Servicing Brief
115201-5.2.2.1

380 ROLLING MEADOW CR SPRING VALLEY ZENS

CITY OF OTTAWA

Prepared for CLARIDGE HOMES
by IBI Group
January 14, 2020

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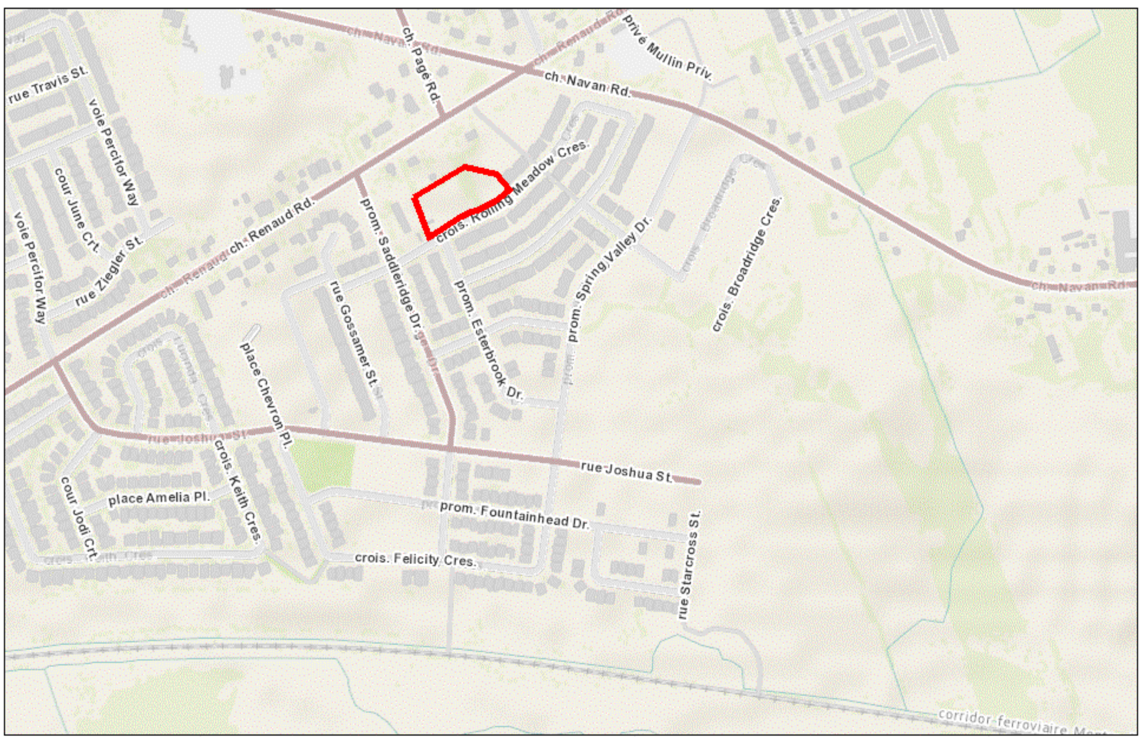
1 INTRODUCTION

IBI Group has been retained by Claridge Homes to prepare a Servicing Brief and detailed servicing design for Block 165 in Phase 2 of the Spring Valley Trails Subdivision in the City of Ottawa, formerly the Town of Gloucester.

Spring Valley Trails is a 35.65 ha parcel owned and developed by Claridge Homes. Of the 35.65ha parcel, Phase 1 is comprised of 11.68ha, Phase 2 is comprised of 9.49 ha, and Phase 4 is comprised of 1.20Ha. The municipal services for each of these phases has been constructed. Phase 3 consists of 13.28 ha and is currently under construction with a pending in-service memo. The development is part of the East Urban Community (EUC) and is subject to the EUC Design plan update which identified this area for low and medium density residential usages.

Block 165 is bounded by existing residential lands to the North, Rolling Meadow Crescent to the south, and existing residential (previous phases of Spring Valley Trails) to the east and vacant residential lands to the west. Refer to key plan on **Figure 1.1** for block location.

Figure 1.1 Site Location



The proposed development consists of Claridge's walk-up townhouse "ZEN" product. Claridge has previously constructed these units in multiple locations in Ottawa. A total of 4 walk-up buildings, each building consists of 12 units, are proposed over 0.68 Ha to be constructed. The site plan was prepared by RLA Architecture is included in **Appendix A**.

The proposed servicing design conforms to current City of Ottawa and MOE design criteria, and no pre-consultation meetings were requested from the Rideau Valley Conservation Authority (RVCA) or the Ministry of Environment of Ontario (MOE). A pre-consultation meeting occurred for this development with the City of Ottawa on February 21, 2018. Meeting notes are unavailable.

2 WATER DISTRIBUTION

2.1 Existing Conditions

As previously noted, the 0.68 hectare proposed development is located in Phase 2 of the development on the north side of Rolling Meadow Crescent. An existing 200mm diameter watermain is located within the Rolling Meadow Crescent right of way. The existing watermain is part of within the City of Ottawa's pressure district **Zone 2E** which will provide the water supply to the site.

2.2 Design Criteria

2.2.1 Water Demands

Water demands have been calculated for the full development. Per unit population density and consumption rates are taken from Tables 4.1 and 4.2 at the Ottawa Design Guidelines – Water Distribution and are summarized as follows:

- Single Family — 3.4 person per unit
- Townhouse and Semi-Detached — 2.7 person per unit
- Average Apartment — 1.8 person per unit
- Residential Average Day Demand — 350 l/cap/day
- Residential Peak Daily Demand — 875 l/cap/day
- Residential Peak Hour Demand — 1,925 l/cap/day

A watermain demand calculation sheet is included in **Appendix A** and the total water demands for area SV1-35 are summarized as follows for 48 walk-up townhouse units:

- Average Day — 0.52 l/s
- Maximum Day — 1.32 l/s
- Peak Hour — 2.88 l/s

2.2.2 System Pressure

The Ottawa Design Guidelines – Water Distribution (WDG001), July 2010, City of Ottawa, Clause 4.2.2 states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 480 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in Clause 4.2.2 of the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Maximum Pressure	In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls will be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

The system pressure at node SV1-35 (node representing the subject development) is 559.87 kPa, dropping to 453.36kPa during the max day demand, to 445.84kPa during peak hour demand, and 354.65kPa during fire flow. A design flow rate of 334.86l/s is provided during fire flow conditions. The aforementioned system pressures meet the minimum requirements, and during basic day the pressures exceed the minimum allowable system pressure, therefore pressure reducing valves are required for each building. Pressure reducing valves are shown on the grading plan.

2.2.3 Fire Flow Rates

The required fire flow rate for this project has been determined by the Fire Underwriters Survey (FUS) method. In the FUS method, a fire flow is calculated based on the type of building construction, type of occupancy, use of sprinklers and exposures to adjacent building. A rate of 15,000 l/min (250 l/s) has been determined with a copy of the calculation included in **Appendix A**.

2.2.4 Boundary Conditions

The City of Ottawa has provided two boundary conditions for this site. They are located at the two connection points to the existing Rolling Meadows Crescent watermain. A copy of the boundary condition is included in **Appendix A** and summarized as follows:

SCENARIO	CONNECTION 1	CONNECTION 2
Maximum HGL	130.8 m	130.8 m
Peak Hour	127.0 m	127.0 m
Maximum Day & Fire (15000 l/min)	106.7 m	104.0 m

2.2.5 Hydraulic Model

A computer model for the project has been created using the InfoWater Program. The model includes the existing watermain and boundary conditions. In the model, Node F-1 and Node J15 represent the existing fire hydrants on Rolling Meadow Crescent. Fire flows are tested at each node in the site. Water demand for Building 'D' is at Node J5, Building 'C' at Node J7 and Buildings A & B are at Node J11.

2.3 Proposed Water Plan

2.3.1 Modelling Results

The hydraulic model was run under basic day, maximum day with fire flows and under peak hour condition. Results of the hydraulic model are included in **Appendix A** and summarized as follows:

SCENARIO	RESULTS
Basic Day (Max. HGL) Pressure Range	521.3 – 536.0 kPa
Peak Hour Pressure Range	484.1 – 498.8 kPa
Max. Day + 15,000 l/min Fire Flow Range	270.4 – 479.8 l/s

A comparison of the results and design criteria are summarized as follows:

Maximum Pressure	All nodes have basic day pressures under 552 kPa therefore, pressure reducing control is not required for this site.
Minimum Pressure	All nodes exceed the minimum value of 276 kPa (40 psi).
Fire Flow	All nodes exceed the fire flow requirement of 250 l/s (15,000 l/min).

2.3.2 Watermain Layout

A 200 mm looped watermain is proposed to service the site with two connections to the existing main on Rolling Meadow Crescent. The site was evaluated with a 150 mm watermain however, the fire flows were not achieved. A single 50 mm water service is supplied to each building.

3 WASTEWATER SYSTEM

3.1 Existing Conditions

Phase 1, 2 and 4 of Spring Valley Trails has been constructed and is operational. The 200mm diameter sanitary sewer on Rolling Meadow Crescent was constructed as part of Phase 2, and was designed to accommodate the subject development. The Phase 2 sanitary drainage area plan and design sheet are included in **Appendix B** illustrating that the design flows for the 48 stacked townhouse was part of the approved design. To this end no negative impact is anticipated on the existing downstream system.

3.2 Design Criteria

The sanitary flows for the development were determined based on the updated City of Ottawa design criteria which includes, but it not limited to the following:

Population (Residential)	3.4 persons per single family unit
	2.7 persons per semi or townhouse unit
	1.8 persons per apartment unit
Domestic Flow:	280l/cap/day
Peak Factor (Residential only)	Harmon Formula
Extraneous Flow (Infiltration)	0.33l/s/Ha
Minimum Pipe Size:	200mm diameter

3.3 Sanitary Hydraulic Analysis

Spring Valley Trails Phase 2 report indicates that the sanitary hydraulic grade line (HGL) in MH 300A on Rolling Meadow Crescent is 68.82m, refer to **Appendix B** for the Spring Valley Trails Phase 2 Sanitary HGL analysis. The sanitary HGL extended through the subject site have been calculated as follows:

LOCATION	MH #	USF ELEV (M)	SANITARY HGL (M)	FREEBOARD (M)
Rolling Meadow Crescent	300A		68.820	
Rolling Meadow Crescent	150A		72.682	
Rolling Meadow Crescent	151A		74.104	
Block 165 ZENS	10A	75.54	74.274	1.27
Block 165 ZENS	11A	75.54	75.213	0.33
Block 165 ZENS	12A	76.35	75.569	0.78
Block 165 ZENS	13A	76.35	75.811	0.54
Block 165 ZENS	1A	75.05	73.037	2.01
Block 165 ZENS	2A	75.05	73.322	1.73
Block 165 ZENS	3A	75.05	73.794	1.26
Block 165 ZENS	4A	75.05	73.895	1.16
Block 165 ZENS	5A	75.05	74.080	0.97
Block 165 ZENS	6A	75.30	74.596	0.70

All underside of footing elevations have been designed to provide a minimum of 300mm separation between the greater of governing pipe obvert or governing HGL. A copy of the sanitary HGL analysis for the subject site is provided in **Appendix B**.

3.4 Recommended Wastewater Plan

As noted previously, the existing sanitary sewer system was designed and approved with 48 stacked townhouses being built on this block. To this end we anticipate no negative impact on the downstream system. The on-site sanitary system will consist of a network of 200mm PVC sewers installed at normal depth and slope and will provide four service connections to each building pad as required by the new building code. The sewers have been designed using the criteria noted above in section 3.2 and outlet via two connections to the existing sanitary sewer within the Rolling Meadow right of way on the south side of the subject site. The sanitary drainage area plan 115201-C-400 and the sanitary sewer design have been included in **Appendix B.**

4 STORMWATER MANAGEMENT

4.1 Background

As identified within Section 1, the development is part of the East Urban Community (EUC) and is subject to the EUC Design plan update which identified this area for low and medium density residential usages. In accordance with the EUC servicing study, stormwater from the neighbourhood will be conveyed to an end of pipe SWM treatment facility, identified in the EUC Infrastructure Servicing Study as Pond 3. Pond 3 has been constructed and is operational. For details on the SWM facility, see Stantec Report EUC SWM Facility #3 Design Brief, dated August 22, 2005, henceforth referred to as the 2005 Pond 3 Design Brief. Also, the EUC infrastructure servicing study report of March 2005 identified the development lands were to restrict stormwater flow into the piped system to an average of 85 l/s/Ha.

Additionally, subsequent to the pre-consultation meeting with City of Ottawa staff, City Staff advised that low impact development (LID) strategies must be implemented on this site. The NCC, the Conservation Authority and the City of Ottawa have undertaken a review and in the absence of the Cumulative Impact Statement (CIS) and its recommendations, the City has determined that all new development must attempt to infiltrate the first 15mm daily event in order to limit low flow erosion in the downstream receiving watercourse of Mud Creek. Notwithstanding the aforementioned criteria, the combination of high groundwater table on the site and low percolation soils as identified by the Geotechnical Engineer make infiltration a challenge. The City has agreed to allow the development to proceed without infiltration.

4.2 Objective

The purpose of this evaluation is to prepare the dual drainage design for the Spring Valley Trails Walk-up development. The design includes the infiltration galleries, the sizing of inlet control devices including storm water retention strategies, sewer sizing.

4.3 Design Criteria

The stormwater system was designed following the principles of dual drainage, making accommodations for both major and minor flow.

Some of the key criteria include the following:

• Design Storm	1:5 year return (Ottawa)
• Rational Method Sewer Sizing	
• Initial Time of Concentration	10 minutes
• Runoff Coefficients	
- Landscaped Areas	C = 0.25
- Landscaped Areas with Walkway	C = 0.30 – 0.60
- Parking with landscaping	C = 0.75
- Roof	C = 0.90
• Pipe Velocities	0.80 m/s to 6.0 m/s
• Minimum Pipe Size	250 mm diameter (200 mm CB Leads)

4.4 Proposed Minor System

Using the criteria identified in Section 4.3, the proposed on-site storm sewers were sized accordingly. A detailed storm sewer design sheet and the associated storm sewer drainage area plan is included in **Appendix C**. The general plan of services, depicting all on-site storm sewers can be found in **Appendix A**.

It has been requested by the City of Ottawa that the site owner provide confirmation that the site owners will be responsible for regular maintenance of the on-site catch basins and inlet control devices (ICDs). Maintenance includes but is not limited to the cost of regular cleaning the structures and ICDs as necessary. The site owner will also be responsible for replacement of damaged or missing catch basin structures, grates or ICDs as needed. Confirmation from the owners will be forwarded directly to the City upon receipt.

4.5 Stormwater Management

The subject site will be limited to a release rate established using the criteria described in section 4.1. This will be achieved through a combination of an inlet control device (ICD), surface storage where possible and underground storage where required.

The stormwater from the majority of the site will be collected and directed to a central storage gallery. Outflow from the gallery will be restricted by an ICD at 48.40 L/s. Flows generated that are in excess of the site's allowable release rate will be stored on site in the underground chambers and gradually released into the minor system so as not to exceed the site's allowable release rate.

The maximum surface retention depth located within the developed areas will be limited to 300mm during a 1:100 year event as show on the ponding and grading plans located in **Appendix D.** Overland flow routes will be provided in the grading to permit emergency overland flow, in excess of the site storage, from the site.

At certain locations within the site, the opportunity to store runoff is limited due to grading constraints and building geometry. These locations are generally located at the perimeter of the site where it is necessary to tie into public boulevards and adjacent properties or in areas where ponding stormwater is undesirable. These "uncontrolled" areas – 0.023 hectares in total, have an average C value of 0.81. Based on 1:100 year storm uncontrolled flows, the uncontrolled areas generate 9.23 l/s runoff (refer to Section 4.6 for calculation).

Due to the steep slope of the site surface ponding storage is limited. The water discharges into an underground storage gallery. The underground storage gallery consists of a series of interconnected hollow bottom High Density Polyethylene (HDPE) arches used for major storm water retention. A Soleno Hydrostor HS180 system is proposed with 5 rows of 5 chambers each (or an approved equal). Refer to **Appendix C** for details. Flows generated by the 100 year storm event will be restricted and retained onsite to meet the 85 L/s/ha requirement of the MSS.

4.6 Inlet Controls

The allowable release rate for the 0.68 Ha site can be calculated as follows:

$\mathbf{Q_{allowable}}$	= 85 L/s/Ha as per EUC infrastructure servicing study report, March 2005
Area	= 0.68 Ha
	= **57.80 L/s**

As noted in Section 4.5, a portion of the site will be left to discharge to the Rolling Meadow Crescent at an uncontrolled rate in addition to the sunken patios which will drain internally and discharge through the building service.

Based on a 1:100 year event, the flow from the 0.07 Ha uncontrolled area can be determined as:

$\mathbf{Q_{uncontrolled}}$	$= \mathbf{2.78} \times \mathbf{C} \times \mathbf{i_{100yr}} \times \mathbf{A}$	where:
C	= Average runoff coefficient of uncontrolled area = 0.81	
$\mathbf{i_{100yr}}$	= Intensity of 100-year storm event (mm/hr)	
	$= 1735.688 \times (T_c + 6.014)^{0.820} = 178.56$ mm/hr; where T_c = 10 minutes	
A	= Uncontrolled Area = 0.023 Ha	

Therefore, the uncontrolled release rate can be determined as:

$\mathbf{Q_{uncontrolled}}$ $= \mathbf{2.78} \times \mathbf{C} \times \mathbf{i_{100yr}} \times \mathbf{A}$

$= 2.78 \times 0.81 \times 178.56 \times 0.023$

= **9.23 L/s**

The maximum allowable release rate from the remainder of the site can then be determined as:

$\mathbf{Q_{max\ allowable}}$ $= \mathbf{Q_{restricted} - Q_{uncontrolled}}$

= 57.80 L/s – 9.23 L/s

= **48.57 L/s**

Based on the aforementioned flow allowance, an inlet control device is proposed for the surface drainage. The custom orifice plate is 126mm x 126mm with a restricted flow rate of **48.29 l/s**, which is less than the maximum allowable flow rate of 48.57 l/s. Refer to **Appendix C** for detailed stormwater management calculations and orifice sizing.

4.7 On-Site Detention

The exterior grade at the top of the stairs leading down to the depressed patios needs to receive a similar consideration as the grade at the back of typical house. The "building opening" is below the finished grade, similar to how a "building opening" for a basement window, for a typical residential dwelling is located well below grade and is contained by a window well. Comparing the freeboard elevation to the physical building opening is irrelevant, as the building opening is protected from a higher grade. It is this higher grade that must meet the freeboard requirements, hence why for the purposes of the proposed depressed patio areas, the grade at the top of the stairs is meeting the freeboard by a minimum of 300mm. Unlike a window well, the grade at the stairs is on a fully maintained hard surface pathway with positive drainage away from the depressed areas.

In addition to the freeboard provided, each depressed patio is provided with a catchbasin and an unrestricted connection to the storm sewer, as well as a minimum 150mm exposed concrete step from the finished patio level up to the sill (building opening).

The surface areas had very limited surface ponding available. A full underground storage strategy was implemented for this site. Soleno HydroStor HS180 Detention System, or approved equivalent is selected for underground storage. The proposed storage includes 5 rows of chambers, each row containing of 5 chambers, all header pipes and the clear stone surround. The storage calculations for the system have been provided by the manufacturer. In this instance, the storage provided, including void ratios in the surrounding clear stone is 203.4m^3. The upstream volume in upstream sewers has not been accounted in the 100 year storage, therefore additional capacity is provided above and beyond what is required to meet the stormwater target. Refer to **Appendix C** for underground storage calculations, and Soleno Hydrostor system storage volume.

4.8 Storm Hydraulic Grade Line

Spring Valley Trail Phase 2 report indicates that the storm hydraulic grade line (HGL) in MH 300 on Rolling Meadow Crescent is 68.99, refer to **Appendix B** for the Spring Valley Trails Phase 2 Storm HGL analysis. The storm HGL extended through the subject site have been calculated as follows:

LOCATION	MH #	USF ELEV (M)	STORM HGL (M)	FREEBOARD (M)
Rolling Meadow Crescent	300		68.990	
Rolling Meadow Crescent	150B		72.419	
Rolling Meadow Crescent	151		74.141	
Block 165 ZENs	6	75.54	74.802	0.74
Block 165 ZENs	1	75.05	74.235	0.81
Block 165 ZENs	3	75.05	74.335	0.71
Block 165 ZENs	4	75.05	74.506	0.54
Block 165 ZENs	2	75.54	74.416	1.12

All underside of footing elevations have been designed to provide a minimum of 300mm separation between the greater of governing pipe obvert or governing HGL. A copy of the storm HGL analysis for the subject site is provided in **Appendix C**.

4.9 Low Impact Development

As previously mentioned, LID measures are no longer required for this site.

5 SOURCE CONTROLS

5.1 General

The subject development Block 165 is part of Spring Valley Trails Subdivision Phase 2. As noted, an existing stormwater management facility provides end of pipe quantity and quality treatment for captured stormwater. In addition to the stormwater management facility, on site level or source control management of runoff will be provided. Such controls or mitigative measures are proposed for the development not only for final development but also during construction and build out. Some of these measures are:

- flat lot grading;
- split lot drainage;
- Roof-leaders to vegetated areas;
- vegetation planting; and
- groundwater recharge through Low impact development (LID).

5.2 Lot Grading

Residential area within the subject development will typically make use of the split drainage runoff concept. In accordance with local municipal standards, all lot grading will be between 2.0 and 7.0 percent. All front yard drainage will be directed over landscaped front yards to the roadway system and all rearyard drainage will be directed to a swale drainage system. Typically swales will have slopes of 2%. These measures all serve to encourage individual lot infiltration.

5.3 Roof Leaders

The subject development will consist of stacked townhouse units with sloped roofs. It is proposed that leaders for the sloped roof sections from these units be constructed such that the runoff is directed to the grass areas adjacent to the units. This will promote water quality treatment through settling, absorption, filtration and infiltration and a slow release rate to the conveyance network.

5.4 Vegetation

As with most site plan agreements, the developer will be required to complete a vegetation and planting program. Vegetation throughout the development including planting along roadsides and within public parks provides opportunities to re-create lost natural habitat.

5.5 Low Impact Development

See section 4.9 for details.

6 CONVEYANCE CONTROLS

6.1 General

Besides source controls, the development also proposes to use several conveyance control measures to improve runoff quality. These will include:

- flat vegetated swales;
- catchbasin and maintenance hole sumps; and
- pervious rearyard drainage.

6.2 Flat Vegetated Swales

The development will make use of relatively flat vegetated swales where possible to encourage infiltration and runoff treatment.

6.3 Catchbasins

All catchbasins within the development, either rear yard or street, will be constructed with minimum 600 mm deep sumps. These sumps trap pollutants, sand, grit and debris which can be mechanically removed prior to being flushed into the minor pipe system. Both rear yard and street catchbasins will be fabricated to OPSD 705.010 or 705.020. All storm sewer maintenance holes servicing local sewers less than 900 mm diameter shall be constructed with a 300 mm sump as per City standards.

6.4 Pervious Landscaping Drainage

Some of the landscape swales make use of a filter wrapped perforated drainage pipe constructed below the rear yard swale. This perforated system is designed to provide some ground water recharge and generally reduce both volumetric and pollutant loadings that enter the minor pipe system. Typically, a 250 mm diameter perforated pipe wrapped in filter sock is constructed in a crushed clear stone surround at an invert elevation of approximately 0.8 m below grade. These pipes are in turn directly connected to the storm sewer at regular intervals as per City Standards.

7 SEDIMENT AND EROSION CONTROL PLAN

7.1 General

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. Although construction is only a temporary situation, it is proposed to introduce a number of mitigative construction techniques to reduce unnecessary construction sediment loadings. An erosion and sediment control plan has been prepared and is included in **Appendix** D. These will include:

- groundwater in trench will be pumped into a filter mechanism prior to release to the environment;
- bulkhead barriers will be installed at the nearest downstream manhole in each sewer which connects to an existing downstream sewer;
- seepage barriers will be constructed in any temporary drainage ditches; and
- Filter cloths will remain on open surface structure such as manholes and catchbasins until these structures are commissioned and put into use.

7.2 Trench Dewatering

During construction of municipal services, any trench dewatering using pumps will be discharged into a filter trap made up of geotextile filters and straw bales similar in design to the OPSD 219.240 Dewatering Trap. These will be constructed in a bowl shape with the fabric forming the bottom and the straw bales forming the sides. Any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filters as needed including sediment removal and disposal and material replacement as needed.

7.3 Temporary Flow Controls in Existing Manholes

Temporary flow controls in existing manholes are not proposed for this site as the existing system has live services upstream. As noted below, bulkhead barriers will be constructed in the first new manhole on-site which will help reduce flows from the site.

7.4 Bulkhead Barriers

At the first manhole constructed immediately upstream of an existing sewer, a ½ diameter bulkhead will be constructed over the lower half of the outlet sewer. This bulkhead will trap any sediment carrying flows, thus preventing any construction –related contamination of existing sewers. The bulkheads will be inspected and maintained including periodic sediment removal as needed.

7.5 Seepage Barriers

These barriers will consist of both the Light Duty Straw Bale Barrier as per OPSD 219.100 or the Light Duty Silt Fence Barrier as per OPSD 219.110 and will be installed in accordance with the sediment and erosion control drawing 900 included in **Appendix D**. The barriers are typically made of layers of straw bales or geotextile fabric staked in place. All seepage barriers will be inspected and maintained as needed.

7.6 Surface Structure Filters

All catchbasins, and to a lesser degree manholes, convey surface water to sewers. However, until the surrounding surface has been completed these structures will be covered to prevent sediment from entering the minor storm sewer system. Until rearyards are sodded or until streets are asphalted and curbed, all catchbasins and manholes will be equipped with geotextile filter socks. These will stay in place and be maintained during construction and build until it is appropriate to remove them.

7.7 Stockpile Management

During construction of any development similar to that being proposed both imported and native soils are stockpiled. Mitigative measures and proper management to prevent these materials entering the sewer systems is needed.

During construction of the deeper municipal services, water, sewers and service connections, imported granular bedding materials are temporarily stockpiled on site. These materials are however quickly used up and generally before any catchbasins are installed. Street catchbasins are installed at the time of roadway construction and rearyard catchbasins are usually installed after base course asphalt is placed.

Contamination of the environment as a result of stockpiling of imported construction materials is generally not a concern since these materials are quickly used and the mitigative measures stated previously, especially the use of filter fabric in catchbasins and manholes help to manage these concerns.

The roadway granular materials are not stockpiled on site. They are immediately placed in the roadway and have little opportunity of contamination. Lot grading sometimes generates stockpiles of native materials. However, this is only a temporary event since the materials are quickly moved off site.

8 SOILS

Golder Associates geotechnical report dated August, 2018 provides details on the existing soils within the development. A copy of the report is included in **Appendix D**. The report contains recommendations which include but are not limited to the following:

- Grade raise constraints are identified within the report 07-1121-0232. The maximum permissible grade raise is 0.5m
- In areas where finished grade exceeds grade raise limits, preloading and surcharging can be employed to induce required settlement, light weight fill may also be used, or a combination or surcharging and light weight fill, as per the Geotechnical recommendations
- Fill placed below the foundations to meet OPSS Granular ‘A’ or Granular ‘B’ Type II placed in 300 mm lifts compacted to 98% SPMDD.
- Fill for roads to be suitable native material in 300mm lifts compared to 95% SPMDD
- Pavement Structure: **Local Road**

  40mm Superpave 12.5mm

  50mm Superpave 19mm

  150mm Granular ‘A’

  375mm Granular ‘B’ Type II
- Pipe bedding and cover; bedding to be minimum 150 mm OPSS Granular ‘A’ up to spring line of pipe. Cover to be 300 mm OPSS A (PUC and concrete pipes) or sand for concrete pipes. Both bedding and cover to be placed in maximum 225 mm lifts compacted to 95% SPMDD.

In general the grading plan for Block 165 of Phase 2 adheres to the grade raise constraints noted above. A copy of the grading plans is included in **Appendix D**. For areas that exceed the grade raise limit a light weight fill program will be in place.

9 RECOMMENDATIONS

Water, wastewater and stormwater systems required to develop Block 165 of Spring Valley Trails Phase 2 are designed in accordance with MOE and City of Ottawa's current level of service requirements.

The use of lot level controls, conveyance controls and end of pipe controls outlined in the report will result in effective treatment of surface stormwater runoff from the site. Adherence to the proposed sediment and erosion control plan during construction will minimize harmful impacts on surface water.

Final detail design will be subject to governmental approval prior to construction, including but not limited to the following:

- Commence Work Order: City of Ottawa
- ECA (sewers): MOECP
- Watermain Approval: City of Ottawa
- Commence Work Order (utilities): City of Ottawa

Report prepared by:

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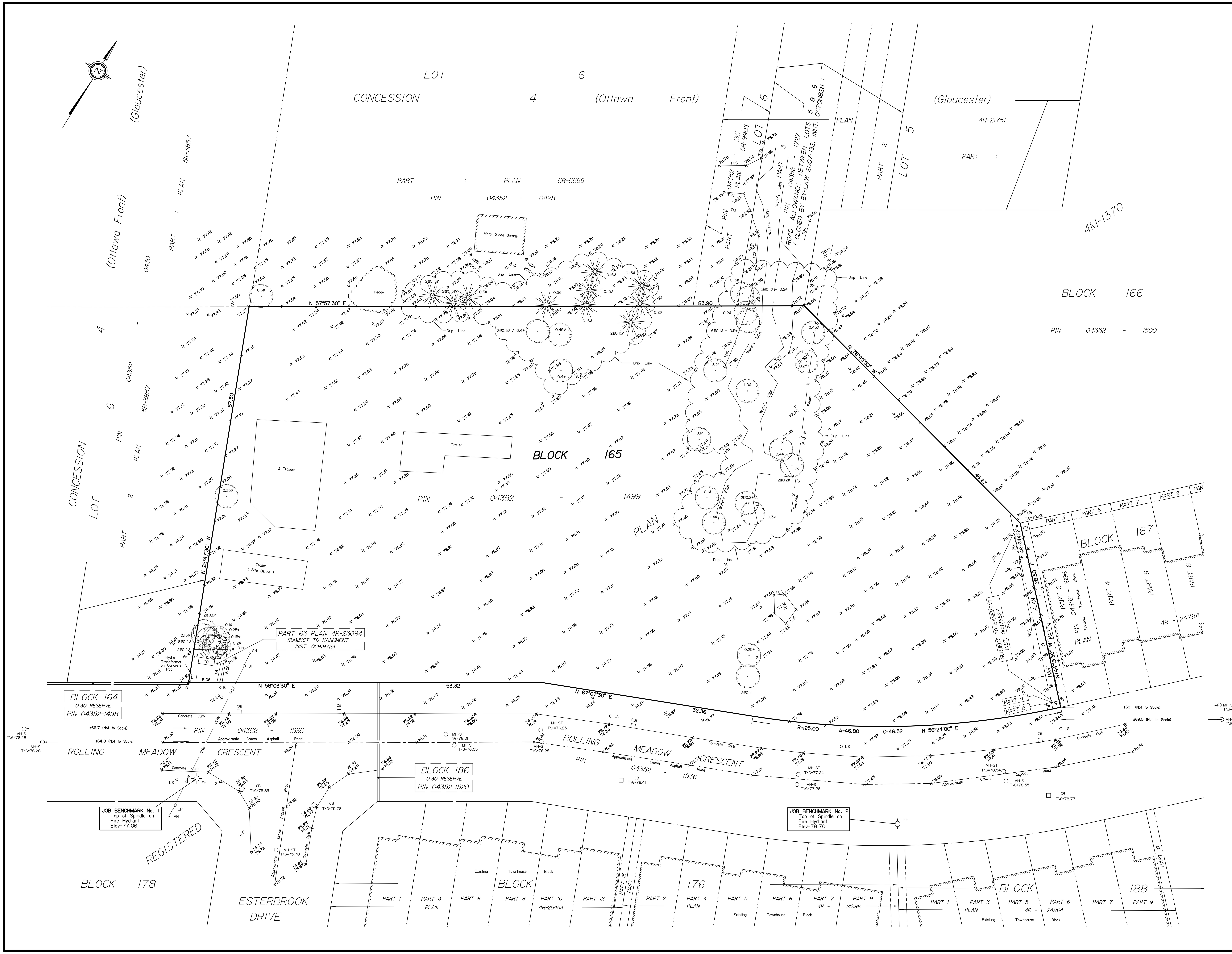
APPENDIX A



TOPOGRAPHICAL PLAN OF

BLOCK 165

REGISTERED PLAN 4M-1370

CITY OF OTTAWA

Prepared by Annis, O'Sullivan, Vollebekk Ltd.

Field Work Completed December 12, 2017

Scale 1 : 250

10 7.5 5.0 2.5 0 5 10 Metres

Metric

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

Notes & Legend

	Denotes	Deciduous Tree
	-	Coniferous Tree
FH	-	Fire Hydrant
MH-ST	-	Maintenance Hole (Storm Sewer)
MH-S	-	Maintenance Hole (Sanitary)
CB	-	Catch Basin
CBI	-	Catch Basin Inlet
TB	-	Unidentified Terminal Box on Concrete Pad
B	-	Bollard
S	-	Sign
UP	-	Utility Pole
AN	-	Anchor
LS	-	Light Standard
Ø	-	Diameter
+ 65.00	-	Location of Elevations
+ 65.00	-	Top of Concrete Curb Elevation
P&W	-	Post and Wire
TOS	-	Top of Slope
BOS	-	Bottom of Slope
OHW	-	Overhead Wires
	-	Property Line

Bearings are grid, derived from GPS observations and are referred to the Central Meridian of MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

SITE AREA = 6767.0 sqm

BOUNDARY INFORMATION COMPILED FROM REGISTERED PLAN 4M-1370.

ELEVATION NOTES

1. Elevations shown are geodetic and are referred to the CGVD28 geodetic datum.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

UTILITY NOTES

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

Ontario Land Surveyors
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com

Job No. 18588-17 Claridge Blk 165 4M-1370 T DI | N

BOUNDARY CONDITIONS

Boundary Conditions For: 380 Rolling Meadow Cres

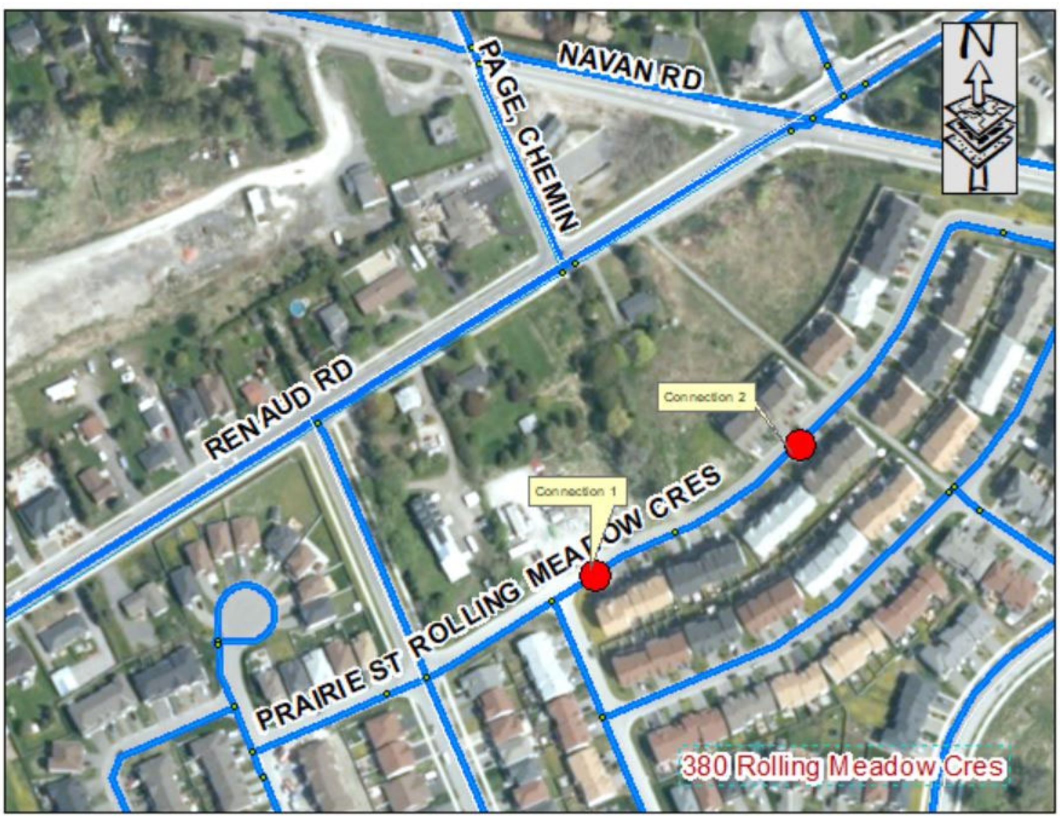
Date of Boundary Conditions: 2019-Mar-27

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	34.8	0.6
Maximum Daily Demand	52.8	0.9
Peak Hour	63.0	1.1
Fire Flow #1 Demand	15,000	250.0

Number Of Connections: 2

Location:



BOUNDARY CONDITIONS

Results:

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.8	77.8
Peak Hour	127.0	72.4
Max Day Plus Fire (15,000) L/min	106.7	43.5

[1]Elevation: **76.090 m**

Connection #: 2

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.8	76.7
Peak Hour	127.0	71.3
Max Day Plus Fire (15,000) L/min	104.0	38.5

[1]Elevation: **76.880**

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

2) City of Ottawa recommends inserting an isolation valve between the two water connections

3) Due to the large drop in HGL during the required fire flow of 250 L/s, we recommend having one connection on Renaud Rd as oppose to having both connections on Rolling Meadow Cres and potentially looping both connections.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time.

BOUNDARY CONDITIONS

The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

WATERMAIN DEMAND CALCULATION SHEET

IBI GROUP
333 PRESTON STREET
OTTAWA, ONTARIO
K1S 5N4

PROJECT : Spring Valley Trails Zens
CLIENT : Claridge Homes

FILE: 115201-5.7
DATE PRINTED: 08-Oct-19
DESIGN: R.M .& W.Z.
PAGE: 1 OF 1

NODE	RESIDENTIAL				NON-RESIDENTIAL (ICI)			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND (l/min)
	SINGLE FAMILY UNITS	TOWN HOUSE UNITS	MEDIUM DENSITY (ha)	POPULATION	INDUST. (ha)	COMM. (ha)	INSTIT. (ha)	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	
			48.00	86.40				0.35		0.35	0.88		0.88	1.93		1.93	15,000

POPULATION DENSITY

Single Family	3.4 persons/unit
Semi Detached & Townhouse	2.7 persons/unit
Medium Density	1.8 persons/unit

WATER DEMAND RATES

Residential	350 l/cap/day

PEAKING FACTORS

Maximum Daily Residential	2.5 x avg. day
Maximum Hourly Residential	2.2 x max. day

FIRE DEMANDS

Single Family	10,000 l/min (166.7 l/s)
Semi Detached & Townhouse	10,000 l/min (166.7 l/s)
Medium Density	15,000 l/min (250 l/s)

Fire Flow Requirement from Fire Underwriters Survey - Spring Valley Trails Zens

Building

Total Floor Area of Largest building	1,282	m^2
Total Floor Area	1,282	m^2

$F = 220C\sqrt{A}$

C	1.5		C =	1.5	wood frame
A	1,282	m^2		1.0	ordinary
				0.8	non-combustible
F	11,815	l/min		0.6	fire-resistive
use	12,000	l/min			

Occupancy Adjustment

			-25%	non-combustible
			-15%	limited combustible
Use	-15%		0%	combustible
			+15%	free burning
Adjustment	-1800	l/min	+25%	rapid burning
Fire flow	10,200	l/min		

Sprinkler Adjustment

			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	0%			
Adjustment	0	l/min		

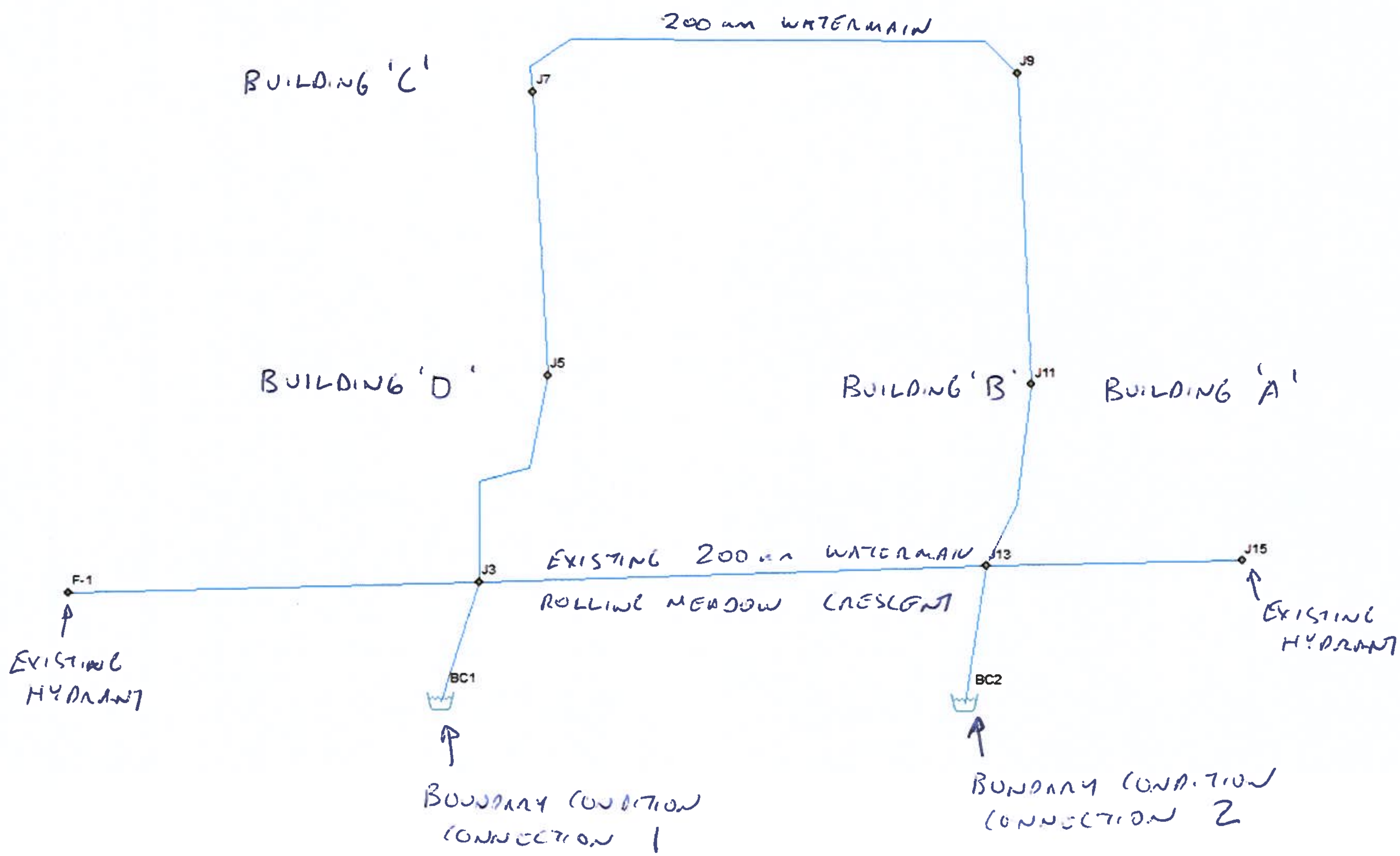
Exposure Adjustment

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Building Face	Separation	Charge
north	45	5%
east	7.6	20%
south	26.6	10%
west	23.3	10%
Total		45%

Adjustment	4,590	l/min
Fire flow	14,790	l/min
Use	**15,000**	**l/min**
	250	**l/s**

SPRING VALLEY TRAILS ZENS WATER MODEL



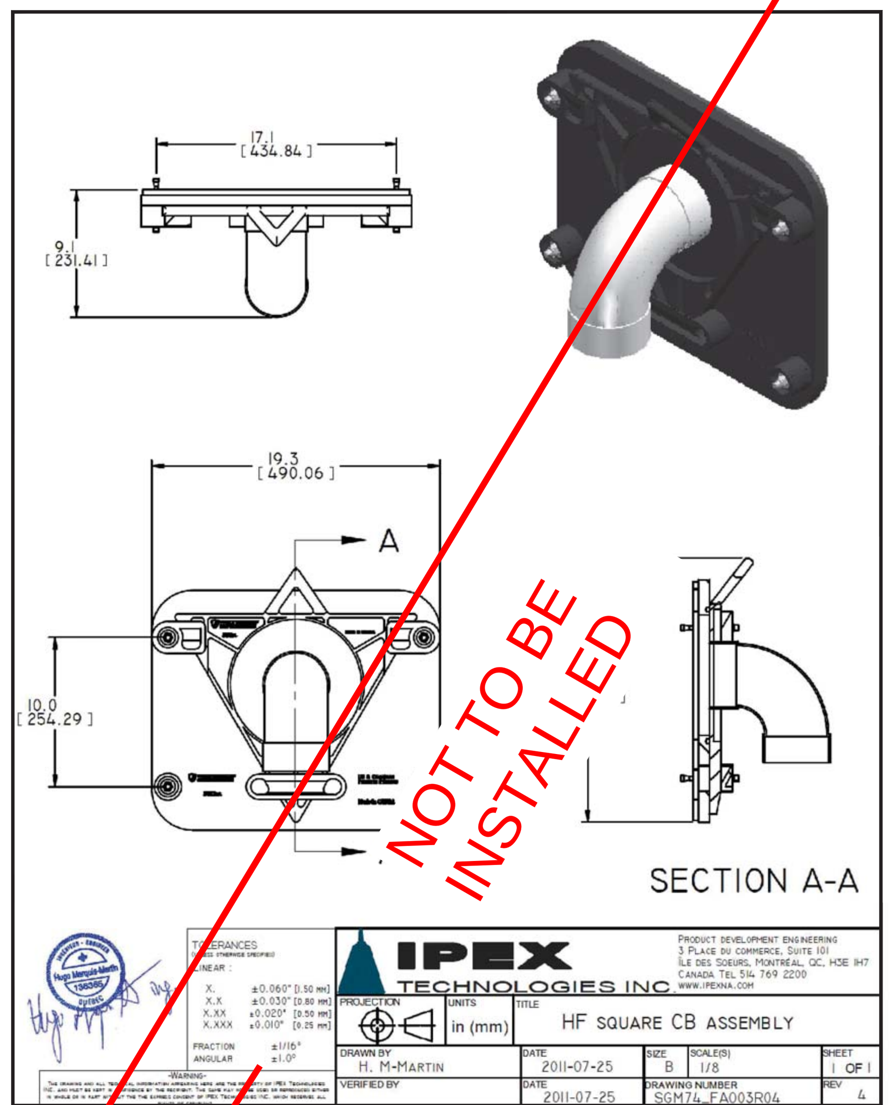
Basic Day (Max HGL) - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	☐	F-1	0.00	76.20	130.80	535.04
2	☐	J11	0.18	77.20	130.80	525.24
3	☐	J13	0.00	77.60	130.80	521.32
4	☐	J15	0.00	77.50	130.80	522.30
5	☐	J3	0.00	76.10	130.80	536.02
6	☐	J5	0.09	76.40	130.80	533.08
7	☐	J7	0.09	77.20	130.80	525.24
8	☐	J9	0.00	77.40	130.80	523.28

Peak Hour - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	☐	F-1	0.00	76.20	127.00	497.80
2	☐	J11	0.96	77.20	127.00	488.00
3	☐	J13	0.00	77.60	127.00	484.08
4	☐	J15	0.00	77.50	127.00	485.06
5	☐	J3	0.00	76.10	127.00	498.78
6	☐	J5	0.48	76.40	127.00	495.84
7	☐	J7	0.48	77.20	127.00	488.00
8	☐	J9	0.00	77.40	127.00	486.04

		ID	Total Demand (L/s)	Available Flow at Hydrant (L/s)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)
1	☐	F-1	250.00	270.40	F-1	139.96	90.48	270.40	139.96	140.20
2	☐	J11	250.44	479.75	J11	139.96	91.48	479.75	139.96	139.99
3	☐	J15	250.00	315.95	J15	139.96	91.78	315.95	139.96	139.98
4	☐	J5	250.22	478.67	J5	139.96	90.68	478.68	139.96	139.94
5	☐	J7	250.22	375.23	J7	139.96	91.48	375.23	139.96	139.95
6	☐	J9	250.00	352.09	J9	139.96	91.68	352.09	139.96	139.74



NOTE:
ALL STREET CBs (6, 9, 10, 11) TO COME WITH IPEX INSERT

STM STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT OUT	DESCRIPTION
MH1	76.41	NW73.899	SE73.879	1200ø OPSD 701.010
MH2	77.10	NE74.430	SW74.410	1200ø OPSD 701.010
MH3	77.00	NE74.366 NW74.284	SE74.264	1200ø OPSD 701.010
MH4	77.13	SW74.408	SE74.348	1200ø OPSD 701.010
MH5	77.74	SE74.990	W74.960	1200ø OPSD 701.010
MH6	77.58	E75.782	SW75.752	1200ø OPSD 701.010
MH7	77.39	E74.911	SW74.718	1200ø OPSD 701.010
MH8	77.10	SW74.679	SE74.609	1200ø OPSD 701.010
MH9	77.04	S74.826	NE74.796	1200ø OPSD 701.010

SAN STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT OUT	DESCRIPTION
MH1A	76.41	NW73.410	SE73.390	1200ø OPSD 705.010
MH2A	76.98	NW73.864 SW73.581	SE73.521	1200ø OPSD 705.010
MH3A	76.86	S73.798 NW74.341	NE73.768	1200ø OPSD 705.010
MH4A	76.91	SE73.899 NE74.515	N73.869	1200ø OPSD 705.010
MH5A	76.45	NE74.114	NW74.054	1200ø OPSD 705.010
MH6A	76.94	NE74.826	SE74.766	1200ø OPSD 705.010
MH10A	77.72	NE75.879	NW74.918	1200ø OPSD 705.010
MH11A	78.20	NE75.251 SE74.845	NW74.825	1200ø OPSD 705.010
MH12A	78.25	SE75.603	SW75.543	1200ø OPSD 705.010
MH13A	78.82	SW75.843	NW75.783	1200ø OPSD 705.010
MH20A	76.97	NE73.675 NW73.509	SE73.489	1200ø OPSD 705.010
MH21A	78.10	SE74.794	SW74.734	1200ø OPSD 705.010

CB STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT OUT	DESCRIPTION
CB6	77.21	W75.835 E76.481	NW75.775	OPSD 705.010
CB7	77.40	SE75.724	NW75.704	OPSD 705.010
CB8	77.00		N75.250	OPSD 705.010
CB9	76.95		NW75.800	OPSD 705.010
CB10	77.38	SW74.925	NE74.895	OPSD 705.010
CB11	76.31	SW75.077	SE75.020	OPSD 705.010
CCB5–1	78.65		NW77.312	CITY STD S29
CCB5–2	79.27		W78.045	CITY STD S29
CCB11–5	76.10	NW75.261	E75.261	CITY STD S29
CCB11–6	76.11	W75.250	NE75.250	CITY STD S29
CCB11–7	76.03	SW75.123	NW75.123	CITY STD S29
ECB1	76.65		NE75.900	CITY STD S29
ECB5	78.30		NE77.350	CITY STD S29
ECB6–1	78.65		SW76.628	CITY STD S29
ECB6–2	76.70		NE75.950	CITY STD S29

CB STRUCTURE TABLE

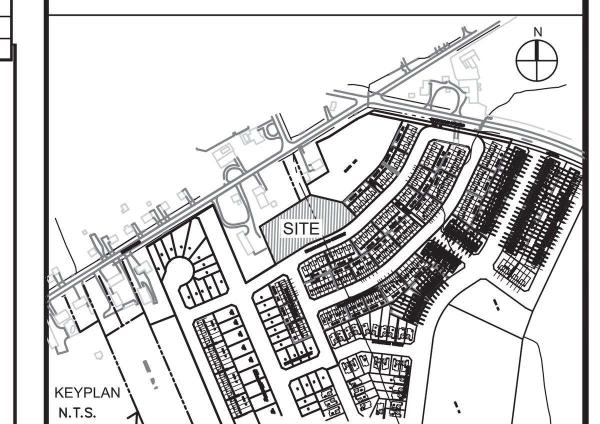
NAME	RIM ELEV.	INVERT IN	INVERT OUT	DESCRIPTION
ECB8	77.45		NE76.250	CITY STD S29
ECB11	76.80		SE75.800	CITY STD S29
ECB11–2	76.70		SE75.700	CITY STD S29
ECB11–6	76.10		SW75.300	CITY STD S29
ECB11–7	76.10		NE75.300	CITY STD S29
RYCB3	77.30	NE76.555 SW75.663	SE75.700	OPSD 705.010
TCB2	77.00	SW75.740	NE75.740	CITY STD S29
TCB3	77.68	NE76.630	SW77.553	CITY STD S29
TCB4	77.85	E76.797	W76.797	CITY STD S29
TCB6–1	78.20	NE76.585	SW76.585	CITY STD S29
TCB6–2	77.87	NE76.548	SW76.548	CITY STD S29
TCB6–3	77.05	SW75.883	E75.883	CITY STD S29
TCB6–4	76.85	SW75.910	NE75.910	CITY STD S29
TCB11	76.60	NW75.600	SE75.600	CITY STD S29
WCB11	76.35	NW75.100 S75.100	NE75.100	CITY STD S29

WATERAIN SCHEDULE

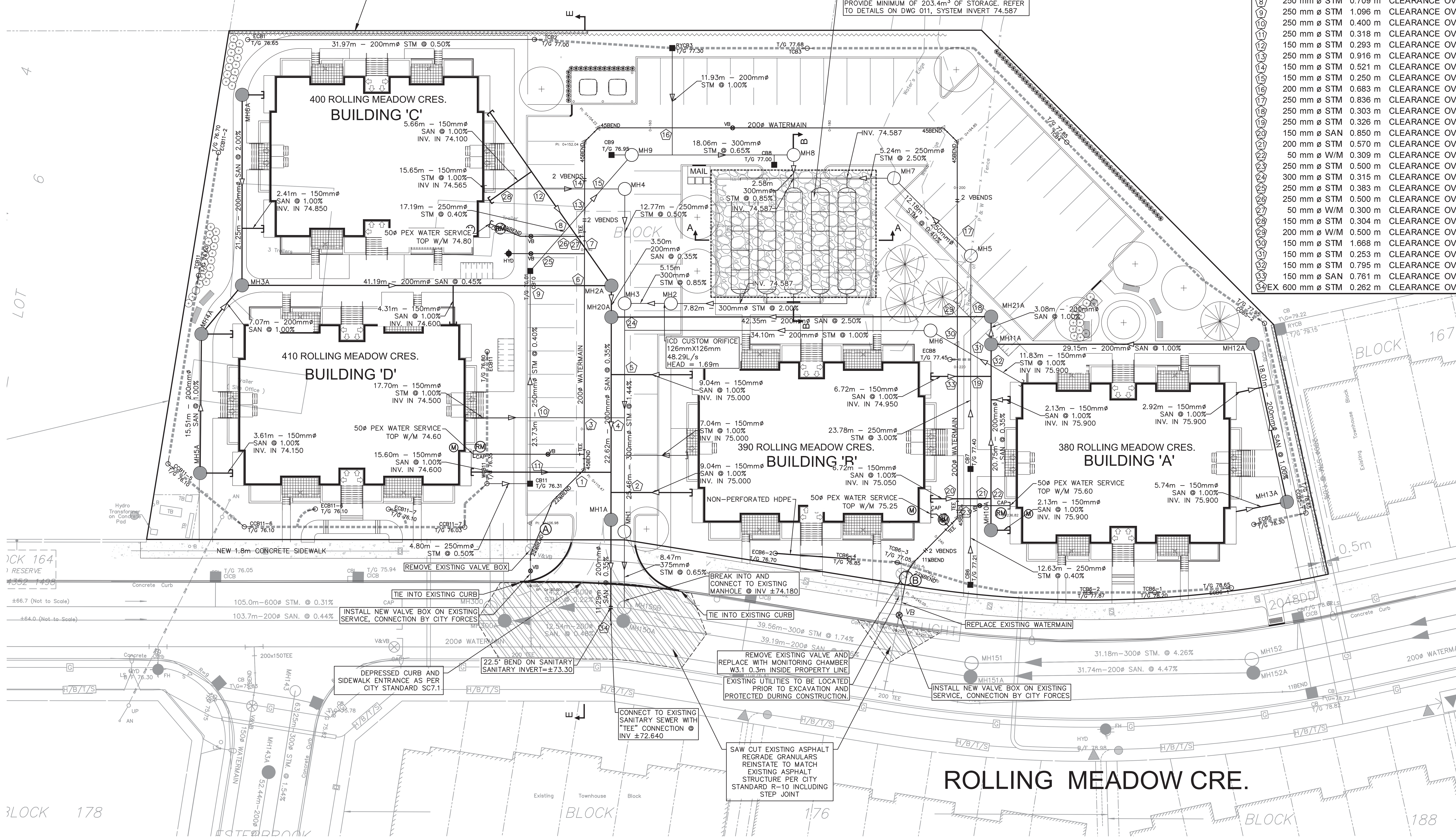
	Station	Description	Finished Grade	Top of Waterain	As Built Waterain
A	0+101.65	200Ø VB	76.197	73.797	
	0+106.98	45° BEND	76.405	74.005	
	0+115.02	TOP WATERMAIN	76.475	74.075	
	0+115.47	45° BEND	76.491	74.091	
	0+117.15	SERVICE TEE	76.531	74.131	
	0+121.23	TOP WATERMAIN	76.630	74.230	
	0+135.97	TOP WATERMAIN	76.917	74.517	
	0+139.53	HYDRANT	76.936	74.536	
	0+140.25	TOP WATERMAIN	76.939	74.539	
	0+141.47	SERVICE TEE	76.946	74.546	
	0+143.17	V BEND	77.005	74.605	
	0+143.42	V BEND	77.017	73.935	
	0+144.54	TOP WATERMAIN	77.072	73.935	
	0+146.77	TOP WATERMAIN	77.181	73.935	
	0+147.67	V BEND	77.153	73.935	
	0+147.92	V BEND	77.130	74.730	
	0+152.04	45° BEND	77.121	74.721	
	0+154.22	45° BEND	77.190	74.790	
	0+162.45	TOP WATERMAIN	77.237	74.837	
	0+169.17	200Ø VB	77.253	74.853	
	0+192.67	45° BEND	77.418	75.018	
	0+194.85	45° BEND	77.439	75.039	
	0+201.30	V BEND	77.426	75.026	
	0+201.55	V BEND	77.439	74.093	
	0+206.05	TOP WATERMAIN	77.661	74.315	
	0+214.38	TOP WATERMAIN	78.056	74.710	
	0+217.66	TOP WATERMAIN	77.755	74.409	
	0+219.16	TOP WATERMAIN	77.618	74.272	
	0+221.04	TOP WATERMAIN	77.546	74.200	
	0+234.70	TOP WATERMAIN	77.529	74.183	
	0+235.47	SERVICE TEE	77.546	74.200	
	0+236.82	45° BEND	77.563	74.217	
	0+238.99	SERVICE TEE	77.549	74.203	
	0+241.77	V BEND	77.374	74.028	
	0+242.02	V BEND	77.346	74.946	
	0+243.80	11.25° BEND	77.147	74.747	
	0+245.05	22.5° BEND	77.077	74.677	
	0+245.76	MONITORING MANHOLE	77.072	74.672	
B	0+249.97	200Ø VB	77.040	74.640	

CROSSING SCHEDULE

1	150 mm ø SAN	0.517 m	CLEARANCE OVER	200 mm ø W/M
2	300 mm ø STM	0.650 m	CLEARANCE OVER	150 mm ø SAN
3	150 mm ø STM	0.510 m	CLEARANCE OVER	200 mm ø W/M
4	150 mm ø STM	0.678 m	CLEARANCE OVER	200 mm ø SAN
5	300 mm ø STM	0.461 m	CLEARANCE OVER	150 mm ø SAN
6	200 mm ø W/M	0.384 m	CLEARANCE OVER	200 mm ø SAN
7	200 mm ø W/M	0.271 m	CLEARANCE OVER	150 mm ø SAN
8	250 mm ø STM	0.709 m	CLEARANCE OVER	150 mm ø SAN
9	250 mm ø STM	1.096 m	CLEARANCE OVER	200 mm ø SAN
10	250 mm ø STM	0.400 m	CLEARANCE OVER	150 mm ø STM
11	250 mm ø STM	0.318 m	CLEARANCE OVER	150 mm ø SAN
12	150 mm ø STM	0.293 m	CLEARANCE OVER	150 mm ø SAN
13	250 mm ø STM	0.916 m	CLEARANCE OVER	200 mm ø W/M
14	150 mm ø STM	0.521 m	CLEARANCE OVER	200 mm ø W/M
15	150 mm ø STM	0.250 m	CLEARANCE OVER	250 mm ø STM
16	200 mm ø STM	0.683 m	CLEARANCE OVER	200 mm ø W/M
17	250 mm ø STM	0.836 m	CLEARANCE OVER	200 mm ø W/M
18	250 mm ø STM	0.303 m	CLEARANCE OVER	200 mm ø SAN
19	250 mm ø STM	0.326 m	CLEARANCE OVER	150 mm ø SAN
20	150 mm ø SAN	0.850 m	CLEARANCE OVER	200 mm ø W/M
21	200 mm ø STM	0.570 m	CLEARANCE OVER	150 mm ø SAN
22	50 mm ø W/M	0.309 m	CLEARANCE OVER	200 mm ø SAN
23	250 mm ø STM	0.500 m	CLEARANCE OVER	200 mm ø W/M
24	300 mm ø STM	0.315 m	CLEARANCE OVER	200 mm ø SAN
25	250 mm ø STM	0.383 m	CLEARANCE OVER	150 mm ø W/M
26	250 mm ø STM	0.500 m	CLEARANCE OVER	50 mm ø W/M
27	50 mm ø W/M	0.300 m	CLEARANCE OVER	150 mm ø SAN
28	150 mm ø STM	0.304 m	CLEARANCE OVER	150 mm ø SAN
29	200 mm ø W/M	0.500 m	CLEARANCE OVER	200 mm ø SAN
30	150 mm ø STM	1.668 m	CLEARANCE OVER	200 mm ø W/M
31	150 mm ø STM	0.253 m	CLEARANCE OVER	250 mm ø STM
32	150 mm ø STM	0.795 m	CLEARANCE OVER	200 mm ø SAN
33	150 mm ø SAN	0.761 m	CLEARANCE OVER	200 mm ø W/M
34	EX. 600 mm ø STM	0.262 m	CLEARANCE OVER	200 mm ø SAN



No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8	REISSUED FOR CWN	DGY	20:02:07
7	ISSUED FOR CWN	DGY	19:12:24
6	REVISED PER CITY COMMENTS	DGY	19:11:21
5	REVISED PER CITY COMMENTS	DGY	19:09:20
4	REVISED PER ADDENDUM #3	DGY	19:09:19
3	ISSUED FOR TENDER	DGY	19:08:26
2	REVISED PER CITY COMMENTS	DGY	19:04:09
1	ISSUED FOR CITY REVIEW	DGY	18:10:11



CLARIDGE HOMES

CLARIDGE HOMES (CARSON) INC.
2001–210 GLADSTONE AVE
OTTAWA, ON
K2P 0Y6
613–233–6030

IBI

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400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
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ibigroup.com

Project Title

SPRING VALLEY TRAILS
ZENS
WALK-UP TOWNHOUSES

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/02/07
PROVINCE OF ONTARIO

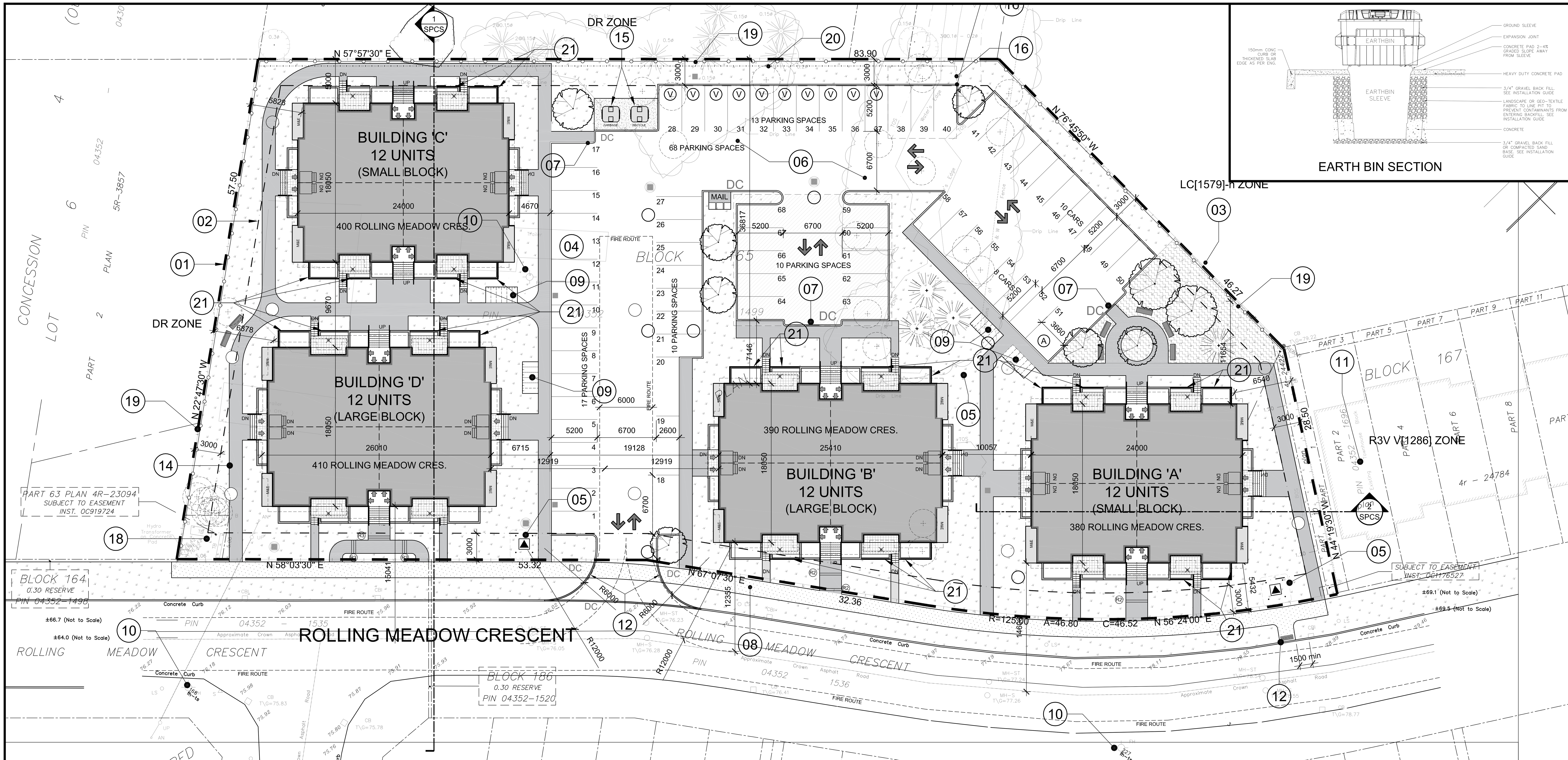
Drawing Title

GENERAL PLAN
OF SERVICING

Scale	
1:250	
Design: R.M./W.Z.	Date: OCTOBER 2018
Drawn: E.H.	Checked: D.G.Y.
Project No.: 115201	Drawing No.: 001

CITY PLAN No. 18055

CITY FILE No. D07-12-18-0167



IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND TO REPORT ALL ERRORS AND/OR OMISSIONS TO THE ARCHITECT.

ALL CONTRACTORS MUST COMPLY WITH ALL PERTINENT CODES AND BY-LAWS.

THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT.

DO NOT SCALE DRAWINGS.

NOTATION SYMBOLS:

- 00 — INDICATES DRAWING NOTES, LISTED ON EACH SHEET.
- 00 — INDICATES ASSEMBLIE TYPE; REFER TO TYPICAL ASSEMBLIES SCHEDUAL.
- 00 — INDICATES WINDOW TYPE; REFER TO WINDOW ELEVATIONS AND DETAILS ON A900 SERIES.
- 000 — INDICATES DOOR TYPE; REFER TO DOOR SCHEDULE AND DETAILS ON A900 SERIES.
- 00 / A000 — DETAIL NUMBER / TITLE / SCALE / DETAIL REFERENCE PAGE

REVISIONS:

No.	DESCRIPTION	DATE
7	REVISED CITY SIDEWALK & TRANSFORMER	Jan. 28, 2020
6	REVISED VISITOR PARKING SPACE LOCATIONS	DEC. 12 2019
5	ISSUED FOR PERMIT	AUG 21 2019
4	REVISED FOR SITE PLAN COMMENTS	MAY 28 2019
3	REVISED FOR COORDINATION	MAR 20 2019
2	REVISED FOR SITE PLAN COMMENTS	FEB 05 2019
1	ISSUED FOR SITE PLAN APPROVAL	OCT 12 2018

ARCHITECT SEAL: ONTARIO ASSOCIATION OF ARCHITECTS — RODERICK LAHEY — LICENCE 4375

SEAL DATE: STAMP DATE

NORTH ARROW:

CLIENT: CLARIDGE HOMES

ARCHITECT: rla/architecture — roderick lahey architect inc. — 56 beech street, ottawa, ontario K1S 3J6 — t. 613.724.9932 f. 613.724.1209 rlaarchitecture.ca

PROJECT TITLE: SPRINGVALLEY TRAILS ZEN — OTTAWA, ONTARIO

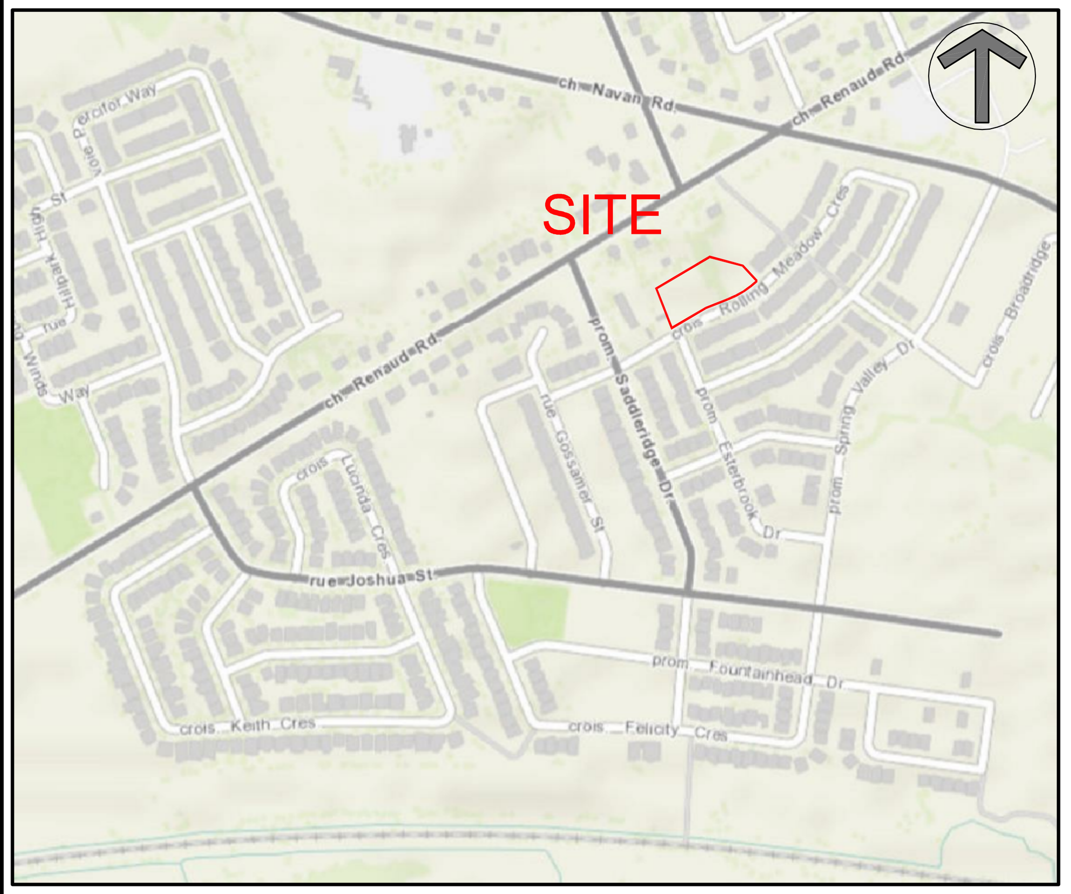
SHEET TITLE: SITE PLAN

DRAWN:	CHECKED:
RV	LL
SCALE: 1:250	SHEET No. SP-1
PROJECT No. 1721	

D07-12-18-0167

1 SP-1 SITE PLAN

SCALE = 1 : 250



KEY PLAN

DRAWING NOTES

1. PROPERTY LINE
2. BUILDING SETBACKS
3. REQUIRED AMENITY AREA
4. PARKING SPACE: STANDARD SIZE 2.6 x 5.2 METRES
5. PROPOSED HYDRO TRANSFORMER
6. ASPHALT DRIVING SURFACE
7. DEPRESSED CURB / SIDEWALK TO CITY STANDARDS
8. 1.8m WIDE CONCRETE SIDEWALK: TO CITY STANDARDS
9. BICYCLE PARKING SPACES WITH BOLLARD STYLE RACK
10. FIRE HYDRANT
11. EXISTING APARTMENT BUILDINGS
12. DEPRESSED CURB WITH TACTILE WALKING SURFACE INDICATORS AS SHOWN
13. NOT IN USE
14. CONCRETE WALK / PATH
15. EARTH BINS
16. TEMPORARY SNOW STORAGE
17. NOT IN USE
18. EXISTING BELL BOXES
19. NEW 2130 ht. WOOD BOARD FENCE. SEE LANDSCAPE
20. TEMPORARY TREE PROTECTION FENCE. SEE LANDSCAPE
21. GUARD RAIL

SITE PLAN SYMBOLS

- CONCRETE UNIT PAVERS SURFACE
- SOFT LANDSCAPING
- CONCRETE WALK / PATH
- HEAVY DUTY CONCRETE PAD
- BIKE RACK
- TWO WAY VEHICLE CIRCULATION
- MAIN ENTRANCE
- PROPERTY LINE
- ZONING SETBACKS
- STANDARD PARKING SPACE
- VISITOR PARKING SPACE
- ACCESSIBLE PARKING SPACE
- AMENITY AREA
- UNDERGROUND STORAGE GALLERY (SEE CIVIL)
- PROPOSED TREE (SEE LANDSCAPE PLAN)
- EXISTING TREE TO BE REMOVED (SEE LANDSCAPE PLAN)

PROJECT DEVELOPER

Claridge Homes
2001 - 201 Gladstone Avenue
Ottawa ON,
Tel.: (613) 233-6030
E-Mail:

LEGAL DESCRIPTION

TOPOGRAPHICAL PLAN OF
BLOCK 165
REGISTERED PLAN 4M-1370
CITY OF OTTAWA
Prepared by Annis, O'Sullivan, Vollebekk Ltd.
Field Work Completed December 12, 2017

SURVEYOR

Annis O'Sullivan Vollebekk Ltd.
Ontario Land Surveyors
14 Concourse Gate, Suite 500,
Nepean, Ontario K2E 7S6
Tel: (613) 727-0850
Fax: (613) 727-1079
E-Mail: EdL@aovltd.com

PROJECT INFORMATION

CURRENT ZONING (Zoning By-Law 2017-113)	R3VV[1286]
SITE AREA	6,768.95 sq. m. (72,860) sq. ft.
BUILDING HEIGHT	11.0 m.
AMENITY AREA PER DWELLING UNIT	6.0 sq. m.
LANDSCAPE AREA	30%
FRONT YARD SETBACK	3.0 M
REAR YARD SETBACK	6.0 M
INTERIOR SIDE YARD SETBACK	1.8 M

PROPOSED ZONING (Zoning By-Law 2017-113)	R4Y
SITE AREA	6,768.95 sq. m. (72,860) sq. ft.
BUILDING HEIGHT	11.0 m.
AMENITY AREA PER DWELLING UNIT	6.0 sq. m.
LANDSCAPE AREA	30%
FRONT YARD SETBACK	3.0 M
REAR YARD SETBACK	3.0 M
INTERIOR SIDE YARD SETBACK	3.0 M

PROJECT STATISTICS

BUILDING HEIGHT			11.0 M
REQUIRED AMENITY SPACE	6 SQ. M. PER UNIT=		288 sq. m.
	50% COMMUNAL AMENITY AREA =		144 sq. m.
PROVIDED AMENITY SPACE	PRIVATE BALCONY / PATIOS =		361 sq. m.
	COMMUNAL EXTERIOR AREA=		200 sq. m.
	TOTAL =		561 sq. m.
SITE COVERAGE	BUILDING FOOTPRINT =	33.6%	2,278.43 sq. m.
	DRIVING SURFACE =	25.9%	1,751.40 sq. m.
	LANDSCAPE AREA =	40.5%	2,739.12 sq. m.
	TOTAL =	100.0%	6,768.95 sq. m.

GROSS BUILDING - AREAS

(CITY OF OTTAWA'S DEFINITION)

PROPOSED BUILDING 'A'	1,135.5 sq. m. (12,222) sq. ft.
PROPOSED BUILDING 'B'	1,235.7 sq. m. (13,301) sq. ft.
PROPOSED BUILDING 'C'	1,135.5 sq. m. (12,222) sq. ft.
PROPOSED BUILDING 'D'	1,235.7 sq. m. (13,301) sq. ft.
TOTAL PROPOSED AREA	4,742.4 sq. m. (51,046) sq. ft.

UNIT STATISTICS

2 BEDROOM UNIT	48

CAR PARKING

REQUIRED by ZONING BY-LAW

RESIDENCE	- 1.2 PER UNIT (48 UNITS)	58
VISITOR	- 0.2 PER DWELLING UNIT	10
TOTAL		68

PROVIDED

RESIDENCE	- 1.2 PER UNIT (48 UNITS)	58
VISITOR	- 0.2 PER DWELLING UNIT	10
TOTAL		68

BICYCLE PARKING

REQUIRED

RESIDENCE	- 0.5 PER UNIT (48 UNITS)	24

PROVIDED

EXTERIOR	24

Ryan Magladry

From: Hal Stimson <hal.stimson@rvca.ca>
Sent: Thursday, October 10, 2019 4:37 PM
To: Ryan Magladry
Cc: Mashaie, Sara; Jamie Batchelor
Subject: RE: 380 Rolling Meadow

Hi Ryan,

I was able to confirm the current site conditions.

As you indicate there is an inlet at Renaud Rd and flow was cut off at Rolling Meadow.

There is some potential ponding occurring in the existing remaining ditch.

RVCA has no issues and agrees the system was previously written off/ abandoned.

Regards,

Hal Stimson
Inspector, RVCA
hal.stimson@rvca.ca ext. 1127

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

From: Ryan Magladry <rmagladry@IBIGroup.com>
Sent: Wednesday, October 09, 2019 4:02 PM
To: Hal Stimson <hal.stimson@rvca.ca>
Cc: Mashaie, Sara <sara.mashaie@ottawa.ca>; Jamie Batchelor <jamie.batchelor@rvca.ca>
Subject: RE: 380 Rolling Meadow

Thanks Hal for the quick turn around.

The temporary crossings (twin culverts) on Rolling Meadow, as part of the 2010 permit, have been decommissioned as part of the final Renaud Road drainage works and completion of Claridge's Phase 2 lands.
Renaud Road frontages and road side ditching has been captured as part of the detail design of Renaud Road, and flows are conveyed to the pond via the Renaud Road storm sewer.

It’s a bit hard to see on google street view, however at the end of Page Road, you can see the top edge of the ditch inlet CB installed to capture this drainage.

If you could confirm your concurrence, and we will add this to the file for the City.
Much appreciated,

Ryan Magladry CET

Project Manager

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 64061 fax +1 613 225 9868

From: Hal Stimson <hal.stimson@rvca.ca>
Sent: Wednesday, October 9, 2019 3:53 PM
To: Ryan Magladry <rmagladry@IBIGroup.com>
Cc: Mashaie, Sara <sara.mashaie@ottawa.ca>; Jamie Batchelor <jamie.batchelor@rvca.ca>
Subject: RE: 380 Rolling Meadow

Hi Ryan,

I have pulled the file to take a look and believe the intent of the permit was to cover all the watercourse abandonments.

I think the DFO authorization also covered this and compensation was done with the habitat pond to the south.

I would caution that a portion of the watercourse remained and I think was picked up into the storm system at Rolling Meadow.

I assume a storm inlet but haven't had time to stop and look. Can you confirm?

RVCA has no issues with further infill but it needs to be verified that whatever drainage still exists upstream (i.e. other property or road drainage) is accommodated.

Regards,

Hal Stimson
Inspector, RVCA
hal.stimson@rvca.ca ext. 1127

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

From: Ryan Magladry <rmagladry@IBIGroup.com>
Sent: Monday, October 07, 2019 2:35 PM
To: Hal Stimson <hal.stimson@rvca.ca>
Cc: Mashaie, Sara <sara.mashaie@ottawa.ca>
Subject: 380 Rolling Meadow

Hi Hal,
We are working on a site plan application for Claridge in the Spring Valley Trails community.

The site plan is a small block of stacked towns, located in the registered plan for Phase 2 of the development. Phase 2 was constructed in 2011.

In 2010, Claridge received a permit for the closure of 3 headwater watercourses tributary to Mud Creek/Green's creek. Our file is mostly old scanned documents, and is 128MB, so hopefully you can track it down on your end for reference. RVCA file # **RV8-1810T**, issued August 13, 2010. If not, please advise, and we can provide it to you through file transfer site.

It was our understanding that the permits granted as part of Phase 2 of the development encompassed all lots and blocks within the development. Are you able to confirm that no additional permits are required for the block circled in red on the attached PDF.

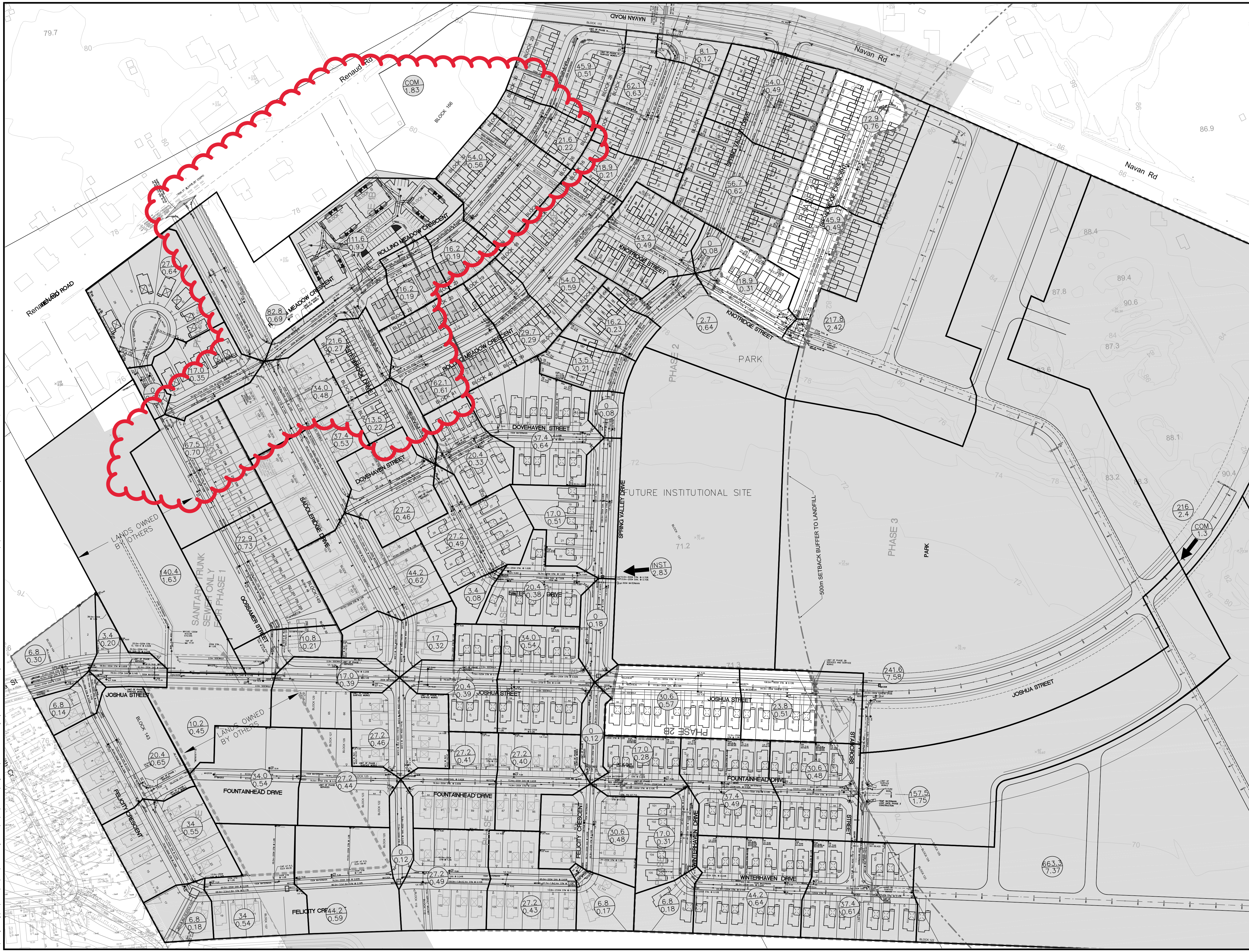
Thanks,

Ryan Magladry CET

Project Manager

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 64061 fax +1 613 225 9868

APPENDIX B



NOTE:

SEE RESPECTIVE SERVICING PLANS FOR SEWER SIZES AND SLOPES.

LEGEND:

SANITARY

7 — POPULATION

0.19 — AREA IN HECTARES

POPULATION

SINGLE FAMILY = 3.4ppu
TOWNHOUSE = 2.7ppu
INST/COM 50,000 l/s/Ha
LOW-MED DENSITY = 90 ppHa

No.	REVISIONS	By	Date
18	REVISED AS PER CITY COMMENTS	DGY	12:01:18
17	REVISED AS PER CITY COMMENTS	DGY	11:08:11
16	ADDED PHASE 2B LIMITS	DGY	11:06:16
15	REVISED AS PER NEW LEGAL	DGY	10:11:17
14	REVISED AS PER NEW LEGAL	DGY	10:10:25
13	REVISED AS PER CITY COMMENTS	DGY	10:09:20
12	REVISED AS PER NEW LEGAL	DGY	09:06:01
11	REVISED AS PER CITY COMMENTS	DGY	09:01:19
10	PHASE 2	DGY	08:11:21
9	REVISED GOSSAMER	DGY	08:07:23
8	REVISED PRAIRIE/GOSSAMER	DGY	08:06:19
7	REVISED AS PER NEW LEGAL	DGY	08:03:04
6	REVISED AS PER NEW LEGAL	DGY	08:02:20
5	REVISED AS PER NEW SITE PLAN	DGY	07:08:16
4	REVISE DRAFT PLAN	DGY	06:12:21
3	REVISED AS PER CITY COMMENTS	DGY	06:10:30
2	REVISED AS PER CITY COMMENTS	DGY	06:09:13
1	ISSUED FOR APPROVAL	DGY	06:08:16

CLARIDGE HOMES

IBI GROUP

333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title

CLARIDGE HOMES
SPRING VALLEY

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
PROVINCE OF ONTARIO

N

Drawing Title

SANITARY DRAINAGE
AREA PLAN
PHASE 2B

Scale 1:1250

Design D.G.Y.

Date AUGUST 2006

Drawn D.D.

Checked

Project No. 10261

Drawing No. 501

IBI GROUP

CCL/IBI
1770 WOODWARD DRIVE
OTTAWA, ONTARIO
K2C OP8

SANITARY SEWER DESIGN SHEET
PROJECT: CLARIDGE HOMES, NAVAN ROAD
LOCATION: CUMBERLAND
DEVELOPER: CLARIDGE HOMES

JOB: 3625-LD
DATE: Dec 2008
DESIGN: DY
FILE: 3625-LD Sewers.xls

LOCATION			INDIVIDUAL			CUMULATIVE			DESIGN FLOW						PROPOSED SEWER					
STREET	FROM MH	TO MH	com/Inst area Ha	Residential AREA (Ha)	Residential POP.	Com/Inst Area Ha	POP.	AREA (Ha)	Pop PEAK FACT.	POPLN FLOW (l/s)	Com/Inst Peak Fact	Com/Inst Peak Flow	INFILT FLOW (l/s)	PEAK FLOW (l/s)	CAPACITY l/s	VELOCITY (full) m/s	LGTH. (m)	PIPE (mm)	GRADE %	AVAIL. CAP. (%)
Phase 2 & External																				
Fountainhead Drive		162A				0.00	853.70	10.36	3.84	13.29	1.50	0.00	2.90	**16.19**						
Felicity Crescent	162A	195A		0.120	0.0	0.00	853.70	10.48	3.84	13.29	9.50	0.00	2.93	**16.22**	**32.23**	0.64	78	250	0.27	49.67%
Phase 2 & External																				
Joshua Avenue		195A				1.30	669.50	12.81	3.91	10.59	1.50	1.13	3.95	**15.67**						
Phase 2																				
Spring Valley		195A				2.83	667.60	9.43	3.91	10.56	1.50	2.46	3.43	**16.45**						
Joshua Avenue	195A	130B		0.540	34.0	4.13	2224.80	33.26	3.55	31.99	1.50	3.59	10.47	**46.05**	**68.41**	0.60	75	375	0.14	32.69%
Joshua Avenue	130B	130A		0.390	20.4	4.13	2245.20	33.65	3.55	32.25	1.50	3.59	10.58	**46.42**	**68.41**	0.60	75	375	0.14	32.15%
Felicity Crescent	162A	161A		0.480	30.6	0.00	30.60	0.48	4.00	0.50	1.50	0.00	0.13	**0.63**	**27.60**	0.85	66.1	200	0.65	97.72%
Felicity Crescent	161A	160B		0.170	6.8	0.00	37.40	0.65	4.00	0.61	1.50	0.00	0.18	**0.79**	**27.60**	0.85	12.6	200	0.65	97.14%
Felicity Crescent	160B	160A		0.430	27.2	0.00	64.60	1.08	4.00	1.05	1.50	0.00	0.30	**1.35**	**27.60**	0.85	65	200	0.65	95.11%
Felicity Crescent	160A	120B		0.490	27.2	0.00	91.80	1.57	4.00	1.49	1.50	0.00	0.44	**1.93**	**30.40**	0.60	68	250	0.24	93.65%
Saddleridge Drive	120B	201A		0.120	0.0	0.00	91.80	1.69	4.00	1.49	2.50	0.00	0.47	**1.96**	**30.40**	0.60	75.8	250	0.24	93.55%
Fountainhead Drive	203A	223A		0.540	34.0	0.00	34.00	0.54	4.00	0.55	3.50	0.00	0.15	**0.70**	**27.60**	0.85	63.9	200	0.65	97.46%
Fountainhead Drive	223A	201A		0.440	27.2	0.00	61.20	0.98	4.00	0.99	4.50	0.00	0.27	**1.26**	**19.36**	0.60	79.9	200	0.32	93.49%
Fountainhead Drive	162A	123A		0.400	27.2	0.00	27.20	0.40	4.00	0.44	4.50	0.00	0.11	**0.55**	**27.60**	0.85	73.4	200	0.65	98.01%
Fountainhead Drive	123A	201A		0.410	27.2	0.00	54.40	0.81	4.00	0.88	5.50	0.00	0.23	**1.11**	**27.60**	0.85	72.4	200	0.65	95.98%
Saddleridge Drive	201A	130A		0.460	27.2	0.00	234.60	3.94	4.00	3.80	7.50	0.00	1.10	**4.90**	**30.40**	0.60	78.1	250	0.24	83.88%
Rolling Meadow Crescent	142B	142A		0.120	8.1	0.00	8.10	0.12	4.00	0.13	1.50	0.00	0.03	**0.16**	**57.27**	1.77	9.7	200	2.80	99.72%
Rolling Meadow Crescent	142A	141A		0.630	62.1	0.00	70.20	0.75	4.00	1.14	1.50	0.00	0.21	**1.35**	**57.27**	1.77	83.2	200	2.80	97.64%
Rolling Meadow Crescent	141A	140A		0.210	18.9	0.00	89.10	0.96	4.00	1.44	1.50	0.00	0.27	**1.71**	**57.27**	1.77	34.9	200	2.80	97.01%
Rolling Meadow Crescent	140A	139A		0.590	54.0	0.00	143.10	1.55	4.00	2.32	1.50	0.00	0.43	**2.75**	**66.71**	2.06	100.1	200	3.80	95.88%
Rolling Meadow Crescent	139A	138A		0.290	29.7	0.00	172.80	1.84	4.00	2.80	1.50	0.00	0.52	**3.32**	**34.21**	1.06	35	200	1.00	90.30%
Rolling Meadow Crescent	138A	137A		0.610	62.1	0.00	234.90	2.45	4.00	3.81	1.50	0.00	0.69	**4.50**	**34.21**	1.06	90	200	1.00	86.85%
Esterbrook Drive	143A	137A		0.270	21.6	0.00	21.60	0.27	4.00	0.35	1.50	0.00	0.08	**0.43**	**41.90**	1.29	52.1	200	1.50	98.97%
Esterbrook Drive	137A	136A		0.220	13.5	0.00	270.00	2.94	4.00	4.38	1.50	0.00	0.82	**5.20**	**34.21**	1.06	75	200	1.00	84.80%
Dovehaven Street	136A	133A		0.460	27.2	0.00	297.20	3.40	4.00	4.82	1.50	0.00	0.95	**5.77**	**24.19**	0.75	79	200	0.50	76.15%
Rolling Meadow Crescent	155A	154A		0.510	45.9	0.00	45.90	0.51	4.00	0.74	1.50	0.00	0.14	**0.88**	**57.27**	1.77	55.8	200	2.80	98.46%
Rolling Meadow Crescent	154A	153A		0.220	21.6	0.00	67.50	0.73	4.00	1.09	1.50	0.00	0.20	**1.29**	**72.58**	2.24	31.5	200	4.50	98.22%
Rolling Meadow Crescent	153A	152A		0.560	54.0	0.00	121.50	1.29	4.00	1.97	1.50	0.00	0.36	**2.33**	**72.58**	2.24	79.9	200	4.50	96.79%
Rolling Meadow Crescent	152A	151A		0.190	16.2	0.00	137.70	1.48	4.00	2.23	1.50	0.00	0.41	**2.64**	**72.58**	2.24	31.5	200	4.50	96.36%
Rolling Meadow Crescent	151A	150A		0.190	16.2	0.00	153.90	1.67	4.00	2.49	1.50	0.00	0.47	**2.96**	**51.56**	1.59	39.2	200	2.27	94.26%
~~Rolling Meadow Crescent~~	~~150A~~	~~300A~~		~~0.000~~	~~0.0~~	~~0.00~~	~~153.90~~	~~1.67~~	~~4.00~~	~~2.49~~	~~1.50~~	~~0.00~~	~~0.47~~	~~**2.96**~~	**21.63**	0.67	13.4	200	0.40	86.32%
Rolling Meadow Crescent	300A	145A		0.930	111.6	0.00	265.50	2.60	4.00	4.30	1.50	0.00	0.73	**5.03**	**21.63**	0.67	103.4	200	0.40	76.75%
Saddleridge Drive	156A	145A		0.690	82.8	0.00	82.80	0.69	4.00	1.34	1.50	0.00	0.19	**1.53**	**41.90**	1.29	70	200	1.50	96.35%

Where Q = average daily per capita flow 350 l/cap/d
I = Unit of peak extraneous flow 0.28 l/sec/Ha
M = Peaking Factor = 1+(14/(4+P)^0.5)), P=POP. IN 1000'S, Max of 4
Q(p) = Peak population flow (l/s)
Q(i) = peak extraneous flow (l/s)
Population = AVERAGE Per unit = 3.4 singles
2.7 Townhouses
General Population Densities Low Density = 120 pers / per gross hectare
Commercial and School - Average flow 50,000 l/ha/day with Peaking Factor = 1.5

SPECIFY
Coeff. of friction (n) = 0.013

REV. # : 9 15-Dec-08

IBI GROUP

CCL/IBI
1770 WOODWARD DRIVE
OTTAWA, ONTARIO
K2C OP8

SANITARY SEWER DESIGN SHEET
PROJECT: CLARIDGE HOMES, NAVAN ROAD
LOCATION: CUMBERLAND
DEVELOPER: CLARIDGE HOMES

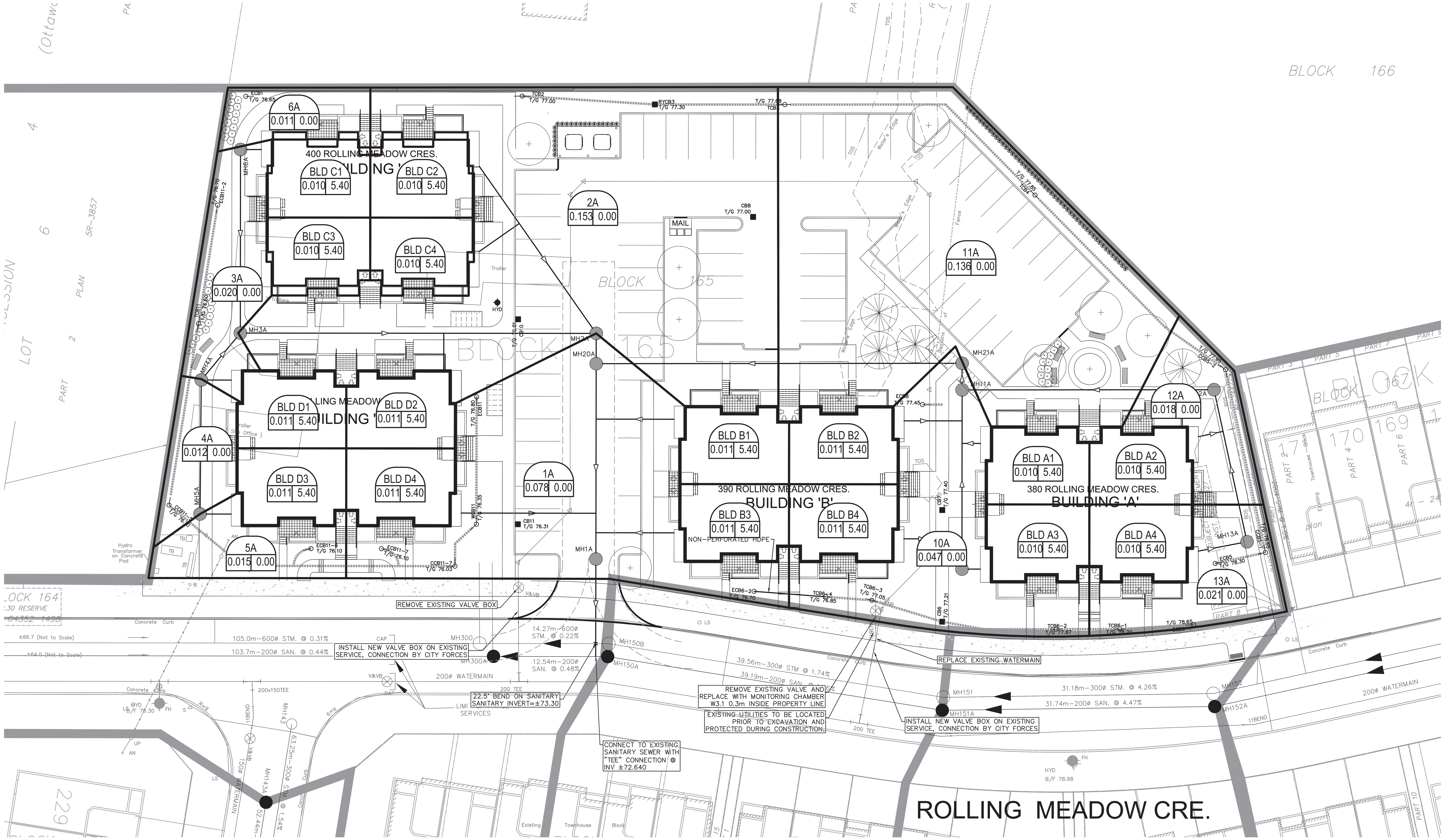
JOB: 3625-LD
DATE: Dec 2008
DESIGN: DY
FILE: 3625-LD Sewers.xls

LOCATION			INDIVIDUAL			CUMULATIVE			DESIGN FLOW						PROPOSED SEWER					
STREET	FROM MH	TO MH	com/Inst area Ha	Residential AREA (Ha)	Residential POP.	Com/Inst Area Ha	POP.	AREA (Ha)	Pop PEAK FACT.	POPLN FLOW (l/s)	Com/Inst Peak Fact	Com/Inst Peak Flow	INFILT FLOW (l/s)	PEAK FLOW (l/s)	CAPACITY l/s	VELOCITY (full) m/s	LGTH. (m)	PIPE (mm)	GRADE %	AVAIL. CAP. (%)
Gossamer St	200A	201A		0.640	27.2	0.00	27.20	0.64	4.00	0.44	1.50	0.00	0.18	**0.62**	**27.60**	0.85	40	200	0.65	97.75%
Gossamer St	201A	202A		0.070	0.0	0.00	27.20	0.71	4.00	0.44	1.50	0.00	0.20	**0.64**	**24.19**	0.75	41.5	200	0.50	97.35%
Prairie St	202A	145A		0.350	17.0	0.00	44.20	1.06	4.00	0.72	1.50	0.00	0.30	**1.02**	**39.22**	0.77	87	250	0.40	97.40%
Saddleridge Drive	145A	134A		0.480	34.0	0.00	426.50	4.83	4.00	6.91	1.50	0.00	1.35	**8.26**	**41.90**	1.29	65.8	200	1.50	80.29%
Saddleridge Drive	134A	133A		0.530	37.4	0.00	463.90	5.36	3.99	7.50	1.50	0.00	1.50	**9.00**	**41.90**	1.29	65.8	200	1.50	78.52%
Saddleridge Drive	133A	132A		0.620	44.2	0.00	805.30	9.38	3.86	12.59	1.50	0.00	2.63	**15.22**	**24.19**	0.75	93.7	200	0.50	37.09%
Saddleridge Drive	132A	130A		0.320	17.0	0.00	822.30	9.70	3.85	12.84	1.50	0.00	2.72	**15.56**	**24.19**	0.75	44	200	0.50	35.68%
Joshua Street	130A	127B		0.390	17.0	4.13	3319.10	47.68	3.40	45.78	1.50	3.59	14.51	**63.88**	**68.41**	0.60	95.05	375	0.14	6.62%
Phase 1B & External																				
Gossamer St	203A	204A		0.700	67.5	0.00	67.50	0.70	4.00	1.09	1.50	0.00	0.20	**1.29**	**34.21**	1.06	87	200	1.00	96.23%
Gossamer St	204A	205A		0.730	72.9	0.00	140.40	1.43	4.00	2.28	1.50	0.00	0.40	**2.68**	**34.21**	1.06	86.7	200	1.00	92.17%
Gossamer St	205A	127B		0.210	10.8	0.00	151.20	1.64	4.00	2.45	1.50	0.00	0.46	**2.91**	**24.19**	0.75	36.6	200	0.50	87.97%
Joshua Street	127B	116A		0.450	10.2	4.13	3480.50	49.77	3.39	47.75	1.50	3.59	15.09	**66.43**	**68.41**	0.60	65.5	375	0.14	2.90%
Joshua Street	116A	104D				4.13	3480.50	49.77	3.39	47.75	1.50	3.59	15.09	**66.43**	**68.41**	0.60	78	375	0.14	2.90%
Felicity Crescent	120A	111B		0.590	44.2	0.00	44.20	0.59	4.00	0.72	3.50	0.00	0.17	**0.89**	**27.60**	0.85	76	200	0.65	96.78%
Felicity Crescent	111B	101A		0.540	34.0	0.00	78.20	1.13	4.00	1.27	1.50	0.00	0.32	**1.59**	**30.40**	0.60	69.5	250	0.24	94.77%
Felicity Crescent	101A	101B		0.180	6.8	0.00	85.00	1.31	4.00	1.38	1.50	0.00	0.37	**1.75**	**30.40**	0.60	13	250	0.24	94.24%
Felicity Crescent	101B	102A		0.550	34.0	0.00	119.00	1.86	4.00	1.93	1.50	0.00	0.52	**2.45**	**313.75**	1.08	74	600	0.24	99.22%
Felicity Crescent	102A	103A		0.650	20.4	0.00	139.40	2.51	4.00	2.26	1.50	0.00	0.70	**2.96**	**313.75**	1.08	75	600	0.24	99.06%
Felicity Crescent	103A	104D		0.140	6.8	0.00	146.20	2.65	4.00	2.37	1.50	0.00	0.74	**3.11**	**311.13**	1.07	32.8	600	0.24	99.00%
External																				
Street 1	116C	116B		1.630	140.4	0.00	140.40	1.63	4.00	2.28	1.50	0.00	0.46	**2.74**	**30.40**	0.60	32	250	0.24	90.99%
Joshua Street	116B	104C		0.200	3.4	0.00	143.80	1.83	4.00	2.33	1.50	0.00	0.51	**2.84**	**30.40**	0.60	60.4	250	0.24	90.66%
Joshua Street	104A	104C		0.300	6.8	0.00	6.80	0.30	4.00	0.11	1.50	0.00	0.08	**0.19**	**27.60**	0.85	45	200	0.65	99.31%
Joshua Street	104C	104D				0.00	150.60	2.13	4.00	2.44	1.50	0.00	0.60	**3.04**	**62.02**	1.22	2.5	250	1.00	95.10%
Joshua Street	104D	EX				4.13	3777.30	54.55	3.36	51.34	1.50	3.59	16.43	**71.36**	**85.85**	0.75	49.6	375	0.22	16.88%

Where Q = average daily per capita flow 350 l/cap/d
I = Unit of peak extraneous flow 0.28 l/sec/Ha
M = Peaking Factor = 1+(14/(4+P)^0.5)), P=POP. IN 1000'S, Max of 4
Q(p) = Peak population flow (l/s)
Q(i) = peak extraneous flow (l/s)
Population = AVERAGE Per unit = 3.4 singles
2.7 Townhouses
General Population Densities Low Density = 120 pers / per gross hectare
Commercial and School - Average flow 50,000 l/ha/day with Peaking Factor = 1.5

SPECIFY
Coeff. of friction (n) = 0.013

REV. # : 9 15-Dec-08



LEGEND

SANITARY TRIBUTARY OUTLINE

TRIBUTARY OUTLINE PREVIOUS PHASE

BLD C2 / 0.010 | 5.40 — AREA IDENTIFICATION, POPULATION, AREA IN HECTARES

POPULATION:
STACKED TOWNHOUSE = 1.8 PPU

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEYPLAN N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	REISSUED FOR CWN	DGY	20:02:07
4	ISSUED FOR CWN	DGY	19:12:24
3	REVISED PER CITY COMMENTS	DGY	19:11:21
2	REVISED PER CITY COMMENTS	DGY	19:04:09
1	ISSUED FOR CITY REVIEW	DGY	18:10:11

CLARIDGE HOMES (CARSON) INC.
2001-210 GLADSTONE AVE
OTTAWA, ON
K2P OY6
613-233-6030

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

SPRING VALLEY TRAILS ZENS
WALK-UP TOWNHOUSES

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/02/07
PROVINCE OF ONTARIO

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale 1:250

Design	Date
R.M./W.Z.	OCTOBER 2018
Drawn	Checked
E.H.	D.G.Y.
Project No.	Drawing No.
115201	400

CITY PLAN No. 18055

CITY FILE No. D07-12-18-0167

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Ottawa, Ontario K1S 5N4 Canada
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ibigroup.com

SANITARY SEWER DESIGN SHEET

Spring Valley Trails ZENS
CITY OF OTTAWA
Claridge Homes

LOCATION: STREET	LOCATION: AREA ID	LOCATION: FROM MH	LOCATION: TO MH	RESIDENTIAL: AREA w/ Units (Ha)	RESIDENTIAL: UNIT TYPES SF	UNIT TYPES SD	UNIT TYPES TH	UNIT TYPES APT	RESIDENTIAL: AREA w/o Units (Ha)	POPULATION IND	POPULATION CUM	RES PEAK FACTOR	PEAK FLOW (L/s)	ICI AREAS: AREA (Ha) INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	ICI PEAK FACTOR	PEAK FLOW (L/s)	INFILTRATION ALLOWANCE: AREA (Ha) IND	AREA (Ha) CUM	FLOW (L/s)	FIXED FLOW (L/s) IND	FIXED FLOW (L/s) CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN: CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	AVAILABLE CAPACITY (%)
										121.5																								
Rolling Meadow Cres.		*MH 152A*	*MH 151A*	0.190			6		0.00	16.2	137.7	3.56	1.59	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.19	0.19	0.06	0.00	0.00	1.65	44.08	*31.74*	*200*	*1.66*	1.359	42.43	96.25%
Rolling Meadow Cres.		*MH 151A*	*MH 150A*	0.190			6		0.00	16.2	153.9	3.55	1.77	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.19	0.34	0.11	0.00	0.00	1.88	44.08	*39.19*	*200*	*1.66*	1.359	42.20	95.73%
	BLD A4	BLD A4	MH 13A	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.01	0.00	0.00	0.00	0.07	15.89	5.74	150	1.00	0.871	15.82	99.57%
	BLD A2	BLD A2	MAIN	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.02	0.01	0.00	0.00	0.07	18.24	2.92	150	1.00	1.000	18.17	99.60%
	13A	MH 13A	MH 12A	0.021					0.00	0.0	10.8	3.73	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.02	0.04	0.01	0.00	0.00	0.14	34.22	18.01	200	1.00	1.055	34.07	99.58%
	12A	MH 12A	MH 11A	0.018					0.00	0.0	10.8	3.73	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.02	0.06	0.02	0.00	0.00	0.15	34.22	29.15	200	1.00	1.055	34.07	99.56%
	BLD A1	BLD A1	MH 10A	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.07	0.02	0.00	0.00	0.09	15.89	2.13	150	1.00	0.871	15.80	99.44%
	BLD B2	BLD B2	MAIN	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.08	0.03	0.00	0.00	0.09	15.89	6.72	150	1.00	0.871	15.80	99.42%
	BLD B4	BLD B4	MAIN	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.09	0.03	0.00	0.00	0.10	15.89	6.72	150	1.00	0.871	15.79	99.40%
	BLD A3	BLD A3	MAIN	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.10	0.03	0.00	0.00	0.10	15.89	2.13	150	1.00	0.871	15.79	99.38%
	10A	MH 10A	MH 11A	0.047					0.00	0.0	32.4	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.05	0.15	0.05	0.00	0.00	0.44	20.24	20.75	200	0.35	0.624	19.81	97.85%
	11A	MH 11A	MH 21A	0.000					0.00	0.0	32.4	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.15	0.05	0.00	0.00	0.44	34.22	3.08	200	1.00	1.055	33.78	98.73%
		MH 21A	MH 20A	0.000					0.00	0.0	32.4	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.15	0.05	0.00	0.00	0.44	54.10	42.35	200	2.50	1.668	53.67	99.20%
	BLD D3	BLD D3	MH 5A	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.16	0.05	0.00	0.00	0.12	15.89	3.61	150	1.00	0.871	15.77	99.26%
	5A	MH 5A	MH 4A	0.015					0.00	0.0	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.02	0.17	0.06	0.00	0.00	0.12	34.22	15.51	200	1.00	1.055	34.09	99.64%
	BLD D1	BLD D1	MH 4A	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.17	0.06	0.00	0.00	0.12	15.89	3.49	150	1.00	0.871	15.77	99.23%
	4A	MH 4A	MH 3A	0.012					0.00	0.0	10.8	3.73	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.19	0.06	0.00	0.00	0.19	34.22	7.07	200	1.00	1.055	34.02	99.44%
	BLD C1	BLD C1	MH 6A	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.20	0.06	0.00	0.00	0.13	15.89	2.41	150	1.00	0.871	15.76	99.18%
	BLD C3	BLD C3	MAIN	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.21	0.07	0.00	0.00	0.13	15.89	2.41	150	1.00	0.871	15.75	99.16%
	6A	MH 6A	MH 3A	0.011					0.00	0.0	10.8	3.73	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.22	0.07	0.00	0.00	0.20	48.39	21.25	200	2.00	1.492	48.19	99.58%
	BLD D2	BLD D2	MAIN	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.23	0.08	0.00	0.00	0.14	15.89	4.31	150	1.00	0.871	15.75	99.11%
	3A	MH 3A	MH 2A	0.020					0.00	0.0	32.4	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.02	0.25	0.08	0.00	0.00	0.47	22.95	41.19	200	0.45	0.708	22.48	97.96%
	BLD C2	BLD C2	MH 2A	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.26	0.09	0.00	0.00	0.15	15.89	23.61	150	1.00	0.871	15.74	99.05%
	BLD C4	BLD C4	MAIN	0.010				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.27	0.09	0.00	0.00	0.15	15.89	5.66	150	1.00	0.871	15.73	99.03%
		MH 2A	MH 20A	0.010					0.00	0.0	37.8	3.67	0.45	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.28	0.09	0.00	0.00	0.54	20.24	3.50	200	0.35	0.624	19.70	97.33%
	BLD B1	BLD B1	MAIN	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.27	0.09	0.00	0.00	0.15	15.89	9.04	150	1.00	0.871	15.73	99.03%
	BLD D4	BLD D4	MAIN	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.28	0.09	0.00	0.00	0.16	15.89	15.60	150	1.00	0.871	15.73	99.01%
	BLD B3	BLD B3	MAIN	0.011				3	0.00	5.4	5.4	3.75	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	0.29	0.10	0.00	0.00	0.16	15.89	9.04	150	1.00	0.871	15.73	98.98%
	2A	MH 20A	MH 1A	0.153					0.00	0.0	86.4	3.61	1.01	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.15	0.41	0.14	0.00	0.00	1.15	20.24	22.62	200	0.35	0.624	19.10	94.34%
	1A	MH 1A	MAIN	0.078					0.00	0.0	86.4	3.61	1.01	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.08	0.37	0.12	0.00	0.00	1.13	20.24	11.29	200	0.35	0.624	19.11	94.41%
Rolling Meadow Cres.		*MH 150A*	*MH 300A*				2		0.00	5.4	245.7	3.49	2.78	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.37	0.12	0.00	0.00	2.90	23.71	*12.54*	*200*	*0.48*	0.731	20.80	87.76%
Rolling Meadow Cres.		*MH 300A*	*MH 145A*	0.250			1		0.00	19.8	265.5	3.48	2.99	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.25	0.25	0.08	0.00	0.00	3.08	22.70	*103.70*	*200*	*0.44*	0.700	19.62	86.44%
				0.55			15	48		265.5	TRUE																							

Design Parameters:

Residential				ICI Areas		
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	28,000	L/Ha/day	
APT	1.8	p/p/u	COM	28,000	L/Ha/day	
Other	60	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart
				17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

Designed: A.Z.

Checked: R.M.

Dwg. Reference: 115201-400

No.	Revision	Date
1.	Servicing Brief - Submission No. 1	2018-10-05
	Servicing Brief - Submission No. 2	2019-03-11
	Servicing Brief - Submission No. 3	2019-09-20

File Reference:	Date:	Sheet No:
115201.5.7.1	2018-10	1 of 1

Sanitary MH	Sanitary HGL	Storm HGL (at Nearest MH)		Proposed USF [A] (at Nearest Lot)	
Joshua Street					
39	69.32				
38	68.88				
MH104D	68.57	72.54	108	73.89	Lot 1
MH116A	68.61	73.06	116	No houses yet	NA
MH127B	68.63	69.86	127C	71.05	TH unit 259
MH130A	68.67	68.79	130	70.10	Lot 71
MH130B	68.69	69.36	130C	70.06	Lot 49
MH195A	68.71	69.10	195	69.91	Lot 53
Felicity Crescent					
MH103A	68.55	70.76	103	73.46	Lot 6
MH102A	68.5	69.10	102	70.54	Lot 12
MH101B	68.46	68.25	101	69.50	Lot 17
MH101A	68.46	68.25	101	69.56	Lot 18
MH111B	68.46	68.42	111	No houses yet	NA
MH120A	68.79	68.45	120	69.14	Lot 93
Saddleridge Drive					
MH201A	68.65	68.61	201	69.60	Lot 92
Felicity Crescent					
MH120B	68.63	68.45	120	69.14	Lot 93
MH160A	68.64	68.58	160	69.32	Lots 96, 104, 105
MH160B	68.67	68.60	160C	69.59	Lot 109
MH161A	68.67	68.72	161	69.65	Lot 111
MH162A	68.73	68.89	162	69.70	Lot 82
Foutainhead Drive					
MH201A	68.65	68.61	201	69.60	Lot 92
MH203A	69.04	69.72	203	70.35	Lot 26
MH223A	68.65	69.33	223	No houses yet	NA
MH123A	68.74	69.47	123	69.75	Lots 77, 78
MH162A	68.73	68.89	162	69.70	Lot 82
MH329A	68.79	68.95	329	69.70	Lots 76, 77
MH330A	68.79	69.02	330	69.80	Lots 71, 87
MH306A	68.79	69.06	306	69.61	Lot 91
Winterhaven Drive					
MH300A	68.82	68.99	300	69.70	Lots 105, 106
MH301A	68.83	68.99	301	69.70	Lots 107, 108
MH302A	68.87	69.05	302	69.80	Lots 93, 94, 113, 114
MH303N	68.9	69.09	303	69.80	Lots 92, 116, 117, 120
MH304A	68.91	69.12	304	69.80	Lot 119
Esterbrook Drive					
MH310A	69.09	70.10	310	70.86	Lot 33
MH311A	69.35	70.20	311	70.91	Lot 32
MH312A	70.08	70.79	312	71.51	Lot 28
Spring Valley Drive					
MH309A	68.81	69.08	309	70.28	Lot 37
MH313A	69.24	70.31	313	71.84	Lot 17
MH316A	70.85	72.02	316	73.40	TH Unit 191
MH317A	72.39	73.60	317	74.60	TH Unit 186
MH318A	74.1	75.03	318	76.71	TH Unit 180
MH319A	75.95	77.31	319	79.26	TH Unit 42
MH321A	78.42	78.95	321	80.91	TH Unit 22
MH322A	81.65	81.83	322	83.16	TH Units 32, 33
MH323A1	83.86	84.02	323	84.61	TH Unit 23
Knotridge Drive					
MH320A	77.53	77.70	320	78.76	TH Unit 172
Dovehaven Drive					
MH314A	70.36	70.89	314	71.74	Lot 13
MH315A	70.85	71.13	315	71.94	Lot 11
MH316A	70.85	72.02	316	73.40	Lot 191

IBI GROUP

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
SPRING VALLEY TRAILS ZENS WALK-UP TOWNHOUSES
CITY OF OTTAWA
CLARIDGE HOMES

JOB #: 115201 - 5.7
DATE: 2019-09-20
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: 02

Rolling Meadow Crescent MH300A to MH150A

FRICTION LOSS		FROM MH	TO MH	PIPE ID
Rolling Meadow Cre.		**MH300A**	**MH150A**	
INVERT ELEVATION (m)		72.590	72.650	
OBVERT ELEVATION (m)		72.790	72.850	
DIAMETER (mm)				200
LENGTH (m)				12.5
FLOW (l/s)				1.38
HGL (m)	***	**68.820**	**68.820**	**0.000**
MANHOLE COEF K=	0.75	LOSS (m)	0.000	
TOTAL HGL (m)			**72.682**	
MAX. SURCHARGE (mm)			**-168**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.450	0.05	0.72	22.68

HYDRAULIC SLOPE = 30.797 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.061
DESIGN FLOW DEPTH = 0.032

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

Rolling Meadow Crescent MH150A to MH 1A

FRICTION LOSS		FROM MH	TO MH	PIPE ID
ZENS		**MH150A**	**MH1A**	
INVERT ELEVATION (m)		72.650	73.390	
OBVERT ELEVATION (m)		72.850	73.590	
DIAMETER (mm)				200
LENGTH (m)				11.3
FLOW (l/s)				1.38
HGL (m)	***	**72.682**	**72.682**	**0.000**
MANHOLE COEF K=	0.75	LOSS (m)	0.000	
TOTAL HGL (m)			**73.406**	
MAX. SURCHARGE (mm)			**-184**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.350	0.05	2.67	83.93

HYDRAULIC SLOPE = 6.413 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.016
DESIGN FLOW DEPTH = 0.016

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS		FROM MH	TO MH	PIPE ID
ZENS		**MH1A**	**MH20A**	
INVERT ELEVATION (m)		73.410	73.489	
OBVERT ELEVATION (m)		73.610	73.689	
DIAMETER (mm)				200
LENGTH (m)				22.6
FLOW (l/s)				1.26
HGL (m)	***	**73.406**	**73.406**	**0.000**
MANHOLE COEF K=	0.05	LOSS (m)	0.000	
TOTAL HGL (m)			**73.523**	
MAX. SURCHARGE (mm)			**-166**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.350	0.05	0.62	19.37

HYDRAULIC SLOPE = 0.517 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.065
DESIGN FLOW DEPTH = 0.034

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS		FROM MH	TO MH	PIPE ID
ZENS		**MH20A**	**MH2A**	
INVERT ELEVATION (m)		73.509	73.521	
OBVERT ELEVATION (m)		73.709	73.721	
DIAMETER (mm)				200
LENGTH (m)				3.5
FLOW (l/s)				1.26
HGL (m)	***	**73.523**	**73.523**	**0.000**
MANHOLE COEF K=	0.05	LOSS (m)	0.000	
TOTAL HGL (m)			**73.555**	
MAX. SURCHARGE (mm)			**-166**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.350	0.05	0.61	19.20

HYDRAULIC SLOPE = 0.914 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.066
DESIGN FLOW DEPTH = 0.034

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS		FROM MH	TO MH	PIPE ID
ZENS		**MH2A**	**MH3A**	
INVERT ELEVATION (m)		73.581	73.768	
OBVERT ELEVATION (m)		73.781	73.968	
DIAMETER (mm)				200
LENGTH (m)				41.2
FLOW (l/s)				1.26
HGL (m)	***	**73.555**	**73.556**	**0.001**
MANHOLE COEF K=	0.05	LOSS (m)	0.000	
TOTAL HGL (m)			**73.800**	
MAX. SURCHARGE (mm)			**-168**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.450	0.05	0.70	22.09

HYDRAULIC SLOPE = 0.595 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.057
DESIGN FLOW DEPTH = 0.032

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
SPRING VALLEY TRAILS ZENS WALK-UP TOWNHOUSES
CITY OF OTTAWA
CLARIDGE HOMES

JOB #: 115201 - 5.7
DATE: 2019-09-20
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: 02

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH3A**	**MH4A**	
INVERT ELEVATION (m)	73.798	73.869	
OBVERT ELEVATION (m)	73.998	74.069	
DIAMETER (mm)			200
LENGTH (m)			7.1
FLOW (l/s)			1.26
HGL (m) ***	**73.800**	**73.800**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**73.895**	
MAX. SURCHARGE (mm)		**-174**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.05	32.84

HYDRAULIC SLOPE = 1.343 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.038
DESIGN FLOW DEPTH = 0.026

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH4A**	**MH5A**	
INVERT ELEVATION (m)	73.899	74.054	
OBVERT ELEVATION (m)	74.099	74.254	
DIAMETER (mm)			200
LENGTH (m)			15.5
FLOW (l/s)			1.26
HGL (m) ***	**73.895**	**73.895**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.080**	
MAX. SURCHARGE (mm)		**-174**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.77

HYDRAULIC SLOPE = 1.192 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.038
DESIGN FLOW DEPTH = 0.026

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH3A**	**MH6A**	
INVERT ELEVATION (m)	74.341	74.766	
OBVERT ELEVATION (m)	74.541	74.966	
DIAMETER (mm)			200
LENGTH (m)			21.3
FLOW (l/s)			1.26
HGL (m) ***	**73.800**	**73.800**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.788**	
MAX. SURCHARGE (mm)		**-178**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	2.000	0.05	1.48	46.36

HYDRAULIC SLOPE = 4.649 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.027
DESIGN FLOW DEPTH = 0.022

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH20A**	**MH21A**	
INVERT ELEVATION (m)	73.675	74.734	
OBVERT ELEVATION (m)	73.875	74.934	
DIAMETER (mm)			200
LENGTH (m)			42.4
FLOW (l/s)			1.26
HGL (m) ***	**73.523**	**73.524**	**0.001**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.754**	
MAX. SURCHARGE (mm)		**-180**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	2.500	0.05	1.65	51.84

HYDRAULIC SLOPE = 2.907 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.024
DESIGN FLOW DEPTH = 0.020

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH21A**	**MH11A**	
INVERT ELEVATION (m)	74.794	74.825	
OBVERT ELEVATION (m)	74.994	75.025	
DIAMETER (mm)			200
LENGTH (m)			3.1
FLOW (l/s)			1.26
HGL (m) ***	**74.754**	**74.754**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.851**	
MAX. SURCHARGE (mm)		**-174**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.05	32.89

HYDRAULIC SLOPE = 3.149 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.038
DESIGN FLOW DEPTH = 0.026

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

IBI GROUP

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
SPRING VALLEY TRAILS ZENS WALK-UP TOWNHOUSES
CITY OF OTTAWA
CLARIDGE HOMES

JOB #: 115201 - 5.7
DATE: 2019-09-20
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: 02

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH11A**	**MH10A**	
INVERT ELEVATION (m)	74.845	74.918	
OBVERT ELEVATION (m)	75.045	75.118	
DIAMETER (mm)			200
LENGTH (m)			20.8
FLOW (l/s)			1.26
HGL (m) ***	**74.851**	**74.851**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.952**	
MAX. SURCHARGE (mm)		**-166**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.350	0.05	0.62	19.44

HYDRAULIC SLOPE = 0.487 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.065
DESIGN FLOW DEPTH = 0.034

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH11A**	**MH12A**	
INVERT ELEVATION (m)	75.251	75.543	
OBVERT ELEVATION (m)	75.451	75.743	
DIAMETER (mm)			200
LENGTH (m)			29.2
FLOW (l/s)			1.26
HGL (m) ***	**74.851**	**74.851**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**75.569**	
MAX. SURCHARGE (mm)		**-174**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.81

HYDRAULIC SLOPE = 2.463 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.038
DESIGN FLOW DEPTH = 0.026

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH12A**	**MH13A**	
INVERT ELEVATION (m)	75.603	75.783	
OBVERT ELEVATION (m)	75.803	75.983	
DIAMETER (mm)			200
LENGTH (m)			18.0
FLOW (l/s)			1.26
HGL (m) ***	**74.851**	**74.851**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**75.809**	
MAX. SURCHARGE (mm)		**-174**	

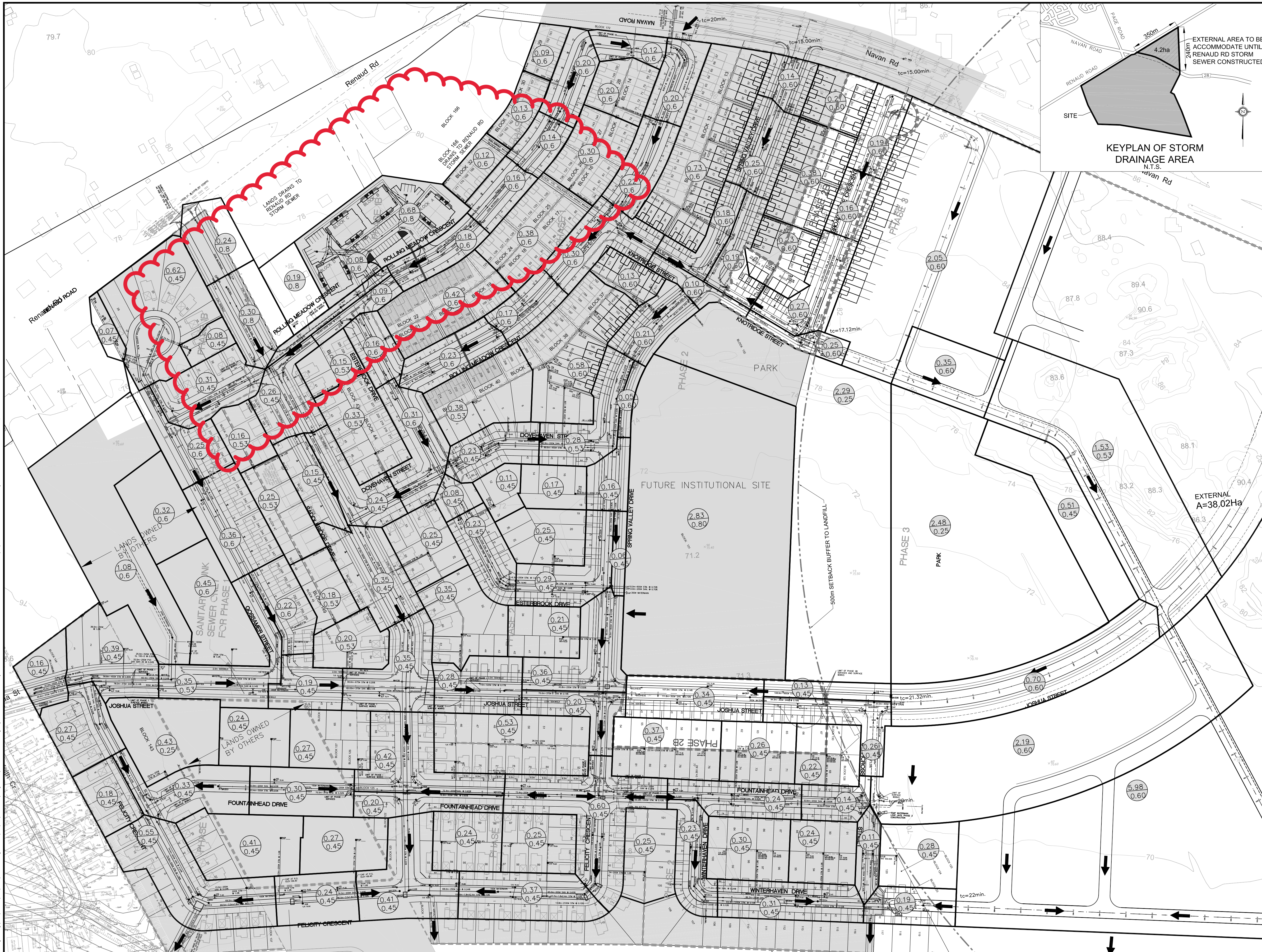
MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.77

HYDRAULIC SLOPE = 5.319 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.038
DESIGN FLOW DEPTH = 0.026

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.04 m/s
HL = K_L * V^2/ 2g

Rolling Meadow Crescent Sanitary HGL has no impact on the proposed development.

APPENDIX C



NOTE:

SEE RESPECTIVE SERVICING PLANS FOR SEWER SIZES AND SLOPES.

LEGEND:

STORM

0.19 — AREA IN HECTARES

0.43 — RUNOFF COEFFICIENT

MAJOR STORM ROUTE

RUNOFF COEFFICIENT

0.25 – PARK/OPEN SPACE
0.45 – SINGLE
0.53 – SINGLES/TOWNS
0.60 – TOWNHOUSES
0.80 – COMMERCIAL/INSTITUTIONAL

No.	REVISIONS	By	Date
19	REVISED AS PER CITY COMMENTS	DGY	12:01:18
18	REVISE AS PER CITY COMMENTS	DGY	11:08:11
17	ADDED PHASE 2B LIMITS	DGY	11:06:16
16	REVISED AS PER NEW LEGAL	DGY	10:11:17
15	REVISED AS PER NEW LEGAL	DGY	10:10:25
14	REVISED AS PER CITY COMMENTS	DGY	10:09:20
13	REVISED AS PER NEW LEGAL	DGY	09:06:01
12	REVISED FOR PHASE 2	DGY	09:02:02
11	REVISED AS PER CITY COMMENTS	DGY	09:01:19
10	REVISED GOSSAMER	DGY	08:07:23
9	REVISED PRAIRIE/GOSSAMER	DGY	08:06:19
8	REVISED AS PER NEW LEGAL	DGY	08:03:04
7	REVISED AS PER NEW LEGAL	DGY	08:02:20
6	REVISED AS PER NEW LEGAL	DGY	07:08:16
5	REVISED AS PER CITY COMMENTS JAN 16, 2007	DGY	07:01:23
4	REVISE DRAFT PLAN	DGY	06:12:21
3	REVISED AS PER CITY COMMENTS	DGY	06:10:30
2	REVISED AS PER CITY COMMENTS	DGY	06:09:13
1	ISSUED FOR APPROVAL	DGY	06:08:16

CLARIDGE HOMES

IBI GROUP

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Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title

CLARIDGE HOMES SPRING VALLEY

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
PROVINCE OF ONTARIO

N

Drawing Title

STORM DRAINAGE AREA PLAN PHASE 2B

Scale
1:1250

Design	Date
D.G.Y.	AUGUST 2006
Drawn	**Checked**
D.D.	
Project No.	**Drawing No.**
10261	500

IBI GROUP	CCL/IBI 1770 WOODWARD DRIVE OTTAWA, ONTARIO K2C OP8	STORM SEWER DESIGN SHEET PROJECT: SPRING VALLEY LOCATION: CITY OF OTTAWA DEVELOPER: CLARIDGE HOMES	PAGE: 1 OF 2 JOB #: 3625-LD DATE: JULY 2006 DESIGN: DY

LOCATION			AREA (Ha.)							DESIGN FLOW					SEWER DATA						
STREET	FROM MH	TO MH	C= 0.25	C= 0.45	C= 0.53	C= 0.6	C= 0.8	INDIV. 2.78AC	ACCUM. 2.78AC	INLET (min.)	TIME IN PIPE	TOTAL	I (mm/Hr)	PEAK FLOW (l/s)	CAP. (l/s)	LENGTH (M)	PIPE (mm)	SLOPE (%)	n	VEL. (M/s)	AVAIL. CAP. (%)
Street 1	Stub	116				1.40		2.34	2.34	15.00	0.29	15.29	83.60	**195.62**	**317.31**	25.0	525	0.5	0.013	1.42	38.35%
Joshua Avenue	116	108		0.39				0.49	2.83	15.00	0.59	15.59	83.60	**236.59**	**274.17**	58.8	450	0.85	0.013	1.67	13.71%
Joshua Avenue	108	104						0.00	2.83	15.59	0.05	15.63	81.70	**231.21**	**473.15**	7.9	450	2.53	0.013	2.882	51.13%
Joshua Avenue	104B	104		0.16				0.20	0.20	10.00	0.36	10.36	104.20	**20.84**	**87.71**	37.0	250	2	0.013	1.731	76.24%
Felicity Crescent	104	103						0.00	3.03	15.63	0.20	15.83	81.60	**247.25**	**515.18**	37.0	450	3	0.013	3.138	52.01%
Felicity Crescent	103	102	0.430	0.45				0.86	3.89	15.83	0.59	16.42	81.00	**315.09**	**511.50**	81.0	525	1.3	0.013	2.289	38.40%
Felicity Crescent	102	101		0.88				1.10	4.99	16.42	0.53	16.95	79.20	**395.21**	**527.14**	75.5	525	1.38	0.013	2.359	25.03%
Rolling Meadow Crescent	155	154				0.09		0.15	0.15	15.00	0.46	15.46	83.60	**12.54**	**103.82**	56.9	250	2.8	0.013	2.049	87.92%
Rolling Meadow Crescent	154	153				0.20		0.33	0.48	15.46	0.20	15.66	82.10	**39.41**	**131.59**	31.2	250	4.5	0.013	2.597	70.05%
Rolling Meadow Crescent	153	152				0.55		0.92	1.40	15.66	0.51	16.17	81.50	**114.10**	**131.59**	79.6	250	4.5	0.013	2.597	13.29%
Rolling Meadow Crescent	152	151				0.00		0.00	1.40	16.17	0.18	16.35	79.90	**111.86**	**214.01**	31.3	300	4.5	0.013	2.933	47.73%
Rolling Meadow Crescent	151	150B				0.18		0.30	1.70	16.35	0.30	16.66	79.40	**134.98**	**156.95**	39.2	300	2.42	0.013	2.151	14.00%
Rolling Meadow Crescent	150B	300				0.08	0.87	2.07	3.77	16.66	0.21	16.86	78.60	**296.32**	**350.82**	14.9	600	0.3	0.013	1.202	15.53%
Rolling Meadow Crescent	300	145						0.00	3.77	16.86	1.46	18.32	78.00	**294.06**	**350.82**	104.9	600	0.3	0.013	1.202	16.18%
Saddleridge Drive	156	145					0.54	1.20	1.20	10.00	0.68	10.68	104.20	**125.04**	**142.65**	80.0	300	2	0.013	1.955	12.34%
Gossamer	200	201		0.15				0.19	0.19	15.00	0.74	15.74	83.60	**15.88**	**43.88**	38.5	250	0.5	0.013	0.866	63.80%
Gossamer	201	202		0.62				0.78	0.97	15.74	0.58	16.32	81.20	**78.76**	**129.29**	39.3	375	0.5	0.013	1.134	39.08%
Prairie	202	145		0.31				0.39	1.36	16.32	1.21	17.53	79.50	**108.12**	**129.29**	82.4	375	0.5	0.013	1.134	16.37%
Saddleridge Drive	145	134		0.26	0.310			0.78	7.11	18.32	0.42	18.74	74.20	**527.56**	**784.53**	68.2	600	1.5	0.013	2.688	32.75%
Saddleridge Drive	134	133						0.00	7.11	18.74	0.41	19.15	73.10	**519.74**	**784.53**	66.0	600	1.5	0.013	2.688	33.75%
External		143B	4.200					2.92	2.92	20.00	0.11	20.11	70.30	**205.28**	**205.33**	12.0	375	1.26	0.013	1.801	0.03%
Rolling Meadow Crescent	143B	142				0.12		0.20	3.12	20.11	0.05	20.17	70.00	**218.40**	**306.11**	8.7	375	2.8	0.013	2.685	28.65%
Rolling Meadow Crescent	142	141				0.40		0.67	3.79	20.17	0.53	20.69	69.90	**264.92**	**306.11**	84.7	375	2.8	0.013	2.685	13.46%
Rolling Meadow Crescent	141	140						0.00	3.79	20.69	0.24	20.93	68.80	**260.75**	**306.11**	38.2	375	2.8	0.013	2.685	14.82%
Rolling Meadow Crescent	140	139				0.82		1.37	5.16	20.93	0.46	21.39	68.30	**352.43**	**579.86**	97.3	450	3.8	0.013	3.532	39.22%
Rolling Meadow Crescent	139	138				0.38		0.63	5.79	21.39	0.29	21.68	67.30	**389.67**	**448.70**	35.3	525	1	0.013	2.008	13.16%
Rolling Meadow Crescent	138	137				0.40		0.67	6.46	21.68	0.67	22.35	66.80	**431.53**	**640.64**	88.7	600	1	0.013	2.195	32.64%

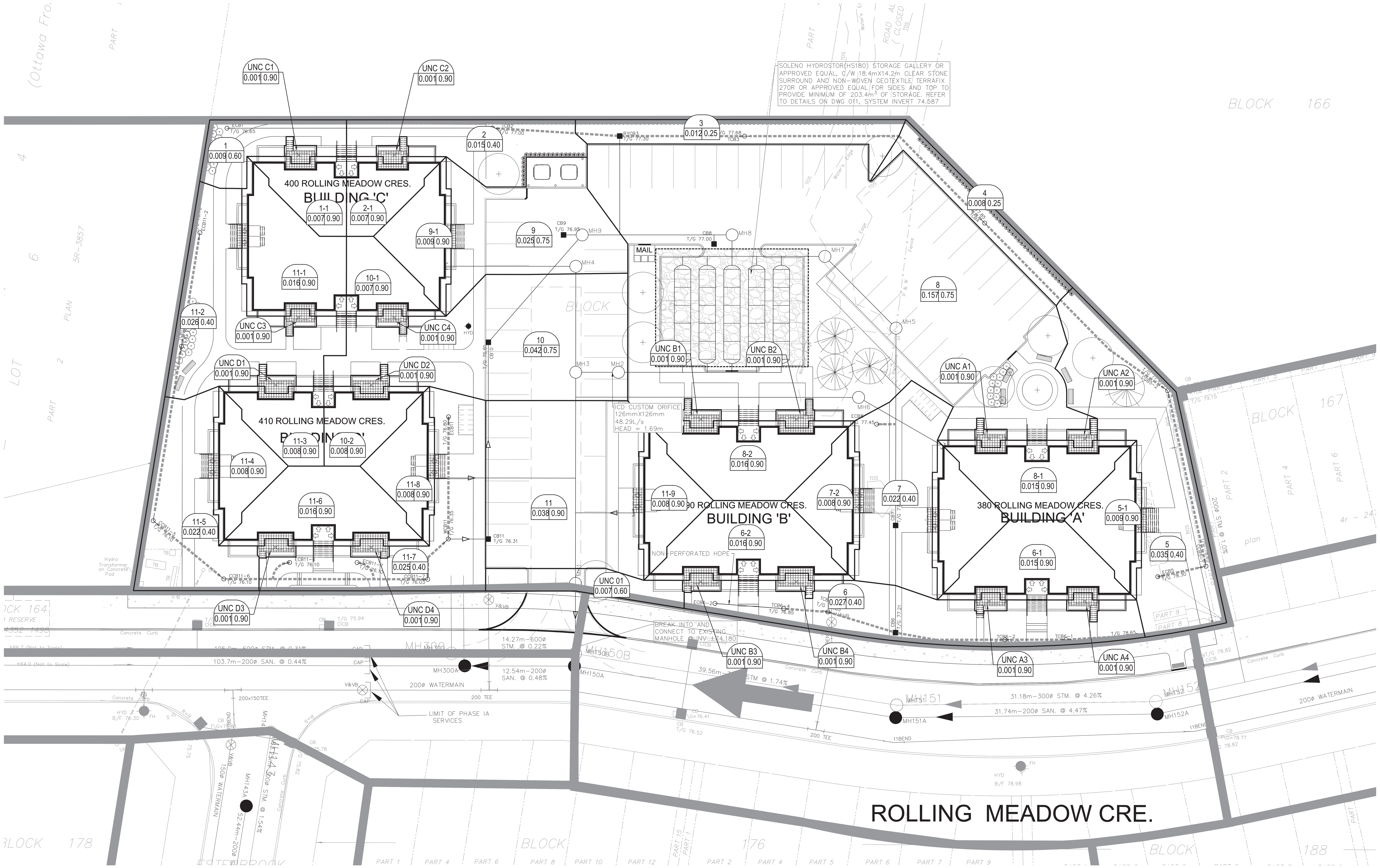
Q = Peak Flow in Litres per Second (l/s)

A = Area in Hectares (ha.)

I = Rainfall Intensity in Millimeters per Hour (mm/hr) ` $I=998.07/(6.053 + TC)^{0.814}$

C = Runoff Coefficient

REV. # : July 22, 2008



LEGEND

- STORM TRIBUTARY OUTLINE
- TRIBUTARY OUTLINE PREVIOUS PHASES
- AREA NUMBER (500)
- COEFFICIENT (0.75)
- AREA (ha) (0.81)

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEYPLAN N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	REISSUED FOR CWN	DGY	20:02:07
4	ISSUED FOR CWN	DGY	19:12:24
3	REVISED PER CITY COMMENTS	DGY	19:11:21
2	REVISED PER CITY COMMENTS	DGY	19:04:09
1	ISSUED FOR CITY REVIEW	DGY	18:10:11

CLARIDGE HOMES (CARSON) INC.
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K2P 0Y6
613–233–6030

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Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

SPRING VALLEY TRAILS ZENS
WALK-UP TOWNHOUSES

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/02/07
PROVINCE OF ONTARIO

Drawing Title

STORM DRAINAGE AREA PLAN

Scale 1:250

Design R.M./W.Z. | Date OCTOBER 2018
Drawn E.H. | Checked D.G.Y.
Project No. 115201 | Drawing No. 500

CITY PLAN No. 18055

CITY FILE No. D07-12-18-0167

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STORM SEWER DESIGN SHEET

Spring Valley Trails ZENS
City of Ottawa
Claridge Homes

LOCATION				AREA (Ha)							RATIONAL DESIGN FLOW															SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.40	C= 0.50	C= 0.60	C= 0.75	C= 0.90	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	(%)
Rolling Meadow Cres.		MH 152	MH 151								1.40	1.40	10.00	0.18	10.18	76.81	104.19	122.14	178.56	107.53	145.87	171.00	249.98		107.53	208.22	31.18	300			4.26	2.854	100.69	48.36%
Rolling Meadow Cres.		MH 151	MH 150B								0.30	1.70	10.18	0.31	10.49	76.11	103.24	121.02	176.91	129.39	175.51	205.73	300.75		129.39	156.94	39.56	300			2.42	2.151	27.54	17.55%
	UNC A	BLD A	MH 6							0.004	0.01	0.01	10.00	0.23	10.23	76.81	104.19	122.14	178.56	0.77	1.04	1.22	1.79		0.77	15.89	11.83	150			1.00	0.871	15.12	95.16%
		MH 6	MAIN								0.00	0.01	10.23	0.54	10.77	75.95	103.01	120.75	176.52	0.76	1.03	1.21	1.77		0.76	34.22	34.10	200			1.00	1.055	33.46	97.78%
	5 & 5-1	ECB 5	CCB 5-1			0.035				0.009	0.06	0.06	10.00	0.11	10.11	76.81	104.19	122.14	178.56	4.72	6.40	7.50	10.97		4.72	43.87	5.95	250			0.50	0.866	39.15	89.24%
		CCB 5-1	CCB 5-2								0.00	0.06	10.11	0.22	10.34	76.37	103.59	121.43	177.52	4.69	6.36	7.46	10.91		4.69	81.36	21.67	250			1.72	1.606	76.67	94.23%
		CCB 5-2	TCB 4								0.00	0.06	10.34	0.58	10.92	75.53	102.43	120.07	175.51	4.64	6.29	7.38	10.78		4.64	43.87	29.91	250			0.50	0.866	39.23	89.42%
	4	TCB 4	TCB 3		0.008						0.01	0.07	10.92	0.64	11.56	73.46	99.59	116.73	170.60	4.92	6.67	7.82	11.43		4.92	43.87	33.34	250			0.50	0.866	38.95	88.78%
	3	TCB 3	RYCB 3		0.012						0.01	0.08	11.56	0.29	11.85	71.30	96.63	113.23	165.48	5.37	7.28	8.53	12.47		5.37	43.87	15.04	250			0.50	0.866	38.50	87.75%
	1 & 1-1	ECB 1	TCB 2					0.009		0.007	0.03	0.03	10.00	0.71	10.71	76.81	104.19	122.14	178.56	2.50	3.39	3.97	5.81		2.50	24.19	31.97	200			0.50	0.746	21.70	89.67%
	2 & 2-1	TCB 2	RYCB 3			0.015				0.007	0.03	0.07	10.71	0.30	11.01	74.17	100.57	117.87	172.28	4.95	6.71	7.86	11.49		4.95	43.87	15.40	250			0.50	0.866	38.92	88.72%
		RYCB 3	MAIN								0.00	0.14	11.85	0.19	12.04	70.37	95.36	111.73	163.27	10.00	13.55	15.87	23.19		10.00	34.22	11.93	200			1.00	1.055	24.22	70.78%
	11-1 & 11-2 & 11-3	ECB 11-2	CCB 11-5			0.026				0.024	0.09	0.09	10.00	0.34	10.34	76.81	104.19	122.14	178.56	6.83	9.27	10.87	15.88		6.83	52.64	21.29	250			0.72	1.039	45.81	87.02%
	11-4 & 11-5	CCB 11-5	CCB 11-6			0.022				0.008	0.04	0.13	10.34	0.12	10.46	75.52	102.42	120.06	175.50	10.08	13.67	16.02	23.42		10.08	75.98	11.04	250			1.50	1.500	65.90	86.74%
	11-6 & 11-7	CCB 11-6	CCB 11-7			0.025				0.016	0.07	0.20	10.46	0.49	10.95	75.07	101.80	119.33	174.42	15.11	20.49	24.02	35.11		15.11	43.87	25.45	250			0.50	0.866	28.76	65.56%
		CCB 11-7	WCB 11								0.00	0.20	10.95	0.10	11.06	73.33	99.41	116.51	170.28	14.76	20.01	23.45	34.27		14.76	43.87	5.31	250			0.50	0.866	29.11	66.36%
	11-8	ECB 11	WCB 11							0.008	0.02	0.02	10.46	0.10	10.56	75.07	101.80	119.33	174.42	1.50	2.04	2.39	3.49		1.50	131.46	15.58	250			4.49	2.594	129.96	98.86%
		WCB 11	CB 11								0.00	0.22	11.06	0.09	11.15	72.97	98.93	115.94	169.45	16.15	21.89	25.66	37.50		16.15	43.87	4.80	250			0.50	0.866	27.72	63.19%
	11 & 11-9	CB 11	CB 10							0.046	0.12	0.34	11.15	0.51	11.66	72.66	98.49	115.43	168.70	24.44	33.13	38.83	56.75		24.44	39.24	23.73	250			0.40	0.774	14.80	37.71%
	10 & 10-1 & 10-2	CB 10	MH 9						0.042	0.015	0.13	0.46	11.66	0.37	12.03	70.97	96.18	112.70	164.69	32.75	44.38	52.01	76.00		32.75	39.24	17.19	250			0.40	0.774	6.49	16.53%
	9 & 9-1	MH 9	MH 8						0.025	0.009	0.07	0.68	12.04	0.27	12.31	69.78	94.55	110.78	161.87	47.33	64.12	75.13	109.78		47.33	81.33	18.06	300			0.65	1.115	34.01	41.81%
	8 & 8-1 & 8-2	MH 8	Gallery						0.157	0.031	0.40	1.08	12.31	0.03	12.34	68.96	93.41	109.45	159.91	74.69	101.17	118.54	173.20		74.69	93.01	2.58	300			0.85	1.275	18.32	19.70%
	6 & 6-1 & 6-2	CB 6	CB 7			0.027				0.031	0.11	0.11	10.00	0.27	10.27	76.81	104.19	122.14	178.56	8.26	11.21	13.14	19.21		8.26	39.24	12.63	250			0.40	0.774	30.97	78.94%
	7 & 7-1 & 7-2	CB 7	MH 5			0.022				0.017	0.07	0.17	10.00	0.19	10.19	76.81	104.19	122.14	178.56	13.41	18.19	21.32	31.17		13.41	107.45	23.78	250			3.00	2.121	94.05	87.52%
		MH 5	MH 7								0.00	0.17	10.27	0.26	10.53	75.78	102.78	120.48	176.11	13.23	17.94	21.03	30.75		13.23	39.24	12.18	250			0.40	0.774	26.01	66.28%
		MH 7	Gallery								0.00	0.17	10.53	0.05	10.58	74.81	101.45	118.92	173.82	13.06	17.71	20.76	30.35		13.06	98.09	5.24	250			2.50	1.936	85.03	86.68%
	Infiltration Gallery	Gallery	MH 2								0.00	1.26	12.34	0.07	12.41	68.86	93.27	109.28	159.67	86.60	117.31	137.44	200.82		86.60	142.67	7.82	300			2.00	1.955	56.07	39.30%
		MH 2	MH 3								0.00	1.26	12.41	0.07	12.47	68.66	93.00	108.96	159.20	86.35	116.96	137.04	200.22		86.35	93.01	5.15	300			0.85	1.275	6.66	7.16%
	UNC C	BLD C	MH 4							0.004	0.01	0.01	10.00	0.30	10.30	76.81	104.19	122.14	178.56	0.77	1.04	1.22	1.79		0.77	15.89	15.65	150			1.00	0.871	15.12	95.16%
		MH 4	MH 3								0.00	0.01	10.30	0.25	10.55	75.67	102.64	120.31	175.87	0.76	1.03	1.20	1.76		0.76	43.87	12.77	250			0.50	0.866	43.11	98.27%
	UNC D	BLD D	MAIN							0.004	0.01	0.01	10.00	0.49	10.49	76.81	104.19	122.14	178.56	0.77	1.04	1.22	1.79		0.77	15.89	25.46	150			1.00	0.871	15.12	95.16%
	UNC B	BLD B	MAIN							0.004	0.01	0.01	10.00	0.16	10.16	76.81	104.19	122.14	178.56	0.77	1.04	1.22	1.79		0.77	15.89	8.47	150			1.00	0.871	15.12	95.16%
		MH 3	MH 1								0.00	1.30	12.47	0.25	12.73	68.46	92.72	108.64	158.72	88.84	120.33	140.98	205.98		88.84	121.06	25.09	300			1.44	1.659	32.22	26.62%
		MH 1	MH 150B								0.00	1.30	12.73	0.11	12.83	67.72	91.71	107.44	156.97	87.88	119.01	139.43	203.70		87.88	147.47	8.47	375			0.65	1.293	59.59	40.41%
Rolling Meadow Cres.		MH 150B	MH 300								0.00	3.00	12.83	0.20	13.03	67.40	91.28	106.93	156.23	202.05	273.62	320.56	468.32		202.05	350.85	14.27	600			0.30	1.202	148.80	42.41%
					0.020	0.172		0.009	0.224	0.244	3.00	TRUE																						
										0.669	TOTAL AREA TO SEWER																							
										0.007	UNCONTROLLED RELEASE OFFSITE																							
										0.676	TOTAL SITE AREA																							

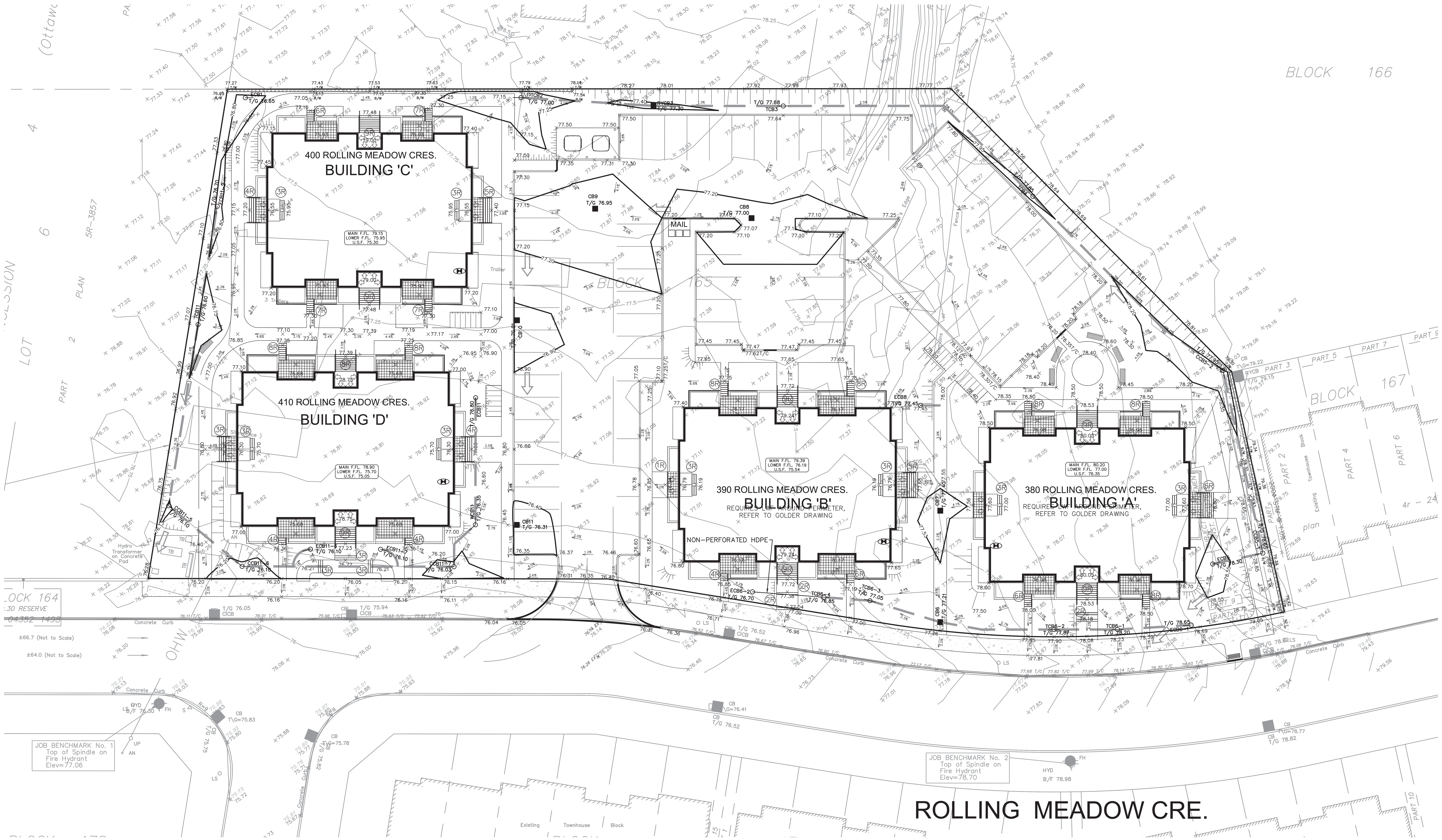
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: W.Z.
Checked: R.M.
Dwg. Reference: 115201-500

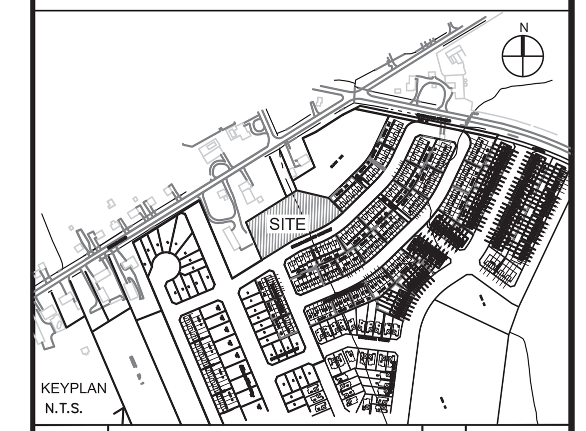
No.	Revision	Date
1.	Servicing Brief - Submission No. 1	2018-10-05
	Servicing Brief - Submission No. 2	2019-03-11
	Servicing Brief - Submission No. 3	2019-09-20

File Reference:	Date:	Sheet No:
115201.5.7.1	2018-08-24	1 of 1



LEGEND :

MAXIMUM PONDING AREA



KEYPLAN
N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
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9			
8			
7			
6	REISSUED FOR CWN	DGY	20:02:07
5	ISSUED FOR CWN	DGY	19:12:24
4	REVISED PER CITY COMMENTS	DGY	19:11:21
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IBI GROUP
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Project Title

SPRING VALLEY TRAILS
ZENS
WALK-UP TOWNHOUSES

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/02/07
PROVINCE OF ONTARIO

N

Drawing Title

PONDING PLAN

Scale

1:250

Design	Date
R.M./W.Z.	OCTOBER 2018
Drawn	Checked
E.H.	D.G.Y.
Project No.	Drawing No.
115201	600

CITY PLAN No. 18055

CITY FILE No. D07-12-18-0167

STORM HYDRAULIC GRADE LINE DESIGN SHEET
SPRING VALLEY TRAILS ZENS WALK-UP TOWNHOUSES
CITY OF OTTAWA
CLARIDGE HOMES

JOB #: 115201 - 5.7
DATE: 2019-09-20
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: 02

Rolling Meadow Crescent MH300 to MH150B

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Rolling Meadow Crescent	**MH300**	**MH150B**	
INVERT ELEVATION (m)	72.364	72.395	
OBVERT ELEVATION (m)	72.964	72.995	
DIAMETER (mm)			600
LENGTH (m)			14.9
FLOW (l/s)			1.38
HGL (m) ***	**68.990**	**68.990**	**0.000**
MANHOLE COEF K= 0.75	LOSS (m)	0.000	
TOTAL HGL (m)		**72.419**	
MAX. SURCHARGE (mm)		**-576**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.6	0.28	1.88	0.210	0.15	0.99	279.65

HYDRAULIC SLOPE = 22.969 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.005
DESIGN FLOW DEPTH = 0.024

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.00 m/s
HL = K_L * V^2/ 2g

Rolling Meadow Crescent MH150B to MH 1

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH150B**	**MH1**	
INVERT ELEVATION (m)	73.824	73.879	
OBVERT ELEVATION (m)	74.199	74.254	
DIAMETER (mm)			375
LENGTH (m)			8.5
FLOW (l/s)			1.38
HGL (m) ***	**72.419**	**72.419**	**0.000**
MANHOLE COEF K= 0.75	LOSS (m)	0.000	
TOTAL HGL (m)		**73.902**	
MAX. SURCHARGE (mm)		**-353**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.375	0.11	1.18	0.650	0.09	1.28	141.21

HYDRAULIC SLOPE = 17.503 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.010
DESIGN FLOW DEPTH = 0.023

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH1**	**MH3**	
INVERT ELEVATION (m)	73.899	74.264	
OBVERT ELEVATION (m)	74.199	74.564	
DIAMETER (mm)			300
LENGTH (m)			25.5
FLOW (l/s)			1.26
HGL (m) ***	**73.902**	**73.902**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.285**	
MAX. SURCHARGE (mm)		**-279**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3	0.07	0.94	1.440	0.08	1.64	115.72

HYDRAULIC SLOPE = 1.506 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.011
DESIGN FLOW DEPTH = 0.021

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.02 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH3**	**MH4**	
INVERT ELEVATION (m)	74.284	74.348	
OBVERT ELEVATION (m)	74.534	74.598	
DIAMETER (mm)			250
LENGTH (m)			12.8
FLOW (l/s)			0.14
HGL (m) ***	**74.285**	**74.285**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.358**	
MAX. SURCHARGE (mm)		**-240**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.25	0.05	0.79	0.500	0.06	0.86	42.08

HYDRAULIC SLOPE = 0.572 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.003
DESIGN FLOW DEPTH = 0.010

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.00 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
ZENS	**MH3**	**MH2**	
INVERT ELEVATION (m)	74.366	74.410	
OBVERT ELEVATION (m)	74.666	74.710	
DIAMETER (mm)			300
LENGTH (m)			5.2
FLOW (l/s)			0.14
HGL (m) ***	**74.285**	**74.285**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**74.416**	
MAX. SURCHARGE (mm)		**-294**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3	0.07	0.94	0.850	0.08	1.26	89.34

HYDRAULIC SLOPE = 2.544 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.002
DESIGN FLOW DEPTH = 0.006

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.00 m/s
HL = K_L * V^2/ 2g

Rolling Meadow Crescent Storm HGL has no impact on the proposed development.

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PROJECT:	SVT Zens
DATE:	2019-09-20
FILE:	39617-5.9
REV #:	02
DESIGNED BY:	AZ
CHECKED BY:	RM

ORIFICE SIZING

Orifice coefficients	
Cv =	0.60
Cv =	0.65

							Theoretical		Recommended	
	Invert	**Diameter**	**Centre ICD**	**Max. Pond Elevation**	**Hydraulic Head**	**Target Flow**	**Orifice**	**Actual Flow**	**Orifice**	**Actual Flow**
	(m)	**(mm)**	**(m)**	**(m)**	**(m)**	**(l/s)**	**(m)**	**(l/s)**	**(m)**	**(l/s)**
Area 1	74.587	300	74.737	76.047	1.310	48.57	0.1264	48.57	0.126	48.29
						48.57				**48.29**

Max Pond Elevation (used to determine Hydraulic Head/Slope) set to the top of the HydroStor HS180 model, including the thickness of the stone. Top of unit 1.46m

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Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

PROJECT:	SVT ZENS
DATE:	2019-09-20
FILE:	115201-5.11
REV #:	02
DESIGNED BY:	R.M. & W.Z.
CHECKED BY:	D.G.Y.

STORMWATER MANAGEMENT

Formulas and Descriptions

i_{2yr} = 1:2 year Intensity = 732.951 / $(T_c+6.199)^{0.810}$
i_{5yr} = 1:5 year Intensity = 998.071 / $(T_c+6.053)^{0.814}$
i_{100yr} = 1:100 year Intensity = 1735.688 / $(T_c+6.014)^{0.820}$
T_c = Time of Concentration (min)
C = Average Runoff Coefficient
A = Area (Ha)
Q = Flow = 2.78CiA (L/s)

Maximum Allowable Release Rate

Restricted Flowrate (based on 85 L/s/Ha)

A_{site} = 0.68 Ha

$Q_{restricted}$ = 57.80 L/s

Uncontrolled Release ($Q_{uncontrolled} = 2.78*C*i_{100yr}*A_{uncontrolled}$)

C = 0.81
T_c = 10 min
i_{100yr} = 178.56 mm/hr
$A_{uncontrolled}$ = 0.023 Ha
$Q_{uncontrolled}$ = 9.23 L/s

Maximum Allowable Release Rate ($Q_{max\ allowable} = Q_{restricted} - Q_{uncontrolled}$)

$Q_{max\ allowable}$ = 48.57 L/s

Stress Test (100yr Peak flow + 20%)

100yr Q_p = 147.23
100yr + 20% Q_p = 176.68
Q_r = 48.29
Q_p - Q_r = 128.39
Tc $_{100yr}$= 26

100yr + 20% Vol = **200.29**
Storage $_{in\ Gallery}$ 84.80
Storage $_{in\ Stone}$ 118.6 up to lowest T/G
Total Storage = **203.40**

MODIFIED RATIONAL METHOD (100-Year, 5-Year & 2-Year Ponding)

Drainage Area	A1
Area (Ha)	0.643
C =	0.81

Restricted Flow Q_r (L/s)= 48.29

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 100yr (m^3)
23	109.68	159.60	48.29	111.31	153.61
25	103.85	151.11	48.29	102.82	154.24
26	101.18	**147.23**	48.29	98.94	**154.35**
27	98.66	143.57	48.29	95.28	154.35
29	94.01	136.81	48.29	88.52	154.02

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	154.35	0.00	183.60	0.00

Overflows to: Rolling Meadow Cre

Total Restricted Flow Q_r (L/s)= 48.29
Allowable= 48.57

Drainage Area	A1
Area (Ha)	0.643
C =	0.68

Restricted Flow Q_r (L/s)= 48.29

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 5yr (m^3)
10	104.19	126.35	48.29	78.06	46.83
12	94.70	114.83	48.29	66.54	47.91
13	90.63	109.90	48.29	61.61	**48.06**
14	86.93	105.42	48.29	57.13	47.99
16	80.46	97.57	48.29	49.28	47.31

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	48.06	0.00	183.60	0.00

overflows to: Rolling Meadow Cre

Drainage Area	A1
Area (Ha)	0.643
C =	0.68

Restricted Flow Q_r (L/s)= 48.29

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p=2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	Q_p-Q_r (L/s)	Volume 2yr (m^3)
7	90.66	109.94	48.29	61.65	25.89
9	80.87	98.07	48.29	49.78	26.88
10	76.81	93.14	48.29	44.85	**26.91**
11	73.17	88.73	48.29	40.44	26.69
13	66.93	81.16	48.29	32.87	25.64

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	26.91	0.00	183.60	0.00

overflows to: Rolling Meadow Cre

April 8th, 2019

Amy Zhuang
IBI Group
Suite 400, 333 Preston Street
Ottawa, ON
K1S 5N4
T: 613-225-1311 X64080
E : amy.zhuang@ibigroup.com

Subject: Spring Valley Trails Zens
Stormwater Detention System (HS180 chambers)

Dear Amy,

In response to your email dated April 5th, see below our storage calculations for the proposed Hydrostor HS-180 system. This information is given for information purposes only. The engineer of record will have to validate the values used as well as the calculations method.

Key Information :
Top of system elevation – 75.96m
Top of chamber elevation – 75.66m
Bottom of chamber elevation – 74.5m
Bottom of system elevation – 74.27m
Width of system – 18.4m
Length of system – 14.2m

Calculation 1 – System Storage

Storage in Chambers and End Caps (cu.m.) = 25chs X 3.22cu.m./ch + 10ec X 0.43cu.m./ec = 84.8cu.m.

Volume of System (cu.m.) = (75.96m - 74.27m) X 18.4m X 14.2m = 441.5cu.m.

Storage in Stone (Assumed 40% voids) = (441.5cu.m. – 84.8cu.m.) X 0.4 = 142.6cu.m.

Storage in Chambers, End Caps and Stone = 84.8cu.m. + 142.6cu.m. = 227.4cu.m. (excluding storage in 300mm dia. manifolds)

Calculation 2 – System Storage (above chamber bottom elevation)

Storage in Chambers and End Caps (cu.m.) = 25chs X 3.22cu.m./ch + 10ec X 0.43cu.m./ec = 84.8cu.m.

Volume of System (cu.m.) = (75.96m - 74.5m) X 18.4m X 14.2m = 381.4cu.m.

Storage in Stone (Assumed 40% voids) = (381.4cu.m. – 84.8cu.m.) X 0.4 = 118.6cu.m.

Storage in Chambers, End Caps and Stone = 84.8cu.m. + 118.6cu.m. = 203.4cu.m. (excluding storage in 300mm dia. Manifolds)

If you have questions on this matter, please contact us.

Warm Regards,

Dave Kanters

David Kanters, P.Eng., CSP
Engineer, Technical Services

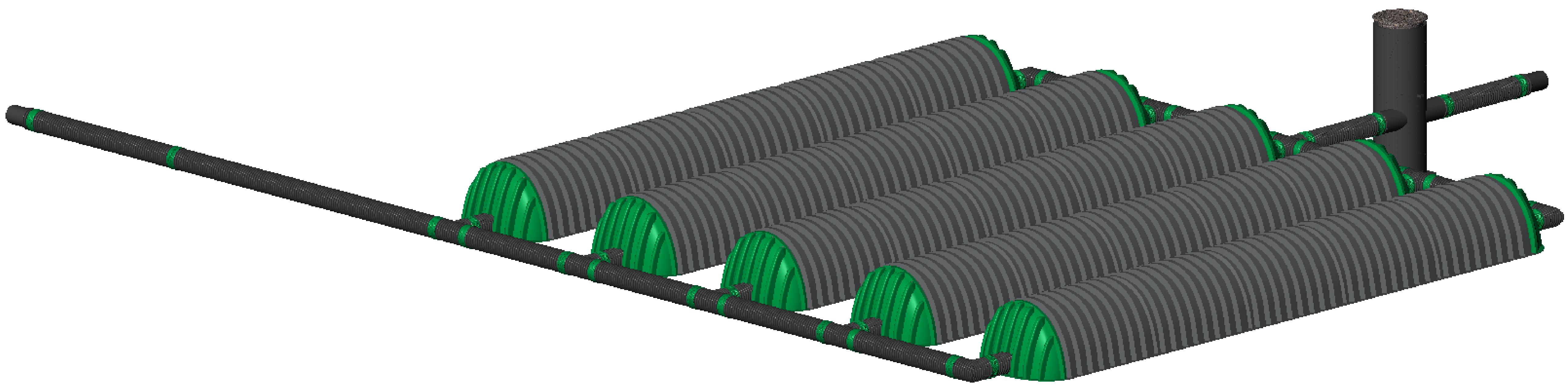
Suite 347, 15-75 Bayly St. W.
Ajax, Ontario
L1S 7K7
Canada

Encl:
Spring Valley Trails Zens - HS180 System Drawings
Spring Valley Trails Zens – Hydrostor HS180 Stage-Storage Volumes

SC02389 SOLENO HYDROSTOR HS180 SYSTEM 25 CHAMBERS 227m³

PROJECT: SPRING VALLEY ZENS
JOB LOCATION: OTTAWA (ON)
CONTACT:
OWNER/ENGINEERING FIRM/CONTRACTOR NAME:

Paul Antoine Sales Representative Tel: 613-292-4094 Email: pantoine@soleno.com
David Kanters Engineer, Technical Service Tel: 416-347-2799 Email: dkanters@soleno.com



1. INSTALLATION MUST BE MADE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. SYSTEM IS DESIGNED TO WITHSTAND TRAFFIC LOAD CSA CL-625 AND AASHTO H-20.
3. HS180 CHAMBERS MUST BE MINIMALLY BACKFILLED WITH 300 mm (12'') OF CRUSHED STONE AND 285 mm (11.5'') OF GRANULAR MATERIAL COMPACTED AT 90% P.M.
4. HYDROSTOR GEOGRID FOR FOUNDATION STABILIZATION IS CONSIDERED UNDER ALL THE CHAMBERS.
5. STORAGE IN BASE COURSE NOT CONSIDERED

APPROVAL : ___________________________

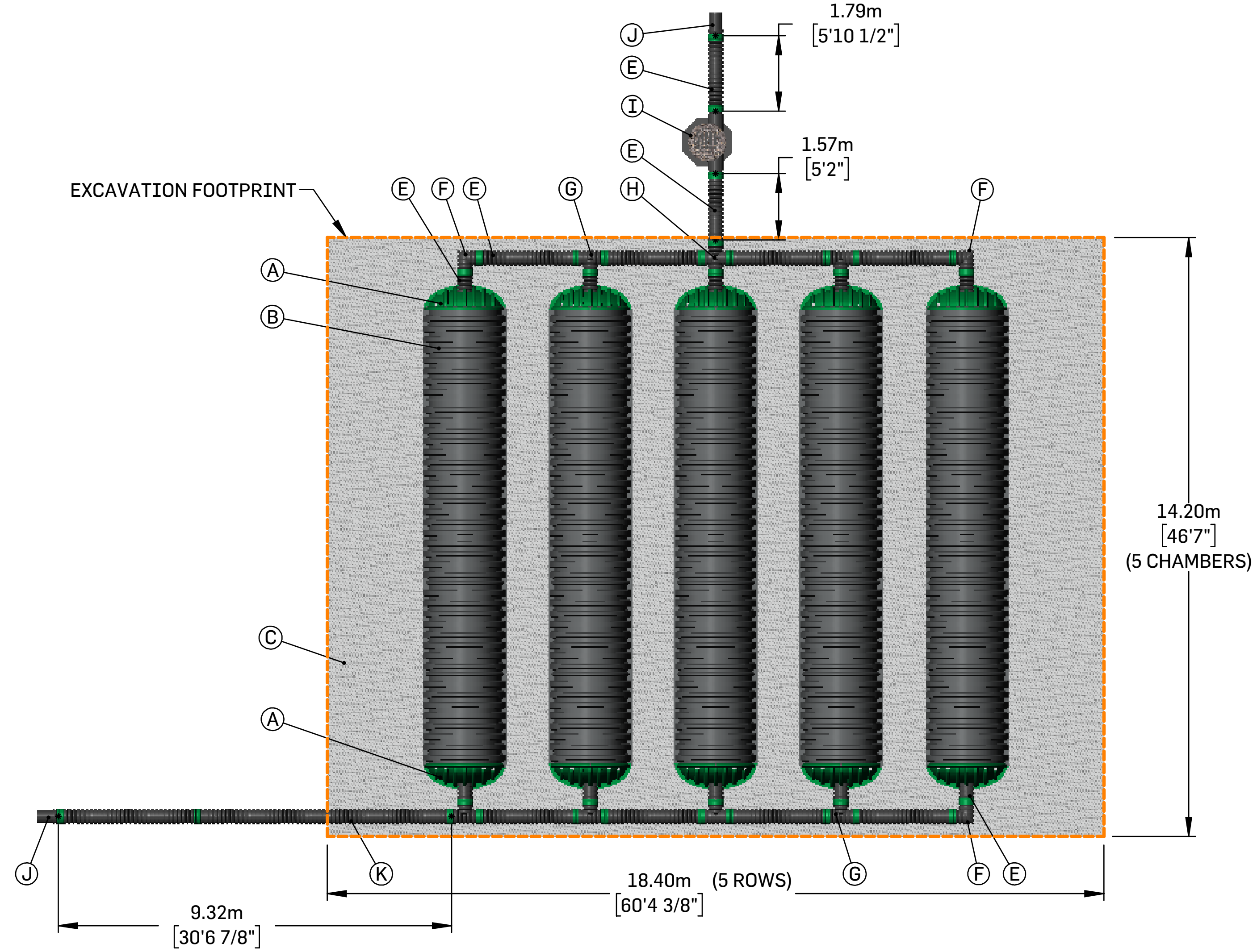
2019-04-08

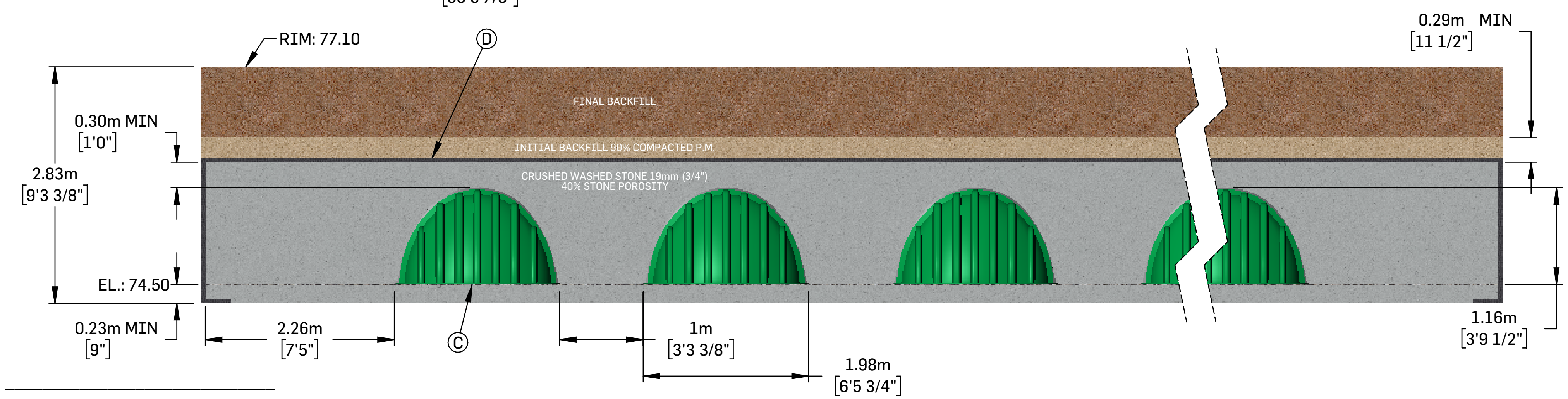
SOLENO
Mastering Storm Water

SC02389 SOLENO HYDROSTOR HS180 SYSTEM 25 CHAMBERS 227m³

Paul Antoine Sales Representative Tel: 613-292-4094 Email: pantoine@soleno.com
David Kanters Engineer, Technical Service Tel: 416-347-2799 Email: dkanters@soleno.com

NOTE: SYSTEM STORAGE ABOVE BOTTOM OF CHAMBER ELEVATION IS 203m³





PART	DESCRIPTION	QTY
A	HYDROSTOR END CAP HS180	10
B	HYDROSTOR CHAMBER HS180	25
C	STABILIZATION NETTING HYDROSTOR	2
D	SOLENO TX-90 SEPARATION NONWOVEN GEOTEXTILE, ABOVE AND ON THE SIDES	1
E	STD LENGTH 6m (236") SOLFLO MAX 300mm (12")	7
F	ELBOW SOLFLO MAX 300mm (12")	3
G	TEE SOLFLO MAX 300mm (12")	6
H	CROSS SOLFLO MAX 300mm (12")	1
I	AS-2	1
J	MANHOLE ADAPTER FORMAT PVC 300mm (12") DR35	2
K	STD LENGTH 6m (236") SOLFLO MAX 300mm (12") BIGC	1

APPROVAL : ______________________

2019-04-08

APPENDIX D

REPORT

Geotechnical Investigation Residential Development Spring Valley Trails - Zen Blocks

Ottawa, Ontario

Submitted to:

Claridge Homes
210 Gladstone Avenue, Suite 2001
Ottawa, Ontario
K2P 0Y6

Submitted by:

Golder Associates Ltd.
1931 Robertson Road
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07-1121-0232

April 2020

Distribution List

1 e-copy - Claridge Homes

1 e-copy - Golder

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TABLES

APPENDICES

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed ‘Zen’ residential blocks within the Spring Valley Trails residential development in Ottawa, Ontario.

The purpose of this subsurface investigation was to determine the general soil and groundwater conditions across the site by means of a limited number of boreholes. Based on an interpretation of the factual information obtained, engineering guidelines are provided on the geotechnical design aspects of the project, including construction considerations which could affect design decisions.

The reader is referred to the “Important Information and Limitations of This Report” which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared to develop ‘Zen’ residential blocks within the Spring Valley Trails residential development in Ottawa, Ontario (see Key Plan inset, on Figure 1).

The overall development site is located on lands south of Navan Road and Renaud Road. The property is bounded to the south by a former CN Rail line and the Mer Bleue Conservation area, to the east by the WSI landfill, to the west by Phases 1 and 2 of this development, and to the north by Navan Road and Renaud Road.

The proposed ‘Zen’ blocks will be located along Rolling Meadow Crescent within Block 165 of the development. The site measured approximately 130 m by 60 m in plan dimension, although somewhat irregular in shape. The site slopes down from the north to the south with an approximate 2 m grade difference (i.e., from about elevation 78 to 76 m), and from the east to the west with a grade difference of about 3 m (i.e., from about elevation 79 to 76 m).

It is understood that this ‘Zen’ blocks will be 3-storeys in height with one basement level and no garages.

The development will also include an underground stormwater storage gallery which has the potential to lower the groundwater level at the site. Golder carried hydrogeological analyses to assess the potential groundwater lowering and the results were provided in the technical memorandum titled “Drawdown Assessment, Spring Valley Trails – Zens, 380 Rolling Meadow Crescent, Ottawa, Ontario” dated November 12, 2019.

Golder has carried out several previous subsurface investigations on the overall development site. The results of one previous investigation, which has some boreholes that were advanced within close proximity to the ‘Zen’ study area, are presented in the following report:

- Report to Claridge Homes by Golder Associates Ltd. titled “*Geotechnical Investigation, Proposed Residential Development, Lands South of Navan Road and Fourth Line Road, Ottawa, Ontario*” dated October 2006 (Report No. 05-1120-041).

The results of the previous investigation indicate that the subsurface conditions within the study area generally consist of a thick deposit of sensitive silty clay. A surficial, discontinuous cap of sandy soil is also indicated to overly the clay.

3.0 PROCEDURE

The fieldwork for this investigation was carried out between October 8 and 9, 2008. During that time, three boreholes (numbered 08-204 to 08-206, inclusive) were put down at the approximate locations shown on the Site Plan, Figure 1. The boreholes were advanced using a track-mounted auger drill rig supplied and operated by Marathon Underground Constructors Corporation of Greely, Ontario. These boreholes were advanced to a depth of about 7.6 m below the existing ground surface.

An additional investigation was carried out on February 20, 2019 for additional sampling for the tree planting restrictions. During that time, three test pits (numbered 19-01, 19-02, and 19-03) were advanced at the approximate locations shown on the Site Plan, Figure 1. The test pits were advanced using a rubber tire backhoe supplied and operated by Glenn Wright Excavating of Ottawa, Ontario. The test pits were advanced to depths ranging from about 4.3 to 4.5 m below the existing ground surface.

Standard penetration tests were carried out in the boreholes at regular intervals of depth and samples of the soils encountered were recovered using split spoon sampling equipment. In situ vane testing was carried out where possible in the silty clay to determine the undrained shear strength of this soil.

Standpipe piezometers were sealed into boreholes 08-205 and 08-206 to allow subsequent measurement of the groundwater levels across the site. The groundwater level in the standpipe piezometer installed at borehole 08-205 was measured on October 17, 2008.

The fieldwork was supervised by experienced personnel from our staff who located the boreholes and test pits, directed the drilling and excavating operations, logged the boreholes and samples, directed the in situ testing, and took custody of the soil samples retrieved.

On completion of the drilling operations, samples of the soils encountered in the boreholes were transported to our laboratory for examination by the project engineer and for laboratory testing. The laboratory testing included natural water content determinations, Atterberg limit testing, and grain size distribution testing.

The borehole and test pit locations were marked in the field, and subsequently surveyed by Golder personnel. The position and ground surface elevation at each borehole location were determined using a Trimble R8 GPS survey unit. The elevations are referenced to Geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

The Record of Borehole sheets for the investigation are provided in Appendix A.

The subsurface conditions beneath the study area generally consist of topsoil and/or sand overlying firm to very stiff grey brown silty clay crust underlain by generally soft to firm grey silty clay.

The following sections present an overview of the subsurface conditions encountered in the boreholes.

4.2 Topsoil and Fill

Topsoil exists at the ground surface at boreholes 08-205 and 08-206 and test pits 19-01 19-02, and 19-03 and below the fill in borehole 08-204. The topsoil thickness ranges from about 100 to 500 mm.

An approximately 0.2 m thick layer of silty clay fill exists extending from the ground surface at borehole 08-204.

4.3 Silty Sand and Sand

Deposits of silty sand and sand exist below the topsoil and fill, where encountered, in borehole 08-206 and test pit 19-01 and 19-03. The sandy deposits ranges from about 1.1 to 2.4 m in thickness and extend down to depths ranging from about 1.1 to 2.9 m below the existing ground surface.

Standard penetration test carried out within the sandy deposit gave a SPT ‘N’ value of 12 blows per 0.3 m of penetration, indicating a compact state of packing.

4.4 Silty Clay

Silty clay underlies the topsoil, fill, and sand in all of the boreholes.

The upper portion of the silty clay has been weathered to a grey brown crust at all locations, except at test pit 19-01. The weathered crust extends to depths ranging from 1.7 to 2.4 m below the existing ground surface.

Standard penetration tests carried out within the weathered silty clay gave SPT ‘N’ values of ‘weight of hammer’ to 6 blows per 0.3 m of penetration. In situ vane testing carried out in the lower portion of the weathered crust gave an undrained shear strength value of 88 kilopascals. The results of this in situ testing indicate that the weathered crust has a very stiff to firm consistency.

The silty clay below the depth of weathering is grey in colour. The unweathered grey silty clay was not fully penetrated but was proven to extend to a depth of about 7.6 m below the ground surface.

The results of in situ vane testing in the grey silty clay gave undrained shear strength values ranging from about 19 to 65 kilopascals. The results of this in situ testing indicate the unweathered portion of the silty clay deposit has a soft to stiff consistency, but more typically, soft to firm consistency.

The results of Atterberg limit testing carried out on three samples of the grey silty clay gave plasticity index values ranging from about 7 to 45 percent and liquid limit values ranging from about 25 to 71 percent, indicating a soil of low to high plasticity. The results of the Atterberg Limit tests are provided on Figure 2.

Water contents ranging from about 30 to 81 percent were measured in the grey silty clay.

The results of grain size distribution testing on one sample of the silty clay are provided on Figure 3.

4.5 Groundwater

Standpipe piezometers were installed in boreholes 08-205 and 08-206 to allow for subsequent measurement of the groundwater levels at the site. However, only the groundwater level in the piezometer in borehole 08-205 was measured on October 17, 2008 as indicated in the table below.

Borehole Number	Ground Surface Elevation	Water Level Depth (m)	Water Level Elevation (m)	Date of Measurement
08-205	77.58	1.88	75.70	October 17, 2008

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

5.0 DISCUSSION

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of this project based on our interpretation of the borehole information as well as the project requirements, and is subject to the limitations in the “Important Information and Limitations of This Report” which follows the text of this report.

5.2 Site Grading

The subsurface conditions beneath the site generally consist of topsoil and/or sand overlying firm to very stiff grey brown silty clay crust underlain by generally soft to firm grey silty clay. It is understood that because of the grade change across the site that the proposed residences will be within both cut (up to about 0.4 m in depth) and fill sections.

The unweathered compressible grey silty clay deposit, which is located beneath the site, has limited capacity to accept additional load from the weight of grade raise fill and from the foundations of houses without undergoing consolidation settlements. Therefore, to leave sufficient remaining capacity for the silty clay to support house foundations, with reasonable footing sizes, the thicknesses of grade raise fill will need to be limited.

In making the site grading assessment, certain assumptions have been made regarding the footing depths, width, and loads, as discussed subsequently in Section 5.3 of this report.

Based on the above, a maximum allowable grade raise of 0.5 m is permitted on this site. This maximum allowable grade raise was calculated assuming that any fill required for site grading (above original grade) would have a unit weight of no more than 19 kilonewtons per cubic metre and that the porches would be backfilled with expanded polystyrene (EPS). Well graded sand, sand and gravel, glacial till, and crushed stone typically have a higher unit weight and, if these materials are to be used, the permissible grade raises would be reduced and would need to be re-evaluated. The maximum allowable grade raise was also based on the preliminary underside of footing elevations provided by IBI Group and will need to be reviewed/confirmed once final underside of footing elevations have been established.

If the grading restrictions given above cannot be accommodated, the following three options could be considered:

1) The additional required grade raising above the limit given above could be accomplished using EPS light weight fill.

2) The area could be pre-loaded and allowed to settle in advance of house construction. The subgrade settlements would need to be monitored to establish when sufficient settlements had occurred such that house construction could proceed. To reduce the time required for the pre-loading, it is likely that a temporary surcharge above the existing grade would need to be considered, however in either case the pre-load time could be months or years.

3) The residences could be supported on driven steel piles, which derive their support from more competent bearing soils (i.e., glacial till) at depth below the “softer” layers of silty clay. However, the depth to more competent strata is not known and the potential settlements of the services, relative to the ‘Zen’ blocks, could be problematic.

4) A test fill area could be established to monitor the settlements of the site and confirm the compressibility of the silty clay deposit. This option is only considered appropriate where the proposed grading will only marginally exceed the permitted levels.

Additional geotechnical guidelines would need to be provided if any of the above options are selected. Additional investigation could also be required (in particular for Options 2, 3 and 4) before those guidelines could be finalized.

It is understood that the use of lightweight fill has been selected as the preferred option. In addition, based on the results of the hydrogeological analysis carried out for the underground storage gallery, there is the potential that groundwater lowering could result in additional loading that reduces the height of grade raise fill that can be accommodated on the site at Buildings A and B. That groundwater lowering essentially results in an allowable grade raise limit of 0.1 m. The EPS requirements at all the buildings are indicated on Figure 4, based on the grading plan prepared by IBI (dated December 18, 2019). The final fill heights and the required EPS thicknesses should be confirmed at the time of construction.

As a general guideline regarding the site grading, the preparation for filling of the site should include stripping the topsoil and fill for predictable performance of structures and services. The topsoil and fill are not suitable as engineered fill and should be stockpiled separately for re-use in landscaping applications only. In areas with no proposed structures, services, or roadways, the topsoil and fill may be left in place provided some settlement of the ground surface following filling can be tolerated.

5.3 Foundations

As discussed in the previous section, the unweathered silty clay deposit beneath this site has limited capacity to accept the combined load from site grading fill and foundation loads. The allowable bearing pressures for spread footing foundations are therefore based on limiting the stress increases on the unweathered compressible silty clay at depth to an acceptable level so that foundation settlements do not become excessive. Four important parameters in calculating the stress increase on the grey silty clay are:

- The thickness of soil below the underside of the footings and above the “softer” unweathered silty clay
- The size (dimensions) of the footings
- The amount of surcharge in the vicinity of the foundations due to landscape fill, underslab fill, floor loads, etc., as described in Section 5.2
- The effects of groundwater lowering caused by this or other construction

Preliminary underside of footing elevations were provided by IBI Group as follows:

Building	Underside of Footing Elevation (m)
A	76.35
B	75.54
C	75.30
D	75.05

Based on the above and the existing subsurface information across the site, the spread footings for the residences will be founded within either the lower portion of the weathered silty clay or directly on the soft to firm compressible silty clay. It is considered that the proposed residences can potentially be supported on strip footings on or within the native silty clay designed using the maximum allowable bearing pressures summarized in the table below for the various building blocks.

Building	Footing Width (metres)	Maximum Allowable Bearing Pressure (kilopascals)
A	0.6	75
B	Up to 0.8	31
	0.9 to 1.6	28
C	Up to 1.6	26
D	Up to 0.6	33
	0.7 to 1.0	24
	1.1 to 1.6	19

The maximum allowable bearing pressures provided above were calculated based on the preliminary underside of footing elevations provided by IBI Group as well as assuming the grade raise on site is limited to 0.5 m as discussed in Section 5.2, and that any fill required for site grading (above original grade) around the foundations has a unit weight of no more than 19 kilonewtons per cubic metre (i.e., native silty clay or clear crushed stone) and that the porches would be backfilled with EPS. The above maximum allowable bearing pressures will need to be reviewed/confirmed once the final underside of footing levels for the residences have been established.

The post construction total and differential settlements of footings sized using the above maximum allowable bearing pressure should be less than about 25 and 15 mm, respectively, provided that the subgrade at or below founding level is not disturbed during construction.

The tolerance of the house foundations to accept those settlements could be increased by providing nominal amounts of reinforcing steel in the top and bottom of the foundation walls.

The provided maximum allowable bearing pressures for footings founded within the silty clay corresponds to settlement resulting from consolidation of these deposits. Consolidation of the silty clay is a process which takes months or longer and, as such, results from sustained loading. Therefore, the foundation loads to be used in conjunction with the allowable bearing pressure for houses founded in the silty clay should be the full dead load plus sustained live load.

If the maximum allowable bearing pressures provided above are not considered feasible the following options could be considered:

1) The silty clay adjacent to the exterior foundation walls could be subexcavated and replaced with EPS to ‘unload’ the underlying silty clay in the zone of influence of the foundations and provide additional capacity for the compressible silty clay to accept foundation loads. However, the feasibility of this option and the details of the EPS fill placement will need to be confirmed on a case-by-case basis and can only be established once the grade level and footing levels have been confirmed.

2) The residences could be supported on raft foundations, which spread the foundation loads over the entire structure footprint.

3) The residences could be supported on driven steel piles, as described in Section 5.2 above.

Additional geotechnical guidelines would need to be provided if any of the above options are selected. Additional investigation may also be required before those guidelines could be finalized.

5.4 Seismic Considerations

5.4.1 Seismic Site Class

The subsurface conditions beneath the site generally consist of topsoil and/or silty sand/sand overlying firm to very stiff grey brown silty clay crust underlain by generally soft to firm grey silty clay.

The seismic design provisions of the 2012 Ontario Building Code depend, in part, on the shear wave velocity of the upper 30 m of soil and/or bedrock below founding level. Based on the 2012 Ontario Building Code methodology, the soil stratigraphy on the site could be assigned a Site Class of E (for any structures requiring design under Part 4 of the Ontario Building Code).

5.4.2 Liquefaction Assessment

It is considered that the fine grained silty clay at this site is not potentially liquefiable during an earthquake.

5.5 Basement Excavations

Excavation for basements will be through the surficial layers of topsoil, fill, silty sand/sand and into soft to firm silty clay.

No unusual problems are anticipated in excavating in the overburden using conventional hydraulic excavating equipment.

The silty sand/sand weathered silty clay and firm to very stiff silty clay (in the upper portion of the deposit) would generally be classified as a Type 3 soil in accordance with the Occupational Health and Safety Act of Ontario (OHSA). Accordingly, side slopes in these materials should be cut back at a minimum of 1 horizontal to 1 vertical. If the water table is encountered within the sandy deposits, side slopes of 3 horizontal to 1 vertical will be required (i.e., Type 4 soil). Should the excavations reach the soft silty clay, side slopes as flat as 3 horizontal to 1 vertical would be required (Type 4 soil).

Some groundwater inflow into the basement excavations should be expected. For the expected excavation depths, it should be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations.

Where the subgrade is found to be wet and sensitive to disturbance, consideration should be given to placing a mud slab of lean concrete over the subgrade (following inspection and approval by geotechnical personnel).

Based on the drawings provided, the nearest structures or services would be more than about 5 m from the edge of the excavations and the excavations will therefore not have any potential impacts on adjacent properties and infrastructure, since those properties and infrastructure will be outside the excavations zones of influence.

5.6 Basement Floor Slabs

In preparation for the construction of the basement floor slabs, all loose, wet, and disturbed material should be removed from beneath the floor slabs. Provision should be made for at least 200 mm of 19 mm crushed clear stone to form the base of the basement floor slabs.

To prevent hydrostatic pressure build up beneath the basement floor slabs, it is suggested that the granular base material be positively drained. This could be achieved by providing a hydraulic link between the underslab fill material and the exterior drainage system.

The backfill within the porches should consist of expanded polystyrene (EPS) sheets or blocks with a unit weight of no more than 1.0 kilonewtons per cubic metre placed on a thin levelling pad of sand. EPS meeting the requirements for EPS 19 as defined by ASTM D6817/D6817M-17 should be suitable for this purpose. The surface of the EPS backfill should be covered with a Class II non-woven geotextile conforming to Ontario Provincial Standard Specification (OPSS) 1860 prior to placement of the underslab granular backfill. The underslab granular backfill should consist of a maximum thickness of 300 mm of clear crushed stone. The EPS backfill should extend from footing level up to the underside of the porch slab base material.

The general groundwater level at this site is within about 1.9 m of the existing ground surface. The sandy soils at this site are somewhat permeable and therefore ideally, from a constructability perspective, excavations below the groundwater level in this soil should be avoided. However, if/where the groundwater level is encountered above subgrade level, a geotextile would be required between the clear stone underslab fill and the sandy subgrade soils, to avoid loss of fine soil particles from the subgrade soil into the voids in the clear stone and ultimately into the drainage system. In the extreme case, loss of fines into the clear stone could cause ground loss beneath the slab and plugging of the drainage system. Where a geotextile is required, it should consist of a Class II non-woven geotextile with a Filtration Opening Size (FOS) not exceeding 100 microns, in accordance with OPSS 1860.

5.7 Frost Protection

All exterior perimeter foundation elements or foundation elements in unheated areas should be provided with a minimum of 1.5 m of earth cover for frost protection purposes. Isolated and/or unheated exterior footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 m of earth cover.

Insulation of the bearing surface with high density insulation could be considered as an alternative to earth cover for frost protection. The details for footing insulation could be provided if and when required.

5.8 Basement Walls and Foundation Wall Backfill

The soils at this site are highly frost susceptible and should not be used as backfill directly against exterior, unheated, or well insulated foundation elements. To avoid problems with frost adhesion and heaving, a bond break such as the Platon system sheeting should be placed against the foundation walls.

Drainage of the wall backfill should be provided by means of a perforated pipe subdrain in a surround of 19 mm clear stone, wrapped in geotextile, which leads by gravity drainage to an adjacent storm sewer or sump pit. Conventional damp proofing of the basement walls is appropriate with the above design approach.

Where design of basement walls in accordance with Part 4 of the 2012 Ontario Building Code is required, walls backfilled with native material and effectively drained as described above should be designed to resist lateral earth pressures calculated using a triangular distribution of the stress with a base magnitude of $K_o\gamma H$, where:

K_o = The lateral earth pressure coefficient in the ‘at rest’ state, use 0.5

γ = The unit weight of the backfill, use 19 kilonewtons per cubic metre

H = The height of the basement wall in metres

Provided the foundation walls are drained, as described above, hydrostatic groundwater pressures need not be considered in the calculation of the lateral earth pressures.

5.9 Site Servicing

Excavation for the installation of site services will be through fill, topsoil, silty sand/sand, firm to very stiff silty clay and will likely extend into the soft silty clay.

No unusual problems are anticipated in trenching in the overburden using conventional hydraulic excavating equipment.

As described previously, the silts sand/sand and firm to very stiff silty clay would generally be classified as a Type 3 soil in accordance with OHSA. If the water table is encountered within the sandy deposits, side slopes of 3 horizontal to 1 vertical will be required (i.e., Type 4 soil per OHSA). The underlying soft silty clay would also be classified as a Type 4 soil. Accordingly, excavations which do not penetrate into the soft silty clay or below the water table in the sand deposits may be made with side slopes at 1 horizontal to 1 vertical. Should the excavations reach the soft silty clay, side slopes of 3 horizontal to 1 vertical would be required. Alternatively, the excavations could be carried out using steeper side slopes with all manual labour carried out within a fully braced, steel trench box for worker safety. The stability of braced excavations which extend into the soft grey silty clay should be assessed individually based on the length, width, and depth of the trench box. For example, the factor of safety against basal instability of a braced excavation 3 m wide by 10 m long to 4 m depth would be about 2, which is acceptable. Shorter, narrower or shallower trenches will therefore also be stable. Further guidance on trenches that exceed the above limits can be provided. In these areas, excavated materials should not be stock piled beside the excavations, even temporarily.

At least 150 mm of OPSS Granular A should be used as pipe bedding for sewer and water pipes.
Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to place a sub-bedding layer consisting of compacted OPSS Granular B Type II beneath the Granular A or to thicken the Granular A bedding. The bedding material should in all cases extend to the spring line of the pipe and should be compacted to at least 95 percent of the material’s standard Proctor maximum dry density. The use of clear crushed stone as a bedding layer should not be permitted anywhere on this project since fine particles from the sandy backfill materials or sandy soils on the trench walls could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from spring line of the pipe to at least 300 mm above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 mm. The cover material should be compacted to at least 95 percent of the material’s standard Proctor maximum dry density.

It should generally be possible to re-use sandy soils and silty clay from the weathered zone as trench backfill. Where the trench will be covered with hard surfaced areas, the type of native material placed in the frost zone (between subgrade level and 1.8 m depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 mm thick lifts and should be compacted to at least 95 percent of the material’s standard Proctor maximum dry density using suitable compaction equipment.

The high moisture content of the unweathered grey silty clay makes this soil difficult to handle and compact.
If grey silty clay is excavated during installation of the site services, this material should be wasted or should only be used as backfill in the lower portion of the trenches to limit the amount of long term settlement of the roadway surface. If the grey silty clay is used in trenches under roadways, some long term settlement of the pavement surface should be expected.

Impervious dykes or cut-offs should be constructed at 100 m intervals in the service trenches to reduce groundwater lowering at the site due to the “french drain” effect of the granular bedding and surround for the service pipes. It is important that these barriers extend from trench wall to trench wall and that they fully penetrate the granular materials to the trench bottom. The dykes should be at least 1.5 m wide and could be constructed using relatively dry (i.e., compactable) grey brown silty clay from the weathered zone.

Excavations deeper than about 1.9 m will likely extend below the groundwater level, depending on the time of construction. Groundwater inflow into the excavated trenches should feasibly be handled by pumping from sumps within the excavations. The rate of groundwater inflow from the silty clay is expected to be low, with moderate inflows, occurring from the sandy fill above the silty clay. The actual rate of groundwater inflow to the trench will depend on many factors including the contractor’s schedule and rate of excavation, the size of the excavation, the number of working areas being excavated at one time, and the time of year at which the excavation is made. Also, there may be instances where volumes of precipitation, surface runoff and/or groundwater collects in an open excavation and must be pumped out.

Under the new regulations, a Permit-To-Take-Water (PTTW) is required from the Ministry of the Environment and Climate Change (MOECC) if a volume of water greater than 400,000 litres per day is pumped from the excavations. If the volume of water to be pumped will be less than 400,000 litres per day, but more than 50,000 litres per day, the water taking will not require a PTTW, but will need to be registered in the Environmental Activity and Sector Registry (EASR) as a prescribed activity.

5.10 Pavement Design

In preparation for pavement construction, all topsoil, disturbed, or otherwise deleterious materials (i.e., fill materials containing organic material) should be removed from the roadway areas.

Pavement areas requiring grade raising to proposed subgrade level should be filled using acceptable (compactable and inorganic) earth borrow or OPSS Select Subgrade Material. These materials should be placed in maximum 300 mm thick lifts and should be compacted to at least 95 percent of the material’s standard Proctor maximum dry density using suitable compaction equipment.

The surface of the pavement subgrade should be crowned to promote drainage of the roadway granular structure. Perforated pipe sub-drains should be provided at subgrade level extending from the catch basins for a distance of at least 3 m longitudinally, parallel to the curb in two directions.

The pavement structure for the interior ‘local’ roadways which will not experience bus or truck traffic should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	375

The pavement structure for the 'fire route', which it is understood will not have bus or truck traffic, should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	400

If any of the roadways would be categorized as 'collector' roadways and/or will experience bus or truck traffic (other than school buses, garbage trucks, moving trucks, etc.), then additional pavement design recommendations will need to be provided.

The granular base and subbase materials should be uniformly compacted as per OPSS 501, Method A. The asphaltic concrete should be compacted in accordance with the procedures outlined in OPSS 310.

The composition of the asphaltic concrete pavement should be as follows:

- Superpave 12.5 mm Surface Course - 40 mm
- Superpave 19 mm Base Course - 50 mm

The asphaltic cement should consist of PG 58-34 and the design of the mixes should be based on a Traffic Category B.

The above pavement designs are based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required density and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

5.11 Corrosion and Cement Type

No soil samples were submitted for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements as part of this investigation. However, the results of this testing within adjacent phases of the development typically indicate that concrete made with Type GU Portland cement should be acceptable for substructures as well as a low to moderate potential for corrosion of exposed ferrous metal.

5.12 Trees

The results of grain size distribution testing on one sample of the silty clay are provided on Figure 3. The grain size distribution test results indicate that the percentage of the soil particles finer than 0.475 mm in diameter is 100 percent. The results of Atterberg limit testing carried out on three samples of the silty clay gave plasticity index values ranging from about 7 to 45 percent and liquid limit values ranging from about 25 to 71 percent. The results of the grain size distribution and Atterberg limit testing indicate that the soil is a silty clay of low to high plasticity.

The results of the shrinkage test are provided in Table 2 and indicate that the silty clay at this site has a shrinkage limit of about 19 and a shrinkage ratio of about 1.8.

The Atterberg limit testing on the three samples of the silty clay from the current investigation are provided in the table below:

Test Pit / Sample Number	Ground Surface Elevation (m)	Sample Depth / Elevation (m)	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Modified Plasticity Index
19-01 / 6	79.0	4.1 / 74.9	81	71	26	45
19-02 / 3	78.0	3.1 / 74.9	30	25	18	7
19-03 / 1	78.1	2.6 / 75.5	69	20	20	41
					Average	**31**

Based on the results of the laboratory testing, the soil on the east side of the site, as shown on Figure 1, have plasticity indices greater than about 40 percent and only small trees of low water demand can be planted and the setback distance must be at least 7.5 m.

On the west side of the site, it should be acceptable to reduce the setback distances for small size (mature tree height up to 7.5 m) and medium size (mature tree height 7.5 to 14 m) trees to 4.5 m from the foundations within the residential development. However, in accordance with current City guidelines, the following conditions must also be met:

- The underside of footing elevation must be 2.1 m or greater below the lowest finished grade
- Available soil volume must be provided for small and medium trees as per the guidelines
- Tree species must be very low to moderate Potential Subsistence Risk
- The foundation walls should be reinforced at least nominally, to provide ductility
- The grading must promote drainage towards the tree root zone

6.0 IMPACTS TO ADJACENT PROPERTIES OR INFRASTRUCTURE

Based on the information available to Golder at the time of this report, excavations for foundations or services at this site will not be within the zone of influence (defined within a line drawn from the existing underside of foundation or utility invert at an angle of 1 horizontal to 1 vertical) of existing structures or utilities. The planned excavations should therefore not have an impact on adjacent properties or utilities.

7.0 ADDITIONAL CONSIDERATIONS

The soils at this site are sensitive to disturbance from ponded water, construction traffic, and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that soil having adequate bearing capacity has been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill as well as sewer bedding and backfill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction point of view.

Golder Associates should be retained to review the final grading plan and specifications for this project prior to construction to ensure that the guidelines in this report have been adequately interpreted.

The groundwater level monitoring devices (i.e., standpipe piezometers or wells) installed at the site will require decommissioning at the time of construction in accordance with Ontario Regulation 903. However, it is expected that most of the wells will either be destroyed during construction or can be more economically abandoned as part of the construction contract. If that is not the case or is not considered feasible, abandonment of the monitoring wells can be carried out separately.

Golder Associates Ltd.

William Cavers, P.Eng.
Associate, Senior Geotechnical Engineer

SAT/WC/hdw
\\golder.gds\gal\ottawa\active\2007\1121 - geotechnical\07-1121-0232 claridge spring valley ottawa\zens-2018\0711210232-005-r-rev4-zens-dec 2019.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client, **Claridge Homes**. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

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The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

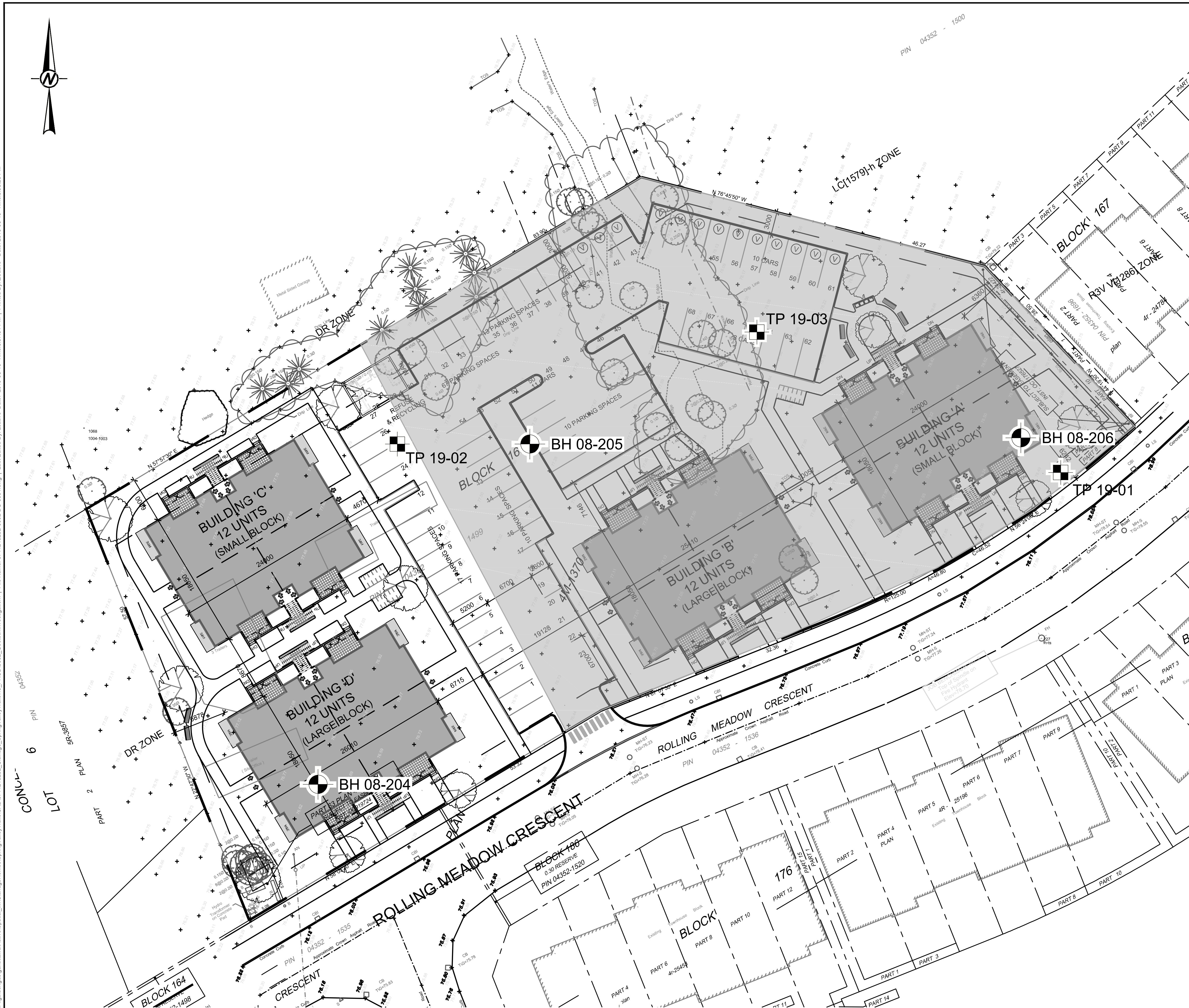
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

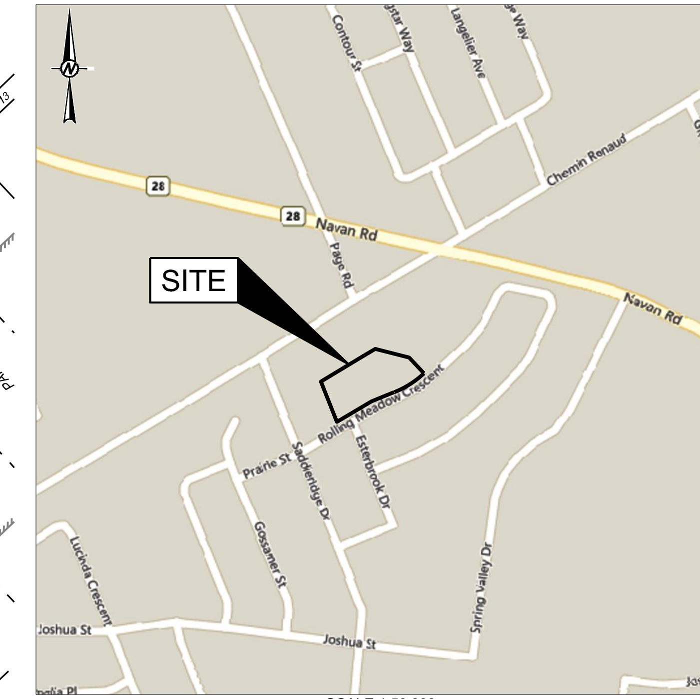
During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



KEY MAP



SCALE 1:50,000

LEGEND

- APPROXIMATE PROPOSED TEST PIT LOCATION
- APPROXIMATE BOREHOLE LOCATION
- AREA WITH TREE PLANTING RESTRICTIONS

REFERENCE(S)

1. BASE PLAN SUPPLIED BY RODERICK LAHEY ARCHITECT INC. ON APRIL 19, 2018, FILE NO 1721 Zen Site Plans 2018.dwg
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 18, VERTICAL DATUM: CGVD28

0 10 20
1:500 METRES

CLIENT
CLARIDGE HOMES

PROJECT
GEOTECHNICAL INVESTIGATION
SPRING VALLEY TRAILS - ZENS
OTTAWA, ONTARIO

TITLE
SITE PLAN

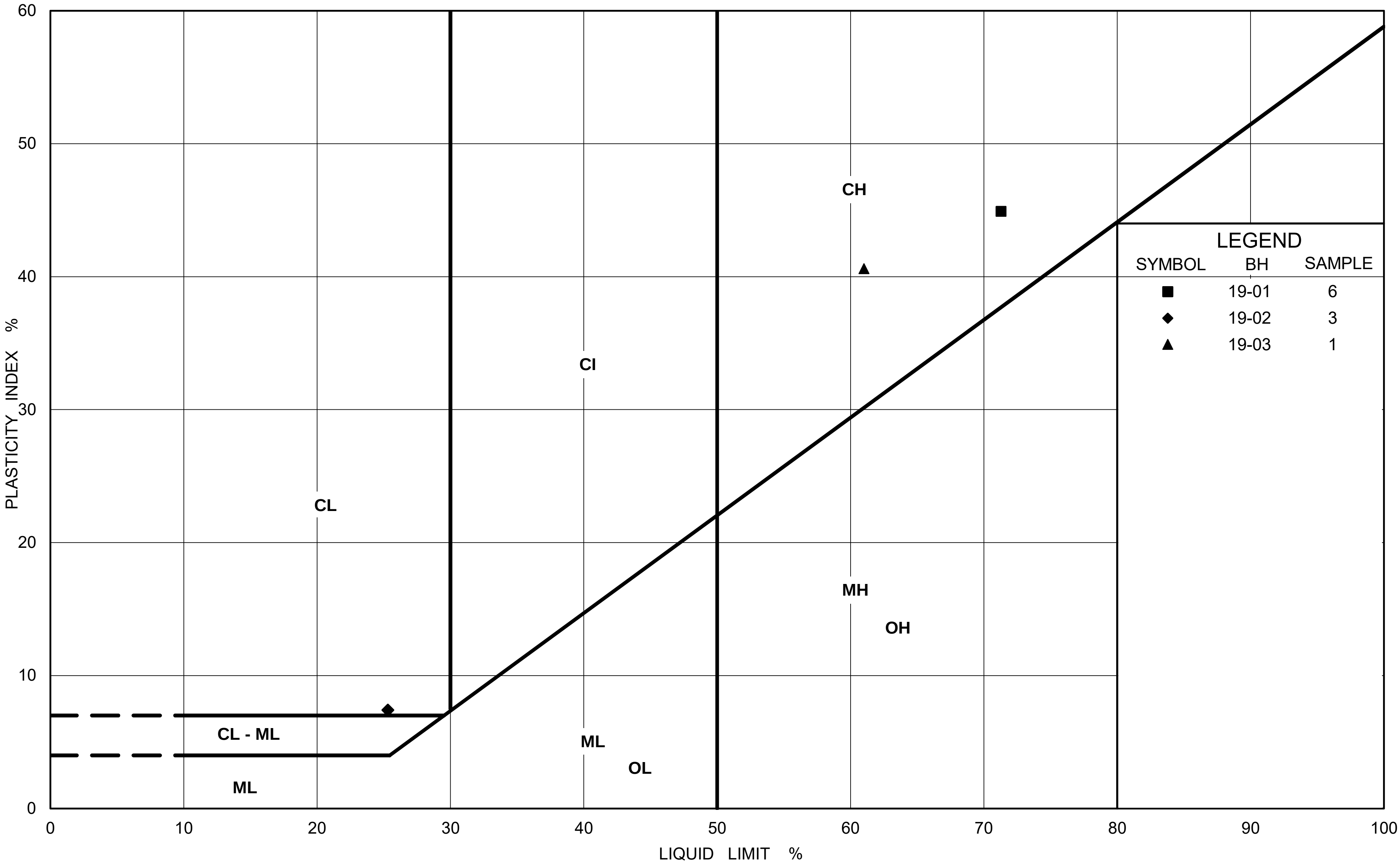
CONSULTANT

GOLDER

YYYY-MM-DD	2019-03-15
DESIGNED	----
PREPARED	JM/ZS
REVIEWED	WAM
APPROVED	WC

PROJECT NO.	CONTROL	REV.	FIGURE
07-1121-0232	0002	A	1

25 mm | IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



GOLDER

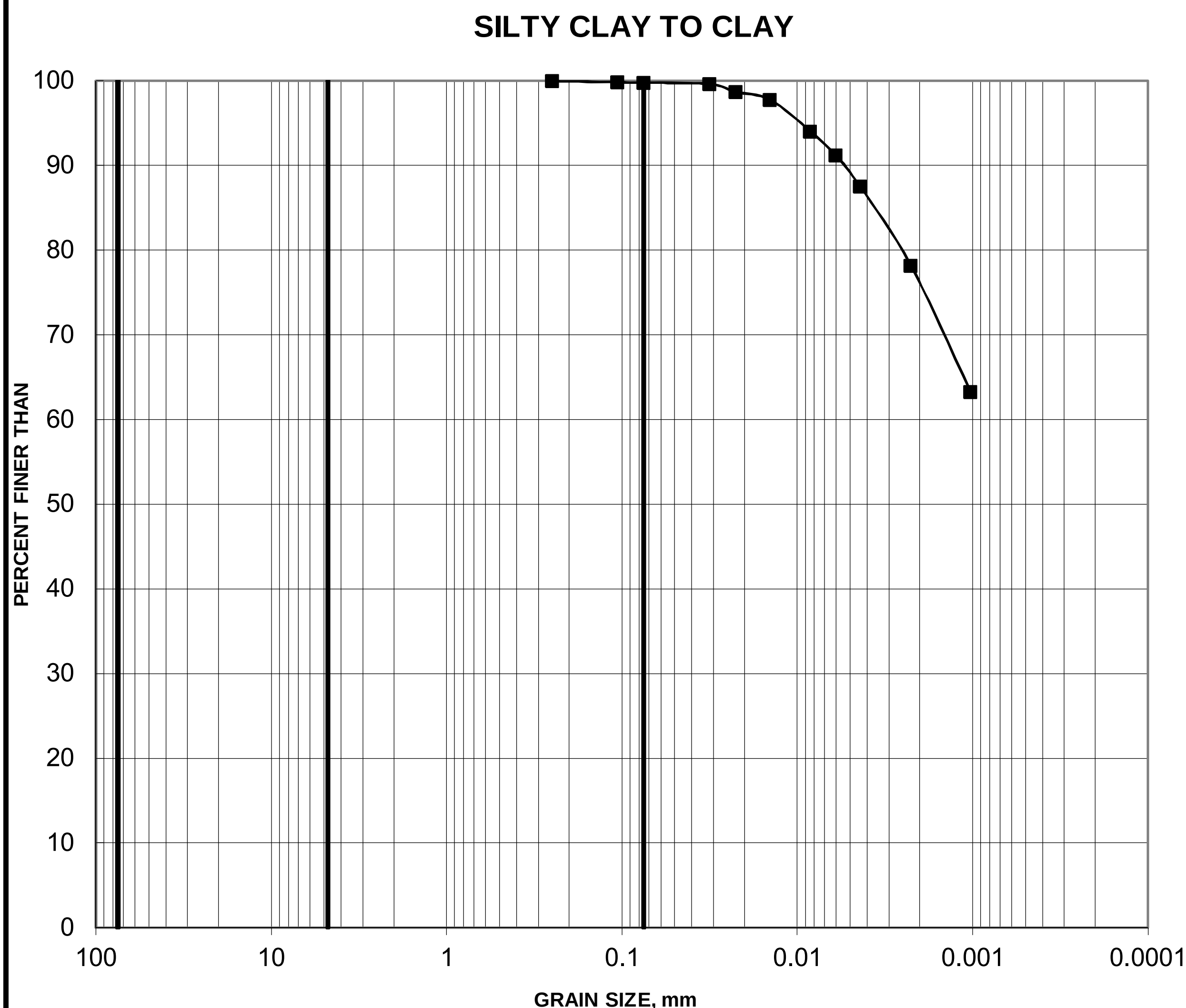
PLASTICITY CHART
SILTY CLAY TO CLAY

Figure : 2

Project No.: 07-1121-0232/7000

Compiled By : CW   Checked By : MI

GRAIN SIZE DISTRIBUTION	FIGURE 3



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
19-03	1	2.60-2.90

Project: 07-1121-0232/7000

Golder Associates

Created by: CW

Checked by: MI

KEY MAP

SCALE: 1: 25,000 m

LEGEND

EPS LIMITS

0.3 THICKNESS OF EPS (IN METERS)

REFERENCE(S)

1. BASE PLANS PROVIDED IN DIGITAL FORMAT BY IBI GROUP, DRAWING NO. 115201 ens Grading_2019-12-18.dwg ON DECEMBER 18, 2019.
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83 CSRS, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 5 10

1:250 METRES

CLIENT

CLARIDGE HOMES

PROJECT

GEOTECHNICAL INVESTIGATION
SPRING VALLEY TRAILS -ZENS
OTTAWA, ONTARIO

TITLE

LWF REQUIREMENTS

CONSULTANT

GOLDER

YYYY-MM-DD	2019-12-20
DESIGNED	----
PREPARED	ZS
REVIEWED	----
APPROVED	----

PROJECT NO.	PHASE	REV.	FIGURE
07-1121-0232	8500	A	4

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Path: \\golder.gds\gal\Ottawa\Active\Spatial_IM\ClaridgeHomes\SpringValleyTrails\CAD\07112\0232_Claridge_SpringValleyTrails\40_PROD\Phase8500_Geotech\ | File Name: 07112\0232-8500-BG-01.dwg | Last Edited By: mkeenan Date: 2019-12-23 Time:4:06:10 PM | Printed By: mkeenan Date: 2019-12-23 Time:4:21:42 PM

TABLE 1

RECORD OF TEST PITS

Test Pit Number Elevation (Metres)	Depth (metres)	Description
19-01	0.0 – 0.1	TOPSOIL – (SM) SILTY SAND; brown; non-cohesive, moist
(79.02 metres)	0.1 – 0.5	FILL – (SM) gravelly SILTY SAND, dark brown; non-cohesive, moist
	0.5 – 2.9	(SP) SAND, grey-brown; non-cohesive, moist
	2.9 – 4.5	(CI/CH) SILTY CLAY to CLAY; grey with red-brown mottling; cohesive, w>PL
	4.5	END OF TEST PIT

Note: water seepage at 2.9 m depth upon completion.

Sample	Depth (m)	Lab Testing
1	2.6 – 2.8	
2	2.9 – 3.1	
3	3.1 – 3.5	
4	3.5 – 3.7	
5	3.7 – 4.0	
6	4.1 – 4.5	w= 81% LL= 71%, PI= 43%

Test Pit Number Elevation (Metres)	Depth (metres)	Description
19-02	0.0 – 0.2	TOPSOIL – (SM) SILTY SAND; dark brown; non-cohesive, moist
(77.67 metres)	0.2 – 2.1	(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red-brown mottling; highly fissured (WEATHERED CRUST); non-cohesive, w>PL
	2.1 – 4.3	(CL) SILTY CLAY; grey with red-brown mottling; cohesive, w>PL
	4.3	END OF TEST PIT

Note: water seepage at 1.5 m depth upon completion.

Sample	Depth (m)	Lab Testing
1	2.4 – 2.7	
2	2.7 – 3.1	
3	3.1 – 3.4	w = 30% LL = 25%, PI = 7%
4	3.4 – 3.7	w = 34%
5	3.7 – 3.9	
6	3.9 – 4.3	

TABLE 1

RECORD OF TEST PITS

Test Pit Number Elevation (Metres)	**Depth (metres)**	**Description**
19-03 (78.15 metres)	0.0 – 0.5	TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive, moist
	0.5 – 1.1	(SP) SAND; brown; non-cohesive, moist
	1.1 – 2.3	(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red-brown mottling; (WEATHERED CRUST); non-cohesive, w>PL
	2.3 – 4.3	(CI/CH) SILTY CLAY to CLAY; grey with red-brown mottling; silty sand layers; cohesive, w>PL
	4.3	END OF TEST PIT

Note: water seepage at 1.5 m depth upon completion.

Sample	Depth (m)	Lab Testing
1	2.6– 2.9	w= 69% LL= 61%, PI= 41%
2	2.9 – 3.3	
3	3.3 – 3.6	
4	3.6 – 4.0	
5	4.0 – 4.3	

GOLDER

SHRINKAGE LIMIT DETERMINATIONS
ASTM D4943

Borehole Number	TP19-02	
Sample Number	4	
Depth, m	3.4-3.7	
Shrinkage Dish Number	1	2
Mass of the dry soil pat, g	20.22	20.04
Mass of dry soil pat + shrinkage dish, g	43.39	42.30
Mass of shrinkage dish, g	23.17	22.26
Volume of shrinkage dish, cm^3	13.40	13.33
Mass of wet soil + shrinkage dish, g	49.60	48.40
Moisture content of the soil	30.71	30.44
Mass of dry soil pat before waxing, g	20.22	20.04
Volume of dry soil pat + wax, cm^3	14.90	16.11
Mass of dry soil pat + wax in air, g	23.79	24.73
Mass of dry soil pat + wax in water, g	8.89	8.62
Mass of wax, g	3.57	4.69
Volume of wax, cm^3	3.86	5.07
Specific gravity of wax	0.925	0.925
Volume of dry soil pat, cm^3	11.04	11.04
SHRINKAGE LIMIT, SL	**19.04**	**19.01**
SHRINKAGE RATIO, R	**1.83**	**1.82**

		Date Tested:	3/08/19
Project Number:	07-1121-0232	Tested By:	Frank M
Project Name CLARIDGE(CARSON)/SPRING VALLEY/OTT			

Notes:

Test carried out using wax method (Microsere Wax 5214)

Checked By: LU

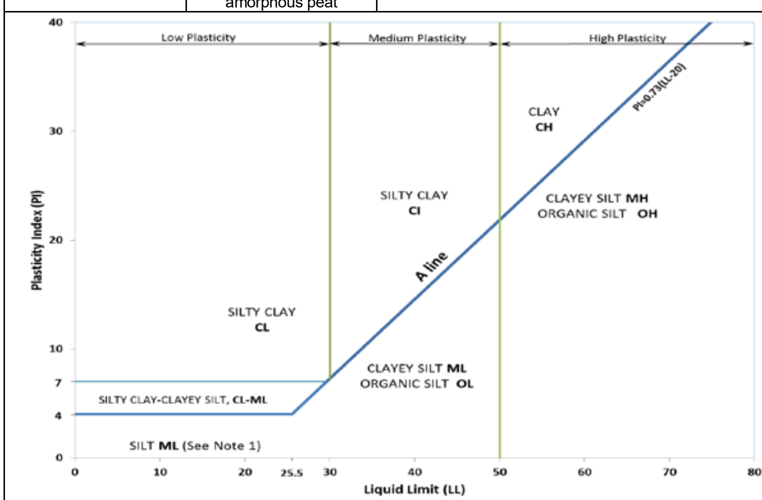
APPENDIX A

List of Abbreviations and Symbols
Record of Borehole Sheets

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators: Dilatancy	Field Indicators: Dry Strength	Field Indicators: Shine Test	Field Indicators: Thread Diameter	Field Indicators: Toughness (of 3 mm thread)	Organic Content	USCS Group Symbol	Primary Name
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.

Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\,\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma$ - u)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c'	effective cohesion
c_u, s_u	undrained shear strength (ϕ = 0 analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$
2 shear strength = (compressive strength)/2

PROJECT: 07-1121-0232

RECORD OF BOREHOLE: 08-204

LOCATION: N 5032526.8 ;E 381695.0

BORING DATE: October 8 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		76.39							
0	Power Auger 200 mm Diam. (Hollow Stem)	Grey brown SILTY CLAY (FILL)		0.00							
		TOPSOIL		76.15 0.24							
		Very stiff to firm, grey brown to red brown SILTY CLAY (WEATHERED CRUST)		75.93 0.46							
1					1	SS	6				
					2	SS	WH				
2		Soft to firm, grey SILTY CLAY		74.50 1.89							
6					3	SS	WH				
		End of Borehole		68.77 7.62							

DEPTH SCALE

1 : 50

GOLDER

LOGGED: D.J.S.

CHECKED: S.A.T.

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 7/16/18 JM

PROJECT: 07-1121-0232

RECORD OF BOREHOLE: 08-205

SHEET 1 OF 1

LOCATION: N 5032570.9 ;E 381718.9

BORING DATE: October 8 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20, 40, 60, 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (20, 40, 60, 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		77.58							
0	Power AUger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very stiff to firm, grey brown SILTY CLAY (WEATHERED CRUST)		77.28 0.30							Bentonite Seal
1					1	SS	6				
		Soft to firm, grey SILTY CLAY		75.87 1.71	2	SS	WH				
2–3											Native Backfill
5											Benonite Seal
											Silica Sand
6											Standpipe
					3	SS	WH				Benonite Seal
7											Cave
		End of Borehole		69.96 7.62							
8											WL in Screen at Elev. 75.70 m on Oct. 17, 2008
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: D.J.S.

CHECKED: S.A.T.

RECORD OF BOREHOLE: 08-206

PROJECT: 07-1121-0232

SHEET 1 OF 1

LOCATION: N 5032572.3 ;E 381786.6

BORING DATE: October 9, 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.30m	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	78.91				
TOPSOIL	0.00				Bentonite Seal
Yellow brown SILTY SAND	78.61 / 0.30				
Loose, brown SAND, trace silt	78.36 / 0.55	1	SS	12	
Compact, brown SILTY SAND	77.81 / 1.10				
Very stiff to stiff, grey brown SILTY CLAY (WEATHERED CRUST)	77.54 / 1.37	2	SS	5	
Stiff to firm, grey SILTY CLAY, with occasional sand seams	76.47 / 2.44				Native Backfill
Firm, grey SILTY CLAY	75.56 / 3.35	3	SS	WH	Benonite Seal; Silica Sand; Standpipe; Cave
End of Borehole	71.29 / 7.62				

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl : 20 40 60 80

ADDITIONAL LAB. TESTING

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 7/16/18 JM

DEPTH SCALE

1 : 50

GOLDER

LOGGED: D.J.S.

CHECKED: S.A.T.

golder.com

GOLDER

TECHNICAL MEMORANDUM

DATE July 23, 2019

Project No. 07-1121-0232

TO Vincent Denomme
Claridge Homes

CC Ryan Magladry
IBI Group

FROM Sean Spanik, EIT

EMAIL sean_spanik@golder.com

INFILTRATION RATE ASSESSMENT
SPRING VALLEY TRAILS - ZENS
380 ROLLING MEADOW CRESCENT, OTTAWA, ONTARIO

Golder Associates Ltd. (Golder), under contract with Claridge Homes (Claridge), undertook an assessment of the infiltration characteristics of the soil strata within the footprint of a proposed development. The tests were completed at 380 Rolling Meadow Crescent Ottawa, Ontario in the vicinity of BH 08-205. Figure 1, attached, shows the site and testing locations.

Method

Measurement of the field-saturated hydraulic conductivity (K_{fs}) of near surface soils was carried out using a Guelph Permeameter apparatus (Model 2800K1) by Golder personnel on July 15, 2019. The testing methodology was based on the stormwater infiltration best management practices described in the Stormwater Management Criteria: Appendix B: Water Balance and Recharge document prepared by the Credit Valley Conservation Authority (CVCA, 2012).

According to CVCA (2012), an infiltration test should be completed at the bottom elevation of the proposed stormwater infiltration best management practice (BMP) and additional tests should be completed at each soil horizon within 1.5 metres of the bottom. It is Golder's understanding that the design elevation for the base of the infiltration BMP is 73.50 metres above sea level (masl). Given that this elevation is below the water table at the site, it was not possible to complete the tests at this depth and instead the tests were completed in the soil layers above the water table.

At each testing location, the Guelph Permeameter was installed in a 6 centimeter (cm) diameter hand-augered hole at a depth ranging from 0.40 to 0.60 metres below ground surface. Four tests were completed in unsaturated soils (above the water table) near BH08-205. The soils encountered during the hand augering were logged. The Guelph Permeameter was operated according to the single head method. The outflow of water at the testing depth was monitored until it was determined that it had reached steady-state. The field-saturated hydraulic conductivity (K_{fs}) of the soil was estimated using the following equation (Elrick et al., 1989):

$$K_{fs} = \frac{C_1 Q_1}{2H_1^2 + \pi a^2 C_1 + 2\pi \frac{H_1}{a^*}}$$

Where: C_1 = shape factor
Q_1 = flow rate (cm^3/s)
H_1 = water column height (cm)
a = well radius (cm)
a^* = alpha factor (0.12 cm^{-1})

In accordance with CVCA (2012), the percolation rate ("T-time" in min/cm) corresponding to each K_{fs} was estimated based on information presented in Tables 2 and 3 of the Supplementary Standard SB-6 Percolation Time and Soil Descriptions, of the Ontario Building Code (OMMAH, 2012) summarized below:

Field-Saturated Hydraulic Conductivity K_{fs} (cm/s)	Estimated Percolation Time, T (min/cm)	Infiltration Rate, 1/T (mm/hr)
10^{-1}	2	300
10^{-2}	4	150
10^{-3}	8	75
10^{-4}	12	50
10^{-5}	20	30
10^{-6}	50	12

Design infiltration rates were then determined in accordance with Table B3 of the Stormwater Management Criteria: Appendix B: Water Balance and Recharge document prepared by the Credit Valley Conservation Authority (CVCA, 2012).

Results

In general, the subsurface conditions at the testing locations consist of a layer of topsoil overlying sand and silty clay. In GP19-01 and GP19-04, the sand layer was not encountered and the silty clay was found beneath the topsoil, similar to nearby BH08-205 (Borehole Record included in Attachment 1). In GP19-02 and GP19-03, the sand layer was found beneath the topsoil, but was not fully penetrated because the water table was encountered prior to reaching the bottom of the sand layer. The Record of Auger Holes is included in Attachment 2.

In order to confirm the depth of the water table, a deeper auger hole was made next to GP19-01, GP19-02 and GP19-03 so that open hole water level measurements could be made. The water level in these holes ranged from 0.85 to 1.05 metres below the ground surface (76.5 to 76.6 masl). As a result of the shallow water table at the site, the testing depth was limited. Two tests were completed in sand and two tests were completed in the silty clay (weathered crust). The results of the tests are presented in the following table:

Test ID	Test Depth (m)	Material	K_{sat} (cm/s)	T-Time (min/cm)	1/T (Infiltration Rate mm/hr)	Design Infiltration Rate (mm/hr)
GP19-01	0.60	silty clay (weathered crust)	2×10^{-6}	38	16	6
GP19-02	0.50	sand	9×10^{-3}	4	150	23
GP19-03	0.40	sand	6×10^{-3}	5	120	18
GP19-04	0.48	silty clay (weathered crust)	2×10^{-6}	38	16	6

Based on the testing results, the field-saturated hydraulic conductivity of the native soils ranges from 2×10^{-6} cm/s (silty clay) to 9×10^{-3} cm/s (sand). Percolation times range from 4 min/cm to 38 min/cm. Infiltration rates (the inverse of the T-times) were calculated to range from 16 mm/hr to 150 mm/hr.

CVCA (2012) recommends incorporation of a safety correction factor, to calculate the “design infiltration rate”. The minimum recommended safety factor is 2.5. A larger safety factor is recommended if less permeable soils are present within 1.5 metres of the bottom elevation of the proposed infiltration BMP. If the infiltration BMP is to be constructed within the sand layer, less than 1.5 metres above the silty clay, the safety factor would be 6.5 and the average design infiltration rate in the sand would be 21 mm/hr. However, given the limited thickness of the sand layer, it is likely that the BMP would be located within the silty clay, which would result in a safety factor of 2.5 and a design infiltration rate of 6 mm/hr for the silty clay. As stated in CVCA (2012), sites where the seasonally high water table is within 0.6 metres of the bottom of a proposed recharge facility (as is expected at this site) may not be suitable for the operation of stormwater facilities based on enhanced recharge measures.

We trust the information included meets your current needs. Should you require clarification, please do not hesitate to contact us.

Yours truly,

Golder Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
B. T. BYERLEY
July 23/19
PROVINCE OF ONTARIO

Sean Spanik, M.A.Sc., EIT
Environmental Consultant

Brian Byerley, M.Sc., P.Eng.
Senior Hydrogeologist/Principal

SPS/BTB/ca
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Attachments: Figure 1 – Guelph Permeameter Test Locations
Attachment 1 – Borehole Record
Attachment 2 – Record of Auger Holes

References

Elrick, D.E., W.D. Reynolds, and K.A. Tan. 1989. Hydraulic conductivity measurements in the unsaturated zone using improved well analyses. Ground Water Monitoring Review. 9:184-193.

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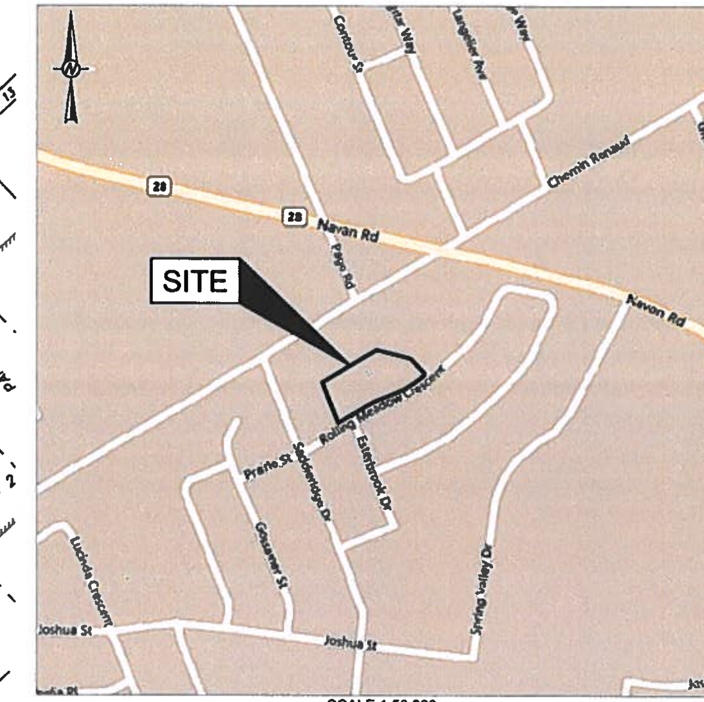
Path: \\golder.gds\gal\ottawa\Active\Spatial_IM\ClaridgeHomes\SpringValleyTrails\CAD\0711210232_Claridge_SpringValleyTrails\40_PROD\0004_Infiltration_Rate_Assessment\ | File Name: 0711210232-0004-CH-0001.dwg | Last Edited By: bradojevic Date: 2019-07-23 Time:1:44:46 PM | Printed By: BRadojevic Date: 2019-07-23 Time:1:45:07 PM

KEY MAP



SCALE 1:50,000

LEGEND

APPROXIMATE GUELPH PERMEAMETER TEST LOCATION

APPROXIMATE BOREHOLE LOCATION

REFERENCE(S)

1. BASE PLAN SUPPLIED BY RODERICK LAHEY ARCHITECT INC. ON APRIL 19, 2018, FILE NO 1721 Zen Site Plans 2018.dwg
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 18, VERTICAL DATUM: CGVD28

0 10 20

1:500 METRES

CLIENT

CLARIDGE HOMES

PROJECT

INFILTRATION RATE ASSESSMENT
SPRING VALLEY TRAILS - ZENS
TTAWA, ONTARIO

TITLE

GUELPH PERMEAMETER TEST LOCATIONS

CONSULTANT

GOLDER

YYYY-MM-DD	2019-07-23
DESIGNED	SS
PREPARED	BR
REVIEWED	BTB
APPROVED	BTB

PROJECT NO.	PHASE	REV.	FIGURE
07-1121-0232	0004	0	1

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

ATTACHMENT 1

Borehole Record

PROJECT: 07-1121-0232

RECORD OF BOREHOLE: 08-205

SHEET 1 OF 1

LOCATION: N 5032570.9 ;E 381718.9

BORING DATE: October 8 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m
		GROUND SURFACE	77.58			
0	Power AUger 200 mm Diam. (Hollow Stem)	TOPSOIL	0.00			
		Very stiff to firm, grey brown SILTY CLAY (WEATHERED CRUST)	77.28 0.30			
1				1	SS	6
		Soft to firm, grey SILTY CLAY	75.87 1.71	2	SS	WH
2–6						
				3	SS	WH
7						
		End of Borehole	69.96 7.62			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl — 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION
Bentonite Seal
Native Backfill
Benonite Seal
Silica Sand
Standpipe
Benonite Seal
Cave

ATTACHMENT 2

Record of Auger Holes

RECORD OF AUGER HOLES

Auger Hole Number Elevation (Metres)	Depth (metres)	Description
GP19-01	0.0 – 0.25	TOPSOIL – (SM) SILTY SAND; brown; non-cohesive, moist
(77.67 metres)	0.25 – 1.50	(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red-brown mottling; highly fissured (WEATHERED CRUST); non-cohesive, w>PL
		END OF AUGER HOLE
		Note: Open hole water level at 1.05 m depth upon completion.
GP19-02	0.0 – 0.25	TOPSOIL – (SM) SILTY SAND; brown; non-cohesive, moist
(77.53 metres)	0.25 – 1.60	(SP) SAND; light brown to grey; non-cohesive, moist
		END OF AUGER HOLE
		Note: Open hole water level at 0.95 m depth upon completion.
GP19-03	0.0 – 0.20	TOPSOIL – (SM) SILTY SAND; brown; non-cohesive, moist
(77.37 metres)	0.20 – 1.40	(SP) SAND; light brown to grey; non-cohesive, moist
		END OF AUGER HOLE
		Note: Open hole water level at 0.85 m depth upon completion.
GP19-04	0.0 – 0.20	TOPSOIL – (SM) SILTY SAND; brown; non-cohesive, moist
(77.53 metres)	0.20 – 0.48	(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red-brown mottling; highly fissured (WEATHERED CRUST); non-cohesive, w>PL
		END OF AUGER HOLE
		Note: Auger hole dry upon completion

GOLDER

TECHNICAL MEMORANDUM

DATE November 12, 2019

Project No. 07-1121-0232

TO Vincent Denomme
Claridge Homes

CC Ryan Magladry
IBI Group

FROM Sean Spanik, EIT

EMAIL sean_spanik@golder.com

DRAWDOWN ASSESSMENT
SPRING VALLEY TRAILS – ZENS
380 ROLLING MEADOW CRESCENT, OTTAWA, ONTARIO

As requested, Golder Associates Ltd. (Golder) undertook an assessment of the potential long-term groundwater lowering as a result of the proposed 100-year underground stormwater storage gallery (storage gallery) for the residential development at 380 Rolling Meadow Crescent (the Site). The current storage gallery design has the potential to lower the groundwater level beneath the foundation of the townhouses, which could lead to foundation settlement and distress since the grade raise design for the townhouses assumed a higher water level. This issue of groundwater lowering has also been raised by the City of Ottawa during their review of the proposed storm water management system.

Groundwater Flow Modelling

Groundwater flow modelling was undertaken in order to evaluate the magnitude of groundwater depressurization that would occur as a result of the proposed storage gallery, particularly in relation to the closest building (building B). The configuration of the numerical model and results of the simulations are detailed below.

Model Construction

Based on logging of borehole 08-205 located at the Site, there are two primary hydrostratigraphic units present in the shallow subsurface (i.e., at the horizon of the storage gallery): a weathered silty clay unit with a thickness of approximately 1.5 m that extends from beneath the topsoil to a depth of approximately 1.7 m, and a non-weathered silty clay unit of at least 6 m thickness (borehole 08-205 was terminated in the non-weathered silty clay unit and its thickness is therefore unknown). Groundwater elevations at the site were measured as 76.5 m above sea level (masl) during infiltration testing that was completed in July 2019, which corresponds to a depth of (building B and the storage gallery), transitioning to a nodal spacing of approximately 2 metres near the boundaries of the model. A total of over 11,000 elements were specified for the 2,500 square metre model domain.

The boundary conditions applied in the model were comprised of constant head boundaries at the model lateral extents specified at an elevation of 76.5 masl, which is reflective of the groundwater elevation that was measured during the infiltration tests completed in July 2019. Given the unknown depth of the silty clay unit the base of the model was assumed to coincide with an impermeable boundary and as such a no flow boundary was specified for this portion of the domain. Recharge applied to the upper surface of the model was specified as zero, as the ground surface will be primarily comprised of impervious materials (e.g., roofs, paved surfaces, etc.) and the soil conditions are expected to allow negligible surficial infiltration to reach the water table.

The foundation drains at building B were simulated by using seepage nodes at the under side of footing (USF) elevation of 75.54 masl and along the perimeter of the foundation. These seepage nodes allow water to exit the model if the calculated groundwater level is above the USF elevation. Based on the drawings provided to Golder, the storage gallery was added to the model 7.25 metres away from building B. The storage gallery was represented with the seepage nodes specified at the outlet pipe invert elevation of 74.59 masl.

Two hydrogeologic units were specified in the model to represent the weathered silty clay and the underlying non-weathered clay. Based on Golder's previous experience in the area, the upper 1 metre of the model was assumed to be weathered silty clay (i.e., from 76.5 to 75.5 masl) and below this to the base of the model was assumed to be non-weathered clay. There were no hydraulic response tests completed at the site to allow for an estimate of hydraulic conductivity of these materials; however, based on infiltration tests completed at the Site, consolidation tests completed on samples of these materials and in consideration of Golder's experience with similar soils, the horizontal hydraulic conductivities of the weathered silty clay and non-weathered clay were assumed to be 1×10^{-7} m/s and 1×10^{-9} m/s, respectively. A horizontal to vertical anisotropy ratio of 10:1 was assumed for both clay units. Given the limited available data and uncertainty in the hydraulic properties of these materials, a range of alternative hydraulic conductivity configurations were tested in the model simulations (refer to Table 1 below).

Model Results

The model was run as a long-term transient simulation of 100 years to approximate steady state conditions. As described above, the model boundary conditions are static and therefore the model does not account for seasonal variability in groundwater elevation.

Table 1 provides a summary of the model scenarios and the simulated additional drawdown below the USF

Table 1 – Model Scenario Parameterization and Simulated Drawdown

Scenario	Weathered Silty Clay K (m/s)	Non-weathered Clay K (m/s)	Anisotropy ($K_{vertical}$:$K_{horizontal}$)	Other Adjustments	Additional Drawdown (m)
1	1×10^{-7}	1×10^{-9}	0.1	N/A	0.65
2	1×10^{-8}	1×10^{-10}	0.1	N/A	0.65
3	1×10^{-6}	1×10^{-7}	0.1	N/A	0.66
4	1×10^{-9}	1×10^{-9}	0.1	N/A	0.70
5	1×10^{-7}	1×10^{-9}	0.01	N/A	0.62
6	1×10^{-7}	1×10^{-9}	0.1	Constant head boundary specified at a value of 76.5 masl along the base of model	0.39
7	1×10^{-7}	1×10^{-9}	0.1	Storage gallery located 19.75 m away from building B	0.58

Notes: 'K' = Hydraulic Conductivity

Based on the results of the model, the additional drawdown below the USF at building B is estimated to be between 0.6 and 0.7 metres given the proposed design. The simulated additional drawdown was not sensitive to changes in hydraulic conductivity or anisotropy as evidenced by scenarios 1 through 5. For scenario 6, where the no flow boundary at the base of the model was replaced with a constant head boundary equivalent to the measured groundwater elevation in the silty clay, to represent the potential of an aquifer underlying the clay, the simulated drawdown below the USF at building B was reduced by about 0.25 metres (i.e., to 0.39 m). For scenario 7, which evaluated the possibility of locating the storage gallery further away from building B to a maximum of 19.75 m (based on the drawings provided to Golder), a minor (0.07 m) reduction in drawdown was achieved.

In summary, the hydrogeologic modelling of this site showed that the maximum estimated drawdown below the USF at building B is expected to be between 0.6 and 0.7 metres based on the current design of the storage gallery.

Based on the results of the simulations with building B, there will likely be some groundwater lowering from the storage gallery at the other buildings on Site as well. At building A, it is anticipated that the additional drawdown

Based on the anticipated maximum drawdown of 0.7 metres indicated above, a 0.4 m thickness of EPS would be required surrounding the building foundations to account for the groundwater drawdown. The EPS layer of fill should extend at least 3 m outwards from the foundation wall. This thickness of EPS is additional to any EPS fill required to meet the grade raise requirement of 0.5 metres. However, if the actual grade raise fill is less than the limit of 0.5 m, the additional EPS thickness around the foundations to accommodate the groundwater lowering can be reduced. For example, on the east side of Building A, the grade raise is indicated to be 0.3 metres, 0.2 metres in height less than the allowable grade raise of 0.5 metres and therefore the additional EPS fill to account for groundwater lowering can be reduced by 0.2 metres.

If EPS fill extending outwards from the foundations by 3 m cannot be accommodated, then EPS fill extending full depth (from 0.3 metres below final ground surface) to the top of the footing will be required. That EPS fill should extend out from the foundation walls a distance of 1.2 metres.

Closed System

In order to eliminate the possibility of impacts due to groundwater lowering, the storage gallery could be designed as a water-tight system. The open arches of the current storage gallery design would need to be replaced by closed pipes to prevent groundwater from entering the system and thereby not causing groundwater lowering. As the storage gallery would be installed below the water table and the pipes would be empty a significant portion of the time, buoyancy would be an important consideration in the design.

Limitations

This technical memorandum was prepared for the exclusive use of Claridge Homes. The technical memorandum, which specifically includes all tables, figures and attachments, is based on data and information collected by Golder Associates Ltd. and is based solely on the conditions of the properties at the time of the work, supplemented by historical information and data obtained by Golder Associates Ltd. as described in this technical memorandum.

Electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore authenticity of any electronic media versions of Golder's technical memorandum should be verified.

Golder Associates Ltd. has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the technical memorandum as a result of omissions, misinterpretation, or fraudulent acts of the persons contacted or errors or omissions in the reviewed documentation.

The services performed, as described in this technical memorandum, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Closure

We trust the information included meets your current needs. Should you require clarification, please do not hesitate to contact us.

Yours truly,

Golder Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
B. T. BYERLEY
Nov 12/19
PROVINCE OF ONTARIO

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Attachments: Attachment 1 – Borehole Record
Attachment 2 – Record of Auger Holes

References

Diersch, H-J G. (2014). FEFLOW, Finite Element Modeling of Flow, Mass and Heat Transport in Porous and Fractured Media. DHI-WASY GmbH, Berlin, Germany.

ATTACHMENT 1

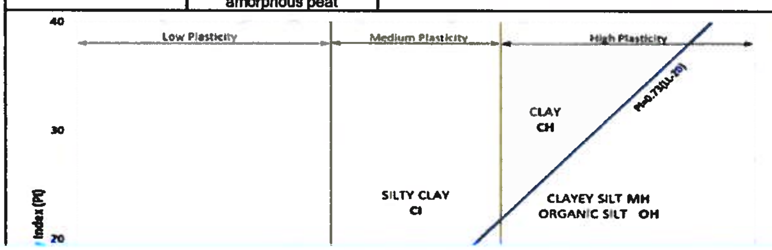
Borehole Record

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators: Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)	Organic Content	USCS Group Symbol	Primary Name
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.

For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.

For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.*, SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)
An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\,\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index $= (w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index $= (w - w_p) / I_p$
I_C	consistency index $= (w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction

RECORD OF BOREHOLE: 08-205

PROJECT: 07-1121-0232

SHEET 1 OF 1

LOCATION: N 5032570.9 ;E 381718.9

BORING DATE: October 8 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power AUger, 200 mm Diam. (Hollow Stem)

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1			1	SS	6
	Soft to firm, grey SILTY CLAY	75.87 / 1.71	2	SS	WH
2–6					
			3	SS	WH
7					

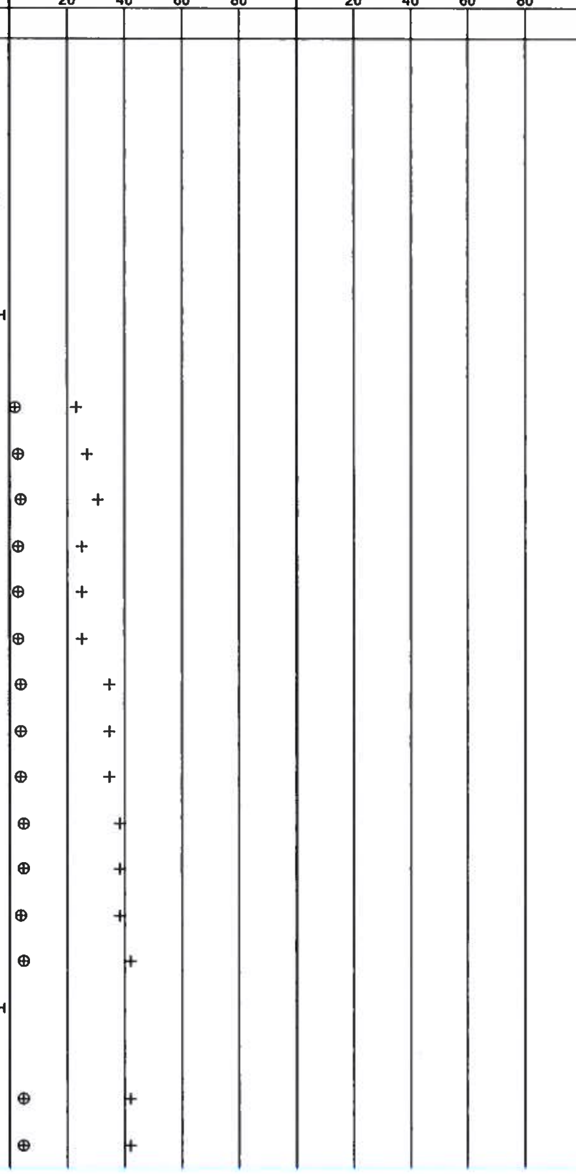
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80)

SHEAR STRENGTH Cu, kPa: nat V. + Q - ●; rem V. ⊕ U - ○ (20, 40, 60, 80)

HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3})

WATER CONTENT PERCENT: Wp, W, Wl (20, 40, 60, 80)

ADDITIONAL LAB. TESTING



PIEZOMETER OR STANDPIPE INSTALLATION

ATTACHMENT 2

Record of Auger Holes

RECORD OF AUGER HOLES

Auger Hole Number Elevation (Metres)	Depth (metres)	Description
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		END OF AUGER HOLE
		Note: Open hole water level at 1.05 m depth upon completion.
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		Note: Open hole water level at 0.95 m depth upon completion.
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(77.37 metres)	0.20 – 1.40	(SP) SAND; light brown to grey; non-cohesive, moist
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		Note: Open hole water level at 0.85 m depth upon completion.
GP19-04	0.0 – 0.20	TOPSOIL – (SM) SILTY SAND; brown; non-cohesive, moist
(77.53 metres)	0.20 – 0.48	(CI/CH) SILTY CLAY to CLAY, trace sand; grey brown with red-brown mottling; highly fissured (WEATHERED CRUST); non-cohesive, w>PL
		END OF AUGER HOLE
		Note: Auger hole dry upon completion

GOLDER

TECHNICAL MEMORANDUM

DATE April 6, 2020 **Proposal No.** 07-1121-0232

TO Vincent Denomme
Claridge Homes

FROM Bill Cavers, P.Eng. **EMAIL wcavers@golder.com**

**GRADING PLAN REVIEW
PROPOSED RESIDENTIAL DEVELOPMENT
SPRING VALLEY TRAILS – ZEN BLOCKS
380 ROLLING MEADOW CRESCENT
OTTAWA, ONTARIO**

As requested, we have reviewed the Grading Plans in relation to the recommendations provided in Golder Associates geotechnical report for the proposed residential development. More specifically, Golder Associates reviewed the following grading plans prepared by IBI Group:

- Grading Plan, Project No. 115201, Drawing No. 200, Revision 8 (February 7, 2020), dated October 2018

The geotechnical recommendations for this development were provided in a report to Claridge Homes titled "*Geotechnical Investigation, Residential Development, Spring Valley Trails – Zen Blocks, Ottawa, Ontario*" dated December 2019 (report number 07-1121-0232).

The table attached summarizes the site specific information gathered from the geotechnical investigation and available plans.

The geotechnical report prepared by Golder indicates that the grade raise limit at Buildings A and B is limited to 0.1 m, due to potential groundwater drawdown, and at Buildings C and D the grade raise limit is 0.5 m. As indicated in the attached table, EPS fill will be required at Buildings A and B due to the grade raise exceedances noted and the thickness and extent of EPS at each building is indicated in the geotechnical report. In addition, EPS fill will be required at the planters at the entranceways at all buildings, as also indicated in the geotechnical report.

Based on the grading review, the review of the grading analysis and the information provided in the geotechnical report, the grading plan is considered acceptable from a geotechnical point of view.

Based on conversations with Roderick Lahey Architect Inc., it is understood that the stairs for entrances to the 'main floor' (located on the north and south sides of the buildings) will be backfilled up to the same level as the surrounding grade raise elevation, and that the remainder of the stairs will be empty. If the stairs are to be backfilled above the maximum permissible grade raise of 0.5 metres, the backfill material should consist of expanded polystyrene (EPS) lightweight fill.

Closure

We trust that this memo provides sufficient information for your present requirements. If you have any questions concerning this memo, please don't hesitate to contact us.

Yours truly,

Golder Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
W. CAVERS
100077934
April 6, 2020
PROVINCE OF ONTARIO

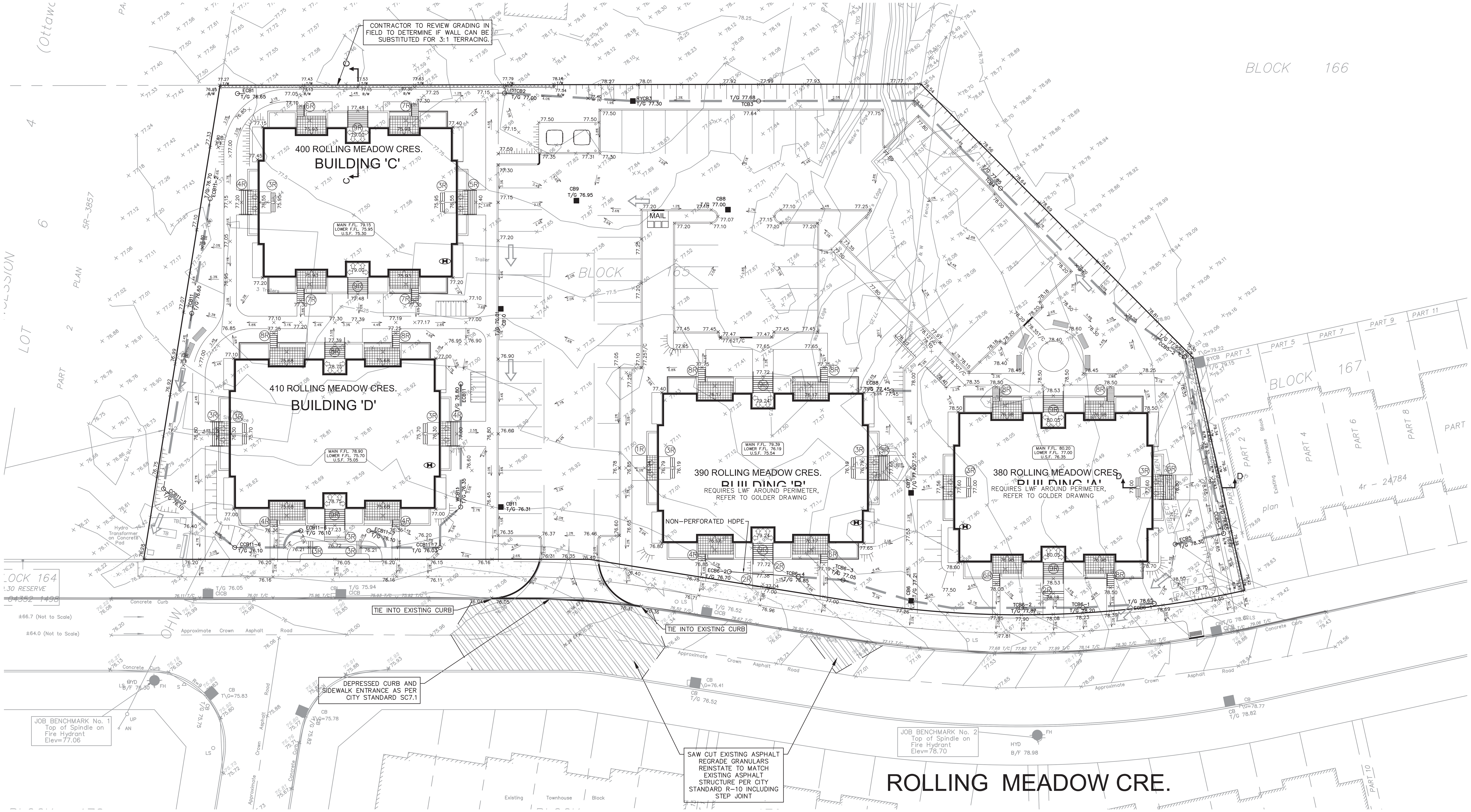
Bill Cavers, P.Eng.
Associate, Senior Geotechnical Engineer

WAM/WC/CH/hdw
n:\active\2007\1121 - geotechnical\07-1121-0232 claridge spring valley ottawa\zens-2018\grading plan review\07-1121-0232-tm-001-rev2-grading plan review-2april20.docx

Attachments: Table 1 – Grade Elevation for Blocks

Table 1 - Summary of Design Details JOB #: 07-1121-0232
Spring Valley Trails - Zen Blocks DATE: May 30, 2019

Street #	Block #	Lot #	Existing Grades					USF	Proposed Finished Grades					Grade Raise Limit	Calculated Grade Raises				Exceeding Grade Raise			
			N	W	S	E	**AVE**		N	W	S	E	**AVE**		N	W	S	E	N	W	S	E
	A		78.76	77.95	77.52	78.90	**78.28**	76.35	78.50	78.35	78.00	78.70	**78.39**	0.50	-0.26	0.40	0.48	-0.20	No	No	No	No
	B		77.31	77.13	76.70	77.36	**77.13**	75.54	77.65	77.40	77.30	77.65	**77.50**	0.50	0.34	0.27	0.60	0.29	No	No	**Yes**	No
	C		77.84	77.52	77.12	77.08	**77.39**	75.30	77.40	77.15	77.20	77.20	**77.24**	0.50	-0.44	-0.37	0.08	0.12	No	No	No	No
	D		77.00	77.12	76.50	76.60	**76.81**	75.05	77.00	77.10	77.00	77.00	**77.03**	0.50	0.00	-0.02	0.50	0.40	No	No	No	No



KEYPLAN N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8	REISSUED FOR CWN	DGY	20:02:07
7	ISSUED FOR CWN	DGY	19:12:24
6	REVISED PER CITY COMMENTS	DGY	19:11:21
5	REVISED PER CITY COMMENTS	DGY	19:09:20
4	REVISED PER ADDENDUM #3	DGY	19:09:19
3	ISSUED FOR TENDER	DGY	19:08:26
2	REVISED PER CITY COMMENTS	DGY	19:04:09
1	ISSUED FOR CITY REVIEW	DGY	18:10:11

CLARIDGE HOMES
CLARIDGE HOMES (CARSON) INC.
2001-210 GLADSTONE AVE
OTTAWA, ON
K2P 0Y6
613-233-6030

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title
SPRING VALLEY TRAILS ZENS
WALK-UP TOWNHOUSES

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/02/07
PROVINCE OF ONTARIO

N

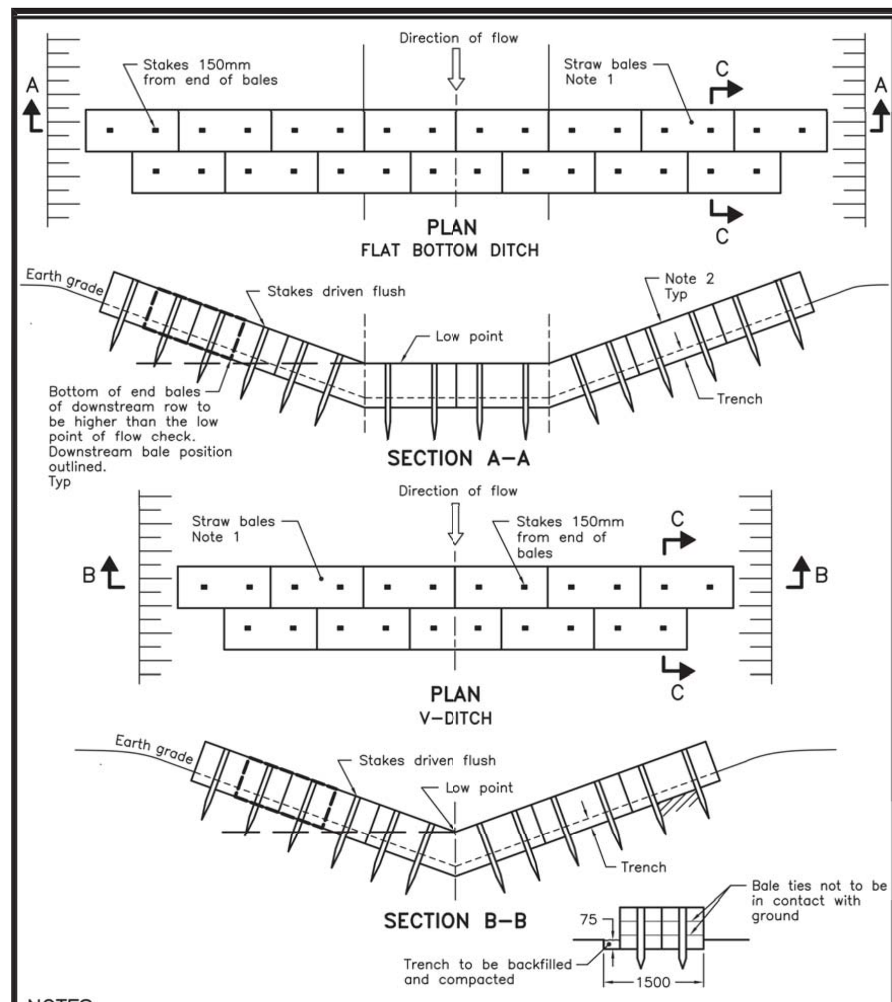
Drawing Title
GRADING PLAN

Scale
1:250

Design	Date
R.M./W.Z.	OCTOBER 2018
Drawn	Checked
E.H.	D.G.Y.
Project No.	Drawing No.
115201	200

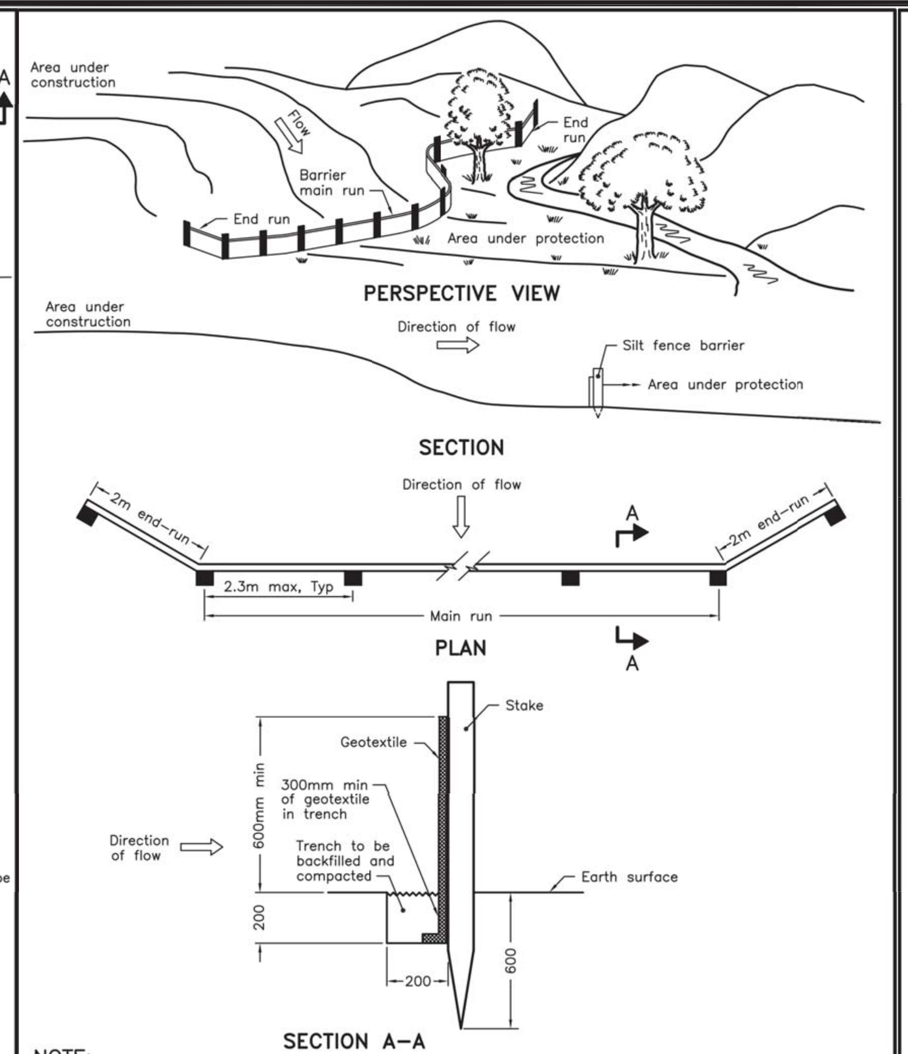
CITY PLAN No. 18055

CITY FILE No. D07-12-18-0167



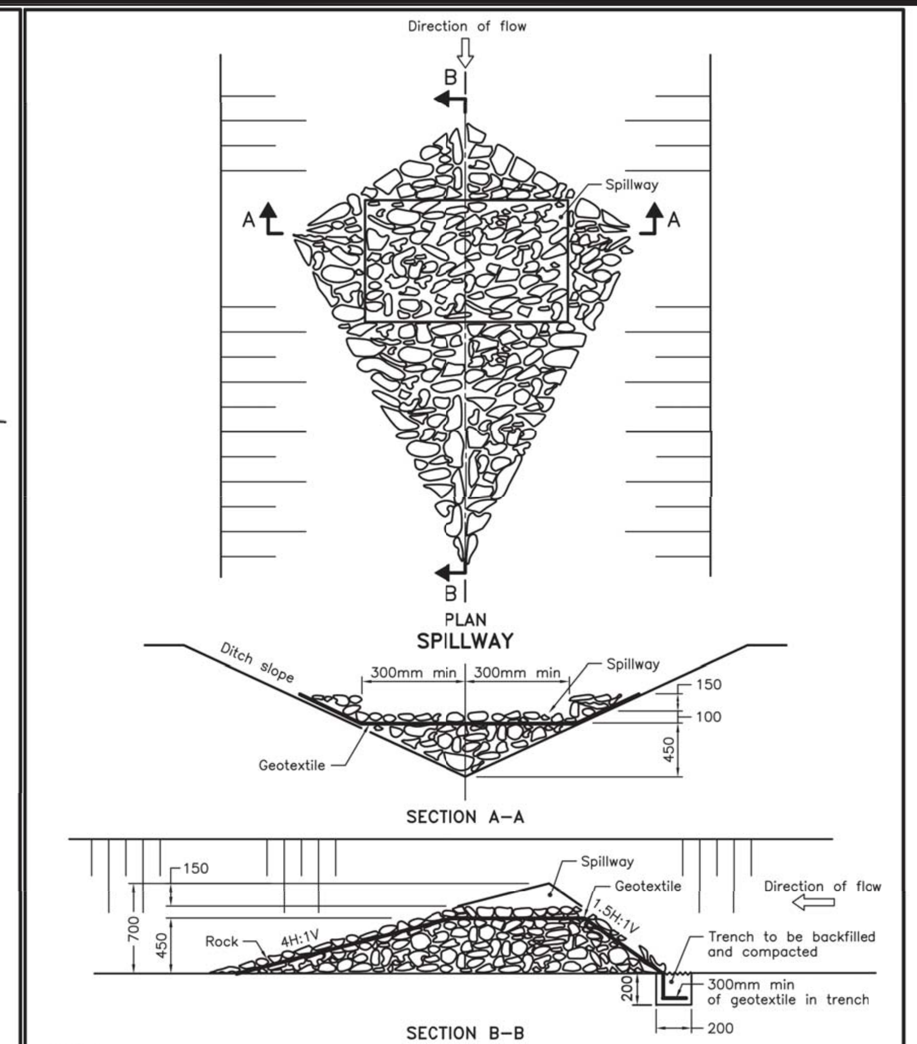
NOTES:
1 Number of bales varies to suit ditch.
2 Straw bales to be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1
STRAW BALE FLOW CHECK DAM		OPSD 219.180



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1
LIGHT–DUTY SILT FENCE BARRIER		OPSD 219.110

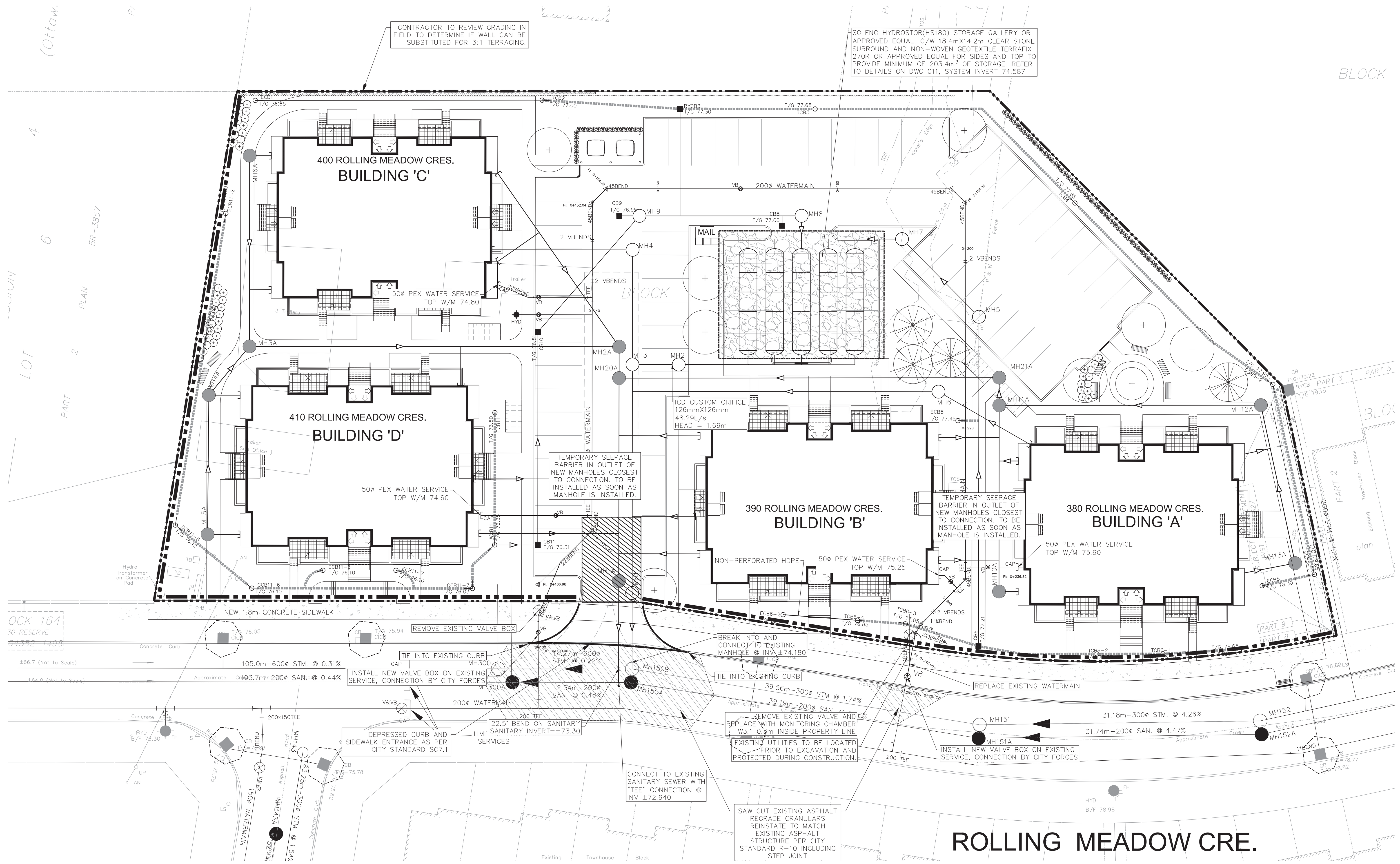


NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev 1
ROCK FLOW CHECK DAM V–DITCH		OPSD 219.210

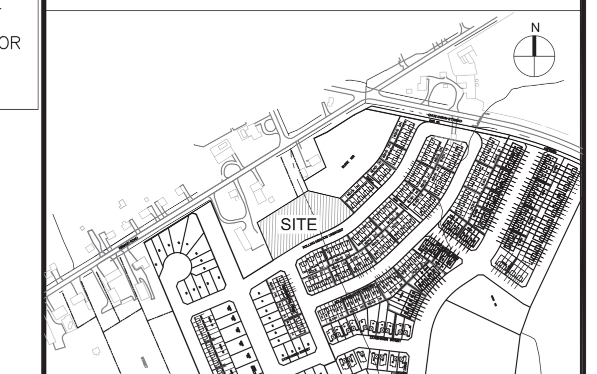
NOTES:

1. SILT FENCE TO BE ERECTED PRIOR TO EARTH WORKS BEING COMMENCED. SILT FENCE TO BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED OR UNTIL START OF SUBSEQUENT PHASE.
2. STRAW BALE SEDIMENT TRAPS TO BE CONSTRUCTED IN EXISTING ROAD SIDE DITCHES. TRAPS TO REMAIN AND BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED.
3. SILT SACK TO BE PLACED AND MAINTAINED UNDER COVER OF ALL CATCHBASINS. GEOTEXTILE SILT SACK IN STREET CBs TO REMAIN UNTIL ALL CURBS ARE CONSTRUCTED. GEOTEXTILE FABRIC IN RYCBs TO REMAIN UNTIL VEGETATION IS ESTABLISHED. ALL CATCHBASINS TO BE REGULARLY INSPECTED AND CLEANED, AS NECESSARY, UNTIL SOD AND CURBS ARE CONSTRUCTED.
4. CONTRACTOR TO PROVIDE DETAILS ON LOCATION(S) AND DESIGN OF DEWATERING TRAP(S) PRIOR TO COMMENCING WORK. CONTRACTOR ALSO RESPONSIBLE FOR MAINTAINING TRAP(S) AND ADJUSTING SIZE(S) IF DEEMED REQUIRED BY THE ENGINEER DURING CONSTRUCTION.
5. CONTRACTOR TO PROTECT EXISTING CATCHBASINS WITH FILTER CLOTH UNDER THE COVERS TO TRAP SEDIMENTATION. REFER TO IDENTIFIED STRUCTURES.
6. ALL DISTURBED AREA TO BE REVEGETATED AS SOON AS POSSIBLE.
7. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED WEEKLY OR IMMEDIATELY FOLLOWING A STORM EVENT. ANY DAMAGED CONTROL MEASURE SHALL BE REPAIRED IMMEDIATELY. CONTRACTOR TO BE RESPONSIBLE FOR PROTECTING EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION.
8. ALL SEDIMENT DEPOSITS SHALL BE REMOVED FROM SITE AND DISPOSED OF AT APPROPRIATE DISPOSAL FACILITY, OR SHALL BE TESTED BY GEOTECHNICAL ENGINEER WHO MAY PROVIDE RECOMMENDATIONS FOR MATERIALS TO BE USED ONSITE PRIOR TO LANDSCAPING.



LEGEND

- HEAVY DUTY SILT FENCE
- SNOW FENCE
- STRAW BALE CHECK DAM
- STRAW BALE CHECK DAM WITH FILTER CLOTH
- ROCK CHECK DAM
- SEDIMENT SACK PLACED UNDER EXISTING CB COVER
- TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOTH



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SPRING VALLEY TRAILS
ZENS
WALK-UP TOWNHOUSES

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/02/07
PROVINCE OF ONTARIO

N

Drawing Title

EROSION AND SEDEMENTATION CONTROL PLAN

Scale	1:500
Design: R.M./W.Z.	Date: OCTOBER 2018
Drawn: E.H.	Checked: D.G.Y.
Project No.: 115201	Drawing No.: 900

CITY PLAN No. 18055

CITY FILE No. D07-12-18-0167