Stormwater Management Report
Prince of Wales & Meadowland Drive KDR Redevelopment

SHELL CANADA LIMITED

NOVEMBER 27, 2024

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Revision History

Revision #	Date	Revised By	Revision Description
0	JULY 19 2024	YVONNE	ORGINAL
1	NOV 27 2024	YVONNE	SITE PLAN REVISED SWM AREAS

Authors

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1 Project Information

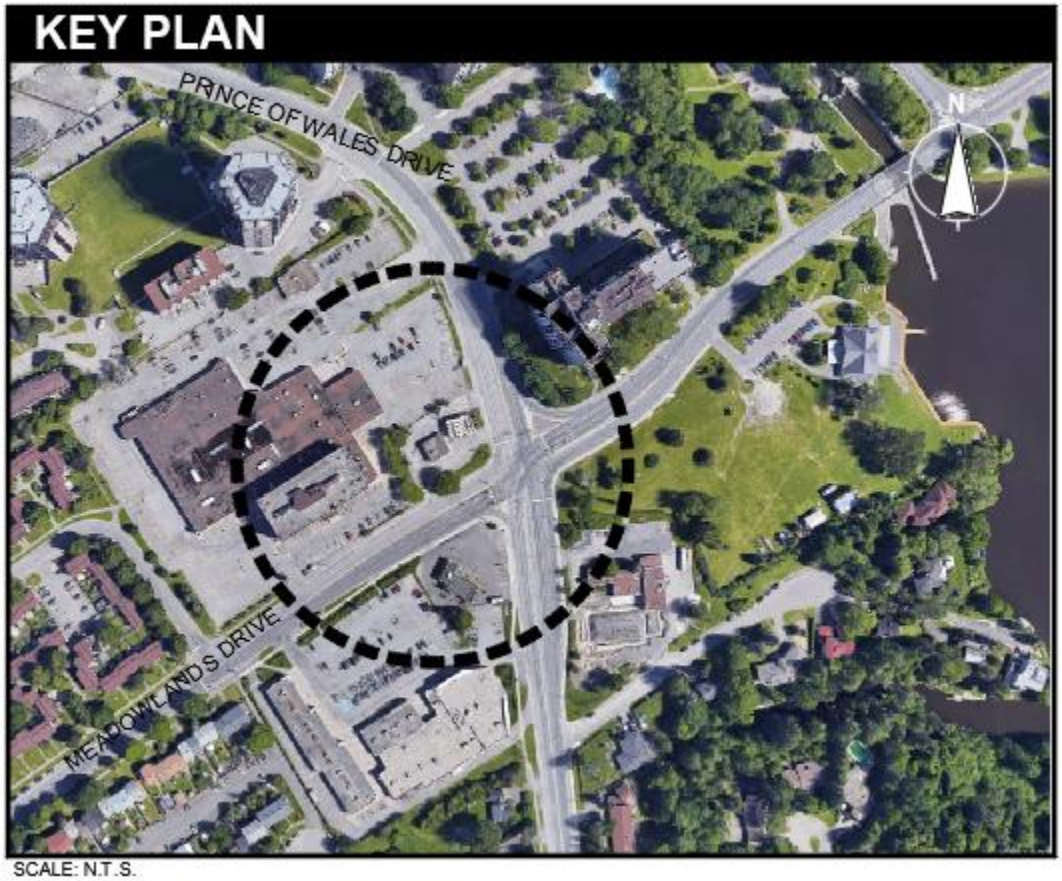
Client:	Shell Canada Products
Contact:	Kerry Morrison, EPCM Advisor
Project Name:	Prince of Wales & Meadowlands KDR
Description:	Redevelopment (Knockdown Rebuild) Gas Bar with Canopy, C-store
Location:	1440 Prince of Wales Drive, Ottawa, Ontario
Consultant:	CTM Design Services Ltd.
Contact:	Yvonne Faas, P.Eng. Civil Engineer

2 Introduction

CTM Design Services Ltd. (CTM) has been retained by Shell Canada Products to provide consulting engineering services for the proposed redevelopment of the property located on the northwest corner of the intersection of Prince of Wales Drive and Meadowlands Drive. The address is 1440 Prince of Wales Drive, Ottawa, Ontario. The location map is shown in Figure 1.

2.1 Location Map

The site is located west of Prince of Wales Drive and north of Meadowlands Drive.



2.2 Existing Conditions

The subject site is 0.444 hectares in size. The site is currently occupied by one c-store and attached canopy over the gas bar which includes 4 dispensers, and a fenced in garbage enclosure. There are two commercial accesses from Prince of Wales Drive and one commercial access from Meadowlands Drive. The existing site cover consists of paved parking and drive areas, and some perimeter grassed landscaping with some mature trees.

2.3 Proposed Conditions

The proposed site will consist of a new C-store, a new 4-dispenser gas bar covered by a canopy, new underground tanks will be installed, new drive-through lanes adjacent to the back property lines, new in-ground waste containers, new retaining wall adjacent to existing parking lot, and new EV charging stations. There will be one commercial access from Prince of Wales Drive and one commercial access from Meadowlands Drive. Most of the site cover will consist of paved parking and drive areas, and some perimeter landscaping frontage; existing mature trees will be protected where possible.

2.4 Purpose of Report

This Stormwater Management Report outlines the engineering design elements for the proposed development, including site grading and driveway access, storm sewers and stormwater management. This report has been prepared in support of the Site Plan Application (SPA).

2.5 Supporting Drawings

This report has been prepared based on the Site Plan, Site Grading, Servicing and Stormwater Management Plans, both Existing and Proposed Conditions and Erosion and Sediment Control. Supporting drawings will accompany the Site Plan Application.

3 Stormwater Management – Existing Conditions

3.1 Existing Conditions

Currently, the site is primarily covered with asphalt and concrete surfaces that drain from north to south and west to east, with slopes ranging from 1% to 5%. Two catch basins in the parking lot collect runoff and direct it into a storm sewer system that discharges into the sewer main on Meadowlands Drive. A third catchbasin is located at the edge of the north-east property line, picking up a portion of the runoff leaving the north catchment of the site.

The existing building and canopy have roof leaders connected directly to the storm system.

The landscaped areas are mostly grass, with slopes ranging from 1% to 15%, and runoff currently flows offsite unmitigated.

On-site Storage:

The as-built survey indicates minimal on-site storage capacity, which means the site cannot detain significant volumes of stormwater.

Catchbasins in Flow-by Conditions:

Existing catchbasins are not effectively capturing all the runoff, particularly during higher flow rates. When catchbasins are in flow-by conditions, water bypasses them rather than being captured and conveyed through the drainage system.

No Ponding Storage:

There's no evidence of ponding storage on-site, which could otherwise help in temporarily storing runoff and reducing peak flow rates.

Inlet Capture Efficiency:

During higher flow rates, the efficiency of inlets (catchbasins) to capture runoff decreases exponentially. This is a common issue, as inlets can become overwhelmed, especially if they are not adequately sized or maintained.

Overland Escape Flows:

Under existing conditions, capture during 1:2 and 1:5 year flows into the catchbasins is occurring. Overland flows occur during storm events greater than 1:5. Significant escape flows occur during 1:100 year storm events. Full calculations are provided in Appendix A.

3.3 Table 1: Existing Stormwater Peak Flows and Runoff Volume

EXISTING STORMWATER PEAK FLOWS AND RUNOFF VOLUMES				
CONDITION	2 YEAR	5 YEAR	100 YEAR	UNITS
TOTAL PEAK FLOW GENERATED	30	39	63	L/s
FREE FLOW OFFSITE	2	2	3	L/s
CONTROLLED IN PIPE	28	37	60	L/s
STORAGE VOLUME PROVIDED	4	4	4	m^3

4 Stormwater Management – Proposed Conditions

4.1 Proposed Conditions

The proposed redevelopment site will see an increase to the asphalt and concrete surfaces, and a corresponding decrease to the landscaped surface area. Therefore, an increase in the overall runoff coefficient from 0.77 to 0.84 will occur.

For the redevelopment site, the proposed stormwater management (SWM) plan addresses several elements to improve the current conditions and manage surface runoff effectively:

Site Grading and Drainage:

Slopes will range from 1% to 5% for asphalt and concrete surfaces, and 1% to 10% for landscaped areas.

The site will be graded towards containment of stormwater runoff into two (2) catchbasins and three (3) grated top manhole.

Areas of uncontrolled, unmitigated, free flow have been minimized. Small areas of landscape frontage drains offsite to public lands and a small portion of the access crossing drains onto Meadowlands Drive.

Roof Leaders:

The proposed building and canopy will have roof leaders that connect directly to the stormwater system, ensuring that runoff from these structures is managed effectively. Alternatively, it may be possible to redirect the rain water leaders to the north landscaped area for infiltration, however, it is a small area, and offers little value. Drainage to the south would offer more landscaped area for infiltration, however a sidewalk crossing would be needed, and there is potential for ice build up or clogging. Regular maintenance would be recommended.

Ponding Conditions:

The new catchbasins and grated top manholes will be designed to create ponding conditions, maximizing on-site storage and reducing peak runoff. Ponding depth will be less than 0.300m.

Flow Control:

An orifice plate will be installed on the outlet pipe to control the release rate of stormwater, ensuring it matches allowable release rate for a runoff coefficient of 0.50, matching a 1:2 year storm event. At this site, the allowable release rate is 19 L/s. The minimum orifice diameter allowable is 75mm. When the 1:100 year ponding elevation is reached, the head acting on the orifice will limit the flow to 18L/s.

Oil Grit Separator (OGS):

A new OGS unit will be installed to treat runoff, removing oil and grit before discharge. A Stormceptor Model EF04 was sized to meet local guidelines.

Overland Escape Flows:

Under proposed conditions, there will be no overland escape flows upto and including the 1:100 year design storm event, which is a significant improvement over existing conditions. The controlled overland escape route will be to via the access crossings to Prince of Wales Drive and Meadowlands Drive.

Full calculations are provided in Appendix B.

4.2 Table 2: Proposed Redevelopment Stormwater Peak Flows and Runoff Volume

PROPOSED STORMWATER PEAK FLOWS AND RUNOFF VOLUMES				
CONDITION	2 YEAR	5 YEAR	100 YEAR	UNITS
TOTAL PEAK FLOW GENERATED	31.4	41.1	66.5	L/s
UNCONTROLLED, FREE FLOW OFFSITE	2.6	3.5	5.5	L/s
CONTROLLED FLOW TO PIPE	28.8	38.0	60.9	L/s
STORAGE VOLUME REQUIRED	9	13	27	m3
STORAGE VOLUME PROVIDED	53	53	5	m3

4.3 Quantity Control

Peak flow calculations are based on rainfall intensity duration frequency (IDF) curves in accordance with the municipal standards. The rainfall intensity values, i, for the2, 5 and 100 year return periods are sourced from the following compilation:

- Ottawa Sewer Design Guidelines
- nearby gauged data provided by Environment Canada
- compiled through Simonovic, S.P., A. Schardong, R. Srivastav, and D. Sandink (2015), IDF_CC Web-based Tool for Updating Intensity-Duration-Frequency Curves to Changing Climate – ver 6.0, Western University Facility for Intelligent Decision Support and Institute for Catastrophic Loss Reduction, open access https://www.idf-cc-uwo.ca.

4.4 Table 3: IDF data

Duration (min)	2 Year (mm/hr)	5 Year (mm/hr)	100 Year (mm/hr)
10	76	101	162

For detailed calculations refer to Appendices A & B. Using the Modified Rational Method, the maximum storage volume requirement and the peak escape flow were predicted for the 1:2, 1:5 and 1:100 year storm events.

4.5 Table 4: Surface Storage

Pond	Area (sq.m)	Depth (m)	Volume (cu.m)
1	120	0.250	10.0
2	140	0.250	11.7
3	218	0.240	17.4
TOTAL			39.1

4.6 Table 5: Underground Storage

Item	Rim or Water Level	Outlet Inv.	Radius	Volume (cu.m)
CB1	82.24	80.34	0.45	1.21
CB2	82.24	80.37	0.45	1.19
GTMH1	82.25	80.03	0.60	2.51
GTMH2	82.42	80.13	0.60	2.59
GTMH3	82.29	80.21	0.60	2.35
TOTAL				9.85

Item	Length	Diameter	Volume (cu.m)
PIPE	19.523	0.150	1.38
PIPE	26.133	0.150	1.85
PIPE	5.739	0.150	0.41
PIPE	7.655	0.150	0.54
TOTAL			4.17

4.7 Table 6: Total Storage

Total Storage	Volume (cu.m)
Surface Storage	39.1
Underground Storage	14.0
Total Storage	53.1

4.8 Quality Control

The landscape areas are generally considered clean runoff and thus permitted to infiltrate and runoff.

The driving surfaces on the redevelopment site will be prone to oil, grit, and sediment collection. These areas will be collected into the on-site storm sewer and transported to an Oil Grit Separator Unit sized to achieve Enhanced Protection Level (Level 1 treatment) which provides a minimum 80% TSS removal. This specification was provided by Ontario Provincial Regulations, Stormwater Management Planning and Design Manual.

For this application a Stormceptor® EF/EFO type oil and grit separator will be selected in accordance with the manufacturer's recommendations. Refer to Appendix C for supporting product documentation, verification of the target 80% TSS removal, Standard Specification, Owner's Manual including Operations & Maintenance Manual.

5 Summary

The proposed redevelopment of this site aims to significantly improve the current stormwater management system. The new plan will substantially reduce unmitigated overland escape flows, with the discharge rate being controlled by an orifice plate under ponding conditions. Onsite storage capacity has been maximized within the constraints of site grading. Additionally, a new Oil Grit Separator will be installed to further enhance stormwater quality management.

Appendices

Appendix A – Existing Conditions SWM Calculations

Appendix B – Proposed Redevelopment SWM Calculations

Appendix C – Oil Grit Separator Product Supporting Documents

Appendix A – Existing Conditions SWM Calculations

1:2 Year Storm Event

Existing A1	Area, m^2	C		
Building & Canopy	241	1	241	m^2
Asphalt/Concrete	1135	0.9	1022	m^2
Landscaping	419	0.3	126	m^2
Total	1795	0.77	1388	m^2

Rational Method

A =	0.1388	ha
i	76.4	mm/h
Q1 =	2.78*A*C*i	L/s
C1 =	0.77	
Q1 =	30	L/s

1:100 Year Storm Event

Rational Method

A =	0.1388	ha
i	162	mm/h
Q1 =	2.78*A*C*i	L/s
C1 =	0.77	
Q1 =	62.5	L/s

Allowable Release Rate for design of redevelopment sites are determined by using the smaller of a runoff coefficient of 0.5 for the 1:2 year storm event.

Rational Method

A =	0.1388	ha
i	76.4	mm/h
Q1 =	2.78*A*C*i	L/s
C1 =	0.5	
Q1 =	19	L/s

Appendix B – Proposed Redevelopment SWM Calculations

A2-1

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	300	0.9	270	m^2
Landscaping	36	0.3	11	m^2
Total	336	0.84	281	m^2

A2-2

Post-Dev	Area, m^2	C		
Building & Canopy	289	1	289	m2
Asphalt/Concrete	235	0.9	212	m2
Landscaping	28	0.3	8	m2
Total	552	0.92	509	m2

A2-3

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	200	0.9	180	m^2
Landscaping	0	0.3	0	m^2
Total	200	0.90	180	m^2

A2-4

Post-Dev	Area, m^2	C		
Building & Canopy	190	1	190	m^2
Asphalt/Concrete	0	0.9	0	m^2
Landscaping	0	0.3	0	m^2
Total	190	1.00	190	m^2

A2-5

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	194	0.9	175	m^2
Landscaping	65	0.3	20	m^2
Total	259	0.75	194	m^2

B2-1

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	33	0.9	30	m^2
Landscaping	115	0.3	35	m^2
Total	148	0.43	64	m^2

B2-2

Post-Dev	Area, m^2	C		
Building & Canopy	0	1	0	m^2
Asphalt/Concrete	43	0.9	39	m^2
Landscaping	67	0.3	20	m^2
Total	110	0.53	59	m^2

ORIFICE CONTROL IN PR. GTMH#1

	1:2 Year	1:100 Year	
R =	38	38	mm
A_0 =	0.00454	0.00454	m^2
Head Calculation			
Top of Pond =	81.300	82.380	m
Pipe Invert =	80.030	80.030	m
Water depth in outgoing pipe (if orifice submerged) =	0.092	0.110	m
H_0 =	1.178	2.282	m/m
Q_{A2} =	13.1	18.2	L/s

STORAGE VOLUME REQUIRED (RATIONAL METHOD MODEL)

	1:2 Year	1:100 Year	
VOLUME $_{REQ}$ =	9.4	27.0	m^3
ELEVATION REACHED =	81.30	82.38	m

STORAGE VOLUME PROVIDED

Storage Volume Available in Surface Ponding =	39.1	m^3
SPILL ELEVATION =	82.49	m
Underground Pipe & Barrel Storage	14.0	m^3
Total Storage	53.1	m^3

TOTAL FREE FLOW + CONTROLLED FLOW =

	1:2 Year	1:100 Year	
$Q_{B2} + Q_{A2}$ =	15.7	23.8	L/s

$Q_{PR} < Q_{ALL}$

$VOL_{REQ} < VOL_{AVL}$

Appendix C – Oil Grit Separator Product Supporting Documents