

Draft Plan of Subdivision Servicing Report

Secret Garden Residential Subdivision

*Located between Tourangeau Road
and Allyson Avenue
Windsor, Ontario*

Our Project No. 19-134

April 5, 2024

Catherine Girgis, P.Eng.
Project Engineer

SUBMITTED TO:
The Corporation of the City of Windsor

INDEX

<u>NO.</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.	INTRODUCTION.....	1
2.	SITE CHARACTERISTICS AND LAND USE	2
3.	SANITARY SEWERAGE.....	5
4.	STORMWATER MANAGEMENT	7
5.	STORMWATER QUALITY DURING CONSTRUCTION.....	10
6.	WATER SUPPLY.....	11

List of Figures

Figure 1 – Aerial Photograph of Existing Site

Figure 2 – Key Plan

Figure 3 – Subdivision Layout

Appendices

Appendix A Sanitary Sewer Design Calculations

Appendix B Central Avenue Pond Report, prepared by D.C. McCloskey Engineering Limited,
dated 25 January, 2021

Appendix C Essex Region Conservation Authority – Permit #9-21 - Place and Grade Fill

The Corporation of the City of Windsor – Central Pond

Cover Letter

Permit

Application

Appendix D Storm Sewer Hydraulic Design Sheet

Appendix E Modeling Catchbasins and Inlets in SWMM

1. INTRODUCTION

1.1 General

Haddad, Morgan and Associates Ltd. has been retained by the Owner (Olivia Construction Homes Inc.) of the proposed Secret Garden Residential Subdivision to prepare a servicing report for a proposed residential development in the City of Windsor.

This report has been prepared as support documentation for the Draft Plan of Subdivision process. The purpose of this report is to present the proposed servicing of the subject lands. This includes roads, sanitary and storm sewers, water supply; as well as electrical and telecommunications services.

The proposed Secret Garden Residential Subdivision is generally bounded by Grand Marais Road East to the north, Pillette Drain No. 1 to the south, Tourangeau Road to the east, and Allyson Avenue to the west.

The site is currently vacant. Refer to Figure 1, which shows the subject property in its undeveloped state.



Figure 1 – Aerial Photograph of Existing Site

2. SITE CHARACTERISTICS AND LAND USE

2.1 General

The subdivision area is comprised of a total of 1.06 hectares (2.62 acres). The legal description of the Secret Garden lands is Part of Block 21, Plan 12M-417 and Part of Lot 105, Concession 2 – Geographic Township of Sandwich East – now in the City of Windsor – County of Essex, Ontario.

The proposed development consists of vacant land, which is currently designated as Residential. The proposed subdivision will include 28 residential units; which includes 14 units on Street 'A' and 14 units on Loon Street.

A site location plan and Proposed Site Layout are shown in Figures 2 and 3.

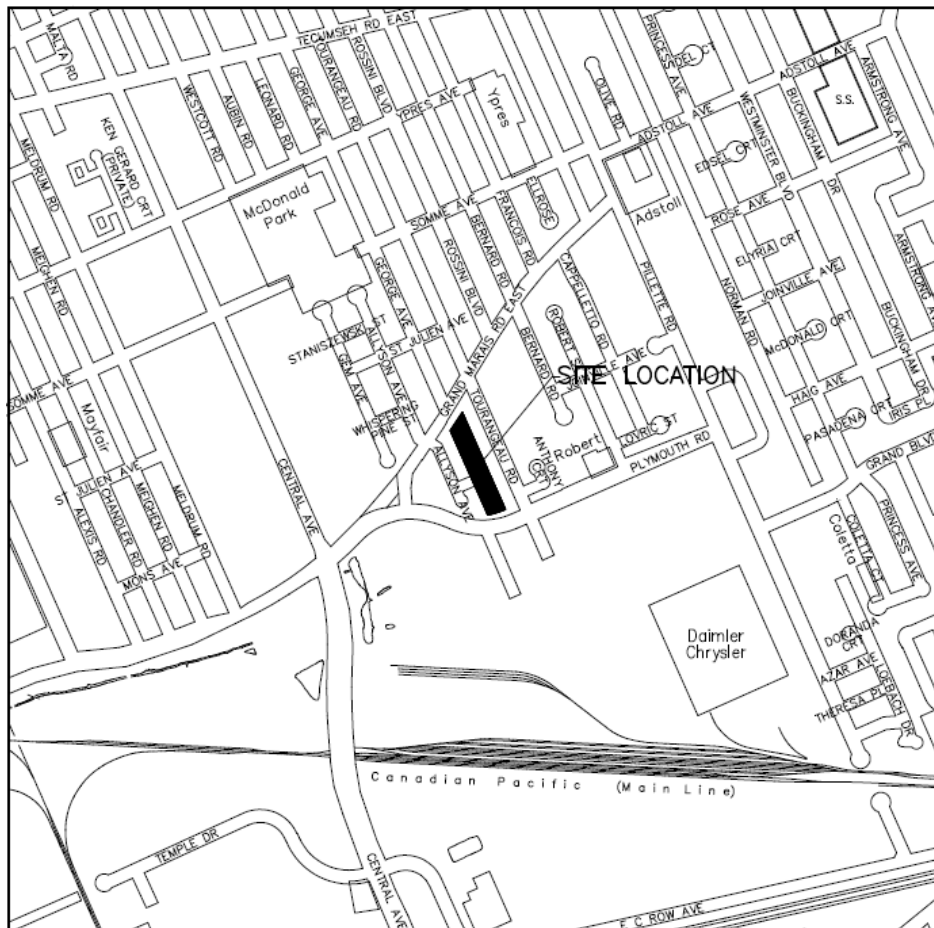


Figure 2 – Key Plan

2.2 Topography

Topographic information was obtained from a topographic survey provided by an Ontario Land Surveyor, as well as mapping provided by the City of Windsor, Geomatics Division of the Public Works Department. The area under study can be defined as relatively flat. The natural gradient of the land generally falls in a westerly direction.

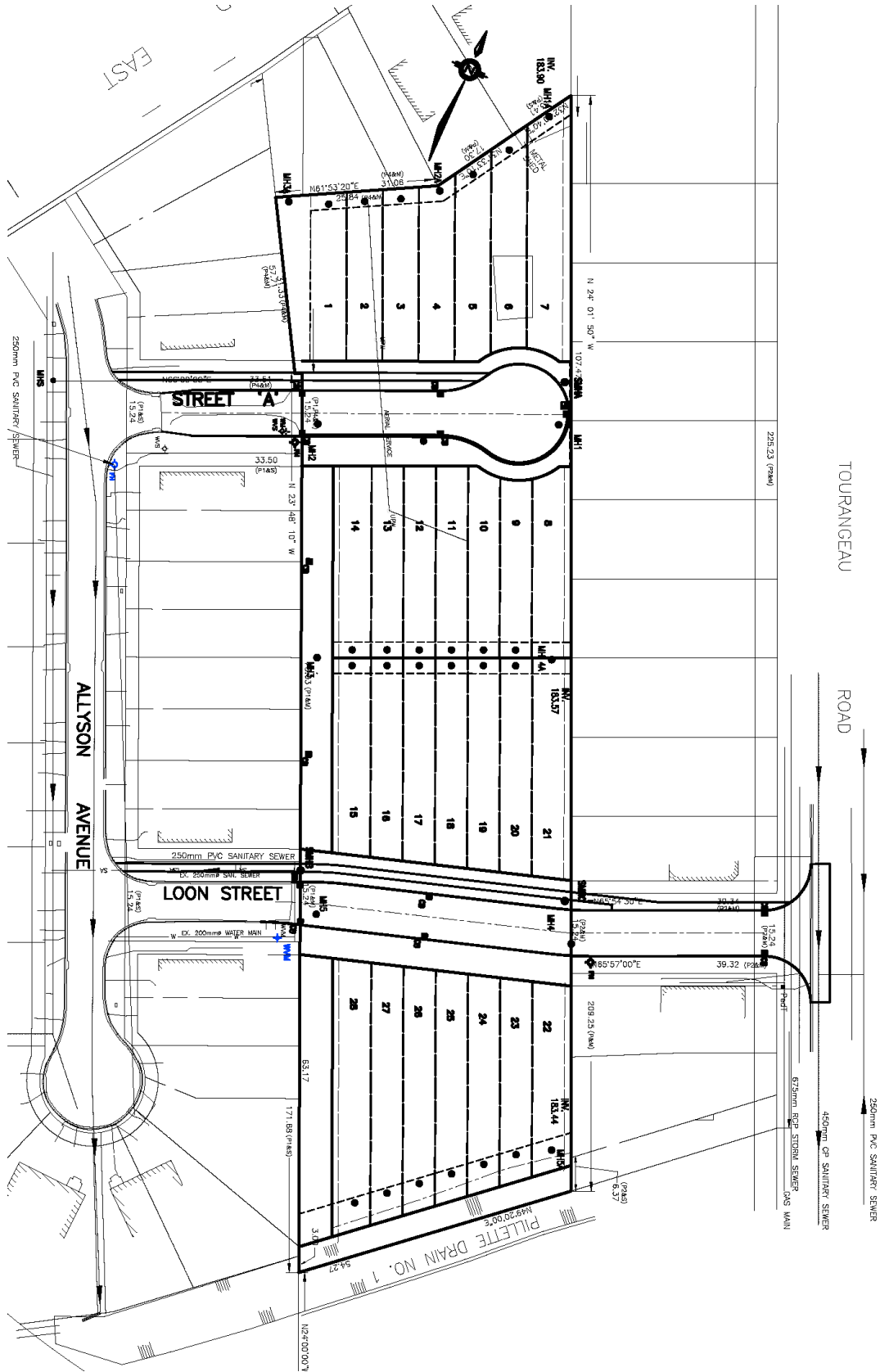


Figure 3 – Subdivision Layout

2.3 Soil Classification

The majority of the area consists of Brookston Clay Loam, having slow infiltration rates.

Symbol	Bcl
Name of Soil	Brookston Clay Loam
Description of Surface and Subsoil	Dark clay loam over mottled and blue-grey gritty clay and clay loam; few stones.
Topography and Drainage	Almost level with poor natural drainage.

In according with Windsor/Essex Region Stormwater Management Standards Manual, Brookston Clay Loam fall within the Hydrologic Group D.

A runoff coefficient of 0.20 for clay soil was used in the stormwater analysis.

2.4 Zoning

The proposed development lies within the Fountain Bleu Planning District and is zoned Medium Density Housing RD2.1, which allows single-unit, duplex, semi-detached housing units. The lands are surrounded with existing residential housing on 3 sides. The site is currently subject to an application for re-zoning.

2.5 Existing Infrastructure

Based on the City of Windsor Sewer Atlas, a topographic survey and record drawings for Allyson Avenue, the current property is serviced by the following:

Roads	Road connection at the east limit of the Allyson Avenue right-of-way. Existing road on Tourangeau Road
Sanitary	Road connection on Loon Street at the west property line 250 mm diameter PVC sanitary sewer stub on Street `A`, immediately east of Allyson Avenue 250 mm diameter PVC sanitary sewer stub on Loon Street, immediately west of the west property line
Storm Water	Pillette Drain No. 1 located at the south end of the site 150 mm diameter watermain on Street `A` 200 mm diameter watermain on Loon Street
Electrical Supply	Electrical plant on Allyson Avenue and Tourangeau Road
Gas Supply	Gas piping on Allyson Avenue and Tourangeau Road

3. SANITARY SEWERAGE

3.1 Existing Sanitary Sewers

The existing 250 mm diameter sanitary sewers are located on Street `A` east of Allyson Avenue and on Loon Street immediately west of the site. The sanitary sewers have depths of approximately 2.9 metres (~ 9.6' feet).

3.2 Sanitary Drainage Area

The proposed drainage areas included Street `A` and Loon Street developments. The Street `A` drainage area is approximately 0.5 hectares and includes 14 residential units. The Loon Street drainage area is approximately 0.56 hectares and includes 14 residential units.

3.3 Design Criteria

3.3.1 Design Parameters

The design of the sanitary sewers for the area are based on the latest City of Windsor standards, as outlined in their Development Manual. The design criteria are as follows:

3.3.1.1 The design criteria for sanitary sewers shall be as follows:

- Residential sewage flow 0.0042 litre/second/capita = 363 Litres/day/capita
- Infiltration 0.1560 litre/second/hectare
- Minimum velocity 0.75 metres per second
- Maximum velocity 3.00 metres per second

3.3.1.2 The ultimate flow shall be determined from the following formula:

$$Q \text{ (Ultimate)} = \text{Residential Sewage Flow} \times \text{Ultimate Population Served} \times \text{Ultimate Flow Factor} + \text{Infiltration}$$

3.3.1.3 The ultimate population to be served by the sanitary sewers was based on 3.5 persons per unit.

3.3.1.4 Peaking Factor

Once average flows have been determined, peaking factors must be applied to establish peak flows for which to design sanitary systems. Variations in flow from the average become less as the serviced population and area increases. The City of Windsor standard peaking factors provides the Ultimate Flow Factor as a function of population. The ultimate flow factor shall be taken from the following table:

Ultimate Flow Factor by Population

Population	Ultimate Flow Factor
1,000	6.00
1,500	5.75
2,000	5.55
2,500	5.35
3,000	5.20
4,000	4.92
6,000	4.50
8,000	4.15
10,000	3.90
15,000	3.40
20,000	3.20

Where population values fall between the population values, a linear interpolation was performed.

- 3.3.1.5 Manning’s Roughness Coefficient “n” factor (smooth walled sewer pipes only) shall be $n = 0.013$.

- 3.3.1.6 City of Windsor standards state that the minimum pipe velocity of 0.75 metres per second. This can be achieved with a minimum slope of 0.39% for a 250 mm diameter pipe. It is recommended that a minimum slope of 0.44% be used, in order to achieve a velocity of 0.80 metres per second.

- 3.3.1.7 All pipe crossings shall be designed and constructed in accordance with the Standard Drawing AS-312 unless otherwise approved by the City Engineer.

- 3.3.1.8 All pipes used as sanitary sewers shall be approved by the City Engineer and shall conform to the latest City of Windsor Specifications.

- 3.3.1.9 An application to the Ministry of the Environment, Conservation and Parks shall be submitted to the City of Windsor for signature prior to submission to the Ministry.

3.4 Analysis on Existing Sanitary Sewer Outlet

The proposed sanitary sewers shall outlet to existing 250 mm diameter sanitary sewers on Allyson Avenue; which are connected downstream to an existing sanitary sewer under Plymouth Drive. This sewer is denoted as a 250 mm diameter pipe on the City of Windsor Sewer Atlas and a 200 mm diameter pipe on the Allyson Avenue Subdivision As-Constructed drawings. For the purposes of this analysis, a 200 mm diameter sanitary sewer was assumed. Based on the calculations, the receiving sewer is flowing at a capacity of 28%. Based on our analysis, the 200 mm diameter sewer has sufficient capacity to receive the sanitary effluent from the combined Secret Garden / Allyson Avenue Subdivisions.

3.5 Recommended Design

It is proposed that 250 mm diameter sewers be constructed on Street `A` and Loon Street. The new sewers shall outlet to existing 250 mm diameter sewers. The proposed sewers have been illustrated on civil design drawings 1 – Infrastructure – Plans and Profiles – Storm Sewer Easement and Street `A`, drawing 2 – Infrastructure – Plan and Profile – Loon Street, and drawing 5 – Sanitary and Storm Drainage – Parameters and Boundaries.

See Appendix A for the Sanitary Sewer Design sheet, which includes the outlet sewer located on Allyson Avenue. The sanitary sewer layout is depicted in drawings 1 – Infrastructure – Plans and Profiles – Storm Sewer Easement and Street `A` and 2 – Infrastructure – Plan and Profile – Loon Street.

4. STORMWATER MANAGEMENT

4.1 General

The proposed Secret Garden Residential Subdivision is generally bounded by Grand Marais Road East to the north, Pillette Drain No. 1 to the south, Tourangeau Road to the east, and Allyson Avenue to the west. The property lies within the Pillette Drain No. 1 drainage area, which drains to the Central Pond and eventually, to the Grand Marais Drain.

4.2 Reference Stormwater Management Report

The following report was relied upon as the basis for the storm sewer design and the outlet storm water quantity and quality conditions:

- Central Avenue Pond Report, prepared by D.C. McCloskey Engineering Limited, dated 25 January, 2021 (Appendix B)

In addition to the report, we relied upon the Essex Region Conservation Authority Permit #9-21. (Appendix C)

4.3 Objective

The main objective for the Stormwater Management is to design a suitable storm sewer system, which will service the proposed development.

4.4 Design Criteria for Stormwater Management

The storm sewers were designed in accordance with parameters outlined in the Windsor/Essex Region Stormwater Management Standards Manual, dated December 6, 2018

4.4.1 Rainfall Intensity

Design Storm Intensities: The design storm intensity shall be calculated using

Rainfall Intensity $i = \frac{A}{(T + B)^c}$ where Intensity (i) = mm/hr.
 Time (T) = minutes
 of concentration

1:5 year return frequency $i_5 = \frac{1259}{(T + 8.8)^{0.838}}$

1:100 year return frequency $i_{100} = \frac{2375}{(T + 11)^{0.861}}$

4.4.2 Design Criteria for Storm Sewers

Storm sewers were designed using the Rational Method to calculate the total peak runoff from the drainage area.

Rational Formula $Q = C i A/360$
 Where $Q =$ Peak runoff rate (m³/s)
 $C =$ Coefficient of Runoff
 $A =$ Tributary Area (hectares)
 $i_5 =$ Rainfall Intensity (mm/hour)
 $t_c =$ Time of Concentration (min)

Runoff coefficients for the various land surfaces are as follows:

Buildings	C = 0.95
Pavement	C = 0.95
Landscaping	C = 0.20

The following are the calculations for the runoff coefficients for Streets 'A' and Loon Street:

Street 'A'	A (m ²)	C	Runoff Coefficient
Total	5281.8		
Road	1742	0.95	
Building	1103.7	0.95	
Landscape	2436.1	0.20	
			0.60
Loon Street			
	A (m ²)	C	
Total	5111.5		
Road	1492.1	0.95	
Building	1043.8	0.95	
Landscape	2575.6	0.20	
			0.57

Combined		
	A (m ²)	C
Total	10,393.3	
Road	3234.1	0.95
Building	2147.5	0.95
Landscape	5011.7	0.20
		0.59

Based on the estimate of the proposed runoff coefficient, a value of 0.60 was assumed.

The storm sewers were initially designed using the 1:5-year return frequency storm. This resulted in storm pipe sizes ranging from 375 mm diameter to 965 x 1525 mm elliptical (equivalent 1200 mm diameter). In order to ensure that the 1:100-year return frequency storm would adequately be conveyed to the outlet, the sewers were designed to handle the 100-year storm event without flooding the streets. The minimum inlet time of concentration was assumed to be 15 minutes. The sewer capacities were calculated based on submerged conditions, using the water levels in the outlet drain, Pillette Drain No. 1. The velocities of the proposed sewers shall range between 0.80 and 0.84 metres per second gravity conditions. For maintenance purposes, A 6 m wide easement shall be provided along the west property line. The storm sewer design calculations are included in Appendix D.

4.4.2.1 Catch Basin Analysis

In order to ensure that the design flows are directed underground to the proposed sewers, an analysis of the capacities of the catch basins was conducted. The analysis was based on the method presented in Modeling Catchbasins and Inlets in SWMM, Method 4: Orifices Representing Grates. The reference information and analysis are provided in Appendix E. Providing a factor of safety, we are recommending that two sets of catch basins be installed on each of Street 'A' and Loon Street.

4.4.2.2 Private Storm Drain Connections

As requested by the developer and in consultation with the Building and Engineering Departments, it is recommended that private storm drain connections from residential units not be provided. The proposed townhouses shall be constructed with slabs on grade and shall be drained on grade via splash-blocking. Rear yard drain catch basins shall be provided and shall outlet to shared rear-yard drainage piping.

4.4.2.3 Runoff Control and Storage Requirement

Based on the Central Avenue Pond Report, prepared by D.C. McCloskey Engineering Limited, the authors confirmed "... that the existing storm sewer system can convey a standard 5-year minor design storm from a fully developed condition without surface ponding ..."

In addition, the report states, "For the 100-year major design storm, our analyses showed that local sewer combined with overland flow along roadways can effectively convey flows to the main drainage pathway, which can convey the 100-year flows to the pond. The main drainage pathway consists of the Grand Marais Drain open channel section (former Pillette No. 1 Drain) from Central Pond to Tourangeau Rd ..."

In order to properly size the storm sewers, the high-water levels in the receiving Pillette Drain No. 1 were considered. The boundary conditions used are as follows:

5-year high water level	184.146
100-year high water level	184.948

4.4.3 Recommended Design

The following storm sewer design is proposed:

Street `A`	MH1	to	MH2	675 mm diameter precast concrete pipe	0.12%
Street `A` outlet pipe	MH2	to	MH3	825 mm diameter precast concrete pipe	0.09%
Street `A` outlet pipe	MH3	to	MH5	865 x 1345 mm precast concrete pipe *	0.07%
Loon Street	MH4	to	MH5	675 mm diameter precast concrete pipe	0.12%
Outlet Sewer	MH5	to	Pillette Drain No. 1	965 x 1525 mm precast concrete pipe *	0.06%

* Elliptical pipes have been recommended in order to meet the City of Windsor’s minimum cover requirement of 1.0 m.

Pipe material shall be precast concrete pipe or a substitute approved by the City of Windsor.

- Sewers shall be constructed in accordance with the City of Windsor standard and specifications.
- Manholes shall have a minimum sump depth of 450 mm
- Single catch basin connections shall be a minimum 200 mm diameter pipe.
- Double catch basin connections shall be a minimum 250 mm diameter pipe
- Private storm drain connections shall not be provided; however, properly sized sewers shall be located, fronting all residential units
- Rear yard drains shall be provided for each dwelling unit

Storm Sewer Hydraulic Design Sheet is included in Appendix D.

The pipe outlet to Pillette Drain No. 1 shall be surrounded in rip-rap, in order to reduce scouring of the open drain. The proposed outlet invert shall be 300 mm above the drain invert.

5. STORMWATER QUALITY DURING CONSTRUCTION

The following temporary quality treatment technique must be provided during the construction period. We recommend that the standard quality measure during construction be employed as follows:

Sediment Control Measures

1. Protect all exposed surfaces and control all runoff during construction.
2. Keep all erosion control measures in place prior to starting construction and until restoration is complete.
3. Maintain erosion control measures during construction.
4. Dispose of all collected sediment at an approved location.
5. Keep area disturbed during construction to a minimum.
6. Dispose of all dewatering in an approved sedimentation basin.

7. Protect all catch basins, manholes and pipe ends from sediment intrusion including placing filter fabric on top of the catch basins (under grates).
8. Keep all sumps clean during construction.
9. Prevent windblown dust.
10. Provide perimeter swales on the sides of the topsoil stockpiles to direct flow to stone sediment pits, which will entrap sediments.
11. Use straw bales as directed by the Engineer during construction.
12. Maintain the grade of the boulevard (during construction) 150 mm below the top of the concrete curb. The curb will form a dike that will restrict, to a great degree, the movement of sediments to the storm sewer system.

6. WATER SUPPLY

The proposed water mains are to be connected to existing mains on the west side of the subdivision. A 150 mm diameter watermain is proposed for Street 'A', which will be connected to an existing 150 mm diameter watermain stub. A 200 mm diameter watermain is proposed for Loon Street, which will be connected to existing watermain on both Allyson Avenue and Tourangeau Road. The water networks shall include fire hydrants for fire protection.

All water mains shall be constructed in accordance with the requirements of Windsor Utilities Commission and the Ministry of Environment, Conservation and Parks.

7. PROPOSED LOT GRADING

The grading plan has been developed using the actual rear yard lengths. Historically, the Building Department reviews the grading plans in compliance with the rear yard lengths as set out in the zoning bylaw. Since these are townhouses, we are requesting that the proposed grading form part of the registered agreement and be accepted as based on actual rear yard lengths. Extensions of units is highly unlikely; however, any modifications to the buildings will be subject to building department compliance at that time.

We trust that this submission meets with your approval. If you have any questions, please contact our office by email at catherine@haddadmorgan.com.

Yours truly,

Haddad, Morgan and Associates Ltd.

Catherine Girgis, P.Eng.
Project Engineer



Appendix A

Sanitary Sewer Design Calculations

SANITARY SEWER DESIGN

DESIGNED BY C.G.
April 5, 2024
19-134

**SECRET GARDEN RESIDENTIAL SUBDIVISION
WINDSOR, ONTARIO**

Q (Ultimate) = Residential Sewage Flow x Ultimate Population Served x
Ultimate Flow Factor + Infiltration

Residential sewage flow = 0.0042 litre/second/capita
Residential Population Density = 3.5 persons / unit
Ultimate Flow Factor = 6.00

STREET OR EASEMENT	FROM MANHOLE	TO MANHOLE	POPULATION SERVED	CUMULATIVE POPULATION SERVED	LAND USE	ULTIMATE FLOW FACTOR	AREA SERVED	CUMULATIVE AREA SERVED	GENERATED FLOW	INFILTRATION FLOW	MAXIMUM FLOW EXPECTED	MAXIMUM FLOW EXPECTED	DIAMETER OF PIPE	SLOPE OF PIPE	LENGTH OF LINE BETWEEN MANHOLES	COEFFICIENT OF ROUGHNESS	VELOCITY FLOWING FULL	QUANTITY FLOWING FULL	PERCENTAGE OF DISCHARGE FOR FULL SECTION	UPSTREAM INVERT	DOWNSTREAM INVERT
			P (persons)	SUM OF P (persons)			A (hectares)	SUM OF A (hectares)	Q _p (l/s)	Q _i (l/s)	Q (l/s)	Q (m ³ /s)	D (mm)	S (%)	L (m)	n	V _{full} (m/s)	Q _{full} (m ³ /s)	Q/Q _{full} (%)	(m)	(m)
Street 'A'	A	7SP-4444	49	49	Res	6.00	0.494	0.494	1.23	0.08	1.31	0.0013	250	0.44	79	0.013	0.80	0.039	3	182.918	182.570
Loon Street	C	B 7SP-4445	49	49	Res	6.00	0.567	0.567	1.23	0.09	1.32	0.0013	250	0.44	52	0.013	0.80	0.039	3	182.519	182.260
Allyson		Plymouth	126	126	Res	6.00	1.933	1.933	3.18	0.30	3.48	0.0035	250	0.44		0.013	0.80	0.039	9		
Street 'A' / Loon / Allyson	Outlet Analysis										6.11	0.0061	200	0.44		0.013	0.69	0.022	28		
													*								

* City of Windsor Sewer Atlas shows a 250 mm diameter sewer / Record drawings show a 200 mm diameter sewer.

Appendix B

Central Avenue Pond Report, prepared by D.C. McCloskey
Engineering Limited, dated 25 January, 2021

App # 9-21

Schedule 'B'
Part 1 of 1

CENTRAL AVENUE POND REPORT (93 pages)

Prepared for:

ROSATI GROUP and N.O.C. DEVELOPMENT



PREPARED BY:

D.C. McCLOSKEY ENGINEERING LTD.

200-5745 Wyandotte Street East

Windsor, ON N8S 1M6

PROJECT M18-321

REVISED: 25 January 2021



Table of Contents

LIST OF FIGURES	ii
LIST OF APPENDICES	ii
LIST OF TABLES	ii
ACKNOWLEDGEMENTS	iii
1.0 Introduction	1
1.1 Report Commissioning	1
1.2 Pond and Catchment Area Location Information	1
1.3 Historical Information of Central Pond	3
1.4 Goals and Objectives of this Assessment	4
1.5 Report References	5
2.0 Assessment of Conveyance Capacity	6
2.1 Minor / Major System Capacity	6
2.2 Boundary Conditions	6
2.3 Low-Lying Area - External Flows	7
2.4 Model Scenarios	7
3.0 Assessment of Storage Capacity	8
3.1 Central Pond Capacity	9
3.2 GCBP Pond Capacity	10
3.3 Future Development in Central Avenue Watershed	11
4.0 Recommended Improvements	12
4.1 Central Pond Improvements	12
4.2 Grand Central Business Park Pond Improvements	13
4.3 Consultation with Windsor International Airport	13
5.0 Conclusions and Recommendations	14
5.1 Conclusions	14
5.2 Recommendations	14

LIST OF FIGURES

1. Central Avenue Pond – Catchment Area Plan
2. Central Avenue Pond – Pond Inlet and Outlet (red arrow) Locations
3. Central Avenue Pond – Flow Route
4. LiDAR Mapping of Central Avenue Pond (top) and GCBP Pond (right side)
5. Pr3 100-year 4-hour Peak Outflow Hydrograph
6. GCBP Topography
7. Pond Modifications

LIST OF APPENDICES

APPENDIX A – Stantec SWM Report for Daimler Chrysler Plant

APPENDIX B – Storm Sewer HGL Profiles

APPENDIX C – Lidar Mapping

APPENDIX D – Central Pond Drawings (LCBA Plans – 1997)

APPENDIX E – Hydrographs (PCSWMM)

APPENDIX F – Landmark Engineers Inc. Supplemental Letter Addressing Waterfowl to the Windsor International Airport and email correspondence

APPENDIX G - N.O.C. Development Overall Servicing Plan

LIST OF TABLES

Table 1 – Central Pond Hydraulics

Table 2 – GCBP Pond Hydraulics

ACKNOWLEDGEMENTS

Special thanks to the team at Landmark Engineering; including Mr. Daniel Krutsch, P. Eng. And Mr. Alain Michaud, P. Eng., for their assistance and technical contributions in the preparation of this report.



1.0 Introduction

1.1 Report Commissioning

D.C. McCloskey Engineering Ltd. has been retained by Rosati Group and N.O.C. Development (the owners of the property known as the Grand Central Business Park (GCBP) and the former school at the south end of Bernard Road in order to to evaluate the capacity of the Central Avenue detention pond in support of the proposed developments on each of the proponents properties and for future developments in the watershed.

1.2 Pond and Catchment Area Location Information

The Central Avenue Pond; herein referred to as "the pond"; is a regional facility located at the southwest quadrant of the intersection of Plymouth Drive and Central Avenue (photograph 1) and owned and maintained by the Corporation of the City of Windsor. This pond; including the linear pond section located on the south side of Plymouth Drive north of Grand Central Business Park (GCBP) detention pond, has a footprint of approximately 3.8 hectares and a catchment area of 108 hectares. The GCBP development located between Pillette Road, Plymouth Road, Central Avenue and the railway to the south has an area of 63 hectares. The GCBP property has an extensive internal network of large diameter storm sewers outletting to a private detention pond located in the northwest corner of the GCBP property which outlets to the Central Avenue Pond. The NOC proposed residential development on Bernard Road has an area of 2.8 hectares; including the eight building lots for Mr. Tom Tomas located on the east side of Bernard Road will outlet to the 1200mm storm sewer on Street B. A plan depicting the catchment area plan and storm sewer network is provided in Figure 1.



Photograph #1 – Central Avenue Pond – (looking east)

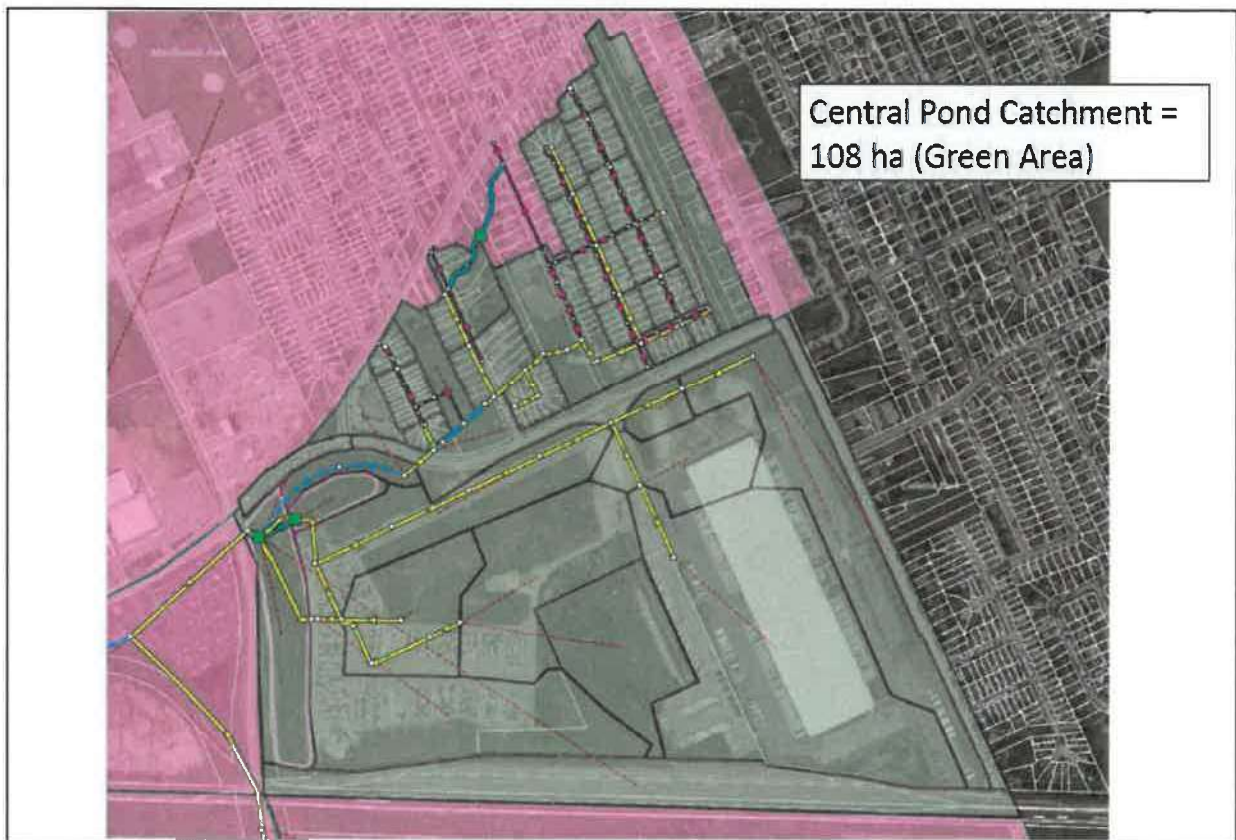


Figure 1 - Central Avenue Pond Catchment Area Storm Sewer Network



1.3 Historical Information of Central Pond

In 1993, MacLaren Engineers prepared a report for the Essex Region Conservation Authority (ERCA) to assess the upper Grand Marais Drain and provide recommendations for the mitigation of flooding occurring in the catchment area between Pillette Road and Walker Road. The MacLaren report; appended to the Stantec report in appendix A, provided several recommendations to prevent/reduce flooding in this area including the construction of a detention pond with a storage volume of 70,000 m³ and a maximum 2 m³/s discharge rate into the Grand Marais Drain.

The initial phase of the Central Avenue Pond was constructed in 1995 with a design having one inlet pipe from the Pillette Drain No. 2 area north of Plymouth Drive and two outlets from the Chrysler Plant (now known as GCBP), outletting into the east side of the pond at the location of the three permanent pools (figure 2). The pond was graded and bermed to route the storm water southerly along the length of the pond and loop back northerly to the outlet located at the northwest corner of this pond. The pond outlet pipe is located below Central Avenue and the parking lot on the southwest corner of Central and Grand Marias East and outlets into the open channel of the Grand Marais Drain. The original design of the pond provided substantial contact and settling time in the flow route that provided the required water quality treatment of the runoff.

Following construction, the Windsor Airport raised concerns regarding waterfowl congregating in the Central Avenue Pond, which is in fairly close proximity to the runway and glide paths at Windsor Airport. To address these concerns, the City subsequently altered the pond by installing a berm at the northerly permanent pool; effectively eliminating the conveyance of frequent flows in the clockwise loop, and directing the low flows northerly to the outlet pipe. In addition, a pump was installed to lower the water level from the design elevation of 182.6m to 182.0m.

These alterations (completed in 1997) eliminated the large expanse of open water within the pond and allowed the perimeter vegetation to grow into the channels and permanent pools. This heavy vegetation deters waterfowl, primarily Canadian Geese, from congregating in areas where predators could be hidden.

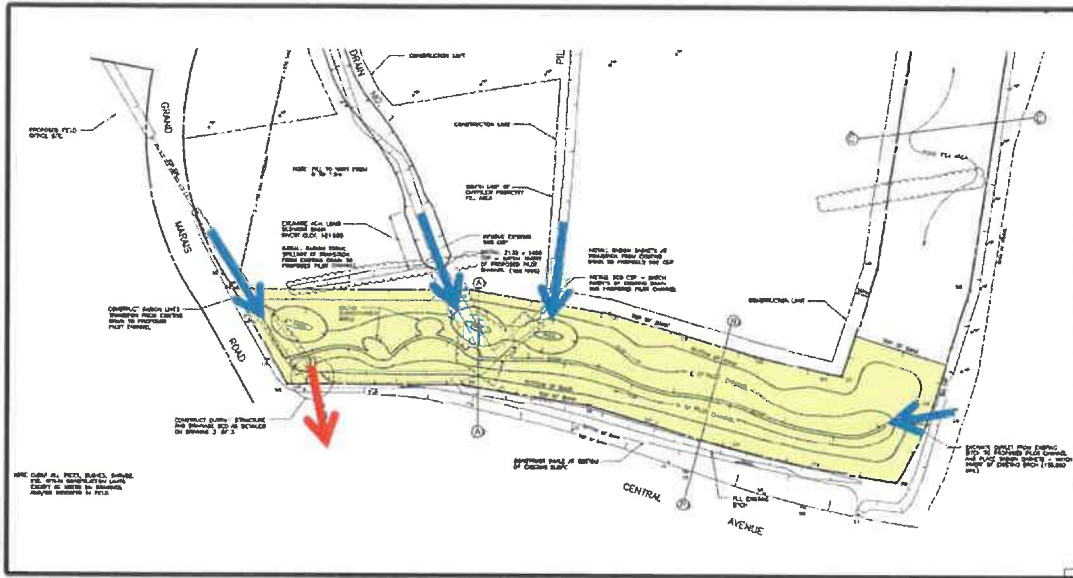


Figure 2 – Central Avenue Pond – Pond Inlet and Outlet (red arrow) Locations

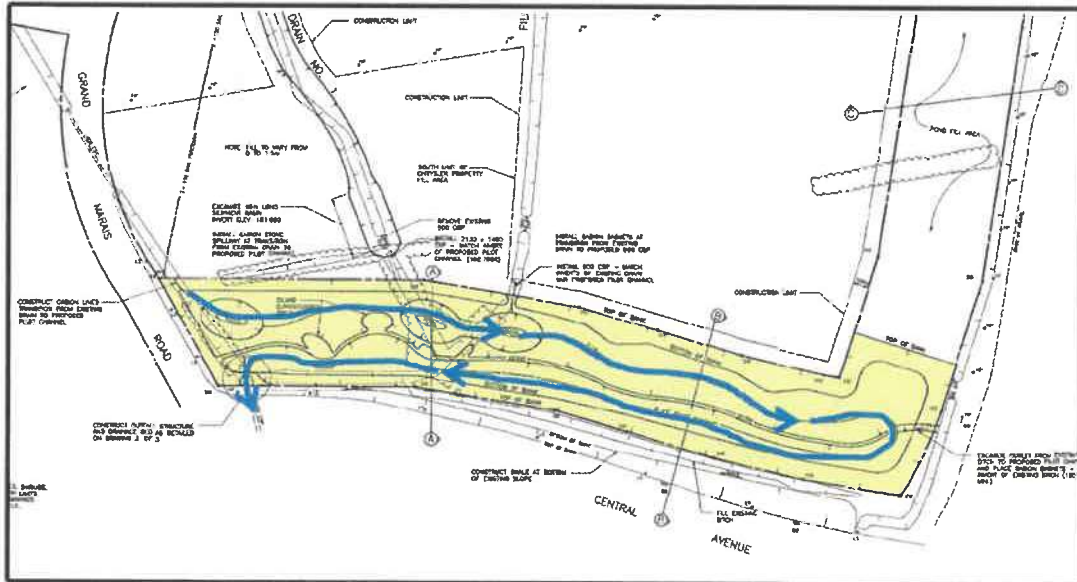


Figure 3 – Central Avenue Pond – Flow Route

1.4 Goals and Objectives of this Assessment

The goal of this assessment is to examine the potential for establishing a regional Stormwater Management (SWM) pond facility; within the existing Central Avenue Pond, to provide the required SWM quality and quantity requirements in accordance with the Ministry of the Environment, Conservation and Parks (MECP) SWM design guidelines and the Windsor/Essex Region Stormwater Management Standards Manual. This regional facility would provide the opportunity to provide SWM requirements for the entire Central Avenue Pond catchment area in lieu of more costly individual property measures.



After some initial discussion between representatives of the City of Windsor, Essex Region Conservation Authority and Landmark Engineers Inc., a preliminary meeting was held on December 4th, 2019 to discuss the potential for restoring/modifying the Central Avenue Pond to achieve some or all of the original SWM requirements for the proponent's developments and the Central Avenue Pond catchment area.

The City of Windsor and ERCA expressed their general receptiveness to the proposed initiative, subject to the proponents determining the feasibility of this initiative. This report outlines the findings of this initiative, more specifically: to assess and determine the full capabilities of the pond as a regional SWM facility; and determine the scope of improvements to be implemented to the pond and local conveyance systems to establish a properly functioning storm water system for the proposed development, as well as future development of the remaining undeveloped properties.

1.5 Report References

The preparation of this report referenced the following information:

1. Stormwater Management Report for Daimler Chrysler (currently known as Grand Central Business Park (GCBP) – prepared by Stantec dated 12 June 2000.
2. Addendum Report on the Upper Grand Marais Drain – prepared by MacLaren Engineers dated March 1993. MacLaren report included in the above Stantec report (appendix C).
3. City of Windsor; Mr. Rob Perissinotti, P. Eng., email on March 17, 2020 – confirmed overland flow routing permitted on Plymouth Drive for flows having a short duration and low flow depth.
4. Pre-Consultation Meeting - ERCA and City of Windsor Meeting - December 4, 2020.
Review of the terms of reference with the City and ERCA including the overland flow conveyance routing on Plymouth Drive.
5. In addition, reference was made to the correspondence between the City, ERCA, Windsor Airport, and MacLaren Engineers prior to implementing objectives of the pond, including fulfilling the modifications to the pond in 1996.



2.0 Assessment of Conveyance Capacity

A hydrologic and hydraulic modelling analysis was performed to evaluate the conveyance capacity the existing minor system (typically sewers that convey frequent storm flows) and major system (typically all roadways, boulevards, swales or watercourses that convey infrequent flows). The analysis was performed using current PCSWMM software with a dual drainage modelling approach that accounts for minor/major system (i.e. typically sewer/roadway) interaction.

The major system (roadway or open channel conveyance) were represented as a 1D network – as conduits with representative cross-sections representing the road surface or channel. The analysis followed the standards of the Windsor / Essex Stormwater Management Standards Manual dated Dec 2018. Impervious levels were based on measured hard surfaces. The Proposed Condition model assumed the GCBP area to be fully developed at 90% impervious levels and undeveloped residential lands north of Plymouth Road to be developed as 60% impervious levels.

2.1 Minor / Major System Capacity

The analysis findings confirm that the existing storm sewer system can convey a standard 5-year minor design storm from a fully developed condition without surface ponding as shown on the hydraulic grade line (HGL) profiles in appendix B.

For the 100-year major design storm, our analyses showed that local sewers combined with overland flow along roadways can effectively convey flows to the main drainage pathway, which can convey the 100-year flows to the pond. The main drainage pathway consists of the Grand Marais Drain open channel section (former Pillette No.1 Drain) from Central Pond to Tourangeau Rd as well as a trunk storm sewer varying from 750mm to 1200 mm diameter, which runs through Robert Park and along Lovric Road (the relevant HGL profiles are provided in appendix B).

It is acknowledged that the existing road grading results in surface ponding depths that exceed a typical standard maximum 0.3m at a few catch basins. Namely, there are two sag locations on both Robert Rd and Cappelletto Rd that range from 0.31m to 0.36m.

2.2 Boundary Conditions

The hydrologic and hydraulic modelling analysis considered water levels in the Central Avenue Pond, including outflow and stage impacts from backwater conditions downstream of the pond. These impacts were considered using the recently updated modelling on the Grand Marias Drain undertaken by Landmark Engineering.



2.3 Low-Lying Area - External Flows

Additional consideration was given to the low-lying area which exists between Bernard Rd and Tourangeau Rd, immediately south of Grand Marais Rd. A review of the topography north Grand Marais Rd confirmed that a sizable external area could potentially direct overland flow towards the low-lying area. A simplified approach was taken to estimate this potential and is summarized as follows. It was assumed that the existing minor system could convey flows from a typical 5-year storm sewer design storm and that all rainfall greater than 5-year would be 100% effective surface runoff (i.e. no losses). Therefore, a rainfall hyetograph representing the resultant 100-year minus 5-year rainfall was uniformly applied over the external area, which was bounded by Grand Marais Rd to the south, Tecumseh Rd to the north, Central Avenue to the west and Pillette Rd to the east. GeoHECRAS 2D software was used purely as a surface model to analyze the surface attenuation and surface flow over a 2D mesh derived from OMAFRA Lidar DTM 2016-2018. The model was used to capture surface flow hydrographs at specific locations, namely along the south side of Grand Marais Rd at intersection of Bernard Rd, Tourangeau Rd, Allyson Rd as well as along the south side of Plymouth Rd adjacent to the pond. These hydrographs were then inputted into the PCSWMM model as external inflows for the 100-year 4-hour Chicago storm scenarios.

2.4 Model Scenarios

The following model scenarios were evaluated to compare various conditions such as; backwater conditions versus free outfall, impact of potential external flows from outside of the Central Pond catchment area, and impact of modifications to the GCBP pond:

- Proposed Condition Scenario 1 (Pr1): Considers the Central Pond catchment area only with no consideration to potential external flows.
- Pr2: Pr1 + external flows north of Grand Marais Rd
- Pr3: Same as Pr2, except for addition of recommended 900mm dia. storm relief to route external flows to the trunk storm sewer at the south end of Bernard Rd.
- Pr4: Same as Pr3, except for Central Pond outlet changed to free outfall.
- Pr5: Same as Pr3, except for recommended 300mm dia. orifice on GCBP 900mm dia. auxiliary outlet and 750mm dia. orifice on GCBP 1200mm dia. pond outlet.
- Pr6: Same as Pr1, except for recommended 300mm dia. orifice on GCBP 900mm dia. auxiliary outlet and 750mm dia. orifice on GCBP 1200mm dia. pond outlet. This scenario applies to the larger volume / lower intensity SCS 100-year 24-hour storm and AES 100-year 12-hour storm. Given the rainfall intensities are significantly lower than typical 5-year design intensities; it is assumed that the minor system of the external area can convey the peak flows from these storms (i.e. no overland flow from the external area under these storm events).

Appendix B includes HGL profiles for various scenarios under minor and major storm events.

3.0 Assessment of Storage Capacity

The hydrologic and hydraulic modelling analysis performed for conveyance assessment were also used to evaluate the stage/storage and outflow relationship of the Central Pond under various design storms. OMAFRA LiDAR DTM 2016-2018 mapping was used to determine the as-built sizing of the pond. As illustrated below, the resolution and accuracy of the LiDAR allows for a very useful and reliable representation of the pond and its storage capacity at various stages. Figure 4 below is a depiction of the LiDAR mapping.

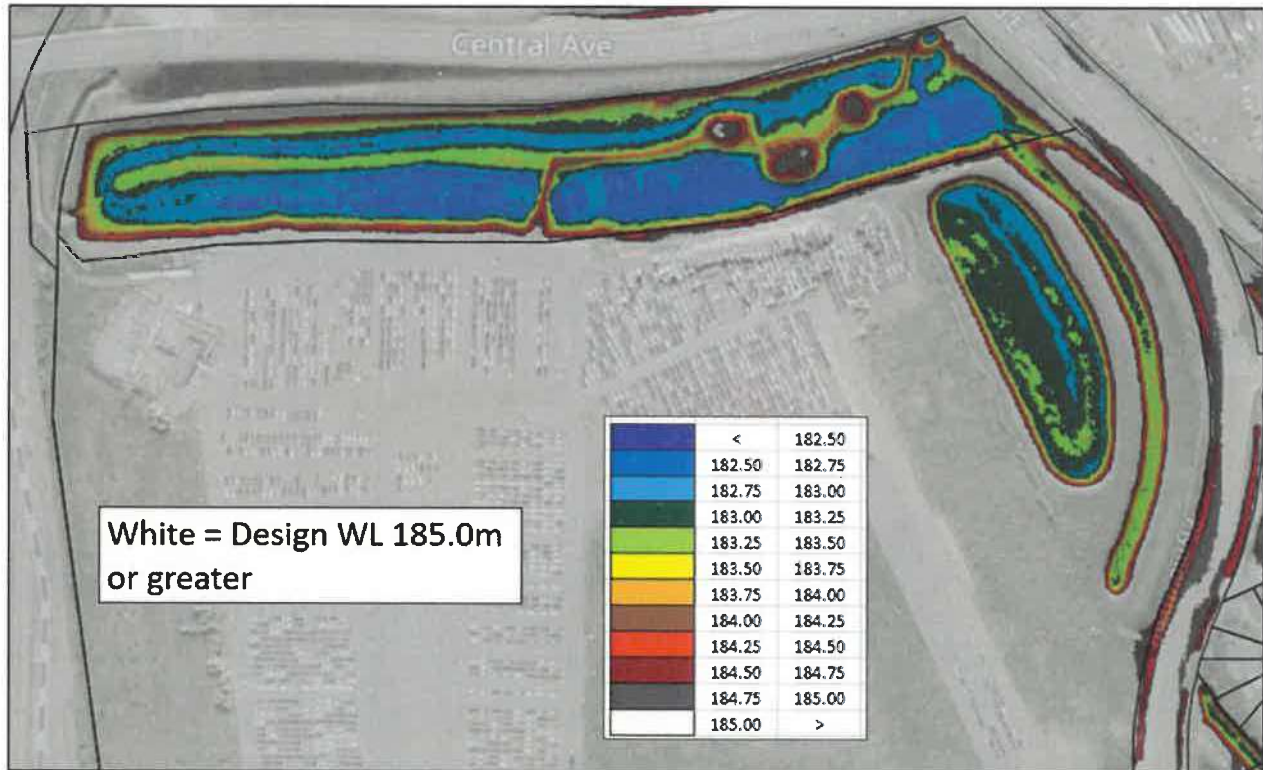


Figure 4 – LiDAR Mapping of Central Avenue Pond (top) and GCBP Pond (right side)

The assessment was undertaken based on the following original design parameters:

- Normal Water Level (NWL) = 182.6m
- High Water Level (HWL) = 185.0m
- Maximum Outflow Rate = 2.0 m³/s

As mentioned in the previous section, existing impervious levels were based on measured hard surfaces, with the GCBP area assumed to be fully developed at 90% impervious and undeveloped residential lands north of Plymouth Road assumed to be developed as 60% impervious. The pond outlet is assumed to be restored similar to its original design intent, which includes a 300mm dia. low flow pipe with invert set at the NWL of 182.6m, a 900mm dia. opening with backflow protection as a secondary outlet starting at elevation 183.4m and a 9m wide weir for high stage relief at a spill elevation of 184.8m.



3.1 Central Pond Capacity

As illustrated in Table 1, the Central Pond is sufficiently sized to handle the expected 100-year storm flow while meeting the original design intent. The table further demonstrates that the boundary condition, external flow and storm distribution have a marginal effect on the pond water level. The pond provides 47,900 m³ of storage at the 185.0m design maximum water level.

Scenario	Max. WL	Max. Volume	Peak Outflow
	m	m ³	m ³ /s
Pr1_5y4h	184.14	25,640	0.97
Pr1_100y4h	184.89	45,050	1.73
Pr2_100y4h	184.92	45,870	1.94
Pr3_100y4h	184.94	46,410	2.08
Pr4_100y4h	184.79	42,380	2.01
Pr5_100y4h	184.92	45,850	1.94
Pr6_100y12h	184.93	46,140	2.00
Pr6_100y24h	184.85	43,900	1.60

Table 1 – Central Pond Hydraulics

During scenario Pr3_100y4h the peak outflow rate of 2.08 m³/s exceeds the recommended release rate from Central Pond of 2.0 m³/s (design flow rate as per McLaren report appended to Stantec report in Appendix C). Table 1 shows a release rate of 2.08 m³/s for Scenario Pr3 (referenced below), which exceeds the recommended rate of 2.0 m³/s as defined by the MacLaren report (appended to Stantec report in Appendix C). We confirm that this exceedance has no impact on the Grand Marais Drain flow regime. Furthermore, we provide Figure 5 below to illustrate the short-duration and relatively negligible volume that exceeds the recommended rate.

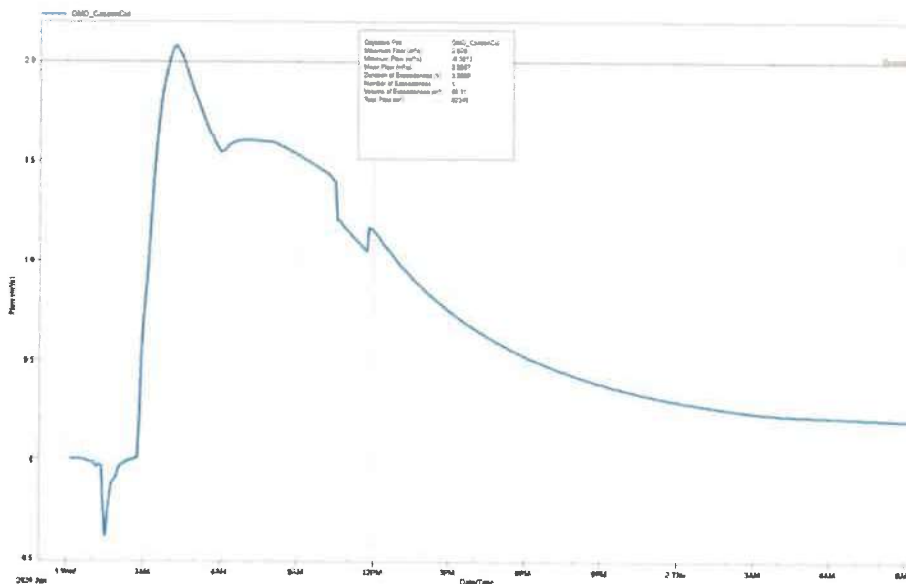


Figure 5 – Pr3 100-year 4-hour Central Pond peak outflow model scenario hydrograph.



3.2 GCBP Pond Capacity

As illustrated in the table below, the pond is sufficiently sized to handle the expected 100-year storm flows.

Scenario	Max. WL	Max. Volume	Peak Outflow
	m	m ³	m ³ /s
Pr1_5y4h	184.15	6,730	1.94
Pr1_100y4h	185.10	13,600	3.51
Pr2_100y4h	185.11	13,680	3.46
Pr3_100y4h	185.18	14,260	3.03
Pr4_100y4h	185.10	13,620	3.50
Pr5_100y4h	185.55	17,190	7.95
Pr6_100y12h	185.40	15,980	2.98
Pr6_100y24h	185.44	16,280	3.92

Table 2 – GCBP Pond Hydraulics

The GCBP pond has an available capacity of 17,300m³ at a low bank elevation of 185.6m. Table 2 demonstrates that an additional 3,500 m³ of storage capacity can be achieved by controlling the outflow of the GCBP into the Central Pond. This recommendation proposes to install a 300mm dia. orifice on the GCBP 900mm dia. auxiliary outlet and a 750mm dia. orifice on the GCBP 1200mm dia. pond outlet. The two additional controls raise the pond 100-year maximum water level from 185.18m (Scenario Pr3) to 185.55m (Scenario Pr5). The aforementioned recommendation is not required to accommodate the proposed NOC development on Bernard Road or any future development within the catchment area. As depicted in Figure 6 below, the existing berming surrounding the GCBP, as well as the topography of the GCBP lands, can accommodate a higher water level. The modifications to the GCBP outlet also include lowering the 30m wide spill weir on the west bank of the pond from +/- 185.6m to 185.3m. These modifications maximize available storage based on existing top of bank elevations without creating undue backwater on the existing storm sewer system. The modifications also keep the Central Avenue Pond levels lower reducing the potential ponding in the low-lying area between Bernard Road and Tourangeau Road.

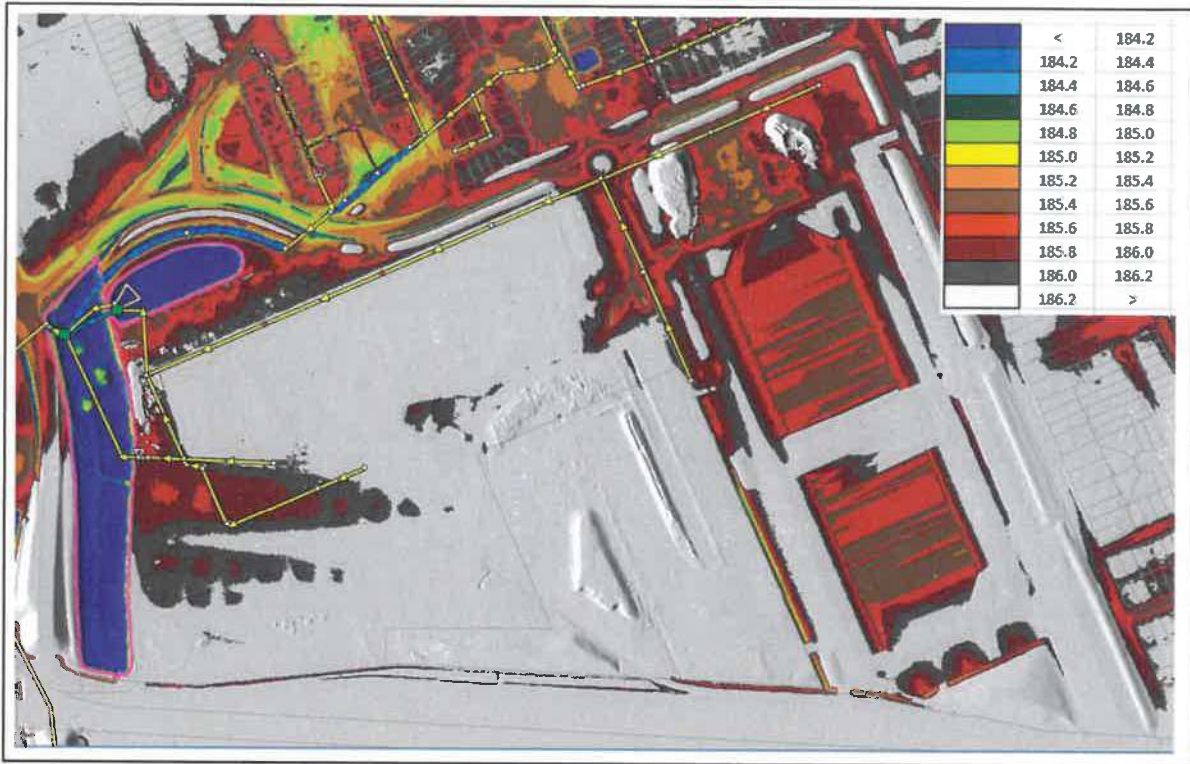


Figure 6 – GCBP Topography

3.3 Future Development in Central Avenue Watershed

Future residential has been assessed at 60% impervious. Should future development propose to exceed 60%, it is recommended that the PCSWMM model be utilized to consider the proposed change and recommend the appropriate SWM measures. NOC and Rosati Group are considering releasing the PCSWMM model to ERCA and the City of Windsor for their use. The model must be utilized by a qualified engineer experienced using PCSWMM modelling software and practical experience with stormwater management projects.



4.0 Recommended Improvements

This section discusses the potential improvements to the Central Avenue Detention Pond and its upstream watershed to improve the level of service of the stormwater conveyance elements. The improvements will not only benefit the two proponents (i.e. Rosati Group and NOC Development), but will also improve function of the overall pond catchment area.

4.1 Central Pond Improvements

The temporary outlet pipes should be removed, leaving only the 300mm diameter low flow pipe, the 900mm diameter secondary outlet and the weir wall. It is recommended that the 900mm diameter CSP outlet pipe shown on the left photograph below be removed. In lieu of a replacement pipe, we confirm that the existing opening in the weir wall is acceptable for flow control and that it would be preferable to modify grading downstream of the opening, including proper rock lining for erosion protection. Moreover, we recommend that a backflow prevention device be fitted on the downstream face of the existing wall or inside the opening to prevent backwater from the downstream reaches of the Grand Marais Drain from entering the pond.

Further consideration should also be given to improving other components of the outlet, such as the existing 300mm diameter low flow outlet and the existing pump station and associated plumbing. These improvements should be coordinated with the recommendations outlined in the recent report on the Grand Marais Drain, which identified the need for remedial work on the existing 2150mm dia. CSP outlet pipe which conveys flows from the pond across Central Avenue to the Grand Marais Drain.



Photograph 2 – Current Central Pond Outlet



Minor earthwork modifications to the Central pond are also recommended, including the removal of the temporary berming (circled in red below) and reinstatement of the berm identified by the white line. This will serve to restore the pond's original design intent and significantly increase the water quality function by creating a long flow path for settling and polishing through the fully-established vegetation.

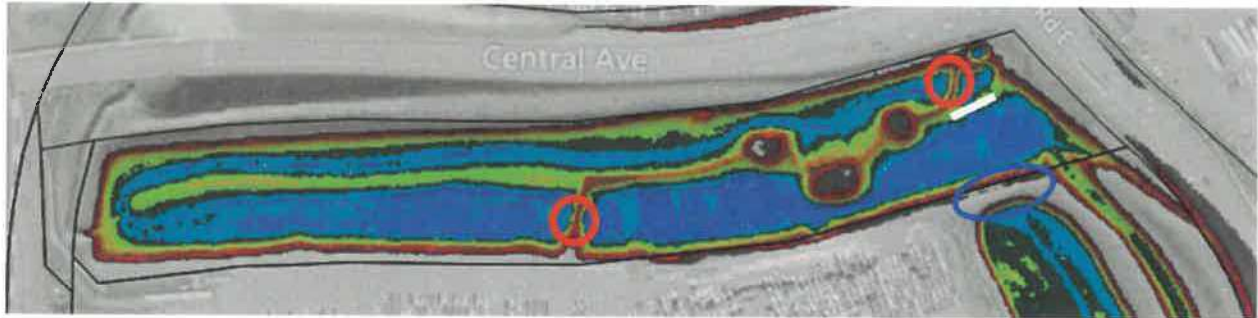


Figure 7 – Pond Modifications

4.2 Grand Central Business Park Pond Improvements

As discussed in the previous section, there is an opportunity to provide additional capacity in the GCBP pond by restricting flow from this pond into the Central Avenue Pond, thus creating a higher HWL and creating additional storage volume. As described in section 3.2, the recommended modifications include installing a 750mm diameter orifice in the existing manhole of the GCBP 1200mm diameter pond outlet as well as the lowering of the 30m wide spill weir on the west bank of the pond from +/- 185.6m to 185.3m (circled in blue on Figure 7 above).

4.3 Consultation with Windsor International Airport

Landmark Engineers Inc. prepared a report dated 30 November 2020 (Appendix F) to Mark Galvin, CEO of the Windsor International Airport to confirm that the proposed improvements to Central Pond discussed in section 4.1 will not promote the attraction of waterfowl, thus not negatively contributing to airport operations and aircraft safety.

Email correspondence from Mark Galvin; included in appendix F, provided Windsor International Airport's approval of Landmark's 30 November 2020 report with the condition that "additional mitigation be instituted if the site becomes 'fowl friendly'".



5.0 Conclusions and Recommendations

The following conclusions from this study and recommended improvements are listed below:

5.1 Conclusions

1. The existing minor and major storm systems have sufficient conveyance capacity to handle the runoff from the study area, including assumed full building conditions of 90% impervious for the GCBP lands and 60% impervious for residential development of undeveloped lands north of Plymouth Rd.
2. The Central and GCBP ponds have sufficient storage capacity to attenuate full buildout flows to a maximum rate of 2 m³/s, which is consistent with MacLaren's original design intent. The existing topography of the GCBP lands provide an opportunity to increase flow controls and subsequently raise the HWL in the GCBP pond to gain additional storage volume without undue backwater effects on the storm sewer system.
3. Minor earthwork modifications and removal of temporary outlet pipes will restore the Central Pond to its original design intent and significantly improve water quality.
4. The existing low-lying area south of Grand Marais Rd between Bernard Rd and Tourangeau Rd is susceptible to surface ponding, which may be exacerbated by overland flows from the north under an extreme storm event.

5.2 Recommendations

1. Implement recommended improvements outlined in section 4.
2. As an added measure of resiliency for storms exceeding the 100-year design, construct an overland flow route along the Bernard Road right-of-way from the proposed NOC development to Plymouth Road. Re-grade the north boulevard and pathway on Plymouth if required to maintain the overland flow route across Plymouth Road.
3. Maintain overland routing along the south boulevard of Plymouth Road.
4. Install an oversized 900mm dia. storm sewer along the NOC development to serve as the local storm sewer as well as to provide the opportunity for a future sewer extension that would provide storm relief to the low-lying area near Grand Marais Rd. This consideration should be coordinated with the City of Windsor's ongoing Sewer Master Plan study.
5. Mr. Mark Galvin - CEO of the Windsor Airport, has approved of the proposed Central Pond modifications and function of the pond. Mr. Galvin stated the Windsor International Airport will require pond modifications if the presence of waterfowl is observed in the Central Pond.
6. The proposed development of GCBP should provide overland routing towards the GCBP pond.

END OF REPORT

Appendix C

Essex Region Conservation Authority – Permit #9-21

Place and Grade Fill

The Corporation of the City of Windsor – Central Pond

Cover Letter

Permit

Application



regs@erca.org
P.519.776.5209
F.519.776.8688

360 Fairview Avenue West
Suite 311, Essex, ON N8M 1Y6

February 2, 2021

The Corporation of the City of Windsor
c/o Rob Perissinotti, P.Eng.
350 City Hall Square West
Windsor, ON N9A 6S1

Re: Application for Permit #9-21
Place and Grade Fill
The Corporation of the City of Windsor
CENTRAL POND

You have applied to this office for a permit for Development (placement and grading of fill for earthwork modifications to restore Central Pond to its original design intent) within the regulated area of the Grand Marais Drain, in the City of Windsor. We have reviewed the following document prepared by D.C. McCloskey Engineering Ltd. (McCloskey Project No. M18-321):

- Central Avenue Pond Report – D.C. McCloskey Engineering Ltd. (January 25, 2021)

The following is our understanding of, and requirements for, this project:

- Placement and grading of fill for earthwork modifications to the existing Central Pond to restore the pond to its original design intent.
- Assessment confirms existing minor and major storm systems have sufficient conveyance capacity to handle the runoff from the study area for the full buildout scenario.
- Assessment confirms that the Central and GCBP Ponds have sufficient storage for the full buildout scenario of the study area.
- Once earthwork modifications are completed, the pond will provide the normal standard level of protection for water quality for the full buildout scenario.
- Sediment and erosion control measures are to be implemented at this site until the site is stabilized.

This is to inform you that your application has been approved and your permit is enclosed. The issue of the permit does not imply adequate protection from flooding/erosion.

Any additional proposed recommended works will require additional approvals from this office.

The Corporation of the City of Windsor
c/o Rob Perissinotti, P.Eng.
February 2, 2021

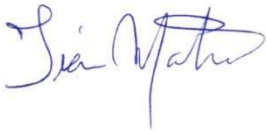
Please review the attached permit and Schedule 'B' documents. All works are to be completed in accordance with the Schedule 'B' documents. Please sign your permit, return a copy to this office by mail, e-mail or fax, and retain a copy for your records.

This approval does not negate your responsibility to obtain any other federal, provincial, or municipal authorizations or clearances that may be necessary.

If our understanding of this project is either incorrect, incomplete, or if there are any changes to the project, the Essex Region Conservation Authority must be contacted immediately.

If you have any questions, please contact the undersigned at this office at (519)776-5209.

Yours truly,



Tian Martin, P.Eng.
Watershed Engineer

C/ Danna Wang – NOC Development
Tony Rosati – Rosati Construction Inc.
Mark McCloskey, P.Eng. – D.C. McCloskey Engineering Ltd.
Joe Baker, P.Eng. – The Corporation of the City of Windsor



360 Fairview Avenue West
 Essex, Ontario, N8M 1Y6
 phone: 776-5209 fax: 776-8688
 email: regs@erca.org



**Permit For Development
 Interference with Wetlands and
 Alterations to Shorelines and Watercourses**

Permit No. 9 - 21

This permit is issued under the authority and provisions of the following indicated Provincial Act(s) and their regulations, and is subject to the limitations and provisions thereof and is also subject to the terms and conditions herein.

Section 28, Conservation Authorities Act as amended

In accordance with the above referenced legislation permission has been granted to

Name of Permittee	City of Windsor	Telephone	519-255-6500
Address	350 City Hall Square W., Box 1607, Windsor ON N9A 6S1		
Location of Works	Central Pond		
Legal description	Lot	Concession	
Municipality	The Corporation of the City of Windsor		

For the following works:

Development (placement and grading of fill for earthwork modifications to restore Central Pond to its original design intent) within the regulated area of the Grand Marais Drain. All works to be undertaken in accordance with the stormwater mangement report prepared by D.C. McCloskey Engineering Ltd. dated January 25, 2021 (McCloskey Project Number MI8-321). Does not imply adequate protection from flooding/erosion.

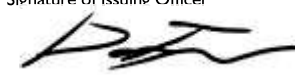
For the period commencing **February 2021** and expiring **February 2022**

Subject to the following general and specific conditions:

General Conditions: **See Reverse Side.**

- Specific Conditions:
- The Permittee shall keep this permit or a true copy thereof on the work permit area.
 - The person in charge of the operation conducted under this permit shall produce and show this permit or the true copy kept on the work permit area to any representative of the ERCA or The Crown when requested by same.
 - Other conditions as listed on the reverse side of this permit, as well as the information contained in Schedule(s) "B" attached, form part of this permit and must be implemented in order that the true intent of the permit be achieved.

I agree to carry out or cause to be carried out the work(s) indicated above in compliance with the general and specific conditions set out herein, and in accordance with the information contained in the application and any accompanying plans. I realize that should I carry out the work(s) contrary to the terms of this permit that this permit may be revoked.

Signature of Issuing Officer 	Signature of Applicant
----- for General Manager	-----

Dated at Essex, Ontario this **2nd** day of **February 2021**.

GENERAL CONDITIONS

The applicant, by acceptance of and in consideration of the issuance of this permit, agrees to the following conditions:

1. This Permit does not preclude any other legislation, federal or provincial, or necessary approvals from the local municipality.
2. Authorized representatives of the Essex Region Conservation Authority and The Crown may, at any time, enter onto the lands which are described herein in order to make any surveys, examinations, investigations or inspections which are required for the purposes of insuring that the work(s) authorized by this Permit are being carried out according to the terms of this Permit.
3. The applicant agrees:
 - (a) to indemnify and save harmless the Essex Region Conservation Authority and The Crown and its officers, employees, or agents, from and against all damage, loss, costs, claims, demands, actions and proceedings, arising out of or resulting from any act or omission of the owner and/or applicant or of any of his agents, employees or contractors relating to any of the particulars, terms or conditions of this Permit;
 - (b) that this Permit shall not release the applicant from any legal liability or obligation and remains in force subject to all limitations, requirements and liabilities imposed by law;
 - (c) that all complaints arising from the execution of the works authorized under this Permit shall be reported prior to the expiration of this Permit by the applicant to the Essex Region Conservation Authority. The applicant shall indicate any action which has been taken, or is planned to be taken, if any, with regard to each complaint;
 - (d) that this Permit is valid only during the specified time prescribed on the front of the Permit, and is subject to review upon expiration. This Permit does not guarantee future renewal, approval or authorization.
4. This Permit is not assignable.
5. The applicant agrees that should the works be carried out contrary to the terms of this Permit, the Essex Region Conservation Authority and/or a Public Lands Officer may enter on to the property and cause the terms to be satisfied, at the expense of the applicant.

Essex Region Conservation Authority

360 Fairview Ave. W., Essex, ON, N8M 1Y6, p: (519)776-5209, f: (519)776-8688, www.erca.org

APPLICATION FOR PERMIT FOR DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATION TO SHORELINES AND WATERCOURSES

<input checked="" type="checkbox"/> Section 28 - Conservation Authorities Act as amended	APPLICATION FEE	APPLICATION NUMBER
<input type="checkbox"/> Section 14 - Public Lands Act as amended	\$2,500	9-21

Applicant/Owner: **Pd. Jan 8/2021**

Name City of Windsor	Telephone 519-255-6257
Complete Mailing Address - Street No. & Name, Town/City 350 City Hall Square West	Postal Code N9A 6S1
E-mail Address	Cell #

Contractor/Agent: *(if applicable)*

Name NOC Development	Telephone 647 339 8870
Complete Mailing Address - Street No. & Name, Town/City 2695 Bernard Road, Windsor ON	Email danna.wang@n
	Postal Code N8W 4S5

Location of Proposed Works:

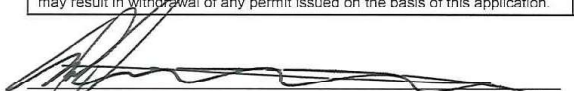
Municipality City of Windsor	Waterway Grand Marais Drain
Municipal Street Address Central Pond	Legal Description: (Lot/Plan/Concession)

Proposed Works to be Undertaken See Schedule "B" attached **1 PART (93 pages)**

CONSTRUCTION OF BREAKWALL, DOCK, BOAT HOUSE/LAUNCH/RAMP etc.		
area: _____ length: _____ width: _____	OFFICE USE	
Construction Details:	Floodproofing Elevation:	
CONSTRUCTION OF A DWELLING, GARAGE, ADDITION, OTHER STRUCTURE		
area: _____ length: _____ width: _____	OFFICE USE	
Setback from Waterway:	Floodproofing Elevation:	
Drainage Details (<i>ie. side yard swales, retaining walls</i>):		
PLACEMENT & GRADING OF FILL		
Dimensions of area to be filled	length: _____	width: _____ depth: _____
Type of materials to be used	<input type="checkbox"/> sand <input type="checkbox"/> earth <input type="checkbox"/> gravel <input type="checkbox"/> armour stone <input type="checkbox"/> other	
Erosion/silting prevention (<i>describe</i>)		
OTHER		

Attach two (2) copies of plans depicting:
 1) Location of property in relation to surrounding buildings, streets, roadways, etc. (*plot plan*)
 2) Size, location and dimensions of property - all existing structures
 3) Location, dimensions and elevation of all proposed structures, and fill
 4) Elevation of any windows, doors, vents, or other exterior openings in relation to final grade

The above submission must be in complete final form before it will be scheduled for consideration by the Board of Directors. This application, if approved, does not preclude any approvals by any other existing laws and regulations. Any false or misleading statement contained in this application may result in withdrawal of any permit issued on the basis of this application.	Personal information on this form is collected under the authority of Conservation Authorities Act, RSO 1980, and will be used only by programme administration. Questions about the collection of personal information should be directed to: ERCA, 360 Fairview Avenue West, Essex, Ontario, N8M 1Y6
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Applicant's Signature

January 7, 2021
Date

Appendix D

Storm Sewer Hydraulic Design Sheet

Storm Sewer Hydraulic Design Sheet

Date: April 5, 2024

Site location: Windsor, Ontario
 Project Name: Secret Garden Residential Subdivision

Project No.: 19-134

Rational Formula: $Q = 2.78 \times C \times I \times A$
 where Q: peak flow (L/s)
 C: runoff coefficient
 I: rainfall intensity (mm/h)
 A: area (ha)

Concentration time: $t_c = t_i + t_f$ (minute)
 where t_i : inlet time before pipe (minute)
 t_f : time of flow in pipe (minute)
 $t_f = L / (60 V)$ (minute)

Design Storm: The 5 -Year Storm Event and the 100 -Year Storm Event

Manning Equations:

$$V_f = 0.397/n_f * D^{2/3} * S^{1/2}$$

V_f = velocity (m/s)

$$Q_f = 0.312/n_f * D^{8/3} * S^{1/2} \quad Q_f = \text{flow rate (m}^3/\text{s)}$$

D: pipe size (mm)
 S: slope (grade) of pipe (%)
 n: roughness coefficient

$$Q = 0.62 * A * \text{SQRT}(2gh)$$

$$Q = 0.62 * D^2 * 3.14 / 4 * \text{SQRT}(2gh)$$

$$D = \text{SQRT}(Q / .62 * 4 / (\text{SQRT}(2 * 9.81 * h)))$$

Sewer Design - Pipe sizes considering water levels in Pillette Drain No. 1

Drainage Area	From (MH/CB)	To (MH/CB)	Runoff Coefficient C local	Area local (hectares)	Area AC local (hectares)	Area AC total (hectares)	Time of Concentration (minutes)	Rainfall Intensity 5 year (mm/hr)	Rainfall Intensity 100 year (mm/hr)	Pipe Diameter (mm)	Slope (%)	Length of Pipe (m)	Peak Flow Runoff 5-year (m ³ /s)	Peak Flow Runoff 100-year (m ³ /s)	Velocity V _{full} (m/s)	Pipe Capacity Q _{full} (m ³ /s)	Q ₅ /Q _f	Q ₁₀₀ /Q _f	Time to next node (5-year) (minutes)	Invert upsttream (m)	Invert downstream (m)
1	1A	2	0.60	0.09405	0.0564	0.0564	15	88.40	143.67	375	0.26	97	0.014	0.023	0.81	0.089	16%	25%	2.00	183.898	183.646
2	1	2	0.60	0.30355	0.1821	0.1821	15	88.40	143.67	675	0.12	46	0.045	0.073	0.81	0.291	15%	25%	0.94	183.251	183.196
Half of 4	CB		0.60	0.022065	0.0132	0.0132	15	88.40	143.67	200	1	1	0.003	0.005	1.04	0.033	10%	16%	0.02	183.495	183.485
1, 2, half of 4	2	3				0.2518	17.00	82.63	134.80	825	0.09	44.6	0.058	0.094	0.81	0.431	13%	22%	0.92	183.196	183.156
3	4A	3	0.60	0.1729	0.1037	0.1037	15	88.40	143.67	525	0.17	44.8	0.025	0.041	0.82	0.177	14%	23%	0.91	183.572	183.496
1 - 4	3	5				0.3688	17.92	80.23	131.09	1050	0.07	49	0.082	0.134	0.83	0.722	11%	19%	0.98	183.156	183.122
Substitute with 865 x 1345 elliptical pipe														0.84	0.799	10%	17%				
5	4	5	0.60	0.26981	0.1619	0.1619	15	88.40	143.67	675	0.12	49	0.040	0.065	0.81	0.291	14%	22%	1.00	183.181	183.122
6	5A		0.60	0.11975	0.0719	0.0719	15	88.40	143.67	450	0.2	47	0.018	0.029	0.80	0.128	14%	23%	0.98	183.439	183.345
7	CB		0.60	0.03514	0.0211	0.0211	15	88.40	143.67	250	1	1	0.005	0.008	1.21	0.059	9%	14%	0.01	183.586	183.576
1 - 7	5	Drain				0.6236	18.90	77.85	127.39	1200	0.06	69.7	0.135	0.221	0.84	0.955	14%	23%	1.38	183.122	183.080
Substitute with 965 x 1525 elliptical pipe														0.84	1.002	13%	22%				
6	if draining to ditch		0.60	0.0244	0.0146	0.0146	15	88.40	143.67	200	0.58	11.5	0.004	0.006	0.80	0.025	14%	23%	0.24		

Lowest road elevation in subdivision	Pillette Drain No. 1 5-year HWL (m)	Pillette Drain No. 1 100-year HWL (m)	Head 5-year (m)	Head 100-year (m)	Pipe size required 5-year (m)	Pipe size required 100-year (m)	D m	D/4	slope decimal	Area SM
185.002	184.146	184.948	0.556	0.054	0.165	0.376	0.375	0.09375	0.0026	0.110447
185.002	184.146	184.948	0.556	0.054	0.296	0.675	0.675	0.16875	0.0012	0.357847
185.002	184.146	184.948	0.556	0.054	0.080	0.182	0.2	0.05	0.01	0.031416
185.002	184.146	184.948	0.556	0.054	0.336	0.769	0.825	0.20625	0.0009	0.534562
185.002	184.146	184.948	0.556	0.054	0.223	0.510	0.525	0.13125	0.0017	0.216475
185.002	184.146	184.948	0.556	0.054	0.401	0.918	1.05	0.2625	0.0007	0.865902
185.002	184.146	184.948	0.556	0.054	0.279	0.637	0.675	0.16875	0.0012	0.357847
185.002	184.146	184.948	0.556	0.054	0.186	0.424	0.45	0.1125	0.002	0.159043
185.002	184.146	184.948	0.556	0.054	0.101	0.230	0.25	0.0625	0.01	0.049087
185.002	184.146	184.948	0.556	0.054	0.513	1.177	1.2	0.3	0.0006	1.130973
185.002	184.146	184.948	0.556	0.054	0.084	0.191	0.2	0.05	0.0058	0.031416

Each unit individually

Appendix E

Modeling Catchbasins and Inlets in SWMM

Modeling Catchbasins and Inlets in SWMM

Matthew Senior, Ron Scheckenberger and Brian Bishop (2018)
Amec Foster Wheeler

DOI: <https://doi.org/10.14796/JWMM.C435>

1. Introduction

1.2 Problem Statement and Methodology

Method 4: Orifices Representing Grates

In this method, catchbasin grates are represented as bottom-draw orifices. The general layout would again be consistent with that presented in Figure 3. Each catchbasin is assumed to have an approximate opening area of 0.125 m², based on measurements of standard grate designs used in Ontario (Ontario Provincial Standard Drawings, OPSD, 400.010 and OPSD 400.100; OPS 2016). Similar to method 3, this opening area is multiplied by the number of grates being represented in the subcatchment, with an equivalent square opening calculated. A standard orifice coefficient of 0.62 is used. This method generally functions more effectively than method 3 in situations where storm sewer surcharge above the surface level is expected (i.e. reverse flow). This method also addresses some of the shortcomings of method 3 by better accounting for the dynamic rate of inflow with varying head (particularly at sag points) and also for permitting reverse flow from the minor system back to the major system. However, this method does not account for any potential inlet restriction provided by the catchbasin lead, as compared to the grate.

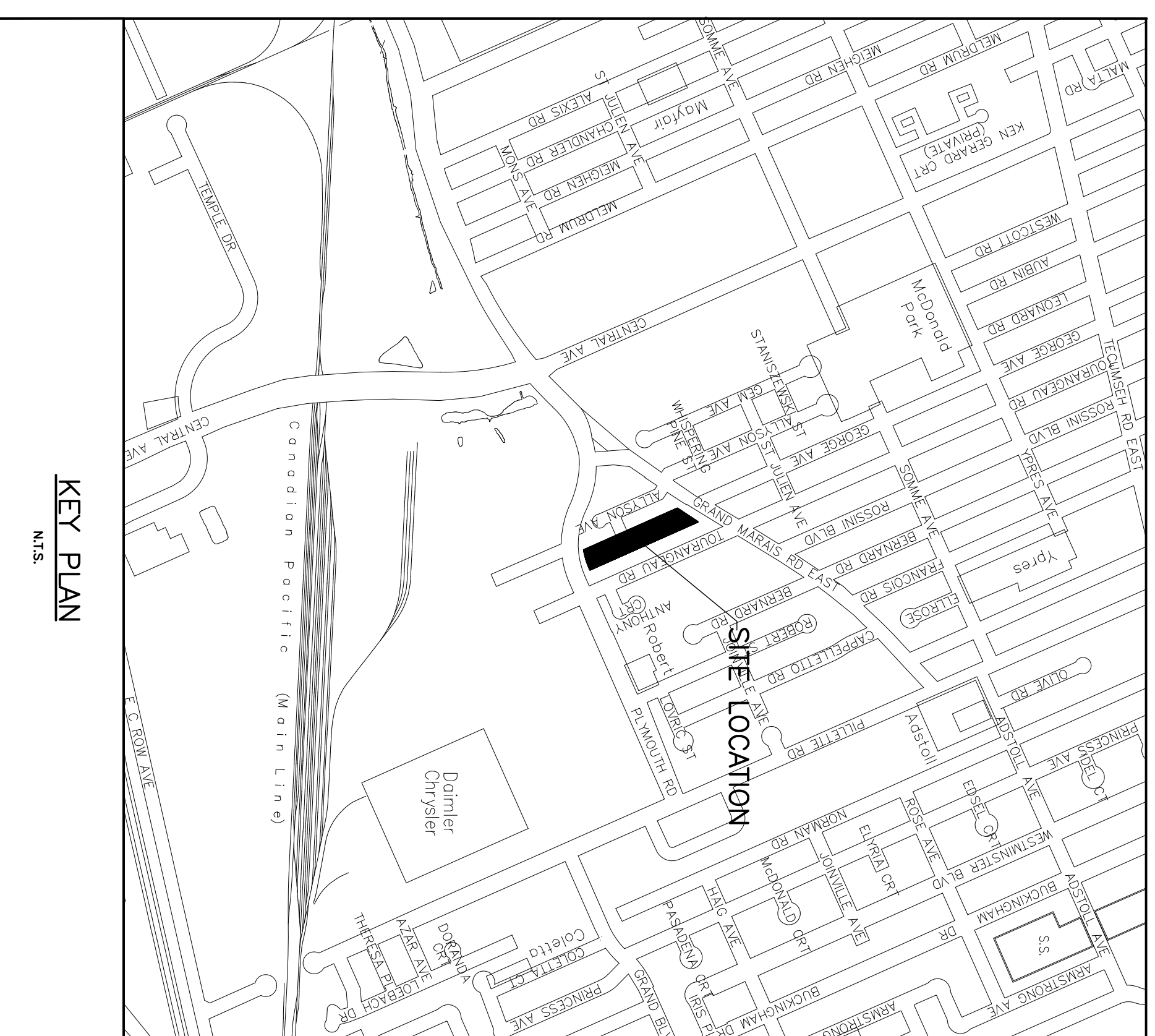
<https://www.chijournal.org/C435>

<u>Analysis of Capacities of Catch Basins</u>						
	<u>Q_{inn}</u>	<u>Flow per catch basin</u>	<u>Number of catch basins required</u>	<u>Number of catch basins</u>	<u>Use</u>	
	(m ³ /s)	Q = cA x SQRT (2 g h) (m ³ /s)				
1	0.023	0.054278	0.415246	1 / lot		
2	0.073	0.054278	1.340222	2	4	Street 'A'
3	Half	0.021	0.381691			
1 - 3	w/ half	0.116	2.137158			
4	0.011	0.054278	0.194841	1		
1, 2, 4	0.106	0.054278	1.950308			
1 - 4	0.143	0.054278	2.632875			
3	Half	0.021	0.381691			
3	Full	0.041	0.763381	1 / lot		
5	0.065	0.054278	1.191254	2	4	Loon Street
6	0.029	0.054278	0.528715	1 / lot		
3 - 6	0.114	0.054278	2.10166			
7	0.008	0.054278	0.155149	1		
1 - 7	Total	0.232	4.265196	5		

SECRET GARDEN RESIDENTIAL SUBDIVISION

INDEX

DRAWING NO.	DESCRIPTION
	COVER SHEET
1	INFRASTRUCTURE – PLAN AND PROFILE – STORM EASEMENT AND STREET 'A'
2	INFRASTRUCTURE – PLAN AND PROFILE – LOON STREET
3	LOT GRADING
4	MISCELLANEOUS NOTES AND DETAILS
5	SANITARY AND STORM DRAINAGE – PARAMETERS AND BOUNDARIES



KEY PLAN
M.T.S.

FOR TOPOGRAPHIC INFORMATION, REFER TO 'TOPOGRAPHIC PLAN OF PART OF BLOCK 21 PLAN 12M-417 AND PART OF LOT 105 CONCESSION 2 - GEOGRAPHIC TOWNSHIP OF SANDWICH EAST NOW IN THE CITY OF WINDSOR - COUNTY OF ESSEX, ONTARIO' PREPARED BY VERHAEGEN LAND SURVEYORS (A DIVISION OF J.D. BARNES LTD.), DATED DECEMBER 17, 2021. REFERENCE NO.: 21-47-551-00

ELEVATIONS

ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES CANADIAN GEODETIC VERTICAL DATUM (1928)

BENCH MARK

BENCH MARK 573 ELEVATION 612.75'
MUN. NO. 4018 GRAND MARAIS ROAD EAST: THE PLATE IS LOCATED ON THE SOUTH WALL, 0.20 WEST OF THE EAST WALL AND 0.32m ABOVE GROUND.

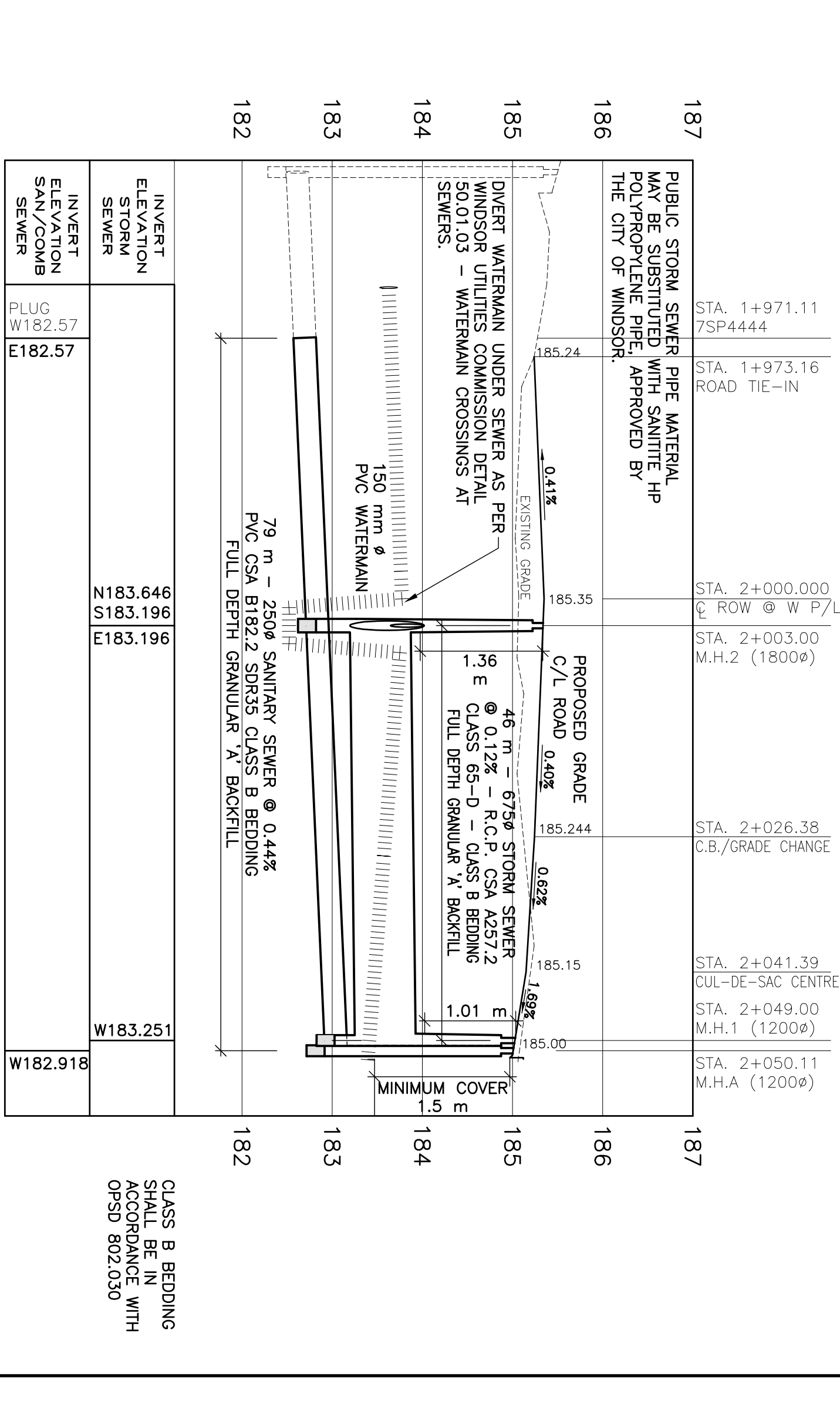
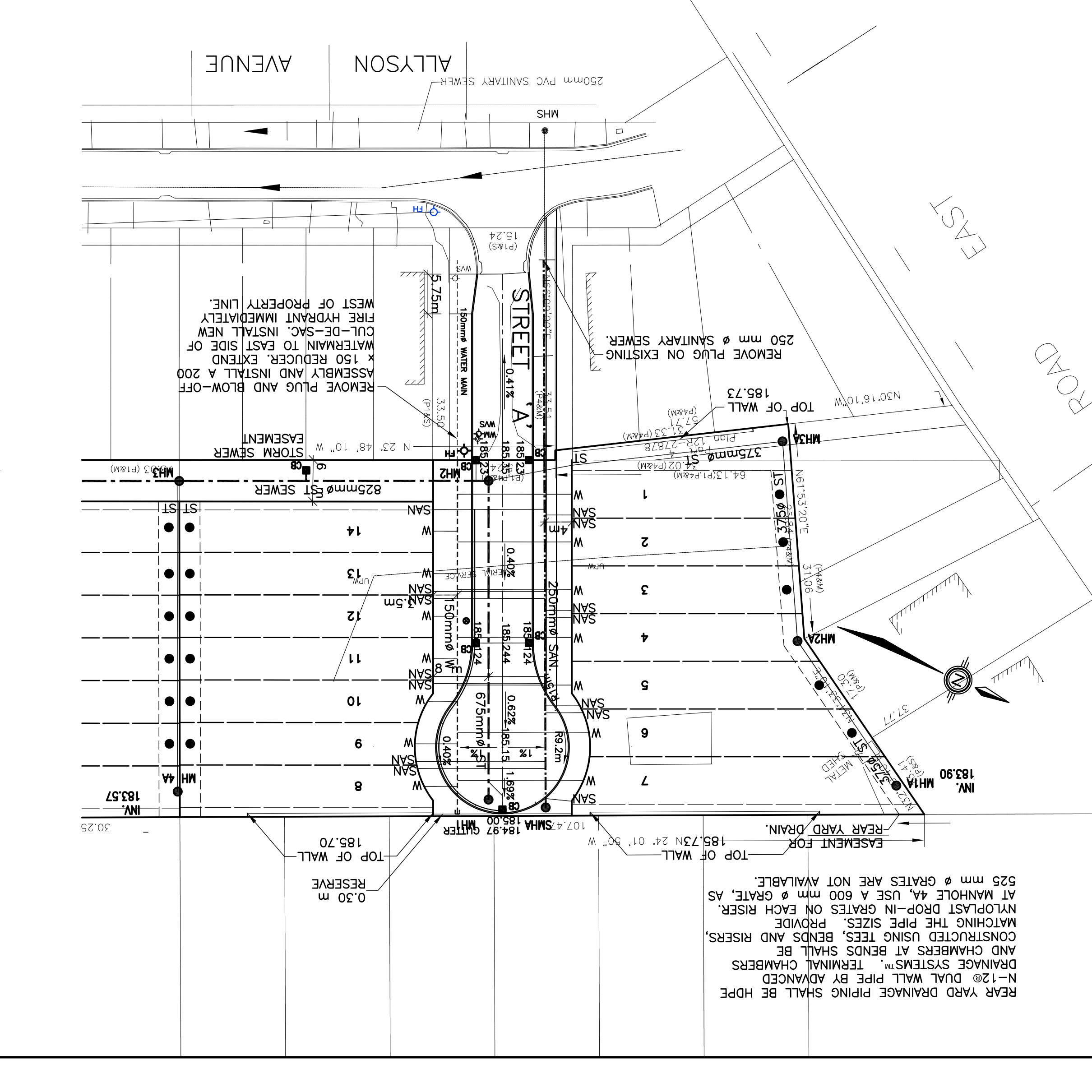
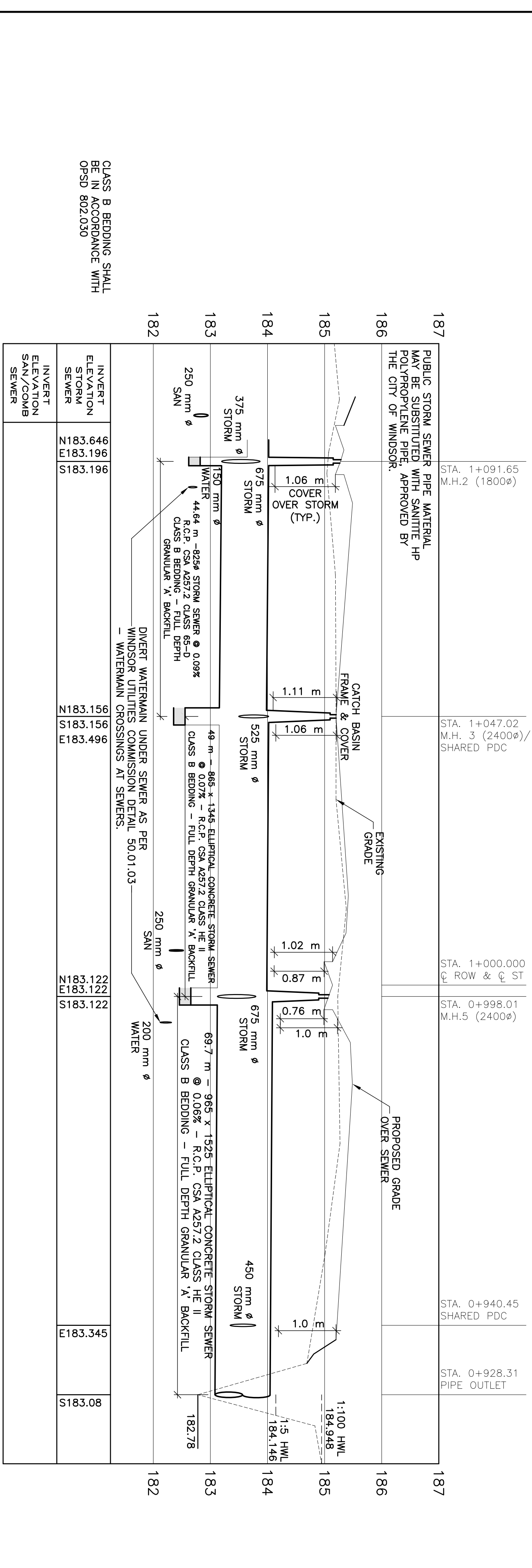
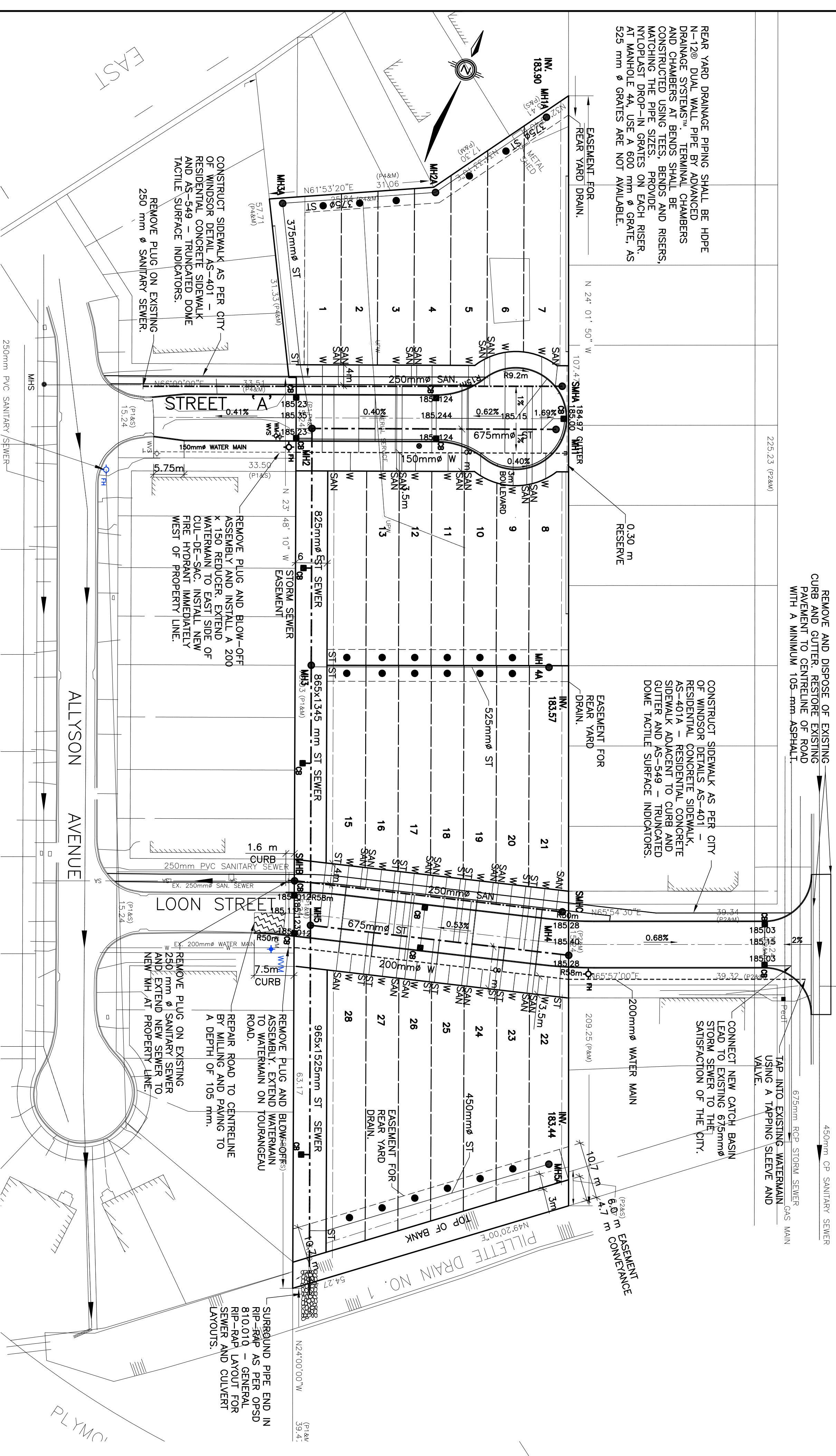
SITE BENCH MARK

TOP OF FIRE HYDRANT IN FRONT OF LOT 3, PLAN 12M-417. ELEVATION 610.79'

LEGEND

DESCRIPTION	EXISTING	NEW
– UNDERGROUND SERVICES		
STORM SEWER	_____	_____
SANITARY SEWER	_____	_____
WATERMAIN	_____	_____
GAS MAIN	—G—	
BELL CANADA	—B—	
HYDRO	—H—	
– TOPOGRAPHY		
SEWER MANHOLE	M.H. ○	M.H. 1 ●
WATER MANHOLE	W.M.H. ○	
CATCH BASIN	□	C.B. ■
SUMP PIT CATCH BASIN	□	● S.P.C.B.
DITCH INLET CATCH BASIN	D.I.C.B. □	D.I.C.B. ■
FIRE HYDRANT & WATER VALVE	F.H. ⊕	F.H. ⊕
WATER VALVE	W.V. ⊕	W.V. ⊕
BLOW-OFF VALVE		BO ⊕
GAS VALVE	GV ⊕	
BELL TELEPHONE PEDESTAL	□ BELL BX	
BELL TELEPHONE POLE	B •	
HYDRO POLE	H.P. ⊕	
LIGHT STANDARD	L •	
SIGN	S •	
CONCRETE	=====	=====
ASPHALT	=====	=====
GRAVEL	=====	=====
PROPERTY BAR	1B" * STB ●	
SHRUB, BRUSH OR HEDGE	●	
TREE	⊙	
FENCE	— x x x —	
LOT GRADE	x 68.5P	(76.35) [76.45]

TOLPANGEAU ROAD

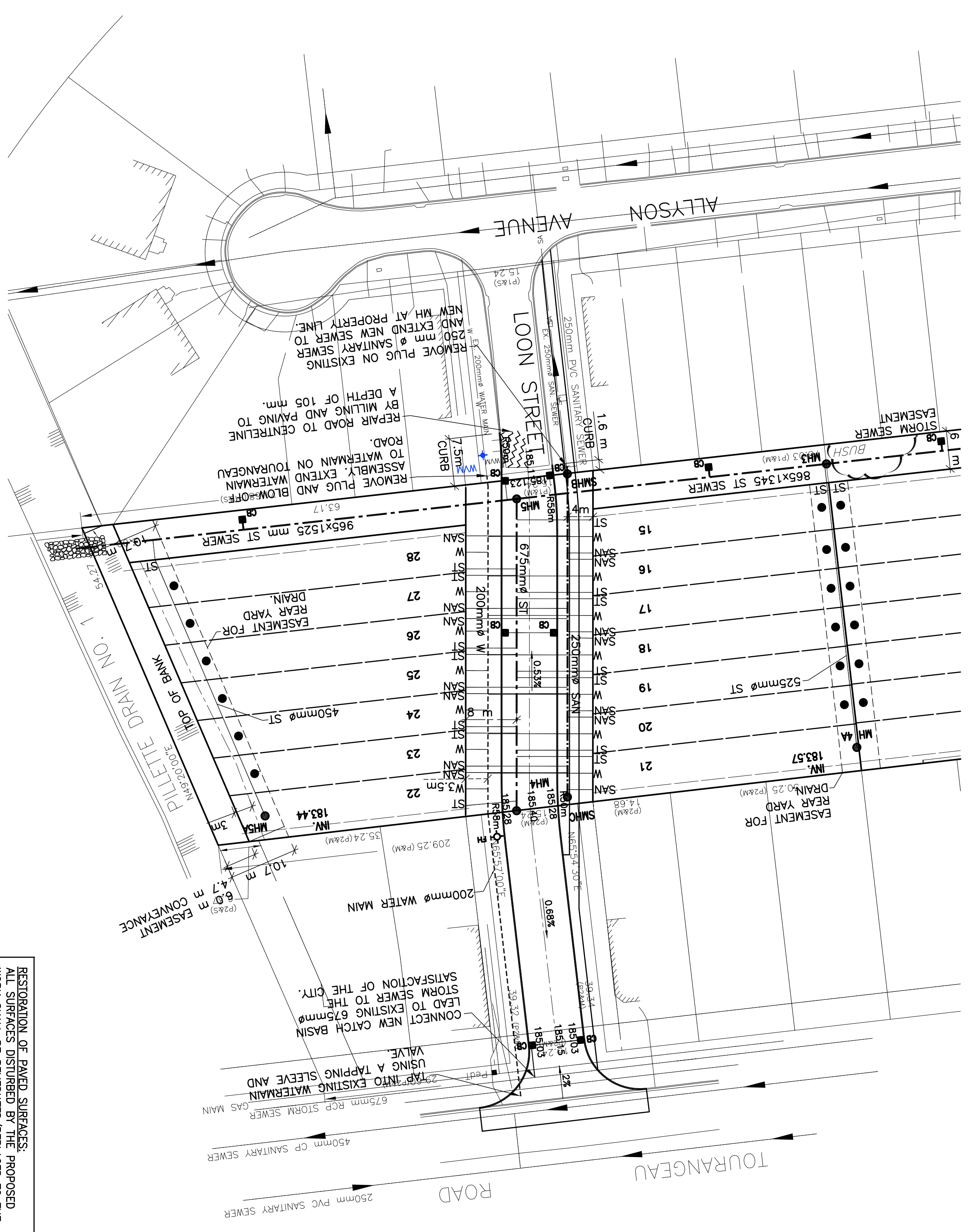


CHG.	DESCRIPTION	DD-MM-YY	BY
0	APPROVAL	09-05-24	CG

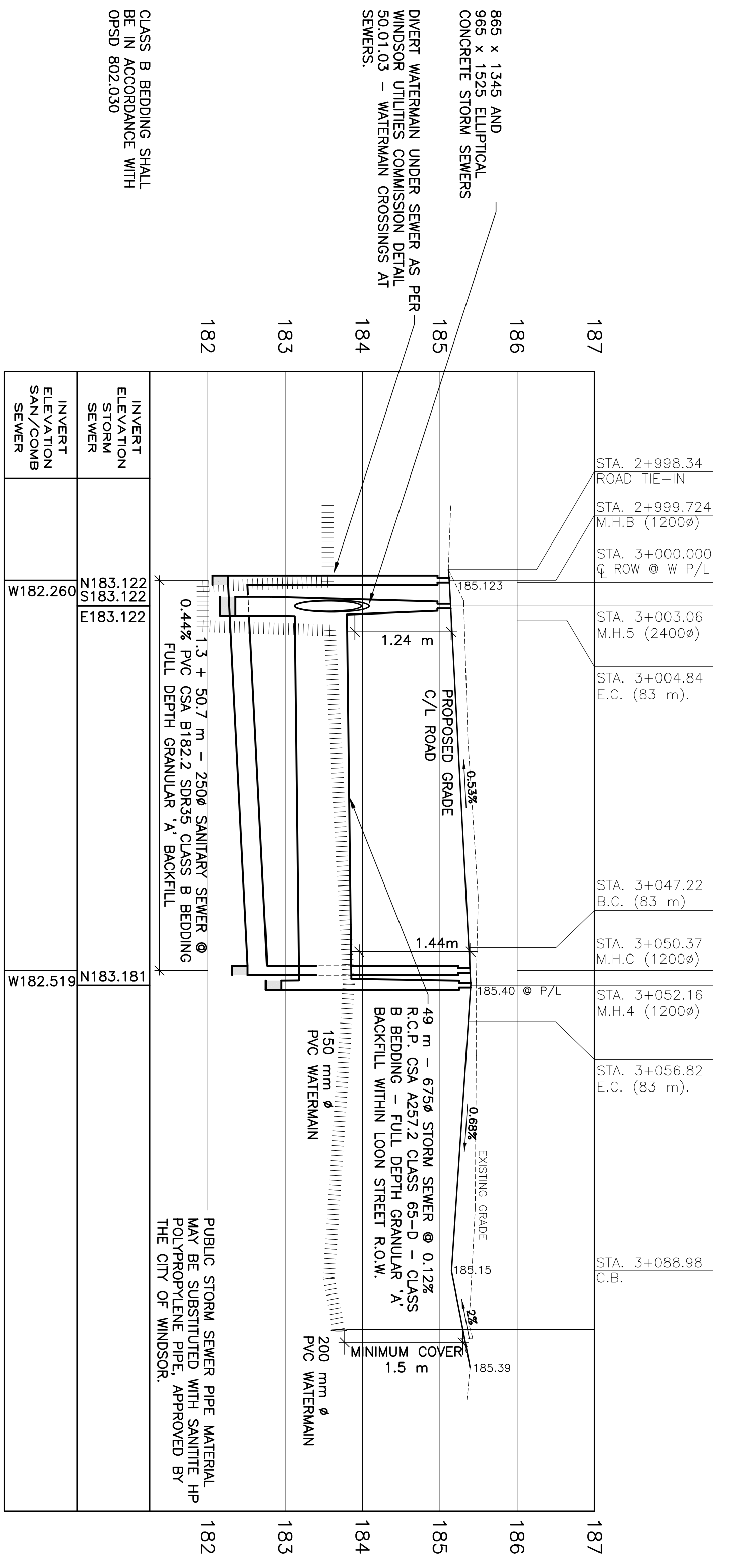
Work written, P.Eng.
Commissioner of Infrastructure Services
THE CORPORATION OF THE CITY OF WINDSOR



DESIGNED BY:	C.G.
DRAWN BY:	C.G.
CHECKED BY:	W.T.
SCALE:	AS NOTED
DATE:	OCTOBER 2022
PROJECT NO.:	19-134
DWG. NO.:	1



RESTORATION OF PAVED SURFACES:
 ALL SURFACES DISTURBED BY THE PROPOSED WORK SHALL BE REMEDIATED/REPLACED TO THE SATISFACTION OF THE CITY ENGINEER.



CLASS B BEDDING SHALL BE IN ACCORDANCE WITH OPSD 802.030

865 x 1345 AND 965 x 1525 ELLIPTICAL CONCRETE STORM SEWERS
 DIVERG WATERMAN UNDER SEWER AS PER 50.0703 UTILITIES COMMISSIONS AT 50.0703 - WATERMAN CROSSINGS AT SEWERS.

PUBLIC STORM SEWER PIPE MATERIAL MAY BE SUBSTITUTED WITH SANITITE HP POLYPROPYLENE PIPE, APPROVED BY THE CITY OF WINDSOR.

CHG.			
0	APPROVAL	09-05-24	CG
	DESCRIPTION	DD-MM-YY	BY

APPROVED AS TO FORM, IN RELIANCE UPON THE PROFESSIONAL SEAL AND SIGNATURE OF HADDAD MORGAN AND ASSOCIATES LTD. AS TO DESIGN AND SPECIFICATION.

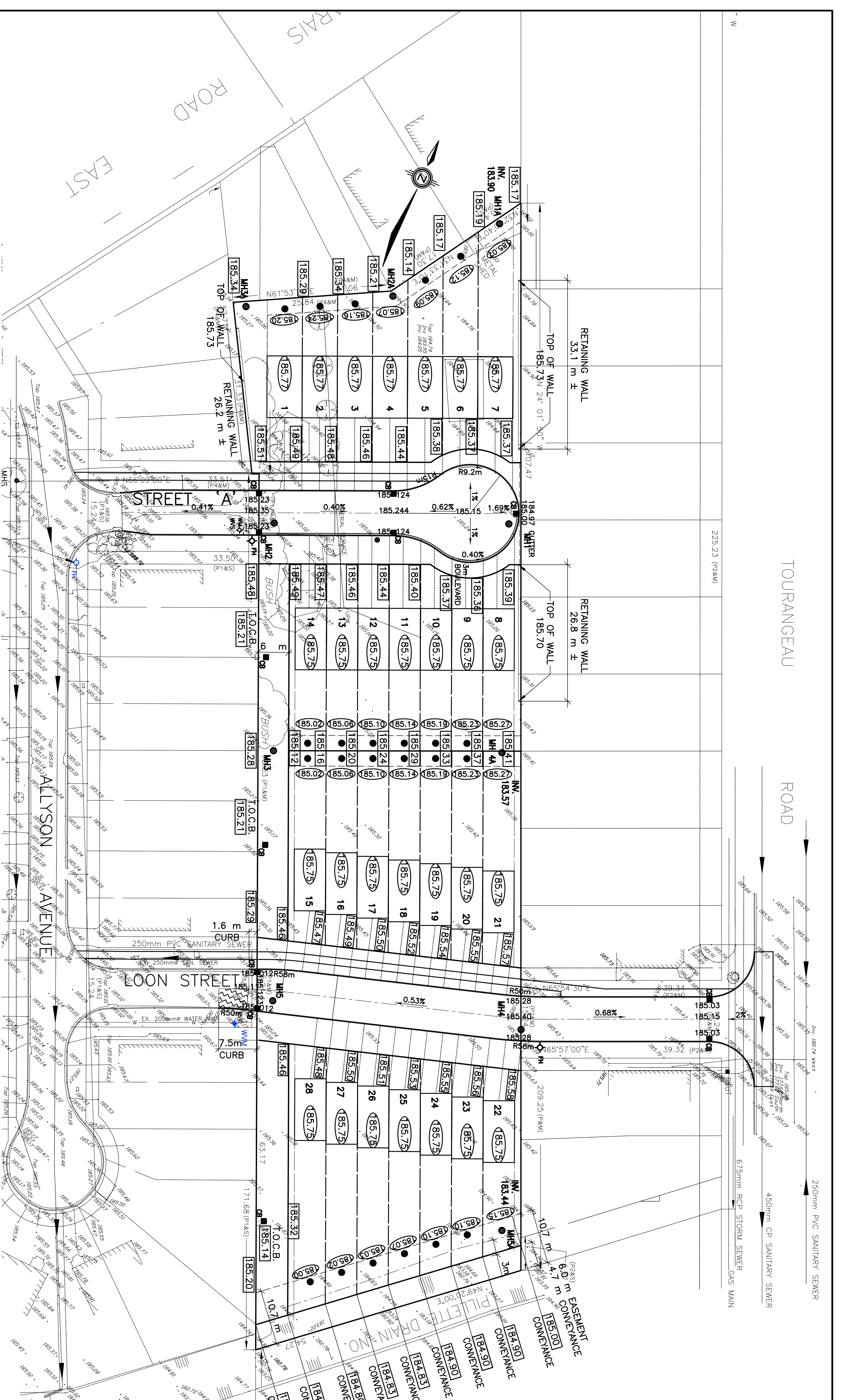
Mort Winterhagen, P.Eng.
 Commissioner of Infrastructure Services
 THE CORPORATION OF THE CITY OF WINDSOR



DESIGNED BY:	C.G.
DRAWN BY:	C.G.
CHECKED BY:	W.T.
SCALE:	AS NOTED
DATE:	OCTOBER 2022

SECRET GARDEN RESIDENTIAL SUBDIVISION

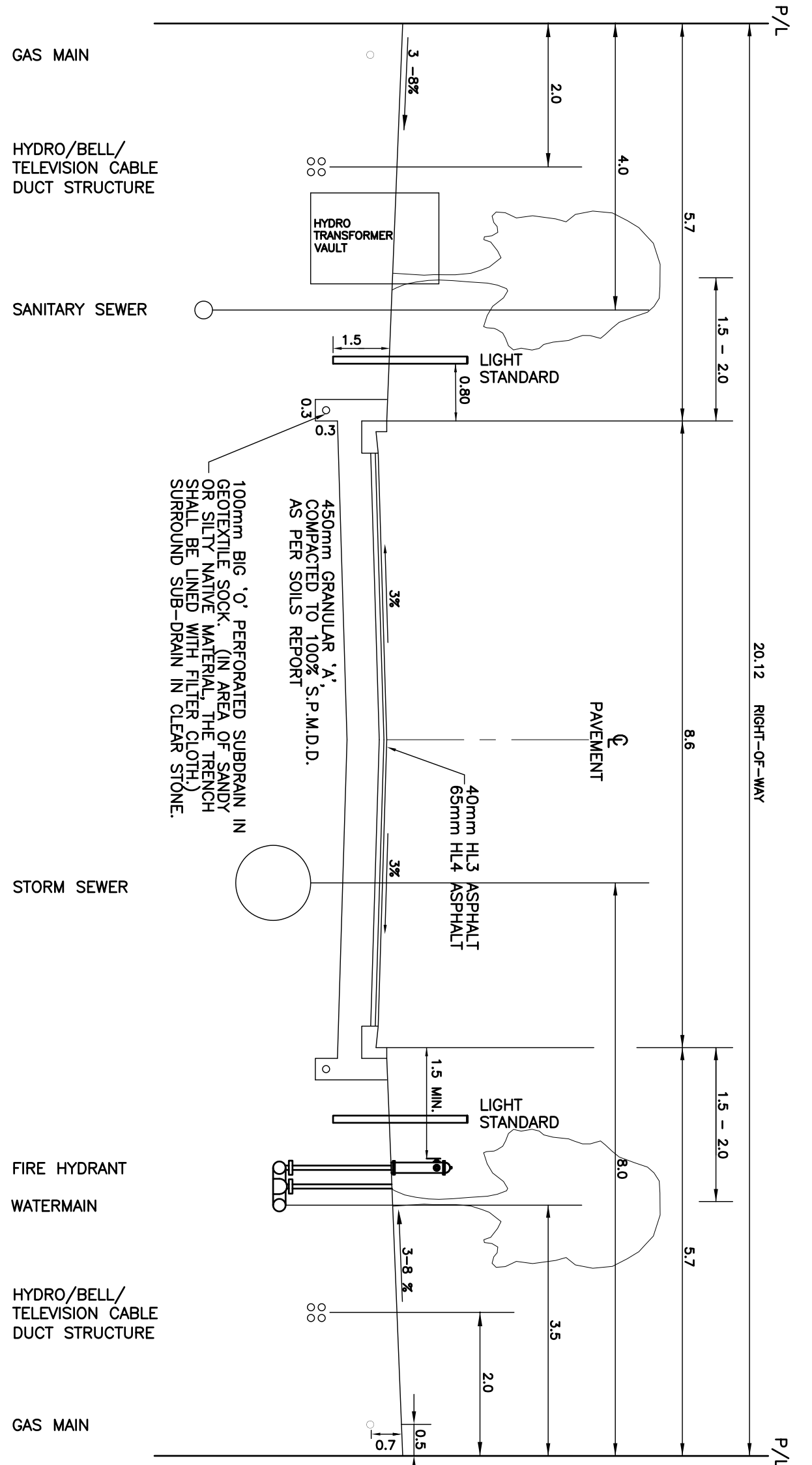
INFRASTRUCTURE PLAN AND PROFILE LOON STREET



LOT	FRONT YARD SLOPE %	REAR YARD SLOPE %
1	3.1	5.9
2	3.1	5.9
3	3.5	5.7
4	3.7	6.2
5	4.8	4.4
6	5.9	3.2
7	5.6	2.8
8	6.0	3.4
9	4.9	3.9
10	3.8	4.2
11	3.5	4.5
12	3.3	4.8
13	3.3	4.8
14	3.1	5.1
15	4.8	3.4
16	4.2	3.4
17	4.0	3.0
18	3.0	2.7
19	3.7	2.7
20	3.4	2.5
21	3.2	2.2
22	3.0	4.9
23	3.2	4.4
24	3.6	3.4
25	3.8	3.4
26	4.1	3.2
27	4.3	2.9
28	4.6	2.7

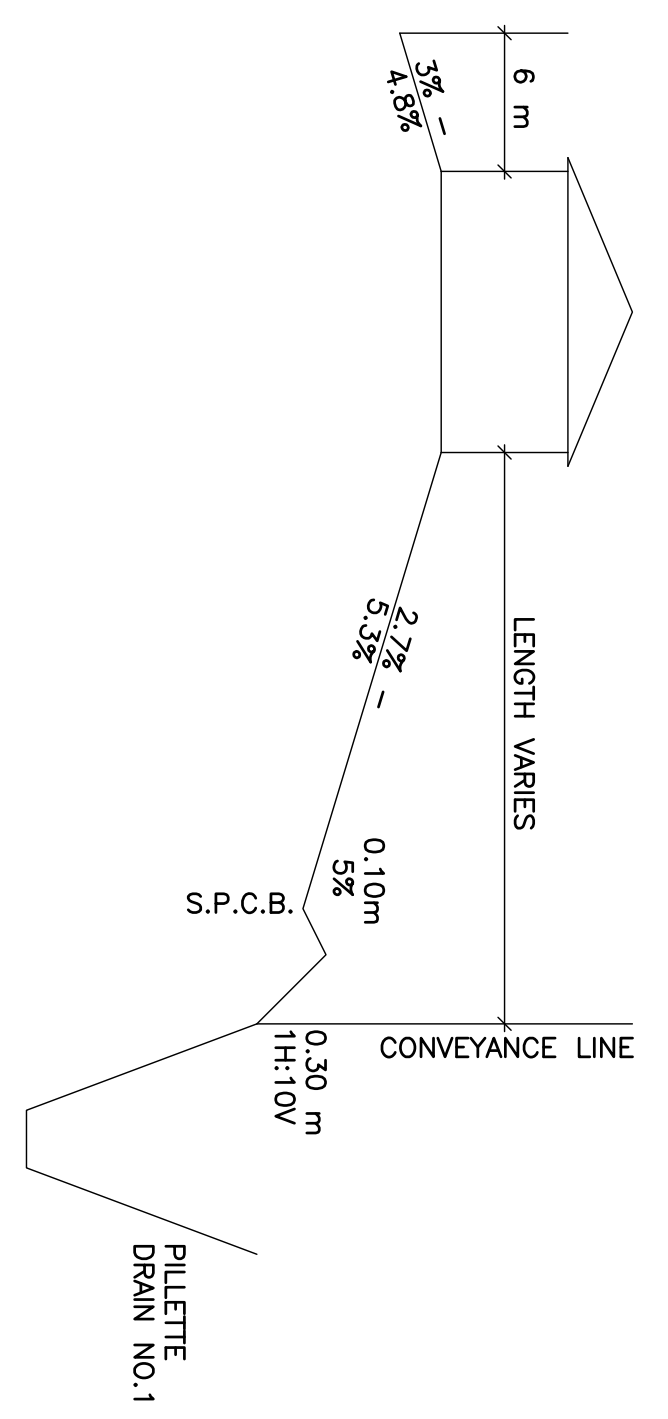
GRADING DESIGN NOTE:
 THE GRADING PLAN HAS BEEN DEVELOPED USING THE ACTUAL REAR YARD LENGTHS. AS THE PROPOSED DEVELOPMENT CONTAINS ONLY TOWNHOUSES, EXTENSIONS OF THE LOTS SHALL NOT BE PERMITTED WITHOUT THE APPROVAL OF A REVISED SITE PLAN.

TYPICAL CROSS-SECTION - 20 m RIGHT-OF-WAY

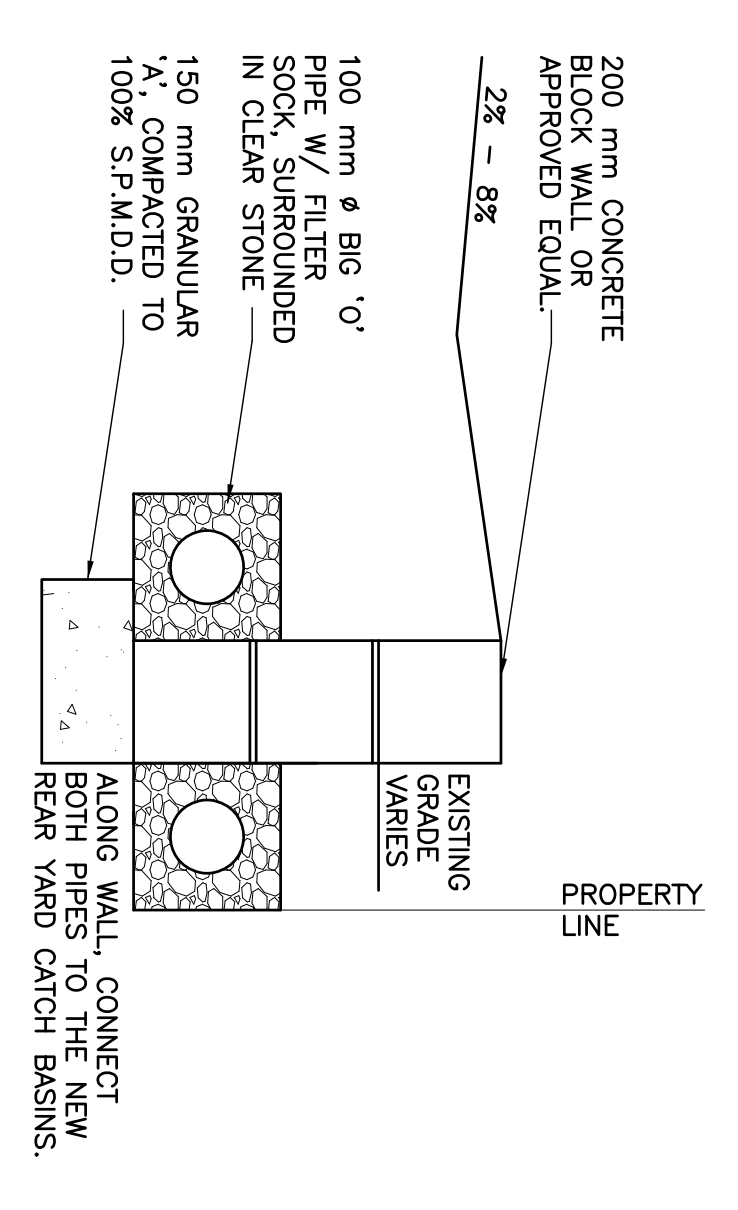


TYPICAL CROSS SECTION FOR STREET 'A' AND LOON STREET ALLYSON AVENUE SUBDIVISION - 1998

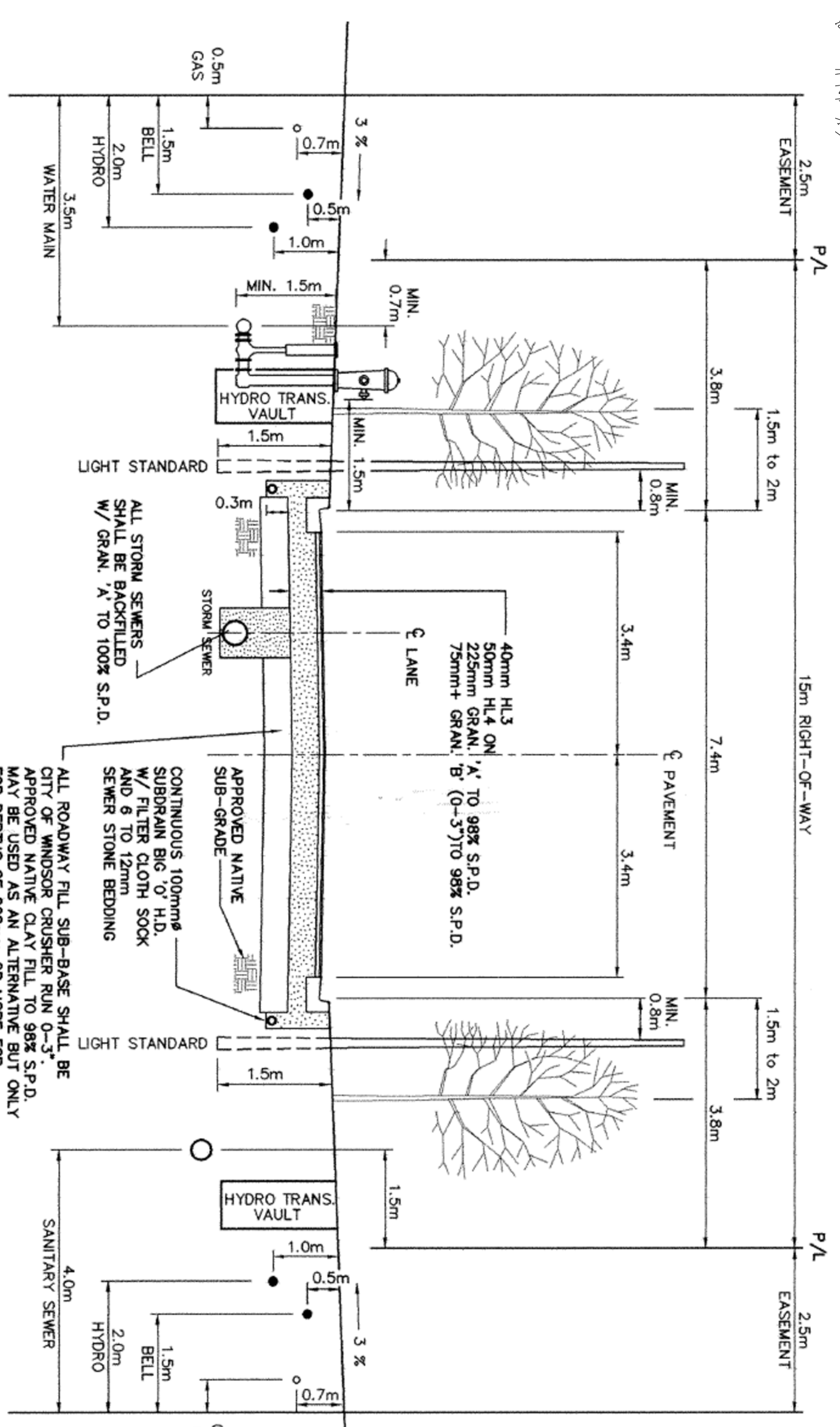
CROSS SECTION THROUGH LOTS 22 - 28



PROPOSED RETAINING WALL



TYPICAL CROSS SECTION



0	APPROVAL	09-05-24	CG	Work: Winterton, P.Eng. Commissioner of Infrastructure Services THE CORPORATION OF THE CITY OF WINDSOR
CHG.	DESCRIPTION	DD-MM-YY	BY	THE CORPORATION OF THE CITY OF WINDSOR

APPROVED AS TO FORM, IN RELIANCE UPON THE PROFESSIONAL JUDGMENT AND SEAL OF HADDAD MORGAN AND ASSOCIATES LTD. AS TO DESIGN AND SPECIFICATION.

CHIEF BUILDING OFFICIAL THE CORPORATION OF THE CITY OF WINDSOR

DESIGNED BY: C.G.
 DRAWN BY: C.G.
 CHECKED BY: W.T.
 SCALE: AS NOTED
 DATE: OCTOBER 2022



DESIGNED BY: C.G.
 DRAWN BY: C.G.
 CHECKED BY: W.T.
 SCALE: AS NOTED
 DATE: OCTOBER 2022

SECRET GARDEN RESIDENTIAL SUBDIVISION

LOT GRADING
 PROJECT NO.: 19-134
 DWG. NO.: 3

GENERAL NOTES:

- ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE ONTARIO BUILDING CODE, PLUMBING CODE, ONTARIO REGULATION 815/84, AND CITY OF WINDSOR PLUMBING DEPARTMENT.
- WINDSOR PLUMBING DEPARTMENT SHALL MEET THE REQUIREMENTS OF THE CITY OF WINDSOR BUILDING DEPARTMENT.
- ALL WORK OUTSIDE PROPERTY SHALL MEET THE REQUIREMENTS OF THE CITY OF WINDSOR PUBLIC WORKS DEPARTMENT.
- RESTORE ALL SURFACES TO A CONDITION EQUAL TO OR BETTER THAN ORIGINAL AND TO THE SATISFACTION OF THE CITY OF WINDSOR PUBLIC WORKS DEPARTMENT.
- THE CONTRACTOR SHALL PROTECT THE UTILITIES AND SERVICES OF EXISTING UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE TO THE OWNER FOR ALL DAMAGES TO ANY UTILITY.
- ALL SEWERS SHALL BE PVC SDR 35 PIPE, UNLESS NOTED OTHERWISE.
- RIGHT-OF-WAY UNDER THE PAVEMENT SHALL BE BACKFILLED WITH GRANULAR 5 P.M.D. ELSWHERE AND WITH APPROVED NAIVE MATERIAL TO 95% EXTEND BACKFILL FOR SEWERS CROSSING PAVEMENT TO 1'-6" (450mm)
- BETWEEN FACE OF CURB.
- CLEAN-OUTS IN PAVED AREAS SHALL BE SURROUNDED IN 6" (150mm)
- CONCRETE COVERS SHALL BE HEAVY DUTY METAL.
- PAVEMENT COVERS SPONGE ARE AT CATCH BASINS OR AT EDGE OF PAVEMENT.
- ALL UTILITY CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH THE CITY OF WINDSOR STANDARD DRAWING.
- THE CONTRACTOR SHALL DISPOSE OF REMOVED AND EXCESS MATERIAL OFF SITE IN A SUITABLE MANNER.
- ALL CATCHBASINS/MANHOLE CATCHBASINS SHALL BE EQUIPPED WITH 4" (100mm) DIA. SUBDRAIN WITH FILTER SOCK, INSTALLED IN FOUR DIRECTIONS EACH 10'-0" (3.0m) IN LENGTH, REINCHED IN THE SUBGRADE.
- ALL PERFORMED PIPE SHALL BE CAPED AT UPSTREAM END.
- ALL STORM AND SANITARY PIPES SHALL BE INSTALLED AND PROTECTED TO MEET THE FOLLOWING: MANHOLES, CLEANOUTS, VALVES, ETC.
- THE CONTRACTOR SHALL SUBMIT A CERTIFICATE BY AN ONTARIO LAND SURVEYOR OR ENGINEER STATING THAT THE GRADES CONFORM TO THE ELEVATIONS SHOWN ON THE APPROVED DRAWINGS AT THE COMPLETION OF CONSTRUCTION.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR APPLYING FOR OBTAINING, SCHEDULING AND PAYING FOR ALL NECESSARY PERMITS, INSPECTIONS, FEES, ETC. TO PERFORM THE WORK.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR VISITING THE SITE TO SATISFY HIMSELF OF THE EXISTING SITE CONDITIONS.
- RESTORATION OF THE RIGHT-OF-WAY SHALL FOLLOW CITY OF WINDSOR STANDARD DRAWING 718 (RESTORATION OF RIGHT-OF-WAY) FOR TEMPORARY ADJUSTMENT. PERMANENT RESTORATION OF ALL HARD SURFACES AND ADJACENT BOULEVARD/LANDSCAPED AREAS SHALL BE COMPLETED BY THE CITY, AND AT THE COST BORNE BY THE CONTRACTOR.

THE FOLLOWING ONTARIO PROVINCIAL STANDARD DRAWINGS SHALL APPLY:

- 0P9D-400.020 CAST IRON, SQUARE FRAME WITH SQUARE FLAT GRATE FOR CATCH BASINS, HERRING BONE OPENINGS
- 0P9D-602.010 FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION, EXCAVATION BEHIND, COVER AND BACKFILL, TYPE 1 OR 2 SOLI - EARTH
- 0P9D-802.030 EXCAVATION BEHIND, COVER AND BACKFILL, TYPE 1 OR 2 SOLI - EARTH
- 0P9D-1006.010 SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER
- 0P9D-1006.020 SEWER SERVICE CONNECTIONS FOR FLEXIBLE MAIN PIPE SEWER

WATER SERVICE NOTES:

- ALL MATERIAL AND WORK SHALL BE IN ACCORDANCE WITH WINDSOR UTILITIES COMMISSION SPECIFICATIONS AND STANDARD DETAILS AND OBTAIN ALL PERMITS.
- WATER SERVICES SHALL HAVE 5 ft. (1.5m) MINIMUM DEPTH OF COVER.
- 4.000mm TO 5.000mm WATERMAIN PIPING SHALL BE POLYETHYLENE GLYCOL (PE) CLASS 150, DR 18, BLUE IN COLOUR.
- 1" (25mm) TO 2" (50mm) WATER SERVICES SHALL BE POLYETHYLENE (PE) PRESSURE TUBING CONFORMING TO THE CURRENT SPECIFICATION AWMA C-901 AND MUST HAVE STAMPED THEREON THE DESIGNATION SERIES 160 PORTABLE OD PIPE PE 2306 CSA CERTIFIED, WATER SERVICE PIPE, 1/2" ANG. CONECTOR, SOLID WHITE, 5/8" FLANGE/ELBOW, SPLICES WILL BE ACCOMPLISHED USING "BURNBY" KS-90 16-10 CONNECTORS.
- ALL WORK SHALL BE IN ACCORDANCE WITH THE WINDSOR UTILITIES COMMISSION REQUIREMENTS, INCLUDING ALL NECESSARY FITTINGS, FLUSHING AND TESTING.
- ALL EXISTING REDUNDANT SERVICES SHALL BE REMOVED UP TO AND INCLUDING THE PROPERTY LINE PER WINDSOR UTILITIES COMMISSION STANDARDS.
- THE CONTRACTOR SHALL SUPPLY THE NECESSARY TRAFFIC PLAN AND INSPECTION WITHIN THE RIGHT-OF-WAY IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY OF WINDSOR PUBLIC WORKS DEPARTMENT AND THE WINDSOR UTILITIES COMMISSION.

SEDIMENT CONTROL MEASURES:

- THE CONTRACTOR SHALL PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
- ALL EROSION CONTROL MEASURES SHALL BE IN PLACE PRIOR TO STARTING CONSTRUCTION AND MUST REMAIN IN PLACE UNTIL RESTORATION IS COMPLETE.
- THE CONTRACTOR SHALL MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION.
- ALL COLLECTED SEDIMENT SHALL BE DISPOSED OF AT AN APPROVED LOCATION.
- AREA DISTURBED DURING CONSTRUCTION SHALL BE KEPT TO A MINIMUM.
- ALL DE-WATERING SHALL BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN.
- THE CONTRACTOR SHALL PROTECT ALL CATCHBASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION WITH FILTER CLOTH OR OTHER APPROVED METHOD.
- ENDS FROM SEDIMENT INTRUSION WITH FILTER CLOTH OR OTHER APPROVED METHOD.
- THE CONTRACTOR SHALL PREVENT WIND-BLOWN DUST.
- STRAW BALES SHALL BE USED DURING CONSTRUCTION, AS REQUIRED.

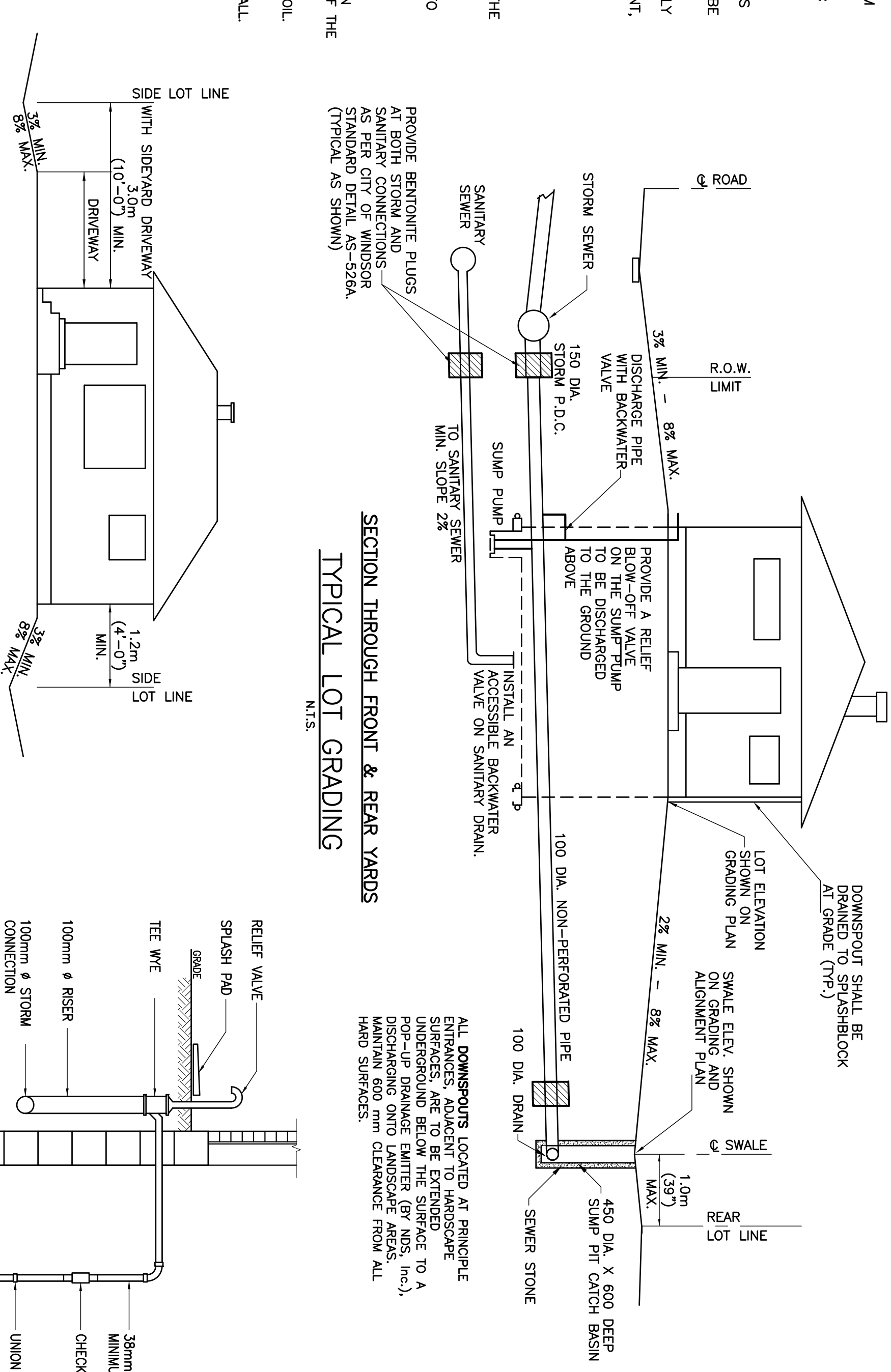
THE FOLLOWING CITY OF WINDSOR STANDARD DRAWINGS/SPECIFICATIONS SHALL APPLY TO THIS CONTRACT:

- | | |
|--|---------|
| 2x2' PRECAST CONCRETE CATCH BASIN WITH T-Y TRAP AND CLEANOUT | BD-02 |
| DRIVEWAY APPROACH ACROSS CULVERT | AS-209 |
| 8ftm (24 ft) WIDE RESIDENTIAL ASPHALT PAVEMENT | AS-214 |
| RESIDENTIAL ASPHALT PAVEMENT | AS-214 |
| RESIDENTIAL ASPHALT PAVEMENT | AS-214 |
| MANHOLE COVER - TYPE II | AS-208 |
| MANHOLE FRAME AND COVER - TYPE II | AS-304A |
| DETAIL OF TYPICAL MANHOLE STEP | AS-305 |
| CLASS "B" BEDDING DETAIL VARIOUS CASES | AS-310B |
| PRECAST MAINTENANCE HOLE 1200 mm DIAMETER | AS-314A |
| RESIDENTIAL CONCRETE SIDEWALK | AS-401 |
| RESIDENTIAL CONCRETE SIDEWALK | AS-401 |
| RESIDENTIAL ASPHALT PAVEMENT | AS-196 |
| RESIDENTIAL ASPHALT PAVEMENT | S-29 |
| UTILITY CURBS RESTORATION | S-29 |
| REPLACEMENT OF PRIVATE DRAIN CONNECTIONS | S-35 |

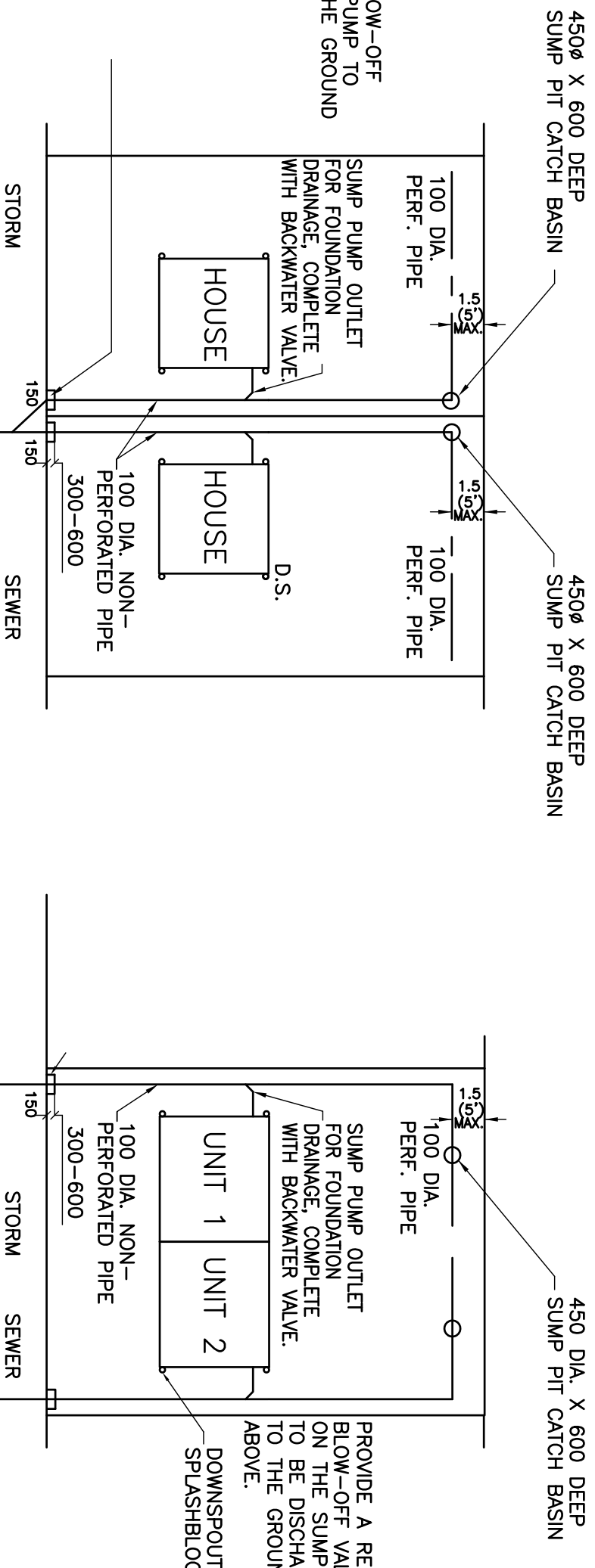
LOT GRADING AND DRAINAGE NOTES:

- LOT GRADING TO DIRECT WATER AWAY FROM HOUSE TO EITHER ROAD OR REAR YARD DRAIN.
- SANITARY CONNECTION TO CARRY DOMESTIC DRAIN.
- CONNECT WEEPING TILES AROUND FOOTING TO BASEMENT SWAMP AND DISCHARGE TO STORM SEWER.
- THE EXISTING CATCH BASINS IN THE ALLEYS AND REAR YARDS, WHICH ARE IMMEDIATELY NORTH AND SOUTH OF THE SITE, ARE TO BE MAINTAINED. THESE CATCH BASINS ARE NOT TO BE USED FOR DRAINAGE FOR THE NEWLY CREATED LOTS. DURING THE SERVING CONSTRUCTION PHASE OF THE DEVELOPMENT, THE DEVELOPER WILL UNDERTAKE TO DETERMINE THE LOCATION AND INVERTS OF EXISTING CATCH BASINS.
- REAR YARD CATCH BASINS TO BE USED. MINIMUM 100mm BELOW THE LOWEST BUILDING OPENING.
- ALL EXPOSED FOUNDATION WALLS BELOW THE FINISHED FLOOR LEVEL SHALL BE WATER-PROOFED.
- A CONCRETE ARCHITECTURAL BLOCK RETAINING WALL SHALL BE CONSTRUCTED TO THE SATISFACTION OF CITY OF WINDSOR, WHERE APPLICABLE.

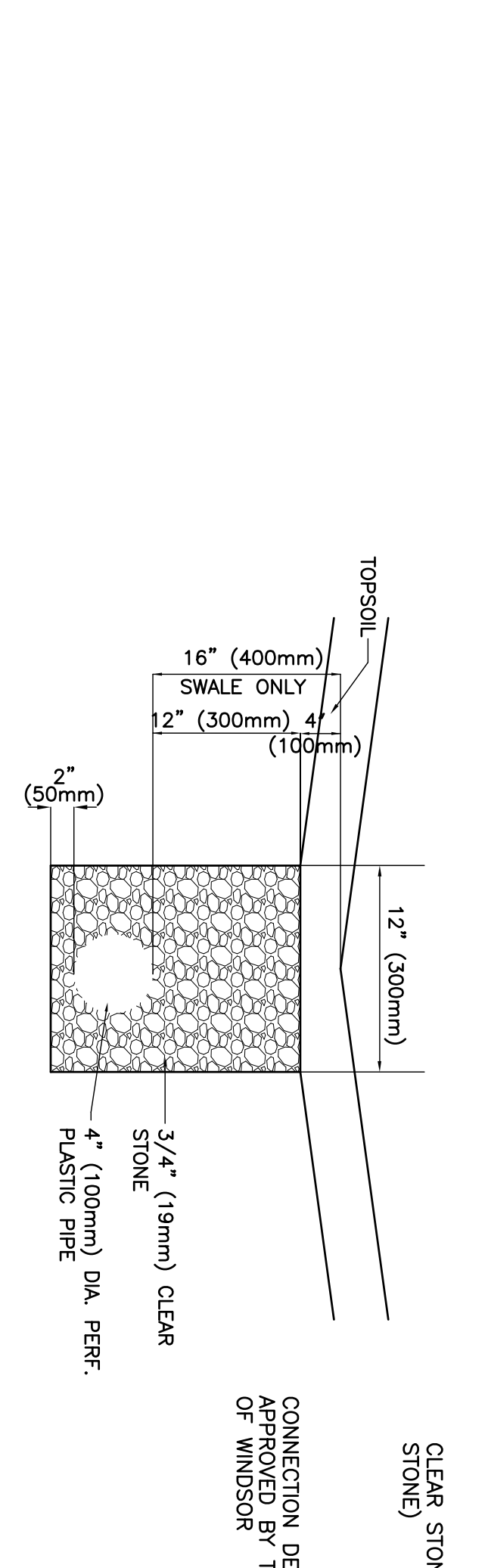
- SUPPORT OF HORIZONTAL STORM WATER PIPING ON FOUNDATION WALLS TO BE PROVIDED BY ONE OF THE FOLLOWING OPTIONS:
- ON UNDISTURBED SOIL.
 - ON CLEAR STONE PLACED ON UNDISTURBED SOIL.
 - ON ENGINEERED TIL SUPPORT STRUCTURE.
 - BY ENGINEERED STRAPPING TO FOUNDATION WALL.



SECTION THROUGH SIDE YARDS

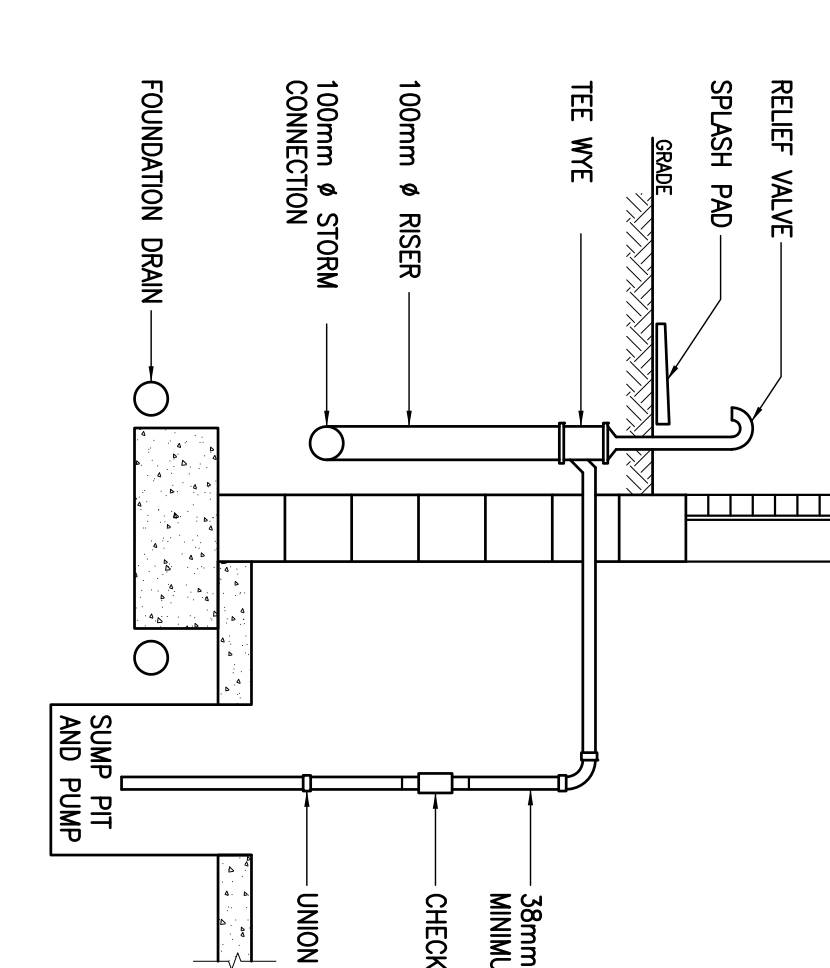


LOTS 11-14 REAR YARD DRAINAGE CONNECTION DETAIL



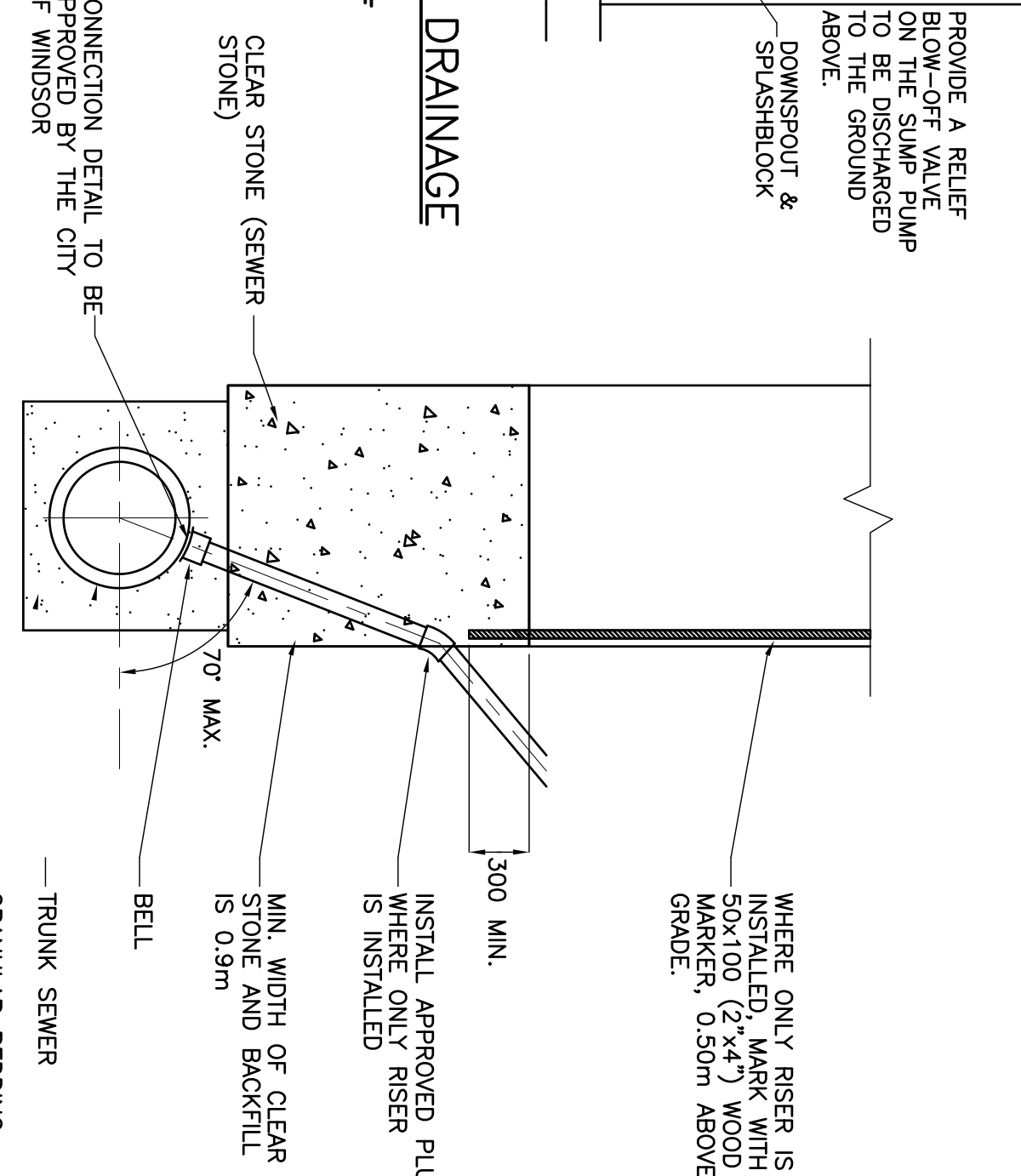
REAR AND SIDE YARD DRAINAGE

SECTION THROUGH FRONT & REAR YARDS

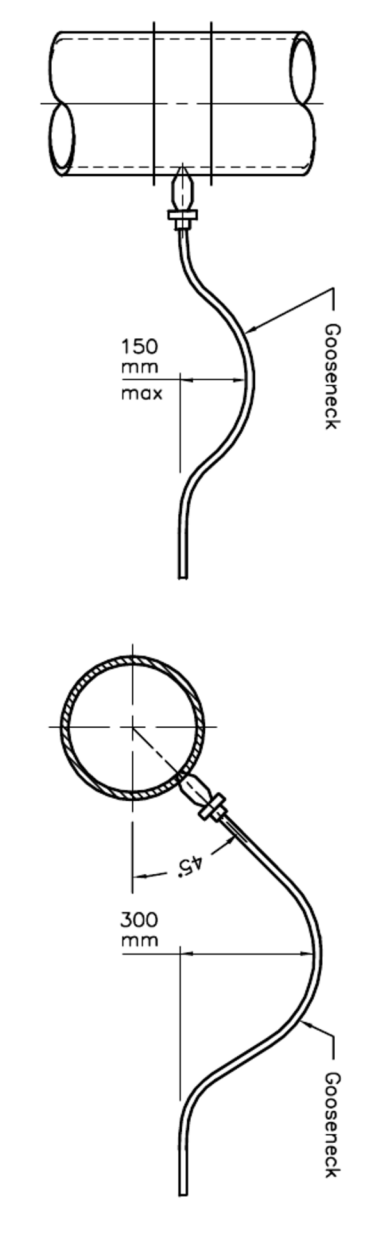


SUMP PUMP DISCHARGE

LOTS 11-14 REAR YARD DRAINAGE CONNECTION DETAIL



TRENCH AND RISER DETAIL



VERTICAL SECTION

NOTES:

- For plastic service pipes, install main stop at 15" above horizontal with a minimum of 12m long gooseneck, slope with approved tool with standard AWMA inlet thread.
- Service connections to plastic watermains shall be made using service saddles or factory made tees.
- All dimensions are in millimetres unless otherwise shown.

When specified, the vertical gooseneck option shall be used.

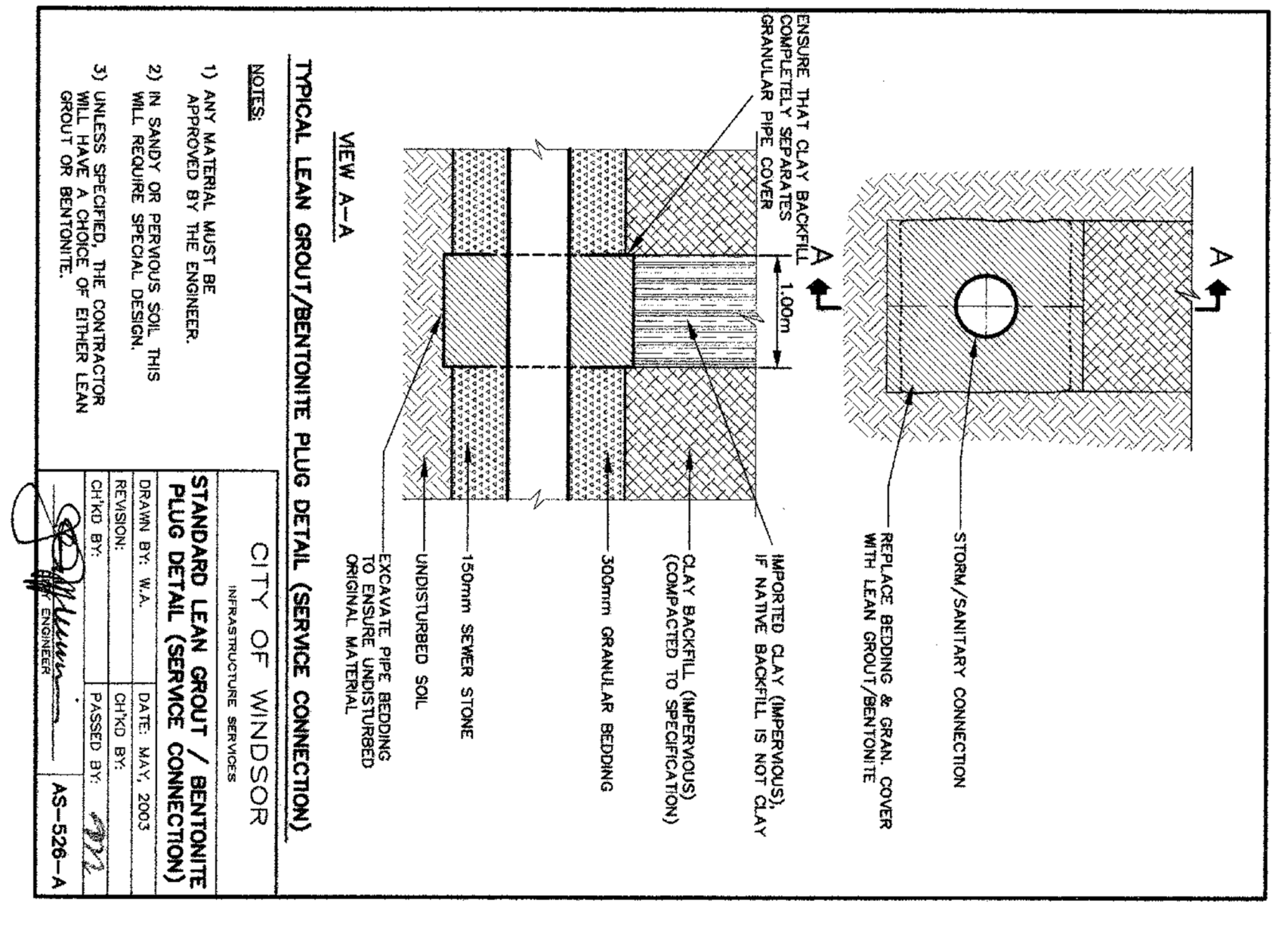
ONTARIO PROVINCIAL STANDARD DRAWING

WATER SERVICE CONNECTION

19 and 25mm DIAMETER SIZES

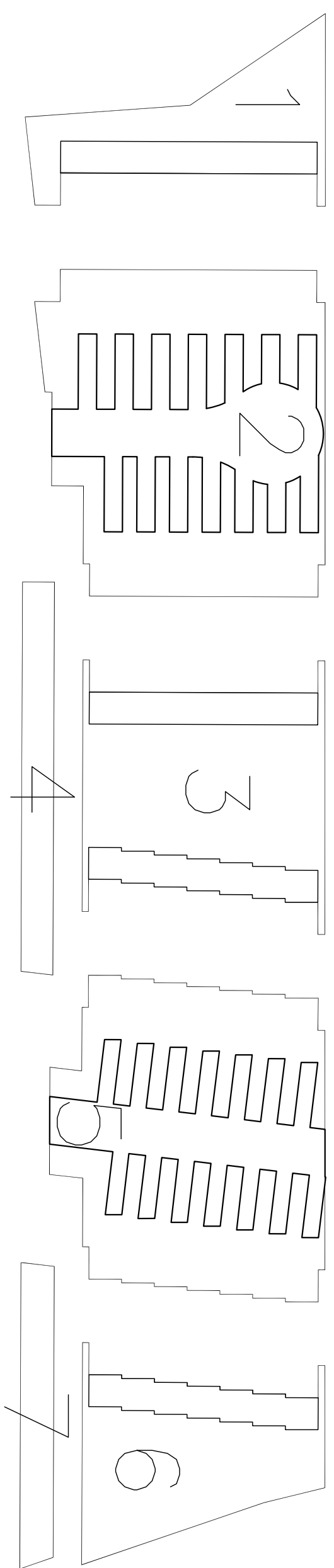
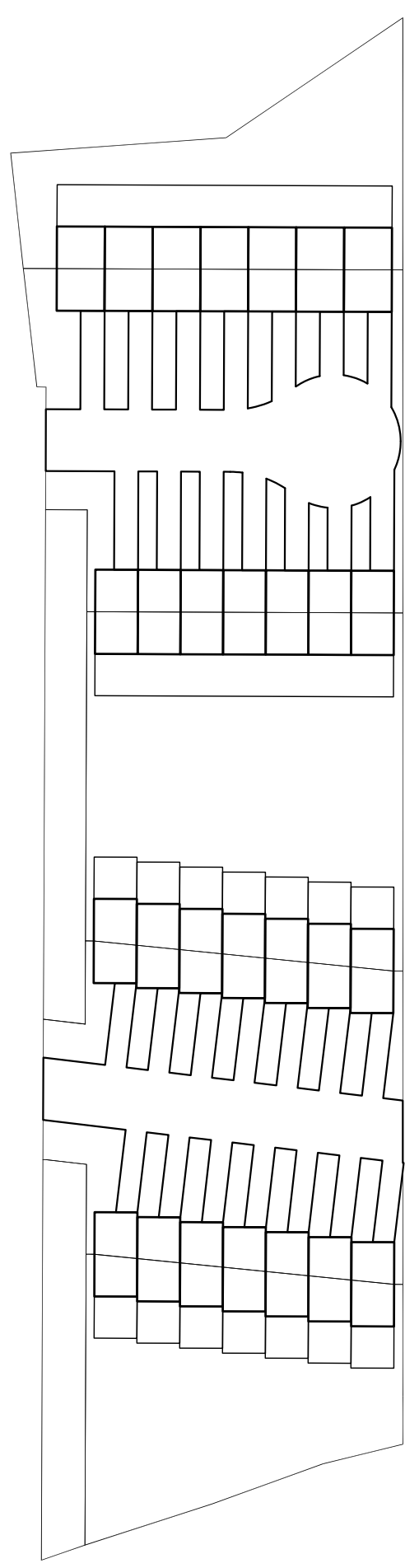
Nov 2013 Rev 3

OPSD 1104.010



TYPICAL LEAN GROUT/BENTONITE PLUG DETAIL (SERVICE CONNECTION)

0	APPROVAL	09-05-24	CG	Mark Winterlton, P.Eng. Commissioner of Infrastructure Services THE CORPORATION OF THE CITY OF WINDSOR	CHIEF BUILDING OFFICIAL THE CORPORATION OF THE CITY OF WINDSOR	DESIGNED BY: C.G.	DRAWN BY: C.G.	CHECKED BY: W.T.	SCALE: AS NOTED	DATE: OCTOBER 2022	WINDSOR	SECRET GARDEN RESIDENTIAL SUBDIVISION	MISCELLANEOUS NOTES AND DETAILS	PROJECT NO.: 19-134	DWG. NO.: 4
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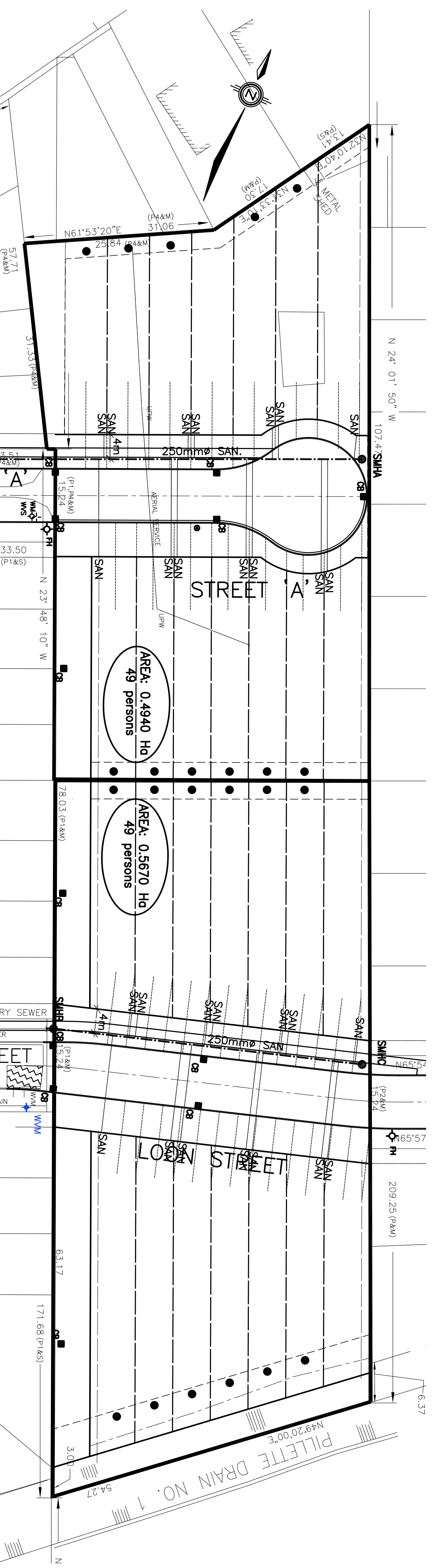
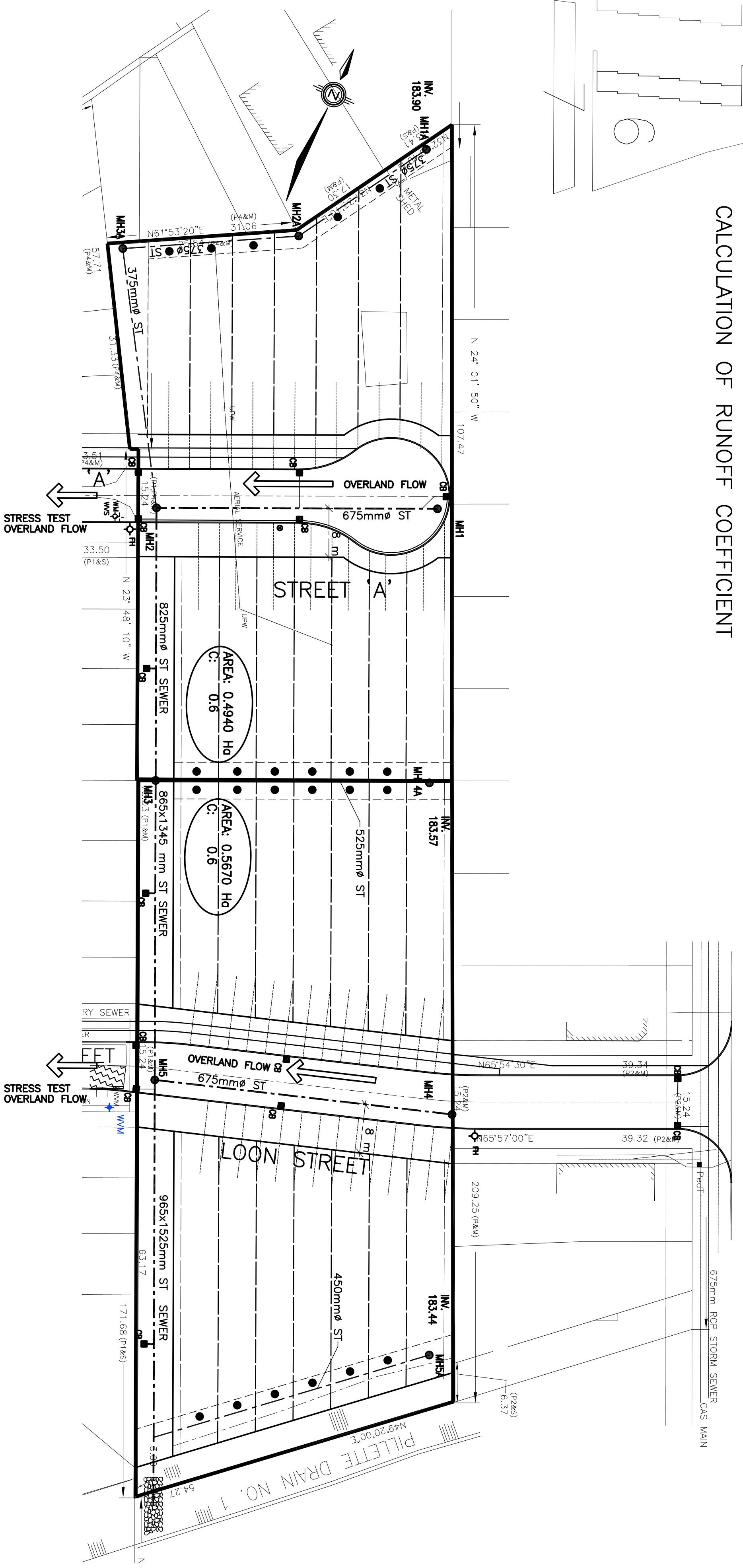


AREA #	TOTAL	BLDG.	PAVEMENT/LANDSCAPE	WEIGHTED COEFF.
1	941	0	289	651
2	3,036	1,104	1,195	737
3	1,729	0	516	1,213
4	441	0	0	441
5	2,698	1,044	975	679
6	1,198	0	259	939
7	351	0	0	351
TOTAL	10,393	2,148	3,234	5,012

CALCULATION OF RUNOFF COEFFICIENT

Storm Calculation
 Rational Formula: $Q_p = CIA$ ($Q = 0.0028ACI$ metric)
 Q_p = Peak Runoff Rate (m^3/s)
 C = Runoff Coefficient
 I = Rainfall Intensity (mm/hr)
 A = Drainage Area (hectares)
 Runoff Coefficient = 0.60

Sanitary Calculation
 Q (Ultimate) = Residential Sewage Flow x Ultimate Population Served x Ultimate Flow Factor + Infiltration
 Residential sewage flow = 0.0042 litre/second/capita
 Residential Population Density = 3.5 persons / unit
 Ultimate Flow Factor = 6.00
 Infiltration = 0.1560 litre/second/hectare



0	APPROVAL	09-05-24	CG	Work: Writerton, P.Eng. Commissioner of Infrastructure Services THE CORPORATION OF THE CITY OF WINDSOR
	DESCRIPTION	DD-MM-YY	BY	

APPROVED AS TO FORM, IN RELIANCE UPON THE PROFESSIONAL SEAL AND SIGNATURE OF HADJAD MORGAN AND ASSOCIATES LTD. AS TO DESIGN AND SPECIFICATION.



DESIGNED BY: C.G.
 DRAWN BY: C.G.
 CHECKED BY: W.T.
 SCALE: AS NOTED
 DATE: OCTOBER 2022

SECRET GARDEN RESIDENTIAL SUBDIVISION

SANITARY AND STORM DRAINAGE PARAMETERS AND BOUNDARIES
 PROJECT NO.: 19-134
 ACCOUNT NO.:
 DWG. NO.: 5