



BURNSIDE

Functional Servicing and Stormwater Management Report

**Losani Homes
Fifth Wheel Development
Town of Grimsby**

**R.J. Burnside & Associates Limited
1465 Pickering Parkway Suite 200
Pickering ON L1V 7G7 CANADA**

**May 2018
300040159.0000**



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R.J. Burnside & Associates Limited

Report Prepared By:



Adam Crookes, P.Eng.
 Project Engineer
 AC:cv

Report Reviewed By:



Steven A. Hader, P.Eng.
 Senior VP, Land Development

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1.0 Introduction and Planning Context

R.J. Burnside & Associates Limited (Burnside) has been retained by Losani Homes (Losani) to prepare a Functional Servicing and Stormwater Management Report (FSR/SWM) in support of the proposed residential development.

The Losani plan of subdivision is proposed to be located on Lot 16 of Part of Broken Front Concession, and Lot 17 of Concession 1, in the Town of Grimsby, Regional Municipality of Niagara. This subject site, generally located east of Casablanca Boulevard and north of the North Service Road, is approximately 6.9 hectares (ha) in area and is bounded by the North Service Road to the south and west, an existing residential lot to the east, and Lake Ontario to the north. Refer to Figure 1 in Appendix A for the site location. The proposed development includes a combination of back to back townhomes, on-street townhouses, and multi-story apartment style condominiums with retail space located on the first floor.

A portion of the site will be dedicated as public road right of way (Winston Road), an open space corridor that bisects the site and lands adjacent to Lake Ontario. The proposed Site Plan is included in Appendix A. The Lake Ontario coastline will be improved with revetment walls and public amenities as part of the development.

1.1 Existing Site Conditions

The site is located approximately 2 km north of the Niagara Escarpment and is generally flat, gently draining northward towards Lake Ontario. The site is situated in the former location of the Fifth Wheel Truck Stop. Two existing buildings located within the subject lands will be demolished. A drainage ditch roughly bisects the site and outlets to Lake Ontario. The east portion of the site is vacant. Much of the site has been cleared, and the remainder is predominantly landscaped or naturally vegetated.

1.2 Site Soils

Soil-Mat Engineering & Consultants Ltd. completed a geotechnical investigation for the subject site, dated January 15, 2016. The Geotechnical Report can be made available if necessary.

A total of 14 boreholes were drilled on site as part of the geotechnical investigation, and an additional 17 boreholes as part of a Phase II Environmental Site Assessment.

Topsoil with an approximate thickness of 0.6 m was observed in formerly landscaped areas of the site. Silty clay or silty sand fill was observed beneath the pavement structure, at depths ranging from 1.1 to 1.8 m. In general, the site is comprised of native silty clay proven to depths ranging from 3.5 to 11.3 m below grade. Static depth of

Functional Servicing and Stormwater Management Report
May 2018

groundwater was reported from 3 to 6 m below grade, fluctuating up to 1.5 m between summer and winter.

Queenston Shale was encountered beneath the silty clay in several boreholes at varying depths from 3.6 to 10.7 m below grade. The report notes that the Shale is shallowest along the south and west areas of the site, stepping down to the east and north.

2.0 Water Distribution

The proposed water network will be designed to current Region of Niagara, Town of Grimsby and MOECC criteria and specifications. In the absence of Town of Grimsby Design Standards, the domestic water and fire flow demands will be calculated using the MOECC guidelines subject to the approval of the Town of Grimsby.

The site will be serviced by a new looped watermain that will be connected in two locations to an existing 300 mm watermain situated on the North Service Road. The proposed water distribution system is depicted on Drawing C101 (Appendix B). Appropriate valving and hydrant placement will be determined at the detailed design stage.

3.0 Wastewater Servicing

The proposed wastewater collection system will be designed and constructed to current Region of Niagara, Town of Grimsby and MOECC criteria and specifications.

Preliminary sewer sizing has carried out based on the following assumptions:

- Residential flow rate – 275 litres per capita per day
- Infiltration – 0.286 litres per second per hectare
- Peaking Factor – Harmon Peaking Factor Formula
- Population Densities
 - Townhouse Units – 3.5 people per unit
 - Apartment Units-2.5 people per unit
 - Retail/Commercial Space – 200 people/ha

The preliminary design sheet is provided in Appendix C.

The site will be serviced by a network of local sewers that will outlet in several locations to an existing 525 mm trunk sewer located with the North Service Road right of way.

The site is graded that all of the units can be serviced by gravity.

Drawing C301(Appendix B) presents the preliminary sanitary servicing scheme for the site and drainage areas.

4.0 Storm Drainage

4.1 Existing Drainage Conditions

The subject lands are located within the Lake Ontario South Shore Watershed and the Niagara Peninsula Conservation Authority's (NPCA) Grimsby Watershed Planning Area. Although the topography of the site is relatively flat outside of the shoreline area, onsite overland drainage is generally directed northward, towards Lake Ontario.

The subject lands contain an unnamed drainage ditch which bisects the site. The ditch is a direct tributary of Lake Ontario. The ditch conveys flows from an external catchment of approximately 105.6 ha. The 100-year peak discharge in the ditch is 6.04 m³/s (Odan/Detech Group, 2005). Local surface flows are conveyed to the southern property boundary via a series of culverts under the South Service Road, the Queen Elizabeth Way and the North Service Road. Refer to Figure 2 (Appendix A) for the External Drainage Area Plan.

4.2 Proposed Drainage

4.2.1 Stormwater Quantity Control

The site is directly adjacent to Lake Ontario and therefore onsite quantity controls are not required.

4.2.2 Stormwater Quality Control

Stormwater quality control will be provided for the site to Enhanced Level Control as defined by the MOECC guidelines to achieve a total suspended solids removal rate of 80%.

Quality control for the majority of the site will be accomplished through the use of Oil Grit Separators (OGS). Four oil grit separators are proposed in locations indicated on Drawing C302 (Appendix B). Preliminary OGS sizing calculations are provided in Appendix D and are summarized on Table 1 below.

Table 1: Oil and Grit Separator Sizing

OGS ID	Drainage Area (ha)	Runoff Coefficient	Imperviousness (%)	OGS Type
OGS01	1.52	0.70	71	STC4000
OGS02	1.94	0.82	89	STC9000
OGS03	1.22	0.90	100	STC5000
OGS04	0.77	0.90	100	STC3000

In addition to the four OGS units, a bio-swale filter is proposed within the open space corridor adjacent to the central roadway. The bio-swale filter will treat a portion of the public right-of-way and the open space lands. The Bio-swale will provide a minimum TSS removal efficiency of 80%. A cross section of the bio-swale is provided on Drawing C202 (Appendix B) and a profile along the bio-swale is provided on Drawing C203 (Appendix B).

The northern catchment areas adjacent to the lakeshore (i.e. rear yard areas) will sheet drain uncontrolled to the lake. No quality control measures are proposed for these lands.

Drainage from building rooftops has been designed (where feasible) to bypass the OGS units, as rooftop runoff is considered to be clean.

4.2.3 Minor System Drainage

The local on-site storm sewers will be sized to convey the 5-year storm. Drawing C302 (Appendix B) presents the drainage areas and proposed storm sewer network.

A design sheet for storm drainage system is provided in Appendix C.

Two outlets to Lake Ontario are proposed as follows:

- A Twin 1350 mm diameter storm sewer located within the north south open space which conveys internal and external flows (see Section 4.2.4).
- A 600 mm diameter sewer located within the proposed public road that conveys flows from a portion of the site and the North Service Road.

4.2.4 External Drainage

External Area 1

Drainage from this area enters the site from south of the QEW and will be conveyed through the site via a 1350 mm diameter storm sewer which will be extended across the North Service Road. The proposed 1350 mm diameter sewer will replace an existing culvert and is sized to convey the 100-year peak flow rate of 6.04 m³/s. This peak flow was documented in a 2005 report prepared by the Odan/Detech Group (Refer to Figure 2 for external drainage area details).

External Area 2

This drainage area consists of a 4.65 ha undeveloped parcel located west of the site and across from North Service Road. Runoff from this area is captured by a drainage ditch running north along west side of North Service Road, is conveyed under the road by an existing 750 mm diameter culvert which discharges into Lake Ontario. Based on Town of Grimsby improvement plans for North Service Road (Plan Reference No. PWC1-02-320102), the ditch along the road will be improved and the existing culvert will be replaced by an 800 mm CSP culvert and the drainage pattern will be maintained. Refer to Drawing C302 (Appendix B).

External Area 3

This area consists of the portion of North Service Road fronting the project. The storm sewer system for the site has been designed to convey runoff from this area via the site's two outfalls and discharge the flows to Lake Ontario after being treated by the respective oil grit separators. Refer to Drawing C302 (Appendix B).

4.2.5 Major System Drainage

Major system flows will be conveyed overland within the public right of way. Major system flows will outlet to Lake Ontario in the vicinity of the central storm sewer outfall.

The direction of major system flows are shown on the Grading and Storm Drainage Area plans C201 and C302 located in Appendix B.

Major system flows will be designed to be contained within the public right of way.

It is not anticipated that any major system flows will originate from the QEW as the highway ditches will convey flows away from the site.

4.2.6 Foundation Drainage

The site design provides for gravity drainage of foundations to at least the P1 level or elevation 279.65. The average water surface elevation of the lake is ~ 275. The extent of sub surface parking is yet to be determined, as such, foundation drainage and groundwater impacts are yet to be assessed.

5.0 Site Grading

Site grading design is depicted on Drawing C201 (Appendix B) and sections are provided on Drawing C202 (Appendix B), and addresses the following constraints:

- Conforms to Town of Grimsby's grading criteria.
- Matches existing boundary grading conditions (interim condition).
- Considers shoreline setbacks and grading as outlined in Shoreline Hazards Assessment by Shoreplan Engineering (Jan 14, 2016).
- Provides urbanization of the North Service Road along the frontage of the site as well as Winston Road.
- Provides overland flow route to discharge major flows to Lake Ontario.
- Provides minimum cover to allow the installation of a storm sewer network which discharges to Lake Ontario as well as the sanitary sewer network which discharges to the trunk sewer on North Service Road.

6.0 Road Design

The site will be serviced by a combination of private roads and driveways as well as public roads. A new public road (Winston Road) is proposed to loop through the site and connect to the North Service Road in two locations. The Road pattern is depicted on Drawing C101 (Appendix B).

6.1 Public Roads

Winston Road is proposed to be constructed with three unique cross sections.

The public Road cross sections have the following design elements:

- Crowned or super-elevated with a minimum 2% cross fall
- Curb and Gutter as per OPSD 600.040
- 1.5 m wide sidewalk on at least one side
- Two driving lanes with a minimum of total of 6.0 m of pavement
- Layby parking with a minimum width of 2.5 m or perpendicular parking with a depth of 6.m.

Typical sections for the Winston Road are provided on Drawing C202 (Appendix B).

6.2 Private Roads

The proposed private roads will be designed in conjunction with the Site Plan Application. The traffic study that accompanies this application addresses intersection spacing for the key driveway accesses that will serve the condominium development.

6.3 North Service Road

The Town of Grimsby has provided design drawings showing an urbanization of the North Service Road to the west of this project. It is anticipated that a portion of the North Service Road along the site frontage will be urbanized. The proposed grading design makes accommodation for urbanization of the north side of the north Service Road.

The ultimate improvements to the North Service Road will likely be determined as part of a traffic study supporting this application.

Accommodation for drainage improvements for the entire width of the NSR right of way (now 22.5 m) across the site frontage have been made in the drainage design for the development.

7.0 Erosion and Sediment Control Plan

The Erosion and Sediment Control Plan for the site will be designed in conformance with the Town of Grimsby and NPCA guidelines. Erosion and sediment control will be implemented for all construction activities including topsoil stripping, foundation excavation and stockpiling of material.

The following erosion and sediment control measures will be installed and maintained during construction:

- Prior to grading, a temporary sediment control fence will be placed around perimeter of all areas that will be disturbed.
- Sediment traps will be provided.
- Gravel mud mats will be provided at all construction access points to minimize off site tracking of sediments.
- Sediment control ponds may be required depending on the total area of the disturbed site and number of natural outlets.
- All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.

A preliminary Erosion and Sediment Control Design is included as Drawing C401 (Appendix B).

8.0 Conclusions

This report has presented a functional design of site servicing and grading at the proposed development. Further refinement will be performed at the detailed design stage. Functional design for the proposed development can be summarized as follows:

- The proposed storm drainage system will be designed in compliance with the NPCA guidelines, MOECC guidelines, and the Town of Grimsby Design Standards.
- Stormwater quantity control is not required as the site is adjacent to Lake Ontario.
- Stormwater quality control will be provided to an enhanced level of control through four oil and grit separators and a bioswale.
- Two outlets to Lake Ontario are proposed to provide local drainage of the internal lands, and conveyance of runoff from external lands.
- External drainage will be conveyed through the site in a 1350 mm diameter storm sewer with the public open space.
- Water servicing will be accomplished by connection to the existing 300 mm diameter watermain along North Service Road.
- The development will be serviced by connection the existing 525 mm diameter sanitary trunk sewer along North Service Road.
- The site will be accessed by public roads and private driveways site entrances from North Service Road and Winston Road.
- Winston Road will be developed as a public road with layby and perpendicular parking.

9.0 References

- “Stormwater Management Study Q.E.W. From Fifty Road to East of Casablanca Boulevard”, prepared for Ontario Ministry of Transportation by Marshall Macklin Monaghan Limited, September 1994
- “Stormwater Management Guidelines”, prepared for Niagara Peninsula Conservation Authority by AECOM, March 2010
- “Stormwater Management Planning and Design Manual”, prepared by Ministry of the Environment, 2003
- “Shoreline Hazard Assessment: Fifth Wheel Truck Stop Property”, prepared by Shoreplan Engineering Limited, January 2016
- “Geotechnical Investigation: Proposed Residential Development, Fifth Wheel – 398 North Service Road”, prepared for Losani Homes by Soil-Mat Engineers & Consultants Limited, January 2016
- “Loblaws Properties Ltd. Casablanca Blvd and South Service Rd, Commercial Development, Final Engineering Report”, prepared for Loblaws Properties Ltd. by The Odan/Detech Group Inc., November 2005



Appendix A

Figures

Site Plan

Figure 1: Site Location

Figure 2: External Drainage Area Plan

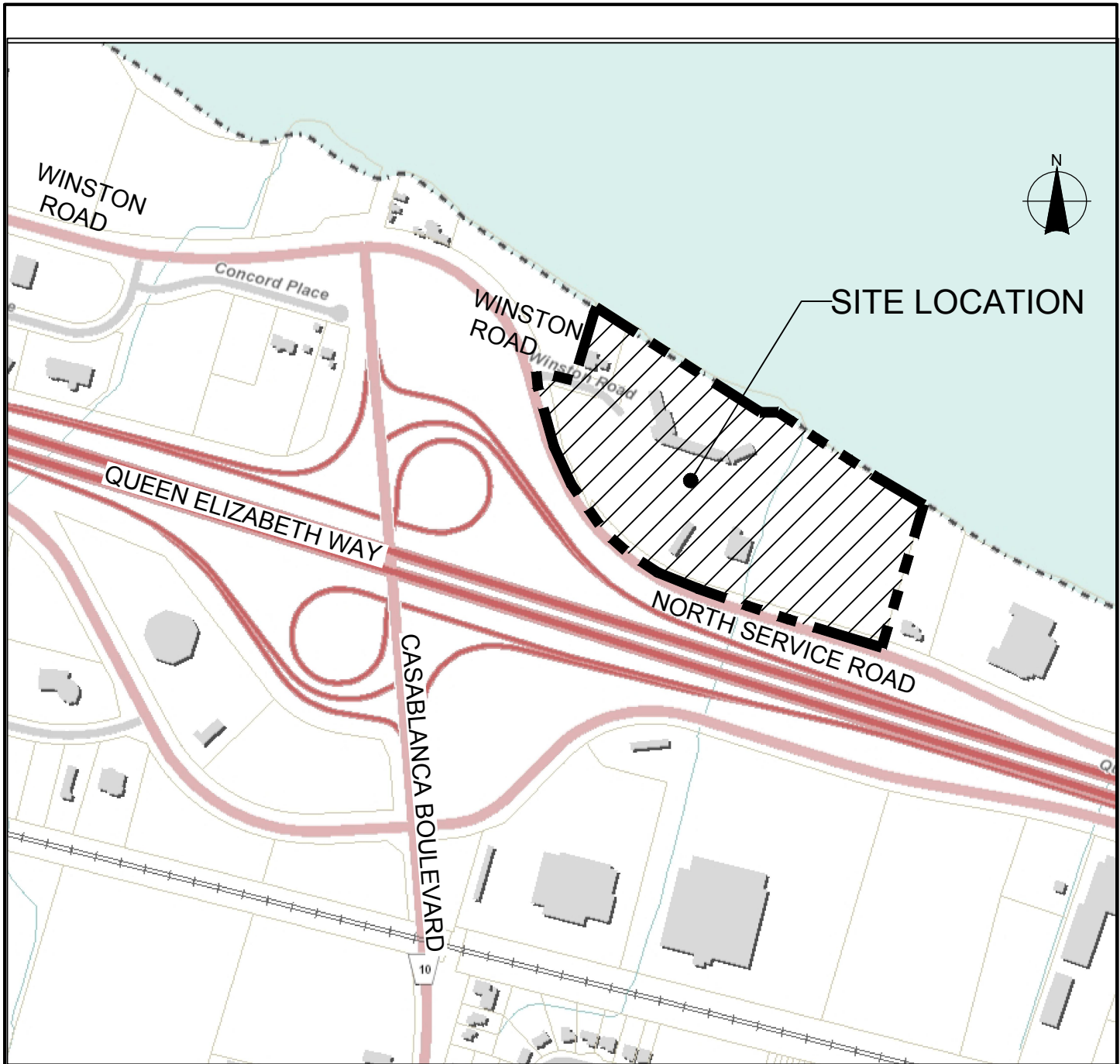


Figure Title
 TOWNSHIP OF NORTH GRIMSBY
FIFTH WHEEL REDEVELOPMENT
 LOCATION MAP

Client
LOSANI HOMES

Drawn AH	Checked SH	Date 2017/07/24
Scale N.T.S.	Project No. 300040159	

Figure No.
FIG-1



Figure Title
FIFTH WHEEL REDEVELOPMENT
 EXISTING DRAINAGE

Client
LOSANI HOMES

Drawn AC	Checked JS	Date 17/07/24
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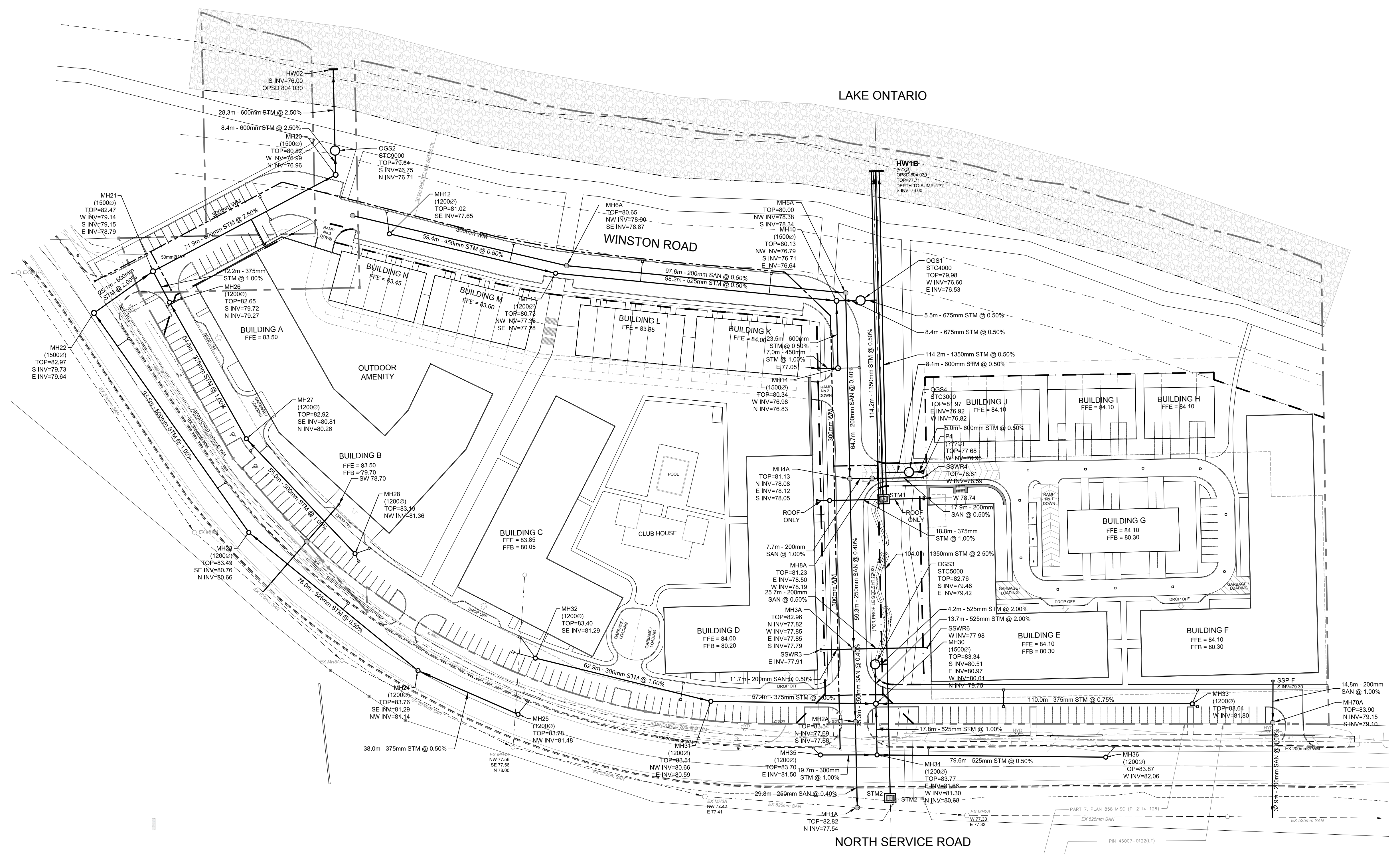
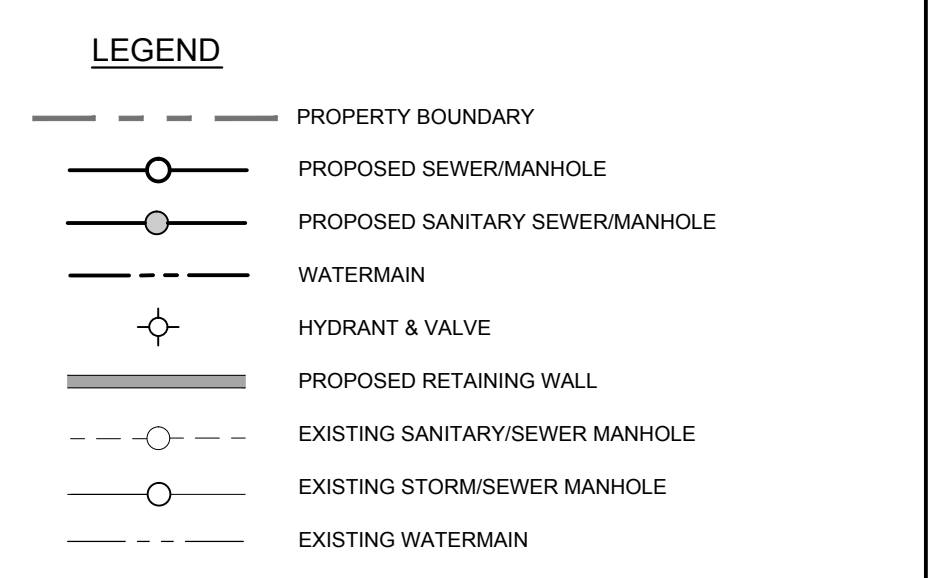
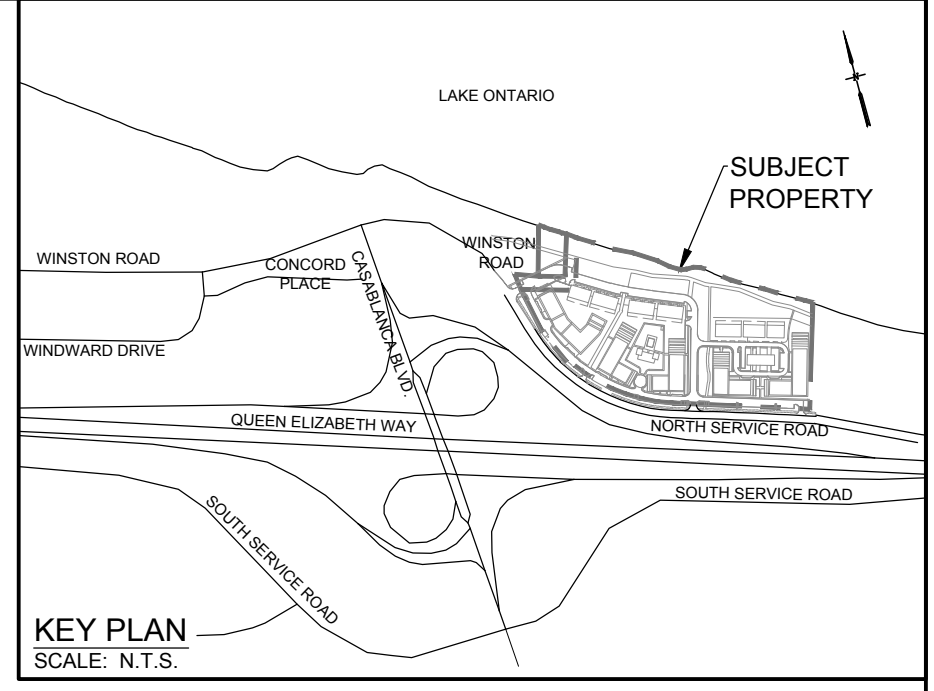
Figure No.
FIG-2



Appendix B

Drawings

Servicing Plan	C101
Grading Plan	C201
Sections	C202
Plan and Profile	C203
Sanitary Drainage Area Plan	C301
Storm Drainage Ara Plan	C302
Erosion and Sediment Control Plan	C303



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No.	Issue / Revision	Date	Auth.
1	ISSUED FOR DRAFT PLAN APPLICATION	6/1/2018	SH

BURNSIDE

R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
Telephone: (905) 821-1800
Fax: (905) 821-1809
Web: www.rjburnside.com

Client
LOSANI HOMES LTD.
430 MCNEILLY ROAD, SUITE 203
STONE CREEK, ON
L8E 5E3

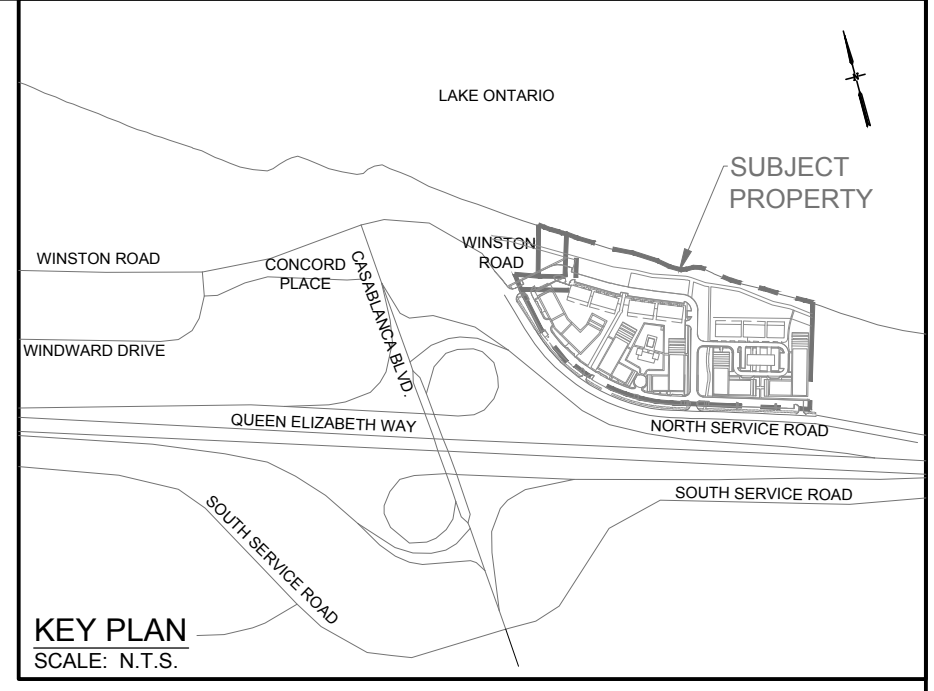
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Drawing Title
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TOWN OF GRIMSBY

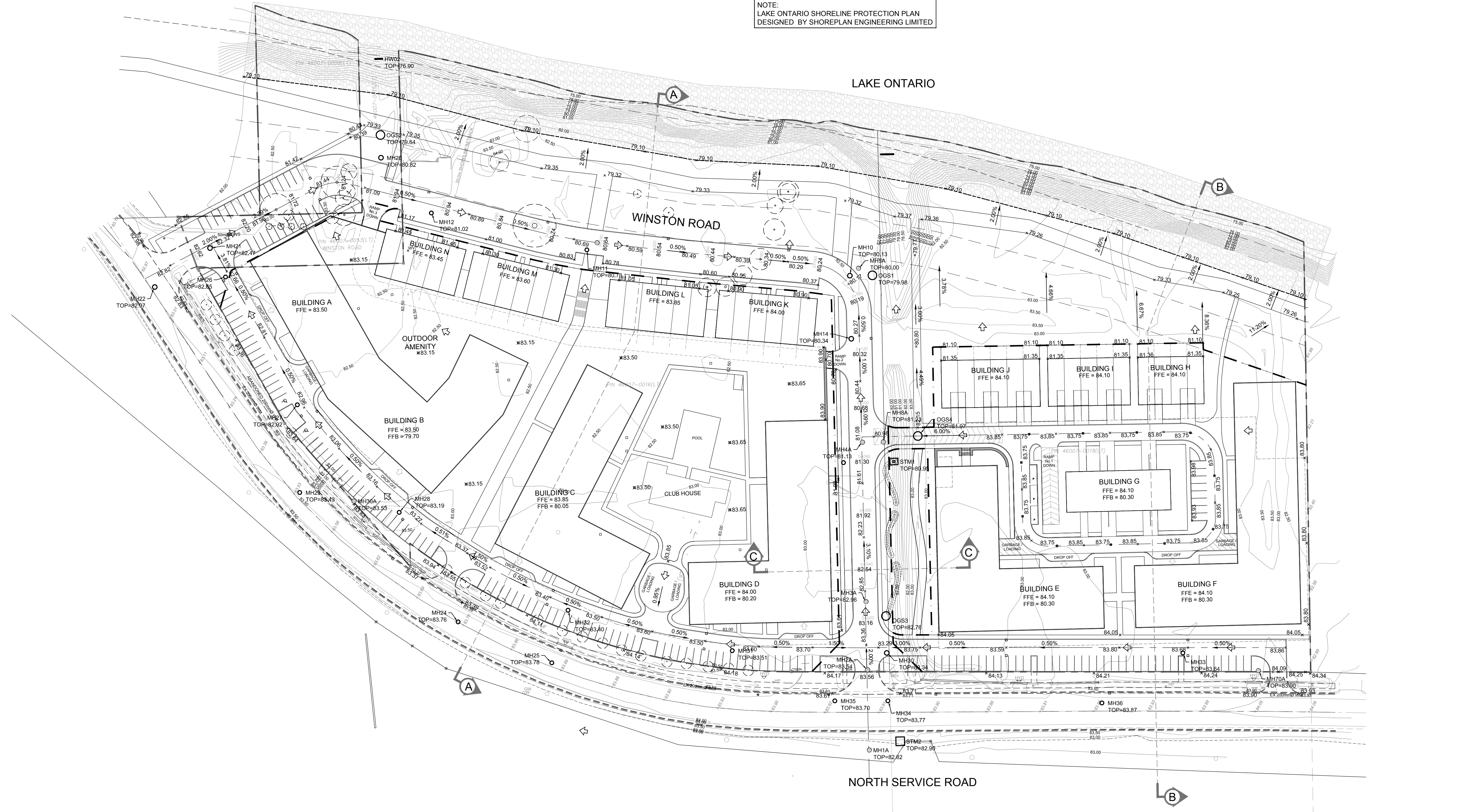
SERVICING PLAN

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C101



NOTE:
LAKE ONTARIO SHORELINE PROTECTION PLAN
DESIGNED BY SHOREPLAN ENGINEERING LIMITED



- LEGEND**
- PROPERTY BOUNDARY
 - 83.00 PROPOSED FINISHED GROUND
 - 83.00 EXISTING GROUND ELEVATION
 - EXISTING GROUND CONTOUR
 - PROPOSED SWALE
 - ← 4.400m @ 1.84% DIRECTION OF FLOW/PROPOSED SLOPE
 - ↗ PROPOSED OVERLAND FLOW DIRECTION
 - PROPOSED RETAINING WALL
 - PROPOSED 3:1 SLOPE
 - HYDRANT & VALVE
 - PROPOSED SEWER/MANHOLE
 - PROPOSED SANITARY SEWER/MANHOLE

NOTES:
1. FOR DETAILED SECTIONS REFER TO DWG C202

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BURNSIDE
R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
Telephone (905) 821-1800
Fax (905) 821-1809
Web www.rjburnside.com

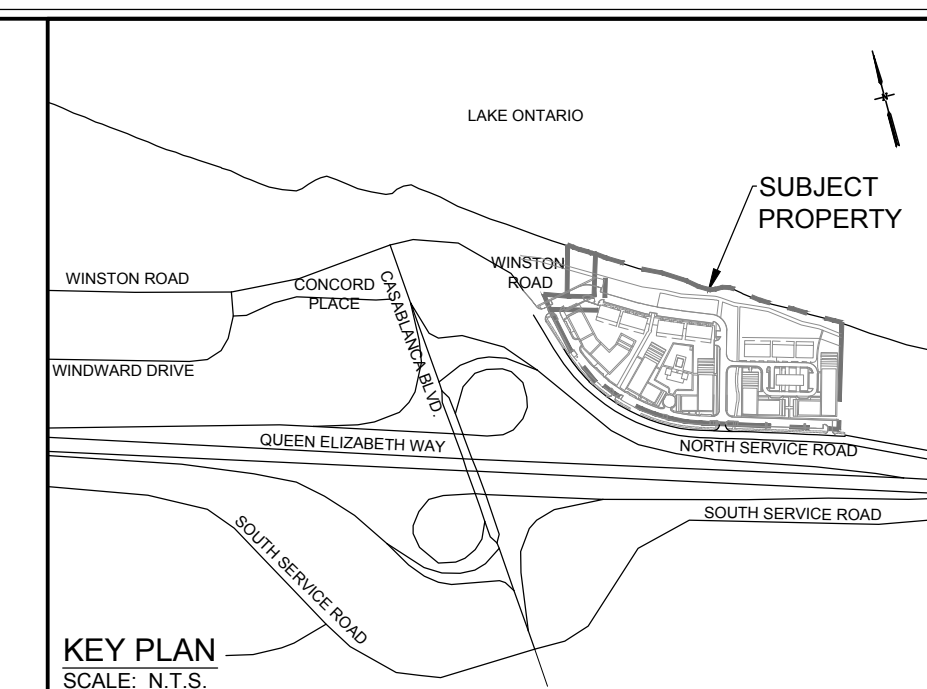
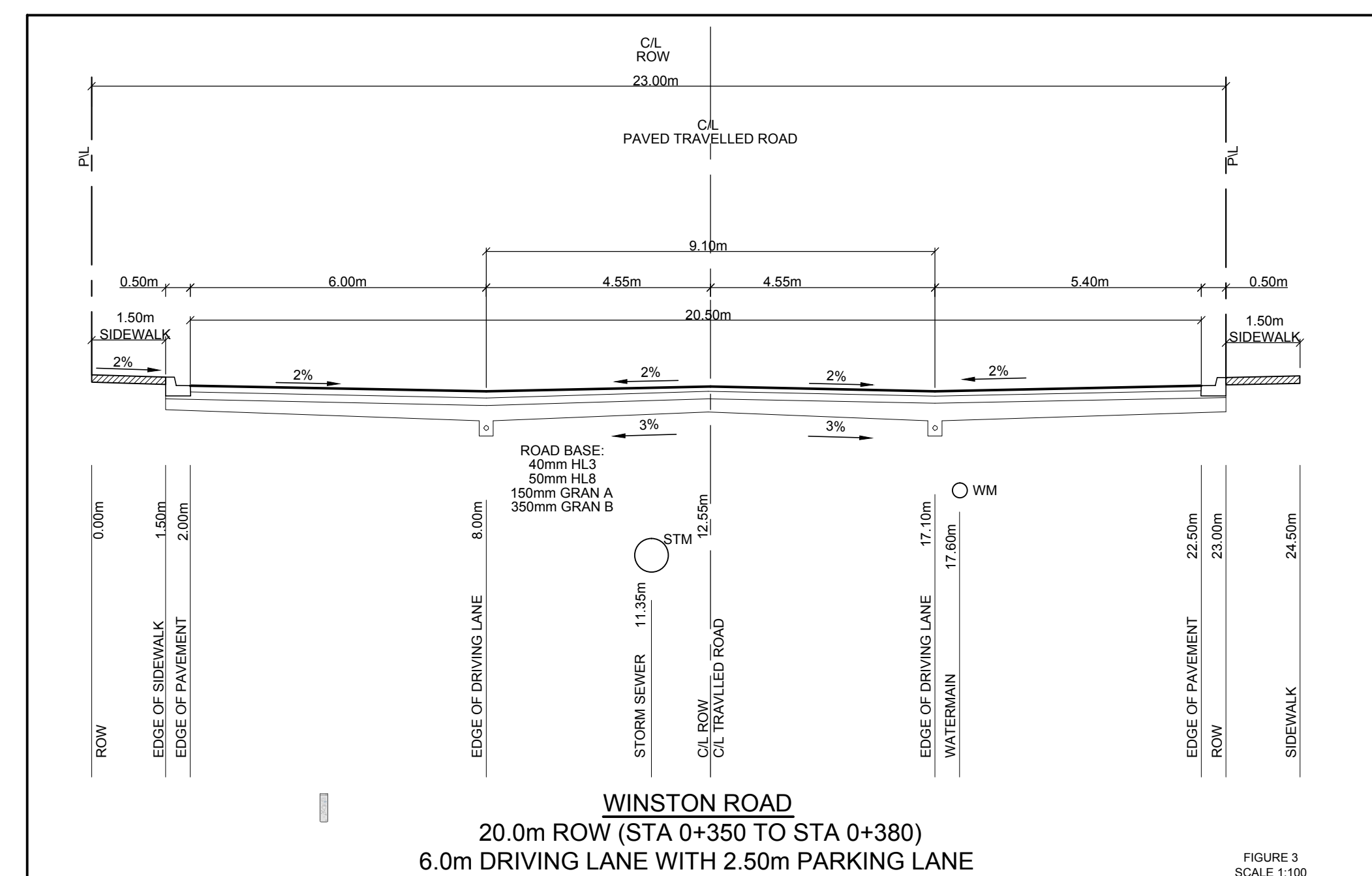
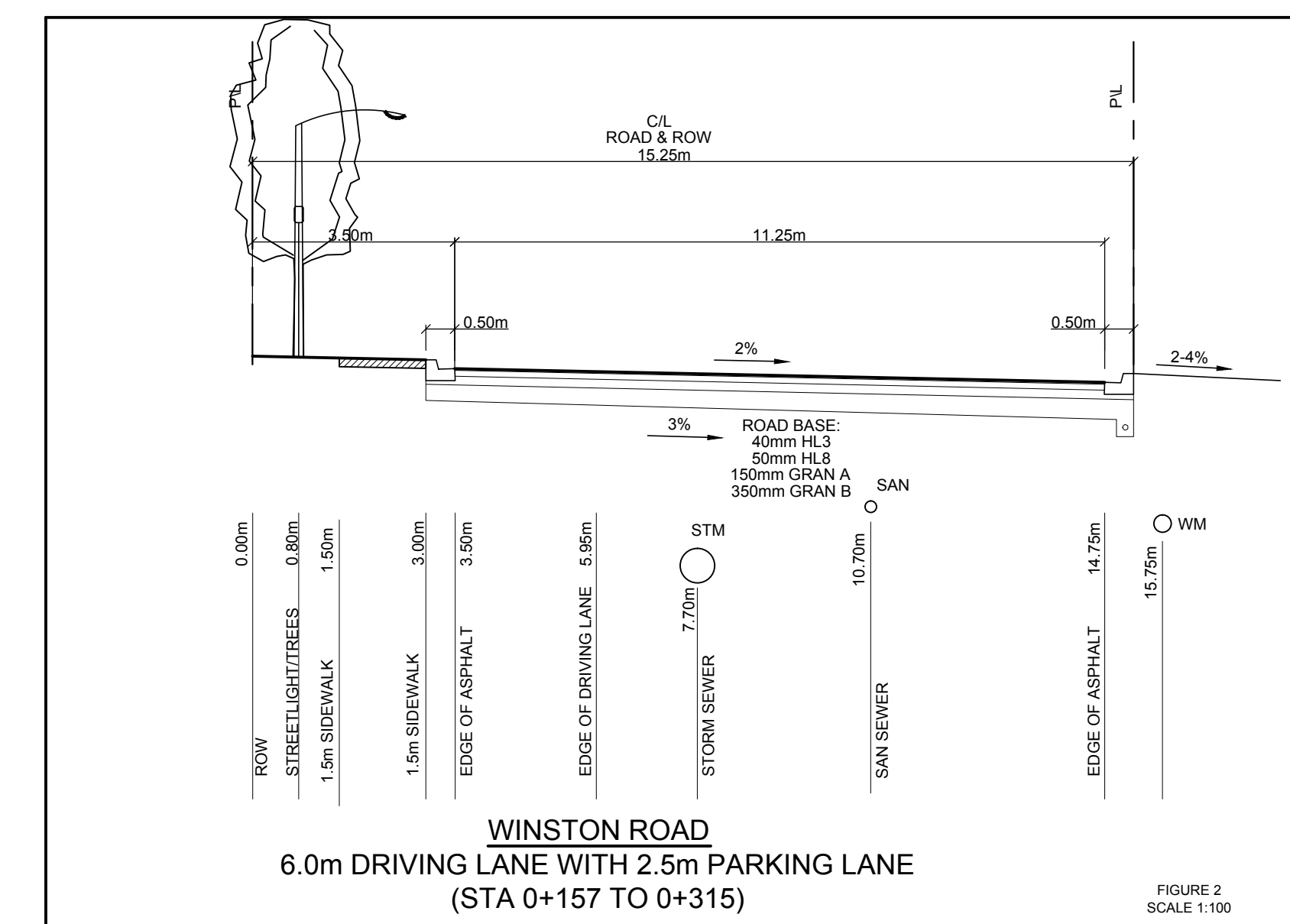
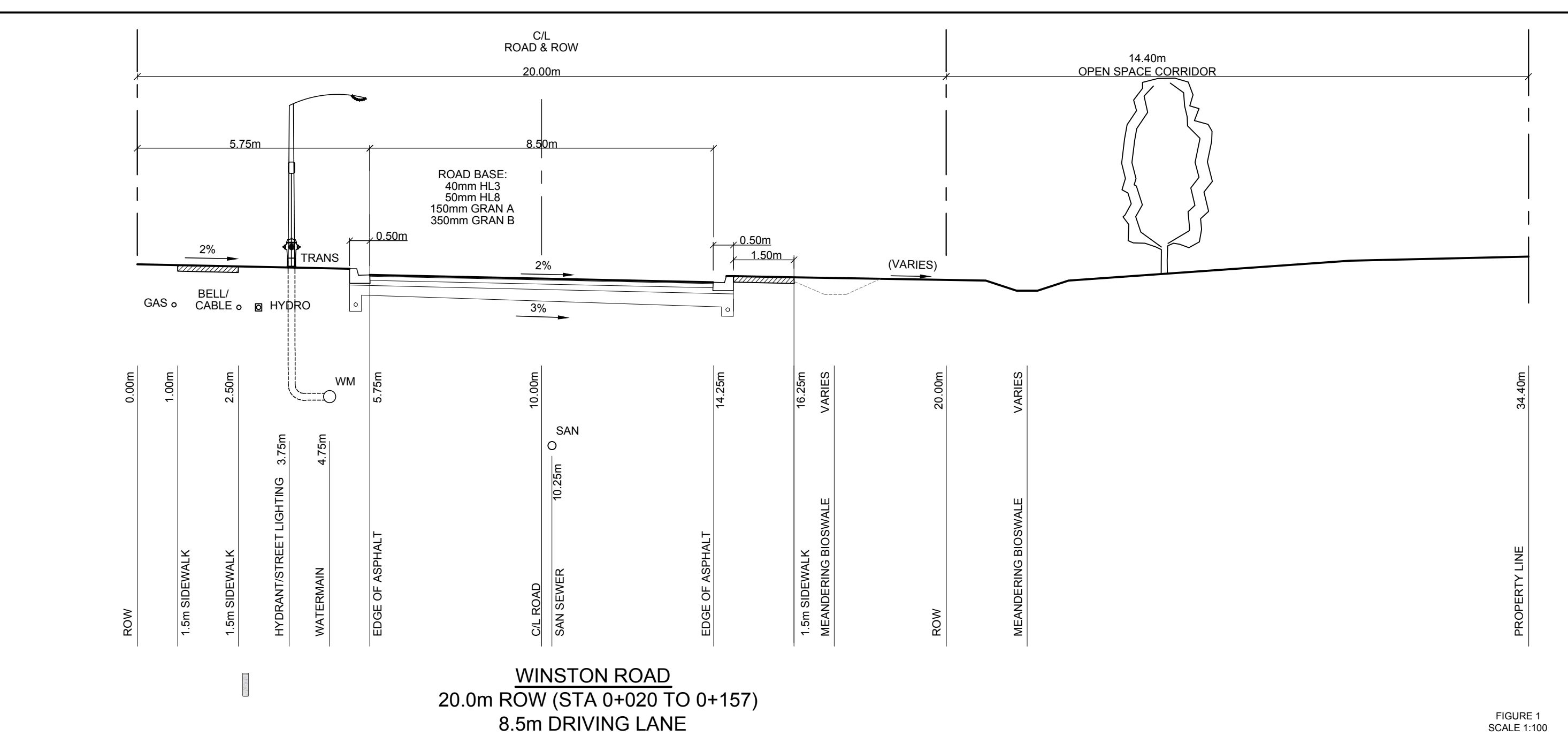
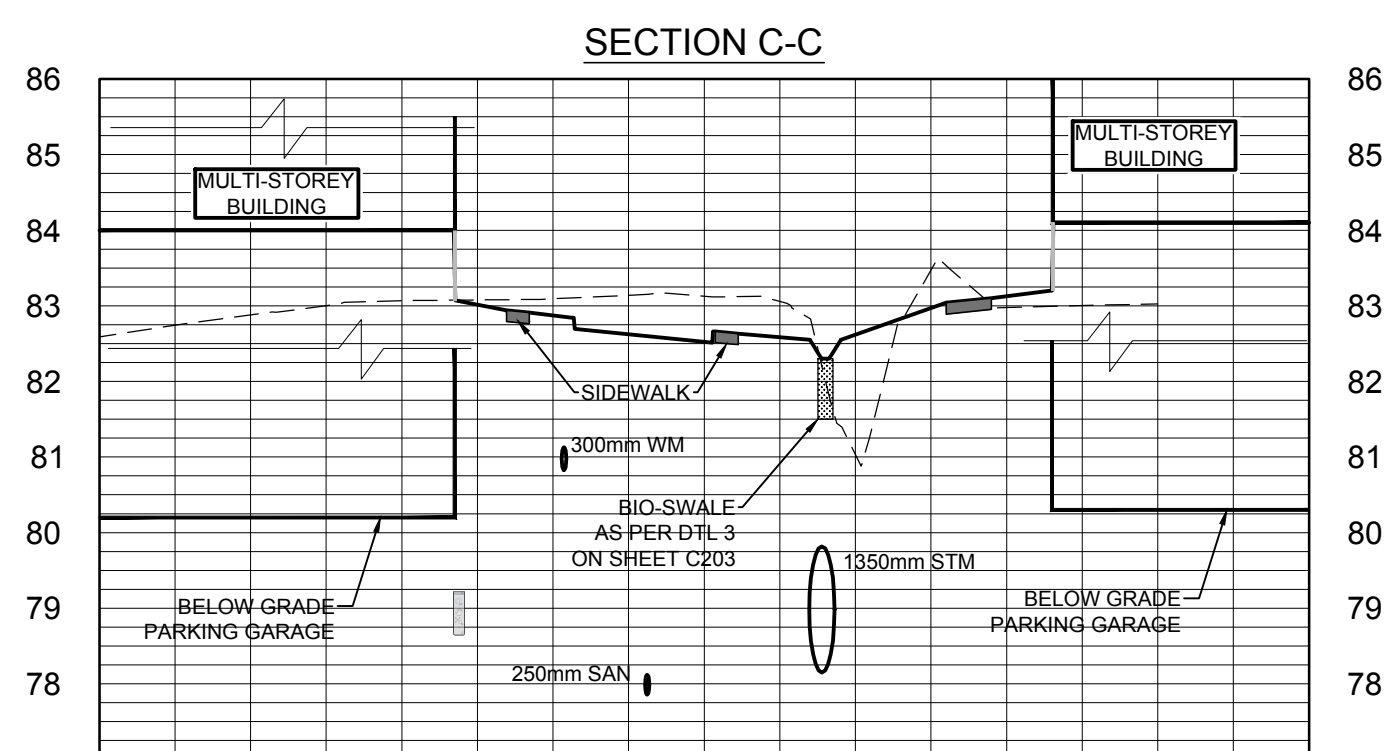
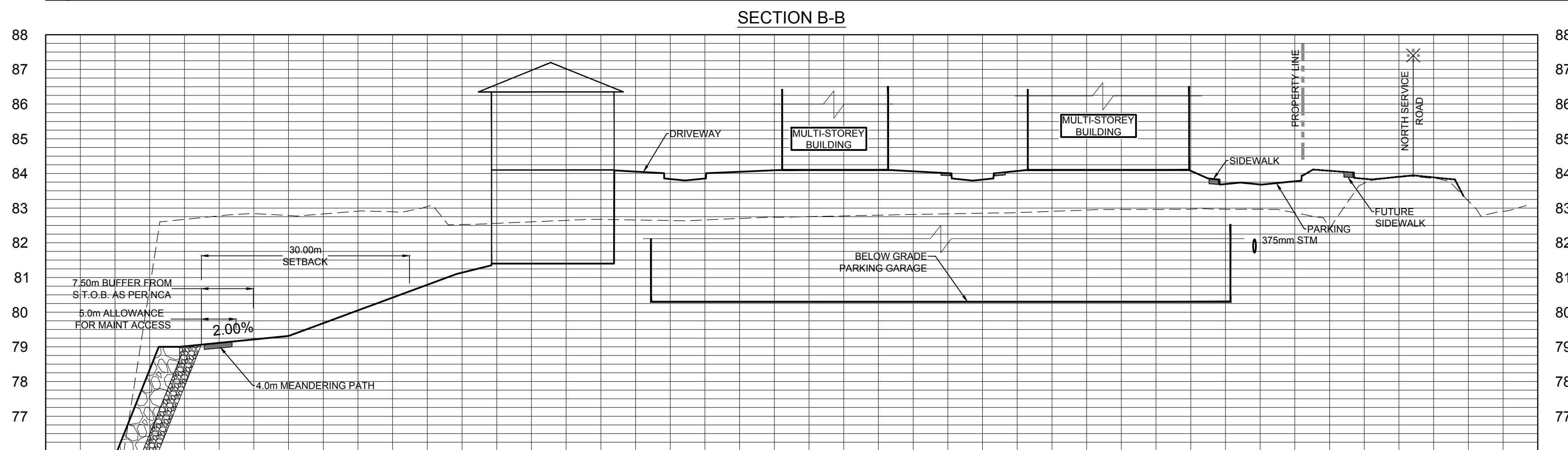
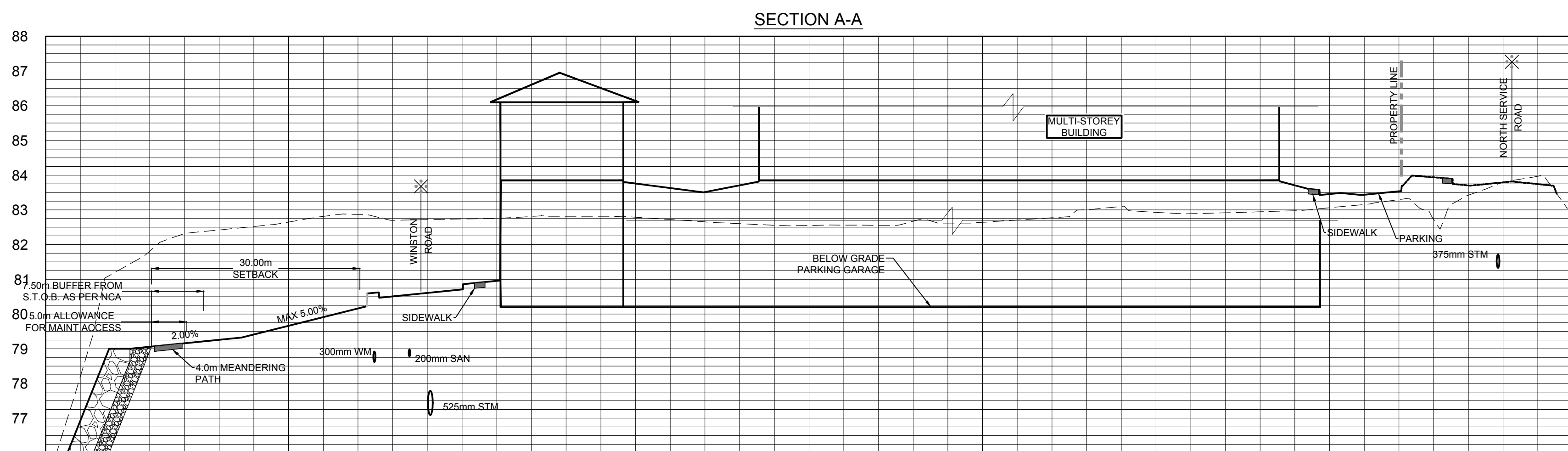
Client
LOSANI HOMES LTD.
430 MCNEILLY ROAD, SUITE 203
STONEY CREEK, ON
L8E 5E3

Drawing Title
LOSANI FIFTH WHEEL
TOWN OF GRIMSBY

GRADING PLAN

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Project No. 040159	Contract No.	Revision No.	0	0	C201
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Mississauga, Ontario, L5N 8R9
Telephone (905) 821-1800
Fax (905) 821-1809
Web www.rjburnside.com

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L8E 5E3

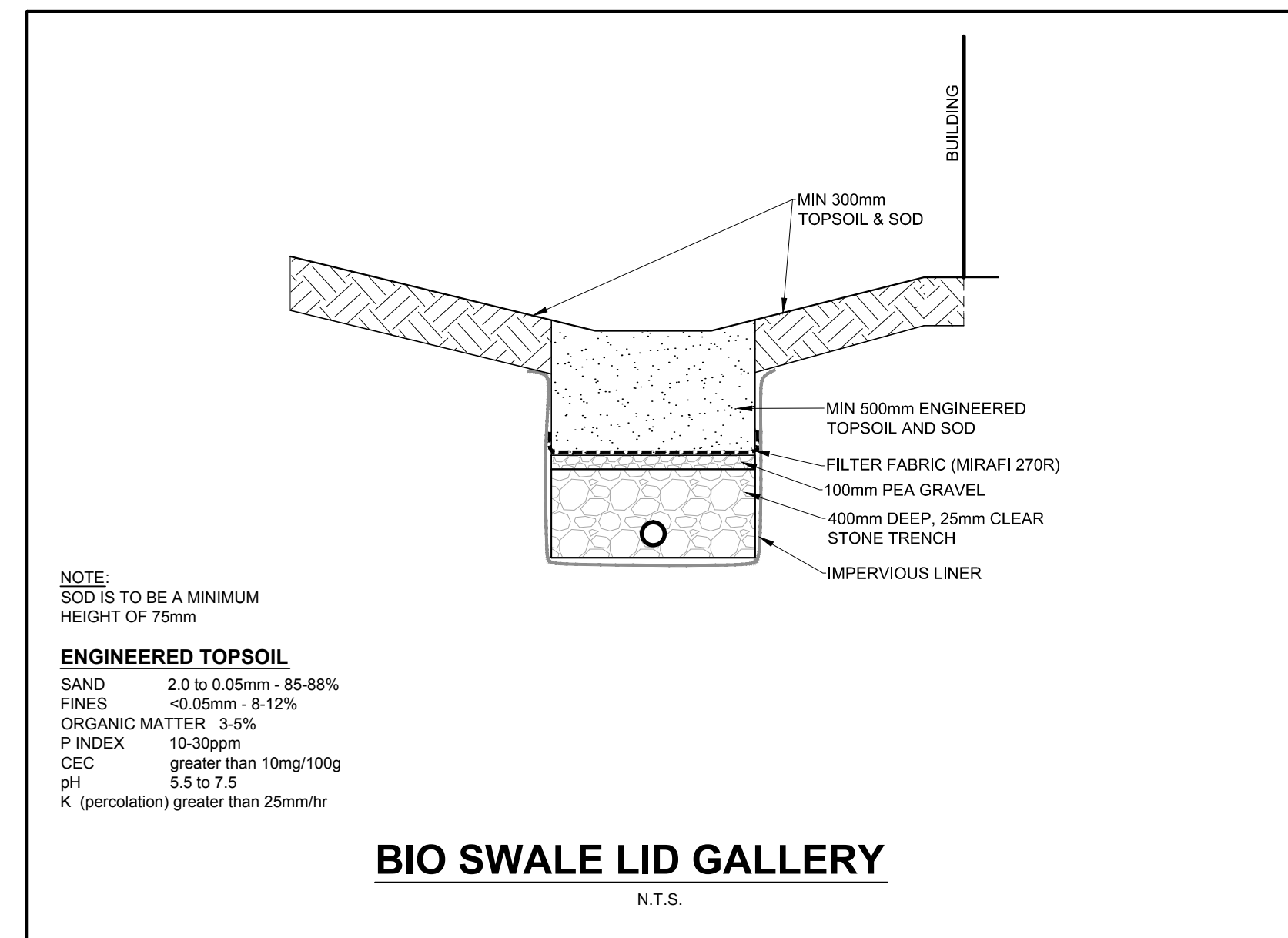
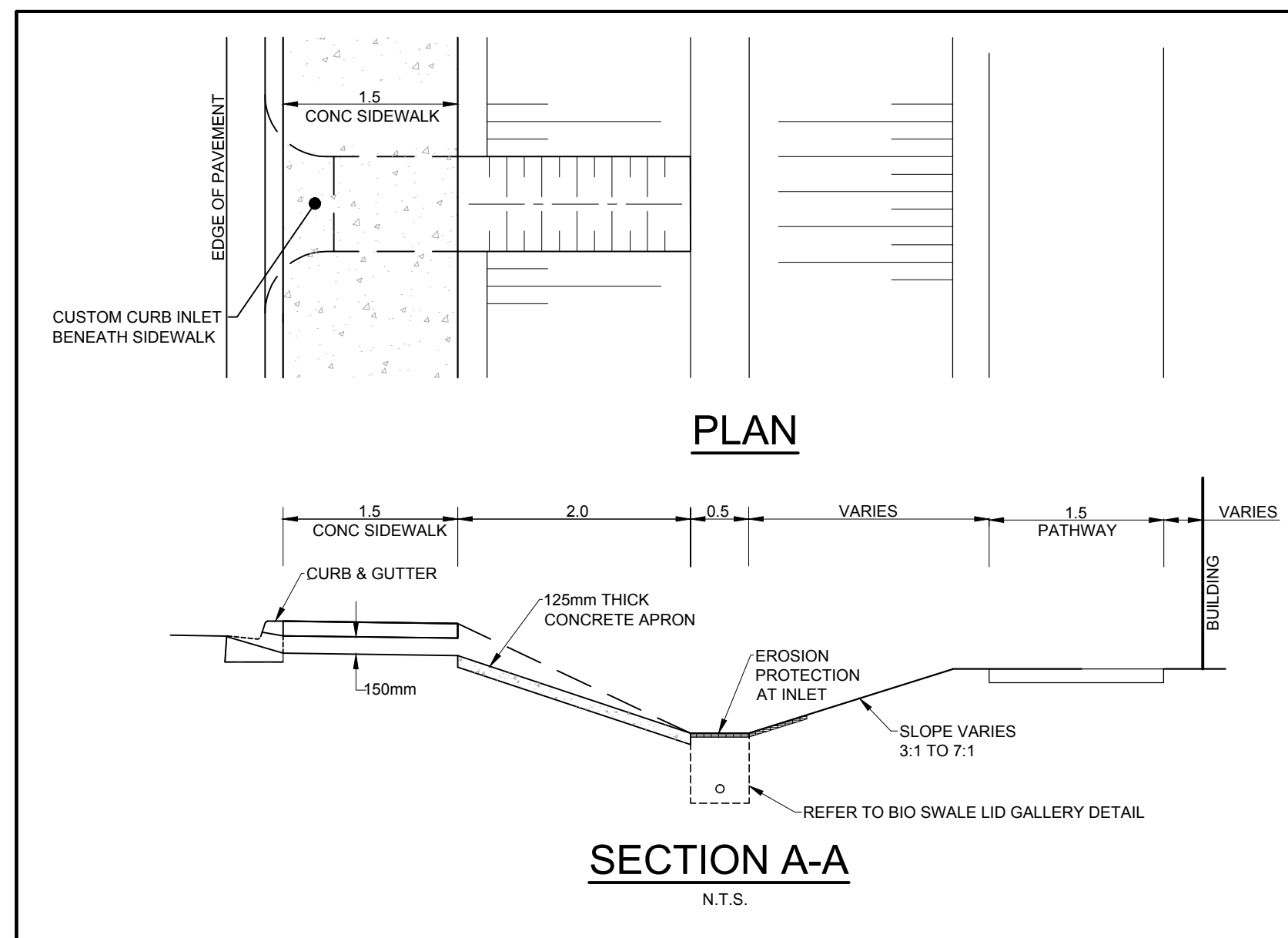
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TOWN OF GRIMSBY

CROSS SECTIONS

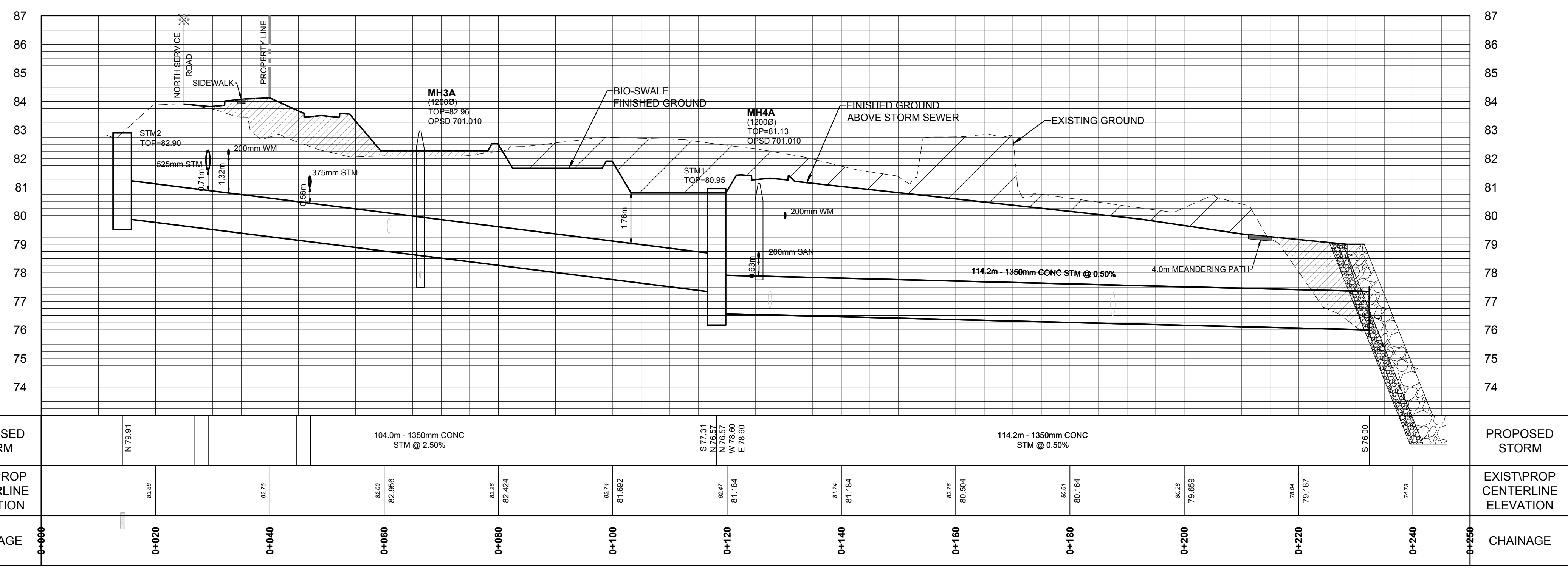
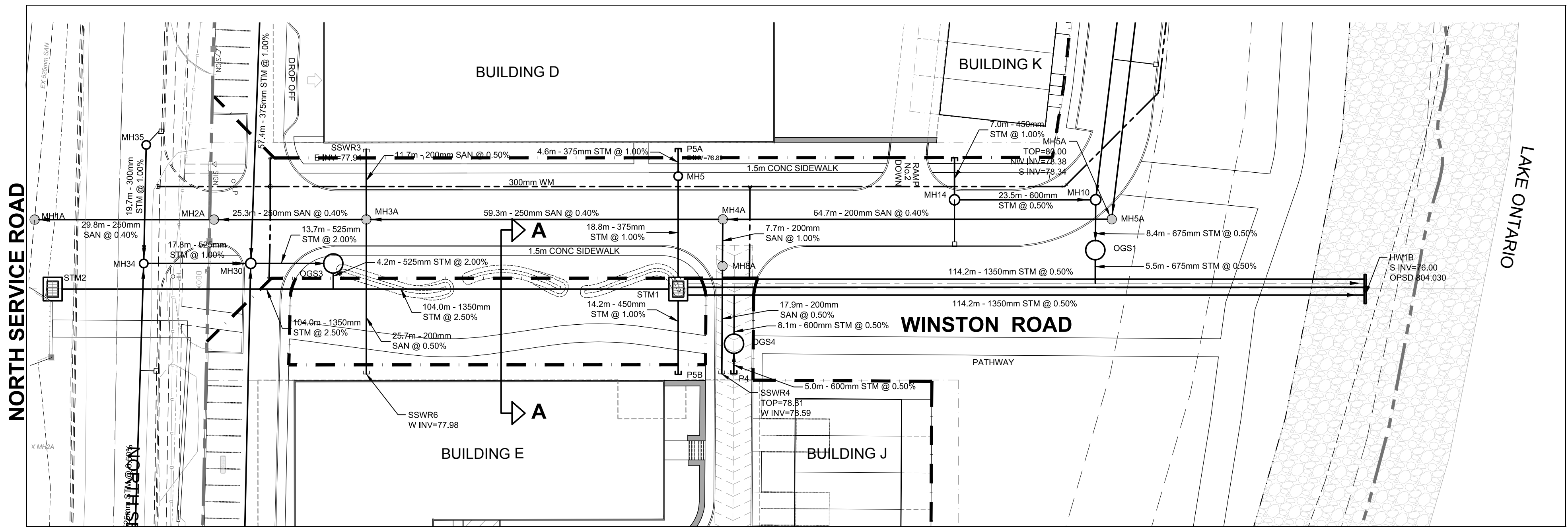
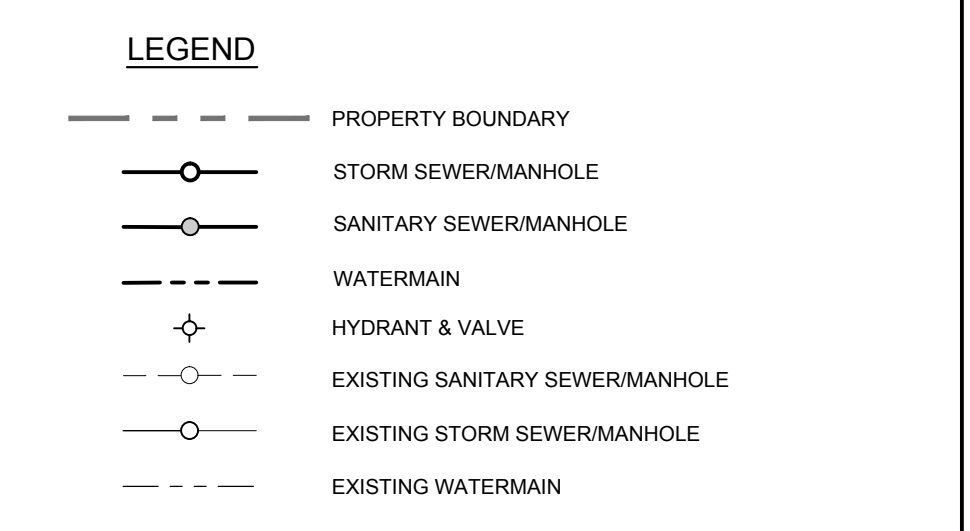
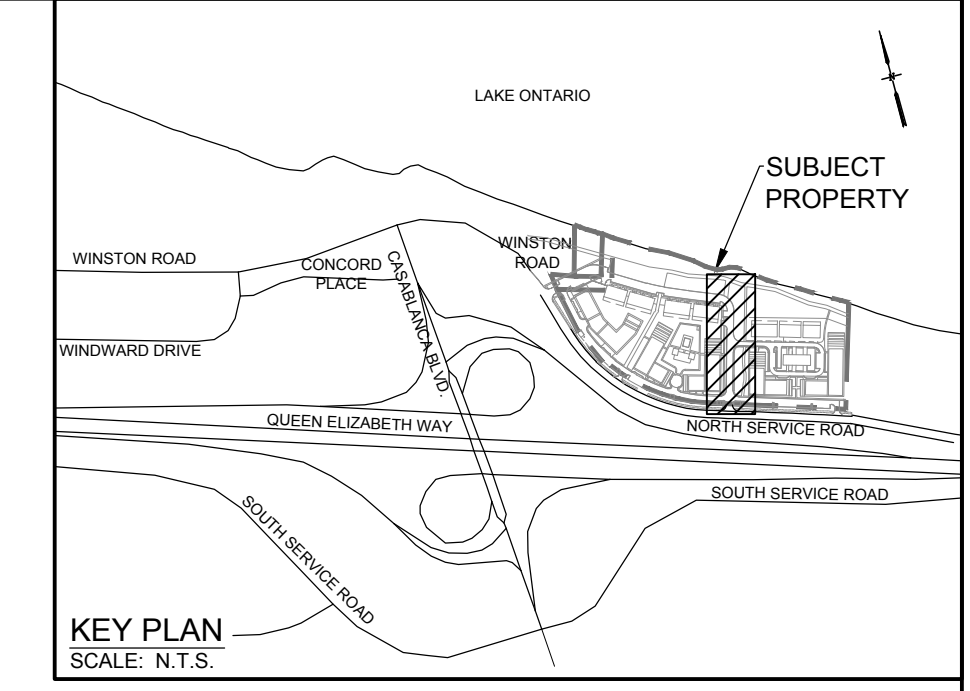
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Project No.	040159	Contract No.		Revision No.	0
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C202



NOTE:
SOD IS TO BE A MINIMUM HEIGHT OF 75mm

ENGINEERED TOPSOIL
SAND 2.0 to 0.075mm - 85-88%
FINES <0.075mm - 8-12%
ORGANIC MATTER 3-5%
P INDEX 10-30ppm
CEC greater than 10mg/100g
pH 5.5 to 7.5
K (percolation) greater than 25mm/hr



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R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
Telephone (905) 821-1800
Fax (905) 821-1809
Web www.rjburnside.com

Client
LOSANI HOMES LTD.
430 MCNEILLY ROAD, SUITE 203
STONEY CREEK, ON
L8E 5E3

LOSANI HOMES

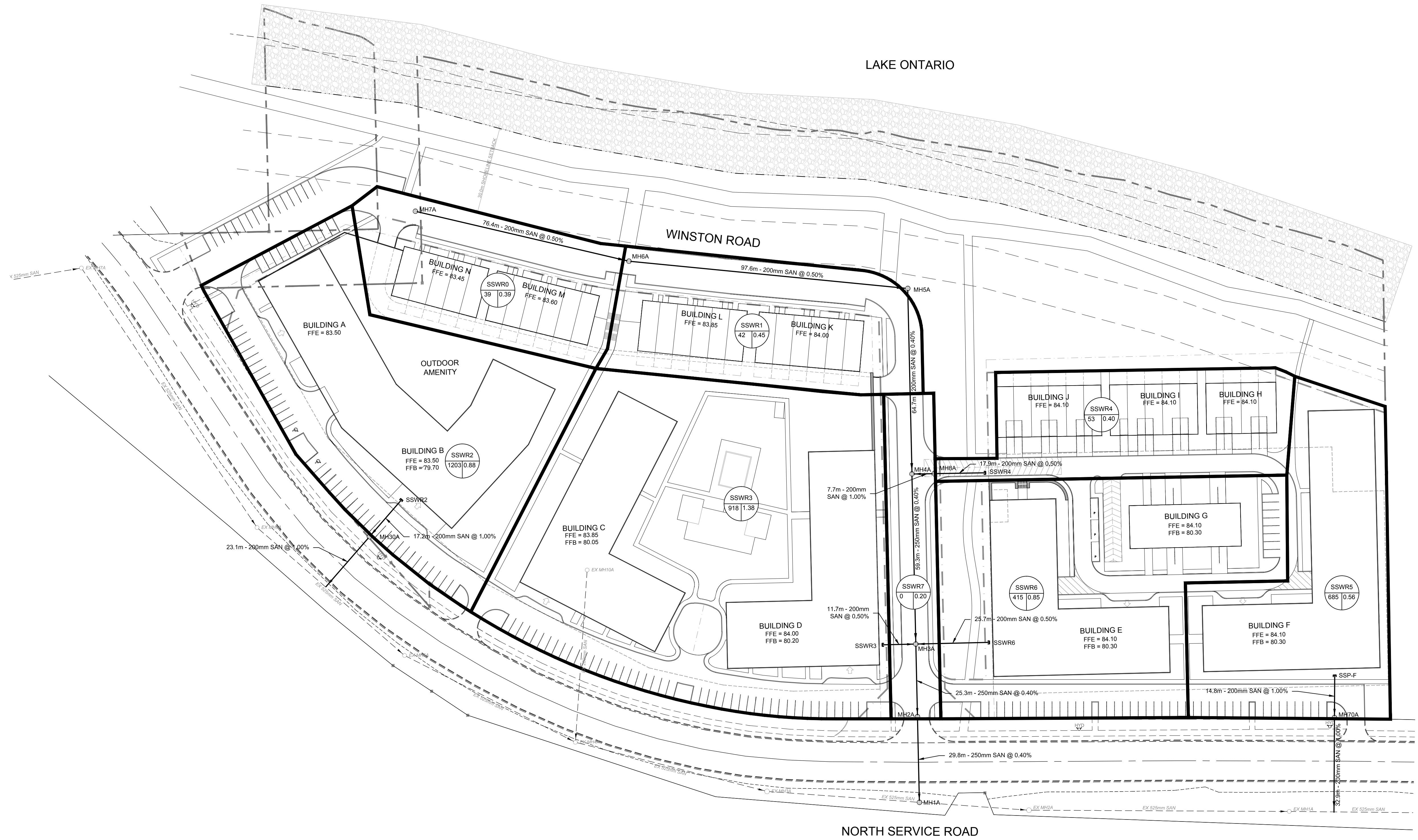
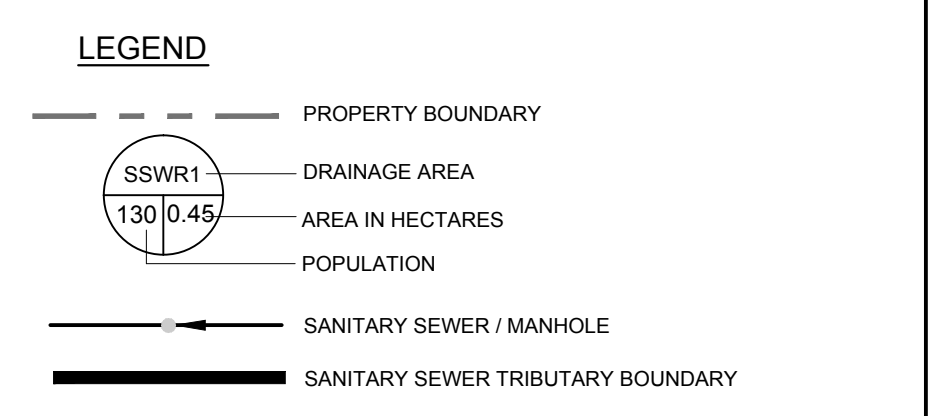
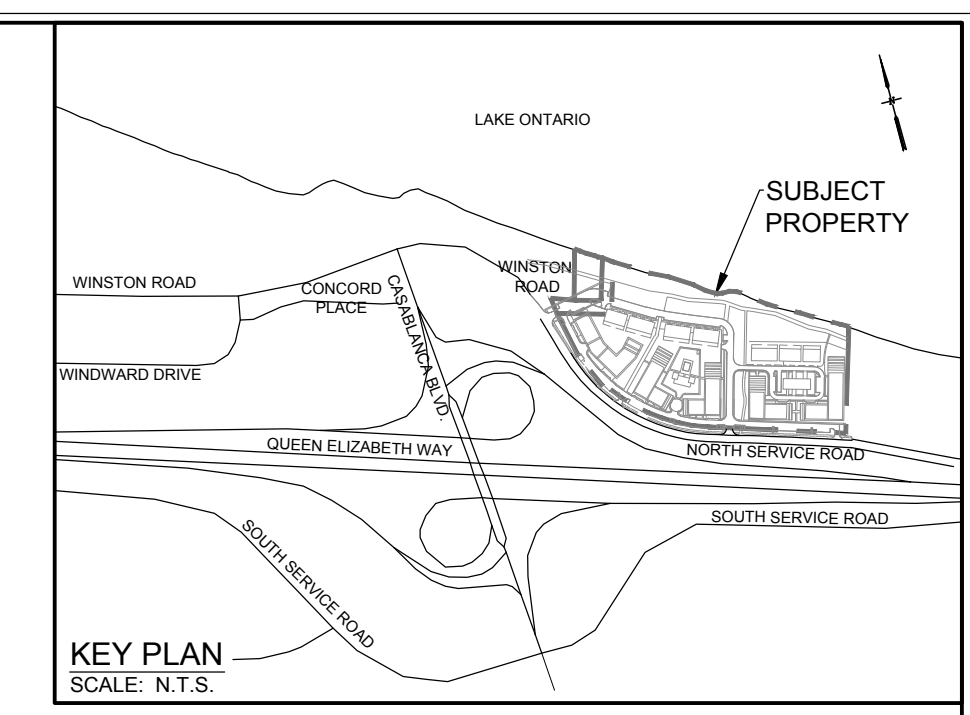
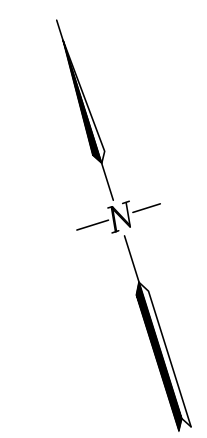
Drawing Title
LOSANI FIFTH WHEEL
TOWN OF GRIMSBY

PLAN AND PROFILE

Dwn	Checked	Designed	Checked	Date	Drawing No.
AH	SH	EL	SH	6/1/2018	
Project No.	Contract No.	Revision No.			
040159		0			

Scale: H 1:500 V 1:100

C203



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No.	Issue / Revision	Date	Auth.
1	ISSUED FOR DRAFT PLAN APPLICATION	6/1/2018	SH

BURNSIDE

R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
Telephone (905) 821-1800
Fax (905) 821-1809
Web www.rjburnside.com

Client
LOSANI HOMES LTD.
430 MCNEILLY ROAD, SUITE 203
STONE CREEK, ON
L8E 5E3

LOSANI HOMES

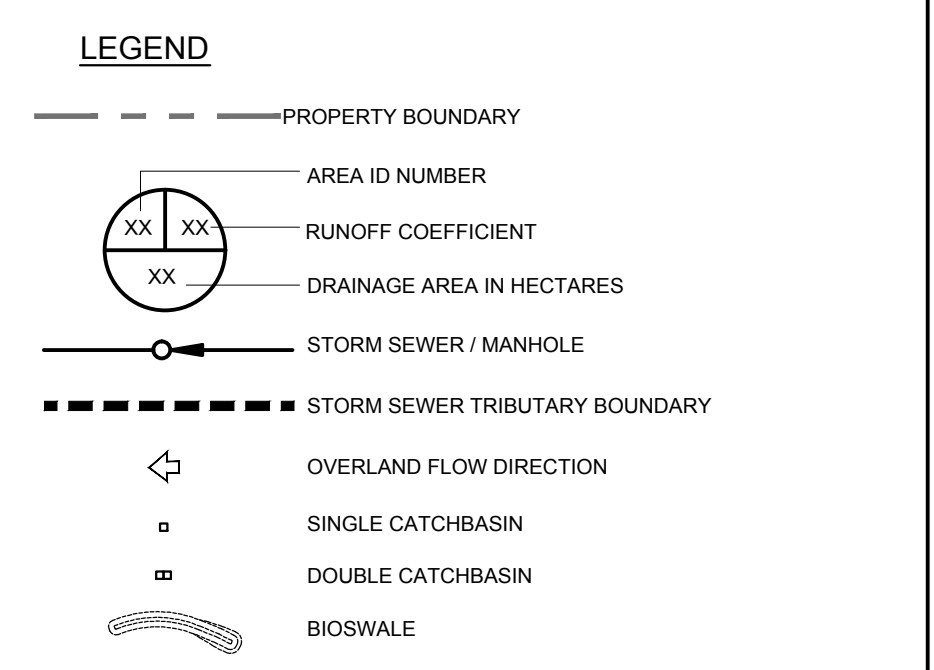
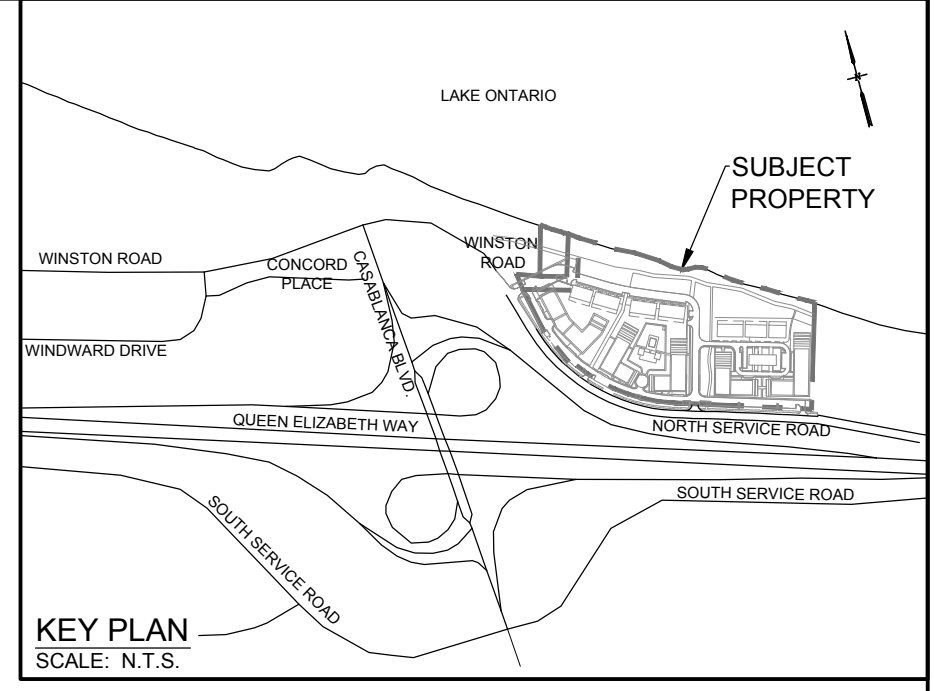
Drawing Title
LOSANI FIFTH WHEEL
TOWN OF GRIMSBY

SANITARY DRAINAGE AREA PLAN

Drawn	Checked	Designed	Checked	Date	Drawing No.
AH	SH	EL	SH	6/1/2018	
Project No.	Contract No.	Revision No.			
040159		0			

Scale: 1:750

C301



OGS SIZING/WATER QUALITY				
AREA ID	OGS #	AREA (Ha)	'C'	OGS TYPE
1.1 TO 1.4	OGS1	1.52	0.68	STC 4000
2.1 TO 2.5	OGS2	1.94	0.82	STC 9000
3.1 TO 3.4	OGS3	1.22	0.90	STC 5000
4.1 TO 4.2	OGS4	0.77	0.90	STC 3000
5.1 TO 5.4+5.7	CLEAN ROOF TOP			
5.5+5.6	BIOSWALE			

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No.	Issue / Revision	Date	Auth.
1	ISSUED FOR DRAFT PLAN SUBMISSION	6/1/2018	SH

BURNSIDE
 R. J. Burnside & Associates Limited
 6990 Creditview Road, Unit 2
 Mississauga, Ontario, L5N 8R9
 telephone (905) 821-1800
 fax (905) 821-1809
 web www.rjburnside.com

LOSANI HOMES LTD.
 430 MCNEILLY ROAD, SUITE 203
 STONEY CREEK, ON
 L8E 5E3

LOSANI HOMES

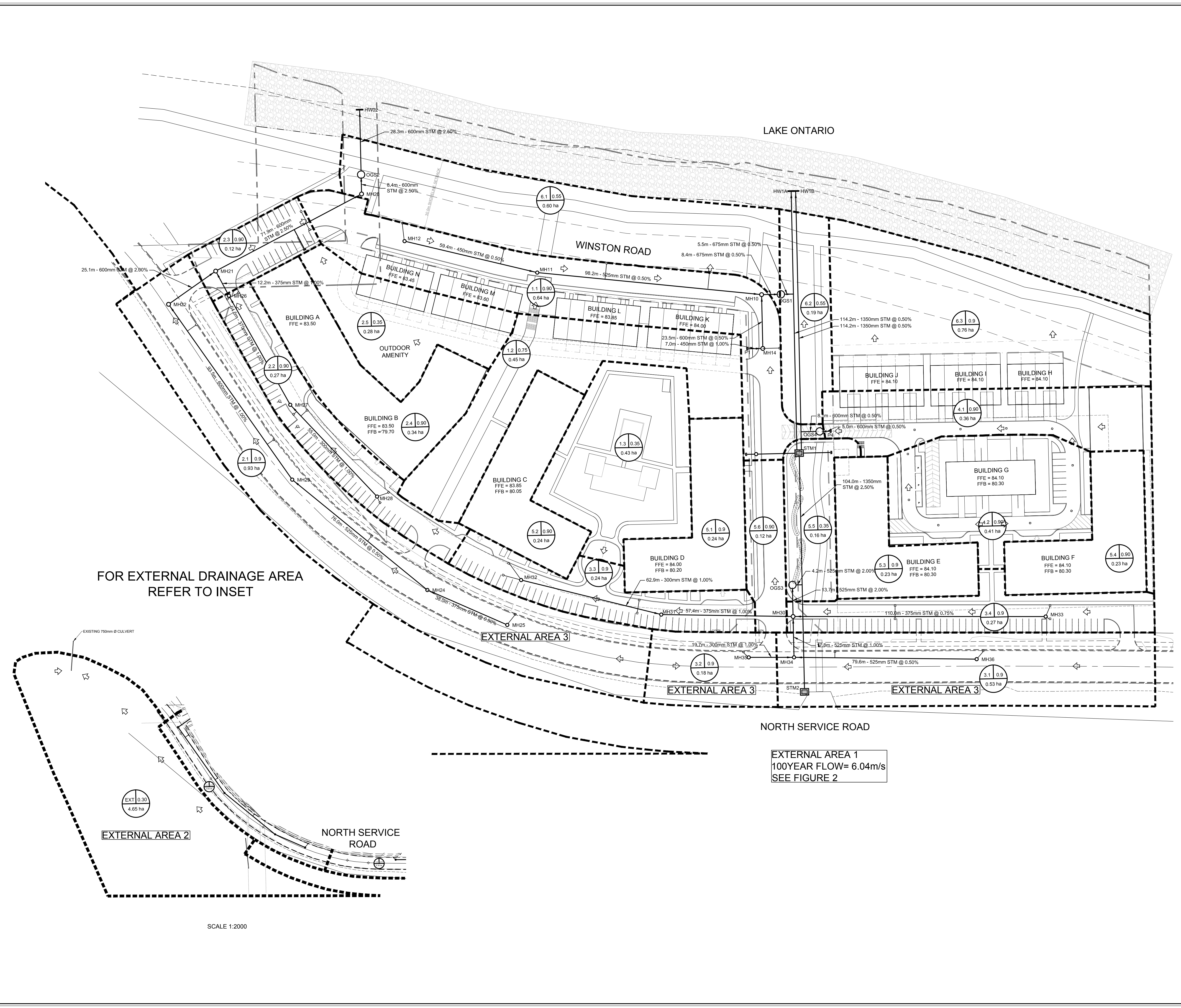
Client
LOSANI FIFTH WHEEL
 TOWN OF GRIMSBY

Storm Drainage Area Plan

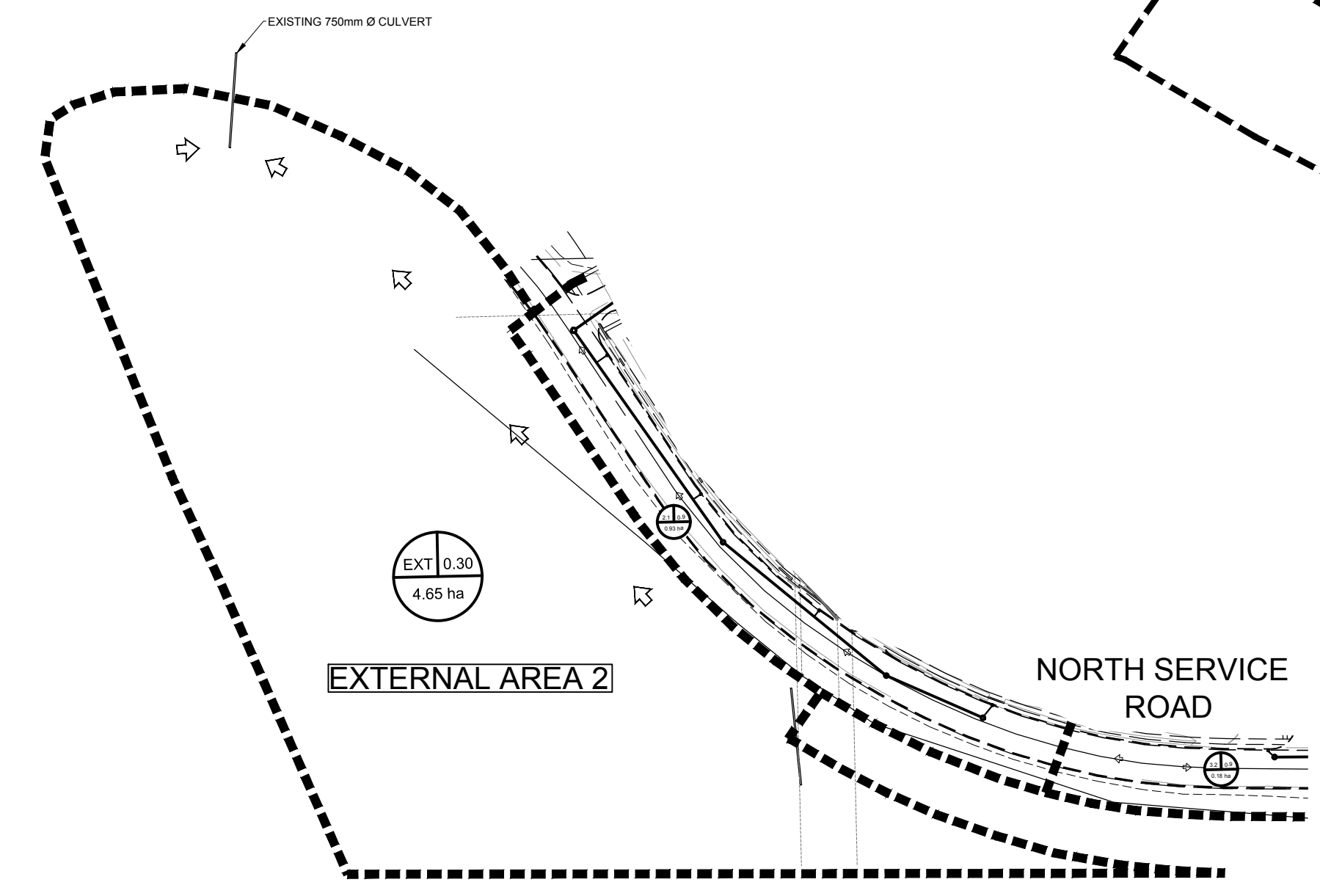
Drawn	Checked	Designed	Checked	Date	Drawing No.
AH	SH	EL	SH	6/1/2018	
Project No.	Contract No.	Revision No.			
040159		0			

Scale: 1:750

C302

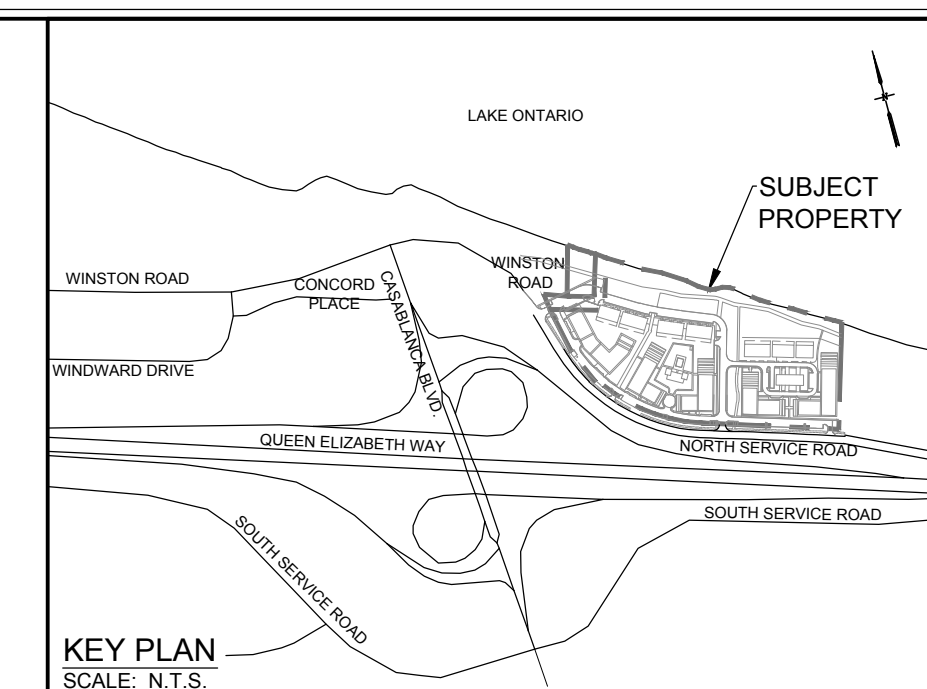
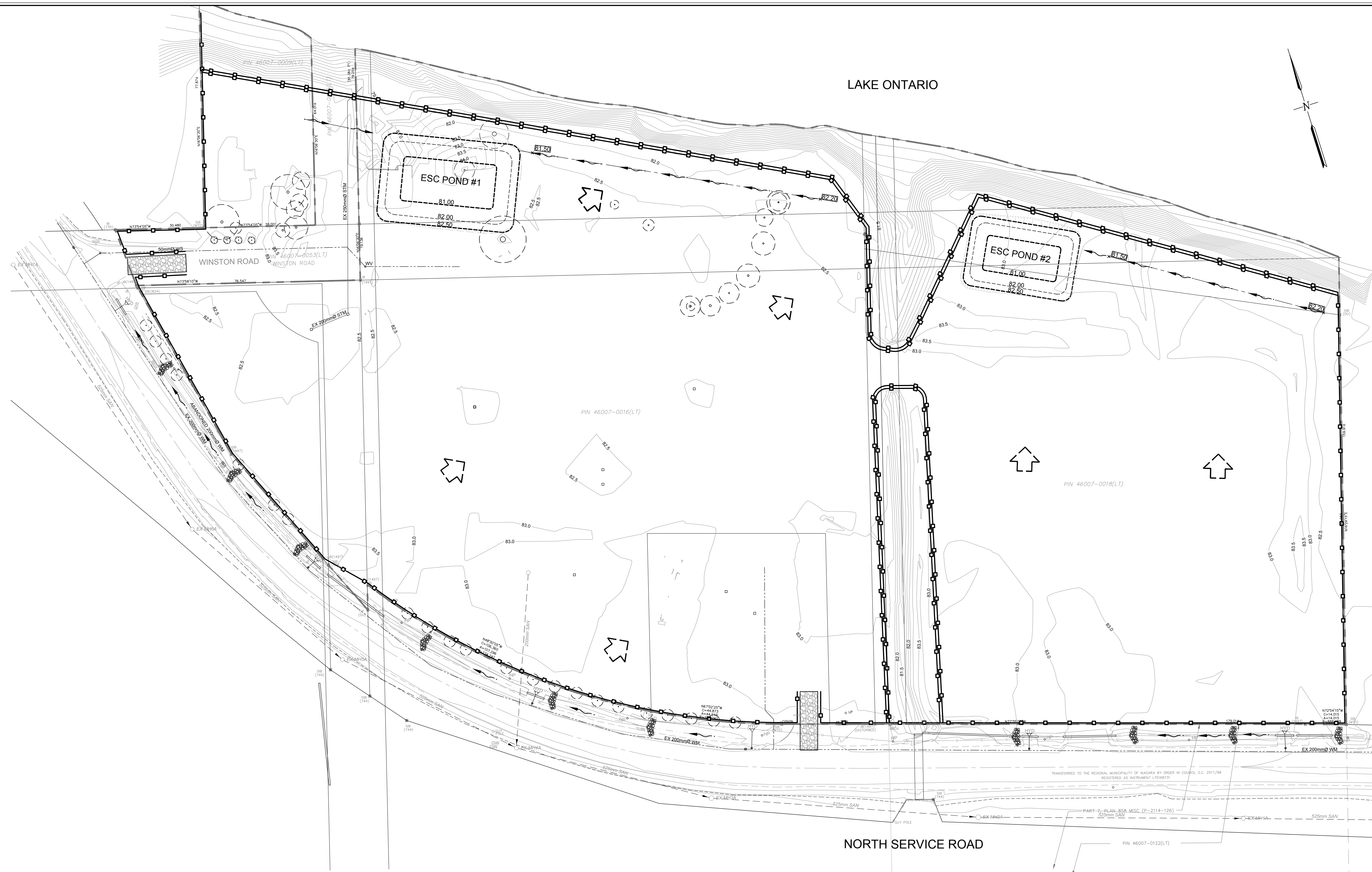


FOR EXTERNAL DRAINAGE AREA REFER TO INSET



EXTERNAL AREA 1
 100YEAR FLOW= 6.04m/s
 SEE FIGURE 2

SCALE 1:2000



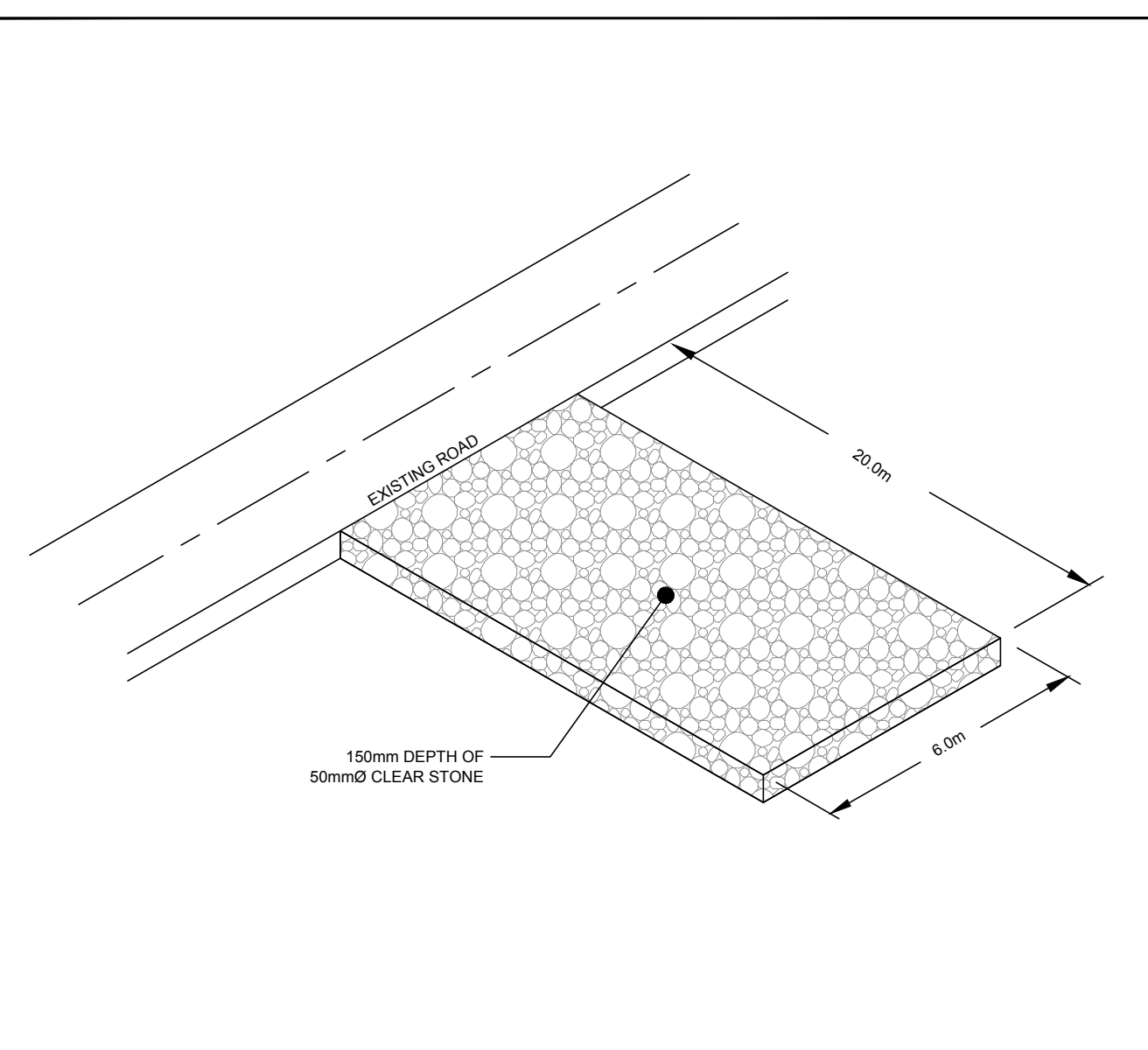
LEGEND

- PROPERTY BOUNDARY
- == DOUBLE RUN EROSION CONTROL FENCE
- o- EROSION CONTROL FENCE
- x-x- PROPOSED CONTOUR
- ▨ MUDMAT
- ➔ DRAINAGE FLOW ARROW
- ~ SWALE
- xx.xx PROPOSED ELEVATION
- x82.50 EXISTING ELEVATION
- ▧ CHECKDAM
- - - EXISTING DITCH
- EXISTING CONTOUR
- EXISTING CULVERT

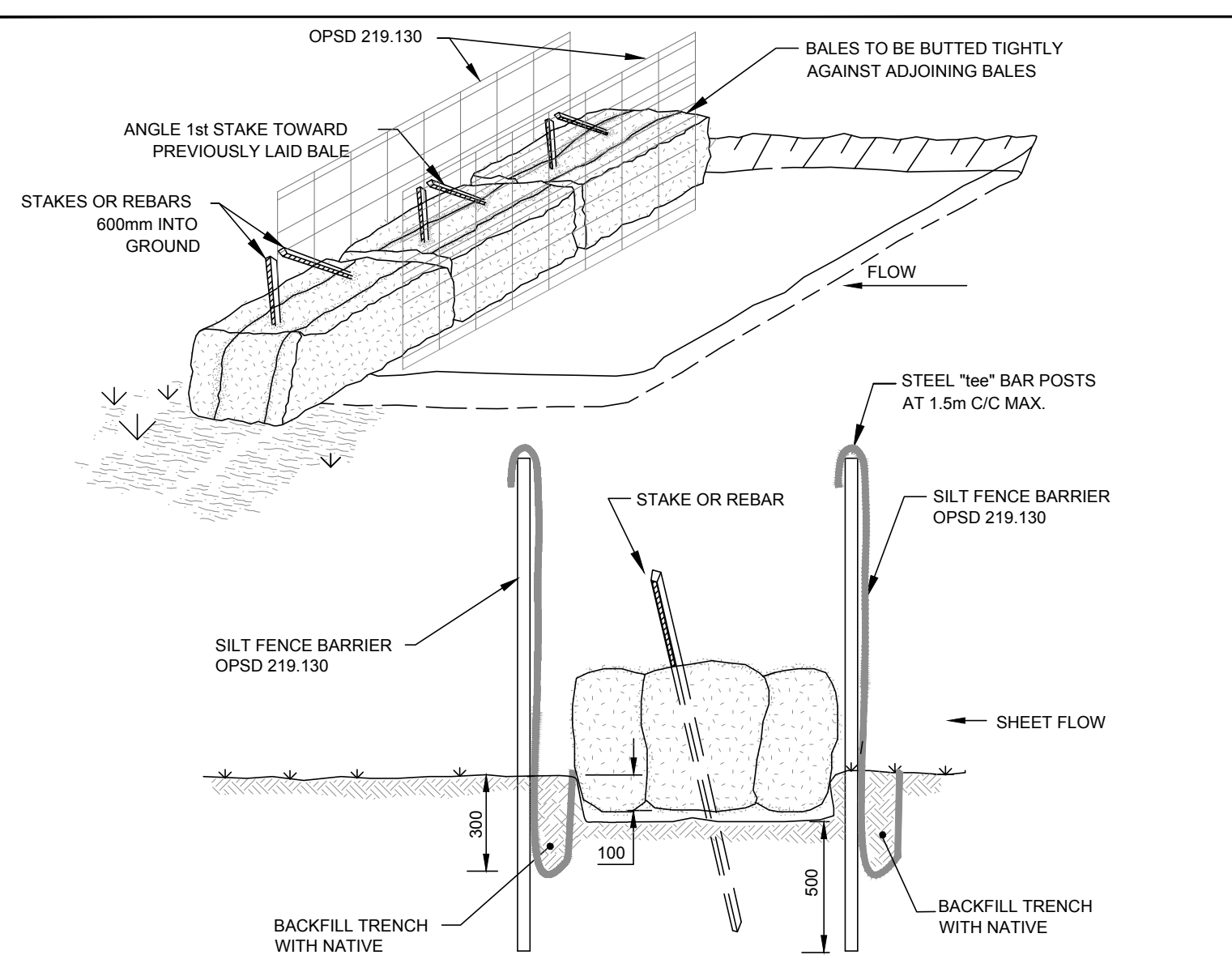
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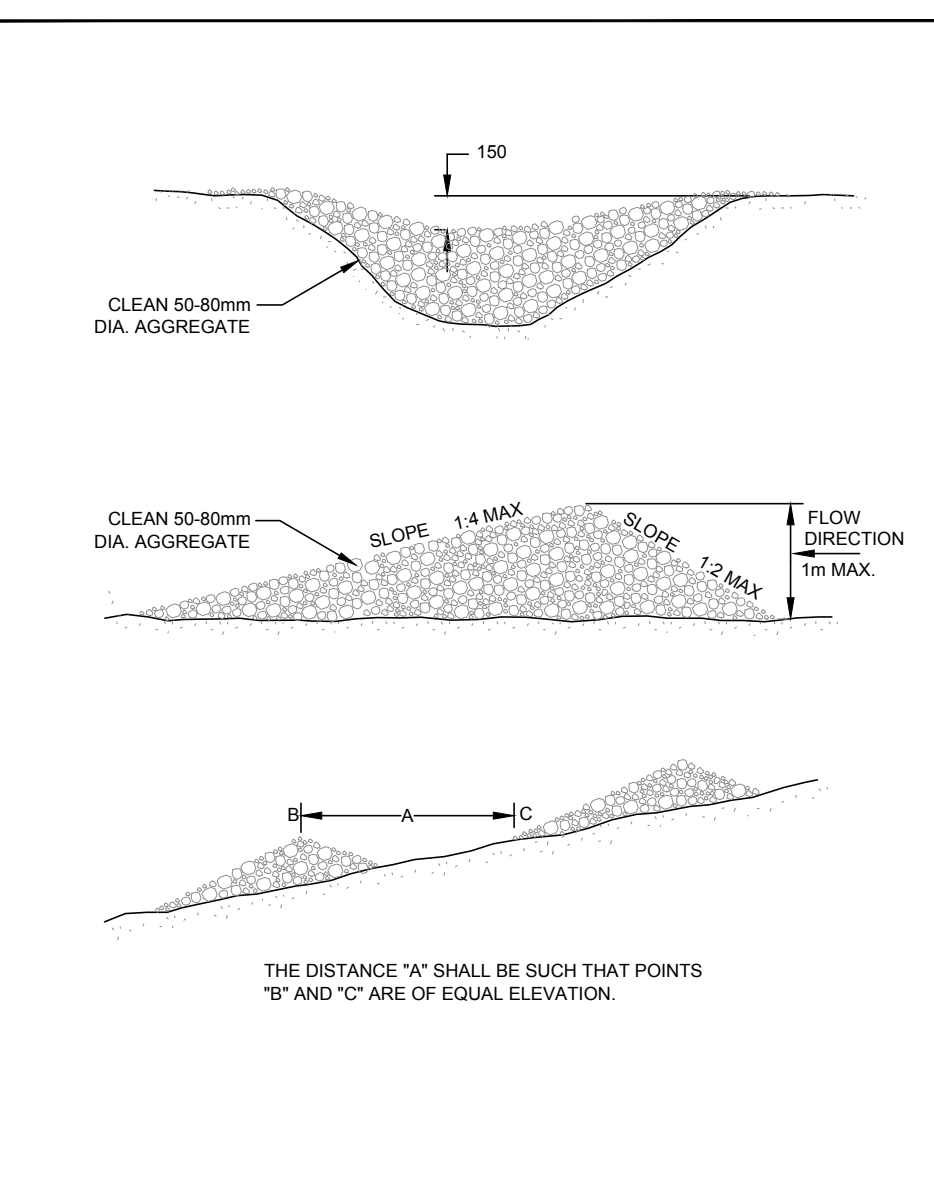
No.	Issue / Revision	Date	Auth.
1	ISSUED FOR DRAFT PLAN APPLICATION	6/1/2018	SH



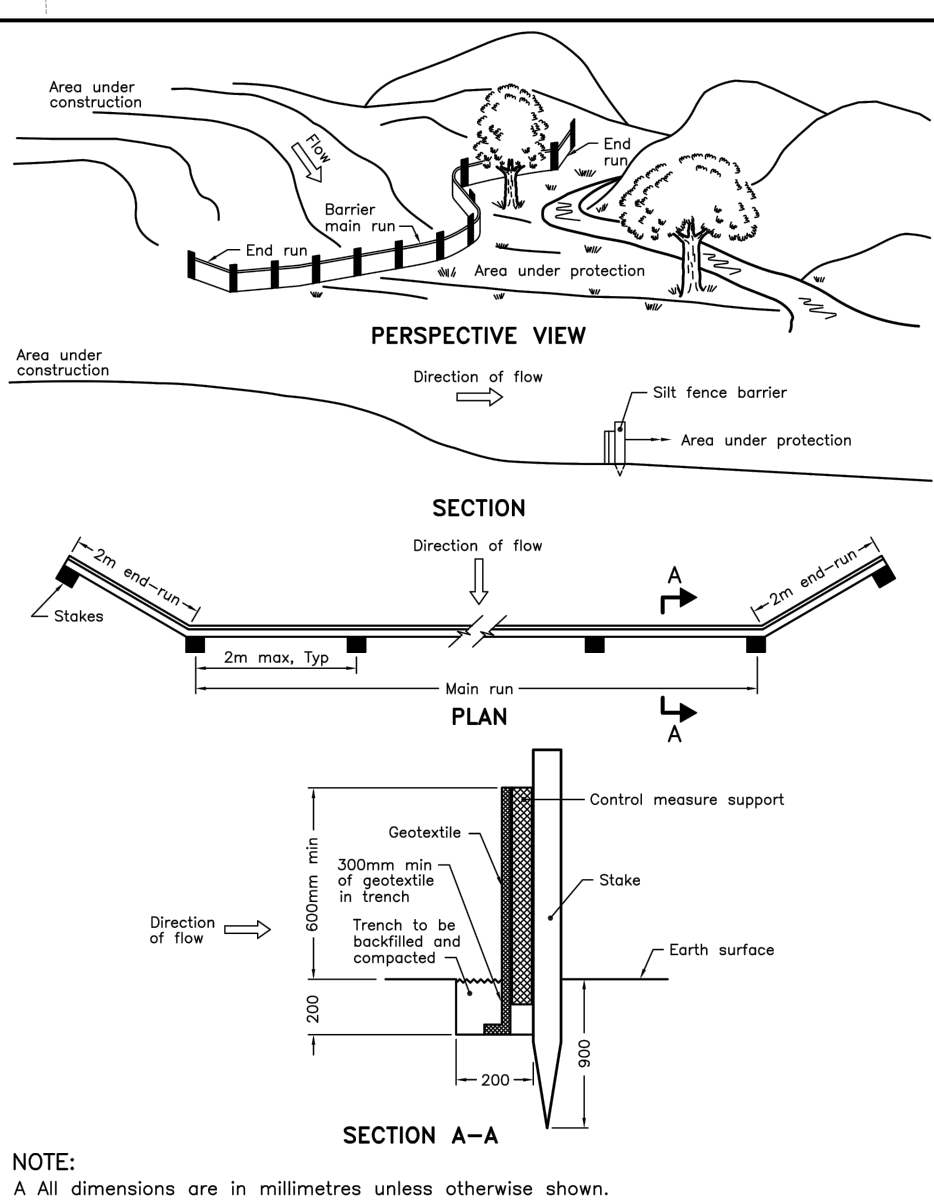
MUD MAT CONSTRUCTION ACCESS
N.T.S.
BURNSIDE
RJB 7.08



DOUBLE RUN SEDIMENT FENCE
N.T.S.
BURNSIDE
RJB 7.15



ROCK CHECK - DAMS FOR ROADSIDE DITCHES
N.T.S.
BURNSIDE
RJB 7.10



HEAVY-DUTY SILT FENCE BARRIER
ONTARIO PROVINCIAL STANDARD DRAWING Nov 2006 Rev 1
BURNSIDE
RJB 7.10
OPS 219.130

BURNSIDE
R. J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
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LOSANI HOMES

Drawing Title
LOSANI FIFTH WHEEL
TOWN OF GRIMSBY
EROSION & SEDIMENT CONTROL PLAN

Drawn	Checked	Designed	Checked	Date	Drawing No.
AH	SH	EL	SH	6/1/2018	
Project No.	Contract No.	Revision No.	0		C303

Scale: 1:750



Appendix C

Sanitary and Storm Sewer Design Sheets

SANITARY SEWER DESIGN SHEET

Losani Homes

Fifth Wheel Development, Grimsby, ON



Project #: 300 040159
 Date: 17-May-18
 Designed: E.L.
 Checked: S.A.H.

Min Diameter = 200 mm Avg. Domestic Flow = 275.0 l/c/d
 Mannings 'n'= 0.013 Infiltration = 0.286 l/s/ha
 Min. Velocity = 0.60 m/s Max. Peaking Factor = 4.00
 Max. Velocity = 3.65 m/s Min. Peaking Factor= 1.50

Factor of Safety = 10 %

NOMINAL PIPE SIZE USED

DESCRIPTION	FROM MH	TO MH	RESIDENTIAL						COMMERCIAL/INDUSTRIAL/INSTITUTIONAL						FLOW CALCULATIONS						PIPE DATA							
			AREA (ha)	ACC. AREA (ha)	UNITS (#)	DENSITY (P/ha)	DENSITY (P/unit)	POP	ACCUM. RES. POP.	AREA (ha)	ACC. AREA (ha)	EQUIV. POP. (p/ha)	FLOW RATE (l/s/ha)	EQUIV. POP.	ACCUM. EQUIV. POP.	INFILTRATION (l/s)	TOTAL ACCUM. POP.	PEAKING FACTOR	POP. FLOW (l/s)	CONSTANT COMM. FLOW (l/s)	ACCUM. COMM. FLOW (l/s)	TOTAL FLOW (l/s)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	ACTUAL VELOCITY (m/s)	PERCENT FULL (%)
BLDG N & M	MH7A	MH6A	0.39	0.39	11		3.5	39	39							0.1	39	4.00	0.5			0.6	0.50	200	23.2	0.74	0.32	3%
BLDG L & K	MH6A	MH5A	0.45	0.84	12		3.5	42	81							0.2	81	4.00	1.0			1.3	0.50	200	23.2	0.74	0.40	5%
ROUTE	MH5A	MH4A		0.84					81							0.2	81	4.00	1.0			1.3	0.40	200	20.7	0.66	0.37	6%
BLDG H, I, & J	SSWR4	MH8A	0.40	0.40	15		3.5	53	53							0.1	53	4.00	0.7			0.8	0.50	200	23.2	0.74	0.34	3%
	MH8A	MH4A		0.40					53							0.1	53	4.00	0.7			0.8	1.00	200	32.8	1.04	0.44	2%
ROUTE	MH4A	MH3A	0.20	1.44					134							0.4	134	4.00	1.7			2.1	0.40	200	20.7	0.66	0.42	10%
BLDG C & D	SSWR3	MH3A	1.38	1.38	356		2.5	890	890	0.14	0.14	200		28	28	0.4	918	3.82	11.2			11.6	0.50	200	23.2	0.74	0.74	50%
BLDG E & G	SSWR6	MH3A	0.85	0.85	158		2.5	395	395	0.10	0.10	200		20	20	0.3	415	4.00	5.3			5.6	0.50	200	23.2	0.74	0.61	24%
ROUTE	MH3A	MH2A		3.67					1419		0.24			48	48	1.1	1467	3.69	17.2			18.3	0.40	250	37.6	0.77	0.76	49%
TO MUNICIPAL SSWR	MH2A	MH1A		3.67					1419		0.24			48	48	1.1	1467	3.69	17.2			18.3	0.40	250	37.6	0.77	0.76	49%
	MH1A	EX		3.67					1419		0.24			48	48	1.1	1467	3.69	17.2			18.3		250				
BLDG A & B	SSWR2	MH30A	0.88	0.88	477		2.5	1193	1193	0.05	0.05	200		10	10	0.3	1203	3.75	14.3			14.6	1.00	200	32.8	1.04	1.01	45%
	MH30A	EX		0.88					1193		0.05			10	10	0.3	1203	3.75	14.3			14.6	1.00	200	32.8	1.04	1.01	45%
BLDG F	SSWR5	MH70A	0.56	0.56	266		2.5	665	665	0.10	0.10	200		20	20	0.2	685	3.90	8.5			8.7	1.00	200	32.8	1.04	0.88	27%
	MH70A	EX		0.56					665		0.10			20	20	0.2	685	3.90	8.5			8.7	1.00	200	32.8	1.04	0.88	27%
	EX	MUN		5.11					3277		0.39			78	78	1.6	3355	3.40	36.3			37.9	0.40	525	272.0	1.26	0.88	14%

STORM SEWER DESIGN SHEET: (5 Year Storm)

Losani Homes
 Fifth Wheel Development, Grimsby, ON



Project #: 300 040159
 Date: 30-May-18
 Designed: E.L.
 Checked: S.A.H.

Min. Diameter = 250 mm
 Mannings 'n' = 0.013
 Starting Tc = 10 min
 Factor of Safety = 5 %

Rainfall Intensity = $\frac{A}{(Tc+B)^c}$ where Tc is in hours
 A = 785.59
 B = 6
 C = 0.79 } (5 Yr)

NOMINAL PIPE SIZE USED

DESCRIPTION	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m ³ /s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m ³ /s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)	
WEST OUTFALL																					
N. SERVICE RD	MH25	MH24	0.20	0.90	0.18	0.18	186.7	0.093			0.093	38.0	0.50	375	0.124	1.12	10.00	0.56	10.56	75%	
N. SERVICE RD	MH24	MH23	0.23	0.90	0.21	0.39	186.4	0.200			0.200	76.0	0.50	525	0.304	1.40	10.56	0.90	11.47	66%	
N. SERVICE RD	MH23	MH22	0.50	0.90	0.45	0.84	186.1	0.433			0.433	93.5	1.00	600	0.614	2.17	11.47	0.72	12.18	70%	
N. SERVICE RD	MH22	MH21				0.84	185.8	0.432			0.432	25.1	2.00	600	0.868	3.07	12.18	0.14	12.32	50%	
	MH28	MH27	0.17	0.90	0.15	0.15	186.7	0.079			0.079	22.0	1.00	300	0.097	1.37	10.00	0.27	10.27	82%	
	MH27	MH26	0.10	0.90	0.09	0.24	186.6	0.126			0.126	54.5	1.00	375	0.175	1.59	10.27	0.57	10.84	72%	
	MH26	MH21				0.24	186.3	0.126			0.126	12.2	1.00	375	0.175	1.59	10.84	0.13	10.97	72%	
BULDINGS A & B	BLGS	P2	0.34	0.90	0.31	0.31	186.7	0.159			0.159	1.0	1.00	375	0.175	1.59	10.00	0.01	10.01	90%	
OUTDOOR AREA	PARK	P2	0.28	0.35	0.10	0.10	186.7	0.051			0.051	1.0	1.00	300	0.097	1.37	10.00	0.01	10.01	53%	
	P2	MH21				0.40	186.7	0.209			0.209	10.0	1.00	450	0.285	1.79	10.01	0.09	10.11	73%	
	MH21	MH20	0.12	0.90	0.11	1.59	185.7	0.821			0.821	71.9	2.50	600	0.971	3.43	12.32	0.35	12.67	85%	
	MH20	OGS2	1.94			1.59	185.6	0.821			0.821	8.4	2.50	600	0.971	3.43	12.67	0.04	12.71	85%	
	OGS2	HW02				1.59	185.6	0.821			0.821	28.3	2.50	600	0.971	3.43	12.71	0.14	12.85	85%	

STORM SEWER DESIGN SHEET: (5 Year Storm)

Losani Homes
Fifth Wheel Development, Grimsby, ON



Project #: 300 040159
 Date: 30-May-18
 Designed: E.L.
 Checked: S.A.H.

Min. Diameter = 250 mm
 Mannings 'n' = 0.013
 Starting Tc = 10 min
 Factor of Safety = 5 %

Rainfall Intensity = $\frac{A}{(Tc+B)^c}$ where Tc is in hours
 A = 785.59
 B = 6
 C = 0.79 } (5 Yr)

NOMINAL PIPE SIZE USED

DESCRIPTION	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m ³ /s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m ³ /s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)	
EAST OUTFALL																					
BUILDINGS M, N	MH12	MH11	0.28	0.90	0.25	0.25	186.7	0.131			0.131	59.4	0.50	450	0.202	1.27	10.00	0.78	10.78	65%	
BUILDINGS K, L	MH11	MH10	0.28	0.90	0.25	0.50	186.4	0.261			0.261	98.2	0.50	525	0.304	1.40	10.78	1.17	11.95	86%	
LANDSCAPE		P1	0.43	0.75	0.32	0.32															
OUTDOOR AREA		P1	0.45	0.35	0.16	0.16															
	P1	MH14				0.48	186.7	0.249			0.249	7.0	1.00	450	0.285	1.79	10.00	0.07	10.07	87%	
	MH14	MH10	0.08	0.90	0.07	0.55	186.6	0.286			0.286	23.5	0.50	600	0.434	1.54	10.07	0.26	10.32	66%	
	MH10	OGS1	1.52			1.06	185.9	0.545			0.545	8.4	0.50	675	0.594	1.66	11.95	0.08	12.03	92%	
	OGS1	STM1A				1.06	185.9	0.545			0.545	5.5	0.50	675	0.594	1.66	12.03	0.06	12.09	92%	
N. SERVICE RD	MH36	MH34	0.53	0.90	0.48	0.48	186.7	0.247			0.247	79.6	0.50	525	0.304	1.40	10.00	0.94	10.94	81%	
N. SERVICE RD	MH35	MH34	0.18	0.90	0.16	0.16	186.7	0.084			0.084	19.7	1.00	300	0.097	1.37	10.00	0.24	10.24	87%	
	MH34	MH30				0.64	186.3	0.331			0.331	17.8	1.00	525	0.430	1.99	10.94	0.15	11.09	77%	
	MH32	MH31	0.14	0.90	0.13	0.13	186.7	0.065			0.065	62.9	1.00	300	0.097	1.37	10.00	0.77	10.77	68%	
	MH31	MH30	0.10	0.90	0.09	0.22	186.4	0.112			0.112	57.4	1.00	375	0.175	1.59	10.77	0.60	11.37	64%	
	MH33	MH30	0.27	0.90	0.24	0.24	186.7	0.126			0.126	110.0	0.75	375	0.152	1.37	10.00	1.33	11.33	83%	
	MH30	OGS3	1.22			1.10	186.1	0.568			0.568	13.7	2.00	525	0.608	2.81	11.37	0.08	11.45	93%	
	OGS3	STM2				1.10	186.1	0.568			0.568	4.2	2.00	525	0.608	2.81	11.45	0.02	11.48	93%	
EXTERNAL FLOWS (1)	STM2	STM1				1.10	186.1	0.568	6.040	6.040	6.608	104.0	2.50	1350	8.439	5.90	11.48	0.29	11.77	78%	
BUILDING C & D	P5A	MH5	0.48	0.90	0.43	0.43	186.7	0.224			0.224	4.6	1.00	450	0.285	1.79	10.00	0.04	10.04	79%	
	MH5	STM1				0.43	186.6	0.224			0.224	18.8	1.00	450	0.285	1.79	10.04	0.17	10.22	79%	
BUILDINGS E & F	P5B	STM1	0.46	0.90	0.41	0.41	186.7	0.215			0.215	14.2	1.00	450	0.285	1.79	10.00	0.13	10.13	75%	
BIO SWALE	5.5	STM1	0.16	0.35	0.06	0.06	190.7	0.030			0.030										
WINSTON RD	5.6	STM1	0.12	0.90	0.11	0.11	190.7	0.057			0.057										
BULDG G, H, I, J	P4	OGS4	0.77	0.90	0.69	0.69	186.7	0.359			0.359	5.0	0.50	600	0.434	1.54	10.00	0.05	10.05	83%	
	OGS4	STM1B				0.69	186.6	0.359			0.359	8.1	0.50	600	0.434	1.54	10.05	0.09	10.14	83%	
	STM1A	HW1A				1.06	185.8	0.545	3.564	3.564	4.110	77.0	0.75	1350	4.622	3.23	12.09	0.40	12.48	89%	
	STM1B	HW1B				0.69	186.6	0.359	3.564	3.564	3.924	77.0	0.75	1350	4.622	3.23	10.14	0.40	10.54	85%	

(1) 100-Year Peak Discharge (Odan/Detech Group, 2005)

STORM SEWER DESIGN SHEET: (5 Year Storm)

Losani Homes
 Fifth Wheel Development, Grimsby, ON



Project #: 300 040159
 Date: 30-May-18
 Designed: E.L.
 Checked: S.A.H.

Min. Diameter = 250 mm
 Mannings 'n' = 0.013
 Starting Tc = 10 min
 Factor of Safety = 5 %

Rainfall Intensity = $\frac{A}{(Tc+B)^c}$ where Tc is in hours
 A = 785.59
 B = 6
 C = 0.79 } (5 Yr)

NOMINAL PIPE SIZE USED

DESCRIPTION	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m3/s)	CONSTANT FLOW (m3/s)	ACCUM. CONSTANT FLOW (m3/s)	TOTAL FLOW (m ³ /s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m ³ /s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)	
UNCONTROLLED FLOWS																					
UNCONTROLLED	6.1	OUT	0.60	0.55	0.33	0.33	190.7	0.175			0.175										
	6.2	OUT	0.19	0.55	0.10	0.10	190.7	0.055			0.055										
	6.3	OUT	0.76	0.55	0.42	0.42	190.7	0.221			0.221										
SHEETFLOW TO LAKE	OUT	UNC				2.96	190.7	1.569		6.040	7.609										



Appendix D

Oil and Grit Separator Design

Brief Stormceptor Sizing Report - OGS01

Project Information & Location			
Project Name	Losani	Project Number	4462
City		State/ Province	Ontario
Country	Canada	Date	8/24/2017
Designer Information		EOR Information (optional)	
Name	Adam Crookes	Name	
Company	R.J. Burnside	Company	
Phone #	289-545-1064	Phone #	
Email	adam.crookes@rjburnside.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	OGS01
Target TSS Removal (%)	80
TSS Removal (%) Provided	80
Recommended Stormceptor Model	STC 4000

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 300	56
STC 750	68
STC 1000	70
STC 1500	70
STC 2000	74
STC 3000	76
STC 4000	80
STC 5000	81
STC 6000	83
STC 9000	87
STC 10000	87
STC 14000	90
StormceptorMAX	Custom

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (ha)	1.58	TSS Removal (%)	80.0
Imperviousness %	70.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (L)	
Station Name	ST CATHARINES A	Peak Conveyed Flow Rate (L/s)	
State/Province	Ontario	Water Quality Flow Rate (L/s)	
Station ID #	7287	Up Stream Storage	
Years of Records	33	Storage (ha-m)	Discharge (cms)
Latitude	43°12'N	0.000	0.000
Longitude	79°10'W	Up Stream Flow Diversion	
		Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Notes
<ul style="list-style-type: none"> Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

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Brief Stormceptor Sizing Report - OGS02

Project Information & Location			
Project Name	Losani	Project Number	4462
City		State/ Province	Ontario
Country	Canada	Date	8/24/2017
Designer Information		EOR Information (optional)	
Name	Adam Crookes	Name	
Company	R.J. Burnside	Company	
Phone #	289-545-1064	Phone #	
Email	adam.crookes@rjburnside.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	OGS02
Target TSS Removal (%)	80
TSS Removal (%) Provided	83
Recommended Stormceptor Model	STC 9000

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 300	50
STC 750	63
STC 1000	64
STC 1500	65
STC 2000	69
STC 3000	71
STC 4000	75
STC 5000	76
STC 6000	79
STC 9000	83
STC 10000	83
STC 14000	87
StormceptorMAX	Custom

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (ha)	1.94	TSS Removal (%)	80.0
Imperviousness %	88.7	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (L)	
Station Name	ST CATHARINES A	Peak Conveyed Flow Rate (L/s)	
State/Province	Ontario	Water Quality Flow Rate (L/s)	
Station ID #	7287	Up Stream Storage	
Years of Records	33	Storage (ha-m)	Discharge (cms)
Latitude	43°12'N	0.000	0.000
Longitude	79°10'W	Up Stream Flow Diversion	
		Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Notes
<ul style="list-style-type: none"> Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

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Brief Stormceptor Sizing Report - OGS03

Project Information & Location			
Project Name	Losani	Project Number	4462
City		State/ Province	Ontario
Country	Canada	Date	8/24/2017
Designer Information		EOR Information (optional)	
Name	Adam Crookes	Name	
Company	R.J. Burnside	Company	
Phone #	289-545-1064	Phone #	
Email	adam.crookes@rjburnside.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	OGS03
Target TSS Removal (%)	80
TSS Removal (%) Provided	80
Recommended Stormceptor Model	STC 5000

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 300	55
STC 750	67
STC 1000	69
STC 1500	69
STC 2000	73
STC 3000	75
STC 4000	79
STC 5000	80
STC 6000	82
STC 9000	86
STC 10000	86
STC 14000	89
StormceptorMAX	Custom

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (ha)	1.22	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (L)	
Station Name	ST CATHARINES A	Peak Conveyed Flow Rate (L/s)	
State/Province	Ontario	Water Quality Flow Rate (L/s)	
Station ID #	7287	Up Stream Storage	
Years of Records	33	Storage (ha-m)	Discharge (cms)
Latitude	43°12'N	0.000	0.000
Longitude	79°10'W	Up Stream Flow Diversion	
		Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Notes
<ul style="list-style-type: none"> Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

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Brief Stormceptor Sizing Report - OGS04

Project Information & Location			
Project Name	Losani	Project Number	4462
City		State/ Province	Ontario
Country	Canada	Date	8/24/2017
Designer Information		EOR Information (optional)	
Name	Adam Crookes	Name	
Company	R.J. Burnside	Company	
Phone #	289-545-1064	Phone #	
Email	adam.crookes@rjburnside.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	OGS04
Target TSS Removal (%)	80
TSS Removal (%) Provided	80
Recommended Stormceptor Model	STC 3000

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 300	62
STC 750	73
STC 1000	74
STC 1500	75
STC 2000	78
STC 3000	80
STC 4000	83
STC 5000	84
STC 6000	86
STC 9000	90
STC 10000	90
STC 14000	92
StormceptorMAX	Custom

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (ha)	0.77	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (L)	
Station Name	ST CATHARINES A	Peak Conveyed Flow Rate (L/s)	
State/Province	Ontario	Water Quality Flow Rate (L/s)	
Station ID #	7287	Up Stream Storage	
Years of Records	33	Storage (ha-m)	Discharge (cms)
Latitude	43°12'N	0.000	0.000
Longitude	79°10'W	Up Stream Flow Diversion	
		Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD) The selected PSD defines TSS removal		
City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Notes
<ul style="list-style-type: none"> Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

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