

MEX Developments Inc.

# Servicing Brief

Proposed Residential Subdivision Development,  
Harriston

Kim Pilon, P.Eng.  
4-22-2021

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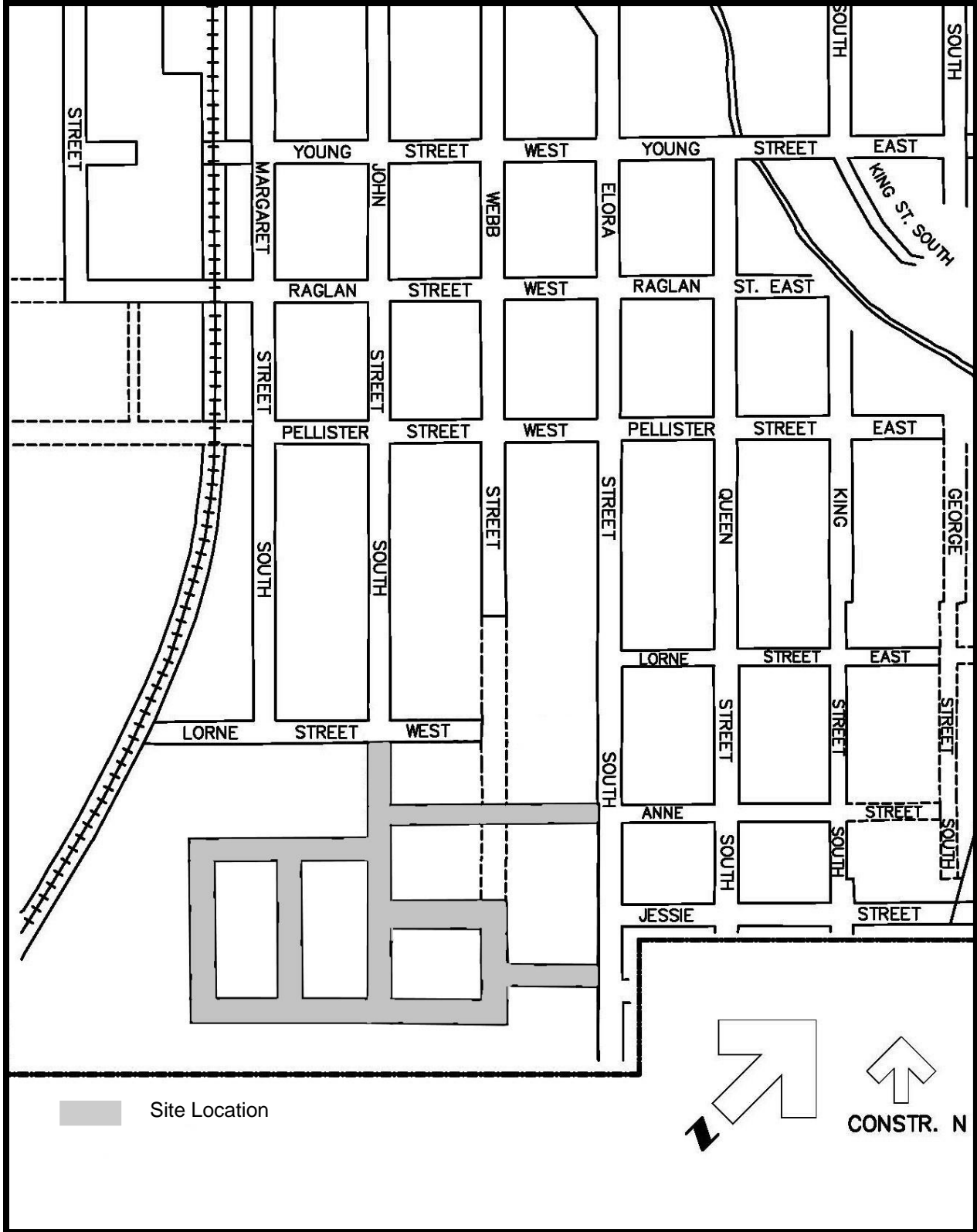
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## **1.0 Introduction**

MEX Developments Inc. is proposing to develop the vacant lands at the southeast end of Harriston and is submitting this servicing brief to review current municipal services available to the site and to identify in general, the availability and/or inadequacies of such services for the proposed multiple residential development of the existing undeveloped parcel. See **Figure 1.1** overleaf for a general site location drawing.



RR#3, 6297 WELLINGTON COUNTY ROAD 109 S  
 HARRISTON, ON, N0S 1Z0  
 PHONE: 519-510-3571 FAX: 519-510-3277  
 WWW.MOOREFIELD.CA

PROJECT:

Harriston Subdivision

TITLE:

Site Location Plan

SCALE: NTS

DATE: Jan 2020

PROJECT NO: 191-103

DRAWING NO:

GEN-1

## 2.0 Property Description

The subject property known as Parts 1, 2 and 5 of Part of Lot 88, Concession D and Part 3 and 4 of Part of Park Lots E and F, Preston's Survey 'D', Village of Harriston, Town of Minto, County of Wellington referenced on the Plan of Survey 61R-21663 by Wilson Ford Surveying and Engineering and can be found overleaf as – **Figure 2.1**, is 10.53 ha, and has frontage on Elora Street through Part 1 – 18 (see **Figure 2.2** for severance R Plan 61R21745). Another Elora street frontage through Part 2 of 56.02m. The property also has access to the future John Street right-of-way extension, Part 6 of Plan 61R-20828. The property is at the south west limit of the town boundary.

The original site ground profile has a gentle gradient towards Dredge Creek at the south west end of the property. Currently the site use consists of some agricultural land as well as vacant land slated for future development.

To the north and west of the property exists single-family dwellings. To the south and east exists agricultural land.

The zoning is currently FD – Future Development. Proposed zoning is R2 Residential. The proposed site will consist of 126 units.

Per the Ontario Soils Survey Report No. 35 for Wellington County the site is composed of Harriston and Listowel loam till, grey-brown podzolic and is classified as soil group AB. The water table is expected to be at equal level to that of Dredge Creek.

Site fill is proposed in order to ensure floodproofing of basements is not required. The floodplain elevation for the area is 382.161. In consultation with the conservation authority, basement floor elevations are to be above 382.161 at the south west corner of the property and 382.309 at the south corner.

PLAN OF SURVEY OF  
**PART OF LOT 88, CONCESSION "D" (MINTO)**  
**PART OF PARK LOTS E & F PRESTON'S SURVEY "D" (MINTO)**  
 (TOWN OF HARRISTON)  
**PART OF LOT 88, CONCESSION "D"**  
 (GEOGRAPHIC TOWNSHIP OF MINTO)  
 TOWN OF MINTO  
 COUNTY OF WELLINGTON  
 WILSON-FORD

Scale 1:600  
 0 6 12 24 Metres

METRIC CONVERSION  
 DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES  
 AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

I REQUIRE THIS PLAN TO BE  
 DEPOSITED UNDER THE  
 LAND TITLES ACT AND THE  
 REGISTRY ACT.

PLAN 61R-21663  
 RECEIVED AND DEPOSITED  
 DATE: Aug 29, 2019

AUGUST 27, 2019

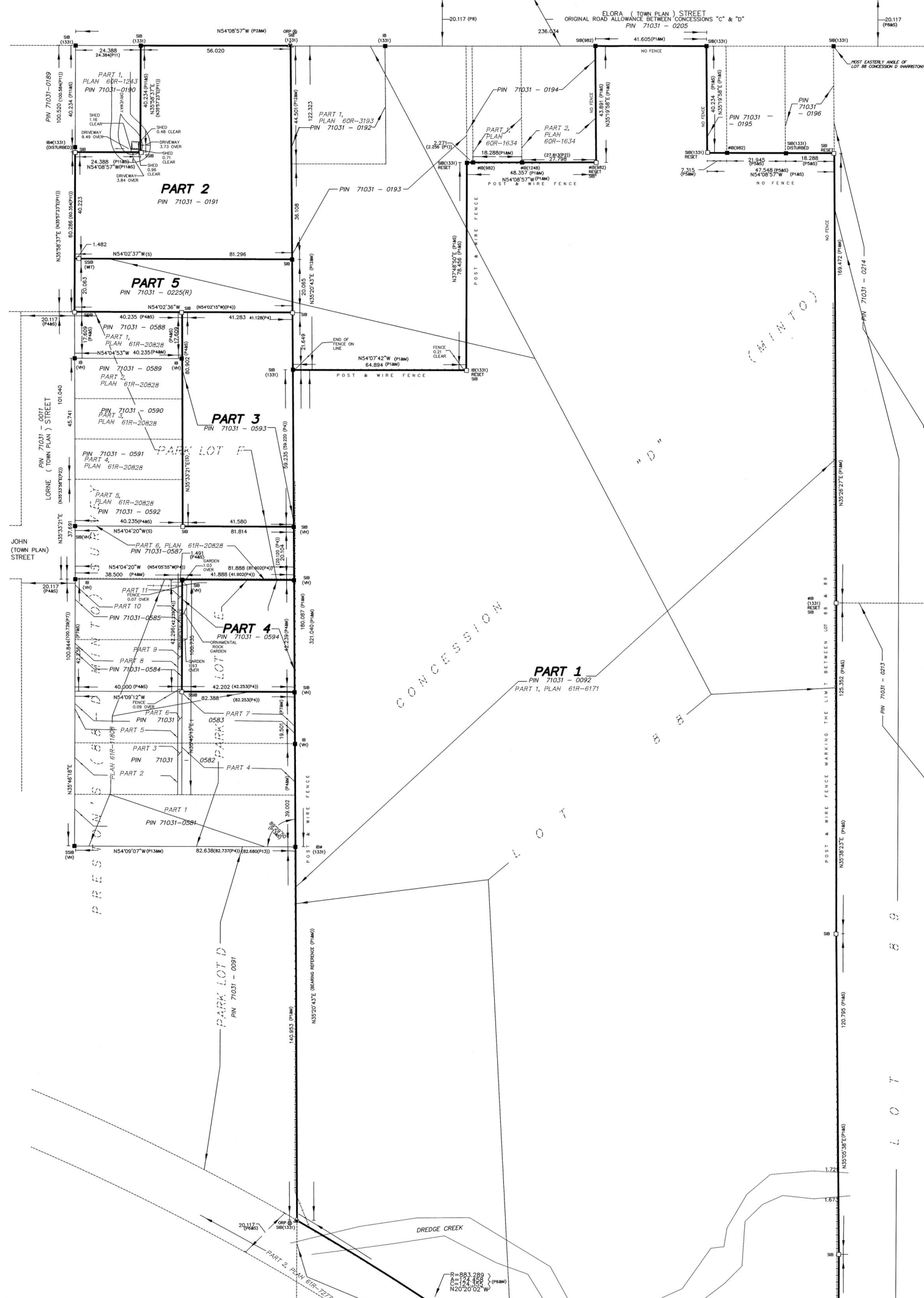
GREG FORD, P. ENG. (CIVIL)  
 ONTARIO LAND SURVEYOR

REPRESENTATIVE FOR THE LAND  
 REGISTRAR FOR THE LAND TITLES  
 AND REGISTRY DIVISION OF  
 WELLINGTON (NO.61)

SCHEDULE - LAND TITLES			
PART	LOT	CON/ SURVEY	PIN
1	PART OF 88 (HARRISTON)	"D" (MINTO)	ALL OF 71031-0092
2	PART OF 88 (MINTO)	"D"	ALL OF 71031-0191
3	PART OF PARK LOT F	PRESTON'S "D" (MINTO)	ALL OF 71031-0593
4	PART OF PARK LOT E	PRESTON'S "D" (MINTO)	ALL OF 71031-0594

SCHEDULE - REGISTRY			
PART	LOT	PIN	
5	PART OF 88 (MINTO)	"D"	ALL OF 71031-0225(R)



**BEARING NOTE**  
 BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010).  
 FOR BEARING COMPARISONS, THE FOLLOWING ROTATIONS WERE USED:

PLAN	ROTATION
P1, P2, P3, P4, P5, P6, P7, P9, P10, P11, P12 & P13	1°33'57" CCW
P8	0°05'42" CCW

DISTANCES ON THIS PLAN ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999946.

OBSERVED REFERENCE POINTS (ORP'S) DERIVED FROM GPS OBSERVATIONS USING THE TOPNET NETWORK (RTN) UTM ZONE 17, NAD83 (CSRS) (2010)

POINT ID	NORTHING	EASTING
ORP (A)	4 861 654.132	511 119.779
ORP (B)	4 861 292.631	510 863.380

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

- LEGEND**
- DENOTES FOUND MONUMENTS
  - SET MONUMENTS
  - IRON BAR
  - STANDARD IRON BAR
  - SHORT STANDARD IRON BAR
  - OBSERVED REFERENCE POINT
  - PROPERTY IDENTIFICATION NUMBER - ALL PINS SHOWN ARE LAND TITLES UNLESS NOTED OTHERWISE
- P1 PLAN 61R-6171
  - P2 PLAN 60R-1634
  - P3 PLAN 60R-1266
  - P4 PLAN 61R-2082B
  - P5 ARW, OLS, PROJECT 76-683
  - P6 PLAN 61R-11600
  - P7 PLAN 61R-11608
  - P8 PLAN 60R-2916
  - P9 PLAN 61R-8155
  - P10 PLAN 61R-7277
  - P11 PLAN 60R-1243
  - P12 PLAN 60R-3183
  - P13 ARW, OLS, PROJECT 74-324
- ALL BEARINGS AND DISTANCES SHOWN HEREON ARE MEASURED UNLESS INDICATED OTHERWISE

**SURVEYOR'S CERTIFICATE**

I CERTIFY THAT:  
 1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEY ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.  
 2. THE SURVEY WAS COMPLETED ON THE 13th DAY OF AUGUST, 2019.

AUGUST 15, 2019  
 DATE

GREG FORD, P. ENG. (CIVIL)  
 ONTARIO LAND SURVEYOR

**WILSON - FORD**  
 Surveying & Engineering  
 120 KING ST. E., Box 294,  
 MOUNT FOREST ON, N0G 2L0  
 PHONE (519)323-2451  
 PROJECT No: 19-0104 MOREFIELD EXCAVATIONS

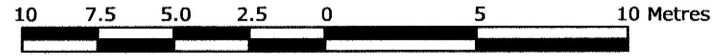
FIGURE 2.1

PLAN OF SURVEY OF  
**PART OF LOT 88,**  
**CONCESSION D (MINTO)**  
**(TOWN OF HARRISTON)**  
**TOWN OF MINTO**  
**COUNTY OF WELLINGTON**  
**WILSON-FORD**

**METRIC CONVERSION**

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

Scale 1 : 250



**LEGEND**

- DENOTES FOUND MONUMENTS
  - DENOTES SET MONUMENTS
  - IB IRON BAR
  - SIB STANDARD IRON BAR
  - SSIB SHORT STANDARD IRON BAR
  - ▲ OBSERVED REFERENCE POINT
  - PIN PROPERTY IDENTIFICATION NUMBER - ALL PINS SHOWN ARE LAND TITLES UNLESS NOTED OTHERWISE
  - P1 PLAN 61R-21663
  - P2 PLAN OF SURVEY BY ALEX R. WILSON, OLS, PROJECT 76-683
- ALL BEARINGS AND DISTANCES SHOWN HEREON ARE MEASURED UNLESS INDICATED OTHERWISE

I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.

31 JANUARY, 2020

GREG FORD, P.Eng (CIVIL)  
 ONTARIO LAND SURVEYOR

PLAN 61R-21745

RECEIVED AND DEPOSITED

DATE: Feb. 4, 2020

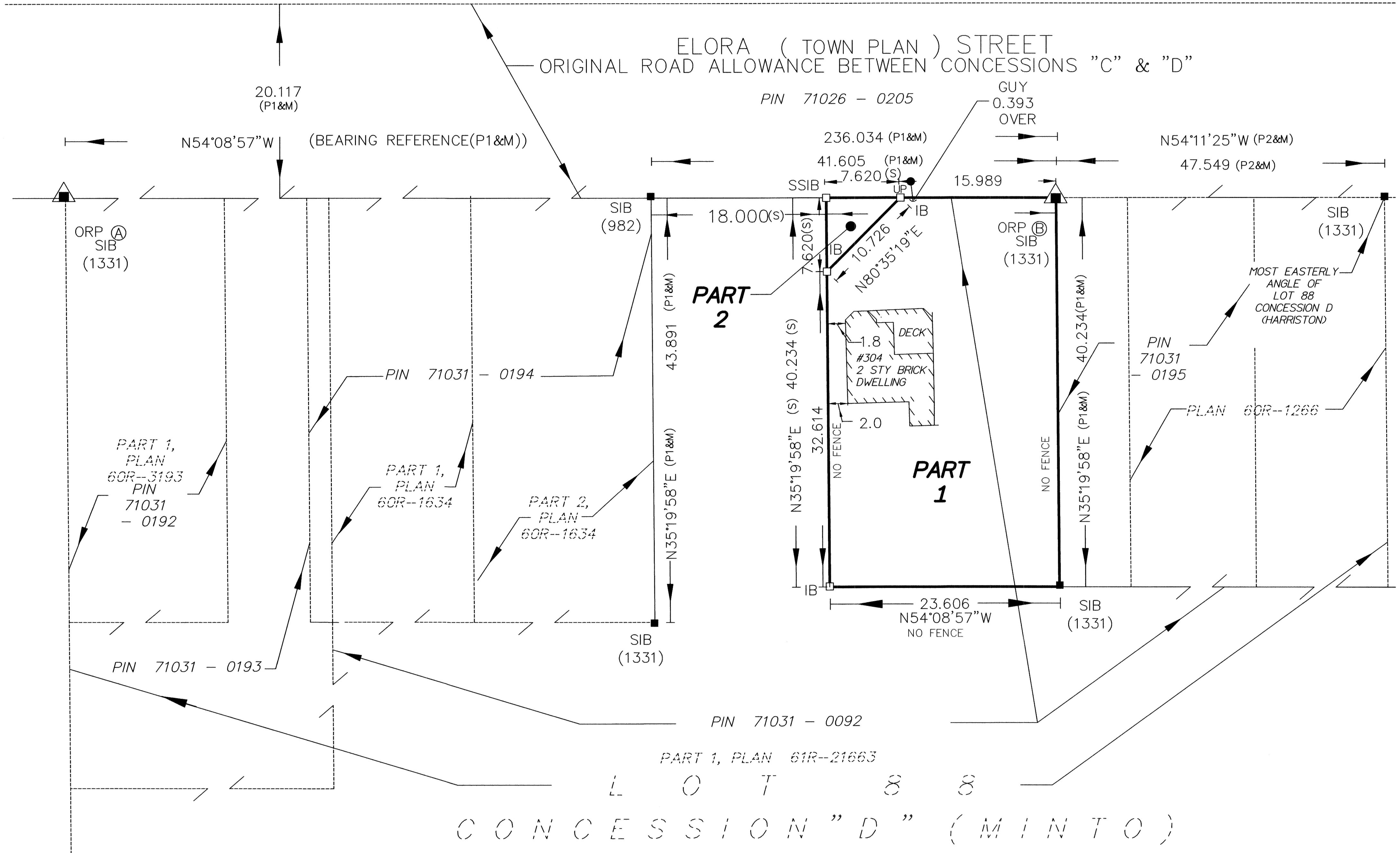
N. Kefalas

REPRESENTATIVE FOR THE LAND REGISTRAR FOR THE LAND TITLES DIVISION OF WELLINGTON (NO.61).

**SCHEDULE**

PART	LOT	CON	PIN
1	PART OF 88	D (MINTO)	PART OF 71031-0092
2	PART OF 88	D (MINTO)	PART OF 71031-0092

PARTS 1 & 2 COMPRISE PART OF PIN 71031-0092.



**BEARING NOTE**

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010).

FOR BEARING COMPARISONS, THE FOLLOWING ROTATIONS WERE USED:

PLAN	ROTATION
P1	0°00'00"
P2	1°53'57" CCW

DISTANCES ON THIS PLAN ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999546.

OBSERVED REFERENCE POINTS (ORP'S) DERIVED FROM GPS OBSERVATIONS USING THE TOPNET NETWORK (RTN) UTM ZONE 17, NAD83 (CSRS)(2010)

COORDINATES TO URBAN ACCURACY PER SEC. 12(2) OF O. REG. 216/10.

POINT ID	NORTHING	EASTING
ORP (A)	4 861 654.114	511 119.808
ORP (B)	4 861 563.007	511 245.880

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

**SURVEYOR'S CERTIFICATE**

- I CERTIFY THAT :
- THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
  - THE SURVEY WAS COMPLETED ON THE 15th DAY OF JANUARY, 2020.

17 JANUARY, 2020  
 DATE

GREG FORD, P. Eng (CIVIL)  
 ONTARIO LAND SURVEYOR

**WILSON - FORD**

Surveying & Engineering  
 120 KING ST. E., Box 294,  
 MOUNT FOREST ON, N0G 2L0  
 PHONE (519)323-2451

PROJECT No.: 20-9154

### 3.0 Proposed Development and Service Population

The proposed draft plan for the development can be found overleaf as **Figure 3.1** and forms the basis of this report. The site will consist of a mix use of residential dwellings including single-family, semi-detached and town homes. This mix use will allow the proposed development to meet the required density of 16 units/hectare.

The site is split into the following uses:

<b>BLOCK</b>	<b>DESCRIPTION</b>	<b>SIZE</b>
1-47, 56-68, 71-76	Single Family	2.940 Ha
48-55, 69, 70	Semi- Detached	0.624 Ha
77-82	Townhomes	1.135 Ha
83	Stormwater Management	0.494 Ha
84	Open Space	2.274 Ha
85	Park	0.167 Ha
86-88	Temp Stormwater Management, Future Development	0.291 Ha
89	Walkway	0.071
	Roads	2.373 Ha
	<b>Total</b>	<b>10.369 Ha</b>

The proposed development population is calculated as follows:

#### **Total Proposed Service Population:**

126 units @ 2.3 p/u = 290 persons (For the purpose of this report 128 units or 294 persons will be referenced to include for the future development block 86)

**DRAFT PLAN OF SUBDIVISION**  
**23T-20201**

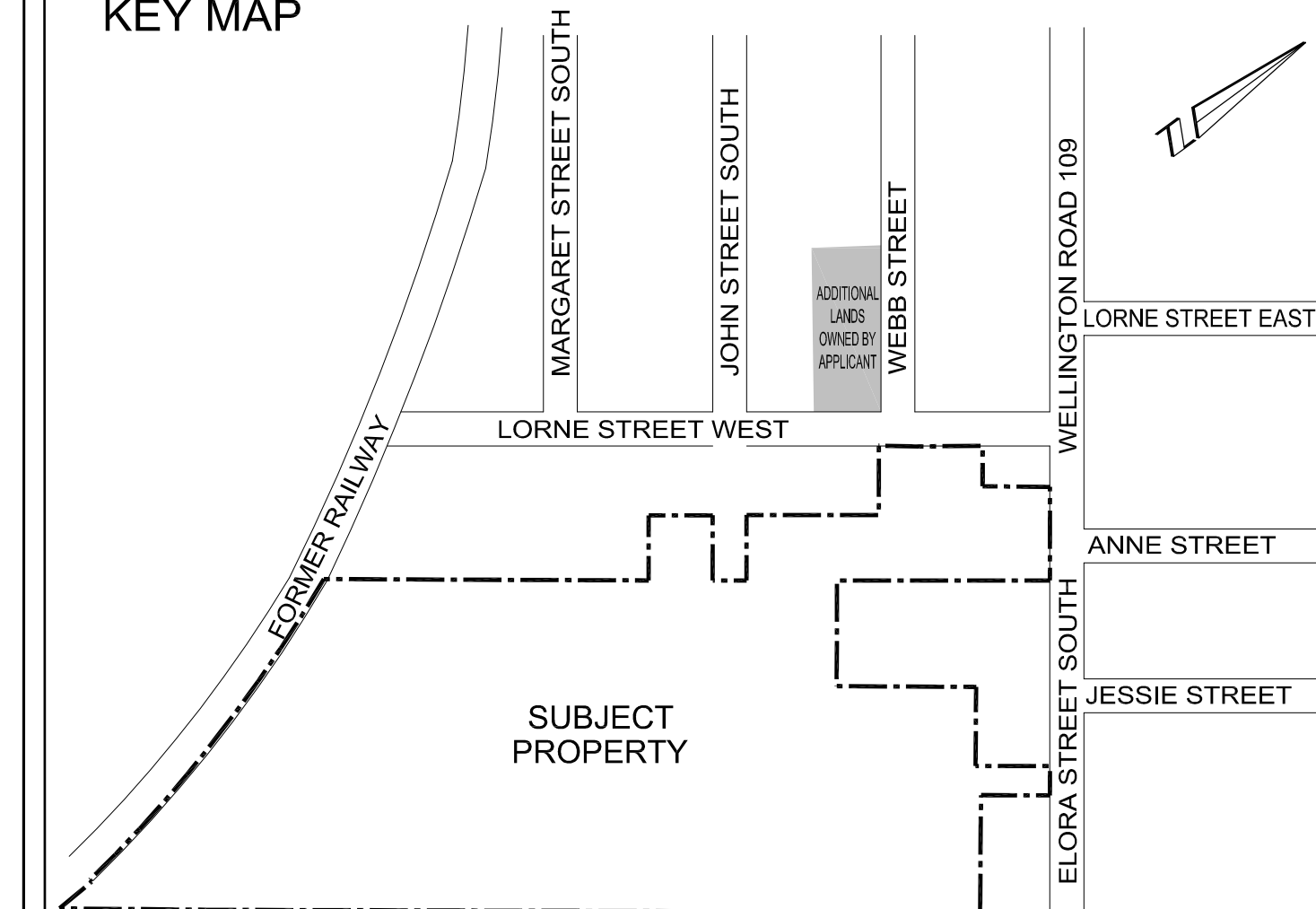
DATE: APRIL 19, 2021

SCALE 1:1,000

PROJECT No. 1841

DRAWN BY: A.R.N.

**KEY MAP**



**LEGAL DESCRIPTION**

PART OF LOT 88, CONCESSION "D" (MINTO)  
 PART OF PARK LOTS E & F PRESTON'S SURVEY "D", (MINTO)  
 (TOWN OF HARRISTON)  
 PART OF LOT 88, CONCESSION "D"  
 (GEOGRAPHIC TOWNSHIP OF MINTO)  
 TOWN OF MINTO  
 COUNTY OF WELLINGTON

**NOTES**

1. TOPOGRAPHIC INFORMATION PROVIDED BY AUTOMATED ENGINEERING TECHNOLOGIES LTD.

**ADDITIONAL INFORMATION**

(UNDER SECTION 51(17) OF THE PLANNING ACT)  
 INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j AND I ARE AS SHOWN ON DRAFT PLAN.  
 h) municipal water supply  
 i) sand and gravel  
 k) municipal sanitary and storm sewers

**LAND USE SCHEDULE**

DESCRIPTION	LOTS/BLOCKS	UNITS	AREA (ha.)
SINGLE DETACHED	1-47,56-68,71-76	66	2,940
SEMI-DETACHED	48-55,69,70	20	0,624
TOWNHOUSE	77-82	40	1,135
STORMWATER MANAGEMENT	83		0,494
OPEN SPACE	84		2,274
PARK	85		0,167
FUTURE DEVELOPMENT	86-88		0,291
WALKWAY	89		0,071
ROADS			2,373
<b>TOTAL</b>	<b>89</b>	<b>126</b>	<b>10,369</b>

**OWNER'S CERTIFICATE**

I, HEREBY AUTHORIZE ASTRID J. CLOS, PLANNING CONSULTANTS TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

JERRY ROUBOS  
 MEX DEVELOPMENTS INC.

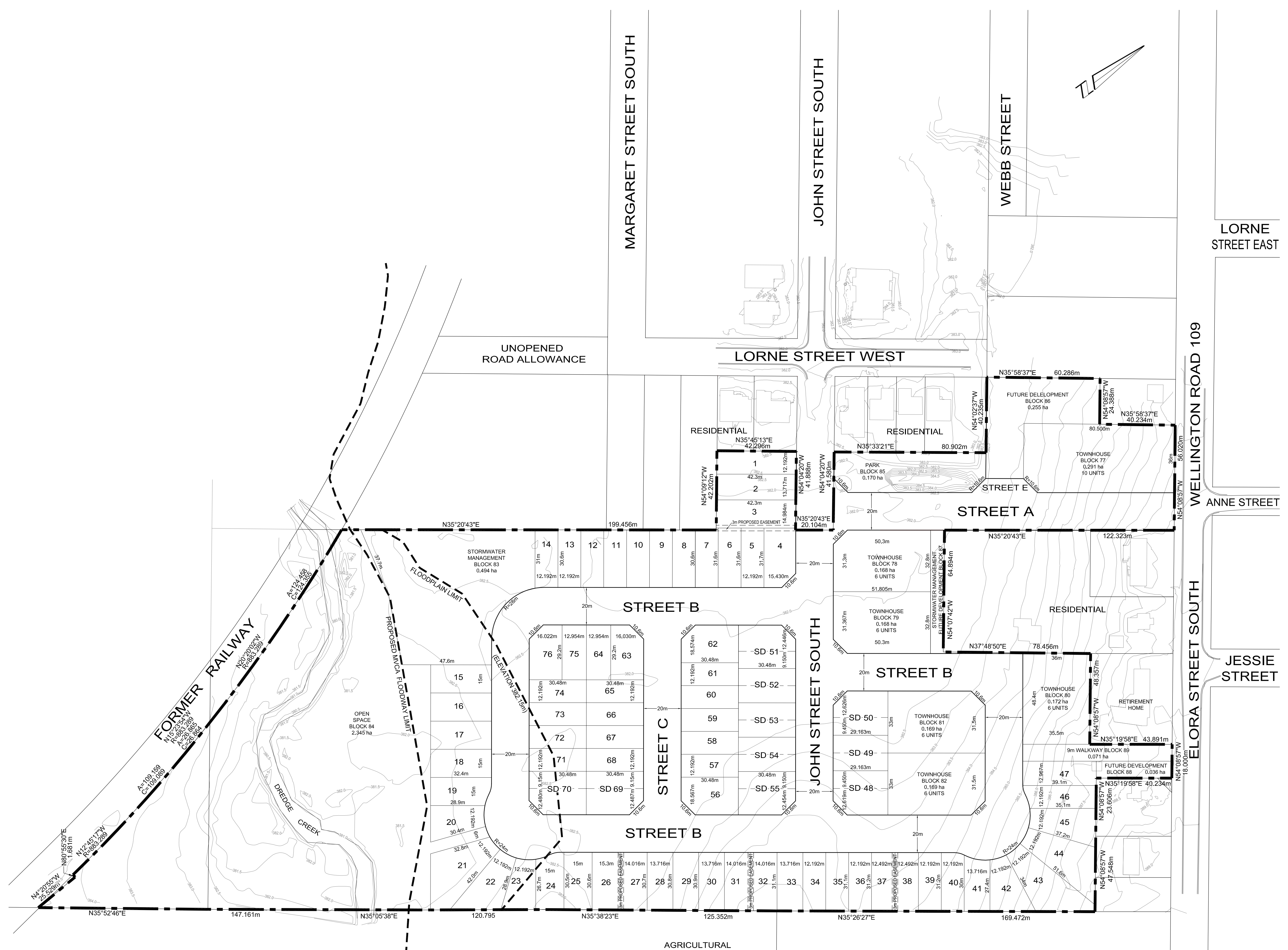
FEBRUARY 12, 2020  
 DATE

**SURVEYOR'S CERTIFICATE**

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

GREG FORD, O.S.  
 Wilson Ford Surveying Inc.

FEBRUARY 12, 2020  
 DATE



AGRICULTURAL

## **4.0 Existing Site Services**

The following is a general description of the existing municipal services available at the perimeter of the property.

### **4.1 Roadways**

#### **4.1.1 Elora Street**

This street is considered an arterial road/County Road. It is a 2-lane paved public roadway with turning lanes as necessary and is constructed with curb and gutter and full services. It is maintained by the Town's Public Works Operations Department.

#### **4.1.2 Lorne Street/John Street**

Lorne Street and John Street are both classified as local roads and are two lanes plus parking. The cross sections generally conform to the town's standard for local roads. These roads are fully serviced.

### **4.2 Sanitary Sewers**

As indicated, Elora Street is a fully serviced local road including a 200mm diameter PVC sanitary sewer. Lorne is also fully developed and includes a 200 mm diameter sewer that drains to a SPS just south west of the Lorne Street and John Street intersection.

### **4.3 Storm Servicing**

Presently, most of the site is not serviced. The farmland was formerly tiled drained to improve soil drainage. The vacant farmland generally sheet flows to Dredge Creek. The vacant land at the north end of the site drains to ditch inlets at the north end of Lorne Street and east end of John Street. The storm sewers on Lorne Street are part of the Barber drain.

### **4.4 Water Servicing**

Presently there is a 200mm diameter watermain servicing Elora Street on the northeast side of the road. Available pressure is unknown at this time. A 150 diameter watermain servicing Lorne Street also exists. It is located on the south east side of the road.

Existing Fire Hydrants are located at the intersection of Lorne and John, northern limit of Lorne, Anne and Elora and at the eastern termination of the Elora Street watermain (across from lot 320 Elora Street).

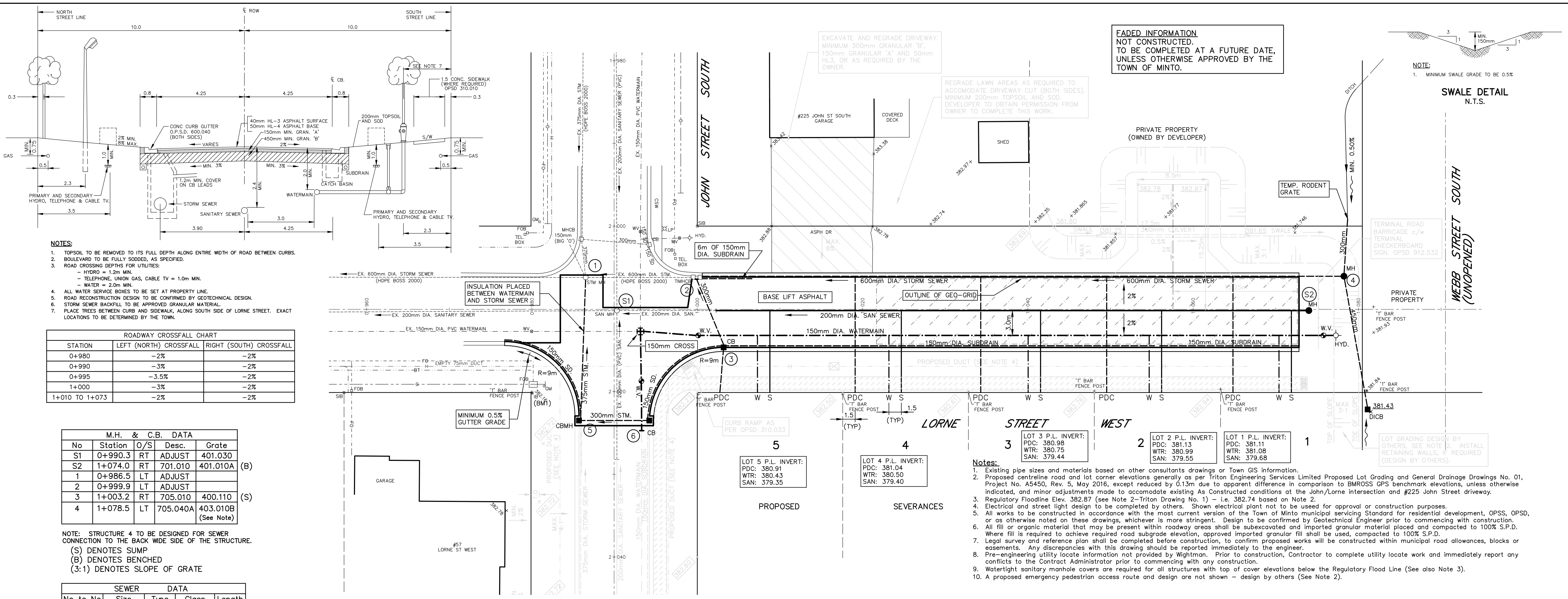
#### **4.5 Servicing Plans**

The following is a list of existing servicing plans for the previously described services that have been provided by the Town. They can be found overleaf.

<b>Figure No.</b>	<b>Description</b>	<b>ID No.</b>
4.1	Lorne Street as Recorded (Dec 11, 2017)	15159 – Dwg 1 of 1
4.2	John Street as Proposed (October 30, 2015)	15159 – Dwg 2 of 2

#### **4.6 Utilities Servicing**

Westario, Union Gas, Wightman, Eastlink and Bell currently service the perimeter the site. These utilities will be contacted to ensure plant capacity and ability to service the proposed development.



- NOTES:**
- TOPSOIL TO BE REMOVED TO ITS FULL DEPTH ALONG ENTIRE WIDTH OF ROAD BETWEEN CURBS.
  - BOULEVARD TO BE FULLY SODDED, AS SPECIFIED.
  - ROAD CROSSING DEPTHS FOR UTILITIES:
    - HYDRO = 1.0m MIN.
    - TELEPHONE, UNION GAS, CABLE TV = 1.0m MIN.
    - WATER = 2.0m MIN.
  - ALL WATER SERVICE BOXES TO BE SET AT PROPERTY LINE.
  - ROAD RECONSTRUCTION DESIGN TO BE CONFIRMED BY GEOTECHNICAL DESIGN.
  - STORM SEWER BACKFILL TO BE APPROVED GRANULAR MATERIAL.
  - PLACE TREES BETWEEN CURB AND SIDEWALK ALONG SOUTH SIDE OF LORNE STREET. EXACT LOCATIONS TO BE DETERMINED BY THE TOWN.

**ROADWAY CROSSFALL CHART**

STATION	LEFT (NORTH) CROSSFALL	RIGHT (SOUTH) CROSSFALL
0+980	-2%	-2%
0+990	-3%	-2%
0+995	-3.5%	-2%
1+000	-3%	-2%
1+010 TO 1+073	-2%	-2%

**M.H. & C.B. DATA**

No	Station	O/S	Desc.	Grate
S1	0+990.3	RT	ADJUST	401.030
S2	1+074.0	RT	701.010	401.010A (B)
1	0+986.5	LT	ADJUST	
2	0+999.9	LT	ADJUST	
3	1+003.2	RT	705.010	400.110 (S)
4	1+078.5	LT	705.040A	403.010B (See Note)

NOTE: STRUCTURE 4 TO BE DESIGNED FOR SEWER CONNECTION TO THE BACK WIDE SIDE OF THE STRUCTURE.  
 (S) DENOTES SUMP  
 (B) DENOTES BENCHED  
 (3:1) DENOTES SLOPE OF GRATE

**SEWER DATA**

No to No	Size	Type	Class	Length
EX - S2	200	PVC	SDR35	83.7
2 - 3	300	HDPE	CSA B182.6	8.5
2 - 4	600	HDPE	CSA B182.6	77.9

**LEGEND**

- SAN. or STM. EXISTING SEWERS, SANITARY or STORM
- M.H. or C.B. MANHOLE and CATCHBASIN
- W. WATERMAIN
- CONC. SIDEWALK AND DRIVES
- REMOVE EXISTING CONC. SIDEWALK AND DRIVES
- PLACE CONC. SIDEWALK AND DRIVES
- REMOVE EXISTING ASPHALT PAVT
- PLACE HOT MIX ASPHALT CONCRETE (H.M. HOT MIX CONC.)
- REMOVE EXISTING CONC. CURB
- PROPOSED ELEVATION (SEE NOTE 2)
- EXISTING ELEVATION
- PROPOSED ELEVATION
- DETECTABLE PEDESTRIAN WARNING SURFACE PLATES AS PER OPSD 310.03
- PROPOSED SANITARY SERVICE
- PROPOSED WATER SERVICE
- PROPOSED PRIVATE DRAIN CONNECTION

**Scale**

1:250

1:50

**CONSTRUCTION NORTH**

**NOTE**

The locations of existing underground utilities are shown in an approximate way only and have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for any damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

**BENCHMARK INFORMATION (See Note 2)**

BM 1 Elev. 382.159  
 IB at Southeast corner of Lorne Street and John Street

Design By: F.C.V Checked By: G.A.F.

**AS RECORDED**

The information on this record drawing is believed to be reliable, however it may be based, in part, upon information provided by others, which can not be verified by B.M. Ross and Associates Limited. Those relying on this record drawing are advised to obtain additional verification of its accuracy before applying it for any purpose.

December 11, 2017  
 Date

**REVISION**

No.	DATE	REVISION
0	Aug. 21, 2015	Preliminary design - issued to Client for review
1	Sep. 25, 2015	Preliminary design - issued to Town of Minto for review
2	Oct. 30, 2015	Issued to MOECC for sewer approvals
3	July 26, 2016	Preliminary design - issued to Client for review
4	Oct. 27, 2016	Final design - issued to Town
5	Dec. 11, 2017	Lorne Street Extension - As-Recorded

**BMROSS**  
 engineering better communities

Goderich (519) 524-2641 Mount Forest (519) 323-2945

**Town of Minto (Harriston)**

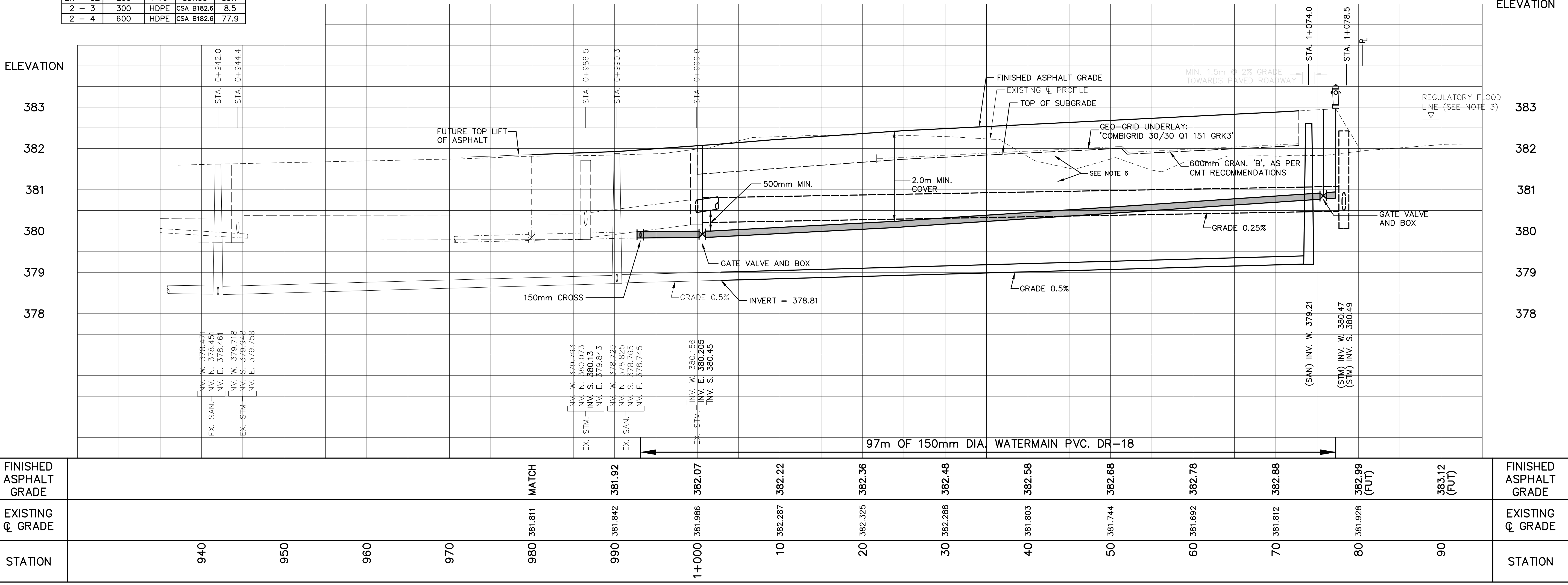
**Lorne Street West**

Plan and Profile  
 John Street to Webb Street

**Project No. 15159**

**Drawing No. 1 of 1**

Scale (24x36)  
 Horizontal: 1:250  
 Vertical: 1:50

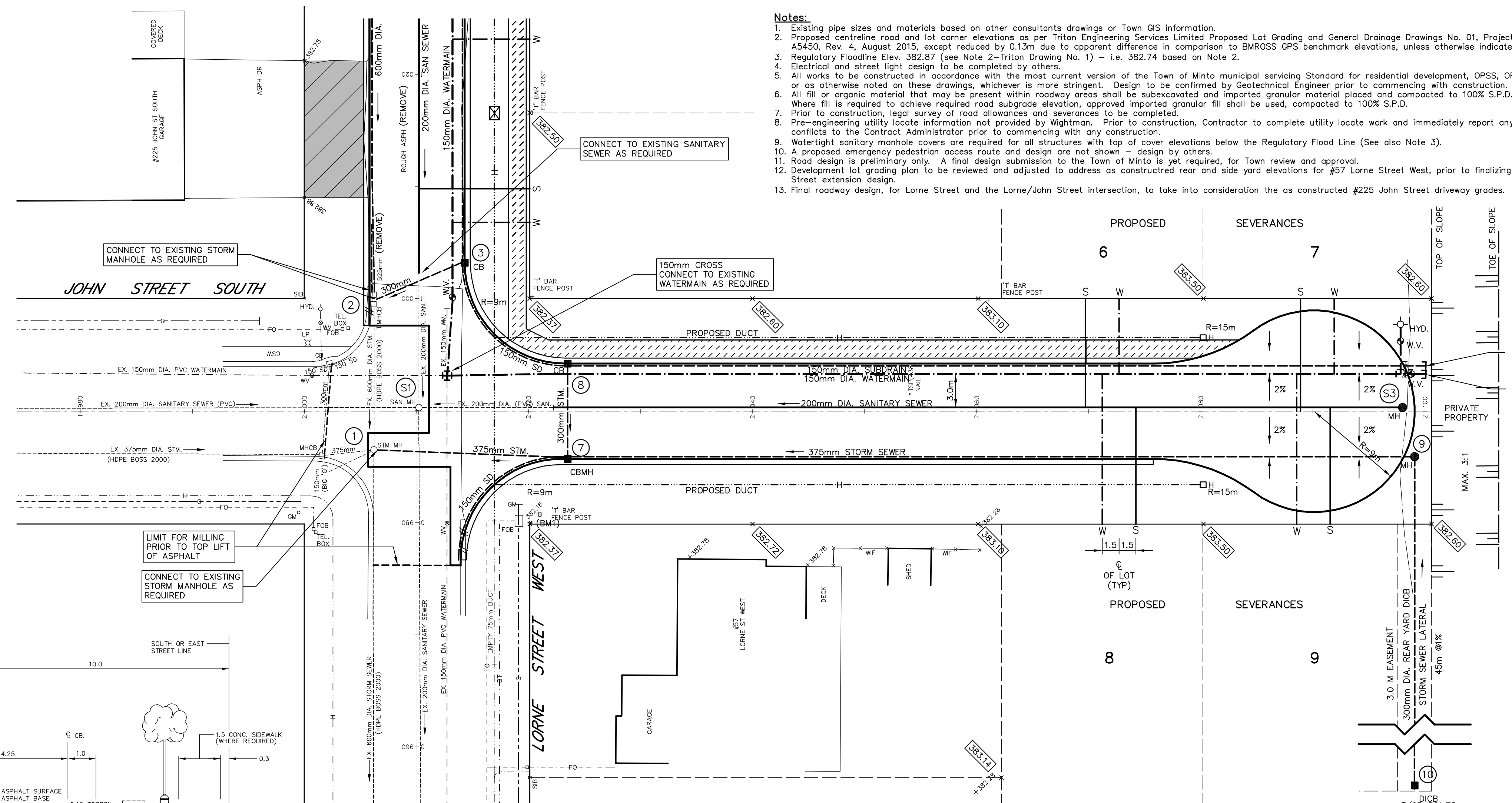


FINISHED ASPHALT GRADE	STATION	EXISTING Q GRADE	STATION	FINISHED ASPHALT GRADE	STATION
	940		940		940
	950		950		950
	960		960		960
	970		970		970
	980	381.811	980	381.811	980
	990	381.842	990	381.842	990
	1+000	381.986	1+000	381.986	1+000
	10	382.287	10	382.287	10
	20	382.325	20	382.325	20
	30	382.288	30	382.288	30
	40	381.803	40	381.803	40
	50	381.744	50	381.744	50
	60	381.692	60	381.692	60
	70	381.812	70	381.812	70
	80	381.928	80	381.928	80
	90	383.12 (FUT)	90	383.12 (FUT)	90

M.H. & C.B. DATA			
No	Station	O/S	Desc. / Grate
S1	2+010.2	LT	ADJUST
S2	2+098.0	LT	701.010 401.010A (B)
1	2+006.2	RT	ADJUST
7	2+023.5	RT	701.010 400.110 (S)
8	2+023.5	LT	705.010 400.110 (S)
9	2+099.0	RT	701.010 401.010B (S)
10	2+099.0	RT	705.030 403.010A (S)

(S) DENOTES SUMP  
(B) DENOTES BENCHED

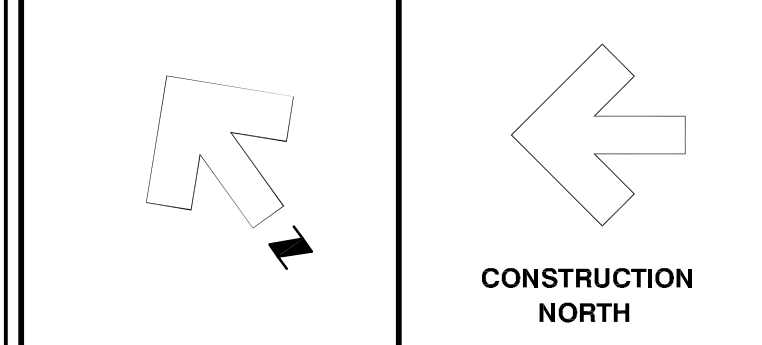
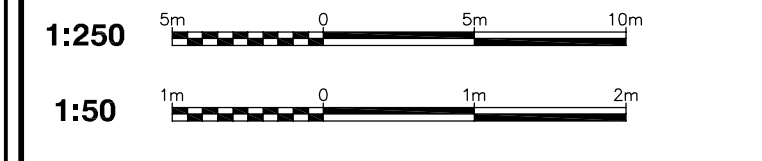
SEWER DATA				
No to No	Size	Type	Class	Length
EX. - S3	200	PVC	SDR35	75.4
1 - 7	375	HDPE	CSA B182.6	16.7
7 - 8	300	HDPE	CSA B182.6	8.5
7 - 9	375	HDPE	CSA B182.6	75.8
9 - 10	300	HDPE	CSA B182.6	45.0



- Notes:**
- Existing pipe sizes and materials based on other consultants drawings or Town GIS information.
  - Proposed centreline road and lot corner elevations as per Triton Engineering Services Limited Proposed Lot Grading and General Drainage Drawings No. 01, Project No. A5450, Rev. 4, August 2015, except reduced by 0.13m due to apparent difference in comparison to BMROSS GPS benchmark elevations, unless otherwise indicated.
  - Regulatory Floodline Elev. 382.87 (see Note 2-Triton Drawing No. 1) - i.e. 382.74 based on Note 2.
  - Electrical and street light design to be completed by others.
  - All works to be constructed in accordance with the most current version of the Town of Minto municipal servicing Standard for residential development, OPSS, OPSD, or as otherwise noted on these drawings, whichever is more stringent. Design to be confirmed by Geotechnical Engineer prior to commencing with construction.
  - All fill or organic material that may be present within roadway areas shall be subexcavated and imported granular material placed and compacted to 100% S.P.D. Where fill is required to achieve required road subgrade elevation, approved imported granular fill shall be used, compacted to 100% S.P.D.
  - Prior to construction, legal survey of road allowances and severances to be completed.
  - Pre-engineering utility locate information not provided by Wightman. Prior to construction, Contractor to complete utility locate work and immediately report any conflicts to the Contract Administrator prior to commencing with any construction.
  - Watertight sanitary manhole covers are required for all structures with top of cover elevations below the Regulatory Flood Line (See also Note 3).
  - A proposed emergency pedestrian access route and design are not shown - design by others.
  - Road design is preliminary only. A final design submission to the Town of Minto is yet required, for Town review and approval.
  - Development lot grading plan to be reviewed and adjusted to address as constructed rear and side yard elevations for #57 Lorne Street West, prior to finalizing John Street extension design.
  - Final roadway design, for Lorne Street and the Lorne/John Street intersection, to take into consideration the as constructed #225 John Street driveway grades.

**LEGEND**

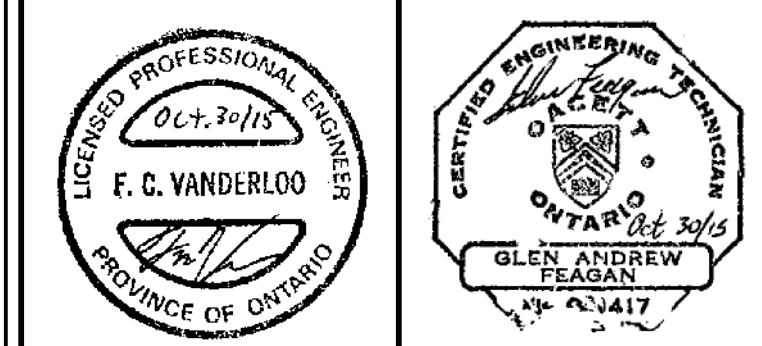
- SAN. or STM. EXISTING SEWERS, SANITARY or STORM
- M.H. CB. MANHOLE and CATCH BASIN
- W. FIRE HYDRANT
- WATERMAIN. FIRE HYDRANT
- GASMAIN
- UNDERGROUND TELEPHONE
- UNDERGROUND HYDRO
- UNDERGROUND TV. CABLE
- UTILITY POLES
- GRUBBER
- REMOVE EXISTING CONC. SIDEWALK AND DRIVES
- REMOVE AND PLACE CONC. SIDEWALK AND DRIVES
- PLACE CONC. SIDEWALK AND DRIVES
- REMOVE EXISTING ASPHALT PAVT
- PLACE HOT MIX ASPHALT
- REMOVE EXISTING CONC. CURB
- PLACE EXISTING CONC. CURB
- PROPOSED ELEVATION (SEE NOTE 2)
- EXISTING ELEVATION
- PROPOSED ELEVATION



**NOTE**  
The locations of existing underground utilities are shown in an approximate way only and have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for any damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

**BENCHMARK INFORMATION (See Note 2)**  
BM 1 Elev. 382.159  
IB at Southeast corner of Lorne Street and John Street

Design By: F.C.V Checked By: G.A.F



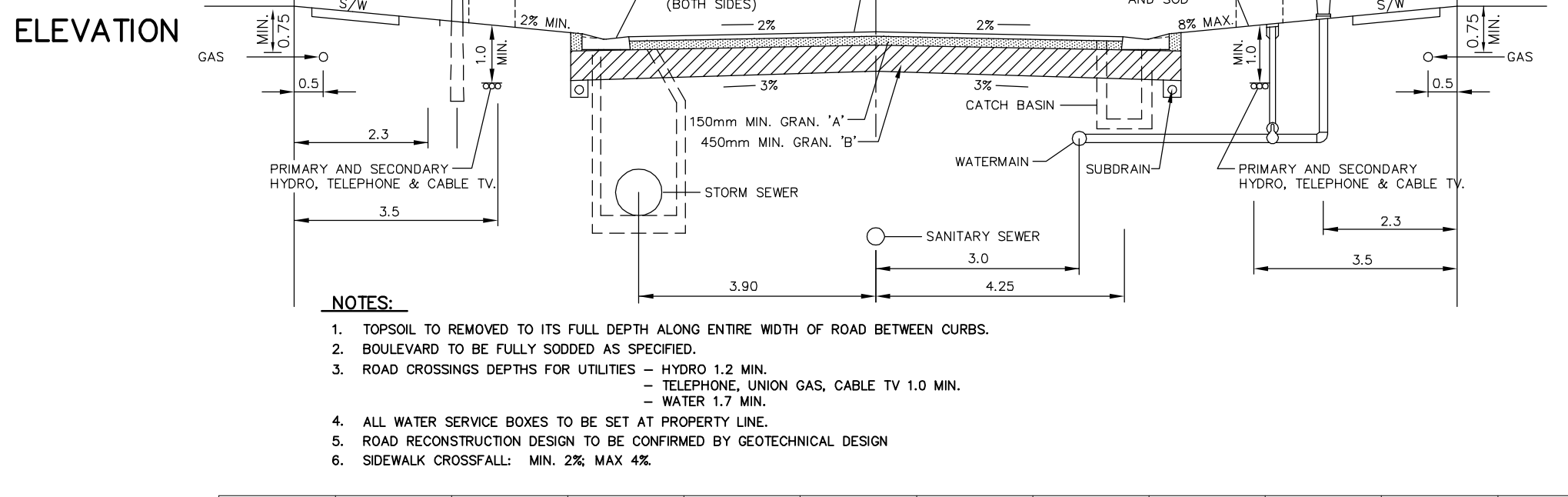
No.	DATE	REVISION
0	Aug. 21, 2015	Preliminary design - issued to Client for review
1	Sep. 25, 2015	Preliminary design - issued to Town of Minto for review
2	Oct. 30, 2015	Issued to MOECC for sewer approvals



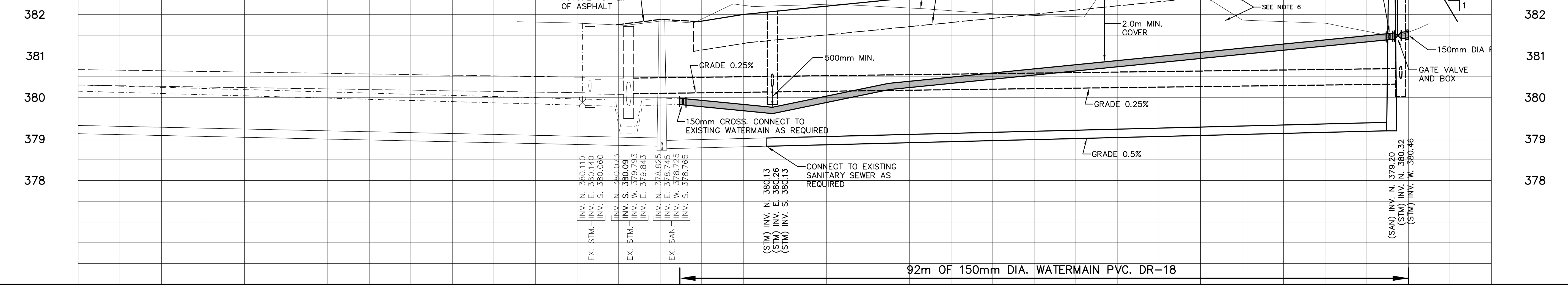
Goderich: (519) 524-2641 Mount Forest: (519) 323-2945

**Town of Minto (Harriston)**  
**John Street South**  
Plan and Profile  
Lorne Street to Sta. 2+100

<b>Project No.</b> 15159
<b>Drawing No.</b> 2 of 2



- NOTES:**
- TOPSOIL TO BE REMOVED TO ITS FULL DEPTH ALONG ENTIRE WIDTH OF ROAD BETWEEN CURBS.
  - BOULEVARD TO BE FULLY SLOTTED AS SPECIFIED.
  - ROAD CROSSINGS DEPTHS FOR UTILITIES - HYDRO 1.2 MIN. - TELEPHONE, UNION GAS, CABLE TV 1.0 MIN. - WATER 1.7 MIN.
  - ALL WATER SERVICE BOXES TO BE SET AT PROPERTY LINE.
  - ROAD RECONSTRUCTION DESIGN TO BE CONFIRMED BY GEOTECHNICAL DESIGN.
  - SIDEWALK CROSSFALL: MIN. 2% MAX 4%



FINISHED ASPHALT GRADE	EXISTING Q GRADE	STATION	STATION	FINISHED ASPHALT GRADE	EXISTING Q GRADE	STATION
		940	950			950
		960	970			970
		980	990			990
		2+000	2+010			2+010
		2+020	2+030			2+030
		2+040	2+050			2+050
		2+060	2+070			2+070
		2+080	2+090			2+090
		2+100				2+100

## **5.0 Proposed Development Servicing**

The following is a general description of the grading design and municipal services necessary to support the proposed development.

### **5.1 Design Constraints**

Constraints in designing the servicing, road profiles and lot grading include:

- Match existing grades around the perimeter of the site, and/or along the wetland setbacks to the southwest;
- Provide allowance for future development of the adjacent lands to the northeast, future Webb Street connection (Lands Owned by Others), and the future Webb Street and Lorne Street Intersection;
- Raise site to provide floodproofing meeting the MVCA's requirements;
- Match existing grades of proposed intersections at Lorne and John, Anne and Elora;
- Satisfy the Town's minimum standards per their design guidelines for road, driveway and swale grades where possible as well as the standards for underground infrastructure;
- Provide for major overland flows to appropriate outlets;
- Maintain adequate cover of underground infrastructure; and,
- Ensure existing sewer capacities are not exceeded.

### **5.2 Roadways**

Paradigm Traffic Consultants were asked to review the proposed development and complete a Traffic Impact Study. A summary of the findings is presented overleaf. The full report has been separately submitted. An addendum was prepared to review former Street D (secondary access to Elora) being removed and as a result an emergency access was recommended along with a north bound left turning lane at Anne Street (pavement width is available, line markings will be removed and adjusted to accommodate.) This addendum has been separately submitted. There are no proposed improvements to Elora Street or Lorne Streets except for service connections, line painting and repaving at the connection areas.

## 6 Conclusions and Recommendations

### 6.1 Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ Under existing 2019 traffic conditions, all turning movements at all study area intersections operate within acceptable levels;
- ▶ The development is forecast to generate 90 and 120 new trips during the AM and PM peak hours, respectively;
- ▶ Under 2034 background traffic conditions, all turning movements at all study area intersections are forecast to operate within acceptable levels;
- ▶ Under 2034 total traffic conditions, all turning movements at all study area intersections are forecast to operate within acceptable levels;
- ▶ Left-turn lanes are not forecast to be warranted on study area roads under 2034 total volumes during the AM or PM peak hours;
- ▶ Under the scenario with all Phase 1 traffic using the Elora Street and Anne Street intersection to access the development a second access is constructed in Phase 2, all turning movements at all study area intersections are forecast to operate within acceptable levels and left-turn lanes are not warranted; and
- ▶ The County of Wellington should consider implementing a northbound left-turn lane on Elora Street South at Anne Street, to occupy the space created by the shadow lane opposite of the existing southbound left-turn lane at this intersection. Since a left-turn lane is not forecast to be warranted, this is not a requirement, but a suggestion to be considered. As the left-turn is not forecast to be warranted, any left-turn lane implemented should therefore not be the responsibility of the developer.

### 6.2 Recommendations

Based on the findings of this study, it is recommended that the site be approved as planned with no conditions related to off-site transportation improvements.



### 5.3 Preliminary Grading

The conceptual site layout and proposed grading is illustrated on Drawing No. GRAD-1, Proposed Site Grading Plan, Harriston in **Appendix A**.

Preliminary road profiles within the subject lands were established to satisfy the constraints outlined in the previous section. Road profiles have grades ranging from approximately 0.5% to 4.5% in order to match perimeter grades, meet the criteria outlined above, and optimize grading to service the subject lands. The resulting design will allow grades along existing property lines to be maintained while allowing the development to be maintained above floodplain elevation limits.

The internal roads will be constructed with a full urban cross-section in mind on a 20m right-of way per the Town's standards. Site services will be connected to the existing municipal infrastructure at the Lorne and John intersection, watermain connections will also be made at the Anne Street intersection with Elora Street and through the emergency access to Elora Street. Roadways will have a typical cross-section consistent with Town Standards and be complete with a 1.8m sidewalk and ramps on one side of the road to facilitate pedestrian linkages. Streetlighting will also be provided.

Proposed lot grading within the development will have slopes ranging from approximately 2.0% to a maximum of 6.0%, some steeper grades (max 3:1) will be utilized in order to match grading along the existing perimeter properties at the northwest end and the south west end to match the existing floodplain. These properties, all fronting on Street 'B' will be lookout or walkout properties pending final site grading. In some cases slopes less than 2% were used in the design to minimize fill and the overall height of the subdivision. A combination of standard lot grading templates including split drainage, back to front, and backsplitted/walkout lots are all utilized to varying degrees in the preliminary grading design.

### 5.4 Water Servicing

Water supply design has two (2) components; supply demand flow and fire protection flow at minimum pressure requirements. Following the Town's Design Standards, the proposed development's water demand has been calculated as follows:

Maximum Day Flow required for the 128 units:

$$\begin{aligned} Q \text{ max day} &= \frac{QP \times 2.75}{86.4} \text{ where } Q = 450 \text{ L/cap/day and } P = 0.294 \\ &= 4.21 \text{ L/s} \end{aligned}$$

Peak Hour Flow:

$$Q_{ph} = \frac{QP \times 3.97}{86.4}$$

$$= 6.08 \text{ L/s}$$

### 5.4.1 Fire Underwriters Survey

To assess the fire flow requirements for the proposed site the Fire Underwriters Survey (FUS) has been referenced. It should be noted that specific building details were not available at the time of preparation for this report. Therefore, a conservative estimate for the building materials, fire separations, and contents was assumed, based on experience.

A fire flow demand analysis was completed for each type of proposed structure. The buildings were assumed to be of ordinary wood-frame, brick and metal siding exterior construction. The floor area used in the analysis assumes that there are rated fire walls subdividing units. The contents of the buildings are considered limited combustible, as defined in the FUS guidelines, consisting of normal low-risk residential occupancy. It has been assumed that there will be no sprinkler systems installed. The exposure charges are based on separation distances from adjacent buildings. Based on the above criteria, the fire flow demands were calculated as shown in the table below using the FUS method.

Structure Type	Fire Flow (L/s)	Storage Requirements (for 2 hours)
Single Detached	100	720
Semi-Detached	133	960
Townhouse – Interior Unit	100	720

Detailed fire flow calculations can be found in **Appendix B**.

Design flow is defined as the maximum daily demand plus fire flow or peak demand flow, whichever is greater. The calculated design flow is 137L/s with 2 hour storage requirements of 960m<sup>3</sup>.

Field testing of available flows and pressures is completed regularly by the Town. Currently, the Town is working on a town wide water model to accurately reflect available flows and pressures within the system. Based on the data provided by the Town it seems the proposed development can be serviced without changes to the existing system.

The proposed watermain will be looped to the existing system with connections at the John and Lorne intersection as well as at Elora Street at both the Anne Street intersection and the emergency access. This allows for adequate fire and residential flows and minimizes maintenance on the system. A 150mm diameter watermain complete with valves, fittings and hydrants will be constructed in accordance with the

Town's Servicing and Design Standards. This is subject to a final review by Town staff for adequate system pressures. Servicing of the units/lots will be as per the Town's design standards.

## 5.5 Storm Water Management

Existing stormwater conditions and associated catchment areas are shown on plan PRE-1, Storm Drainage Plan Pre Development Conditions, Harriston in **Appendix A**. The site drains to two different areas both draining to Dredge Creek and then the Maitland River. Overall proposed catchment areas are shown on plan POST-1, Proposed General Post Development Conditions also available in **Appendix A**. The north western portion of the property drains to the Barber Drain, the remaining area drains overland directly into Dredge Creek.

The Stormwater Management Planning and Design Manual (SWMPD) (March 2003) was used for the basis of the design of the proposed stormwater management system. Further, the Town of Minto's design standards were followed along with the Maitland Valley Conservation Authority's Guidelines. To summarize, the following are the guiding principals:

- The storm sewers to be designed for the 5 year design storm (Rational Method);
- Overland flow consideration for the 100 year storm;
- Control of post development flows to pre development flows for the 5 to 100 year storm events;
  - Using 3 hour Chicago Storm Rainfall Distribution Method;
- Quality Control requirement of basic protection (60% long-term S.S. removal);
- CA preference for 36hr detention vs 24hr detention for storm pond design; and,
- Bottom of storm pond may not be lower than 381.4m per MVCA.

PCSWMM Version 5.6.1803 Professional 2D was used to determine the pre and post development peak flows for the 2 year, 5 year, 25 year, 50 year and 100 year storm events (3 hour Chicago storm distribution). Modelling results are summarized in the sections below, but full model outputs can be found in **Appendix C.3**.

Storm sewers were sized for the 5 year storm event and are based on the rational method calculations which can be found in **Appendix C.2**.

Proposed conditions are as described below:

### 5.5.1 Barber Drain Catchment Area

The Barber Drain was constructed in 1997 and was approved based on a design report dated June 23, 1997 and has been appended for reference in **Appendix C.1**. It consists of storm sewers on Lorne Street which replaced a previous open ditch drain and outlets to Dredge Creek.

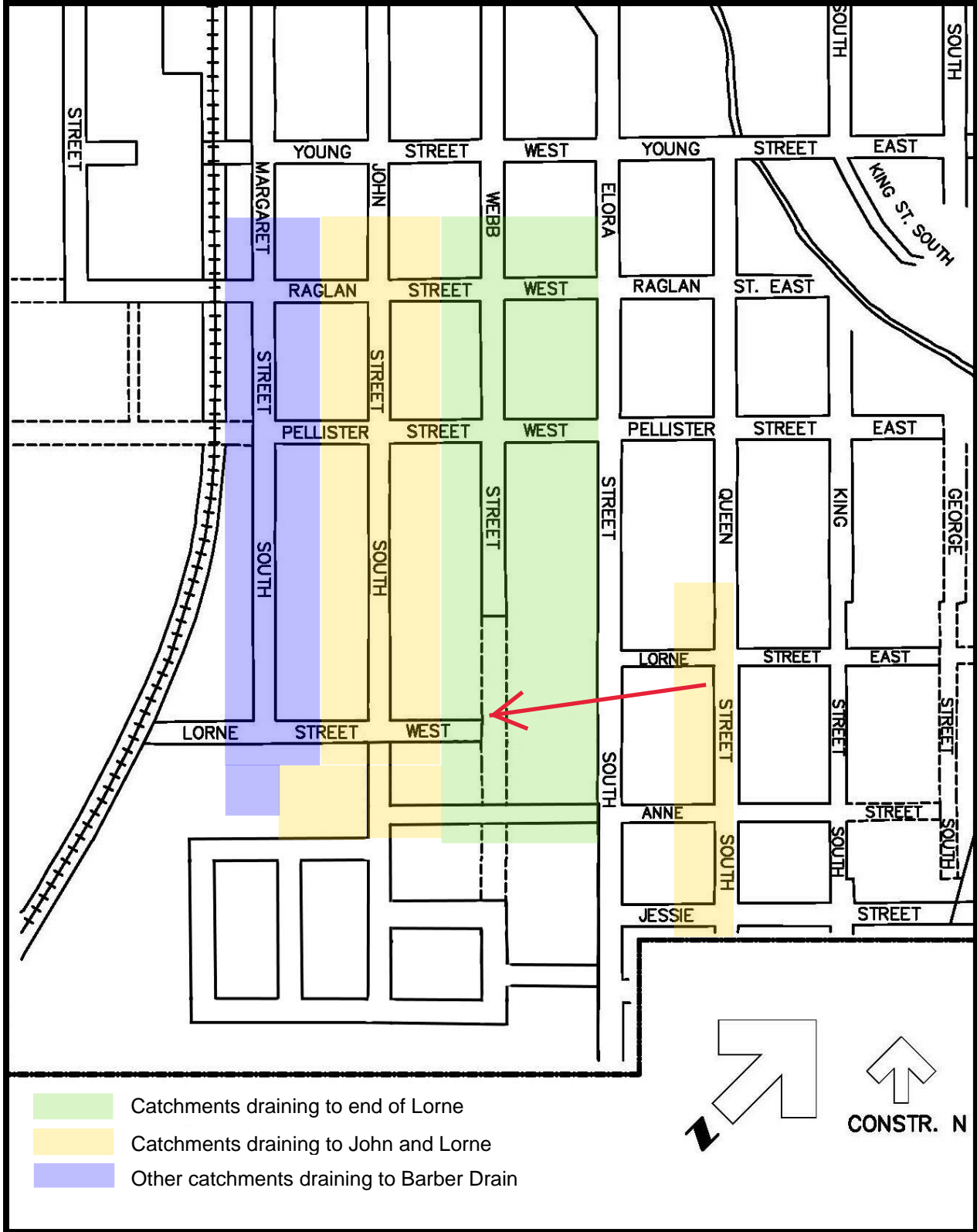
The overall catchment areas draining to this drain are outlined in the original report. Since the construction of the drain (confirmed by field investigation), areas north of Elora Street were removed from the overall drain area. The field investigation revealed that these were accommodated by the Queen Street storm sewers. The original overall catchments are shown overleaf on figure BARBER-1. This area accounts for approximately 1.63 Ha of residential (developed) area. An additional area of 1.1 Ha, mostly grassed areas, is being directed towards this catchment area but is being controlled via a small storm swale (Interim Development Conditions in model output). In interim conditions this area is mostly undeveloped grassed area with some new row housing. In final conditions this area is residential semi-detached/ row housing and will be directed to the overall storm pond for the site. See figure BARBER-2 overleaf for the revised interim catchment areas overleaf.

A subsequent report, attached in **Appendix C.1**, for the Lorne Street extension (north of John) dated November 4, 2015 by BM Ross reviews the available capacity of the drain. Drainage areas and peak flows in this section are based on the original design report for Barber Drain dated June 23, 1997. MIDUSS version 4.72.1 was used at the time to calculate the 5 year design flows for the proposed storm sewer (drain replacement). Flows were scaled based on revised areas.

The Existing John/Lorne sewers were approved under CofA 5822-78NMJB dated November 5, 2007 and 5474-AAXKDU date June 16, 2016 also attached in **Appendix C.1**.

Based on the Town's design standards, a storm run-off collection system should be designed with capacity to meet the 5 year design storm. Details for the storm collection system including a storm sewer design sheet and associated catchment areas can be found in **Appendix C.2**. The collection system draining to the Barber Drain will include a depressed area for storage with a discharge through a 75mm diameter orifice. The swale has storage capacity of 97 m<sup>3</sup> plus 0.3m freeboard (136m<sup>3</sup> total). This will alleviate the drain under high flows. The overland flow route will be directed to the road system and ultimately discharge to Dredge Creek at the end of Lorne.

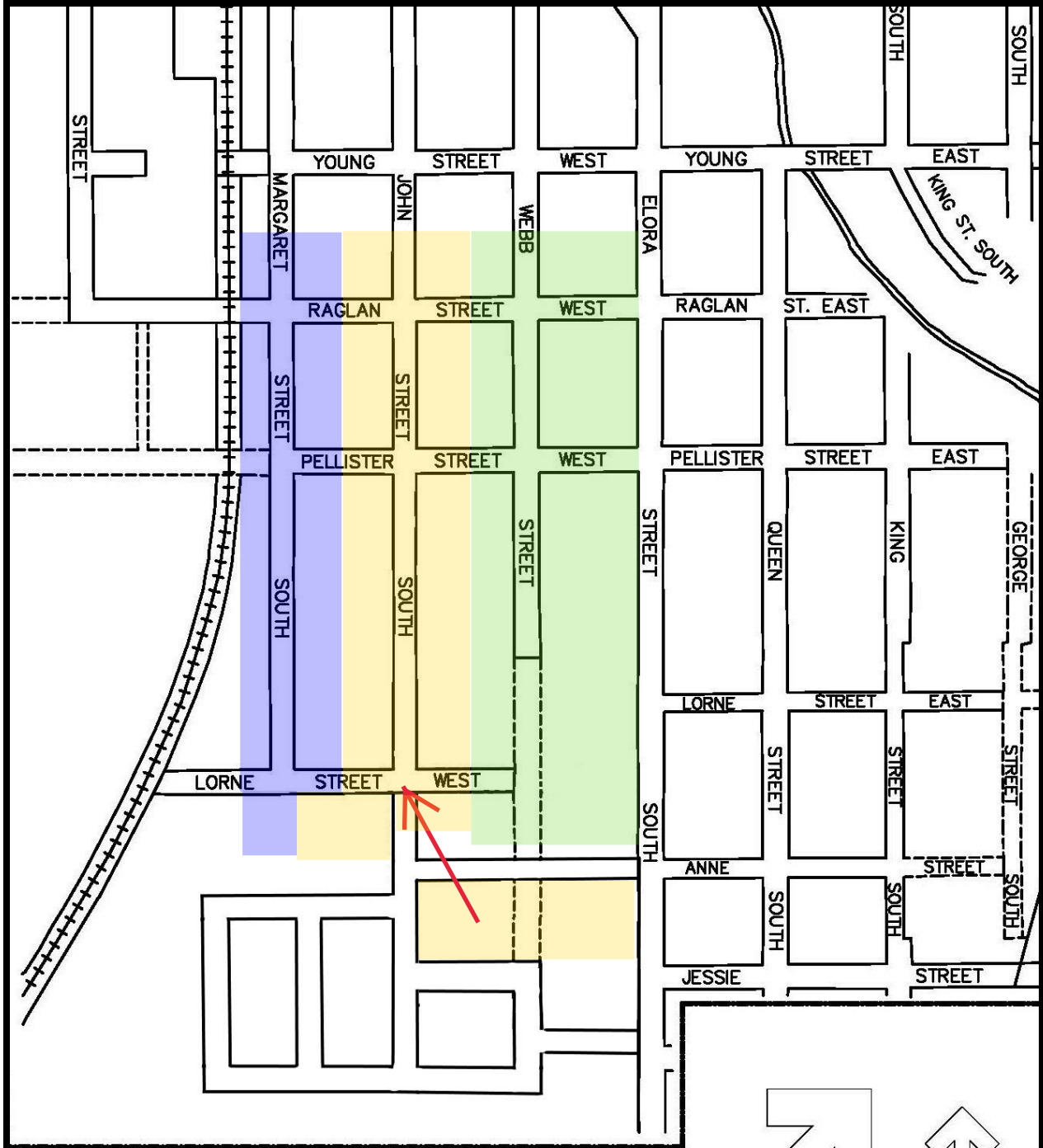
PCSWMM modelling results can be found in **Appendix C.3** and are summarized below for the pre development and post development peak flows from the catchments discharging to the Barber Drain from the proposed development:



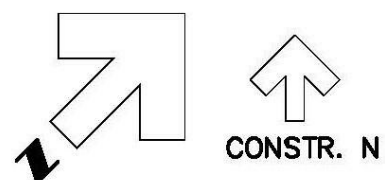

RR#3, 6297 WELLINGTON COUNTY ROAD 109 S  
 HARRISTON, ON, N0S 1Z0  
 PHONE: 519-510-3571 FAX: 519-510-3277  
 WWW.MOOREFIELDEX.CA

PROJECT: Harriston Subdivision  
 TITLE: Barber Drain Catchment Areas - Original

SCALE: NTS  
 DATE: Jan 2020  
 PROJECT NO: 191-103  
 DRAWING NO: BARBER-1



- Catchments draining to end of Lorne
- Catchments draining to John and Lorne
- Other catchments draining to Barber Drain



**MOOREFIELD**  
excavating

RR#3, 6297 WELLINGTON COUNTY ROAD 109 S  
HARRISTON, ON, N0S 1Z0  
PHONE: 519-510-3571 FAX: 519-510-3277  
WWW.MOOREFIELDEX.CA

PROJECT:  
Harriston Subdivision

TITLE:  
Barber Drain Overall Catchment Areas

SCALE: NTS

DATE: Jan 2020

PROJECT NO: 191-103

DRAWING NO:  
BARBER-2

RETURN PERIOD	DRAINING TO EXISTING MH AT LORNE AND JOHN STREET (L/s)		
	PRE	POST-INTERIM	POST
2 YEAR	42.27	80.69	78.97
5 YEAR	68.79	103.72	99.77
25 YEAR	130.62	169.83	164.44
50 YEAR	165.00	203.47	197.48
100 YEAR	194.53	233.71	227.27

RETURN PERIOD	DRAINING TO EXISTING MH AT LORNE AND WEBB STREET (L/s)		
	PRE	POST-INTERIM	POST
2 YEAR	35.65	33.44	33.44
5 YEAR	40.87	36.81	36.81
25 YEAR	67.86	56.94	56.94
50 YEAR	84.14	66.74	66.74
100 YEAR	98.76	77.3	77.3

RETURN PERIOD	Overall Draining to Dredge by Way of Lorne				
	PRE	POST-INTERIM	POST	Interim Exceedance	Post Exceedance
2 YEAR	77.92	114.13	112.41	-36.21	-34.49
5 YEAR	109.66	140.53	136.58	-30.87	-26.92
25 YEAR	198.48	226.77	221.38	-28.29	-22.9
50 YEAR	249.14	270.21	264.22	-21.07	-15.08
100 YEAR	293.29	311.01	304.57	-17.72	-11.28

Areas draining to Lorne and Webb were reduced as much as possible to minimize discharge to the existing storm sewer on Lorne Street. Per the above tables, post development flows exceed pre-development flows. However, storm sewer capacity is not exceeded. Further, as outlined in the following section the storm pond for the remainder of the site is over-controlling flows to accommodate the exceedance outlined in the table above such that overall post-development flows into Dredge Creek do not exceed pre-development levels.

## 5.5.2 Storm Pond Catchment Area Draining to Dredge Creek

Under pre development conditions, the remainder of the site drains overland to Dredge Creek. The proposed development includes a storm sewer system designed for the post development 5 year flows. A preliminary grading and drainage plan as well as a servicing drawing can be found appended in **Appendix A** with further details. Details for the storm collection system design including a storm sewer design sheet and associated catchment areas can be found in **Appendix C.2**. Pipe sizes and slopes are based on the SWMPD manual.

The outlet for the sewers is a dry pond at the southwestern corner of the property. The pond has been designed to control the 5 year to the 100 year post development design flows to pre development levels. The pond size accommodates the exceedance of flows outlined in the previous section. Control of the pond is via a 100mm orifice outlet. Larger flows are accommodated by way of a flat top ditch inlet and 225mm orifice pipe. Details can be found on the appended drawings for the subdivision in **Appendix A**. Overland flows from this catchment area are also directed towards the pond. Note, the pond has been designed such that additional lands to the north east (Webb Street connection from Anne to Street B) could be accommodated (see discussion in section 5.5.1 paragraph 2). This is identified in the model output as the Post Development Conditions

Calculations were completed regarding the required stormwater storage system using PCSWMM. The model results can be found attached in **Appendix C.3**. Modelling results are summarized below for the pre development and post development peak flows from the catchments discharging to the proposed pond from the proposed development:

RETURN PERIOD	DRAINING TO STORM POND WITH OUTLET TO BARBER DRAIN (L/s)		
	PRE	POST-INTERIM	POST
2 YEAR	49.18	46.79	46.87
5 YEAR	88.25	53.80	53.89
25 YEAR	175.77	92.04	100.6
50 YEAR	228.64	118.90	186.19
100 YEAR	273.77	187.80	219.65

For the 100 year post development conditions, the required stormwater storage is approximately 3889 m<sup>3</sup>. A stormwater pond with bottom area of 1830m<sup>2</sup> and 4:1 side slopes is proposed. The top of pond is at an elevation of 383.71m with overflow at 383.61m. The water level during the 100 year storm is expected to

reach 383.30m. Therefore, the required 0.3 m freeboard is provided. The pond discharge consists of two outlets as detailed on the servicing drawing A stage-storage-discharge chart for the pond is provided below:

<b>Stage Storage Discharge</b>					
<b>Storm Event</b>	<b>Inflow (l/s)</b>	<b>Outflow (l/s)</b>	<b>Storage (m<sup>3</sup>)</b>	<b>Water level (m)</b>	<b>Drawdown Time (hrs)</b>
<b>2 Year</b>	1,364.90	6.08	1,914	382.58	128
<b>5 Year</b>	1,478.20	6.76	2,604	382.85	158
<b>25 Year</b>	2,017.60	84.39	3,487	383.17	186
<b>50 Year</b>	2,249.20	148.68	3,629	383.22	187
<b>100 Year</b>	2,495.00	155.19	3,889	383.30	192

A multiple stage outlet device has been designed to ensure a minimum drawdown time exceeding the GSCA's minimum drawdown requirement of 36 hours. In addition, outflow was limited to ensure total outflow to dredge creek from the various outlets (Lorne and pond) do not exceed the pre-development discharge rates. Details for the discharge can be found in the drawings but consist of a 100mm orifice at an invert of 381.40, a secondary discharge with a flat top DICB at 383.10 and a 225mm orifice on the outlet at an elevation of 381.50. The SYMPDM recommends a minimum orifice size of not less than 0.1m to prevent clogging.

### **5.5.3 Quality Control**

To meet the requirements of the MVCA and the MOECC, stormwater quality control will be provided for the proposed development. The MOE SWMPD Manual recommends that the required level of protection be associated with the habitat sensitivity of the receiving watercourse. The receiving watercourse for this development is Dredge Creek. For the purposes of this report, a 'Basic' water quality protection level will be implemented in accordance to the MOE 2003 Guidelines and MVCA requirements

In keeping with the approach suggested in the SWMPD manual however, a 'treatment train' approach to stormwater quality management has been proposed for this development. This approach consists of three (3) levels of treatment which are described as follows:

- Lot level control measures
- Conveyance control measures
- End-of-Pipe control measures

A review of each measure and it's suitability for use in the development is discussed below:

#### **5.5.3.1 Lot Level Control Measures**

The Town's design standards require minimum grades of 2% from the back of curb to the property line. Therefore, reduced lot grading of the front, side and rear yards to less than 2% is not a feasible control measure.

The subdivision property contains native soils that exhibit average drainage characteristics. The use of individual drainage pits and infiltration trenches therefore has not been considered as a feasible option based on the ongoing maintenance that is typically not undertaken.

It is proposed that all runoff draining from rooftops be directed overland across the grass lawns to encourage infiltration and filtering of pollutants from this runoff. The following note will be added to the Lot Grading Plan "Roof drain troughs shall be directed to grassed areas of the property and not to driveways or private drain connections".

#### **5.5.3.2 Conveyance Control Measures**

The Town's standard road cross section only allows for the use of curb and gutter in new urban type subdivisions. Therefore, the use of grass swales as a conveyance control measure for runoff from the subdivision streets cannot be implemented.

Grassed drainage swales are proposed to be constructed in the rear yards of the majority of the lots. These swales will provide rear yard drainage for the proposed lots. This will assist with removing pollutants and sediment from the runoff prior to draining into the municipal storm sewer system.

All catchbasins and manholes within the subdivision will be provided with minimum 600 mm and 300mm sumps respectively which will assist in removing a portion of the sediment contained in the runoff from the street.

### **5.5.3.3 End-of-Pipe Control Measures**

The use of an Oil Grit Separator (OGS) was selected as an 'end of pipe' control measure. The basic function of an OGS is to remove pollutants from runoff. An OGS was selected to maximize the developable area.

The OGS units have been designed in conformance with the MOE design guidelines to achieve a "Basic" Level of protection for this development. The OGS units will be a PMSU 3030\_8 from CDS or approved equivalent. Design details can be found in **Appendix C.2**.

## **5.5.4 Erosion & Sedimentation Control**

### **5.5.4.1 Construction Stage**

The following are details regarding the erosion and sediment control measures to be implemented during construction. Details can be found on GRAD-2, Sediment and Erosion Control Plan in **Appendix A**:

- Placement of siltation fences in all areas where surface drainage flows over disturbed areas. Siltation fence shall remain erect until construction is completed, and the upstream area is fully re-vegetated;
- Placement of temporary straw check dams within swales and any other locations where a concentrated flow of runoff may occur. All proposed drainage swales are to be seeded during construction;
- Mud mats will be placed at construction accesses to keep public roadways free from debris during the construction period.

Once the ground surface of the site has been stabilized, the straw bale check dams and siltation fences can then be removed. Before final acceptance of the subdivision, storm structures shall be cleaned to remove all silt and the storm pond should be reshaped to remove any sediment deposits.

During the construction phase, it is important to ensure that erosion/sediment controls are in place to ensure limited transport of sediment into the existing downstream drainage ditches.

#### 5.5.4.2 Lot Development

During individual construction of homes within the subdivision, siltation barriers are to be constructed, as appropriate, to prevent the erosion of materials into the storm sewer system or the existing drainage ditches. The siltation barriers can be in the form of siltation fences or shallow excavated sediment traps in the direction of flow from the construction site to the proposed drainage system.

Individual lot sediment control is the responsibility of the landowner constructing the dwelling.

### 5.6 Sanitary Sewer Servicing

Design flow calculations were completed in accordance with the Town's Municipal Servicing and Design Standards. A peak flow for the proposed development was calculated as follows:

$$\begin{aligned} Q_p \text{ (Peak Flow)} &= \frac{MQP}{86.4} + IA \\ \text{Where: } Q &= 450 \text{ L/cap/day} \\ M &= \text{Peak Flow Factor "Harmon"} \\ &= 1 + \frac{14}{4 + P^{0.5}} = 4.08 \\ P &= \text{Population/1000} = 0.294 \\ I &= 0.15 \text{ L/ha. (extraneous flow)} \\ A &= \text{Area (site)} = (7.52 \text{ ha.}) \\ \text{Therefore, } Q_p &= \frac{4.08 \times 450 \times 0.294 + 0.15 \times 7.52}{86.4} \\ &= 6.25 + 1.13 \\ &= 7.38 \text{ L/s} \end{aligned}$$

In a 200mm diameter PVC sewer at minimum 0.5% grade, a full flow velocity of 0.73m/s is reached which exceeds the ministry's requirement of 0.6m/s.

A sanitary sewer design sheet for the subdivision can be found in **Appendix D**. An associated catchment area drawing can be found in **Appendix A**.

Servicing of the units/lots will be as per the Town's design standards.

The sewage pumping station capacity was also reviewed. The station was constructed in 2008 and was designed with a capacity of 10.8 L/s at 6.10m dynamic head.

The available capacity of the pump station was reviewed to ensure the system could accommodate the proposed development flows. This was accomplished by reviewing existing sewage demands of the area presently draining to the pump station. A sanitary sewer design sheet can be found attached in **Appendix D**. The existing 19 single family residences on Lorne and John Streets contribute a peak design flow of 1.25 L/s. The proposed development will contribute 7.38 L/s. Total combined peak flow of the existing and proposed development is 8.63L/s which is less then the 10.8L/s capacity of the sewage pump station. As such, no upgrades are expected at the sewage pumping station.

## **5.7 Reserve Capacity**

A summary of the Hydraulic Reserve Capacity Calculations for the Town's water and sanitary systems in Harriston, is as follows. This is consistent with the summary report provided to the Town by Triton Engineering:

### Harriston Water System:

The three (3) year average maximum day flow of the water system within the Community of Harriston is 1,541 m<sup>3</sup>/d. The water system is operating at 59% capacity and has 338 uncommitted units available based on the firm capacity and 290 committed units. Please refer to Table 2.1 in **Appendix E** for the Harriston water system capacity calculations. This development would commit another 128 units.

### Harriston Sanitary System:

The three (3) year average daily sewage flow for the Harriston sewage treatment works is 1,557 m<sup>3</sup>/d. Without consideration of performance characteristics, the Harriston sewage treatment works currently has a total surplus hydraulic reserve capacity of 821 m<sup>3</sup>/d, which is equivalent to 471 units based on the average daily sewage flow per capita and population density. Given that Harriston has 290 committed units for development, there are 181 uncommitted units available based on the total surplus hydraulic reserve capacity. Please refer to Table 2.2 in **Appendix E** for the Harriston sewage reserve capacity calculations. This development would commit another 128 units.

## **5.8 Utility Servicing**

The existing (hydro, gas, telephone and cable) perimeter utility plants have been consulted and are available to provide services for the proposed development. However, access and any upgrade/improvements will need to be determined by the utility providers during the detailed design stage.

## 6.0 Conclusions and Recommendations

Based on the foregoing, the following is concluded regarding the proposed multi-residential development.

1. Existing public roadway access is available to the site, subject to entrance access construction and necessary improvements to the Town's standards and approval.
2. Storm Water Management control provided by a dry pond which controls post development to pre development flows. Use of multiple outlets to maintain existing drainage patterns. Storm sewers designed to manage the 5 year post development flows. Overland flow consideration as shown on the grading and drainage plan. Quality control by treatment train approach utilizing swales, overland flow of roof discharge and an OGS for end of pipe control. Sedimentation and erosion control provided during construction. All of which shall be completed in accordance with Town's Servicing and Design Standards and all necessary agency approvals shall be obtained.
3. The sanitary sewers and pump station on Lorne Street have available capacity and will be utilized to provide service for the proposed development. A 200mm diameter sewer will be constructed throughout the development in accordance with Town's Servicing and Design Standards. This is subject to final review by Town staff for adequate pumping station capacity.
4. The proposed watermain will be looped to the existing system with connections at the John and Lorne intersection as well on Elora Street at both Anne Street intersection and the emergency access. This allows for adequate fire and residential flows and minimizes maintenance on the system. A 150mm diameter watermain complete with valves, fittings and hydrants will be constructed in accordance with Town's Servicing and Design Standards. This is subject to a final review by Town staff for adequate system pressures.
5. Utility companies will be notified of the proposed development to confirm servicing requirements and planning for plant upgrades, if necessary, to provide such servicing to the site.
6. Meeting with Town officials for detailed discussions regarding the contents of this Servicing Study and to provide direction to complete the final design to meet their approval for this development to proceed.

Respectfully submitted,

MEX Developments Inc.



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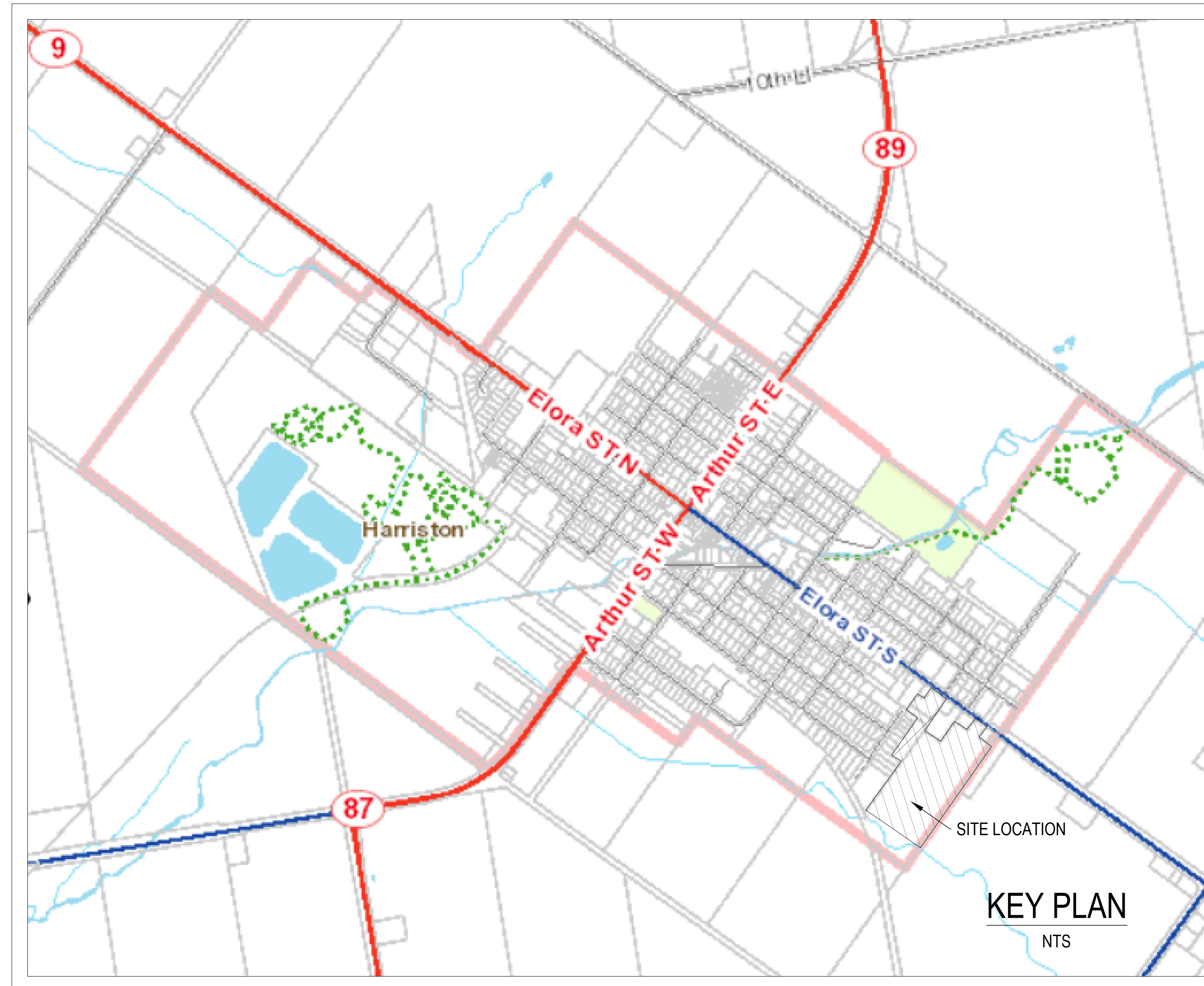
Kim Pilon, P. Eng.  
Civil Engineer

**APPENDIX A**  
**Preliminary Servicing and Grading Plans**

# HARRISTON SUBDIVISION

## TOWN OF MINTO

PROJECT No. 191-103

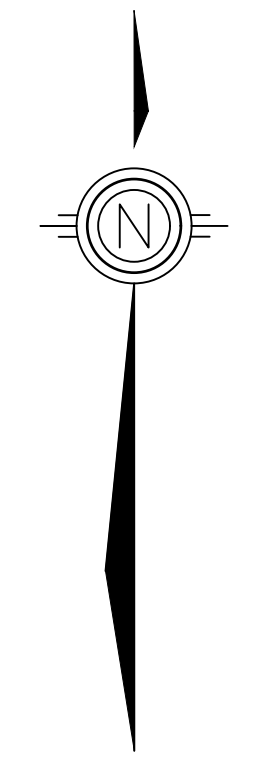


### DRAWING LIST

TITLE-1	TITLE SHEET AND DRAWING LIST
SP-1	PROPOSED SITE PLAN
PRE-1	STORM DRAINAGE PLAN PRE DEVELOPMENT CONDITIONS
POST-1	OVERALL STORM DRAINAGE PLAN POST DEVELOPMENT CONDITIONS
POST-2	STORM DRAINAGE PLAN POST DEVELOPMENT CONDITIONS
SAN-1	SANITARY DRAINAGE PLAN
SERV-1	GENERAL SERVICING PLAN
GRAD-1	PROPOSED SITE GRADING PLAN, OVERALL
GRAD-2	PROPOSED SITE GRADING PLAN, SOUTH END
GRAD-3	PROPOSED SITE GRADING PLAN, NORTH END
GRAD-4	SEDIMENT AND EROSION CONTROL PLAN

**ISSUED FOR  
DRAFT PLAN APPROVAL**

DATE: APRIL 2021



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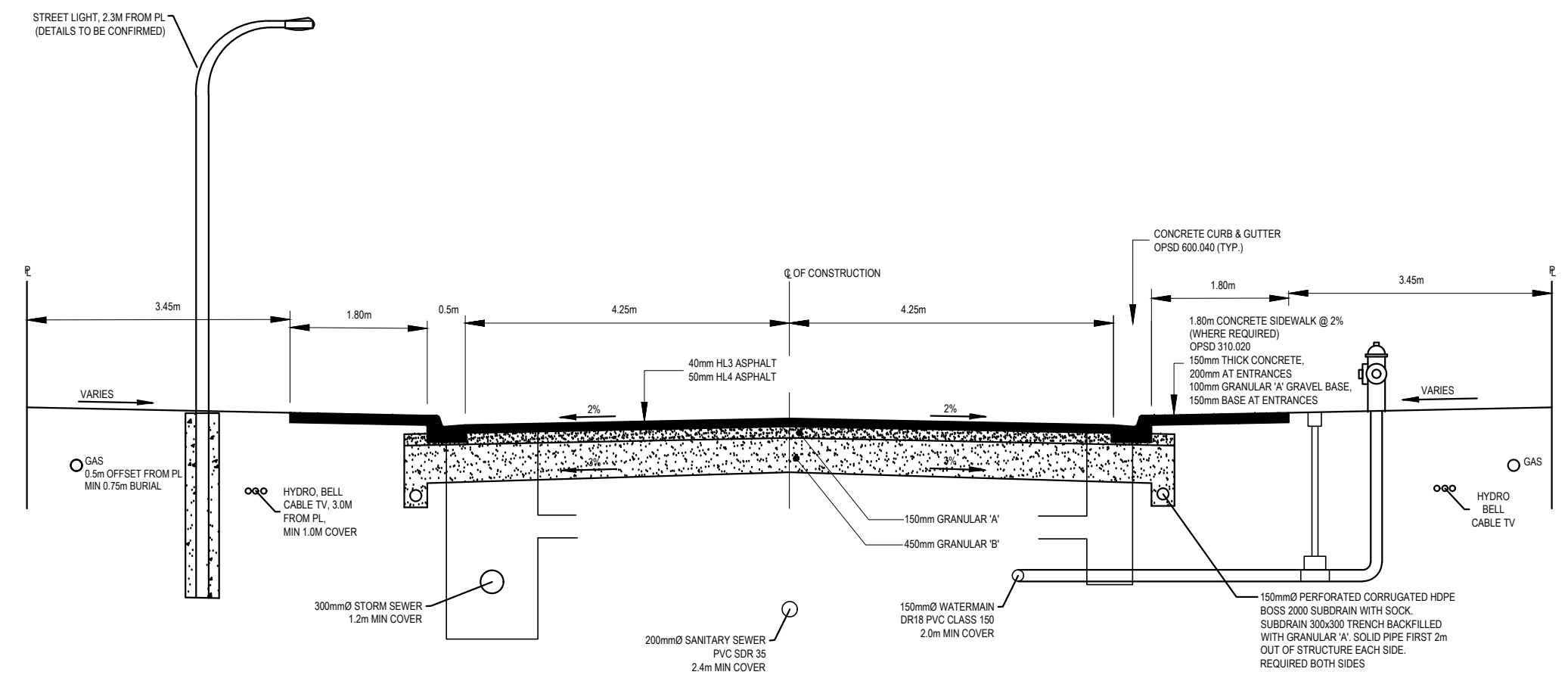
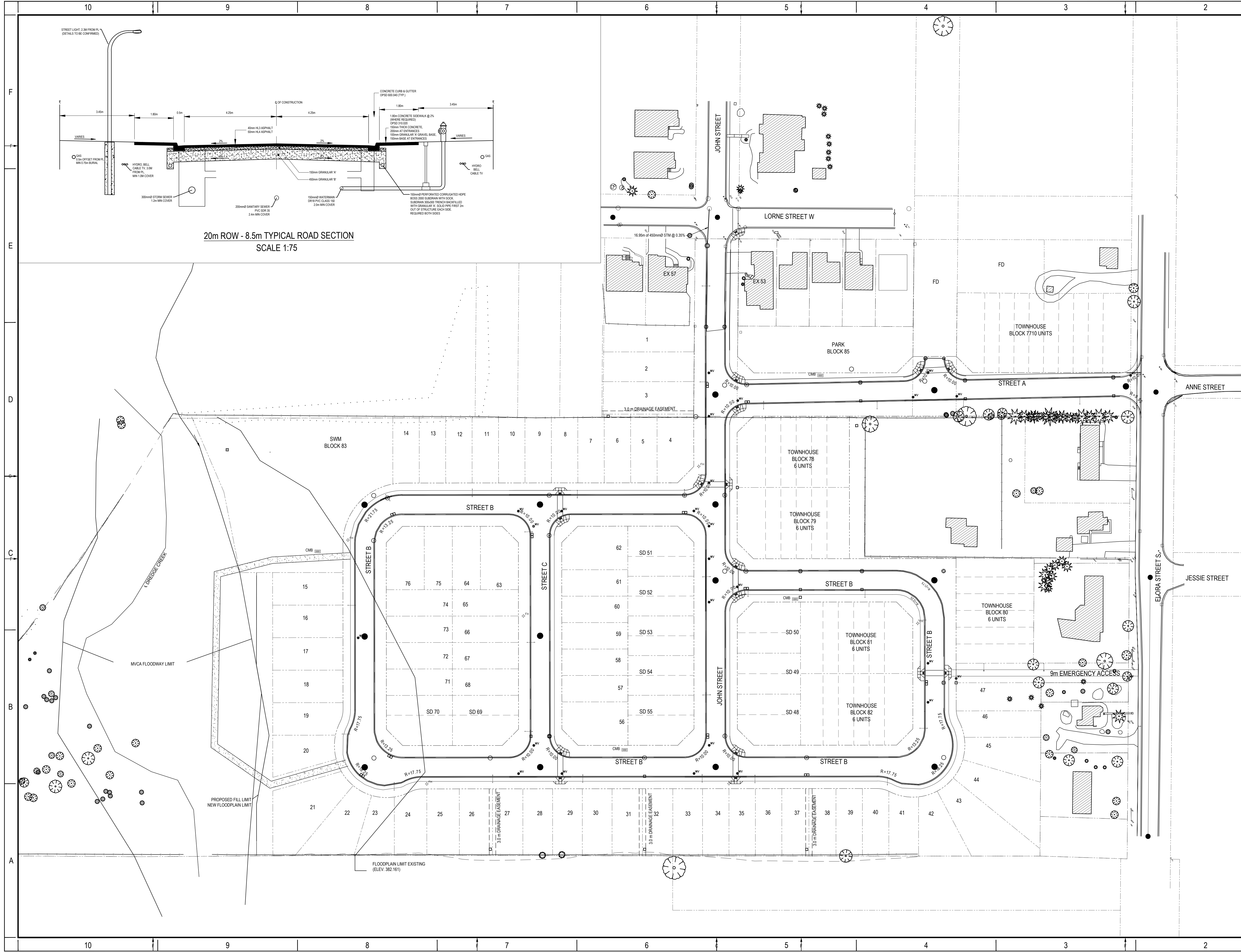
ISSUED FOR - REVISION

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1	01-20-2020	FIRST SUBMISSION

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HARRISTON**

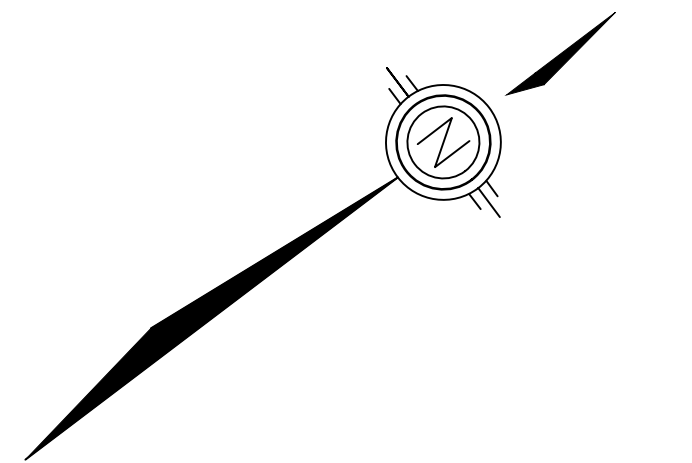
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20m ROW - 8.5m TYPICAL ROAD SECTION  
SCALE 1:75

**PRELIMINARY**

NOT FOR CONSTRUCTION



BENCHMARK: ELEV. 382.441M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
OF LORNE ST. (CGVD 2013)  
SURVEY BY AUTOMATED ENGINEERING 2018



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1	0	01-20-2020	FIRST SUBMISSION

PROJECT NO: 191-103	DATE: APRIL 2021
ORIGINAL SCALE: 1:750	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTING SCALE.
DESIGNED BY: K. PILON	
DRAWN BY: K. PILON	
CHECKED BY:	

TITLE:  
**PROPOSED SITE PLAN  
HARRISTON**

SHEET NUMBER:  
SP-1

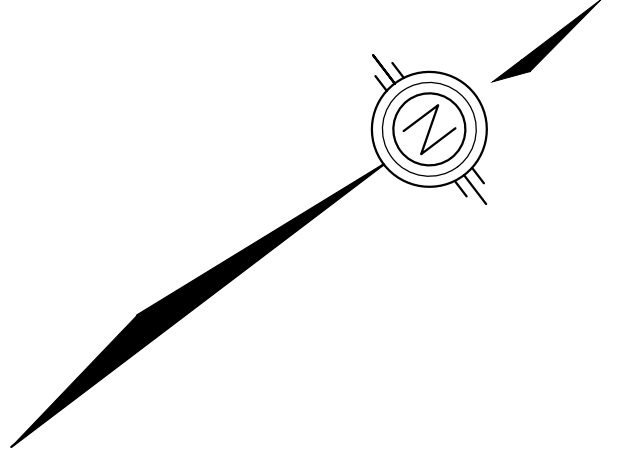
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  - EXISTING CENTERLINE
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  - EXISTING TREELINE
  - EXISTING DITCH
  - SANITARY SEWER
  - WATERMAIN
  - STORM SEWER
  - BOTTOM OF SLOPE
  - MH1 EXISTING BUILDING
  - CBMH EXISTING SANITARY MANHOLE
  - POST EXISTING CATCHBASIN MANHOLE
  - CO EXISTING CATCHBASIN
  - CS EXISTING SANITARY CLEANOUT
  - FH EXISTING CURB STOP VALVE
  - HW EXISTING FIRE HYDRANT
  - WV EXISTING WATERVALVE
  - HP ○ AN EXISTING HYDRO POLE AND ANCHOR
  - RPED EXISTING BELL PEDESTAL
  - BMH EXISTING BELL MANHOLE
  - SB EXISTING STANDARD IRON BAR
  - IB EXISTING IRON BAR
  - RB EXISTING ROUND IRON BAR
  - EXISTING FLOWERBED
  - EXISTING CONIFEROUS TREE
  - EXISTING DECIDUOUS TREE
  - EXISTING DECIDUOUS SHRUB
  - ASPHALT - REMOVE AND REPLACE
  - EXISTING ON VICTORIA ST.
- PROPOSED CONSTRUCTION**
- PROPOSED CENTRELINE OF ROAD
  - PROPOSED BUILDING ENVELOPE
  - BACK OF CURB
  - EDGE OF ASPHALT
  - CS PROPOSED CURB STOP VALVE
  - WV PROPOSED WATERMAIN VALVE
  - FH PROPOSED FIRE HYDRANT
  - MH1 PROPOSED SANITARY MANHOLE
  - PROPOSED STORM SEWER MANHOLE
  - EXISTING GRADE
  - x 203.86 PROPOSED GRADE
  - PROPOSED SWALE
  - STORM SEWER
  - SANITARY SEWER
  - WATERMAIN
  - LIMIT OF CONTRACT
  - DRAINAGE FLOW
  - A1 CATCHMENT AREA ID
  - CATCHMENT AREA (ha)
  - MANNINGS n VALUE (RUNOFF COEFFICIENT)
  - STORM DRAINAGE BOUNDARY



**PRELIMINARY**

NOT FOR CONSTRUCTION



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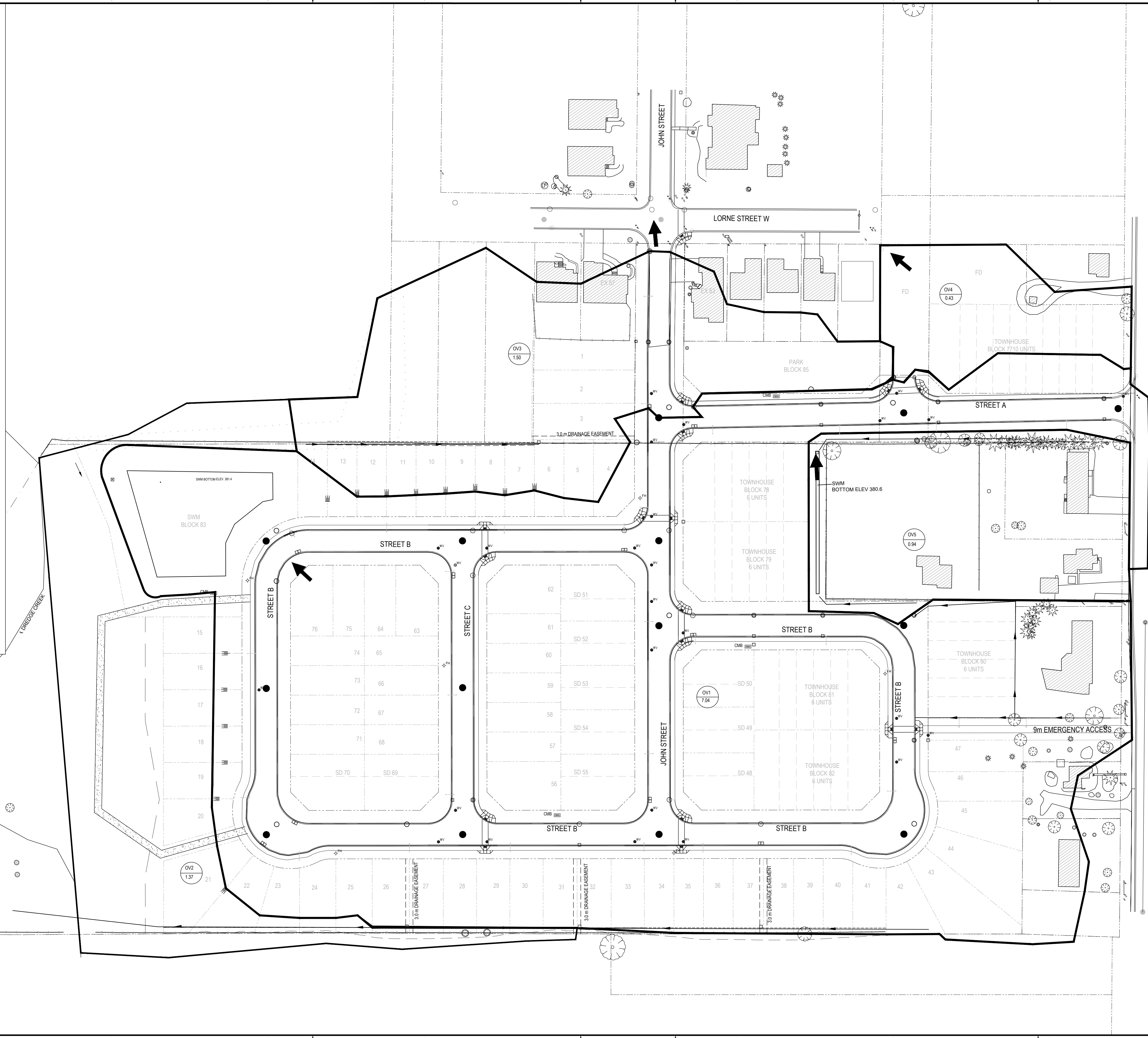
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DESIGNED BY: K.PILON	
DRAWN BY: K.PILON	
CHECKED BY:	

TITLE:  
**STORM DRAINAGE PLAN  
PRE-DEVELOPMENT CONDITIONS  
HARRISTON**

SHEET NUMBER:  
PRE-1

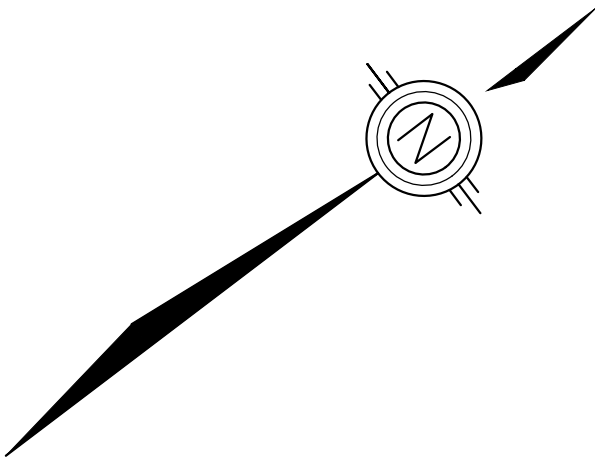
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  - EXISTING TREELINE
  - EXISTING DITCH
  - SANITARY SEWER
  - WATERMAIN
  - STORM SEWER
  - BOTTOM OF SLOPE
  - EXISTING BUILDING
  - EXISTING SANITARY MANHOLE
  - EXISTING CATCHBASIN MANHOLE
  - EXISTING POST
  - EXISTING CATCHBASIN
  - EXISTING SANITARY CLEANOUT
  - EXISTING CURB STOP VALVE
  - EXISTING FIRE HYDRANT
  - EXISTING WATERVALVE
  - EXISTING HYDRO POLE AND ANCHOR
  - EXISTING BELL PEDESTAL
  - EXISTING BELL MANHOLE
  - EXISTING STANDARD IRON BAR
  - EXISTING IRON BAR
  - EXISTING ROUND IRON BAR
  - EXISTING FLOWERBED
  - EXISTING CONIFEROUS TREE
  - EXISTING DECIDUOUS TREE
  - EXISTING DECIDUOUS SHRUB
  - ASPHALT - REMOVE AND REPLACE
  - EXISTING ON VICTORIA ST.
- PROPOSED CONSTRUCTION**
- PROPOSED CENTRELINE OF ROAD
  - PROPOSED BUILDING ENVELOPE
  - BACK OF CURB
  - EDGE OF ASPHALT
  - PROPOSED CURB STOP VALVE
  - PROPOSED WATERMAIN VALVE
  - PROPOSED FIRE HYDRANT
  - PROPOSED SANITARY MANHOLE
  - PROPOSED STORM SEWER MANHOLE
  - EXISTING GRADE
  - PROPOSED GRADE
  - PROPOSED SWALE
  - STORM SEWER
  - SANITARY SEWER
  - WATERMAIN
  - LIMIT OF CONTRACT
  - DRAINAGE FLOW
  - CATCHMENT AREA ID
  - CATCHMENT AREA (ha)
  - MANNINGS n VALUE (RUNOFF COEFFICIENT)
  - STORM DRAINAGE BOUNDARY



**PRELIMINARY**

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BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
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ORIGINAL SCALE:	1:750	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.	
DESIGNED BY:	K. PILON		
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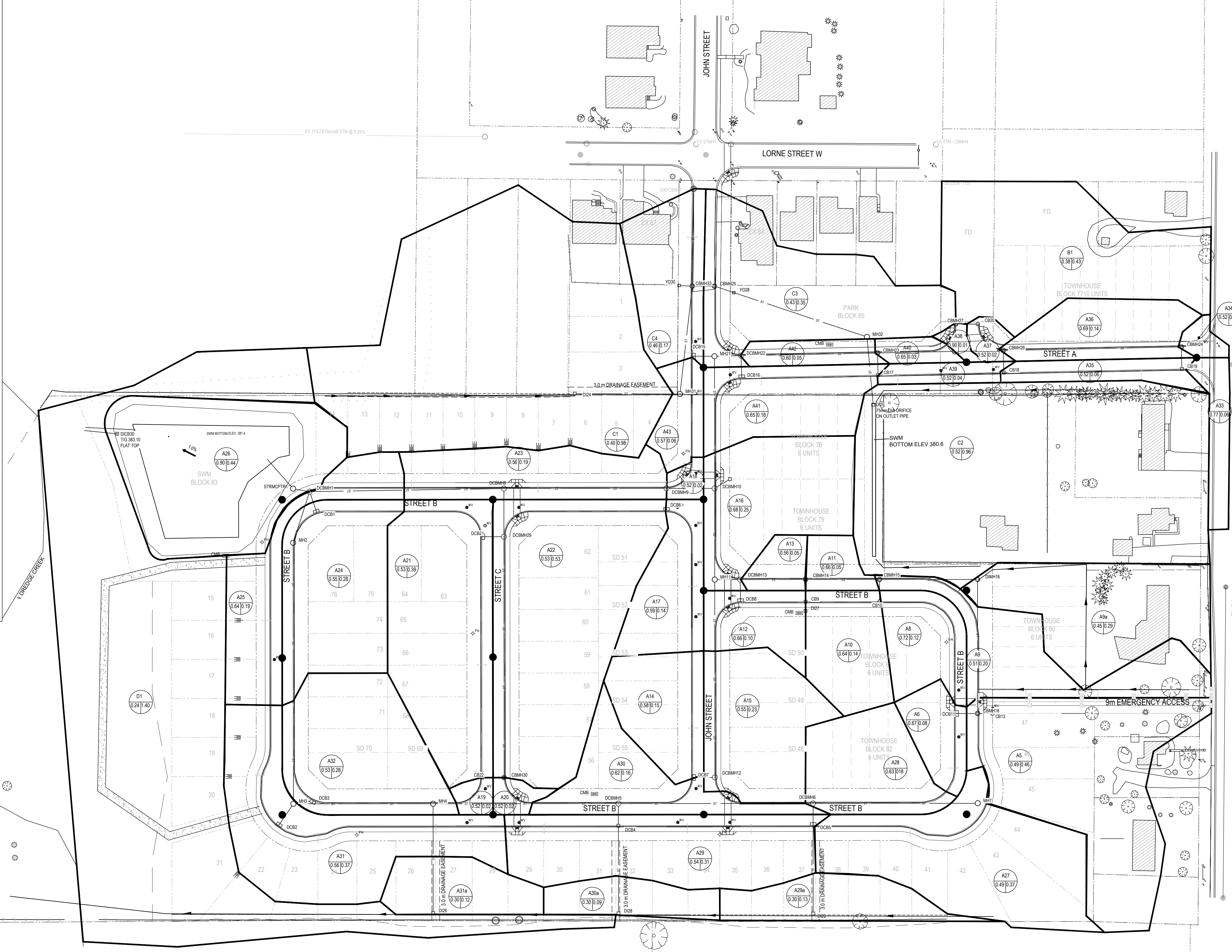
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POST-DEVELOPMENT CONDITIONS  
HARRISTON**

SHEET NUMBER: POST-1

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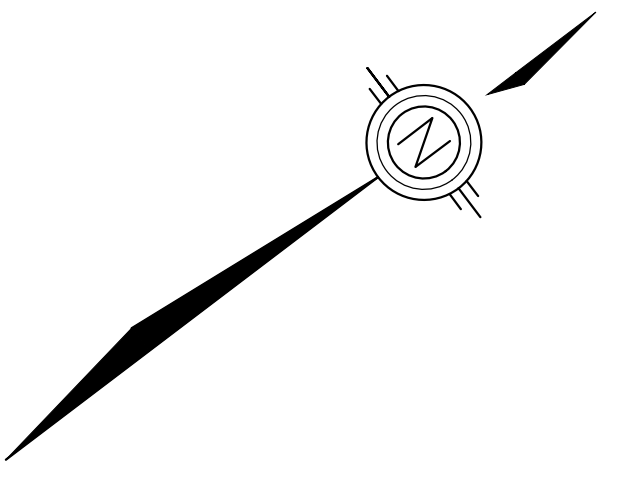
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  - - - - - EXISTING DITCH
  - - - - - SANITARY SEWER
  - - - - - WATERMAIN
  - - - - - STORM SEWER
  - - - - - BOTTOM OF SLOPE
  - MH EXISTING BUILDING
  - CBMH EXISTING SANITARY MANHOLE
  - CBMH EXISTING CATCHBASIN MANHOLE
  - POST EXISTING POST
  - CB EXISTING CATCHBASIN
  - CO EXISTING SANITARY CLEANOUT
  - CS EXISTING CURB STOP VALVE
  - FH EXISTING FIRE HYDRANT
  - WV EXISTING WATERVALVE
  - HP-AN EXISTING HYDRO POLE AND ANCHOR
  - SPED EXISTING BELL PEDESTAL
  - BMH EXISTING BELL MANHOLE
  - SIB EXISTING STANDARD IRON BAR
  - IB EXISTING IRON BAR
  - RB EXISTING ROUND IRON BAR
  - EXISTING FLOWERBED
  - EXISTING CONIFEROUS TREE
  - EXISTING DECIDUOUS TREE
  - EXISTING DECIDUOUS SHRUB
  - ASPHALT - REMOVE AND REPLACE
  - EXISTING ON VICTORIA ST.

- PROPOSED CONSTRUCTION**
- - - - - PROPOSED CENTRELINE OF ROAD
  - - - - - PROPOSED BUILDING ENVELOPE
  - - - - - BACK OF CURB
  - - - - - EDGE OF ASPHALT
  - CS PROPOSED CURB STOP VALVE
  - WV PROPOSED WATERMAIN VALVE
  - FH PROPOSED FIRE HYDRANT
  - MH1 PROPOSED SANITARY MANHOLE
  - PROPOSED STORM SEWER MANHOLE
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  - × 203.86 PROPOSED GRADE
  - - - - - PROPOSED SWALE
  - - - - - STORM SEWER
  - - - - - SANITARY SEWER
  - - - - - WATERMAIN
  - - - - - LIMIT OF CONTRACT
  - - - - - DRAINAGE FLOW
  - A1 CATCHMENT AREA ID
  - CATCHMENT AREA (ha)
  - MANNINGS n VALUE (RUNOFF COEFFICIENT)
  - - - - - STORM DRAINAGE BOUNDARY



**PRELIMINARY**

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BENCHMARK: ELEV. 382.441M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
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SURVEY BY AUTOMATED ENGINEERING 2018



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PROJECT NO:	191-103	DATE:	APRIL 2021
ORIGINAL SCALE:	1:750	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.	
DESIGNED BY:	K. PILON		
DRAWN BY:	K. PILON		
CHECKED BY:			

**STORM DRAINAGE PLAN**  
POST-DEVELOPMENT CONDITIONS  
HARRISTON

SHEET NUMBER  
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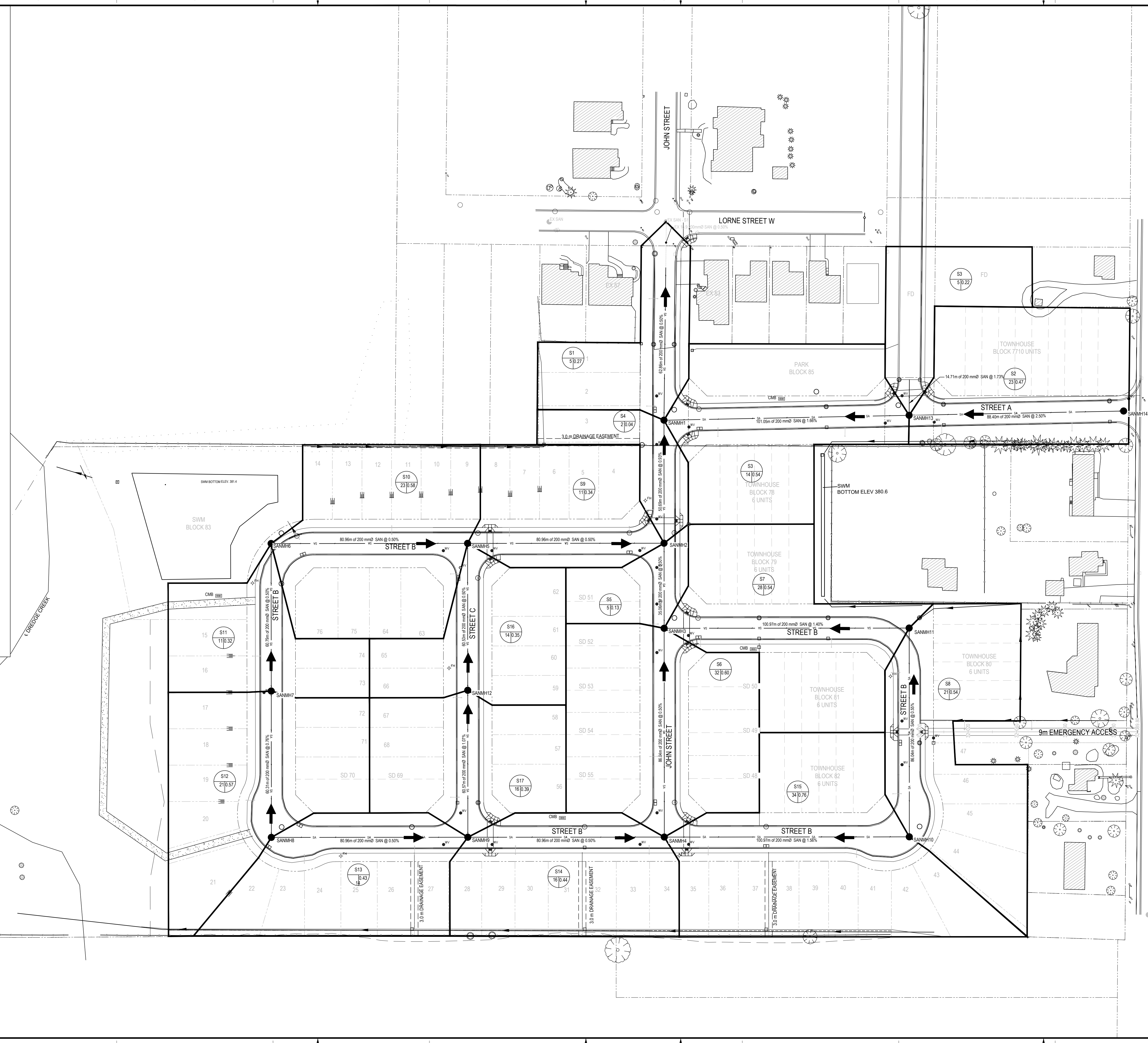
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- SANITARY SEWER
- WATERMAIN
- STORMSEWER
- BOTTOM OF SLOPE
- TOP OF SLOPE
- EXISTING BUILDING
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN MANHOLE
- EXISTING POST
- EXISTING CATCHBASIN
- EXISTING SANITARY CLEANOUT
- EXISTING CURB STOP VALVE
- EXISTING FIRE HYDRANT
- EXISTING WATERVALVE
- EXISTING HYDRO POLE AND ANCHOR
- EXISTING BELL PEDESTAL
- EXISTING BELL MANHOLE
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- EXISTING IRON BAR
- EXISTING ROUND IRON BAR
- EXISTING ROAD SIGN
- EXISTING TEST PIT
- EXISTING FLOWERBED
- EXISTING CONIFEROUS TREE
- EXISTING DECIDUOUS TREE
- EXISTING DECIDUOUS SHRUB
- ASPHALT
- (TO BE REMOVED AND REPLACED)

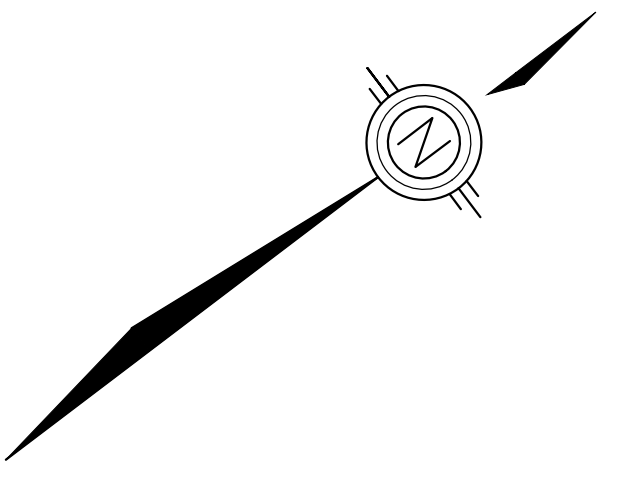
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- PROPOSED EDGE OF SIDEWALK
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- PROPOSED WATERMAIN VALVE
- PROPOSED FIRE HYDRANT
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM SEWER MANHOLE
- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED CONTOURS
- PROPOSED BOTTOM OF SWALE
- STORM SEWER
- SANITARY SEWER
- WATERMAIN
- LIMIT OF CONTRACT
- DRAINAGE FLOW
- CATCHMENT AREA ID
- CATCHMENT AREA (ha)
- POPULATION
- DRAINAGE BOUNDARY



**PRELIMINARY**

NOT FOR CONSTRUCTION



BENCHMARK: ELEV. 382.441M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
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ORIGINAL SCALE:	1:750	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.	
DESIGNED BY:	K. PILON		
DRAWN BY:	K. PILON		
CHECKED BY:			

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HARRISTON**

SHEET NUMBER: **SAN-1**

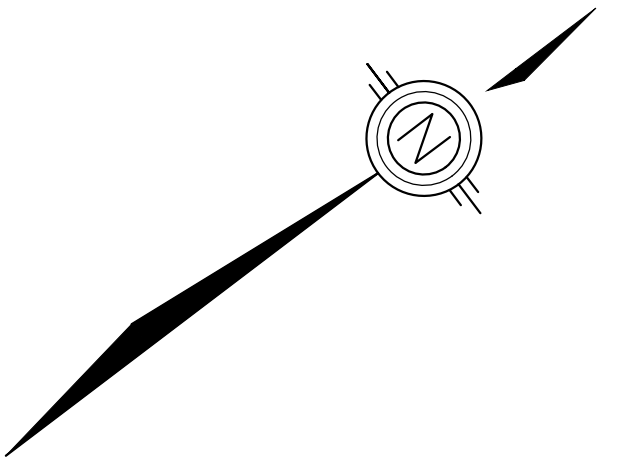
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- EXISTING CONDITIONS**
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  - EXISTING GRANULAR SHOULDER
  - EXISTING TREELINE
  - SANITARY SEWER
  - WATERMAIN
  - STORMSEWER
  - BOTTOM OF SLOPE
  - TOP OF SLOPE
  - EXISTING BUILDING
  - EXISTING SANITARY MANHOLE
  - EXISTING CATCHBASIN MANHOLE
  - EXISTING POST
  - EXISTING CATCHBASIN
  - EXISTING SANITARY CLEANOUT
  - EXISTING CURB STOP VALVE
  - EXISTING FIRE HYDRANT
  - EXISTING WATERVALVE
  - EXISTING HYDRO POLE AND ANCHOR
  - EXISTING BELL PEDESTAL
  - EXISTING BELL MANHOLE
  - EXISTING STANDARD IRON BAR
  - EXISTING IRON BAR
  - EXISTING ROUND IRON BAR
  - EXISTING ROAD SIGN
  - EXISTING TEST PIT
  - EXISTING FLOWERBED
  - EXISTING CONIFEROUS TREE
  - EXISTING DECIDUOUS TREE
  - EXISTING DECIDUOUS SHRUB
  - ASPHALT  
(TO BE REMOVED AND REPLACED)

- PROPOSED CONSTRUCTION**
- PROPOSED EDGE OF SIDEWALK
  - PROPOSED BUILDING ENVELOPE
  - BACK OF CURB
  - EDGE OF ASPHALT
  - PROPOSED CURB STOP VALVE
  - PROPOSED WATERMAIN VALVE
  - PROPOSED FIRE HYDRANT
  - PROPOSED SANITARY MANHOLE
  - PROPOSED STORM SEWER MANHOLE
  - EXISTING GRADE
  - PROPOSED GRADE
  - PROPOSED CONTOURS
  - PROPOSED BOTTOM OF SWALE
  - STORM SEWER
  - SANITARY SEWER
  - WATERMAIN
  - LIMIT OF CONTRACT
  - OVERLAND FLOW ROUTE
  - GRADING LIMIT

**PRELIMINARY**

NOT FOR CONSTRUCTION



BENCHMARK: ELEV. 382.411M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
OF LORNE ST. (CGVD 2013)  
SURVEY BY AUTOMATED ENGINEERING 2018



**MOOREFIELD**  
excavating

6297 WELLINGTON COUNTY ROAD R963  
HARRISTON, ONTARIO  
CANADA N0G 1Z0  
PHONE: 519-515-3271 FAX: 519-515-3277  
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IS	RE	DATE	DESCRIPTION
2	0	04-20-2021	SECOND SUBMISSION - DRAFT PLAN
1	0	01-20-2020	FIRST SUBMISSION

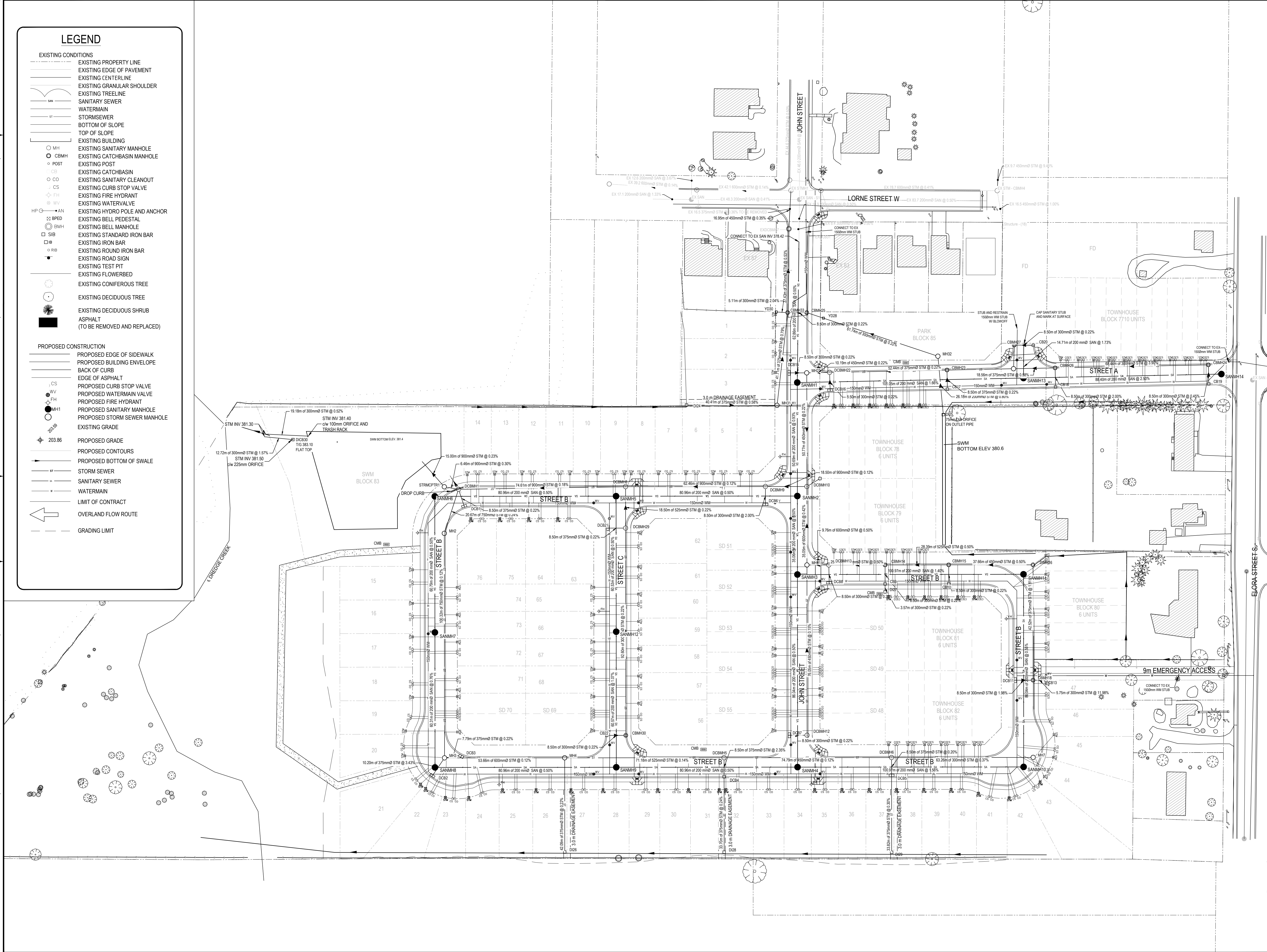
PROJECT NO:	191-103	DATE:	APRIL 2021
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ORIGINAL SCALE:	1:750	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
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DESIGNED BY:	K. PILON
DRAWN BY:	K. PILON
CHECKED BY:	

**GENERAL SERVICING PLAN  
HARRISTON**

SHEET NUMBER:	SERV-1
---------------	--------





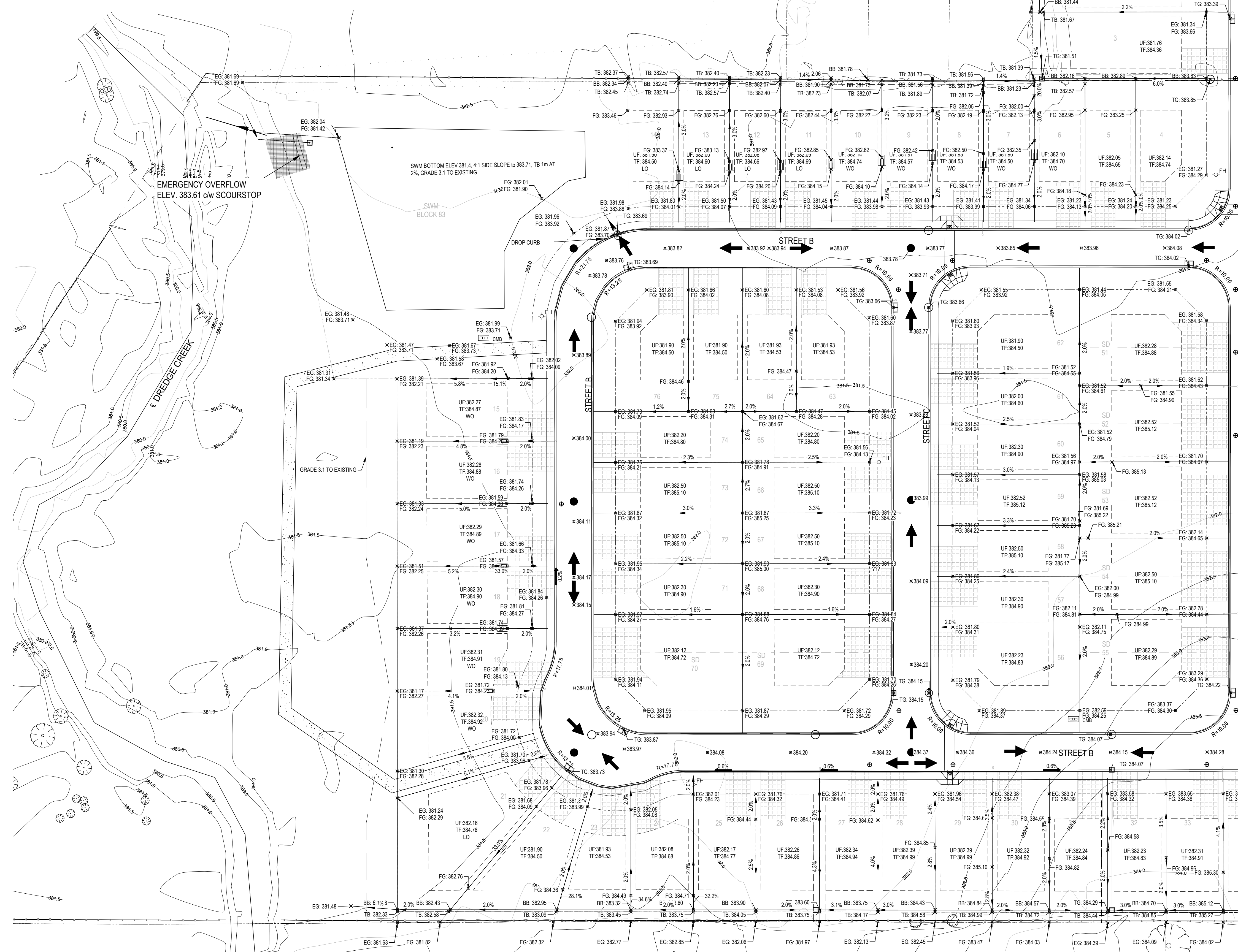
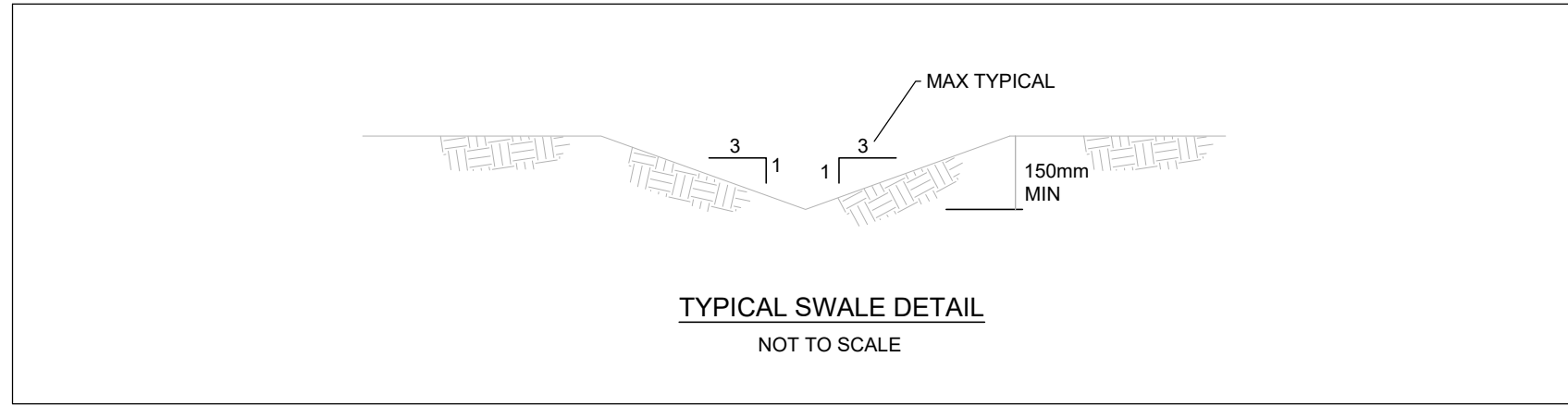
### LEGEND

**EXISTING CONDITIONS**

- EXISTING PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING CENTERLINE
- EXISTING GRANULAR SHOULDER
- EXISTING TREELINE
- 0.5m CONTOURS
- BOTTOM OF SLOPE
- TOP OF SLOPE
- EXISTING BUILDING
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN MANHOLE
- EXISTING POIST
- EXISTING CATCHBASIN
- EXISTING SANITARY CLEANOUT
- EXISTING CURB STOP VALVE
- EXISTING FIRE HYDRANT
- EXISTING WATERVALVE
- EXISTING HYDRO POLE AND ANCHOR
- EXISTING BELL PEDESTAL
- EXISTING BELL MANHOLE
- EXISTING STANDARD IRON BAR
- EXISTING IRON BAR
- EXISTING ROUND IRON BAR
- EXISTING ROAD SIGN
- EXISTING FLOWERBED
- EXISTING CONIFEROUS TREE
- EXISTING DECIDUOUS TREE
- EXISTING DECIDUOUS SHRUB

**PROPOSED CONSTRUCTION**

- EDGE OF SIDEWALK
- BUILDING ENVELOPE
- BACK OF CURB
- EDGE OF ASPHALT
- PROPOSED CURB STOP VALVE
- PROPOSED WATERMAIN VALVE
- PROPOSED FIRE HYDRANT
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- CATCHBASIN MANHOLE
- DOUBLE CATCHBASIN MANHOLE
- DOUBLE CATCHBASIN
- CATCH BASIN
- EXISTING GRADE
- PROPOSED GRADE
- TOP OF GRATE GRADE
- TOP OF BANK GRADE
- BOTTOM OF BANK/SWALE GRADE
- PROPOSED SLOPE DIRECTION %
- MIN. UNDERSIDE OF FOOTING
- MIN. TOP OF FOUNDATION
- WALKOUT BASEMENT
- LOOKOUT BASEMENT
- PROPOSED TOP OF BANK
- PROPOSED BOTTOM OF SWALE
- OVERLAND FLOW ROUTE
- DRIVEWAY
- GRADING LIMIT



**PROPOSED BUILDING ELEVATION**

THE MINIMUM ELEVATION FOR TOP OF FOUNDATION (T.F.) WALL IS CALCULATED FROM HIGHEST FRONT LOT CORNER PLUS 0.45m.

THE MINIMUM BASEMENT SLAB ELEVATION (B.S.E.) IS 382.16m.

FINISHED FLOOR ELEVATION (F.F.E.), UNDERSIDE OF FOOTING (U.F.) AND GARAGE FINISHED FLOOR MAY VARY BASED ON BUILDING SPECIFICATIONS AND WILL REQUIRE THE TOWNSHIP'S APPROVAL THROUGH THE BUILDING PERMIT PROCESS.

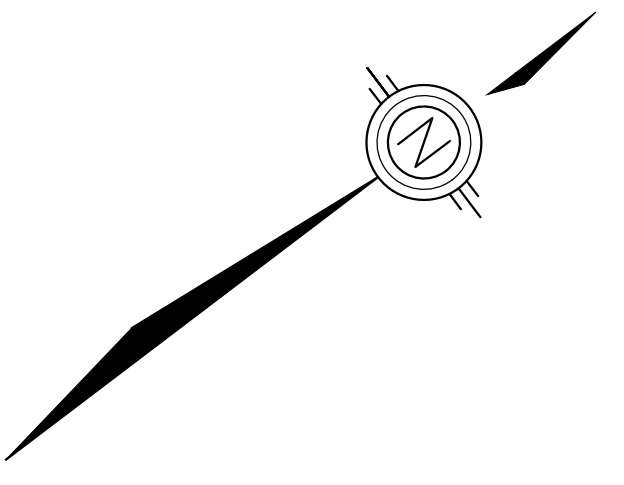
MAXIMUM DRIVEWAY GRADE IS 6%.

LOTS DRAINING BACK TO FRONT WILL REQUIRE RAINBOW SWALE DETAILED ON LOT SPECIFIC SITE GRADING PLAN.

SITE SPECIFIC LOT GRADING PLANS REQUIRED BEFORE CONSTRUCTION OF INDIVIDUAL LOTS. PLANS TO BE PREPARED BY MOOREFIELD EXCAVATING.

**PRELIMINARY**

NOT FOR CONSTRUCTION



BENCHMARK ELEV. 382.441M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
OF LORNE ST. (CGVD 2013)  
SURVEY BY AUTOMATED ENGINEERING 2018



6297 WELLINGTON COUNTY ROAD R363  
HARRISTON, ONTARIO  
CANADA N0G 1Z0  
PHONE: 519-515-3571 FAX: 519-510-3277  
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ISSUE	DATE	DESCRIPTION
2	04-20-2021	SECOND SUBMISSION - DRAFT PLAN
1	01-20-2020	FIRST SUBMISSION

PROJECT NO:	191-103	DATE:	APRIL 2021
ORIGINAL SCALE:	1:500	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.	
DESIGNED BY:	K. PILON		
CHECKED BY:	K. PILON		

**PROPOSED SITE GRADING PLAN  
SOUTH END  
HARRISTON**

SHEET NUMBER: GRAD-2

### LEGEND

**EXISTING CONDITIONS**

- EXISTING PROPERTY LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING CENTERLINE
- EXISTING GRANULAR SHOULDER
- EXISTING TREELINE
- 0.5m CONTOURS
- BOTTOM OF SLOPE
- TOP OF SLOPE
- EXISTING BUILDING
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN MANHOLE
- EXISTING POST
- EXISTING CATCHBASIN
- EXISTING SANITARY CLEANOUT
- EXISTING CURB STOP VALVE
- EXISTING FIRE HYDRANT
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- EXISTING HYDRO POLE AND ANCHOR
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- EXISTING ROAD SIGN
- EXISTING FLOWERBED
- EXISTING CONIFEROUS TREE
- EXISTING DECIDUOUS TREE
- EXISTING DECIDUOUS SHRUB

**PROPOSED CONSTRUCTION**

- EDGE OF SIDEWALK
- BUILDING ENVELOPE
- BACK OF CURB
- EDGE OF ASPHALT
- PROPOSED CURB STOP VALVE
- PROPOSED WATERMAIN VALVE
- PROPOSED FIRE HYDRANT
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- CATCHBASIN MANHOLE
- DOUBLE CATCHBASIN MANHOLE
- DOUBLE CATCHBASIN
- CATCH BASIN
- EXISTING GRADE
- PROPOSED GRADE
- TOP OF GRATE GRADE
- TOP OF BANK GRADE
- BOTTOM OF BANK/SWALE GRADE
- PROPOSED SLOPE DIRECTION %
- MIN. UNDERSIDE OF FOOTING
- MIN. TOP OF FOUNDATION
- WALKOUT BASEMENT
- LOOKOUT BASEMENT
- PROPOSED TOP OF BANK
- PROPOSED BOTTOM OF SWALE
- OVERLAND FLOW ROUTE
- DRIVEWAY
- GRADING LIMIT

**PROPOSED BUILDING ELEVATION**

THE MINIMUM ELEVATION FOR TOP OF FOUNDATION (T.F.) WALL IS CALCULATED FROM HIGHEST FRONT LOT CORNER PLUS 0.45m.

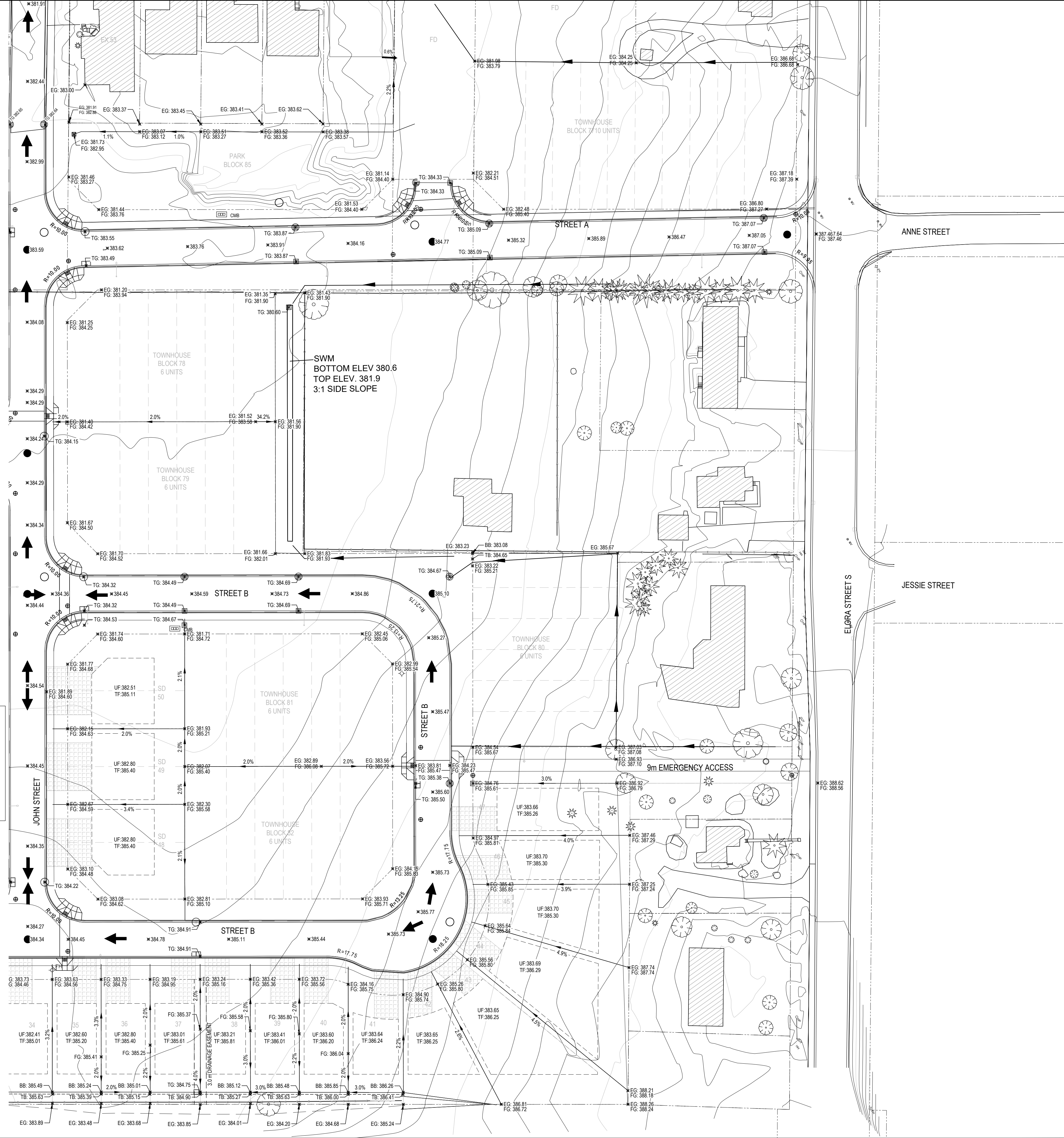
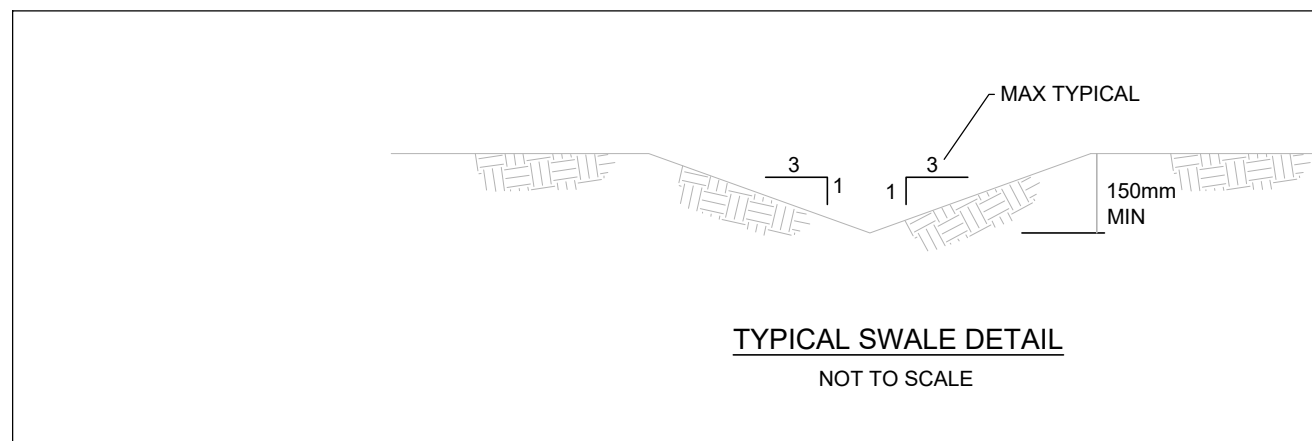
THE MINIMUM BASEMENT SLAB ELEVATION (B.S.E.) IS 382.16m.

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MAXIMUM DRIVEWAY GRADE IS 6%.

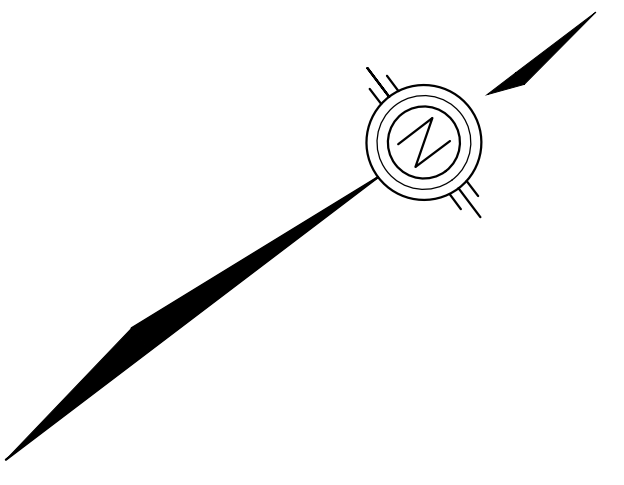
LOTS DRAINING BACK TO FRONT WILL REQUIRE RAINBOW SWALE DETAILED ON LOT SPECIFIC SITE GRADING PLAN.

SITE SPECIFIC LOT GRADING PLANS REQUIRED BEFORE CONSTRUCTION OF INDIVIDUAL LOTS. PLANS TO BE PREPARED BY MOOREFIELD EXCAVATING.



**PRELIMINARY**

NOT FOR CONSTRUCTION



BENCHMARK: ELEV. 382.441M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
OF LORNE ST. (CGVD 2013)  
SURVEY BY AUTOMATED ENGINEERING 2018



6297 WELLINGTON COUNTY ROAD R363  
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IS	RE	DATE	DESCRIPTION
2	0	04-20-2021	SECOND SUBMISSION - DRAFT PLAN
1	0	01-20-2020	FIRST SUBMISSION

PROJECT NO: 191-103	DATE: APRIL 2021
ORIGINAL SCALE: 1:500	IF THIS BAR IS NOT 20mm LONG, ADJUST YOUR PLOTTING SCALE.
DESIGNED BY: K. PILON	
DRAWN BY: K. PILON	
CHECKED BY:	

TITLE:  
**PROPOSED SITE GRADING PLAN  
NORTH END  
HARRISTON**

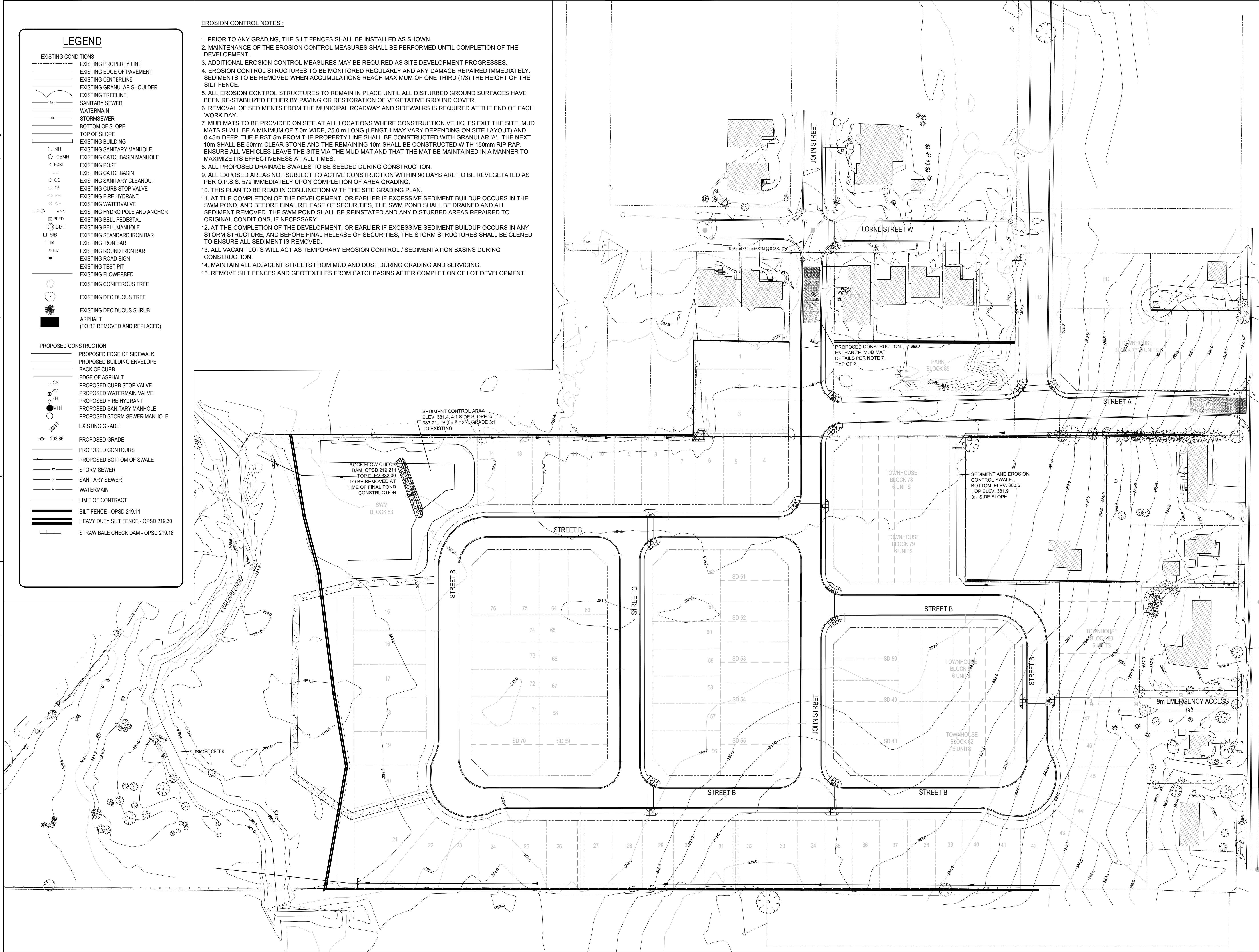
SHEET NUMBER:  
GRAD-3

**LEGEND**

- EXISTING CONDITIONS**
- EXISTING PROPERTY LINE
  - EXISTING EDGE OF PAVEMENT
  - EXISTING CENTERLINE
  - EXISTING GRANULAR SHOULDER
  - EXISTING TREELINE
  - SANITARY SEWER
  - WATERMAIN
  - STORMSEWER
  - BOTTOM OF SLOPE
  - TOP OF SLOPE
  - EXISTING BUILDING
  - EXISTING SANITARY MANHOLE
  - EXISTING CATCHBASIN MANHOLE
  - EXISTING POST
  - EXISTING CATCHBASIN
  - EXISTING SANITARY CLEANOUT
  - EXISTING CURB STOP VALVE
  - EXISTING FIRE HYDRANT
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  - EXISTING HYDRO POLE AND ANCHOR
  - EXISTING BELL PEDESTAL
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  - EXISTING ROUND IRON BAR
  - EXISTING ROAD SIGN
  - EXISTING TEST PIT
  - EXISTING FLOWERBED
  - EXISTING CONIFEROUS TREE
  - EXISTING DECIDUOUS TREE
  - EXISTING DECIDUOUS SHRUB
  - ASPHALT  
(TO BE REMOVED AND REPLACED)
- PROPOSED CONSTRUCTION**
- PROPOSED EDGE OF SIDEWALK
  - PROPOSED BUILDING ENVELOPE
  - BACK OF CURB
  - EDGE OF ASPHALT
  - PROPOSED CURB STOP VALVE
  - PROPOSED WATERMAIN VALVE
  - PROPOSED FIRE HYDRANT
  - PROPOSED SANITARY MANHOLE
  - PROPOSED STORM SEWER MANHOLE
  - EXISTING GRADE
  - PROPOSED GRADE
  - PROPOSED CONTOURS
  - PROPOSED BOTTOM OF SWALE
  - STORM SEWER
  - SANITARY SEWER
  - WATERMAIN
  - LIMIT OF CONTRACT
  - SILT FENCE - OPSD 219.11
  - HEAVY DUTY SILT FENCE - OPSD 219.30
  - STRAW BALE CHECK DAM - OPSD 219.18

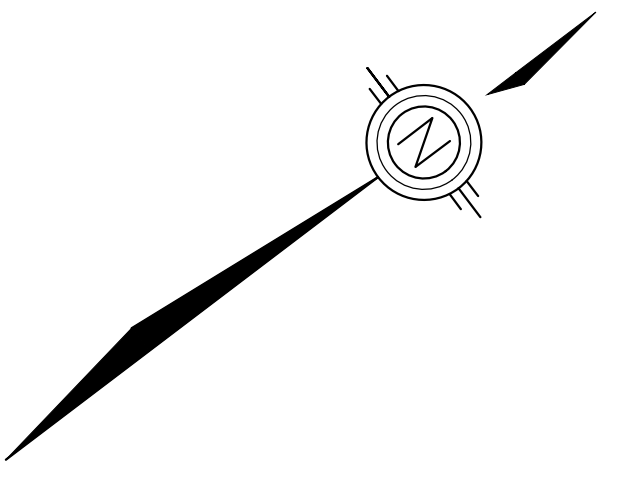
**EROSION CONTROL NOTES:**

1. PRIOR TO ANY GRADING, THE SILT FENCES SHALL BE INSTALLED AS SHOWN.
2. MAINTENANCE OF THE EROSION CONTROL MEASURES SHALL BE PERFORMED UNTIL COMPLETION OF THE DEVELOPMENT.
3. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE DEVELOPMENT PROGRESSES.
4. EROSION CONTROL STRUCTURES TO BE MONITORED REGULARLY AND ANY DAMAGE REPAIRED IMMEDIATELY. SEDIMENTS TO BE REMOVED WHEN ACCUMULATIONS REACH MAXIMUM OF ONE THIRD (1/3) THE HEIGHT OF THE SILT FENCE.
5. ALL EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RE-STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
6. REMOVAL OF SEDIMENTS FROM THE MUNICIPAL ROADWAY AND SIDEWALKS IS REQUIRED AT THE END OF EACH WORK DAY.
7. MUD MATS TO BE PROVIDED ON SITE AT ALL LOCATIONS WHERE CONSTRUCTION VEHICLES EXIT THE SITE. MUD MATS SHALL BE A MINIMUM OF 7.0m WIDE, 25.0 m LONG (LENGTH MAY VARY DEPENDING ON SITE LAYOUT) AND 0.45m DEEP. THE FIRST 5m FROM THE PROPERTY LINE SHALL BE CONSTRUCTED WITH GRANULAR 'A'. THE NEXT 10m SHALL BE 50mm CLEAR STONE AND THE REMAINING 10m SHALL BE CONSTRUCTED WITH 150mm RIP RAP. ENSURE ALL VEHICLES LEAVE THE SITE VIA THE MUD MAT AND THAT THE MAT BE MAINTAINED IN A MANNER TO MAXIMIZE ITS EFFECTIVENESS AT ALL TIMES.
8. ALL PROPOSED DRAINAGE SWALES TO BE SEEDED DURING CONSTRUCTION.
9. ALL EXPOSED AREAS NOT SUBJECT TO ACTIVE CONSTRUCTION WITHIN 90 DAYS ARE TO BE REVEGETATED AS PER O.P.S.S. 572 IMMEDIATELY UPON COMPLETION OF AREA GRADING.
10. THIS PLAN TO BE READ IN CONJUNCTION WITH THE SITE GRADING PLAN.
11. AT THE COMPLETION OF THE DEVELOPMENT, OR EARLIER IF EXCESSIVE SEDIMENT BUILDUP OCCURS IN THE SWM POND, AND BEFORE FINAL RELEASE OF SECURITIES, THE SWM POND SHALL BE DRAINED AND ALL SEDIMENT REMOVED. THE SWM POND SHALL BE REINSTATED AND ANY DISTURBED AREAS REPAIRED TO ORIGINAL CONDITIONS, IF NECESSARY.
12. AT THE COMPLETION OF THE DEVELOPMENT, OR EARLIER IF EXCESSIVE SEDIMENT BUILDUP OCCURS IN ANY STORM STRUCTURE, AND BEFORE FINAL RELEASE OF SECURITIES, THE STORM STRUCTURES SHALL BE CLEARED TO ENSURE ALL SEDIMENT IS REMOVED.
13. ALL VACANT LOTS WILL ACT AS TEMPORARY EROSION CONTROL / SEDIMENTATION BASINS DURING CONSTRUCTION.
14. MAINTAIN ALL ADJACENT STREETS FROM MUD AND DUST DURING GRADING AND SERVICING.
15. REMOVE SILT FENCES AND GEOTEXTILES FROM CATCHBASINS AFTER COMPLETION OF LOT DEVELOPMENT.



**PRELIMINARY**

NOT FOR CONSTRUCTION



BENCHMARK ELEV. 382.441M  
BRASS PLUG (BENCHMARK #11) IN CONCRETE  
SEWAGE ACCESS ON THE WEST SIDE  
OF LORNE ST. (CGVD 2013)  
SURVEY BY AUTOMATED ENGINEERING 2018



**MOOREFIELD**  
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IS	RE	DATE	DESCRIPTION
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1	0	01-20-2020	FIRST SUBMISSION

PROJECT NO:	191-103	DATE:	APRIL 2021
ORIGINAL SCALE:	1:750	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.	
DESIGNED BY:	K. PILON		
DRAWN BY:	K. PILON		
CHECKED BY:			

**SEDIMENT AND EROSION CONTROL PLAN**  
HARRISTON

SHEET NUMBER  
GRAD-4

**APPENDIX B**  
**Fire Flow Calculations**

# Fire Flows and Fire Storage Requirement Calculation

Project: **Harriston Subdivision**

Owner: **Mex Developments Inc**

Project No. 19-103

Guidelines: **Water Supply for Public Fire Protection - Fire Underwriters Survey - 1999**

Date: January 2020

Facility	Building Classification								Fire Flow Calculations			Adjustments to Fire Flow			Recommended Values		
	Occupancy	Floor Area (m <sup>2</sup> )		Fire Walls	Dist. To Adj. Bldgs (m)	Roofing Material	Construction		C Value	A Area (m <sup>2</sup> )	F Fire F (l/min)	Occupancy Hazard	Sprinkler Reduction	Building Exposure	Fire Flow Rate (l/s)	Duration (hours)	Fire Storage (m <sup>3</sup> )
		Above Grade*	Basement				Type	Year									
<b>1. Single Detached</b>																	
	Group C	280	0	N/A	side 1 ~ 2.4m side 2 ~ 2.4m side 3 ~ 15.2m side 4 ~ 32m	Asphalt Shingles	Wood framed single storey structure with loft and brick veneer	2020	1.2	280	4,000	-15%	0%	70%	100	2	720
<b>2. Semi-Detached</b>																	
	Group C	408	0	N	side 1 ~ 0m side 2 ~ 2.4m side 3 ~ 15.2m side 4 ~ 32m	Asphalt Shingles	Wood framed single storey structure with loft and brick veneer	2020	1.2	408.000	5333	-15%	0%	70%	133	2	960
<b>4. Multiple Units Together - Interior Unit</b>																	
	Group C	270	0	Y	side 1 ~ 0m side 2 ~ 0m side 3 ~ 15.2m side 4 ~ 32m	Asphalt Shingles	Wood framed single storey structure with loft and brick veneer	2020	1.2	270.000	4338	-15%	0%	70%	100	2	720

\* Assumed Fire resistive between units

- Floor Area - Total floor area in square metres (including all storeys, but excluding basements which are at least 50% below grade) in the building considered. Condos assumed to contain loft (1.5xmain floor area was used).  
For fire-resistive buildings, consider the two largest adjoining floors plus 50 percent of each of any floors immediately above them up to eight, when the vertical openings are inadequately protected. If the vertical openings and exterior vertical communications are properly protected (one hour rating), consider only the area of the largest floor plus 25 percent of each of the two immediately adjoining floors.  
Note D: Wood frame structures separated by less than 3 metres shall be considered as one fire area.  
Note E: Fire Walls: - In determining floor areas, a fire wall that meets or exceeds the requirements of the current edition of the National Building Code of Canada (provided this necessitates a fire resistance rating of 2 or more hours) may be deemed to subdivide the building into more than one area or may, as a party wall, separate the building from an adjoining building.  
Normally any unpierced party wall considered to form a boundary when determining floor areas may warrant up to a 10% exposure charge.
- C Value - Coefficient related to the type of construction: 1.5 - for wood frame construction (structure essentially all combustible); 1.0 - for ordinary construction (brick or other masonry walls, combustible floor and interior); 0.8 - for non-combustible construction (unprotected metal structural components, masonry or metal walls); 0.6 - for fire-resistive construction (fully protected frame, floors, roof)
- F - the required fire flow in litres per minute calculated as follows:  $F = 220 \times C \times A^{0.5}$
- Occupancy Hazard Adjustments: the calculated fire flow may be modified based on the potential fire hazard of the occupancy contents. Adjustment factors for the type of contents are as follows:  
Non-combustible: -25%; Limited combustible: -15%; Combustible: no change; Free burning: +15%; Rapid burning: +25%. The fire flow demand shall not be less than 2,000 l/min.
- Automatic Sprinkler Protection - the adjusted fire flow (as modified by the Occupancy Hazard Adjustment) may be further reduced by up to 50% for complete automatic sprinkler protection, depending upon adequacy of the system.  
Typical adjustments include: -30% for sprinkler system that complies with NFPA 13 and other sprinkler standards; additional credit of up to -10% if the water supply is standard for both the system and fire department hose lines; additional credit up to -10% for a fully supervised system.
- Adjacent Building Exposure - the value obtained in #4 above (adjusted fire flow as modified by the Occupancy Hazard Adjustment) should be increased for structures exposed within 45 metres by the fire area under consideration.  
The charge for any one side generally should not exceed the following limits for the separations shown: 0 to 3 m 25%; 3.1 to 10 m 20%; 10.1 to 20 m 15%; 20.1 to 30 m 10%; 30.1 to 45 m 5%. The total shall be the sum of the percentages for all sides, but shall not exceed 75%.
- The adjusted fire flow shall not exceed 45,000 l/min nor be less than 2,000 l/min.
- Required Duration of Fire Flow: 2,000 l/min or less - 1.0 hr; 3,000 l/min - 1.25 hrs; 4,000 l/min - 1.5 hrs; 5,000 l/min - 1.75 hrs; 6,000 l/min - 2 hrs; 8,000 l/min - 2.0 hrs.
- Occupancy Group per OBC

**APPENDIX C.1**

**Stormwater Management – Existing Reports & Existing Ministry Approvals**

**ENVIRONMENTAL COMPLIANCE APPROVAL**NUMBER 5474-AAXKDU  
Issue Date: June 16, 2016

Wellingdale Construction Ltd.  
6622 Wellington Rd 123  
Minto, Ontario  
N0G 2P0

Site Location: Lorne Street West and John Street South  
Part of Lot 88, Concession D  
Town of Minto, Wellington County

*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:*

the construction of sewage infrastructure related to the extension of Lorne Street West and John Street South to service five new residential lots in the Town of Minto, Wellington County, consisting of the following:

**sanitary sewers** on Lorne Street West from the northeast end connecting to the existing sanitary sewer approximately 15 m northeast of the intersection of Lorne Street West and John Street South;

**sanitary sewers** on John Street South from the southeast end connecting to the existing sanitary sewer approximately 15 m southeast of the intersection of Lorne Street West and John Street South;

**storm sewers** on Lorne Street West from the northeast end connecting to the existing storm sewer approximately 10 m northeast of the intersection of Lorne Street West and John Street South;

**storm sewers** on John Street South from the southeast end connecting to the existing storm sewer on Lorne Street West;

including erosion/ sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted supporting documents forming part of this Approval.

*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:*

1. 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;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

*The Notice should also include:*

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. 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 and  
Climate Change  
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](http://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 16th day of June, 2016



---

Gregory Zimmer, P.Eng.  
Director  
appointed for the purposes of Part II.1 of the  
*Environmental Protection Act*

JW/

c: District Manager, MOECC Guelph Office



Ontario

Ministry of the Environment  
Ministère de l'Environnement

CERTIFICATE OF APPROVAL  
MUNICIPAL AND PRIVATE SEWAGE WORKS  
NUMBER 5822-78NMJB  
Issue Date: November 5, 2007

Wellington Construction Limited  
8718 Wellington Road 7, No. Unit 7  
Rural Route, No. 1  
Minto, Ontario  
N0G 2P0

Site Location: John Street and Lorne Street  
John Street and Lorne St  
Minto Town, County of Wellington

*You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:*

**Sanitary and Storm Sewers**

storm and sanitary sewers to be constructed on John Street and Lorne Street;

**Sewage Pumping Station**

a sanitary sewage pumping station to be constructed at the Southeast corner of Lot 5 on the West side of Lorne Street, with:

- a design peak flow of 10.8 L/s,
- a 2.4 m diameter wet well
- two (2) submersible pumps, one for duty and another for standby, each rated at 10.8 L/s against a total dynamic head of 6.10 m,
- complete with control panel, air vents, access ladder, ultrasonic transducers and float switches including high level alarm
- discharge piping, by-pass connection, and
- all other appurtenances necessary to have a complete and operable pumping station, discharging to the proposed forcemain;

**Sanitary Forcemain**

- a 100 mm diameter sanitary forcemain to be constructed on Lorne Street and Margaret Street, discharging to existing sanitary manhole MH9;

in the Town of Minto, County of Wellington;

all in accordance with the application dated April 24, 2007 and received on May 14, 2007, and all supporting documentation and information, including final plans and specifications prepared by Henderson Paddon & Associates Limited.

*For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:*

1. "Act " means the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended;
2. "Certificate " means this entire certificate of approval document, issued in accordance with Section 53 of the Act , and includes any schedules;
3. "Director " means any *Ministry* employee appointed by the Minister pursuant to section 5 of the Act ;
4. "District Manager " means the District Manager of the ??? District Office of the Ministry;
5. "Ministry " means the Ontario Ministry of the Environment;
6. "Owner " means Wellington Construction Limited and includes its successors and assignees;
7. "Regional Director " means the Regional Director of the West-Central Region of the Ministry;
8. "Substantial Completion " has the same meaning as "substantial performance " in the Construction Lien Act; and
9. "Works " means the sewage works described in the *Owner* 's application, this *Certificate* and in the supporting documentation referred to herein, to the extent approved by this *Certificate* .

*You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:*

## TERMS AND CONDITIONS

### 1. GENERAL PROVISIONS

- 1.1 The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Works* is notified of this *Certificate* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
- 1.2 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 *Certificate* , the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this *Certificate* .
- 1.3 Where there is a conflict between a provision of any submitted document referred to in this *Certificate* and the Conditions of this *Certificate* , the Conditions in this *Certificate* shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

- 1.4 Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
- 1.5 The requirements of this *Certificate* are severable. If any requirement of this *Certificate*, or the application of any requirement of this *Certificate* to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this *Certificate* shall not be affected thereby.

## **2. EXPIRY OF APPROVAL**

- 2.1 The approval issued by this *Certificate* will cease to apply to those parts of the *Works* which have not been constructed within five (5) years of the date of this *Certificate*.

## **3. UPON THE SUBSTANTIAL COMPLETION OF THE WORKS**

- 3.1 Upon the *Substantial Completion* of the *Works*, the Owner shall prepare a statement, certified by a Professional Engineer, that the works are constructed in accordance with this *Certificate*, and upon request, shall make the written statement available for inspection by Ministry personnel.
- 3.2 Within one year of the *Substantial Completion* of the *Works*, a set of as-built drawings showing the works "as constructed" shall be prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the *Works* for the operational life of the *Works*.

## **4. OPERATION AND MAINTENANCE**

- 4.1 The *Owner* shall exercise due diligence in ensuring that, at all times, the *Works* and the related equipment and appurtenances used to achieve compliance with this *Certificate* are properly operated and maintained. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of this *Certificate* and the *Act* and regulations, adequate laboratory facilities, process controls and alarms and the use of process chemicals and other substances used in the *Works*.
- 4.2 The *Owner* shall prepare an operations manual within six (6) months of *Substantial Completion* of the *Works*, that includes, but not necessarily limited to, the following information:
- (a) operating 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) procedures for the inspection and calibration of monitoring equipment;
  - (e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures

for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the *District Manager* ; and

- (f) procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

4.3 The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* for the operational life of the *Works* . Upon request, the *Owner* shall make the manual available to *Ministry* staff.

*The reasons for the imposition of these terms and conditions are as follows:*

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the *Certificate* and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the *Owners* their responsibility to notify any person they authorized to carry out work pursuant to this *Certificate* the existence of this *Certificate* .
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 *Works* are constructed in accordance with the approval and that record drawings of the *Works* “as constructed” are maintained for future references.
4. Condition 4 is included to require that the *Works* be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the *Owner* and made available to the *Ministry* . Such a manual is an integral part of the operation of the *Works* . Its compilation and use should assist the *Owner* in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for *Ministry* staff when reviewing the *Owner*' s operation of the *Works* .

*In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, 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 101 of the Ontario Water Resources Act , R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:*

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

*The Notice should also include:*

3. The name of the appellant;

4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

*And the Notice should be signed and dated by the appellant.*

*This Notice must be served upon:*

The Secretary\*  
Environmental Review Tribunal  
2300 Yonge St., Suite 1700  
P.O. Box 2382  
Toronto, Ontario  
M4P 1E4

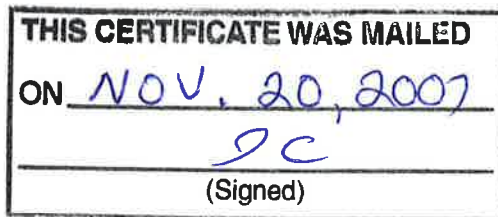
AND

The Director  
Section 53, *Ontario Water Resources Act*  
Ministry of the Environment  
2 St. Clair Avenue West, Floor 12A  
Toronto, Ontario  
M4V 1L5

\* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or [www.ert.gov.on.ca](http://www.ert.gov.on.ca)

*The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.*

DATED AT TORONTO this 5th day of November, 2007



---

Mansoor Mahmood, P.Eng.  
Director  
Section 53, *Ontario Water Resources Act*

BH/

c: District Manager, MOE Guelph  
George A. Davis, P. Eng., Henderson Paddon & Associates Limited ✓

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**WELLINGDALE CONSTRUCTION LIMITED**

**LORNE STREET WEST  
AND  
JOHN STREET SOUTH  
MUNICIPAL SERVICING EXTENSIONS  
In the Community of Harriston (Town of Minto)**

**DESIGN BRIEF**

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**WELLINGDALE CONSTRUCTION LIMITED**

**LORNE STREET WEST  
AND  
JOHN STREET SOUTH  
MUNICIPAL SERVICING EXTENSIONS  
In the Community of Harriston (Town of Minto)**

**DESIGN BRIEF**

November 4, 2015

**B. M. ROSS AND ASSOCIATES LIMITED**  
Engineers and Planners  
206 Industrial Drive, P.O. Box 1179  
Mount Forest, ON N0G 2L0  
Phone: 519-323-2945  
Fax: 519-323-3551

File No. 15159

**WELLINGDALE CONSTRUCTION LIMITED**

**LORNE STREET WEST AND JOHN STREET SOUTH**  
**MUNICIPAL SERVICING EXTENSIONS**  
**In the Community of Harriston (Town of Minto)**

**DESIGN BRIEF**

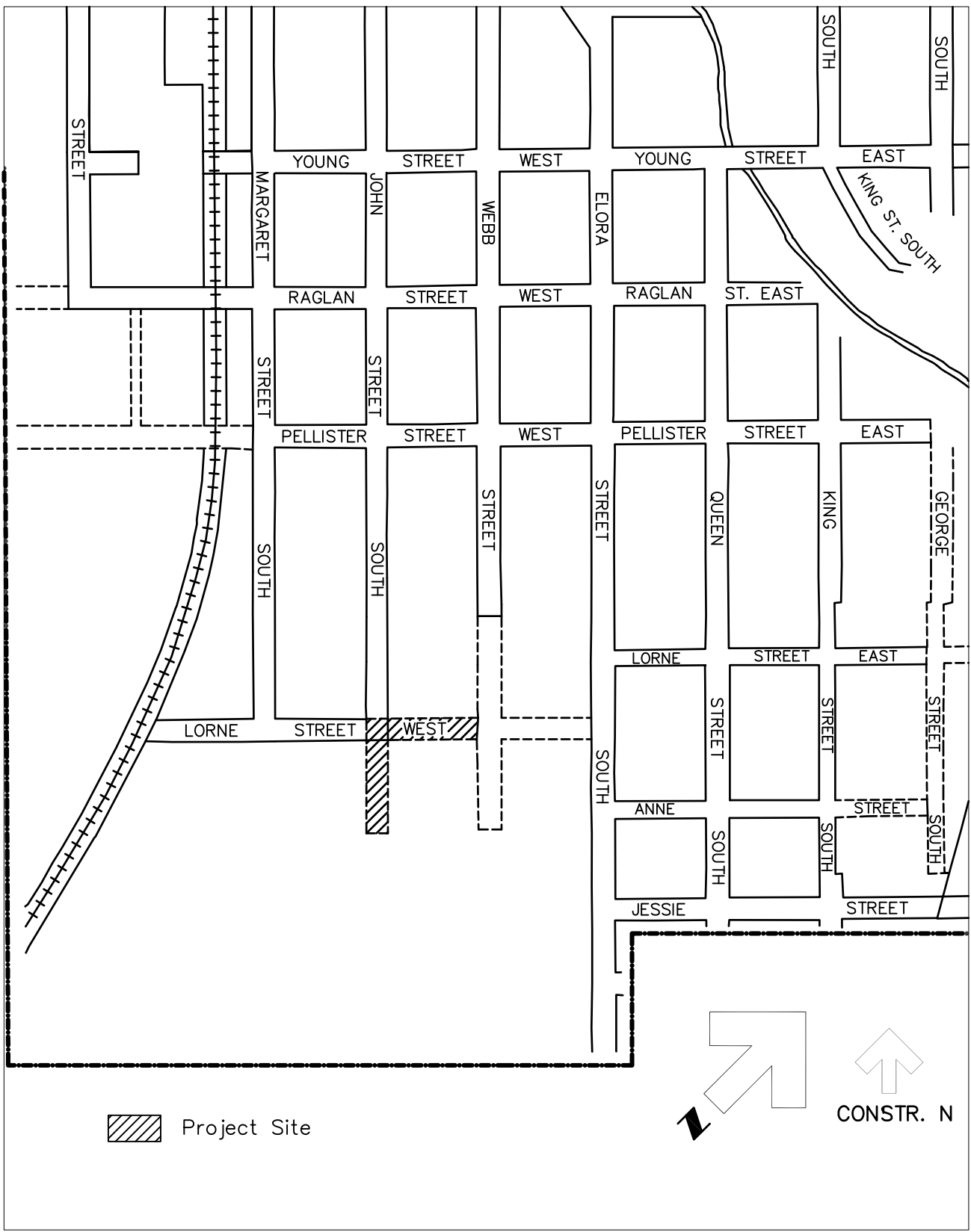
**1.0 DESCRIPTION OF PROPOSED WORK**

Wellingdale Construction Limited is extending municipal services (sanitary sewer; storm sewer; watermain; roadway), on Lorne Street West and John Street South in the community of Harriston, Town of Minto. These services are being extended to fulfill conditions of consent and to comply with the Town of Minto's requirements, to service 5 new single family residential lots on Lorne Street West and 4 new single family residential lots on John Street South. The purpose of this application is to obtain MOECC approvals for the sanitary sewer and storm sewer extensions, and the proposed works are described by the following table:

**Table 1**  
**Description Proposed Works**

<b>Street</b>	<b>From</b>	<b>To</b>	<b>Size</b>	<b>Roughness</b>
<b>Storm Sewer</b>				
Lorne Street	DICB5	CBMH4	600 mm	0.013
Lorne Street	CBMH4	CBMH2 (existing)	600 mm	0.013
John Street	MH9	CBMH7	300 mm	0.013
John Street	CBMH7	MH1 (existing)	300 mm	0.013
<b>Sanitary Sewer</b>				
Lorne Street	S2	S1 (existing)	200 mm	0.013
Jones Street	S3	S1 (existing)	200 mm	0.013

The general locations of the Site are shown in Figure 1.



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**Wellingdale Construction  
Harriston (Town of Minto)**

Extension of John Street  
and Lorne Street  
General Location

SCALE  
1:5000

Oct. 30/15

**PROJECT No.**  
15159

**Figure No.**  
1

## **2.0 SANITARY SEWER SERVICING**

### **2.1 Description of Works**

Sanitary sewers are to be constructed on extensions of Lorne Street West and John Street South, as summarized in the preceding Table 1. Sanitary sewer pipe sizes, class and material are as noted on the approval drawings.

The drainage area contributing to the proposed sanitary sewer extension on Lorne Street West is approximately 2.3ha of future residential lands. The drainage area contributing to the proposed sanitary sewer extension on John Street South is approximately 0.3ha of future residential lands. Refer to the sanitary drainage area drawing included as Figure 2 in Appendix A.

### **2.2 Design Flows**

Residential Areas – assume:

- 40 persons/hectare
- 450 L/capita/day average sewage flow
- A peaking factor of  $M = 1 + 14 / (4 + p^{0.5})$
- An infiltration allowance of 0.28 L/ha/s

A sanitary design sheet has been included as Appendix “A”.

## **3.0 STORM SEWER SERVICING**

### **3.1 Description of Works**

Storm sewers are to be constructed on extensions of Lorne Street West and John Street South, as summarized in the preceding Table 1. Roadway catch basin laterals and rear yard catch basin laterals will be constructed in addition to the main line sewers. Storm sewer pipe sizes, class and material are as noted on the approvals drawings.

The outlet for the proposed sewers is the existing 600mm dia. Lorne Street West storm sewer, which was approved by MOECC through issuance of Certificate of Approval No. 5822-78NMJB, dated November 5, 2007. This existing sewer outlets to a ditch that discharges to Dredge Creek and thence to the North Maitland River.

The drainage area contributing to the proposed storm sewer extensions on Lorne Street West and John Street South is based on a Design Report for Barber Drain dated June 23, 1997, as included in Appendix C. For clarity, a drainage area sketch is included as Figure 3 in Appendix B.

### 3.2 Design Flows

The storm sewer design flows are based on a five (5) year storm using MIDUSS Version 4.72.1. The rainfall intensity duration frequency curve for Mount Forest was used for this design (see Appendix “C”). The pipe size and capacity are based on calculations provided in the design sheet included in Appendix “B” and not those used in the MIDUSS model.

The storm sewer design flows and data are summarized in Table 2.

**Table 2**  
**Design Flow and Storm Sewer Data**

MH to MH	*Design Flow (cms)	Pipe Dia. (mm)	Slope (%)	Capacity (cms)	Velocity (m/s)
5 - 4	0.191	600	0.25	0.307	1.1
4 - 2	0.191	600	0.25	0.307	1.1
9 - 7	0.015	375	0.25	0.088	0.8
7 - 1	0.029	375	0.25	0.088	0.8

\* Design flows taken from MIDUSS output data sheets in Appendix ‘C’  
Note: The computer program MIDUSS Version 4.72.2 (Allen A. Smith Inc., 17 Lyndale Drive, Dundas, Ontario L9H 3L4) was used to simulate the 1:5 year rainfall event.

### 4.0 SANITARY SEWER, STORM SEWER AND WATERMAIN INSTALLATION

The storm and sanitary sewers in this application are designed to MOECC Guidelines, and the most recent OPS Specifications and Standard Drawings. As per MOE Procedure F-6-1 “Procedures to Govern the Separation of Sewers and Watermains”, watermains and sewers/sewage works, when located parallel to each other, shall be constructed in parallel and separate trenches maintaining a **minimum horizontal separation of 2.5 metres measured from the outside of the watermain to the outside of the sewer or appurtenance**. If this 2.5 metre separation cannot be achieved, the watermain may be laid closer provided that the crown of the sewer is at least 0.5 metres below the invert of the watermain.

Watermains shall cross over sewers with sufficient vertical separation as to provide for proper bedding and structural support. When watermains cross under sewers, to maintain frost protection, they shall be installed with a minimum of 0.5 metres separation.

Construction of the works will be supervised by the Consultant.

Design Brief Prepared by



B. M. ROSS AND ASSOCIATES LIMITED

Per *Glen Feagan*  
Glen Feagan, C.E.T.



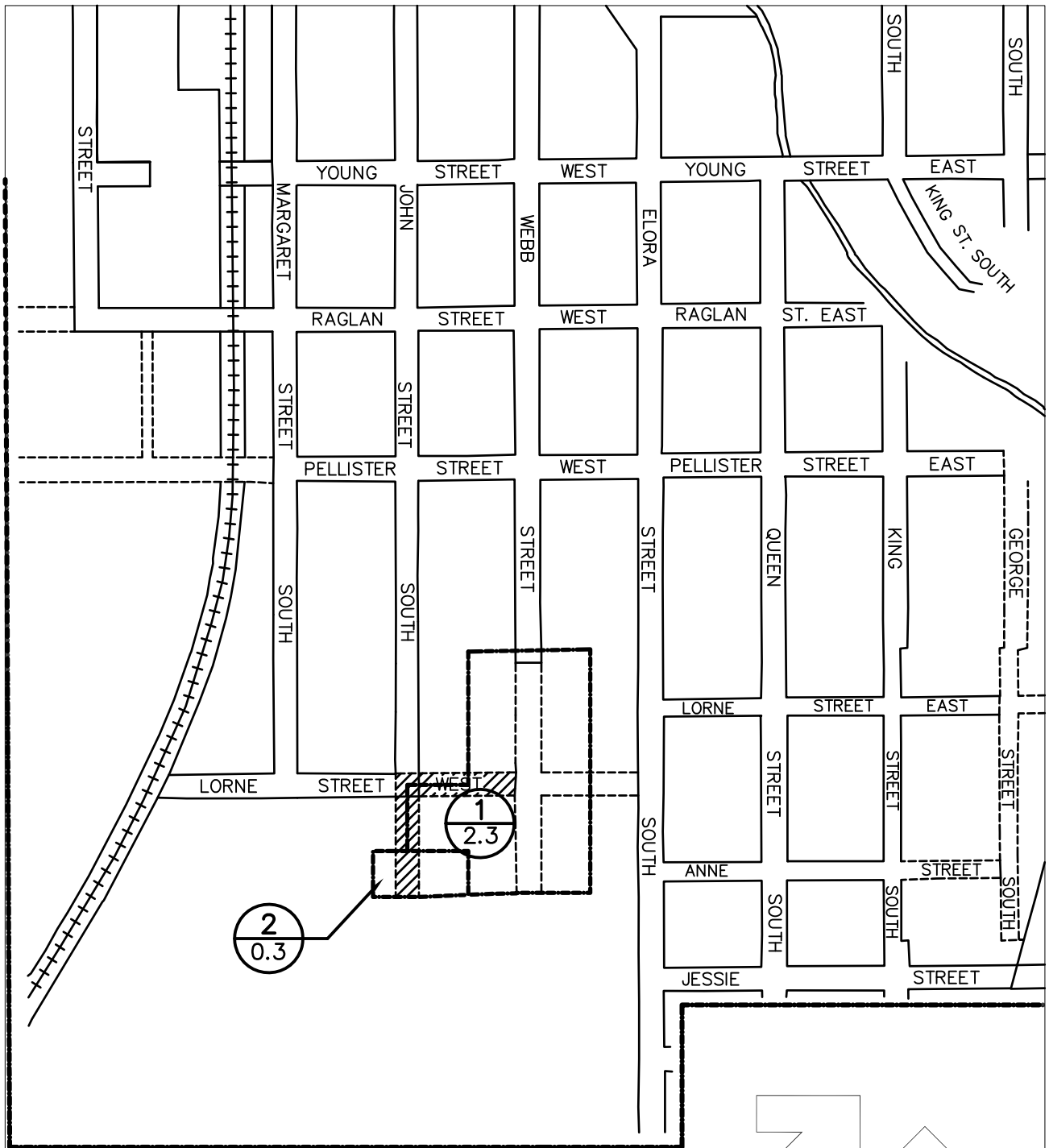
Per *Frank Vanderloo*  
Frank Vanderloo, P. Eng.




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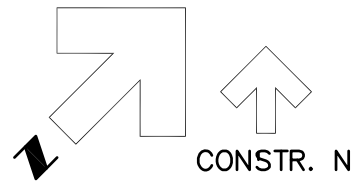
**APPENDIX “A”**

**SANITARY SEWERS**

**DRAINAGE AREA FIGURE AND  
DESIGN SHEET**



-  Project Site
-  Catchment Boundary
-  Catchment Number  
Catchment Area (ha)



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**Wellingdale Construction  
Harriston (Town of Minto)**

Extension of John Street  
and Lorne Street  
Sanitary Sewer Catchment Area

SCALE

1:5000

Oct. 30/15

PROJECT No.

15159

Figure No.

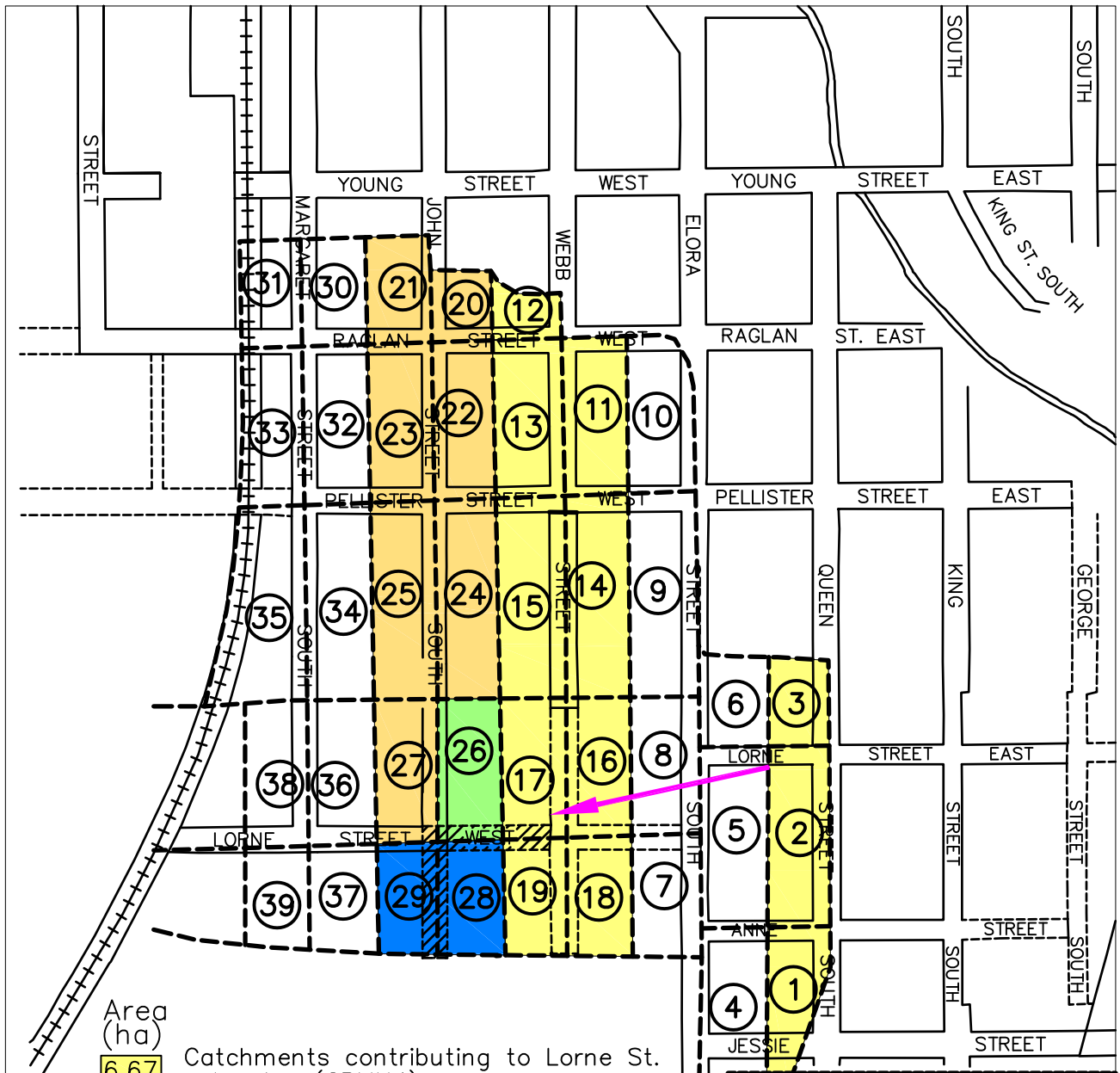
SAN1



**APPENDIX “B”**

**STORM SEWERS**

**DRAINAGE AREA FIGURE AND  
DESIGN SHEET**



- Area (ha)
- 6.67 Catchments contributing to Lorne St. extension (CBMH4).
  - 0.57 Additional Lorne St. ext. catchment contributing to CBMH2.
  - 0.96 Catchments contributing to John St. extension.
  - Existing John St. storm sewer catchment area.
  - ▶ Catchments 1–3 buried drain line.
  - / / / / Project Site
  - Catchment Boundary
  - 1 Catchment Number

See BMROSS "Design Report for Barber Drain, Town of Harriston," File No. 97087, dated June 23, 1997, for details.



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engineering better communities

**Wellingdale Construction  
Harriston (Town of Minto)**

Extension of John Street  
and Lorne Street  
Storm Sewer Catchment Area

SCALE  
1:5000

Oct. 30/15

PROJECT No.  
15159

Figure No.  
STM1



**APPENDIX 'C'**

**DESIGN REPORT FOR BARBER DRAIN  
TOWN OF HARRISTON**

**DESIGN REPORT  
FOR BARBER DRAIN  
TOWN OF HARRISTON**

**DESIGN REPORT  
FOR BARBER DRAIN  
TOWN OF HARRISTON**

**June 23, 1997**

**B. M. ROSS AND ASSOCIATES LIMITED  
Consulting Engineers  
165 King Street  
Mount Forest, Ontario  
NOG 2L0**

**File No. 97087**

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## **1.0 INTRODUCTION**

The purpose of this report is to assess the stormwater capacities of the Barber Drain located in the Town of Harriston.

## **2.0 SITE CHARACTERISTICS**

### **2.1 SITE LOCATION**

The existing Barber Drain is located in the Town of Harriston, County of Wellington, as shown by Figure 1 - Existing Drainage Area Plan.

### **2.2 EXISTING LAND USE**

The existing drainage area is presently in urban residential and agricultural use with approximately 55 percent urban development and the remainder of the land is grassed pasture land. The undeveloped lands within the Barber Street drainage area are generally zoned planned development.

### **2.3 SOILS**

Report No. 35 of the Ontario Soil Survey describes the underlying soil as a loam of the Harriston and Listowel Series.

### **2.4 TOPOGRAPHY**

Site topography is flat to gently rolling.

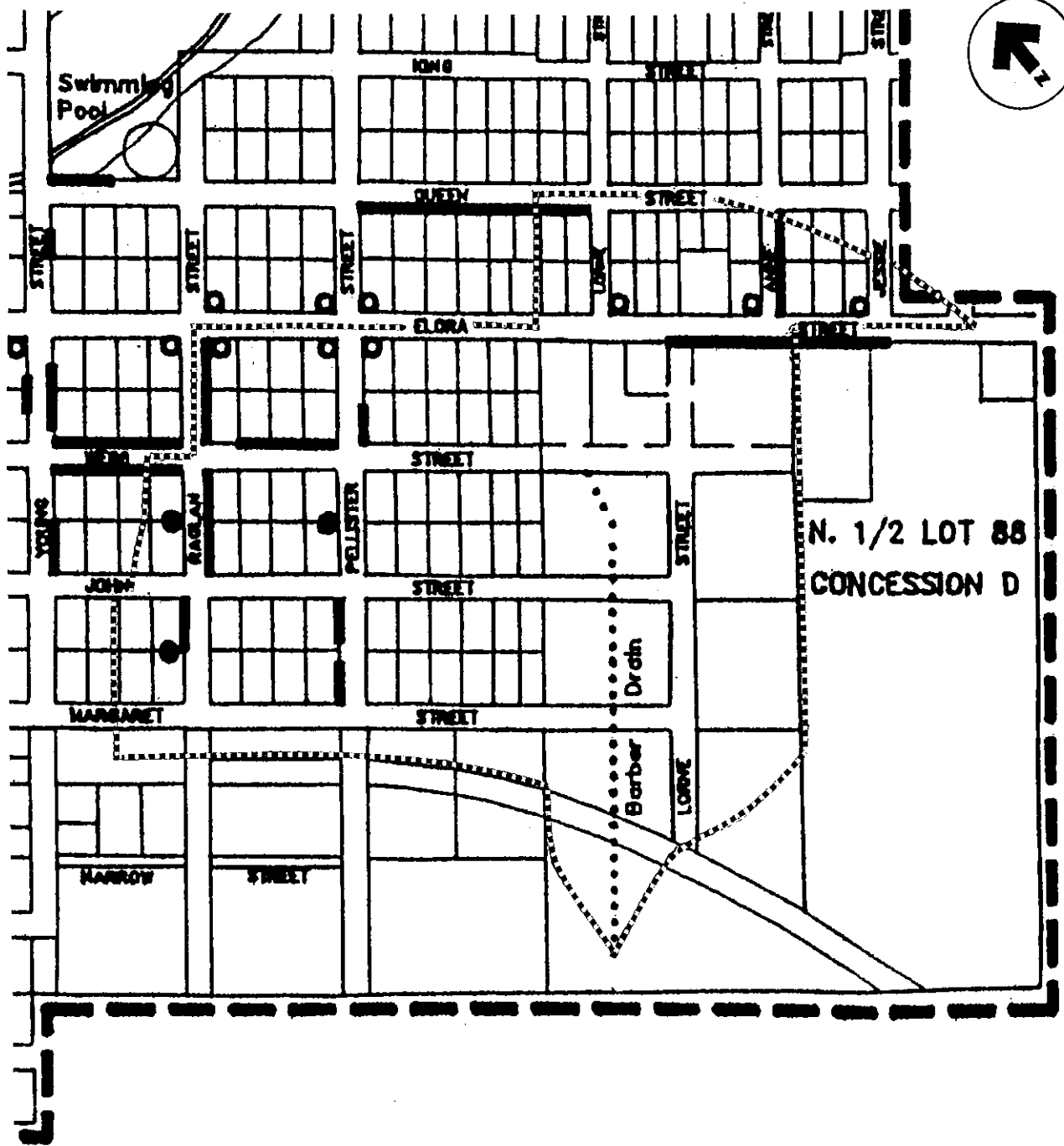
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## 2.5 EXISTING DRAINAGE CONDITIONS

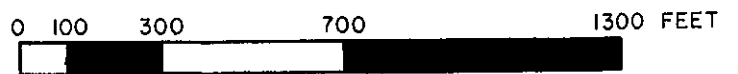
The Barber Drain does not lie within an area governed by a master watershed plan.

The existing Barber Drain catchment lies within the drainage area of the Maitland River and more specifically the south tributary (Drain #1) of the Maitland River. Development of the Barber Drain in 1951 enhanced the natural drainage runoff for a portion of the lands within the municipality lying north of railway and east of Pellister Street which flowed easterly to the Maitland Tributary. The affected lands consisted of a total of some 21.23 ha which include the proposed 11.2 ha under development and approximately 10 ha of farmland to the east and south of the developed area. At present, surface water from the drainage area enters the Barber Drain and flows to the outlet at the Drain #1 outfall in the north half of lot 88 Concession D.

Figure No. 2 presents the existing Barber Drain Schematic Diagram.

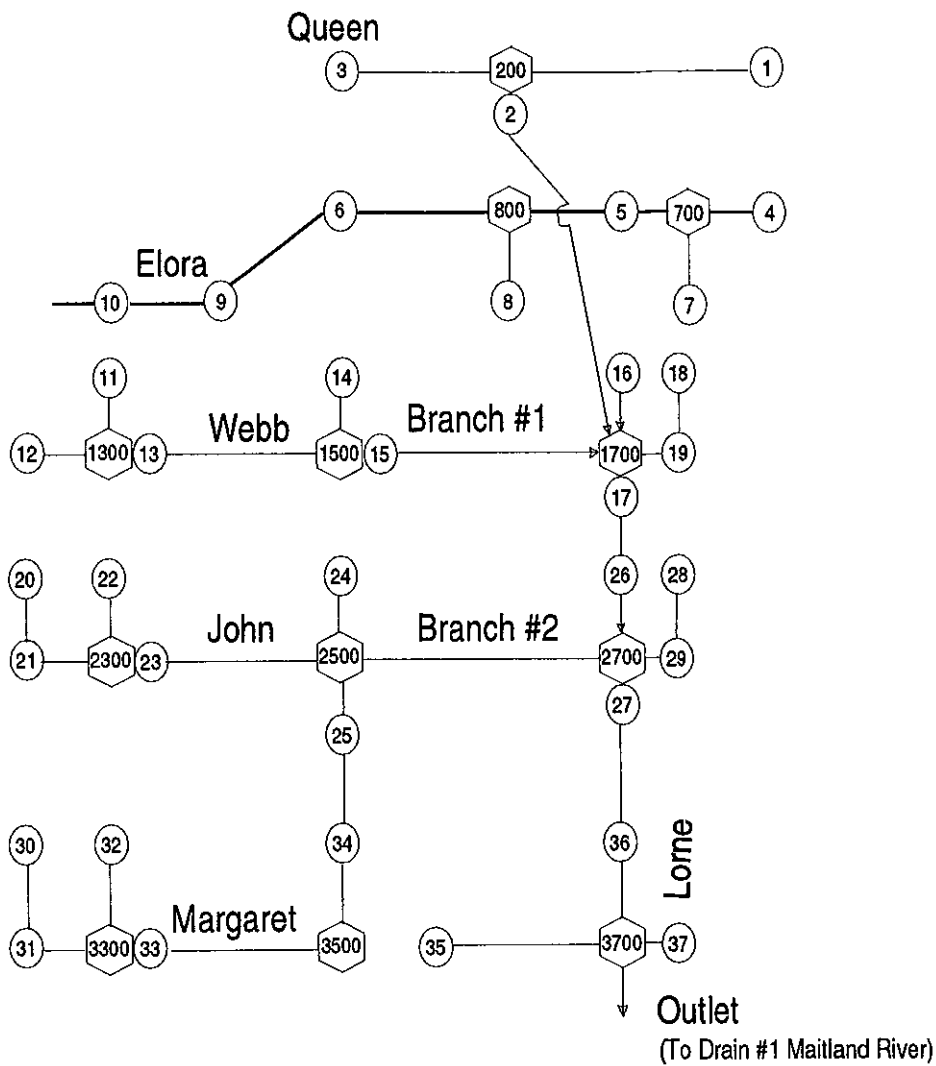


SCALE :



EXISTING DRAINAGE AREA PLAN

FIG. 1



○ Catchment Area  
 ⬡ Confluence

— Drains to Elora Street  
 - - - Barber Drain

Barber Drain - Existing Drainage

Fig. 2

---

### 3.0 PROPOSED FUTURE STORM DRAINAGE

#### 3.1 DRAINAGE LAYOUT

The existing drainage north of Margaret Street will be maintained during the first Phase of the development of the Lorne Street storm sewer. At present, the area west of Pellister Street and north of Margaret Street drain to the existing Barber Drain north of Margaret and Lorne Streets. As part of the overall drainage scheme, the lots fronting on Margaret Street will be drained by a future Margaret Street Street storm sewer which will outlet to the Lorne Street storm sewer at the intersection of Margaret and Lorne Streets. A full urban standard cross-section to be applied to Margaret Street as it is developed under a cost sharing agreement between the Municipality and the Developer. This change in drainage pattern will provide relief for the existing upper Barber Drain between Margaret and John Streets and for the Branch 2 section that currently carries the flow from the area being returned to the Margaret Street drainage pattern. (See Figure No. 3)

The full design concept storm sewer will provide a trunk sewer alignment that follows Lorne Street right of way from Margaret Street to Webb Street. There will be a storm sewer along Webb Street to its intersection with Lorne Street. As John Street is developed, there will be a storm sewer within it's right of way to carry stormwater to the Lorne Street storm sewer. It is proposed that the drainage area north of Elora Street will remain connected to the Barber Drain and the Drain will be intercepted at Webb Street and directed to the Lorne Street system.

### 4.0 BASIS OF DESIGN

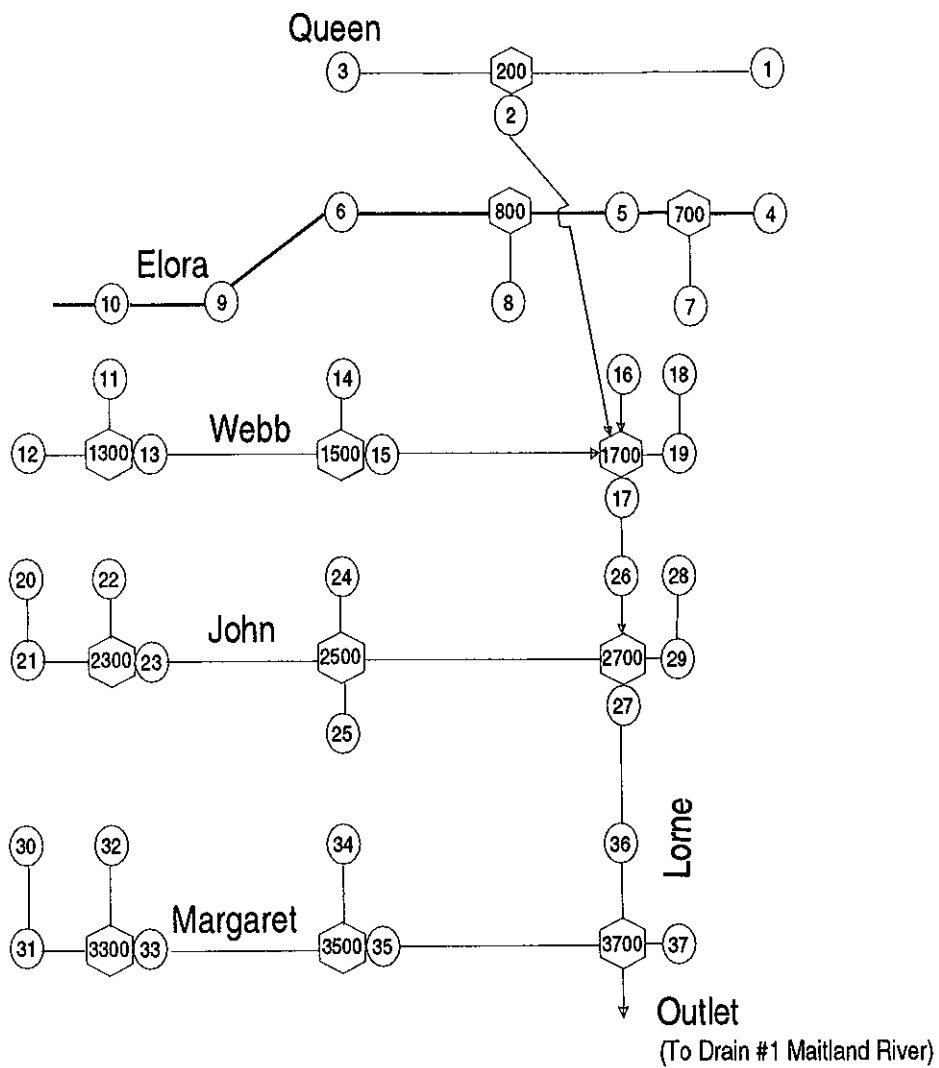
#### 4.1 EXISTING DESIGN CONSTRAINTS

The existing Barber Drain below Margaret Street does not have sufficient capacity to carry runoff water from the drainage catchment. There must be a new storm sewer system designed to provide the needed capacity to drain the watershed in its existing state of development. The portions of the watershed that are currently developed have been experiencing drainage outlet problems over the years. The problem has been related to insufficient capacity within the Barber Drain itself.

#### 4.2 DESIGN GUIDELINES

The design of the stormwater system will be undertaken using the hydraulic modelling program MIDUSS \*. The program will be used to develop a model of the Barber Drain watershed using the rainfall data from the Mount Forest AES rainfall frequency data presented in Table No. 1. The design return frequency will be based upon the 1:5 year rainfall rate of 49 mm over a 6 hour period.

\* Note: The computer program MIDUSS Version 4.72.1 (Allen A. Smith Inc., 17 Lyndale Drive, Dundas, Ontario, L9H 3L4) was used to simulate the 1:5 year rainfall event.



- Catchment Area
- Drains to Elora Street
- ⬭ Confluence
- - - Barber Drain

Lorne St. Storm Sewer - Proposed Drainage

Fig. 3

**TABLE 1**  
**MOUNT FOREST**  
**RAINFALL INTENSITY - DURATION FREQUENCY VALUES**  
**RETURN PERIOD RAINFALL AMOUNTS (MM)**

DURATION	2 YEAR	5 YEAR	10 YEAR	25 YEAR	50 YEAR	100 YEAR
1 HOUR	24.8	33.3	39.0	46.1	51.4	56.7
2 HOUR	30.0	39.5	45.8	53.7	59.6	65.4
6 HOUR	37.9	49.0	56.3	65.6	72.5	79.3
12 HOUR	43.1	55.3	63.4	73.7	81.2	88.8
24 HOUR	49.2	63.7	73.3	85.4	94.3	103.3

#### 4.3 STORMWATER MODEL

The schematic diagram for the MIDUSS model of the Barber Drain watershed is presented in Figure No. 2. The proposed Lorne Street storm sewer schematic diagram is presented in Figure No. 3. The individual catchment data input into the MIDUSS model is presented in Table No. 2.

The model was prepared to represent current runoff conditions within the watershed for assessment purposes and to represent the proposed re-routing of the Lorne Street storm sewer for design purposes.

**TABLE 2  
MIDUSS INPUT PARAMETERS  
FOR SUBDIVISION CATCHMENT AREAS**

Description Barber Drain - Harriston Minor Event Precip. 49.0 in. Major Event Precip. 79.3 in.  
 Design Storm Mount Forest - 6 HR S.C.S.

No.	IMPERVIOUS				CATCHMENT				CATCH AREA (acres)	FLOW LENGTH (feet)	OVER-LAND SLOPE	% IMPERVIOUS
	n	CN	Ia/S	in.ab	n	CN	Ia/S	in.ab				
1	.013	88	.1	3.464	.20	70	.1	10.886	0.50	100	3.0	5
2	.013	88	.1	3.464	.20	70	.1	10.886	0.79	50	2.0	5
3	.013	88	.1	3.464	.20	70	.1	10.886	0.34	50	3.5	10
4									0.94	50	3.0	5
5									0.70	50	2.0	5
6									0.35	50	4.5	10
7									0.53	50	6.0	5
8									0.55	50	6.0	5
9									0.76	50	6.0	20
10									0.60	50	4.0	15
11	.013	88	.1	3.464	.20	70	.1	10.886	0.60	50	4.0	15
12	.013	88	.1	3.464	.20	70	.1	10.886	0.19	50	3.0	15
13	.013	88	.1	3.464	.20	70	.1	10.886	0.60	50	3.0	15
14	.013	88	.1	3.464	.20	70	.1	10.886	0.76	120	3.0	10
15	.013	88	.1	3.464	.20	70	.1	10.886	0.76	120	1.0	10
16	.013	88	.1	3.464	.20	70	.1	10.886	0.55	90	3.0	0
17	.013	88	.1	3.464	.20	70	.1	10.886	0.57	90	2.5	0
18	.013	88	.1	3.464	.20	70	.1	10.886	0.53	80	3.0	0
19	.013	88	.1	3.464	.20	70	.1	10.886	0.48	80	2.0	0



**5.0 DISCUSSION OF STORMWATER MODELLING**

**5.1 EXISTING BARBER DRAIN MODEL**

Table No. 3 illustrates the hydraulic inadequacy of the existing Barber Drain. In the entire Barber Drain only the portion above Branch #1 has adequate hydraulic capacity for practical stormwater design criteria. This section is currently fully developed in terms of land use. The remaining portions of the drainage area are not adequately serviced in terms of stormwater conveyance. It would be prudent to define an adequate design capacity for the various Barber Drain sections and by beginning at the outlet section, replace the existing system with one of adequate hydraulic capacity.

The modelling results for the existing Barber Drain runoff under a 5 year storm event are presented in Table No. 3.

**TABLE 3**

Node	Location	Assessment Flow (c.m.s.)		
		Existing Capacity	Required Capacity	Remarks
1700	Barber Drain @ Lorne	.033	.045	
1500	Branch #1	.033	.087	Pipe too small
1700	Webb Street @ Lorne	.033	.087	Pipe too small
1700	Lorne Street below Webb	.047	.175	Pipe too small
2500	John Street @ Lorne	.047	.099	Pipe too small
2500	Branch #2	.033	.099	Pipe too small
2700	Lorne Street below John	.047	.333	Pipe too small
3500	Margaret Street @ Lorne	N/A	.031	N/A
3700	Lorne Street below Branch 2	.068	.333	Pipe too small
3700	Lorne Street outlet	.068	.407	Pipe too small

5.2 PROPOSED LORNE STREET STORM SEWER

Table No. 4 illustrates the design flows computed by the MIDUSS model set up to represent the new storm sewer configuration that maintains the stormwater network on Municipal rights-of-way as far as practical. The proposed system will allow the Margaret Street drainage to be collected on the right-of-way and conveyed to the Lorne Street intersection. This will allow the Branch #2 drain to be relieved of the current flow it is receiving from Margaret Street. It is anticipated that development occurring along Margaret Street will be conditional of stormwater drainage being placed on Margaret Street with a connection to the new Lorne Street storm sewer.

Table No. 4 details the preliminary pipe sizing required to meet design criteria currently in use for the design of stormwater systems within the Town of Harriston.

The modelling results for the proposed Lorne Street storm sewer runoff under a 5 year storm event are presented in Table No. 4

TABLE 4

Node	Location	Design Flow (c.m.s.)		
		Barber Drain Flow	Lorne Street Flow	Recommended Pipe Sizes (m.)
	Barber Drain @ Lorne	.045	.045	.300
	Branch #1	.087		
	Webb Street @ Lorne	.087	.132	.375
	Lorne Street below Webb	.175	.175	.450
	John Street @ Lorne	.099	.099	.375
	Branch #2	.099		
	Lorne Street below John	.033	.333	.600
	Margaret Street @ Lorne	.031	.117	.375
	Lorne Street below Branch 2	.333	.366	.600
	Lorne Street outlet	.407	.489	.600

## 6.0 RECOMMENDATIONS

Based upon the modelling results of the Barber Drain model, it is evident that the existing drain is inadequate in the main drain below Branch #1 through to the outlet. Both Branch #1 and Branch #2 are not of sufficient capacity to service the existing catchment area. It is recommended that the Barber Street drain be systematically replaced by a municipal storm sewer system that is located where possible on Municipal rights-of-way and that the hydraulic capacities of the storm sewer be sized to reflect the flow values displayed in Table No. 4 of this report.

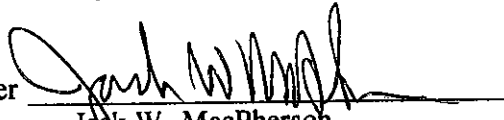
The priorities of the development of the new Lorne Street storm sewer system be such that the drain is constructed from Margaret and Lorne Streets to an outlet in the Maitland River tributary (Drain 1) along the Lorne Street right-of-way or a projection thereof as a first phase.

It is also recommended that the Margaret Street drainage be conveyed along Margaret Street to Lorne Street and then into the Lorne Street storm sewer trunk line (previously constructed). As budget permits, the trunk sewer should be extended up the Lorne Street right-of-way to John and then Webb Street in the hydraulic configuration identified in this report. The extensions of John Street and Webb Streets can then take place with storm sewer systems emptying into the Lorne Street trunk sewer (previously constructed).

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED  
Consulting Engineers

Per



Jack W. MacPherson,  
Senior Hydrologist

JWM/kt



Output File (4.7) BARBER5P.OUT opened 1997-05-29 9:45

Units used are defined by G = 9.810

72 288 5.000 are MAXDT MAXHYD & DTMIN values

Licensee: B.M. Ross and Associates Limited

2 STORM

3 1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic

49.000 Total depth of Rain

360.000 Duration ≤ 360 min

49.000 mm Total depth

3 IMPERVIOUS

1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat

.013 Manning "n"

88.000 SCS Curve No or C

.100 Ia/S Coefficient

3.464 Initial Abstraction

4 CATCHMENT

1.000 ID No. ≤ 99999

.500 Area in hectares

100.000 Length (PERV) metres

3.000 Gradient (%)

20.000 Per cent Impervious

100.000 Length (IMPERV)

.000 %Imp. with Zero Dpth

1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat

.200 Manning "n"

70.000 SCS Curve No or C

.100 Ia/S Coefficient

10.886 Initial Abstraction

1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv

.016 .000 .000 .000 c.m/s

.202 .526 .266 C perv/imperv/total

15 ADD RUNOFF

.016 .016 .000 .000 c.m/s

8 PIPE

.500 Minimum velocity m/sec

4.000 Maximum velocity m/sec

.013 Pipe Manning's 'n'

.300 Diameter in metres

1.000 Select Grade in %

Depth = .083 metres

Velocity = 1.012 m/sec

Pipe Capacity = .097 c.m/s

Critical depth = .096 metres

9 ROUTE

140.000 Conduit Length

.484 Supply X-factor <.5  
 103.758 Supply K-lag (sec)  
 .500 Beta weighting factor  
 100.000 Routing timestep  
     1 No. of sub-reaches  
       .016 .016 .015 .000 c.m/s  
 17 COMBINE  
     200 Junction Node No.  
       .016 .016 .015 .015 c.m/s  
 14 START  
     1 1=Zero; 2=Define  
 4 CATCHMENT  
     3.000 ID No. ≤ 99999  
     .340 Area in hectares  
     50.000 Length (PERV) metres  
     3.500 Gradient (%)  
     20.000 Per cent Impervious  
     50.000 Length (IMPERV)  
     .000 %Imp. with Zero Dpth  
       1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
     .200 Manning "n"  
     70.000 SCS Curve No or C  
     .100 Ia/S Coefficient  
     10.886 Initial Abstraction  
       1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
       .012 .000 .015 .015 c.m/s  
       .201 .517 .265 C perv/imperv/total  
 15 ADD RUNOFF  
     .012 .012 .015 .015 c.m/s  
 8 PIPE  
     .500 Minimum velocity m/sec  
     4.000 Maximum velocity m/sec  
     .013 Pipe Manning's 'n'  
     .300 Diameter in metres  
     2.500 Select Grade in %  
     Depth = .056 metres  
     Velocity = 1.280 m/sec  
     Pipe Capacity = .153 c.m/s  
     Critical depth = .082 metres  
 9 ROUTE  
     60.000 Conduit Length  
     .491 Supply X-factor <.5  
     35.165 Supply K-lag (sec)  
     .500 Beta weighting factor  
     33.333 Routing timestep

1 No. of sub-reaches  
 .012 .012 .011 .015 c.m/s  
 17 COMBINE  
 200 Junction Node No.  
 .012 .012 .011 .025 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 18 CONFLUENCE  
 200 Junction Node No.  
 .012 .025 .011 .000 c.m/s  
 4 CATCHMENT  
 2.000 ID No. ≤ 99999  
 .700 Area in hectares  
 50.000 Length (PERV) metres  
 2.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .024 .025 .011 .000 c.m/s  
 .202 .515 .264 C perv/imperv/total  
 15 ADD RUNOFF  
 .024 .049 .011 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 2.300 Select Grade in %  
 Depth = .119 metres  
 Velocity = 1.862 m/sec  
 Pipe Capacity = .147 c.m/s  
 Critical depth = .170 metres  
 9 ROUTE  
 215.000 Conduit Length  
 .493 Supply X-factor <.5  
 86.586 Supply K-lag (sec)  
 .500 Beta weighting factor  
 75.000 Routing timestep  
 1 No. of sub-reaches

.024 .049 .045 .000 c.m/s  
 17 COMBINE  
 1700 Junction Node No.  
 .024 .049 .045 .045 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 4 CATCHMENT  
 11.000 ID No. ≤ 99999  
 .600 Area in hectares  
 50.000 Length (PERV) metres  
 4.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .021 .000 .045 .045 c.m/s  
 .202 .519 .265 C perv/imperv/total  
 15 ADD RUNOFF  
 .021 .021 .045 .045 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .121 metres  
 Velocity = .785 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth = .110 metres  
 9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 6.685 Supply K-lag (sec)  
 .724 Beta weighting factor  
 21.429 Routing timestep  
 1 No. of sub-reaches  
 .021 .021 .021 .045 c.m/s  
 17 COMBINE  
 1300 Junction Node No.  
 .021 .021 .021 .021 c.m/s

```

14  START
    1  1=Zero; 2=Define
4   CATCHMENT
    12.000  ID No. ≤ 99999
    .190   Area in hectares
    50.000  Length (PERV) metres
    3.000   Gradient (%)
    20.000  Per cent Impervious
    50.000  Length (IMPERV)
    .000   %Imp. with Zero Dpth
    1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
    .200   Manning "n"
    70.000  SCS Curve No or C
    .100   Ia/S Coefficient
    10.886  Initial Abstraction
    1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
    .006   .000   .021   .021 c.m/s
    .202   .516   .264   C perv/imperv/total
15  ADD RUNOFF
    .006   .006   .021   .021 c.m/s
8   PIPE
    .500   Minimum velocity m/sec
    4.000  Maximum velocity m/sec
    .013   Pipe Manning's 'n'
    .300   Diameter in metres
    2.500  Select Grade in %
    Depth   = .042 metres
    Velocity = 1.071 m/sec
    Pipe Capacity = .153 c.m/s
    Critical depth = .060 metres
9   ROUTE
    110.000  Conduit Length
    .496   Supply X-factor <.5
    77.009  Supply K-lag (sec)
    .500   Beta weighting factor
    75.000  Routing timestep
    1     No. of sub-reaches
    .006   .006   .006   .021 c.m/s
17  COMBINE
    1300  Junction Node No.
    .006   .006   .006   .027 c.m/s
14  START
    1  1=Zero; 2=Define
18  CONFLUENCE
    1300  Junction Node No.

```

.006 .027 .006 .000 c.m/s

4 CATCHMENT

13.000 ID No. ≤ 99999

.600 Area in hectares

50.000 Length (PERV) metres

3.000 Gradient (%)

20.000 Per cent Impervious

50.000 Length (IMPERV)

.000 %Imp. with Zero Dpth

1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat

.200 Manning "n"

70.000 SCS Curve No or C

.100 Ia/S Coefficient

10.886 Initial Abstraction

1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv

.020 .027 .006 .000 c.m/s

.202 .516 .264 C perv/imperv/total

15 ADD RUNOFF

.020 .047 .006 .000 c.m/s

8 PIPE

.500 Minimum velocity m/sec

4.000 Maximum velocity m/sec

.013 Pipe Manning's 'n'

.300 Diameter in metres

.400 Select Grade in %

Depth = .198 metres

Velocity = .955 m/sec

Pipe Capacity = .061 c.m/s

Critical depth = .168 metres

9 ROUTE

150.000 Conduit Length

.381 Supply X-factor <.5

117.747 Supply K-lag (sec)

.500 Beta weighting factor

100.000 Routing timestep

1 No. of sub-reaches

.020 .047 .044 .000 c.m/s

17 COMBINE

1500 Junction Node No.

.020 .047 .044 .044 c.m/s

14 START

1 1=Zero; 2=Define

4 CATCHMENT

14.000 ID No. ≤ 99999

.760 Area in hectares

120.000 Length (PERV) metres  
 3.000 Gradient (%)  
 20.000 Per cent Impervious  
 120.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .024 .000 .044 .044 c.m/s  
 .202 .526 .267 C perv/imperv/total  
 15 ADD RUNOFF  
 .024 .024 .044 .044 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .129 metres  
 Velocity = .810 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth= .117 metres  
 9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 6.485 Supply K-lag (sec)  
 .728 Beta weighting factor  
 23.077 Routing timestep  
 1 No. of sub-reaches  
 .024 .024 .023 .044 c.m/s  
 17 COMBINE  
 1500 Junction Node No.  
 .024 .024 .023 .065 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 18 CONFLUENCE  
 1500 Junction Node No.  
 .024 .065 .023 .000 c.m/s  
 4 CATCHMENT  
 15.000 ID No. ≤ 99999  
 .760 Area in hectares  
 120.000 Length (PERV) metres

1.000 Gradient (%)  
 20.000 Per cent Impervious  
 120.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .023 .065 .023 .000 c.m/s  
 .202 .525 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .023 .088 .023 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .375 Diameter in metres  
 .400 Select Grade in %  
 Depth = .252 metres  
 Velocity = 1.114 m/sec  
 Pipe Capacity = .111 c.m/s  
 Critical depth= .217 metres  
 9 ROUTE  
 110.000 Conduit Length  
 .289 Supply X-factor <.5  
 74.069 Supply K-lag (sec)  
 .500 Beta weighting factor  
 100.000 Routing timestep  
 1 No. of sub-reaches  
 .023 .088 .087 .000 c.m/s  
 17 COMBINE  
 1700 Junction Node No.  
 .023 .088 .087 .132 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 4 CATCHMENT  
 16.000 ID No. ≤ 99999  
 .550 Area in hectares  
 90.000 Length (PERV) metres  
 3.000 Gradient (%)  
 20.000 Per cent Impervious  
 90.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth

1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .018 .000 .087 .132 c.m/s  
 .202 .524 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .018 .018 .087 .132 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .111 metres  
 Velocity = .750 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth= .101 metres  
 9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 6.996 Supply K-lag (sec)  
 .696 Beta weighting factor  
 21.429 Routing timestep  
 1 No. of sub-reaches  
 .018 .018 .018 .132 c.m/s  
 17 COMBINE  
 1700 Junction Node No.  
 .018 .018 .018 .147 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 4 CATCHMENT  
 18.000 ID No. ≤ 99999  
 .530 Area in hectares  
 80.000 Length (PERV) metres  
 3.000 Gradient (%)  
 20.000 Per cent Impervious  
 80.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient

10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .017 .000 .018 .147 c.m/s  
 .202 .520 .265 C perv/imperv/total

15 ADD RUNOFF  
 .017 .017 .018 .147 c.m/s

8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .110 metres  
 Velocity = .745 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth= .100 metres

9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 7.043 Supply K-lag (sec)  
 .692 Beta weighting factor  
 21.429 Routing timestep  
 1 No. of sub-reaches  
 .017 .017 .017 .147 c.m/s

16 NEXT LINK  
 .017 .017 .017 .147 c.m/s

4 CATCHMENT  
 19.000 ID No.≤ 99999  
 .480 Area in hectares  
 80.000 Length (PERV) metres  
 2.000 Gradient (%)  
 20.000 Per cent Impervious  
 80.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient

10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .015 .017 .017 .147 c.m/s  
 .202 .526 .266 C perv/imperv/total

15 ADD RUNOFF  
 .015 .033 .017 .147 c.m/s

8 PIPE

.500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .156 metres  
 Velocity = .880 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth= .139 metres  
 9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 5.969 Supply K-lag (sec)  
 .778 Beta weighting factor  
 25.000 Routing timestep  
 1 No. of sub-reaches  
 .015 .033 .032 .147 c.m/s  
 17 COMBINE  
 1700 Junction Node No.  
 .015 .033 .032 .175 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 18 CONFLUENCE  
 1700 Junction Node No.  
 .015 .175 .032 .000 c.m/s  
 4 CATCHMENT  
 17.000 ID No. ≤ 99999  
 .570 Area in hectares  
 90.000 Length (PERV) metres  
 2.500 Gradient (%)  
 20.000 Per cent Impervious  
 90.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .018 .175 .032 .000 c.m/s  
 .202 .526 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .018 .191 .032 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec

4.000 Maximum velocity m/sec  
.013 Pipe Manning's 'n'  
.450 Diameter in metres  
1.000 Select Grade in %  
Depth = .269 metres  
Velocity = 1.920 m/sec  
Pipe Capacity = .285 c.m/s  
Critical depth= .307 metres

9 ROUTE

100.000 Conduit Length  
.412 Supply X-factor <.5  
39.053 Supply K-lag (sec)  
.500 Beta weighting factor  
42.857 Routing timestep  
1 No. of sub-reaches  
.018 .191 .190 .000 c.m/s

191 L/S 4 → 2

16 NEXT LINK

.018 .190 .190 .000 c.m/s

4 CATCHMENT

26.000 ID No. < 99999  
.570 Area in hectares  
90.000 Length (PERV) metres  
1.000 Gradient (%)  
20.000 Per cent Impervious  
90.000 Length (IMPERV)  
.000 %Imp. with Zero Dpth  
1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
.200 Manning "n"  
70.000 SCS Curve No or C  
.100 Ia/S Coefficient  
10.886 Initial Abstraction  
1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
.017 .190 .190 .000 c.m/s  
.202 .522 .266 C perv/imperv/total

15 ADD RUNOFF

.017 .207 .190 .000 c.m/s

8 PIPE

.500 Minimum velocity m/sec  
4.000 Maximum velocity m/sec  
.013 Pipe Manning's 'n'  
.450 Diameter in metres  
1.000 Select Grade in %  
Depth = .284 metres  
Velocity = 1.954 m/sec  
Pipe Capacity = .285 c.m/s

Critical depth= .321 metres

9 ROUTE

7.000 Conduit Length  
.000 Supply X-factor <.5  
2.686 Supply K-lag (sec)  
.741 Beta weighting factor  
10.000 Routing timestep

1 No. of sub-reaches

.017 .207 .207 .000 c.m/s

207 L/S 2 → 1

17 COMBINE

2700 Junction Node No.

.017 .207 .207 .207 c.m/s

14 START

1 1=Zero; 2=Define

4 CATCHMENT

20.000 ID No. ≤ 99999

.300 Area in hectares

50.000 Length (PERV) metres

1.000 Gradient (%)

20.000 Per cent Impervious

50.000 Length (IMPERV)

.000 %Imp. with Zero Dpth

1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat

.200 Manning "n"

70.000 SCS Curve No or C

.100 Ia/S Coefficient

10.886 Initial Abstraction

1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv

.010 .000 .207 .207 c.m/s

.202 .523 .266 C perv/imperv/total

15 ADD RUNOFF

.010 .010 .207 .207 c.m/s

8 PIPE

.500 Minimum velocity m/sec

4.000 Maximum velocity m/sec

.013 Pipe Manning's 'n'

.300 Diameter in metres

.400 Select Grade in %

Depth = .081 metres

Velocity = .634 m/sec

Pipe Capacity = .061 c.m/s

Critical depth= .074 metres

9 ROUTE

7.000 Conduit Length

.000 Supply X-factor <.5

8.284 Supply K-lag (sec)  
 .609 Beta weighting factor  
 20.000 Routing timestep  
 1 No. of sub-reaches  
 .010 .010 .010 .207 c.m/s  
 16 NEXT LINK  
 .010 .010 .010 .207 c.m/s  
 4 CATCHMENT  
 21.000 ID No. < 99999  
 .420 Area in hectares  
 50.000 Length (PERV) metres  
 1.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .014 .010 .010 .207 c.m/s  
 .202 .523 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .014 .023 .010 .207 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 1.000 Select Grade in %  
 Depth = .100 metres  
 Velocity = 1.126 m/sec  
 Pipe Capacity = .097 c.m/s  
 Critical depth= .116 metres  
 9 ROUTE  
 120.000 Conduit Length  
 .477 Supply X-factor <.5  
 79.913 Supply K-lag (sec)  
 .500 Beta weighting factor  
 75.000 Routing timestep  
 1 No. of sub-reaches  
 .014 .023 .021 .207 c.m/s  
 17 COMBINE  
 2300 Junction Node No.

```

        .014   .023   .021   .021 c.m/s
14  START
    1  1=Zero; 2=Define
4  CATCHMENT
22.000  ID No. ≤ 99999
    .600  Area in hectares
50.000  Length (PERV) metres
    2.000  Gradient (%)
20.000  Per cent Impervious
50.000  Length (IMPERV)
    .000  %Imp. with Zero Dpth
    1  Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
    .200  Manning "n"
70.000  SCS Curve No or C
    .100  Ia/S Coefficient
10.886  Initial Abstraction
    1  Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
        .020   .000   .021   .021 c.m/s
        .202   .515   .264   C perv/imperv/total
15  ADD RUNOFF
        .020   .020   .021   .021 c.m/s
8  PIPE
    .500  Minimum velocity m/sec
4.000  Maximum velocity m/sec
    .013  Pipe Manning's 'n'
    .300  Diameter in metres
    .400  Select Grade in %
    Depth    =   .119 metres
    Velocity  =   .776 m/sec
    Pipe Capacity =   .061 c.m/s
    Critical depth=   .108 metres
9  ROUTE
    7.000  Conduit Length
    .000  Supply X-factor <.5
    6.767  Supply K-lag (sec)
    .717  Beta weighting factor
    21.429  Routing timestep
    1  No. of sub-reaches
        .020   .020   .020   .021 c.m/s
17  COMBINE
    2300  Junction Node No.
        .020   .020   .020   .041 c.m/s
14  START
    1  1=Zero; 2=Define
18  CONFLUENCE

```

2300 Junction Node No.  
       .020 .041 .020 .000 c.m/s  
 4 CATCHMENT  
   23.000 ID No. ≤ 99999  
       .600 Area in hectares  
   50.000 Length (PERV) metres  
       2.000 Gradient (%)  
   20.000 Per cent Impervious  
   50.000 Length (IMPERV)  
       .000 %Imp. with Zero Dpth  
       1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
       .200 Manning "n"  
   70.000 SCS Curve No or C  
       .100 Ia/S Coefficient  
   10.886 Initial Abstraction  
       1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
       .020 .041 .020 .000 c.m/s  
       .202 .515 .264 C perv/imperv/total  
 15 ADD RUNOFF  
       .020 .061 .020 .000 c.m/s  
 8 PIPE  
   .500 Minimum velocity m/sec  
   4.000 Maximum velocity m/sec  
   .013 Pipe Manning's 'n'  
   .300 Diameter in metres  
   1.000 Select Grade in %  
   Depth = .173 metres  
   Velocity = 1.447 m/sec  
   Pipe Capacity = .097 c.m/s  
   Critical depth = .192 metres  
 9 ROUTE  
   150.000 Conduit Length  
       .463 Supply X-factor <.5  
   77.729 Supply K-lag (sec)  
       .500 Beta weighting factor  
   75.000 Routing timestep  
       1 No. of sub-reaches  
       .020 .061 .056 .000 c.m/s  
 17 COMBINE  
   2500 Junction Node No.  
       .020 .061 .056 .056 c.m/s  
 14 START  
   1 1=Zero; 2=Define  
 4 CATCHMENT  
   24.000 ID No. ≤ 99999

.760 Area in hectares  
 50.000 Length (PERV) metres  
 1.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .025 .000 .056 .056 c.m/s  
 .202 .523 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .025 .025 .056 .056 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .133 metres  
 Velocity = .820 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth= .120 metres  
 9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 6.405 Supply K-lag (sec)  
 .737 Beta weighting factor  
 23.077 Routing timestep  
 1 No. of sub-reaches  
 .025 .025 .025 .056 c.m/s  
 17 COMBINE  
 2500 Junction Node No.  
 .025 .025 .025 .081 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 18 CONFLUENCE  
 2500 Junction Node No.  
 .025 .081 .025 .000 c.m/s  
 4 CATCHMENT  
 25.000 ID No. ≤ 99999  
 .760 Area in hectares

50.000 Length (PERV) metres  
 2.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .026 .081 .025 .000 c.m/s  
 .202 .515 .264 C perv/imperv/total  
 15 ADD RUNOFF  
 .026 .107 .025 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .375 Diameter in metres  
 .400 Select Grade in %  
 Depth = .295 metres  
 Velocity = 1.143 m/sec  
 Pipe Capacity = .111 c.m/s  
 Critical depth= .240 metres  
 9 ROUTE  
 110.000 Conduit Length  
 .200 Supply X-factor <.5  
 72.154 Supply K-lag (sec)  
 .500 Beta weighting factor  
 100.000 Routing timestep  
 1 No. of sub-reaches  
 .026 .107 .099 .000 c.m/s  
 17 COMBINE  
 2700 Junction Node No.  
 .026 .107 .099 .306 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 4 CATCHMENT  
 28.000 ID No. ≤ 99999  
 .480 Area in hectares  
 80.000 Length (PERV) metres  
 1.000 Gradient (%)  
 20.000 Per cent Impervious  
 80.000 Length (IMPERV)

9941s John → ex. at Lorne

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.000 %Imp. with Zero Dpth
  1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
.200 Manning "n"
70.000 SCS Curve No or C
.100 Ia/S Coefficient
10.886 Initial Abstraction
  1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
    .015 .000 .099 .306 c.m/s
    .202 .523 .266 C perv/imperv/total
15 ADD RUNOFF
    .015 .015 .099 .306 c.m/s
8 PIPE
.500 Minimum velocity m/sec
4.000 Maximum velocity m/sec
.013 Pipe Manning's 'n'
.300 Diameter in metres
.400 Select Grade in %
Depth = .099 metres
Velocity = .709 m/sec
Pipe Capacity = .061 c.m/s
Critical depth= .091 metres
9 ROUTE
7.000 Conduit Length
.000 Supply X-factor <.5
7.410 Supply K-lag (sec)
.663 Beta weighting factor
21.429 Routing timestep
  1 No. of sub-reaches
  .015 .015 .014 .306 c.m/s


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16 NEXT LINK
    .015 .014 .014 .306 c.m/s
4 CATCHMENT
29.000 ID No. ≤ 99999
.480 Area in hectares
80.000 Length (PERV) metres
1.000 Gradient (%)
20.000 Per cent Impervious
80.000 Length (IMPERV)
.000 %Imp. with Zero Dpth
  1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
.200 Manning "n"
70.000 SCS Curve No or C
.100 Ia/S Coefficient
10.886 Initial Abstraction
  1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv

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*15215 9 → 7*

.015 .014 .014 .306 c.m/s  
.202 .523 .266 C perv/imperv/total  
15 ADD RUNOFF  
.015 .029 .014 .306 c.m/s

8 PIPE  
.500 Minimum velocity m/sec  
4.000 Maximum velocity m/sec  
.013 Pipe Manning's 'n'  
.300 Diameter in metres  
.400 Select Grade in %  
Depth = .145 metres  
Velocity = .853 m/sec  
Pipe Capacity = .061 c.m/s  
Critical depth = .130 metres

9 ROUTE  
7.000 Conduit Length  
.000 Supply X-factor <.5  
6.156 Supply K-lag (sec)  
.769 Beta weighting factor  
23.077 Routing timestep

1 No. of sub-reaches  
1  
.015 .029 .029 .306 c.m/s

29 L/S

7 → 1

17 COMBINE  
2700 Junction Node No.  
.015 .029 .029 .333 c.m/s

14 START  
1 1=Zero; 2=Define

18 CONFLUENCE  
2700 Junction Node No.  
.015 .333 .029 .000 c.m/s

333 L/S ex. Lorne 600 φ

4 CATCHMENT  
27.000 ID No. ≤ 99999  
.550 Area in hectares  
90.000 Length (PERV) metres  
1.000 Gradient (%)  
20.000 Per cent Impervious  
90.000 Length (IMPERV)  
.000 %Imp. with Zero Dpth  
1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
.200 Manning "n"  
70.000 SCS Curve No or C  
.100 Ia/S Coefficient  
10.886 Initial Abstraction  
1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
.016 .333 .029 .000 c.m/s

.202 .522 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .016 .349 .029 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .450 Diameter in metres  
 1.500 Select Grade in %  
 Depth = .369 metres  
 Velocity = 2.503 m/sec  
 Pipe Capacity = .349 c.m/s  
 Critical depth = .404 metres  
 9 ROUTE  
 65.000 Conduit Length  
 .500 Supply X-factor <.5  
 .000 Supply K-lag (sec)  
 .500 Beta weighting factor  
 300.000 Routing timestep  
 1 No. of sub-reaches  
 .016 .349 .349 .000 c.m/s  
 16 NEXT LINK  
 .016 .349 .349 .000 c.m/s  
 4 CATCHMENT  
 36.000 ID No. ≤ 99999  
 .550 Area in hectares  
 50.000 Length (PERV) metres  
 5.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .020 .349 .349 .000 c.m/s  
 .201 .520 .265 C perv/imperv/total  
 15 ADD RUNOFF  
 .020 .366 .349 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'

.600 Diameter in metres  
 1.500 Select Grade in %  
 Depth = .295 metres  
 Velocity = 2.642 m/sec  
 Pipe Capacity = .752 c.m/s  
 Critical depth= .396 metres

9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 1.987 Supply K-lag (sec)  
 .624 Beta weighting factor  
 5.172 Routing timestep  
 1 No. of sub-reaches  
 .020 .366 .366 .000 c.m/s

17 COMBINE  
 3700 Junction Node No.  
 .020 .366 .366 .366 c.m/s

14 START  
 1 1=Zero; 2=Define

4 CATCHMENT  
 30.000 ID No. ≤ 99999  
 .420 Area in hectares  
 50.000 Length (PERV) metres  
 3.000 Gradient (%)  
 20.000 Per cent Impervious  
 50.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .014 .000 .366 .366 c.m/s  
 .202 .516 .264 C perv/imperv/total

15 ADD RUNOFF  
 .014 .014 .366 .366 c.m/s

8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .099 metres  
 Velocity = .705 m/sec

Pipe Capacity = .061 c.m/s  
 Critical depth= .090 metres  
 9 ROUTE  
   7.000 Conduit Length  
   .000 Supply X-factor <.5  
   7.448 Supply K-lag (sec)  
   .660 Beta weighting factor  
   21.429 Routing timestep  
     1 No. of sub-reaches  
       .014 .014 .014 .366 c.m/s  
 16 NEXT LINK  
   .014 .014 .014 .366 c.m/s  
 4 CATCHMENT  
   31.000 ID No. ≤ 99999  
   .370 Area in hectares  
   40.000 Length (PERV) metres  
   4.000 Gradient (%)  
   20.000 Per cent Impervious  
   40.000 Length (IMPERV)  
   .000 %Imp. with Zero Dpth  
     1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
   .200 Manning "n"  
   70.000 SCS Curve No or C  
   .100 Ia/S Coefficient  
   10.886 Initial Abstraction  
     1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
       .014 .014 .014 .366 c.m/s  
       .201 .521 .265 C perv/imperv/total  
 15 ADD RUNOFF  
   .014 .028 .014 .366 c.m/s  
 8 PIPE  
   .500 Minimum velocity m/sec  
   4.000 Maximum velocity m/sec  
   .013 Pipe Manning's 'n'  
   .300 Diameter in metres  
   2.000 Select Grade in %  
   Depth = .092 metres  
   Velocity = 1.518 m/sec  
   Pipe Capacity = .137 c.m/s  
   Critical depth= .128 metres  
 9 ROUTE  
   120.000 Conduit Length  
   .490 Supply X-factor <.5  
   59.289 Supply K-lag (sec)  
   .500 Beta weighting factor

60.000 Routing timestep  
     1 No. of sub-reaches  
       .014 .028 .026 .366 c.m/s  
 17 COMBINE  
   3300 Junction Node No.  
       .014 .028 .026 .026 c.m/s  
 14 START  
     1 1=Zero; 2=Define  
 4 CATCHMENT  
   32.000 ID No. ≤ 99999  
     .600 Area in hectares  
   50.000 Length (PERV) metres  
     2.000 Gradient (%)  
   20.000 Per cent Impervious  
   50.000 Length (IMPERV)  
     .000 %Imp. with Zero Dpth  
       1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
     .200 Manning "n"  
   70.000 SCS Curve No or C  
     .100 Ia/S Coefficient  
   10.886 Initial Abstraction  
       1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
       .020 .000 .026 .026 c.m/s  
       .202 .515 .264 C perv/imperv/total  
 15 ADD RUNOFF  
     .020 .020 .026 .026 c.m/s  
 8 PIPE  
   .500 Minimum velocity m/sec  
   4.000 Maximum velocity m/sec  
   .013 Pipe Manning's 'n'  
   .300 Diameter in metres  
   .400 Select Grade in %  
   Depth = .119 metres  
   Velocity = .776 m/sec  
   Pipe Capacity = .061 c.m/s  
   Critical depth = .108 metres  
 9 ROUTE  
   7.000 Conduit Length  
   .000 Supply X-factor <.5  
   6.767 Supply K-lag (sec)  
   .717 Beta weighting factor  
   21.429 Routing timestep  
     1 No. of sub-reaches  
       .020 .020 .020 .026 c.m/s  
 17 COMBINE

3300 Junction Node No.  
       .020 .020 .020 .046 c.m/s  
 14 START  
    1 1=Zero; 2=Define  
 18 CONFLUENCE  
   3300 Junction Node No.  
       .020 .046 .020 .000 c.m/s  
 4 CATCHMENT  
   33.000 ID No. ≤ 99999  
    .540 Area in hectares  
   45.000 Length (PERV) metres  
    3.000 Gradient (%)  
   20.000 Per cent Impervious  
   45.000 Length (IMPERV)  
    .000 %Imp. with Zero Dpth  
    1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
    .200 Manning "n"  
   70.000 SCS Curve No or C  
    .100 Ia/S Coefficient  
  10.886 Initial Abstraction  
    1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
    .019 .046 .020 .000 c.m/s  
    .201 .518 .265 C perv/imperv/total  
 15 ADD RUNOFF  
    .019 .065 .020 .000 c.m/s  
 8 PIPE  
    .500 Minimum velocity m/sec  
   4.000 Maximum velocity m/sec  
    .013 Pipe Manning's 'n'  
    .375 Diameter in metres  
    .400 Select Grade in %  
   Depth = .206 metres  
   Velocity = 1.043 m/sec  
   Pipe Capacity = .111 c.m/s  
   Critical depth = .185 metres  
 9 ROUTE  
  150.000 Conduit Length  
    .395 Supply X-factor <.5  
  107.878 Supply K-lag (sec)  
    .500 Beta weighting factor  
  100.000 Routing timestep  
    1 No. of sub-reaches  
    .019 .065 .060 .000 c.m/s  
 17 COMBINE  
   3500 Junction Node No.

```

        .019   .065   .060   .060 c.m/s
14  START
    1  1=Zero; 2=Define
4  CATCHMENT
34.000  ID No. < 99999
    .760  Area in hectares
50.000  Length (PERV) metres
    3.000  Gradient (%)
20.000  Per cent Impervious
50.000  Length (IMPERV)
    .000  %Imp. with Zero Dpth
    1  Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
    .200  Manning "n"
70.000  SCS Curve No or C
    .100  Ia/S Coefficient
10.886  Initial Abstraction
    1  Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
    .026   .000   .060   .060 c.m/s
    .202   .516   .264   C perv/imperv/total
15  ADD RUNOFF
    .026   .026   .060   .060 c.m/s
8  PIPE
    .500  Minimum velocity m/sec
4.000  Maximum velocity m/sec
    .013  Pipe Manning's 'n'
    .300  Diameter in metres
    .400  Select Grade in %
Depth   =   .136 metres
Velocity =   .828 m/sec
Pipe Capacity = .061 c.m/s
Critical depth= .122 metres
9  ROUTE
7.000  Conduit Length
    .000  Supply X-factor <.5
6.341  Supply K-lag (sec)
    .744  Beta weighting factor
23.077  Routing timestep
    1  No. of sub-reaches
    .026   .026   .026   .060 c.m/s
17  COMBINE
3500  Junction Node No.
    .026   .026   .026   .084 c.m/s
14  START
    1  1=Zero; 2=Define
18  CONFLUENCE

```

3500 Junction Node No.  
       .026 .084 .026 .000 c.m/s  
 4 CATCHMENT  
   35.000 ID No. ≤ 99999  
       .980 Area in hectares  
   55.000 Length (PERV) metres  
       2.000 Gradient (%)  
   20.000 Per cent Impervious  
   55.000 Length (IMPERV)  
       .000 %Imp. with Zero Dpth  
       1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
       .200 Manning "n"  
   70.000 SCS Curve No or C  
       .100 Ia/S Coefficient  
   10.886 Initial Abstraction  
       1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
       .033 .084 .026 .000 c.m/s  
       .202 .516 .265 C perv/imperv/total  
 15 ADD RUNOFF  
       .033 .117 .026 .000 c.m/s  
 8 PIPE  
   .500 Minimum velocity m/sec  
   4.000 Maximum velocity m/sec  
   .013 Pipe Manning's 'n'  
   .375 Diameter in metres  
   1.250 Select Grade in %  
   Depth = .208 metres  
   Velocity = 1.852 m/sec  
   Pipe Capacity = .196 c.m/s  
   Critical depth = .252 metres  
 9 ROUTE  
   110.000 Conduit Length  
       .453 Supply X-factor <.5  
   44.555 Supply K-lag (sec)  
       .500 Beta weighting factor  
   42.857 Routing timestep  
       1 No. of sub-reaches  
       .033 .117 .111 .000 c.m/s  
 17 COMBINE  
   3700 Junction Node No.  
       .033 .117 .111 .476 c.m/s  
 14 START  
   1 1=Zero; 2=Define  
 4 CATCHMENT  
   37.000 ID No. ≤ 99999

.480 Area in hectares  
 80.000 Length (PERV) metres  
 2.000 Gradient (%)  
 20.000 Per cent Impervious  
 80.000 Length (IMPERV)  
 .000 %Imp. with Zero Dpth  
 1 Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat  
 .200 Manning "n"  
 70.000 SCS Curve No or C  
 .100 Ia/S Coefficient  
 10.886 Initial Abstraction  
 1 Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv  
 .015 .000 .111 .476 c.m/s  
 .202 .526 .266 C perv/imperv/total  
 15 ADD RUNOFF  
 .015 .015 .111 .476 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec  
 .013 Pipe Manning's 'n'  
 .300 Diameter in metres  
 .400 Select Grade in %  
 Depth = .103 metres  
 Velocity = .721 m/sec  
 Pipe Capacity = .061 c.m/s  
 Critical depth= .094 metres  
 9 ROUTE  
 7.000 Conduit Length  
 .000 Supply X-factor <.5  
 7.286 Supply K-lag (sec)  
 .672 Beta weighting factor  
 21.429 Routing timestep  
 1 No. of sub-reaches  
 .015 .015 .015 .476 c.m/s  
 17 COMBINE  
 3700 Junction Node No.  
 .015 .015 .015 .489 c.m/s  
 14 START  
 1 1=Zero; 2=Define  
 18 CONFLUENCE  
 3700 Junction Node No.  
 .015 .489 .015 .000 c.m/s  
 8 PIPE  
 .500 Minimum velocity m/sec  
 4.000 Maximum velocity m/sec

.013 Pipe Manning's 'n'  
.600 Diameter in metres  
1.000 Select Grade in %  
Depth = .405 metres  
Velocity = 2.411 m/sec  
Pipe Capacity = .614 c.m/s  
Critical depth= .458 metres

9 ROUTE  
1.000 Conduit Length  
.000 Supply X-factor <.5  
.311 Supply K-lag (sec)  
.980 Beta weighting factor  
9.375 Routing timestep  
1 No. of sub-reaches  
.015 .489 .489 .000 c.m/s

16 NEXT LINK  
.015 .489 .489 .000 c.m/s

22 FILE HYDROGRAPH  
2 1=READ: 2=WRITE  
8 BARBER5P .5YR is Filename  
3 1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary  
5 year hydrograph at Margaret and Lorne  
.015 .489 .489 .000 c.m/s

28 PLOT HYDROGRAPH  
3 Hydr. selection  
2 Clear (1) or Retain (2)

29 PLOT HYETOGRAPH  
1 Hyeto. selection  
2 Clear (1) or Retain (2)

20 MANUAL

**DESIGN REPORT  
FOR BARBER DRAIN  
TOWN OF HARRISTON**

**DESIGN REPORT  
FOR BARBER DRAIN  
TOWN OF HARRISTON**

**June 23, 1997**

**B. M. ROSS AND ASSOCIATES LIMITED  
Consulting Engineers  
165 King Street  
Mount Forest, Ontario  
NOG 2L0**

**File No. 97087**

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## **1.0 INTRODUCTION**

The purpose of this report is to assess the stormwater capacities of the Barber Drain located in the Town of Harriston.

## **2.0 SITE CHARACTERISTICS**

### **2.1 SITE LOCATION**

The existing Barber Drain is located in the Town of Harriston, County of Wellington, as shown by Figure 1 - Existing Drainage Area Plan.

### **2.2 EXISTING LAND USE**

The existing drainage area is presently in urban residential and agricultural use with approximately 55 percent urban development and the remainder of the land is grassed pasture land. The undeveloped lands within the Barber Street drainage area are generally zoned planned development.

### **2.3 SOILS**

Report No. 35 of the Ontario Soil Survey describes the underlying soil as a loam of the Harriston and Listowel Series.

### **2.4 TOPOGRAPHY**

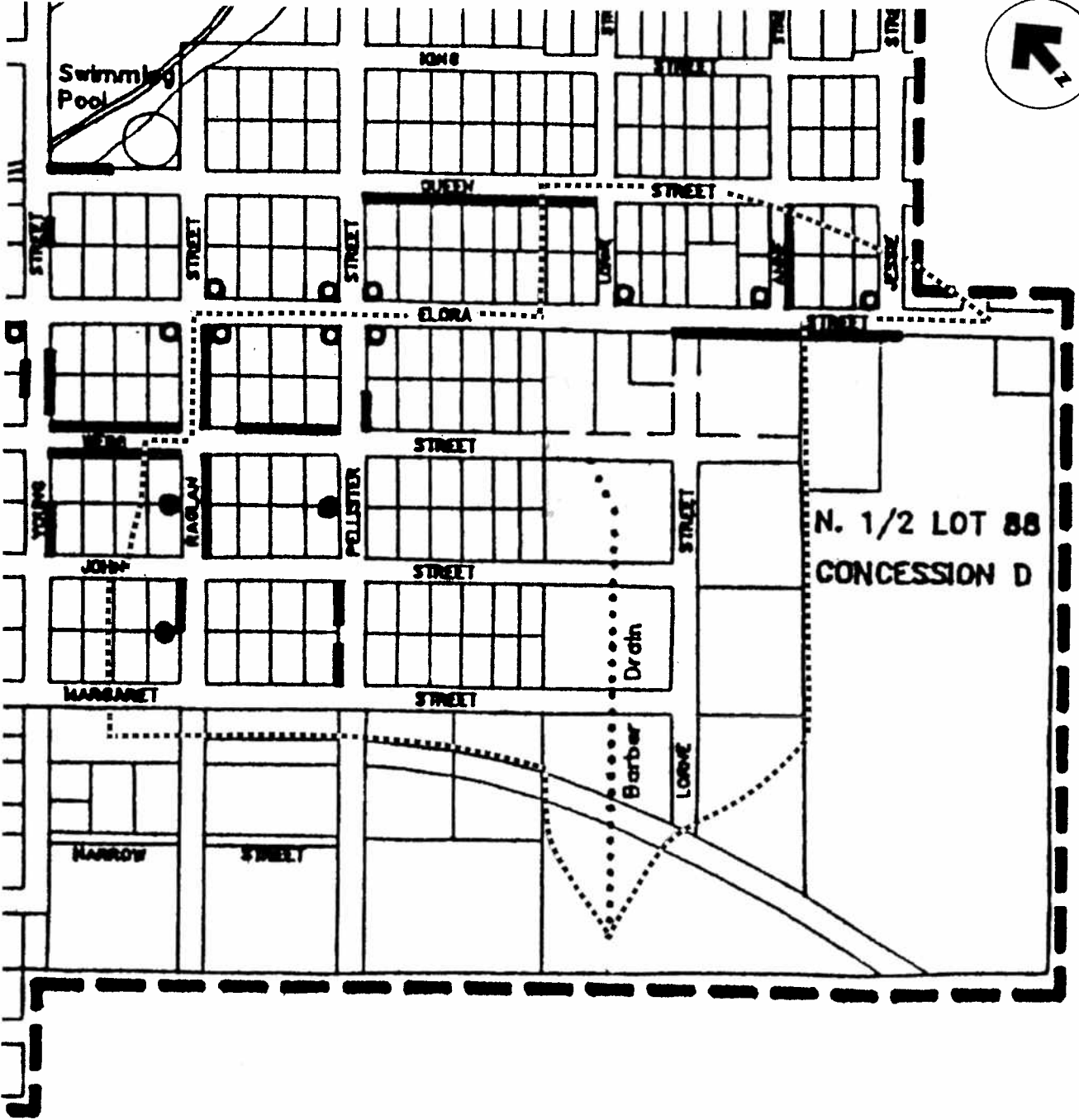
Site topography is flat to gently rolling.

## **2.5 EXISTING DRAINAGE CONDITIONS**

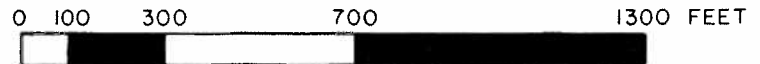
The Barber Drain does not lie within an area governed by a master watershed plan.

The existing Barber Drain catchment lies within the drainage area of the Maitland River and more specifically the south tributary (Drain #1) of the Maitland River. Development of the Barber Drain in 1951 enhanced the natural drainage runoff for a portion of the lands within the municipality lying north of railway and east of Pellister Street which flowed easterly to the Maitland Tributary. The affected lands consisted of a total of some 21.23 ha which include the proposed 11.2 ha under development and approximately 10 ha of farmland to the east and south of the developed area. At present, surface water from the drainage area enters the Barber Drain and flows to the outlet at the Drain #1 outfall in the north half of lot 88 Concession D.

Figure No. 2 presents the existing Barber Drain Schematic Diagram.

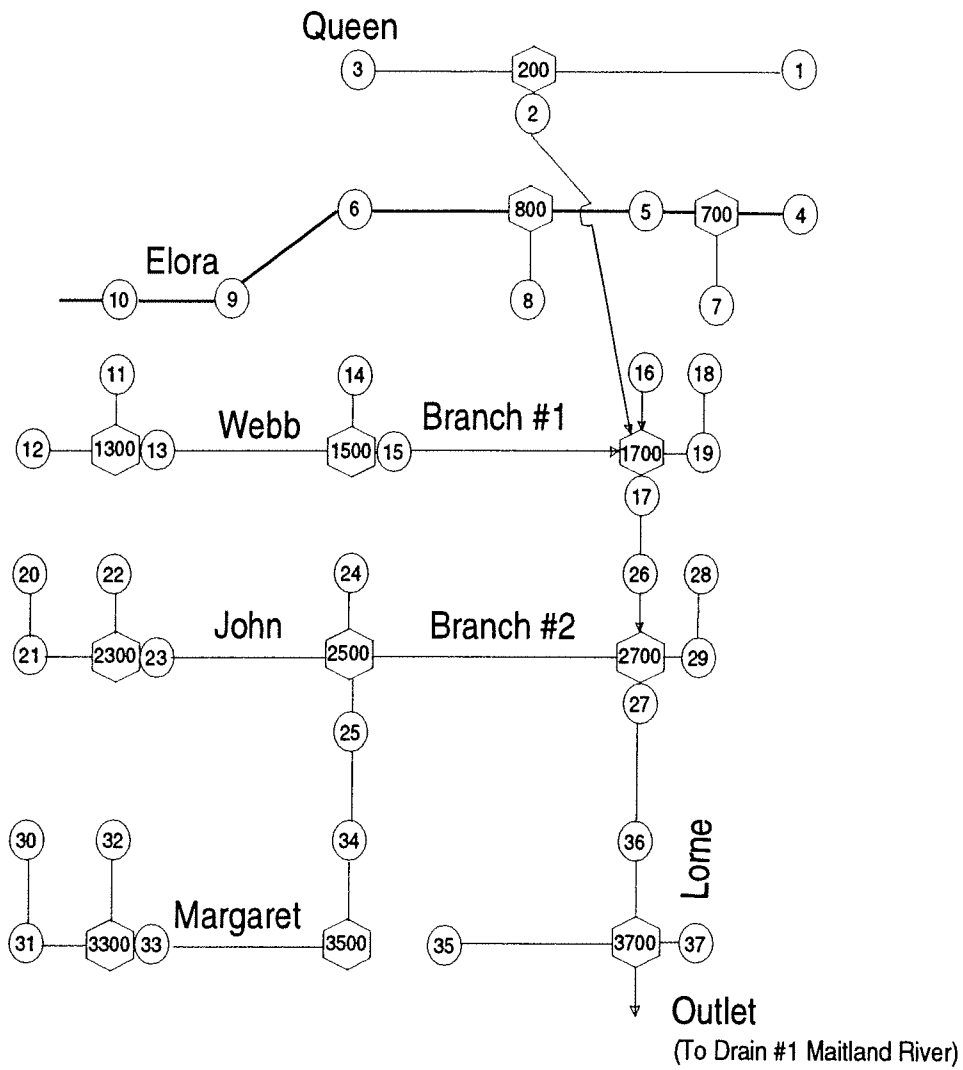


SCALE :



EXISTING DRAINAGE AREA PLAN

FIG. 1



-  Catchment Area
-  Confluence
-  Drains to Elora Street
-  Barber Drain

Barber Drain - Existing Drainage

Fig. 2

### **3.0 PROPOSED FUTURE STORM DRAINAGE**

#### **3.1 DRAINAGE LAYOUT**

The existing drainage north of Margaret Street will be maintained during the first Phase of the development of the Lorne Street storm sewer. At present, the area west of Pellister Street and north of Margaret Street drain to the existing Barber Drain north of Margaret and Lorne Streets. As part of the overall drainage scheme, the lots fronting on Margaret Street will be drained by a future Margaret Street Street storm sewer which will outlet to the Lorne Street storm sewer at the intersection of Margaret and Lorne Streets. A full urban standard cross-section to be applied to Margaret Street as it is developed under a cost sharing agreement between the Municipality and the Developer. This change in drainage pattern will provide relief for the existing upper Barber Drain between Margaret and John Streets and for the Branch 2 section that currently carries the flow from the area being returned to the Margaret Street drainage pattern. (See Figure No. 3)

The full design concept storm sewer will provide a trunk sewer alignment that follows Lorne Street right of way from Margaret Street to Webb Street. There will be a storm sewer along Webb Street to its intersection with Lorne Street. As John Street is developed, there will be a storm sewer within it's right of way to carry stormwater to the Lorne Street storm sewer. It is proposed that the drainage area north of Elora Street will remain connected to the Barber Drain and the Drain will be intercepted at Webb Street and directed to the Lorne Street system.

### **4.0 BASIS OF DESIGN**

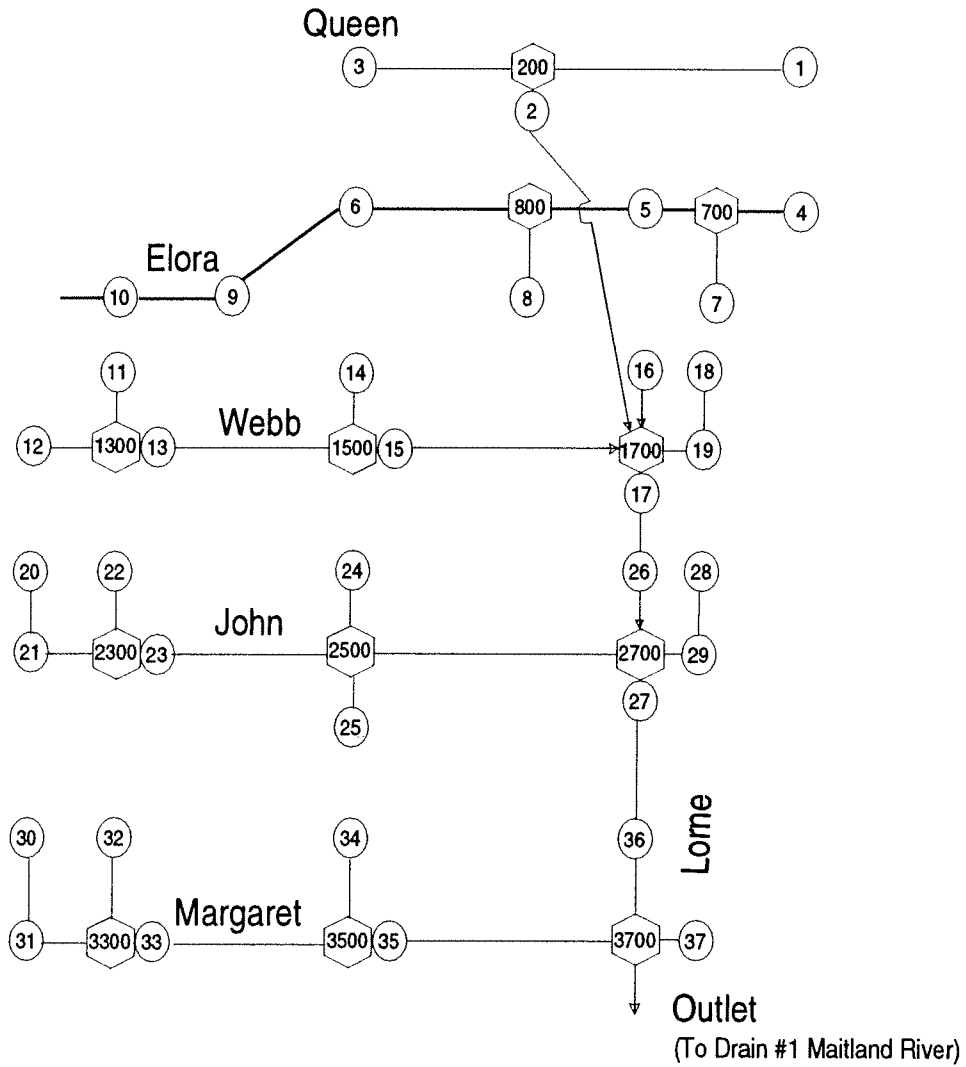
#### **4.1 EXISTING DESIGN CONSTRAINTS**

The existing Barber Drain below Margaret Street does not have sufficient capacity to carry runoff water from the drainage catchment. There must be a new storm sewer system designed to provide the needed capacity to drain the watershed in its existing state of development. The portions of the watershed that are currently developed have been experiencing drainage outlet problems over the years. The problem has been related to insufficient capacity within the Barber Drain itself.

#### **4.2 DESIGN GUIDELINES**

The design of the stormwater system will be undertaken using the hydraulic modelling program MIDUSS \*. The program will be used to develop a model of the Barber Drain watershed using the rainfall data from the Mount Forest AES rainfall frequency data presented in Table No. 1. The design return frequency will be based upon the 1:5 year rainfall rate of 49 mm over a 6 hour period.

\* Note: The computer program MIDUSS Version 4.72.1 (Allen A. Smith Inc., 17 Lyndale Drive, Dundas, Ontario, L9H 3L4) was used to simulate the 1:5 year rainfall event.



- Catchment Area
- ⬢ Confluence
- Drains to Elora Street
- Barber Drain

Lorne St. Storm Sewer - Proposed Drainage

Fig. 3

**TABLE 1**  
**MOUNT FOREST**  
**RAINFALL INTENSITY - DURATION FREQUENCY VALUES**  
**RETURN PERIOD RAINFALL AMOUNTS (MM)**

DURATION	2 YEAR	5 YEAR	10 YEAR	25 YEAR	50 YEAR	100 YEAR
1 HOUR	24.8	33.3	39.0	46.1	51.4	56.7
2 HOUR	30.0	39.5	45.8	53.7	59.6	65.4
6 HOUR	37.9	49.0	56.3	65.6	72.5	79.3
12 HOUR	43.1	55.3	63.4	73.7	81.2	88.8
24 HOUR	49.2	63.7	73.3	85.4	94.3	103.3

#### 4.3 STORMWATER MODEL

The schematic diagram for the MIDUSS model of the Barber Drain watershed is presented in Figure No. 2. The proposed Lorne Street storm sewer schematic diagram is presented in Figure No. 3. The individual catchment data input into the MIDUSS model is presented in Table No. 2.

The model was prepared to represent current runoff conditions within the watershed for assessment purposes and to represent the proposed re-routing of the Lorne Street storm sewer for design purposes.

**TABLE 2**  
**MIDUSS INPUT PARAMETERS**  
**FOR SUBDIVISION CATCHMENT AREAS**

Description Barber Drain - Harriston Minor Event Precip. 49.0 in. Major Event Precip. 79.3 in.  
 Design Storm Mount Forest - 6 HR S.C.S.

No.	IMPERVIOUS			CATCHMENT			CATCH AREA (acres)	FLOW LENGTH (feet)	OVER-LAND SLOPE	% IMPERVIOUS	
	n	CN	Ia/S	in.ab	n	CN					Ia/S
1	.013	88	.1	3.464	.20	70	.1	10.886	100	3.0	5
2	.013	88	.1	3.464	.20	70	.1	10.886	50	2.0	5
3	.013	88	.1	3.464	.20	70	.1	10.886	50	3.5	10
4								0.94	50	3.0	5
5								0.70	50	2.0	5
6								0.35	50	4.5	10
7								0.53	50	6.0	5
8								0.55	50	6.0	5
9								0.76	50	6.0	20
10								0.60	50	4.0	15
11	.013	88	.1	3.464	.20	70	.1	10.886	50	4.0	15
12	.013	88	.1	3.464	.20	70	.1	10.886	50	3.0	15
13	.013	88	.1	3.464	.20	70	.1	10.886	50	3.0	15
14	.013	88	.1	3.464	.20	70	.1	10.886	120	3.0	10
15	.013	88	.1	3.464	.20	70	.1	10.886	120	1.0	10
16	.013	88	.1	3.464	.20	70	.1	10.886	90	3.0	0
17	.013	88	.1	3.464	.20	70	.1	10.886	90	2.5	0
18	.013	88	.1	3.464	.20	70	.1	10.886	80	3.0	0
19	.013	88	.1	3.464	.20	70	.1	10.886	80	2.0	0



**5.0 DISCUSSION OF STORMWATER MODELLING**

**5.1 EXISTING BARBER DRAIN MODEL**

Table No. 3 illustrates the hydraulic inadequacy of the existing Barber Drain. In the entire Barber Drain only the portion above Branch #1 has adequate hydraulic capacity for practical stormwater design criteria. This section is currently fully developed in terms of land use. The remaining portions of the drainage area are not adequately serviced in terms of stormwater conveyance. It would be prudent to define an adequate design capacity for the various Barber Drain sections and by beginning at the outlet section, replace the existing system with one of adequate hydraulic capacity.

The modelling results for the existing Barber Drain runoff under a 5 year storm event are presented in Table No. 3.

**TABLE 3**

Node	Location	Assessment Flow (c.m.s.)		
		Existing Capacity	Required Capacity	Remarks
1700	Barber Drain @ Lorne	.033	.045	
1500	Branch #1	.033	.087	Pipe too small
1700	Webb Street @ Lorne	.033	.087	Pipe too small
1700	Lorne Street below Webb	.047	.175	Pipe too small
2500	John Street @ Lorne	.047	.099	Pipe too small
2500	Branch #2	.033	.099	Pipe too small
2700	Lorne Street below John	.047	.333	Pipe too small
3500	Margaret Street @ Lorne	N/A	.031	N/A
3700	Lorne Street below Branch 2	.068	.333	Pipe too small
3700	Lorne Street outlet	.068	.407	Pipe too small

5.2 PROPOSED LORNE STREET STORM SEWER

Table No. 4 illustrates the design flows computed by the MIDUSS model set up to represent the new storm sewer configuration that maintains the stormwater network on Municipal rights-of-way as far as practical. The proposed system will allow the Margaret Street drainage to be collected on the right-of-way and conveyed to the Lorne Street intersection. This will allow the Branch #2 drain to be relieved of the current flow it is receiving from Margaret Street. It is anticipated that development occurring along Margaret Street will be conditional of stormwater drainage being placed on Margaret Street with a connection to the new Lorne Street storm sewer.

Table No. 4 details the preliminary pipe sizing required to meet design criteria currently in use for the design of stormwater systems within the Town of Harriston.

The modelling results for the proposed Lorne Street storm sewer runoff under a 5 year storm event are presented in Table No. 4

TABLE 4

Node	Location	Design Flow (c.m.s.)		
		Barber Drain Flow	Lorne Street Flow	Recommended Pipe Sizes (m.)
	Barber Drain @ Lorne	.045	.045	.300
	Branch #1	.087		
	Webb Street @ Lorne	.087	.132	.375
	Lorne Street below Webb	.175	.175	.450
	John Street @ Lorne	.099	.099	.375
	Branch #2	.099		
	Lorne Street below John	.033	.333	.600
	Margaret Street @ Lorne	.031	.117	.375
	Lorne Street below Branch 2	.333	.366	.600
	Lorne Street outlet	.407	.489	.600

---

## 6.0 RECOMMENDATIONS

Based upon the modelling results of the Barber Drain model, it is evident that the existing drain is inadequate in the main drain below Branch #1 through to the outlet. Both Branch #1 and Branch #2 are not of sufficient capacity to service the existing catchment area. It is recommended that the Barber Street drain be systematically replaced by a municipal storm sewer system that is located where possible on Municipal rights-of-way and that the hydraulic capacities of the storm sewer be sized to reflect the flow values displayed in Table No. 4 of this report.

The priorities of the development of the new Lorne Street storm sewer system be such that the drain is constructed from Margaret and Lorne Streets to an outlet in the Maitland River tributary (Drain 1) along the Lorne Street right-of-way or a projection thereof as a first phase.

It is also recommended that the Margaret Street drainage be conveyed along Margaret Street to Lorne Street and then into the Lorne Street storm sewer trunk line (previously constructed). As budget permits, the trunk sewer should be extended up the Lorne Street right-of-way to John and then Webb Street in the hydraulic configuration identified in this report. The extensions of John Street and Webb Streets can then take place with storm sewer systems emptying into the Lorne Street trunk sewer (previously constructed).

All of which is respectfully submitted.

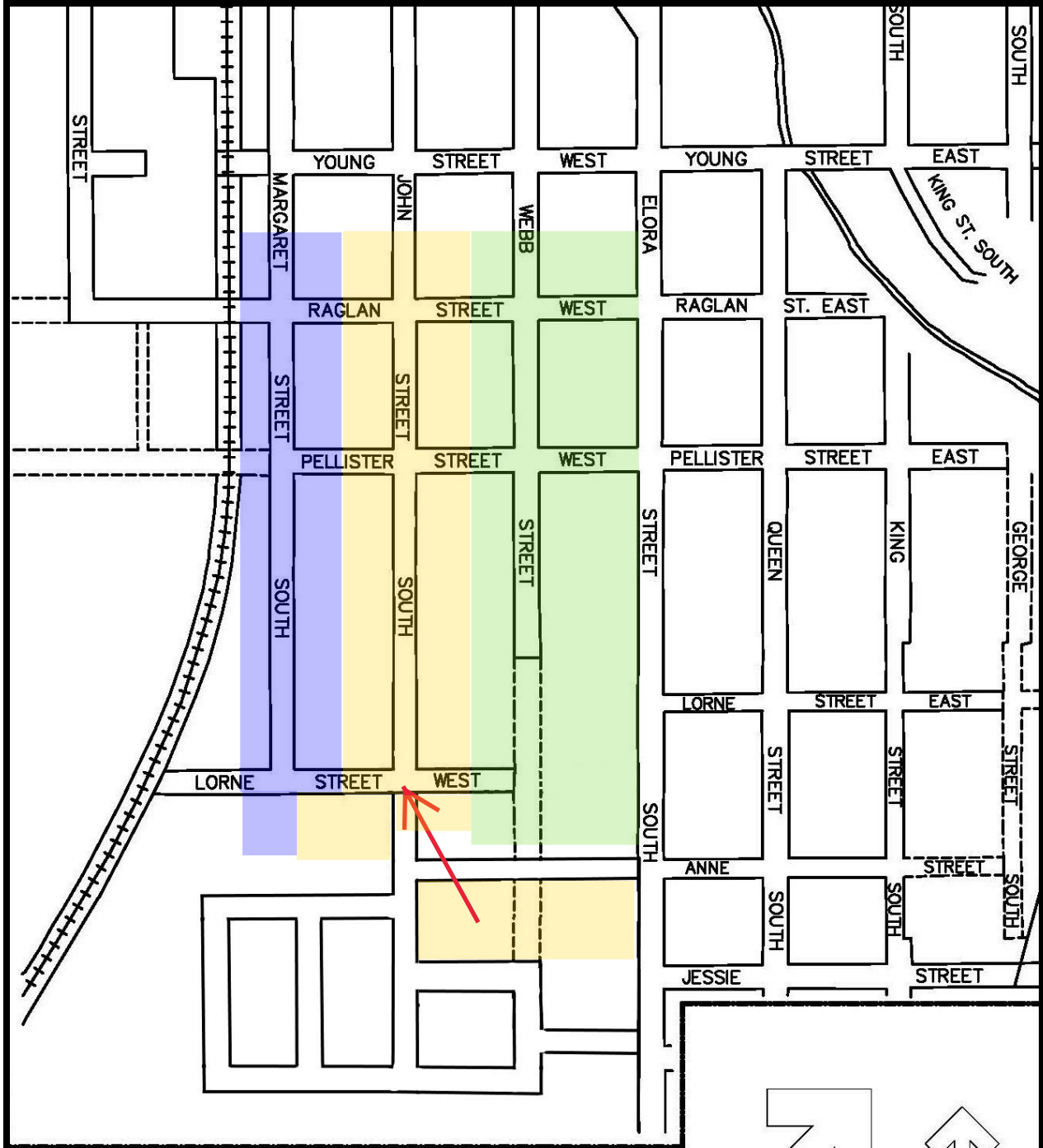
B. M. ROSS AND ASSOCIATES LIMITED  
Consulting Engineers

Per \_\_\_\_\_  
Jack W. MacPherson,  
Senior Hydrologist

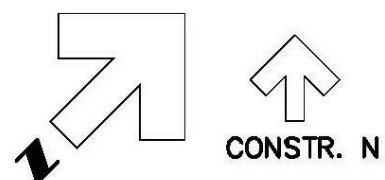
JWM/kt

**APPENDIX C.2**

**Stormwater Management – Storm Sewer Calculations, Rational Method**



- Catchments draining to end of Lorne
- Catchments draining to John and Lorne
- Other catchments draining to Barber Drain



**MOOREFIELD**  
excavating

RR#3, 6297 WELLINGTON COUNTY ROAD 109 S  
HARRISTON, ON, N0S 1Z0  
PHONE: 519-510-3571 FAX: 519-510-3277  
WWW.MOOREFIELDEX.CA

PROJECT:  
Harriston Subdivision

TITLE:  
Barber Drain Overall Catchment Areas

SCALE: NTS

DATE: Jan 2020

PROJECT NO: 191-103

DRAWING NO:  
BARBER-2

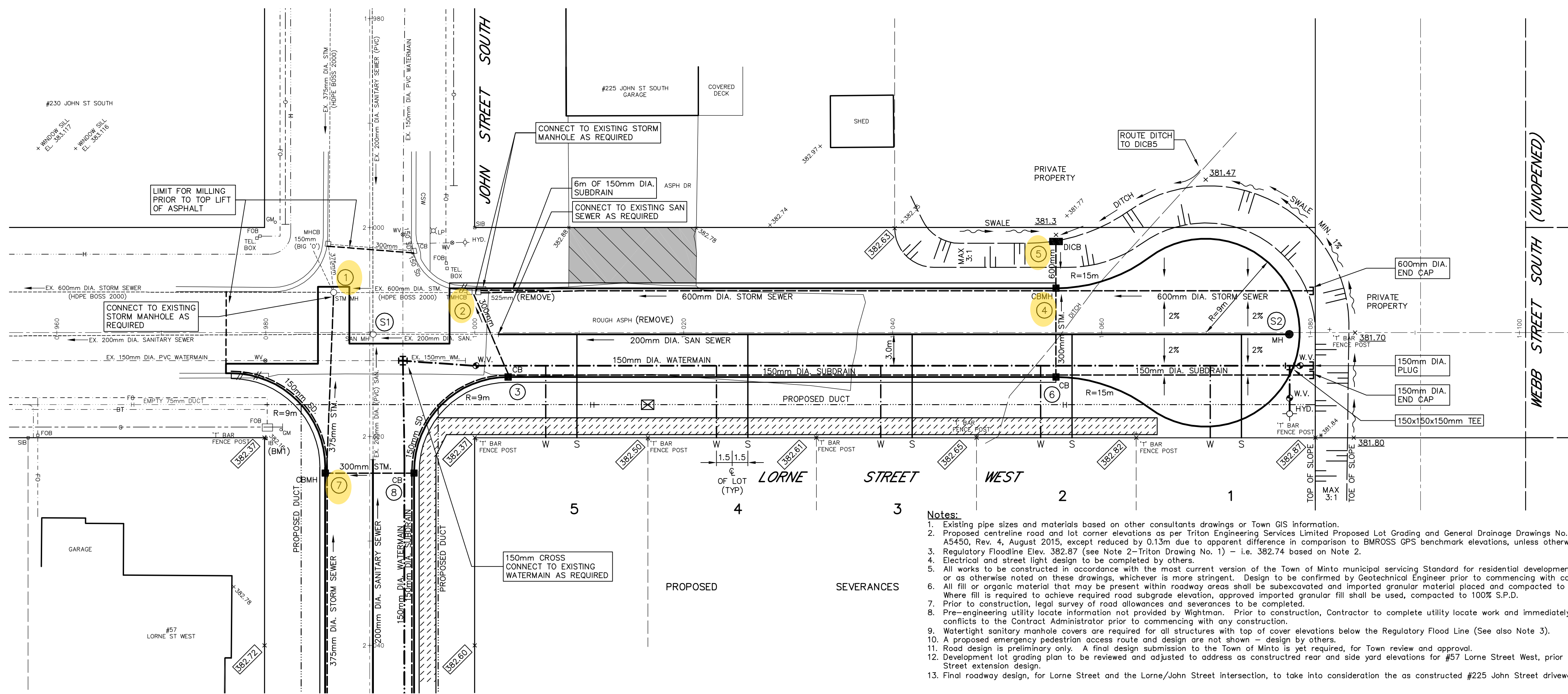
**STORM SEWER FLOW DESIGN SHEET**  
**5 Year Design Storm**  
**Proposed Conditions - Barber Drain**

LOCATION					PEAK FLOW Q (L/s)	REVISED Q (L/s)	Pipe	SEWER DATA					Total Time (min)	% Capacity	Comments							
STREET	AREA TOTAL	REVISED AREA	FROM	TO				DIAMETER (mm)	SLOPE (%)	LENGTH (m)	CAPACIT Y	VELOCITY (m/s)				TIME (minutes)						
End of Lorne Street	6.67	5.47	5	4	191.00	156.64		450	9.40	6.50	874.12	5.50	0.02	0.02	21.9%	LESS AREAS NORTH OF ELORA (1.63 HA) ADD IN AREAS (0.43 HA)						
Lorne Street	6.67	5.42	4	2	191.00	155.21	Metric	600	0.41	39.93	393.16	1.39	0.48	0.48	48.6%							
Lorne Street - ex Sewer	7.24	5.99	2	1	207.00	171.26	Metric	600	1.94	6.50	855.22	3.02	0.04	0.04	24.2%							
John Street	0.48	0.96	9	7	15.00	25.87	Metric	300	0.22	8.50	45.36	0.64	0.22	0.22	33.1%	AREA C2						
	0.96	1.50	7	1	29.00	71.18	Metric	300	0.22	8.50	45.36	0.64	0.22	0.22	63.9%	AREAS C1, C3, C4						
John Street - ex sewer			ex	1	99.00	99.00	Metric	375	0.91	37.96	167.25	1.51	0.42	0.42	59.2%							
Lorne Street - ex sewer			1	ex	333.00	341.44	Metric	600	0.25	40.00	307.01	1.09	0.61	0.61	108.5%							
Drainage areas and peak flows based on design report for Barber Drain date June 23, 1997. Flows scaled based on revised areas. See report for further discussion. Existing John/Lorne sewer approved under CofA 5822-78NMJB dated November 5, 2007 and 5474-AAXKDU date June 16, 2016.																						
<b>PROJECT :</b>	Harriston Subdivision					Comments: <table border="1"> <thead> <tr> <th colspan="2">Roughness Coefficients</th> </tr> </thead> <tbody> <tr> <td>Concrete and PVC Pipe</td> <td>n=0.013</td> </tr> <tr> <td>Corrugated Pipe</td> <td>n=0.024</td> </tr> </tbody> </table> $I_{5YR} = 30.5 * T^{-0.699}$  Bransby Williams $t_c = 0.057 * L / (S_w^{0.2} * A^{0.1})$ minimum 10 minutes											Roughness Coefficients		Concrete and PVC Pipe	n=0.013	Corrugated Pipe	n=0.024
Roughness Coefficients																						
Concrete and PVC Pipe	n=0.013																					
Corrugated Pipe	n=0.024																					
<b>PROJECT NUMBER :</b>	191-103																					
<b>DATE :</b>	May 3, 2021																					

M.H. & C.B. DATA				
No	Station	O/S	Desc.	Grate
S1	0+990.3	RT	ADJUST	401.010A (B)
S2	1+015.5	RT	ADJUST	
1	0+986.5	LT	ADJUST	
2	0+999.9	LT	ADJUST	
3	1+003.2	RT	705.010	400.110 (S)
4	1+055.6	LT	701.011	400.110 (S)
5	1+055.6	LT	705.040A	403.010B (S) (See Note)
6	1+055.6	RT	705.010	400.110 (S)

NOTE: STRUCTURE 5 TO BE DESIGNED FOR SEWER CONNECTION TO THE BACK WIDE SIDE OF THE STRUCTURE. 3:1 GRADE SLOPE.  
(S) DENOTES SUMP  
(B) DENOTES BENCHMARK

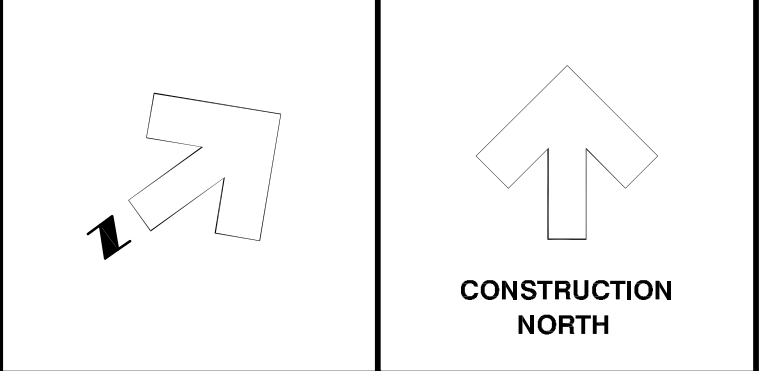
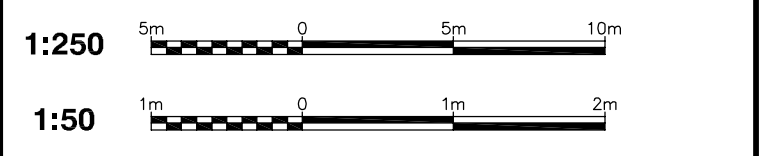
SEWER DATA				
No to No	Size	Type	Class	Length
EX - S2	200	PVC	SDR35	75.7
2 - 3	300	HDPE	CSA B182.6	8.5
2 - 4	600	HDPE	CSA B182.6	53.5
4 - 5	600	HDPE	CSA B182.6	4.0
4 - 6	300	HDPE	CSA B182.6	8.5



- Notes:**
- Existing pipe sizes and materials based on other consultants drawings or Town GIS information.
  - Proposed centreline road and lot corner elevations as per Triton Engineering Services Limited Proposed Lot Grading and General Drainage Drawings No. 01, Project No. A5450, Rev. 4, August 2015, except reduced by 0.13m due to apparent difference in comparison to BMROSS GPS benchmark elevations, unless otherwise indicated.
  - Regulatory Floodline Elev. 382.87 (see Note 2-Triton Drawing No. 1) - i.e. 382.74 based on Note 2.
  - Electrical and street light design to be completed by others.
  - All works to be constructed in accordance with the most current version of the Town of Minto municipal servicing Standard for residential development, OPSS, OPSP, or as otherwise noted on these drawings, whichever is more stringent. Design to be confirmed by Geotechnical Engineer prior to commencing with construction.
  - All fill or organic material that may be present within roadway areas shall be subexcavated and imported granular material placed and compacted to 100% S.P.D. Where fill is required to achieve required road subgrade elevation, approved imported granular fill shall be used, compacted to 100% S.P.D.
  - Prior to construction, legal survey of road allowances and severances to be completed.
  - Pre-engineering utility locate information not provided by Wightman. Prior to construction, Contractor to complete utility locate work and immediately report any conflicts to the Contract Administrator prior to commencing with any construction.
  - Waterlight sanitary manhole covers are required for all structures with top of cover elevations below the Regulatory Flood Line (See also Note 3).
  - A proposed emergency pedestrian access route and design are not shown - design by others.
  - Road design is preliminary only. A final design submission to the Town of Minto is yet required, for Town review and approval.
  - Development lot grading plan to be reviewed and adjusted to address as constructed rear and side yard elevations for #57 Lorne Street West, prior to finalizing John Street extension design.
  - Final roadway design, for Lorne Street and the Lorne/John Street intersection, to take into consideration the as constructed #225 John Street driveway grades.

**LEGEND**

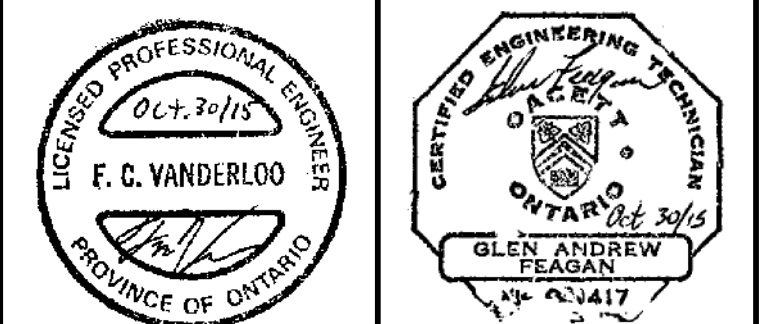
- SAN. or STM. EXISTING SEWERS, SANITARY or STORM
- M.H. CB. MANHOLE and CATCHBASIN
- W. FIRE HYDRANT
- GASMAIN
- UNDERGROUND TELEPHONE
- UNDERGROUND FIBRE
- TV. H-B. CABLE
- UTILITY POLES
- GRAVING
- REMOVE EXISTING CONC. SIDEWALK AND DRIVES
- REMOVE AND PLACE CONC. SIDEWALK AND DRIVES
- PLACE CONC. SIDEWALK AND DRIVES
- REMOVE EXISTING ASPHALT PAVT
- PLACE HOT MIX ASPHALT CORDED (DOWN H-3 HOT MIX MISC.)
- REMOVE EXISTING CONC. CURB
- PROPOSED ELEVATION (SEE NOTE 2)
- EXISTING ELEVATION
- PROPOSED ELEVATION



**NOTE**  
The locations of existing underground utilities are shown in an approximate way only and have not been independently verified by the owner or its representative. The contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for any damages which might be occasioned by the contractor's failure to exactly locate and preserve any and all underground utilities.

**BENCHMARK INFORMATION (See Note 2)**  
BM 1 Elev. 382.159  
IB at Southeast corner of Lorne Street and John Street

Design By: F.C.V Checked By: G.A.F.



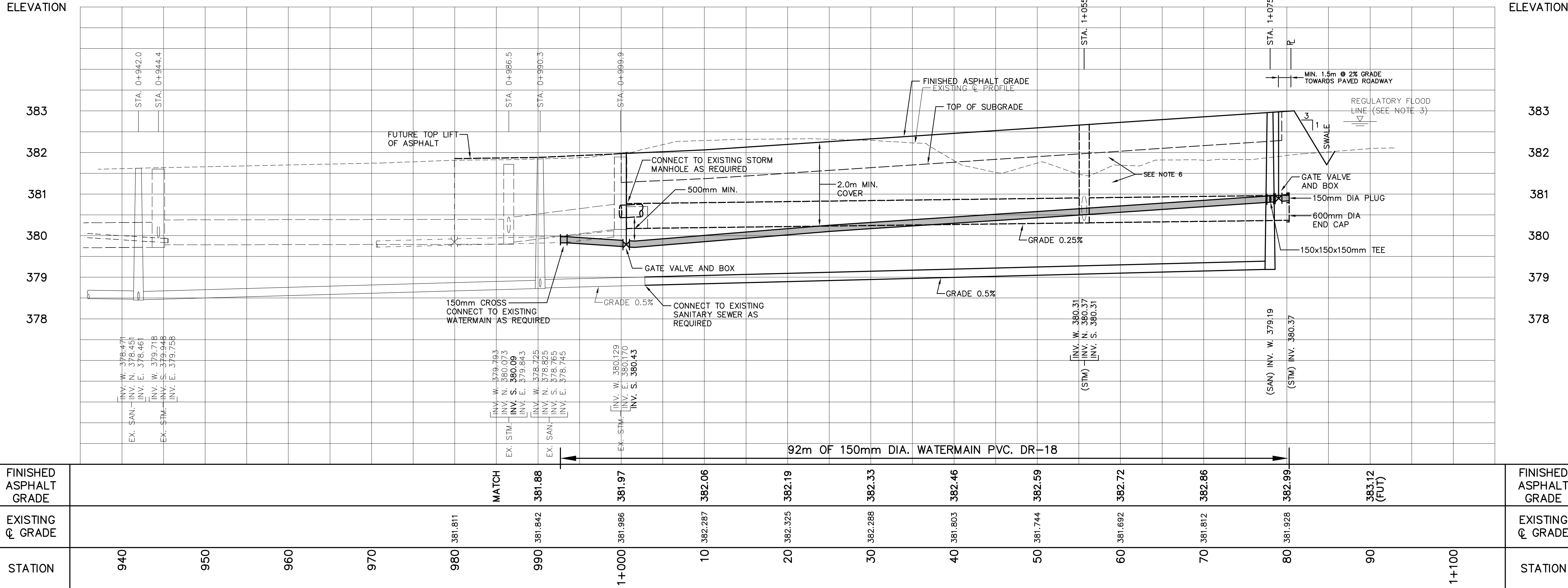
No.	DATE	REVISION
0.	Aug. 21, 2015	Preliminary design - issued to Client for review
1.	Sep. 25, 2015	Preliminary design - issued to Town of Minto for review
2.	Oct. 30, 2015	Issued to MOECC for sewer approvals



Goderich (519) 524-2641 Mount Forest (519) 323-2945

**Town of Minto (Harriston)**  
**Lorne Street West**  
Plan and Profile  
John Street to Webb Street

**Project No. 15159**  
**Drawing No. 1 of 2**



FINISHED ASPHALT GRADE	STATION	EXISTING Q GRADE	STATION	FINISHED ASPHALT GRADE	STATION
	940		940		940
	950		950		950
	960		960		960
	970		970		970
	980		980		980
	990		990		990
	1+000		1+000		1+000
	10		10		10
	20		20		20
	30		30		30
	40		40		40
	50		50		50
	60		60		60
	70		70		70
	80		80		80
	90		90		90
	1+100		1+100		1+100

**STORM SEWER FLOW DESIGN SHEET**  
**5 Year Design Storm**  
**Proposed Conditions**

STREET	LOCATION				AREAS (ha)							INDV. 2.78 AR	ACCUM. 2.78 AR	TIME OF CONC.	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)	Pipe	SEWER DATA					Total Time (min)	% Capacity	Comments		
	CATCHMENT	AREA TOTAL	FROM	TO	at R=0.15 (ha)	at R=0.25 (ha)	at R=0.40 (ha)	at R=0.45 (ha)	at R=0.50 (ha)	at R=0.60 (ha)	at R=0.90 (ha)							DIAMETER (mm)	SLOPE (%)	LENGTH (m)	CAPACIT Y	VELOCITY (m/s)				TIME (minutes)	
Street 'D'	A1	0.12	DCB14	CBMH20		0.09						0.03	0.138	0.138	10.00	106.72	14.67	Metric	300	0.22	5.53	45.36	0.64	0.14	10.14	32.4%	
Street 'D'	A2	0.01	CBMH20	CBMH19								0.01	0.025	0.163	10.14	105.66	17.17	Metric	300	3.03	38.76	168.33	2.38	0.27	10.41	10.2%	
Street 'D'	A3	0.23	DCB13	CBMH19		0.22						0.01	0.178	0.178	10.00	106.72	18.97	Metric	300	0.22	5.52	45.36	0.64	0.14	10.14	41.8%	
Street 'D'	A4	0.09	CBMH19	MH18								0.02	0.099	0.439	10.41	103.73	45.52	Metric	300	2.96	40.51	166.37	2.35	0.29	10.70	27.4%	
Webb Street	A5	0.16	CB12	MH18			0.13					0.03	0.219	0.219	10.00	106.72	23.42	Metric	300	4.66	15.14	208.75	2.95	0.09	10.09	11.2%	
Webb Street	A6	0.08	CB11	MH18						0.06		0.02	0.150	0.150	10.00	106.72	16.01	Metric	300	1.98	7.53	136.07	1.92	0.07	10.07	11.8%	
Webb Street			DCB18	CBMH17								0.009	0.898	10.70	101.77	82.27	Metric	375	0.86	9.42	162.59	1.47	0.19	10.61	50.6%		
Webb Street	A7	0.06	CBMH17	DIMH16	0.02							0.04	0.108	0.917	10.81	101.09	92.67	Metric	375	0.91	36.76	167.25	1.51	0.40	11.21	55.4%	
Street 'E'	A8	0.12	CB10	CBMH15							0.07	0.05	0.242	0.242	10.00	106.72	25.79	Metric	300	0.22	7.51	45.36	0.64	0.20	10.20	56.9%	
Future Development Webb	D1	0.39	DIMH16	CBMH15			0.18					0.21	0.550	1.467	11.21	98.53	144.51	Metric	450	0.50	36.46	201.60	1.27	0.48	11.69	71.7%	
Street 'E'	A9	0.05	CBMH15	CBMH14		0.02		0.79				0.03	1.076	2.785	11.69	95.69	266.46	Metric	525	0.50	27.20	304.10	1.40	0.32	12.01	87.6%	add in 0.79ha for future development of Webb
Street 'E'	A10	0.14	CB9	CBMH14						0.12		0.02	0.250	0.250	10.00	106.72	26.68	Metric	300	0.22	7.52	45.36	0.64	0.20	10.20	58.8%	
Street 'E'	A11	0.06	CBMH24	CBMH23							0.03	0.092	3.728	12.91	93.88	293.52	Metric	525	0.50	23.96	304.10	1.40	0.28	12.30	96.5%		
Street 'E'	A12	0.10	CB8	CBMH13							0.06	0.04	0.183	0.183	10.00	106.72	19.56	Metric	300	0.22	7.53	45.36	0.64	0.20	10.20	43.1%	
Street 'E'	A13	0.05	CBMH13	MH11							0.02	0.078	3.388	12.30	92.36	312.87	Metric	600	0.50	8.56	434.17	1.54	0.29	12.39	72.1%		
John Street	A14	0.15	DCB7	CBMH12							0.12	0.03	0.242	0.242	10.00	106.72	25.79	Metric	300	0.22	7.53	45.36	0.64	0.20	10.20	56.9%	
John Street	A15	0.23	CBMH12	MH11							0.20	0.03	0.353	0.594	10.20	105.28	62.58	Metric	450	0.15	74.85	110.42	0.69	1.80	11.99	56.7%	
John Street			MH11	CBMH10							0.05	0.000	3.982	12.39	91.88	365.84	Metric	600	0.42	33.85	397.93	1.41	0.40	12.79	91.9%		
John Street	A16	0.09	CBMH10	CBMH9							0.11	0.04	0.169	5.296	12.79	89.85	475.85	Metric	900	0.12	17.30	627.11	0.99	0.29	13.08	75.9%	
Street 'B'	A17	0.14	DCB6	CBMH9							0.11	0.03	0.228	0.228	10.00	106.72	24.31	Metric	300	2.00	7.53	136.76	1.93	0.06	10.06	17.8%	
Street 'B'	A18	0.02	CBMH9	CBMH8	0.01							0.01	0.029	5.553	13.08	84.44	491.11	Metric	900	0.12	61.26	627.11	0.99	1.04	11.21	78.3%	
Street 'C'	A19	0.02	CB22	CBMH30	0.01							0.01	0.029	0.029	10.00	106.72	3.11	Metric	300	0.22	7.53	45.36	0.64	0.20	10.20	6.9%	
Street 'C'	A20	0.02	CBMH30	CBMH29	0.01							0.01	0.029	0.058	10.20	105.28	6.14	Metric	300	0.22	91.40	45.36	0.64	2.37	12.57	13.5%	
Street 'C'	A21	0.39	DCB21	CBMH29			0.32					0.07	0.575	0.575	10.00	106.72	61.36	Metric	375	0.22	7.53	82.24	0.74	1.17	10.17	74.6%	
Street 'C'	A22	0.53	CBMH29	CBMH8			0.43					0.10	0.788	1.421	12.57	90.95	129.23	Metric	525	0.22	17.30	201.72	0.93	0.31	12.88	64.1%	
Street 'B'	A23	0.19	CBMH8	CBMH1			0.13					0.06	0.294	7.268	14.12	83.86	609.48	Metric	900	0.18	73.41	768.05	1.21	1.01	15.13	79.4%	
Street 'B'	A24	0.28	CBMH1	CBMH1			0.22					0.06	0.425	0.425	10.00	106.72	45.35	Metric	375	0.22	7.52	82.24	0.74	1.17	10.17	55.2%	
Street 'B'	A25	0.19	CBMH1	STRMCPTR1			0.10					0.09	0.336	10.985	16.69	74.53	193.66	Metric	900	0.30	5.26	991.55	1.56	0.06	16.76	82.6%	
Storm Pond	A26	0.36	STRMCPTR1	OUTLET 1		0.35					0.35	0.01	0.608	11.593	16.75	74.41	862.65	Metric	900	0.23	14.39	868.20	1.36	1.18	16.93	99.4%	Outlet to Pond
Street 'B'	A27	0.35	DCB5	CBMH6		0.29						0.06	0.472	0.472	10.00	106.72	50.39	Metric	375	8.00	8.21	495.91	4.49	0.03	10.03	10.2%	
Street 'B'	A28	0.18	CBMH6	CBMH5						0.16		0.02	0.317	0.789	10.03	106.49	84.01	Metric	450	0.13	71.18	102.80	0.65	1.84	11.87	81.7%	
Street 'B'	A29	0.28	DCB4	CBMH5		0.20						0.08	0.422	0.422	10.00	106.72	45.06	Metric	375	2.35	7.54	268.78	2.43	0.05	10.05	16.8%	
Rear Yards South East	E1	0.76	DI34	MH4	0.39		0.37					0.06	0.574	0.574	10.00	106.72	61.21	Metric	375	0.22	40.87	82.24	0.74	0.91	10.91	74.4%	
Street 'B'	A30	0.16	CBMH5	MH4			0.10					0.06	0.275	1.486	11.87	94.69	140.72	Metric	525	0.15	67.79	166.96	0.77	1.47	13.33	84.5%	
Street 'B'	A31	0.31	DCB2	MH3		0.21						0.10	0.483	0.483	10.00	106.72	51.58	Metric	375	3.43	9.24	324.72	2.94	0.05	10.05	15.9%	
Street 'B'	A32	0.28	DCB3	MH3			0.23					0.05	0.413	0.413	10.00	106.72	44.02	Metric	375	0.22	6.74	82.24	0.74	1.15	10.15	53.5%	
			MH3	MH2								0.000	2.956	14.54	82.15	242.81	Metric	750	0.12	99.12	385.65	0.87	1.89	16.43	63.0%		
			MH2	CBMH1								0.000	2.956	16.43	75.42	222.90	Metric	750	0.24	19.47	545.39	1.23	0.26	16.69	40.9%		
Anne Street	A33	0.04	CB17	CBMH23	0.02							0.02	0.058	0.058	10.00	106.72	6.23	Metric	300	0.22	7.53	45.36	0.64	0.20	10.20	13.7%	
Anne Street	A34	0.03	CBMH23	CBMH22	0.01							0.02	0.054	0.625	10.20	105.28	65.80	Metric	375	0.22	51.24	82.24	0.74	1.15	11.34	80.0%	
Anne Street	A35	0.18	DCB16	CBMH22						0.13		0.05	0.342	0.342	10.00	106.72	36.46	Metric	300	0.22	7.46	45.36	0.64	0.19	10.19	80.4%	
Anne Street	A36	0.05	CBMH22	MH21	0.02							0.03	0.083	1.050	11.34	97.72	102.61	Metric	450	0.22	8.99	133.73	0.84	0.18	11.52	76.7%	
John Street	A37	0.06	DCB15	MH21			0.04					0.02	0.094	0.094	10.00	106.72	10.08	Metric	300	0.22	7.53	45.36	0.64	0.20	10.20	22.2%	
			MH21	CBMH10								0.000	1.144	11.52	96.66	110.62	Metric	450	0.22	49.57	133.73	0.84	0.98	12.50	82.7%		
Anne Street	B1	0.06	DCB19	CBMH24	0.01							0.05	0.129	0.129	10.00	106.72	13.78	Metric	300	0.44	4.57	64.14	0.91	0.14	10.14	21.5%	
Anne Street	B2	0.02	CBMH24	CBMH25	0.01							0.01	0.029	0.158	10.14	105.69	16.73	Metric	300	3.86	68.05	189.99	2.69	0.42	10.56	8.8%	
Anne Street	B3	0.06	DCB18	CBMH25	0.03							0.03	0.088	0.088	10.00	106.72	9.34	Metric	300	2.00	7.55	136.76	1.93	0.07	10.07	6.8%	
Anne Street	B4	0.14	CBMH25	CBMH23						0.10		0.04	0.267	0.513	10.56	102.72	52.64	Metric	375	0.59	46.35	134.67	1.22	0.63	11.19	39.1%	
Webb Street	B5	0.01	CBMH26	CBMH28								0.01	0.025	0.054	10.20	105.28	5.70	Metric	375	0.22	52.53	82.24	0.74	1.18	11.38	6.9%	
Webb Street	B6	0.02	CB20	CBMH26	0.01							0.01	0.029	0.029	10.00	106.72	3.11	Metric	300	0.22	7.78	45.36	0.64	0.20	10.20	6.9%	
Webb Street	B7	0.38	CB23	CBMH28			0.35					0.03	0.658	0.658	10.00	106.72	70.25	Metric	375	4.77	12.98	382.93	3.47	0.06	10.06	18.3%	
Webb Street	B8	0.16	CBMH28	OUTLET 2		0.13						0.03	0.165	0.878	10.06	106.25	93.27	Metric	450	1.00	16.50	285.11	1.79	0.15	10.22	32.7%	Outlet to End of Lorne
Future Development Webb	D2	1.10	DI25	MH33.			0.43				0.67	1.594	1.594	14.00	84.35	134.49	Metric	200	0.80	25.14	29.34	0.93	0.45	14.45	458.5%	release rate 29.34L/s, small pond provides 100m3 of storage + 0.3m freeboard	
above adjusted for outflow			DI25	MH33								0.3															



**CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION  
BASED ON THE RATIONAL RAINFALL METHOD  
BASED ON A FINE PARTICLE SIZE DISTRIBUTION**



**Project Name:** Subdivision in Harriston Ontario

**Engineer:** Moorefieldex

**Location:** Harriston

**Contact:** Kim Pilon

**OGS #:**

**Report Date:** 13-Nov-19

**Area** 7.560 ha  
**Weighted C** 0.63  
**CDS Model** 3030-D

**Rainfall Station #** 195  
**Particle Size Distribution** Fine  
**CDS Treatment Capacity** 85 l/s

<u>Rainfall Intensity<sup>1</sup></u> <u>(mm/hr)</u>	<u>Percent Rainfall Volume<sup>1</sup></u>	<u>Cumulative Rainfall Volume</u>	<u>Total Flowrate (l/s)</u>	<u>Treated Flowrate (l/s)</u>	<u>Operating Rate (%)</u>	<u>Removal Efficiency (%)</u>	<u>Incremental Removal (%)</u>
1.0	10.3%	20.1%	13.2	13.2	15.5	94.4	9.7
1.5	9.7%	29.7%	19.8	19.8	23.3	92.2	8.9
2.0	8.9%	38.6%	26.4	26.4	31.0	90.0	8.0
2.5	7.7%	46.2%	32.9	32.9	38.8	87.7	6.7
3.0	6.5%	52.7%	39.5	39.5	46.5	85.5	5.5
3.5	4.2%	56.9%	46.1	46.1	54.3	83.3	3.5
4.0	4.7%	61.6%	52.7	52.7	62.0	81.1	3.8
4.5	3.9%	65.4%	59.3	59.3	69.8	78.9	3.0
5.0	3.4%	68.8%	65.9	65.9	77.6	76.6	2.6
6.0	4.7%	73.6%	79.1	79.1	93.1	72.2	3.4
7.0	4.6%	78.2%	92.2	85.0	100.0	64.7	3.0
8.0	3.5%	81.7%	105.4	85.0	100.0	56.6	2.0
9.0	2.3%	84.0%	118.6	85.0	100.0	50.3	1.2
10.0	2.6%	86.6%	131.8	85.0	100.0	45.3	1.2
15.0	6.7%	93.3%	197.7	85.0	100.0	30.2	2.0
20.0	2.7%	96.0%	263.6	85.0	100.0	22.6	0.6
25.0	1.7%	97.7%	329.4	85.0	100.0	18.1	0.3
30.0	1.3%	99.0%	395.3	85.0	100.0	15.1	0.2
35.0	0.6%	99.6%	461.2	85.0	100.0	12.9	0.1
40.0	0.3%	99.8%	527.1	85.0	100.0	11.3	0.0
45.0	0.0%	99.8%	593.0	85.0	100.0	10.1	0.0
50.0	0.2%	100.0%	658.9	85.0	100.0	9.1	0.0

75.2

Removal Efficiency Adjustment<sup>2</sup> = 6.5%

**Predicted Net Annual Load Removal Efficiency = 68.7%**

**Predicted Annual Rainfall Treated = 88.4%**

1 - Based on 44 years of hourly rainfall data from Canadian Station 6144475, London ON

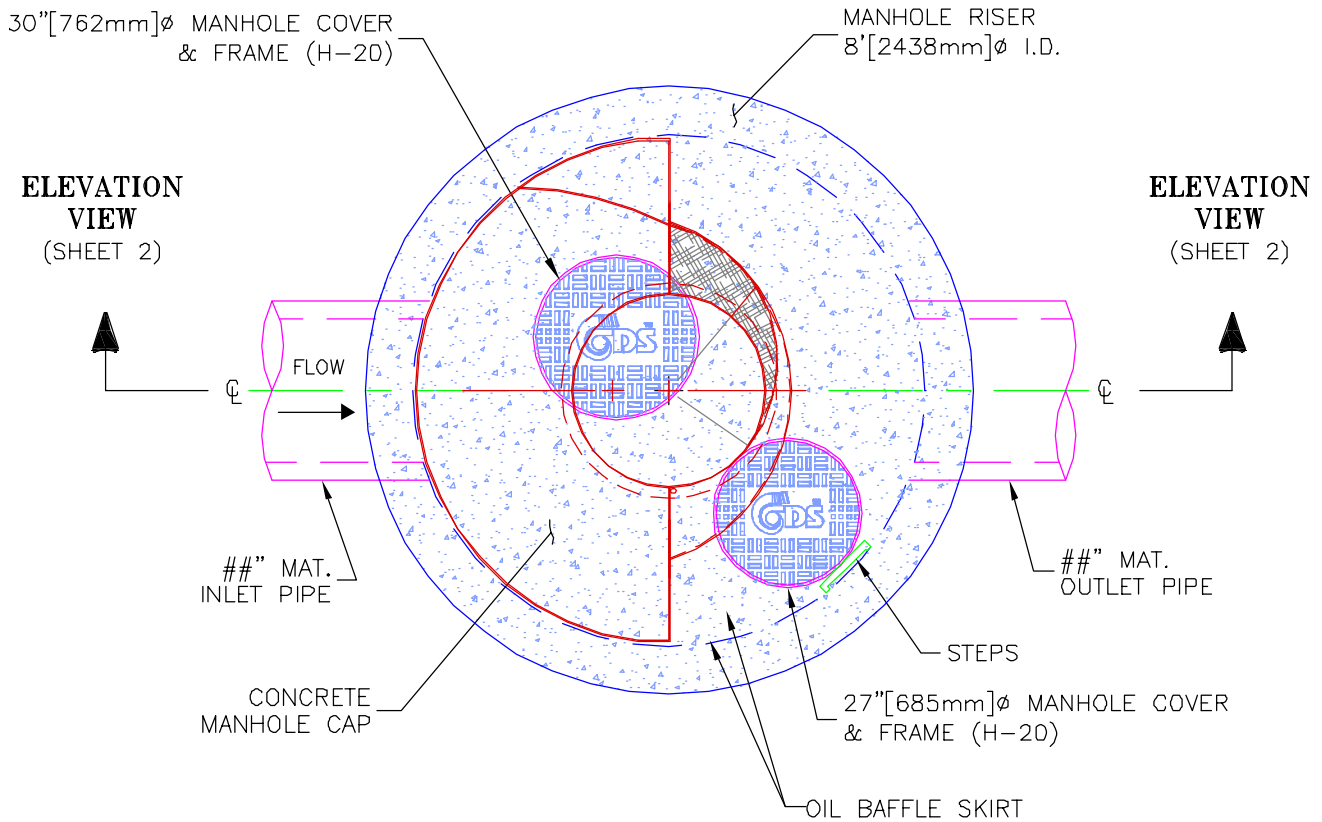
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

3 - CDS Efficiency based on testing conducted at the University of Central Florida

4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications



# PLAN VIEW



## CDS MODEL CDS3030-8m, 3 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT



PROJECT NAME  
CITY, STATE

JOB# XX-##-###

DATE ##/##/##

DRAWN INITIALS

APPROV.

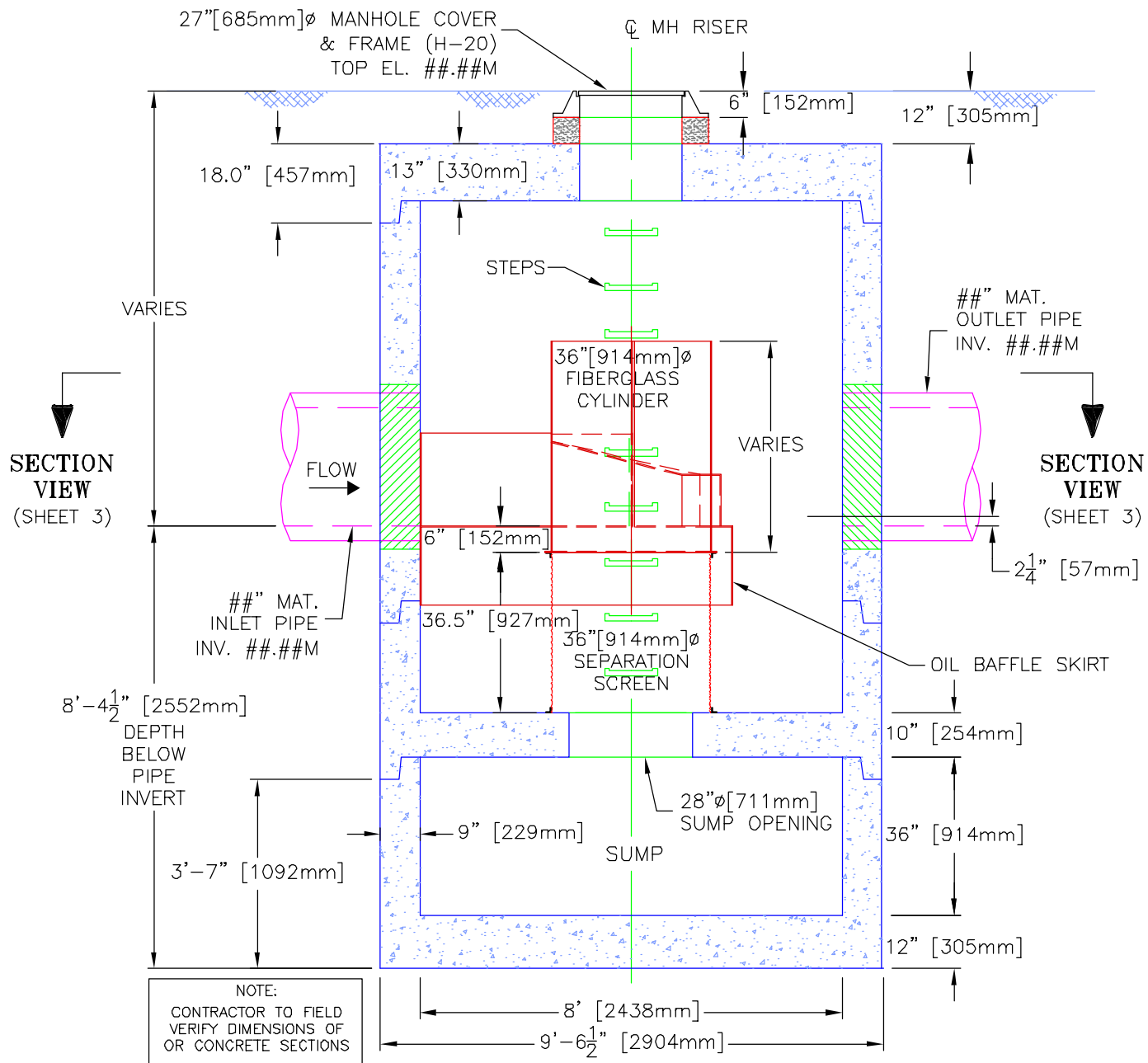
SCALE  
1" = 3'

SHEET

1



# ELEVATION VIEW



## CDS MODEL CDS3030-8, 3 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT



PROJECT NAME  
CITY, STATE

JOB# XX-##-###

DATE ##/##/##

DRAWN INITIALS

APPROV.

SCALE  
1" = 3'

SHEET

2

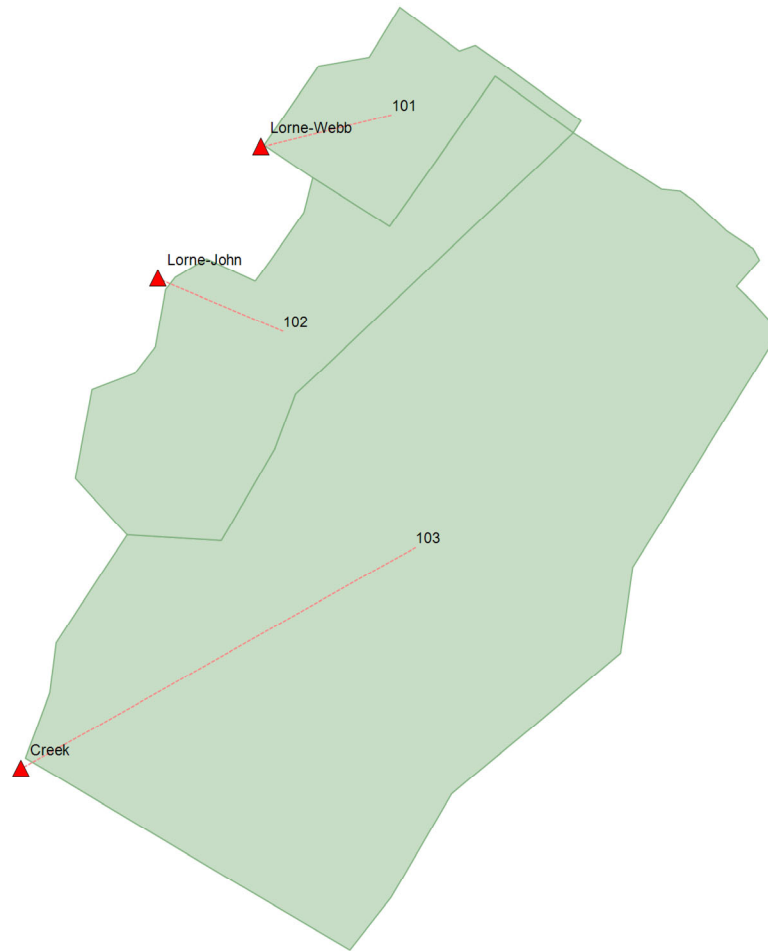
**APPENDIX C.3**  
**Stormwater Management – PCSWMM Outputs**

	Pre Development (L/s)				Interim Development (L/s)				Post Development (L/s)			
	Creek	Lorne/John	Lorne/Webb	TOTAL	Creek	Lorne/John	Lorne/Webb	TOTAL	Creek	Lorne/John	Lorne/Webb	TOTAL
<b>2 Year</b>	49.18	42.27	35.65	127.1	46.79	80.69	33.44	160.92	46.87	78.97	33.44	159.28
<b>5 Year</b>	88.25	68.79	40.87	197.91	53.8	103.72	36.81	194.33	53.89	99.77	36.81	190.47
<b>25 Year</b>	175.77	130.62	67.86	374.25	92.04	169.83	56.94	318.81	100.16	164.44	56.94	321.54
<b>50 Year</b>	228.64	165	84.14	477.78	118.9	203.47	66.74	389.11	186.19	197.48	66.74	450.41
<b>100 Year</b>	273.77	194.53	98.76	567.06	187.8	233.71	77.3	498.81	219.65	227.27	77.3	524.22

**Stage Storage Discharge**

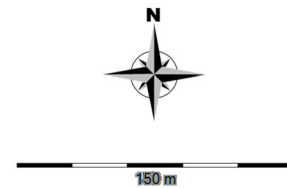
Storm Event	Inflow (l/s)	Outflow (l/s)	Storage (m <sup>3</sup> )	Water level (m)
<b>2 Year</b>	1,364.90	6.08	1,914	382.58
<b>5 Year</b>	1,478.20	6.76	2,604	382.85
<b>25 Year</b>	2,017.60	84.39	3,487	383.17
<b>50 Year</b>	2,249.20	148.68	3,629	383.22
<b>100 Year</b>	2,495.00	155.19	3,889	383.30

# MEX Developments - Harriston Subdivision - Pre Development Model Schematic



**Legend**

- ▲ Outfalls
- Subcatchments



## MEX Developments – Harriston Subdivision – Pre Development Model Details

### [TITLE]

### [OPTIONS]

```

;;Options      Value
;;-----
FLOW_UNITS      LPS
INFILTRATION    CURVE_NUMBER
FLOW_ROUTING    DYNWAVE
START_DATE      12/17/2019
START_TIME      00:00
REPORT_START_DATE 12/17/2019
REPORT_START_TIME 00:00
END_DATE        12/18/2019
END_TIME        00:00
SWEEP_START     1/1
SWEEP_END       12/31
DRY_DAYS        0
REPORT_STEP     00:01:00
WET_STEP        00:05:00
DRY_STEP        00:05:00
ROUTING_STEP    5
ALLOW_PONDING  NO
INERTIAL_DAMPING PARTIAL
VARIABLE_STEP   0.75
LENGTHENING_STEP 0
MIN_SURFAREA    0
NORMAL_FLOW_LIMITED BOTH
SKIP_STEADY_STATE NO
FORCE_MAIN_EQUATION H-W
LINK_OFFSETS    ELEVATION
MIN_SLOPE       0
MAX_TRIALS      8
HEAD_TOLERANCE  0
SYS_FLOW_TOL    5
LAT_FLOW_TOL    5
MINIMUM_STEP    0.5
THREADS         2

```

### [EVAPORATION]

```

;;Type      Parameters
;;-----
CONSTANT    0.0
DRY_ONLY    NO

```

### [RAINGAGES]

```

;;      Rain      Time      Snow      Data
;;Name  Type      Intrvl  Catch   Source
;;-----
Chicago_3hr_100yr INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_100yr
Chicago_3hr_25yr  INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_25yr
Chicago_3hr_2yr   INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_2yr
Chicago_3hr_50yr  INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_50yr
Chicago_3hr_5yr   INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_5yr

```

### [SUBCATCHMENTS]

```

;;      Total      Pcnt.      Pcnt.      Curb      Snow
;;Name  Raingage      Outlet     Area      Imperv    Width    Slope    Length    Pack
;;-----
101     Chicago_3hr_2yr  Lorne-Webb  0.8132   8.1      81      6      0
102     Chicago_3hr_2yr  Lorne-John  2.1616   4.6      200     2      0
103     Chicago_3hr_2yr  Creek      8.7762   2.1      210     1      0

```

### [SUBAREAS]

```

;;Subcatchment  N-Imperv  N-Perv    S-Imperv  S-Perv    PctZero  RouteTo  PctRouted
;;-----
101             0.01     0.15     0.05     0.05     25      PERVIOUS  2
102             0.01     0.13     0.05     0.05     25      PERVIOUS  50
103             0.01     0.13     0.05     0.05     25      PERVIOUS  53

```

### [INFILTRATION]

```

;;Subcatchment  CurveNum  HydCon    DryTime
;;-----
101             77.8     0.5      7

```

## MEX Developments – Harriston Subdivision – Pre Development Model Details

102	77.9	0.5	7
103	78	0.5	7

### [OUTFALLS]

;;Name	Invert Elev.	Outfall Type	Stage/Table Time Series	Tide Gate Route To
Creek	0	FREE		NO
Lorne-John	0	FREE		NO
Lorne-Webb	0	FREE		NO

### [TIMESERIES]

;;Name	Date	Time	Value
;Chicago design storm, a = 1720.73, b = 10.674, c = 0.822, Duration = 180 minutes, r = 0.4, rain units = mm/hr. Chicago_3hr_100yr			
;Chicago design storm, a = 1387.38, b = 9.697, c = 0.82, Duration = 180 minutes, r = 0.4, rain units = mm/hr. Chicago_3hr_25yr			
;Chicago design storm, a = 410.152, b = 0.085, c = 0.703, Duration = 180 minutes, r = 0.4, rain units = mm/hr. Chicago_3hr_2yr			
;Chicago design storm, a = 1644.39, b = 11.085, c = 0.829, Duration = 180 minutes, r = 0.4, rain units = mm/hr. Chicago_3hr_50yr			
;Chicago design storm, a = 955.42, b = 7.82, c = 0.807, Duration = 180 minutes, r = 0.4, rain units = mm/hr. Chicago_3hr_5yr			

### [REPORT]

INPUT YES  
 CONTROLS NO  
 SUBCATCHMENTS ALL  
 NODES ALL  
 LINKS ALL

### [TAGS]

### [MAP]

DIMENSIONS	510843.574223953	4861156.00099864	511296.84786833	4861719.60010775
UNITS	Meters			

# MEX Developments – Harriston Subdivision – Pre Development – 2yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
 Element Count  
 \*\*\*\*\*

Number of rain gages ..... 5  
 Number of subcatchments ... 3  
 Number of nodes ..... 3  
 Number of links ..... 0  
 Number of pollutants ..... 0  
 Number of land uses ..... 0

\*\*\*\*\*  
 Raingage Summary  
 \*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
 Subcatchment Summary  
 \*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.81	81.00	8.10	6.0000	Chicago_3hr_2yr	Lorne-Webb
102	2.16	200.00	4.60	2.0000	Chicago_3hr_2yr	Lorne-John
103	8.78	210.00	2.10	1.0000	Chicago_3hr_2yr	Creek

\*\*\*\*\*  
 Node Summary  
 \*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Creek	OUTFALL	0.00	0.00	0.0	
Lorne-John	OUTFALL	0.00	0.00	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*

Flow Units ..... LPS  
 Process Models:  
 Rainfall/Runoff ..... YES  
 RDII ..... NO  
 Snowmelt ..... NO  
 Groundwater ..... NO  
 Flow Routing ..... NO  
 Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00

# MEX Developments – Harriston Subdivision – Pre Development – 2yr Design Storm

Dry Time Step ..... 00:05:00

```

*****
Volume      Depth
Runoff Quantity Continuity  hectare-m      mm
*****
Total Precipitation .....      0.375      31.950
Evaporation Loss .....      0.000      0.000
Infiltration Loss .....      0.290      24.688
Surface Runoff .....      0.081      6.875
Final Storage .....      0.005      0.390
Continuity Error (%) .....      -0.010
    
```

```

*****
Volume      Volume
Flow Routing Continuity  hectare-m      10^6 ltr
*****
Dry Weather Inflow .....      0.000      0.000
Wet Weather Inflow .....      0.081      0.808
Groundwater Inflow .....      0.000      0.000
RDII Inflow .....      0.000      0.000
External Inflow .....      0.000      0.000
External Outflow .....      0.081      0.808
Flooding Loss .....      0.000      0.000
Evaporation Loss .....      0.000      0.000
Exfiltration Loss .....      0.000      0.000
Initial Stored Volume ...      0.000      0.000
Final Stored Volume .....      0.000      0.000
Continuity Error (%) .....      0.000
    
```

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101	31.95	0.00	0.00	20.81	11.07	0.09	35.65	0.347
102	31.95	0.00	0.00	22.13	9.72	0.21	42.27	0.304
103	31.95	0.00	0.00	25.68	5.79	0.51	49.18	0.181

Analysis begun on: Wed Dec 18 08:43:20 2019  
Analysis ended on: Wed Dec 18 08:43:20 2019  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Pre Development – 5yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
 Number of subcatchments ... 3  
 Number of nodes ..... 3  
 Number of links ..... 0  
 Number of pollutants ..... 0  
 Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.81	81.00	8.10	6.0000	Chicago_3hr_5yr	Lorne-Webb
102	2.16	200.00	4.60	2.0000	Chicago_3hr_5yr	Lorne-John
103	8.78	210.00	2.10	1.0000	Chicago_3hr_5yr	Creek

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Creek	OUTFALL	0.00	0.00	0.0	
Lorne-John	OUTFALL	0.00	0.00	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	

\*\*\*\*\*  
NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
\*\*\*\*\*

\*\*\*\*\*  
Analysis Options  
\*\*\*\*\*

Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00

# MEX Developments – Harriston Subdivision – Pre Development – 5yr Design Storm

Dry Time Step ..... 00:05:00

```

*****
                Volume          Depth
Runoff Quantity Continuity  hectare-m          mm
*****
Total Precipitation .....      0.493          41.919
Evaporation Loss .....          0.000           0.000
Infiltration Loss .....          0.347          29.489
Surface Runoff .....            0.141          12.026
Final Storage .....             0.005           0.405
Continuity Error (%) .....      -0.005
    
```

```

*****
                Volume          Volume
Flow Routing Continuity    hectare-m          10^6 ltr
*****
Dry Weather Inflow .....          0.000           0.000
Wet Weather Inflow .....          0.141           1.413
Groundwater Inflow .....          0.000           0.000
RDII Inflow .....               0.000           0.000
External Inflow .....            0.000           0.000
External Outflow .....           0.141           1.413
Flooding Loss .....              0.000           0.000
Evaporation Loss .....           0.000           0.000
Exfiltration Loss .....           0.000           0.000
Initial Stored Volume ....        0.000           0.000
Final Stored Volume .....         0.000           0.000
Continuity Error (%) .....         0.000
    
```

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101	41.92	0.00	0.00	24.90	16.94	0.14	40.87	0.404
102	41.92	0.00	0.00	26.37	15.43	0.33	68.79	0.368
103	41.92	0.00	0.00	30.68	10.73	0.94	88.25	0.256

Analysis begun on: Fri Jan 24 10:26:48 2020  
Analysis ended on: Fri Jan 24 10:26:48 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Pre Development – 25yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 3  
Number of nodes ..... 3  
Number of links ..... 0  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.81	81.00	8.10	6.0000	Chicago_3hr_25yr	Lorne-Webb
102	2.16	200.00	4.60	2.0000	Chicago_3hr_25yr	Lorne-John
103	8.78	210.00	2.10	1.0000	Chicago_3hr_25yr	Creek

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Creek	OUTFALL	0.00	0.00	0.0	
Lorne-John	OUTFALL	0.00	0.00	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	

\*\*\*\*\*  
NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
\*\*\*\*\*

\*\*\*\*\*  
Analysis Options  
\*\*\*\*\*

Flow Units ..... LPS  
Process Models:  
  Rainfall/Runoff ..... YES  
  RDII ..... NO  
  Snowmelt ..... NO  
  Groundwater ..... NO  
  Flow Routing ..... NO  
  Water Quality ..... NO  
Infiltration Method ..... CURVE\_NUMBER  
Starting Date ..... 12/17/2019 00:00:00  
Ending Date ..... 12/18/2019 00:00:00  
Antecedent Dry Days ..... 0.0  
Report Time Step ..... 00:01:00  
Wet Time Step ..... 00:05:00

# MEX Developments – Harriston Subdivision – Pre Development – 25yr Design Storm

Dry Time Step ..... 00:05:00

```

*****
Runoff Quantity Continuity      Volume      Depth
                               hectare-m   mm
*****
Total Precipitation .....      0.663      56.404
Evaporation Loss .....          0.000          0.000
Infiltration Loss .....         0.414      35.246
Surface Runoff .....            0.244      20.744
Final Storage .....             0.005          0.416
Continuity Error (%) .....     -0.005
    
```

```

*****
Flow Routing Continuity      Volume      Volume
                               hectare-m   10^6 ltr
*****
Dry Weather Inflow .....          0.000          0.000
Wet Weather Inflow .....         0.244          2.438
Groundwater Inflow .....         0.000          0.000
RDII Inflow .....              0.000          0.000
External Inflow .....           0.000          0.000
External Outflow .....          0.244          2.438
Flooding Loss .....            0.000          0.000
Evaporation Loss .....          0.000          0.000
Exfiltration Loss .....         0.000          0.000
Initial Stored Volume ....       0.000          0.000
Final Stored Volume .....        0.000          0.000
Continuity Error (%) .....        0.000
    
```

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101	56.40	0.00	0.00	29.81	26.52	0.22	67.86	0.470
102	56.40	0.00	0.00	31.49	24.81	0.54	130.62	0.440
103	56.40	0.00	0.00	36.68	19.21	1.69	175.77	0.341

Analysis begun on: Fri Jan 24 10:29:08 2020  
Analysis ended on: Fri Jan 24 10:29:08 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Pre Development – 50yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
 Number of subcatchments ... 3  
 Number of nodes ..... 3  
 Number of links ..... 0  
 Number of pollutants ..... 0  
 Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.81	81.00	8.10	6.0000	Chicago_3hr_50yr	Lorne-Webb
102	2.16	200.00	4.60	2.0000	Chicago_3hr_50yr	Lorne-John
103	8.78	210.00	2.10	1.0000	Chicago_3hr_50yr	Creek

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Creek	OUTFALL	0.00	0.00	0.0	
Lorne-John	OUTFALL	0.00	0.00	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	

\*\*\*\*\*  
NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
\*\*\*\*\*

\*\*\*\*\*  
Analysis Options  
\*\*\*\*\*

Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00

# MEX Developments – Harriston Subdivision – Pre Development – 50yr Design Storm

Dry Time Step ..... 00:05:00

```

*****
Runoff Quantity Continuity      Volume      Depth
                               hectare-m    mm
*****
Total Precipitation .....      0.745      63.386
Evaporation Loss .....          0.000        0.000
Infiltration Loss .....         0.441      37.516
Surface Runoff .....            0.299      25.454
Final Storage .....            0.005        0.418
Continuity Error (%) .....     -0.005
    
```

```

*****
Flow Routing Continuity      Volume      Volume
                               hectare-m    10^6 ltr
*****
Dry Weather Inflow .....          0.000        0.000
Wet Weather Inflow .....         0.299        2.991
Groundwater Inflow .....         0.000        0.000
RDII Inflow .....              0.000        0.000
External Inflow .....           0.000        0.000
External Outflow .....          0.299        2.991
Flooding Loss .....            0.000        0.000
Evaporation Loss .....          0.000        0.000
Exfiltration Loss .....         0.000        0.000
Initial Stored Volume .....      0.000        0.000
Final Stored Volume .....        0.000        0.000
Continuity Error (%) .....       0.000
    
```

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101	63.39	0.00	0.00	31.80	31.52	0.26	84.14	0.497
102	63.39	0.00	0.00	33.56	29.72	0.64	165.00	0.469
103	63.39	0.00	0.00	39.02	23.84	2.09	228.64	0.376

Analysis begun on: Fri Jan 24 10:32:08 2020  
Analysis ended on: Fri Jan 24 10:32:08 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Pre Development – 100yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
 Number of subcatchments ... 3  
 Number of nodes ..... 3  
 Number of links ..... 0  
 Number of pollutants ..... 0  
 Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	0.81	81.00	8.10	6.0000	Chicago_3hr_100yr	Lorne-Webb
102	2.16	200.00	4.60	2.0000	Chicago_3hr_100yr	Lorne-John
103	8.78	210.00	2.10	1.0000	Chicago_3hr_100yr	Creek

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Creek	OUTFALL	0.00	0.00	0.0	
Lorne-John	OUTFALL	0.00	0.00	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	

\*\*\*\*\*  
NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
\*\*\*\*\*

\*\*\*\*\*  
Analysis Options  
\*\*\*\*\*

Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00

# MEX Developments – Harriston Subdivision – Pre Development – 100yr Design Storm

Dry Time Step ..... 00:05:00

```

*****
Runoff Quantity Continuity      Volume      Depth
*****                          hectare-m    mm
*****                          -----
Total Precipitation .....      0.810      68.934
Evaporation Loss .....          0.000      0.000
Infiltration Loss .....         0.461      39.211
Surface Runoff .....            0.344      29.308
Final Storage .....             0.005      0.419
Continuity Error (%) .....      -0.005
    
```

```

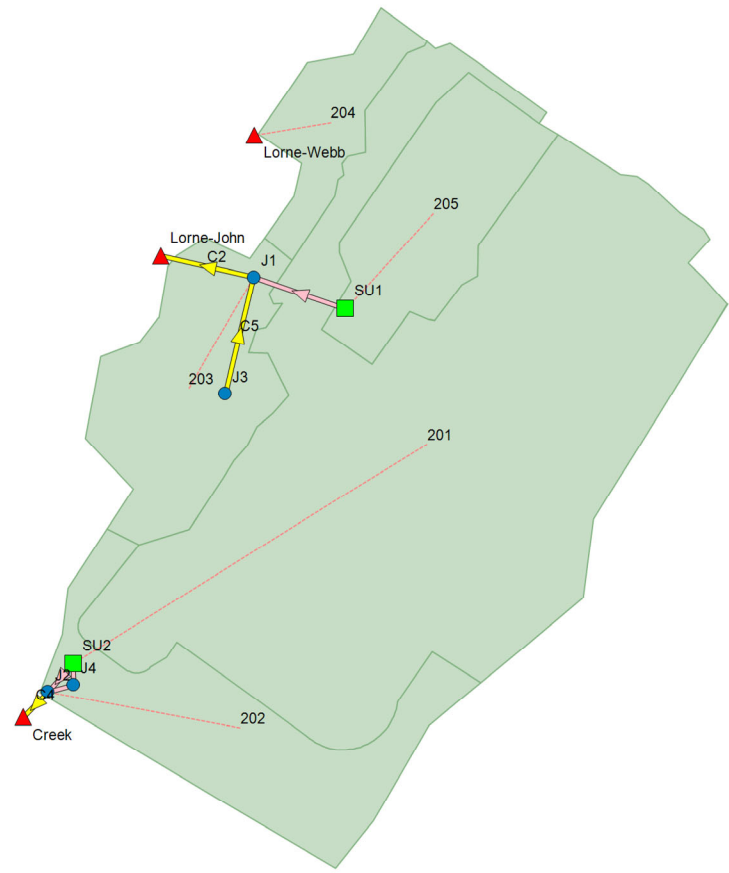
*****
Flow Routing Continuity      Volume      Volume
*****                          hectare-m    10^6 ltr
*****                          -----
Dry Weather Inflow .....          0.000      0.000
Wet Weather Inflow .....         0.344      3.444
Groundwater Inflow .....         0.000      0.000
RDII Inflow .....               0.000      0.000
External Inflow .....            0.000      0.000
External Outflow .....           0.344      3.444
Flooding Loss .....              0.000      0.000
Evaporation Loss .....           0.000      0.000
Exfiltration Loss .....          0.000      0.000
Initial Stored Volume .....       0.000      0.000
Final Stored Volume .....         0.000      0.000
Continuity Error (%) .....        0.000
    
```

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101	68.93	0.00	0.00	33.25	35.61	0.29	98.76	0.517
102	68.93	0.00	0.00	35.08	33.75	0.73	194.53	0.490
103	68.93	0.00	0.00	40.78	27.63	2.42	273.77	0.401

Analysis begun on: Fri Jan 24 11:15:10 2020  
Analysis ended on: Fri Jan 24 11:15:10 2020  
Total elapsed time: < 1 sec

# MEX Developments - Harriston Subdivision - Interim Model Schematic



### Legend

- Junctions
- ▲ Outfalls
- Storages
- Conduits
- Orifices
- Subcatchments

A north arrow is located below the legend, pointing upwards. Below the north arrow is a scale bar labeled "150 m".

## MEX Developments – Harriston Subdivision – Interim Development – Model Details

### [TITLE]

### [OPTIONS]

```

;;Options      Value
;;-----
FLOW_UNITS    LPS
INFILTRATION  CURVE_NUMBER
FLOW_ROUTING  DYNWAVE
START_DATE    12/17/2019
START_TIME    00:00
REPORT_START_DATE 12/17/2019
REPORT_START_TIME 00:00
END_DATE      12/18/2019
END_TIME      00:00
SWEEP_START   1/1
SWEEP_END     12/31
DRY_DAYS      0
REPORT_STEP   00:01:00
WET_STEP      00:05:00
DRY_STEP      00:05:00
ROUTING_STEP  5
ALLOW_PONDING NO
INERTIAL_DAMPING PARTIAL
VARIABLE_STEP 0.75
LENGTHENING_STEP 0
MIN_SURFAREA  0
NORMAL_FLOW_LIMITED BOTH
SKIP_STEADY_STATE NO
FORCE_MAIN_EQUATION H-W
LINK_OFFSETS  ELEVATION
MIN_SLOPE     0
MAX_TRIALS    8
HEAD_TOLERANCE 0
SYS_FLOW_TOL  5
LAT_FLOW_TOL  5
MINIMUM_STEP  0.5
THREADS       2

```

### [EVAPORATION]

```

;;Type      Parameters
;;-----
CONSTANT    0.0
DRY_ONLY    NO

```

### [RAINGAGES]

```

;;          Rain      Time      Snow      Data
;;Name      Type      Intrvl  Catch    Source
;;-----
Chicago_3hr_100yr INTENSITY 0:05  1.0  TIMESERIES Chicago_3hr_100yr
Chicago_3hr_25yr  INTENSITY 0:05  1.0  TIMESERIES Chicago_3hr_25yr
Chicago_3hr_2yr   INTENSITY 0:05  1.0  TIMESERIES Chicago_3hr_2yr
Chicago_3hr_50yr  INTENSITY 0:05  1.0  TIMESERIES Chicago_3hr_50yr
Chicago_3hr_5yr   INTENSITY 0:05  1.0  TIMESERIES Chicago_3hr_5yr

```

### [SUBCATCHMENTS]

```

;;          Total      Pcnt.      Pcnt.      Curb      Snow
;;Name      Raingage      Outlet      Area      Imperv      Width      Slope      Length      Pack
;;-----
201         Chicago_3hr_100yr SU2          7.57      63.5      2600      3          0
202         Chicago_3hr_100yr J2          1.34       6         250       2.5        0
203         Chicago_3hr_100yr J1          1.5        25        200       6          0
204         Chicago_3hr_100yr Lorne-Webb 0.43      15.4      120       7          0
205         Chicago_3hr_100yr SU1          0.94       5.3       70        7          0

```

### [SUBAREAS]

```

;;Subcatchment N-Imperv N-Perov S-Imperv S-Perov PctZero RouteTo PctRouted
;;-----
201             0.01     0.25     0.05     0.05     25     PERVIOUS  43
202             0.01     0.25     0.05     0.05     25     OUTLET    0
203             0.01     0.25     0.05     0.05     25     PERVIOUS  60
204             0.01     0.25     0.05     0.05     25     PERVIOUS  2
205             0.01     0.25     0.05     0.05     25     PERVIOUS  60

```

## MEX Developments – Harriston Subdivision – Interim Development – Model Details

**[INFILTRATION]**

;;Subcatchment	CurveNum	HydCon	DryTime
201	77	0.5	7
202	77	0.5	7
203	77	0.5	7
204	77	0.5	7
205	77	0.5	7

**[JUNCTIONS]**

;;Name	Invert Elev.	Max. Depth	Init. Depth	Surcharge Depth	Ponded Area
J1	379.95	1.87	0	0	0
J2	381.22	0.78	0	0	0
J3	380.55	0.65	0	0	0
J4	381.5	2.15	0	0	0

**[OUTFALLS]**

;;Name	Invert Elev.	Outfall Type	Stage/Table Time Series	Tide Gate Route To
Creek	381	FREE		NO
Lorne-John	379.67	FREE		NO
Lorne-Webb	0	FREE		NO

**[STORAGE]**

;;Name	Invert Elev.	Max. Depth	Init. Depth	Storage Curve	Curve Params	Ponded Area	Evap. Frac.
SU1	380.6	1.3	0	TABULAR	Int-Pond	0	0
SU2	381.4	2.31	0	TABULAR	Main-Pond	0	0

**[CONDUITS]**

;;Name	Inlet Node	Outlet Node	Length	Manning N	Inlet Offset	Outlet Offset	Init. Flow	Max. Flow
C2	J1	Lorne-John	56.83	0.013	379.95	379.75	0	0
C4	J2	Creek	20.83	0.013	381.22	381	0	0
C5	J3	J1	40	0.013	380.55	380.31	0	0

**[ORIFICES]**

;;Name	Inlet Node	Outlet Node	Orifice Type	Crest Height	Disch. Coeff.	Flap Gate	Open/Close Time
C1	SU1	J1	SIDE	380.6	0.65	NO	0
C3	SU2	J2	SIDE	381.4	0.65	NO	0
C6	J4	J2	SIDE	381.5	0.65	NO	0
OR1	SU2	J4	BOTTOM	383.1	0.65	NO	0

**[XSECTIONS]**

;;Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrels
C2	CIRCULAR	0.9	0	0	0	1
C4	TRIANGULAR	0.5	20	0	0	1
C5	CIRCULAR	0.3	0	0	0	1
C1	CIRCULAR	0.075	0	0	0	
C3	CIRCULAR	0.05	0	0	0	
C6	CIRCULAR	0.225	0	0	0	
OR1	RECT_CLOSED	0.6	0.6	0	0	

**[LOSSES]**

;;Link	Inlet	Outlet	Average	Flap Gate	SeepageRate
--------	-------	--------	---------	-----------	-------------

**[CURVES]**

;;Name	Type	X-Value	Y-Value
Int-Pond	Storage	0	57
Int-Pond		0.9	360

## MEX Developments – Harriston Subdivision – Interim Development – Model Details

Main-Pond	Storage	0	0
Main-Pond		.5	1830
Main-Pond		2.31	3430

### [TIMESERIES]

```
;;Name      Date      Time      Value
;;-----
```

```
;Chicago design storm, a = 1720.73, b = 10.674, c = 0.822, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_100yr
```

```
;Chicago design storm, a = 1387.38, b = 9.697, c = 0.82, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_25yr
```

```
;Chicago design storm, a = 410.152, b = 0.085, c = 0.703, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_2yr
```

```
;Chicago design storm, a = 1644.39, b = 11.085, c = 0.829, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_50yr
```

```
;Chicago design storm, a = 955.42, b = 7.82, c = 0.807, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_5yr
```

### [REPORT]

```
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL
```

### [TAGS]

### [MAP]

```
DIMENSIONS 510835.647075695 4861156.00099864 511297.147915939 4861719.60010775
UNITS      Meters
```

**Table B.1 Parameter Summary Table**

<b>Proposed Conditions</b>										
<b>Outlet Location</b>	<b>Model Catchment ID</b>	<b>Description</b>	<b>Area (ha)</b>	<b>Drainage Channel (m)</b>	<b>Flow Length (m)</b>	<b>Gradient (%)</b>	<b>Total Imperv. (%)</b>	<b>Not Connected Imperv. (%)</b>	<b>Manning's 'n' (Perv.)</b>	<b>CN (Perv.)</b>
	201	Majority of Development	7.57	2600	29	3.0	63.5	43%	0.25	77.0
	202	South and Eastern portion of Development	1.34	250	54	2.5	6.0	100%	0.25	77.0
	203	Western Portion of Development	1.50	200	75	6.0	25.0	60%	0.25	77.0
	204	Northwest portion of Development	0.43	120	36	7.0	15.4	2%	0.25	77.0
	205	External Area to North of Development	0.94	70	134	7.0	5.3	60%	0.25	77.0

**Table B.2 Site Soils: (as per Ontario Soil Survey Report No. 35 for Wellington County)**

**Soil Type**  
Harriston Loam and Listowel Loam

**Hydrologic Soil Group**  
BC

TABLE OF CURVE NUMBERS (CN's)									
Land Use	Hydrologic Soil Type							Manning's 'n'	
	A	AB	B	BC	C	CD	D		
Meadow	50	54	58	64.5	71	74.5	78	0.4	continuous grass
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.4	forests
Long Grass	55	60	65	72	79	81.5	84	0.3	natural, not maintained
Lawns	60	65.5	71	77	83	86	89	0.25	maintained
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17	farm pasture
Crop	66	70	74	78	82	84	86	0.13	farm land
Fallow (bare)	77	82	86	89	91	93	94	0.05	idle farm land (bare)
Built-up	60	65.5	71	77	83	89	89	0.25	Lawns Existing
Streets, paved	98	98	98	98	98	98	98	0.01	

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
201	0	0	0	100	0	0	0	100
202	0	0	0	100	0	0	0	100
203	0	0	0	100	0	0	0	100
204	0	0	0	100	0	0	0	100
205	0	0	0	100	0	0	0	100

LAND USE (%) - Proposed Conditions										
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Imperv. Not Connected (Rooftops)	Imperv. Connected	Total
201	0	0	0	37	0	0.0	0	27.0	36.5	100
202	0	0	0.0	94	0	0	0	6.0	0.0	100
203	0	0	0.0	75	0	0	0	15.0	10.0	100
204	0	0	0.0	85	0	0	0	0.2	15.2	100
205	0	0	0	95	0	0.0	0	3.2	2.1	100

CURVE NUMBER (CN) - Proposed Conditions											
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Built-up	Imperv. Not Connected (Rooftops)	Weighted CN - Pervious	Manning's 'n'
201	65	67	72	77	70.5	78	89	77	90	77.0	0.25
202	65	67.0	72	77	71	78	89	77	90	77.0	0.25
203	65	67	72	77	70.5	78	89	77	90	77.0	0.25
204	65	67	72	77	70.5	78	89	77	90	77.0	0.25
205	65	67	72	77	70.5	78	89	77	90	77.0	0.25

**Table B.3: Impervious Area Determination for Subcatchment 201-205**

**Existing Conditions**

<b>Area of Concern</b>	<b>Total Area (ha)</b>	<b>Impervious Area Connected</b>		<b>Impervious Area Not Connected (Rooftops)</b>		<b>Total (%)</b>
		<b>(ha)</b>	<b>(%)</b>	<b>(ha)</b>	<b>(%)</b>	
201	7.57	2.76	36.5	2.05	27.0	63.5
202	1.34	0.00	0.0	0.08	6.0	6.0
203	1.50	0.15	10.0	0.23	15.0	25.0
204	0.43	0.07	15.2	0.00	0.2	15.4
205	0.94	0.02	2.1	0.03	3.2	5.3

**Table B.3 - Impervious Area Determination for Existing Catchments 201-205**

Catchment					Imperv. Area	Imperv %
201	1330	m of	20	m wide ROW @ 55% imperv.	1.46 ha	19.3 %
		Impervious Area	100	m <sup>2</sup> @ 100% imperv.	1.30 ha	17.2 %
	45	Roof Area	250	m <sup>2</sup> @ 100% imperv.	1.13 ha	14.9 %
	22.0	Roof Area	200	m <sup>2</sup> @ 100% imperv.	0.44 ha	5.8 %
	32	Roof Area	150	m <sup>2</sup> @ 100% imperv.	0.48 ha	6.3 %
				<b>4.81 ha</b>		
202		m of	20	m wide ROW @ 55% imperv.	0.00 ha	0.0 %
		Impervious Area	90	m <sup>2</sup> @ 100% imperv.	0.00 ha	0.0 %
	4.0	Roof Area	200	m <sup>2</sup> @ 100% imperv.	0.08 ha	6.0 %
				<b>0.08 ha</b>		
203	100	m of	20	m wide ROW @ 55% imperv.	0.11 ha	7.3 %
	4	Impervious Area	100	m <sup>2</sup> @ 100% imperv.	0.04 ha	2.7 %
	9	Roof Area	250	m <sup>2</sup> @ 100% imperv.	0.23 ha	15.0 %
				<b>0.38 ha</b>		
204	70	m of	10	m wide ROW @ 80% imperv.	0.06 ha	13.1 %
	1	Impervious Area	90	m <sup>2</sup> @ 100% imperv.	0.01 ha	2.1 %
	1	Roof Area	10	m <sup>2</sup> @ 100% imperv.	0.00 ha	0.2 %
	0	Roof Area	150	m <sup>2</sup> @ 100% imperv.	0.00 ha	0.0 %
				<b>0.07 ha</b>		
205	0	m of	20	m wide ROW @ 55% imperv.	0.00 ha	0.0 %
	2	Impervious Area	100	m <sup>2</sup> @ 100% imperv.	0.02 ha	2.1 %
	2	Roof Area	150	m <sup>2</sup> @ 100% imperv.	0.03 ha	3.2 %
				<b>0.05 ha</b>		

# MEX Developments – Harriston Subdivision – Interim Development – 2yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 5  
Number of nodes ..... 9  
Number of links ..... 7  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	7.57	2600.00	63.50	3.0000	Chicago_3hr_2yr	SU2
202	1.34	250.00	6.00	2.5000	Chicago_3hr_2yr	J2
203	1.50	200.00	25.00	6.0000	Chicago_3hr_2yr	J1
204	0.43	120.00	15.40	7.0000	Chicago_3hr_2yr	Lorne-Webb
205	0.94	70.00	5.30	7.0000	Chicago_3hr_2yr	SU1

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	379.95	1.87	0.0	
J2	JUNCTION	381.22	0.78	0.0	
J3	JUNCTION	380.55	0.65	0.0	
J4	JUNCTION	381.50	2.15	0.0	
Creek	OUTFALL	381.00	0.50	0.0	
Lorne-John	OUTFALL	379.67	0.98	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	380.60	1.30	0.0	
SU2	STORAGE	381.40	2.31	0.0	

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J1	Lorne-John	CONDUIT	56.8	0.3519	0.0130
C4	J2	Creek	CONDUIT	20.8	1.0562	0.0130
C5	J3	J1	CONDUIT	40.0	0.6000	0.0130
C1	SU1	J1	ORIFICE			
C3	SU2	J2	ORIFICE			
C6	J4	J2	ORIFICE			
OR1	SU2	J4	ORIFICE			

\*\*\*\*\*  
Cross Section Summary

# MEX Developments – Harriston Subdivision – Interim Development – 2yr Design Storm

```
*****
```

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	CIRCULAR	0.90	0.64	0.23	0.90	1	1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1	15674.61
C5	CIRCULAR	0.30	0.07	0.07	0.30	1	74.91

```
*****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****
```

```
*****
Analysis Options
*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 12/17/2019 00:00:00
Ending Date ..... 12/18/2019 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
```

```
*****
```

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	0.376	31.950
Evaporation Loss	0.000	0.000
Infiltration Loss	0.148	12.525
Surface Runoff	0.230	19.485
Final Storage	0.001	0.062
Continuity Error (%)	-0.383	

```
*****
```

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.230	2.296
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.096	0.963
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.133	1.332
Continuity Error (%)	-0.001	

```
*****
Time-Step Critical Elements
*****
```

# MEX Developments – Harriston Subdivision – Interim Development – 2yr Design Storm

None

\*\*\*\*\*  
 Highest Flow Instability Indexes  
 \*\*\*\*\*  
 All links are stable.

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*  
 Minimum Time Step : 4.50 sec  
 Average Time Step : 5.00 sec  
 Maximum Time Step : 5.00 sec  
 Percent in Steady State : 0.00  
 Average Iterations per Step : 2.00  
 Percent Not Converging : 0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	31.95	0.00	0.00	8.25	23.82	1.80	1260.75	0.746
202	31.95	0.00	0.00	21.88	9.99	0.13	43.12	0.313
203	31.95	0.00	0.00	17.46	14.47	0.22	81.38	0.453
204	31.95	0.00	0.00	19.13	12.81	0.06	33.44	0.401
205	31.95	0.00	0.00	22.68	9.16	0.09	14.70	0.287

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.17	380.12	0 01:15	0.17
J2	JUNCTION	0.03	0.06	381.28	0 01:15	0.06
J3	JUNCTION	0.00	0.00	380.55	0 00:00	0.00
J4	JUNCTION	0.00	0.00	381.50	0 00:00	0.00
Creek	OUTFALL	0.03	0.06	381.06	0 01:15	0.06
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.04	0.30	380.90	0 03:00	0.30
SU2	STORAGE	0.98	1.11	382.51	0 03:35	1.11

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	81.38	82.89	0 01:15	0.217	0.303	-0.002
J2	JUNCTION	43.12	47.09	0 01:15	0.134	0.605	0.028
J3	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
J4	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
Creek	OUTFALL	0.00	46.79	0 01:15	0	0.605	0.000
Lorne-John	OUTFALL	0.00	80.69	0 01:16	0	0.303	0.000
Lorne-Webb	OUTFALL	33.44	33.44	0 01:15	0.0551	0.0551	0.000
SU1	STORAGE	14.70	14.70	0 01:15	0.0861	0.0861	0.000

# MEX Developments – Harriston Subdivision – Interim Development – 2yr Design Storm

SU2                      STORAGE      1260.75   1260.75      0   01:15                      1.8                      1.8                      0.008

\*\*\*\*\*  
Node Surcharge Summary  
\*\*\*\*\*

No nodes were surcharged.

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.004	1	0	0	0.032	9	0 03:00	6.48
SU2	1.456	28	0	0	1.733	33	0 03:35	5.88

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.88	7.01	46.79	0.605
Lorne-John	93.32	3.76	80.69	0.303
Lorne-Webb	30.69	2.07	33.44	0.055
System	74.63	12.84	156.32	0.963

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	80.69	0 01:16	1.02	0.08	0.18
C4	CONDUIT	46.79	0 01:15	0.73	0.00	0.11
C5	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
C1	ORIFICE	6.48	0 03:00			1.00
C3	ORIFICE	5.88	0 03:35			1.00
C6	ORIFICE	0.00	0 00:00			0.00
OR1	ORIFICE	0.00	0 00:00			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

# MEX Developments – Harriston Subdivision – Interim Development – 2yr Design Storm

C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.20	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 08:51:46 2020  
Analysis ended on: Tue Nov 03 08:51:46 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Interim Development – 5yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 5  
Number of nodes ..... 9  
Number of links ..... 7  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	7.57	2600.00	63.50	3.0000	Chicago_3hr_5yr	SU2
202	1.34	250.00	6.00	2.5000	Chicago_3hr_5yr	J2
203	1.50	200.00	25.00	6.0000	Chicago_3hr_5yr	J1
204	0.43	120.00	15.40	7.0000	Chicago_3hr_5yr	Lorne-Webb
205	0.94	70.00	5.30	7.0000	Chicago_3hr_5yr	SU1

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	379.95	1.87	0.0	
J2	JUNCTION	381.22	0.78	0.0	
J3	JUNCTION	380.55	0.65	0.0	
J4	JUNCTION	381.50	2.15	0.0	
Creek	OUTFALL	381.00	0.50	0.0	
Lorne-John	OUTFALL	379.67	0.98	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	380.60	1.30	0.0	
SU2	STORAGE	381.40	2.31	0.0	

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J1	Lorne-John	CONDUIT	56.8	0.3519	0.0130
C4	J2	Creek	CONDUIT	20.8	1.0562	0.0130
C5	J3	J1	CONDUIT	40.0	0.6000	0.0130
C1	SU1	J1	ORIFICE			
C3	SU2	J2	ORIFICE			
C6	J4	J2	ORIFICE			
OR1	SU2	J4	ORIFICE			

\*\*\*\*\*  
Cross Section Summary

# MEX Developments – Harriston Subdivision – Interim Development – 5yr Design Storm

```
*****
```

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	CIRCULAR	0.90	0.64	0.23	0.90	1	1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1	15674.61
C5	CIRCULAR	0.30	0.07	0.07	0.30	1	74.91

```
*****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****
```

```
*****
Analysis Options
*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 12/17/2019 00:00:00
Ending Date ..... 12/18/2019 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
```

```
*****
```

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	0.494	41.919
Evaporation Loss	0.000	0.000
Infiltration Loss	0.177	15.018
Surface Runoff	0.317	26.941
Final Storage	0.001	0.062
Continuity Error (%)	-0.244	

```
*****
```

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.317	3.174
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.127	1.272
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.190	1.903
Continuity Error (%)	0.000	

```
*****
Time-Step Critical Elements
*****
```

# MEX Developments – Harriston Subdivision – Interim Development – 5yr Design Storm

None

\*\*\*\*\*  
 Highest Flow Instability Indexes  
 \*\*\*\*\*  
 All links are stable.

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*  
 Minimum Time Step : 4.50 sec  
 Average Time Step : 5.00 sec  
 Maximum Time Step : 5.00 sec  
 Percent in Steady State : 0.00  
 Average Iterations per Step : 2.00  
 Percent Not Converging : 0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	41.92	0.00	0.00	9.94	32.07	2.43	1368.79	0.765
202	41.92	0.00	0.00	26.22	15.63	0.21	49.40	0.373
203	41.92	0.00	0.00	20.84	21.07	0.32	100.11	0.503
204	41.92	0.00	0.00	22.94	18.98	0.08	36.81	0.453
205	41.92	0.00	0.00	27.06	14.75	0.14	25.40	0.352

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.03	0.19	380.14	0 01:20	0.19
J2	JUNCTION	0.03	0.06	381.28	0 01:15	0.06
J3	JUNCTION	0.00	0.00	380.55	0 00:00	0.00
J4	JUNCTION	0.00	0.00	381.50	0 00:00	0.00
Creek	OUTFALL	0.03	0.06	381.06	0 01:15	0.06
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.08	0.48	381.08	0 03:01	0.48
SU2	STORAGE	1.21	1.36	382.76	0 03:32	1.36

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	100.11	104.07	0 01:20	0.316	0.455	-0.000
J2	JUNCTION	49.40	53.74	0 01:15	0.209	0.735	0.026
J3	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
J4	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
Creek	OUTFALL	0.00	53.80	0 01:15	0	0.735	0.000
Lorne-John	OUTFALL	0.00	103.72	0 01:20	0	0.455	0.000
Lorne-Webb	OUTFALL	36.81	36.81	0 01:15	0.0817	0.0817	0.000
SU1	STORAGE	25.40	25.40	0 01:30	0.139	0.139	0.000

# MEX Developments – Harriston Subdivision – Interim Development – 5yr Design Storm

SU2                      STORAGE      1368.79   1368.79      0   01:15                      2.43                      2.43                      0.009

\*\*\*\*\*  
Node Surcharge Summary  
\*\*\*\*\*

No nodes were surcharged.

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.009	3	0	0	0.067	19	0 03:01	8.51
SU2	2.018	39	0	0	2.352	45	0 03:32	6.53

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.88	8.52	53.80	0.735
Lorne-John	94.40	5.57	103.72	0.455
Lorne-Webb	31.12	3.02	36.81	0.082
System	75.13	17.12	186.89	1.272

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	103.72	0 01:20	1.10	0.10	0.21
C4	CONDUIT	53.80	0 01:15	0.76	0.00	0.12
C5	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
C1	ORIFICE	8.51	0 03:01			1.00
C3	ORIFICE	6.53	0 03:32			1.00
C6	ORIFICE	0.00	0 00:00			0.00
OR1	ORIFICE	0.00	0 00:00			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

# MEX Developments – Harriston Subdivision – Interim Development – 5yr Design Storm

C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.19	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 08:51:22 2020  
Analysis ended on: Tue Nov 03 08:51:22 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Interim Development – 25yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 5  
Number of nodes ..... 9  
Number of links ..... 7  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	7.57	2600.00	63.50	3.0000	Chicago_3hr_25yr	SU2
202	1.34	250.00	6.00	2.5000	Chicago_3hr_25yr	J2
203	1.50	200.00	25.00	6.0000	Chicago_3hr_25yr	J1
204	0.43	120.00	15.40	7.0000	Chicago_3hr_25yr	Lorne-Webb
205	0.94	70.00	5.30	7.0000	Chicago_3hr_25yr	SU1

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	379.95	1.87	0.0	
J2	JUNCTION	381.22	0.78	0.0	
J3	JUNCTION	380.55	0.65	0.0	
J4	JUNCTION	381.50	2.15	0.0	
Creek	OUTFALL	381.00	0.50	0.0	
Lorne-John	OUTFALL	379.67	0.98	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	380.60	1.30	0.0	
SU2	STORAGE	381.40	2.31	0.0	

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J1	Lorne-John	CONDUIT	56.8	0.3519	0.0130
C4	J2	Creek	CONDUIT	20.8	1.0562	0.0130
C5	J3	J1	CONDUIT	40.0	0.6000	0.0130
C1	SU1	J1	ORIFICE			
C3	SU2	J2	ORIFICE			
C6	J4	J2	ORIFICE			
OR1	SU2	J4	ORIFICE			

\*\*\*\*\*  
Cross Section Summary

# MEX Developments – Harriston Subdivision – Interim Development – 25yr Design Storm

```
*****
```

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	CIRCULAR	0.90	0.64	0.23	0.90	1	1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1	15674.61
C5	CIRCULAR	0.30	0.07	0.07	0.30	1	74.91

```
*****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****
```

```
*****
Analysis Options
*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 12/17/2019 00:00:00
Ending Date ..... 12/18/2019 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
```

```
*****
```

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	0.664	56.404
Evaporation Loss	0.000	0.000
Infiltration Loss	0.212	18.000
Surface Runoff	0.453	38.475
Final Storage	0.001	0.062
Continuity Error (%)	-0.238	

```
*****
```

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.453	4.533
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.175	1.747
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.279	2.786
Continuity Error (%)	0.003	

```
*****
Time-Step Critical Elements
*****
```

# MEX Developments – Harriston Subdivision – Interim Development – 25yr Design Storm

None

\*\*\*\*\*  
 Highest Flow Instability Indexes  
 \*\*\*\*\*  
 All links are stable.

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*  
 Minimum Time Step : 4.50 sec  
 Average Time Step : 5.00 sec  
 Maximum Time Step : 5.00 sec  
 Percent in Steady State : 0.00  
 Average Iterations per Step : 2.00  
 Percent Not Converging : 0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	56.40	0.00	0.00	11.89	44.63	3.38	1865.26	0.791
202	56.40	0.00	0.00	31.51	24.85	0.33	86.46	0.441
203	56.40	0.00	0.00	24.97	31.47	0.47	165.17	0.558
204	56.40	0.00	0.00	27.57	28.88	0.12	56.94	0.512
205	56.40	0.00	0.00	32.42	23.90	0.22	48.49	0.424

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.03	0.24	380.19	0 01:20	0.24
J2	JUNCTION	0.03	0.07	381.29	0 01:20	0.07
J3	JUNCTION	0.00	0.00	380.55	0 00:00	0.00
J4	JUNCTION	0.00	0.01	381.51	0 03:34	0.01
Creek	OUTFALL	0.03	0.07	381.07	0 01:20	0.07
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.15	0.74	381.34	0 03:05	0.74
SU2	STORAGE	1.54	1.70	383.10	0 03:32	1.70

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	165.17	170.52	0 01:20	0.472	0.697	-0.001
J2	JUNCTION	86.46	92.05	0 01:20	0.333	0.927	0.024
J3	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
J4	JUNCTION	0.00	0.21	0 03:32	0	0.00029	0.012
Creek	OUTFALL	0.00	92.04	0 01:20	0	0.927	0.000
Lorne-John	OUTFALL	0.00	169.83	0 01:20	0	0.697	0.000
Lorne-Webb	OUTFALL	56.94	56.94	0 01:15	0.124	0.124	0.000
SU1	STORAGE	48.49	48.49	0 01:25	0.225	0.225	-0.000

# MEX Developments – Harriston Subdivision – Interim Development – 25yr Design Storm

SU2                      STORAGE      1865.26   1865.26      0   01:15                      3.38                      3.38                      0.009

\*\*\*\*\*  
Node Surcharge Summary  
\*\*\*\*\*

No nodes were surcharged.

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.023	6	0	0	0.134	37	0 03:05	10.64
SU2	2.877	55	0	0	3.294	63	0 03:32	7.53

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.91	10.73	92.04	0.927
Lorne-John	95.01	8.48	169.83	0.697
Lorne-Webb	31.50	4.55	56.94	0.124
System	75.47	23.77	309.80	1.747

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	169.83	0 01:20	1.26	0.16	0.26
C4	CONDUIT	92.04	0 01:20	0.87	0.01	0.15
C5	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
C1	ORIFICE	10.64	0 03:05			1.00
C3	ORIFICE	7.32	0 03:32			1.00
C6	ORIFICE	0.21	0 03:34			0.03
OR1	ORIFICE	0.21	0 03:32			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

# MEX Developments – Harriston Subdivision – Interim Development – 25yr Design Storm

C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.18	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 08:51:03 2020  
Analysis ended on: Tue Nov 03 08:51:03 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Interim Development – 50yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 5  
Number of nodes ..... 9  
Number of links ..... 7  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	7.57	2600.00	63.50	3.0000	Chicago_3hr_50yr	SU2
202	1.34	250.00	6.00	2.5000	Chicago_3hr_50yr	J2
203	1.50	200.00	25.00	6.0000	Chicago_3hr_50yr	J1
204	0.43	120.00	15.40	7.0000	Chicago_3hr_50yr	Lorne-Webb
205	0.94	70.00	5.30	7.0000	Chicago_3hr_50yr	SU1

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	379.95	1.87	0.0	
J2	JUNCTION	381.22	0.78	0.0	
J3	JUNCTION	380.55	0.65	0.0	
J4	JUNCTION	381.50	2.15	0.0	
Creek	OUTFALL	381.00	0.50	0.0	
Lorne-John	OUTFALL	379.67	0.98	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	380.60	1.30	0.0	
SU2	STORAGE	381.40	2.31	0.0	

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J1	Lorne-John	CONDUIT	56.8	0.3519	0.0130
C4	J2	Creek	CONDUIT	20.8	1.0562	0.0130
C5	J3	J1	CONDUIT	40.0	0.6000	0.0130
C1	SU1	J1	ORIFICE			
C3	SU2	J2	ORIFICE			
C6	J4	J2	ORIFICE			
OR1	SU2	J4	ORIFICE			

\*\*\*\*\*  
Cross Section Summary

# MEX Developments – Harriston Subdivision – Interim Development – 50yr Design Storm

```
*****
```

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	CIRCULAR	0.90	0.64	0.23	0.90	1	1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1	15674.61
C5	CIRCULAR	0.30	0.07	0.07	0.30	1	74.91

```
*****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****
```

```
*****
Analysis Options
*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 12/17/2019 00:00:00
Ending Date ..... 12/18/2019 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
```

```
*****
```

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	0.747	63.386
Evaporation Loss	0.000	0.000
Infiltration Loss	0.227	19.240
Surface Runoff	0.521	44.230
Final Storage	0.001	0.062
Continuity Error (%)	-0.231	

```
*****
```

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.521	5.211
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.239	2.386
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.282	2.825
Continuity Error (%)	0.003	

```
*****
Time-Step Critical Elements
*****
```

# MEX Developments – Harriston Subdivision – Interim Development – 50yr Design Storm

None

\*\*\*\*\*  
 Highest Flow Instability Indexes  
 \*\*\*\*\*  
 All links are stable.

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*  
 Minimum Time Step : 4.50 sec  
 Average Time Step : 5.00 sec  
 Maximum Time Step : 5.00 sec  
 Percent in Steady State : 0.00  
 Average Iterations per Step : 2.00  
 Percent Not Converging : 0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	63.39	0.00	0.00	12.73	50.78	3.84	2077.42	0.801
202	63.39	0.00	0.00	33.68	29.68	0.40	108.68	0.468
203	63.39	0.00	0.00	26.61	36.83	0.55	198.32	0.581
204	63.39	0.00	0.00	29.51	33.94	0.15	66.74	0.535
205	63.39	0.00	0.00	34.60	28.72	0.27	61.75	0.453

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.04	0.26	380.21	0 01:20	0.26
J2	JUNCTION	0.03	0.08	381.30	0 02:50	0.08
J3	JUNCTION	0.00	0.00	380.55	0 00:00	0.00
J4	JUNCTION	0.04	0.75	382.25	0 02:56	0.75
Creek	OUTFALL	0.03	0.08	381.08	0 02:50	0.08
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.19	0.85	381.45	0 03:07	0.85
SU2	STORAGE	1.56	1.78	383.18	0 02:56	1.78

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	198.32	204.26	0 01:20	0.552	0.822	-0.001
J2	JUNCTION	108.68	118.90	0 02:50	0.398	1.42	0.018
J3	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
J4	JUNCTION	0.00	91.40	0 02:56	0	0.422	0.000
Creek	OUTFALL	0.00	118.90	0 02:50	0	1.42	0.000
Lorne-John	OUTFALL	0.00	203.47	0 01:20	0	0.822	0.000
Lorne-Webb	OUTFALL	66.74	66.74	0 01:15	0.146	0.146	0.000
SU1	STORAGE	61.75	61.75	0 01:25	0.27	0.27	-0.000

# MEX Developments – Harriston Subdivision – Interim Development – 50yr Design Storm

SU2                      STORAGE      2077.42    2077.42      0    01:15                      3.85                      3.85                      0.008

\*\*\*\*\*  
Node Surcharge Summary  
\*\*\*\*\*

No nodes were surcharged.

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.032	9	0	0	0.171	48	0 03:07	11.48
SU2	2.944	56	0	0	3.511	67	0 02:56	98.88

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.92	16.42	118.90	1.418
Lorne-John	95.16	10.00	203.47	0.822
Lorne-Webb	31.44	5.36	66.74	0.146
System	75.51	31.79	375.65	2.386

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	203.47	0 01:20	1.33	0.19	0.29
C4	CONDUIT	118.90	0 02:50	0.93	0.01	0.16
C5	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
C1	ORIFICE	11.48	0 03:07			1.00
C3	ORIFICE	7.48	0 02:56			1.00
C6	ORIFICE	91.40	0 02:56			1.00
OR1	ORIFICE	91.40	0 02:56			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

# MEX Developments – Harriston Subdivision – Interim Development – 50yr Design Storm

C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.16	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 08:50:41 2020  
Analysis ended on: Tue Nov 03 08:50:42 2020  
Total elapsed time: 00:00:01

# MEX Developments – Harriston Subdivision – Interim Development – 100yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 5  
Number of nodes ..... 9  
Number of links ..... 7  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
201	7.57	2600.00	63.50	3.0000	Chicago_3hr_100yr	SU2
202	1.34	250.00	6.00	2.5000	Chicago_3hr_100yr	J2
203	1.50	200.00	25.00	6.0000	Chicago_3hr_100yr	J1
204	0.43	120.00	15.40	7.0000	Chicago_3hr_100yr	Lorne-Webb
205	0.94	70.00	5.30	7.0000	Chicago_3hr_100yr	SU1

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	379.95	1.87	0.0	
J2	JUNCTION	381.22	0.78	0.0	
J3	JUNCTION	380.55	0.65	0.0	
J4	JUNCTION	381.50	2.15	0.0	
Creek	OUTFALL	381.00	0.50	0.0	
Lorne-John	OUTFALL	379.67	0.98	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	380.60	1.30	0.0	
SU2	STORAGE	381.40	2.31	0.0	

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J1	Lorne-John	CONDUIT	56.8	0.3519	0.0130
C4	J2	Creek	CONDUIT	20.8	1.0562	0.0130
C5	J3	J1	CONDUIT	40.0	0.6000	0.0130
C1	SU1	J1	ORIFICE			
C3	SU2	J2	ORIFICE			
C6	J4	J2	ORIFICE			
OR1	SU2	J4	ORIFICE			

\*\*\*\*\*  
Cross Section Summary

# MEX Developments – Harriston Subdivision – Interim Development – 100yr Design Storm

\*\*\*\*\*

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	CIRCULAR	0.90	0.64	0.23	0.90	1	1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1	15674.61
C5	CIRCULAR	0.30	0.07	0.07	0.30	1	74.91

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*

Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... YES  
   Ponding Allowed ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Flow Routing Method ..... DYNWAVE  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00  
 Dry Time Step ..... 00:05:00  
 Routing Time Step ..... 5.00 sec  
 Variable Time Step ..... YES  
 Maximum Trials ..... 8  
 Number of Threads ..... 1  
 Head Tolerance ..... 0.001524 m

	Volume hectare-m	Depth mm
Runoff Quantity Continuity		
Total Precipitation	0.812	68.934
Evaporation Loss	0.000	0.000
Infiltration Loss	0.237	20.125
Surface Runoff	0.576	48.910
Final Storage	0.001	0.062
Continuity Error (%)	-0.237	

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.576	5.763
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.294	2.935
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.283	2.827
Continuity Error (%)	0.002	

\*\*\*\*\*  
 Time-Step Critical Elements  
 \*\*\*\*\*

# MEX Developments – Harriston Subdivision – Interim Development – 100yr Design Storm

None

\*\*\*\*\*  
 Highest Flow Instability Indexes  
 \*\*\*\*\*  
 Link OR1 (4)  
 Link C6 (4)

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*  
 Minimum Time Step : 4.50 sec  
 Average Time Step : 5.00 sec  
 Maximum Time Step : 5.00 sec  
 Percent in Steady State : 0.00  
 Average Iterations per Step : 2.02  
 Percent Not Converging : 0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	68.93	0.00	0.00	13.32	55.77	4.22	2302.49	0.809
202	68.93	0.00	0.00	35.20	33.73	0.45	128.98	0.489
203	68.93	0.00	0.00	27.90	41.10	0.62	228.24	0.596
204	68.93	0.00	0.00	30.86	38.16	0.16	77.30	0.554
205	68.93	0.00	0.00	36.15	32.72	0.31	73.36	0.475

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.04	0.28	380.23	0 01:20	0.28
J2	JUNCTION	0.03	0.10	381.32	0 02:13	0.10
J3	JUNCTION	0.00	0.00	380.55	0 00:00	0.00
J4	JUNCTION	0.09	1.61	383.11	0 02:31	1.61
Creek	OUTFALL	0.03	0.10	381.10	0 02:13	0.10
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.23	0.94	381.54	0 03:08	0.94
SU2	STORAGE	1.57	1.81	383.21	0 02:31	1.81

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	228.24	234.65	0 01:20	0.617	0.924	-0.002
J2	JUNCTION	128.98	187.83	0 02:13	0.452	1.85	0.015
J3	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
J4	JUNCTION	0.00	149.62	0 02:18	0	0.795	-0.003
Creek	OUTFALL	0.00	187.80	0 02:13	0	1.85	0.000
Lorne-John	OUTFALL	0.00	233.71	0 01:20	0	0.924	0.000
Lorne-Webb	OUTFALL	77.30	77.30	0 01:15	0.164	0.164	0.000



# MEX Developments – Harriston Subdivision – Interim Development – 100yr Design Storm

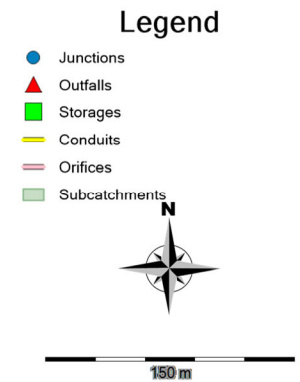
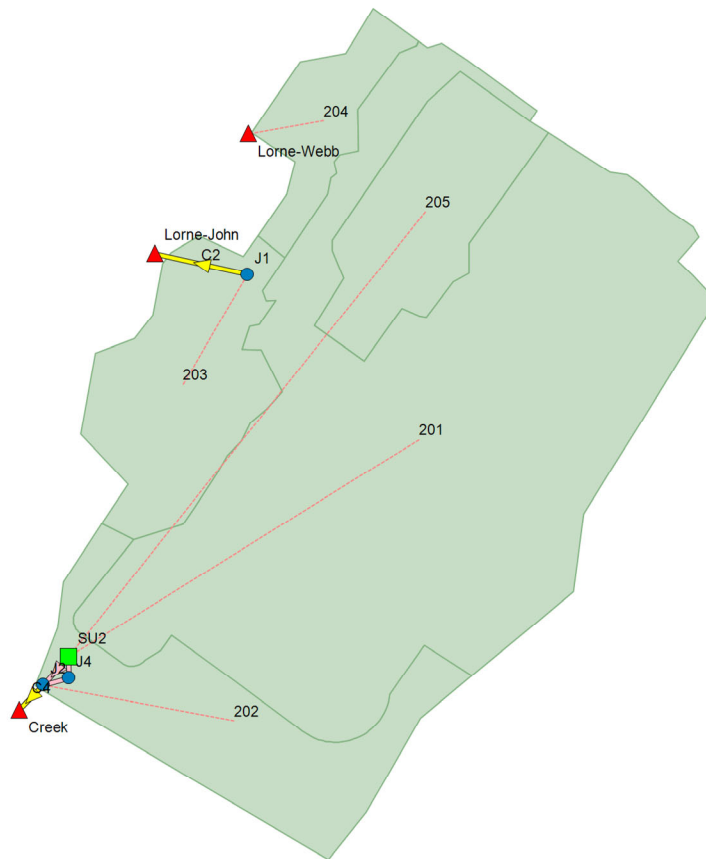
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.17	0.00	
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Mon Nov 02 17:07:19 2020  
Analysis ended on: Mon Nov 02 17:07:19 2020  
Total elapsed time: < 1 sec

# MEX Developments - Harriston Subdivision - Post Development Model Schematic



## MEX Developments – Harriston Subdivision – Post Development – Model Details

### [TITLE]

### [OPTIONS]

```

;;Options      Value
;;-----
FLOW_UNITS      LPS
INFILTRATION    CURVE_NUMBER
FLOW_ROUTING    DYNWAVE
START_DATE      12/17/2019
START_TIME      00:00
REPORT_START_DATE 12/17/2019
REPORT_START_TIME 00:00
END_DATE        12/18/2019
END_TIME        00:00
SWEEP_START     1/1
SWEEP_END       12/31
DRY_DAYS        0
REPORT_STEP     00:01:00
WET_STEP        00:05:00
DRY_STEP        00:05:00
ROUTING_STEP    5
ALLOW_PONDING  NO
INERTIAL_DAMPING PARTIAL
VARIABLE_STEP   0.75
LENGTHENING_STEP 0
MIN_SURFAREA    0
NORMAL_FLOW_LIMITED BOTH
SKIP_STEADY_STATE NO
FORCE_MAIN_EQUATION H-W
LINK_OFFSETS    ELEVATION
MIN_SLOPE       0
MAX_TRIALS      8
HEAD_TOLERANCE  0
SYS_FLOW_TOL    5
LAT_FLOW_TOL    5
MINIMUM_STEP    0.5
THREADS         2

```

### [EVAPORATION]

```

;;Type      Parameters
;;-----
CONSTANT    0.0
DRY_ONLY    NO

```

### [RAINGAGES]

```

;;      Rain      Time      Snow      Data
;;Name   Type      Intrvl  Catch   Source
;;-----
Chicago_3hr_100yr INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_100yr
Chicago_3hr_25yr  INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_25yr
Chicago_3hr_2yr   INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_2yr
Chicago_3hr_50yr  INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_50yr
Chicago_3hr_5yr   INTENSITY 0:05  1.0    TIMESERIES Chicago_3hr_5yr

```

### [SUBCATCHMENTS]

```

;;
;;Name      Raingage      Outlet      Total      Pcnt.      Width      Pcnt.      Curb      Snow
;;-----      -----      -----      Area      Imperv      Slope      Length      Pack
201         Chicago_3hr_2yr  SU2         7.57      63.5      2600      3          0
202         Chicago_3hr_2yr  J2          1.34      6          250       2.5        0
203         Chicago_3hr_2yr  J1          1.5       25        200       6          0
204         Chicago_3hr_2yr  Lorne-Webb  0.43      15.4     120       7          0
205         Chicago_3hr_2yr  SU2         0.94      48.9     70        7          0

```

### [SUBAREAS]

```

;;Subcatchment  N-Imperv  N-Perov  S-Imperv  S-Perov  PctZero  RouteTo  PctRouted
;;-----
201             0.01     0.25     0.05     0.05     25       PERVIOUS  43
202             0.01     0.25     0.05     0.05     25       OUTLET    0
203             0.01     0.25     0.05     0.05     25       PERVIOUS  60
204             0.01     0.25     0.05     0.05     25       PERVIOUS  2
205             0.01     0.25     0.05     0.05     25       PERVIOUS  46

```

## MEX Developments – Harriston Subdivision – Post Development – Model Details

**[INFILTRATION]**

;;Subcatchment	CurveNum	HydCon	DryTime
201	77	0.5	7
202	77	0.5	7
203	77	0.5	7
204	77	0.5	7
205	77	0.5	7

**[JUNCTIONS]**

;;Name	Invert Elev.	Max. Depth	Init. Depth	Surcharge Depth	Ponded Area
J1	379.95	1.87	0	0	0
J2	381.22	0.78	0	0	0
J4	381.5	2.15	0	0	0

**[OUTFALLS]**

;;Name	Invert Elev.	Outfall Type	Stage/Table Time Series	Tide Gate Route To
Creek	381	FREE		NO
Lorne-John	379.67	FREE		NO
Lorne-Webb	0	FREE		NO

**[STORAGE]**

;;Name	Invert Elev.	Max. Depth	Init. Depth	Storage Curve	Curve Params	Ponded Area	Evap. Frac.
Infiltration parameters							
SU2	381.4	2.31	0	TABULAR	Main-Pond	0	0

**[CONDUITS]**

;;Name	Inlet Node	Outlet Node	Length	Manning N	Inlet Offset	Outlet Offset	Init. Flow	Max. Flow
C2	J1	Lorne-John	56.83	0.013	379.95	379.75	0	0
C4	J2	Creek	20.83	0.013	381.22	381	0	0

**[ORIFICES]**

;;Name	Inlet Node	Outlet Node	Orifice Type	Crest Height	Disch. Coeff.	Flap Gate	Open/Close Time
C3	SU2	J2	SIDE	381.4	0.65	NO	0
C6	J4	J2	SIDE	381.5	0.65	NO	0
OR1	SU2	J4	BOTTOM	383.1	0.65	NO	0

**[XSECTIONS]**

;;Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrels
C2	CIRCULAR	0.9	0	0	0	1
C4	TRIANGULAR	0.5	20	0	0	1
C3	CIRCULAR	0.05	0	0	0	
C6	CIRCULAR	0.225	0	0	0	
OR1	RECT_CLOSED	0.6	0.6	0	0	

**[LOSSES]**

;;Link	Inlet	Outlet	Average	Flap Gate	SeepageRate
--------	-------	--------	---------	-----------	-------------

**[CURVES]**

;;Name	Type	X-Value	Y-Value
Int-Pond	Storage	0	57
Int-Pond		0.9	360
Main-Pond	Storage	0	0
Main-Pond		.5	1830
Main-Pond		2.31	3430

**[TIMESERIES]**

;;Name	Date	Time	Value
--------	------	------	-------

# MEX Developments – Harriston Subdivision – Post Development – Model Details

```

;;-----
;Chicago design storm, a = 1720.73, b = 10.674, c = 0.822, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_100yr

;Chicago design storm, a = 1387.38, b = 9.697, c = 0.82, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_25yr

;Chicago design storm, a = 410.152, b = 0.085, c = 0.703, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_2yr

;Chicago design storm, a = 1644.39, b = 11.085, c = 0.829, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_50yr

;Chicago design storm, a = 955.42, b = 7.82, c = 0.807, Duration = 180 minutes, r = 0.4, rain units = mm/hr.
Chicago_3hr_5yr

```

**[REPORT]**  
INPUT YES  
CONTROLS NO  
SUBCATCHMENTS ALL  
NODES ALL  
LINKS ALL

**[TAGS]**

**[MAP]**  
DIMENSIONS 510835.647075695 4861156.00099864 511297.147915939 4861719.60010775  
UNITS Meters

**Table B.1 Parameter Summary Table**

Proposed Conditions										
Outlet Location	Model Catchment ID	Description	Area (ha)	Drainage Channel (m)	Flow Length (m)	Gradient (%)	Total Imperv. (%)	Not Connected Imperv. (%)	Manning's 'n' (Perv.)	CN (Perv.)
	201	Majority of Development	7.57	2600	29	3.0	63.5	43%	0.25	77.0
	202	South and Eastern portion of Development	1.34	250	54	2.5	6.0	100%	0.25	77.0
	203	Western Portion of Development	1.50	200	75	6.0	25.0	60%	0.25	77.0
	204	Northwest portion of Development	0.43	120	36	7.0	15.4	2%	0.25	77.0
	205	External Area to North of Development	0.94	70	134	7.0	48.9	46%	0.25	77.0

**Table B.2 Site Soils: (as per Ontario Soil Survey Report No. 35 for Wellington County)**

**Soil Type**  
Harriston Loam and Listowel Loam

**Hydrologic Soil Group**  
BC

TABLE OF CURVE NUMBERS (CN's)									
Land Use	Hydrologic Soil Type							Manning's 'n'	
	A	AB	B	BC	C	CD	D		
Meadow	50	54	58	64.5	71	74.5	78	0.4	continuous grass
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.4	forests
Long Grass	55	60	65	72	79	81.5	84	0.3	natural, not maintained
Lawns	60	65.5	71	77	83	86	89	0.25	maintained
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17	farm pasture
Crop	66	70	74	78	82	84	86	0.13	farm land
Fallow (bare)	77	82	86	89	91	93	94	0.05	idle farm land (bare)
Built-up	60	65.5	71	77	83	89	89	0.25	Lawns Existing
Streets, paved	98	98	98	98	98	98	98	0.01	

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
201	0	0	0	100	0	0	0	100
202	0	0	0	100	0	0	0	100
203	0	0	0	100	0	0	0	100
204	0	0	0	100	0	0	0	100
205	0	0	0	100	0	0	0	100

LAND USE (%) - Proposed Conditions										
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Imperv. Not Connected (Rooftops)	Imperv. Connected	Total
201	0	0	0	37	0	0.0	0	27.0	36.5	100
202	0	0	0.0	94	0	0	0	6.0	0.0	100
203	0	0	0.0	75	0	0	0	15.0	10.0	100
204	0	0	0.0	85	0	0	0	0.2	15.2	100
205	0	0	0	51	0	0.0	0	22.3	26.6	100

CURVE NUMBER (CN) - Proposed Conditions											
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Built-up	Imperv. Not Connected (Rooftops)	Weighted CN - Pervious	Manning's 'n'
201	65	67	72	77	70.5	78	89	77	90	77.0	0.25
202	65	67.0	72	77	71	78	89	77	90	77.0	0.25
203	65	67	72	77	70.5	78	89	77	90	77.0	0.25
204	65	67	72	77	70.5	78	89	77	90	77.0	0.25
205	65	67	72	77	70.5	78	89	77	90	77.0	0.25

**Table B.3: Impervious Area Determination for Subcatchment 201-205**

**Existing Conditions**

<b>Area of Concern</b>	<b>Total Area (ha)</b>	<b>Impervious Area Connected</b>		<b>Impervious Area Not Connected (Rooftops)</b>		<b>Total (%)</b>
		<b>(ha)</b>	<b>(%)</b>	<b>(ha)</b>	<b>(%)</b>	
201	7.57	2.76	36.5	2.05	27.0	63.5
202	1.34	0.00	0.0	0.08	6.0	6.0
203	1.50	0.15	10.0	0.23	15.0	25.0
204	0.43	0.07	15.2	0.00	0.2	15.4
205	0.94	0.25	26.6	0.21	22.3	48.9

**Table B.3 - Impervious Area Determination for Existing Catchments 201-205**

Catchment					Imperv. Area	Imperv %
201	1330	m of	20	m wide ROW @ 55% imperv.	1.46 ha	19.3 %
	130	Impervious Area	100	m <sup>2</sup> @ 100% imperv.	1.30 ha	17.2 %
	45	Roof Area	250	m <sup>2</sup> @ 100% imperv.	1.13 ha	14.9 %
	22.0	Roof Area	200	m <sup>2</sup> @ 100% imperv.	0.44 ha	5.8 %
	32	Roof Area	150	m <sup>2</sup> @ 100% imperv.	0.48 ha	6.3 %
				<b>4.81 ha</b>		
202		m of	20	m wide ROW @ 55% imperv.	0.00 ha	0.0 %
		Impervious Area	90	m <sup>2</sup> @ 100% imperv.	0.00 ha	0.0 %
	4.0	Roof Area	200	m <sup>2</sup> @ 100% imperv.	0.08 ha	6.0 %
				<b>0.08 ha</b>		
203	100	m of	20	m wide ROW @ 55% imperv.	0.11 ha	7.3 %
	4	Impervious Area	100	m <sup>2</sup> @ 100% imperv.	0.04 ha	2.7 %
	9	Roof Area	250	m <sup>2</sup> @ 100% imperv.	0.23 ha	15.0 %
				<b>0.38 ha</b>		
204	70	m of	10	m wide ROW @ 80% imperv.	0.06 ha	13.1 %
	1	Impervious Area	90	m <sup>2</sup> @ 100% imperv.	0.01 ha	2.1 %
	1	Roof Area	10	m <sup>2</sup> @ 100% imperv.	0.00 ha	0.2 %
	0	Roof Area	150	m <sup>2</sup> @ 100% imperv.	0.00 ha	0.0 %
				<b>0.07 ha</b>		
205	100	m of	20	m wide ROW @ 55% imperv.	0.11 ha	11.7 %
	14	Impervious Area	100	m <sup>2</sup> @ 100% imperv.	0.14 ha	14.9 %
	14	Roof Area	150	m <sup>2</sup> @ 100% imperv.	0.21 ha	22.3 %
				<b>0.46 ha</b>		



# MEX Developments – Harriston Subdivision – Post Development – 2yr Design Storm

C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1 15674.61

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*  
 Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... YES  
   Ponding Allowed ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Flow Routing Method ..... DYNWAVE  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00  
 Dry Time Step ..... 00:05:00  
 Routing Time Step ..... 5.00 sec  
 Variable Time Step ..... YES  
 Maximum Trials ..... 8  
 Number of Threads ..... 1  
 Head Tolerance ..... 0.001524 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation .....	0.376	31.950
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.138	11.676
Surface Runoff .....	0.240	20.353
Final Storage .....	0.001	0.056
Continuity Error (%) .....	-0.424	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.240	2.398
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.089	0.895
Flooding Loss .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.150	1.503
Continuity Error (%) .....	0.000	

\*\*\*\*\*  
 Time-Step Critical Elements  
 \*\*\*\*\*  
 None

\*\*\*\*\*  
 Highest Flow Instability Indexes

# MEX Developments – Harriston Subdivision – Post Development – 2yr Design Storm

\*\*\*\*\*  
 All links are stable.

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	31.95	0.00	0.00	8.25	23.82	1.80	1260.75	0.746
202	31.95	0.00	0.00	21.88	9.99	0.13	43.12	0.313
203	31.95	0.00	0.00	17.46	14.47	0.22	81.38	0.453
204	31.95	0.00	0.00	19.13	12.81	0.06	33.44	0.401
205	31.95	0.00	0.00	12.03	20.04	0.19	104.12	0.627

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.17	380.12	0 01:15	0.17
J2	JUNCTION	0.03	0.06	381.28	0 01:15	0.06
J4	JUNCTION	0.00	0.00	381.50	0 00:00	0.00
Creek	OUTFALL	0.03	0.06	381.06	0 01:15	0.06
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU2	STORAGE	1.05	1.18	382.58	0 03:39	1.18

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	81.38	81.38	0 01:15	0.217	0.217	-0.007
J2	JUNCTION	43.12	47.17	0 01:15	0.134	0.623	0.028
J4	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
Creek	OUTFALL	0.00	46.87	0 01:15	0	0.623	0.000
Lorne-John	OUTFALL	0.00	78.97	0 01:16	0	0.217	0.000
Lorne-Webb	OUTFALL	33.44	33.44	0 01:15	0.0551	0.0551	0.000
SU2	STORAGE	1364.87	1364.87	0 01:15	1.99	1.99	0.008

\*\*\*\*\*  
 Node Surcharge Summary  
 \*\*\*\*\*

No nodes were surcharged.

# MEX Developments – Harriston Subdivision – Post Development – 2yr Design Storm

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU2	1.622	31	0	0	1.914	37	0 03:39	6.08

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.88	7.21	46.87	0.623
Lorne-John	59.68	4.20	78.97	0.217
Lorne-Webb	30.69	2.07	33.44	0.055
System	63.42	13.48	154.89	0.895

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	78.97	0 01:16	1.02	0.07	0.18
C4	CONDUIT	46.87	0 01:15	0.73	0.00	0.11
C3	ORIFICE	6.08	0 03:39			1.00
C6	ORIFICE	0.00	0 00:00			0.00
OR1	ORIFICE	0.00	0 00:00			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.19

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 08:52:22 2020  
Analysis ended on: Tue Nov 03 08:52:22 2020  
Total elapsed time: < 1 sec



# MEX Developments – Harriston Subdivision – Post Development – 5yr Design Storm

C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1 15674.61

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*  
 Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... YES  
   Ponding Allowed ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Flow Routing Method ..... DYNWAVE  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00  
 Dry Time Step ..... 00:05:00  
 Routing Time Step ..... 5.00 sec  
 Variable Time Step ..... YES  
 Maximum Trials ..... 8  
 Number of Threads ..... 1  
 Head Tolerance ..... 0.001524 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation .....	0.494	41.919
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.165	14.002
Surface Runoff .....	0.329	27.971
Final Storage .....	0.001	0.056
Continuity Error (%) .....	-0.263	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.330	3.296
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.115	1.153
Flooding Loss .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.214	2.143
Continuity Error (%) .....	0.002	

\*\*\*\*\*  
 Time-Step Critical Elements  
 \*\*\*\*\*  
 None

\*\*\*\*\*  
 Highest Flow Instability Indexes

# MEX Developments – Harriston Subdivision – Post Development – 5yr Design Storm

\*\*\*\*\*  
All links are stable.

\*\*\*\*\*  
Routing Time Step Summary  
\*\*\*\*\*

Minimum Time Step	:	4.50	sec
Average Time Step	:	5.00	sec
Maximum Time Step	:	5.00	sec
Percent in Steady State	:	0.00	
Average Iterations per Step	:	2.00	
Percent Not Converging	:	0.00	

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	41.92	0.00	0.00	9.94	32.07	2.43	1368.79	0.765
202	41.92	0.00	0.00	26.22	15.63	0.21	49.40	0.373
203	41.92	0.00	0.00	20.84	21.07	0.32	100.11	0.503
204	41.92	0.00	0.00	22.94	18.98	0.08	36.81	0.453
205	41.92	0.00	0.00	14.31	27.67	0.26	109.40	0.660

\*\*\*\*\*  
Node Depth Summary  
\*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.19	380.14	0 01:20	0.19
J2	JUNCTION	0.03	0.06	381.28	0 01:15	0.06
J4	JUNCTION	0.00	0.00	381.50	0 00:00	0.00
Creek	OUTFALL	0.03	0.06	381.06	0 01:15	0.06
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU2	STORAGE	1.30	1.45	382.85	0 03:37	1.45

\*\*\*\*\*  
Node Inflow Summary  
\*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	100.11	100.11	0 01:20	0.316	0.316	-0.004
J2	JUNCTION	49.40	53.84	0 01:15	0.209	0.755	0.026
J4	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
Creek	OUTFALL	0.00	53.89	0 01:15	0	0.755	0.000
Lorne-John	OUTFALL	0.00	99.77	0 01:20	0	0.316	0.000
Lorne-Webb	OUTFALL	36.81	36.81	0 01:15	0.0817	0.0817	0.000
SU2	STORAGE	1478.19	1478.19	0 01:15	2.69	2.69	0.009

\*\*\*\*\*  
Node Surcharge Summary  
\*\*\*\*\*

No nodes were surcharged.

# MEX Developments – Harriston Subdivision – Post Development – 5yr Design Storm

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU2	2.249	43	0	0	2.604	50	0 03:37	6.76

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.88	8.75	53.89	0.755
Lorne-John	60.29	6.06	99.77	0.316
Lorne-Webb	31.12	3.02	36.81	0.082
System	63.76	17.83	184.17	1.153

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	99.77	0 01:20	1.08	0.09	0.20
C4	CONDUIT	53.89	0 01:15	0.76	0.00	0.12
C3	ORIFICE	6.76	0 03:37			1.00
C6	ORIFICE	0.00	0 00:00			0.00
OR1	ORIFICE	0.00	0 00:00			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.19

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 09:09:55 2020  
Analysis ended on: Tue Nov 03 09:09:55 2020  
Total elapsed time: < 1 sec



## MEX Developments – Harriston Subdivision – Post Development – 25yr Design Storm

C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1 15674.61

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*  
 Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... YES  
   Ponding Allowed ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Flow Routing Method ..... DYNWAVE  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00  
 Dry Time Step ..... 00:05:00  
 Routing Time Step ..... 5.00 sec  
 Variable Time Step ..... YES  
 Maximum Trials ..... 8  
 Number of Threads ..... 1  
 Head Tolerance ..... 0.001524 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation .....	0.664	56.404
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.198	16.781
Surface Runoff .....	0.468	39.709
Final Storage .....	0.001	0.056
Continuity Error (%) .....	-0.252	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.468	4.679
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.185	1.850
Flooding Loss .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.283	2.829
Continuity Error (%) .....	0.003	

\*\*\*\*\*  
 Time-Step Critical Elements  
 \*\*\*\*\*  
 None

\*\*\*\*\*  
 Highest Flow Instability Indexes

# MEX Developments – Harriston Subdivision – Post Development – 25yr Design Storm

\*\*\*\*\*  
 All links are stable.

\*\*\*\*\*  
 Routing Time Step Summary  
 \*\*\*\*\*  
 Minimum Time Step : 4.50 sec  
 Average Time Step : 5.00 sec  
 Maximum Time Step : 5.00 sec  
 Percent in Steady State : 0.00  
 Average Iterations per Step : 2.00  
 Percent Not Converging : 0.00

\*\*\*\*\*  
 Subcatchment Runoff Summary  
 \*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
201	56.40	0.00	0.00	11.89	44.63	3.38	1865.26	0.791
202	56.40	0.00	0.00	31.51	24.85	0.33	86.46	0.441
203	56.40	0.00	0.00	24.97	31.47	0.47	165.17	0.558
204	56.40	0.00	0.00	27.57	28.88	0.12	56.94	0.512
205	56.40	0.00	0.00	17.13	39.36	0.37	152.32	0.698

\*\*\*\*\*  
 Node Depth Summary  
 \*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.24	380.19	0 01:20	0.24
J2	JUNCTION	0.03	0.08	381.30	0 03:00	0.08
J4	JUNCTION	0.03	0.56	382.06	0 03:01	0.56
Creek	OUTFALL	0.03	0.08	381.08	0 03:00	0.08
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU2	STORAGE	1.56	1.77	383.17	0 03:01	1.77

\*\*\*\*\*  
 Node Inflow Summary  
 \*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	165.17	165.17	0 01:20	0.472	0.472	-0.004
J2	JUNCTION	86.46	100.18	0 03:00	0.333	1.25	0.019
J4	JUNCTION	0.00	76.92	0 03:01	0	0.323	0.000
Creek	OUTFALL	0.00	100.16	0 03:00	0	1.25	0.000
Lorne-John	OUTFALL	0.00	164.44	0 01:20	0	0.472	0.000
Lorne-Webb	OUTFALL	56.94	56.94	0 01:15	0.124	0.124	0.000
SU2	STORAGE	2017.58	2017.58	0 01:15	3.75	3.75	0.008

\*\*\*\*\*  
 Node Surcharge Summary  
 \*\*\*\*\*

No nodes were surcharged.

# MEX Developments – Harriston Subdivision – Post Development – 25yr Design Storm

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU2	2.939	56	0	0	3.487	67	0 03:01	84.39

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.91	14.52	100.16	1.254
Lorne-John	60.82	8.97	164.44	0.472
Lorne-Webb	31.50	4.55	56.94	0.124
System	64.08	28.05	304.64	1.850

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	164.44	0 01:20	1.25	0.15	0.26
C4	CONDUIT	100.16	0 03:00	0.89	0.01	0.15
C3	ORIFICE	7.46	0 03:01			1.00
C6	ORIFICE	76.92	0 03:01			1.00
OR1	ORIFICE	76.92	0 03:01			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.16

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 09:45:15 2020  
Analysis ended on: Tue Nov 03 09:45:15 2020  
Total elapsed time: < 1 sec



## MEX Developments – Harriston Subdivision – Post Development – 50yr Design Storm

C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1074.01
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1 15674.61

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*  
 Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... YES  
   Ponding Allowed ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Flow Routing Method ..... DYNWAVE  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00  
 Dry Time Step ..... 00:05:00  
 Routing Time Step ..... 5.00 sec  
 Variable Time Step ..... YES  
 Maximum Trials ..... 8  
 Number of Threads ..... 1  
 Head Tolerance ..... 0.001524 m

*****	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation .....	0.747	63.386
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.211	17.940
Surface Runoff .....	0.537	45.544
Final Storage .....	0.001	0.056
Continuity Error (%) .....	-0.244	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.537	5.366
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.253	2.534
Flooding Loss .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.283	2.832
Continuity Error (%) .....	0.003	

\*\*\*\*\*  
 Time-Step Critical Elements  
 \*\*\*\*\*  
 None

\*\*\*\*\*  
 Highest Flow Instability Indexes

# MEX Developments – Harriston Subdivision – Post Development – 50yr Design Storm

\*\*\*\*\*  
Link OR1 (5)

\*\*\*\*\*  
Routing Time Step Summary  
\*\*\*\*\*

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.03
Percent Not Converging	:	0.00

\*\*\*\*\*  
Subcatchment Runoff Summary  
\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
201	63.39	0.00	0.00	12.73	50.78	3.84	2077.42	0.801
202	63.39	0.00	0.00	33.68	29.68	0.40	108.68	0.468
203	63.39	0.00	0.00	26.61	36.83	0.55	198.32	0.581
204	63.39	0.00	0.00	29.51	33.94	0.15	66.74	0.535
205	63.39	0.00	0.00	18.31	45.18	0.42	171.78	0.713

\*\*\*\*\*  
Node Depth Summary  
\*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.26	380.21	0 01:20	0.26
J2	JUNCTION	0.03	0.09	381.31	0 02:10	0.09
J4	JUNCTION	0.10	1.61	383.11	0 02:33	1.61
Creek	OUTFALL	0.03	0.09	381.09	0 02:10	0.09
Lorne-John	OUTFALL	0.00	0.00	379.67	0 00:00	0.00
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU2	STORAGE	1.57	1.82	383.22	0 02:33	1.82

\*\*\*\*\*  
Node Inflow Summary  
\*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	198.32	198.32	0 01:20	0.552	0.552	-0.004
J2	JUNCTION	108.68	186.16	0 02:10	0.398	1.84	0.015
J4	JUNCTION	0.00	141.12	0 02:28	0	0.838	0.001
Creek	OUTFALL	0.00	186.19	0 02:10	0	1.84	0.000
Lorne-John	OUTFALL	0.00	197.48	0 01:20	0	0.552	0.000
Lorne-Webb	OUTFALL	66.74	66.74	0 01:15	0.146	0.146	0.000
SU2	STORAGE	2249.20	2249.20	0 01:15	4.27	4.27	0.007

\*\*\*\*\*  
Node Surcharge Summary  
\*\*\*\*\*

No nodes were surcharged.

# MEX Developments – Harriston Subdivision – Post Development – 50yr Design Storm

\*\*\*\*\*  
Node Flooding Summary  
\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*  
Storage Volume Summary  
\*\*\*\*\*

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU2	2.967	57	0	0	3.629	70	0 02:33	148.68

\*\*\*\*\*  
Outfall Loading Summary  
\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Creek	99.92	21.26	186.19	1.836
Lorne-John	61.29	10.42	197.48	0.552
Lorne-Webb	31.44	5.36	66.74	0.146
System	64.22	37.05	369.90	2.534

\*\*\*\*\*  
Link Flow Summary  
\*\*\*\*\*

Link	Type	Maximum  Flow  LPS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C2	CONDUIT	197.48	0 01:20	1.32	0.18	0.29
C4	CONDUIT	186.19	0 02:10	1.03	0.01	0.19
C3	ORIFICE	7.57	0 02:33			1.00
C6	ORIFICE	140.31	0 02:33			1.00
OR1	ORIFICE	141.12	0 02:28			

\*\*\*\*\*  
Flow Classification Summary  
\*\*\*\*\*

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class							
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C2	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.18

\*\*\*\*\*  
Conduit Surcharge Summary  
\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Nov 03 09:45:51 2020  
Analysis ended on: Tue Nov 03 09:45:51 2020  
Total elapsed time: < 1 sec

# MEX Developments – Harriston Subdivision – Post Development – 100yr Design Storm

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

\*\*\*\*\*  
Element Count  
\*\*\*\*\*

Number of rain gages ..... 5  
Number of subcatchments ... 5  
Number of nodes ..... 6  
Number of links ..... 3  
Number of pollutants ..... 0  
Number of land uses ..... 0

\*\*\*\*\*  
Raingage Summary  
\*\*\*\*\*

Name	Data Source	Data Type	Recording Interval
Chicago_3hr_100yr	Chicago_3hr_100yr	INTENSITY	5 min.
Chicago_3hr_25yr	Chicago_3hr_25yr	INTENSITY	5 min.
Chicago_3hr_2yr	Chicago_3hr_2yr	INTENSITY	5 min.
Chicago_3hr_50yr	Chicago_3hr_50yr	INTENSITY	5 min.
Chicago_3hr_5yr	Chicago_3hr_5yr	INTENSITY	5 min.

\*\*\*\*\*  
Subcatchment Summary  
\*\*\*\*\*

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
202	1.50	325.00	8.70	2.5000	Chicago_3hr_100yr	J2
203	1.34	200.00	33.10	10.0000	Chicago_3hr_100yr	J1
204	0.54	120.00	52.00	7.0000	Chicago_3hr_100yr	Lorne-Webb
205	1.12	70.00	41.20	7.0000	Chicago_3hr_100yr	SU2
S1	7.24	2600.00	65.70	3.0000	Chicago_3hr_100yr	SU2

\*\*\*\*\*  
Node Summary  
\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	379.95	2.95	0.0	
J2	JUNCTION	381.22	0.78	0.0	
Creek	OUTFALL	381.00	0.50	0.0	
Lorne-John	OUTFALL	379.75	0.38	0.0	
Lorne-Webb	OUTFALL	0.00	0.00	0.0	
SU2	STORAGE	381.40	2.33	0.0	

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J1	Lorne-John	CONDUIT	36.5	0.5487	0.0130
C3	SU2	J2	CONDUIT	18.0	1.0001	0.0130
C4	J2	Creek	CONDUIT	20.8	1.0562	0.0130

\*\*\*\*\*  
Cross Section Summary  
\*\*\*\*\*

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	CIRCULAR	0.38	0.11	0.09	0.38	1	129.88
C3	CIRCULAR	0.10	0.01	0.03	0.10	1	5.17
C4	TRIANGULAR	0.50	5.00	0.25	20.00	1	15674.61

# MEX Developments – Harriston Subdivision – Post Development – 100yr Design Storm

\*\*\*\*\*  
 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.  
 \*\*\*\*\*

\*\*\*\*\*  
 Analysis Options  
 \*\*\*\*\*  
 Flow Units ..... LPS  
 Process Models:  
   Rainfall/Runoff ..... YES  
   RDII ..... NO  
   Snowmelt ..... NO  
   Groundwater ..... NO  
   Flow Routing ..... YES  
   Ponding Allowed ..... NO  
   Water Quality ..... NO  
 Infiltration Method ..... CURVE\_NUMBER  
 Flow Routing Method ..... DYNWAVE  
 Starting Date ..... 12/17/2019 00:00:00  
 Ending Date ..... 12/18/2019 00:00:00  
 Antecedent Dry Days ..... 0.0  
 Report Time Step ..... 00:01:00  
 Wet Time Step ..... 00:05:00  
 Dry Time Step ..... 00:05:00  
 Routing Time Step ..... 5.00 sec  
 Variable Time Step ..... YES  
 Maximum Trials ..... 8  
 Number of Threads ..... 1  
 Head Tolerance ..... 0.001524 m

	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
*****	-----	-----
Total Precipitation .....	0.809	68.934
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.209	17.786
Surface Runoff .....	0.602	51.266
Final Storage .....	0.001	0.055
Continuity Error (%) .....	-0.250	

	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.602	6.016
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.268	2.682
Flooding Loss .....	0.000	0.000
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.333	3.332
Continuity Error (%) .....	0.020	

\*\*\*\*\*  
 Time-Step Critical Elements  
 \*\*\*\*\*  
 Link C3 (96.25%)

\*\*\*\*\*  
 Highest Flow Instability Indexes  
 \*\*\*\*\*  
 All links are stable.

# MEX Developments – Harriston Subdivision – Post Development – 100yr Design Storm

\*\*\*\*\*

Routing Time Step Summary

\*\*\*\*\*

```

Minimum Time Step      :      1.56 sec
Average Time Step      :      3.66 sec
Maximum Time Step      :      5.00 sec
Percent in Steady State :      0.00
Average Iterations per Step :      2.01
Percent Not Converging :      0.00
    
```

\*\*\*\*\*

Subcatchment Runoff Summary

\*\*\*\*\*

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 <sup>6</sup> ltr	Peak Runoff LPS	Runoff Coeff
202	68.93	0.00	0.00	33.97	34.98	0.52	164.74	0.507
203	68.93	0.00	0.00	24.57	44.48	0.60	261.61	0.645
204	68.93	0.00	0.00	17.51	51.56	0.28	142.87	0.748
205	68.93	0.00	0.00	22.23	46.77	0.52	190.03	0.679
S1	68.93	0.00	0.00	12.51	56.57	4.10	2269.29	0.821

\*\*\*\*\*

Node Depth Summary

\*\*\*\*\*

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.03	0.94	380.89	0 01:20	0.94
J2	JUNCTION	0.04	0.09	381.31	0 01:20	0.09
Creek	OUTFALL	0.04	0.09	381.09	0 01:20	0.09
Lorne-John	OUTFALL	0.02	0.35	380.10	0 01:20	0.35
Lorne-Webb	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU2	STORAGE	1.95	2.22	383.62	0 03:23	2.22

\*\*\*\*\*

Node Inflow Summary

\*\*\*\*\*

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 <sup>6</sup> ltr	Total Inflow Volume 10 <sup>6</sup> ltr	Flow Balance Error Percent
J1	JUNCTION	261.61	261.61	0 01:20	0.596	0.595	-0.017
J2	JUNCTION	164.74	178.64	0 01:20	0.525	1.81	0.021
Creek	OUTFALL	0.00	178.58	0 01:20	0	1.81	0.000
Lorne-John	OUTFALL	0.00	261.56	0 01:20	0	0.596	0.000
Lorne-Webb	OUTFALL	142.87	142.87	0 01:15	0.278	0.278	0.000
SU2	STORAGE	2459.32	2459.32	0 01:15	4.62	4.62	0.036

\*\*\*\*\*

Node Surcharge Summary

\*\*\*\*\*

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
------	------	---------------------	--------------------------------------	-----------------------------------



# MEX Developments – Harriston Subdivision – Post Development – 100yr Design Storm

---

C2	0.01	0.31	0.01	0.38	0.01
C3	0.01	23.44	0.01	23.44	0.01

Analysis begun on: Thu Jan 23 11:39:12 2020  
Analysis ended on: Thu Jan 23 11:39:13 2020  
Total elapsed time: 00:00:01

	Pre Development (L/s)				Interim Development (L/s)				Post Development (L/s)			
	Creek	Lorne/John	Lorne/Webb	TOTAL	Creek	Lorne/John	Lorne/Webb	TOTAL	Creek	Lorne/John	Lorne/Webb	TOTAL
<b>2 Year</b>	49.18	42.27	35.65	127.1	46.79	80.69	33.44	160.92	46.87	78.97	33.44	159.28
<b>5 Year</b>	88.25	68.79	40.87	197.91	53.8	103.72	36.81	194.33	53.89	99.77	36.81	190.47
<b>25 Year</b>	175.77	130.62	67.86	374.25	92.04	169.83	56.94	318.81	100.16	164.44	56.94	321.54
<b>50 Year</b>	228.64	165	84.14	477.78	118.9	203.47	66.74	389.11	186.19	197.48	66.74	450.41
<b>100 Year</b>	273.77	194.53	98.76	567.06	187.8	233.71	77.3	498.81	219.65	227.27	77.3	524.22

**Stage Storage Discharge**

Storm Event	Inflow (l/s)	Outflow (l/s)	Storage (m <sup>3</sup> )	Water level (m)
<b>2 Year</b>	1,364.90	6.08	1,914	382.58
<b>5 Year</b>	1,478.20	6.76	2,604	382.85
<b>25 Year</b>	2,017.60	84.39	3,487	383.17
<b>50 Year</b>	2,249.20	148.68	3,629	383.22
<b>100 Year</b>	2,495.00	155.19	3,889	383.30

**APPENDIX D**  
**Sanitary Sewer Design Sheet**

# SANITARY SEWER DESIGN SHEET

$q$  = average daily per capita flow = 450 L/cap. d)  
 $l$  = unit of peak extraneous flow = 0.15 L/ha. s)  
 $M$  = peaking factor  
 $Q(p)$  = peak population flow (L/s)  
 $Q(i)$  = peak extraneous flow (L/s)  
 $Q(d)$  = peak design flow

**PROJECT:** Harriston Subdivision  
**DATE:** 03-May-21  
**PROJECT NO:** 191-203  
**COMPLETED BY:** KP  
**CHECKED BY:**

$M = 1 + \frac{14}{4 + \sqrt{P}}$  where  $P$  = population in 1000's  
 where  $M$  = peaking factor (Harmon Formula)  
 $Q(p) = \frac{PqM}{86.4}$  (L/s)  
 $Q(i) = IA$  (L/s) where  $A$  = area in hectares  
 $Q(d) = Q(p) + Q(i)$  (L/s)

LOCATION						INDIVIDUAL		CUMULATIVE		Peaking factor M	Pop. Flow Q (p) (L/s)	Peak extraneous flow Q(i) (L/s)	Peak design flow Q(d) (L/s)	PROPOSED SEWER					
STREET		FROM	TO	Units	Units * 2.3	Population	Area A (hectares)	Population	Area A (hectares)					Length (m)	Pipe size (mm)	Type of pipe	Grade %	Capacity (L/s) n=0.013	Full flow velocity (m/s)
EXISTING SERVICED UNITS (19 SINGLE FAMILY) ON LORNE AND JOHN						44.0	2.44	334.0	9.74	4.06	7.06	1.46	8.52	62.27	200	PVC	0.50	23.19	0.74
John Street	S1	SANMH1	EXSANMH	2	4.6	5	0.27	290.0	7.30	4.08	6.17	1.10	7.26	81.80	200	PVC	1.44	39.35	1.25
Street A	S2	SANMH14	SANMH13	10	23	23	0.47	23.0	0.47	4.37	0.52	0.07	0.59	88.40	200	PVC	2.50	51.85	1.65
Street A	S3	SANMH13	SANMH1	6	13.8	14	0.54	37.0	1.01	4.34	0.84	0.15	0.99	101.05	200	PVC	2.00	46.38	1.48
John Street	S4	SANMH2	SANMH1	1	2.3	2	0.04	248.0	6.02	4.11	5.31	0.90	6.21	50.69	200	PVC	0.50	23.19	0.74
John Street	S5	SANMH3	SANMH2	2	4.6	5	0.13	150.0	3.44	4.19	3.27	0.52	3.79	35.06	200	PVC	0.50	23.19	0.74
John Street	S6	SANMH4	SANMH3	14	32.2	32	0.60	96.0	2.23	4.25	2.12	0.33	2.46	86.04	200	PVC	0.50	23.19	0.74
Street B	S7	SANMH11	SANMH3	12	27.6	28	0.54	49.0	1.08	4.32	1.10	0.16	1.26	100.97	200	PVC	1.40	38.80	1.24
Street B	S8	SANMH10	SANMH11	9	20.7	21	0.54	21.0	0.54	4.38	0.48	0.08	0.56	47.29	200	PVC	0.58	24.98	0.80
Street B	S9	SANMH5	SANMH2	5	11.5	11	0.34	96.0	2.54	4.25	2.12	0.38	2.51	80.96	200	PVC	0.50	23.19	0.74
Street B	S10	SANMH6	SANMH5	10	23	23	0.58	55.0	1.47	4.31	1.23	0.22	1.45	80.96	200	PVC	0.50	23.19	0.74
Street B	S11	SANMH7	SANMH6	5	11.5	11	0.32	32.0	0.89	4.35	0.73	0.13	0.86	60.79	200	PVC	0.50	23.19	0.74
Street B	S12	SANMH8	SANMH7	9	20.7	21	0.57	21.0	0.57	4.38	0.48	0.09	0.56	60.31	200	PVC	0.50	23.19	0.74
Street B	S13	SANMH8	SANMH9	6	13.8	14	0.43	14.0	0.43	4.40	0.32	0.06	0.39	80.96	200	PVC	0.50	23.19	0.74
Street B	S14	SANMH9	SANMH4	7	16.1	16	0.44	30.0	0.87	4.35	0.68	0.13	0.81	80.96	200	PVC	0.50	23.19	0.74
Street B	S15	SANMH10	SANMH4	15	34.5	34	0.76	34.0	0.76	4.35	0.77	0.11	0.88	100.97	200	PVC	1.56	40.96	1.30
Street C	S16	SANMH12	SANMH5	6	13.8	14	0.35	30.0	0.73	4.35	0.68	0.11	0.79	60.53	200	PVC	0.50	23.19	0.74
Street C	S17	SANMH9	SANMH12	7	16.1	16	0.39	16.0	0.38	4.39	0.37	0.06	0.42	60.57	200	PVC	1.07	33.92	1.08

**APPENDIX E**  
**Reserve Capacity Tables**

**TABLE 2.1**  
**SUMMARY OF RESERVE CAPACITY CALCULATIONS (2020)**  
**HARRISTON DRINKING WATER SYSTEM**  
**TOWN OF MINTO, ONTARIO**

Item	Description	Units	Value	Note
(1)	Design (FIRM) Capacity of the Well Supplies <sup>(a)</sup>	m <sup>3</sup> /d	2,613	Refer to note (a)
(2)	Average Maximum Day Flow (2017 -2019)	m <sup>3</sup> /d	1,541	Refer to note (c) and Table 2.3
(3)	Reserve Capacity	m <sup>3</sup> /d	1,072	(1)-(2)
(4)	Existing Connected Population <sup>(e)</sup>	persons	2,167	(5)*(8)
(5)	Serviced Households/Residential Connections <sup>(b)</sup>	ERU	903	Refer to Table 2.6
(6)	Maximum Day Per Capita Flow	m <sup>3</sup> /person/d	0.71	(2)/(4)
(7)	Additional Population that can be Served <sup>(d)</sup>	persons	1,507	(3)/(6)
(8)	Existing Persons Per Equivalent Residential Unit	persons/ERU	2.4	See Note (e)
(9)	Additional Units that can be Served <sup>(d)</sup>	ERU	628	(7)/(8)
(10)	Number of Unconnected Approved/Committed Units	ERU	290	Refer to Table 2.5
(11)	Uncommitted Hydraulic Reserve Capacity (Water)	ERU	338	(9)-(10)
(12)	System Capacity Used Based on Max Day	%	59	(3)/(1)

- (a) Firm capacity is equivalent to the total system capacity while the largest well is out of service.  
The Harriston Drinking Water System currently operates under MDWL 106-102, DWWP 106-202 and PTTW #3012-A8QRPF.  
As per the MDWL for Harriston, the rated capacity (m<sup>3</sup>/day) for the drinking water system is as follows: Well 1 = 979, Well 2 = 2,065, Well 3 = 1,634.  
Assuming the wells can operate at their rated capacity, Firm Capacity with Well 2 out of service is equivalent to Well 1 + Well 3 = 2,613 m<sup>3</sup>/day.
- (b) Serviced households/residential connections as reported by Town Billing.
- (c) Based on the average of the annual maximum day flow for 2017 (1,433.3 m<sup>3</sup>/day), 2018 (1,604.9 m<sup>3</sup>/day) and 2019 (1,586 m<sup>3</sup>/day)
- (d) Additional population and units that can be served without consideration of unconnected approved/committed units.
- (e) As per Statistics Canada 2016 Census for Harriston, the average household size is 2.4 (i.e. average capita per dwelling).

TABLE 2.2  
SUMMARY OF HYDRAULIC RESERVE CAPACITY CALCULATIONS (2020)  
HARRISTON SEWAGE TREATMENT WORKS  
TOWN OF MINTO, ONTARIO

Item	Description	Units	Value	Note
(1)	Design Capacity of Sewage Treatment Works	m <sup>3</sup> /d	2,378	As per MECP CoA No. 6100-8UYMCM
(2)	Average Daily Flow (Sewage) (Average for 2017-2019) <sup>(a)</sup>	m <sup>3</sup> /d	1,557	Refer to Table 2.4
(3)	Reserve Capacity (Surplus Treatment Capacity)	m <sup>3</sup> /d	821	(1)-(2)
(4)	Existing Connected Population <sup>(f)</sup>	persons	2,143	(5)*(8)
(5)	Serviced Households <sup>(b)</sup>	ERU	893	Refer to Table 2.6
(6)	Average Daily (Sewage) Flow per Capita <sup>(c)</sup>	m <sup>3</sup> /person/d	0.73	(2)/(4)
(7)	Additional Population that can be Served <sup>(d)</sup>	persons	1,131	(3)/(6)
(8)	Existing Persons Per Equivalent Residential Unit (ERU)	persons/ERU	2.4	See Note (f)
(9)	Additional ERUs that can be Served <sup>(d)</sup>	ERU	471	(7)/(8)
(10)	Number of Unconnected Approved/Committed Units	ERU	290	Refer to Table 2.5
(11)	Uncommitted Hydraulic Reserve Capacity (Sewage) <sup>(e)</sup>	ERU	181	(9)-(10)

Notes:

- <sup>(a)</sup> Average daily flow is based on the annual total flow from all sewage sources (i.e., all types of land uses [residential, commercial, industrial, institutional, etc] and other flow sources [i.e., infiltration]) divided by the the number of days in the year. Average daily sewage flows as reported by Town of Minto.
- <sup>(b)</sup> Serviced households/residential connections as reported by Town Billing.
- <sup>(c)</sup> Non-residential sewage flow sources are included in the measured average daily sewage flow, which will result in a more conservative evaluation of the uncommitted hydraulic reserve capacity.
- <sup>(d)</sup> Additional population and units that can be served without consideration of unconnected approved/committed units.
- <sup>(e)</sup> Uncommitted hydraulic reserve capacity does not consider organic reserve capacity or other performance characteristics of the sewage treatment works.
- <sup>(f)</sup> As per Statistics Canada 2016 Census for Harriston, the average household size is 2.4 (i.e. average capita per dwelling).

TABLE 2.3  
SUMMARY OF DRINKING WATER CONSUMPTION  
HARRISTON  
TOWN OF MINTO, ONTARIO

Month	Maximum Day Flow (m <sup>3</sup> /day)			
	Calendar Year			
	2017 <sup>(1)</sup>	2018 <sup>(1)</sup>	2019 <sup>(1)</sup>	
January	1,020.2	1,033.1	967.9	
February	968.1	1,024.0	1,237.7	
March	<b>1,433.3</b>	<b>995.5</b>	<b>1,082.2</b>	
April	949.1	986.5	1,522.0	
May	1,203.3	1,330.8	1,160.3	
June	1,152.8	1,134.1	988.8	
July	1,253.4	1,096.1	1,374.7	
August	1,070.8	1,223.8	1,586.0	
September	1,009.2	1,099.1	1,091.3	
October	1,142.2	1,604.9	1,321.8	
November	1,217.2	1,171.1	1,136.6	<b>3-Year Average Maximum Day Flow</b>
December	1,019.7	955.9	981.5	
<b>Max Maximum Day Flow</b>	<b>1,433.3</b>	<b>1,604.9</b>	<b>1,586.0</b>	<b>1,541.4</b>

Notes:

<sup>(1)</sup> Drinking Water System flow/consumption data as reported by Town of Minto. Summary of Maximum Day Flows excludes data not representative of typical consumption, such as watermain breaks, tower cleaning/refilling, flow meter malfunctions, etc.

TABLE 2.4  
SUMMARY OF RAW SEWAGE FLOWS  
HARRISTON  
TOWN OF MINTO, ONTARIO

**Harriston Sewage Treatment Works <sup>(1)</sup>**

		<b>2017</b>												
<b>Raw Flows</b>	<b>Units</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Summary</b>
Total	m3	81,605	63,969	60,789	57,387	65,044	56,803	41,435	32,022	32,814	40,412	54,285	40,572	627,136
Avg. day flow	m3/d	2,632	2,285	1,961	1,913	2,098	1,893	1,337	1,049	1,094	1,304	1,810	1,309	1,724
Max day flow	m3/d	4,836	5,337	3,868	3,149	4,665	8,180	1,724	1,303	1,348	2,122	2,631	1,574	8,180

		<b>2018</b>												
<b>Raw Flows</b>	<b>Units</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Summary</b>
Total	m3	55,507	57,319	44,884	76,978	47,326	33,263	29,201	33,566	31,141	34,786	45,938	53,886	543,795
Avg. day flow	m3/d	1,791	2,047	1,448	2,566	1,527	1,109	942	1,083	1,038	1,122	1,531	1,738	1,495
Max day flow	m3/d	4,469	7,458	2,153	4,123	2,114	1,412	1,235	1,839	1,380	1,431	2,187	2,386	7,458

		<b>2019</b>												
<b>Raw Flows</b>	<b>Units</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Summary</b>
Total	m3	48,426	46,078	65,328	69,860	56,249	37,512	30,615	25,824	26,078	31,677	44,233	47,127	529,005
Avg. day flow	m3/d	1,562	1,646	2,107	2,329	1,815	1,250	988	833	869	1,022	1,474	1,520	1,451
Max day flow	m3/d	2,500	3,285	5,044	4,318	2,701	1,599	1,169	1,084	1,128	1,971	2,098	2,372	5,044

**ECA # 6100-8UYMCM**

2,378 **Design Capacity (m<sup>3</sup>/day)**  
not rated **Peak Capacity (m<sup>3</sup>/day)**

**Summary**

566,645 **Annual Total Average (m<sup>3</sup>)**  
1,557 **Average Daily Flow (m<sup>3</sup>/d)**  
8,180 **Max. Daily Flow (m<sup>3</sup>/d)**

Notes:

<sup>(1)</sup> Wastewater treatment data as reported by Town of Minto. This data is assumed to include all sewage sources (i.e., all types of land uses [i.e., residential, commercial, industrial, institutional, etc] and other flow sources [i.e., infiltration]).

TABLE 2.5  
SUMMARY OF COMMITTED DEVELOPMENT (2020)  
HARRISTON  
TOWN OF MINTO, ONTARIO

ID	Planned Development Information <sup>(1)</sup>		Total Units Developed (as of December 31, 2019)	Units Remaining <sup>(2)</sup> (Committed, Undeveloped)
	Name	Total # of Units Approved		
1	Keith Gray Subdivision	13	10	3
2	Schikendanz Subdivision	181	0	181
3	Santos	4	0	4
4	Heritage Builders (formerly Howes)	16	1	15
5	Moorefield Excavating (formerly Wellington Construction)	39	10	29
6	Metzgers (George St. N)	17	15	2
7	Quality Homes (formerly Metzgers)	23	11	12
8	Metzgers (Lawrence St.)	11	0	11
9	Available Vacant Serviced Lots & Infill Lots	44	11	33
	<b>TOTAL (sum of 1 through 9)</b>	<b>348</b>	<b>58</b>	<b>290</b>

**Notes**

- (1) Serviced households/residential connections as reported by Town of Minto.  
Note that the Available Vacant Serviced and/or Infilling Lots may not be representative of the maximum development potential (in terms of total units) for the property. For the purpose of hydraulic reserve capacity calculations, the totals provided in this table should be considered "draft estimates" to be reviewed and confirmed by the Town of Minto.
- (2) Total Committed Development = Total Planned Development - Units Developed (to date)

TABLE 2.6  
SUMMARY OF WATER AND SEWER CUSTOMERS (2020)  
HARRISTON  
TOWN OF MINTO, ONTARIO

		Harriston <sup>(1)</sup>
		# of Customers
<b>RESIDENTIAL</b>		
	Homes	722
	Apartments (Total Units)	182
	<b>Total Residential (Water and Sewer)</b>	<b>904</b>
	Residential (With Water Only, No Sewer)	11
	Residential (No Water, With Sewer Only)	1
	<b>Total Residential (With Water and Sewer)</b>	<b>892</b>
<b>COMMERCIAL</b>		
	Municipal	10
	Car Wash	3
	Farms	2
	Feed Mill	2
	Garage	6
	Businesses	59
	Manufacturing	4
	Restaurants	7
	Rest Homes & Boarding Houses	3
	School	1
	Hospital	0
	<b>Total Commercial (Water and Sewer)</b>	<b>97</b>
	Commercial (With Water Only, No Sewer)	7
	<b>Commercial (With Water and Sewer)</b>	<b>90</b>
	<b>Totals: Residential + Commercial (With Water and Sewer)</b>	<b>982</b>

Notes:

<sup>(1)</sup> Serviced connections as reported by Town Billing.