Technical Memorandum

Project Name: 1120 Cooke Blvd

MTE File No.: 48247-100

To: Joshua Medeiros, City of Burlington

Date: June 30, 2023

cc:

From: George Berenyi, MTE Consultants

RE: External Drainage flows on Waterdown Road

MTE Consultants Inc. were retained by ADI Developments (Masonry) Inc. to complete the site grading, servicing, and stormwater management design for the proposed mixed-used development located at 1120 Cooke Boulevard in the City of Burlington (see Key Plan in Figure 4). The overall site comprises 0.97ha. Following the OPA/ZBA submission, the City's engineering department requested additional calculations to show that the external storm water flows on Waterdown Road would not enter the site via the proposed entrance driveway (high point of 108.75m). In addition, they asked to check whether the proposed CSP culvert can handle the 25yr flow from the east boulevard assuming 50% blockage and to show the upstream 100yr ponding limits. This technical memorandum addresses these concerns.

Flows to Waterdown Road DCBs at Low Point

Referring to Figure 4, External Catchment Area Plan, we have identified and labeled four distinct external catchment areas on Waterdown Road, EXT1 to EXT4, which are tributary to the low point at pair of the existing DCBs just north of the proposed entrance (east side DCB top grate = 108.35m, top of curb 108.50). We used the as-built plan and profiles as supplied by the City and Region, as well as google street view, to establish the drainage boundaries and existing overland flow routes (the white arrows).

These areas are labelled as EXT1 to EXT4 and are assumed to have a 0.95 runoff coefficient (i.e. 99% impervious). The north south boundary between them is the existing crown of the pavement. A storm design sheet is attached, showing the overland flow tributary to the DCB low point by subtracting the 5-year flows captured by the existing storm sewers on Waterdown Road from the 100-year flows. The four overland flows are added together to get the total flow (~152L/s) which is to spill east over the existing DCB.

Next, we used the FlowMaster software to check that each individual external area could handle its overland flow by conservatively using a "gutter" model to check the flow depth and spread. In each case, the flows are contained by a spread less than a typical single lane width (max. 2.3m) and a depth less than 0.065m, and this includes the flow from both sides of any additional crown from a future centre median.

The total overland flow from all four external areas was then modelled using a broad crested weir to check the flow depth over the DCB on the east side at the low point on Waterdown Road. The results conservatively show that even with 2m of flow either side of the DCB (a 4m top width), and the proposed 1.5m wide sidewalk (Crest elevation = 180.50 + 1.5m x2.0% = 180.53m), the maximum depth of flow (headwater elevation) to achieve the design flow of 152L/s is 180.61m. Since the proposed high point of the entrance driveway is 108.75m, there is minimal risk of overland flow entering the site via the driveway.

For more details of the above overland flow calculations, please refer to the enclosed design sheet, FlowMaster design output and Figure 4.

Flows to Proposed Culvert within East Blvd

The grassed and treed area in the east boulevard that drains to the proposed culvert under the entrance is shown on Figure 4 as EXT5 and is 0.224ha. Of that area, 340m^2 will be gravel so a calculation of the percent imperviousness using the City's values for gravel and grass as 80% and 0%, respectively, yields a net percent imperviousness of 12%. This also equates to an average runoff coefficient of C=0.33, as calculated for the design sheet.

Using the above values, including a CSP culvert Manning's n=0.024, and the required x1.25 multiplier to account for expected soil saturation, the calculated 100-year storm flow is 41.7L/s as shown in the enclosed design sheet. At a design slope of 0.5% and using a factor of x0.50 on its capacity to represent 50% blockage (in line with the City's request), a 500mm CSP culvert can handle the 100yr design flow even at half capacity.

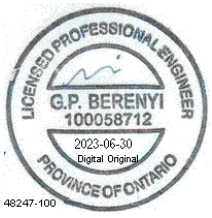
Therefore, since the proposed 500mm CSP culvert can convey the 100yr flow even with 50% blockage, there will not be any upstream ponding during the 100yr storm, and by default the same culvert has more than the capacity required to convey the lesser 25yr storm flow, also with 50% blockage.

Conclusion

We trust the above meets with the City's requirement for the requested calculations as we have shown the external overland flows will not enter the site via the proposed entrance driveway and that the proposed CSP culvert can handle the 25yr flow from the east boulevard assuming it is 50% blocked and there is no upstream 100yr ponding.

Yours truly,

MTE Consultants Inc.



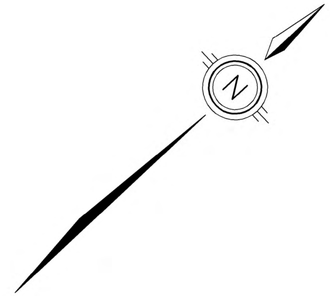
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GBerenyi@mte85.com

GPB:cnf

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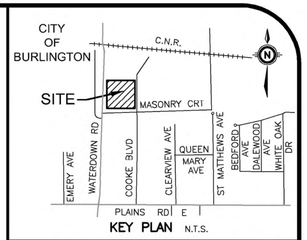
Attachments.





LEGEND

- SITE BOUNDARY
- EXISTING SPOT ELEVATIONS
- EXISTING DIRECTION OF DRAINAGE
- EXISTING STORM SEWER
- STORM SEWER
- CATCHMENT 201
- CATCHMENT 202
- CATCHMENT EXT1
- CATCHMENT EXT2
- CATCHMENT EXT3
- CATCHMENT EXT4
- ID No.
- AREA (Ha)
- PERCENT IMPERVIOUS
- SWM TANK
- TRENCH DRAIN
- OVERLAND FLOW ROUTE (MAJOR STORM)
- AREA DRAIN



KEY PLAN N.T.S.

GEODETIC BM **ELEV. = 100.718m**

ELEVATIONS ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK NO. 001192u2445.

SITE BENCHMARK **ELEV. = m**

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	YYYY-MM-DD
8.			
7.			
6.			
5.			
4.			
3.			
2.	RE-ISSUED FOR ZBA	GPB	2023-02-17
1.	ISSUED FOR ZBA	GPB	2021-11-22

MTE
Engineers, Scientists, Surveyors
905-639-2552

CLIENT
ADI DEVELOPMENT (MASONRY INC)
1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT
1120 COOKE BLVD
THREE MULTI-STOREY BUILDING
1120 COOKE BLVD BURLINGTON, ON

DRAWING
EXTERNAL CATCHMENT AREA PLAN

Project Manager: G. BERENYI	Project No.: 48247-100
Design By: EXK	Checked By: GPB
Drawn By: LXQ/DXC	Checked By: LXQ
Surveyed By: OTHERS	Drawing No.: Figure 4
Date: Mar.05/21	
Scale: 1:1000	Sheet 3 of 3

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MTE FILE PATH:
June 16, 2023 - 11:59:09 AM - Plotted By: Chris Falchuk

1120 Cooke Boulevard

CITY OF
Burlington, Ontario

External O/L Flow DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 48247-100
Date: June 13, 2023
Design By: CNF
Checked By: GXB
File: Q:\48247\100\STM\External drainage calcs\48247-100 External Storm Design Sheet.xls

Drainage Area Plan No:

Design Parameters

5 YEAR STORM

Q=kAIR, k=0.00278
Intensity (I) = $a/(tc+b)^c$
a = 802.04
b = 5.0
c = 0.7640

Manning's "n" 0.013
Min. Velocity 0.750 m/s
Max. Velocity 4.500 m/s

100 YEAR STORM

a = 1281.34
b = 5.0
c = 0.7610
C Multiplier = 1.25

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/s*	*mm*	*m*	*%*	*L/s*	*m/s*	*m/s*
5 YEAR FLOWS																	
Waterdown Rd, east side	EXT1	Mansory Ct	Ex.E.DCB	0.147	0.95	0.140	0.140	10.0	n/a	101	39.2						
	EXT3	Alayne B.Wy	Ex.E.DCB	0.165	0.95	0.157	0.157	10.0	n/a	101	43.9						
Waterdown Rd, west side	EXT2	Mansory Ct	Ex.W.DCB	0.234	0.95	0.222	0.222	10.0	n/a	101	62.3						
	EXT4	Alayne B.Wy	Ex.W.DCB	0.271	0.95	0.257	0.257	10.0	n/a	101	72.2						
(1.25 multiplier used, C<=1.0)																	
100 YEAR FLOWS																	
Waterdown Rd, east side	EXT1	Mansory Ct	Ex.E.DCB	0.147	0.95	0.147	0.147	10.0	n/a	163	66.4						
	EXT3	Alayne B.Wy	Ex.E.DCB	0.165	0.95	0.165	0.165	10.0	n/a	163	74.5						
Waterdown Rd, west side	EXT2	Mansory Ct	Ex.W.DCB	0.234	0.95	0.234	0.234	10.0	n/a	163	105.5						
	EXT4	Alayne B.Wy	Ex.W.DCB	0.271	0.95	0.271	0.271	10.0	n/a	163	122.5						
OVERLAND Flow (100-5)																	
Waterdown Rd, east side	EXT1	Mansory Ct	Ex.E.DCB								27.3						
	EXT3	Alayne B.Wy	Ex.E.DCB								30.6						
Waterdown Rd, west side	EXT2	Mansory Ct	Ex.W.DCB								43.3						
	EXT4	Alayne B.Wy	Ex.W.DCB								50.2						
										Total O/L=	**151.3**						
(1.25 multiplier used, C<=1.0)																	
100 YEAR FLOW															**Modified to 50% Blocked**	For CSP n=0.024	
Driveway Culvert in East Blvd	EXT5	East Blvd	Prop.Culvert	0.224	0.33	0.092	0.092	10.0	n/a	163	41.7	500	9.0	0.50	**72.3**	0.74	0.76

Area EXT1 - gutter flow

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.010 m/m
Discharge	27.30 L/s
Gutter Width	0.3 m
Gutter Cross Slope	0.083 m/m
Road Cross Slope	0.020 m/m
Roughness Coefficient	0.013

Results	
Spread	1.9 m
Flow Area	0.0 m²
Depth	56.5 mm
Gutter Depression	1.9 cm
Velocity	0.71 m/s

Area EXT2 - gutter flow

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.010 m/m
Discharge	43.30 L/s
Gutter Width	0.3 m
Gutter Cross Slope	0.083 m/m
Road Cross Slope	0.020 m/m
Roughness Coefficient	0.013

Results	
Spread	2.3 m
Flow Area	0.1 m²
Depth	64.6 mm
Gutter Depression	1.9 cm
Velocity	0.79 m/s

Area EXT3 - gutter flow

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.013 m/m
Discharge	30.60 L/s
Gutter Width	0.3 m
Gutter Cross Slope	0.083 m/m
Road Cross Slope	0.020 m/m
Roughness Coefficient	0.013

Results	
Spread	1.9 m
Flow Area	0.0 m²
Depth	56.3 mm
Gutter Depression	1.9 cm
Velocity	0.81 m/s

Area EXT4 - gutter flow

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.013 m/m
Discharge	50.20 L/s
Gutter Width	0.3 m
Gutter Cross Slope	0.083 m/m
Road Cross Slope	0.020 m/m
Roughness Coefficient	0.013

Results	
Spread	2.3 m
Flow Area	0.1 m²
Depth	64.9 mm
Gutter Depression	1.9 cm
Velocity	0.90 m/s

BC Weir Calc - Total over DCB

Project Description	
Solve For	Headwater Elevation

Input Data		
Discharge	152.00	L/s
Crest Elevation	180.53	m
Tailwater Elevation	180.53	m
Crest Surface Type	Paved	
Crest Breadth	1.70	m
Crest Length	4.0	m

Results		
Headwater Elevation	180.61	m
Headwater Height Above Crest	0.08	m
Tailwater Height Above Crest	0.00	m
Weir Coefficient	1.64	m^(1/2)/s
Submergence Factor	1.000	
Adjusted Weir Coefficient	1.64	m^(1/2)/s
Flow Area	0.3	m²
Velocity	0.47	m/s
Wetted Perimeter	4.2	m
Top Width	4.00	m