Stantec Consulting Ltd.
100-300 Hagey Boulevard
Waterloo ON N2L 0A4

November 28, 2023

Project/File: 161414233

Mr. Carlos Ramirez
York Developments
201-303 Richmond Street
London Ontario
N6B 2H8

Dear Mr. Ramirez,

Reference: 735 Wonderland Road, London Ontario
Storm Water Management Plan Update (Version 2.0)

1.0 Introduction

Stantec Consulting Ltd. (Stantec) has been retained by York Developments (Client) to assist with the engineering services, including the Stormwater Management (SWM) Plan, to support the proposed infill development of part of the 1.441 ha parcel at 735 Wonderland Road North, herein referred to as the 'Site'. The site consists of a parking lot and an existing partial two-story commercial building, including an existing restaurant (Swiss Chalet), fronting Beaverbrook Avenue. The two proposed commercial buildings will be constructed fronting Beaverbrook and Wonderland Road in underutilized parking lot space. The existing restaurant will be removed, and a 222-unit 25 story apartment building will be constructed in its place (22 residential storeys and a 3-storey parking podium). The site is bounded by Wonderland Road to the west, Beaverbrook Avenue to the north and Horizon Drive to the East.

This letter is considered an update to the previous SWM strategy submission letter (Version 1.0, dated June 2023). The goal of this letter is to outline the proposed SWM strategy for site development.

The following tasks are summarized in this letter:

• A complete review of relevant, existing documents (listed in Section 2.0 Background)
• A drainage strategy to manage the post-development runoff
• A confirmation of the stormwater management criteria and downstream receivers.

2.0 Background

In preparation of this letter, the following documents and reports/letters have been referenced:

- *Storm Water Management Plan Update,* 735 Wonderland Road, London Ontario (Version 1.0, submitted June 13, 2023)
- *Design Specifications and Requirements Manual,* City of London, October 2003 (Updated March 2022).

- *Stormwater Management Planning and Design Manual (SWMPD Manual),* Ontario Ministry of Environment, Conservation and Parks (MECP), March 2003.
- *City of London Subwatershed Studies Group 1 Subwatershed Medway, Stanton, and Mud Creeks,* Marshall Macklin Monaghan Limited et al., May 1995.
- City Reference Drawings 11515 and 9582.

3.0 Stormwater Management Criteria

The SWM criteria for the site are established as per the City of London comments in conjunction with the SWM criteria and environmental targets identified in the Stanton Drain Sub-Watershed Study. The SWM design criteria for the proposed development are:

- **Water Quality** – Provide sufficient treatment measures to meet the Ministry of the Environment, Conservation and Parks, (MECP) *Enhanced* (80% TSS Removal) criteria and promote the at-source removal of potential contaminants.
- **Water Quantity** – Provide sufficient water quantity control to maintain post-development peak flow rates up to the 250-year storm event to the target discharge rate allowed for the Site in the design of the receiving storm sewer (5-year storm event).
- **Erosion and Sediment Control** – Provide appropriate erosion and sediment control during construction/area grading to protect adjacent properties from potential siltation.

4.0 Existing Drainage Conditions

The property, approximately 1.446 ha in area, is located on the southeast corner of Wonderland Road and Beaverbrook Avenue. Under the existing conditions, runoff from the site is tributary to a 1200mm municipal storm sewer on Horizon Drive, which has the capacity to account for a runoff coefficient of 0.65 from the entirety of the subject site.

5.0 Proposed Drainage Conditions

The proposed development is two single-story commercial buildings at the northwest corner of the site, and a 25-Storey apartment building on the eastern portion. Due to the existing paved conditions, the percentage of impervious area on the site is not changing significantly, however the runoff coefficient was calculated to be 0.90 (fully impervious). Site grading is not proposed to be substantially changed and as such, overland flows will continue to drain to the 1200mm municipal storm sewer on Horizon Drive. The site has been divided into four (4) catchments which are described below.

A201 – This 0.72 ha area is the area collected by the proposed storm system and controlled via a proposed underground stormwater storage facility. The new commercial buildings have been added in this area.

A202 – This 0.23 ha area is the remaining portion consists of paved areas (drive lanes, loading bay and drop-off zone). An Envirohood is proposed for the lone catchbasin serving this area to improve drainage treatment. Runoff from this catchment drains uncontrolled to Horizon Drive.

A203 – This 0.27 ha area consists of the existing building on site not slated for demolition. This area does contribute to the proposed storm system and is controlled by an orifice plate fitted to DICBMH4.

A204 – This 0.19 ha area consists of the 25-storey apartment building and 3-storey parking podium. Rooftop storage will be required to mitigate the peak flow.

6.0 Stormwater Management Strategy

The site requires additional water quality and quantity controls as the existing drainage controls do not have the capacity to account for the proposed drainage conditions. These controls are discussed below in Section 6.1 and 6.2.

6.1 Water Quantity Controls

Under the proposed conditions, the runoff coefficient calculated is higher than the existing 0.65 runoff coefficient. Therefore, quantity controls capable of mitigating the peak discharge for all storms up to the 100-year storm event on the proposed development will be required. The allowable release rates are tabulated below.

Table 1: Allowable Release Rates

Condition [Catchment]	Release Rate (m^3/s)
Total Allowable at 0.65C [Entire Site]	0.24
Total Uncontrolled 5-year [A202]	0.06
From Stormtech System [A201, A203][1]	0.15
Remaining for Rooftop Control [A204]	0.03

[1] StormTech system was designed using the parameters from the V1 proposed drainage condition (without the inclusion of the apartment building) and has not been altered for V2.

1.1.1 StormTech Storage Facility

An underground storage facility is recommended onsite to handle the peak discharges produced by the 100-year storm. The proposed underground system shall consist of ADS Stormtech MC-3500 chambers. It will have a total area of 297 m^2 and provide a total storage volume of 302 m^3. A series of calculations and a layout of the system justifying the SWM strategy are appended to this letter. The system is oversized to

account for the 30 m³ in storage located in the stone layer below the outlet pipe. In addition to the underground storage system, the orifice size was calculated to have a diameter of 225 mm to achieve a flow of 0.15 m^3/s at a 2 m head. Summarized in the Table 2 (below) is the storage required to control the 100-year design storm to the 5-year rate.

1.1.2 Apartment Rooftop Storage

Rooftop storage is recommended to mitigate peak flows originating from the eastern portion of the site, namely catchment A204. The roof shall come equipped with flow control devices (equal or similar to Zurn Control Flo Roof Drains) which allow a **peak flow of not more than 30 L/s to the downstream system**. The mechanical engineer is responsible for designing the rooftop controls such that the peak outflow is met. Based on preliminary calculations (calculations attached), the required rooftop storage to mitigate the peak flow is 41.3 m^3 (summary provided in Table 2, below). An inverted truncated rectangular pyramid was used to model the shape of the roof and provide an estimate for the expected maximum ponding depth. It was found the maximum ponding depth associated with the 42.0 m^3 of storage was 145 mm (5.7") (full calculations are attached). It is recommended that a manhole be placed as close as possible to the civil/ mechanical (internal plumbing to external sewer) interface to allow for pressure relief and provide tolerance in invert elevations/pipe sizes where the two systems connect.

Table 2: Water Quantity Control

Storage System	Condition	Storage (m^3)
StormTech Underground Facility	Required	265.0
	Provided	302.0
Rooftop Storage	Required	41.3
	Provided	42.0

6.2 Water Quality Controls

The standards of the Ministry of Environment, Conservation and Parks state that an *Enhanced* water quality control (a minimum of 80% TSS removal) is required for the sites where the number of proposed/existing parking spaces exceeds 29. Thus, under the proposed conditions, quality control is required on this site.

Quality treatment for the western portion of the Site will be provided using an Oil/Grit Separator (OGS). The Site area draining east includes the majority of the existing and proposed parking spaces. The characteristics of this OGS are summarized in Table 3 below.

Roof runoff is considered to be 'clean' and therefore catchment A204 does not require any additional quality controls. Runoff from catchment A202 drains to an existing catchbasin where it will be treated via a proposed Envirohood device fitted inside of the catchbasin.

Table 3: Water Quality Control – OGS Sizing

Drainage Area (ha)	OGS Location	Outlet	Runoff Coefficient (C)	Stormceptor Model	TSS Removal (%)
0.99	Eastern edge of site	Horizon Drive Storm Sewer	0.90	EF6	85

7.0 Erosion and Sediment Control Measures

This section describes the Erosion and Sediment Control Measures that will be implemented during and immediately after construction to reduce the possibility of sediment being deposited downstream.

7.1 Types of Selected Erosion/Sediment Control Methods

The details and locations of the proposed erosion and sediment control measures are shown in the submitted drawings package. The proposed erosion and sediment control measures include the following:

- Install a siltation barrier ring along the site perimeter using heavy-duty silt fence.
- Stabilize all disturbed areas where work will not take place for a period of 30 days or more according to OPSS 572.
- Perform street sweeping as necessary to remove soil accumulation caused by construction traffic.
- Use filter socks, where necessary, to further filter the discharge.
- Install and maintain strawbale filters and silt sacks at all catchbasins to prevent sediment from entering the proposed storm sewer.

The proposed temporary erosion & sediment control measures have been selected based on the site's susceptibility to erosion, sensitivity of the downstream environment, site slopes, and total drainage area. The proposed measures should provide adequate erosion and sediment control for the proposed project without the need for additional measures; however, the site should be monitored during construction, and additional measures may be added, if required. Such measures may include, but are not limited to, additional rows of silt fence or rock check dams in areas that are susceptible to erosion.

7.2 Contingency Plan

The purpose of the Contingency Plan is to help minimize the risk or consequence of failure of the erosion and sediment control works. Failure could result from insufficient measures, lack of maintenance, or severe weather conditions. The Contingency Plan includes two (2) areas of consideration: the procedures that will be followed where a failure has occurred; and the contingency measures that will be implemented where there is potential for failure.

The Contractor shall be responsible for following the Contingency Plan, and will prepare the following items:

- The Contractor will create an emergency contact list for emergency situations.
- Workers shall be on call for emergency situations for all aspects of the emergency from design to construction of emergency sediment and erosion control measures. Any associated health and safety issues are the responsibility of Contractor.
- Heavy duty silt fence, erosion control blanket, straw bales and stakes, sandbags, appropriately sized rip-rap, and clean gravel fill shall be available for emergency installation.
- Gas powered pumps, appropriately sized hoses, filtration hose socks, and filter cloth shall be available for emergency dewatering.
- Heavy equipment shall be on standby for emergency works.
- Fuel spill equipment shall be available for emergency spills of deleterious substances.
- A contact list for any further required equipment or materials shall be prepared and made available for emergency use.

1.1.3 Contingency Measures in Case of Failure

In the event of a failure, the Contractor will cease all construction related work and focus on erosion and sediment control as required to effectively stabilize the site where a failure has occurred or is imminent. The work shall be completed to the satisfaction of the Contract Administrator and any regulatory agencies that have been consulted.

Any unexpected discharge of silt or sediment or other deleterious substance outside of the work limits shall be reported to the City within a period of 2 hours. If significant long-term damage to fish habitat or property is suspected, a Restoration Plan will be developed by the Owner's Engineer. Development of the initial Restoration Plan will begin within 24 hours of the discovery of sediment discharge, and will be implemented as soon as possible, following consultation and approval from the MECP, UTRCA, DFO and City of London (EESD). The Plan will address:

- Removal and disposal of sediment from outside of the work limits
- Restoration of the affected area
- Restoration of any areas disturbed through deposition or removal.

1.1.4 Contingency Measures Where There is a High Risk of Failure

Conditions that may potentially cause failures can be identified through two (2) methods: monitoring of the erosion and sediment control measures, and weather forecasts that anticipate severe weather conditions.

1.1.4.1 HIGH RISK IDENTIFIED THROUGH MONITORING

Where monitoring has identified a high potential for failure, steps shall be immediately taken to reduce the risk. These measures may include repair to existing measures, modification of existing measures, and the addition of new measures.

The Contractor shall document the proposed approach and submit it to the Contract Administrator for immediate review and response. Where no response is forthcoming, the Contractor shall immediately proceed with implementation.

The Contract Administrator shall immediately provide a copy of the proposed approach to the City of London. As time may be of the essence, it will be the City's responsibility to respond forthwith, otherwise the Contractor shall proceed with the proposed measures.

1.1.4.2 SEVERE WEATHER ANTICIPATED

In cases where the weather forecast indicates that significant rainfall is expected within a 24-hour period, the Contractor shall immediately complete the following:

- Verify that all erosion and sediment control measures are secure and that there is no exposed soil that could erode and be deposited downstream,
- Verify that any exposed slopes are covered with erosion control blankets or other stabilization measures,
- Verify that all other measures are in good working order,
- Cease all dewatering operations,
- Remove all equipment and stockpiled materials to an appropriate location,
- Monitor all measures during the rainfall event, and where a potential for failure is identified, take corrective measures.

The Contract Administrator shall document the status of the above-listed steps.

If unforeseen events cause the strategies set out in the Contingency Plan to be insufficient or inappropriate to meet the objective of containing sediment within the work limits, the Contractor, either independently or as directed by the Contract Administrator, will respond in a timely manner with all reasonable measures consistent with safety, to prevent, counteract or remedy any effects on fish or fish habitat, human interest (i.e., safety, property value) and general watercourse slope stabilization.

7.3 When and Where Devices Will Be Installed

Construction of this project will likely begin during 2024. The locations of the proposed erosion and sediment control measures are shown on the drawings that are included with this letter. The order in which the proposed measures will be implemented is summarized in the following table.

Table 4: Erosion and Sediment Control Sequencing

Stage	Erosion and Sediment Control Measure
Pre-Construction	Create contact list for emergency Contingency Plan operations.
Construction	Monitor weather reports for significant precipitation events for contingency planning.
	Install silt fencing along all the necessary site limits.
	Install catchbasin inserts in catchbasins and strawbale filters around them.
	Perform street sweeping, as necessary.
	Complete final grading
	Remove any remaining erosion and sediment control measures.
Post-Construction	In consultation with the City, re-establish any downstream area showing signs of erosion or sedimentation.

7.4 Land Slopes and Proposed Land Alterations

The proposed work involves two single-story commercial buildings. The existing site slopes 2.0%. As such, substantial alteration in the site topography caused by the proposed site grading is not expected.

7.5 Need for Enhanced Erosion/Sediment Control Measures

The proposed erosion and sediment control measures should convey the typical summer runoff during construction, while simultaneously preventing sediment transport. Additional measures will likely not be required. However, the site will be monitored during construction and additional measures (i.e., rock check dams and/or additional rows of silt fence) may be installed, at the discretion of the Contract Administrator. The triggers for the installation of enhanced erosion and sediment control measures would include breaching of the proposed erosion and sediment control measures, and / or re-evaluation based on site conditions during construction. In any event, site conditions and erosion / sediment control measures will be monitored on a regular basis by onsite inspection staff.

7.6 Proximity to Environmentally Significant/Sensitive Areas

No Environmentally Sensitive Areas (ESA) are noted in the proximity of the subject Site. The subject Site is located within the Stanton Drain Sub-watershed, which outlets to the Thames River.

7.7 Infiltration Measures and Existing Groundwater Levels

Erosion & sediment infiltration measures have not been included in the proposed Erosion and Sediment Control Plan.

7.8 Dewatering Requirements

Significant groundwater infiltration is not anticipated within conventional depths, thus, significant dewatering will likely not be necessary; however, if dewatering in excess of 50,000 L/day is required, the Contractor will be responsible for obtaining an MECP Permit to Take Water (PTTW). Regardless, all dewatering effluent must be discharged to a sediment trap. Under no circumstances will dewatering effluent be discharged directly to the downstream sewer system. Both the Contractor and the Contract Administrator will be responsible for monitoring the water quality leaving the sediment traps.

Any minor groundwater infiltration can likely be accommodated using conventional sump pumping techniques. However, if, during construction, the dewatering volume is significantly greater than initially expected, additional dewatering sediment traps will be constructed within the proposed work limits. The exact location of the dewatering sediment traps will depend on what work has been completed and the location of the excavation to be dewatered. Thus, the locations of any additional dewatering areas will be identified by the Owner's Engineer in consultation with the Contractor and the Contract Administrator.

7.9 Proposed Reporting System

The Contract Administrator shall prepare weekly erosion and sediment control monitoring reports for the duration of construction and submit them to the City of London by April 1, July 1, and November 1 of each year until all works and services of the plan are assumed. The Monitoring Reports should document the status of the ESC Plan, any repairs, rainfall or pumping that has occurred since the last report, and any failure of the erosion and sediment control measures shall be reported as described in the Contingency Plan.

7.10 Inspection Requirements

To monitor the effectiveness of the erosion and sediment control measures during construction, frequent inspections will be required. The inspection activities will include the following tasks:

- The Developer's Contract Administrator and the Developer shall inspect the erosion control works on all days when construction is active,
- The Developer and Developer's Contract Administrator shall monitor weather reports daily and record daily temperatures and rainfall,
- The Developer's Contract Administrator and the Developer shall inspect the erosion control works following periods of excessive precipitation (i.e., rainfall depths that exceed 25 millimeters). Any deficiencies will be corrected by the Developer within 24 hours,
- The Developer's Contract Administrator will document all inspection activities in weekly erosion and sediment control inspection reports,
- The Developer shall be responsible for constructing and maintaining all erosion and sediment control measures,
- Maintenance will be the responsibility of the Developer and shall include maintaining all erosion and sediment control measures. These shall include, but not be limited to, the following: maintaining fencing, erosion control blankets, and dewatering traps, and removing accumulated sediment,
- Prior to removal of erosion and sediment control measures, the Owner's Engineer and the City of London shall conduct a joint inspection of the construction site to confirm that the measures can be removed and discuss the methods that will be used for removal. Removal of the erosion and sediment control measures will be the responsibility of the Owner.

Reference: **735 Wonderland Road, London, Ontario, Storm Water Management Plan Update**

8.0 Conclusions and Recommendations

Based on the preceding documentation, the following conclusions can be drawn:

- **Water Quantity** – proposed SWM storage measures provide sufficient storage to maintain the target flow rates.
- **Water Quality** – an OGS sized using Stormceptor model to achieve greater than 80% TSS removal.
- **Erosion and Sediment Control Measures** – standard measures are proposed for the site including silt-fence and silt sacks in the catchbasins.

As the site conforms to the assumptions in the proposed SWM strategy, we trust that this report is sufficient and meets your needs. However, should you have any questions, please do not hesitate to contact the undersigned at your convenience.

Regards,

STANTEC CONSULTING LTD.

Digitally signed by D'hoine, Nate
Date: 2023.11.29 11:49:10 -05'00'

LICENSED PROFESSIONAL ENGINEER
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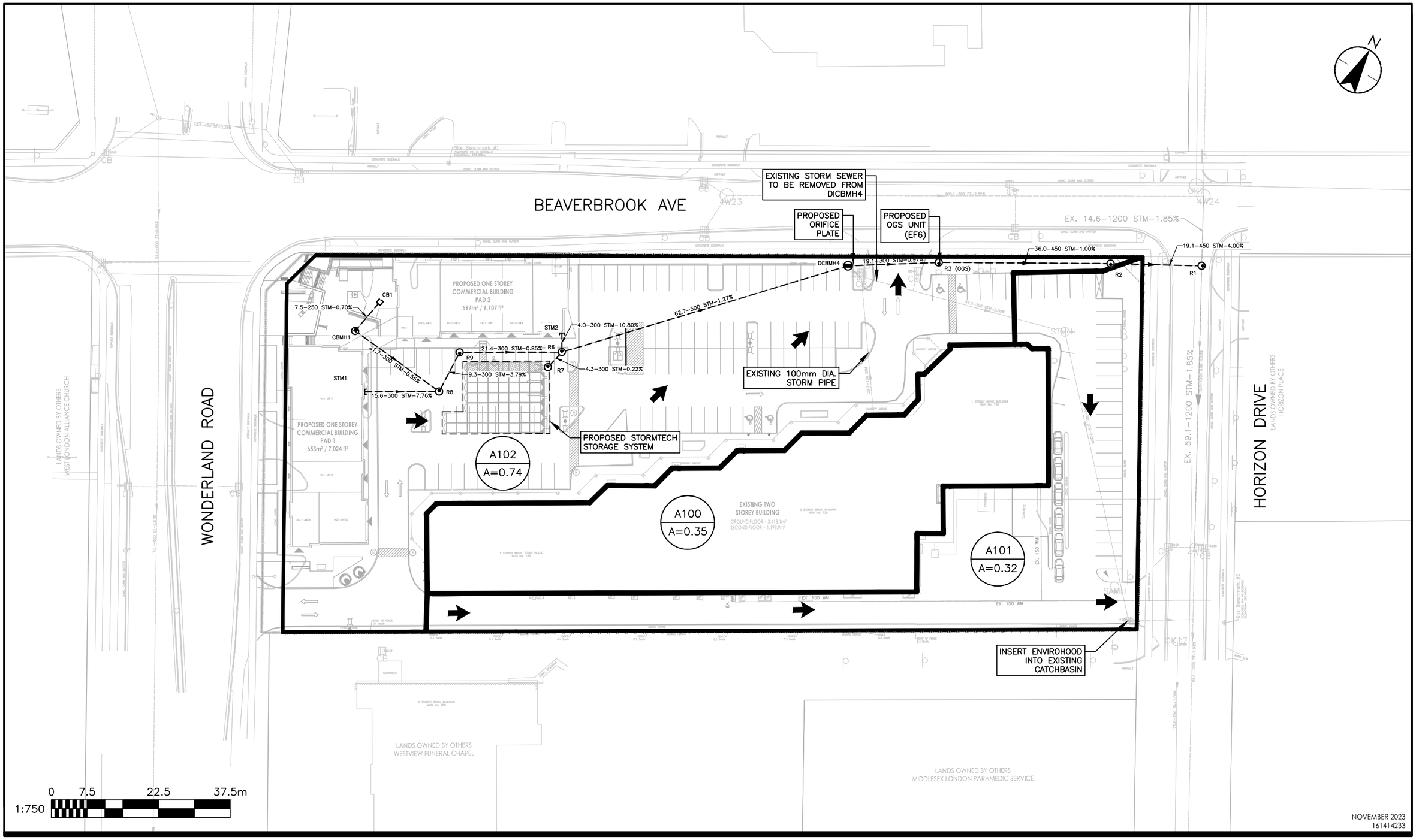
Attachments: Drainage Area Plans
SWM Calculations



NOVEMBER 2023
161414233

Stantec

1305 Riverbend Road
London ON Canada
Tel.

Legend

A201 / A=1.73 — AREA ID / CONTRIBUTING AREA (ha)

MAJOR OVERLAND FLOOD ROUTE

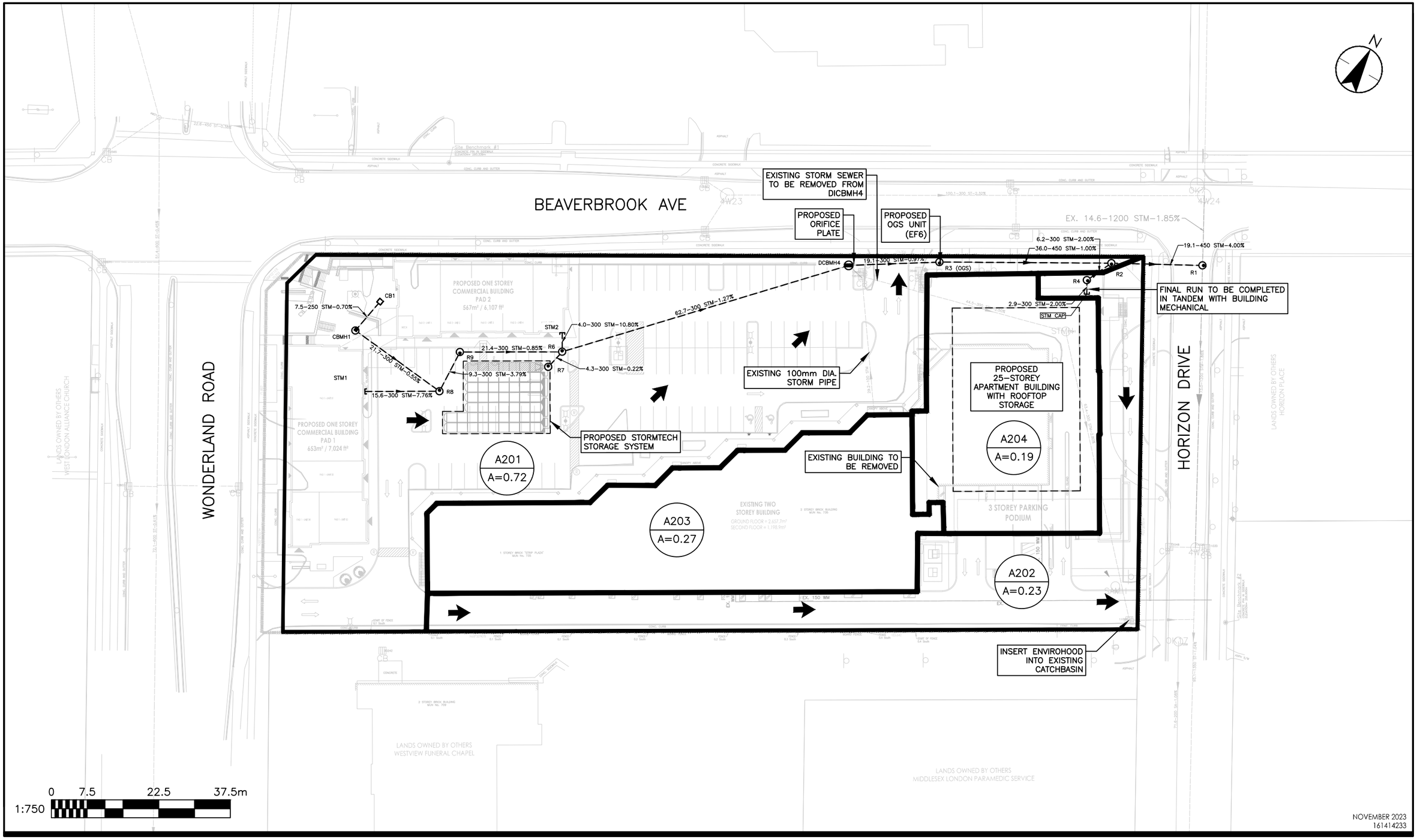
DRAINAGE BOUNDARY

NOTE: THIS FIGURE ACCOMPANIES THE PREVIOUS SWM LETTER SUBMISSION FOR 735 WONDERLAND ROAD (V1, RECEIVED JUNE 2023).

Client/Project
YORK DEVELOPMENTS INC.
735 WONDERLAND ROAD

Figure No.
1.0

Title
PREVIOUS STORM DRAINAGE AREA CONCEPT FIGURE



Stantec

1305 Riverbend Road
London ON Canada
Tel.

Legend

A201 / A=1.73 — AREA ID / CONTRIBUTING AREA (ha)

MAJOR OVERLAND FLOOD ROUTE

DRAINAGE BOUNDARY

NOTE: THIS FIGURE REPRESENTS THE CURRENT PROPOSED SWM STRATEGY AND ACCOMPANIES V2 OF THE LETTER TITLED 735 WONDERLAND ROAD SWM STRATEGY UPDATE (SUBMITTED NOVEMBER 2023)

Client/Project
YORK DEVELOPMENTS INC.
735 WONDERLAND ROAD

Figure No.
2.0

Title
PROPOSED STORM DRAINAGE AREA CONCEPT FIGURE

Subject: **Runoff Coefficient Calculations**
Project: **735 Wonderland Road**
Project No.: **161414233**
Client: **York Developments**
Date: **27-Nov-23**

	% of Total Area	Area (ha)	Runoff Coefficient	CA
Impervious Land	95.00	1.37	0.90	1.24
Pervious Land	5.00	0.07	0.20	0.01

Composite Runoff Coefficient 0.87 -
Total Drainage Area 1.45 ha

Subject:	**Target Flows (StormTech Release)**
Project:	**735 Wonderland Road**
Project No.:	**161414233**
Client:	**York Developments**
Date:	**27-Nov-23**

Target Flow

Total Drainage Area	1.45	ha	
Runoff Coefficient	0.65	-	
tc	13.5	min	From DSRM Fig 5.3
	5-Year		
A	1183.74		
B	7.641		
C	0.838		
Rainfall Intensity	91.8	mm/hr	$I = A/(T+B)^C$
Peak Discharge	0.240	cms	$Q = 0.0028CIA$

Uncontrolled Portion

Total Drainage Area	0.35	ha	
Runoff Coefficient	0.87	-	
tc	10.5	min	From DSRM Fig 5.3
	5-Year		
A	1183.74		
B	7.641		
C	0.838		
Rainfall Intensity	104.4	mm/hr	$I = A/(T+B)^C$
Peak Discharge	0.088	cms	$Q = 0.0028CIA$

Remaining Capacity	0.152

Subject:	**Target Flows (Apartment Building)**
Project:	**735 Wonderland Road**
Project No.:	**161414233**
Client:	**York Developments**
Date:	**27-Nov-23**

Target Flow

Total Drainage Area	1.45	ha	
Runoff Coefficient	0.65	-	
tc	13.5	min	From DSRM Fig 5.3
	5-Year		
A	1183.74		
B	7.641		
C	0.838		
Rainfall Intensity	91.8	mm/hr	$I = A/(T+B)^C$
Peak Discharge	0.240	cms	$Q = 0.0028CIA$
From Stormtech System	0.150	cms	

Uncontrolled Portion

Total Drainage Area	0.23	ha	
Runoff Coefficient	0.90	-	
tc	10.25	min	From DSRM Fig 5.3
	5-Year		
A	1183.74		
B	7.641		
C	0.838		
Rainfall Intensity	105.6	mm/hr	$I = A/(T+B)^C$
Peak Discharge	0.061	cms	$Q = 0.0028CIA$

Apartment Building

Total Drainage Area	0.19	ha	
Runoff Coefficient	0.90	-	
tc	10.25	min	From DSRM Fig 5.3
	5-Year		
A	1183.74		
B	7.641		
C	0.838		
Rainfall Intensity	105.6	mm/hr	$I = A/(T+B)^C$
Peak Discharge	0.050	cms	$Q = 0.0028CIA$

Remaining Capacity	0.030	cms

Subject:	**Orifice Calcs**
Project:	**735 Wonderland Road**
Project No.:	**161414233**
Client:	**York Developments**
Date:	**27-Nov-23**

Orifice Sizing

Target Flow	**0.030**	**m^3/s**	
		Orifice C:	0.6
		Invert (m):	100.00
		Diameter (mm):	**225**
		Centre (m):	100.1125
		Area (m^2):	0.040
		Q=CA(2gh)^0.5	
Design Q	0.149	m^3/s at 2m head	

Subject:	**StormTech Storage Requirements**
Project:	**735 Wonderland Road**
Project No.:	**161414233**
Client:	**York Developments**
Date:	**27-Nov-23**

			100-year IDF	
Total Drainage Area	1.10	ha	**A**	2619.393
Runoff Coefficient	0.87	-	**B**	10.5
Adjustment	25	%	**C**	0.884
Effective Runoff Coefficient	0.95			
2 Year Release Rate	0.15	cms		

Time	Rainfall Intensity (mm/hr)	Peak Runoff Rate (cms)	Incremental Runoff Volume (cu. m)	Incrimental Outflow Volume (cu. m)	Storage Volume (cu. m)
5	232.2	0.674	202.25	44.83	157.41
10	181.4	0.527	315.92	89.66	226.25
15	149.6	0.434	390.73	134.50	256.23
20	127.7	0.371	444.71	179.33	265.38
25	111.6	0.324	486.08	224.16	261.91
30	99.4	0.288	519.15	268.99	250.16
35	89.6	0.260	546.45	313.83	232.62
40	81.8	0.237	569.53	358.66	210.87
45	75.2	0.218	589.42	403.49	185.93
50	69.7	0.202	606.83	448.32	158.50
55	65.0	0.189	622.26	493.16	129.10
60	60.9	0.177	636.09	537.99	98.10
65	57.3	0.166	648.60	582.82	65.77
70	54.1	0.157	659.99	627.65	32.34
75	51.3	0.149	670.45	672.49	-2.03
80	48.8	0.142	680.11	717.32	-37.21
85	46.5	0.135	689.07	762.15	-73.08
90	44.5	0.129	697.42	806.98	-109.56
95	42.6	0.124	705.24	851.82	-146.58
100	40.9	0.119	712.58	896.65	-184.07
105	39.3	0.114	719.50	941.48	-221.98
110	37.9	0.110	726.05	986.31	-260.26
115	36.6	0.106	732.26	1031.15	-298.89
120	35.3	0.103	738.15	1075.98	-337.82

Required Storage	**265.38**

Subject:	**Rooftop Storage Calculations**
Project:	**735 Wonderland Road**
Project No.:	**161414233**
Client:	**York Developments**
Date:	**27-Nov-23**

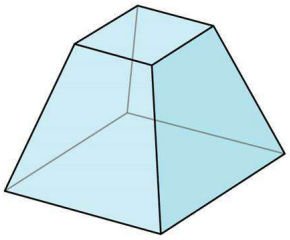
			100-year IDF	
Total Drainage Area	0.19	ha	**A**	2619.393
Runoff Coefficient	0.90	-	**B**	10.5
Adjustment	25	%	**C**	0.884
Effective Runoff Coefficient	0.95			
2 Year Release Rate	0.03	cms		

Time	Rainfall Intensity (mm/hr)	Peak Runoff Rate (cms)	Incremental Runoff Volume (cu. m)	Incrimental Outflow Volume (cu. m)	Storage Volume (cu. m)
5	232.2	0.116	34.93	8.88	26.05
10	181.4	0.091	54.57	17.77	36.80
15	149.6	0.075	67.49	26.65	40.84
20	127.7	0.064	76.81	35.53	41.28
25	111.6	0.056	83.96	44.42	39.54
30	99.4	0.050	89.67	53.30	36.37
35	89.6	0.045	94.39	62.18	32.20
40	81.8	0.041	98.37	71.07	27.31
45	75.2	0.038	101.81	79.95	21.86
50	69.7	0.035	104.82	88.83	15.98
55	65.0	0.033	107.48	97.72	9.77
60	60.9	0.031	109.87	106.60	3.27
65	57.3	0.029	112.03	115.48	-3.45
70	54.1	0.027	114.00	124.36	-10.37
75	51.3	0.026	115.81	133.25	-17.44
80	48.8	0.024	117.47	142.13	-24.66
85	46.5	0.023	119.02	151.01	-31.99
90	44.5	0.022	120.46	159.90	-39.43
95	42.6	0.021	121.81	168.78	-46.97
100	40.9	0.021	123.08	177.66	-54.58
105	39.3	0.020	124.28	186.55	-62.27
110	37.9	0.019	125.41	195.43	-70.02
115	36.6	0.018	126.48	204.31	-77.83
120	35.3	0.018	127.50	213.20	-85.70

Required Storage	**41.28**

Subject:	**Roof Ponding Calcs**
Project:	**735 Wonderland Road**
Project No.:	**161414233**
Client:	**York Developments**
Date:	**27-Nov-23**

Truncated Pyramid



Bottom area of a truncated pyramid can be found using the following formula

$$A = LW + 2Zx(L + W) + (2Zx)^2$$

Where:
- L=Bottom Length
- W=Bottom Width
- Z=Slope (Run/Rise)
- x=Depth

To find the volume, the above equation can be integrated on the limits from zero (0) to the Depth (D)

$$V = \int_0^D \left[LW + 2Zx(L + W) + (2Zx)^2\right] dx$$

Assumptions

1. 80% of the roof area can be used for storge
2. Roof slope is 1.0%
3. Max allowable depth is 0.15m
4. Ponding occurs on top of 25-storey residential roof area (area = 1025 sq.m)

Evaluating, we get:

$$V = LWD + \frac{4D^3Z^2}{3} + D^2Z(L + W)$$

Side Slopes [Z] =	100	:1	→ Slope =	1 %
Base Length [L] =	3	m		
Base Width [W] =	2	m		
Depth [D] =	0.145	m	→ Depth =	5.7 "
Volume [V] =	52.5	cu.m		
Top Area [A] =	997.96	sq.m		
Allowable Ponding =	80%			
Actual Volume =	42.00	cu.m		