Report
Project: 123888-6.04.01

ADEQUACY OF PUBLIC SERVICES REPORT SPRING VALLEY TRAILS SUBDIVISION PHASE 5/6

Prepared for CLARIDGE HOMES
by IBI Group
February 10, 2020

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APPENDICIES:

1 INTRODUCTION

IBI Group has been retained by Claridge Homes to prepare an Adequacy of Public Services Report (APSR) to support the proposed draft plan application for Phase 5/6 of their Spring Valley Trails (SVT) residential development in the City of Ottawa, formerly the Town of Gloucester.

Spring Valley Trails Phases 1 to 5 is a 35.65 ha parcel owned and developed by Claridge Homes. Recently, Claridge purchased the 7.88 Ha property directly abutting the developments eastern boundary and proposes to develop it in conjunction with Phase 5; hence, the notation is Phase 5/6. The previous four phases of SVT have all been designed approved and municipal services installed and operational.

The SVT 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.

Phase 5/6 is bounded by Navan Road to the North, Trans Canada Trail (formerly CP railway corridor) and Mer Bleue Conservation area to the south, existing residential lands (previous phases of Spring Valley Trails to the west, and undeveloped rural land and the Navan Road waste management facility (BFI Canada Inc.) to the east. Refer to key plan on **Figure 1** for site location.

Figure 1 Site Location

The proposed development consists of typical low and medium density residential suburban construction for the Ottawa surroundings. A total of 11 single family homes, 218 townhomes, 44 back to back townhouse units and 48 walk-up apartment units are proposed to be constructed within the 12.71 Ha Phase 5/6. A copy of the proposed draft Plan of Subdivision, prepared by AOV, is included in **Appendix A**.

This ASPR supports the draft plan application by demonstrating that the existing municipal water, sanitary and storm infrastructure is capable of servicing the proposed subdivision. The conceptual servicing design conforms to current City of Ottawa and MOE design criteria. No pre-consultation meetings were requested from the Rideau Valley Conservation Authority (RVCA) or the Ministry of Environment of Ontario (MOE). Since the SUT development is part of the approved EUC MSS and no downstream works are required to accommodate the development. A pre-consultation meeting was held with the City and the meeting notes are included in **Appendix A**.

In addition to this report, the subject area is supported by the following reports:

- EUC Pond 3 detail design
- EUC MSS
- Phase 1 Detail Design Report
- Phase 2 Detail Design Report
- Phase 3 Detail Design Report

2 WATER DISTRIBUTION

2.1 Existing Conditions

The Spring Valley Trails (SVT) development is located within the City of Ottawa pressure zone 2E. The March 2005 Stantec EUC Infrastructure Servicing Study update (MSS), which outlined the proposed water distribution system for the EUC, identified 300 mm diameter watermains along Renaud Road and Navan Road, a 300 mm diameter main along Joshua Street was also identified to connect the above noted mains. As part of SVT Phase 3, there are several existing watermains adjacent to the site including 300 mm diameter watermain along Joshua Street, 200 mm diameter watermains along Knotridge Street, Perrodale Walk, Broadridge Crescent and a 150 mm diameter along Winterhaven Drive. All of these have been constructed to the limits of the proposed development. Phase 3 General Plan 100 in **Appendix B** illustrates the location of the existing water plant adjacent to the site.

2.2 Design Criteria

2.2.1 Water Demands

Phase 5/6 consists of a mix of single-family homes, street townhomes, back-to-back units and apartments. 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 1.9 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

2.2.2 System Pressures

The 2010 City of Ottawa Water Distribution Guidelines 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 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in 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	Maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code the maximum pressure should not exceed 552 kPa (80 psi) in occupied areas. Pressure reduction controls may be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.2.3 Fire Flow Rate

The Fire Underwriters Survey (FUS) method of calculating fire flow requirements is to be used in accordance with the Ottawa Design Guidelines – Water Distribution. In the FUS method, wood frame buildings with separations less than three meters are considered one fire area. Buildings in the SVT Phase 5/6 development are wood frame buildings, with separation less than three meters. Similar to Phase 3, the expected fire flow rating will be 10,000 l/min. This will be confirmed at detailed design.

2.3 Conceptual Water Plan

At detail design, a Hydraulic Model of the water network will be developed to ensure both domestic and fire flows are achieved. **Figure 2.1** in **Appendix B** illustrates the conceptual layout of the water network. Based on the observed results of the adjacent Phase 3, it is anticipated the units in the south end of Phase 5/6 will require pressure reducing valves due to ground elevation change.

3 WASTEWATER SYSTEM

The wastewater system approved for the East Urban Community (EUC) is outlined in the EUC infrastructure Servicing Study Update, dated March 2005, prepared by Stantec. The servicing study identified a 375/300 mm diameter trunk sanitary sewer (Trunk 4) along Joshua Street to service the SVT lands. The sewer also services the residential lands between SVT and Navan Road including a 1.3 Ha allocation for future commercial development. The trunk sewers ultimately drain to the Forest Valley Pump Station, located on Renaud Road.

3.1 Existing Conditions

Phase 1 to 4 of SVT have been constructed and are operational. Those works also included the extension of municipal services to the limits of Phase 3 to support the development of SVT Phase 5/6. A total of 5 sanitary connection points have been constructed to service Phase 5/6. They include a 250 mmØ on Joshua Street, a 200 mmØ on Winterhaven Drive, a 200 mmØ on Perrodale Walk, a 200 mmØ on Fountainhead Drive and a 200 mmØ on Broadridge Crescent. Phase 3 General Plan 100 in **Appendix B** illustrates the connection points.

3.2 Design Criteria

The sanitary flows for the development were determined based on the 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
	1.9 persons per apartment unit
Domestic Flow:	280l/cap/day
Peak Factor (Residential only)	Harmon Formula
Institutional/Industrial/Commercial:	28,000l/d/Ha
Peak Factor (ICI only)	1.0
Extraneous Flow (Infiltration)	0.33l/s/Ha
Minimum Pipe Size:	200mm diameter

3.3 Conceptual Wastewater Plan

The 2005 EUC Infrastructure Servicing Update Study identified a 375 mmØ sanitary sewer, trunk #4, along Joshua Street to service this general area, as highlighted on the EUC Tributary Area Plan - SAN in **Appendix C**. The study projected for this tributary area of 69.74 Ha a population of approximately 3457 plus 1.3 Ha commercial and 2.8 Ha institutional uses would be serviced by this sewer. Based on the design criteria at the time, this resulted in a peak flow of 70.58 l/s. As this area has progressed from CDP to Plan of Subdivision, the development plan has been refined to meet market conditions. Currently this sewer services 607 singles, 100 semis and 722 townhouse units combined with proposed 11 singles, 218 towns, 44 back-to-back units and 48 zen (apt) units, along with potential future development of 0.96 Ha commercial lands. Based on the densities used in the EUC study, 3.2 ppu single, 2.4 ppu semi and townhouses, 1.9 ppu high density (low rise apartments), the projected population to be serviced by this sewer is now approximately 4374.4. The projected total peak flow for this population plus ICI and infiltration allowance usages is approximately 64.72 l/s using current City Design Criteria which is less than the EUC projection of 70.58 l/s and within the capacity of the sewer 85.79 l/s. The sewer design

sheet in **Appendix C** "EUC vs. Actual" provides this comparison and also confirms the downstream sewer has ample capacity to accommodate the projected flows from this area.

During design of the Forest Valley pump station, the impacts from catastrophic failure were reviewed. Specifically, if the pump station failed during a major, 100 year storm event, while the sanitary system was under peak loading. The sanitary sewer system would become overwhelmed and surcharge, creating a Hydraulic Grade Line (HGL) in the pipe network. The sanitary sewer surcharge levels were investigated, and Stantec Engineering completed a sanitary sewer HGL analysis under the above noted conditions. In order to minimize the sanitary HGL, two emergency overflows were installed at MH101B and 120B of SVT Phase 1. The analysis was updated in support for the previously approved Phase 3. Since the current proposed flows are less than the flows used in the above noted analysis, no system impact on the downstream HGL is anticipated.

Figure 3.1 in **Appendix C** illustrates the conceptual layout of the sanitary sewer network to service phase 5/6, and the Phase 3 sanitary sewer design sheets have been updated to illustrate the proposed extension of municipal services will not have a negative impact on the existing downstream sanitary sewer system. The sewers within Phase 5/6 will be designed to meet City of Ottawa and MOE requirements.

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.

Following the approval of the 2005 EUC infrastructure servicing study report and design of the trunk storm sewer tributary to Pond 2, the drainage area tributary to Pond 2 was redefined. As outlined within the report 'Gloucester East Urban Community Phase 2 Infrastructure Servicing Study Update' (Stantec, September 27, 2013), approximately 29.8ha of land which was formerly tributary to the existing Pond 3 SWM Facility will be directed towards the proposed Pond 2 SWMF. Please refer to Drawing 2 titled 'Storm Sewer System' provided within Appendix C of this report which identifies the area total tributary to Pond 2. Subsequent to that report, the total drainage area has been confirmed as an approximate 32.7ha portion of the upstream tributary drainage area as re-directed to the EUC Pond 2 SWM facility. The removal of this drainage area equates to an approximate 2779l/s of spare capacity within the existing trunk storm sewer within the SVT system and Phase 3 was designed accordingly. Phase 3 provided multiple points of connection with the major sewers being a 825 mm diameter sewer in Joshua Street, and a 975 mm diameter sewer in Winterhaven Drive, with a total allocation of 2384 l/s for Phase 5/6.

4.2 System Concept

The stormwater management system for the site incorporates standard urban drainage design and stormwater management features that can be summarized as follows:

- a dual drainage concept;
- routing of surface runoff; and,
- an end-of-pipe SWM facility (designed by others).

The stormwater management system has been developed based on the MOE *Stormwater Management Planning and Design Manual* (March 2003) and the *City of Ottawa Sewer Design Guidelines* (October 2012). Additionally, the system has incorporated, wherever possible given the existing trunk sewer inlet capacity restrictions, the new guidelines set forth within the Technical Bulletin PIEDTB-2016-01.

4.2.1 Minor System

The minimum minor system capture of ICDs for the SVT Ph 5/6 site will be based on 2 year SWMHYMO generated flows for individual areas. The subject site will be modelled using SWMHYMO to confirm minor and major system flows. Hydrographs from the site will be downloaded to XPSWMM hydraulic model to confirm hydraulic grade line within the proposed storm sewers.

4.2.2 Major System

Inlet control devices (ICDs) will be proposed to control the surcharge in the minor system during infrequent storm events and maximize the use of available on site storage. Due to the relatively steep topography across a portion of the site, on-site storage is mainly limited to the South portion of the site. Surface runoff in excess of the minor system capture will cascade via street segment blocks to the SWM pond or for the southern section released into the buffer area.

4.3 Hydrological Analysis

Hydrological analysis of the proposed dual drainage system of the subject site will be conducted using SWMHYMO. This technique offers a single storm event flow generating and routing.

The primary focus of the hydrological analysis will be to evaluate surface flow and ponding conditions during the 100 year storm event in order to satisfy City of Ottawa Sewer Design Guidelines (2012) in terms of velocity x depth. The 2 year simulation will be performed to assure that after the storm is over there will be no ponding on the streets. The parameters to be used to model the subject site are presented below.

4.3.1 Design Storms and Drainage Area Parameters

The following design parameters will be used in the evaluation of the stormwater management system for the subject site:

4.3.2 Design Storms

- 2, 5 and 100 year, 12 hour SCS type II storm event, consistent with the Carp River Model Calibration Validation Exercise Draft Final Report (Greenland, April 29, 2011);
- 5 and 100 year, 3 hour Chicago storm event with a 10 minute time step, including a 100 year + 20% 3 hr Chicago storm per ISDTB-2012-1;
- July 1, 1979 and August 8, 1996 Historical storms as per the City of Ottawa Sewer Design Guidelines (2012);
- 100 year, 12 hour SCS type II storm event with a 20% increase in intensity, as per the Technical Bulletin ISDTB-2012-1

4.3.3 Run-Off Coefficients

The run-off coefficients for the minor system design will be derived from an analysis of a representative sample of the proposed development area. To be confirmed at detail design, it is anticipated the coefficients will be similar to the following:

	C^{Ave}
Single/Townhome Mix	0.70
Town Homes/Back to Back	0.8
Low Rise Apartments	0.8
Commercial	0.8

4.3.4 Time of Concentration

Inlet times of 10 min. for street segments and rear yard inlets will be utilized as per the City of Ottawa Sewer Design Guidelines (2012).

4.3.5 Area and Imperviousness:

The catchment areas and imperviousness values are based on the rational method spreadsheet. The total and directly connected imperviousness rations will be based upon the previous and impervious areas for the front yard and rear yard catchment areas.

4.4 Conceptual Storm Sewer System

Figure 4.1 in **Appendix D** illustrates a conceptual layout of the storm sewer network to service Phase 5/6 and the Phase 3 storm sewer design sheets have been updated to illustrate the existing downstream infrastructure is suitably sized to accommodate the proposed development. The storm sewers for Phase 5/6 will be designed to meet City of Ottawa and MOE requirements.

5 SOURCE CONTROLS

5.1 General

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.

5.2 Lot Grading

Residential lots within the 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

Phase 5/6 of the development will consist of single family lots and townhomes. It is proposed that roof leaders from these units be constructed such that runoff is directed to 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 subdivision 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.

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 Rear Yard Drainage

Some of the rearyard 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 rear yard catchbasins 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. A preliminary erosion and sediment control plan has been prepared and is included in **Appendix E**. 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 are proposed at the outlet of existing manholes, or where a stub was provided, the first upstream manhole outlet. Temporary flow controls will be sized based on the peak flows for sanitary sewers.

Temporary flow controls are to be maintained during construction and shall not be removed until a letter of conformance has been issued by the Engineer confirming that upstream sewers, services, inlet control devices (where applicable) and base course asphalt have been constructed.

7.4 Seepage Barriers

The presence of road side ditches along Navan Road and the proximity of the Mer Bleue wetland necessitates the installation of 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. 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.

7.5 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.

7.6 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 ROADS

Vehicular access to Phase 5/6 is provided by multiple local street connections to the existing SVT subdivision. The draft plan of subdivision identifies a combination of 18.0m and 20m local right of ways, with 8.5m asphalt widths throughout, with the exception of Joshua Street, which is proposed as a 26.0m collector right of way, with 11.0m asphalt.

A collector road connection (Joshua Street) is provided for future lands to the east, and is intended on being extended to Navan Road.

In support of detail design, an environmental noise impact assessment will be prepared to assess noise impact from traffic along Navan Road and Joshua Street. The proposed draft plan makes reasonable effort to reduce noise barriers by incorporated window streets, there are inevitably locations where outdoor living areas are exposed to vehicular generated noise. These areas include sideyard flankages in close proximity to Navan Road and Joshua Street, and rear yards which are not yet protected by future development. It is anticipated the results of the Environmental Noise Impact Assessment will include but are not limited to the following:

- Noise Barrier along Navan Road
- Noise Barrier along Joshua Street
- Indoor and Outdoor noise clauses for various units, with various requirements

9 SOILS

Patterson Group geotechnical investigation dated February 1, 2020 provides details on the existing soils within the development. A copy of the report is included in **Appendix E**. The report contains recommendations which include but are not limited to the following:

- Grade raise constraints are recommended for Phase 5/6 are identified within the report PG5224-1 as 3 separate areas. Area 1 with a permissible grade raise of 2.5m, and Area 2 with a permissible grade raise of 1.0 m and area 3 with a permissible grade raise of 0.5 m.
- 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 HL3 superpave 12.5mm

50mm superpave 19mm

150mm Granular 'A'

400mm Granular 'B' Type II

Collector Road

40mm HL3 superpave 12.5mm (wear)

50mm superpave 19mm (upper binder)

50mm superpave 19 mm (lower binder)

150mm Granular 'A'

600mm Granular 'B' Type II

A conceptual grading plan for Phase 5/6, **Figure 6.1**, is included in **Appendix E**, the plan follows the grade raise constraints noted above. At detail design, the grading plan will be developed in concert with the building type, geotechnical constraints, and City of Ottawa Design Guidelines. The geotechnical engineer will review the detailed grading plan and provide their acceptances of the grades relative to the geotechnical constraints prior to submission to the City of Ottawa for review/approval.

10 RECOMMENDATIONS

Water, wastewater and stormwater systems required to develop Phase 5/6 of Spring Valley Trails will be designed in accordance with MOE and City of Ottawa's current level of service requirements.

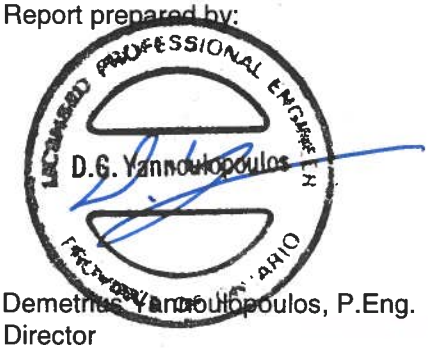
The use of lot level controls, conveyance controls and end of pipe controls outlined in the report will result in effective treatment of surface stormwater runoff from the site. Adherence to the proposed sediment and erosion control plan during construction will minimize harmful impacts on surface water.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

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

- Phase 5/6 Commence Work Order: City of Ottawa
- Phase 5/6 ECA (sewers): MOE
- Phase 5/6 Watermain Approval: City of Ottawa
- Phase 5/6 Commence Work Order (utilities): City of Ottawa

This report was proposed in accordance with the City's Development Servicing Study Guidelines, see study checklist in **Appendix E**.

Report prepared by:



Demetrios Yannoulopoulos, P.Eng.
Director

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APPENDIX A

- Legal Plan
- Pre-Consult Meeting Notes

SKETCH TO ILLUSTRATE

CONCEPT A
SPRING VALLEY
PHASE 5
CITY OF OTTAWA

Prepared by Annis, O'Sullivan, Vollebekk Ltd.
January 23, 2020

Scale 1 : 1000

Metric

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

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
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Ontario Land Surveyors

Job No. 20313-19 Claridge Pt Lts 4 5 C4 OF GL SK D2 | N

CLARIDGE HOMES

Vincent Denomme <vincent.denomme@claridgehomes.com>

Fwd: 3252 Navan Road - Plan of subdivision and Zoning Amendment

Jim Burghout <jim.burghout@claridgehomes.com> Thu, Dec 12, 2019 at 9:52 AM
To: Vincent Denomme <vincent.denomme@claridgehomes.com>

When you have a spare hour or two to review... looks like we can proceed with just zoning frist, and then follow up with subdivision if our buffer study is not rejected

---------- Forwarded message ---------
From: **Murshid, Shoma** <Shoma.Murshid@ottawa.ca>
Date: Wed, Dec 11, 2019 at 8:55 AM
Subject: 3252 Navan Road - Plan of subdivision and Zoning Amendment
To: Jim Burghout <jim.burghout@claridgehomes.com>
Cc: Rehman, Sami <Sami.Rehman@ottawa.ca>, Knight, Melanie (Planning) <Melanie.Knight@ottawa.ca>, Richardson, Mark <Mark.Richardson@ottawa.ca>, Gervais, Josiane <josiane.gervais@ottawa.ca>, Lacroix, Julien <julien.lacroix@ottawa.ca>, Thivierge, Mike <mike.thivierge@ottawa.ca>

Good morning Jim,

Thank you for meeting with us last Wednesday, December 4, 2019, to discuss the plan of subdivision and zoning by-law amendment for blocks of (48) apartment dwelling units, 44 back to back townhouses, 218 on-street towns and 11 single family lots at 3252 Navan Road.

Before I proceed to summarize the requirements of the triggered development applications, Plan of Subdivision and a Major Zoning By-law amendment, I must also mention a Lifting of 30 cm Reserve application will be required, prior to the registration of the subdivision.

A letter of clearance from the Landowner's Group shall be required prior to subdivision registration. A Record of Site Condition will also be required prior to subdivision registration.

You may wish to submit the Zoning Amendment application prior to the Plan of Subdivision in this particular case. We typically do not accept zoning amendment applications independently of the plan of subdivision, however in rare instances, accepting a submission and proceeding to circulation may seem appropriate. In this case, we will accept a Zoning Amendment application independently of the Plan of Subdivision and will be able to complete the circulation. However, I will not proceed to drafting up recommendations to Planning Committee for a Zoning Amendment until a Plan of Subdivision has been, at minimum 'draft approved'. *Please note that consideration of a Zoning Amendment independent of the Plan of Subdivision submission is an exception in this case and certainly not the rule. This sequencing of development application submissions will not set a precedence, as all proposals have differing contextual situations.

If you wish to exercise submitting a Zoning Amendment first, I will be in a position to deem it complete, provided you submit completed plans and reports, as identified below, along with a completed application form with required fees. **The plans and reports required at time of submission for a Zoning Amendment (Major)** shall be:

Draft Plan of Subdivision and/or Concept Plan (4 plans + PDF)

Survey Plan (2 plans + PDF)

Planning Rationale, including details of requested rezoning, clay soil type and requested front yard and corner side yard setbacks for accommodation of trees. (2 reports + PDF)

Preliminary Typical Block/Lot Plan (2 plans + PDF)

Archaeological Assessment report (4 reports + PDF)

Servicing/Design Brief and Stormwater Management Report (3 Reports+ PDF)

Geotechnical Report with Slope Stability and Hydrogeotechnical Components (2 reports+ PDF)

Phase 1 ESA (4 reports + PDF)

Phase 2 ESA (4 reports + PDF)

Landfill Buffer Impact Study (4 reports + PDF)

TIA (4 reports + PDF)

Noise Impact Study (2 reports + PDF)

Tree Conservation Report (3 reports + PDF)

EIS (4 reports + PDF)

I can exercise proceeding to circulation, however, I cannot guarantee that the City's Real Estate Dept. will provide an exhaustive review and/or approval of the Landfill Buffer Impact Study under the Zoning Amendment process. If they do not approve under the Zoning Amendment for any reason, you may have to consider the submission of a Plan of Subdivision and having it run its course.

N.B. The following fees are subject to change once 2020 rings in. Today, a Major Zoning by-law Amendment's submission fees are **$16,960.99 + Initial Conservation Authority Fee of $370.00**. If multiple applications are being submitted concurrently for the same lands (i.e. a Plan of Subdivision), then a 10% reduction shall occur on the planning fee component of said applications. As this is for approximately 320 dwelling units, the triggered Subdivision process is 'Application for a New Development, 251 or more dwelling units' and its associated submission fee shall be (in 2019) the accumulation of **$76,368.51 + an Initial Engineering Design Review and Inspection, between $5K to $10K (based on the value of infrastructure and landscaping) + an Initial Conservation Authority Fee of $3,685.00.**

To deem a Plan of Subdivision complete at time of submission, please submit the following completed plans and reports, along with a completed application form and required fees. The **plans and reports required at time of submission for this Plan of Subdivision** are:

Draft Plan of Subdivision (including AutoCAD or MicroStation CAD format) (4 plans + PDF)

Survey Plan (2 plans + PDF)

Topographical Plan of Survey (2 plans + PDF)

Archaeological Assessment Report (4 plans + PDF)

Planning Rationale, including details of requested rezoning, clay soil type and requested front yard and corner side yard setbacks for accommodation of trees. (2 reports + PDF)

Public Consultation Strategy (may be included as part of the Planning Rationale)

Servicing Plan (3 plans + PDF)

Grading and Drainage Plan (2 plans + PDF)

Erosion and Sediment Control Plan (2 plans + PDF)

Engineering Details and Cross sections (2 plans + PDF)

Grade Control and Drainage Plan (2 plans + PDF)

Erosion and Sediment Control Plan (2 plans + PDF)

Functional Servicing Report (2 reports + PDF)

Preliminary Typical Block/Lot Plan (2 plans + PDF)

Geotechnical Report with Slope Stability and Hydrogeotechnical Components (4 reports + PDF)

TIA (4 reports + PDF)

Tree Conservation Report (3 reports + PDF)

Phase 1 ESA (4 reports + PDF)

Phase 2 ESA (4 reports + PDF)

Landfill Buffer Impact Study (4 reports + PDF)

Erosion and Sediment Control Plan (2 plans + PDF)

EIS (4 reports + PDF)

Noise Impact Study (2 reports + PDF)

Environmental Unit Comments (Sami Rehman):

The subject property is within the adjacency distance to Mer Bleue Bog, a Provincially Significant Wetland, and any development application requires a full Environmental Impact Statement (EIS), as per OP policies (Sections 2.4.2, 3.2.1, and 4.7.8). Our mapping also identifies unevaluated wetlands and a watercourse on the subject property. The EIS should cover the following items on the subject property and vicinity:

-proximity to Mer Bleue Bog, verify boundaries of current PSW and mitigating impacts on the PSW

-unevaluated wetlands on the subject property

-potential significant habitat for threatened or endangered species (OP Section 4.7.4)

-potential significant wildlife habitat (OP Section 2.4.2)

-determine the appropriate setbacks to the watercourse (OP Section 4.7.3)

-potential significant woodlands

Aerial photos identify trees on the subject property. For the plan of subdivision application, a Tree Conservation Report will be required, which can be combined with the EIS (for the subdivision application) to avoid duplications.

As well, Schedule K of the OP identifies unstable slopes traversing the property.

The applicant should also consult with the local Conservation Authority to determine if any permits or approvals are required under their regulations.

Given the proposed development's proximity to the watercourse, a permit from the Dept. of Fisheries and Oceans maybe required under the updated Fisheries Act. The applicant should consult with the DFO website to conduct an evaluation if a DFO review is required and follow DFO's process.

Transportation & Noise Comments (Josiane Gervais):

1. Follow Traffic Impact Assessment Guidelines
    - Traffic Impact Assessment will be required.
    - Start this process asap.
    - The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable), draft functional plans (if applicable) and/or monitoring report (if applicable).
    - Request base mapping asap if RMA is required. Contact Engineering Services (https://ottawa.ca/en/city-hall/planning-and-development/engineering-services)
2. Geometric Road Design (GRD) drawings will be required with the first submission of underground infrastructure and grading drawings. These drawings should include such items as, but are not limited to:
    - Road signage and pavement markings;
    - Location of depressed curbs and tactile walking surface indicators (TWSI);
    - Intersection control measures at new internal intersections; and
    - Traffic calming measures aimed at reducing vehicle speed and enhancing pedestrian safety. Measures may include either vertical or horizontal features, however such measures shall not interfere with stormwater management and overland flow routing. Traffic calming measures shall reference best management practices from the Canadian Guide to Neighbourhood Traffic Calming, published by the Transportation Association of Canada, and/or Ontario Traffic Manual, and/or the City of Ottawa's Traffic Calming Design Guidelines.
3. ROW protection on Navan Rd between Greenbelt boundary and urban area limit is 37.5m even.
4. Corner triangles as per OP Annex 1 - Road Classification and Rights-of-Way at the following locations on the final plan will be required:
    - Local Road to Local Road: 3 m x 3 m
    - Local Road to Collector Road: 5 m x 5 m

- Collector Road to Collector Road: 5 m x 5 m
- Collector Road to Arterial Road: 5 m x 5 m

5. Ensure to pair driveways where possible.
6. Noise Impact Studies are required. Feasibility Study required before draft approval and Detailed Study required before registration. Both studies must assess:
    - Road
    - Rail
    - Stationary due to the proximity to the waste disposal site.

    Note that the Feasibility Study is not required at the time of application, but is required before draft approval. However, it is highly recommended to submit the Noise Feasibility Study as soon as possible so that noise effects can be avoided or mitigated as part of the subdivision design.

The above notes relate to the subdivision application.

If the applicant is going for a re-zoning application only at this time, then only the TIA and Noise Feasibility Studies are required.

Design Comments (Melanie Knight):

- Overall, I don't have any concerns with the proposed layout of streets and blocks/lots.
- A greater mix of singles and towns is preferred – with more singles provided especially the southern quadrant of the site.
- The existing (previously approved subdivision) has pedestrian walkways to the open space network to the south. These walkways are spaced no more than 325 metres apart. An additional walkway connection to the open space corridor should be included in the southeast area of the development. It is also preferred to have another connection lined up with Beaufield Street (close to where the concept plan currently proposes a connection) to maintain the minimum 325 metre spacing from the existing connection to the west.

Engineering Comments (Mike Thivierge):

Key Considerations:

- An update to the MSS is not required where a buffer study has been competed for the additional land.
- Consultant should identify the capacity of Pond 2 and all other infrastructure within the design brief. A pond expansion is not expected and stormwater should be managed accordingly.
- An ECA amendment will be required for Pond 2 with the addition for serviceable lands and water quality.
- Low Impact Developments (Infiltration and/or Filtration) is a preferred method to stormwater management. The Consultant is encouraged to consider LID components in their design. The Dersign brief should discuss the available options and proposed features from a stormwater management perspective. Note that High Ground Water or tight soils have applicable LID designs.

OC Transpo Comments (Julien Lacroix):

OC Transpo doesn't have any submission requirements, but we do have information we would like to share with the applicant at this stage:

1. Please ensure that the extension of Joshua Street is built as a transit-supportive street as per TAC standards. Although details of a long term transit service plan are still being worked out, it is likely transit would run along Joshua Street if/when it is extended to Navan Road. A previous phase of Spring Valley will see the installation of bus stops at the intersection of Joshua and Knotridge, meaning bus stops will not be required for this latest extension east of Knotridge.

2. The applicant indicated in the pre-application meeting that phasing for this development is yet to be confirmed. Depending on the phasing of this proposed development, OC Transpo may look to implement an Early Service Agreement. Early Service is provided in new residential and employment areas in advance of the time when ridership would be high enough to meet the financial performance standard. Normally, the cost to provide a basic peak-period service is paid by the developer of the areas until the number of units occupied is at a level when ridership would normally be high enough to meet the minimum financial performance standard. Staff enter into agreements with developers for this funding as part of the development approval process. Further analysis will be required once details regarding possible phasing of this development become available.

Planning Forester TCR requirements (Mark Richardson R.P.F.):

1. a Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City; an approved TCR is a requirement of Site Plan or Plan of Subdivision approval

2. any removal of privately-owned trees 10cm or larger in diameter requires a tree permit issued under the Urban Tree Conservation Bylaw; the permit is based on the approved TCR

3. any removal of City-owned trees will require the permission of Forestry Services who will also review the submitted TCR

4. for this site, the TCR may be combined with the EIS provided all information is clearly displayed

    a. if possible, please submit separate plans showing 1) existing tree inventory, and 2) a plan showing to be retained and to be removed trees with tree protection details

5. the TCR must list all trees on site by species, diameter and health condition – separate stands of trees may be combined using averages

6. the TCR must address all trees with a critical root zone that extends into the developable area – all trees that could be impacted by the construction that are outside the developable area need to be addressed.

7. trees with a trunk that crosses/touches a property line are considered co-owned by both property owners; permission from the adjoining property owner must be obtained prior to the removal of co-owned trees

8. If trees are to be removed, the TCR must clearly show where they are, and document the reason they can not be retained – please provide a plan showing retained and removed treed areas

9. All retained trees must be shown and all retained trees within the area impacted by the development process must be protected as per City guidelines listed on Ottawa.ca

10. the City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.

11. Please ensure newly planted trees have an adequate soil volume for their size at maturity

12. For more information on the process or help with tree retention options, contact Mark Richardson mark.richardson@ottawa.ca

Please refer to the links to “Guide to preparing studies and plans” and fees for further information. Additional information is available related to building permits, development charges, and the Accessibility Design Standards. Be aware that other fees and permits may be required, outside of the development review process. You may obtain background drawings by contacting informationcentre@ottawa.ca.

NOTE: Plans are to be submitted on standard A1 size (594mm x 841mm) sheets, utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400, or 1:500).

With all submitted hard copies provide individual PDF (FLATTENED) of the DWGs and for reports please provide one PDF file of the reports.

These pre-con comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change. You are as well encouraged to contact us for a follow-up meeting if the plan/concept will be further refined.

Please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

Shoma Murshid, MCIP, RPP
File Lead, Planner II

Responsable de dossier, urbaniste II
City of Ottawa/ Ville d'Ottawa
Development Review (Suburban Services, East)/ Examen des projets d'aménagement (Services suburbains Est)
Planning, Infrastructure, and Economic Development Department/ Service de la planification, de l'infrastructure et du développement économique
110 Laurier Avenue West, 4th Floor, Ottawa ON K1P 1J1/ 110, avenue Laurier Ouest, 4e étage, Ottawa (Ontario) K1P 1J1
Mail Code/ Code de courrier : 01-14
Tel/ Tél: (613) 580-2424 ext. 15430
Fax/ Téléc. : (613) 580-4751

e-mail/ courriel : shoma.murshid@ottawa.ca

www.ottawa.ca

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5 attachments

lifting_30cm_reserves_en.pdf
1017K

zoning_amendment_en.pdf
1394K

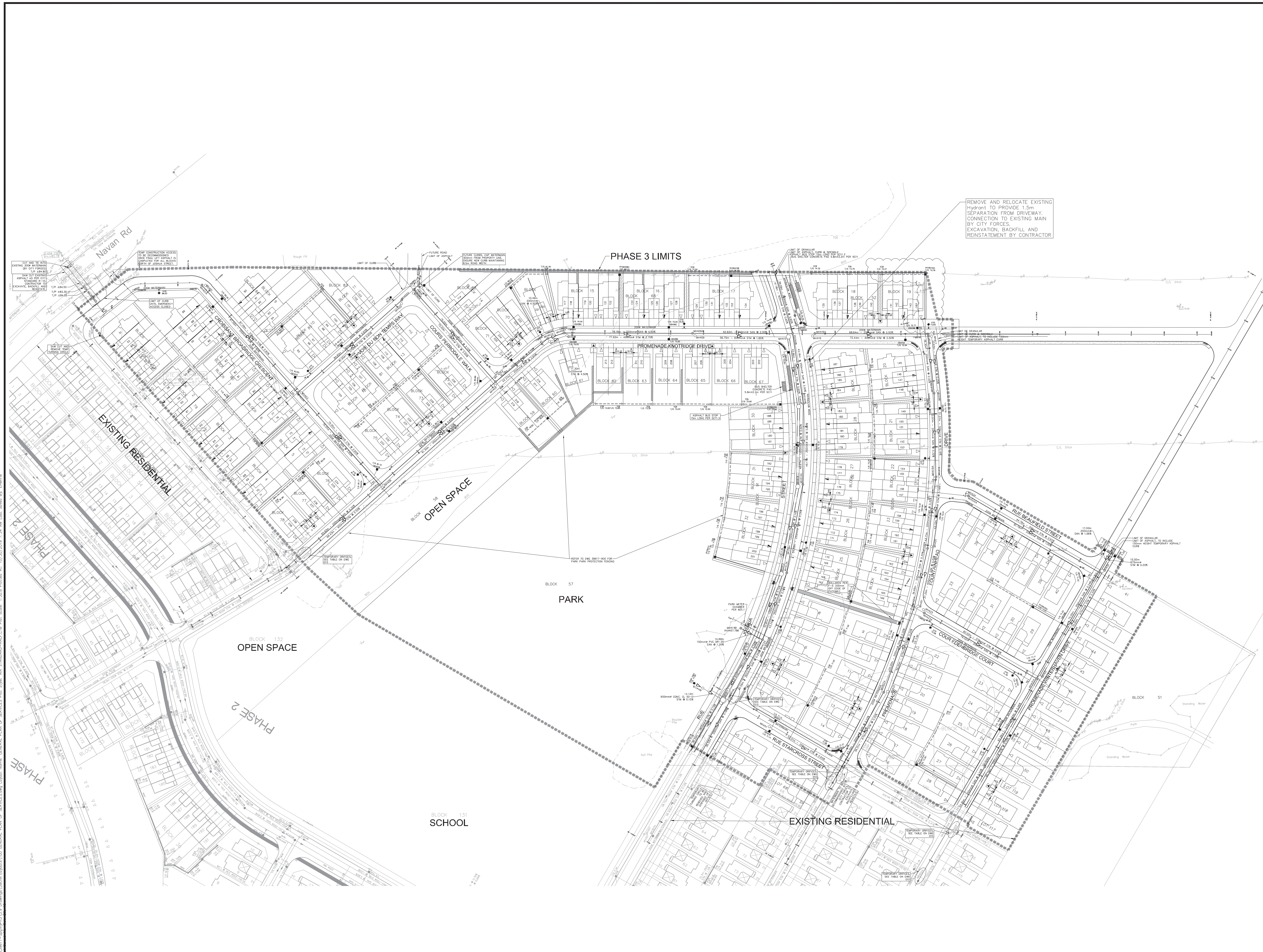
subdivision_en.pdf
1756K

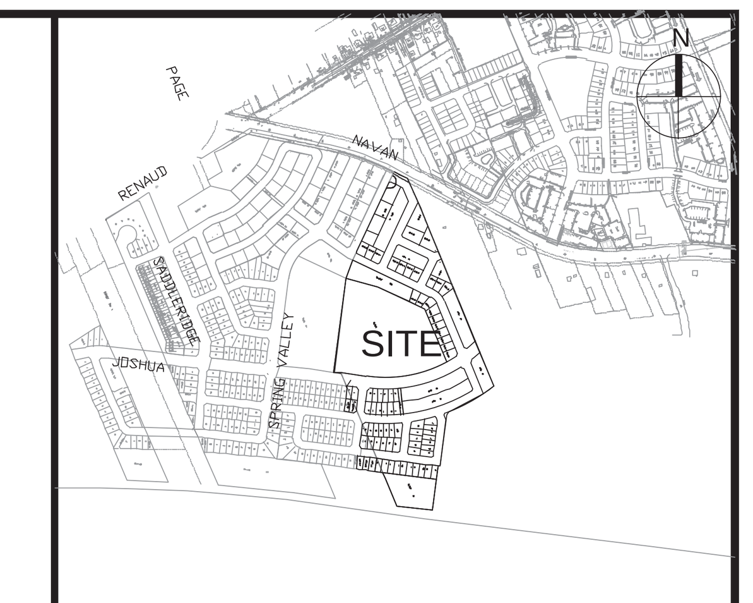
Concept Plan.pdf
95K

20313-19 Claridge Pt Lts 4 5 C4 OF GL SK D1-SK 24X48 (1).pdf
466K

APPENDIX B

- Drawing 39617-100 General Plan
- Figure 2.1 – Conceptual Water Plan





KEY PLAN
NTS

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

No.	REVISIONS	By	Date
14			
13			
12			
11			
10	REVISED FIRE HYDRANT BLOCK 29	DGY	19:10:29
9	REVISED SERVICES PER NEW HYDRO LAYOUT	DGY	18:03:13
8	ISSUED FOR CONSTRUCTION	DGY	18:01:18
7	ISSUED FOR MYLAR	DGY	18:01:15
6	ISSUED FOR TENDER	DGY	17:11:30
5	ISSUED FOR MOE	DGY	17:11:15
4	REVISED PER LEGAL PLAN	DGY	17:10:13
3	REVISED PER CITY COMMENTS	DGY	17:08:09
2	REVISED PER CITY COMMENTS	DGY	17:05:05
1	ISSUED FOR APPROVAL	DGY	16:10:24

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 PHASE 3

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2018/06/xx
PROVINCE OF ONTARIO

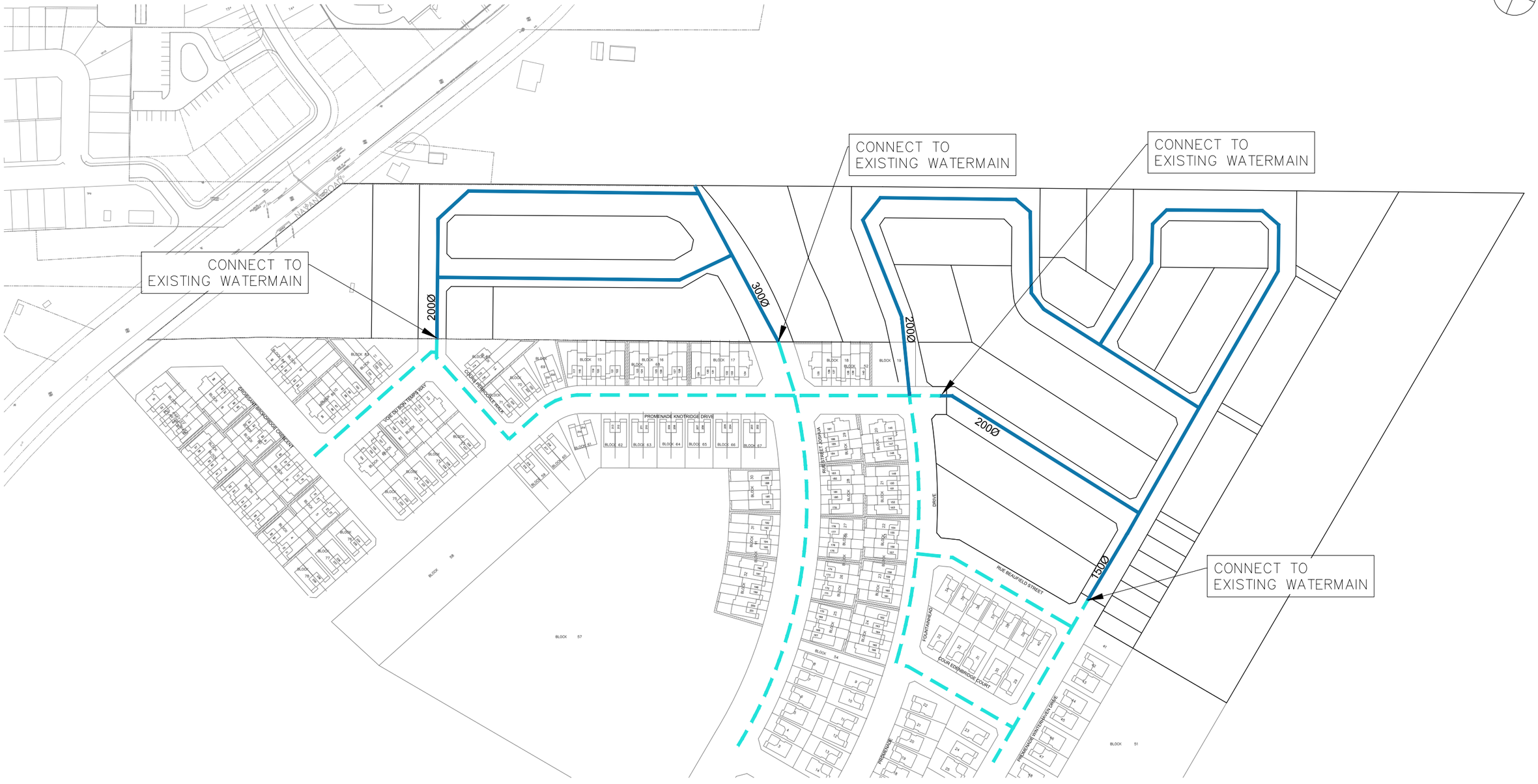
N

Drawing Title

GENERAL PLAN OF SERVICES

Scale: 1:1000	
Design: R.M.	Date: MARCH 2016
Drawn: E.H.	Checked: D.G.Y.
Project No.: 39617	Drawing No.: 100

D07-16-03-0011PH3



Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	SPRING VALLEY TRAILS PHASE 5 & 6	WATERMAIN	FIGURE 2.1

APPENDIX C

- EUC Drainage Area Markup
- EUC & Actual Flow Comparison
- Figure 3.1 – Conceptual Sanitary Sewer Plan
- Updated Phase 3 Sanitary Sewer Design Sheets

N

SANITARY SEWER AND MANHOLE

SANITARY TRUNK SEWER AND MANHOLE

SANITARY FORCEMAIN

SANITARY CATCHMENT AREA

ORIGINAL GROUND / OBVERT

AREA (ha) / POPULATION / MANHOLE No.

AREA (ha) / POPULATION / MANHOLE No. / INST (INSTUTIONAL) ha / IND (INDUSTRIAL) ha / COM (COMMERCIAL) ha

* EQUIVALENT AREA (17.7 l/s ALLOWABLE PEAK FLOW UNDER C of O SEWER USE AGREEMENT)

HYDRO CORRIDOR

PROPOSED TRANSITWAY

PROPOSED BLACKBURN BY-PASS EXTENSION

MER BLEUE ROAD

SANITARY TRUNK No.1

SANITARY TRUNK No.2

SANITARY TRUNK No.3

SANITARY TRUNK No.4

FOURTH LINE ROAD

PAGE ROAD

NAVAN ROAD

WALL ROAD

SAPHIR AVE.

GRAND PRE

SCHOOL

PARK

INSTIT.

INSTITUTIONAL

COMMERCIAL

FIRE HALL

ESCARPMENT

WSI LANDFILL

ABANDONED C.P.R. RIGHT OF WAY

FOREST VALLEY PUMPING STATION

LOCAL PUMP STA. No.1

LOCAL PUMP STA. No.2

REVISION No.2 MARCH, 2005

CITY OF OTTAWA
GLOUCESTER EUC INFRASTRUCTURE SERVICING STUDY UPDATE

SANITARY SEWER SYSTEM

Scale 0 40 120 200m

Dwg. No. SAN

Own By E.C. Date 04.10.29 Revision 2

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Comparison EUC vs Actual (using EUC Densities)

SANITARY SEWER DESIGN SHEET

Spring Valley Trails Phase 5/6 - ECU Review
CITY OF OTTAWA
Claridge Homes

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						PEAK FLOW (L/s)	AREA (Ha)		FLOW				CAPACITY	LENGTH	DIA	SLOPE	VELOCITY (full)	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH		SF	SD	TH	APT		IND	CUM			INSTITUTIONAL		COMMERCIAL		INDUSTRIAL			IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
														IND	CUM	IND	CUM	IND	CUM													
Original ECU Report		39	18	56.26					9.35	3457.0	3457.0	3.39	47.46	2.83	2.83	1.30	1.30	0.00	0.00	3.59	69.74	69.74	19.53			70.58	85.79	105.00	375	0.22	0.753	15.22	17.74%

Original MSS Design Parameters:

Residential			ICI Areas			
						Peak Factor
SF	3.2	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.4	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	95	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

Designed: CM
Checked: DY
Dwg. Reference: EUC SAN

No.	Revision	Date
1.	Spring Valley Phase 5/6	2020-02-05

File Reference: 39617.5.7.1 | **Date:** 2017-04-05 | **Sheet No:** 1 of 1

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						PEAK FLOW (L/s)	AREA (Ha)		FLOW				CAPACITY	LENGTH	DIA	SLOPE	VELOCITY (full)	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH		SF	SD	TH	APT		IND	CUM			INSTITUTIONAL		COMMERCIAL		INDUSTRIAL			IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
														IND	CUM	IND	CUM	IND	CUM													
Spring Valley Ph 5/6 Adequacy of Services Report																																
Actual Values		39	18	57.63	607	100	722	48	0.00	4001.6	4001.6	3.33	43.23	2.83	2.83	0.96	0.96	0.00	0.00	1.23	61.42	61.42	20.27			64.72	85.79	105.00	375	0.22	0.753	21.07	24.56%
Actual Values		18	19	0.00					0.00	0.0	18240.6	2.69	198.97	0.00	26.58	0.00	2.74	0.00	11.40	32.38	0.00	452.59	126.73			358.07	452.94	110.00	600	0.50	1.552	94.87	20.95%
Actual Values		19	19a	0.00					0.00	0.0	18240.6	2.69	198.97	0.00	26.58	0.00	2.74	0.00	11.40	44.62	0.00	452.59	126.73			370.31	452.94	110.00	600	0.50	1.552	82.64	18.24%
Actual Values		19a	19b	0.40					0.00	0.0	18240.6	2.69	198.97	0.00	26.58	0.00	2.74	0.00	11.40	44.62	0.40	452.99	126.84			370.42	452.94	110.00	600	0.50	1.552	82.52	18.22%
Actual Values		19b	FVPS	0.00					0.00	0.0	18566.6	2.68	201.94	0.00	26.58	0.00	2.74	0.00	11.40	44.62	0.00	458.89	128.49			375.05	452.94	110.00	600	0.50	1.552	77.90	17.20%

2020 Design Parameters:

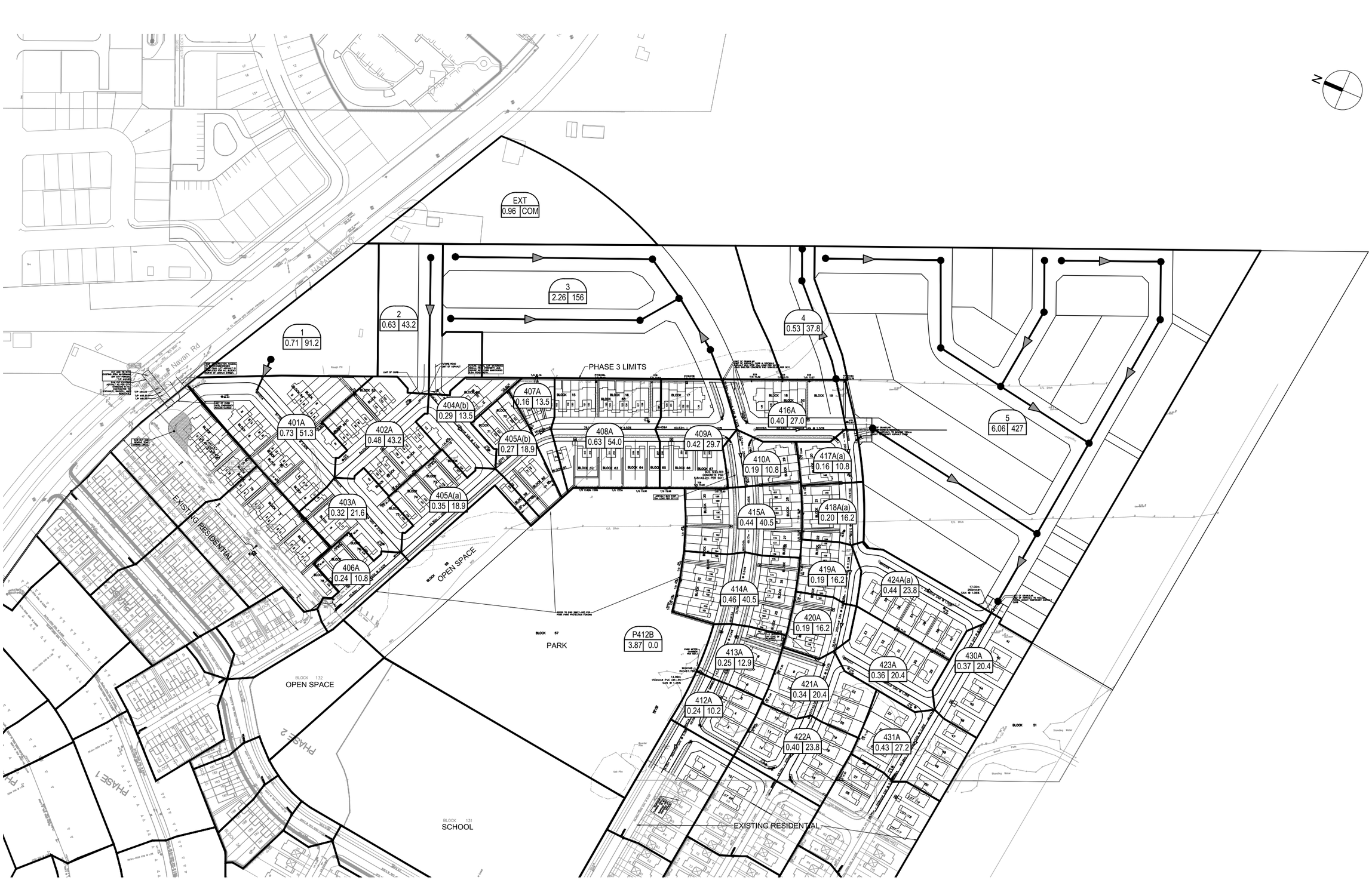
Residential			ICI Areas			
						Peak Factor
SF	3.2	p/p/u				
TH/SD	2.4	p/p/u	INST	28,000	L/Ha/day	1
APT	1.8	p/p/u	COM	28,000	L/Ha/day	1
Other	95	p/p/Ha	IND	28,000	L/Ha/day	MOE Chart

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

Designed: DY
Checked: DY
Dwg. Reference: EUC SAN

No.	Revision	Date
1.	Spring Valley Phase 5/6	2020-02-05

File Reference: 39617.5.7.1 | **Date:** 2020-02-04 | **Sheet No:** 1 of 1



J:\123888_SVTPh5&6\7.0_Production\7.03_Design\04_Civil_LAND_Adequacy Report_SheetsSet\Figure 3.1 SANITARY SEWERS.dwg Layout Name: Layout1 Plot Scale: 1:5.13 Plotted At: 2/10/2020 Last Saved By:

IBI	Scale: NTS	Project Title: SPRING VALLEY TRAILS PHASE 5 & 6	Drawing Title: CONCEPTUAL SANITARY SEWER SYSTEM	Sheet No.: FIGURE 3.1

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tel 613 225 1311 fax 613 225 9868
ibigroup.com

CONCEPTUAL SANITARY SEWER DESIGN SHEET

Spring Valley Phase 5/6
CITY OF OTTAWA
Claridge Homes

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE		FIXED FLOW	TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						PEAK FLOW (L/s)	AREA (Ha)		FLOW								
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL												
STREET	AREA ID	FROM MH	TO MH		SF	SD	TH	APT		IND	CUM			IND	CUM	IND	CUM	IND	CUM		IND	CUM	(L/s)	(L/s)	(L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	AVAILABLE CAPACITY (%)
Apt Block	**1**	**1**	**MH401A**	**0.71**				**48**		**91.2**	**91.2**	**4.00**	**1.18**		**0.00**		**0.00**		**0.00**	**0.00**	**0.71**	**0.71**	**0.23**	**0.00**	**1.42**	**48.39**	**50.00**	**200**	**2.00**	**1.49**	**46.97**	**97.07%**
Broadridge Cresent	4101A	MH401A	MH403A	0.73			19			51.3	142.5	4.00	1.85		0.00		0.00		0.00	0.00	0.73	1.44	0.48	0.00	2.32	58.27	87.50	200	2.90	1.80	55.95	96.01%
Perrodale Street	402A	MH402A	MH403A	0.48			16			43.2	43.2	4.00	0.56		0.00		0.00		0.00	0.00	0.48	0.48	0.16	0.00	0.72	27.59	84.65	200	0.65	0.85	26.87	97.40%
Broadridge Cresent	403A	MH403A	MH406A	0.32		2	6			21.6	207.3	4.00	2.69		0.00		0.00		0.00	0.00	0.32	2.24	0.74	0.00	3.43	55.17	75.06	200	2.60	1.70	51.75	93.79%
Perrodale Street	**2**	**2**	**MH404A**	**0.63**			**16**			**43.2**	**43.2**	**4.00**	**0.56**		**0.00**		**0.00**		**0.00**	**0.00**	**0.63**	**0.63**	**0.21**	**0.00**	**0.77**	**27.59**	**50.00**	**200**	**0.65**	**0.85**	**26.82**	**97.22%**
Perrodale Street	404A(a), 404A(b)	MH404A	MH405A	0.29		1	4			13.5	56.7	4.00	0.74		0.00		0.00		0.00	0.00	0.29	0.92	0.30	0.00	1.04	60.24	75.06	200	3.10	1.86	59.21	98.28%
Knotridge Drive	405A(a)	MH405A	MH406A	0.35		7				18.9	75.6	4.00	0.98		0.00		0.00		0.00	0.00	0.35	1.27	0.42	0.00	1.40	27.59	94.30	200	0.65	0.85	26.19	94.93%
Knotridge Drive	406A	MH406A	Ex. MH325A	0.24		4				10.8	293.7	4.00	3.81		0.00		0.00		0.00	0.00	0.24	3.75	1.24	0.00	5.04	19.36	65.83	200	0.32	0.60	14.31	73.94%
Knotridge Drive - Ph2B		Ex. MH325A	Ex. MH324A							0.0	293.7	4.00	3.81		0.00		0.00		0.00	0.00	0.00	3.75	1.24	0.00	5.04	30.39	13.20	250	0.24	0.60	25.35	83.40%
Broadridge Cres		Ex Mh328A	Ex MH327A	0.59			20			54.0	54.0	4.00	0.70		0.00		0.00		0.00	0.00	0.59	0.59	0.19	0.00	0.89	46.92	92.99	200	1.88	1.45	46.02	98.09%
Broadridge Cres		Ex Mh327A	Ex MH326A	0.70		1	24			67.5	121.5	4.00	1.58		0.00		0.00		0.00	0.00	0.70	1.29	0.43	0.00	2.00	68.43	93.06	200	4.00	2.11	66.43	97.08%
Broadridge Cres		Ex Mh326A	Ex MH324A	0.00						0.0	121.5	4.00	1.58		0.00		0.00		0.00	0.00	0.00	1.29	0.43	0.00	2.00	68.43	10.20	200	4.00	2.11	66.43	97.08%
Knotridge Drive - Ph2B		Ex. MH324A	Ex. MH319A	0.31			7			18.9	434.1	4.00	5.63		0.00		0.00		0.00	0.00	0.31	5.35	1.77	0.00	7.39	30.39	82.80	250	0.24	0.60	23.00	75.68%
Knotridge Drive	405A(b)	MH405A	MH407A	0.27		7				18.9	18.9	4.00	0.25		0.00		0.00		0.00	0.00	0.27	0.27	0.09	0.00	0.33	56.22	41.18	200	2.70	1.73	55.89	99.41%
Knotridge Drive	407A	MH407A	MH408A	0.16		4	1			13.5	32.4	4.00	0.42		0.00		0.00		0.00	0.00	0.16	0.43	0.14	0.00	0.56	72.58	10.49	200	4.50	2.24	72.02	99.23%
Knotridge Drive	408A	MH408A	MH409A	0.63		8	12			54.0	86.4	4.00	1.12		0.00		0.00		0.00	0.00	0.63	1.06	0.35	0.00	1.47	72.58	78.19	200	4.50	2.24	71.11	97.98%
Knotridge Drive	409A	MH409A	MH410A	0.42		6	5			29.7	116.1	4.00	1.51		0.00		0.00		0.00	0.00	0.42	1.48	0.49	0.00	1.99	48.39	60.83	200	2.00	1.49	46.40	95.88%
Joshua Street	**EXT**	**EXT**	**3**							**0.0**	**0.0**	**4.00**	**0.00**		**0.00**	**0.96**	**0.96**		**0.00**	**0.31**	**0.96**	**0.96**	**0.32**	**0.00**	**0.63**	**87.74**	**50.00**	**250**	**2.00**	**1.73**	**87.11**	**99.28%**
Perrodale Street	**3**	**3**	**MH410A**	**2.26**			**58**			**156.6**	**156.6**	**4.00**	**2.03**		**0.00**		**0.96**		**0.00**	**0.31**	**2.26**	**3.22**	**1.06**	**0.00**	**3.40**	**87.74**	**100.00**	**250**	**2.00**	**1.73**	**84.33**	**96.12%**
Joshua Street	410A	MH410A	MH415A	0.19			4			10.8	167.4	4.00	2.17		0.00		0.96		0.00	0.31	0.19	3.41	1.13	0.00	3.61	107.45	43.16	250	3.00	2.12	103.85	96.64%
Joshua Street	415A	MH415A	MH414A	0.44			15			40.5	207.9	4.00	2.70		0.00		0.96		0.00	0.31	0.44	3.85	1.27	0.00	4.28	48.06	49.17	250	0.60	0.95	43.78	91.10%
Joshua Street	414A	MH414A	MH413A	0.46			15			40.5	248.4	4.00	3.22		0.00		0.96		0.00	0.31	0.46	4.31	1.42	0.00	4.95	30.39	54.59	250	0.24	0.60	25.44	83.70%
Joshua Street	413A	MH413A	MH412A	0.25	3		1			12.9	261.3	4.00	3.39		0.00		0.96		0.00	0.31	0.25	4.56	1.50	0.00	5.20	30.39	43.24	250	0.24	0.60	25.19	82.88%
PARK	P412B	MH412B	MH412A	4.31						0.0	0.0	4.00	0.00		0.00		0.00		0.00	0.00	4.31	4.31	1.42	5.00	6.42	15.89	18.88	150	1.00	0.87	9.47	59.58%
Joshua Street	412A	MH412A	MH411A	0.24	3					10.2	271.5	4.00	3.52		0.00		0.96		0.00	0.31	0.24	4.80	1.58	5.00	10.41	30.39	42.22	250	0.24	0.60	19.98	65.73%
Joshua Street		MH411A	Ex. CAP							0.0	271.5	4.00	3.52		0.00		0.96		0.00	0.31	0.00	9.11	3.01	5.00	11.84	43.97	37.70	300	0.19	0.60	32.14	73.08%
Joshua Street - Ph2B		Ex. CAP	Ex. MH307A	0.51	7					23.8	295.3	4.00	3.83		0.00		0.96		0.00	0.31	0.51	9.62	3.17	5.00	12.31	43.97	56.41	300	0.19	0.60	31.66	72.00%
Joshua Street - Ph2B		Ex. MH307A	Ex. MH195A	0.57	9					30.6	325.9	4.00	4.22		0.00		0.96		0.00	0.31	0.57	10.19	3.36	5.00	12.90	43.97	111.80	300	0.19	0.60	31.07	70.67%
Knotridge Drive	416A	MH416A	MH417A	0.40			10			27.0	27.0	4.00	0.35		0.00		0.00		0.00	0.00	0.40	0.40	0.13	0.00	0.48	54.10	68.64	200	2.50	1.67	53.62	99.11%
Fountainhead Drive	**4**	**4**	**MH417A**	**0.53**			**14**			**37.8**	**37.8**	**4.00**	**0.49**		**0.00**		**0.00**		**0.00**	**0.00**	**0.53**	**0.53**	**0.17**	**0.00**	**0.66**	**30.39**	**74.96**	**250**	**0.24**	**0.60**	**29.73**	**97.81%**
Fountainhead Drive	417A(a), 417A(b)	MH417A	MH418A	0.24			8			21.6	86.4	4.00	1.12		0.00		0.00		0.00	0.00	0.24	1.17	0.39	0.00	1.51	19.36	36.30	200	0.32	0.60	17.85	92.22%
Fountainhead Drive	418A(a), 418A(b)	MH418A	MH419A	0.30			10			27.0	113.4	4.00	1.47		0.00		0.00		0.00	0.00	0.30	1.47	0.49	0.00	1.96	19.36	50.97	200	0.32	0.60	17.40	89.90%
Fountainhead Drive	419A	MH419A	MH420A	0.19			6			16.2	129.6	4.00	1.68		0.00		0.00		0.00	0.00	0.19	1.66	0.55	0.00	2.23	19.36	43.71	200	0.32	0.60	17.13	88.49%
Fountainhead Drive	420A	MH420A	MH421A	0.19			6			16.2	145.8	4.00	1.89		0.00		0.00		0.00	0.00	0.19	1.85	0.61	0.00	2.50	19.36	36.65	200	0.32	0.60	16.86	87.08%
Fountainhead Drive	421A	MH421A	MH422A	0.34	6					20.4	166.2	4.00	2.15		0.00		0.00		0.00	0.00	0.34	2.19	0.72	0.00	2.88	19.36	55.00	200	0.32	0.60	16.48	85.14%
Fountainhead Drive	422A	MH422A	Ex. MH306A	0.40	7					23.8	190.0	4.00	2.46		0.00		0.00		0.00	0.00	0.40	2.59	0.85	0.00	3.32	19.36	63.10	200	0.32	0.60	16.04	82.86%
Fountainhead Drive - Ph2		Ex. MH306A	Ex. MH330A	0.48	9					30.6	220.6	4.00	2.86		0.00		0.00		0.00	0.00	0.48	3.07	1.01	0.00	3.87	27.59	53.70	200	0.65	0.85	23.71	85.96%
Fountainhead Drive - Ph2		Ex. MH330A	Ex. MH329A	0.49	11					37.4	258.0	4.00	3.34		0.00		0.00		0.00	0.00	0.49	3.56	1.17	0.00	4.52	25.14	66.20	200	0.54	0.78	20.62	82.03%
Winterhaven Drive	**4**	**4**	**MH430A**	**6.06**	**11**		**144**			**426.2**	**426.2**	**4.00**	**5.52**		**0.00**		**0.00**		**0.00**	**0.00**	**6.06**	**6.06**	**2.00**	**0.00**	**7.52**	**30.39**	**74.96**	**250**	**0.24**	**0.60**	**22.87**	**75.24%**
Beaufield Drive	424A(a), 424A(b)	MH424A	MH430A	0.71	14					47.6	47.6	4.00	0.62		0.00		0.00		0.00	0.00	0.71	0.71	0.23	0.00	0.85	34.22	91.79	200	1.00	1.06	33.37	97.51%
Winterhaven Drive	430A	MH430A	MH431A	0.37	6					20.4	494.2	3.98	6.37		0.00		0.00		0.00	0.00	0.37	7.14	2.36	0.00	8.73	30.39	75.00	250	0.24	0.60	21.67	71.29%
Edenbridge Drive	423A	MH423A	MH431A	0.36	6					20.4	20.4	4.00	0.26		0.00		0.00		0.00	0.00	0.36	0.36	0.12	0.00	0.38	39.76	79.02	200	1.35	1.23	39.37	99.04%
Winterhaven Drive	431A	MH431A	MH304A	0.43	8					27.2	541.8	3.96	6.95		0.00		0.00		0.00	0.00	0.43	7.93	2.62	0.00	9.56	30.39	66.71	250	0.24	0.60	20.83	68.54%
Winterhaven Drive		MH304A	Ex. CAP							0.0	541.8	3.96	6.95		0.00		0.00		0.00	0.00	0.00	7.93	2.62	0.00	9.56	30.39	21.30	250	0.24	0.60	20.83	68.54%
Winterhaven Drive - Ph2		Ex. CAP	Ex. MH302A	0.61	11					37.4	579.2	3.94	7.40		0.00		0.00		0.00	0.00	0.61	8.54	2.82	0.00	10.21	30.39	59.00	250	0.24	0.60	20.18	66.39%
Winterhaven Drive - Ph2		Ex. MH302A	Ex. MH301A	0.64	13					44.2	623.4	3.92	7.93		0.00		0.00		0.00	0.00	0.64	9.18	3.03	0.00	10.96	33.41	86.70	250	0.29	0.66	22.45	67.21%

Design Parameters:

Residential			ICI Areas			
						Peak Factor
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	28,000	L/Ha/day	1
APT	1.9	p/p/u	COM	28,000	L/Ha/day	1
Other	100	p/p/Ha towns	IND	28,000	L/Ha/day	MOE Chart
Other	65	p/p/Ha singles		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 300 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

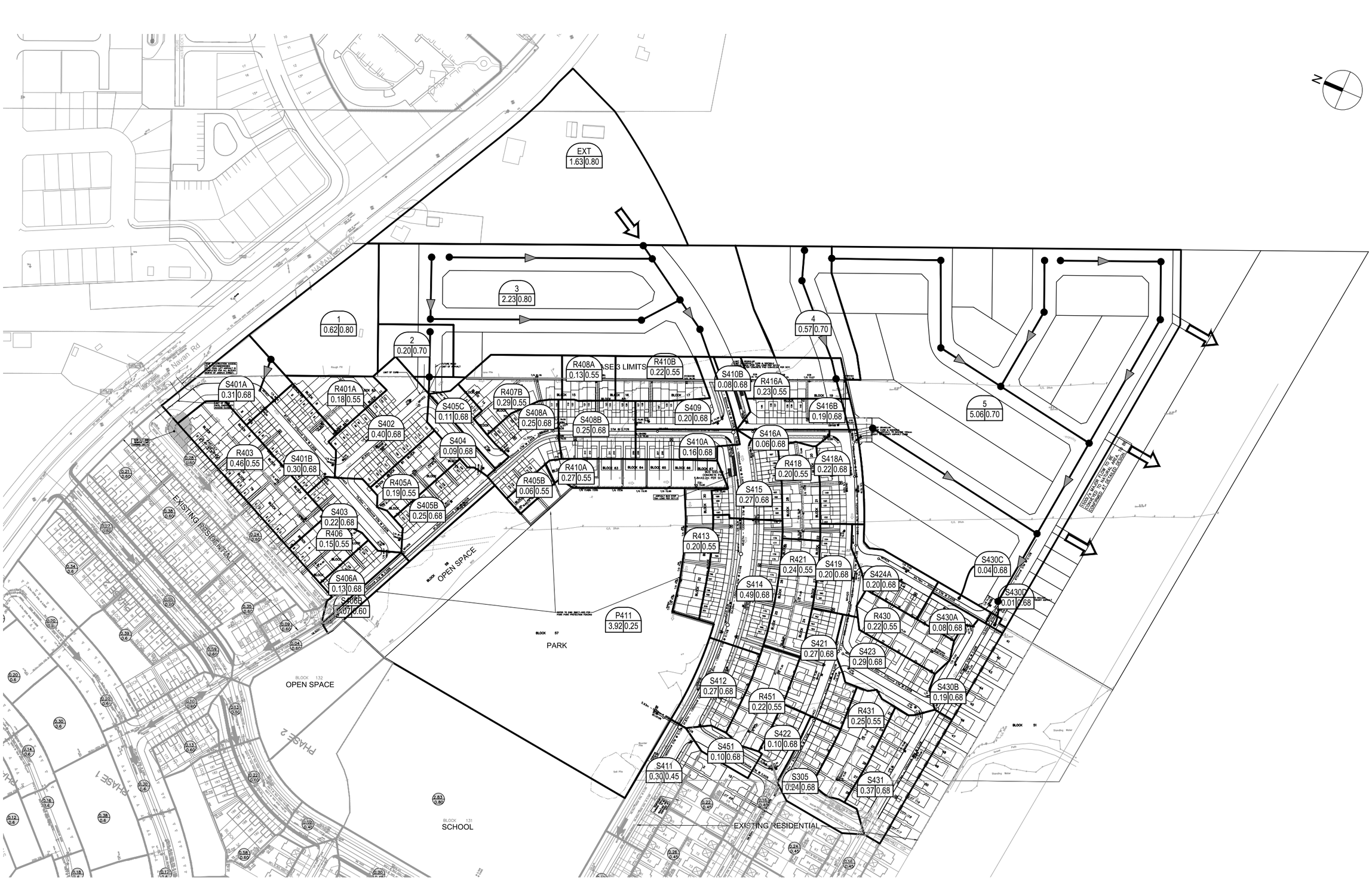
Designed: D.Y.
Checked: D.Y.
Dwg. Reference: 123888 FIG 3.1

No.	Revision	Date
1.	ADEQUACY OF PUBLIC SERCIES REPORT	2020-02-07

File Reference: 39617.5.7.1
Date: 2016-03-31
Sheet No: 1 of 1

APPENDIX D

- Figure 4.1 – Conceptual Storm Sewer Plan
- Updated Phase 3 Storm Sewer Design Sheets



Scale	Project Title	Drawing Title	Sheet No.
NTS	SPRING VALLEY TRAILS PHASE 5 & 6	CONCEPTUAL STORM SEWER SYSTEM	FIGURE 4.1

IBI GROUP
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CONCEPTUAL STORM SEWER DESIGN SHEET

Spring Valley Phase 5/6
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= 0.45	C= 0.50	C= 0.55	C= 0.60	C= 0.68	C= 0.70	C= 0.73	C= 0.80	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)	ICD FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	PIPE SIZE (mm) W	PIPE SIZE (mm) H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	AVAIL CAP (5yr) (%)
APT BLOCK	**1**	**1**	**MH401**										**0.62**	**1.38**	**1.38**	**10.00**	**1.29**	**11.29**	**76.81**	**104.19**	**122.14**	**178.56**	**105.90**					**105.90**	**147.47**	**100.00**	**375**			**0.65**	**1.293**	**41.56**	**28.18%**
Broadridge Crescent	S401A, S401B,, R401B	MH401	MH403					0.18		0.61				1.43	2.81	11.29	0.53	11.82	72.19	97.85	114.67	167.58	202.65					202.65	311.49	87.49	375			2.90	2.732	108.84	34.94%
Perrodale Street	S402	MH402	MH403							0.40				0.76	0.76	10.00	1.05	11.05	76.81	104.19	122.14	178.56	58.08					58.08	147.47	81.65	375			0.65	1.293	89.39	60.62%
Broadridge Crescent	S403, R403	MH403	MH406					0.46		0.22				1.12	4.68	11.82	0.43	12.25	70.45	95.46	111.86	163.46	329.90					329.90	479.60	75.00	450			2.60	2.921	149.70	31.21%
Perrodale Street	**2**	**2**	**MH404**								**0.20**			**0.39**	**0.39**	**10.00**	**0.79**	**10.79**	**76.81**	**104.19**	**122.14**	**178.56**	**29.89**					**29.89**	**107.45**	**100.00**	**250**			**3.00**	**2.121**	**77.56**	**72.18%**
Perrodale Street	S404	MH404	MH405							0.09				0.17	0.56	10.79	0.55	11.33	73.91	100.22	117.46	171.68	41.34					41.34	116.06	75.00	250			3.50	2.291	74.72	64.38%
Knotridge Drive	S405B, R405A	MH405	MH406					0.19		0.25				0.76	1.32	11.33	1.53	12.87	72.04	97.65	114.43	167.24	95.27					95.27	162.91	91.30	450			0.30	0.992	67.64	41.52%
Knotridge Drive	S406, R406	MH406	Ex. MH325					0.15		0.10				0.42	6.42	12.87	0.68	13.55	67.31	91.16	106.79	156.02	432.38					432.38	475.05	66.43	600			0.55	1.628	42.67	8.98%
Knotridge Drive - Ph2B		Ex. MH325	Ex. MH324											0.00	6.42	13.55	0.18	13.72	65.43	88.57	103.75	151.55	420.28					420.28	452.94	16.50	600			0.50	1.552	32.67	7.21%
Knotridge Drive - Ph2B		Ex. MH324	Ex. MH319						1.00					1.67	8.09	13.72	0.59	14.31	64.96	87.93	102.99	150.44	525.59					525.59	640.56	78.00	600			1.00	2.195	114.97	17.95%
Knotridge Drive	S405C, R405B	MH405	MH407					0.06		0.11				0.30	0.30	10.00	0.35	10.35	76.81	104.19	122.14	178.56	23.02					23.02	100.99	42.27	250			2.65	1.993	77.97	77.21%
Knotridge Drive	R407	MH407	MH408					0.29						0.44	0.74	10.35	0.07	10.43	75.47	102.36	119.99	175.39	56.08					56.08	131.60	11.30	250			4.50	2.597	75.52	57.38%
Knotridge Drive	S408A-B, R408B	MH408	MH409					0.13		0.50				1.14	1.89	10.43	0.44	10.86	75.21	102.00	119.55	174.76	141.92					141.92	488.73	77.92	450			2.70	2.977	346.81	70.96%
Knotridge Drive	S409	MH409	MH410							0.20				0.38	2.27	10.86	0.32	11.18	73.65	99.85	117.03	171.04	166.82					166.82	871.26	56.75	600			1.85	2.985	704.44	80.85%
From External	**EXT**	**EXT**	**3**										**1.63**	**3.63**	**3.63**	**10.00**	**1.13**	**11.13**	**76.81**	**104.19**	**122.14**	**178.56**		**377.71**				**377.71**	**516.44**	**120.00**	**600**			**0.65**	**1.769**	**138.72**	**26.86%**
Joshua Street	**3**	**3**	**BULK410E**										**2.23**	**4.96**	**8.58**	**11.13**	**0.84**	**11.97**	**72.72**	**98.58**	**115.53**	**168.85**		**846.27**				**846.27**	**1,207.32**	**110.00**	**825**			**0.65**	**2.188**	**361.06**	**29.91%**
Joshua Street	S410B R410B	BULK410E	MH410					0.22		0.08				0.49	9.07	11.97	0.31	12.28	69.99	94.83	111.12	162.37		860.34				860.34	1,207.32	41.18	825			0.65	2.188	346.99	28.74%
Joshua Street	S410C, R410	MH410	MH415					0.27		0.16				0.72	12.05	12.28	0.29	12.57	69.03	93.51	109.56	160.08		1,127.03				1,127.03	2,206.67	42.86	1050			0.60	2.469	1079.63	48.93%
Joshua Street	S415	MH415	MH414							0.27				0.51	12.56	12.57	0.30	12.87	68.17	92.32	108.17	158.04		1,159.88				1,159.88	3,150.52	48.67	1200			0.60	2.699	1990.64	63.18%
Joshua Street	S414	MH414	MH413							0.49				0.93	13.49	12.87	0.64	13.51	67.29	91.13	106.76	155.97		1,229.28				1,229.28	2,083.42	54.04	1350			0.14	1.410	854.15	41.00%
Joshua Street	R413	MH413	MH412					0.20						0.31	13.80	13.51	0.51	14.02	65.52	88.70	103.90	151.77		1,223.63				1,223.63	2,083.42	42.81	1350			0.14	1.410	859.79	41.27%
Joshua Street	S412	MH412	MH411							0.27				0.51	14.31	14.02	0.49	14.51	64.19	86.88	101.75	148.62		1,242.80				1,242.80	2,083.42	41.87	1350			0.14	1.410	840.62	40.35%
Park Service	P411	MH411B	MH411		3.92									2.72	2.72	12.50	0.30	12.80	68.38	92.61	108.51	158.53	186.28					186.28	239.68	14.84	600			0.14	0.821	53.39	22.28%
Joshua Street		MH411	Ex. CAP			0.30								0.38	17.41	14.51	0.37	14.88	62.94	85.17	99.75	145.68		1,482.39				1,482.39	4,323.69	36.20	1800			0.13	1.646	2841.30	65.71%
Joshua Street - Ph2B		Ex. CAP	Ex. MH307											0.00	17.41	14.88	0.59	15.47	62.06	83.95	98.32	143.58		1,461.23				1,461.23	4,323.69	58.75	1800			0.13	1.646	2862.46	66.20%
Joshua Street - Ph2B		Ex. MH307	Ex. MH195			0.34								0.43	17.83	15.47	1.04	16.52	60.67	82.06	96.09	140.31		1,463.18				1,463.18	4,486.91	107.00	1800			0.14	1.708	3023.73	67.39%
Knotridge Drive	S416A-B, R416A-B	MH416	MH417					0.23		0.25				0.82	0.82	10.00	0.55	10.55	76.81	104.19	122.14	178.56	63.31					63.31	159.51	72.44	300			2.50	2.186	96.20	60.31%
Fountainhead Drive	**4**	**4**	**MH417**								**0.57**			**1.11**	**1.11**	**10.00**	**0.85**	**10.85**	**76.81**	**104.19**	**122.14**	**178.56**	**85.19**					**85.19**	**142.67**	**100.00**	**300**			**2.00**	**1.955**	**57.47**	**40.29%**
Fountainhead Drive		MH417	MH418											0.00	0.82	10.85	0.70	11.55	73.68	99.90	117.08	171.12	60.73					60.73	91.46	33.63	375			0.25	0.802	30.72	33.59%
Fountainhead Drive	S418B, S418, R418	MH418	MH419					0.21		0.31				0.91	1.73	11.55	0.97	12.52	71.32	96.66	113.27	165.52	123.49					123.49	198.12	51.57	525			0.20	0.887	74.64	37.67%
Fountainhead Drive	S419	MH419	MH420							0.20				0.38	2.11	12.52	0.74	13.26	68.31	92.53	108.41	158.39	144.11					144.11	282.86	43.10	600			0.20	0.969	138.76	49.05%
Fountainhead Drive		MH420	MH421											0.00	2.11	13.26	0.64	13.90	66.20	89.63	104.99	153.38	139.65					139.65	282.86	37.33	600			0.20	0.969	143.22	50.63%
Fountainhead Drive	S421, R421	MH421	MH422					0.29		0.27				0.95	3.06	13.90	0.86	14.77	64.48	87.28	102.23	149.31	197.53					197.53	392.18	55.00	675			0.20	1.062	194.65	49.63%
Fountainhead Drive	S422	MH422	Ex. MH306							0.10				0.19	3.25	14.77	0.88	15.65	62.32	84.32	98.75	144.21	202.69					202.69	392.18	56.21	675			0.20	1.062	189.48	48.32%
Starcross Street	S451, R451	MH451	Ex. MH306					0.16		0.10				0.43	0.43	10.00	0.88	10.88	76.81	104.19	122.14	178.56	33.31					33.31	50.02	52.01	250			0.65	0.987	16.71	33.41%
Fountainhead Drive - Ph2		Ex. MH306	Ex. MH330			0.40								0.50	4.19	15.65	1.17	16.82	60.28	81.52	95.45	139.37	252.34					252.34	367.27	56.70	750			0.10	0.805	114.93	31.29%
Fountainhead Drive - Ph2		Ex. MH330	Ex. MH329			0.45								0.56	4.75	16.82	1.04	17.86	57.78	78.10	91.43	133.47	274.39					274.39	532.23	72.90	750			0.21	1.167	257.83	48.44%
Winterhaven Drive	**5**	**5**	**MH430**							**0.05**	**5.06**			**9.94**	**9.94**	**10.00**	**8.08**	**18.08**	**76.81**	**104.19**	**122.14**	**178.56**	**763.54**					**763.54**	**874.78**	**550.00**	**975**			**0.14**	**1.135**	**111.24**	**12.72%**
Beaufield Drive	S424, S424A	MH424	MH430							0.30				0.57	0.57	10.00	1.42	11.42	76.81	104.19	122.14	178.56	43.56					43.56	81.33	94.79	300			0.65	1.115	37.78	46.45%
Winterhaven Drive	S430A-B, R430	MH430	MH431					0.22		0.33				0.96	11.47	18.08	0.92	19.00	55.35	74.78	87.53	127.75	634.76					634.76	1,045.56	75.00	975			0.20	1.357	410.81	39.29%
Edenbridge Drive	S423	MH423	MH431							0.29				0.55	0.55	10.00	1.06	11.06	76.81	104.19	122.14	178.56	42.11					42.11	147.47	82.02	375			0.65	1.293	105.36	71.45%
Winterhaven Drive	S431	MH431	Ex. CAP					0.25		0.45				1.23	13.25	19.00	1.50	20.50	53.70	72.53	84.89	123.88	711.54					711.54	900.87	90.79	1050			0.10	1.008	189.33	21.02%
Winterhaven Drive - Ph2		Ex. CAP	Ex. MH303											0.00	13.25	20.50	0.29	20.79	51.24	69.18	80.95	118.10	678.95					678.95	900.87	17.50	1050			0.10	1.008	221.92	24.63%
Starcross Street - Ph2	S305	Ex. MH305	Ex. MH303							0.24				0.45	0.45	10.00	0.79	10.79	76.81	104.19	122.14	178.56	34.85					34.85	64.60	42.10	300			0.41	0.885	29.75	46.06%
Winterhaven Drive - Ph2		Ex. MH303	Ex. MH302			0.40								0.50	14.20	20.79	0.96	21.75	50.80	68.57	80.23	117.05	721.51					721.51	900.87	58.10	1050			0.10	1.008	179.36	19.91%
Winterhaven Drive - Ph2		Ex. MH302	Ex. MH301			0.48								0.60	14.80	21.75	0.91	22.66	49.38	66.63	77.96	113.72	731.01					731.01	1,408.95	66.00	1200			0.12	1.207	677.95	48.12%

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

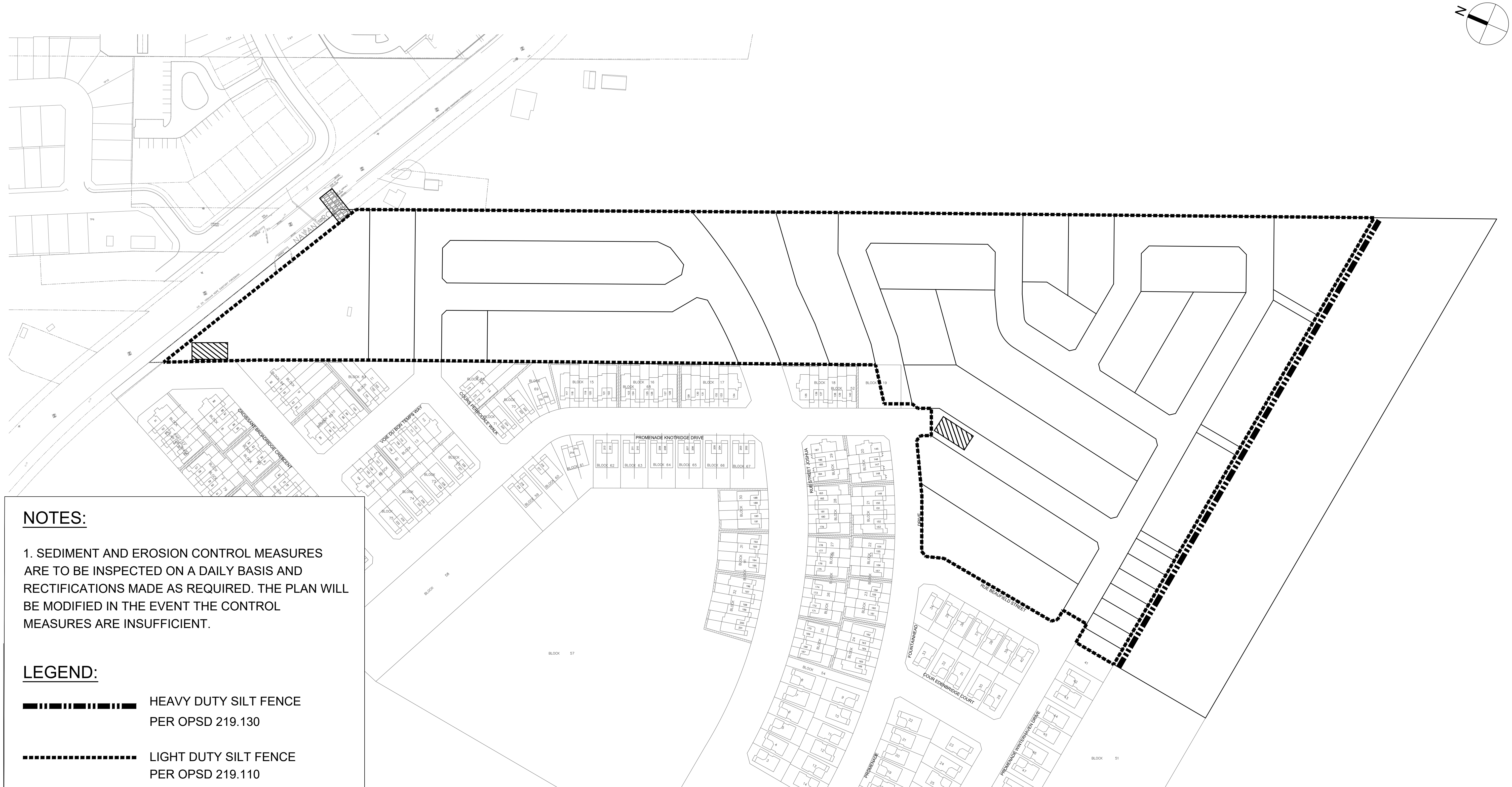
Designed: D.Y.
Checked: D.Y.
Dwg. Reference: 39617-500

No.	Revision	Date
1.	ADEQUACY OF PUBLIC SERVICES REPORT	2020-02-07
2		
3		
4.		
5		

File Reference: 39617.5.7.1
Date: 2016-03-31
Sheet No: 1 of 1

APPENDIX E

- Figure 5.1 – Preliminary Erosion and Sediment Control Plan
- Paterson Group Geotechnical Report
- Figure 6.1 – Conceptual Grading
- City of Ottawa Servicing Study Guidelines Checklist



NOTES:

1. SEDIMENT AND EROSION CONTROL MEASURES ARE TO BE INSPECTED ON A DAILY BASIS AND RECTIFICATIONS MADE AS REQUIRED. THE PLAN WILL BE MODIFIED IN THE EVENT THE CONTROL MEASURES ARE INSUFFICIENT.

LEGEND:

- HEAVY DUTY SILT FENCE PER OPSD 219.130
- LIGHT DUTY SILT FENCE PER OPSD 219.110
- STRAW BALE BARRIER PER OPSD 219.100
- TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR WOVEN FILTER CLOTH (15m × 7m)

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	SPRING VALLEY TRAILS PHASE 5 & 6	EROSION AND SEDIMENT CONTROL PLAN	FIGURE 5.1

IBI

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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Geotechnical Investigation

Proposed Residential Development
3252 Navan Road - Ottawa

Prepared For

Claridge Homes (Gladstone)

February 1, 2020

Report: PG5224-1 Revision 1

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Claridge Homes (Gladstone) to conduct a geotechnical investigation for the proposed residential development to be located at 3252 Navan Road in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2). The objective of the investigation was to:

- ❏ determine the subsurface soil and groundwater conditions by means of boreholes and monitoring well program.
- ❏ provide preliminary geotechnical recommendations for the foundation design of the proposed buildings and provide geotechnical construction precautions which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. The report contains our findings and includes geotechnical recommendations pertaining to the design and construction of the proposed development as understood at the time of this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

Details of the proposed development were not available at the time of issuance of this report. Based on current available information, it is expected that the proposed development will consist of low rise residential dwellings and townhouse style housing. Local roadways and residential driveways are also anticipated for the proposed development. It is further anticipated that the site will be serviced by future municipal services.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current investigation was carried out on May 16, 17 and 22, 2019 as well as September 5, 2019. At that time, thirteen boreholes were completed to a maximum depth of 10.7 m below existing ground surface. The test hole locations were placed in a manner to provide general coverage taking into consideration site access, features and underground utilities. The test hole locations for the current investigation are presented on Drawing PG5224-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a portable drill rig or a track-mounted auger drill rig operated by a two person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The testing procedure consisted of augering to the required depths and at the selected locations sampling the overburden.

Sampling and In Situ Testing

Soil samples were recovered from the auger flights, and using a 50 mm diameter split-spoon sampler or a thin walled Shelby tube in combination with a fixed piston sampler. The split-spoon samples were placed in sealed plastic bags and the Shelby tubes were sealed at both ends on site. All the samples were transported to our laboratory. The depths at which the auger and split-spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations

Groundwater

51 mm diameter groundwater monitoring wells were installed in all the boreholes to monitor the groundwater level subsequent to the completion of the sampling program. The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples from the current investigation will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were determined by Paterson personnel and surveyed in the field by Annis O'Sullivan Vollebekk Ltd. The locations of the boreholes are presented on Drawing PG5224-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from our field investigation were examined in our laboratory to collaborate the field findings.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a earthworks/landscaping contractor. A 2 storey structure of slab on grade construction used as office space is located on the north portion of the site near Navan Road. Numerous stockpiles of different type of fill and landscaping material are piled further south with laneways to allow movement of heavy equipment between them. Fill material was noted to have been placed to extend the level working area towards the center of the property. This platform created a slope approximately 6 m in heigth. The south portion of the site slopes down toward the Prescott-Russell Trail Link and is covered by mature trees and vegetation.

4.2 Subsurface Profile

Generally, the soil profile encountered at the test hole locations consists of a layer of fill composed mainly of silty sand with trace clay and some construction debris overlying a stiff to very stiff brown silty clay crust followed by a deep, stiff to firm grey silty clay deposit. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Bedrock

Based on available geological mapping, the bedrock in the area is part of the Billings formation, which consists of shale. Also, based on available geological mapping, the overburden thickness is expected to range from 25 to 50 m.

4.3 Groundwater

Groundwater level readings were recorded on May 30 and 31, 2019 as well as September 9, 2019 at the monitoring well locations. The groundwater level readings are presented in the Soil Profile and Test Data sheets in Appendix 1. It should be noted that surface water can become trapped within a backfilled borehole that can lead to higher than typical groundwater level observations. Long-term groundwater level can also be estimated based on the observed color, moisture levels and consistency of the recovered soil samples. Based on these observations, the long-term groundwater level is expected between 3 to 4 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations, therefore the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for a residential development. However, due to the presence of the sensitive silty clay layer, a proposed development will be subjected to grade raise restrictions.

For areas where the existing fill and deleterious material is encountered below the proposed building footprint, it is recommended to sub-excavate the building footprint to a native silty clay bearing surface and reinstate with a compact fill approved by Paterson at the time of construction. It should be further noted that our permissible grade raise restrictions provided in Subsection 5.3 may be adjusted once settlement monitoring data is available to determine the current settlement rate associated with the existing fill piles within the west and central portions of the current development phase.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures. The existing fill, where free of organics and deleterious materials, should be proof-rolled by a vibratory roller making several passes and approved by Paterson personnel. Poor performing fill should be removed and reinstated with a compacted engineered fill as detailed below.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II or approved alternative. Granular material should be tested and approved prior to delivery to the site. The fill should be placed in loose lifts of 300 mm thick or less and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of the Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of the SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Proof Rolling

For the proposed driveways and roadways, proof rolling of the subgrade is required in areas where the existing fill, free of organics and deleterious materials, is encountered. It is recommended that the subgrade surface be proof-rolled **under dry conditions and above freezing temperature** by an adequately sized roller making several passes to achieve optimum compaction levels. The compaction program should be reviewed and approved by the geotechnical consultant at the time of construction.

5.3 Foundation Design

Bearing Resistance Values

Using continuously applied loads, footings for the proposed buildings can be designed using the bearing resistance values presented in Table 2.

Table 2 - Bearing Resistance Values

Bearing Surface	Bearing Resistance Value at SLS (kPa)	Factored Bearing Resistance Value at ULS (kPa)
Stiff Brown Silty Clay	100	200
Firm Grey Silty Clay	60	120
Engineered Fill	100	200

Note: Strip footings, up to 1.5 m wide, and pad footings, up to 3 m wide, can be designed using the above noted bearing resistance values.

The bearing resistance values are provided on the assumption that the footings will be placed on undisturbed soil bearing surfaces. An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in-situ or not, have been removed, prior to the placement of concrete for footings.

Bearing resistance values for footing design should be determined on a per lot basis at the time of construction.

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in-situ soil of the same or higher capacity as the bearing medium soil.

Settlement

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when buildings are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

Permissible Grade Raise Recommendations

Based on the undrained shear strength testing results and our experience with the local silty clay deposit, we have determined permissible grade raise restrictions for the current development phase. The recommended permissible grade raise restrictions are presented on Drawing PG5224-2 - Permissible Grade Raise Plan in Appendix 2. It is important to note that the grade raise restrictions presented are given from original native ground surface elevation. Due to the presence of the existing fill layer, it is recommended that a settlement monitoring program be completed to confirm if the permissible grade raise restrictions can be adjusted due to effect of the fill piles. It is recommended that a series of settlement plates be installed within the fill area and periodic settlement monitoring be completed by Paterson to verify the on-going settlement rate of the underlying silty clay deposit. Details of the recommended settlement monitoring program can be provided once preliminary grading has been determined for the current development phase.

The following options could be used alone or in combination, where grade raise exceedances occur. Where limited grade raise is proposed over the existing fill lightweight fill (LWF) can be used. LWF consists of EPS (expanded polystyrene) Type 19 or 22 blocks or other light weight materials which allow for raising the grade without adding a significant load to the underlying soils. However, these materials are expensive and, in the case of the EPS, are more difficult to use under the groundwater level, as they are buoyant, and must be protected against potential hydrocarbon spills. Use lightweight fill within the interior of the garage and porch areas to reduce the fill related loads.

Provided sufficient time is available to induce the required settlements, consideration could be given to surcharging the subject site. Settlement plates to monitor long term settlement should be installed at selected locations within the existing fill pile. Once the desired settlements have taken place, the surcharged portion can be removed and the site is considered acceptable for development.

5.4 Design for Earthquakes

A seismic site response **Class E** should be used for design of the proposed buildings at the subject site according to the OBC 2012. The soils underlying the site are not susceptible to liquefaction.

5.5 Basement Slab/Slab-on-Grade Construction

With the removal of all topsoil and deleterious fill, containing organic matter, within the footprints of the proposed buildings, the native soil surfac, approved engineered fill pad or approved existing fill will be considered an acceptable subgrade on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material. A clear crushed stone fill is recommended for backfilling below the floor slab for limited span slab-on-grade areas, such as front porch or garage footprints. It is recommended that the upper 200 mm of sub-slab fill consist of 19 mm clear crushed stone below basement floor slabs.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3. The applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable.

Lateral Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil, 0.5
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the "at-rest" case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}). The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of driveways, local residential streets and roadways with bus traffic. It should be noted that for residential driveways and car only parking areas, an Ontario Traffic Category A is applicable. For local roadways and roadways with bus traffic, an Ontario Traffic Category B and Category D should be used for design purposes, respectively.

Table 3 - Recommended Pavement Structure - Driveways

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

Table 4 - Recommended Pavement Structure - Local Residential Roadways

Thickness (mm)	Material Description
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 5 - Recommended Pavement Structure - Roadways with Bus Traffic	
Thickness mm	**Material Description**
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course** - Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
600	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for driveways and local roadways and PG 64-34 asphalt cement should be used for roadways with bus traffic. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing load carrying capacity.

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

5.8 Slope Stability

A slope stability analysis was modeled in SLIDE, a computer program which permits a two-dimensional slope stability analysis calculating several methods including the Bishop's method, which is a widely accepted slope analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to forces favoring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsurface soil and groundwater conditions, a factor of safety greater than 1.0 is generally required for the failure risk to be considered acceptable. A minimum factor of safety of 1.5 is generally recommended for conditions where the slope failure would comprise occupied structures. An analysis considering seismic loading was also completed. A peak ground acceleration of 0.32G was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

Two slope sections were studied for the subject slope, see Drawing PG5224-1 - Test Hole Location Plan for detail. It should be noted that details of the slope height and slope angle at the cross-section locations are presented in Figures 2A through 3C in Appendix 2. The slope details were based on available historic topographic data for the subject site.

Various stockpiles of material used by the current occupant were noted to appear on topographic data. Figure 2A and 3A show the slope section with the presence of the stockpiled material under static conditions. It was, however, assumed that the stockpiles would be removed from site for the proposed development. The slope was then analyzed as presented in Figures 2B, 2C, 2B and 3C without the presence of stockpiled material.

Stable Slope

The stable slope limit is usually defined by the extent of the lowest slip circle (failure slip plains) analyzed behind the top of slope where the minimum factor of safety calculated is less than 1.5.

The static analysis (long-term) results for slope sections are presented in Figures 2B and 3B, respectively. The factor of safety for the slopes was greater than 1.5 for the slope sections analysed.

The results of the analyses with seismic loading are shown in Figures 2C and 3C, respectively. The results indicate that the factor of safety for the section A is greater than 1.1. Based on the results, the slope is considered stable under seismic loading.

However, a factor of safety of 1.1 was not achieved for Section B. A stable slope setback of 8.7 m will be required if the existing slope is not modified.

Since no water course is present near the toe of the slope, no erosion access allowance or toe erosion allowance are required for the subject slopes.

Geotechnical Recommendations

Based on available information for the proposed development, it is expected that the existing fill material will be partially removed and that the slopes will be reshaped for the construction of local roadways. It is recommended to reshape the area to a minimum 3H:1V slope or flatter and reinstate vegetation by placing 100 to 150 mm of topsoil mixed with hardy seed and/or an erosion control system.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended for proposed structures. The system should consist of a 150 mm diameter, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. The site materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system (such as system Platon or Miradrain G100N) connected to a drainage system is provided.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum 1.5 m thick soil cover (or equivalent) should be provided in this regard.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

The excavations for the proposed development will be mostly through a stiff silty clay. Where excavation is above the groundwater level to a depth of approximately 3 m, the excavation side slopes should be stable in the short term at 1H:1V. Flatter slopes could be required for deeper excavations or for excavation below the groundwater level. Where such side slopes are not permissible or practical, temporary shoring should be used. The subsoil at this site is considered to be mainly a Type 2 or 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

The slope cross-sections recommended above are for temporary slopes. Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

It is expected that deep service trenches in excess of 3 m will be completed using a temporary shoring system designed by a structural engineer, such as stacked trench boxes in conjunction with steel plates. The trench boxes should be installed to ensure that the excavation sidewalls are tight to the outside of the trench boxes and that the steel plates are extended below the base of the excavation to prevent basal heave (if required).

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

6.4 Groundwater Control

Due to the relatively impervious nature of the silty clay materials, it is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

6.5 Winter Construction

The subsurface conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be constructed in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

7.0 Recommendations

It is recommended that the following be completed once the master plan and site development are determined:

- ❑ Complete a supplemental geotechnical investigation to further evaluate the effect of the existing fill and further detail permissible grade raise restriction.
- ❑ Review detailed grading plan(s) from a geotechnical perspective.
- ❑ Review proposed changes to the existing slopes.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to placing backfilling materials.
- ❑ Observation of clay seal placement at specified locations.
- ❑ Field density tests to ensure that the specified level of compaction has been achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with Paterson's recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with Paterson's present understanding of the project. Paterson requests permission to review the grading plan once available. Paterson's recommendations should be reviewed when the drawings and specifications are complete.

The client should be aware that any information pertaining to soils and the test hole log are furnished as a matter of general information only. Test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests to be notified immediately in order to permit reassessment of the recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Claridge Homes (Gladstone) or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

February 7, 2020

Joey R. Villeneuve, M.A.Sc., P.Eng. David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Claridge Homes (Gladstone)
- ❑ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

BOREHOLE LOGS BY OTHERS

SYMBOLS AND TERMS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3252 Navan Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5224

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 2019 May 16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	85.78		
FILL: Brown silty sand with crushed stone and gravel 0.51		AU	1						
FILL: Brown silty clay, trace gravel 1.37		SS	2	33	14	1	84.78		
FILL: Brown silty sand 2.59		SS	3	75	6	2	83.78		
		SS	4	100	6				
Brown **SILTY CLAY**		SS	5	100	4	3	82.78		
- grey by 3.8m depth		SS	6	100	4	4	81.78		
		SS	7	100	1	5	80.78		
		SS	8	100	W				
6.10						6	79.78		
End of Borehole									
(GWL @ 1.60m - May 31, 2019)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5224

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 2019 May 16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	85.67		
FILL: Brown silty sand, some gravel, trace clay		AU	1						
		SS	2	21	15	1	84.67		
		SS	3	79	13	2	83.67		
2.29									
Brown **SILTY CLAY**		SS	4	46	7	3	82.67		
		SS	5	100	5				
- grey by 3.8m depth		SS	6	100	4	4	81.67		
		SS	7	100	W	5	80.67		
		SS	8	100	W				
6.10						6	79.67		
End of Borehole									
(GWL @ 1.70m - May 30, 2019)									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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REMARKS

FILE NO. PG5224

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 2019 May 16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel		AU	1				
		SS	2	71	18	1	
1.52							
		SS	3	83	7	2	
Brown **SILTY CLAY**		SS	4	100	3		
- grey by 2.3m depth		SS	5	100	3	3	
		SS	6	100	1	4	
4.57							
End of Borehole							
(MW damaged - May 30, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM

REMARKS

FILE NO. PG5224

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** 2019 May 16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel		AU	1				
0.60							
FILL: Brow nsilty sand with clay, gravel and sandstone, trace organics		SS	2	33	27	1	
1.37		SS	3	58	9	2	
		SS	4	88	7	3	
		SS	5	100	7		
Brown **SILTY CLAY**		SS	6	100	9	4	
		SS	7	100	7	5	
		SS	8	100	4		
- grey by 6.1m depth		SS	9	100	2	6	
		SS	10	100	2	7	
		SS	11	100			
8.38						8	
End of Borehole							
(GWL @ 3.40m - May 30, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5224

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** 2019 May 17

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	82.34		
		AU	1						
		SS	2	33	8	1	81.34		
		SS	3	54	9	2	80.34		
FILL: Brown silty sand, some gravel and brick		SS	4	29	14	3	79.34		
		SS	5	58	5				
		SS	6	42	15	4	78.34		
		SS	7	38	6	5	77.34		
		SS	8	12	5				
6.10						6	76.34		
		SS	9	79	21				
		SS	10	100	15	7	75.34		
Brown **SILTY CLAY**		SS	11	100	8	8	74.34		
- grey by 8.4m depth		SS	12	88	4				
		SS	13	100	2	9	73.34		
		SS	14	100	1	10	72.34		
10.67									
End of Borehole									
(GWL @ 5.95m - May 30, 2019)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM

REMARKS

FILE NO. PG5224

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** 2019 May 17

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
		AU	1				
		SS	2	58	16	1	
		SS	3	33	7	2	
		SS	4	71	7		
FILL: Brown silty sand with gravel, some clay, trace brick and topsoil		SS	5	62	8	3	
		SS	6	75	22	4	
		SS	7	71	8	5	
		SS	8	67	20		
		SS	9	46	8	6	
6.86							
		SS	10	88	15	7	
Brown **SILTY CLAY**		SS	11	100	7	8	
- grey by 8.4m depth		SS	12	100	5		
		SS	13	100	2	9	
		SS	14	100	W	10	
10.67							
End of Borehole							
(GWL @ 5.20m - May 30, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM

REMARKS

BORINGS BY Portable Drill **DATE** 2019 May 22

FILE NO. PG5224

HOLE NO. BH 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.30		SS	1	100		0	
Brown **SILTY CLAY** 0.71		SS	2	100		1	
Brown **SILTY CLAY**		SS	3	100		2	
- grey by 1.8m depth		SS	4	100			
3.05		SS	5	100		3	
End of Borehole							
(GWL @ 0.60m - June 3, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM

REMARKS

BORINGS BY Portable Drill **DATE** 2019 May 22

FILE NO. PG5224

HOLE NO. BH 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.28		SS	1	12		0	
Grey **SILTY SAND** 0.91		SS	2	58		1	
Brown **SILTY CLAY** - grey by 1.5m depth 1.83		SS	3	100			
End of Borehole							
(GWL @ 0.05m - June 3, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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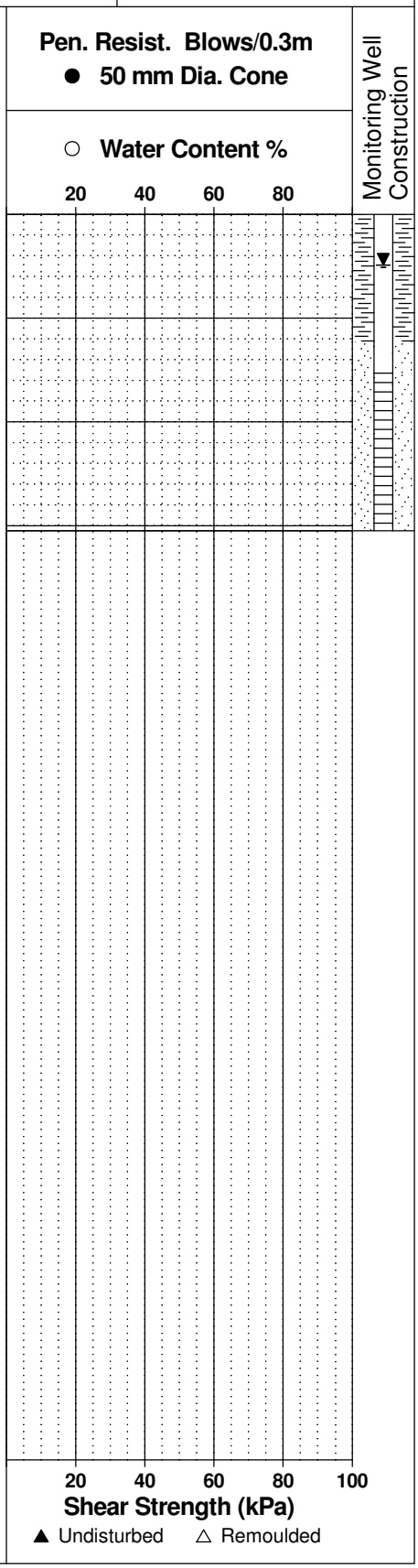
FILE NO. PG5224

REMARKS

HOLE NO. BH 9

BORINGS BY Portable Drill **DATE** 2019 May 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.49
TOPSOIL 0.15		SS	1	62			
		SS	2	71		1	68.49
Brown **SILTY CLAY**		SS	3	100			
		SS	4	100		2	67.49
		SS	5	100			
3.05						3	66.49
End of Borehole							
(GWL @ 0.49m - June 3, 2019)							



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

FILE NO. PG5224

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** 2019 September 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.03
FILL: Brown silty clay, trace sand and gravel							
0.81							
		SS	1	75	10	1	85.03
Compact to loose, brown **SILTY SAND**		SS	2	88	24	2	84.03
2.82		SS	3	88	9		
Brown **SILTY CLAY**		SS	4	100	2	3	83.03
- grey by 3.3m depth		SS	5	100	W	4	82.03
5.18		SS	6	100	W	5	81.03
End of Borehole							
(GWL @ 1.92m - Sept. 9, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM

REMARKS

BORINGS BY CME 55 Power Auger **DATE** 2019 September 5

FILE NO. PG5224

HOLE NO. BH11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
OVERBURDEN						1	
						2	
						3	
						4	
						5	
6.10						6	
		SS	1	100	1	7	
		SS	2	100		8	
		SS	3	100		9	
		SS	4	100		10	
Grey **SILTY CLAY**		SS	5	100		11	
		SS	6	100			
11.28		SS	7	100			
End of Borehole							
(GWL @ 2.84m - Sept. 9, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3252 Navan Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5224

REMARKS

HOLE NO. BH12

BORINGS BY CME 55 Power Auger **DATE** 2019 September 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.14
FILL: Brown silty sand with gravel		SS	1	79	30	1	84.14
1.27							
Compact, grey **SILTY SAND**		SS	2	75	12	2	83.14
2.11		SS	3	100	1		
		SS	4	100	W	3	82.14
Brown to grey **SILTY CLAY**		SS	5	100	W	4	81.14
		SS	6	100	W		
5.18						5	80.14
End of Borehole							
(GWL @ 3.66m - Sept. 9, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3252 Navan Road
Ottawa, Ontario

DATUM

REMARKS

FILE NO. PG5224

HOLE NO. BH13

BORINGS BY CME 55 Power Auger **DATE** 2019 September 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel, trace cobbles and boulders		SS	1	58	24	1	
1.52		SS	2	58	18	2	
Compact, brown **SILTY SAND**		SS	3	17	42		
3.05		SS	4	100	4	3	
Brown **SILTY SAND**		SS	5	100	3	4	
- grey by 3.8m depth		SS	6	100	W	5	
5.18							
End of Borehole							
(GWL @ 2.28m - Sept. 9, 2019)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 12, 2016

DATUM:

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. +, rem V. ⊕, Q - ●, 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		86.29							
0	Power Auger 200 mm Diam. (Hollow Stem)	ASPHALTIC CONCRETE		0.02							
		FILL - Stone dust		0.12							
		TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive		85.99 0.30	1	AS	-				
		(SP) SAND; brown; non-cohesive, moist to wet, compact									
1					2	SS	12				
					3	SS	12				
2											▽
					4	SS	16				
3				83.24							
		(CI/CH) SILTY CLAY to CLAY; grey and red brown; cohesive, w>PL, soft		3.05	5	SS	WH	+			
4				82.02				+			
		(CI/CH) SILTY CLAY to CLAY; grey and red brown, with black mottling; cohesive, w>PL, firm		4.27				+			
5								⊕ +			
6								⊕ +			
					6	SS	WH	+			
7								+			
8				78.06				+			
		End of Borehole		8.23				+			WL in open borehole at 2.13 m depth below ground surface upon completion of drilling
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED:

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-1A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 12, 2016

DATUM:

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	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		86.24				SHEAR STRENGTH Cu, kPa: nat V. + Q - ●; rem V. ⊕ U - ○ (20 40 60 80)	WATER CONTENT PERCENT: Wp — W — Wl (20 40 60 80)		
0	Power Auger 200 mm Diam. (Hollow Stem)	For soil descriptions refer to Record of Borehole 16-1		0.00							Native Backfill
1											
2											
3											Bentonite Seal
					1	TP	PH			C	Standpipe
				82.43							
		End of Borehole		3.81							
4											WL in Standpipe at Elev. 83.38 m on Jan. 22, 2016
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: PAH

CHECKED:

Golder Associates

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 12, 2016

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 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		84.33							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive		0.00	1	AS	-				▽
		(SP) SAND; grey brown, thinly laminated; non-cohesive, wet, loose		0.12							
1				83.17	2	SS	6				
		(CI/CH) SILTY CLAY to CLAY; grey and red brown, with black mottling; cohesive, w>PL, firm		1.16							
2					3	SS	WH				
3											
4											
					4	SS	WH				
5											
6											
					5	SS	PM				
7											
8				76.10							
		End of Borehole		8.23							WL in open borehole at 0.50 m depth below ground surface upon completion of drilling
9											
10											

DEPTH SCALE

1 : 50

LOGGED: PAH

CHECKED:

Golder Associates

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-2A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 12, 2016

DATUM:

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	SAMPLES: TYPE	SAMPLES: 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		84.33									
0	Power Auger 200 mm Diam. (Hollow Stem)	For soil descriptions refer to Record of Borehole 16-2		0.00									
3					1	TP	PH				W	C	
				80.67									
		End of Borehole		3.66									

DEPTH SCALE

1 : 50

LOGGED: PAH

CHECKED:

Golder Associates

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-3

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 12, 2016

DATUM:

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		81.01							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SP) SAND; dark brown, contains organic matter and wood; non-cohesive, moist to wet, very loose		0.00	1	AS	-				
1					2	SS	2				▽
				79.49							
		TOPSOIL - (SM) SAND; brown; non-cohesive		1.52	3	SS	8				
		(SP) SAND; grey brown; wet, loose		1.65 79.03							
2		(CI/CH) SILTY CLAY to CLAY; grey brown to grey (WEATHERED CRUST); cohesive, w>PL, stiff		1.98	4	SS	2				
				78.11							
3		(CI/CH) SILTY CLAY to CLAY; grey and red brown, with black mottling; cohesive, w>PL, firm		2.90							
4											
5					5	SS	WH				
6					6	SS	WH				
7											
8				72.78							
		End of Borehole		8.23							WL in open borehole at 0.90 m depth below ground surface upon completion of drilling
9											
10											

DEPTH SCALE

1 : 50

LOGGED: PAH

CHECKED:

Golder Associates

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-3A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 12, 2016

DATUM:

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	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, 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		81.01									
0	Power Auger 200 mm Diam. (Hollow Stem)	For soil descriptions refer to Record of Borehole 16-3		0.00									Native Backfill
1													
2													
3													Bentonite Seal
4					1	TP	PH						Standpipe
				76.74									
		End of Augerhole		4.27									WL in Standpipe at Elev. 78.50 m on Jan. 22, 2016
5													
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED:

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-4

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 13, 2016

DATUM:

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. +, rem V. ⊕; Q - ●, 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		82.07							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (OL) ORGANIC SILT, trace gravel; dark brown, contains sand, clay, wood, and debris; non-cohesive, moist, loose		0.00							
1					1	SS	6				
2					2	SS	8				
					3	SS	8				
3		(CI/CH) SILTY CLAY to CLAY; grey brown and red brown, highly fissured (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		79.17 2.90	4	SS	10				
4					5	SS	8				
5					6	SS	9				
					7	SS	8				
6					8	SS	6				
7								>96 +			
								>96 +			
8					9	SS	WH				
								>96 +			
				73.23				⊕			
9		End of Borehole		8.84							Open borehole dry upon completion of drilling
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED:

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 13, 2016

DATUM:

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	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, 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		72.24							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) CLAYEY SILT and sandy SILT; dark brown; non-cohesive		0.00 72.02							
		(CI/CH) SILTY CLAY to CLAY; grey brown, highly fissured (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.22							
1					1	SS	6				
2					2	SS	6				
3					3	SS	2				
				68.89				⊕			
		(CI/CH) SILTY CLAY to CLAY; grey and red brown, with black mottling; cohesive, w>PL, firm to stiff		3.35				+			
4								⊕ +			
								+			
5					4	SS	PM				
								+			
6								+			
					5	SS	PM				
7								⊕ +			
								+			
8				64.01				+			
		End of Borehole		8.23							Open borehole dry upon completion of drilling
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED:

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-6

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 14, 2016

DATUM:

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; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		70.50							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (SP) SAND; brown; non-cohesive		0.00							
		(CI/CH) SILTY CLAY to CLAY; grey brown, highly fissured (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.08							
1					1	SS	4				
					2	SS	1				
2				68.52							
		(CI/CH) SILTY CLAY to CLAY; grey and red brown, with black mottling; cohesive, w>PL, firm to stiff		1.98							
3					3	TP	PH				
4											
5					4	SS	PM				
6					5	SS	PM				
7											
8				62.27							
		End of Borehole		8.23							Open borehole dry upon completion of drilling
9											
10											

DEPTH SCALE

1 : 50

LOGGED: PAH

CHECKED:

Golder Associates

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-101

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: June 18, 2016

DATUM:

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; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		73.67							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 73.34							
		(CI/CH) SILTY CLAY to CLAY; grey brown, contains rootlets (WEATHERED CRUST); cohesive, w>PL, very stiff to stiff		0.33	1	SS	5				
1					2	SS	4				
2					3	SS	1				
3				70.62							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff		3.05	4	SS	WH				
4											
					5	SS	WH				Cuttings
5											
6					6	SS	WH				
7											
					7	TP	PH				
8											
9					8	SS	WH				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: TMS

Golder Associates

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-101

SHEET 2 OF 2

LOCATION: See Site Plan

BORING DATE: June 18, 2016

DATUM:

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
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
10	Power Auger 200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff									
11					9	SS	WH				Cuttings
12					10	SS	WH				
13											Bentonite Seal
14					11	TP	PH				Silica Sand
					12	SS	-				Standpipe
				58.73							
15		End of Borehole		14.94							W.L. in Standpipe at 0.53 m above ground surface on August 24, 2016
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: TMS

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-102

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: June 18, 2016

DATUM:

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 - ○)	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		73.91							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 73.63							
		(SM) SILTY SAND; grey brown; non-cohesive, moist		0.28 / 73.15							
1		(CI/CH) SILTY CLAY to CLAY; grey brown, contains rootlets (WEATHERED CRUST); cohesive, w>PL, stiff to very stiff		0.76	1	SS	5				
					2	SS	4				
2											
					3	SS	1				
3				70.86							
		(CI/CH) SILTY CLAY; grey; cohesive, w>PL, firm to stiff		3.05	4	SS	WH				
4								⊕ + ⊕ +			
					5	SS	WH				
5								⊕ + ⊕ +			
6					6	SS	WH				
7								⊕ + ⊕ +			
					7	TP	PH				
8								⊕ + ⊕ +			
					8	TP	PH				
9											
					9	SS	-				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: TMS

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-102

SHEET 2 OF 2

LOCATION: See Site Plan

BORING DATE: June 18, 2016

DATUM:

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	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, 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
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		(CI/CH) SILTY CLAY; grey; cohesive, w>PL, firm to stiff		63.55	9	SS	-	⊕ + ⊕ +			
		End of Borehole		10.36							
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: TMS

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 07-1121-0232-7000

RECORD OF BOREHOLE: 16-103

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: June 18, 2016

DATUM:

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 - ○)	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		71.00							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 70.77							
		(SM) SILTY SAND; brown grey; non-cohesive, moist		0.23 / 70.39							
		(CI/CH) SILTY CLAY to CLAY; grey brown, contains rootlets (WEATHERED CRUST); cohesive, w>PL		0.61	1	SS	4				
1											
					2	SS	WH				
2				68.87							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff		2.13							
3					3	SS	WH				
4											
					4	SS	WH				
5											
6					5	SS	WH				
7											
					6	SS	WH				
8											
				62.16							
9		End of Borehole		8.84							
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: TMS

MIS-BHS 001 07-1121-0232.GPJ GAL-MIS.GDT 08/31/16 JM

PROJECT: 05-1120-041

RECORD OF BOREHOLE: 05-3

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 10, 2005

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/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○)	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		69.86							
0	Power Auger 200mm Diam. (Hollow Stem)	Brown sandy TOPSOIL		0.00 / 69.65							Bentonite Seal
		Very stiff grey brown SILTY CLAY, trace red brown layer (Weathered Crust)		0.21	1	50 DO	7				
1											Native Backfill
					2	50 DO	1				
2				67.73							
		Firm grey SILTY CLAY, trace red brown layer, trace black organic matter		2.13				⊕ +			Bentonite Seal
					3	73 TP	PH			C	Standpipe
3								⊕ +			Bentonite Seal
					4	50 DO	PM				
4								⊕ +			
								⊕ +			
											Native Backfill
5					5	50 DO	PM				
								⊕ +			
				64.07				⊕ +			
6		End of Borehole		5.79							Water level in standpipe at elev. 68.96m on July 11, 2005
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: K.S.L.

CHECKED: T.M.S.

BOREHOLE 05-1120-041.GPJ GLDR_CAN.GDT 8/12/05

PROJECT: 05-1120-041

RECORD OF BOREHOLE: 05-11

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 12, 2005

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/0.3m	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		82.13							
0	Power Auger 200mm Diam. (Hollow Stem)	Brown silty clay, trace gravel and organic matter (FILL)		0.00							Bentonite Seal
				81.70							
		Grey brown crushed stone (FILL)		0.43							
				81.40							Native Backfill
		Brown silty clay, trace organic matter (FILL)		0.73							
1				81.22							
		Brown fine SAND		0.91							
		Very stiff to stiff grey brown SILTY CLAY, occasional red brown layer (Weathered Crust)		1.04	1	50 DO	12				
					2	50 DO	7				Bentonite Seal
2											
					3	50 DO	7				
											Native Backfill
3					4	50 DO	5				
4											Bentonite Seal
				77.71							Silica Sand
		Firm to stiff grey SILTY CLAY		4.42							
					5	50 DO	WH				Standpipe
5											
											Bentonite Seal
				76.34							
		End of Borehole		5.79							
6											Water level in standpipe at elev. 80.73m on July 11, 2005
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: T.M.S.

BOREHOLE 05-1120-041.GPJ GLDR_CAN.GDT 8/12/05

PROJECT: 05-1120-041

RECORD OF BOREHOLE: 05-12

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 11, 2005

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - ○	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		86.34							
0	Power Auger 200mm Diam (Hollow Stem)	Dark brown sandy TOPSOIL		0.00 / 86.13							Bentonite Seal
		Yellow brown SILTY fine SAND		0.21							
		Loose to compact brown to grey stratified fine SAND, trace silt		0.37							Native Backfill
1					1	50 DO	11				Bentonite Seal
2					2	50 DO	13				Native Backfill
3					3	50 DO	11				Standpipe
				82.99	4	50 DO	6				Silica Sand
		Soft to firm grey SILTY CLAY, occasional red brown layer		3.35							Bentonite Seal
4								⊕ +			
								⊕ +			
5					5	73 TP	PH		⊖	C	Native Backfill
								⊕ +			
				80.55				⊕ +			
6		End of Borehole		5.79							Water level in standpipe at elev 84.76m on July 11, 2005
7											
8											
9											
10											

MIS-BHS 001 05-1120-041 GPJ GAL-MIS GDT 06/23/11

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: D.J.S.
CHECKED: T.M.S.

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

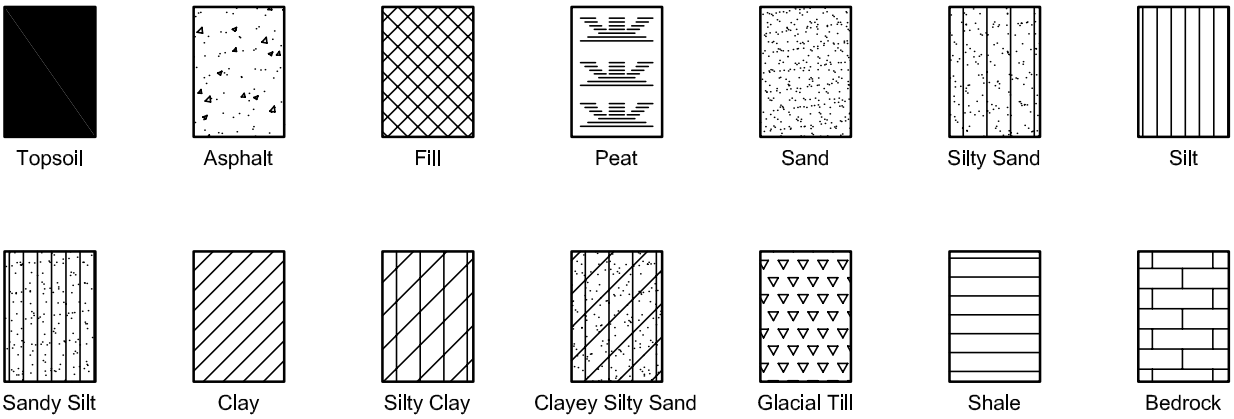
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

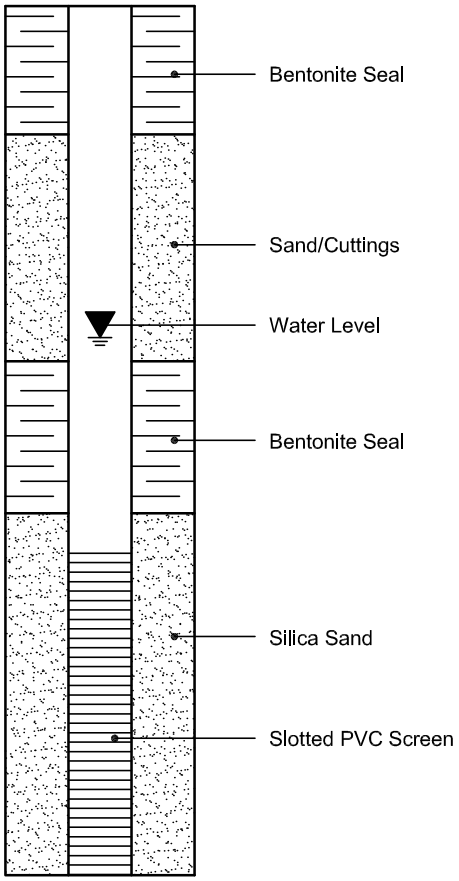
SYMBOLS AND TERMS (continued)

STRATA PLOT

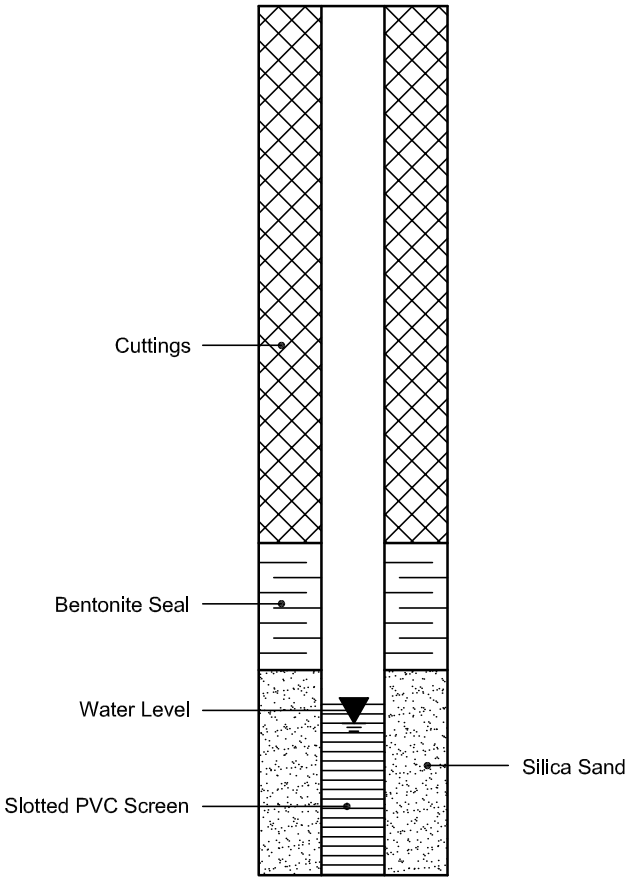


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2A - 3C - SLOPE STABILITY CROSS SECTIONS

DRAWING PG5224-1 - TEST HOLE LOCATION PLAN

DRAWING PG5224-2 - PERMISSIBLE GRADE RAISE PLAN

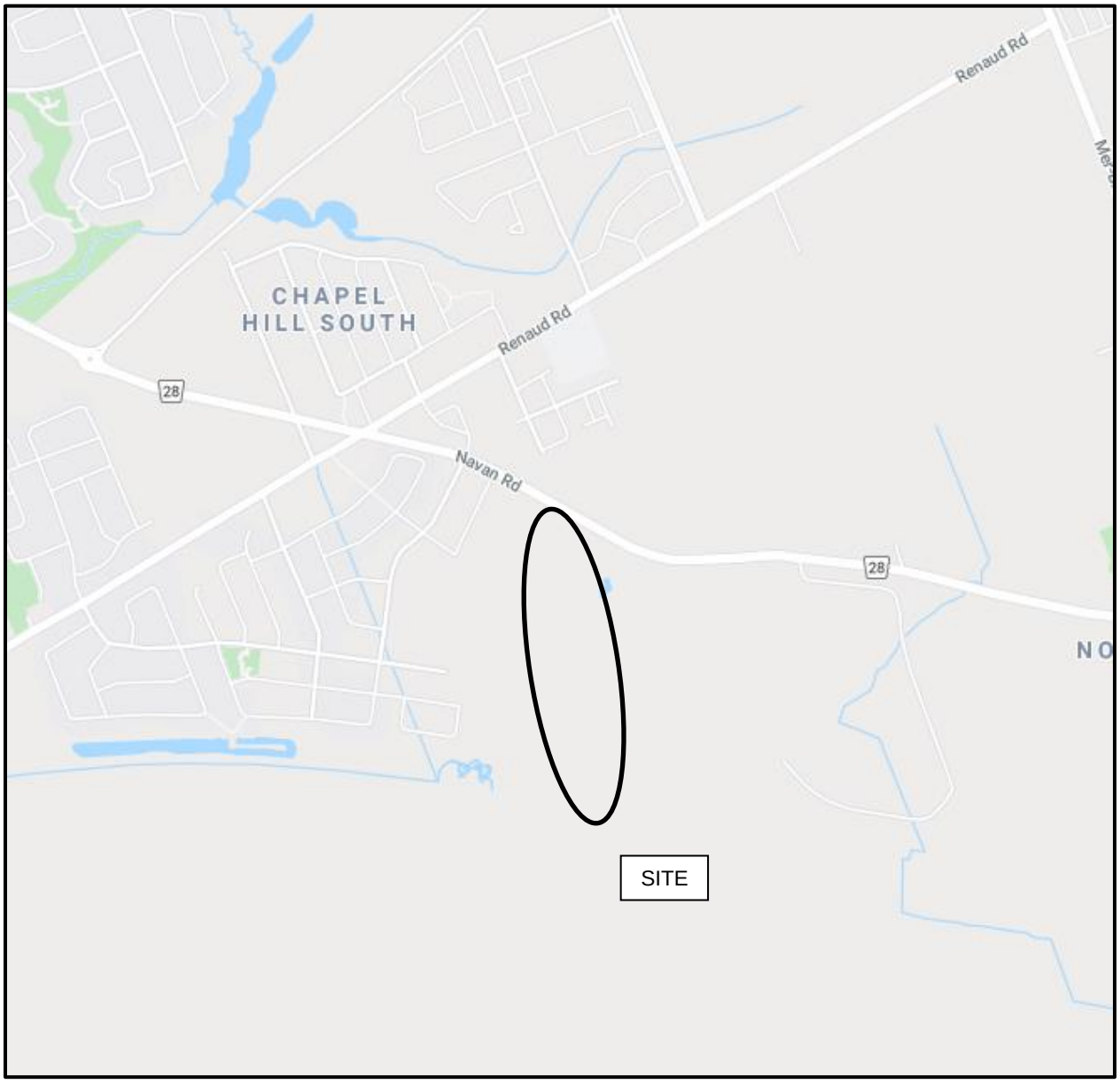
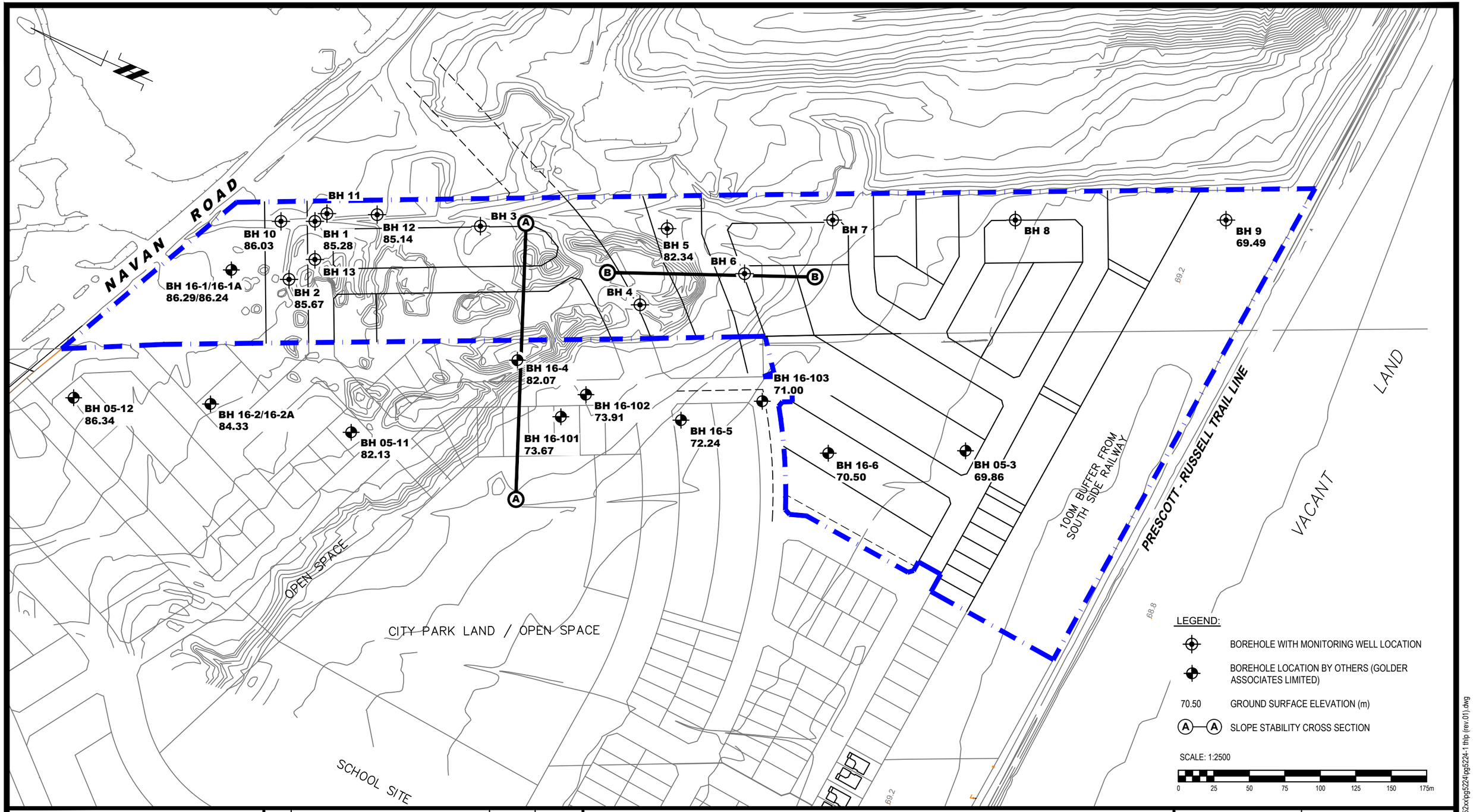


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW BASE PLAN	04/02/2020	JV

CLARIDGE HOMES (GLADSTONE) INC.

GEOTECHNICAL INVESTIGATION
3252 NAVAN ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:2500	Date: 01/2020
Drawn by: NFRV	Report No.: PG5224-1
Checked by: JV	Dwg. No.: PG5224-1
Approved by: DJG	Revision No.: 1

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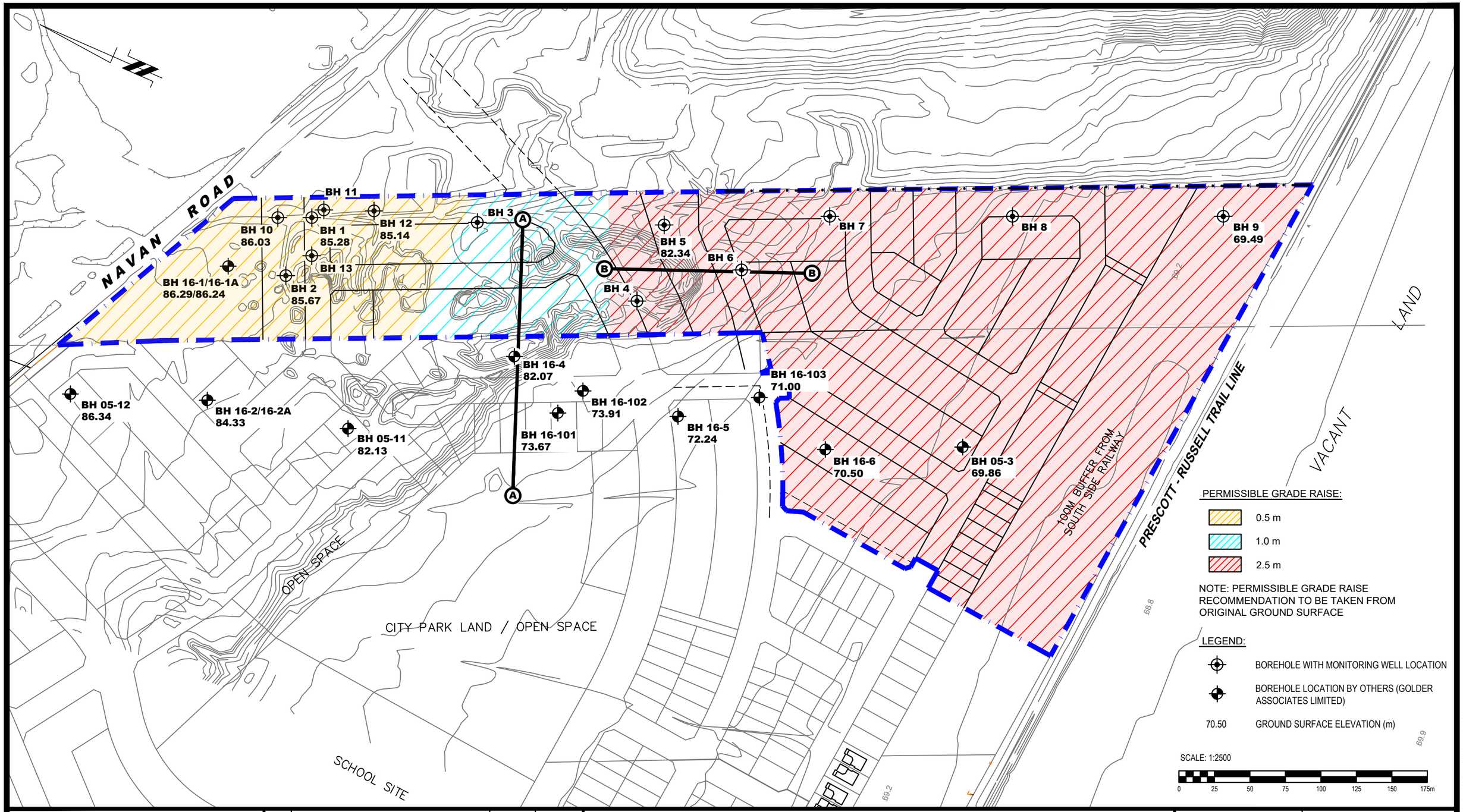

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED TO NEW BASE PLAN	04/02/2020	JV

CLARIDGE HOMES (GLADSTONE) INC.

GEOTECHNICAL INVESTIGATION
3252 NAVAN ROAD

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:2500	Date: 01/2020
Drawn by: NFRV	Report No.: PG5224-1
Checked by: JV	Dwg. No.: PG5224-2
Approved by: DJG	Revision No.: 1

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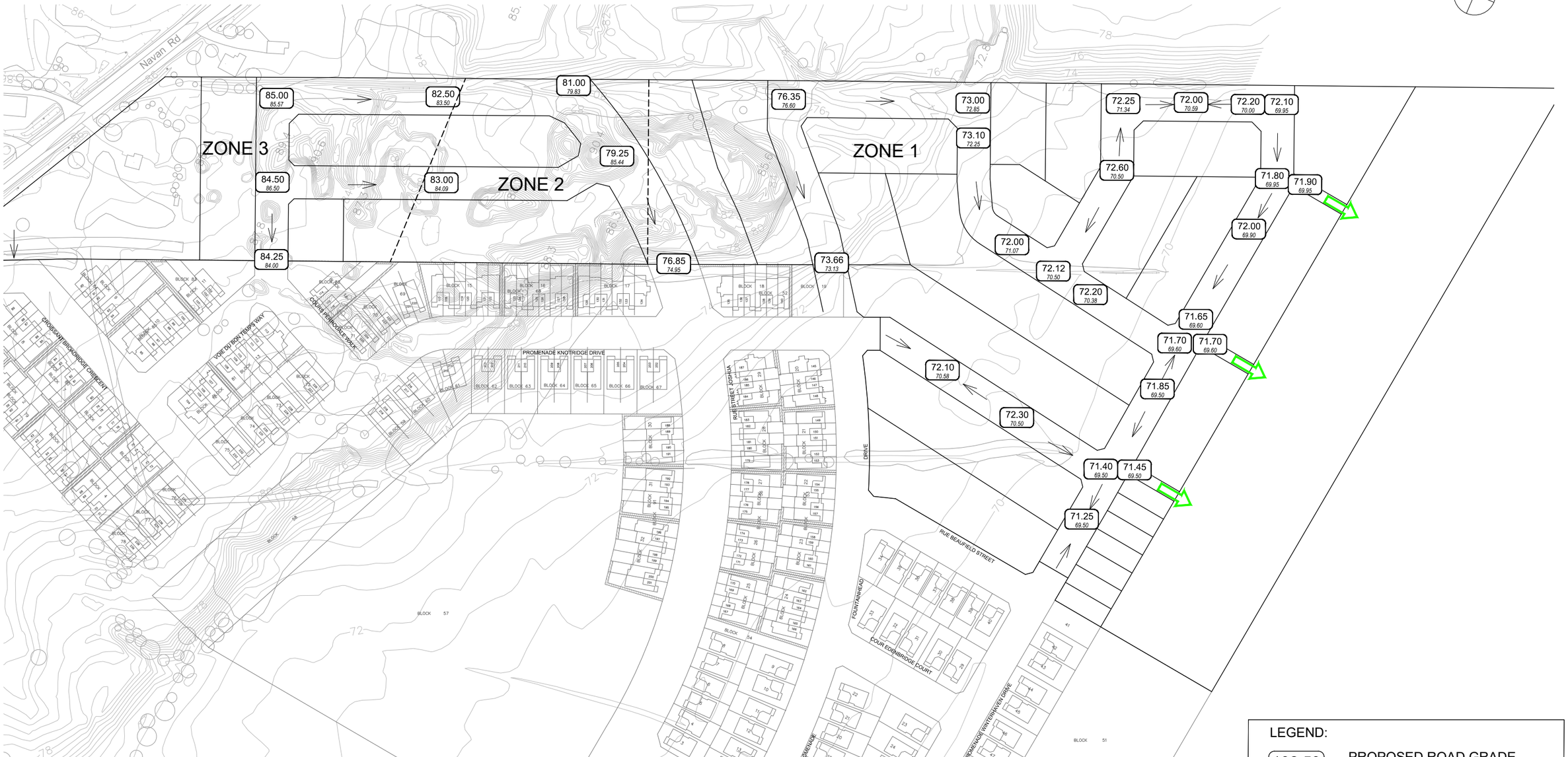

PERMISSIBLE GRADE RAISE	
ZONE	m
1	2.5m
2	1.0m
3	0.5m

LEGEND:

102.50 / 101.55	PROPOSED ROAD GRADE EXISTING GRADE
⇨	DIRECTION OF MAJOR FLOW
*	DENOTES UNITS MAY REQUIRE SPECIAL DESIGN

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	SPRING VALLEY TRAILS PHASE 5 & 6	MACRO GRADING	FIGURE 6.1

General Content

ITEM DESCRIPTION		LOCATION
	Executive Summary (for larger reports only)	N/A
√	Date and revision number of the report	Front Cover
√	Location Map and plan showing municipal address, boundary, and layout of proposed development.	Figure 1
√	Plan showing the site and location of all existing services.	39617-100
√	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Sections 1, 2.1, 3, 3.3 and 4.1
√	Summary of Pre-consultation Meeting with City and other approval agencies.	Appendix E
√	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Sections 2.1, 3, and 4.1
√	Statement of objectives and servicing criteria	Sections 2.2, 3.2, and 4.2
√	Identification of existing and proposed infrastructure available in the immediate area.	Figures 2.1, 3.1 and 4.1
√	Identification of Environmentally Significant Areas, Watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Sections 1, 7.4
√	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Section 9, Figure 6.1
	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	N/A
	Proposed phasing of the development, if applicable.	N/A
√	Reference to geotechnical studies and recommendations concerning servicing.	Section 9

ITEM DESCRIPTION		LOCATION
	All preliminary and formal site plan submissions should have the following information: • Metric scale • North arrow (including construction North) • Key plan • Name and contact information of applicant and property owner • Property limits including bearings and dimensions • Existing and proposed structures and parking areas • Easements, road widening and rights-of-way • Adjacent street names	N/A

Development Servicing Report: Water

ITEM DESCRIPTION		LOCATION
√	Confirm consistency with Master Servicing Study, if available	Section 2.1
√	Availability of public infrastructure to service proposed development	Figure 2.1 and Section 2.1
√	Identification of system constraints – external water needed	Section 2.2.1
	Identify boundary conditions	N/A
	Confirmation of adequate domestic supply and pressure	N/A
	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	N/A
	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	N/A
	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defining phases of the project including the ultimate design.	N/A
	Address reliability requirements such as appropriate location of shut-off valves.	N/A
	Check on the necessity of a pressure zone boundary modification.	N/A

ITEM DESCRIPTION		LOCATION
√	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Section 2.1
√	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Figure 2.1
	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities and timing of implementation.	N/A
√	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 2.2.1
	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N/A

Development Servicing Report: Wastewater

ITEM DESCRIPTION		LOCATION
√	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 3.2
√	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Section 3.3
	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age condition of sewers.	N/A
√	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 3.1 Figure 3.1

	ITEM DESCRIPTION	LOCATION
√	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 3.3
	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix “C”) format.	N/A
√	Description of proposed sewer network including sewers, pumping stations and forcemains.	Section 3.3 Figure 3.1
	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A
√	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Section 3.3
	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
√	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	Section 3.3
	Special considerations such as contamination, corrosive environment, check soils, etc.	N/A

Development Servicing Report: Stormwater Checklist

	ITEM DESCRIPTION	LOCATION
√	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 4.1
√	Analysis of available capacity in existing public infrastructure.	Section 4.1
√	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Figure 4.1

ITEM DESCRIPTION		LOCATION
√	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Sections 4.2, 4.3
√	Water quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Section 4.1
√	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 4.1
	Set-back from private sewage disposal systems.	N/A
	Watercourse and hazard lands setbacks.	N/A
	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N/A
√	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Section 4.1
	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	N/A
	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N/A
	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	N/A
	Any proposed diversion of drainage catchment areas from one outlet to another.	N/A
√	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 4.1 Figure 4.1

ITEM DESCRIPTION		LOCATION
√	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	Section 4.4
	Identification of potential impacts to receiving watercourses	N/A
	Identification of municipal drains and related approval requirements.	N/A
√	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 4.2
	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	N/A
	Inclusion of hydraulic analysis including hydraulic grade line elevations.	N/A
√	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Sections 6 & 7
	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A
	Identification of fill constraints related to floodplain and geotechnical investigation.	N/A

Approval and Permit Requirements: Checklist

	ITEM DESCRIPTION	LOCATION
√	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Section 10
√	Application for Certification of Approval (CofA) under the Ontario Water resources Act.	Section 10
	Changes to Municipal Drains	N/A
√	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Section 10

Conclusion Checklist

	ITEM DESCRIPTION	LOCATION
√	Clearly stated conclusions and recommendations	Section 10
	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A
√	All draft and final reports shall be signed and stamped by professional Engineer registered in Ontario.	Done