Site Servicing and Stormwater Management Report – Terry Fox Drive and Cope Drive Commercial Shopping Development

Project # 160401397

Prepared for:
983656 Ontario Limited

Prepared by:
Stantec Consulting Ltd..

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Sign-off Sheet

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1.0 INTRODUCTION

Stantec Consulting Ltd. has been commissioned by 983656 Ontario Limited to prepare a servicing study in support of Site Plan Control submission of the proposed commercial development located at 5331 Fernbank Road. The site is situated east of the intersection of Terry Fox Drive and Cope Drive within the City of Ottawa. The property location is indicated in **Figure 1**. The proposed commercial development comprises approximately 3.68ha of land. The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the background studies noted in **Section 2.0**, and as per consultation with City of Ottawa staff.

Figure 1: Location Plan

2.0 BACKGROUND

Documents referenced in preparation of the design for the Terry Fox Drive and Cope Drive Commercial Shopping Development include:

- Geotechnical Investigation – Proposed Commercial Development- Terry Fox Drive at Cope Drive, Paterson Group Inc. Consulting Engineers, February 18, 2018
- Serviceability Report – Cavanaugh Construction Ltd. / Karam SOHO West – Rev 3, Stantec Consulting Ltd., October 31, 2007
- Cavanaugh Construction – Soho West (Phase 1 and 2), Kanata South, City of Ottawa Stormwater Management Report, Stantec Consulting Ltd. October 31, 2007
- Monahan Drain Model Update to Identify Potential HGL Issues on Existing / Future Infrastructure in Cell 1 and Evaluation of Potential Alternative Solutions – City of Ottawa, J.F. Sabourin and Associates Inc (JFSA), September 7, 2014
- SOHO Subdivision – Monahan Drain HGL Analysis – City of Ottawa, Stantec Consulting Ltd, January 17, 2014
- Servicing and Stormwater Management Brief - Van Gaal Lands 5331 Fernbank Road and 1039 Terry Fox Drive, Novatech Engineers, Planners & Landscape Architects, September 1, 2015
- City of Ottawa Sewer Design Guidelines, City of Ottawa, October 2012
- City of Ottawa Design Guidelines – Water Distribution, City of Ottawa, July 2010
- City of Ottawa Technical Bulletin ISBT-2018-01 Revision to Ottawa Sewer Design Guidelines, March 2018

3.0 WATER SUPPLY SERVICING

3.1 BACKGROUND

The proposed development comprises eight commercial buildings, and above ground parking areas. The site is situated on the east side of Terry Fox Drive, south of Cope Drive and north of Fernbank Road. The site will be serviced via the existing 300mm and 150mm watermain within the Cope Drive and Patriot Place ROW's. The property is located within the City's Pressure Zone 3W. Proposed ground elevations of the site vary from approximately 96.5m to 99.1m. Under normal operating conditions, hydraulic gradelines vary from approximately 128.5m to 162.1m as confirmed through boundary conditions as provided by the City of Ottawa (see **Appendix A.3**).

3.2 WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008). A rate of 28,000 L/gross ha/day of commercial space was used for the proposed site. See **Appendix A.1** for detailed domestic water demand estimates.

The average day demand (AVDY) for the entire site was determined to be 0.27 L/s. The maximum daily demand (MXDY) is 1.5 times the AVDY (commercial property), which totals 0.40 L/s. The peak hour demand (PKHR) is 1.8 times the MXDY, totaling 0.73 L/s.

Ordinary construction and automatic sprinkler system conforming to NFPA 13 for all eight buildings was considered in the assessment for fire flow requirements according to the FUS Guidelines. Based on calculations per the FUS Guidelines (**Appendix A.2**), the maximum required fire flow occurs in Building A with a requirement of 200 L/s.

3.3 HYDRAULIC MODEL RESULTS

A hydraulic model of the water supply system was created by Stantec based on current boundary conditions to assess the proposed watermain layout under the above demands and during fire flow scenarios. Results of the hydraulic modeling demonstrate that adequate flows are available for the subject site, with on-site pressures ranging from **85 psi** to **93 psi** under normal operating conditions. These values exceed the desired pressure range of 80 psi as defined by Ministry of Environment Climate & Parks (MOECP) and City of Ottawa design guidelines. As a result, pressure reducing valves may be required to be installed. This will be examined further as part of detailed design. Results of the hydraulic model analysis can be found in **Appendix A.4.**

A fire flow analysis was carried out using the hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and fire flow requirements per the FUS methodology. Results of the modeling analysis indicate that flows in excess of 12,000L/min (200 L/sec) can be delivered while still maintaining a residual pressure of 140 kPa (20 psi). Results of the hydraulic modeling are included for reference in **Appendix A.4**.

The hydraulic analysis was completed with connections to both the 305mm watermain within Cope Drive and the 152mm watermain within Patriot Place as directed by the City of Ottawa. A connection at Patriot Place would impact an existing municipal pathway block and ROW within the neighbouring SOHO development. The need and benefit of this connection can be examined further at the detailed design stage of the development.

3.4 SUMMARY OF FINDINGS

Based on the results of the hydraulic analysis, the proposed water servicing will meet all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions) as well as under emergency fire demand conditions (maximum day + fire flow). The use of pressure reducing valves may be required to maintain pressures within service limits.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

The site will be serviced via a proposed 250mm diameter sanitary sewer which will direct flows to an existing 525mm diameter sanitary sewer installed within the Cope Drive ROW situated northwest of the proposed commercial development, and ultimately through the existing SOHO residential subdivision to Hazeldean Pumping Station (see **Drawing SSP-1**). The 525mm sanitary sewer within Cope Drive was sized as part of the SOHO subdivision design convey peak flows from future commercial and residential developments.

4.2 DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the MOECP's Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Minimum size – 200mm dia. for residential areas, 250mm for commercial areas
- Average Wastewater Generation – 28,000L/ha/day
- Peak Factor – 1.5 (Harmon's) (Commercial)
- Extraneous Flow Allowance – 0.33 L/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m

4.3 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows (approx. 1.6 L/s with allowance for infiltration) to the existing 525mm diameter sanitary sewer within Cope Drive. The proposed drainage pattern is detailed on **Drawing SA-1**. A sanitary sewer design sheet for the proposed service lateral is included in **Appendix B.1**. Full port backwater valves are to be installed on all sanitary services within the site to prevent any potential surcharge from the downstream sanitary sewer from impacting the proposed property.

As outlined in the Serviceability Report – Cavanaugh Construction Ltd. / Karam SOHO West – Rev 3, Stantec Consulting Ltd., October 31, 2007, wastewater servicing for the SOHO subdivision was designed to convey peak flows from future commercial and residential developments. The allowance for the proposed commercial development parcel was based on an anticipated residential flow from an area of 3.75 ha and a population of 459 persons and the design criteria of 3.50 L/p/d and infiltration rate of 0.28L/s/ha which were applicable at the time. The peak flow allowance for this development site is 6.5 L/s, much greater than the expected design flow of 1.6 L/s. The sanitary sewer design sheet and drainage area plan for the SOHO subdivision are included in **Appendix B.2**.

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The subject site is included in the SOHO Phase 1 Subdivision drainage area which discharges to Cell 1 of the Monahan Drain Constructed Wetlands Stormwater Management Facility. As part of the design of the SOHO subdivision, flow from external development parcels, including this commercial site, was accounted for and criteria were set for the future development of the external parcels.

The objective of this stormwater management plan is to determine the measures necessary to control the quantity/quality of stormwater released from the proposed development to criteria established by the Cavanaugh Construction – Soho West (Phase 1 and 2), Stormwater Management Report, Stantec Consulting Ltd. October 31, 2007 and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

Criteria were established by combining current design practices outlined by the City of Ottawa Design Guidelines (2012), and through consultation with City of Ottawa staff. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Use of the dual drainage principle (City of Ottawa).
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (City of Ottawa).
- Assess impact of 100 year event outlined in the City of Ottawa Sewer Design Guidelines on major & minor drainage system (City of Ottawa).

Storm Sewer & Inlet Controls

- Proposed site to discharge the existing 1200mm x 1800mm box storm sewer on Cope Drive at the northwestern boundary of the subject site (City of Ottawa).
- Minor system inflow to be restricted to 317.1 L/s during the 100 year storm event (Soho West (Phase 1 and 2), Stormwater Management Report)
- 100-year HGL boundary condition at the site outlet sewer of 94.72m.
- 100-year Storm HGL to be a minimum of 0.30 m below building foundation footing (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30m above the 100-year water level (City of Ottawa).
- Major system flow to be restricted to 781 L/s during the 100 year storm event (Soho West (Phase 1 and 2), Stormwater Management Report)
- Rooftop and parking lot storage to be maximized where possible.
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.30m (City of Ottawa).
- Provide adequate emergency overflow conveyance off-site (City of Ottawa).
- Enhanced quality control (80% TSS removal) has been provided downstream of the development in Vortechs Cell 1 hydrodynamic separator.

5.2.1 Allowable Release Rate

The overall approach for storm servicing and stormwater management for the proposed development was initially outlined in the Serviceability Report – Cavanaugh Construction Ltd. / Karam SOHO West – Rev 3, Stantec Consulting Ltd., October 31, 2007 and Cavanaugh Construction – Soho West (Phase 1 and 2), Stormwater Management Report, Stantec Consulting Ltd. October 31, 2007

Discharge rates were assigned to the undeveloped parcels upstream of the SOHO Phase 1 subdivision. These are summarized in **Table 1** below. The external contributions are also identified on the Overall Storm Drainage Plan, OSD, SOHO-Kanata South included in **Appendix C.4**. The subject lands were identified as FUT-13B in the SOHO Phase 1 design.

Table 1: Target Release Rates for External Development Lands – SOHO-Kanata South

Drainage Area	Description	Minor System 100 Year Storm (L/s)	Major System 100 Year Storm (L/s)	Total Flow 100 Year Storm (L/s)
FUT-13A	Claridge Residential Lands	702.10	1,537	2,239
FUT-13B	Commercial Shopping Development (subject lands)	317.10	781	1,098

5.2.2 Modeling Rationale

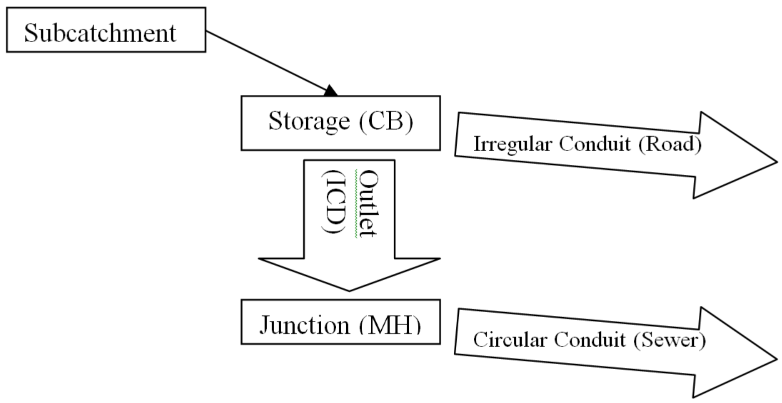
A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. Parking lot surface storage estimates were based on average commercial volume stored per hectare. The following assumptions were applied to the detailed model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for the 5-year and 100-year analysis.
- 24-hour SCS Type II Storm distribution for the 100-year analysis.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year Chicago storm event at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces on each subcatchment, converted to equivalent Runoff Coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Subcatchment areas are defined from high-point to high-point where sags occur. Subcatchment width (average length of overland sheet flow) was determined by 225 x the subcatchment area as per City of Ottawa Sewer Design Guidelines.
- Number of catchbasins based on servicing plan (**Drawing SSP-1**).
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain inflow target rate and maximize use of surface storage.
- Inlet control devices(ICDs) to have a minimum orifice diameter of 83mm.

5.2.2.1 SWMM Dual Drainage Methodology

The proposed subdivision is modeled in one modeling program as a dual conduit system (see Figure 2), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catchbasins. The dual drainage systems are connected via orifice link objects (or outlets) from storage node (i.e. CB and MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 2: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins, manholes and major system junctions. For storage nodes representing catchbasins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node (equal to the top of the CB plus an additional 0.35 m or higher). The additional depth has been added to rim elevations to allow routing from one surface storage to the next, and is unused where no spillage occurs between ponding areas. Ponding at low points is represented via storage area-depth curves for each individual storage node. Storage volumes exceeding the sag storage available in the node will route through the connected irregular conduit to the next storage node and continue routing through the system until, ultimately, flows either re-enter the minor system or reach the outfall of the major system.

Inlet control devices, as represented by orifice links, use a user-specified diameter and discharge coefficient taken from manufacturer's specifications for the chosen ICD model.

Subcatchment imperviousness was calculated via impervious area measured from **Drawing SP-1**.

5.2.2.2 Boundary Conditions

The detailed PCSWMM hydrology and the proposed storm sewers were used to assess the peak inflows and hydraulic grade line (HGL) for the site. All storm events used to demonstrate adherence to SWM target outflow rates for the site were run with a free-flowing outlet condition to be conservative with respect to the maximum expected release rate from the site.

5.2.3 Input Parameters

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed site, and outlines the major overland flow paths. All parameters were assigned as per applicable OSDG, MOECC and background report requirements.

Appendices C.2 summarize the modeling input parameters and results for the subject area; an example input and output file are provided for the 100-year 3hr Chicago storm. For all other input files and results of storm scenarios, please examine the electronic model files located on the CD provided with this report. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.010.

5.2.3.1 Hydrologic Parameters

Table 2 presents the general subcatchment parameters used:

Table 2: General Subcatchment Parameters

Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Impervious	0.013
N Pervious	0.25
Dstore Imperv. (mm)	1.57
Dstore perv. (mm)	4.67
Zero Imperv. (%)	0

Table 3 presents the individual parameters that vary for each of the proposed subcatchments.

Table 3: Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Slope (%)	Imperv. (%)
L1000A	L1000A-S	0.342	76.940	2	93
L1001A	L1001A-S	0.291	65.360	2	69
L1003A	L1003A-S	0.298	67.010	2	91
L1003B	L1003B-S	0.557	125.350	2	91
L1005A	L1005A-S	0.559	125.780	2	86
L1006A	1006-MH	0.072	16.110	2	100
L1006B	L1006B-S	0.338	76.150	2	64
L1006C	L1006B-S	0.249	55.980	2	73

R1001A	R1001A-S	0.057	12.800	2	100
R1001B	R1001B-S	0.083	18.650	2	100
R1002A	R1002A-S	0.325	73.090	2	100
R1003A	R1003A-S	0.113	25.500	2	100
R1003B	R1003B-S	0.037	8.360	2	100
R1005A	R1005A-S	0.141	31.770	2	100
R1005B	R1005B-S	0.058	12.960	2	100
R1006B	R1006B-S	0.028	6.270	2	100
U100A	U100A-OF	0.100	22.540	2	9
U100B	U100B-OF	0.010	2.330	2	100
U100C	U100C-OF	0.010	2.240	2	100
U100D	U100D-OF	0.015	3.280	2	100
TOTAL		**3.682**			**89**

Table 4 summarizes the storage node parameters used in the model. Storage curves for each node have been created based on and assumed 100m³ volumes. Rim elevations for each node correspond to the rim elevation of the associated area's catchbasin plus maximum depth of storage plus an additional buffer depth to allow for demonstration of overland flow in the climate change event scenario. The buffer is unused during other modeled events. Storage curves noted as 'functional' are set not to provide any additional storage for the node, as storage will occur within the major system conduit (transect) connecting the storage nodes within the model. Storage curves for roof areas are based on roof design spreadsheets included as **Appendix C.1**.

Table 4: Storage Node Parameters

Name	Invert	Rim	Depth	Storage Curve	Curve Name
L1000A-S	94.92	97.25	2.33	TABULAR	L1000A-S
L1000A-S(1)	96.97	97.32	0.35	FUNCTIONAL	*
L1001A-S	94.82	97.15	2.33	TABULAR	L1001A-S
L1003A-S	95.02	97.35	2.33	TABULAR	L1003A-S
L1003B-S	95.9	97.63	1.73	TABULAR	L1003B-S
L1003B-S(1)	97.5	97.85	0.35	FUNCTIONAL	*
L1005A-S	94.13	97.46	3.33	TABULAR	L1005A-S
L1006B-S	95.02	97.78	2.76	TABULAR	L1006B-S
L1006B-S(1)	97.14	97.49	0.35	FUNCTIONAL	*

R1001A-S	105.00	105.30	0.30	TABULAR	BLDG_B
R1001B-S	105.00	105.30	0.30	TABULAR	BLDG_C
R1002A-S	105.00	105.30	0.30	TABULAR	BLDG_A
R1003A-S	105.00	105.30	0.30	TABULAR	BLDG_D
R1003B-S	105.00	105.30	0.30	TABULAR	BLDG_G
R1005A-S	105.00	105.30	0.30	TABULAR	BLDG_E
R1005B-S	105.00	105.30	0.30	TABULAR	BLDG_F
R1006B-S	105.00	105.30	0.30	TABULAR	BLDG_H

5.2.3.2 Hydraulic Parameters

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways within the parking lot.

Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) in the ultimate condition. The detailed storm sewer design sheet is included in **Appendix C.1**.

The major system flows both to the northwestern and southeastern boundaries of the site where all runoff will be captured through rooftop and parking lot storage with the exception of a limited amount of major system flow which will flow to the Cope Drive ROW. The entirety of the site is proposed to discharge through the minor system and connect to MH 1013 on Cope Drive. **Tables 5 and 6** below present the parameters for the outlet and orifice link objects in the model, which represent ICDs and flow controlled roof drains. All IPEX tempest orifices were assigned a discharge coefficient of 0.572. Roof release discharge curves assume a standard Watts Model R1100 Accuflow controlled release roof drain as noted in the calculation sheets in **Appendix C.1**. The number of roof notches are to be confirmed with the building mechanical engineer at detailed design. It is assumed that no major system spillage will occur from surrounding areas to those within the proposed development.

Surface ponding within the parking lot will permit reduction of peak site discharge to the required levels:

Table 5: Orifice Parameters

Name	Inlet	Outlet	Inlet Elev.	Type	Diameter
L1000A-IC	L1000A-S	1000-MH	94.92	IPEX Tempest	0.083
L1001A-IC	L1001A-S	1001-MH	95.42	IPEX Tempest	0.083
L1003A-IC	L1003A-S	1003-MH	95.62	IPEX Tempest	0.083

L1003B-IC	L1003B-S	1003-MH	95.90	IPEX Tempest	0.083
L1005A-IC	L1005A-S	1005-MH	94.87	IPEX Tempest	0.108
L1005A-IC(1)	L1005A-S	1005-MH	94.91	IPEX Tempest	0.108
L1005A-IC(2)	L1005A-S	1005-MH	95.21	IPEX Tempest	0.108
L1006B-IC	L1006B-S	1006-MH	95.62	CIRCULAR	0.200

Table 6: Outlet Parameters

Name	Inlet	Outlet	Inlet Elev.	Curve Name
R1005B-O	R1005B-S	1005-MH	105	BLDG_F_O
R1005A-O	R1005A-S	1004-MH	105	BLDG_E_O
R1003A-O	R1003A-S	1003-MH	105	BLDG_D_O
R1003B-O	R1003B-S	1003-MH	105	BLDG_G_O
R1001A-O	R1001A-S	1001-MH	105	BLDG_B_O
R1001B-O	R1001B-S	1001-MH	105	BLDG_C_O
R1002A-O	R1002A-S	1002-MH	105	BLDG_A_O
R1006B-O	R1006B-S	1006-MH	105	BLDG_H_O

5.2.4 Model Results

The following section summarizes the key hydrologic and hydraulic model results. For detailed model results or inputs please refer to the example input file in **Appendix C.2** and the electronic model files on the enclosed CD.

5.2.4.1 Hydrologic Results

The following tables demonstrate the peak outflow from each modeled outfall during the design storm (3hr Chicago 5yr -100yr+20) events. A free-flowing outfall condition has been modeled for these events to be conservative with respect to site peak release rates. Outfalls U100A – U100D denote uncontrolled flows from the perimeter of the site that, due to grading restrictions, are captured by the existing rights-of-way at the west, south and north boundaries of the site. These flows will have a minimal contribution to the infrastructure within Cope Drive, Terry Fox Drive and Fernbank Road, which ultimately discharge to the Monahan Drain. Peaks from these uncontrolled flows have been considered in the total target release rates. The required surface parking lot storage volumes have been assumed to capture 100 m^3 per subcatchment area as part of the functional design. The total surface storage volume captured in the 100-year storm event is 154.3 m^3/ha. Surface storage rates will be reassessed for the site during detailed design of the site.

Table 7: 3 Hour Chicago Event Peak Discharge Rates

Event	Location	Discharge Rate (L/s)
3 Hr Chicago 5-Year	Outlet Sewer (OF-MN, OF-MJ)	274.1
	U100A	3.5
3 Hr Chicago 100-Year	Outlet Sewer (OF-MN, OF-MJ)	346.7
	U100A	18.1
3 Hr Chicago 100-Year + 20%	Outlet Sewer (OF-MN, OF-MJ)	566.9
	U100A	27.4

5.2.4.2 Hydraulic Results

Table 8 summarizes the HGL results within the site for the 100 year, 3 hour Chicago storm event and the ‘climate change’ scenario storm required by the City of Ottawa Sewer Design Guidelines (2012), where intensities are increased by 20%.

The City of Ottawa requires that during major storm events, the maximum hydraulic grade line be kept at least 0.30 m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer during design storm events. HGLs during the climate change event are not to exceed adjacent USF elevations. USF elevations are detailed on **Drawing GP-1**.

Table 8: Modeled Hydraulic Grade Line (HGL) Results

STM MH	Adjacent USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	USF-HGL Clearance (m)
1000	-	94.67	-	94.69	-
1001	97.00	94.68	2.32	94.69	2.31
1002	97.70	94.97	2.73	94.97	2.73
1003	97.40	94.75	2.65	94.77	2.63
1004	97.40	94.82	2.58	94.84	2.56
1005	97.30	94.95	2.35	94.97	2.33
1006	97.45	95.08	2.37	95.09	2.36

As is demonstrated in the table above, the worst-case scenario results in HGL elevations remain at least 0.30 m below the proposed underside of footings, and HGL elevations remain below the proposed underside of footing elevations during the 20% increased intensity 'climate change' scenario. HGL elevations, as well as required storage volumes and minor system discharge rates are to be reassessed for the site upon detailed design.

5.2.5 Results

Table 9 demonstrates that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow rates for the site. During the 100-year event, minor system flow is controlled to 300.4 L/s and major system flow including uncontrolled flow is calculated to be 64.3 L/s. These meet the target release rates identified in **Table 1**. Combined minor system and major system discharge rates are included in the table below.

Table 9: Summary of Total 5 and 100 Year Event Release Rates

Storm Event	Site Peak Discharge (L/s)*	Target Discharge Rate (L/s)*
3 Hour Chicago 5-Year	277.6	317.1
3 Hour Chicago 100-Year	364.8	1098.0
3 Hour Chicago 100-Year+20%	591.3	-

*Includes uncontrolled discharge areas.

5.3 WATER QUALITY CONTROL

Stormwater quality control for runoff from the proposed commercial site has been accounted for through existing downstream Vortechs Cell 1 hydrodynamic separator as detailed in the Cavanaugh Construction – Soho West (Phase 1 and 2), Stormwater Management Report, Stantec Consulting Ltd. October 31, 2007. Vortechs systems are located at three downstream outlets from the subdivision lands discharging into the Monahan drain to achieve enhanced protection of 80% total net annual TSS removal. The Vortechs units are inspected annually to ensure sediment accumulation is cleaned out to ensure optimal cell efficiency.

5.4 SOHO PHASE 1 HGL ANALYSIS & MONAHAN DRAIN HYDRAULIC IMPACT ANALYSIS

5.4.1 Updated Boundary Conditions and Impact of Upstream Development on the SOHO Subdivision

In January 2014, Stantec provided an updated hydraulic analysis to examine the HGL impacts to the SOHO subdivision development based on revised dynamic boundary conditions in the Monahan Drain. Both the existing condition scenario and potential improved condition scenario were modeled at the time considering the dynamic boundary conditions and a fixed backwater elevation. The results of the analysis demonstrated that although some units in Phase 1 have HGL to USF clearance levels below the 0.30m minimum clearance specified in the City of Ottawa sewer design guidelines, none have HGL levels above USF.

A further analysis of the of the downstream Monahan Drain Constructed Wetland Facility was completed in September 2014 by JFSA. The analysis determined that peak water levels differ from those reported in the *Monahan Drain Constructed Wetlands Phase 2 – Final Design Report* and used in Stantec's January 2014 analysis. As a result, the City of Ottawa has asked that the impacts of the updated peak water levels in the Monahan Drain be reassessed with the proposed development contributions from the upstream land to ensure that sufficient clearance will remain from the HGL to the USF of the homes within the SOHO Phase 1 Subdivision.

A new hydraulic analysis for SOHO Phase 1 has been completed using the updated boundary conditions for the Monahan Drain established by JFSA. The stormwater models for the SOHO Phase 1 subdivision design were developed in XPSWMM and DDSWMM. These have been converted to PCSWMM for the updated modeling.

Two Storm events were modeled, the 100-year 24hr SCS and 100-year 3hr Chicago event. Hydrographs representing the proposed flows from the external Claridge residential lands north of Cope Drive and the commercial development lands south of Cope Drive were used in the updated modeling. These lands were identified as FUT-13A and FUT-13B in the SOHO Phase 1 subdivision design, see **Table 1** and **Appendix C.4**.

The flows from the proposed commercial shopping site have been limited to the minor and major system flows assigned to the development parcel as part of the SOHO Phase 1 stormwater management design. However, a greater volume of storage is proposed on the commercial site limiting major system flow to well below the allowable flow and reducing the overall flow contribution to the Monahan drain from the commercial development site.

The outflow hydrographs for the Claridge residential lands north of Cope Drive were supplied by Novatech who are undertaking the design of these lands on behalf of Claridge Homes. Flows from these lands into the minor system exceed the design flows assigned to the lands as part of the SOHO subdivision design specified in **Table 1**. Major system flow is less than the design criteria resulting in an overall lower flow contribution to the Monahan drain from these lands.

The HGL elevations through the SOHO subdivision lands were modeled based on the existing condition scenario using the updated peak water levels in the Monahan Drain. The improved condition scenario was not modeled given that the potential changes proposed have not been implemented. The fixed backwater condition scenario was not considered in the analysis as the Cope trunk sewer will peak prior to the downstream portion of the Monahan Drain and does not reflect a condition that will occur. Final grading and actual USF elevations were established following the 2014 analysis and have been used in the current analysis.

The HGL elevations were compared to USF elevations within the SOHO subdivision. Results show that the impact to the HGL is limited even with the higher minor system contribution from the Claridge residential lands. HGL to USF clearance is less than 0.3 m at 4 manholes as compared to 2 & 3 when modeled in 2014. The clearance of 0.3 m and greater is maintained at all other 53 manholes. The results indicate that, although the clearance to the USF is less than 0.3 m for some units, no basement flooding will occur.

Table 10 below summarizes and compares the number of manholes within each range of HGL to USF clearance calculated in the original 2007 report, 2014 revised HGL analysis and the current 2018 HGL analysis. For detailed model results or inputs please refer to the example input file in **Appendix C.2.**

Table 10: Summary of SOHO Phase 1 HGL to USF Clearance at Storm Manholes

Level of Clearance to USF	Original 2007 Design Fixed BC = 94.38	January 2014 100-year 24hr SCS	January 2014 100-year 3hr CHI	July 2018 100-year 24hr SCS	July 2018 100-year 3hr CHI
>0.30m	57	54	55	53	53
0.30m-0.10m	0	2	1	4	4
0.10m-0.00m	0	1	1	0	0
Above USF	0	0	0	0	0
Above Basement Floor	0	0	0	0	0
TOTAL # MHs	**57**	**57**	**57**	**57**	**57**

5.4.2 Hydraulic Impact Analysis on Monahan Drain

The City of Ottawa has required that all land owners of 5331 Fernbank Road and 1039 Terry Fox Drive provide a single hydraulic impact analysis of the Monahan Drain. The City wants to ensure that the upstream developments will not impact the 100 year water elevations in the municipal drain and that the Hazeldean Pump Station overflow will not be affected by the water levels in the municipal drain. This analysis will be undertaken by JFSA based on stormwater management designs for the three upstream development parcels. These three parcels include the two development parcels identified in **Table 1** which flow through the SOHO Phase 1 subdivision and a third Business Park parcel located east of Terry Fox and north of the Monahan Drain. This third parcel discharges to the drain upstream of the SOHO subdivision.

The updated outflow hydrographs to the Monahan Drain based on the functional design of the proposed commercial development and the Claridge residential development north of Cope Drive (data provided by Novatech) have been provided to JFSA for use in their analysis.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 3.68 ha in area. The topography across the site is relatively flat, and currently drains to the northwest to southeast. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, adhere to permissible grade raise restrictions (see **Section 10.0**) for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the proposed municipal rights-of-way at both the southeastern and northwestern boundaries of the development as depicted in **Drawing GP-1.**

7.0 UTILITIES

As the subject site is bound to the west by an existing commercial business park, and to the east and south by existing residential development, Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available. Pole mounted infrastructure exist along Terry Fox Drive. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities, along with determination of transformer locations and any off-site works required for development, will be finalized after design circulation.

8.0 APPROVALS

An Environmental Compliance Approval (ECA, formerly Certificate of Approval (CofA)) under the Ontario Water Resources Act from the Ontario Ministry of Environment Climate & Parks (MOECP) may be required given that the concept plan for the proposed development currently includes an industrial use. The ECA application will fall under direct submission to the MOECP.

The Rideau Valley Conservation Authority will need to be review the serviceability report for the proposed site development to ensure that their requirements are met prior to municipal approval.

Requirement for a MOECP Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (EASR) for site dewatering will be confirmed by the geotechnical consultant closer to site development.

9.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

9. Verification that water is not flowing under silt barriers.
10. Clean and change silt traps at catch basins.

Refer to **Drawing EC-1** for the proposed location of silt fences, straw bales and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION AND ENVIRONMENTAL ASSESSMENT

A geotechnical Investigation Report was prepared by Paterson Group dated Frebruary 20, 2018. The report summarizes the existing soil conditions within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson report(PG4411-1).

Subsurface soil conditions within the subject area were determined from 8 boreholes distributed across the proposed site. In general soil stratigraphy consisted of topsoil/organic layer or crashed stone fill material underlain by loose silty sand and grey silty clay to clayey silt. Followed by a firm to very stiff brown silty clay crust and/or a firm grey silty clay deposit within interbedded silt seams.The bedrock consisted of mainly interbedded limestone and dolomite and elevations range from depths of 15 to 50m below ground surface. Groundwater Levels vary in elevation from 2.5m to 3.5m below ground surface. A grade raise is recommended for grading within 6m of building footprints of 1.5m above existing, and 2.0m for finished grading beyond 6m of the building footprints.

The required pavement structure for proposed hard surfaced areas are outlined in **Table 11** and **12** below:

Table 11: Pavement Structure – Car only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL 3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
300	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

Table 12: Pavement Structure – Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-8 or Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
400	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill.

11.0 CONCLUSIONS

11.1 WATER SERVICING

Based on the supplied boundary conditions for existing watermains and estimated domestic and fire flow demands for the subject site, it is anticipated that the proposed servicing in this development will provide sufficient capacity to sustain the required domestic demands and emergency fire flow demands of the proposed site. Fire flows greater than those required per the FUS Guidelines are available for this development. It is recommended that pressure reducing valves be installed as domestic pressures exceed the desired 80 psi.

11.2 SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site. The proposed site will be serviced by a network of gravity sewers which will direct wastewater flows to the existing 525mm dia. sanitary sewer within Cope Drive at the northern boundary of the site. The proposed drainage outlet to the north has sufficient capacity to receive sanitary discharge from the site.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through consultation with the City of Ottawa. On-site catchbasins and connected ICDs have been proposed to limit peak storm sewer inflows to downstream storm sewers to 317.1L/s/ha and the total release rate to 781 L/s. The downstream receiving sewer has sufficient capacity to receive runoff volumes from the site based on the findings of the Cavanaugh Construction – Soho West (Phase 1 and 2), Stormwater Management Report, Stantec Consulting Ltd. October 31, 2007.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the recommendations made in the Geotechnical Investigation Report prepared by Patersongroup. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.5 UTILITIES

Utility infrastructure exists within the right-of-ways of the adjacent streets and developments. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized as part of the detailed design of the site.

11.6 APPROVALS/PERMITS

An Environmental Compliance Approval from the MOECP may be required for the site as the concept plan for the proposed development currently includes an industrial use. The ECA application will fall under direct submission to the MOECP.

Requirement for a MOECP Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (EASR) for site dewatering will be confirmed by the geotechnical consultant closer to site development.