SEPT. 22, 2022
PROJECT NO. 2018-012

WASAGA RIVERWOODS HOMES DETAILED DESIGN & STORMWATER MANAGEMENT REPORT

TOWN OF WASAGA BEACH

CAPES ENGINEERING

355310 BLUE MOUNTAINS-EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0

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1.0 Introduction

CAPES Engineering Ltd. has been retained by Wasaga Riverwoods Homes to prepare a detailed servicing and stormwater management report in support of a Site Plan application for the 0.987 ha currently vacant site located south of River Road West in between Beck Street and Westbury Road in the Town of Wasaga Beach. A portion of the site (0.326 ha) is deemed undevelopable, leaving 0.661 ha of developable land. The site is to be developed as a residential plan of condominium.

The proposed development is a five-storey residential building containing a total of 70 condominium apartment units. It is proposed to service the building with municipal water and sewer from River Road West and a new permanent two-way entrance off River Street West.

The proposed stormwater management plan has been designed to meet the 2021 updated standards and guidelines of the Town of Wasaga Beach, and the 2013 Nottawasaga Valley Conservation Authority (NVCA) Stormwater Technical Guide.

The previous submission for this site was based on a six-story building with 86 apartment units and no amenity area. The purpose of this report is to provide engineering support for the updated Site Plan and advance the previous design concepts to a more detailed design stage and ultimately Site Plan Approval.

Final approvals from Town of Wasaga Beach, NVCA and the County of Simcoe will be required for this development as well as a Permit from the NVCA as the entire site is within an NVCA Regulated Area.

2.0 Background

Development at this site was originally proposed to be completed as Phase 3 of Wasaga Beach Village, a larger subdivision development located south of the site. A Functional Servicing and Stormwater Management Report (FSR) was completed for the site dated January 2013 based on a different site plan design. The property was subsequently purchased by Berkley Homes and additional design work completed between 2014 and 2017. As part of the proposed development prior to Wasaga Riverwoods Homes purchasing the site in 2018, comments were provided by the Town of Wasaga Beach and the Nottawasaga Valley Conservation Authority (NVCA) dated July 29, 2013.

Wasaga Riverwoods Homes proposes a different site configuration from that previously suggested which will provide one building with 70 condominium units. The site will include a 99 space parking lot with the undevelopable part of the site forming a nature reserve. The proposed development will have a single two-way road connection to River Road West and a connection to existing Town of Wasaga Beach walking trails off the south side of the parking area.

The subject lands are legally described as Part of the North Half of Lot 27, Concession 8 in the Town of Wasaga Beach and County of Simcoe. A 6.0 m wide Town owned Block (216) lies along the east side of the site. This Block was previously dedicated to the Town as part of Wasaga Beach Village Phase 1 to be used as a back-up stormwater overland flow route but was never formalized as a drainage channel. The developable portion of the site is bound by River Road West to the north, existing residential to the east and west, and environmental protection lands to the south.

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In March 2013, the NVCA reviewed the Functional Servicing and Stormwater Management Report, Wasaga Beach Village – Phase 3 (prepared by RJ Burnside) and provided comments. The current proposed Wasaga Riverwoods Homes design report has been completed with consideration to the previous reports and comments from both the NVCA and the Town including the updated 2021 Town of Wasaga Beach Engineering Standards.

Following the submission of the Official Plan Amendment and Zoning By-Law Amendment in July 2013, comments were received from the Town, Simcoe County District School Board, Enbridge, Rogers and NVCA and changes were made to the design culminating in the First Detailed Engineering Submission dated November 14th 2014. Comments in response to First Engineering Submission were received February 6, 2015, after which the project went dormant and subject lands were purchased by Sterling Group Corporation. A Second Engineering Submission was submitted addressing comments received February 6, 2015 as well as a June 2017 project consultation with the Town of Wasaga Beach. The project went dormant again in 2017 before being purchased by the current owner, Wasaga Riverwoods Homes in 2018. The first submission design report under Riverwoods Homes was dated July 28, 2020 with the (revised) second submission dated November 2021.

This current (3rd) submission reflects the updated site plan and will discuss the proposed servicing as well as the use of infiltration-based stormwater controls providing the required stormwater quantity and quality control.

3.0 Existing Site Conditions

The 0.661 ha developable portion of the site is currently vacant, and tree covered. The site topography generally falls from the southeast to the northwest of the site, to the existing roadside ditch on the south side of River Road West. Rough internal ditches exist on site, which discharge to an existing ditch inlet catchbasin at the River Road West ditch and outlet to a 1050 by 700 mm arch culvert which crosses underneath River Road West. The culvert that crosses River Road West currently has no slope and water ponds in both the ditch system and in the road crossing culvert. The road crossing culvert invert is located approximately 0.2 m above the bottom of the existing ditch on the south side of River Road West causing flooding in the ditch. Flow on the north side of River Road West flows west towards Beck Street where it enters a storm sewer system which crosses back south under River Road West to discharge west on the south side of the road.

There is an existing drainage ditch that runs along the east side of the site out letting at the existing ditch inlet catchbasin located just south of River Road West. This drainage ditch also splits and runs west to the centre of the site and then north out to the existing roadside ditch on River Road West. The eastern section of this ditch is partially located in the Town owned drainage Block 216, and it conveys flows from the neighbouring Treetop Condominium property and flows from the environmental protection lands to the south. The channel meanders on and off the Town owned property into both the Riverwoods site and the Treetop site.

The only external private property drainage that contributes toward the site is from the neighbouring property to the east, the Treetop Development, contributing runoff from 0.05 ha of their land to the Town owned SWM Block. The Wasaga Riverwoods existing catchment area is equal to 0.661 ha or the

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entire developable site. The exact size of the drainage from the environmental protection lands passing through Block 216 is unclear. Pease refer to **Drawing C1** which shows the existing conditions.

3.1 Geotechnical Information

A geotechnical study was completed by Soil Engineering Ltd. in May 2014 for the site with 4 boreholes located on the development site. Please refer to **Appendix B** for a copy of the geotechnical report.

The site contains a peat or topsoil layer 0.25 to 0.30 m thick that is highly compressible and unstable under loading conditions. Beyond the peat and topsoil layers, fine sand was encountered. The fine sand continued to the maximum investigated depths for all boreholes.

The groundwater level varies from 0.06 m above grade to 0.8 metres (m) below the existing ground surface, as noted in the geotechnical report.

A follow up groundwater investigation was completed by GEI in the spring on 2021 in which an additional 3 drive point piezometers were installed on the site. Three of the original groundwater monitoring wells from 2014 were still present on the site and the elevations for all 6 wells were recorded by GEI in March 2021. The updated results showed groundwater levels between 0.02 m and 0.21 m deep below the existing surface level corresponding to elevations of between 183.70 and 184.59.

These high groundwater levels are shown on the Plan and Profiles, with the supporting documents included in **Appendix B**.

The geotechnical report and the Simcoe County Soils Mapping identifies Tioga Loamy Sand (Group A) soils for the site. The existing site has been hydrologically modelled as a wetland area, due to the high groundwater table, generally flat grades across the site and based on the Beacon Environmental scoped EIS (July 2012) which identifies the majority of the site as wetland.

3.2 Existing Condition Stormwater Modelling

We have utilized PCSWMM 2021 modelling software (Version 7.4.3240, SWMM version 5.0.013-5.1.015) to undertake the analysis of the existing site.

The contributing drainage area for the site was determined by using a combination of aerial imagery from Simcoe County Mapping (https://maps.simcoe.ca/public/), topographic survey of the site and multiple site visits.

We have modelled the site as a single 0.66 ha catchment (“Site”) as there are no external drainage areas which contribute flow onto the property. The majority of the site drains north or north-east towards the existing Town owned drainage block along the east side of the site or towards the existing River Road West roadside ditch. We have routed the flow through the existing DCB in the Town owned SWM block.

Although the site contains mostly fine sand (Type A soil), due to the elevated groundwater found throughout the site, and as per USDA NRCS Part 630 Hydrology National Engineering Handbook, Chapter 7, the hydrologic soil group was altered to group D. As per the NRCS report the high groundwater decreases the availability for percolation of the surface water and sandy soils tend to act more akin to

clayey soils. For this reason, we have selected the parameters for the Green Ampt Method of infiltration for the site for a “Sandy Clay Loam”.

We have utilized the Green Ampt Values as presented in Rawls et al. (1983) and NVCA guidelines and selected the existing condition parameters based on the upper 1.2 m zone of material as per the USDA NRCS Part 630 Hydrology National Engineering Handbook, Chapter 7, Table 7.2.

K_{eff} = 3.0 mm/hr Suction Head = 218.5 mm Initial Deficit (fraction) = 0.32

Additional PCSWMM model input parameters for the Manning’s roughness coefficient (*n*) and depression storage were determined from the US SCS TR-55 (1986) Report and the UNESCO Manual on Drainage Urbanized Areas (1987).

Table 5.9: Manning Roughness Coefficients - Overland Flow

Cover	*n*
Impervious areas	0.013
Woods	
with light underbrush	0.4
with dense underbrush	0.8
Lawns	
Short grass	0.15
Dense grass	0.24
Agriculture Land	0.050-0.170

Ref: Adapted from Soil Conservation Service, Urban Hydrology for Small Watersheds, U.S. Dept. of Agriculture, Soil Conservation Service, Engineering Division, Technical Release 55, June 1986

10.2 Initial Abstraction/Depression Storage

Table 10.2: Initial abstraction/depression storage

Cover	Depth (mm)
Woods	10
Pasture/Meadow	8
Cultivated	7
Lawns	5
Wetland	12/16
Impervious areas	2

Ref: UNESCO, Manual on Drainage in Urbanized Areas, 1987.

We have modelled the existing condition site as a single 0.66 ha catchment (A1) as 100% treed and as such we have calculated an overall Manning’s value of 0.40 and depression storage value of 10 mm.

There is a small external area from the environmental protection lands to the south and a small portion of the Treetop site to the east which currently drain through the existing ditch on the Town owned drainage Block 216.

Based on Mannings open channel flow equation the Block 216 drainage ditch capacity is approximately 0.6 m^3/s during periods with low groundwater conditions and no consideration for freeboard. When the

high groundwater levels are present the capacity is reduced to approximately 0.3 m^3/s. It is difficult to anticipate exact flows as the ditch is not uniform.

There is also an external area upstream (north-east of the site on River Road West) that outlets at the road side ditch on River Road West in front of the site from the existing storm sewer. The flow at the current termination of the existing storm sewer for the 2-year storm event is 0.551 m^3/s, which was provided in the Ainley and Associates C of A Application for the Westbury Road design, provided to us by the Town of Wasaga Beach. The capacity of the 1050 mm diameter concrete storm sewer running at the as-constructed slope of 0.11% is 0.91 m^3/s which is greater than 0.551 m^3/s.

The flow for the 5-year storm event from the upstream drainage area is assumed to result in the existing 1050 mm diameter storm sewer to flow at 80% full. And for the 10 to 100-year storm events the existing 1050 mm diameter storm sewer is assumed to be flowing at full capacity (0.91 m^3/s).

Since the location of measurement for the existing flows is downstream of the Block 216 channel outlet, it is assumed the existing channel flows including flow from the development site would have been included in this maximum flow rate. The remainder of any additional flow from upstream in excess of the 1050 pipe capacity is assumed to flow overland.

The design storms used for the PCSWMM model include the 2 through 100-year, for both the 4-Hr Chicago and the SCS 24-Hr Type II (2021 Town IDF information), Timmins Storm and the 25 mm Chicago (quality storm). The IDF information was obtained from the MTO IDF Curve Look Up Tool and the curve information included in **Appendix C**.

Please refer to **Table 1** below for a summary of the results from the existing condition PCSWMM model.

Table 1 – Existing Condition Modelling Results

Storm Event	Peak Flow Offsite (m^3/s)
24 Hr SCS Type II	
2-year	0.02
5-year	0.05
10-year	0.06
25-year	0.09
50-year	0.11
100-year	0.14
4 Hr Chicago	
2-year	0.00
5-year	0.01
10-year	0.02
25-year	0.03
50-year	0.04
100-year	0.05
25 mm	0.00
Timmins	0.05

The PCSWMM summary output file for the 100-year SCS Type II storm has been included in **Appendix C** for reference. The remaining output files can be provided upon request in either digital or hardcopy format.

Under existing conditions, despite the high groundwater condition much of the runoff will be infiltrated for the more frequent Chicago storms, however, there are higher flows (although still relatively very low) during the Regional event, SCS storms and less frequent Chicago storms.

4.0 Proposed Site Design

It is proposed to develop the existing site to provide a total of 70 condominium units in a five-storey building. The site will also include a 99 space parking lot including 5 barrier free spaces. Access to the existing Town walking trail system will be provided from the south end of the site and a 140 sq. m playground and 257 sq. m outdoor amenity area will be provided in the SW corner of the site.

The site will be accessed from River Road West via a driveway located at the western edge of the property. An updated Traffic Impact Study (TIS) has been completed by JD Engineering in Barrie and has been submitted under separate cover. We understand there are no required upgrades or changes to River Road West based on the TIS.

As requested by the Town the entire frontage of the site will dedicate a 3.0 m wide road widening to the Town and will be upgraded to an Urban Standard including curb and gutter, sidewalk and storm sewer.

We should note that River Road West is to be widened and we have followed the direction of the Town of Wasaga Beach to provide a transition from the existing cross section to the proposed cross section including adjusting the location of the proposed sidewalk and storm sewer.

Due to the high groundwater levels on the site, it is required to raise the site by between 1.5 to 2.0 m. The raised parking lot will be located south of the proposed building and will be surrounded with retaining walls. Please refer to **Appendix H** for the retaining wall design (by others).

It is proposed to construct the entire parking lot and driveway using permeable pavers (Ecoraster Bloxx or approved equivalent). The site has been graded to allow for the suggested clearance of 1 m between the bottom of the storage layer to the groundwater surface. In some cases, this will mean a reduced effective storage layer depth and/or the inclusion of a filtration geotextile to ensure the water quality of the runoff prior to infiltration into the shallow groundwater layer.

The proposed Ecoraster permeable paver system utilizes a geogrid system that replaces some of the traditional parking area structure. The blocks are 0.05 m thick and the proposed gravel storage layer below the pavers will equal 0.48 m for a total depth from finished grade to the bottom of the storage layer of 0.53 m.

The proposed permeable pavers will provide the entirety of the stormwater management controls for the site and the existing 6.0 m Town owner drainage block east of the site will not be altered in any way.

A walkway/trail has been provided along the south edge of the site to connect to the existing Town of Wasaga Beach Trail system in the EP Lands.

Please refer to **Drawing C2** for additional details on the proposed site configuration and to **Appendix I** for the Landscape Plan.

4.1 Sanitary Servicing

The proposed sanitary servicing will utilize the existing 250mm sanitary sewer stub currently located at property line. A new sanitary manhole is proposed at property line with a 200mm sewer servicing the building.

As per the Town of Wasaga Beach Engineering Standards, the following design flows were used for the calculation of the sanitary sewer capacity:

- Average Daily per capita Flow- 350 L/cap/day
- Extraneous Flow Allowance - 0.28 L/sec/gross hectare
- 2.6 people per unit
- Minimum velocity at peak flow of 0.40 m/s in sanitary sewers

The total anticipated peak sewage flow using Harmon peaking factor from Wasaga Riverwoods site is therefore 3.35 L/s.

Both the proposed sewer from the building to proposed MH 4 and the existing sewer from proposed MH 4 to existing MH 156A have sufficient capacity to convey the anticipated peak flow. The Sanitary Sewer Design Sheet is included in **Appendix D**. The existing 250 mm dia. stub was installed at 0.31% and the actual flow velocity just meets the minimum required by the Town at 0.43 m/s.

4.2 Water Supply

It is proposed to service Wasaga Riverwoods development through the use of the existing 150 mm diameter stub which will need to be extended approximately 4.32 m to the new property line. The Ontario Building Code was utilized to determine both domestic and fire supply flow rates for the building. Please refer to **Appendix E** for the water demand calculations.

The proposed 70-unit building will be comprised of 23 two-bedroom units and 37 one bedroom units.

Fixture units were calculated for 14 one-bedroom units to include a kitchen sink, dishwasher, washing machine and a 3-piece bathroom, 33 one-bedroom units plus a den with kitchen sink, dishwasher, washing machine and two 3-piece bathrooms. The 23 two-bedroom units will have a kitchen sink, dishwasher, washing machine and two 3-piece bathrooms.

The total number of water using fixture units in the building is therefore equal to:

- flush toilet = 1.5 fixture units x 126 = 189 fixture units
- wash sink = 1.4 fixture units x 196 = 274.4 fixture units
- bathtub/shower = 1.4 fixture units x 126 = 176.4 fixture units
- dishwasher = 1.4 fixture units x 70 = 98 fixture units
- clothes washer = 1.4 fixture units x 70 = 98 fixture units

Total number of fixture units is equal to 835.8

In total, the peak domestic demand is 0.35 L/s. The peak fire supply flow rate is 150 L/s resulting in a combined domestic and fire supply flow rate of 150.35 L/s.

No additional fire hydrants are required due to the proximity to existing fire hydrants located on River Road West. The existing street hydrant located west of the site is 60 m from the front entrance of the building. In addition, the existing street hydrant east of the site is 95 m from the front entrance of the building. Therefore, the entirety of the roadside face of the building is located within 90 m of a hydrant.

Please refer to **Drawing C4** for the water servicing and connection details.

4.3 Stormwater Management

4.3.1 Approval Criteria

The site requires approval from both the Town and the NVCA for the stormwater management design. The following is a list of the approval criteria the site must meet.

- provide quantity control to match predevelopment runoff for the 2 to 100 year storm events.
- Provide quality controls to an enhanced level of protection as defined by the MECP, specifically the removal of 80% Total Suspended Solids over a long-term annual basis
- Removal of 100% of the post development total phosphorous (TP) and best efforts towards an additional 20% TP removal below existing condition levels.
- Safe conveyance of the Regional storm event
- Use Low Impact Design (LID) measures where possible
- Best efforts towards a site water balance

4.3.2 Proposed Stormwater Management Design

The native sandy soils of the site typically allow for Low Impact Development (LID) infiltration practices provided 1.0 m of separation can be achieved between the bottom of the LID and the seasonal high groundwater. As the site is being raised by between 1.5 to 2.0 m it is proposed to import suitable similar sandy material to allow for more favorable infiltration conditions. A filtration geotextile is also proposed where a full 1.0 m of separation from the groundwater cannot be achieved to ensure water quality of the infiltrated runoff. In addition, a reduction in the effective thickness of the stone storage layer within the model has been implemented to only account for the stone that is 1.0 m above the groundwater level.

As in the existing condition model we have utilized the Green Ampt Values as presented in Rawls et al. (1983) and NVCA guidelines and selected the proposed condition parameters based on importing 1.5 to 2.0 m of sandy material. We have assumed the imported sand would have at least the same infiltration capacity as the native material and have selected the following green ampt parameters based on the geotechnical information for a “Sand”

K_{eff} = 117.8 mm/hr Suction Head = 49.02 mm Initial Deficit (fraction) = 0.375

As per NVCA guidelines we have assumed a 2.5x reduction factor for any subsurface infiltration which would equate to a K_{eff} of 47.12 mm/hr.

All pervious (non-permeable paver) areas on the site will be modelled as urban lawn with an n value of 0.15 and a depression storage of 5 mm.

The permeable paver area is assumed to be 100% impervious for the PCSWMM subcatchment parameters as the model LID editor is used which accounts for the permeable nature of the LID. The following permeable paver input parameters are used in the model:

- Berm Height – 150 mm (height of the bounding concrete curb)
- Surface Roughness – 0.013

- Average Surface Slope of the Permeable Pavers – 1%
- Paver Thickness – 50 mm
- Impervious Surface Fraction – 0.9 (Paver layer is 90% impervious, 10% open space)
- Surface Permeability – 100 mm/hr
- Storage layer Thickness– 100 mm (actual is 450 mm, assumed only 100 mm will function)
- Void ratio of storage layer – 0.66
- Seepage rate – 47.12 mm/hr (seepage from the storage layer to underlying soil)

Runoff from the building roof, concrete walkways and the parking lot itself will be directed to permeable pavers for infiltration. The very small areas of the site around the perimeter which can't be directed to the permeable pavers will runoff directly to adjacent lands (as per existing) or directly to the River Road West ditch.

The Town owned SWM conveyance channel located in the 6 m Block 216 at the east side the site will not be altered, however any overflow from the eastern portion of the parking area will discharge into the block as per existing conditions.

The existing 1050 mm diameter storm sewer running along the frontage of the site will be removed back to existing MH1 and replaced in a new location that better fits with the River Road West cross section. No ditches will remain along the frontage of the property. The new urban road cross section will tie into the existing ditch at approximately the western property limit.

The proposed access driveway is located in close proximity to the western property limit, and this places the driveway beyond the outlet for the 1050 mm storm sewer. A 450 mm diameter storm sewer has been included under the driveway to convey flow east from the existing ditch to the west. We are lacking external stormwater flow limit calculations on this pipe, however, the existing culvert immediately upstream is 400 mm diameter. It is proposed to install a 450 mm diameter storm sewer to match the culvert immediately upstream and to achieve the minimum allowable size of 400 mm as per the Town of Wasaga Beach Engineering Standards. The 450 mm pipe is selected instead of 400 mm to use a standard pipe size.

The site requires long structural retaining walls around the perimeter of the site, which require drains through them to release any water pressure behind the wall. These drains are directed south or east to Town owned lands (EP and the SWM block), west into EP lands owned by the developer or will be directed north to connect into the storm sewer at the frontage of the site, as there are no other locations available to discharge to.

4.3.3 Proposed Stormwater Management Model

In the post-development model, we have divided the site into 6 small catchment areas as follows

A1 – 0.341 ha subcatchment consisting of the western part of the parking area, western part of the building roof and the amenity and park area in the southwest corner of the site. This catchment will be 85% impervious consisting of 18.7% roof, 60.9% permeable pavers with the remainder being concrete walkway (5.4%). The pervious areas will be primarily grass around the building or within the

park/outdoor amenity space. This subcatchment will be graded to drain west towards the entrance to River Road West, however it is not expected that there will be any surface flow due to the permeable paving system. Any overflow would be directed to the storm sewer system, either the ditch on the west side of the entrance or the DCB on the east side of the entrance.

A2 – 0.237 ha subcatchment consisting of the eastern part of the parking area and building. This catchment will consist of 28.7% building roof and 69.3% permeable pavers with the remainder being concrete walkway/pad (2.0%). This area will be graded to drain east towards the existing Town owned Block 216 (as per the existing condition).

A3– 0.008 ha – Thin strip of grassed area along the NW edge of the site between the retaining wall and the property line. It is assumed this area will vegetated but not maintained (mowed) and will be returned to a natural state. We have assumed an n value of 0.24 and depression storage value of 8 mm. Any runoff will sheet flow to the west of the site as per existing conditions.

A4 – 0.018 ha – Thin strip of grassed area along the SW and S edge of the site between the retaining wall and the property line. It is assumed this area will vegetated but not maintained (mowed) and will be returned to a natural state. We have assumed an n value of 0.24 and depression storage value of 8 mm. Any runoff will sheet flow to the south of the site into the existing forested area.

A5 – 0.032 ha – Thin strip of grassed area along the E edge of the site between the retaining wall and the property line and on the east side of the building. It is assumed this area will vegetated and partially maintained (mowed) with some of it being returned to a natural state. As this area will be filled to accommodate the building grading, we have assumed the sandier soil infiltration parameters will apply. We have assumed an n value of 0.15 and depression storage value of 5 mm to reflect the majority being maintained lawn. Any runoff will sheet flow to the east of the site into the existing Town owned SWM Block 216.

A6 – 0.0058 ha – Thin strip of grassed area along the N edge of the site between the building and the property line. It is assumed this area will vegetated and maintained (mowed) and will be filled with sandy material. Any runoff will sheet flow north towards River Road West.

Using PCSWMM, the peak flows for the SCS-24hr and Chicago design storms were checked for the 2-year through 100-year storm events. Storm flows for pre- and post-development are summarized in **Table 2** below.

The permeable pavers have been designed to ensure that post development flows are maintained below, or as close to, existing flows as possible. As shown in **Table 2**, the flows are so small that it was necessary to show to the third decimal place in order to clearly demonstrate offsite flows.

Refer to **Drawing 43** and **C7** for the drainage areas and proposed storm sewer layout in the Town ROW. Also, refer to **Appendix F** for the proposed PCSWMM modelling.

Under the proposed conditions, since there is a significant amount of fill required to be placed on the site. The proposed fill will be required to demonstrate a minimum hydraulic conductivity of

117.8 mm/hr. This will ensure the majority of the runoff to be infiltrated through the permeable pavement and the fill below it.

Table 2 – PCSWMM Post Development Peak Runoff Summary

Storm Event	Existing Condition Peak Flow (m^3/s)	Offsite South (m^3/s)	Offsite West (m^3/s)	Offsite North (m^3/s)	Total Peak Flow Offsite (m^3/s)
24 Hr - SCS Type II					
2-year	0.02	0.00	0.00	0.00	0.00
5-year	0.05	0.01	0.00	0.00	0.01
10-year	0.06	0.01	0.00	0.00	0.01
25-year	0.09	0.01	0.00	0.00	0.01
50-year	0.11	0.01	0.00	0.00	0.01
100-year	0.14	0.01	0.00	0.00	0.01
4 Hr - Chicago					
2-year	0.00	0.00	0.00	0.00	0.00
5-year	0.01	0.00	0.00	0.00	0.00
10-year	0.02	0.00	0.00	0.00	0.00
25-year	0.03	0.01	0.00	0.00	0.01
50-year	0.04	0.01	0.00	0.00	0.01
100-year	0.05				
25 mm	0.00	0.00	0.00	0.00	0.00
Timmins	0.05	0.00	0.00	0.00	0.00

Please refer to **Appendix F** for a summary of the post-development 24 hr 100-year SCS storm modelling results. Additional storm events and the full digital model can be provided upon request.

There is a reduction in peak runoff from the site for all storm events including the Regional Event. The permeable pavers, with even at a very conservatively modelled 100 mm storage layer provides sufficient infiltration capacity to eliminate all runoff from the impervious areas. There is no runoff to the west towards private property and only a small amount of runoff south to the existing wooded area, which is far below the existing condition. There is also no runoff from the site into the Town owned SWM Block 216 and therefore the flow into the storm system on River Road West will be reduced compared to the existing condition.

4.3.4 Stormwater Quality Control

To achieve the desired stormwater quality criteria, the site needs to achieve an "Enhanced" level of protection. An enhanced level of protection, as defined by the MECP, requires 80% long term suspended solid removal.

Stormwater quality design on the site is based on a 4-hour Chicago Distribution 25 mm storm event. The proposed stormwater quality controls are to provide minimum 80% removal of total suspended solids (TSS). Treatment is primarily provided through infiltration of water in the permeable pavers.

The permeable pavers will achieve full infiltration, and 100% TSS removal, for the area they cover (0.4180 ha) as well as the runoff from the building (0.137 ha) and the pervious contributing areas.

There is no runoff from the site in the 25 mm storm event and therefore the site achieves 100% TSS removal and exceeds the MECP Enhanced level criteria. Please refer to the output for the 25 mm storm in **Appendix F**.

The site is also required to provide 100% TP removal as per the NVCA guidelines. As the site has no runoff in the quality control storm the site will achieve a minimum of 100% TP removal as required by the NVCA.

4.3.5 Water Balance

We have completed a Thornthwaite Water Balance for the site and have included the information in **Appendix J**. This analysis does not incorporate the proposed LID measures which is discussed below.

In the existing condition analysis (assuming sandy soils and mature forest) the 0.66 ha site produces 449 m^3/year runoff and 1796 m^3/year of infiltration.

In the post development condition and assuming the permeable pavers would be 100% impervious the site would generate 4,422 m^3/year of runoff and would only contribute 189 m^3/year towards infiltration.

With the permeable pavers infiltrating all of the of the runoff from the site we believe a full water balance is achieved. There is no runoff from the site in the 25 mm storm which accounts for 90-95% of the rainfall in a year and in this case the site infiltrates all runoff up to and including the 5-year storm event.

We believe therefore that the site achieves a full water balance.

4.4 Erosion and Sediment Controls

The use of silt fence, as per the NVCA and Town of Wasaga Beach standards, is recommended around the perimeter of the site. The silt fence shall be installed prior to, and remain for, the duration of construction. A mud mat shall be installed and maintained as per the Town of Wasaga Beach standards. There shall be no mud or debris transfer onto River Road West for the duration of the construction.

Special care shall be taken of the permeable pavers during construction to ensure proper function after construction is complete. The pavers once installed shall not be used for storage of materials and effort shall be taken to keep the pavers clean and free of sediment during construction. We recommend sediment or silt booms be placed on the surface of the parking area around the perimeter of the

permeable pavers during construction and/or the pavers be cleaned using a vacuum truck following construction. Additional recommendations including maintenance measures for the site are included in the site Operation and Maintenance Manual which has been submitted under separate cover.

We recommend the site be constructed in stages in order to minimize the impact to the proposed permeable paver system. It is anticipated that the following sequence will be undertaken:

- Installation of a temporary entrance and mud mat from River Road West
- Removal of the site trees as per the tree removal/preservation plan
- Installation of the perimeter erosion and sediment control fencing
- Installation of the site perimeter retaining walls and building foundation
- Installation of the walkway trail south of the site
- Backfill of the site with approved material to below the permeable paver stone storage level
- Installation of the River Road West servicing
- Construction of the proposed building
- Installation of the stone storage layer for the permeable paving system with removal of contaminated sand layer as required under the supervision of a geotechnical engineer
- Installation of concrete barrier curb and walkways
- Installation of the permeable paving surface system

The stone storage layer and permeable pavers should not be used for storage of materials and the contractor should limit access to finished permeable paver areas as much as possible with construction equipment.

Sediment and erosion controls are summarized and illustrated on **Drawing C8 & C9**.

4.5 Utility Design

It is proposed to service the proposed development with new connections off the utilities available on River Road West. The existing utility poles are located on the northern side of River Road West.

A lighting plan for the proposed development has been prepared by Ziyutec and provided to us by AND Architecture. The updated lighting plan is included in **Appendix G**.

Detailed design and coordination of utilities is being completed by others, but a composite utility plan has been prepared (**Drawing C10**) based on the information provided by AND and Northstar Engineering.

5.0 Conclusions

It is proposed to develop the site located south of River Road West in Wasaga Beach to provide 70 apartment style condominium units in a five storey building. The site plan also includes a 99 space parking area, nature reserve, outdoor amenity and play area.

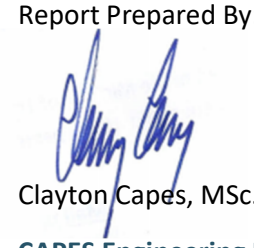
The proposed development will be serviced from River Road West for water, sanitary sewer and utilities. Existing water and sanitary services currently extend to property line and these will be extended to the proposed building. Utility services are not currently provided for the site and new connections will be required.

Stormwater management on the site will be provided through the use of Ecoraster Bloxx (or approved equivalent) permeable pavers. Quality and quantity control including Phosphorous reduction and a water balance have been achieved on the site through the use of the permeable pavers.

The existing and adjacent Town owned SWM Block 216 will not be altered under the current design.

This report is intended to provide support for the proposed Site Plan Agreement and demonstrates that the development on the site is feasible from an engineering perspective. We believe that this report demonstrates the site can be constructed to meet the Town of Wasaga Beach requirements.

Report Prepared By:



Clayton Capes, MSc. P.Eng.

CAPES Engineering Ltd.

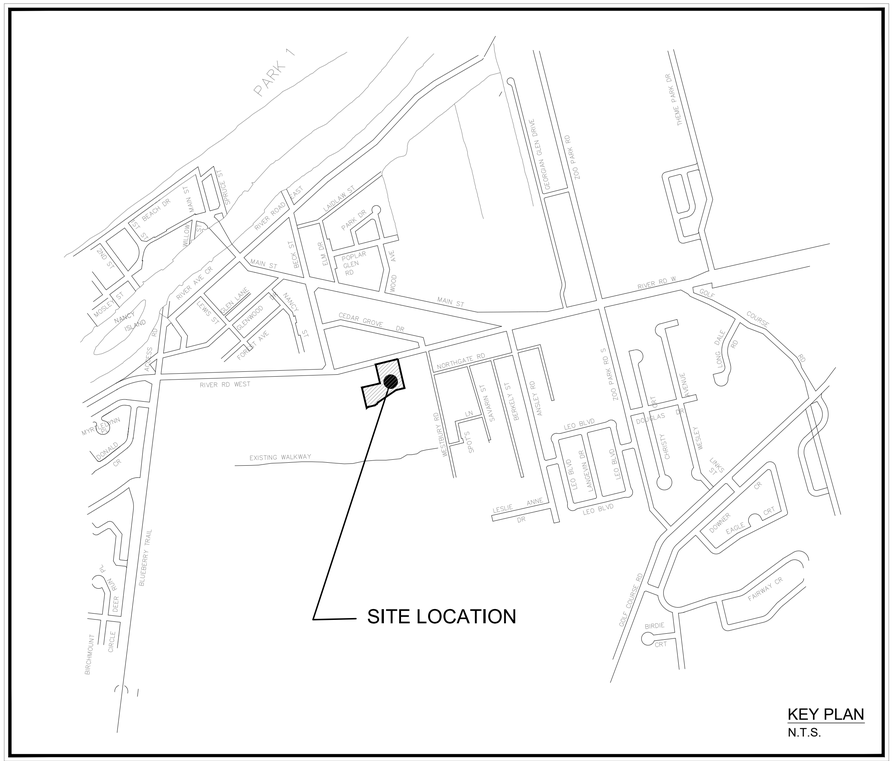
CAPES Engineering
355310 Blue Mountains-Euphrasia Townline
Clarksburg, ON
N0H 1J0

Drawings

WASAGA RIVERWOODS HOMES

WASAGA RIVERWOODS

DRAWING INDEX



KEY PLAN
N.T.S.

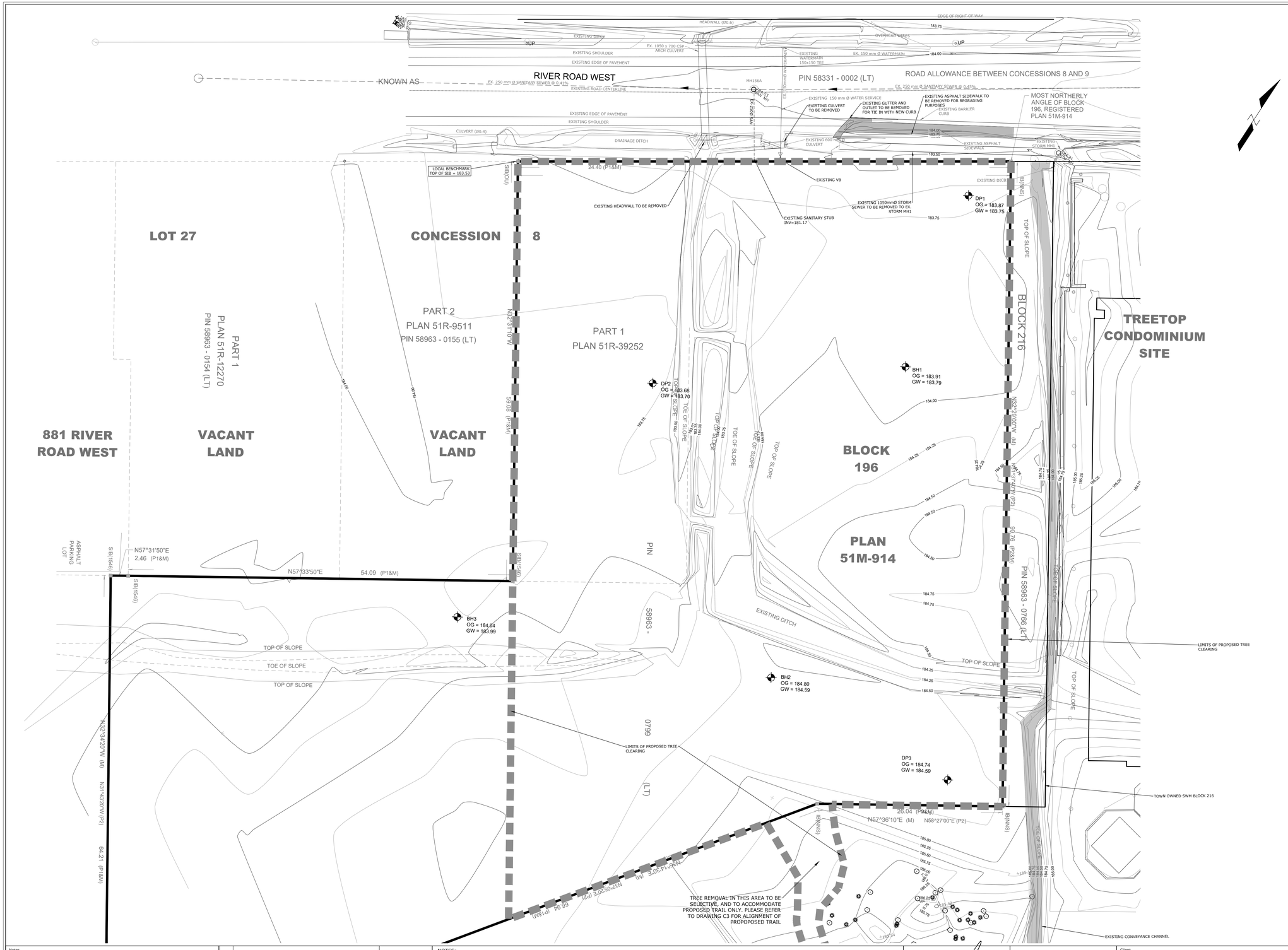
WASAGA RIVERWOODS HOMES
30 FULTON WAY, UNIT 8
RICHMOND HILL, ON
L4B 1E6

Project No. 2018-012

REVISED FOR APPROVALS - 22/09/21

CAPES ENGINEERING

WASAGA RIVERWOODS HOMES - RIVER ROAD WEST, WASAGA BEACH
REVISED FOR APPROVALS - SEPTEMBER 21, 2022



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1	ISSUED FOR APPROVALS	20/08/10
2	REVISED FOR APPROVALS	21/11/16
3	REVISED FOR APPROVALS	22/03/17
4	REVISED FOR APPROVALS	22/09/21

NOTES:
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BENCHMARKS
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO BENCHMARK NO. 00119711U191, HAVING A ELEVATION 187.747 PER CGVD28 METRES LOCATED AT Mr. ca ANDERSON RESIDENCE, WHITE FRAME HOUSE ON NORTHWEST SIDE OF HIGHWAY 92, AT INTERSECTION WITH ZOO PARK ROAD, 1.6km NORTHEAST OF BRIDGE OVER NOTTAWASAGA RIVER, TABLET IN SOUTHWEST CONCRETE FOUNDATION, 3.08m NORTHWEST OF SOUTHWEST CORNER, 51cm NORTHWEST OF A BASEMENT WINDOW AND 39cm BELOW STUCCO SIDING

LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

LICENSED PROFESSIONAL ENGINEER
C. CAPES
100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

Client
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WASAGA RIVERWOODS

EXISTING CONDITIONS & REMOVALS

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C1
Project No.		Rev No.	
2018-012		4	
Scale	0 5.0 10.0 15.0m		
1:250			

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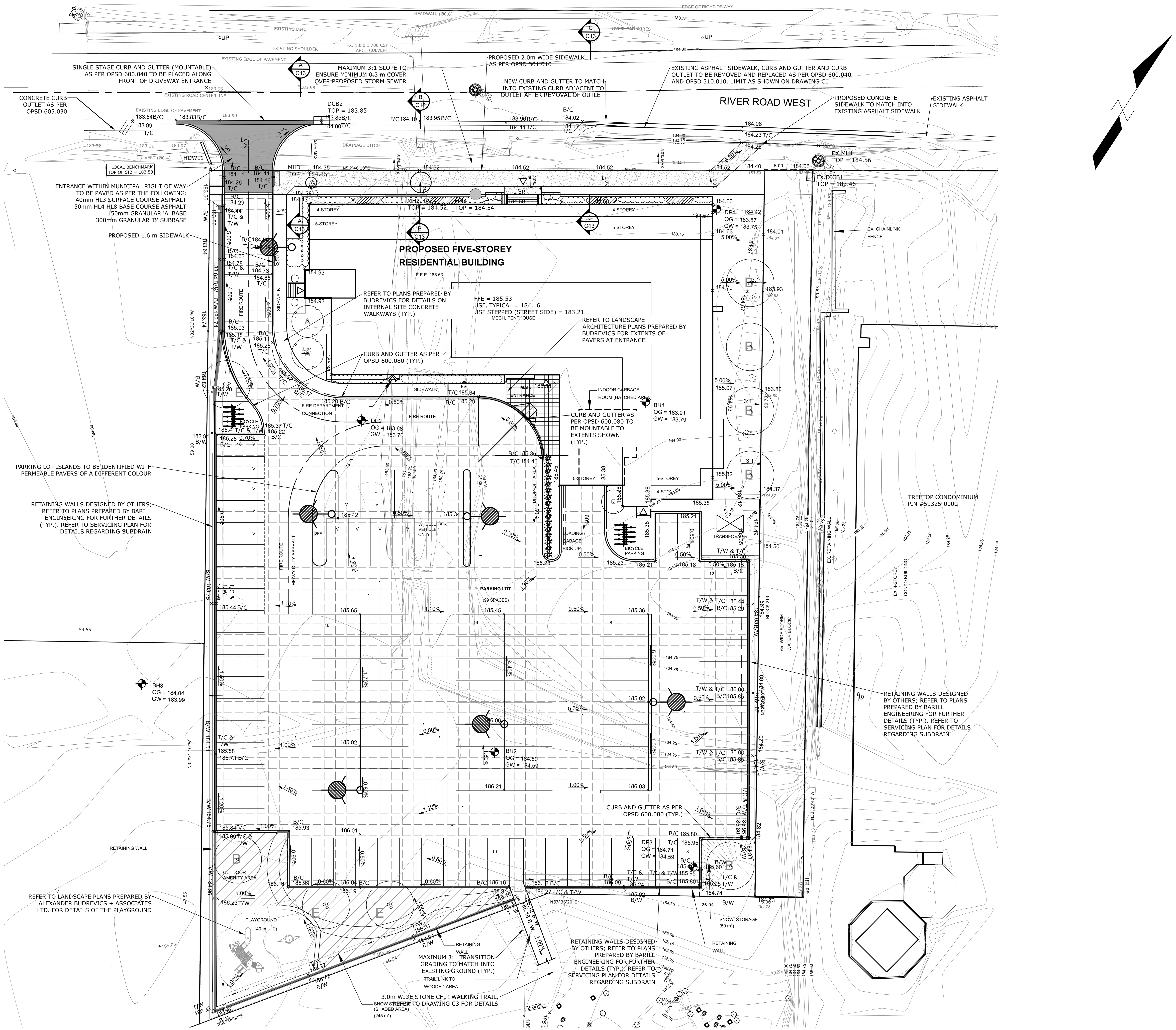

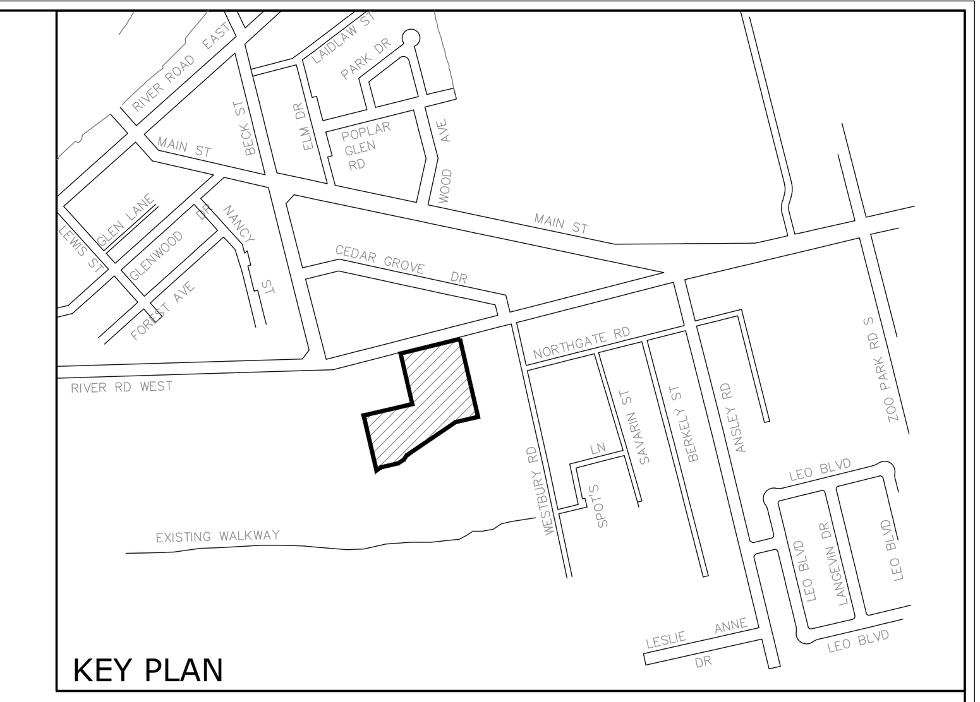

LEGEND

- 221.21 PROPOSED ELEVATION
- 221.21 EXISTING ELEVATION
- 221.21 T/C PROPOSED TOP OF CURB
- 221.21 B/C PROPOSED BOTTOM OF CURB
- 221.21 T/W PROPOSED TOP OF RETAINING WALL
- 221.21 B/W PROPOSED BOTTOM OF RETAINING WALL
- 1.00% PROPOSED SLOPE
- BOREHOLE LOCATION
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SANITARY & STORM MANHOLE
- PERMEABLE PAVER SURFACE, REFER TO DETAILS
- LUMINAIRE ON STEEL POLE

BUILDING DETAILS

FFE = 185.53
USF, TYPICAL = 184.16
USF STEPPED (STREET SIDE) = 183.21

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SEPT. 21, 2022
PROVINCE OF ONTARIO

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TEL: 705-994-4818

WASAGA RIVERWOODS

GRADING PLAN (1 OF 2)

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C2
Project No. 2018-012		Rev No. 4	
Scale 1:250	0 5.0 10.0 15.0m		

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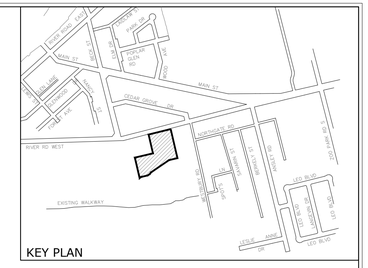
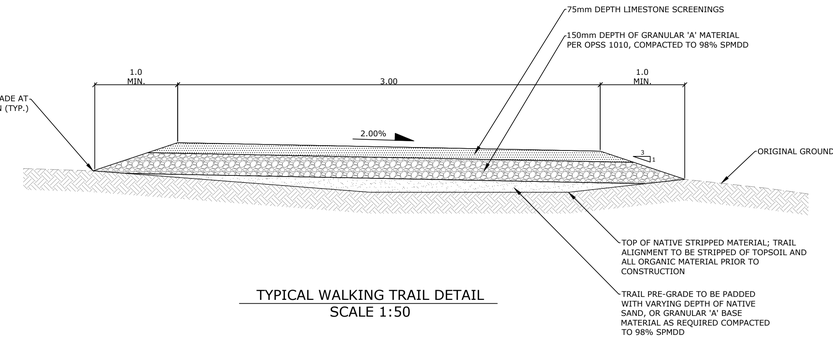


LEGEND

221.21	PROPOSED ELEVATION
221.21	EXISTING ELEVATION
221.21 T/C	PROPOSED TOP OF CURB
221.21 B/C	PROPOSED BOTTOM OF CURB
221.21 T/W	PROPOSED TOP OF RETAINING WALL
221.21 B/W	PROPOSED BOTTOM OF RETAINING WALL
1.00%	PROPOSED SLOPE
	BOREHOLE LOCATION
	MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
	SANITARY & STORM MANHOLE
	PERMEABLE PAVER SURFACE, REFER TO DETAILS
	LUMINAIRE ON STEEL POLE

BUILDING DETAILS

FFE = 185.53
USF, TYPICAL = 184.16
USF STEPPED (STREET SIDE) = 183.21



TYPICAL WALKING TRAIL DETAIL
SCALE 1:50

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SEPT. 21, 2022
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CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

WASAGA RIVERWOODS

GRADING PLAN (2 OF 2)

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C3
Project No. 2018-012		Rev No. 4	
Scale 1:250	0 5.0 10.0 15.0m		

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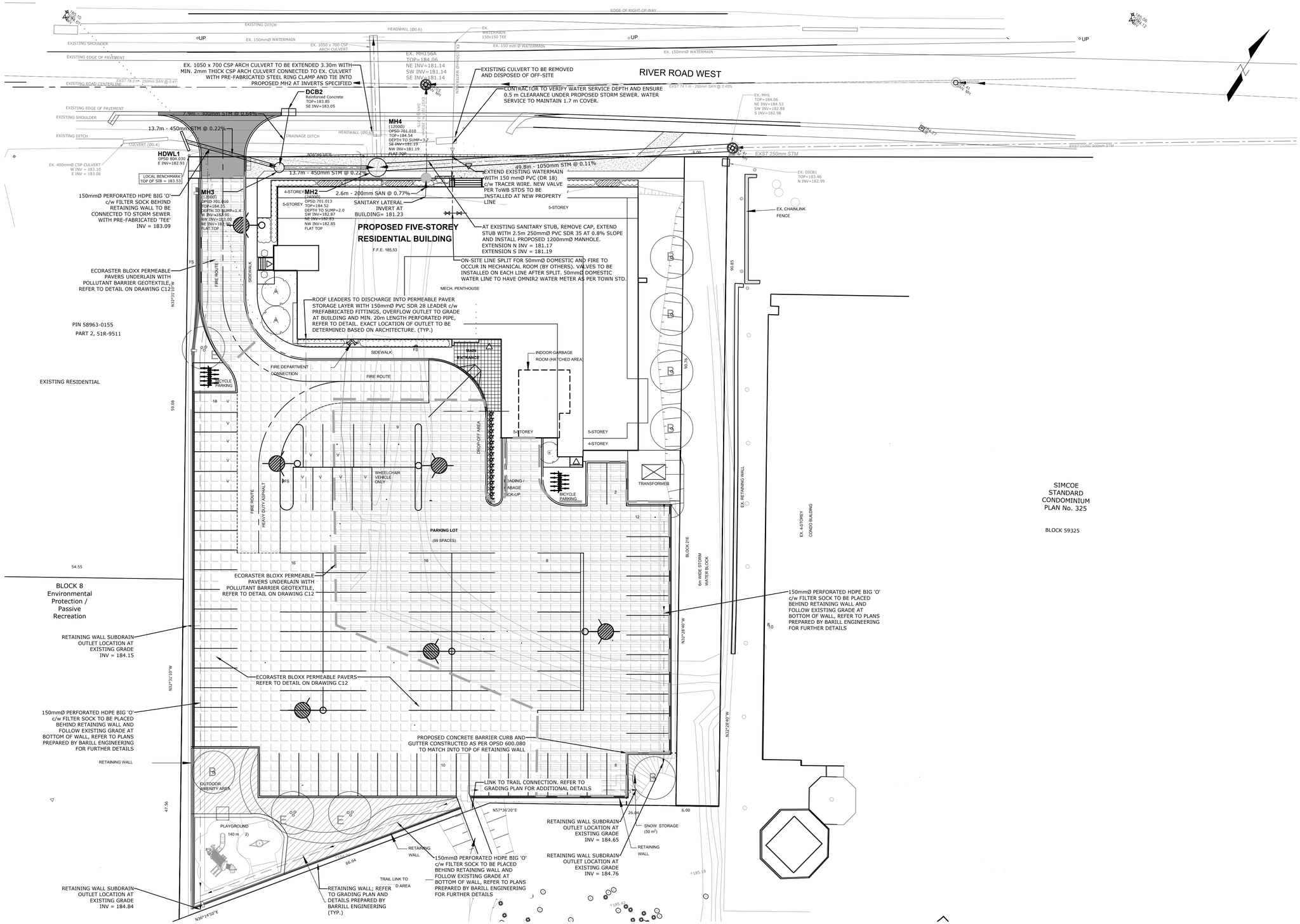

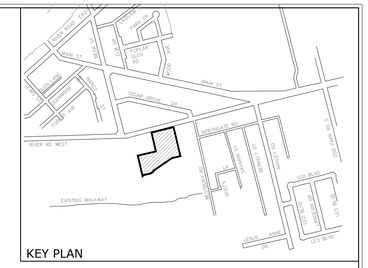

LEGEND

- CURB DEPRESSION
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SANITARY SEWER
- WATERMAIN
- HYDRANT & VALVE
- WATER VALVE
- TRANSFORMER
- UTILITY PEDESTAL
- PERMEABLE PAVER SURFACE, REFER TO DETAILS
- PERMEABLE PAVERS UNDERLAIN WITH POLLUTANT BARRIER GEOTEXTILE, REFER TO DETAILS
- STEEL POLE / LUMINAIRE — LUMINAIRE ON STEEL POLE
- UTILITY POLE
- SIGN

BUILDING DETAILS

FFE = 185.53
USF, TYPICAL = 184.16
USF STEPPED (STREET SIDE) = 183.21

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LOCAL BENCHMARK:
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LICENSED PROFESSIONAL ENGINEER
C. CAPES
100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

Client
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30 FULTON WAY, UNIT 8
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CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

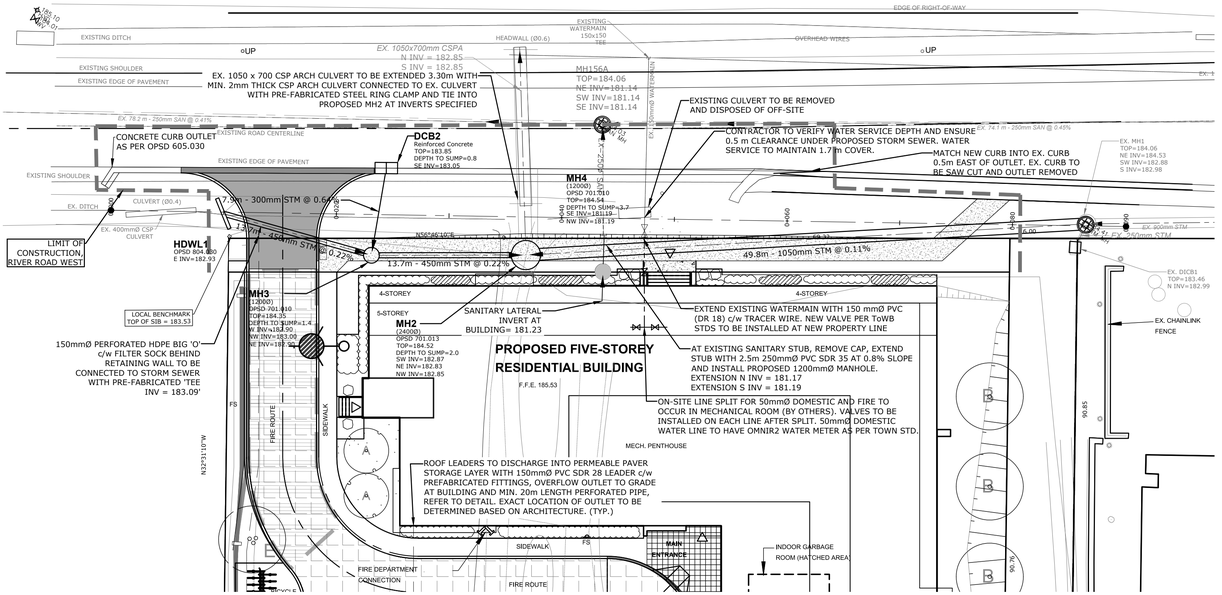
WASAGA RIVERWOODS

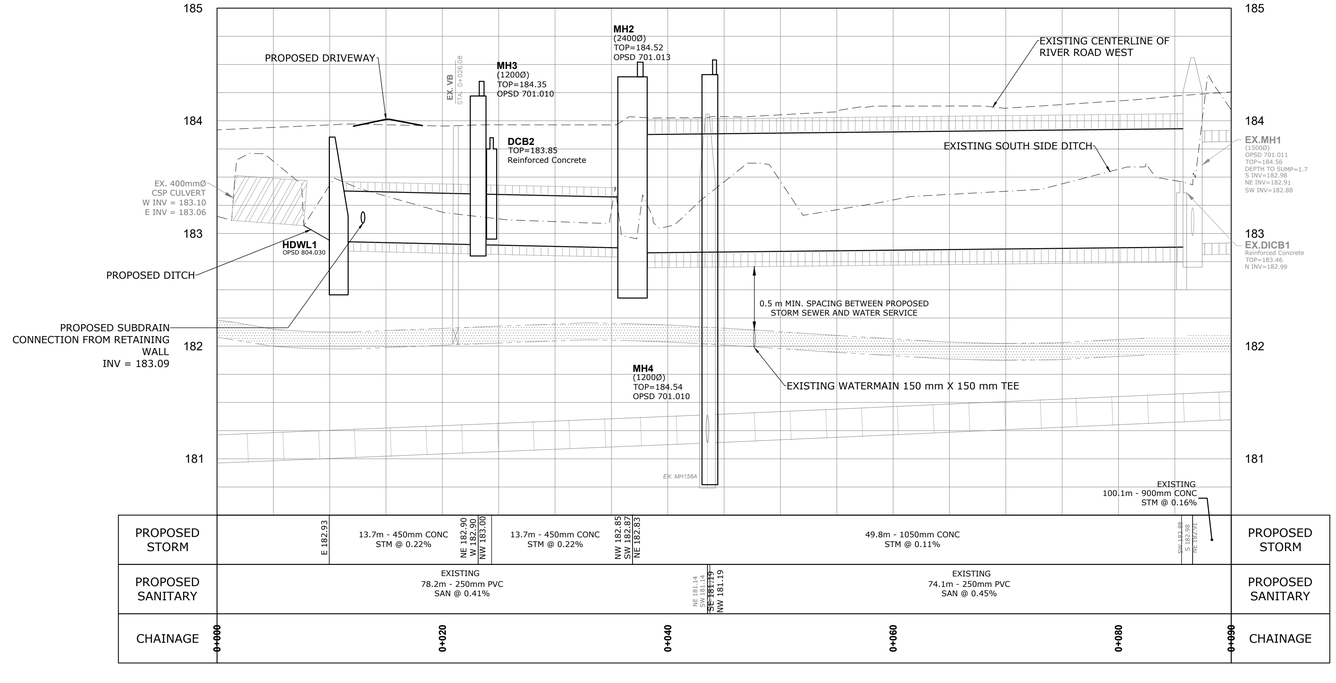
SITE SERVICING PLAN

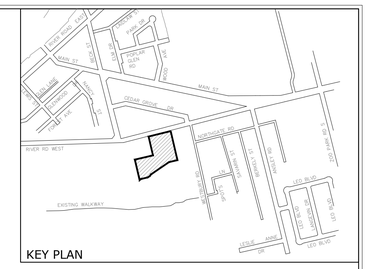
Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C4
Project No. 2018-012		Rev No. 4	
Scale 1:250	0 5.0 10.0 15.0m		

File: C:\CAES\Capes Engineering Dropbox\Projects\CAD\2018-012 Wasaga Riverwoods\Drawings\01 Production\Dwgs\2018-012 Site Servicing Plan.dwg Date Plotted: September 21, 2022 - 1:29 PM

RIVER ROAD WEST







LEGEND

× 221.21	PROPOSED ELEVATION
× 221.21	EXISTING ELEVATION
	MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
	SANITARY & STORM MANHOLE

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LICENSED PROFESSIONAL ENGINEER
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100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

Client
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L4B 1E6

CAPES ENGINEERING
355310 BLUE MOUNTAINS - EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

WASAGA RIVERWOODS

PLAN AND PROFILE
RIVER ROAD WEST
STA. 0+000 - STA. 0+090

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C5
Project No.		Rev No.	
2018-012		4	
Scale	0 5.0 10.0 15.0m		
1:250			

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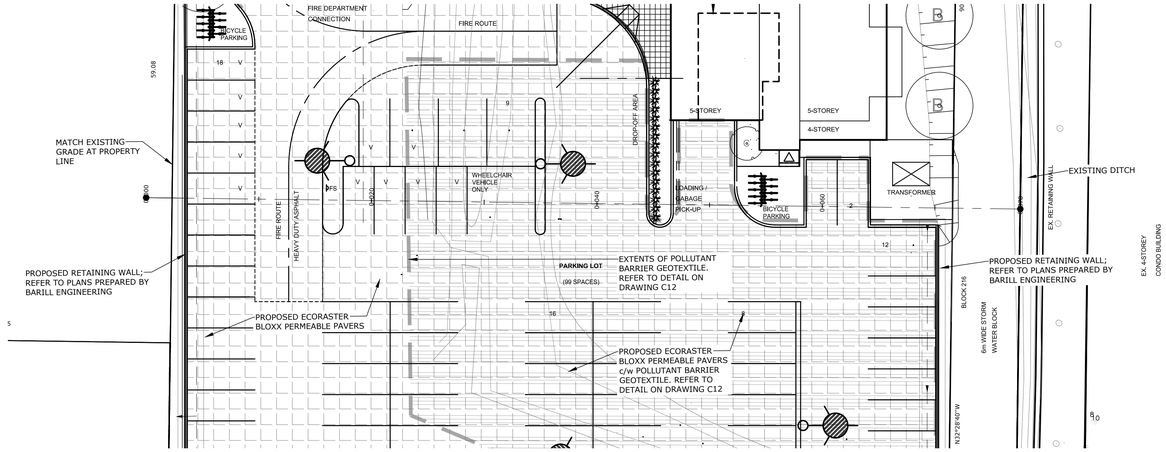
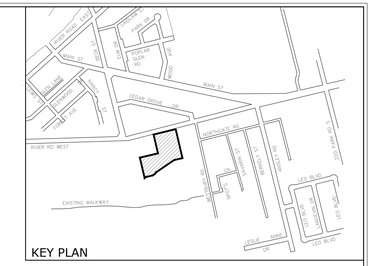
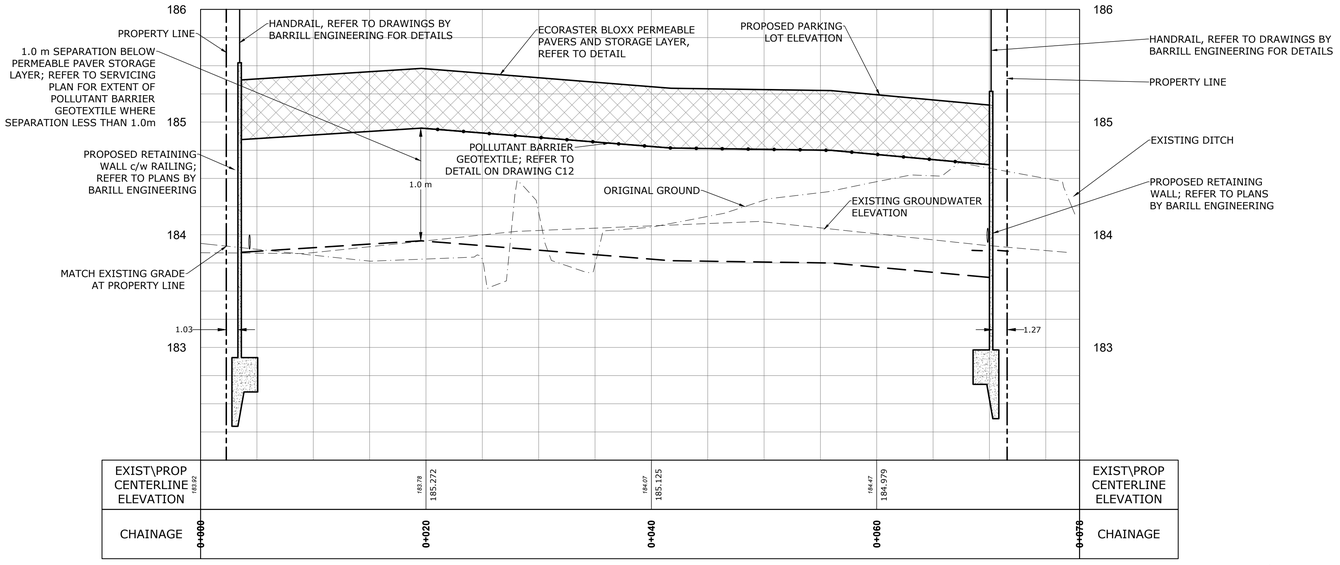




LEGEND

- 221.21 — PROPOSED ELEVATION
- 221.21 — EXISTING ELEVATION
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SANITARY & STORM MANHOLE



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LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO
C/CAPES
100056104
SEPT. 21, 2022

Client
WASAGA RIVERWOODS HOMES
30 FULTON WAY, UNIT 8
RICHMOND HILL, ON
L4B 1E6

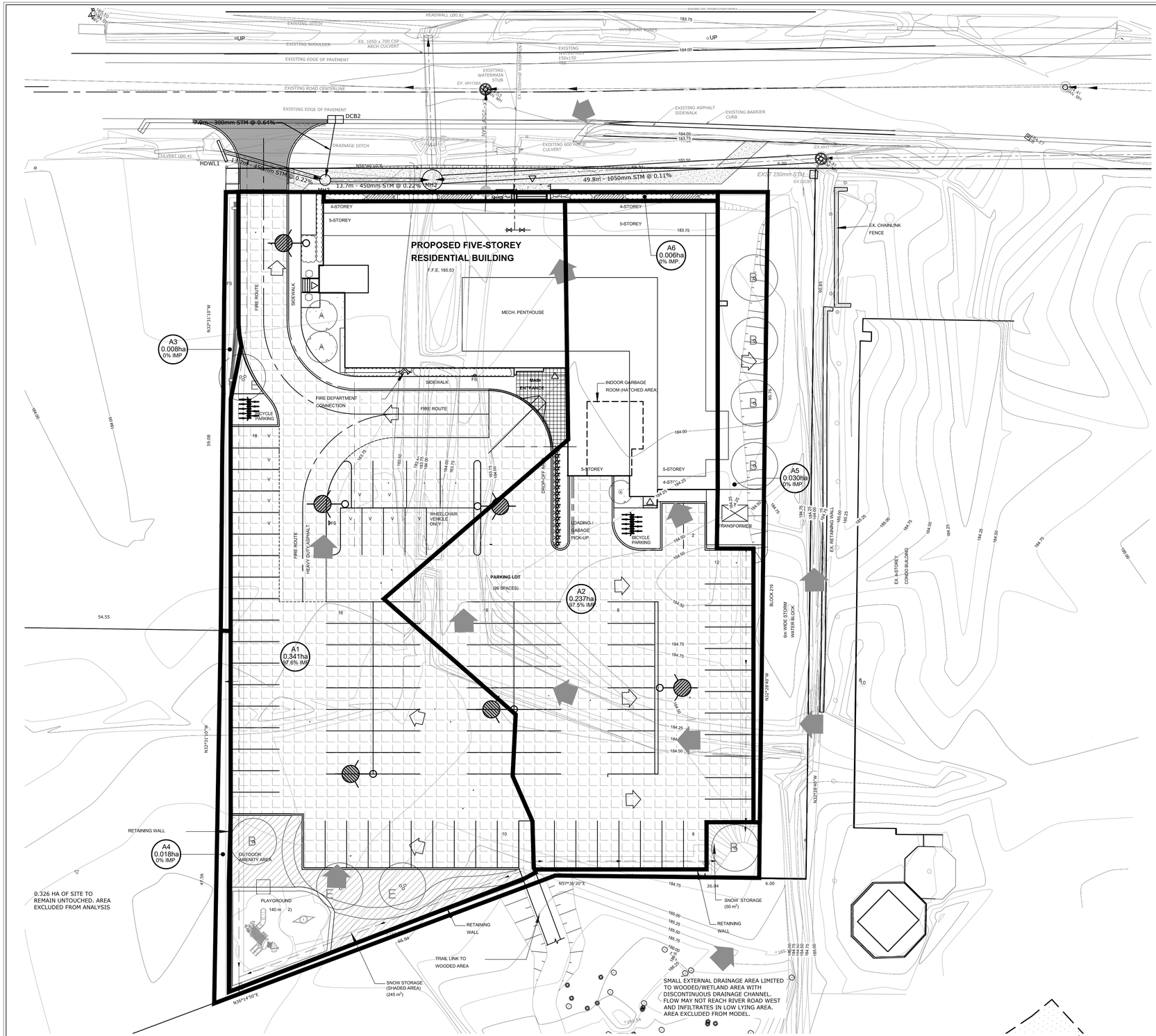
CAPES ENGINEERING
355310 BLUE MOUNTAINS - EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

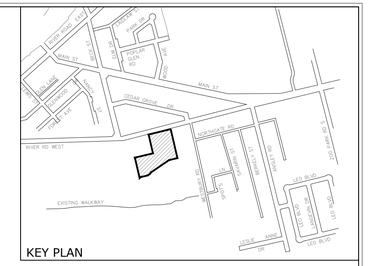
WASAGA RIVERWOODS

PLAN AND PROFILE
PARKING LOT
STA. 0+000 - STA. 0+075

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C6
Project No.		Rev No.	
2018-012		4	
Scale	0 5.0 10.0 15.0m		
1:250			

File: C:\SC\Capes Engineering Dropbox\Projects\2018\2018-012 Wasaga Riverwoods\Drawings\01 Production\Dwg\2018-012 PROFILES.dwg Date Plotted: September 22, 2022 - 1:34 PM





LEGEND

- STORM SEWER/MANHOLE
- STORM SEWER TRIBUTARY BOUNDARY
- EXISTING OVERLAND FLOW ROUTE
- PROPOSED OVERLAND FLOW DIRECTION
- 0.40 — DRAINAGE AREA IN HECTARES
- PERMEABLE PAVER SURFACE, REFER TO DETAILS

Notes
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No	Revision	Date
1	ISSUED FOR APPROVALS	20/08/10
2	REVISED FOR APPROVALS	21/11/16
3	REVISED FOR APPROVALS	22/03/17
4	REVISED FOR APPROVALS	22/09/21

NOTES:
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LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

LICENSED PROFESSIONAL ENGINEER
C. CAPES
100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

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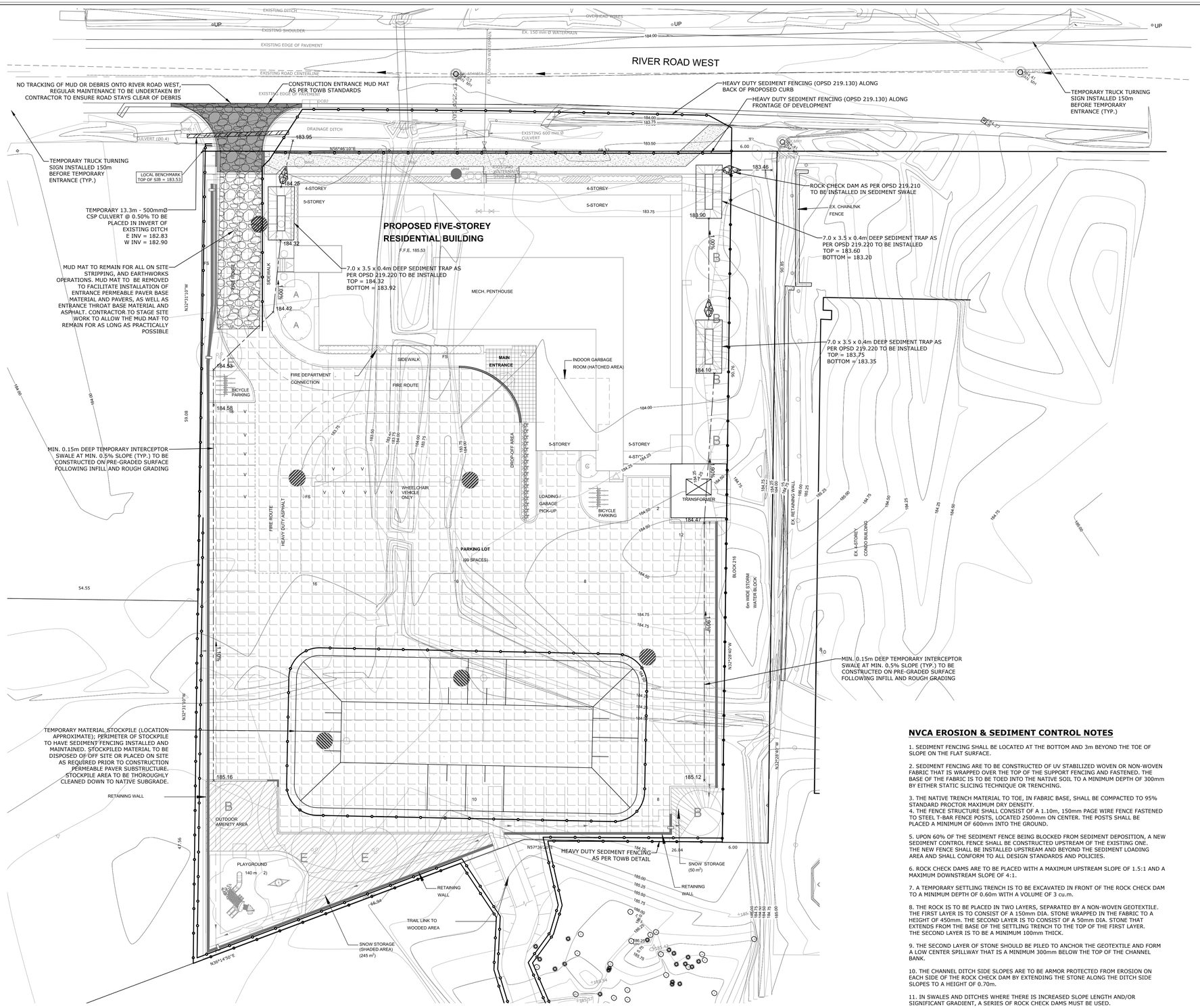
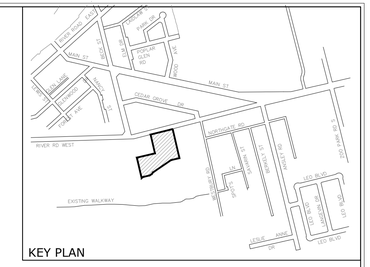
WASAGA RIVERWOODS

POST DEVELOPMENT STORMWATER DRAINAGE PLAN

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C7
Project No. 2018-012		Rev No. 4	
Scale 1:250	0 5.0 10.0 15.0m		





LEGEND

- CURB DEPRESSION
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SANITARY SEWER
- WATERMAIN
- HYDRANT & VALVE
- WATER VALVE
- TRANSFORMER
- UTILITY PEDESTAL
- PERMEABLE PAVER SURFACE, REFER TO DETAILS
- STEEL POLE / LUMINAIRE — LUMINAIRE ON STEEL POLE
- UP — UTILITY POLE
- SIGN
- ROCK CHECK DAM
- SEDIMENT FENCE
- MUD MAT
- TEMPORARY SWALE

NOTES:

1. INSTALL TEMPORARY ENTRANCE CULVERT AND TEMPORARY CONSTRUCTION ENTRANCE.
2. SEDIMENT FENCE TO BE INSTALLED PRIOR TO COMMENCING ANY ON SITE ACTIVITIES.
3. ALL VEGETATION AND TOPSOIL REMOVED DURING CLEARING AND GRUBBING AND TOPSOIL STRIPPING TO BE FULLY REMOVED FROM SITE.
4. CLEARING AND VEGETATION REMOVAL TO OCCUR BETWEEN NOVEMBER 1 AND APRIL 15.
5. FILL TO BE ESTABLISHED WITHIN PARKING AREAS TO PROVIDE STORAGE LOCATION FOR BUILDING MATERIALS DURING CONSTRUCTION.
6. EROSION AND SEDIMENT CONTROLS INCLUDING SWALES, SEDIMENT TRAPS AND CHECK DAMS TO BE ESTABLISHED AS SOON AS FILL IS PLACED.
7. PERMEABLE PAVERS TO BE INSTALLED FOLLOWING CONSTRUCTION OF BUILDING AND SITE WORKS. MATERIALS NOT TO BE STORED ON PERMEABLE PAVERS ONCE INSTALLED. ALL STOCKPILED MATERIAL TO BE REMOVED FROM SITE PRIOR TO PLACEMENT OF PERMEABLE PAVER SUBSTRUCTURE.
8. SEDIMENT FENCE TO REMAIN UNTIL STABILIZATION OF DISTURBED AREAS OCCURS.
9. ALL AGGREGATE MATERIAL STORED ON SITE TO BE CONTAINED BY HEAVY-DUTY SEDIMENT FENCING
10. FENCING MUST BE CONSTRUCTED OF HEAVY-DUTY AND SOLID POSTS AND PROPERLY TRENCHED IN TO MAINTAIN ITS INTEGRITY
11. INSPECTION OF SEDIMENT AND EROSION CONTROL MEASURES TO BE COMPLETED WITHIN 24 HOURS OF THE ONSET OF A STORM
12. MEASURES MUST BE MAINTAINED IN GOOD WORKING ORDER UNTIL VEGETATION HAS BEEN ESTABLISHED ON THE EXPOSED SOILS

NVCA EROSION & SEDIMENT CONTROL NOTES

1. SEDIMENT FENCING SHALL BE LOCATED AT THE BOTTOM AND 3m BEYOND THE TOE OF SLOPE ON THE FLAT SURFACE.

2. SEDIMENT FENCING ARE TO BE CONSTRUCTED OF UV STABILIZED WOVEN OR NON-WOVEN FABRIC THAT IS WRAPPED OVER THE TOP OF THE SUPPORT FENCING AND FASTENED. THE BASE OF THE FABRIC IS TO BE TOED INTO THE NATIVE SOIL TO A MINIMUM DEPTH OF 300mm BY EITHER STATIC SLICING TECHNIQUE OR TRENCHING.

3. THE NATIVE TRENCH MATERIAL TO TOE, IN FABRIC BASE, SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. THE FENCE STRUCTURE SHALL CONSIST OF A 1.10m, 150mm PAGE WIRE FENCE FASTENED TO STEEL T-BAR FENCE POSTS, LOCATED 2500mm ON CENTER. THE POSTS SHALL BE PLACED A MINIMUM OF 600mm INTO THE GROUND.

5. UPON 60% OF THE SEDIMENT FENCE BEING BLOCKED FROM SEDIMENT DEPOSITION, A NEW SEDIMENT CONTROL FENCE SHALL BE CONSTRUCTED UPSTREAM OF THE EXISTING ONE. THE NEW FENCE SHALL BE INSTALLED UPSTREAM AND BEYOND THE SEDIMENT LOADING AREA AND SHALL CONFORM TO ALL DESIGN STANDARDS AND POLICIES.

6. ROCK CHECK DAMS ARE TO BE PLACED WITH A MAXIMUM UPSTREAM SLOPE OF 1.5:1 AND A MAXIMUM DOWNSTREAM SLOPE OF 4:1.

7. A TEMPORARY SETTLING TRENCH IS TO BE EXCAVATED IN FRONT OF THE ROCK CHECK DAM TO A MINIMUM DEPTH OF 0.60m WITH A VOLUME OF 3 cu.m.

8. THE ROCK IS TO BE PLACED IN TWO LAYERS, SEPARATED BY A NON-WOVEN GEOTEXTILE. THE FIRST LAYER IS TO CONSIST OF A 150mm DIA. STONE WRAPPED IN THE FABRIC TO A HEIGHT OF 450mm. THE SECOND LAYER IS TO CONSIST OF A 50mm DIA. STONE THAT EXTENDS FROM THE BASE OF THE SETTLING TRENCH TO THE TOP OF THE FIRST LAYER. THE SECOND LAYER IS TO BE A MINIMUM 100mm THICK.

9. THE SECOND LAYER OF STONE SHOULD BE PILED TO ANCHOR THE GEOTEXTILE AND FORM A LOW CENTER SPILLWAY THAT IS A MINIMUM 300mm BELOW THE TOP OF THE CHANNEL BANK.

10. THE CHANNEL DITCH SIDE SLOPES ARE TO BE ARMOR PROTECTED FROM EROSION ON EACH SIDE OF THE ROCK CHECK DAM BY EXTENDING THE STONE ALONG THE DITCH SIDE SLOPES TO A HEIGHT OF 0.70m.

11. IN SWALES AND DITCHES WHERE THERE IS INCREASED SLOPE LENGTH AND/OR SIGNIFICANT GRADIENT, A SERIES OF ROCK CHECK DAMS MUST BE USED.

12. THE HEIGHT OF SUBSEQUENT ROCK CHECK DAMS MUST BE EQUAL TO THE ELEVATION OF THE BASE OF THE PREVIOUS ROCK CHECK DAMS.

13. THE ROCK CHECK DAM IS TO BE REPLACED UPON 50% OF THE HEIGHT OF THE ROCK CHECK DAM BEING COVERED WITH SEDIMENT.

14. CONSTRUCTION PROJECTS SHALL PROVIDE A MINIMUM 3m WIDE VEGETATIVE BUFFER STRIP ALONG THE LIMITS OF THE DEVELOPMENT INCLUDING FRONTAGES ALONG EXISTING ROAD BOULEVARDS.

15. AREAS ADJACENT TO WATERCOURSES SHALL PROVIDE A MINIMUM 15m BUFFER ZONE SETBACK FROM TOP OF BANK (30m FOR COLD WATER FISHERIES) AND/OR AVERAGE HIGH WATER MARK, WHICHEVER IS GREATER.

16. UPON OBSERVATION OF CONTINUOUS MUD TRACKING, OCCURRING ONTO ADJACENT STREETS, THE STONE ENTRANCE PAD IS TO BE FULLY REPLACED.

17. THE SITE PROJECT ENGINEER SHALL UNDERTAKE WEEKLY INSPECTIONS OF ALL SEDIMENT/EROSION CONTROL FACILITIES DURING THE EXTENT OF THE ENTIRE CONSTRUCTION PROJECT INCLUDING THE BUILDING CONSTRUCTION PERIOD AS WELL AS AFTER ALL RAIN EVENTS 13mm OR GREATER.

18. CONSTRUCTION AREAS THAT EXCEED 30 DAYS OF INACTIVITY SHALL BE STABILIZED BY SEEDING. THE IS TO INCLUDE STOCKPILES OF FILL AND TOPSOIL. THE SPECIFICATION FOR SITE STABILIZATION ARE AS FOLLOWS:
18.1. LARGE OPEN AREAS: LOOSEN SOIL TO A DEPTH OF 100mm AND APPLY THE FOLLOWING HYDROSEED MIXTURE (30% ANNUAL RYEGRASS, 40% PERENNAIL RYEGRASS, 15% CREEPING RED FESCUE, 10% TIMOTHY, 5% WHITE CLOVER) WITH VERDOYL MULCH AT A RATE OF 200kg/ha AND A FERTILIZER 8-32-16 AT A RATE OF 450 kg/ha.
18.2. TOPSOIL STOCKPILES: LOOSEN SOIL TO A DEPTH OF 50mm AND APPLY THE HYDROSEED MIXTURE INDICATED IN #1 ABOVE.
18.3. BUFFER ZONES: SPREAD 50mm OF TOPSOIL AND APPLY HYDROSEED MIXTURE, "GREENFIELDS" BY PICKSEED, AT AN APPLICATION RATE OF 200 kg/ha

19. DURING THE CONSTRUCTION PERIOD, WHEN INTERNAL STREETS SYSTEMS HAVE HAD ASPHALT INSTALLED, A STREET CLEANING SCHEDULE WILL BE UNDERTAKEN ON A MINIMUM WEEKLY BASIS, OR AS DIRECTED BY THE MUNICIPALITY OR CONSERVATION AUTHORITY.

20. ALL CATCHBASINS, REAR YARD CATCHBASIN AND CATCHBASIN MANHOLES TO BE INSTALLED WITH A SILT SACK INLET SEDIMENT CONTROL DEVICE.

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LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

LICENSED PROFESSIONAL ENGINEER
C. CAPES
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SEPT. 21, 2022
PROVINCE OF ONTARIO

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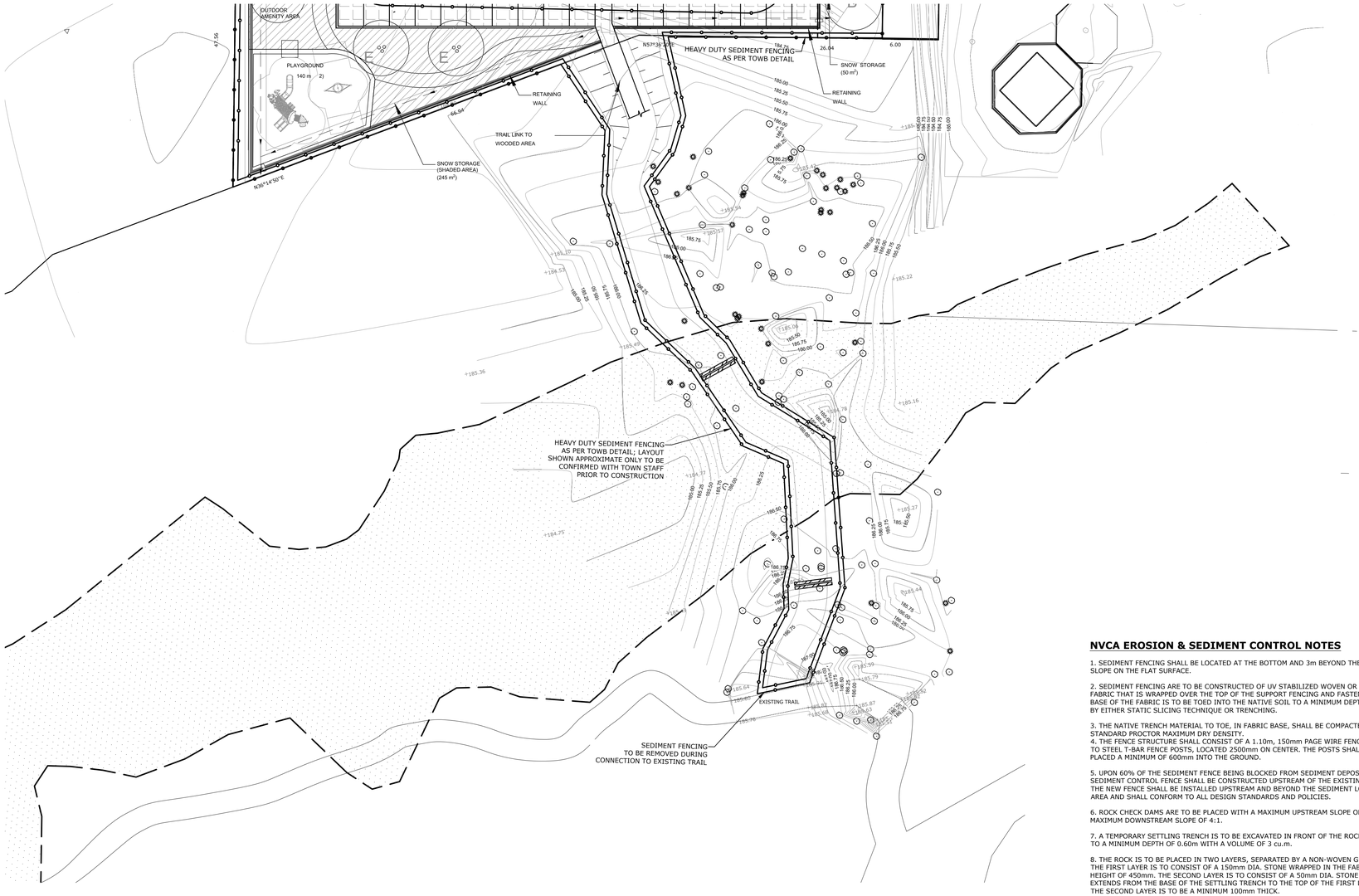
TEL: 705-994-4818

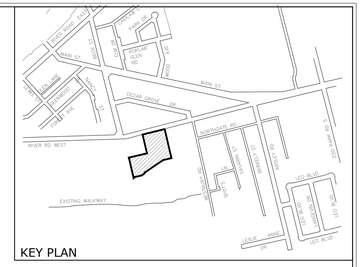
WASAGA RIVERWOODS

EROSION AND SEDIMENT CONTROL PLAN (1 OF 2)

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C8
Project No. 2018-012		Rev No. 4	
Scale 1:250	0 5.0 10.0 15.0m		

File: C:\CAPES Engineering Dropbox\Projects\CAD\2018-012 Wasaga Riverwoods\Drawings\01 Production\Dwg\2018-012 EROSION.dwg Date Plotted: September 22, 2022 - 1:39 PM





LEGEND

- CURB DEPRESSION
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SANITARY SEWER
- WATERMAIN
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- WATER VALVE
- TRANSFORMER
- UTILITY PEDESTAL
- PERMEABLE PAVER SURFACE, REFER TO DETAILS
- STEEL POLE / LUMINAIRE — LUMINAIRE ON STEEL POLE
- UP — UTILITY POLE
- SIGN
- ROCK CHECK DAM
- SEDIMENT FENCE
- MUD MAT
- TEMPORARY SWALE
- PROPOSED CULVERTS, REFER TO GRADING PLAN FOR ADDITIONAL INFORMATION

NOTES:

1. INSTALL TEMPORARY ENTRANCE CULVERT AND TEMPORARY CONSTRUCTION ENTRANCE.
2. SEDIMENT FENCE TO BE INSTALLED PRIOR TO COMMENCING ANY ON SITE ACTIVITIES.
3. ALL VEGETATION AND TOPSOIL REMOVED DURING CLEARING AND GRUBBING AND TOPSOIL STRIPPING TO BE FULLY REMOVED FROM SITE.
4. CLEARING AND VEGETATION REMOVAL TO OCCUR BETWEEN NOVEMBER 1 AND APRIL 15.
5. FILL TO BE ESTABLISHED WITHIN PARKING AREAS TO PROVIDE STORAGE LOCATION FOR BUILDING MATERIALS DURING CONSTRUCTION.
6. EROSION AND SEDIMENT CONTROLS INCLUDING SWALES, SEDIMENT TRAPS AND CHECK DAMS TO BE ESTABLISHED AS SOON AS FILL IS PLACED.
7. PERMEABLE PAVERS TO BE INSTALLED FOLLOWING CONSTRUCTION OF BUILDING AND SITE WORKS. MATERIALS NOT TO BE STORED ON PERMEABLE PAVERS ONCE INSTALLED. ALL STOCKPILED MATERIAL TO BE REMOVED FROM SITE PRIOR TO PLACEMENT OF PERMEABLE PAVER SUBSTRUCTURE.
8. SEDIMENT FENCE TO REMAIN UNTIL STABILIZATION OF DISTURBED AREAS OCCURS.
9. ALL AGGREGATE MATERIAL STORED ON SITE TO BE CONTAINED BY HEAVY-DUTY SEDIMENT FENCING
10. FENCING MUST BE CONSTRUCTED OF HEAVY-DUTY AND SOLID POSTS AND PROPERLY TRENCHED IN TO MAINTAIN ITS INTEGRITY
11. INSPECTION OF SEDIMENT AND EROSION CONTROL MEASURES TO BE COMPLETED WITHIN 24 HOURS OF THE ONSET OF A STORM
12. MEASURES MUST BE MAINTAINED IN GOOD WORKING ORDER UNTIL VEGETATION HAS BEEN ESTABLISHED ON THE EXPOSED SOILS

NOTES:

1. ACCESS FOR NEW TRAIL DEVELOPMENT TO BE FROM SUBJECT SITE ONLY.
2. OWNER/CONTRACTOR TO COORDINATE WITH TOWN STAFF TO CONFIRM EXACT TRAIL AND CULVERT LOCATIONS PRIOR TO INSTALLING SEDIMENT FENCE.
3. SILT FENCE TO BE INSTALLED PRIOR TO COMMENCEMENT OF CONSTRUCTION EFFORTS.
4. CLEARING AND VEGETATION REMOVAL TO OCCUR BETWEEN NOVEMBER 1 AND APRIL 15.
5. CONTRACTOR TO CONSTRUCT TRAIL AND CULVERTS PER AGREED UPON LOCATION.
6. SEDIMENT FENCE TO REMAIN UNTIL STABILIZATION OF DISTURBED AREAS OCCURS.

NVCA EROSION & SEDIMENT CONTROL NOTES

1. SEDIMENT FENCING SHALL BE LOCATED AT THE BOTTOM AND 3m BEYOND THE TOE OF SLOPE ON THE FLAT SURFACE.

2. SEDIMENT FENCING ARE TO BE CONSTRUCTED OF UV STABILIZED WOVEN OR NON-WOVEN FABRIC THAT IS WRAPPED OVER THE TOP OF THE SUPPORT FENCING AND FASTENED. THE BASE OF THE FABRIC IS TO BE TOED INTO THE NATIVE SOIL TO A MINIMUM DEPTH OF 300mm BY EITHER STATIC SLICING TECHNIQUE OR TRENCHING.

3. THE NATIVE TRENCH MATERIAL TO TOE, IN FABRIC BASE, SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. THE FENCE STRUCTURE SHALL CONSIST OF A 1.10m, 150mm PAGE WIRE FENCE FASTENED TO STEEL T-BAR FENCE POSTS, LOCATED 2500mm ON CENTER. THE POSTS SHALL BE PLACED A MINIMUM OF 600mm INTO THE GROUND.

5. UPON 60% OF THE SEDIMENT FENCE BEING BLOCKED FROM SEDIMENT DEPOSITION, A NEW SEDIMENT CONTROL FENCE SHALL BE CONSTRUCTED UPSTREAM OF THE EXISTING ONE. THE NEW FENCE SHALL BE INSTALLED UPSTREAM AND BEYOND THE SEDIMENT LOADING AREA AND SHALL CONFORM TO ALL DESIGN STANDARDS AND POLICIES.

6. ROCK CHECK DAMS ARE TO BE PLACED WITH A MAXIMUM UPSTREAM SLOPE OF 1.5:1 AND A MAXIMUM DOWNSTREAM SLOPE OF 4:1.

7. A TEMPORARY SETTLING TRENCH IS TO BE EXCAVATED IN FRONT OF THE ROCK CHECK DAM TO A MINIMUM DEPTH OF 0.60m WITH A VOLUME OF 3 cu.m.

8. THE ROCK IS TO BE PLACED IN TWO LAYERS, SEPARATED BY A NON-WOVEN GEOTEXTILE. THE FIRST LAYER IS TO CONSIST OF A 150mm DIA. STONE WRAPPED IN THE FABRIC TO A HEIGHT OF 450mm. THE SECOND LAYER IS TO CONSIST OF A 50mm DIA. STONE THAT EXTENDS FROM THE BASE OF THE SETTLING TRENCH TO THE TOP OF THE FIRST LAYER. THE SECOND LAYER IS TO BE A MINIMUM 100mm THICK.

9. THE SECOND LAYER OF STONE SHOULD BE PILED TO ANCHOR THE GEOTEXTILE AND FORM A LOW CENTER SPILLWAY THAT IS A MINIMUM 300mm BELOW THE TOP OF THE CHANNEL BANK.

10. THE CHANNEL DITCH SIDE SLOPES ARE TO BE ARMOR PROTECTED FROM EROSION ON EACH SIDE OF THE ROCK CHECK DAM BY EXTENDING THE STONE ALONG THE DITCH SIDE SLOPES TO A HEIGHT OF 0.70m.

11. IN SWALES AND DITCHES WHERE THERE IS INCREASED SLOPE LENGTH AND/OR SIGNIFICANT GRADIENT, A SERIES OF ROCK CHECK DAMS MUST BE USED.

12. THE HEIGHT OF SUBSEQUENT ROCK CHECK DAMS MUST BE EQUAL TO THE ELEVATION OF THE BASE OF THE PREVIOUS ROCK CHECK DAMS.

13. THE ROCK CHECK DAM IS TO BE REPLACED UPON 50% OF THE HEIGHT OF THE ROCK CHECK DAM BEING COVERED WITH SEDIMENT.

14. CONSTRUCTION PROJECTS SHALL PROVIDE A MINIMUM 3m WIDE VEGETATIVE BUFFER STRIP ALONG THE LIMITS OF THE DEVELOPMENT INCLUDING FRONTAGES ALONG EXISTING ROAD BOULEVARDS.

15. AREAS ADJACENT TO WATERCOURSES SHALL PROVIDE A MINIMUM 15m BUFFER ZONE SETBACK FROM TOP OF BANK (30m FOR COLD WATER FISHERIES) AND/OR AVERAGE HIGH WATER MARK, WHICHEVER IS GREATER.

16. UPON OBSERVATION OF CONTINUOUS MUD TRACKING, OCCURRING ONTO ADJACENT STREETS, THE STONE ENTRANCE PAD IS TO BE FULLY REPLACED.

17. THE SITE PROJECT ENGINEER SHALL UNDERTAKE WEEKLY INSPECTIONS OF ALL SEDIMENT/EROSION CONTROL FACILITIES DURING THE EXTENT OF THE ENTIRE CONSTRUCTION PROJECT INCLUDING THE BUILDING CONSTRUCTION PERIOD AS WELL AS AFTER ALL RAIN EVENTS 13mm OR GREATER.

18. CONSTRUCTION AREAS THAT EXCEED 30 DAYS OF INACTIVITY SHALL BE STABILIZED BY SEEDING. THE IS TO INCLUDE STOCKPILES OF FILL AND TOPSOIL. THE SPECIFICATION FOR SITE STABILIZATION ARE AS FOLLOWS:
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18.2. TOPSOIL STOCKPILES: LOOSEN SOIL TO A DEPTH OF 50mm AND APPLY THE HYDROSEED MIXTURE INDICATED IN #1 ABOVE.
18.3. BUFFER ZONES: SPREAD 50mm OF TOPSOIL AND APPLY HYDROSEED MIXTURE, "GREENFIELDS" BY PICKSEED, AT AN APPLICATION RATE OF 200 kg/ha

19. DURING THE CONSTRUCTION PERIOD, WHEN INTERNAL STREETS SYSTEMS HAVE HAD ASPHALT INSTALLED, A STREET CLEANING SCHEDULE WILL BE UNDERTAKEN ON A MINIMUM WEEKLY BASIS, OR AS DIRECTED BY THE MUNICIPALITY OR CONSERVATION AUTHORITY.

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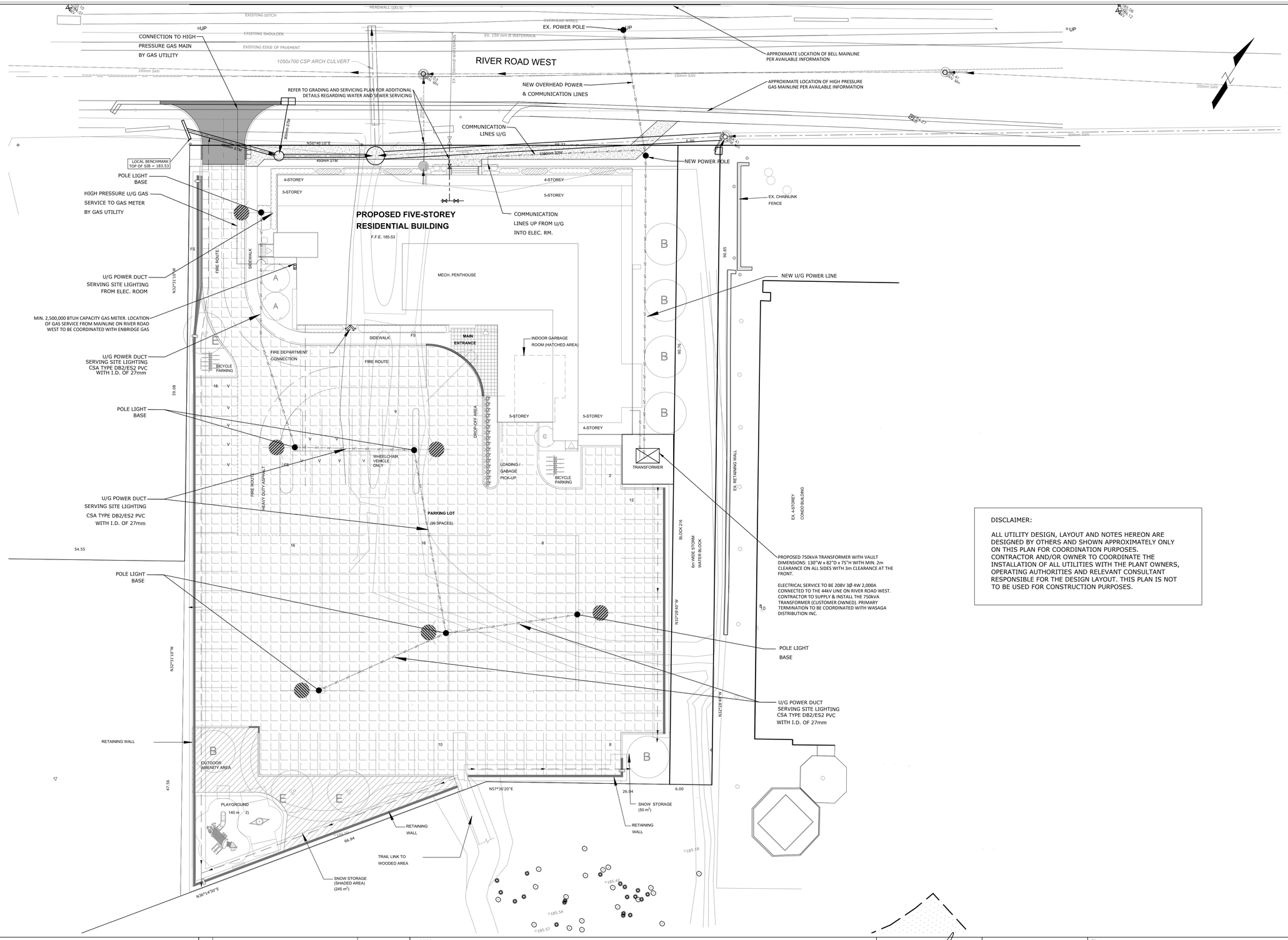
L4B 1E6

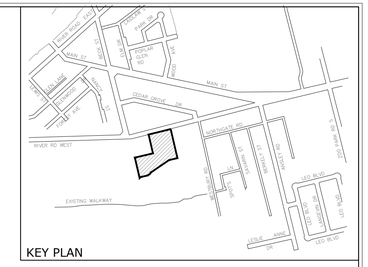
CAPES ENGINEERING
355310 BLUE MOUNTAINS - EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

WASAGA RIVERWOODS

EROSION AND SEDIMENT CONTROL PLAN (2 OF 2)

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C9
Project No. 2018-012		Rev No. 4	
Scale 1:250	0 5.0 10.0 15.0m		





LEGEND

- CURB DEPRESSION
- MAXIMUM 3:1 SLOPE UNLESS OTHERWISE NOTED
- SANITARY SEWER
- WATERMAIN
- HYDRANT & VALVE
- WATER VALVE
- TRANSFORMER
- UTILITY PEDESTAL
- PERMEABLE PAVER SURFACE, REFER TO DETAILS
- STEEL POLE / LUMINAIRE — LUMINAIRE ON STEEL POLE
- UP — UTILITY POLE
- SIGN
- BURIED NATURAL GAS SERVICE
- UH — UH — BURIED HYDRO/STREETLIGHT/TELECOM CONDUIT
- OH — OH — OVERHEAD HYDRO/STREETLIGHT/TELECOM CONDUIT

DISCLAIMER:

ALL UTILITY DESIGN, LAYOUT AND NOTES HEREON ARE DESIGNED BY OTHERS AND SHOWN APPROXIMATELY ONLY ON THIS PLAN FOR COORDINATION PURPOSES. CONTRACTOR AND/OR OWNER TO COORDINATE THE INSTALLATION OF ALL UTILITIES WITH THE PLANT OWNERS, OPERATING AUTHORITIES AND RELEVANT CONSULTANT RESPONSIBLE FOR THE DESIGN LAYOUT. THIS PLAN IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.

No	Revision	Date
1	ISSUED FOR APPROVALS	20/08/10
2	REVISED FOR APPROVALS	21/11/16
3	REVISED FOR APPROVALS	22/03/17
4	REVISED FOR APPROVALS	22/09/21

NOTES:
TOPOGRAPHIC SURVEY INFORMATION PROVIDED BY NANFARA & NG SURVEYORS INC. AND JOETOPO SURVEYS AND CADD INC..

BOUNDARY SURVEY INFORMATION PROVIDED BY OWNER, PREPARED BY NANFARA & NG SURVEYORS INC. AND SHOWN APPROXIMATELY HEREON. THIS IS NOT A PLAN OF SURVEY.

BENCHMARKS
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO BENCHMARK NO. 00119711191, HAVING A ELEVATION 187.747 PER CGVD28 METRES LOCATED AT Mr. ca ANDERSON RESIDENCE, WHITE FRAME HOUSE ON NORTHWEST SIDE OF HIGHWAY 92, AT INTERSECTION WITH ZOO PARK ROAD, 1.6km NORTHEAST OF BRIDGE OVER NOTTAWASAGA RIVER, TABLET IN SOUTHWEST CONCRETE FOUNDATION, 3.08m NORTHWEST OF SOUTHWEST CORNER, 51cm NORTHWEST OF A BASEMENT WINDOW AND 39cm BELOW STUCCO SIDING

LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

LICENSED PROFESSIONAL ENGINEER
C/CAPES
100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

Client
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RICHMOND HILL, ON
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WASAGA RIVERWOODS

COMPOSITE UTILITY PLAN

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C10
Project No.		Rev No.	
2018-012		4	
Scale	0 5.0 10.0 15.0m		
1:250			

File: C:\SC\Capes Engineering Stephen\Projects\2018\2018-012 Wasaga Riverwoods\Drawings\01 Production\Dwg\2018-012 CUP.dwg Date Plotted: September 22, 2022 - 1:41 PM

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH TOWN OF WASAGA BEACH STANDARDS AND OPSS. WHERE INCONSISTENCY OCCURS, TOWN STANDARDS GOVERN.
3. CLEAR STONE WRAPPED IN FILTER FABRIC MAY BE SUBSTITUTED FOR PIPE BEDDING MATERIAL IF APPROVED BY THE ENGINEER.
4. DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS–517 AND 518. THE OWNER IS RESPONSIBLE FOR OBTAINING DEWATERING PERMITS AS REQUIRED TO MAINTAIN DRY TRENCH CONDITIONS.
5. UNDERGROUND UTILITITES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
6. HYDRO POLES TO BE SUPPORTED AND PROTECTED BY THE CONTRACTOR DURING CONSTRUCTED AS DIRECTED BY WASAGA DISTRIBUTION INC.
7. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH UTILITIES WHICH MAY ALSO BE UNDER CONSTRUCTION.
8. EXISTING GAS MAIN TO BE PROTECTED IN ACCORDANCE WITH ENBRIDGE GAS SPECIFICATIONS.
9. ALL EXISTING PAVED PRIVATE ENTRANCES TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE AND 150mm GRANULAR 'A' BASE TO LIMITS OF CONSTRUCTION.
10. ALL EXISTING GRAVEL OR GRASSED PRIVATE ENTRANCES TO BE REINSTATED WITH 150mm GRANULAR 'A' BASE TO LIMITS OF CONSTRUCTION AND 50mm HL3 TO 2.75m BEHIND CURB.
11. ALL COMMERCIAL ENTRANCES TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE, MATCH EXISTING ASPHALT BASE COURSE(S), 150mm GRANULAR 'A' BASE AND 150mm GRANULAR 'B' SUBBASE TO LIMITS OF CONSTRUCTION.
12. JOINTS WITH EXISTING ASPHALT TO BE SAW CUT PRIOR TO PLACING NEW ASPHALT; DENSO REINSTATEMENT TAPE SHALL BE USED AT THE JOINT OF SURFACE ASPHALT. SURFACE ASPHALT JOINTS TO HAVE MIN. 0.5m WIDE LAP JOINT.
13. ALL BOULEVARDS AND DISTURBED AREAS TO HAVE 150mm SCREENED TOPSOIL AND NURSERY SOD UNLESS OTHERWISE NOTED.
14. PAVED BOULEVARD AREAS TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE ASPHALT AND 150mm GRANULAR 'A' WHERE NOTED.
15. ACCESS TO BUSINESS AND RESIDENTIAL PROPERTIES MUST BE MAINTAINED AT ALL TIMES.
16. THE CONTRACTOR MUST GIVE MIN. 48 HOURS NOTICE TO THE TOWN OF WASAGA BEACH PUBLIC WORKS DEPARTMENT THROUGH THE TOWN ENGINEER FOR OFFICIALS TO BE PRESENT FOR THE OPERATION OF VALVES, TESTING, DISINFECTION AND CONNECTION OF WATERMAIN AND TESTING OF SEWERS.
17. EARTH FILL MATERIAL UP TO AND INCLUDING SUBGRADE TO BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD). GRANULAR BASE AND SUB–BASE TO BE COMPACTED TO 100% SPMDD. HOT–MIX ASPHALT TO BE COMPACTED TO 92% MAXIMUM RELATIVE DENSITY.
18. MINIMUM VERTICAL SEPARATION OF 150mm BETWEEN SEWERS AT CROSSINGS.
19. THE CONTRACTOR MUST OBTAIN A ROAD OCCUPATION PERMIT FROM PUBLIC WORKS PRIOR TO INSTALLATION OF PROPOSED DRIVEWAY AND/OR ANY CONSTRUCTION WORKS WITHIN THE EXISTING MUNICIPAL RIGHT–OF–WAY.
20. ALL DISTURBED AREAS SHALL BE REINSTATED TO EXISTING CONDITION OR BETTER.

SEDIMENT & EROSION CONTROL NOTES:

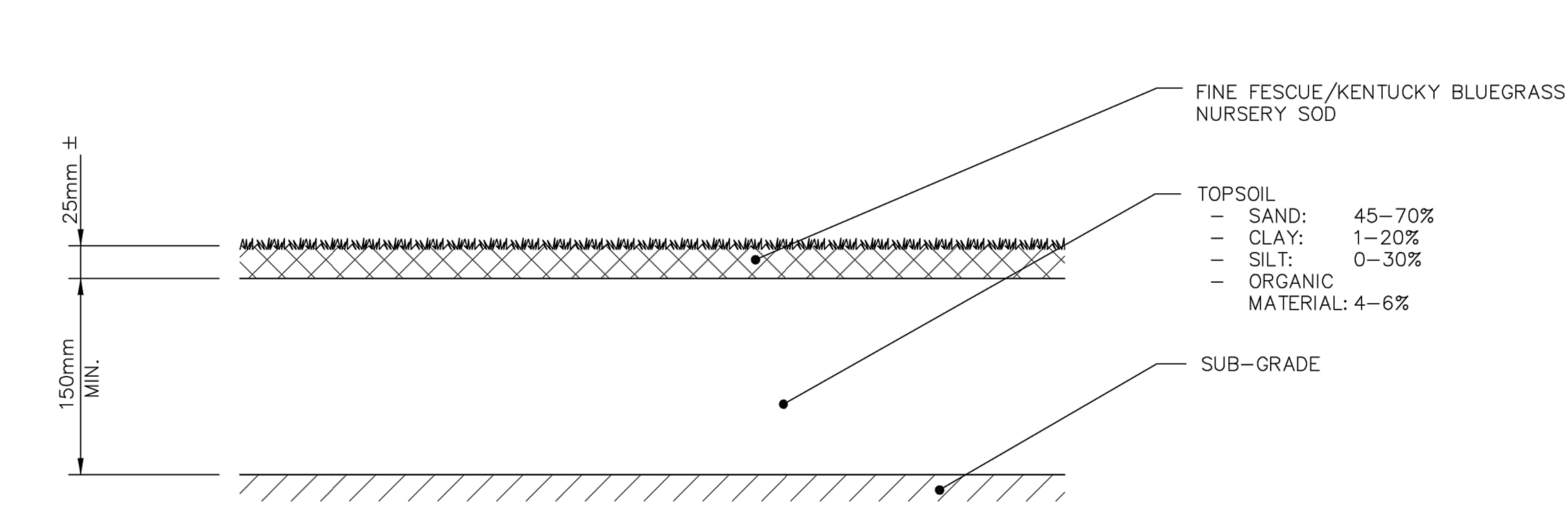
1. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED, AFTER WHICH, THEY SHALL BE FULLY REMOVED BY THE CONTRACTOR. SEDIMENT AND EROSION CONTROL MEASURES THAT ARE DESIGNED TO CONTROL RUNOFF FROM SPECIFIC AREAS MUST BE INSTALLED PRIOR TO ANY DISTURBANCE OF THAT PART OF THE SITE.
2. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES. SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL OF THE TOWN ENGINEER AND THE NOTTAWASAGA VALLEY CONSERVATION AUTHORITY.
3. THE CONTRACTOR SHALL HAVE MATERIALS AVAILABLE ON–SITE TO REPAIR SEDIMENT AND EROSION CONTROL MEASURES IN THE EVENT OF UNFORESEEN CONDITIONS: HIGH WATER, EXTREME RAINFALL EVENTS ETC.
4. ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED BY THE ENGINEER BI–WEEKLY AND AFTER EACH MAJOR STORM EVENT. INSPECTION REPORTS TO BE FORWARDED TO THE TOWN ENGINEER BI–WEEKLY. AREAS THAT ARE UNDEVELOPED FOR AN EXTENDED PERIOD OF TIME SHALL BE REVEGETATED WITH TOPSOIL AND HYDRAULIC SEED AND MULCH AS DIRECTED BY THE TOWN.

STORM SEWER:

1. ALL MATERIALS SHALL BE CSA CERTIFIED AND IN ACCORDANCE WITH THE TOWN APPROVED MATERIALS LIST.
2. CLASS 'B' BEDDING AND COVER AS PER OPSD–802.030 (RIGID PIPE) OR EMBEDMENT AS PER OPSD–802.010 (FLEXIBLE PIPE) USING GRANULAR 'A'. USE SELECT NATIVE MATERIAL COMPACTED TO 95% MAXIMUM DRY DENSITY FOR COVER MATERIAL IF APPROVED BY THE TOWN ENGINEER.
3. CATCHBASINS & MANHOLES TO BE BACKFILLED WITH SELECT NATIVE MATERIAL AND COMPACTED TO 95% MAXIMUM DRY DENSITY.
4. STEPS AS PER OPSD–405.010 HOLLOW CIRCULAR ALUMINUM.
5. CATCHBASIN LEADS; – 300mm DIA. FOR SINGLE AND DOUBLE CATCHBASINS.
6. CATCHBASIN FRAMES AND COVERS PER OPSD 400.020.
7. STORM SEWER SHALL BE CCTV INSPECTED.
8. REAR LOT CATCHBASIN LEADS SHALL BE CONCRETE SEWER PIPE.

TOWN OF WASAGA BEACH	
GENERAL NOTES	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: APRIL 2021

STD.DWG.No.1A



NOTES:

1. SOD MUST FINE FESCUE/KENTUCKY BLUEGRASS AS SPECIFIED BY THE NURSERY SOD GROWERS ASSOCIATION OF ONTARIO.
2. TOPSOIL MUST BE TESTED AND AN AGRONOMY REPORT PREPARED BY AN ACCREDITED LABORATORY CONFIRMING THE SUITABILITY OF THE TOPSOIL AND RECOMMENDATIONS FOR FERTILIZATION.
3. TOPSOIL MUST BE COMPLETELY CLEAR OF ALL STONES IN EXCESS OF 25mm, DEBRIS, AND WOODY MATERIAL.
4. THE SUB–GRADE MUST BE GRADED TO ENSURE CONSISTENT TOPSOIL THICKNESS AND PROVIDE POSITIVE SURFACE DRAINAGE.
5. A PRE–SOD INSPECTION IS RECOMMENDED TO BE COMPLETED BY THE TOWN ENGINEER PRIOR TO THE PLACEMENT OF TOPSOIL.

TOWN OF WASAGA BEACH	
TOPSOIL & SOD REQUIREMENTS	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: APRIL 2021

STD.DWG.No.9C

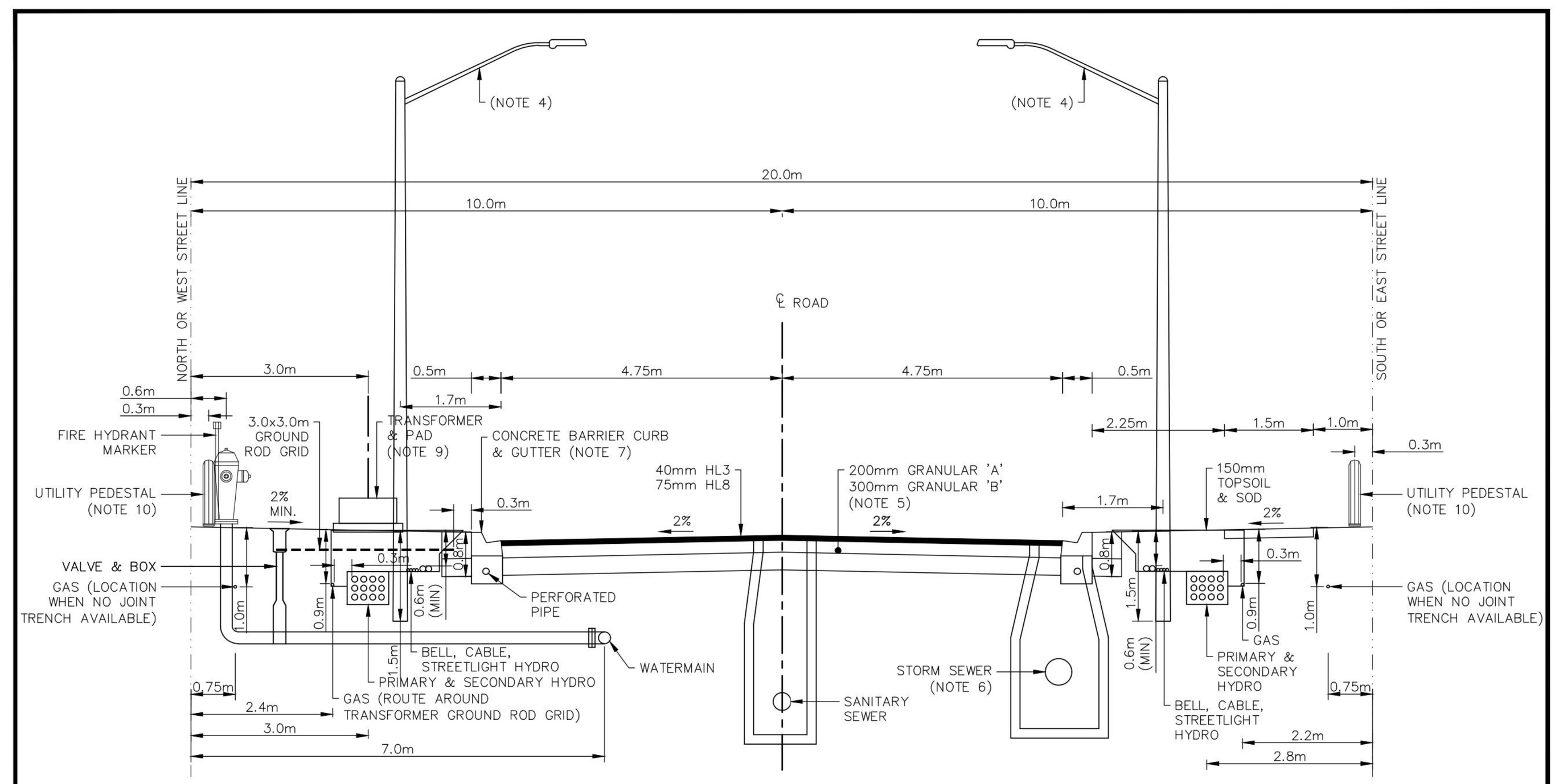
WATERMAIN:

1. ALL MATERIALS SHALL BE CSA CERTIFIED AND IN ACCORDANCE WITH THE TOWN APPROVED MATERIALS LIST.
2. ALL WATERMAIN TO HAVE MINIMUM 1.7m COVER OR APPROVED EQUIVALENT FROST PROTECTION WITH INSULATION.
3. BEDDING AND BACKFILL IN ACCORDANCE WITH OPSS–401.
4. PVC PIPE INSTALLATION TO INCLUDE 12awg TWH SOLID PLASTIC COVERED TRACER WIRE, TWU 75°C 600V OR APPROVED EQUAL. TRACER WIRE CONTINUITY MUST BE TESTED & CERTIFIED BY PUBLIC WORKS STAFF.
5. CATHODIC PROTECTION (S–12 ZINC ANODE @ 30.0m SPACING ON DUCTILE IRON PIPE AND AT ALL METAL RESTRAINTS, FITTINGS, APPURTENANCES, ETC.) TO BE PROVIDED IN ACCORDANCE WITH OPSS–442. CATHODIC PROTECTION IS TO BE CAD WELDED ON WITH MASTIC TAPE. FOR CURB STOPS, 7LB ZINC ANODES CAN BE TWISTED ON BUTTON TWIST NUT.
6. CLASS 'B' BEDDING AS PER OPSD–802.030 (RIGID PIPE) OR BEDDING AS PER OPSD–802.010 (FLEXIBLE PIPE) USING GRANULAR 'A'.
7. THRUST PROTECTION SHALL BE PROVIDED USING MECHANICAL JOINT FITTINGS AND RESTRAINERS.
8. GATE VALVES TO BE LEFT HAND OPENING COMPLETE WITH SLIDE TYPE VALVE BOXES 125mmø WITH LIDS MARKED WATER AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST.
9. WATER SERVICES COMPLETE WITH MAIN STOP TO BE AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST.
10. WHERE RESIDENTIAL WATER SERVICES ARE TO BE ABANDONED, EXPOSE MAIN STOP, CLOSE AND DISCONNECT SERVICE PIPE, AND SALVAGE THE CURB STOP AND RETURN TO PUBLIC WORKS YARD.
11. ALL WATERMAINS AND SERVICES SHALL BE BACKFILLED WITH APPROVED SITE MATERIAL. ALL BACKFILL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY AS PER OPSS 514. ALL GRANULAR ROAD BASE SHALL BE COMPACTED TO 100% MAXIMUM DRY DENSITY.
12. EXISTING SERVICE LOCATIONS TO BE VERIFIED IN THE FIELD.
13. HYDRANT TO BE AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST WITH MECHANICAL JOINT ENDS, WITH 2–50mm PORTS AND FACTORY INSTALLED STORZ FITTING PER OPSD–1105.010.
14. TESTING CONNECTION TO THE MUNICIPAL WATER SYSTEM SHALL BE PER TOWN STD. DWG. No. 13.
15. MINIMUM VERTICAL SEPARATION 500mm BETWEEN WATERMAINS AND SEWERS. MINIMUM HORIZONTAL SEPARATION OF 2.5m BETWEEN WATERMAINS AND SEWERS.
16. WATERMAINS SHALL BE SWABBED, FLUSHED, DISINFECTED AND TESTED IN ACCORDANCE WITH OPSS 441 WITH TOWN OFFICIALS PRESENT.
17. DISINFECTING OF WATERMAINS SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF AWWA C651 SPECIFICATIONS.
18. ANTI–TAMPERING DEVICES ARE TO BE INSTALLED ON ALL FIRE HYDRANTS FOLLOWING COMPLETION OF ALL WATER SYSTEM TESTING BY THE TOWN. ANTI–TAMPERING DEVICES ARE TO BE REMOVED FROM ALL FIRE HYDRANTS AT END OF WARRANTY PERIOD, PRIOR TO MUNICIPAL ASSUMPTION.

SANITARY SEWER:

1. ALL MATERIALS SHALL BE CSA CERTIFIED AND IN ACCORDANCE WITH THE TOWN APPROVED MATERIALS LIST.
2. BEDDING AS PER OPSD–802.010 USING GRANULAR 'A' COMPACTED TO 95% MAXIMUM DRY DENSITY. USE SELECTED SITE MATERIAL FOR BACKFILL COMPACTED TO 95% MAXIMUM DRY DENSITY.
3. SANITARY SERVICE LATERALS COMPLETE WITH CLEANOUT TO BE INSTALLED PER TOWN STD. DWG No. 12.
4. LOT SERVICE LOCATIONS TO BE VERIFIED BY CONTRACTOR.
5. MH'S PER OPSD–701.010 WITH FROST STRAPS PER OPSD 701.100 WITH "QUICK ANCHORED" BOLTS.
6. FRAMES AND COVERS PER OPSD–401.010 TYPE 'A'.
7. MH BENCHING PER OPSD–701.021 AND STEPS PER OPSD–405.010 CIRCULAR ALUMINUM.
8. SANITARY SEWER TESTING SHALL INCLUDE INFILTRATION, EXFILTRATION, DEFLECTION (MANDREL) AND CCTV.
9. SANITARY MAINTENANCE HOLES SHALL BE PROVIDED WITH DENSO PETROLIUM TAPE (OR APPROVED EQUIVALENT) AROUND THE OUTSIDE OF ALL SECTION JOINTS.

TOWN OF WASAGA BEACH	
GENERAL NOTES	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1

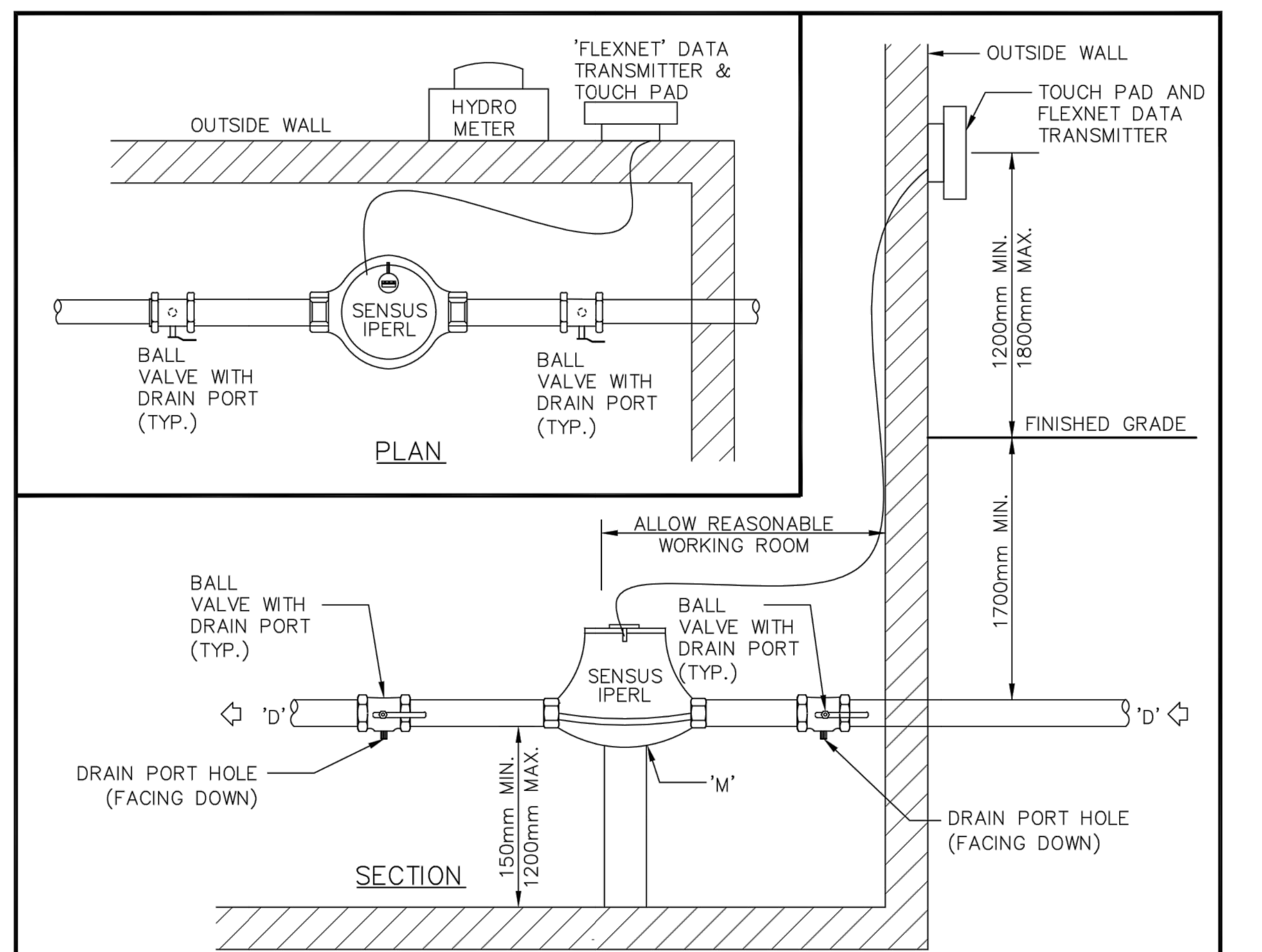


NOTES

1. TOPSOIL TO BE REMOVED TO ITS FULL DEPTH ALONG ENTIRE WIDTH OF ROAD ALLOWANCE BY CONTRACTOR.
2. BOULEVARD TO BE FULLY SODDED WITH 150mm TOPSOIL.
3. ROAD CROSSING DEPTHS FOR UTILITIES: –BELL 0.9m –GAS 1.0m –HYDRO 1.2m
4. STREET LIGHTS – CREE RSW LED LUMINAIRE MOUNTED ON STRESSCRETE CLASS C 9.14m DIRECT BURIED POLE AS PER TOWN STANDARDS.
5. WHERE SELECTED NATIVE SAND IS TO BE USED IN LIEU OF GRANULAR 'B' ROAD BASE, INCREASE GRANULAR 'A' THICKNESS TO 250mm.
6. IN AREAS OF HIGH GROUND WATER TABLE, AN INFILTRATING STORM SEWER SYSTEM MUST BE CONSIDERED PER ENGINEERING STANDARDS.
7. O.P.S.D. 600.040 – EXISTING ROAD IMPROVEMENTS, O.P.S.D. 600.070 (TWO STAGE) – NEW ROAD CONSTRUCTION.
8. ALL DRIVEWAYS TO INCLUDE APRON PAVING 2.75m BEHIND CURB AND ALL DRIVEWAY EDGING/CURBING SHALL BE FLUSH WITH DRIVEWAY PER THE TOWN ENGINEERING STANDARDS.
9. TRANSFORMERS INCLUDE 3m x 3m GROUND ROD GRID REQUIRING 0.3m MIN CLEARANCE FROM BACK OF CURB.
10. UTILITY PEDESTALS TO BE 0.3m FROM PROPERTY LINE OR BESIDE HYDRO TRANSFORMERS WHERE APPLICABLE.

TOWN OF WASAGA BEACH	
CROSS–SECTION COLLECTOR ROAD ON 20m R.O.W.	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1:1
CHECKED: MJP	DATE: APRIL 2021

STD.DWG.No.2B



* AFTER WATER METER PACKAGE INSTALLATION IS COMPLETE/INSPECTED, THE OWNER/INSTALLER IS RESPONSIBLE TO CONTACT PUBLIC WORKS DEPT. TO CO–ORDINATE INSTALLATION OF THE 'FLEXNET' DATA TRANSMITTER PH. No. (705) 429–2540

NOTES:

1. DATA TRANSMITTER TO BE LOCATED ADJACENT TO THE HYDRO ELECTRIC METER.
2. METERS SHALL BE INSTALLED IN A HORIZONTAL POSITION.
3. ALL PIPE AND APPURTENANCES TO BE SIZED AS REQUIRED FOR SERVICE DIA. 'D'
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN.
5. METERS SHALL BE 'SENSUS' AS OUTLINED IN TABLE 1 BELOW c/w FLEXNET REMOTE TOUCH PAD & TRANSMITTER.
6. PROVIDE SUPPORT FOR THE METER AND RELATED COMPONENTS.
7. WORKING SPACE AROUND THE METER SHALL ALLOW MIN. 600mm ACCESS FOR MAINTENANCE PURPOSES.
8. ALL LAWN WATERING SYSTEMS SHALL INLUDE A BACKFLOW PREVENTION DEVICE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE AND TOWN OF WASAGA BEACH STANDARDS.

TABLE 1

SERVICE 'D' (mm)	SENSUS METER SIZE 'M' (mm)	METER MODEL
19ø	EXISTING 19ø	IPERL
25ø	25ø	IPERL
38ø	38ø	OMNIR2
50ø	50ø	OMNIR2

*METER SIZE MAY CHANGE BASED ON DEMAND REQUIREMENTS

TOWN OF WASAGA BEACH	
TYPICAL WATER METER INSTALLATION 19mmø TO 50mmø	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP/GER	PLOT: 1=1
CHECKED: MJP	DATE: APRIL 2021

STD.DWG.No.14A

GEOTECHNICAL NOTES

1. The investigation has disclosed that beneath either a peat layer or a veneer of topsoil, the site is underlain by a stratum of very loose to dense, generally compact fine sand. The sand is weathered to depths ranging from 0.6 to 2.1 m below the prevailing ground surface.
2. Groundwater was encountered at depths ranging from 0.3 to 0.8 m below the prevailing ground surface upon completion of the field work.
3. The yield of groundwater from the fine sand is expected to be appreciable and persistent.
4. The geotechnical findings which warrant special consideration are presented below:

a) The topsoil and peat will generate volatile gases under anaerobic conditions and is unsuitable for engineering applications. If possible, the peat should be stripped from the project site; for the environmental as well as the geotechnical well-being of the future development, the topsoil should not be buried over 1.2 m below the proposed finished grade, or below any structure. If using the topsoil for planting and sodding purposes, it must be assessed by a fertility analysis.

b) The sound natural soil is suitable for normal spread and strip footing construction. Due to the presence of topsoil, peat and weathered soil, the footing subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, or a building inspector who has geotechnical experience, to ensure that its condition is compatible with the design of the foundation.

c) For shallow basement construction, perimeter subdrains and dampproofing of the foundation walls will be required. All the subdrains must be encased in a fabric filter to protect them against blockage by silting and must be connected to a positive outlet. As noted, groundwater occurs at shallow depths; therefore, floor subdrains will be required for basement construction. The basement level must be placed at least 0.5 m above the detected groundwater level.

d) For slab-on-grade construction, any loose and weathered sand must be subexcavated, sorted and properly recompacted, or the wet material should be drained and surface densified by a vibratory compactor.

e) A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. The stone immersion technique and thickening of the Crusher-Run Limestone bedding will likely be required for sewer subgrade stabilization. In areas where extensive dewatering is required, a Class 'A' concrete bedding may be necessary.

f) Excavations within a depth of 0.3 m below the groundwater in wet sand may require stabilization by vigorous pumping from closely spaced sump-wells. Deep excavations in water-bearing sand will require the use of a well-point dewatering system to stabilize the excavation.

g) In-ground services to be constructed in water-bearing sand must consist of pipes with leak-proof joints, or the joints must be wrapped with a waterproof membrane.

5. The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

Foundations

1. The foundations should be placed beneath the peat, topsoil layer and weathered soil onto the sound natural soil. A Maximum Allowable Soil Pressure (SLS) of 150 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 250 kPa, respectively, can be used for the design of the normal spread and strip foundations. As a general guide, the recommended soil pressures and suitable founding levels, based on the borehole findings, are presented below.

BH 1 - 1.0 m or +
BH 2 - 1.0 m or +
BH 3 - 2.0 m or +
BH 4 - 1.2 m or +

2. As noted, groundwater at the time of investigation was encountered at depths ranging from 0.3 to 0.8 m. Therefore, the subgrade should be protected immediately after exposure by a concrete mud-slab. This will prevent construction disturbance and costly rectification.
3. Due to the occurrence of shallow groundwater throughout the entire site, it is recommended that engineered fill should be considered to raise the grade of the site, and that the basement level should is placed at least 0.5 m above the detected groundwater level. To provide a dry floor, subdrains consisting of filter-wrapped weepers must be installed beneath the floor slabs and connected to a positive outlet. A vapour barrier must be placed in the granular base of the floor above the crown of the subdrain.
4. The recommended soil pressures (SLS) for normal foundations incorporate a safety factor of 3 against shear failure of the underlying soils. The total and differential settlements of the foundations are estimated to be 25 mm and 15 mm, respectively.
5. The footing subgrade should be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, or a building inspector who has geotechnical experience, to ensure that the revealed conditions are compatible with the foundation design requirements.
6. Foundations exposed to weathering or in unheated areas should be protected against frost action by a minimum of 1.4 m of earth cover, or must be properly insulated.
7. The foundations must meet the requirements specified by the Ontario Building Code 2012, and the buildings must be designed to resist a minimum earthquake force using Site Classification 'D' (stiff soil).

Engineered Fill

1. The existing weathered soil can be replaced and/or upgraded to engineered fill status; where earth fill is required to raise the site, or where extended footings are necessary, it is generally economical to place engineered fill for normal footing, slab-on-grade, sewer and road construction.
2. The engineering requirements for a certifiable fill for road construction, municipal services, and footings designed with a Maximum Allowable Soil Pressure (SLS) of 150 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 250 kPa are presented below:

a) All of the peat and topsoil must be removed, and the subgrade must be inspected and proof-rolled prior to any fill placement. The weathered sand must be subexcavated and recompacted, or the wet sand should be drained and surface densified by a vibratory roller achieving a 95% or + Standard Proctor dry density.

b) Inorganic soils must be used, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of their maximum Standard Proctor dry density up to the proposed grade and/or pavement subgrade. The soil moisture must be properly controlled on the wet side of the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% of the maximum Standard Proctor compaction.

c) If imported fill is to be used, the hauler is responsible for its environmental quality and must provide a document to certify that the material is free of hazardous contaminants.

d) If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.

e) The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors. Foundations partially on engineered fill must be reinforced by two 15-mm steel reinforcing bars in the footings and upper section of the foundation walls, or designed by a structural engineer, to properly distribute the stress induced by the abrupt differential settlement (estimated to be 15± mm) between the natural soils and engineered fill.

f) The engineered fill must not be placed during the period from late November to early April, when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.

g) Where the ground is wet due to subsurface water seepage, an appropriate subdrain scheme must be implemented prior to the fill placement, particularly if it is to be carried out on sloping ground or a bank. In places, the subgrade may require stabilization by a Crusher-Run Limestone mat.

h) Where the fill is to be placed on a bank steeper than 1 vertical:3 horizontal, the face of the bank must be flattened to 3+ so that it is suitable for safe operation of the compactor and the required compaction can be obtained.

i) The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.

j) The footing and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.

k) Any excavations carried out in certified fill must be reported to the geotechnical consultant who inspected the fill placement in order to document the locations of excavation and/or to inspect reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.

l) Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the strip footings and upper section of the foundation walls constructed on the engineered fill may require continuous reinforcement with steel bars, depending on the uniformity of the soils in the engineered fill and the thickness of the engineered fill underlying the foundations. Should the footing and/or walls require reinforcement, the required number and size of reinforcing bars must be assessed by considering the uniformity as well as the thickness of the engineered fill beneath the foundations. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic
soil.

Slab-On-Grade

1. The sound natural soil is suitable for the slab-on-grade construction; the weathered soil must be subexcavated and properly recompacted to at least 98% of its maximum Standard Proctor dry density. The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.
2. The topsoil and peat must be stripped for slab-on-grade construction.
3. A Modulus of Subgrade Reaction of 25 MPa/m is recommended for the design of the floor slab.
4. The ground around the building must be graded to direct water away from the structure to minimize the frost heave phenomenon generally associated with the disclosed soil.

Basement

1. Perimeter subdrains and dampproofing of the foundation walls will be required in order to provide a dry basement. Foundations exposed to weathering, or in unheated areas, should be protected against frost action by a minimum of 1.4 m of earth cover. All the subdrains should be encased in a fabric filter to prevent blockage by silting.
2. The foundation walls should be shielded by a polyethylene slip-membrane for protection against soil adfreezing. The membrane will allow vertical movement of the heaving soil (due to frost) without imposing structural distress on the foundations. The recommended measures are schematically illustrated in Diagram 1 found in the Geotechnical Report.
3. The membrane will allow vertical movement of the heaving soil (due to frost) without imposing structural distress on the foundations.
4. The necessity to implement this scheme should be further assessed by a geotechnical consultant at the time of construction.

Underground Services

1. The subgrade for the underground services should consist of natural soil or compacted organic-free earth fill. Where topsoil, peat and badly weathered soil are encountered, these materials must be subexcavated and replaced with properly compacted bedding material.
2. A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. Where water-bearing sand occurs, the sewer joints should be leak-proof, or wrapped with an appropriate waterproof membrane, to prevent subgrade migration. If subgrade stabilization is required, the stone immersion technique may be applied. In areas where more extensive dewatering is required for sewer construction, a Class 'A' bedding should be considered.
3. In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover with a thickness equal to the diameter of the pipe should be in place at all times after completion of the pipe installation.
4. Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

Trench Backfilling

1. The on-site inorganic soil is suitable for trench backfill. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density with the moisture content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered to be adequate; however, the material must be compacted on the wet side of the optimum.
2. The narrow trenches should be cut at 1 vertical:2 or + horizontal so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. The lift of each backfill layer should either be limited to a thickness of 20 cm, or the thickness should be determined by test strips.
3. One must be aware of the possible consequences during trench backfilling and exercise caution as described below:

- When construction is carried out in freezing winter weather, allowance should be made for these following conditions. Despite stringent backfill monitoring, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in situ soil have a water content on the dry side of the optimum, it would be impossible to wet the soil due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as in a narrow vertical trench section, or when the trench box is removed. The above will invariably cause backfill settlement that may become evident within 1 to several years, depending on the depth of the trench which has been backfilled.
- In areas where the underground services construction is carried out during winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to final surfacing of the new pavement and the slab-on-grade construction.
- To backfill a deep trench, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 1 vertical: 1.5 + horizontal, and the lifts of the fill and its moisture content are stringently controlled; i.e., lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 95% of the maximum Standard Proctor dry density, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand. In a trench stabilized by a trench box, the void left after the removal of the box will be filled by the backfill. It is necessary to backfill this sector with sand, and the compacted backfill must be flooded for 1 day, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section. In areas where groundwater movement is expected in the sand fill mantle, seepage collars should be provided.

Garages, Driveways and Interlocking Stone Pavement

1. The driveways at the entrances to the garages should be backfilled with non-frost-susceptiblegranular material, with a frost taper at a slope of 1 vertical:1 horizontal.
2. Interlocking stone pavement in areas which are sensitive to frost-induced ground movement, such as entrances, must be constructed on a free-draining, non-frost-susceptible granular material such as Granular 'B'. This material must extend to 1.4 m below the slab or pavementsurface and be provided with positive drainage such as weeper subdrains connected to manholes or catch basins. Alternatively, the sidewalks and the interlocking stone pavement should be properly insulated with 50-mm Styrofoam, or equivalent, as approved by a geotechnical engineer.
3. The grading around the structures must be sloped such that surface runoff is directed away from the structures.

Pavement Design

1. Based on the borehole findings, the recommended pavement design for local roads is presented below:

Asphalt Surface - 40 mm HL-3
Asphalt Binder - 50 mm (Local) or 75 mm (Collector) HL-4
Granular Base - 150 mm Granular 'A' or equivalent
Granular Sub-base - 300 mm Granular 'B' or equivalent

2. In preparation of the subgrade, the subgrade surface should be proof-rolled; any soft subgrade, organics and deleterious materials within 1.0 m below the underside of the granular sub-base should be subexcavated and replaced by properly compacted organic-free earth fill or granular material.
3. All the granular bases should be compacted to their maximum Standard Proctor dry density.
4. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density, with the water content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered adequate.
5. The road subgrade will suffer a strength regression if water is allowed to infiltrate prior to paving. The following measures should therefore be incorporated in the construction procedures and road design:

- If the road construction does not immediately follow the trench backfilling, the subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Lot areas adjacent to the roads should be properly graded to prevent the ponding of large amounts of water during the interim construction period.
- Curb subdrains will be required. The subdrains should consist of filter-sleeved weepers to prevent blockage by silting.
- If the roads are to be constructed during the wet seasons and extensively soft subgrade occurs, the granular sub-base may require thickening. This can be assessed during construction.

Soil Parameters

1. The recommended soil parameters for the project design are given below:

Fine sand unit weight - 20.5 kN/m3
Fine sand estimated bulk factor (loose) - 1.25, (compacted) - 1.00
Fine Sand Active Ka - 0.33
Fine Sand At Rest K0 - 0.45
Passive Kp - 3.00

Excavation

1. Excavation should be carried out in accordance with Ontario Regulation 213/91.
2. Excavations in excess of 1.2 m should be sloped at 1 vertical:1 horizontal for stability.
3. For excavation purposes, the types of soils are classified below:

Sand above groundwater - 3
Sand below groundwater - 4

4. The groundwater yield from the sand will be appreciable and persistent. When excavating into the water-bearing sand at a shallow depth, groundwater should be controlled by vigorous pumping from closely spaced sump-wells at a depth of 0.3 m or less below the groundwater level. For excavation deeper than 0.3 m below the groundwater level, a well-point dewatering system will be required.
5. Prospective contractors must be asked to assess the in situ subsurface conditions by digging test pits to at least 0.5 m below the intended bottom of excavation in order to determine the appropriate dewatering measures for subgrade stabilization.

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BENCHMARKS
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO BENCHMARK NO. 0011971U191, HAVING A ELEVATION 187.747 PER CGVD28 METRES LOCATED AT Mr. ca ANDERSON RESIDENCE, WHITE FRAME HOUSE ON NORTHWEST SIDE OF HIGHWAY 92, AT INTERSECTION WITH ZOO PARK ROAD, 1.6km NORTHEAST OF BRIDGE OVER NOTTAWASAGA RIVER, TABLET IN SOUTHWEST CONCRETE FOUNDATION, 3.08m NORTHWEST OF SOUTHWEST CORNER, 51cm NORTHWEST OF A BASEMENT WINDOW AND 39cm BELOW STUCCO SIDING

LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

LICENSED PROFESSIONAL ENGINEER
C/CAPES
100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

Client
WASAGA RIVERWOODS HOMES
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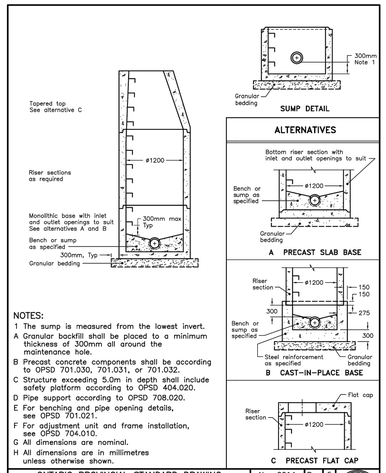
WASAGA RIVERWOODS
STANDARD DETAILS

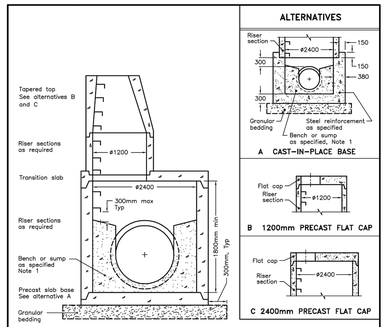
Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C11
Project No. 2018-012		Rev No. 4	
Scale 1:___			

File: C:\CAPES Engineering Dropbox\Projects\CAD\2018-012 Wasaga Riverwoods\Drawings\03_ProductionDwg\2018-012 DETAILS.dwg Date Plotted: September 22, 2022 - 1:43 PM



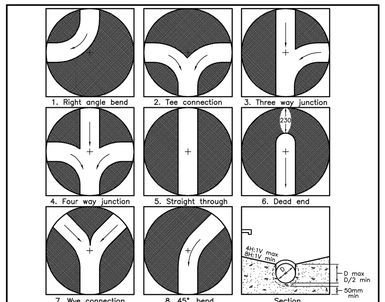
NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 1200mm DIAMETER		OPSD 701.010



NOTES:
1 For sump detail, see OPSD 701.010.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.060, 701.061, 703.013, 703.023, 706.030 and 706.031.
C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support shall be according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 2400mm DIAMETER		OPSD 701.013

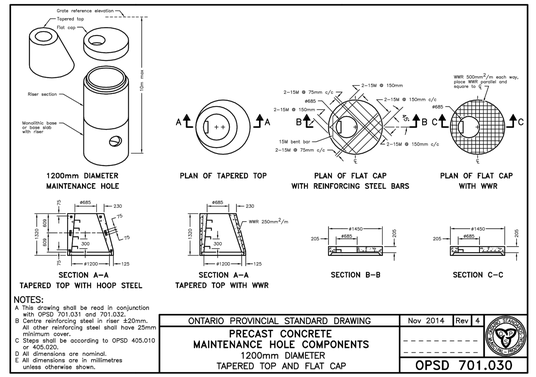


MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS

Maintenance Hole Diameter	No. 1–4	No. 5 and 6	No. 8	No.7	
				Inlet Hole	Outlet Hole
1200	700	860	780	700	860
1500	860	1220	960	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2470	3085	2730	2470	3085

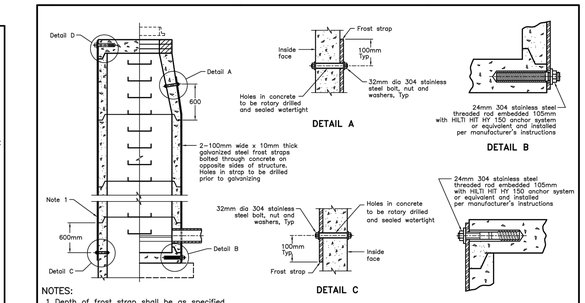
NOTES:
A Slopes shall be maintained from the outlet hole opening for top of benching.
A Concrete for benching shall be 30MPa.
B When benching is hand-finished, it shall be given wood float finish, channel shall be given steel trowel finish.
C Benching slope and height shall be as specified.
D When specified, maintenance holes that are 1200mm in diameter with a uniform channel for 200 or 250mm pipe may be prebenched at the manufacturer with standardized benching slope and channel orientation.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 4
MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES		OPSD 701.021



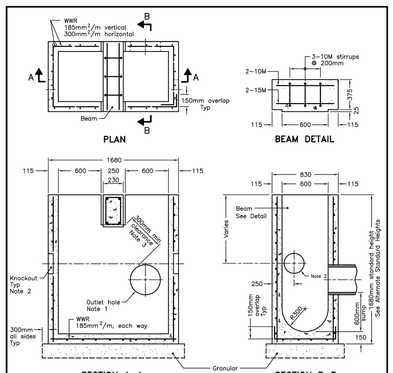
NOTES:
A This drawing shall be read in conjunction with OPSD 701.031 and 701.032.
B Cast-in reinforcing steel in riser ±20mm. All other reinforcing steel shall have 25mm minimum cover.
C Steps shall be according to OPSD 405.010 or 405.020.
D All dimensions are nominal.
E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 4
PRECAST CONCRETE MAINTENANCE HOLE COMPONENTS 1200mm DIAMETER TAPERED TOP AND FLAT CAP		OPSD 701.030



NOTES:
1 Depth of frost strap shall be as specified.
A Frost straps shall be placed so they do not interfere with sewer pipe openings and the steps.
B Frost straps shall be placed when specified.
C Galvanizing shall be according to CAN/CSA G164.
D All dimensions are in millimetres unless otherwise shown.

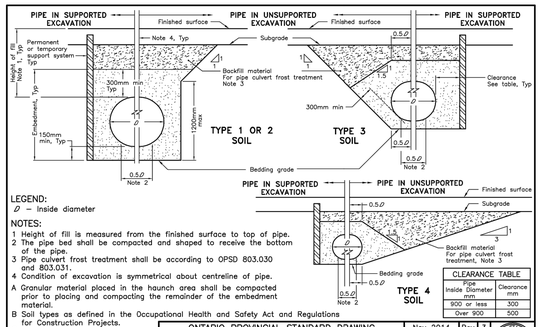
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2018	Rev 3
FROST STRAP INSTALLATION		OPSD 701.100



NOTES:
1 Outlet hole size 525mm diameter maximum, location as required.
2 200mm diameter knockout to accommodate subdrain. Knockout shall be 60mm deep.
3 Minimum clearance between beam recess and hole for pipe shall be 300mm or minimum clearance can be 150mm with addition of two 15M size rebar on 45 degree diagonal.
A Centre reinforcing in base slab and walls ±20mm.
B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.
D Pipe support shall be according to OPSD 708.020.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ALTERNATE STANDARD HEIGHTS	
ALTERNATIVE	DIMENSION
A	1980
B	1830
C	1680

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2019	Rev 4
PRECAST CONCRETE TWIN INLET CATCH BASIN 600 x 1450mm		OPSD 705.020

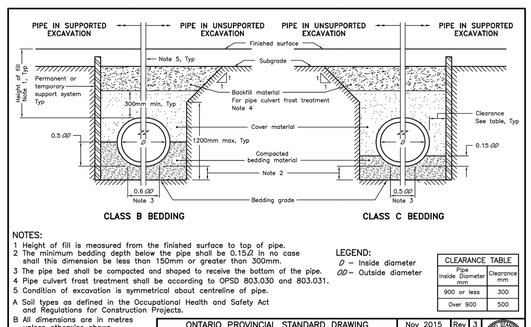


LEGEND:
D – Inside diameter

NOTES:
1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.
A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.
B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
C All dimensions are in metres unless otherwise shown.

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 3
FLEXIBLE PIPE EMBEDMENT AND BACKFILL EARTH EXCAVATION		OPSD 802.010

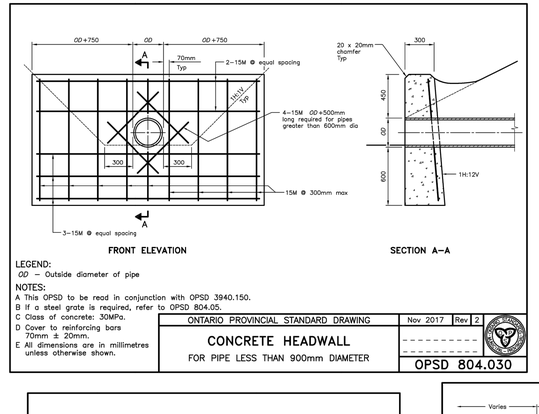


NOTES:
1 Height of fill is measured from the finished surface to top of pipe.
2 The minimum bedding depth below the pipe shall be 0.15D in no case shall this dimension be less than 150mm or greater than 300mm.
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.
A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
B All dimensions are in metres unless otherwise shown.

LEGEND:
D – Inside diameter
OD– Outside diameter

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

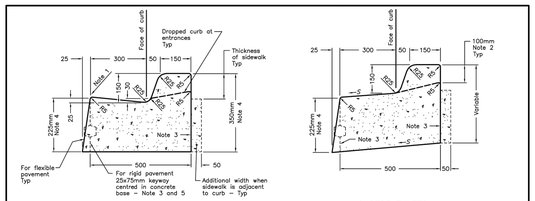
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 3
RIGID PIPE BEDDING, COVER, AND BACKFILL TYPE 1 OR 2 SOIL – EARTH EXCAVATION		OPSD 802.030



LEGEND:
OD – Outside diameter of pipe

NOTES:
A This OPSD to be read in conjunction with OPSD 3940.150.
B If a steel grate is required, refer to OPSD 804.05.
C Class of concrete: 30MPa.
D Cover to reinforcing bars 70mm ± 20mm.
E All dimensions are in millimetres unless otherwise shown.

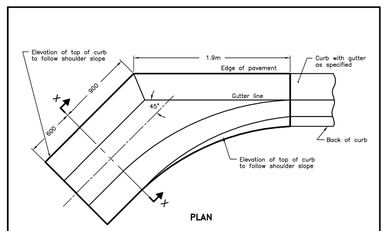
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2017	Rev 2
CONCRETE HEADWALL FOR PIPE LESS THAN 900mm DIAMETER		OPSD 804.030



LEGEND:
S – Rate of pavement superelevation in percent, %.

NOTES:
1 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.
2 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
3 For slipforming procedure a 5% batter is acceptable.
4 For composite pavement the depth of concrete curb shall be adjusted to depth of concrete pavement.
5 When tie bars are specified, refer to OPSD 552.010 and 552.020 for details.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

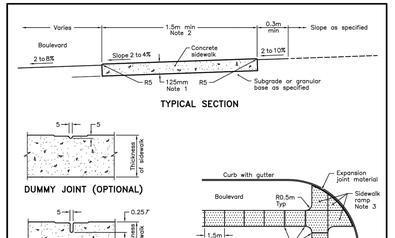
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE BARRIER CURB WITH STANDARD GUTTER		OPSD 600.040



CURB with GUTTER Type	x
Barrier	200
Semi–Mountable	300
Mountable	400

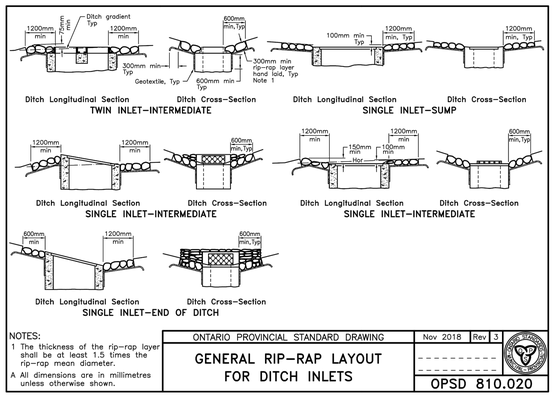
NOTES:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
45° CONCRETE OUTLET FOR CONCRETE CURB WITH GUTTER AT END OF RUN		OPSD 605.030



NOTES:
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.
2 Sidewalk width shall be wider when specified.
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.033, and 310.039.
4 Contraction Joint may be tooled or sawcut.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2019	Rev 3
CONCRETE SIDEWALK		OPSD 310.010



NOTES:
1 The thickness of the rip–rap layer shall be at least 1.5 times the rip–rap mean diameter.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2018	Rev 3
GENERAL RIP–RAP LAYOUT FOR DITCH INLETS		OPSD 810.020

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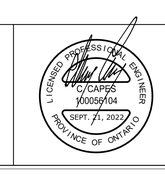
LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

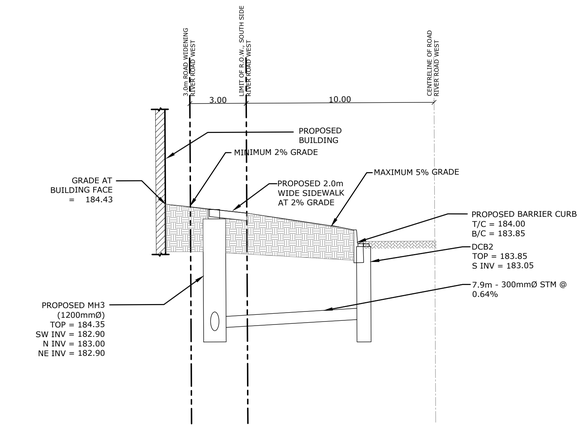


Client
WASAGA RIVERWOODS HOMES
30 FULTON WAY, UNIT 8
RICHMOND HILL, ON
L4B 1E6

CAPES ENGINEERING
355310 BLUE MOUNTAINS - EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

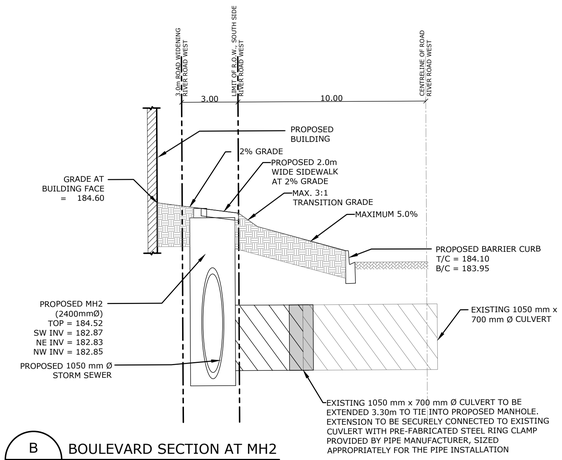
WASAGA RIVERWOODS
STANDARD DETAILS

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C12
Project No. 2018-012		Rev No. 4	
Scale 1:___			



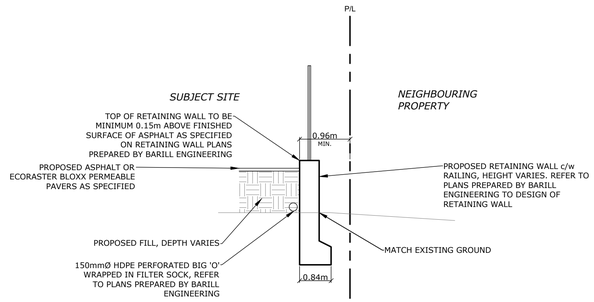
A C2 BOULEVARD SECTION AT MH3

SCALE 1:150H 1:30V



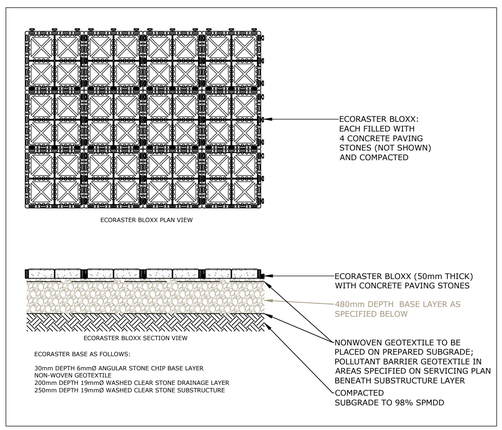
B C2 BOULEVARD SECTION AT MH2

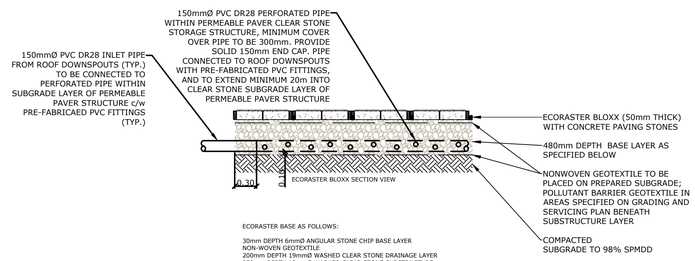
SCALE 1:150H 1:30V



TYPICAL EDGE OF PARKING LOT
c/w RETAINING WALL

N.T.S.





DOWNSPOUT CONNECTION TO PERMEABLE PAVER INFILTRATION LAYER

NTS

Notes
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2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to CAPES Engineering Ltd. prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No	Revision	Date
1	ISSUED FOR APPROVALS	20/08/10
2	REVISED FOR APPROVALS	21/11/16
3	REVISED FOR APPROVALS	22/03/17
4	REVISED FOR APPROVALS	22/09/21

NOTES:
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BOUNDARY SURVEY INFORMATION PROVIDED BY OWNER, PREPARED BY NANFARA & NG SURVEYORS INC. AND SHOWN APPROXIMATELY HEREON. THIS IS NOT A PLAN OF SURVEY.

BENCHMARKS
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LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

LICENSED PROFESSIONAL ENGINEER
C. CAPES
100056104
SEPT. 21, 2022
PROVINCE OF ONTARIO

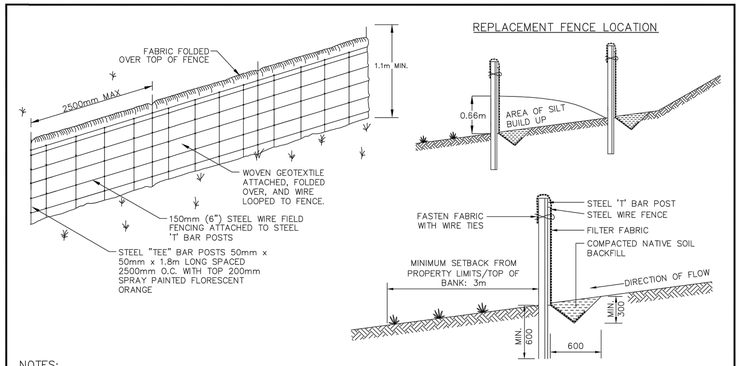
Client
WASAGA RIVERWOODS HOMES
30 FULTON WAY, UNIT 8
RICHMOND HILL, ON
L4B 1E6

CAPES ENGINEERING
355310 BLUE MOUNTAINS - EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

WASAGA RIVERWOODS

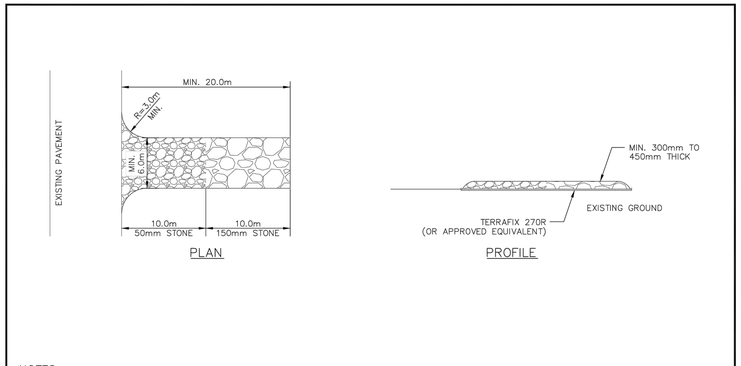
STANDARD DETAILS

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C13
Project No.		Rev No.	
2018-012		4	
Scale			
AS NOTED			



NOTES:
1. SILT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW.
2. SILT/SEDIMENT CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFORM TO MTO DRAINAGE MANUAL VOLUME 2 "CHART F4–3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT."
3. SILT/SEDIMENT CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL A MIN. OF 300mm BY EITHER STATIC SLICING OR TRENCH METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% INSITU SOIL STRENGTH.
4. STEEL "T" BAR POSTS ARE TO BE SPACED MAX. 2500mm ON CENTER.
5. FROZEN GROUND CONDITIONS REQUIRE FILTER FABRIC TO BE BACKFILLED IN TRENCH WITH CLEAR STONE.
6. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
7. GEOTEXTILE FABRIC TO BE COMPRISED OF WOVEN OR NON–WOVEN U.V. STABILIZED MATERIAL. FABRIC TO BE FOLDED OVER TOP OF FENCE MIN. 300mm AND WIRE FASTENED.

TOWN OF WASAGA BEACH	
TYPICAL DETAIL OF SILT/SEDIMENT FENCE	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: APRIL 2021
	STD.DWG.No.16



NOTES:
1. LENGTH AS REQUIRED BUT NOT LESS THAN 20m.
2. WIDTH OF 6m BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.
3. MINIMUM 300mm TO 450mm THICKNESS OF 50mm MINIMUM STONE SIZE EXTENDING FROM THE EDGE OF ROAD FOR 10m, THEN 150mm STONE FOR THE REMAINING 10m.
4. TERRAFIX 270R GEOTEXTILE (OR APPROVED EQUIVALENT) TO BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
5. ENTRANCES SHALL BE PROVIDED WITH A CULVERT IF REQUIRED FOR ROADSIDE SURFACE DRAINAGE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN THE ENTRANCE AND PROVIDE ADDITIONAL STONE TO THE SATISFACTION OF THE TOWN SUCH THAT SEDIMENT IS NOT TRACKED ONTO THE ADJACENT ROADWAY.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEARING ANY SEDIMENT THAT IS TRACKED ONTO MUNICIPAL RIGHTS–OF–WAY TO THE SATISFACTION OF THE TOWN.
8. INSPECTED DAILY AND REINSTATED ACCORDINGLY.

TOWN OF WASAGA BEACH	
STONE MUD MAT DETAIL	
DRAWN: MRT	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: APRIL 2021
	STD.DWG.No.17

NVCA EROSION & SEDIMENT CONTROL NOTES

1. SEDIMENT FENCING SHALL BE LOCATED AT THE BOTTOM AND 3m BEYOND THE TOE OF SLOPE ON THE FLAT SURFACE.

2. SEDIMENT FENCING ARE TO BE CONSTRUCTED OF UV STABILIZED WOVEN OR NON-WOVEN FABRIC THAT IS WRAPPED OVER THE TOP OF THE SUPPORT FENCING AND FASTENED. THE BASE OF THE FABRIC IS TO BE TOED INTO THE NATIVE SOIL TO A MINIMUM DEPTH OF 300mm BY EITHER STATIC SLICING TECHNIQUE OR TRENCHING.

3. THE NATIVE TRENCH MATERIAL TO TOE, IN FABRIC BASE, SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. THE FENCE STRUCTURE SHALL CONSIST OF A 1.10m, 150mm PAGE WIRE FENCE FASTENED TO STEEL T-BAR FENCE POSTS, LOCATED 2500mm ON CENTER. THE POSTS SHALL BE PLACED A MINIMUM OF 600mm INTO THE GROUND.

5. UPON 60% OF THE SEDIMENT FENCE BEING BLOCKED FROM SEDIMENT DEPOSITION, A NEW SEDIMENT CONTROL FENCE SHALL BE CONSTRUCTED UPSTREAM OF THE EXISTING ONE. THE NEW FENCE SHALL BE INSTALLED UPSTREAM AND BEYOND THE SEDIMENT LOADING AREA AND SHALL CONFORM TO ALL DESIGN STANDARDS AND POLICIES.

6. ROCK CHECK DAMS ARE TO BE PLACED WITH A MAXIMUM UPSTREAM SLOPE OF 1.5:1 AND A MAXIMUM DOWNSTREAM SLOPE OF 4:1.

7. A TEMPORARY SETTLING TRENCH IS TO BE EXCAVATED IN FRONT OF THE ROCK CHECK DAM TO A MINIMUM DEPTH OF 0.60m WITH A VOLUME OF 3 cu.m.

8. THE ROCK IS TO BE PLACED IN TWO LAYERS, SEPARATED BY A NON-WOVEN GEOTEXTILE. THE FIRST LAYER IS TO CONSIST OF A 150mm DIA. STONE WRAPPED IN THE FABRIC TO A HEIGHT OF 450mm. THE SECOND LAYER IS TO CONSIST OF A 50mm DIA. STONE THAT EXTENDS FROM THE BASE OF THE SETTLING TRENCH TO THE TOP OF THE FIRST LAYER. THE SECOND LAYER IS TO BE A MINIMUM 100mm THICK.

9. THE SECOND LAYER OF STONE SHOULD BE PILED TO ANCHOR THE GEOTEXTILE AND FORM A LOW CENTER SPILLWAY THAT IS A MINIMUM 300mm BELOW THE TOP OF THE CHANNEL BANK.

10. THE CHANNEL DITCH SIDE SLOPES ARE TO BE ARMOR PROTECTED FROM EROSION ON EACH SIDE OF THE ROCK CHECK DAM BY EXTENDING THE STONE ALONG THE DITCH SIDE SLOPES TO A HEIGHT OF 0.70m.

11. IN SWALES AND DITCHES WHERE THERE IS INCREASED SLOPE LENGTH AND/OR SIGNIFICANT GRADIENT, A SERIES OF ROCK CHECK DAMS MUST BE USED.

12. THE HEIGHT OF SUBSEQUENT ROCK CHECK DAMS MUST BE EQUAL TO THE ELEVATION OF THE BASE OF THE PREVIOUS ROCK CHECK DAMS.

13. THE ROCK CHECK DAM IS TO BE REPLACED UPON 50% OF THE HEIGHT OF THE ROCK CHECK DAM BEING COVERED WITH SEDIMENT.

14. CONSTRUCTION PROJECTS SHALL PROVIDE A MINIMUM 3m WIDE VEGETATIVE BUFFER STRIP ALONG THE LIMITS OF THE DEVELOPMENT INCLUDING FRONTAGES ALONG EXISTING ROAD BOULEVARDS.

15. AREAS ADJACENT TO WATERCOURSES SHALL PROVIDE A MINIMUM 15m BUFFER ZONE SETBACK FROM TOP OF BANK (30m FOR COLD WATER FISHERIES) AND/OR AVERAGE HIGH WATER MARK, WHICHEVER IS GREATER.

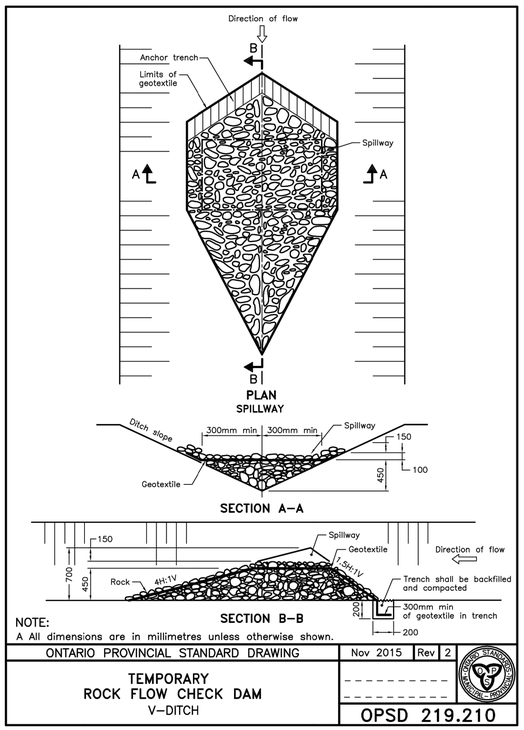
16. UPON OBSERVATION OF CONTINUOUS MUD TRACKING, OCCURRING ONTO ADJACENT STREETS, THE STONE ENTRANCE PAD IS TO BE FULLY REPLACED.

17. THE SITE PROJECT ENGINEER SHALL UNDERTAKE WEEKLY INSPECTIONS OF ALL SEDIMENT/EROSION CONTROL FACILITIES DURING THE EXTENT OF THE ENTIRE CONSTRUCTION PROJECT INCLUDING THE BUILDING CONSTRUCTION PERIOD AS WELL AS AFTER ALL RAIN EVENTS 13mm OR GREATER.

18. CONSTRUCTION AREAS THAT EXCEED 30 DAYS OF INACTIVITY SHALL BE STABILIZED BY SEEDING. THE IS TO INCLUDE STOCKPILES OF FILL AND TOPSOIL. THE SPECIFICATION FOR SITE STABILIZATION ARE AS FOLLOWS:
18.1. LARGE OPEN AREAS: LOOSEN SOIL TO A DEPTH OF 100mm AND APPLY THE FOLLOWING HYDROSEED MIXTURE (30% ANNUAL RYEGRASS, 40% PERENNIAL RYEGRASS, 15% CREEPING RED FESCUE, 10% TIMOTHY, 5% WHITE CLOVER) WITH VERDOYL MULCH AT A RATE OF 200kg/ha AND A FERTILIZER 8-32-16 AT A RATE OF 450 kg/ha.
18.2. TOPSOIL STOCKPILES: LOOSEN SOIL TO A DEPTH OF 50mm AND APPLY THE HYDROSEED MIXTURE INDICATED IN #1 ABOVE.
18.3. BUFFER ZONES: SPREAD 50mm OF TOPSOIL AND APPLY HYDROSEED MIXTURE, "GREENFIELDS" BY PICKSEED, AT AN APPLICATION RATE OF 200 kg/ha

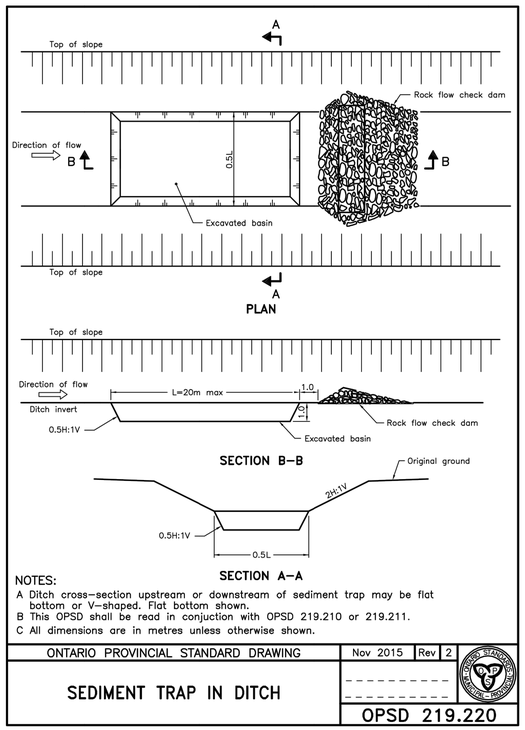
19. DURING THE CONSTRUCTION PERIOD, WHEN INTERNAL STREETS SYSTEMS HAVE HAD ASPHALT INSTALLED, A STREET CLEANING SCHEDULE WILL BE UNDERTAKEN ON A MINIMUM WEEKLY BASIS, OR AS DIRECTED BY THE MUNICIPALITY OR CONSERVATION AUTHORITY.

20. ALL CATCHBASINS, REAR YARD CATCHBASIN AND CATCHBASIN MANHOLES TO BE INSTALLED WITH A SILT SACK INLET SEDIMENT CONTROL DEVICE.



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

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
TEMPORARY ROCK FLOW CHECK DAM V–DITCH		OPSD 219.210



NOTES:
A Ditch cross–section upstream or downstream of sediment trap may be flat bottom or V–shaped. Flat bottom shown.
B This OPSD shall be read in conjuction with OPSD 219.210 or 219.211.
C All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
SEDIMENT TRAP IN DITCH		OPSD 219.220

Notes
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No	Revision	Date
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2	REVISED FOR APPROVALS	21/11/16
3	REVISED FOR APPROVALS	22/03/17
4	REVISED FOR APPROVALS	22/09/21

NOTES:
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LOCAL BENCHMARK:
TOP OF SIB AT NORTH WEST CORNER OF SUBJECT SITE. ELEV = 183.53

Client
WASAGA RIVERWOODS HOMES
30 FULTON WAY, UNIT 8
RICHMOND HILL, ON
L4B 1E6

WASAGA RIVERWOODS

STANDARD DETAILS

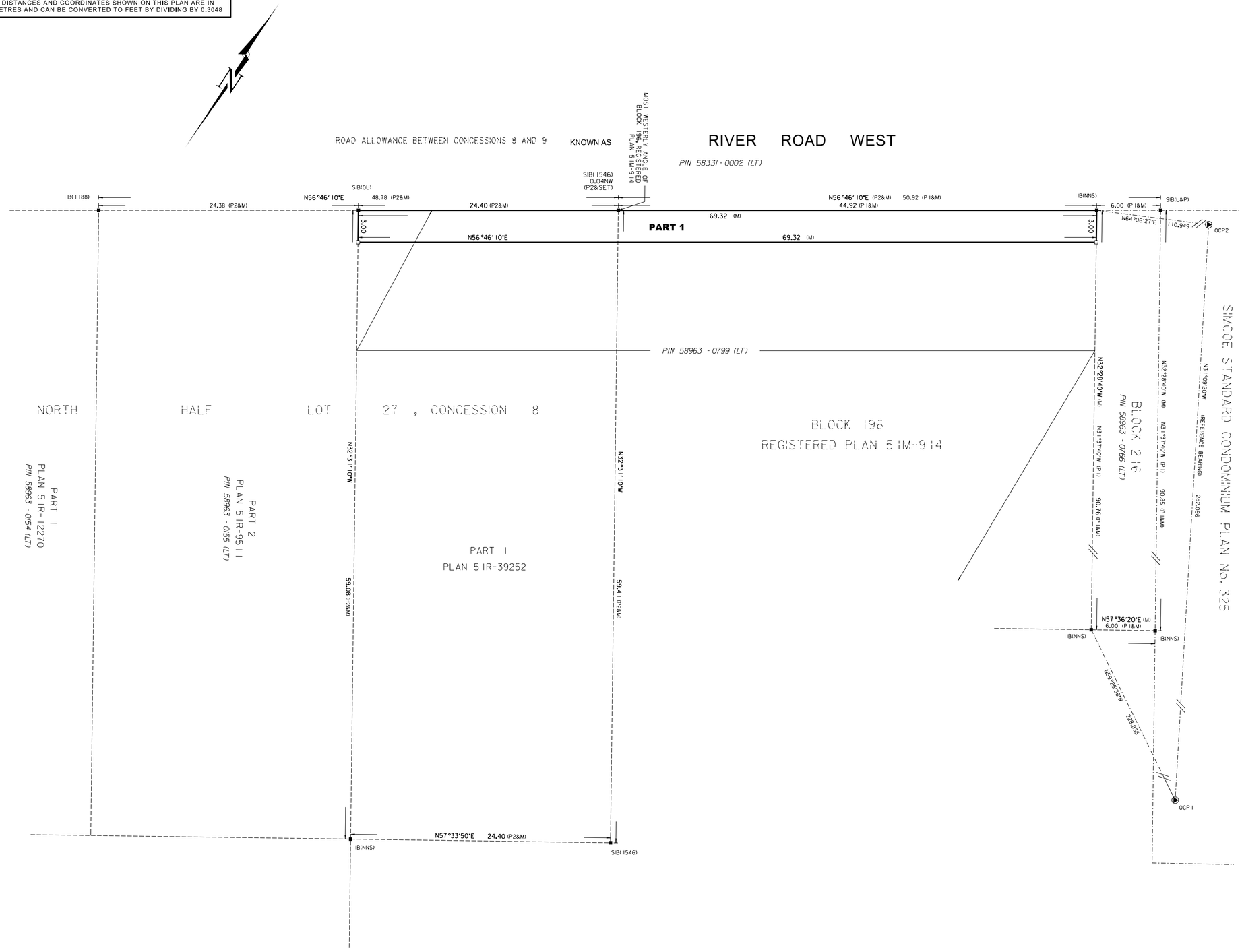
CAPES ENGINEERING
355310 BLUE MOUNTAINS - EUPHRASIA TOWNLINE
CLARKSBURG, ON N0H 1J0
TEL: 705-994-4818

Designed	Checked	Date	Drawing No.
B. COLLINS	C. CAPES	20/07/20	C14
Project No. 2018-012		Rev No. 4	
Scale 1:___			

Appendices

Appendix A – Legal & Site Plan

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



COORDINATES (UTM), ZONE 17, NAD 83 (CSRS) (2010)		
STATION	NORTHING	EASTING
ORP1	4930059.754	579059.023
ORP2	4930301.071	578913.125

I REQUIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.

DATE: XXXXXXXXXXX

FOO YIP NG
ONTARIO LAND SURVEYOR

PLAN 51R-

RECEIVED AND DEPOSITED

DATE: _____

_____
REPRESENTATIVE FOR THE LAND REGISTRAR FOR THE LAND TITLES DIVISION OF SIMCOE (No. 51)

PART SCHEDULE

PART	LOT / BLOCK	PLAN / CONCESSION	PIN No.
1	PART OF BLOCK196 AND PART OF LOT 27	REGISTERED PLAN 51M-914 AND CONCESSION 8	PART OF PIN 58963-0799 (LT)

PLAN OF SURVEY OF

PART OF BLOCK 196 REGISTERED PLAN 51M-914

AND

PART OF THE NORTH HALF OF LOT 27, CONCESSION 8

(GEOGRAPHIC TOWNSHIP OF FLOS)

TOWN OF WASAGA BEACH

COUNTY OF SIMCOE

SCALE 1 : 200

5m 0 5 10 15m

NOTES

BEARINGS ARE UTM GRID, ZONE 17, NAD83(CSRS)(2010) AND ARE DERIVED FROM THE OBSERVED REFERENCE POINTS OCP1 AND OCP2 BY REAL TIME NETWORK AND STATIC OBSERVATIONS.

DISTANCES SHOWN ON THIS PLAN ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.99962322.

CONTROL MONUMENTS SHOWN HAVE BEEN TIED TO THIS SURVEY TO THE URBAN ACCURACY PER SEC. 14(2) OF ONTARIO REGULATION 216/10.

COORDINATES BSHOWN CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

PLANTED MONUMENTS SHOWN HEREON ARE IB'S UNLESS SHOWN OTHERWISE.

LEGEND

P1	_____	REGISTERED PLAN 51M-914
P2	_____	PLAN 51R-39252
M	_____	MEASURED
OU	_____	ORIGIN UNKNOWN
NNS	_____	NANFARA & NG SURVEYORS INC.
1188	_____	C.A. SEXTON LIMITED
1546	_____	RUDY MAK SURVEYING LTD.
L&P	_____	LLOYD & PURCELL LTD.
ORP	_____	OBSERVED REFERENCE POINT

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.

2. THE SURVEY WAS COMPLETED ON THE 22th DAY OF JUNE, 2021.

JUNE 30, 2021
DATE:

FOO YIP NG
ONTARIO LAND SURVEYOR

nanfara & ng surveyors inc
PROFESSIONAL LAND SURVEYORS

#1 ASHBRIDGE CIRCLE, UNIT 9 WOODBRIDGE, ONTARIO, L4L 3R5
TEL:905.856.5923 FAX:905.856.7092 nnsurveyors@gmail.com

CHECKED BY:	DRAWN BY:	REV. DATE:	W.O.	REV.
JN	FYN	2021/06/30	20130509R3	A

1 SITE PLAN
1 : 400

SITE STATISTICS

ZONING CATOGORY: DOWNTOWN CORE
LOT AREA: 9886.4 m² (2.44 ACRE)

NET LOT AREA: 9678.5 m² (2.39 ACRE)

	PERMITTED / REQUIRED	PROPOSED / PROVIDED
BUILDING AREA		1,337.48 M² (14,396 SF)
GROSS FLOOR AREA		6,492.16 M² (69,881 SF)
LOT COVERAGE	75% MAX.	13.8%
LANDSCAPE AREA	30% MIN.	45.77%
BUILDING HEIGHT	4 STOREYS MAX.	5 STOREYS (18.17m)
LOT FRONTAGE	25m MIN.	69.32m
LOT AREA	1,000m² MIN.	9,678.5m²
FRONT YARD	0m MIN.	1.22m
INTERIOR YARD	1.2m MIN.	5.96m / 12.08m
REAR YARD	7.5m MIN.	48.56 m
AMENITY SPACE	1BD: 14X5=70 M² 1BD+DEN & 2BD: 56X10=560 M² **TOTAL: 630 m²**	249 m² (INDOOR) 397 m² (OUTDOOR) **TOTAL: 646 m²**
RESIDENTIAL UNITS		1-BEDROOM: 14 UNITS 1-BEDROOM + DEN: 33 UNITS 2-BEDROOM: 23 UNITS **TOTAL: 70 UNITS**
DENSITY	74 UNITS/HECTARE MAX.	72 UNITS/HECTARE
LOCKERS		70
PARKING	RESIDENCE: 88 SPACES (1.25 SPACE/UNIT)	88 SPACES
	VISITOR: 11 SPACES (0.15 SPACE/UNIT)	11 SPACES
	TOTAL 99 SPACES	99 SPACES
	BARRIER-FREE: 5 SPACES	5 SPACES
BICYCLE PARKING	**18 SPACES** (0.25 SPACE/UNIT)	**18 SPACES**

LEGEND

- FS — FIRE ROUTE SIGN
- FIRE DEPARTMENT CONNECTION
- MEN DOOR (ENTRANCES & EXITS)
- × XXX.XX — PROPOSED GRADING
- MH — MANHOLES
- LIGHT STANDARD
- CB — CATCH BASIN
- FH — FIRE HYDRANT
- (XX) — INDICATE NUMBER OF PARKING SPACES
- ACCESSIBLE PARKING SPACES

No.	Date:	Issued/Revision:	By
9	SEPT. 1/22	REISSUED FOR SPA	HW
8	MAR 22/22	REISSUED FOR SPA	HW
7	OCT 20/21	ISSUED FOR REVIEW	HW
6	NOV 23/20	REISSUED FOR SPA	HW
5	AUG 26/20	ISSUED FOR SPA	HW
4	MAY 06/20	ISSUED FOR REVIEW	HW
3	APR. 08/20	ISSUED FOR REVIEW	HW
2	AUG. 08/18	ISSUED FOR REVIEW	HW
1	AUG. 03/18	ISSUED FOR REVIEW	HW

AND Architecture Inc.
3950 14th Ave. Suite 609
Markham, ON L3R 0A9
T: 905-604-6960
E: info@andarchitectureinc.com
www.andarchitectureinc.com

Project :

RIVERWOODS HOMES

RIVER ROAD WEST
WASAGA BEACH, ON

Drawing Name :

SITE PLAN

Date JUNE 2019	Project No : 18026
Scale : As indicated	
Drawn by : JW	Drawing No : A1
Checked by : HW	

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Appendix B – Geotechnical Information

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
100 NUGGET AVENUE, TORONTO, ONTARIO M1S 3A7 • TEL: (416) 754-8515 • FAX: (416) 754-8516

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A REPORT TO
R. J. BURNSIDE & ASSOCIATES LIMITED

A SOIL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

WESTBURY ROAD AND RIVER ROAD WEST

TOWN OF WASAGA BEACH

Reference No. 1401-S081

MAY 2014

DISTRIBUTION

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1.0 **INTRODUCTION**

In accordance with authorization by email dated January 31, 2014, from Mr. Clayton Capes of R.J. Burnside & Associates Limited, a soil investigation was carried out at a parcel of land at the southwest sector of Westbury Road and River Road West in the Town of Wasaga Beach, for a proposed Residential Development.

The purpose of the investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils for the design and construction of the proposed project.

The geotechnical findings and resulting recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The site is situated on a bluff on the Nottawasaga basin where glacial Lake Nipissing previously extended. The stratigraphy consists of sand derived from outwash of the Edenvale Moraine, fluvial deposit of Lake Nipissing and the present Nottawasaga River.

The subject site is irregular in shape and is situated at the southwest sector of Westbury Road and River Road West in the Town of Wasaga Beach. The investigated site is within a bushy area covered with weeds and trees. The ground surface is relatively flat with some undulations.

It is understood that the proposed project will consist of a residential development which will be provided with municipal services and roadways meeting the municipal standards.

3.0 **FIELD WORK**

The field work, consisting of 4 boreholes to a depth of 5.0 m, was performed on April 28, 2014, at the locations shown on the Borehole Location Plan and Subsurface Profile, Drawing No. 1. One monitoring well was installed at Borehole 1 for future groundwater monitoring.

The holes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine equipped for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed "List of Abbreviations and Terms", were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or 'N' values) of the subsoil. The relative density of the granular strata and the consistency of the cohesive strata are inferred from the 'N' values. Split-spoon samples were recovered for soil classification and laboratory testing.

The field work was supervised and the findings recorded by a Geotechnical Technician.

The sampling depths and the depths of the soil strata changes were referred to the prevailing ground surface at each of the borehole locations.

4.0 SUBSURFACE CONDITIONS

Detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 4, inclusive. The revealed stratigraphy is plotted on the subsurface profile on Drawing No. 1, and the engineering properties of the disclosed soils are discussed herein.

The investigation has disclosed that beneath either a peat layer or a veneer of topsoil, the site is underlain by a stratum of fine sand.

4.1 **Peat** (Boreholes 1 and 4)

The peat layer is 25 cm or 30 cm thick; it is fibrous-granular in texture, containing fine, fibrous decaying vegetation with occasional topsoil layers. It was formed by the progressive accumulation of incompletely decomposed plants in a wet environment. Its natural water content values are 111% and 723%, indicating that the peat is highly compressible and unstable under loading conditions. Due to its high humus content, it will produce volatile gases and generate an offensive odour under anaerobic conditions.

4.2 **Topsoil** (Boreholes 2 and 3)

The revealed topsoil is 8 cm or 25 cm in thickness. The topsoil is dark brown in colour, indicating it contains appreciable amounts of roots and humus. These materials are unstable and compressible under loads; therefore, the topsoil is considered to be void of engineering value. Due to its humus content, it may produce volatile gases and generate an offensive odour under anaerobic conditions. Therefore, the topsoil must not be buried below any structures or deeper than 1.2 m below the

finished grade so it will not have an adverse impact on the environmental well-being of the developed areas.

Since the topsoil is considered void of engineering value, it can only be used for general landscaping and landscape contouring purposes. A fertility analysis can determine the suitability of the topsoil as a planting material.

4.3 **Fine Sand** (All Boreholes)

The sand deposit was encountered beneath either a peat layer or a veneer of topsoil and extends to the maximum investigated depths of all boreholes. The fine sand contains some silt and medium sand layers with occasional silt seams and layers, showing that it is a lacustrine and alluvial deposit. The upper portion of the sand has been loosened by weathering to depths ranging from 0.6 to 2.1 m below the prevailing ground surface.

Sample examinations showed that the sand is non-cohesive, and it is in a saturated condition. This is confirmed by the determined water content values of the samples which range from 21% to 33%, with a median of 23%, showing the sand is in a saturated and water-bearing condition.

The obtained ‘N’ values range from 3 to 43, with a median of 20 blows per 30 cm of penetration; therefore, the relative density of the sand is inferred to be very loose to dense, being generally compact.

Grain size analyses were performed on 3 representative samples; the results are plotted on Figure 5.

Based on the above findings, the following engineering properties of the sand are deduced:

- Low frost susceptibility and soil-adfreezing potential, with high water erodibility.
- Susceptible to migration through small openings under seepage pressure.
- Pervious, with an estimated coefficient of permeability of 10^{-3} to 10^{-4} cm/sec, an estimated percolation rate of 2 to 5 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.04 to 0.07
2% - 6%	0.09 to 0.12
6% +	0.13 to 0.18

- A frictional soil, its shear strength is dependent on its internal friction angle and soil density. Due to its dilatancy, its shear strength is susceptible to impact disturbance; i.e., the disturbance will induce a build-up of pore pressure within the soil mantle, resulting in soil dilation and reduction of shear strength.
- A fair pavement-supportive material, with a California Bearing Ratio value of 10%.
- Moderately low corrosivity to buried metal, with an estimated electrical resistivity of 6000 ohm·cm.

4.4 **Compaction Characteristics of the Revealed Soils**

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied.

As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Fine Sand	21 to 33 (median 23)	11	5 to 16

Based on the above findings, the fine sand is excessively wet for 95% or + Standard Proctor compaction. It will require prior aeration or mixing with drier soil prior to compaction. Aeration of the wet sand can be effectively carried out by spreading it thinly on the ground in the dry, warm weather, or it can also be properly stockpiled.

The sand can be compacted by a smooth roller with or without vibration, depending on the water content of the soils being compacted. The lifts for compaction should be limited to 20 cm, or to a suitable thickness as assessed by test strips performed by the equipment which will be used at the time of construction. The sand should be compacted by a vibratory roller or a plate compactor.

One should be aware that, with considerable effort, a 90%± Standard Proctor compaction of the wet sand is achievable. Further densification is prevented by the pore pressure induced by the compactive effort; however, large random voids will have been expelled and, with time, the pore pressure will dissipate and the percentage of compaction will increase. There are many cases on record where, after a few months of rest, the density of the compacted mantle has increased to over 95% of its maximum Standard Proctor dry density.

If the compaction of the sand is carried out with the water content within the range for 95% Standard Proctor dry density but on the wet side of the optimum, the surface of the compacted soil mantle will roll under the dynamic compactive load. This is unsuitable for pavement construction since each component of the pavement structure is to be placed under dynamic conditions which will induce the rolling action of the subgrade surface and cause structural failure of the new pavement. The foundation or bedding of the sewer and slab-on-grade will be placed on a subgrade which will not be subjected to impact loads. Therefore, the structurally compacted soil mantle with the water content on the wet side or dry side of the optimum will provide an adequate subgrade for the construction.

5.0 GROUNDWATER CONDITIONS

Groundwater seepage encountered during augering was recorded on the field logs. The level of groundwater was measured upon completion of the boreholes; the data are plotted on the Borehole Logs and listed in Table 2.

Table 2 - Groundwater Levels

	Borehole	Soil Colour Changes Brown to Grey	Seepage Encountered During Augering		Measured Groundwater Level On Completion
BH No.	Depth (m)	Depth (m)	Depth (m)	Amount	Depth (m)
1	5.0	1.0	0.2	Appreciable	0.3
2	5.0	2.3	0.3	Appreciable	0.5
3	5.0	2.3	0.3	Appreciable	0.8
4	5.0	1.8	0.2	Appreciable	0.3

Groundwater was encountered at depths ranging from 0.3 to 0.8 m below the prevailing ground surface upon completion of the field work.

The soil colour changes from brown to grey at depths ranging from 1.0 to 2.3 m, and the groundwater will fluctuate with the seasons.

The yield of groundwater from the fine sand is expected to be appreciable and persistent.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation has disclosed that beneath either a peat layer or a veneer of topsoil, the site is underlain by a stratum of very loose to dense, generally compact fine sand. The sand is weathered to depths ranging from 0.6 to 2.1 m below the prevailing ground surface.

Groundwater was encountered at depths ranging from 0.3 to 0.8 m below the prevailing ground surface upon completion of the field work.

The yield of groundwater from the fine sand is expected to be appreciable and persistent.

The geotechnical findings which warrant special consideration are presented below:

1. The topsoil and peat will generate volatile gases under anaerobic conditions and is unsuitable for engineering applications. If possible, the peat should be stripped from the project site; for the environmental as well as the geotechnical well-being of the future development, the topsoil should not be buried over 1.2 m below the proposed finished grade, or below any structure. If using the topsoil for planting and sodding purposes, it must be assessed by a fertility analysis.
2. The sound natural soil is suitable for normal spread and strip footing construction. Due to the presence of topsoil, peat and weathered soil, the footing subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, or a building inspector who has geotechnical experience, to ensure that its condition is compatible with the design of the foundation.

3. For shallow basement construction, perimeter subdrains and dampproofing of the foundation walls will be required. All the subdrains must be encased in a fabric filter to protect them against blockage by silting and must be connected to a positive outlet. As noted, groundwater occurs at shallow depths; therefore, floor subdrains will be required for basement construction. The basement level must be placed at least 0.5 m above the detected groundwater level.
4. For slab-on-grade construction, any loose and weathered sand must be subexcavated, sorted and properly recompacted, or the wet material should be drained and surface densified by a vibratory compactor.
5. A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. The stone immersion technique and thickening of the Crusher-Run Limestone bedding will likely be required for sewer subgrade stabilization. In areas where extensive dewatering is required, a Class 'A' concrete bedding may be necessary.
6. Excavations within a depth of 0.3 m below the groundwater in wet sand may require stabilization by vigorous pumping from closely spaced sump-wells. Deep excavations in water-bearing sand will require the use of a well-point dewatering system to stabilize the excavation.
7. In-ground services to be constructed in water-bearing sand must consist of pipes with leak-proof joints, or the joints must be wrapped with a waterproof membrane.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 **Foundations**

The foundations should be placed beneath the peat, topsoil layer and weathered soil onto the sound natural soil. A Maximum Allowable Soil Pressure (SLS) of 150 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 250 kPa, respectively, can be used for the design of the normal spread and strip foundations. As a general guide, the recommended soil pressures and suitable founding levels, based on the borehole findings, are presented in Table 3.

Table 3 - Founding Levels

	Recommended Maximum Allowable Soil Pressure (SLS)/ Factored Ultimate Soil Bearing Pressure (ULS) and Suitable Founding Level
	150 kPa (SLS) 250 kPa (ULS)
BH No.	**Depth (m)**
1	1.0 or +
2	1.0 or +
3	2.0 or +
4	1.2 or +

As noted, groundwater at the time of investigation was encountered at depths ranging from 0.3 to 0.8 m. Therefore, the subgrade should be protected immediately after exposure by a concrete mud-slab. This will prevent construction disturbance and costly rectification.

Due to the occurrence of shallow groundwater throughout the entire site, it is recommended that engineered fill should be considered to raise the grade of the site,

and that the basement level should is placed at least 0.5 m above the detected groundwater level. To provide a dry floor, subdrains consisting of filter-wrapped weepers must be installed beneath the floor slabs and connected to a positive outlet. A vapour barrier must be placed in the granular base of the floor above the crown of the subdrain.

The recommended soil pressures (SLS) for normal foundations incorporate a safety factor of 3 against shear failure of the underlying soils. The total and differential settlements of the foundations are estimated to be 25 mm and 15 mm, respectively.

The footing subgrade should be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, or a building inspector who has geotechnical experience, to ensure that the revealed conditions are compatible with the foundation design requirements.

Foundations exposed to weathering or in unheated areas should be protected against frost action by a minimum of 1.4 m of earth cover, or must be properly insulated.

The foundations must meet the requirements specified by the Ontario Building Code 2012, and the buildings must be designed to resist a minimum earthquake force using Site Classification ‘D’ (stiff soil).

6.2 **Engineered Fill**

The existing weathered soil can be replaced and/or upgraded to engineered fill status; where earth fill is required to raise the site, or where extended footings are necessary, it is generally economical to place engineered fill for normal footing, slab-on-grade, sewer and road construction.

The engineering requirements for a certifiable fill for road construction, municipal services, and footings designed with a Maximum Allowable Soil Pressure (SLS) of 150 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 250 kPa are presented below:

1. All of the peat and topsoil must be removed, and the subgrade must be inspected and proof-rolled prior to any fill placement. The weathered sand must be subexcavated and recompacted, or the wet sand should be drained and surface densified by a vibratory roller achieving a 95% or + Standard Proctor dry density.
2. Inorganic soils must be used, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of their maximum Standard Proctor dry density up to the proposed grade and/or pavement subgrade. The soil moisture must be properly controlled on the wet side of the optimum.
   If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% of the maximum Standard Proctor compaction.
3. If imported fill is to be used, the hauler is responsible for its environmental quality and must provide a document to certify that the material is free of hazardous contaminants.
4. If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.
5. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors.
   Foundations partially on engineered fill must be reinforced by two 15-mm steel reinforcing bars in the footings and upper section of the foundation walls, or designed by a structural engineer, to properly distribute the stress induced by

the abrupt differential settlement (estimated to be 15± mm) between the natural soils and engineered fill.

6. The engineered fill must not be placed during the period from late November to early April, when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.
7. Where the ground is wet due to subsurface water seepage, an appropriate subdrain scheme must be implemented prior to the fill placement, particularly if it is to be carried out on sloping ground or a bank. In places, the subgrade may require stabilization by a Crusher-Run Limestone mat.
8. Where the fill is to be placed on a bank steeper than 1 vertical:3 horizontal, the face of the bank must be flattened to 3+ so that it is suitable for safe operation of the compactor and the required compaction can be obtained.
9. The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.
10. The footing and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
11. Any excavations carried out in certified fill must be reported to the geotechnical consultant who inspected the fill placement in order to document the locations of excavation and/or to inspect reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.

12. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the strip footings and upper section of the foundation walls constructed on the engineered fill may require continuous reinforcement with steel bars, depending on the uniformity of the soils in the engineered fill and the thickness of the engineered fill underlying the foundations. Should the footing and/or walls require reinforcement, the required number and size of reinforcing bars must be assessed by considering the uniformity as well as the thickness of the engineered fill beneath the foundations. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic soil.

6.3 **Slab-On-Grade**

The sound natural soil is suitable for the slab-on-grade construction; the weathered soil must be subexcavated and properly recompacted to at least 98% of its maximum Standard Proctor dry density. The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.

The topsoil and peat must be stripped for slab-on-grade construction.

A Modulus of Subgrade Reaction of 25 MPa/m is recommended for the design of the floor slab.

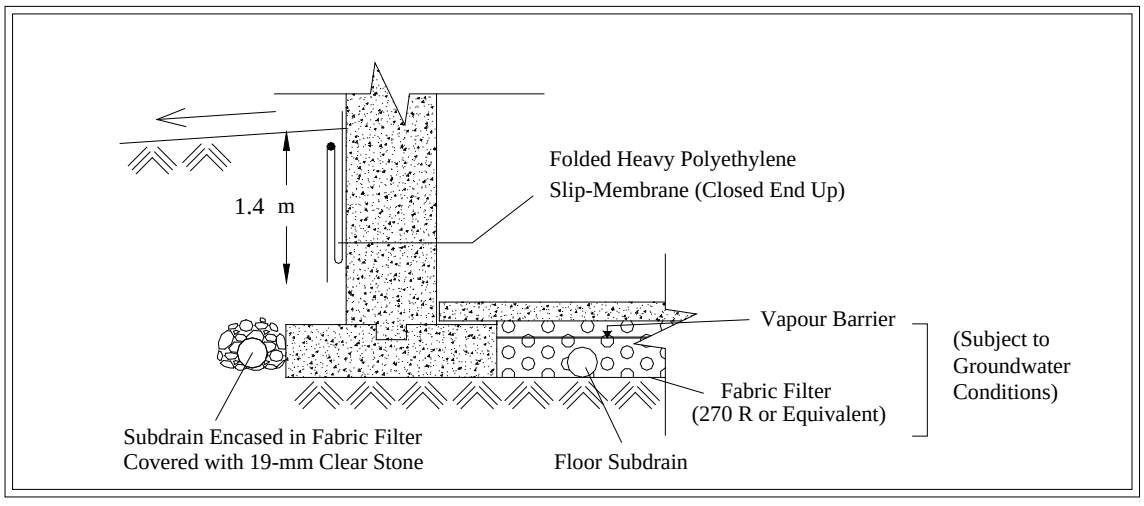
The ground around the building must be graded to direct water away from the structure to minimize the frost heave phenomenon generally associated with the disclosed soil.

6.4 **Basement**

Perimeter subdrains and dampproofing of the foundation walls will be required in order to provide a dry basement. Foundations exposed to weathering, or in unheated areas, should be protected against frost action by a minimum of 1.4 m of earth cover. All the subdrains should be encased in a fabric filter to prevent blockage by silting.

The foundation walls should be shielded by a polyethylene slip-membrane for protection against soil adfreezing. The membrane will allow vertical movement of the heaving soil (due to frost) without imposing structural distress on the foundations. The recommended measures are schematically illustrated in Diagram 1.

Diagram 1 - Frost Protection Measures (Foundations)



The membrane will allow vertical movement of the heaving soil (due to frost) without imposing structural distress on the foundations.

The necessity to implement this scheme should be further assessed by a geotechnical consultant at the time of construction.

6.5 Underground Services

The subgrade for the underground services should consist of natural soil or compacted organic-free earth fill. Where topsoil, peat and badly weathered soil are encountered, these materials must be subexcavated and replaced with properly compacted bedding material.

A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. Where water-bearing sand occurs, the sewer joints should be leak-proof, or wrapped with an appropriate waterproof membrane, to prevent subgrade migration. If subgrade stabilization is required, the stone immersion technique may be applied. In areas where more extensive dewatering is required for sewer construction, a Class 'A' bedding should be considered.

In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover with a thickness equal to the diameter of the pipe should be in place at all times after completion of the pipe installation.

Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

6.6 Trench Backfilling

The on-site inorganic soil is suitable for trench backfill. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density with the moisture content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is

considered to be adequate; however, the material must be compacted on the wet side of the optimum.

The narrow trenches should be cut at 1 vertical:2 or + horizontal so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. The lift of each backfill layer should either be limited to a thickness of 20 cm, or the thickness should be determined by test strips.

One must be aware of the possible consequences during trench backfilling and exercise caution as described below:

- When construction is carried out in freezing winter weather, allowance should be made for these following conditions. Despite stringent backfill monitoring, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in situ soil have a water content on the dry side of the optimum, it would be impossible to wet the soil due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as in a narrow vertical trench section, or when the trench box is removed. The above will invariably cause backfill settlement that may become evident within 1 to several years, depending on the depth of the trench which has been backfilled.
- In areas where the underground services construction is carried out during winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to final surfacing of the new pavement and the slab-on-grade construction.

- To backfill a deep trench, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 1 vertical: 1.5 + horizontal, and the lifts of the fill and its moisture content are stringently controlled; i.e., lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 95% of the maximum Standard Proctor dry density, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand. In a trench stabilized by a trench box, the void left after the removal of the box will be filled by the backfill. It is necessary to backfill this sector with sand, and the compacted backfill must be flooded for 1 day, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section. In areas where groundwater movement is expected in the sand fill mantle, seepage collars should be provided.

6.7 **Garages, Driveways and Interlocking Stone Pavement**

The driveways at the entrances to the garages should be backfilled with non-frost-susceptible granular material, with a frost taper at a slope of 1 vertical:1 horizontal.

Interlocking stone pavement in areas which are sensitive to frost-induced ground movement, such as entrances, must be constructed on a free-draining, non-frost-susceptible granular material such as Granular ‘B’. This material must extend to

1.4 m below the slab or pavement surface and be provided with positive drainage such as weeper subdrains connected to manholes or catch basins. Alternatively, the sidewalks and the interlocking stone pavement should be properly insulated with 50-mm Styrofoam, or equivalent, as approved by a geotechnical engineer.

The grading around the structures must be sloped such that surface runoff is directed away from the structures.

6.8 **Pavement Design**

Based on the borehole findings, the recommended pavement design for local roads is presented in Table 4.

Table 4 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder Local Collector	 50 75	HL-4
Granular Base	150	Granular 'A' or equivalent
Granular Sub-base	300	Granular 'B' or equivalent

In preparation of the subgrade, the subgrade surface should be proof-rolled; any soft subgrade, organics and deleterious materials within 1.0 m below the underside of the granular sub-base should be subexcavated and replaced by properly compacted organic-free earth fill or granular material.

All the granular bases should be compacted to their maximum Standard Proctor dry density.

In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density, with the water content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered adequate.

The road subgrade will suffer a strength regression if water is allowed to infiltrate prior to paving. The following measures should therefore be incorporated in the construction procedures and road design:

- If the road construction does not immediately follow the trench backfilling, the subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Lot areas adjacent to the roads should be properly graded to prevent the ponding of large amounts of water during the interim construction period.
- Curb subdrains will be required. The subdrains should consist of filter-sleeved weepers to prevent blockage by silting.
- If the roads are to be constructed during the wet seasons and extensively soft subgrade occurs, the granular sub-base may require thickening. This can be assessed during construction.

6.9 **Soil Parameters**

The recommended soil parameters for the project design are given in Table 5.

Table 5 - Soil Parameters

Unit Weight and Bulk Factor			
	Unit Weight (kN/m^3)	**Estimated Bulk Factor**	
	Bulk	**Loose**	**Compacted**
Fine Sand	20.5	1.25	1.00
Lateral Earth Pressure Coefficients			
	Active K_a	**At Rest K_o**	**Passive K_p**
Fine Sand	0.33	0.45	3.00

6.10 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91.

Excavations in excess of 1.2 m should be sloped at 1 vertical:1 horizontal for stability.

For excavation purposes, the types of soils are classified in Table 6.

Table 6 - Classification of Soils for Excavation

Material	Type
Sand above groundwater	3
Sand below groundwater	4

The groundwater yield from the sand will be appreciable and persistent. When excavating into the water-bearing sand at a shallow depth, groundwater should be controlled by vigorous pumping from closely spaced sump-wells at a depth of 0.3 m or

less below the groundwater level. For excavation deeper than 0.3 m below the groundwater level, a well-point dewatering system will be required.

Prospective contractors must be asked to assess the in situ subsurface conditions by digging test pits to at least 0.5 m below the intended bottom of excavation in order to determine the appropriate dewatering measures for subgrade stabilization.

7.0 LIMITATIONS OF REPORT

It should be noted that no tests have been carried out to determine whether environmental contaminants are present in the soils. Therefore, this report deals only with a study of the geotechnical aspects of the proposed project.

This report was prepared by Soil Engineers Ltd. for the account of R.J. Burnside & Associates Limited, and for review by their designated consultants and government agencies. The material in it reflects the judgement of Frank Lee, P.Eng., and Victor S. Chan, P.Eng., in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

SOIL ENGINEERS LTD.

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FL/VSC:dd

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS Auger sample
CS Chunk sample
DO Drive open (split spoon)
DS Denison type sample
FS Foil sample
RC Rock core (with size and percentage recovery)
ST Slotted tube
TO Thin-walled, open
TP Thin-walled, piston
WS Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH Sampler advanced by static weight
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
NP No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

□ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres
1lb = 0.454 kg
1 inch = 25.4 mm
1ksf = 47.88 kPa

JOB NO: 1401-S081

LOG OF BOREHOLE NO: 1

FIGURE NO: 1

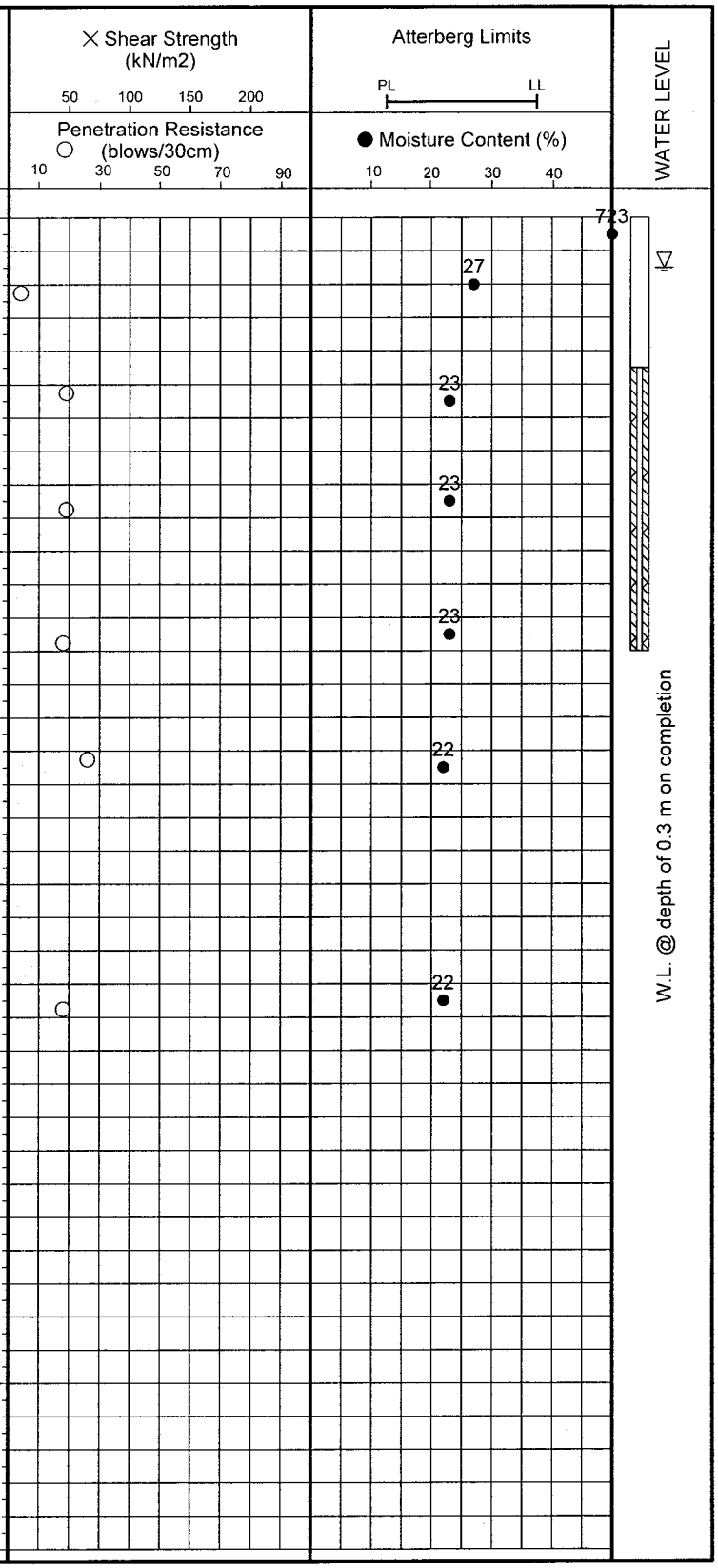
JOB DESCRIPTION: Proposed Residential Subdivision

JOB LOCATION: Westbury Road and River Road West
Town of Wasaga Beach

METHOD OF BORING: Hollow-Stem Auger

DATE: April 28, 2014

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
	30 cm PEAT with topsoil layer	1A	DO	-
	Loose to compact	1B	DO	4
	weathered brown grey	2	DO	19
		3	DO	19
	FINE SAND some silt	4	DO	18
		5	DO	26
		6	DO	18
5.0	**END OF BOREHOLE** Install 50 mm Ø standpipe to 2.6 m. Sand backfill from 0.9 to 2.6 m. Bentonite seal from 0 to 0.9 m. Mounted with a steel protective casing.			



Soil Engineers Ltd.

JOB NO: 1401-S081

LOG OF BOREHOLE NO: 2

FIGURE NO: 2

JOB DESCRIPTION: Proposed Residential Subdivision

JOB LOCATION: Westbury Road and River Road West
Town of Wasaga Beach

METHOD OF BORING: Hollow-Stem Auger

DATE: April 28, 2014

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
	25 cm TOPSOIL	1A	DO	-
	Loose to dense weathered	1B	DO	7
		2	DO	18
		3	DO	20
	FINE SAND			
	some silt brown grey			
		4	DO	35
		5	DO	31
		6	DO	33
5.0	**END OF BOREHOLE**			

Depth Scale (m): 0 1 2 3 4 5 6 7 8

× Shear Strength (kN/m2): 50 100 150 200

Penetration Resistance ○ (blows/30cm): 10 30 50 70 90

Atterberg Limits: PL — LL

● Moisture Content (%): 10 20 30 40

	Moisture Content (%)
1B	27
2	24
3	26
4	21
5	23
6	21
	74

WATER LEVEL

▽ W.L. @ depth of 0.5 m on completion

Soil Engineers Ltd.

JOB NO: 1401-S081

LOG OF BOREHOLE NO: 3

FIGURE NO: 3

JOB DESCRIPTION: Proposed Residential Subdivision

JOB LOCATION: Westbury Road and River Road West
Town of Wasaga Beach

METHOD OF BORING: Hollow-Stem Auger

DATE: April 28, 2014

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
	8 cm TOPSOIL	1A	DO	-
	Very loose to dense	1B	DO	3
		2	DO	5
	FINE SAND			
	some silt	3	DO	9
	weathered brown grey	4	DO	38
		5	DO	43
		6	DO	40
5.0	**END OF BOREHOLE**			

Depth Scale (m): 0 1 2 3 4 5 6 7 8

× Shear Strength (kN/m2): 50 100 150 200

○ Penetration Resistance (blows/30cm): 10 30 50 70 90

Atterberg Limits: PL — LL

● Moisture Content (%): 10 20 30 40

Measured values: 43, 28, 23, 26, 25, 22, 23

WATER LEVEL

W.L. @ depth of 0.8 m on completion

Soil Engineers Ltd.

JOB NO: 1401-S081

LOG OF BOREHOLE NO: 4

FIGURE NO: 4

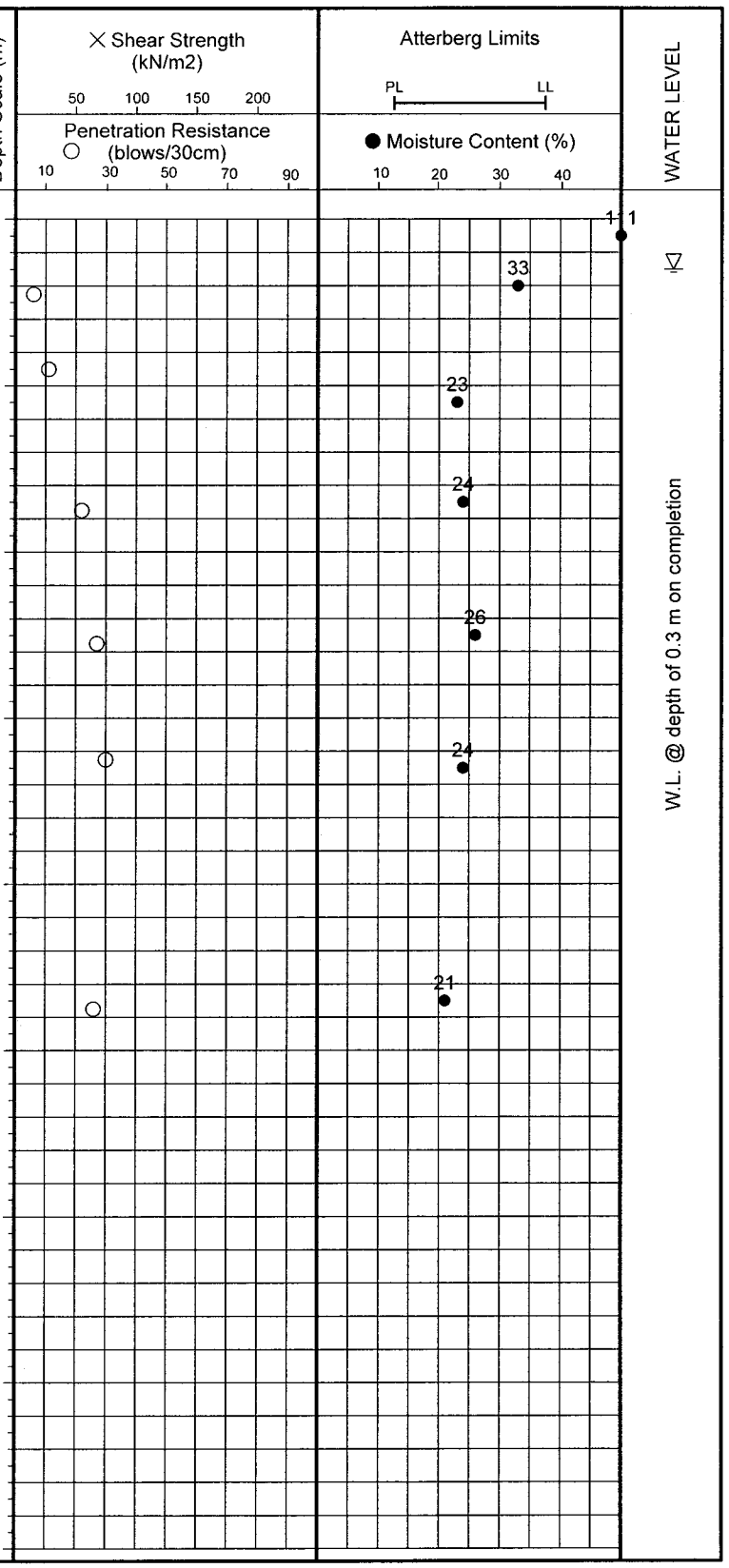
JOB DESCRIPTION: Proposed Residential Subdivision

JOB LOCATION: Westbury Road and River Road West
Town of Wasaga Beach

METHOD OF BORING: Hollow-Stem Auger

DATE: April 28, 2014

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
	25 cm PEAT with topsoil layer	1A	DO	-
		1B	DO	6
	Loose to compact	2	DO	11
	weathered			
	FINE SAND brown grey	3	DO	22
	some silt			
		4	DO	27
		5	DO	30
		6	DO	26
5.0	**END OF BOREHOLE**			



Soil Engineers Ltd.

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

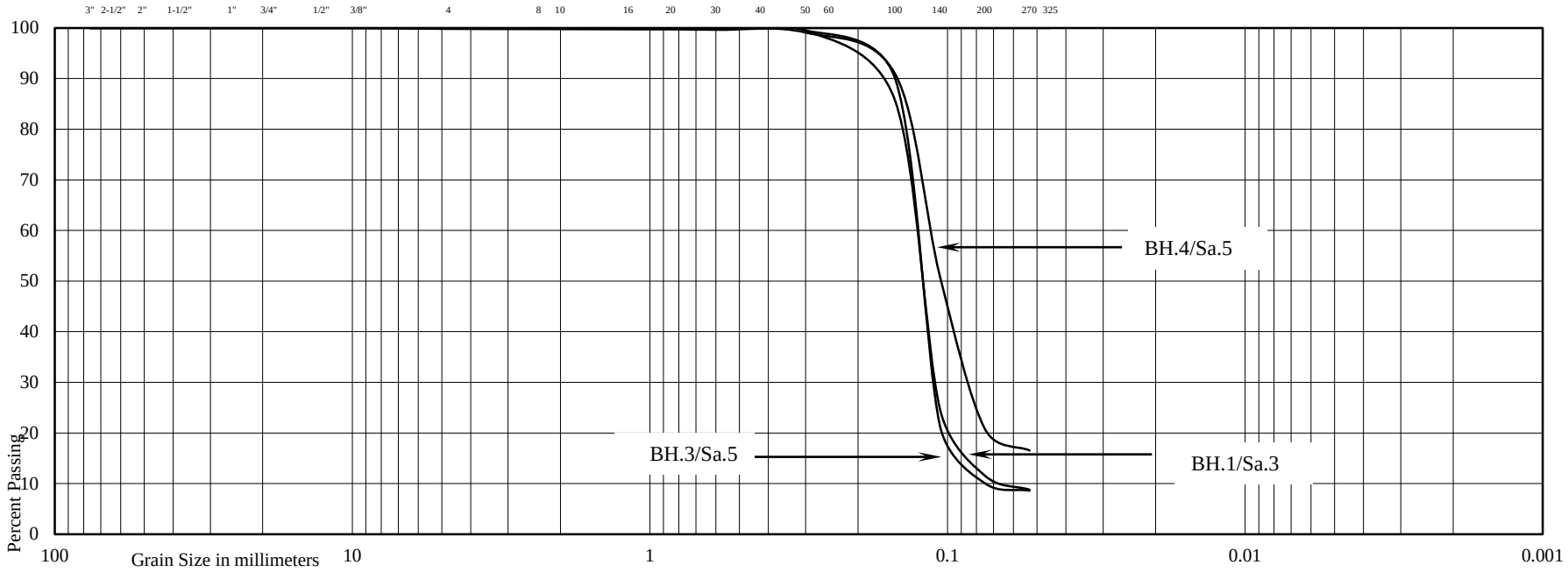
Reference No: 1401-S081

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Subdivision

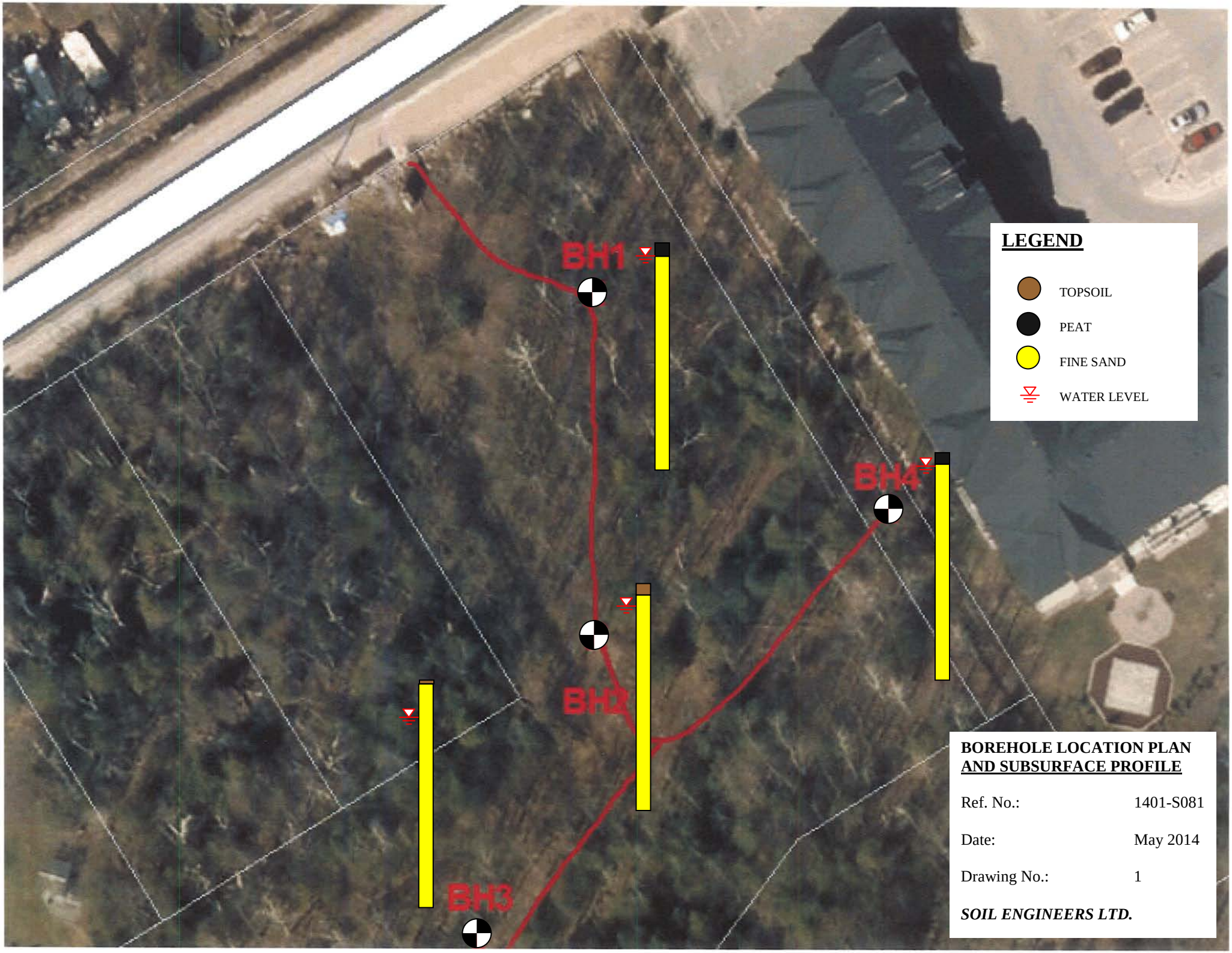
Location: Westbury Road and River Road West, Town of Wasaga Beach

Borehole No:	1	3	4
Sample No:	3	5	5
Depth (m):	1.7	3.3	3.3
Elevation (m):	-	-	-

BH./Sa.	1/3	3/5	4/5
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	23	22	24
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}	10^{-4}

Classification of Sample [& Group Symbol]: FINE SAND
some silt

Figure: 5


BH1
BH2
BH3
BH4
LEGEND
TOPSOIL
PEAT
FINE SAND
WATER LEVEL
BOREHOLE LOCATION PLAN
AND SUBSURFACE PROFILE
Ref. No.: 1401-S081
Date: May 2014
Drawing No.: 1
SOIL ENGINEERS LTD.

July 9, 2021 Reference No. 2100801

Wasaga Riverwoods Homes Inc.
30 Fulton Way, Unit 8-100
Richmond Hill, Ontario
L4B 1E6

Attn: Walter Zhou

Re: Groundwater Monitoring for Proposed Residential Development
Wasaga Riverwoods
River Road West & Westbury Road
Wasaga Beach, Ontario

The subject property is located on the south side of River Road West, just west of Westbury Road. The property is currently forested with a few trails that traverse the property. The property is approximately 1 hectare in size. It is understood that a residential condominium development consisting of 86 apartment units is being proposed to be constructed.

The following letter report was provided to GEI: "*Water Level Monitoring Report (Final Report), Proposed Residential Subdivision, Westbury Road and River Road West, Town of Wasaga Beach*", Reference No. 1104-W016, dated March 26, 2013, by Soil Engineers Ltd. This letter report detailed the groundwater monitoring results in five previously installed monitoring wells on the site between September 15, 2010 and March 22, 2013. The groundwater was generally within 1 metre below existing grades.

It is understood that a detailed design submission was provided to the Town of Wasaga Beach in late 2020. One of the comments that was received back related to providing updated groundwater readings to be more reflective of current conditions in 2021, and to capture the seasonally high groundwater table. GEI visited the property on February 17, 2021 to determine if the monitoring wells installed approximately a decade ago were still in usable condition. Only three (3) of the five (5) monitoring wells were noted to be in usable condition.

To provide better coverage across the site, an additional three (3) drive point piezometers were installed to approximately 2 metres below existing grade on March 12, 2021. At the same time, the ground surface elevation for the three existing monitoring wells from 2013 (BH's 1 to 3) and the three newly installed drive point piezometers (DP's 1 to 3) were surveyed relative to geodetic elevation. A monitoring well and drive point piezometer location plan is enclosed. The benchmark used was Manhole #156A located on the centre of River Road West with a known geodetic elevation of 184.06 metres.

Direct groundwater levels were taken in the six monitoring well and/or drive point piezometer locations; once in March, twice in April, twice in May and once in June, for a total of six (6) direct groundwater level measurements.

The results of all water levels obtained are enclosed in a tabular format. Based on the results of the bi-weekly groundwater level measurements, the highest groundwater elevation measured for each of the monitoring wells, which should be used for design purposes, is as follows:

- Borehole DP1: Elev. 183.75 metres (depth of 0.09 metres below grade).
- Borehole DP2: Elev. 183.7 metres (depth of 0.02 metres above grade).
- Borehole DP3: Elev. 184.59 metres (depth of 0.15 metres below grade).
- Borehole BH1: Elev. 183.79 metres (depth of 0.03 metres below grade).
- Borehole BH2: Elev. 184.59 metres (depth of 0.21 metres below grade).
- Borehole BH3: Elev. 183.99 metres (depth of 0.05 metres below grade).

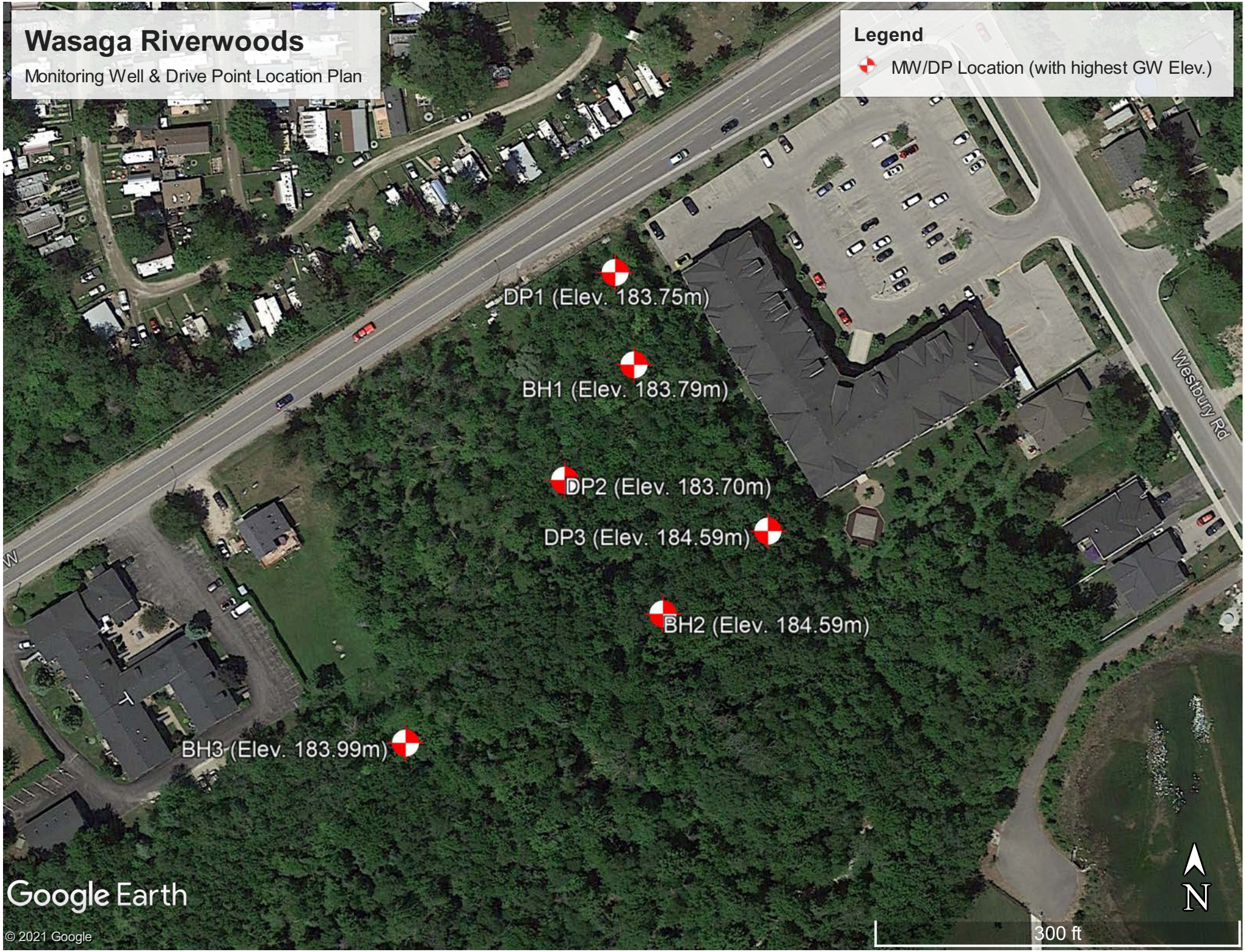
We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Regards,

GEI Consultants

Alexander Winkelmann, P.Eng.
Geotechnical & Earth Sciences Manager

MONITORING WELL & DRIVE POINT LOCATION PLAN


Wasaga Riverwoods
Monitoring Well & Drive Point Location Plan
Legend
MW/DP Location (with highest GW Elev.)
DP1 (Elev. 183.75m)
BH1 (Elev. 183.79m)
DP2 (Elev. 183.70m)
DP3 (Elev. 184.59m)
BH2 (Elev. 184.59m)
BH3 (Elev. 183.99m)
Westbury Rd
Google Earth
© 2021 Google
N
300 ft

TABLES OF MONITORING WELL & DRIVE POINT DETAILS

Table 1 – Monitoring Well Installation Details

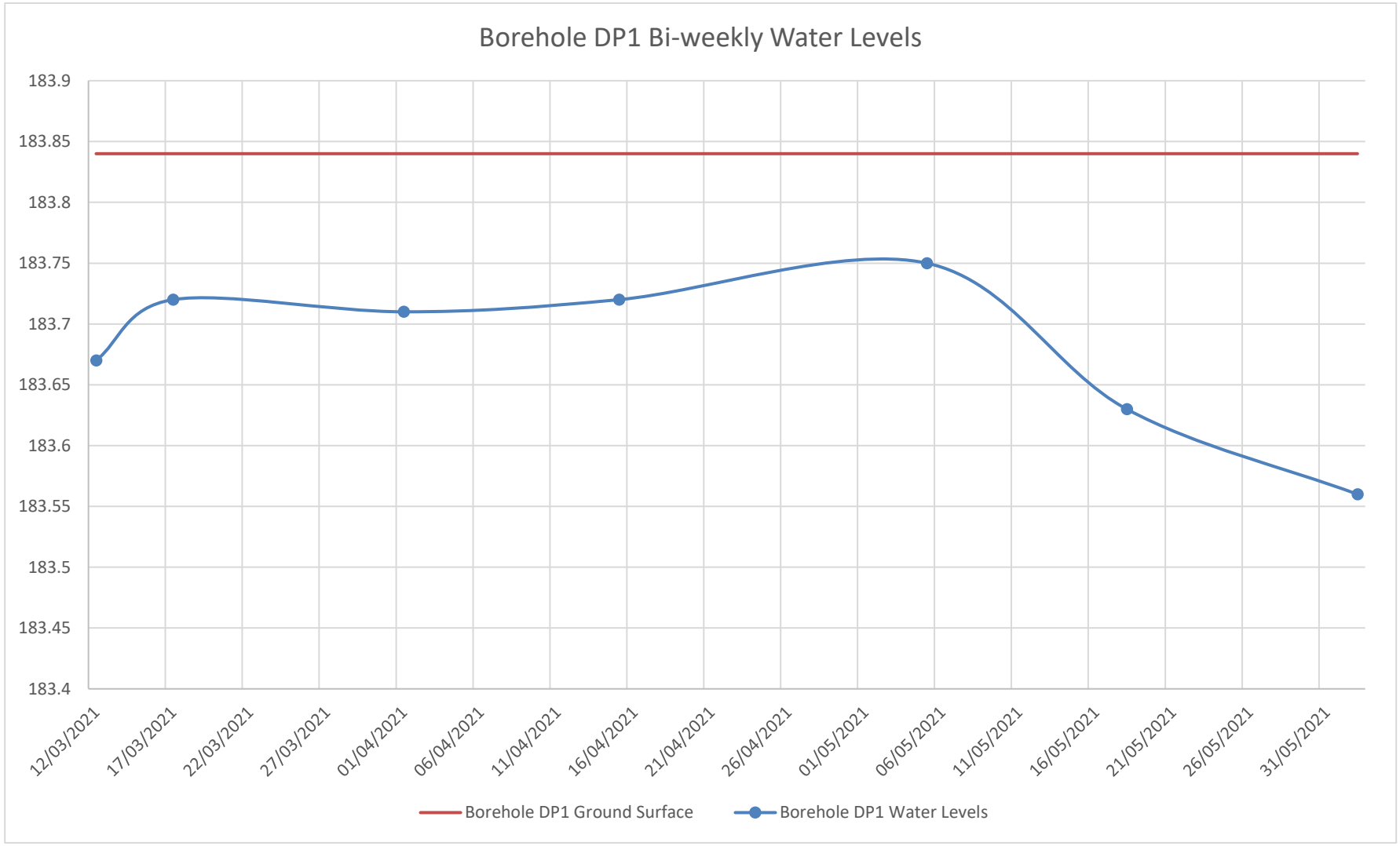
Monitoring Well	GPS Coordinates		Geodetic Ground Surface Elevation (m)	Top of Screen		Bottom of Screen		Strata Screened
	Northing	Easting		Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	
DP1	4930244	578815	183.84	0.98	182.86	1.29	182.55	Fine Sand
DP2	4930192	578803	183.68	0.84	182.84	1.15	182.53	Fine Sand
DP3	4930180	578854	184.74	0.96	183.78	1.27	183.47	Fine Sand
BH1	4930221	578820	183.82	1.11	182.72	2.63	181.19	Fine Sand
BH2	4930159	578828	184.80	2.05	182.75	3.55	181.25	Fine Sand
BH3	4930126	578764	184.04	3.68	180.36	5.18	178.86	Fine Sand

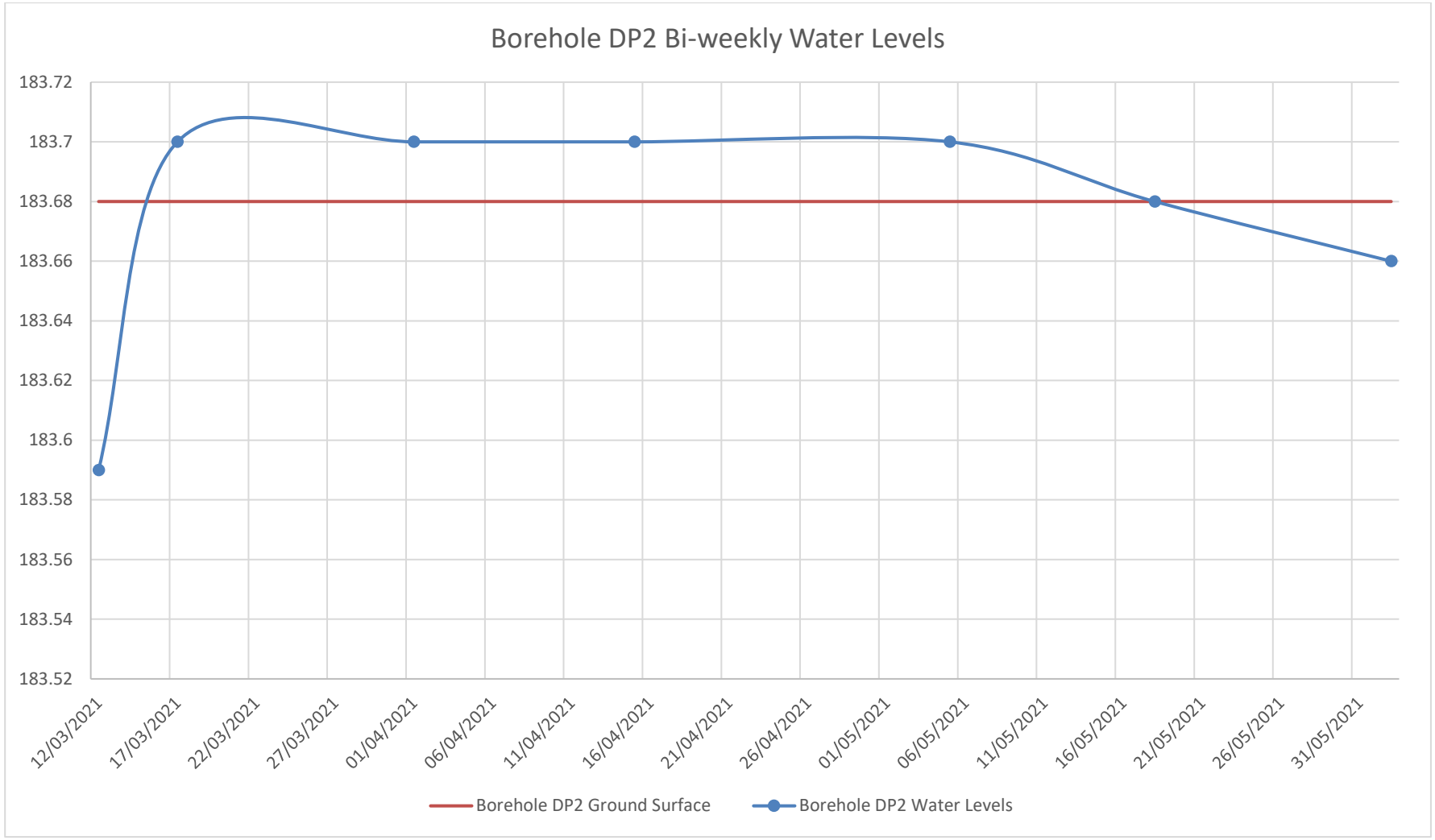
Table 2 – Results of Monthly Groundwater Monitoring

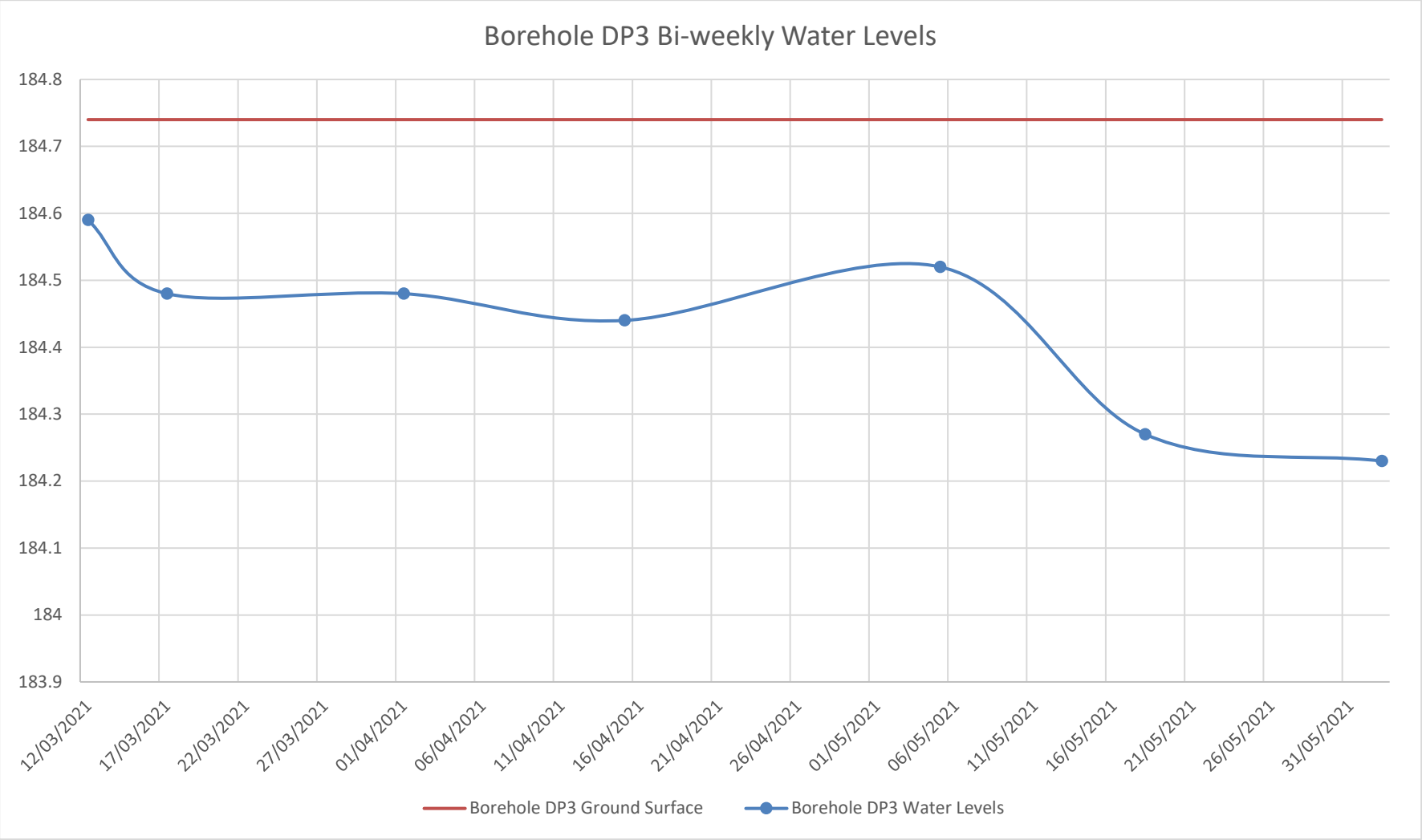
Date of Groundwater Level Reading	Ground Water Table Measurement											
	DP1		DP2		DP3		BH1		BH2		BH3	
	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)
March 12, 2021	0.17	183.67	0.09	183.59	0.15	184.59	0.03	183.79	0.21	184.59	0.05	183.99
March 17, 2021	0.12	183.72	0.02*	183.7	0.26	184.48	0.05	183.77	0.41	184.39	0.11	183.93
April 1, 2021	0.13	183.71	0.02*	183.7	0.26	184.48	0.05	183.77	0.41	184.39	0.13	183.91
April 15, 2021	0.12	183.72	0.02*	183.7	0.3	184.44	0.06	183.76	0.44	184.36	0.14	183.9
May 5, 2021	0.09	183.75	0.02*	183.7	0.22	184.52	0.03	183.79	0.34	184.46	0.1	183.94
May 18, 2021	0.21	183.63	0	183.68	0.47	184.27	0.14	183.68	0.61	184.19	0.2	183.84
June 2, 2021	0.28	183.56	0.02	183.66	0.51	184.23	0.19	183.63	0.74	184.06	0.33	183.71
Highest	**0.09**	**183.75**	**0.02***	**183.7**	**0.15**	**184.59**	**0.03**	**183.79**	**0.21**	**184.59**	**0.05**	**183.99**

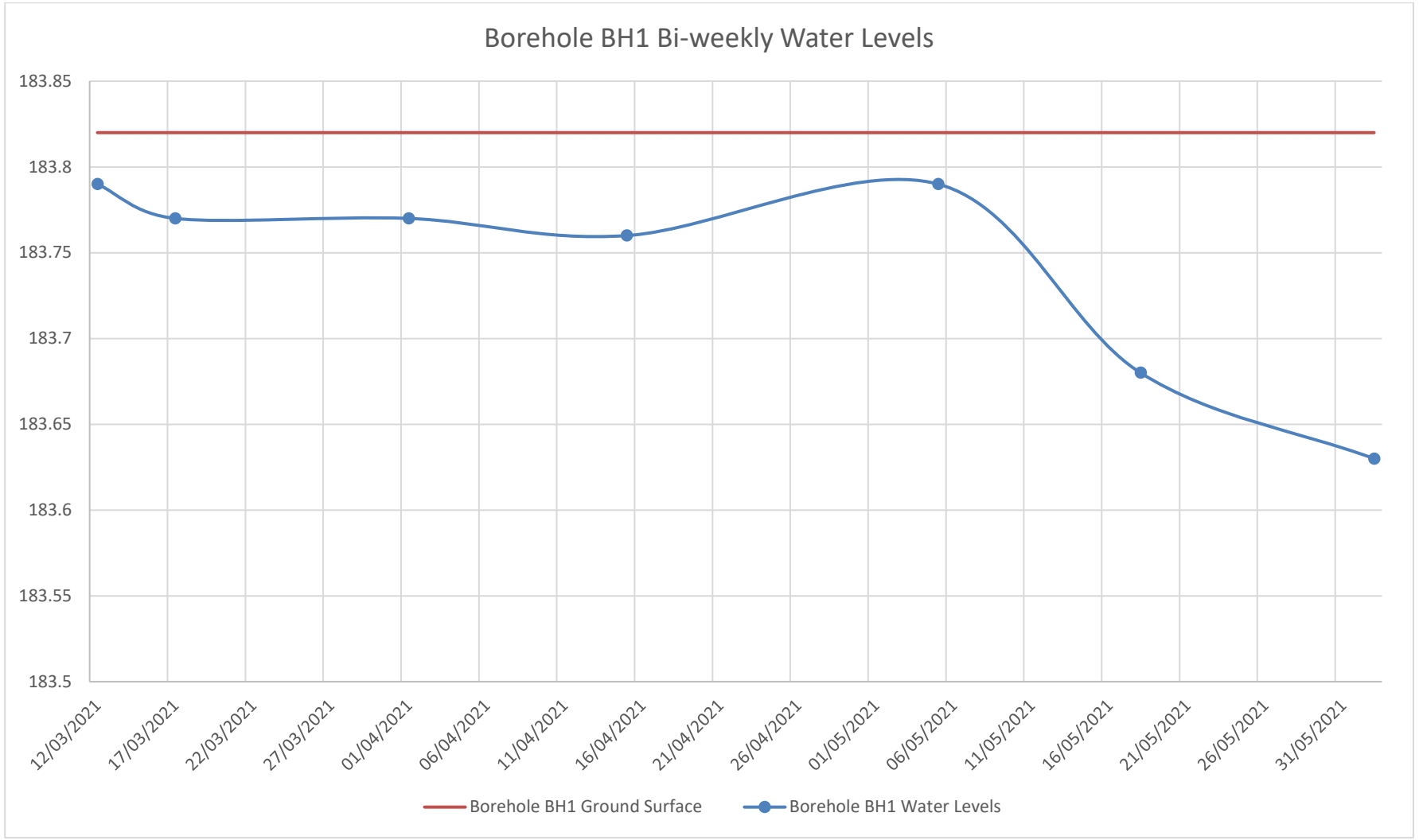
***Note:** Asterix indicates water level was above prevailing grade.

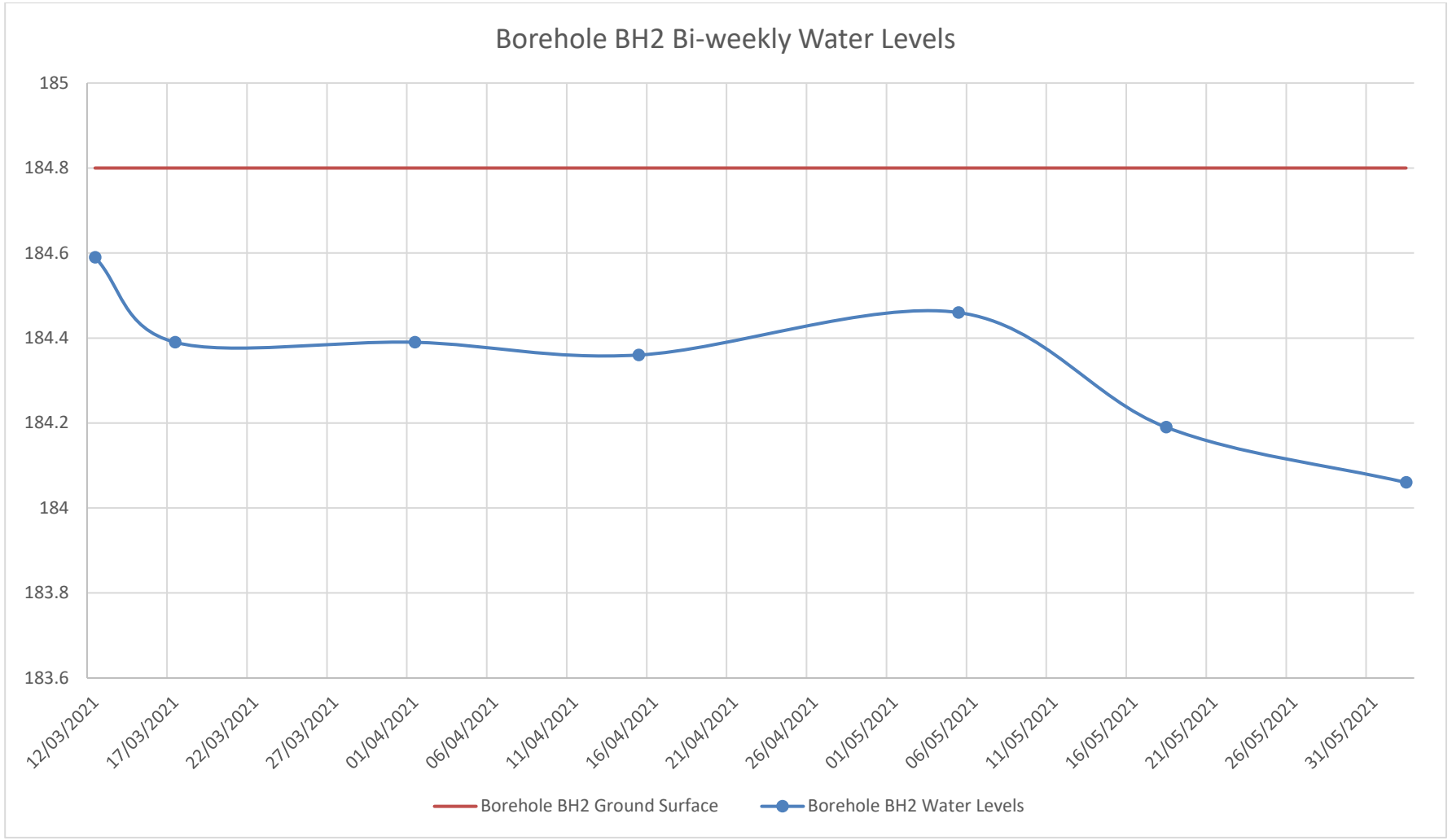
GRAPHS OF MEASURED WATER LEVELS

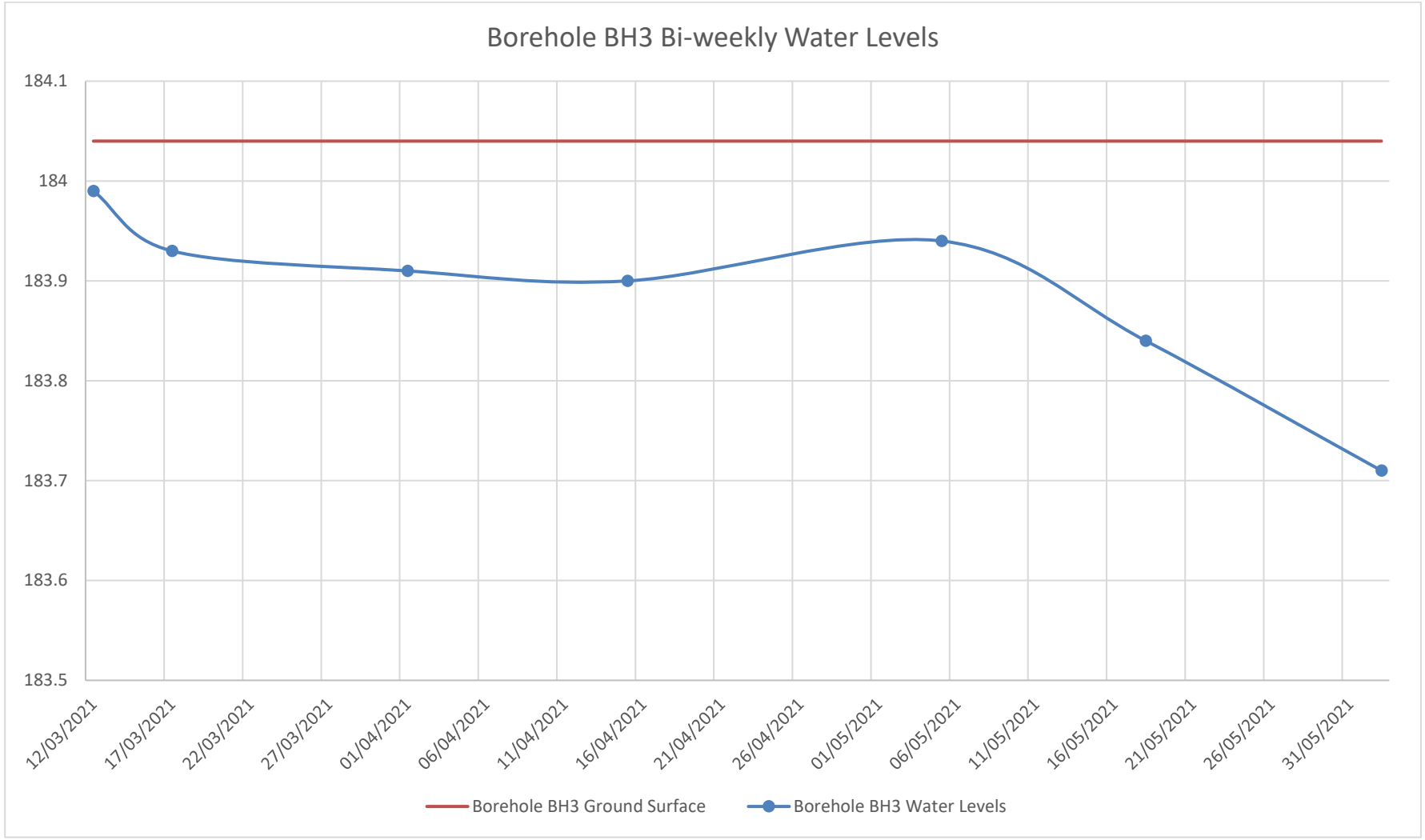

Borehole DP1 Bi-weekly Water Levels
183.9
183.85
183.8
183.75
183.7
183.65
183.6
183.55
183.5
183.45
183.4
12/03/2021
17/03/2021
22/03/2021
27/03/2021
01/04/2021
06/04/2021
11/04/2021
16/04/2021
21/04/2021
26/04/2021
01/05/2021
06/05/2021
11/05/2021
16/05/2021
21/05/2021
26/05/2021
31/05/2021
Borehole DP1 Ground Surface
Borehole DP1 Water Levels


Borehole DP2 Bi-weekly Water Levels
183.72
183.7
183.68
183.66
183.64
183.62
183.6
183.58
183.56
183.54
183.52
12/03/2021
17/03/2021
22/03/2021
27/03/2021
01/04/2021
06/04/2021
11/04/2021
16/04/2021
21/04/2021
26/04/2021
01/05/2021
06/05/2021
11/05/2021
16/05/2021
21/05/2021
26/05/2021
31/05/2021
Borehole DP2 Ground Surface
Borehole DP2 Water Levels


Borehole DP3 Bi-weekly Water Levels
184.8
184.7
184.6
184.5
184.4
184.3
184.2
184.1
184
183.9
12/03/2021
17/03/2021
22/03/2021
27/03/2021
01/04/2021
06/04/2021
11/04/2021
16/04/2021
21/04/2021
26/04/2021
01/05/2021
06/05/2021
11/05/2021
16/05/2021
21/05/2021
26/05/2021
31/05/2021
Borehole DP3 Ground Surface
Borehole DP3 Water Levels


Borehole BH1 Bi-weekly Water Levels
183.85
183.8
183.75
183.7
183.65
183.6
183.55
183.5
12/03/2021
17/03/2021
22/03/2021
27/03/2021
01/04/2021
06/04/2021
11/04/2021
16/04/2021
21/04/2021
26/04/2021
01/05/2021
06/05/2021
11/05/2021
16/05/2021
21/05/2021
26/05/2021
31/05/2021
Borehole BH1 Ground Surface
Borehole BH1 Water Levels


Borehole BH2 Bi-weekly Water Levels
185
184.8
184.6
184.4
184.2
184
183.8
183.6
12/03/2021
17/03/2021
22/03/2021
27/03/2021
01/04/2021
06/04/2021
11/04/2021
16/04/2021
21/04/2021
26/04/2021
01/05/2021
06/05/2021
11/05/2021
16/05/2021
21/05/2021
26/05/2021
31/05/2021
Borehole BH2 Ground Surface
Borehole BH2 Water Levels


Borehole BH3 Bi-weekly Water Levels
184.1
184
183.9
183.8
183.7
183.6
183.5
12/03/2021
17/03/2021
22/03/2021
27/03/2021
01/04/2021
06/04/2021
11/04/2021
16/04/2021
21/04/2021
26/04/2021
01/05/2021
06/05/2021
11/05/2021
16/05/2021
21/05/2021
26/05/2021
31/05/2021
Borehole BH3 Ground Surface
Borehole BH3 Water Levels

Appendix C – Existing Condition SWM Information

Ontario IDF CURVE LOOKUP

Active coordinate

44° 32' 45" N, 79° 59' 45" W (44.545833,-79.995833)

Retrieved: Tue, 28 Jan 2020 14:50:57 GMT

Location summary

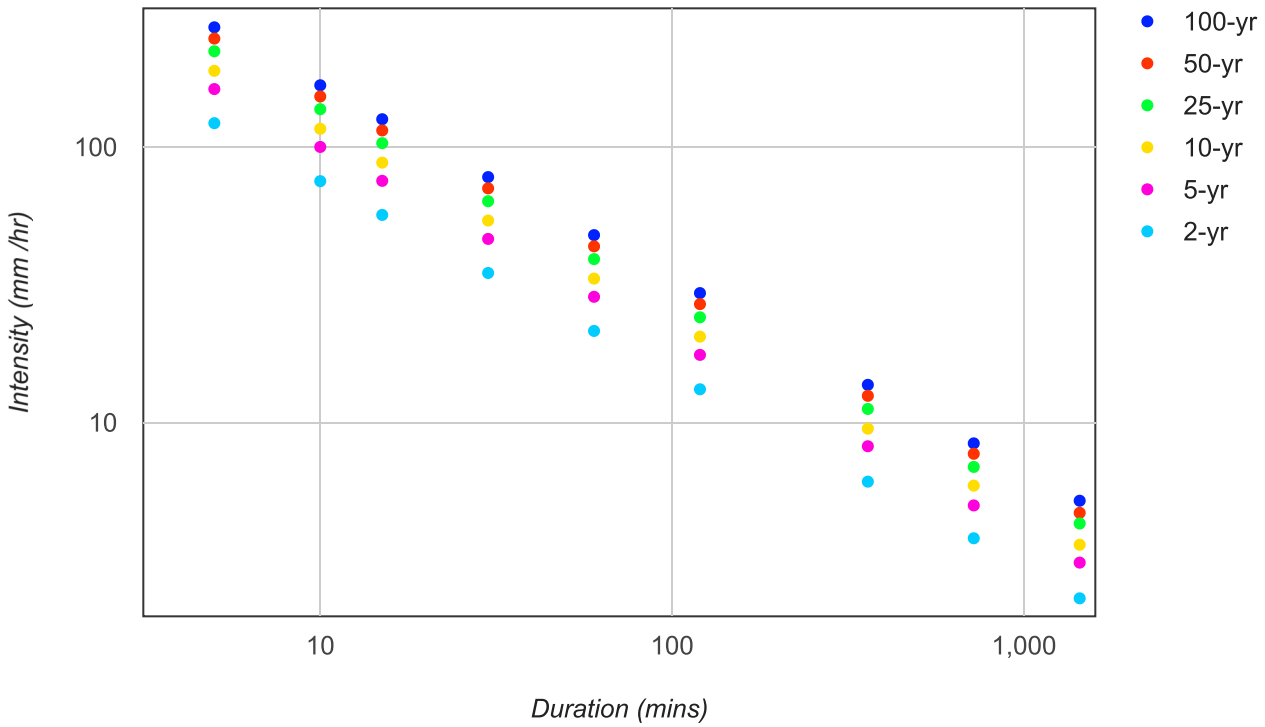
These are the locations in the selection.

IDF Curve: 44° 32' 45" N, 79° 59' 45" W (44.545833,-79.995833)

Results

An IDF curve was found.

Coordinate: 44.545833, -79.995833
IDF curve year: 2010



Coefficient summary

IDF Curve: 44° 32' 45" N, 79° 59' 45" W (44.545833,-79.995833)

Retrieved: Tue, 28 Jan 2020 14:50:57 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.5	28.6	33.3	39.2	43.6	47.9
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

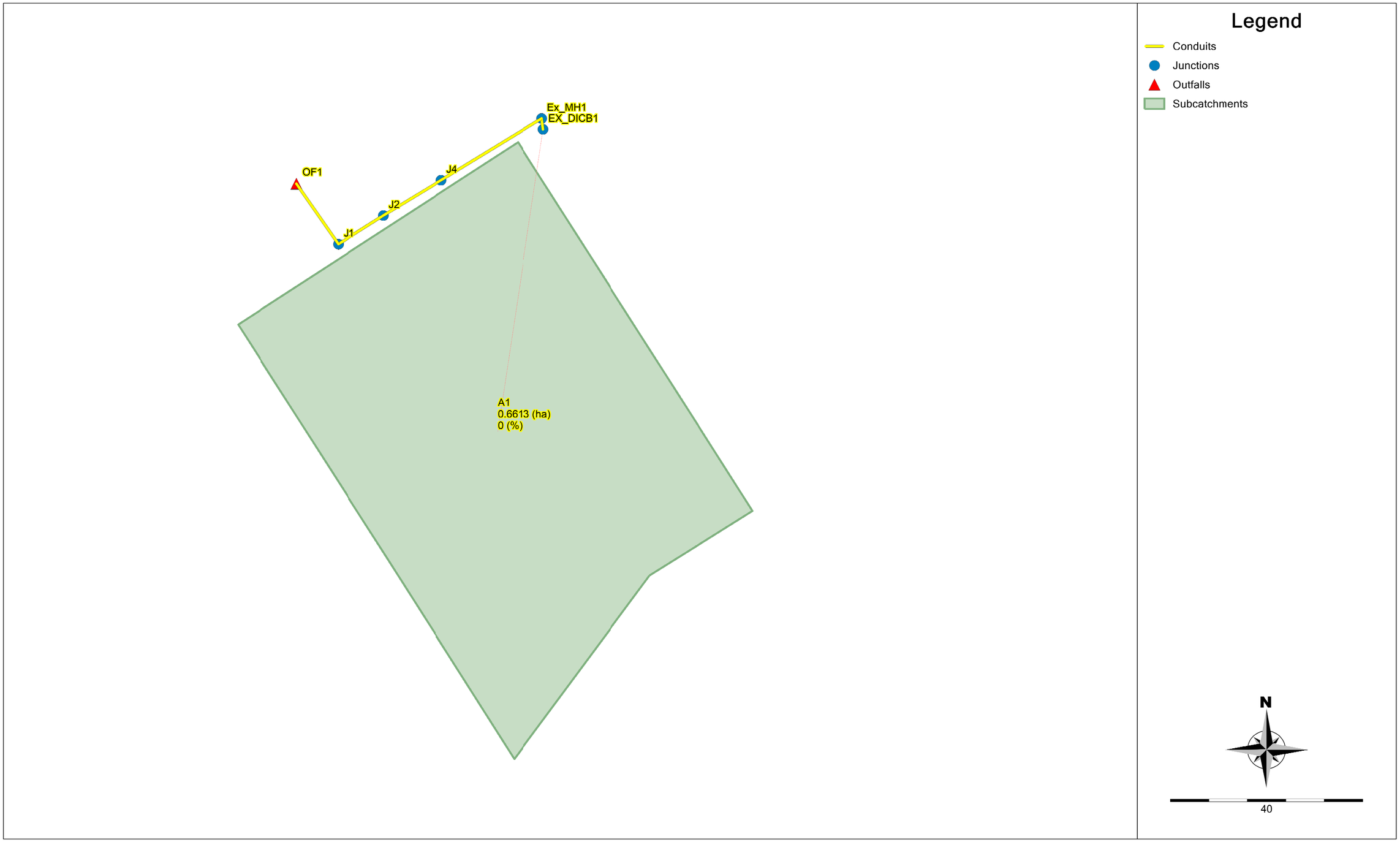
Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	122.1	75.2	56.7	34.9	21.5	13.2	6.1	3.8	2.3
5-yr	162.4	100.1	75.4	46.4	28.6	17.6	8.2	5.0	3.1
10-yr	189.1	116.5	87.8	54.1	33.3	20.5	9.5	5.9	3.6
25-yr	222.7	137.2	103.3	63.6	39.2	24.1	11.2	6.9	4.3
50-yr	247.6	152.6	114.9	70.8	43.6	26.9	12.5	7.7	4.7
100-yr	272.1	167.6	126.2	77.8	47.9	29.5	13.7	8.4	5.2

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.2	12.5	14.2	17.5	21.5	26.5	36.9	45.4	56.0
5-yr	13.5	16.7	18.8	23.2	28.6	35.2	49.0	60.4	74.4
10-yr	15.8	19.4	21.9	27.0	33.3	41.0	57.1	70.4	86.7
25-yr	18.6	22.9	25.8	31.8	39.2	48.3	67.2	82.8	102.0
50-yr	20.6	25.4	28.7	35.4	43.6	53.7	74.8	92.1	113.5
100-yr	22.7	27.9	31.6	38.9	47.9	59.0	82.1	101.2	124.7

Terms of Use

Existing Condition Catchment Plan & PCSWMM Model View



Existing Condition 100 Year SCS 24 Hr Type II Storm - PCSWMM Output

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 14
Number of subcatchments ... 1
Number of nodes ........... 6
Number of links ........... 5
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                    Data       Recording
Name                 Data Source                    Type       Interval
------------------------------------------------------------------------
100YR_4HR_CHIC       100yrChic                      INTENSITY    5 min.
10YR_4HR_CHIC        10yrChic                       INTENSITY    5 min.
25MMCHIC             25MMCHIC                       INTENSITY   10 min.
25YR_4HR_CHIC        25yrChic                       INTENSITY    5 min.
2YR_4HR_CHIC         2yrChic                        INTENSITY    5 min.
50YR_4HR_CHIC        50yrChic                       INTENSITY    5 min.
5YR_4HR_CHIC         5yrChic                        INTENSITY    5 min.
SCS_24h_Type_II_100YR 100yrSCS                       INTENSITY    6 min.
SCS_24h_Type_II_10YR 10yrSCS                        INTENSITY    6 min.
SCS_24h_Type_II_25YR 25yrSCS                        INTENSITY    6 min.
SCS_24h_Type_II_2YR  2yrSCS                         INTENSITY    6 min.
SCS_24h_Type_II_50YR 50yrSCS                        INTENSITY    6 min.
SCS_24h_Type_II_5YR  5yrSCS                         INTENSITY    6 min.
Timmins_Storm_(Northern_Ontario) Timmins_Storm_(Northern_Ontario) INTENSITY   60 min.


********************
Subcatchment Summary
********************
```

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A1	0.66	91.00	0.00	1.0000	SCS_24h_Type_II_100YR	EX_DICB1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
EX_DICB1	JUNCTION	182.99	0.47	0.0	
Ex_MH1	JUNCTION	182.88	1.65	0.0	
J1	JUNCTION	182.41	1.14	0.0	
J2	JUNCTION	182.79	1.05	0.0	
J4	JUNCTION	182.83	1.26	0.0	
OF1	OUTFALL	182.53	1.02	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
1050	Ex_MH1	J4	CONDUIT	24.5	0.2043	0.0130
C1	EX_DICB1	Ex_MH1	CONDUIT	2.2	0.8905	0.0130
C1_2	J4	J2	CONDUIT	14.1	0.2845	0.0250
C3	J2	J1	CONDUIT	11.1	3.4291	0.0218
EX_1050_CONC	J1	OF1	CONDUIT	15.2	0.0066	0.0130

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
1050	CIRCULAR	1.05	0.87	0.26	1.05	1	1.23
C1	CIRCULAR	0.25	0.05	0.06	0.25	1	0.06
C1_2	TRAPEZOIDAL	1.00	3.00	0.55	5.00	1	4.29
C3	TRAPEZOIDAL	1.05	2.99	0.55	4.95	1	17.06

```
EX_1050_CONC     HORIZ_ELLIPSE        0.70     0.62     0.21     1.10        1     0.14


************************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
************************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 01/09/2013 00:00:00
Ending Date .............. 01/10/2013 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
```

Total Precipitation	0.099	149.640
Evaporation Loss	0.000	0.000
Infiltration Loss	0.044	65.814
Surface Runoff	0.051	77.837
Final Storage	0.004	6.069
Continuity Error (%)	-0.054	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.052	0.515
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.051	0.510
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.001	0.005
Continuity Error (%)	-0.086	

Time-Step Critical Elements

Link C1 (71.21%)

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step : 0.50 sec

```
Average Time Step           :     2.32 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :    30.43 %
    3.155 -  1.991 sec      :     6.45 %
    1.991 -  1.256 sec      :    19.57 %
    1.256 -  0.792 sec      :    24.03 %
    0.792 -  0.500 sec      :    19.52 %
```

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
A1	149.64	0.00	0.00	65.81	0.00	77.84	77.84	0.51	0.14	0.520

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
EX_DICB1	JUNCTION	0.07	0.35	183.34	0 12:00	0.35
Ex_MH1	JUNCTION	0.06	0.27	183.15	0 12:01	0.27
J1	JUNCTION	0.41	0.73	183.14	0 12:02	0.73
J2	JUNCTION	0.12	0.35	183.14	0 12:02	0.35
J4	JUNCTION	0.09	0.31	183.14	0 12:01	0.31
OF1	OUTFALL	0.00	0.00	182.53	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
EX_DICB1	JUNCTION	0.137	0.137	0	12:00	0.515	0.515	0.001
Ex_MH1	JUNCTION	0.000	0.137	0	12:00	0	0.515	-0.024
J1	JUNCTION	0.000	0.131	0	12:00	0	0.514	0.690
J2	JUNCTION	0.000	0.134	0	12:00	0	0.515	0.185
J4	JUNCTION	0.000	0.136	0	12:00	0	0.515	0.058
OF1	OUTFALL	0.000	0.131	0	12:02	0	0.51	0.000

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
EX_DICB1	JUNCTION	0.48	0.099	0.121

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary

****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	72.51	0.022	0.131	0.510
System	72.51	0.022	0.131	0.510

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1050	CONDUIT	0.136	0 12:00	0.70	0.11	0.28
C1	CONDUIT	0.137	0 12:00	2.79	2.44	1.00
C1_2	CONDUIT	0.134	0 12:00	0.28	0.03	0.33
C3	CONDUIT	0.131	0 12:00	0.13	0.01	0.51
EX_1050_CONC	CONDUIT	0.131	0 12:02	0.77	0.94	0.34

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
1050	1.00	0.22	0.06	0.00	0.72	0.00	0.00	0.00	0.38	0.00
C1	1.00	0.22	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00
C1_2	1.00	0.22	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00
C3	1.00	0.22	0.00	0.00	0.78	0.00	0.00	0.00	0.01	0.00

EX_1050_CONC	1.00	0.24	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.25	0.48	0.25	0.79	0.25

Analysis begun on: Mon May 30 20:29:16 2022
Analysis ended on: Mon May 30 20:29:16 2022
Total elapsed time: < 1 sec

Appendix D – Sanitary Sewer Design Sheet

Project:	**Wasaga Riverwoods**
Municipality:	**Town of Wasaga Beach**
Project No.:	**2018-012**
Analyzed by:	**BC**
Date:	**September 21, 2022**
Manning n Value	**0.013**

Sanitary Sewer Design Sheet
Wasaga Riverwoods
Town of Wasaga Beach

CAPES ENGINEERING

	DESIGN SEWAGE FLOWS									SANITARY SEWER CAPACITY						
Location of Section	**Cumulative Sanitary Catchment Area (ha)**	**From Upstream MH #**	**To Downstream MH #**	**Cumulative Serviced Population Cap.**	**Peaking Factor**	**Average Flow Residential L/s**	**Peak Flow Residential L/s**	**Peak Flow Infiltration L/s**	**Total Peak Flow L/s**	**Pipe Length m**	**Pipe Diameter mm**	**Pipe Grade %**	**Full Flow. Cap. L/s**	**Full Flow Velocity m/s**	**Peak Flow Velocity m/s**	**Percentage Full**
Wasaga Riverwoods	**0.99**	**Building**	**MH4**	**182**	**4.16**	**0.74**	**3.07**	**0.28**	**3.35**	**2.6**	**200**	**0.77**	**28.8**	**0.11**	**0.44**	**11.6%**
River Road West		**MH4**	**EX. MH 156A**						**3.35**	**12.6**	**250**	**0.5**	**42.0**	**0.86**	**0.43**	**8.0%**
River Road West		**EX. MH 156**	**EX. MH 156A**						**3.35**	**74.6**	**250**	**0.45**	**39.9**	**0.81**		**8.4%**
River Road West		**EX. MH 156A**	**EX. MH 155**						**3.35**	**78.5**	**250**	**0.41**	**38.1**	**0.78**		**8.8%**

NOTE:	**BASED ON 2.6 PERSONS PER UNIT**
	AVERAGE DAILY PER CAPITA FLOW = 350 L/cap/day
	EXTRANEOUS FLOW ALLOWANCE = 0.28 L/s/ gross ha
	PEAKING FACTOR : HARMON
	MANNING "n" = 0.013

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Sanitary Sewer Flow Velocity

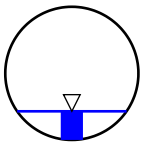
Wasaga Riverwoods

Inputs

Pipe diameter, d_0	0.25	m
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.31	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	21.5	%

Results

Flow, Q (See notes)	0.0034	m^3/s
Velocity, v	0.4330	m/s
Velocity head, h_v	0.0096	m H2O
Flow area	0.0077	m^2
Wetted perimeter	0.2411	m
Hydraulic radius	0.0321	m
Top width, T	0.2054	m
Froude number, F	0.71	
Average shear stress (tractive force), tau	0.9772	N/m^2



Appendix E – Water Demand Calculations

CAPES ENGINEERING

Domestic & Fire Protection Water Supply/Storage

Project: **Wasaga Riverwoods**
River Road West

Prepared by:	B. Collins
Checked by:	C. Capes
Project No:	2018-012
Date:	September 21, 2022

Domestic Flow Calculations

Number of Water Fixture Units =	835.8		OBC Table 7.6.3.2 Hydraulic Load
Water Demand =	7605.78	L	OBC Table 7.4.10.5 Conversion of WFSU to L/min (9.1 L per fixture unit)
Operating Hours =	24	hrs	
Average Day Demand =	7606	L/day	
=	5.3	L/min	
=	0.09	L/s	
Peak Factor =	4		MECP Recommended Range 2 to 4
Peak Demand =	0.35	L/s	
Total Domestic Peak Demand =	**0.35**	**L/s**	

Fire Flow Calculations

Office of the Fire Marshal, OFM Guideline, Fire Protection Water Supply Guideline for Part 3 in the Ontarion Building Code (Oct 1999)
Subsection 3.2.2 of the Ontario Building Code, 2012

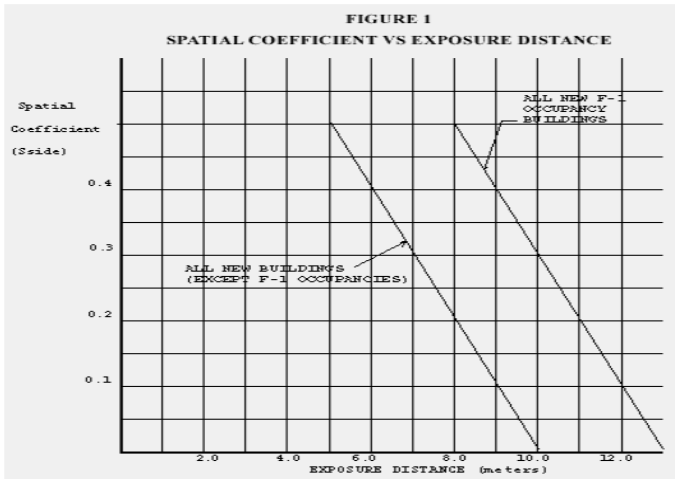
$Q=KVS_{Total}$ where

Q = Minimum supply of water in Litres (L)
K = water supply coefficient from Table 1
V = total building volume in cubic meters
S_{Tot} = total of the spacial coefficient values from the property line exposures on all sides as obtained from the formula:

$S_{Tot} = 1.0 + [(S_{Side1}) + (S_{Side2}) + (S_{Side3}) + \ldots etc.]$

where S_{Side} values are obtained from Figure 1, as modified by Sections 6.39(e) and 6.3(f) of the OBC Guideline
S_{Tot} need not exceed 2.0

FIGURE 1
SPATIAL COEFFICIENT VS EXPOSURE DISTANCE



1 Building Classification:

Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.

Water Supply Coefficient - K — Table 1 of OBC A.3.2.5.7

K = 18 — Type C, OBC Table 3.1.2.1

2 Building Volumes

Bldg.	Area (m^2)	Height (m)	Volume (m^3)
Bldg. 1	1,339	25.60	34272
Total			**34272**

← Total Building Volume

3 Exposure Distances $S_{Tot} = 1.0 + [(S_{Side1}) + (S_{Side2}) + (S_{Side3}) + \ldots etc.]$

Bldg.	North (m)	S_{Side} (N)	East (m)	S_{Side} (E)	South (m)	S_{Side} (S)	West (m)	S_{Side} (W)	S_{Tot}
Bldg. 1	>10 m	0	>10 m	0	>10 m	0	>10 m	0	**0**

← Max S_{Tot}

S_{Tot} = 1.00 — Max. Value = 2.0

4 **Minimum Fire Water Supply**

$Q=KVS_{Total}$ = **616901** Litres

5 **Fire Water Supply Flow Rate** = **9000** L/min — Table 2 Required Minimum Water Supply Flow Rate (L/min), provided in the OBC A.3.2.5.7

= **150.00** L/s

6 **Domestic + Fire Flow Rate** = **150.35** L/s

Appendix F – Post Development SWM Information

Post Development PCSWMM Model View

Legend

- Junctions
- Subcatchments
- Conduits
- Outfalls
- ACAD-2018-012 PROPBASE

N

40

Post Development - 25 mm 4 Hr Chicago Storm Event - PCSWMM Output

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------

Expanded Permeable pavers Sept 2021

WARNING 04: minimum elevation drop used for Conduit C1
WARNING 04: minimum elevation drop used for Conduit C2

*************
Element Count
*************
Number of rain gages ...... 14
Number of subcatchments ... 6
Number of nodes ........... 12
Number of links ........... 9
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
100YR_4HR_CHIC       100yrChic                    INTENSITY    5 min.
10YR_4HR_CHIC        10yrChic                     INTENSITY    5 min.
25MMCHIC             25MMCHIC                     INTENSITY    5 min.
25YR_4HR_CHIC        25YrChic                     INTENSITY    5 min.
2YR_4HR_CHIC         2yrChic                      INTENSITY    5 min.
50YR_4HR_CHIC        50yrChic                     INTENSITY    5 min.
5YR_4HR_CHIC         5yrChic                      INTENSITY    5 min.
SCS_24h_Type_II_100YR 100yrSCS                     INTENSITY    6 min.
SCS_24h_Type_II_10YR 10yrSCS                      INTENSITY    6 min.
SCS_24h_Type_II_25YR 25yrSCS                      INTENSITY    6 min.
SCS_24h_Type_II_2YR  2yrSCS                       INTENSITY    6 min.
SCS_24h_Type_II_50YR 50yrSCS                      INTENSITY    6 min.
SCS_24h_Type_II_5YR  5yrSCS                       INTENSITY    6 min.
Timmins_Storm_(Northern_Ontario) Timmins_Storm_(Northern_Ontario) INTENSITY   60 min.
```

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A1	0.34	63.19	97.60	1.0000	25MMCHIC	HDWL
A2	0.24	43.97	97.50	1.0000	25MMCHIC	A5
A3	0.01	80.00	0.00	0.5000	25MMCHIC	J1
A4	0.02	112.50	0.00	0.5000	25MMCHIC	J2
A5	0.03	105.00	0.00	0.5000	25MMCHIC	EX_DICB1
A6	0.01	38.67	0.00	2.0000	25MMCHIC	DCB2

****
LID Control Summary
****

Subcatchment	LID Control	No. of Units	Unit Area	Unit Width	% Area Covered	% Imperv Treated	% Perv Treated
A1	Permeable_Pavers	1	2077.00	30.00	60.98	100.00	100.00
A2	Permeable_Pavers	1	1642.00	30.00	69.28	100.00	100.00

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DCB2	JUNCTION	183.05	0.76	0.0	
EX_DICB1	JUNCTION	182.99	0.47	0.0	
EX_MH1	JUNCTION	182.88	1.18	0.0	
HDWL	JUNCTION	182.93	1.00	0.0	
J1	JUNCTION	0.00	0.00	0.0	
J2	JUNCTION	0.00	0.00	0.0	
MH2	JUNCTION	182.83	1.68	0.0	
MH3	JUNCTION	182.90	1.22	0.0	
MH5	JUNCTION	182.85	1.68	0.0	
OF_SOUTH	OUTFALL	0.00	0.00	0.0	
OF_WEST	OUTFALL	0.00	0.00	0.0	

OF1 OUTFALL 182.83 0.70 0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J2	OF_SOUTH	CONDUIT	7.4	0.0041	0.0100
C2	J1	OF_WEST	CONDUIT	7.9	0.0039	0.0100
C3	MH2	OF1	CONDUIT	15.9	0.1256	0.0130
C4	HDWL	MH3	CONDUIT	14.1	0.2131	0.0130
C5	MH3	MH2	CONDUIT	12.6	0.2389	0.0130
C6	DCB2	MH3	CONDUIT	3.1	1.6110	0.0130
C7	MH5	MH2	CONDUIT	21.4	0.0933	0.0130
C8	EX_DICB1	EX_MH1	CONDUIT	2.3	0.4411	0.0130
C9	EX_MH1	MH5	CONDUIT	28.5	0.1054	0.0130

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	DUMMY	0.00	0.00	0.00	0.00	1	0.00
C2	DUMMY	0.00	0.00	0.00	0.00	1	0.00
C3	HORIZ_ELLIPSE	0.70	0.62	0.21	1.10	1	0.61
C4	CIRCULAR	0.45	0.16	0.11	0.45	1	0.13
C5	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
C6	CIRCULAR	0.30	0.07	0.07	0.30	1	0.12
C7	CIRCULAR	1.05	0.87	0.26	1.05	1	0.83
C8	CIRCULAR	0.25	0.05	0.06	0.25	1	0.04
C9	CIRCULAR	1.05	0.87	0.26	1.05	1	0.89

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.

```
************************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 01/09/2013 00:00:00
Ending Date .............. 01/10/2013 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.016        24.999
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.016        24.416
Surface Runoff ...........        -0.000        -0.000
Final Storage ............         0.000         0.626
Continuity Error (%) .....        -0.174
```

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	-0.000	-0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.000	0.000
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %

```
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
A1	25.00	0.00	0.00	24.29	8.81	0.00	-0.00	-0.00	0.00	-0.000
A2	25.00	0.00	0.00	24.44	6.93	0.00	0.00	0.00	0.00	0.000
A3	25.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.000
A4	25.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.000
A5	25.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.000
A6	25.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.000

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Initial Storage mm	Final Storage mm	Continuity Error %
A1	Permeable_Pavers	39.45	0.00	39.45	0.00	0.00	0.00	0.00	-0.00
A2	Permeable_Pavers	35.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00

****
Node Depth Summary
****

	Average Depth	Maximum Depth	Maximum HGL	Time of Max Occurrence	Reported Max Depth

Node	Type	Meters	Meters	Meters	days	hr:min	Meters
DCB2	JUNCTION	0.00	0.00	183.05	0	00:00	0.00
EX_DICB1	JUNCTION	0.00	0.00	182.99	0	00:00	0.00
EX_MH1	JUNCTION	0.00	0.00	182.88	0	00:00	0.00
HDWL	JUNCTION	0.00	0.00	182.93	0	09:08	0.00
J1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
J2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
MH2	JUNCTION	0.00	0.00	182.83	0	00:00	0.00
MH3	JUNCTION	0.00	0.00	182.90	0	00:00	0.00
MH5	JUNCTION	0.00	0.00	182.85	0	00:00	0.00
OF_SOUTH	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF_WEST	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	182.83	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent	
DCB2	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
EX_DICB1	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
EX_MH1	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
HDWL	JUNCTION	-0.000	0.000	0	09:05	-3.12e-18	2.87e-23	-0.000	ltr
J1	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
J2	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
MH2	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
MH3	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
MH5	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
OF_SOUTH	OUTFALL	0.000	0.000	0	00:00	0	0	0.000	ltr
OF_WEST	OUTFALL	0.000	0.000	0	00:00	0	0	0.000	ltr
OF1	OUTFALL	0.000	0.000	0	00:00	0	0	0.000	ltr

****

Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	24.00	0.000	0.000
J2	JUNCTION	24.00	0.000	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF_SOUTH	0.00	0.000	0.000	0.000
OF_WEST	0.00	0.000	0.000	0.000
OF1	0.00	0.000	0.000	0.000
System	0.00	0.000	0.000	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	DUMMY	0.000	0	00:00			
C2	DUMMY	0.000	0	00:00			
C3	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C4	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C5	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C6	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C7	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C8	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C9	CONDUIT	0.000	0	00:00	0.00	0.00	0.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C3	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C7	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C8	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C9	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Sep 21 16:09:11 2022

Analysis ended on: Wed Sep 21 16:09:11 2022
Total elapsed time: < 1 sec

Post Development 100Yr SCS Type II Storm - PCSWMM Output

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------

Expanded Permeable pavers Sept 2021

WARNING 04: minimum elevation drop used for Conduit C1
WARNING 04: minimum elevation drop used for Conduit C2

*************
Element Count
*************
Number of rain gages ...... 14
Number of subcatchments ... 6
Number of nodes ........... 12
Number of links ........... 9
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
----------------------------------------------------------------------
100YR_4HR_CHIC       100yrChic                    INTENSITY    5 min.
10YR_4HR_CHIC        10yrChic                     INTENSITY    5 min.
25MMCHIC             25MMCHIC                     INTENSITY    5 min.
25YR_4HR_CHIC        25YrChic                     INTENSITY    5 min.
2YR_4HR_CHIC         2yrChic                      INTENSITY    5 min.
50YR_4HR_CHIC        50yrChic                     INTENSITY    5 min.
5YR_4HR_CHIC         5yrChic                      INTENSITY    5 min.
SCS_24h_Type_II_100YR 100yrSCS                     INTENSITY    6 min.
SCS_24h_Type_II_10YR 10yrSCS                      INTENSITY    6 min.
SCS_24h_Type_II_25YR 25yrSCS                      INTENSITY    6 min.
SCS_24h_Type_II_2YR  2yrSCS                       INTENSITY    6 min.
SCS_24h_Type_II_50YR 50yrSCS                      INTENSITY    6 min.
SCS_24h_Type_II_5YR  5yrSCS                       INTENSITY    6 min.
Timmins_Storm_(Northern_Ontario) Timmins_Storm_(Northern_Ontario) INTENSITY   60 min.
```

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A1	0.34	63.19	97.60	1.0000	SCS_24h_Type_II_100YR	HDWL
A2	0.24	43.97	97.50	1.0000	SCS_24h_Type_II_100YR	A5
A3	0.01	80.00	0.00	0.5000	SCS_24h_Type_II_100YR	J1
A4	0.02	112.50	0.00	0.5000	SCS_24h_Type_II_100YR	J2
A5	0.03	105.00	0.00	0.5000	SCS_24h_Type_II_100YR	EX_DICB1
A6	0.01	38.67	0.00	2.0000	SCS_24h_Type_II_100YR	DCB2

****
LID Control Summary
****

Subcatchment	LID Control	No. of Units	Unit Area	Unit Width	% Area Covered	% Imperv Treated	% Perv Treated
A1	Permeable_Pavers	1	2077.00	30.00	60.98	100.00	100.00
A2	Permeable_Pavers	1	1642.00	30.00	69.28	100.00	100.00

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DCB2	JUNCTION	183.05	0.76	0.0	
EX_DICB1	JUNCTION	182.99	0.47	0.0	
EX_MH1	JUNCTION	182.88	1.18	0.0	
HDWL	JUNCTION	182.93	1.00	0.0	
J1	JUNCTION	0.00	0.00	0.0	
J2	JUNCTION	0.00	0.00	0.0	
MH2	JUNCTION	182.83	1.68	0.0	
MH3	JUNCTION	182.90	1.22	0.0	
MH5	JUNCTION	182.85	1.68	0.0	
OF_SOUTH	OUTFALL	0.00	0.00	0.0	
OF_WEST	OUTFALL	0.00	0.00	0.0	

OF1 OUTFALL 182.83 0.70 0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J2	OF_SOUTH	CONDUIT	7.4	0.0041	0.0100
C2	J1	OF_WEST	CONDUIT	7.9	0.0039	0.0100
C3	MH2	OF1	CONDUIT	15.9	0.1256	0.0130
C4	HDWL	MH3	CONDUIT	14.1	0.2131	0.0130
C5	MH3	MH2	CONDUIT	12.6	0.2389	0.0130
C6	DCB2	MH3	CONDUIT	3.1	1.6110	0.0130
C7	MH5	MH2	CONDUIT	21.4	0.0933	0.0130
C8	EX_DICB1	EX_MH1	CONDUIT	2.3	0.4411	0.0130
C9	EX_MH1	MH5	CONDUIT	28.5	0.1054	0.0130

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	DUMMY	0.00	0.00	0.00	0.00	1	0.00
C2	DUMMY	0.00	0.00	0.00	0.00	1	0.00
C3	HORIZ_ELLIPSE	0.70	0.62	0.21	1.10	1	0.61
C4	CIRCULAR	0.45	0.16	0.11	0.45	1	0.13
C5	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
C6	CIRCULAR	0.30	0.07	0.07	0.30	1	0.12
C7	CIRCULAR	1.05	0.87	0.26	1.05	1	0.83
C8	CIRCULAR	0.25	0.05	0.06	0.25	1	0.04
C9	CIRCULAR	1.05	0.87	0.26	1.05	1	0.89

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.

```
***********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 01/09/2013 00:00:00
Ending Date .............. 01/10/2013 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:00:05
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.096       149.640
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.093       145.615
Surface Runoff ...........         0.002         3.346
Final Storage ............         0.001         0.782
Continuity Error (%) .....        -0.069
```

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.002	0.021
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.002	0.021
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
5.000 - 3.155 sec	:	100.00 %
3.155 - 1.991 sec	:	0.00 %

```
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
A1	149.64	0.00	0.00	148.88	56.23	0.00	-0.00	-0.00	0.00	-0.000
A2	149.64	0.00	0.00	149.04	44.22	0.00	-0.00	-0.00	0.00	-0.000
A3	149.64	0.00	0.00	65.81	0.00	82.43	82.43	0.01	0.00	0.551
A4	149.64	0.00	0.00	65.81	0.00	82.51	82.51	0.01	0.01	0.551
A5	149.64	-0.00	0.00	149.64	0.00	0.00	0.00	0.00	0.00	0.000
A6	149.64	0.00	0.00	149.64	0.00	0.00	0.00	0.00	0.00	0.000

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Initial Storage mm	Final Storage mm	Continuity Error %
A1	Permeable_Pavers	241.85	0.00	241.85	0.00	0.00	0.00	0.00	0.00
A2	Permeable_Pavers	213.46	0.00	213.46	0.00	0.00	0.00	0.00	0.00

****
Node Depth Summary
****

	Average Depth	Maximum Depth	Maximum HGL	Time of Max Occurrence	Reported Max Depth

Node	Type	Meters	Meters	Meters	days	hr:min	Meters
DCB2	JUNCTION	0.00	0.00	183.05	0	00:00	0.00
EX_DICB1	JUNCTION	0.00	0.00	182.99	0	00:00	0.00
EX_MH1	JUNCTION	0.00	0.00	182.88	0	00:00	0.00
HDWL	JUNCTION	0.00	0.00	182.93	0	11:18	0.00
J1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
J2	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
MH2	JUNCTION	0.00	0.00	182.83	0	00:00	0.00
MH3	JUNCTION	0.00	0.00	182.90	0	00:00	0.00
MH5	JUNCTION	0.00	0.00	182.85	0	00:00	0.00
OF_SOUTH	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF_WEST	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	182.83	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent	
DCB2	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
EX_DICB1	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
EX_MH1	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
HDWL	JUNCTION	-0.000	0.000	0	11:17	-1.64e-17	4.73e-19	-0.000	ltr
J1	JUNCTION	0.004	0.004	0	11:54	0.00659	0.00659	0.000	
J2	JUNCTION	0.010	0.010	0	11:54	0.0149	0.0149	0.000	
MH2	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
MH3	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
MH5	JUNCTION	0.000	0.000	0	00:00	0	0	0.000	ltr
OF_SOUTH	OUTFALL	0.000	0.010	0	11:54	0	0.0149	0.000	
OF_WEST	OUTFALL	0.000	0.004	0	11:54	0	0.00659	0.000	
OF1	OUTFALL	0.000	0.000	0	00:00	0	0	0.000	ltr

****

Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	24.00	0.000	0.000
J2	JUNCTION	24.00	0.000	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF_SOUTH	21.39	0.001	0.010	0.015
OF_WEST	18.10	0.000	0.004	0.007
OF1	0.00	0.000	0.000	0.000
System	13.16	0.001	0.015	0.021

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	DUMMY	0.010	0	11:54			
C2	DUMMY	0.004	0	11:54			
C3	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C4	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C5	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C6	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C7	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C8	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C9	CONDUIT	0.000	0	00:00	0.00	0.00	0.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C3	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C7	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C8	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C9	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Sep 21 15:53:39 2022

Analysis ended on: Wed Sep 21 15:53:40 2022
Total elapsed time: 00:00:01

PURUS PLASTICS

Ground reinforcement system

ECORASTER® E50

Technical Data

Product features

ECORASTER® E50 - The indestructible grid

The perfect solution for heavy-duty gardening and landscaping.

Weight per sq m **9.55 kg**

Wall height **2 in**

Laying time **100 sq m/h**

Technical specifications

Dimensions	13 in x 13 in x 2 in
Wall thickness	0,2 in
Carrying load	Up to 350 t per sq m (unfilled)
Weight per sq m	9.55 kg
Weight per unit	1.06 kg
Wall height	2 in
Material	100% recycled PE (polyethylene)
Pressure resistance	Up to 20 t axle load in acc. with DIN 1072
Dimensional stability	Temperature range -50° to +90°
Deformation	0.5% (at normal temperatures +20 to +80 °)
Moisture absorption	0.01%
Solubility	Resistant to acids, alkalis, alcohols, oil and petrol (de-icing salt, ammonia, acid rain, etc.)

Delivery units

Packaging unit	1 layer (= 12 pieces = 1,33 sq m)
Layer per pallet	43
Sq m per Pallet	57,19 sq m
Pieces per pallet	516
Dimensions	41,3 in x 53,1 in x 90,2 in
Weight per pallet	560 kg (incl. Pallet)

Certificates

TÜV	unlimited lifespan
DIN 1072	Carrying load up to 20 t axle load
DIN 38412	Environmentally neutral
DIN 1072	Road and footbridges
DIN EN ISO 124	B125 requirements for coverings on car parking areas

Suitable for

Gardening and landscaping

Trade fair flooring, Loading areas, Logistics surfaces,Storage areas and landfills, Open-air events, Temporary surfaces, Aviation, Camping, Golf, Rainwater retention, Erosion protection, Railway and tramway construction, Entrances and exits, Lay-bys, Roundabouts, Traffic islands, Soft shoulders, Escape routes, Emergency access routes, Parking areas, Construction site access roads, Stabilisation of slopes and embankments, Pond and riverbank reinforcement, Footpaths and cycle lanes, Parks, Town and village squares

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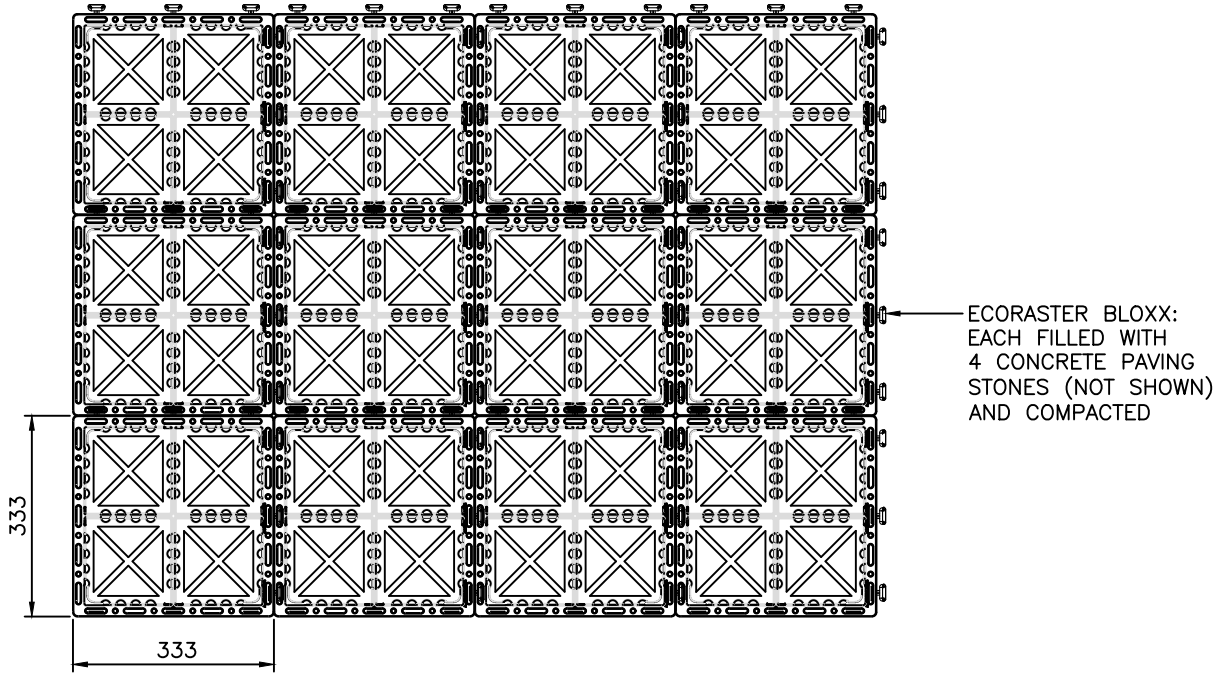
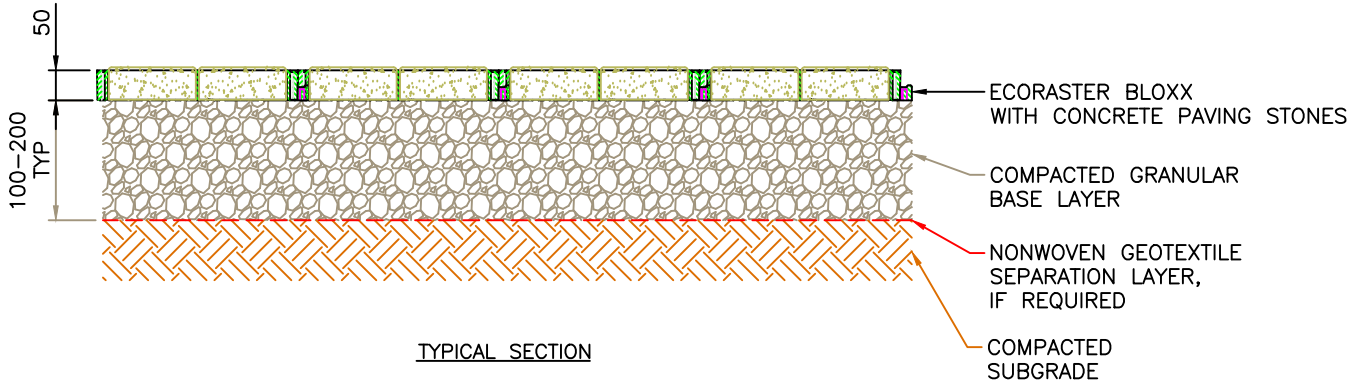


PLAN VIEW



TYPICAL SECTION

NOTES:

1. THICKNESS OF GRANULAR LAYER DEPENDENT UPON SPECIFIC SITE & LOADING CONDITIONS.

2. A SUITABLE CLEAR STONE (E.G. ¼" CHIP OR 1", AASHTO #8 OR #57, MTO 9.5 OR 19 mm) CAN BE USED FOR THE GRANULAR BASE LAYER TO INCREASE WATER STORAGE CAPACITY.

3. IF CLEAR STONE IS USED FOR THE GRANULAR LAYER, THEN A NONWOVEN GEOTEXTILE SHOULD BE USED AS A SEPARATION LAYER BETWEEN THE CLEAR STONE BASE AND THE SUBGRADE.

4. DRAINAGE SYSTEM OF THE PERMEABLE PAVEMENT SYSTEM SHOULD BE DESIGNED TO ACCOMMODATE EXPECTED INFILTRATION RATES, STORAGE CAPACITIES, OUTLET FLOW RATES, AND OTHER SITE SPECIFIC CONDITIONS.

5. SUBGRADE SHOULD BE SLOPED TO AID IN DRAINAGE.

6. FOR LIGHT LOADS SUCH AS RESIDENTIAL PEDESTRIAN APPLICATIONS (E.G. PATIOS), COMPACTION OF THE SUBGRADE IS OPTIONAL TO MAXIMIZE SUBGRADE PERMEABILITY.

7. ALL DIMENSIONS IN mm UNLESS STATED OTHERWISE.

8. THIS DRAWING IS FOR CONCEPTUAL DESIGN PURPOSES ONLY, NOT FOR CONSTRUCTION.

PURUS PLASTICS NORTH AMERICA

ECORASTER®

www.ecoraster.ca

ECORASTER BLOXX PERMEABLE PAVING SYSTEM WITH CONCRETE PAVING STONES

DATE:	FEB. 2016
SCALE:	NTS
SHEET:	1 OF 1
REVISION:	0

ECORASTER®

Permeable Ground Reinforcement

Installation manual

ECORASTER®

Disclaimer

The explanations in this document, particularly application and usage recommendations of our products, are based on our experience and knowledge under normal conditions, and assume that the products have been stored and used appropriately. Due to differences in subsoils and local conditions Purus cannot warranty an installation based on verbal instructions or the guidelines printed in this manual. Local experts should be consulted. Terms and conditions apply. Subject to change without notice.

Thanks for going permeable!

The consequences of global use of land surface are noticeable and emphasize the urgent need for permeable ground reinforcement solutions

Since the year 2000, in Germany alone 100 hectares of land are sealed every day by construction and roadbuilding. Worldwide it is even worse.

PURUS PLASTICS operates one of the most modern plastics recycling facilities in the world. Our goal: manufaturing truly sustainable products.

ECORASTER® products have been developed and produced in Germany from 100% recycled materials (LDPE) since 1994.

ECORASTER® is absolutely 100% environmentally friendly, time proven with millions of square meters sold, and is versatile and excellent value.

With the right choice of grid types and well-designed accessories, this system is suitable for almost every type of application.

Choosing our quality products help to save precious resources and reduces the environmental impact of waste plastics. Your benefits: You will save money and time during installation, on maintenance and usage.

Your PURUS PLASTICS Team

*(Quelle: StBA 2014)

Installation Manual **ECORASTER®**

Contents

CIVIL ENGINEERING | ROAD CONSTRUCTION | MUNICIPAL CONSTRUCTION | LANDSCAPE GARDENING | MILITARY | SPECIAL CIVIL ENGINEERING | PRIVATE AND PUBLIC SPACE

Why ECORASTER®?

Particularly in metropolitan and industrial areas, because the ground is paved or compacted it is less able to fulfill its natural functions. On one hand the ground loses the natural ability to store or "buffer" rain water which can lead to very quickly over-burdening storm water infrastructure leading to flooding, and on the other hand the air cannot be cooled and humidified by the natural ground "perspiring", contributing to the well-known "Heat Island Effect".

To counteract this trend and to help to prevent the negative effects of traditional sealed paving, more and more municipalities, architects and civil engineers are designing permeable and vegetated paving systems - a wise and affordable investment.

Using the ECORASTER® system, in comparison to sealed surfaces, saves costly storm water retention ponds and other drainage and infrastructure systems. Often storm water taxes can also be saved and grants may be available to help implement alternative paving options such as the ECORASTER® system.

ECORASTER® installation is quick and simple without the use of expensive mechanical equipment. The paved area is filled with gravel or vegetated and remains permeable.

Compared with heavy ioncrete pavers ECORASTER® is easy and economical to transport and has ultra-high load bearing capacity (up to 800 t / m^2). The 95% open surface is significantly more permeable and allows a much higher degree of infiltration. In contrast to the concrete pavers ECORASTER® does not absorb water, which prevents frost damage and increases the infiltration capacity.

The proven safety interlocking system and the integral expansion joints create excellent surface weight distribution and resistance to dynamic loading , no matter what kind of application the system is be used for.

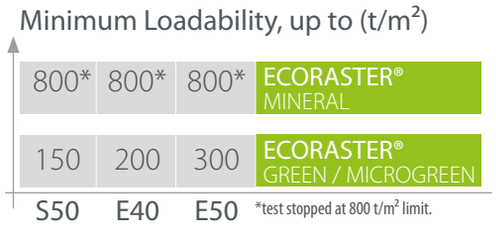
Benefits at a glance.

- ✓ easy and quick installation (up to 100 m^2| 1,076 ft^2/h per person)
- ✓ high resilience (up to 800 t/m^2)
- ✓ low maintenance
- ✓ installation without heavy construction equipment
- ✓ no edging needed
- ✓ permeable ground reinforcement
- ✓ low transport and handling costs
- ✓ versatile applicable, accessories available
- ✓ weatherproof and unbreakable
- ✓ Safety interlocking, 36 notches per m^2
- ✓ UV-resistant and frostproof
- ✓ 20 years warranty
- ✓ „Made in Germany" (TÜV Nord)

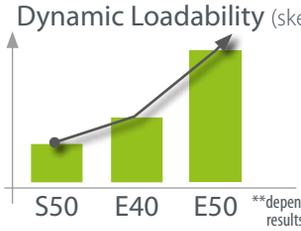
Matrix of Application

ECORASTER® Application			GREEN / MICROGREEN vegetated	MINERAL gravel filled
Load		Roads and paths used only for pedestrians and bicycles may use this	E40 alternative: S50	E40 alternative: S50
		Paths, walkways and similar applications, as well as car parking	E40 alternative: E50 or S50	E40 alternative: E50
		Roads, road shoulders and parking lots used for all types of vehicles	E50	E50* alternative: ECORASTER® STONE
		Areas used with high point axle loading e.g. warehousing (forklifts and trucks), truck parking lots, bus parking, helicopter landing pads.	---	E50* alternative: ECORASTER® STONE *with 3/8" - 3/4" inches covering-over
	Installed and unfilled, the **ECORASTER®** system can be driven on with heavy wheeled vehicles (EN 124 / D400 except Bloxx).			

Minimum Loadability, up to (t/m²)



Dynamic Loadability (sketched)**



Certificates and Approvals

- UV-resistant, certified DIN EN 60068-2-5
- Point axle loading up to 20 t/m², DIN 1072:1985
- Heavy-duty, tried and tested DIN EN 124:2011
- Environmentally safe, tested OECD 202:2004
- Factory warranty: 20 years from purchase date (private use)
- NATO certified E50 - MOD / 9330-99-858-1406
- TÜV CERT
- TÜV Nord „Made in Germany"

Please note: Please read the manual/ check our website for more information!

1m² = 10.764 ft²

Occupancy and parking duration

Installation examples for permeable areas

Dependent on daily occupancy and parking duration

ECORASTER® Mineral ECORASTER® Stone

Occupancy > 10 h per day

» visitor parking
» shopping malls (near mall entrances)
» driveways, entrances and exits, access roads
» storage areas
» fire rescue paths, fire access lanes ... and much more

parking time > 10 h per day

ECORASTER® Bloxx

Occupancy > 10 h per day

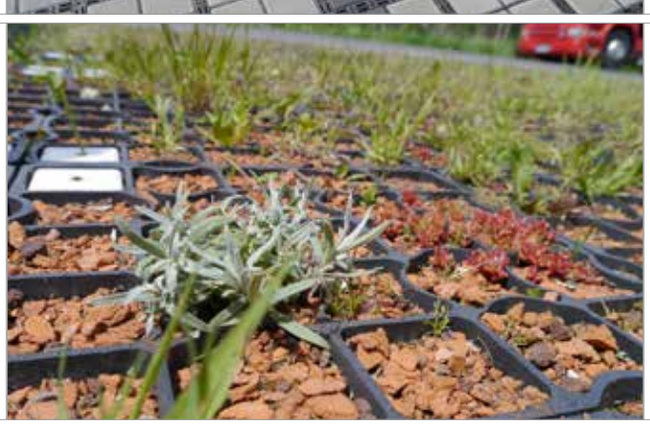
» high traffic areas
» accessible parking space, public sector, etc.
» office buildings, public buildings, commercial areas
» shopping malls, parks
» parking areas in residential districts ... and much more

parking time > 10 h per day

ECORASTER® Microgreen

Occupancy max. 8 h per day

» parking space, public sector, etc.
» office buildings, public buildings, commercial areas
» shopping malls, parks
» parking areas in residential districts ... and much more



parking time max. 8 h per day

ECORASTER® Green

Occupancy max. 4 h per day

» parking spaces in tourist areas
» office and commercial areas (overflow)
» paths for golf carts, etc.
» cemeteries
» fire access lanes
» stadiums and sporting areas (located non inner-city)
» campsites ... and much more

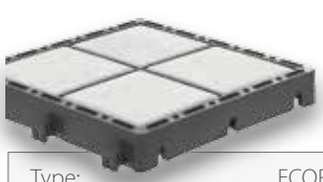
parking time max. 4 h per day

Adapt to the intensity of use:
Parking lots and driveways can be planned according to their distance from the building.

20 YEAR warranty ECORASTER®

Specifications

Type:	ECORASTER® E50	ECORASTER® S50	ECORASTER® A50	ECORASTER® E40
Dimensions:	330 x 330 x 50 mm 12.99 x 12.99 x 1.97 inches	330 x 330 x 50 mm 12.99 x 12.99 x 1.97 inches	330 x 330 x 50 mm 12.99 x 12.99 x 1.97 inches	330 x 330 x 40 mm 12.99 x 12.99 x 1.57 inches
Material:	100% recycled LDPE			
Wall height:	50 mm • 1.97 inches	50 mm • 1.97 inches	50 mm • 1.97 inches	40 mm • 1.57 inches
Wall thickness:	5 mm • 0.1968 inches	2,5 mm • 0.098 inches	5 mm • 0.1968 inches	3,6 mm • 0.14 inches
Loadability:	up to 800 t/m² (depending on fill type)			
Interlock:	36 notched connectors per m²			
Dimensional stability:	-50° / 90 ° C • -58° / 194° F			
Change in shape:	0.5% (at normal temperature +68°F to 176°F)			
Moisture absorption:	0,01% • 0.01%			
Solubility:	resistant to acids, alkalis, alcohol, oil and petrol (de-icing salt, ammonia, acid rain, etc.)			
Compressive strength:	up to 20t point axle load (DIN 1072)			
Area per pallet:	57,19 m² • 615.59 ft²	57,19 m² • 615.59 ft²	57,19 m² • 615.59 ft²	73,15 m² • 787.38 ft²
Weight per piece:	1,06 kg • 2.34 lbs	0,76 kg • 1.67 lbs	1,06 kg • 2.34 lbs	0,58 kg • 1.27 lbs
Weight per m² | 10.76 ft²:	9,55 kg • 21.05 lbs	6,84 kg • 15.07 lbs	9,55 kg • 21.05 lbs	5,22 kg • 11.50 lbs



Type:	ECORASTER ® Bloxx
Dimensions:	330 mm x 330 mm x 50 mm 12.99 X 12.99 x 1.97 inches
Weight:	approx. 85 kg | 187.39 lbs (incl. blocks)
Locking System:	36 T-elements /m² 6 T-elements/ sqft
Dimensional Stability (Temperature):	-50° to +90 ° C -58° F to +194°F
Block Dimensions:	140 x 140 x 45mm (each) 5.51 x 5.51 x 1.77 inches
Weight per Block:	approx. 2.12 kg | 4.67 lbs
Available Colours:	red, white, dark grey and light grey

Questions? Give us a call:
+1 800 495 55 17

Info: 1m² = 10.76 ft²

Check the water permeability

What are the criteria for infiltration?

The infiltration rate of the ground affects the feasibility of a construction project involving water-permeable surfaces. It is indicated by the coefficient of permeability K (m/s). To be considered for such a project, the infiltration rate of the ground must be tested. Geotechnical surveys are required for certain surfaces to be reinforced or for heterogeneous ground.

$K > 10^{-4}$ m/s	$10^{-4} > K > 10^{-6}$ m/s	$10^{-6} > K > 10^{-8}$ m/s
stony / sandy soil	**sandy / clay soil**	**clay / loam**
		
quick infiltration	**average infiltration**	**slow infiltration**
		safety drainage 

A possible test method to establish infiltration capability

For this quick test dig out a circular area with a of 40 cm diameter and 40 cm depth. Fill 10 liters of water and measure the time it takes the water to fully infiltrate into the soil. Repeat this process until the same approximate time is measured 3 times in a row. The test should be done in the natural undisturbed soil, so as not to distort the results.

Evaluation of test results (in minutes):

time of infiltration ≤ 2	2 < time of infiltration ≤ 20	infiltration > 20
QUICK	AVERAGE	SLOW

Determination of requirements: Sand, gravel etc.

Before determining your requirements of gravel, loose gravel etc., please determine the height of your area.
For larger areas we recommend using leveling instruments or laser technology.

To calculate the material required to fill up the ECORASTER® elements please use the following formula:

0,95 x area x height of ECORASTER®

Installation without substructure?

Thanks to the interlocking system and the excellent area load balancing ECORASTER® can be installed without substructure. If you do not use a substructure (water-storing bed) area drainage is not ensured. Additionally soil variations can effect surface irregularities and cause different loadabilities.

If you plan to install without substructure please contact us we are eager to help you.

Please keep in mind!

» ECORASTER® should be installed with a vibrating plate tamper after installation (Bloxx with rubber mat).

» For the final height of the substructure please note, that the ECORASTER® settles into base layer approx. 0.5cm | 0.19“

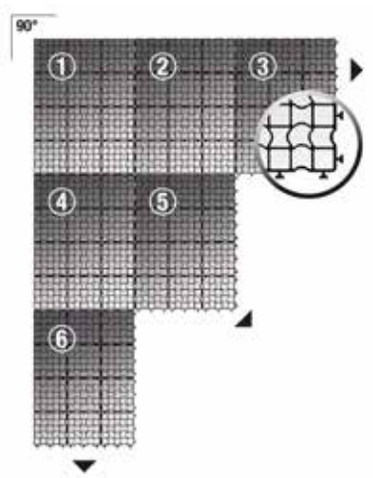
» After filling ECORASTER® a slight settlingt is possible. For Bloxx use a geotextile (mesh) to avoid mixing gravel and floor.

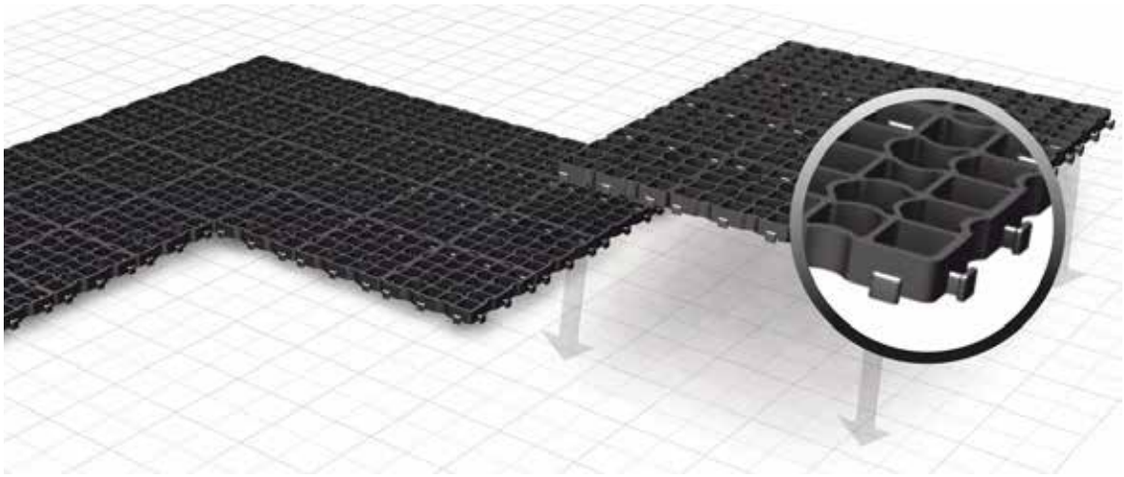
» In hot conditions please fill the ECORASTER® elements immediately after correct installation.

» For areas mainly used by heavy trucks and forklifts (small turning radius), we recommend using ECORASTER® E50 with 1 - 2 cm | 3/8“ - 3/4“ over fill, e.g. with loose gravel. Alternatively ECORASTER® E50 Stone (resin-bound) can be installed.

Installing the pre-assembled layers

ECORASTER® can be installed quickly and easily without heavy construction equipment. The elements are delivered in "layers". One layer is equal to 1.33 m^2 | 14.32 ft^2 and consists of 12 single ECORASTER® pieces (4x3). Large areas can be installed in a single operation directly from the pallet as the weight of a layer is low and the interlocking system works quickly and easily.





Installation

Start the installation at a corner of the area. Make sure the interlocking notches point outwards towards the direction of the further area to be installed. The next layers are simply connected to the notches of the already installed ECORASTER® elements. To achieve a straight result, we recommend using a guideline along the outside of the area.

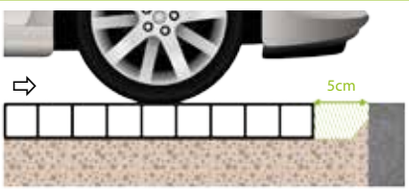
Disassembly

The pre-assembled layers can be disconnected if needed. Put the layer you want to separate on top of another layer, the edge along the area you want to split up. Push the upper layer (the one you want to separate) down using your foot. Enough force will loosen the safety interlocking system notches.

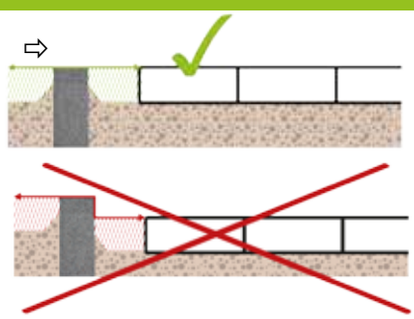
Adapt – cut to size

For quick and clean cutting of ECORASTER® the following tools have proven themselves in practice:

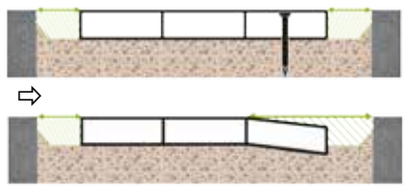
- » portable circular saw
- » cutting disc
- » jigsaw
- » crosscut saw



Please ensure that that you keep 5 cm | 2 inches of space is kept between ECORASTER® and edging*



Please place ECORASTER® on the same level like the edging.*



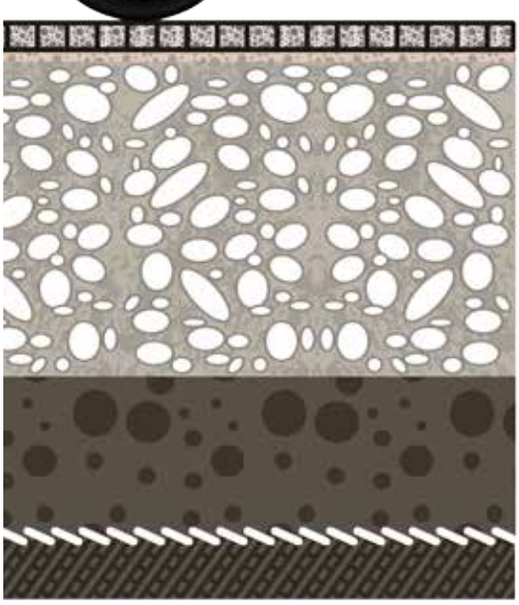
To prevent rising or lifting due to braking forces in parking areas, ECORASTER® can be anchored with ground nails.
Alternatively the end of the system can be lowered as shown.*

*driving direction from left to right.

Example: Parking with ECORASTER® **MINERAL**

Filling: Gravel

Areas, which can not be greened because of the heavy use or their insufficient location, can be filled with loose gravel. These areas are also considered to be fully permeable! Due to the high loadability this type of filling is highly recommended for heavy duty areas such as parking or warehouse/logistic areas.



ECORASTER® — Filling;
Fill with gravel/ loose gravel/ sand (with proper grain size, no fines)

Base layer

Levelling course, 1/4“ (chip or similar);
Approx. 4-5 cm levelled, then install ECORASTER® and plate tamp or roll to compact

Draining layer — Drainage layer 20 cm clear angular gravel (e.g. 0/32mm | 3/4“);
Fill with gravel and compact

Substructure — 10 to 45 cm gravel (e.g. 30/60 or 40/80mm | 1 1/2“) ;
For cars approx. 25 cm • Truck approx. 40 cm

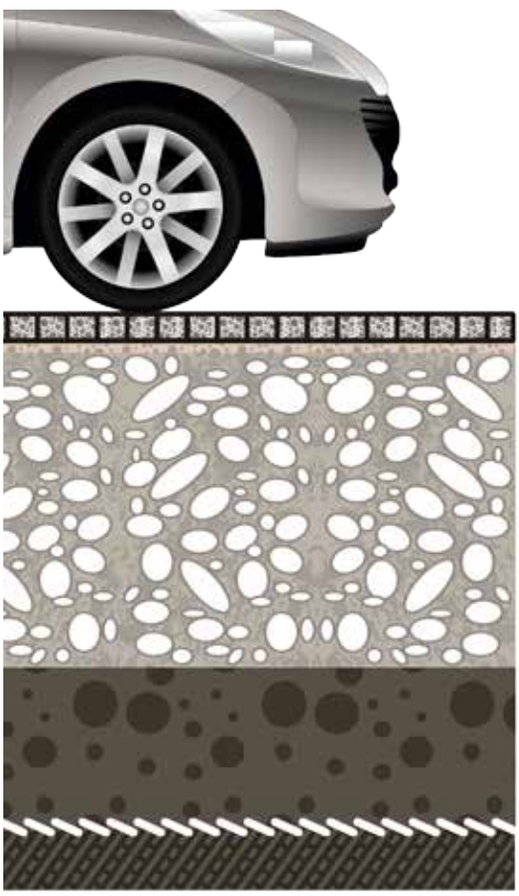
Pollutant barrier geotextile

floor/level — Level and plane with 1-1.5% slope

Example: Parking with ECORASTER® **STONE**

Filling: Hard-surfaced gravel

Heavy used areas, which shall be fully permeable and free of loose gravel can be installed with our "stone" system. In a special procedure two eco-friendly components are mixed together and get blended with the gravel filling. The results are sturdy and tough surfaces, with a high percolation rate (one liter per m^2 per second).



ECORASTER® — Filling;
Fill with gravel-glue-mix, screed redundant material.

Base layer

Levelling course, 1/4“ chip (or similar);
Approx. 4-5 cm levelled, then install ECORASTER® and plate tamp or roll to compact

Draining layer — Drainage layer 20 cm clear angular gravel (e.g. 0/32mm | 3/4“);
Fill with gravel and compact

Substructure — 10 to 45 cm gravel (e.g. 30/60 or 40/80mm | 1 1/2“) ;
For cars approx. 25 cm • Truck approx. 40 cm

Pollutant barrier geotextile

floor/level — Level and plane with 1-1.5% slope

Please note:

Considering the required technology and skills for this type of filling and the limited processing time, this system is best installed by professionals

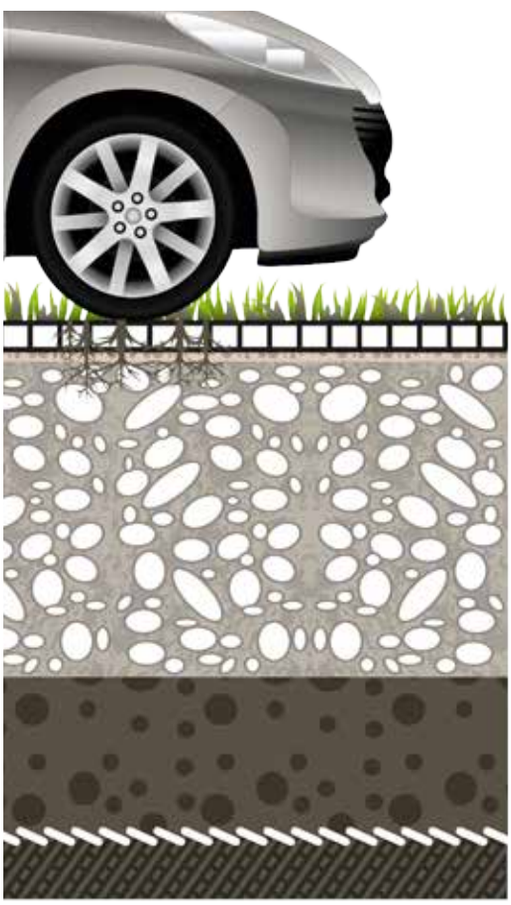
Please take advantage of our highly qualified customer service and consulting department to achieve the best possible results.

Important: This system is not loadable until full setting.

Example: Parking with ECORASTER® **MICROGREEN**

Filling: Substrate + seeds

After installing the ECORASTER® the area is filled with MICROGREEN, an compound of a highly durable substrate mixture and hardy herbage, sedum and moss plants. This type of filling is unique due to its high resilience and its low need for maintenance.



Advice!

To cut the ECORASTER® fast and straight we recommend using a hand-held circular saw. For smaller corners or areas which need to be cut more precisely please use a jigsaw. Do not cut the layers in advance. If possible please cut the layers after extending them beyond the edges of the area. Setting the ECORASTER® on a base for cutting can make it easier.

- **ECORASTER®** — Filling;
- **Base layer**
  - Fill with mineral substrate, sow seeds (mix of sand-thyme, mosses, sedum, mountain sweet grass, white clover)
  - **Levelling course, mineral substrate** (3/15mm, Microgreen-substrate); Approx. 4 cm levelled, then compact with roller to approx. 3 cm
- **Draining layer** — Drainage layer 20 cm clear angular gravel (e.g. 0/32mm | 3/4“); Fill with gravel and compact
- **Substructure** — 10 to 45 cm gravel (e.g. 30/60 or 40/80mm | 1 1/2“) ; For cars approx. 25 cm • Truck approx. 40 cm
- **Pollutant barrier geotextile**
- **floor/level** — Level and plane with 1-1.5% slope

Please note:

• This system is only suitable to a limited extent, when mainly used by heavy trucks.

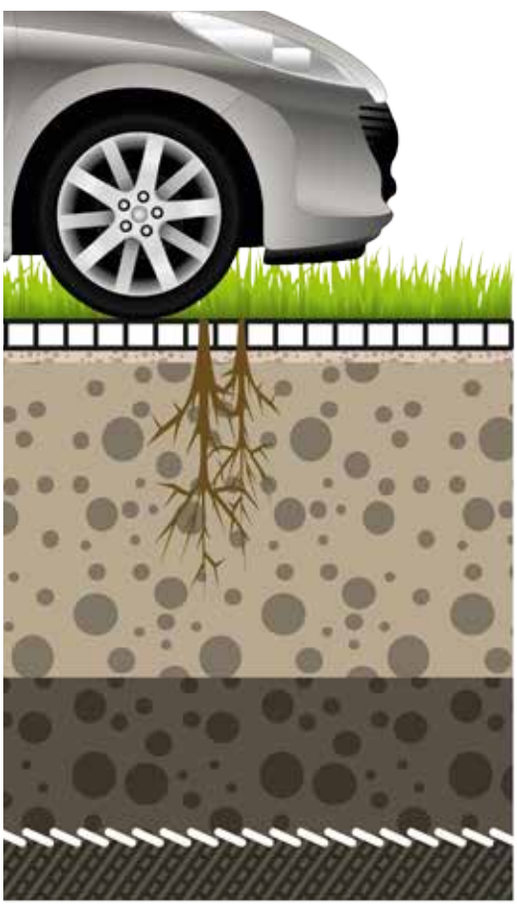
• Seeds need to be stored in a dry and dark place until sowing.

• Areas do not need mowing, fertilization or watering.

Example: Parking with ECORASTER® **GREEN**

Filling: Lawns, pre-greened or DIY greened

Installing the pre-greened ECORASTER® bleak and earthy soil turns into a grass field within a couple of hours. The immediate green result enables a swift acceptance of construction work. The surface is reinforced, drivable and permeable. Of course the ECORASTER® can be filled and greened as a DIY project.



We recommend the following seed mix::
20% Festuca Rubra Corn Rodeo
25% Festuca Rubra Trich Dawson
20% Festuca Arundinacea Mustang
15% Lolium Perenne Langa
20% Poa Pratensis Cynthia

ECORASTER® — Filling:
- pre-greened: Install ECORASTER® Green, use lawn roller to press on
- DIY greened: SEMILIT® (alt. mix 30% gravel + 70% humus + long-time fertilizer), elutriate seeding material.

Base layer
Levelling course: Fertilit®
(alt.: mix quartz sand, gravel, humus + long-time fertilizer);
Approx. 4 cm levelled, compact with roller to 3 cm.
Water compacted area before installing ECORASTER®.

Fertile layer — Intermediate: HYDROFERTIL® (mix with 65-70 % gravel 30/60 mm)
(alt.: mix 30-35 % Humus and 65 - 70 % gravel 30/60 mm)
Height approx. 20 - 30 cm

Drainning layer — Drainage layer; Gravel (e.g. 30/60 - 40/80 mm | 1 1/2")
Height approx. 10 - 40 cm, plate tamp or roll to compact

Pollutant barrier geotextile

floor/level — Level and plane with 1-1.5% slope

Please note:

- This system is of limited suitabilty for areas mainly used by heavy trucks.
- Green areas need maintenance (fertilization, watering and lawn care).
- In case of DIY greening please check if the location meets the demands of your seeding materials.
- Daily occupancy and the time of parking will affect the result of the greening.

Note:
Keep the soil level just below the top of the ECORASTER to protect the germinating seeds and ensure a durable parking/driving surface.

Example: Parking with ECORASTER® **Bloxx**

Filling: Paving stones

The new ECORASTER® Bloxx system allows quick ground reinforcement with modern paver design in a fully permeable manner. This system is perfect for parking, concrete replacement, accessible areas, driveways and paths. Look closely at the integrated drain: This innovative system prevents clogging. Grouting the joints? Not needed!

Feel free to combine Bloxx with the other ECORASTER® elements to include greened accents into your permeable area.

ECORASTER® Bloxx fits perfect into the safety interlocking system. As a result Bloxx can be combined with any other ECORASTER®.

ECORASTER® — Bloxx, filling with paving stones,
settle area with plate compactor (rubber mat).
140*140*45mm (each paver); Dark grey, light, red, white

Geo-fabric

Base layer

ECORASTER® mesh;
Construction textile with grid/net structure

Levelling course, 1/4" (chip or similar);
Approx. 4-5 cm levelled, then plate tamp or roll to compact

Draining layer — Drainage layer 20 cm clear angular gravel (e.g. 0/32mm | 3/4");
Fill with gravel and compact

Substructure — 10 to 45 cm gravel (e.g. 30/60 or 40/80mm | 1 1/2") ;
For cars approx. 25 cm • Truck approx. 40 cm

Pollutant barrier geotextile

floor/level — Level and plane with 1-1.5% slope

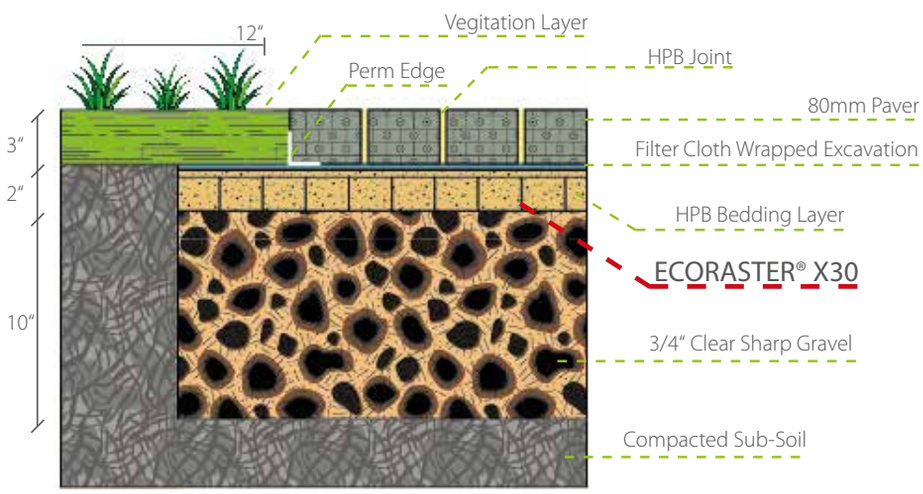
ECORASTER® X30 | Hardscape Base Stabilizer

Safe money and time on your substructure. The ECORASTER ® X30 is a heavy duty linking grid system that allows you to build stronger hardscapes by stabilizing the base material.

Your Benefits:

» Up to 50% base reduction in excavation
» Up to 30% labour cost savings
» Wider pin-point load dispersal
» Reduced warrantee call-backs from shifting and sinking
» Reduced risk of poor sub-base compaction
» Sustainable, efficient, and profitable!

Easy to install:



» Heavy Duty Base Stabilization
» Permeable Base Stabilization
» Interlock Driveway Base Support
» Permeable Interlock Concrete Paving Installation

Questions? Give us a call:
+1 800 495 55 17

Type:	Dimensions:	Material:	Wall thickness:	Load up to:	Solubility:	Compressive strength:	Weight per piece:	Weight per m^2 | 10.76 ft^2:
X30 Base Stabilizer	330 x 330 x 30 mm • 12.99 x 12.99 x 1.18"	100% recycled LDPE	0.2 in	23 t/ft^2 (unfilled) 75 t/ft^2 (filled)	resistant to acids, alkalis, alcohol, oil and petrol (de-icing salt, ammonia, acid rain, etc.)	up to 20t point axle load (DIN 1072)	0,77 kg • 1.7 lbs	6,93 kg • 15.3 lbs

Fire Access

So help won't stuck!

Fire-fighting operations are often hindered by the poor quality or lack of access lanes and parking and turning areas.
The reason for this is the development of organic material (humus). Mud filled tire treads and getting stuck in the mud can delay lifesaving access to the site in an emergency situation. Muddy, unstable and uneven ground will compromise the quick extinguishing of fire and other life saving measures.

The Requirements:

Access roads, parking and turning surfaces have to meet the minimum standards of the Road Building Class VI (Guidelines for standardizing vehicular trac surfaces- RStO)

Our Test Run Result:

Our pictures (bottom right) show a modern German fire truck, weighing16 tons fully equipped. Even though the truck has a fully adjustable 4WD and semi-offroad tires, it got stuck in normal grassland after driving only five meters. Heavy equipment was needed to get it back on track. The grass was unstructured and the area was under dry conditions..

The Solution:

The ECORASTER® system reinforces or "paves" the ground surface without sealing it. This means that even with high surface loads (up to 800 t / m^2 , depending on the filling type) the rainwater/ firefighting water can easily infiltrate into the ground, usually without additional complex drainage elements.

This also means that in some cases (depending on local legislation) there is no stormwater tax dependent on sealed surface area. The ECORASTER® system can be installed with different fill materials and it allows total design freedom for landscaping.

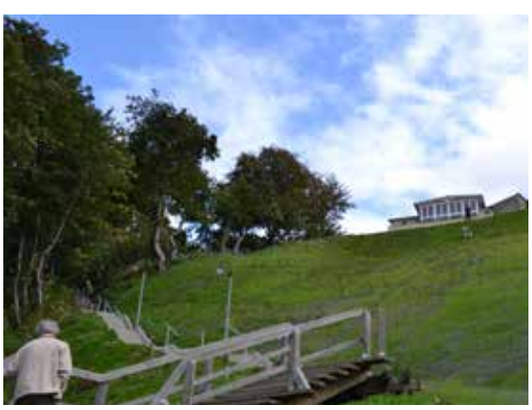
ECORASTER® E50 ensures safe access and parking/ turning of emergency vehicles.

Section from „Fire access surfaces" (TBB/ DIN 14090)		
Access	with:	• minimum 3 m (straight entrances) • minimum 3,5 m (entrances bordered with structures, where both side ≥ 12 m)
	tonnage:	total allowed weight minimum 16t minimum 10t per axle
Hard-standing	dimensions:	minimum 5 m x 11 m*
	tonnage:	minimum 800 kN per m^2
Turning area	dimensions:	• i.e. vehicle minimum 7 m x 12 m, • plus extensions (4 m) front and rear of turning areas
	tonnage:	minimum 16 t, minimum 10 t per axle

» Please note:
Please follow the instructions and guidelines on our website/ installation manual. The local code must be followed.

Questions? Give us a call:
+1 800 495 55 17

Installation on slopes: ECORASTER® A50



With over 200 expansion joints per square meter and 36 notched interlocking connectors per square meter the ECORASTER® counters the forces which are impacting the embankment. Erosion of the solum, soil destruction e.g. by rain water made channels, line-shaped erosion and nutrient washout can be prevented by a proper installation of the ECORASTER® system. Local engineering should can be consulted to address specific soil conditions.

The system's components (ECORASTER® A50 with groove for ground nails, universal hinge, ribbed ground nails) should be adapted to the requirements and the proper dimensions (e.g. ground nail size) and the interval between the nails (e.g. one per m^2) should be advised by the architect/ engineer.

To achieve the best result for this application following actions might to be taken before the ECORASTER® installation, depending on the initial conditions and soil conditions:

- Removal of loose rocks and non suitable soil material
- Clearing, removal of vegetation
- Fill up channels and draws
- Levelling/ profiling

Depending on the requirements, a sufficient measured substructure (as a base course/ levelling course) should be placed on the prepared slope. The installed ECORASTER® is filled to the top edge with suitable topsoil or a mixture of sand with soil, humus and e.g. substrate, which contains starting fertilizer for the greening. Substructure and filling material shall contain a small amount of fine material, to ensure a certain water reservoir capacity for the greening and to ensure water permeability.

Installation profile, ECORASTER® on slopes:

Please note:

- For a swift greening we recommend a standard mix of herbs or lawns with an application of minimum 20 g/m^2.
- Depending on the location vegetation types might vary. Please check the habitat requirements of your seeds. Preferable time for sowing is springtime.
- The bigger and better the area of ECORASTER® is covered/ vegetated the better the filling is protected against weather effects. Growing root penetration increases the interlocking with the substructure and effects the results of the ground/ embankment reinforcement.

Perfect fitting extensions | Softground

» Geotextiles/ Landscape fabric

Matching your project we are offering the required textiles.

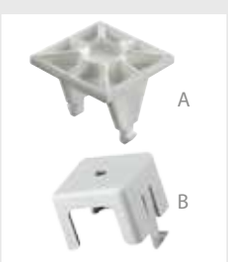
Installing the Bloxx we recommend to use ECORASTER® **mesh**.

» Hinge & Groundnails

Depending on the slope, the application and the tensile forces impacting the hillside/ embankment hinges and/or ECORASTER® A50 with ground nails are recommended. The ECORASTER® area will be interlocked with the slope and the tensile forces will be reduced effectively. The hinge can be adjusted 90° both ways.

» Curve-Element

The flexible connector for laying curves, radii and circles, e.g. for changes in direction when reinforcing soft road shoulders. Specially developed for the ECORASTER® system, it inserts seamlessly into the surface.



» Parking lot markers

The markers are inserted into the ECORASTER® and fixed in place with locking elements.

Two types of markers are available. For areas with snow-plowing service we recommend type B, as type A is raised.

360° View plus animation online:
Have a closer look : All ECORASTER® elements and accessories in 360° HD with animation on www.purus-plastics.de.

» SOFTGROUND®

The tough and non-slip rubber mat locks directly into the ECORASTER® E30 elements. Softground® is suitable for terraces, trade fairs, horseboxes and many other applications.

The substructure for SOFTGROUND® areas is similar to Mineral/ Stone.

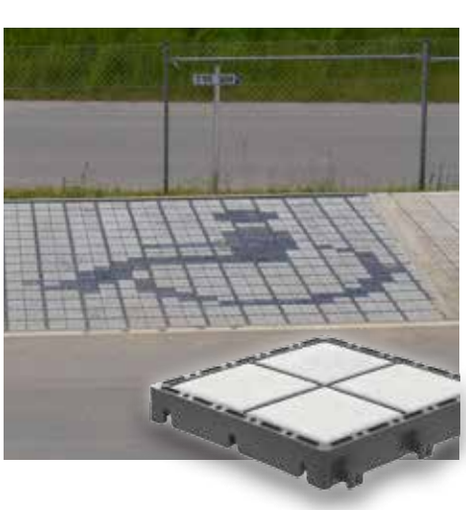
Accessible areas, accessibility

If you want to install accessible areas you can chose from different ECORASTER® types/ fillings.

Besides SOFTGROUND® you can also install ECORASTER® Stone or Bloxx.

Just give us a call...

We are eager to help you!



Review

For more than 20 years, Purus Plastics has manufactured ECORASTER® permeable ground reinforcement system, made of 100% recycled materials (LDPE). Our very first installation of ECORASTER E50 „Classic" was installed over 20 years ago at a busy waste collection depot. This specific installation is found in a cold climate and the grid has been subjected to the constant freeze-thaw cycle as well as constant snow plowing. Even with constant use by heavy trucks and repetitive loading and unloading, the area remains level, stable and in very good condition. The area has been allowed to naturally vegetate.

Our Promise of Quality

PURUS PLASTICS constantly monitors the quality of the self-generated raw materials and the in-house produced products, to guarantee what we promise: "Quality, made in Germany!"

As a technology leader we will not stop improving, in order to relieve future generations and to save valuable resources.

Manufacturing our ECORASTER® system for more than 20 years and its installation worldwide has proven that our system is durable, loadable and sustainable. As a founding member of the European quality network for "products made out of recycled materials" we want to ensure that best quality, best value and the highest environmental compatibility is ensured.

Frequently Asked Questions

Can I drive on ECORASTER®?

Yes you can! ECORASTER® is durable. Depending on the substructure and filling, the loadabilty can exceed 800 metric tons per m^2 (TÜV approved). Even right after installation, the empty elements (excl. Bloxx) are sturdy enough in empty conditions to drive on. This simplifies filling the area. See page 6 for more details.

Can I clear snow on ECORASTER® areas?

Yes you can! ECORASTER® withstands de-icing salt, brooms, snow plows, brush rollers. Please contact us for specific guidelines.

Is an ECORASTER® area considered ”permeable“?

More than 95% of the ECORASTER® surface is permeable/ open, so surface water cannot accumulate. Local authorities may declare "permeabillity" in order to save taxes or fees.

Can I install ECORASTER® w/o substructure?

Yes you can! In some circumstances there may be limitations to the performance of the ECORASTER® system. Thanks to the interlocking system and the excellent load distribution ECORASTER® can be installed without substructure. If you do not use a substructure (stormwater buffer) area drainage cannot be ensured. Additionally soil changes can effect surface irregularities and cause different loadabilities. If you plan to install without substructure, please contact us, we are eager to help you.

Are plastic reinforcement tiles less durable?

Not if you focus on quality! Our ECORASTER® come with a 20 year warranty and the best possible value. As both the raw material producer and the product manufacturer we can ensure a consistently high quality. Promise! Our system is made of 100% recycled LDPE (also recycable), heavy-duty, weatherproof and UV-resistant.

Do I have to install an edging?

No! The structure of the ECORASTER® tiles incorporates integral expansions joints which make an edging unnecessary. We suggest leaving a 5cm/2 inches space between the ECORASTER and the fixed border which also acts as an expansion joint

Is ECORASTER® eco-friendly?

PURUS PLASTICS operates one of the worlds most modern plastics recycling facility. Our products are eco-neutral and are engineered/ produced in Germany. We focus on a high input of recycled materials and the that our products remain recycable.

Basic information | Safety notes • Allgemeine Hinweise | Sicherheitshinweise

Dear customer,

Thank you for choosing the original ECORASTER®. You have chosen a premium class product that combines high performance and eco-friendliness. Our products are subject to our constant quality checks to match highest requirements. We want you to have the best possible and most enduring benefit from ECORASTER® and appreciate you noting the information below.

Thank you for your choice, PURUS PLATICS GmbH Germany.

Important information. Read carefully and keep for further reference.

• Please read the manual before handling ECORASTER®. For questions please contact your dealer/ sales representative.

• Please make sure that you always wear appropriate protective wear during handling (cutting, laying and filling) with ECORASTER® (safety goggles, gloves, ear and breathing protection, safety shoes and hardhat) and mind your environment and third parties. Do not breathe dust from cutting.

• ECORASTER® is inapplicable to bridge terrain indentations (e.g. holes, ditches and troughs).

• ECORASTER® is only extendable with original accessories.

• Do not combine ECORASTER® with third-party products.

• Make sure that substructure is level and sufficiently dimensioned.

• Make sure that all ECORASTER® are locked proper before filling.

• Please dispose no longer required ECORASTER® according to your local waste regulations.

WARNING

• Surface might be slippery when wet and icy

• Inappropriate handling (e.g. wrong transport or wrong storage) might cause (personal) damage.

• Broken or incorrect placed ECORASTER® might cause (personal) damage and influence the functionality. Beware of sharp edges.

• ECORASTER® is flammable. Don't breathe fumes of burning elements.

Sehr geehrte Kundin, sehr geehrter Kunde,

mit unserem original ECORASTER® haben Sie sich für ein erstklassiges Produkt entschieden, dass Umweltfreundlichkeit und hohe Leistungsfähigkeit kombiniert. Unsere Produkte unterliegen ständigen Qualitätskontrollen, um unseren Anforderungen zu entsprechen. Wir möchten, dass Sie lange Nutzen und Freude an Ihrem ECORASTER® haben und bitten Sie daher einige Hinweise zu beachten.

Vielen Dank für Ihre Wahl, PURUS PLASTICS GmbH Deutschland.

Wichtige Information. Sorgfältig lesen. Diese Information aufbewahren.

• Bitte lesen Sie vor der Verarbeitung der ECORASTER® die Anleitung. Für Fragen steht Ihnen Ihr Händler gern zur Verfügung.

• Bitte tragen Sie bei der Verarbeitung (dem Zuschneiden, der Verlegung sowie dem Verfüllen) angemessene Schutzbekleidung (Sicherheitsschuhe, Schutzbrille, Handschuhe, Mundschutz, Gehörschutz, Kopfschutz) und achten Sie auf Ihre Umwelt und Dritte. Abrieb, z.B. durch Zerspanen, bitte nicht einatmen.

• ECORASTER® eignet sich nicht zum Überbrücken von Geländevertiefungen (z.B. Gräben, Löcher, Mulden)

• ECORASTER® kann nur mit originalem Zubehör erweitert werden. • ECORASTER® ist nicht mit fremden Produkten kombinierbar.

• Der Unterbau muss vor dem Verlegen eben und ausreichend dimensioniert sein.

• Bitte prüfen Sie vor dem Verfüllen der ECORASTER® auf einwandfreie Verhakung der Elemente.

• Bitte entsorgen Sie nicht benötigte ECORASTER® gemäß den national geltenden Abfallbestimmungen.

ACHTUNG

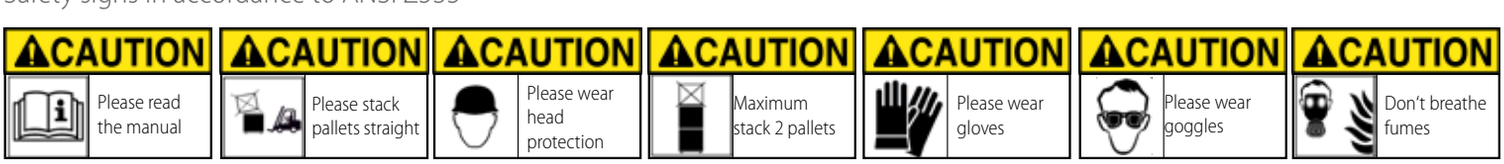
• Oberfläche kann durch Eis und Nässe glatt sein.

• Unsachgemäße Handhabung (z.B. falscher Transport oder fehlerhafte Lagerung) kann zu (Personen-) Schäden führen.

• Beschädigte oder unsachgemäß verlegte ECORASTER® können (Personen-) Schäden verursachen und die Funktion des Bodengitters beeinträchtigen. Achtung vor scharfen Kannten.

• ECORASTER® sind brennbar. Die Dämpfe brennender Kunststoffgitter nicht einatmen.

Safety signs in accordance to ANSI Z535



Developing sustainable solutions for a permeable ground reinforcement.

German engineering – available worldwide.
Questions? Please give us a call or contact your local dealer:

20 YEAR warranty
ECORASTER®

PURUS PLASTICS NORTH AMERICA

ECORASTER®

www.purus-northamerica.com

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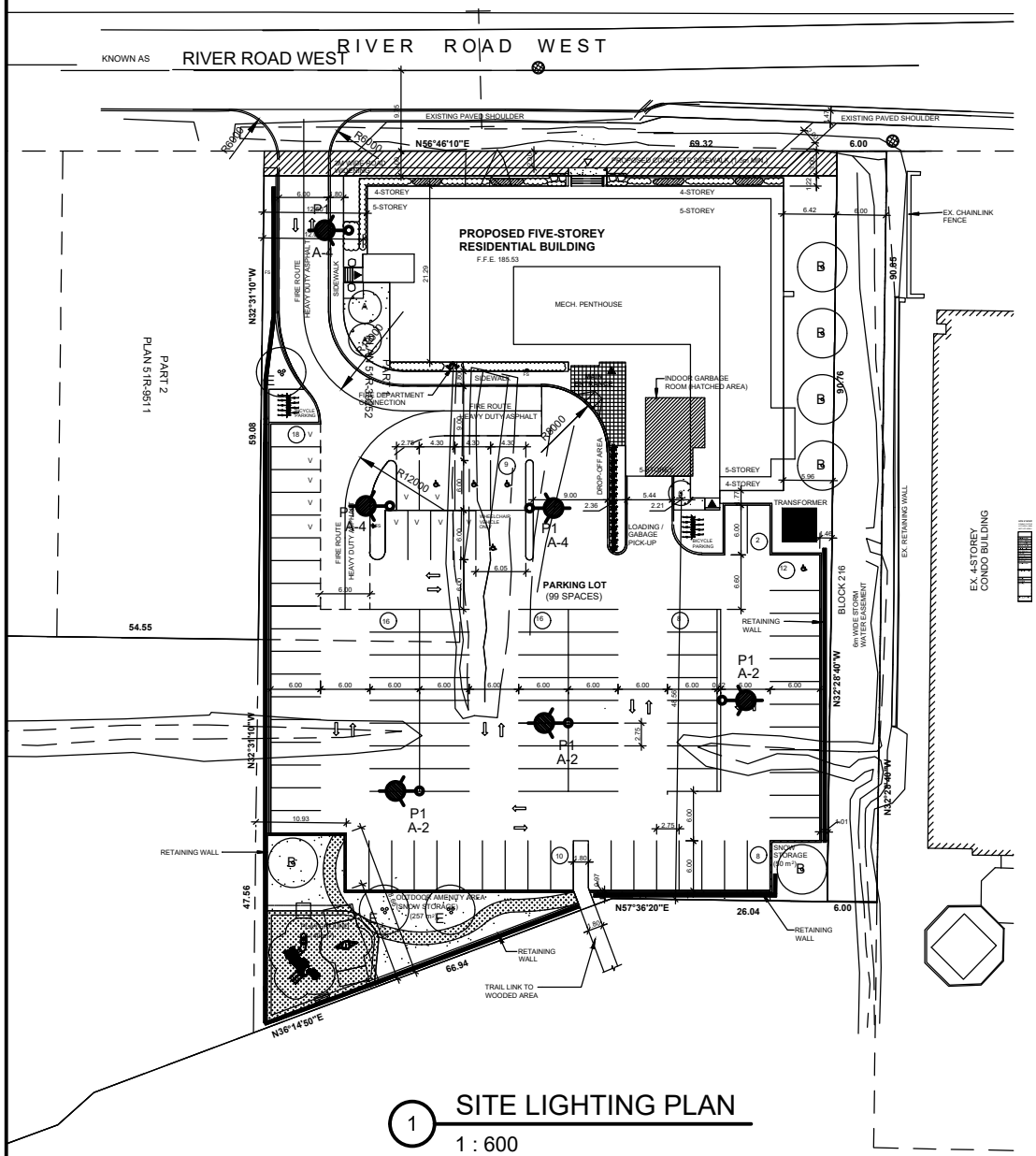
Toll Free. +1-800-495-5517 | purus@purus-northamerica.com

Version PNA_IM_2015_rev1

Appendix G – Lighting Plan



1 SITE LIGHTING PLAN

1 : 600

DRAWING NOTES:

1. ALL LIGHTING FIXTURES SHALL BE SUPPLIED 5 YEARS WARRANTY.
2. CONTRACTOR TO ADJUST LIGHTING SHIELDS TO MINIMIZE GLARE AND LIGHT TRESPASS TO ADJACENT PROPERTIES.
3. EACH LIGHTING POLE SHALL HAVE A GROUNDING TERMINAL.
4. PROVIDE A GROUNDING ROD EVERY TWO POLES.
5. LIGHTNING RODS TO BE CONNECTED EACH OTHER AND CONNECT WITH EACH POLE DOWN CONDUCTOR.
6. STRUCTURAL ENGINEER SHALL REVIEW AND APPROVE THE CLASS OF CONCRETE AND SIZE OF CONCRETE BASE.
7. CONTRACTOR TO VERIFY THE OPENING SIZE AT POLE BASE PLATE PRIOR TO SETTING CONDUIT SLEEVES.
7. EACH LIGHTING POLE SHALL HAVE A INTEGRATED SENSOR FOR ON/OFF OPERATION. WALL MOUNTED LED LIGHTS TO BE CONTROLLED BY TIME SWITCH OR BY OWNER'S REQUIREMENTS.
8. CONTRACTOR TO COORDINATE WITH EXISTING PANEL SCHEDULES FOR EXACT CIRCUITING. ADD TWO 20A-1P BREAKERS IN PANEL FOR EXTERIOR PARKING LOT LIGHTING.
9. CABLE FEEDERS TO EXTERIOR LIGHTING POLES SHOULD BE 2#8+#10G IN 21mmC.

SCHEDULE OF LUMINAIRES

TYPE	SYMBOL	PRODUCT DESCRIPTION AND CATALOG NUMBER	VOLTS	WATTS & LAMPS	LUMEN OUTPUT	ACCEPTABLE MANUFACTURERS
P1		SINGLE-HEAD LED LUMINAIRE (EPA 0.8) 106W, 3000K TYPE III OPTICS, C/W PHOTOCELL&SHIELD, 7.5M STRAIGHT STEEL POLE. (WITH LIGHTING SHIELD TO MINIMIZE GLARE AND LIGHT TRESPASS AND TO FACILITATE BETTER VISION AT NIGHT)	120V	106W 1 LAMP	15,230 LUMEN	ATB0 P303 R3

DRAWING LIST

DRAWING NUMBER	SHEET TITLE
E1	SITE LIGHTING PLAN, DRAWING LIST AND SCHEDULE OF LUMINAIRES
E2	SITE LIGHTING PHOTOMATRIC, ILLUMINANCE DATA AND TYPICAL LIGHT STAND DETAIL

Project No Z2020-040

Drawing No : E1

Date : JUNE 5, 2020

Scale : As indicated

Drawn AG

Checked by : GF

Project : RIVERWOODS HOMES

RIVER ROAD WEST
WASAGA BEACH, ON

Drawing Name : SITE LIGHTING PLAN, DRAWING LIST AND SCHEDULE OF LUMINAIRES

No.	Date:	Issued/Revision:	By
4	JUN. 29/22	3RD SUBMISSION TO TOWN	AW
3	JUL. 7/21	2ND SUBMISSION TO TOWN	TS
2	AUG. 7/20	1ST SUBMISSION TO TOWN	SL
1	JUN. 18/20	ISSUED FOR REVIEW	GF

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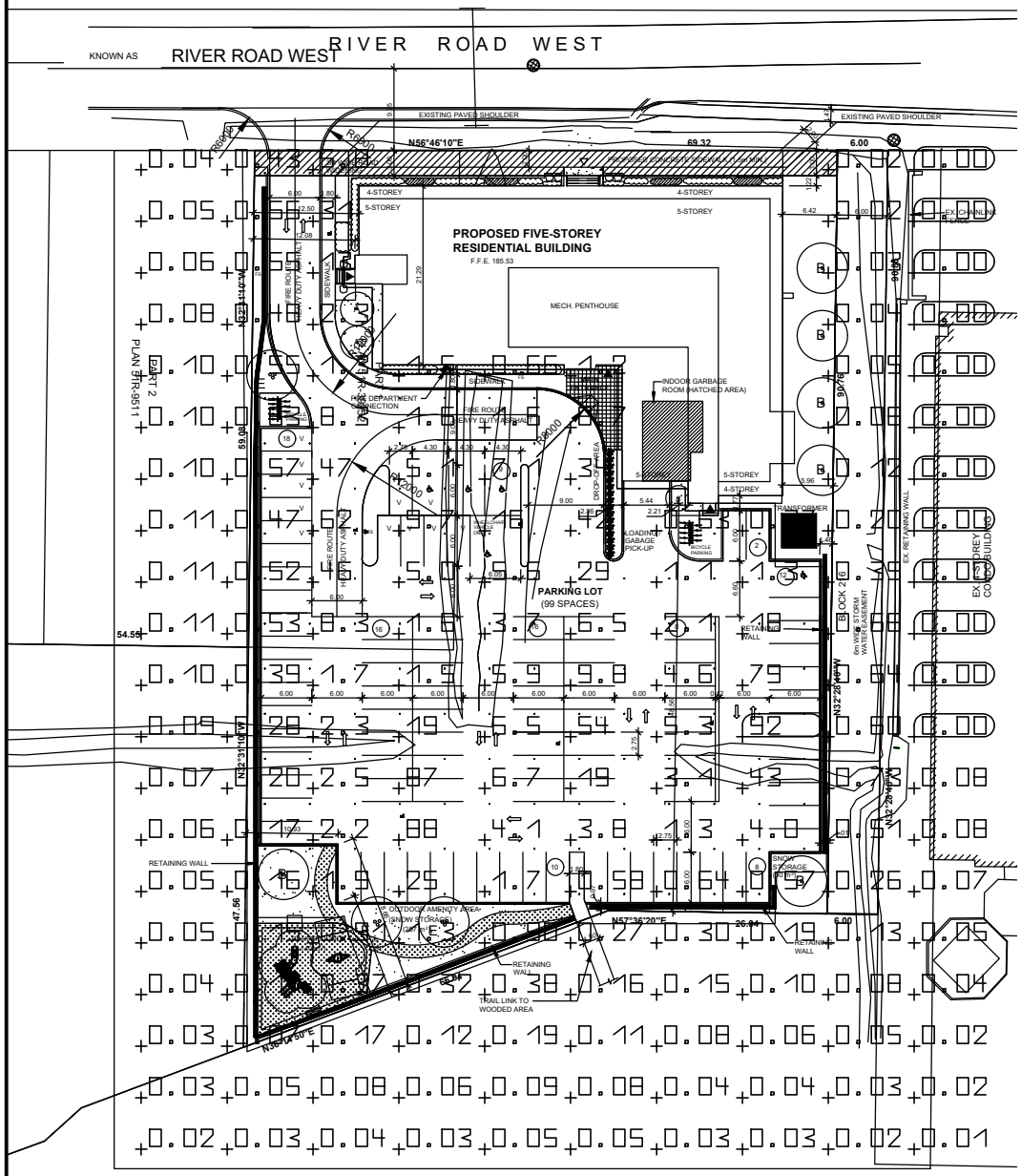
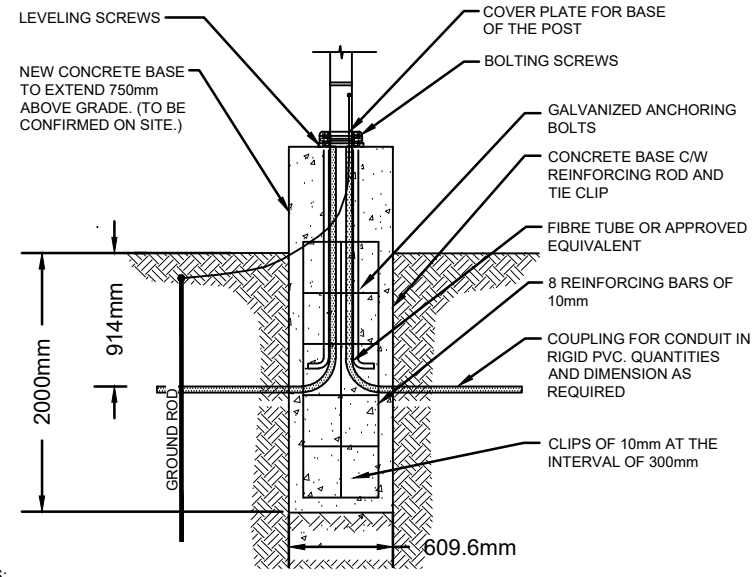
Email: Info@ziyutec.com
Website: www.ziyutec.com

AND ARCHITECTURE INC.
3950 14th Avenue Suite 609
Markham ON L3R 0A9
T: 905-604-6960
www.andarchitecture.ca



1 SITE LIGHTING PHOTOMATRIC

1 : 600



NOTES:

1. THE TOP OF THE FOUNDATION MUST BE LEVEL.
2. THE CONTRACTOR MUST CHECK THE OPENING DIMENSION OF THE PLATE, FOR THE POST BEFORE INSTALLING COUPLING CONNECTION FOR CONDUIT.
3. CONCRETE BASE: 30MPa CONCRETE, 20mm MAX. AGGREGATED SIZE, 5-8% AIR ENTRAIMENT, 80mm SLUMP. CURING AS PER CAN/CAS-A-23.1-94.
4. POLE SHALL BE C/W BARRIER FOR COMMUNICATIONS/POWER CONDUCTORS AS PER ESA REQUIREMENTS.
5. LIGHT STANDARD SHALL BE C/W 120V, 15A GFCI RECEPTACLE ON BE MOUNTED WITHIN WEATHERPROOF WATERTIGHT ENCLOSURE.
6. EXACT LIGHT STANDARD DETAILS SHALL BE CONFIRMED ON SITE.

2 TYPICAL LIGHT STANDARD DETAIL

N.T.S.

RIVERWOODS HOME PARKING LOT ILLUMINANCE DATA	
ITEM	**ACHIEVED**
LOCATION	RIVERROAD WEST, WASAGA BEACH, ON
AVERAGE ILLUMINATION	14.7 LUX
MIN ILLUMINATION	1.01 LUX
MAX ILLUMINATION	92 LUX
UNIFORMITY RATIO	17.2
ILLUMINATION TYPE	
FIXTURE TYPE / WATTAGE	LED / 106W
HEIGHT	7.5m
MODEL	ABT0-P303-R3-3000K

Project No: Z2020-040

Drawing No: E2

Date: JUNE 5, 2020

Scale: As indicated

Drawn: AG

Checked by: GF

Project: RIVERWOODS HOMES
RIVER ROAD WEST
WASAGA BEACH, ON

Drawing Name: SITE LIGHTING PHOTOMATRIC
ILLUMINANCE DATA
TYPICAL LIGHT STAND DETAIL

No.	Date:	Issued/Revision:	By
4	JUN. 29/22	3RD SUBMISSION TO TOWN	AW
3	JUL. 7/21	2ND SUBMISSION TO TOWN	TS
2	AUG. 7/20	1ST SUBMISSION TO TOWN	SL
1	JUN. 18/20	ISSUED FOR REVIEW	GF

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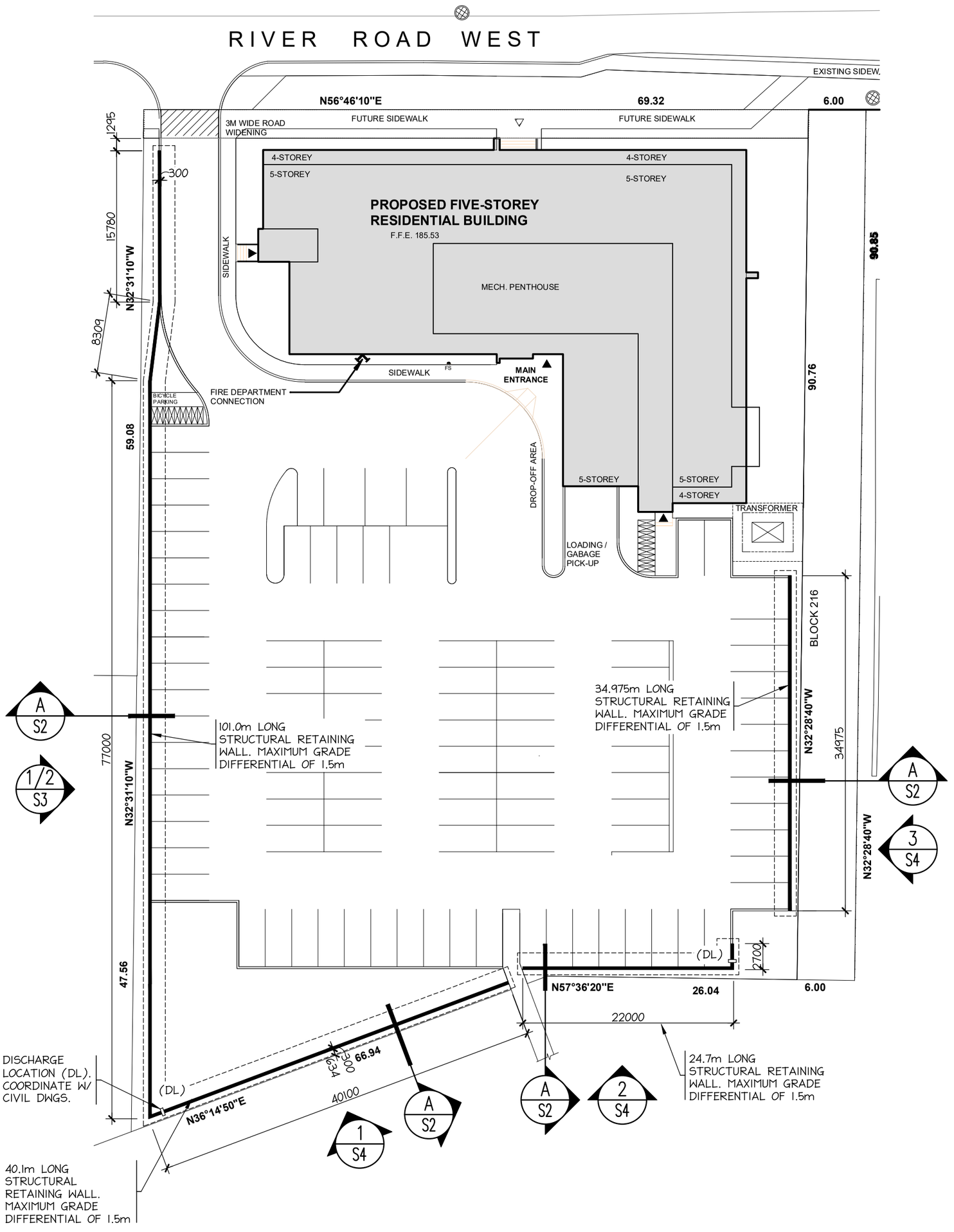
Email: Info@ziyutec.com
Website: www.ziyutec.com

AND ARCHITECTURE INC.
3950 14th Avenue Suite 609
Markham ON L3R 0A9
T: 905-604-6960
www.andarchitecture.ca

Appendix H – Structural Design



DRAWING TITLE

PROPOSED RETAINING WALL SITE PLAN LAYOUT

PROJECT

WASAGA RIVERWOODS RETAINING WALLS

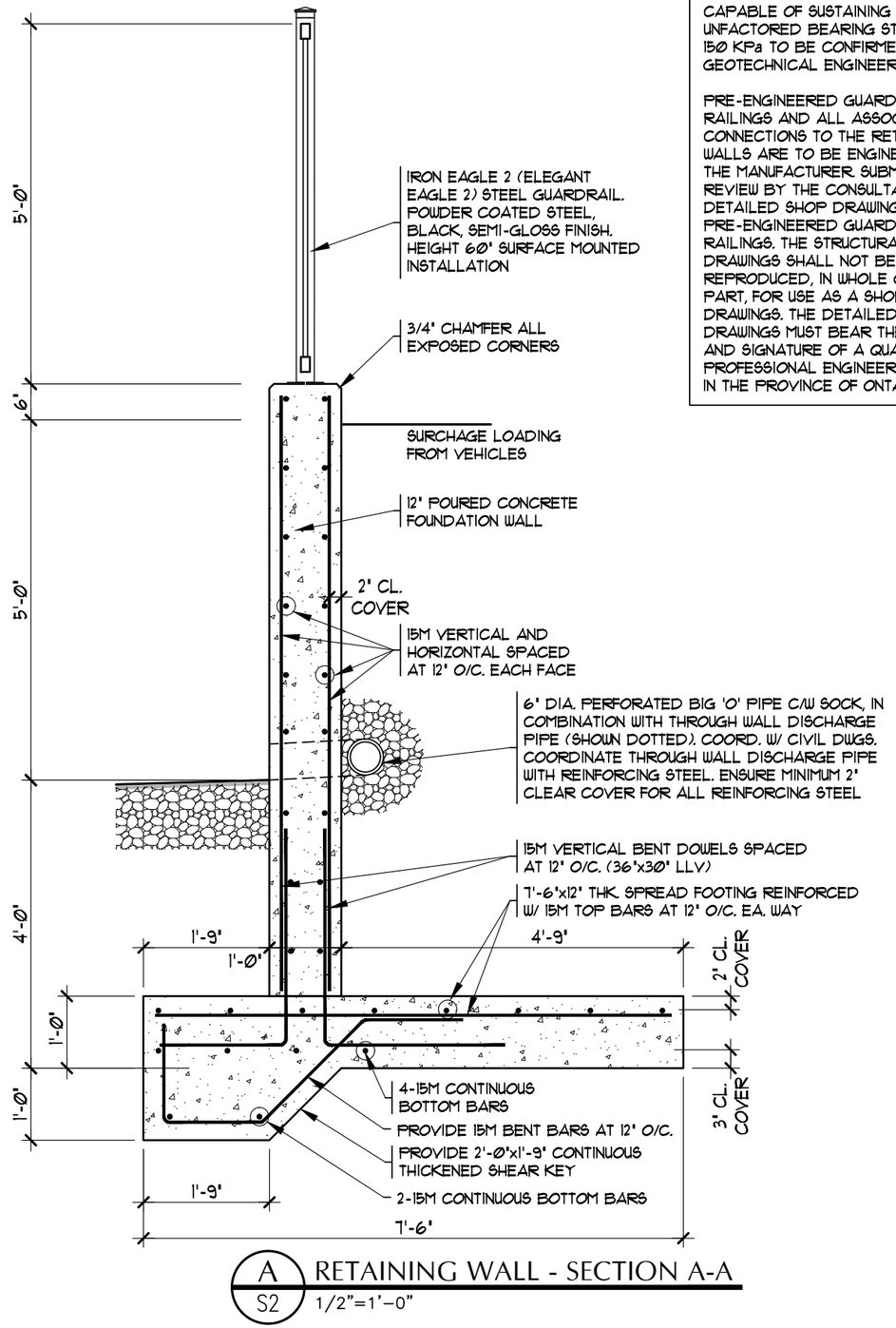
RIVER ROAD WEST
WASAGA BEACH, ONTARIO

BARILL
ENGINEERING LIMITED
50 TRAIL'S END, COLLINGWOOD, ONTARIO, L9Y 5B2
PHONE: (705) 445-4905 FAX: (705) 445-6107

SCALE:	1:400
DRAWN BY	MHW
CHECK BY	JB
DATE	SEP. 16/22
PROJECT NO.	21-256
SHEET NUMBER	S1

S

LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO
J. D. BARILL
100542488
September 22, 2022



A / S2 RETAINING WALL - SECTION A-A
1/2"=1'-0"

STRUCTURAL DESIGN NOTES:

FOUNDATION SUBSTRUCTURE:
FOUND ALL FOOTINGS ON SOIL CAPABLE OF SUSTAINING AN UNFACTORED BEARING STRESS OF 150 KPa TO BE CONFIRMED BY GEOTECHNICAL ENGINEER.

PRE-ENGINEERED GUARDS AND RAILINGS AND ALL ASSOCIATED CONNECTIONS TO THE RETAINING WALLS ARE TO BE ENGINEERED BY THE MANUFACTURER. SUBMIT FOR REVIEW BY THE CONSULTANT, DETAILED SHOP DRAWINGS FOR PRE-ENGINEERED GUARDS AND RAILINGS. THE STRUCTURAL DRAWINGS SHALL NOT BE REPRODUCED, IN WHOLE OR IN PART, FOR USE AS A SHOP DRAWINGS. THE DETAILED SHOP DRAWINGS MUST BEAR THE SEAL AND SIGNATURE OF A QUALIFIED PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO.

CONCRETE MIX SCHEDULE

	STRENGTH AT 28 DAYS (MPa)	SLUMP AT DELIVERY (mm)	AIR ENTRAINMENT	MAXIMUM W/C RATIO	EXPOSURE CLASSIFICATION
FOOTINGS	20	80 +/- 20	---	TO SUIT	N
EXTERIOR WALLS	30	80 +/- 20	5-8%	TO SUIT	F-2
EXTERIOR SIDEWALKS, CURBS AND APRON SLABS	32	80 +/- 20	5-8%	0.45	C-2

LICENSED PROFESSIONAL ENGINEER
J. D. BARILL
100542488
September 22, 2022
PROVINCE OF ONTARIO

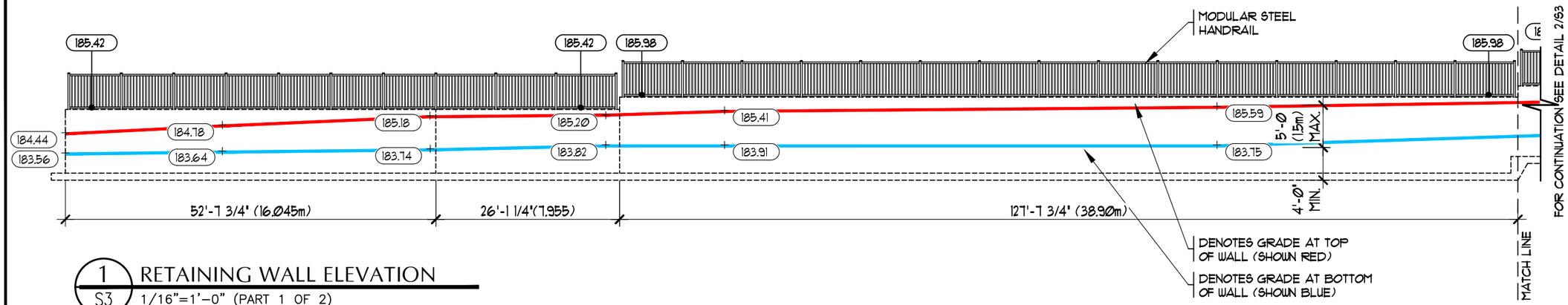
SCALE:	3/4"=1'-0"
DRAWN BY	MHW
CHECK BY	JB
DATE	SEP. 16/22
PROJECT NO.	21-256
SHEET NUMBER	S2

DRAWING TITLE
RETAINING WALL - SECTIONS A-A

PROJECT
WASAGA RIVERWOODS
RETAINING WALLS

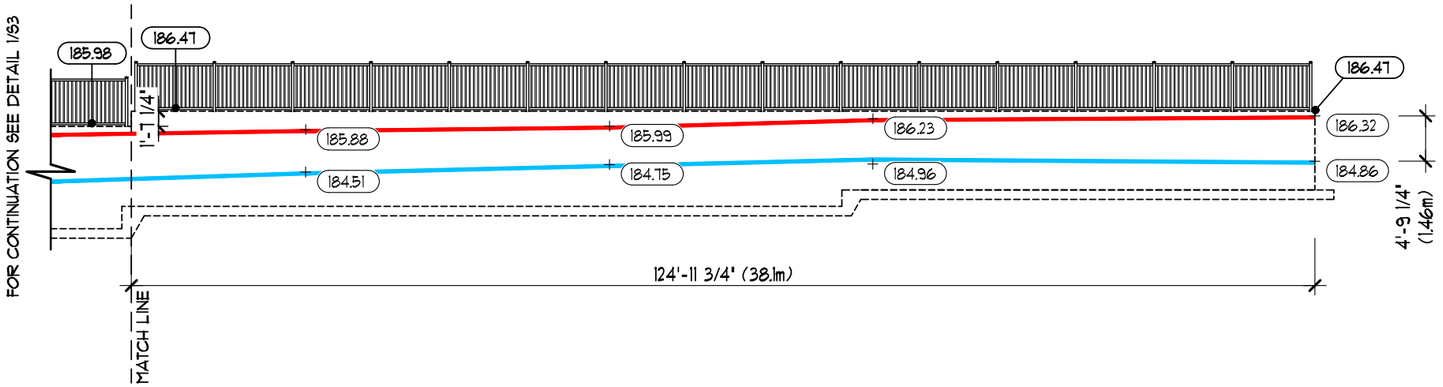
RIVER ROAD WEST
WASAGA BEACH, ONTARIO

BARILL
ENGINEERING LIMITED
50 TRAIL'S END, COLLINGWOOD, ONTARIO, L9Y 5B2
PHONE: (705) 445-4905 FAX: (705) 445-6107



1 S3 RETAINING WALL ELEVATION

1/16"=1'-0" (PART 1 OF 2)



2 S3 RETAINING WALL ELEVATION

1/16"=1'-0" (PART 2 OF 2)

LEGEND

185.42 DENOTES TOP OF WALL (COORDINATE W/ CIVIL DWGS.)

+ 183.82 DENOTES PROPOSED CIVIL GRADING (REFER TO CIVIL DWGS.)

LICENSED PROFESSIONAL ENGINEER
J. D. BARILL
100542488
September 22, 2022
PROVINCE OF ONTARIO

SCALE:	1/16"=1'-0"
DRAWN BY	MHW
CHECK BY	JB
DATE	SEP. 16/22
PROJECT NO.	21-256
SHEET NUMBER	S3

DRAWING TITLE

RETAINING WALL - SECTIONS A-A AND B-B

PROJECT

WASAGA RIVERWOODS
RETAINING WALLS

RIVER ROAD WEST
WASAGA BEACH, ONTARIO

BARILL
ENGINEERING LIMITED
50 TRAIL'S END, COLLINGWOOD, ONTARIO, L9Y 5B2
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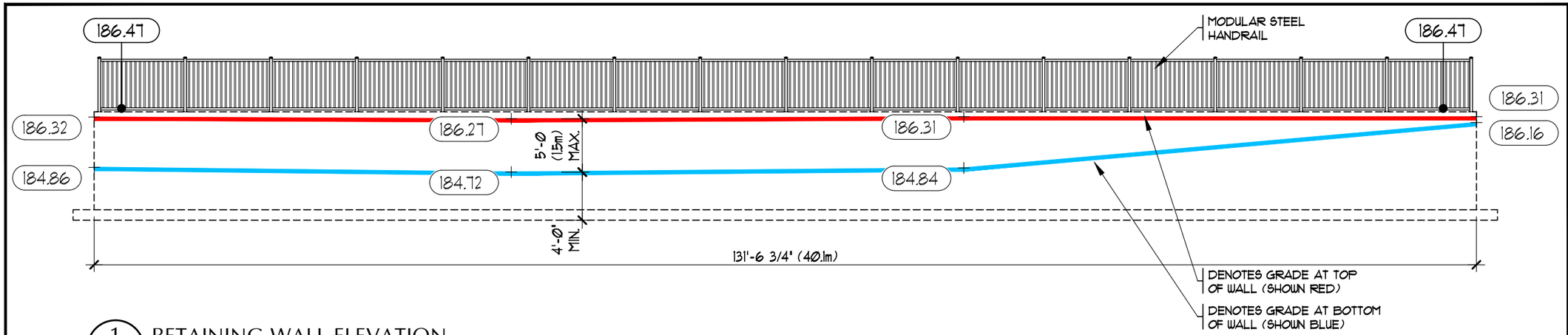
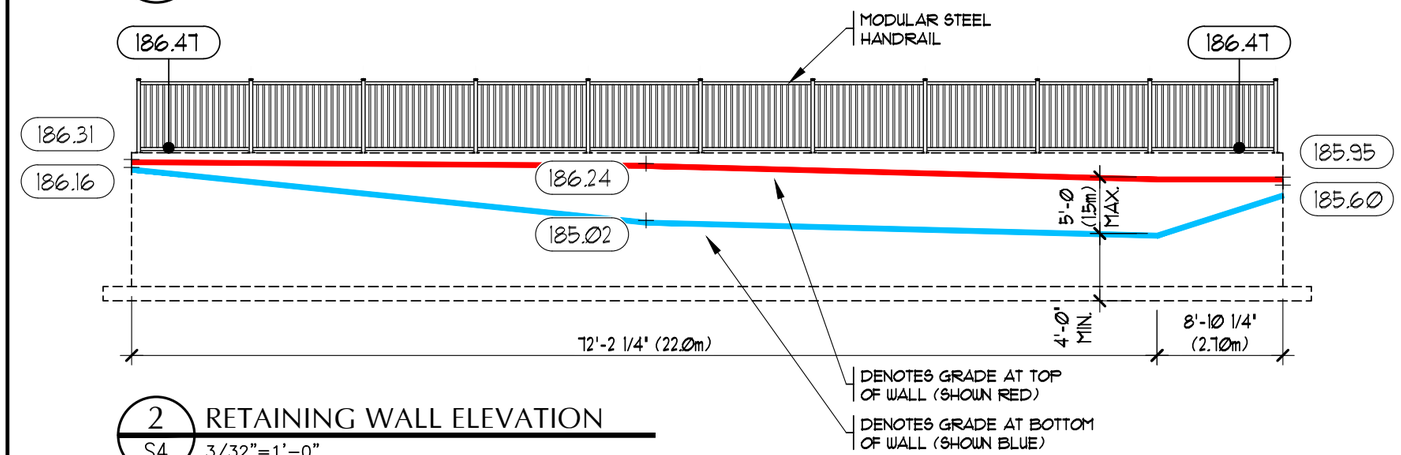
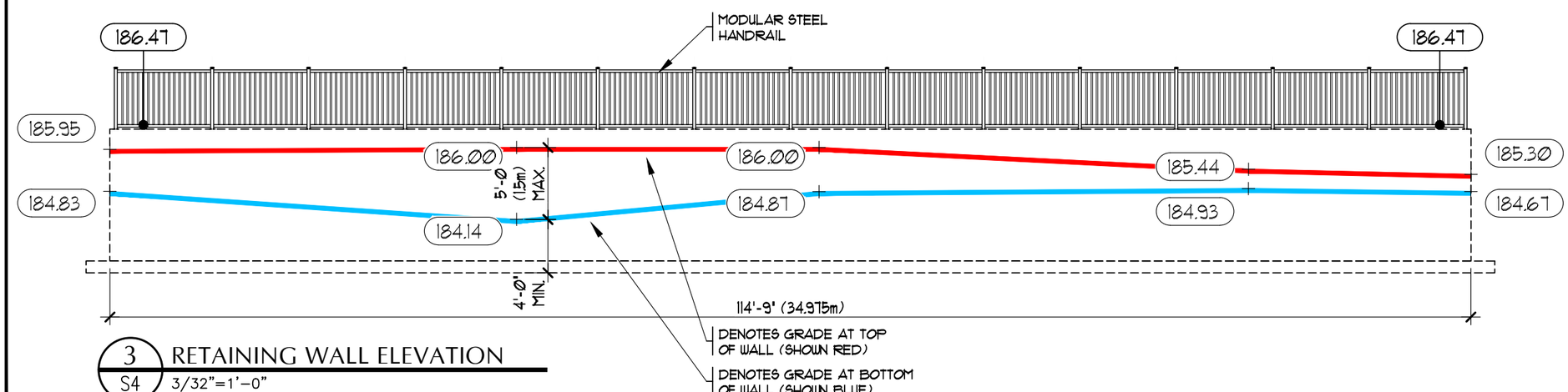


1 S4 RETAINING WALL ELEVATION
3/32"=1'-0"



2 S4 RETAINING WALL ELEVATION
3/32"=1'-0"



3 S4 RETAINING WALL ELEVATION
3/32"=1'-0"

LEGEND

185.42 DENOTES TOP OF WALL (COORDINATE W/ CIVIL DWGS.)

+ 183.82 DENOTES PROPOSED CIVIL GRADING (REFER TO CIVIL DWGS.)

LICENSED PROFESSIONAL ENGINEER
J. D. BARILL
100542488
September 22, 2022
PROVINCE OF ONTARIO

ST.

SCALE:	3/32"=1'-0"
DRAWN BY	MHW
CHECK BY	JB
DATE	SEP. 16/22
PROJECT NO.	21-256
SHEET NUMBER	S4

DRAWING TITLE
RETAINING WALL - SECTIONS A-A AND B-B

PROJECT
WASAGA RIVERWOODS
RETAINING WALLS
RIVER ROAD WEST
WASAGA BEACH, ONTARIO

BARILL
ENGINEERING LIMITED
50 TRAIL'S END, COLLINGWOOD, ONTARIO, L9Y 5B2
PHONE: (705) 445-4905 FAX: (705) 445-6107

STRUCTURAL NOTES

A. GENERAL

1. WHERE DOCUMENTS ARE REFERENCED IN THE GENERAL AND DESIGN NOTES, THEY SHALL BE THE LATEST EDITIONS OR REVISION, UNLESS NOTED OTHERWISE.
2. READ STRUCTURAL DOCUMENTS IN CONJUNCTION WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND OTHER CONTRACT DOCUMENTS.
3. BEFORE PROCEEDING WITH THE WORK, CHECK ALL DIMENSIONS SHOWN ON THE STRUCTURAL DOCUMENTS WITH SITE CONDITIONS AND THOSE SHOWN ON THE ARCHITECTURAL, MECHANICAL AND ELECTRICAL DOCUMENTS AND REPORT DISCREPANCIES TO THE CONSULTANT.
4. CARRY OUT CONSTRUCTION OPERATIONS, INCLUDING THE INSTALLATION OF TEMPORARY GUYING AND SHORING REQUIRED, ENSURING THAT THE EXISTING STRUCTURE OR MEMBERS ALREADY ERECTED ARE NOT LOADED IN EXCESS OF THEIR SAFE LOAD CARRYING CAPACITY.

B. REFERENCE STANDARDS/CODES AND ACTS

1. CONFORM WITH THE ONTARIO REGULATION 332/12, AND ANY APPLICABLE ACTS OF ANY AUTHORITY HAVING JURISDICTION, AND THE FOLLOWING:
   - 1.1 CAN/CSA A23.1 - CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION.
   - 1.2 CAN/CSA A23.2 - METHODS OF TEST FOR CONCRETE.
   - 1.3 CAN/CSA A23.3 - DESIGN OF CONCRETE STRUCTURES.
   - 1.4 CAN/CSA-S16 - LIMIT STATES DESIGN OF STEEL STRUCTURES.
   - 1.5 RSIC - REINFORCING STEEL INSTITUTE OF CANADA (RSIC), MANUAL OF STANDARD PRACTICE.
   - 1.6 S136 - COLD FORMED STEEL STRUCTURAL MEMBERS.
   - 1.7 CAN/CSA G40.20/G40.21 - STRUCTURAL QUALITY STEEL.
2. ALL STANDARDS AND PUBLICATIONS REFERENCED BY THE STANDARDS NOTED ABOVE ARE TO APPLY.
3. WHERE THERE ARE DIFFERENCES BETWEEN THE DOCUMENTS AND THE STANDARDS, CODES AND ACTS, THE MOST STRINGENT SHALL GOVERN.

C. QUALIFICATIONS

1. ANY ORGANIZATION UNDERTAKING TO WELD UNDER THIS CONTRACT SHALL BE CERTIFIED BY THE CANADIAN WELDING BUREAU UNDER REQUIREMENTS OF DIVISION 1 OR DIVISION 2.1 OF W47.1.

D. SUBMITTALS

1. SHOP DRAWINGS
   - 1.1. SUBMIT FOR REVIEW BY THE CONSULTANT, DETAILED SHOP DRAWINGS FOR ALL TEMPORARY AND PERMANENT STRUCTURAL AND ARCHITECTURAL WORK INCLUDING, BUT NOT LIMITED TO: PRE-ENGINEERED STRUCTURAL STEEL OR ALUMINUM GUARDRAILS.
   - 1.2. THE SCALE OF THE DRAWINGS SHALL BE SUCH THAT THE DETAILS OF THE STRUCTURAL WORK ARE CLEARLY SHOWN, AND IN NO CASE SMALLER THAN 1:50 (1/4" = 1'0").
   - 1.3. THE STRUCTURAL DRAWINGS SHALL NOT BE REPRODUCED, IN WHOLE OR IN PART, FOR USE AS SHOP DRAWINGS.
   - 1.4. EACH DRAWING SUBMITTED FOR PRE-ENGINEERED STRUCTURAL STEEL OR ALUMINUM GUARDRAILS SHALL BEAR THE SEAL AND SIGNATURE OF A QUALIFIED PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO.
   - 1.5. CONTRACTOR SHALL ALLOW FOR A 5 WORKING DAY TURN AROUND TIME FOR STRUCTURAL CONSULTANT TO REVIEW THE SHOP DRAWINGS.
2. CONCRETE MIX DESIGNS
   - 2.1. SUBMIT ALL CONCRETE MIX DESIGNS FOR REVIEW.
   - 2.2. DESCRIBE IN DETAIL ON THE MIX DESIGN SUMMARY THE LOCATION(S) WHERE EACH MIX IS TO BE PLACED IN THE STRUCTURE.
3. AS-BUILT DRAWINGS
   - 3.1. MARK ON A COMPLETE SET OF REPRODUCIBLE AS-BUILT DRAWINGS ANY CHANGES, ADDITIONS, OR DELETIONS THAT OCCUR DURING CONSTRUCTION AS A RESULT OF THE CONTRACTOR'S WORK, CHANGE OF ORDERS OR FOR ANY OTHER REASON.

E. MATERIALS

1. PROVIDE ONLY NEW STRUCTURAL MATERIALS IN ACCORDANCE WITH THE REFERENCE STANDARDS AND THE FOLLOWING, UNLESS OTHERWISE NOTED.
   - 1.1. CONCRETE: CONFORM TO THE REQUIREMENTS OF CSA-A23.1 AND THE FOLLOWING:
     - 1.1.1. EXPOSED TO FREEZE-THAW & CHLORIDES (EXPOSURE CLASS C-1): f'c = 35MPa.
     - 1.1.2. EXPOSED TO FREEZE-THAW (EXPOSURE CLASS F-1): f'c = 30MPa.
     - 1.1.3. NOT EXPOSED: f'c = 25MPa.
   - 1.2. REINFORCEMENT: CONFORM TO CSA G30 SERIES, FY=400MPa FOR ALL REINFORCEMENT. ALL REINFORCEMENT IS TO BE BLACK EXCEPT WHERE THE SUFFIX C IS USED TO DESIGNATE EPOXY COATED REINFORCEMENT.
   - 1.3. ANCHOR BOLTS: GRADE A307 OR 300W THREADED ROD CONFORMING TO CSA G40.21-M.
   - 1.4. NON-SHRINK GROUT = PREMIXED COMPOSITION OF NON METALLIC AGGREGATE, CEMENT, WATER REDUCING AND PLASTICIZING AGENTS, OF FLOWABLE CONSISTENCY AND CAPABLE OF ACHIEVING A COMPRESSIVE STRENGTH AT 28 DAYS OF AT LEAST 35 MPa (5 ksi).
   - 1.5. FOUNDATION INSULATION: EXTRUDED POLYSTYRENE WITH A MINIMUM COMPRESSIVE STRENGTH OF 0.24 MPA UNLESS NOTED OTHERWISE.

F. EXECUTION

1. FOUNDATIONS
   - 1.1. A COPY OF THE SOIL INVESTIGATION REPORT BY SOIL ENGINEERS LIMITED DATED MAY 203,5
   - 1.2. 14 IS AVAILABLE FROM THE CONSULTANT. READ THE REPORT, VISIT THE SITE AND THOROUGHLY FAMILIARIZE YOURSELF WITH ALL SURFACE AND SUBSURFACE CONDITIONS. THIS INFORMATION IS GIVEN SOLELY AS A GUIDE. NO RESPONSIBILITY IS ACCEPTED BY THE OWNER OR THE CONSULTANT FOR IT'S CORRECTNESS, NOR SHALL IT'S ACCURACY OR ANY OMISSIONS AFFECT THE PROVISION OF THIS CONTRACT.
   - 1.3. FOUND ALL FOOTINGS ON SOIL CAPABLE OF SUSTAINING AN UNFACTORED BEARING STRESS OF 150 kN/m2 (3000 psf).
   - 1.4. FOUND ALL FOOTINGS WHICH WILL BE EXPOSED TO FROST ACTION IN THE COMPLETED BUILDING A MINIMUM OF 1200mm (4'-0") BELOW FINISHED GRADE.
   - 1.5. DO NOT EXCEED A RISE OF 7 IN A RUN OF 10 IN THE LINE OF SLOPE BETWEEN ADJACENT FOOTING EXCAVATIONS OR ALONG STEPPED FOOTINGS. FOR STEPPED FOOTINGS, USE STEPS NOT EXCEEDING 600 mm (2'-0") IN HEIGHT AND 1200 mm (4'-0") (MIN.) IN LENGTH.
   - 1.6. SOIL BEARING CAPACITY SPECIFIED MUST BE VERIFIED IN WRITING BY THE SOIL ENGINEER PRIOR TO THE PLACING OF FOOTINGS AND ANY NON-CONFORMANCE WITH THE SPECIFIED MINIMUM CAPACITIES MUST BE IMMEDIATELY REPORTED TO THE STRUCTURAL ENGINEERS.
   - 1.7. PLACE 150mm (6") CLEAR CRUSHED STONE OVER THE SUB_BASE, COMPACTED TO 100% SPMDD, WITH A MAXIMUM SURFACE VARIATION OF +/- 10MM.
   - 1.8. BELOW SLABS ON GRADE BACKFILL USING NATIVE MATERIALS OR ENGINEERED FILL APPROVED BY THE GEOTECHNICAL CONSULTANT AND COMPACT IN MAX 150 MM LIFTS TO 98% SPMDD.
   - 1.9. BELOW EXTERIOR LANDSCAPED AREAS BACKFILL USING NATIVE MATERIALS OR FREE DRAINING MATERIALS AND COMPACT IN MAX 150 MM LIFTS TO 98% SPMDD.
   - 1.10. PROVIDE TEMPORARY FROST PROTECTION, DURING CONSTRUCTION, FOR ALL FOUNDATIONS WHICH ARE NOT FOUNDED A MINIMUM OF 1200mm (4'-0") BELOW GRADE.
   - 1.11. FOUND NEW FOOTINGS WHICH ARE LOCATED ADJACENT TO EXISTING FOOTINGS, AT THE SAME ELEVATION AS THE EXISTING FOOTINGS, UNLESS NOTED OTHERWISE.
   - 1.12. INSULATION IS SHOWN WHERE REQUIRED FOR PROTECTION OF THE FOUNDATIONS FROM DAMAGE DUE TO FROST ACTION ONLY. REFER TO ARCHITECTURAL DRAWINGS FOR FOUNDATION INSULATION NOT SHOWN ON THE STRUCTURAL DRAWINGS.
   - 1.13. DO NOT PLACE BACKFILL AGAINST WALLS RETAINING EARTH (OTHER THAN CANTILEVER RETAINING WALLS) UNTIL THE WALLS AND THE FLOOR CONSTRUCTION AT TOP AND BOTTOM OF THE WALLS HAVE BEEN CAST AND ATTAINED 100% OF THEIR DESIGN STRENGTH.
   - 1.14. WHERE THE SLAB ON GRADE IS USED TO TIE THE TOP OF WALL RETAINING EARTH, THAT WALL SHALL BE ADEQUATELY BRACED UNTIL THE SLAB HAS BEEN CAST AND ATTAINED 100% OF ITS DESIGN STRENGTH.
   - 1.15. CARRY OUT BACKFILLING AGAINST FOUNDATION WALLS WHERE THERE IS GRADE ON BOTH SIDES IN SUCH A MANNER THAT THE LEVEL OF BACKFILLING ON ONE SIDE OF THE WALL IS NEVER MORE THAN 600 MM (2'-0") DIFFERENT FROM THE LEVEL ON THE OTHER SIDE OF THE WALL.
   - 1.16. DO NOT COMPACT CLOSER THAN 1800 MM (6'-0") FROM WALLS WITH HEAVY EQUIPMENT. USE LIGHT HAND CONTROLLED EQUIPMENT WITHIN 1800 MM (6'-0") FROM WALLS.
2. SLAB-ON-GRADE
   - 2.1. PLACE SLAB-ON-GRADE ON MATERIAL CAPABLE OF SUSTAINING A MINIMUM SLAB BEARING PRESSURE OF 25 KPa (500 psf) WITHOUT SETTLEMENT.
3. CONCRETE
   - 3.1. THE CONTRACTOR SHALL ENSURE THAT REINFORCING STEEL IS ADEQUATELY BRACED AGAINST MOVEMENT DURING CONCRETE PLACING.
   - 3.2. FABRICATE REINFORCEMENT IN ACCORDANCE WITH CAN/CSA A23.1 AND THE RSIC MANUAL OF STANDARD PRACTICE.
   - 3.3. PERFORM FORMING OPERATIONS AND PLACE HARDWARE SO THAT FINISHED CONCRETE WILL BE WITHIN THE TOLERANCES SET OUT IN CAN/CSA-A23.1.
   - 3.4. FOLLOW MANUFACTURER'S INSTRUCTIONS REGARDING INSTALLATION PROCEDURES AND MINIMUM EMBEDMENT OF ANCHORS.
   - 3.5. GROUT BENEATH PLATES BEARING ON CONCRETE WITH AN APPROVED NON_SHRINK FLOWABLE GROUT. CONFORM TO THE MANUFACTURER'S DIRECTIONS FOR MIXING AND PLACING GROUT. COMPLETELY FILL VOIDS BENEATH STEEL BASES ON CONCRETE WITH AN APPROVED NON-SHRINK 35 MPa (5ksi) GROUT.
   - 3.6. ALL DOWELS SHALL HAVE MINIMUM EMBEDMENT EQUIVALENT TO THE STRAIGHT TENSION EMBEDMENT LENGTH OR 600 MM (2'-0"), WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
   - 3.7. PROVIDE DOWELS TO WALLS AND COLUMNS SIMILAR IN NUMBER, SIZE, AND SPACING TO THE VERTICAL STEEL IN THE WALL OR COLUMN ABOVE UNLESS NOTED OTHERWISE.
   - 3.8. REINFORCEMENT IDENTIFIED AS 'CONTINUOUS' SHALL TERMINATE WITH STANDARD END HOOKS AND SHALL BE LAPPED WITH CLASS 'B' TENSION LAP SPLICES.
   - 3.9. REINFORCEMENT LENGTHS NOTED IN TYPICAL DETAILS ARE MINIMUM LENGTHS UNLESS NOTED OTHERWISE.
   - 3.10. CONSTRUCTION JOINTS:
     - 3.10.1. HORIZONTAL CONSTRUCTION JOINTS SHALL NOT BE MADE IN BEAMS, UNLESS SHOWN OR APPROVED BY THE CONSULTANT.
     - 3.10.2. HORIZONTAL CONSTRUCTION JOINTS IN WALLS SHALL BE ONLY MADE WHERE SHOWN ON THE DRAWINGS.
     - 3.10.3. VERTICAL CONSTRUCTION JOINTS MAY BE MADE ONLY AT MIDSPAN OF BEAMS AND SLABS UNLESS NOTED OTHERWISE.
     - 3.10.4. SUBMIT PROPOSED LOCATION OF ALL CONSTRUCTION JOINTS FOR REVIEW BY THE CONSULTANT.
   - 3.11. OPENINGS, SLEEVES, EMBEDDED DUCTS:
     - 3.11.1. NO SLEEVES SHALL BE PLACED VERTICALLY OR HORIZONTALLY THROUGH BEAMS UNLESS REVIEWED AND APPROVED BY THE CONSULTANT.
     - 3.11.2. NO OPENINGS SHALL BE MADE IN FLAT PLATE OR FLAT SLAB UNLESS REVIEWED AND APPROVED BY THE CONSULTANT.
   - 3.12. CONCRETE COVER:
     - 3.12.1. COVER SHALL BE MEASURED FROM THE DEEPEST POINT TEXTURED CONCRETE SURFACE TO THE NEAREST DEFORMATION OF REINFORCEMENT. REINFORCEMENT INCLUDES TIES / STIRRUPS AND MAIN REINFORCEMENT.
     - 3.12.2. ALL CONCRETE CAST AGAINST EARTH IS TO HAVE 75 MM (3") COVER, UNO.
   - 3.13. WHERE REINFORCEMENT IS NOT SPECIFICALLY IDENTIFIED ON THE DRAWINGS, PROVIDE 152x152 MW18.7xMW18.7 WELDED WIRE FABRIC AT IN SLABS ON GRADE, OR WALKS AND 51x51 MW5.6xMW5.6 TOPPINGS 60 MM (2½") IN THICKNESS OR GREATER.
   - 3.14. PLACING CONCRETE
     - 3.14.1. CONFORM TO REQUIREMENTS OF CSA A23.1. AND THE FOLLOWING:
       - 3.14.1.1. IMMEDIATELY BEFORE PLACING CONCRETE, CLEAN FORMS AND REINFORCEMENT OF FOREIGN MATTER.
       - 3.14.1.2. DO NOT USE CONCRETE MIXED MORE THAN TWO HOURS AFTER INTRODUCTION OF MIXING WATER.
       - 3.14.1.3. DURING HOT WEATHER CONDITIONS, DO NOT USE CONCRETE MIXED MORE THAN ONE HOUR AFTER INTRODUCTION OF MIXING WATER.
       - 3.14.1.4. ALLOW 24 HOURS MINIMUM AFTER PLACING CONCRETE IN COLUMNS, PIERS OR WALLS BEFORE PLACING CONCRETE IN BEAMS OR SLABS SUPPORTED THEREON.
     - 3.14.2. PLACE CONCRETE ON AND STEEL DECK FLOORS IN A MANNER THAT AVOIDS PILING UP OF CONCRETE. DO NOT DROP CONCRETE DIRECTLY FROM BUCKETS, BUT EMPLOY SUITABLE MEANS OF DISTRIBUTION. WET DOWN DECK DURING HOT WEATHER PRIOR TO CONCRETING.
       - 3.14.2.1. REMOVE CONCRETE SPILLED ONTO FORMS AROUND HOISTING EQUIPMENT BEFORE DEPOSITING CONCRETE IN THESE AREAS.
   - 3.15. CURING CONCRETE
     - 3.15.1. CURE ALL CONCRETE IN ACCORDANCE WITH CSA A23.1, THE CONCRETE SUPPLIERS REQUIREMENTS AND AS SPECIFIED HEREIN.
   - 3.16. PROTECTION
     - 3.16.1. CONFORM TO THE REQUIREMENTS OF CSA A23.1. PROTECT FRESHLY DEPOSITED CONCRETE FROM FREEZING, PREMATURE DRYING AND EXTREMES OF TEMPERATURE. MAINTAIN CONCRETE WITH MINIMAL MOISTURE LOSS AT A RELATIVELY CONSTANT TEMPERATURE FOR THE PERIOD OF TIME NECESSARY FOR THE HYDRATION OF THE CEMENT AND TO ACHIEVE THE SPECIFIED STRENGTH OF THE CONCRETE.
     - 3.16.2. PROVIDE SUFFICIENT INSULATION, AND HEAT AS NECESSARY, TO PREVENT FREEZING OF FROST SUSCEPTIBLE SOIL WHICH LIES AGAINST STRUCTURAL ELEMENTS; IN PARTICULAR PROTECT SOIL BENEATH FOOTINGS AND BEHIND FOUNDATION WALLS UNTIL THE BUILDING IS COMPLETED.
     - 3.16.3. CRACK REPAIR: PRIOR TO COMPLETION OF THE PROJECT AND IN ANY CASE NOT SOONER THAN 28 DAYS AFTER CONCRETE HAS BEEN PLACED, EXAMINE CONCRETE FLOOR SURFACES AND REPAIR ALL MAJOR CRACKS IN THEM. ROUT CRACKS OUT WITH MECHANICAL ROUTER TO 13 MM (½") SQUARE APPROXIMATE CROSS SECTION. THEN CLEAN AND FILL CRACKS IN SAME MANNER AS SAW CUTS IN SLAB ON GRADE.
4. POST-INSTALLED ANCHORS
   - 4.1. EXCEPT WHERE INDICATED ON THE DRAWINGS, POST-INSTALLED ANCHORS SHALL CONSIST OF THE FOLLOWING ANCHOR TYPES AS PROVIDED BY HILTI (CANADA) CORPORATION.
     - 4.1.1. ANCHORAGE TO CONCRETE
       - 4.1.1.0.1. ADHESIVE ANCHORS FOR CONCRETE USE:
         - 4.1.1.0.1.1. HILTI HIT-HY 200 SAFE SET SYSTEM WITH HILTI HIT-Z ROD FOR FAST CURE APPLICATIONS.
         - 4.1.1.0.1.2. HILTI HIT-HY 200 SAFE SET SYSTEM WITH HILTI HOLLOW DRILL BIT SYSTEM FOR FAST CURE APPLICATIONS.
         - 4.1.1.0.1.3. HILTI HIT-RE 500-SD EPOXY ADHESIVE ANCHORING SYSTEM FOR SLOW CURE APPLICATIONS.
         - 4.1.1.0.1.4. HILTI HIT-RE 500 EPOXY ADHESIVE ANCHORING SYSTEM FOR SLOW CURE APPLICATIONS.
         - 4.1.1.0.1.5. STEEL ANCHOR ELEMENT SHALL BE HILTI HIS-N INTERNALLY THREADED INSERTS, HILTI HAS-E CONTINUOUSLY THREADED ROD, OR CONTINUOUSLY DEFORMED STEEL REBAR.
     - 4.1.2. MEDIUM DUTY MECHANICAL ANCHORS FOR CONCRETE USE:
       - 4.1.2.1. HILTI KWIK HUS EZ AND KWIK HUS EZ-I SCREW ANCHORS.
       - 4.1.2.2. HILTI KWIK BOLT-TZ EXPANSION ANCHORS.
       - 4.1.2.3. HILTI KWIK BOLT 3 EXPANSION ANCHORS.
     - 4.1.3. HEAVY DUTY MECHANICAL ANCHORS FOR CONCRETE USE:
       - 4.1.3.1. HILTI HDA UNDERCUT ANCHORS.
       - 4.1.3.2. HILTI HSL-3 EXPANSION ANCHORS.
     - 4.1.4. REBAR DOWELING INTO CONCRETE
       - 4.1.4.1. ADHESIVE ANCHORS FOR CRACKED AND UNCRACKED CONCRETE USE:
         - 4.1.4.1.1. HILTI HIT-HY 200 SAFE SET SYSTEM WITH HILTI HOLLOW DRILL BIT SYSTEM WITH CONTINUOUSLY DEFORMED REBAR.
         - 4.1.4.1.2. HILTI HIT-RE 500-SD EPOXY ADHESIVE ANCHORING SYSTEM WITH CONTINUOUSLY DEFORMED REBAR.
         - 4.1.4.1.3. HILTI HIT-RE 500 EPOXY ADHESIVE ANCHORING SYSTEM WITH CONTINUOUSLY DEFORMED REBAR.
   - 4.2. ANCHOR CAPACITY USED IN DESIGN HAS BEEN BASED ON THE TECHNICAL DATA PUBLISHED BY HILTI. SUBSTITUTION REQUESTS FOR ALTERNATE ANCHORS MUST BE APPROVED IN WRITING BY THE CONSULTANT PRIOR TO USE. CONTRACTOR SHALL PROVIDE CALCULATIONS DEMONSTRATING THAT THE ALTERNATIVE ANCHOR IS CAPABLE OF ACHIEVING THE PERFORMANCE VALUES OF THE SPECIFIED PRODUCT. SUBSTITUTIONS WILL BE EVALUATED FOR COMPLIANCE WITH THE RELEVANT BUILDING CODE. ADHESIVE ANCHOR EVALUATION WILL ALSO CONSIDER CREEP, IN-SERVICE TEMPERATURE AND INSTALLATION TEMPERATURE.
   - 4.3. INSTALL ANCHORS PER THE MANUFACTURER WRITTEN INSTRUCTIONS.
   - 4.4. OVERHEAD ADHESIVE ANCHORS MUST BE INSTALLED USING THE HILTI PROFI SYSTEM.
   - 4.5. THE CONTRACTOR SHALL ARRANGE AN ANCHOR MANUFACTURER'S REPRESENTATIVE TO PROVIDE ONSITE INSTALLATION TRAINING FOR ALL OF THEIR ANCHORING PRODUCTS SPECIFIED. THE CONSULTANT MUST RECEIVE DOCUMENTED CONFIRMATION THAT ALL OF THE CONTRACTOR'S PERSONNEL WHO INSTALL ANCHORS ARE TRAINED PRIOR TO THE COMMENCEMENT OF INSTALLING ANCHORS.
   - 4.6. ANCHOR CAPACITY IS DEPENDANT UPON SPACING BETWEEN ADJACENT ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF CONCRETE. INSTALL ANCHORS IN STRICT ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS.
   - 4.7. EXISTING REINFORCEMENT IN THE CONCRETE STRUCTURE MAY CONFLICT WITH SPECIFIC ANCHOR LOCATIONS. UNLESS NOTED ON THE DRAWINGS THAT THE BARS CAN BE CUT, THE CONTRACTOR SHALL REVIEW THE EXISTING STRUCTURAL DRAWINGS AND SHALL UNDERTAKE TO LOCATE THE POSITION OF THE EXISTING REINFORCEMENT AT THE LOCATIONS OF THE CONCRETE ANCHORS, BY HILTI FERROSCAN, HILTI PS 1000, GPR, X-RAY, CHIPPING OR OTHER MEANS.
5. NOTIFICATION
   - 5.1. PRIOR TO COMMENCING SIGNIFICANT SEGMENTS OF THE WORK, GIVE THE CONSULTANT AND INDEPENDENT INSPECTION AND TESTING COMPANIES APPROPRIATE NOTIFICATION (MINIMUM 24 HOURS) SO AS TO AFFORD THEM REASONABLE OPPORTUNITY TO REVIEW THE WORK. FAILURE TO MEET THIS REQUIREMENT MAY BE CAUSE FOR THE CONSULTANT TO CLASSIFY THE WORK AS DEFECTIVE.
6. DEFECTIVE MATERIALS AND WORK
   - 6.1. WHERE EVIDENCE EXISTS THAT DEFECTIVE WORK HAS OCCURRED OR THAT WORK HAS BEEN CARRIED OUT INCORPORATING DEFECTIVE MATERIALS, THE CONSULTANT MAY HAVE TESTS, INSPECTIONS OR SURVEYS PERFORMED, ANALYTICAL CALCULATIONS OF STRUCTURAL STRENGTH MADE, AND THE LIKE, IN ORDER TO HELP DETERMINE WHETHER THE WORK MUST BE CORRECTED OR REPLACED. TESTS, INSPECTIONS, SURVEYS, OR CALCULATIONS CARRIED OUT UNDER THESE CIRCUMSTANCES WILL BE MADE AT THE CONTRACTOR'S EXPENSE, REGARDLESS OF THEIR RESULTS, WHICH MAY BE SUCH THAT, IN THE CONSULTANT'S OPINION, THE WORK MAY BE ACCEPTABLE.
   - 6.2. ALL TESTING SHALL BE CONDUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE BUILDING CODE, EXCEPT WHERE THIS WOULD, IN THE CONSULTANT'S OPINION, CAUSE UNDUE DELAY OR GIVE RESULTS NOT REPRESENTATIVE OF THE REJECTED MATERIAL IN PLACE. IN THIS CASE, THE TESTS SHALL BE CONDUCTED IN ACCORDANCE WITH THE STANDARDS GIVEN BY THE CONSULTANT.
   - 6.3. MATERIALS OR WORK, WHICH FAIL TO MEET SPECIFIED REQUIREMENTS, MAY BE REJECTED BY THE CONSULTANT WHENEVER FOUND AT ANY TIME PRIOR TO FINAL ACCEPTANCE OF THE WORK REGARDLESS OF PREVIOUS INSPECTION. IF REJECTED, DEFECTIVE MATERIALS OR WORKMANSHIP SHALL BE PROMPTLY REMOVED AND REPLACED OR REPAIRED TO THE SATISFACTION OF THE CONSULTANT, AT NO EXPENSE TO THE OWNER.

LICENSED PROFESSIONAL ENGINEER
J. D. BARILL
100542488
September 22, 2022
PROVINCE OF ONTARIO

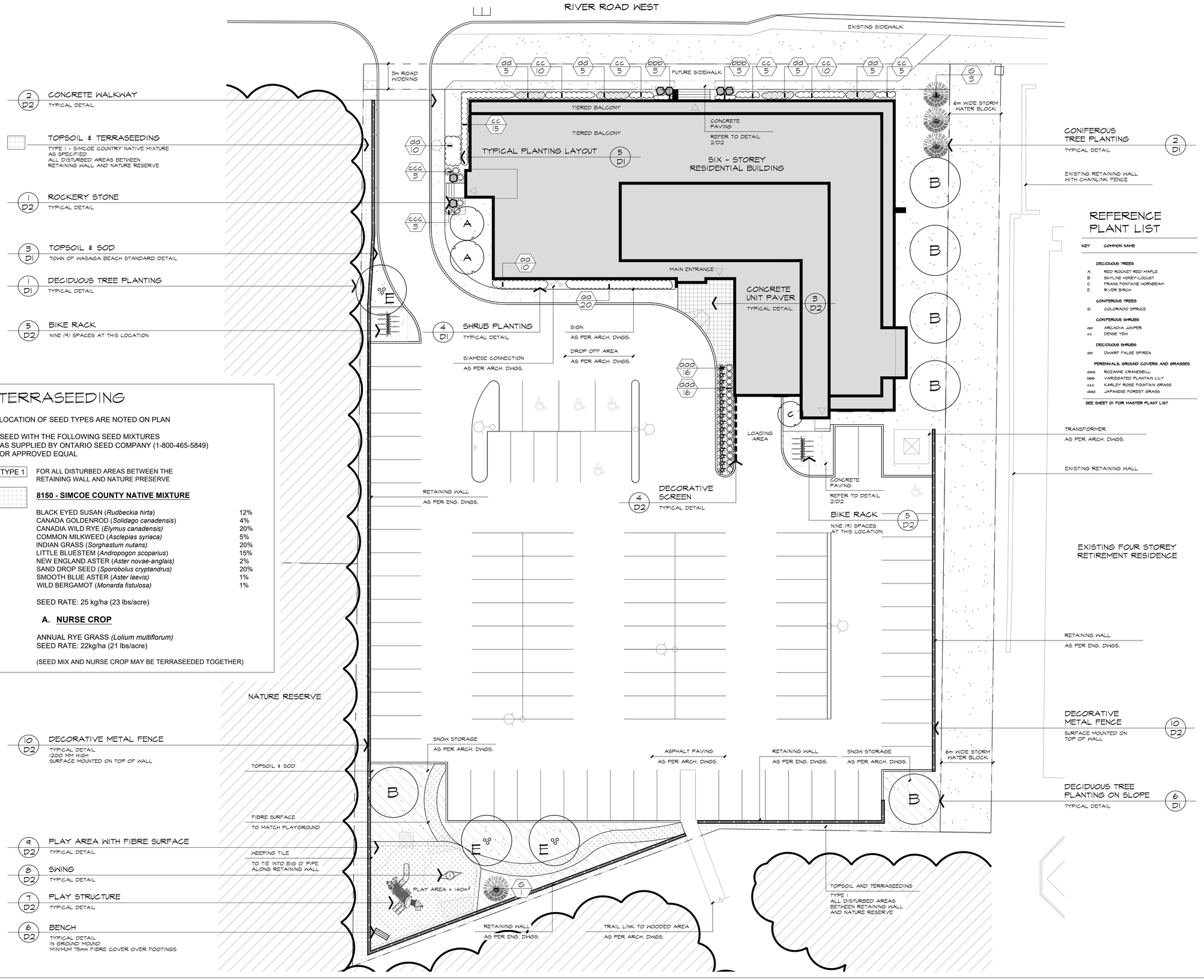
SCALE:	---
DRAWN BY	MHW
CHECK BY	JB
DATE	SEP. 16/22
PROJECT NO.	21-256
SHEET NUMBER	S5

DRAWING TITLE: STRUCTURAL NOTES

PROJECT
WASAGA RIVERWOODS RETAINING WALLS
RIVER ROAD WEST
WASAGA BEACH, ONTARIO

BARILL ENGINEERING LIMITED
50 TRAIL'S END, COLLINGWOOD, ONTARIO, L9Y 5B2
PHONE: (705) 445-4905 FAX: (705) 445-6107

Appendix I – Landscape Plans



TERRASEEDING

LOCATION OF SEED TYPES ARE NOTED ON PLAN

SEED WITH THE FOLLOWING SEED MIXTURES
AS SUPPLIED BY ONTARIO SEED COMPANY (1-800-465-5849)
OR APPROVED EQUAL

TYPE 1 — FOR ALL DISTURBED AREAS BETWEEN THE RETAINING WALL AND NATURE PRESERVE

8150 - SIMCOE COUNTY NATIVE MIXTURE

BLACK EYED SUSAN (*Rudbeckia hirta*)	12%
CANADA GOLDENROD (*Solidago canadensis*)	4%
CANADIA WILD RYE (*Elymus canadensis)*	20%
COMMON MILKWEED (*Asclepias syriaca)*	5%
INDIAN GRASS (*Sorghastum nutans)*	20%
LITTLE BLUESTEM (*Andropogon scoparius*)	15%
NEW ENGLAND ASTER (*Aster novae-anglais)*	2%
SAND DROP SEED (*Sporobolus cryptandrus)*	20%
SMOOTH BLUE ASTER (*Aster laevis)*	1%
WILD BERGAMOT (*Monarda fistulosa)*	1%

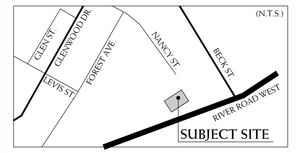
SEED RATE: 25 kg/ha (23 lbs/acre)

A. NURSE CROP

ANNUAL RYE GRASS *(Lolium multiflorum)*
SEED RATE: 22kg/ha (21 lbs/acre)

(SEED MIX AND NURSE CROP MAY BE TERRASEEDED TOGETHER)

KEY PLAN



LEGEND

EXISTING VEGETATION TO BE PRESERVED
DECIDUOUS TREES
CONIFEROUS TREES
SHRUB PLANTING
ROCKERY STONES
CONCRETE UNIT PAVER
DECORATIVE SCREEN
DECORATIVE FENCE
RETAINING WALL
BIKE RACK

REFERENCE PLANT LIST

KEY	COMMON NAME
DECIDUOUS TREES	
A	RED ROCKET RED MAPLE
B	SKYLINE HONEYLOCUST
C	FRANS FONTAINE HORNBEAM
E	RIVER BIRCH
CONIFEROUS TREES	
G	COLORADO SPRUCE
CONIFEROUS SHRUBS	
aa	ARCADIA JUNIPER
cc	DENSE YEW
DECIDUOUS SHRUBS	
dd	DWARF FALSE SPIREA
PERENNIALS, GROUND COVERS AND GRASSES	
aaa	ROZANNE CRANESBILL
bbb	VARIEGATED PLANTAIN LILY
ccc	KARLEY ROSE FOUNTAIN GRASS
ddd	JAPANESE FOREST GRASS

SEE SHEET D1 FOR MASTER PLANT LIST

BASE INFORMATION OBTAINED ELECTRONICALLY FROM AND ARCHITECTURE INC. (JOB NO. 18026; TEL. 905-604-6960)

no.	date	version	by
4	SEPT. 22 2022	ISSUED FOR THIRD SPA SUBMISSION	AV/ ED
3	DEC 7 2021	ISSUED FOR SECOND SPA SUBMISSION	SO /LB
2	AUG 21 2020	ISSUED FOR ZONING & SPA SUBMISSION	RS /AV
1	JUN 31 2020	ISSUED FOR CLIENT REVIEW	LK /RS

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
MONICA E. CLARKE
OALA
MEMBER

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project

RIVERWOODS HOMES
RIVER ROAD WEST
WASAGA BEACH, ON

WASAGA RIVERWOODS HOMES INC.

drawing

LANDSCAPE PLANTING PLAN

date: JUNE 4 , 2020	drawn: RS
scale*: 1:200	file: 3383 L1 V6-220922
direction	project no.: 3383
	sheet no.: L-1

*NOTED SCALE IS APPLICABLE ONLY WHEN PRINTED ON ARCH D (24"x36") SIZE SHEET

SPECIFICATIONS

GENERAL

THESE SPECIFICATIONS ARE TO BE READ IN CONJUNCTION WITH THE GENERAL CONDITIONS OF THE CONTRACT AS PREPARED BY AND AVAILABLE AT THE OFFICE OF ALEXANDER BUDREVICS & ASSOCIATES LTD.

PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL:
1. FAMILIARIZE HIMSELF WITH THE PLANS, DETAILS, AND SPECIFICATIONS OF THIS PROJECT.
2. VISIT THE SITE TO ASCERTAIN AND TAKE ACCOUNT OF EXISTING CONDITIONS AND ANY DEVIATIONS FROM THE PLANS IN WORK BY OTHERS, AND
3. FINALIZE ALL DESIGN ALTERNATIVES IN CONSULTATION WITH THE LANDSCAPE ARCHITECT.

PRIOR TO EXCAVATING, THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES. IN THE EVENT OF A CONFLICT BETWEEN A PROPOSED TREE LOCATION AND AN UNDERGROUND SERVICE, THE EXACT LOCATION OF THE TREE SHALL BE DETERMINED ON SITE BY THE LANDSCAPE ARCHITECT.

THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, REPAIR ANY DAMAGE TO EXISTING UTILITIES, STRUCTURES, FACILITIES, ETC. DONE IN THE PERFORMANCE OF HIS WORK.

ALL SITE WORK SHALL CONFORM TO THE CANADIAN NATIONAL MASTER CONSTRUCTION SPECIFICATIONS. A COPY OF WHICH CAN BE OBTAINED FROM CONSTRUCTION SPECIFICATIONS CANADA:
Tel: (416) 777-2198, Fax: (416) 777-219, Email: info@cscs-dcc.ca
IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO BE THOROUGHLY FAMILIAR WITH THESE SPECIFICATIONS AND THEIR IMPLICATIONS FOR THIS PROJECT.

SOFT LANDSCAPING

PLANT MATERIALS

ALL PLANTS SHALL BE INSTALLED TRUE TO SPECIFIED NAMES, SIZES, GRADES, ETC. AND SHALL CONFORM TO THE STANDARDS OF THE CANADIAN NURSERY TRADES ASSOCIATION.

ALL PLANTS SHALL BE NURSERY GROWN.

IN THE EVENT OF A DISCREPANCY IN PLANT QUANTITY BETWEEN THE PLANTING PLAN AND THE PLANT LIST, THE PLANTING PLAN SHALL GOVERN.

THE CONTRACTOR SHALL MAKE PLANTS AVAILABLE FOR INSPECTION BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION. MATERIAL NOT CONFORMING TO THE SPECIFICATIONS SHALL BE REPLACED AT THE EXPENSE OF THE CONTRACTOR.

PLANT SUBSTITUTIONS MUST BE APPROVED IN WRITING BY THE OWNER OR THE LANDSCAPE ARCHITECT PRIOR TO DELIVERY OF THE MATERIAL ON SITE.

THE LANDSCAPE ARCHITECT MAY, UPON COMPLETION OF THE WORK AND NOTWITHSTANDING PRIOR APPROVAL AT SOURCE, REJECT PLANT MATERIAL NOT CONFORMING TO THE SPECIFICATIONS.

THE CONTRACTOR SHALL USE STANDARD INDUSTRY METHODS FOR PLANTING TREES. TREES SHALL BE TURNED TO GIVE THE BEST APPEARANCE; THEY SHALL ALSO BE GUYED AND STAKED IMMEDIATELY AFTER PLANTING AND AS DETAILED ON THE DRAWINGS.

BED PREPARATION

THE CONTRACTOR SHALL BACKFILL TREE PITS AND PLANTING BEDS TO SPECIFIED DEPTHS WITH EITHER PRE-MIXED TOPSOIL (VIZ., "TRIPLE-MIX") OR A MIXTURE COMPRISED OF:
6 PARTS SANDY LOAM
1 PART FINELY PULVERIZED CANADIAN PEAT MOSS
1 PART WELL-ROTTED FARM MANURE, WITH "AGRIFORM" 20-10-5
TABLETS (OR APPROVED EQUAL) ADDED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.

THE CONTRACTOR SHALL CONSTRUCT TREE PITS AND SHRUB BEDS WITH SOIL SAUCERS, MULCH, AND SUBSURFACE DRAINAGE AS DETAILED.

THE CONTRACTOR SHALL CONSTRUCT SHRUB BEDS IN CONTINUOUS FORMS, THE SHAPE OF WHICH SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT AND/OR OWNER. ON SLOPES, SHRUB BEDS SHALL BE FASHIONED TO ALLOW FOR PROPER DRAINAGE.

TOPSOIL & FINE GRADING

THE CONTRACTOR SHALL PLACE 150mm OF RICH TOPSOIL ON APPROVED SUBGRADES. TOPSOIL SHALL BE IMPORTED WHERE REQUIRED. 10-6-4 FERTILIZER SHALL BE APPLIED ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS AT A RATE OF 7.32 kg/100m² FOR SODDED AREAS; THE MIXTURE AND RATE OF APPLICATION SHALL BE ADJUSTED FOR SEEDED AREAS.

MINOR GRADE DEFICIENCIES AND IRREGULARITIES SHALL BE ELIMINATED PRIOR TO SODDING.

SODDING

THE CONTRACTOR SHALL SOD ALL AREAS SO INDICATED ON THE DRAWINGS. SOD SHALL BE FRESHLY CUT NO.1 GRADE NURSERY-GROWN TURF 50-75mm THICK.

SOD FOR SUNNY, EXPOSED AREAS SHALL BE 50% KENTUCKY BLUEGRASS AND 50% MERION BLUEGRASS. SOD FOR SHADED AREAS SHALL BE 50% NUGGET KENTUCKY BLUEGRASS AND 50% CREEPING RED FESCUE.

SOD SHALL BE PLACED ON PREPARED TOPSOIL, WITH JOINTS STAGGERED AND SECTIONS ABUTTED TIGHTLY. IMMEDIATELY AFTER LAYING, IRRIGATION SUFFICIENT TO ENSURE MOISTURE PENETRATION TO A DEPTH OF 100mm SHALL BE APPLIED.

SOD SHALL BE MACHINE ROLLED TO ENSURE UNIFORM CONTACT WITH TOPSOIL.
SOD ON ALL SLOPES SHALL BE PEGGED WHERE REQUIRED.

TERRASEEDING

THE CONTRACTOR SHALL FINE GRADE AND FERTILIZE AS RECOMMENDED BY SOIL TEST ANALYSIS REPORT. MINOR GRADE DEFICIENCIES AND IRREGULARITIES SHALL BE ELIMINATED PRIOR TO SEEDING.

THE CONTRACTOR SHALL TERRASEED ALL AREAS WITH SPECIFIED SEED MIXTURES AS NOTED ON DRAWINGS.

DEPENDING ON SLOPE GRADATION, DEPTH OF COMPOSTED SOIL, SEED SHALL BE AS FOLLOWS:

0-5% SLOPE: 10-15 mm. DEPTH
5-10% SLOPE: 15-20 mm. DEPTH
10-25% SLOPE: (4:1) 20-25 mm. DEPTH
25-35% SLOPE: (3:1) 25-40 mm. DEPTH
35-45% SLOPE: 40-50 mm. DEPTH

THE CONTRACTOR SHALL FERTILIZE AS RECOMMENDED BY SEED SUPPLIER.

WATER AS REQUIRED TO OBTAIN THICK GROWTH. FOLLOW UP OVERSEEDING IS PART OF THIS WORK.

HARD LANDSCAPING

POURED-IN-PLACE CONCRETE WORK

THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL OF FORMWORK PRIOR TO POURING CONCRETE. ALL CONCRETE, STEEL REINFORCING, AND FORMWORK SHALL BE AS DETAILED AND SPECIFIED ON THE DRAWINGS.

THE STYLE, COLOUR, AND FINISH OF CONCRETE ELEMENTS SHALL BE APPROVED BY THE OWNER AND/OR LANDSCAPE ARCHITECT PRIOR TO THE COMMENCEMENT OF CONCRETE WORK.

ALL STRUCTURAL CONCRETE WORK SHALL CONFORM TO LOCAL BUILDING CODES AND REGULATIONS.

BRICKWORK, STONEWORK & CONCRETE UNIT PAVING

WHERE APPLICABLE, THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE LANDSCAPE ARCHITECT OF ALL STRUCTURAL CONCRETE WORK BEFORE COMMENCING BRICKWORK, STONEWORK OR PAVING WORK.

ALL BRICKWORK, STONEWORK, AND CONCRETE UNIT PAVING SHALL BE AS DETAILED AND SPECIFIED ON THE DRAWINGS, UNLESS THE LANDSCAPE ARCHITECT AND/OR THE OWNER APPROVE SUBSTITUTIONS IN WRITING.

PRIOR TO STARTING THIS PORTION OF WORK, THE CONTRACTOR SHALL SUBMIT SAMPLES OF ALL PROPOSED BRICKWORK, STONEWORK, AND CONCRETE UNIT PAVERS FOR APPROVAL BY THE LANDSCAPE ARCHITECT AND/OR THE OWNER WITH RESPECT TO STYLE, COLOUR, AND FINISH. THE CONTRACTOR MAY ALSO BE ASKED TO SUBMIT SAMPLES OF ALTERNATIVES TO THE MATERIALS SPECIFIED ON THE DRAWINGS.

ALL BRICKWORK, STONEWORK, AND CONCRETE UNIT PAVING SHALL CONFORM TO LOCAL BUILDING CODES AND OTHER MUNICIPAL REQUIREMENTS.

WOODWORK

ALL WOOD SHALL BE NO. 1 GRADE DRESSED CLEAR CEDAR, PRESSURE-TREATED RED PINE, OR PRESSURE-TREATED JACK PINE, AS SPECIFIED ON THE DRAWINGS.

PRESSURE TREATMENT SHALL BE FACTORY-APPLIED COPPER CHROME ARSENATE OR EQUAL, AS PER CSA-080 SPECIFICATIONS.

CLEAR CEDAR OR SPECIALTY WOODS SHALL BE STAINED WITH TWO (2) COATS OF STAIN, PAINT OR PRESERVATIVE.

THE CONTRACTOR SHALL SUBMIT SAMPLES OF ALL PROPOSED FINISHES FOR APPROVAL BY THE LANDSCAPE ARCHITECT AND/OR THE OWNER PRIOR TO ITS APPLICATION. THE CONTRACTOR MAY ALSO BE ASKED TO SUBMIT SAMPLES OF ALTERNATIVES TO THE MATERIALS OR FINISHES SPECIFIED ON THE DRAWINGS.

METALWORK

PRIOR TO ORDERING MATERIAL FOR THIS PORTION OF WORK, THE CONTRACTOR SHALL SUBMIT SAMPLES OF ALL PROPOSED METALWORK FOR THE APPROVAL OF THE LANDSCAPE ARCHITECT AND/OR THE OWNER WITH RESPECT TO STYLE, COLOUR, AND FINISH. THE CONTRACTOR MAY ALSO BE ASKED TO SUBMIT SAMPLES OF ALTERNATIVES TO THE MATERIALS SPECIFIED ON THE DRAWINGS.

LENGTHS FOR FENCING SHALL BE MEASURED IN THE FIELD BY THE CONTRACTOR; SCALED MEASUREMENTS FROM THE DRAWINGS SHALL NOT BE RELIED UPON FOR DETERMINING THE NUMBER OF SECTIONS OF FENCE OR THE SIZE OF GATES THAT WILL BE NEEDED.

MAINTENANCE

THE CONTRACTOR SHALL MAINTAIN ALL LANDSCAPED AREAS FOR A PERIOD OF FOUR (4) GROWING MONTHS FROM THE DATE OF SUBSTANTIAL COMPLETION.

MAINTENANCE SHALL INCLUDE:
- PROPER IRRIGATION TO ENSURE OPTIMUM GROWTH OF TREES, SHRUBS, AND SOD
- GRASS MOWING TO MAINTAIN AN APPROXIMATE HEIGHT OF 50mm
- THE CULTIVATION AND WEEDING OF TREE PITS AND PLANTING BEDS
- INSECT AND DISEASE CONTROL

AT THE END OF THE SPECIFIED MAINTENANCE PERIOD, PROVIDED ALL PLANT MATERIAL IS ALIVE AND IN A HEALTHY GROWING CONDITION, THE OWNER WILL ASSUME THE RESPONSIBILITY OF MAINTAINING THE LANDSCAPE WORK.

PERFORMANCE ACCEPTANCE (SUBSTANTIAL COMPLETION)

WRITTEN NOTICE OF PERFORMANCE ACCEPTANCE BY THE LANDSCAPE ARCHITECT FOR SUBSTANTIAL COMPLETION OF THE PROJECT LANDSCAPE WORKS SHALL MARK THE START OF THE GUARANTEE PERIOD.

SHOULD LOCAL LAW REQUIRE MUNICIPAL ACCEPTANCE, THE LANDSCAPE ARCHITECT WILL SUBMIT THE SUBSTANTIAL COMPLETION CERTIFICATE TO THE MUNICIPALITY SO THAT THEY MAY PROCEED TO INSPECT THE WORK, ISSUE THEIR PERFORMANCE ACCEPTANCE CERTIFICATE, AND REDUCE THE AMOUNT OF SECURITIES.

GUARANTEE

ALL PLANT MATERIAL SHALL BE GUARANTEED FOR TWO (2) YEARS FROM THE DATE ON THE PERFORMANCE ACCEPTANCE CERTIFICATE ISSUED BY THE LANDSCAPE ARCHITECT. PLANTS THAT EXPIRE OR OTHERWISE FAIL TO THRIVE DURING THE GUARANTEE PERIOD SHALL BE REPLACED AT THE EXPENSE OF THE CONTRACTOR.

SIMILARLY, ALL OTHER LANDSCAPE WORK PERFORMED UNDER THIS CONTRACT SHALL BE FULLY GUARANTEED FOR ONE (1) YEAR FROM THE DATE OF PERFORMANCE. ACCEPTANCE BY THE LANDSCAPE ARCHITECT.

FINAL ACCEPTANCE

ALL WORK SHALL BE INSPECTED AT THE END OF THE GUARANTEE PERIOD BY THE LANDSCAPE ARCHITECT. ANY DEFICIENCIES SHALL BE RECTIFIED BY THE CONTRACTOR TO THE SATISFACTION OF THE LANDSCAPE ARCHITECT AND THE OWNER. THE LANDSCAPE ARCHITECT WILL THEN ISSUE A FINAL ACCEPTANCE CERTIFICATE.

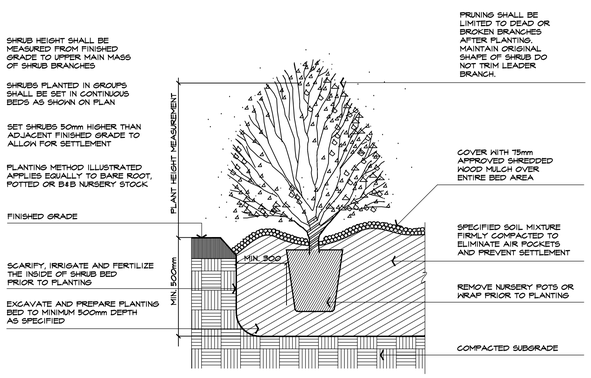
SHOULD LOCAL LAW REQUIRE MUNICIPAL ACCEPTANCE, THE LANDSCAPE ARCHITECT WILL SUBMIT THE FINAL ACCEPTANCE CERTIFICATE TO THE MUNICIPALITY SO THAT THEY MAY PROCEED TO INSPECT THE WORK, GIVE FINAL APPROVAL, AND RELEASE ALL OUTSTANDING LANDSCAPE SECURITIES.

MASTER PLANT LIST

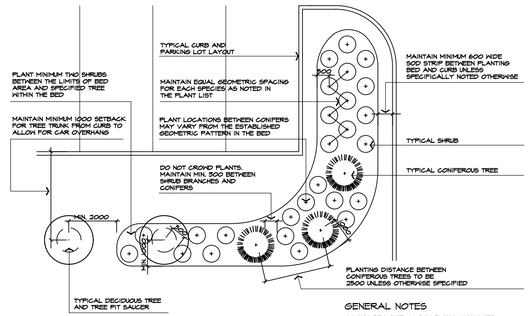
PROJECT NAME:
RIVERWOODS HOMES-(ABAL 3383)

In the event of a discrepancy between the planting plan and the plant list quantities, the planting plan shall govern.

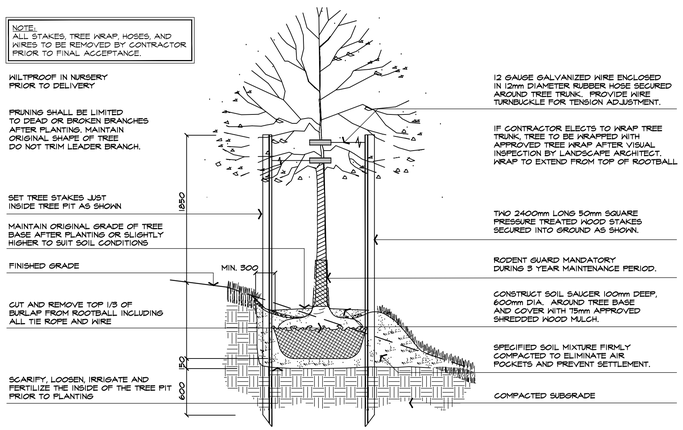
KEY	QUANTITY	BOTANICAL NAME	COMMON NAME	CALIPER	HEIGHT	SPREAD	ROOT	REMARKS	SPACING
		DECIDUOUS TREES							
A	2	ACER RUBRUM 'RED ROCKET'	RED ROCKET RED MAPLE	60mm	3500mm	1500mm	B.B.	EQUAL FORM	- - - -
B	6	GLEDITSIA TRIACANTHOS 'SKYLINE'	SKYLINE HONEY-LOCUST	60mm	3500mm	1500mm	B.B.	EQUAL FORM	- - - -
C	1	CARPINUS BETULUS 'FRANS FONTAINE'	FRANS FONTAINE HORNBEAM	50mm	3500mm	1500mm	B.B.	EQUAL FORM	- - - -
E	3	BETULA NIGRA	RIVER BIRCH	50mm	3500mm	1500mm	B.B.	MULTI STEM	- - - -
		CONIFEROUS TREES							
G	4	PICEA PUNGENS	COLORADO SPRUCE	- - - -	2000mm	1000mm	B.B.	SPECIMEN	- - - -
		CONIFEROUS SHRUBS							
aa	30	JUNIPERUS SABINA 'ARCADIA'	ARCADIA JUNIPER	- - - -	- - - -	600mm	POTTED	MIN. 15 CANDLES	800mm
cc	50	TAXUS MEDIA 'DENSIFORMIS'	DENSE YEW	- - - -	- - - -	600mm	POTTED	MIN. 15 CANDLES	800mm
		DECIDUOUS SHRUBS							
dd	30	SORBARIA SORBIFOLIA 'SEM'	DWARF FALSE SPIREA	- - - -	600mm	- - - -	POTTED	MIN. 10 STEMS	650mm
		PERENNIALS, GROUND COVERS AND GRASSES							
aaa	16	GERANUM x 'ROZANNE'	ROZANNE CRANESBILL	- - - -	- - - -	- - - -	1 gal. POT	MIN. 2 YRS. 6TH.	400mm
bbb	6	HOSTA FORTUNEI 'ALBOMARGINATA'	VARIEGATED PLANTAIN LILY	- - - -	- - - -	- - - -	1 gal. POT	MIN. 2 YRS. 6TH.	400mm
ccc	6	PENNISETUM ORIENTALE 'KARLEY ROSE'	KARLEY ROSE FOUNTAIN GRASS	- - - -	- - - -	- - - -	1 gal. POT	MIN. 2 YRS. 6TH.	800mm
ddd	16	HAKONECHLOA MACRA	JAPANESE FOREST GRASS	- - - -	- - - -	- - - -	1 gal. POT	MIN. 2 YRS. 6TH.	400mm



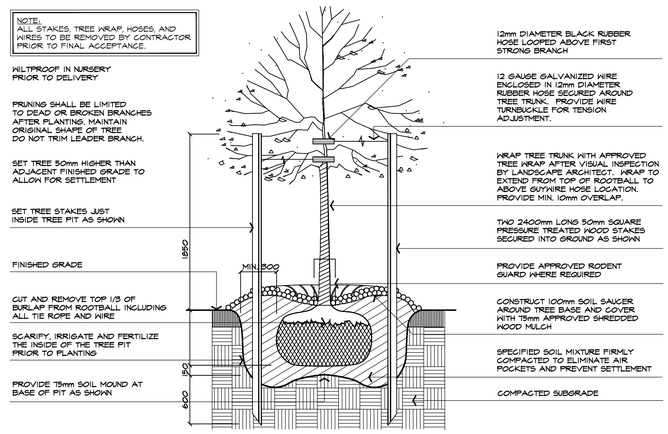
4 SHRUB PLANTING DETAIL — NTS
TYPICAL INSTALLATION — ABAL P301-040305



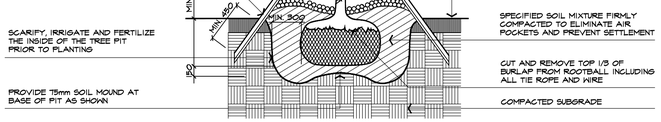
5 TYPICAL PLANTING LAYOUT — NTS
SYMBOLS REPRESENT INSTALLED PLANT SIZE — ABAL P401-140328



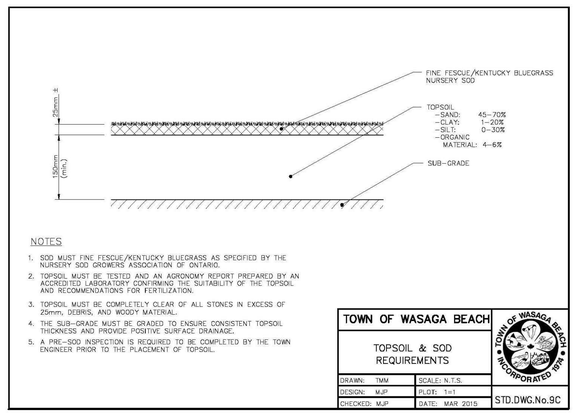
6 DECIDUOUS TREE PLANTING ON SLOPE DETAIL — NTS
ABAL P303-051027



1 DECIDUOUS TREE PLANTING DETAIL — NTS
TYPICAL INSTALLATION FOR 75mm CALIPER TREES OR LESS — ABAL P101-051027



2 CONIFEROUS TREE PLANTING DETAIL — NTS
TYPICAL INSTALLATION FOR 2000mm HEIGHT TREES OR LESS — ABAL P201-051027



3 TOPSOIL AND SOD DETAIL — NTS
TOWN OF WASAGA BEACH STANDARD DETAIL

no.	date	version	by
4	SEPT. 22 2022	ISSUED FOR THIRD SPA SUBMISSION	AV/ ED
3	DEC 7 2021	ISSUED FOR SECOND SPA SUBMISSION	SO /LB
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ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO — MONICA E. CLARKE — OALA MEMBER

project
RIVERWOODS HOMES
RIVER ROAD WEST
WASAGA BEACH, ON
WASAGA RIVERWOODS HOMES INC.

drawing
LANDSCAPE DETAILS

date JUNE 4 , 2020	drawn RS
scale* AS SHOWN	file 3383 D1 V6-220922
direction	project no. 3383
	sheet no. D-1

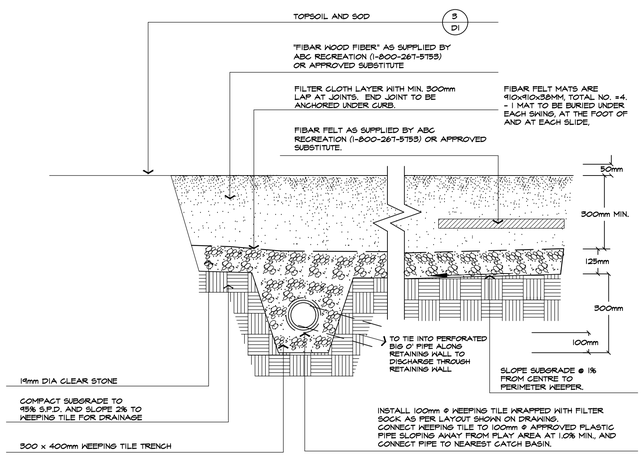
*NOTED SCALE IS APPLICABLE ONLY WHEN PRINTED ON ARCH D (24"x36") SIZE SHEET

8 SWING

NTS

MANUFACTURER: JAMBETTE

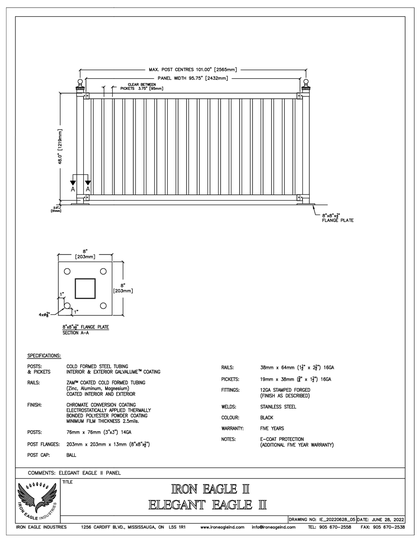
PRODUCT: ETNA TRAPP-1 - GX-07069
COLOUR: TO BE APPROVED BY CLIENT & LANDSCAPE ARCHITECT PRIOR TO ORDERING



9 PLAY AREA WITH FIBRE SURFACE DETAIL

NTS

ABAL G105x-220617



10 DECORATIVE METAL FENCE

NTS

MANUFACTURER: IRON EAGLE

PRODUCT: ELEGANT EAGLE II
COLOUR: TO MATCH BUILDING FEATURES OR BLACK POWDERCOAT
HEIGHT: 1200 MM

400 SERIES

MBR-0400-00015
Legacy # MBR400-9-S

Sustainability Facts

Unit Size	One (1) 400 Bike Rack
	MIN. MAX.
Carbon footprint (GWP)	129 238 Kg CO2-Eq
Measured in kilograms of carbon dioxide equivalent	
Total energy use (TPE)	2260 4390 MJ-Eq
Measured in megajoules of energy equivalent	
Water use (WDP)	1.06 3 m3 water
Measured in cubic metres of water	
Material recyclability	100%
LEED v4.1 Credits	
Type III Environmental Product Declaration	✓
Material Inventory	✓✓
Low VOC finishes	✓✓
Free of Red List substances	✓

*Full EPD can be referenced for more information: https://www.epdinformation.com/maglin/

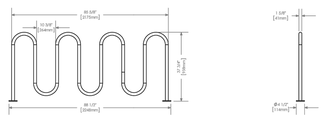
DESCRIPTION: 400 Series - 400 Bike Rack: H.S. Steel Tube, Surface Mount, 9 Bike Configuration

FINISH: All steel components are protected with E-Coat rust proofing.
The Maglin Powdercoat System provides a durable finish on all metal surfaces.

INSTALLATION: The bike racks are delivered pre-assembled. It is available with a surface mount installation.

TO SPECIFY: Select MBE-0400-00015
Choose:
- Powdercoat Color

HEIGHT: 37.75" (95.8cm) LENGTH: 85.63" (217.5cm) DEPTH: 1.63" (4.1cm) WEIGHT: 45.86 lbs (20.8kg)



MAGLIN Site Furniture
T 800 718 5558
F 877 290 5558
www.maglin.com
sales@maglin.com

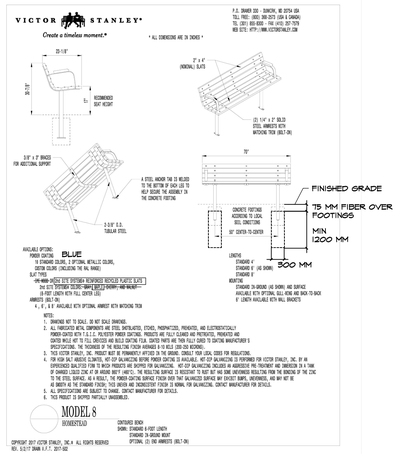
5 BIKE RACK

NTS

MANUFACTURER: MAGLIN

PRODUCT: MBR-0400-00015 400 SERIES
COLOUR: GUNMETAL FINE TEXTURE
QUANTITY: TWO (2)

OR APPROVED SUBSTITUTE



6 BENCH - DIRECT BURIAL

NTS

MANUFACTURER: VICTOR STANLEY
PRODUCT: MODEL 8 CONTOURED BENCH
MATERIAL: REINFORCED RECYCLED PLASTIC SLATS
COLOUR: TO MATCH PLAY STRUCTURE - TO BE APPROVED BY CLIENT & LANDSCAPE ARCHITECT PRIOR TO ORDERING

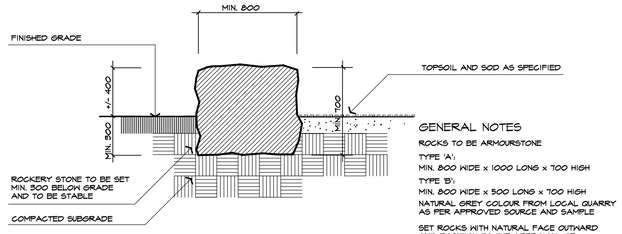
OR APPROVED SUBSTITUTE

7 PLAY STRUCTURE

NTS

MANUFACTURER: JAMBETTE

PRODUCT: PLAYSTRUCTURE - JB-22310-SHA
COLOUR: TO BE APPROVED BY CLIENT & LANDSCAPE ARCHITECT PRIOR TO ORDERING



GENERAL NOTES

ROCKS TO BE ARMOURSTONE

TYPE 'A':
MIN. 800 WIDE x 1000 LONG x 700 HIGH

TYPE 'B':
MIN. 800 WIDE x 500 LONG x 700 HIGH

NATURAL GREY COLOUR FROM LOCAL QUARRY AS PER APPROVED SOURCE AND SAMPLE

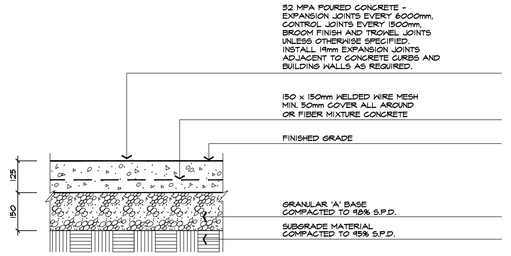
SET ROCKS WITH NATURAL FACE OUTWARD AND POSITION TO THE APPROVAL OF LANDSCAPE ARCHITECT

1 ROCKERY STONE DETAIL

NTS

SINGLE TIER AT GRADE

ABAL R201X-180502

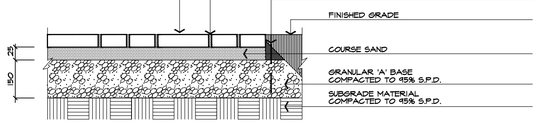


2 CONCRETE WALKWAY DETAIL

NTS

TYPICAL INSTALLATION

ABAL H201-000529



3 CONCRETE UNIT PAVER DETAIL

NTS

TYPICAL INSTALLATION

ABAL H301-070613

4 WOOD SCREEN DETAIL

NTS

TO FUTURE DETAIL

no.	date	version	by
4	SEPT. 22 2022	ISSUED FOR THIRD SPA SUBMISSION	AV/ ED
3	DEC 7 2021	ISSUED FOR SECOND SPA SUBMISSION	SO /LB
2	AUG 21 2020	ISSUED FOR ZONING & SPA SUBMISSION	RS /AV
1	JUN 11 2020	ISSUED FOR CLIENT REVIEW	LK /RS

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project

RIVERWOODS HOMES
RIVER ROAD WEST
WASAGA BEACH, ON

WASAGA RIVERWOODS HOMES INC.

drawing

LANDSCAPE DETAILS

date JUNE 4 , 2020	drawn RS
scale* AS SHOWN	file 3383 D2 V6-220922
direction	project no. 3383
	sheet no. D-2

*NOTED SCALE IS APPLICABLE ONLY WHEN PRINTED ON ARCH D (24"x36") SIZE SHEET

Appendix J – Water Balance

THORNTHWAITE WATER BALANCE CALCULATIONS

PROJECT No. 2018-012
Wasaga Riverwoods
Town of Wasaga Beach

CAPES ENGINEERING

TABLE 1

Pre- and Post-Development Monthly Water Balance Components

Potential Evapotranspiration Calculation	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Average Temperature (Degree C) [1]	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	**6.9**
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	**36.8**
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	**499**
Adjusting Factor for U (Latitude 44° 22' N)[2]	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
PRE-DEVELOPMENT WATER BALANCE	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)[3]	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	**340**
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-27	17	39	58	0	**0**
Soil Moisture Storage max 250 mm	250	250	250	250	250	221	164	137	153	192	250	250	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
Soil Moisture Deficit max 250 mm	0	0	0	0	0	29	86	113	97	58	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	22	74	**340**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	66	49	46	27	6	0	0	0	0	0	18	59	**272**
Potential Direct Surface Water Runoff (independent of temperature)	17	12	12	7	2	0	0	0	0	0	4	15	**68**
POST-DEVELOPMENT WATER BALANCE	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evaporation (PE) from impervious areas (assume 20%)	17	12	12	12	16	17	15	18	19	16	18	15	**187**
P-PE (surplus available for runoff from impervious areas)	66	49	46	50	66	68	62	72	75	62	71	59	**746**
Water surplus change compared to pre-condition (for areas that change from vegetated open areas to impervious areas)	-17	-12	-12	16	58	68	62	72	75	62	49	-15	**407**

Soil Moisture Storage: 250 mm <-- See "Water Holding Capacity" values for Fine Sand & Mature Forest in Table 3.1, MOE SWMPDM, 200

Forest	100%
Urban Lawn	0%
Pasture	0%
Crops	0%
Impervious	0%

*MOE SWM infiltration calculations

topography - rolling land	0.2	<-- Infiltration Factors from Table 3.1, MOE SWMPDM, 2003
soils - fine sand	0.4	<-- Infiltration Factors from Table 3.1, MOE SWMPDM, 2003
cover - 100% forest	0.2	<-- Infiltration Factors from Table 3.1, MOE SWMPDM, 2003
Infiltration factor	**0.8**	

Latitude of site (or climate station): 44 ° N.

USER INPUTS

THORNTHWAITE WATER BALANCE CALCULATIONS

PROJECT No. 2018-012
Wasaga Riverwoods
Town of Wasaga Beach

CAPES ENGINEERING

Thornthwaite Water Balance

Land Use Description	Approx. Land Area* (m^2)	Estimated Impervious Fraction for Land Use	Estimated Impervious Area (m^2)	Runoff from Impervious Area (m/a)	Runoff Volume from Impervious Area (m^3/a)	Estimated Pervious Area (m^2)	Runoff from Pervious Area (m/a)	Runoff Volume from Pervious Area (m^3/a)	Recharge from Pervious Area (m/a)	Recharge Volume from Pervious Area (m^3/a)	Total Runoff (Direct and Indirect) Volume (m^3/a)	Total Recharge Volume (m^3/a)
Pre Development Site	6,610	0.00	0	0.746	0	6,610	0.068	449	0.272	1,796	449	1,796
TOTAL PRE-DEVELOPMENT	**6,610**		**0**		**0**	**6,610**		**449**		**1,796**	**449**	**1,796**
Post Development Site	6,610	0.88	5,817	0.746	4,341	793	0.102	81	0.238	189	4,422	189
TOTAL POST-DEVELOPMENT	**6,610**		**5,817**		**4,341**	**793**		**81**		**189**	**4,422**	**189**
										% Change from Pre to Post	985	89
										Effect of development (**with no mitigation**)	**9.85 times increase in runoff**	**89% reduction of recharge**

To balance pre- to post-, the recharge target (m^3/a)= **1,608**