

DILLON
CONSULTING

CORPORATION OF THE CITY OF WINDSOR

Functional Servicing Study

Official Plan and Zoning By-Law Amendments
Surplus Airport Lands, City of Windsor

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1.0

Introduction

Dillon Consulting Limited (Dillon) was retained by the City of Windsor (City) to develop a Functional Servicing Strategy for the development lands located at 3200 County Road 42, in the City of Windsor. This document outlines the servicing strategy and identifies the supporting studies and related information for the transportation, sanitary, stormwater, watermain, gas, hydro, and communication utility servicing for the site.

The proposed development area is approximately 109.31 ha and is currently in operation as agricultural lands. When fully developed, the land uses will consist of 26.96 ha of business park and 74.29 ha of industrial land use.

1.1

Reference Documents

The following documents and drawings were referenced when completing this study:

- City of Windsor – Development Standards Manual (Windsor, 2015);
- WUC Water System Master Plan (ENWIN Utilities, 2020);
- Lauzon Parkway Environmental Assessment Study (McCormick Rankin Corporation, 2014);
- Sandwich South Master Servicing Plan (Dillon, 2023) (Draft);
- Design Guidelines for Sewage Works (MOE, 2008); and
- Windsor/Essex Region Stormwater Management Standards Manual (ERCA, 2018).

2.0 Transportation Servicing

2.1 Existing Conditions

Currently, there is no access to the development. The property is bounded on the north and west limit by Windsor International Airport, on the east limit by a provincially significant wetland and a stormwater management pond, and on the south limit by County Road 42.

2.2 Proposed Roadways

The proposed access points to this development will be at two proposed intersections at County Road 42, one near the east limit and the other near the west limit of the proposed development. This will form a four-way intersection at 8th Concession Road and at 9th Concession Road with County Road 42.

The internal road network is proposed to be local roads with the road intersecting County Road 42 at 9th Concession Road having a 26 m right-of-way and the remaining road network having a 20 m right-of-way. The roads will be designed to the City of Windsor's standard urban cross-section. The proposed road layout is shown in [Figure 1 \(Appendix A\)](#).

The pavement structure of the proposed roadway will be consistent with geotechnical recommendations.

An Environmental Assessment was completed by McCormick Rankin Corporation in 2014. This study identifies the widening of County Road 42 from 2 lanes to 4 lanes with an urban cross section as well as construct roundabouts at 8th and 9th Concession Road intersections. This should be taken into consideration during detailed design to ensure that there are no conflicts between existing and new utilities.

A Traffic Impact Brief has been completed for this development by Dillon. Any impacts to the existing road network have been identified in that report and will be incorporated in the detailed design of this development.

3.0 Sanitary Servicing

3.1 Existing Conditions

Currently, there is an existing 1,200 mm diameter sanitary trunk sewer along the north side of County Road 42 heading east, which increases to a 1,350 mm diameter sanitary sewer after 9th Concession Road intersection and ultimately outlets into the Little River Pollution Control Plant.

3.2 Design Criteria

The following sanitary sewer design criteria for this property are outlined in [Table 1](#). The design criteria were established by the City of Windsor's Development Standards Manual (2015) and the Sandwich South Master Servicing Plan (SSMSP).

Table 1: Sanitary Sewer Design Criteria

Criteria	City of Windsor Development Standards Manual
Hydraulic Sewer Sizing	Manning's Equation
Minimum Sewer Size (mm)	250 diameter
Maximum Manhole Spacing	90 m preferred, maximum 120 m
Manning's Roughness Coefficient "n"	0.013
Velocity:	
Minimum (m/s)	0.76
Maximum (m/s)	3.00
Extraneous Flow	0.156 L/Ha/s
Peaking Factor	Based on Harmon Formula
Population Density For:	
Industrial Land Use	68 pop/ha
Business Park Land Use	74 pop/ha
Average Daily Sewage	363 L/capita/day

3.3 Proposed Servicing

Refer to [Figure 2](#) and [3](#) ([Appendix A](#)) which illustrates the proposed sanitary servicing layout. The sanitary servicing for the proposed development is as follows:

- All sanitary flows within the proposed development (Phase 1 and Phase 2) will be conveyed via the local sanitary sewers constructed within the roadway of the proposed internal road network.

- The proposed sanitary sewer outlets into the existing sanitary trunk sewer along County Road 42 at the 9th Concession Road intersection via pump station located at CR 42 and 9th Concession Road.
- The preliminary sanitary sewer design sheet is provided in [Appendix B](#) and assumes a full development buildout. Criteria used in flow calculation is listed in [Table 1](#).

The existing invert elevations of the sanitary trunk sewer does not allow for 2.4 m cover at the top end of the internal sewers in Phase 2; therefore, a sanitary pump station is required to provide sufficient cover. However, proposed inverts and ground elevations are subject to change during detailed design.

The future detailed design of the sanitary sewers and services are to be consistent with the requirements of the Ministry of Environment, Conservation and Parks (MECP) and City standards.

It should be noted that Site A, Site I, Site J and Site D were not assessed to the existing County Road 42 Trunk Sewer though the Sandwich South Master Servicing Plan (SSMSP), adding an additional 3704 population and 58.27 Ha of additional extraneous flow to the sanitary trunk sewer. Further analysis of the sanitary allotment should be conducted to determine the impact of these lots on the sanitary sewer and confirm if the lands may develop, before detailed design.

Additionally Phase 2 of the proposed development is planned over an existing solar farm that was not assessed to be developed in the SSMSP by land use and population estimates completed by Hemson in March 2020, which adds additional population to the existing sanitary trunk sewer. Further analysis should be conducted before detailed design to confirm expectant sewage flows can be accommodated within the downstream sanitary system.

The preliminary sanitary sewer design sheet is provided in [Appendix B](#).

4.0

Stormwater Management Servicing

4.1

Background Information

The proposed development lands are currently undeveloped lands and are assessed to the existing Rivard Drain, which is an open Municipal Drain, located within the development lands. The drain flows east into Little River Drain and is then conveyed into the Detroit River.

4.2

Design Criteria

The following storm sewer design criteria for this property are outlined in [Table 2](#). The design criteria were established by the City of Windsor's Development Standard Manual (2015) and the SSMSP.

Table 2: Storm Sewer Design Criteria

Criteria	City of Windsor Development Standards Manual
Design Method	Rational Method
Standard Return Period	1 in 10 years Storm Event
Rainfall Intensity	$I = a / (t+b)^c$ a=1511.0 b=9.50 c=0.845
Manning's Roughness Coefficient 'n'	0.013
Velocity:	
Minimum (m/s)	0.76
Maximum (m/s)	3.00
Maximum Manhole Spacing	Less than 675 mm diameter: 120 metres 750 mm diameter or greater: 150 metres
Inlet Times:	
Industrial/Commercial	20 minutes
Runoff Coefficients:	
Industrial/Commercial	0.90
Minimum Manhole Size	1,200 mm

Note: The detailed design for stormwater servicing will be completed with a hydrodynamic model and will adhere to the Windsor-Essex Region Stormwater Management Standards Manual.

Proposed Servicing

Refer to [Figure 2 and 3 \(Appendix A\)](#) for the proposed servicing layout. The stormwater servicing for the proposed development is as follows:

- The proposed lots and local roads will be serviced through a new storm trunk sewer network constructed within the proposed road network. A 1:10 year return period level of service was used for the design.
- The proposed storm sewer network is designed to have a minimum cover of 1.0 m. However, proposed inverts and ground elevations are subject to change during detailed design.
- Where the storm sewer is greater than 1,200 mm in diameter, a precast concrete manhole tee shall be used as shown in OPSD 707.010.
- The roads will be graded to allow for overland flow to be directed towards Pond 8. The flow depth will not exceed 300 mm within the roadways.
- The proposed storm sewer network will outlet into Pond 8 outlined in the SSMSP, east of the proposed development, which is then conveyed to Little River Drain and then ultimately to the Detroit River.
- It should be noted that Site A, Site I, Site J and Site D were not assessed into Pond 8 resulting in a 32% increase in drainage area from what was included in the SSMSP. An in-depth Stormwater Management Study should be completed to determine the impact of the increased flow on pond 8.
- During detailed design, an alternative hybrid method to reduce outflow to the proposed trunk sewer could be possible, which would reduce the runoff from each site, therefore decreasing the sizing of the storm sewer. This would require each site to provide stormwater storage during infrequent storm events.
- Phase 2 of the development was not assessed to Pond 8 in the SSMSP, therefore the proposed sewer and outlet along Road A has not been sized to convey those flows and it is assumed that the stormwater runoff will be conveyed through municipal drains.
- For details of stormwater quality and quantity control, a stormwater management report should be conducted.

The preliminary storm sewer design sheet is provided in [Appendix B](#).

5.0 Watermain Servicing

5.1 Existing Conditions

The site is not currently connected to a municipal watermain service. There is an existing 150mm diameter watermain along County Road 42 from 8th Concession Road to 9th Concession Road, which increases to a 200mm diameter water main to the east of 9th Concession Road. There is also a 300mm watermain along 8th Concession Road, north of County Road 42 ending at the airport building, which comes from a 900mm watermain that runs along the north side of County Road 42 heading towards Windsor.

5.2 Proposed Servicing

Please refer to the attached [Figure 2 and 3 \(Appendix A\)](#) which illustrate the proposed watermain servicing. The watermain servicing for the proposed development is as follows:

- The internal development will be serviced by a new 300 mm diameter watermain constructed within the proposed internal road network;
- The watermain will connect via the existing 300 mm watermain along 8th Concession Road and will loop around the development and be stepped down to connect to the 150 mm watermain along County Road 42; and
- A 600 mm watermain expansion from 8th Concession Road to Lauzon Road along County Road 42 is outlined in the WUC Water System Master Plan (2020). When this expansion is complete the watermain from the development connected to the 150 mm watermain at 9th Concession will be connected to the new 600 mm watermain along County Road 42.

No pressure/flow testing has been completed for this development. During detailed design, pressure testing of the existing watermain on County Road 42 may be required.

The detailed design of the watermain services are to be consistent with the requirements of the City of Windsor and the EnWin Utilities (WUC) and will be coordinated with the City and WUC during the detailed design process. Placement of hydrants for adequate fire protection will be completed during detailed design.

6.0 Utilities

6.1 Gas

Existing natural gas service is available along County Road 42 for the west half of the development. A gas main extension may need to be completed in order to service the entire development. During detailed design, future conversation on loading will be required with Enbridge.

6.2 Bell

No information was given by Bell at this time. Additional consultation will be held with the utility owner to confirm site and internal servicing requirements during detailed design.

6.3 Cogeco

Cogeco service are available along 9th Concession Road but are not available along County Road 42 adjacent to the proposed development. Additional consultation will be held with the utility owner to confirm site and internal servicing requirements.

6.4 Power Distribution

Hydro One has an existing power line located in the immediate vicinity of the site. Coordination with Hydro One is required during detailed design.

7.0

Conclusion

The review of the adjacent services have been found to be sufficient for the proposed development. The design of the proposed internal services will be finalized during detailed design.

Yours sincerely,

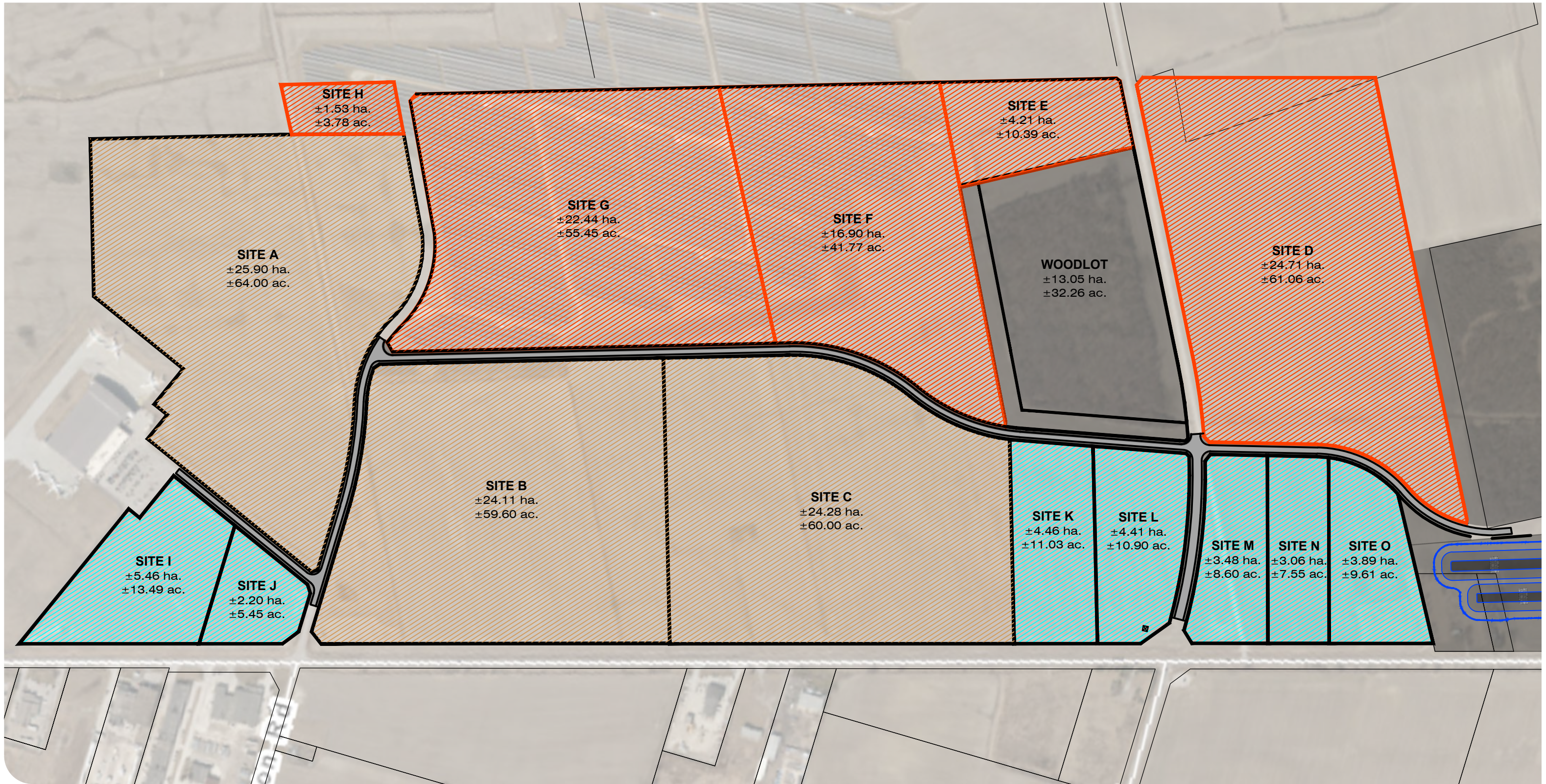
DILLON CONSULTING LIMITED




Tyler Nantais, P.Eng.
Project Engineer

Appendix A


Functional Servicing Plans





**THE CORPORATION OF THE CITY OF WINDSOR
FUTURE AIRPORT LAND DEVELOPMENT**

 PHASE 1
PROPOSED SUBJECT AREA
(±101.25 ha / 250.20 acre)

 PROPOSED INDUSTRIAL LOTS
(±74.29 ha / 183.57 acre)

 PROPOSED BUSINESS PARK LOTS
(±26.96 ha / 66.62 acre)

 PHASE 2
PROPOSED SUBJECT AREA
(±69.79 ha / 172.45 acre)

 PROPOSED SWM
PONDS

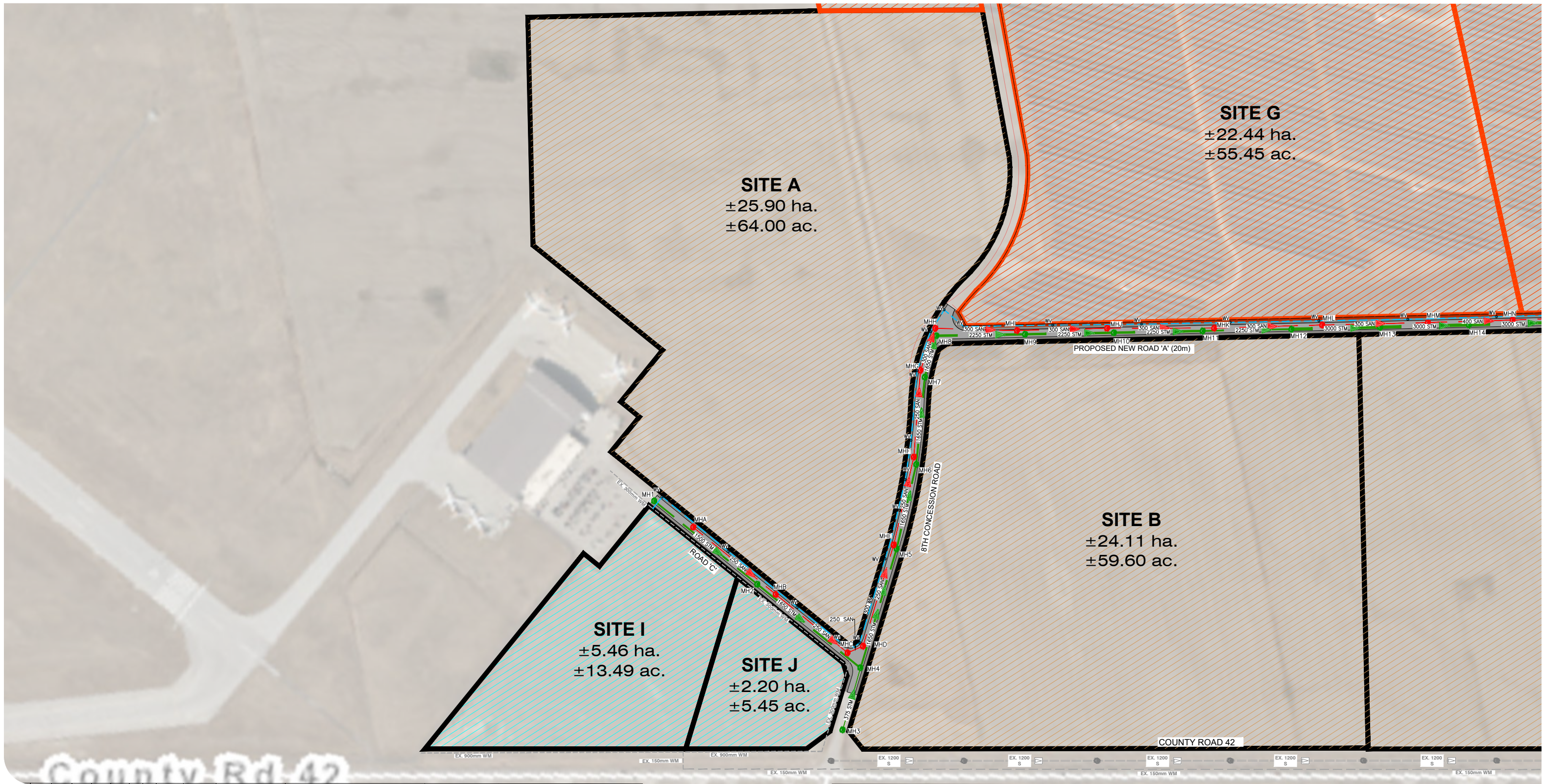
SERVICE PLAN
Figure 1

MAP/DRAWING INFORMATION
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. ALL DIMENSIONS AND BOUNDARY INFORMATION SHOULD BE VERIFIED BY AN O.L.S. PRIOR TO CONSTRUCTION.
CREATED BY: MRU
CHECKED BY: KDT
DESIGNED BY: KDT/MMM

SCALE: N.T.S



PROJECT: 23-5796
STATUS: FINAL
DATE: 08/25/2023



See Figure 3

THE CORPORATION OF THE CITY OF WINDSOR
AIRPORT LAND DEVELOPMENT

SERVICE PLAN
FIGURE 2

PHASE 1
PROPOSED SUBJECT AREA
(±101.25 ha / 250.20 acre)

PROPOSED INDUSTRIAL LOTS
(±74.29 ha / 183.57 acre)

PROPOSED BUSINESS PARK LOTS
(±26.96 ha / 66.62 acre)

PHASE 2
PROPOSED SUBJECT AREA
(±69.79 ha / 172.45 acre)

PROPOSED SANITARY SEWER

PROPOSED STORM SEWER

PROPOSED WATER MAIN

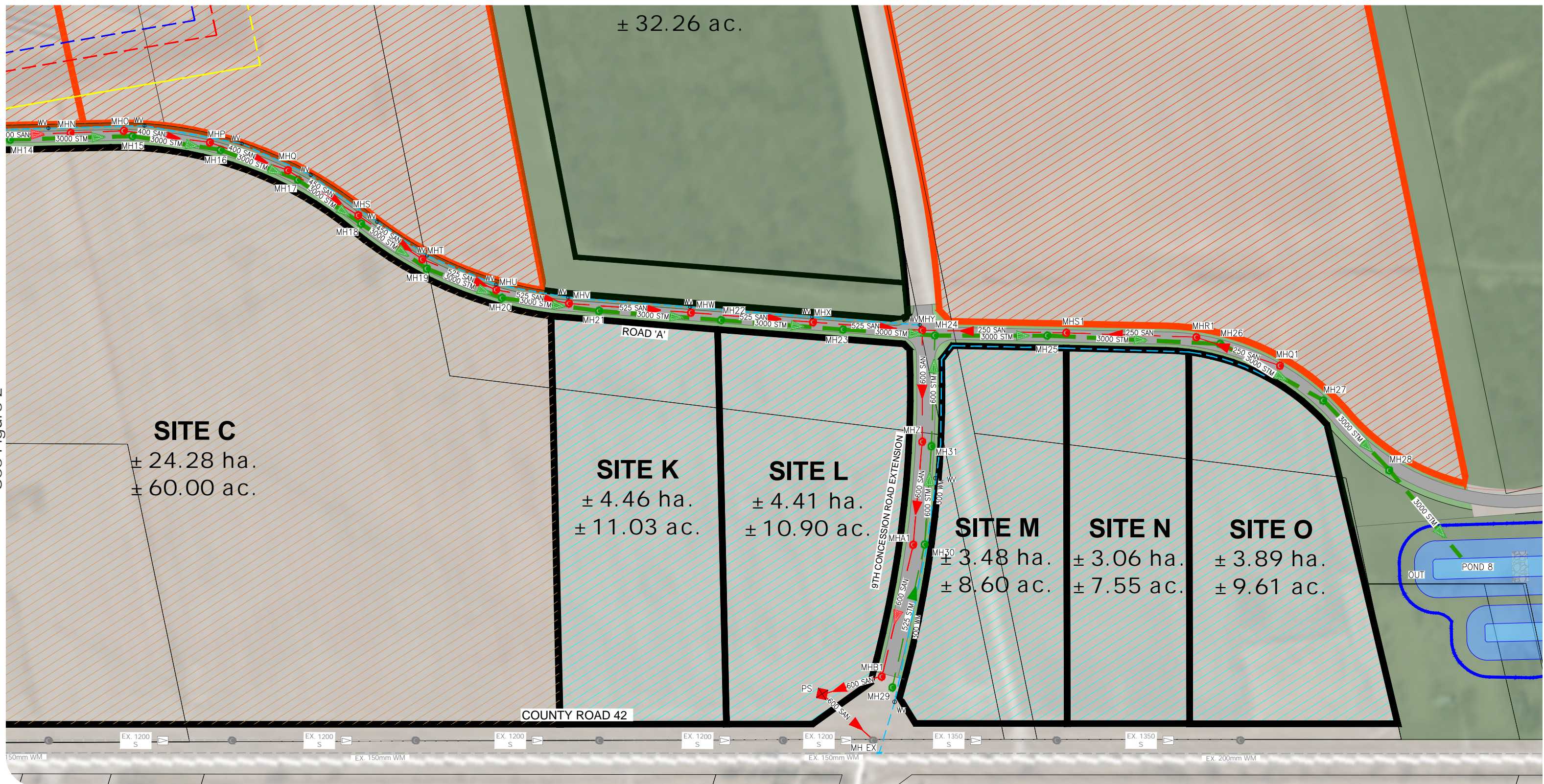
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CREATED BY: MRU
CHECKED BY:KDT
DESIGNED BY:KDT/MMM

SCALE: N.T.S



PROJECT: 23-5796
STATUS: FINAL
DATE: 08/28/2023

See Figure 2



THE CORPORATION OF THE CITY OF WINDSOR
AIRPORT LAND DEVELOPMENT

SERVICE PLAN
FIGURE 3



MAP/DRAWING INFORMATION
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CREATED BY: MRU
CHECKED BY: KDT
DESIGNED BY: KDT/MMM

SCALE: N.T.S



PROJECT: 23-5796
STATUS: FINAL
DATE: 08/28/2023

Appendix B

Design Sheets

WINDSOR AIRPORT DEVELOPMENT SANITARY SEWER DESIGN SHEET

Project Name: Windsor Airport Development
Project No: 23-5796

The Peaking Factor was derived:
Using Harmon Formula= **Y** (Y or N)
From a Table= **N**
Value from table=

Residential Average Daily Flow= **363** L/Cap.D
Peak Extraneous Flow= **0.156** L/Ha.S

Outlet Invert Elevation= **174.500**

Mannings 'n'= **0.013**

Basement Floor Elevation =

Total Area= **179.145**

Hydraulic Grade Line Cover = **2.40**

City of Windsor

ROAD/STN	Location		Flow Characteristics								Sewer Design/Profile								Cover				
	FROM MH	TO MH	INDIVIDUAL		CUMULATIVE		PEAKING	POP FLOW	PEAK EXTR.	PEAK DESIGN	CAPACITY	LENGTH	PIPE DIA.	Wall Thickness	SLOPE	UPPER INVERT	LOWER INVERT	FALL	VELOCITY	DROP IN LOWER MANHOLE	Ground Elevation Upper MH	Cover @ Up MH	Cover @ Low MH
			POP	AREA (ha.)	POP	AREA (ha.)	FACTOR M	Q(p) (L/s)	FLOW Q(i) (L/s)	FLOW Q(d) (L/s)	(L/s)	(m)	(mm)	(mm)	(%)	(m)	(m)	(m)	(m/s)	(m)	(m)	(m)	(m)
SITE I (ROAD C)	A	B	422.4	5.71	422	5.71	4.011	7.118	0.890	8.01	37.14	119.0	250	16	0.39	181.553	181.089	0.464	0.76	187.630	5.810	5.832	
SITE J (ROAD C)	B	C	195.8	2.65	618	8.35	3.925	10.195	1.303	11.50	37.14	104.4	250	16	0.39	181.089	180.682	0.407	0.76	187.187	5.832	6.225	
ROAD C	C	D	0.00	0.00	618	8.35	3.925	10.195	1.303	11.50	37.14	18.8	250	16	0.39	180.682	180.609	0.073	0.76	187.173	6.225	5.940	
8TH CON	D	E	0.00	0.00	618	8.35	3.925	10.195	1.303	11.50	37.14	119.5	250	16	0.39	180.609	180.143	0.466	0.76	186.815	5.940	6.182	
8TH CON	E	F	0.00	0.00	618	8.35	3.925	10.195	1.303	11.50	37.14	101.6	250	16	0.39	180.143	179.747	0.396	0.76	186.591	6.182	6.547	
8TH CON	F	G	0.00	0.00	618	8.35	3.925	10.195	1.303	11.50	37.14	97.9	250	16	0.39	179.747	179.365	0.382	0.76	186.560	6.547	6.251	
SITE A (8TH CON)	G	H	1876.4	27.59	2495	35.95	3.509	36.780	5.608	42.39	60.39	50.2	300	16	0.39	179.365	179.169	0.196	0.85	185.882	6.201	6.375	
SITE H (8TH CON)	I1	J1	104.0	1.53	104	1.53	4.239	1.853	0.239	2.09	37.14	100.0	250	16	0.39	180.966	180.576	0.390	0.76	185.630	4.398	4.742	
8TH CON	J1	K1	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	100.0	250	16	0.39	180.576	180.186	0.390	0.76	185.584	4.742	5.268	
8TH CON	K1	L1	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	44.7	250	16	0.39	180.186	180.012	0.175	0.76	185.720	5.268	5.317	
8TH CON	L1	M1	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	33.8	250	16	0.39	180.012	179.880	0.132	0.76	185.595	5.317	5.666	
8TH CON	M1	N1	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	44.0	250	20	0.39	179.880	179.708	0.172	0.76	185.812	5.662	5.986	
8TH CON	N1	O1	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	50.8	250	34	0.39	179.708	179.510	0.198	0.76	185.965	5.972	6.376	
8TH CON	O1	P1	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	46.6	250	34	0.39	179.510	179.328	0.182	0.76	186.170	6.376	6.248	
8TH CON	P1	H	0.00	0.00	104	1.53	4.239	1.853	0.239	2.09	37.14	40.8	250	34	0.39	179.328	179.169	0.159	0.76	185.860	6.248	6.407	
ROAD A	H	I	0.00	0.00	2599	37.48	3.495	38.155	5.847	44.00	74.90	92.0	300	16	0.60	179.169	178.617	0.552	1.06	185.860	6.375	6.936	
ROAD A	I	J	0.00	0.00	2599	37.48	3.495	38.155	5.847	44.00	68.38	101.5	300	16	0.50	178.617	178.109	0.508	0.97	185.869	6.936	7.117	
ROAD A	J	K	0.00	0.00	2599	37.48	3.495	38.155	5.847	44.00	68.38	120.0	300	16	0.50	178.109	177.509	0.600	0.97	185.542	7.117	7.491	
SITE B (ROAD A)	K	L	1702.6	25.04	4301	62.52	3.305	59.725	9.753	69.48	147.26	120.0	400	16	0.50	177.509	176.909	0.600	1.17	185.317	7.391	7.802	
ROAD A	L	M	0.00	0.00	4301	62.52	3.305	59.725	9.753	69.48	147.26	119.0	400	16	0.50	176.909	176.314	0.595	1.17	185.128	7.802	8.096	
SITE G (ROAD A)	M	N	1525.9	22.44	5827	84.96	3.183	77.921	13.253	91.17	95.44	95.1	400	16	0.21	176.314	176.115	0.200	0.76	184.826	8.096	8.120	
ROAD A	N	O	0.00	0.00	5827	84.96	3.183	77.921	13.253	91.17	95.44	43.5	400	16	0.21	176.115	176.023	0.091	0.76	184.651	8.120	8.050	
ROAD A	O	P	0.00	0.00	5827	84.96	3.183	77.921	13.253	91.17	95.44	71.0	400	16	0.21	176.023	175.874	0.149	0.76	184.489	8.050	7.945	
ROAD A	P	Q	0.00	0.00	5827	84.96	3.183	77.921	13.253	91.17	95.44	67.7	400	16	0.21	175.874	175.732	0.142	0.76	184.235	7.945	7.990	
SITE C (ROAD A)	Q	S	1718.4	25.27	7546	110.23	3.075	97.484	17.196	114.68	120.96	68.2	450	16	0.18	175.732	175.609	0.123	0.76	184.138	7.940	7.894	
ROAD A	S	T	0.00	0.00	7546	110.23	3.075	97.484	17.196	114.68	120.96	69.4	450	16	0.18	175.609	175.485	0.125	0.76	183.969	7.894	7.935	
SITE F (ROAD A)	T	U	1149.2	16.90	8695	127.13	3.015	110.130	19.832	129.96	160.91	65.4	525	16	0.14	175.485	175.393	0.092	0.74	183.886	7.860	7.956	
ROAD A	U	V	0.00	0.00	8695	127.13	3.015	110.130	19.832	129.96	160.91	60.5	525	16	0.14	175.393	175.308	0.085	0.74	183.889	7.956	7.878	
SITE K (ROAD A)	V	W	330.0	4.46	9025	131.59	2.999	113.706	20.528	134.23	160.91	100.0	525	16	0.14	175.308	175.168	0.140	0.74	183.727	7.878	7.874	
ROAD A	W	X	0.00	0.00	9025	131.59	2.999	113.706	20.528	134.23	160.91	100.0	525	16	0.14	175.168	175.028	0.140	0.74	183.583	7.874	7.939	
SITE L (ROAD A)	X	Y	432.8	5.85	9458	137.44	2.979	118.360	21.440	139.80	160.91	89.4	525	16	0.14	175.028	174.903	0.125	0.74	183.509	7.939	8.065	
SITE O (9TH CON)	Q1	R1	287.9	3.89	288	3.89	4.086	4.942	0.607	5.55	37.14	72.4	250	34	0.39	176.059	175.777	0.282	0.76	183.251	6.908	7.398	
SITE N (9TH CON)	R1	S1	226.4	3.06	514	6.95	3.968	8.574	1.084	9.66	37.14	106.2	250	16	0.39	175.777	175.362	0.414	0.76	183.458	7.416	8.294	
SITE M (9TH CON)	S1	Y	306.8	4.1463	821	11.10	3.854	13.294	1.731	15.03	37.14	117.7	250	16	0.39	175.362	174.903	0.459	0.76	183.922	8.294	8.340	
SITE E (9TH CON)	C1	D1	286.3	4.21	286	4.21	4.087	4.916	0.657	5.57	37.14	100.0	250	16	0.39	177.321	176.931	0.390	0.76	183.478	5.891	6.332	
9TH CON	D1	E1	0.00	0.00	286	4.21	4.087	4.916	0.657	5.57	37.14	100.0	250	16	0.39	176.931	176.541	0.390	0.76	183.529	6.332	6.755	
9TH CON	E1	F1	0.00	0.00	286	4.21	4.087	4.916	0.657	5.57	37.14	100.0	250	16	0.39	176.541	176.151	0.390	0.76	183.562	6.755	7.382	
9TH CON	F1	G1	0.00	0.00	286	4.21	4.087	4.916	0.657	5.57	37.14	100.0	250	16	0.39	176.151	175.761	0.390	0.76	183.799	7.382	7.737	
SITE D (9TH CON)	G1	H1	1795.4	26.40	2082	30.61	3.572	31.242	4.776	36.02	37.14	100.0	250	16	0.39	175.761	175.371	0.390	0.76	183.764	7.737	8.189	
9TH CON	H1	Y	0.00	0.00	2082	30.61	3.572	31.242	4.776	36.02	37.14	120.0	250	16	0.39	175.371	174.903	0.468	0.76	183.826	8.189	8.340	
9TH CON	Y	Z	0.00	0.00	12360	179.15	2.863	148.666	27.947	176.61	212.70	91.1	600	16	0.12	174.903	174.794	0.109	0.75	183.509	7.990	8.136	
9TH CON	Z	A1	0.00	0.00	12360	179.15	2.863	148.666	27.947	176.61	212.70	84.6	600	16	0.12	174.794	174.692	0.102	0.75	183.545	8.136	8.368	
9TH CON	A1	B1	0.00	0.00	12360	179.15	2.863	148.666	27.947	176.61	212.70	111.9	600	16	0.12	174.692	174.558	0.134	0.75	183.676	8.368	8.427	
9TH CON	B1	PS	0.00	0.00	12360	179.15	2.863	148.666	27.947	176.61	212.70	48.4	600	16	0.12	174.558	174.500	0.058	0.75	183.601	8.427	8.484	

PS OUTLET

Part of Phase 2 Area

**WINDSOR AIRPORT DEVELOPMENT
STORM SEWER DESIGN SHEET**

Intensity Option # **1**

Project Name: Windsor Airport Development
Project Number: 23-5796

1) Intensity (i) = a/(t+b)^c 2) Intensity (i) = a*t^b 3) Insert Intensity

Based on 1:10 Year Storm Event
City of Windsor

a= 1511.000
b= 9.500
c= 0.845

a=
b=

i=

Manning's n = 0.013

Total Area (ha)= 109.31 Outlet Invert Elevation= 178.500 ation @ Outlet = 183.50

Location					Sewer Design / Profile										Cover							
Road /Stations	From MH	To MH	Area (ha)	Run. Coef.	2.78AC	Accum. 2.78AC	T of In (min)	T of F (min)	T of Conc. (min)	Intensity (mm/hr)	Exp. Flow (L/s)	Capacity (L/s)	Velocity (m/s)	Length (m)	Pipe Dia. (mm)	Slope (%)	Invert Up MH	Invert Low MH	Fall (m)	Ground Elev Up MH	Cover @ Up MH (m)	Cover @ Low MH (m)
SITE I (ROAD C)	1	2	5.71	0.90	14.28	14.28	20.0	2.78	20.00	86.55	1236.29	1580.65	0.89	149.4	1500	0.05	180.425	180.350	0.07	187.630	5.70	5.34
SITE J (ROAD C)	2	4	2.56	0.90	6.39	20.68	20.0	2.62	22.78	80.20	1658.29	2038.05	0.95	149.9	1650	0.05	180.350	180.275	0.07	187.187	5.19	4.89
8TH CON	3	4	0.23	0.90	0.57	0.57	20.0	1.38	20.00	86.55	49.09	96.03	0.87	72.0	375	0.30	180.491	180.275	0.22	187.173	6.31	6.16
8TH CON	4	5	0.27	0.90	0.67	21.91	20.0	2.46	25.40	75.08	1645.04	2038.05	0.95	140.7	1650	0.05	180.275	180.205	0.07	186.815	4.89	4.74
8TH CON	5	6	0.19	0.90	0.48	22.39	20.0	1.44	27.86	70.88	1587.32	2411.46	1.13	97.5	1650	0.07	180.205	180.137	0.07	186.591	4.74	4.77
8TH CON	6	7	0.19	0.90	0.47	22.86	20.0	1.46	29.30	68.65	1569.43	2411.46	1.13	98.8	1650	0.07	180.137	180.067	0.07	186.560	4.77	4.16
8TH CON	7	8	0.08	0.90	0.20	23.06	20.0	0.71	30.76	66.54	1534.49	2411.46	1.13	48.4	1650	0.07	180.067	180.034	0.03	185.882	4.16	4.18
ITE A & H (ROAD A)	8	9	27.80	0.90	69.57	92.63	20.0	1.11	31.48	65.56	6072.77	7698.91	1.51	100.0	2550	0.07	180.034	179.964	0.07	185.860	3.28	3.36
ROAD A	9	10	0.20	0.90	0.49	93.12	20.0	1.11	32.58	64.10	5969.07	7698.91	1.51	100.0	2550	0.07	179.964	179.894	0.07	185.869	3.36	3.10
ROAD A	10	11	0.20	0.90	0.49	93.61	20.0	1.19	33.69	62.71	5870.73	7127.81	1.40	100.0	2550	0.06	179.894	179.834	0.06	185.542	3.10	2.93
ROAD A	11	12	0.20	0.90	0.49	94.10	20.0	1.19	34.88	61.29	5767.06	7127.81	1.40	100.0	2550	0.06	179.834	179.774	0.06	185.317	2.93	2.80
SITE B (ROAD A)	12	13	24.31	0.90	60.83	154.93	20.0	0.99	36.08	59.93	9284.14	11875.33	1.68	100.0	3000	0.07	179.774	179.704	0.07	185.128	2.35	2.12
ROAD A	13	14	0.20	0.90	0.50	155.43	20.0	0.99	37.07	58.85	9146.38	11875.33	1.68	100.0	3000	0.07	179.704	179.634	0.07	184.826	2.12	2.02
ROAD A	14	15	0.20	0.90	0.50	155.93	20.0	0.99	38.06	57.81	9013.93	11875.33	1.68	100.0	3000	0.07	179.634	179.564	0.07	184.651	2.02	1.93
ROAD A	15	16	0.14	0.90	0.36	156.29	20.0	0.78	39.05	56.81	8878.60	10994.42	1.56	72.78	3000	0.06	179.564	179.520	0.04	184.489	1.93	1.72
ROAD A	16	17	0.14	0.90	0.34	156.64	20.0	0.72	39.83	56.05	8779.00	10994.42	1.56	67.63	3000	0.06	179.520	179.479	0.04	184.235	1.72	1.66
ROAD A	17	18	0.13	0.90	0.31	156.95	20.0	0.67	40.56	55.36	8688.89	10994.42	1.56	62.9	3000	0.06	179.479	179.442	0.04	184.138	1.66	1.53
ROAD A	18	19	0.13	0.90	0.33	157.27	20.0	0.70	41.23	54.74	8609.00	10994.42	1.56	65.0	3000	0.06	179.442	179.403	0.04	183.969	1.53	1.48
ROAD A	19	20	0.13	0.90	0.33	157.60	20.0	0.70	41.93	54.11	8528.08	10994.42	1.56	65.8	3000	0.06	179.403	179.363	0.04	183.886	1.48	1.53
SITE C (ROAD A)	20	21	24.44	0.90	61.14	218.74	20.0	0.66	42.63	53.49	11701.22	14193.73	2.01	80.1	3000	0.10	179.363	179.283	0.08	183.889	1.53	1.44
SITE K (ROAD A)	21	22	4.66	0.90	11.66	230.41	20.0	0.79	43.30	52.92	12193.96	14886.51	2.11	100.0	3000	0.11	179.283	179.173	0.11	183.727	1.44	1.41
SITE L (ROAD A)	22	23	4.61	0.90	11.54	241.95	20.0	0.83	44.09	52.26	12644.67	14193.73	2.01	100.0	3000	0.10	179.173	179.073	0.10	183.583	1.41	1.44
	23	24	0.20	0.90	0.50	242.44	20.0	0.62	44.92	51.59	12507.15	14193.73	2.01	75.1	3000	0.10	179.073	178.998	0.08	183.509	1.44	1.92
9TH CON	29	30	0.55	0.90	1.39	1.39	20.0	2.37	20.00	86.55	119.90	182.46	0.84	120.0	525	0.18	179.462	179.246	0.22	183.601	3.61	3.90
9TH CON	30	31	0.25	0.90	0.63	2.01	20.0	1.62	22.37	81.07	163.05	237.81	0.84	81.7	600	0.15	179.246	179.124	0.12	183.676	3.83	3.82
9TH CON	31	24	0.21	0.90	0.51	2.52	20.0	1.85	23.99	77.75	196.29	229.74	0.81	90.1	600	0.14	179.124	178.998	0.13	183.545	3.82	4.32
SITE M (ROAD A)	24	25	3.63	0.90	9.09	254.06	20.0	0.76	45.54	51.09	12980.90	14193.73	2.01	91.6	3000	0.10	178.998	178.906	0.09	183.922	1.92	1.55
SITE N (ROAD A)	25	26	3.34	0.90	8.37	262.43	20.0	1.17	46.30	50.50	13253.88	14193.73	2.01	141.4	3000	0.10	178.906	178.765	0.14	183.458	1.55	1.49
SITE O (ROAD A)	26	27	4.27	0.90	10.68	273.11	20.0	0.79	47.48	49.62	13552.84	14193.73	2.01	94.8	3000	0.10	178.765	178.670	0.09	183.251	1.49	1.77
ROAD A	27	28	0.16	0.90	0.40	273.51	20.0	0.65	48.26	49.05	13416.09	14193.73	2.01	78.5	3000	0.10	178.670	178.592	0.08	183.445	1.77	1.78
	28	OUTLET	0.00	0.90	0.00	273.51	20.0	0.76	48.92	48.59	13289.59	14193.73	2.01	91.6	3000	0.10	178.592	178.500	0.09	183.372	1.78	2.00