

Geotechnical Investigation

Proposed Residential Development

Westwood – Block 324
5725 Fernbank Road
Ottawa, Ontario

Prepared for CRT Developments

Report PG2236-3 Revision 6 dated July 3, 2026

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 dated November 4, 2024
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 PG2236-9 Revision 4 Redi-Rock Retaining Wall Design (RR4)
 dated April 2, 2024

1.0 Introduction

Paterson Group (Paterson) was commissioned by CRT Developments to conduct a geotechnical investigation for Block 324 of the proposed residential development to be located along 5725 Fernbank Road in the City of Ottawa (refer to Figure 1 – Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

- ☐ Determine the subsoil and groundwater conditions at this site by means of test pits.
- ☐ Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

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

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

2.0 Proposed Development

It is anticipated that Block 324 of the development will consist of townhouse residential dwellings with paved car parking areas and local driveways. It is further anticipated that the site will be serviced by future municipal services.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on January 27, 2025, and consisted of advancing a total of twenty (20) test pits to a maximum depth of 2.5 m below existing ground surface.

A previous investigation was undertaken by Paterson on January 26, 2021, and consisted of advancing a total of nine (9) test pits to a maximum depth of 2.2 m below existing ground surface. The test pit locations were distributed in a manner to provide general coverage of the subject site and taking into consideration underground utilities and site features. The test pit locations are shown on Drawing PG2236-5 – Test Hole Location Plan included in Appendix 2.

The test pits were completed using an excavator and backfilled with the excavated soil upon completion. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The test pit procedures consisted of excavating to the required depth at the selected location and sampling the overburden.

Sampling and In Situ Testing

Grab samples were collected from the test pits at selected intervals. The samples were initially classified on site, placed in sealed plastic bags and transported to our laboratory. The depths at which the grab samples were recovered from the test pits are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

The subsurface conditions observed in the test pits were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Sample Storage

All samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test pit locations were selected by Paterson to provide general coverage of the proposed development, taking into consideration the existing site features and underground utilities. The test pit locations and ground surface elevation at each test pit location were surveyed by Paterson using a handheld GPS and referenced to a geodetic datum.

The location of the test pits and ground surface elevation at each test pit location as well as the survey points along the fill pile are presented on Drawing PG2236-5 – Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was analyzed to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are discussed in Section 6.7 and shown in Appendix 1.

4.0 Observations

4.1 Surface Conditions

The subject site is currently undeveloped land that is relatively flat along the northern portion, and uneven across the southern portion. The ground surface across the site slopes down towards the north. Fill piles varying from 1 to 3 m in height are present throughout the southern portion of the site.

The site is bordered by Robert Grant Avenue to the east, similar undeveloped land to the south, a residential development to the west, and a property containing transmission towers to the north.

4.2 Subsurface Profile

Generally, the soil profile at the test hole locations consists of topsoil and/or fill overlying compact to dense glacial till and/or bedrock. The encountered glacial till layer consisted of brown silty sand to sandy silt with gravel, cobbles, and boulders. All test holes were terminated on the bedrock surface varying between 0.2 and 2.5 m below existing ground surface. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Bedrock

Based on available geological mapping, and refusal to excavation, the bedrock in the subject area consists of interbedded dolostone and limestone of the Gull River formation, with an overburden drift thickness of 0 to 5 m depth.

Reference can be made to Drawing PG2236-5A – Bedrock Contour Plan for the test hole locations and depth which bedrock had been encountered. It should be understood that the bedrock contours depicted on the aforementioned contour plan are based on linear interpolation between test holes where bedrock had been confirmed by Paterson and is limited to that information.

Actual site conditions and bedrock depths/elevation may vary beyond the test hole locations and as inferred by the depicted contour lines. Based on this, it is possible that the bedrock surface may vary within plus or minus 500 mm to 1 m at contour line locations and where the bedrock surface has not been discretely confirmed by a test hole.

4.3 Groundwater

Groundwater infiltration levels were recorded within the open holes. Based on our observations, the groundwater table is not present within the overburden soils.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is anticipated that the proposed buildings will be founded over conventional shallow footings placed over an undisturbed, compact glacial till or clean, bedrock bearing surface.

It is anticipated that bedrock removal will be required as part of the excavation operations for the proposed development.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Bedrock Removal

It is expected that line-drilling in conjunction with hoe-ramming and controlled blasting will be required to remove the bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

Prior to considering blasting operations, the effects of blasting on existing services, buildings, and other structures should be addressed. A pre-blasting or pre-construction survey of existing structures located in proximity blasting operations must be conducted before any activities commence on the site.

The extent of the survey should be determined by the blasting consultant and should be sufficient to address any inquiries or claims related to blasting operations.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is an experienced blasting consultant.

Vibration Considerations

Construction operations are the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: piling equipment, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of a shoring system with soldier piles or sheet piling will require these pieces of equipment. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). The guidelines are for current construction standards.

Considering that these guidelines are beyond human perceptible levels and, in some cases, could be very disturbing for certain individuals, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or after the construction of the proposed buildings.

Over-Excavation of Bedrock

Sedimentary bedrock, such as limestone, dolomite, and shale, contain bedding planes, joints, fractures, and mud seams which create natural planes of weakness within the rock mass. Although several factors of a blast can be controlled to reduce backbreak and overbreak, during blasting the rock mass tends to break along natural planes of weakness that may extend beyond the designed excavation profile. However, estimating the exact amount of backbreak and overbreak that may occur is not possible with conventional drilling and blasting construction methods.

It should be expected that overbreak might occur along the excavation perimeter with conventional drilling and blasting methods for bedrock excavation. Additionally, overbreak is expected throughout the lower blasting layers due to variable stratification planes and weakness planes in the bedrock substrate.

It is very difficult to mitigating significant overbreak given the constraints posed by the geometry and spacing of the foundations relative to the zone of influence of blast and the in-situ characteristics of the bedrock.

Depending on the methodology undertaken by the contractor, efforts to minimize backbreak and overbreak may significantly increase the time and cost of excavation operations and are not guaranteed to completely eliminate the potential for backbreak and overbreak. As such, volume estimates of bedrock to be removed may not be reflective of the actual volume of bedrock that may be required to be removed at the time of construction. This may result in additional materials, such as imported fill and concrete, to compensate for the loss of additional rock.

Where overbreak of the bedrock surface has occurred and the footings are to be placed on clean surface sounded bedrock, the foundation bearing surface should be reinstated with lean concrete from the bedrock surface to the underside of the footing.

It is recommended that blasting operations be planned and conducted under the supervision of a licensed professional engineer in blasting operations.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000.

If excavated rock is to be used as fill, it should be suitably fragmented to produce a well-graded material with a maximum particle size of 300 mm. This material should be used structurally only to build up the subgrade for pavements.

Where the fill is open-graded, a blinding layer of finer granular fill and/or a woven geotextile may be required to prevent adjacent finer materials from migrating into the voids, with associated loss of ground and settlements. This can be assessed at the time of construction.

5.3 Foundation Design

Bearing Resistance Values (Conventional Shallow Foundation)

Based on the subsurface profile encountered, it is anticipated that the proposed buildings will be founded on bedrock or loose to dense glacial till.

Bedrock Bearing Surface

Footings placed on a clean, surface sounded bedrock surface can be designed using a bearing resistance value at ultimate limits states (ULS) of **500 kPa**. A geotechnical factor of 0.5 was applied to the above noted bearing resistance value. A higher bearing capacity may be provided for the bedrock if additional testing consisting of coring the bedrock is completed.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Footings bearing on an acceptable bedrock bearing surface and designed for the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

Overburden Bearing Surface

Footings placed on an undisturbed, compact glacial till can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **250 kPa** incorporating a geotechnical factor of 0.5. Where soils are noted to be in a loose state of compaction, a proof-rolling program witnessed by Paterson personnel is recommended to be completed.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed, in the dry, prior to the placement of concrete footings.

Footings bearing on an undisturbed soil bearing surface and designed using the bearing resistance values provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the above noted overburden soils bearing media when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil of the same or higher capacity as that of the bearing medium. In unfractured bedrock, a plane with a slope of 1H:6V can be used.

Bedrock/Soil Transition

Where a building is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on soil bearing media to reduce the potential long term total and differential settlements. Also, at the soil/bedrock and bedrock/soil transitions, it is recommended that the upper 0.5 m of the bedrock be removed for a minimum length of 2 m (on the bedrock side) and replaced with nominally compacted OPSS Granular A or Granular B Type II material. The width of the sub-excavation should be at least the proposed footing width plus 0.5 m. Steel reinforcement, extending at least 3 m on both sides of the 2 m long transition, should be placed in the top part of the footings and foundation walls.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations constructed at the subject site. A higher site class, such as Class A or B may be provided for foundations placed on or near the bedrock surface. However, the higher site class will need to be confirmed by a site-specific seismic shear wave velocity test. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and deleterious fill within the footprint of the proposed buildings, the native soils or bedrock surface approved by Paterson will be considered an acceptable subgrade upon which to commence backfilling for floor slab construction.

Where existing fill or glacial till subgrade is encountered below the basement slab, provisions should be made to proof-rolling the soil subgrade using heavy vibratory compaction equipment prior to placing any fill. Any soft areas should be removed and backfilled with appropriate backfill material.

OPSS Granular B Types I or II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab (outside the zones of influence of the footings). It is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone.

5.6 Pavement Design

Car only parking and local residential roadways are expected at this site. The subgrade material will consist of native soil and fill. The proposed pavement structures are presented in Tables 1 and 2.

Table 1 – Recommended Pavement Structure – Car only parking	
Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	BASE – OPSS Granular A Crushed Stone
300	SUBBASE – OPSS Granular B Type II
Subgrade – Either fill, in-situ soil, or OPSS Granular B Type I or II material placed over in-situ soil or fill.	

Table 2 – Recommended Pavement Structure – Local Residential Roadways	
Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Wear Course – HL-8 or Superpave 19 Asphaltic Concrete
150	BASE – OPSS Granular A Crushed Stone
400	SUBBASE – OPSS Granular B Type II
Subgrade – Either fill, in-situ soil, or OPSS Granular B Type I or II material placed over in-situ soil or fill.	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material.

Minimum Performance Graded (PG) 64-28 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

The pavement granular (base and subbase) should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed buildings. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The clear stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Underfloor Drainage

Underfloor drainage may be required to control water infiltration for the lower basement area. For preliminary design purposes, we recommend that 150 mm diameter perforated PVC pipes be placed at every bay opening. The spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

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

Other exterior unheated footings, such as those for isolated exterior piers and retaining walls, are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations). Where space restrictions exist, or to reduce the trench width, the excavation can be carried out within the confines of a fully braced steel trench box.

Unsupported Side Slopes

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

In bedrock, almost vertical side slopes can be used provided that all loose rock and blocks with unfavourable weak planes are removed or stabilized.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

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

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

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 95% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the glacial till above the cover material if the excavation and filling operations are carried out in dry weather conditions. Any stones greater than 200 mm in their longest dimension should be removed from these materials prior to placement. Well fractured bedrock should be acceptable as backfill for the lower portion of the trenches when the excavation is within bedrock provided the rock fill is placed only from at least 300 mm above the top of the service pipe and that all stones are 300 mm or smaller in their longest dimension.

The backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

It is anticipated that groundwater infiltration into the excavation should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of the shallow excavation. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR).

A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

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

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderate to slightly aggressive corrosive environment.

6.8 Retaining Wall Design

Paterson Group Inc. (Paterson) completed a Redi-Rock retaining wall design for four proposed walls to be located along the Robert Grant Avenue and Fernbank Road property lines at the subject site. The Redi Rock retaining wall system has been designed for the subject site to consider site constraints and grading requirements. The walls have also been designed in accordance with the Canadian Highway and Bridge Design Code (CHBDC) 2019. Details of the retaining walls are presented below and are depicted in Drawing PG2236-6 Revision 3, PG2236-7 Revision 3, PG2236-8 Revision 3, and PG2236-9 Revision 4 attached.

This memorandum should be read in conjunction with the documentation listed below as part of our retaining wall designs:

- ☐ Paterson Group Report PG2236-1 dated January 14, 2011
- ☐ Paterson Group Report PG2236-2 Revision 2 dated July 23, 2014
- ☐ Paterson Group Report PG2236-3 Revision 1 dated April 3, 2022
- ☐ IBI Group - Project No. 126086, Phase 3 Grading Plan, dated June 22, 2023.

Based on our review, the exposed portions of the subject Redi Rock retaining wall vary in height between 0.46 to 2.3 m. The design and wall materials were selected to provide a minimum life span of 75 years.

The proposed privacy fence and noise barrier posts (designed by others) are recommended to be extended through the top three Redi Rock a minimum of 1.3 m. The post should have a maximum width of 140 mm to be inserted in the block openings. It is understood that privacy fencing will be installed along the entirety of each retaining wall with noise barriers at select locations to reduce sound from regular traffic. **Wind and snow/ice loads were considered as per CHBDC 2019 on noise barriers.** It should be noted that the fencing should be installed using galvanized steel to protect the railing/fencing system from long-term corrosion.

6.9 Global Stability Analysis

The global stability analysis was modeled using Fine by Geo 5, a computer program which permits a two-dimensional slope stability analysis calculating several methods including the Bishop's method, which is a widely accepted slope analysis method. The software further allows for the internal review of the design as per various codes including the CHBDC 2019. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to forces favoring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable.

However, due to intrinsic limitations of the calculation methods and the variability of the subsurface soil and groundwater conditions, a factor of safety greater than 1.0 is generally required for the failure risk to be considered acceptable.

A minimum factor of safety of 1.5 is generally recommended for conditions where the slope failure would comprise permanent structures. An analysis considering seismic loading was also completed. A horizontal acceleration of 0.127 g was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The retaining wall section was reviewed using the design loading according to CHBDC 2015.

The highest retaining wall cross-section was studied as the worst-case scenario. The following parameters presented in Table 3 below were used for the slope stability analysis under static and seismic conditions:

Table 3 – Effective Soil Parameters for Stability Analysis			
Soil Layer	Unit Weight (kN/m³)	Friction Angle (degrees)	Cohesion (kPa)
Glacial Till	21	35	0
Bedrock	24	40	500
Granular B Type II & Native Fill	21	38	0

The total strength parameters for seismic analysis were chosen based on our general knowledge of the geology in the area. The strength parameters used for seismic analysis at the slope cross-section are presented in Table 4 below.

Table 4 – Total Strength Soil Parameters for Seismic Analysis			
Soil Layer	Unit Weight (kN/m³)	Friction Angle (degrees)	Cohesion (kPa)
Glacial Till	21	35	0
Bedrock	24	40	500
Granular B Type II & Native Fill	21	38	0

Backfill Material

The retaining wall should be backfilled with free-draining granular backfill materials and incorporate longitudinal drains and weeper holes to provide positive drainage for the backfill. For the purpose of this report, it is recommended that the wall is backfilled with either OPSS Granular B Type II or Granular A materials.

The backfill should be placed within a wedge-shaped zone defined by a line drawn up and back from the back edge of the base block of the wall at an inclination of 1H:1V or a minimum of 1 m behind the back of the blocks. All material should be compacted to a minimum of 98% of the material's SPMDD.

Lateral Earth Pressures

It is recommended that a minimum of 1 m of the backfill material consist of clean imported engineered crushed stone such as OPSS Granular A or Granular B Type II. The soil parameters presented in Table 5 should be used for the design of the retaining wall.

Table 5 – Geotechnical Parameters for backfill material							
Material Description	Unit Weight (kN/m ³)		Friction Angle (°) ϕ'	Friction Factor, $\tan \delta$	Earth Pressure Coefficients		
	Drained γ_{dr}	Effective γ'			Active K_a	At-Rest K_o	Passive K_p
OPSS Granular A (Crushed Stone)	22	13.5	38	0.6	0.24	0.38	4.2
OPSS Granular B Type II (Crushed Stone)	22	14	38	0.6	0.24	0.38	4.2
Notes: - Properties for fill materials are for condition of 98% of standard Proctor maximum dry density. - The earth pressure coefficients provided are for horizontal backfill profile. - For soil above the groundwater level the “drained” unit weight should be used and below groundwater level the “effective” unit weight should be used.							

Drainage

A 100 mm diameter perforated drainage pipe wrapped in geotextile such as Terrafix 270R or equivalent approved other, surrounded on all sides by 150 mm of clear crushed stone, and should be installed at the heel of the bottom block. The drainage system should have a positive outlet to a nearby catch basin or an existing ditch.

It is recommended that the outlets be spaced evenly along the retaining wall with a minimum spacing of 30 m center to center passing through the wall or connected to a nearby catch basin.

Analysis Results

The factor of safety for the retaining wall section was greater than 1.5 for static conditions. Similarly, the results under seismic loading yielded a factor of safety for this section greater than 1.1.

The internal and structural compound analysis including the bearing capacity, overturning resistance, and sliding resistance of the retaining wall units as per various loading conditions described in the CHBDC 2019. All analysis were found to be acceptable; the worst-case scenario is presented in attached calculation sheets.

Based on these results, the retaining wall design is considered suitable from a geotechnical perspective.

6.10 Retaining Wall Vehicle Barrier Addition

Vehicle Barrier Design

Based on the CHBDC 2019, a minimum height of 825 mm is required for vehicle barriers for any given roadway. In addition, based on the expected transverse, Longitudinal and vertical loads as well as the maximum allowable speed within these roadways, a minimum barrier size of 3.5 m³ is required to resist the expected vehicle impacts. This translates into a minimum barrier size of 1 m (H) x 1.5 m (L) x 2.4 m (D). However, due to the space constraints, the code allows to split the blocks within a 4 m stretch provided that the smaller blocks be spaced no greater than 600 mm edge to edge. This results in a minimum block size of 1 m (H) x 1.5 m (L) x 1.2 m (D). All vehicle barriers must be free of any significant cracking greater in length than 300 mm or depth than 50 mm. Any vehicle barrier should be reviewed and approved by Paterson prior to importing to site.

The proposed vehicle barriers are recommended to be placed along the top of the granular backfill material of the retaining walls with a minimum offset of 300 mm from the back of the top retaining wall block. It is understood that vehicle barriers will be installed along the entirety of each retaining wall where a roadway is located adjacent to the retaining wall.

Furthermore, the vehicle barrier must be embedded by a minimum of 150 mm below finished grade on the granular backfill of the retaining walls. This will leave an exposed barrier face of 850 mm to resist any vehicle impact. Reference should be made to Figure- 1 attached to this memorandum for block size, spacing and specification. Additional recommendations are discussed in the section below.

Geotechnical Considerations

Block Types

As mentioned above, the blocks must be selected from a quarry where limestone or armour stone blocks are in a good shape. The stone should be free of significant cracking and must be handled with care during hauling to prevent splitting of the blocks. Paterson should accompany the contractor to the blocks source to review the barriers prior to hauling the material to site.

Subgrade Material

The barriers should be placed over the wall's granular backfill material. Upon exposing the backfill material, where the extent of the backfill material does not cover the entire barrier bearing medium, additional granular material should be placed. A minimum 300 mm thick layer of Granular A or Granular B Type II should be placed in 300 mm thick loose lifts and compacted to a minimum 98% of the material's SPMDD.

Testing and Inspections

It is recommended that the following be completed once the retaining wall design and construction program are determined:

- ☐ Observation of all bearing surfaces prior to backfill.
- ☐ Observation of the drainage system prior to placement of the sub-base.
- ☐ Field density tests to ensure the specified level of compaction was achieved.
- ☐ Periodic observation of the vehicle barrier installation.

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

It is recommended that Paterson be present at the time of the placement of the barrier block.

7.0 Recommendations

It is recommended that the following be carried out by Paterson once preliminary and future details of the proposed development have been prepared:

- ☐ Review preliminary and detailed grading, servicing, and structural plan(s) from a geotechnical perspective.
- ☐ Review of the geotechnical aspects of the excavation contractor's shoring design, prior to construction, if applicable.

It is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

- ☐ Review and inspection of the installation of the foundation drainage systems.
- ☐ Observation of all bearing surfaces prior to the placement of concrete.
- ☐ Sampling and testing of the concrete and fill materials.
- ☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ☐ Observation of all subgrades prior to backfilling and follow-up field density tests to determine the level of compaction achieved.
- ☐ Field density tests to determine the level of compaction achieved.
- ☐ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

All excess soil must be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

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

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than CRT Developments or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.



Owen R. Canton, B.Eng.



David J. Gilbert, P.Eng.

Report Distribution:

- ☐ CRT Developments
- ☐ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TEST RESULTS

COORD. SYS.: MTM ZONE 9 **EASTING:** 352328.68 **NORTHING:** 5014757.39 **ELEVATION:** 108.56

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:
DATE: January 27, 2025

HOLE NO. : TP 1-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							20	40	60	80		
PL (%)	WATER CONTENT (%)		LL (%)									
20	40	60	80									
GROUND SURFACE		0										
FILL: Brown silty sand, with gravel and crushed stone, trace debris												108
0.90m [107.66m]												
End of Test Pit		1										
Test pit terminated on bedrock surface												107
		2										106
		3										105
		4										104
		5										

COORD. SYS.: MTM ZONE 9 **EASTING:** 352333.16 **NORTHING:** 5014778.22 **ELEVATION:** 107.55

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:
DATE: January 27, 2025

HOLE NO. : TP 2-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							PL (%)	WATER CONTENT (%)		LL (%)		
					20	40	60	80				
GROUND SURFACE		0										
FILL: Brown silty sand, with gravel, crushed stone and cobbles		0										
0.50m [107.05m]				G 1							107	
End of Test Pit												
Test pit terminated on bedrock surface												
		1										

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COORD. SYS.: MTM ZONE 9	EASTING: 352338.96	NORTHING: 5014803.97	ELEVATION: 107.60
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PROJECT: Proposed Residential Development	FILE NO. : PG2236
BORINGS BY: Excavator	
REMARKS:	HOLE NO. : TP 3-25
DATE: January 27, 2025	

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20 40 60 80					
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
				20 40 60 80				PL (%) WATER CONTENT (%) LL (%)				
				20 40 60 80								
GROUND SURFACE												
FILL: Brown silty clay, with sand, gravel and crushed stone, trace cobbles		0	G 1									107
0.90m [106.70m]												
GLACIAL TILL: Brown sandy silt, trace gravel and cobbles		1										
1.40m [106.20m]												
End of Test Pit												106
Test pit terminated on bedrock surface												
		2										105
		3										104
		4										103
		5										

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COORD. SYS.: MTM ZONE 9 EASTING: 352361.44 NORTHING: 5014795.93 ELEVATION: 107.26

PROJECT: Proposed Residential Development

FILE NO. : **PG2236**

BORINGS BY: Excavator

REMARKS:

DATE: January 27, 2025

HOLE NO. : **TP 4-25**

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							PL (%)	WATER CONTENT (%)		LL (%)		
					20	40	60	80				
GROUND SURFACE		0										
FILL: Brown silty sand, with gravel and crushed stone, trace cobbles												
0.40m [106.86m]				G 1							107	
End of Test Pit												
Test pit terminated on bedrock surface												
		1										

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COORD. SYS.: MTM ZONE 9 **EASTING:** 352385.68 **NORTHING:** 5014794.44 **ELEVATION:** 107.36

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:

DATE: January 27, 2025

HOLE NO. : TP 5-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							20	40	60	80		
PL (%)		WATER CONTENT (%)		LL (%)								
20	40	60	80									
GROUND SURFACE		0										
FILL: Brown silty sand, with gravel and crushed stone												
0.20m [107.16m]											107	
End of Test Pit												
Test pit terminated on bedrock surface												
		1										
											106	
		2										
											105	
		3										
											104	
		4										
											103	
		5										

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COORD. SYS.: MTM ZONE 9 EASTING: 352357.08 NORTHING: 5014830.00 ELEVATION: 106.25

PROJECT: Proposed Residential Development

FILE NO. : **PG2236**

BORINGS BY: Excavator

REMARKS:

DATE: January 27, 2025

HOLE NO. : **TP 6-25**

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							PL (%)	WATER CONTENT (%)		LL (%)		
					20	40	60	80				
GROUND SURFACE		0										
FILL: Brown silty sand, with topsoil, trace crushed stone				G 1							106	
0.50m [105.75m]												
End of Test Pit												
Test pit terminated on bedrock surface												
		1									105	

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COORD. SYS.: MTM ZONE 9	EASTING: 352362.07	NORTHING: 5014854.81	ELEVATION: 105.89
PROJECT: Proposed Residential Development			FILE NO. : PG2236
BORINGS BY: Excavator			HOLE NO. : TP 7-25
REMARKS:			DATE: January 27, 2025

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
PL (%)	WATER CONTENT (%)		LL (%)									
20	40	60	80									
GROUND SURFACE		0										
FILL: Brown silty sand, trace gravel, crushed stone, cobbles and wood												
0.90m [104.99m]												
End of Test Pit		1									105	
Test pit terminated on bedrock surface												
		2									104	
		3									103	
		4									102	
		5									101	



Geotechnical Investigation

Block 324 - 5725 Fernbank Road, Ottawa, Ontario

ELEVATION: 105.51

FILE NO. : PG2236

HOLE NO.: TP 8-25

DATE: January 27, 2025

GROUND SURFACE

0.30m [105.21m]

105—

1.90m [103.61m]

104—

103—

102—

101—

PAGE: 1 / 1



Geotechnical Investigation

Block 324 - 5725 Fernbank Road, Ottawa, Ontario

ELEVATION: 105.96

FILE NO. : PG2236

HOLE NO.: TP 9-25

DATE: January 27, 2025

[illegible]

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PAGE: 1 / 1

COORD. SYS.: MTM ZONE 9 **EASTING:** 352315.23 **NORTHING:** 5014808.37 **ELEVATION:** 106.17

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:
DATE: January 27, 2025

HOLE NO. : TP10-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							20	40	60	80		
PL (%)	WATER CONTENT (%)		LL (%)									
20	40	60	80									
GROUND SURFACE		0										106
FILL: Brown sandy silt, trace gravel and cobbles												
0.80m [105.37m]												
End of Test Pit		1										105
Test pit terminated on bedrock surface												
		2										104
		3										103
		4										102
		5										

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COORD. SYS.: MTM ZONE 9 **EASTING:** 352297.48 **NORTHING:** 5014835.92 **ELEVATION:** 105.79

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:

DATE: January 27, 2025

HOLE NO. : TP12-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
						PL (%)	WATER CONTENT (%)		LL (%)			
							20	40	60	80		
GROUND SURFACE		0										
GLACIAL TILL: Brown sandy silt, trace gravel and cobbles		1	G 1									105
1.30m [104.49m]												
End of Test Pit		2										104
Test pit terminated on bedrock surface		3										103
		4										102
		5										101

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COORD. SYS.: MTM ZONE 9 **EASTING:** 352286.02 **NORTHING:** 5014866.08 **ELEVATION:** 105.14

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:
DATE: January 27, 2025

HOLE NO. : TP13-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							20	40	60	80		
PL (%)	WATER CONTENT (%)		LL (%)									
20	40	60	80									
GROUND SURFACE		0										105
FILL: Brown silty sand, trace gravel, crushed stone and wood												
0.40m [104.74m]												
GLACIAL TILL: Brown silty sand, trace gravel and cobbles												
		1										104
			G 1									
1.50m [103.64m]												
End of Test Pit												
Test pit terminated on bedrock surface		2										103
		3										102
		4										101
		5										

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COORD. SYS.: MTM ZONE 9	EASTING: 352266.04	NORTHING: 5014878.15	ELEVATION: 104.55
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PROJECT: Proposed Residential Development	FILE NO. : PG2236
BORINGS BY: Excavator	
REMARKS:	HOLE NO. : TP14-25
DATE: January 27, 2025	

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
						PL (%)	WATER CONTENT (%)	LL (%)				
						20	40	60	80			
GROUND SURFACE		0										
FILL: Brown silty sand, trace gravel, crushed stone and wood		0.40m [104.15m]										
GLACIAL TILL: Brown silty sand, trace gravel and cobbles		1.50m [103.05m]										
End of Test Pit												
Test pit terminated on bedrock surface												
		2										
		3										
		4										
		5										

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Geotechnical Investigation

Block 324 - 5725 Fernbank Road, Ottawa, Ontario

ELEVATION: 103.80

FILE NO. : PG2236

HOLE NO.: TP15-25

DATE: January 27, 2025

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COORD. SYS.: MTM ZONE 9 **EASTING:** 352284.06 **NORTHING:** 5014914.88 **ELEVATION:** 103.76

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:
DATE: January 27, 2025

HOLE NO. : TP16-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							20	40	60	80		
PL (%)	WATER CONTENT (%)		LL (%)									
20	40	60	80									
GROUND SURFACE		0										
FILL: Brown silty sand, trace gravel and crushed stone		0.30m [103.46m]										
GLACIAL TILL: Brown silty sand, trace gravel and cobbles											103	
		1										
				G 1								
											102	
1.80m [101.96m]												
End of Test Pit		2										
Test pit terminated on bedrock surface											101	
		3										
											100	
		4										
											99	
		5										

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COORD. SYS.: MTM ZONE 9 **EASTING:** 352287.99 **NORTHING:** 5014945.68 **ELEVATION:** 103.32

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:

DATE: January 27, 2025

HOLE NO. : TP17-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
				20	40	60	80					
				PL (%)	WATER CONTENT (%)		LL (%)					
				20	40	60	80					
GROUND SURFACE		0										
TOPSOIL												
0.30m [103.02m]												
GLACIAL TILL: Brown silty sand, trace gravel and cobbles											103	
								</				

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COORD. SYS.: MTM ZONE 9 **EASTING:** 352327.64 **NORTHING:** 5014908.30 **ELEVATION:** 104.16

PROJECT: Proposed Residential Development

FILE NO. : PG2236

BORINGS BY: Excavator

REMARKS:

DATE: January 27, 2025

HOLE NO. : TP18-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE				■ PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE)				PIEZOMETER CONSTRUCTION	ELEVATION (m)
			TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	20	40	60	80		
							△ REMOULDED SHEAR STRENGTH, Cur (kPa)					
							▲ PEAK SHEAR STRENGTH, Cu (kPa)					
							20	40	60	80		
PL (%)	WATER CONTENT (%)		LL (%)									
20	40	60	80									
GROUND SURFACE												
FILL: Brown silty sand, trace topsoil, gravel and crushed stone		0										
0.30m [103.86m]												
GLACIAL TILL: Brown silty sand, trace gravel and cobbles												
1.10m [103.06m]												
GLACIAL TILL: Brown sandy silt, trace clay, gravel and cobbles												
1.60m [102.56m]												
End of Test Pit												
Test pit terminated on bedrock surface												
		2										

DISCLAIMER: THE DATA PRESENTED IN THIS LOG IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHO IT WAS PRODUCED. THIS LOG SHOULD BE READ IN CONJUNCTION WITH ITS COORESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.



Geotechnical Investigation

Block 324 - 5725 Fernbank Road, Ottawa, Ontario

ELEVATION: 104.78

FILE NO. : PG2236

HOLE NO.: TP19-25

DATE: January 27, 2025

DISCLAIMER: THE DATA PRESENTED IN THIS LOG IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHO IT WAS PRODUCED. THIS LOG SHOULD BE READ IN CONJUNCTION WITH ITS COORESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.



ELEVATION: 105.72

FILE NO. : PG2236

DATE: January 27, 2025

HOLE NO. : TP20-25

REMARKS:

PAGE: 1 / 1

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Westwood
Block 324 - 5725 Fernbank Road - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE 2021 January 26

FILE NO.

PG2236

HOLE NO.

TP 1-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone				Piezometer Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			○ Water Content %					
								20	40	60	80		
GROUND SURFACE						0	105.69						
FILL: Brown silty clay some organics		G	1										
0.80		G	2										
TOPSOIL						1	104.69						
1.00													
GLACIAL TILL: Comapct brown silty sand to sandy silt, trace clay, gravel, cobbles and boulders		G	3										
2.20						2	103.69						
End of Test Pit													
Excavation refusal on bedrock surface at 2.20 m depth													
(TP dry upon completion)													

DATUM	Geodetic
-------	----------

FILE NO. PG2236

REMARKS

HOLE NO. TP 2-21

BORINGS BY Excavator

DATE 2021 January 26

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone				Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD			○ Water Content %				
								20	40	60	80	
GROUND SURFACE						0	103.55					
FILL: Brown silty sand, trace clay and organics												
----- 0.30 -----												
GLACIAL TILL: Compact to dense brown silty sand to sandy silt with gravel, cobbles and boulders trace clay	G	1										
	G	2				1	102.55					
----- 1.80 -----												
End of Test Pit												
Excavation refusal on bedrock surface at 1.80 m depth												
(TP dry upon completion)												

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Westwood
Block 324 - 5725 Fernbank Road - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE 2021 January 26

FILE NO.

PG2236

HOLE NO.

TP 3-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone				Piezometer Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			○ Water Content %				
								20	40	60	80	
GROUND SURFACE												
TOPSOIL						0	103.32					
0.30		G	1									
GLACIAL TILL: Compact to dense silty sand with clay, some gravel and cobbles												
		G	2			1	102.32					
1.60		G	3									
GLACIAL TILL: Compact brown silty sand with gravel, cobbles and boulders												
						2	101.32					
2.20												
End of Test Pit												
Excavation refusal on bedrock surface at 2.20 m depth												
(TP dry upon completion)												

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Westwood
Block 324 - 5725 Fernbank Road - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE 2021 January 26

FILE NO.

PG2236

HOLE NO.

TP 4-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone				Piezometer Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			○ Water Content %					
								20	40	60	80		
GROUND SURFACE						0	104.42						
TOPSOIL		G	1										
0.50													
GLACIAL TILL: Loose to compact brown sandy silt with gravel, cobbles and boulders, trace clay		G	2			1	103.42						
1.70													
End of Test Pit													
Excavation refusal on bedrock surface at 1.70 m depth													
(TP dry upon completion)													
							</						

SOIL PROFILE AND TEST DATA

DATUM	Geodetic
-------	----------

REMARKS

BORINGS BY Excavator

FILE NO.

PG2236

HOLE NO.

TP 5-21

DATE 2021 January 26

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone				Piezometer Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			○ Water Content %				
								20	40	60	80	
GROUND SURFACE						0	104.91					
TOPSOIL												
0.30		G	1									
GLACIAL TILL: Compact brown sandy silt with gravel, cobbles, boulders, trace clay												
		G	2			1	103.91					
		G	3									
2.10						2	102.91					
End of Test Pit												
Excavation refusal on bedrock surface at 2.10 m depth												
(TP dry upon completion)												

20406080100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

**Geotechnical Investigation
Proposed Residential Development - Westwood
Block 324 - 5725 Fernbank Road - Ottawa, Ontario**

FILE NO. PG2236

HOLE NO. TP 6-21

DATE 2021 January 26

[illegible]

[illegible]

SOIL PROFILE AND TEST DATA

**Geotechnical Investigation
Proposed Residential Development - Westwood
Block 324 - 5725 Fernbank Road - Ottawa, Ontario**

FILE NO. PG2236

HOLE NO. **TP 8-21**

DATE 2021 January 26

[illegible]

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Westwood
Block 324 - 5725 Fernbank Road - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE 2021 January 26

FILE NO.

PG2236

HOLE NO.

TP 9-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone				Piezometer Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			○ Water Content %					
								20	40	60	80		
GROUND SURFACE						0	107.36						
TOPSOIL													
	0.50	G	1										
FILL: Loose brown sandy silt with rootlets, crushed stone and trace clay													

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D_{30})^2 / (D_{10} \times D_{60})$
Cu	-	Uniformity coefficient = D_{60} / D_{10}

Cc and Cu are used to assess the grading of sands and gravels:

Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$

Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$

Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.

Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

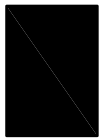
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidation ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

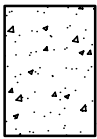
k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during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

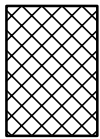
STRATA PLOT



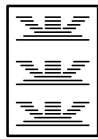
Topsoil



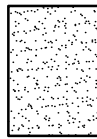
Asphalt



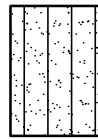
Fill



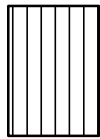
Peat



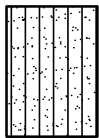
Sand



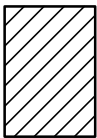
Silty Sand



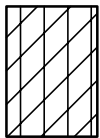
Silt



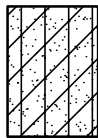
Sandy Silt



Clay



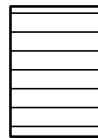
Silty Clay



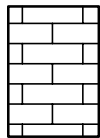
Clayey Silty Sand



Glacial Till



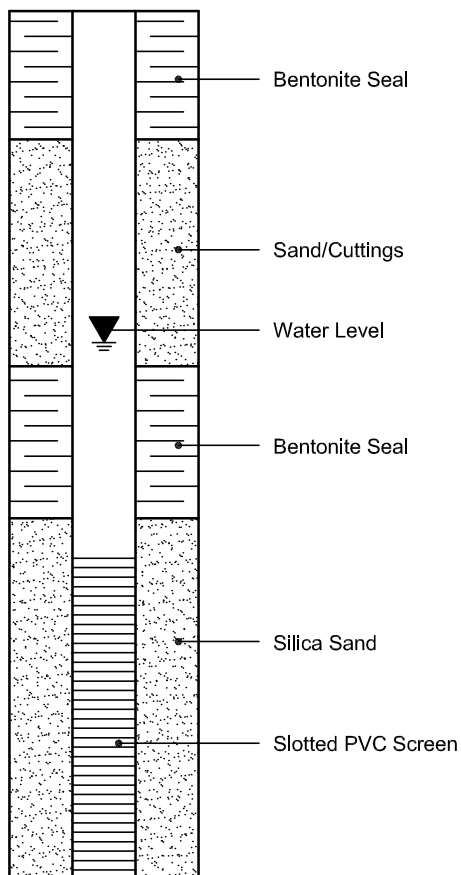
Shale



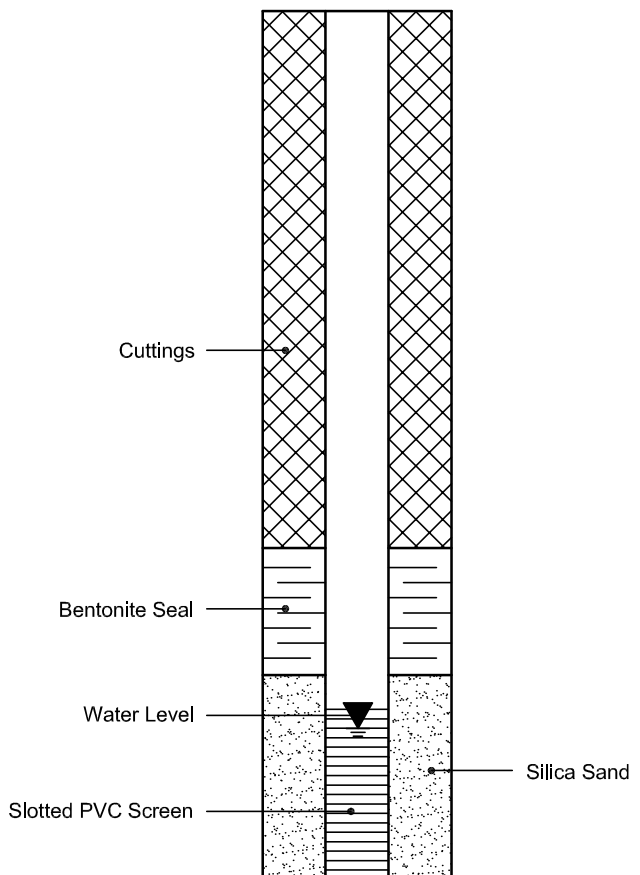
Bedrock

MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Report Date: 01-Feb-2021

Client: Paterson Group Consulting Engineers

Order Date: 26-Jan-2021

Client PO: 31198

Project Description: PG2236

Client ID:	TP2-G2	-	-	-
Sample Date:	26-Jan-21 09:00	-	-	-
Sample ID:	2105197-01	-	-	-
MDL/Units	Soil	-	-	-

Physical Characteristics

% Solids	0.1 % by Wt.	91.2	-	-	-
----------	--------------	------	---	---	---

General Inorganics

pH	0.05 pH Units	7.72	-	-	-
Resistivity	0.10 Ohm.m	87.8	-	-	-

Anions

Chloride	5 ug/g dry	<5	-	-	-
Sulphate	5 ug/g dry	10	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

FIGURE 2 – BARRIER BLOCK SPECIFICATIONS

DRAWING PG2236-5 – TEST HOLE LOCATION PLAN

DRAWING PG2236-5A – BEDROCK CONTOUR PLAN

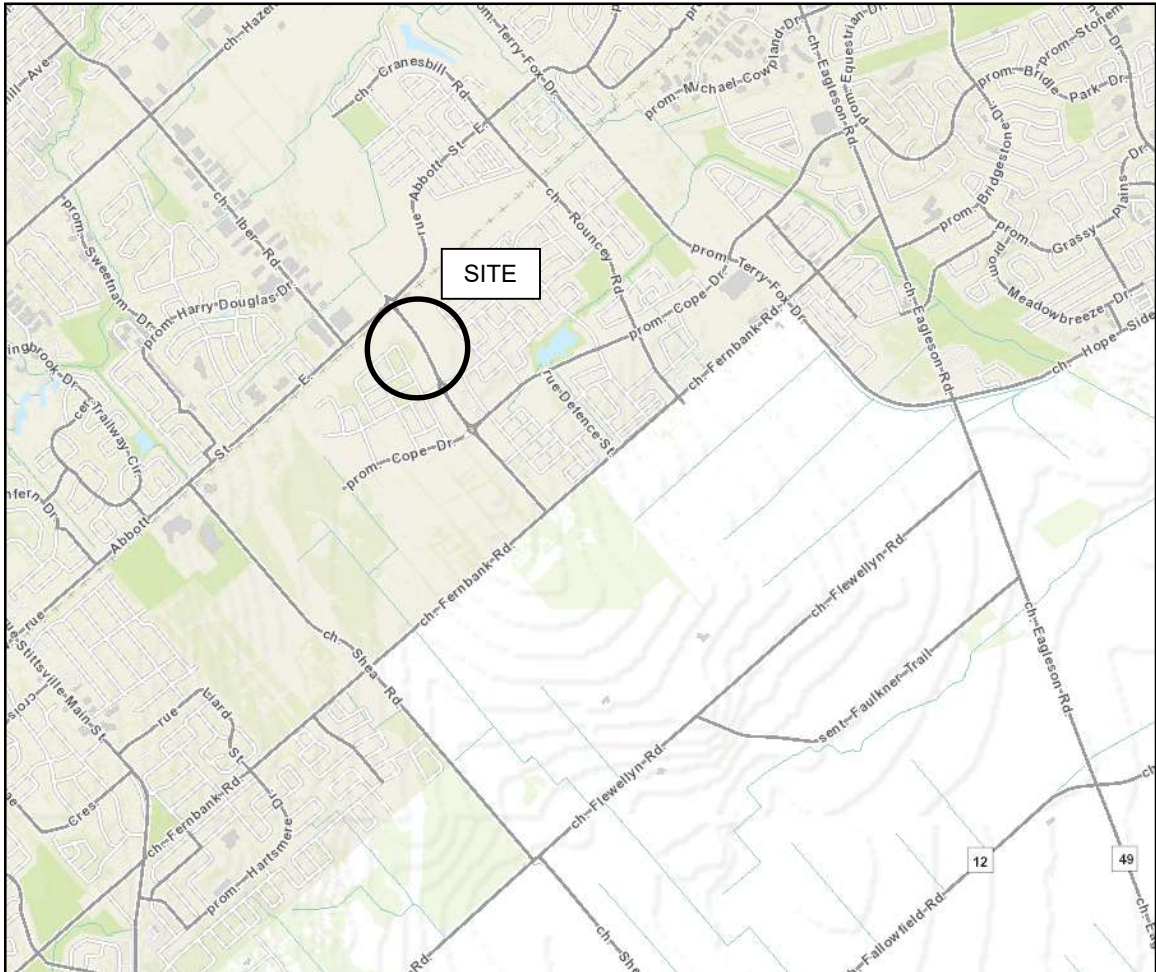


FIGURE 1

KEY PLAN



**PATERSON
GROUP**

Geotechnical Review

Job No.: PG5451

CRT Phase 3, Fernbank Road, Ottawa

Date: December 8, 2023

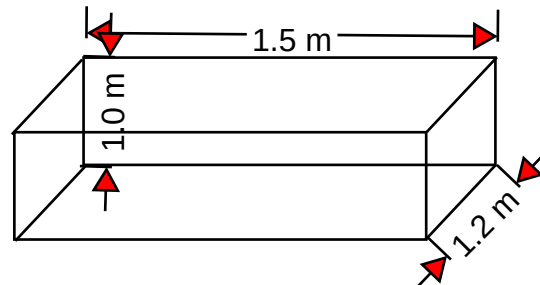
Figure 2-Barrier Block Specifications

Dwn: PB

Drawing is not to scale

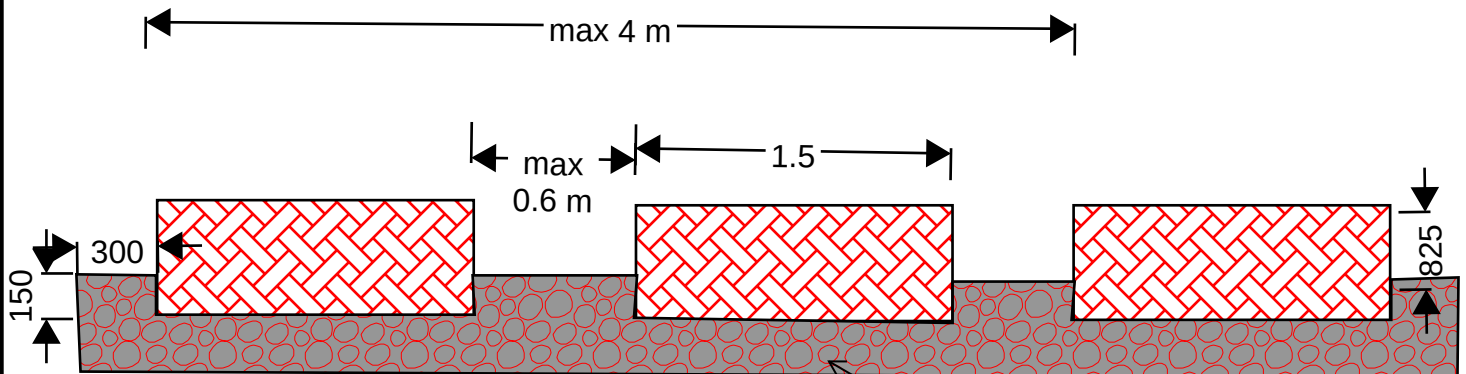
Page: 1 of 1

Block Size (NTS)

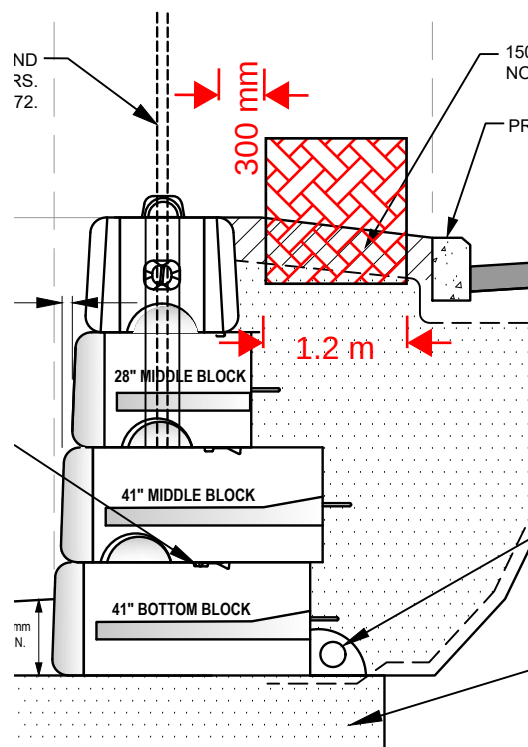


- All blocks must be free of significant cracking.
- Blocks should be handled with care to avoid splitting the blocks while handling

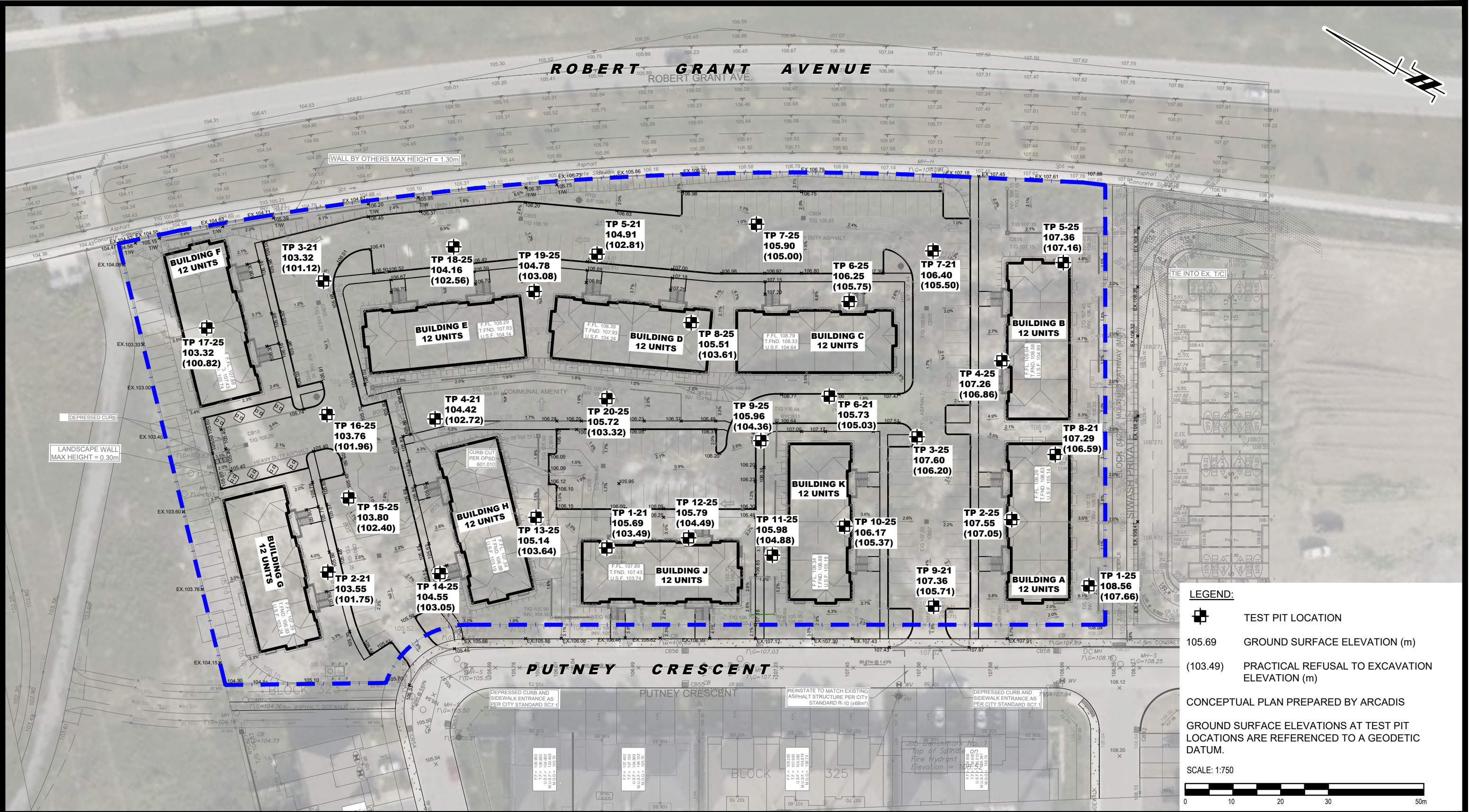
Profile View



Cross Section



Granular B Type II or Granular A minimum 300 mm around side of boulders and minimum 200 mm base





9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

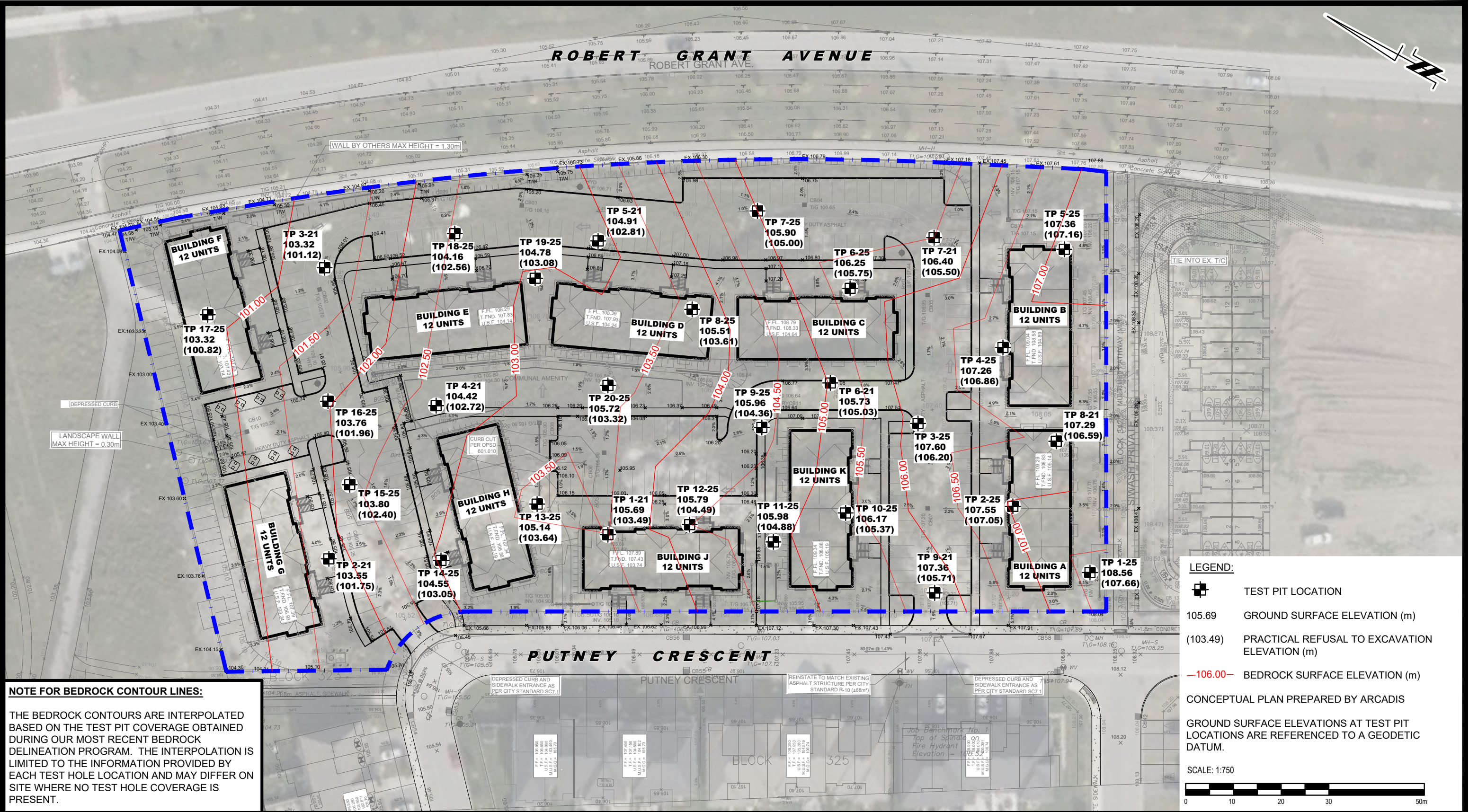
3	UPDATED TO NEW CONCEPTUAL PLAN	18/06/2026	OC
2	ADDED 2025 TEST PITS TO DRWAING	28/01/2025	KB
1	LATEST CONCEPTUAL PLAN ADDED TO DRAWING	22/03/2022	MS
NO.	REVISIONS	DD/MM/YYYY	INITIAL

OTTAWA,
Title:

CRT DEVELOPMENTS INC.
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
WESTWOOD - BLOCK 324 - 5725 FERNBANK ROAD
TEST HOLE LOCATION PLAN

ONTARIO

Scale:	1:750	Date:	01/2021
Drawn by:	YA	Report No.:	PG2236-3
Checked by:	MS	Dwg. No.:	PG2236-5
Approved by:	DJG	Revision No.:	3



NOTE FOR BEDROCK CONTOUR LINES:

THE BEDROCK CONTOURS ARE INTERPOLATED BASED ON THE TEST PIT COVERAGE OBTAINED DURING OUR MOST RECENT BEDROCK DELINEATION PROGRAM. THE INTERPOLATION IS LIMITED TO THE INFORMATION PROVIDED BY EACH TEST HOLE LOCATION AND MAY DIFFER ON SITE WHERE NO TEST HOLE COVERAGE IS PRESENT.

LEGEND:

- TEST PIT LOCATION
- 105.69 GROUND SURFACE ELEVATION (m)
- (103.49) PRACTICAL REFUSAL TO EXCAVATION ELEVATION (m)
- 106.00- BEDROCK SURFACE ELEVATION (m)

CONCEPTUAL PLAN PREPARED BY ARCADIS

GROUND SURFACE ELEVATIONS AT TEST PIT LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:750



NO.	REVISIONS	DD/MM/YYYY	INITIAL
1	UPDATED TO NEW CONCEPTUAL PLAN	18/06/2026	OC

OTTAWA, Title:		ONTARIO	
CRT DEVELOPMENTS INC.		Date: 03/2025	
GEOTECHNICAL INVESTIGATION		Report No.: PG2236-3	
PROPOSED RESIDENTIAL DEVELOPMENT		Dwg. No.: PG2236-5A	
WESTWOOD - BLOCK 324 - 5725 FERNBANK ROAD		Revision No.: 1	
BEDROCK CONTOUR PLAN		Checked by: KB	
		Approved by: DJG	

APPENDIX 3

GLOBAL STABILITY AND INTERNAL COMPOUND STABILITY ANALYSIS

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

Canadian Highway and Bridge Design Code

Stability analysis

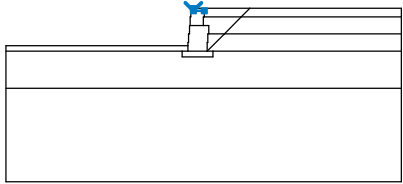
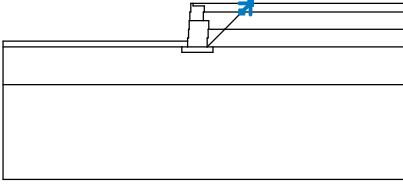
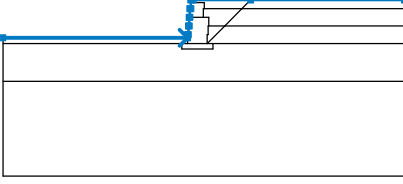
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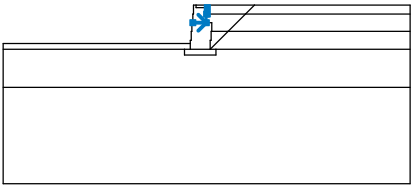
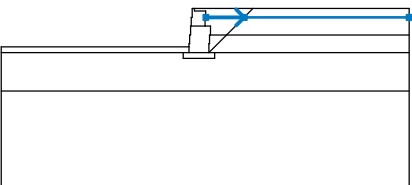
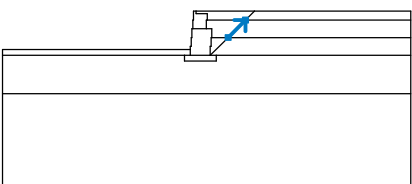
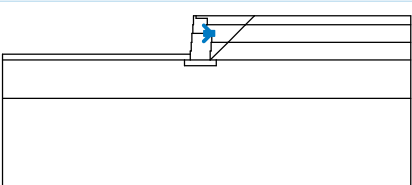
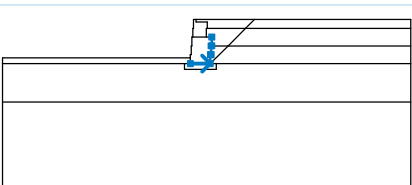
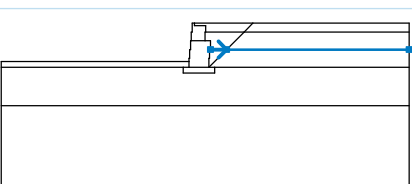
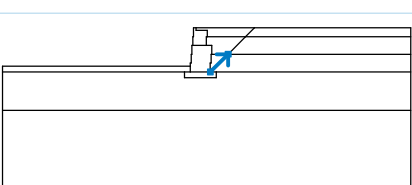
Earthquake analysis : Standard

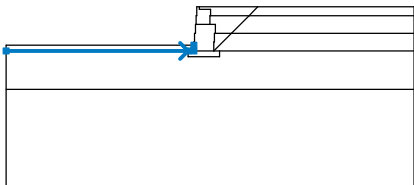
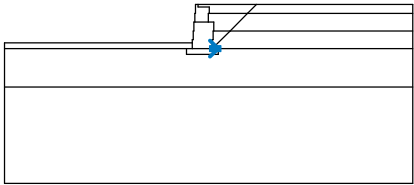
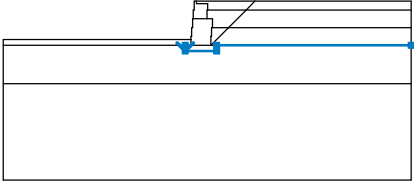
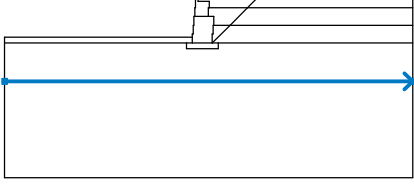
Load factors				
Design situation - Service I				
		Minimum	Maximum	
Earth surcharge load (permanent) :	ES =	1.00 [-]	1.00	[-]
Live load surcharge :	LL =	0.00 [-]	1.00	[-]

Resistance factors				
Design situation - Service I				
Resistance factor on stability :	φ_{SS} =	0.65	[-]	

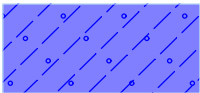
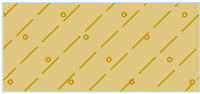
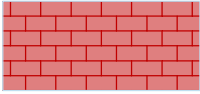
Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.13	0.58	-0.13
2		2.56	-0.46	3.02	0.00		
3		-10.00	-1.99	-0.29	-1.99	-0.29	-1.83
		-0.25	-1.83	-0.25	-1.37	-0.21	-1.37
		-0.21	-0.91	-0.17	-0.91	-0.17	-0.46
		-0.13	-0.46	-0.13	0.00	0.00	0.00
		3.02	0.00	11.10	0.00		

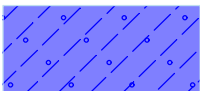
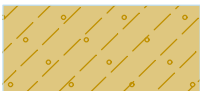
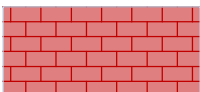
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
4		-0.17	-0.91	0.54	-0.91	0.54	-0.46
		0.58	-0.46	0.58	-0.13		
5		0.58	-0.46	2.56	-0.46	11.10	-0.46
6		1.66	-1.37	2.56	-0.46		
7		0.54	-0.91	0.82	-0.91		
8		-0.29	-2.29	0.74	-2.29	0.74	-1.83
		0.78	-1.83	0.78	-1.37	0.82	-1.37
		0.82	-0.91				
9		0.82	-1.37	1.66	-1.37	11.10	-1.37
10		0.74	-2.29	1.66	-1.37		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
11		-10.00	-2.29	-0.59	-2.29	-0.29	-2.29
		-0.29	-1.99				
12		0.74	-2.29	1.04	-2.29		
13		-0.59	-2.29	-0.59	-2.59	1.04	-2.59
		1.04	-2.29	11.10	-2.29		
14		-10.00	-4.28	11.10	-4.28		

Soil parameters - effective stress state

No.	Name	Pattern	ϕ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]
1	Granular B Type II		38.00	0.00	22.00
2	Glacial Till		30.00	0.00	21.00
3	Native Fill		30.00	0.00	22.00
4	Bedrock		40.00	500.00	24.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m ³]	γ_s [kN/m ³]	n [-]
1	Granular B Type II		22.00		
2	Glacial Till		21.00		
3	Native Fill		22.00		
4	Bedrock		24.00		

Soil parameters

Granular B Type II

Unit weight : $\gamma = 22.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 38.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 22.00 \text{ kN/m}^3$

Glacial Till

Unit weight : $\gamma = 21.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 30.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 21.00 \text{ kN/m}^3$

Native Fill

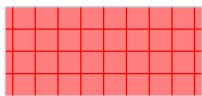
Unit weight : $\gamma = 22.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 30.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 22.00 \text{ kN/m}^3$

Bedrock

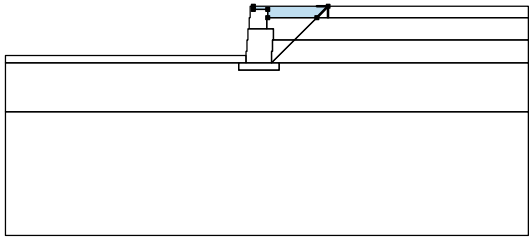
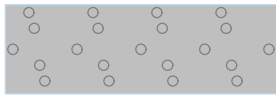
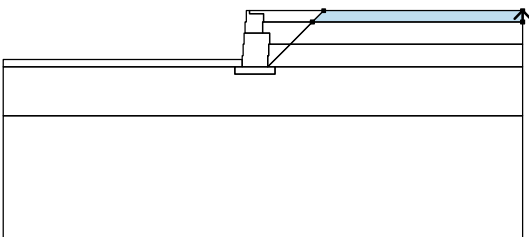
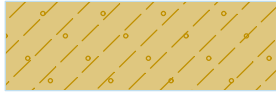
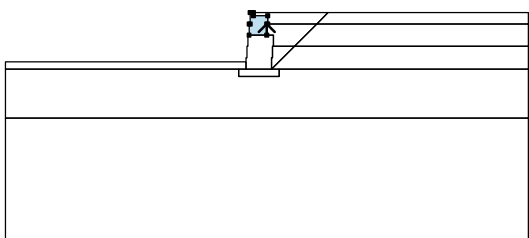
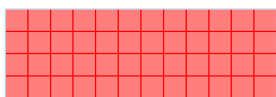
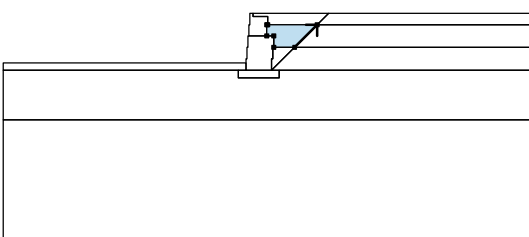
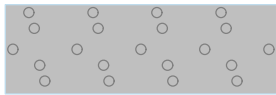
Unit weight : $\gamma = 24.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 40.00^\circ$
 Cohesion of soil : $c_{ef} = 500.00 \text{ kPa}$

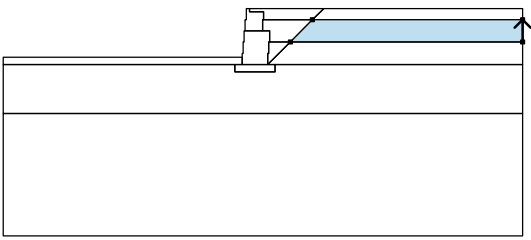
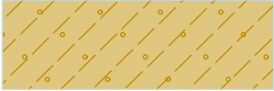
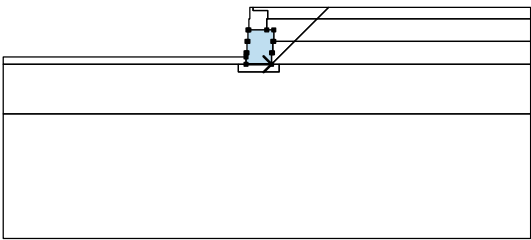
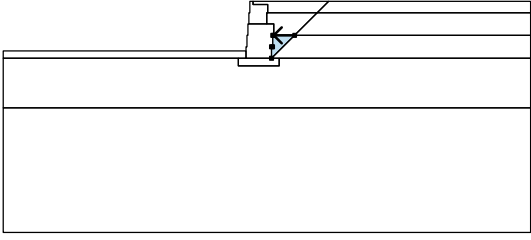
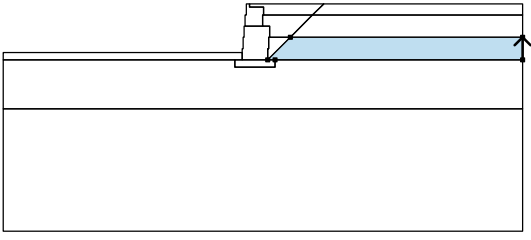
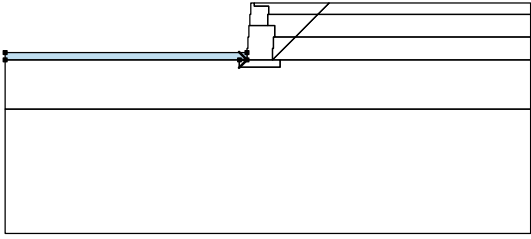
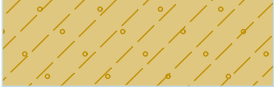
Saturated unit weight : $\gamma_{\text{sat}} = 24.00 \text{ kN/m}^3$

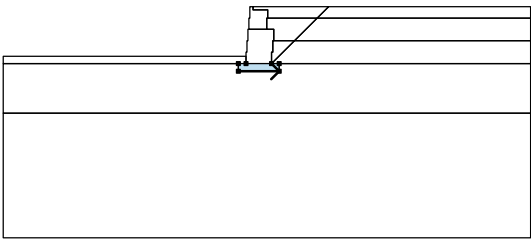
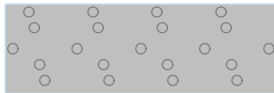
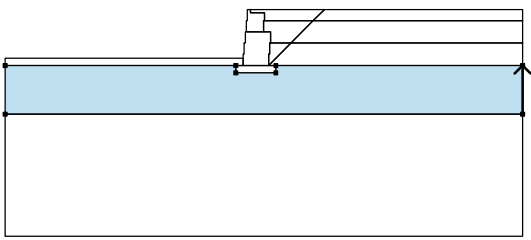
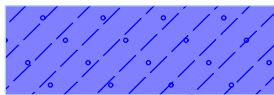
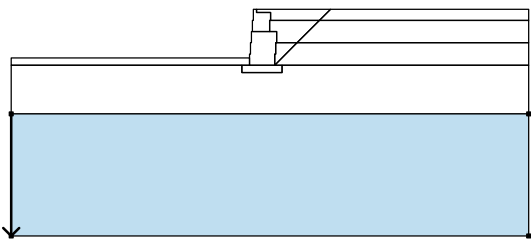
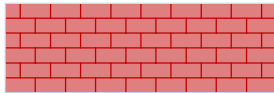
Rigid Bodies

No.	Name	Sample	γ [kN/m ³]
1	Material of structure		18.85

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		2.56	-0.46	3.02	0.00	Granular B Type II 
		0.00	0.00	0.00	-0.13	
		0.58	-0.13	0.58	-0.46	
2		11.10	-0.46	11.10	0.00	Native Fill 
		3.02	0.00	2.56	-0.46	
3		0.54	-0.91	0.54	-0.46	Material of structure 
		0.58	-0.46	0.58	-0.13	
		0.00	-0.13	0.00	0.00	
		-0.13	0.00	-0.13	-0.46	
		-0.17	-0.46	-0.17	-0.91	
4		1.66	-1.37	2.56	-0.46	Granular B Type II 
		0.58	-0.46	0.54	-0.46	
		0.54	-0.91	0.82	-0.91	
		0.82	-1.37			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
5		11.10	-1.37	11.10	-0.46	Native Fill 
		2.56	-0.46	1.66	-1.37	
6		-0.29	-2.29	0.74	-2.29	Material of structure 
		0.74	-1.83	0.78	-1.83	
		0.78	-1.37	0.82	-1.37	
		0.82	-0.91	0.54	-0.91	
		-0.17	-0.91	-0.21	-0.91	
		-0.21	-1.37	-0.25	-1.37	
		-0.25	-1.83	-0.29	-1.83	
		-0.29	-1.99			
7		1.66	-1.37	0.82	-1.37	Granular B Type II 
		0.78	-1.37	0.78	-1.83	
		0.74	-1.83	0.74	-2.29	
8		11.10	-2.29	11.10	-1.37	Native Fill 
		1.66	-1.37	0.74	-2.29	
		1.04	-2.29			
9		-0.59	-2.29	-0.29	-2.29	Native Fill 
		-0.29	-1.99	-10.00	-1.99	
		-10.00	-2.29			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
10		-0.59	-2.59	1.04	-2.59	Granular B Type II 
		1.04	-2.29	0.74	-2.29	
		-0.29	-2.29	-0.59	-2.29	
11		11.10	-4.28	11.10	-2.29	Glacial Till 
		1.04	-2.29	1.04	-2.59	
		-0.59	-2.59	-0.59	-2.29	
		-10.00	-2.29	-10.00	-4.28	
12		-10.00	-4.28	-10.00	-9.28	Bedrock 
		11.10	-9.28	11.10	-4.28	

Surcharge

No.	Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude		
								q, q ₁ , f, F, x	q ₂ , z	unit
1	strip	variable	on terrain	x = 2.30	l = 8.80		0.00	18.00		kN/m ²

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : $K_h = 0.0000$

Vertical seismic coefficient : $K_v = 0.0000$

Settings of the stage of construction

Design situation : Service I

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters					
Center :	x =	-0.48 [m]	Angles :	α_1 =	-28.12 [°]
	z =	1.67 [m]		α_2 =	66.27 [°]
Radius :	R =	4.15 [m]			
The slip surface after optimization.					

Total weight of soil above the slip surface: 143.87 kN/m

Slope stability verification (Bishop)

Sum of active forces : $F_a = 64.42$ kN/m

Sum of passive forces : $F_p = 102.59$ kN/m

Sliding moment : $M_a = 267.34$ kNm/m

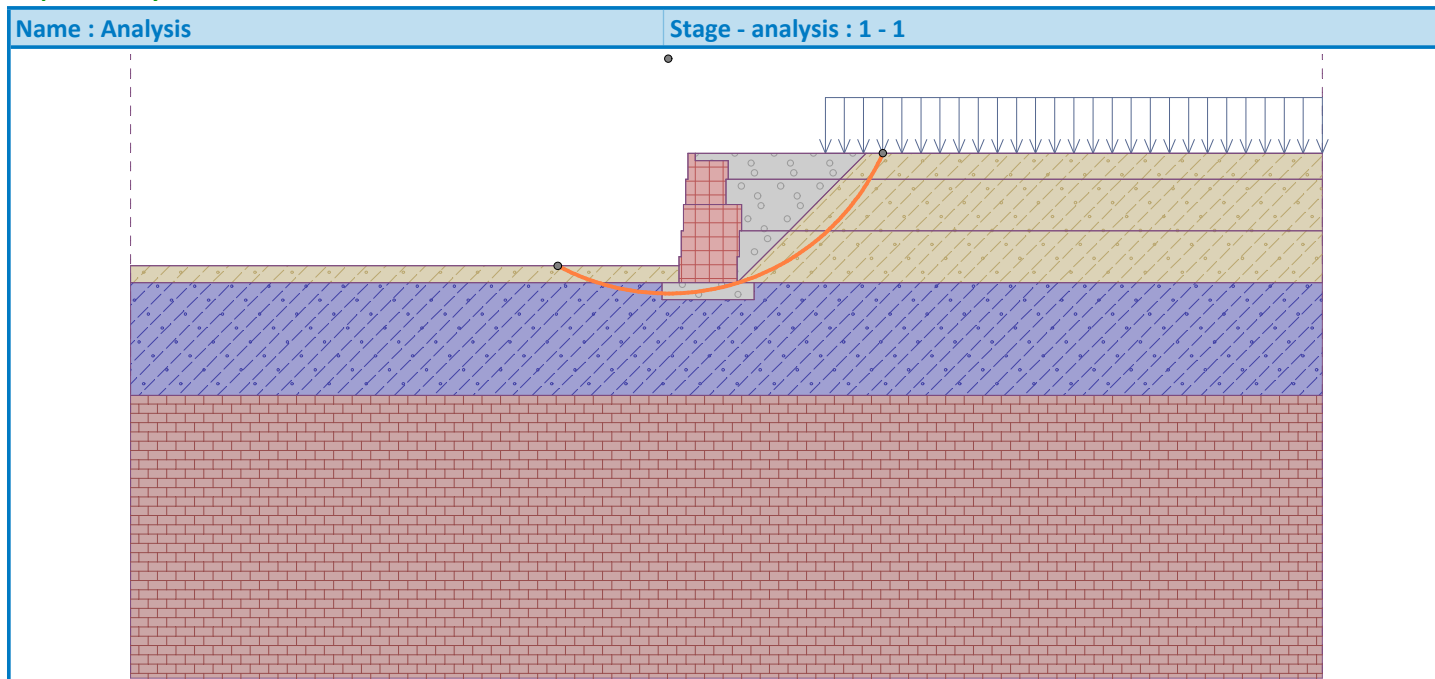
Resisting moment : $M_p = 276.75$ kNm/m

Utilization : 96.6 %

Capacity demand ratio CDR: 1.035

Factor of Safety: FS = 1.59

Slope stability ACCEPTABLE



Slope stability analysis

Input data (Construction stage 1)

Project

Settings

Canadian Highway and Bridge Design Code

Stability analysis

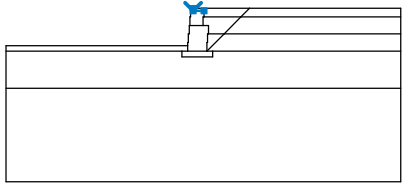
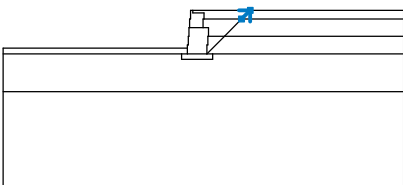
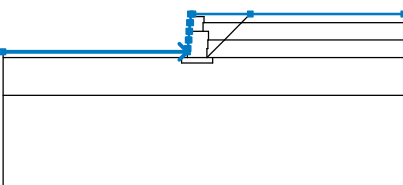
Verification methodology : according to LRFD

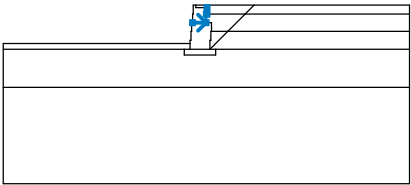
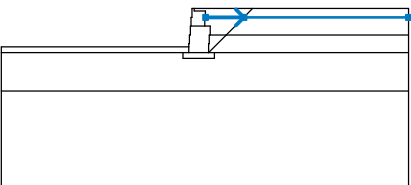
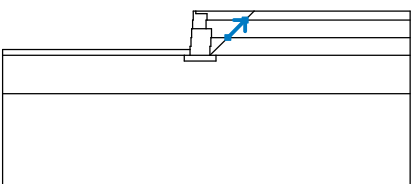
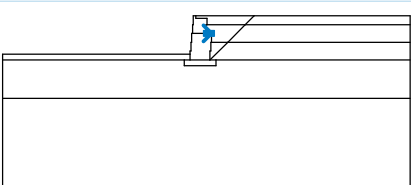
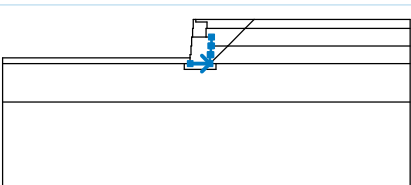
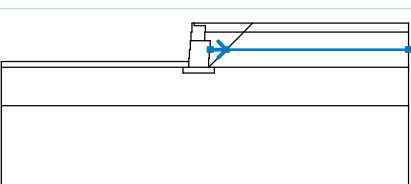
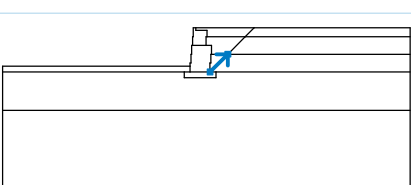
Earthquake analysis : Standard

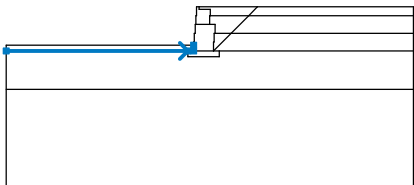
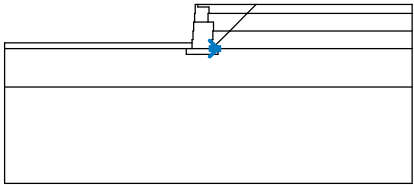
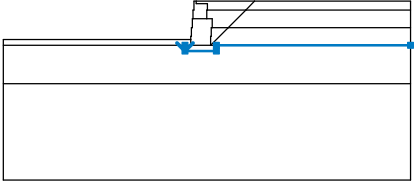
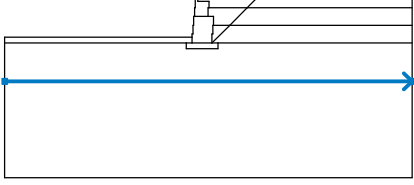
Load factors			
Design situation - Service I			
		Minimum	Maximum
Earth surcharge load (permanent) :	ES =	1.00 [-]	1.00 [-]
Live load surcharge :	LL =	0.00 [-]	1.00 [-]

Resistance factors			
Design situation - Service I			
Resistance factor on stability :	φ_{SS} =	0.65 [-]	

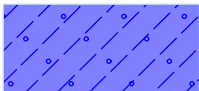
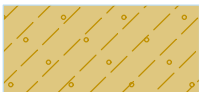
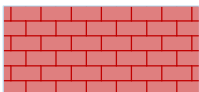
Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.13	0.58	-0.13
2		2.56	-0.46	3.02	0.00		
3		-10.00	-1.99	-0.29	-1.99	-0.29	-1.83
		-0.25	-1.83	-0.25	-1.37	-0.21	-1.37
		-0.21	-0.91	-0.17	-0.91	-0.17	-0.46
		-0.13	-0.46	-0.13	0.00	0.00	0.00
		3.02	0.00	11.10	0.00		

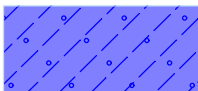
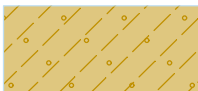
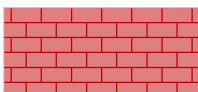
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
4		-0.17	-0.91	0.54	-0.91	0.54	-0.46
		0.58	-0.46	0.58	-0.13		
5		0.58	-0.46	2.56	-0.46	11.10	-0.46
6		1.66	-1.37	2.56	-0.46		
7		0.54	-0.91	0.82	-0.91		
8		-0.29	-2.29	0.74	-2.29	0.74	-1.83
		0.78	-1.83	0.78	-1.37	0.82	-1.37
		0.82	-0.91				
9		0.82	-1.37	1.66	-1.37	11.10	-1.37
10		0.74	-2.29	1.66	-1.37		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
11		-10.00	-2.29	-0.59	-2.29	-0.29	-2.29
		-0.29	-1.99				
12		0.74	-2.29	1.04	-2.29		
13		-0.59	-2.29	-0.59	-2.59	1.04	-2.59
		1.04	-2.29	11.10	-2.29		
14		-10.00	-4.28	11.10	-4.28		

Soil parameters - effective stress state

No.	Name	Pattern	ϕ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]
1	Granular B Type II		38.00	0.00	22.00
2	Glacial Till		30.00	0.00	21.00
3	Native Fill		30.00	0.00	22.00
4	Bedrock		40.00	500.00	24.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m ³]	γ_s [kN/m ³]	n [-]
1	Granular B Type II		22.00		
2	Glacial Till		21.00		
3	Native Fill		22.00		
4	Bedrock		24.00		

Soil parameters

Granular B Type II

Unit weight : $\gamma = 22.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 38.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 22.00 \text{ kN/m}^3$

Glacial Till

Unit weight : $\gamma = 21.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 30.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 21.00 \text{ kN/m}^3$

Native Fill

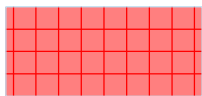
Unit weight : $\gamma = 22.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 30.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 22.00 \text{ kN/m}^3$

Bedrock

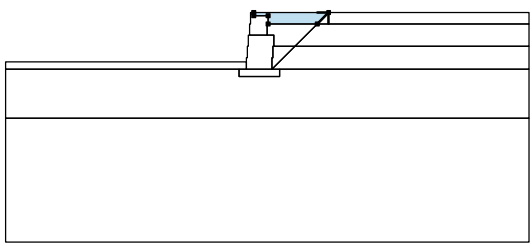
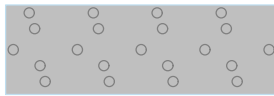
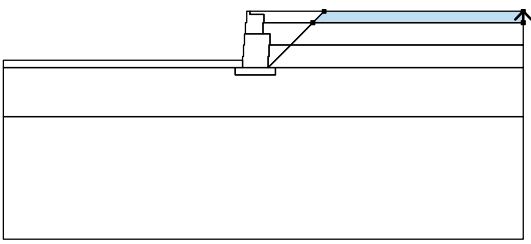
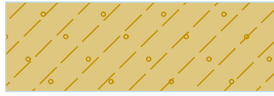
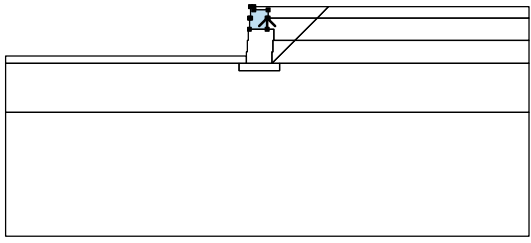
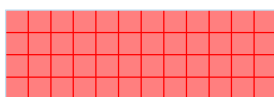
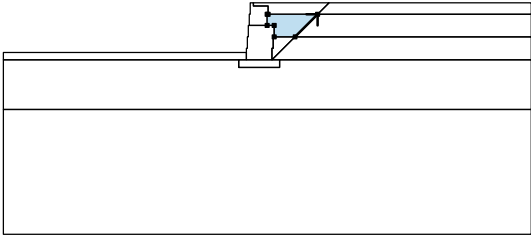
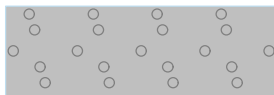
Unit weight : $\gamma = 24.00 \text{ kN/m}^3$
 Stress-state : effective
 Shear strength : Mohr-Coulomb
 Angle of internal friction : $\phi_{ef} = 40.00^\circ$
 Cohesion of soil : $c_{ef} = 500.00 \text{ kPa}$

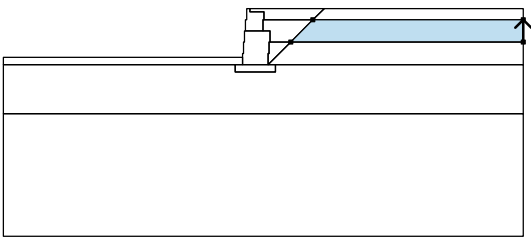
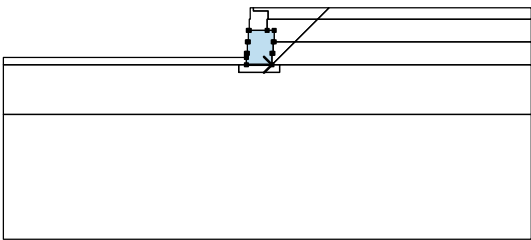
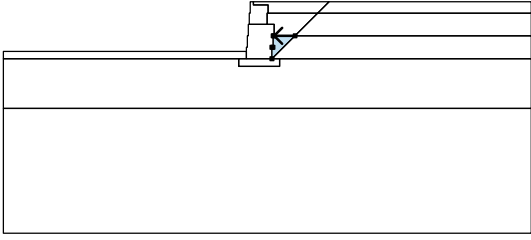
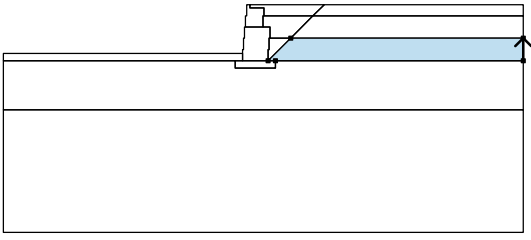
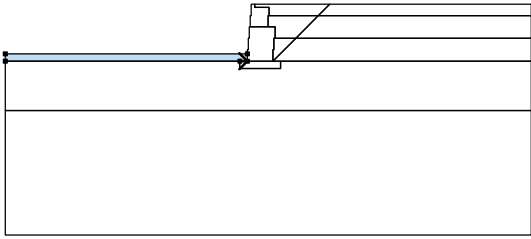
Saturated unit weight : $\gamma_{\text{sat}} = 24.00 \text{ kN/m}^3$

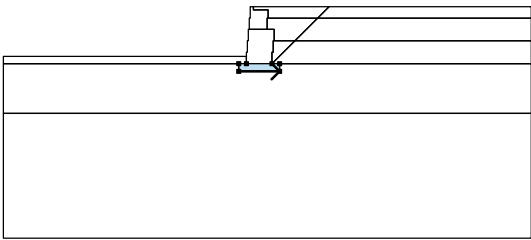
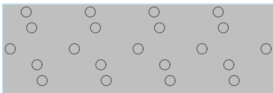
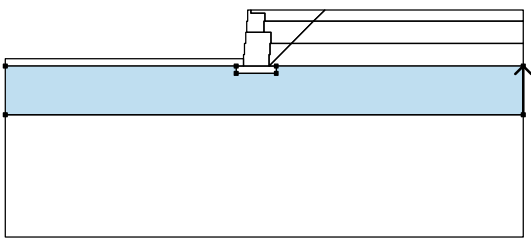
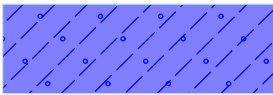
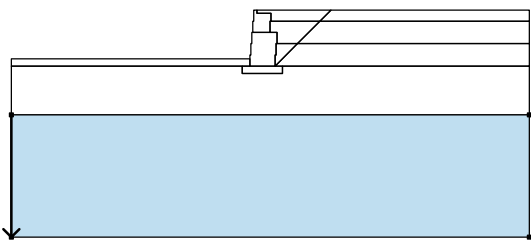
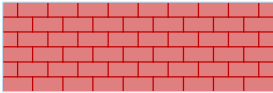
Rigid Bodies

No.	Name	Sample	γ [kN/m ³]
1	Material of structure		18.85

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		2.56	-0.46	3.02	0.00	Granular B Type II 
		0.00	0.00	0.00	-0.13	
		0.58	-0.13	0.58	-0.46	
2		11.10	-0.46	11.10	0.00	Native Fill 
		3.02	0.00	2.56	-0.46	
3		0.54	-0.91	0.54	-0.46	Material of structure 
		0.58	-0.46	0.58	-0.13	
		0.00	-0.13	0.00	0.00	
		-0.13	0.00	-0.13	-0.46	
		-0.17	-0.46	-0.17	-0.91	
4		1.66	-1.37	2.56	-0.46	Granular B Type II 
		0.58	-0.46	0.54	-0.46	
		0.54	-0.91	0.82	-0.91	
		0.82	-1.37			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
5		11.10	-1.37	11.10	-0.46	Native Fill
		2.56	-0.46	1.66	-1.37	
6		-0.29	-2.29	0.74	-2.29	Material of structure
		0.74	-1.83	0.78	-1.83	
		0.78	-1.37	0.82	-1.37	
		0.82	-0.91	0.54	-0.91	
		-0.17	-0.91	-0.21	-0.91	
		-0.21	-1.37	-0.25	-1.37	
		-0.25	-1.83	-0.29	-1.83	
		-0.29	-1.99			
7		1.66	-1.37	0.82	-1.37	Granular B Type II
		0.78	-1.37	0.78	-1.83	
		0.74	-1.83	0.74	-2.29	
8		11.10	-2.29	11.10	-1.37	Native Fill
		1.66	-1.37	0.74	-2.29	
		1.04	-2.29			
9		-0.59	-2.29	-0.29	-2.29	Native Fill
		-0.29	-1.99	-10.00	-1.99	
		-10.00	-2.29			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
10		-0.59	-2.59	1.04	-2.59	Granular B Type II 
		1.04	-2.29	0.74	-2.29	
		-0.29	-2.29	-0.59	-2.29	
11		11.10	-4.28	11.10	-2.29	Glacial Till 
		1.04	-2.29	1.04	-2.59	
		-0.59	-2.59	-0.59	-2.29	
		-10.00	-2.29	-10.00	-4.28	
12		-10.00	-4.28	-10.00	-9.28	Bedrock 
		11.10	-9.28	11.10	-4.28	

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : $K_h = 0.1270$

Vertical seismic coefficient : $K_v = 0.0000$

Settings of the stage of construction

Design situation : Service I

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters					
Center :	x =	-0.72 [m]	Angles :	$\alpha_1 =$	-29.46 [°]
	z =	1.78 [m]		$\alpha_2 =$	65.73 [°]

Slip surface parameters

Radius : R = 4.33 [m]

The slip surface after optimization.

Total weight of soil above the slip surface: 146.93 kN/m

Slope stability verification (Bishop)

Sum of active forces : $F_a = 64.01$ kN/m

Sum of passive forces : $F_p = 91.27$ kN/m

Sliding moment : $M_a = 277.17$ kNm/m

Resisting moment : $M_p = 256.89$ kNm/m

Utilization : 107.9 %

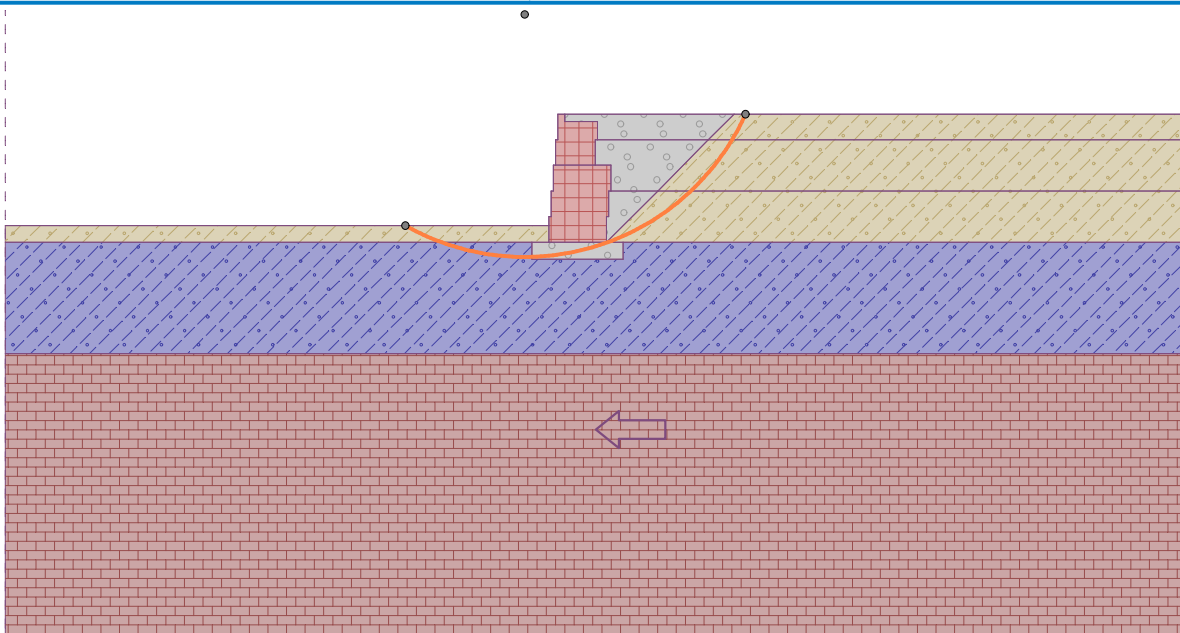
Capacity demand ratio CDR: 0.927

Factor of Safety: FS = 1.43

Slope stability ACCEPTABLE

Name : Analysis

Stage - analysis : 1 - 1



APPENDIX 4

PG2236-6 Revision 4 Redi-Rock Retaining Wall Design (RR1) dated November 4, 2024

PG2236-7 Revision 4 Redi-Rock Retaining Wall Design (RR2) dated November 4, 2024

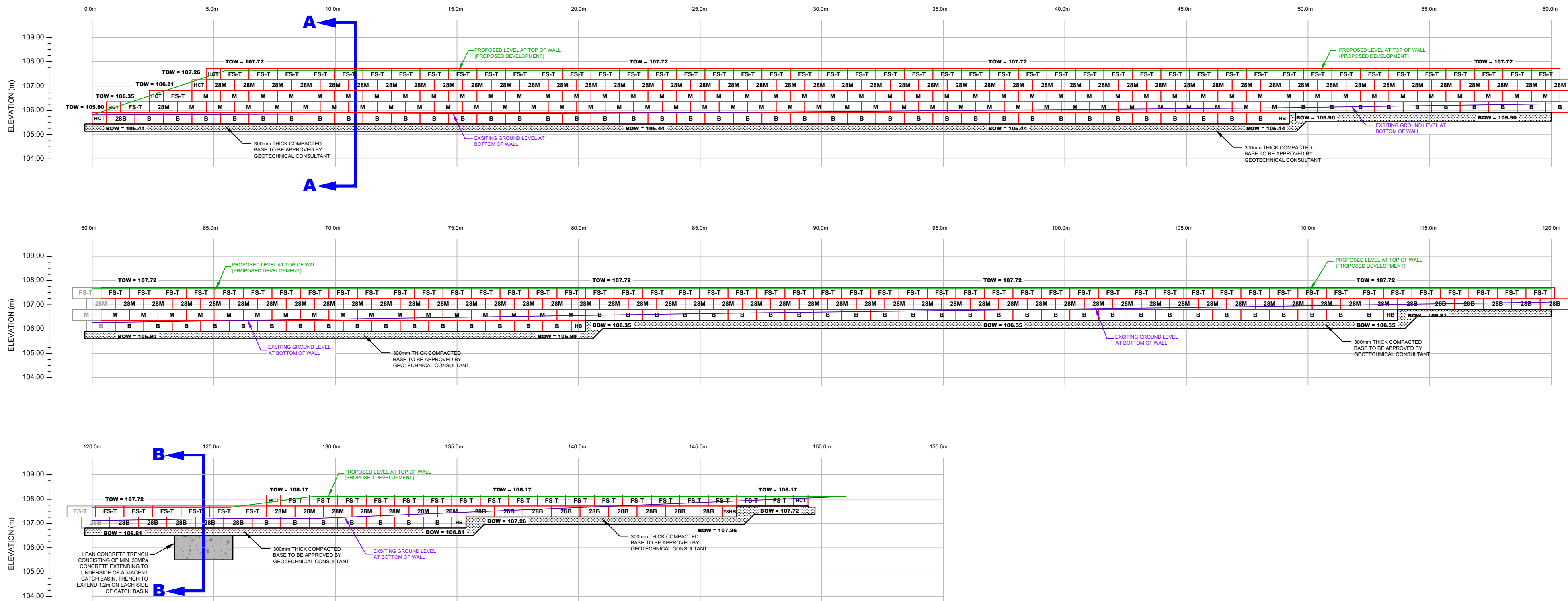
PG2236-8 Revision 4 Redi-Rock Retaining Wall Design (RR3) dated April 2, 2024

PG2236-9 Revision 4 Redi-Rock Retaining Wall Design (RR4) dated April 2, 2024

PROFILE VIEW (RR1):

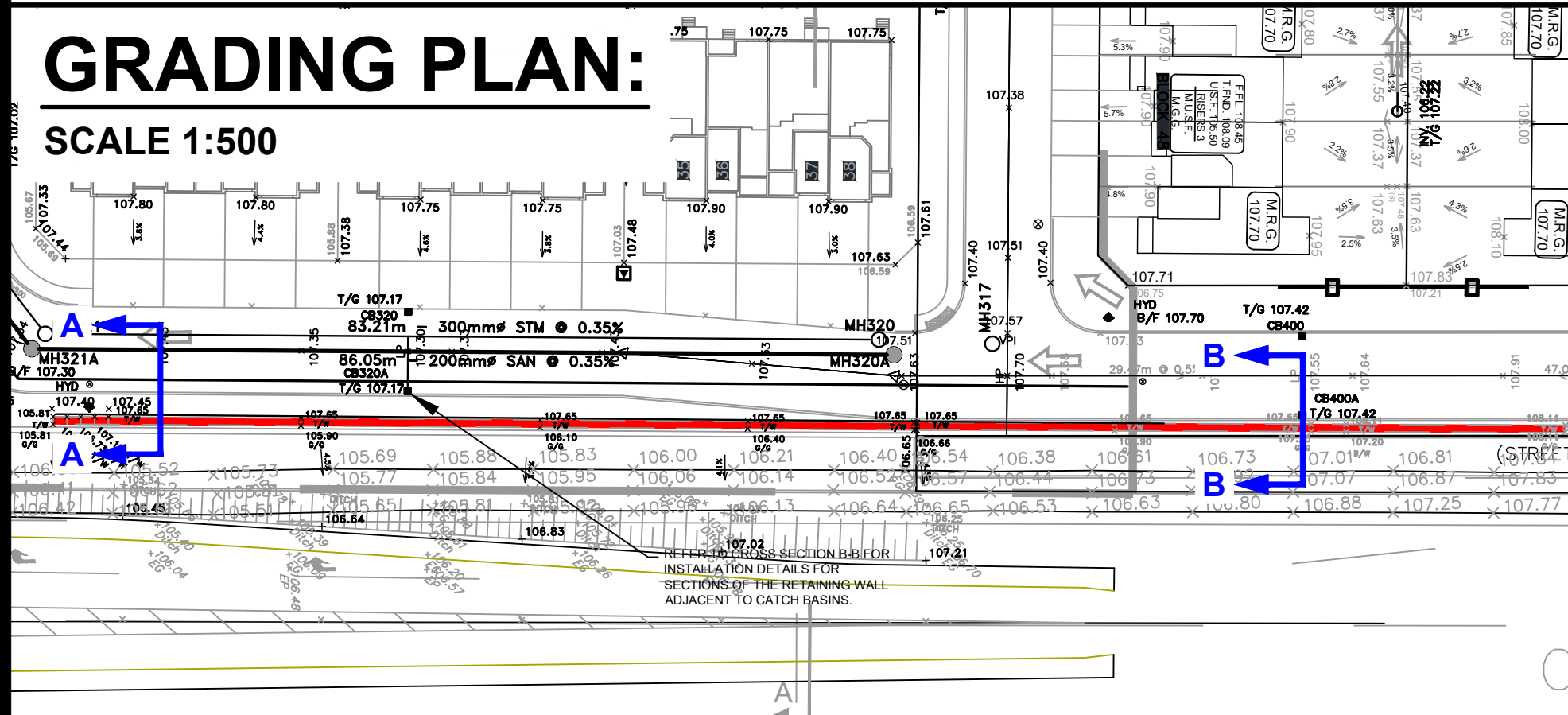
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ISSUED FOR CONSTRUCTION



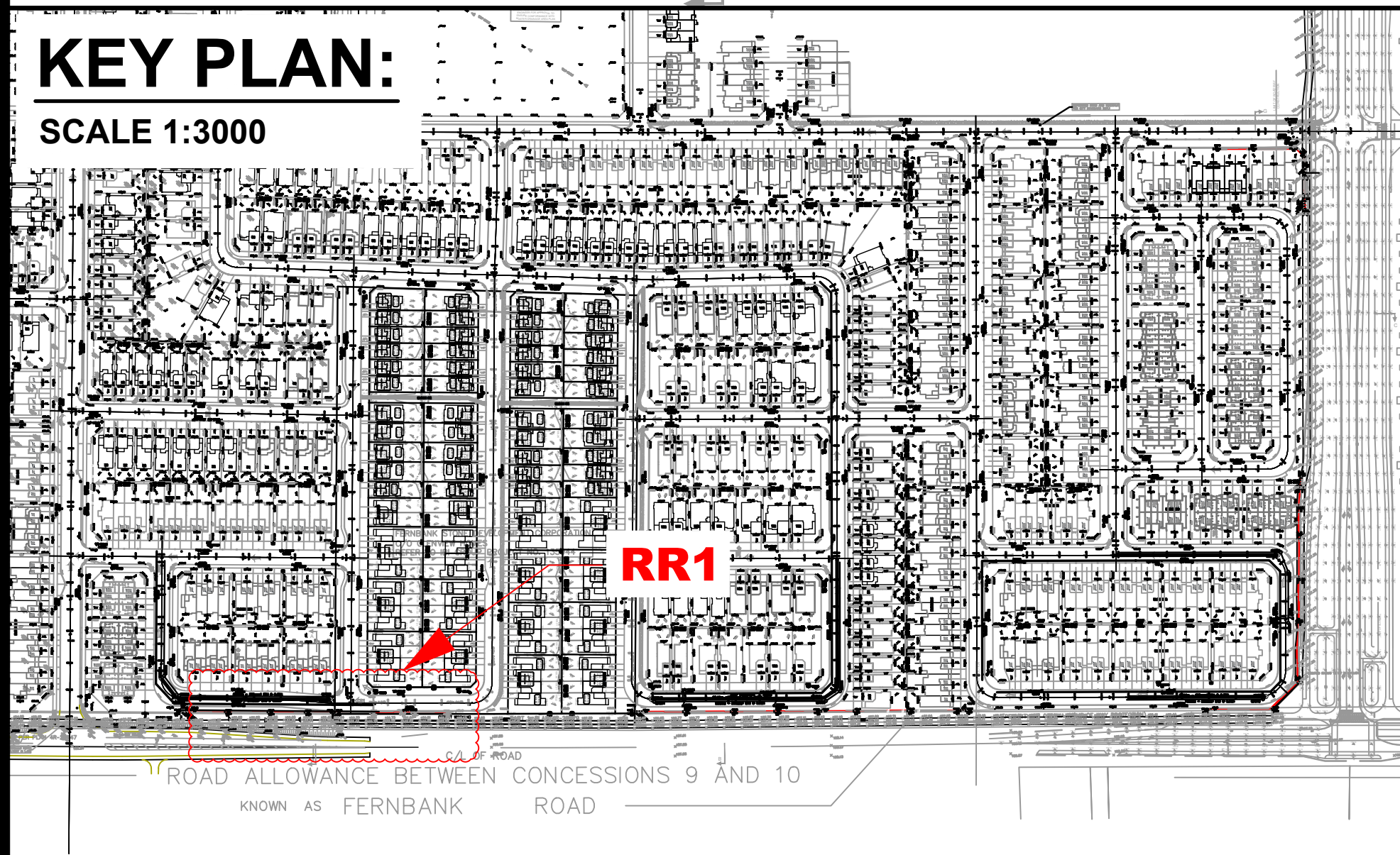
GRADING PLAN:

SCALE 1:500



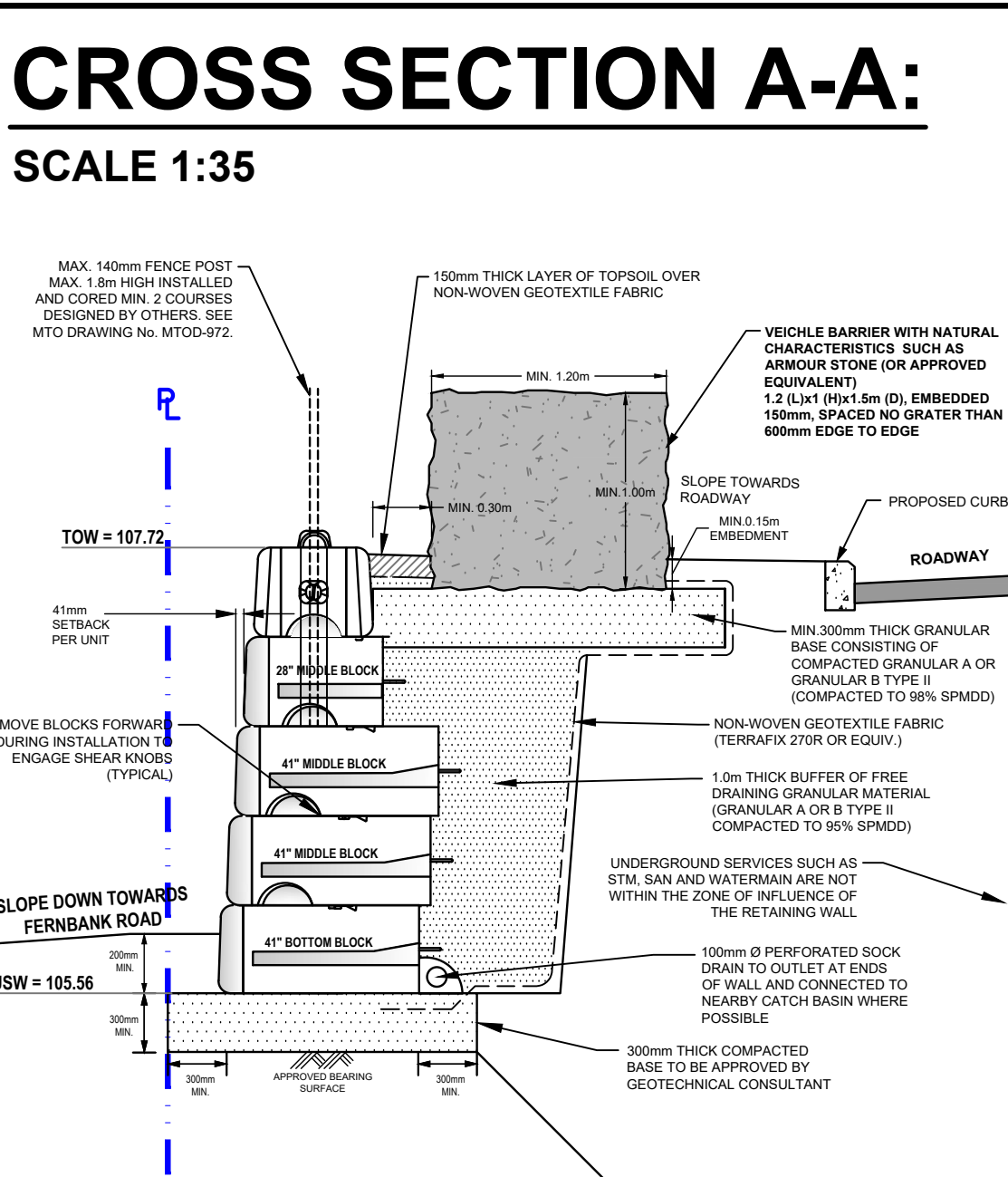
KEY PLAN:

SCALE 1:3000



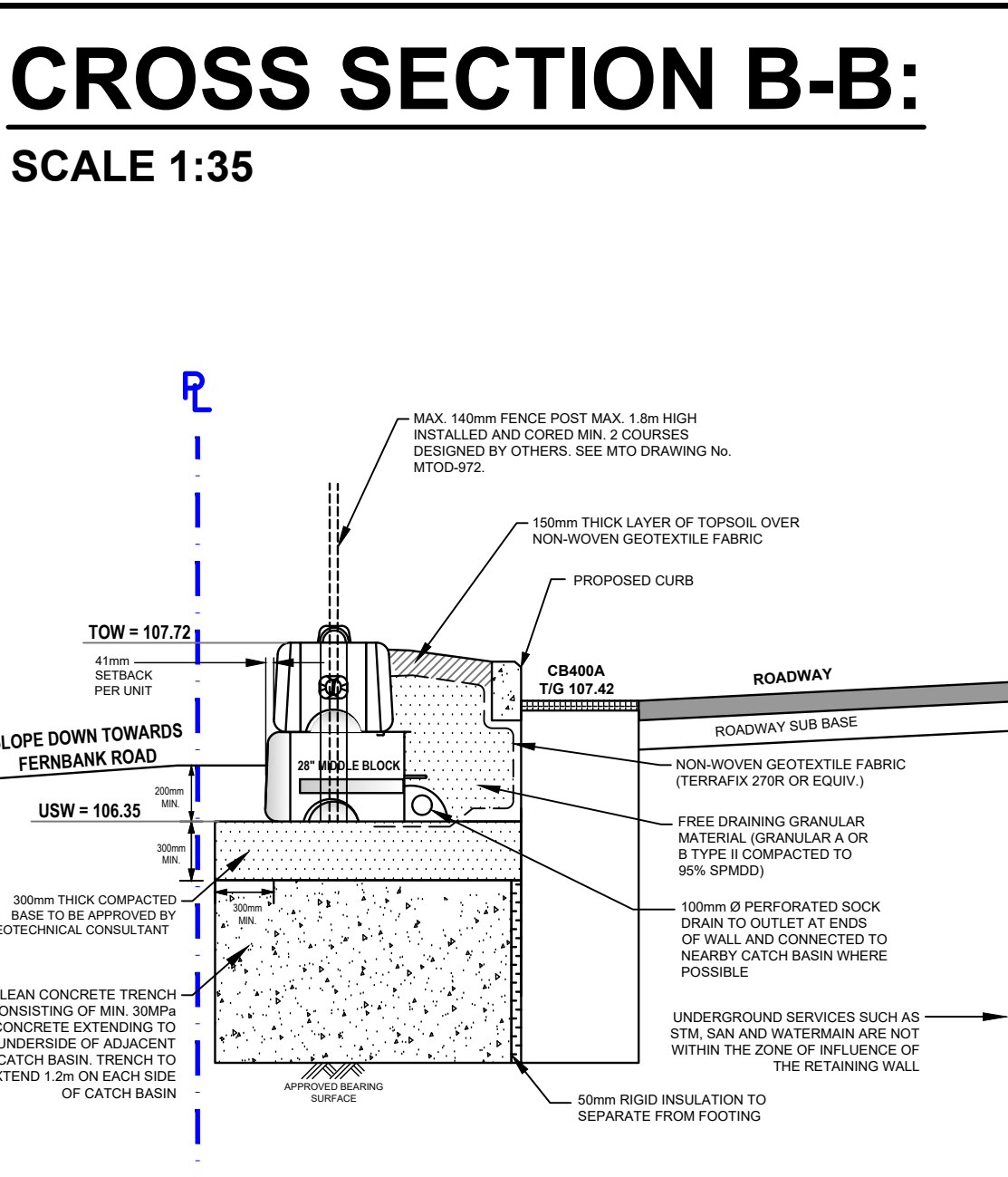
CROSS SECTION A-A:

SCALE 1:35



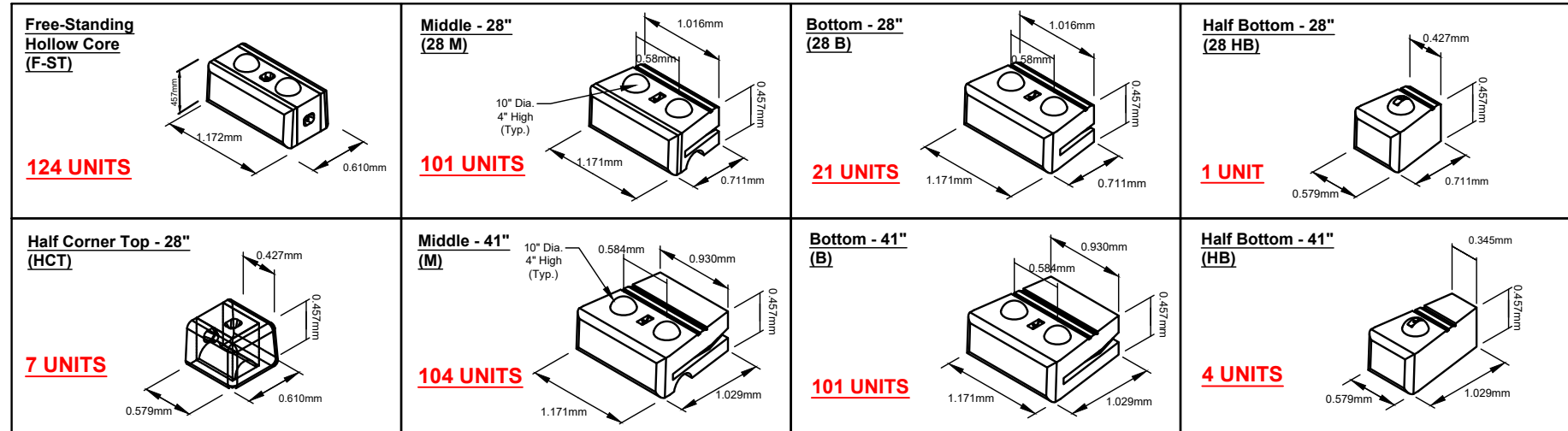
CROSS SECTION B-B:

SCALE 1:35



BLOCK COUNT:

N.T.S.



NOTES:

- THE CONTRACTOR IS SOLELY RESPONSIBLE FOR UTILITY CLEARANCE AND CONSTRUCTION SITE SAFETY. MOON PRODUCTS INC. AND PATERSON GROUP SHALL NOT BE RESPONSIBLE FOR MEANS OR METHODS OF CONSTRUCTION OR FOR SAFETY OF WORKERS OR OF THE PUBLIC.
- THIS DESIGN IS BASED ON THE FOLLOWING SOIL PROPERTIES:

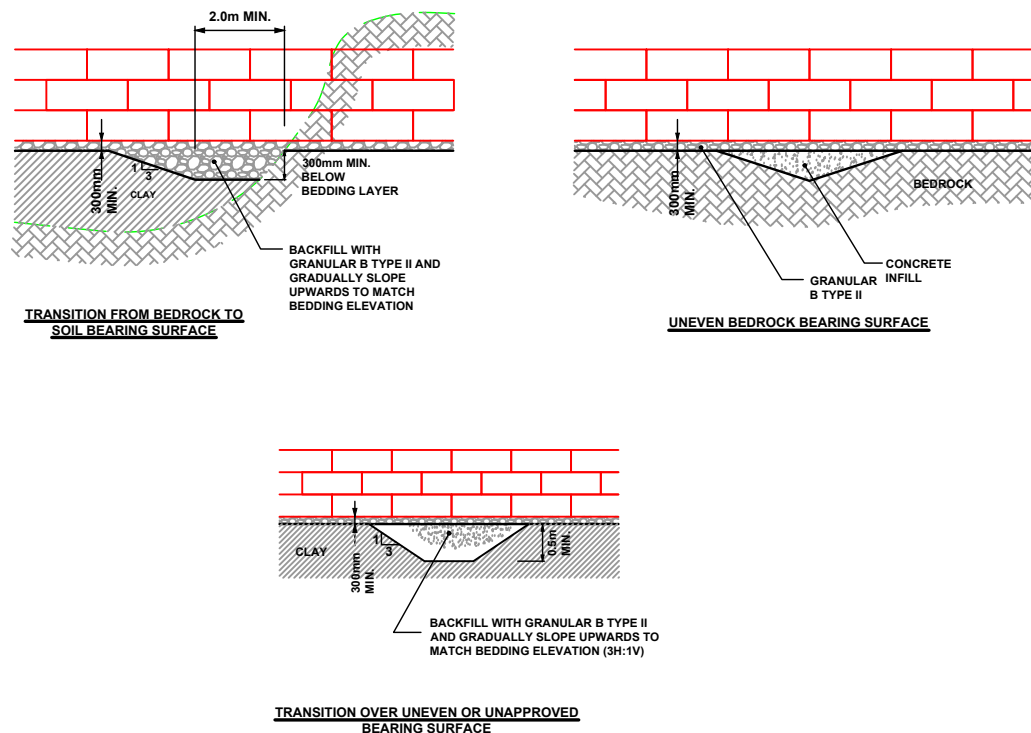
PROPERTY	RETAINED FILL	FOUNDATION MEDIUM (1)	FOUNDATION MEDIUM (2)
FRICITION ANGLE - PHI	38	35	40
UNIT WEIGHT - γ	22 KN/m ³	21 KN/m ³	24KN/m ³
COHESION - C	0	0 kPa	500 kPa
SOIL TYPE	GRANULAR B TYPE II & NATIVE FILL	GLACIAL TILL	BEDROCK

MATERIAL PROPERTIES ARE BASED ON SITE EVALUATION BY PATERSON GROUP. SEISMIC LOADING WAS EVALUATED ACCORDING TO THE CHBDC 2015, WITH A PEAK GROUND ACCELERATION VALUE OF 0.254.

- THIS DESIGN ELEVATIONS USED WERE BASED ON CAD GRADING PLAN PROVIDED BY IBI GROUP, RECEIVED SEPTEMBER 29, 2022. THE WALL BASE DESIGN ASSUMES A BEARING RESISTANCE AT SLS OF 150 KPa ON GLACIAL TILL, BEDROCK OR EXISTING FILL. PATERSON GROUP ENGINEER SHOULD OBSERVE THE BEARING CONDITIONS AND ADJUST THE THICKNESS OF THE GRANULAR BASE TO ACCOMMODATE THE SITE CONDITIONS, IF NECESSARY.
- THE DESIGN HAS BEEN REVIEWED FOR THE STABILITY OF THE PRECAST MODULAR RETAINING WALL SYSTEM AND GLOBAL STABILITY WITH A FACTOR OF SAFETY OF 1.5 FOR STATIC CONDITIONS AND 1.1 UNDER SEISMIC CONDITIONS. WALL GEOMETRY AND GRADE ELEVATIONS ABOVE AND BELOW THE WALL SHOULD CONFORM WITH THE GRADING PLAN PROVIDED HEREIN. IF ACTUAL SITE GRADES VARY SIGNIFICANTLY FROM THOSE SHOWN OR IF THE BACK SLOPE DOES NOT CONFORM, INSTALLATION SHALL NOT PROCEED UNTIL THE DESIGN IS VERIFIED OR MODIFIED IN THE APPLICABLE AREA.
- HORIZONTAL LAYOUT DIMENSIONS ARE MEASURED ALONG THE FACE OF THE WALL, CORRESPONDING TO A HORIZONTAL REFERENCE ESTABLISHED BY PATERSON GROUP BASED ON DRAWINGS BY IBI GROUP.
- PRECAST UNITS SHALL BE REDI-ROCK RETAINING WALL UNITS MANUFACTURED UNDER LICENSE FROM REDI-ROCK
- THE WALL BASE SHALL CONSIST OF A MINIMUM OF 300mm OF OPSS GRANULAR A OR GRANULAR B TYPE II ON NATIVE SOIL. A MINIMUM OF 150mm OF GRANULAR MATERIAL CAN BE USED WHERE BEDROCK IS ENCOUNTERED ALONG THE BASE OF THE WALL. THE BASE SHALL BE COMPACTED AS TO PROVIDE A LEVEL AND HARD SURFACE ON WHICH TO PLACE THE FIRST COURSE OF UNITS. GRANULAR BASE MATERIAL SHALL BE COMPACTED TO A MINIMUM 98% OF STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMD). THE BASE SHALL BE SMOOTHED TO ENSURE COMPLETE CONTACT OF RETAINING WALL UNIT WITH BASE. SURFACE OF GRANULAR BASE MAY BE DRESSED WITH FINER AGGREGATE TO AID LEVELING. ENSURE GRADATION OF DRESSING MATERIAL IS SUCH AS TO PRECLUDE LOSS OF FINES INTO BASE. THE THICKNESS OF DRESSING LAYER SHOULD NOT EXCEED 3 TIMES THE MAXIMUM PARTICLE SIZE USED. THE CONTRACTOR MAY SUBSTITUTE CONCRETE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 20 MPa AND AIR ENTRAINMENT FOR THE GRANULAR BASE MATERIAL.
- INSTALL 100mm DIAMETER PERFORATED PIPE DRAIN WRAPPED IN GEOTEXTILE UNDER LOWER COURSE OF WALL (OR ALTERNATIVELY BEHIND HEEL OF WALL). PROVIDE CLEAR STONE SURROUNDING THE DRAIN TO PROTECT PIPE FROM CLOGGING AND DAMAGE. PROVIDE OUTLETS AT ENDS OF WALL OR CONNECT TO NEARBY CATCH BASIN TO DRAIN WHERE POSSIBLE.
- PATERSON SHOULD REVIEW THE BEARING SURFACE DURING THE CONSTRUCTION, WHERE COMPACT SILTY SAND FILL MATERIAL IS ENCOUNTERED, PROOF ROLLING OF THE BEARING SURFACE WILL BE REQUIRED.
- WALL IS DESIGNED FOR A MINIMUM OF 200 mm TOE EMBEDMENT WITH A MINIMUM HORIZONTAL LEDGE OF 300mm BEYOND THE FACE AND REAR OF BASE BLOCK, WHERE GRANULAR BEDDING WILL NOT BE SUFFICIENT, THE USE OF CONCRETE BEDDING MAY BE REQUIRED. EXTRA PRECAUTIONS MUST BE TAKEN TO PROVIDE TOE EMBEDMENT IN AREAS WHERE BASE OF WALL STEPS.
- THE RETAINING WALL IS A BATTERED WALL. ALIGNMENT OF THE BOTTOM WALL UNIT COURSE SHOULD BE PLANNED TO CONSIDER THAT A NOMINAL 41 mm AUTOMATIC SETBACK WILL OCCUR WITH EACH 0.46 m HIGH UNIT.
- BACKFILL MATERIAL SHALL BE APPROVED BY THE SITE GEOTECHNICAL ENGINEER PRIOR TO USE AND SHOULD CONSIST OF OPSS GRANULAR B TYPE II BUFFER OF 100mm (AS SHOWN) WIDTH. ALL FILL WITHIN A H+1V ZONE UP AND BACK FROM THE HEEL SHOULD ALSO BE COMPACTED. BACKFILL SHALL BE PLACED IN MAXIMUM 300 mm LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF THE MATERIAL'S SPMD. MOISTURE CONTENT SHOULD BE CONTROLLED AND MAINTAINED WITHIN -3 TO +4 PERCENT OF OPTIMUM. ONLY WHERE WALL PASSES DIRECTLY AGAINST A FENCE POST SHOULD CLEAR STONE BE USED.
- ENSURE EACH COARSE IS COMPLETELY FILLED AND BACKFILL IS PLACED TO THE SAME LEVEL PRIOR TO PROCEEDING TO THE NEXT COURSE. ENSURE ADJACENT UNITS ARE IN CONTACT SO THAT UNIT FILL MAY NOT ESCAPE THROUGH THE JOINT BETWEEN UNITS. GAPS GREATER THAN 6 mm BETWEEN UNITS (AT THE FACE) SHALL NOT BE ALLOWED. AT THE INTERSECTIONS WITH STRUCTURES, CUT UNITS TO OBTAIN A NEAT FIT. PULL BLOCK UNITS FORWARD TO ENGAGE THE ALIGNMENT LOOPS ON THE UNIT BELOW BEFORE INFILLING IN ALL CASES.
- MAINTAIN TEMPORARY GRADES TO DIVERT SURFACE WATER AWAY FROM THE RETAINING WALL EXCAVATION. SLOPE FINAL BACKFILL TO PROVIDE POSITIVE DRAINAGE AND TO ELIMINATE PONDING.
- IF WINTER CONSTRUCTION IS CONSIDERED, HEAT MUST BE MAINTAINED WHEN THE BASE IS EXPOSED. THE WALL BASE MUST BE COVERED WITH INSULATION TARPES TO MAINTAIN HEAT AND PROTECT THE BASE FROM POTENTIAL FROST HEAVE. ONCE THE BASE IS BACKFILLED, THE TOP OF WALL MUST BE COVERED WITH INSULATION TARPES OVERNIGHT UNTIL THE WALL CONSTRUCTION IS COMPLETE.
- THE GEOTECHNICAL CONSULTANT SHOULD BE NOTIFIED AT THE BEGINNING OF THE WALL CONSTRUCTION TO COMPLETE PERIODIC INSPECTIONS AND PROVIDE GEOTECHNICAL RECOMMENDATIONS AS THE WALL CONSTRUCTION PROGRESSES.
- DURING THE CONSTRUCTION OF THE RETAINING WALL, THE CONTRACTOR MUST ENSURE THAT A SAFE SLOPE IS PROVIDED BEHIND THE RETAINING WALL. THE GEOTECHNICAL CONSULTANT SHOULD COMPLETE PERIODIC INSPECTIONS TO ENSURE A PROPER SLOPE IS PROVIDED AS PER THE SITE GEOTECHNICAL RECOMMENDATIONS.
- ANY INADEQUATE PERFORMING SUBGRADE SHOULD BE SUB-EXCAVATED AND REPLACED WITH OPSS GRANULAR B TYPE II, COMPACTED TO 98% OF THE MATERIAL'S SPMD.
- ANY CUTTING OF BLOCKS TO SUIT SITE CONDITIONS OR WALL DESIGN WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. REMOVAL/CUTTING OF LIFTING LOOPS ON THE FINAL ROW OF BLOCKS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- SECTIONS OF THE RETAINING WALL IN CLOSE PROXIMITY TO THE PAVEMENT STRUCTURE SHALL BE SUBJECTED TO A SEALANT AGAINST SALT USED DURING WINTER SEASONS. A WATER BASED SILANE PENETRATING SEALANT, SUCH AS MASTERPROTECT H-400 OR EQUIVALENT, RECOMMENDED TO BE USED DURING OR POST INSTALLATION OF THE RETAINING WALL SYSTEM. THE METHOD CONSISTS OF PRESSURE WASHING THE WALL BLOCKS AND APPLYING THE SEALANT. THE PROCESS SHOULD BE REPEATED EVERY 5 YEARS. DEVELOPER TO APPLY FIRST AND SECOND COAT OF SEALANT BEFORE TURNING WALL OVER TO THE CITY OF OTTAWA.
- THE CONTRACTOR SHOULD REFER TO THE INSTALLATION MANUAL PROVIDED FOR THE RETAINING WALL BLOCK TYPE PROVIDED HEREIN FOR ADDITIONAL DETAILS ON ACCEPTABLE INSTALLATION PRACTICES.
- THE REDI-ROCK PRODUCT HAS BEEN DESIGNED FOR A MINIMUM LIFE SPAN OF 75 YEARS. REFER TO REDI-ROCK MANUFACTURER.
- REFER TO PATERSON GROUP PG5451-MEMO.04 FOR DETAILS ABOUT PLACEMENT OF ARMOUR STONE BLOCKS ALONG STREETS.

BEDROCK TRANSITION DETAILS:

N.T.S.



9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
4	VEICHLER BARRIER (NATURAL STONE)	04/11/2024	JV
3	ISSUED FOR CONSTRUCTION	02/04/2024	JV
2	AS PER CITY OF OTTAWA COMMENTS	29/06/2023	JV
1	AS PER CLIENT COMMENTS	25/01/2023	JV

CRT DEVELOPMENTS

PROPOSED RETAINING WALLS

5725 FERNBANK ROAD - CRT PHASE 3

OTTAWA,

Title:

REDI-ROCK RETAINING WALL DESIGN (RR1)

ONTARIO

Stamp:

04/11/2024

J. R. VILLENEUVE

100504314

PROVINCE OF ONTARIO

Stamp:

04/11/2024

F. I. ABOL-SEDO

100156744

PROVINCE OF ONTARIO

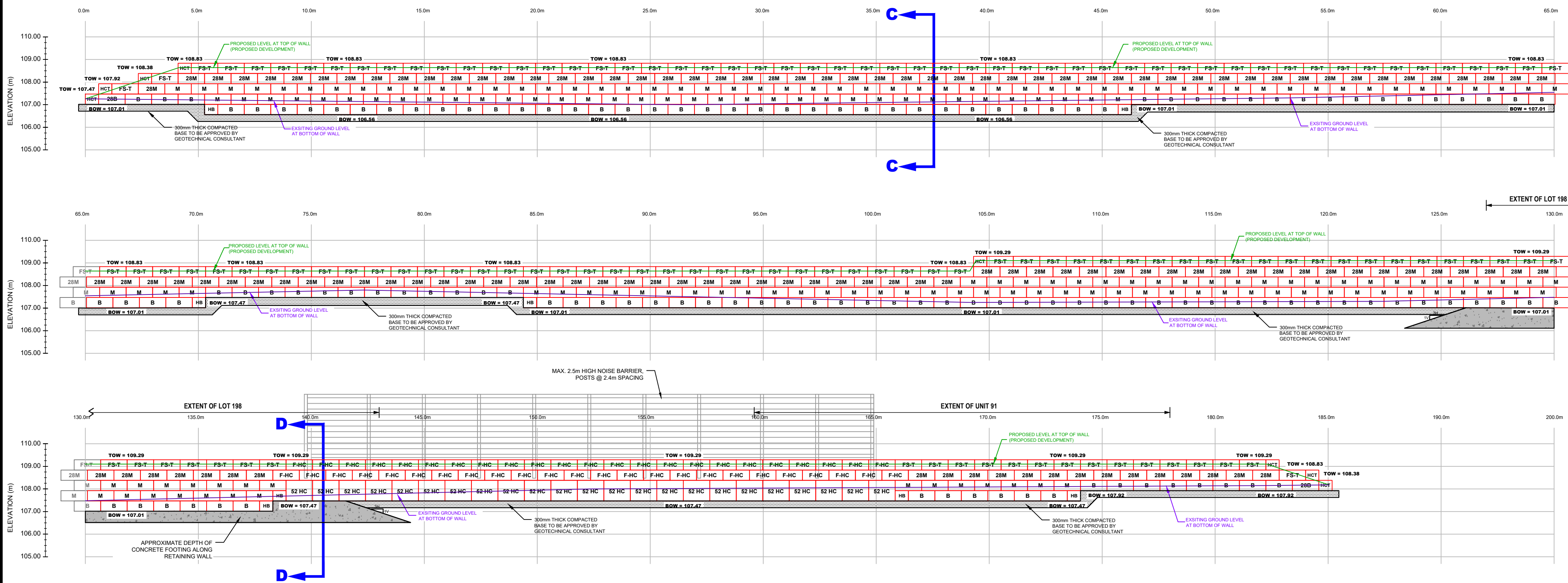
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Drawn by:	NFRV	Drawing No.:	
Checked by:	JV		
Approved by:	FA		
Date:	09/2022	Revision No.:	4

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PROFILE VIEW (RR2):

SCALE 1:125

ISSUED FOR CONSTRUCTION



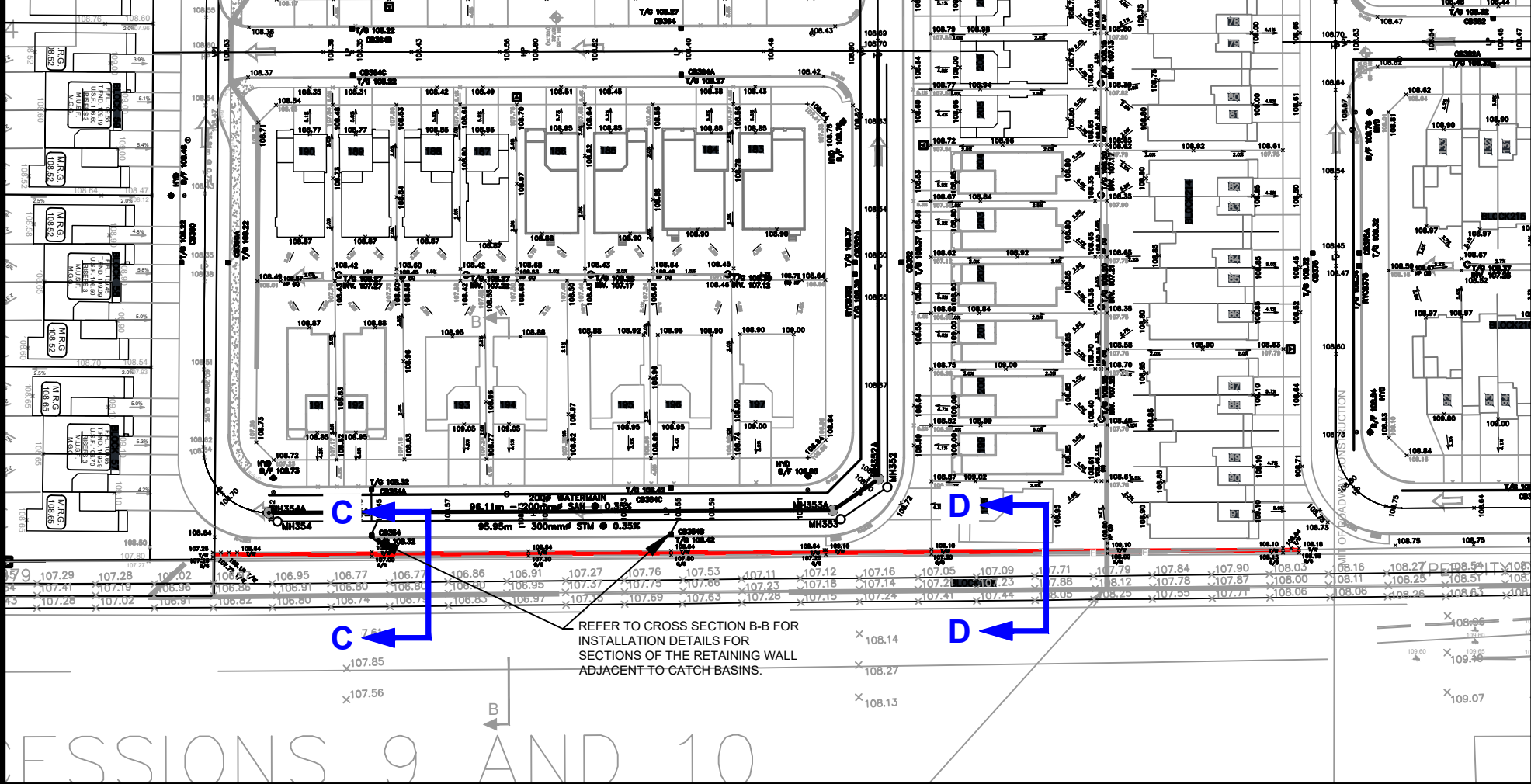
NOTES:

- THE CONTRACTOR IS SOLELY RESPONSIBLE FOR UTILITY CLEARANCE AND CONSTRUCTION SITE SAFETY. MCON PRODUCTS INC. AND PATERSON GROUP SHALL NOT BE RESPONSIBLE FOR MEANS OR METHODS OF CONSTRUCTION OR FOR SAFETY OF WORKERS OR OF THE PUBLIC.
- THIS DESIGN IS BASED ON THE FOLLOWING SOIL PROPERTIES:

PROPERTY	RETAINED FILL	FOUNDATION MEDIUM (1)	FOUNDATION MEDIUM (2)
FRICTION ANGLE - PHI	38	35	40
UNIT WEIGHT - γ	22 KN/m ³	21 KN/m ³	24KN/m ³
COHESION - C	0 kPa	0 kPa	500 kPa
SOIL TYPE	GRANULAR B TYPE II & NATIVE FILL	GLACIAL TILL	BEDROCK
- MATERIAL PROPERTIES ARE BASED ON SITE EVALUATION BY PATERSON GROUP. SEISMIC LOADING WAS EVALUATED ACCORDING TO THE CHBDC 2015, WITH A PEAK GROUND ACCELERATION VALUE OF 0.254.
- THIS DESIGN ELEVATIONS USED WERE BASED ON CAD GRADING PLAN PROVIDED BY IBI GROUP, RECEIVED SEPTEMBER 29, 2022. THE WALL BASE DESIGN ASSUMES A BEARING RESISTANCE AT SLS OF 150 kPa ON GLACIAL TILL, BEDROCK OR EXISTING FILL. PATERSON GROUP ENGINEER SHOULD OBSERVE THE BEARING CONDITIONS AND ADJUST THE THICKNESS OF THE GRANULAR BASE TO ACCOMMODATE THE SITE CONDITIONS, IF NECESSARY.
- THE DESIGN HAS BEEN REVIEWED FOR THE STABILITY OF THE PRECAST MODULAR RETAINING WALL SYSTEM AND GLOBAL STABILITY WITH A FACTOR OF SAFETY OF 1.5 FOR STATIC CONDITIONS AND 1.1 UNDER SEISMIC CONDITIONS. WALL GEOMETRY AND GRADE ELEVATIONS ABOVE AND BELOW THE WALL SHOULD CONFORM WITH THE GRADING PLAN PROVIDED HEREIN. IF ACTUAL SITE GRADES VARY SIGNIFICANTLY FROM THOSE SHOWN OR IF THE BACK SLOPE DOES NOT CONFORM, INSTALLATION SHALL NOT PROCEED UNTIL THE DESIGN IS VERIFIED OR MODIFIED IN THE APPLICABLE AREA.
- HORIZONTAL LAYOUT DIMENSIONS ARE MEASURED ALONG THE FACE OF THE WALL, CORRESPONDING TO A HORIZONTAL REFERENCE ESTABLISHED BY PATERSON GROUP BASED ON DRAWINGS BY IBI GROUP.
- PRECAST UNITS SHALL BE REDI-ROCK RETAINING WALL UNITS MANUFACTURED UNDER LICENSE FROM REDI-ROCK
- THE WALL BASE SHALL CONSIST OF A MINIMUM OF 300mm OF OPSS GRANULAR A OR GRANULAR B TYPE II ON NATIVE SOIL. A MINIMUM OF 150mm OF GRANULAR MATERIAL CAN BE USED WHERE BEDROCK IS ENCOUNTERED ALONG THE BASE OF THE WALL. THE BASE SHALL BE COMPACTED AS TO PROVIDE A LEVEL AND HARD SURFACE ON WHICH TO PLACE THE FIRST COURSE OF UNITS. GRANULAR BASE MATERIAL SHALL BE COMPACTED TO A MINIMUM 98% OF STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMD). THE BASE SHALL BE SMOOTHED TO ENSURE COMPLETE CONTACT OF RETAINING WALL UNIT WITH BASE. SURFACE OF GRANULAR BASE MAY BE DRESSED WITH FINER AGGREGATE TO AID LEVELING. ENSURE GRADATION OF DRESSING MATERIAL IS SUCH AS TO PRECLUDE LOSS OF FINES INTO BASE. THE THICKNESS OF DRESSING LAYER SHOULD NOT EXCEED 3 TIMES THE MAXIMUM PARTICLE SIZE USED. THE CONTRACTOR MAY SUBSTITUTE CONCRETE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 20 MPa AND AIR ENTRAINMENT FOR THE GRANULAR BASE MATERIAL.
- INSTALL 100mm DIAMETER PERFORATED PIPE DRAIN WRAPPED IN GEOTEXTILE UNDER LOWER COURSE OF WALL (OR ALTERNATIVELY BEHIND HEEL OF WALL). PROVIDE CLEAR STONE SURROUNDING THE DRAIN TO PROTECT PIPE FROM CLOGGING AND DAMAGE. PROVIDE OUTLETS AT ENDS OF WALL OR CONNECT TO NEARBY CATCH BASIN TO DRAIN WHERE POSSIBLE.
- PATERSON SHOULD REVIEW THE BEARING SURFACE DURING THE CONSTRUCTION. WHERE COMPACT SILTY SAND FILL MATERIAL IS ENCOUNTERED, PROOF ROLLING OF THE BEARING SURFACE WILL BE REQUIRED.
- WALL IS DESIGNED FOR A MINIMUM OF 200 mm TOE EMBEDMENT WITH A MINIMUM HORIZONTAL LEAD OF 300mm BEYOND THE FACE AND REAR OF BASE BLOCK. WHERE GRANULAR BEDDING WILL NOT BE SUFFICIENT, THE USE OF CONCRETE BEDDING MAY BE REQUIRED. EXTRA PRECAUTIONS MUST BE TAKEN TO PROVIDE TOE EMBEDMENT IN AREAS WHERE BASE OF WALL STEPS.
- THE RETAINING WALL IS A BATTERED WALL. ALIGNMENT OF THE BOTTOM WALL UNIT COURSE SHOULD BE PLANNED TO CONSIDER THAT A NOMINAL 41 mm AUTOMATIC SETBACK WILL OCCUR WITH EACH 0.46 m HIGH UNIT.
- BACKFILL MATERIAL SHALL BE APPROVED BY THE SITE GEOTECHNICAL ENGINEER PRIOR TO USE AND SHOULD CONSIST OF OPSS GRANULAR B TYPE II BUFFER OF 1000mm AS SHOWN. WIDTH ALL FILL WITHIN A 1H:1V ZONE UP AND BACK FROM THE HEEL SHOULD ALSO BE COMPACTED. BACKFILL SHALL BE PLACED IN MAXIMUM 300 mm LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF THE MATERIAL'S SPMD. MOISTURE CONTENT SHOULD BE CONTROLLED AND MAINTAINED WITHIN -3 TO +4 PERCENT OF OPTIMUM. ONLY WHERE WALL PASSES DIRECTLY AGAINST A FENCE POST SHOULD CLEAR STONE BE USED.
- ENSURE EACH COARSE IS COMPLETELY FILLED AND BACKFILL IS PLACED TO THE SAME LEVEL PRIOR TO PROCEEDING TO THE NEXT COURSE. ENSURE ADJACENT UNITS ARE IN CONTACT SO THAT UNIT FILL MAY NOT ESCAPE THROUGH THE JOINT BETWEEN UNITS. GAPS GREATER THAN 6 mm BETWEEN UNITS (AT THE FACE) SHALL NOT BE ALLOWED. AT THE INTERSECTIONS WITH STRUCTURES, CUT UNITS TO OBTAIN A NEAT FIT. PULL BLOCK UNITS FORWARD TO ENGAGE THE ALIGNMENT LOOPS ON THE UNIT BELOW BEFORE INFILLING IN ALL CASES.
- MAINTAIN TEMPORARY GRADES TO DIVERT SURFACE WATER AWAY FROM THE RETAINING WALL EXCAVATION. SLOPE FINAL BACKFILL TO PROVIDE POSITIVE DRAINAGE AND TO ELIMINATE PONDING.
- IF WINTER CONSTRUCTION IS CONSIDERED, HEAT MUST BE MAINTAINED WHEN THE BASE IS EXPOSED. THE WALL BASE MUST BE COVERED WITH INSULATION TARPS TO MAINTAIN HEAT AND PROTECT THE BASE FROM POTENTIAL FROST HEAVE. ONCE THE BASE IS BACKFILLED, THE TOP OF WALL MUST BE COVERED WITH INSULATION TARPS OVERNIGHT UNTIL THE WALL CONSTRUCTION IS COMPLETED.
- THE GEOTECHNICAL CONSULTANT SHOULD BE NOTIFIED AT THE BEGINNING OF THE WALL CONSTRUCTION TO COMPLETE PERIODIC INSPECTIONS AND PROVIDE GEOTECHNICAL RECOMMENDATIONS AS THE WALL CONSTRUCTION PROGRESSES.
- DURING THE CONSTRUCTION OF THE RETAINING WALL, THE CONTRACTOR MUST ENSURE THAT A SAFE SLOPE IS PROVIDED BEHIND THE RETAINING WALL. THE GEOTECHNICAL CONSULTANT SHOULD COMPLETE PERIODIC INSPECTIONS TO ENSURE A PROPER SLOPE IS PROVIDED AS PER THE SITE GEOTECHNICAL RECOMMENDATIONS.
- ANY INADEQUATE PERFORMING SUBGRADE SHOULD BE SUB-EXCAVATED AND REPLACED WITH OPSS GRANULAR B TYPE II, COMPACTED TO 98% OF THE MATERIAL'S SPMD.
- ANY CUTTING OF BLOCKS TO SUIT SITE CONDITIONS OR WALL DESIGN WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. REMOVAL/CUTTING OF LIFTING LOOPS ON THE FINAL ROW OF BLOCKS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- SECTIONS OF THE RETAINING WALL IN CLOSE PROXIMITY TO THE PAVEMENT STRUCTURE SHALL BE SUBJECTED TO A SEALANT AGAINST SALT USED DURING WINTER SEASONS. A WATER-BASED SILANE PENETRATING SEALANT, SUCH AS MASTERPROTECT H-400 OR EQUIVALENT, RECOMMENDED TO BE USED DURING OR POST INSTALLATION OF THE RETAINING WALL SYSTEM. THE METHOD CONSISTS OF PRESSURE WASHING THE WALL BLOCKS AND APPLYING THE SEALANT. THE PROCESS SHOULD BE REPEATED EVERY 5 YEARS. DEVELOPER TO APPLY FIRST AND SECOND COAT OF SEALANT BEFORE TURNING WALL OVER TO THE CITY OF OTTAWA.
- THE CONTRACTOR SHOULD REFER TO THE INSTALLATION MANUAL PROVIDED FOR THE RETAINING WALL BLOCK TYPE PROVIDED HEREIN FOR ADDITIONAL DETAILS ON ACCEPTABLE INSTALLATION PRACTICES.
- THE REDI-ROCK PRODUCT HAS BEEN DESIGNED FOR A MINIMUM LIFE SPAN OF 75 YEARS. REFER TO REDI-ROCK MANUFACTURER.
- THE RETAINING WALL HAS BEEN DESIGNED TO RESIST TO THE WIND LOAD ACTING ON THE NOISE BARRIER FOUND IN APPLICABLE AREAS.
- REFER TO PATERSON GROUP PG5451-MEMO.04 FOR DETAILS ABOUT PLACEMENT OF ARMOUR STONE BLOCKS ALONG STREETS.

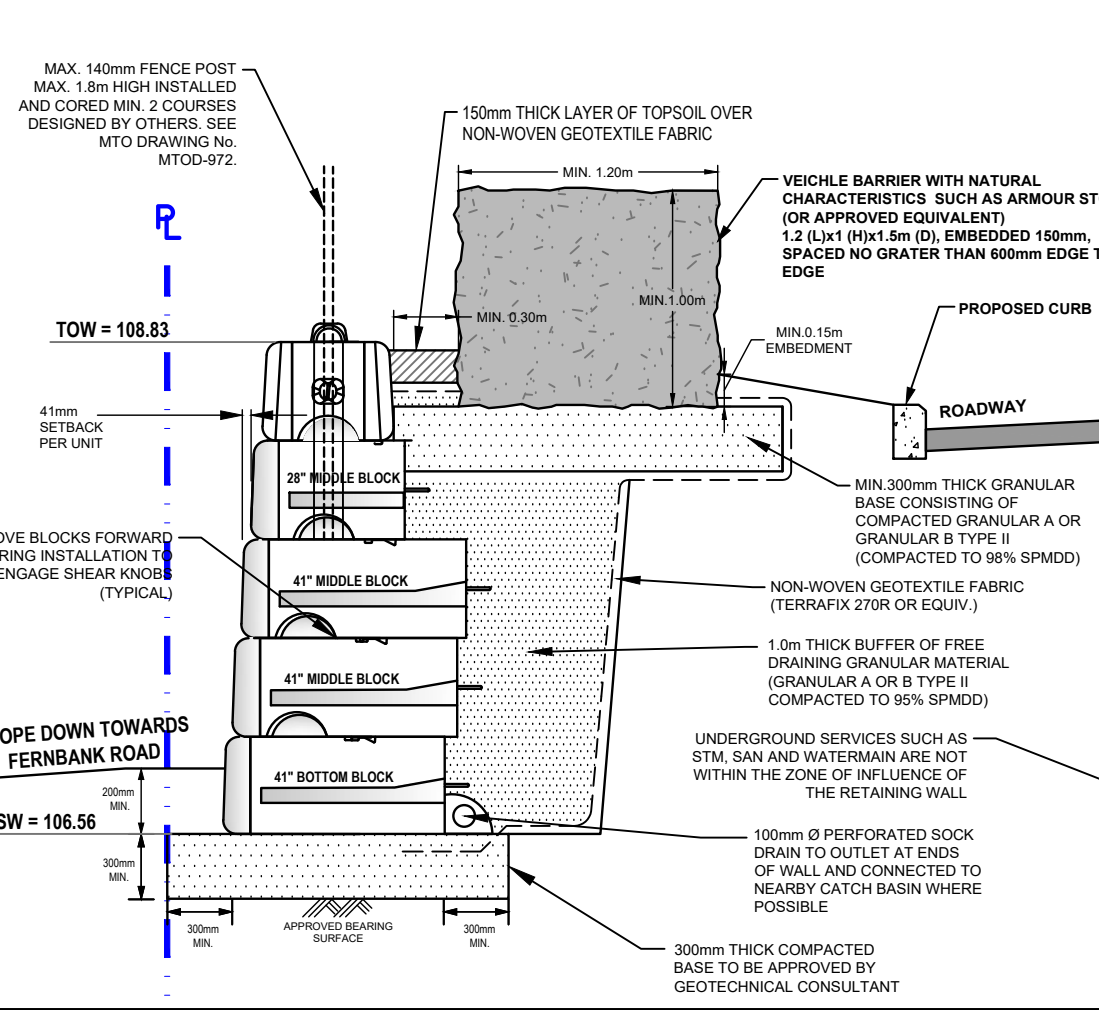
GRADING PLAN:

SCALE 1:1000



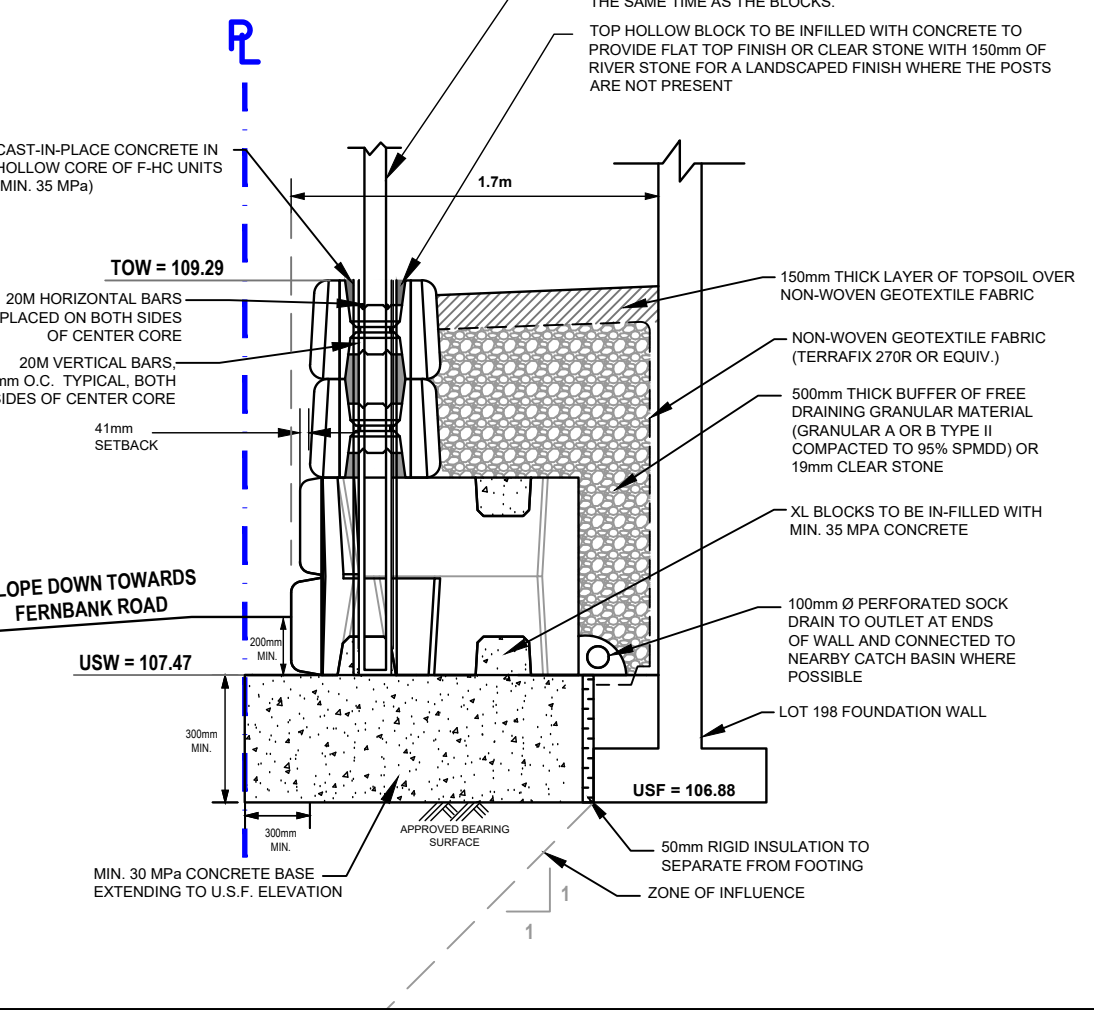
CROSS SECTION C-C:

SCALE 1:35



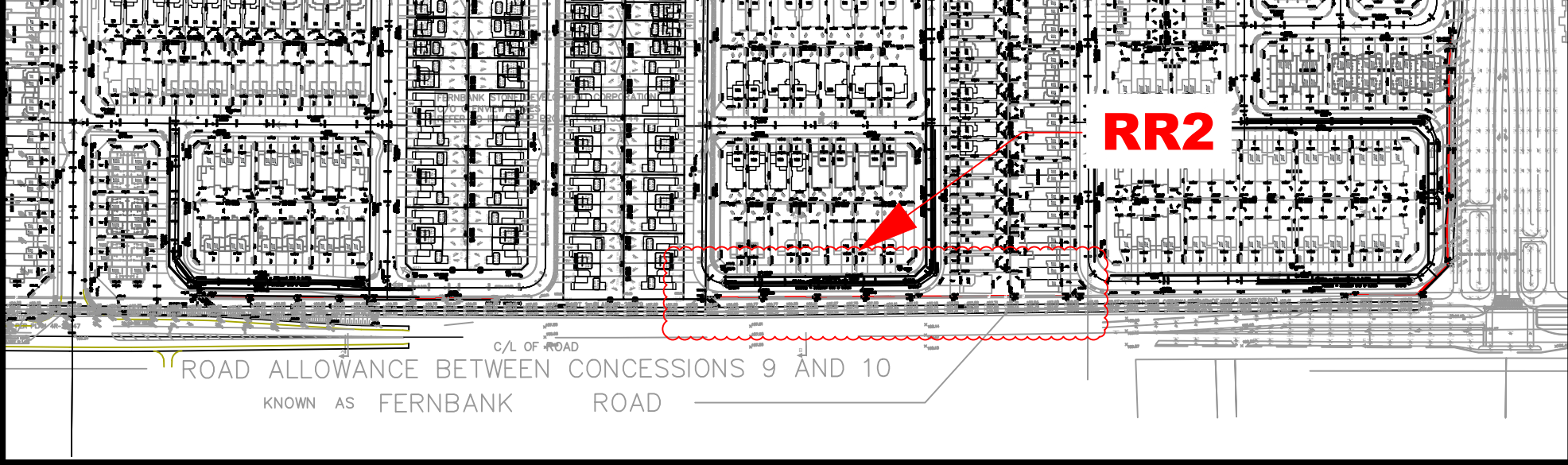
CROSS SECTION D-D:

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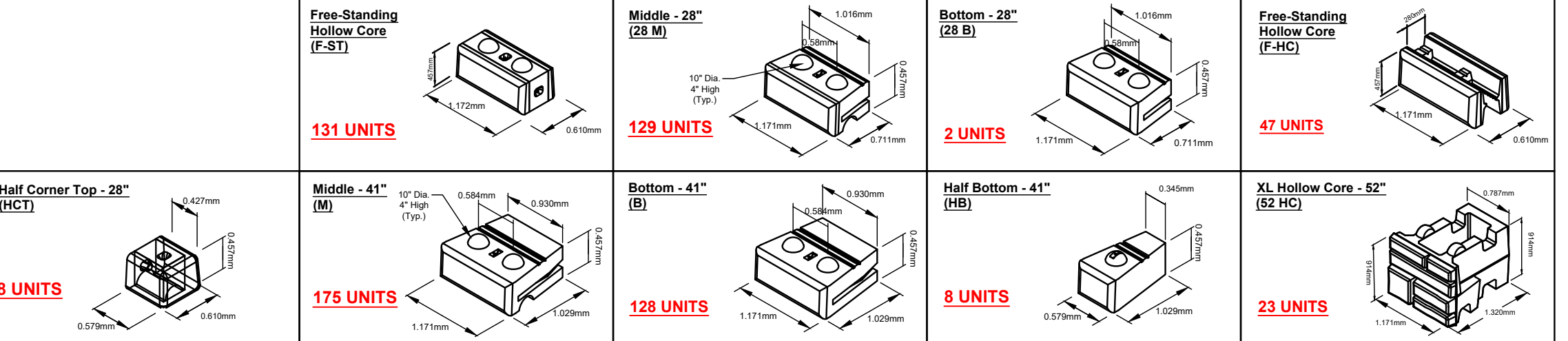
KEY PLAN:

SCALE 1:3000



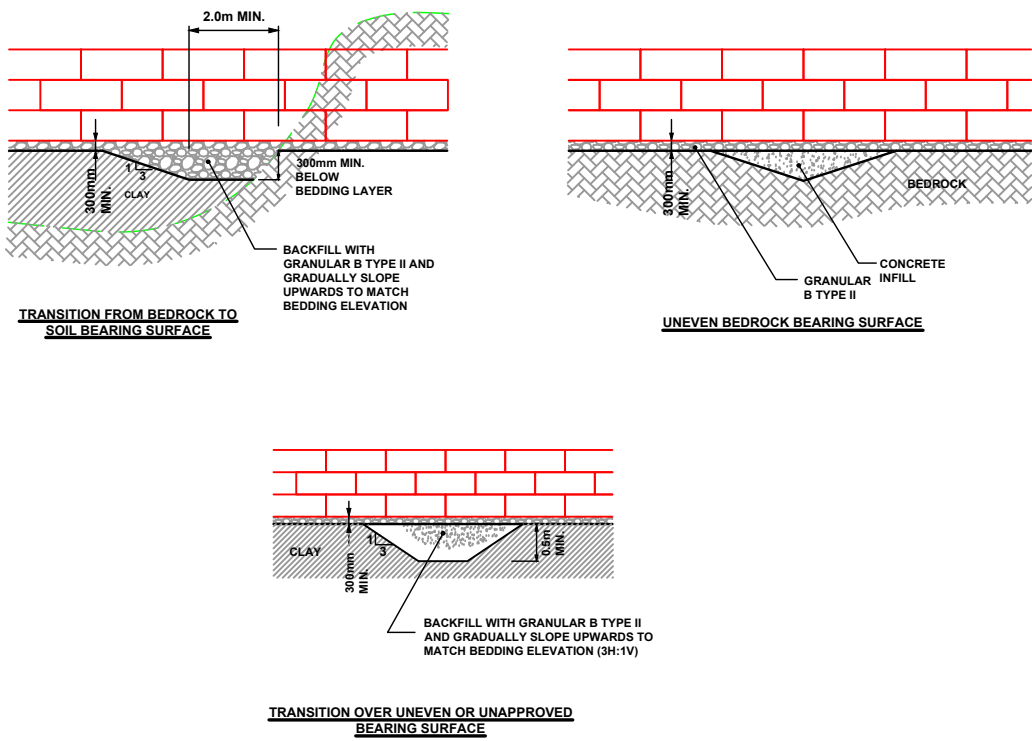
BLOCK COUNT:

N.T.S.



BEDROCK TRANSITION DETAILS:

N.T.S.



PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
4	VEICHLER BARRIER (NATURAL STONE)	04/11/2024	JV
3	ISSUED FOR CONSTRUCTION	02/04/2024	JV
2	AS PER CITY OF OTTAWA COMMENTS	29/06/2023	JV
1	AS PER CLIENT COMMENTS	25/01/2023	JV

CRT DEVELOPMENTS
PROPOSED RETAINING WALLS
5725 FERNBANK ROAD - CRT PHASE 3
OTTAWA, ONTARIO
REDO-ROCK RETAINING WALL DESIGN (RR2)

Stamp:

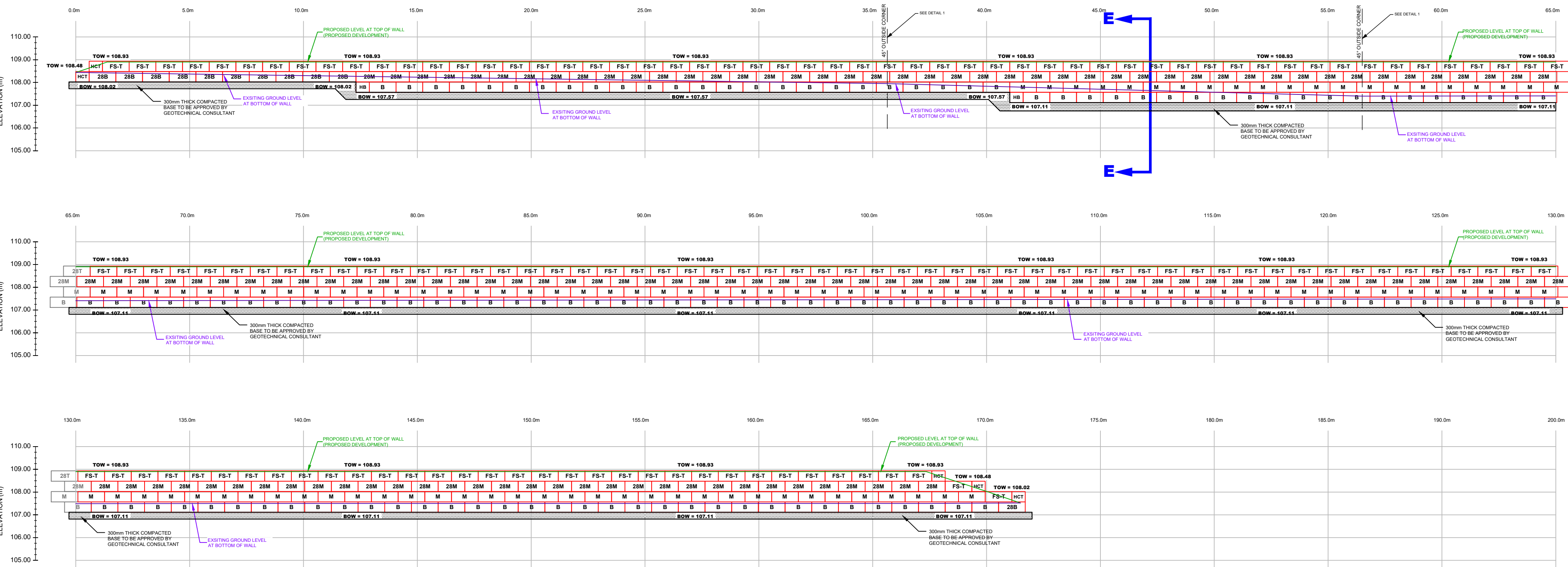
Stamp:

Scale:	AS SHOWN
Drawn by:	NFRV
Checked by:	JV
Approved by:	FA
Date:	09/2022

File No.:	PG2236
Drawing No.:	PG2236-7
Revision No.:	4

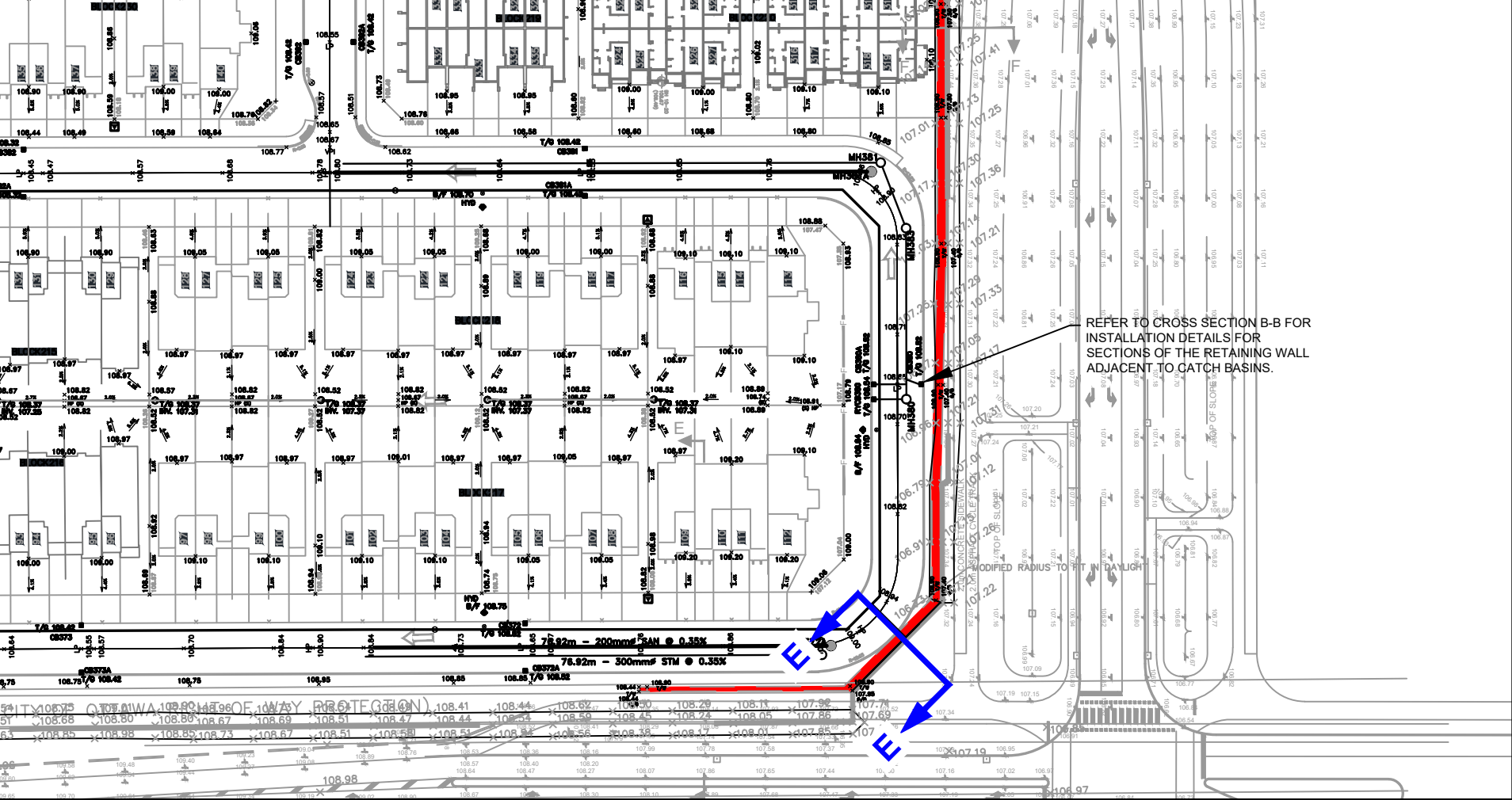
PROFILE VIEW (RR3):

SCALE 1:125



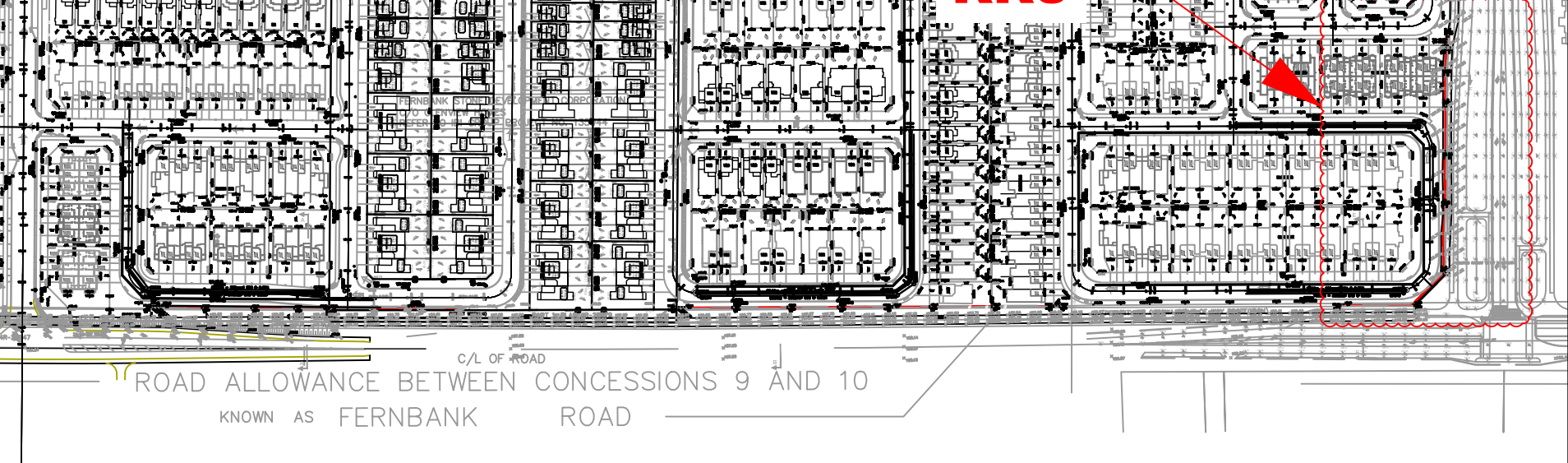
GRADING PLAN:

SCALE 1:1000



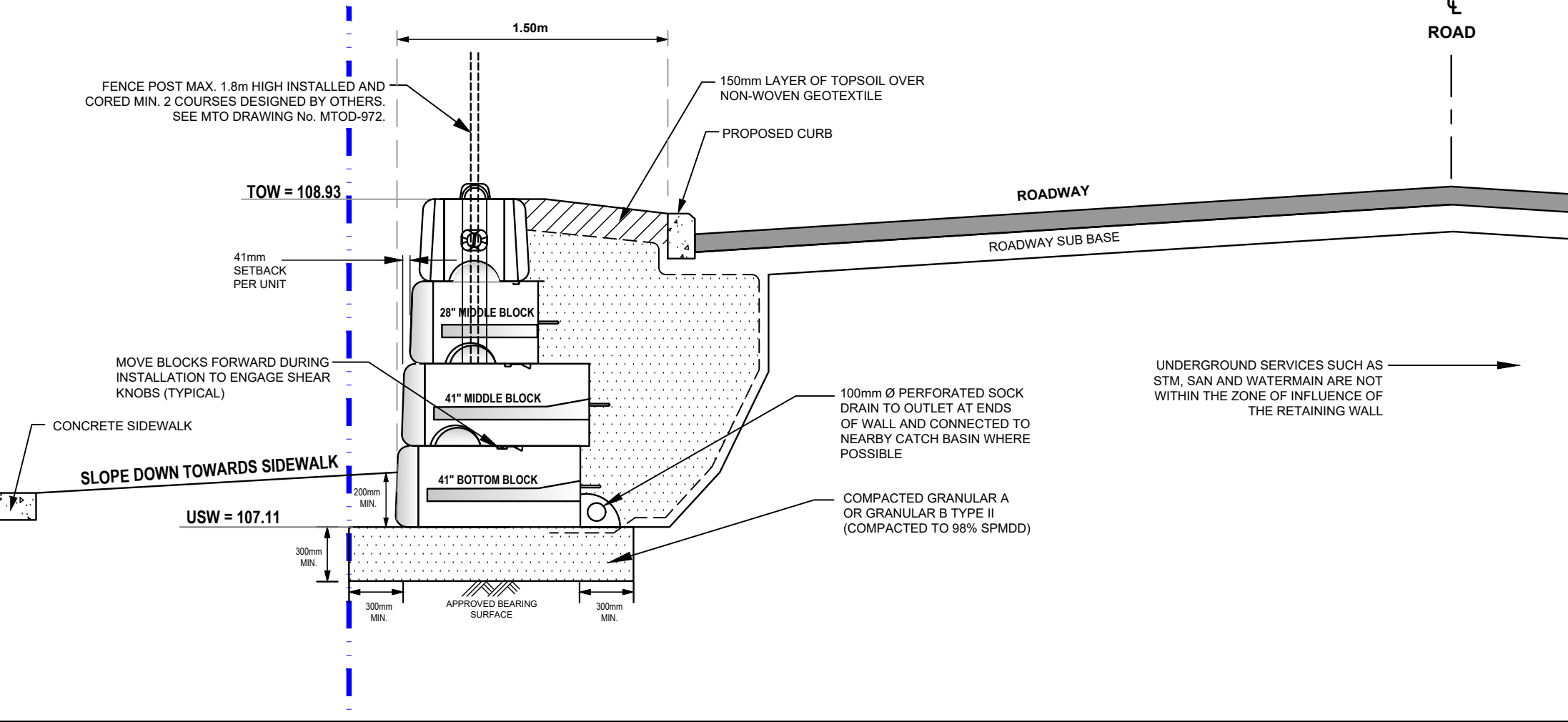
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SCALE 1:3000



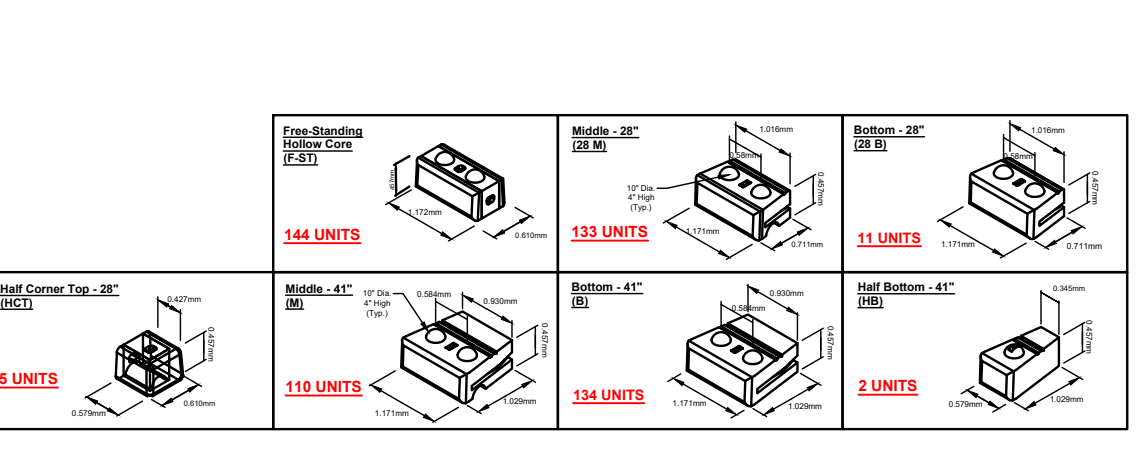
CROSS SECTION E-E:

SCALE 1:30



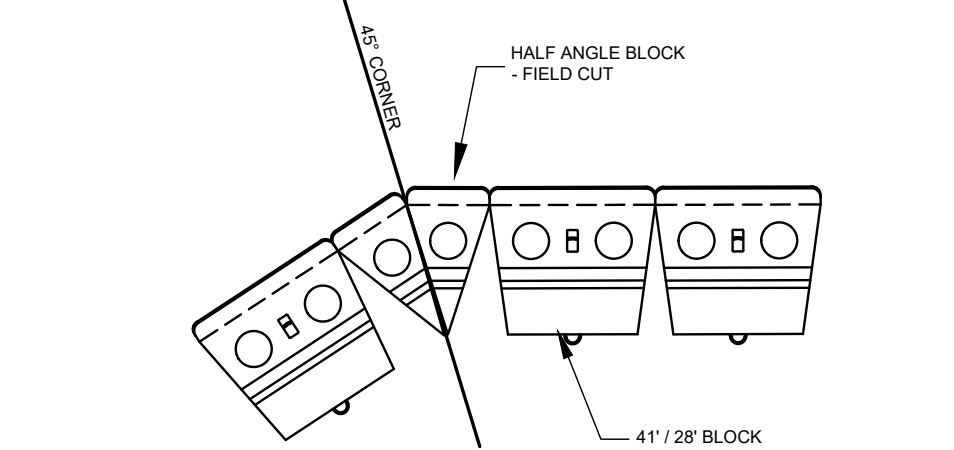
BLOCK COUNT:

N.T.S.



DETAIL 1:

N.T.S.



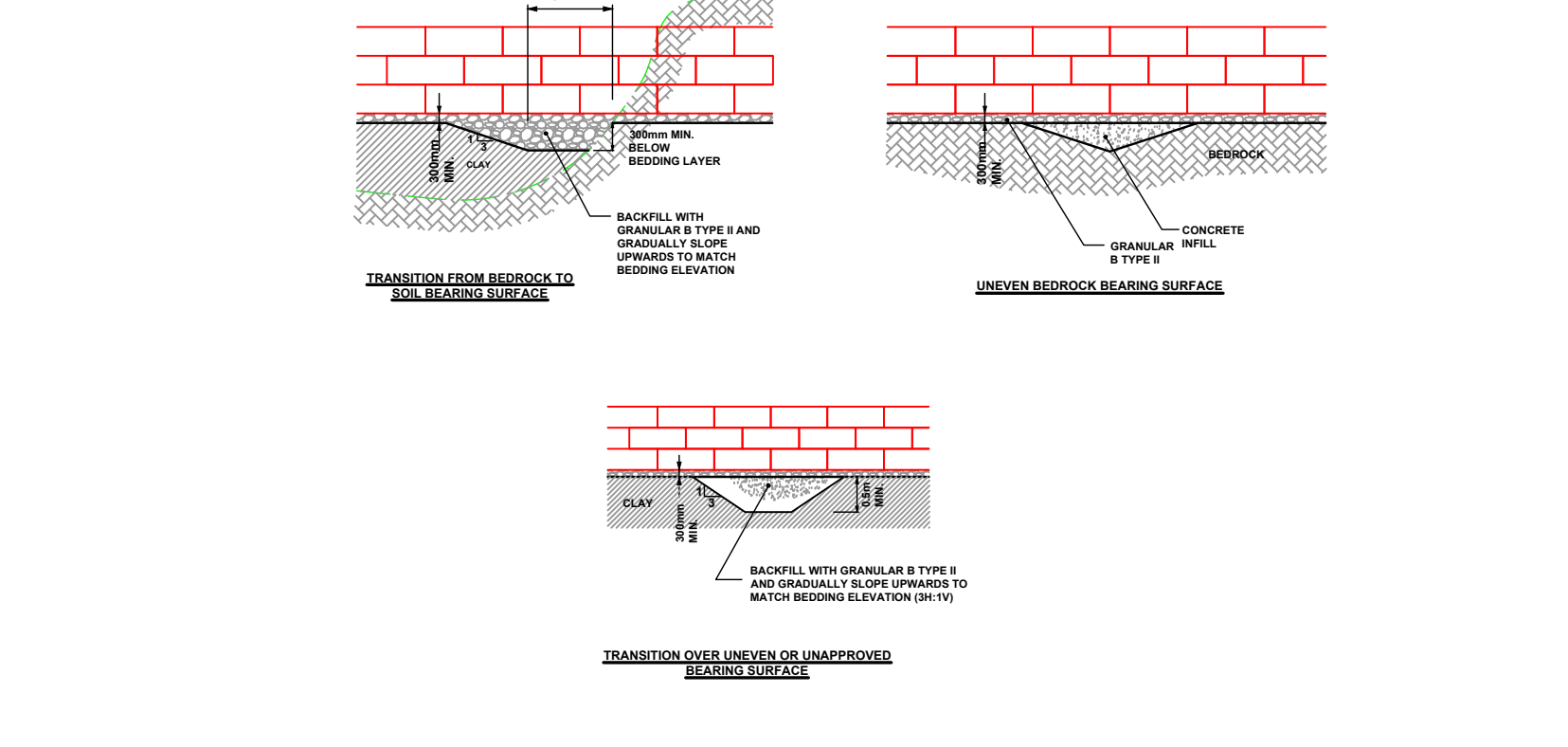
NOTES:

- THE CONTRACTOR IS SOLELY RESPONSIBLE FOR UTILITY CLEARANCE AND CONSTRUCTION SITE SAFETY. MCON PRODUCTS INC. AND PATERSON GROUP SHALL NOT BE RESPONSIBLE FOR MEANS OR METHODS OF CONSTRUCTION OR FOR SAFETY OF WORKERS OR OF THE PUBLIC.
- THIS DESIGN IS BASED ON THE FOLLOWING SOIL PROPERTIES:

PROPERTY	RETAINED FILL	FOUNDATION MEDIUM (1)	FOUNDATION MEDIUM (2)
FRICITION ANGLE - PHI	38	35	40
UNIT WEIGHT - γ	22 KN/m ³	21 KN/m ³	24KN/m ³
COHESION - C	0	0 kPa	500 kPa
SOIL TYPE	GRANULAR B TYPE II & NATIVE FILL	GLACIAL TILL	BEDROCK
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- MAINTAIN TEMPORARY GRADES TO DIVERT SURFACE WATER AWAY FROM THE RETAINING WALL EXCAVATION. SLOPE FINAL BACKFILL TO PROVIDE POSITIVE DRAINAGE AND TO ELIMINATE PONDING.
- IF WINTER CONSTRUCTION IS CONSIDERED, HEAT MUST BE MAINTAINED WHEN THE BASE IS EXPOSED. THE WALL BASE MUST BE COVERED WITH INSULATION TARPES TO MAINTAIN HEAT AND PROTECT THE BASE FROM POTENTIAL FROST HEAVE. ONCE THE BASE IS BACKFILLED, THE TOP OF WALL MUST BE COVERED WITH INSULATION TARPES OVERNIGHT UNTIL THE WALL CONSTRUCTION IS COMPLETED.
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- ANY INADEQUATE PERFORMING SUBGRADE SHOULD BE SUB-EXCAVATED AND REPLACED WITH OPSS GRANULAR B TYPE II, COMPACTED TO 98% OF THE MATERIALS SPMDD.
- ANY CUTTING OF BLOCKS TO SUIT SITE CONDITIONS OR WALL DESIGN WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. REMOVAL/CUTTING OF LIFTING LOOPS ON THE FINAL ROW OF BLOCKS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
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- THE CONTRACTOR SHOULD REFER TO THE INSTALLATION MANUAL PROVIDED FOR THE RETAINING WALL BLOCK TYPE PROVIDED HEREIN FOR ADDITIONAL DETAILS ON ACCEPTABLE INSTALLATION PRACTICES.
- THE REDI-ROCK PRODUCT HAS BEEN DESIGNED FOR A MINIMUM LIFE SPAN OF 75 YEARS. REFER TO REDI-ROCK MANUFACTURER

BEDROCK TRANSITION DETAILS:

N.T.S.



PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
3	ISSUED FOR CONSTRUCTION	02/04/2024	JV
2	AS PER CITY OF OTTAWA COMMENTS	29/06/2023	JV
1	AS PER CLIENT COMMENTS	25/01/2023	JV

CRT DEVELOPMENTS

PROPOSED RETAINING WALLS
5725 FERNBANK ROAD - CRT PHASE 3

OTTAWA,

Title:

REDI-ROCK RETAINING WALL DESIGN (RR3)

Stamp:

02/04/2024
J. R. VILLENEUVE
100504314
PROVINCE OF ONTARIO

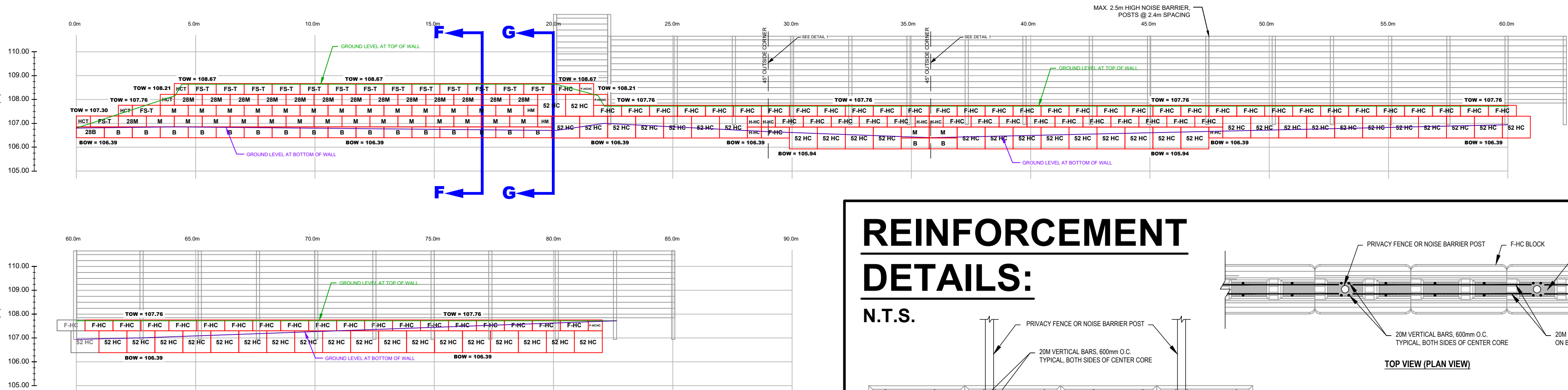
Stamp:

02/04/2024
F. I. ABOL-SEDO
100156744
PROVINCE OF ONTARIO

Scale:	AS SHOWN	File No.:	PG2236
Drawn by:	NFRV	Drawing No.:	
Checked by:	JV		
Approved by:	FA		
Date:	09/2022		
		Revision No.:	3

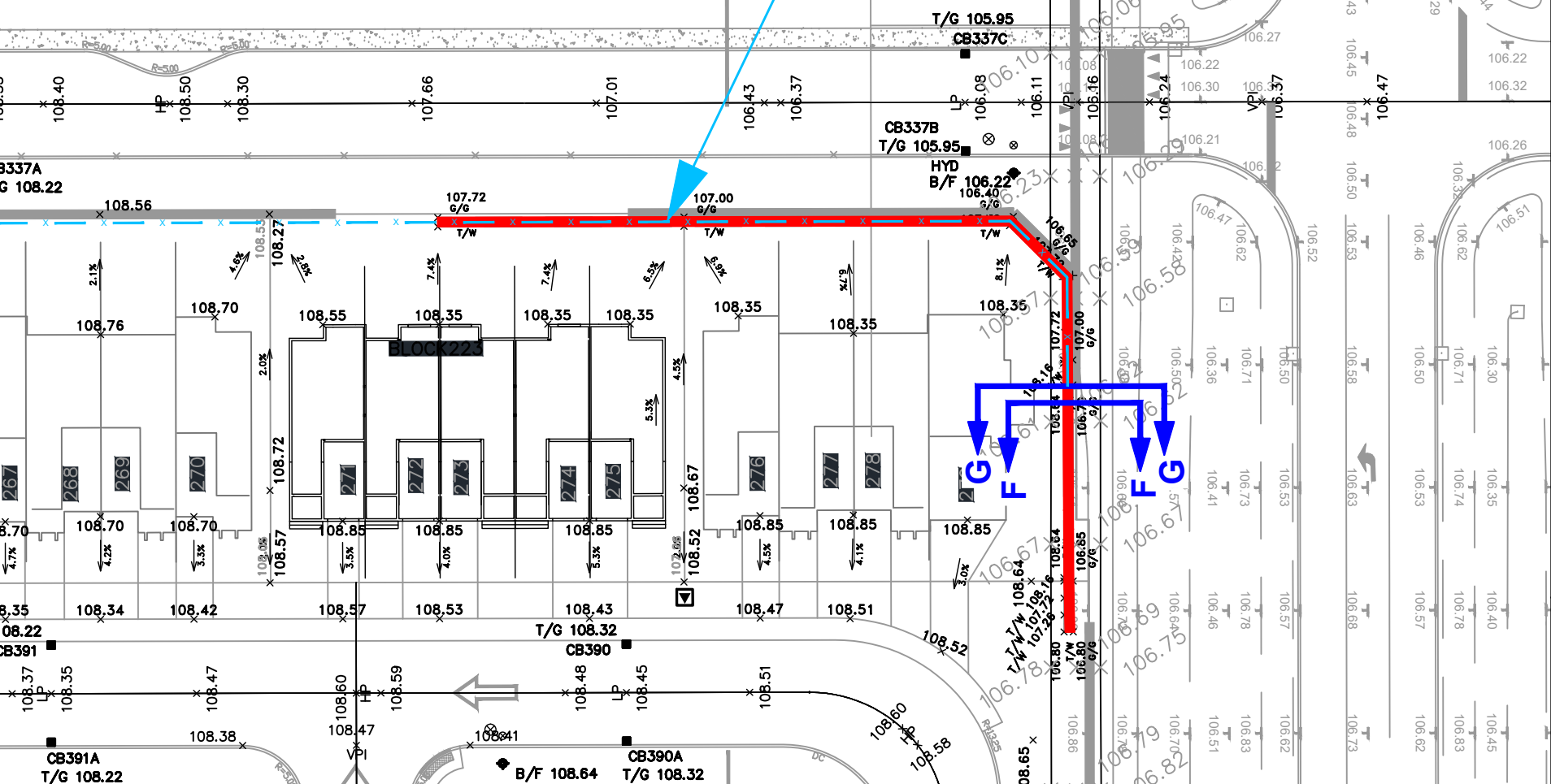
PROFILE VIEW (RR4):

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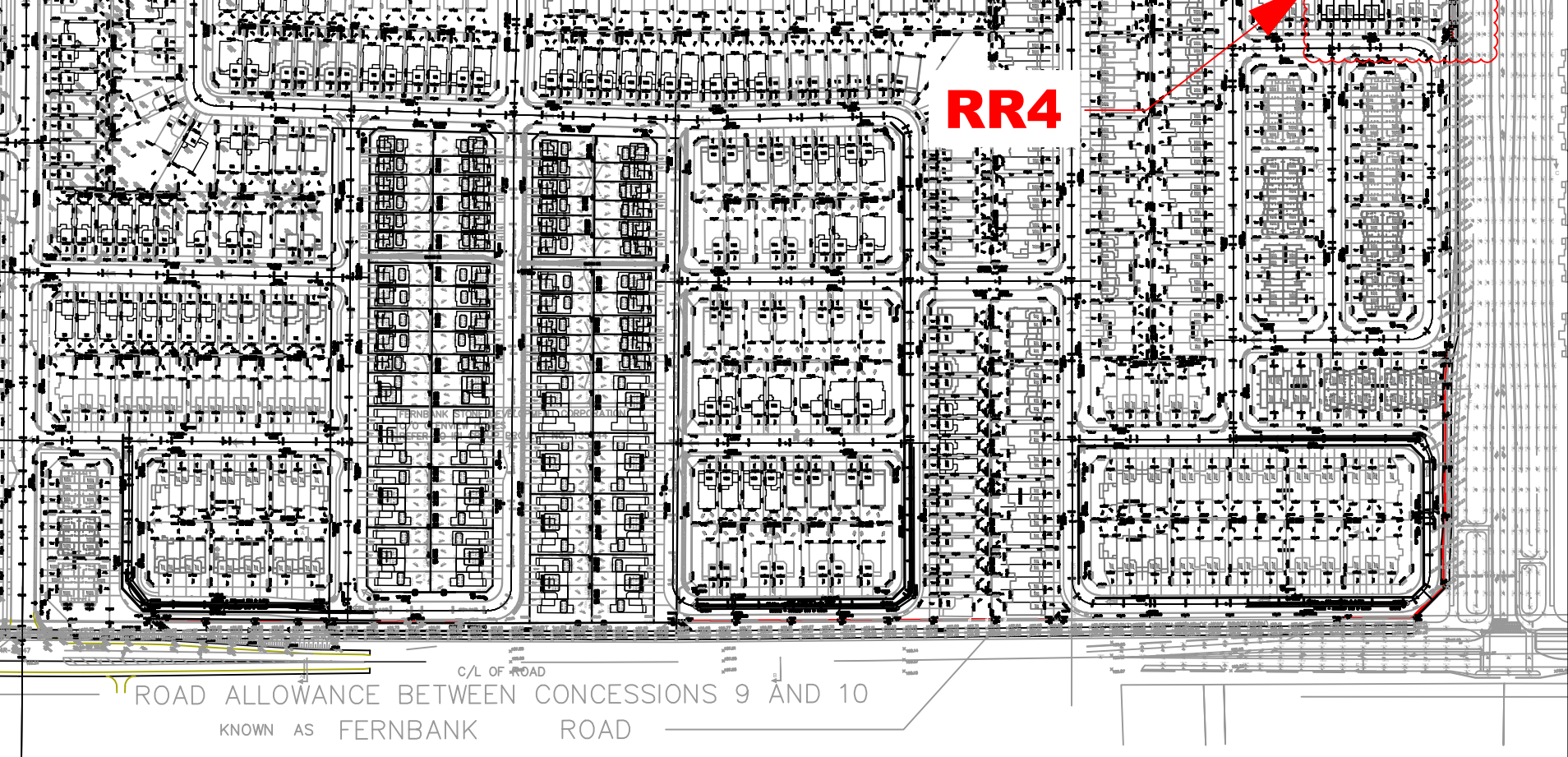
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SCALE 1:500



KEY PLAN:

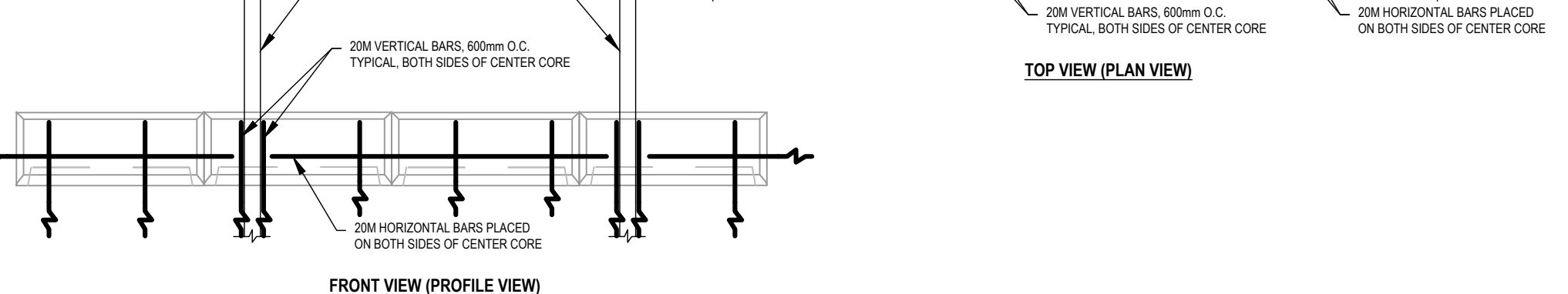
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ISSUED FOR CONSTRUCTION

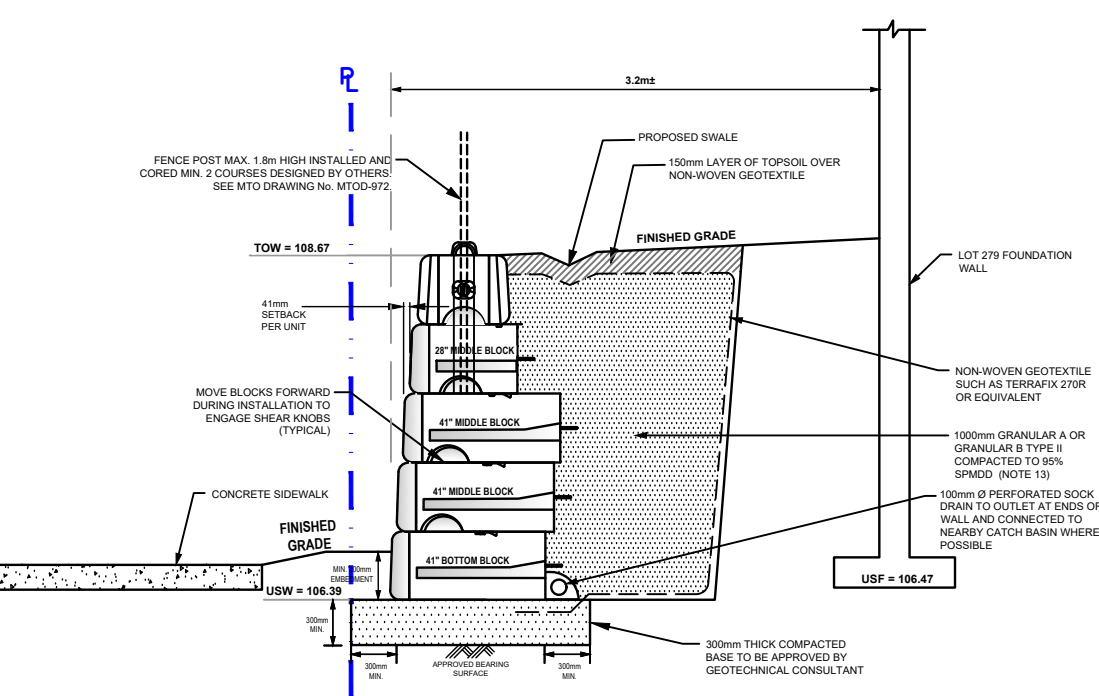
REINFORCEMENT DETAILS:

N.T.S.



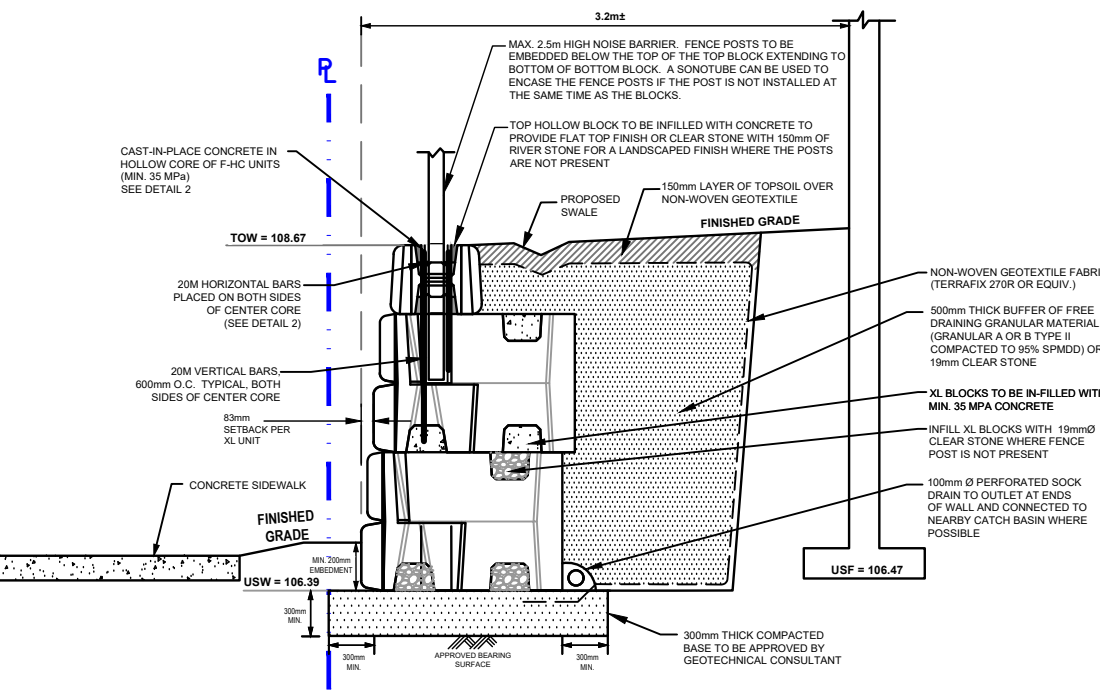
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SCALE 1:50



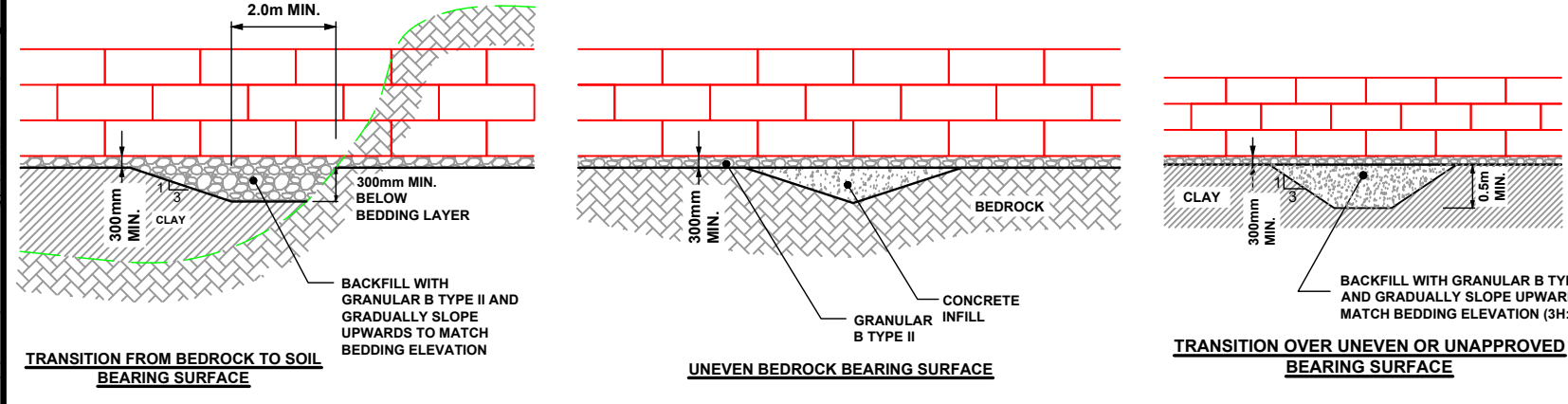
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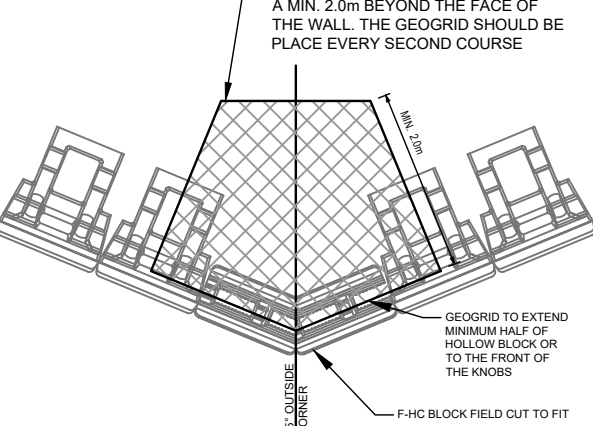
BEDROCK TRANSITION DETAILS:

N.T.S.



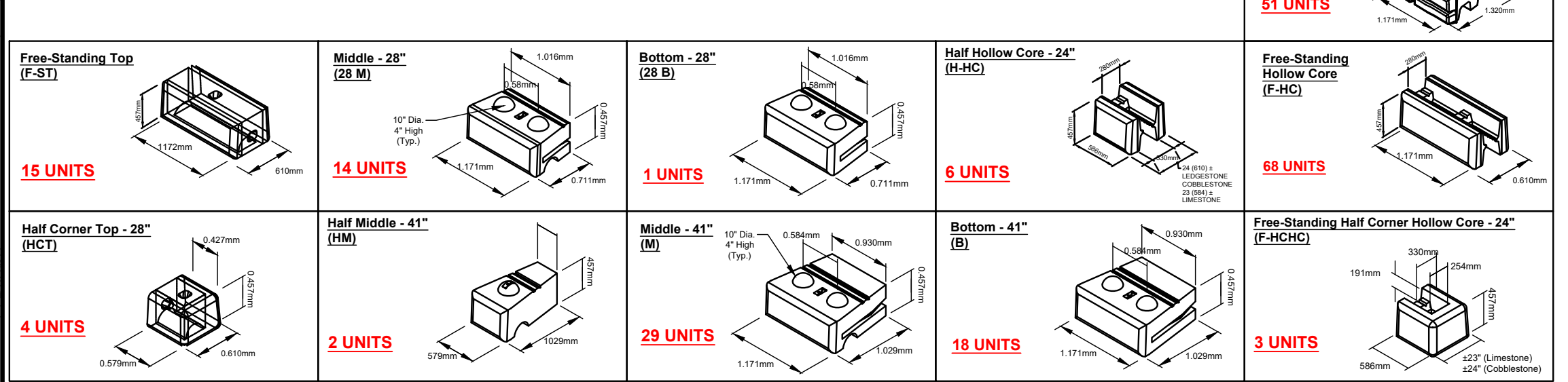
DETAIL 1:

N.T.S.



BLOCK COUNT:

N.T.S.



NOTES:

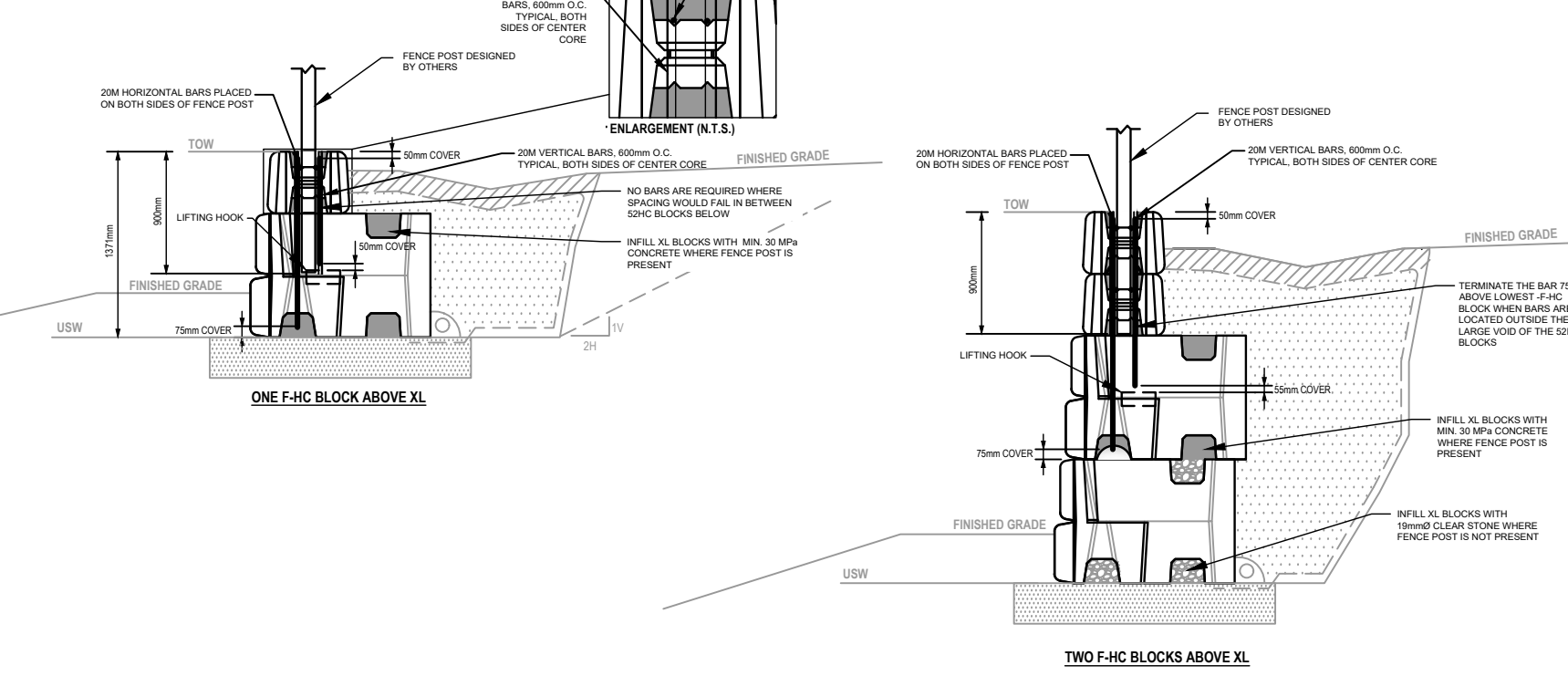
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PROPERTY	RETAINED FILL	FOUNDATION MEDIUM (1)	FOUNDATION MEDIUM (2)
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UNIT WEIGHT - γ	22 KN/m ³	21 KN/m ³	24KN/m ³
COHESION - C	0	0 kPa	500 kPa
SOIL TYPE	GRANULAR B TYPE II & NATIVE FILL	GLACIAL TILL	BEDROCK

MATERIAL PROPERTIES ARE BASED ON SITE EVALUATION BY PATERSON GROUP, SEISMIC LOADING WAS EVALUATED ACCORDING TO THE CHBDC 2015, WITH A PEAK GROUND ACCELERATION VALUE OF 0.254.
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- THE DESIGN HAS BEEN REVIEWED FOR THE STABILITY OF THE PRECAST MODULAR RETAINING WALL SYSTEM AND GLOBAL STABILITY WITH A FACTOR OF SAFETY OF 1.5 FOR STATIC CONDITIONS AND 1.1 UNDER SEISMIC CONDITIONS. WALL GEOMETRY AND GRADE ELEVATIONS ABOVE AND BELOW THE WALL SHOULD CONFORM WITH THE GRADING PLAN PROVIDED HEREIN. IF ACTUAL SITE GRADES VARY SIGNIFICANTLY FROM THOSE SHOWN OR IF THE BACK SLOPE DOES NOT CONFORM, INSTALLATION SHALL NOT PROCEED UNTIL THE DESIGN IS VERIFIED OR MODIFIED IN THE APPLICABLE AREA.
- HORIZONTAL LAYOUT DIMENSIONS ARE MEASURED ALONG THE FACE OF THE WALL, CORRESPONDING TO A HORIZONTAL REFERENCE ESTABLISHED BY PATERSON GROUP BASED ON DRAWINGS BY IBI GROUP.
- PRECAST UNITS SHALL BE REDI-ROCK RETAINING WALL UNITS MANUFACTURED UNDER LICENSE FROM REDI-ROCK
- THE WALL BASE SHALL CONSIST OF A MINIMUM OF 300mm OF OPSS GRANULAR A OR GRANULAR B TYPE II ON NATIVE SOIL. A MINIMUM OF 150mm OF GRANULAR MATERIAL CAN BE USED WHERE BEDROCK IS ENCOUNTERED ALONG THE BASE OF THE WALL. THE BASE SHALL BE COMPACTED AS TO PROVIDE A LEVEL AND HARD SURFACE ON WHICH TO PLACE THE FIRST COURSE OF UNITS. GRANULAR BASE MATERIAL SHALL BE COMPACTED TO A MINIMUM 98% OF STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMD). THE BASE SHALL BE SMOOTHED TO ENSURE COMPLETE CONTACT OF RETAINING WALL UNIT WITH BASE. SURFACE OF GRANULAR BASE MAY BE DRESSED WITH FINER AGGREGATE TO AID LEVELING. ENSURE GRADATION OF DRESSING MATERIAL IS SUCH AS TO PRECLUDE LOSS OF FINES INTO BASE. THE THICKNESS OF DRESSING LAYER SHOULD NOT EXCEED 3 TIMES THE MAXIMUM PARTICLE SIZE USED. THE CONTRACTOR MAY SUBSTITUTE CONCRETE WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 20 MPa AND AIR ENTRAINMENT FOR THE GRANULAR BASE MATERIAL.
- INSTALL 100mm DIAMETER PERFORATED PIPE DRAIN WRAPPED IN GEOTEXTILE UNDER LOWER COURSE OF WALL (OR ALTERNATIVELY BEHIND HEEL OF WALL), PROVIDE CLEAR STONE SURROUNDING THE DRAIN TO PROTECT PIPE FROM CLOGGING AND DAMAGE. PROVIDE OUTLETS AT ENDS OF WALL OR CONNECT TO NEARBY CATCH BASIN TO DRAIN WHERE POSSIBLE.
- PATERSON SHOULD REVIEW THE BEARING SURFACE DURING THE CONSTRUCTION, WHERE COMPACT SILTY SAND FILL MATERIAL IS ENCOUNTERED, PROOF ROLLING OF THE BEARING SURFACE WILL BE REQUIRED.
- WALL IS DESIGNED FOR A MINIMUM OF 200 mm TOE EMBEDMENT WITH A MINIMUM HORIZONTAL LEDGE OF 300mm BEYOND THE FACE AND REAR OF BASE BLOCK, WHERE GRANULAR BEDDING WILL NOT BE SUFFICIENT, THE USE OF CONCRETE BEDDING MAY BE REQUIRED. EXTRA PRECAUTIONS MUST BE TAKEN TO PROVIDE TOE EMBEDMENT IN AREAS WHERE BASE OF WALL STEPS.
- THE RETAINING WALL IS A BATTERED WALL, ALIGNMENT OF THE BOTTOM WALL UNIT COURSE SHOULD BE PLANNED TO CONSIDER THAT A NOMINAL 41 mm AUTOMATIC SETBACK WILL OCCUR WITH EACH 0.46 m HIGH UNIT.
- BACKFILL MATERIAL SHALL BE APPROVED BY THE SITE GEOTECHNICAL ENGINEER PRIOR TO USE AND SHOULD CONSIST OF OPSS GRANULAR B TYPE II BUFFER OF 1000mm (AS SHOWN) WIDTH. ALL FILL WITHIN A 1H:1V ZONE UP AND BACK FROM THE HEEL SHOULD ALSO BE COMPACTED. BACKFILL SHALL BE PLACED IN MAXIMUM 300 mm LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF THE MATERIAL'S SPMD. MOISTURE CONTENT SHOULD BE CONTROLLED AND MAINTAINED WITHIN -3 TO +4 PERCENT OF OPTIMUM. ONLY WHERE WALL PASSES DIRECTLY AGAINST A FENCE POST SHOULD CLEAR STONE BE USED.
- ENSURE EACH COARSE IS COMPLETELY FILLED AND BACKFILL IS PLACED TO THE SAME LEVEL PRIOR TO PROCEEDING TO THE NEXT COURSE. ENSURE ADJACENT UNITS ARE IN CONTACT SO THAT UNIT FILL MAY NOT ESCAPE THROUGH THE JOINT BETWEEN UNITS. GAPS GREATER THAN 6 mm BETWEEN UNITS (AT THE FACE) SHALL NOT BE ALLOWED. AT THE INTERSECTIONS WITH STRUCTURES, CUT UNITS TO OBTAIN A NEAT FIT. PULL BLOCK UNITS FORWARD TO ENGAGE THE ALIGNMENT LOOPS ON THE UNIT BELOW BEFORE INFILLING IN ALL CASES.
- MAINTAIN TEMPORARY GRADES TO DIVERT SURFACE WATER AWAY FROM THE RETAINING WALL EXCAVATION. SLOPE FINAL BACKFILL TO PROVIDE POSITIVE DRAINAGE AND TO ELIMINATE PONDING.
- IF WINTER CONSTRUCTION IS CONSIDERED, HEAT MUST BE MAINTAINED WHEN THE BASE IS EXPOSED. THE WALL BASE MUST BE COVERED WITH INSULATION TARPS TO MAINTAIN HEAT AND PROTECT THE BASE FROM POTENTIAL FROST HEAVE. ONCE THE BASE IS BACKFILLED, THE TOP OF WALL MUST BE COVERED WITH INSULATION TARPS OVERNIGHT UNTIL THE WALL CONSTRUCTION IS COMPLETED.
- THE GEOTECHNICAL CONSULTANT SHOULD BE NOTIFIED AT THE BEGINNING OF THE WALL CONSTRUCTION TO COMPLETE PERIODIC INSPECTIONS AND PROVIDE GEOTECHNICAL RECOMMENDATIONS AS THE WALL CONSTRUCTION PROGRESSES.
- DURING THE CONSTRUCTION OF THE RETAINING WALL, THE CONTRACTOR MUST ENSURE THAT A SAFE SLOPE IS PROVIDED BEHIND THE RETAINING WALL. THE GEOTECHNICAL CONSULTANT SHOULD COMPLETE PERIODIC INSPECTIONS TO ENSURE A PROPER SLOPE IS PROVIDED AS PER THE SITE GEOTECHNICAL RECOMMENDATIONS.
- ANY INADEQUATE PERFORMING SUBGRADE SHOULD BE SUB-EXCAVATED AND REPLACED WITH OPSS GRANULAR B TYPE II, COMPACTED TO 98% OF THE MATERIALS SPMD.
- ANY CUTTING OF BLOCKS TO SUIT SITE CONDITIONS OR WALL DESIGN WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. REMOVAL/CUTTING OF LIFTING LOOPS ON THE FINAL ROW OF BLOCKS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- SECTIONS OF THE RETAINING WALL IN CLOSE PROXIMITY TO THE PAVEMENT STRUCTURE SHALL BE SUBJECT TO A SEALANT AGAINST SALT USED DURING WINTER SEASONS. A WATER BASED SILANE PENETRATING SEALANT, SUCH AS MASTERPROTECT H-400 OR EQUIVALENT, RECOMMENDED TO BE USED DURING OR POST INSTALLATION OF THE RETAINING WALL SYSTEM. THE METHOD CONSISTS OF PRESSURE WASHING THE WALL BLOCKS AND APPLYING THE SEALANT. THE PROCESS SHOULD BE REPEATED EVERY 5 YEARS. DEVELOPER TO APPLY FIRST AND SECOND COAT OF SEALANT BEFORE TURNING WALL OVER TO THE CITY OF OTTAWA
- THE CONTRACTOR SHOULD REFER TO THE INSTALLATION MANUAL PROVIDED FOR THE RETAINING WALL BLOCK TYPE PROVIDED HEREIN FOR ADDITIONAL DETAILS ON ACCEPTABLE INSTALLATION PRACTICES.
- THE REDI-ROCK PRODUCT HAS BEEN DESIGNED FOR A MINIMUM LIFE SPAN OF 75 YEARS. REFER TO REDI-ROCK MANUFACTURER
- THE RETAINING WALL HAS BEEN DESIGNED TO RESIST TO THE WIND LOAD ACTING ON THE NOISE BARRIER FOUND IN APPLICABLE AREAS.

DETAIL 2:

N.T.S.



PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
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NO.	REVISIONS	DATE	INITIAL
4	ISSUED FOR CONSTRUCTION	02/04/2024	JV
3	AS PER CLIENT COMMENTS	07/02/2024	JV
2	AS PER CITY OF OTTAWA COMMENTS	29/06/2023	JV
1	AS PER CLIENT COMMENTS	25/01/2023	JV

CRT DEVELOPMENTS
PROPOSED RETAINING WALLS
5725 FERNBANK ROAD - CRT PHASE 3

OTTAWA,
Title:
REDI-ROCK RETAINING WALL DESIGN (RR4)

ONTARIO

Stamp:
LICENSED PROFESSIONAL ENGINEER
02/04/2024
J. R. VILLENEUVE
100504314
PROVINCE OF ONTARIO

Stamp:
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Scale:	AS SHOWN	File No.:	PG2236
Drawn by:	NFRV	Drawing No.:	
Checked by:	JV		
Approved by:	FA		
Date:	09/2022	Revision No.:	4