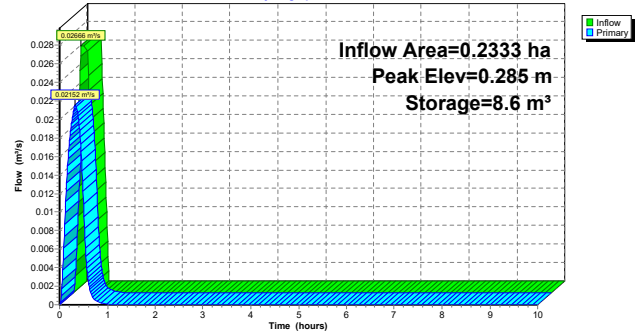
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	18.4 m³	600 mm Round Pipe Storage L= 65.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.02151 m³/s @ 0.33 hrs HW=0.285 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.02151 m³/s @ 1.22 m/s)

Pond S9: S9

Hydrograph



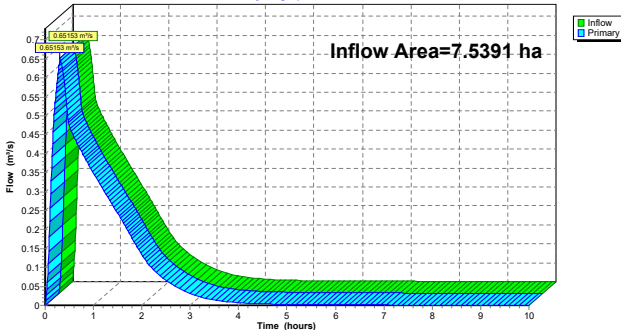
Summary for Link Outfall: Outfall

Inflow Area = 7.5391 ha, 83.01% Impervious, Inflow Depth > 37 mm for 100-Year event
 Inflow = 0.65153 m³/s @ 0.30 hrs, Volume= 2.761 MI
 Primary = 0.65153 m³/s @ 0.30 hrs, Volume= 2.761 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall

Hydrograph



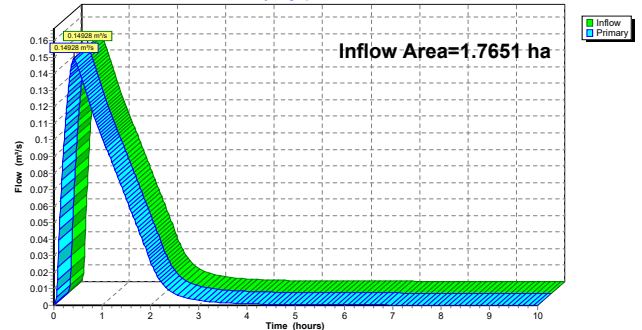
Summary for Link PH1: PH1

Inflow Area = 1.7651 ha, 93.99% Impervious, Inflow Depth > 38 mm for 100-Year event
 Inflow = 0.14928 m³/s @ 0.42 hrs, Volume= 0.673 MI
 Primary = 0.14928 m³/s @ 0.42 hrs, Volume= 0.673 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1

Hydrograph

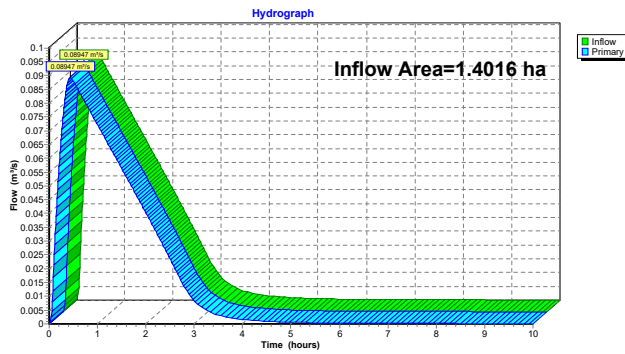


Summary for Link PH2: PH2

Inflow Area = 1.4016 ha, 100.00% Impervious, Inflow Depth > 40 mm for 100-Year event
 Inflow = 0.08947 m³/s @ 0.44 hrs, Volume= 0.557 MI
 Primary = 0.08947 m³/s @ 0.44 hrs, Volume= 0.557 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2: PH2

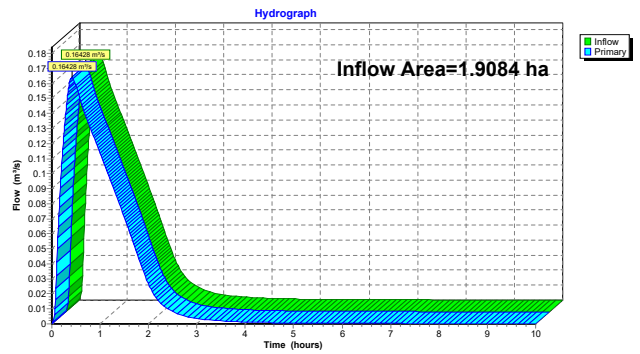


Summary for Link PH3: PH3

Inflow Area = 1.9084 ha, 96.41% Impervious, Inflow Depth > 39 mm for 100-Year event
 Inflow = 0.16428 m³/s @ 0.42 hrs, Volume= 0.739 MI
 Primary = 0.16428 m³/s @ 0.42 hrs, Volume= 0.739 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3

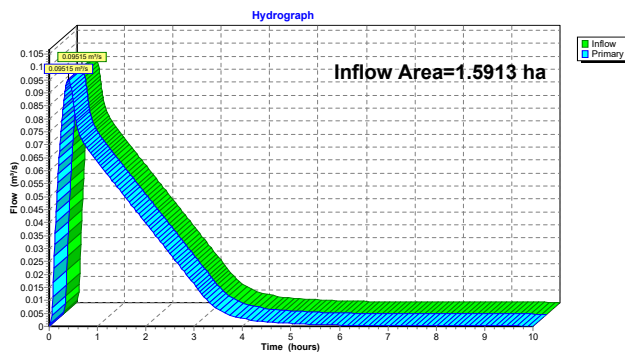


Summary for Link PH4: PH4

Inflow Area = 1.5913 ha, 85.34% Impervious, Inflow Depth > 36 mm for 100-Year event
 Inflow = 0.09515 m³/s @ 0.39 hrs, Volume= 0.568 MI
 Primary = 0.09515 m³/s @ 0.39 hrs, Volume= 0.568 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

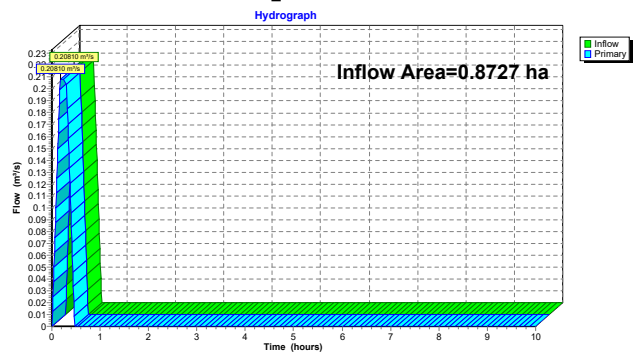


Summary for Link PH4_Un: PH4 Uncontrolled

Inflow Area = 0.8727 ha, 0.00% Impervious, Inflow Depth = 26 mm for 100-Year event
 Inflow = 0.20810 m³/s @ 0.17 hrs, Volume= 0.225 MI
 Primary = 0.20810 m³/s @ 0.17 hrs, Volume= 0.225 MI, Atten= 0%, Lag= 0.0 min

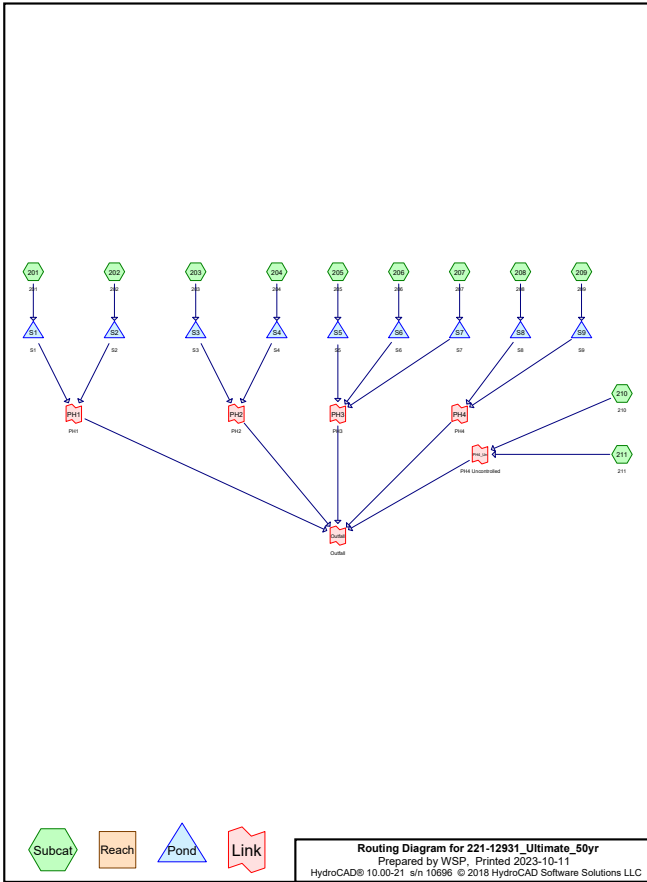
Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4_Un: PH4 Uncontrolled



Area Listing (selected nodes)

Area (hectares)	C	Description (subcatchment-numbers)
6.2585	1.00	(201, 203, 204, 205, 206, 208)
0.4079	0.30	(202, 207, 209)
0.3801	0.60	(210)
0.4926	0.63	(211)
7.5391	0.92	TOTAL AREA



Soil Listing (selected nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.5391	Other	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
7.5391		TOTAL AREA

Ground Covers (selected 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	7.5391	7.5391		201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
0.0000	0.0000	0.0000	0.0000	7.5391	7.5391	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

Subcatchment201: 201	Runoff Area=1.6590 ha 100.00% Impervious Runoff Depth=38 mm Tc=10.0 min C=1.00 Runoff=0.49846 m³/s 0.628 MI
Subcatchment202: 202	Runoff Area=0.1061 ha 0.00% Impervious Runoff Depth=11 mm Tc=10.0 min C=0.30 Runoff=0.00956 m³/s 0.012 MI
Subcatchment203: 203	Runoff Area=1.2444 ha 100.00% Impervious Runoff Depth=38 mm Tc=10.0 min C=1.00 Runoff=0.37389 m³/s 0.471 MI
Subcatchment204: 204	Runoff Area=0.1572 ha 100.00% Impervious Runoff Depth=38 mm Tc=10.0 min C=1.00 Runoff=0.04723 m³/s 0.060 MI
Subcatchment205: 205	Runoff Area=1.4302 ha 100.00% Impervious Runoff Depth=38 mm Tc=10.0 min C=1.00 Runoff=0.42971 m³/s 0.541 MI
Subcatchment206: 206	Runoff Area=0.4097 ha 100.00% Impervious Runoff Depth=38 mm Tc=10.0 min C=1.00 Runoff=0.12310 m³/s 0.155 MI
Subcatchment207: 207	Runoff Area=0.0685 ha 0.00% Impervious Runoff Depth=11 mm Tc=10.0 min C=0.30 Runoff=0.00617 m³/s 0.008 MI
Subcatchment208: 208	Runoff Area=1.3580 ha 100.00% Impervious Runoff Depth=38 mm Tc=10.0 min C=1.00 Runoff=0.40802 m³/s 0.514 MI
Subcatchment209: 209	Runoff Area=0.2333 ha 0.00% Impervious Runoff Depth=11 mm Tc=10.0 min C=0.30 Runoff=0.02103 m³/s 0.026 MI
Subcatchment210: 210	Runoff Area=0.3801 ha 0.00% Impervious Runoff Depth=23 mm Tc=10.0 min C=0.60 Runoff=0.06852 m³/s 0.086 MI
Subcatchment211: 211	Runoff Area=0.4926 ha 0.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.63 Runoff=0.09324 m³/s 0.117 MI
Pond S1: S1	Peak Elev=1.600 m Storage=480.0 m³ Inflow=0.49846 m³/s 0.628 MI Outflow=0.13635 m³/s 0.627 MI
Pond S2: S2	Peak Elev=0.332 m Storage=5.0 m³ Inflow=0.00956 m³/s 0.012 MI Outflow=0.00637 m³/s 0.012 MI
Pond S3: S3	Peak Elev=1.549 m Storage=387.2 m³ Inflow=0.37389 m³/s 0.471 MI Outflow=0.07602 m³/s 0.470 MI
Pond S4: S4	Peak Elev=0.769 m Storage=47.6 m³ Inflow=0.04723 m³/s 0.060 MI Outflow=0.01004 m³/s 0.060 MI
Pond S5: S5	Peak Elev=1.192 m Storage=417.1 m³ Inflow=0.42971 m³/s 0.541 MI Outflow=0.11632 m³/s 0.540 MI

Pond S6: S6	Peak Elev=0.658 m Storage=114.2 m³ Inflow=0.12310 m³/s 0.155 MI Outflow=0.03585 m³/s 0.155 MI
Pond S7: S7	Peak Elev=0.232 m Storage=2.1 m³ Inflow=0.00617 m³/s 0.008 MI Outflow=0.00518 m³/s 0.008 MI
Pond S8: S8	Peak Elev=1.445 m Storage=433.4 m³ Inflow=0.40802 m³/s 0.514 MI Outflow=0.07328 m³/s 0.512 MI
Pond S9: S9	Peak Elev=0.233 m Storage=6.6 m³ Inflow=0.02103 m³/s 0.026 MI Outflow=0.01867 m³/s 0.026 MI
Link Outfall: Outfall	Inflow=0.59608 m³/s 2.614 MI Primary=0.59608 m³/s 2.614 MI
Link PH1: PH1	Inflow=0.14245 m³/s 0.639 MI Primary=0.14245 m³/s 0.639 MI
Link PH2: PH2	Inflow=0.08607 m³/s 0.530 MI Primary=0.08607 m³/s 0.530 MI
Link PH3: PH3	Inflow=0.15675 m³/s 0.703 MI Primary=0.15675 m³/s 0.703 MI
Link PH4: PH4	Inflow=0.08945 m³/s 0.539 MI Primary=0.08945 m³/s 0.539 MI
Link PH4_Un: PH4 Uncontrolled	Inflow=0.16176 m³/s 0.204 MI Primary=0.16176 m³/s 0.204 MI

Total Runoff Area = 7.5391 ha Runoff Volume = 2.619 MI Average Runoff Depth = 35 mm
16.99% Pervious = 1.2806 ha 83.01% Impervious = 6.2585 ha

Summary for Subcatchment 201: 201

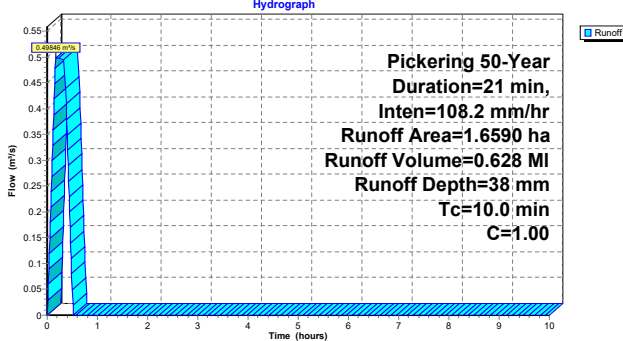
Runoff = 0.49846 m³/s @ 0.17 hrs, Volume= 0.628 MI, Depth= 38 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
1.6590	1.00	
1.6590		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



Summary for Subcatchment 202: 202

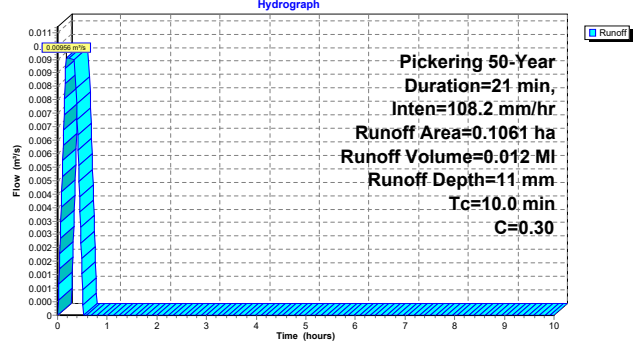
Runoff = 0.00956 m³/s @ 0.17 hrs, Volume= 0.012 MI, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 50-Year Duration=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.1061	0.30	
0.1061		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

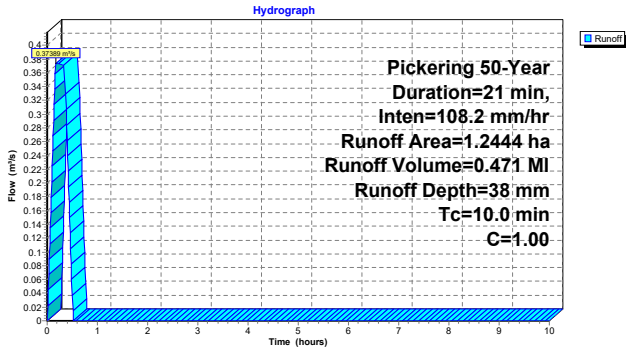
Runoff = 0.37389 m³/s @ 0.17 hrs, Volume= 0.471 MI, Depth= 38 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
1.2444	1.00	
1.2444	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 203: 203



Summary for Subcatchment 204: 204

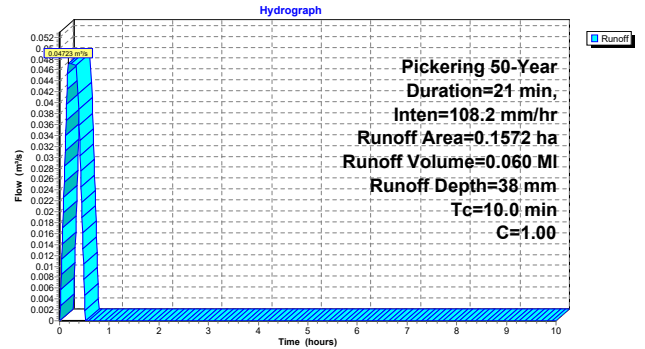
Runoff = 0.04723 m³/s @ 0.17 hrs, Volume= 0.060 MI, Depth= 38 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.1572	1.00	
0.1572	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 204: 204



Summary for Subcatchment 205: 205

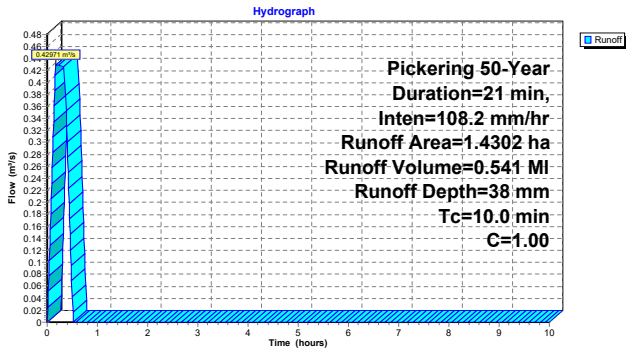
Runoff = 0.42971 m³/s @ 0.17 hrs, Volume= 0.541 MI, Depth= 38 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
1.4302	1.00	
1.4302	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 205: 205



Summary for Subcatchment 206: 206

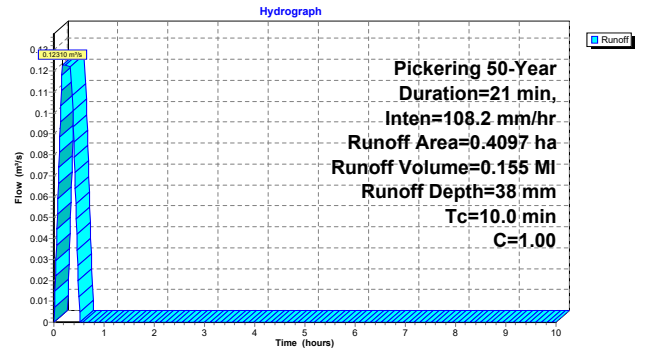
Runoff = 0.12310 m³/s @ 0.17 hrs, Volume= 0.155 MI, Depth= 38 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.4097	1.00	
0.4097	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 206: 206



Summary for Subcatchment 207: 207

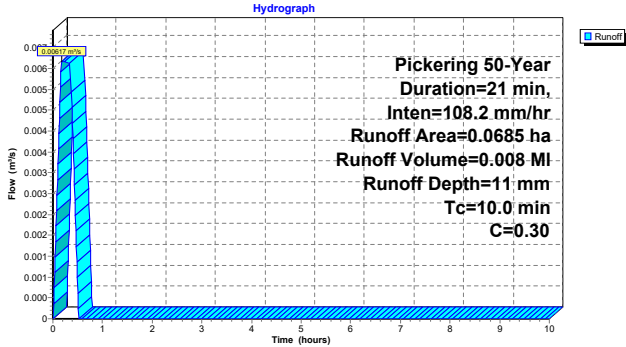
Runoff = 0.00617 m³/s @ 0.17 hrs, Volume= 0.008 MI, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 50-Year Duration=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.0685	0.30	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 207: 207



Summary for Subcatchment 208: 208

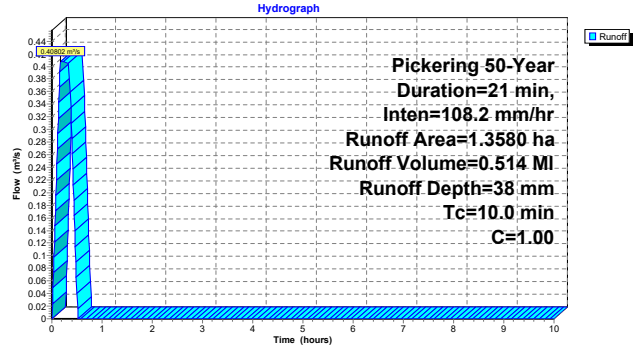
Runoff = 0.40802 m³/s @ 0.17 hrs, Volume= 0.514 MI, Depth= 38 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
1.3580	1.00	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 208: 208



Summary for Subcatchment 209: 209

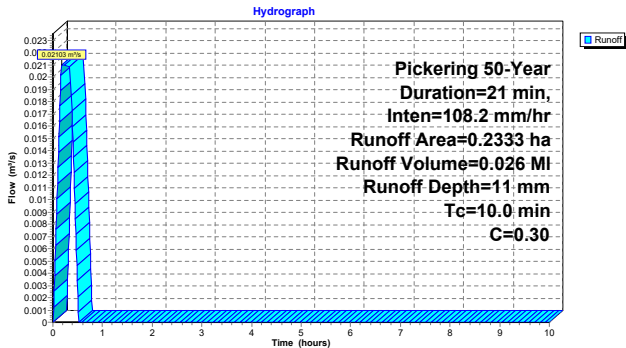
Runoff = 0.02103 m³/s @ 0.17 hrs, Volume= 0.026 MI, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 50-Year Duration=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.2333	0.30	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 209: 209



Summary for Subcatchment 210: 210

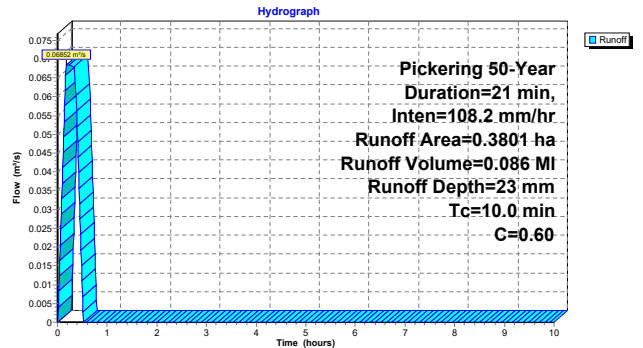
Runoff = 0.06852 m³/s @ 0.17 hrs, Volume= 0.086 MI, Depth= 23 mm

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=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.3801	0.60	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 210: 210



Summary for Subcatchment 211: 211

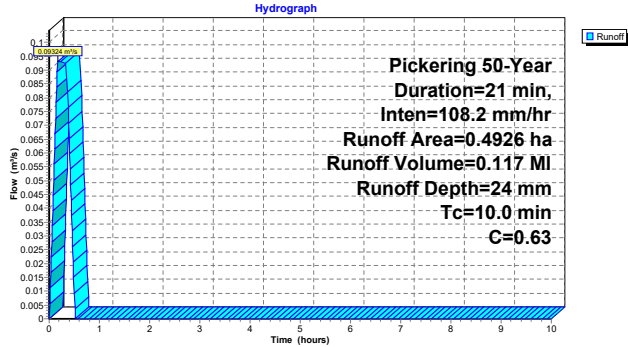
Runoff = 0.09324 m³/s @ 0.17 hrs, Volume= 0.117 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 50-Year Duration=21 min, Inten=108.2 mm/hr

Area (ha)	C	Description
0.4926	0.63	
0.4926		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



Summary for Pond S1: S1

Inflow Area = 1.6590 ha, 100.00% Impervious, Inflow Depth = 38 mm for 50-Year event
 Inflow = 0.49846 m³/s @ 0.17 hrs, Volume= 0.628 MI
 Outflow = 0.13635 m³/s @ 0.47 hrs, Volume= 0.627 MI, Atten= 73%, Lag= 18.1 min
 Primary = 0.13635 m³/s @ 0.47 hrs, Volume= 0.627 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.600 m @ 0.47 hrs Surf.Area= 300.0 m² Storage= 480.0 m³

Plug-Flow detention time= 46.4 min calculated for 0.627 MI (100% of inflow)
 Center-of-Mass det. time= 46.4 min (61.9 - 15.5)

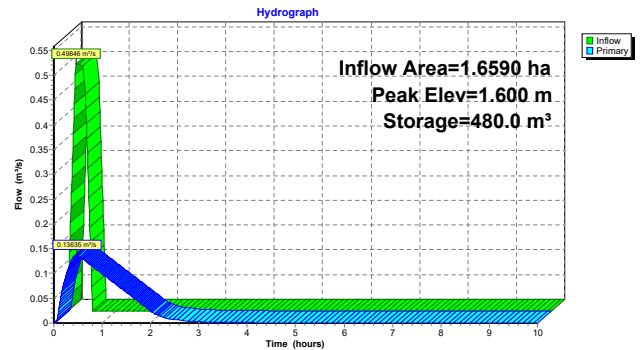
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.13634 m³/s @ 0.47 hrs HW=1.600 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.13634 m³/s @ 4.34 m/s)

Pond S1: S1



Summary for Pond S2: S2

Inflow Area = 0.1061 ha, 0.00% Impervious, Inflow Depth = 11 mm for 50-Year event
 Inflow = 0.00956 m³/s @ 0.17 hrs, Volume= 0.012 MI
 Outflow = 0.00637 m³/s @ 0.41 hrs, Volume= 0.012 MI, Atten= 33%, Lag= 14.1 min
 Primary = 0.00637 m³/s @ 0.41 hrs, Volume= 0.012 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.332 m @ 0.41 hrs Surf.Area= 15.8 m² Storage= 5.0 m³

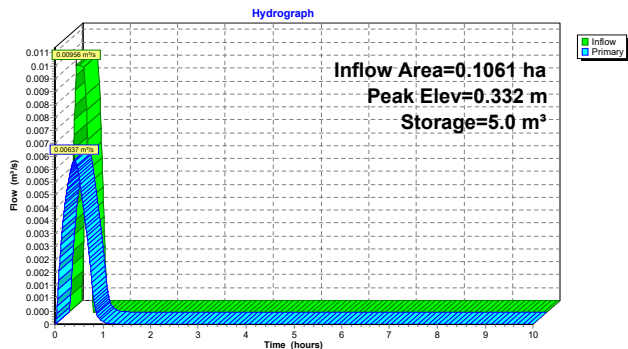
Plug-Flow detention time= 10.3 min calculated for 0.012 MI (100% of inflow)
 Center-of-Mass det. time= 10.1 min (25.6 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	6.4 m³	450 mm Round Pipe Storage L= 40.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00637 m³/s @ 0.41 hrs HW=0.332 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00637 m³/s @ 1.44 m/s)

Pond S2: S2



Summary for Pond S3: S3

Inflow Area = 1.2444 ha, 100.00% Impervious, Inflow Depth = 38 mm for 50-Year event
 Inflow = 0.37389 m³/s @ 0.17 hrs, Volume= 0.471 MI
 Outflow = 0.07602 m³/s @ 0.48 hrs, Volume= 0.470 MI, Atten= 80%, Lag= 18.8 min
 Primary = 0.07602 m³/s @ 0.48 hrs, Volume= 0.470 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.549 m @ 0.48 hrs Surf.Area= 250.0 m² Storage= 387.2 m³

Plug-Flow detention time= 63.4 min calculated for 0.470 MI (100% of inflow)
 Center-of-Mass det. time= 63.8 min (79.3 - 15.5)

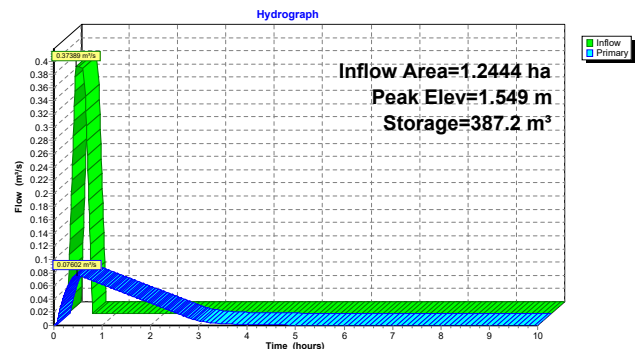
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	500.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	250.0	0.0	0.0
2.000	250.0	500.0	500.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.07602 m³/s @ 0.48 hrs HW=1.549 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.07602 m³/s @ 4.30 m/s)

Pond S3: S3



Summary for Pond S4: S4

Inflow Area = 0.1572 ha, 100.00% Impervious, Inflow Depth = 38 mm for 50-Year event
 Inflow = 0.04723 m³/s @ 0.17 hrs, Volume= 0.060 MI
 Outflow = 0.01004 m³/s @ 0.48 hrs, Volume= 0.060 MI, Atten= 79%, Lag= 18.7 min
 Primary = 0.01004 m³/s @ 0.48 hrs, Volume= 0.060 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.769 m @ 0.48 hrs Surf.Area= 65.1 m² Storage= 47.6 m³

Plug-Flow detention time= 53.0 min calculated for 0.060 MI (100% of inflow)
 Center-of-Mass det. time= 52.8 min (68.3 - 15.5)

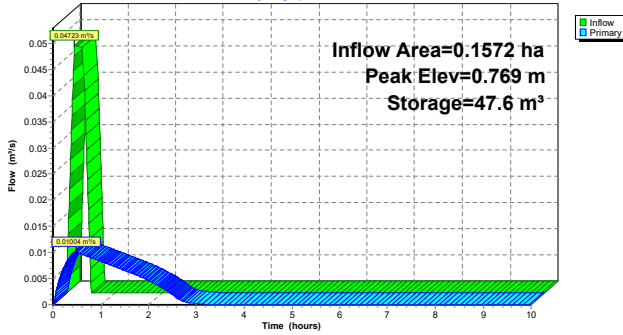
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	60.6 m³	1,050 mm Round Pipe Storage L= 70.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.01004 m³/s @ 0.48 hrs HW=0.769 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.01004 m³/s @ 2.27 m/s)

Pond S4: S4

Hydrograph



Summary for Pond S5: S5

Inflow Area = 1.4302 ha, 100.00% Impervious, Inflow Depth = 38 mm for 50-Year event
 Inflow = 0.42971 m³/s @ 0.17 hrs, Volume= 0.541 MI
 Outflow = 0.11632 m³/s @ 0.47 hrs, Volume= 0.540 MI, Atten= 73%, Lag= 18.1 min
 Primary = 0.11632 m³/s @ 0.47 hrs, Volume= 0.540 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.192 m @ 0.47 hrs Surf.Area= 350.0 m² Storage= 417.1 m³

Plug-Flow detention time= 49.1 min calculated for 0.540 MI (100% of inflow)
 Center-of-Mass det. time= 49.1 min (64.6 - 15.5)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	700.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

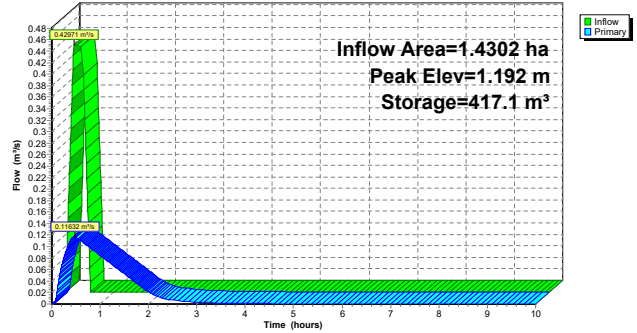
Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	350.0	0.0	0.0
2.000	350.0	700.0	700.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.11631 m³/s @ 0.47 hrs HW=1.192 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.11631 m³/s @ 3.70 m/s)

Pond S5: S5

Hydrograph



Summary for Pond S6: S6

Inflow Area = 0.4097 ha, 100.00% Impervious, Inflow Depth = 38 mm for 50-Year event
 Inflow = 0.12310 m³/s @ 0.17 hrs, Volume= 0.155 MI
 Outflow = 0.03585 m³/s @ 0.47 hrs, Volume= 0.155 MI, Atten= 71%, Lag= 17.9 min
 Primary = 0.03585 m³/s @ 0.47 hrs, Volume= 0.155 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.658 m @ 0.47 hrs Surf.Area= 203.2 m² Storage= 114.2 m³

Plug-Flow detention time= 37.5 min calculated for 0.155 MI (100% of inflow)
 Center-of-Mass det. time= 37.8 min (53.3 - 15.5)

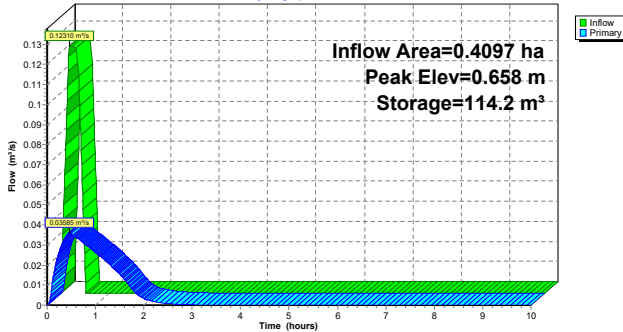
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	173.2 m³	1,050 mm Round Pipe Storage L= 200.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.03585 m³/s @ 0.47 hrs HW=0.658 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.03585 m³/s @ 2.03 m/s)

Pond S6: S6

Hydrograph



Summary for Pond S7: S7

Inflow Area = 0.0685 ha, 0.00% Impervious, Inflow Depth = 11 mm for 50-Year event
 Inflow = 0.00617 m³/s @ 0.17 hrs, Volume= 0.008 MI
 Outflow = 0.00518 m³/s @ 0.38 hrs, Volume= 0.008 MI, Atten= 16%, Lag= 12.4 min
 Primary = 0.00518 m³/s @ 0.38 hrs, Volume= 0.008 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.232 m @ 0.38 hrs Surf.Area= 11.2 m² Storage= 2.1 m³

Plug-Flow detention time= 5.3 min calculated for 0.008 MI (100% of inflow)
 Center-of-Mass det. time= 5.3 min (20.9 - 15.5)

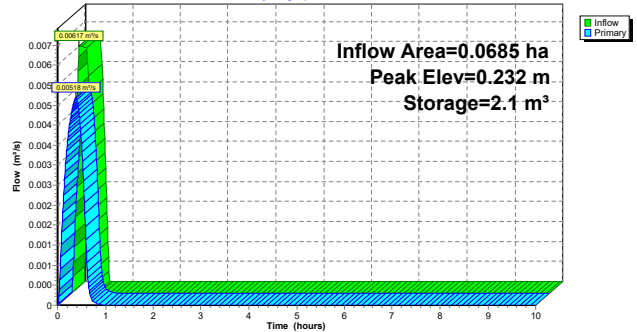
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	4.0 m³	450 mm Round Pipe Storage L= 25.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00517 m³/s @ 0.38 hrs HW=0.232 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00517 m³/s @ 1.17 m/s)

Pond S7: S7

Hydrograph



Summary for Pond S8: S8

Inflow Area = 1.3580 ha, 100.00% Impervious, Inflow Depth = 38 mm for 50-Year event
 Inflow = 0.40802 m³/s @ 0.17 hrs, Volume= 0.514 MI
 Outflow = 0.07328 m³/s @ 0.49 hrs, Volume= 0.512 MI, Atten= 82%, Lag= 19.0 min
 Primary = 0.07328 m³/s @ 0.49 hrs, Volume= 0.512 MI

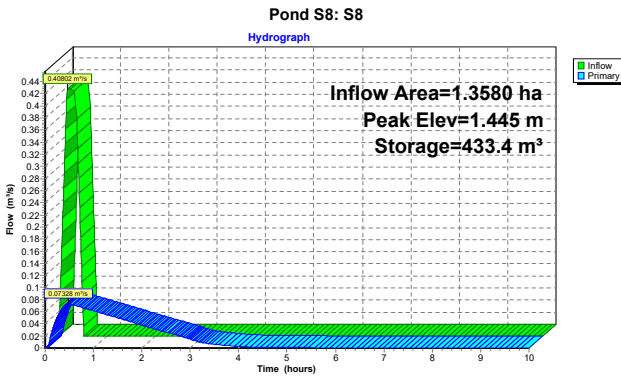
Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.445 m @ 0.49 hrs Surf.Area= 300.0 m² Storage= 433.4 m³

Plug-Flow detention time= 73.7 min calculated for 0.512 MI (100% of inflow)
 Center-of-Mass det. time= 73.6 min (89.1 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic), listed below (Recalc)
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.07327 m³/s @ 0.49 hrs HW=1.444 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.07327 m³/s @ 4.15 m/s)



Summary for Pond S9: S9

Inflow Area = 0.2333 ha, 0.00% Impervious, Inflow Depth = 11 mm for 50-Year event
 Inflow = 0.02103 m³/s @ 0.17 hrs, Volume= 0.026 MI
 Outflow = 0.01867 m³/s @ 0.37 hrs, Volume= 0.026 MI, Atten= 11%, Lag= 11.9 min
 Primary = 0.01867 m³/s @ 0.37 hrs, Volume= 0.026 MI

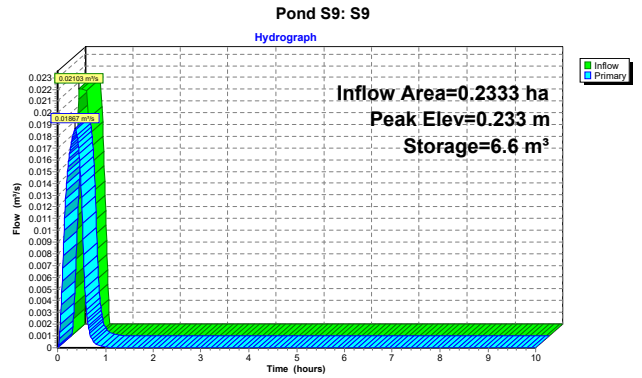
Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.233 m @ 0.37 hrs Surf.Area= 38.0 m² Storage= 6.6 m³

Plug-Flow detention time= 5.3 min calculated for 0.026 MI (100% of inflow)
 Center-of-Mass det. time= 5.3 min (20.9 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	18.4 m³	600 mm Round Pipe Storage L= 65.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.01866 m³/s @ 0.37 hrs HW=0.233 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.01866 m³/s @ 1.06 m/s)

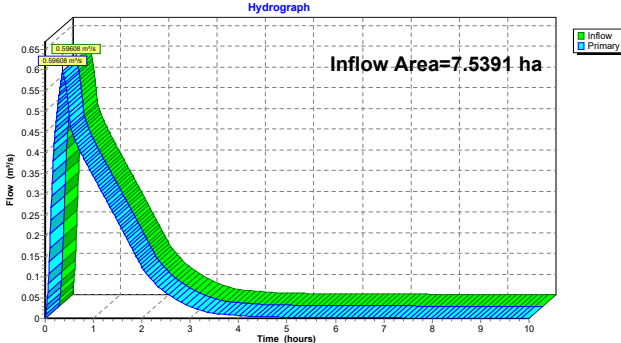


Summary for Link Outfall: Outfall

Inflow Area = 7.5391 ha, 83.01% Impervious, Inflow Depth > 35 mm for 50-Year event
 Inflow = 0.59608 m³/s @ 0.35 hrs, Volume= 2.614 MI
 Primary = 0.59608 m³/s @ 0.35 hrs, Volume= 2.614 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall

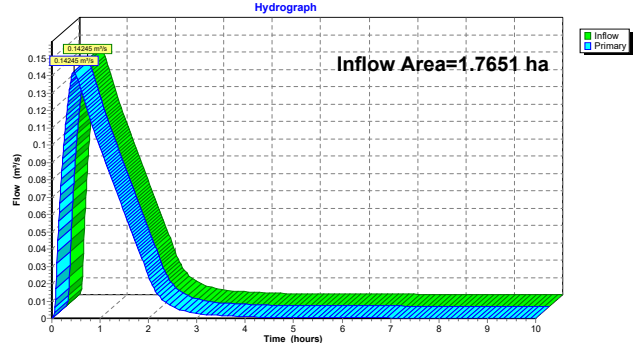


Summary for Link PH1: PH1

Inflow Area = 1.7651 ha, 93.99% Impervious, Inflow Depth > 36 mm for 50-Year event
 Inflow = 0.14245 m³/s @ 0.47 hrs, Volume= 0.639 MI
 Primary = 0.14245 m³/s @ 0.47 hrs, Volume= 0.639 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1



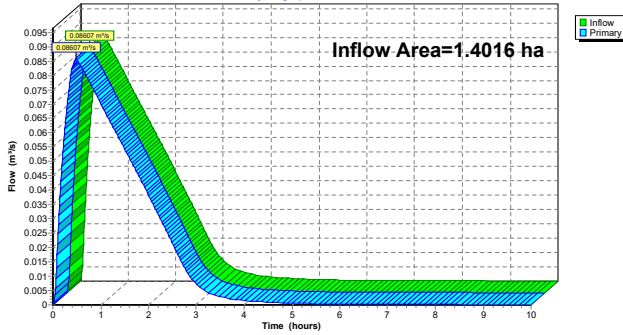
Summary for Link PH2: PH2

Inflow Area = 1.4016 ha, 100.00% Impervious, Inflow Depth > 38 mm for 50-Year event
 Inflow = 0.08607 m³/s @ 0.48 hrs, Volume= 0.530 MI
 Primary = 0.08607 m³/s @ 0.48 hrs, Volume= 0.530 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2: PH2

Hydrograph



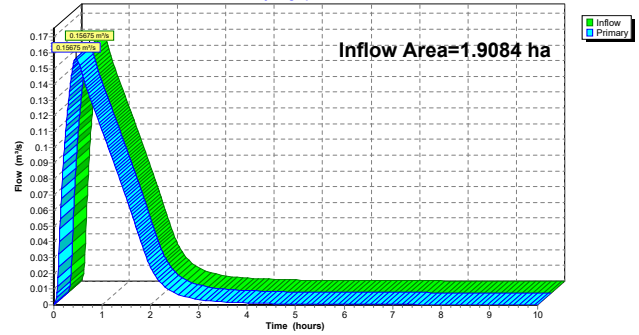
Summary for Link PH3: PH3

Inflow Area = 1.9084 ha, 96.41% Impervious, Inflow Depth > 37 mm for 50-Year event
 Inflow = 0.15675 m³/s @ 0.46 hrs, Volume= 0.703 MI
 Primary = 0.15675 m³/s @ 0.46 hrs, Volume= 0.703 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3

Hydrograph



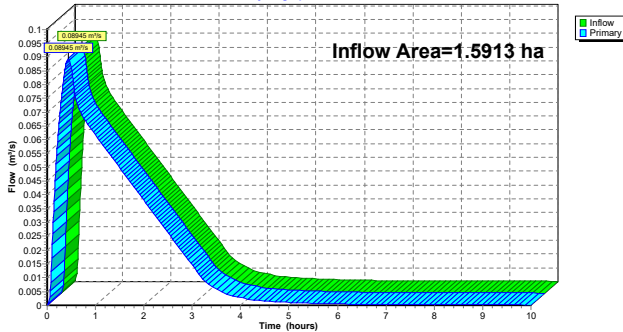
Summary for Link PH4: PH4

Inflow Area = 1.5913 ha, 85.34% Impervious, Inflow Depth > 34 mm for 50-Year event
 Inflow = 0.08945 m³/s @ 0.43 hrs, Volume= 0.539 MI
 Primary = 0.08945 m³/s @ 0.43 hrs, Volume= 0.539 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

Hydrograph



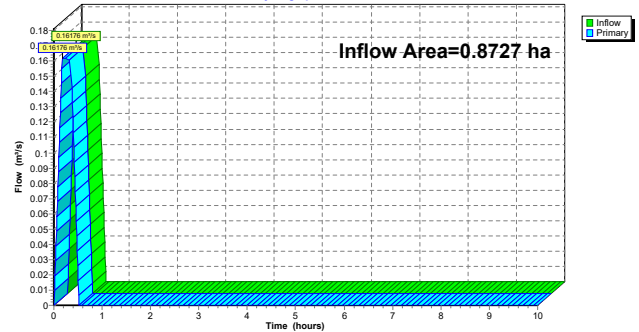
Summary for Link PH4_Un: PH4 Uncontrolled

Inflow Area = 0.8727 ha, 0.00% Impervious, Inflow Depth = 23 mm for 50-Year event
 Inflow = 0.16176 m³/s @ 0.17 hrs, Volume= 0.204 MI
 Primary = 0.16176 m³/s @ 0.17 hrs, Volume= 0.204 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

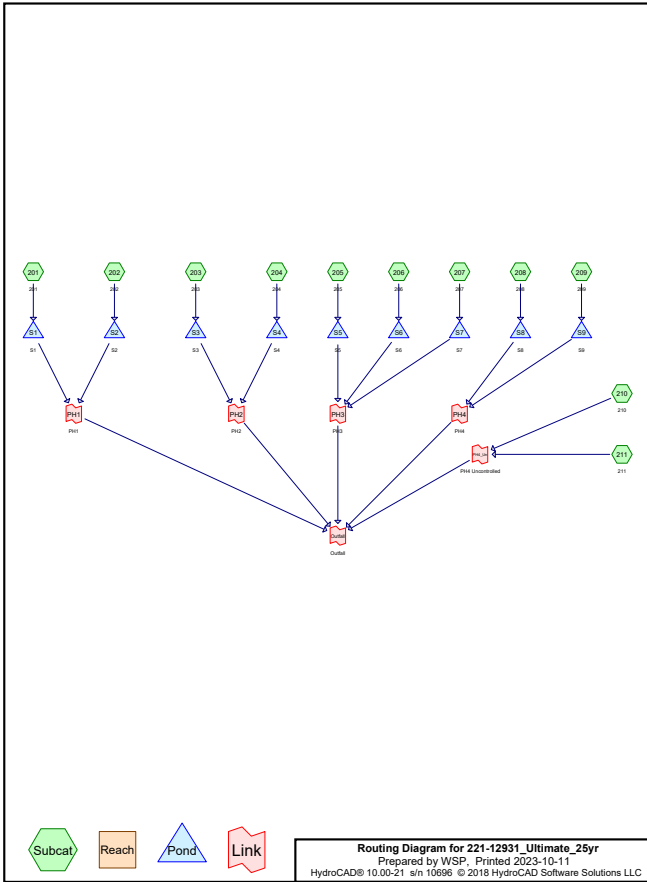
Link PH4_Un: PH4 Uncontrolled

Hydrograph



Area Listing (selected nodes)

Area (hectares)	C	Description (subcatchment-numbers)
6.2585	1.00	(201, 203, 204, 205, 206, 208)
0.4079	0.28	(202, 207, 209)
0.3801	0.55	(210)
0.4926	0.58	(211)
7.5391	0.91	TOTAL AREA



Soil Listing (selected nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.5391	Other	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
7.5391		TOTAL AREA

Ground Covers (selected 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	7.5391	7.5391		201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
0.0000	0.0000	0.0000	0.0000	7.5391	7.5391	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

Subcatchment201: 201	Runoff Area=1.6590 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.44543 m³/s 0.561 MI
Subcatchment202: 202	Runoff Area=0.1061 ha 0.00% Impervious Runoff Depth=9 mm Tc=10.0 min C=0.28 Runoff=0.00798 m³/s 0.010 MI
Subcatchment203: 203	Runoff Area=1.2444 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.33411 m³/s 0.421 MI
Subcatchment204: 204	Runoff Area=0.1572 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.04221 m³/s 0.053 MI
Subcatchment205: 205	Runoff Area=1.4302 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.38400 m³/s 0.484 MI
Subcatchment206: 206	Runoff Area=0.4097 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.11000 m³/s 0.139 MI
Subcatchment207: 207	Runoff Area=0.0685 ha 0.00% Impervious Runoff Depth=9 mm Tc=10.0 min C=0.28 Runoff=0.00515 m³/s 0.006 MI
Subcatchment208: 208	Runoff Area=1.3580 ha 100.00% Impervious Runoff Depth=34 mm Tc=10.0 min C=1.00 Runoff=0.36461 m³/s 0.459 MI
Subcatchment209: 209	Runoff Area=0.2333 ha 0.00% Impervious Runoff Depth=9 mm Tc=10.0 min C=0.28 Runoff=0.01754 m³/s 0.022 MI
Subcatchment210: 210	Runoff Area=0.3801 ha 0.00% Impervious Runoff Depth=19 mm Tc=10.0 min C=0.55 Runoff=0.05613 m³/s 0.071 MI
Subcatchment211: 211	Runoff Area=0.4926 ha 0.00% Impervious Runoff Depth=20 mm Tc=10.0 min C=0.58 Runoff=0.07671 m³/s 0.097 MI
Pond S1: S1	Peak Elev=1.412 m Storage=423.7 m³ Inflow=0.44543 m³/s 0.561 MI Outflow=0.12753 m³/s 0.560 MI
Pond S2: S2	Peak Elev=0.264 m Storage=3.9 m³ Inflow=0.00798 m³/s 0.010 MI Outflow=0.00559 m³/s 0.010 MI
Pond S3: S3	Peak Elev=1.371 m Storage=342.8 m³ Inflow=0.33411 m³/s 0.421 MI Outflow=0.07129 m³/s 0.420 MI
Pond S4: S4	Peak Elev=0.685 m Storage=41.9 m³ Inflow=0.04221 m³/s 0.053 MI Outflow=0.00945 m³/s 0.053 MI
Pond S5: S5	Peak Elev=1.053 m Storage=368.7 m³ Inflow=0.38400 m³/s 0.484 MI Outflow=0.10870 m³/s 0.482 MI

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Pond S6: S6	Peak Elev=0.590 m Storage=100.3 m³ Inflow=0.11000 m³/s 0.139 MI Outflow=0.03371 m³/s 0.139 MI
Pond S7: S7	Peak Elev=0.184 m Storage=1.5 m³ Inflow=0.00515 m³/s 0.006 MI Outflow=0.00450 m³/s 0.006 MI
Pond S8: S8	Peak Elev=1.280 m Storage=384.1 m³ Inflow=0.36461 m³/s 0.459 MI Outflow=0.06875 m³/s 0.458 MI
Pond S9: S9	Peak Elev=0.192 m Storage=5.1 m³ Inflow=0.01754 m³/s 0.022 MI Outflow=0.01608 m³/s 0.022 MI
Link Outfall: Outfall	Inflow=0.53838 m³/s 2.318 MI Primary=0.53838 m³/s 2.318 MI
Link PH1: PH1	Inflow=0.13287 m³/s 0.570 MI Primary=0.13287 m³/s 0.570 MI
Link PH2: PH2	Inflow=0.08074 m³/s 0.473 MI Primary=0.08074 m³/s 0.473 MI
Link PH3: PH3	Inflow=0.14627 m³/s 0.627 MI Primary=0.14627 m³/s 0.627 MI
Link PH4: PH4	Inflow=0.08225 m³/s 0.480 MI Primary=0.08225 m³/s 0.480 MI
Link PH4_Un: PH4 Uncontrolled	Inflow=0.13284 m³/s 0.167 MI Primary=0.13284 m³/s 0.167 MI
Total Runoff Area = 7.5391 ha Runoff Volume = 2.323 MI Average Runoff Depth = 31 mm 16.99% Pervious = 1.2806 ha 83.01% Impervious = 6.2585 ha	

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Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

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Summary for Subcatchment 201: 201

Runoff = 0.44543 m³/s @ 0.17 hrs, Volume= 0.561 MI, Depth= 34 mm

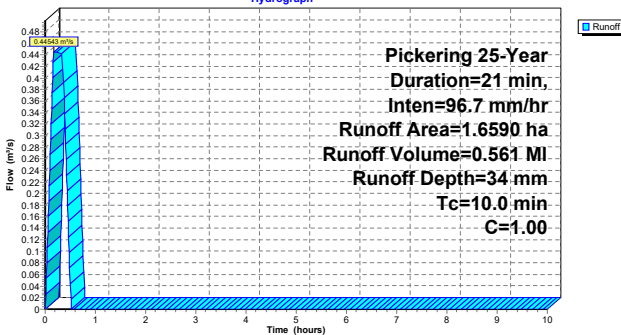
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
1.6590	1.00	
1.6590		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

Hydrograph



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Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

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Summary for Subcatchment 202: 202

Runoff = 0.00798 m³/s @ 0.17 hrs, Volume= 0.010 MI, Depth= 9 mm

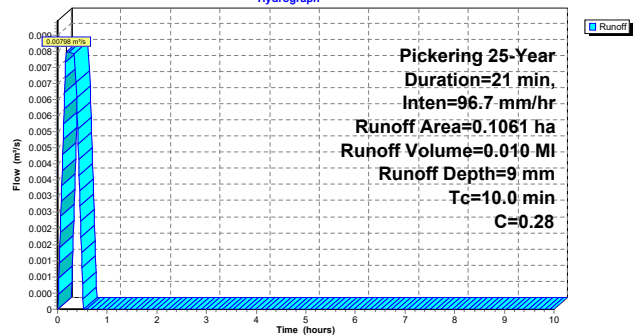
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.1061	0.28	
0.1061		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



Summary for Subcatchment 203: 203

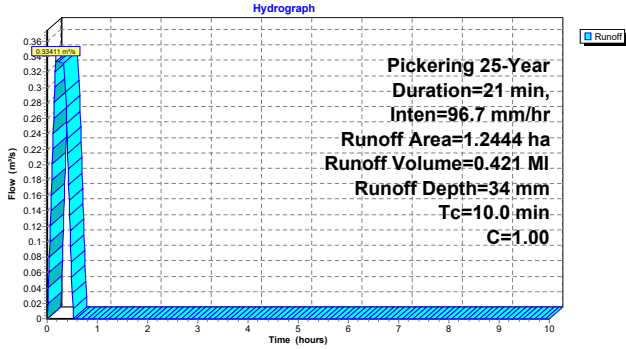
Runoff = 0.33411 m³/s @ 0.17 hrs, Volume= 0.421 MI, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
1.2444	1.00	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 203: 203



Summary for Subcatchment 204: 204

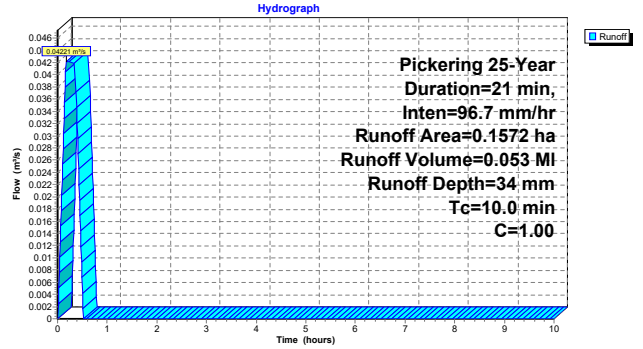
Runoff = 0.04221 m³/s @ 0.17 hrs, Volume= 0.053 MI, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.1572	1.00	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 204: 204



Summary for Subcatchment 205: 205

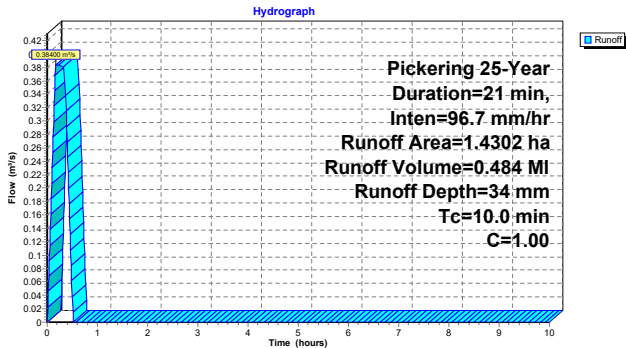
Runoff = 0.38400 m³/s @ 0.17 hrs, Volume= 0.484 MI, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
1.4302	1.00	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 205: 205



Summary for Subcatchment 206: 206

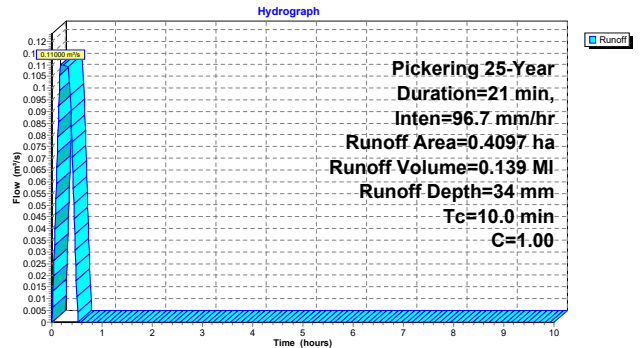
Runoff = 0.11000 m³/s @ 0.17 hrs, Volume= 0.139 MI, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.4097	1.00	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 206: 206



Summary for Subcatchment 207: 207

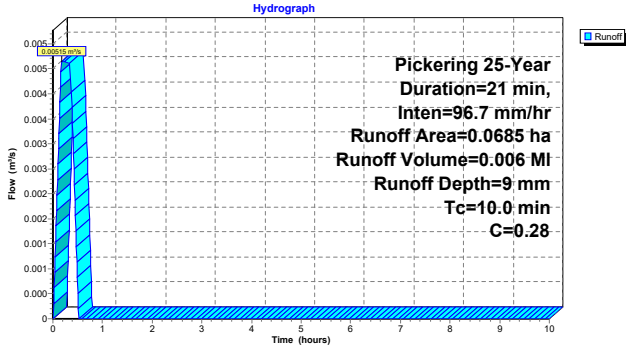
Runoff = 0.00515 m³/s @ 0.17 hrs, Volume= 0.006 MI, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.0685	0.28	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 207: 207



Summary for Subcatchment 208: 208

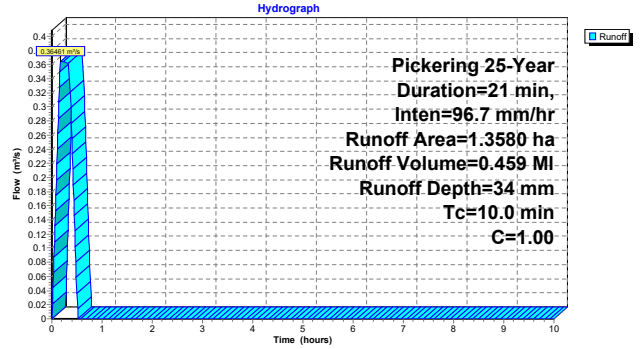
Runoff = 0.36461 m³/s @ 0.17 hrs, Volume= 0.459 MI, Depth= 34 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
1.3580	1.00	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 208: 208



Summary for Subcatchment 209: 209

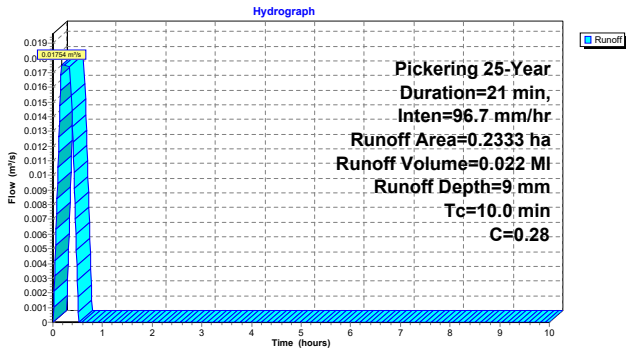
Runoff = 0.01754 m³/s @ 0.17 hrs, Volume= 0.022 MI, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.2333	0.28	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 209: 209



Summary for Subcatchment 210: 210

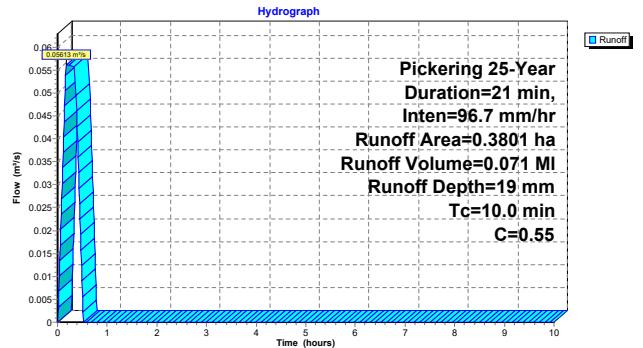
Runoff = 0.05613 m³/s @ 0.17 hrs, Volume= 0.071 MI, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.3801	0.55	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 210: 210



Summary for Subcatchment 211: 211

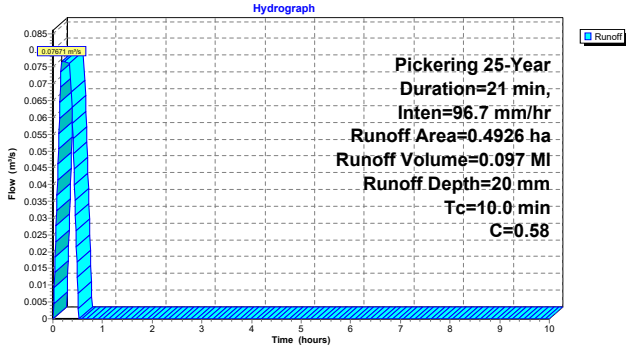
Runoff = 0.07671 m³/s @ 0.17 hrs, Volume= 0.097 MI, Depth= 20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 25-Year Duration=21 min, Inten=96.7 mm/hr

Area (ha)	C	Description
0.4926	0.58	
0.4926		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 211: 211



Summary for Pond S1: S1

Inflow Area = 1.6590 ha, 100.00% Impervious, Inflow Depth = 34 mm for 25-Year event
 Inflow = 0.44543 m³/s @ 0.17 hrs, Volume= 0.561 MI
 Outflow = 0.12753 m³/s @ 0.47 hrs, Volume= 0.560 MI, Atten= 71%, Lag= 17.9 min
 Primary = 0.12753 m³/s @ 0.47 hrs, Volume= 0.560 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.412 m @ 0.47 hrs Surf.Area= 300.0 m² Storage= 423.7 m³

Plug-Flow detention time= 44.2 min calculated for 0.560 MI (100% of inflow)
 Center-of-Mass det. time= 44.7 min (60.2 - 15.5)

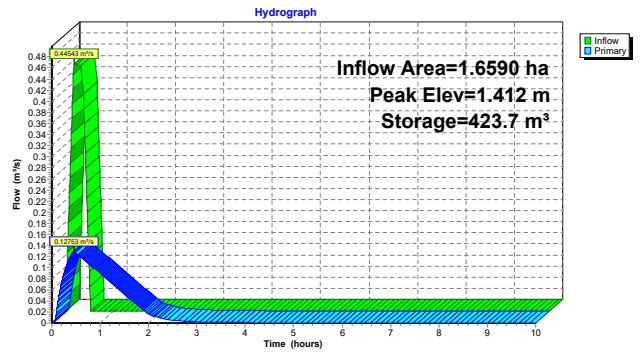
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m ³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.12753 m³/s @ 0.47 hrs HW=1.412 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.12753 m³/s @ 4.06 m/s)

Pond S1: S1



Summary for Pond S2: S2

Inflow Area = 0.1061 ha, 0.00% Impervious, Inflow Depth = 9 mm for 25-Year event
 Inflow = 0.00798 m³/s @ 0.17 hrs, Volume= 0.010 MI
 Outflow = 0.00559 m³/s @ 0.40 hrs, Volume= 0.010 MI, Atten= 30%, Lag= 13.8 min
 Primary = 0.00559 m³/s @ 0.40 hrs, Volume= 0.010 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.264 m @ 0.40 hrs Surf.Area= 17.7 m² Storage= 3.9 m³

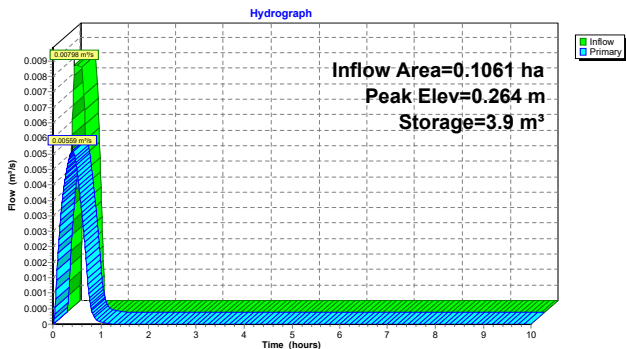
Plug-Flow detention time= 9.2 min calculated for 0.010 MI (100% of inflow)
 Center-of-Mass det. time= 9.0 min (24.5 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	6.4 m ³	450 mm Round Pipe Storage L= 40.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00559 m³/s @ 0.40 hrs HW=0.264 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00559 m³/s @ 1.27 m/s)

Pond S2: S2



Summary for Pond S3: S3

Inflow Area = 1.2444 ha, 100.00% Impervious, Inflow Depth = 34 mm for 25-Year event
 Inflow = 0.33411 m³/s @ 0.17 hrs, Volume= 0.421 MI
 Outflow = 0.07129 m³/s @ 0.48 hrs, Volume= 0.420 MI, Atten= 79%, Lag= 18.7 min
 Primary = 0.07129 m³/s @ 0.48 hrs, Volume= 0.420 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.371 m @ 0.48 hrs Surf.Area= 250.0 m² Storage= 342.8 m³

Plug-Flow detention time= 60.7 min calculated for 0.420 MI (100% of inflow)
 Center-of-Mass det. time= 61.2 min (76.7 - 15.5)

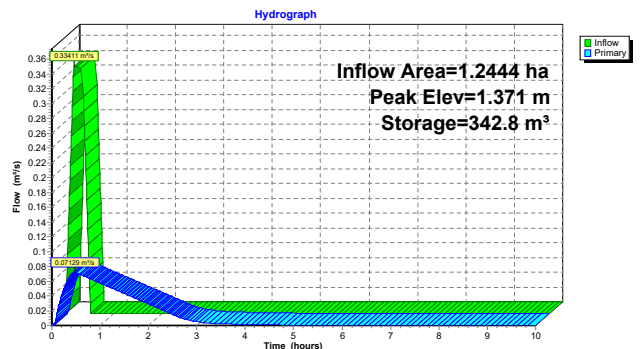
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	500.0 m ³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	250.0	0.0	0.0
2.000	250.0	500.0	500.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.07129 m³/s @ 0.48 hrs HW=1.371 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.07129 m³/s @ 4.03 m/s)

Pond S3: S3



Summary for Pond S4: S4

Inflow Area = 0.1572 ha, 100.00% Impervious, Inflow Depth = 34 mm for 25-Year event
 Inflow = 0.04221 m³/s @ 0.17 hrs, Volume= 0.053 MI
 Outflow = 0.00945 m³/s @ 0.48 hrs, Volume= 0.053 MI, Atten= 78%, Lag= 18.6 min
 Primary = 0.00945 m³/s @ 0.48 hrs, Volume= 0.053 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.685 m @ 0.48 hrs Surf.Area= 70.0 m² Storage= 41.9 m³

Plug-Flow detention time= 49.5 min calculated for 0.053 MI (100% of inflow)
 Center-of-Mass det. time= 49.3 min (64.8 - 15.5)

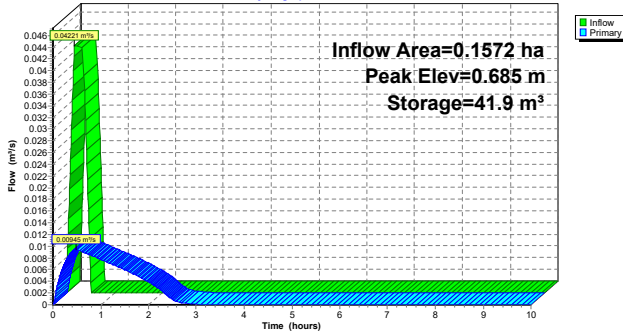
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	60.6 m³	1,050 mm Round Pipe Storage L= 70.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00945 m³/s @ 0.48 hrs HW=0.685 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00945 m³/s @ 2.14 m/s)

Pond S4: S4

Hydrograph



Summary for Pond S5: S5

Inflow Area = 1.4302 ha, 100.00% Impervious, Inflow Depth = 34 mm for 25-Year event
 Inflow = 0.38400 m³/s @ 0.17 hrs, Volume= 0.484 MI
 Outflow = 0.10870 m³/s @ 0.47 hrs, Volume= 0.482 MI, Atten= 72%, Lag= 18.0 min
 Primary = 0.10870 m³/s @ 0.47 hrs, Volume= 0.482 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.053 m @ 0.47 hrs Surf.Area= 350.0 m² Storage= 368.7 m³

Plug-Flow detention time= 47.7 min calculated for 0.482 MI (100% of inflow)
 Center-of-Mass det. time= 47.6 min (63.1 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	700.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

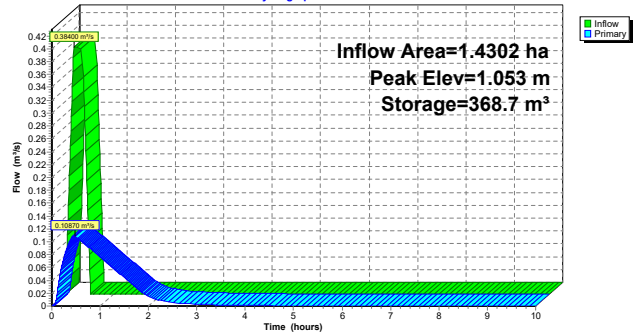
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	350.0	0.0	0.0
2.000	350.0	700.0	700.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.10869 m³/s @ 0.47 hrs HW=1.053 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.10869 m³/s @ 3.46 m/s)

Pond S5: S5

Hydrograph



Summary for Pond S6: S6

Inflow Area = 0.4097 ha, 100.00% Impervious, Inflow Depth = 34 mm for 25-Year event
 Inflow = 0.11000 m³/s @ 0.17 hrs, Volume= 0.139 MI
 Outflow = 0.03371 m³/s @ 0.47 hrs, Volume= 0.139 MI, Atten= 69%, Lag= 17.7 min
 Primary = 0.03371 m³/s @ 0.47 hrs, Volume= 0.139 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.590 m @ 0.47 hrs Surf.Area= 208.4 m² Storage= 100.3 m³

Plug-Flow detention time= 35.7 min calculated for 0.139 MI (100% of inflow)
 Center-of-Mass det. time= 35.6 min (51.1 - 15.5)

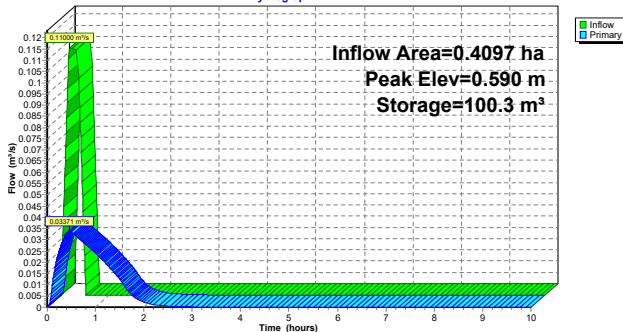
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	173.2 m³	1,050 mm Round Pipe Storage L= 200.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.03371 m³/s @ 0.47 hrs HW=0.590 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.03371 m³/s @ 1.91 m/s)

Pond S6: S6

Hydrograph



Summary for Pond S7: S7

Inflow Area = 0.0685 ha, 0.00% Impervious, Inflow Depth = 9 mm for 25-Year event
 Inflow = 0.00515 m³/s @ 0.17 hrs, Volume= 0.006 MI
 Outflow = 0.00450 m³/s @ 0.37 hrs, Volume= 0.006 MI, Atten= 13%, Lag= 12.1 min
 Primary = 0.00450 m³/s @ 0.37 hrs, Volume= 0.006 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.184 m @ 0.37 hrs Surf.Area= 11.1 m² Storage= 1.5 m³

Plug-Flow detention time= 4.7 min calculated for 0.006 MI (100% of inflow)
 Center-of-Mass det. time= 4.7 min (20.2 - 15.5)

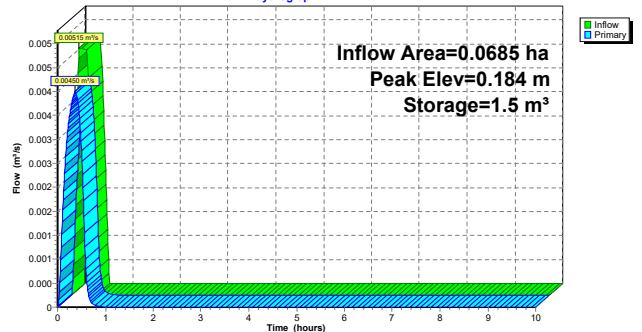
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	4.0 m³	450 mm Round Pipe Storage L= 25.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00450 m³/s @ 0.37 hrs HW=0.184 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00450 m³/s @ 1.02 m/s)

Pond S7: S7

Hydrograph



Summary for Pond S8: S8

Inflow Area = 1.3580 ha, 100.00% Impervious, Inflow Depth = 34 mm for 25-Year event
 Inflow = 0.36461 m³/s @ 0.17 hrs, Volume= 0.459 MI
 Outflow = 0.06875 m³/s @ 0.49 hrs, Volume= 0.458 MI, Atten= 81%, Lag= 18.9 min
 Primary = 0.06875 m³/s @ 0.49 hrs, Volume= 0.458 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.280 m @ 0.49 hrs Surf.Area= 300.0 m² Storage= 384.1 m³

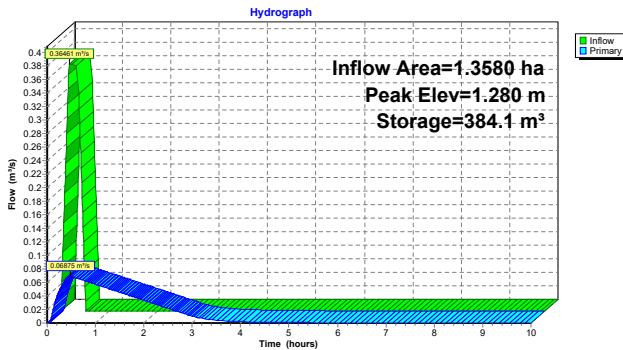
Plug-Flow detention time= 70.2 min calculated for 0.457 MI (100% of inflow)
 Center-of-Mass det. time= 70.6 min (86.1 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic), listed below (Recalc)
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.06874 m³/s @ 0.49 hrs HW=1.280 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.06874 m³/s @ 3.89 m/s)

Pond S8: S8



Summary for Pond S9: S9

Inflow Area = 0.2333 ha, 0.00% Impervious, Inflow Depth = 9 mm for 25-Year event
 Inflow = 0.01754 m³/s @ 0.17 hrs, Volume= 0.022 MI
 Outflow = 0.01608 m³/s @ 0.36 hrs, Volume= 0.022 MI, Atten= 8%, Lag= 11.6 min
 Primary = 0.01608 m³/s @ 0.36 hrs, Volume= 0.022 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.192 m @ 0.36 hrs Surf.Area= 36.4 m² Storage= 5.1 m³

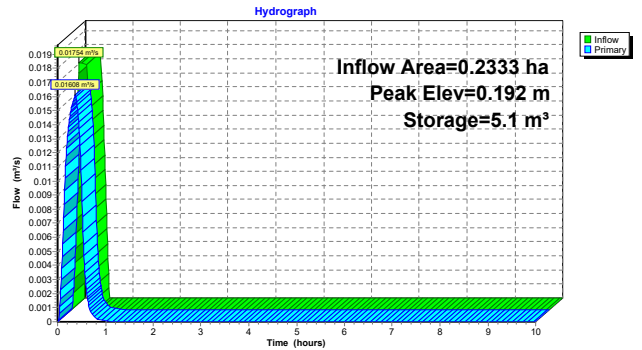
Plug-Flow detention time= 5.2 min calculated for 0.022 MI (100% of inflow)
 Center-of-Mass det. time= 5.0 min (20.5 - 15.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	18.4 m³	600 mm Round Pipe Storage L= 65.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.01608 m³/s @ 0.36 hrs HW=0.192 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.01608 m³/s @ 0.91 m/s)

Pond S9: S9

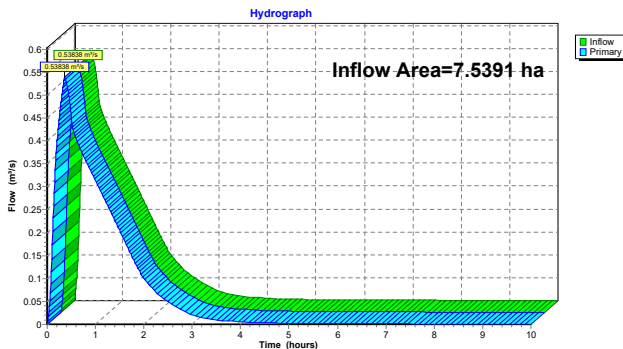


Summary for Link Outfall: Outfall

Inflow Area = 7.5391 ha, 83.01% Impervious, Inflow Depth > 31 mm for 25-Year event
 Inflow = 0.53838 m³/s @ 0.35 hrs, Volume= 2.318 MI
 Primary = 0.53838 m³/s @ 0.35 hrs, Volume= 2.318 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall

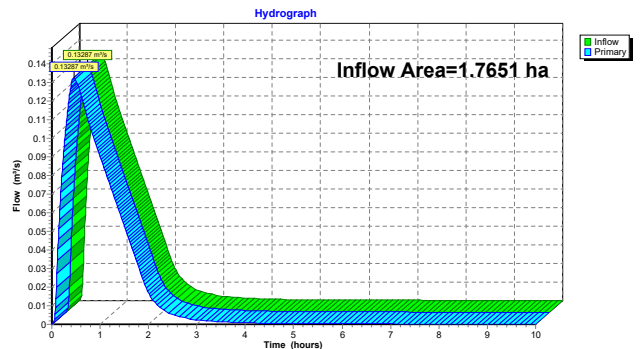


Summary for Link PH1: PH1

Inflow Area = 1.7651 ha, 93.99% Impervious, Inflow Depth > 32 mm for 25-Year event
 Inflow = 0.13287 m³/s @ 0.46 hrs, Volume= 0.570 MI
 Primary = 0.13287 m³/s @ 0.46 hrs, Volume= 0.570 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1



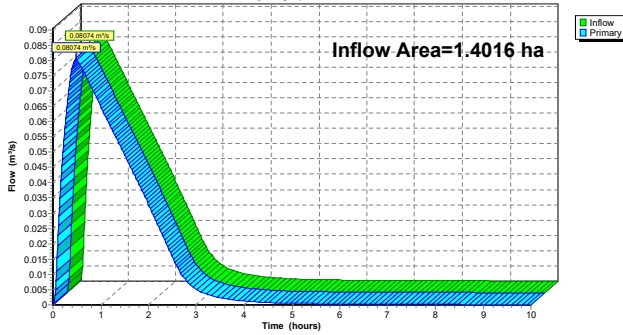
Summary for Link PH2: PH2

Inflow Area = 1.4016 ha, 100.00% Impervious, Inflow Depth > 34 mm for 25-Year event
 Inflow = 0.08074 m³/s @ 0.48 hrs, Volume= 0.473 MI
 Primary = 0.08074 m³/s @ 0.48 hrs, Volume= 0.473 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2: PH2

Hydrograph



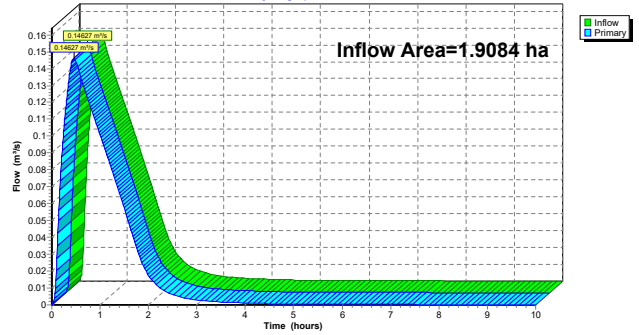
Summary for Link PH3: PH3

Inflow Area = 1.9084 ha, 96.41% Impervious, Inflow Depth > 33 mm for 25-Year event
 Inflow = 0.14627 m³/s @ 0.46 hrs, Volume= 0.627 MI
 Primary = 0.14627 m³/s @ 0.46 hrs, Volume= 0.627 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3

Hydrograph



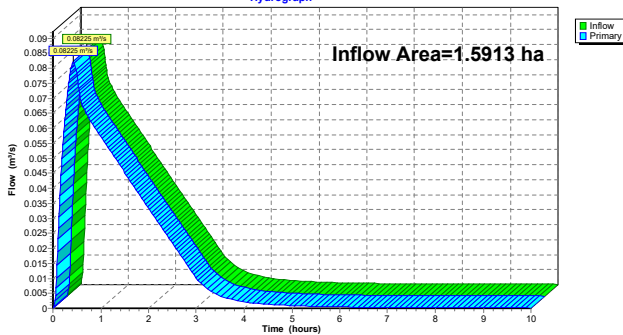
Summary for Link PH4: PH4

Inflow Area = 1.5913 ha, 85.34% Impervious, Inflow Depth > 30 mm for 25-Year event
 Inflow = 0.08225 m³/s @ 0.43 hrs, Volume= 0.480 MI
 Primary = 0.08225 m³/s @ 0.43 hrs, Volume= 0.480 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

Hydrograph



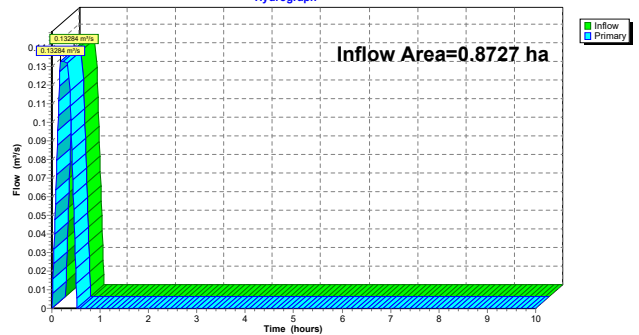
Summary for Link PH4_Un: PH4 Uncontrolled

Inflow Area = 0.8727 ha, 0.00% Impervious, Inflow Depth = 19 mm for 25-Year event
 Inflow = 0.13284 m³/s @ 0.17 hrs, Volume= 0.167 MI
 Primary = 0.13284 m³/s @ 0.17 hrs, Volume= 0.167 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

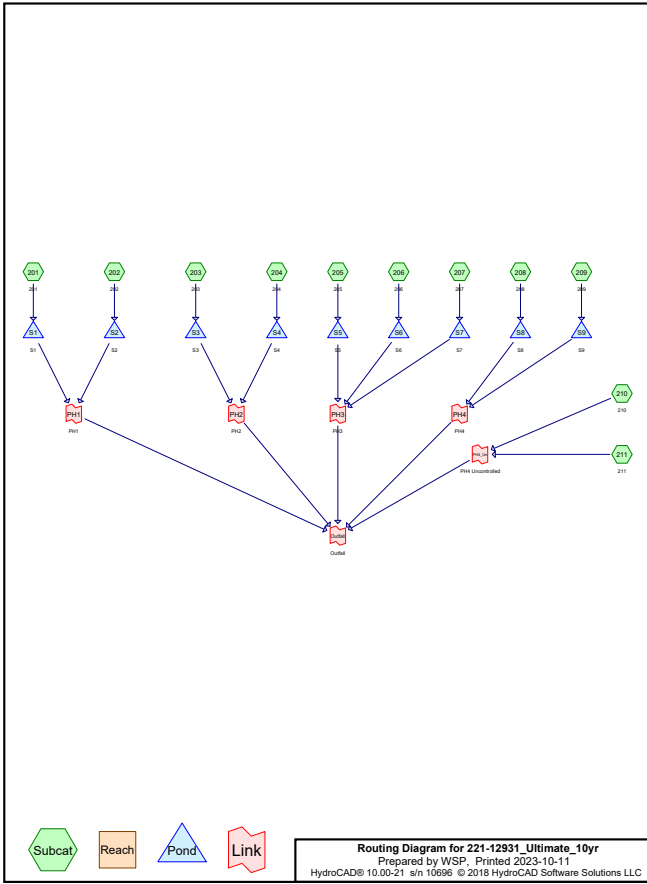
Link PH4_Un: PH4 Uncontrolled

Hydrograph



Area Listing (selected nodes)

Area (hectares)	C	Description (subcatchment-numbers)
6.2585	0.95	(201, 203, 204, 205, 206, 208)
0.4079	0.25	(202, 207, 209)
0.3801	0.50	(210)
0.4926	0.52	(211)
7.5391	0.86	TOTAL AREA



Soil Listing (selected nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.5391	Other	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
7.5391		TOTAL AREA

Ground Covers (selected 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	7.5391	7.5391		201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
0.0000	0.0000	0.0000	0.0000	7.5391	7.5391	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

Subcatchment201: 201	Runoff Area=1.6590 ha 100.00% Impervious Runoff Depth=28 mm Tc=10.0 min C=0.95 Runoff=0.32462 m³/s 0.467 MI
Subcatchment202: 202	Runoff Area=0.1061 ha 0.00% Impervious Runoff Depth=7 mm Tc=10.0 min C=0.25 Runoff=0.00546 m³/s 0.008 MI
Subcatchment203: 203	Runoff Area=1.2444 ha 100.00% Impervious Runoff Depth=28 mm Tc=10.0 min C=0.95 Runoff=0.24349 m³/s 0.351 MI
Subcatchment204: 204	Runoff Area=0.1572 ha 100.00% Impervious Runoff Depth=28 mm Tc=10.0 min C=0.95 Runoff=0.03076 m³/s 0.044 MI
Subcatchment205: 205	Runoff Area=1.4302 ha 100.00% Impervious Runoff Depth=28 mm Tc=10.0 min C=0.95 Runoff=0.27985 m³/s 0.403 MI
Subcatchment206: 206	Runoff Area=0.4097 ha 100.00% Impervious Runoff Depth=28 mm Tc=10.0 min C=0.95 Runoff=0.08017 m³/s 0.115 MI
Subcatchment207: 207	Runoff Area=0.0685 ha 0.00% Impervious Runoff Depth=7 mm Tc=10.0 min C=0.25 Runoff=0.00353 m³/s 0.005 MI
Subcatchment208: 208	Runoff Area=1.3580 ha 100.00% Impervious Runoff Depth=28 mm Tc=10.0 min C=0.95 Runoff=0.26572 m³/s 0.383 MI
Subcatchment209: 209	Runoff Area=0.2333 ha 0.00% Impervious Runoff Depth=7 mm Tc=10.0 min C=0.25 Runoff=0.01201 m³/s 0.017 MI
Subcatchment210: 210	Runoff Area=0.3801 ha 0.00% Impervious Runoff Depth=15 mm Tc=10.0 min C=0.50 Runoff=0.03914 m³/s 0.056 MI
Subcatchment211: 211	Runoff Area=0.4926 ha 0.00% Impervious Runoff Depth=15 mm Tc=10.0 min C=0.52 Runoff=0.05276 m³/s 0.076 MI
Pond S1: S1	Peak Elev=1.118 m Storage=335.5 m³ Inflow=0.32462 m³/s 0.467 MI Outflow=0.11234 m³/s 0.467 MI
Pond S2: S2	Peak Elev=0.182 m Storage=2.4 m³ Inflow=0.00546 m³/s 0.008 MI Outflow=0.00446 m³/s 0.008 MI
Pond S3: S3	Peak Elev=1.099 m Storage=274.9 m³ Inflow=0.24349 m³/s 0.351 MI Outflow=0.06338 m³/s 0.350 MI
Pond S4: S4	Peak Elev=0.563 m Storage=33.1 m³ Inflow=0.03076 m³/s 0.044 MI Outflow=0.00851 m³/s 0.044 MI
Pond S5: S5	Peak Elev=0.837 m Storage=293.0 m³ Inflow=0.27985 m³/s 0.403 MI Outflow=0.09558 m³/s 0.402 MI

Pond S6: S6	Peak Elev=0.485 m Storage=78.1 m³ Inflow=0.08017 m³/s 0.115 MI Outflow=0.03005 m³/s 0.115 MI
Pond S7: S7	Peak Elev=0.120 m Storage=0.9 m³ Inflow=0.00353 m³/s 0.005 MI Outflow=0.00338 m³/s 0.005 MI
Pond S8: S8	Peak Elev=1.032 m Storage=309.6 m³ Inflow=0.26572 m³/s 0.383 MI Outflow=0.06126 m³/s 0.381 MI
Pond S9: S9	Peak Elev=0.137 m Storage=3.2 m³ Inflow=0.01201 m³/s 0.017 MI Outflow=0.01178 m³/s 0.017 MI
Link Outfall: Outfall	Inflow=0.45481 m³/s 1.922 MI Primary=0.45481 m³/s 1.922 MI
Link PH1: PH1	Inflow=0.11652 m³/s 0.475 MI Primary=0.11652 m³/s 0.475 MI
Link PH2: PH2	Inflow=0.07189 m³/s 0.394 MI Primary=0.07189 m³/s 0.394 MI
Link PH3: PH3	Inflow=0.12834 m³/s 0.522 MI Primary=0.12834 m³/s 0.522 MI
Link PH4: PH4	Inflow=0.07045 m³/s 0.398 MI Primary=0.07045 m³/s 0.398 MI
Link PH4_Un: PH4 Uncontrolled	Inflow=0.09190 m³/s 0.132 MI Primary=0.09190 m³/s 0.132 MI

Total Runoff Area = 7.5391 ha Runoff Volume = 1.926 MI Average Runoff Depth = 26 mm
16.99% Pervious = 1.2806 ha 83.01% Impervious = 6.2585 ha

Summary for Subcatchment 201: 201

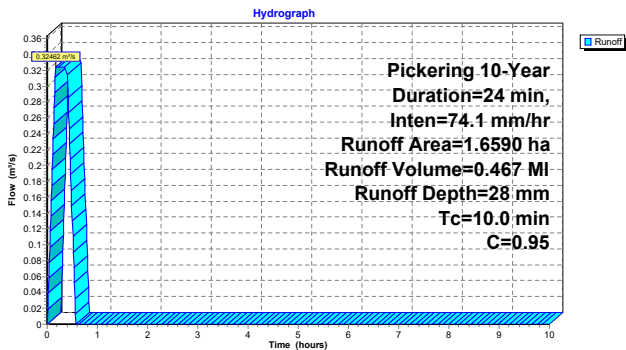
Runoff = 0.32462 m³/s @ 0.17 hrs, Volume= 0.467 MI, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span=0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
1.6590	0.95	
1.6590		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



Summary for Subcatchment 202: 202

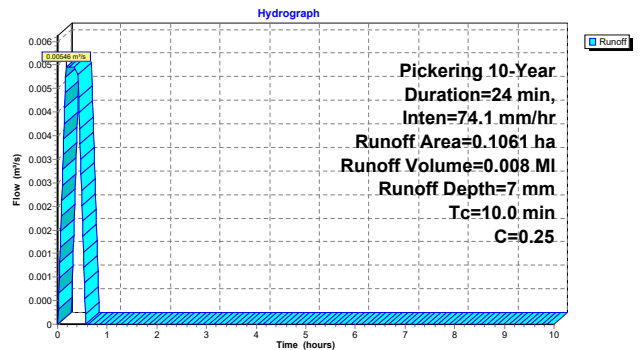
Runoff = 0.00546 m³/s @ 0.17 hrs, Volume= 0.008 MI, Depth= 7 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span=0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.1061	0.25	
0.1061		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

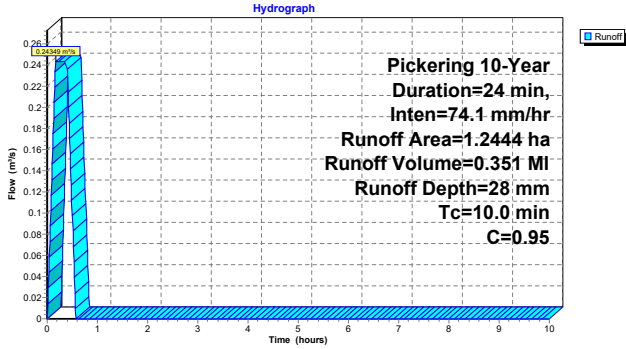
Runoff = 0.24349 m³/s @ 0.17 hrs, Volume= 0.351 MI, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
1.2444	0.95	
1.2444	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 203: 203



Summary for Subcatchment 204: 204

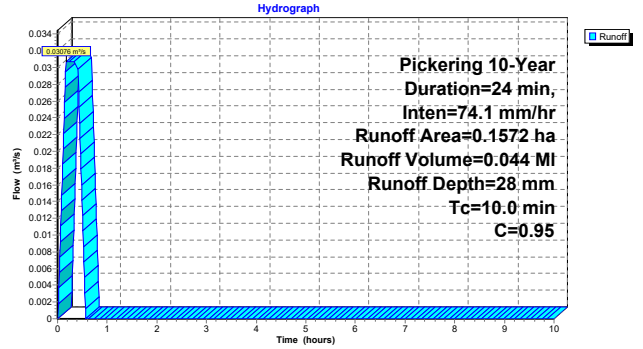
Runoff = 0.03076 m³/s @ 0.17 hrs, Volume= 0.044 MI, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.1572	0.95	
0.1572	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 204: 204



Summary for Subcatchment 205: 205

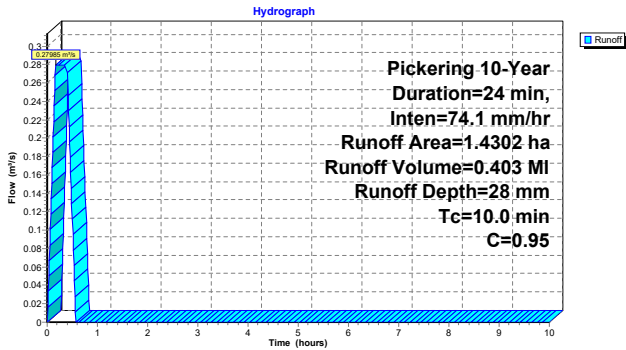
Runoff = 0.27985 m³/s @ 0.17 hrs, Volume= 0.403 MI, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
1.4302	0.95	
1.4302	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 205: 205



Summary for Subcatchment 206: 206

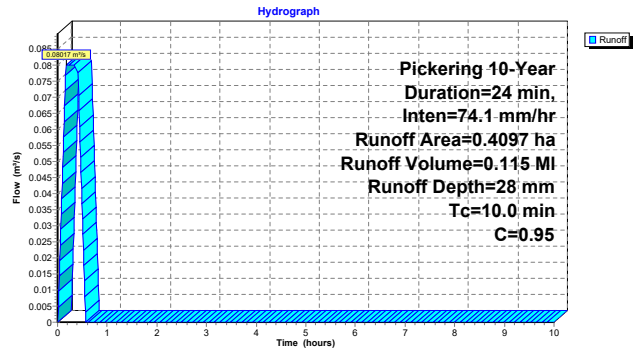
Runoff = 0.08017 m³/s @ 0.17 hrs, Volume= 0.115 MI, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.4097	0.95	
0.4097	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 206: 206



Summary for Subcatchment 207: 207

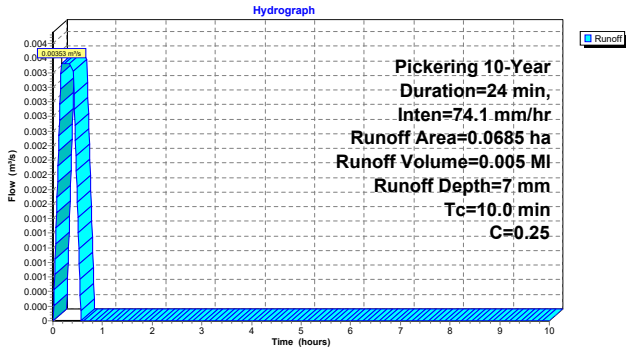
Runoff = 0.00353 m³/s @ 0.17 hrs, Volume= 0.005 MI, Depth= 7 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.0685	0.25	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 207: 207



Summary for Subcatchment 208: 208

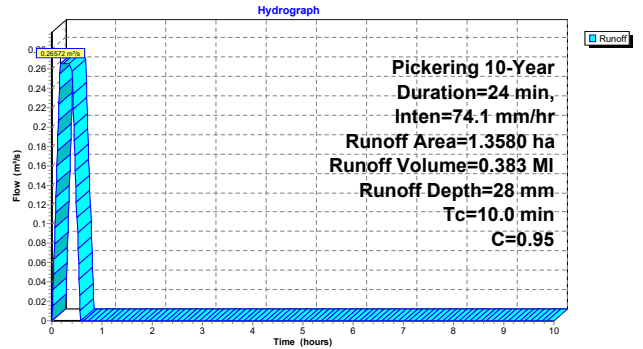
Runoff = 0.26572 m³/s @ 0.17 hrs, Volume= 0.383 MI, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
1.3580	0.95	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 208: 208



Summary for Subcatchment 209: 209

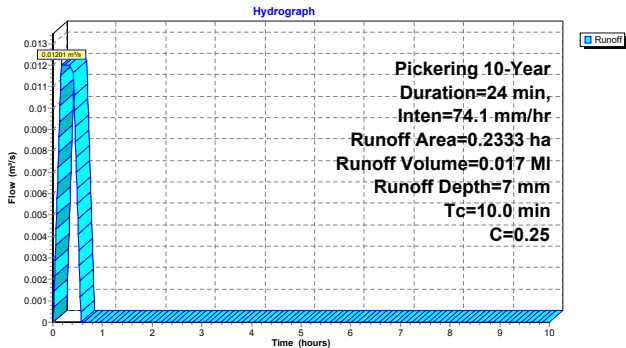
Runoff = 0.01201 m³/s @ 0.17 hrs, Volume= 0.017 MI, Depth= 7 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.2333	0.25	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 209: 209



Summary for Subcatchment 210: 210

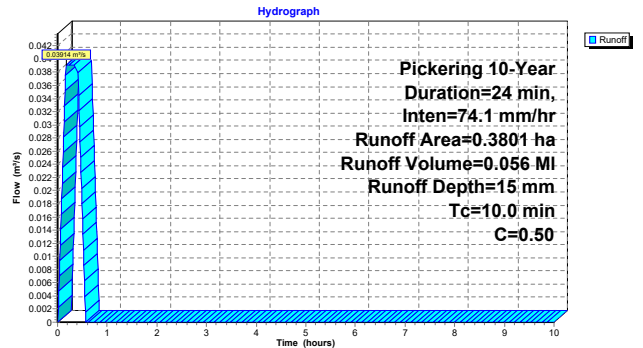
Runoff = 0.03914 m³/s @ 0.17 hrs, Volume= 0.056 MI, Depth= 15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.3801	0.50	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 210: 210



Summary for Subcatchment 211: 211

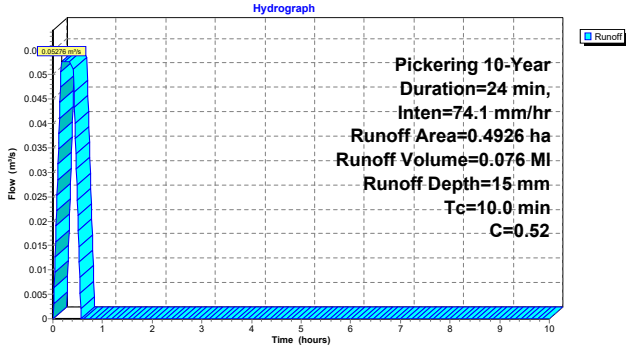
Runoff = 0.05276 m³/s @ 0.17 hrs, Volume= 0.076 MI, Depth= 15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 10-Year Duration=24 min, Inten=74.1 mm/hr

Area (ha)	C	Description
0.4926	0.52	
0.4926		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



Summary for Pond S1: S1

Inflow Area = 1.6590 ha, 100.00% Impervious, Inflow Depth = 28 mm for 10-Year event
 Inflow = 0.32462 m³/s @ 0.17 hrs, Volume= 0.467 MI
 Outflow = 0.11234 m³/s @ 0.51 hrs, Volume= 0.467 MI, Atten= 65%, Lag= 20.3 min
 Primary = 0.11234 m³/s @ 0.51 hrs, Volume= 0.467 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.118 m @ 0.51 hrs Surf.Area= 300.0 m² Storage= 335.5 m³

Plug-Flow detention time= 42.0 min calculated for 0.467 MI (100% of inflow)
 Center-of-Mass det. time= 42.0 min (59.0 - 17.0)

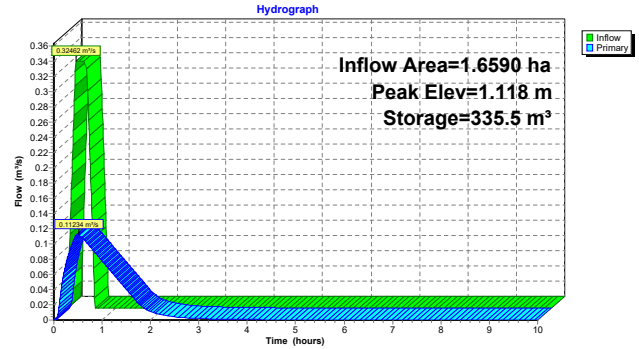
Volume #1	Invert	Avail.Storage	Storage Description
	0.000 m	600.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device #1	Routing	Invert	Outlet Devices	C
	Primary	0.000 m	200 mm Vert. Orifice/Grate	0.800

Primary OutFlow Max=0.11234 m³/s @ 0.51 hrs HW=1.118 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.11234 m³/s @ 3.58 m/s)

Pond S1: S1



Summary for Pond S2: S2

Inflow Area = 0.1061 ha, 0.00% Impervious, Inflow Depth = 7 mm for 10-Year event
 Inflow = 0.00546 m³/s @ 0.17 hrs, Volume= 0.008 MI
 Outflow = 0.00446 m³/s @ 0.43 hrs, Volume= 0.008 MI, Atten= 18%, Lag= 15.6 min
 Primary = 0.00446 m³/s @ 0.43 hrs, Volume= 0.008 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.182 m @ 0.43 hrs Surf.Area= 17.7 m² Storage= 2.4 m³

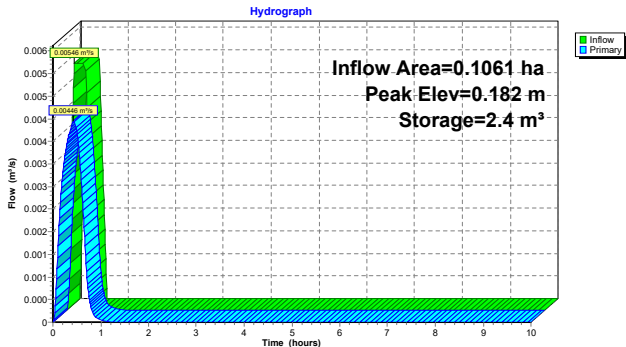
Plug-Flow detention time= 7.3 min calculated for 0.008 MI (100% of inflow)
 Center-of-Mass det. time= 7.4 min (24.4 - 17.0)

Volume #1	Invert	Avail.Storage	Storage Description
	0.000 m	6.4 m³	450 mm Round Pipe Storage L= 40.00 m

Device #1	Routing	Invert	Outlet Devices	C
	Primary	0.000 m	75 mm Vert. Orifice/Grate	0.600

Primary OutFlow Max=0.00446 m³/s @ 0.43 hrs HW=0.182 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00446 m³/s @ 1.01 m/s)

Pond S2: S2



Summary for Pond S3: S3

Inflow Area = 1.2444 ha, 100.00% Impervious, Inflow Depth = 28 mm for 10-Year event
 Inflow = 0.24349 m³/s @ 0.17 hrs, Volume= 0.351 MI
 Outflow = 0.06338 m³/s @ 0.52 hrs, Volume= 0.350 MI, Atten= 74%, Lag= 21.2 min
 Primary = 0.06338 m³/s @ 0.52 hrs, Volume= 0.350 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.099 m @ 0.52 hrs Surf.Area= 250.0 m² Storage= 274.9 m³

Plug-Flow detention time= 57.0 min calculated for 0.350 MI (100% of inflow)
 Center-of-Mass det. time= 57.0 min (74.0 - 17.0)

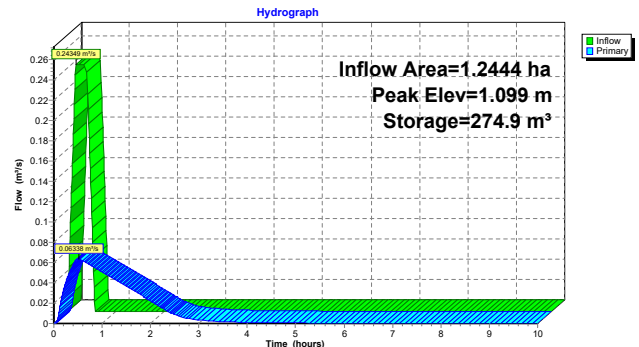
Volume #1	Invert	Avail.Storage	Storage Description
	0.000 m	500.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	250.0	0.0	0.0
2.000	250.0	500.0	500.0

Device #1	Routing	Invert	Outlet Devices	C
	Primary	0.000 m	150 mm Vert. Orifice/Grate	0.800

Primary OutFlow Max=0.06337 m³/s @ 0.52 hrs HW=1.099 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.06337 m³/s @ 3.59 m/s)

Pond S3: S3



Summary for Pond S4: S4

Inflow Area = 0.1572 ha, 100.00% Impervious, Inflow Depth = 28 mm for 10-Year event
 Inflow = 0.03076 m³/s @ 0.17 hrs, Volume= 0.044 MI
 Outflow = 0.00851 m³/s @ 0.52 hrs, Volume= 0.044 MI, Atten= 72%, Lag= 21.0 min
 Primary = 0.00851 m³/s @ 0.52 hrs, Volume= 0.044 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.563 m @ 0.52 hrs Surf.Area= 73.3 m² Storage= 33.1 m³

Plug-Flow detention time= 43.4 min calculated for 0.044 MI (100% of inflow)
 Center-of-Mass det. time= 43.5 min (60.5 - 17.0)

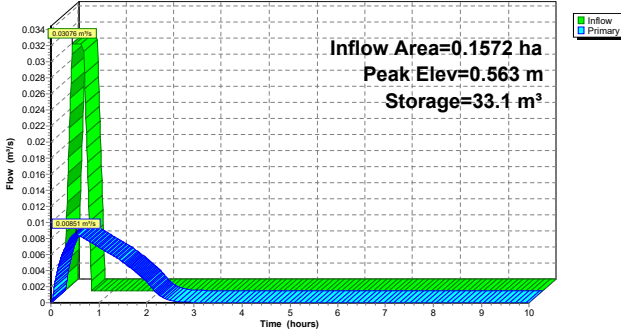
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	60.6 m³	1,050 mm Round Pipe Storage L= 70.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00851 m³/s @ 0.52 hrs HW=0.563 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00851 m³/s @ 1.93 m/s)

Pond S4: S4

Hydrograph



Summary for Pond S5: S5

Inflow Area = 1.4302 ha, 100.00% Impervious, Inflow Depth = 28 mm for 10-Year event
 Inflow = 0.27985 m³/s @ 0.17 hrs, Volume= 0.403 MI
 Outflow = 0.09558 m³/s @ 0.51 hrs, Volume= 0.402 MI, Atten= 66%, Lag= 20.4 min
 Primary = 0.09558 m³/s @ 0.51 hrs, Volume= 0.402 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.837 m @ 0.51 hrs Surf.Area= 350.0 m² Storage= 293.0 m³

Plug-Flow detention time= 45.0 min calculated for 0.401 MI (100% of inflow)
 Center-of-Mass det. time= 45.5 min (62.5 - 17.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	700.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

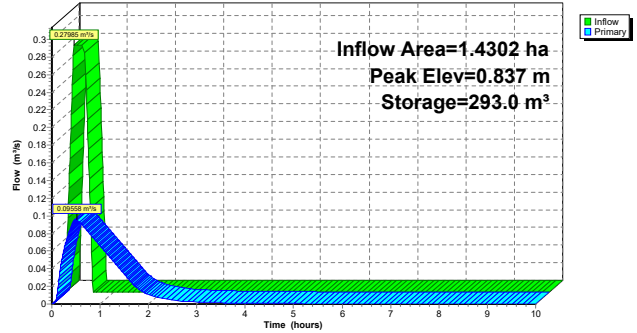
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	350.0	0.0	0.0
2.000	350.0	700.0	700.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.09558 m³/s @ 0.51 hrs HW=0.837 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.09558 m³/s @ 3.04 m/s)

Pond S5: S5

Hydrograph



Summary for Pond S6: S6

Inflow Area = 0.4097 ha, 100.00% Impervious, Inflow Depth = 28 mm for 10-Year event
 Inflow = 0.08017 m³/s @ 0.17 hrs, Volume= 0.115 MI
 Outflow = 0.03005 m³/s @ 0.50 hrs, Volume= 0.115 MI, Atten= 63%, Lag= 20.1 min
 Primary = 0.03005 m³/s @ 0.50 hrs, Volume= 0.115 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.485 m @ 0.50 hrs Surf.Area= 209.4 m² Storage= 78.1 m³

Plug-Flow detention time= 32.0 min calculated for 0.115 MI (100% of inflow)
 Center-of-Mass det. time= 31.9 min (48.9 - 17.0)

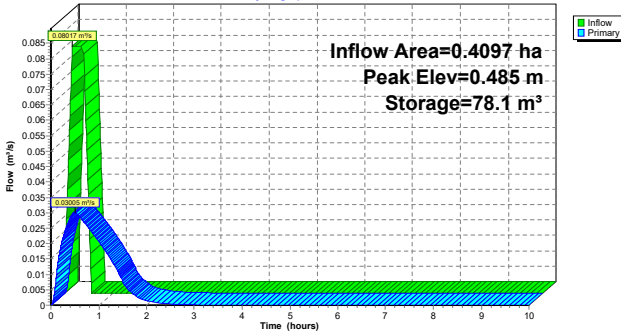
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	173.2 m³	1,050 mm Round Pipe Storage L= 200.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.03005 m³/s @ 0.50 hrs HW=0.484 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.03005 m³/s @ 1.70 m/s)

Pond S6: S6

Hydrograph



Summary for Pond S7: S7

Inflow Area = 0.0685 ha, 0.00% Impervious, Inflow Depth = 7 mm for 10-Year event
 Inflow = 0.00353 m³/s @ 0.17 hrs, Volume= 0.005 MI
 Outflow = 0.00338 m³/s @ 0.41 hrs, Volume= 0.005 MI, Atten= 4%, Lag= 14.2 min
 Primary = 0.00338 m³/s @ 0.41 hrs, Volume= 0.005 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.120 m @ 0.41 hrs Surf.Area= 10.0 m² Storage= 0.9 m³

Plug-Flow detention time= 3.8 min calculated for 0.005 MI (100% of inflow)
 Center-of-Mass det. time= 3.8 min (20.8 - 17.0)

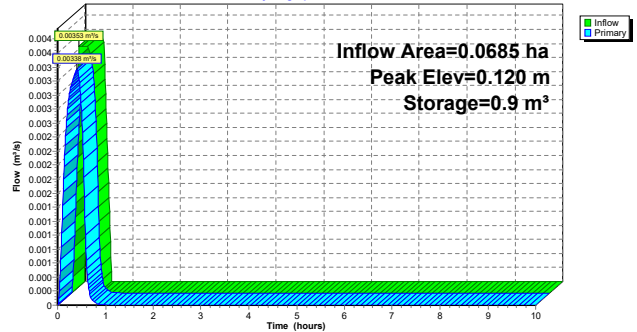
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	4.0 m³	450 mm Round Pipe Storage L= 25.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00337 m³/s @ 0.41 hrs HW=0.120 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00337 m³/s @ 0.76 m/s)

Pond S7: S7

Hydrograph



Summary for Pond S8: S8

Inflow Area = 1.3580 ha, 100.00% Impervious, Inflow Depth = 28 mm for 10-Year event
 Inflow = 0.26572 m³/s @ 0.17 hrs, Volume= 0.383 MI
 Outflow = 0.06126 m³/s @ 0.53 hrs, Volume= 0.381 MI, Atten= 77%, Lag= 21.5 min
 Primary = 0.06126 m³/s @ 0.53 hrs, Volume= 0.381 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 1.032 m @ 0.53 hrs Surf.Area= 300.0 m² Storage= 309.6 m³

Plug-Flow detention time= 65.5 min calculated for 0.381 MI (99% of inflow)
 Center-of-Mass det. time= 65.9 min (82.9 - 17.0)

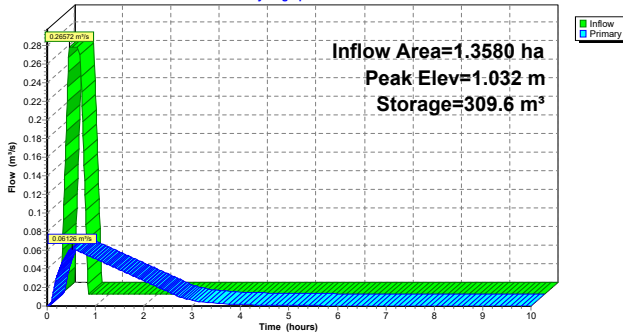
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.06125 m³/s @ 0.53 hrs HW=1.032 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.06125 m³/s @ 3.47 m/s)

Pond S8: S8

Hydrograph



Summary for Pond S9: S9

Inflow Area = 0.2333 ha, 0.00% Impervious, Inflow Depth = 7 mm for 10-Year event
 Inflow = 0.01201 m³/s @ 0.17 hrs, Volume= 0.017 MI
 Outflow = 0.01178 m³/s @ 0.40 hrs, Volume= 0.017 MI, Atten= 2%, Lag= 13.9 min
 Primary = 0.01178 m³/s @ 0.40 hrs, Volume= 0.017 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.137 m @ 0.40 hrs Surf.Area= 32.7 m² Storage= 3.2 m³

Plug-Flow detention time= 4.6 min calculated for 0.017 MI (100% of inflow)
 Center-of-Mass det. time= 4.7 min (21.7 - 17.0)

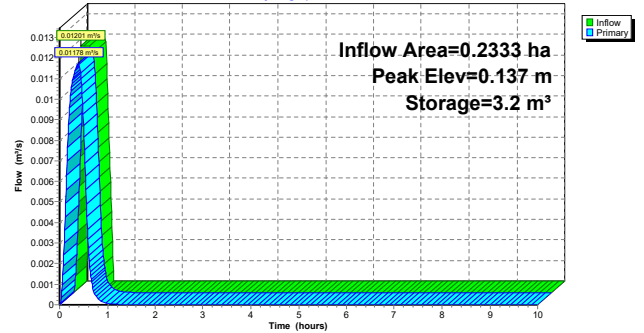
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	18.4 m³	600 mm Round Pipe Storage L= 65.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.01178 m³/s @ 0.40 hrs HW=0.137 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.01178 m³/s @ 0.70 m/s)

Pond S9: S9

Hydrograph



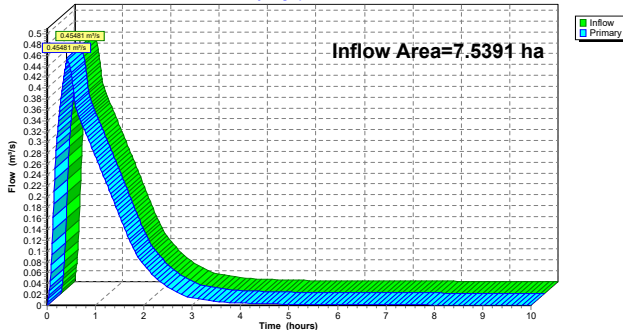
Summary for Link Outfall: Outfall

Inflow Area = 7.5391 ha, 83.01% Impervious, Inflow Depth > 25 mm for 10-Year event
 Inflow = 0.45481 m³/s @ 0.40 hrs, Volume= 1.922 MI
 Primary = 0.45481 m³/s @ 0.40 hrs, Volume= 1.922 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall

Hydrograph



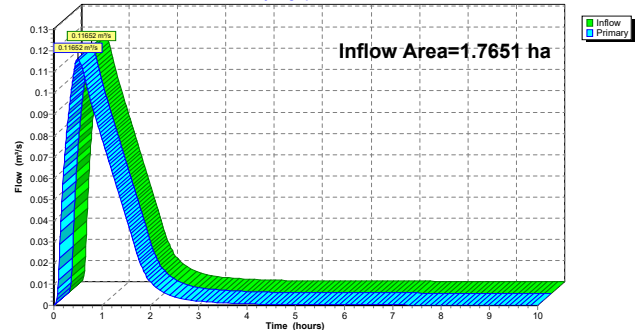
Summary for Link PH1: PH1

Inflow Area = 1.7651 ha, 93.99% Impervious, Inflow Depth > 27 mm for 10-Year event
 Inflow = 0.11652 m³/s @ 0.50 hrs, Volume= 0.475 MI
 Primary = 0.11652 m³/s @ 0.50 hrs, Volume= 0.475 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1

Hydrograph

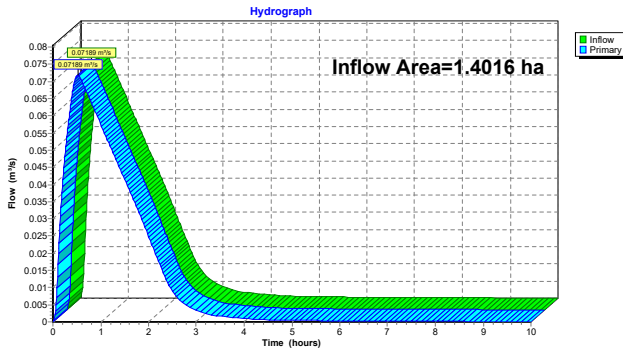


Summary for Link PH2: PH2

Inflow Area = 1.4016 ha, 100.00% Impervious, Inflow Depth > 28 mm for 10-Year event
 Inflow = 0.07189 m³/s @ 0.52 hrs, Volume= 0.394 MI
 Primary = 0.07189 m³/s @ 0.52 hrs, Volume= 0.394 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2: PH2

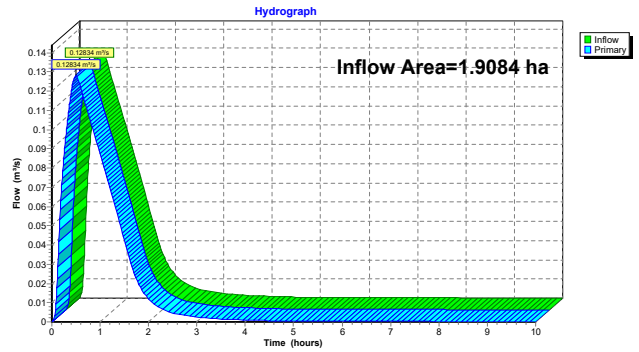


Summary for Link PH3: PH3

Inflow Area = 1.9084 ha, 96.41% Impervious, Inflow Depth > 27 mm for 10-Year event
 Inflow = 0.12834 m³/s @ 0.50 hrs, Volume= 0.522 MI
 Primary = 0.12834 m³/s @ 0.50 hrs, Volume= 0.522 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3

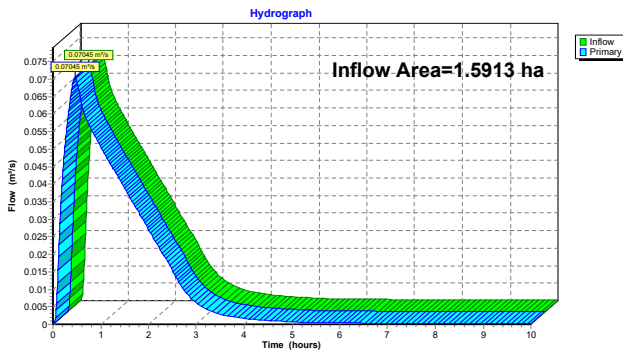


Summary for Link PH4: PH4

Inflow Area = 1.5913 ha, 85.34% Impervious, Inflow Depth > 25 mm for 10-Year event
 Inflow = 0.07045 m³/s @ 0.46 hrs, Volume= 0.398 MI
 Primary = 0.07045 m³/s @ 0.46 hrs, Volume= 0.398 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

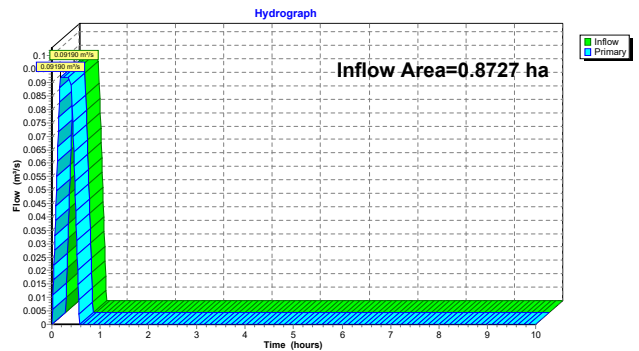


Summary for Link PH4_Un: PH4 Uncontrolled

Inflow Area = 0.8727 ha, 0.00% Impervious, Inflow Depth = 15 mm for 10-Year event
 Inflow = 0.09190 m³/s @ 0.17 hrs, Volume= 0.132 MI
 Primary = 0.09190 m³/s @ 0.17 hrs, Volume= 0.132 MI, Atten= 0%, Lag= 0.0 min

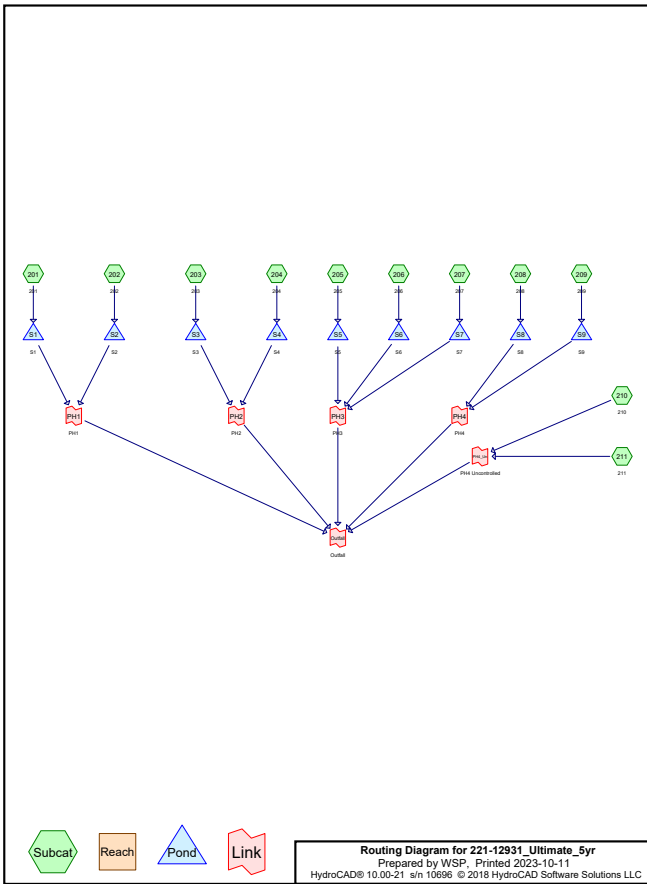
Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4_Un: PH4 Uncontrolled



Area Listing (selected nodes)

Area (hectares)	C	Description (subcatchment-numbers)
6.2585	0.95	(201, 203, 204, 205, 206, 208)
0.4079	0.25	(202, 207, 209)
0.3801	0.50	(210)
0.4926	0.52	(211)
7.5391	0.86	TOTAL AREA



Soil Listing (selected nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.5391	Other	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
7.5391		TOTAL AREA

Ground Covers (selected 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	7.5391	7.5391		201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
0.0000	0.0000	0.0000	0.0000	7.5391	7.5391	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

Subcatchment201: 201	Runoff Area=1.6590 ha 100.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.95 Runoff=0.27506 m³/s 0.396 MI
Subcatchment202: 202	Runoff Area=0.1061 ha 0.00% Impervious Runoff Depth=6 mm Tc=10.0 min C=0.25 Runoff=0.00463 m³/s 0.007 MI
Subcatchment203: 203	Runoff Area=1.2444 ha 100.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.95 Runoff=0.20632 m³/s 0.297 MI
Subcatchment204: 204	Runoff Area=0.1572 ha 100.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.95 Runoff=0.02606 m³/s 0.038 MI
Subcatchment205: 205	Runoff Area=1.4302 ha 100.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.95 Runoff=0.23712 m³/s 0.341 MI
Subcatchment206: 206	Runoff Area=0.4097 ha 100.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.95 Runoff=0.06793 m³/s 0.098 MI
Subcatchment207: 207	Runoff Area=0.0685 ha 0.00% Impervious Runoff Depth=6 mm Tc=10.0 min C=0.25 Runoff=0.00299 m³/s 0.004 MI
Subcatchment208: 208	Runoff Area=1.3580 ha 100.00% Impervious Runoff Depth=24 mm Tc=10.0 min C=0.95 Runoff=0.22515 m³/s 0.324 MI
Subcatchment209: 209	Runoff Area=0.2333 ha 0.00% Impervious Runoff Depth=6 mm Tc=10.0 min C=0.25 Runoff=0.01018 m³/s 0.015 MI
Subcatchment210: 210	Runoff Area=0.3801 ha 0.00% Impervious Runoff Depth=13 mm Tc=10.0 min C=0.50 Runoff=0.03317 m³/s 0.048 MI
Subcatchment211: 211	Runoff Area=0.4926 ha 0.00% Impervious Runoff Depth=13 mm Tc=10.0 min C=0.52 Runoff=0.04470 m³/s 0.064 MI
Pond S1: S1	Peak Elev=0.929 m Storage=278.6 m³ Inflow=0.27506 m³/s 0.396 MI Outflow=0.10133 m³/s 0.395 MI
Pond S2: S2	Peak Elev=0.150 m Storage=1.9 m³ Inflow=0.00463 m³/s 0.007 MI Outflow=0.00394 m³/s 0.007 MI
Pond S3: S3	Peak Elev=0.917 m Storage=229.2 m³ Inflow=0.20632 m³/s 0.297 MI Outflow=0.05745 m³/s 0.296 MI
Pond S4: S4	Peak Elev=0.484 m Storage=27.3 m³ Inflow=0.02606 m³/s 0.038 MI Outflow=0.00784 m³/s 0.038 MI
Pond S5: S5	Peak Elev=0.697 m Storage=244.0 m³ Inflow=0.23712 m³/s 0.341 MI Outflow=0.08603 m³/s 0.340 MI

Pond S6: S6	Peak Elev=0.417 m Storage=64.1 m³ Inflow=0.06793 m³/s 0.098 MI Outflow=0.02746 m³/s 0.098 MI
Pond S7: S7	Peak Elev=0.099 m Storage=0.6 m³ Inflow=0.00299 m³/s 0.004 MI Outflow=0.00291 m³/s 0.004 MI
Pond S8: S8	Peak Elev=0.862 m Storage=258.7 m³ Inflow=0.22515 m³/s 0.324 MI Outflow=0.05556 m³/s 0.323 MI
Pond S9: S9	Peak Elev=0.121 m Storage=2.7 m³ Inflow=0.01018 m³/s 0.015 MI Outflow=0.01004 m³/s 0.015 MI
Link Outfall: Outfall	Inflow=0.40598 m³/s 1.628 MI Primary=0.40598 m³/s 1.628 MI
Link PH1: PH1	Inflow=0.10498 m³/s 0.402 MI Primary=0.10498 m³/s 0.402 MI
Link PH2: PH2	Inflow=0.06529 m³/s 0.334 MI Primary=0.06529 m³/s 0.334 MI
Link PH3: PH3	Inflow=0.11574 m³/s 0.442 MI Primary=0.11574 m³/s 0.442 MI
Link PH4: PH4	Inflow=0.06325 m³/s 0.337 MI Primary=0.06325 m³/s 0.337 MI
Link PH4_Un: PH4 Uncontrolled	Inflow=0.07787 m³/s 0.112 MI Primary=0.07787 m³/s 0.112 MI

Total Runoff Area = 7.5391 ha Runoff Volume = 1.632 MI Average Runoff Depth = 22 mm
16.99% Pervious = 1.2806 ha 83.01% Impervious = 6.2585 ha

Summary for Subcatchment 201: 201

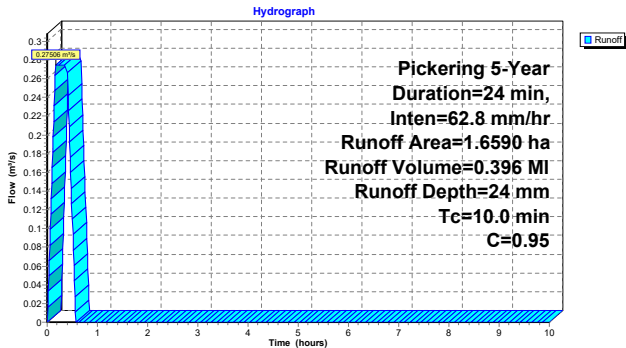
Runoff = 0.27506 m³/s @ 0.17 hrs, Volume= 0.396 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
1.6590	0.95	
1.6590		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



Summary for Subcatchment 202: 202

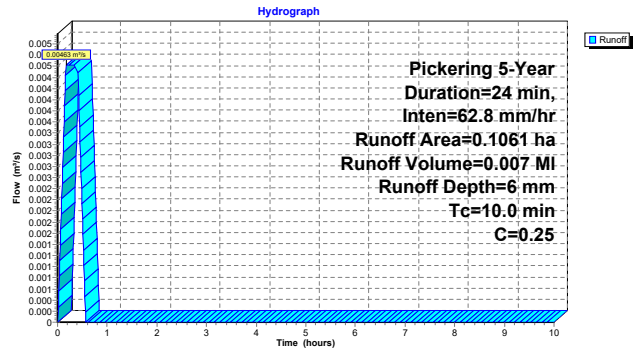
Runoff = 0.00463 m³/s @ 0.17 hrs, Volume= 0.007 MI, Depth= 6 mm

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=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.1061	0.25	
0.1061		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

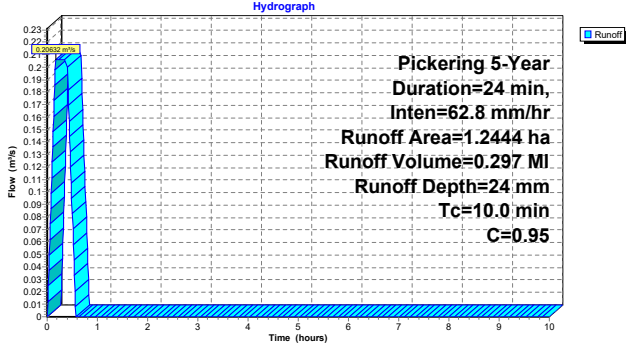
Runoff = 0.20632 m³/s @ 0.17 hrs, Volume= 0.297 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
1.2444	0.95	
1.2444	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 203: 203



Summary for Subcatchment 204: 204

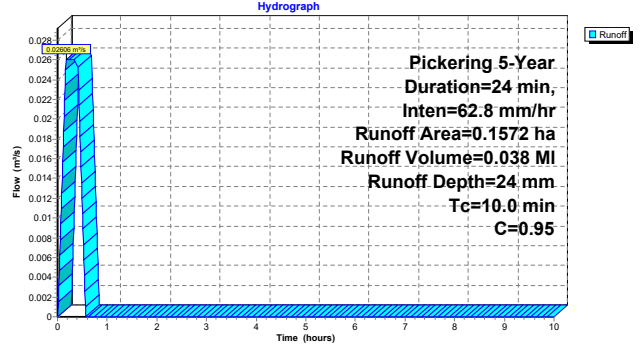
Runoff = 0.02606 m³/s @ 0.17 hrs, Volume= 0.038 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.1572	0.95	
0.1572	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 204: 204



Summary for Subcatchment 205: 205

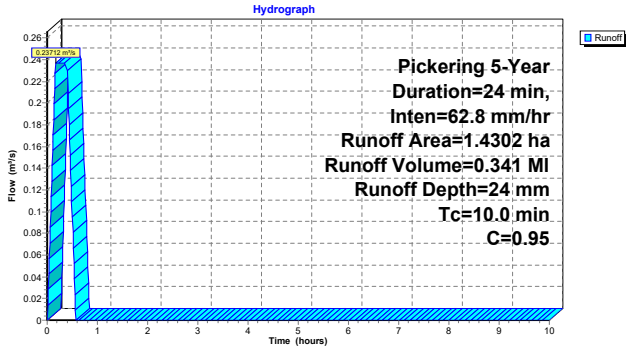
Runoff = 0.23712 m³/s @ 0.17 hrs, Volume= 0.341 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
1.4302	0.95	
1.4302	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 205: 205



Summary for Subcatchment 206: 206

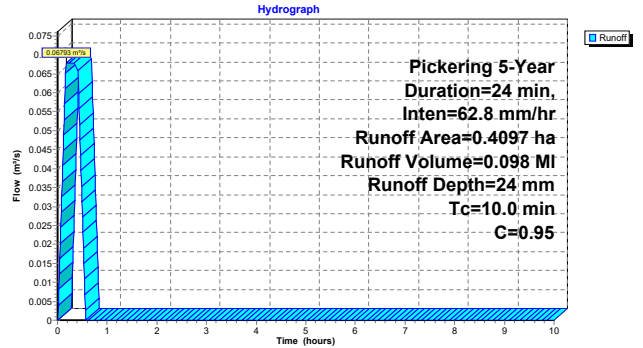
Runoff = 0.06793 m³/s @ 0.17 hrs, Volume= 0.098 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.4097	0.95	
0.4097	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 206: 206



Summary for Subcatchment 207: 207

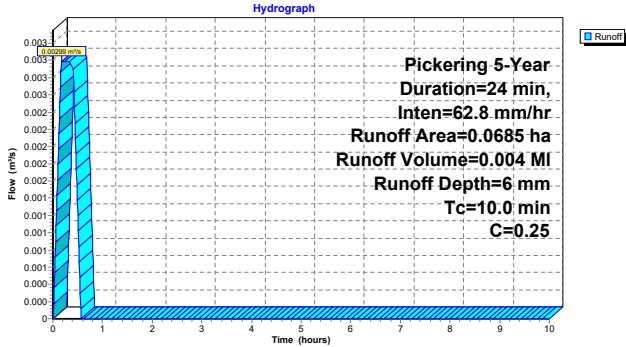
Runoff = 0.00299 m³/s @ 0.17 hrs, Volume= 0.004 MI, Depth= 6 mm

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=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.0685	0.25	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 207: 207



Summary for Subcatchment 208: 208

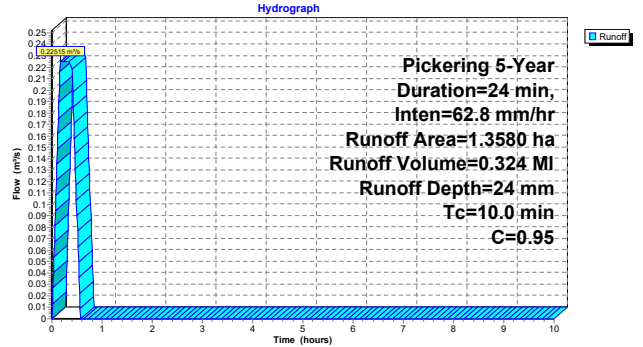
Runoff = 0.22515 m³/s @ 0.17 hrs, Volume= 0.324 MI, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
1.3580	0.95	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 208: 208



Summary for Subcatchment 209: 209

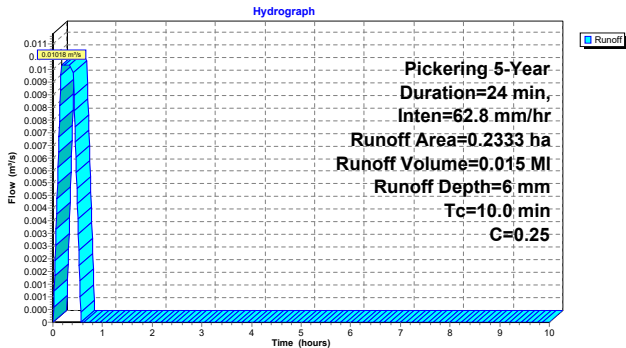
Runoff = 0.01018 m³/s @ 0.17 hrs, Volume= 0.015 MI, Depth= 6 mm

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=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.2333	0.25	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 209: 209



Summary for Subcatchment 210: 210

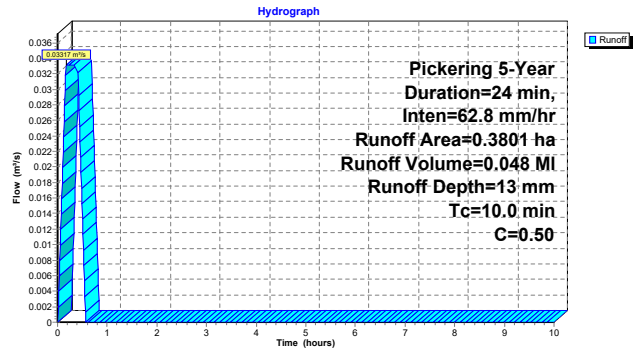
Runoff = 0.03317 m³/s @ 0.17 hrs, Volume= 0.048 MI, Depth= 13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.3801	0.50	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 210: 210



Summary for Subcatchment 211: 211

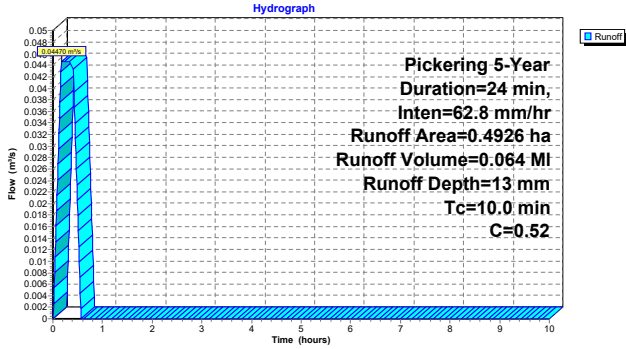
Runoff = 0.04470 m³/s @ 0.17 hrs, Volume= 0.064 MI, Depth= 13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 5-Year Duration=24 min, Inten=62.8 mm/hr

Area (ha)	C	Description
0.4926	0.52	
0.4926		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 211: 211



Summary for Pond S1: S1

Inflow Area = 1.6590 ha, 100.00% Impervious, Inflow Depth = 24 mm for 5-Year event
 Inflow = 0.27506 m³/s @ 0.17 hrs, Volume= 0.396 MI
 Outflow = 0.10133 m³/s @ 0.51 hrs, Volume= 0.395 MI, Atten= 63%, Lag= 20.1 min
 Primary = 0.10133 m³/s @ 0.51 hrs, Volume= 0.395 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.929 m @ 0.51 hrs Surf.Area= 300.0 m² Storage= 278.6 m³

Plug-Flow detention time= 40.4 min calculated for 0.395 MI (100% of inflow)
 Center-of-Mass det. time= 40.3 min (57.3 - 17.0)

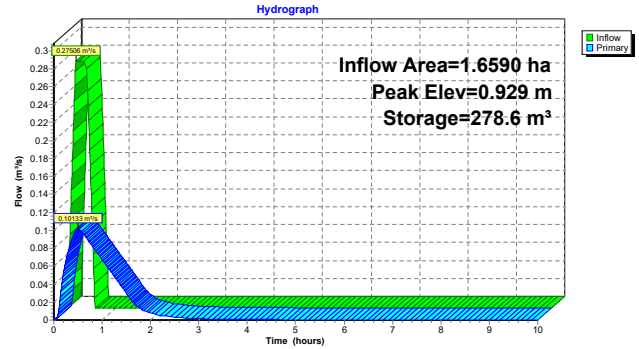
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m ³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices	C
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate	0.800

Primary OutFlow Max=0.10132 m³/s @ 0.51 hrs HW=0.928 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.10132 m³/s @ 3.23 m/s)

Pond S1: S1



Summary for Pond S2: S2

Inflow Area = 0.1061 ha, 0.00% Impervious, Inflow Depth = 6 mm for 5-Year event
 Inflow = 0.00463 m³/s @ 0.17 hrs, Volume= 0.007 MI
 Outflow = 0.00394 m³/s @ 0.42 hrs, Volume= 0.007 MI, Atten= 15%, Lag= 15.3 min
 Primary = 0.00394 m³/s @ 0.42 hrs, Volume= 0.007 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.150 m @ 0.42 hrs Surf.Area= 17.0 m² Storage= 1.9 m³

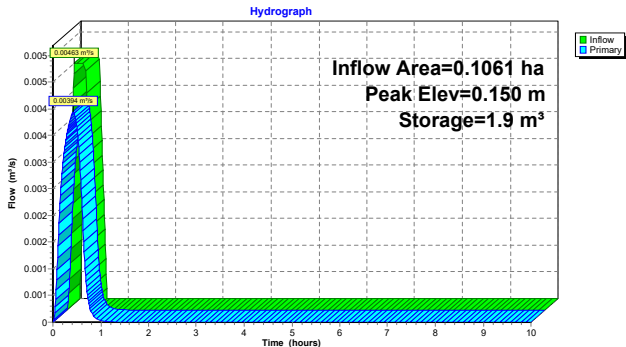
Plug-Flow detention time= 6.6 min calculated for 0.007 MI (100% of inflow)
 Center-of-Mass det. time= 6.7 min (23.7 - 17.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	6.4 m ³	450 mm Round Pipe Storage L= 40.00 m

Device	Routing	Invert	Outlet Devices	C
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate	0.600

Primary OutFlow Max=0.00394 m³/s @ 0.42 hrs HW=0.150 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00394 m³/s @ 0.89 m/s)

Pond S2: S2



Summary for Pond S3: S3

Inflow Area = 1.2444 ha, 100.00% Impervious, Inflow Depth = 24 mm for 5-Year event
 Inflow = 0.20632 m³/s @ 0.17 hrs, Volume= 0.297 MI
 Outflow = 0.05745 m³/s @ 0.52 hrs, Volume= 0.296 MI, Atten= 72%, Lag= 21.0 min
 Primary = 0.05745 m³/s @ 0.52 hrs, Volume= 0.296 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.917 m @ 0.52 hrs Surf.Area= 250.0 m² Storage= 229.2 m³

Plug-Flow detention time= 53.7 min calculated for 0.296 MI (100% of inflow)
 Center-of-Mass det. time= 54.1 min (71.1 - 17.0)

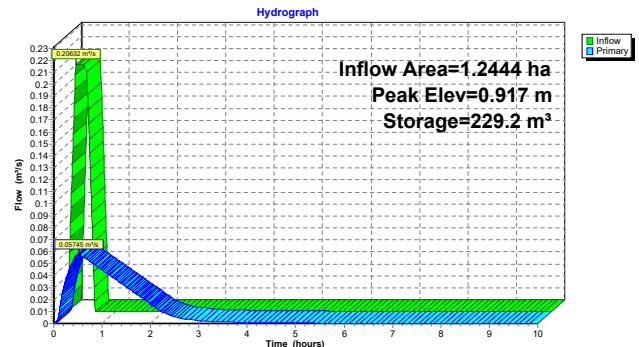
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	500.0 m ³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	250.0	0.0	0.0
2.000	250.0	500.0	500.0

Device	Routing	Invert	Outlet Devices	C
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate	0.800

Primary OutFlow Max=0.05745 m³/s @ 0.52 hrs HW=0.917 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.05745 m³/s @ 3.25 m/s)

Pond S3: S3



Summary for Pond S4: S4

Inflow Area = 0.1572 ha, 100.00% Impervious, Inflow Depth = 24 mm for 5-Year event
 Inflow = 0.02606 m³/s @ 0.17 hrs, Volume= 0.038 MI
 Outflow = 0.00784 m³/s @ 0.52 hrs, Volume= 0.038 MI, Atten= 70%, Lag= 20.8 min
 Primary = 0.00784 m³/s @ 0.52 hrs, Volume= 0.038 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.484 m @ 0.52 hrs Surf.Area= 73.3 m² Storage= 27.3 m³

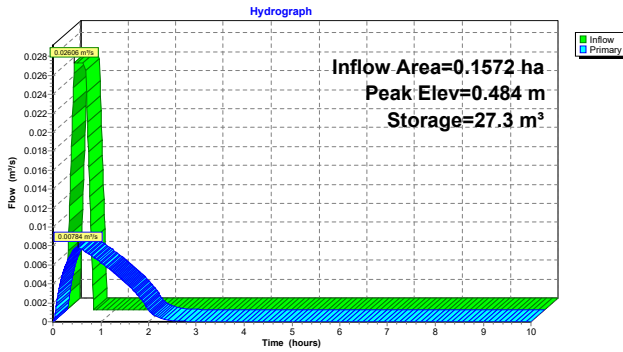
Plug-Flow detention time= 39.1 min calculated for 0.037 MI (100% of inflow)
 Center-of-Mass det. time= 39.2 min (56.2 - 17.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	60.6 m³	1,050 mm Round Pipe Storage L= 70.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00784 m³/s @ 0.52 hrs HW=0.484 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00784 m³/s @ 1.78 m/s)

Pond S4: S4



Summary for Pond S5: S5

Inflow Area = 1.4302 ha, 100.00% Impervious, Inflow Depth = 24 mm for 5-Year event
 Inflow = 0.23712 m³/s @ 0.17 hrs, Volume= 0.341 MI
 Outflow = 0.08603 m³/s @ 0.51 hrs, Volume= 0.340 MI, Atten= 64%, Lag= 20.2 min
 Primary = 0.08603 m³/s @ 0.51 hrs, Volume= 0.340 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.697 m @ 0.51 hrs Surf.Area= 350.0 m² Storage= 244.0 m³

Plug-Flow detention time= 44.4 min calculated for 0.340 MI (100% of inflow)
 Center-of-Mass det. time= 44.3 min (61.3 - 17.0)

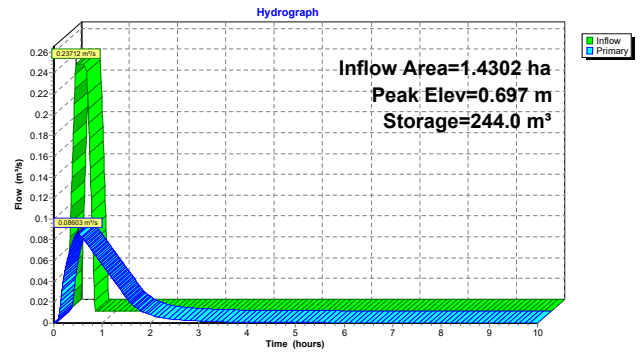
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	700.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	350.0	0.0	0.0
2.000	350.0	700.0	700.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.08603 m³/s @ 0.51 hrs HW=0.697 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.08603 m³/s @ 2.74 m/s)

Pond S5: S5



Summary for Pond S6: S6

Inflow Area = 0.4097 ha, 100.00% Impervious, Inflow Depth = 24 mm for 5-Year event
 Inflow = 0.06793 m³/s @ 0.17 hrs, Volume= 0.098 MI
 Outflow = 0.02746 m³/s @ 0.50 hrs, Volume= 0.098 MI, Atten= 60%, Lag= 19.8 min
 Primary = 0.02746 m³/s @ 0.50 hrs, Volume= 0.098 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.417 m @ 0.50 hrs Surf.Area= 205.5 m² Storage= 64.1 m³

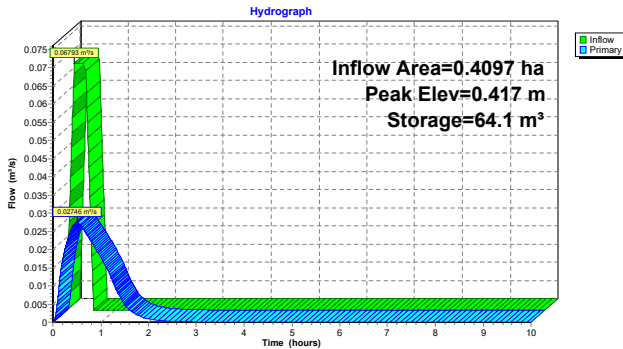
Plug-Flow detention time= 29.5 min calculated for 0.098 MI (100% of inflow)
 Center-of-Mass det. time= 29.3 min (46.3 - 17.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	173.2 m³	1,050 mm Round Pipe Storage L= 200.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.02746 m³/s @ 0.50 hrs HW=0.417 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.02746 m³/s @ 1.55 m/s)

Pond S6: S6



Summary for Pond S7: S7

Inflow Area = 0.0685 ha, 0.00% Impervious, Inflow Depth = 6 mm for 5-Year event
 Inflow = 0.00299 m³/s @ 0.17 hrs, Volume= 0.004 MI
 Outflow = 0.00291 m³/s @ 0.40 hrs, Volume= 0.004 MI, Atten= 3%, Lag= 14.0 min
 Primary = 0.00291 m³/s @ 0.40 hrs, Volume= 0.004 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.099 m @ 0.40 hrs Surf.Area= 9.3 m² Storage= 0.6 m³

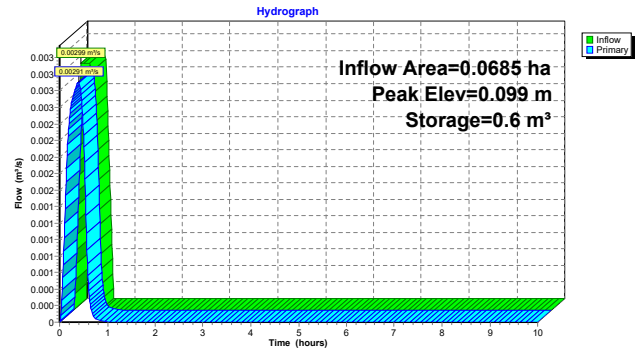
Plug-Flow detention time= 3.4 min calculated for 0.004 MI (100% of inflow)
 Center-of-Mass det. time= 3.5 min (20.5 - 17.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	4.0 m³	450 mm Round Pipe Storage L= 25.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00291 m³/s @ 0.40 hrs HW=0.099 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00291 m³/s @ 0.66 m/s)

Pond S7: S7



Summary for Pond S8: S8

Inflow Area = 1.3580 ha, 100.00% Impervious, Inflow Depth = 24 mm for 5-Year event
 Inflow = 0.22515 m³/s @ 0.17 hrs, Volume= 0.324 MI
 Outflow = 0.05556 m³/s @ 0.53 hrs, Volume= 0.323 MI, Atten= 75%, Lag= 21.3 min
 Primary = 0.05556 m³/s @ 0.53 hrs, Volume= 0.323 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.862 m @ 0.53 hrs Surf.Area= 300.0 m² Storage= 258.7 m³

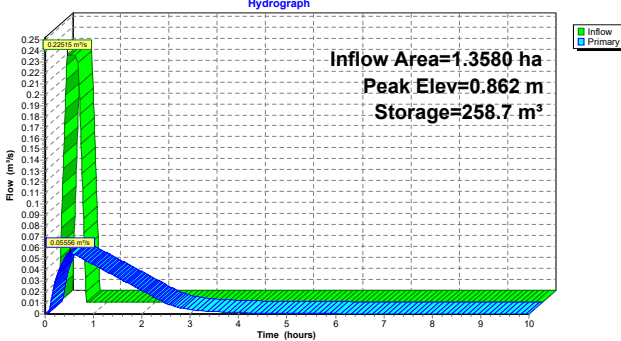
Plug-Flow detention time= 62.3 min calculated for 0.322 MI (99% of inflow)
 Center-of-Mass det. time= 62.7 min (79.7 - 17.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m ³	Custom Stage Data (Prismatic), listed below (Recalc)
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.05556 m³/s @ 0.53 hrs HW=0.862 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.05556 m³/s @ 3.14 m/s)

Pond S8: S8



Summary for Pond S9: S9

Inflow Area = 0.2333 ha, 0.00% Impervious, Inflow Depth = 6 mm for 5-Year event
 Inflow = 0.01018 m³/s @ 0.17 hrs, Volume= 0.015 MI
 Outflow = 0.01004 m³/s @ 0.40 hrs, Volume= 0.015 MI, Atten= 1%, Lag= 13.8 min
 Primary = 0.01004 m³/s @ 0.40 hrs, Volume= 0.015 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.121 m @ 0.40 hrs Surf.Area= 31.3 m² Storage= 2.7 m³

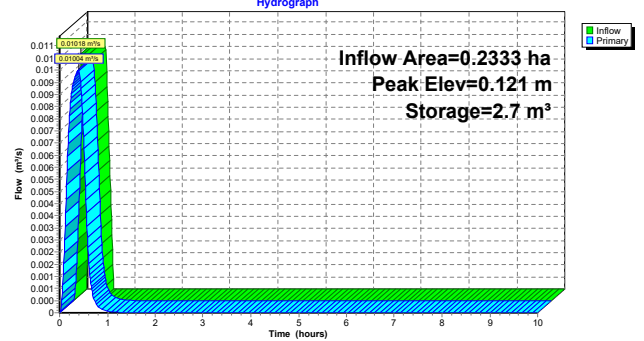
Plug-Flow detention time= 4.7 min calculated for 0.015 MI (100% of inflow)
 Center-of-Mass det. time= 4.7 min (21.7 - 17.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	18.4 m ³	600 mm Round Pipe Storage L= 65.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.01004 m³/s @ 0.40 hrs HW=0.121 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.01004 m³/s @ 0.65 m/s)

Pond S9: S9

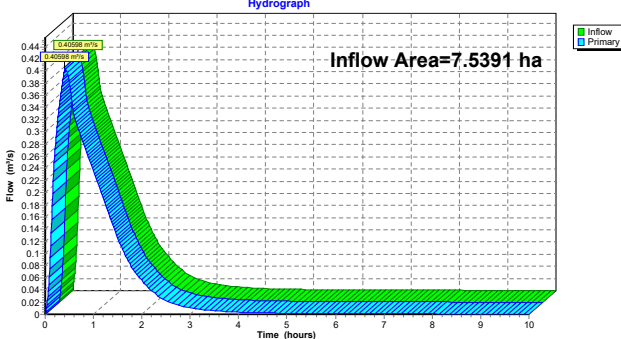


Summary for Link Outfall: Outfall

Inflow Area = 7.5391 ha, 83.01% Impervious, Inflow Depth > 22 mm for 5-Year event
 Inflow = 0.40598 m³/s @ 0.40 hrs, Volume= 1.628 MI
 Primary = 0.40598 m³/s @ 0.40 hrs, Volume= 1.628 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall

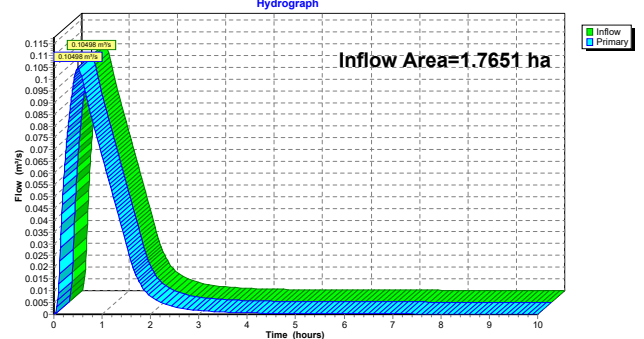


Summary for Link PH1: PH1

Inflow Area = 1.7651 ha, 93.99% Impervious, Inflow Depth > 23 mm for 5-Year event
 Inflow = 0.10498 m³/s @ 0.50 hrs, Volume= 0.402 MI
 Primary = 0.10498 m³/s @ 0.50 hrs, Volume= 0.402 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1



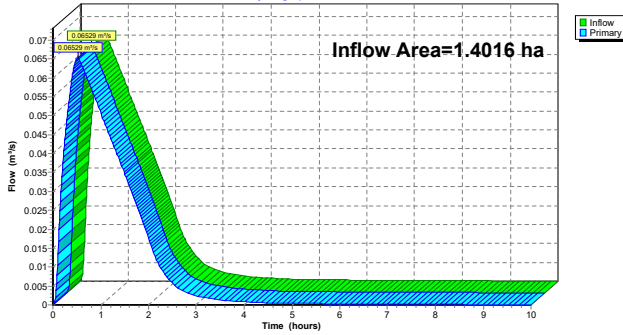
Summary for Link PH2: PH2

Inflow Area = 1.4016 ha, 100.00% Impervious, Inflow Depth > 24 mm for 5-Year event
 Inflow = 0.06529 m³/s @ 0.52 hrs, Volume= 0.334 MI
 Primary = 0.06529 m³/s @ 0.52 hrs, Volume= 0.334 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2: PH2

Hydrograph



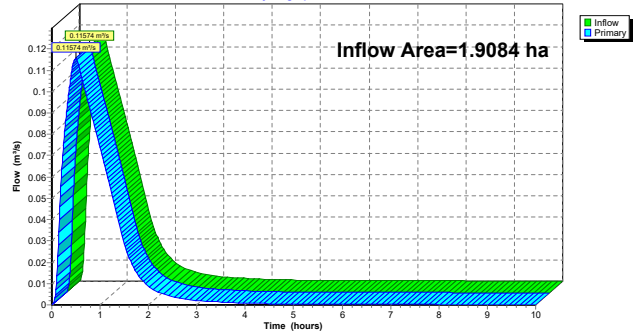
Summary for Link PH3: PH3

Inflow Area = 1.9084 ha, 96.41% Impervious, Inflow Depth > 23 mm for 5-Year event
 Inflow = 0.11574 m³/s @ 0.50 hrs, Volume= 0.442 MI
 Primary = 0.11574 m³/s @ 0.50 hrs, Volume= 0.442 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3

Hydrograph



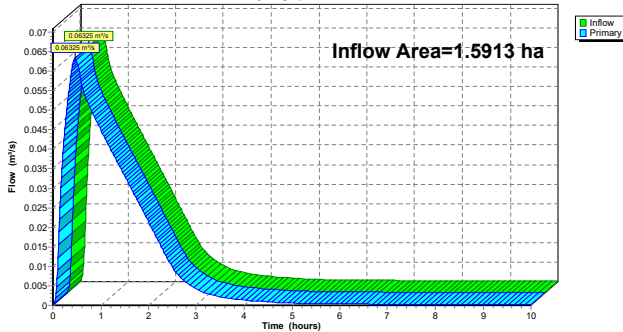
Summary for Link PH4: PH4

Inflow Area = 1.5913 ha, 85.34% Impervious, Inflow Depth > 21 mm for 5-Year event
 Inflow = 0.06325 m³/s @ 0.46 hrs, Volume= 0.337 MI
 Primary = 0.06325 m³/s @ 0.46 hrs, Volume= 0.337 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

Hydrograph



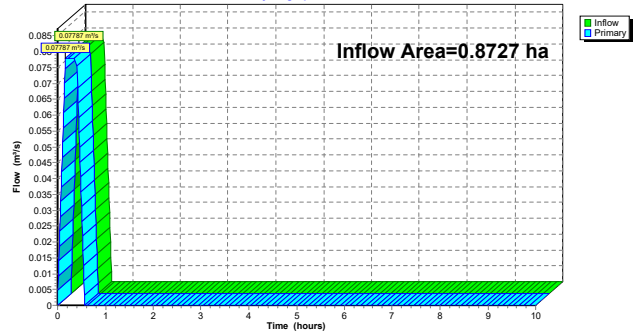
Summary for Link PH4_Un: PH4 Uncontrolled

Inflow Area = 0.8727 ha, 0.00% Impervious, Inflow Depth = 13 mm for 5-Year event
 Inflow = 0.07787 m³/s @ 0.17 hrs, Volume= 0.112 MI
 Primary = 0.07787 m³/s @ 0.17 hrs, Volume= 0.112 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

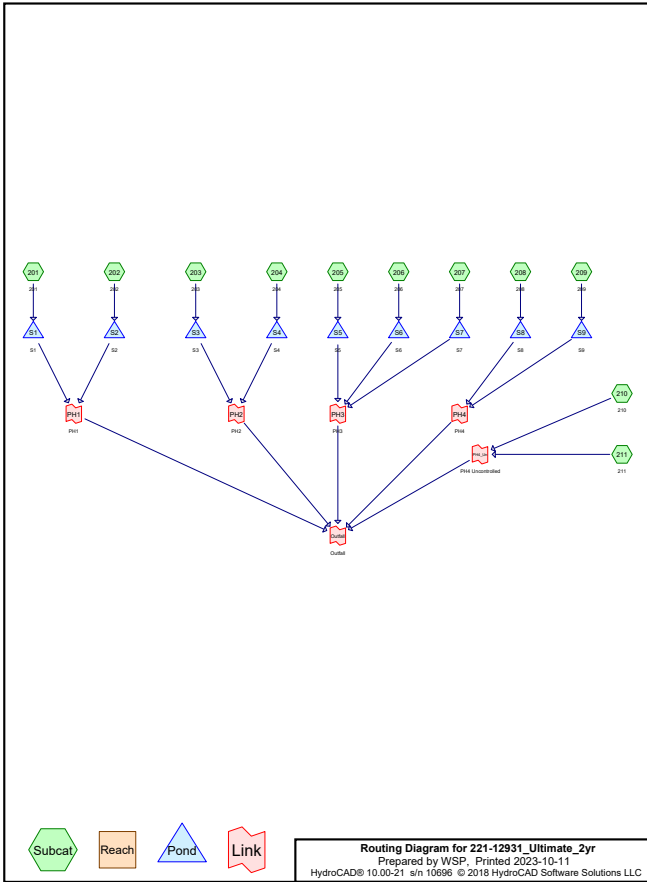
Link PH4_Un: PH4 Uncontrolled

Hydrograph



Area Listing (selected nodes)

Area (hectares)	C	Description (subcatchment-numbers)
6.2585	0.95	(201, 203, 204, 205, 206, 208)
0.4079	0.25	(202, 207, 209)
0.3801	0.50	(210)
0.4926	0.52	(211)
7.5391	0.86	TOTAL AREA



Soil Listing (selected nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
7.5391	Other	201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
7.5391		TOTAL AREA

Ground Covers (selected 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	7.5391	7.5391		201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211
0.0000	0.0000	0.0000	0.0000	7.5391	7.5391	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

Subcatchment201: 201	Runoff Area=1.6590 ha 100.00% Impervious Runoff Depth=18 mm Tc=10.0 min C=0.95 Runoff=0.18931 m³/s 0.295 MI
Subcatchment202: 202	Runoff Area=0.1061 ha 0.00% Impervious Runoff Depth=5 mm Tc=10.0 min C=0.25 Runoff=0.00319 m³/s 0.005 MI
Subcatchment203: 203	Runoff Area=1.2444 ha 100.00% Impervious Runoff Depth=18 mm Tc=10.0 min C=0.95 Runoff=0.14200 m³/s 0.221 MI
Subcatchment204: 204	Runoff Area=0.1572 ha 100.00% Impervious Runoff Depth=18 mm Tc=10.0 min C=0.95 Runoff=0.01794 m³/s 0.028 MI
Subcatchment205: 205	Runoff Area=1.4302 ha 100.00% Impervious Runoff Depth=18 mm Tc=10.0 min C=0.95 Runoff=0.16320 m³/s 0.255 MI
Subcatchment206: 206	Runoff Area=0.4097 ha 100.00% Impervious Runoff Depth=18 mm Tc=10.0 min C=0.95 Runoff=0.04675 m³/s 0.073 MI
Subcatchment207: 207	Runoff Area=0.0685 ha 0.00% Impervious Runoff Depth=5 mm Tc=10.0 min C=0.25 Runoff=0.00206 m³/s 0.003 MI
Subcatchment208: 208	Runoff Area=1.3580 ha 100.00% Impervious Runoff Depth=18 mm Tc=10.0 min C=0.95 Runoff=0.15497 m³/s 0.242 MI
Subcatchment209: 209	Runoff Area=0.2333 ha 0.00% Impervious Runoff Depth=5 mm Tc=10.0 min C=0.25 Runoff=0.00701 m³/s 0.011 MI
Subcatchment210: 210	Runoff Area=0.3801 ha 0.00% Impervious Runoff Depth=9 mm Tc=10.0 min C=0.50 Runoff=0.02283 m³/s 0.036 MI
Subcatchment211: 211	Runoff Area=0.4926 ha 0.00% Impervious Runoff Depth=10 mm Tc=10.0 min C=0.52 Runoff=0.03077 m³/s 0.048 MI
Pond S1: S1	Peak Elev=0.653 m Storage=195.8 m³ Inflow=0.18931 m³/s 0.295 MI Outflow=0.08277 m³/s 0.295 MI
Pond S2: S2	Peak Elev=0.102 m Storage=1.1 m³ Inflow=0.00319 m³/s 0.005 MI Outflow=0.00298 m³/s 0.005 MI
Pond S3: S3	Peak Elev=0.652 m Storage=163.0 m³ Inflow=0.14200 m³/s 0.221 MI Outflow=0.04757 m³/s 0.221 MI
Pond S4: S4	Peak Elev=0.365 m Storage=18.7 m³ Inflow=0.01794 m³/s 0.028 MI Outflow=0.00672 m³/s 0.028 MI
Pond S5: S5	Peak Elev=0.494 m Storage=173.1 m³ Inflow=0.16320 m³/s 0.255 MI Outflow=0.06992 m³/s 0.253 MI

Pond S6: S6	Peak Elev=0.314 m Storage=43.6 m³ Inflow=0.04675 m³/s 0.073 MI Outflow=0.02298 m³/s 0.073 MI
Pond S7: S7	Peak Elev=0.068 m Storage=0.4 m³ Inflow=0.00206 m³/s 0.003 MI Outflow=0.00205 m³/s 0.003 MI
Pond S8: S8	Peak Elev=0.618 m Storage=185.3 m³ Inflow=0.15497 m³/s 0.242 MI Outflow=0.04613 m³/s 0.240 MI
Pond S9: S9	Peak Elev=0.096 m Storage=1.9 m³ Inflow=0.00701 m³/s 0.011 MI Outflow=0.00695 m³/s 0.011 MI
Link Outfall: Outfall	Inflow=0.32478 m³/s 1.213 MI Primary=0.32478 m³/s 1.213 MI
Link PH1: PH1	Inflow=0.08543 m³/s 0.300 MI Primary=0.08543 m³/s 0.300 MI
Link PH2: PH2	Inflow=0.05429 m³/s 0.249 MI Primary=0.05429 m³/s 0.249 MI
Link PH3: PH3	Inflow=0.09437 m³/s 0.329 MI Primary=0.09437 m³/s 0.329 MI
Link PH4: PH4	Inflow=0.05146 m³/s 0.251 MI Primary=0.05146 m³/s 0.251 MI
Link PH4_Un: PH4 Uncontrolled	Inflow=0.05360 m³/s 0.084 MI Primary=0.05360 m³/s 0.084 MI
Total Runoff Area = 7.5391 ha Runoff Volume = 1.216 MI Average Runoff Depth = 16 mm 16.99% Pervious = 1.2806 ha 83.01% Impervious = 6.2585 ha	

Summary for Subcatchment 201: 201

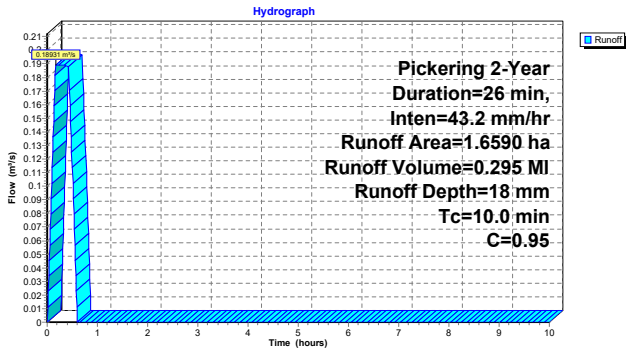
Runoff = 0.18931 m³/s @ 0.17 hrs, Volume= 0.295 MI, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
1.6590	0.95	
1.6590		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



Summary for Subcatchment 202: 202

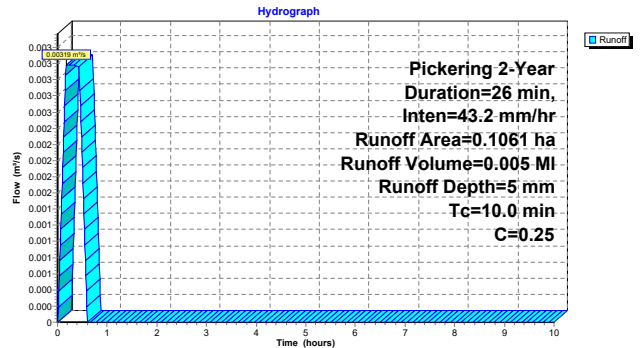
Runoff = 0.00319 m³/s @ 0.17 hrs, Volume= 0.005 MI, Depth= 5 mm

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=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.1061	0.25	
0.1061		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

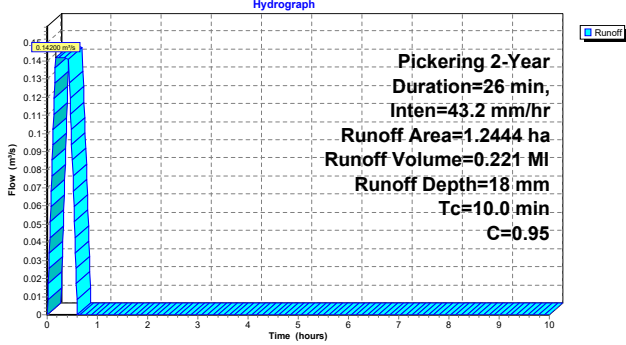
Runoff = 0.14200 m³/s @ 0.17 hrs, Volume= 0.221 MI, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
1.2444	0.95	
1.2444	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 203: 203



Summary for Subcatchment 204: 204

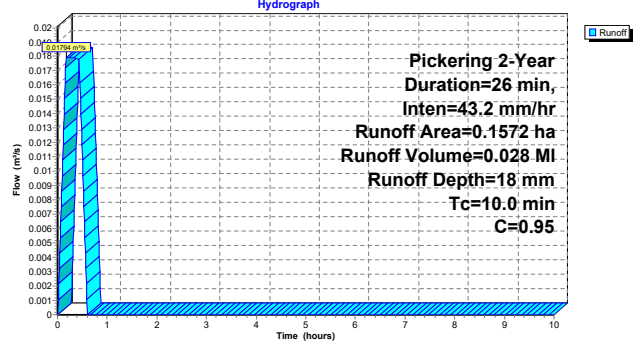
Runoff = 0.01794 m³/s @ 0.17 hrs, Volume= 0.028 MI, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.1572	0.95	
0.1572	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 204: 204



Summary for Subcatchment 205: 205

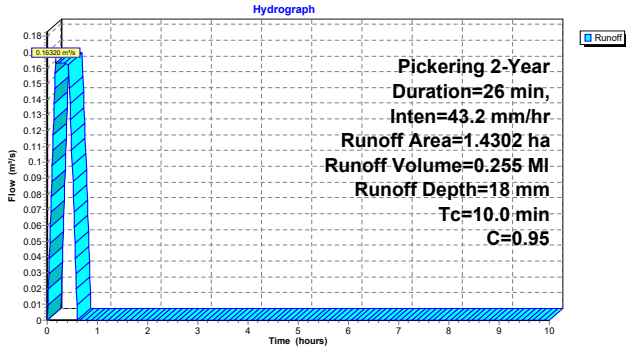
Runoff = 0.16320 m³/s @ 0.17 hrs, Volume= 0.255 MI, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
1.4302	0.95	
1.4302	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 205: 205



Summary for Subcatchment 206: 206

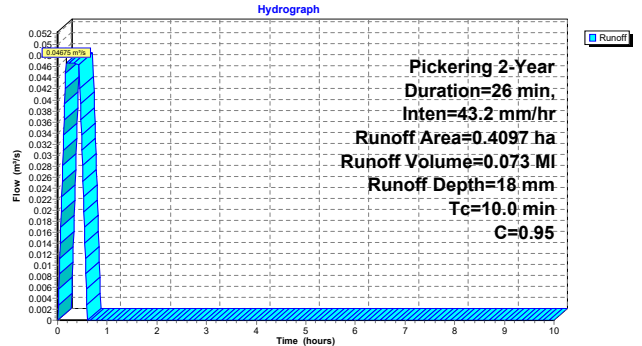
Runoff = 0.04675 m³/s @ 0.17 hrs, Volume= 0.073 MI, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.4097	0.95	
0.4097	100.00%	Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 206: 206



Summary for Subcatchment 207: 207

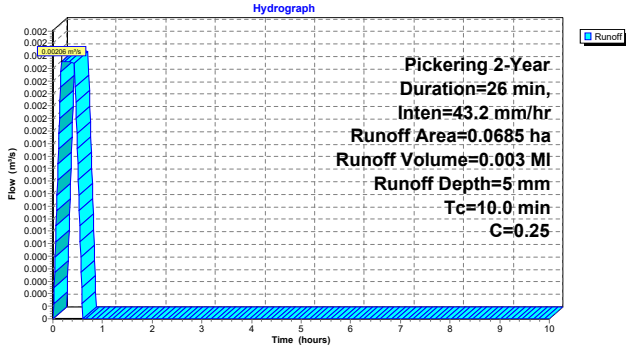
Runoff = 0.00206 m³/s @ 0.17 hrs, Volume= 0.003 MI, Depth= 5 mm

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=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.0685	0.25	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 207: 207



Summary for Subcatchment 208: 208

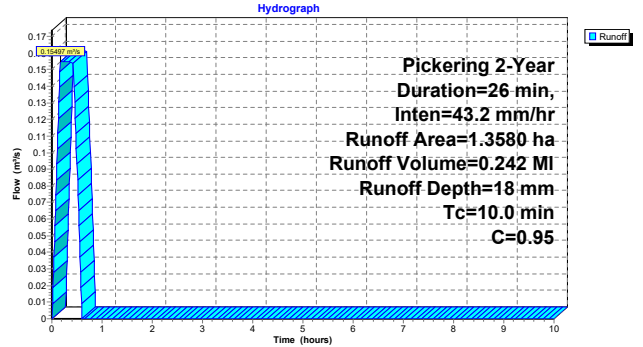
Runoff = 0.15497 m³/s @ 0.17 hrs, Volume= 0.242 MI, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Pickering 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
1.3580	0.95	100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 208: 208



Summary for Subcatchment 209: 209

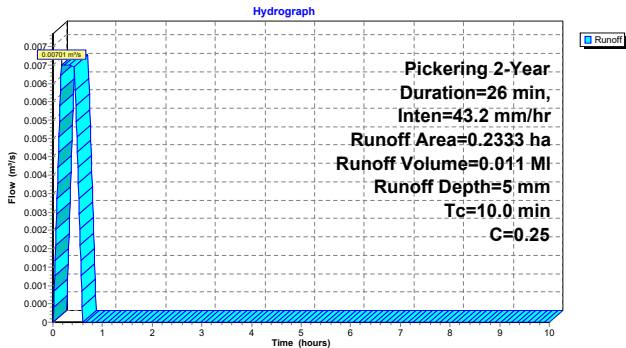
Runoff = 0.00701 m³/s @ 0.17 hrs, Volume= 0.011 MI, Depth= 5 mm

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=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.2333	0.25	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 209: 209



Summary for Subcatchment 210: 210

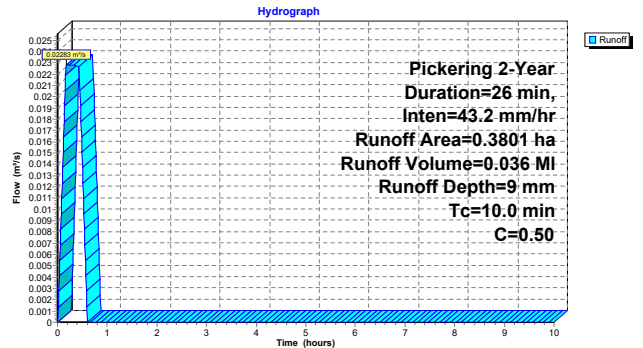
Runoff = 0.02283 m³/s @ 0.17 hrs, Volume= 0.036 MI, Depth= 9 mm

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=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.3801	0.50	100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m ³ /s)	Description
10.0					Direct Entry,

Subcatchment 210: 210



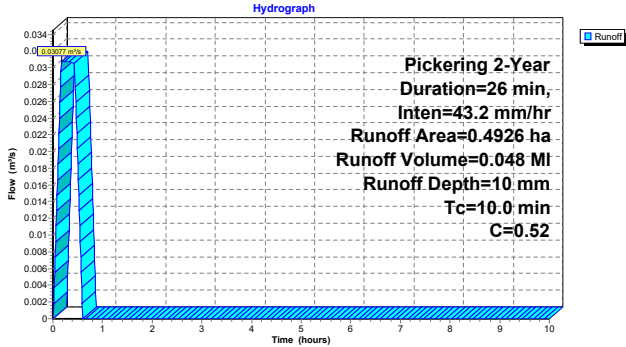
Summary for Subcatchment 211: 211

Runoff = 0.03077 m³/s @ 0.17 hrs, Volume= 0.048 MI, 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 2-Year Duration=26 min, Inten=43.2 mm/hr

Area (ha)	C	Description
0.4926	0.52	
0.4926		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



Summary for Pond S1: S1

Inflow Area = 1.6590 ha, 100.00% Impervious, Inflow Depth = 18 mm for 2-Year event
 Inflow = 0.18931 m³/s @ 0.17 hrs, Volume= 0.295 MI
 Outflow = 0.08277 m³/s @ 0.53 hrs, Volume= 0.295 MI, Atten= 56%, Lag= 21.4 min
 Primary = 0.08277 m³/s @ 0.53 hrs, Volume= 0.295 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.653 m @ 0.53 hrs Surf.Area= 300.0 m² Storage= 195.8 m³

Plug-Flow detention time= 37.8 min calculated for 0.294 MI (100% of inflow)
 Center-of-Mass det. time= 38.3 min (56.3 - 18.0)

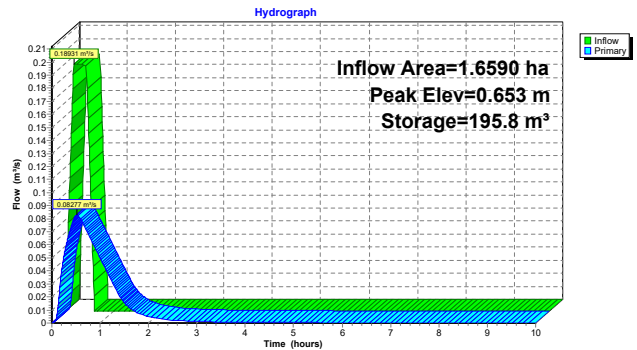
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.08276 m³/s @ 0.53 hrs HW=0.653 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.08276 m³/s @ 2.63 m/s)

Pond S1: S1



Summary for Pond S2: S2

Inflow Area = 0.1061 ha, 0.00% Impervious, Inflow Depth = 5 mm for 2-Year event
 Inflow = 0.00319 m³/s @ 0.17 hrs, Volume= 0.005 MI
 Outflow = 0.00298 m³/s @ 0.44 hrs, Volume= 0.005 MI, Atten= 7%, Lag= 16.5 min
 Primary = 0.00298 m³/s @ 0.44 hrs, Volume= 0.005 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.102 m @ 0.44 hrs Surf.Area= 15.1 m² Storage= 1.1 m³

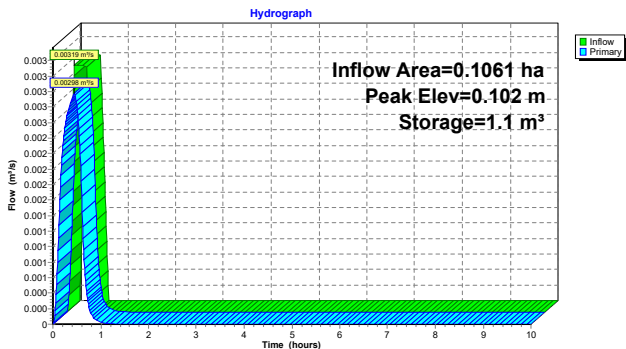
Plug-Flow detention time= 5.6 min calculated for 0.005 MI (100% of inflow)
 Center-of-Mass det. time= 5.6 min (23.6 - 18.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	6.4 m³	450 mm Round Pipe Storage L= 40.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00297 m³/s @ 0.44 hrs HW=0.102 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00297 m³/s @ 0.67 m/s)

Pond S2: S2



Summary for Pond S3: S3

Inflow Area = 1.2444 ha, 100.00% Impervious, Inflow Depth = 18 mm for 2-Year event
 Inflow = 0.14200 m³/s @ 0.17 hrs, Volume= 0.221 MI
 Outflow = 0.04757 m³/s @ 0.54 hrs, Volume= 0.221 MI, Atten= 67%, Lag= 22.5 min
 Primary = 0.04757 m³/s @ 0.54 hrs, Volume= 0.221 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.652 m @ 0.54 hrs Surf.Area= 250.0 m² Storage= 163.0 m³

Plug-Flow detention time= 49.6 min calculated for 0.221 MI (100% of inflow)
 Center-of-Mass det. time= 50.1 min (68.1 - 18.0)

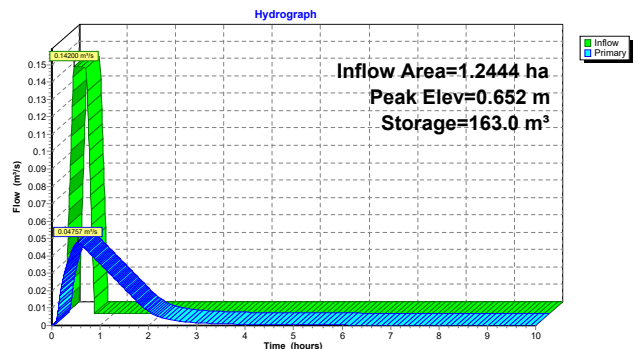
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	500.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	250.0	0.0	0.0
2.000	250.0	500.0	500.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.04756 m³/s @ 0.54 hrs HW=0.652 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.04756 m³/s @ 2.69 m/s)

Pond S3: S3



Summary for Pond S4: S4

Inflow Area = 0.1572 ha, 100.00% Impervious, Inflow Depth = 18 mm for 2-Year event
 Inflow = 0.01794 m³/s @ 0.17 hrs, Volume= 0.028 MI
 Outflow = 0.00672 m³/s @ 0.54 hrs, Volume= 0.028 MI, Atten= 63%, Lag= 22.1 min
 Primary = 0.00672 m³/s @ 0.54 hrs, Volume= 0.028 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.365 m @ 0.54 hrs Surf.Area= 70.0 m² Storage= 18.7 m³

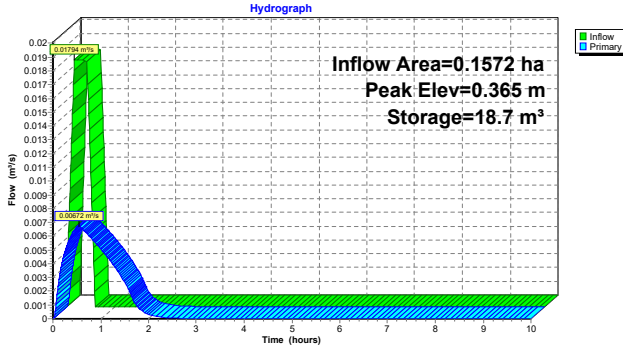
Plug-Flow detention time= 32.1 min calculated for 0.028 MI (100% of inflow)
 Center-of-Mass det. time= 32.2 min (50.2 - 18.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	60.6 m³	1,050 mm Round Pipe Storage L= 70.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00672 m³/s @ 0.54 hrs HW=0.365 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00672 m³/s @ 1.52 m/s)

Pond S4: S4



Summary for Pond S5: S5

Inflow Area = 1.4302 ha, 100.00% Impervious, Inflow Depth = 18 mm for 2-Year event
 Inflow = 0.16320 m³/s @ 0.17 hrs, Volume= 0.255 MI
 Outflow = 0.06992 m³/s @ 0.53 hrs, Volume= 0.253 MI, Atten= 57%, Lag= 21.5 min
 Primary = 0.06992 m³/s @ 0.53 hrs, Volume= 0.253 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.494 m @ 0.53 hrs Surf.Area= 350.0 m² Storage= 173.1 m³

Plug-Flow detention time= 43.5 min calculated for 0.253 MI (100% of inflow)
 Center-of-Mass det. time= 43.4 min (61.4 - 18.0)

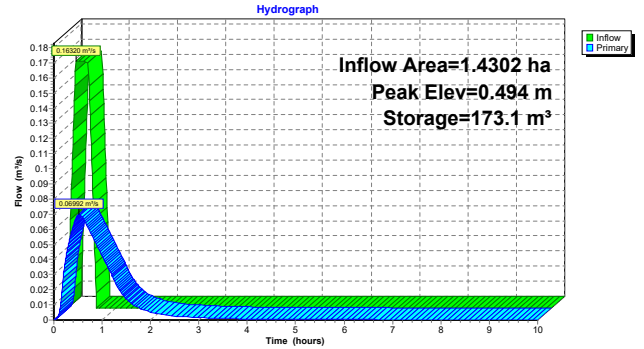
Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	700.0 m³	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (meters)	Surf. Area (sq-meters)	Inc. Store (cubic-meters)	Cum. Store (cubic-meters)
0.000	350.0	0.0	0.0
2.000	350.0	700.0	700.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	200 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.06992 m³/s @ 0.53 hrs HW=0.494 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.06992 m³/s @ 2.23 m/s)

Pond S5: S5



Summary for Pond S6: S6

Inflow Area = 0.4097 ha, 100.00% Impervious, Inflow Depth = 18 mm for 2-Year event
 Inflow = 0.04675 m³/s @ 0.17 hrs, Volume= 0.073 MI
 Outflow = 0.02298 m³/s @ 0.52 hrs, Volume= 0.073 MI, Atten= 51%, Lag= 20.9 min
 Primary = 0.02298 m³/s @ 0.52 hrs, Volume= 0.073 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.314 m @ 0.52 hrs Surf.Area= 192.4 m² Storage= 43.6 m³

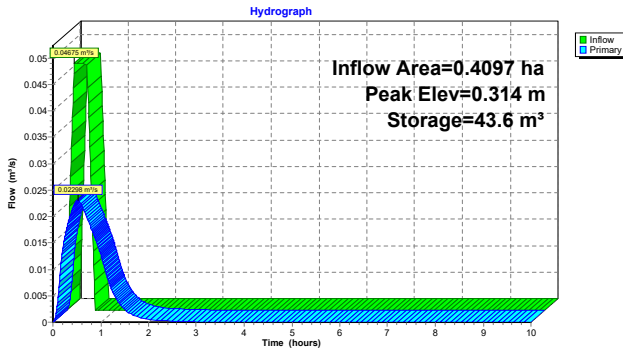
Plug-Flow detention time= 25.2 min calculated for 0.073 MI (100% of inflow)
 Center-of-Mass det. time= 25.4 min (43.4 - 18.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	173.2 m³	1,050 mm Round Pipe Storage L= 200.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.02298 m³/s @ 0.52 hrs HW=0.314 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.02298 m³/s @ 1.30 m/s)

Pond S6: S6



Summary for Pond S7: S7

Inflow Area = 0.0685 ha, 0.00% Impervious, Inflow Depth = 5 mm for 2-Year event
 Inflow = 0.00206 m³/s @ 0.17 hrs, Volume= 0.003 MI
 Outflow = 0.00205 m³/s @ 0.43 hrs, Volume= 0.003 MI, Atten= 0%, Lag= 15.4 min
 Primary = 0.00205 m³/s @ 0.43 hrs, Volume= 0.003 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.068 m @ 0.43 hrs Surf.Area= 8.0 m² Storage= 0.4 m³

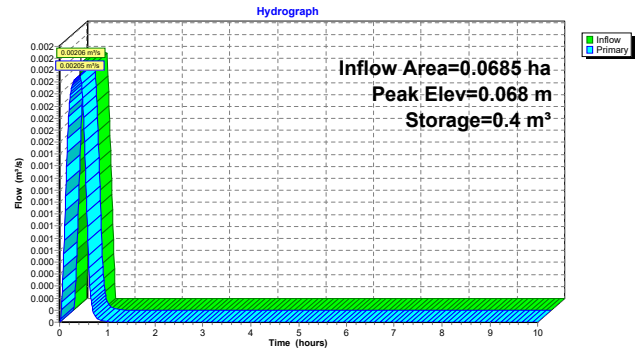
Plug-Flow detention time= 3.1 min calculated for 0.003 MI (100% of inflow)
 Center-of-Mass det. time= 3.1 min (21.1 - 18.0)

Volume	Invert	Avail. Storage	Storage Description
#1	0.000 m	4.0 m³	450 mm Round Pipe Storage L= 25.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	75 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00205 m³/s @ 0.43 hrs HW=0.068 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00205 m³/s @ 0.49 m/s)

Pond S7: S7



Summary for Pond S8: S8

Inflow Area = 1.3580 ha, 100.00% Impervious, Inflow Depth = 18 mm for 2-Year event
 Inflow = 0.15497 m³/s @ 0.17 hrs, Volume= 0.242 MI
 Outflow = 0.04613 m³/s @ 0.55 hrs, Volume= 0.240 MI, Atten= 70%, Lag= 22.8 min
 Primary = 0.04613 m³/s @ 0.55 hrs, Volume= 0.240 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.618 m @ 0.55 hrs Surf.Area= 300.0 m² Storage= 185.3 m³

Plug-Flow detention time= 57.8 min calculated for 0.240 MI (99% of inflow)
 Center-of-Mass det. time= 58.2 min (76.2 - 18.0)

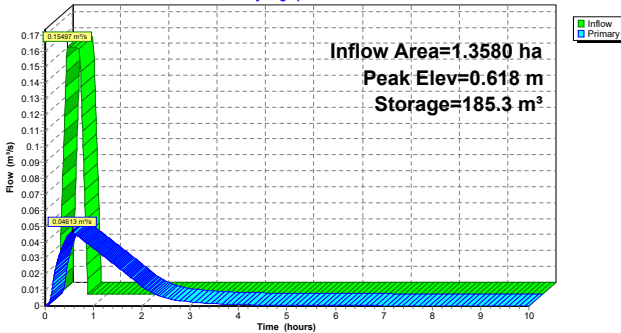
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	600.0 m³	Custom Stage Data (Prismatic), listed below (Recalc)
Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
0.000	300.0	0.0	0.0
2.000	300.0	600.0	600.0

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.800

Primary OutFlow Max=0.04613 m³/s @ 0.55 hrs HW=0.618 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.04613 m³/s @ 2.61 m/s)

Pond S8: S8

Hydrograph



Summary for Pond S9: S9

Inflow Area = 0.2333 ha, 0.00% Impervious, Inflow Depth = 5 mm for 2-Year event
 Inflow = 0.00701 m³/s @ 0.17 hrs, Volume= 0.011 MI
 Outflow = 0.00695 m³/s @ 0.43 hrs, Volume= 0.011 MI, Atten= 1%, Lag= 15.5 min
 Primary = 0.00695 m³/s @ 0.43 hrs, Volume= 0.011 MI

Routing by Stor-Ind method, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs
 Peak Elev= 0.096 m @ 0.43 hrs Surf.Area= 28.6 m² Storage= 1.9 m³

Plug-Flow detention time= 4.9 min calculated for 0.011 MI (100% of inflow)
 Center-of-Mass det. time= 4.9 min (22.9 - 18.0)

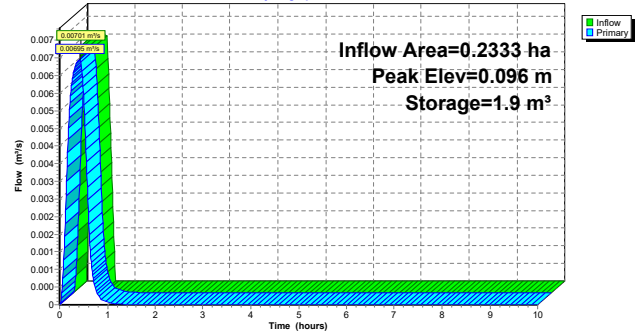
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	18.4 m³	600 mm Round Pipe Storage L= 65.00 m

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	150 mm Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00695 m³/s @ 0.43 hrs HW=0.096 m (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.00695 m³/s @ 0.58 m/s)

Pond S9: S9

Hydrograph



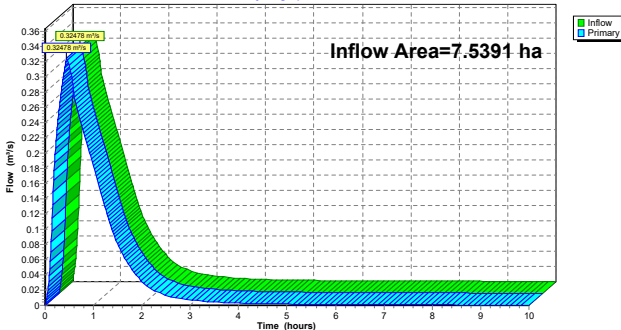
Summary for Link Outfall: Outfall

Inflow Area = 7.5391 ha, 83.01% Impervious, Inflow Depth > 16 mm for 2-Year event
 Inflow = 0.32478 m³/s @ 0.44 hrs, Volume= 1.213 MI
 Primary = 0.32478 m³/s @ 0.44 hrs, Volume= 1.213 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link Outfall: Outfall

Hydrograph



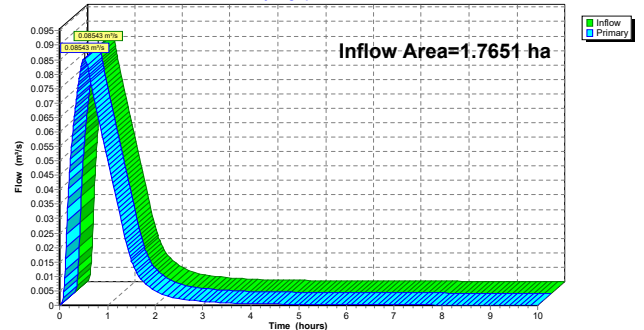
Summary for Link PH1: PH1

Inflow Area = 1.7651 ha, 93.99% Impervious, Inflow Depth > 17 mm for 2-Year event
 Inflow = 0.08543 m³/s @ 0.52 hrs, Volume= 0.300 MI
 Primary = 0.08543 m³/s @ 0.52 hrs, Volume= 0.300 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH1: PH1

Hydrograph

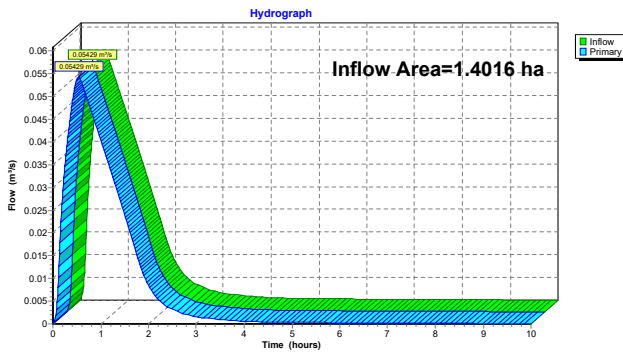


Summary for Link PH2: PH2

Inflow Area = 1.4016 ha, 100.00% Impervious, Inflow Depth > 18 mm for 2-Year event
 Inflow = 0.05429 m³/s @ 0.54 hrs, Volume= 0.249 MI
 Primary = 0.05429 m³/s @ 0.54 hrs, Volume= 0.249 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH2: PH2

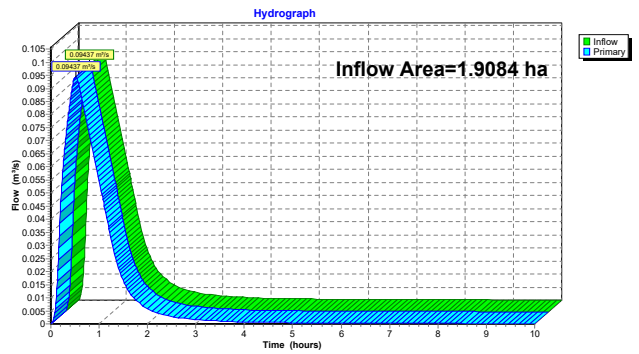


Summary for Link PH3: PH3

Inflow Area = 1.9084 ha, 96.41% Impervious, Inflow Depth > 17 mm for 2-Year event
 Inflow = 0.09437 m³/s @ 0.52 hrs, Volume= 0.329 MI
 Primary = 0.09437 m³/s @ 0.52 hrs, Volume= 0.329 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH3: PH3

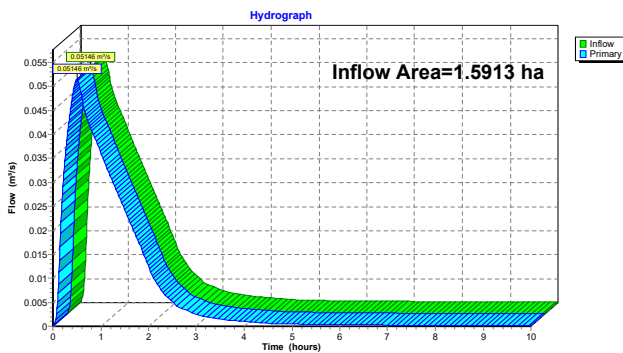


Summary for Link PH4: PH4

Inflow Area = 1.5913 ha, 85.34% Impervious, Inflow Depth > 16 mm for 2-Year event
 Inflow = 0.05146 m³/s @ 0.50 hrs, Volume= 0.251 MI
 Primary = 0.05146 m³/s @ 0.50 hrs, Volume= 0.251 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4: PH4

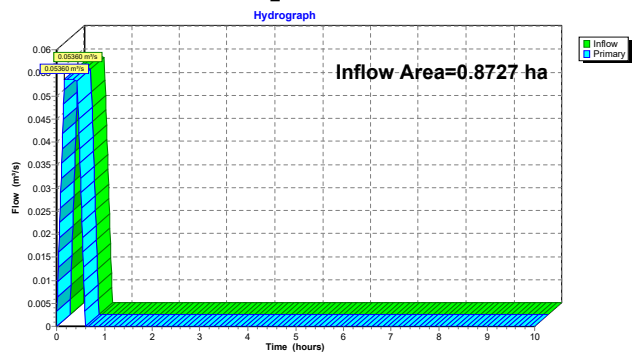


Summary for Link PH4_Un: PH4 Uncontrolled

Inflow Area = 0.8727 ha, 0.00% Impervious, Inflow Depth = 10 mm for 2-Year event
 Inflow = 0.05360 m³/s @ 0.17 hrs, Volume= 0.084 MI
 Primary = 0.05360 m³/s @ 0.17 hrs, Volume= 0.084 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-10.00 hrs, dt= 0.01 hrs

Link PH4_Un: PH4 Uncontrolled



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*
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

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.

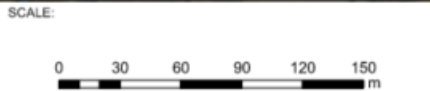
The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells 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



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

SHALLOW GROUNDWATER
CONTOUR PLAN

FIGURE:
6A

exp.

DRAWN BY: AC

CHECKED BY: AN

HYDROGEOLOGICAL INVESTIGATION
1101A AND 1105 KINGSTON ROAD
PICKERING, ONTARIO

PROJECT NUMBER: GTR-22015419-80

DATE: JULY 2023



- 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	
PROJECT NUMBER: GTR-22015419-B0	DATE: JULY 2023

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