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
November 27, 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 15 single family homes, and 256 townhomes, 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. Since the SVT development is part of the approved EUC MSS and no downstream works are required to accommodate the sanitary sewer or storm sewer systems, and the storm sewer system discharges into the existing EUC SWM pond 3, no pre-consultation meetings were requested from the Rideau Valley Conservation Authority (RVCA) or the Ministry of Environment of Ontario (MOE). A pre-consultation meeting was held with the City and the meeting notes are included in **Appendix A**. In February 2020 a submission was made to the City of Ottawa and comments were received in April of 2020. Copy of email from the City Planner summarizing comments received is included in **Appendix A**. This report builds on the previous submission with a modified draft plan to address City and agency comments.

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, Broadridge Crescent and a 150 mm diameter along Winterhaven Drive and Perrodale Way. 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. Two sanitary connection points will be utilized to service Phase 5/6. They include a 200 mmØ on Joshua Street, a 250 mmØ on Winterhaven Drive. Phase 3 General Plan 100 in **Appendix B** illustrates the connection points.

3.2 Design Criteria

The sanitary flows for Phase 5/6 of the SVT development are 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 City of Ottawa design criteria at the time, this resulted in a peak flow of 70.58 l/s. As this area has progressed from CDP to various Plans of Subdivision, the development plan has been refined to meet market conditions. Currently this sewer services 506 singles, 88 semis, 543 townhouse units and 482 “Zen” apartment units, combined with the proposed 15 singles, 256 towns, along with potential future development of 1.31 Ha commercial lands, yields a total of 521 singles, 88 semis, 799 towns and 48 apartment units, 2.3 Ha school and 1.31 Ha commercial. Based on the design densities noted in the City of Ottawa sewer design guidelines, 3.4 ppu single, 2.7 ppu semi and townhouses, 1.8 ppu high density (low rise apartments), the projected population to be serviced by this sewer is now approximately 4252.7. The projected total peak flow for this population plus ICI and infiltration allowance usages is approximately 69.98 l/s. Comparing the actual sewage design flow of 69.98l/s to the EUC projection of 70.59 l/s the flows

are essentially equal. It should ne noted the design capacity of the outleting sewer is 85.79 l/s, therefor sewer has ample capacity to accommodate the development. **Appendix C** contains a comparison of the "EUC MSS vs. Actual" 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 (reduced due to City revising design criteria 350 l/p/d to 280l/p/d and ICI from 50,000 l/Ha/d to 28,000 l/Ha/d and infiltration from 0.28 l/s/Ha to 0.33 l/s/Ha), 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 included the proposed conceptual extension of municipal services. The inclusion of Phase 5/6 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, Ashcroft Homes advanced the design of their development north of Navan Road. A portion of their site was tributary to Pond 3 and was serviced through SVT. Ashcroft requested and received approval to redirect flow to Pond 2 from Pond 3. To support their proposal the design of the trunk storm sewer tributary to Pond 2, the drainage area tributary to Pond 2 were all 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 would 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 Ashcrofts' updated area tributary to Pond 2. Subsequent to that report, detail design was completed and the total drainage area re-directed to the EUC Pond 2 SWM facility from the Ashcroft Lands is 32.7 Ha. 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.

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 (existing EUC pond 3).

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.

Figure 4.1 also illustrates an existing ditch which starts from Navan Road runs along the eastern limits of the site, and eventually crosses diagonally across the lower half of the site discharging into the wet land buffer zone. The upper section which runs along the eastern limits will be located within a 20m buffer, the section which crosses diagonally will be realigned to follow the 20m buffer along the eastern limits and discharge into the adjacent wet lands buffer zone.

5 SOURCE CONTROLS (LID's)

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.

5.5 Buffer Block

The existing/realigned ditch along the eastern limits of the site will be within 6m wide buffer this green space will provide the opportunity to employ bioswales or rain gardens. Similarly the rear lot drainage from the lots backing onto the Mer Bleue wetland buffer can flow into bioswales outletting to the buffer rather then being collected and discharging into the municipal storm sewer system.

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.

If during construction excavated onsite material is suspected of being contaminated or hazardous, the material is to be stockpiled separately complete with sediment and erosion controls to suit the specific needs. The material shall be tested by a qualified firm and depending on the specific contaminate, dealt with in the recommended manner.

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, with a view to ultimately 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. There are locations where outdoor living areas are exposed to vehicular generated noise. These areas include rear yards and side yard flankages in close proximity to Navan Road and Joshua Street, and rear yards which are not yet shielded by the future commercial 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 October 9, 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.
- A temporary PTTW may be obtained from MECP if greater than 400,000l/day of ground or surface water is to be pumped during construction.
- 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:

Driveways

50mm HL3 superpave 12.5mm

150mm Granular 'A'

300mm Granular 'B' Type II

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. Developer/Builder to review possibility of incorporating LID features.

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

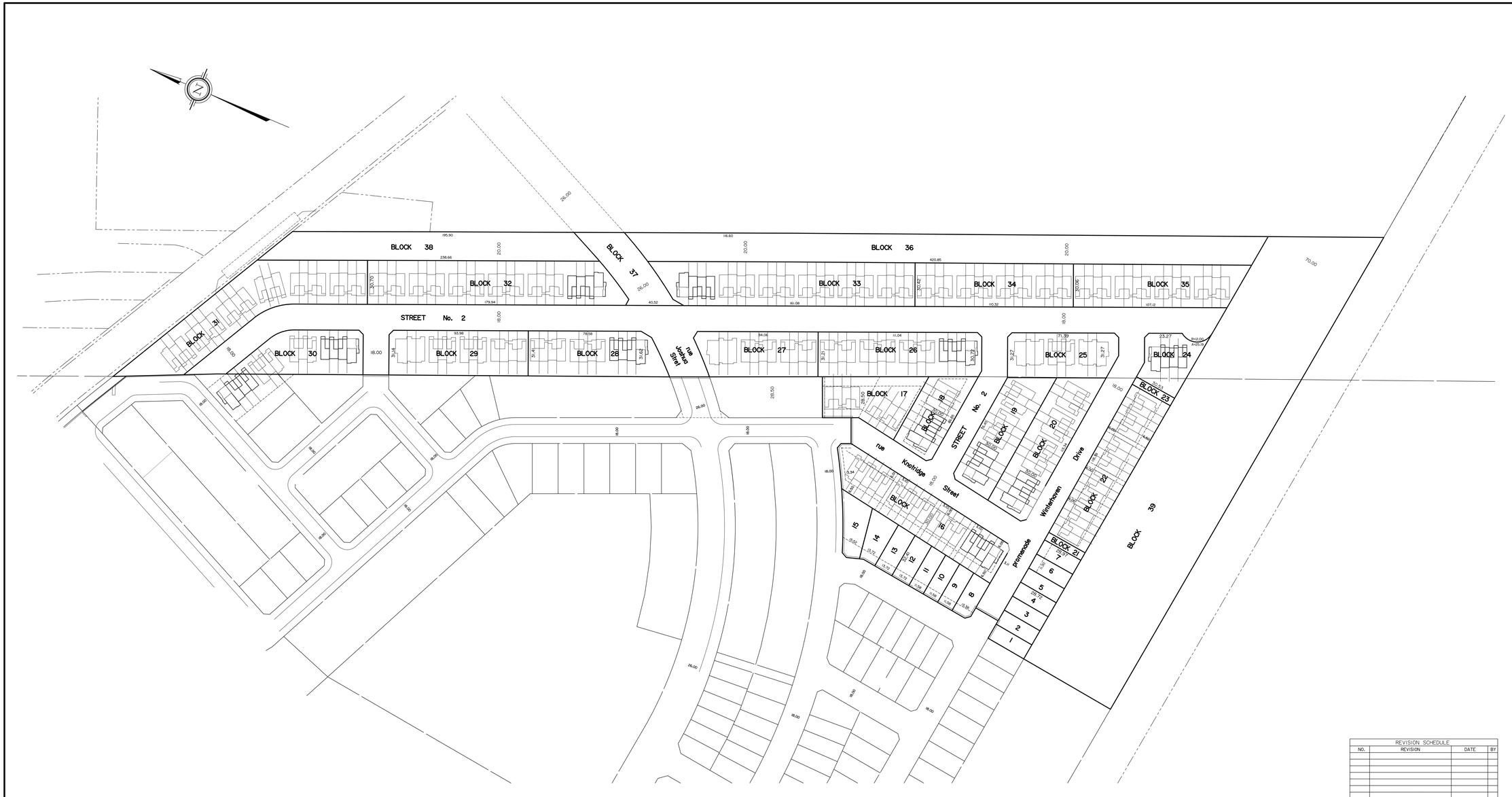
This report was proposed in accordance with the City's Development Servicing Study Guidelines, see study checklist in **Appendix E**.

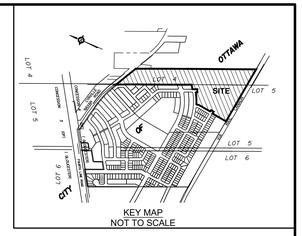
Report prepared by:

Demetrius Yannoulopoulos, P.Eng.
Director

APPENDIX A

- Legal Plan
- Pre-Consult Meeting Notes
- Review Comments





KEY MAP
NOT TO SCALE

SKETCH TO ILLUSTRATE

PROPOSED UNIT LAYOUT ON PHASE 5 SPRING VALLEY TRAILS DEVELOPMENT CITY OF OTTAWA

Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1000

40 30 20 10 0 20 40 Metres

Metric

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

REVISION SCHEDULE			
NO.	REVISION	DATE	BY
3.	REVISED LAYOUT	JUNE 9, 2020	N
2.	TOWNHOUSE UNITS ADDED	MAR. 18, 2020	N
1.	PLAN PREPARED FOR DISCUSSION	FEB 25, 2020	N

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
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Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
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Job No. 20313-19 Claridge Pt Lts 4, 5 C4 OF GL DPS 03 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
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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

From: **Murshid, Shoma** <Shoma.Murshid@ottawa.ca>
Date: Tue, Apr 21, 2020 at 2:32 PM
Subject: 3252 Navan Road - Zoning By-law Amendment D02-02-20-0015 - 1st Review Comments
To: Vincent Denomme <vincent.denomme@claridgehomes.com>
Cc: Baird, Natasha <Natasha.Baird@ottawa.ca>, Arasteh, Vahid <vahid.arasteh@ottawa.ca>, Petrovic, Sue <Sue.Petrovic@ottawa.ca>, Knight, Melanie (Planning) <Melanie.Knight@ottawa.ca>, Jamie Batchelor <jamie.batchelor@rvca.ca>, Jim Burghout <jim.burghout@claridgehomes.com>, Shawn Malhotra <shawn.malhotra@claridgehomes.com>

Technical Review Comments

General Comments:

1. Pending a draft approval of a subdivision application, this Zoning Amendment application will remain ON-HOLD. Please note that when re-activating this Zoning Amendment process for another comprehensive review post draft-plan of subdivision approval, a resubmission package must also address the following comments.

2. It is premature to ask for a specific residential zone/subzone until it is demonstrated that one tree per lot or residential unit can be achieved. In order to help determine this, the submission of a preliminary typical block/lot plan along with a geotechnical engineer's confirmation on the clay soil plasticity levels and confirmation of tree setback distances for medium and large shade trees to proposed foundations is required.

3. Revised Planning Rationale required

4. Still awaiting submission of Preliminary Typical Block/Lot Plan (2 plans + PDF)
5. Still awaiting submission of Noise Impact Study (2 reports + PDF)

6. Clay soils: A request for a short front yard setback (e.g. 3 to 3.5 metres), particularly when fronting onto local residential roads that are 18-metre ROWs or less (based on a cross-section that does not include sidewalks - for 18-metre ROW with sidewalks, a higher front yard setback than 4.75 metre will be required for small caliper trees), cannot accommodate even a small-caliper tree per lot, if

the geotechnical report states, for example, a minimum of 7.5 metres between the foundation of a dwelling and a tree. For larger caliper trees, that provides more consistent shading and an urban canopy, consideration of a higher setback, higher than 4.75-metres from the property line to the foundation needs to be made. The City wishes for larger caliper, shade trees. Get your landscape architect and geotechnical engineer to provide the distance for shade trees. Increased corner yard setbacks may also be required in order to allow for tree planting. Please provide your mitigation techniques to accommodate trees and also revise your request for the front yard and corner side yard setback provisions under the zoning by-law.

7. Note that the small caliper trees will not secure a tree canopy at maturity. In order to achieve a consistent street tree planting, it is encouraged that this be reviewed in more detail prior to draft plan approval, so we can achieve this important objective despite the Marine Clay soils present at this site. As such, a street layout plan, with cross sections, including tree details, will need to be submitted within the next revision package in order that we start our review and before we can proceed to draft plan of subdivision approval and zoning recommendation.

8. Tree setbacks, confirmed by both the geotechnical engineer and landscape architect, will be required to determine if the ROW design is appropriate for this development.
9. An adequate analysis of the plasticity of soils is required before we can confirm if the density being proposed is appropriate.

Environmental Review Comments:

I think the ZBA application should be deemed incomplete because after a quick review of the EIS (WSP 31Jan2020), it has omitted important aspects of the required study and offers very limited information.

More specifically,

1) the study area and subject property identified in the EIS is different from the subject site identified in the planning rationale and project summary. At the very least, the EIS must examine the entire property that is included in the zoning application. In fact, the EIS guidelines require examination of the broader ecosystem and landscape than just investigating within the subject property's boundaries. Given the subject property's proximity to Mer Bleue, a significant wetland complex in Ottawa's east side, a broader examination will be warranted.

2) the EIS conducted its site visit in December 2019, which is outside of the growing season as stated in the EIS guidelines. While the EIS has suggested that further field studies will be required, the December field studies and lack of SAR investigations offer insufficient data and results.

It would be imprudent to proceed with the proposed development review without having the fundamental information from a complete EIS to inform design. Doing so counters "design with nature" principles and the City's Official Plan policies.

I recommend only circulating the ZBA when the EIS field investigations are satisfactorily completed and offer sufficient information to identify existing conditions and environmental constraints, analyze potential impacts, inform design and recommend appropriate mitigation measures.

Engineering Comments

This submission is now being circulated to asset management and also to Michel Kearney to see if they have any comments. Deadline for their comments is May 8, 2020. The comments from Waste Connections, RVCA and Real Estate will be circulated to Asset Management for their information as well. They wouldn't have been able to provide comments earlier but now that we are in receipt of Waste Connections, RVCA and Real Estate's comments, this circulation is now being inititated.

Here are Engineering's comments for this first review:

Assessment of Adequacy of Public Services:

1. The proposed development is tributary to the EUC Pond 2 which has not be constructed yet. No development can occur until such time Pond 2 is in operation. Other proposed developments are tributary to Pond 2 and discussions are occurring in this area. The approved outlet for Pond 2 has not been determined at this stage.
2. Dewatering will require a PTTW and the water quality will have to be determined before discharging.
3. Stockpile management should include a section on hazardous soils and were to transport and discharge the material.
4. Provide additional information for LID measures.
5. The development will be subject to grade raise restrictions.

Geotechnical Report:

6. Grade raise restrictions are present and efforts should include preloading as soon as possible for the future development. Delays of these works will hinder the approval of the works and require expensive infrastructure. The applicant should take more precautions to maximize the flexibility of the development and the quality of their product.
7. Multiple boreholes do not provide the geodetic elevation. This information is required to determine the type of soil will be encountered during the design and construction of the development.
8. The proximity of the residential development is a concern and further investigations will be required to determine the zone of influence from leachate to the facility. The development is required to respect the O.Reg 53.1 requirements.
9. The proposed development could impact the groundwater table and affect the soil stability for the existing facilities, notably the waste disposal site and existing residential development.
10. Provide a grading plan showing the limits of hazard lands.
11. The slope stability analysis requires a toe erosion allowance or a 6 meters access erosion allowance as per City's geotechnical guidelines. This submission is unacceptable. Given the location of the proposed development, the slope is required to be entirely outside of the hazardous site. The depth of the geotechnical samples should be 2m deeper than the base of the slope.
12. The latest geotechnical report will require updated annual monitoring data.
13. Provide tree setback from foundations.
14. Provide an adequate analysis of the plasticity of soils.
15. All geotechnical analysis could be subject to peer review.

Transportation Engineering Services' Comments

- This is the first submission of the Strategy report (received on Mar 10) and it was submitted with the development application.
- Update the TDM checklists. Some measures of the TDM-supportive Development Design and Infrastructure checklist are required. Given that the target mode share for transit may not be reached until the extension of Joshua Street to Navan Road, consider some post-occupancy measures to promote transit ridership. The need and opportunity section of the report should go into more detail regarding any effects that a higher auto driver mode share will have on the development.

- (At time of subdivision application) Provide a pedestrian and cycling plan and typical cross-sections of the subdivision street network for the City to review the suggested crossings and sidewalk locations. Local roads are to be designed to control vehicle movements to planned 30km/hr posted speeds.
- (At time of subdivision application) Design new neighbourhood collector streets with the City of Ottawa's Designing Neighbourhood Collector Streets (2019) guide.
- The roundabout screening form for Joshua Street / Renaud Road is missing from Appendix I.
- Note that the access intersections achieve acceptable PETSI scores, only the delay creates the PLOS of E.
- Review the concerns with implementing auxiliary lanes (cut through traffic) on Navan Road at Spring Valley Drive with Road Safety and Traffic Investigations.

Traffic Signal Operations
No comment.
Traffic Signal Design
No comment.
Street Lighting
Comments were not received.
Transit Services

- Due to the location of the development and the alignment of existing transit routes, and as identified in Section 5.1.1 of the TIA, the development will not meet transit service coverage standards. Once Joshua Street is connected to Navan Road in a future phase, transit routes will be able to serve bus stops at the intersection of Joshua and Knotridge (as planned in Phase 3). However, in the interim the Owner may be required to implement a Transit Service Strategy to improve access to transit in advance of the Joshua Street connection. Interim measures may include, but not be limited to: adjusting Route 34 and/or Route 225 to serve new temporary bus stops along Spring Valley Drive to reduce walking distances to bus stops; constructing a temporary hard-surface pedestrian pathway connection from the development to Navan Road, reducing walking distance to existing Route 228 bus stops at 3252 and 3253 Navan Road. The Owner will work with Transit Services, and the Strategy may include funding and cost-sharing arrangements.

Development Review - Transportation

- A 20m ROW for local roads is preferred.
- Section 5.4.3.1, reference to Table 22, should read Table 12.
- The Renaud Road and Joshua Street intersection is on the list for City funded traffic signal installation. Implementation is not currently scheduled and is subject to available funding.
- Please address the above comments and proceed to submitting the Step 5: Final TIA.

Urban Design and Zoning Review Comments:

- Block 33 is proposed to be rezoned to R4Z. With the irregular shaped block, it is recommended that the applicant consider the definition of 'lot lines' and 'yards' in relation to the R4Z performance standards, how the site will be accessed and the arrangement of the low-rise building(s) on the site. A concept plan for Block 33 may be appropriate to ensure the R4Z zoning is the most appropriate subzone. It is also noted that hydro wires are located along Navan Road and will require sufficient setbacks. Overall, the proposed multi-unit low-rise (up to four storeys) building form provides a transition from Navan Road to the other low-rise residential uses existing and proposed.
- There is little information regarding the proposed exception for the R3Z and R3VV zoning to permit 70% of the front yard to be used for a driveway. Will this exception be needed for every townhouse unit or specific units in certain areas? Please provide additional information related to this exception especially with respect to the ability to provide street trees.

Corporate Real Estate Office (CREO) Comments:

The southern boundary of 3252 Navan Road abuts the non-active Montreal and Ottawa Rail Corridor which is owned by VIA and currently leased by the City of Ottawa as the Prescott-Russell Pathway MUP (Multi-Use Pathway). 3252 Navan Road's proximity to this non-active rail corridor also puts it within the 300 metre area of potential concern.

Accordingly, I offer the following:

1. The City of Ottawa's Corporate Real Estate Office (CREO) has adopted the Guidelines for New Development in Proximity to Rail Operations, created by the Railway Association of Canada and the Federation of Canadian Municipalities, see: https://www.proximityissues.ca/wp-content/uploads/2017/09/2013_05_29_Guidelines_NewDevelopment_E.pdf

    1. CREO's main objective in its adoption of these guidelines is to mitigate railway-oriented impacts such as noise, vibration, and safety hazards, to ensure that the quality of life of a building's occupants and users are not negatively affected and to the maintain the long-term integrity and viability of the rail corridor.

1. The guidelines are intended to be applied primarily to new residential development but are applicable to other sensitive/occupied dwellings.
2. According the guidelines, a 30 metre setback from the property line to the face of the building is recommended combined with an earthen berm 2 meters above grade (2.5:1) (see page 27 & 38). It is also recommended that a noise and vibration study should be conducted according to page 28 of the guidelines.
3. Appropriate uses within the 30 metre setback area include public and private roads; landscaping, parking spaces/structures; and storage sheds.
4. Consideration to reducing the stated setback is possible, subject to engineered mitigation measures. (such as a crash wall, larger berm etc.)

Since the proposed development is located within the 300 metre area of concern, I hereby request that the guidelines be followed, which recommend that the future potential and the existence of the rail corridor be registered on title and that the following clause should be inserted in all developments, offers to purchase, and agreements of Purchase and Sale or Lease for all developments within 300 meters of the railway right-of-way:

1. Warning: The City of Ottawa or its assigns or successors in interest has or have a rights-of-way within 300 metres from the land subject hereof. There may be alteration to or expansions of the railway facilities on such rights-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its operations, which expansion may affect the environment of the occupants in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwellings. The City of Ottawa will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way.

Please contact Sue Petrovic, 613.580.2424, ext. 21517 Sue.Petrovic@ottawa.ca if you have questions or require clarification about the above comments.

Environmental Remediation Unit (CREO) Comments:

Paterson, 2019, Buffer Study Update in Relation to Waste Connections Canada Navan Waste Recycling and Disposal Facility.

- As indicated in the report, this study is an update to a previous report completed by Golder in 2013:

    - "Claridge Homes Spring Valley Trails Development - Phase 3 – Buffer Study in Relation to the BFI Navan Waste Recycling and Disposal Facility, Golder, December of 2013".
- The subject property is located immediately adjacent to the "Claridge Homes Spring Valley Trails Development – Phase 3" on the west side and the Navan landfill on the east side. The Claridge Homes property (Phase 3) is located 100 m west of the Navan landfill property.
- The Golder 2013 report was mainly based on:
    - the design studies in support of the landfill original or expansion approval;
    - the annual / periodic monitoring reports, including the 2012 annual monitoring report of the Navan landfill, which was the most recent monitoring report available at the time of Golder's 2013 study.
- However, it seems the Paterson 2019 report does not include any updated data from the annual monitoring reports. The Paterson 2019 report needs to be updated to include the most recent data. The annual monitoring report may be obtained through the Landfill owner or the MECP. Please note, as per the City's OP, consultation with the landfill owner and regulatory agencies is required.
- As for the soil and groundwater contamination section of the Paterson 2019, the report refers to the Phase Two ESA completed by Paterson on this site (Paterson, Phase Two ESA, Feb 2020). As such, comments are provided under the Phase Two ESA comments.

Paterson, Dec 2019, Phase One ESA.

- The aerial photo review of the report is limited to the photos taken post-1965. Please confirm if there is no aerial photo available for earlier dates from National Air Photo Library.
- Obtaining and utilization of an ERIS report is required to ensure the "Environmental Source Information" requirements of the O.Reg. 153/04 are met.
- While the Phase One ESA considers an APEC on-site due to the presence of the Navan landfill, the proposed contaminants of potential concern (COPCs) does not all the landfill indicator parameters. It is required to consult the Navan landfill documents to ensure the landfill indicator parameters are included in groundwater testing program.

Paterson, Feb 2020, Phase Two ESA.

- As per the comment on the phase one ESA, it is required to consult the Navan landfill documents to ensure the landfill indicator parameters are included in groundwater laboratory program.
- It seems there is no duplicate sample (QA/QC samples) included in the sampling program. QA/QC samples are required under O. Reg. 153/04 to verify the data quality. Please advise if any duplicate sampling has been conducted. Please ensure QA/QC requirements are met in any future sampling program.
- As the subject property is immediately adjacent to Navan landfill, potential for vapour intrusion can be evaluated through measurement of methane gas concentrations in the select boreholes.
- Impacted groundwater was identified in BH1. Although the identified groundwater shall be addressed during the site development, it is not clear if the source of groundwater impact is the landfill or other sources. This should be cleared to avoid any future impacts post-development.
- As recommended by the report, the impacted soil in BH7 requires further delineation.

Please note, the current use of the site is industrial/commercial and the proposed development is residential, which is more sensitive. Thus, filing an RSC is required as a condition of approval.

RVCA Comments

RVCA recommends this application be placed ON HOLD until such time that

the constraints have been appropriately identified and the appropriate zoning boundaries and

designations have been identified.

Full RVCA comments attached.

Waste Connections of Canada Comments:

See attached, directly from Waste Connections as well as their hired consultant, Holzman Consultants Inc.

Public Comments

Residents

- Public very concerned about the on-street parking ‘ghetto’ that will be created around the existing lower density residential lots abutting the proposed blocks of townhouse and back-to-back, stacked units, as it is known that these types of blocks have very limited on-street parking opportunities for the 2nd vehicle, or above, per household, plus any associated visitors.
- Residents of previous Claridge phases abutting this current proposal worried about the negligence of Claridge (staff and contractors/sub-contractors) on future construction projects as the feel Claridge has not maintained the roads well during and after their have completed their works in previous phases (flat tires reported by several residents, multiple times)

    - Claridge wants to build house on what appeared to be a land that is on a hill or a slope, the problem is that Claridge can't be trusted, in our opinion, to do quality work, if you walk around the project for phase 1-5 the only thing you see is poor quality work for the public infrastructure and the existing retaining wall (example on Joshua St) you see retaining walls that were built last year that are already on a curved or crooked, they will fall sooner or later, I'm really concern with this phase there will be way more water coming from the hill and that Claridge will not be able to manage water flow and drainage and all that water will end up on the street and everywhere in the project, since they can't build retaining walls properly how is the public protected for the years to come and how will the city of Ottawa ensure that proper walls are built to manage drainage and the grading of the slopes, they already have build ravine lot on Winterhaven Rd and these ravine lot all have crooked retaining walls, same thing on Knotridge Drive

Councillor Dudas’ concerns:

Will this proposal and density exacerbate existing traffic problems on Navan and Renaud, particularly during peak periods

Not creating on-street parking ‘ghettos’

Not exacerbating existing traffic on local and collectors, such as Joshua

Whether lots and blocks that directly abut a noxious use, such as an active landfill, is appropriate.

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

www.ottawa.ca

'

April 19, 2020

Shoma Murshid
File Lead, Planner II
City of Ottawa
110 Laurier Avenue West, 4th Floor
Ottawa, ON
K1P 1J1

Re: ZONING BY-LAW AMENDMENT APPLICATION FILE NO. D02-02-20-0015
CLARIDGE HOMES INC. SPRING VALLEY TRAILS DEVELOPMENT

Dear Ms. Murshid,

The following provide Waste Connections of Canada (WCC) preliminary observations and concerns with the Zoning By-law Amendment application submitted by Claridge Homes Inc. for the planned residential subdivision development named Spring Valley Trails - Phases 5 and 6. This subject site abuts the WCC Landfill. Additional comments and concerns will be provided during the various stages of the City of Ottawa's zoning and site development approval process.

1. GEOTECHNICAL INVESTIGATION REPORT – PREPARED BY PATERSON GROUP INC.

WCC has a concern that the drainage caused by the proposed development's foundations and municipal services would result in a lowering of the groundwater water table along the landfill west property limit. The clay soils underlying the landfill including the west side adjacent to the proposed development are highly sensitive with water content approaching or exceeding the liquid limit for these soils, and are subject to significant consolidation.

In addition, development work at the toe of the existing slopes on the west side of the WCC property could impact stability of these landfill slopes. The factor of safety for these slopes will have to be increased due to the change in land use and occupation of the proposed development lands by residential dwellings.

2. BUFFER STUDY UPDATE IN RELATION TO WASTE CONNECTIONS CANADA NAVAN WASTE RECYCLING AND DISPOSAL FACILITY– PREPARED BY PATERSON GROUP INC.

It should be noted there is no new information presented in this report that would be considered an update. This report, for the most part, is a replica of the Golder report. Unlike the Golder report, the conclusions of the Paterson report are not based on science or updated modelling but rather on conjecture. The City of Ottawa also retained various consultants for the PEER review of all previous buffer study reports, but this proposed development was not considered in any of these previously completed PEER reviews. WCC recommend these PEER reviews must be revisited by the previous consultants retained by the City of Ottawa.

The landfill's approved leachate collection system and clay cut-off located along the west limits of waste act as a "hydraulic trap". This trap design and functionality relies on ground water levels on the west side of the trap remaining higher than the leachate levels within the leachate collection system. Development of the lands adjacent to the WCC Landfill Facility west property line will results in drainage of the lands below the escarpment that could alter the groundwater levels, the hydraulic gradients in the area, the localized direction of ground water flow and effective performance of the leachate collection system (hydraulic trap) as per approved landfill design.

Upstream flows originating to the north and northwest of the WCC Landfill Facility site are diverted around the landfill by ditches that exist along the perimeters of the on-site buffer zones. The proposed development will result in alterations to these existing ditches and surface runoff will be required to flow through the proposed development.

Paterson wrongfully states that the landfill closure is expected in 2022. The remaining life of the WCC Landfill Facility is based on remaining permitted air space which is limited by the approved final waste grades / site contours. Air space use is quite variable and is influenced by many operating factors. Presently, the timeline has been estimated to extend to the years 2026/27. With additional landfill capacity expected in the Ottawa area in the very near future, this time line may be extended significantly.

3. TRANSPORTATION IMPACT ASSESSMENT REPORT – PREPARED BY IBI GROUP

The report states that there will be no changes to transit service within the vicinity of the proposed development until such time that the future extension of Joshua Street and its connection with Navan Road is implemented, maintaining consistency with the conceptual alignment presented in the East Urban Community Phase 1 Community Design Plan. This alignment runs through WCC Landfill property at the northwest corner of the site. Although expropriation by the City of Ottawa may be possible in the future, the site is subject to a provincial Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA). There is also a habitat for threatened Bank Swallows in the proposed Joshua Street extension alignment on WCC land.

4. ENVIRONMENTAL IMPACT STATEMENT AND TREE CONSERVATION REPORT PREPARED BY WSP

It should be noted the investigation on which the Environmental Impact Statement is based was a very short period during the winter months (One visit on December 17, 2019). Species at risk (SAR) habitat such as the Bank Sparrow which is a seasonal bird, or others such as reptiles, amphibian and aquatic species can only be observed during frost free periods of the year.

Given the importance of protecting SAR and endangered species, the presence of two separate wetland communities identified in the "Study Area" and the proximity of the proposed development to the Mer Bleue Bog (an Area of Natural and Scientific Interest (ANSI) managed by the National Capital Commission), the Zoning By-law Amendment and Plan of Subdivision application could be viewed as incomplete and pre-mature. This is supported by WSP's conclusion in Section 9 of the report that the study was incomplete and inadequate to effectively evaluate environmental impacts to natural heritage features. Although the report conclusions contradicts this statement by WSP by stating the

proposed residential development is unlikely to negatively impact the natural heritage system, SAR, or local wildlife.

5. GENERAL COMMENTS

5.1. MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS

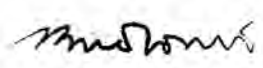
It should be noted that the Ontario Ministry of Environment, Conservation and Parks (MECP) in its *Guideline D-4 Land Use on or near Landfills and Dumps "*considers the most significant contaminant discharges and visual problems to be normally within 500 meters of the perimeter of a fill area. Accordingly, the Ministry recommends this distance be used as a study area for land use proposals." Other Provinces such as Alberta are even more stringent and do not allow any development that could involve food preparation (e.g. kitchen in a home) within 450 meters of an active landfill. These guidelines and regulations have been put in place so that people don't unwittingly purchase homes and are subsequently surprised by possible impacts either visual, nuisance or environmental as a result of being so close to an operating landfill.

5.2. SPRING VALLEY TRAILS BANK SWALLOW MITIGATION AND MONITORING RECORD – PREPARED BY MCKINLEY ENVIRONMENTAL SOLUTIONS

McKinley Environmental Solutions was retained by Claridge Homes Limited Partnership (Claridge) to undertake work to support the removal of a sand stockpile that was habitat for threatened Bank Swallows (Riparia riparia), in accordance with the registration process outlined by the rules and regulations of the Ontario Endangered Species Act (ESA). Claridge completed the habitat relocation project onto WCC property located along the west property line above the escarpment during the Spring Valley Trails Phase 2 development. Bank Swallow nesting has since been observed at this location. Although the relocated habitat is not on the proposed Spring Valley Trails – Phase 5/6 development land, it is immediately adjacent to the habitat that may be negatively impacted due to harassment. It is also located within the proposed alignment of the Joshua Street extension.

If you should have any questions please do not hesitate to contact the undersigned.

Sincerely,



Brian Forrestal, P.Eng.
Region Engineering Manager - Canada

cc. John Snelling, Division Vice President, Waste Connections of Canada
Henri Huneault, District Manager, Navan Landfill, Waste Connections of Canada

20-1839-WAS

April 20, 2020

Shoma Murshid
File Lead, Planner II
Planning, Infrastructure and Economic Development Department
City of Ottawa
110 Laurier Avenue West
Ottawa, ON
K1P 1J1

Re: Spring Valley Trails Subdivision Phase 5/6
3252 Navan Road, Ottawa, ON
Application for Zoning By-law Amendment
(D02-02-20-0015)

Dear Ms. Murshid:

Holzman Consultants Inc. has been retained by Waste Connections of Canada to prepare a letter in response to the application for Zoning By-law Amendment for the Spring Valley Trails Subdivision Phase 5/6 at 3252 Navan Road (the "Subject Property"), in the City of Ottawa. We also submit the attached letter dated April 19, 2020 from Water Connections of Canada for your consideration as well.

The purpose of our letter is to highlight our land use planning concerns with respect to the proposed development abutting their facility at 3354 Navan Road.

Application Evaluation

Provincial Policy Statement, 2014

Per Policy 1.6.10 of the PPS below, waste management systems are critical facilities that planning authorities must consider in land development applications. Notably, these systems must be able to accommodate both present and future requirements. It is concerning that much of the above noted materials prepared in support of the application has been presented under the assumption that the Waste Connections facility would be ceasing operations in 2022, which is incorrect. In fact, operations could continue through to 2027 or beyond depending on remaining capacity, among other considerations. Therefore, any conclusions or recommendations in the above noted applications must be reconsidered for the potential future requirements of the Waste Connections facility.

Furthermore, given this longer timeline for future operations, it will be especially important for the City to consider the implications for public health and safety, per Policy 3.0 of the PPS below. Reducing the potential risk from this human-made, yet required and important, hazard will be critical, as it is an industrial waste and recycling facility that accepts materials that pose risks.

> ***1.6.10 Waste management***
>
> *1.6.10.1 Waste management systems need to be provided that are of an appropriate size and type to accommodate present and future requirements, and facilitate, encourage and promote*

reduction, reuse and recycling objectives. Planning authorities should consider the implications of development and land use patterns on waste generation, management and diversion.
Waste management systems shall be located and designed in accordance with provincial legislation and standards.

3.0 Protecting public health and safety

Ontario's long-term prosperity, environmental health and social well-being depend on reducing the potential for public cost or risk to Ontario's residents from natural or human-made hazards.
Development shall be directed away from areas of natural or human-made hazards where there is an unacceptable risk to public health or safety or of property damage, and not create new or aggravate existing hazards.

Provincial Policy Statement, 2020

Per Policy 1.2.6 of the updated PPS, major facilities, such as the Waste Connections facility, and sensitive land uses, such as the proposed subdivision phases, should be planned to avoid any potential adverse effects, as noted below. We feel the Planning Rationale submitted as part of the above noted applications does not speak to the appropriateness and compatibility of residential and landfill uses abutting one another. From a site inspection, the fact that the waste disposal facility is not only located immediately adjacent to, but is at a much higher elevation, and can be perceived as being quite physically imposing, could lead to the potential that future neighbours will inevitably feel uncomfortable being in the "shadow" of the facility. This could result in concerns raised by these residents with the city, even though the existing facility has been in existence for many years. Questions from the public regarding the compatibility of new residential uses adjacent to the facility will no doubt follow. This is the case in other areas of the City, most notably in the Stittsville area where a long-standing waste disposal site is often the target of complaints from many residents, most if not all arrive long after the facility has been in existence.

Furthermore, as previously mentioned, planning authorities shall protect the long-term viability of the Waste Connections facility, vulnerable to encroachment, based on the stated conditions below. Good land use planning should address this compatibility of uses, or lack therein by imposing reasonable setbacks to mitigate impact. The onus should be on the proponent, not the waste disposal site that is operating under existing Environmental Certificate of Approvals. Again, we feel the Planning Rationale did not address these conditions, nor do the associated reports make conclusions or recommendations based on the potential future timeline of the Waste Connections facility.

1.2.6 Land Use Compatibility

1.2.6.1 Major facilities and sensitive land uses shall be planned and developed to avoid, or if avoidance is not possible, minimize and mitigate any potential adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term operational and economic viability of major facilities in accordance with provincial guidelines, standards and procedures.

1.2.6.2 Where avoidance is not possible in accordance with policy 1.2.6.1, planning authorities shall protect the long-term viability of existing or planned industrial, manufacturing or other uses that are vulnerable to encroachment by ensuring that the planning and development of proposed adjacent sensitive land uses are only permitted if the following are demonstrated in accordance with provincial guidelines, standards and procedures:

a) there is an identified need for the proposed use;
b) alternative locations for the proposed use have been evaluated and there are no reasonable alternative locations;
c) adverse effects to the proposed sensitive land use are minimized and mitigated; and
d) potential impacts to industrial, manufacturing or other uses are minimized and mitigated.

The discussion above related to the shadowing affect is directly relevant to the question of compatibility of the two uses being side by side without adequate buffering.

City of Ottawa Official Plan

Per Section 3.8.6 – Development adjacent to solid waste disposal sites, "*Proponents for any development that requires planning approval on land within the influence area of an operating or non-operating solid waste disposal site, will undertake a study, in consultation with the owner/operator of the disposal site, to demonstrate that the solid waste disposal site will not have unacceptable any adverse effects on the proposed development and will not pose any risks to human health and safety. Particular attention will be required for those proposals that will accommodate people or include animal husbandry or food production. Where an operating solid waste disposal site is involved the City must be satisfied that the development will not impact the continuing operation of a solid waste disposal site (e.g., a use that would have the potential of impacting the water table).*"

As previously mentioned, we feel that the Buffer Study undertaken as part of the above noted applications was based on incorrect assumptions about the timeline of operations for the Waste Connections facility. Therefore, any conclusions or recommendations in the Buffer Study must be reconsidered. In particular, said study must demonstrate that it will not have unacceptable risk to human health and safety (the focus of the submitted study), but also that the development will not impact this future timeline and continuing operation of the Waste Connections facility (an area significantly lacking in the submitted study). Section 4.2 also echoes the requirement that the applicant demonstrates that there will be no impact on the current and future expanded operations of the landfill. The same issue of compatibility or lack thereof between the two uses and possible mitigation measures so that they could possibly co-exist is generally absent from the submitted materials.

East Urban Community – Community Design Plan Phase 1

Per Section 3.10 of the East Urban Community – Community Design Plan (EUC CDP) Phase 1, "*Waste Services Inc. occupies a large portion of Phase 2 and has an unknown operational lifespan…The 500m buffer zone around waste disposal facility may limit development potential while the facility is operational"*. Therefore, it has also been recognized by the City that nearby or abutting development may be limited due to the Waste Connections facility and its operational lifespan. The proposed development suggests housing immediately adjacent to a portion of the boundary of the facility without any mitigation measures.

Section 4.4 below outlines additional recognition of these lands and important regional infrastructure, as well as how the Province's Ministry recommends against proposals for sensitive land uses adjacent to operating landfills:

4.4 Waste Disposal Facility

The [Waste Connections] lands are regulated by a Certificate of Approval issued by the Ministry of the Environment. This Certificate does not have an expiry date and [Waste Connections] is expected to continue operations well into the future. It is in the best interest of [Waste Connections], the City and the future residents of the community to recognize that this facility is

a key component of the waste management infrastructure of the region and it plays an important role in the provision of waste management services such as recycling, composting, and disposal for the community. Development should not hamper the ability of this site to perform its prescribed function to serve the community.

As described previously, there is a 500m buffer study area around the waste disposal facility. Given the uncertainty regarding lifespan of the facility, it is assumed that all or a portion of the site will continue in use for solid waste disposal in the foreseeable future. [Waste Connections] is a well-managed and run operation however, odours have and may continue to be an issue at the [Waste Connections] site as with all landfills. Although the concept shows development up to the edge of the waste disposal facility this is only to illustrate the potential for future development and a functional road pattern.

The Ministry of the Environment Guidelines D-1 and D-4 Land Use On or Near Landfills and Dumps provides direction on development adjacent to existing landfill sites. "The guideline applies to all proposals for land use on or near any landfill or dump which contains municipal solid waste, industrial solid waste and/or sewage sludges" (Section 3.1). The Guideline notes that, "the Ministry will normally recommend against proposals for sensitive land use adjacent to operating landfills" (Section 5.1). Sensitive land uses include permanent structures "where a person sleeps or [where] a person is present on a full time basis" (Section 5.1.1)… The guidelines add that, "in consideration of long-range planning, the Ministry may recommend the proponents delay or phase certain types of land use to coincide with the closure of sections of a landfill, or the operation itself" (Section 5.6).

Furthermore, the EUC CDP also outlines guidelines for development, including the following: "*Foster biodiversity and establish planting guidelines that promote ecological integrity."* Despite the TCR/EIS recommendations, the streetscapes will lack tress in front yards, particularly where the driveway is 70% of the front yard per the ZBA (discussed in further detail below). There are also no parks contributing to the neighbourhood fabric either, as the parkland requirements were previously met in the earlier phases of the subdivision (also discussed in further detail below).

Zoning By-law Amendment

With regards to the ZBA, the proposed R3Z zoning is cause for concern due to the reduced lot area of only 75sqm. In our opinion, this is insufficient amenity space, especially when paired with the front yard being 70% driveway and with the parkland requirements already satisfied in previous phases with none in this application. Would these lots be better located near the open space buffer to the south? Increased density does not need to come at the expense of green space, as all people need access to green/amenity space; furthermore, distant public park space won't help residents during pandemics.

Development Application Process

It is our opinion that this particular project does not warrant consideration, even at the Staff level, of receiving and processing an application for zoning bylaw amendment before the draft plan of subdivision is considered. It is premature to consider zoning particular sections of land before the required road pattern, site servicing, stormwater management, and other key factors that would deem such an application warranted are flushed out, both through the review of technical studies as well as the formal public process. The rationale that financial considerations were considered by the City to rationalize the acceptance of the application for zoning bylaw amendment is not relevant. In our view, that is the cost of doing business and as noted, the detailed studies undertaken would likely be required to support an

application for plan of subdivision, and have already been completed so the cost savings is only with respect to the application fee and not to study preparations.

Finally, the question of considering the suitability of the land for residential uses is premature if considered before the land use pattern, the full gambit of technical studies and related designs are flushed out, even at the draft approval stage. This is the standard procedure which has been deemed suitable throughout the City of Ottawa's land use planning process.

Summary

In conclusion, it is our professional planning opinion that the application for Zoning By-law Amendment for the Spring Valley Trails Subdivision Phase 5/6 at 3252 Navan Road is inappropriate based on the materials to date since many of the associated studies and recommendations were made based on incorrect assumptions about the Waste Connections facility and its associated operating lifespan. Furthermore, we are of the opinion that the proposed development requires additional planning justification on the appropriateness and compatibility of residential and landfill uses abutting one another. Finally, consideration to the suitability of zoning is premature until such time as a plan of subdivision application is submitted, reviewed and granted draft plan approval.

We trust that you will include these written comments with the processing of the aforementioned application and that they will be considered in any of the decisions made by the City of Ottawa moving forward. If you have any questions or require clarification on any matters, please do not hesitate to contact the undersigned.

Sincerely,

Colleen Ivits

Colleen Ivits, M.Pl.
Junior Planner
Holzman Consultants Inc.

Bill Holzman

William S. Holzman, MCIP, RPP
Principal
Holzman Consultants Inc.

Conservation Partners
Partenaires en conservation

Mississippi Valley Conservation Authority | Rideau Valley Conservation Authority | South Nation Conservation / Conservation de la Nation Sud

File: 20-GLO-ZBA-0024

April 17th, 2020

City of Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West, 4th Floor
Ottawa, ON K1P 1J1

Attention: Shoma Murshid

Subject: Claridge Homes (Carson) Inc.
Zoning By-law Amendment Application D02-02-20-0015
3252 Navan Road, Part Lot 4, Concession 4, formerly Gloucester, now City of Ottawa

Dear Ms. Murshid:

The Conservation Partners Planning and Development Review Team has completed a review of the above noted Zoning By-law Amendment application to rezone the property to permit 48 stacked townhouse dwelling units, 44 (back to back) townhouse dwellings, 218 townhouse dwellings, 11 single family dwellings and three pathway connections. An Open Space will be dedicated at the southern part of the subject site.

We have undertaken our review within the context of Sections 1.6.6 Sewage, Water and Stormwater, 2.1 Natural Heritage, 2.2 Water and 3.1 Natural Hazards of the Provincial Policy Statement, 2014 issued under Section 3 of the *Planning Act*, and from the perspective of the Conservation Authority regulations. The following preliminary comments are offered for your consideration.

Natural Hazards

Slope Stability

Conservation Authorities were delegated natural hazard responsibilities by the Minister of Natural Resources. This includes flood plain management, hazardous slopes, Great Lakes shorelines, unstable soils and erosion which are now encompassed by Section 3.1 “Natural Hazards” of the Provincial Policy Statement.

A slope has been identified on the property. As part of the submission, the applicant has provided the geotechnical report "*Geotechnical Investigation – Proposed Residential Development, 3252 Navan Road, Ottawa*" dated February 1st, 2020, prepared by Paterson Group Inc. Consulting Engineers. The Review of this report was completed by Terry K. Davidson, P.Eng, RVCA Director of Engineering and Regulations. The report has identified a limit of hazard lands for the slope. The applicant provided a stable slope allowance in the analysis but did not provide a toe erosion allowance or a 6 metre access erosion allowance. The RVCA is not prepared to accept this assumption. The consultant has not provided the limit of hazard lands for the slope at the south portion of the site (Section "B") which would include the 6 metre access erosion allowance. Therefore, the consultant must delineate the limit of hazard lands including the 6 metre access erosion allowance on a site plan.

We note that further in the report, there is reference to altering the slope to permit development including the construction of roadways. Therefore, it would appear that the approach preferred by the applicant is to alter the slope in order to make it safe for development rather than avoidance. The Provincial Policy Statement (Section 3.1.1 c)) states:

Development shall generally be directed to areas outside of:

c) *Hazardous sites.*

Hazardous Sites: means property or lands that could be unsafe for development and site alteration due to naturally occurring hazards. These may include unstable soils (sensitive marine clays [leda], organic soils) or unstable bedrock (karst topography).

Section 3.1.7 of the PPS provides criteria which must be met if avoidance for hazardous sites is not being considered:

Further to policy 3.1.6, and except as prohibited in policies 3.1.2 and 3.1.5, development and site alteration may be permitted in those portions of hazardous lands and hazardous sites where the effect and risk to public safety are minor, could be mitigated in accordance with provincial standards, and where all of the following are demonstrated and achieved:

a) *Development and site alteration is carried out in accordance with floodproofing standards, protection works standards, and access standards;*

b) *Vehicles and people have a way of safely entering and existing the area during times of flooding, erosion and other emergencies;*
c) *New hazards are not created and existing hazards are not aggravated; and*
d) *No adverse environmental impact will result.*

While Provincial Policy recommends avoiding *hazardous sites*, if the City is willing to consider alterations to the slope to facilitate development, then the City should request confirmation from the geotechnical consultant how the remediation plan specifically meets the requirements of Section 3.1.7 of the PPS. If the City's direction is to avoid the *hazardous site* (slope) then the additional information as noted by our technical review will be required. This will impact the area available for residential development and therefore impact the zoning boundaries proposed.

Natural Heritage

Watercourses

A watercourse has been identified on the property. As part of the application, the applicant has assumed that the watercourse will be eliminated (filled in) to facilitate the proposed subdivision. The applicant has provided an EIS "*Environmental Impact Statement and Tree Conservation Report – 3252 Navan Road*" dated January 31st, prepared by WSP. The report was reviewed by Jennifer Lamoureux, RVCA Aquatic and Fish Habitat Biologist.

As identified in the WSP report, there is an identified headwater drainage feature(s) within the study area. As noted in Section 5.2 Aquatic Environment, due to the time of year, a headwater drainage feature(s) assessment was not completed but it is anticipated to be completed in 2020. The headwater drainage feature(s) on the subject property supports an EUC fish habitat compensation site downstream by providing upstream flows and connectivity.

Headwater drainage features (HDFs) provide a multitude of ecological and hydrological functions such as recharge, discharge, infiltration and the provision of food, water, sediments, nutrients, organic matter and energy to downstream reaches. HDFs can provide aquatic and terrestrial habitat. The importance of maintaining HDFs on the landscape is accentuated by the by the fact that the largest portion of a stream or river's flow may be generated by the collective contributions of HDFs. HDFs are increasingly coming under pressure for alterations in form of relocation, removal, channelization, channel lowering, ditching, piping, flow diversion, tile drainage, terracing, etc. The functional attributes that are evaluated include hydrology (surface

and groundwater), riparian conditions, terrestrial and aquatic habitat. The Conservation Authority has an interest in the preservation of HDFs, recognizing their important functions with respect to watershed health and diversity. (understanding existing conditions/values prior to proposed modifications). The following policies apply in this regard:

1. Applications to alter HDFs shall be assessed in accordance with the document titled "*Evaluation, Classification and Management of Headwater Drainage Features Guideline."* Toronto and Region Conservation Authority and Credit Valley Conservation, TRCA Approval July 2013 (Finalized January 2014).

2. The applicant shall pre- consult with the Conservation Authority to ensure that the scope and timing of the evaluation is appropriate for the scale/type of the proposal, availability of information for the feature and the sensitivity of the feature.

3. The evaluation of an HDF shall include collecting information that may be available in a watershed or subwatershed plan, catchment reports, an environmental management plan, fisheries management plan etc.

In order for the Conservation Authority to issue future permits under the *Conservation Authorities Act* the guideline provides a consistent methodology to evaluate, classify and provide a management action for all HDF's. The results from the management classifications for HDF will inform what future permits are necessary and how best to manage them based on their function.

Detailed information pertaining to future in water work and alterations to the watercourse will be required for review by RVCA.

- channel piping/realignments
- storm water/discharge outlets to existing watercourses
- flow diversions
- Other alterations not yet identified

Therefore, until the findings of the Headwater Drainage Features Assessment (HDFA) are known and accepted, it cannot be assumed that the existing watercourse can be altered/eliminated to facilitate development. The requirements for development setbacks, etc. has the potential to alter the proposed zoning boundaries should the HDFA not support the alteration/filling in of the watercourse.

Conservation Authority Regulations

For the applicant's information, the watercourse identified on the property is subject to Ontario Regulation 174/06 "*Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation*" made pursuant to Section 28 of the *Conservation Authorities Act* (or as amended). This regulation affects the properties in the following manner:

- The prior written approval of the RVCA is required for any alteration, straightening, changing, diverting or interfering in any way with any watercourse.

Conclusion

In conclusion, the RVCA recommends this application be placed ON HOLD until such time that the constraints have been appropriately identified and the appropriate zoning boundaries and designations have been identified. Please keep us informed on the status of this application. For any questions regarding the information contained in this letter, please feel free to contact me.

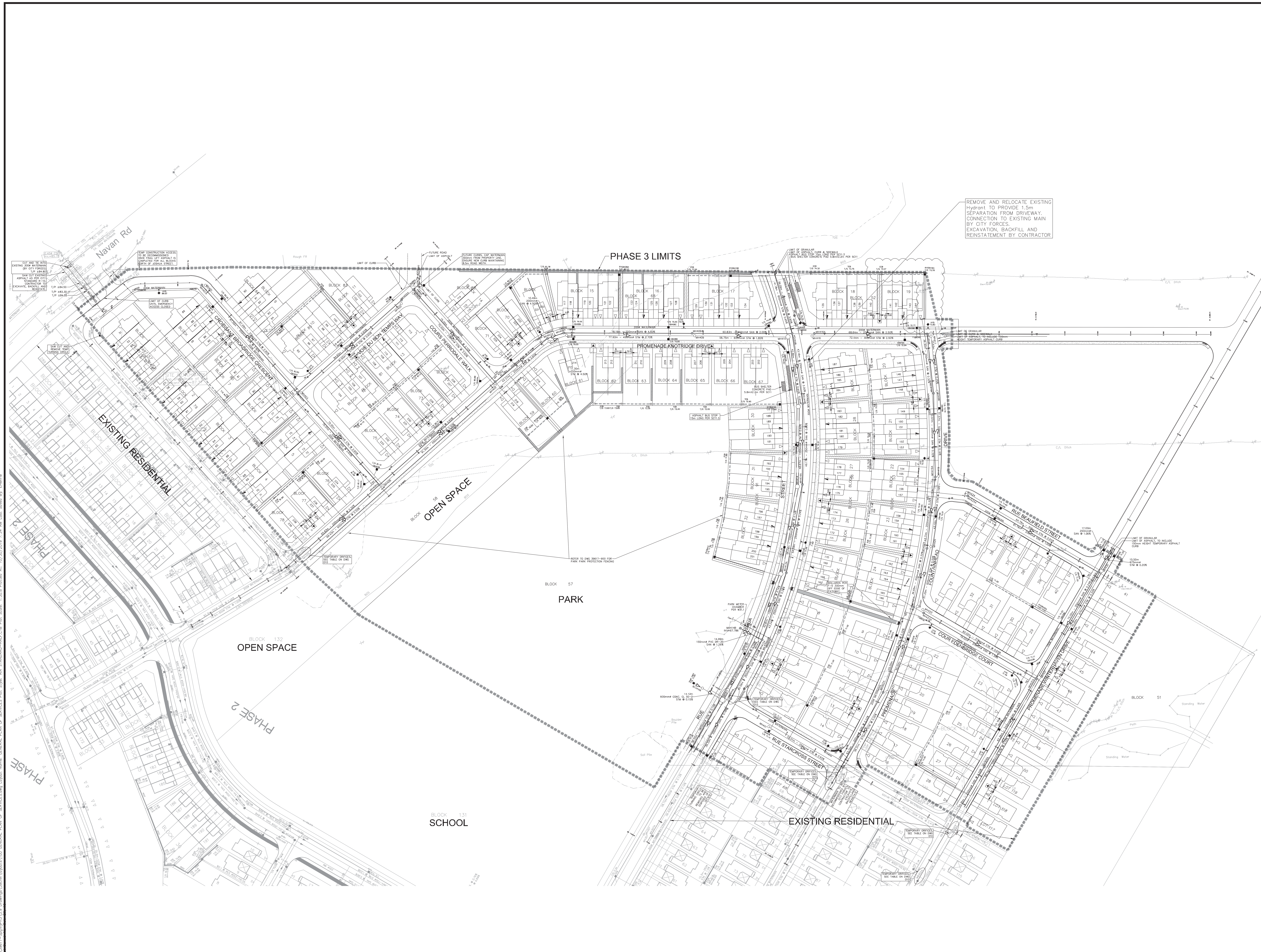
Respectfully,

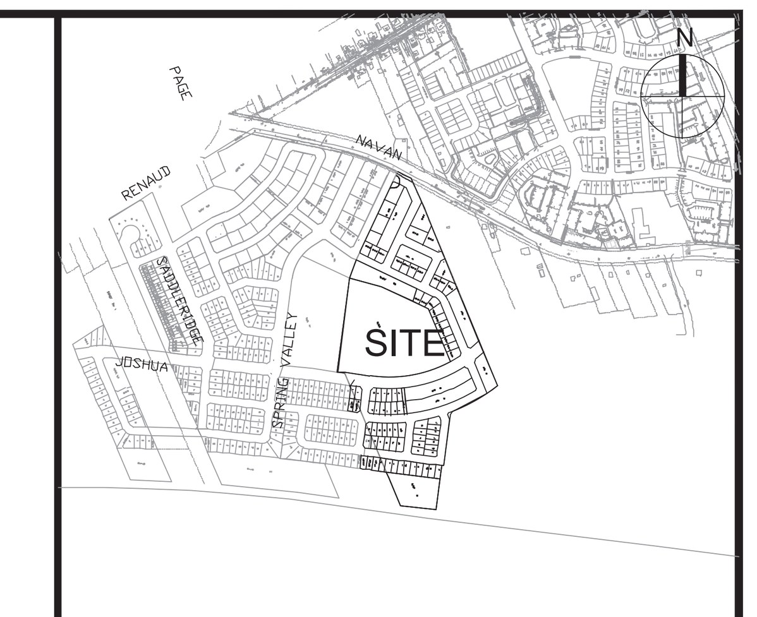
Jamie Batchelor, MCIP, RPP
Planner, Planning and Watershed Science
Rideau Valley Conservation Authority
613-692-3571 ext. 1191
Jamie.batchelor@rvca.ca

Cc: Teresa Thomas: Novatech Engineers, Planners and Landscape Architects
Vincent Denomme: Claridge Homes
Jennifer Lamoureux: RVCA
Terry Davidson: RVCA

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

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Project Title

SPRING VALLEY TRAILS PHASE 3

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

Drawing Title

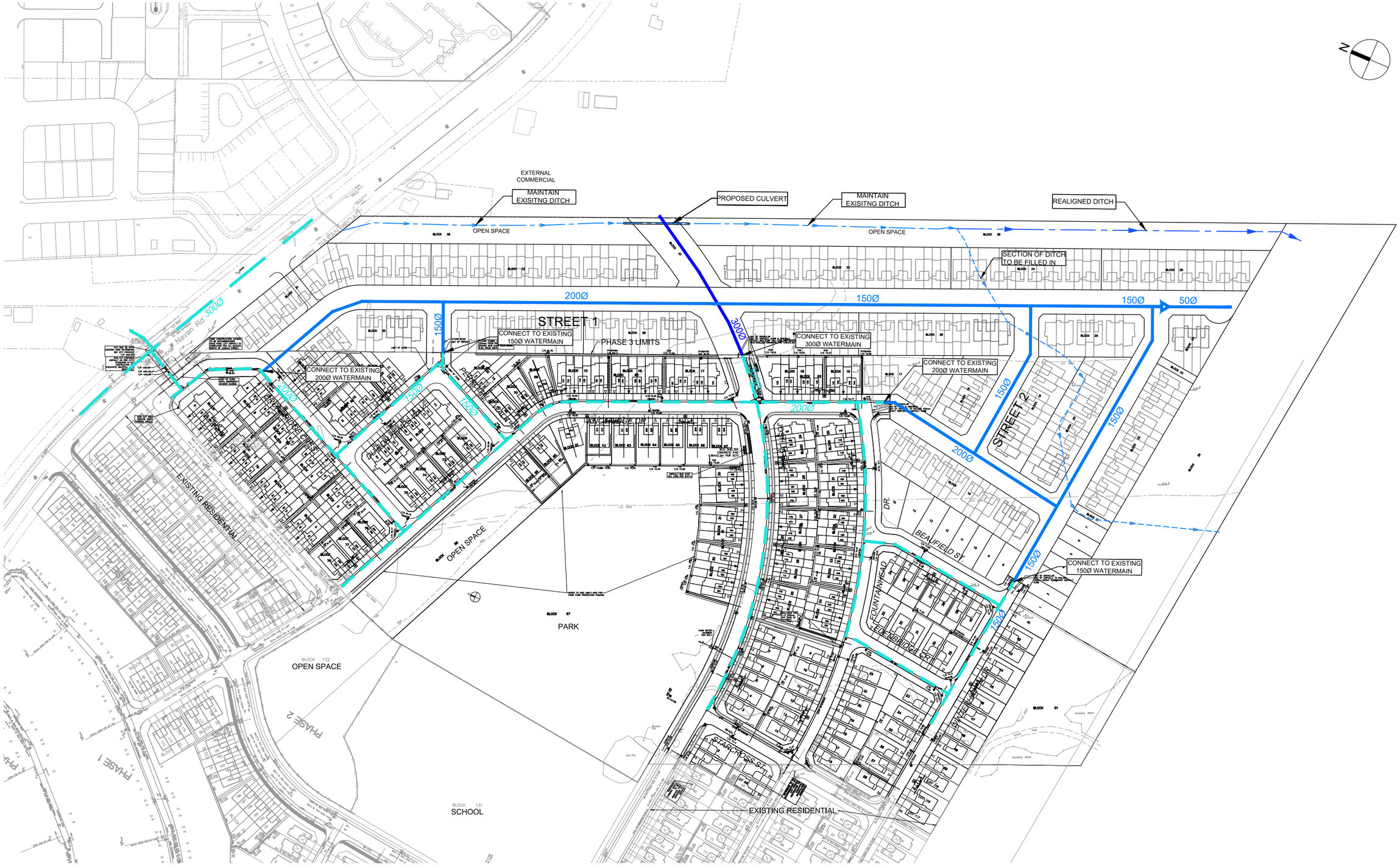
GENERAL PLAN OF SERVICES

Scale
1:1000

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

D07-16-03-0011PH3

17339



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 (12a)
- SANITARY TRUNK SEWER AND MANHOLE (12)
- SANITARY FORCEMAIN
- SANITARY CATCHMENT AREA
- ORIGINAL GROUND / OBVERT (71.50 / 67.33)
- AREA (ha) / POPULATION / MANHOLE No. (3.25 / 56 / 2)
- AREA (ha) / POPULATION / MANHOLE No. / INST (INSTITUTIONAL) ha / IND (INDUSTRIAL) ha / COM (COMMERCIAL) ha (3.25 / 56 / 2 / 3.2 INST)
- * 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
FOURTH LINE ROAD
PAGE ROAD
NAVAN ROAD
WALL ROAD
SAPHIR AVE.
GRAND PRE
ABANDONED C.P.R. RIGHT OF WAY
SANITARY TRUNK No.1
SANITARY TRUNK No.2
SANITARY TRUNK No.3
SANITARY TRUNK No.4
SCHOOL
PARK
INSTIT.
INSTITUTIONAL
COMMERCIAL
ESCARPMENT
FIRE HALL
WSI LANDFILL
"FOREST VALLEY PUMPING STATION" PVC
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

Dwn 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	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW			FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL													
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	FACTOR	FLOW (L/s)	IND	CUM	IND	CUM	IND	CUM	FLOW (L/s)	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
Original ECU Report		39	18						65.64	3457.0	3457.0	3.39	47.46	2.83	2.83	1.30	1.30	0.00	0.00	3.59	69.77	69.77	19.54			70.59	85.79	105.00	375	0.22	0.753	15.21	17.73%

Original MSS Design Parameters:

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

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 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	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW			FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL													
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	FACTOR	FLOW (L/s)	IND	CUM	IND	CUM	IND	CUM	FLOW (L/s)	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
Spring Valley Ph 5/6 Adequacy of Services Report																																	
Actual Values		39	18	65.64	521	88	799	48	0.00	4252.7	4252.7	3.31	45.61	2.83	2.83	1.31	1.31	0.00	0.00	1.34	69.78	69.78	23.03			69.98	85.79	105.00	375	0.22	0.753	15.81	18.43%
Actual Values		18	19	0.00					0.00	0.0	18491.7	2.69	201.26	0.00	26.58	0.00	2.74	0.00	11.40	32.38	0.00	452.59	126.73			360.36	452.94	110.00	600	0.50	1.552	92.58	20.44%
Actual Values		19	19a	0.00					0.00	0.0	18491.7	2.69	201.26	0.00	26.58	0.00	2.74	0.00	11.40	44.62	0.00	452.59	126.73			372.60	452.94	110.00	600	0.50	1.552	80.35	17.74%
Actual Values		19a	19b	0.40					0.00	0.0	18491.7	2.69	201.26	0.00	26.58	0.00	2.74	0.00	11.40	44.62	0.40	452.99	126.84			372.71	452.94	110.00	600	0.50	1.552	80.23	17.71%
Actual Values		19b	FVPS	0.00					0.00	0.0	18817.7	2.68	204.22	0.00	26.58	0.00	2.74	0.00	11.40	44.62	0.00	458.89	128.49			377.33	452.94	110.00	600	0.50	1.552	75.62	16.69%

2020 Design Parameters:

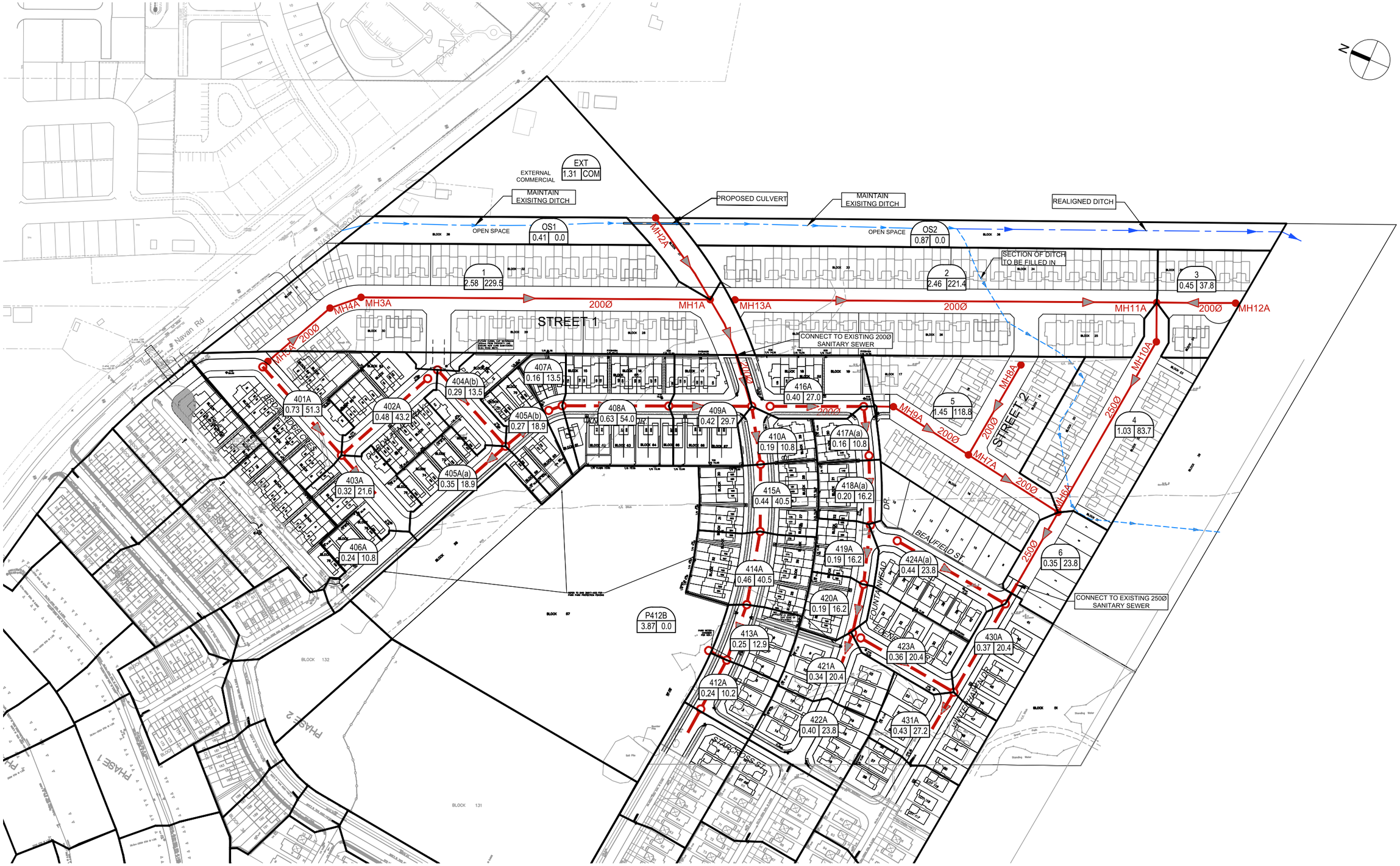
Residential			ICI Areas			
						Peak Factor
SF	3.4	p/p/u				
TH/SD	2.7	p/p/u	INST	28,000	L/Ha/day	1
APT	1.8	p/p/u	COM	28,000	L/Ha/day	1
Other	95	p/p/Ha	IND	28,000	L/Ha/day	MOE Chart

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



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

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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	UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW			CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	FACTOR	FLOW (L/s)	INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	FLOW (L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
Broadridge Cresent	4101A	MH401A	MH403A	0.73			19			51.3	51.3	4.00	0.67		0.00		0.00		0.00	0.00	0.73	0.73	0.24	0.00	0.91	58.27	87.50	200	2.90	1.80	57.36	98.45%
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	116.1	4.00	1.51		0.00		0.00		0.00	0.00	0.32	1.53	0.50	0.00	2.01	55.17	75.06	200	2.60	1.70	53.16	96.36%
Perrodale Street	404A(a), 404A(b)	MH404A	MH405A	0.29		1	4			13.5	13.5	4.00	0.18		0.00		0.00		0.00	0.00	0.29	0.29	0.10	0.00	0.27	60.24	75.06	200	3.10	1.86	59.97	99.55%
Knotridge Drive	405A(a)	MH405A	MH406A	0.35		7				18.9	32.4	4.00	0.42		0.00		0.00		0.00	0.00	0.35	0.64	0.21	0.00	0.63	27.59	94.30	200	0.65	0.85	26.96	97.71%
Knotridge Drive	406A	MH406A	Ex. MH325A	0.24		4				10.8	159.3	4.00	2.07		0.00		0.00		0.00	0.00	0.24	2.41	0.80	0.00	2.86	19.36	65.83	200	0.32	0.60	16.50	85.22%
Knotridge Drive - Ph2B		Ex. MH325A	Ex. MH324A							0.0	159.3	4.00	2.07		0.00		0.00		0.00	0.00	0.00	2.41	0.80	0.00	2.86	30.39	13.20	250	0.24	0.60	27.53	90.59%
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	299.7	4.00	3.89		0.00		0.00		0.00	0.00	0.31	4.01	1.32	0.00	5.21	30.39	82.80	250	0.24	0.60	25.18	82.86%
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**	**2A**	**1A**	**0.41**						**0.0**	**0.0**	**4.00**	**0.00**		**0.00**	**1.31**	**1.31**		**0.00**	**0.42**	**1.72**	**1.72**	**0.57**	**0.00**	**0.99**	**76.51**	**72.00**	**200**	**5.00**	**2.36**	**75.52**	**98.70%**
Street 1	**1**	**5A**	**1A**	**2.58**			**85**			**229.5**	**229.5**	**4.00**	**2.98**		**0.00**		**0.00**		**0.00**	**0.00**	**2.58**	**2.58**	**0.85**	**0.00**	**3.83**	**34.22**	**330.00**	**200**	**1.00**	**1.06**	**30.39**	**88.82%**
Joshua Street		**1A**	**MH410A**							**0.0**	**229.5**	**4.00**	**2.98**		**0.00**		**1.31**		**0.00**	**0.42**	**0.00**	**4.30**	**1.42**	**0.00**	**4.82**	**76.51**	**100.00**	**200**	**5.00**	**2.36**	**71.69**	**93.70%**
Joshua Street	410A	MH410A	MH415A	0.19			4			10.8	240.3	4.00	3.12		0.00		1.31		0.00	0.42	0.19	4.49	1.48	0.00	5.02	107.45	43.16	250	3.00	2.12	102.43	95.33%
Joshua Street	415A	MH415A	MH414A	0.44			15			40.5	280.8	4.00	3.64		0.00		1.31		0.00	0.42	0.44	4.93	1.63	0.00	5.69	48.06	49.17	250	0.60	0.95	42.36	88.16%
Joshua Street	414A	MH414A	MH413A	0.46			15			40.5	321.3	4.00	4.17		0.00		1.31		0.00	0.42	0.46	5.39	1.78	0.00	6.37	30.39	54.59	250	0.24	0.60	24.02	79.05%
Joshua Street	413A	MH413A	MH412A	0.25	3		1			12.9	334.2	4.00	4.33		0.00		1.31		0.00	0.42	0.25	5.64	1.86	0.00	6.62	30.39	43.24	250	0.24	0.60	23.77	78.23%
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	344.4	4.00	4.46		0.00		1.31		0.00	0.42	0.24	5.88	1.94	5.00	11.83	30.39	42.22	250	0.24	0.60	18.56	61.08%
Joshua Street		MH411A	Ex. CAP							0.0	344.4	4.00	4.46		0.00		1.31		0.00	0.42	0.00	10.19	3.36	5.00	13.25	43.97	37.70	300	0.19	0.60	30.72	69.86%
Joshua Street - Ph2B		Ex. CAP	Ex. MH307A	0.51	7					23.8	368.2	4.00	4.77		0.00		1.31		0.00	0.42	0.51	10.70	3.53	5.00	13.73	43.97	56.41	300	0.19	0.60	30.24	68.78%
Joshua Street - Ph2B		Ex. MH307A	Ex. MH195A	0.57	9					30.6	398.8	4.00	5.17		0.00		1.31		0.00	0.42	0.57	11.27	3.72	5.00	14.31	43.97	111.80	300	0.19	0.60	29.66	67.45%
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	417A(a), 417A(b)	MH417A	MH418A	0.24			8			21.6	48.6	4.00	0.63		0.00		0.00		0.00	0.00	0.24	0.64	0.21	0.00	0.84	19.36	36.30	200	0.32	0.60	18.51	95.65%
Fountainhead Drive	418A(a), 418A(b)	MH418A	MH419A	0.30			10			27.0	75.6	4.00	0.98		0.00		0.00		0.00	0.00	0.30	0.94	0.31	0.00	1.29	19.36	50.97	200	0.32	0.60	18.07	93.33%
Fountainhead Drive	419A	MH419A	MH420A	0.19			6			16.2	91.8	4.00	1.19		0.00		0.00		0.00	0.00	0.19	1.13	0.37	0.00	1.56	19.36	43.71	200	0.32	0.60	17.79	91.93%
Fountainhead Drive	420A	MH420A	MH421A	0.19			6			16.2	108.0	4.00	1.40		0.00		0.00		0.00	0.00	0.19	1.32	0.44	0.00	1.84	19.36	36.65	200	0.32	0.60	17.52	90.52%
Fountainhead Drive	421A	MH421A	MH422A	0.34	6					20.4	128.4	4.00	1.66		0.00		0.00		0.00	0.00	0.34	1.66	0.55	0.00	2.21	19.36	55.00	200	0.32	0.60	17.14	88.57%
Fountainhead Drive	422A	MH422A	Ex. MH306A	0.40	7					23.8	152.2	4.00	1.97		0.00		0.00		0.00	0.00	0.40	2.06	0.68	0.00	2.65	19.36	63.10	200	0.32	0.60	16.70	86.29%
Fountainhead Drive - Ph2		Ex. MH306A	Ex. MH330A	0.48	9					30.6	182.8	4.00	2.37		0.00		0.00		0.00	0.00	0.48	2.54	0.84	0.00	3.21	27.59	53.70	200	0.65	0.85	24.38	88.37%
Fountainhead Drive - Ph2		Ex. MH330A	Ex. MH329A	0.49	11					37.4	220.2	4.00	2.85		0.00		0.00		0.00	0.00	0.49	3.03	1.00	0.00	3.85	25.14	66.20	200	0.54	0.78	21.29	84.67%
Street 1	**2**	**13A**	**11A**	**3.33**			**82**			**221.4**	**221.4**	**4.00**	**2.87**		**0.00**		**0.00**		**0.00**	**0.00**	**3.33**	**3.33**	**1.10**	**0.00**	**3.97**	**34.22**	**309.00**	**200**	**1.00**	**1.06**	**30.25**	**88.40%**
Street 1	**3**	**12A**	**11A**	**0.45**			**14**			**37.8**	**37.8**	**4.00**	**0.49**		**0.00**		**0.00**		**0.00**	**0.00**	**0.45**	**0.45**	**0.15**	**0.00**	**0.64**	**27.59**	**58.30**	**200**	**0.65**	**0.85**	**26.95**	**97.69%**
Winterhaven		**11A**	**6A**	**1.03**			**31**			**83.7**	**342.9**	**4.00**	**4.45**		**0.00**		**0.00**		**0.00**	**0.00**	**1.03**	**4.81**	**1.59**	**0.00**	**6.03**	**31.02**	**170.00**	**250**	**0.25**	**0.61**	**24.99**	**80.55%**
Knotridge	**5**	**7A**	**6A**	**1.45**			**44**			**118.8**	**118.8**	**4.00**	**1.54**		**0.00**		**0.00**		**0.00**	**0.00**	**1.45**	**1.45**	**0.48**	**0.00**	**2.02**	**27.59**	**309.00**	**200**	**0.65**	**0.85**	**25.57**	**92.68%**
Winterhaven Drive	**6**	**6A**	**MH430A**	**0.35**	**7**					**23.8**	**485.5**	**3.98**	**6.26**		**0.00**		**0.00**		**0.00**	**0.00**	**0.35**	**6.61**	**2.18**	**0.00**	**8.44**	**30.39**	**74.96**	**250**	**0.24**	**0.60**	**21.95**	**72.22%**
Beaufield Drive	424A(a), 424A(b)	MH424A	MH430A	0.71	15					51.0	51.0	4.00	0.66		0.00		0.00		0.00	0.00	0.71	0.71	0.23	0.00	0.90	34.22	91.79	200	1.00	1.06	33.32	97.38%
Winterhaven Drive	430A	MH430A	MH431A	0.37	6					20.4	556.9	3.95	7.13		0.00		0.00		0.00	0.00	0.37	7.69	2.54	0.00	9.67	30.39	75.00	250	0.24	0.60	20.73	68.20%
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	604.5	3.93	7.70		0.00		0.00		0.00	0.00	0.43	8.48	2.80	0.00	10.50	30.39	66.71	250	0.24	0.60	19.89	65.46%
Winterhaven Drive		MH304A	Ex. CAP							0.0	604.5	3.93	7.70		0.00		0.00		0.00	0.00	0.00	8.48	2.80	0.00	10.50	30.39	21.30	250	0.24	0.60	19.89	65.46%
Winterhaven Drive - Ph2		Ex. CAP	Ex. MH302A	0.61	11					37.4	641.9	3.92	8.15		0.00		0.00		0.00	0.00	0.61	9.09	3.00	0.00	11.15	30.39	59.00	250	0.24	0.60	19.25	63.33%
Winterhaven Drive - Ph2		Ex. MH302A	Ex. MH301A	0.64	13					44.2	686.1	3.90	8.67		0.00		0.00		0.00	0.00	0.64	9.73	3.21	0.00	11.88	33.41	86.70	250	0.29	0.66	21.53	64.44%

Design Parameters:

Residential			ICI Areas			
SF	3.4	p/p/u				Peak Factor
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

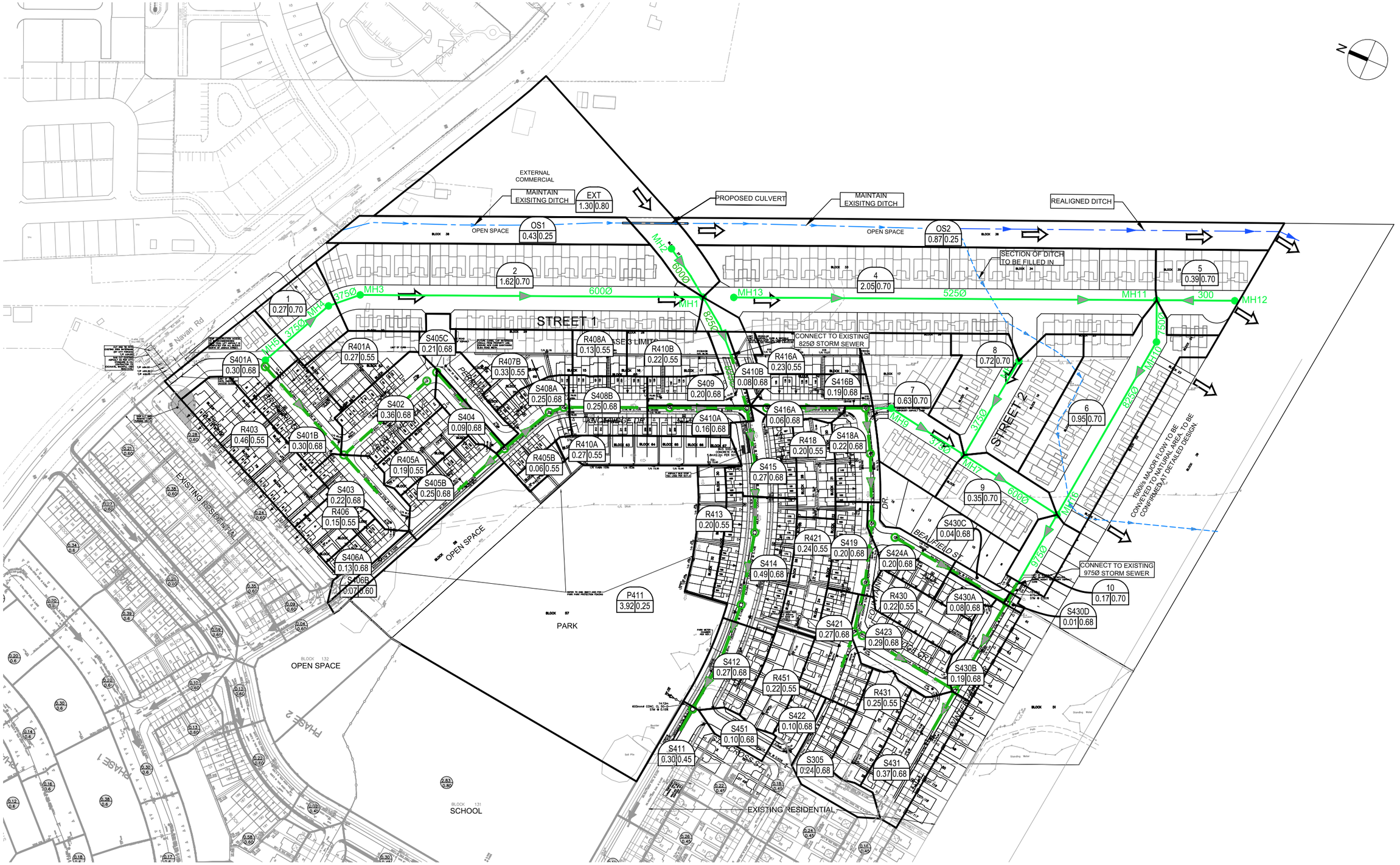
Designed: D.Y.
Checked: D.Y.
Dwg. Reference: 123888 FIG 3.1

No.	Revision	Date
1.	ADEQUACY OF PUBLIC SERCIES REPORT	2020-02-07
2	ADEQUACY OF PUBLIC SERCIES REPORT	2020-10-27

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
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
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ibigroup.com

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	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	(%)
Broadridge Crescent	S401A, S401B, R401B	MH401	MH403					0.18		0.61				1.43	1.43	10.00	0.53	10.53	76.81	104.19	122.14	178.56	109.71					109.71	311.49	87.49	375			2.90	2.732	201.78	64.78%
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	3.30	11.05	0.43	11.48	72.99	98.95	115.96	169.48	241.14					241.14	479.60	75.00	450			2.60	2.921	238.46	49.72%
Perrodale Street	S404	MH404	MH405							0.09				0.17	0.17	10.00	0.55	10.55	76.81	104.19	122.14	178.56	13.07					13.07	116.06	75.00	250			3.50	2.291	103.00	88.74%
Knotridge Drive	S405B, R405A	MH405	MH406					0.19		0.25				0.76	0.93	10.55	1.53	12.08	74.77	101.40	118.85	173.72	69.78					69.78	162.91	91.30	450			0.30	0.992	93.13	57.17%
Knotridge Drive	S406, R406	MH406	Ex. MH325					0.15		0.10				0.42	4.66	12.08	0.68	12.76	69.65	94.36	110.56	161.55	324.24					324.24	475.05	66.43	600			0.55	1.628	150.81	31.75%
Knotridge Drive - Ph2B		Ex. MH325	Ex. MH324											0.00	4.66	12.76	0.18	12.94	67.62	91.57	107.28	156.74	314.78					314.78	452.94	16.50	600			0.50	1.552	138.16	30.50%
Knotridge Drive - Ph2B		Ex. MH324	Ex. MH319						1.00					1.67	6.32	12.94	0.59	13.53	67.11	90.88	106.46	155.53	424.36					424.36	640.56	78.00	600			1.00	2.195	216.20	33.75%
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**	**2**	**1**										**1.30**	**2.89**	**2.89**	**10.00**	**1.13**	**11.13**	**76.81**	**104.19**	**122.14**	**178.56**		**301.24**				**301.24**	**516.44**	**120.00**	**600**			**0.65**	**1.769**	**215.19**	**41.67%**
Street 1	**1**	**5**	**4**								**0.27**			**0.53**	**0.53**	**10.00**	**0.81**	**10.81**	**76.81**	**104.19**	**122.14**	**178.56**	**40.35**					**40.35**	**147.47**	**63.10**	**375**			**0.65**	**1.293**	**107.11**	**72.63%**
Street 1		**4**	**3**											**0.00**	**0.53**	**10.81**	**0.29**	**11.11**	**73.82**	**100.09**	**117.30**	**171.45**	**38.79**					**38.79**	**147.47**	**22.80**	**375**			**0.65**	**1.293**	**108.68**	**73.70%**
Street 1	**2**	**3**	**1**								**1.62**			**3.15**	**3.68**	**11.11**	**1.90**	**13.01**	**72.80**	**98.69**	**115.66**	**169.04**	**267.76**					**267.76**	**640.56**	**250.70**	**600**			**1.00**	**2.195**	**372.80**	**58.20%**
Joshua Street		**1**	**Bulk**											**0.00**	**6.57**	**13.01**	**0.36**	**13.37**	**66.90**	**90.59**	**106.12**	**155.04**		**595.09**				595.09	1,207.32	47.80	825			0.65	2.188	612.23	50.71%
Joshua Street	S410B R410B	BULK410E	MH410					0.22		0.08				0.49	7.06	13.37	0.31	13.69	65.89	89.20	104.49	152.64		629.49				629.49	1,207.32	41.18	825			0.65	2.188	577.83	47.86%
Joshua Street	S410C, R410	MH410	MH415					0.27		0.16				0.72	10.04	13.69	0.29	13.98	65.05	88.05	103.14	150.65		883.76				883.76	2,206.67	42.86	1050			0.60	2.469	1322.91	59.95%
Joshua Street	S415	MH415	MH414							0.27				0.51	10.55	13.98	0.30	14.28	64.29	87.01	101.92	148.86		917.77				917.77	3,150.52	48.67	1200			0.60	2.699	2232.75	70.87%
Joshua Street	S414	MH414	MH413							0.49				0.93	11.47	14.28	0.64	14.92	63.52	85.96	100.68	147.05		986.33				986.33	2,083.42	54.04	1350			0.14	1.410	1097.09	52.66%
Joshua Street	R413	MH413	MH412					0.20						0.31	11.78	14.92	0.51	15.42	61.96	83.83	98.17	143.36		987.44				987.44	2,083.42	42.81	1350			0.14	1.410	1095.98	52.60%
Joshua Street	S412	MH412	MH411							0.27				0.51	12.29	15.42	0.49	15.92	60.79	82.21	96.27	140.58		1,010.43				1,010.43	2,083.42	41.87	1350			0.14	1.410	1073.00	51.50%
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	15.39	15.92	0.37	16.28	59.68	80.70	94.50	137.97		1,242.02				1,242.02	4,323.69	36.20	1800			0.13	1.646	3081.68	71.27%
Joshua Street - Ph2B		Ex. CAP	Ex. MH307											0.00	15.39	16.28	0.59	16.88	58.89	79.62	93.23	136.11		1,225.40				1,225.40	4,323.69	58.75	1800			0.13	1.646	3098.29	71.66%
Joshua Street - Ph2B		Ex. MH307	Ex. MH195			0.34								0.43	15.82	16.88	1.04	17.92	57.66	77.94	91.25	133.20		1,232.62				1,232.62	4,486.91	107.00	1800			0.14	1.708	3254.29	72.53%
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		MH417	MH418											0.00	0.82	10.00	0.70	10.70	76.81	104.19	122.14	178.56	63.31					63.31	91.46	33.63	375			0.25	0.802	28.15	30.78%
Fountainhead Drive	S418B, S418, R418	MH418	MH419					0.21		0.31				0.91	1.73	10.70	0.97	11.67	74.22	100.64	117.96	172.41	128.51					128.51	198.12	51.57	525			0.20	0.887	69.61	35.14%
Fountainhead Drive	S419	MH419	MH420							0.20				0.38	2.11	11.67	0.74	12.41	70.94	96.14	112.65	164.62	149.65					149.65	282.86	43.10	600			0.20	0.969	133.21	47.09%
Fountainhead Drive		MH420	MH421											0.00	2.11	12.41	0.64	13.05	68.65	92.98	108.94	159.17	144.81					144.81	282.86	37.33	600			0.20	0.969	138.06	48.81%
Fountainhead Drive	S421, R421	MH421	MH422					0.29		0.27				0.95	3.06	13.05	0.86	13.91	66.79	90.43	105.94	154.76	204.58					204.58	392.18	55.00	675			0.20	1.062	187.59	47.83%
Fountainhead Drive	S422	MH422	MH306							0.10				0.19	3.25	13.91	0.88	14.80	64.45	87.24	102.18	149.24	209.62					209.62	392.18	56.21	675			0.20	1.062	182.55	46.55%
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	14.80	1.17	15.97	62.25	84.22	98.63	144.04	260.61					260.61	367.27	56.70	750			0.10	0.805	106.67	29.04%
Fountainhead Drive - Ph2		Ex. MH330	Ex. MH329			0.45								0.56	4.75	15.97	1.04	17.01	59.57	80.55	94.31	137.70	282.91					282.91	532.23	72.90	750			0.21	1.167	249.32	46.84%
Street 1	**5**	**12**	**11**								**0.39**			**0.76**	**0.76**	**10.00**	**0.67**	**10.67**	**76.81**	**104.19**	**122.14**	**178.56**	**58.29**					**58.29**	**100.88**	**55.50**	**300**			**1.00**	**1.383**	**42.59**	**42.22%**
Street 1	**4**	**13**	**11**								**2.05**			**3.99**	**3.99**	**10.00**	**3.20**	**13.20**	**76.81**	**104.19**	**122.14**	**178.56**	**306.40**					**306.40**	**361.72**	**310.50**	**525**			**0.65**	**1.619**	**55.32**	**15.29%**
Winterhaven Drive		**11**	**10**											**0.00**	**4.75**	**13.20**	**0.49**	**13.69**	**66.38**	**89.87**	**105.28**	**153.80**	**315.18**					**315.18**	**478.86**	**31.00**	**750**			**0.17**	**1.050**	**163.68**	**34.18%**
Winterhaven Drive	**6**	**10**	**16**								**0.95**			**1.85**	**6.60**	**13.69**	**2.18**	**15.87**	**65.05**	**88.05**	**103.13**	**150.65**	**429.10**					**429.10**	**617.44**	**146.50**	**825**			**0.17**	**1.119**	**188.33**	**30.50%**
Knotridge St	**7**	**9**	**7**								**0.63**			**1.23**	**1.23**	**10.00**	**0.82**	**10.82**	**76.81**	**104.19**	**122.14**	**178.56**	**94.16**					**94.16**	**147.47**	**63.50**	**375**			**0.65**	**1.293**	**53.31**	**36.15%**
Street 2	**8**	**8**	**7**								**0.72**			**1.40**	**1.40**	**10.00**	**1.03**	**11.03**	**76.81**	**104.19**	**122.14**	**178.56**	**107.61**					**107.61**	**147.47**	**80.00**	**375**			**0.65**	**1.293**	**39.85**	**27.03%**
Knotridge St	**9**	**7**	**16**								**0.35**			**0.68**	**3.31**	**11.03**	**0.75**	**11.78**	**73.06**	**99.05**	**116.08**	**169.65**	**241.70**					**241.70**	**516.44**	**79.50**	**600**			**0.65**	**1.769**	**274.73**	**53.20%**
Winterhaven Drive	**10**	**16**	**EX**								**0.17**			**0.33**	**10.24**	**15.87**	**1.01**	**16.89**	**59.79**	**80.84**	**94.66**	**138.21**	**611.96**					**611.96**	**905.48**	**71.50**	**975**			**0.15**	**1.175**	**293.53**	**32.42%**
Beaufield Drive	S424A, S430A,C,D	MH424	MH430							0.33				0.62	0.62	10.00	1.42	11.42	76.81	104.19	122.14	178.56	47.91					47.91	81.33	94.79	300			0.65	1.115	33.42	41.09%
Winterhaven Drive	S430B, R430	MH430	MH431					0.22		0.19				0.70	11.56	16.89	0.92	17.81	57.65	77.92	91.23	133.17	666.15					666.15	1,045.56	75.00	975			0.20	1.357	379.42	36.29%
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, R431	MH431	Ex. CAP					0.25		0.37				1.08	13.19	17.81	1.50	19.31	55.85	75.46	88.34	128.93	736.39					736.39	900.87	90.79	1050			0.10	1.008	164.48	18.26%
Winterhaven Drive - Ph2		Ex. CAP	Ex. MH303											0.00	13.19	19.31	0.29	19.60	53.17	71.81	84.04	122.63	701.08					701.08	900.87	17.50	1050			0.10	1.008	199.79	22.18%
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	14.14	19.60	0.96	20.56	52.69	71.15	83.26	121.49	744.97					744.97	900.87	58.10	1050			0.10	1.008	155.90	17.31%
Winterhaven Drive - Ph2		Ex. MH302	Ex. MH301			0.48								0.60	14.74	20.56	0.91	21.47	51.15	69.05	80.80	117.88	753.95					753.95	1,408.95	66.00	1200			0.12	1.207	655.01	46.49%

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

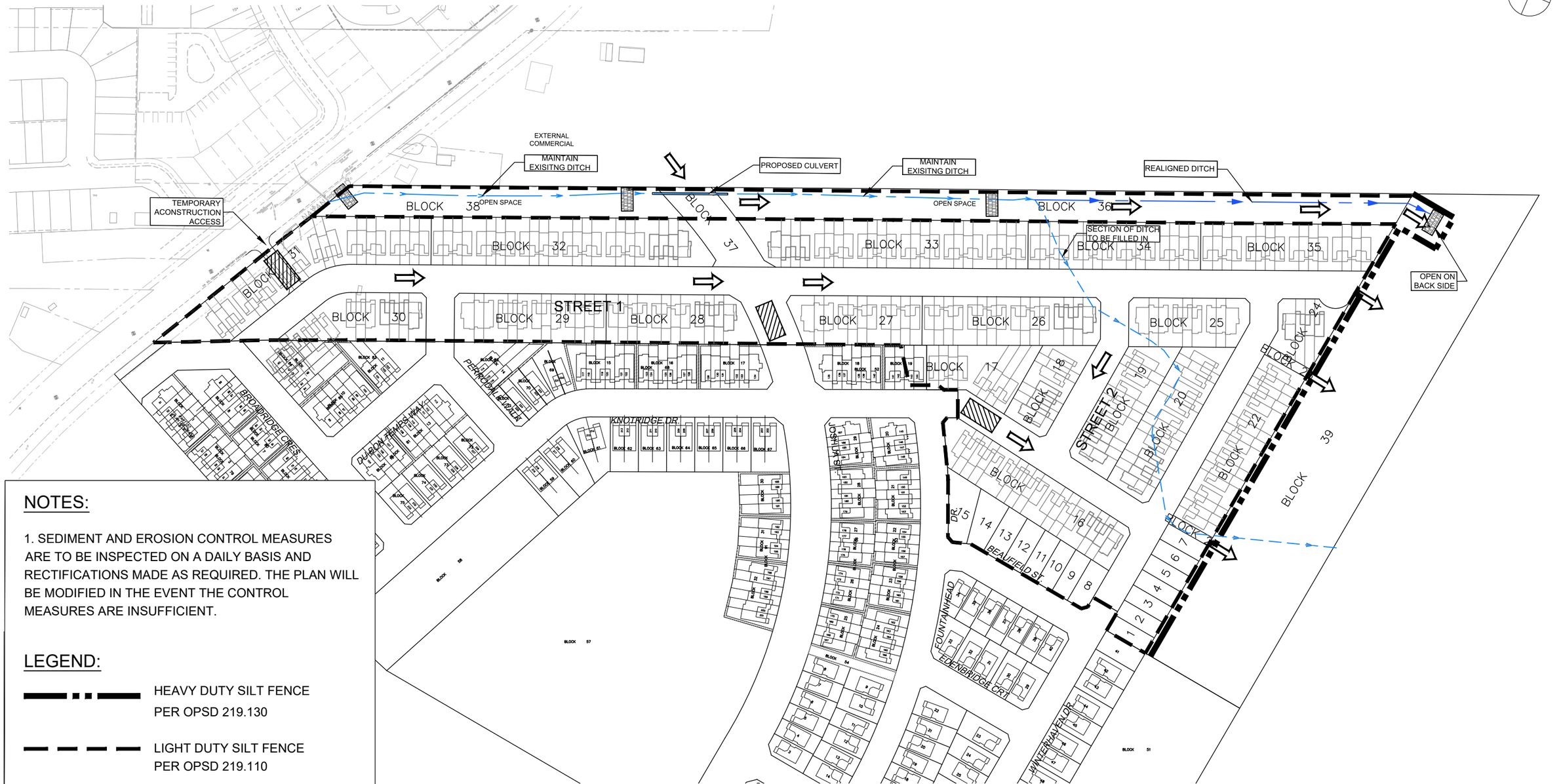
Designed: D.Y.
Checked: D.Y.
Dwg. Reference: 39617-500

No.	Revision	Date
1.	ADEQUACY OF PUBLIC SERVICES REPORT	2020-02-07
2.	ADEQUACY OF PUBLIC SERVICES REPORT	2020-11-27
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

IBI

Scale
N.T.S.

Project Title
SPRING VALLEY TRAILS
PHASE 5 & 6

Drawing Title
EROSION AND SEDIMENT
CONTROL PLAN

Sheet No.
Figure 5.1

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

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Geotechnical Investigation

Proposed Residential Development
3252 Navan Road - Ottawa

Prepared For

Claridge Homes (Gladstone)

October 9, 2020

Report: PG5224-1 Revision 2

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. A supplemental field investigation was carried out on September 10 and 11, 2020. At that time, thirteen boreholes were completed to a maximum depth of 11.3 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.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

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.

A total of 5 representative soil samples were submitted for Atterberg limits testing as part of the current geotechnical investigation.

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 $K_o \cdot \tilde{a} \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil, 0.5
$\tilde{a}$ = 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 $0.375 \cdot a_c \cdot \tilde{a} \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
$\tilde{a}$ = 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 $P_o = 0.5\ K_o\ \tilde{a}\ H^2$, 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.

Six slope sections were studied for the subject slopes, see Drawing PG5224-1 - Test Hole Location Plan in Appendix 2 for the section locations. It should be noted that details of the slope height and slope angle at the cross-section locations are presented in Figures 2A through 7B in Appendix 2. The slope details were based on available historic topographic data and topographic information from a recent site visit by Paterson.

Various stockpiles of material were noted based on our site visits and review of aerial photographs. Figure 2A and 3A show the slope section with the presence of the stockpiled material under static conditions. It is expected that the stockpiles will be relocated as part of the proposed development. Therefore, the subject slope was then analyzed as presented in Figures 2B, 2C, 3B and 3C without the presence of stockpiled material.

Figures 4A to 7B present the results of our slope stability analysis for the existing slope located adjacent to the east property boundary. A 2 to 6 m wide, ditch watercourse runs near or at the toe of the existing slope. The subject section of the watercourse was noted to be approximately 600 mm deep up to the normal high watermark. Photographs from our recent site visit are presented in Appendix 2. Based on the preliminary grading plan, an open space block will be created for the ditch watercourse and proposed slope between the watercourse and finished grading at the rear lot line of the adjacent buildings. The preliminary grading details for the proposed development indicate that sufficient space is available to provide a 3H:1V slope from the rear property line to the adjacent watercourse.

Existing Slope within Proposed Development

The stable slope limit is defined by the extent of the lowest slip circle analyzed behind the top of slope where the minimum factor of safety calculated is less than 1.5. The static analysis results for slope sections (Sections A and B) along the slope within the proposed development are presented in Figures 2B and 3B, respectively. The factor of safety for the slope was greater than 1.5 for the slope sections analysed.

The results of the analyses with seismic loading for Sections A and B 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, Section A is considered stable under seismic loading. However, a factor of safety less than 1.1 was noted for Section B, therefore, a slope stability setback would be required, if the existing slope were not re-graded as part of the proposed development. A stable slope setback of 8.7 m at Section B will be required if the existing slope is not modified. However, the existing slope will be re-graded as part of the proposed development. It is recommended that the proposed grading provide a 3H:1V profile or flatter for any subject slopes required as part of the proposed development.

Slope adjacent to Ditch Watercourse

The static analysis results for slope sections along the ditch watercourse are presented in Sections C to F (Figures 4A and 7A). The factor of safety for the existing slope was greater than 1.5 for the slope sections analysed, with the exception of Sections D and F. A stable slope allowance setback from top of existing slope was presented in Figures 5A and 7A for Sections D and F, respectively. However, as previously noted, it is expected that the existing slope will be re-graded to provide a stable slope shaped to a 3H:1V profile or flatter as part of the proposed development. Therefore, a stable slope allowance will not be required for the future slope to be re-shaped along the watercourse.

The results of the analyses when considering seismic loading for the slope along the watercourse are shown in Figures 4B, 5B, 6B and 7B. The results indicate that the factor of safety for the section A is greater than 1.1 with the exception of Sections D and F. A stable slope allowance setback from top of existing slope was presented in Figures 5B and 7B for Sections D and F, respectively. However, as previously noted, it is expected that the existing slope will be re-graded to provide a stable slope shaped to a 3H:1V profile or flatter as part of the proposed development. Therefore, a stable slope allowance will not be required for the future slope to be re-shaped along the watercourse.

Limit of Hazard Lands

Based on available information for the proposed development, it is expected that the existing slope along the ditch watercourse will be reshaped to provide a stable slope within the future, open space block. Therefore, a stable slope allowance will not be required for the subject slope. It is recommended to reshape the area to a maximum 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 blanket.

A toe erosion allowance is not required for the subject slope due to the absence of active erosion along the slope toe. It is expected, that a grassed face slope will be sufficient to provide resistance to any surficial erosion that could occur. Also, based on the absence of active erosion, a 6 m erosion access allowance is not required for the subject slope. **Therefore, a limit of hazard lands setback line can be applied along the top of the ditch watercourse bank since an allowance setback is not required for the future slope to be constructed adjacent to the watercourse.**

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.

6.6 Landscaping Considerations

Tree Planting Restrictions

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for the recovered silty clay samples at selected locations throughout the subject site. The soil samples were recovered from elevations 2.1 m below the current ground surface elevation. The results of our testing are presented in Appendix 1.

Based on the results of the representative soil samples, the subject site is considered as a **low/medium** sensitivity area for tree planting according to the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines)

Since the modified plasticity limit (PI) generally does not exceed 40%, large trees (mature height over 14 m) can be planted at the subject site provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space).

Based on our testing results, tree planting setback limits should be 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the following conditions are met:

- ❑ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

- ❑ A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- ❑ The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

- ❑ The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- ❑ Grading surround the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

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.

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

ATTERBERG LIMITS TESTING RESULT

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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

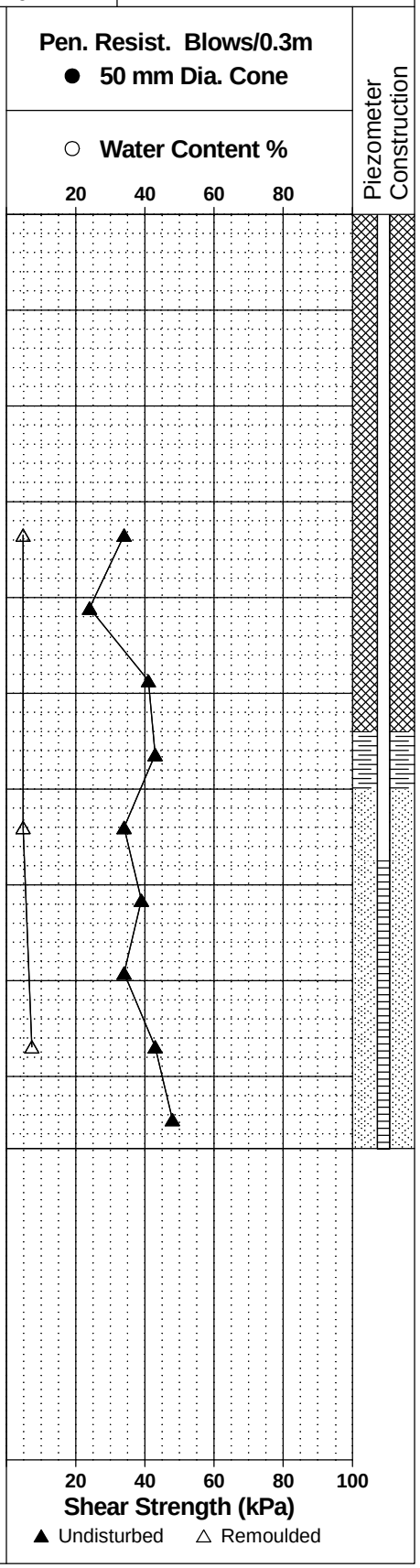
FILE NO. PG5224

REMARKS

HOLE NO. BH 1-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.59
FILL: Brown silty sand, trace gravel and cobbles		AU	1				
0.76							
FILL: Grey-brown silty clay, trace sand and gravel		SS	2	75	23	1	84.59
0.97							
FILL: Brown silty sand, trace gravel		SS	3	100	21	2	83.59
2.39							
		SS	4	100	2	3	82.59
		SS	5	100	P		
		SS	6	100	P	4	81.59
		SS	7	50		5	80.59
Firm, grey **SILTY CLAY**						6	79.59
		SS	8	50	P		
						7	78.59
		SS	9	79	P	8	77.59
						9	76.59
9.75							
End of Borehole							
(Piezometer damaged - Sept. 18, 2020)							



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Geotechnical Investigation
3252 Navan Road
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DATUM Geodetic

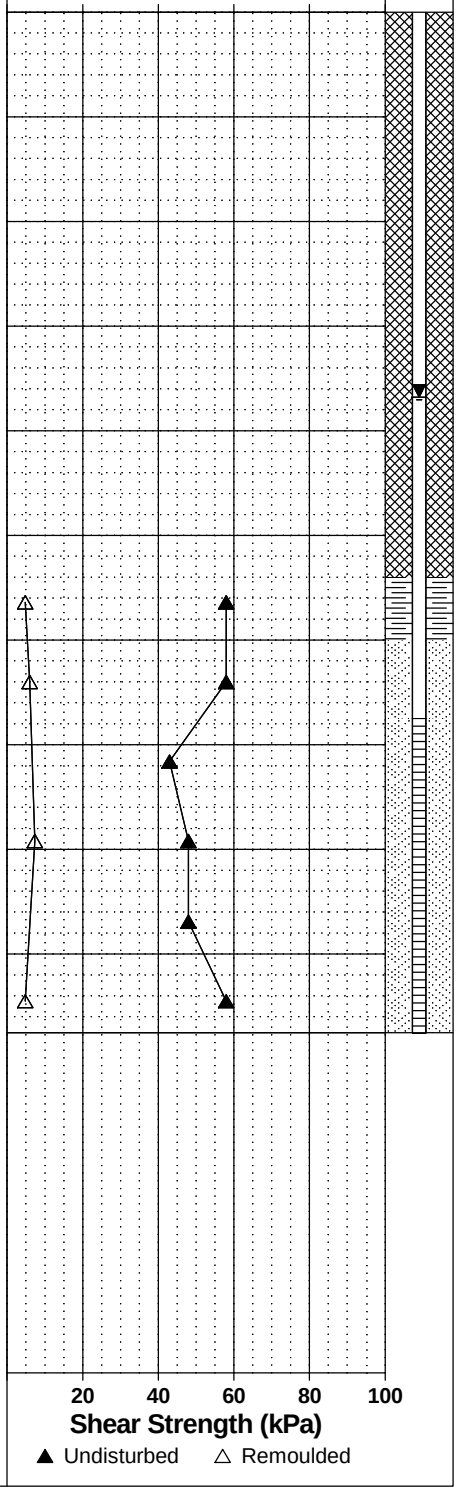
FILE NO. PG5224

REMARKS

HOLE NO. BH 2-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	83.59
FILL: Topsoil with construction debris and gravel		AU	1				
0.60							
		SS	2		6	1	82.59
FILL: Grey silty clay with roots, asphalt, gravel and brick		SS	3		18	2	81.59
2.29							
		SS	4		10	3	80.59
		SS	5		9	4	79.59
		SS	6				
		SS	7		4	5	78.59
Stiff to firm, brown **SILTY CLAY**							
- grey by 6.1m depth						6	77.59
						7	76.59
						8	75.59
						9	74.59
9.75							
End of Borehole							
(GWL @ 3.68m - Sept. 18, 2020)							



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Geotechnical Investigation
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Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5224

REMARKS

HOLE NO. BH 3-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	83.22
FILL: Brown silty sand with topsoil and construction debris		AU	1			1	82.22
1.52							
FILL: Grey silty clay with sand and construction debris		SS	2	38	16	2	81.22
2.29							
		SS	3	75	6	3	80.22
Stiff to firm, brown **SILTY CLAY**		SS	4	54	7		
- grey by 3.8m depth		SS	5	92	6	4	79.22
4.42							
End of Borehole							

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 Geodetic

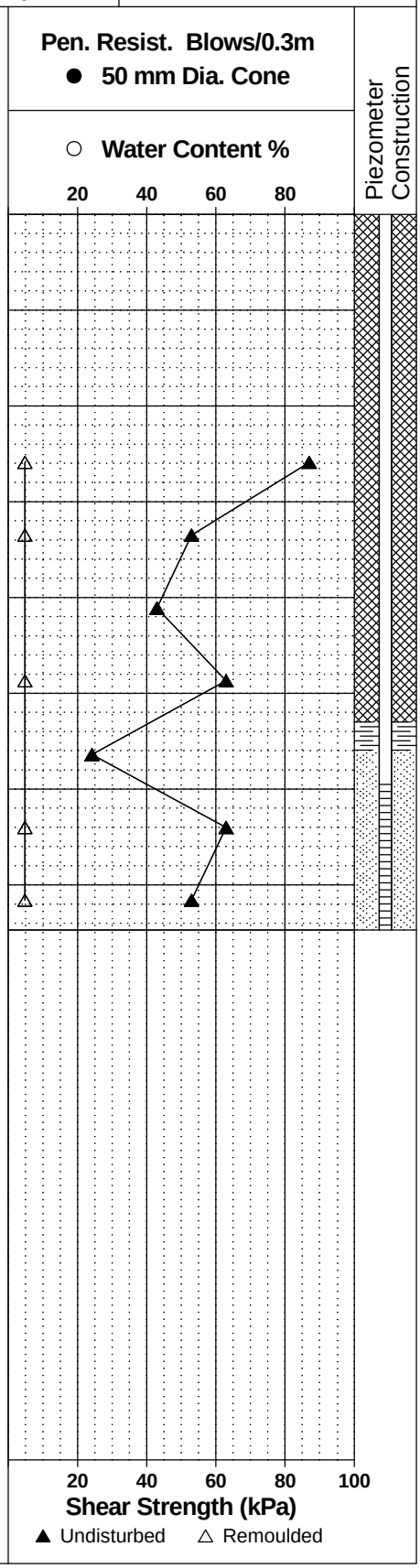
FILE NO. PG5224

REMARKS

HOLE NO. BH 4-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.66
TOPSOIL 0.15		AU	1				
Stiff, brown **SILTY CLAY**		SS	2	83	7	1	69.66
- grey by 1.5m depth		SS	3	92	5	2	68.66
						3	67.66
- firm to stiff by 3.8m depth						4	66.66
		SS	4	75	P	5	65.66
						6	64.66
		SS	5	83	P	7	63.66
7.47							
End of Borehole							
(Piezometer damaged - Sept. 18, 2020)							



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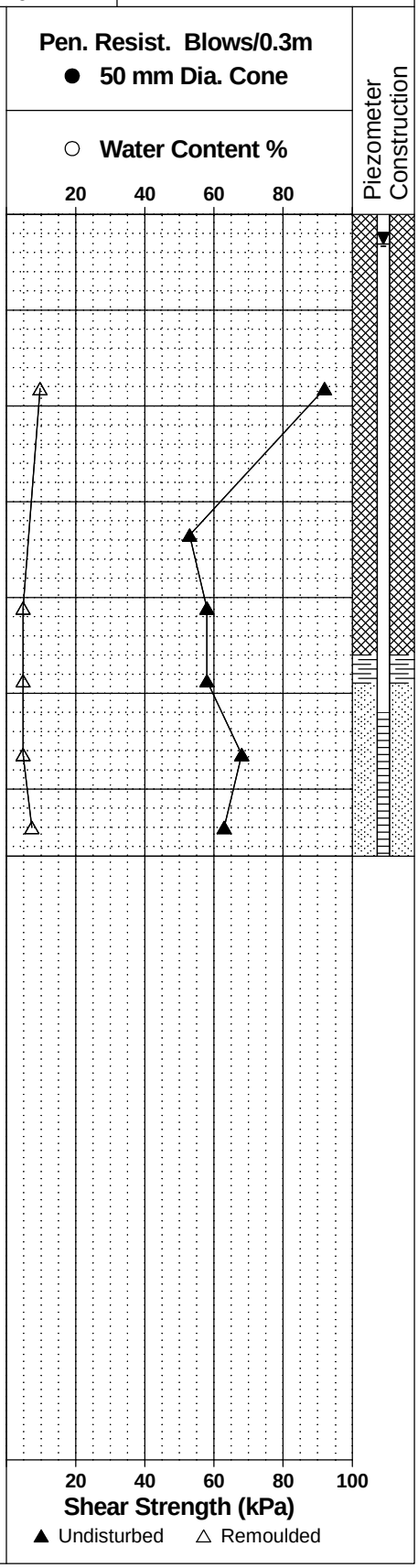
FILE NO. PG5224

REMARKS

HOLE NO. BH 5-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 11, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.68
TOPSOIL 0.20		AU	1				
Stiff, brown **SILTY CLAY,** trace organics to 0.9m depth.		SS	2	75	4	1	68.68
- grey by 1.4m depth		SS	3	100	P	2	67.68
		SS	4	50	P	3	66.68
		SS	5	83	P	4	65.68
						5	64.68
6.70						6	63.68
Dynamic Cone Penetration Test commenced at 6.70m depth and cone was pushed to 24.0m depth.							
Practical DCPT refusal at 24.56m depth.							
(GWL @ 0.31m - Sept. 18, 2020)							



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FILE NO. PG5224

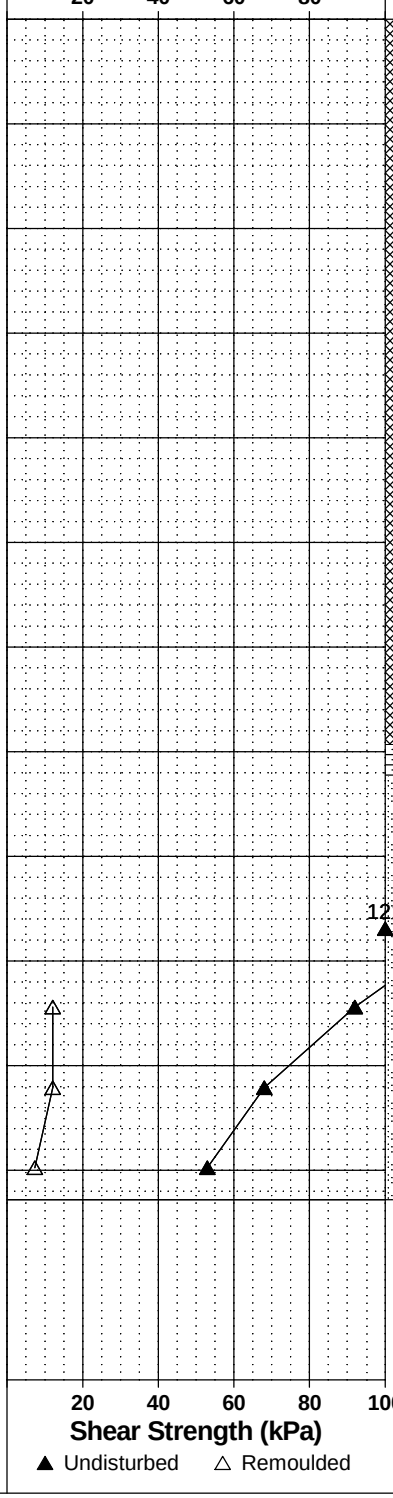
REMARKS

HOLE NO. BH 6-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 11, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	81.73
FILL: Brown silty sand, trace gravel, cobbles, topsoil and construction debris		AU	1			1	80.73
		SS	2	0	7	2	79.73
2.29							
		SS	3	29	8	3	78.73
FILL: Brown silty sand, trace clay, gravel and construction debris		SS	4	21	10	4	77.73
4.57							
		SS	5	21	7	5	76.73
		SS	6	17	7		
FILL: Grey silty clay, trace organics, gravel and construction debris		SS	7	67	14	6	75.73
7.16		SS	8	67	15	7	74.73
FILL: Brown silty clay with sand							
7.62							
		SS	9	79	8	8	73.73
Very stiff to stiff, brown **SILTY CLAY,** trace sand seams						9	72.73
- grey by 9.1m depth		SS	10	96	P	10	71.73
		SS	11	96	P	11	70.73
11.28							
End of Borehole							
(Piezometer damaged - Sept. 18, 2020)							

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



Piezometer Construction

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3252 Navan Road
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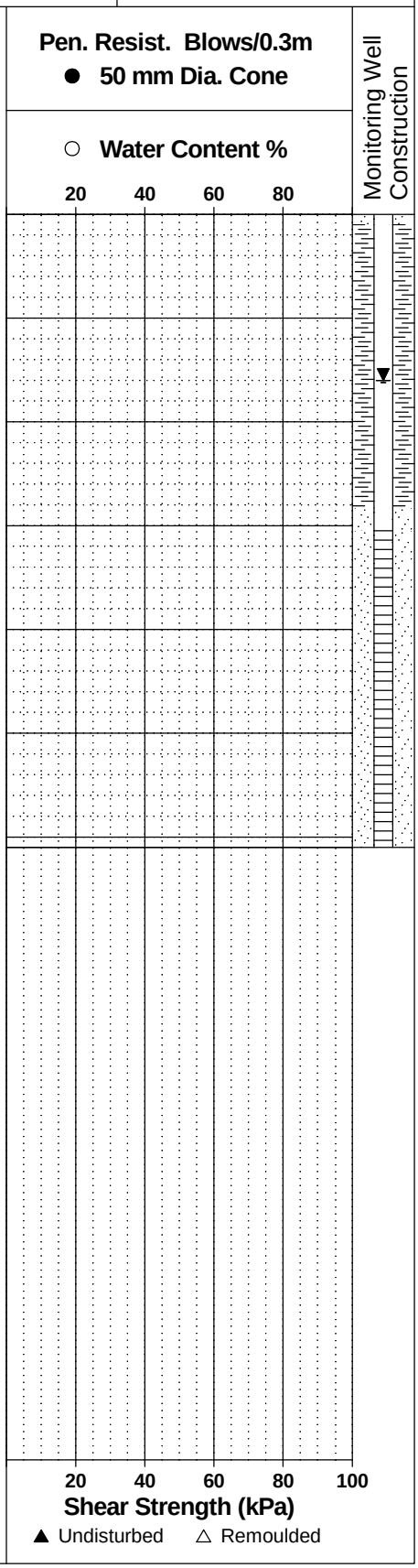
FILE NO. PG5224

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)
GROUND SURFACE						0	85.78
FILL: Brown silty sand with crushed stone and gravel		AU	1				
0.51							
FILL: Brown silty clay, trace gravel		SS	2	33	14	1	84.78
1.37							
FILL: Brown silty sand		SS	3	75	6	2	83.78
2.59		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)							



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Geotechnical Investigation
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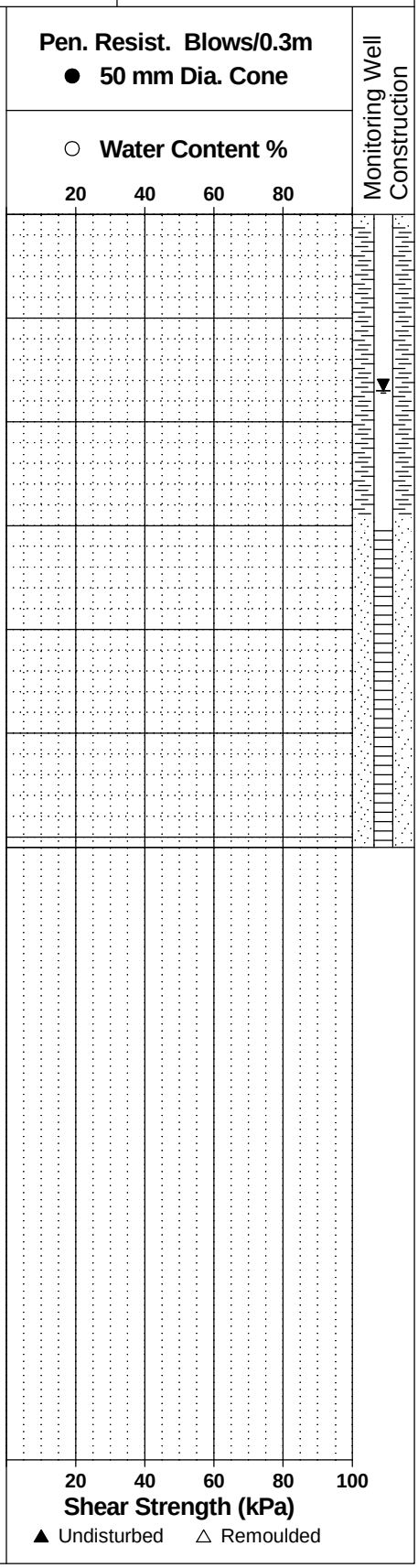
FILE NO. PG5224

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)
GROUND SURFACE						0	85.67
		AU	1				
FILL: Brown silty sand, some gravel, trace clay		SS	2	21	15	1	84.67
		SS	3	79	13	2	83.67
2.29							
		SS	4	46	7		
Brown **SILTY CLAY**		SS	5	100	5	3	82.67
- 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)							



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Geotechnical Investigation
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DATUM

REMARKS

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

FILE NO. PG5224

HOLE NO. BH 3

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

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

FILE NO. PG5224

HOLE NO. BH 4

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

Geotechnical Investigation
3252 Navan Road
Ottawa, Ontario

DATUM Geodetic

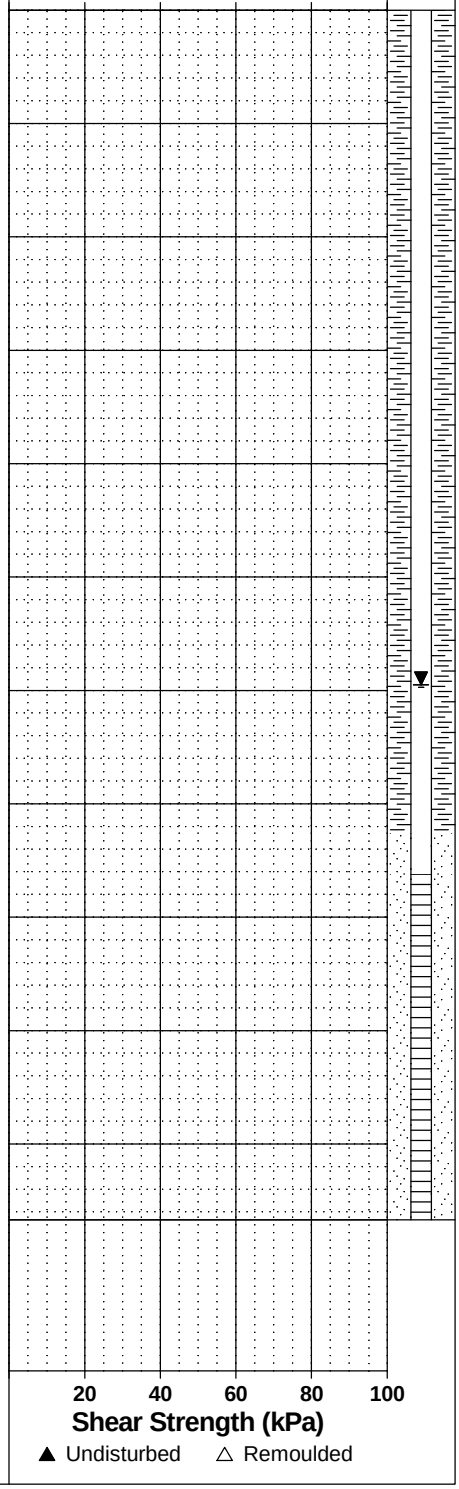
FILE NO. PG5224

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)									



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REMARKS

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

FILE NO. PG5224

HOLE NO. BH 6

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, some clay, trace brick and topsoil		AU	1				
		SS	2	58	16	1	
		SS	3	33	7	2	
		SS	4	71	7		
		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							
Brown **SILTY CLAY**		SS	10	88	15	7	
		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
3252 Navan Road
Ottawa, Ontario

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FILE NO. PG5224

REMARKS

HOLE NO. BH 7

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

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									
TOPSOIL 0.30		SS	1	100		0	73.97		
Brown **SILTY CLAY** 0.71		SS	2	100		1	72.97		
Brown **SILTY CLAY**		SS	3	100		2	71.97		
- grey by 1.8m depth		SS	4	100					
3.05		SS	5	100		3	70.97		
End of Borehole									
(GWL @ 0.60m - June 3, 2019)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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REMARKS

HOLE NO. BH 8

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

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									
TOPSOIL 0.28		SS	1	12		0	71.09		
Grey **SILTY SAND** 0.91		SS	2	58		1	70.09		
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: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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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							
TOPSOIL 0.15		SS	1	62		0	69.49
		SS	2	71		1	68.49
Brown **SILTY CLAY**		SS	3	100			
		SS	4	100		2	67.49
3.05		SS	5	100		3	66.49
End of Borehole							
(GWL @ 0.49m - 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

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. 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3252 Navan Road
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		
		SS	2	100		7	
		SS	3	100			
		SS	4	100		8	
Grey **SILTY CLAY**		SS	5	100			
		SS	6	100		9	
		SS	7	100			
11.28						10	
End of Borehole							
(GWL @ 2.84m - Sept. 9, 2019)						11	

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
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

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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

REMARKS

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

FILE NO. PG5224

HOLE NO. BH13

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 / 85.99	1	AS	-				
		TOPSOIL - (SM) SILTY SAND; dark brown; non-cohesive		0.30							
		(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

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: 16-1A

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)	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		86.24									
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									
4		End of Borehole		3.81									WL in Standpipe at Elev. 83.38 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: 16-2

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	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		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							
1											
2											
3					1	TP	PH		W	C	
				80.67							
		End of Borehole		3.66							
4											
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: 16-3

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. +, 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)	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)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		81.01				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 16-3		0.00							Native Backfill
1											
2											
3											Bentonite Seal
4					1	TP	PH				Standpipe
				76.74							
		End of Augerhole		4.27							
5											WL in Standpipe at Elev. 78.50 m on Jan. 22, 2016
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		○ Wp–W–Wl		
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:

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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

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: 16-6

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 (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		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								⊕ +			
					4	SS	PM	+			
5								⊕ +			
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 (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		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					1	SS	5				
					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								⊕ + +			
8					7	TP	PH				
9								⊕ ⊕ + +			
					8	SS	WH				
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: 16-101

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
		--- 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. +, 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		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								⊕ + ⊕ +			
9					8	TP	PH				
					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)	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											
8					6	SS	WH				
				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	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	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					1	50 DO	7				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							
		End of Borehole		5.79							Water level in standpipe at elev. 68.96m on July 11, 2005
6											
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	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	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							
		Brown silty clay, trace organic matter (FILL)		0.73							Native Backfill
				81.22							
1		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	SOIL PROFILE: 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 (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
0		GROUND SURFACE		86.34							
	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	50 DO	13				
2											Native Backfill
					3	50 DO	11				
3											Standpipe
		Soft to firm grey SILTY CLAY, occasional red brown layer		82.99 / 3.35	4	50 DO	6				Silica Sand
											Bentonite Seal
4								⊕ +			
								⊕ +			
					5	73 TP	PH		⊖	C	Native Backfill
5								⊕ +			
				80.55				⊕ +			
		End of Borehole		5.79							
6											Water level in standpipe at elev 84.76m on July 11, 2005
7											
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

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

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

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 = $(D30)^2 / (D10 \times D60)$
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

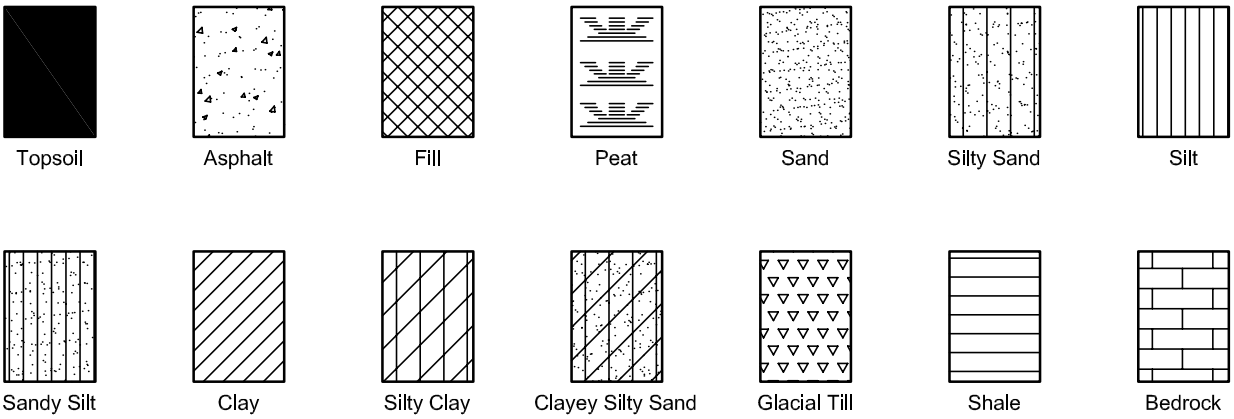
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

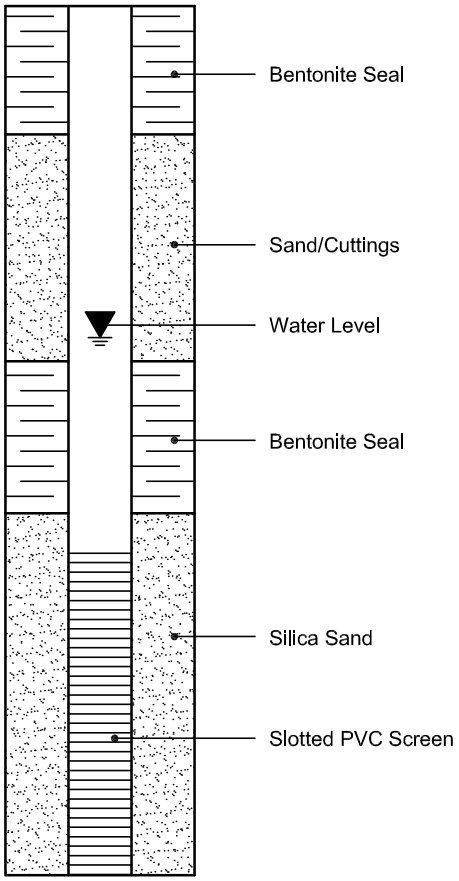
SYMBOLS AND TERMS (continued)

STRATA PLOT

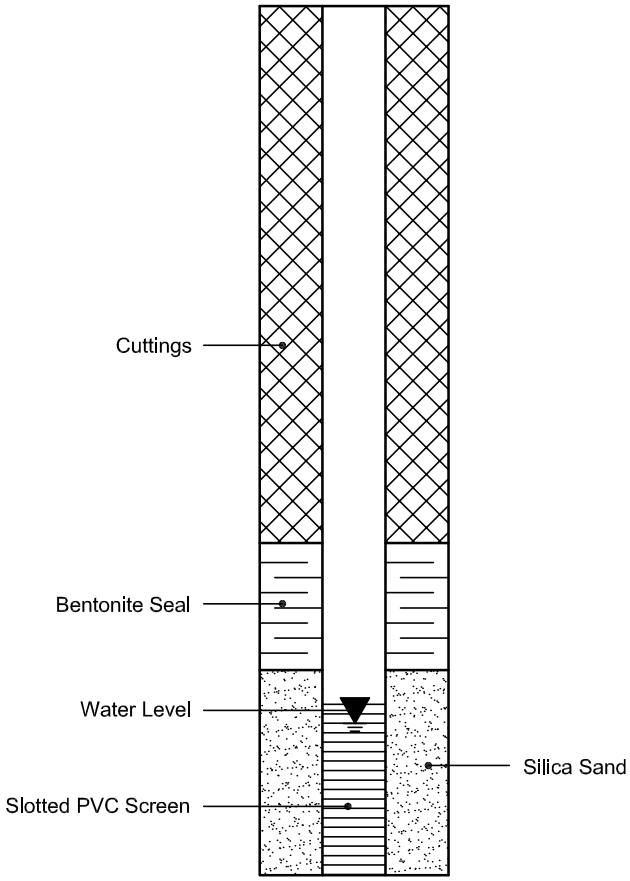


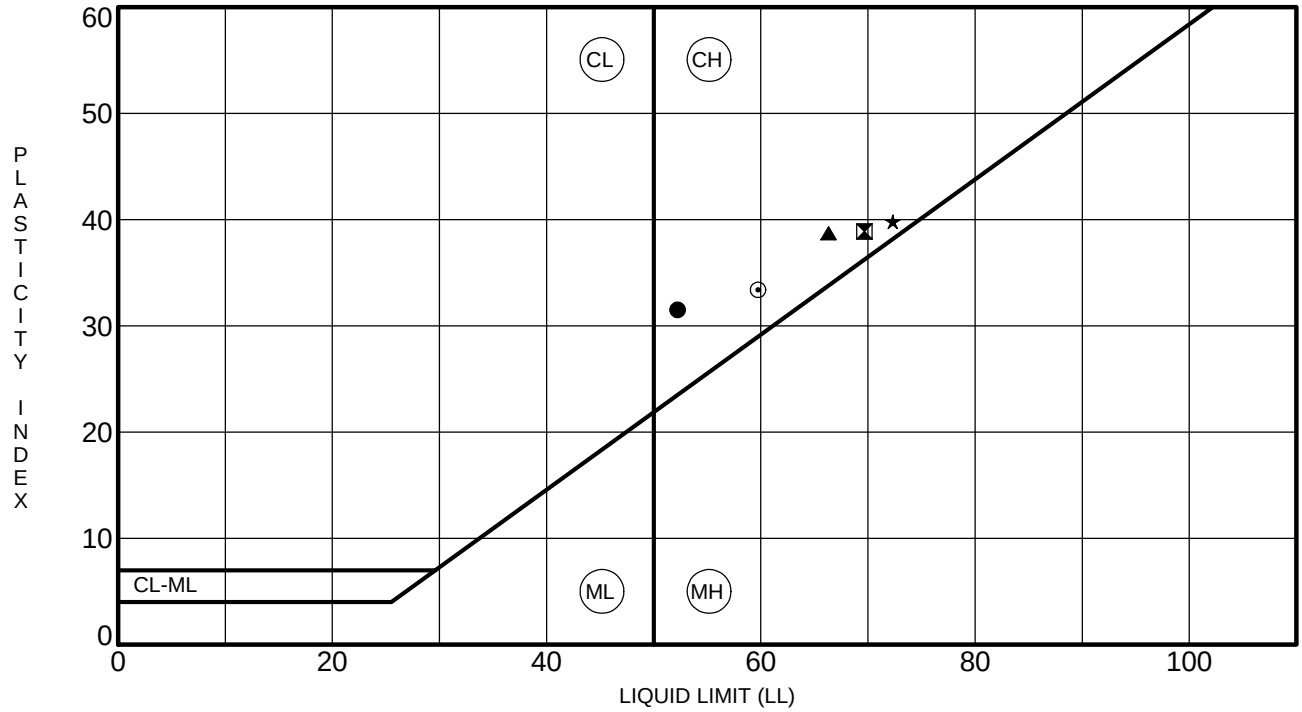
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





Specimen Identification			LL	PL	PI	Fines	Classification
●	**BH 2-20**	**SS 4**	**52**	**21**	**32**		**CH - Inorganic clays of high plasticity**
⊠	**BH 3-20**	**SS 4**	**70**	**31**	**39**		**CH - Inorganic clays of high plasticity**
▲	**BH 4-20**	**SS 3**	**66**	**28**	**39**		**CH - Inorganic clays of high plasticity**
★	**BH 5-20**	**SS 2**	**72**	**32**	**40**		**CH - Inorganic clays of high plasticity**
⊙	**BH 6-20**	**SS10**	**60**	**26**	**33**		**CH - Inorganic clays of high plasticity**

CLIENT	**Claridge Homes**	FILE NO.	**PG5224**
PROJECT	**Geotechnical Investigation - 3252 Navan Road**	DATE	**11 Sep 20**

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2A - 7B - SLOPE STABILITY CROSS SECTIONS

PHOTOGRAPHS FROM SITE VISIT

DRAWING PG5224-1 - TEST HOLE LOCATION PLAN

DRAWING PG5224-2 - PERMISSIBLE GRADE RAISE PLAN

FIGURE 1

KEY PLAN

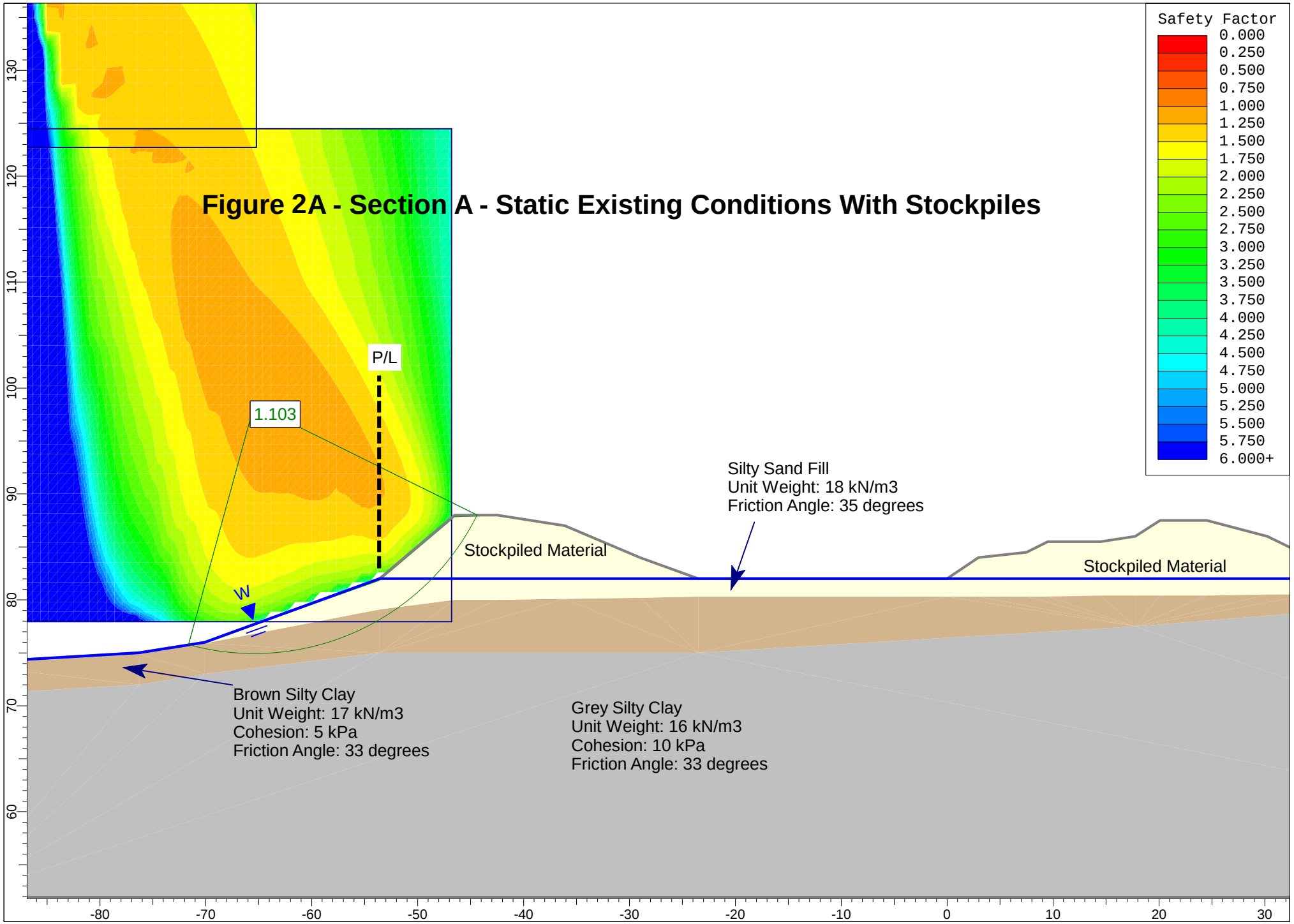
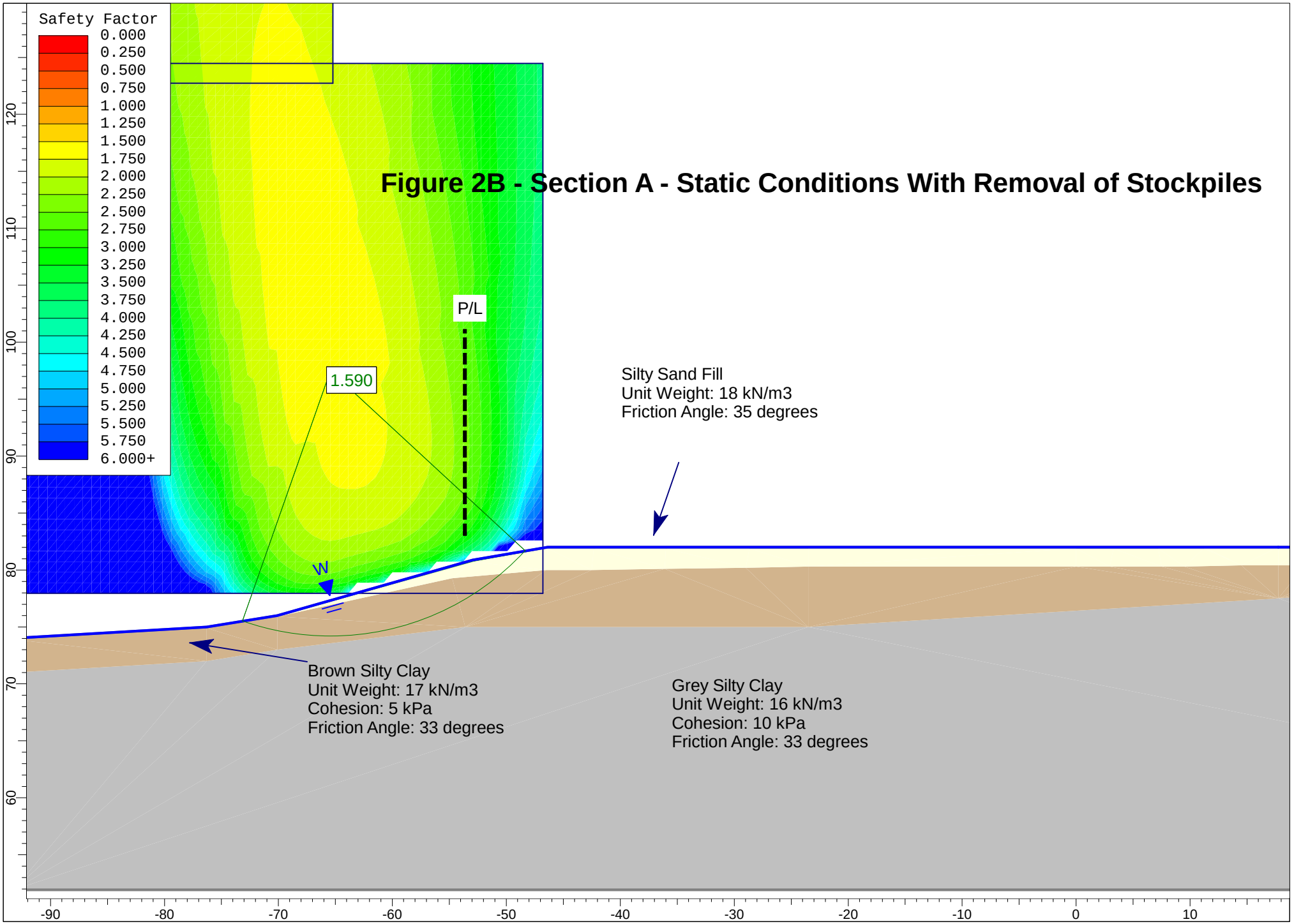
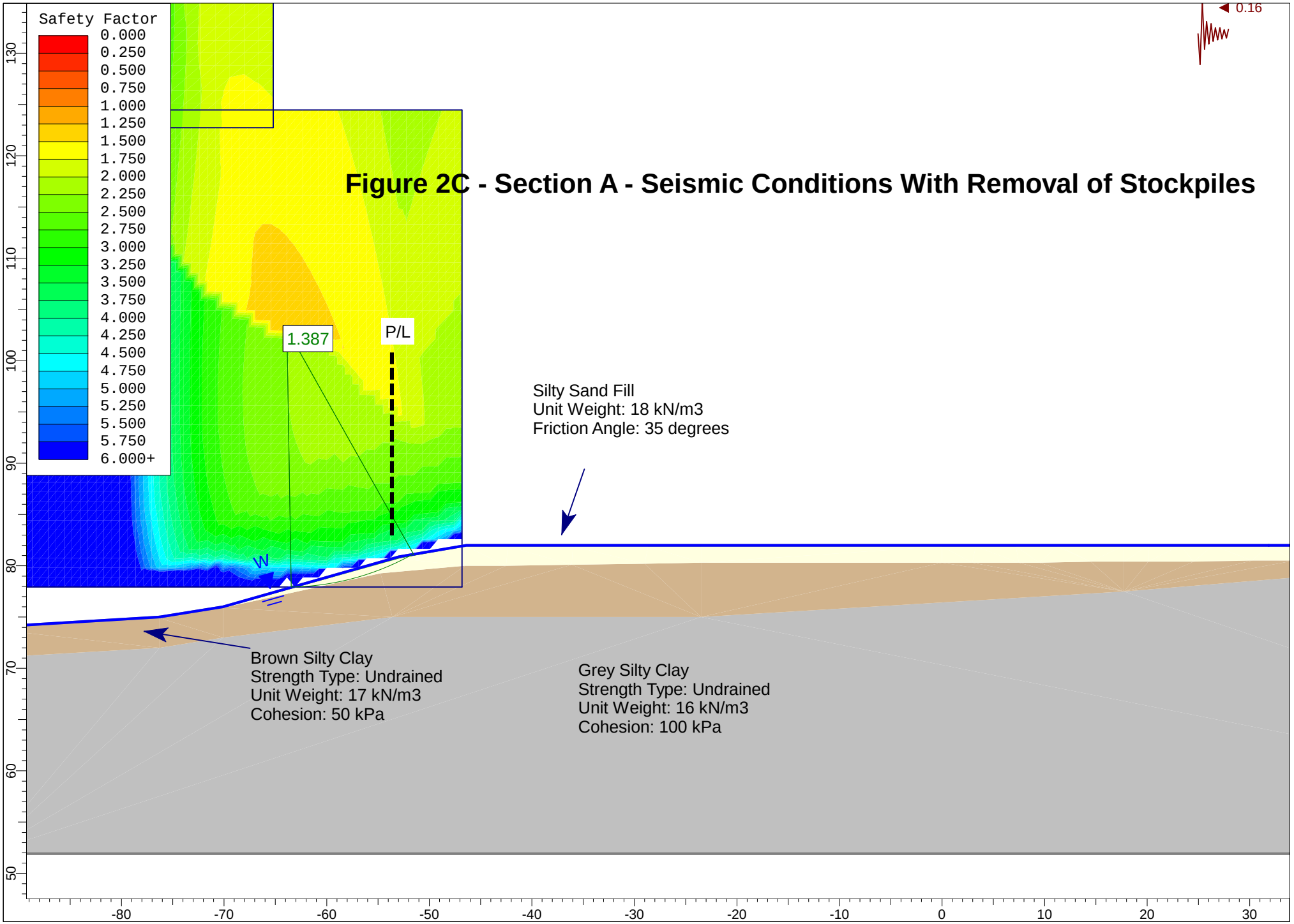


Figure 2A - Section A - Static Existing Conditions With Stockpiles
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
P/L
1.103
W
Silty Sand Fill
Unit Weight: 18 kN/m3
Friction Angle: 35 degrees
Stockpiled Material
Stockpiled Material
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
130
120
110
100
90
80
70
60
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 2B - Section A - Static Conditions With Removal of Stockpiles
P/L
1.590
W
Silty Sand Fill
Unit Weight: 18 kN/m3
Friction Angle: 35 degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
120
110
100
90
80
70
60
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10


Safety Factor
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0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
Figure 2C - Section A - Seismic Conditions With Removal of Stockpiles
1.387
P/L
W
Silty Sand Fill
Unit Weight: 18 kN/m3
Friction Angle: 35 degrees
Brown Silty Clay
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 50 kPa
Grey Silty Clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 100 kPa
130
120
110
100
90
80
70
60
50
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30

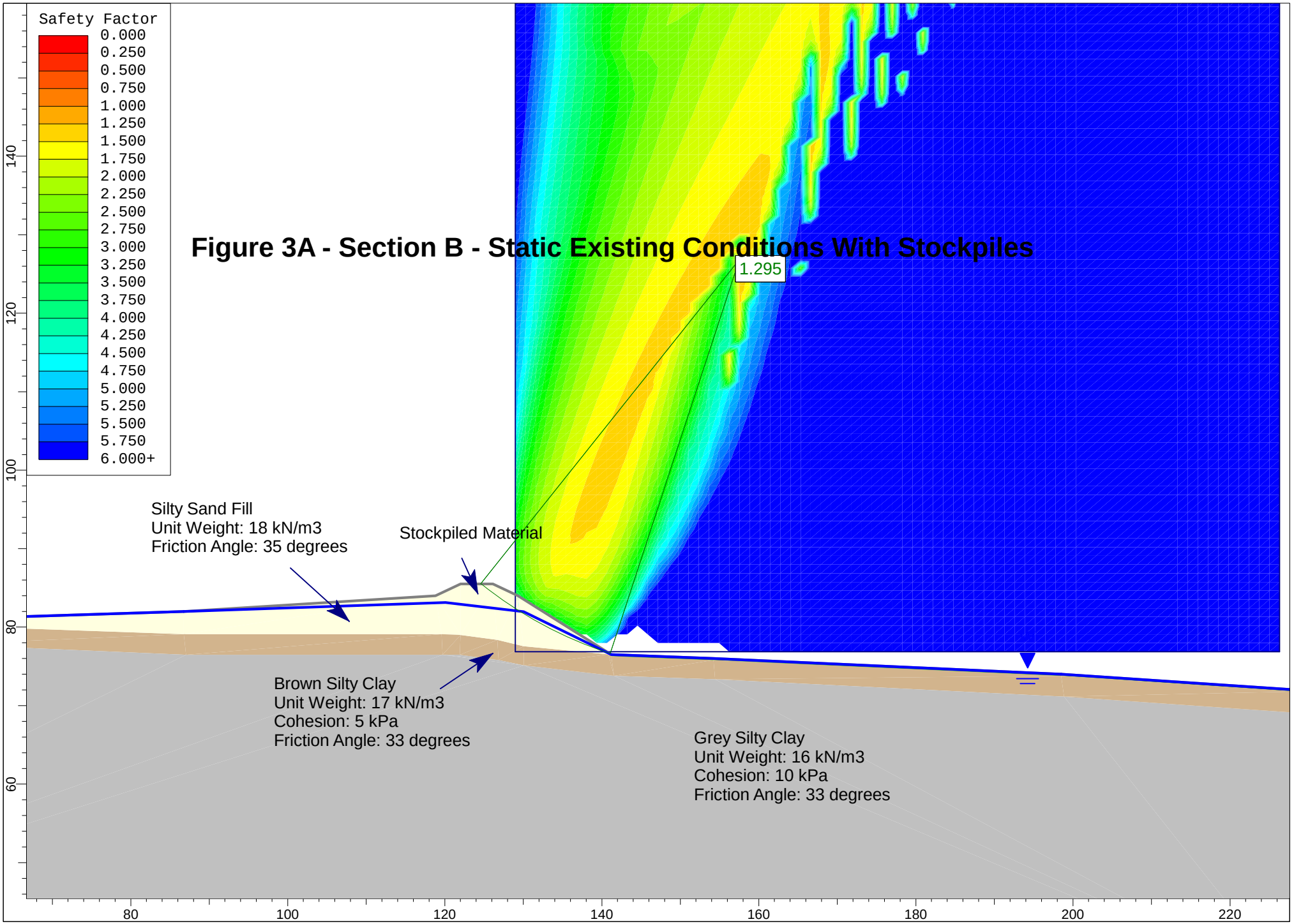
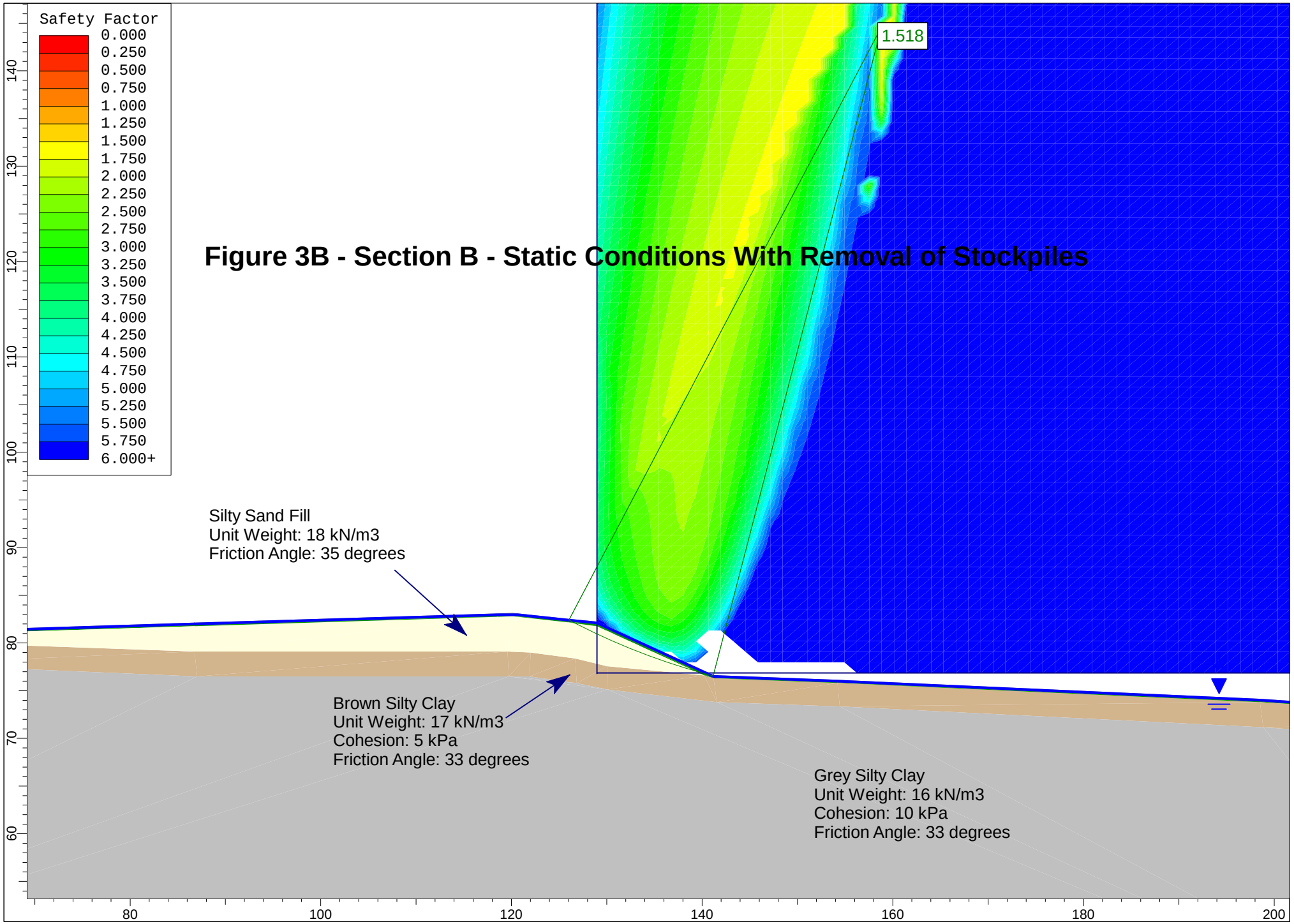


Figure 3A - Section B - Static Existing Conditions With Stockpiles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0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
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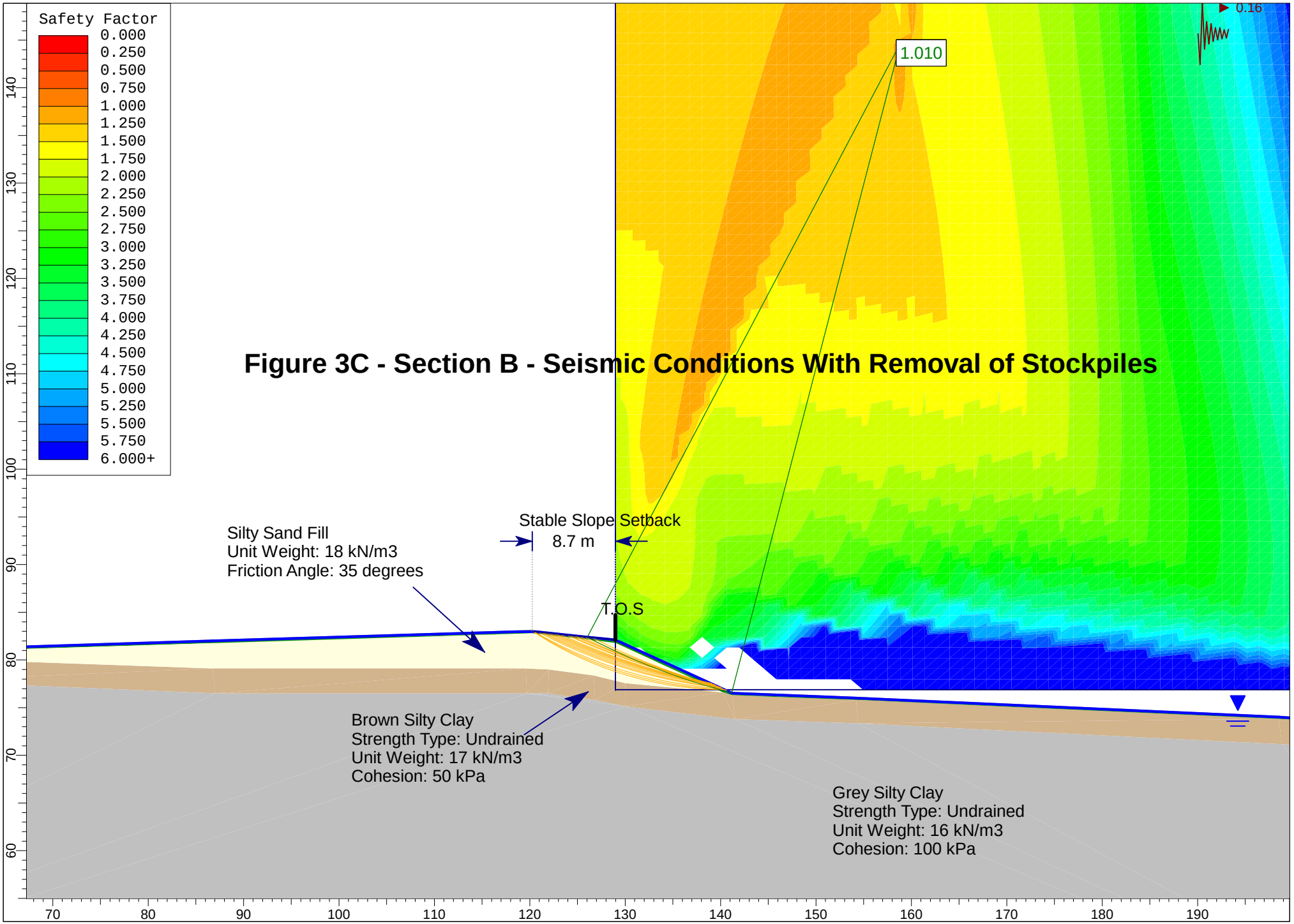
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.518
Figure 3B - Section B - Static Conditions With Removal of Stockpiles
Silty Sand Fill
Unit Weight: 18 kN/m3
Friction Angle: 35 degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
140
130
120
110
100
90
80
70
60
80
100
120
140
160
180
200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0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.010
0.16
Figure 3C - Section B - Seismic Conditions With Removal of Stockpiles
Silty Sand Fill
Unit Weight: 18 kN/m3
Friction Angle: 35 degrees
Stable Slope Setback
8.7 m
T.O.S
Brown Silty Clay
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 50 kPa
Grey Silty Clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 100 kPa
140
130
120
110
100
90
80
70
60
70
80
90
100
110
120
130
140
150
160
170
180
190

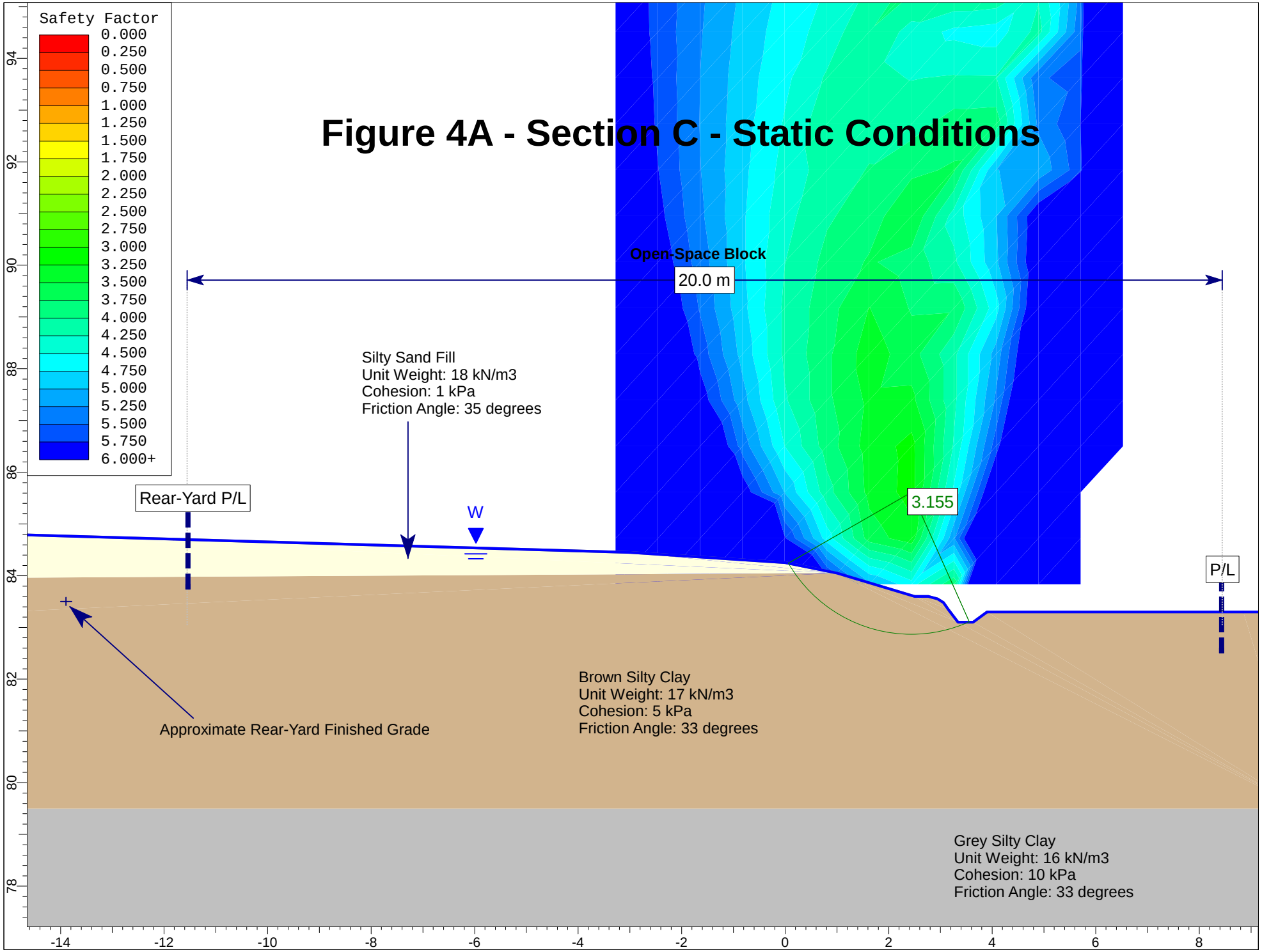


Figure 4A - Section C - Static Conditions
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Open-Space Block
20.0 m
Silty Sand Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 35 degrees
Rear-Yard P/L
W
3.155
P/L
Approximate Rear-Yard Finished Grade
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
94
92
90
88
86
84
82
80
78
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
8

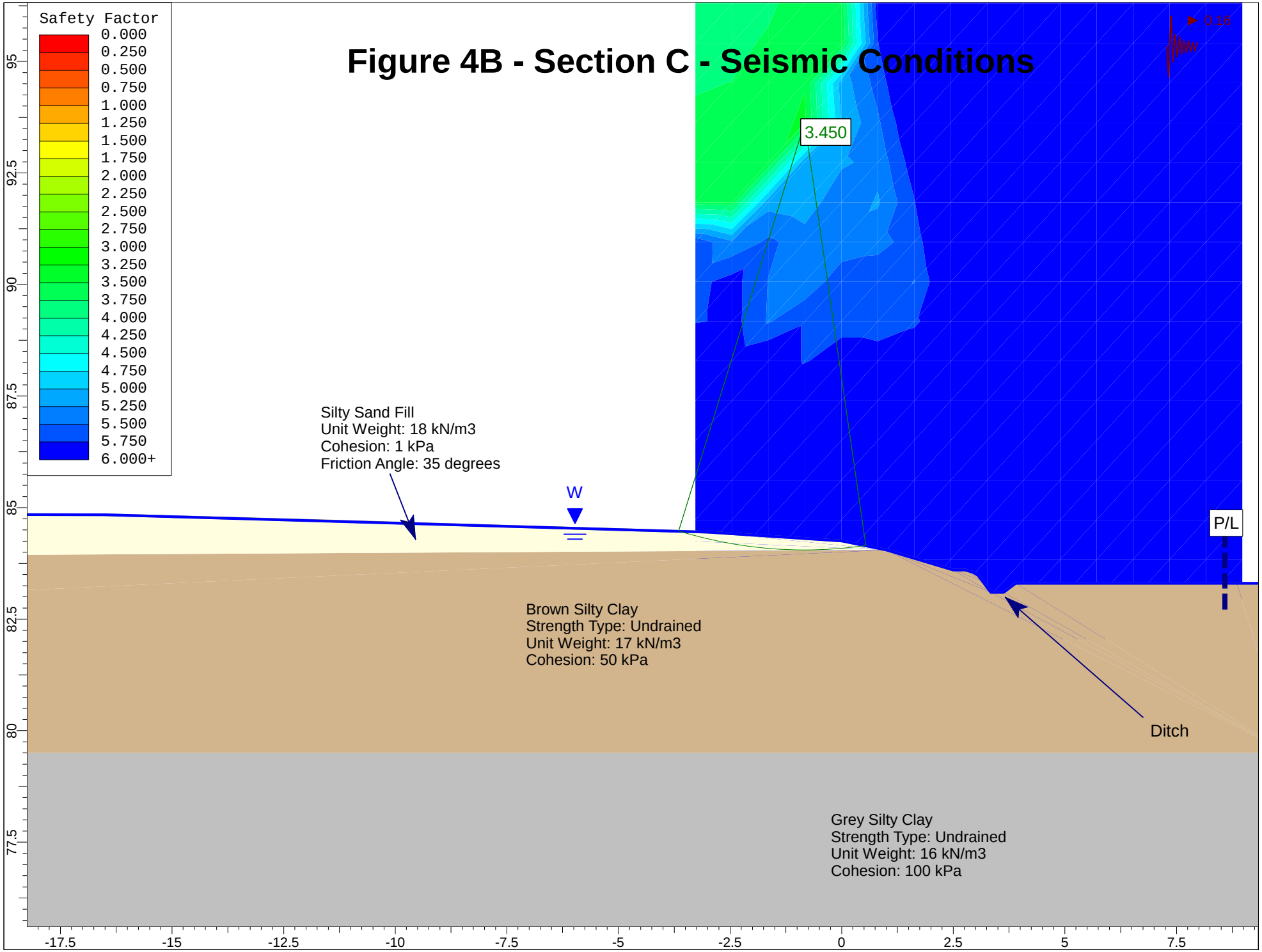


Figure 4B - Section C - Seismic Conditions
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
3.450
Silty Sand Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 35 degrees
W
P/L
Brown Silty Clay
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 50 kPa
Ditch
Grey Silty Clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 100 kPa
95
92.5
90
87.5
85
82.5
80
77.5
-17.5
-15
-12.5
-10
-7.5
-5
-2.5
0
2.5
5
7.5

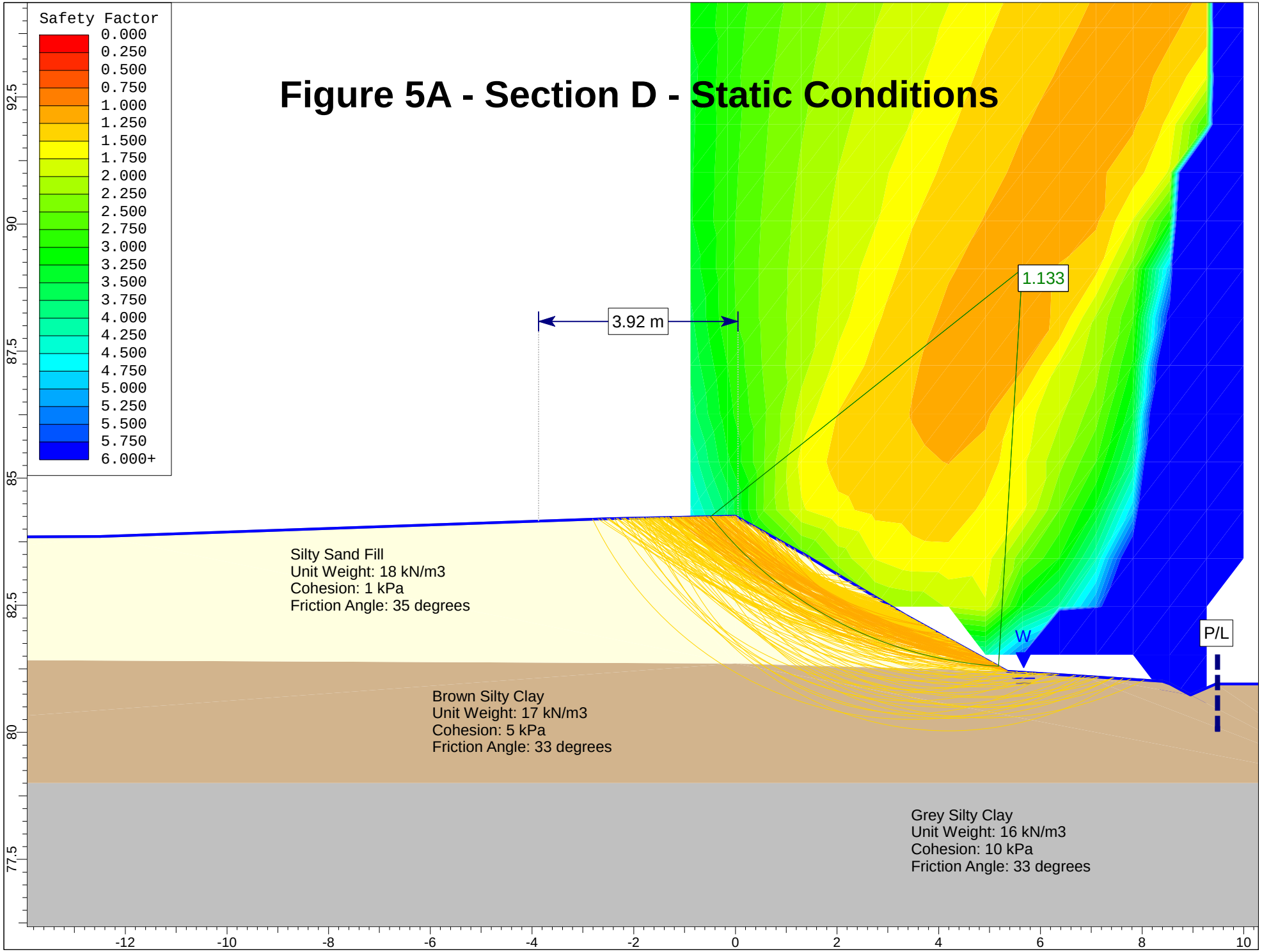
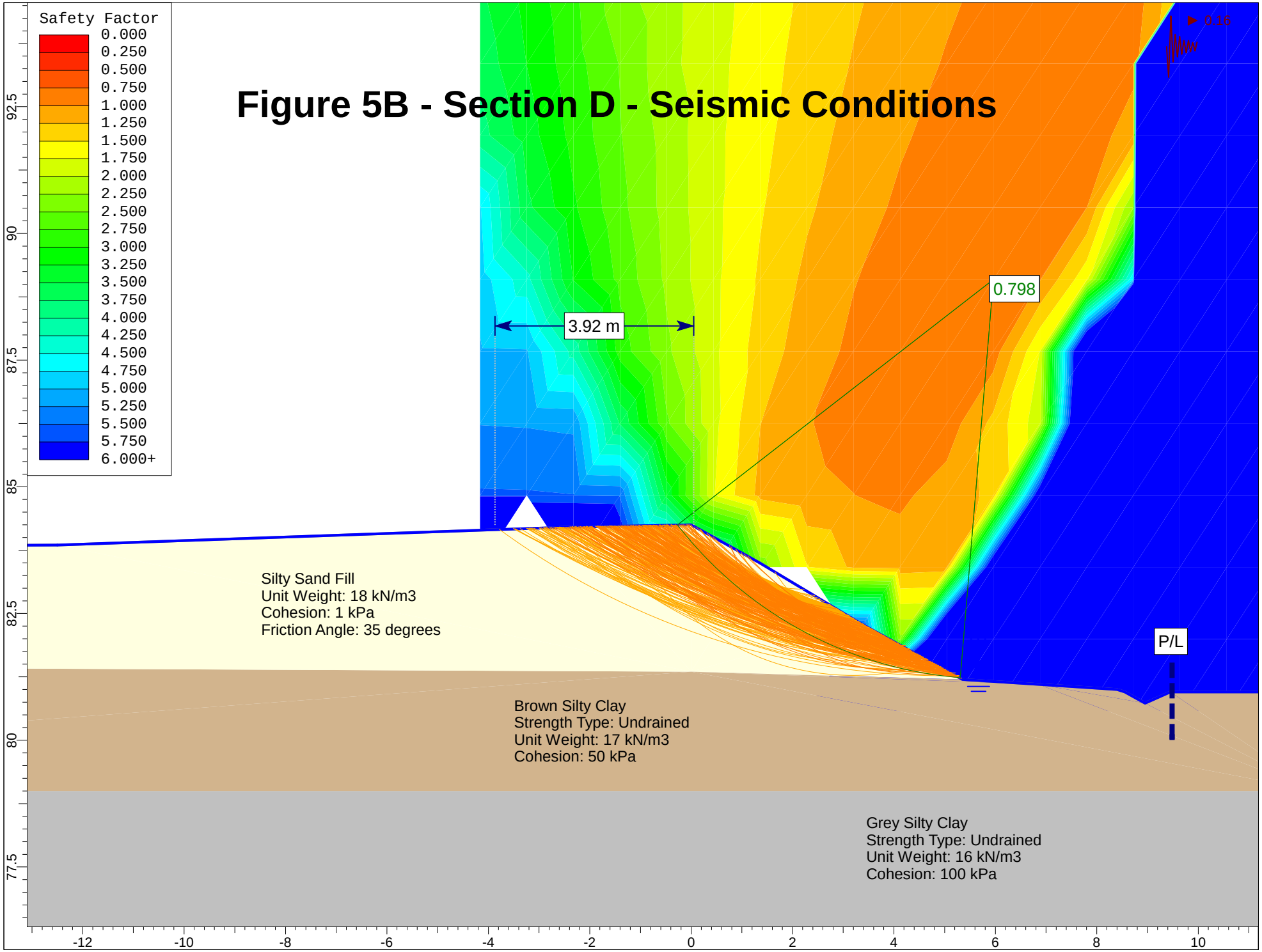


Figure 5A - Section D - Static Conditions
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.133
3.92 m
W
P/L
Silty Sand Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 35 degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
92.5
90
87.5
85
82.5
80
77.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10


Safety Factor
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0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
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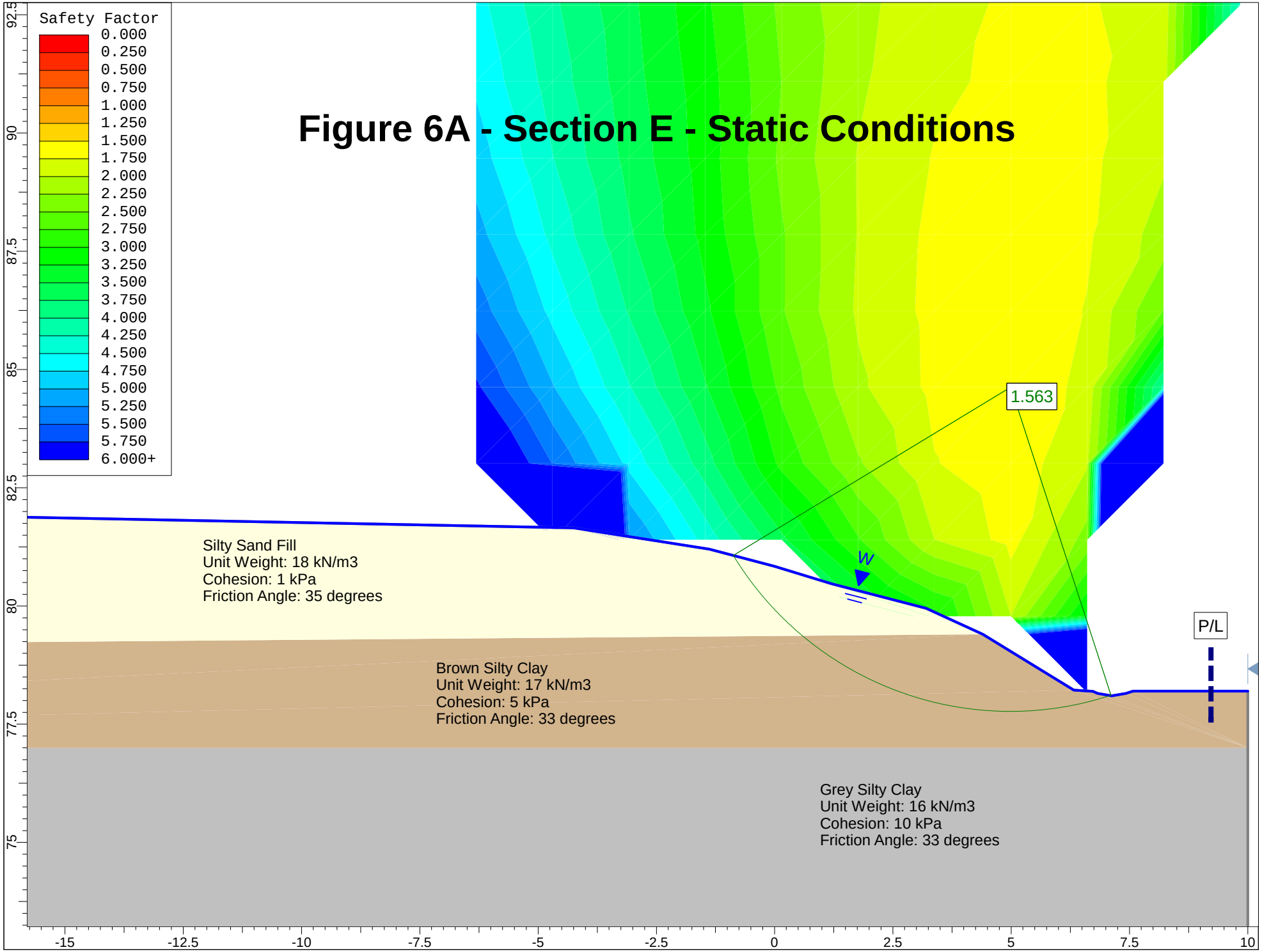
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 5B - Section D - Seismic Conditions
0.16
0.798
3.92 m
P/L
Silty Sand Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 35 degrees
Brown Silty Clay
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 50 kPa
Grey Silty Clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 100 kPa
92.5
90
87.5
85
82.5
80
77.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 6A - Section E - Static Conditions
1.563
W
P/L
Silty Sand Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 35 degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
92.5
90
87.5
85
82.5
80
77.5
75
-15
-12.5
-10
-7.5
-5
-2.5
0
2.5
5
7.5
10

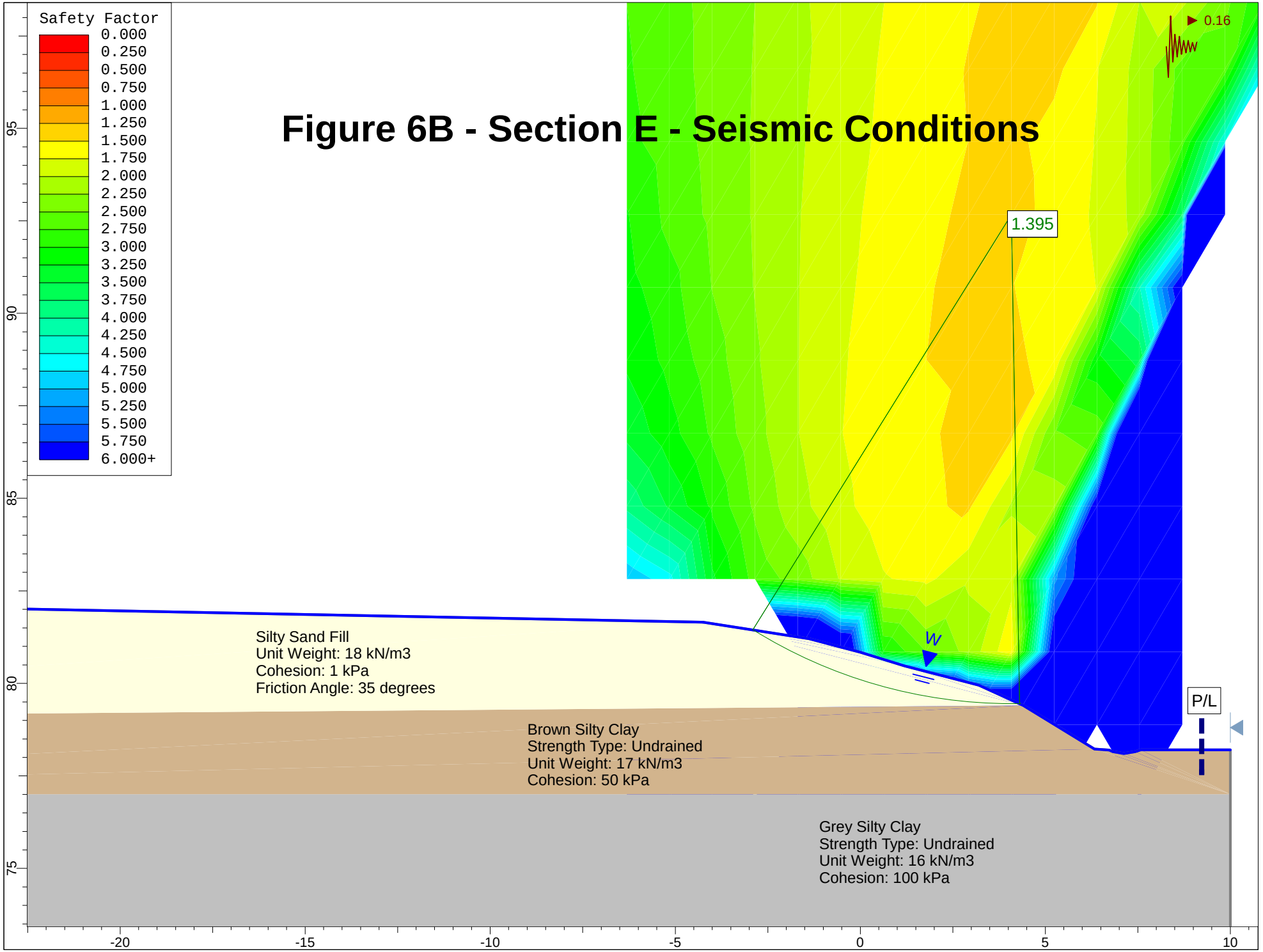


Figure 6B - Section E - Seismic Conditions

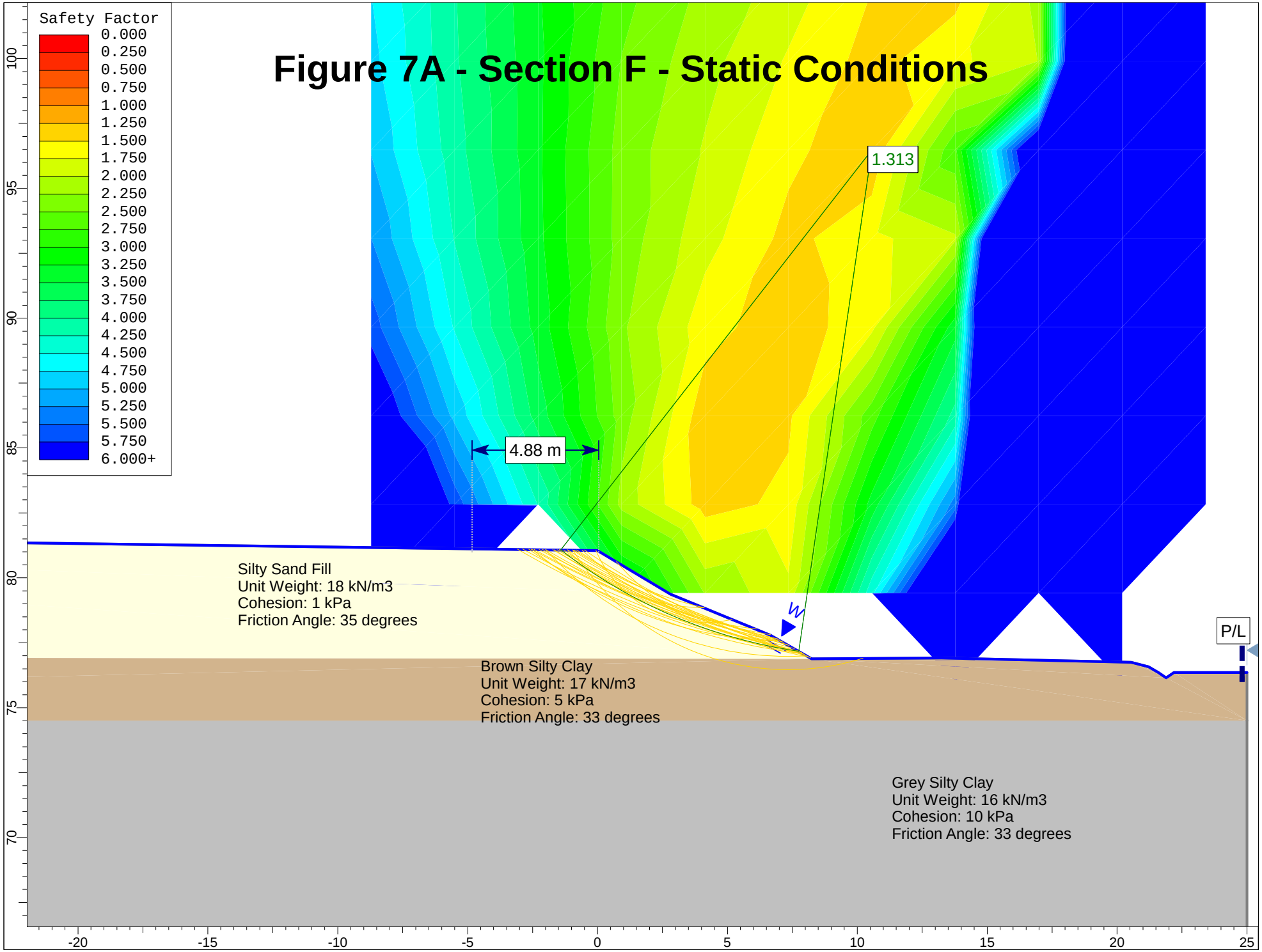


Figure 7A - Section F - Static Conditions
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.313
4.88 m
Silty Sand Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 35 degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey Silty Clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 33 degrees
P/L
100
95
90
85
80
75
70
-20
-15
-10
-5
0
5
10
15
20
25

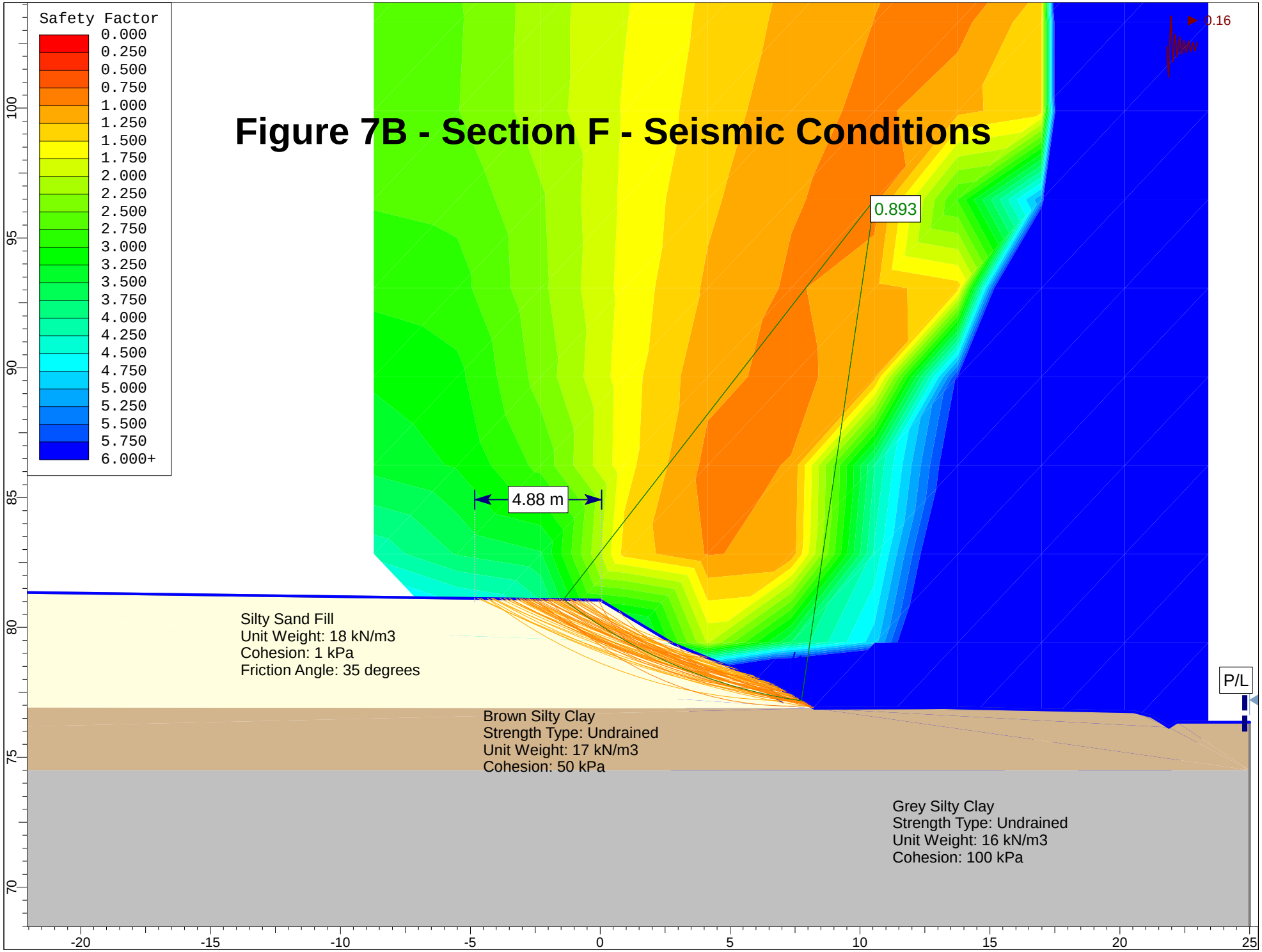


Figure 7B - Section F - Seismic Conditions

Photographs from Site Visit – September 30, 2020

Photo 1: Area of Section C facing north with subject site observed on left portion of photo. Area of ditch observed to be well-vegetated. Prior to our arrival a heavy-rainfall event had taken place which generated a gentle and low-volume flow close to Navan Road and Section C which further became negligible in flow downstream and beyond Section E.

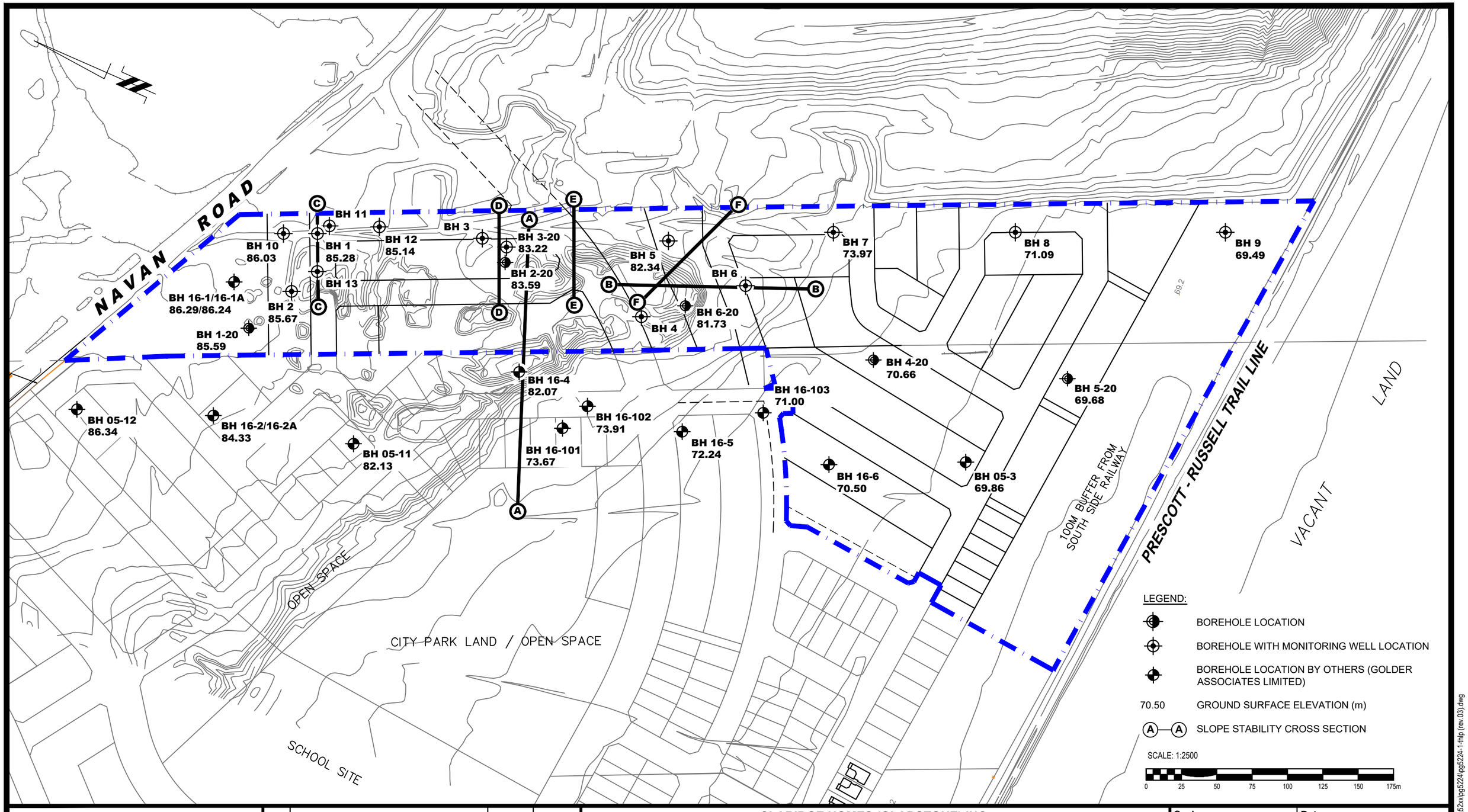
Photo 2: Area of Section C facing north with subject site observed on left portion of photo. No signs of erosion, sloughing or distress noted throughout slope face and section.

Photo 3: Area of Section D facing north with subject site to the left portion of photo. Area observed to be retaining majority of runoff and storm water and well vegetated. Slope face observed to generally consist of compacted sandy fill generated from subject site.

Photo 4: Area of Section E facing south with subject site to right portion of photo. Overburden throughout slope face generally observed to consist of an undsiturbed, stiff brown silty clay with some vegetation covered by a thin layer of fill across the majority of the slope face. No notable signs of erosion, sloughing or distress throughout the slope section were observed.

Photo 5: Area of Section E facing north with subject site to left portion of photo. Majority of ditch alignment observed to be well-vegetated. Water throughout ditch observed to be ponding with no flow, likely runoff from abutting portions of property.

Photo 6: Area of Section F facing south-east with photo taken from top of existing fill pile abutting towards the reviewed slope section. Existing fill side-slope observed to be well-vegetated with no signs of distress. Ground observed to be relatively flat beyond toe of fill pile and throughout valley surrounding the ditch alignment. Area of creek observed to be heavily vegetated with negligible amount of ponding water.



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
3	ADDED NEW SLOPE STABILITY CROSS SECTIONS	14/10/2020	DP
2	ADDED NEW BOREHOLES (BH 1-20 TO BH 6-20)	21/09/2020	JV
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.: 3

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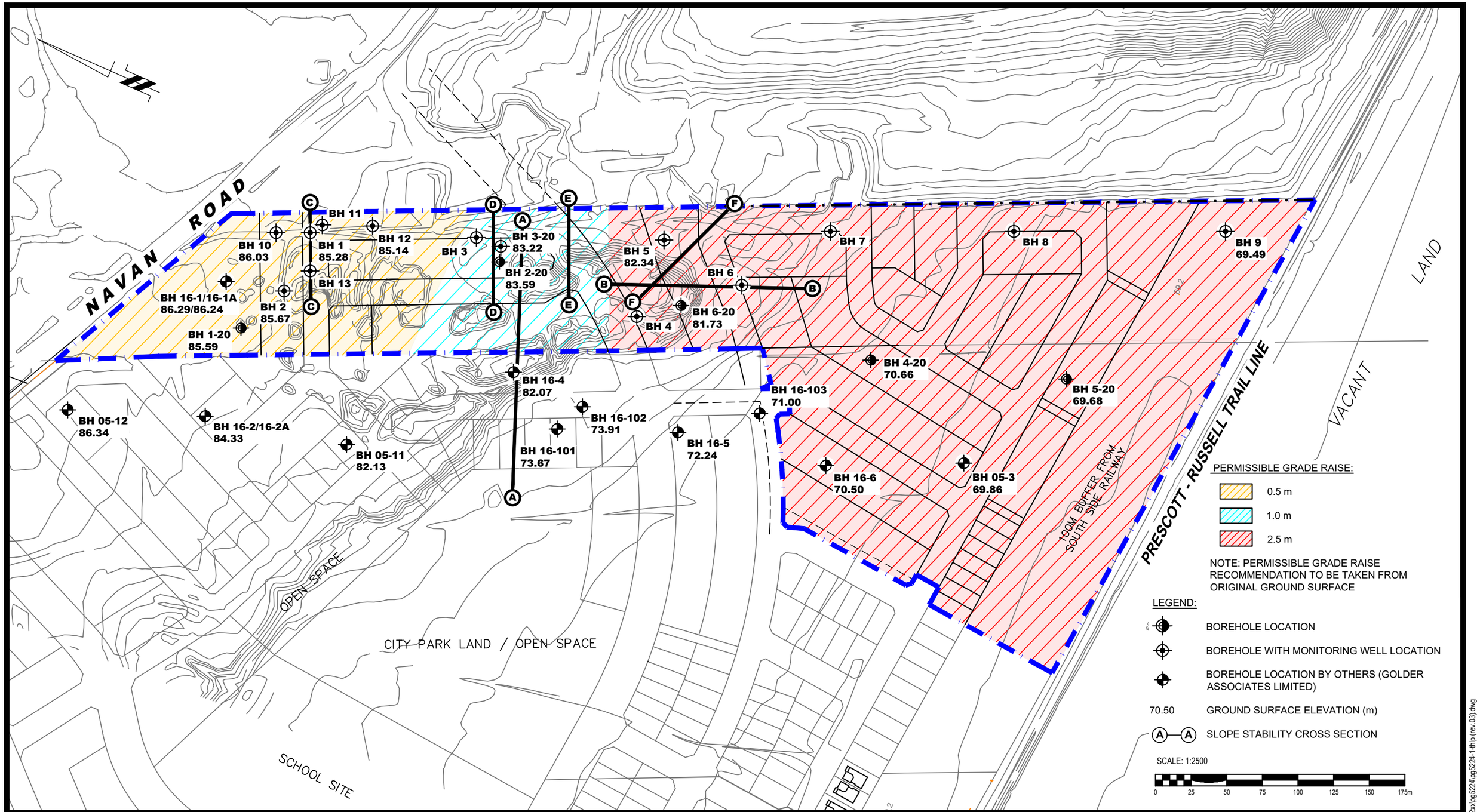

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
3	ADDED NEW SLOPE STABILITY CROSS SECTIONS	14/10/2020	DP
2	ADDED NEW BOREHOLES (BH 1-20 TO BH 6-20)	21/09/2020	JV
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.: 3

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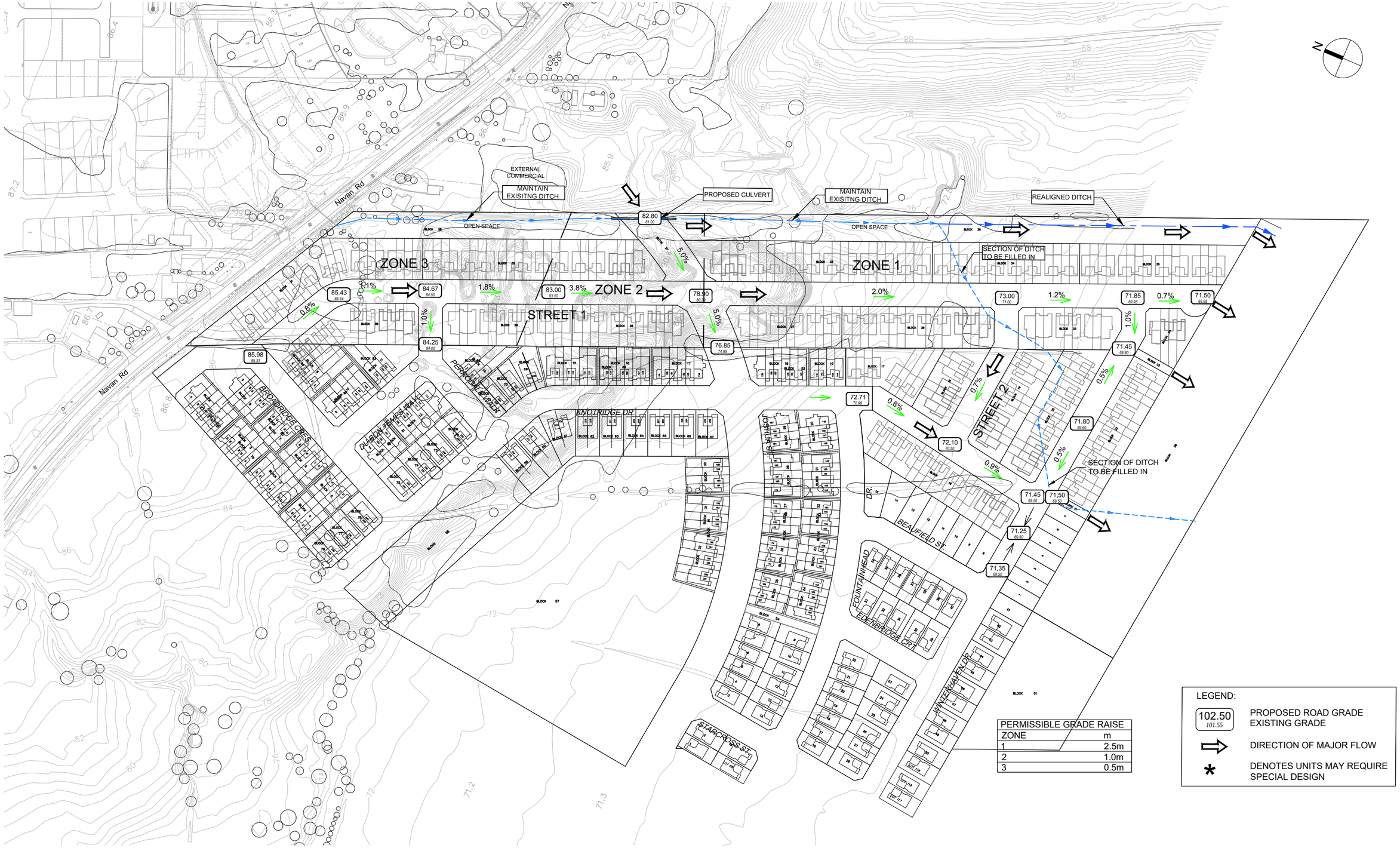

PERMISSIBLE GRADE RAISE	
ZONE	m
1	2.5m
2	1.0m
3	0.5m

LEGEND:

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

IBI

Scale: NTS

Project Title: SPRING VALLEY TRAILS PHASE 5 & 6

Drawing Title: MACRO GRADING

Sheet No.: 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