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EPA 1 BOUNDARY REFINEMENT/FUTURE INDUSTRIAL DEVELOPMENT
8281 Healey Road
BOLTON, ONTARIO

FUNCTIONAL SERVICING REPORT
AND
STORM WATER MANAGEMENT
DESIGN BRIEF

Prepared For:

8281 HEALEY ROAD GP LIMITED
c/o ONE Properties

City File No: RZ 2020-0007

ORIGINAL: JULY 2020
REVISED: FEBRUARY 2021

TABLE OF CONTENTS

DESCRIPTION page

Note: This report should be read in conjunction with the complete Site Servicing & Grading Plans prepared by The Odan/Detech Group Inc.

APPENDIX A
- Aerial Photo of Site

APPENDIX B
- Concept Sanitary Sewer (Fig. SAN)

APPENDIX C
- Concept Storm Sewer (Fig. STM)
- Pre & Post Development Flood Plain Mapping (Fig. FPM)
- Scenario 1, Pre-Development, HEC-RAS Model Output Table
- Scenario 2, Post-Development, HEC-RAS Model Output Table
- Geoprocess Technical Memo (8281 Healey Road Development Fluvial Geomorphology and Erosion Hazard Assessment)
- AM Candaras Technical Memo (Stormwater Management Facility #3 Evaluation for Additional Drainage Design Brief)

APPENDIX D
Cole Engineering HEC-RAS Flood Plain Mapping Program - Sheet No. 172
HEC-RAS Cross Sections (Fig. XSEC)

APPENDIX E
Concept Grading (Fig. SG)
Topographic Survey

EXECUTIVE SUMMARY

It is proposed to develop the existing lands located at 8281 Healey Road in Bolton, Ontario. The site is located on the south side of Healey Road, west of the intersection of Healey Road and Coleraine Drive. The proposed development currently zoned for industrial use. This report together with the EIS will establish the development limits and will address the requirements for storm water drainage to the existing Stormwater Management Pond (SWMP) located on AIMCo lands (Amazon Site) to the south. Preliminary review with AM Candaras confirmed that there is capacity available within the existing downstream pond and that adjustment to the pond inlet and outlet will be required to accommodate the flows from this development. A Technical Memo related to this has been included within Appendix C. This report will evaluate the flood plain and determine impacts as a result of the proposed development on the existing water course as required by the TRCA. Further to the Stormwater Management requirements a brief summary of water and sanitary services will be provided to aid in review of the stormwater management requirements for the development.

8281 Healey Road GP Limited are proposing to develop the subject lands within the context of the permitted uses under the MP-580 and MS-579 zones under the Town of Caledon Zoning By-law 2006-50, as amended. However, prior to finalizing the details of development, adjustments to the EPA1 Zone Boundary that extends through the subject lands are proposed, refer to the Planning Justification Report, as amended, prepared by Zelinka Priamo for further details. The proposed zone boundary refinement is based upon additional environmental analysis of the Clarkway Tributary Corridor. The proposed boundary refinement will continue to maintain the ecological integrity of the Clarkway Tributary Corridor, while making efficient use of the surrounding lands by creating a more developable footprint. Site design matters are to be finalized following the refinement of the zoning boundaries proposed by the Zoning By-law Amendment application.

The proposed waste water flow from this site based on development area of 9.21 ha. will be 10.69 L/sec total including an allowance for infiltration, the total sanitary flow will be adjusted based on the final accepted development limits. The proposed service pipe for the Site will be a Force Main adequately sized at the Site Plan Approval stage to convey flows to the proposed 250mm proposed gravity sewer extension from Coleraine Drive on Healey Road. There is a creek and culvert crossing located on Healey Road which limits the ability to provide a gravity feed directly to the proposed development. The location and details of the proposed sanitary service within the Town right-of-way will require approval from the Town and Region. The preferred location for the Force Main is within the south shoulder of Healey Road to avoid the need for expropriation and or Private Easements. The Region of Peel has indicated that there is an existing 600mm sanitary sewer on Coleraine Drive to accommodate the site. This will be confirmed during the review process with the Region of Peel.

The required water demand for Site is 6.8 L/sec peak hour, 4.5 L/sec peak day and 344.3 L/sec fire flow demand. A fire flow test conducted on November 18 2020 determine that the available fire flows at the nearest hydrant on Healey Road provided for a flow of 2222 USPGPM at 20 PSI or 140 L/sec at 20 PSI. As flows are below that required for the site improvements to the

water main may be required at the SPA stage. Detailed Sprinkler Calculations completed under the Ontario Building Code will confirm if an available fire flow of 140 L/sec will be sufficient for the intended use. It is important to note the Region has planned improvements to increase the existing water main on Healey Road to a 600mm main.

Storm water management can be accomplished as follows:

1. Roof top storage and control flow roof drains. Maximum roof ponding of 150 mm. Emergency overflow scuppers around the roof perimeter.
2. Parking area surface storage including piping and oversized manholes (if required).
3. Downstream storm water management pond providing water quantity and quality as per MOE Design Guidelines. Pond is existing and both quantity and quality have been confirmed by AM Candaras through a separate Technical Memo, refer to Appendix C. The pond was sized to accept allowable flows from an area of 21.87ha. for a 100 year release rate of 180 L/sec/ha. The proposed development area has been established at 9.21 ha. The total allowable flow from the proposed development has thus been established at
4. The pond will provide for Erosion Control detention to a 25mm storm for 48 hours. This will be accomplished in the downstream pond.

The Site is serviceable with water, waste water and storm water quantity and quality controls utilizing the downstream pond. In addition the site has no deleterious effect on the down-stream and up-stream flood plain.

1. BACKGROUND

The property under study is an 13.58 ha (33.54 acres) site. The developable areas will be determined through this report together with the EIS, established currently at 9.21 ha. within this report. The site is located at 8281 Healey Road Coleraine Drive in Bolton, Ontario. The site is located on the south side of Healey Road, west of the intersection of Healey Road and Coleraine Drive. The proposed development is zoned Industrial and the extent of development limits will be determined within this report and the EIS. There are existing residences located to the northwest of the site, north side of Healey Road. The site is primarily an agricultural field (see aerial view). There is an existing drainage feature adjacent to the east within the site boundaries and a portion of this is located within the adjacent lands to the east.

8281 Healey Road GP Limited are proposing to develop the subject lands within the context of the permitted uses under the MP-580 and MS-579 zones under the Town of Caledon Zoning By-law 2006-50, as amended. However, prior to finalizing the details of development, adjustments to the EPA1 Zone Boundary that extends through the subject lands are proposed, refer to the Planning Justification Report, as amended, prepared by Zelinka Priamo for further details. The proposed zone boundary refinement is based upon additional environmental analysis of the Clarkway Tributary Corridor. The proposed boundary refinement will continue to maintain the ecological integrity of the Clarkway Tributary Corridor, while making efficient use of the surrounding lands by creating a more developable footprint. Site design matters are to be finalized following the refinement of the zoning boundaries proposed by the Zoning By-law Amendment application.

The property generally slopes from north to south.

Refer to topographic survey completed by Speight Van Nostrand & Gibson OLS within Appendix E.

2. SCOPE OF WORK

THE ODAN/DETECH GROUP INC. was retained by 8281 Healey Road GP Limited to review the site, collect data, evaluate the site for the proposed industrial use and present the findings in a this Functional Servicing Report in support of a Zoning By-Law Amendment (“ZBA”). The purpose of this Functional Servicing Report is to present findings related to the conveyance of Storm Water from the development to the existing Stormwater Management Pond located on the AIMco (Amazon Site) Lands to the south. In addition this report will determine the development limits based on the floodplain analysis and findings within the EIS determining the natural heritage features as discussed with the TRCA. The scope of work in brief involves the following:

a) Collecting existing servicing drawings from the Town of Caledon and Region of Peel in order to establish availability and feasibility of site servicing;
b) Meetings/conversations with Town Planners & Engineers, Region of Peel and TRCA.
c) Evaluation of the data and presentation of the findings in a Functional Servicing Report for Stormwater Management and Floodplain Mapping in support of a Site Plan Application.

d) Collecting information for Floodplain Modelling from the TRCA.

3. SANITARY WASTE WATER DISPOSAL

The proposed development will consist of an Industrial Development. The area of Building area will be determined at a later date upon determine the development limits. As such the sanitary flows will based on the full development area at this stage and adjusted upon determining the exact development limits.

The proposed service pipe for the Site will be a Force Main adequately sized at the Site Plan Approval stage to convey flows to the proposed 250mm gravity sewer extension from Coleraine Drive on Healey Road. There is a creek and culvert crossing located on Healey Road which limits the ability to provide a gravity feed directly to the proposed development. The location and details of the proposed sanitary service within the Town right-of-way will require approval from the Town and Region. The preferred location for the Force Main is within the south shoulder of Healey Road to avoid the need for expropriation and or Private Easements. The Region of Peel has indicated that there is an existing 600mm sanitary sewer on Coleraine Drive to accommodate the site. This will be confirmed during the review process with the Region of Peel. The site is zoned for he intended use and therefore is considered serviceable.

The Table below shows the summary of the sanitary flow calculations. The development will utilize the existing sanitary sewer on Coleraine Drive. Extension of this sewer will be required on Healey Road to service the development. The proposed conceptual sewer and existing sewers are shown on the proposed sanitary figure in Appendix B.

There are currently no existing sanitary sewer connections to the Site.

This is the only land use proposed for the Site.

The proposed flows are based on the anticipated final development area as determined within this report. At this time the development area used for calculating sanitary flows has been established at 9.21 ha.

Since the tenant(s) for the site are yet to be determined, the actual employee count for the site is unknown. Therefore the calculated sanitary flows were based on the Region of Peel Sanitary Design Guidelines which estimates 70 persons per hectare for the proposed Light Industrial land use. See the following spread sheet below for more details of the calculations.

Note, not all of the Site area will contribute to infiltration as a portion of the site is located within TRCA regulated area.

Based on the above Table the maximum sanitary flow the proposed development will be as follows:

Total = 10.69 L/sec including infiltration.

It is proposed to provide a Force Main to service the development to a new gravity sewer on Healey Road. The Region minimum sewer size is 250mmØ. The 250mmØ sewer will be at a slope of approximately 0.7% to maximize cover and distance for a gravity feed to the development. A pipe with these properties has a full flow capacity of 50.0 L/sec (n=0.013).
This pipe will have sufficient capacity for the proposed development at 8281 Healey Road as well as available capacity for any developments east of 8281 Healey fronting the south side of Healey Road.

The location of the lateral services including the Force Main required for 8281 Healey Road will be determined at the Site Plan Approval stage with the Town of Caledon.

Refer to the Site Servicing drawings for the sanitary sewer system to the site and through the site.

SANITARY FLOW CALCULATIONS

SCENARIO: 8281 Healey Road
Single Warehouse
(Assumed)

This program calculates the sanitary discharge from various land use
As per the Region of Peel Guideline

FILL IN COLOURED CELLS AS REQUIRED

INDUSTRIAL SITE AREA (ha) =	13.58
RESIDENTIAL SITE AREA (ha) =	0.00
TOTAL SITE AREA for infiltration (ha) =	9.21

LAND USE	.	SITE AREA, (ha)	GROSS FLOOR AREA, m2	TOTAL POPULATION	TOTAL DAILY FLOW (LITERS)	AVERAGE DAILY FLOW l/sec	PEAKING FACTOR, M	TOTAL FLOW FROM LAND USE, l/sec
RESIDENTIAL Density 1, using 86 person/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Density 2, using 170 persons/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Density 3, using 270 persons/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Density 3, using 2.7 persons/unit				0	0	0.00	4.50	0.00
RESIDENTIAL Density 4, using 400person/site area				0	0	0.00	4.50	0.00
RESIDENTIAL Density 4, using 2.7 persons/unit				0	0	0.00	4.50	0.00
INDUSTRIAL, Using estimated population for Site (Light Industrial 70 persons/ha)		9.21		645	195215	2.26	3.91	8.85
COMMERCIAL, Using 1.1 persons/100 m2				0	0	0.00	4.50	0.00
OFFICES, Using 3.3 persons/100 m2				0	0	0.00	4.50	0.00
INDUSTRIAL, Using 2 persons/100 m2				0	0	0.00	4.50	0.00
				645				

TOTAL

V1= 195215

Q1=	0.00
Q2=	8.85
Qinfil	1.84
Qtot	10.69

Q = (MqP/86400) + A * I (L/sec)

Q1= total flow from Residential Land Use (L/sec)
Q2= total flow from Industrial Land Use (L/sec)
Qinfil = total flow from infiltration (L/sec)
Qtot = total flow (Land use + infiltration)

V1= Total Volume from Land Use in liters

where :
P is population
q = 302.8 L/person/day for residential and
q = 302.8 L/person/day for INDUSTRIAL
A = gross site area for infiltration
i = 0.20 L/sec/ha (infiltration rate)
Peaking Factor M = 1 + [14 / (4 + (P/1000,1/2))]

4. WATER DISTRIBUTION

Domestic & Fire Water Requirements:

There is an existing 200mm water main located on Healey Road looped from Coleraine Drive to Humber Station Road and 750mm dia. water main on Coleraine Drive. It is proposed to utilize the existing 200mm water main for both domestic and firefighting services to the proposed Industrial lands. As the site is located within an existing Industrial Corridor with large Regional Feeder mains. The Region of Peel constructed a water Tower near the intersection of Holland Road and Coleraine Drive to the north located north of the existing CTC Warehouse site. Future water main improvements on Healy Road by the Region will increase the existing water main to a 600mm dia. main. The anticipated date for this work is between 2025 and 2029.

Fire Flow – based on FUS. All calculations to be verified by Fire Consultant at time of sprinkler design based on the Ontario Building Code (OBC).

Refer to the Fire Underwriters' calculation on the following page for the fire flow demand. In calculating the fire flow demand for the industrial building, the following assumptions were made as the final size of the building is unknown at this time. The calculation assume maximizing the building footprint within the proposed development limits:

- The building is of fire resistive (steel) construction.
- The building will be sprinklered and the sprinkler system will be fully supervised.
- The building contents will be of combustible classification.

A hydrant flow test has been conducted on the existing 300mm water main located in front of the Site on Coleraine Drive. The flow test will provide the available flows and pressures in order to determine if the water supply has sufficient capacity for the proposed development.
According to the MOE criteria, the allowable pressures are as follows:

Condition	**Allowable Pressures (kPa)**	
	Min.	**Max.**
1) Minimum Hour	275	700
2) Peak Hour	275	700
3) Peak Day + Fire Flow	140	700

The unit rate and peaking factors of water consumption, minimum pipe size and allowable pressure in line were established from the Region Design Manual Standards.

The pressures and volumes must be sufficient for peak hour conditions and under fire conditions as established by the Ontario Building Code 2006. The minimal residual pressure under fire conditions is 140 kPa (20.3 psi).

The required firefighting flows are calculated below based on the assumption of maximizing the development area and building area within the development. The final required fire flows will be determined at the Site Plan Approval stage.

WATER SUPPLY FOR PUBLIC FIRE PROTECTION , FIRE UNDERWRITERS SURVEY GUIDE FOR DETERMINATION OF REQUIRED FIRE FLOWS										
F = 220 x C x √ A										
Where:										
F = required fire flow in liters per minute										
C= Coefficient related to the type of construction										
A = the total floor area in square meters (excluding basements) in the building considered										
LOCATION:	8281 Healey Road					**Building:**	Industrial Warehouse			
OBC OCCUPANCY:	Industrial Warehouse					**PROJECT No:**	19233			
BUILDING FOOT PRINT (m2):	48810								Contents	Charge
# OF STOREYS	1								Non-Combustible	-25%
									Limited Combustible	-15%
									Combustible	0%
CONSTRUCTION CLASS:	Non combustible								Free Burning	15%
									Rapid Buring	25%
AUTOMATED SPRINKLER PROTECTION		Credit	Total							
NFPA 13 sprinkler standard	yes	30%							Construction Class	
Standard Water Supply	yes	10%	50%						1.5	Wood Frame
Fully Supervised System	yes	10%							1	Ordinary
		50%							0.8	Non combustible
									0.6	Fire Resistive
CONTENTS FACTOR:	combustible					CHARGE:	0%			
									Separation	Charge
EXPOSURE 1 (south)	Distance to Exposure Building (m)					>45	0%		0-3 m	25%
	Length - Height								3.1 -10 m	20%
EXPOSURE 2 (east)	Distance to Exposure Building (m)					>45	0%		10.1 - 20 m	15%
	Length - Height								20.1 - 30 m	10%
EXPOSURE 3 (west)	Distance to Exposure Building (m)					>45	0%		30.1 - 45	5%
	Length - Height								> 45 m	0%
EXPOSURE 4 (north)	Distance to Exposure Building (m)					>45	0%			
	Length - Height									
						Total:	0%	no more than 75%		
ARE BUILDINGS CONTIGUOUS:	No									
FIRE RESISTANT BUILDING	Are vertical openings and exterior vertical communications protected with a minimum								Yes	
	one (1) hr rating?									
CALCULATIONS	*C* =	0.8		non combustible						
	A =	48810	m2	(2 largest floors + 50% of 8 floors above)					STOREY AREAS m2	
	F =	38884	L/min							
Round to Nearest 1000 L/min	F =	39000	L/min	must be > 2000 L/min					48810	1
CORRECTION FACTORS:										
OCCUPANCY		0	L/min							
FIRE FLOW ADJUSTED FOR OCCUPANCY		39000	L/min							
REDUCTION FOR SPRINKLER		-19500	L/min							
EXPOSURE CHARGE		0	L/min							
REQUIRED FIRE FLOW	**F =**	19500	L/min							
Round to Nearest 1000 L/min	**F =**	20000	L/min	5283	usgm					
	F =	333	L/sec							

Fire Flow Test Results

Fire Flow Testing Report

Residual Hydrant #	**349026**
NFPA Colour Code	**BLUE**

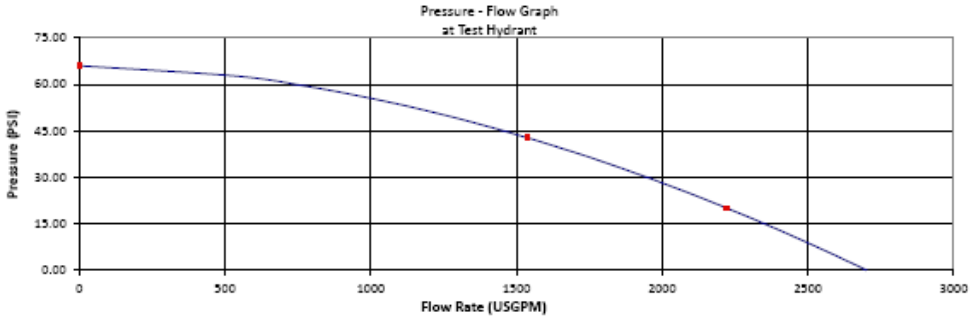
RESIDUAL HYDRANT INFO.

HYDRANT #	349026		DATE	18-Nov-20
N.F.P.A. COLOUR CODE	BLUE		TIME	11:30 AM
			ADDRESS	8281 Healey Rd
STATIC PRESSURE	66.0	psi		Bolton, ON
RESIDUAL PRESSURE	42.7	psi		
PRESSURE DROP	23.27	psi	SIZE-inches/mm	8 200
% PRESSURE DROP	35.3	% psi		
NFPA 291 CONFORMANCE	TEST MEETS NFPA 291 CONFORMANCE FOR REQUIRED PRESSURE DROP			Jeff Marshall
criteria - 25% pressure drop				One Properties
AWWA M-17 CONFORMANCE	TEST MEETS AWWA M-17 PRACTICAL PRESSURE DROP OF 10 PSI or GREATER			P : (647) 256-1019
criteria - 10 psi pressure drop				E : jmarshall@oneproperties.com
Flow on Water Main At Test Hydrant -	20 psi	2222 USGPM		

FLOW HYDRANT(S) INFO.

HYDRANT ASSET ID	HYD. # PORTS	OUTLET DIAMETER (INCHES)	NOZZLE COEFFICIENT	DIFFUSER TYPE	DIFFUSER COEFFICIENT	PITOT READING (psi)	PITOT FLOW (USGPM)	FLOW METER (USGPM)
349030	2	2.5	Round	LPD250	1.00	21.0	1538	0
			Round	None	1.00			0
								0
								0
								0
								0
				Total Flow (USGPM)			1538	0
				Total Flow (USGPM)			1538	

FIRE FLOW CHART



COMMENTS

OPERATOR	FMX	Jordan Whitlock
OPERATOR	FMX	Morgan Whitten
OPERATOR		Peel Region
PRESSURE ZONE		n/a
TOWER LEVEL	ft	n/a
PUMPS (ON/OFF)		n/a
OTHER-1		n/a
OTHER-2		n/a

Copy of Fire Flow Testing Report-Healey Rd

"If we don't measure it, how do you manage it?"

Other Design Considerations

The water mains within the proposed site shall be installed in accordance with the current Region specifications and requirements.

If there is a crossing of the water main and a sewer, the water main shall cross above the sewer with sufficient vertical separation to allow for proper bedding and structural support of the water main (0.5m minimum).

In cases where there is a conflict with the elevation of the sewer and the water main such that the water main cannot cross above the sewer, the water main has been designed to cross below the sewer subject to the following conditions.

a) There shall be a minimum vertical separation of 0.5m between the bottom of the sewer pipe and the top of the water main,
b) The water main shall be lowered below the sewer using vertical thrust blocks and restraining joints,
c) The length of the water main pipe shall be centered at the point of crossing so that the joints are equidistant and as far as possible from the sewer, and
d) The sewer shall be adequately supported to prevent joint deflection and settling.

The unit rate and peaking factors of water consumption, minimum pipe size and allowable pressure in line were established from the Region of Peel criteria.

The Water demands were calculated as follows:

Note that the Region water per capita is 300 while the Sanitary is 300 for Industrial.

a)	Average Day domestic demand - Refer to the Sanitary calculations	(645 persons)	2.3 L/sec
b)	Peak day demand -	2.0 x daily demand	4.5 L/sec
c)	Peak hour demand -	3.0 daily demand	6.8 L/sec
d)	Fire Flow Demand -	Based on FUS	*333 L/sec

** - based on anticipated building size to be verified upon determining development limits.*

Total Development Water Demand	344.3 L/s	(5457 USgpm)

5. STORMWATER MANAGEMENT

INTRODUCTION

The site is primarily an agricultural field (see aerial view). There is an existing drainage feature adjacent to the east property bound and a portion of this is located within the site boundary. This drainage feature has a flood plain present. The Natural Heritage Features and related limits will be evaluated under a separate EIS Memorandum. This report will evaluate the proposed site stormwater management and flood plain in relation to the proposed development limits.

The SWM for this site will follow the guidelines of the Bolton Community Plan, Employment Lands and North Hill Supermarket Site, Comprehensive Environmental Impact Study and Management Plan, Phase 3 report, Aquafor Beech Limited, June 21, 2012 (Technical Memo and Implementation).

It is our understanding that the above mentioned Aquafor Beech Report has been adopted by the Town of Caledon and Toronto Region Conservation Authority and is to be followed for design requirements.

In addition to the above noted report the SWM Facility located on the AIMCo. Property (Amazon Site) to the south will be utilized for conveyance and storage of this development. This pond was designed and approved under separate Site Plan Application. Preliminary evaluation and discussions with AM Candaras, design Engineer for the downstream receiving pond, indicated that the pond has available capacity to accept flows from this proposed development. Alterations to the pond outlet structure and appurtenances may be required, however, the pond was constructed to accept a larger site area initially based on an allowable flow rate of 180 l/sec/ha. The SWM Pond tributary area was reduced during the original design with the construction of a separate pond to service a private development to the north east, therefore, reducing the tributary area to the AIMCo. Site pond. The pond was however constructed based on the original tributary area and the volume within the pond remained unchanged.

The following targets will be evaluated by AM Canadras for the downstream pond as the pond will ultimately control the flows to the Clark Tributary from the proposed development. A separate design brief (included within this report) has been prepared by AM Candaras to confirm pond capacity for both quantity and quality.

CRITERIA (Targets)

1. Level 1 (“enhanced”) water quality control.
2. Capture and release of 25mm over 48 hours for erosion control.
3. Retain 5mm On Site Water Balance (TRCA)
4. Flood (quantity control)
    - 100 Year Release Rate of 180 L/s/ha (to downstream SWM Pond).
    - Regional Storm

DISCUSSION:

- A conceptual Site Plan is will be finalized upon determining the development limits based on this report and the EIS.

- The site soil is a Clayey Silt Till and or clay till and is based on Geotechnical information available within this and surrounding areas. The soils are not conducive to large scale infiltration, thus Infiltration was ruled out as a major means of Storm Water Management for quantity controls.

- Rooftop storage will be utilized to attenuate flow prior to entering into the storm water management facility. The maximum storage depth is to be limited to 150 mm as per OBC. The roof areas will have emergency scuppers in case of blockage. The detained flow will discharge to the storm sewer on site and be further detained within the Storm Water Management Pond downstream of the proposed development. Flow to the downstream pond will be conveyed via a proposed series of inline pipes crossing through TRCA lands and under the existing drainage feature.

- The Regional Storm event will be used for determine rooftop storage and required hoppers and weirs to aid in the reduction of downstream pipe sizing. Any downsizing of storm pipes will be reviewed at the Site Plan Approval stage. This report will provide pipe sizing based on the allowable flows to the downstream Stormwater Management Pond as provided by AM Candaras.

- The allowable conveyance from this development will be based on the larger of the 100 Year and Regional Storm Events. The governing allowable flows for this development were established previously by AM Candaras. The allowable flows to the downstream SWM Pond have been determined to be 3.39 m3/s for the Regional Storm Event and 3.94 m3/s for the 100 year storm event. As such the allowable flows from the upstream area will be 180 l/s/ha. with a maximum tributary area of 21.87 ha. The proposed development is comprised of a development area of 9.21 ha. The conveyance system will be reviewed for the development area only as per TRCA requirements.

- 5mm Water Balance Retention

STORM WATER CONVEYANCE:

As per meetings and discussions with the TRCA the flows from the proposed development will be conveyed through TRCA lands, through the floodplain and below the drainage feature. In order to minimize impacts the conveyance system will be sloped and sized to achieve a minimum 1.0m separation from the bottom of the channel.

As required by the TRCA a Geomorphologist has assessed the impact of the sewer depth in comparison to the bottom of the channel. This report, 8281 Healey Road Development Fluvial Geomorphology and Erosion Hazard Assessement dated February 1 2021 completed by GeoProcess Research Associates can be found within Appendix C.

The report provides the following conclusions and recommendations;

The Study Reach is characterized as a wide unconfined swale that is dominated by heavy vegetation growth and contains a poorly defined channel. Historical aerial photography reveals that the Study Reach was previously channelized (1961 photography). The stream corridor has since expanded to encompass a wide, vegetated riparian zone that is isolated from adjacent agricultural activities.

- *Lateral bank erosion was noted along the right bank of the upstream segment of the Study Reach; however, observed instances were localized and not indicative of systemic instability.*

- *The Study Reach flow regime aligns with the regional expectation of rural streams in Southern Ontario, suggesting that the watercourse has not undergone considerable adjustment and maintains a frequent floodplain connection.*

- *Scour modelling results suggest that anticipated bed scour rates would pose a low risk to infrastructure buried at a depth of 1 m below the channel bed in the vicinity of the proposed crossing for post-development conditions. Moderate to low erodibility estimates of critical shear stress and low erodibility scour rates indicate that bed scour is largely negligible at the location of the proposed crossing even for low-frequency return period events. Conservative estimates demonstrate that extremely rare flow conditions are required to occur for extended durations before infrastructure buried at a depth of 1 m below the channel bed in the vicinity of the proposed crossing would be considered at risk of exposure.*

- *The cut-fill configuration in the vicinity of the proposed storm sewer crossing includes cutting material from the river-left valley. This action is expected to disturb the cohesive properties of the channel bed material and potentially increase the risk of channel bed scour in the vicinity of the proposed crossing. Furthermore, the installation of the storm sewer crossing may involve construction activities that directly disturb the channel bed, which would further degrade the cohesive properties of the channel bed material and increase the risk of channel bed scour. As a result, it is recommended that channel bed protection is incorporated into the proposed crossing design.*

In order to provide a gravity sewer and maintain a separation of 1.0m the conveyance system will consist of multiple pipes sized adequately to convey the allowable flows to the downstream sewers and SWM pond.

The allowable flows from the proposed development have been established at 180 L/sec/ha. Therefore the allowable flow from the development will be limited to 1,658 L/sec based on developable area of 9.21 ha.

As such the conveyance pipes will be determined based on the allowable flows and allowable tributary areas as provided established by AM Candaras. The following total flow will be conveyed to the downstream sewers from the upstream tributary areas.

Total Area = 9.21 ha.
Allowable Release Rate 100 Year Storm = 180 L/sec/ha.

Total Conveyance Required = 1,658 l/sec

Based on the above is proposed to provide three (2) 900mm storm sewers at a slope of 0.35% to convey flows. Each pipe is capable of conveying 1,071 L/sec under full flow conditions for a total conveyance of 2,142 l/sec. These details will be determined at the Site Plan Site Plan Approval stage.

As previously indicated the flows from the site will be further reduced at the Site Plan Approval stage through the use of rooftop controls. Adjustments to pipe sizes will be addressed at that time. In addition the proposed development will utilize rooftop storage to further reduce the conveyance pipe size. An inlet control device in combination with rooftop storage will be utilized to restrict flows to the allowable 1,658 l/sec.

Adjustments to the downstream pond release rates will be made to meet the allowable flows from addition of 8281 Healey Road to this SWM pond. The addition of the proposed development upstream area to the existing storm water management pond will increase the allowable flows as per the following table. This is further assessed within the AM Candaras report. It is important to note that since the development area has not been finalized direction was provided to AM Candaras to assume a developable area of 10 ha. to confirm pond size as it is expected that the development area of this development will be less than 10 ha. and thus AM Candaras pond assessment will confirm that an area of less than 10 ha. can be directed to the downstream pond located on the AIMco. Property (Amazon site).

AREA = 9.21 ha A - AREA IN ha

STORM EVENT	UNIT EQUATION	UNIT FLOW (L/sec/ha)	TOTAL FLOW (L/sec)
REGIONAL	Q = 55 L/sec/ha	55	507
100 YEAR	Q = 29.912 - 2.316 ln (A)	25	228
50 YEAR	Q = 26.566 - 2.082 ln (A)	22	202
25 YEAR	Q = 22.639 - 1.741 ln (A)	19	173
10 YEAR	Q = 17.957 - 1.373 ln (A)	15	137
5 YEAR	Q = 14.652 - 1.136 ln (A)	12	112
2 YEAR	Q = 9.506 - 0.719 ln (A)	8	73

AM Candaras has verified that the downstream pond has capacity to provide necessary quantity controls without significant alteration to the SWM pond. This will be further detailed at the Site Plan Approval stage. Refer to Appendix C for AM Candaras Stormwater Management Brief related to the downstream pond.

QUALITY CONTROL:

Since the developed portion of the Site is > 0.25 ha water quality needs to be addressed. Quality control will follow MOE 2003 guidelines Level 1. The SWM pond for this site will be located on the AIMCo. (Amazon) Property to the south, the low point of the development. Flow will be conveyed via a conveyance storm sewer as identified previously within this report through the TRCA regulated lands.

Water Quality will be addressed within the existing SWM Pond. It is proposed to retrofit the pond to address the required water quality for this development.

The following Tables identify the requirements to obtain necessary volumes, velocities and flows to achieve the required Water Quality under MOE 2003 Guidelines. To aid in retrofitting the downstream storm water management facility to achieve the required water quality the following preliminary assessment has been completed. AM Candaras has provided an additional assessment with regards to the existing SWM Facility and required alteration included within Appendix C of this report.

SUMMARY OF POND DESIGN MOE 2003, TOWN & TRCA	
DESIGN ELEMENT	REQUIRED
DRAINAGE AREA (ha)	10 ha (preferred)
SITE DRAINAGE AREA	9.21 ha.
PERMENANT STORAGE	1934 m^3
FOREBAY DEPTH	1.0 m

FOREBAY AREA	< 33% OF TOTAL PERMANENT POOL
PERMANENT POOL DEPTH	MAX 3.0 m
FREE BOARD FROM TOP OF POND TO 100 YR HGL POND TO REGION HGL	0.30 m N/A
FOREBAY SETTLING LENGTH	TBD
DRAWDOWN TIME	Minimum 12 hr Preferred 24 to 48 hr
CLEAN OUT FREQUENCY (years)	TBD

Permanent storage is based on the following MOE Pond Calculations.

MOE POND CALCULATIONS
Pond Design

Drainage Area:	9.21	ha
% Impervious:	85	%
Storage Volume for Impervious Level:	250	(m^3/ha)
Pond Volume:	2303	m^3
Extended Detention Volume:	368	m^3
Permanent Pool Volume:	1934	m^3

Further review on options to address water quality will be reviewed at the Site Plan Approval stage.

AM Candaras has confirmed through their assessment that the pond was designed for a larger tributary area and that water quality can be addressed without significant alterations to the downstream pond.

WATER BALANCE:

TRCA's site water balance requirement is on-site retention of 5mm runoff from total impervious area and this retained runoff can be infiltrated and or evapotranspiration using low impact development measures. Please submit supporting calculations that demonstrate the achievements of this criteria.

The first 5mm of all storm events shall be retained on site from impervious areas. The total site area is 9.21 ha. Assuming an imperviousness of 85% it is expected that the volume of water to be retained on site for reuse or infiltration will be approximately 391 cu.m.

The method for meeting this requirement will be determined at the Site Plan Approval stage, however, it is anticipated that these methods would be infiltration galleries, irrigation, or a combination of such but not limited to these methods. This will be further detailed at the SPA Site Plan Approval Stage.

EROSION CONTROL:

The criterion is to capture and release 25mm of rainfall over a 24-48 hour period. Erosion Control will be determined based on the downstream pond. The downstream pond was designed to the same requirements and it is expected that the requirement will be achieved based on available volume in the downstream pond.

IMPLEMENTATION OF SWM:

- The site is to utilize roof top storage to minimize impacts and flows to the downstream receiving sewers and conveyance system. This will also minimize the total flows to the storm water management pond and thus reduce alterations to existing sewers, forebays and extended detention requirements.
- Parking surface storage is not utilized due to design constraints, but will be reviewed further at the Site Plan Approval stage.
- All Storms will be conveyed to the downstream SWM facility including the 100 year and Regional Storm Events to the established allowable flows and tributary areas.
- LID (soak away pits) will be provided for water balance of the development, if required, and will be determined at the Site Plan Approval stage.
- The downstream SWM Pond will be utilized for water quality/quantity as detailed above. A Memo at this stage will be provided from AM Candaras confirming that the downstream pond can accept flows from the proposed development and will be capable of providing the necessary water quality treatment.

6. FLOOD PLAIN ANALYSIS

1. Background & Criteria

There is a regulated floodplain established by the TRCA which impacts the proposed development. As per discussions with the TRCA and based on the Natural Heritage features the watercourse has migrated to the east from it historical records. This was determined by the Ecologist during site visits. In order to improve the function of the water course this report together with the EIS will assess both the floodplain and Natural Heritage features.

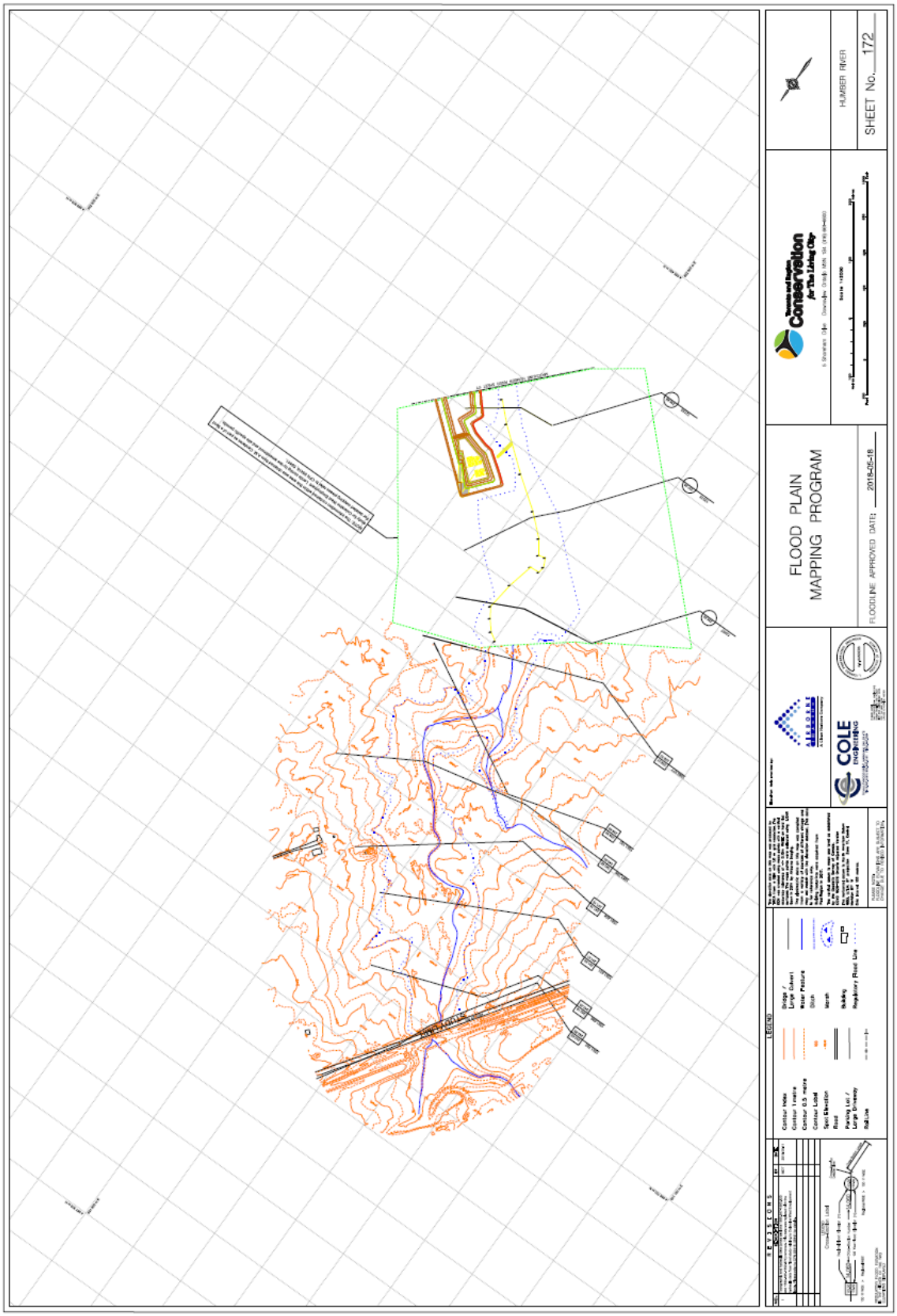
The TRCA has provided a hydraulic analysis of the Clarkway Tributary floodplain using the computer modelling software *HEC-RAS.* The regulated flood limit as given by TRCA's HEC-RAS Model extends within the site, and adjacent lands.

The existing floodplain regulated area as given by TRCA is within the subject site. The existing regulated flood line is given by the hydraulic analysis prepared using the computer hydraulic modelling software *HEC-RAS* by Cole Engineering. The following page shows the HEC-RAS Flood Plain Mapping Program Sheet No. 172 for the Clarkway HEC-RAS sections located within 8281 Healey Road. These will be used to assess both the predevelopment and post development Flood plain conditions.

The HEC-RAS Model prepared by Cole Engineering was provided to The Odan/Detech Group and informs the following cut-fill-balance analysis and post-development flood conveyance HEC-RAS analysis herein.

The proposed development's grading and layout has been designed to satisfy TRCA's criteria for development within floodplain-regulated areas and cause no greater flood risk than existing to the adjacent properties.

The TRCA's criteria for floodplain Cut-Fill balance was considered herein – it is shown as follows that the proposed development satisfies TRCA's criteria for *Active Floodplain Storage* within the subject site.



A full size copy of the above drawings can be located within Appendix D.

The Regional Storm and 100-Year flood elevations that were established at each HEC-RAS section within the model.

The following HEC-RAS models will be used to analyze the impacts of the proposed development on the flood plain. The output tables are enclosed here and referenced later in this report.

- HEC-RAS Scenario 1: Original HEC-RAS Model provided by the TRCA herein referred to as the Predevelopment HEC-RAS Model.
- HEC-RAS Scenario 2: Updated HEC-RAS Model with modified cross-sections sections for modifications to the watercourse and flood plain to improve conveyance to aid with improvement to natural heritage features and watercourse features herein referred to as the Post Development Model.

It is proposed to manage the existing flood condition and modifications to such on the subject site and to balance both water levels and cut-fill balance on the site located at 8281 Healey Road. This will be completed through providing compensation lands for floodplain loss in order to provide both additional flood plain volume as well as improving on natural heritage features and wetlands in the area.

As discussed during meetings with TRCA staff modifications to the floodplain within the site will be considered due to the minimal loss of volumes within the proposed development area due to the shallow spread of the floodplain into the development.

The HEC-RAS post development model will therefore show a net zero impact to the change in elevations or improvement to the floodplain post development. The site will be graded such that it provides flood volume to the floodplain where loss of floodplain volume occurs. The site will be graded up within the site such that the floodplain limit is off the subject site. Setbacks will be established based on the flood line given here.

The "fill" thus created by the proposed development will thereafter be compensated-for by a "cut" within the site. The calculations and analysis for this approach are as follows.

2. Subject Proposed Development & Grading

The setbacks from the critical flood elevations appear on the enclosed Floodplain & Conceptual Grading Plans, Appendix C.

It is proposed to grade the subject site such that the critical Regional Flood elevation and 100 year storm – established in post-development conditions in Section 6 of this report - are comparable to the predevelopment conditions. Refer to the enclosed Concept Grading Plan for the proposed grades relative to the floodwater elevation as well as the critical setback.

The proposed building's FFE is proposed to be 244.00, significantly higher than the Regional Flood Elevation based on preliminary conceptual layouts and concept grading plans. Additionally the site grading will be established from the access at Healey Road to the north which will establish the FFE at a higher elevation in relation to the flood plain elevations.

It is proposed to provide a compensating flood volume to compensate for the flood volume lost as a result of the proposed site grading. This required volume was determined as follows.

3. Flood Volume Cut-Fill Analysis

There is presently (pre-development) a volume of 29,855m^3 of flood storage volume (active storage) within the site in a Regional Storm. The following analysis shows that 31,356m^3 is provided post-development as active storage in the Regional Storm, therefore the proposed development does not represent a reduction in available volume post-development.

The TRCA's *Balanced Cut and Fill Procedure* provides criteria for analysis of *Active Floodplain Storage*. That document defines active floodplain storage as storage which is located within the effective flow area of the floodplain where the storage is formed by the floodplain areas which are normally modelled by HEC-RAS to develop flood levels.

Presently, pre-development, there is only active floodplain storage provided within the site. The above TRCA criteria requires that where active storage exists and a Cut-Fill Balance is provided, active storage is replaced with active storage post-development (not passive or dead storage). Thus, the site has been graded to provide equivalent storage volume post-development as compared to pre-development by providing additional volume in the area of the site's southeast corner where it has been lost in the site's middle, within the (revised) active flow area.

The methodology for the cut-fill balance is as follows.

1. Pre-development volume – a *Volume TIN* was prepared to determine the pre-development active storage volume. The Volume TIN was prepared using Autodesk AutoCAD Civil3D 2021. The Volume TIN and the volume analysis results are provided in Figures 1 through 14 on the following pages. The volume TIN was assembled as follows:

    a. Pre-Development flood elevations were given by the Scenario 1 HEC-RAS model and existing floodplain mapping. A pre-development flood 'surface' or TIN was prepared by projecting horizontally the flood elevation over the area within the site where flooding would occur in the Regional Storm based on the existing topography and pre-development flood elevations from the Scenario 1 HEC-RAS model.

        i. We note that this methodology results in a slightly different pre-development flood line than as given in the pre-development flood mapping provided by the TRCA – the flood line extends farther into the site. This analysis is more conservative because it is based on a topographic survey prepared using a total station rather than Lidar (as per the existing flood line mapping). The resulting pre-development flood volume is larger than it would be were it based on the provided flood mapping, which is conservative.

    b. Existing site topography was taken from the original topographic survey by Speight, Van Nostrand & Gibson Ltd. of July 2019.

    c. The Volume TIN was prepared by projecting the pre-development flood surface to the existing topography to determine the pre-development volume. Refer to results for each respective storm in Figures 1 through 7, and provided in Table 1 below .

2. Post-development volume – similarly to pre-development, a *Volume TIN* was prepared to determine post-development active storage volume. The post-development TIN was also prepared using Autodesk AutoCAD Civil3D 2021. The Volume TIN and the volume analysis results are provided in Figures 8 through 14 for respective storm on the following pages. The volume TIN was assembled as follows:

    a. For the purpose of identifying that the post-development active flood volume is the same or more than pre-development, flood elevation was taken as per HEC-RAS Scenario 1 – pre-development. That is, if the post-development volume were based on the HEC-RAS Scenario 2, this would skew the conclusion as to whether more or less active volume is provided given that the flood elevation would be different.

    b. The post-development topography TIN was prepared by merging the post-development proposed grading (where proposed) with the existing topography (where proposed to remain; it within the main channel in the east-west run along the site's south side).

    c. The post-development active flood storage volume TIN was prepared by projecting the pre-development flood surface to the post-development TIN. Refer to results in Figures 8 through 14 and summarized in Table 1.

The active flood storage volume provided on-site post-development is greater than pre-development for all respective storm events, as shown in Table 1 (in reference to the results in Figures 1 through 14) therefore it follows that the flood volume compensation criteria is satisfied.

Table 1 - Pre-Development vs. Post-Development Active Flood Storage Volume Comparison

	Scenario 1: Pre-development Active Flood Storage Volume (m^3)	**Scenario 2: Post Development Active Flood Storage Volume (m^3)**
2-Year Storm	10,271	16,672
5-Year Storm	12,893	18,756
10-Year Storm	19,505	25,831
25-Year Storm	22,458	26,982
50-Year Storm	24,438	28,546
100-Year Storm	29,855	31,356
Regional Storm	29,001	29,579

Figure 1 - Pre-Development 2-year Storm Active Storage Flood Volume

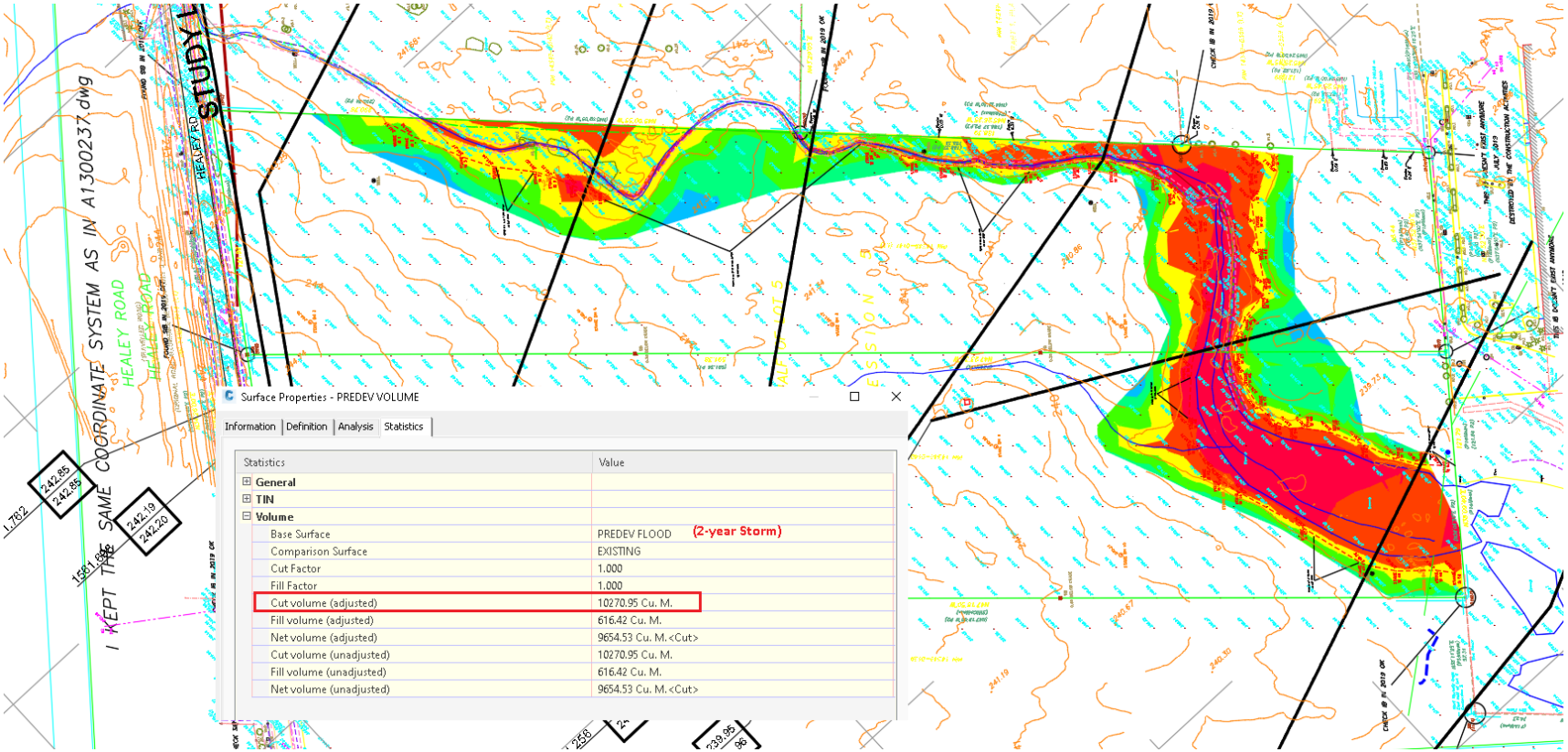


Figure 2 - Pre-Development 5-Year Storm Active Storage Volume

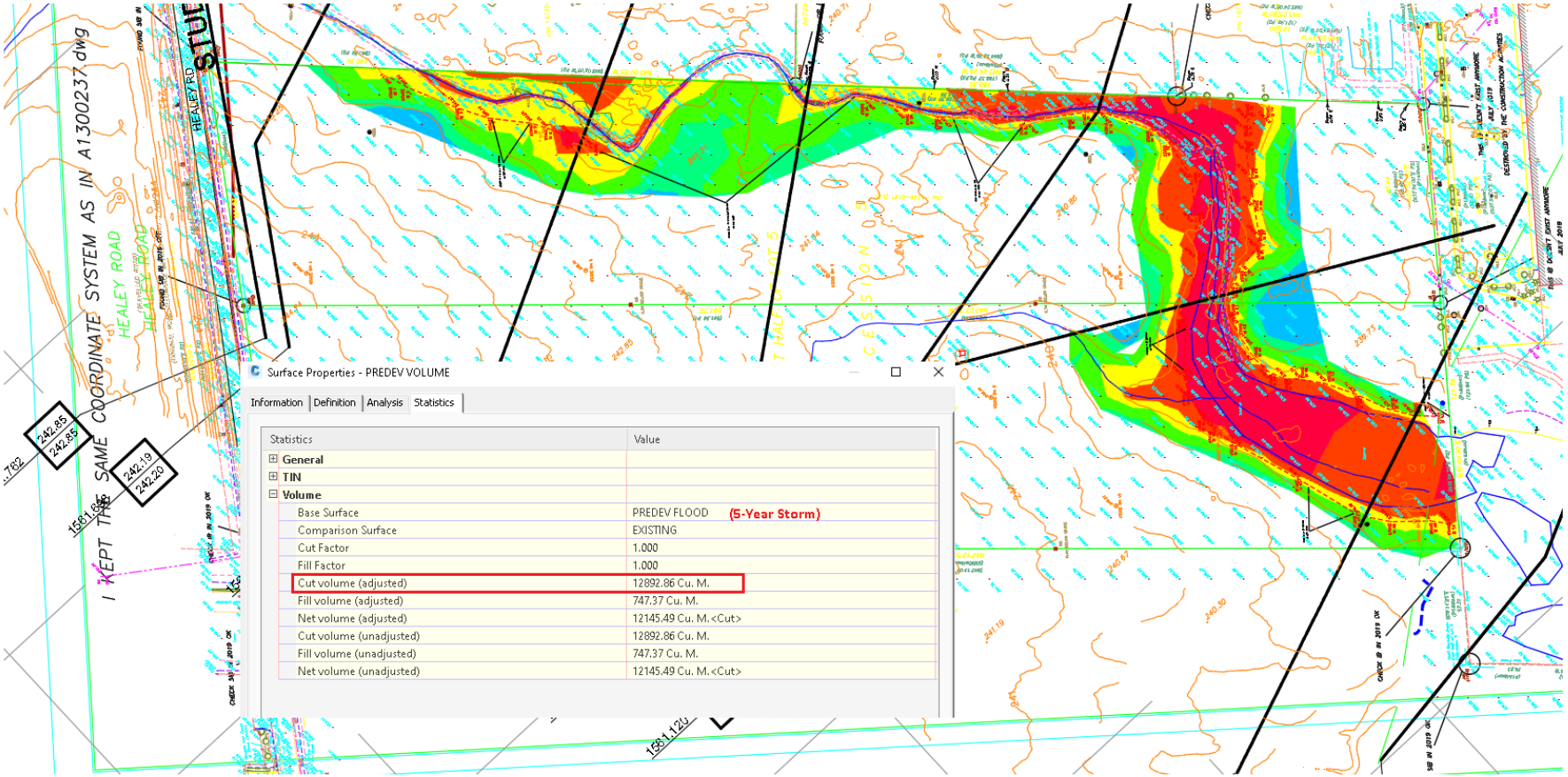


Figure 3 - Pre-Development 10-Year Storm Active Storage Volume

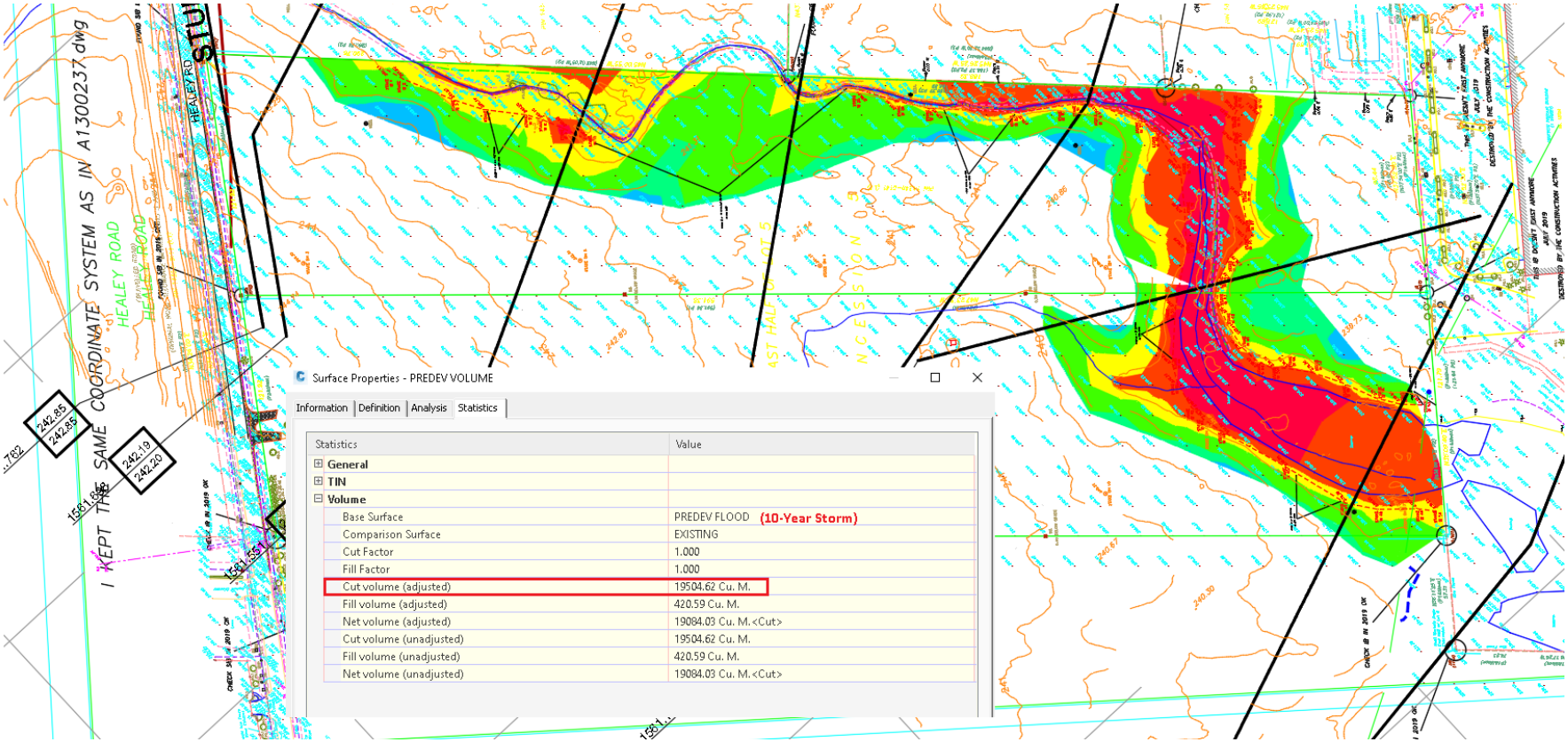


Figure 4 - Pre-Development 25-Year Storm Active Storage Volume

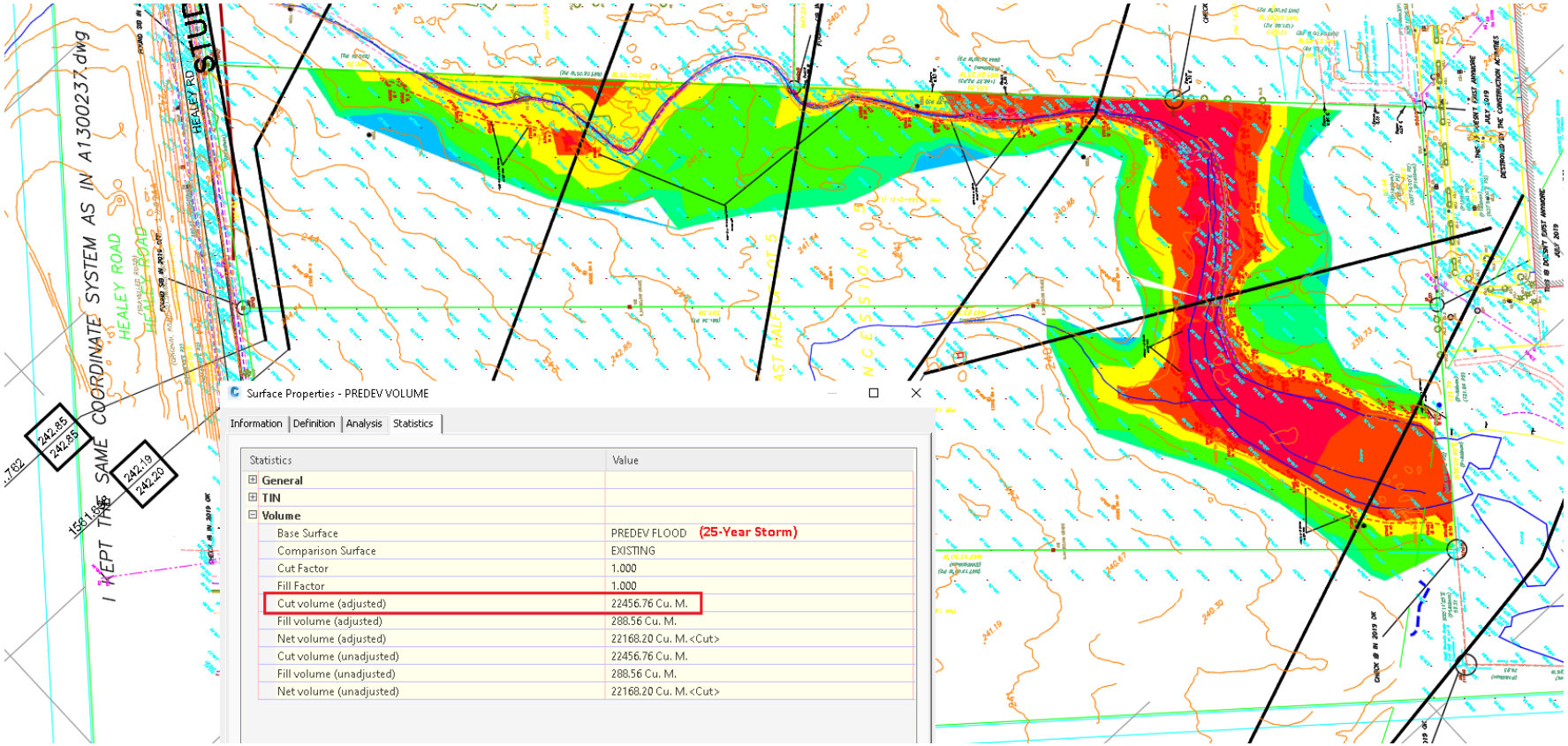


Figure 5 - Pre-Development 50-Year Storm Active Storage Volume

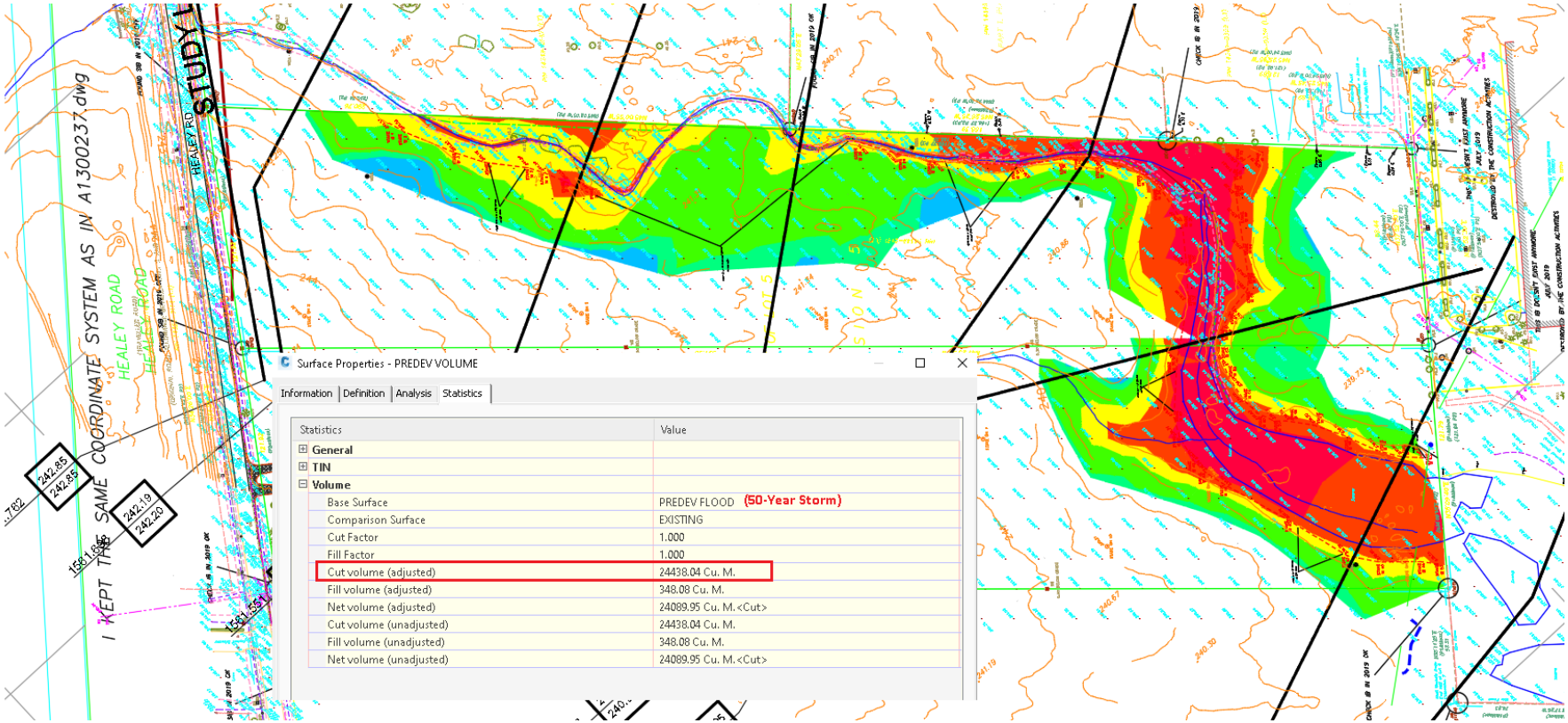


Figure 6 - Pre-Development 100-Year Storm Active Storage Volume

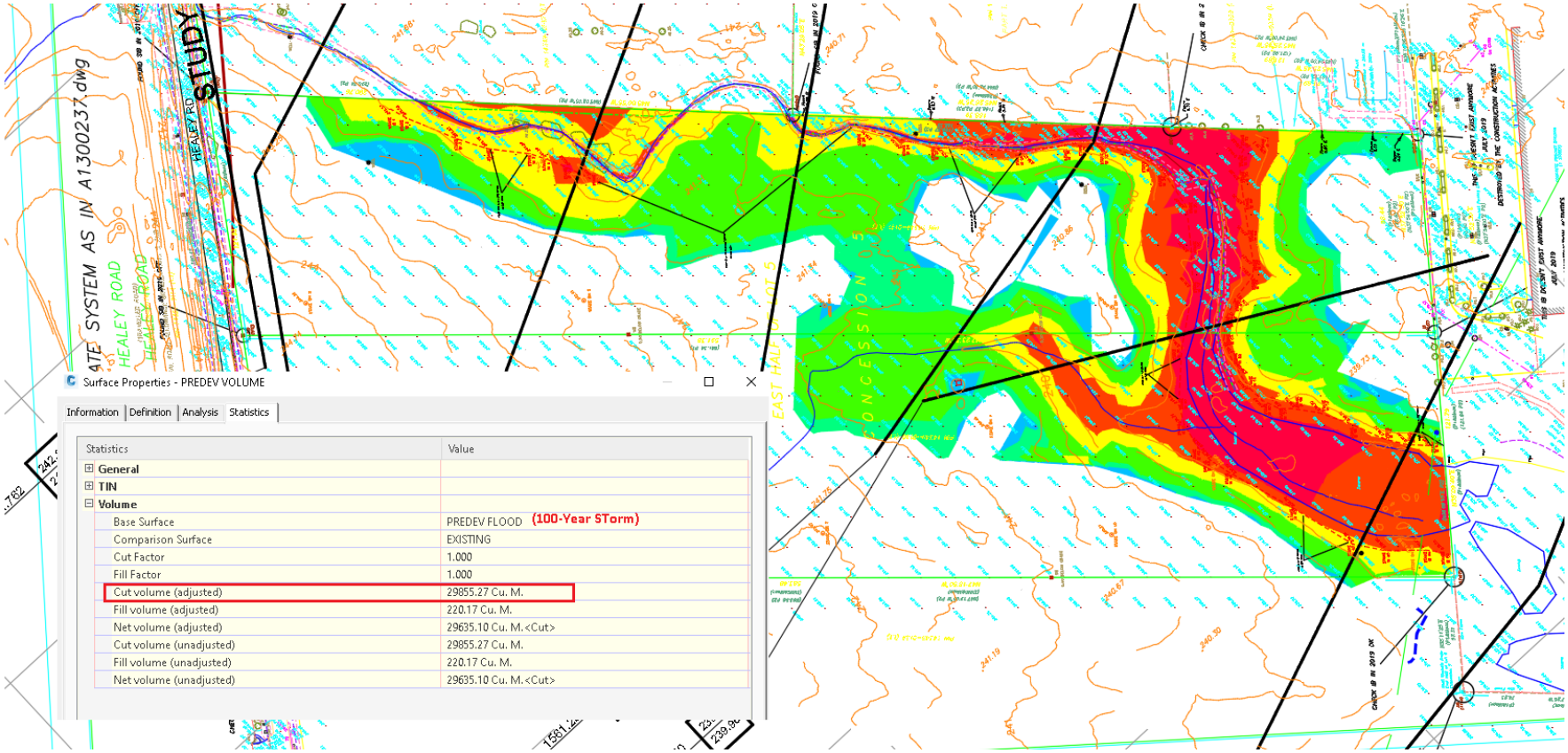


Figure 7 - Pre-Development Regional Storm Active Storage Volume

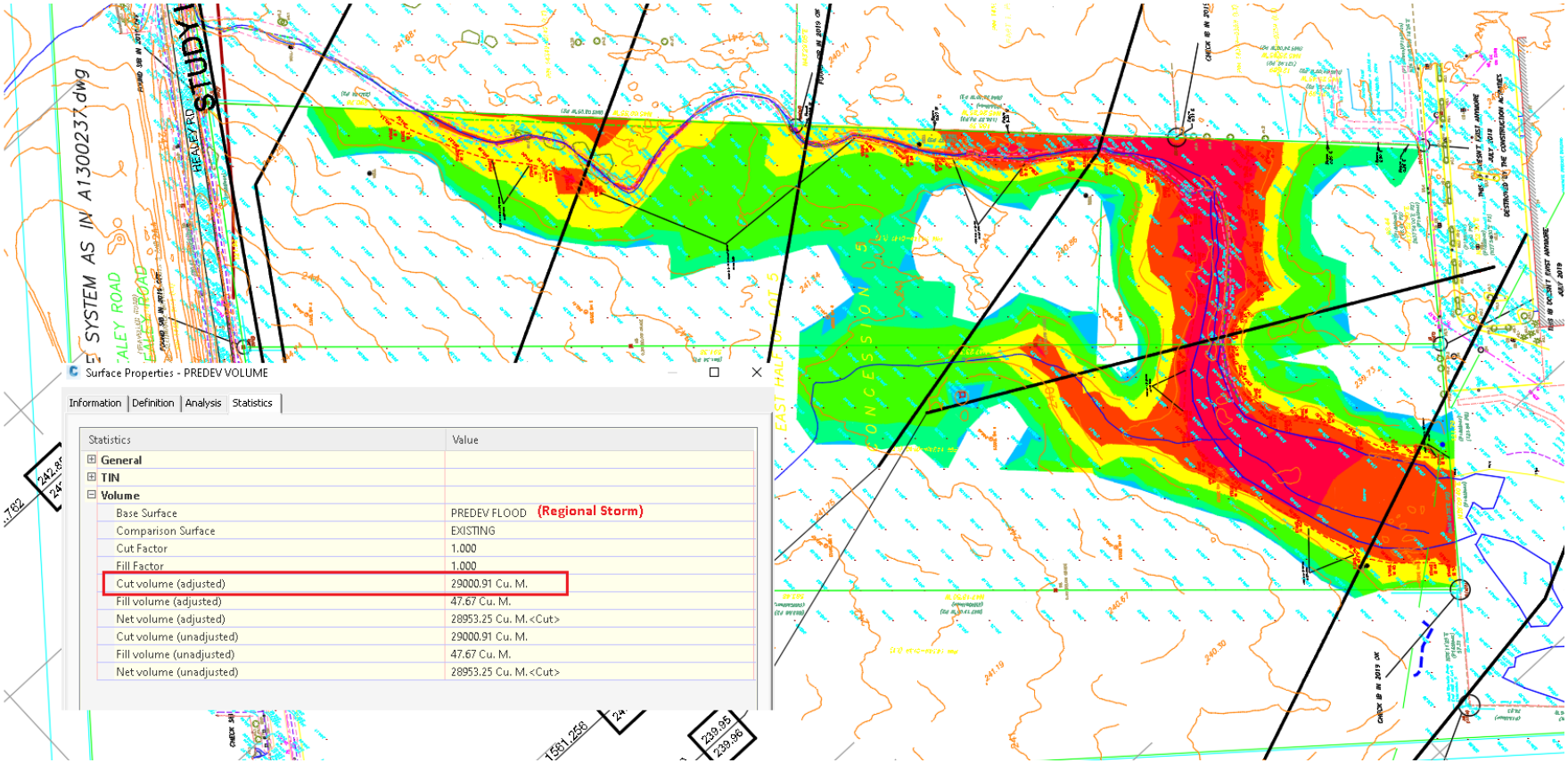


Figure 8 - Post-Development 2-Year Storm Active Storage Volume

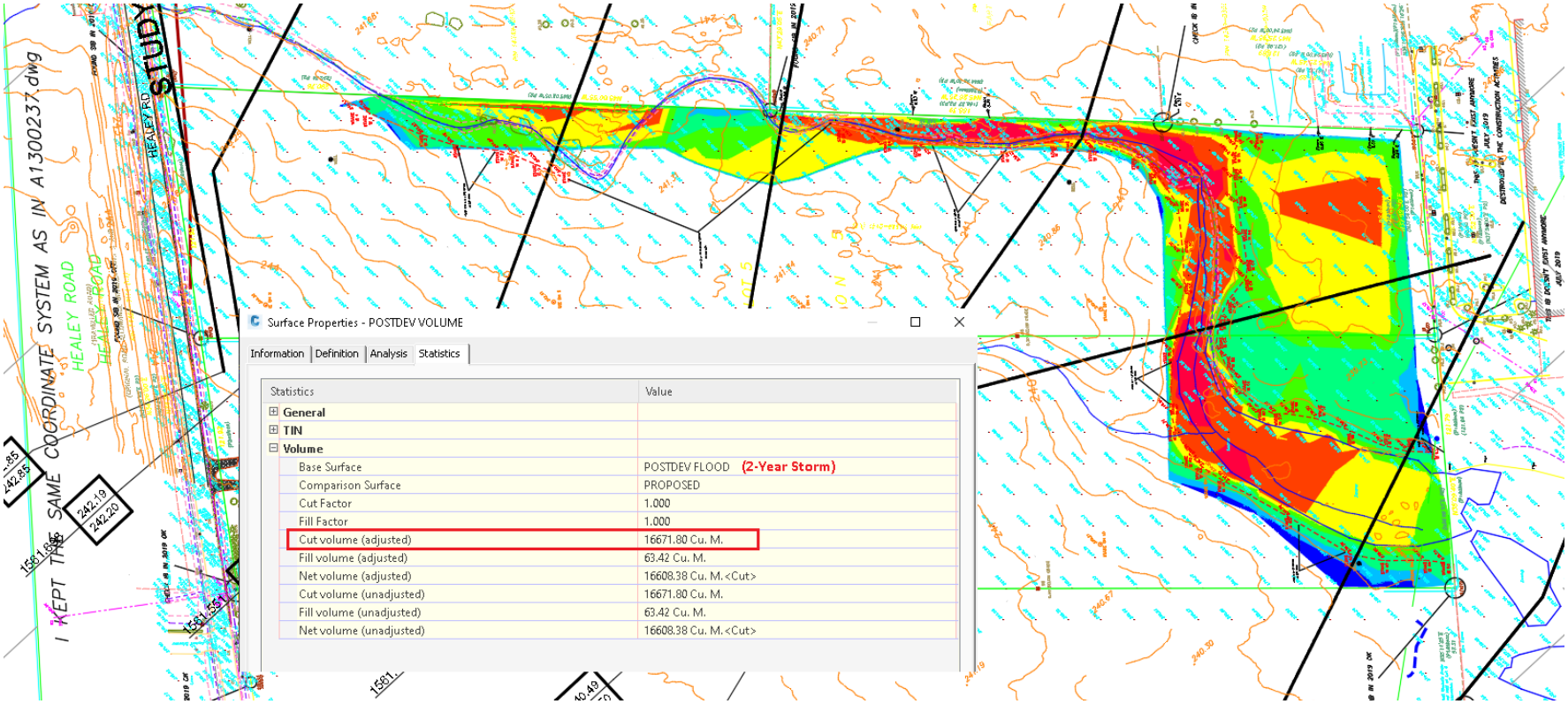


Figure 9 - Post-Development 5-Year Storm Active Storage Volume

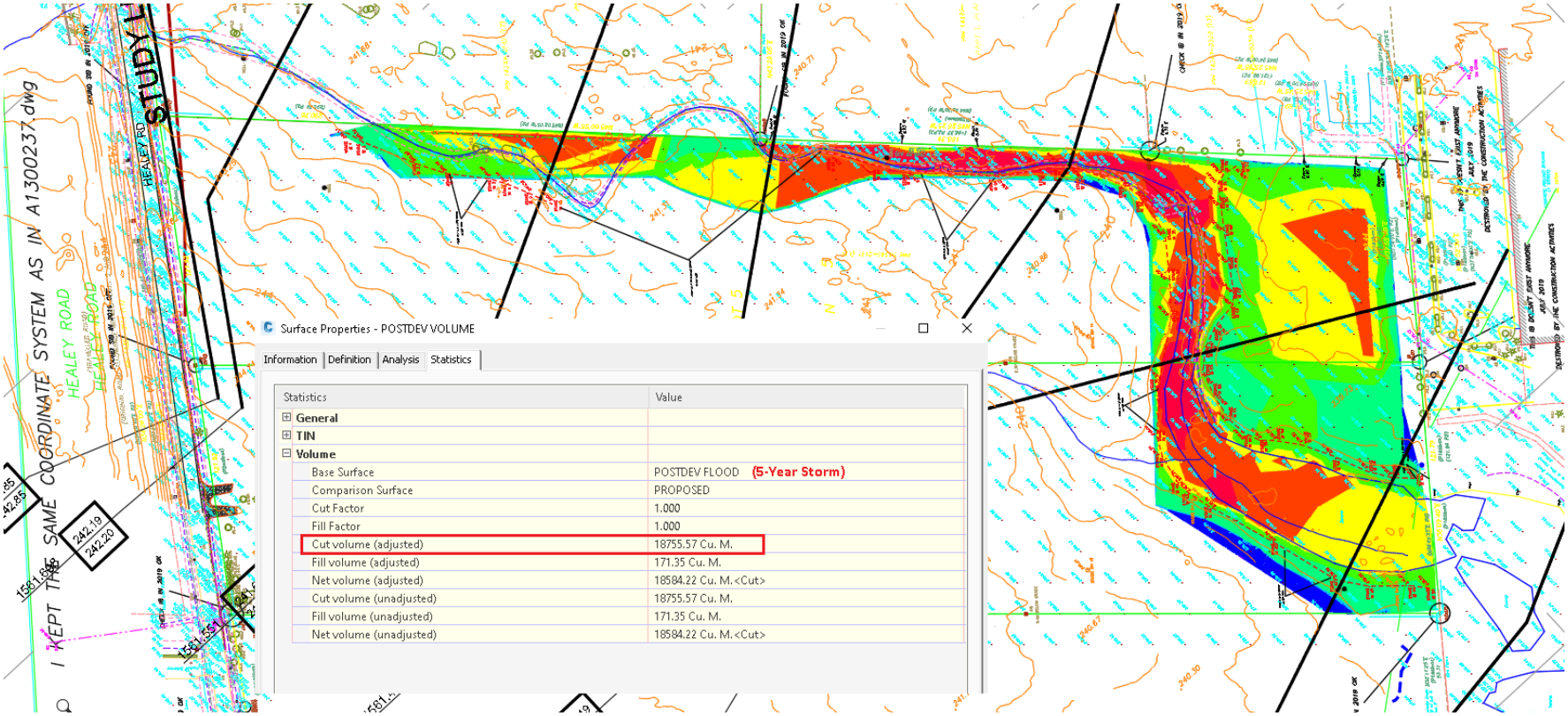


Figure 10 - Post-Development 10-Year Storm Active Storage Volume

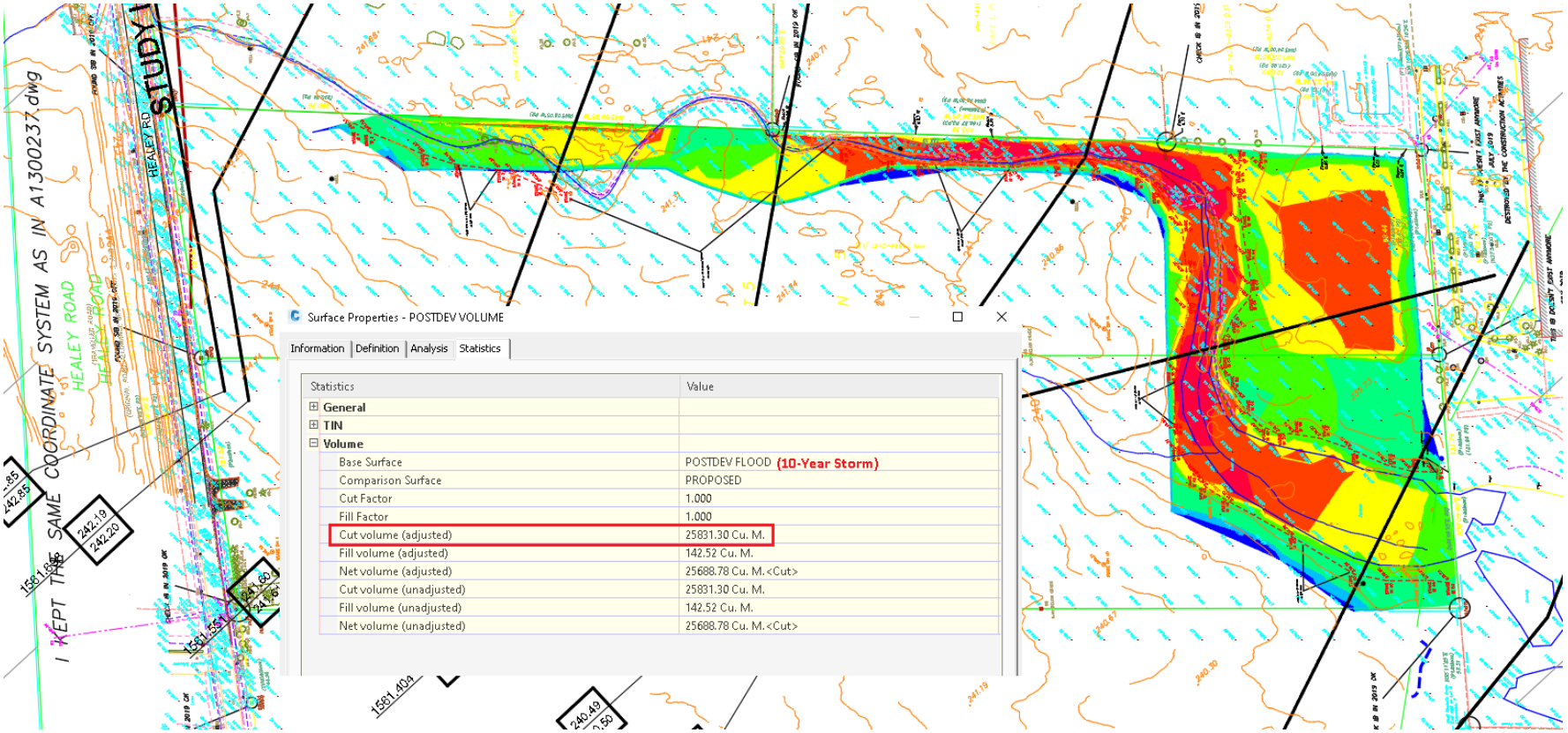


Figure 11 - Post-Development 25-Year Storm Active Storage Volume

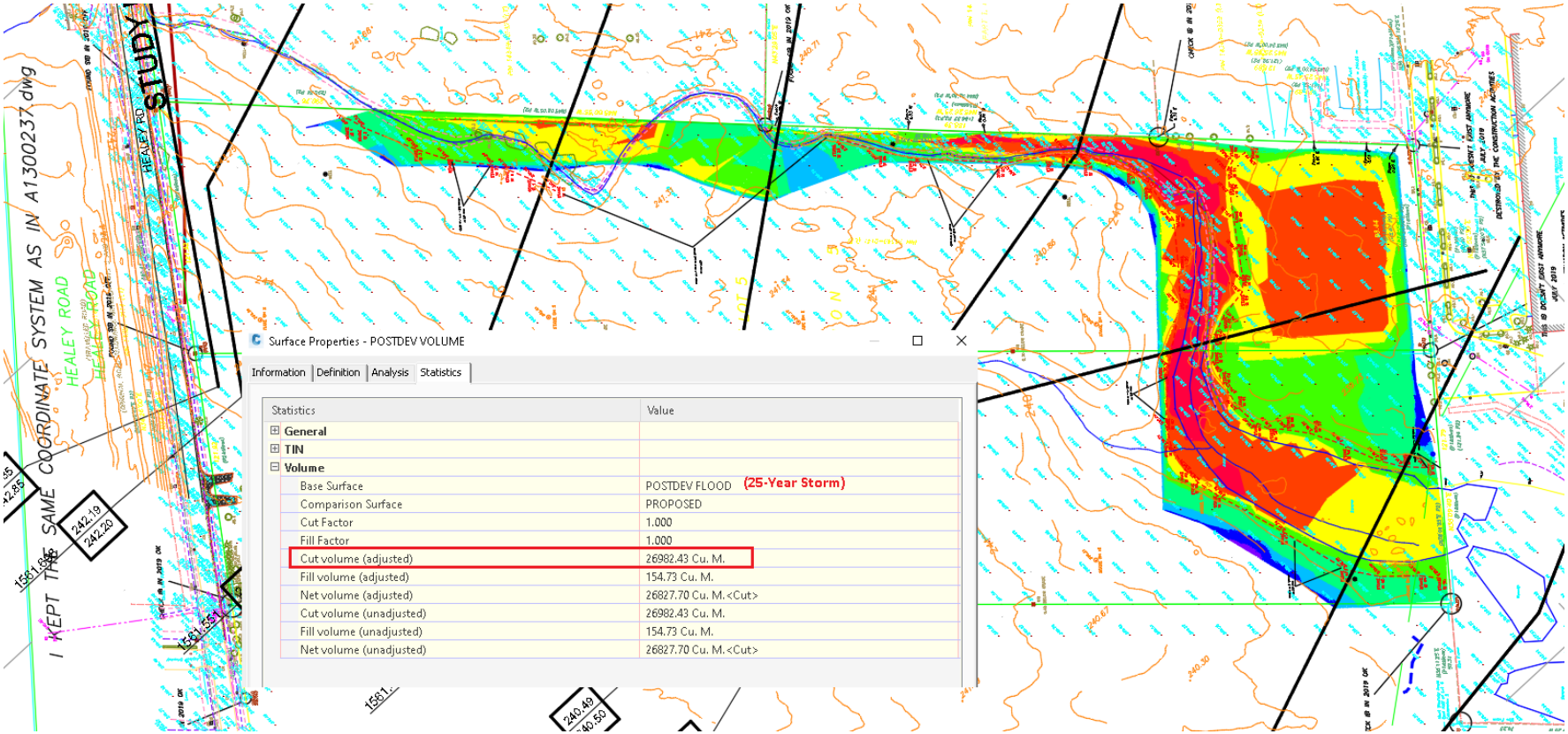


Figure 12 - Post-Development 50-Year Storm Active Storage Volume

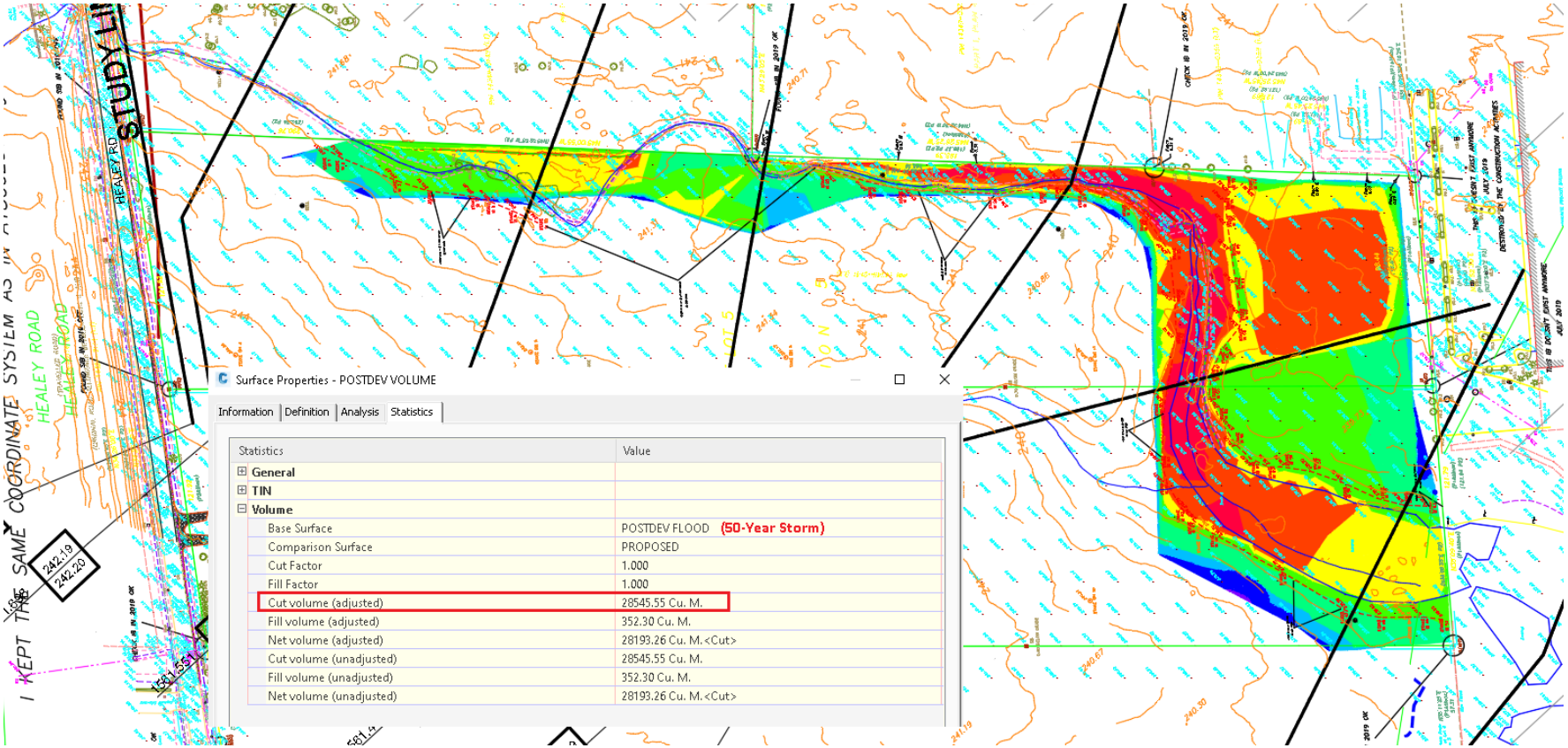


Figure 13 - Post-Development 100-Year Storm Active Storage Volume

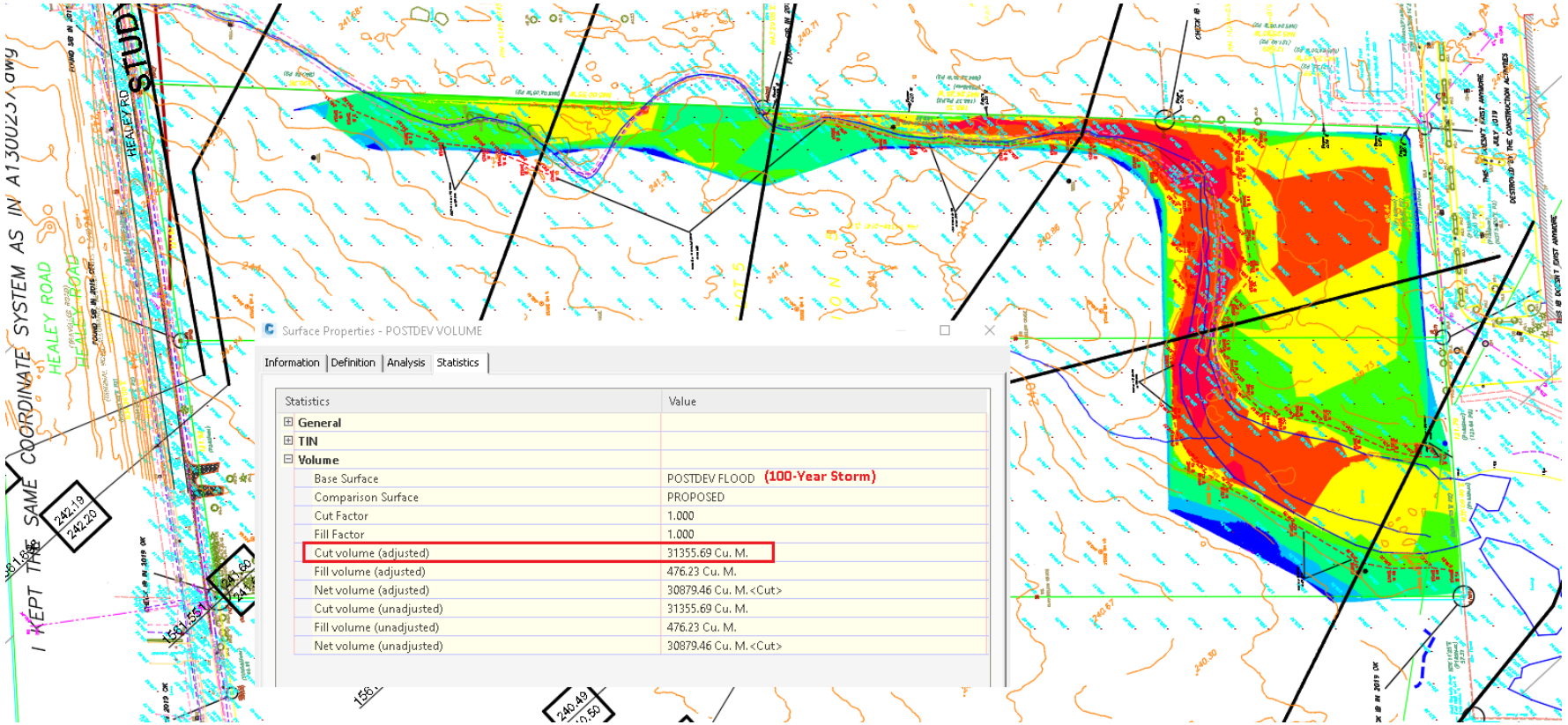
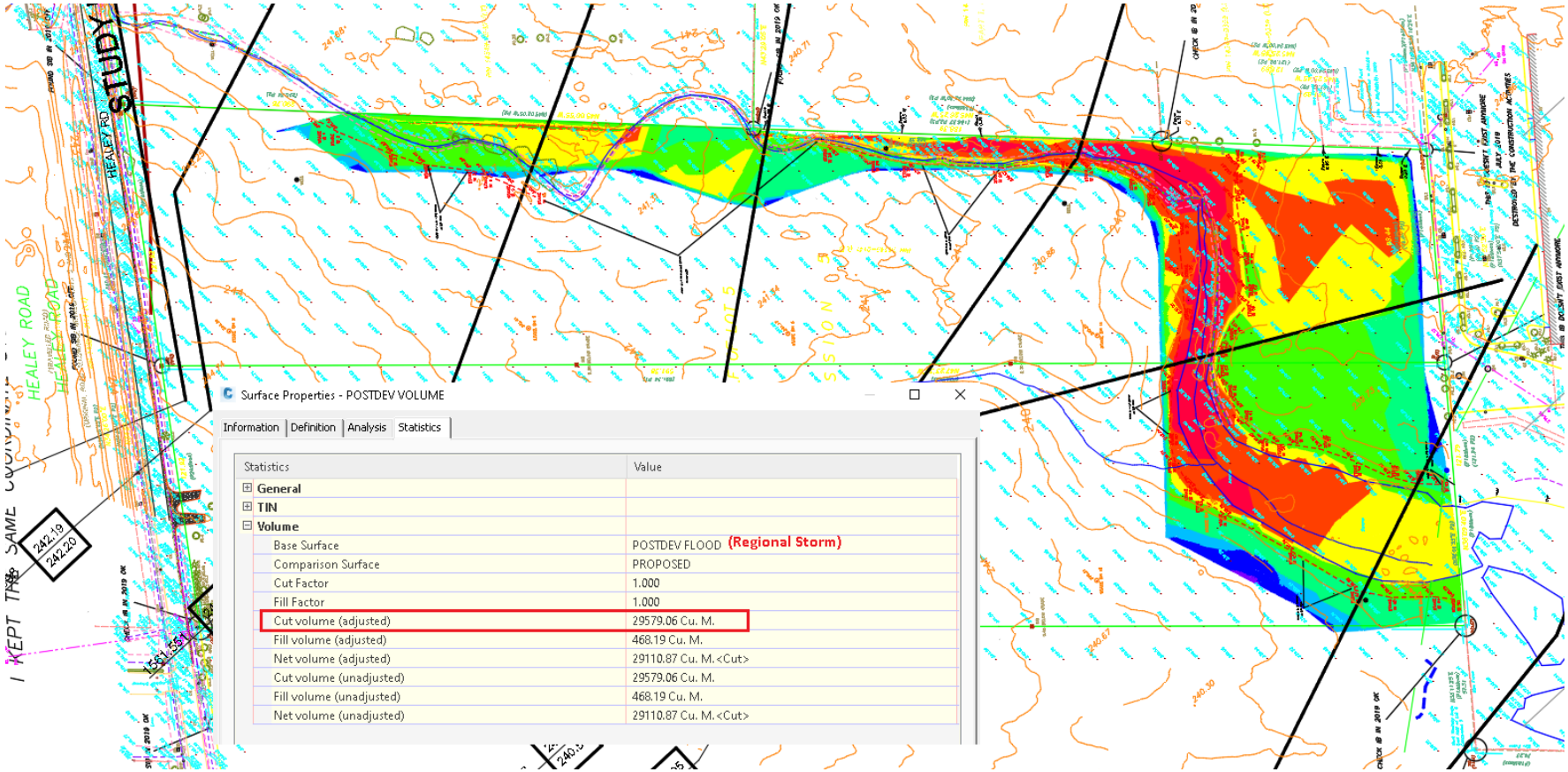


Figure 14 - Post-Development Regional Storm Active Storage Volume



4. HEC-RAS Floodplain Conveyance Model & Floodplain Impacts

As shown in the above volume compensation analysis, the existing flood channel is proposed to be reconfigured to accommodate the proposed development.

There are five existing HEC-RAS Cross-Sections in the Scenario 1 HEC-RAS analysis within the subject site: 1561.551, 1561.404, 1561.256, 1561.120 and 1560.977. This is considered a sufficient number of sections to adequately model the pre-development and post-development flood cut-fill balance and conveyance impacts of the subject site, therefore no additional sections were added to the model in either scenario.

The methodology for the two scenarios HEC-RAS analysis is as follows.

4.1. Scenario 1: Pre-Development

The pre-development HEC-RAS model prepared by Cole Engineering 2018 for the TRCA was determined to be accurate relative to the existing topography and was thus used to represent pre-development conditions.

Refer to the Floodplain Plan (Appendix C) for the location of the HEC-RAS cross-sections through the subject site and existing flood line.

It is not necessary to adjust the existing sections or add new ones to accurately model the pre-development scenario. As discussed above – existing topography within and adjacent-to the subject site was given in an original topographic survey by Speight, Van Nostrand & Gibson Ltd. of July 2019. Various elevations were compared between that original survey and the existing HEC-RAS model (based on the cross-sections on the Floodplain Cross-Sections Plan – Appendix C). It was determined that the topographic elevations coded into the existing HEC-RAS sections accurately represents existing topography given by the topographic survey, typically within 0.05-0.10m.

Scenario 1 HEC-RAS results tables are provided in Appendix C and Table 1, below, provides the pre-development Scenario 1 HEC-RAS results summary.

4.2. Scenario 2: Post-Development

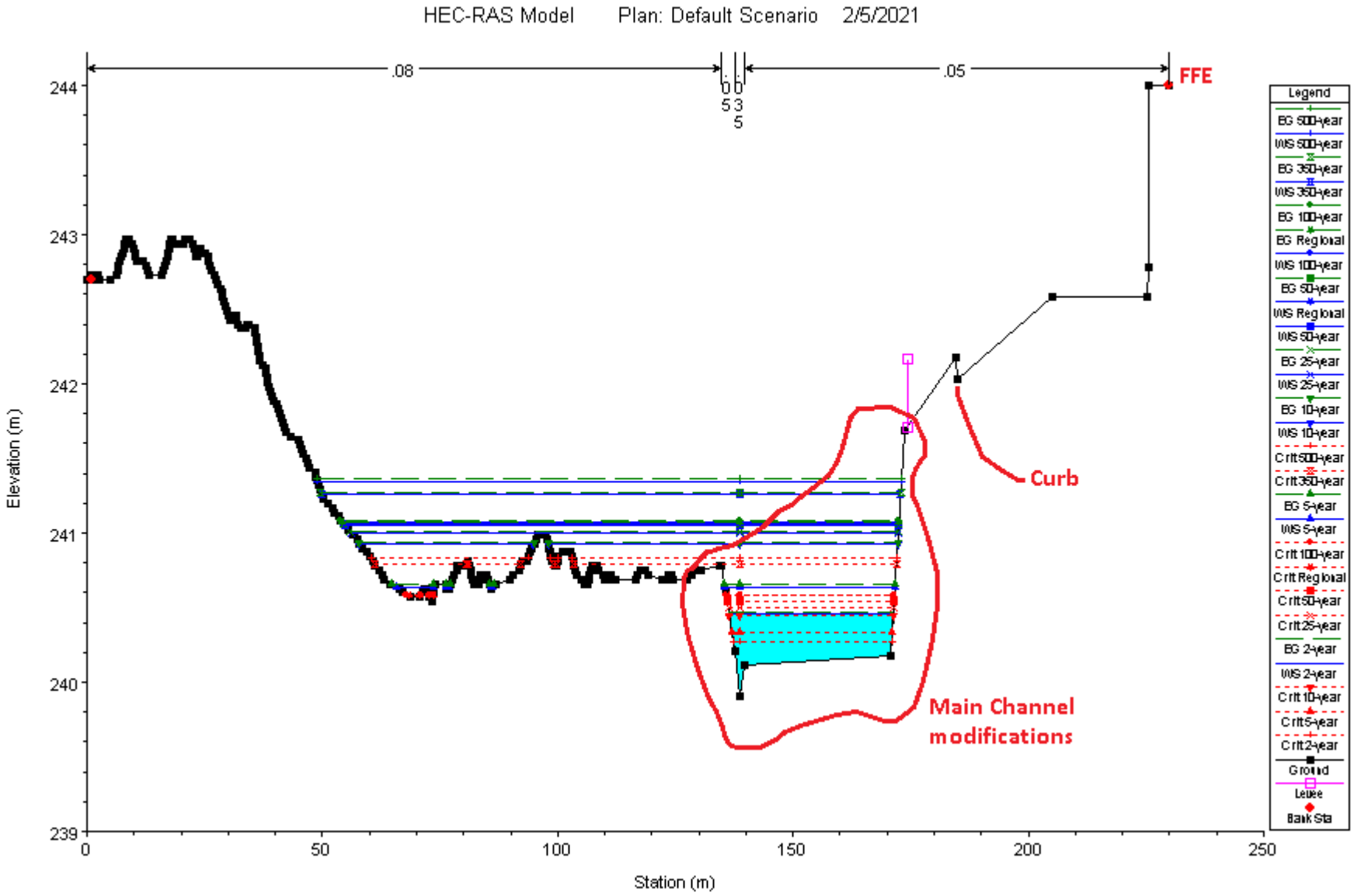
The methodology for the post-development HEC-RAS model is as follows. The existing Scenario 1 model was modified to reflect the proposed grading and conclusions provided on that basis.

The proposed grading appears in section in the Cross-Sections Plan (Appendix C) which provide the proposed grading and existing topography (from the topographic survey). The proposed grading was modelled in the HEC-RAS model as enclosed with this report.

Figure 15, below, shows how the proposed grading was merged with the existing topography in HEC-RAS Station 1561.404, for example. Refer to the enclosed HEC-RAS model for the complete revised geometry through the five sections which are within the site and for which the geometry was modified. Refer to Appendix C for the Scenario 2 HEC-RAS results table. Table 2, below, summarizes the results.

Note that an n-value of 0.035 was used for a maximum width of 4.0m in the main-channel where the main channel is proposed to be re-graded (refer to the Functional Grading Plan). An n-value of 0.05 was used in the overbank areas in areas of proposed.

Figure 15 - HEC-RAS Station 1561.404 with Post-Development Grading



4.3. Results & Discussion

The HEC-RAS model results in the foregoing Scenarios is described as follows. Refer to the appended detailed output files for additional results. Refer to the enclosed Grading Plan for the location of the stations relative to the subject site.

Table 2 - HEC-RAS Model Results - Flood Elevation (m) – Stations within subject site & immediately upstream/downstream

Station	Scenario 1: Pre-development Model Water Surface Elevation (TRCA Approved Model)							Scenario 2: Post Development Model Water Surface Elevation						
	2-Year Storm	5-Year Storm	10-Year Storm	25-year Storm	50-Year Storm	100-Y Storm	Regional Storm	2-Year Storm	5-Year Storm	10-Year Storm	25-year Storm	50-Year Storm	100-Y Storm	Regional Storm
1561.762	242.36	242.49	242.71	242.78	242.82	242.85	242.85	242.33	242.47	242.71	242.78	242.82	242.85	242.85
1561.698	241.87	241.94	242.07	242.12	242.16	242.20	242.19	241.90	241.97	242.07	242.13	242.17	242.21	242.20
1561.551	241.25	241.33	241.49	241.54	241.57	241.61	241.60	240.95	241.09	241.33	241.39	241.43	241.47	241.47
1561.404	240.75	240.86	241.00	241.06	241.11	241.15	241.14	240.46	240.64	240.93	241.00	241.05	241.07	241.06
1561.256	239.85	240.01	240.27	240.37	240.44	240.50	240.49	239.44	239.53	239.76	239.82	239.84	239.96	239.96
1561.120	239.38	239.51	239.75	239.84	239.91	239.96	239.95	238.93	239.02	239.18	239.24	239.29	239.34	239.33
1560.977	238.92	239.00	239.16	239.23	239.27	239.32	239.31	238.92	239.00	239.16	239.22	239.27	239.31	239.30
1560.820	238.07	238.17	238.35	238.42	238.47	238.51	238.50	238.07	238.17	238.35	238.42	238.47	238.51	238.50

The following discussion is drawn from the above HEC-RAS results summary, detailed results in Appendix C, enclosed HEC-RAS model and the enclosed Flood Line Plan (Appendix C).

1. The post-development flood line is the same elevation or lower post-development (scenario 2) as compared to pre-development (scenario 1) in all storm events. It follows that the flood risk to adjacent properties will be no greater than pre-development by the proposed development.

2. The channel cross-section area or channel width has been reduced within the flood area in Stations 1561.551, 1561.404 and 1561.256 however, as discussed above, the flood elevation is the same or less than pre-development. This is accomplished by reconfiguring the channel area and applying an n-value of 0.05 in the overbank areas of proposed re-grading.

3. Whereas the previous iteration of this report/analysis showed that post-development flood elevation was less than existing by applying an n-value of 0.035 over a width greater-than 4.0m in the main channel (not permissible as per TRCA), the analysis/design has been revised herein such that flood elevations are less than existing by grading design and by applying an n-value of 0.035 over no-more-than a 4.0m width.

4. Post-development (Scenario 2) flood elevations are plotted on the Flood Line Drawing (Appendix C) – note that the flood lines are plotted based on the flood elevations given in Table 2 and the original topographic survey prepared for this site. The post-development flood line external of the site, to the east, is plotted as extending in some cases farther east into the neighbour's property than the pre-development flood line, whereas the flood elevation is actually lower than pre-development. This discrepancy is because the pre-development flood line as plotted on the drawing is as given in the prior modelling/flood line mapping rather than the site's original topographic survey.

5. Conclusions

The following conclusions are drawn from the foregoing analysis.

1. The proposed development falls within the regulated TRCA floodplain associated with the Don Valley. The floodplain limits were previously established as given in a HEC-RAS analysis by Cole Engineering in 2018 which was provided to The Odan/Detech Group and which forms the basis for the post-development analysis herein.
2. The subject property can be graded such that the flood line falls generally outside the proposed development limits when completed so as to provide a 10m setback from the flood line.
3. 29,855m^3 of flood storage volume (active storage) within the site in a Regional Storm. requires compensation in the proposed development to maintain the hydraulic function of the floodplain. This was determined by a cut-fill analysis using Autodesk AutoCAD Civil3D.
4. It is proposed to re-grade the site to provide 29,579m^3 post-development active storage flood volume. This is greater than the pre-development active flood storage volume, therefore the TRCA's criteria for Cut-Fill Balance is satisfied.
5. The pre-development HEC-RAS model (Scenario 1) was modified to represent the proposed grading within the subject site – thereby creating Scenario 2, post-development HEC-RAS model.
6. When comparing the HEC-RAS Scenario 2 (post-development) results to Scenario 1 (pre-development), it is evident that the water elevations are the same or lower than existing. It is therefore concluded that there is no additional flood impact to adjacent properties by the proposed development.
7. There floodplain does not impact the path of any emergency vehicles to access the site.

7. SOILS REPORT

A geotechnical study has been conducted by EXP. The report is titled "**Preliminary Geotechnical Investigation" "8281 Healey Road"** project number MRK-00254710-A0 dated 2019-08-12.

The underlying soils are Clayey Silt Till and Sandy Silt Till.

8. EROSION AND SEDIMENT CONTROL

Since the new construction will utilize excavation, erosion control must be utilized. Silt fence, multiple silt ponds, interception swales and rock check dams will be incorporated around the site. In order to prevent erosion use of erosion blankets, silt sacks, scarification of exposed soil and use of a sediment pond will be implemented on site at the time of construction. In addition a mud mat will be utilized at the construction entrance. A plan for erosion and sediment control will be prepared in accordance with Town, TRCA and current Erosion and Sediment Control Guidelines for Urban Development upon determining the exact development limits through the Functional Servicing and Storm Water Management stage.

9. CONCLUSIONS

From our investigation the Site is serviceable with sanitary, to be extended from Coleraine Drive and storm sewers to downstream SWM pond as well as water supply for domestic and firefighting purposes. In addition gas and hydro services are available, capacities are to be confirmed, however based on surrounding development there will be sufficient capacity available to the development from Colerain Drive. There is adequate access from Coleraine Drive to the site.

The alterations proposed to the flood plain will not alter the current floodplain elevations both on the current and adjacent development. Flood Plain volumes have been maintained or improved on.

The site is favourable for the Future Industrial Development.

10. REFERENCES:

1. Bolton Community Plan, Employment Lands and North Hill Supermarket Site, Comprehensive Environmental Impact Study and Management Plan, Phase 3 report, Aquafor Beech Limited, June 21, 2012 (Implementation).

2. Regional Municipality of Peel, Bolton Urban Community Water and Wastewater Analysis, AECOM, Markham office, Revision 4, Final Report, March 2010.

3. Storm water Management Planning and Design Manual, Ontario Ministry of the Environment, March 2003.

4. Region of Peel, North Bolton Elevated Tank, "Storm Water Management Report", Project Nos. 09-1115, 09-1970, CIMA Partners, Kitchener Office, September 7, 2012.

5. Ritchie Bros. Auctioneers, Coleraine Drive, "Site Stormwater management calculations", Town of Caledon, Aquafor Beech Limited, July 29, 1997.

6. **"Town Of Caledon Development Standards, Policies and Guidelines"**, Version 5, 2019).

7. City of Toronto **"DESIGN GUIDELINES FOR 'GREENING' SURFACE PARKING LOTS",** November 2007.

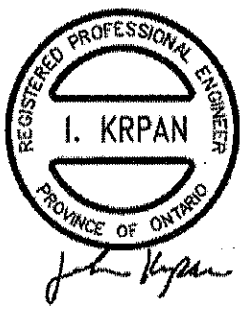
8. New Jersey Storm Water Best Management Practices Manual, April 2004.

9. EPA SWMM 5, Build 5.0.022, Manual.

10. **LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT MANUAL**, 2008, by Credit Valley Conservation Authority and Toronto Region Conservation Authority.

11. **THE EROSION AND SEDIMENTATION CONTROL GUIDELINES FOR URBAN CONSTRUCTION** prepared by the Greater Golden Horseshoe Area Conservation Authorities.

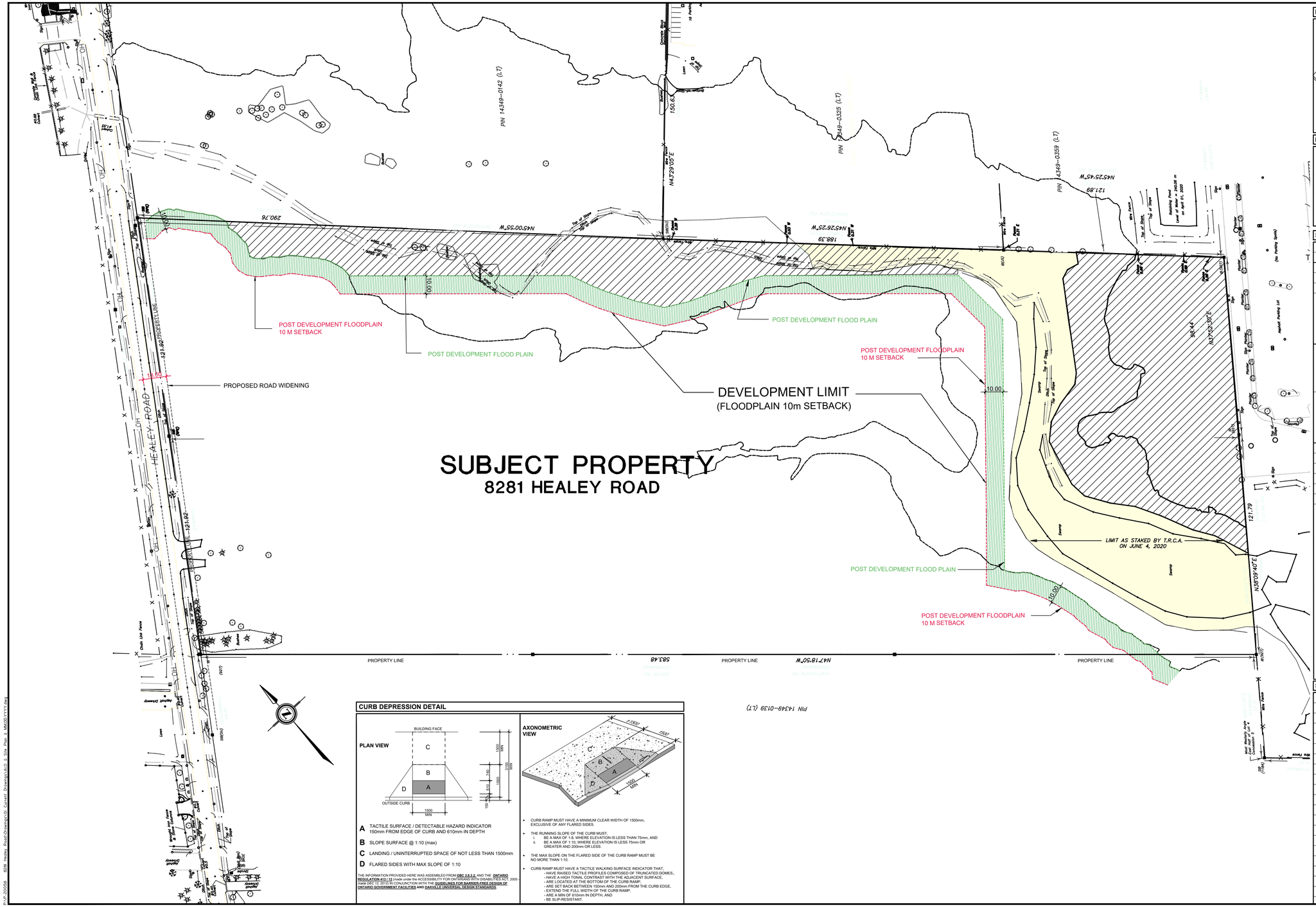
Respectfully Submitted;
The Odan Detech Group Inc.



John Krpan, M.S.C.E., P.Eng. | Mark Harris, Dipl. Tech. | DATE

APPENDIX A

- Aerial Photo of Site



CURB DEPRESSION DETAIL

A TACTILE SURFACE / DETECTABLE HAZARD INDICATOR
150mm FROM EDGE OF CURB AND 610mm IN DEPTH

B SLOPE SURFACE @ 1:10 (max)

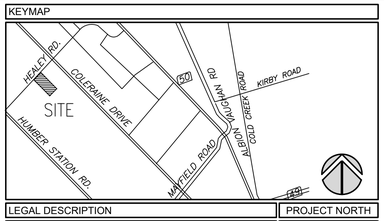
C LANDING / UNINTERRUPTED SPACE OF NOT LESS THAN 1500mm

D FLARED SIDES WITH MAX SLOPE OF 1:10

THE INFORMATION PROVIDED HERE WAS ASSEMBLED FROM **ONC 3.8.3.2.** AND THE **ONTARIO REGULATION 413 / 12** made under the ACCESSIBILITY FOR ONTARIANS WITH DISABILITIES ACT, 2005 - made DEC 12 2012 IN CONJUNCTION WITH THE **GUIDELINES FOR BARRIER-FREE DESIGN OF ONTARIO GOVERNMENT FACILITIES** AND **OAKVILLE UNIVERSAL DESIGN STANDARDS**

- CURB RAMP MUST HAVE A MINIMUM CLEAR WIDTH OF 1500mm, EXCLUSIVE OF ANY FLARED SIDES.
- THE RUNNING SLOPE OF THE CURB MUST,
  - i. BE A MAX OF 1:8, WHERE ELEVATION IS LESS THAN 75mm, AND
  - ii. BE A MAX OF 1:10, WHERE ELEVATION IS LESS 75mm OR GREATER AND 200mm OR LESS.
- THE MAX SLOPE ON THE FLARED SIDE OF THE CURB RAMP MUST BE NO MORE THAN 1:10.
- CURB RAMP MUST HAVE A TACTILE WALKING SURFACE INDICATOR THAT,
  - HAVE RAISED TACTILE PROFILES COMPOSED OF TRUNCATED DOMES,
  - HAVE A HIGH TONAL CONTRAST WITH THE ADJACENT SURFACE,
  - ARE LOCATED AT THE BOTTOM OF THE CURB RAMP,
  - ARE SET BACK BETWEEN 150mm AND 200mm FROM THE CURB EDGE,
  - EXTEND THE FULL WIDTH OF THE CURB RAMP,
  - ARE A MIN OF 610mm IN DEPTH, AND
  - BE SLIP-RESISTANT.

KEYMAP



LEGAL DESCRIPTION

TOPOGRAPHY SURVEY OF
PART OF LOT 5
CONCESSION 5
(GEOGRAPHIC TOWNSHIP OF ALBION)
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

SPEIGHT, VAN NOSTRAND & GIBSON LIMITED
ONTARIO LAND SURVEYORS
2020

PROJECT NORTH

TRUE NORTH

SITE STATISTICS

SITE AREA			135,830.97 m2 or	33.56 acres
ZONING	Prestige Industrial Zone	MP - 580	MS - 579	
		REQUIRED	REQUIRED	PROVIDED
LOT FRONTAGE		30 m	30 m	243.85 m
PLANTING STRIP (FRONT YARD)		6.0 m	6.0 m	TBD m
SETBACKS	FRONT YARD (EAST)	6.0 m	6.0 m	TBD m
SETBACKS	REAR YARD (WEST)	7.5 m	3.0 m	TBD m
SETBACKS	EXTERIOR YARD	6.0 m	6.0 m	N/A
SETBACKS	INTERIOR SIDE YARD (NORTH)	6.0 m	6.0 m	TBD m
SETBACKS	INTERIOR SIDE YARD (SOUTH)	3.0 m	3.0 m	TBD m
PARKING	PROPOSED BUILDING			
PARKING	TOTAL PARKING		TBD spaces	TBD spaces
PARKING	ACCESSIBLE PARKING (TYPE A AND B) TBD		TBD spaces	TBD spaces
PARKING SETBACKS	FRONT YARD (EAST)	6.0 m	6.0 m	TBD m
PARKING SETBACKS	REAR YARD (WEST)	7.5 m	3.0 m	TBD m
PARKING SETBACKS	EXTERIOR YARD	6.0 m	6.0 m	N/A
PARKING SETBACKS	INTERIOR SIDE YARD (NORTH) ABUTTING ZONE EPA1 - SETBACK REDUCED 50%	(3m to 1.5m) 1.5 m	(3m to 1.5m) 1.5 m	TBD m
PARKING SETBACKS	INTERIOR SIDE YARD (SOUTH)	3.0 m	3.0 m	TBD m
BUILDING GFA			TBD m2 or	TBD sq.ft.
SITE COVERAGE MAX 60%			TBD m2 or	0 %
LANDSCAPED AREA (10%)			TBD m2 or	TBD %
PAVED AREA			TBD m2 or	TBD %
		REQUIRED	REQUIRED	PROVIDED
BUILDING HEIGHT (MAXIMUM)		18.0 m	18.0 m	TBD

SYMBOL LEGEND

	MAN DOOR
	LOADING DOCK DOOR
	DRIVE-IN / OVERHEAD DOOR
FH	HYDRANT + VALVE
	FIRE DEPARTMENT CONNECTION / SIAMESE
CB	CATCH BASIN
DCB	DOUBLE CATCH BASIN
SANMH	SANITARY MAN HOLE
CB/MH	CATCH BASIN / MAN HOLE
SMH	STORM MAN HOLE
HP	HYDRO POLE STANDARD / UTILITY POLE
BR	BIKE RACK (2 SPACES)
HT	HYDRO TRANSFORMER
	ACCESSIBLE PARKING SPACE
	ACCESSIBLE PARKING SPACE SIGNAGE
SNW	SNOW STORAGE AREA
	WALL MOUNTED LIGHT (SEE ELECTR. DWGS.)
	POLE MOUNTED LIGHT (SEE ELECTR. DWGS.)

No.	ISSUED	DATE

No.	REVISION	DATE

BALDASSARRA Architects Inc.
30 Great Gulf Drive, Unit 20 | Concord ON | L4K 0K7
T. 905.660.0722 | **www.baldassarra.ca**

OWNERS INFORMATION:
One Properties
2710-333 Bay Street
Toronto, ON. M5H 2R2

8281 Healey Road GP Limited

Caledon, ON

Site Plan

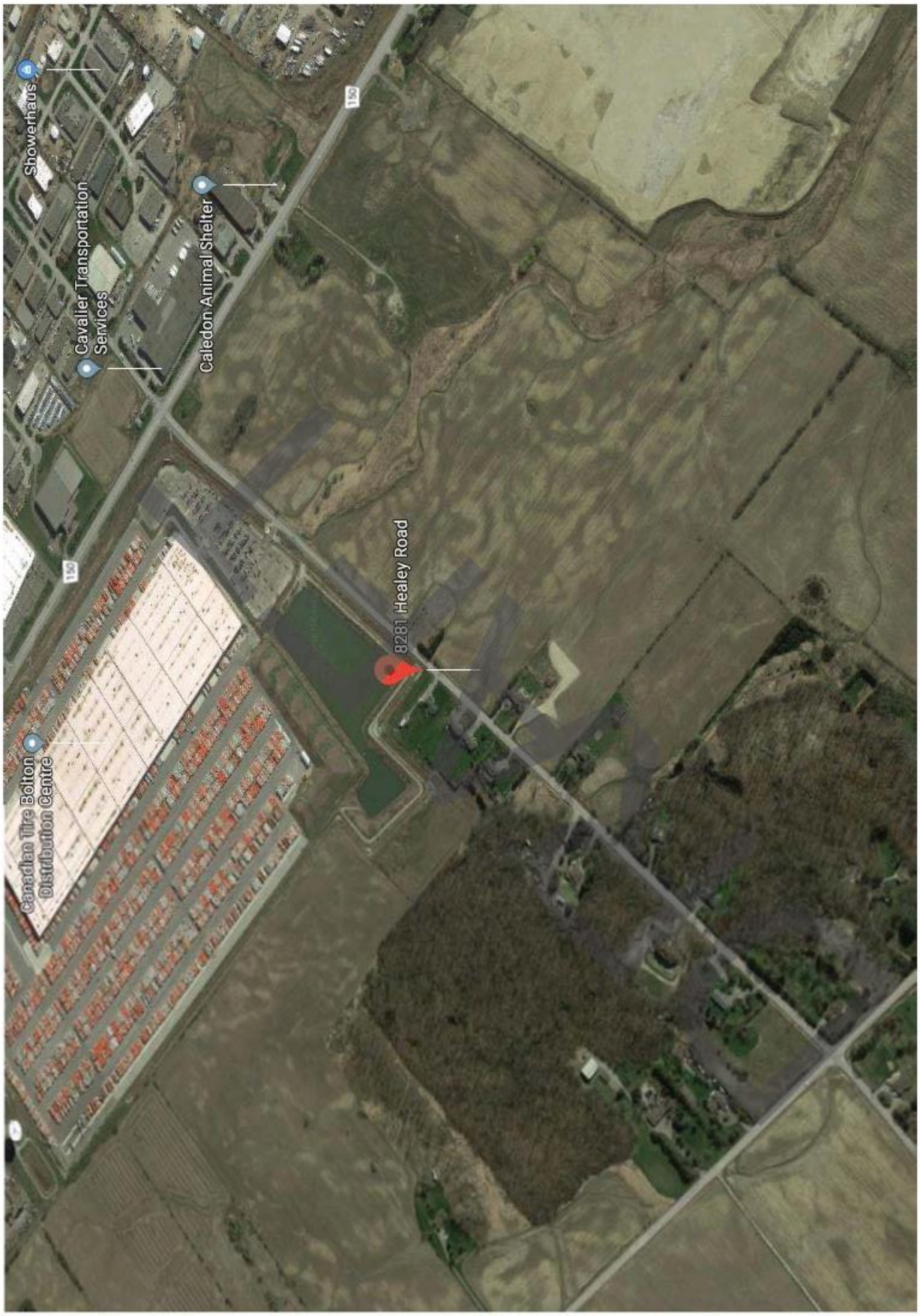
RZ 2020-0007

DATE:	DRAWN BY:	CHECKED:	SCALE:
MAR, 2021	DM		N.T.S.

PROJECT No. P-20058

DRAWING No. A-1.0

P:\P-20058 - 8281 Healey Road\Drawings\05 Current Drawings\A0.0 Site Plan & MMO's.vwx 2021-03-31 3:42:41 PM


Showerhaus
Cavalier Transportation Services
Caledon Animal Shelter
8281 Healey Road
Canadian Tire Bolton Distribution Centre
50
50

APPENDIX B

- Concept Sanitary Sewer (Fig. SAN)

HEALEY ROAD

8281
HEALEY ROAD

250m+/- PROPOSED FORCE MAIN LOCATED WITH SOUTH SHOULDER OF HEALEY ROAD

PROP. SAN. MH 103A
RIM ELEV 246.46
NE INV EL 243.50
S INV EL 243.50

PROP 45.28m 250mmø PVC SAN @ 0.60%

PROP. SAN. MH 102A
RIM ELEV 247.24
SW INV EL 243.23
NE INV EL 243.23

PROP 77.61m 250mmø PVC SAN @ 0.60%

PROP. SAN. MH 101A
RIM ELEV 247.57
SW INV EL 242.76
NE INV EL 242.76

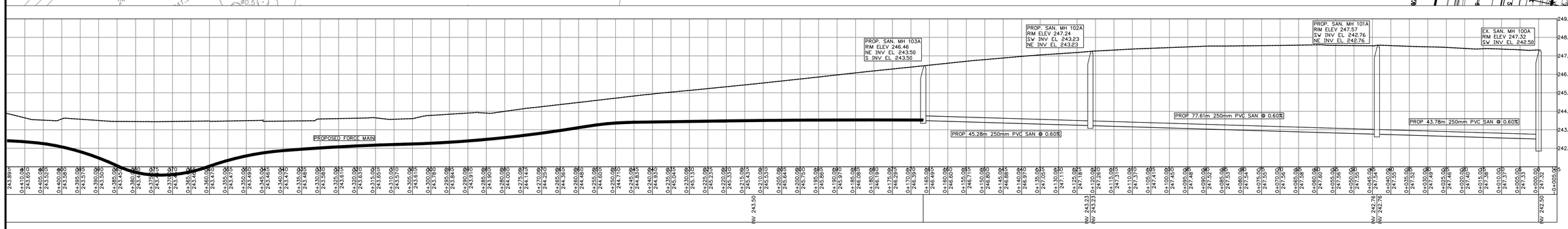
PROP 43.78m 250mmø PVC SAN @ 0.60%

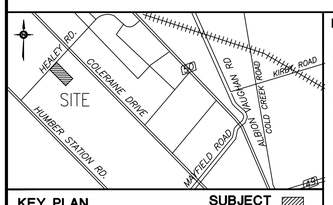
EX. SAN. MH 100A
RIM ELEV 247.32
SW INV EL 242.50

MATCH LINE
REFER TO DWG. No. FF184-D

COLERAINE DRIVE

ALBION CEMETERY





KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

NOTES:

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EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY R. AVIS SURVEYING INC.

BOUNDARY DATA DERIVED FROM INFORMATION FROM R. AVIS SURVEYING INC.

BENCH MARK:

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM THE TOWN OF CALEDON BENCHMARK No. 758056.

ELEVATION:
PUBLISHED ELEVATION = 251.263 metres.

BEARING NOTE:

BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE REFERRED TO THE NORTHEASTERLY LIMIT OF PART 1 AS SHOWN ON PLAN 43R-30545, HAVING A BEARING OF N45°52'40"W.

METRIC NOTE:

DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
1	1ST SUBMISSION	JULY 31/20	M.H.H.
2	ISSUED FOR COORDINATION	FEB 8/21	M.H.H.
3	2ND SUBMISSION	MAR 5/21	M.H.H.

PROJECT:

PROPOSED INDUSTRIAL DEVELOPMENT
8281 HEALEY ROAD
CALEDON, ONTARIO

CITY FILE: RZ 2020-0007

CLIENT :

8281 HEALEY ROAD GP LIMITED
c/o ONE PROPERTIES
333 BAY ST SUITE 2710,
TORONTO, ON. M5H 2R2

ODAN·DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE: 1:500 | PROJECT NO: 19233 | DATE: JUNE 2020

SCALE:

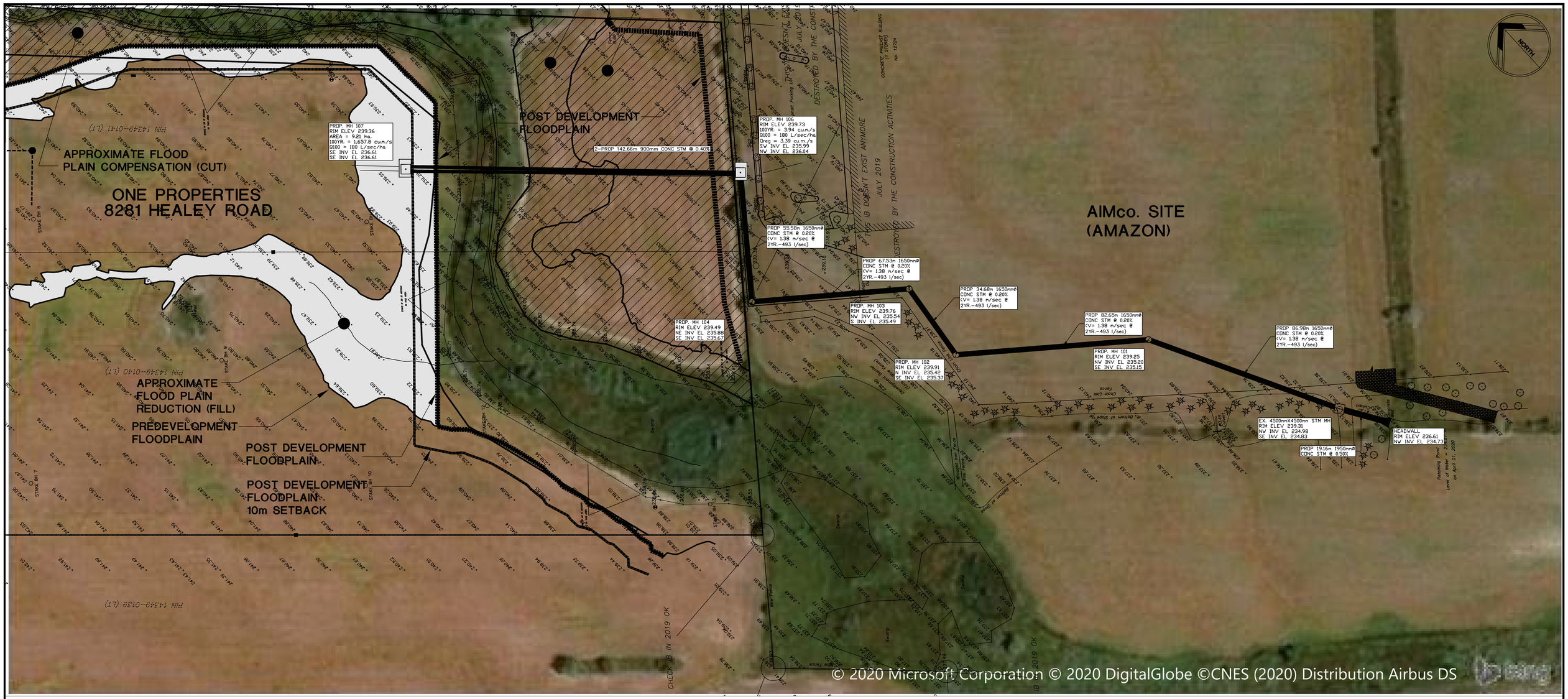
DRAWING : **HEALEY ROAD CONCEPTUAL SANITARY SEWER LAYOUT**

REGISTERED PROFESSIONAL ENGINEER
I. KRPAN
MAR 5/21
PROVINCE OF ONTARIO
ENGINEER

DESIGN BY:	M.H.H.
DRAWN BY:	S.B.
CHECKED BY:	J.K.
APPROVED BY:	J.K.
DRWG. NO.:	FIG. SAN.

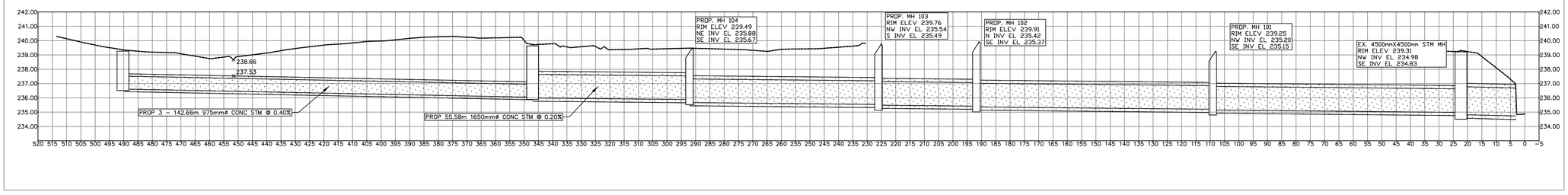
APPENDIX C

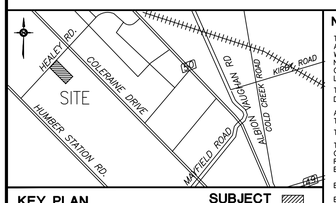
- Concept Storm Sewer (Fig. STM)
- Pre & Post Development Flood Plain Mapping (Fig. FPM)
- Scenario 1, Pre-Development, HEC-RAS Model Output Table
- Scenario 2, Post-Development, HEC-RAS Model Output Table
- Geoprocess Technical Memo (8281 Healey Road Development Fluvial Geomorphology and Erosion Hazard Assessment)
- AM Candaras Technical Memo (Stormwater Management Facility #3 Evaluation for Additional Drainage Design Brief)



LEGEND:

- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES PROPOSED INLET CONTROL DEVICE (ICD)
- DENOTES EXISTING STORM SEWER
- DENOTES PROPOSED STORM SEWER





KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

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PROJECT:

PROPOSED INDUSTRIAL DEVELOPMENT
8281 HEALEY ROAD
CALEDON, ONTARIO

CITY FILE: RZ 2020-0007

CLIENT :

8281 HEALEY ROAD GP LIMITED
c/o ONE PROPERTIES
333 BAY ST SUITE 2710,
TORONTO, ON. M5H 2R2

ODAN·DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3911 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE: 1:500 | PROJECT NO: 19233 | DATE: JUNE 2020

SCALE:

DRAWING : **HEALEY ROAD CONCEPTUAL STORM SEWER LAYOUT**

REGISTERED PROFESSIONAL ENGINEER I. KRPAN MAR 5/21 PROVINCE OF ONTARIO ENGINEER

DESIGN BY:	M.H.H.
DRAWN BY:	S.B.
CHECKED BY:	J.K.
APPROVED BY:	J.K.
DRWG. NO.:	FIG. STM.

LEGEND

Cross-Section Label

REGULATORY FLOOD ELEVATION IS THE HIGHER OF THE TWO ELEVATIONS DISPLAYED

Regional Flood Elevation (m)

172.00 / 172.00 — 14.060 — Cross-Section Number — 14.060 — 172.00 / 172.00

100 Year Flood Elevation (m)

Cross-Section Leader Line

Cross-Section Length

100 Yr WSE > Regional WSE

Regional WSE > 100 Yr WSE

ITALICS Denotes Post-Development Flood Elevation

NORTH

242.19 / 242.20

1561.698

242.19 / 242.20

APPROXIMATE FLOOD PLAIN COMPENSATION (CUT)

EXISTING DRAIN 2020

PROPOSE CREEK REALIGNMENT

POST DEVELOPMENT FLOODPLAIN 10m SETBACK

POST DEVELOPMENT FLOODPLAIN

PROPOSE CREEK REALIGNMENT

239.99 / 239.98

APPROXIMATE FLOOD PLAIN COMPENSATION (CUT)

APPROXIMATE FLOOD PLAIN COMPENSATION (CUT)

242.85 / 242.85

1561.762

POST DEVELOPMENT FLOODPLAIN 10m SETBACK

POST DEVELOPMENT FLOODPLAIN

APPROXIMATE FLOOD PLAIN REDUCTION

APPROXIMATE FLOOD PLAIN COMPENSATION (CUT)

240.49 / 240.50

1561.256

POST DEVELOPMENT FLOODPLAIN

PREDEVELOPMENT FLOODPLAIN (TRCA)

239.30 / 239.37

241.47 / 241.48

241.07 / 241.08

241.14 / 241.15

APPROXIMATE FLOOD PLAIN REDUCTION (FILL)

PREDEVELOPMENT FLOODPLAIN

239.50 / 239.49

239.95 / 239.96

POST DEVELOPMENT FLOODPLAIN

POST DEVELOPMENT FLOODPLAIN 10m SETBACK

239.31 / 239.32

241.60 / 241.61

1561.551

1561.404

1561.120

1560.977

HEALEY ROAD (ORIGINAL ROAD ALLOWANCE BETWEEN LOTS 5 AND 6) PIN 14326-0114 (LT)

CONCESSION 5 EAST HALF LOT 5

KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

SITE

HEALEY RD.

COLERAINE DRIVE

HUMBER STATION RD.

MAYFIELD ROAD

NORTH HILL PROPERTIES LTD

CREDITVIEW ROAD

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2	ISSUED FOR COORDINATION	FEB 8/21	M.H.H.
3	2ND SUBMISSION	MAR 5/21	M.H.H.

PROJECT:

PROPOSED INDUSTRIAL DEVELOPMENT
8281 HEALEY ROAD
CALEDON, ONTARIO

CITY FILE: RZ 2020-0007

CLIENT :

8281 HEALEY ROAD GP LIMITED
c/o ONE PROPERTIES
333 BAY ST SUITE 2710,
TORONTO, ON. M5H 2R2

ODAN·DETECH CONSULTING ENGINEERS

The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE:

PROJECT NO: 19233

DATE: JUNE 2020

SCALE:

DRAWING : **HEC-RAS FLOODPLAIN MAPPING**

REGISTERED PROFESSIONAL ENGINEER I. KRPAN MAR 5/21 PROVINCE OF ONTARIO ENGINEER

DESIGN BY:	M.H.H.
DRAWN BY:	S.B.
CHECKED BY:	J.K.
APPROVED BY:	J.K.
DRWG. NO.:	FIG. FPM

Scenario 1 Pre-Development HEC-RAS Output Table

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Reach1	1561.762	43.10-14	2-year	5.03	241.59	242.36	242.19	242.45	0.005013	1.35	4.70	17.81	0.58
Reach1	1561.762	43.10-14	5-year	8.77	241.59	242.49	242.43	242.63	0.006099	1.72	8.78	40.59	0.66
Reach1	1561.762	43.10-14	10-year	18.33	241.59	242.71	242.71	242.87	0.006680	2.15	21.21	76.11	0.72
Reach1	1561.762	43.10-14	25-year	23.05	241.59	242.78	242.78	242.94	0.006570	2.25	27.11	82.82	0.72
Reach1	1561.762	43.10-14	50-year	26.61	241.59	242.82	242.82	242.99	0.007098	2.39	29.98	85.15	0.76
Reach1	1561.762	43.10-14	100-year	30.15	241.59	242.85	242.85	243.03	0.007262	2.48	33.31	87.70	0.77
Reach1	1561.762	43.10-14	350-year	48.79	241.59	243.01	243.01	243.22	0.008254	2.90	47.88	97.96	0.84
Reach1	1561.762	43.10-14	500-year	58.76	241.59	243.07	243.07	243.30	0.008809	3.10	54.09	100.27	0.88
Reach1	1561.762	43.10-14	Regional	29.41	241.59	242.85	242.85	243.03	0.007266	2.46	32.55	87.18	0.77
Reach1	1561.698	43.10-13	2-year	5.03	241.38	241.87	241.87	241.95	0.013038	1.75	8.41	53.80	0.88
Reach1	1561.698	43.10-13	5-year	8.77	241.38	241.94	241.94	242.03	0.015072	2.10	12.34	59.38	0.97
Reach1	1561.698	43.10-13	10-year	18.33	241.38	242.07	242.07	242.18	0.016630	2.59	22.26	81.35	1.06
Reach1	1561.698	43.10-13	25-year	23.05	241.38	242.12	242.11	242.23	0.016509	2.72	26.28	83.36	1.07
Reach1	1561.698	43.10-13	50-year	26.61	241.38	242.16	242.14	242.27	0.015525	2.75	29.72	85.15	1.05
Reach1	1561.698	43.10-13	100-year	30.15	241.38	242.20	242.15	242.31	0.015419	2.83	32.68	87.76	1.06
Reach1	1561.698	43.10-13	350-year	48.79	241.38	242.37	242.32	242.49	0.014264	3.14	50.82	117.67	1.05
Reach1	1561.698	43.10-13	500-year	58.76	241.38	242.44	242.38	242.56	0.013372	3.19	58.97	120.60	1.03
Reach1	1561.698	43.10-13	Regional	29.41	241.38	242.19	242.16	242.30	0.015409	2.81	32.10	87.31	1.06
Reach1	1561.551	43.10-12	2-year	5.03	240.75	241.25		241.26	0.001754	0.28	23.89	130.70	0.14
Reach1	1561.551	43.10-12	5-year	8.77	240.75	241.33		241.34	0.001929	0.34	34.96	143.52	0.15
Reach1	1561.551	43.10-12	10-year	18.33	240.75	241.49		241.49	0.001918	0.40	58.28	157.36	0.16
Reach1	1561.551	43.10-12	25-year	23.05	240.75	241.54		241.54	0.002102	0.44	66.11	163.05	0.17
Reach1	1561.551	43.10-12	50-year	26.61	240.75	241.57		241.58	0.002168	0.47	72.00	164.61	0.18
Reach1	1561.551	43.10-12	100-year	30.15	240.75	241.61		241.62	0.002167	0.48	78.18	166.29	0.18
Reach1	1561.551	43.10-12	350-year	48.79	240.75	241.76		241.78	0.002350	0.57	104.32	172.81	0.19
Reach1	1561.551	43.10-12	500-year	58.76	240.75	241.84		241.85	0.002371	0.60	117.38	175.36	0.19
Reach1	1561.551	43.10-12	Regional	29.41	240.75	241.60		241.61	0.002172	0.48	76.83	165.84	0.18
Reach1	1561.404	43.10-11	2-year	5.03	239.94	240.75	240.75		240.85	0.005707	1.50	7.43	69.82	0.61
Reach1	1561.404	43.10-11	5-year	8.77	239.94	240.86	240.86		240.94	0.005459	1.63	16.25	91.68	0.61
Reach1	1561.404	43.10-11	10-year	18.33	239.94	241.00	240.97	241.09	0.006302	1.98	30.76	114.96	0.68
Reach1	1561.404	43.10-11	25-year	23.05	239.94	241.06	240.99	241.14	0.005884	2.00	38.09	119.86	0.66
Reach1	1561.404	43.10-11	50-year	26.61	239.94	241.11	241.05	241.18	0.005566	2.01	43.52	122.58	0.65
Reach1	1561.404	43.10-11	100-year	30.15	239.94	241.15	241.08	241.22	0.005434	2.04	49.13	137.47	0.65
Reach1	1561.404	43.10-11	350-year	48.79	239.94	241.33	241.19	241.40	0.004460	2.07	78.55	183.75	0.60
Reach1	1561.404	43.10-11	500-year	58.76	239.94	241.42	241.24	241.48	0.004176	2.10	97.32	228.93	0.59
Reach1	1561.404	43.10-11	Regional	29.41	239.94	241.14	241.07	241.22	0.005348	2.02	48.49	137.33	0.64
Reach1	1561.256	43.10-10	2-year	5.03	239.10	239.85	239.61		239.87	0.007322	0.68	9.89	40.73	0.30
Reach1	1561.256	43.10-10	5-year	8.77	239.10	240.01	239.73		240.03	0.005749	0.71	17.36	53.59	0.28

Reach1	1561.256 43.10-10	10-year	18.33	239.10	240.27	239.91	240.29	0.004508	0.78	33.64	71.37	0.26
Reach1	1561.256 43.10-10	25-year	23.05	239.10	240.37	239.97	240.39	0.004244	0.81	41.16	78.96	0.25
Reach1	1561.256 43.10-10	50-year	26.61	239.10	240.44	240.00	240.46	0.004153	0.84	47.06	87.59	0.25
Reach1	1561.256 43.10-10	100-year	30.15	239.10	240.50	240.04	240.52	0.004014	0.86	52.83	94.02	0.25
Reach1	1561.256 43.10-10	350-year	48.79	239.10	240.75	240.18	240.77	0.003812	0.95	78.77	116.03	0.25
Reach1	1561.256 43.10-10	500-year	58.76	239.10	240.86	240.23	240.88	0.003817	1.00	108.98	216.44	0.26
Reach1	1561.256 43.10-10	Regional	29.41	239.10	240.49	240.03	240.51	0.004061	0.86	51.60	93.28	0.25
Reach1	1561.120 43.10-09	2-year	5.03	238.71	239.38	239.09	239.39	0.002123	0.40	13.31	36.85	0.17
Reach1	1561.120 43.10-09	5-year	8.77	238.71	239.51	239.17	239.53	0.002565	0.51	18.45	40.82	0.19
Reach1	1561.120 43.10-09	10-year	18.33	238.71	239.75	239.31	239.77	0.003192	0.68	29.15	49.65	0.22
Reach1	1561.120 43.10-09	25-year	23.05	238.71	239.84	239.38	239.87	0.003395	0.75	33.77	52.81	0.23
Reach1	1561.120 43.10-09	50-year	26.61	238.71	239.91	239.41	239.93	0.003478	0.79	37.21	54.88	0.24
Reach1	1561.120 43.10-09	100-year	30.15	238.71	239.96	239.45	239.99	0.003652	0.83	40.34	58.70	0.25
Reach1	1561.120 43.10-09	350-year	48.79	238.71	240.20	239.62	240.22	0.004036	0.99	67.05	159.29	0.27
Reach1	1561.120 43.10-09	500-year	58.76	238.71	240.29	239.69	240.32	0.004069	1.04	83.75	181.91	0.27
Reach1	1561.120 43.10-09	Regional	29.41	238.71	239.95	239.45	239.98	0.003649	0.83	39.52	57.42	0.25
Reach1	1560.977 43.10-08	2-year	5.03	238.47	238.92	238.76	238.92	0.005948	0.40	13.08	62.40	0.25
Reach1	1560.977 43.10-08	5-year	8.77	238.47	239.00	238.82	239.01	0.006028	0.48	18.79	68.10	0.26
Reach1	1560.977 43.10-08	10-year	18.33	238.47	239.16	238.91	239.18	0.006155	0.63	30.19	74.14	0.28
Reach1	1560.977 43.10-08	25-year	23.05	238.47	239.23	238.94	239.25	0.006170	0.68	35.04	76.56	0.29
Reach1	1560.977 43.10-08	50-year	26.61	238.47	239.27	238.97	239.30	0.006201	0.71	38.52	78.82	0.29
Reach1	1560.977 43.10-08	100-year	30.15	238.47	239.32	238.99	239.35	0.006153	0.75	42.42	84.24	0.29
Reach1	1560.977 43.10-08	350-year	48.79	238.47	239.51	239.11	239.55	0.006329	0.90	60.14	110.25	0.31
Reach1	1560.977 43.10-08	500-year	58.76	238.47	239.60	239.15	239.64	0.006389	0.96	71.04	137.36	0.32
Reach1	1560.977 43.10-08	Regional	29.41	238.47	239.31	238.99	239.33	0.006129	0.74	41.39	81.34	0.29
Reach1	1560.820 43.10-07	2-year	5.03	237.72	238.07		238.08	0.005295	0.43	11.51	54.74	0.24
Reach1	1560.820 43.10-07	5-year	8.77	237.72	238.17		238.18	0.005112	0.50	18.29	76.21	0.25
Reach1	1560.820 43.10-07	10-year	18.33	237.72	238.35		238.37	0.004904	0.62	32.52	83.70	0.26
Reach1	1560.820 43.10-07	25-year	23.05	237.72	238.42		238.44	0.004830	0.67	38.55	88.47	0.26
Reach1	1560.820 43.10-07	50-year	26.61	237.72	238.47		238.49	0.004768	0.69	42.80	90.58	0.26
Reach1	1560.820 43.10-07	100-year	30.15	237.72	238.51		238.53	0.004782	0.72	46.78	93.94	0.26
Reach1	1560.820 43.10-07	350-year	48.79	237.72	238.71		238.74	0.004641	0.83	66.45	105.70	0.27
Reach1	1560.820 43.10-07	500-year	58.76	237.72	238.80		238.83	0.004611	0.88	75.92	109.20	0.27
Reach1	1560.820 43.10-07	Regional	29.41	237.72	238.50		238.53	0.004771	0.72	46.00	93.57	0.26
Reach1	1560.680 43.10-06	2-year	5.03	236.40	237.18	237.07	237.20	0.008013	0.69	8.80	36.88	0.31
Reach1	1560.680 43.10-06	5-year	8.77	236.40	237.28	237.12	237.31	0.007935	0.76	12.69	37.78	0.32
Reach1	1560.680 43.10-06	10-year	18.33	236.40	237.48		237.52	0.007829	0.85	21.17	46.26	0.32
Reach1	1560.680 43.10-06	25-year	23.05	236.40	237.56		237.60	0.007774	0.91	24.83	50.56	0.33
Reach1	1560.680 43.10-06	50-year	26.61	236.40	237.61		237.66	0.007680	0.94	27.64	53.34	0.33
Reach1	1560.680 43.10-06	100-year	30.15	236.40	237.67		237.72	0.007436	0.97	30.57	55.74	0.33
Reach1	1560.680 43.10-06	350-year	48.79	236.40	237.90		237.97	0.006937	1.10	44.94	67.95	0.33
Reach1	1560.680 43.10-06	500-year	58.76	236.40	238.02		238.08	0.006524	1.13	53.07	73.72	0.32

Reach1	1560.680 43.10-06	Regional	29.41	236.40	237.65		237.70	0.007532	0.96	29.89	55.19	0.33
Reach1	1560.547 43.10-05	2-year	5.03	235.53	236.02		236.09	0.008492	1.46	7.25	29.02	0.72
Reach1	1560.547 43.10-05	5-year	8.77	235.53	236.15		236.23	0.007958	1.69	11.27	32.88	0.73
Reach1	1560.547 43.10-05	10-year	18.33	235.53	236.39		236.49	0.007402	2.08	19.85	38.62	0.75
Reach1	1560.547 43.10-05	25-year	23.05	235.53	236.49		236.60	0.007011	2.19	23.78	39.98	0.74
Reach1	1560.547 43.10-05	50-year	26.61	235.53	236.56		236.68	0.006878	2.28	26.67	41.96	0.75
Reach1	1560.547 43.10-05	100-year	30.15	235.53	236.62		236.75	0.006802	2.37	29.29	43.08	0.75
Reach1	1560.547 43.10-05	350-year	48.79	235.53	236.91		237.07	0.006491	2.74	42.74	49.65	0.77
Reach1	1560.547 43.10-05	500-year	58.76	235.53	237.04		237.22	0.006416	2.90	49.42	52.89	0.77
Reach1	1560.547 43.10-05	Regional	29.41	235.53	236.61		236.74	0.006724	2.34	28.89	42.95	0.75
Reach1	1560.383 43.10-04	2-year	5.03	234.60	235.23		235.24	0.003570	0.50	10.64	32.80	0.22
Reach1	1560.383 43.10-04	5-year	8.77	234.60	235.37		235.39	0.003666	0.59	15.67	36.42	0.23
Reach1	1560.383 43.10-04	10-year	18.33	234.60	235.64		235.66	0.003789	0.75	26.18	42.35	0.24
Reach1	1560.383 43.10-04	25-year	23.05	234.60	235.73		235.76	0.004021	0.82	30.09	43.83	0.25
Reach1	1560.383 43.10-04	50-year	26.61	234.60	235.79		235.83	0.004111	0.86	33.01	44.82	0.26
Reach1	1560.383 43.10-04	100-year	30.15	234.60	235.86		235.90	0.004160	0.90	35.92	46.09	0.26
Reach1	1560.383 43.10-04	350-year	48.79	234.60	236.11		236.17	0.004724	1.09	48.35	50.94	0.29
Reach1	1560.383 43.10-04	500-year	58.76	234.60	236.24		236.30	0.004838	1.17	54.81	53.31	0.30
Reach1	1560.383 43.10-04	Regional	29.41	234.60	235.83		235.87	0.004290	0.90	34.89	45.62	0.27
Reach1	1560.237 43.10-03	2-year	5.03	233.85	234.32	234.31	234.40	0.011102	1.44	6.31	37.02	0.80
Reach1	1560.237 43.10-03	5-year	8.77	233.85	234.40	234.39	234.51	0.012228	1.76	9.52	38.87	0.87
Reach1	1560.237 43.10-03	10-year	18.33	233.85	234.56	234.53	234.72	0.013710	2.30	15.81	42.23	0.97
Reach1	1560.237 43.10-03	25-year	23.05	233.85	234.64	234.60	234.81	0.012709	2.41	19.13	43.39	0.95
Reach1	1560.237 43.10-03	50-year	26.61	233.85	234.69	234.63	234.87	0.012394	2.51	21.50	45.19	0.95
Reach1	1560.237 43.10-03	100-year	30.15	233.85	234.74	234.69	234.93	0.012169	2.59	23.70	46.31	0.95
Reach1	1560.237 43.10-03	350-year	48.79	233.85	234.98	234.87	235.20	0.010219	2.87	35.85	52.20	0.92
Reach1	1560.237 43.10-03	500-year	58.76	233.85	235.09	234.97	235.33	0.009842	3.02	41.60	54.59	0.92
Reach1	1560.237 43.10-03	Regional	29.41	233.85	234.75	234.68	234.92	0.011039	2.49	24.11	46.54	0.91
Reach1	1560.111 43.10-02	2-year	5.03	232.29	233.12		233.14	0.008922	0.86	9.42	34.45	0.34
Reach1	1560.111 43.10-02	5-year	8.77	232.29	233.26		233.28	0.007738	0.91	14.34	36.51	0.33
Reach1	1560.111 43.10-02	10-year	18.33	232.29	233.53		233.56	0.006404	1.00	24.65	39.55	0.31
Reach1	1560.111 43.10-02	25-year	23.05	232.29	233.63		233.66	0.006537	1.08	28.56	41.13	0.32
Reach1	1560.111 43.10-02	50-year	26.61	232.29	233.70		233.73	0.006611	1.12	31.40	42.35	0.32
Reach1	1560.111 43.10-02	100-year	30.15	232.29	233.77		233.81	0.006492	1.16	34.44	43.62	0.32
Reach1	1560.111 43.10-02	350-year	48.79	232.29	234.01		234.07	0.007510	1.40	45.68	47.85	0.36
Reach1	1560.111 43.10-02	500-year	58.76	232.29	234.15		234.22	0.007459	1.47	52.45	50.85	0.36
Reach1	1560.111 43.10-02	Regional	29.41	232.29	233.71		233.75	0.007678	1.22	31.95	42.59	0.35
Reach1	1560.000 43.10-01	2-year	5.03	231.96	232.38		232.41	0.005163	1.14	9.74	31.10	0.56
Reach1	1560.000 43.10-01	5-year	8.77	231.96	232.50		232.54	0.006091	1.45	13.40	33.15	0.64
Reach1	1560.000 43.10-01	10-year	18.33	231.96	232.71		232.79	0.007711	2.04	20.98	39.25	0.76
Reach1	1560.000 43.10-01	25-year	23.05	231.96	232.80		232.89	0.007758	2.22	24.74	41.79	0.78

Reach1	1560.000 43.10-01	50-year	26.61	231.96	232.86	232.96	0.007659	2.32	27.50	43.07	0.78
Reach1	1560.000 43.10-01	100-year	30.15	231.96	232.91	233.02	0.008063	2.46	29.47	43.88	0.81
Reach1	1560.000 43.10-01	350-year	48.79	231.96	233.37	233.46	0.004367	2.36	52.80	55.86	0.64
Reach1	1560.000 43.10-01	500-year	58.76	231.96	233.54	233.63	0.003992	2.43	62.46	59.52	0.62
Reach1	1560.000 43.10-01	Regional	29.41	231.96	233.05	233.12	0.004533	2.02	36.05	48.49	0.62

Scenario 2 Post-Development HEC-RAS Output Table

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Reach1	1561.762	43.10-14 2-year	5.03	241.59	242.33	242.19	242.43	0.006257	1.45	4.17	16.06	0.64
Reach1	1561.762	43.10-14 5-year	8.77	241.59	242.47	242.43	242.62	0.007153	1.82	7.87	38.37	0.71
Reach1	1561.762	43.10-14 10-year	18.33	241.59	242.71	242.71	242.87	0.006680	2.15	21.21	76.11	0.72
Reach1	1561.762	43.10-14 25-year	23.05	241.59	242.78	242.78	242.94	0.006570	2.25	27.11	82.82	0.72
Reach1	1561.762	43.10-14 50-year	26.61	241.59	242.82	242.82	242.99	0.007098	2.39	29.98	85.15	0.76
Reach1	1561.762	43.10-14 100-year	30.15	241.59	242.85	242.85	243.03	0.007262	2.48	33.31	87.70	0.77
Reach1	1561.762	43.10-14 350-year	48.79	241.59	243.01	243.01	243.22	0.008254	2.90	47.88	97.96	0.84
Reach1	1561.762	43.10-14 500-year	58.76	241.59	243.07	243.07	243.30	0.008809	3.10	54.09	100.27	0.88
Reach1	1561.762	43.10-14 Regional	29.41	241.59	242.85	242.85	243.03	0.007266	2.46	32.55	87.18	0.77
Reach1	1561.698	43.10-13 2-year	5.03	241.38	241.90	241.87	241.95	0.008494	1.48	10.02	56.17	0.72
Reach1	1561.698	43.10-13 5-year	8.77	241.38	241.97	241.94	242.04	0.010826	1.85	14.34	69.91	0.83
Reach1	1561.698	43.10-13 10-year	18.33	241.38	242.07	242.07	242.18	0.016630	2.59	22.26	81.35	1.06
Reach1	1561.698	43.10-13 25-year	23.05	241.38	242.13	242.11	242.23	0.015142	2.63	27.10	83.85	1.03
Reach1	1561.698	43.10-13 50-year	26.61	241.38	242.17	242.14	242.27	0.014680	2.69	30.35	85.73	1.03
Reach1	1561.698	43.10-13 100-year	30.15	241.38	242.21	242.15	242.31	0.014455	2.76	33.45	88.36	1.03
Reach1	1561.698	43.10-13 350-year	48.79	241.38	242.38	242.32	242.49	0.013310	3.05	52.04	118.14	1.02
Reach1	1561.698	43.10-13 500-year	58.76	241.38	242.47	242.38	242.57	0.011567	3.02	61.89	121.39	0.97
Reach1	1561.698	43.10-13 Regional	29.41	241.38	242.20	242.16	242.30	0.014602	2.75	32.73	87.80	1.03
Reach1	1561.551	43.10-12 2-year	5.03	240.75	240.95		240.98	0.005531	0.22	8.31	39.73	0.21
Reach1	1561.551	43.10-12 5-year	8.77	240.75	241.09		241.11	0.004190	0.31	14.72	59.29	0.20
Reach1	1561.551	43.10-12 10-year	18.33	240.75	241.33		241.34	0.002763	0.40	35.46	112.17	0.18
Reach1	1561.551	43.10-12 25-year	23.05	240.75	241.39		241.41	0.002886	0.44	42.47	118.44	0.19
Reach1	1561.551	43.10-12 50-year	26.61	240.75	241.43		241.45	0.002912	0.47	47.64	120.99	0.20
Reach1	1561.551	43.10-12 100-year	30.15	240.75	241.47		241.49	0.002883	0.49	52.87	123.55	0.20
Reach1	1561.551	43.10-12 350-year	48.79	240.75	241.66		241.68	0.002967	0.59	76.60	133.97	0.21
Reach1	1561.551	43.10-12 500-year	58.76	240.75	241.75		241.77	0.003053	0.64	88.77	142.43	0.22
Reach1	1561.551	43.10-12 Regional	29.41	240.75	241.47		241.49	0.002868	0.48	51.95	123.20	0.20
Reach1	1561.404	43.10-11 2-year	5.03	239.91	240.46	240.27	240.47	0.002596	0.47	10.70	34.79	0.27
Reach1	1561.404	43.10-11 5-year	8.77	239.91	240.64	240.33	240.65	0.002778	0.50	17.67	45.64	0.25
Reach1	1561.404	43.10-11 10-year	18.33	239.91	240.93	240.45	240.94	0.003128	0.42	43.36	111.23	0.22
Reach1	1561.404	43.10-11 25-year	23.05	239.91	241.00	240.50	241.01	0.003005	0.45	51.38	116.12	0.22
Reach1	1561.404	43.10-11 50-year	26.61	239.91	241.05	240.54	241.06	0.002768	0.46	57.78	117.73	0.21
Reach1	1561.404	43.10-11 100-year	30.15	239.91	241.07	240.59	241.09	0.003155	0.50	60.03	118.37	0.23
Reach1	1561.404	43.10-11 350-year	48.79	239.91	241.26	240.79	241.28	0.003047	0.59	82.43	123.07	0.23
Reach1	1561.404	43.10-11 500-year	58.76	239.91	241.35	240.84	241.37	0.002928	0.63	93.64	124.20	0.23
Reach1	1561.404	43.10-11 Regional	29.41	239.91	241.06	240.58	241.08	0.003194	0.50	58.84	118.04	0.23
Reach1	1561.256	43.10-10 2-year	5.03	238.88	239.44	239.44	239.54	0.028923	1.50	3.69	17.85	1.07
Reach1	1561.256	43.10-10 5-year	8.77	238.88	239.53	239.53	239.68	0.029204	1.76	5.47	19.22	1.05
Reach1	1561.256	43.10-10 10-year	18.33	238.88	239.76	239.76	239.95	0.021241	2.00	11.23	32.30	0.92
Reach1	1561.256	43.10-10 25-year	23.05	238.88	239.82	239.82	240.04	0.022454	2.18	13.20	35.11	0.96
Reach1	1561.256	43.10-10 50-year	26.61	238.88	239.84	239.84	240.10	0.026076	2.41	14.08	39.32	1.03
Reach1	1561.256	43.10-10 100-year	30.15	238.88	239.96	239.96	240.16	0.016769	2.13	19.82	53.52	0.84
Reach1	1561.256	43.10-10 350-year	48.79	238.88	240.15	240.15	240.37	0.016277	2.38	30.58	64.18	0.85
Reach1	1561.256	43.10-10 500-year	58.76	238.88	240.21	240.21	240.46	0.017909	2.58	34.36	67.08	0.90
Reach1	1561.256	43.10-10 Regional	29.41	238.88	239.96	239.96	240.15	0.016309	2.09	19.63	53.38	0.83
Reach1	1561.120	43.10-09 2-year	5.03	0.00	238.93	5.82	238.93	0.000000	0.00	1892.79	76.72	0.00

Reach1	1561.120	43.10-09	5-year	8.77	0.00	239.02	7.27	239.02	0.000000	0.00	1899.96	91.28	0.00
Reach1	1561.120	43.10-09	10-year	18.33	0.00	239.18	9.76	239.18	0.000000	0.00	1918.03	118.96	0.00
Reach1	1561.120	43.10-09	25-year	23.05	0.00	239.24	10.69	239.24	0.000000	0.00	1926.01	121.16	0.00
Reach1	1561.120	43.10-09	50-year	26.61	0.00	239.29	11.32	239.29	0.000000	0.01	1931.78	122.17	0.00
Reach1	1561.120	43.10-09	100-year	30.15	0.00	239.34	11.89	239.34	0.000000	0.01	1937.56	122.43	0.00
Reach1	1561.120	43.10-09	350-year	48.79	0.00	239.54	14.42	239.54	0.000000	0.01	1962.47	123.53	0.00
Reach1	1561.120	43.10-09	500-year	58.76	0.00	239.63	15.54	239.63	0.000000	0.01	1973.48	124.02	0.00
Reach1	1561.120	43.10-09	Regional	29.41	0.00	239.33	11.79	239.33	0.000000	0.01	1936.24	122.37	0.00
Reach1	1560.977	43.10-08	2-year	5.03	238.47	238.92	238.76	238.93	0.006059	0.28	13.69	71.58	0.23
Reach1	1560.977	43.10-08	5-year	8.77	238.47	239.00	238.82	239.01	0.006037	0.37	19.73	75.24	0.24
Reach1	1560.977	43.10-08	10-year	18.33	238.47	239.16	238.92	239.17	0.006077	0.51	31.59	79.81	0.26
Reach1	1560.977	43.10-08	25-year	23.05	238.47	239.22	238.95	239.24	0.006059	0.55	36.70	81.86	0.27
Reach1	1560.977	43.10-08	50-year	26.61	238.47	239.27	238.98	239.29	0.006057	0.57	40.43	84.05	0.27
Reach1	1560.977	43.10-08	100-year	30.15	238.47	239.31	239.00	239.34	0.006061	0.59	44.34	88.34	0.27
Reach1	1560.977	43.10-08	350-year	48.79	238.47	239.51	239.10	239.54	0.006141	0.68	62.77	111.04	0.28
Reach1	1560.977	43.10-08	500-year	58.76	238.47	239.59	239.15	239.63	0.006232	0.71	73.58	136.19	0.29
Reach1	1560.977	43.10-08	Regional	29.41	238.47	239.30	239.00	239.32	0.005993	0.58	43.40	85.64	0.27
Reach1	1560.820	43.10-07	2-year	5.03	237.72	238.07		238.08	0.005295	0.43	11.51	54.74	0.24
Reach1	1560.820	43.10-07	5-year	8.77	237.72	238.17		238.18	0.005112	0.50	18.29	76.21	0.25
Reach1	1560.820	43.10-07	10-year	18.33	237.72	238.35		238.37	0.004904	0.62	32.52	83.70	0.26
Reach1	1560.820	43.10-07	25-year	23.05	237.72	238.42		238.44	0.004825	0.67	38.56	88.48	0.26
Reach1	1560.820	43.10-07	50-year	26.61	237.72	238.47		238.49	0.004768	0.69	42.80	90.58	0.26
Reach1	1560.820	43.10-07	100-year	30.15	237.72	238.51		238.53	0.004782	0.72	46.78	93.94	0.26
Reach1	1560.820	43.10-07	350-year	48.79	237.72	238.71		238.74	0.004641	0.83	66.45	105.70	0.27
Reach1	1560.820	43.10-07	500-year	58.76	237.72	238.80		238.83	0.004611	0.88	75.92	109.20	0.27
Reach1	1560.820	43.10-07	Regional	29.41	237.72	238.50		238.53	0.004771	0.72	46.00	93.57	0.26
Reach1	1560.680	43.10-06	2-year	5.03	236.40	237.18	237.07	237.20	0.008013	0.69	8.80	36.88	0.31
Reach1	1560.680	43.10-06	5-year	8.77	236.40	237.28	237.12	237.31	0.007935	0.76	12.69	37.78	0.32
Reach1	1560.680	43.10-06	10-year	18.33	236.40	237.48		237.52	0.007829	0.85	21.17	46.26	0.32
Reach1	1560.680	43.10-06	25-year	23.05	236.40	237.56		237.60	0.007790	0.91	24.81	50.54	0.33
Reach1	1560.680	43.10-06	50-year	26.61	236.40	237.61		237.66	0.007680	0.94	27.64	53.34	0.33
Reach1	1560.680	43.10-06	100-year	30.15	236.40	237.67		237.72	0.007436	0.97	30.57	55.74	0.33
Reach1	1560.680	43.10-06	350-year	48.79	236.40	237.90		237.97	0.006937	1.10	44.94	67.95	0.33
Reach1	1560.680	43.10-06	500-year	58.76	236.40	238.02		238.08	0.006524	1.13	53.07	73.72	0.32
Reach1	1560.680	43.10-06	Regional	29.41	236.40	237.65		237.70	0.007532	0.96	29.89	55.19	0.33
Reach1	1560.547	43.10-05	2-year	5.03	235.53	236.02		236.09	0.008492	1.46	7.25	29.02	0.72
Reach1	1560.547	43.10-05	5-year	8.77	235.53	236.15		236.23	0.007958	1.69	11.27	32.88	0.73
Reach1	1560.547	43.10-05	10-year	18.33	235.53	236.39		236.49	0.007402	2.08	19.85	38.62	0.75
Reach1	1560.547	43.10-05	25-year	23.05	235.53	236.49		236.60	0.006991	2.19	23.80	40.00	0.74
Reach1	1560.547	43.10-05	50-year	26.61	235.53	236.56		236.68	0.006878	2.28	26.67	41.96	0.75
Reach1	1560.547	43.10-05	100-year	30.15	235.53	236.62		236.75	0.006802	2.37	29.29	43.08	0.75
Reach1	1560.547	43.10-05	350-year	48.79	235.53	236.91		237.07	0.006491	2.74	42.74	49.65	0.77
Reach1	1560.547	43.10-05	500-year	58.76	235.53	237.04		237.22	0.006416	2.90	49.42	52.89	0.77
Reach1	1560.547	43.10-05	Regional	29.41	235.53	236.61		236.74	0.006724	2.34	28.89	42.95	0.75
Reach1	1560.383	43.10-04	2-year	5.03	234.60	235.23		235.24	0.003570	0.50	10.64	32.80	0.22
Reach1	1560.383	43.10-04	5-year	8.77	234.60	235.37		235.39	0.003666	0.59	15.67	36.42	0.23
Reach1	1560.383	43.10-04	10-year	18.33	234.60	235.64		235.66	0.003789	0.75	26.18	42.35	0.24
Reach1	1560.383	43.10-04	25-year	23.05	234.60	235.73		235.76	0.004040	0.82	30.04	43.81	0.26
Reach1	1560.383	43.10-04	50-year	26.61	234.60	235.79		235.83	0.004111	0.86	33.01	44.82	0.26
Reach1	1560.383	43.10-04	100-year	30.15	234.60	235.86		235.90	0.004160	0.90	35.92	46.09	0.26
Reach1	1560.383	43.10-04	350-year	48.79	234.60	236.11		236.17	0.004724	1.09	48.35	50.94	0.29
Reach1	1560.383	43.10-04	500-year	58.76	234.60	236.24		236.30	0.004838	1.17	54.81	53.31	0.30

Reach1	1560.383	43.10-04	Regional	29.41	234.60	235.83		235.87	0.004290	0.90	34.89	45.62	0.27
Reach1	1560.237	43.10-03	2-year	5.03	233.85	234.32	234.31	234.40	0.011102	1.44	6.31	37.02	0.80
Reach1	1560.237	43.10-03	5-year	8.77	233.85	234.40	234.39	234.51	0.012228	1.76	9.52	38.87	0.87
Reach1	1560.237	43.10-03	10-year	18.33	233.85	234.56	234.53	234.72	0.013710	2.30	15.81	42.23	0.97
Reach1	1560.237	43.10-03	25-year	23.05	233.85	234.64	234.60	234.81	0.012528	2.40	19.23	43.46	0.95
Reach1	1560.237	43.10-03	50-year	26.61	233.85	234.69	234.63	234.87	0.012394	2.51	21.50	45.19	0.95
Reach1	1560.237	43.10-03	100-year	30.15	233.85	234.74	234.69	234.93	0.012169	2.59	23.70	46.31	0.95
Reach1	1560.237	43.10-03	350-year	48.79	233.85	234.98	234.87	235.20	0.010219	2.87	35.85	52.20	0.92
Reach1	1560.237	43.10-03	500-year	58.76	233.85	235.09	234.97	235.33	0.009842	3.02	41.60	54.59	0.92
Reach1	1560.237	43.10-03	Regional	29.41	233.85	234.75	234.68	234.92	0.011039	2.49	24.11	46.54	0.91
Reach1	1560.111	43.10-02	2-year	5.03	232.29	233.12		233.14	0.008922	0.86	9.42	34.45	0.34
Reach1	1560.111	43.10-02	5-year	8.77	232.29	233.26		233.28	0.007738	0.91	14.34	36.51	0.33
Reach1	1560.111	43.10-02	10-year	18.33	232.29	233.53		233.56	0.006404	1.00	24.65	39.55	0.31
Reach1	1560.111	43.10-02	25-year	23.05	232.29	233.63		233.66	0.006538	1.08	28.56	41.13	0.32
Reach1	1560.111	43.10-02	50-year	26.61	232.29	233.70		233.73	0.006611	1.12	31.40	42.35	0.32
Reach1	1560.111	43.10-02	100-year	30.15	232.29	233.77		233.81	0.006492	1.16	34.44	43.62	0.32
Reach1	1560.111	43.10-02	350-year	48.79	232.29	234.01		234.07	0.007510	1.40	45.68	47.85	0.36
Reach1	1560.111	43.10-02	500-year	58.76	232.29	234.15		234.22	0.007459	1.47	52.45	50.85	0.36
Reach1	1560.111	43.10-02	Regional	29.41	232.29	233.71		233.75	0.007678	1.22	31.95	42.59	0.35
Reach1	1560.000	43.10-01	2-year	5.03	231.96	232.38		232.41	0.005163	1.14	9.74	31.10	0.56
Reach1	1560.000	43.10-01	5-year	8.77	231.96	232.50		232.54	0.006091	1.45	13.40	33.15	0.64
Reach1	1560.000	43.10-01	10-year	18.33	231.96	232.71		232.79	0.007711	2.04	20.98	39.25	0.76
Reach1	1560.000	43.10-01	25-year	23.05	231.96	232.80		232.89	0.007754	2.22	24.75	41.79	0.78
Reach1	1560.000	43.10-01	50-year	26.61	231.96	232.86		232.96	0.007659	2.32	27.50	43.07	0.78
Reach1	1560.000	43.10-01	100-year	30.15	231.96	232.91		233.02	0.008063	2.46	29.47	43.88	0.81
Reach1	1560.000	43.10-01	350-year	48.79	231.96	233.37		233.46	0.004367	2.36	52.80	55.86	0.64
Reach1	1560.000	43.10-01	500-year	58.76	231.96	233.54		233.63	0.003992	2.43	62.46	59.52	0.62
Reach1	1560.000	43.10-01	Regional	29.41	231.96	233.05		233.12	0.004533	2.02	36.05	48.49	0.62

START

AM CANDARAS STORM WATER MANAGEMENT BRIEF

STORMWATER MANAGEMENT FACILITY #3 EVALUATION FOR ADDITIONAL DRAINAGE DESIGN BRIEF

FOR

8281 HEALEY RD
INDUSTRIAL DEVELOPMENT

ONE PROPERTIES

TOWN OF CALEDON

February 8, 2021

a.m. candaras associates inc.
8551 Weston Rd, Suite 203
Woodbridge, Ontario
L4L 9R4

Project No. 2109

a.m. candaras associates inc.
consulting engineers

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLANS

LIST OF APPENDICIES

DISK ENCLOSED

Enclosed disk includes all SWMHYMO input and output files.

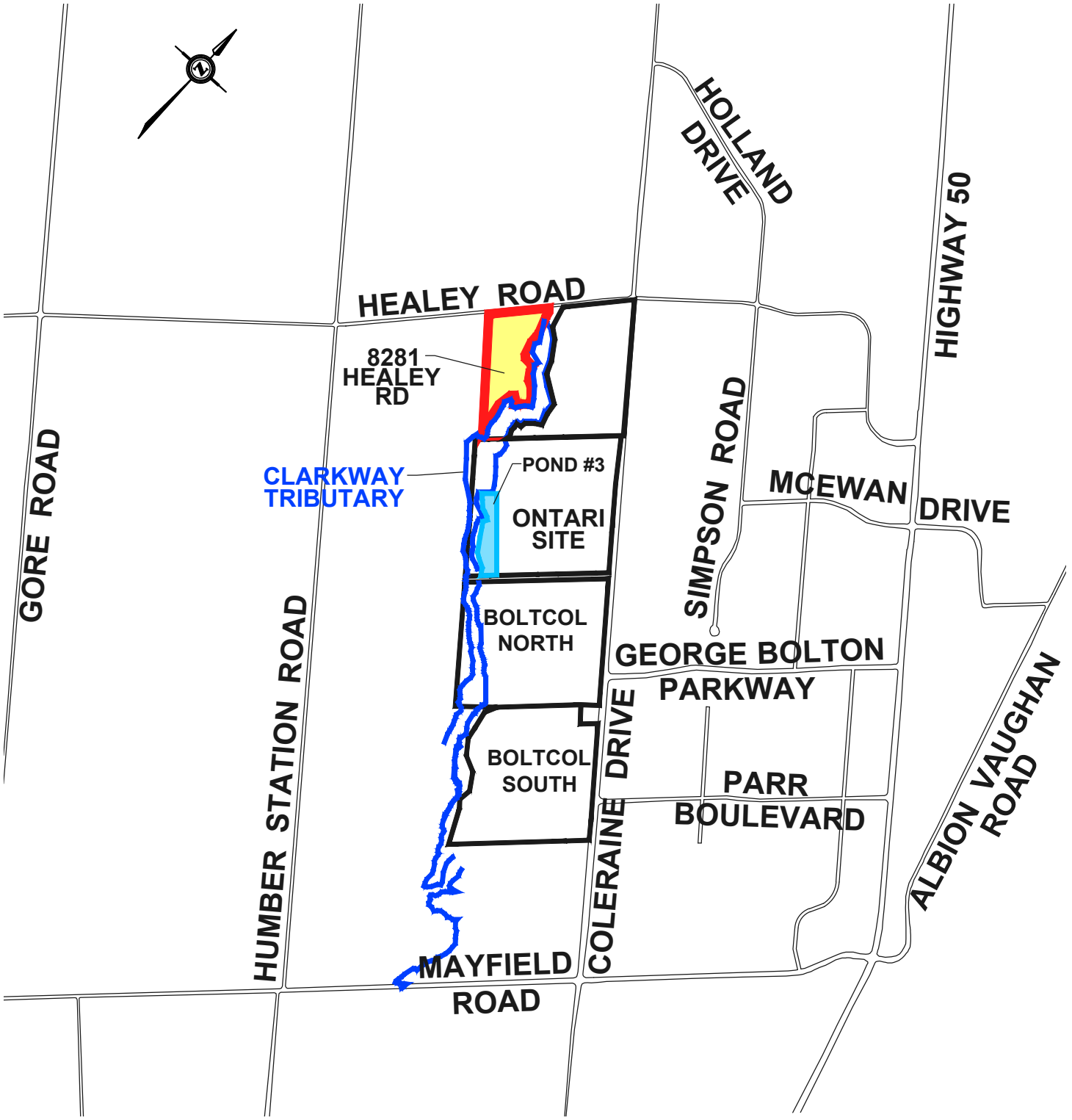
1.0 INTRODUCTION

The purpose of this report is to evaluate whether the existing stormwater management facility design (Pond#3) has available capacity to accommodate an additional 10.0ha of drainage area from the proposed development at 8281 Healy Rd to the north. The existing pond and subject property on Healey Road are located on the west side of Coleraine Dr, between Healy Rd and Mayfield Rd in the Town of Caledon, as shown in Figure 1. The existing Pond #3 is located on the One Properties site on Coleraine Dr, with an existing tributary design area of 36.83 ha of industrial land use and is within the Humber River watershed under the jurisdiction of the Toronto Region Conservation Authority (TRCA). The proposed site at 8281 Healey Rd is located on the south side of Healey Rd, to the northwest side of the Clarkway Tributary. The proposed drainage from the Healey site will convey controlled flows to existing Pond #3 by pipe, crossing below the existing Clarkway watercourse. The stormwater management analysis was based on on-site stormwater discharge controls of 180 l/sec/ha for the 2 year to 100 year events plus the Regional Storm with no controls.

The existing Pond #3 currently provides quantity and quality treatment area of 36.83ha. The additional 10.0ha external Healey Rd lands to the northwest, originally located within the ESA-5b Fut boundary, tributary to Future Pond #2, are proposed to be diverted to Pond #3 and will require SWM quality and quantity controls be provided within Pond #3. The existing Pond #3 must continue to satisfy the requirements of the *Comprehensive Environment Impact Study and Management Plan Phase 3* (CEISMP) and limit discharge to the TRCA Target flow rates, including the additional external drainage area.

The original pond design was completed in accordance with the *CEISMP*, dated June 21, 2012, for the South Albion-Bolton Community Plan. As part of this study, the stormwater management requirements were established for the preferred Employment Lands, located west of Coleraine Drive to Humber Station Road and north from Mayfield Road to the Holland Drive/Coleraine Drive intersection. The preferred stormwater management and drainage strategy, identified in Section 2.4.1 in the CEISMP, is as summarized follows:

Stormwater management recommendations consist of the works required to mitigate the impacts from proposed future development and to protect that development and related



LOCATION PLAN

FIGURE 1

a.m.candaras associates inc.
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PROJECT:
8281 HEALEY RD
DEVELOPMENT
TOWN OF CALEDON

SCALE : NTS

DATE: FEB 2021

PROJECT No. 2109

infrastructure from flooding. Figure 2.1 illustrates the key elements of the Management Plan related to stormwater management and drainage for the Employment Lands site:

- *provision of stormwater management ponds, or equivalent on-site source and conveyance controls for water quality control, erosion control, and flood (quantity) control;*
- *Provision of adequately-sized future drainage infrastructure such as road crossing (bridge/culvert) structures over the Clarkway Tributary;'*
- *Protection of future properties and structures through the delineation of the Regional Storm flood hazard lands along the Clarkway Tributary;*
- *Provision of low impact development (LID) measures to provide further water balance and environmental benefits.*

In addition, the following documents were also referenced:

- MOE SWMPD Manual, March 2003;
- TRCA Stormwater Management Criteria, August 2012;
- Town of Caledon Development Design Criteria, January 2009.

2.0 POST-DEVELOPMENT STORM DRAINAGE

The post development storm drainage consists of the evaluation of existing Pond #3, maintaining the existing drainage area of 36.87ha plus the additional 10.0ha area from the Healey Rd site. Refer to Drawing G1 for an overall plan of the existing and proposed site areas.

2.1 Model Background Information

2.1.1 Post-Development Hydrologic Model

The base post-development SWMHYMO model as previously provided by the TRCA and updated by AMCAI. Background documentation from the previous studies are provided in Appendix A, including details of the hydrologic model catchment areas in which the current study area is located. The sub-catchments for the subject areas in the current hydrologic analysis have been isolated to reflect only the drainage areas tributary to Pond #3, removing reference to areas not included in the current analysis. The post-development drainage areas are shown in Figure 2. The updated schematics based on the proposed development are provided in Appendix B, Figures 3a and 3b.

The SWMHYMO model computed flows are based on the 6-hour and 12-hour AES design storms, and the Regional Storm event. As requested by the TRCA, various models were completed to evaluate the function of the proposed SWM facilities.

LEGEND

- SWM POND
- FLOW NODE LOCATION (A)
- TRIBUTARY STORM DRAINAGE AREA DRAINING TO WEST ROBINSON CREEK
- POST-DEVELOPMENT TRIBUTARY STORM DRAINAGE AREA DRAINING TO WEST HUMBER RIVER
- SITE PROPERTY LIMITS
- REGIONAL FLOODLINE
- STORMWATER FLOW DIRECTION
- ESA-5a / 74.7 ha — URBAN CATCHMENT I.D. / DRAINAGE AREA
- ESA-5b fut. / 17.4 ha — RURAL CATCHMENT I.D. / DRAINAGE AREA
- RC 1 — ROUTE CHANNEL
- MTO STUDY LANDS

CTC LANDS
ESA-5a fut. 74.7 ha
ESA-5a ex. 71.7 ha
HOLLAND DRIVE
ESA-6 ex. 149.8 ha
ESA-5b Valley 8.6 ha
EX POND #1
HEALEY ROAD
ESA-5C fut. 10.0 ha
RC 1
ESA-6 fut. ext. 21.87 ha
8281 HEALEY RD
MARCONI COURT
EX POND
SIMPSON ROAD
EX POND
EX POND
EX POND WHEELER DRIVE
ESA-5b fut. 7.4 ha
FUTURE POND #2
CLARKWAY TRIBUTARY
FUTURE POND #3A
A
RC 2
PIPED ENCLOSURE Q_{100YR} & REGIONAL
RC 3
KING DRAIN
$Q_{100yr6h,UNCTRL}$=24.36m³/s
$Q_{REGIONAL}$=21.10m³/s
MCEWAN DRIVE
ESA-6 Valley 7.7 ha
PROPOSED WETLAND FEATURE
ESA-6 fut. 36.83 ha
F
ESA-7 ex Coleraine 1.99 ha
ESA-7a ex 18.22 ha
EXISTING POND #3
ONE PROPERTY AMAZON LANDS
3000mm PIPED ENCLOSURE
REALIGNED OPEN CHANNEL
B
HUMBER STATION ROAD
PROPOSED 1500mm DIVERSION STORM SEWER
EX POND
$Q_{100yr6h,UNCTRL}$=5.74m³/s
$Q_{REGIONAL}$ =4.38m³/s
ESA-8ex 13.7 ha
NIXON ROAD
ESA-7 Valley 13.6 ha
1.99ha COLERAINE DR DIVERTED TO NEW CHANNEL
EX POND
1.49ha COLERAINE DR- DIVERT TO NEW CHANNEL
FUTURE CONTROLS TO TRCA SUB-BASIN 36
EX POND
GEORGE BOLTON PARKWAY
G
RC 4
GEORGE BOLTON DRAINAGE FEATURE TO BE REMOVED IN POST DEVELOPMENT CONDITION
ESA-7b ex 8.25 ha
EX POND
ESA-9 73.8 ha
C
BOLTCOL LANDS
ESA-7 ex GB/C 1.49 ha
ESA (7+8) fut. 66.18 ha
EXISTING POND #(4+5)
ESA-11b 30.4 ha
SIMPSON ROAD
COLERAINE DRIVE
PILLSWORTH DRIVE
ESA-8 Valley 15.9 ha
RC 6
ESA-7 Fut. MTO Lands 7.60 ha
ESA-11c 20.0 ha
PARR BOULEVARD
D
MTO STUDY AREA
1.34 ha DRAIN TO POND 4+5
EX POND
EX POND
BOLTCOL SOUTH LANDS 50.0acres
RC 7
POND #6 1.63ha
BOLTCOL PROP LIMIT
DRAINING TO WEST ROBINSON CREEK
ESA-10a Valley 13.2 ha
ESA-10b fut. 40.56ha
EX POND
E
NODE 43.20
MAYFIELD ROAD
DRAINING TO WEST RAINBOW CREEK

POST–DEVELOPMENT STORMWATER MANAGEMENT AND DRAINAGE AREAS

SOURCE: CEISMP

FIGURE 2

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POND #3 EVALUATION
ADDITIONAL DRAINAGE
FROM HEALEY RD LANDS

PROJECT:
HEALEY RD DEVELOPMENT
TOWN OF CALEDON
ONE PROPERTIES

SCALE : 1:12000
DATE: FEBRUARY 2021
PROJECT No. 2109

3.0 STORMWATER MANAGEMENT

Stormwater management for the Coleraine Drive site was previously undertaken in accordance with the criteria presented in the CEISMP, MOE SWMPD Manual (March 2003), the TRCA (2012), and the Town of Caledon (2009). The stormwater management strategy addresses stormwater quality and quantity controls, including the Regional Storm event. Quality and quantity controls has been provided and in accordance with the CEIMP. SWM Facility Pond #3 also satisfies the requirements of the TRCA and MOE as well as providing quantity control of the Regional Storm event. The existing SWM Facility #3 location is schematically shown on Figure 2. The existing pond design calculations and performance summary are provided in Appendix C. In order to satisfy the design requirements, SWM Pond #3 was designed as a wet pond. Refer to Drawing G1, C1, and S2 for additional detail.

3.1 Stormwater Quantity and Quality Controls

In order to provide the required stormwater quantity and quality controls for the tributary 36.83ha lands plus the additional 10.0ha, the existing SWM Facility #3 function will be evaluated.

The stormwater quantity and quality controls must satisfy the criteria provided in the following documents:

- Comprehensive Environmental Impact Study and Management Plan Phase 3 Report: June 21, 2012 (CEIMP)
- M.O.E.E. – Stormwater Management Practices Planning and Design Manual March 2003;
- Toronto Research and Conservation Authority (TRCA) – Stormwater Management Criteria, August 2012 Version 1.0;
- Town of Caledon – Development Standards, Policies & Guidelines, January 2009 Version 4.

3.1.1 Stormwater Objectives

From documents listed previously in Section 3.1, the stormwater objectives are summarized as follows:

- Water quality – Enhanced Level 1 protection – 80% TSS removal;
- Erosion control – Capture and release the 25mm storm over 48hrs
- Water quantity – Control 2 to 100-year post-development peak flows to: The Unit Flow Relationships for the Employment Lands (Clarkway Tributary)
- Regional Storm release rate to 55l/s/ha.

Based on the TRCA's Unit Flow Relationship for these lands, located in the Humber River Watershed in sub-basin 36, the allowable existing target flow rates were established for the subject lands and summarized in Table 1. The target flows have been updated to reflect the proposed additional 10.0ha area, and also included in Table 1.

Table 1 – Target Flow Rates

Storm	TRCA Unit Flow Equation (1)	Original Tributary Area 36.83 ha (m^3/s)	Proposed Tributary Area 46.83 ha (m^3/s)
25mm	1.2 l/s/ha(2)	0.044	0.056
2-year	Q=9.506-0.719*ln(A)	0.255	0.316
5-year	Q=14.652-1.136*ln(A)	0.389	0.482
10-year	Q=17.957-1.373*ln(A)	0.479	0.594
25-year	Q=22.639-1.741*ln(A)	0.603	0.747
50-year	Q=26.566-2.082*ln(A)	0.702	0.869
100-year	Q=29.912-2.316*ln(A)	0.794	0.984
Regional	55 l/s/ha(2)	2.026	2.576

1. Refer to TRCA Table E1, Appendix A.
2. Allowable Regional Flow based on recommendations of CEISMP.
3. 46.83ha includes additional 10.0ha from 8281 Healey Rd.

4.0 QUALITY CONTROL EVALUATION OF SWM#3

The current design drainage area tributary to SWM Facility #3 is 36.83ha. The following sections evaluate the existing pond capacity in order to accommodate the additional 10.0ha from the 8281 Healey Rd site.

The existing permanent pool elevation of this facility is 234.75m, with a permanent pool volume of 13,526m^3 provided between the 233.25m and 234.75m elevations. The available erosion control volume of 12,514m^3 is provided between the 234.75m and the 235.55m elevations. Refer to Table 2 for a summary of the respective stormwater quality requirements based on the existing conditions, the proposed 10.0ha area addition, and the existing available volumes. The existing stage-storage relationship for this facility is shown in Table 3. As demonstrated, there is sufficient volume available to accommodate the increase in permanent pool and extended detention volume requirements based on the additional 10.0ha drainage area, satisfying the quality requirements.

The existing outlet control structure includes a 175mm orifice with an invert elevation of 234.75m. The existing control parameters and pond stage storage discharge relationship for SWMP #3 are shown in Tables 2 and 3, respectively. The erosion control volume is drains over a period of 92.3-hours at peak release rate of 0.049m^3/s, under existing conditions. The draw down time based on the additional area increases to 103.5hours. The existing condition sediment forebay and drawdown calculations have been provided in Appendix C, with the updated calculations provided in Appendix D.

Table 2 – SWMP #3 - Stormwater Quality Requirements

Area	Imperviousness	Permanent Pool	Extended Detention
Existing Pond #3 Requirements			
36.83ha	85%	210m³/ha (1)	200m³/ha (2)
Required:		7,734m³	7,366m³
Pond #3 Requirements with Additional 10.0ha			
46.83ha (3)	**85%**	**210m³/ha (1)**	**200m³/ha (2)**
Required		**9,834.3m³**	**9,366m³**
Available:		13,526m³	12,514m³
Elevation:		234.75m	235.55m

(1) MOE SWM Planning and Design Manual for a wet pond based on 85% imperviousness. (250m³/ha permanent pool storage – 40m³/ha active storage)

(2) Aquafor Beech Phase 3 Report – 200m³/ha, using a 25mm storm event over 48 hours

(3) 46.83 ha includes additional 10.0ha from 8281 Healey Rd.

Table 3 – Existing SWM Facility #3 Stage Storage Relationship

	AREA (m^2)		VOLUME (m^3)				DISCHARGE (m^3/s) AND HEAD (m)					
Elevation	Pond	Forebay	Pond	Forebay	Total	Effective	Orifice	Orifice Head	Weir	Weir Head	Discharge (m^3/s)	Storage (ha*m)
233.25	0	1,943	0	0	0						0	0
233.75	8,897	2,246	0	1,047	1,047						0	0
234.15	9,492	2,503	3,678	1,997	5,675						0	0
234.75	11,039	3,135	9,837	3,689	13,526	0	0.000	0.00			0	0
234.90	11,426	3,307	11,522	4,172	15,694	2,168	0.017	0.15			0.017	0.217
235.05	11,812	3,478	13,265	4,681	17,945	4,420	0.031	0.30			0.031	0.442
235.20	12,199	3,649	15,066	5,215	20,281	6,755	0.040	0.45			0.040	0.675
235.25	12,328	3,706	15,679	5,399	21,078	7,552	0.043	0.50			0.043	0.755
235.35	12,585	3,821	16,925	5,775	22,700	9,174	0.048	0.60			0.048	0.917
235.45	12,791	3,909	18,193	6,162	24,355	10,829	0.052	0.70			0.052	1.083
235.55	12,996	3,998	19,483	6,557	26,040	12,514	0.057	0.80	0.000	0.00	0.057	1.251
235.60	17,132	0	20,316	6,557	26,873	13,348	0.058	0.85	0.006	0.05	0.064	1.335
236.00	18,093	0	27,361	6,557	33,918	20,392	0.072	1.25	0.154	0.45	0.227	2.039
236.50	19,295	0	36,708	6,557	43,265	29,739	0.086	1.75	0.474	0.95	0.560	2.974
237.00	20,496	0	46,656	6,557	53,213	39,687	0.098	2.25	0.893	1.45	0.992	3.969
237.50	21,698	0	57,205	6,557	63,762	50,236	0.109	2.75	1.393	1.95	1.502	5.024
238.00	22,900	0	68,354	6,557	74,911	61,385	0.119	3.25	1.962	2.45	2.081	6.139
238.50	24,102	0	80,104	6,557	86,662	73,136	0.128	3.75	2.592	2.95	2.720	7.314
239.00	25,303	0	92,456	6,557	99,013	85,487	0.137	4.25	3.278	3.45	3.414	8.549
239.15	25,664	0	96,278	6,557	102,835	89,310	0.139	4.40	3.494	3.60	3.633	8.931

Table 4 – Existing SWMP #3 Control Parameters

Item	Value	Unit
Orifice Elevation	234.75	m
Orifice Size	0.175	m
Orifice Area	0.0240	m^2
Orifice Discharge Coefficient	0.63	-
Orifice Head	0.80	m
Weir Elevation	235.55	m
Weir Length	0.30	m
Weir Discharge Coefficient:	1.705	-

5.0 QUANTITY CONTROL EVALUATION OF SWM #3

5.1 Pond #3 Performance with Additional 10.0ha Healey Rd Flows

The existing hydrologic model was updated to reflect the additional 10.0ha area from the 8281 Healey Rd site draining to existing SWM Pond #3. The corresponding updated SWMHYMO model schematic and input and output are provided in Appendix B. The updated models provide 2 year through 100year storm with on-site controls of 180 L/sec/ha and the Regional Storm Hazel with no on-site controls. The resulting pond performance with on-site controls has been summarized in Table 5. As demonstrated in Table 5, the pond continues to function within the allowable flow parameters established in Table 1, in accordance with TRCA Target flows.

The outlet control structural will not require modifications, as the existing orifice and weir structures continue to limit flows to less than the established target flows. The updated peak outflow from the pond for the Region storm has been calculated to be 2.418 m^3/s. The existing 1350mm dia storm outlet, at a slope of 0.27%, has a capacity of 2.89m^3/s. Therefore, the existing outlet pipe has sufficient capacity to accommodate the increase in tributary area and peak outflow.

Table 5 –SWMP #3 Performance Summary with 10.0ha Site – With On-site Controls

Storm Event	Allowable [1] (m^3/s)	Inflow (m^3/s)	Post (m^3/s)	Storage Volume (m^3)	HWL (m)
Chic25mm	0.056	4.859	0.049	9,796	235.39
2yr-6h	0.316	3.924	0.083	14,300	235.66
5yr-6h	0.482	5.327	0.195	18,820	235.91
10yr-6h	0.594	6.264	0.282	21,740	236.07
25yr-6h	0.747	7.455	0.399	25,390	236.27
50yr-6h	0.869	8.311	0.527	28,000	236.41
100yr-6h	0.984	8.461	0.651	30,530	236.54
2yr-12h	0.316	2.406	0.110	15,930	235.75
5yr-12h	0.482	3.149	0.233	20,080	235.98
10yr-12h	0.594	3.647	0.313	22,780	236.13
25yr-12h	0.747	4.274	0.435	26,130	236.31
50yr-12h	0.869	4.740	0.549	28,450	236.43
100yr-12h	0.984	5.203	0.661	30,730	236.55
Regional*	2.576	6.874	2.418	67,640	238.27

1. Model includes on-site controls for the tributary site areas, based on 180 l/sec/ha. Refer to file 2109Sa.out.

* Regional Storm modelled without on-site controls

5.2 Healey Site Storm Sewer Connection

Stormwater drainage from the 8281 Healey Rd site will be conveyed to the existing Pond #3 by an enclosed pipe. The flows generate from the proposed 10.0ha development area were calculated using the SWMHYMO model, and have been summarized in Table 6, based on on-site controls of 180 l/sec/ha. The site outlet pipe must be sized to convey the controlled 100year storm flow of 1.80 m^3/s. The design of the pipe crossing the watercourse from the Healey Road site will be completed by others. Following the crossing of the watercourse, the outlet pipe will continue to the south along the west limit of the existing Amazon site trailer parking area. The proposed storm outlet pipe design is to be co-ordinated with the existing site conditions and below grade utilities, including an existing 450mm storm pipe outlet headwall to the wetland located north of Pond #3.

The proposed Healy Rd outlet pipe will connect to existing 2400mm x 3000mm Box MH 1S, located immediately upstream of the outlet headwall to Pond #3. The existing outlet invert of MH 1S is 234.83. The outlet pipe to the pond is a 1650mm dia at 0.50%, with a capacity of 6.723 m^3/s. Based on the additional controlled flow from the 10.0ha Healey Road site, the total inflow to the pond, based on a 100year 6hour AES storm is 8.46 m^3/s. Therefore the existing inlet pipe will require an upgrade to a 1950mm dia pipe, with a capacity of 10.5m^3/s at 0.50%. The existing 2400mm x 3000mm box MH 1S should be sufficiently large to allow for the increased 1950mm outlet pipe on the south face of the structure, which is 3000mm wide, however the structure should be assessed by a structural engineer to ensure the increased pipe can be accommodated. Similarly, the existing Headwall structure HW#4 will require inspection and assessment to confirm if it can be maintained or if replacement is required to accommodate the increase pipe size.

The Healey Rd site storm outlet works will also require a by-pass outlet to the watercourse, to be utilized only during maintenance of the pond. The existing by-pass outlet located at the inlet to the pond was sized to accommodate the 2year flows from the existing tributary drainage area of 36.83ha and therefore does not have sufficient capacity. The by-pass outlet from the Healey site shall be configured with a stop log or gate system that will allow for an outlet to the Clarkway Tributary directly at the site limit, preventing flow from being directed to Pond #3 during maintenance activities.

Table 6 –Healey Rd Site Flows

Storm Event	Controlled Site Outflow [1] (m^3/s)
Chic25mm	1.13
2yr-6h	0.82
5yr-6h	1.11
10yr-6h	1.31
25yr-6h	1.57
50yr-6h	1.77
100yr-6h	1.79
2yr-12h	0.50
5yr-12h	0.66
10yr-12h	0.77
25yr-12h	0.90
50yr-12h	1.00
100yr-12h	1.10
Regional*	1.47

1. Controlled site flow based on 180 l/sa/ha, for total 10.0ha site area, refer to SWMHYMO model output.

6.0 SWM FACILITY #3 MOECCP ECA

The MOECC ECA application was submitted and approved for SWM Pond #3 during the detailed design and approval process. The current ECA approval has been provided in Appendix E. The proposed additional 10.0ha drainage area from the Healey Road site will require an amendment to the existing ECA. Following approval from the Town of Caledon and the Toronto Region Conservation Authority, an application to amend the existing ECA will be submitted.

7.0 CONCLUSIONS

1. The existing SWM Facility #3 has sufficient capacity to provide the required quality and quantity controls for all storms up to the Regional Storm event, to accommodate the additional flows from the 10.0ha drainage area of the site at 8281 Healey Rd.

2. The inlet pipe, from MH 1S to inlet HW 4, will require replacement to provide sufficient capacity for the additional flows. The existing structures MH 1S at the pond inlet and inlet headwall HW#4 will both require evaluation to confirm if the additional inlet pipe and upgraded outlet pipe can be accommodated or require replacement.

3. The existing outlet control structure and outlet pipe from SWM Pond #3 will accommodate the increase in controlled flow and will not require modifications as a result of the increased drainage area.

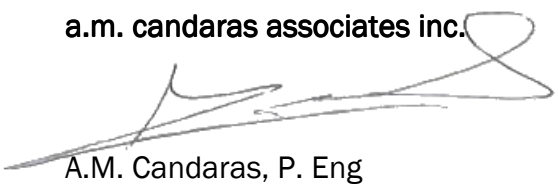
4. The existing SWM Facility #3 sediment forebay can accommodate the increased drainage area and will not require any modifications.

5. The outlet works and connection from the 8281 Healey Rd site to the existing pond inlet will be designed and detailed by others.

6. The existing maintenance by-pass piping, utilized only during pond maintenance, has been sized for the original drainage area. The storm outlet works on 8281 Healey will require a separate by-pass outlet to the Clarkway Tributary, only to be used during pond maintenance.

Prepared by,

a.m. candaras associates inc.



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Associate

February 8, 2021

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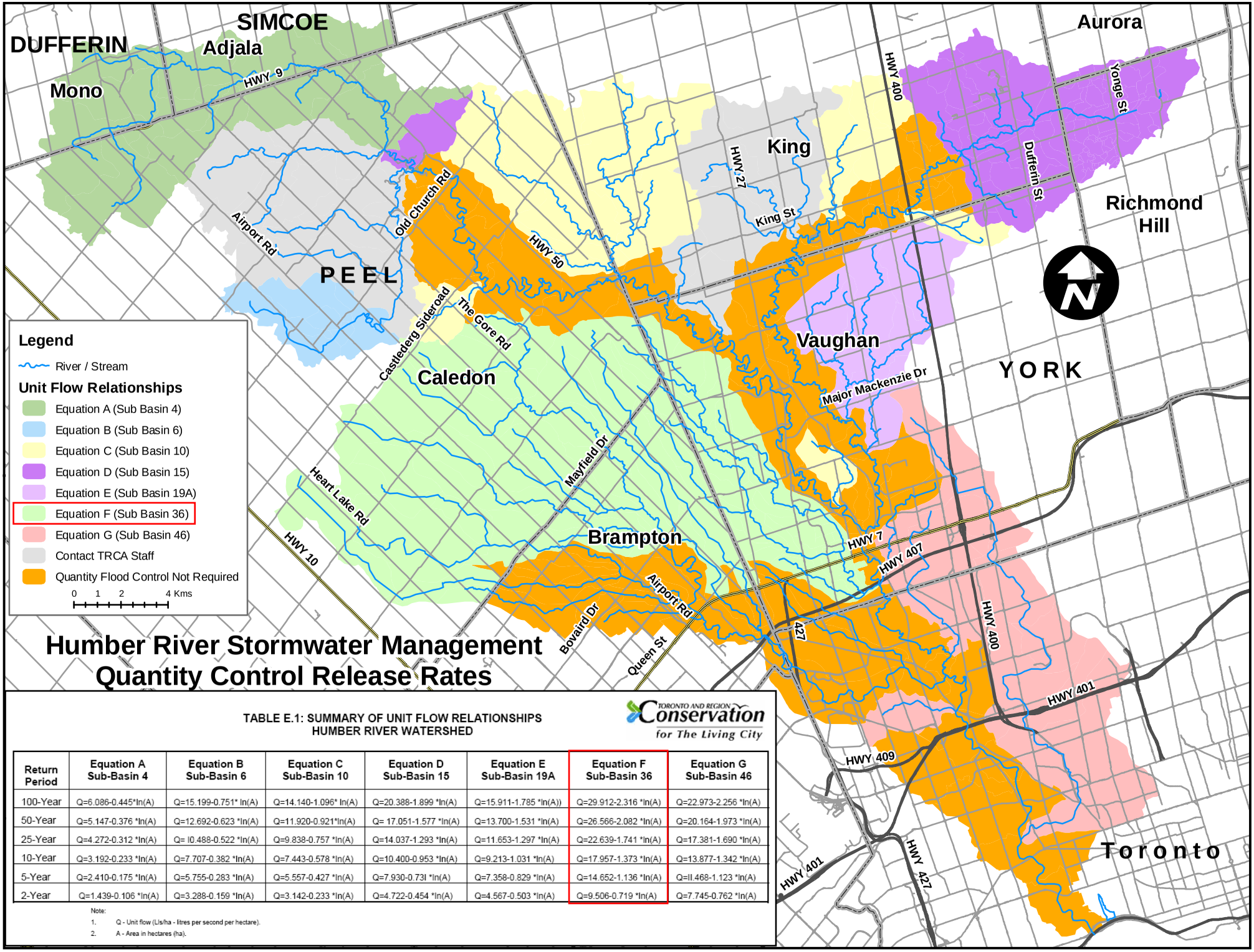
APPENDIX A
BACKGROUND DOCUMENTATION



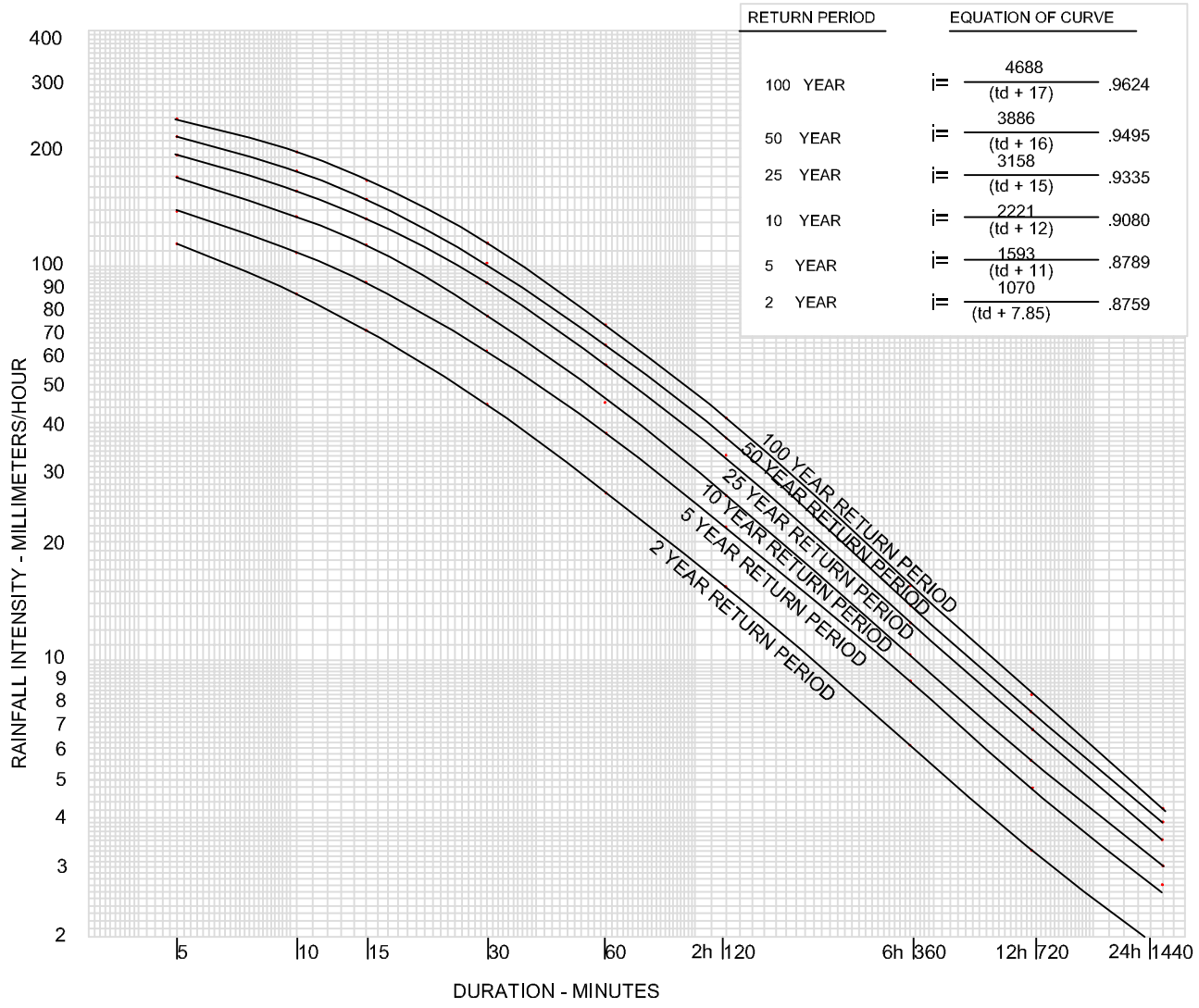
Humber River Stormwater Management Quantity Control Release Rates

TABLE E.1: SUMMARY OF UNIT FLOW RELATIONSHIPS
HUMBER RIVER WATERSHED

Toronto and Region Conservation for The Living City

Return Period	Equation A Sub-Basin 4	Equation B Sub-Basin 6	Equation C Sub-Basin 10	Equation D Sub-Basin 15	Equation E Sub-Basin 19A	Equation F Sub-Basin 36	Equation G Sub-Basin 46
100-Year	Q=6.086-0.445*ln(A)	Q=15.199-0.751* ln(A)	Q=14.140-1.096* ln(A)	Q=20.388-1.899 *ln(A)	Q=15.911-1.785 *ln(A))	Q=29.912-2.316 *ln(A)	Q=22.973-2.256 *ln(A)
50-Year	Q=5.147-0.376 *ln(A)	Q=12.692-0.623 *ln(A)	Q=11.920-0.921*ln(A)	Q= 17.051-1.577 *ln(A)	Q=13.700-1.531 *ln(A)	Q=26.566-2.082 *ln(A)	Q=20.164-1.973 *ln(A)
25-Year	Q=4.272-0.312 *ln(A)	Q= I0.488-0.522 *ln(A)	Q=9.838-0.757 *ln(A)	Q=14.037-1.293 *ln(A)	Q=11.653-1.297 *ln(A)	Q=22.639-1.741 *ln(A)	Q=17.381-1.690 *ln(A)
10-Year	Q=3.192-0.233 *ln(A)	Q=7.707-0.382 *ln(A)	Q=7.443-0.578 *ln(A)	Q=10.400-0.953 *ln(A)	Q=9.213-1.031 *ln(A)	Q=17.957-1.373 *ln(A)	Q=13.877-1.342 *ln(A)
5-Year	Q=2.410-0.175 *ln(A)	Q=5.755-0.283 *ln(A)	Q=5.557-0.427 *ln(A)	Q=7.930-0.73l *ln(A)	Q=7.358-0.829 *ln(A)	Q=14.652-1.136 *ln(A)	Q=II.468-1.123 *ln(A)
2-Year	Q=1.439-0.106 *ln(A)	Q=3.288-0.159 *ln(A)	Q=3.142-0.233 *ln(A)	Q=4.722-0.454 *ln(A)	Q=4.567-0.503 *ln(A)	Q=9.506-0.719 *ln(A)	Q=7.745-0.762 *ln(A)

Note:
1. Q - Unit flow (Ls/ha - litres per second per hectare).
2. A - Area in hectares (ha).



RETURN PERIOD	EQUATION OF CURVE	
100 YEAR	$i = \frac{4688}{(td + 17)}$	.9624
50 YEAR	$i = \frac{3886}{(td + 16)}$	.9495
25 YEAR	$i = \frac{3158}{(td + 15)}$	.9335
10 YEAR	$i = \frac{2221}{(td + 12)}$	.9080
5 YEAR	$i = \frac{1593}{(td + 11)}$	.8789
2 YEAR	$i = \frac{1070}{(td + 7.85)}$	.8759

INLET TIMES

SUBURBAN RESIDENTIAL	
(ROOF DRAINS UNCONNECTED)	15 min
(ROOF DRAINS CONNECTED)	10 min
SUBURBAN, COMMERCIAL, INDUSTRIAL MULTIPLE FAMILY	10 min
DOWNTOWN COMMERCIAL, HIGH DENSITY APARTMENTS, EXPRESSWAYS	5 min

RUNOFF COEFFICIENT

COMMERCIAL	
- DOWNTOWN & SUBURBAN SHOPPING	0.90
INDUSTRIAL	
- DOWNTOWN	0.90
- SUBURBAN INDUSTRIAL PARKS	0.75
RESIDENTIAL	
- APARTMENTS	0.75
- ROW DWELLINGS	0.70
- DUPLEX DWELLINGS	0.70
- SEMIDETACHED - DOWNTOWN	0.60
- SINGLE FAMILY - DOWNTOWN	0.60
- SEMIDETACHED - SUBURBAN	0.50
- SINGLE FAMILY - SUBURBAN	0.40
SCHOOLS, CHURCHES, HOSPITALS	0.75
PARKS, CEMETERIES, RAIL YARDS	
(OVER 4 Ha)	0.20
(UNDER 4 Ha)	0.25

TOWN OF CALEDON

RAINFALL INTENSITY CURVES

NO.	REVISION	APR'D	DATE
1	STANDARD 112.01 NOW 104		JUNE 08

APR'D: C.C. DATE: FEB 2000

DRAWN: BJM SCALE: N.T.S.

STANDARD No. 104

COMPREHENSIVE ENVIRONMENTAL IMPACT STUDY AND MANAGEMENT PLAN

Figure 2.1 - Conceptual Stormwater Management Recommendations

Holland Drive

Healey Road

Simpson Road

Regional Road 50

Humber Station Road

Coleraine Drive

Mayfield Road

Pond #1

Pond #2

Pond #3

Pond #4

Pond #5

Pond #6

Legend

- Proposed Empoyment Lands Area
- Proposed Future Road (approx.)
- Future culvert / bridge crossing
- Regional Storm Floodline
- GTA West Highway Corridor

Stormwater Management

Stormwater Pond *

- Water Quality - Level 1
- Erosion Control - 25mm / 48hrs
- Flood Control - 2yr to 100 yr and Regional Storm

*Note: Locations illustrated are conceptual. Final site and location subject to grading, servicing, and development phasing constrants.

*Note: Traditional on site source and conveyance controls acceptable in place of SWM Ponds for small sites provided same level of control is achieved.

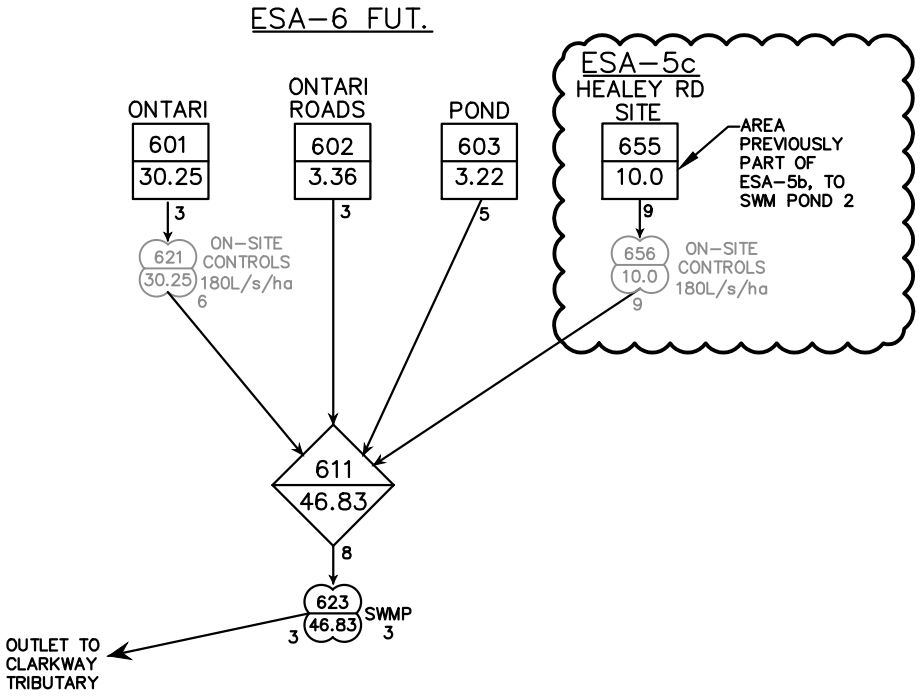
- LID Source Controls for water balance - 5mm retenion

N W E S

0 250 500 Meters

TOWN OF CALEDON

APPENDIX B
SWMHYMO MODEL



LEGEND:

- 5501 / 11848 — ROUTE CHANNEL ID No. / HEC-RAS SECTION No.
- 718 / 1.50 — DESIGN STANDHYD CATCHMENT ID No. / DESIGN STANDHYD AREA IN HECTARES
- 0028 / 0.02 — CALIB NASHYD CATCHMENT ID No. / CALIB NASHYD AREA IN HECTARES
- 0007 / 0.17 — CALIB STANDHYD CATCHMENT ID No. / CALIB STANDHYD AREA IN HECTARES
- 0022 / 5.32 — ADD HYD ID No. / ADD HYD AREA IN HECTARES
- 0011 / 0.21 — ROUTE RESERVOIR CATCHMENT ID No. / ROUTE RESERVOIR AREA IN HECTARES

*NOTE: ON-SITE CONTROLS NOT INCLUDED IN REGIONAL MODEL

FIGURE 3A

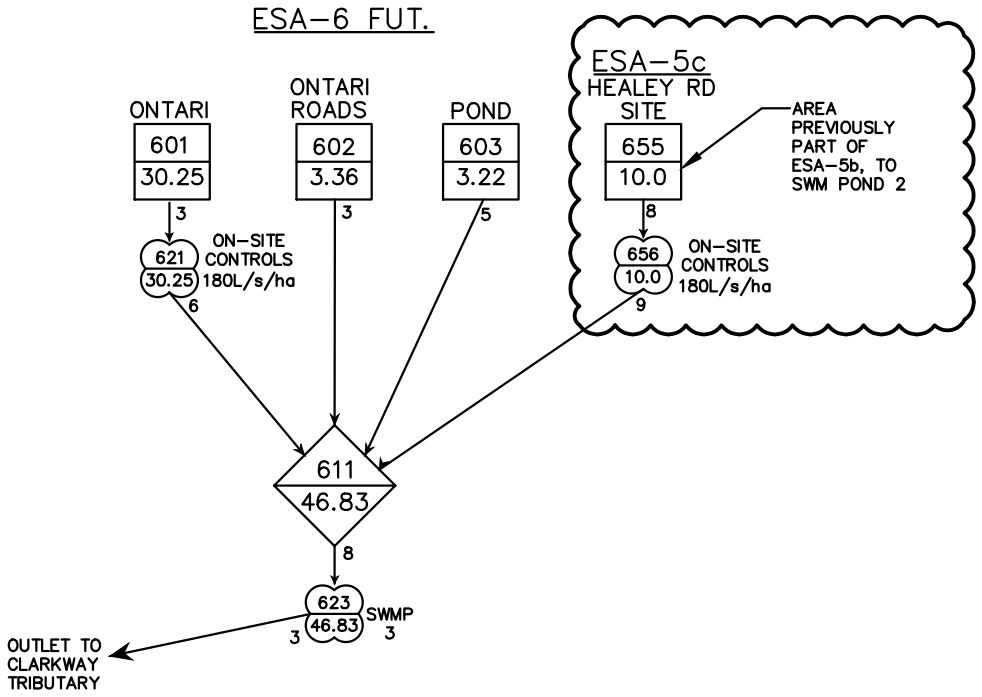
POST-DEVELOPMENT REGIONAL WITH CONTROL SWMHYMO MODEL SCHEMATIC

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

PROJECT:
HEALEY RD DEVELOPMENT
ONE PROPERTY
SWM FACILITY 3
ANALYSIS

DATE: FEB 2021

PROJECT No.: 2109



LEGEND:

- 5501 / 11848 — ROUTE CHANNEL ID No. / HEC-RAS SECTION No.
- 718 / 1.50 — DESIGN STANDHYD CATCHMENT ID No. / DESIGN STANDHYD AREA IN HECTARES
- 0028 / 0.02 — CALIB NASHYD CATCHMENT ID No. / CALIB NASHYD AREA IN HECTARES
- 0007 / 0.17 — CALIB STANDHYD CATCHMENT ID No. / CALIB STANDHYD AREA IN HECTARES
- 0022 / 5.32 — ADD HYD ID No. / ADD HYD AREA IN HECTARES
- 0011 / 0.21 — ROUTE RESERVOIR CATCHMENT ID No. / ROUTE RESERVOIR AREA IN HECTARES

* NOTE: 2YEAR – 100YEAR MODEL, WITH ON-SITE CONTROLS

FIGURE 3B

POST-DEVELOPMENT WITH CONTROLS SWMHYMO MODEL SCHEMATIC

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

PROJECT:
HEALEY RD DEVELOPMENT
ONE PROPERTY
SWM FACILITY 3
ANALYSIS

DATE: JAN 2021

PROJECT No.: 2109

```
================================================================================

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S   W W   M   M  H   H    Y    M   M  O   O       9999    9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9       9 =========
                                                      9   9  9   9 # 3813174
      StormWater Management HYdrologic Model           999    999  =========

 ********************************************************************************
 ************************** SWMHYMO-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: swmhymo@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: 2021-02-03     TIME: 15:44:47     RUN COUNTER: 000211       *
 ********************************************************************************
 * Input   filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2109Sa.DAT           *
 * Output  filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2109Sa.out           *
 * Summary filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2109Sa.sum           *
 * User comments:                                                           *
 * 1:_______________________________________________________________________*
 * 2:_______________________________________________________________________*
 * 3:_______________________________________________________________________*
 ********************************************************************************


--------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                *
*#                                                               *
*# HUMBER RIVER HYDROLOGY/                                       *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                    *
*#                                                               *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY        *
*#---------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                    *
*#                                                               *
```



```
*# MODEL: SWMHYMO 1999                                           *
*#                                                               *
*# MODEL UPDATE: JAN 2021                                        *
*# MODEL UPDATED BY: FP                                          *
*# PROJECT NO: 2109                                              *
*# DATA FILE: 2109Sa.DAT                                         *
*#---------------------------------------------------------------*
*#                                                               *
*# POST DEVELOPMENT MODEL                                        *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY  *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE               *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0) *
*#                                                               *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)       *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA   *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION      *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL     *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s       *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                          *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#***************************************************************
*
--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=2y6.STM
--------------------------------------------------------------------------------
001:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2y6.ST
| Ptotal=  36.00 mm|    Comments: 2yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  12.240 |   3.75   5.040 |   5.50    .720
               .50    .720 |   2.25  12.240 |   4.00   2.880 |   5.75    .720
               .75    .720 |   2.50  33.120 |   4.25   2.880 |   6.00    .720
              1.00    .720 |   2.75  33.120 |   4.50   1.440 |   6.25    .720
              1.25    .720 |   3.00   9.360 |   4.75   1.440 |
              1.50   4.320 |   3.25   9.360 |   5.00    .720 |
              1.75   4.320 |   3.50   5.040 |   5.25    .720 |

--------------------------------------------------------------------------------
001:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                           New rainfall volume =  36.00   (mm)
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	2.00	12.24	3.75	5.04	5.50	.72
.50	.72	2.25	12.24	4.00	2.88	5.75	.72
.75	.72	2.50	33.12	4.25	2.88	6.00	.72
1.00	.72	2.75	33.12	4.50	1.44	6.25	.72
1.25	.72	3.00	9.36	4.75	1.44		
1.50	4.32	3.25	9.36	5.00	.72		
1.75	4.32	3.50	5.04	5.25	.72		

001:0004----------

* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha

| CALIB STANDHYD | Area (ha)= 30.25
| 03:000601 DT= 5.00 | Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	29.65	.60
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	404.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		33.12	16.44
over (min)		10.00	25.00
Storage Coeff. (min)=		10.01 (ii)	25.66 (ii)
Unit Hyd. Tpeak (min)=		10.00	25.00
Unit Hyd. peak (cms)=		.11	.04
			TOTALS
PEAK FLOW	(cms)=	2.61	.02	2.619 (iii)
TIME TO PEAK	(hrs)=	2.75	3.00	2.750
RUNOFF VOLUME	(mm)=	34.00	15.37	33.627
TOTAL RAINFALL	(mm)=	36.00	36.00	36.000
RUNOFF COEFFICIENT	=	.94	.43	.934

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0005----------

*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area

| ROUTE RESERVOIR | Requested routing time step = 1.0 min.
| IN>03:(000601) |
| OUT<06:(000621) |

========= OUTLFOW STORAGE TABLE =========

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.0000E+00	5.450	.9900E+01
5.440	.1000E-01	.000	.0000E+00

ROUTING RESULTS	AREA	QPEAK	TPEAK	R.V.
INFLOW >03: (000601)	30.25	2.619	2.750	33.627
OUTFLOW<06: (000621)	30.25	2.614	2.750	33.627

PEAK FLOW REDUCTION [Qout/Qin](%)= 99.810
TIME SHIFT OF PEAK FLOW (min)= .00
MAXIMUM STORAGE USED (ha.m.)=.4820E-02

001:0006----------

* # ESA-6-FUT. - ONTARI ROADS

| CALIB STANDHYD | Area (ha)= 3.36
| 03:000602 DT= 5.00 | Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.29	.07
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	404.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		33.12	16.44
over (min)		10.00	25.00
Storage Coeff. (min)=		10.01 (ii)	25.66 (ii)
Unit Hyd. Tpeak (min)=		10.00	25.00
Unit Hyd. peak (cms)=		.11	.04
			TOTALS
PEAK FLOW	(cms)=	.29	.00	.291 (iii)
TIME TO PEAK	(hrs)=	2.75	3.00	2.750
RUNOFF VOLUME	(mm)=	34.00	15.37	33.627
TOTAL RAINFALL	(mm)=	36.00	36.00	36.000
RUNOFF COEFFICIENT	=	.94	.43	.934

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0007----------

*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha

| CALIB STANDHYD | Area (ha)= 3.22
| 05:000603 DT= 5.00 | Total Imp(%)= 55.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.77	1.45
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	139.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		33.12	17.46
over (min)		5.00	20.00
Storage Coeff. (min)=		5.28 (ii)	20.55 (ii)
Unit Hyd. Tpeak (min)=		5.00	20.00
Unit Hyd. peak (cms)=		.21	.06

				TOTALS	
PEAK FLOW	(cms)=	.16	.05	.202	(iii)
TIME TO PEAK	(hrs)=	2.75	2.92	2.750	
RUNOFF VOLUME	(mm)=	34.00	15.37	25.615	
TOTAL RAINFALL	(mm)=	36.00	36.00	36.000	
RUNOFF COEFFICIENT	=	.94	.43	.712	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0008

*# ESA-5b Future Employment Lands Development - Healey Rd One Properties

CALIB STANDHYD	Area (ha)= 10.00
08:000655 DT= 5.00	Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	9.00	1.00
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	341.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		33.12	16.44
over (min)		10.00	25.00
Storage Coeff. (min)=		9.04 (ii)	24.69 (ii)
Unit Hyd. Tpeak (min)=		10.00	25.00
Unit Hyd. peak (cms)=		.12	.05

				TOTALS	
PEAK FLOW	(cms)=	.80	.03	.822	(iii)
TIME TO PEAK	(hrs)=	2.75	3.00	2.750	
RUNOFF VOLUME	(mm)=	34.00	15.37	32.137	
TOTAL RAINFALL	(mm)=	36.00	36.00	36.000	
RUNOFF COEFFICIENT	=	.94	.43	.893	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

001:0009

*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area

ROUTE RESERVOIR	Requested routing time step = 1.0 min.
IN>08:(000655)	
OUT<09:(000656)	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.0000E+00	1.800	.9900E+01
1.790	.1000E-01	.000	.0000E+00

ROUTING RESULTS	AREA	QPEAK	TPEAK	R.V.

	(ha)	(cms)	(hrs)	(mm)
INFLOW >08: (000655)	10.00	.822	2.750	32.137
OUTFLOW<09: (000656)	10.00	.817	2.750	32.137

PEAK FLOW REDUCTION [Qout/Qin](%)= 99.422
TIME SHIFT OF PEAK FLOW (min)= .00
MAXIMUM STORAGE USED (ha.m.)=.4579E-02

001:0010

*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP

ADD HYD (000611)	ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
	ID1 03:000602	3.36	.291	2.75	33.63	.000
	+ID2 05:000603	3.22	.202	2.75	25.62	.000
	+ID3 06:000621	30.25	2.614	2.75	33.63	.000
	+ID4 09:000656	10.00	.817	2.75	32.14	.000
	SUM 08:000611	46.83	3.924	2.75	32.76	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0011

*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m

ROUTE RESERVOIR	Requested routing time step = 1.0 min.
IN>08:(000611)	
OUT<03:(000623)	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.0000E+00	.853	.3464E+01
.031	.4420E+00	1.238	.4489E+01
.043	.7550E+00	1.783	.5574E+01
.052	.1083E+01	2.393	.6719E+01
.057	.1266E+01	3.060	.7924E+01
.110	.1594E+01	3.781	.9189E+01
.379	.2499E+01	.000	.0000E+00

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >08: (000611)	46.83	3.924	2.750	32.758
OUTFLOW<03: (000623)	46.83	.083	6.300	32.669

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.127
TIME SHIFT OF PEAK FLOW (min)= 213.00
MAXIMUM STORAGE USED (ha.m.)=.1430E+01

001:0012

*
** END OF RUN : 1

```
********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=5y6.STM
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
*# MODEL: SWMHYMO 1999                                             *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# MODEL UPDATED BY: FP                                            *
*# PROJECT NO: 2109                                                *
*# DATA FILE: 2109Sa.DAT                                           *
*#-----------------------------------------------------------------*
*#                                                                 *
*# POST DEVELOPMENT MODEL                                          *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA     *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s         *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                            *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------------------------------------------------------------------
002:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\5y6.ST
| Ptotal=  47.81 mm|    Comments: 5yr/6hr
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
```



```
              .25    .000 |   2.00  16.250 |   3.75   6.690 |   5.50    .960
              .50    .960 |   2.25  16.250 |   4.00   3.820 |   5.75    .960
              .75    .960 |   2.50  43.980 |   4.25   3.820 |   6.00    .960
             1.00    .960 |   2.75  43.980 |   4.50   1.910 |   6.25    .960
             1.25    .960 |   3.00  12.430 |   4.75   1.910 |
             1.50   5.740 |   3.25  12.430 |   5.00    .960 |
             1.75   5.740 |   3.50   6.690 |   5.25    .960 |

--------------------------------------------------------------------------------
002:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                           New rainfall volume =  47.81   (mm)

                                  ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .25    .00 |   2.00  16.25 |   3.75   6.69 |   5.50    .96
                 .50    .96 |   2.25  16.25 |   4.00   3.82 |   5.75    .96
                 .75    .96 |   2.50  43.98 |   4.25   3.82 |   6.00    .96
                1.00    .96 |   2.75  43.98 |   4.50   1.91 |   6.25    .96
                1.25    .96 |   3.00  12.43 |   4.75   1.91 |
                1.50   5.74 |   3.25  12.43 |   5.00    .96 |
                1.75   5.74 |   3.50   6.69 |   5.25    .96 |

--------------------------------------------------------------------------------
002:0004----------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       29.65          .60
    Dep. Storage     (mm)=        2.00         4.00
    Average Slope     (%)=        1.00         1.00
    Length            (m)=      404.00        40.00
    Mannings n           =        .015         .200

    Max.eff.Inten.(mm/hr)=       43.98        27.61
              over (min)         10.00        20.00
    Storage Coeff.  (min)=        8.94 (ii)   21.65 (ii)
    Unit Hyd. Tpeak (min)=       10.00        20.00
    Unit Hyd. peak  (cms)=         .12          .05
                                                        *TOTALS*
    PEAK FLOW       (cms)=        3.51          .03          3.532 (iii)
    TIME TO PEAK    (hrs)=        2.75         2.92          2.750
    RUNOFF VOLUME    (mm)=       45.81        24.47         45.383
    TOTAL RAINFALL   (mm)=       47.81        47.81         47.810
    RUNOFF COEFFICIENT   =         .96          .51           .949

  (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
      CN* =  88.0    Ia = Dep. Storage  (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
      THAN THE STORAGE COEFFICIENT.
```

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0005----------

*

*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area

ROUTE RESERVOIR	IN>03:(000601)	OUT<06:(000621)

Requested routing time step = 1.0 min.

========= OUTLFOW STORAGE TABLE =========

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.0000E+00	5.450	.9900E+01
5.440	.1000E-01	.000	.0000E+00

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000601)	30.25	3.532	2.750	45.383
OUTFLOW<06: (000621)	30.25	3.526	2.750	45.383

PEAK FLOW REDUCTION [Qout/Qin](%)= 99.840
TIME SHIFT OF PEAK FLOW (min)= .00
MAXIMUM STORAGE USED (ha.m.)=.6499E-02

002:0006----------

* # ESA-6-FUT. - ONTARI ROADS

CALIB STANDHYD	03:000602 DT= 5.00

Area (ha)= 3.36
Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.29	.07
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	404.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		43.98	27.61
over (min)		10.00	20.00
Storage Coeff.	(min)=	8.94 (ii)	21.65 (ii)
Unit Hyd. Tpeak	(min)=	10.00	20.00
Unit Hyd. peak	(cms)=	.12	.05

		TOTALS
PEAK FLOW	(cms)=	.392 (iii)
TIME TO PEAK	(hrs)=	2.750
RUNOFF VOLUME	(mm)=	45.383
TOTAL RAINFALL	(mm)=	47.810
RUNOFF COEFFICIENT	=	.949

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0007----------

*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha

CALIB STANDHYD	05:000603 DT= 5.00

Area (ha)= 3.22
Total Imp(%)= 55.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.77	1.45
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	139.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		43.98	28.73
over (min)		5.00	15.00
Storage Coeff.	(min)=	4.71 (ii)	17.23 (ii)
Unit Hyd. Tpeak	(min)=	5.00	15.00
Unit Hyd. peak	(cms)=	.22	.07

		TOTALS
PEAK FLOW	(cms)=	.295 (iii)
TIME TO PEAK	(hrs)=	2.750
RUNOFF VOLUME	(mm)=	36.205
TOTAL RAINFALL	(mm)=	47.810
RUNOFF COEFFICIENT	=	.757

*** WARNING: Storage Coefficient is smaller than DT!
Use a smaller DT or a larger area.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0008----------

*# ESA-5b Future Employment Lands Development - Healey Rd One Properties

CALIB STANDHYD	08:000655 DT= 5.00

Area (ha)= 10.00
Total Imp(%)= 90.00 Dir. Conn.(%)= 90.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	9.00	1.00
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	341.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		43.98	27.61
over (min)		10.00	20.00
Storage Coeff.	(min)=	8.07 (ii)	20.79 (ii)
Unit Hyd. Tpeak	(min)=	10.00	20.00
Unit Hyd. peak	(cms)=	.13	.06

		TOTALS
PEAK FLOW	(cms)=	1.119 (iii)
TIME TO PEAK	(hrs)=	2.750
RUNOFF VOLUME	(mm)=	43.676
TOTAL RAINFALL	(mm)=	47.810
RUNOFF COEFFICIENT	=	.914

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

```
          CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0009--------------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.800  .9900E+01
                          1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.119     2.750     43.676
     OUTFLOW<09: (000656)      10.00     1.113     2.750     43.676

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.494
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6235E-02

--------------------------------------------------------------------------------
002:0010--------------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------               (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 03:000602     3.36     .392    2.75  45.38    .000
                +ID2 05:000603     3.22     .295    2.75  36.21    .000
                +ID3 06:000621    30.25    3.526    2.75  45.38    .000
                +ID4 09:000656    10.00    1.113    2.75  43.68    .000
                 ====================================================
                 SUM 08:000611    46.83    5.327    2.75  44.39    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0011--------------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
```



```
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     5.327     2.750     44.387
     OUTFLOW<03: (000623)      46.83      .195     4.917     44.274

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.670
                  TIME SHIFT OF PEAK FLOW         (min)=   130.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1882E+01

--------------------------------------------------------------------------------
002:0012--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------------
  ** END OF RUN :   2

********************************************************************************



--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=10y6.STM
--------------------------------------------------------------------------------
003:0002--------------------------------------------------------------------------
*#****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                *
*#                                                                *
*# HUMBER RIVER HYDROLOGY/                                        *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                     *
*#                                                                *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY         *
*#----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                     *
*#                                                                *
*# MODEL: SWMHYMO 1999                                           *
*#                                                                *
*# MODEL UPDATE: JAN 2021                                         *
*# MODEL UPDATED BY: FP                                           *
*# PROJECT NO: 2109                                               *
*# DATA FILE: 2109Sa.DAT                                         *
*#----------------------------------------------------------------*
*#                                                                *
*# POST DEVELOPMENT MODEL                                         *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE               *
```

```
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)        *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA    *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION       *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL      *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s        *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                           *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#****************************************************************
*
--------------------------------------------------------------------------------
003:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\10y6.S
| Ptotal=  55.69 mm|    Comments: 10yr/6hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   2.00  18.940 |   3.75   7.800 |   5.50   1.110
               .50   1.110 |   2.25  18.940 |   4.00   4.460 |   5.75   1.110
               .75   1.110 |   2.50  51.240 |   4.25   4.460 |   6.00   1.110
              1.00   1.110 |   2.75  51.240 |   4.50   2.230 |   6.25   1.110
              1.25   1.110 |   3.00  14.480 |   4.75   2.230 |
              1.50   6.680 |   3.25  14.480 |   5.00   1.110 |
              1.75   6.680 |   3.50   7.800 |   5.25   1.110 |

--------------------------------------------------------------------------------
003:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                         New rainfall volume =  55.69   (mm)

                              ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .00 |   2.00  18.94 |   3.75   7.80 |   5.50   1.11
               .50   1.11 |   2.25  18.94 |   4.00   4.46 |   5.75   1.11
               .75   1.11 |   2.50  51.24 |   4.25   4.46 |   6.00   1.11
              1.00   1.11 |   2.75  51.24 |   4.50   2.23 |   6.25   1.11
              1.25   1.11 |   3.00  14.48 |   4.75   2.23 |
              1.50   6.68 |   3.25  14.48 |   5.00   1.11 |
              1.75   6.68 |   3.50   7.80 |   5.25   1.11 |

--------------------------------------------------------------------------------
003:0004----------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
```



```
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      51.24        34.74
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       8.41 (ii)   20.01 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .12          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.11          .04          4.143 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.92          2.750
     RUNOFF VOLUME    (mm)=      53.69        30.95         53.235
     TOTAL RAINFALL   (mm)=      55.69        55.69         55.690
     RUNOFF COEFFICIENT   =        .96          .56           .956

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
003:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     4.143     2.750     53.235
     OUTFLOW<06: (000621)      30.25     4.137     2.750     53.235

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.856
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7623E-02

--------------------------------------------------------------------------------
003:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
```

```
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      51.24        34.74
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       8.41 (ii)   20.01 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .12          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .46          .00          .460 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.92         2.750
     RUNOFF VOLUME    (mm)=      53.69        30.95        53.235
     TOTAL RAINFALL   (mm)=      55.69        55.69        55.690
     RUNOFF COEFFICIENT   =        .96          .56          .956

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
003:0007--------------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
---------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77         1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      51.24        35.97
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       4.43 (ii)   15.87 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .23          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .25          .11          .356 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83         2.750
     RUNOFF VOLUME    (mm)=      53.69        30.95        43.457
     TOTAL RAINFALL   (mm)=      55.69        55.69        55.690
     RUNOFF COEFFICIENT   =        .96          .56          .780
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
003:0008--------------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
---------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
```



```
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      51.24        34.74
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       7.59 (ii)   19.19 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .13          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.26          .07          1.317 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.92         2.750
     RUNOFF VOLUME    (mm)=      53.69        30.95        51.416
     TOTAL RAINFALL   (mm)=      55.69        55.69        55.690
     RUNOFF COEFFICIENT   =        .96          .56          .923

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
003:0009--------------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>08:(000655)    |
| OUT<09:(000656)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)    |    (cms)    (ha.m.)
                            .000  .0000E+00    |    1.800  .9900E+01
                           1.790  .1000E-01    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.317     2.750     51.416
     OUTFLOW<09: (000656)      10.00     1.311     2.750     51.416

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.531
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7341E-02

--------------------------------------------------------------------------------
003:0010--------------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------                (ha)     (cms)   (hrs)   (mm)   (cms)
                ID1 03:000602     3.36      .460    2.75  53.24    .000
               +ID2 05:000603     3.22      .356    2.75  43.46    .000
               +ID3 06:000621    30.25    4.137    2.75  53.24    .000
```

```
               +ID4 09:000656    10.00    1.311    2.75  51.42    .000
                ========================================================
                SUM 08:000611    46.83    6.264    2.75  52.17    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
003:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     6.264     2.750     52.174
     OUTFLOW<03: (000623)      46.83      .282     4.800     52.051

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.507
                  TIME SHIFT OF PEAK FLOW         (min)=   123.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2174E+01

--------------------------------------------------------------------------------
003:0012----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
003:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
003:0002----------------------------------------------------------------------
  ** END OF RUN :   3

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
           #  1=25y6.STM
```



```
--------------------------------------------------------------------------------
004:0002----------------------------------------------------------------------
*#**************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                              *
*#                                                              *
*# HUMBER RIVER HYDROLOGY/                                      *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                   *
*#                                                              *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY       *
*#--------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                   *
*#                                                              *
*# MODEL: SWMHYMO 1999                                          *
*#                                                              *
*# MODEL UPDATE: JAN 2021                                       *
*# MODEL UPDATED BY: FP                                         *
*# PROJECT NO: 2109                                             *
*# DATA FILE: 2109Sa.DAT                                        *
*#--------------------------------------------------------------*
*#                                                              *
*# POST DEVELOPMENT MODEL                                       *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY  *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE             *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                              *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)      *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA  *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION     *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL    *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s      *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                         *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#**************************************************************
*
--------------------------------------------------------------------------------
004:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\25y6.S
| Ptotal=  65.59 mm|    Comments: 25yr/6hr
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             .25    .000 |   2.00  22.300 |   3.75   9.180 |   5.50   1.310
             .50   1.310 |   2.25  22.300 |   4.00   5.250 |   5.75   1.310
             .75   1.310 |   2.50  60.350 |   4.25   5.250 |   6.00   1.310
            1.00   1.310 |   2.75  60.350 |   4.50   2.620 |   6.25   1.310
            1.25   1.310 |   3.00  17.060 |   4.75   2.620 |
            1.50   7.870 |   3.25  17.060 |   5.00   1.310 |
            1.75   7.870 |   3.50   9.180 |   5.25   1.310 |

--------------------------------------------------------------------------------
004:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
```

| NSHIFT = 0 x SDT | Corresponding time shift (min)= .00

New rainfall volume = 65.59 (mm)

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	2.00	22.30	3.75	9.18	5.50	1.31
.50	1.31	2.25	22.30	4.00	5.25	5.75	1.31
.75	1.31	2.50	60.35	4.25	5.25	6.00	1.31
1.00	1.31	2.75	60.35	4.50	2.62	6.25	1.31
1.25	1.31	3.00	17.06	4.75	2.62		
1.50	7.87	3.25	17.06	5.00	1.31		
1.75	7.87	3.50	9.18	5.25	1.31		

004:0004

* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha

CALIB STANDHYD	Area (ha)= 30.25
03:000601 DT= 5.00	Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	29.65	.60
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	404.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		60.35	43.92
over (min)		10.00	20.00
Storage Coeff. (min)=		7.87 (ii)	18.44 (ii)
Unit Hyd. Tpeak (min)=		10.00	20.00
Unit Hyd. peak (cms)=		.13	.06

		TOTALS
PEAK FLOW	(cms)=	4.86 .05 4.911 (iii)
TIME TO PEAK	(hrs)=	2.75 2.92 2.750
RUNOFF VOLUME	(mm)=	63.59 39.42 63.107
TOTAL RAINFALL	(mm)=	65.59 65.59 65.590
RUNOFF COEFFICIENT	=	.97 .60 .962

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

004:0005

*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area

ROUTE RESERVOIR	Requested routing time step = 1.0 min.
IN>03:(000601)	
OUT<06:(000621)	========= OUTLFOW STORAGE TABLE =========

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.000	.0000E+00	5.450	.9900E+01
5.440	.1000E-01	.000	.0000E+00

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000601)	30.25	4.911	2.750	63.107
OUTFLOW<06: (000621)	30.25	4.905	2.750	63.107

PEAK FLOW REDUCTION [Qout/Qin](%)= 99.872
TIME SHIFT OF PEAK FLOW (min)= .00
MAXIMUM STORAGE USED (ha.m.)=.9035E-02

004:0006

* # ESA-6-FUT. - ONTARI ROADS

CALIB STANDHYD	Area (ha)= 3.36
03:000602 DT= 5.00	Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.29	.07
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	404.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		60.35	43.92
over (min)		10.00	20.00
Storage Coeff. (min)=		7.87 (ii)	18.44 (ii)
Unit Hyd. Tpeak (min)=		10.00	20.00
Unit Hyd. peak (cms)=		.13	.06

		TOTALS
PEAK FLOW	(cms)=	.54 .01 .545 (iii)
TIME TO PEAK	(hrs)=	2.75 2.92 2.750
RUNOFF VOLUME	(mm)=	63.59 39.42 63.107
TOTAL RAINFALL	(mm)=	65.59 65.59 65.590
RUNOFF COEFFICIENT	=	.97 .60 .962

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

004:0007

*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha

CALIB STANDHYD	Area (ha)= 3.22
05:000603 DT= 5.00	Total Imp(%)= 55.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.77	1.45
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	139.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		60.35	45.25

```
              over (min)        5.00        15.00
     Storage Coeff.  (min)=      4.15 (ii)   14.59 (ii)
     Unit Hyd. Tpeak (min)=      5.00        15.00
     Unit Hyd. peak  (cms)=       .24          .08
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .30          .14          .435 (iii)
     TIME TO PEAK    (hrs)=      2.75         2.83         2.750
     RUNOFF VOLUME    (mm)=     63.59        39.42        52.714
     TOTAL RAINFALL   (mm)=     65.59        65.59        65.590
     RUNOFF COEFFICIENT   =       .97          .60          .804
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
004:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      9.00         1.00
     Dep. Storage     (mm)=      2.00         4.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=    341.00        40.00
     Mannings n            =      .015         .200

     Max.eff.Inten.(mm/hr)=     60.35        43.92
              over (min)        5.00        20.00
     Storage Coeff.  (min)=      7.11 (ii)   17.67 (ii)
     Unit Hyd. Tpeak (min)=      5.00        20.00
     Unit Hyd. peak  (cms)=       .17          .06
                                                    *TOTALS*
     PEAK FLOW       (cms)=      1.49          .09          1.576 (iii)
     TIME TO PEAK    (hrs)=      2.75         2.92         2.750
     RUNOFF VOLUME    (mm)=     63.59        39.42        61.173
     TOTAL RAINFALL   (mm)=     65.59        65.59        65.590
     RUNOFF COEFFICIENT   =       .97          .60          .933

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
004:0009----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
```



```
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.800  .9900E+01
                          1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)       10.00     1.576     2.750     61.173
     OUTFLOW<09: (000656)       10.00     1.571     2.750     61.173

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.677
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.8789E-02

--------------------------------------------------------------------------------
004:0010----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------                (ha)     (cms)   (hrs)   (mm)   (cms)
                ID1 03:000602      3.36      .545    2.75  63.11    .000
               +ID2 05:000603      3.22      .435    2.75  52.71    .000
               +ID3 06:000621     30.25     4.905    2.75  63.11    .000
               +ID4 09:000656     10.00     1.571    2.75  61.17    .000
                ==========================================================
                SUM 08:000611     46.83     7.455    2.75  61.98    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
004:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)       46.83     7.455     2.750     61.979
     OUTFLOW<03: (000623)       46.83      .399     4.550     61.847

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.350
                  TIME SHIFT OF PEAK FLOW         (min)=   108.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2539E+01
```

```
--------------------------------------------------------------------------------
004:0012--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
004:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
004:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
004:0002--------------------------------------------------------------------------
  ** END OF RUN :   4

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=50y6.STM
--------------------------------------------------------------------------------
005:0002--------------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
*# MODEL: SWMHYMO 1999                                            *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# MODEL UPDATED BY: FP                                            *
*# PROJECT NO: 2109                                                *
*# DATA FILE: 2109Sa.DAT                                          *
*#-----------------------------------------------------------------*
*#                                                                 *
*# POST DEVELOPMENT MODEL                                          *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA     *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s         *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                            *
```



```
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------------------------------------------------------------------
005:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\50y6.S
| Ptotal=  73.00 mm|    Comments: 50yr/6hr
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .25    .000 |   2.00  24.820 |   3.75  10.220 |   5.50   1.460
              .50   1.460 |   2.25  24.820 |   4.00   5.840 |   5.75   1.460
              .75   1.460 |   2.50  67.160 |   4.25   5.840 |   6.00   1.460
             1.00   1.460 |   2.75  67.160 |   4.50   2.920 |   6.25   1.460
             1.25   1.460 |   3.00  18.980 |   4.75   2.920 |
             1.50   8.760 |   3.25  18.980 |   5.00   1.460 |
             1.75   8.760 |   3.50  10.220 |   5.25   1.460 |

--------------------------------------------------------------------------------
005:0003--------------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                         New rainfall volume =  73.00   (mm)

                                  ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                  .25    .00 |   2.00  24.82 |   3.75  10.22 |   5.50   1.46
                  .50   1.46 |   2.25  24.82 |   4.00   5.84 |   5.75   1.46
                  .75   1.46 |   2.50  67.16 |   4.25   5.84 |   6.00   1.46
                 1.00   1.46 |   2.75  67.16 |   4.50   2.92 |   6.25   1.46
                 1.25   1.46 |   3.00  18.98 |   4.75   2.92 |
                 1.50   8.76 |   3.25  18.98 |   5.00   1.46 |
                 1.75   8.76 |   3.50  10.22 |   5.25   1.46 |

--------------------------------------------------------------------------------
005:0004--------------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      67.16        52.28
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       7.54 (ii)   17.40 (ii)
     Unit Hyd. Tpeak (min)=      10.00        15.00
```

```
     Unit Hyd. peak  (cms)=        .13          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.43          .07          5.491 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83          2.750
     RUNOFF VOLUME    (mm)=      71.00        45.94         70.499
     TOTAL RAINFALL   (mm)=      73.00        73.00         73.000
     RUNOFF COEFFICIENT   =        .97          .63           .966

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    5.450  .9900E+01
                          5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     5.491     2.750     70.499
     OUTFLOW<06: (000621)      30.25     5.440     2.717     70.499

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.078
                   TIME SHIFT OF PEAK FLOW         (min)=    -2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1052E-01

--------------------------------------------------------------------------------
005:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      67.16        52.28
                 over (min)      10.00        15.00
     Storage Coeff.  (min)=       7.54 (ii)   17.40 (ii)
     Unit Hyd. Tpeak (min)=      10.00        15.00
     Unit Hyd. peak  (cms)=        .13          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .60          .01           .610 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83          2.750
```



```
     RUNOFF VOLUME    (mm)=      71.00        45.94         70.499
     TOTAL RAINFALL   (mm)=      73.00        73.00         73.000
     RUNOFF COEFFICIENT   =        .97          .63           .966

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77         1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      67.16        52.28
                 over (min)       5.00        15.00
     Storage Coeff.  (min)=       3.98 (ii)   13.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .24          .08
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .33          .17           .495 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83          2.750
     RUNOFF VOLUME    (mm)=      71.00        45.94         59.723
     TOTAL RAINFALL   (mm)=      73.00        73.00         73.000
     RUNOFF COEFFICIENT   =        .97          .63           .818
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      67.16        52.28
```

```
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       6.81 (ii)   16.67 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .18          .07
                                                *TOTALS*
     PEAK FLOW       (cms)=       1.67          .11          1.772 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83          2.750
     RUNOFF VOLUME    (mm)=      71.00        45.94         68.494
     TOTAL RAINFALL   (mm)=      73.00        73.00         73.000
     RUNOFF COEFFICIENT   =        .97          .63           .938

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0009--------------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    1.800  .9900E+01
                           1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.772     2.750     68.494
     OUTFLOW<09: (000656)      10.00     1.767     2.750     68.494

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.710
                  TIME SHIFT OF PEAK FLOW         (min)=     .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9886E-02

--------------------------------------------------------------------------------
005:0010--------------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
-------------------                (ha)     (cms)   (hrs)   (mm)    (cms)
                ID1 03:000602     3.36      .610    2.75  70.50    .000
               +ID2 05:000603     3.22      .495    2.75  59.72    .000
               +ID3 06:000621    30.25    5.440    2.72  70.50    .000
               +ID4 09:000656    10.00    1.767    2.75  68.49    .000
                ================================================
                SUM 08:000611    46.83    8.311    2.75  69.33    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
005:0011--------------------------------------------------------------------------
*
*# SWMP 3
```



```
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .853  .3464E+01
                            .031  .4420E+00   |    1.238  .4489E+01
                            .043  .7550E+00   |    1.783  .5574E+01
                            .052  .1083E+01   |    2.393  .6719E+01
                            .057  .1266E+01   |    3.060  .7924E+01
                            .110  .1594E+01   |    3.781  .9189E+01
                            .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     8.311     2.750     69.330
     OUTFLOW<03: (000623)      46.83      .527     4.433     69.192

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    6.338
                  TIME SHIFT OF PEAK FLOW         (min)=   101.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2800E+01

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005:0012--------------------------------------------------------------------------
*
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005:0002--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
005:0002--------------------------------------------------------------------------
  ** END OF RUN :   5

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
           #  1=100y6.STM
--------------------------------------------------------------------------------
006:0002--------------------------------------------------------------------------
*#*************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                             *
*#                                                            *
*# HUMBER RIVER HYDROLOGY/                                    *
```

```
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                          *
*#                                                                     *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY             *
*#---------------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                         *
*#                                                                     *
*# MODEL: SWMHYMO 1999                                               *
*#                                                                     *
*# MODEL UPDATE: JAN 2021                                            *
*# MODEL UPDATED BY: FP                                              *
*# PROJECT NO: 2109                                                  *
*# DATA FILE: 2109Sa.DAT                                             *
*#---------------------------------------------------------------------*
*#                                                                     *
*# POST DEVELOPMENT MODEL                                            *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT    *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY      *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                   *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)     *
*#                                                                     *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)           *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA       *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5    *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION          *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL         *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s           *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND   *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                              *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES  *
*#*********************************************************************
*
------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\100y6.
| Ptotal=  80.31 mm|    Comments: 100yr/6hr
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .25    .000 |   2.00  27.300 |   3.75  11.240 |   5.50   1.610
              .50   1.610 |   2.25  27.300 |   4.00   6.420 |   5.75   1.610
              .75   1.610 |   2.50  73.880 |   4.25   6.420 |   6.00   1.610
             1.00   1.610 |   2.75  73.880 |   4.50   3.210 |   6.25   1.610
             1.25   1.610 |   3.00  20.880 |   4.75   3.210 |
             1.50   9.640 |   3.25  20.880 |   5.00   1.610 |
             1.75   9.640 |   3.50  11.240 |   5.25   1.610 |

------------------------------------------------------------------------------
006:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                         New rainfall volume =  80.31   (mm)

                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
```



```
                hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .25    .00 |  2.00  27.30 |  3.75  11.24 |  5.50   1.61
                 .50   1.61 |  2.25  27.30 |  4.00   6.42 |  5.75   1.61
                 .75   1.61 |  2.50  73.88 |  4.25   6.42 |  6.00   1.61
                1.00   1.61 |  2.75  73.88 |  4.50   3.21 |  6.25   1.61
                1.25   1.61 |  3.00  20.88 |  4.75   3.21 |
                1.50   9.64 |  3.25  20.88 |  5.00   1.61 |
                1.75   9.64 |  3.50  11.24 |  5.25   1.61 |

------------------------------------------------------------------------------
006:0004----------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      73.88        59.27
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       7.26 (ii)   16.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .17          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.02          .08          6.095 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83          2.750
     RUNOFF VOLUME    (mm)=      78.31        52.49         77.794
     TOTAL RAINFALL   (mm)=      80.31        80.31         80.310
     RUNOFF COEFFICIENT   =        .98          .65           .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
006:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     6.095     2.750     77.794
```

```
     OUTFLOW<06: (000621)      30.25     5.440     2.767     77.794

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   89.249
                   TIME SHIFT OF PEAK FLOW         (min)=     1.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5843E-01

--------------------------------------------------------------------------------
006:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      73.88        59.27
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       7.26 (ii)   16.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .17          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .67          .01          .677 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83         2.750
     RUNOFF VOLUME    (mm)=      78.31        52.49        77.793
     TOTAL RAINFALL   (mm)=      80.31        80.31        80.310
     RUNOFF COEFFICIENT   =        .98          .65          .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77         1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      73.88        59.27
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.83 (ii)   13.20 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .25          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .36          .19          .554 (iii)
```



```
     TIME TO PEAK    (hrs)=       2.75         2.83         2.750
     RUNOFF VOLUME    (mm)=      78.31        52.49        66.690
     TOTAL RAINFALL   (mm)=      80.31        80.31        80.310
     RUNOFF COEFFICIENT   =        .98          .65          .830
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      73.88        59.27
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       6.56 (ii)   15.93 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .18          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.83          .13         1.958 (iii)
     TIME TO PEAK    (hrs)=       2.75         2.83         2.750
     RUNOFF VOLUME    (mm)=      78.31        52.49        75.728
     TOTAL RAINFALL   (mm)=      80.31        80.31        80.310
     RUNOFF COEFFICIENT   =        .98          .65          .943

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
006:0009----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.800  .9900E+01
                          1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
```

```
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.958     2.750     75.728
     OUTFLOW<09: (000656)      10.00     1.790     2.767     75.728

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   91.399
                   TIME SHIFT OF PEAK FLOW         (min)=     1.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2027E-01

--------------------------------------------------------------------------------
006:0010----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.      DWF
--------------------               (ha)     (cms)   (hrs)   (mm)    (cms)
                 ID1 03:000602     3.36      .677    2.75  77.79     .000
                +ID2 05:000603     3.22      .554    2.75  66.69     .000
                +ID3 06:000621    30.25    5.440    2.77  77.79     .000
                +ID4 09:000656    10.00    1.790    2.77  75.73     .000
                 ================================================
                 SUM 08:000611    46.83    8.461    2.75  76.59     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
006:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     8.461     2.750     76.589
     OUTFLOW<03: (000623)      46.83      .651     4.333     76.448

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    7.695
                   TIME SHIFT OF PEAK FLOW         (min)=    95.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3053E+01

--------------------------------------------------------------------------------
006:0012----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
```



```
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
006:0002----------------------------------------------------------------------
  ** END OF RUN :   6

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=2y12.STM
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
*#****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                *
*#                                                                *
*# HUMBER RIVER HYDROLOGY/                                        *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                     *
*#                                                                *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY         *
*#----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                     *
*#                                                                *
*# MODEL: SWMHYMO 1999                                            *
*#                                                                *
*# MODEL UPDATE: JAN 2021                                         *
*# MODEL UPDATED BY: FP                                           *
*# PROJECT NO: 2109                                               *
*# DATA FILE: 2109Sa.DAT                                          *
*#----------------------------------------------------------------*
*#                                                                *
*# POST DEVELOPMENT MODEL                                         *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY  *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE               *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0) *
*#                                                                *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)        *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA    *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION       *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL      *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s        *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                           *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#****************************************************************
```

```
*
------------------------------------------------------------------------------
007:0002--------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2y12.S
| Ptotal=  42.00 mm|    Comments: 2yr/12hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	3.50	7.140	6.75	2.940	10.00	.420
.50	.420	3.75	7.140	7.00	2.940	10.25	.420
.75	.420	4.00	7.140	7.25	2.940	10.50	.420
1.00	.420	4.25	7.140	7.50	1.680	10.75	.420
1.25	.420	4.50	19.320	7.75	1.680	11.00	.420
1.50	.420	4.75	19.320	8.00	1.680	11.25	.420
1.75	.420	5.00	19.320	8.25	1.680	11.50	.420
2.00	.420	5.25	19.320	8.50	.840	11.75	.420
2.25	.420	5.50	5.460	8.75	.840	12.00	.420
2.50	2.520	5.75	5.460	9.00	.840	12.25	.420
2.75	2.520	6.00	5.460	9.25	.840		
3.00	2.520	6.25	5.460	9.50	.420		
3.25	2.520	6.50	2.940	9.75	.420		

```
------------------------------------------------------------------------------
007:0003--------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------

                       New rainfall volume =  42.00   (mm)

                           ---- TRANSFORMED HYETOGRAPH ----
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	3.50	7.14	6.75	2.94	10.00	.42
.50	.42	3.75	7.14	7.00	2.94	10.25	.42
.75	.42	4.00	7.14	7.25	2.94	10.50	.42
1.00	.42	4.25	7.14	7.50	1.68	10.75	.42
1.25	.42	4.50	19.32	7.75	1.68	11.00	.42
1.50	.42	4.75	19.32	8.00	1.68	11.25	.42
1.75	.42	5.00	19.32	8.25	1.68	11.50	.42
2.00	.42	5.25	19.32	8.50	.84	11.75	.42
2.25	.42	5.50	5.46	8.75	.84	12.00	.42
2.50	2.52	5.75	5.46	9.00	.84	12.25	.42
2.75	2.52	6.00	5.46	9.25	.84		
3.00	2.52	6.25	5.46	9.50	.42		
3.25	2.52	6.50	2.94	9.75	.42		

```
------------------------------------------------------------------------------
007:0004--------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
```



```
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      19.32        11.77
               over (min)        10.00        30.00
     Storage Coeff.  (min)=      12.42 (ii)   30.30 (ii)
     Unit Hyd. Tpeak (min)=      10.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.58          .01          1.594 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.50          5.250
     RUNOFF VOLUME    (mm)=      40.00        19.88         39.598
     TOTAL RAINFALL   (mm)=      42.00        42.00         42.000
     RUNOFF COEFFICIENT   =        .95          .47           .943

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
007:0005--------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     1.594     5.250     39.598
     OUTFLOW<06: (000621)      30.25     1.594     5.250     39.598

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.976
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2931E-02

------------------------------------------------------------------------------
007:0006--------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
```

```
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      19.32        11.77
               over (min)        10.00        30.00
     Storage Coeff.  (min)=      12.42 (ii)   30.30 (ii)
     Unit Hyd. Tpeak (min)=      10.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .18          .00         .177 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.50         5.250
     RUNOFF VOLUME    (mm)=      40.00        19.88        39.598
     TOTAL RAINFALL   (mm)=      42.00        42.00        42.000
     RUNOFF COEFFICIENT   =        .95          .47          .943

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
007:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77         1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      19.32        12.00
               over (min)         5.00        25.00
     Storage Coeff.  (min)=       6.55 (ii)   24.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .18          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .10          .04         .132 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.42         5.250
     RUNOFF VOLUME    (mm)=      40.00        19.88        30.946
     TOTAL RAINFALL   (mm)=      42.00        42.00        42.000
     RUNOFF COEFFICIENT   =        .95          .47          .737

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
007:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
```



```
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      19.32        11.77
               over (min)        10.00        30.00
     Storage Coeff.  (min)=      11.22 (ii)   29.10 (ii)
     Unit Hyd. Tpeak (min)=      10.00        30.00
     Unit Hyd. peak  (cms)=        .10          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .48          .02         .504 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.50         5.250
     RUNOFF VOLUME    (mm)=      40.00        19.88        37.988
     TOTAL RAINFALL   (mm)=      42.00        42.00        42.000
     RUNOFF COEFFICIENT   =        .95          .47          .904

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
007:0009----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    1.800  .9900E+01
                           1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00      .504     5.250     37.988
     OUTFLOW<09: (000656)      10.00      .503     5.250     37.988

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.893
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2812E-02

--------------------------------------------------------------------------------
007:0010----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------                (ha)     (cms)   (hrs)   (mm)   (cms)
                ID1 03:000602     3.36     .177    5.25  39.60    .000
               +ID2 05:000603     3.22     .132    5.25  30.95    .000
               +ID3 06:000621    30.25    1.594    5.25  39.60    .000
               +ID4 09:000656    10.00     .503    5.25  37.99    .000
                ==========================================================
```

```
                SUM 08:000611    46.83    2.406    5.25  38.66    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
007:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     2.406     5.250     38.659
     OUTFLOW<03: (000623)      46.83      .110     9.233     38.546

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.568
                  TIME SHIFT OF PEAK FLOW         (min)=   239.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1593E+01

--------------------------------------------------------------------------------
007:0012----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
007:0002----------------------------------------------------------------------
  ** END OF RUN :   7

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
```



```
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 008
    NSTORM=   1
           #  1=5y12.STM
--------------------------------------------------------------------------------
008:0002----------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
*# MODEL: SWMHYMO 1999                                             *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# MODEL UPDATED BY: FP                                            *
*# PROJECT NO: 2109                                                *
*# DATA FILE: 2109Sa.DAT                                           *
*#-----------------------------------------------------------------*
*#                                                                 *
*# POST DEVELOPMENT MODEL                                          *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA     *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s         *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                            *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------------------------------------------------------------------
008:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\5y12.S
| Ptotal=  54.38 mm|    Comments: 5yr/12hr
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             .25    .000 |   3.50   9.250 |   6.75   3.810 |  10.00    .540
             .50    .540 |   3.75   9.250 |   7.00   3.810 |  10.25    .540
             .75    .540 |   4.00   9.250 |   7.25   3.810 |  10.50    .540
            1.00    .540 |   4.25   9.250 |   7.50   2.180 |  10.75    .540
            1.25    .540 |   4.50  25.020 |   7.75   2.180 |  11.00    .540
            1.50    .540 |   4.75  25.020 |   8.00   2.180 |  11.25    .540
            1.75    .540 |   5.00  25.020 |   8.25   2.180 |  11.50    .540
            2.00    .540 |   5.25  25.020 |   8.50   1.090 |  11.75    .540
```

2.25	.540	5.50	7.070	8.75	1.090	12.00	.540
2.50	3.260	5.75	7.070	9.00	1.090	12.25	.540
2.75	3.260	6.00	7.070	9.25	1.090		
3.00	3.260	6.25	7.070	9.50	.540		
3.25	3.260	6.50	3.810	9.75	.540		

```
--------------------------------------------------------------------------------
008:0003--------------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------

                         New rainfall volume =  54.38   (mm)
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	3.50	9.25	6.75	3.81	10.00	.54
.50	.54	3.75	9.25	7.00	3.81	10.25	.54
.75	.54	4.00	9.25	7.25	3.81	10.50	.54
1.00	.54	4.25	9.25	7.50	2.18	10.75	.54
1.25	.54	4.50	25.02	7.75	2.18	11.00	.54
1.50	.54	4.75	25.02	8.00	2.18	11.25	.54
1.75	.54	5.00	25.02	8.25	2.18	11.50	.54
2.00	.54	5.25	25.02	8.50	1.09	11.75	.54
2.25	.54	5.50	7.07	8.75	1.09	12.00	.54
2.50	3.26	5.75	7.07	9.00	1.09	12.25	.54
2.75	3.26	6.00	7.07	9.25	1.09		
3.00	3.26	6.25	7.07	9.50	.54		
3.25	3.26	6.50	3.81	9.75	.54		

```
--------------------------------------------------------------------------------
008:0004--------------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	29.65	.60	
Dep. Storage	(mm)=	2.00	4.00	
Average Slope	(%)=	1.00	1.00	
Length	(m)=	404.00	40.00	
Mannings n	=	.015	.200	
Max.eff.Inten.(mm/hr)=		25.02	17.65	
over (min)		10.00	25.00	
Storage Coeff. (min)=		11.20 (ii)	26.41 (ii)	
Unit Hyd. Tpeak (min)=		10.00	25.00	
Unit Hyd. peak (cms)=		.10	.04	
				TOTALS
PEAK FLOW	(cms)=	2.05	.02	2.075 (iii)
TIME TO PEAK	(hrs)=	5.25	5.42	5.250
RUNOFF VOLUME	(mm)=	52.38	29.85	51.930
TOTAL RAINFALL	(mm)=	54.38	54.38	54.380
RUNOFF COEFFICIENT	=	.96	.55	.955


```
  (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
      CN* =  88.0    Ia = Dep. Storage  (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
      THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
008:0005--------------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

    ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
    --------------------       (ha)     (cms)     (hrs)       (mm)
    INFLOW >03: (000601)      30.25     2.075     5.250     51.930
    OUTFLOW<06: (000621)      30.25     2.074     5.250     51.929

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.982
                TIME SHIFT OF PEAK FLOW         (min)=      .00
                MAXIMUM  STORAGE   USED       (ha.m.)=.3814E-02

--------------------------------------------------------------------------------
008:0006--------------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.29	.07	
Dep. Storage	(mm)=	2.00	4.00	
Average Slope	(%)=	1.00	1.00	
Length	(m)=	404.00	40.00	
Mannings n	=	.015	.200	
Max.eff.Inten.(mm/hr)=		25.02	17.65	
over (min)		10.00	25.00	
Storage Coeff. (min)=		11.20 (ii)	26.41 (ii)	
Unit Hyd. Tpeak (min)=		10.00	25.00	
Unit Hyd. peak (cms)=		.10	.04	
				TOTALS
PEAK FLOW	(cms)=	.23	.00	.230 (iii)
TIME TO PEAK	(hrs)=	5.25	5.42	5.250
RUNOFF VOLUME	(mm)=	52.38	29.85	51.930
TOTAL RAINFALL	(mm)=	54.38	54.38	54.380
RUNOFF COEFFICIENT	=	.96	.55	.955

```
  (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
      CN* =  88.0    Ia = Dep. Storage  (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
      THAN THE STORAGE COEFFICIENT.
```

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------------------------------------------------------------------
008:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      1.77          1.45
     Dep. Storage     (mm)=      2.00          4.00
     Average Slope     (%)=      1.00          1.00
     Length            (m)=    139.00         40.00
     Mannings n           =      .015          .200

     Max.eff.Inten.(mm/hr)=     25.02         17.90
               over (min)       5.00         20.00
     Storage Coeff.  (min)=     5.90 (ii)    21.03 (ii)
     Unit Hyd. Tpeak (min)=     5.00         20.00
     Unit Hyd. peak  (cms)=      .19           .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .12           .06          .183 (iii)
     TIME TO PEAK    (hrs)=     5.25          5.33         5.250
     RUNOFF VOLUME    (mm)=    52.38         29.85        42.244
     TOTAL RAINFALL   (mm)=    54.38         54.38        54.380
     RUNOFF COEFFICIENT   =      .96           .55          .777

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
008:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      9.00          1.00
     Dep. Storage     (mm)=      2.00          4.00
     Average Slope     (%)=      1.00          1.00
     Length            (m)=    341.00         40.00
     Mannings n           =      .015          .200

     Max.eff.Inten.(mm/hr)=     25.02         17.65
               over (min)      10.00         25.00
     Storage Coeff.  (min)=    10.12 (ii)    25.32 (ii)
     Unit Hyd. Tpeak (min)=     10.00         25.00
     Unit Hyd. peak  (cms)=      .11           .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .62           .04          .662 (iii)
     TIME TO PEAK    (hrs)=     5.25          5.33         5.250
     RUNOFF VOLUME    (mm)=    52.38         29.85        50.128
     TOTAL RAINFALL   (mm)=    54.38         54.38        54.380
     RUNOFF COEFFICIENT   =      .96           .55          .922
```


(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------------------------------------------------------------------
008:0009----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    1.800  .9900E+01
                           1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00      .662     5.250     50.128
     OUTFLOW<09: (000656)      10.00      .661     5.250     50.127

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.908
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3697E-02

--------------------------------------------------------------------------------
008:0010----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------                (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 03:000602     3.36     .230    5.25  51.93    .000
                +ID2 05:000603     3.22     .183    5.25  42.24    .000
                +ID3 06:000621    30.25    2.074    5.25  51.93    .000
                +ID4 09:000656    10.00     .661    5.25  50.13    .000
                 ==========================================================
                 SUM 08:000611    46.83    3.149    5.25  50.88    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
008:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
```

```
                          .000  .0000E+00   |     .853  .3464E+01
                          .031  .4420E+00   |    1.238  .4489E+01
                          .043  .7550E+00   |    1.783  .5574E+01
                          .052  .1083E+01   |    2.393  .6719E+01
                          .057  .1266E+01   |    3.060  .7924E+01
                          .110  .1594E+01   |    3.781  .9189E+01
                          .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     3.149     5.250     50.879
     OUTFLOW<03: (000623)      46.83      .233     8.400     50.747

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    7.399
                    TIME SHIFT OF PEAK FLOW         (min)=   189.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.2008E+01

--------------------------------------------------------------------------------
008:0012----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
008:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
008:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
008:0002----------------------------------------------------------------------
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008:0002----------------------------------------------------------------------
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008:0002----------------------------------------------------------------------
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008:0002----------------------------------------------------------------------
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008:0002----------------------------------------------------------------------
--------------------------------------------------------------------------------
008:0002----------------------------------------------------------------------
  ** END OF RUN :   8

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 009
    NSTORM=   1
           #  1=10y12.STM
--------------------------------------------------------------------------------
009:0002----------------------------------------------------------------------
*#**************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                              *
*#                                                              *
*# HUMBER RIVER HYDROLOGY/                                      *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                   *
*#                                                              *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY       *
*#--------------------------------------------------------------*
```



```
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                   *
*#                                                              *
*# MODEL: SWMHYMO 1999                                          *
*#                                                              *
*# MODEL UPDATE: JAN 2021                                       *
*# MODEL UPDATED BY: FP                                         *
*# PROJECT NO: 2109                                             *
*# DATA FILE: 2109Sa.DAT                                        *
*#--------------------------------------------------------------*
*#                                                              *
*# POST DEVELOPMENT MODEL                                       *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY  *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE             *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0) *
*#                                                              *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)      *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA  *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION     *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL    *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s      *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                         *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#**************************************************************
*
--------------------------------------------------------------------------------
009:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\10y12.
| Ptotal=  62.71 mm|    Comments: 10yr/12hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .25    .000 |   3.50  10.660 |   6.75   4.390 |  10.00    .630
               .50    .630 |   3.75  10.660 |   7.00   4.390 |  10.25    .630
               .75    .630 |   4.00  10.660 |   7.25   4.390 |  10.50    .630
              1.00    .630 |   4.25  10.660 |   7.50   2.510 |  10.75    .630
              1.25    .630 |   4.50  28.840 |   7.75   2.510 |  11.00    .630
              1.50    .630 |   4.75  28.840 |   8.00   2.510 |  11.25    .630
              1.75    .630 |   5.00  28.840 |   8.25   2.510 |  11.50    .630
              2.00    .630 |   5.25  28.840 |   8.50   1.250 |  11.75    .630
              2.25    .630 |   5.50   8.150 |   8.75   1.250 |  12.00    .630
              2.50   3.760 |   5.75   8.150 |   9.00   1.250 |  12.25    .630
              2.75   3.760 |   6.00   8.150 |   9.25   1.250 |
              3.00   3.760 |   6.25   8.150 |   9.50    .630 |
              3.25   3.760 |   6.50   4.390 |   9.75    .630 |

--------------------------------------------------------------------------------
009:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                           New rainfall volume =  62.71   (mm)
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	3.50	10.66	6.75	4.39	10.00	.63
.50	.63	3.75	10.66	7.00	4.39	10.25	.63
.75	.63	4.00	10.66	7.25	4.39	10.50	.63
1.00	.63	4.25	10.66	7.50	2.51	10.75	.63
1.25	.63	4.50	28.84	7.75	2.51	11.00	.63
1.50	.63	4.75	28.84	8.00	2.51	11.25	.63
1.75	.63	5.00	28.84	8.25	2.51	11.50	.63
2.00	.63	5.25	28.84	8.50	1.25	11.75	.63
2.25	.63	5.50	8.15	8.75	1.25	12.00	.63
2.50	3.76	5.75	8.15	9.00	1.25	12.25	.63
2.75	3.76	6.00	8.15	9.25	1.25		
3.00	3.76	6.25	8.15	9.50	.63		
3.25	3.76	6.50	4.39	9.75	.63		

009:0004

* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha

CALIB STANDHYD	Area (ha)= 30.25
03:000601 DT= 5.00	Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	29.65	.60	
Dep. Storage	(mm)=	2.00	4.00	
Average Slope	(%)=	1.00	1.00	
Length	(m)=	404.00	40.00	
Mannings n	=	.015	.200	
Max.eff.Inten.(mm/hr)=		28.84	21.55	
over (min)		10.00	25.00	
Storage Coeff. (min)=		10.58 (ii)	24.62 (ii)	
Unit Hyd. Tpeak (min)=		10.00	25.00	
Unit Hyd. peak (cms)=		.11	.05	
				TOTALS
PEAK FLOW	(cms)=	2.37	.03	2.397 (iii)
TIME TO PEAK	(hrs)=	5.25	5.33	5.250
RUNOFF VOLUME	(mm)=	60.71	36.93	60.234
TOTAL RAINFALL	(mm)=	62.71	62.71	62.710
RUNOFF COEFFICIENT	=	.97	.59	.961

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

009:0005

*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area

ROUTE RESERVOIR	Requested routing time step = 1.0 min.
IN>03:(000601)	
OUT<06:(000621)	========= OUTLFOW STORAGE TABLE =========

	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	.000	.0000E+00	5.450	.9900E+01
	5.440	.1000E-01	.000	.0000E+00

ROUTING RESULTS	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >03: (000601)	30.25	2.397	5.250	60.234
OUTFLOW<06: (000621)	30.25	2.396	5.250	60.234

PEAK FLOW REDUCTION [Qout/Qin](%)= 99.985
TIME SHIFT OF PEAK FLOW (min)= .00
MAXIMUM STORAGE USED (ha.m.)=.4406E-02

009:0006

* # ESA-6-FUT. - ONTARI ROADS

CALIB STANDHYD	Area (ha)= 3.36
03:000602 DT= 5.00	Total Imp(%)= 98.00 Dir. Conn.(%)= 98.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	3.29	.07	
Dep. Storage	(mm)=	2.00	4.00	
Average Slope	(%)=	1.00	1.00	
Length	(m)=	404.00	40.00	
Mannings n	=	.015	.200	
Max.eff.Inten.(mm/hr)=		28.84	21.55	
over (min)		10.00	25.00	
Storage Coeff. (min)=		10.58 (ii)	24.62 (ii)	
Unit Hyd. Tpeak (min)=		10.00	25.00	
Unit Hyd. peak (cms)=		.11	.05	
				TOTALS
PEAK FLOW	(cms)=	.26	.00	.266 (iii)
TIME TO PEAK	(hrs)=	5.25	5.33	5.250
RUNOFF VOLUME	(mm)=	60.71	36.93	60.234
TOTAL RAINFALL	(mm)=	62.71	62.71	62.710
RUNOFF COEFFICIENT	=	.97	.59	.961

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 88.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

009:0007

*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha

CALIB STANDHYD	Area (ha)= 3.22
05:000603 DT= 5.00	Total Imp(%)= 55.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.77	1.45
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	139.00	40.00
Mannings n	=	.015	.200

```
     Max.eff.Inten.(mm/hr)=      28.84        21.82
               over (min)         5.00        20.00
     Storage Coeff.  (min)=       5.58 (ii)   19.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .20          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .14          .08          .217 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33         5.250
     RUNOFF VOLUME    (mm)=      60.71        36.93        50.007
     TOTAL RAINFALL   (mm)=      62.71        62.71        62.710
     RUNOFF COEFFICIENT   =        .97          .59          .797

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
009:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      28.84        21.55
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       9.56 (ii)   23.60 (ii)
     Unit Hyd. Tpeak (min)=      10.00        25.00
     Unit Hyd. peak  (cms)=        .12          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .72          .05          .768 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33         5.250
     RUNOFF VOLUME    (mm)=      60.71        36.93        58.331
     TOTAL RAINFALL   (mm)=      62.71        62.71        62.710
     RUNOFF COEFFICIENT   =        .97          .59          .930

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
009:0009----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
```



```
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.800  .9900E+01
                          1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00      .768     5.250     58.331
     OUTFLOW<09: (000656)      10.00      .767     5.250     58.331

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.915
                   TIME SHIFT OF PEAK FLOW         (min)=      .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4288E-02

--------------------------------------------------------------------------------
009:0010----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------                (ha)     (cms)   (hrs)   (mm)   (cms)
                ID1 03:000602     3.36     .266    5.25  60.23    .000
               +ID2 05:000603     3.22     .217    5.25  50.01    .000
               +ID3 06:000621    30.25    2.396    5.25  60.23    .000
               +ID4 09:000656    10.00     .767    5.25  58.33    .000
                ==========================================================
                SUM 08:000611    46.83    3.647    5.25  59.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
009:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     3.647     5.250     59.125
     OUTFLOW<03: (000623)      46.83      .313     8.300     58.984

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    8.586
                   TIME SHIFT OF PEAK FLOW         (min)=   183.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2278E+01
```

```
--------------------------------------------------------------------------------
009:0012----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
009:0002----------------------------------------------------------------------
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009:0002----------------------------------------------------------------------
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009:0002----------------------------------------------------------------------
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009:0002----------------------------------------------------------------------
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009:0002----------------------------------------------------------------------
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009:0002----------------------------------------------------------------------
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009:0002----------------------------------------------------------------------
  ** END OF RUN :   9

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
           #  1=25y12.STM
--------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
*# MODEL: SWMHYMO 1999                                            *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# MODEL UPDATED BY: FP                                           *
*# PROJECT NO: 2109                                               *
*# DATA FILE: 2109Sa.DAT                                          *
*#-----------------------------------------------------------------*
*#                                                                 *
*# POST DEVELOPMENT MODEL                                         *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                *
```



```
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA     *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s         *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                           *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\25y12.
| Ptotal=  73.10 mm|    Comments: 25yr/12hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	3.50	12.430	6.75	5.120	10.00	.730
.50	.730	3.75	12.430	7.00	5.120	10.25	.730
.75	.730	4.00	12.430	7.25	5.120	10.50	.730
1.00	.730	4.25	12.430	7.50	2.920	10.75	.730
1.25	.730	4.50	33.630	7.75	2.920	11.00	.730
1.50	.730	4.75	33.630	8.00	2.920	11.25	.730
1.75	.730	5.00	33.630	8.25	2.920	11.50	.730
2.00	.730	5.25	33.630	8.50	1.460	11.75	.730
2.25	.730	5.50	9.500	8.75	1.460	12.00	.730
2.50	4.390	5.75	9.500	9.00	1.460	12.25	.730
2.75	4.390	6.00	9.500	9.25	1.460		
3.00	4.390	6.25	9.500	9.50	.730		
3.25	4.390	6.50	5.120	9.75	.730		

```
--------------------------------------------------------------------------------
010:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                         New rainfall volume =  73.10   (mm)
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	3.50	12.43	6.75	5.12	10.00	.73
.50	.73	3.75	12.43	7.00	5.12	10.25	.73
.75	.73	4.00	12.43	7.25	5.12	10.50	.73
1.00	.73	4.25	12.43	7.50	2.92	10.75	.73
1.25	.73	4.50	33.63	7.75	2.92	11.00	.73
1.50	.73	4.75	33.63	8.00	2.92	11.25	.73
1.75	.73	5.00	33.63	8.25	2.92	11.50	.73
2.00	.73	5.25	33.63	8.50	1.46	11.75	.73
2.25	.73	5.50	9.50	8.75	1.46	12.00	.73
2.50	4.39	5.75	9.50	9.00	1.46	12.25	.73
2.75	4.39	6.00	9.50	9.25	1.46		

```
                3.00   4.39 |   6.25   9.50 |   9.50    .73 |
                3.25   4.39 |   6.50   5.12 |   9.75    .73 |

--------------------------------------------------------------------------------
010:0004----------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      33.63        26.50
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       9.95 (ii)   22.88 (ii)
     Unit Hyd. Tpeak (min)=      10.00        25.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.76          .04         2.800 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33         5.250
     RUNOFF VOLUME    (mm)=      71.10        46.03        70.599
     TOTAL RAINFALL   (mm)=      73.10        73.10        73.100
     RUNOFF COEFFICIENT   =        .97          .63          .966

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>03:(000601)  |
| OUT<06:(000621)  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    5.450  .9900E+01
                          5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     2.800     5.250     70.599
     OUTFLOW<06: (000621)      30.25     2.800     5.250     70.598

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.988
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5148E-02
```



```
--------------------------------------------------------------------------------
010:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      33.63        26.50
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       9.95 (ii)   22.88 (ii)
     Unit Hyd. Tpeak (min)=      10.00        25.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .31          .00          .311 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33         5.250
     RUNOFF VOLUME    (mm)=      71.10        46.03        70.599
     TOTAL RAINFALL   (mm)=      73.10        73.10        73.100
     RUNOFF COEFFICIENT   =        .97          .63          .966

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77         1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      33.63        26.78
               over (min)        5.00         20.00
     Storage Coeff.  (min)=       5.25 (ii)   18.12 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .21          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .17          .10          .261 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.25         5.250
     RUNOFF VOLUME    (mm)=      71.10        46.03        59.818
     TOTAL RAINFALL   (mm)=      73.10        73.10        73.100
     RUNOFF COEFFICIENT   =        .97          .63          .818

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
          CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      33.63        26.78
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       8.99 (ii)   21.86 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .12          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .84          .06          .903 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33         5.250
     RUNOFF VOLUME    (mm)=      71.10        46.03        68.593
     TOTAL RAINFALL   (mm)=      73.10        73.10        73.100
     RUNOFF COEFFICIENT   =        .97          .63          .938

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0009----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.800  .9900E+01
                          1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00      .903     5.250     68.593
     OUTFLOW<09: (000656)      10.00      .902     5.250     68.593

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.927
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5043E-02
```



```
--------------------------------------------------------------------------------
010:0010----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------                (ha)     (cms)   (hrs)   (mm)   (cms)
                  ID1 03:000602     3.36      .311    5.25  70.60    .000
                 +ID2 05:000603     3.22      .261    5.25  59.82    .000
                 +ID3 06:000621    30.25     2.800    5.25  70.60    .000
                 +ID4 09:000656    10.00      .902    5.25  68.59    .000
                  ================================================
                  SUM 08:000611    46.83     4.274    5.25  69.43    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0011----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     4.274     5.250     69.429
     OUTFLOW<03: (000623)      46.83      .435     7.583     69.280

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   10.173
                  TIME SHIFT OF PEAK FLOW         (min)=   140.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2613E+01

--------------------------------------------------------------------------------
010:0012----------------------------------------------------------------------
*
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010:0002----------------------------------------------------------------------
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010:0002----------------------------------------------------------------------
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010:0002----------------------------------------------------------------------
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010:0002----------------------------------------------------------------------
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010:0002----------------------------------------------------------------------
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--------------------------------------------------------------------------------
010:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
010:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
010:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
010:0002--------------------------------------------------------------------------
  ** END OF RUN :  10

********************************************************************************




--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 011
    NSTORM=   1
           #  1=50y12.STM
--------------------------------------------------------------------------------
011:0002--------------------------------------------------------------------------
*#****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                               *
*#                                                               *
*# HUMBER RIVER HYDROLOGY/                                       *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                    *
*#                                                               *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY        *
*#---------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                    *
*#                                                               *
*# MODEL: SWMHYMO 1999                                           *
*#                                                               *
*# MODEL UPDATE: JAN 2021                                        *
*# MODEL UPDATED BY: FP                                          *
*# PROJECT NO: 2109                                              *
*# DATA FILE: 2109Sa.DAT                                         *
*#---------------------------------------------------------------*
*#                                                               *
*# POST DEVELOPMENT MODEL                                        *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY  *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE              *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0) *
*#                                                               *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)       *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA   *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION      *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL     *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s       *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                          *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#****************************************************************
```



```
*
--------------------------------------------------------------------------------
011:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\50y12.
| Ptotal=  80.82 mm|    Comments: 50yr/12hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	3.50	13.740	6.75	5.660	10.00	.810
.50	.810	3.75	13.740	7.00	5.660	10.25	.810
.75	.810	4.00	13.740	7.25	5.660	10.50	.810
1.00	.810	4.25	13.740	7.50	3.230	10.75	.810
1.25	.810	4.50	37.170	7.75	3.230	11.00	.810
1.50	.810	4.75	37.170	8.00	3.230	11.25	.810
1.75	.810	5.00	37.170	8.25	3.230	11.50	.810
2.00	.810	5.25	37.170	8.50	1.620	11.75	.810
2.25	.810	5.50	10.500	8.75	1.620	12.00	.810
2.50	4.850	5.75	10.500	9.00	1.620	12.25	.810
2.75	4.850	6.00	10.500	9.25	1.620		
3.00	4.850	6.25	10.500	9.50	.810		
3.25	4.850	6.50	5.660	9.75	.810		

```
--------------------------------------------------------------------------------
011:0003--------------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                         New rainfall volume =  80.82   (mm)
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	3.50	13.74	6.75	5.66	10.00	.81
.50	.81	3.75	13.74	7.00	5.66	10.25	.81
.75	.81	4.00	13.74	7.25	5.66	10.50	.81
1.00	.81	4.25	13.74	7.50	3.23	10.75	.81
1.25	.81	4.50	37.17	7.75	3.23	11.00	.81
1.50	.81	4.75	37.17	8.00	3.23	11.25	.81
1.75	.81	5.00	37.17	8.25	3.23	11.50	.81
2.00	.81	5.25	37.17	8.50	1.62	11.75	.81
2.25	.81	5.50	10.50	8.75	1.62	12.00	.81
2.50	4.85	5.75	10.50	9.00	1.62	12.25	.81
2.75	4.85	6.00	10.50	9.25	1.62		
3.00	4.85	6.25	10.50	9.50	.81		
3.25	4.85	6.50	5.66	9.75	.81		

```
--------------------------------------------------------------------------------
011:0004--------------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      37.17        30.47
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       9.56 (ii)   21.78 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       3.06          .04          3.100 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33          5.250
     RUNOFF VOLUME    (mm)=      78.82        52.95         78.303
     TOTAL RAINFALL   (mm)=      80.82        80.82         80.820
     RUNOFF COEFFICIENT   =        .98          .66           .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
011:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     3.100     5.250     78.303
     OUTFLOW<06: (000621)      30.25     3.099     5.250     78.302

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.989
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5698E-02

--------------------------------------------------------------------------------
011:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
---------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
```



```
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      37.17        30.47
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       9.56 (ii)   21.78 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .34          .00          .344 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33          5.250
     RUNOFF VOLUME    (mm)=      78.82        52.95         78.303
     TOTAL RAINFALL   (mm)=      80.82        80.82         80.820
     RUNOFF COEFFICIENT   =        .98          .66           .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
011:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
---------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77          1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      37.17        30.73
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       5.04 (ii)   17.22 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .21          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .18          .11          .295 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.25          5.250
     RUNOFF VOLUME    (mm)=      78.82        52.95         67.177
     TOTAL RAINFALL   (mm)=      80.82        80.82         80.820
     RUNOFF COEFFICIENT   =        .98          .66           .831

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
011:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
---------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
---------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      37.17        30.47
                over (min)      10.00        20.00
     Storage Coeff.  (min)=       8.63 (ii)   20.86 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .12          .05
                                                              *TOTALS*
     PEAK FLOW       (cms)=        .93          .07            1.002 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.33            5.250
     RUNOFF VOLUME    (mm)=      78.82        52.95           76.233
     TOTAL RAINFALL   (mm)=      80.82        80.82           80.820
     RUNOFF COEFFICIENT   =        .98          .66             .943

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
011:0009-----------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    1.800  .9900E+01
                           1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.002     5.250     76.233
     OUTFLOW<09: (000656)      10.00     1.001     5.250     76.233

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.932
                   TIME SHIFT OF PEAK FLOW         (min)=      .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5594E-02

-------------------------------------------------------------------------------
011:0010-----------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------              (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 03:000602     3.36      .344    5.25  78.30    .000
                +ID2 05:000603     3.22      .295    5.25  67.18    .000
                +ID3 06:000621    30.25     3.099    5.25  78.30    .000
                +ID4 09:000656    10.00     1.001    5.25  76.23    .000
                 ======================================================
```

```
                 SUM 08:000611    46.83    4.740    5.25  77.10    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
011:0011-----------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .853  .3464E+01
                            .031  .4420E+00   |    1.238  .4489E+01
                            .043  .7550E+00   |    1.783  .5574E+01
                            .052  .1083E+01   |    2.393  .6719E+01
                            .057  .1266E+01   |    3.060  .7924E+01
                            .110  .1594E+01   |    3.781  .9189E+01
                            .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     4.740     5.250     77.095
     OUTFLOW<03: (000623)      46.83      .549     7.450     76.942

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   11.585
                   TIME SHIFT OF PEAK FLOW         (min)=   132.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2845E+01

-------------------------------------------------------------------------------
011:0012-----------------------------------------------------------------------
*
-------------------------------------------------------------------------------
011:0002-----------------------------------------------------------------------
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011:0002-----------------------------------------------------------------------
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011:0002-----------------------------------------------------------------------
  ** END OF RUN :  11
```

```
********************************************************************************
```

```
--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 012
    NSTORM=   1
           #  1=100y12.STM
--------------------------------------------------------------------------------
012:0002----------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
*# MODEL: SWMHYMO 1999                                             *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# MODEL UPDATED BY: FP                                            *
*# PROJECT NO: 2109                                                *
*# DATA FILE: 2109Sa.DAT                                           *
*#-----------------------------------------------------------------*
*#                                                                 *
*# POST DEVELOPMENT MODEL                                          *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA     *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s         *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                            *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------------------------------------------------------------------
012:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\100y12
| Ptotal=  88.54 mm|    Comments: 100yr/12hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.000	3.50	15.050	6.75	6.200	10.00	.890
.50	.890	3.75	15.050	7.00	6.200	10.25	.890
.75	.890	4.00	15.050	7.25	6.200	10.50	.890
1.00	.890	4.25	15.050	7.50	3.540	10.75	.890
1.25	.890	4.50	40.710	7.75	3.540	11.00	.890
1.50	.890	4.75	40.710	8.00	3.540	11.25	.890
1.75	.890	5.00	40.710	8.25	3.540	11.50	.890
2.00	.890	5.25	40.710	8.50	1.770	11.75	.890
2.25	.890	5.50	11.510	8.75	1.770	12.00	.890
2.50	5.310	5.75	11.510	9.00	1.770	12.25	.890
2.75	5.310	6.00	11.510	9.25	1.770		
3.00	5.310	6.25	11.510	9.50	.890		
3.25	5.310	6.50	6.200	9.75	.890		


```
--------------------------------------------------------------------------------
012:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------

                           New rainfall volume =  88.54   (mm)
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.25	.00	3.50	15.05	6.75	6.20	10.00	.89
.50	.89	3.75	15.05	7.00	6.20	10.25	.89
.75	.89	4.00	15.05	7.25	6.20	10.50	.89
1.00	.89	4.25	15.05	7.50	3.54	10.75	.89
1.25	.89	4.50	40.71	7.75	3.54	11.00	.89
1.50	.89	4.75	40.71	8.00	3.54	11.25	.89
1.75	.89	5.00	40.71	8.25	3.54	11.50	.89
2.00	.89	5.25	40.71	8.50	1.77	11.75	.89
2.25	.89	5.50	11.51	8.75	1.77	12.00	.89
2.50	5.31	5.75	11.51	9.00	1.77	12.25	.89
2.75	5.31	6.00	11.51	9.25	1.77		
3.00	5.31	6.25	11.51	9.50	.89		
3.25	5.31	6.50	6.20	9.75	.89		

```
--------------------------------------------------------------------------------
012:0004----------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	29.65	.60
Dep. Storage	(mm)=	2.00	4.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	404.00	40.00
Mannings n	=	.015	.200
Max.eff.Inten.(mm/hr)=		40.71	34.17
over (min)		10.00	20.00
Storage Coeff. (min)=		9.22 (ii)	20.89 (ii)
Unit Hyd. Tpeak (min)=		10.00	20.00

```
     Unit Hyd. peak  (cms)=        .12          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.35          .05          3.398 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.25          5.250
     RUNOFF VOLUME    (mm)=      86.54        59.97         86.009
     TOTAL RAINFALL   (mm)=      88.54        88.54         88.540
     RUNOFF COEFFICIENT   =        .98          .68           .971

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
012:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     3.398     5.250     86.009
     OUTFLOW<06: (000621)      30.25     3.398     5.250     86.009

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.991
                   TIME SHIFT OF PEAK FLOW         (min)=     .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6247E-02

--------------------------------------------------------------------------------
012:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      40.71        34.17
                 over (min)      10.00        20.00
     Storage Coeff.  (min)=       9.22 (ii)   20.89 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .12          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .37          .01           .377 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.25          5.250
```



```
     RUNOFF VOLUME    (mm)=      86.54        59.97         86.009
     TOTAL RAINFALL   (mm)=      88.54        88.54         88.540
     RUNOFF COEFFICIENT   =        .98          .68           .971

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
012:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77         1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      40.71        34.44
                 over (min)       5.00        15.00
     Storage Coeff.  (min)=       4.86 (ii)   16.50 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .22          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .20          .13           .328 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.25          5.250
     RUNOFF VOLUME    (mm)=      86.54        59.97         74.583
     TOTAL RAINFALL   (mm)=      88.54        88.54         88.540
     RUNOFF COEFFICIENT   =        .98          .68           .842
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
012:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00         1.00
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      40.71        34.17
```

```
                over (min)       10.00        20.00
     Storage Coeff.  (min)=       8.33 (ii)   20.00 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .13          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.02          .08          1.101 (iii)
     TIME TO PEAK    (hrs)=       5.25         5.25          5.250
     RUNOFF VOLUME    (mm)=      86.54        59.97         83.883
     TOTAL RAINFALL   (mm)=      88.54        88.54         88.540
     RUNOFF COEFFICIENT   =        .98          .68           .947

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
012:0009------------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    1.800  .9900E+01
                          1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.101     5.250     83.883
     OUTFLOW<09: (000656)      10.00     1.100     5.250     83.883

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.937
                   TIME SHIFT OF PEAK FLOW        (min)=      .00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6147E-02

--------------------------------------------------------------------------------
012:0010------------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------              (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 03:000602     3.36      .377    5.25  86.01    .000
                +ID2 05:000603     3.22      .328    5.25  74.58    .000
                +ID3 06:000621    30.25     3.398    5.25  86.01    .000
                +ID4 09:000656    10.00     1.100    5.25  83.88    .000
                 ===================================================
                 SUM 08:000611    46.83     5.203    5.25  84.77    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
012:0011------------------------------------------------------------------------
*
*# SWMP 3
```

```
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     5.203     5.250     84.769
     OUTFLOW<03: (000623)      46.83      .661     7.400     84.612

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   12.707
                   TIME SHIFT OF PEAK FLOW        (min)=   129.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3073E+01

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012:0012------------------------------------------------------------------------
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012:0002------------------------------------------------------------------------
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012:0002------------------------------------------------------------------------
  ** END OF RUN :  12

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 013
    NSTORM=   1
           #  1=CHIC25MM.STM
--------------------------------------------------------------------------------
013:0002--------------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
*# MODEL: SWMHYMO 1999                                             *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# MODEL UPDATED BY: FP                                            *
*# PROJECT NO: 2109                                                *
*# DATA FILE: 2109Sa.DAT                                           *
*#-----------------------------------------------------------------*
*#                                                                 *
*# POST DEVELOPMENT MODEL                                          *
*# 2yr~100yr AES DESIGN STORM EVENTS-6HR&12HR DURATION, 25mm EVENT *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE                *
*# THE BOLTON (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)  *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# MAY 2016 REVISION 2: ON-SITE CONTROLS REVISED TO 180 L/S/HA     *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# MAY 2018 - INCREASE DISCHARGE FROM JAGER SITE TO 134l/s         *
*#          - POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                            *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------------------------------------------------------------------
013:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\CHIC25
| Ptotal=  25.00 mm|    Comments: *BLOOR ST STAT DATA 10 MIN DISCRITIZATIO
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.624	1.08	12.284	2.08	3.786	3.08	1.940
.17	1.624	1.17	12.284	2.17	3.786	3.17	1.940
.25	1.853	1.25	58.772	2.25	3.233	3.25	1.803
.33	1.853	1.33	58.772	2.33	3.233	3.33	1.803
.42	2.170	1.42	16.185	2.42	2.838	3.42	1.688
.50	2.170	1.50	16.185	2.50	2.838	3.50	1.688

.58	2.651	1.58	8.549	2.58	2.529	3.58	1.588
.67	2.651	1.67	8.549	2.67	2.529	3.67	1.588
.75	3.470	1.75	5.927	2.75	2.292	3.75	1.501
.83	3.470	1.83	5.927	2.83	2.292	3.83	1.501
.92	5.201	1.92	4.598	2.92	2.098	3.92	1.422
1.00	5.201	2.00	4.598	3.00	2.098	4.00	1.422

```
--------------------------------------------------------------------------------
013:0003--------------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                           New rainfall volume =  25.00   (mm)
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	1.62	1.08	12.28	2.08	3.79	3.08	1.94
.17	1.62	1.17	12.28	2.17	3.79	3.17	1.94
.25	1.85	1.25	58.77	2.25	3.23	3.25	1.80
.33	1.85	1.33	58.77	2.33	3.23	3.33	1.80
.42	2.17	1.42	16.19	2.42	2.84	3.42	1.69
.50	2.17	1.50	16.19	2.50	2.84	3.50	1.69
.58	2.65	1.58	8.55	2.58	2.53	3.58	1.59
.67	2.65	1.67	8.55	2.67	2.53	3.67	1.59
.75	3.47	1.75	5.93	2.75	2.29	3.75	1.50
.83	3.47	1.83	5.93	2.83	2.29	3.83	1.50
.92	5.20	1.92	4.60	2.92	2.10	3.92	1.42
1.00	5.20	2.00	4.60	3.00	2.10	4.00	1.42

```
--------------------------------------------------------------------------------
013:0004--------------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 03:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	29.65	.60	
Dep. Storage	(mm)=	2.00	4.00	
Average Slope	(%)=	1.00	1.00	
Length	(m)=	404.00	40.00	
Mannings n	=	.015	.200	
Max.eff.Inten.(mm/hr)	=	58.77	8.81	
over (min)		10.00	30.00	
Storage Coeff.	(min)=	7.96 (ii)	28.04 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	30.00	
Unit Hyd. peak	(cms)=	.13	.04	
				TOTALS
PEAK FLOW	(cms)=	3.25	.01	3.249 (iii)
TIME TO PEAK	(hrs)=	1.42	1.83	1.417
RUNOFF VOLUME	(mm)=	23.00	7.93	22.699
TOTAL RAINFALL	(mm)=	25.00	25.00	25.000
RUNOFF COEFFICIENT	=	.92	.32	.908

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
013:0005----------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>03:(000601)   |
| OUT<06:(000621)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    5.450  .9900E+01
                           5.440  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (000601)      30.25     3.249     1.417     22.699
     OUTFLOW<06: (000621)      30.25     3.239     1.417     22.699

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.716
                  TIME SHIFT OF PEAK FLOW         (min)=      .00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5982E-02

--------------------------------------------------------------------------------
013:0006----------------------------------------------------------------------
* # ESA-6-FUT. - ONTARI ROADS
---------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n           =       .015         .200

     Max.eff.Inten.(mm/hr)=      58.77         8.81
               over (min)        10.00        30.00
     Storage Coeff.  (min)=       7.96 (ii)   28.04 (ii)
     Unit Hyd. Tpeak (min)=      10.00        30.00
     Unit Hyd. peak  (cms)=        .13          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .36          .00          .361 (iii)
     TIME TO PEAK    (hrs)=       1.42         1.83         1.417
     RUNOFF VOLUME    (mm)=      23.00         7.93        22.699
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
     RUNOFF COEFFICIENT   =        .92          .32          .908

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```



```
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
013:0007----------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
---------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000603 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77          1.45
     Dep. Storage     (mm)=       2.00          4.00
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     139.00         40.00
     Mannings n           =       .015          .200

     Max.eff.Inten.(mm/hr)=      58.77          9.72
               over (min)        5.00         25.00
     Storage Coeff.  (min)=       4.20 (ii)   23.51 (ii)
     Unit Hyd. Tpeak (min)=       5.00         25.00
     Unit Hyd. peak  (cms)=        .24          .05
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .27          .02          .272 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.333
     RUNOFF VOLUME    (mm)=      23.00         7.93        16.217
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.000
     RUNOFF COEFFICIENT   =        .92          .32          .649
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
013:0008----------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
---------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 08:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00          1.00
     Dep. Storage     (mm)=       2.00          4.00
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     341.00         40.00
     Mannings n           =       .015          .200

     Max.eff.Inten.(mm/hr)=      58.77          9.72
               over (min)        5.00         25.00
     Storage Coeff.  (min)=       7.19 (ii)   26.50 (ii)
     Unit Hyd. Tpeak (min)=       5.00         25.00
     Unit Hyd. peak  (cms)=        .17          .04
                                                    *TOTALS*
     PEAK FLOW       (cms)=       1.17          .01         1.170 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75         1.333
     RUNOFF VOLUME    (mm)=      23.00         7.93        21.493
```

```
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.000
     RUNOFF COEFFICIENT   =        .92          .32           .860

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  88.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
013:0009------------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000655)   |
| OUT<09:(000656)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    1.800  .9900E+01
                           1.790  .1000E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000655)      10.00     1.170     1.333     21.493
     OUTFLOW<09: (000656)      10.00     1.126     1.350     21.493

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   96.263
                   TIME SHIFT OF PEAK FLOW        (min)=     1.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6388E-02

--------------------------------------------------------------------------------
013:0010------------------------------------------------------------------------
*
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------              (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 03:000602     3.36      .361    1.42  22.70    .000
                +ID2 05:000603     3.22      .272    1.33  16.22    .000
                +ID3 06:000621    30.25     3.239    1.42  22.70    .000
                +ID4 09:000656    10.00     1.126    1.35  21.49    .000
                 ==================================================
                 SUM 08:000611    46.83     4.859    1.35  22.00    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
013:0011------------------------------------------------------------------------
*
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
```

```
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .853  .3464E+01
                            .031  .4420E+00   |    1.238  .4489E+01
                            .043  .7550E+00   |    1.783  .5574E+01
                            .052  .1083E+01   |    2.393  .6719E+01
                            .057  .1266E+01   |    3.060  .7924E+01
                            .110  .1594E+01   |    3.781  .9189E+01
                            .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     4.859     1.350     21.995
     OUTFLOW<03: (000623)      46.83      .049     4.233     21.946

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.012
                   TIME SHIFT OF PEAK FLOW        (min)=   173.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9796E+00

--------------------------------------------------------------------------------
013:0012------------------------------------------------------------------------
*
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013:0002------------------------------------------------------------------------
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013:0002------------------------------------------------------------------------
  ** END OF RUN :  13

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 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S   W W   M   M  H   H    Y    M   M  O   O       9999    9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9       9 =========
                                                      9   9  9   9 # 3813174
      StormWater Management HYdrologic Model           999    999  =========

 ********************************************************************************
 ************************** SWMHYMO-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: swmhymo@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: 2021-02-03     TIME: 16:38:35     RUN COUNTER: 000213       *
 ********************************************************************************
 * Input   filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2109Ra.DAT           *
 * Output  filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2109Ra.out           *
 * Summary filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\2109Ra.sum           *
 * User comments:                                                           *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
001:0001----------------------------------------------------------------------
*#*****************************************************************
*# HYDROLOGIC MODEL (HUMBER RIVER)                                 *
*#                                                                 *
*# HUMBER RIVER HYDROLOGY/                                         *
*# HYDRAULICS AND STORMWATER MANAGEMENT STUDY                      *
*#                                                                 *
*# METROPOLITAN TORONTO AND REGION CONSERVATION AUTHORITY          *
*#-----------------------------------------------------------------*
*# MODEL SETUP BY: A.M. CANDARAS & ASSOCIATES                      *
*#                                                                 *
```



```
*# MODEL: SWMHYMO 1999                                             *
*#                                                                 *
*# MODEL UPDATE: JAN 2021                                          *
*# PROJECT NO: 2109                                                *
*# MODEL UPDATED BY: FP                                            *
*# DATA FILE: 2109Ra.DAT                                           *
*#-----------------------------------------------------------------*
*# REGIONAL STORM EVENTS-12HR DURATION                             *
*# WITH Controls (AMCAI)                                           *
*# BLACKWOOD AND BOLTCO LANDS WEST OF COLERAINE, SOUTH OF HEALEY   *
*# 2002 MODEL UPDATED TO REFLECT DEVELOPMENT OF THE BOLTON         *
*# (SOUTH ALBION) EMPLOYMENT LANDS (SUBWATERSHED 43.0)             *
*#                                                                 *
*# Jan 2016 - Merge (ESA-7 Fut. + ESA-8 Fut.) SWMP's (4+5)         *
*# Direct Regional from east of George Bolton to Pond 4+5          *
*# SEPT 2016 - COLERAINE DRAINAGE MINOR TO CHANNEL, MAJOR POND 4+5 *
*# MAY 2017 - MTO LANDS REMOVED; SUBMISSION TO TOWN, REGION        *
*# JAN 2018 - COLERAINE EAST DRAINAGE ALL DIVERED TO CHANNEL       *
*# JUNE 2018- POND#3 REMOVE EXTERNAL DRAINAGE AREAS, SEPARATE POND *
*# OCT 2018 - REV. POND#4+5 SIDE SLOPES                            *
*# JAN 2021 - REV POND#3 TO ADD 10.0ha HEALEY SITE - ONE PROPERTIES*
*#*****************************************************************
*
--------------------
| START            |  Project  dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
--------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=HAZEL.STM
--------------------------------------------------------------------------------
001:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: C:\PROGRA~1\SWMHYMO\PROJECTS\2109\HAZEL.
| Ptotal= 212.00 mm|    Comments: Hurricane Hazel for the last 12 hrs of t
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   6.000 |   4.00  13.000 |   7.00  23.000 |  10.00  53.000
              2.00   4.000 |   5.00  17.000 |   8.00  13.000 |  11.00  38.000
              3.00   6.000 |   6.00  13.000 |   9.00  13.000 |  12.00  13.000

--------------------------------------------------------------------------------
001:0003----------------------------------------------------------------------
*
----------------------
| MODIFY STORM       |    MODIFYING PARAMETERS:
| ICASEms= 1         |    Multiplication Factor,   RFACT=  1.00
| NSHIFT =  0 x SDT  |    Corresponding time shift (min)=    .00
----------------------
                           New rainfall volume = 212.00   (mm)

                                  ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                  hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                 1.00   6.00 |   4.00  13.00 |   7.00  23.00 |  10.00  53.00
                 2.00   4.00 |   5.00  17.00 |   8.00  13.00 |  11.00  38.00
                 3.00   6.00 |   6.00  13.00 |   9.00  13.00 |  12.00  13.00
```

```
--------------------------------------------------------------------------------
001:0004--------------------------------------------------------------------------
* # ESA-6-FUT.
* TOTAL ONTARI DEVELOPMENT AREA = 30.25 ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=   30.25
| 06:000601 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      29.65          .60
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      53.00        52.64
                 over (min)      10.00        20.00
     Storage Coeff.  (min)=       8.29 (ii)   18.12 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .13          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=       4.36          .08         4.445 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00        10.000
     RUNOFF VOLUME    (mm)=     210.00       195.44       209.709
     TOTAL RAINFALL   (mm)=     212.00       212.00       212.000
     RUNOFF COEFFICIENT   =        .99          .92          .989

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  95.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0005--------------------------------------------------------------------------
*
*# ESA-6-FUT. - ONTARI AREA CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 30.25ha = 5.45 m3/s
* Max ponding volume based on 100mm over total site area
*ROUTE RESERVOIR     ID=6  NHYD=621 IDIN=3  DT=1 min
*                    DISCH(cms)      STORAGE(ha m)
*                        0               0
*                        5.44            0.010
*                        5.45            9.90 END=-1
* # ESA-6-FUT. - ONTARI ROADS
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.36
| 03:000602 DT= 5.00 |   Total Imp(%)=   98.00   Dir. Conn.(%)=   98.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.29          .07
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     404.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      53.00        52.64
                 over (min)      10.00        20.00
     Storage Coeff.  (min)=       8.29 (ii)   18.12 (ii)
```



```
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .13          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .48          .01          .494 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00        10.000
     RUNOFF VOLUME    (mm)=     210.00       195.44       209.709
     TOTAL RAINFALL   (mm)=     212.00       212.00       212.000
     RUNOFF COEFFICIENT   =        .99          .92          .989

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  95.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006--------------------------------------------------------------------------
*# ESA-6-FUT. - SWMP PARAMETERS
* SWMP# 3 AREA = 3.22ha
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 05:000604 DT= 5.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.77          1.45
     Dep. Storage     (mm)=       2.00         4.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     139.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      53.00        52.65
                 over (min)       5.00        15.00
     Storage Coeff.  (min)=       4.37 (ii)   14.20 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .23          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .26          .21          .469 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00        10.000
     RUNOFF VOLUME    (mm)=     210.00       195.44       203.447
     TOTAL RAINFALL   (mm)=     212.00       212.00       212.000
     RUNOFF COEFFICIENT   =        .99          .92          .960
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  95.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0007--------------------------------------------------------------------------
*# ESA-5b Future Employment Lands Development - Healey Rd One Properties
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.00
| 09:000655 DT= 5.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.00          1.00
     Dep. Storage     (mm)=       2.00         4.00
```

```
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     341.00        40.00
     Mannings n            =       .015         .200

     Max.eff.Inten.(mm/hr)=      53.00        52.65
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       7.49 (ii)   17.32 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .17          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.32          .14         1.466 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00        10.000
     RUNOFF VOLUME    (mm)=     210.00       195.44       208.544
     TOTAL RAINFALL   (mm)=     212.00       212.00       212.000
     RUNOFF COEFFICIENT   =        .99          .92          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  95.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008---------------------------------------------------------------------
*# ESA-5b-FUT. - HEALEY RD ONE PROPERTIES SITE - CONTROLLED TO 180 L/S/ha
* The max. allowable discharge is 180l/s/ha x 10.0ha = 1.80 m3/s
* Max ponding volume based on 100mm over total site area
*ROUTE RESERVOIR     ID=9  NHYD=656 IDIN=8  DT=1 min
*                    DISCH(cms)      STORAGE(ha m)
*                        0               0
*                        1.79            0.010
*                        1.80            9.900 END=-1
*# Add ESA-6-FUT. + ESA-FUT EXT. + SWMP
--------------------
| ADD HYD (000611) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.     DWF
--------------------              (ha)     (cms)   (hrs)   (mm)   (cms)
                 ID1 05:000604     3.22      .469   10.00 203.45    .000
                +ID2 06:000601    30.25    4.445   10.00 209.71    .000
                +ID3 03:000602     3.36      .494   10.00 209.71    .000
                +ID4 09:000655    10.00    1.466   10.00 208.54    .000
                 ================================================
                 SUM 08:000611    46.83    6.874   10.00 209.03    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0009---------------------------------------------------------------------
*# SWMP 3
* Added - SWM control pond for the ESA-6 tributary area.
* Forebay Bottom - 233.25m, Pond Bottom - 233.75m
* Orifice size/invert - 0.175m/234.75m
* Weir size/invert - 0.30m/235.55m
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>08:(000611)   |
| OUT<03:(000623)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .853  .3464E+01
                           .031  .4420E+00   |    1.238  .4489E+01
```



```
                           .043  .7550E+00   |    1.783  .5574E+01
                           .052  .1083E+01   |    2.393  .6719E+01
                           .057  .1266E+01   |    3.060  .7924E+01
                           .110  .1594E+01   |    3.781  .9189E+01
                           .379  .2499E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >08: (000611)      46.83     6.874    10.000    209.029
     OUTFLOW<03: (000623)      46.83     2.418    11.267    208.825

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   35.180
                  TIME SHIFT OF PEAK FLOW         (min)=    76.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6764E+01

--------------------------------------------------------------------------------
001:0010---------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0006 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2021-02-03     at 16:38:35
================================================================================
```

APPENDIX C
EXISTING SWM FACILITY CALCULATIONS

Table 7 – Existing SWMP #3 Performance Summary – With On-site Controls

Storm Event	Allowable (m^3/s)	Inflow (m^3/s)	Post (m^3/s)	Storage Volume (m^3)	HWL (m)
Chic25mm	0.044	3.746	0.043	7,715	235.26
2yr-6h	0.255	3.107	0.054	11,380	235.48
5yr-6h	0.389	4.214	0.098	15,210	235.71
10yr-6h	0.479	4.953	0.160	17,610	235.84
25yr-6h	0.603	5.885	0.246	20,520	236.01
50yr-6h	0.702	6.545	0.310	22,680	236.12
100yr-6h	0.794	6.671	0.374	24,830	236.25
2yr-12h	0.255	1.902	0.060	12,850	235.57
5yr-12h	0.389	2.488	0.126	16,480	235.78
10yr-12h	0.479	2.880	0.191	18,680	235.90
25yr-12h	0.603	3.372	0.271	21,360	236.05
50yr-12h	0.702	3.739	0.329	23,320	236.16
100yr-12h	0.794	4.103	0.395	25,320	236.27
Regional*	2.026	5.408	1.775	55,570	237.74

* Regional Storm modelled without on-site controls

1. Model includes on-site controls for Ontari Site area, 180 l/sec/ha. Refer to file 1409Se.out.

Existing SWMP #3 Calculations

Existing Drawdown Time

The master drainage study has specified that the average erosion control release rate should not exceed 1.2l/s/ha. Therefore, the pond orifice has been sized to limit the 25mm design quality storm to this rate, which yields a required size of 175mm.

The allowable release rate for the erosion volume is determined as follows:

36.83ha x 1.2l/s/ha = 70l/s = 0.044m^3/s

As per the SWMHYMO output simulation provided in Appendix B, the release rate is about the same at 0.043m^3/s.

The existing drawdown time for this facility was determined using the falling head equation as per the MOE manual 2003 which is represented below.

$$t = \frac{2Ap}{(CA_o)\sqrt{2g}}\left(\sqrt{h_1} - \sqrt{h_2}\right)$$

t	=	draw down time in seconds
A_p	=	surface area of the pond (m^2)
C	=	discharge coefficient (0.63)
A_o	=	cross-sectional area of the orifice
g	=	gravitational acceleration constant (9.81m/s^2)
h_1	=	starting water elevation above the orifice
h_2	=	ending water elevation above the orifice

The calculation has been completed based on a 175mm orifice at an invert of 234.75m. This orifice will be a vertical orifice located within the outlet control structure as shown on Plan C2. Since this orifice is greater than 100mm, protection of the orifice is not required in accordance to the M.O.E. SWMP manual. The proposed orifice will provide a 92 hr 20 min drain time for erosion control volume as calculated below.

$$t = \frac{2 \times 15{,}584}{(0.63 \times 0.0240)\sqrt{2 \times 9.81}}\left(\sqrt{0.51}\right)$$

$$t = 332{,}423 \text{ sec}$$

$$t = 92.3 \text{ hr}$$

t = draw down time in seconds
A_p = 15,584m^2 (average area at elevations 234.75m and 235.55m)
C = discharge coefficient (0.63)
A_o = (πx(0.175 m^2) ÷ 4 = 0.0240m^2
g = gravitational acceleration constant (9.81m/s^2)
h_1 = 234.75m
h_2 = 235.55m

Existing Emergency Overflow

The emergency overflow for this facility has been sized to convey the 100-year 6hour post-development inflow, which yields the largest flow rate of the storms, of 10.60m^3/s, refer to SWMHYMO Output. The emergency overflow will operate between the 238.85m elevation and the 239.15m elevation which is the top of the facility. The emergency overflow will be a weir configuration as calculated below:

$Q = 1.705 \times L \times h^{3/2}$

where:

Q = 7.33 m^3/s
h = 239.15m – 238.85m = 0.30m

therefore:

$$L = \frac{Q}{1.705 \times h^{3/2}} = \frac{7.33}{1.705 \times (0.30)^{3/2}}$$

L = 26.2m

set:

L = 45.0m

A 45.0m emergency overflow at elevation 238.85 will be constructed to direct the uncontrolled 100-year 6hour post-development inflow in a safe manner if the outlet control structure becomes inoperable. The resulting depth of flow based on a 45.0m emergency overflow weir is 0.27m, as calculated below:

$Q = 1.705 \times L \times h^{2/3}$
$H = (Q / 1.705 \times L)^{2/3}$
$= (7.33 / (1.705 \times 45.0))^{2/3}$
$= 0.21$ m

Erosion control for the emergency overflow will be provided by the Terrafix Terraweb liner, which may accommodate velocities up to 6.0m/s. Based on the peak flow, the maximum velocity is 0.77m/s, as calculated below:

Q = V x A
V = 7.33m^3/s / (45.0m x 0.21m)
= 0.77m/s

Existing Sediment Forebay Sizing

An additional requirement for this stormwater quality facility is a sediment forebay. The sediment forebay is required to provide a localized area for the majority of the sediments within the stormwater facility to settle out. This sediment forebay makes maintenance of the stormwater quality facility easier and minimizes total wetland disruption. As per the MOE Stormwater Management Planning and Design Manual (March 2003), there are two equations for the design of a sediment forebay as listed below:

Equation 4.5: Forebay Settling Length

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

where: Dist = sediment forebay length (m)
Q_p = peak flow rate from the pond during design quality storm (0.057m^3/s @ 235.55)
V_s = settling velocity (0.0003m/s)
r = length-to-width ratio of forebay (2:1 min)

$$Dist = \sqrt{\frac{2(0.057)}{0.0003}}$$
$$= 19.5m$$

Note: Q = 0.043 m^3/s: (Peak discharge of the 25mm 4-hour Chicago Storm as a result of SWMHYMO output from the 175mm orifice)

Equation 4.6: Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

where: Dist = sediment forebay length (m)
Q = inlet flow rate (4.95m^3/s, based on the 10year-6hour storm event with on-site controls)
V_f = desired velocity in the forebay (0.5m/s)
d = depth of permanent pool in the forebay (1.5m)

$$Dist = \frac{8\times4.95}{1.5\times0.5}$$
$$= 52.8m$$

Equation 4.7: Minimum Forebay Deep Zone Bottom Width

$$Width = \frac{Dist}{8}$$
$$= \frac{52.8}{8}$$
$$= 6.6\text{m}$$

The sediment forebay has a length of 87.5m and a minimum width of 11.3m. Therefore, the sediment forebay will accommodate the development and will promote localized settling of particulate matter.

Existing Sediment Forebay By-Pass Pipe

Maintenance of the sediment forebay will be completed in the dry, with flows will by-pass around the SWM Facility to the adjacent watercourse. The by-pass pipe has been sized to convey the 2year 6hour storm inflow to the pond, with diversion occurring at Diversion MH 1S, located immediately upstream of the inlet head wall. The uncontrolled inflow rate for the 2year storm is 4.84m^3/s, conveyed to the watercourse by a a1200mmx1800mm box pipe at 0.35%, with a capacity of 4.97m^3/s. The outlet then connects to the existing watercourse by a 34m long, 11.4m wide channel at a slope of 0.25%, with a capacity of 5.74m^3/s. Refer to Plan C2 and S6 for details.

APPENDIX D
UPDATED
SWM FACILITY CALCULATIONS

SWMP #3 Calculations Including Additional Drainage Area

Updated Drawdown Time

The master drainage study has specified that the average erosion control release rate should not exceed 1.2l/s/ha. Therefore, the pond orifice has been sized to limit the 25mm design quality storm to this rate, which yields a required size of 175mm.

The allowable release rate for the erosion volume is determined as follows:

46.83ha x 1.2l/s/ha = 0.056m^3/s

As per the SWMHYMO output simulation provided in Appendix B, the peak release rate is about the same at 0.049m^3/s.

The drawdown time for this facility was determined using the falling head equation as per the MOE manual 2003 which is represented below.

$$t = \frac{2Ap}{(CA_o)\sqrt{2g}}\left(\sqrt{h_1} - \sqrt{h_2}\right)$$

t	=	draw down time in seconds
A_p	=	surface area of the pond (m^2)
C	=	discharge coefficient (0.63)
A_o	=	cross-sectional area of the orifice
g	=	gravitational acceleration constant (9.81m/s^2)
h_1	=	starting water elevation above the orifice
h_2	=	ending water elevation above the orifice

The calculation has been completed based on a 175mm orifice at an invert of 234.75m. This orifice will be a vertical orifice located within the outlet control structure as shown on Plan C1. Since this orifice is greater than 100mm, protection of the orifice is not required in accordance to the M.O.E. SWMP manual. The proposed orifice will provide a 103 hr 28 min drain time for erosion control volume as calculated below.

$$t = \frac{2 \times 15{,}584}{(0.63 \times 0.0240)\sqrt{2 \times 9.81}}\left(\sqrt{0.64}\right)$$

$$t = 372{,}529 \text{ sec}$$

$$t = 103.5 \text{ hr}$$

t = draw down time in seconds
A_p = 15,584m^2 (average area at elevations 234.75m and 235.55m)
C = discharge coefficient (0.63)
A_o = (πx(0.175 m^2) ÷ 4 = 0.0240m^2
g = gravitational acceleration constant (9.81m/s^2)
h_1 = 234.75m
h_2 = 235.39m

Updated Emergency Overflow

The emergency overflow for this facility has been sized to convey the 100-year 6hour post-development inflow, which yields the largest flow rate of the storms, of 9.29 m^3/s, refer to SWMHYMO Output. The emergency overflow will operate between the 238.85m elevation and the 239.15m elevation which is the top of the facility. The emergency overflow will be a weir configuration as calculated below:

$$Q = 1.705 \times L \times h^{3/2}$$

where:

Q = 9.29 m^3/s
h = 239.15m – 238.85m = 0.30m

therefore:

$$L = \frac{Q}{1.705 \times h^{3/2}} = \frac{9.29}{1.705 \times (0.30)^{3/2}}$$

L = 33.16m

set:

L = 45.0m

A 45.0m emergency overflow at elevation 238.85 was constructed to direct the uncontrolled 100-year 6hour post-development inflow in a safe manner if the outlet control structure becomes inoperable. The resulting depth of flow based on a 45.0m emergency overflow weir is 0.24m, as calculated below:

$$Q = 1.705 \times L \times h^{3/2}$$
$$H = (Q / 1.705 \times L)^{2/3}$$
$$= (9.29 / (1.705 \times 45.0))^{2/3}$$
$$= 0.24 \text{ m}$$

Erosion control for the emergency overflow will be provided by the Terrafix Terraweb liner, which may accommodate velocities up to 6.0m/s. Based on the peak flow, the maximum velocity is 0.86m/s, as calculated below:

Q = V x A
V = 9.29m³/s / (45.0m x 0.24m)
= 0.86m/s

Updated Sediment Forebay Sizing

An additional requirement for this stormwater quality facility is a sediment forebay. The sediment forebay is required to provide a localized area for the majority of the sediments within the stormwater facility to settle out. This sediment forebay makes maintenance of the stormwater quality facility easier and minimizes total wetland disruption. As per the MOE Stormwater Management Planning and Design Manual (March 2003), there are two equations for the design of a sediment forebay as listed below:

Equation 4.5: Forebay Settling Length

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

where: Dist = sediment forebay length (m)
Q_p = peak flow rate from the pond during design quality storm (0.057m³/s @ 235.55)
V_s = settling velocity (0.0003m/s)
r = length-to-width ratio of forebay (2:1 min)

$$Dist = \sqrt{\frac{2(0.057)}{0.0003}}$$
$$= 19.5m$$

Note: Q = 0.049 m³/s: (Peak discharge of the 25mm 4-hour Chicago Storm as a result of SWMHYMO output from the 175mm orifice)

Equation 4.6: Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

where: Dist = sediment forebay length (m)
Q = inlet flow rate (6.26m³/s, based on the 10year-6hour storm event with on-site controls)
V_f = desired velocity in the forebay (0.5m/s)
d = depth of permanent pool in the forebay (1.5m)

$$Dist = \frac{8\times6.26}{1.5\times0.5}$$
$$= 66.8m$$

Equation 4.7: Minimum Forebay Deep Zone Bottom Width

$$Width = \frac{Dist}{8}$$
$$= \frac{66.8}{8}$$
$$= 8.35\text{m}$$

The existing sediment forebay has a length of 87.5m and a minimum width of 11.3m. Therefore, the existing sediment forebay will accommodate the additional development area and will promote localized settling of particulate matter.

Sediment Forebay By-Pass Pipe

Maintenance of the sediment forebay will be completed in the dry, with flows will by-pass around the SWM Facility to the adjacent watercourse. The existing by-pass pipe has been sized to convey the 2year 6hour storm inflow to the pond, with diversion occurring at Diversion MH 1S, located immediately upstream of the inlet head wall. The uncontrolled inflow rate for the 2year storm is 4.84m^3/s, conveyed to the watercourse by a a1200mmx1800mm box pipe at 0.35%, with a capacity of 4.97m^3/s. The outlet then connects to the existing watercourse by a 34m long, 11.4m wide channel at a slope of 0.25%, with a capacity of 5.74m^3/s.

The additional 10.0ha site area will be required to provide a separate by-pass pipe, discharging directly into the water course at the Healey Road property limit into the Clarkway tributary. The by-pass is to be equipped with a gate or stop log configuration that will divert flows to the watercourse and preventing flows from draining to Pond #3, only during maintenance activities.

APPENDIX E
EXISTING SWM FACILITY
MOECC ECA

ENVIRONMENTAL COMPLIANCE APPROVAL

NUMBER 4742-BA9U2Y
Issue Date: March 19, 2019

ONTARI Holdings Ltd.
110 Yonge St, No. 1500
Toronto, Ontario
M5C 1T4

Site Location: 12724 Coleraine Drive
Lot 4 and 5, Concession 5
Caledon Town, Regional Municipality of Peel
L7E 3B1

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

establishment of wastewater infrastructure Works to service the 36.83 ha of Ontari land development with three industrial warehouse buildings, located on the west side of Coleraine Dr. between Healy Road and Mayfield Road in the Town of Caledon, for the collection, treatment and disposal of stormwater run-off from contributing areas within the site (36.83 ha) as identified in the Stormwater Management Facility #3 Detailed Design Report, to provide Enhanced Level water quality control, erosion protection, and quantity control for all storm events up to Regional Storm event, discharging into Clarkway Tributary and ultimately to Humber River, consisting of the following:

Stormwater Management Facility #3

- One (1) wet pond with a sediment forebay for approximately 36.83 hectares of drainage area, having a permanent pool volume of 13,526 cubic metres (at a permanent depth of 1.5 m) and an extended detention storage volume of 12,514 cubic metres, and a total storage volume of approximately 102,835 cubic metres, with a total depth of approximately 5.9 m (including 300 mm freeboard), discharging via a control structure complete with a control manhole, a 175 mm diameter orifice at elevation of 234.75 m, a 300 mm weir at elevation of 235.55 m, a 450 mm diameter reverse slope pipe, a 1,350 mm diameter outlet pipe, and a 45 m wide emergency overflow at elevation of 238.85 m, to Clarkway Tributary and ultimately to Humber River;

including erosion/sedimentation control measures during construction and all other pipes, controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted supporting documents listed in Schedule "A" forming part of this Approval.

For the purpose of this environmental compliance approval, the following definitions apply:

1. "Approval" means this entire document and any schedules attached to it, and the application;

2. "Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;

3. "District Manager" means the District Manager of the appropriate local District Office of the Ministry, where the Works are geographically located;

4. "EPA" means the *Environmental Protection Act,* R.S.O. 1990, c.E.19, as amended;

5. "Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;

6. "Owner" means ONTARI Holdings Ltd., and includes its successors and assignees;

7. "OWRA" means the *Ontario Water Resources Act, R.S.O. 1990, c. O.40* , as amended;

8. "Wet Event" means a rainfall event with a minimum of 15 millimetres of rain in a 24 hour period;

9. "Works" means the sewage Works described in the Owner's application, and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

    1. The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

    2. Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.

    3. Where there is a conflict between a provision of any document in the schedule referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.

    4. Where there is a conflict between the documents listed in Schedule "A" and the application, the

application shall take precedence unless it is clear that the purpose of the document was to amend the application.

5. The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

6. The issuance of, and compliance with the Conditions of this Approval does not:

   a. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority necessary to construct or operate the sewage Works; or

   b. limit in any way the authority of the Ministry to require certain steps be taken to require the Owner to furnish any further information related to compliance with this Approval.

2. EXPIRY OF APPROVAL

1. This Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.

2. In the event that completion and commissioning of any portion of the Works is anticipated to be delayed beyond the specified expiry period, the Owner shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the Works are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.

3. CHANGE OF OWNER

1. The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:

   a. change of Owner;

   b. change of address of the Owner;

   c. change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Business Names Act,* R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; or

   d. change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the *Corporations Information Act,*

R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

2. In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.

3. The Owner shall ensure that all communications made pursuant to this condition refer to the number at the top of this Approval.

4. OPERATION AND MAINTENANCE

1. If applicable, any proposed storm sewers or other stormwater conveyance in this Approval can be constructed but not operated until the proposed stormwater management facilities in this Approval or any other Approval that are designed to service the storm sewers or other stormwater conveyance are in operation.

2. The Owner shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the Works do not constitute a safety or health hazard to the general public.

3. The Owner shall inspect and ensure that the design minimum liquid retention volume is maintained in the Works at all times, except when maintenance is required.

4. The Owner shall undertake an inspection of the condition of the Works, at least once a year, and undertake any necessary cleaning and maintenance to ensure that sediment, debris and excessive decaying vegetation are removed from the Works to prevent the excessive build-up of sediment, oil/grit, debris and/or decaying vegetation, to avoid reduction of the capacity and/or permeability of the Works, as applicable. The Owner shall also regularly inspect and clean out the inlet to and outlet from the Works to ensure that these are not obstructed.

5. The Owner shall construct, operate and maintain the Works with the objective that the effluent from the Works is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen, foam or discoloration on the receiving waters.

6. The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the Owner's administrative office for inspection by the Ministry. The logbook shall include the following:

    a. the name of the Works; and

    b. the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed and method of clean-out of the Works.

7. The Owner shall prepare an operations manual prior to the commencement of operation of the

Works that includes, but is not necessarily limited to, the following information:

a. operating and maintenance procedures for routine operation of the Works;

b. inspection programs, including frequency of inspection, for the Works and the methods or tests employed to detect when maintenance is necessary;

c. repair and maintenance programs, including the frequency of repair and maintenance for the Works;

d. contingency plans and procedures for dealing with potential spills and any other abnormal situations and for notifying the District Manager; and

e. procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

8. The Owner shall maintain the operations manual current and retain a copy at the Owner's administrative office for the operational life of the Works. Upon request, the Owner shall make the manual available to Ministry staff.

5. TEMPORARY EROSION AND SEDIMENT CONTROL

1. The Owner shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every two (2) weeks and after each significant storm event (a significant storm event is defined as a minimum of 25 millimetre of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.

2. The Owner shall maintain records of inspections and maintenance which shall be made available for inspection by the Ministry, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures, if any, undertaken to maintain the temporary sediment and erosion control measures.

6. RECORD KEEPING

1. The Owner shall retain for a minimum of five (5) years from the date of their creation, all records and information related to or resulting from the operation, maintenance and monitoring activities required by this Approval.

7. SPILL CONTINGENCY AND POLLUTION PREVENTION PLAN

1. Upon commencement of operation of the Works, the Owner shall implement a Spill Contingency and Pollution Prevention Plan that outlines procedures as to how to mitigate the impacts of a spill within the area serviced by the Works and/or prevent pollution incidents. The said plan shall include

as a minimum, but not limited to:

a. the name, job title and 24-hour telephone number of the person(s) responsible for activating the Spill Contingency and Pollution Prevention Plan;

b. a site plan drawn to scale showing the types of business, streets, catch basins & manholes, drainage patterns (including direction(s) of flow in storm sewers) and any features which need to be taken into account in terms of potential impacts on access and response (including physical obstructions and location of response and clean-up equipment);

c. steps to be taken to report, contain, clean up and dispose of contaminants following a spill;

d. a listing of telephone numbers for: local clean-up companies who may be called upon to assist in responding to spills; local emergency responders including health institution(s); and Ministry of the Environment and Climate Change (MOECC) Spills Action Centre 1-800-268-6060;

e. Materials Safety Data Sheets (MSDS) for each and every hazardous material which may be transported or stored within the area serviced by the Works;

f. a description of the spill response and pollution prevention training provided to employees assigned to work in the area serviced by the Works, the date(s) on which the training was provided and to whom;

g. an inventory of response and clean-up equipment available to implement the Spill Contingency and Pollution Prevention Plan, location and date of maintenance/replacement if warranted, including testing and calibration of the equipment; and

h. the date on which the Spill Contingency and Pollution Prevention Plan was prepared and subsequently, amended.

2. The Spill Contingency and Pollution Prevention Plan shall be kept in a conspicuous place near the reception area on site.

3. The Spill Contingency and Pollution Prevention Plan will be amended from time to time as needed by changes in the operation of the facility or to reflect updates in the Municipal By-Laws, or improved Best Management Practices by the Owner.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are constructed and operated in the manner in which they were described and upon which approval was granted. This condition is also included to emphasize the precedence of conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to the approved Works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included as regular inspection and necessary removal of sediment and excessive decaying vegetation from the Works are required to mitigate the impact of sediment, debris and/or decaying vegetation on the treatment capacity of the Works. The Condition also ensures that adequate storage is maintained in the Works at all times as required by the design. Furthermore, this Condition is included to ensure that the Works are operated and maintained to function as designed.

5. Condition 5 is included as installation, regular inspection and maintenance of the temporary sediment and erosion control measures is required to mitigate the impact on the downstream receiving watercourse during construction until they are no longer required.

6. Condition 6 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

7. Condition 7 is included to ensure that the Ministry is immediately informed of the occurrence of an emergency or otherwise abnormal situation so that appropriate steps are taken to address the immediate concerns regarding the protection of public health and minimizing environmental damage and to be able to devise an overall abatement strategy to prevent long term degradation and the re-occurrence of the situation.

Schedule A

1. Application for Environmental Compliance Approval submitted by John Hayes, ASO of ONTARI Holdings Ltd., dated March 28, 2018 and received on November 26, 2018;

2. Stormwater management Facility #3 Detailed Design Report along with drawings, dated July 24, 2018, prepared by A.M. Candaras Associates Inc.;

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of
Part II.1 of the Environmental Protection Act
Ministry of the Environment,
Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

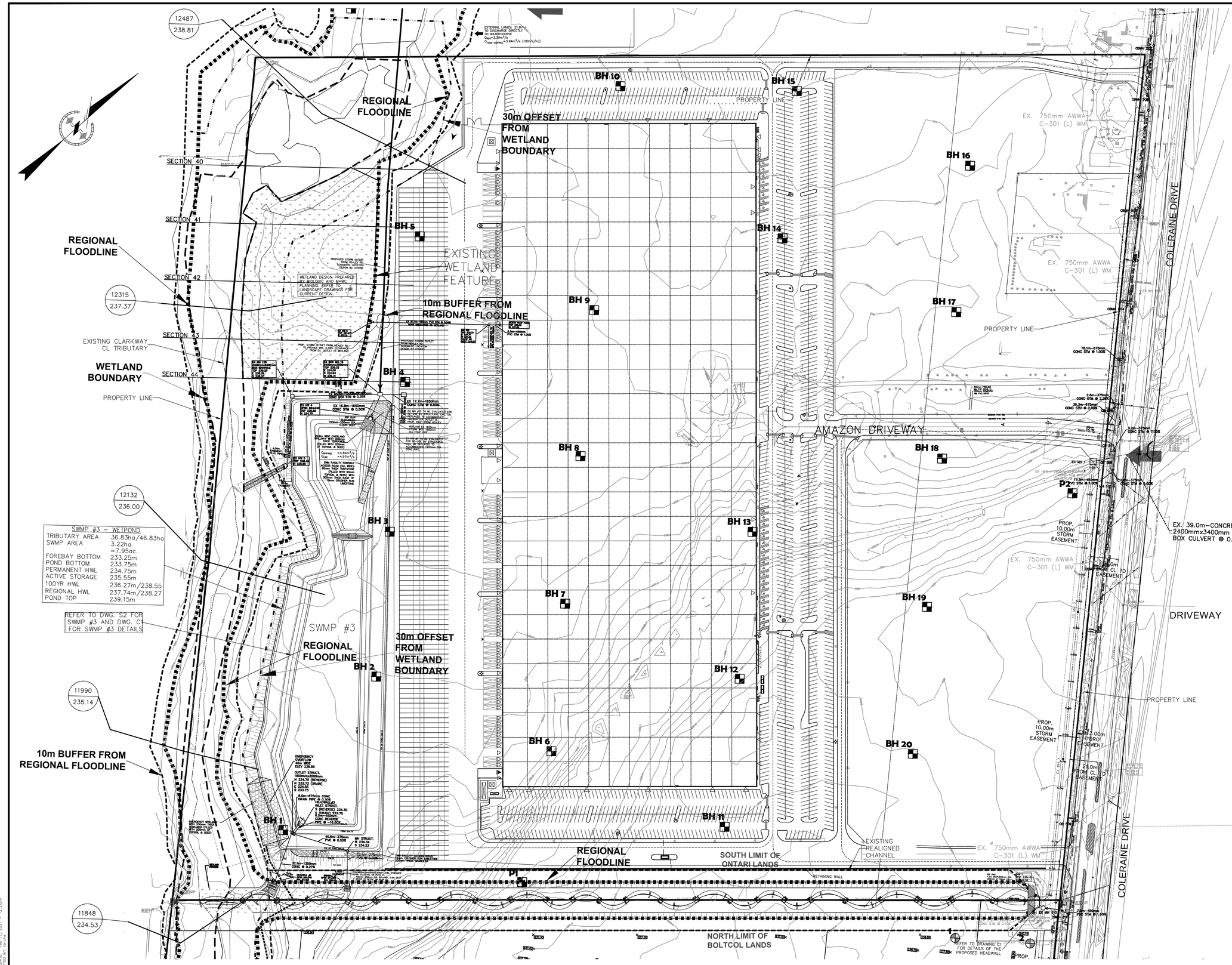
DATED AT TORONTO this 19th day of March, 2019

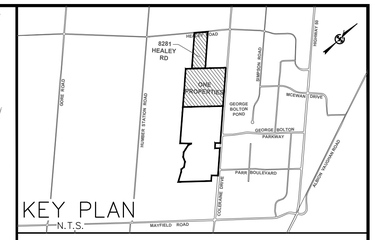
A. Ahmed

Aziz Ahmed, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

YZ/

c: District Manager, MECP Halton-Peel District Office
Fanche (Sancha) Petkovski, AM Candaras & Associates Inc., ONTARI Holdings Ltd.





LEGEND

×234.20	PROPOSED ELEVATION
235.50	EXISTING ELEVATION
	EXISTING REGIONAL FLOODLINE
	10m TRCA FLOODPLAIN SETBACK
	WETLAND BOUNDARY
	30m WETLAND BUFFER
	CATCHBASIN
	DOUBLE CATCHBASIN
	PROPOSED STORM MANHOLE
	PROPOSED SANITARY MANHOLE
	PROPOSED CATCHBASIN MANHOLE
	VALVE AND BOX
	VALVE AND CHAMBER
	HYDRANT AND VALVE
SILT	SILT FENCE
	FILL AREA
	WETLAND FEATURE
BH 20	BOREHOLE LOCATIONS PREPARED BY EXP, DEC 3/13
12132 / 236.10	HEC-RAS STATION / REGIONAL HIGH WATER LEVEL (WITHOUT SWM CONTROLS)

TOWN OF CALEDON

APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____

APPROVED BY: _____

MANAGER OF DEVELOPMENT
EAST COMMUNITY SERVICES

CONTRACTOR TO BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ALL EXISTING UNDERGROUND AND ABOVE UTILITIES AND SERVICES. THE CONTRACTOR SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH CONSTRUCTION. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCED NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. A.M. CANDARAS ASSOCIATES INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

LEGAL DESCRIPTION

PART OF LOTS 2, 3, 4 AND 5,
CONCESSION 5,
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

BENCH MARK

BENCH MARK No. 10519980009
OBTAINED FROM THE MINISTRY OF NATURAL RESOURCES COSINE INTERNET SITE HAVING AN ELEVATION OF 217.968 METRES

TOWN OF CALEDON BENCHMARK No. 758056,
ELEVATIONS ARE BASED ON THE CANADIAN GEODETIC DATUM AND HAVING A PUBLISHED ELEVATION OF 251.263 metres.

LICENSED PROFESSIONAL ENGINEER
FEB 17,2021
A. M. CANDARAS
PROVINCE OF ONTARIO

No.	Date	By	REVISIONS
1	FEB./21	F.P.	ADDITIONAL DRAINAGE AREA FROM HEALEY RD SITE

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

8281 HEALEY RD DEVELOPMENT
EX POND #3 EVALUATION
ONE PROPERTIES

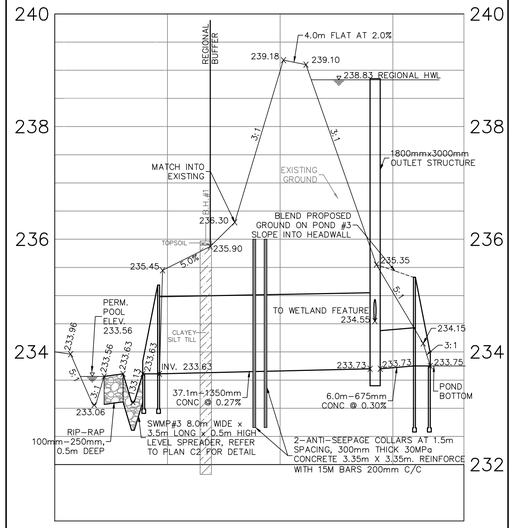
TOWN OF CALEDON
REGION OF PEEL

GENERAL PLAN
ONTARI LANDS

SCALE: 1:1250	DATE: FEB 2021	PROJ No.	2109
DRAWN: F.P.	CHK'D: A.M.C.	PLAN No.	G1
DESIGNED: F.P.	SHEET 1 OF 4		

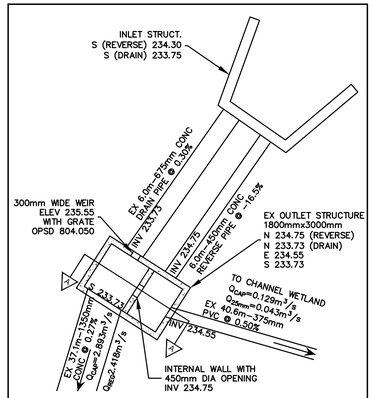
FILENAME: G:\2109\STDS\G1.dwg
PLOTDATE: Feb 17, 2021 - 12:21pm
PLOTTED BY: Fabio Pinto

SWM FACILITY #3 OUTLET CROSS SECTION DETAIL



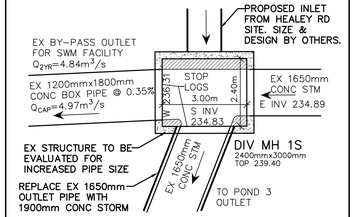
QUALITY/QUANTITY CONTROL STRUCTURE SWM POND #3 PLAN VIEW

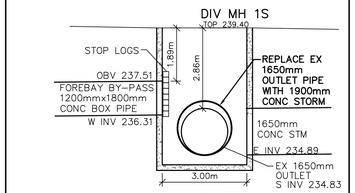
SCALE: 1:100



NOTE: STOP LOGS TO BE MOUNTED TO WEST SIDE OF MH 1S DURING NORMAL OPERATING CONDITIONS, AND MOVED TO SOUTH OUTLET ONLY DURING FOREBAY MAINTENANCE.

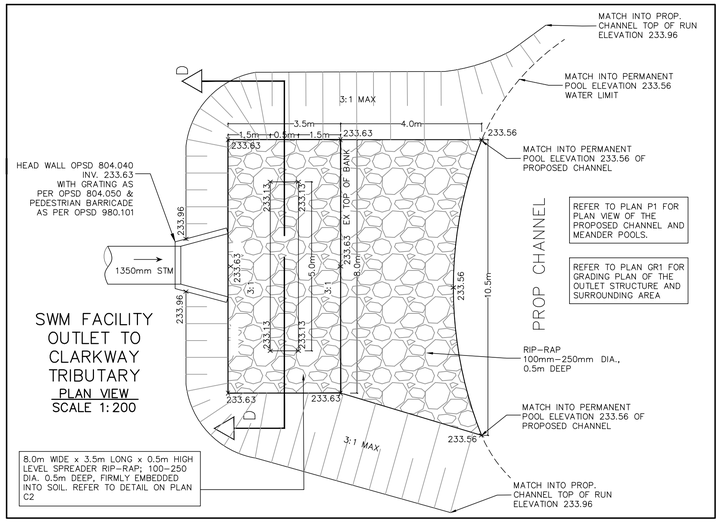
Q=CAIN
I_{2YR}=62.0mm/hr,
Tc=18min
A=31.2ha
Q_{2YR}=0.90x31.2x62.0x2.778
Q_{2YR}=4.84m³/s





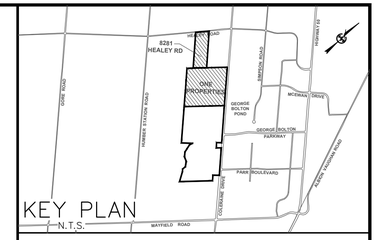
DIVERSION MH 1S DETAIL

SCALE: 1:125



SWM FACILITY OUTLET TO CLARKWAY TRIBUTARY PLAN VIEW

SCALE 1:200



KEY PLAN

N.T.S.

LEGEND

- HYDRANT AND VALVE
- CATCHBASIN
- DOUBLE CATCHBASIN
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- 236.00 PROPOSED ELEVATION
- 235.50 EXISTING ELEVATION
- VALVE AND BOX
- VALVE AND CHAMBER

TOWN OF CALEDON

APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____

APPROVED BY: _____

MANAGER OF DEVELOPMENT EAST COMMUNITY SERVICES

CONTRACTOR TO BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ALL EXISTING UNDERGROUND AND ABOVE UTILITIES AND SERVICES. THE CONTRACTOR SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH CONSTRUCTION. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCED NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. A.M. CANDARAS ASSOCIATES INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

LEGAL DESCRIPTION

PART OF LOTS 2, 3, 4 AND 5, CONCESSION 5, TOWN OF CALEDON REGIONAL MUNICIPALITY OF PEEL

BENCH MARK

BENCH MARK No. 10519980009
OBTAINED FROM THE MINISTRY OF NATURAL RESOURCES COSINE INTERNET SITE HAVING AN ELEVATION OF 217.968 METRES

TOWN OF CALEDON BENCHMARK No. 758056,
ELEVATIONS ARE BASED ON THE CANADIAN GEODETIC DATUM AND HAVING A PUBLISHED ELEVATION OF 251.263 metres.

LICENSED PROFESSIONAL ENGINEER — FEB 17,2021 — A. M. CANDARAS — PROVINCE OF ONTARIO

No.	Date	By	REVISIONS
1	FEB./21	F.P.	POND#3 W. INLET REVISED AS PER ADDITIONAL DRAINAGE AREA FROM 8281 HEALEY RD.

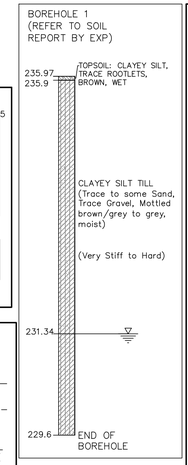
a.m.candaras associates inc.
consulting engineers
8551 Weston rd., suite 203
Woodbridge ont. L4L 9R4
905-850-8020 Fax 905-850-8099
Email: civil@amcai.com

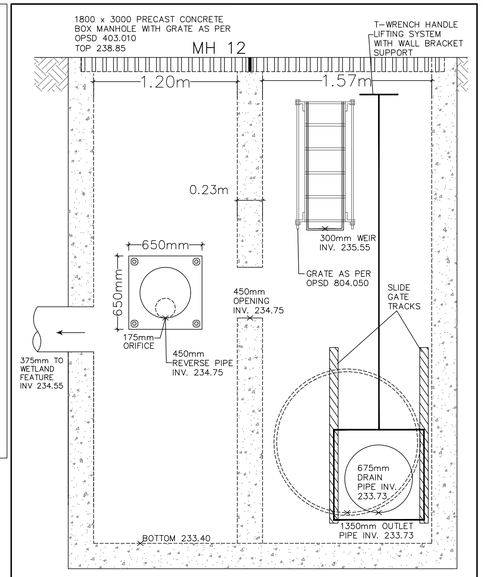
8281 HEALEY RD DEVELOPMENT
EX POND #3 EVALUATION
ONE PROPERTIES

TOWN OF CALEDON
REGION OF PEEL

STORMWATER MANAGEMENT POND 3 DETAILS

SCALE: AS NOTED	DATE: FEB 2021	PROJ No.	2109
DRAWN: F.P.	CHK'D: A.M.C.	PLAN No.	C1
DESIGNED: F.P.	SHEET 2 OF 4		





SECTION A-A
QUALITY/QUANTITY CONTROL STRUCTURE SWM POND #3

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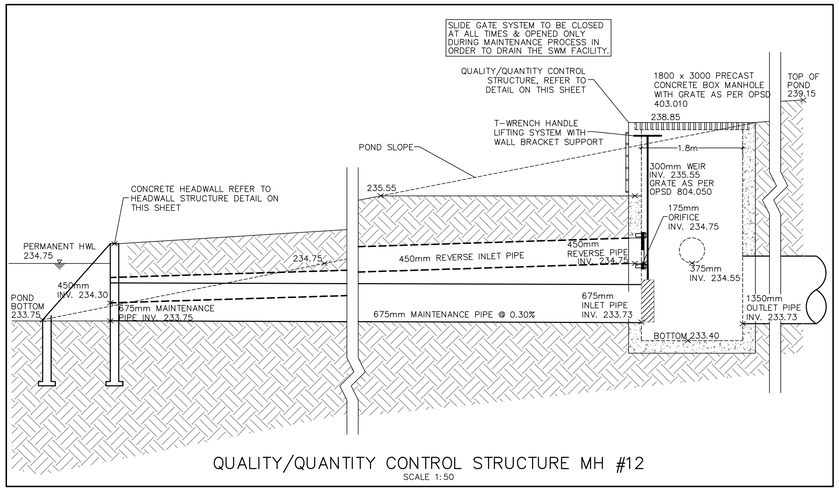

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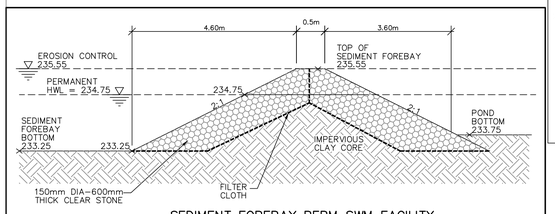
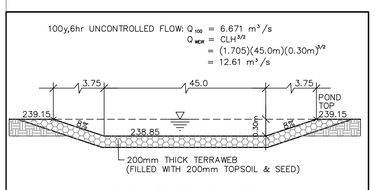


SEDIMENT FOREBAY BERM SWM FACILITY
SECTION B-B

SCALE 1:50



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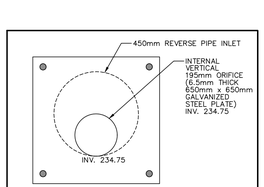

SWM FACILITY
ORIFICE PLATE DETAIL

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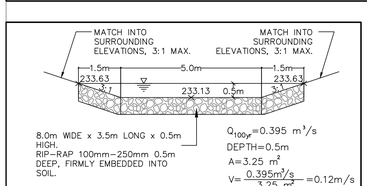

SWM FACILITY #3
LEVEL SPREADER DETAIL
SECTION D-D

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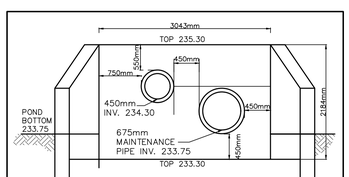

SWM POND #3
CONCRETE HEADWALL
STRUCTURE DETAIL

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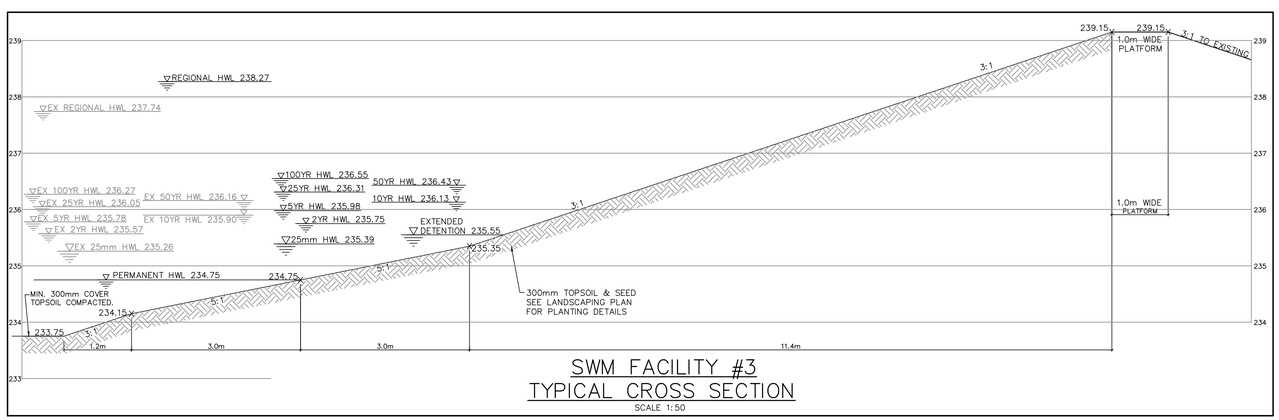
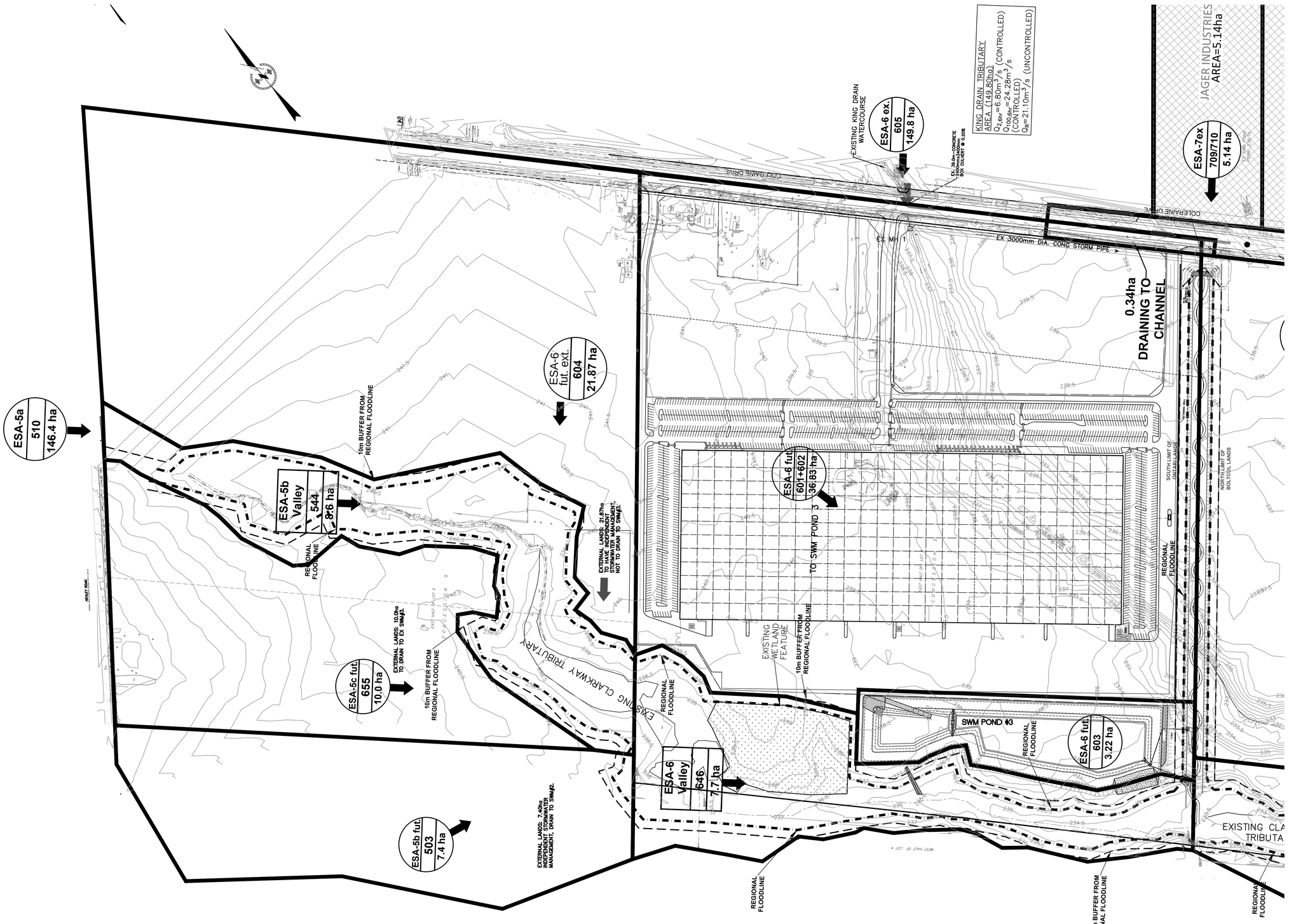
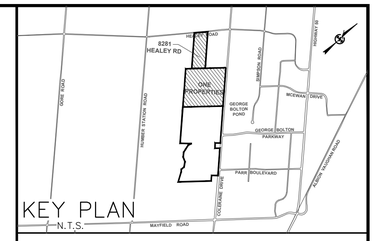


SWM FACILITY #3
TYPICAL CROSS SECTION

SCALE 1:50





LEGEND

- −250.65− EXISTING CONTOUR
- POST-DEVELOPMENT REGIONAL FLOODLINE
- 10m TRCA FLOODPLAIN SETBACK
- ESA-5a fut. / 74.7 ha — URBAN CATCHMENT I.D. / DRAINAGE AREA
- ESA-8 valley / 15.1 ha — RURAL CATCHMENT I.D. / DRAINAGE AREA
- DRAINAGE AREA FLOW DIRECTION

TOWN OF CALEDON

APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____

APPROVED BY: _____

MANAGER OF DEVELOPMENT
EAST COMMUNITY SERVICES

CONTRACTOR TO BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ALL EXISTING UNDERGROUND AND ABOVE UTILITIES AND SERVICES. THE CONTRACTOR SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES PROIR TO PROCEEDING WITH CONSTRUCTION. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCED NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. A.M. CANDARAS ASSOCIATES INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

LEGAL DESCRIPTION

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CONCESSION 5,
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

BENCH MARK

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OBTAINED FROM THE MINISTRY OF NATURAL RESOURCES COSINE INTERNET SITE HAVING AN ELEVATION OF 217.968 METRES

TOWN OF CALEDON BENCHMARK No. 758056,
ELEVATIONS ARE BASED ON THE CANADIAN GEODETIC DATUM AND HAVING A PUBLISHED ELEVATION OF 251.263 metres.

LICENSED PROFESSIONAL ENGINEER
FEB 17,2021
A. M. CANDARAS
PROVINCE OF ONTARIO

No.	Date	By	REVISIONS
1	FEB./21	F.P.	10.0ha ADDITIONAL DRAINAGE AREA TO DRAIN FROM HEALEY RD. SITE TO EX POND #3

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

8281 HEALEY RD DEVELOPMENT
EX POND#3 EVALUATION
ONE PROPERTIES

TOWN OF CALEDON
REGION OF PEEL

STORM DRAINAGE AREA PLAN

SCALE: 1:2000	DATE: FEB 2021	PROJ No.	2109
DRAWN: F.P.	CHK'D: A.M.C.	PLAN No.	S1
DESIGNED: F.P.	SHEET 3 OF 4		

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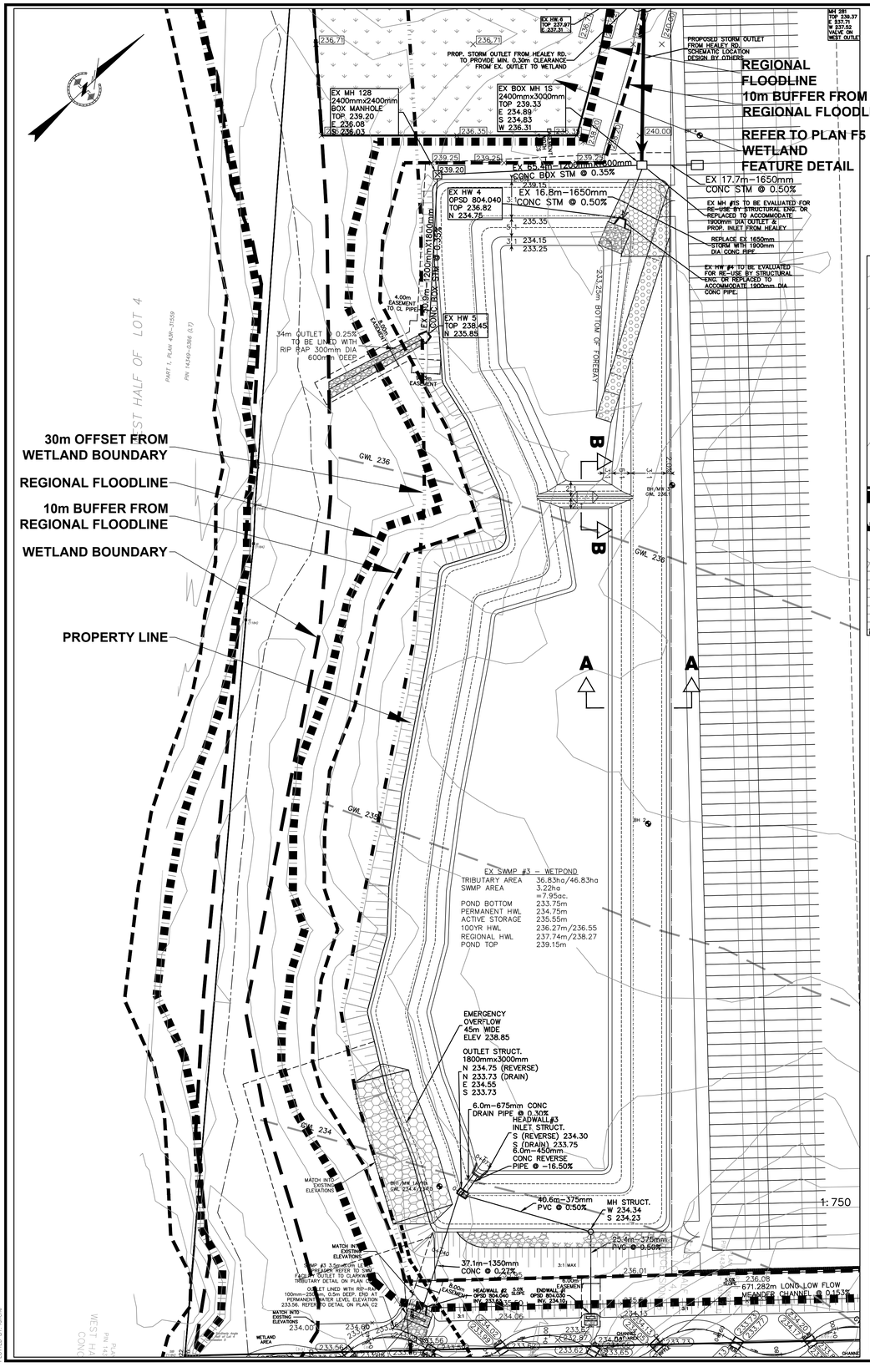
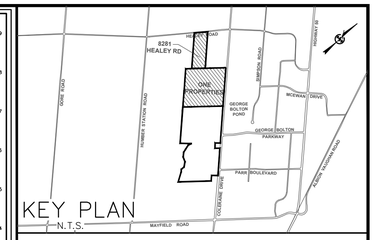
PLOTDATE: Feb 17, 2021 - 12:20pm
PLOTTED By: Fabrice





LEGEND

- ×234.20 PROPOSED ELEVATION
- 235.50 EXISTING ELEVATION
- EXISTING REGIONAL FLOODLINE
- 10m TRCA FLOODPLAIN SETBACK
- CATCHBASIN
- DOUBLE CATCHBASIN
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- VALVE AND BOX
- VALVE AND CHAMBER
- HYDRANT AND VALVE
- WETLAND BOUNDARY
- 30m WETLAND BUFFER
- ENHANCED PROTECTION AREA

TOWN OF CALEDON

APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____

APPROVED BY: _____

DIRECTOR OF PUBLIC WORKS & ENGINEERING

REFER TO DRAWING C2 FOR SWMP DETAILS

CONTRACTOR TO BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ALL EXISTING UNDERGROUND AND ABOVE UTILITIES AND SERVICES. THE CONTRACTOR SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH CONSTRUCTION. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCED NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. A.M. CANDARAS ASSOCIATES INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

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LICENSED PROFESSIONAL ENGINEER A. M. CANDARAS PROVINCE OF ONTARIO
FEB 17,2021

No.	Date	By	REVISIONS
1	FEB./21	F.P.	PROPOSED HEALEY SITE STORM INLET, REV. POND#3 INLET STRUCTURES

a.m.candaras associates inc.
consulting engineers
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Woodbridge ont. L4L 9R4
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Email: civil@amcai.com

8281 HEALEY RD DEV.
EX POND #3 EVALUATION
ONE PROPERTIES

TOWN OF CALEDON
REGION OF PEEL

STORMWATER MANAGEMENT
POND #3

SCALE: AS NOTED	DATE: JULY 2016	PROJ No.	2109
DRAWN: F.P.	CHK'D: A.M.C.	PLAN No.	S2
DESIGNED: F.P.	SHEET 4 OF 4		

PLOTTED BY: Renzie
PLOTDATE: Feb. 17, 2021 - 12:18pm
FILENAME: C:\2109\2109-S2.dwg

END

AM CANDARAS STORM WATER MANAGEMENT BRIEF

START

GEOPROCESS FLUVIAL GEOMORPHOLOGY AND EROSION HAZARD ASSESSMENT

8281 Healey Road Development Fluvial Geomorphology and Erosion Hazard Assessment

Prepared for

8281 Healey Road Properties GP Ltd c/o One Properties

Suite 2710, 33 Bay Street
Toronto, ON M5H 2R2

February 1, 2021
Project No. P2020-486

Prepared by

GeoProcess Research Associates Inc.
133 King Street West
PO Box 65506 DUNDAS
Dundas, ON L9H 6Y6

Version History

Version	Date	Issue	Description	Author	Approved
1	Feb 1, 2021	Review	Issued for Agency review	MVI/BDP	KAG

Table of Contents

List of Figures

List of Tables

1. Introduction

GeoProcess Research Associates Inc. (GRA) was retained by 8281 Healey Road Properties GP Ltd. to complete a fluvial geomorphology and erosion hazard assessment for the Clarkway Tributary in support of a proposed development at 8281 Healey Road, Bolton, Ontario, herein referred to as the Subject Property. GRA understands that the proposed development includes a planned storm sewer that will cross under the tributary to convey stormwater to an existing stormwater management (SWM) facility located on adjacent private land, southeast of the Subject Property. The objectives of this study were to characterize the existing geomorphological conditions of the watercourse near the proposed crossing and to estimate the erosion potential for a range of flows. To address the objectives, a detailed field assessment and geomorphic survey were undertaken. Field data and literature sources were used to estimate erosion thresholds for the channel bed material. Erosion threshold estimates and outputs from the Toronto and Region Conservation Authority (TRCA) post-development HEC-RAS model were used to estimate potential bed scour for a range of flows under proposed conditions. This report outlines the technical rationale and results of this study.

2. Study Area

Clarkway Tributary is situated within the West Humber River Watershed and flows along the northeastern edge of the Subject Property in a southeasterly direction. The Study Reach (Figure 1) expands beyond the Subject Property limits and contains approximately 850 m of channel between Healey Road (upstream limit) and the southeastern property boundary, which borders private land adjacent to Coleraine Drive (downstream limit). At the downstream limit, the Clarkway Tributary watershed has a drainage area of approximately 164 ha and is dominated by agricultural land-use (~88.1%), with some urban land use (~11.8%). Remaining land-use in the watershed primarily consists of marsh, swamp, and woodland.

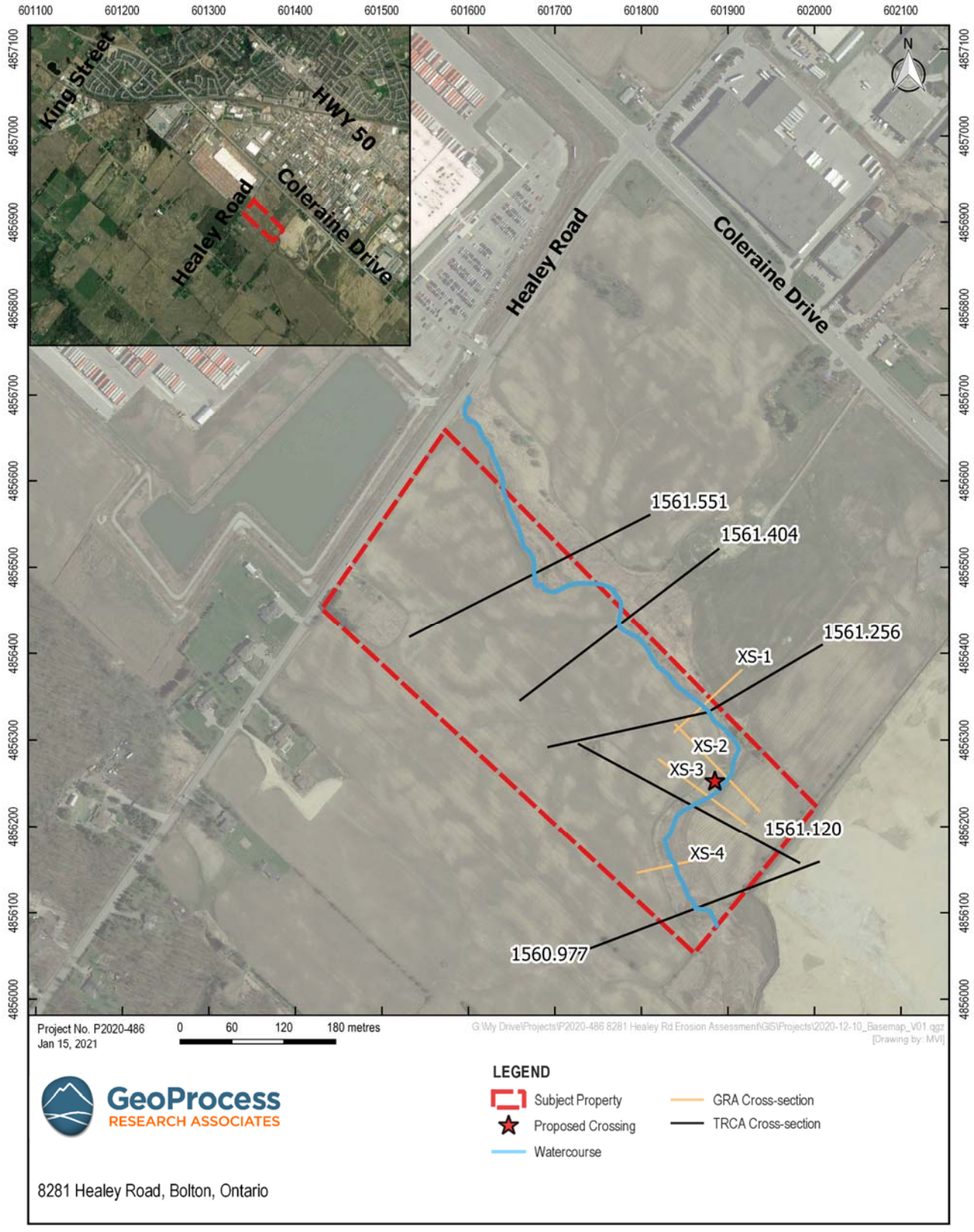


Figure 1: Study Reach Map

3. Field Methods

A detailed geomorphic survey of the Study Reach was completed by GRA on November 17, 2020, using survey-grade global navigation satellite system (GNSS) receivers with enabled real-time kinematic (RTK) corrections (+/- 0.04 m error). The survey consisted of a longitudinal profile, where significant breaks in slope were measured. Cross-sections were surveyed to characterize the dominant cross-sectional morphology. Channel substrate was visually characterized and photographed. A detailed georeferenced photo record was compiled.

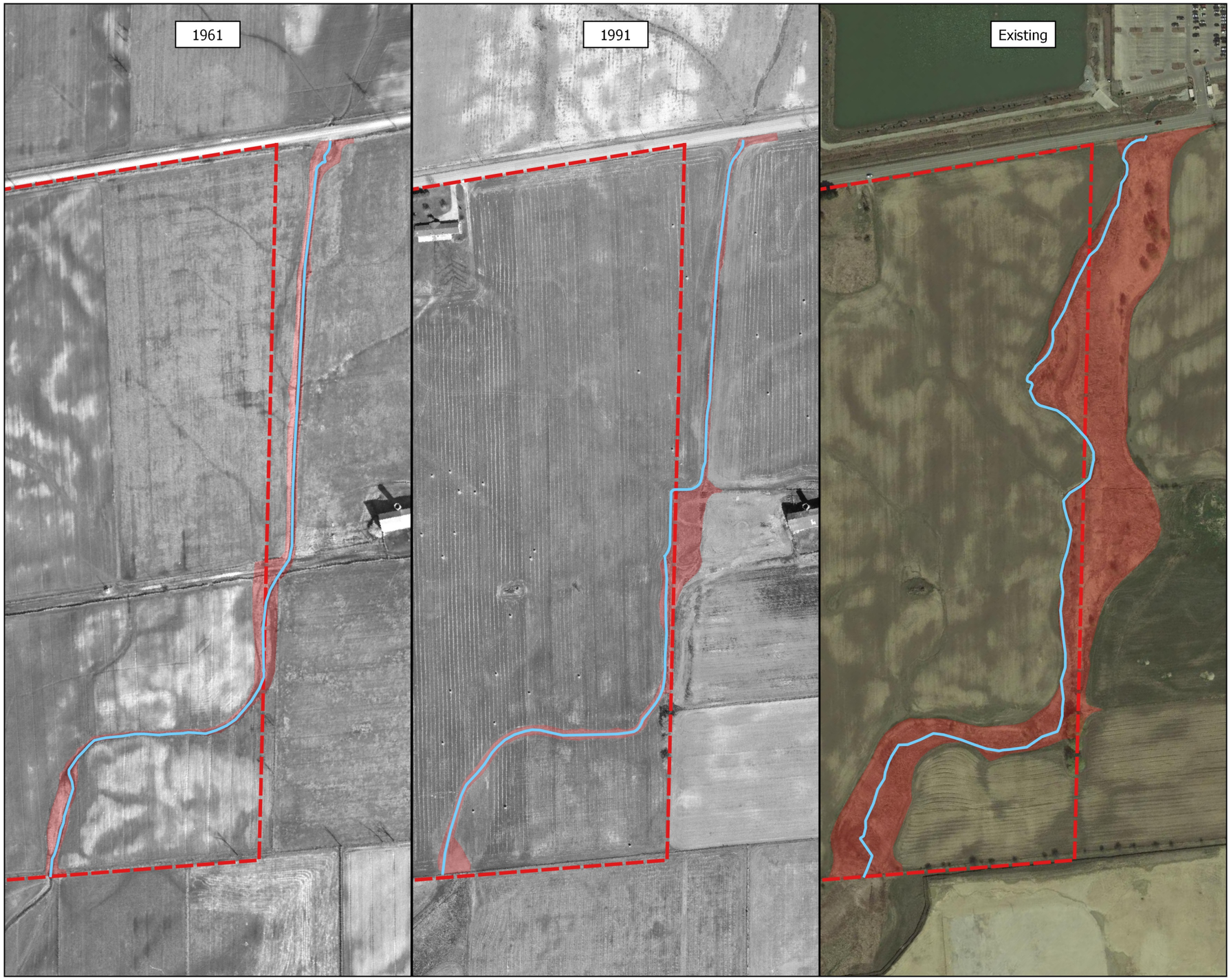
4. Existing Conditions

4.1. Geology

The Study Reach is situated within the Wildfield till geological unit (White, 1975) where surficial geology is characterized as clay to silt-textured till derived from glaciolacustrine deposits or shale (OGS, 2010). The thickness of the Wildfield till unit typically varies between 2 – 6 feet and overlays Halton till in this area. Halton till surfaces along the Clarkway Tributary corridor downstream of the Study Reach (White, 1975). A geotechnical investigation of the Subject Property completed by Exp Services Inc. (Exp) characterizes the subsurface geology of tablelands situated west of the watercourse through a record of borehole logs (Exp Services Inc., 2019). The borehole logs generally characterize the subsurface geology as sandy silt till that is overlain by shallow layers of reworked native fill and topsoil.

4.2. Historical Erosion Trends

A review of historical aerial photography and satellite imagery was completed to characterize the historic geomorphic conditions of the Study Reach and ascertain trends of lateral erosion as shown in Figure 2. Aerial photos captured in May 1961 and spring 1991 were available and included in the review. Satellite imagery dating as far back as 2004 was available and also reviewed. Photography from 1961 reveals that the Study Reach was originally channelized and followed a near-perfectly straight planform extending southeast of Healey Road to a fence line. Downstream of the fence line, the historic channel planform largely aligns with the present-day planform following a series of two 90° bends to the downstream study limit. 1961 photography shows that the channel was void of riparian vegetation and relatively narrow, with adjacent agricultural operations nearly extended to the channel banks. Photography from 1991 shows a similar channel planform compared to 1961, which indicates that the channel was likely maintained through regular agricultural operations. 1991 photography appears to show a wider riparian vegetation along the two downstream bends and better-established riparian vegetation throughout the Study Reach. Several pathways crossing the channel are apparent near a building that was previously situated at the end of the laneway extending southwest of Coleraine Drive. Various satellite images appear to show machine tracks crossing the channel in the vicinity of the proposed storm sewer crossing (prominent in 2005 imagery). Satellite imagery generally shows that the stream corridor has expanded in recent years to encompass a wider vegetated riparian zone.



Legend

- Subject Property
- Riparian Zone
- Channel Centerline

N

0 100 200 300 metres

GeoProcess RESEARCH ASSOCIATES

CREATED BY:	MVI	PROJECT NO.:	P2020-486
CHECKED BY:	BDP	DATE:	Jan 27, 2021

Coordinate System:
UTM Zone 17 N

Figure 2: Historical Watercourse Delineation

8281 Healey Road, Bolton, Ontario

Differences in channel planform are apparent when comparing the surveyed channel centerline to historical photography; however, the overall width of the stream corridor has increased over time and differences in planform are commensurate with this expansion. For example, the existing channel centerline appears to have shifted since 1991 (1991 shares similar planform with 1961) along the outer bank at the first 90° bend in the vicinity of the proposed storm sewer crossing; however, the width of the riparian vegetation (i.e.stream corridor) at this location has also increased from approximately 8 m (1991) to 25 m (existing) and contains both planform alignments. Furthermore, the existing channel centerline was generally subject to considerable surveyor interpretation at this location due to poor channel definition and ponding water. In summary, the historical channel planform alignment dating back to 1961 lies within the present-day stream corridor.

4.3. Geomorphic Conditions

The Study Reach is characterized as a wide unconfined swale that is dominated by heavy vegetation growth (including tall grasses, cattails and phragmites) and generally contains a poorly defined main channel with instances of multi-channel flow along the corridor edges (Photo 1). The Study Reach has a gentle slope of 0.34% and excellent floodplain connectivity, which contribute towards a low energy depositional environment. Channel bed substrate predominantly consists of fine-grained cohesive soils and deposits of loose fine-sediment. Beaver activity is prevalent throughout the Study Reach. Beaver lodge structures were noted along the entirety of the Study Reach and ponding water was observed in the vicinity of the proposed crossing (Photo 2 & 3). Evidence of lateral bank erosion was noted along the right bank of the upstream segment of the Study Reach where the stream corridor borders agricultural lands (Photo 4). This instance of lateral bank erosion is localized and not considered indicative of system-wide instability. A recently constructed SWM pond is situated adjacent to the Clarkway Tributary on the lands located east of the stream corridor, upstream of the proposed crossing. The SWM pond is believed to convey runoff from the new industrial development on Coleraine Drive into the Clarkway Tributary. Geomorphic survey data collected at the study site were used to complete an at-a-stage hydraulic analysis of existing conditions. Bankfull geometry and corresponding hydraulic parameter estimates are summarized in Table 1.

Photo 1: Typical view of Study Reach. Poorly defined channel and dominant vegetation.

Photo 2: Depositional area in vicinity of proposed crossing. View of a beaver lodge.

Photo 3: Ponding water upstream of proposed crossing.

Photo 4: Evidence of channel widening into adjacent agricultural lands.

Table 1: Summary of bankfull channel geometry and estimated hydraulic parameters.

Parameter	Reach Minimum	Reach Maximum	Reach Average
Cross-sectional Area (m^2)	9.46	10.89	10.22
Width (m)	28.97	50.97	41.38
Mean Depth (m)	0.21	0.33	0.26
Wetted Perimeter (m)	29.37	51.05	41.52
Hydraulic Radius (m)	0.21	0.32	0.26
Width to Depth Ratio	88.76	238.49	172.35
Discharge (m^3/s)	4.13	5.11	4.69

The average bankfull discharge estimated from the at-a-station hydraulic analysis is slightly less than the 2-year return period peak flow incorporated in the TRCA HEC-RAS model for the Clarkway Tributary (5.034 m^3/s). This observation agrees with the typical bankfull flow frequency return period for rural streams in Southern Ontario of 1.5 – 1.7 years (Annable, 1996), which suggests that the watercourse has not undergone considerable adjustment and maintains a frequent floodplain connection.

5. Erosion Hazard Assessment

Erosion thresholds were estimated for the channel bed material to assess the potential risk of general scour at the location of the proposed storm sewer crossing. Based on literature sources, regional mapping and the Exp borehole records, the channel bed material is classified as Wildfield till that is characterized by a range of soil properties as summarized in Table 2. The data source of each listed soil property is also provided in Table 2. The material properties data were used to inform the erosion threshold estimates.

Table 2: Summary of material properties for channel bed substrate.

Property	Low Range	High Range	Average	Source
Moisture Content (%)	10	40	25	Exp Services Inc., 2019
Liquid Limit (%)	31	48	37	White, 1975
Plastic Limit (%)	15	25	20	White, 1975
Plasticity Index (%)	11	24	17	White, 1975
% Gravel	0	7	3	White, 1975
% Sand	6	34	17	White, 1975
% Silt	26	55	43	White, 1975
% Clay	23	64	40	White, 1975
% Fines	49	100	75	White, 1975
Undrained Shear Strength (kPa)	96	287	191	White, 1975
Unconfined Compressive Strength (kPa)	192	574	382	Calculated value

5.1. Methods

Erosion and scour in cohesive material is a highly variable and stochastic process. Additionally, estimating the erodibility of cohesive material has an inherent degree of uncertainty. This assessment evaluated scour and erosion potential based on an envelope approach whereby a range of potential erosion rates were estimated to account for variability in: 1) material properties (resistance to erosion); 2) hydraulic forces acting on the channel (driving erosion); and, 3) the uncertainties associated with modelling scour in cohesive systems (empirical model parameters). The envelope (or range) of erosion estimates varies in the level of conservatism from low to high to reflect the assumptions made regarding material erodibility. This is discussed throughout the section.

A suite of empirical equations and literature sources were used to estimate the critical shear stress (τ_c) for Wildfield till. Critical shear stress is a parameter that relates to the material's resistance to erosion from hydraulic forces. Important to note is that the shear strength commonly reported in geotechnical borehole logs is not the same as the critical hydraulic shear stress. The shear strength refers to the threshold at which the material will deform, which is only very loosely related to the threshold at which the material will erode from hydraulic forces (Khan, 2006). These relationships have been derived from laboratory and field experiments in a variety of cohesive soil types. Each relationship has its associated advantages and limitations as the erodibility of cohesive material varies inherently.

Table 3: Critical shear stress equations and literature sources.

No.	Equation	Variables	Source
A-1	$\tau_c = -51.5 + 0.67(\%fines) + 0.26(\bar{s}_u)$	$\%fines$ $= percentage\ of\ fine\ material\ (< 0.063mm)$ $\bar{s}_u = mean\ shear\ strength$ (kPa)	Khan, 2006
A-2	$\tau_c = 0.16(I_w)^{0.84}$	$I_w = Plasticity\ Index\ (\%)$	Smerdon and Beasley, 1961
A-3	$\tau_c = 0.493x10^{0.0182P_c}$	$P_c = percent\ clay\ by\ weight$	Smerdon and Beasley, 1961
A-4	$\tau_c = 0.1 + 0.18(SC) + 0.002(SC)^2 - 2.34E - 5(SC)^3$	$SC = percentage\ of\ fine\ material\ (< 0.063mm)$	Julian and Torres, 2006
A-5	$\tau_c = \alpha\left(\frac{w}{F}\right)^{-2.0} PI^{1.3} q_u^{0.4}$	$w = water\ content\ (ratio)$ $F = fraction\ of\ fines < 0.075mm\ (ratio)$ $PI = plasticity\ index\ (ratio)$ $q_u = unconfined\ compressive\ strength\ (Pa)$ $\alpha = constant\ (0.1)$	FHWA, 2015
A-6	$\tau_c = 12.4\ Pa$	Stiff clay and alluvial silt (colloidal)	Fischenich, 2001
A-7	$\tau_c = 2.2 - 2.4\ Pa$	Alluvial silt (noncolloidal)	Fischenich, 2001

Critical shear stress estimates were derived for the upper and lower ranges and average values of the material properties listed in Table 2 to account for the inherent variability and uncertainty associated with the erodibility of cohesive materials. These critical shear stress estimates were compared against hydraulic model outputs obtained from the TRCA post-development HEC-RAS model (modified by The Odan/Detech Group Inc.). Critical shear stress estimates and HEC-RAS hydraulic outputs were used to estimate general bed scour erosion rates according to empirical equations presented by FHWA, 2015 listed in Table 4.

Table 4: Erosion rate equations and literature sources.

No.	Equation	Variables	Source
B-1	$\dot{z} = \alpha C_1(\tau - \tau_c)^{C_2}$ $C_1 = \beta(q_u)^{-1.0} PI^{-1.1}$	$\dot{z} = erosion\ rate\ (mm/h)$ $\alpha = unit\ conversion\ constant\ (1.0)$ $C_1 = multiplier\ coefficient$ $\tau = applied\ shear\ stress\ (Pa)$ $\tau_c = critical\ shear\ stress\ (Pa)$ $C_2 = exponent$ $\beta = unit\ conversion\ constant\ (680)$ $q_u = unconfined\ compressive\ strength\ (Pa)$ $PI = plasticity\ index\ dimensionless\ ratio$	FHWA, 2015
B-2	$\dot{z} = \alpha C_3 \tau - C_4$	$C_3 = multiplier\ coefficient$ $C_4 = constant\ (mm/h)$	FHWA, 2015

The multiplier coefficient (C_1) of equation B-1 can be selected from a table of values presented in FHWA, 2015, or estimated from specific soil properties according to the equation listed in Table 4. As a result, bed scour rates were estimated according to three methods for a given applied shear stress: 1) equation B-1 and an estimated C_1 value; 2) equation B-1 and a table value of C_1; and 3) equation B-2. For each method, high and moderate to low erodibility estimates of bed scour were calculated by applying corresponding values for equation input variables and critical shear stress to ultimately arrive at the envelope of scour estimates where the high erodibility case used the most conservative parameters and the low erodibility used the least conservative parameters. Additionally, an average case was assessed which evaluated the scour potential using average parameters and, where possible, parameter estimates that best represent the Wildfield till material.

5.2. Results

Estimated critical shear stress results are summarized in Table 5 and Figure 3. As expected, there is a considerable spread in the estimated values owing to the empirical formulae and overall variability of cohesive material erodibility. The low and average erodibility estimates of critical shear stress share a common median value, which is the value outlined by Fischenich (2001) for stiff clay and colloidal alluvial silt. The median of the high erodibility critical shear stress estimates is the value outlined by Fischenich (2001) for noncolloidal alluvial silt. Several critical shear stress estimates were deemed unrealistically high for the cohesive bed material and were regarded as outliers. Although the soil material inputs used to derive these outliers are valid, the empirical nature of the critical shear stress equations ultimately resulted in estimates considered unrealistic in these specific cases. A conservative approach was subsequently adopted for the estimation of channel bed scour erosion rates by removing outlier critical shear stress estimates from consideration. Furthermore, average and low erodibility critical shear stress estimates were pooled due to the similarity in the range of these values following the removal of outliers (as shown in Figure 3). It is important to note that these critical shear stress estimates do not include the effect of vegetation in stabilizing soil and decreasing erosion potential. As documented in the field assessment, the Clarkway Tributary corridor is well-vegetated and the estimates used in this assessment (corresponding to bare-soil) are underestimating the actual critical shear stress of the channel boundary (adding further conservatism to the approach).

Table 5: Critical shear stresses (Pa) for the cohesive bed material. Table shows shear stresses estimated based on the ranges and average material properties in Table 2.

Equation No.	High Erodibility Estimate (Pa)	Low Erodibility Estimate (Pa)	Average Estimate (Pa)
A-1	6.9	90.2[1]	48.2[1]
A-2	1.2	2.3	1.7
A-3	1.3	7.2	2.6
A-4	11.2	14.7	15.0
A-5	0.8	314.8[1]	15.3
A-6	12.4	12.4	12.4
A-7	2.2	2.4	2.3
Minimum	0.8	2.3	1.7
Median	2.2	12.4	12.4
Maximum	12.4	314.8	48.2

[1] Critical shear stress estimate considered unrealistically high and regarded as an outlier.

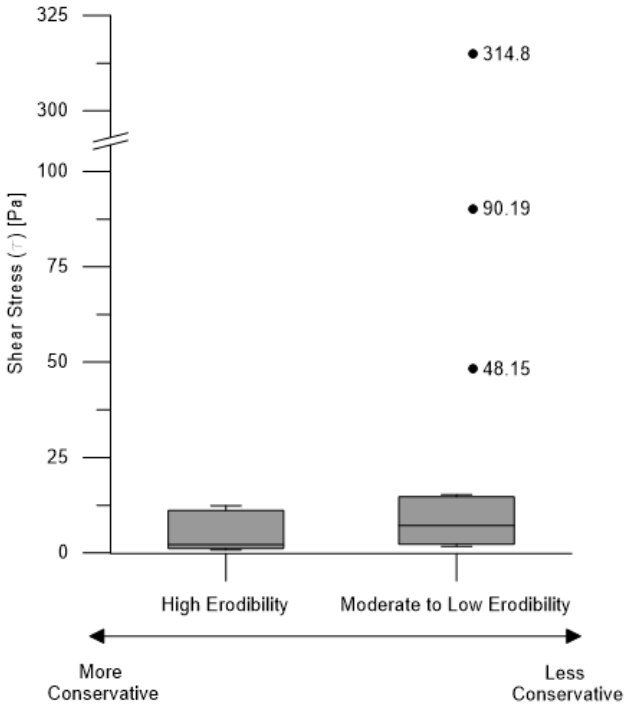


Figure 3: Critical shear stress range for cohesive bed material. Figure shows shear stresses estimated based on the ranges and average material properties in Table 2. Box represents the 25th, 50th and 75th percentiles. Whiskers represent the max and min values. Outliers are indicated by the labelled points.

Table 6 summarizes the channel velocities and channel shear stresses along the Study Reach for return period peak flows reported in the TRCA HEC-RAS model ranging from the 1:2-year event to the 1:500-year event. The most extreme event available in the HEC-RAS model (1:500-year) was considered to add to the conservatism of this analysis. Table values are plotted with the Study Reach (Figure 1) longitudinal profile in Figure 4 and Figure 5. In the general location of the proposed crossing (XS 1561.120), both channel velocity and shear stress are relatively low compared to other segments of the Study Reach. Elevated channel velocity and shear stress is noted at the cross-section situated upstream of the proposed crossing (XS 1561.256) where model outputs for the 1:2-year return period exceed the maximum values documented at XS 1561.120 (which occur during the 1:500-year return period). This large variation in channel velocity and shear stress is primarily attributed to the channel geometry associated with the proposed development as outlined in the Functional Servicing Report and Stormwater Management Design Brief prepared by The Odan/Detech Group Inc. (The Odan/Detech Group Inc, 2020). At the proposed storm sewer crossing, proposed earthworks include cutting material from the river-left valley that will improve floodplain connectivity and energy dissipation, reducing the erosion potential in this location. The proposed earthworks in the vicinity of the crossing are reflected within the post-development HEC-RAS model by the geometry of XS 1561.120, thus model outputs pertaining to this cross-section are assumed to be representative of the proposed crossing location. Channel cross-sectional geometry obtained from the TRCA HEC-RAS model in the vicinity of the proposed crossing (XS 1561.120) for pre- and post-development conditions is presented in Appendix A.

Table 6: TRCA HEC-RAS post-development model output for Study Reach cross-sections.

Return Period (Years)	Peak Flow (m^3/s)	XS 1561.404		XS 1561.256		XS 1561.120		XS 1560.977	
		Channel Velocity (m/s)	Channel Shear Stress (Pa)	Channel Velocity (m/s)	Channel Shear Stress (Pa)	Channel Velocity (m/s)	Channel Shear Stress (Pa)	Channel Velocity (m/s)	Channel Shear Stress (Pa)
2-year	5.034	0.81	9.58	1.54	47.51	0.5	3.71	0.28	9.22
5-year	8.771	0.83	6.35	1.84	60.52	0.58	4.74	0.37	13.85
10-year	18.334	0.73	10.13	2.12	65.98	0.75	7.29	0.51	22.5
25-year	23.046	0.7	11.45	2.37	79.6	0.82	8.48	0.55	25.18
50-year	26.613	0.74	13.05	2.34	74.22	0.86	9.15	0.57	26.61
100-year	30.154	0.77	14.85	2.32	70.39	0.9	9.75	0.59	28.05
350-year	48.789	0.81	19.17	2.71	89.27	1.07	12.98	0.68	34.54
500-year	58.762	0.85	21.3	2.86	96.3	1.16	14.8	0.71	36.91
Regional	29.409	0.77	14.65	2.29	69.13	0.89	9.66	0.58	27.41

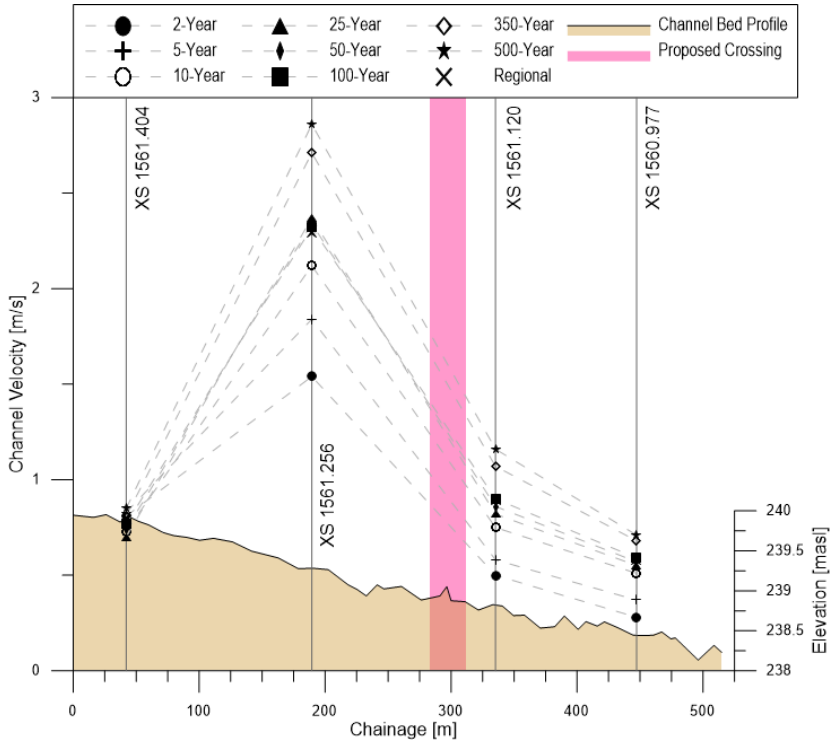


Figure 4: Channel velocities at HEC-RAS model cross-section locations for range of return period flows.

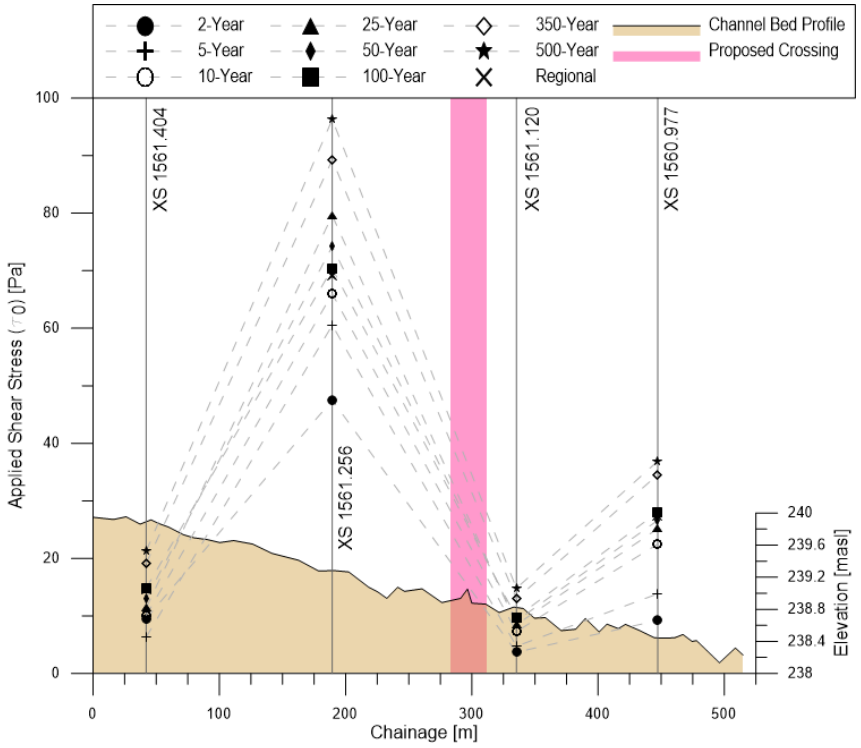


Figure 5: Channel shear stress at HEC-RAS model cross-section locations for range of return period flows.

Figure 6 compares the ranges of critical shear stress for the cohesive bed material against the ranges of applied channel shear stress (1:2-year event to the 1:500-year event) for proposed conditions in the vicinity of the crossing and upstream of the crossing where shear stress in the Study Reach is maximized. The following points summarize the results pertaining to the erosion threshold estimates employed in this study:

- Applied shear stress at the crossing exceeds high erodibility threshold estimates for lower frequency return periods (1:350-year and 1:500-year); however, higher frequency return periods (< 1:350-year) are constrained by the 75th percentile of high erodibility threshold estimates.
- The maximum applied shear stress at the crossing is constrained by the 75th percentile of moderate to low erodibility threshold estimates.
- Applied shear stress at XS 1561.256 (upstream of the proposed crossing) exceeds all erosion threshold estimates (in exception to outlier estimates).

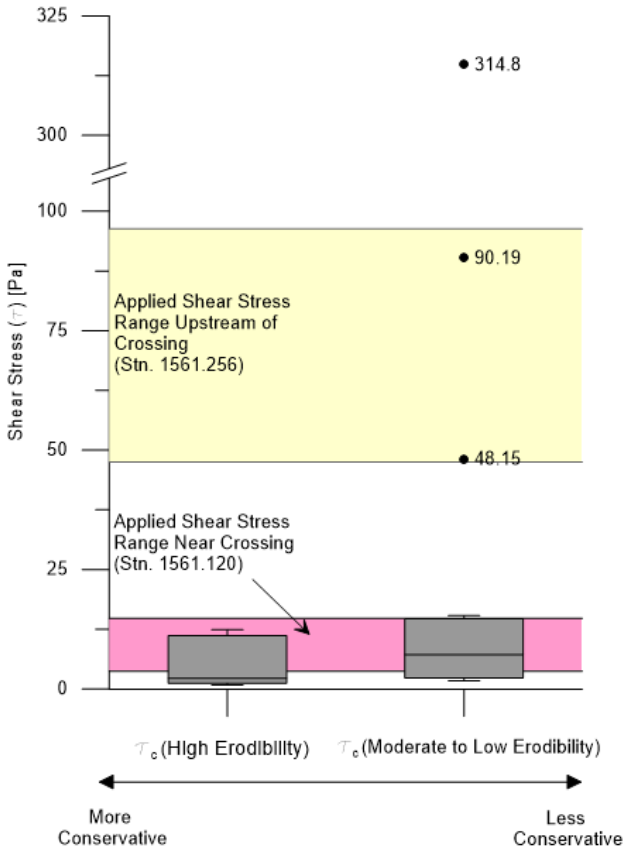


Figure 6: Estimated critical shear stress ranges for cohesive bed material compared to the estimated ranges in applied channel shear stress (1:2-year to Regional) for proposed conditions at crossing location and upstream of crossing (Table 6). Box represents the 25th, 50th and 75th percentiles. Whiskers represent the max and min values. Outliers are indicated by the labelled points.

The high and moderate to low erodibility critical shear stress estimates were used to calculate an envelope of low to high erodibility scour rates. Table 7 summarizes estimated bed scour erosion rates for the minimum and maximum applied shear stress at the crossing location, and the maximum applied shear stress observed across the Study Reach for proposed conditions (Table 6). Scour rate estimates corresponding to the maximum applied shear stress at the crossing location (1:500-year return period) were used to calculate theoretical peak flow durations required to scour the channel bed to a depth of 1 m for proposed conditions, as presented in Table 8. Low erodibility scour rate estimates indicate that bed scour is negligible at the crossing location for all return periods. By comparison, conservative scour rate estimates (high erodibility) suggest storm sewer exposure if the 1:500-year return period peak flow was maintained for a duration of approximately 2.2 days on average (ranging between 0.4 and 5.3 days). The scour estimate derived from average critical shear stress and empirical parameters suggests that a 1:500-year peak flow duration of 53.3 days (ranging from 14.3 to 121.7 days) would be required to achieve a 1 m scour depth. The highest applied shear stress in the Study Reach (XS 1561.256) is approximately 7 times higher than in the vicinity of the crossing. The theoretical peak flow durations resulting in a 1 m scour depth range from less than a day (high erodibility) to 37.6 days (low erodibility), with an average of 1.6 days.

Table 7: Erosion rates (mm/h) for the cohesive bed material. Table shows erosion rates estimated based on the ranges of critical and applied shear stresses in Table 5 and Table 6 respectively.

Applied Shear Stress	Low Erodibility (mm/h)			High Erodibility (mm/h)		
	Method 1	Method 2	Method 3	Method 1	Method 2	Method 3
Minimum at crossing (2-Year; 3.7 Pa)	0	0	0	0.3	4	10
Maximum at crossing (500-Year; 14.8 Pa)	0	0	0	8	98	40
Reach maximum (500-Year; 96.3 Pa)	1	10	0	367	4560	264

Table 8: Theoretical peak flow duration (days) required to scour channel bed to a depth of 1 m at the crossing for proposed conditions (1:500-year return period).

Erodibility	Method 1 (days)	Method 2 (days)	Method 3 (days)
Low Erodibility	N/A	N/A	N/A
High Erodibility	5.3	0.4	1.0
Average Erodibility	121.7	23.9	14.3

5.3. Summary

Erosion thresholds for The Clarkway Tributary cohesive bed material were estimated and channel bed scour was modelled using a variety of available literature and data sources. Low and high erodibility scour rate estimates were derived to identify the potential range and expected degree of erosion with respect to the range of peak flows incorporated into the TRCA HEC-RAS model. Results of the erosion threshold and scour assessment suggest that there is a low risk of bed scour in the vicinity of the proposed storm sewer crossing for post-development conditions. Moderate to low erodibility estimates of critical shear stress and low erodibility scour rates indicate that bed scour is largely negligible at the location of the proposed crossing even for low-frequency return period events. Conservative estimates demonstrate that extremely rare flow conditions are required to occur for extended durations before infrastructure buried at a depth of 1 m below the channel bed in the vicinity of the proposed crossing would be considered at risk of exposure. The maximum channel velocity and shear stress in the Study Reach, upstream of the crossing location (XS 1561.256) for proposed conditions, would still require an extremely rare flow event to occur for an average of 1.6 days to result in an exposure risk for the proposed storm sewer.

The results of the erosion threshold and scour assessment are supported by field assessment observations and historical analysis. Although the Clarkway Tributary was originally channelized (as seen in aerial photography captured in 1961), the stream corridor has since expanded to encompass a wide vegetated riparian zone that improves erosive energy dissipation and is considered a low-energy system. The at-a-station hydraulic analysis reveals that the Study Reach flow regime aligns with the regional expectation of rural streams in Southern Ontario. No evidence of systemic erosion was observed during the field assessment.

5.4. Assumptions and Limitations

This erosion threshold and scour assessment is limited to the specific channel geometry corresponding to the cut-fill configuration proposed by The Odan/Detech Group Inc. as presented within the TRCA post-development HEC-RAS model dated 2020-07-24. The proposed regrading in the vicinity of the crossing increases energy dissipation by increasing the floodplain connectivity, thus reducing erosion potential at this location. If the cut-fill configuration of the proposed development is modified, the hydraulic parameters used to inform the scour assessment would change and would need to be re-evaluated. This assessment is also limited by the lack of site-specific geotechnical information. As a result, erosion threshold and scour rate estimates were calculated using soil material properties obtained from literature sources (Exp Services Inc., 2019; White, 1975). Although literature values pertain to the Wildfield till geologic unit present at the study site, soil material properties can vary significantly on a local scale even for the same general parent material (Hanson and Simon, 2001; Khan, 2006; Shugar et al., 2007; Briaud, 2008). To account for material variability and uncertainty associated with estimating scour in cohesive material, this study employed an envelope approach where the range of potential scour estimates were evaluated based on the range of material properties, applied forces and empirical parameters with conservative assumptions.

5.5. Recommendations for Bed Protection

This scour assessment evaluated the scour potential for the Study Reach at the location of the proposed crossing. Although the scour assessment indicates the reach has a low scour risk, disturbance to the native material during the construction of the sewer crossing can change the properties of the disturbed material near the crossing. As such, it is recommended that erosion risk be mitigated by limiting the area of streambed disturbance during construction and the placement of targetted erosion protection at the crossing location. Erosion protection comprised of a roundstone mixture and riparian plantings is recommended at the storm sewer crossing. Given the well-vegetated conditions of the Clarkway Tributary, it is expected that vegetation will re-establish in the channel throughout the erosion protection measures to provide additional erosion resistance and blend with the existing corridor. A recommended roundstone gradation is provided below (Table 9). This stone should be placed on top of the sewer backfill material to a depth of 300 mm and keyed into the riverbanks.

Table 9: Proposed roundstone gradation for erosion protection at proposed sewer crossing.

%Finer	Size (mm)
100	230
80	180
50	150
20	100
10	Pit Run

6. Conclusions and Recommendations

A fluvial geomorphology and erosion hazard assessment was conducted for a portion of the Clarkway Tributary located near 8281 Healey Road, Bolton, Ontario. The objectives of this assessment were to characterize the existing geomorphological conditions of the watercourse near the proposed crossing and to estimate erosion potential for a range of flows. Key conclusions and recommendations of the assessment are as follows:

- The Study Reach is characterized as a wide unconfined swale that is dominated by heavy vegetation growth and contains a poorly defined channel. Historical aerial photography reveals that the Study Reach was previously channelized (1961 photography). The stream corridor has since expanded to encompass a wide, vegetated riparian zone that is isolated from adjacent agricultural activities.
- Lateral bank erosion was noted along the right bank of the upstream segment of the Study Reach; however, observed instances were localized and not indicative of systemic instability.
- The Study Reach flow regime aligns with the regional expectation of rural streams in Southern Ontario, suggesting that the watercourse has not undergone considerable adjustment and maintains a frequent floodplain connection.
- Scour modelling results suggest that anticipated bed scour rates would pose a low risk to infrastructure buried at a depth of 1 m below the channel bed in the vicinity of the proposed crossing for post-development conditions. Moderate to low erodibility estimates of critical shear stress and low erodibility scour rates indicate that bed scour is largely negligible at the location of the proposed crossing even for low-frequency return period events. Conservative estimates demonstrate that extremely rare flow conditions are required to occur for extended durations before infrastructure buried at a depth of 1 m below the channel bed in the vicinity of the proposed crossing would be considered at risk of exposure.
- The cut-fill configuration in the vicinity of the proposed storm sewer crossing includes cutting material from the river-left valley. This action is expected to disturb the cohesive properties of the channel bed material and potentially increase the risk of channel bed scour in the vicinity of the proposed crossing. Furthermore, the installation of the storm sewer crossing may involve construction activities that directly disturb the channel bed, which would further degrade the cohesive properties of the channel bed material and increase the risk of channel bed scour. As a result, it is recommended that channel bed protection is incorporated into the proposed crossing design.

7. References

Annable, W. K. (1996) "Morphological Relationships of Rural Watercourses in Southern Ontario and Selected Field Methods in Fluvial Geomorphology", *Ontario Ministry of Natural Resources*.

Briaud, J. L. (2008) "Case Histories in Soil and Rock Erosion: Woodrow Wilson Bridge, Brazos River Meander, Normandy Cliffs, and New Orleans Levees", *Journal of Geotechnical and Geoenvironmental Engineering, 134*(10), 1425-1447.

Federal Highway Administration (2012) "Evaluating Scour at Bridges", Hydraulic Engineering Circular No. 18. U.S. Department of Transportation.

Federal Highway Administration (2015) "Scour in Cohesive Soils", Publication No. FHWA-HRT-15-033. U.S. Department of Transportation.

Fischenich, C. (2001) "Stability Thresholds for Stream Restoration Materials" EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-29), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Grabowski, R. C. (2014) "Measuring the shear strength of cohesive sediment in the field", Geomorphological Techniques, Part 1, British Society for Geomorphology.

Hanson, G. J. and K. R. Cook (2004) "Apparatus, Test Procedures, and Analytical Methods to Measure Soil Erodibility In Situ", *Applied Engineering in Agriculture, 20*(4), 455-462.

Hanson, G. J. and A. Simon (2001) "Erodibility of cohesive streambeds in the loess area of the midwestern USA" *Hydrological Processes, 15*, 23-38.

Julian, J. P. and R. Torres (2006) "Hydraulic erosion of cohesive riverbanks", *Geomorphology, 76*, 193-206.

Khan, I. R. (2006) "Determining the erodibility of cohesive glacial till bed sediments in the Toronto Region", Master of Science Thesis, University of Guelph.

Shugar, D., R. Kostaschuk, P. Ashmore, J. Desloges, L. Burge (2007) "In situ jet-testing of the erosional resistance of cohesive streambeds", *Canadian Journal of Civil Engineering, 34*, 1192-1195.

Smerdon, E. T. and R. P. Beasley (1961) "Critical tractive forces in cohesive soil.", *Agricultural Engineering*, 42(1), 26-29.

The Odan/Detech Group Inc. (2020) "Functional Servicing Report and Stormwater Management Design Brief", Prepared for 8281 Healey Road GP Limited c/o One Properties, July, 2020.

White, O.L. 1975. Quaternary geology of the Bolton Area, Southern Ontario; Ontario Div. of Mines, GR 117, 119p. Accompanied by Maps 2275 and 2276, scale 1 inch to 1 mile.

8281 Healey Road Development
Fluvial Geomorphology and Erosion Hazard Assessment

Prepared for 8281 Healey Road Properties GP Ltd
c/o One Properties

February 1, 2021

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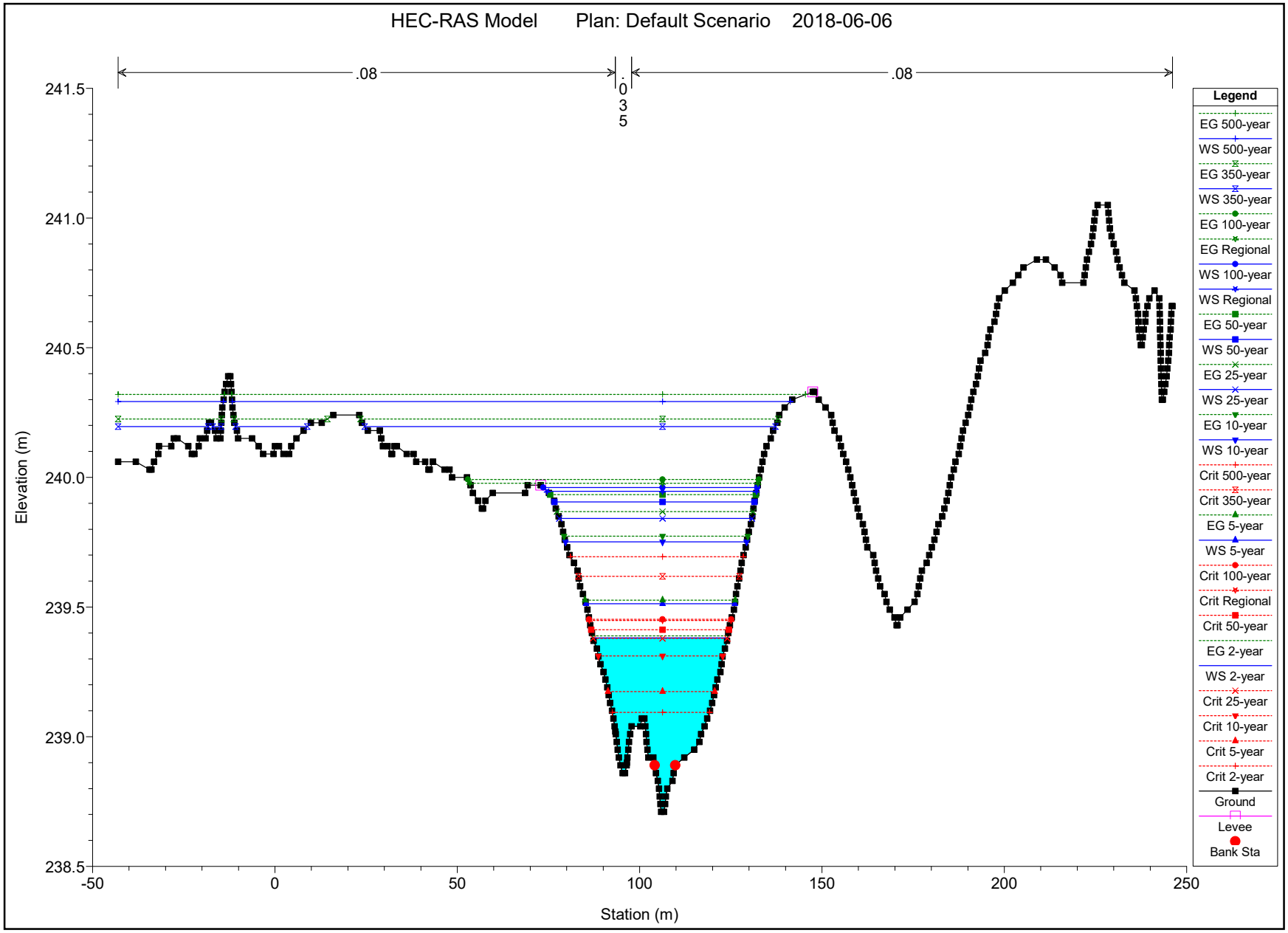
Project Number P2020-486

Appendix A

TRCA HEC-RAS Model Cross-Sections


HEC-RAS Model Plan: Default Scenario 2018-06-06
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Elevation (m)
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239.0
238.5
-50
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50
100
150
200
250
Station (m)
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WS 500-year
EG 350-year
WS 350-year
EG 100-year
EG Regional
WS 100-year
WS Regional
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 10-year
WS 10-year
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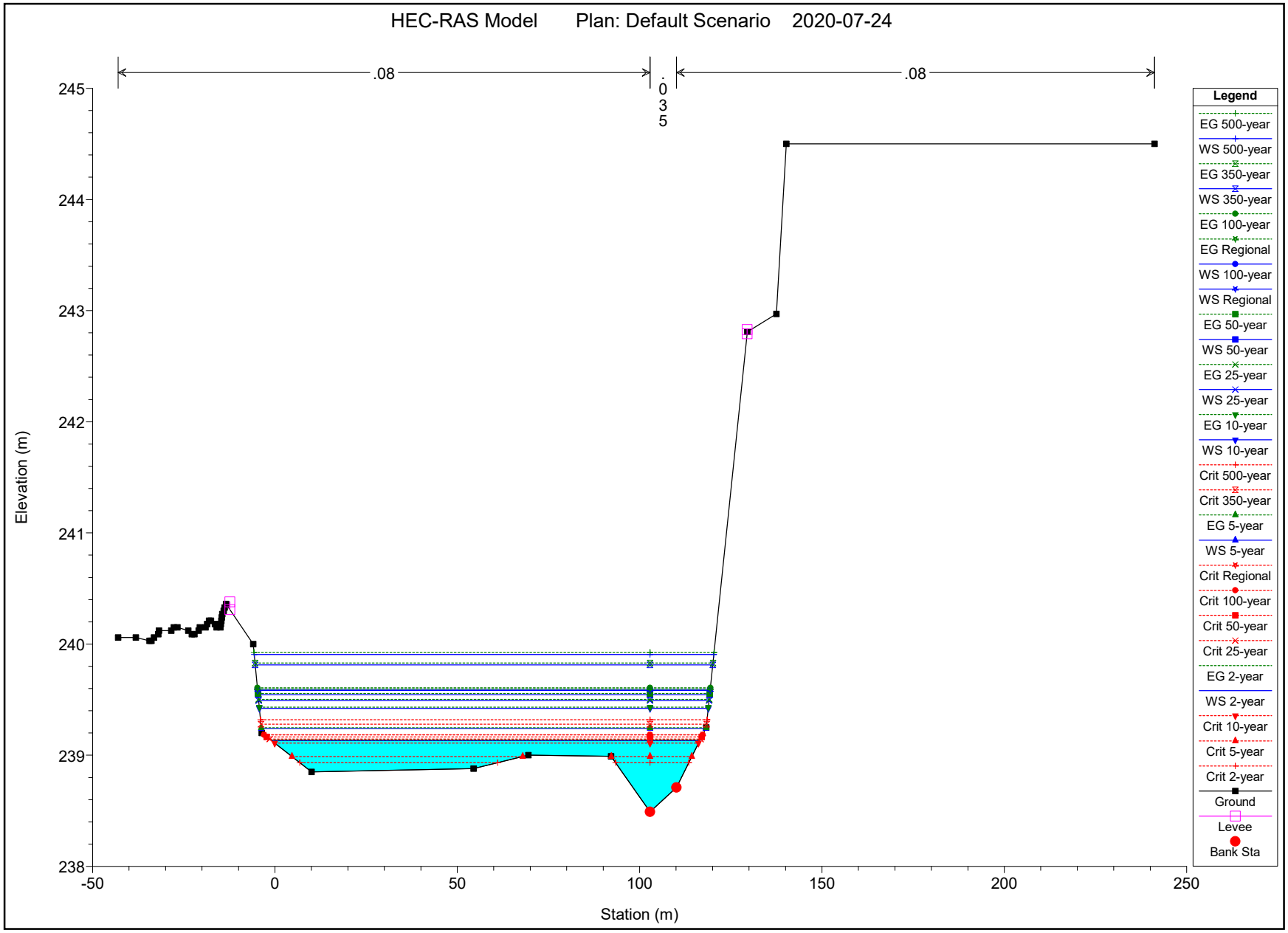
HEC-RAS Model Plan: Default Scenario 2020-07-24
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Elevation (m)
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Station (m)
Legend
EG 500-year
WS 500-year
EG 350-year
WS 350-year
EG 100-year
EG Regional
WS 100-year
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END

GEOPROCESS FLUVIAL GEOMORPHOLOGY AND EROSION HAZARD ASSESSMENT

APPENDIX D

- Cole Engineering HEC-RAS Flood Plain Mapping Program - Sheet No. 172
- HEC-RAS Cross Sections (Fig. XSEC)

4 857 500 m N
601 900 m E

4 865 900 m N
602 900 m E

NOTE: The information contained within this area was obtained from AIM Corporate as part of a flood study for Coleraine West Employment Lands, zoned by-law amendment and site specific permits. For detailed mapping please refer to CFN 56416, 58441

STUDY LIMIT

MATCHLINE HUMBER SHEET 171

4 856 700 m N
601 100 m E

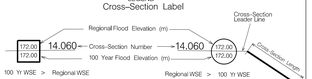
4 865 400 m N
602 000 m E

1561.782 — 245.68 / 245.68
1561.699 — 243.15 / 242.85
1561.551 — 241.68 / 241.68
1561.404 — 240.14 / 241.02
1561.256 — 240.68 / 240.68
1561.120 — 239.68 / 239.68
1560.977 — 239.71 / 239.71
12387 — 255.65
12315 — 237.98
12332 — 255.68

REVISIONS

NO.	DESCRIPTION	BY	DATE
1	Topographic and hydraulic data (cross sections 1560,547-1560,820 and 1550,495-1550,874) removed, This data was replaced with the hydraulic data from flood study relating to Coleraine West Employment lands, Please refer to CFN 56416, 58441 for details.	MDT	2018-06-11

LEGEND
Cross-Section Label



REGULATORY FLOOD ELEVATION IS THE HIGHER OF THE TWO ELEVATIONS DISPLAYED

LEGEND

Contour Index
Contour 1 metre
Contour 0.5 metre
Contour Label — 100
Spot Elevation — 100.10
Road
Parking Lot / Large Driveway
Rail Line
Bridge / Large Culvert
Water Feature
Ditch
Marsh
Building
Regulatory Flood Line

The elevation data on this map was produced by TRCA from a DEM with 1.0 m grid resolution. The DEM was created using mass points with a vertical accuracy tolerance of +/- 0.10m RMSE on hard flat surfaces. The mass points were collected using LiDAR flown in 2014 by Airborne Imaging.

The planimetric data on this map was compiled from a variety of sources of different vintage and may not match with the elevation dataset. This data is for reference only.

Building footprints were acquired from Peel Region in 2017.

The vertical datum is mean sea level as established by the Geodetic Survey of Canada, CGVD 1928-1978 Ontario Adjusted Version

The horizontal datum is North American Datum 1983, U.T.M. 6° projection Zone 17, Central Meridian 81° W.

Grid interval 100 metres.

PLEASE NOTE:
FLOODLINE ELEVATIONS ARE SUBJECT TO CHANGE DUE TO REVISED INFORMATION.

Elevation Data provided by

AIRBORNE IMAGING
A Clean Harbors Company

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.8161 / 905.940.8161 F:905.940.2064

PLEASE NOTE:
THE PROFESSIONAL ENGINEER'S STAMP VERIFIES THE FLOOD PLAIN MAPPING ONLY. DATA NOT THE MAP DETAIL UNLESS OTHERWISE NOTED

I, LEONARD PROFESSIONAL ENGINEER, O.F. SANDERS, PROVINCE OF ONTARIO

FLOOD PLAIN MAPPING PROGRAM

FLOODLINE APPROVED DATE: 2018-05-18

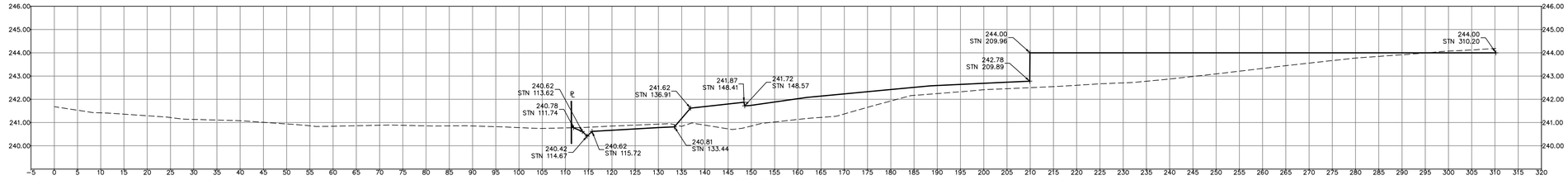
Toronto and Region Conservation for The Living City
5 Shoreham Drive Downsview Ontario M3N 1S4 (416) 661-6600

Scale 1:2000

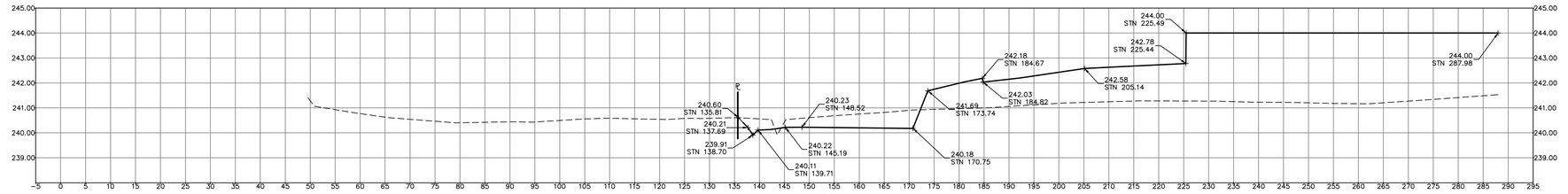
100 0 100 200 Metres
200 0 200 400 600 800 1000 Feet

HUMBER RIVER

SHEET No. 172



SECTION 1561.551



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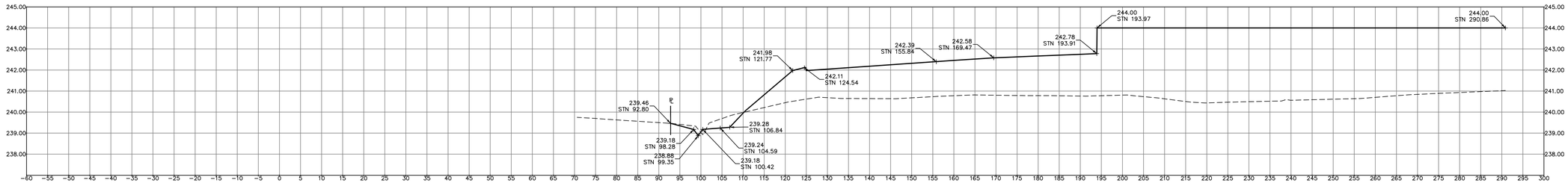

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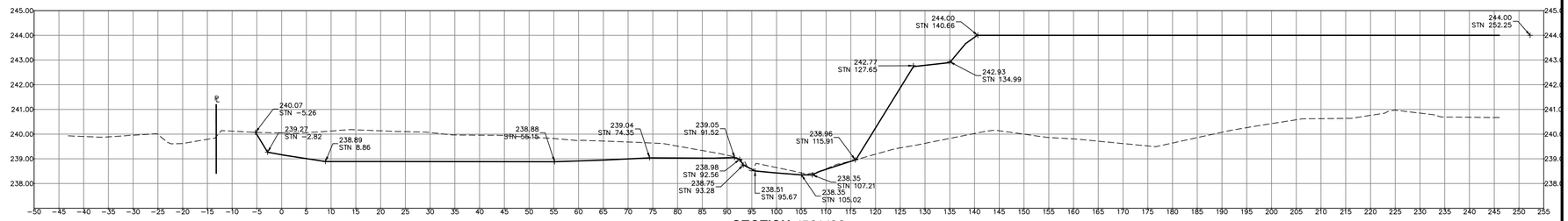

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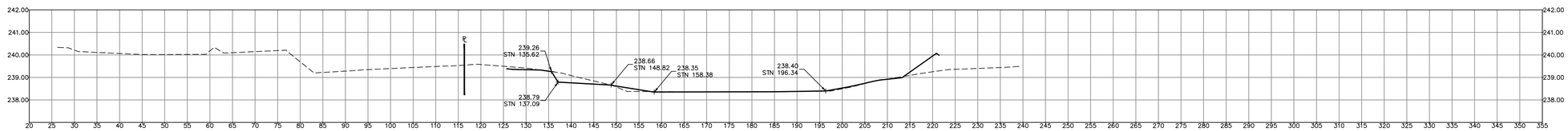

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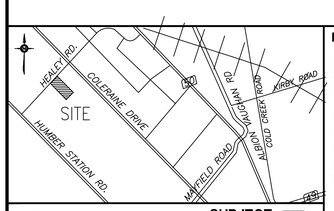


KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

NOTES:

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND UNDERGROUND AND ABOVE GROUND UTILITIES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING THE WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCY TO THE ARCHITECTS/ENGINEERS BEFORE PROCEEDING WITH THE WORKS.

ALL DRAWINGS AND SPECIFICATIONS ARE INSTRUMENTS OF SERVICE AND THE PROPERTY OF THE ENGINEER WHICH MUST BE RETURNED AT THE COMPLETION OF WORK.

THIS DRAWING IS NOT TO BE SCALED.

THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S CONTRACTOR FROM OBTAINING, BUT NOT LIMITED TO THE FOLLOWING PERMITS: ROAD CUT, SEWER PERMITS, RELOCATION OF SERVICES, ENCROACHMENT AGREEMENTS, APPROACH APPROVAL PERMITS, ETC..

EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY R. AVIS SURVEYING INC.

BOUNDARY DATA DERIVED FROM INFORMATION FROM R. AVIS SURVEYING INC.

BENCH MARK:
ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM THE TOWN OF CALEDON BENCHMARK No. 758056.

ELEVATION:
PUBLISHED ELEVATION - 251.283 metres.

BEARING NOTE:
BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE REFERRED TO THE NORTHEASTERLY LIMIT OF PART 1 AS SHOWN ON PLAN 43R-30545, HAVING A BEARING OF N45°52'40"W.

METRIC NOTE:
DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
1	1ST SUBMISSION	JULY 31/20	M.H.H.
2	ISSUED FOR COORDINATION	FEB 8/21	M.H.H.
3	2ND SUBMISSION	MAR 5/21	M.H.H.

PROJECT:
PROPOSED INDUSTRIAL DEVELOPMENT
8281 HEALEY ROAD
CALEDON, ONTARIO

CITY FILE: RZ 2020-0007

CLIENT :
8281 HEALEY ROAD GP LIMITED
c/o ONE PROPERTIES
333 BAY ST SUITE 2710,
TORONTO, ON. M5H 2R2

ODAN·DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE: H: 1:500 V: 1:100
PROJECT NO: 19233
DATE: JUNE 2020
SCALE:

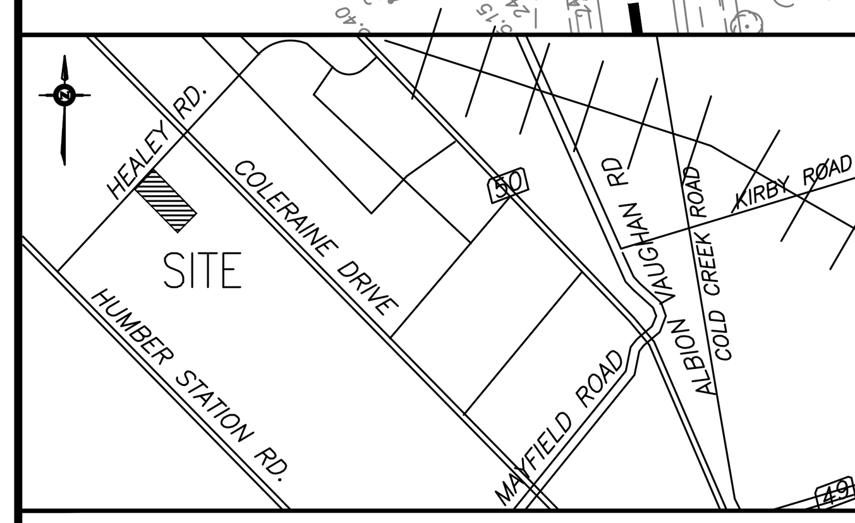
DRAWING :
HEC-RAS FLOODPLAIN CROSS-SECTIONS

REGISTERED PROFESSIONAL ENGINEER
I. KRPAN
MAR 5/21
PROVINCE OF ONTARIO
ENGINEER

DESIGN BY: M.H.H.
DRAWN BY: S.B.
CHECKED BY: J.K.
APPROVED BY: J.K.
DRWG. NO.: FIG.-XSEC

APPENDIX E

- Concept Grading (Fig. SG)
- Topographic Survey



KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

NOTES:

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND UNDERGROUND AND ABOVE GROUND UTILITIES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING THE WORK THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

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EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY R. AVIS SURVEYING INC.

BOUNDARY DATA DERIVED FROM INFORMATION FROM R. AVIS SURVEYING INC.

BENCH MARK:
ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM THE TOWN OF CALEDON BENCHMARK No. 758056.

ELEVATION:
PUBLISHED ELEVATION - 251.263 metres.

BEARING NOTE:
BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE REFERRED TO THE NORTHEASTERLY LIMIT OF PART 1 AS SHOWN ON PLAN 43R-30545, HAVING A BEARING OF N45°52'40"W.

METRIC NOTE:
DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
1	1ST SUBMISSION	JULY 31/20	M.H.H.
2	ISSUED FOR COORDINATION	FEB 8/21	M.H.H.
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PROJECT:
PROPOSED INDUSTRIAL DEVELOPMENT
8281 HEALEY ROAD
CALEDON, ONTARIO

CITY FILE: RZ 2020-0007

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The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE: 1: 750 | PROJECT NO: 19233 | DATE: JUNE 2020
SCALE:

DRAWING :
8281 HEALEY ROAD
CONCEPT SITE GRADING

REGISTERED PROFESSIONAL ENGINEER
I. KRPAN
MAR 5/21
PROVINCE OF ONTARIO
ENGINEER

DESIGN BY: M.H.H.
DRAWN BY: S.B.
CHECKED BY: J.K.
APPROVED BY: J.K.
DRWG. NO.: **FIG. SG**

TOPOGRAPHY SURVEY OF

PART OF LOT 5
CONCESSION 5

(GEOGRAPHIC TOWNSHIP OF ALBION)

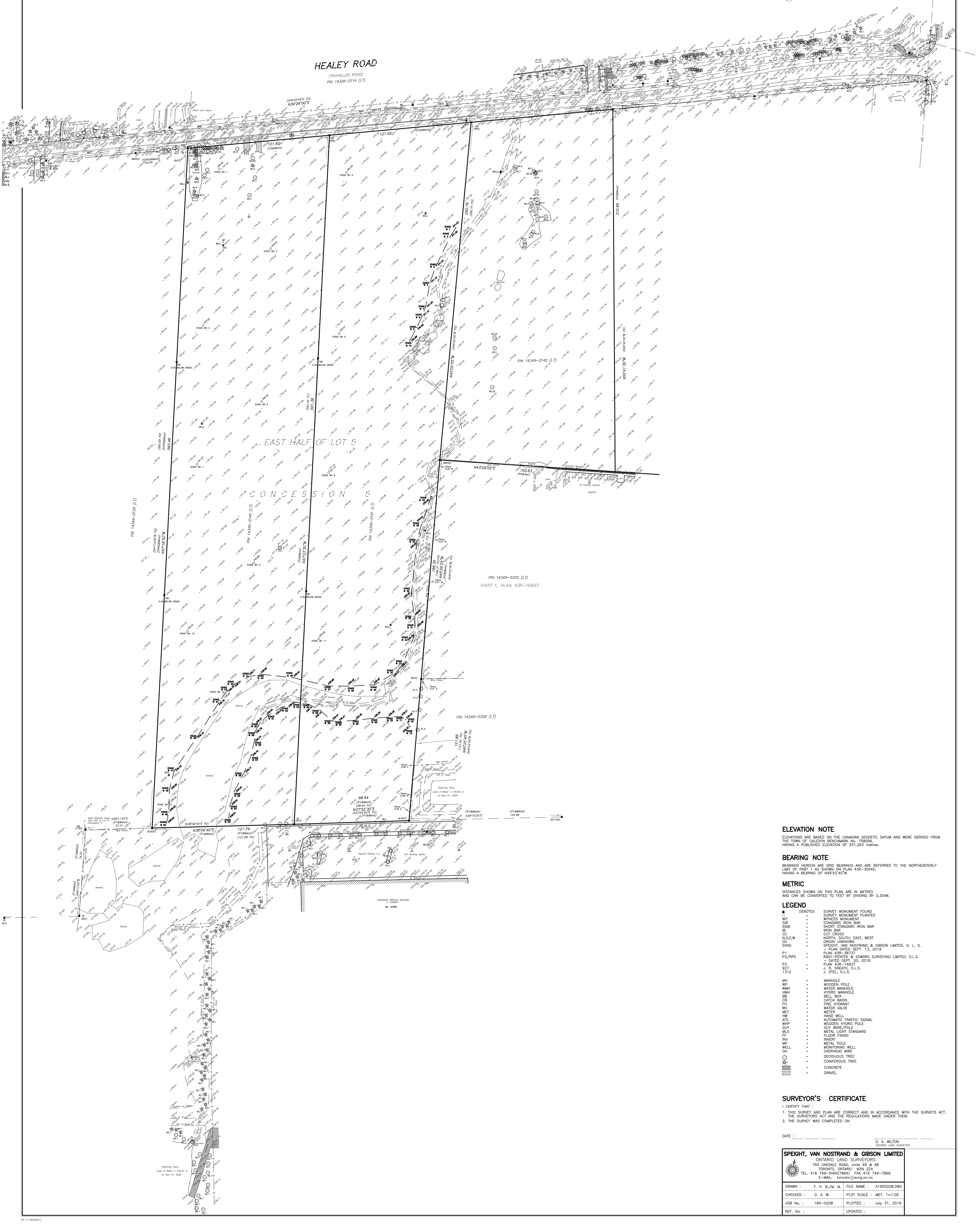
TOWN OF CALEDON

REGIONAL MUNICIPALITY OF PEEL

SCALE 1 : 1000

10 0 10 20 30 40 50 60 70 80 90 100 metres

SPEIGHT, VAN NOSTRAND & GIBSON LIMITED
ONTARIO LAND SURVEYORS
2020



ELEVATION NOTE

ELEVATIONS ARE BASED ON THE CANADIAN GEODETIC DATUM AND WERE DERIVED FROM THE TOWN OF CALEDON BENCHMARK No. 758056, HAVING A PUBLISHED ELEVATION OF 251.263 metres.

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS AND ARE REFERRED TO THE NORTHEASTERLY LIMIT OF PART 1 AS SHOWN ON PLAN 43R–30545, HAVING A BEARING OF N45°52'40"W.

METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
□	"	SURVEY MONUMENT PLANTED
WIT	"	WITNESS MONUMENT
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
IB	"	IRON BAR
CC	"	CUT CROSS
N,S,E,W	"	NORTH, SOUTH, EAST, WEST
OU	"	ORIGIN UNKNOWN
SVNG	"	SPEIGHT, VAN NOSTRAND & GIBSON LIMITED, O. L. S. – PLAN DATED SEPT. 13, 2019
P1	"	PLAN 43R–38737
P2/RPE	"	RADY–PENTEK & EDWARD SURVEYING LIMITED, O.L.S. – DATED SEPT. 20, 2018
P3	"	PLAN 43R–16937
927	"	J. R. SNEATH, O.L.S.
1312		J. STEL, O.L.S.
MH	"	MANHOLE
WP	"	WOODEN POLE
WMH	"	WATER MANHOLE
HMH	"	HYDRO MANHOLE
BB	"	BELL BOX
CB	"	CATCH BASIN
FH	"	FIRE HYDRANT
WV	"	WATER VALVE
MET	"	METER
HW	"	HAND WELL
ATS	"	AUTOMATIC TRAFFIC SIGNAL
WHP	"	WOODEN HYDRO POLE
GUY	"	GUY WIIRE/POLE
MLS	"	METAL LIGHT STANDARD
FF	"	FLOOR FINISH
INV	"	INVERT
MP	"	METAL POLE
WELL	"	MONITORING WELL
OH	"	OVERHEAD WIRE
(deciduous tree symbol)	"	DECIDUOUS TREE
(coniferous tree symbol)	"	CONIFEROUS TREE
(concrete hatch)	"	CONCRETE
(gravel hatch)	"	GRAVEL

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON

DATE : ____________

D. A. WILTON
ONTARIO LAND SURVEYOR

SPEIGHT, VAN NOSTRAND & GIBSON LIMITED
ONTARIO LAND SURVEYORS
750 OAKDALE ROAD, Units 65 & 66
TORONTO, ONTARIO M3N 2Z4
TEL. 416 749–SVNG(7864) FAX 416 749–7866
E–MAIL: toronto@svng.on.ca

DRAWN :	F. P. B./M. M.	FILE NAME :	A1900208.DWG
CHECKED :	D. A. W.	PLOT SCALE :	MET. 1=1.00
JOB No. :	190–0208	PLOTTED :	July 31, 2019
REF. No. :		UPDATED :	

A0 (1189x841)