PROPOSED EIGHT STOREY MIXED-USE BUILDING
179 MELLANBY AVE, 48, 56-56½ MAIN ST, PORT COLBORNE

STORM WATER MANAGEMENT DESIGN BRIEF
NEW DEVELOPMENT DRAINAGE SYSTEM

REV 1 – October 24, 2023

PREPARED BY:

HALLEX ENGINEERING LTD.

HALLEX PROJECT #230403

HALLEX NIAGARA
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1. PRE-DEVELOPMENT CONDITIONS

1.1 LOCATION

The proposed eight-storey mixed-use building development is located at 179 Mellanby Avenue, 48 and 56-56½ Main Street, which is at the southeast corner of the Main Street and Mellanby Avenue intersection in the City of Port Colborne, ON.

1.2 DRAINAGE PATTERN

The current drainage path for the site consists mostly of overland sheet flow to the south park area and partly of overland sheet flow to the existing 300mm municipal storm sewer at Main Street. The proposed stormwater management controls will ensure the storm flows are controlled to the pre-development flow rate to the overland sheet drainage route through the south park area.

2. PROPOSED WORK

2.1 GRADING

The objective of the design is to utilize the existing natural slope and achieve the minimum and maximum slopes in the grading of the asphalt surface. This will ensure the surface not only drains as per the design but is not too steep. The grading of the site also ensures that the storm water flow will drain along the overland sheet drainage route while providing measures for storm water quantity controls. The proposed drainage system onsite has been designed according to the five and one-hundred-year storm events as per the City of Welland intensity-duration-frequency curve given an IDF curve is not available from the City of Port Colborne.

2.2 DRAINAGE

The proposed design requires a cast-in-place stormwater management tank (formed as part of the proposed building) and a rip-rap outfall area from the proposed building.

3. DESIGN CONSIDERATIONS

3.1 PRE-DEVELOPMENT SITE DRAINAGE

3.1.1 Peak Runoff

The total drainage area for the development is 0.475 hectares with an existing runoff coefficient of 0.47 based on the existing roof, concrete, gravel and grass surfaces.

The time of concentration is determined to be 10 minutes to the start of the existing drainage system as required by the City of Welland municipal standards.

Using the Rational Method, the peak flow rates are $Q = \frac{CiA}{360}$

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Main St	0.008	10
Area.2	Sheet	South Park	0.467	10
5-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.008	0.76	91	1.5
Area.2	0.467	0.46	91	54.2
TOTAL	0.475	0.47	91	55.7
100-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.008	0.76	143	2.4
Area.2	0.467	0.46	143	85.6
TOTAL	0.475	0.47	143	88.0

Therefore, the total pre-development flow for the subject site is 55.7L/s for the five-year storm and 88.0L/s for the one-hundred-year storm.

3.1.2 Quantity

There is no known storm quantity control measure in place for the pre-development condition.

3.1.3 Quality

There is no known storm quality control measure in place for the pre-development condition.

3.2 POST-DEVELOPMENT SITE DRAINAGE

3.2.1 Peak Runoff

The proposed eight-storey mixed-use building development consists of the demolition of the existing residential and commercial buildings complete with concrete walkways, gravel parking areas and grass areas and the construction of an eight-storey mixed-use building, asphalt laneway and grass areas. The resulting runoff coefficient in the post-development condition of the site is 0.72.

The proposed development will drain from the new building and shall discharge to the rip-rap outfall area on grade at the east side of the building. Drainage from the building and asphalt surfaces shall be graded to ensure storm water will drain along the overland sheet drainage route and shall discharge through the south park area similar to the pre-development site condition. Part of the site will continue to drain directly to Main Street via sheet flow, similar to the pre-development site condition.

The time of concentration is determined to be 10 minutes to the start of the existing drainage system as required by the City of Welland municipal standards.

Using the Rational Method, the peak flow rates are as follows:

Subcatchment	Description	Draining to	Area, ha	Tc, min
Area.1	Sheet	Main St	0.000	10
Area.2	Sheet	South Park	0.000	10
5-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.007	0.70	91	1.2
Area.2	0.468	0.72	91	84.5
TOTAL	0.475	0.72	91	85.7
100-year Storm	A,ha	C	i,mm/h	Q, L/s
Area.1	0.007	0.70	143	1.9
Area.2	0.468	0.72	143	133.3
TOTAL	0.475	0.72	143	135.2

Therefore, the total post-development flow for the subject site is 85.7L/s for the five-year storm and 135.2L/s for the one-hundred-year storm. The flows and other design information are contained in Exhibit #1 for the five -year storm and Exhibit #2 for the one-hundred-year storm at the end of the design brief.

3.2.2 Quantity

The post-development storm water runoff for Area.1 will decrease as a result of the development. As such, stormwater quantity controls are not proposed for this drainage area.

The post-development storm water runoff to the south park area is higher than the pre-development runoff. As such, storm water detention is required to maintain pre-development flow conditions.

Stormwater quantity controls for the site will be achieved by utilizing a 50mm diameter orifice plate at the outlet side of the cast-in-place stormwater management tank prior to discharging to the rip-rap outfall area on grade at the east side of the building. Part of the roof will bypass the stormwater management tank and will discharge without controls to the rip-rap outfall area. The orifice plate will ensure the post-development runoff is controlled to the pre-development runoff rate for the five and one-hundred-year storm events. The resulting 39m^3 volume generated from the five-year storm and 65m^3 volume generated from the one-hundred-year storm will be contained within the cast-in-place stormwater management tank.

The following table summarizes the pre-development flow rates, the post-development uncontrolled flow rates and the post-development controlled flow rates for the subject site:

	Pre- Development Flow Rate (L/s)	Post- Development Uncontrolled Flow Rate (L/s)	Post- Development Controlled Flow Rate (L/s)
5-year Storm			
Area.1	1.5	1.2	1.2
Area.2	54.2	84.5	51.0
TOTAL	55.7	85.7	52.2
100-year Storm			
Area.1	2.4	1.9	1.9
Prop. Sewer	85.6	133.3	79.5
TOTAL	88.0	135.2	81.4

The orifice plate sizing and subsequent storage volume for the detained flow are indicated in Exhibit #3 for the five -year storm and Exhibit #4 for the one-hundred-year storm at the end of the design brief.

3.2.3 Quality

Due to the relatively minor increase in asphalt driving surfaces, and to maintain existing overland drainage routs through the existing parking areas, stormwater quality controls are not proposed for this development.

3.2.4 Maintenance Recommendations

The storm sewer system includes the rip-rap outfall from the proposed building and the grass overland sheet drainage route. It is important to regularly inspect the elements to ensure that storm water is flowing as originally designed. Debris and sediment commonly clog the system and reduce the overall effectiveness.

The following maintenance and inspection tasks should be done:

1. Conduct routine inspections for trash or other debris that may be blocking the overland drainage. (Monthly and after rain events) Remove all trash and debris.
2. Conduct routine inspections for erosion at the rip-rap outfall from the proposed building. (Annually and after rain events). Any erosion shall be corrected by sodding the area. There may be a need to provide further erosion control (ie rip-rap) to prevent the re-occurrence of erosion.
3. If there is a visible accumulation of sediment in the rip-rap area, then removal of sediment accumulation is required.
4. Conduct routine maintenance of overland flow areas including grass cutting.
5. Do not dump any materials in the storm system.

4. CONCLUSION

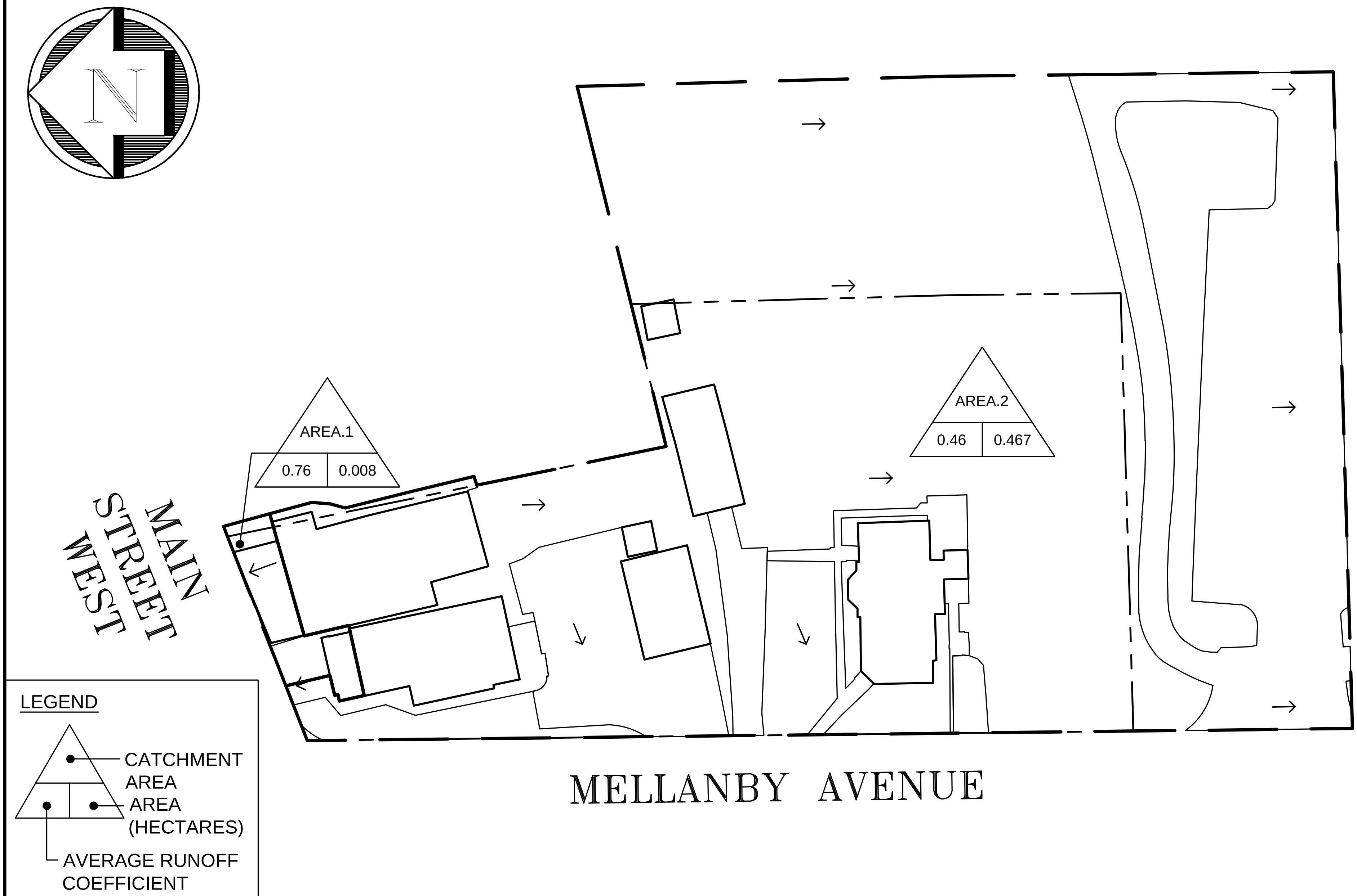
The aforementioned calculations and recommendations for the storm drainage system are based on the current design for the site as of writing this report.

We trust this report meets your approval. Please contact the undersigned should you have any questions or comments.

Yours truly,
HALLEX ENGINEERING LTD

Jim Halucha P.Eng
Civil/Structural Engineer

Jonathan Skinner, C.E.T., B.Tech
Civil Technologist



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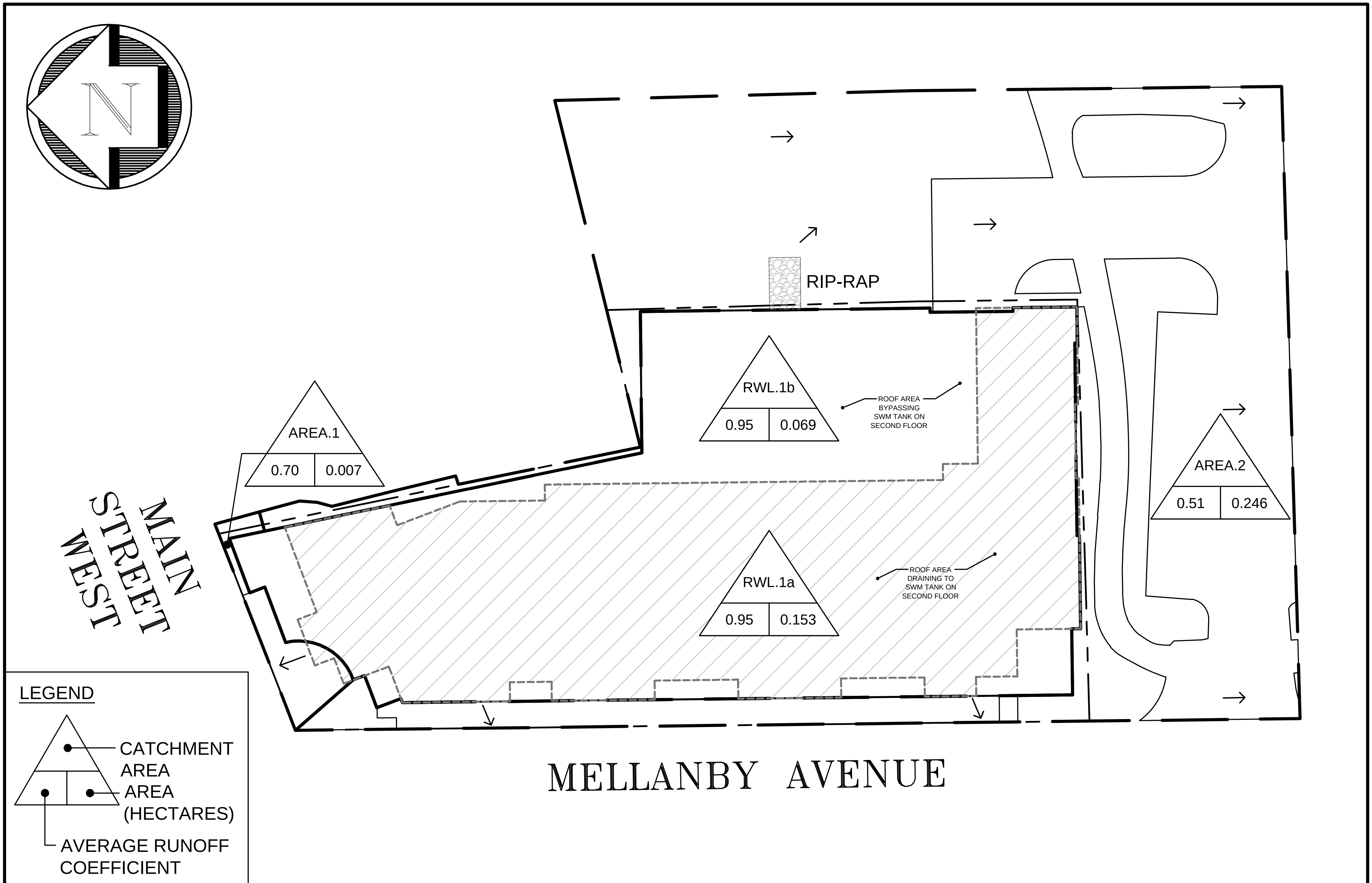
PROJECT:
PROP. 8 STOREY MIXED-USE BUILDING
179 MELLANBY AVENUE, 48 & 56-56-1/2 MAIN STREET, PORT COLBORNE, ON

SHEET TITLE:
PRE-DEVELOPMENT CATCHMENT AREA PLAN

DATE: 10/24/2023
SCALE: 1:500
DR. BY: MA
CH. BY: JS/JH
JOB No.: 230403
DWG. CSK1
REV. 1



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PROJECT:
PROP. 8 STOREY MIXED-USE BUILDING
179 MELLANBY AVENUE, 48 & 56-56-1/2 MAIN STREET, PORT COLBORNE, ON

SHEET TITLE:
POST-DEVELOPMENT CATCHMENT AREA PLAN

DATE: 10/24/2023
SCALE: 1:500
DR. BY: MA
CH. BY: JS/JH
JOB No.: 230403
DWG. CSK2
REV. 1

Eight Storey Mixed-Use Building
Exhibit #1 - 5 Year Post - Development Calculations

MUNICIPALITY: **Welland**

Rainfall Intensity Values =
A= 830.000
B= 7.300
C= 0.777

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow	
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)
1	**Area 1**	**Street**	**N/A**	**0.007**	**0.007**	**10.00**	**N/A**	**91**	**23918**	**106.5**	**0.0012**	**0.0012**
Paved	-	-	-	0.005	-	-	-	-	19569.1	97.8	-	-
Grass	-	-	-	0.002	-	-	-	-	4348.7	8.7	-	-
2	**RWL. 1a**	**Tank.**	**N/A**	**0.153**	**0.153**	**10.00**	**N/A**	**91**	**20656**	**3160.4**	**0.0366**	**0.0366**
Roof	-	-	-	0.153	-	-	-	-	20656.2	3160.4	-	-
3	**Tank.**	**RWL. 1b**	**N/A**	**0.000**	**0.153**	**10.00**	**N/A**	**91**	**0**	**3160.4**	**0.0366**	**0.0031**
4	**RWL. 1b**	**Area 2**	**N/A**	**0.069**	**0.222**	**10.00**	**N/A**	**91**	**20656**	**4585.7**	**0.0531**	**0.0196**
Roof	-	-	-	0.069	-	-	-	-	20656.2	1425.3	-	-
5	**Area 2**	**Prpty**	**N/A**	**0.246**	**0.468**	**10.00**	**N/A**	**91**	**23918**	**7299.3**	**0.0845**	**0.0510**
Paved	-	-	-	0.108	-	-	-	-	19569.1	2113.5	-	-
Grass	-	-	-	0.138	-	-	-	-	4348.7	600.1	-	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.20

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

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Eight Storey Mixed-Use Building
Exhibit #2 - 100 Year Post - Development Calculations

MUNICIPALITY: **Welland**

Rainfall Intensity Values =

A= 1020.000
B= 4.700
C= 0.731

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow	
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)
1	**Area 1**	**Street**	**N/A**	**0.007**	**0.007**	**10.00**	**N/A**	**143**	**37748**	**168.2**	**0.0019**	**0.0019**
Paved	-	-	-	0.005	-	-	-	-	30884.8	154.4	-	-
Grass	-	-	-	0.002	-	-	-	-	6863.3	13.7	-	-
2	**RWL. 1a**	**Tank.**	**N/A**	**0.153**	**0.153**	**10.00**	**N/A**	**143**	**32601**	**4987.9**	**0.0577**	**0.0577**
Roof	-	-	-	0.153	-	-	-	-	32600.6	4987.9	-	-
3	**Tank.**	**RWL. 1b**	**N/A**	**0.000**	**0.153**	**10.00**	**N/A**	**143**	**0**	**4987.9**	**0.0577**	**0.0039**
4	**RWL. 1b**	**Area 2**	**N/A**	**0.069**	**0.222**	**10.00**	**N/A**	**143**	**32601**	**7237.3**	**0.0838**	**0.0300**
Roof	-	-	-	0.069	-	-	-	-	32600.6	2249.4	-	-
5	**Area 2**	**Prpty**	**N/A**	**0.246**	**0.468**	**10.00**	**N/A**	**143**	**37748**	**11520.0**	**0.1333**	**0.0795**
Paved	-	-	-	0.108	-	-	-	-	30884.8	3335.6	-	-
Grass	-	-	-	0.138	-	-	-	-	6863.3	947.1	-	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.20

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

Eight Storey Mixed-Use Building
Exhibit #3 - 5 Year Orifice Plate and Storage Volume Calcs

Site Data

Site Discharge	Site Flow	Area.2 Flow	Adj. Flow (Direct Flow to Tank)	Total Storm Volume
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3)
Pre - Develop.	0.0557	0.0542	0.0063	
Post - Develop.	0.0857	0.0845	0.0366	39.0

Outlet Pipe	Storm Control Node
3	Tank.

* Volume calculated using SWMM 5.1 modelling software in accordance with the flow rate for actual size of the orifice.

Head Height 0.33 m

Cast-in-Place Concrete Tank Storage

CIP Tank	Length	Width	Height	Storage Volume
	(m)	(m)	(m)	(m^3)
CIP Tank	12.20	10.00	0.35	42.7
Total				**42.7**

Total Storage = 42.7 m^3 **Required Storage Achieved**

Orifice Diameter Calculation (A=Q/(Cd*sqrt(2*g*h)))

Coefficient of Discharge	Cd =	0.62	(sharp)	0.62 Sharp Orifice coefficient of discharge
Allowable Flow Rate	Q =	0.0063	m^3/s	0.80 Tube coefficient of discharge
Force of Gravity	g =	9.81	m/s/s	
Head Height	h =	0.33	m	
Dia of Max. Orifice	dia =	71.42	mm	Use - 50 mm

Flow Rate for Actual Size of Hole (Q=Cd*A*sqrt(2*g*h))

Area of Orifice	A =	0.0020	m^2
Flow Rate through Orifice	Q =	0.0031	m^3/s

Eight Storey Mixed-Use Building
Exhibit #4 - 100 Year Orifice Plate and Storage Volume Calcs

Site Data

Site Discharge	Site Flow	Area.2 Flow	Adj. Flow (Direct Flow to Tank)	Total Storm Volume
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3)
Pre - Develop.	0.0880	0.0856	0.0100	
Post - Develop.	0.1353	0.1333	0.0577	65.0

Outlet Pipe	Storm Control Node
3	Tank.

* Volume calculated using SWMM 5.1 modelling software in accordance with the flow rate for actual size of the orifice.

Head Height 0.53 m

Cast-in-Place Concrete Tank Storage

CIP Tank	Length	Width	Height	Storage Volume
	(m)	(m)	(m)	(m^3)
CIP Tank	12.20	10.00	0.55	67.1
Total				**67.1**

Total Storage = 67.1 m^3 **Required Storage Achieved**

Orifice Diameter Calculation (A=Q/(Cd*sqrt(2*g*h)))

Coefficient of Discharge	Cd =	0.62	(sharp)	0.62	Sharp Orifice coefficient of discharge
Allowable Flow Rate	Q =	0.0100	m^3/s	0.80	Tube coefficient of discharge
Force of Gravity	g =	9.81	m/s/s		
Head Height	h =	0.53	m		
Dia of Max. Orifice	dia =	79.70	mm	Use - 50	mm

Flow Rate for Actual Size of Hole (Q=Cd*A*sqrt(2*g*h))

Area of Orifice	A =	0.0020	m^2
Flow Rate through Orifice	Q =	0.0039	m^3/s