



210-222 College Avenue East

Functional Servicing and Stormwater Management Report

Project Location:

210-222 College Avenue East, Guelph, ON

Prepared for:

EM Guelph Developments Limited Partnership
6 Adelaide Street East Suite 300
Toronto, ON M5C 1H6

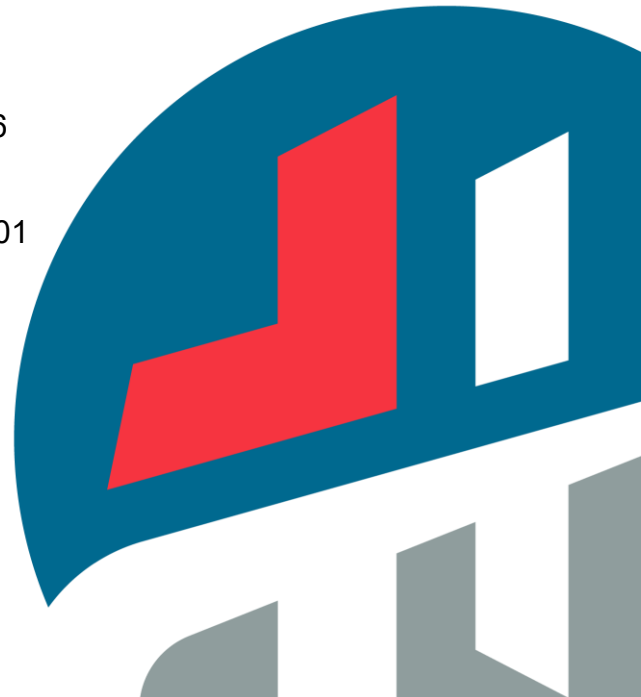
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1.0 INTRODUCTION

MTE Consultants Inc. was retained by EM Guelph Developments Limited Partnership to complete a Functional Servicing and Stormwater Management Report for a new student residence development to be constructed at 210-222 College Avenue East (herein referred to as 'the Site') in the City of Guelph in support of the Official Plan Amendment and Zoning By-Law Amendment Applications.

The property is bounded to the north by Cutten Fields golf course, to the east by a parking area for the Cutten Fields golf course, to the south by College Avenue East and to the west by an existing single detached residential development. For the exact location of the Site refer the key plan in the separately appended drawings.

The proposed development for the Site is the construction of an 8-storey student residence building. The proposed development also includes underground parking complete with access off College Avenue East.

The purpose of this study is to support the Official Plan Amendment and Zoning By-Law Amendment Applications. This will be accomplished by reviewing the opportunities and constraints for the Site with respect to servicing, grading, and stormwater management; describing the development concept; and demonstrating the functional serviceability of the property. Pending approval of the Amendment applications, detailed design of the Site will commence and be submitted to the City in support of Site Plan Approval.

2.0 EXISTING CONDITIONS

2.1 Existing Topography

The Site encompasses an area of 0.393ha and currently comprises of three separate lots; each with a single-detached residential dwelling. In the existing condition, a portion of the runoff drains northeast towards College Avenue East while the remaining drains southwest towards the golf course. There is an elevation difference of approximately 1.80m from the west property line to the east, and from south to north. College Avenue East falls approximately 6.5% across the frontage of the Site. In the existing condition, the Site is approximately 29.2% impervious.

2.2 Existing Servicing

2.2.1 Water

There is an existing 300mm diameter municipal watermain along College Avenue East. The watermain is capped just after the existing municipal fire hydrant which is located directly in front of the Site. There are three existing water services that extend to each property within the Site which will be capped and removed from the Site and right-of-way at the time of construction.

2.2.2 Sanitary

There is an existing 200mm diameter municipal sanitary sewer along College Avenue East flowing which drains southwest. There is one existing municipal sanitary manhole fronting the Site, approximately 3.4m below grade, with an invert elevation of 339.78+/- . There are three existing sanitary services that extend to each property within the Site which will be capped and removed from the Site and right-of-way at the time of construction, per City of Guelph SS-26.

2.2.3 Storm

There is an existing 300mm diameter municipal storm sewer along College Avenue East, flowing northeast. The approximate depth of the storm sewer is 3.4m. There is an existing catchbasin located directly in front of the Site.

2.3 Existing Soils Information

A Geotechnical Report was completed on January 9, 2026 by Chung & Vander Doelen Engineering Ltd. (CVD) and summarized the results of the drilling of three boreholes to determine the underlying soil conditions. The boreholes revealed that the Site is predominantly underlain by a sand and silt to sandy silt till deposit. Surface topsoil/fill deposits were encountered to depths ranging from 0.16mbgs (BH 1) to 1.45mbgs (BH 3). Fill consisting of sandy silt with trace gravel, trace clay, and trace rootlets was observed in Borehole 3, with a moist to wet moisture condition.

A 'Scoped' Hydrogeological Assessment was completed by CVD, dated April 28, 2026, and included a full one-year groundwater monitoring program from April 2025 to April 2026. Three monitoring wells were installed between April 9 and 10, 2025. Manual and automated water level measurements indicate groundwater elevations across the Site ranged from 338.40 to 343.77masl, with peak groundwater elevations between 341.46 and 343.79masl, occurring during the spring 2026 high-water event.

The hydrogeological assessment also conducted three single well response tests to determine the hydraulic conductivity of the soils, which resulted in 1.6×10^{-7} m/s to 2.5×10^{-7} m/s.

For additional information, refer to the Geotechnical Report and 'Scoped' Hydrogeological Assessment completed by Chung & Vander Doelen both dated April 28, 2026, both included in Appendix A for reference.

3.0 PROPOSED CONDITIONS

Preliminary grading and servicing strategies for the proposed development have been developed based on the topographic survey, plan and profile information, and Conceptual Site Plan prepared by 5468796 Architecture Inc, dated June 11, 2026.

3.1 Proposed Grading

The proposed development will have an 8-storey residential building, complete with access from College Avenue East and underground parking. The proposed grading strategy will respect the existing grades along surrounding property lines and the right-of-way fronting the Site. Re-grading will involve swales to direct runoff from landscaped areas to the proposed infiltration gallery and a catchbasin to capture the runoff from the driveway.

Due to the elevation change of the proposed and existing grades along the northeast and north property line, retaining walls are required.

All proposed elevations are subject to change during detailed design. The grading strategy has been developed to ensure water will flow away from the building with a major storm overland flow route being directed to the north, towards the golf course.

3.2 Proposed Servicing

3.2.1 Water

A new connection to the existing 300mm diameter municipal watermain along College Avenue East will be required to service the proposed building. The final size of the private water service will be confirmed during detailed design; however, it is anticipated to be a 200mm diameter connection. The service line will tie into the existing 300mm watermain located approximately 110m northeast of the College Avenue East and East Ring Road intersection.

The proposed 200mm diameter watermain will enter the south face of the parking garage and extend to the service room. MTE has submitted a request to the City for water modelling. We are currently awaiting these results. Preliminary calculations completed by MTE indicate that the off-site fire hydrant can supply a maximum fire flow of 16,500L/min while maintaining the Ontario Building Code minimum pressure requirement of 140kPa.

Refer to Appendix B for the fire flow test completed by Northern Sprinkler Design and the associated fire flow analysis calculations.

3.2.2 Sanitary

Anticipated Peak Flow Rates

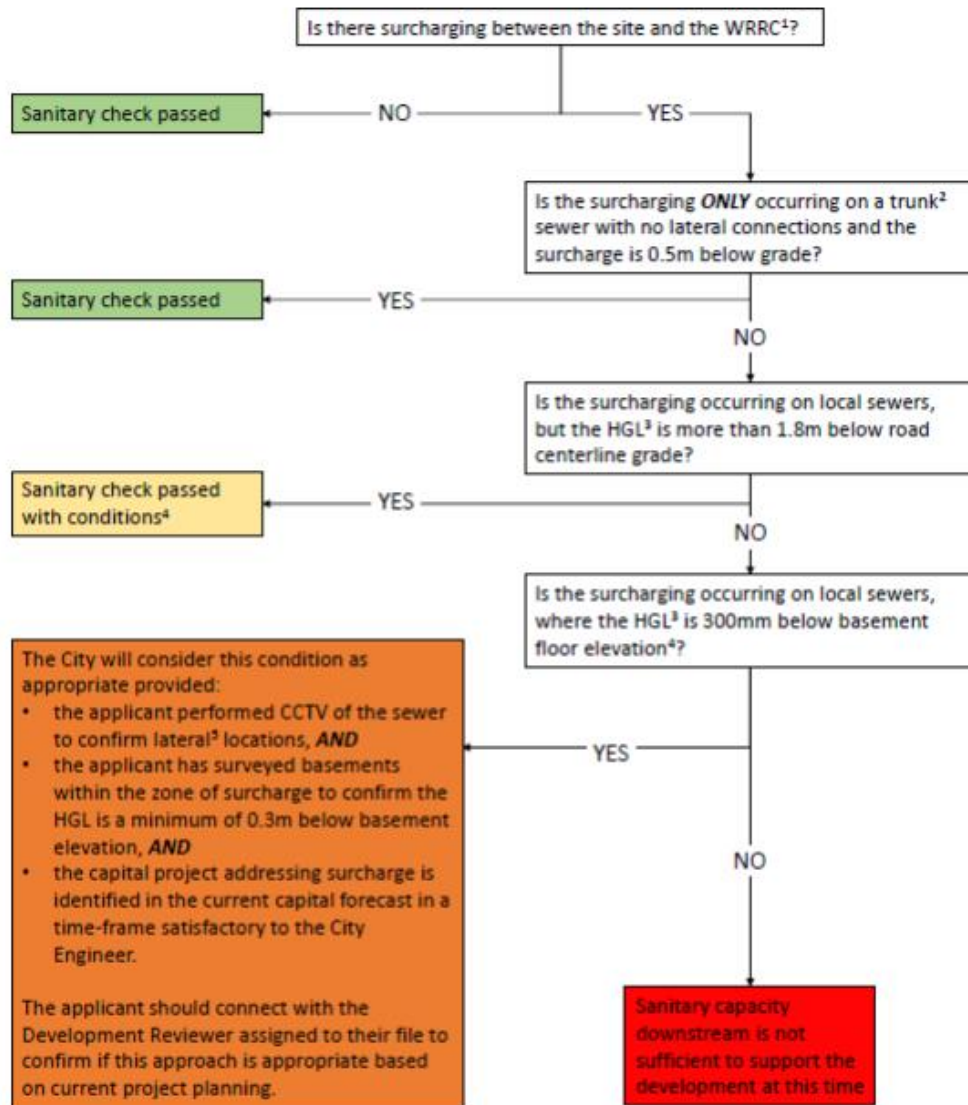
A sanitary flow design sheet has been prepared to determine the flows anticipated to be generated by the proposed development. As per the City of Guelph Engineering Standards, an average daily sewage flow rate of 300L/person/day was used to determine the anticipated peak flow rate for the Site. The peak sanitary flow rate was calculated based on 117 units, resulting in an anticipated peak sanitary flow rates of 3.2L/s, including infiltration. Refer to Appendix C for the sanitary sewer design sheet and Drawing SSP-1 for the proposed sanitary servicing concept.

Sanitary Sewer Assessment Framework Analysis

In March 2025, a preliminary anticipated flow rate of 4.7L/s was provided to the City for the Site to confirm the capacity of the downstream municipal sanitary sewers. Results were provided from the City in April 2025 stating that the model surcharges twice between the Site and the Water Resource Recovery Centre (WRRRC). Refer to the wastewater modeling completed by the City located in Appendix D.

Based on the system surcharging at two locations, the below framework and descriptions identify how these sections of the sewers pass the criteria of the City's Sanitary Sewer Assessment Framework.

Sanitary Capacity Assessment Framework



Footnotes:

1 Water Resource Recovery Centre

2 Trunk sewers, for the purposes of this process, shall be defined as sewers 450mm in diameter or greater and with no lateral connections directly to properties

3 Hydraulic Grade Line in the 25YR Wet Weather Event, using the City's hydraulic model

4 Basement level is assumed to be 1.8m below grade, as measured from the centreline of the road. Applicant must demonstrate that there are no buildings/properties within surcharged segment that have reverse slope driveways or have a property grade lower than the road grade.

5 Applicant must perform individual survey of each lateral connection and demonstrate they are below HGL at basement connection with 300mm of freeboard

Notes:

*all questions refer to the existing pipe network, wet weather flow scenario with the proposed development flow in the City's hydraulic model

** surcharging means, for the purposes of this framework, when the HGL is above the obvert of the pipe

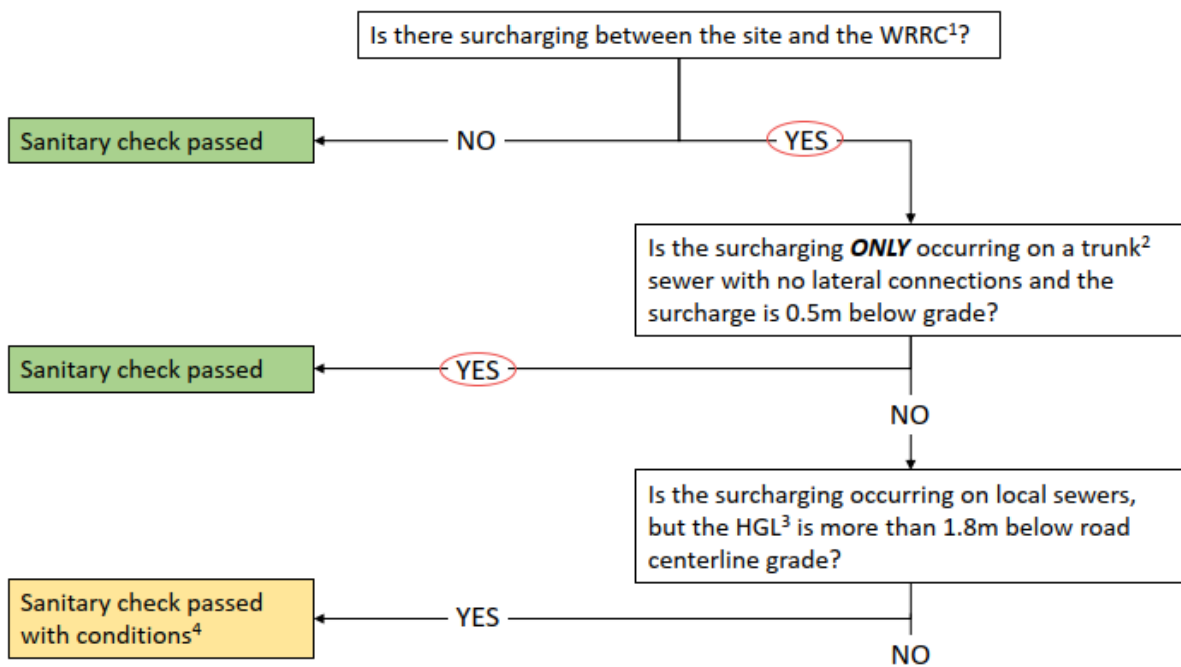
Results

Based on the results of the Wastewater Modelling Analysis provided by the City of Guelph, there are two areas where surcharging occurs between the Site and the water Resource Recovery Centre. At each location, we have determined how they pass the criteria in the Framework.

Location 1: College Avenue to Golf Course (Figure 5 in Appendix A)

At Location 1, the City identified a junction where the sewer was surcharged according to the modelling. The below framework and following descriptions identify how this section of sewer passes the requirements for development upstream of a surcharged sewer.

Sanitary Capacity Assessment Framework

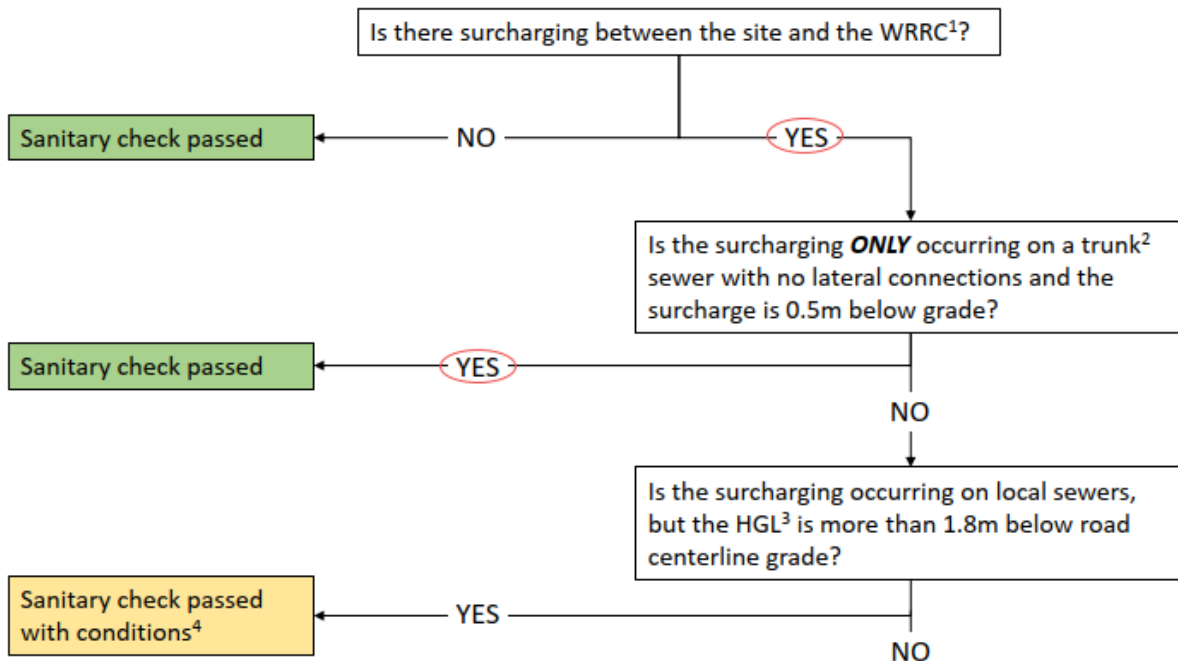


- Yes, the City identified surcharging between the Site and the WRRRC.
- Yes, the surcharging is occurring only on a trunk sewer that is smaller than 450mm but there is no lateral connections and the surcharge is 0.50m below grade. Refer to the calculations below.
 - The level of the surcharge is as follows: $333.43 - 328.473 = 4.957\text{m}$
- We pass the City's Framework at Location 1.

Location 2: York Road Park to Wellington St W and Edinburgh Rd S intersection
(Figure 6, 7, 8 & 9 in Appendix A)

At Location 2, the City identified twenty-seven junctions where the sewer was surcharged according to the modelling. The below framework and following descriptions identify how this section of sewer passes the requirements for development upstream of a surcharged sewer.

Sanitary Capacity Assessment Framework



- Yes, the City identified surcharging between the Site and the WRRC.
- Yes, the surcharging is occurring only on a trunk sewer that is greater than 450mm with no lateral connections and the surcharge is 0.50m below grade. Refer to the calculations below for the following Junctions.
 - Junction 8795: $309.93 - 306.861 = 3.069\text{m}$
 - Junction 8794: $310.57 - 306.751 = 3.819\text{m}$
 - Junction 8793: $310.65 - 306.674 = 3.976\text{m}$
 - Junction 8792: $310.45 - 306.569 = 3.881\text{m}$
 - Junction 8324: $310.53 - 306.520 = 4.010\text{m}$
 - Junction 8325: $310.49 - 306.500 = 3.990\text{m}$
 - Junction 8326: $309.91 - 306.401 = 3.509\text{m}$
 - Junction 8811: $309.66 - 306.375 = 3.285\text{m}$
 - Junction 8810: $308.89 - 306.300 = 2.590\text{m}$
 - Junction 8327: $308.93 - 306.254 = 2.676\text{m}$
 - Junction 8328: $308.97 - 306.153\text{m} = 2.817\text{m}$

- Junction 8329: $309.66 - 306.100 = 3.560\text{m}$
- Junction 8330: $309.42 - 306.070 = 3.350\text{m}$
- Junction 8331: $309.56 - 305.954 = 3.606\text{m}$
- Junction 8332: $309.12 - 305.874 = 3.246\text{m}$
- Junction 8333: $308.61 - 305.784 = 2.826\text{m}$
- Junction 8334: $307.50 - 305.771 = 1.729\text{m}$
- Junction 8335: $307.26 - 305.733 = 1.527\text{m}$
- Junction 8336: $307.32 - 305.630 = 1.690\text{m}$
- Junction 8337: $307.26 - 305.579 = 1.681\text{m}$
- Junction 8338: $307.42 - 305.544 = 1.876\text{m}$
- Junction 8339: $307.61 - 305.526 = 2.084\text{m}$
- Junction 8340: $307.54 - 305.486 = 2.054\text{m}$
- Junction 8341: $307.75 - 305.450 = 2.300\text{m}$
- Junction 8342: $308.47 - 305.372 = 3.098\text{m}$
- Junction 8343: $307.37 - 305.350 = 2.020\text{m}$
- Junction 8344: $307.76 - 305.266 = 2.494\text{m}$
- The surcharging in Junction 'Dummy' [109409.1@109409.2](#) is located within the siphon. Previous discussions with the City reveal that surcharging at the siphon does not impact any basement elevations and the siphon has no lateral connections.
- We pass the City's Framework at Location 2.

Therefore, all locations pass the City's criteria of the Sanitary Capacity Assessment Framework.

Since the wastewater modeling was completed using 4.7L/s and our anticipated peak sanitary flow rate for the Site is now calculated to be 3.2L/s, our framework above is still relevant and we do not anticipate any additional issues with the lower flow rate.

Service Connections

It is proposed that the Site will be serviced by a new 200mm diameter sanitary service complete with new manhole within the existing 200mm diameter municipal sewer on College Avenue East. The 200mm diameter sanitary service will enter the Site approximately 115.0m northeast of the College Avenue East and East Ring Road intersection. The private sanitary service is to be installed at a slope that provides depth for the servicing of the building while maintaining adequate capacity. The service size and inverts will be confirmed at detailed design.

3.2.3 Storm

A private storm sewer system will be installed on-site to collect runoff from the drive isle. The private storm sewer will connect into the underground parking and be pumped to the storm sewer connection prior to being discharged to the right-of-way. The existing catchbasin within the right-of-way, fronting the Site, will be replaced with a catchbasin-manhole, and the private storm sewer will connect into the new catchbasin-manhole via a new 300mm storm sewer. Refer to Appendix E for the storm sewer design sheet and Drawing SSP-1 for the proposed storm servicing design concept.

4.0 PRELIMINARY STORMWATER MANAGEMENT DESIGN

4.1 SWM Criteria

The stormwater management design criteria for the subject Site, as established by the City of Guelph, are as follows:

- i) Attenuation of the post-development peak flows for the 2-, 5- and 100-year storm events to the pre-development (existing) peak flows.
- ii) Implementation of Enhanced (Level 1) water quality controls.
- iii) Water Balance Analysis.
- iv) Provide 5mm of volume retention.
- v) Implementation of Erosion and Sediment Control measures.

4.2 Water Quantity Control

In order to successfully complete the preliminary stormwater management design for the Site, the following specific tasks were undertaken:

- i) Calculate the allowable runoff rates using MIDUSS NET.
- ii) Determine the percent impervious of the Site and catchment parameters for inclusion in MIDUSS modeling.
- iii) Calculate post-development runoff hydrographs using MIDUSS NET.

The following table summarizes the catchments used in modeling of the Site. The pre-development was separated into two catchments; draining to the Golf Course and draining to College Avenue East. The post-development conditions were separated into four catchment areas; draining to the infiltration gallery, sheet draining to the golf course, draining to College Avenue East right-of-way controlled, and draining to College Avenue East right-of-way uncontrolled. Figure 1.0 illustrates the limits of the pre-development and Figure 2.0 illustrates the limits of the post-development.

Table 4.1 – Catchment Parameters

#	Catchment	Area (m)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Pre-Development Catchment Area							
101	Draining to Golf Course	0.250	18.6%	80	98	4.9	35
102	Draining to ROW	0.110	53.6%	80	98	1.5	14

#	Catchment	Area (m)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Post-Development Catchment Area							
201	Draining to infiltration gallery	0.260	81.0%	80	98	2.0	45
202	Sheet draining to golf course – Uncontrolled	0.015	0.0%	80	98	15.0	25
203	Draining to ROW – Controlled	0.059	45.0%	80	98	2.0	50
204	Draining to ROW – Uncontrolled	0.026	59.0%	80	98	1.5	4.5

Based on the information within the geotechnical report completed by Chung & Vander Doelen, described above, the Site consists of till soils that consist of generally compact to very dense soils. The till consisted of trace gravel and clay with silt to silty sand till, resulting in a CN value of 80.

In order to achieve the stormwater management requirements for the Site, runoff generated on the drive isle will be collected by a catchbasin and will be conveyed to a cistern located within the parking garage. Overflow from the infiltration gallery will also be conveyed to the cistern for the 5-year storm. Major storm events will overflow to the golf course. The flow leaving the cistern is proposed to be controlled by a pump designed by the mechanical engineer in the detailed design. The flow rate that the pump will be designed to will ensure that the post-development flow discharged to College Avenue East is the same as the pre-development flow. During the detailed design, the exact location of the cistern and control system will be coordinated and designed. The controlled flow will then outlet to the municipal storm sewer along College Avenue East via the 300mm diameter storm service.

The flow equations for the orifice are included in Appendix F. Refer to Appendix G for the MIDUSS NET output.

As mentioned above, the mechanical engineer will design the pumps within the cistern to match the post-development flow to pre-development. With the addition of the pump, the post-development runoff from the controlled portion of the Site for the 2-, 5- and 100-year storm events is controlled to 0.007m³/s, 0.012m³/s and 0.030m³/s, respectively. The following table summarizes the flows generated by the whole Site.

Table 4.2 – Summary of Flows

Modelling Condition	2-Year Storm Event (m ³ /s)	5-Year Storm Event (m ³ /s)	100-Year Storm Event (m ³ /s)
Draining to the Golf Course (101, 201(Major flow), & 202)			
Pre-Development	0.013	0.020	0.051
Post-Development	0.001	0.002	0.029

Modelling Condition	2-Year Storm Event (m ³ /s)	5-Year Storm Event (m ³ /s)	100-Year Storm Event (m ³ /s)
Draining to the College Avenue East (102, 201 (Minor Flow), 203 & 204)			
Pre-Development	0.017	0.024	0.088
Post-Development	0.008	0.013	0.032

The maximum storage within the cistern for the 2-, 5- and 100-year storm events is approximately 35.9m³, 50.2m³ and 80.8m³, respectively. The cistern size, volume, and pump system will be further coordinated and detailed at the detailed design stage.

4.3 Water Quality Control

The water quality control requirement will be met through the installation of an Oil and Grit Separator (OGS) unit on the private storm sewer system upstream of the outlet connection to the municipal storm sewer along College Avenue East. The unit will be chosen to provide Enhanced Level water quality control. The unit type and sizing will be specified during detailed design. In addition, all the storm structures will have a 600mm deep sump.

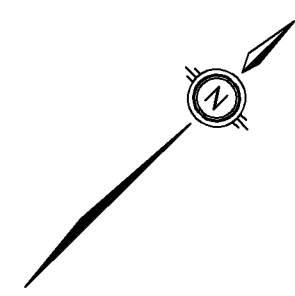
4.4 Infiltration Gallery

The proposed infiltration gallery supports the stormwater management strategy by providing controlled infiltration and clean runoff. Section 5.7.9 of the City of Guelph's Design Engineering Manual (DEM) identifies a default 5m setback from foundations; however, this generally applies to buildings with habitable below-grade space. The proposed building has no habitable space below grade, and the foundation walls will be waterproofed due to the high groundwater table and will extend to the elevation at the bottom of the gallery. MTE's professional opinion is that reduced setbacks are commonly accepted for non-habitable or structurally protected underground foundations when analysis demonstrates no risk of seepage or structural impact. This supports the principle that reduced setbacks are acceptable when supported by technical justification, particularly for clean stormwater infiltration systems.

The adjacent retaining wall will be designed by a structural engineer to account for the gallery. This approach has been used on previous projects, and the wall design will incorporate the infiltration gallery conditions.

Due to the high groundwater table on-site, the proposed grades around the rear of the building are being raised to ensure the gallery will maintain at least 1.0m separation the groundwater table, consistent with DEM requirements. Granular materials will be used as backfill to ensure proper drainage below the gallery. A Permeameter Test is underway, and the report will be updated once results are available. Conservative infiltration rates have been used, and the results are not expected to change the overall strategy.

Based on the geotechnical findings and planned supporting analyses, the infiltration gallery remains appropriate in its current location.



LEGEND

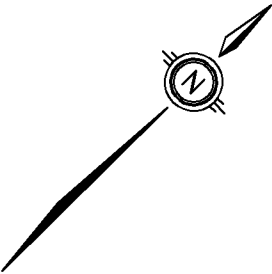
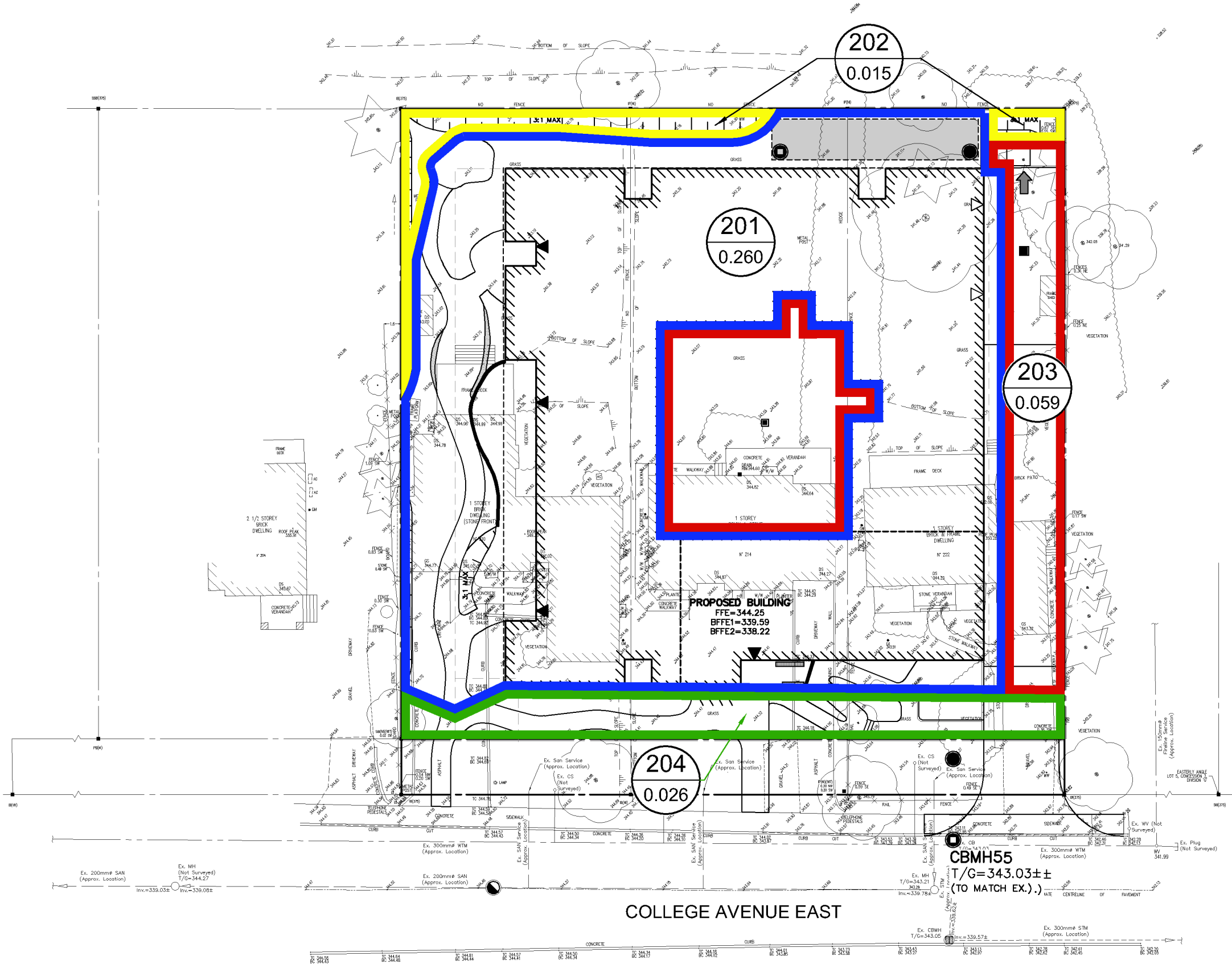
- CATCHMENT 101
- CATCHMENT 102
- 101
0.250

 SUB-CATCHMENT NUMBER
AREA (ha.)



PROJECT		
210-222 COLLEGE AVENUE EAST		
TITLE		
PRE-DEVELOPMENT CATCHMENT AREAS		
Drawn	SMX	Scale 1:400
Checked	MLW	Project No. 61748_001
Date (yyyy-mm-dd)	Rev No.	0
2026-01-09		

Figure
F1.0



LEGEND

- CATCHMENT 201
- CATCHMENT 202
- CATCHMENT 203
- CATCHMENT 204

201
0.260

SUB-CATCHMENT NUMBER
AREA (ha.)



PROJECT		
210-222 COLLEGE AVENUE EAST		
TITLE		
POST-DEVELOPMENT CATCHMENT AREAS		
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Checked	MLW	Project No. 61748_001
Date (yyyy-mm-dd)	Rev No.	0
2026-01-09		

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4.5 Water Balance/Budget Analysis

The proposed development results in an increase of imperviousness which will reduce infiltration capacity on an annual basis.

The existing property, in its pre-development condition is 29.2% impervious, which results in an annual infiltration rate of 392m³/year, based on the soil type, existing ground cover and existing terrain (rolling lands). The Site consists of trace gravel and clay, with silt to silty sand till, but based on the hydrogeological assessment by Chung & Vander Doelen, the infiltration rate of the soils is poor, therefore a land use of clay loam was used for the water balance. The development of the property, complete with the building and the underground parking area will result in an increase from 29.3% impervious to 79.0% impervious. This would result in an annual loss in infiltration.

The Site is located within Source Water Protection Policy Area (WHPA) zone WHPA-B. WHPA-B denotes that the travel time of groundwater to the nearest well is 2 years or less. The WHPA vulnerability score of the property is 6; therefore, pre-development infiltration volumes must be maintained in the post-development condition.

To mitigate the loss of infiltration on the Site, runoff from the building rooftop and some of the landscaped areas will be infiltrated via an on-site infiltration gallery. 15mm of runoff from a total area noted above of 0.126ha will be infiltrated with the installation of an infiltration gallery system, providing 18.9m³ of storage (0.015m x 1260m²), which exceeds the City's requirements to retain 5 mm of runoff over the full 0.36ha Site (18m³). This results in an annual infiltration rate of 462m³/year, providing a net gain of infiltration of 103m³/year. Further refinement of the infiltration gallery, including final sizing and construction details, will be completed during detailed design and provided in subsequent submissions. See Appendix H for the water balance analysis.

With the 'Scoped' Hydrogeological Assessment' completed by Chung & Vander Doelen as summarized above, the soils beneath the proposed infiltration gallery have a low hydraulic conductivity and infiltration rate. The infiltration gallery will be installed at a minimum, 1.0m above the high groundwater elevation. The retaining wall and foundation design will be designed with consideration of the infiltration gallery. Further detailed design will be conducted on the infiltration gallery at detailed design.

4.6 5mm Volume Retention

The City's requirement to retain 5mm of runoff over the full 0.36ha Site has been satisfied through the proposed infiltration gallery, as demonstrated in Section 4.5. As shown, the gallery system provides 18.9m³ of storage from 15mm of runoff over 0.126ha of rooftop and some landscapes, which exceeds the required 5mm retention volume over the entire Site (18m³); please refer to Section 4.5 for the full water balance analysis.

4.7 Erosion and Sediment Control

Precautions will need to be taken during construction to limit erosion and sedimentation. Typically, the following measures are recommended during construction for erosion and sedimentation control:

- i) Erosion and sedimentation facilities are to be installed prior to any area grading operations.
- ii) All erosion control measures are to be inspected and monitored by the contractor and repairs are to be completed as required.

- iii) All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance from leaving the Site.
- iv) To minimize the amount of mud being tracked onto the roadway, a mud mat should be
- v) installed at the primary construction entrance.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing analysis, it is concluded that:

- i) The proposed grading design will respect the natural topography of the Site.
- ii) Existing municipal infrastructure for water, sanitary and storm is available along College Avenue East.
- iii) The inclusion of a cistern within the underground parking structure will provide effective on-site water quantity control.
- iv) An OGS unit will be installed to ensure the Site meets required water quality treatment objectives.
- v) Infiltration gallery performance will result in a net gain in annual infiltration over pre-development conditions on the Site, and the proposed stormwater strategy reduces post-development runoff volumes to levels lower than pre-development, due to the capture and infiltration provided by the gallery.
- vi) Water balance compliance has been demonstrated, with the proposed infiltration gallery providing an annual infiltration rate of 462m³/year, resulting in a net gain of 103m³/year compared to the pre-development conditions.
- vii) 5mm volume retention has been satisfied, as the infiltration gallery provides 18.9m³ of storage, exceeding the required 5mm retention volume of 18m³ for the full Site.
- viii) Additional grading, servicing and stormwater management details will be provided during detailed design.

All of which is respectfully submitted,

MTE Consultants Inc



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https://mte85.sharepoint.com/sites/61748_001/Shared Documents/Reports/FSSWM/rpt_2026-06-16_FSSWM.docx

Appendix A

Geotechnical Investigations – CVD



CHUNG & VANDER DOELEN
ENGINEERING LTD.

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
210 - 222 College Avenue East
Guelph, Ontario

SUBMITTED TO:

EM Guelph Developments Limited Partnership
6 Adelaide Street East, Suite 300
Toronto, Ontario
M5C 1H6

ATTENTION:

Mr. Sayf Hassan, CEO



CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1
519-742-8979

January 9, 2026

File No.: 2372 Rev. 2

EM Guelph Developments Limited Partnership
6 Adelaide Street East, Suite 300
Toronto, Ontario
M5C 1H6

Attention: Mr. Safy Hassan, CEO

RE: Geotechnical Investigation
Proposed Residential Development
210-222 College Avenue East, Guelph, Ontario

We take pleasure in enclosing one (1) copy of our Geotechnical Investigation Report carried out at the above-referenced Site. Soil samples will be retained for a period of three (3) months and will thereafter be disposed of unless we are otherwise instructed.

If you have any questions or clarifications are required, please contact the undersigned at your convenience.

We thank you for giving us this opportunity to be of service to you.

Yours truly,

CHUNG & VANDER DOELEN ENGINEERING LTD.

Eric Y. Chung, M.Eng., P.Eng.
Principal Engineer

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1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by EM Guelph Developments Limited Partnership to carry out a geotechnical investigation for the proposed residential development at 210-222 College Avenue East in Guelph, Ontario.

It is understood that the site is proposed to be redeveloped with a 10-storey residential building. One (1) level of underground parking is proposed underneath the residential building. The finished ground floor elevation has been established at 344.25 m, and the lowest parking level is at elevation 337.58 m.

The purpose of this investigation was to determine the subsurface conditions at the site and, based on the findings, to make geotechnical recommendations for:

- Foundation design recommendations;
- Excavation condition;
- Groundwater control during and after construction;
- Slab on grade design;
- Backfilling recommendations;
- Foundation soil classification seismic design per OBC 2024;
- Estimates of infiltration rates and hydraulic conductivities of the encountered soils

2.0 FIELD WORK

To investigate the subsurface conditions at the site, three (3) boreholes were advanced to depths between 12.45 and 12.80 m below ground surface. The investigation was performed on April 9 and 10, 2025. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The field work was carried out under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling, and monitored the groundwater conditions.

The boreholes were advanced to the sampling depths using a track-mounted drilling rig, supplied and operated by a specialized contractor. The drill rig was equipped with continuous flight hollow stem augers and standard soil sampling equipment.

Standard Penetration tests (SPTs) in accordance with ASTM Specification D1586 were carried out at frequent intervals of depth during the advancement of the boreholes. These test results are shown on the Borehole Log Sheets as Penetration Resistance or “N”-values. The compactness condition of the soil strata has been inferred from these test results.

Groundwater conditions were monitored during advancement of the borehole augering and immediately following the withdrawal of the drilling augers at each borehole location. Monitoring wells were installed in each borehole to allow long-term monitoring of the groundwater table.



The borehole locations, temporary benchmark, and associated ground surface elevations were surveyed by CVD for the purpose of this report using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using The UTM Zone 17N Projection, NAD83(CSRS)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28).

The ground surface elevations were referenced to a temporary benchmark (TBM) which is shown on Drawing No. 1 and described below:

TBM: Top of catch basin in road edge of westbound lane of College Avenue East, approximately 3 m west of existing driveway at 222 College Avenue East, as shown on Drawing No. 1

Elevation: 343.01 m (geodetic)

3.0 LABORATORY TESTING

Soil samples obtained from the in-situ tests were examined in the field and subsequently brought to our laboratory for visual and tactile examination to confirm field classification. Moisture content determination of all retrieved samples occurred.

In addition, two (2) grain size distribution analyses were performed on the major soil deposits to confirm field identification and to assist in determining the infiltration rates of the encountered soils.

4.0 EXISTING SITE CONDITIONS

The site is comprised of three (3) adjoining properties currently occupied by three (3) 1- to 2-storey residential dwellings with asphalt/granular fill driveways. The existing dwellings are serviced by municipal water and sanitary sewer. The remainder of the properties are grass-covered with occasional trees.

The site grades generally slope down from the southwest corner of the site to the north and east. The ground surface elevations at the borehole locations ranged between 341.83 and 344.59 m.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface conditions encountered in the three (3) boreholes advanced as part of this investigation are shown on the Borehole Log Sheets, Enclosures 1 to 3, inclusive. The following sections provide descriptions of the major soil deposits encountered in the boreholes. Enclosure A provides explanations of the various soil abbreviations and terms used on these borehole log sheets.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions



between soil types rather than exact planes of geologic change. The subsurface conditions will vary between and beyond the borehole locations.

5.1 Topsoil/Pavement

Topsoil was encountered at ground surface at Borehole 2 with a measured thickness of 500 mm.

Asphalt pavement was encountered at ground surface at Borehole 1 with a measured thickness of 35 mm. Granular base materials were encountered below the asphalt in Borehole 1, and at ground surface at Borehole 3, with measured thicknesses of 125 and 100 mm, respectively.

5.2 Fill

A layer of fill was encountered underlying the granular base at Borehole 3 which extended to a depth of 1.45 m below existing grade. The fill layer comprised sandy silt with trace gravel, trace clay, and trace rootlets.

The SPT “N”-values measured within the fill materials ranged from 2 to 5 blows per 300 mm of penetration, indicating a very loose to loose compactness condition. The water contents of the fill were measured between 11 and 18%, indicating a moist to wet moisture condition.

5.3 Till

A sand and silt to sandy silt till deposit was encountered below the pavement structure in Borehole 1, topsoil in Borehole 2, and fill in Borehole 3. The till contained trace to some gravel and trace clay. Occasional cobbles and boulders were encountered during advancement of the augers through the till. Occasional sand seams were also encountered within the till deposit throughout the stratum. All boreholes were terminated within the till deposit at depths between 12.45 and 12.80 m below existing grade. The results of two (2) grain size distribution analyses conducted on the samples retrieved from Boreholes 1 and 2 are shown graphically on Enclosures 4 and 5.

SPT “N”-values measured within this deposit ranged from 5 blows per 300 mm of penetration to 50 blows per 75 mm of penetration, indicating a loose to very dense compactness condition, generally compact to very dense. The loose layers were encountered within the upper $2\pm$ m of the till deposit, becoming compact to very dense with increasing depth.

The measured water content of the samples collected from this deposit ranged between 6 and 14%, indicating a damp to moist moisture condition.



5.4 Groundwater

Groundwater conditions were monitored during and following completion of borehole sampling. Monitoring wells were installed at each Borehole to determine the depth of the groundwater table. Groundwater levels were measured within the monitoring wells on April 14 and May 1, 2025. The table below summarizes the water levels measured within the monitoring wells:

Borehole No.	Existing Ground Elevation (m)	Observed/Measured Water Level Below Existing Ground Surface (m)		Water Level Elevation (m)	
		April 14, 2025	May 1, 2025	April 14, 2025	May 1, 2025
1	344.59	1.36	1.95	343.23	342.64
2	341.83	0.89	1.54	340.95	340.29
3	342.94	1.95	2.55	340.99	340.39

Based on the observed groundwater levels, natural moisture contents and observations during borehole drilling and sampling, the groundwater is considered to lie at depths of $0.9\pm$ m to $2.6\pm$ m below existing grades, corresponding to elevations between $340.9\pm$ and $343.2\pm$ m.

The groundwater was encountered in the upper loose to compact stratum of the sand and silt till and is considered to be a “perched” condition. The groundwater table follows the surficial topography and flows in both northerly and easterly direction. It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

A long-term groundwater monitoring program is being conducted by the Hydrogeology team at CVD. Please refer to the Hydrogeological Assessment for additional water level information.



6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

It is understood that the site is proposed to be redeveloped with a 10-storey residential building. One (1) level of underground parking is proposed underneath the residential building. The finished ground floor elevation has been established at 344.25 m, and the lowest parking level is at elevation 337.58 m.

In general, the surficial granular fill in Borehole 3 was underlain by very loose to loose fill materials, extending to a depth of 1.45 m below existing grade. The surficial pavement structure at Borehole 1, surficial topsoil at Borehole 2, and fill in Borehole 3 were underlain by a loose to very dense till deposit, extending to the maximum depths of exploration between 12.45 and 12.80 m below existing grade. The loose layers were encountered within the upper 2± m of the till deposit, becoming compact to very dense with increasing depth.

Based on the observed groundwater levels, natural moisture contents and observations during borehole drilling and sampling, the groundwater is considered to lie at depths of 0.9± m to 2.6± m below existing grades, corresponding to elevations between 340.9± and 343.2± m. The groundwater was encountered in the upper loose to compact stratum of the sand and silt till and is considered to be a “perched” condition. The groundwater table follows the surficial topography and flows in both northerly and easterly direction. It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

6.2 One-Level Basement

One level of underground parking (P1) is proposed for this site. Since the lowest parking level has been established at elevation 337.58 m, the underground parking will be approximately 3.3± to 5.6± m below the groundwater table measured on April 14, 2025.

It is noted that the City of Guelph does not allow basement to be constructed below the groundwater table using permanent dewatering. Thus, the P1 floor slabs will need to be waterproofed and structurally reinforced to withstand the hydrostatic pressure.

Foundation excavations will be made in very loose to loose fill materials and loose to very dense till deposit with occasional sand seams. Based on the proposed one-level of underground parking and the perched groundwater conditions within the native till deposit, it is anticipated that no significant amount of groundwater ingress into the excavations would be encountered. Storm water runoff and local perched groundwater conditions at site can be controlled by pumping from filtered sump pits as and where required. It should be noted that the observed groundwater table will likely be higher in the spring following snow melt and will fluctuate seasonally and in response to major weather events.



6.3 Footing Foundations

Conventional strip and spread footing foundations can be used to support the proposed 10-storey residential building. Footings cast on competent native compact to very dense till can be designed using a net Geotechnical Reaction at SLS of 250 kPa with a Factored Geotechnical Resistance at ULS of 375 kPa. These soil bearing pressures can be achieved provided the exposed bearing surface is undisturbed during construction.

The following table summarizes the highest founding level and elevation for the footing at each borehole location:

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
1	344.59	1.49	343.10
2	341.83	2.43	339.40
3	342.94	2.44	340.50

These soil bearing pressures can be achieved provided that the founding subgrade is undisturbed during construction. In addition, the footings should be founded below any existing fill materials and former building/structure foundations, on competent native till deposits unless if constructed on approved engineered fill. Spacing between adjacent footing steps should not be steeper than 10H to 7V.

The maximum total and differential settlements of footings designed to the above recommended soil bearing pressures are expected to be less than 25 and 20 mm, respectively, and these are considered tolerable for the structure being contemplated. The majority of the settlements will take place during construction and the first loading cycle of the building.

It is recommended that a lean concrete mat be placed over approved footing subgrade in wet or saturated areas to prevent further disturbance to the bearing soils resulting from construction activities.

Exterior footings and footings in unheated portions of the building should be provided with a soil cover of not less than 1.2 m or equivalent synthetic thermal insulation for adequate frost protection. The founding subgrade soils must be protected from frost penetration during winter construction.

It is recommended that the footing excavations be inspected by the geotechnical engineer to ensure adequate soil bearing and proper excavation and subgrade preparation.

6.4 Raft Foundation

It is understood that the proposed residential building could be supported on a raft foundation. Using the soil parameters obtained from SPT value correlations and a soil contact pressure assumed to



be approximately 100 kPa (10 kPa per floor), the total settlements due to live load and dead load were calculated for the residential building. The maximum total settlements of a rigid raft supporting the 10-storey apartment building will be less than 25 mm. The settlement response will be “immediate” once the loading is imposed. Assuming the dead load of the apartment buildings will be 80±% of the total loading, settlements due to lived load will be in the order of 5 mm.

The following design and construction criteria are recommended:

- Modulus of vertical subgrade reaction of 20 MN/m³ can be used for preliminary structural design of the raft foundation.
- Design the structures to accommodate the relative movement between the residential tower and parking garage(s).
- Remove any loose or soft soils exposed at the raft founding subgrade and replace such materials with lean concrete or engineered fill.
- Place a 50 to 100 mm thick lean concrete working pad to facilitate placement of reinforcement steel and support the installation of waterproofing materials.
- Groundwater must be properly controlled during the raft slab construction.
- The factored Geotechnical Resistance at ULS is 800 kPa

The designer must take into consideration that the relative settlements between the apartment tower and the garage structure could be up to 5 mm due to the live loads.

It is recommended that the foundation excavations be inspected by the geotechnical engineer to ensure adequate soil bearing and proper subgrade preparation.

6.5 Earthquake Considerations

In accordance with The Ontario Building Code 2024 (OBC), the proposed structure should be designed to resist earthquake load and effects as per OBC Subsection 4.1.8.

Based on the anticipated condition of the engineered fill materials and the underlying soil condition encountered at the boreholes, the site can be classified as a Site Class C as per OBC Table 4.1.8.4.B.

It may be beneficial to conduct shear wave velocity testing (MASW) as OBC 2024 permits its direct use in structural design as an XV_{s30} classification, rather than relying solely on a generalized site class (e.g., Site Class C or D). As a result, the use of a measured V_{s30} value may lead to reduced seismic design requirements and associated cost savings through optimized structural elements such as bracing, foundations, and lateral force-resisting systems.

6.6 Open Cut Excavation and Groundwater Control

The maximum depth of excavation could be in the order of 7.0± to 9.0± m deep for site servicing, underground parking, footings, and elevator pit. The excavations will penetrate topsoil, pavement structure, very loose to loose fill materials, and loose to very dense native soils.



These materials are considered to be Type 3 Soils in accordance with the latest Occupational Health and Safety Act. Excavations in the Type 3 Soils are expected to remain stable during the construction period provided that side slopes are cut to 1H : 1V from the bottom of the excavation. Where seepage or groundwater is encountered, side slopes should be cut to more stable angles of 3H : 1V. The side slopes should be suitably protected from erosion processes.

Based on the proposed one-level of underground parking and the groundwater conditions within the native till deposit, it is anticipated that no significant amount of groundwater ingress into the excavations would be encountered. Storm water runoff and local perched groundwater conditions at site can be controlled by pumping from filtered sump pits as and where required. It is recommended that excavation for the future development be done during the typically drier summer months when groundwater conditions would be expected to lie at lower elevations.

In wet to saturated subgrade condition, it will be necessary to excavate below founding level and pour a 75 mm thick mud slab of lean concrete to protect the founding soil from disturbance during the installation of reinforcing steel bars and form work.

The native sand and silt till deposit has a hydraulic conductivity of 2.45×10^{-5} cm/s. Considering the slow rate of groundwater ingress, the water to be handled during excavation can be limited/controlled to be less than 50,000 L/day and conventional pumping from filter sump pits should be sufficient to control perched water ingress.

6.7 Floor Slab Design Against Hydrostatic Pressure

Since the proposed P1 level is below the measured groundwater table, the basement walls and floor slabs will have to be water-proofed. The basement floor slabs will need to be structurally reinforced to withstand the hydrostatic pressure and may require to be anchored down dependent on the final structural design and analysis.

6.8 Floor Slab Construction

The basement floor slab will be constructed as slab on grade, on the 450 to 600 mm thick granular fill which will be placed on top of the raft foundation and/or the water-proofed basement floor slab. The granular fill layer is intended to allow utilities to be buried between the slab on grade and raft.

It is recommended that the granular fill layer be consisted of clear crushed stone (9 mm size preferred for the ease of handling and installing utilities). The clear crushed stone should be suitably compacted/densified to ensure settlement does not take place.

At the time of floor slab construction, the exposed clear crushed stone subgrade should be proof-rolled with a heavy roller in conjunction with an inspection by the geotechnical engineer.

A modulus of subgrade reaction (k_s) of 80 MN/m^3 may be used for the design of the floor slabs, if the floor subgrade consists of clear crushed stone at least 600 mm thick. Otherwise, a modulus of subgrade



reaction (k_s) of 40 MN/m^3 may be used for the design of the floor slabs assuming a sand/silt subgrade.

The floor slabs should be separated structurally from the columns and foundation walls. Sawcut control joints should be provided at regular spacing (less than 30 times the concrete slab thickness) and to depths between one-third and one-quarter of the slab thickness.

6.9 Shored Excavation

As excavation is expected to be between $7.0 \pm$ to $9.0 \pm$ m deep, a shoring system will be required for temporary excavation support during construction where sufficient space is not available for open cut excavation and to support the adjacent structures. Possible shoring supports include soldier pile and timber lagging system, caisson wall or soil nail retaining system with shotcrete facing.

The shoring system is generally designed and built by a specialized shoring contractor. The shoring system should be designed in accordance with the guidelines provided in the Canadian foundation Engineering Manual (CFEM) 5th Edition.

The shoring system will have to withstand the lateral earth pressure, the adjacent roadways, buried services and the traffic loads as well as the adjacent building structures. Frost pressures on the shoring system should be considered if the system is exposed to winter freezing condition. The shoring system should be monitored to ensure deflection and lateral movements are acceptable, and modifications made to the shoring system if deflection and lateral movements become a problem.

The following soil parameters may be used in the design of shoring. K_o (at rest condition) should be used where the shoring will need to support any existing building/structure.

Soil	Unit Weight (kN/m^3)	Friction Angle (ϕ°)	K_o	K_a	K_p
Very loose to loose Fill Materials	19	28	0.53	0.36	2.77
Loose to very dense Till Deposit	21	34	0.44	0.28	3.54

The shoring system can be supported by soil anchor tie-backs and/or raker footings. Soil anchors will provide an unobstructed open space for construction whereas raker supports will obstruct the forming and construction of footings and foundation walls.

If a soldier pile and timber lagging system is adopted, the augering/installation of the soldier piles and timber laggings, especially where they are located adjacent existing structures, should be carried out with caution such that the installation process will not cause future settlements to the adjacent existing structures. The geotechnical engineer should be retained to perform inspection during the installation.



6.10 Lateral Earth Pressure

Unbalanced foundation walls and any other soil retaining structures should be designed to resist the lateral earth pressure acting against these walls. The following formula may be used to calculate the unfactored earth pressure distribution. The factored resistance can be calculated by using a factor of 0.8.

$$P = K (\gamma h_1 + \gamma' h_2 + q) + \gamma_w h_2$$

Where:

P	=	lateral earth pressure, kPa
K	=	theoretical earth pressure coefficient, 0.5 for non-yielding walls
γ	=	unit weight of retained soil, kN/m ³ , 20 kN/m ³
γ'	=	submerged unit weight of backfill, ($\gamma - 9.8$ kN/m ³)
γ_w	=	unit weight of water, 9.8 kN/m ³
h_1	=	depth below top of backfill to water table, m
h_2	=	depth below water table to bottom of wall, m
q	=	surcharge, kPa

If free-draining granular material (OPSS Granular “B” Type I) is used as backfill and the water table is kept below the footing of the retaining wall or foundation wall, the hydrostatic pressure component can be ignored in the earth pressure calculation.

The backfill should be placed in thin layers and compacted to 95% SPMDD. Over-compaction adjacent to the foundation/retaining walls should be avoided. Compaction should be carried out with hand operated equipment within 1 m of the foundation wall or retaining wall. Weeping tiles leading to a frost-free outlet or weep holes should be installed to effect drainage behind the retaining wall.

The sliding resistance of the retaining wall footings should be checked. The unfactored horizontal resistance against sliding between cast-in-place concrete and the various soils can be calculated using a friction coefficient as follows:

Soil	Unit Weight (kN/m ³)	Friction Coefficient
Well-compacted granular backfill	21	0.45
Very loose to loose sandy silt fill	19	0.30
Compact to very dense till	21	0.35



6.11 Access Driveway and Paved Parking Areas

6.11.1 Access Driveways Pavement

Based on the results of the field work, the predominant subgrade materials at the site will consist of fine-grained fill or native soil deposits. The following flexible pavement structures are recommended based on the results of grain size distribution, assumed CBR values, groundwater table, frost susceptibility of subgrade soils and traffic volume.

Component	Light Duty Pavement (mm)	Heavy Duty Pavement (mm)
Asphaltic Concrete HL3	40	50
Asphaltic Concrete HL8	50	50
Granular "A" Base	150	150
Granular "B" Sub-base	300	400

The pavement design considers that pavement construction will be carried out during the drier time of the year and that the subgrade is stable, not heaving under construction equipment traffic. If the subgrade is wet or unstable, additional granular sub-base may be required.

Prior to the placement of the granular base, the subgrade will be stripped of existing pavements, topsoil, and deleterious materials. The exposed subgrade should be thoroughly recompact with a heavy vibratory compactor and inspected by a qualified geotechnical inspector. Any soft spots encountered during the process should be excavated to the level of competent soil. The required grades can then be achieved by placing approved on-site soils in maximum 200 to 300 mm thick lifts which should be compacted to 95% SPMDD.

The base and sub-base materials should be produced in accordance with the current OPSS specifications and placed and uniformly compacted to at least 100% SPMDD. The asphaltic concrete should be placed and compacted in accordance with OPSS Form 310 and to at least 92% of the Marshall Density (MRD). Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction is being achieved and maintained.

SS-1 or SS-1HH tack coat should be applied to all binder course surfaces and vertical surfaces (i.e., curbs, pavement joints, etc.) prior to placement of asphalt. Refer to OPSS 310 and OPSS 1101 for additional details.

It should be noted that even well compacted trench backfill could settle for a period of time after construction. In this regard, the surface course of the asphaltic concrete should be placed at least one (1) year after trench backfill is completed to allow any minor settlements to occur within the trench backfill. The incomplete pavement structure may not be capable of supporting construction traffic. Consequently, minor repairs of the sub-base, base and asphaltic concrete may be required prior to



paving with the base course and/or the surface course asphaltic concrete.

6.11.2 Pavement Above Underground Parking Garage

It is anticipated that asphalt pavement may be constructed above the underground garage on concrete slab and the following pavement structure is recommended:

Component	Component Thickness (mm)
Superpave 12.5 Surface Course	45
Asphaltic Concrete HL4 Base Course	45
Granular "A" Base (less than 5% silt)	Variable

A water-proofing membrane should be installed above the concrete slab to prevent moisture migration into the underground parking level, protect the concrete slab and reinforcing steel rebar, and aid the drainage of infiltrated water from the Granular "A" base layer to area drains. The structural concrete slab should be sloped to direct water runoff to area drains.

Protection board should be installed above the waterproofing membrane in order protect it from damage and improve the durability and performance of the pavement structure.

The granular base thickness above the underground parking structure will be variable. The granular base materials should contain less than 5% silt and be uniformly compacted to at least 100% SPMDD. The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff to area drains.

6.12 On Site Infiltration

Based on the results of grain size analyses and our past experience, the hydraulic conductivity and infiltration rate of the native inorganic soil types encountered at the boreholes are estimated and provided in the following table and may be used for storm water management purposes:

MATERIAL	PERMEABILITY (K) (cm/sec)	INFILTRATION RATE (mm/hr)
Sand and silt till	2.45×10^{-5}	6



6.13 Handling of Excess Soil

Excess soil may be generated due to the proposed site works. The management of excess soil is now governed by Ontario Regulation 406/19. In accordance with the regulation, the Project Leader is responsible for the handling, storage, reuse, transportation, and removal of all soil. To support off-site removal, the following is required:

- Planning Documentation
 - Assessment of Past Use
 - Sampling and Analysis Plan
 - Excess Soil Characterization Report
 - Excess Soil Destination Report
- Tracking
- Registry
- Record Keeping

CVD can provide further assistance on this matter as the project develops.



7.0 CLOSURE

The Limitations of Report, as quoted in Appendix A, is an integral part of this report.

We trust that the information presented in this report is complete within our terms of reference. If there are any further questions concerning this report, please do not hesitate to contact our office.

Yours truly,

CHUNG & VANDER DOELEN ENGINEERING LTD.

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Principal Engineer



APPENDIX A

LIMITATIONS OF REPORT



APPENDIX “A”

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes and their respective depths may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. CHUNG & VANDER DOELEN ENGINEERING LIMITED accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.



ENCLOSURES



Soil Abbreviations and Terms Used on Record of Borehole Sheets

TERMINOLOGY DESCRIBING COMMON SOIL TYPES:

Topsoil	-	mixture of soil and humus capable of supporting vegetation
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	soil materials identified as being placed anthropologically

CLASSIFICATION (UNIFIED SYSTEM)

Clay	<0.002mm
Silt	0.002 to .075mm
Sand	0.075 to 4.75mm
	Fine 0.075 to 0.425 mm
	Medium 0.425 to 2.0 mm
	Coarse 2.0 to 4.75 mm
Gravel	4.75 to 75mm
	Fine 4.75 to 19 mm
	Coarse 19 to 75 mm
Cobbles	75 to 300mm
Boulders	>300mm

TERMINOLOGY

Soil Composition	% by Weight
"traces"	<10%
"some"(eg. some silt)	10-20%
Adjective (eg. sandy)	20-35%
"and"(eg. sand and gravel)	35-50%

Standard Penetration Resistance (SPT): Standard Penetration Resistance ('N' Values) refers to the number of blows required to advance a standard (ASTM D1586) 51 mm Ø (2 inch) split-spoon sampler by the use of a free falling, 63.5 Kg (140lbs) hammer. The number of blows from the drop weight is recorded for every 15 cm (6 inches). The hammer is dropped from a distance of 0.76m (30 inches) providing 474.5 Joules per blow. When the sampler is driven a total of 45 cm (18 inches) into the soil, the standard penetration index ('N' Value) is the total number of blows for the last 30 cm (12 inches).

Dynamic Cone Penetration Resistance (DCPT): Dynamic Cone Penetration Resistance is similar to a SPT with the 474.5 Joule/blow impulse provided by the free falling hammer where the split-spoon sampler is replaced by a 51 mm Ø, 60° conical point and the number of blows is recorded continuously for every 30 cm (12 inches).

COHESIVE SOILS CONSISTENCY

	(kPa)	(P.S.F.)	Nominal 'N' Value
Very Soft	<12	<250	0-2
Soft	12-25	250-500	2-4
Firm	25-50	500-1000	4-8
Stiff	50-100	1000-2000	8-15
Very Stiff	100-200	2000-4000	15-30
Hard	>200	>4000	>30

RELATIVE DENSITY OF COHESIONLESS SOIL

	'N' Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

MOISTURE CONDITIONS:

Cohesive Soil
DTPL- Drier than plastic limit
APL- About plastic limit
WTPL- Wetter than plastic limit
MWTPL- Much wetter than plastic limit

Cohesionless Soil
Damp
Moist
Wet
Saturated

SAMPLE TYPES AND ADDITIONAL FIELD TESTS

SS	Split Spoon Sample (obtained from SPT)	GS	Grab Sample	PP	Pocket Penetrometer
AS	Auger Sample	BS	Bulk Sample	VANE	Peak & Remolded shear
		TW	Thin Wall Sample or Shelby Tube	DMT	Flat Plate Dilatometer

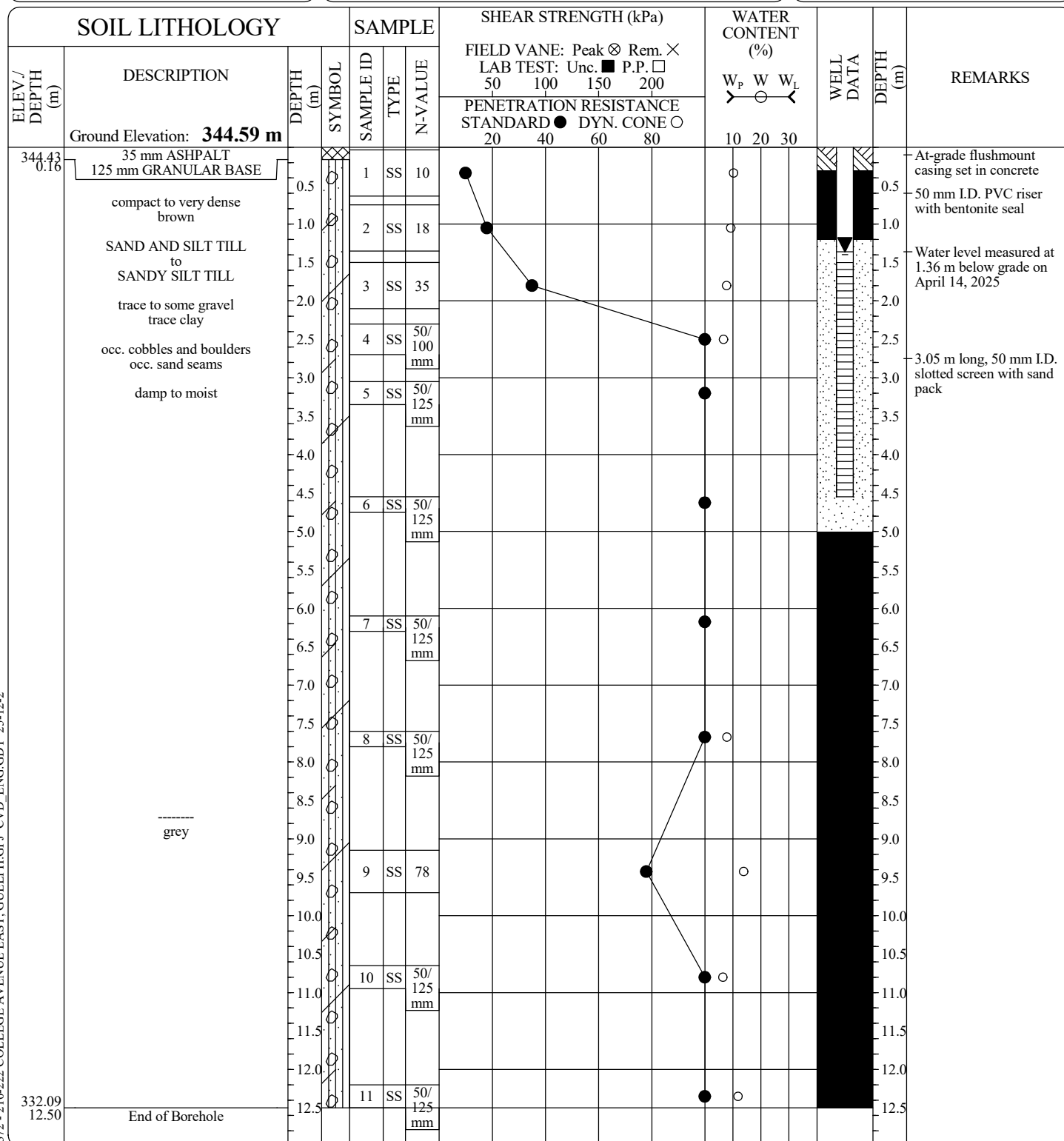
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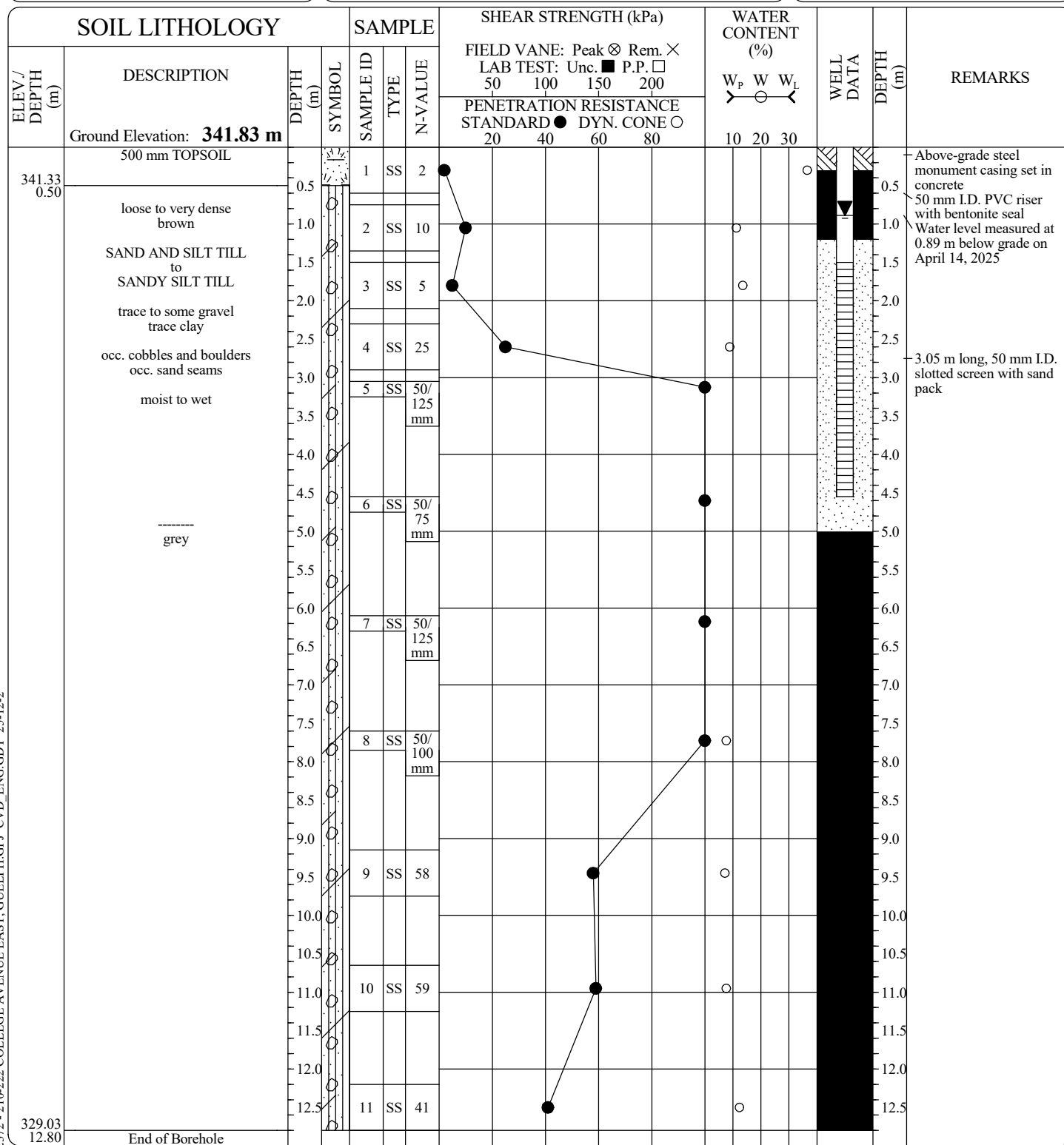
SG	Specific Gravity	S	Sieve Analysis	W	Water Content
H	Hydrometer	P	Field Permeability	K	Lab Permeability
W_p	Plastic Limit	W_L	Liquid Limit	I_p	Plasticity Index
GSA	Grain Size Analysis	C	Consolidation	UNC	Unconfined compression

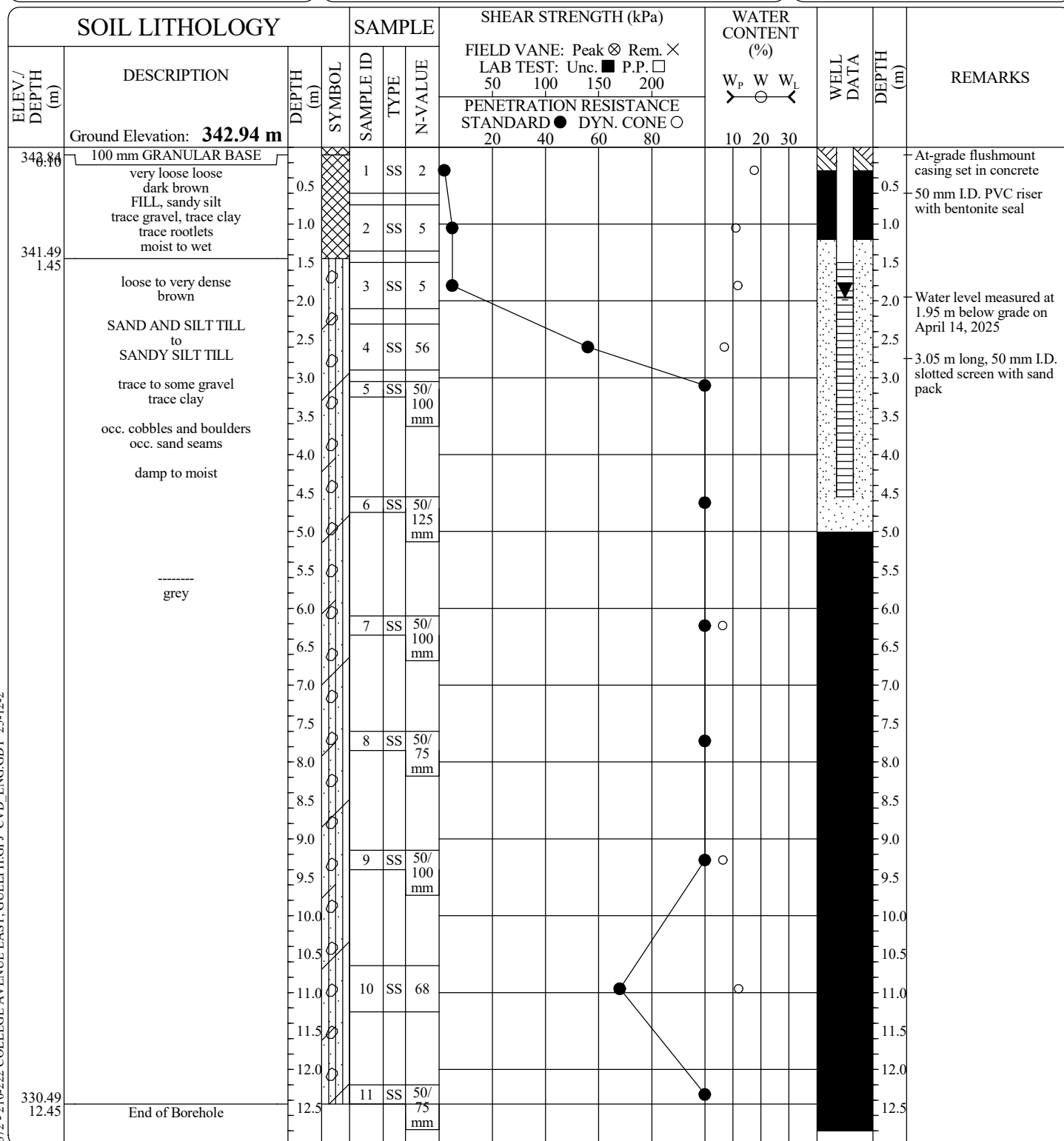


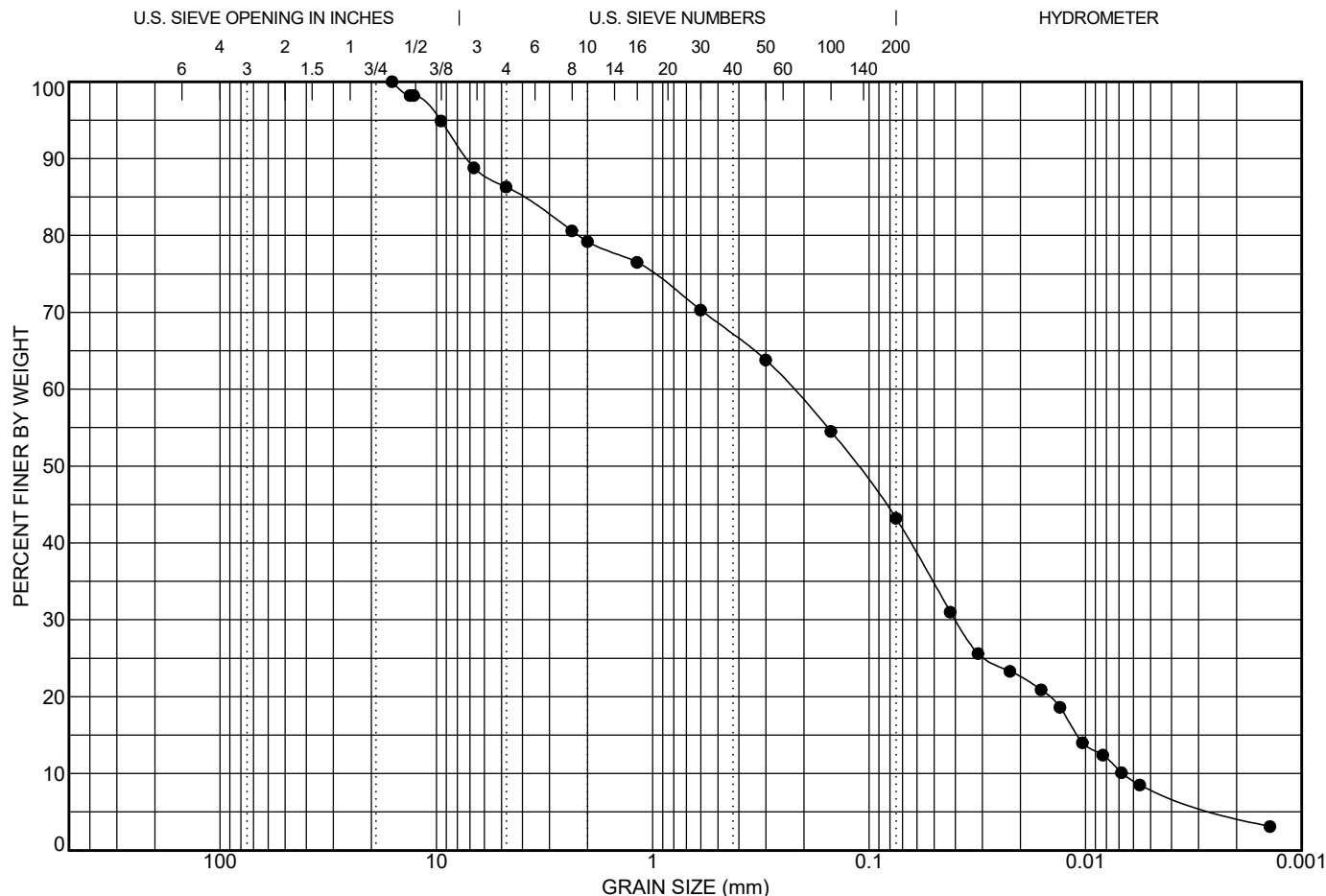
CHUNG & VANDER DOELEN
ENGINEERING LTD.

Enclosure A

FILE No: 2372**BOREHOLE No. 1**Client: **EM Guelph Developments Limited Partnership**Project: **Proposed Residential Development**Location: **210-222 College Avenue East, Guelph****EQUIPMENT DATA**Machine: **CME 55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Apr 10 - 25 TO Apr 10 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 2372**BOREHOLE No. 2**Client: **EM Guelph Developments Limited Partnership**Project: **Proposed Residential Development**Location: **210-222 College Avenue East, Guelph****EQUIPMENT DATA**Machine: **CME 55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Apr 09 - 25 TO Apr 10 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 2372**BOREHOLE No. 3**Client: **EM Guelph Developments Limited Partnership**Project: **Proposed Residential Development**Location: **210-222 College Avenue East, Guelph****EQUIPMENT DATA**Machine: **CME 55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Apr 10 - 25 TO Apr 10 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.05	33.64	16	0.226	0.04	0.007	13.7	43.1	43.2	

Date: May. 09 - 2025
Client: EM Guelph Developments Limited Partnership
Contractor:
Source:
Sampled From: BH1 - SA4; 2.3 to 2.9 m depth
Sample No.: 1-4
Date Sampled: Apr. 10 - 2025
Sampled By: JR
Lab No.: 407
Date Tested: May. 07 - 2025
Type of Material: Sand and Silt Till, some gravel, trace clay

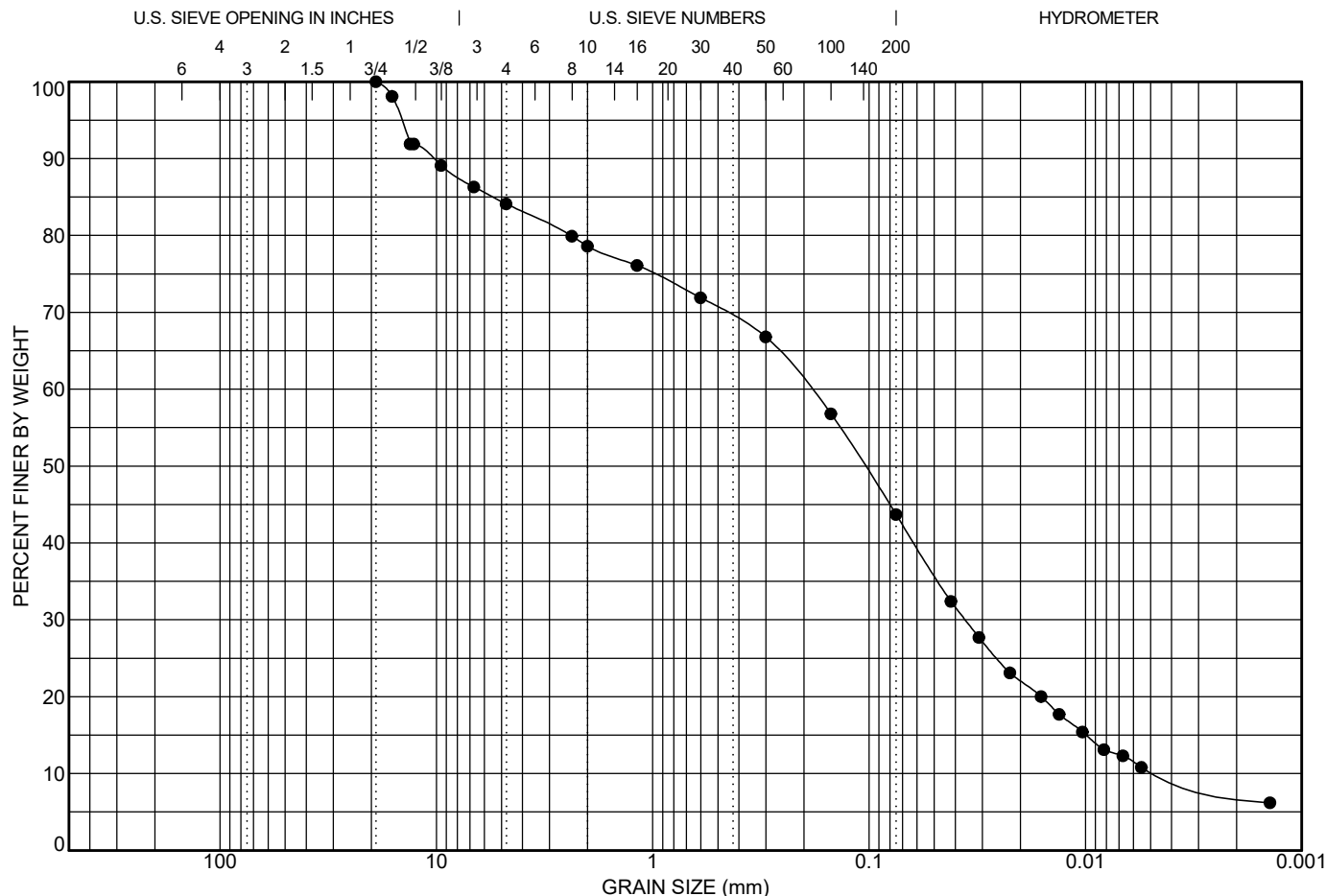
Sieve Size (mm)	Percent Passing	No Specifications



**CHUNG & VANDER DOELEN
ENGINEERING LTD.**
 311 Victoria Street North
 Kitchener, Ontario N2H 5E1
 Telephone: 519-742-8979
 Fax: 519-742-7739
 e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development
Location: 210-222 College Avenue East, Guelph
File No.: 2372
Enclosure No.: 4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.59	43.19	19	0.187	0.036	0.004	15.9	40.4	43.7	

Date: May. 09 - 2025
Client: EM Guelph Developments Limited Partnership
Contractor:
Source:
Sampled From: BH2 - SA3; 1.5 to 2.1 m depth
Sample No.: 2-3
Date Sampled: Apr. 10 - 2025
Sampled By: JR
Lab No.: 408
Date Tested: May. 07 - 2025
Type of Material: Sand and Silt Till, some gravel, trace clay

Sieve Size (mm)	Percent Passing	No Specifications



**CHUNG & VANDER DOELEN
ENGINEERING LTD.**
 311 Victoria Street North
 Kitchener, Ontario N2H 5E1
 Telephone: 519-742-8979
 Fax: 519-742-7739
 e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development
Location: 210-222 College Avenue East, Guelph
File No.: 2372
Enclosure No.: 5



File: 2372H-1v2

Date: April 28, 2026

Attn: Mr. Sayf Hassan, CEO
EM Guelph Developments Limited Partnership
6 Adelaide Street East, Suite 300
Toronto, Ontario
M5C 1H6

Re: 'Scoped' Hydrogeological Assessment
Proposed Residential Development
210 – 222 College Avenue East, Guelph, Ontario

Project Overview

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) was retained by EM Guelph Developments Limited Partnership ("Client") to complete a 'scoped' hydrogeological investigation involving a seasonal monitoring program of groundwater level fluctuations at the subject lands located at 210 – 222 College Avenue East in Guelph, Ontario (hereinafter referred to as the "Site"). The purpose of this investigation is to assess the seasonal high groundwater elevation at the Site to support the proposed construction of a 10-storey residential development.

It is understood that the structure will have a finished floor elevation (FFE) of 344.25 mASL, as shown in the Site Grading Plan (5468796 Architecture Inc., December 18, 2025) included in Appendix B. The building will also have one (1) level of underground parking with a basement finished floor elevation (BFFE) of 337.58 mASL.

This report presents a complete summary of the findings gathered from April 2025 to April 2026 as part of the CVD combined hydrogeological and geotechnical Investigation. This technical memorandum should be read in conjunction with the CVD Geotechnical Investigation Report, Rev. 2, dated January 9, 2026.

Field Investigation

As part of the CVD geotechnical investigation, three (3) boreholes were advanced to a depth of 12.20 m below ground surface (mbgs) across the Site between April 9 and 10, 2025, as shown in the CVD Borehole Location Plan included in Appendix E. All three (3) were converted into monitoring wells (labelled BHs 1, 2, and 3). Each monitoring well was developed using Waterra™ polyethylene tubing, foot-valve and hand pumps.

Based on the results of the investigation, following the surficial topsoil / fill deposits, which extend to

between 0.16 (BH 1) and 1.45 (BH 3) mbgs, the Site is predominantly underlain by a sand and silt to sandy silt till deposit. This deposit extends to the maximum depth of exploration between 12.45 and 12.80 mbgs (lowest elevation down to 329.03 mASL).

Groundwater Level Monitoring Program

During the groundwater monitoring program, water level readings were manually taken on six (6) occasions between April 2025 and April 2026 at all three (3) monitoring wells, representing a full year of groundwater level readings. Additionally, two (2) rounds of spring high groundwater level readings were recorded in April 2025 and April 2026.

Van Essen DI801 10 m TD-Diver automated pressure transducer data loggers were installed in all three (3) monitoring wells on April 14, 2025, to provide continuous water level measurements at 2-hr intervals during the monitoring period. A barometric pressure data logger was also installed to compensate for atmospheric noise and pressure at the ground surface.

Table 1 in Appendix C summarizes the depths and elevations of the on-Site water table as well as the fluctuations in the water table compared to a baseline reading taken on April 14, 2025, which are representative of peak groundwater conditions. Additionally, a hydrograph, Figure 1, which visually presents the water table elevations shown in Table 1 and from data loggers, is also included in Appendix C.

Furthermore, three (3) single well response test (SWRT) analyses were performed at each monitoring well. Hydraulic conductivities for the monitoring wells were calculated from 1.6×10^{-7} m/s to 2.5×10^{-7} m/s, which corresponds with the values expected from a compact to very dense sand and silt till which underlies the entirety of the Site. The hydraulic conductivity values were calculated using the Bouwer-Rice Method through AquiferTest software, and the results of these tests are included in both Appendix D and summarized in Table 1.

Site Characterization

According to the surficial soil mapping for the area (Karrow, 1968), the soil underlying the area is primarily comprised of sandy till corresponding to the Wentworth Till unit. The Wentworth Till is part of the Guelph Drumlin field in which drumlins are aligned in a northwesterly / southeasterly direction. Lacustrine sand deposits are interspaced within the Wentworth Till, along with northwesterly-southeasterly aligned eskers, and occasional areas of outwash gravel along with sand and silt pond deposits in low lying areas. The underlying bedrock is comprised of the Guelph formation dolostone, located approximately $15 \pm$ to $25 \pm$ mbgs, based on nearby water well records.

In terms of nearby groundwater receptors, the Site is situated approximately $550 \pm$ m south of the Eramosa River, $1.2 \pm$ km southeast of the bifurcation point of the Speed and Eramosa Rivers, and $550 \pm$ m southeast of Arboretum Creek.



The property is located in the Grand River Conservation Authority (GRCA) wellhead protection area (WHPA) zone WHPA-B of the municipal wellfield located on Water Street and Edinburgh Road, approximately 1.7± to 1.8± km west of the Site. WHPA-B denotes an area in which horizontal groundwater travel time to the well is 2 years or less, and the WHPA vulnerability score of the property is 6.

Hydrogeological Assessment

Based on the results of manual groundwater level measurements recorded during the monitoring period, water level elevations across the Site and across all visits varied from 338.40 to 343.77 mASL, corresponding to depths between 0.47 and 4.20 mbgs. Peak groundwater elevations, based on both manual and automated measurements, ranged from 341.46 to 343.79 mASL across all monitoring well locations and Site visits, with the highest overall groundwater elevations occurring during April 2026. The overall variation between the individual wells, i.e., in comparison to each other during each monitoring event, varied by up to 3.34 m across all measurements. This large seasonal variation is due to the aquitard nature of the predominant till subsoils.

As shown in Figures 2 and 3 (included in Appendix C), the overall shallow groundwater flow direction travels in a north / northeastern direction, with an approximate water table gradient of 0.04± m/m across the Site.

Preliminary Dewatering Assessment

Considering that the lowest basement level is proposed to be founded at elevation 337.58 mASL, based on the highest recorded groundwater elevation of 343.77 mASL, the basement walls and floor slab need to be waterproofed, and the floor slab designed as a structurally reinforced element capable of resisting hydrostatic uplift pressures. Anchorage may be required depending on the final structural design and analysis. Elevator pits, sump pits, or other structural components located below the groundwater table will require similar waterproofing and structural design considerations.

Furthermore, in order to facilitate construction of the underground level in the dry, groundwater control will be required. Since the water table is located in a sand and silt till with very low hydraulic conductivity (2.5×10^{-7} m/s) and considering that the depth of excavation requiring drawdown will be in the range of only 5.5± to 6.0± m, it is expected that the volume of groundwater ingress into the excavation will be less than 50,000 L/day with a zone of influence (ZOI) of less than 50 metres. As such, an Environment and Sector Registry (EASR) for temporary construction dewatering is not anticipated to be required.

Temporary construction dewatering can be accomplished using traditional filtered sump pumping techniques.



Recommendations

Based on the findings of this scoped hydrogeological assessment, it is concluded that as long as the underground structure is properly waterproofed and reinforced, no issues should arise in terms of constructability, and that the total quantity of pumped groundwater for temporary construction dewatering needs will be less than 50,000 L/day with a zone of influence (ZOI) of less than 50 m. This ZOI is far less than the distance required to reach any nearby water bodies (at least 550± m) or the nearby municipal wellfield (at least 1.7± km), and, as such, no notable issues should arise during temporary construction dewatering.

Based on the completed one-year groundwater level monitoring program, two spring high-water events were recorded, with peak groundwater elevations ranging from 341.46 to 343.79 mASL. Given that groundwater levels in spring 2026 were abnormally high, CVD considers these elevations to be generally representative of the Site's seasonal high groundwater conditions, notwithstanding typical yearly variability. As such, no further groundwater level monitoring is considered necessary, as additional groundwater level readings are unlikely to alter the conclusions of this assessment.



Closing

This assessment has been prepared for the exclusive use of the Client and their assigns for specific application to this project property.

The assessment was conducted in accordance with the verbal and written requests from the Client, and generally accepted assessment practices. Performance of this assessment is intended to reduce, but not eliminate, uncertainty regarding the hydrogeological conditions encountered at the project site, given reasonable limits of time and cost. No other warranty, expressed or implied, is made.

We trust this report is sufficient for your immediate requirements. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
CHUNG & VANDER DOELEN ENGINEERING LTD.



Yaroslav Chudin, P.Eng.
Project Engineer & Hydrogeologist



Peter Dao, M.Sc., P.Geo.
Manager – Environmental & Hydrogeology



APPENDIX A

Limitations of Report



STATEMENT OF LIMITATIONS

1. The work performed in this report was carried out in accordance with the Standard Terms of Conditions made part of our contract. The conclusions presented herein are based solely upon the scope of services and time and budgetary limitations described in our contract.
2. The report has been prepared in accordance with generally accepted hydrogeological study and/or engineering practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.
3. The services performed and outlined in this report were based, in part, upon visual observations of the site and attendant structures. Our opinion cannot be extended to portions of the site which were unavailable for direct observation, reasonably beyond the control of CHUNG & VANDER DOELEN ENGINEERING LTD.
4. The objective of this report was to assess hydrogeological conditions at the site, within the context of our contract and hydrogeological assessment guidelines within the applicable jurisdiction. Evaluating compliance of past or future owners with applicable local, provincial and federal government laws and regulations was not included in our contract for services.
5. CHUNG & VANDER DOELEN ENGINEERING LTD. has relied in good faith on information and services provided by others while conducting the record search. We accept no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omission, misinterpretation or fraudulent acts of the services used.
6. It should be noted that the observations and recommendations presented in this report are limited to the actual locations explored. The information presented in terms of the thickness and types of the subsoils encountered, groundwater levels, and chemical testing results, etc., are only applicable to the actual locations explored. Variations may be present between these locations. Should significant variation become apparent during later investigations, it may be necessary to reevaluate the findings of this report.
7. The conclusions of this report are based in part, on the information provided by others. The possibility remains that unexpected environmental conditions may be encountered at the site in locations not specifically investigated. Should such an event occur, CHUNG & VANDER DOELEN ENGINEERING LTD. must be notified in order that we may determine if modifications to our conclusions are necessary.



APPENDIX B

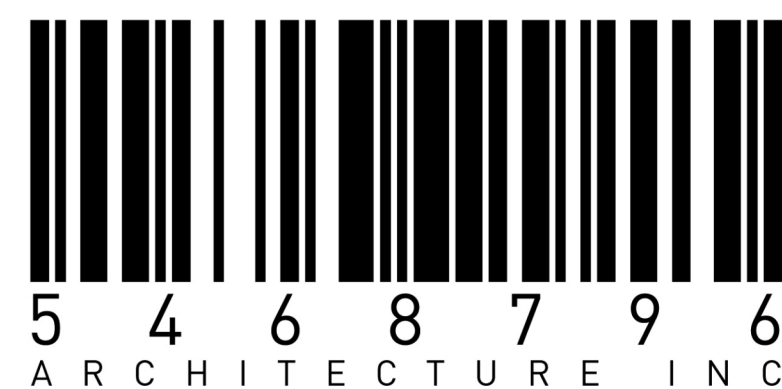
Selected Design Drawings



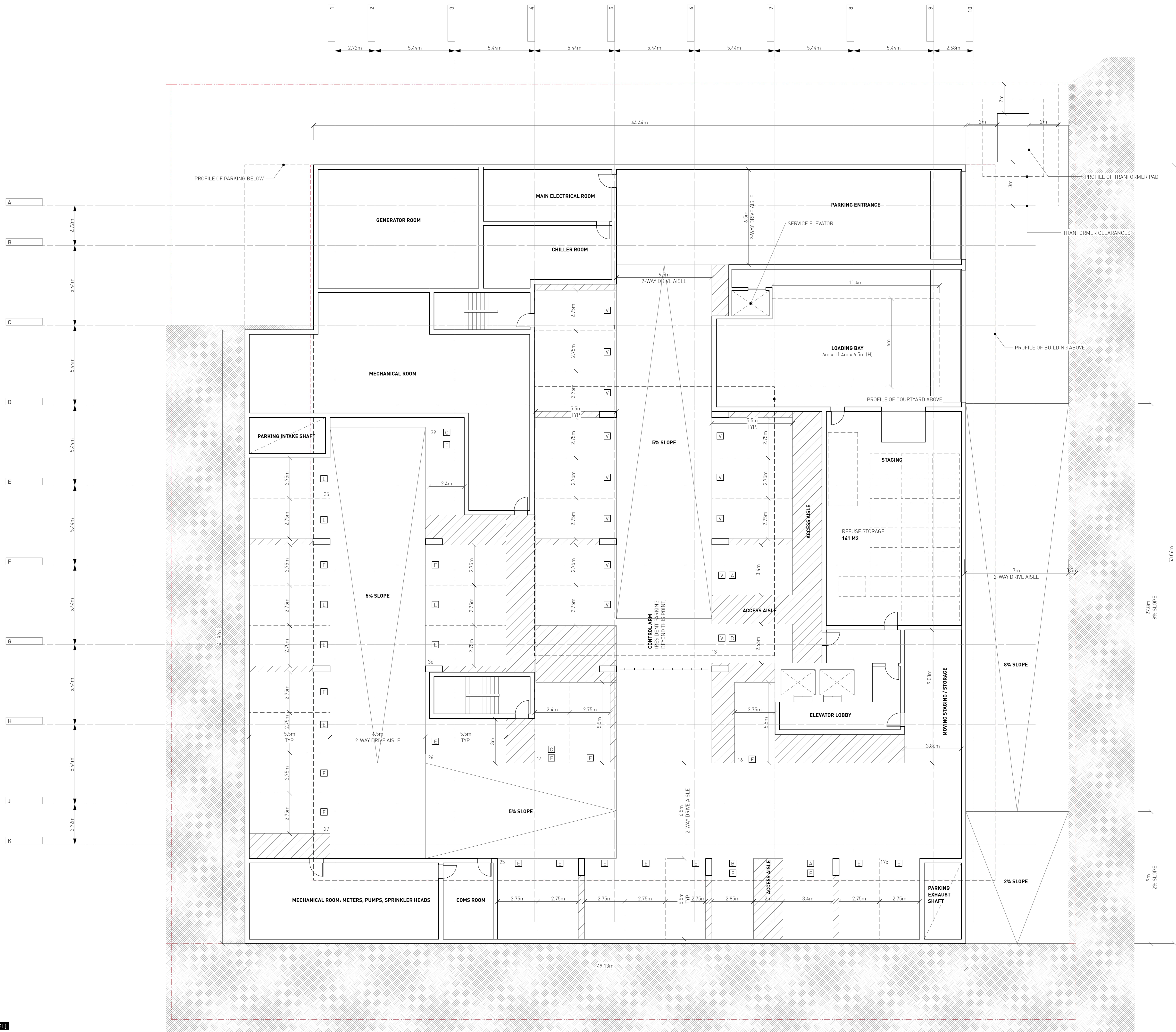
YARRA BY ELYSIUM

210-214-222 COLLEGE AVENUE EAST, GUELPH ON CAN

Issued for client review
2025.12.18







LEGEND	
A	ACCESSIBLE PARKING SPOT TYPE A (2 TOTAL)
B	ACCESSIBLE PARKING SPOT TYPE B (2 TOTAL)
C	COMPACT PARKING SPOT (6 TOTAL)
V	VISITOR PARKING SPOT (13 TOTAL)
T	ELECTRIC VEHICLE PARKING SPOT (53 TOTAL)
66 PARKING SPOTS TOTAL	
194 LONG-TERM BICYCLE PARKING SPOTS TOTAL	

Drawn By: EA
Checked By: SR
Printing Date: 2025.12.18

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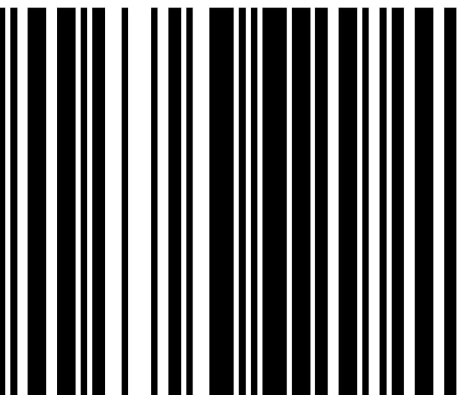
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Winnipeg MB R3B 0S8
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F: 204.480.8876

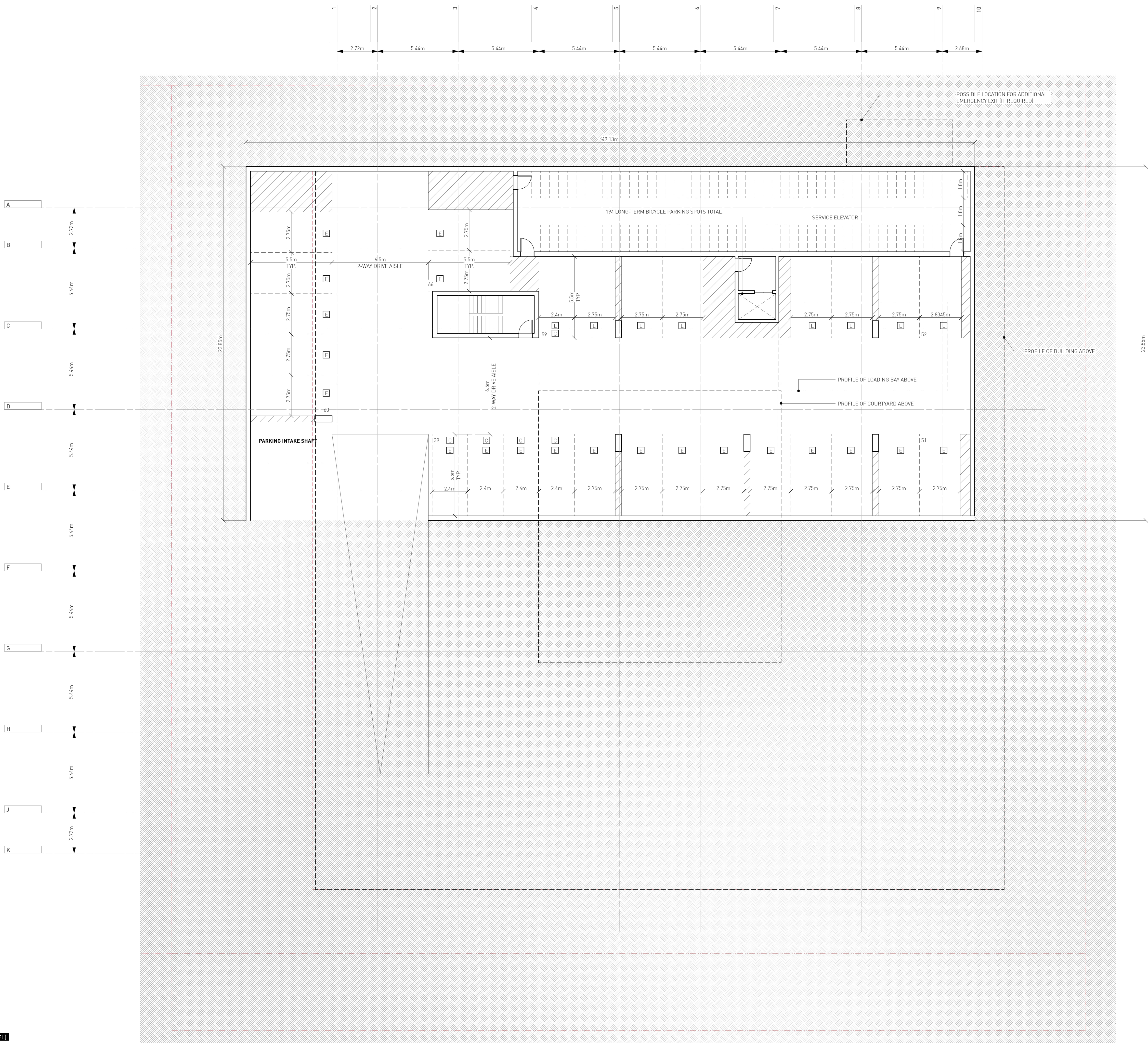
YARRA by ELYSIUM

210-222 COLLEGE AVE EAST
GUELPH ON CAN

PARKING LEVEL FLOOR
PLAN (ENTRY)

Project
0837
Sheet

FP-1



LEGEND	
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	ACCESSIBLE PARKING SPOT TYPE B (2 TOTAL)
	COMPACT PARKING SPOT (6 TOTAL)
	VISITOR PARKING SPOT (13 TOTAL)
	ELECTRIC VEHICLE PARKING SPOT (53 TOTAL)
66 PARKING SPOTS TOTAL	
194 LONG-TERM BICYCLE PARKING SPOTS TOTAL	

Drawn By: EA
Checked By: SR
Printing Date: 2025.12.18

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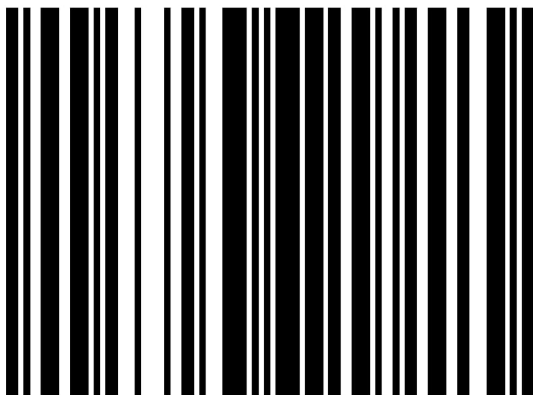
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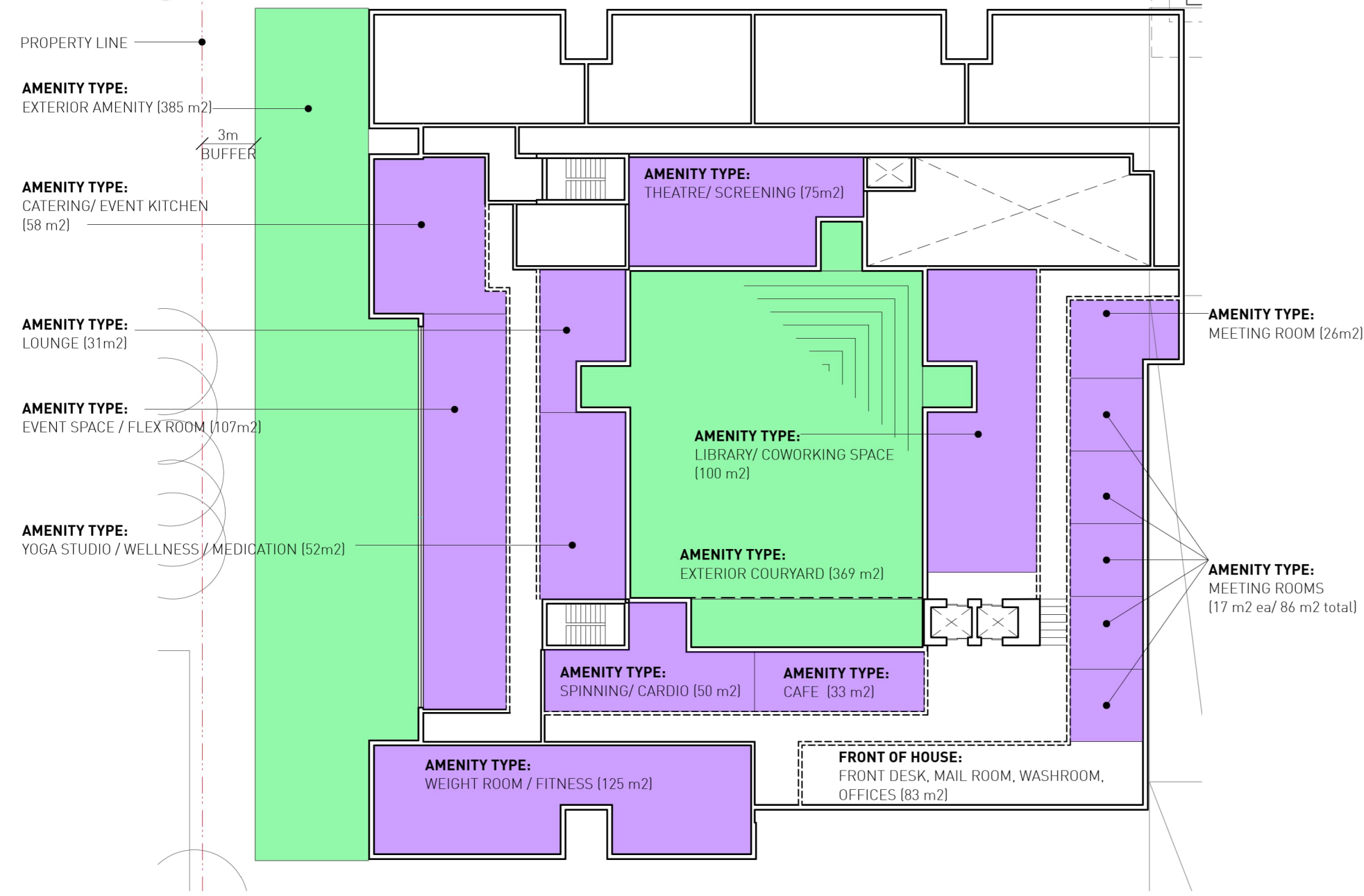
YARRA by ELYSIUM

210-222 COLLEGE AVE EAST
GUELPH ON CAN

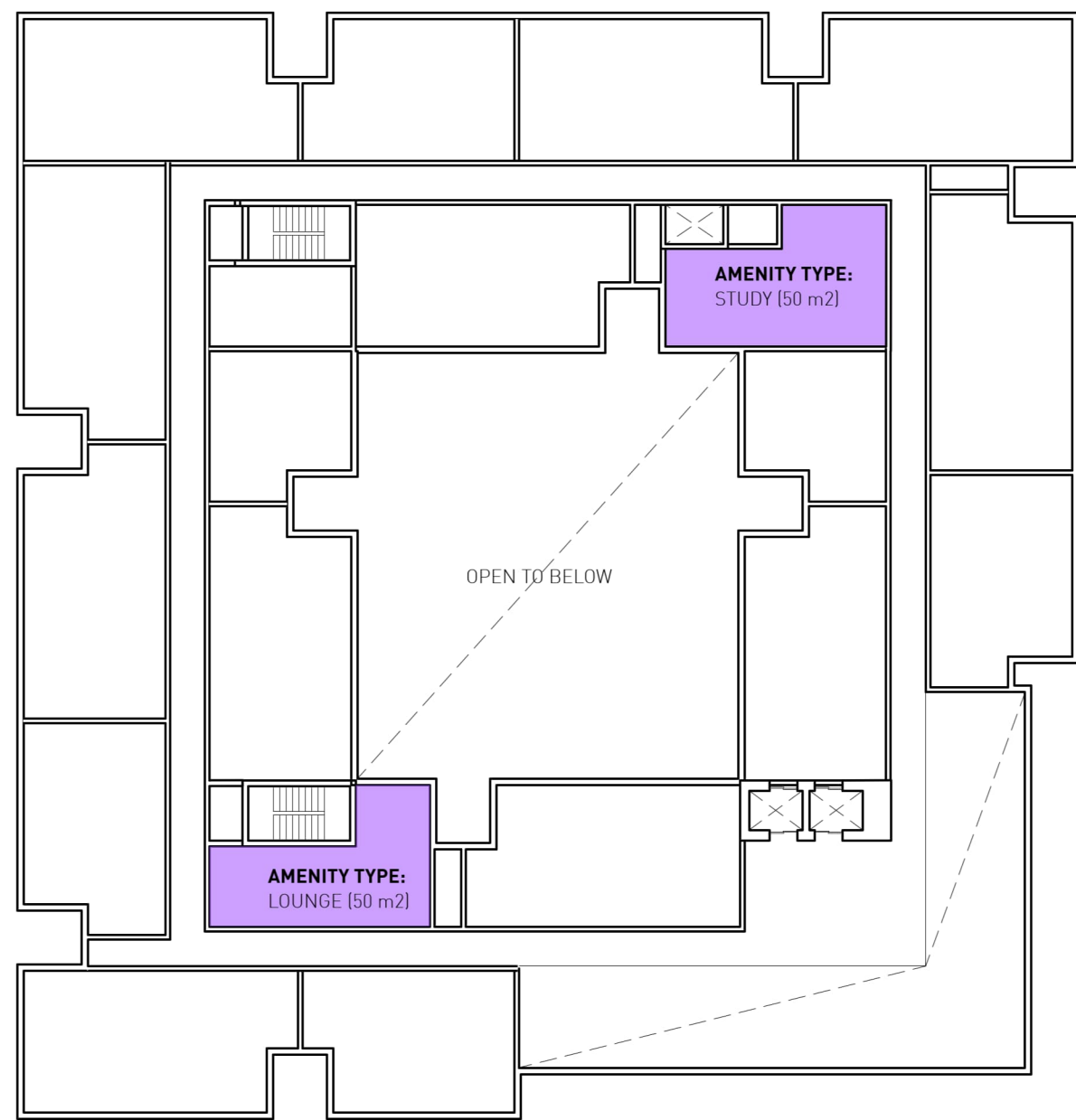
PARKING LEVEL FLOOR
PLAN (LOW)

Project
0837
Sheet

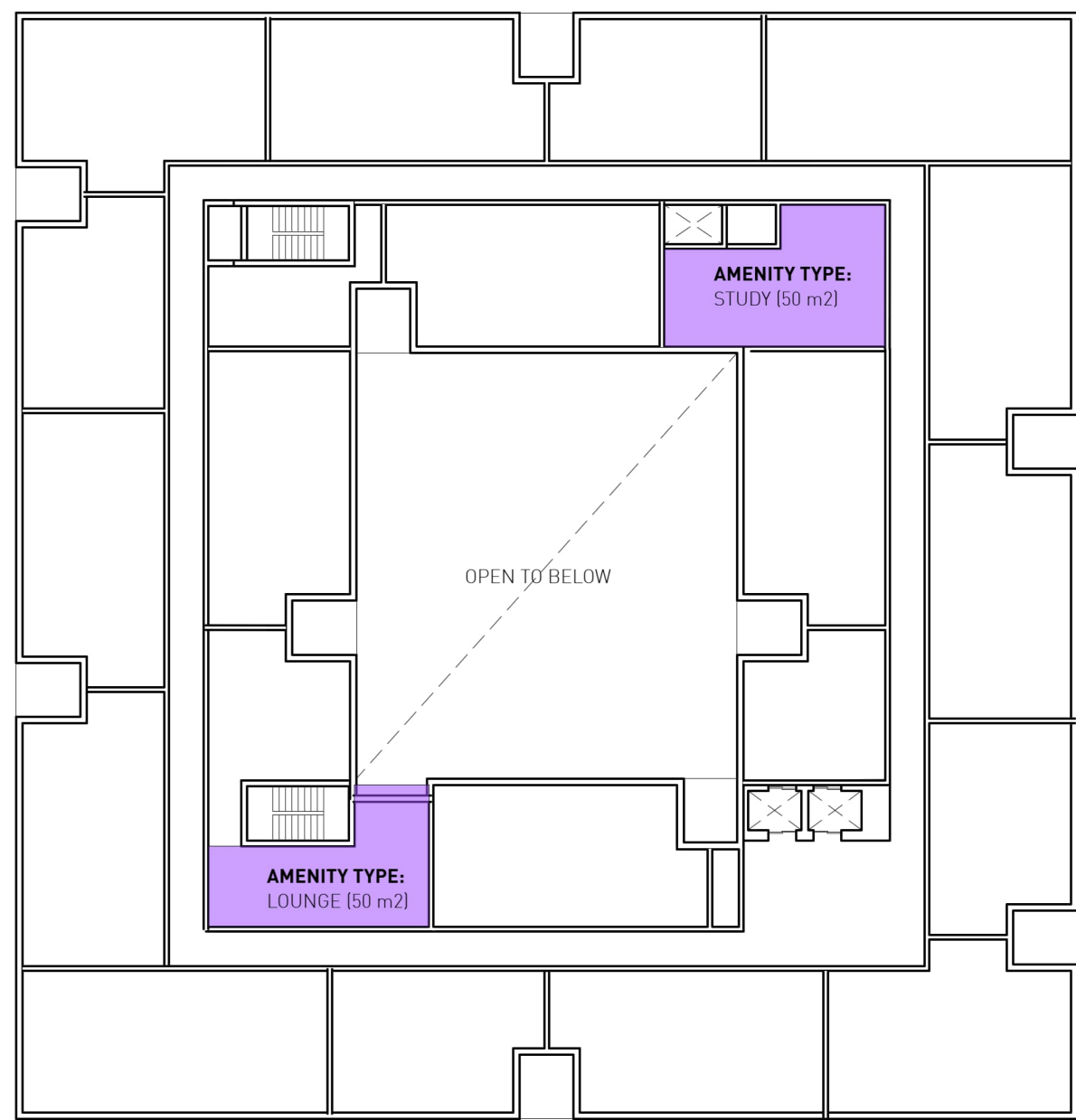
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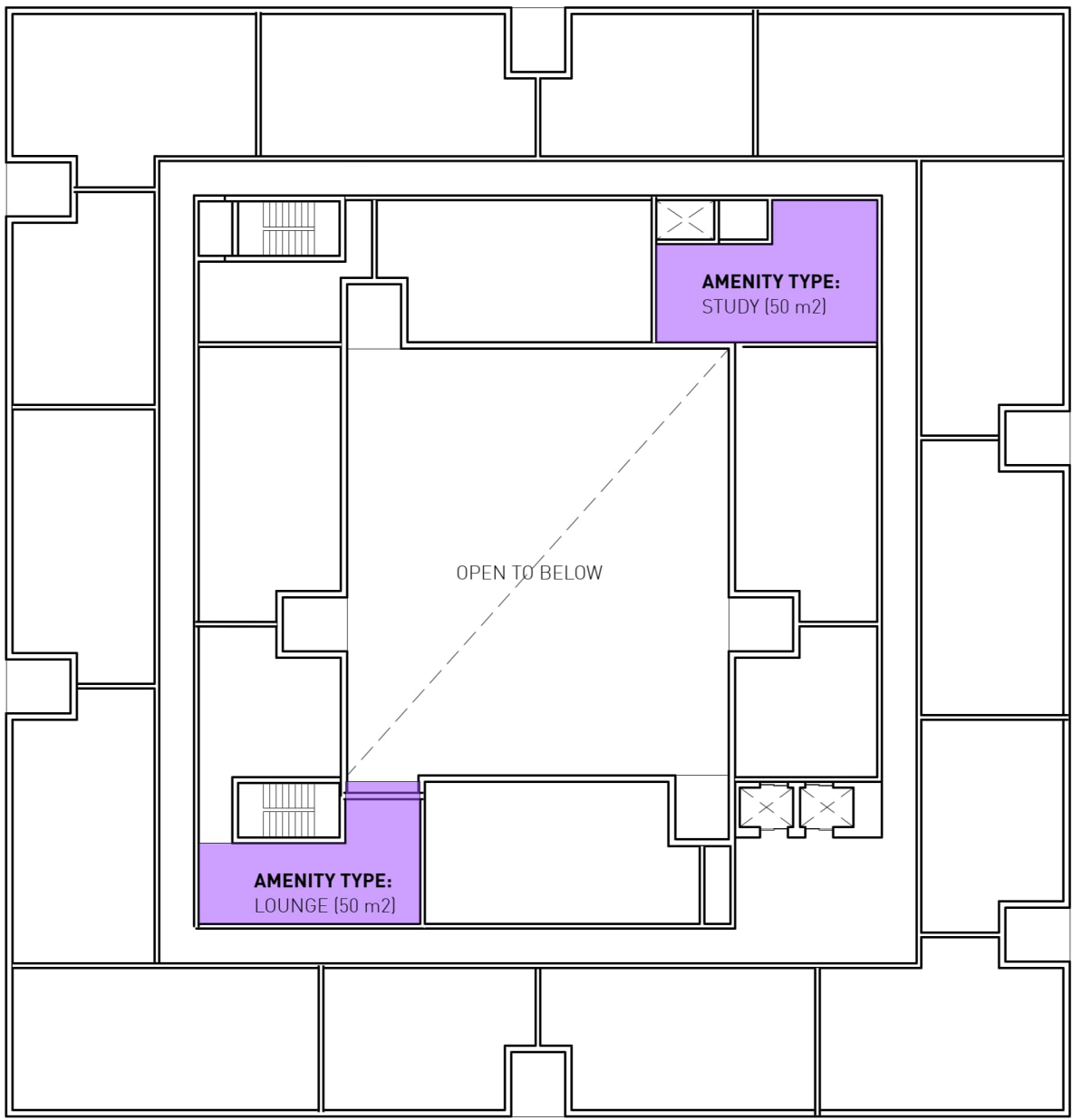
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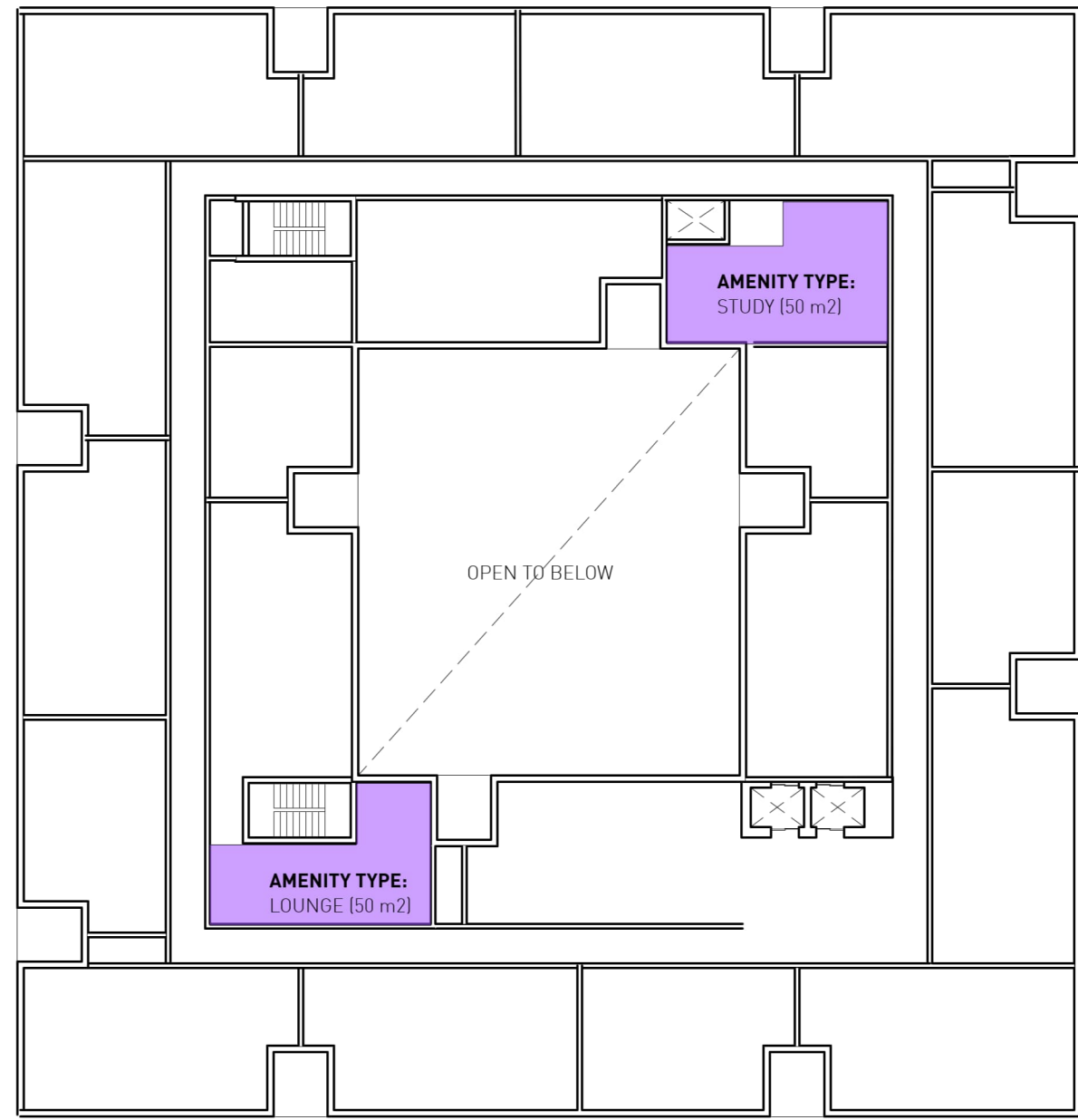
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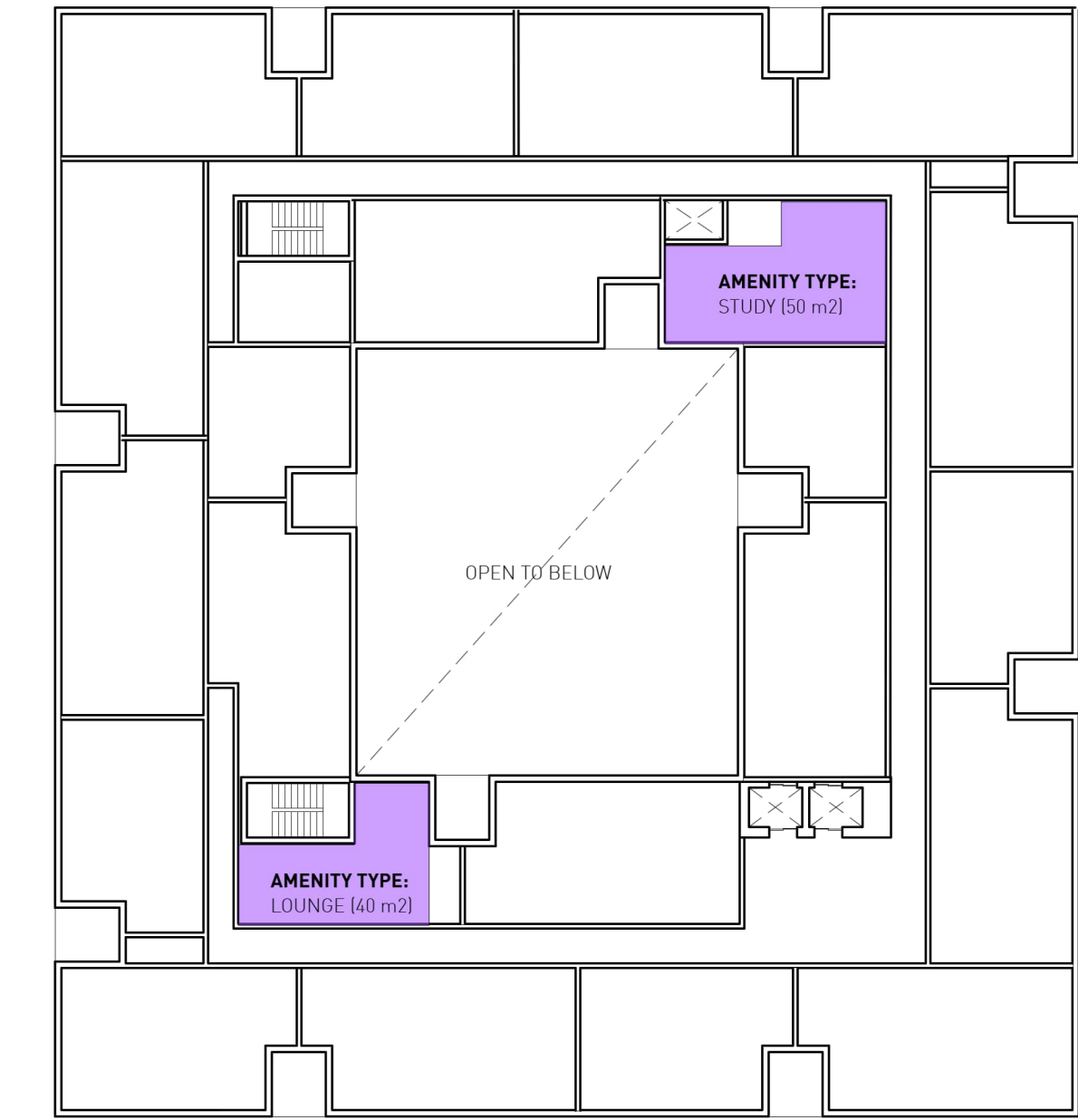
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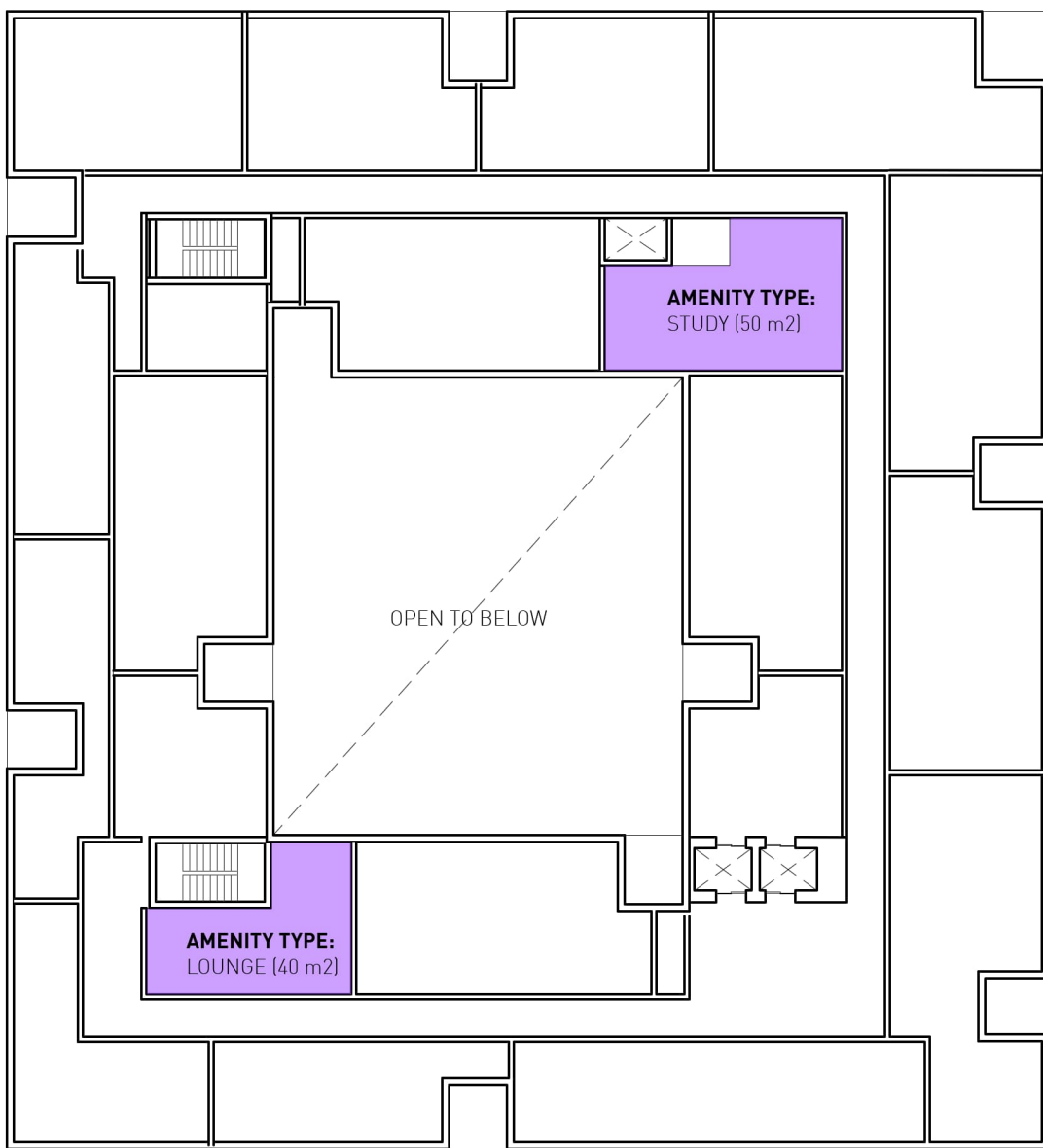
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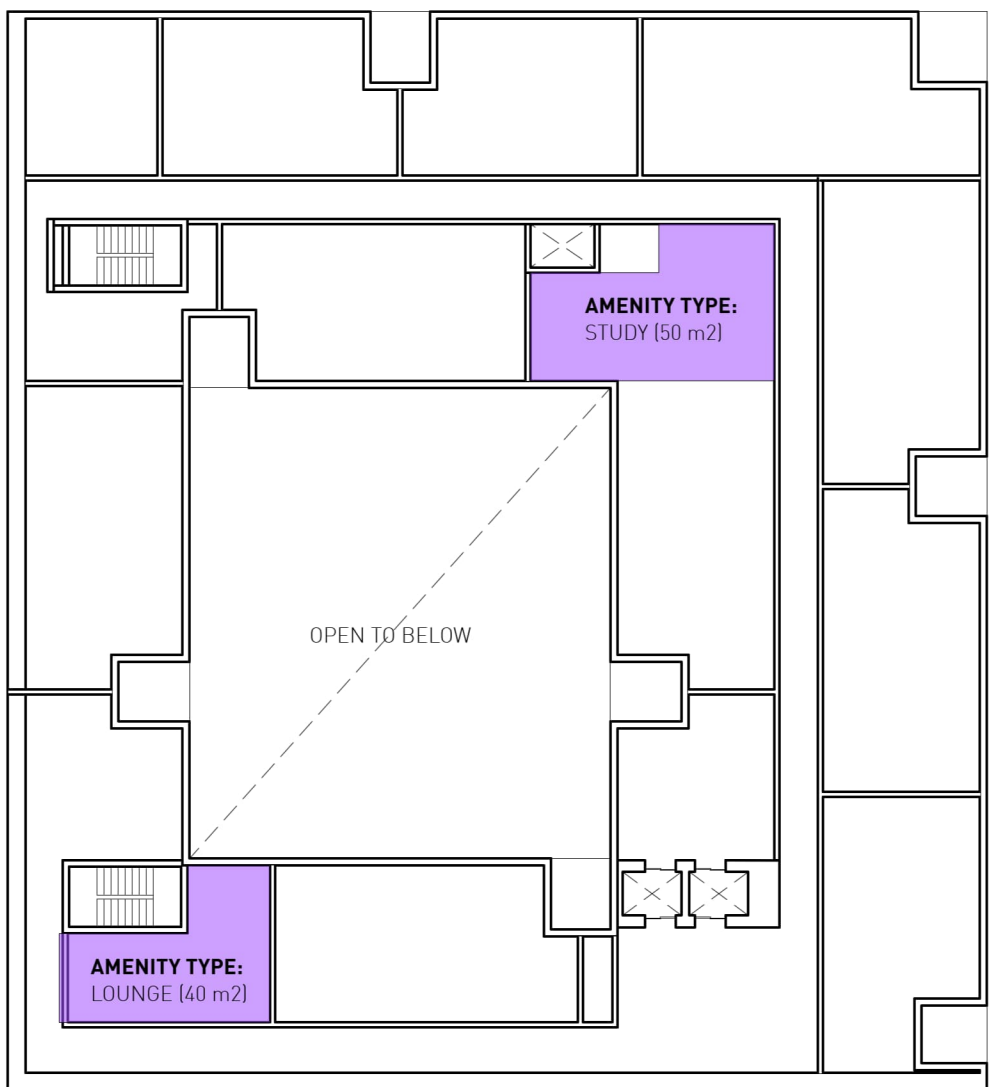
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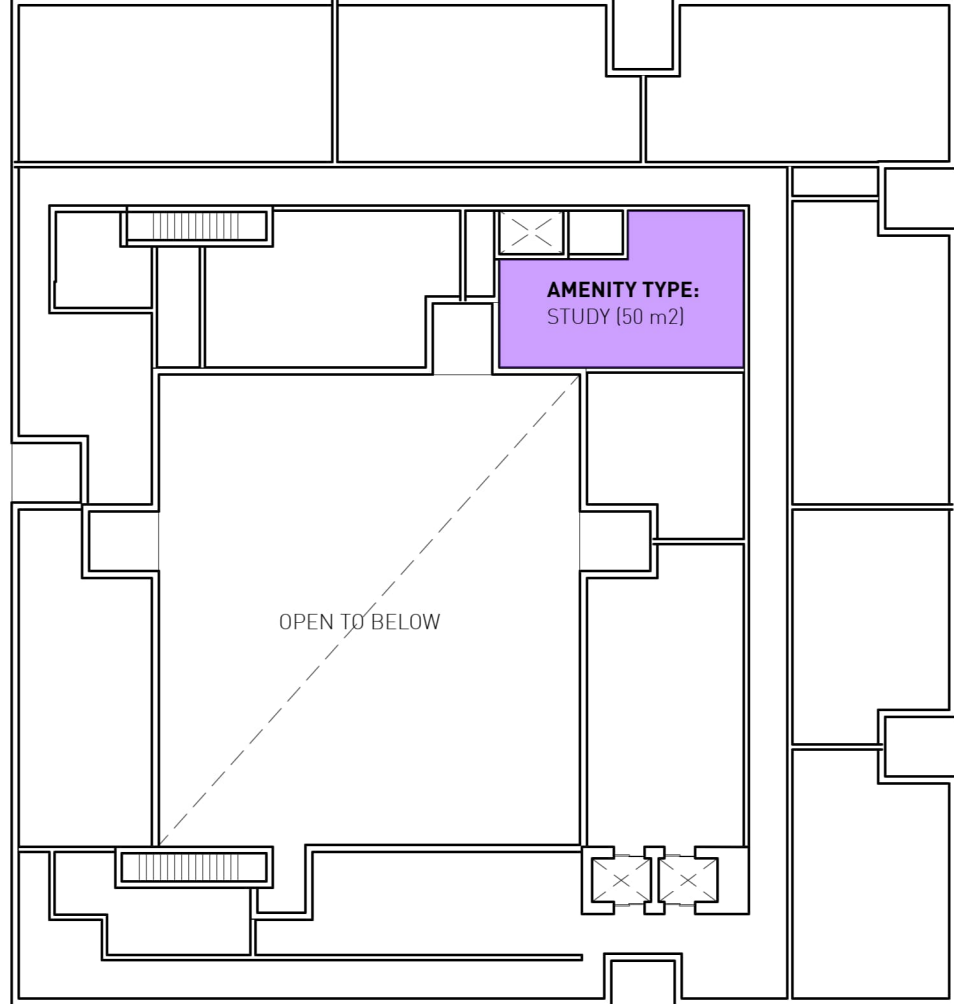
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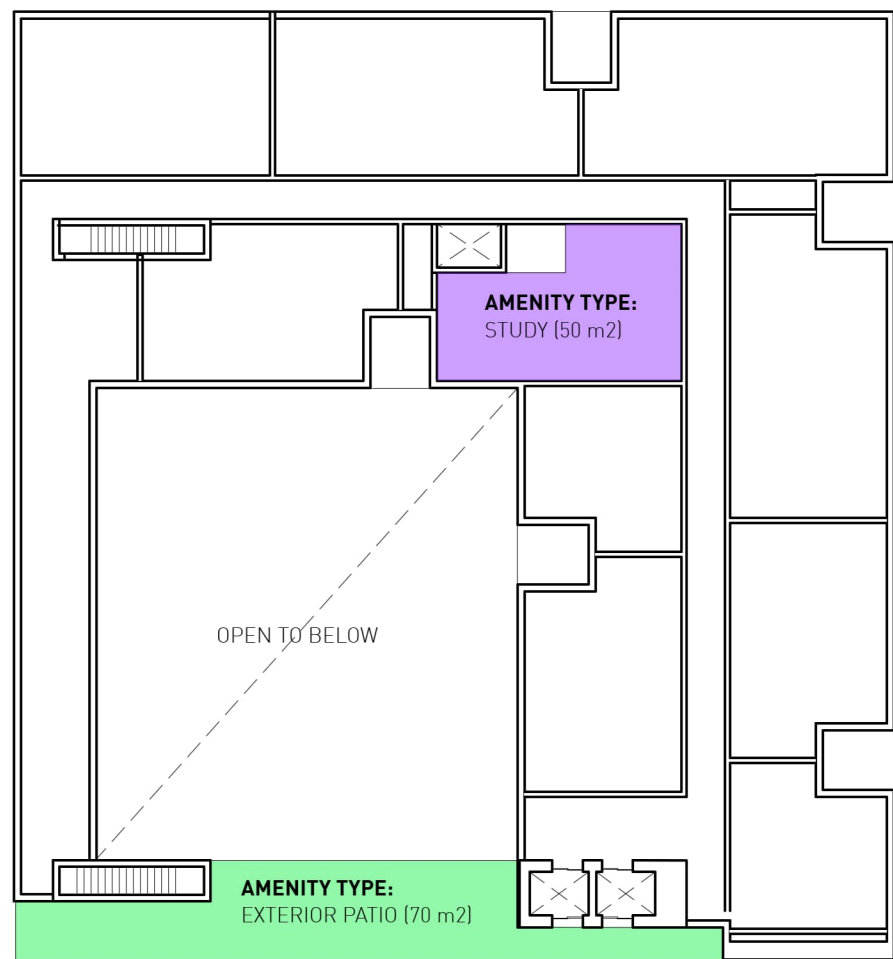
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CAP-1
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SCALE: 1:300



9
CAP-1
L09 - AMENITY PLAN
SCALE: 1:300



10
CAP-1
L10 - AMENITY PLAN
SCALE: 1:300

Drawn By: NC
Checked By: SR
Printing Date: 2025.12.18

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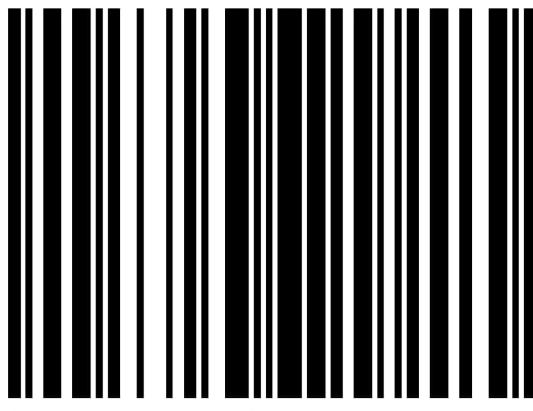
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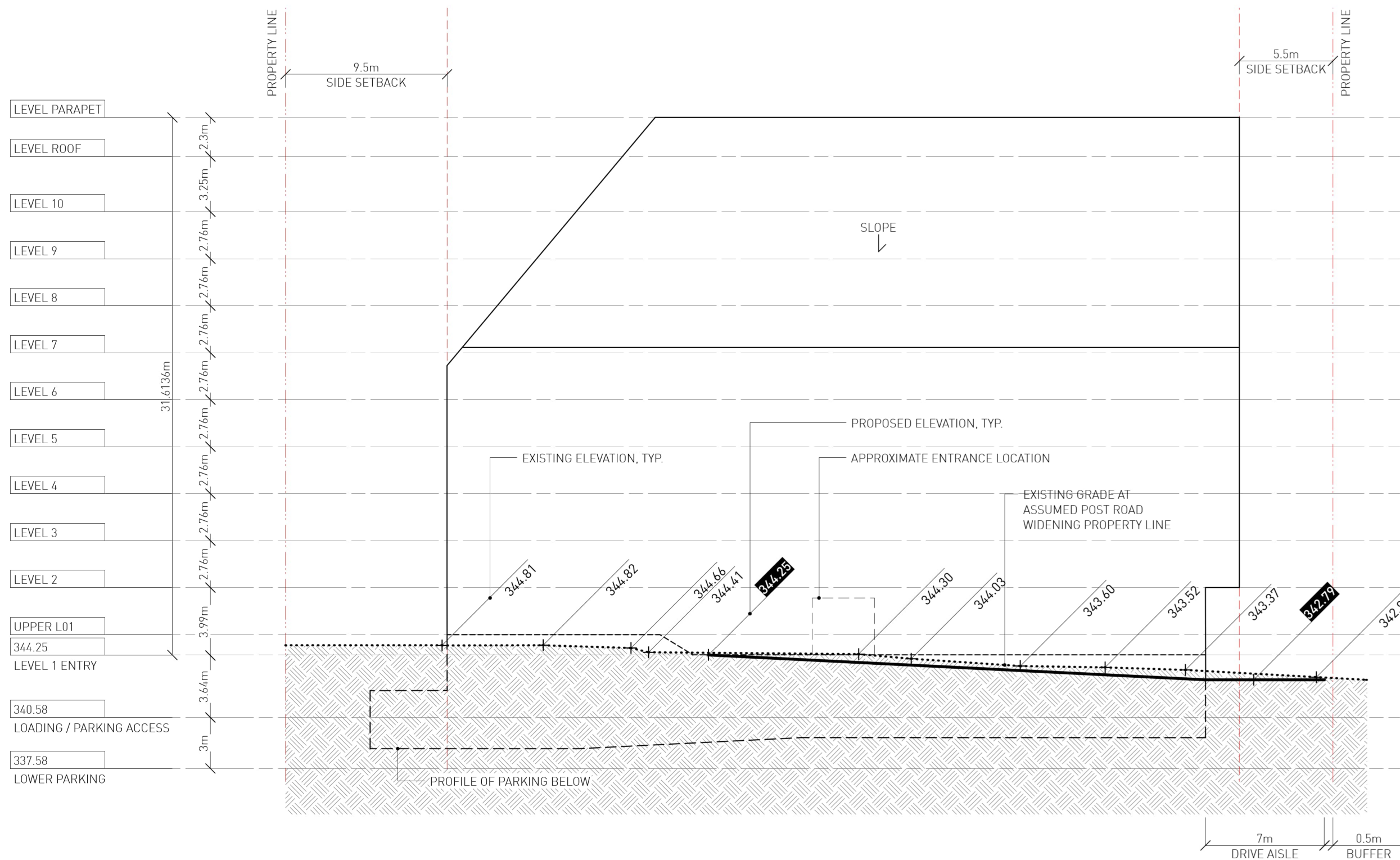
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266 MCDERMOT AVE
Winnipeg MB R3B 0S8
P: 204.480.8421
F: 204.480.8876

YARRA by ELYSIUM

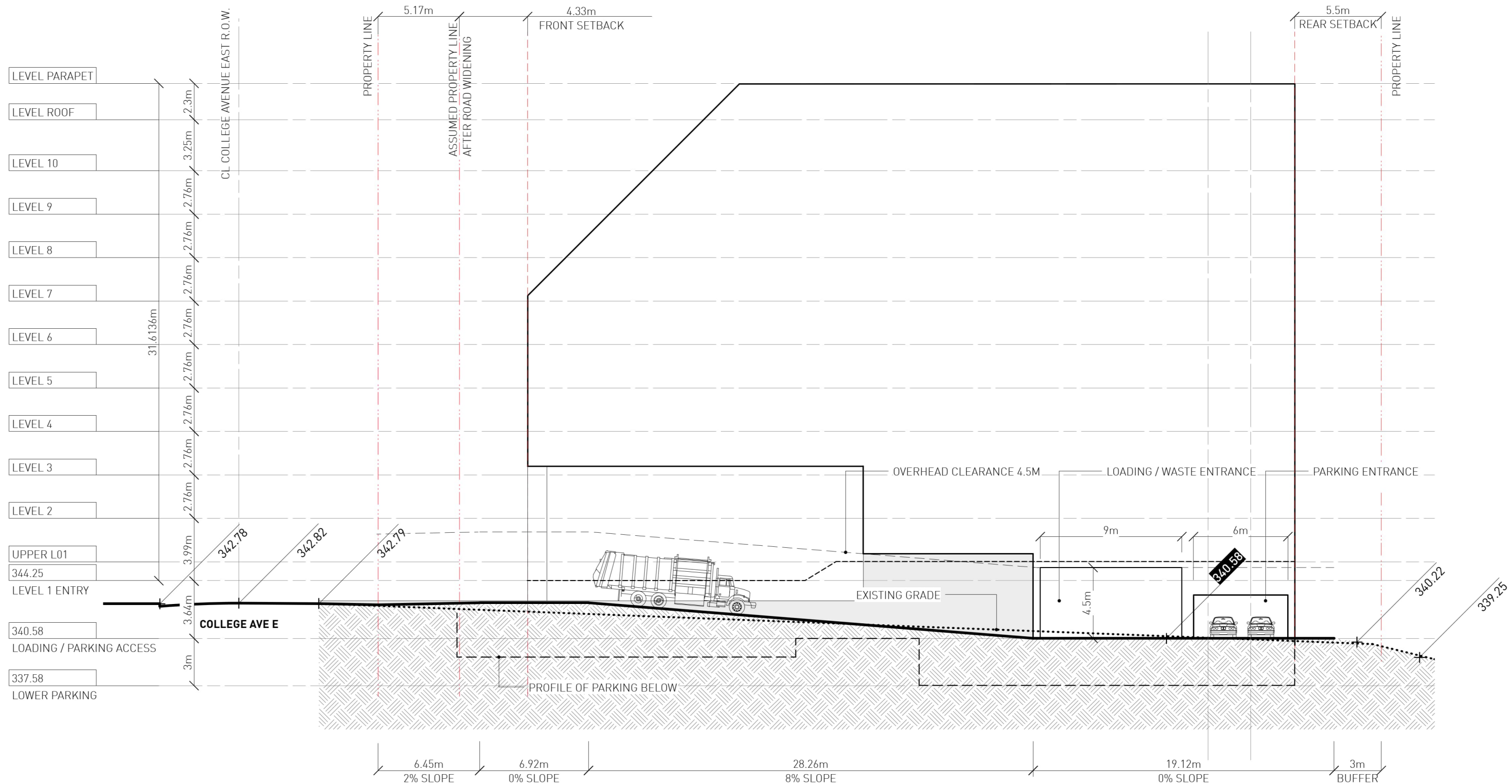
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Project: 0837
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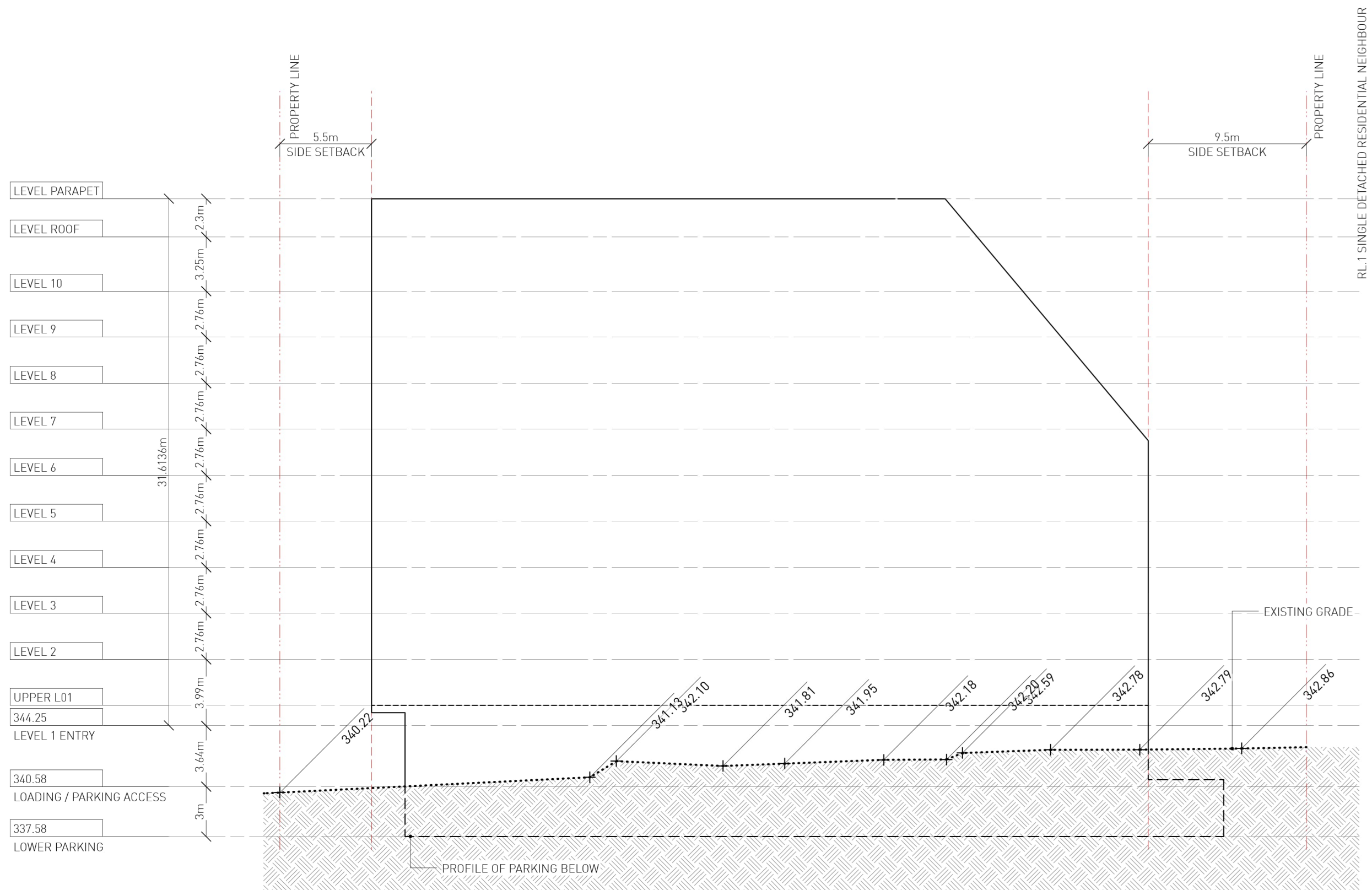
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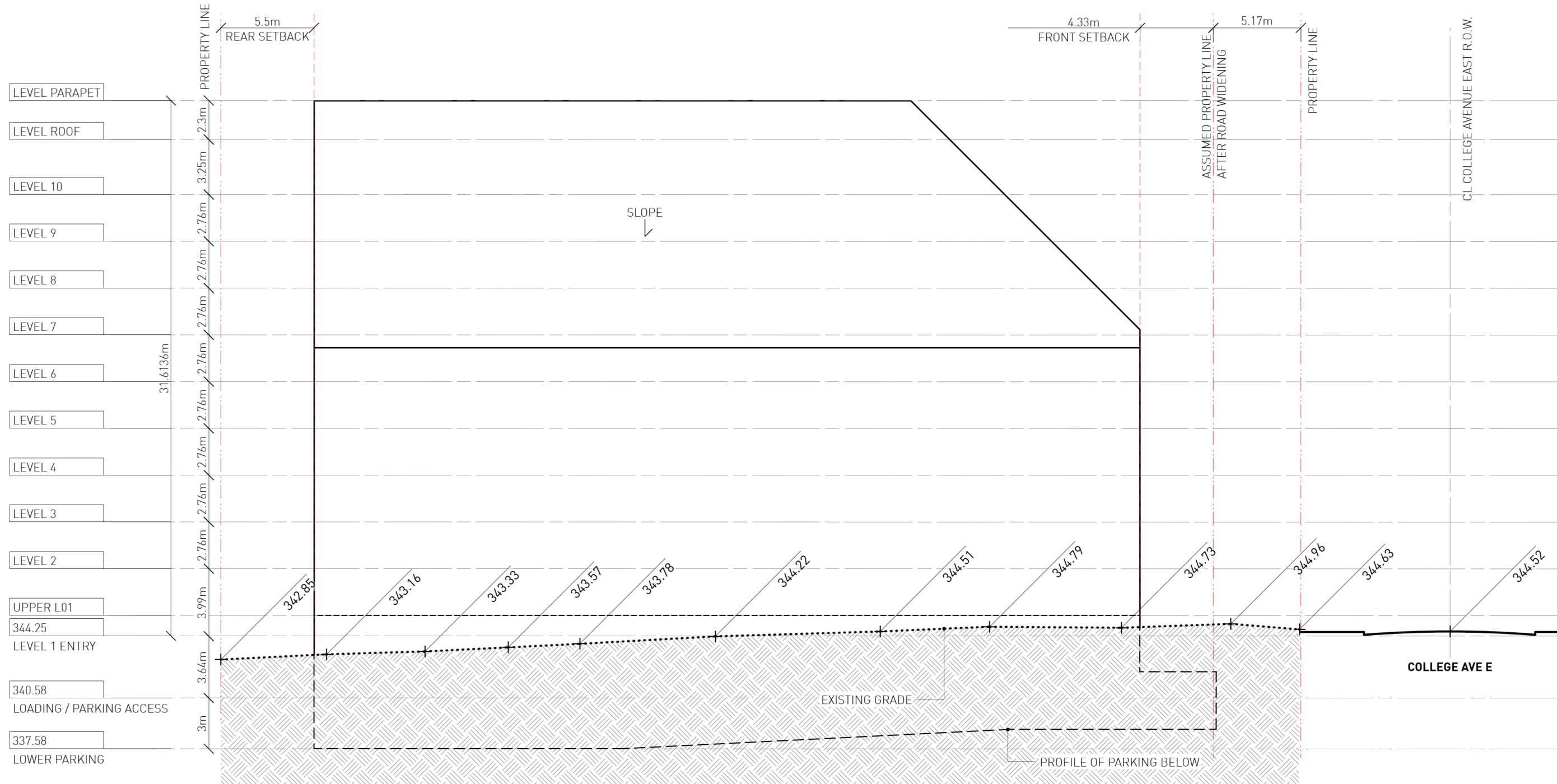
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2 ELEVATIONS
EP-1 SCALE: 1:250



3 ELEVATIONS
EP-1 SCALE: 1:250



4 ELEVATIONS
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Drawn By: NC
Checked By: SR
Printing Date: 2025.12.18

The Contractor shall verify all dimensions, datums and levels prior to commencement of work.

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210-222 COLLEGE AVE EAST
GUELPH ON CAN

ELEVATIONS Project
0837 Sheet

EP-1



Drawn By: NC
Checked By: SR
Printing Date: 2025.12.18

The Contractor shall verify all dimensions, datums and levels prior to commencement of work.

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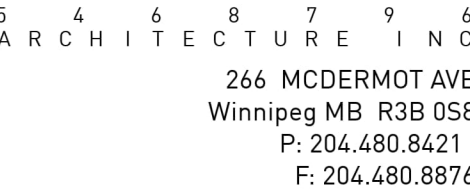
This drawing must not be scaled

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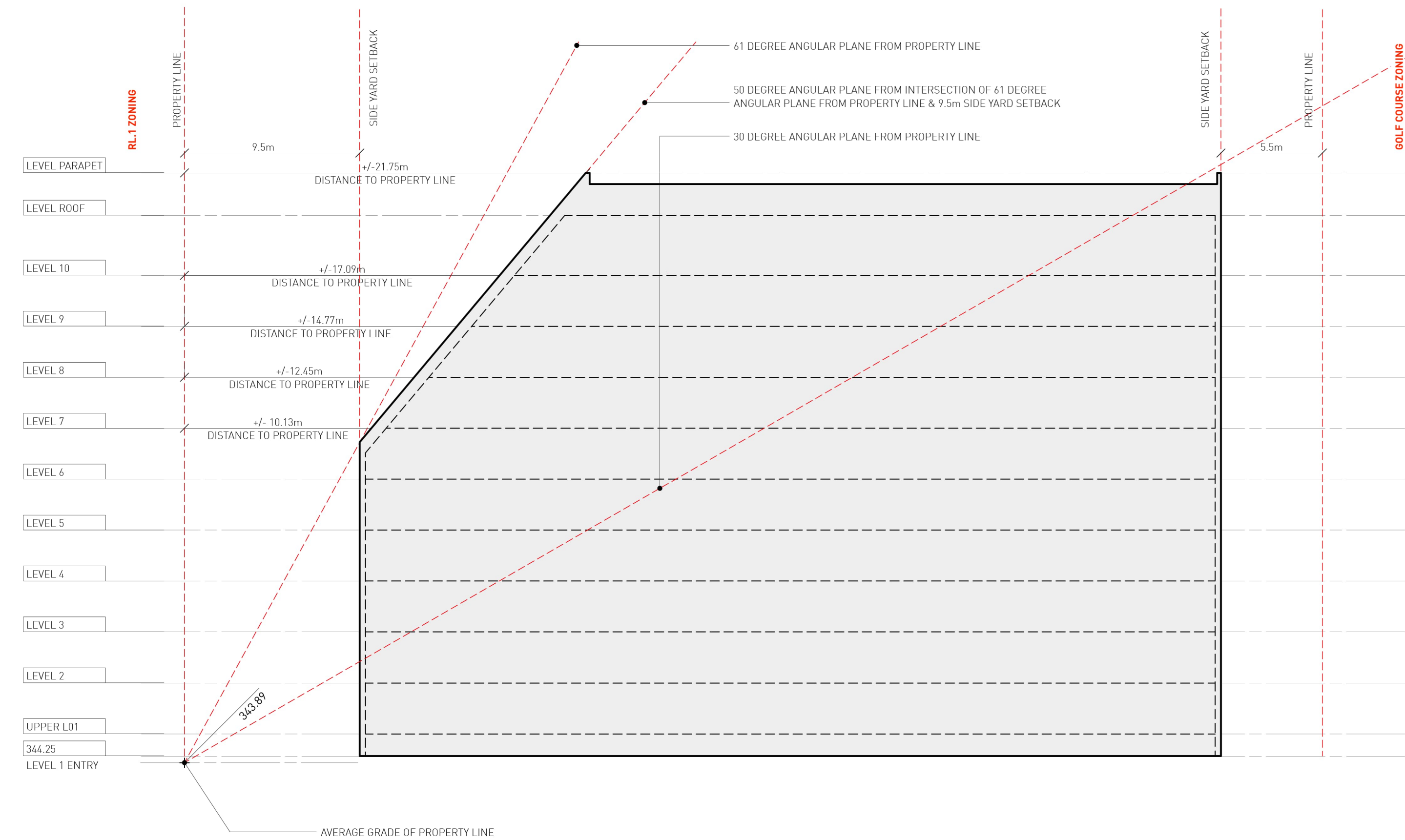


YARRA by ELYSIUM

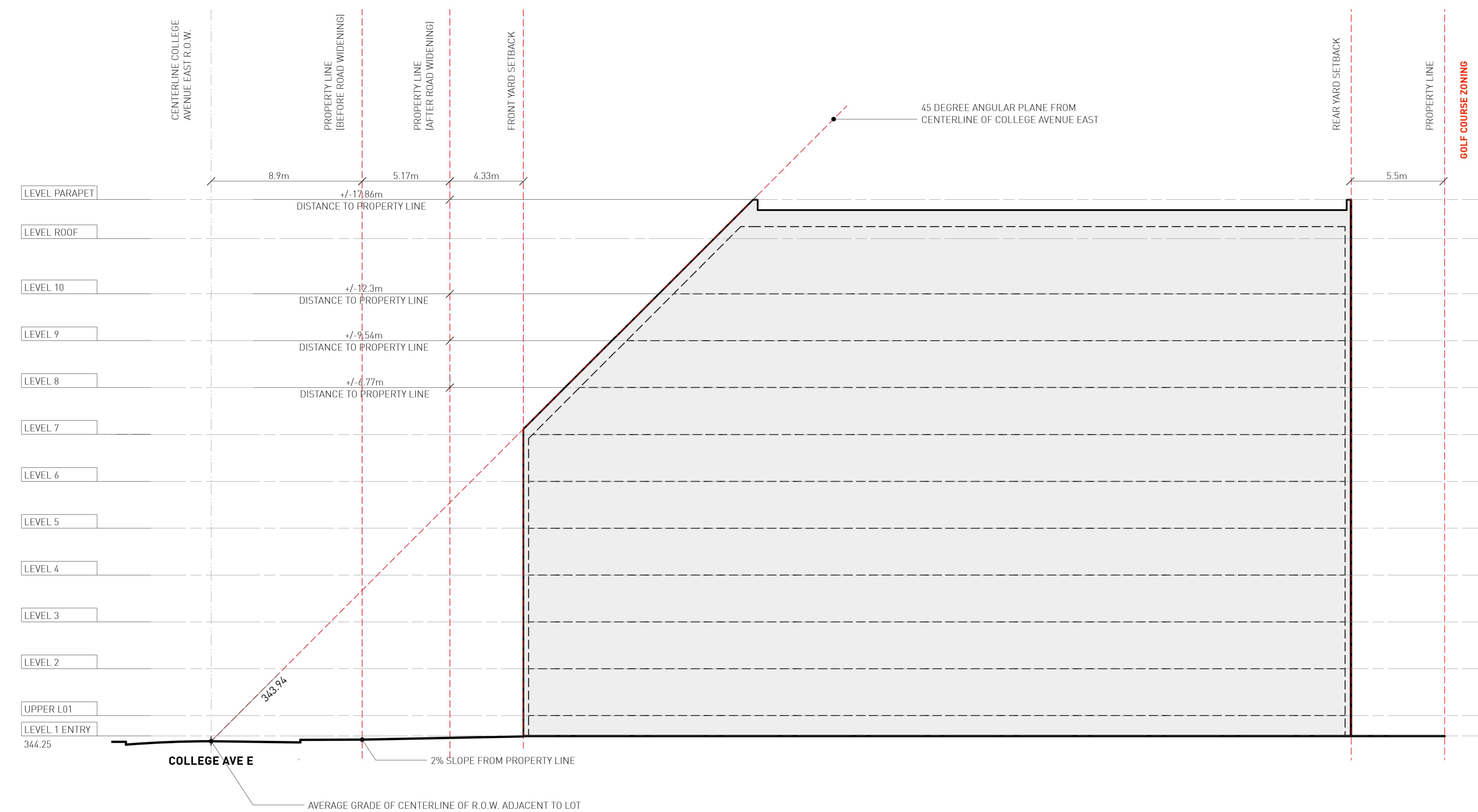
210-222 COLLEGE AVE EAST
GUELPH ON CAN

ELEVATIONS
Project
0837
Sheet

EP-2



1 ANGULAR PLANE DIAGRAM WEST / EAST
AP-1 SCALE: 1:200



2 ANGULAR PLANE DIAGRAM NORTH / SOUTH
AP-1 SCALE: 1:200

Drawn By: NC
Checked By: SR
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The Contractor shall verify all dimensions, datums and levels prior to commencement of work.

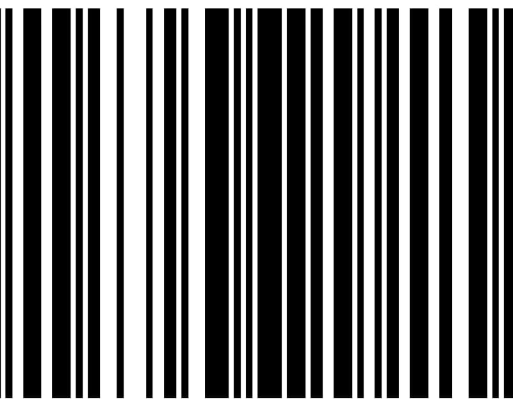
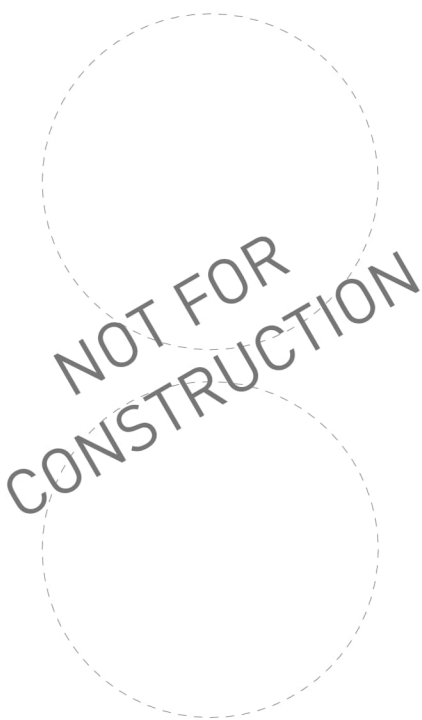
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ARCHITECTURE INC
266 MCDERMOT AVE
Winnipeg MB R3B 0S8
P: 204.480.8421
F: 204.480.8876

YARRA by ELYSIUM

210-222 COLLEGE AVE EAST
GUELPH ON CAN

ANGULAR PLANE
DIAGRAMS
Project
0837
Sheet

AP-1

APPENDIX C

Groundwater Data



Table 1 - Summary of Water Levels, Elevations & Fluctuations

210 – 222 College Avenue East, Guelph
CVD Engineering Ltd.
Project: 2372H

Well	Ground Elevation (mASL)	Stickup (m)	Hydraulic Conductivity (m/s)	Water Level (m Below Ground)						Water Elevation (mASL)						Water Level Fluctuations Relative to April 14, 2025 (m)					Max Groundwater Elevation (Manual + Loggers) (mASL)
				14-Apr-25	01-May-25	29-Aug-25	12-Nov-25	29-Jan-26	17-Apr-26	14-Apr-25	01-May-25	29-Aug-25	12-Nov-25	29-Jan-26	17-Apr-26	01-May-25	29-Aug-25	12-Nov-25	29-Jan-26	17-Apr-26	
BH 1	344.59	0.00	2.5×10^{-7}	1.36	1.95	3.78	4.16	2.24	0.83	343.23	342.64	340.81	340.43	342.35	343.77	-0.59	-2.42	-2.80	-0.88	0.54	343.79
BH 2	341.83	1.11	2.1×10^{-7}	0.89	1.54	2.99	3.44	1.54	0.47	340.95	340.29	338.85	338.40	340.29	341.36	-0.66	-2.10	-2.55	-0.66	0.42	341.46
BH 3	342.94	0.00	1.6×10^{-7}	1.95	2.55	4.05	4.20	2.95	1.25	340.99	340.39	338.89	338.74	339.99	341.69	-0.60	-2.09	-2.25	-1.00	0.70	341.72

- Notes:
- 1) All Elevations Referenced to Geodetic Survey by CVD.

2) **Bolded** elevations represent the maximum water table aquifer elevation manually measured at each monitoring well throughout all seasons.

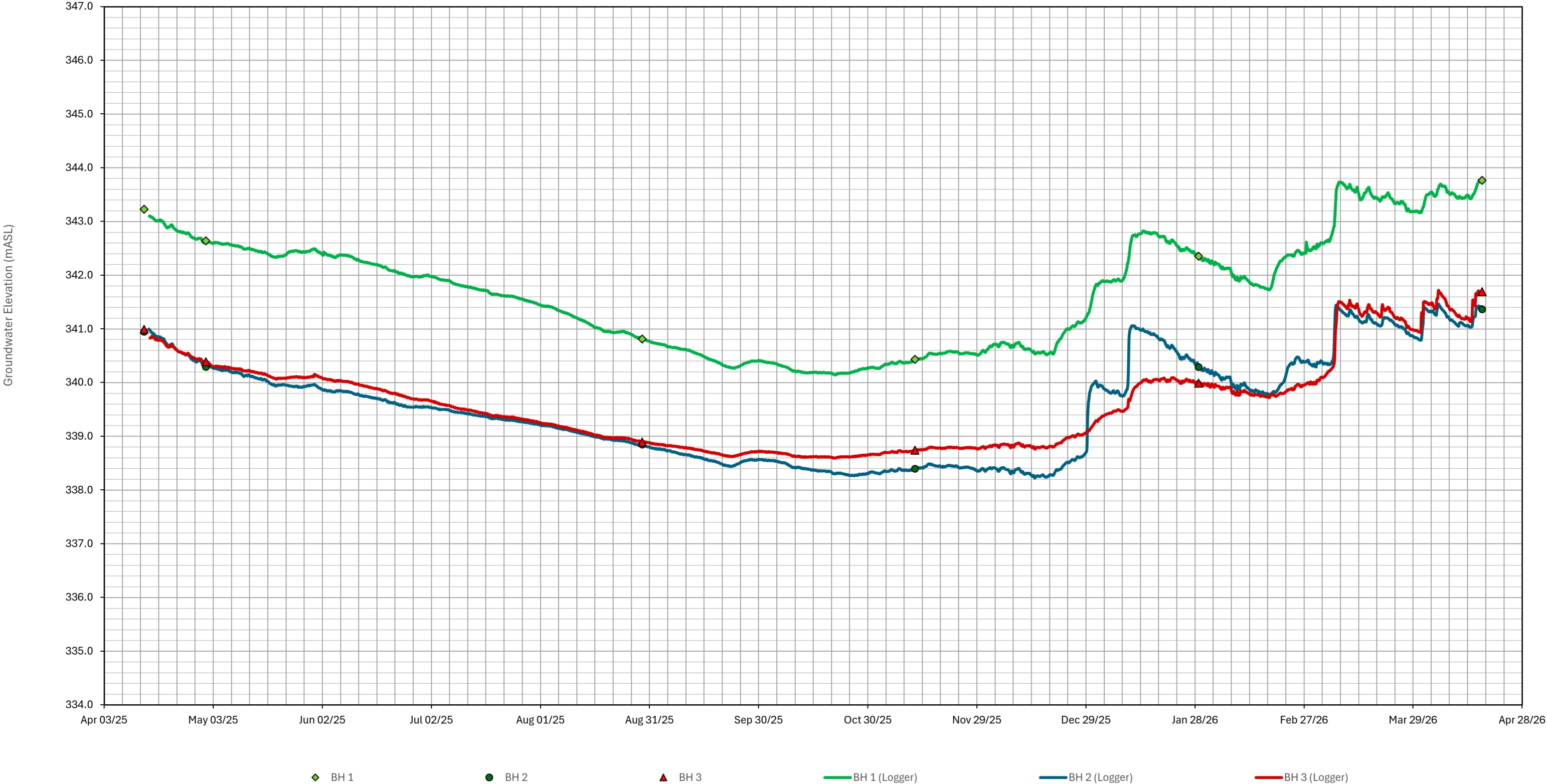
3) Negative water level indicates that water level is above ground.

4) : Monitoring well dry.

5) Negative fluctuation indicates drop in water level relative to baseline.

6) : Water level not stabilized.

Figure 1 - Hydrographs (April 2025 to April 2026)



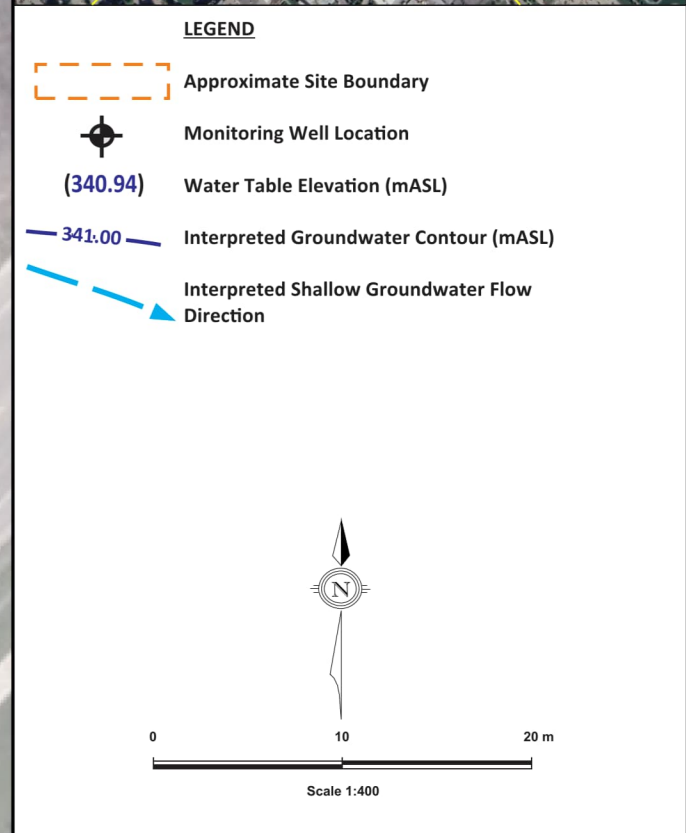
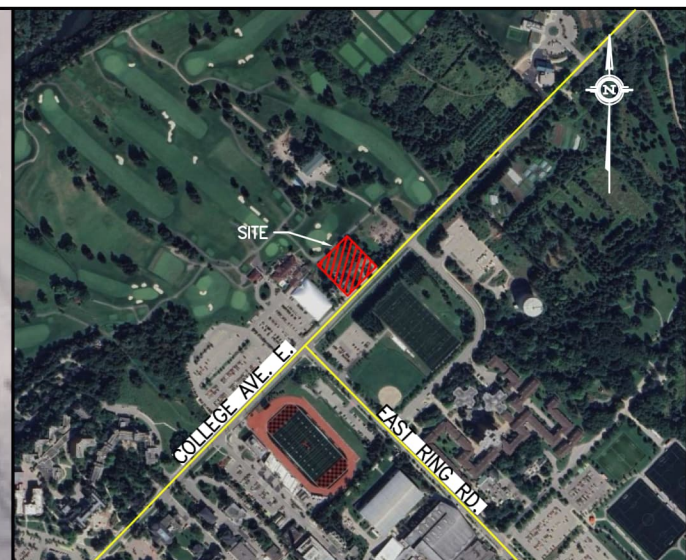


Image Ref.: City of Guelph; GIS Locator; ESRI; Retrieved: December 2025

Figure 2:
Water Table Interpretation (April 14, 2025)

Scoped Hydrogeological Assessment
Proposed Residential Development

210 – 222 College Avenue East Guelph, ON

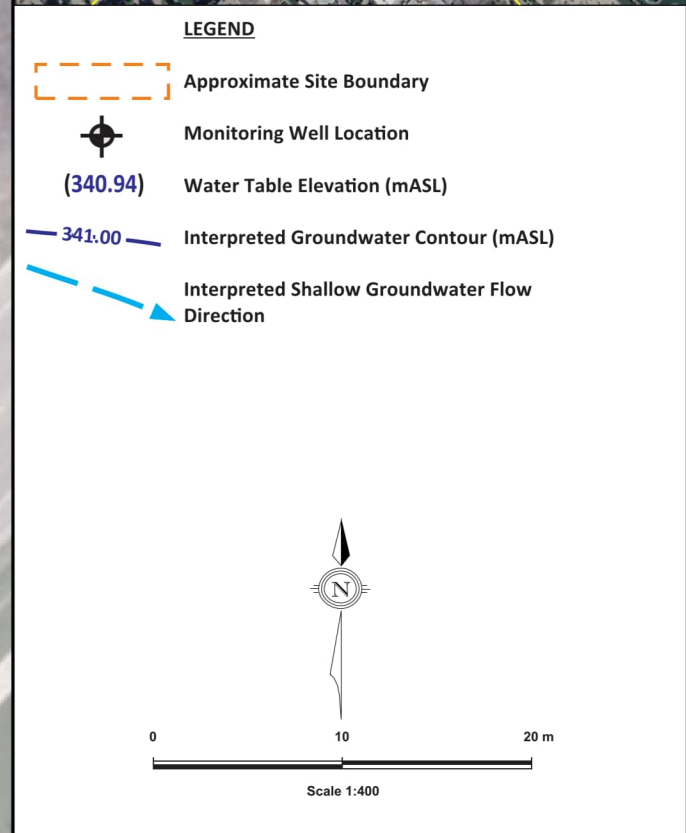
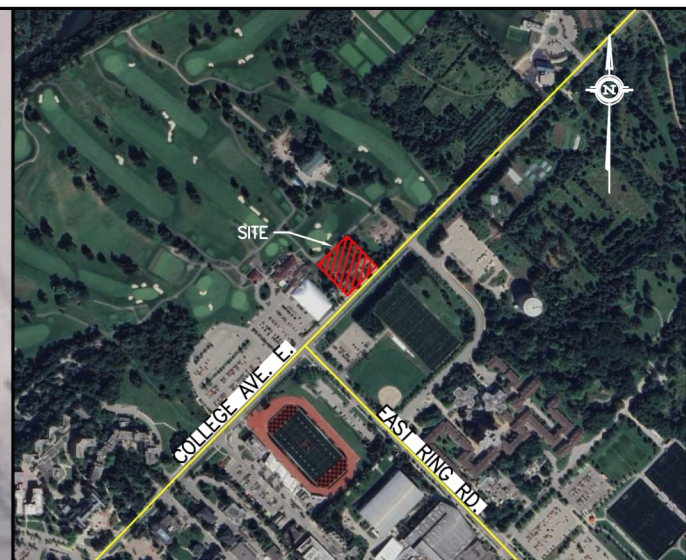


Image Ref.: City of Guelph; GIS Locator; ESRI; Retrieved: December 2025

Figure 3:
Water Table Interpretation (April 17, 2026)

Scoped Hydrogeological Assessment
Proposed Residential Development

210 – 222 College Avenue East Guelph, ON

APPENDIX D

Single Well Response Tests





CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 Victoria Street North
Kitchener / Ontario / N2H 5E1
519-742-8979

Response Test - Water Level Data and Analysis

Page 1 of 3

Project: Proposed Residential Development

Number: 2372

Client: Trolleybus Urban Development

Location: 210 – 222 College Avenue East, Guelph, ON Response Test: BH 1

Test Conducted by: R.S.

Test Date: 2025-05-01

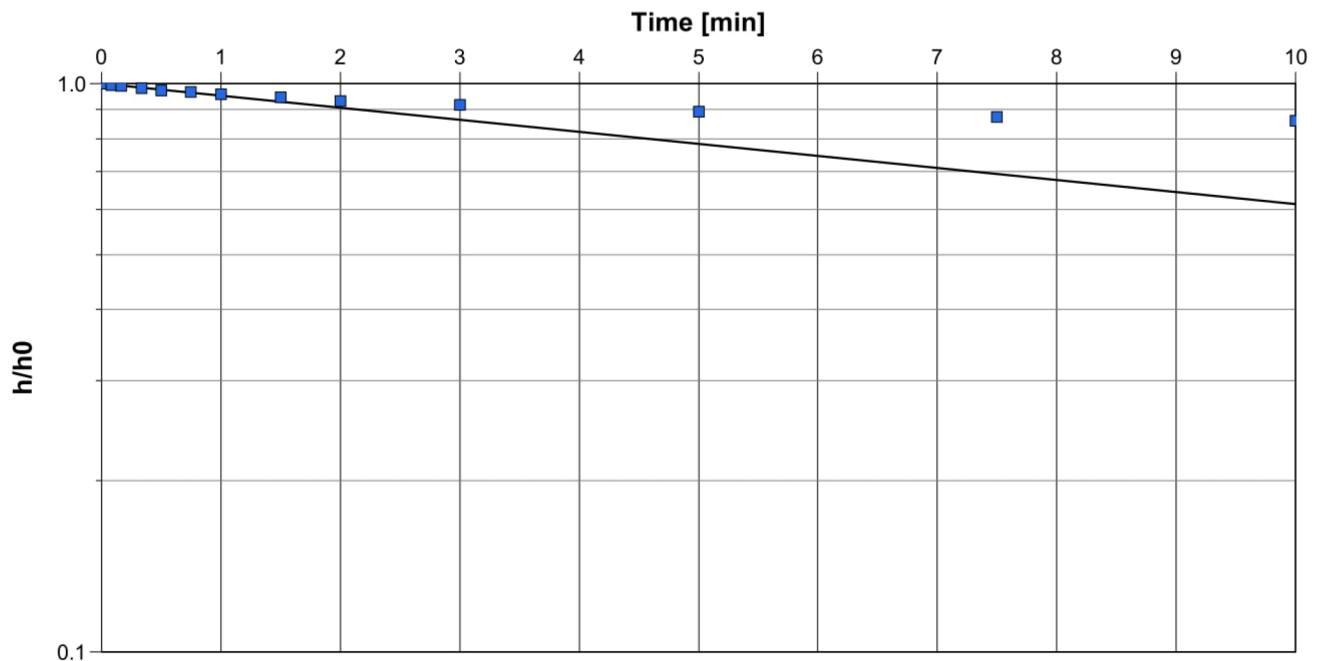
Aquifer Thickness: 12.0 m

Water level at t=0 [m]: 3.03

Static Water Level [m]: 1.95

Water level change at t=0 [m]: 1.08

	Time [min]	Water Level [m]	WL Change [m]
1	0	3.03	1.077
2	0.0833	3.025	1.072
3	0.1667	3.02	1.067
4	0.3333	3.011	1.058
5	0.5	3.00	1.047
6	0.75	2.995	1.042
7	1	2.985	1.032
8	1.5	2.972	1.019
9	2	2.958	1.005
10	3	2.941	0.988
11	5	2.915	0.962
12	7.5	2.895	0.942
13	10	2.881	0.928
14	12.5	2.872	0.919
15	15	2.86	0.907



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]
BH 1	2.45×10^{-7}



CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 Victoria Street North
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519-742-8979

Response Test - Water Level Data and Analysis

Page 2 of 3

Project: Proposed Residential Development

Number: 2372

Client: Trolleybus Urban Development

Location: 210 – 222 College Avenue East, Guelph, ON Response Test: BH 2

Test Conducted by: R.S.

Test Date: 2025-05-01

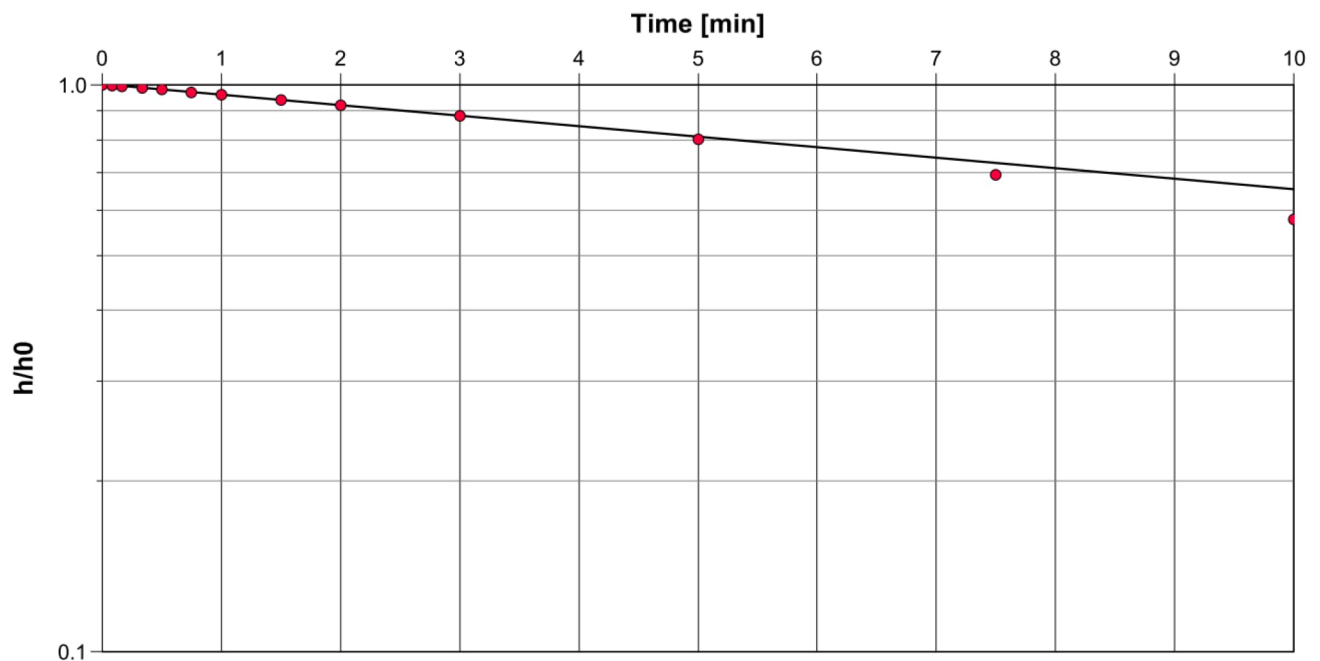
Aquifer Thickness: 12.0 m

Water level at t=0 [m]: 3.03

Static Water Level [m]: 1.55

Water level change at t=0 [m]: 1.49

	Time [min]	Water Level [m]	WL Change [m]
1	0	3.03	1.485
2	0.0833	3.027	1.482
3	0.1667	3.022	1.477
4	0.3333	3.013	1.468
5	0.5	3.003	1.458
6	0.75	2.986	1.441
7	1	2.97	1.425
8	1.5	2.941	1.396
9	2	2.912	1.367
10	3	2.853	1.308
11	5	2.734	1.189
12	7.5	2.575	1.03
13	10	2.405	0.86
14	12.5	2.226	0.681
15	15	2.048	0.503



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]
BH 2	2.11×10^{-7}



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ENGINEERING LTD.

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Kitchener / Ontario / N2H 5E1
519-742-8979

Response Test - Water Level Data and Analysis

Page 3 of 3

Project: Proposed Residential Development

Number: 2372

Client: Trolleybus Urban Development

Location: 210 – 222 College Avenue East, Guelph, ON Response Test: BH 3

Test Conducted by: R.S.

Test Date: 2025-05-01

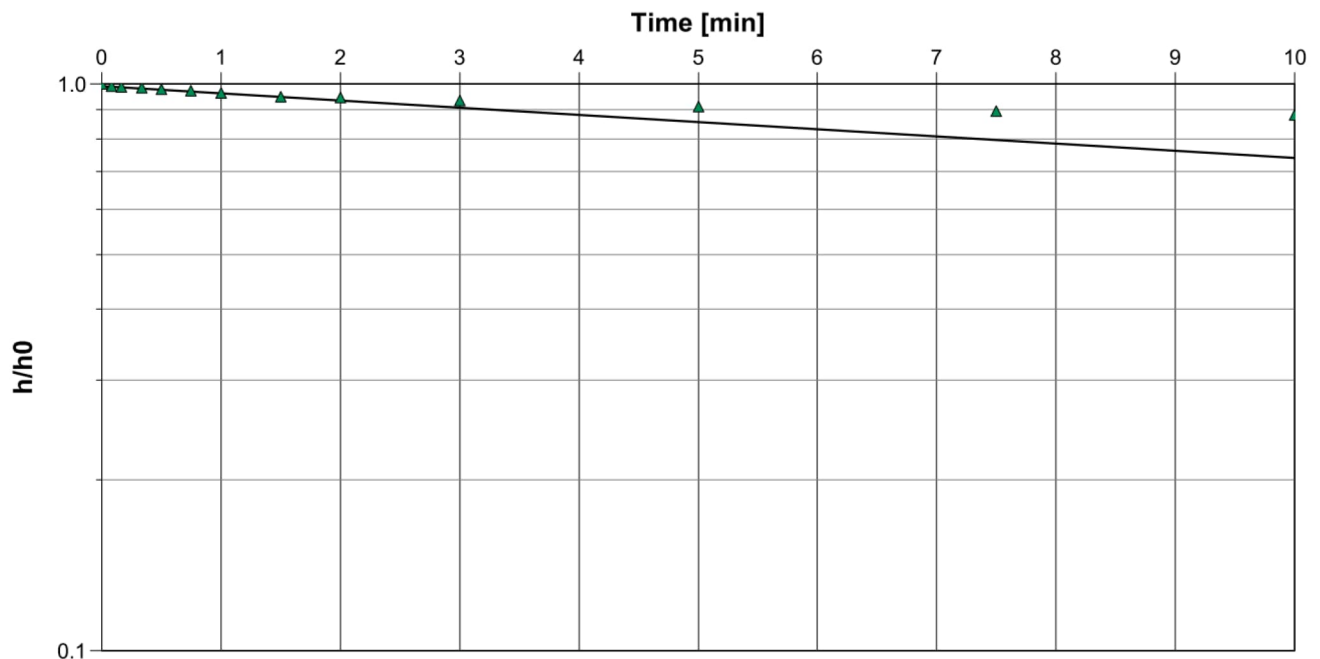
Aquifer Thickness: 12.0 m

Water level at t=0 [m]: 3.48

Static Water Level [m]: 2.55

Water level change at t=0 [m]: 0.93

	Time [min]	Water Level [m]	WL Change [m]
1	0	3.48	0.927
2	0.0833	3.471	0.918
3	0.1667	3.469	0.916
4	0.3333	3.465	0.912
5	0.5	3.459	0.906
6	0.75	3.454	0.901
7	1	3.447	0.894
8	1.5	3.434	0.881
9	2	3.43	0.877
10	3	3.419	0.866
11	5	3.398	0.845
12	7.5	3.382	0.829
13	10	3.37	0.817
14	12.5	3.357	0.804
15	15	3.345	0.792



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]
BH 3	1.55×10^{-7}

APPENDIX E

Enclosures



Soil Abbreviations and Terms Used on Record of Borehole Sheets

TERMINOLOGY DESCRIBING COMMON SOIL TYPES:

Topsoil	- mixture of soil and humus capable of supporting vegetation
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- soil materials identified as being placed anthropologically

CLASSIFICATION (UNIFIED SYSTEM)

Clay	<0.002mm
Silt	0.002 to .075mm
Sand	0.075 to 4.75mm
	Fine 0.075 to 0.425 mm
	Medium 0.425 to 2.0 mm
	Coarse 2.0 to 4.75 mm
Gravel	4.75 to 75mm
	Fine 4.75 to 19 mm
	Coarse 19 to 75 mm
Cobbles	75 to 300mm
Boulders	>300mm

TERMINOLOGY

Soil Composition	% by Weight
"traces"	<10%
"some"(eg. some silt)	10-20%
Adjective (eg. sandy)	20-35%
"and"(eg. sand and gravel)	35-50%

Standard Penetration Resistance (SPT): Standard Penetration Resistance ('N' Values) refers to the number of blows required to advance a standard (ASTM D1586) 51 mm Ø (2 inch) split-spoon sampler by the use of a free falling, 63.5 Kg (140lbs) hammer. The number of blows from the drop weight is recorded for every 15 cm (6 inches). The hammer is dropped from a distance of 0.76m (30 inches) providing 474.5 Joules per blow. When the sampler is driven a total of 45 cm (18 inches) into the soil, the standard penetration index ('N' Value) is the total number of blows for the last 30 cm (12 inches).

Dynamic Cone Penetration Resistance (DCPT): Dynamic Cone Penetration Resistance is similar to a SPT with the 474.5 Joule/blow impulse provided by the free falling hammer where the split-spoon sampler is replaced by a 51 mm Ø, 60° conical point and the number of blows is recorded continuously for every 30 cm (12 inches).

COHESIVE SOILS CONSISTENCY

	(kPa)	(P.S.F.)	Nominal 'N' Value
Very Soft	<12	<250	0-2
Soft	12-25	250-500	2-4
Firm	25-50	500-1000	4-8
Stiff	50-100	1000-2000	8-15
Very Stiff	100-200	2000-4000	15-30
Hard	>200	>4000	>30

RELATIVE DENSITY OF COHESIONLESS SOIL

	'N' Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

MOISTURE CONDITIONS:

Cohesive Soil
DTPL- Drier than plastic limit
APL- About plastic limit
WTPL- Wetter than plastic limit
MWTPL- Much wetter than plastic limit

Cohesionless Soil
Damp
Moist
Wet
Saturated

SAMPLE TYPES AND ADDITIONAL FIELD TESTS

SS	Split Spoon Sample (obtained from SPT)	GS	Grab Sample	PP	Pocket Penetrometer
AS	Auger Sample	BS	Bulk Sample	VANE	Peak & Remolded shear
		TW	Thin Wall Sample or Shelby Tube	DMT	Flat Plate Dilatometer

LABORATORY TESTS

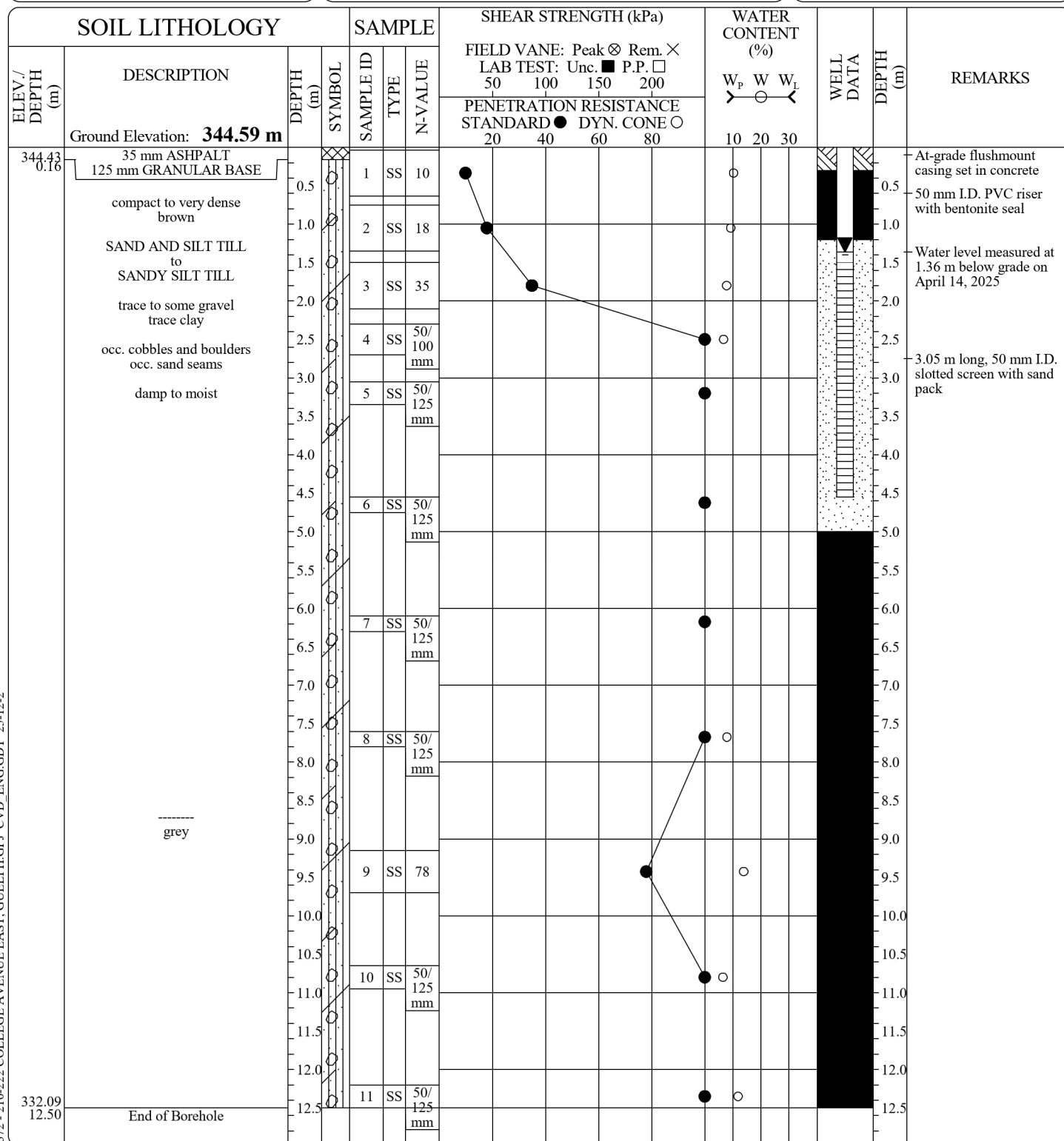
SG	Specific Gravity	S	Sieve Analysis	W	Water Content
H	Hydrometer	P	Field Permeability	K	Lab Permeability
W_p	Plastic Limit	W_L	Liquid Limit	I_p	Plasticity Index
GSA	Grain Size Analysis	C	Consolidation	UNC	Unconfined compression

FILE No: 2372**BOREHOLE No. 1**

Client: **EM Guelph Developments Limited Partnership**
 Project: **Proposed Residential Development**
 Location: **210-222 College Avenue East, Guelph**

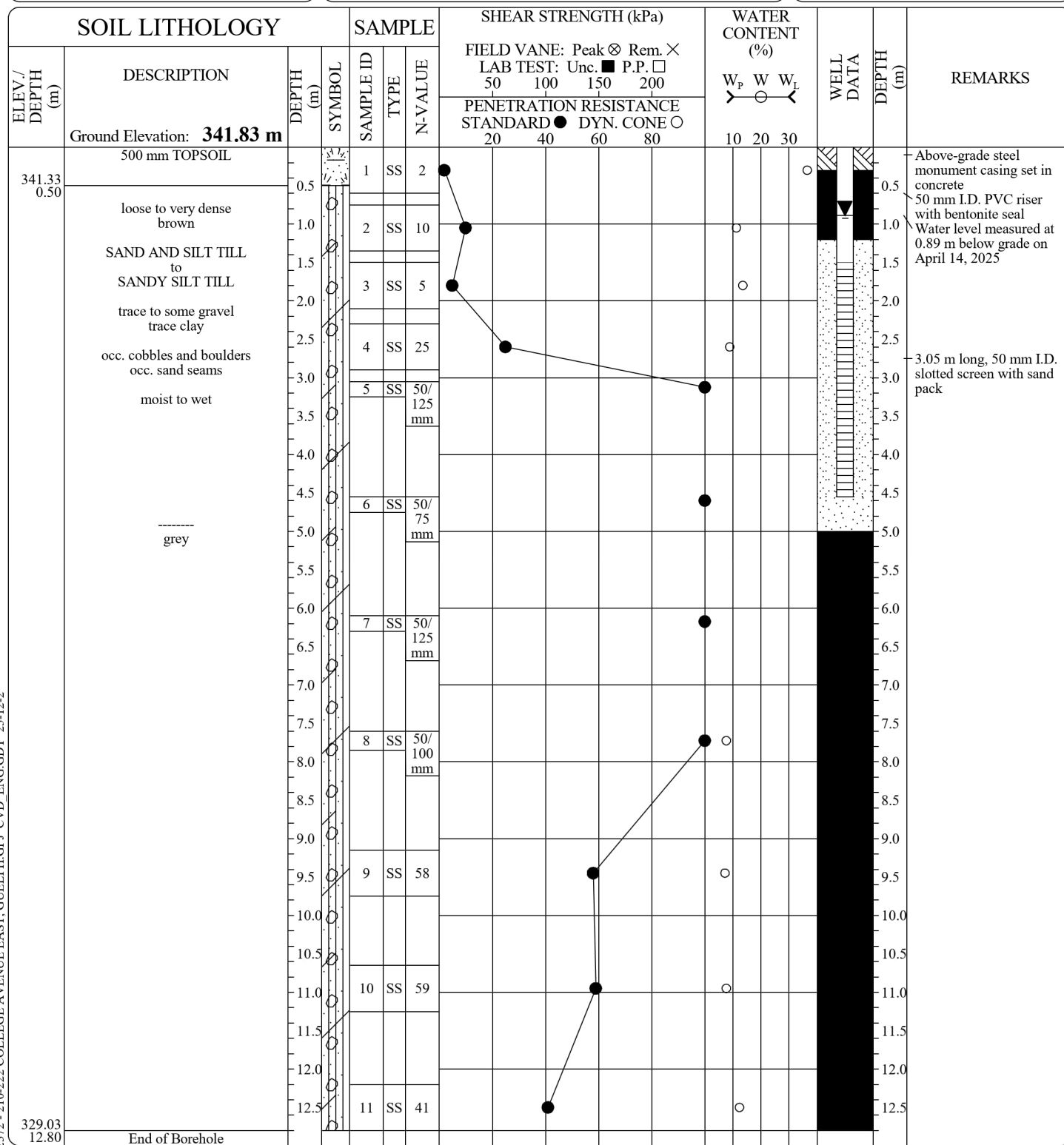
EQUIPMENT DATA

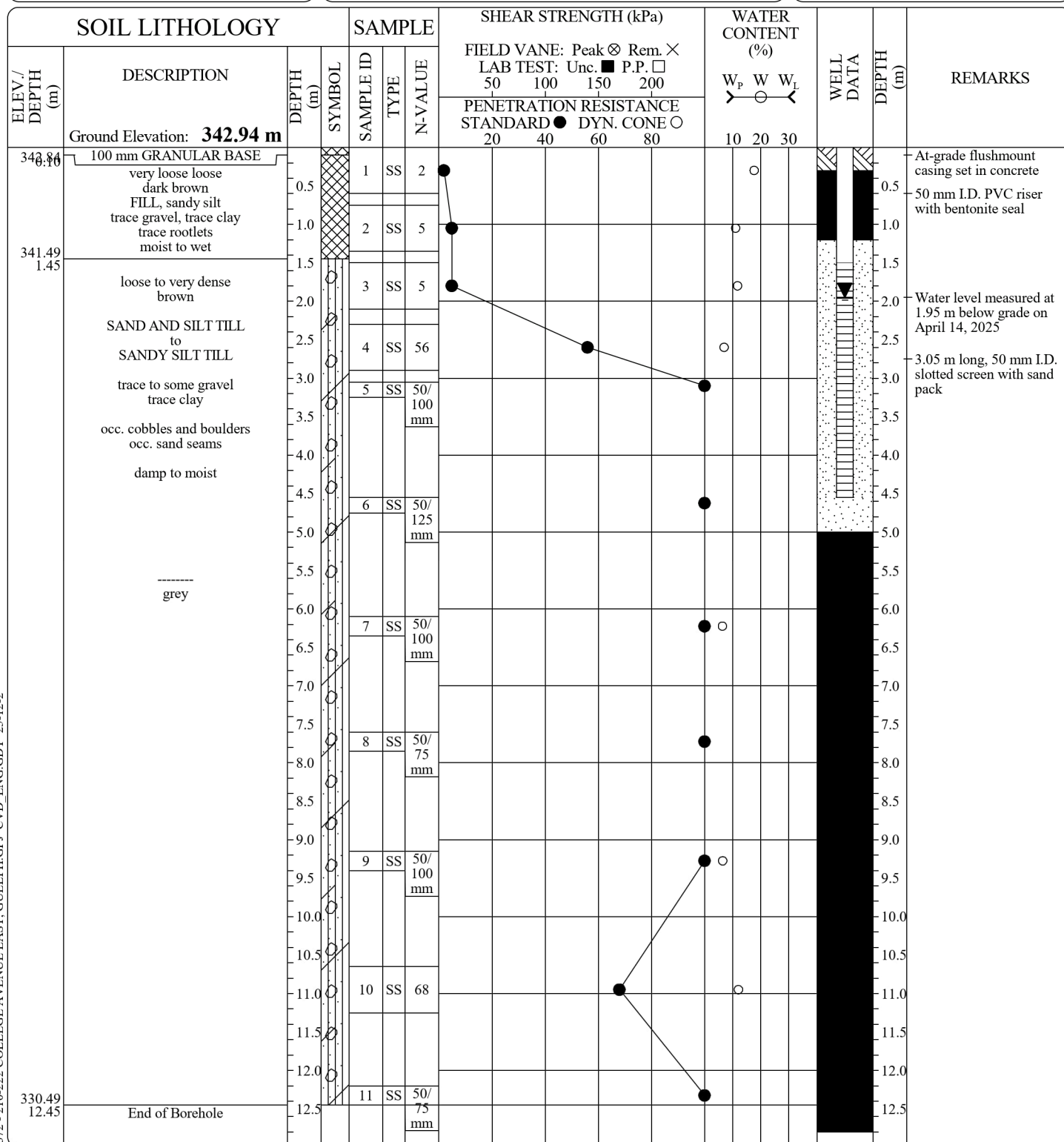
Machine: **CME 55**
 Method: **Hollow Stem Auger**
 Size: **83 mm I.D.**
 Date: **Apr 10 - 25 TO Apr 10 - 25**

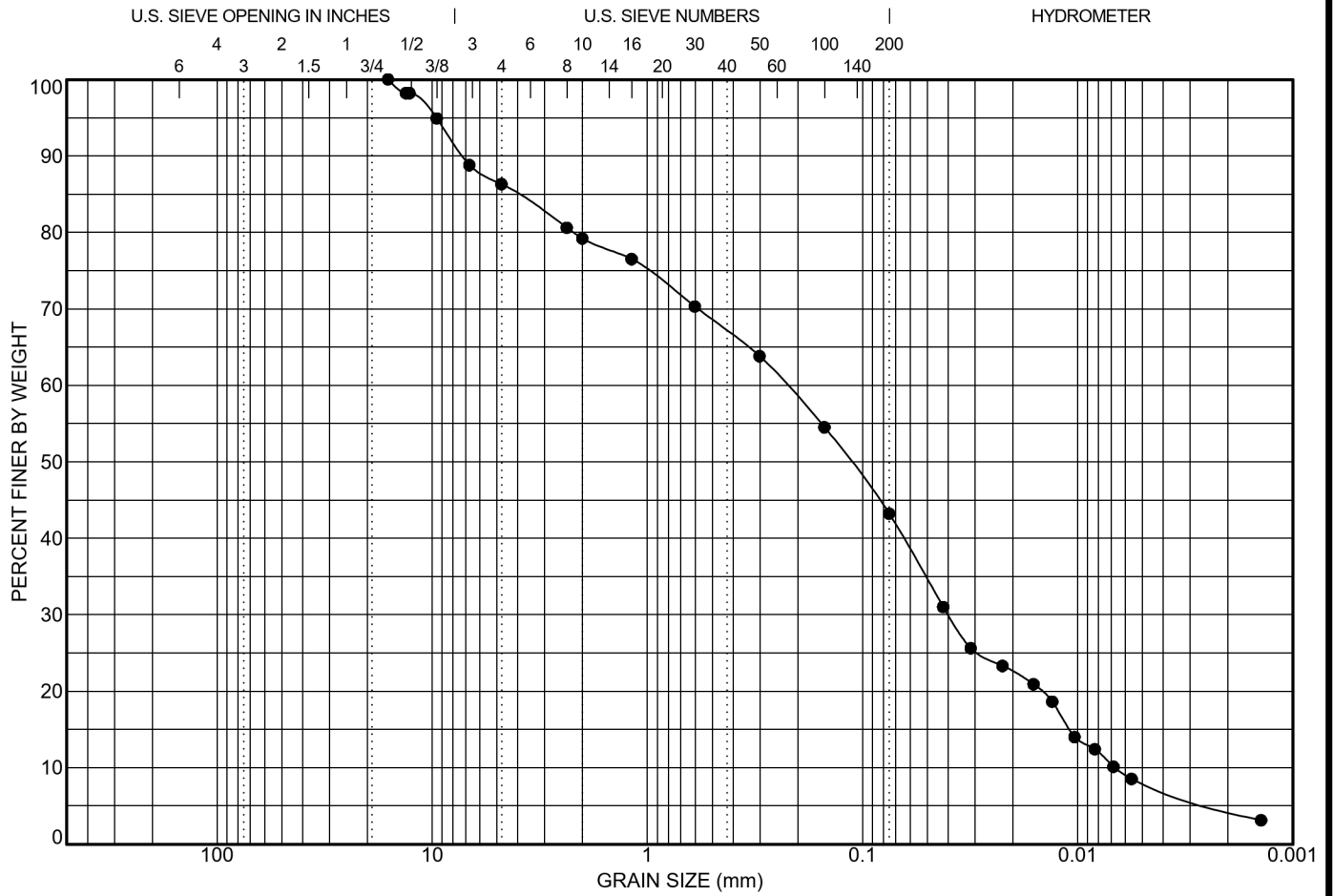
PROJECT MANAGER: **NZ**

**CHUNG & VANDER DOELEN
ENGINEERING LTD.**

311 Victoria Street North
 Kitchener, Ontario N2H 5E1
 ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 2372**BOREHOLE No. 2**Client: **EM Guelph Developments Limited Partnership**Project: **Proposed Residential Development**Location: **210-222 College Avenue East, Guelph****EQUIPMENT DATA**Machine: **CME 55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Apr 09 - 25 TO Apr 10 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 2372**BOREHOLE No. 3**Client: **EM Guelph Developments Limited Partnership**Project: **Proposed Residential Development**Location: **210-222 College Avenue East, Guelph****EQUIPMENT DATA**Machine: **CME 55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Apr 10 - 25 TO Apr 10 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.05	33.64	16	0.226	0.04	0.007	13.7	43.1	43.2	

Date: May. 09 - 2025
Client: EM Guelph Developments Limited Partnership
Contractor:
Source:
Sampled From: BH1 - SA4; 2.3 to 2.9 m depth
Sample No.: 1-4
Date Sampled: Apr. 10 - 2025
Sampled By: JR
Lab No.: 407
Date Tested: May. 07 - 2025
Type of Material: Sand and Silt Till, some gravel, trace clay

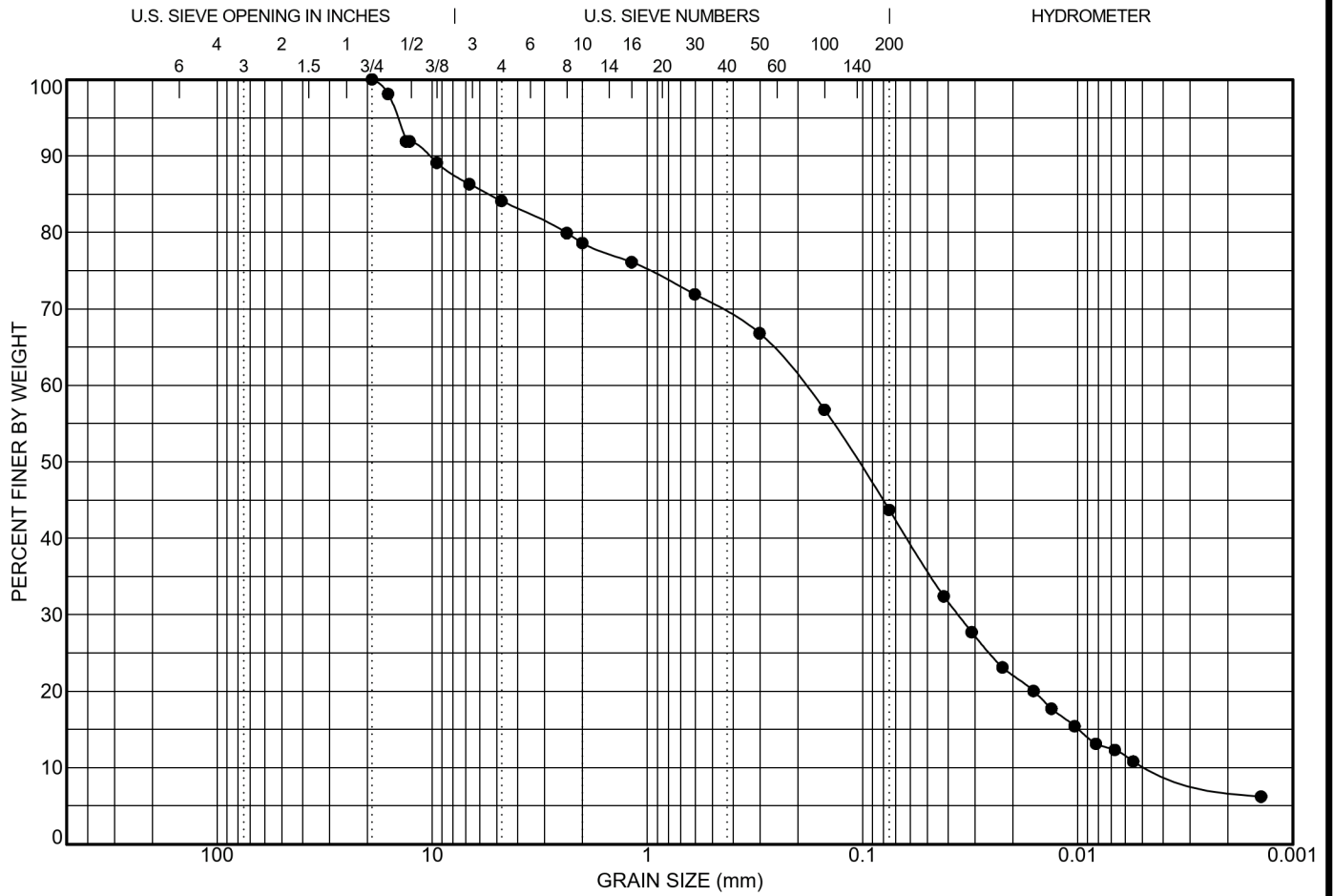
Sieve Size (mm)	Percent Passing	No Specifications



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ENGINEERING LTD.**
 311 Victoria Street North
 Kitchener, Ontario N2H 5E1
 Telephone: 519-742-8979
 Fax: 519-742-7739
 e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development
Location: 210-222 College Avenue East, Guelph
File No.: 2372
Enclosure No.: 4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.59	43.19	19	0.187	0.036	0.004	15.9	40.4	43.7	

Date: May. 09 - 2025
Client: EM Guelph Developments Limited Partnership
Contractor:
Source:
Sampled From: BH2 - SA3; 1.5 to 2.1 m depth
Sample No.: 2-3
Date Sampled: Apr. 10 - 2025
Sampled By: JR
Lab No.: 408
Date Tested: May. 07 - 2025
Type of Material: Sand and Silt Till, some gravel, trace clay

Sieve Size (mm)	Percent Passing	No Specifications



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 Kitchener, Ontario N2H 5E1
 Telephone: 519-742-8979
 Fax: 519-742-7739
 e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development
Location: 210-222 College Avenue East, Guelph
File No.: 2372
Enclosure No.: 5

Appendix B

Preliminary Fire Flow

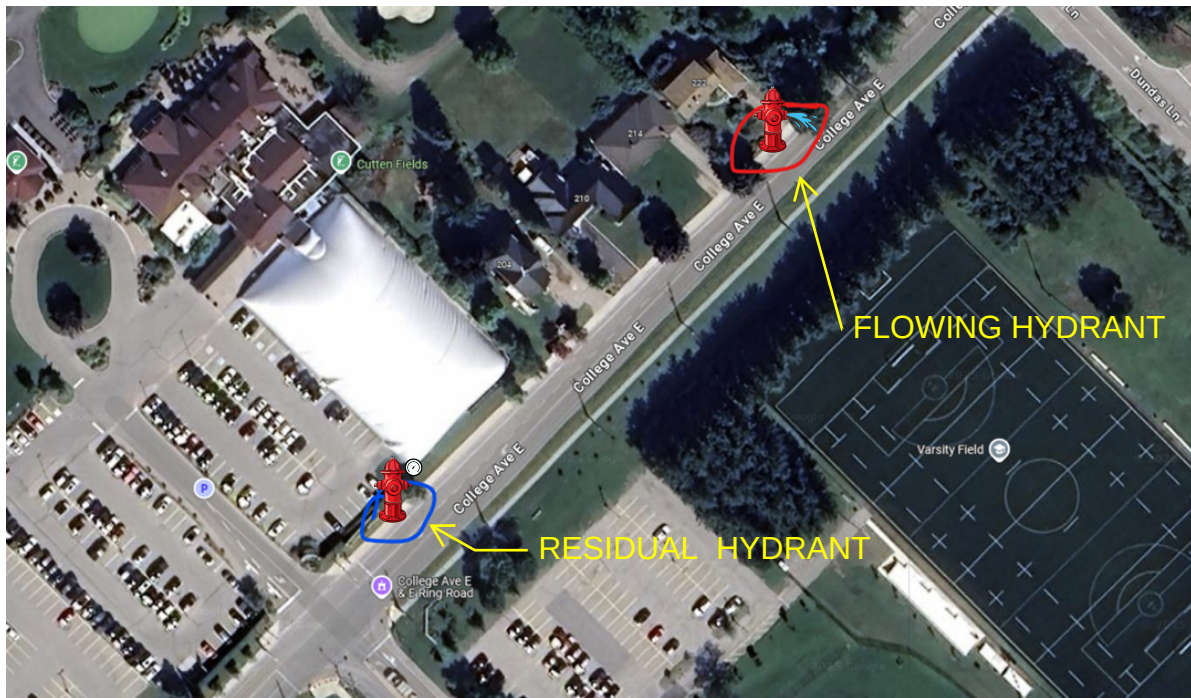


PROJECT INFORMATION

Project Name:	Guelph Flow Test #3	Design Project #:	2025-NSD-030
Site Address:	College Ave E/ Dundas Guelph	Const. Project #:	NA
City Contact:	Josh Baker	Phone #:	519-826-1655
Flow Tester:	Rob Smith	Phone #:	226-376-3053
Technical Contact:	Andy Coghlin	Phone #:	519-476-0761

SITE INFORMATION

SITE MAP



Note: If the main is a dead end, the flowing hydrant shall be closest to the dead end

ITEMS TO LABEL ON MAP	HYDRANTS USED	MAIN SIZE
☒ Static / Residual & Flow Hydrants	☒ City Hydrant(s)	City: 300 pvc
☐ Flow Direction (if the main is dead end)	☐ Site Hydrant(s)	Site:

SITE NOTES



TEST INFORMATION							
Minimum Required Flow:		NA			Min Ports:		2
Personnel Present:		Robert Smith			Test Date:		2025-04-03
City / External Company:		Guelph Utilities			Test Time:		10:00am
TEST EQUIPMENT							
☐ Hose Monsters with built in Pitot				Hose length used:			
☐ Hand held pitot gauge				☒ Pollard diffuser elbow with built in Pitot			
☐ Other:							
TEST RESULTS							
Number of Ports	Outlet Size (IN)	Discharge Coefficient	Pitot Reading (PSI)			Total Flow (GPM)	Static / Residual Pressure (PSI)
0 Ports							46
1 Port	2.5	0.9	43			1,101	44
2 Ports	2.5	0.9	25	28		1,727	43
3 Ports	2.5	0.9				0	
4 Ports	2.5	0.9				0	
0 Ports	STATIC RE-CHECK						46
TEST NOTES							
HYDRAULIC ADJUSTMENTS (FOR OFFICE USE ONLY)							
ADJUSTMENTS FOR HYDRAULIC GRADE LINE (HGL)							
Reservoir HGL (m):				Site Elevation (m):			
Theoretical Static Head (PSI):		0		PSI to subtract from test pressures:		0	
OTHER HYDRAULIC ADJUSTMENTS							
Other adjustment as required by the City / AHJ:							



210-222 College Ave

FIRE FLOW ANALYSIS

Guelph, Ontario

Project Number: 61748_001

Date: April 30, 2025

Design By: MLW

File: Q:\61748_001\61748_001_Fire Flow Demand.xlsx

CALCULATION OF RESIDUAL PRESSURE AT OFF-SITE HYDRANT - MAX FIRE FLOW

1. Boundary Conditions (Based on Fire Flow Test Results):			
	Metric	Imperial	
P0 - Starting Pressure	32.35 m	46 psi	
P1 - Pressure at Q1	30.94 m	44 psi	
Q1 - From Fire Flow Test	4168 L/min	1101 U.S. gal/min	
Q2 - Required Flow	16500 L/min	4359 U.S. gal/min	From: Water Demand calculations by MTE
P-loss 1	1.41 m	2 psi	
P-loss 2	17.98 m	26 psi	
P2 - Residual Pressure	14.37 m	20 psi	Extrapolated from Fire Flow Test Results

ANALYSIS SUMMARY

Total Losses	0.000 m		
	0.00 kPa	0.0 psi	
Residual Pressure after Losses	14.37 m		
	141 kPa	20.4 psi	PASS
Allowable Residual Pressure	140 kPa	20.3 psi	

Appendix C

Sanitary Sewer Design Sheet

210-222 College CITY OF GUELPH				SANITARY SEWER DESIGN SHEET - PER BED ENGINEERING SERVICES							Design Parameters							
Project Number: 61748_001 Date: January 8, 2026 Design By: MLW Checked By: XXX File: Q:\61748_001\College - Sanitary Sewer Design Sheet Guelph.xls											<u>Average Daily Flow</u> Residential 300.00 L/person/day Manning's "n" 0.013 0.00347 L/person/s Beds 529.00 bed Harmon Peaking Factor F = 1 + 14/(4 + P0.5) Infiltration 0.25 L/s/ha							
LOCATION				SANITARY FLOW							DESIGN							
STREET	AREA	MANHOLE LOCATION		UNITS	CONTRIBUTING UNIT TYPE	POPUL.	PEAK FACTOR	PEAK FLOW	INFIL FLOW	TOTAL FLOW	PIPE SIZE	PIPE TYPE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	% PIPE FULL	
		FROM MH	TO MH															
	ha					1000s		L/s	L/s	L/s	mm		m	%	L/s	m/s	%	
210-222 College	0.36			153.00	APARTMENT	0.529	3.961506	7.2765	0.0900	7.3665	200	PVC	9.1	0.50	23.1802	0.7382	31.8%	

*unit and bed count were provided by 5468796 Architecture

Appendix D

Wastewater Modelling Analysis

April 22, 2025

Jeff Lerch
MTE Consultants Inc
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

RE: 210 – 222 College Avenue East – Wastewater Modelling Capacity Check

Dear Mr. Lerch,

City staff have conducted a wastewater capacity check based on the proposed development at the above-titled site. Please find the results summarized within the attached report.

If you have any questions, please don't hesitate to contact me.

Sincerely,

Jamie Menchenton Engineering Technologist III

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1.0 Introduction and Background

The proposed development is located at 210 - 222 College Avenue East, on the North side of College Avenue East between East Ring Road and Dundas Lane. The following information has been provided as part of a preliminary proposal and has been shared with the City:

- To permit the development of a 154-unit residence apartment.

2.0 Wastewater Servicing Analysis

2.1 Wastewater Flow Generation

Wastewater from the 0.38 ha proposed development will flow to a proposed sewer on College Avenue East. As per section 5.6 of the City's current Development Engineering Manual, capacity modelling has been carried out using an anticipated peak flow of 4.07 L/s to ensure that the downstream sanitary servicing can accommodate the increased sewage flow from the proposed development. This additional flow consideration was added as a constant flow to the receiving pipe to be conservative and ensure that it coincides with existing peak flows.

2.2 Wastewater Capacity Analysis

The model represents the City's wastewater network and is based on the City's GIS data and is calibrated to available flow data. The model was used to assess the existing and projected capacity within the system for wet weather conditions using a 25-year 3-hour storm event.

The analysis considers the immediate capacity at the local neighborhood level, as well as a look downstream to account for the overall system's capacity (i.e., at the trunk sewer level and to the wastewater treatment plant [WWTP]). Wet weather flow (WWF) conditions were considered. The model developed for the City-wide Water and Wastewater Servicing Master Plan (2023) was used for this purpose, and the impact of increased flow from the development site was assessed. Figures supporting this analysis are provided throughout this report.

The receiving sewer on College Avenue East travels north through the existing golf course, and flows continue to Wellington Street West before continuing to the sanitary treatment plant. Figures 1 and 2 below show the entire flow path to the sanitary treatment plant.

2.3 Existing Wastewater Conditions

Existing modelling was carried out from MH7319 which demonstrates the closest existing sewer maintenance to the proposed development to the sanitary treatment plant. The flow route can be seen in Figure 1 while the profile view is demonstrated in Figure 2.

Figure 1 – Flow Route from Proposed Development to Treatment Plant

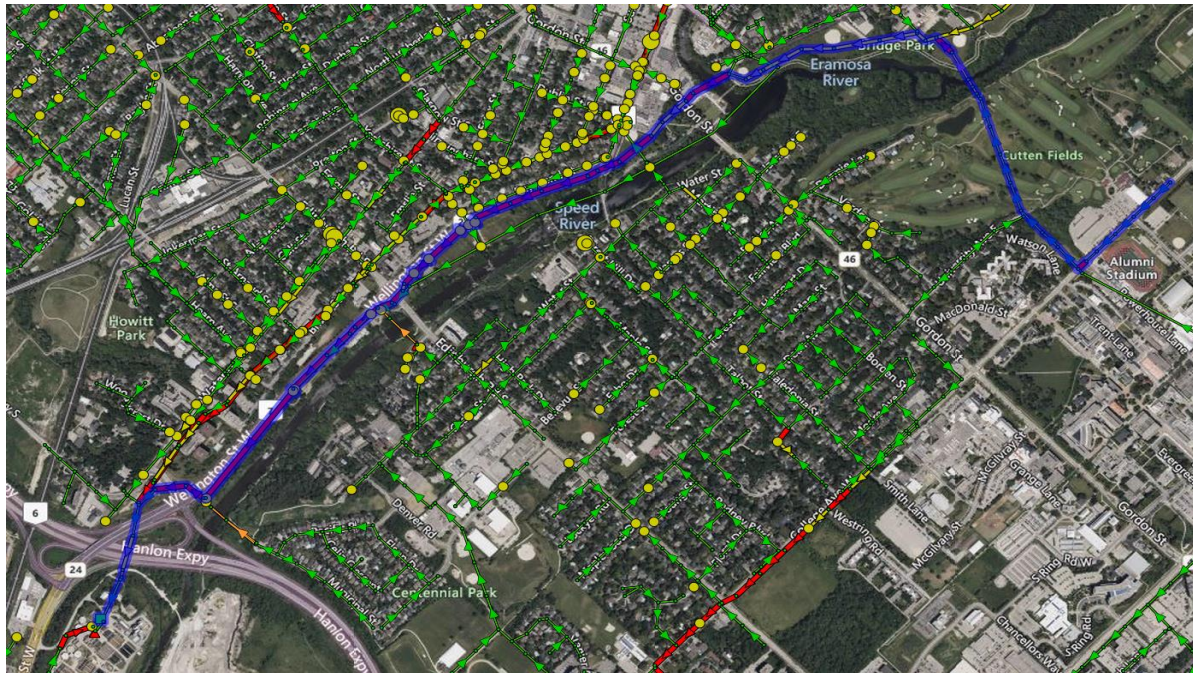
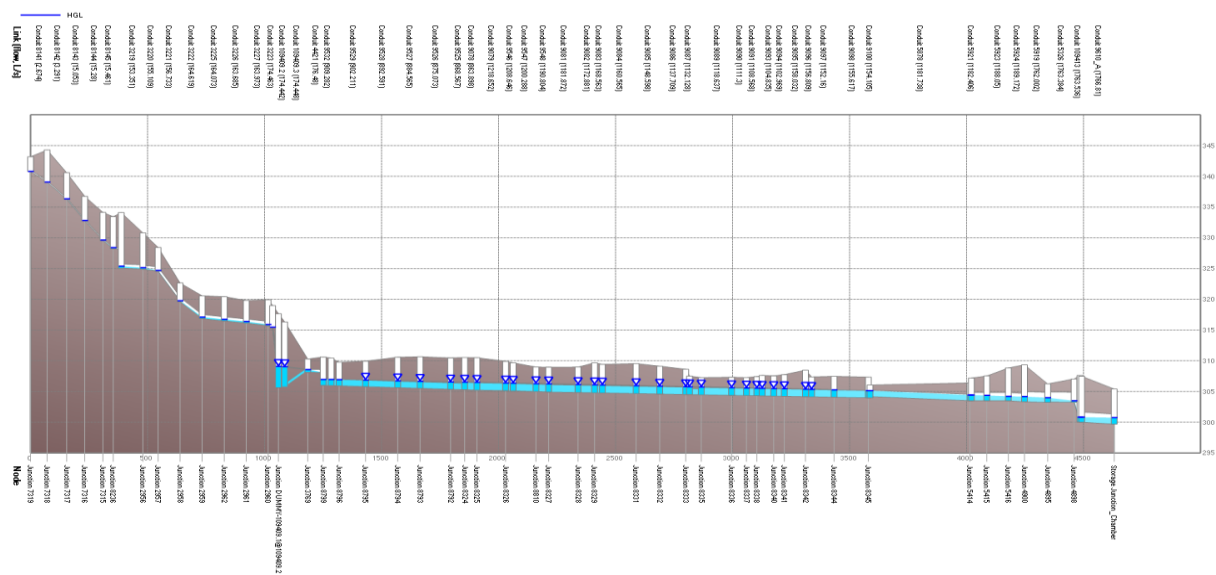


Figure 2 – Profile of Sanitary Peak Flows Under Existing Conditions



2.4 Proposed Wastewater Conditions

Proposed modelling was carried out along the flow route noted above. An additional flow of 4.07 L/s was added at the pipe length fronting the development. Figures 3 - 12 provided below demonstrate that there is surcharging within the receiving sewers from the sanitary sewer through the proposed flow path.

Figure 3 – Profile of Sanitary Peak Flows Under Proposed Conditions

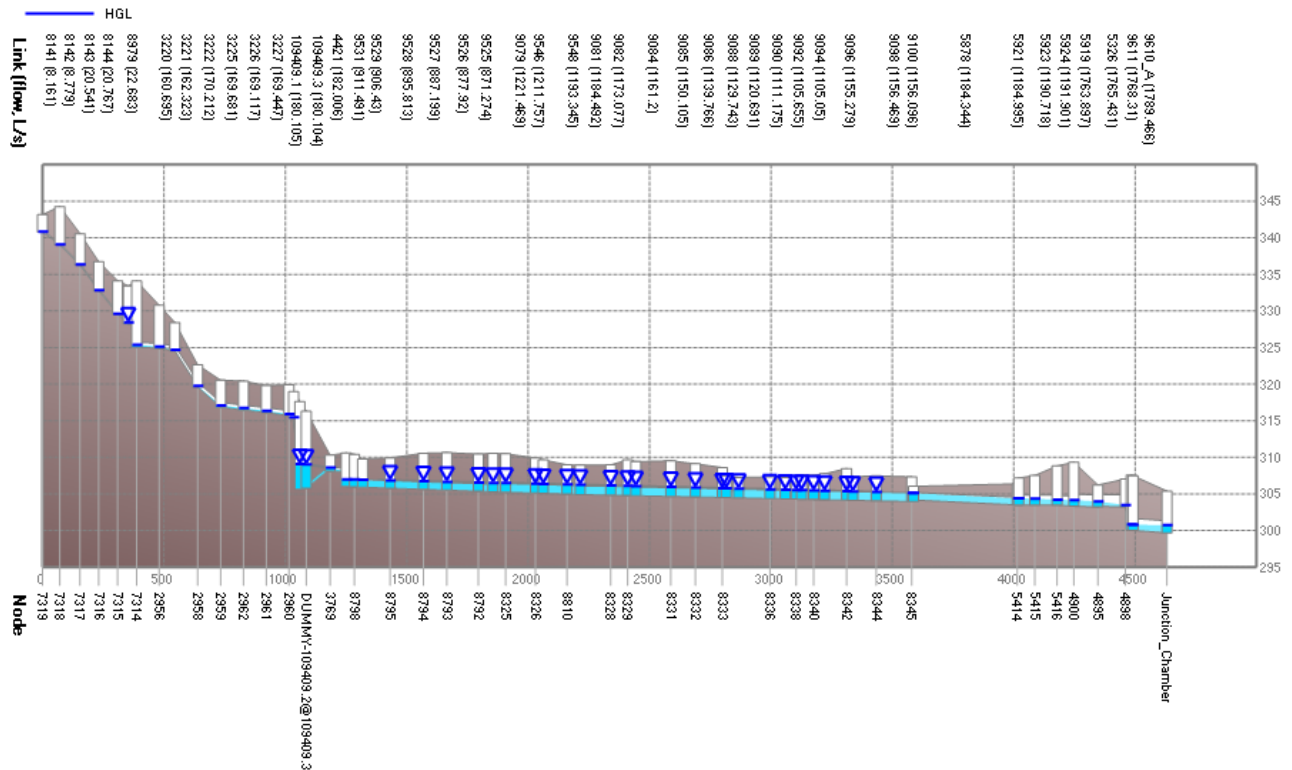


Figure 4 – Profile View of Surcharged Area 1

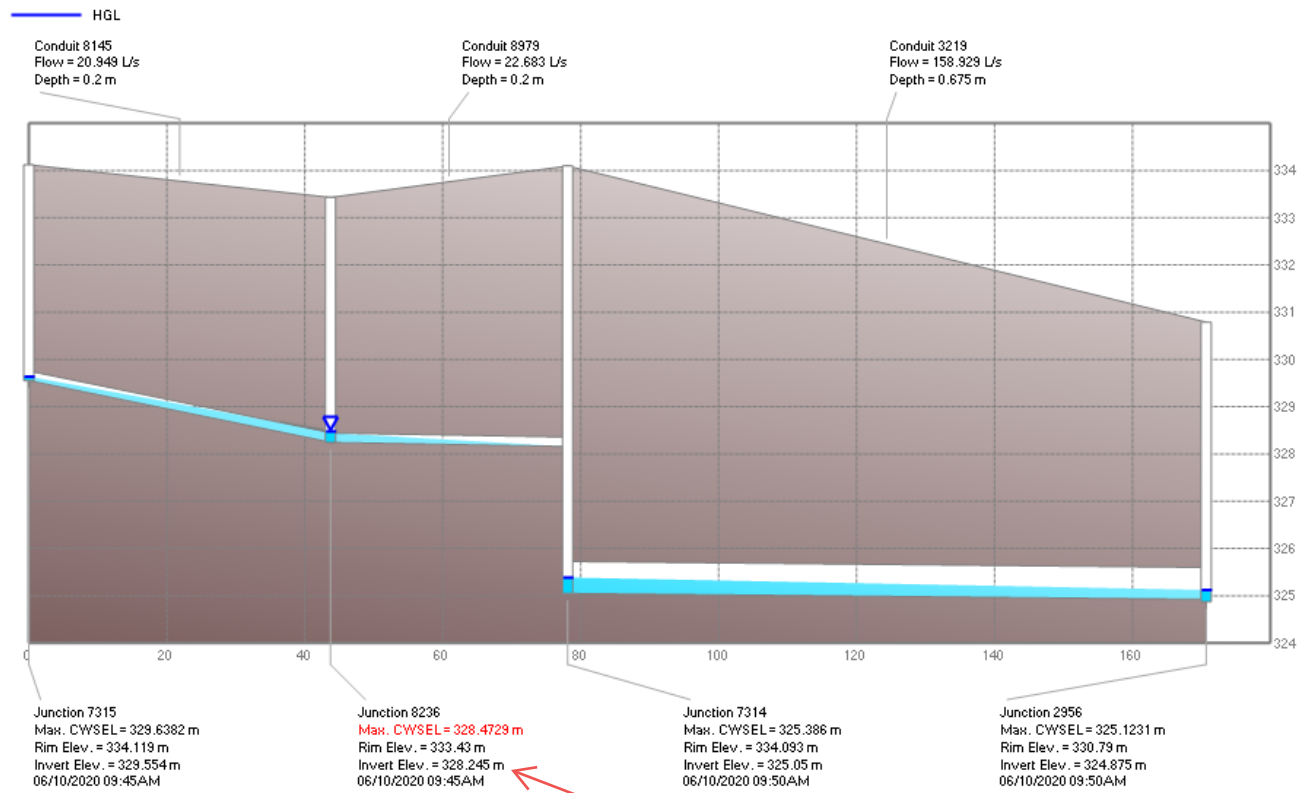


Figure 5 – Aerial View of Surcharged Area 1

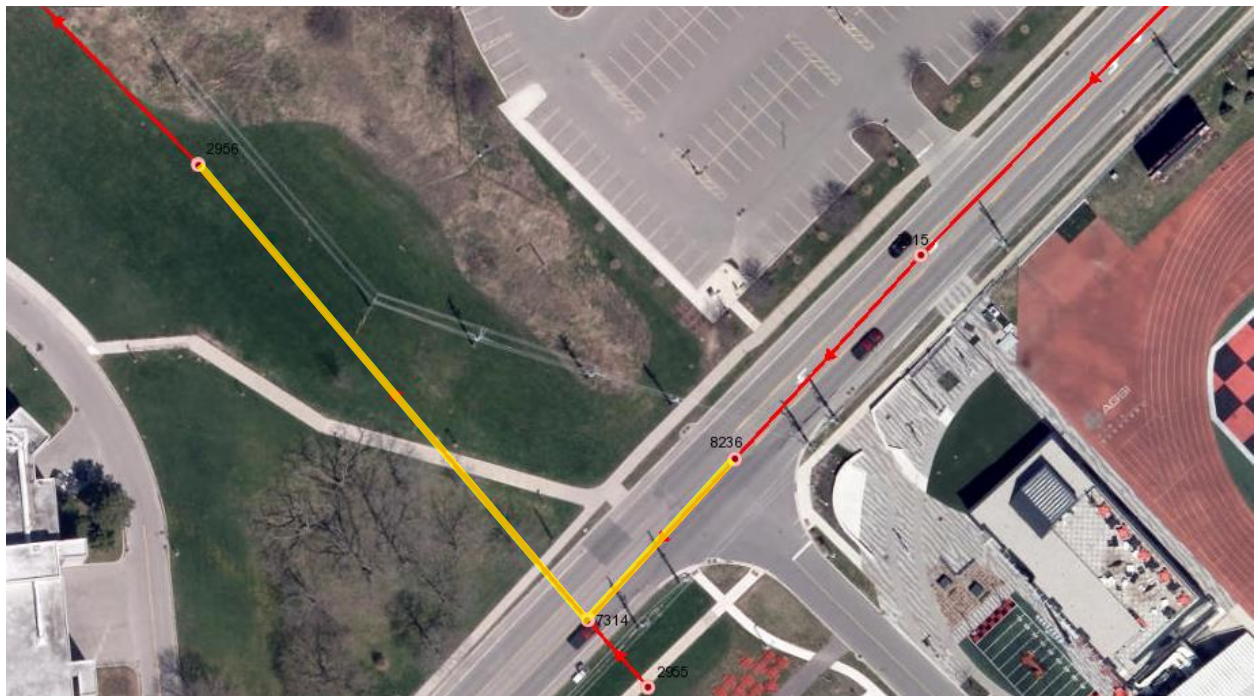


Figure 6 – Profile View of Surcharged Area 2, Part 1

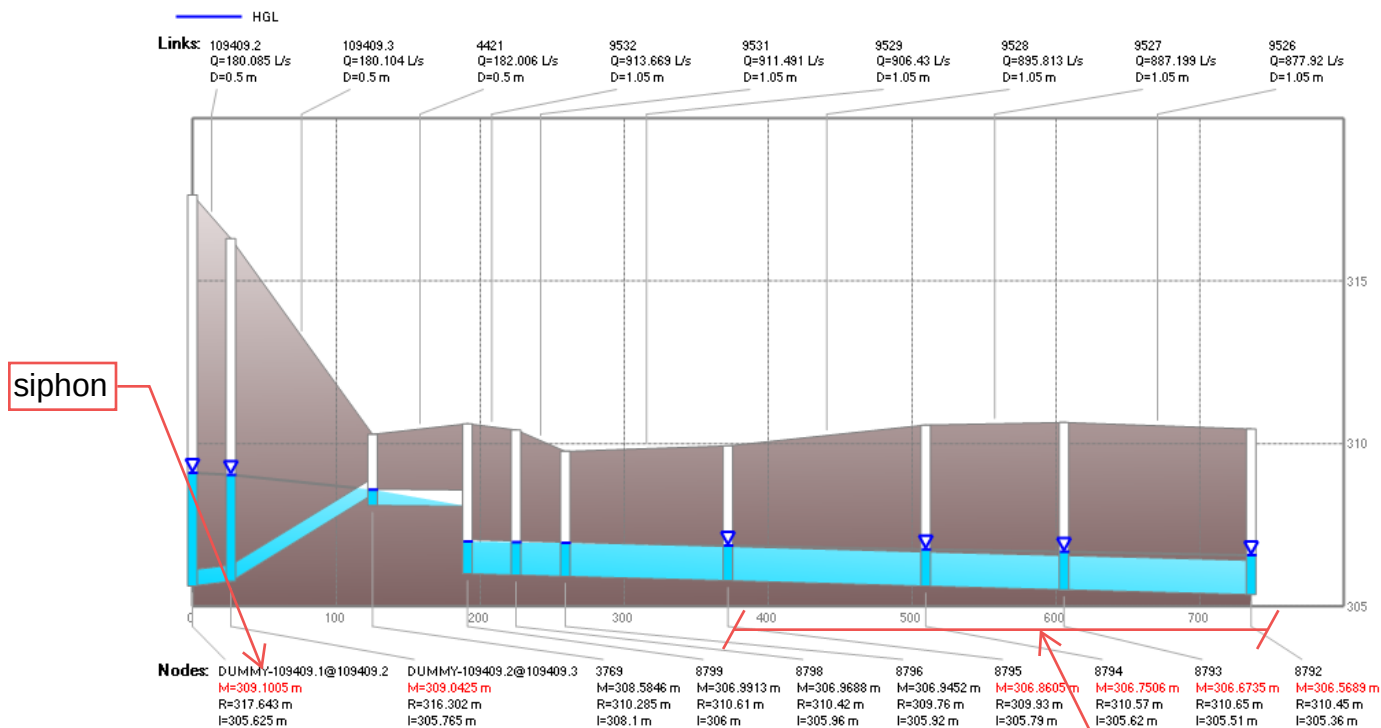


Figure 7 – Profile View of Surcharged Area 2, Part 2

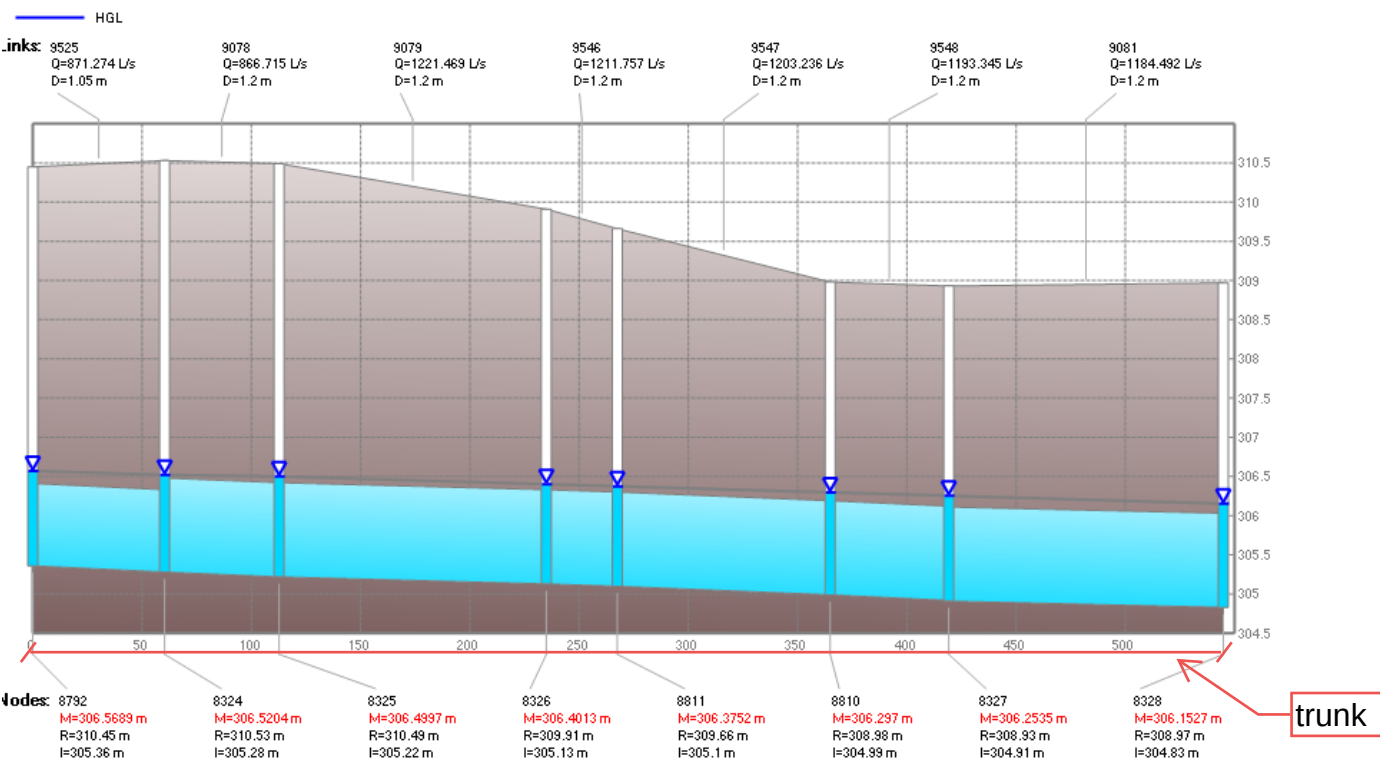


Figure 8 – Profile View of Surcharged Area 2, Part 3

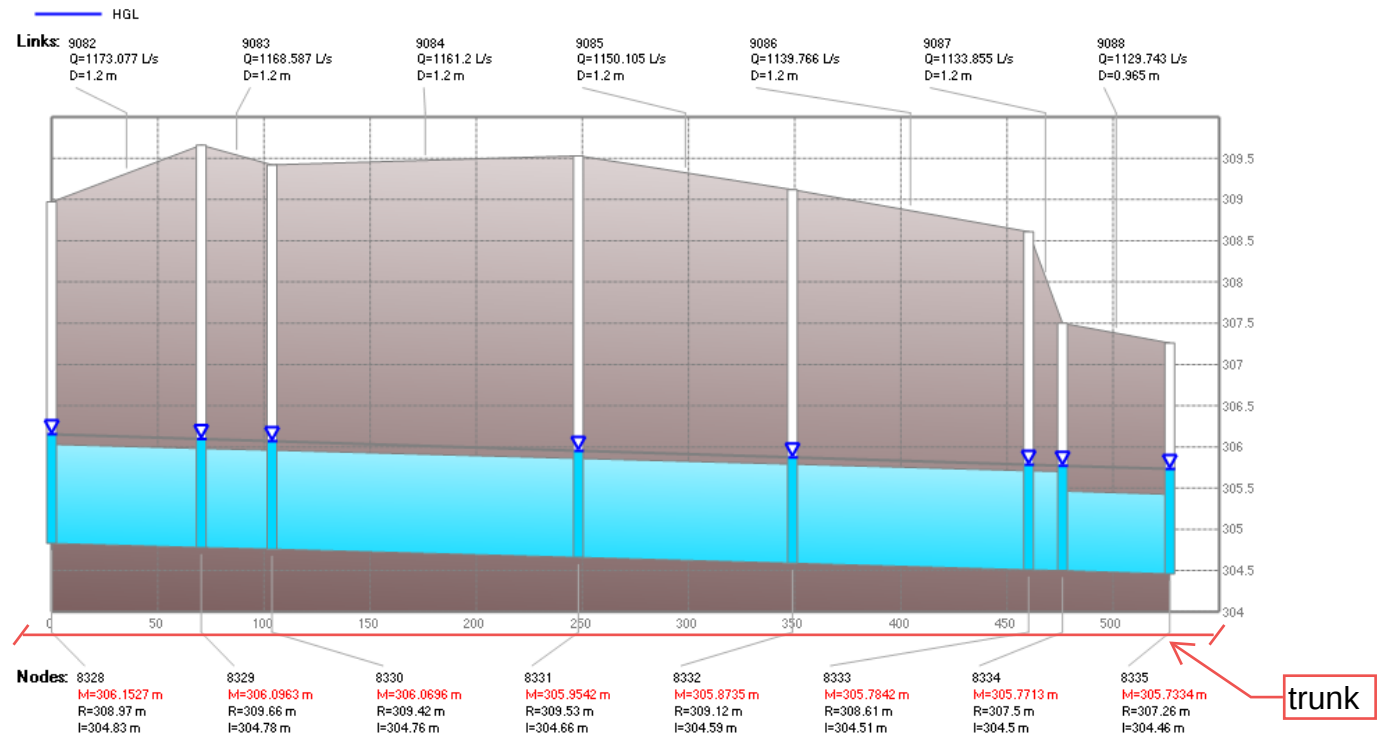


Figure 9 – Profile View of Surcharged Area 2, Part 4

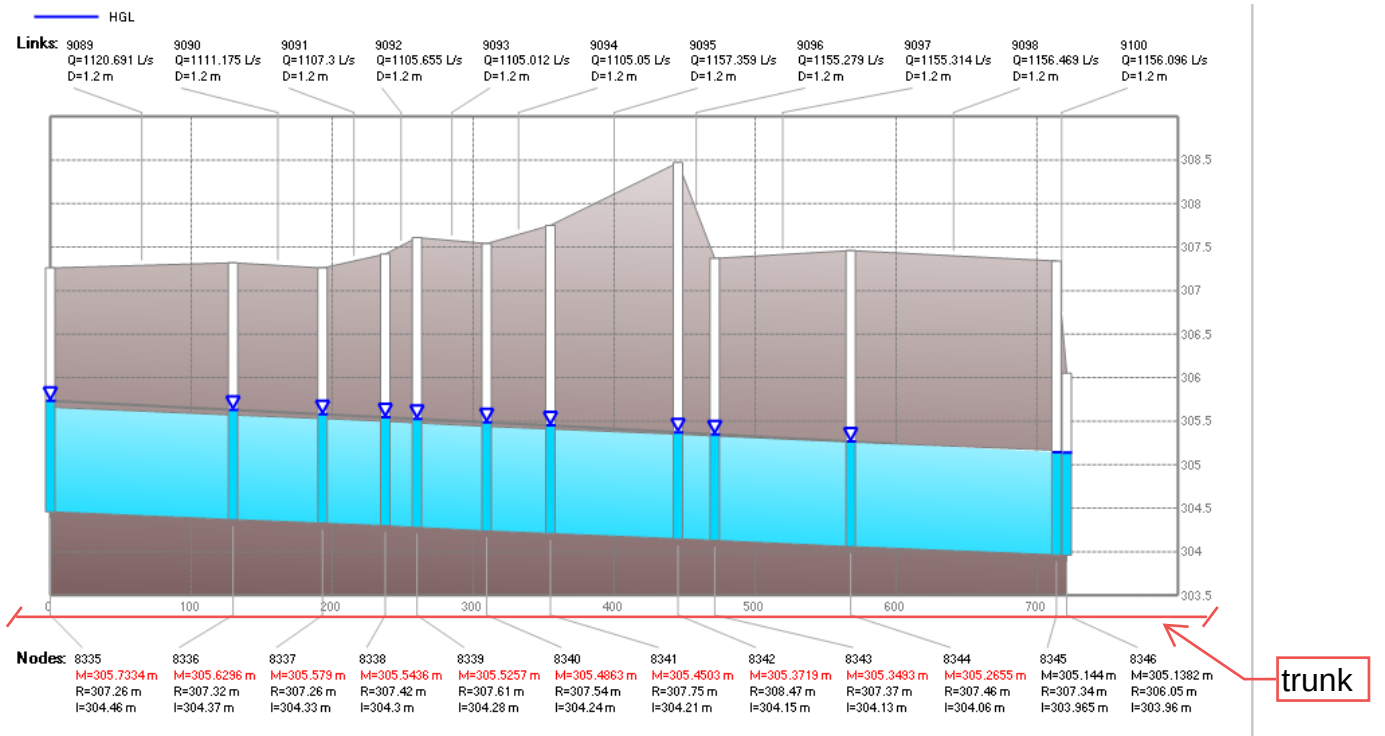


Figure 10 – Aerial View of Surcharged Area 2, Part 1



Figure 11 – Aerial View of Surcharged Area 2, Part 2



Figure 12 – Aerial View of Surcharged Area 2, Part 3



As seen in the preceding figures, surcharging is occurring at two locations. To satisfy the requirement for capacity, the conditions outlined in the framework provided in the Sanitary Capacity Assessment Framework (included as Appendix A) must be met. Demonstrating that the conditions provided in the framework have been adequately met is the responsibility of the applicant.

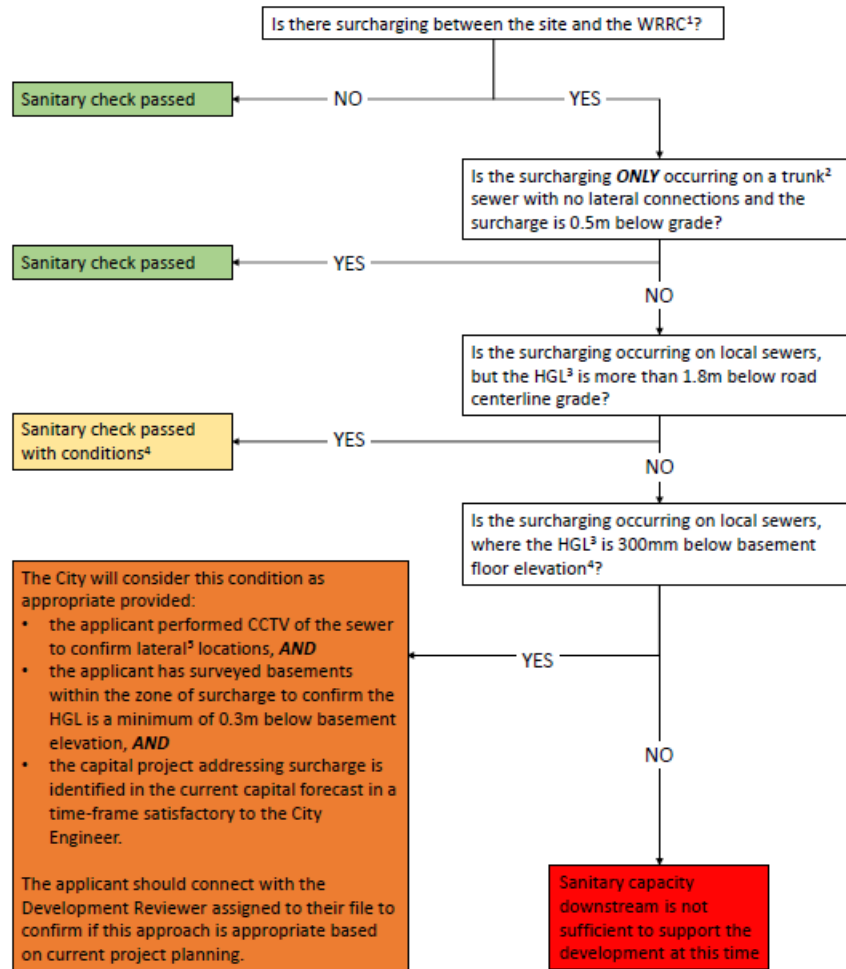
3.0 Conclusion and Recommendations

The analysis has been completed and as noted above, there is a surcharged area that does not immediately satisfy the framework provided in the Sanitary Capacity Assessment Framework. Should you wish to proceed with the development, demonstrating that adequate capacity is available will be required and you must demonstrate that the conditions in the framework have been adequately met.

4.0 Appendices

Appendix A

Sanitary Capacity Assessment Framework



Footnotes:

1 Water Resource Recovery Centre

2 Trunk sewers, for the purposes of this process, shall be defined as sewers 450mm in diameter or greater and with no lateral connections directly to properties

3 Hydraulic Grade Line in the 25YR Wet Weather Event, using the City's hydraulic model

4 Basement level is assumed to be 1.8m below grade, as measured from the centreline of the road. Applicant must demonstrate that there are no buildings/properties within surcharged segment that have reverse slope driveways or have a property grade lower than the road grade.

5 Applicant must perform individual survey of each lateral connection and demonstrate they are below HGL at basement connection with 300mm of freeboard

Notes:

*all questions refer to the existing pipe network, wet weather flow scenario with the proposed development flow in the City's hydraulic model

** surcharging means, for the purposes of this framework, when the HGL is above the invert of the pipe

Appendix E

Storm Sewer Design Sheets

210-222 College Avenue East				STORM SEWER DESIGN SHEET				Design Parameters									
CITY OF GUELPH								ENGINEERING AND PUBLIC WORKS								5 YEAR STORM	
Project Number: 61748_001 Date: December 19, 2025 Design By: MLW Checked By: XXX File: Q:\61748_001\61748_001_STM_2025-12-18.xlsx				Drainage Area Plan No: n/a				Q=kAIC, k=0.00278 Intensity (I) = a/(tc+b) ^c a = 1593 b = 11 c = 0.8789 Manning's "n" 0.013 Min. Velocity 0.800 m/s Max. Velocity 6.000 m/s									
LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION		AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION		RAIN INTENSITY (I)	FLOW (Q) ¹	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL	
		FROM MH	TO MH					TOTAL	IN PIPE							FLOW VELOCITY	PIPE FULL
				ha		ha	ha	min	min	mm/hr	L/s	mm	m	%	L/s	m/s	%
		MH2	CBMH3	0.191							22.00000	300	1.5	0.50	68.37776	0.9673	32.17

1) Allowable release rate to College Avenue based on pre-development modelling in MIDUSS

Appendix F

Calculations

CALCULATIONS

Orifice Equation (MIDUSS NET)

$$Q = C_c \pi/4 D^5 \sqrt{2g(H-2/3D)}$$

where

- C_c coefficient of contraction
- H head relative to the invert of the orifice
- D orifice diameter
- g gravitational acceleration

Appendix G

MIDUSS Output

Pre-Development

```

"      MIDUSS Output ----->"
"      MIDUSS version          Version 2.25 rev. 473"
"      MIDUSS created          Sunday, February 7, 2010"
"      10 Units used:          ie METRIC"
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"      Output filename:         61748_001_Pre-2yr_v1.out"
"      Licensee name:          A"
"      Company                  "
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"      5.000 Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"      1 Chicago storm"
"      475.610 Coefficient A"
"      0.000 Constant B"
"      0.738 Exponent C"
"      0.400 Fraction R"
"      180.000 Duration"
"      1.000 Time step multiplier"
"      Maximum intensity        145.014 mm/hr"
"      Total depth              30.902 mm"
"      6 002hyd Hydrograph extension used in this file"
" 33      CATCHMENT 101"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      101 Draining to the Golf Course"
"      18.600 % Impervious"
"      0.250 Total Area"
"      35.000 Flow length"
"      4.900 Overland Slope"
"      0.204 Pervious Area"
"      35.000 Pervious length"
"      4.900 Pervious slope"
"      0.047 Impervious Area"
"      35.000 Impervious length"
"      4.900 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.221 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.027 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.013 0.000 0.000 0.000 c.m/sec"
"      Catchment 101 Pervious Impervious Total Area "

```

```

"      Surface Area            0.204 0.047 0.250 hectare"
"      Time of concentration    16.924 1.665 9.896 minutes"
"      Time to Centroid         126.397 91.177 110.174 minutes"
"      Rainfall depth           30.902 30.902 30.902 mm"
"      Rainfall volume          62.88 14.37 77.25 c.m"
"      Rainfall losses          24.064 5.349 20.583 mm"
"      Runoff depth             6.838 25.553 10.319 mm"
"      Runoff volume            13.91 11.88 25.80 c.m"
"      Runoff coefficient        0.221 0.827 0.334 "
"      Maximum flow             0.005 0.013 0.013 c.m/sec"
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"      1 Equal length"
"      1 SCS method"
"      102 Draining to ROW"
"      53.600 % Impervious"
"      0.110 Total Area"
"      14.000 Flow length"
"      1.500 Overland Slope"
"      0.051 Pervious Area"
"      14.000 Pervious length"
"      1.500 Pervious slope"
"      0.059 Impervious Area"
"      14.000 Impervious length"
"      1.500 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.221 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.821 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"

```

"	0.017	0.000	0.013	0.013 c.m/sec"
"	Catchment 102	Pervious	Impervious	Total Area "
"	Surface Area	0.051	0.059	0.110 hectare"
"	Time of concentration	13.931	1.371	3.745 minutes"
"	Time to Centroid	122.038	90.729	96.649 minutes"
"	Rainfall depth	30.902	30.902	30.902 mm"
"	Rainfall volume	15.77	18.22	33.99 c.m"
"	Rainfall losses	24.067	5.524	14.128 mm"
"	Runoff depth	6.835	25.377	16.774 mm"
"	Runoff volume	3.49	14.96	18.45 c.m"
"	Runoff coefficient	0.221	0.821	"
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"	Total % impervious		29.294"	
" 19	EXIT"			


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"      0.250 Total Area"
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"      4.900 Overland Slope"
"      0.204 Pervious Area"
"      35.000 Pervious length"
"      4.900 Pervious slope"
"      0.047 Impervious Area"
"      35.000 Impervious length"
"      4.900 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.293 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
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"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.856 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.020 0.000 0.000 0.000 c.m/sec"
"      Catchment 101 Pervious Impervious Total Area "

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```

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"      Time to Centroid         119.002 89.882 107.345 minutes"
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"      Rainfall volume          82.37 18.82 101.19 c.m"
"      Rainfall losses          28.613 5.819 24.373 mm"
"      Runoff depth             11.863 34.657 16.103 mm"
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"      1 SCS method"
"      102 Draining to ROW"
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"      0.110 Total Area"
"      14.000 Flow length"
"      1.500 Overland Slope"
"      0.051 Pervious Area"
"      14.000 Pervious length"
"      1.500 Pervious slope"
"      0.059 Impervious Area"
"      14.000 Impervious length"
"      1.500 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.294 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.849 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"

```

"	0.024	0.000	0.020	0.020 c.m/sec"
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"	Time of concentration	10.710	1.209	3.402 minutes"
"	Time to Centroid	115.458	89.600	95.567 minutes"
"	Rainfall depth	40.476	40.476	40.476 mm"
"	Rainfall volume	20.66	23.86	44.52 c.m"
"	Rainfall losses	28.572	6.122	16.539 mm"
"	Runoff depth	11.904	34.354	23.937 mm"
"	Runoff volume	6.08	20.26	26.33 c.m"
"	Runoff coefficient	0.294	0.849	"
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"	6 Combine "			
"	1 Node #"			
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"	Hydrograph volume	66.588		c.m"
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" 38	START/RE-START TOTALS 102"			
"	3 Runoff Totals on EXIT"			
"	Total Catchment area		0.360	hectare"
"	Total Impervious area		0.105	hectare"
"	Total % impervious		29.294"	
" 19	EXIT"			

```

"      MIDUSS Output ----->"
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"      Company                 "
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"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"      1 Chicago storm"
"      953.290 Coefficient A"
"      0.000 Constant B"
"      0.711 Exponent C"
"      0.400 Fraction R"
"      180.000 Duration"
"      1.000 Time step multiplier"
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"      Total depth              71.260 mm"
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"      1 Equal length"
"      1 SCS method"
"      101 Draining to the Golf Course"
"      18.600 % Impervious"
"      0.250 Total Area"
"      35.000 Flow length"
"      4.900 Overland Slope"
"      0.204 Pervious Area"
"      35.000 Pervious length"
"      4.900 Pervious slope"
"      0.047 Impervious Area"
"      35.000 Impervious length"
"      4.900 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.460 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.899 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.051 0.000 0.000 0.000 c.m/sec"
"      Catchment 101 Pervious Impervious Total Area "

```

```

"      Surface Area            0.204 0.047 0.250 hectare"
"      Time of concentration    8.722 1.204 6.401 minutes"
"      Time to Centroid        110.941 88.865 104.125 minutes"
"      Rainfall depth          71.260 71.260 71.260 mm"
"      Rainfall volume         145.01 33.14 178.15 c.m"
"      Rainfall losses          38.495 7.216 32.677 mm"
"      Runoff depth            32.766 64.044 38.583 mm"
"      Runoff volume           66.68 29.78 96.46 c.m"
"      Runoff coefficient       0.460 0.899 0.541 "
"      Maximum flow            0.037 0.030 0.051 c.m/sec"
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"      4 Add Runoff "
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" 40      HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Flows"
"      Maximum flow            0.051 c.m/sec"
"      Hydrograph volume       96.458 c.m"
"      0.051 0.051 0.051 0.051"
" 40      HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
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" 33      CATCHMENT 102"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      102 Draining to ROW"
"      53.600 % Impervious"
"      0.110 Total Area"
"      14.000 Flow length"
"      1.500 Overland Slope"
"      0.051 Pervious Area"
"      14.000 Pervious length"
"      1.500 Pervious slope"
"      0.059 Impervious Area"
"      14.000 Impervious length"
"      1.500 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.457 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.888 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"

```


"	0.043	0.000	0.051	0.051 c.m/sec"
"	Catchment 102	Pervious	Impervious	Total Area "
"	Surface Area	0.051	0.059	0.110 hectare"
"	Time of concentration	7.179	0.991	2.899 minutes"
"	Time to Centroid	108.720	88.327	94.613 minutes"
"	Rainfall depth	71.260	71.260	71.260 mm"
"	Rainfall volume	36.37	42.02	78.39 c.m"
"	Rainfall losses	38.695	8.001	22.243 mm"
"	Runoff depth	32.566	63.260	49.018 mm"
"	Runoff volume	16.62	37.30	53.92 c.m"
"	Runoff coefficient	0.457	0.888	"
"	Maximum flow	0.012	0.040	0.043 c.m/sec"
" 40	HYDROGRAPH Add Runoff "			
"	4 Add Runoff "	0.043	0.043	0.051
"	0.043	0.043	0.051	0.051"
" 40	HYDROGRAPH Copy to Outflow"			
"	8 Copy to Outflow"	0.043	0.043	0.043
"	0.043	0.043	0.043	0.051"
" 40	HYDROGRAPH Combine 1"			
"	6 Combine "			
"	1 Node #"			
"	Total Flows"			
"	Maximum flow	0.088		c.m/sec"
"	Hydrograph volume	150.378		c.m"
"	0.043	0.043	0.043	0.088"
" 38	START/RE-START TOTALS 102"			
"	3 Runoff Totals on EXIT"			
"	Total Catchment area		0.360	hectare"
"	Total Impervious area		0.105	hectare"
"	Total % impervious		29.294"	
" 19	EXIT"			

Post-Development

```

"          MIDUSS Output ----->"
"          MIDUSS version          Version 2.25  rev. 473"
"          MIDUSS created          Sunday, February 7, 2010"
"          10 Units used:          ie METRIC"
"          Job folder:             Q:\61748_001\SWM"
"          Output filename:        61748_001_2yr_PostDev_V5.out"
"          Licensee name:         A"
"          Company                 "
"          Date & Time last used:   6/10/2026 at 5:03:40 PM"
" 31          TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1 Chicago storm"
"          475.610 Coefficient A"
"          0.000 Constant B"
"          0.738 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity        145.014 mm/hr"
"          Total depth              30.902 mm"
"          6 100hyd Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Draining to Infiltration Gallery"
"          81.000 % Impervious"
"          0.260 Total Area"
"          45.000 Flow length"
"          2.000 Overland Slope"
"          0.049 Pervious Area"
"          45.000 Pervious length"
"          2.000 Pervious slope"
"          0.211 Impervious Area"
"          45.000 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          80.000 Pervious SCS Curve No."
"          0.221 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          6.350 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.834 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.050 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 201          Pervious Impervious Total Area "
"          Surface Area          0.049 0.211 0.260 hectare"
"          Time of concentration 25.748 2.533 3.893 minutes"
"          Time to Centroid      139.296 92.652 95.384 minutes"
"          Rainfall depth        30.902 30.902 30.902 mm"
"          Rainfall volume       15.27 65.08 80.34 c.m"
"          Rainfall losses       24.065 5.127 8.726 mm"
"          Runoff depth          6.836 25.774 22.176 mm"
"          Runoff volume         3.38 54.28 57.66 c.m"
"          Runoff coefficient     0.221 0.834 0.718 "
"          Maximum flow          0.001 0.049 0.050 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.050 0.050 0.000 0.000"
" 57          TRENCH Design d/s of 201"
"          0.050 Peak inflow"
"          57.658 Hydrograph volume"
"          343.000 Ground elevation"
"          342.000 Downstream trench invert"
"          0.550 Trench height"
"          341.000 Water table elevation"
"          3.800 Trench top width"
"          3.800 Trench bottom width"
"          54.500 Voids ratio (%)"
"          1.000 Hydraulic conductivity"
"          0.000 Trench gradient (%)"
"          19.200 Trench length"
"          1.000 Include base width"
"          21. Number of stages"
"          Level Discharge Volume"
"          342.000 0.000 0.0"
"          342.050 0.018 2.0"
"          342.100 0.026 4.0"
"          342.150 0.035 6.0"
"          342.200 0.045 8.0"
"          342.250 0.055 9.9"
"          342.300 0.064 11.9"
"          342.350 0.073 13.9"
"          342.400 0.081 15.9"
"          342.450 0.088 17.9"
"          342.500 0.095 19.9"
"          342.550 0.102 21.9"
"          342.600 0.108 21.9"
"          342.650 0.114 22.0"
"          342.700 0.119 22.0"
"          342.750 0.125 22.1"
"          342.800 0.130 22.2"
"          342.850 0.135 22.2"
"          342.900 0.140 22.3"
"          342.950 0.144 22.3"

```



```

"      343.000      0.320      22.4"
"
"      1. WEIRS"
"      Crest      Weir      Crest      Left      Right"
"      elevation coefficient breadth sideslope sideslope"
"      342.950      0.900      10.000      0.000      0.000"
"      1. TRENCH PIPES"
"      Downstream      Pipe      Pipe      Pipe Perf'ted?      Offset"
"      Invert      length      diam.      grade%      0=Yes      distance"
"      341.850      1.500      0.000      -0.533      1.000      0.000"
"      1. MANHOLE"
"      Access"
"      diameter"
"      1.200"
"      1. OUTFLOW PIPE"
"      0. Inflow at upstream end of trench: 1=True; 0=False"
"      Upstream Downstr'm      Pipe      Pipe      Manning      Entry"
"      invert      invert      Length      Diameter      'n'      loss Ke"
"      341.850      341.858      1.500      0.300      0.013      0.500"
"      Peak outflow      0.041      c.m/sec"
"      Outflow volume      57.093      c.m"
"      Peak exfiltration      0.000      c.m/sec"
"      Exfiltration volume      0.055      c.m"
"      Maximum level      342.178      metre"
"      Maximum storage      7.093      c.m"
"      Centroidal lag      1.631      hours"
"      Infiltration area 2 sides      6.850      sq.metre"
"      Infiltration Base area      72.960      sq.metre"
"      0.050      0.050      0.041      0.000 c.m/sec"
" 40 HYDROGRAPH Next link "
"      5 Next link "
"      0.050      0.041      0.041      0.000"
" 56 DIVERSION"
"      201 Node number"
"      0.068 Overflow threshold"
"      1.000 Required diverted fraction"
"      0 Conduit type; 1=Pipe;2=Channel"
"      Peak of diverted flow      0.000      c.m/sec"
"      Volume of diverted flow      0.000      c.m"
"      DIV00201.100hyd"
"      Major flow at 201"
"      0.050      0.041      0.041      0.000 c.m/sec"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Flows to College"
"      Maximum flow      0.041      c.m/sec"
"      Hydrograph volume      57.093      c.m"
"      0.050      0.041      0.041      0.041"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"

```

```

"      0.050      0.000      0.041      0.041"
" 33 CATCHMENT 202"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      202 Sheet draining to golf course - uncontrolled"
"
"      0.000 % Impervious"
"      0.019 Total Area"
"      25.000 Flow length"
"      15.000 Overland Slope"
"      0.019 Pervious Area"
"      25.000 Pervious length"
"      15.000 Pervious slope"
"      0.000 Impervious Area"
"      25.000 Impervious length"
"      15.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.220 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.000 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.001      0.000      0.041      0.041 c.m/sec"
"      Catchment 202      Pervious      Impervious      Total Area "
"      Surface Area      0.019      0.000      0.019      hectare"
"      Time of concentration      9.887      0.973      9.887      minutes"
"      Time to Centroid      116.241      90.011      116.241      minutes"
"      Rainfall depth      30.902      30.902      30.902      mm"
"      Rainfall volume      5.87      0.00      5.87      c.m"
"      Rainfall losses      24.110      6.073      24.110      mm"
"      Runoff depth      6.792      24.828      6.792      mm"
"      Runoff volume      1.29      0.00      1.29      c.m"
"      Runoff coefficient      0.220      0.000      0.220      "
"      Maximum flow      0.001      0.000      0.001      c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.001      0.001      0.041      0.041"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.001      0.001      0.001      0.041"
" 40 HYDROGRAPH Combine 2"
"      6 Combine "
"      2 Node #"
"      Total to the Golf Course"
"      Maximum flow      0.001      c.m/sec"

```

```

"          Hydrograph volume          1.290    c.m"
"          0.001    0.001    0.001    0.001"
" 40      HYDROGRAPH Start - New Tributary"
"          2    Start - New Tributary"
"          0.001    0.000    0.001    0.001"
" 33      CATCHMENT 203"
"          1    Triangular SCS"
"          1    Equal length"
"          1    SCS method"
"          203    Draining to ROW - controlled
"
" 45.000    % Impervious"
" 0.059    Total Area"
" 50.000    Flow length"
" 2.000    Overland Slope"
" 0.032    Pervious Area"
" 50.000    Pervious length"
" 2.000    Pervious slope"
" 0.027    Impervious Area"
" 50.000    Impervious length"
" 2.000    Impervious slope"
" 0.250    Pervious Manning 'n'"
" 80.000    Pervious SCS Curve No."
" 0.221    Pervious Runoff coefficient"
" 0.100    Pervious Ia/S coefficient"
" 6.350    Pervious Initial abstraction"
" 0.015    Impervious Manning 'n'"
" 98.000    Impervious SCS Curve No."
" 0.832    Impervious Runoff coefficient"
" 0.100    Impervious Ia/S coefficient"
" 0.518    Impervious Initial abstraction"
"          0.006    0.000    0.001    0.001 c.m/sec"
"          Catchment 203    Pervious    Impervious    Total Area "
"          Surface Area    0.032    0.027    0.059    hectare"
"          Time of concentration    27.428    2.698    8.769    minutes"
"          Time to Centroid    141.731    92.954    104.928    minutes"
"          Rainfall depth    30.902    30.902    30.902    mm"
"          Rainfall volume    10.03    8.20    18.23    c.m"
"          Rainfall losses    24.057    5.190    15.567    mm"
"          Runoff depth    6.844    25.712    15.335    mm"
"          Runoff volume    2.22    6.83    9.05    c.m"
"          Runoff coefficient    0.221    0.832    0.496    "
"          Maximum flow    0.001    0.006    0.006    c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4    Add Runoff "
"          0.006    0.006    0.001    0.001"
" 40      HYDROGRAPH Copy to Outflow"
"          8    Copy to Outflow"
"          0.006    0.006    0.006    0.001"
" 40      HYDROGRAPH Combine 1"

```

```

"          6    Combine "
"          1    Node #"
"          Total Flows to College"
"          Maximum flow          0.046    c.m/sec"
"          Hydrograph volume    66.141    c.m"
"          0.006    0.006    0.006    0.046"
" 40      HYDROGRAPH Confluence 1"
"          7    Confluence "
"          1    Node #"
"          Total Flows to College"
"          Maximum flow          0.046    c.m/sec"
"          Hydrograph volume    66.141    c.m"
"          0.006    0.046    0.006    0.000"
" 54      POND DESIGN"
"          0.046    Current peak flow    c.m/sec"
"          0.025    Target outflow    c.m/sec"
"          66.1    Hydrograph volume    c.m"
"          3.    Number of stages"
"          0.000    Minimum water level    metre"
"          1.000    Maximum water level    metre"
"          0.000    Starting water level    metre"
"          0    Keep Design Data: 1 = True; 0 = False"
"          Level Discharge    Volume"
"          0.000    0.000    0.000"
"          0.5000    0.00937    45.000"
"          1.000    0.03575    90.000"
"          2.    ORIFICES"
"          Orifice    Orifice    Orifice Number of"
"          invert coefficie    diameter    orifices"
"          0.000    0.630    0.0800    1.000"
"          0.500    0.630    0.1250    1.000"
"          Peak outflow          0.007    c.m/sec"
"          Maximum level          0.399    metre"
"          Maximum storage          35.895    c.m"
"          Centroidal lag          2.980    hours"
"          0.006    0.046    0.007    0.000 c.m/sec"
" 40      HYDROGRAPH Combine 3"
"          6    Combine "
"          3    Node #"
"          Total to College"
"          Maximum flow          0.007    c.m/sec"
"          Hydrograph volume    66.141    c.m"
"          0.006    0.046    0.007    0.007"
" 40      HYDROGRAPH Start - New Tributary"
"          2    Start - New Tributary"
"          0.006    0.000    0.007    0.007"
" 33      CATCHMENT 204"
"          1    Triangular SCS"
"          1    Equal length"
"          1    SCS method"

```

```

"      204   Draining to ROW - uncontrolled
"
"      59.000   % Impervious"
"      0.026   Total Area"
"      4.500   Flow length"
"      1.500   Overland Slope"
"      0.011   Pervious Area"
"      4.500   Pervious length"
"      1.500   Pervious slope"
"      0.015   Impervious Area"
"      4.500   Impervious length"
"      1.500   Impervious slope"
"      0.250   Pervious Manning 'n'"
"      80.000   Pervious SCS Curve No."
"      0.220   Pervious Runoff coefficient"
"      0.100   Pervious Ia/S coefficient"
"      6.350   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"      0.786   Impervious Runoff coefficient"
"      0.100   Impervious Ia/S coefficient"
"      0.518   Impervious Initial abstraction"
"      0.005   0.000   0.007   0.007 c.m/sec"
"      Catchment 204   Pervious   Impervious   Total Area "
"      Surface Area   0.011   0.015   0.026   hectare"
"      Time of concentration   7.051   0.694   1.727   minutes"
"      Time to Centroid   112.168   89.871   93.496   minutes"
"      Rainfall depth   30.902   30.902   30.902   mm"
"      Rainfall volume   3.29   4.74   8.03   c.m"
"      Rainfall losses   24.115   6.606   13.785   mm"
"      Runoff depth   6.786   24.296   17.117   mm"
"      Runoff volume   0.72   3.73   4.45   c.m"
"      Runoff coefficient   0.220   0.786   0.554   "
"      Maximum flow   0.000   0.005   0.005   c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4   Add Runoff "
"      0.005   0.005   0.007   0.007"
" 40      HYDROGRAPH Copy to Outflow"
"      8   Copy to Outflow"
"      0.005   0.005   0.005   0.007"
" 40      HYDROGRAPH Combine   3"
"      6   Combine "
"      3   Node #"
"      Total to College"
"      Maximum flow   0.008   c.m/sec"
"      Hydrograph volume   70.591   c.m"
"      0.005   0.005   0.005   0.008"
" 40      HYDROGRAPH Start - New Tributary"
"      2   Start - New Tributary"
"      0.005   0.000   0.005   0.008"

```

```

" 47      FILEI_0 Read/Open DIV00201.100hyd"
"      1   1=read/open; 2=write/save"
"      2   1=rainfall; 2=hydrograph"
"      1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"      DIV00201.100hyd"
"      Major flow at 201"
"      Total volume   0.000   c.m"
"      Maximum flow   0.000   c.m/sec"
"      0.000   0.000   0.005   0.008 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4   Add Runoff "
"      0.000   0.000   0.005   0.008"
" 40      HYDROGRAPH Copy to Outflow"
"      8   Copy to Outflow"
"      0.000   0.000   0.000   0.008"
" 40      HYDROGRAPH Combine   2"
"      6   Combine "
"      2   Node #"
"      Total to the Golf Course"
"      Maximum flow   0.001   c.m/sec"
"      Hydrograph volume   1.290   c.m"
"      0.000   0.000   0.000   0.001"
" 40      HYDROGRAPH Confluence   2"
"      7   Confluence "
"      2   Node #"
"      Total to the Golf Course"
"      Maximum flow   0.001   c.m/sec"
"      Hydrograph volume   1.290   c.m"
"      0.000   0.001   0.000   0.000"
" 38      START/RE-START TOTALS 2"
"      3   Runoff Totals on EXIT"
"      Total Catchment area   0.364   hectare"
"      Total Impervious area   0.252   hectare"
"      Total % impervious   69.365"
" 19      EXIT"

```



```

"          MIDUSS Output ----->"
"          MIDUSS version          Version 2.25 rev. 473"
"          MIDUSS created          Sunday, February 7, 2010"
"          10 Units used:          ie METRIC"
"          Job folder:             Q:\61748_001\SWM"
"          Output filename:        61748_001_5yr_PostDev_V7.out"
"          Licensee name:         A"
"          Company                 "
"          Date & Time last used:   6/10/2026 at 4:57:51 PM"
" 31          TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1 Chicago storm"
"          632.750 Coefficient A"
"          0.000 Constant B"
"          0.741 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity        191.997 mm/hr"
"          Total depth              40.476 mm"
"          6 100hyd Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Draining to Infiltration Gallery"
"          81.000 % Impervious"
"          0.260 Total Area"
"          45.000 Flow length"
"          2.000 Overland Slope"
"          0.049 Pervious Area"
"          45.000 Pervious length"
"          2.000 Pervious slope"
"          0.211 Impervious Area"
"          45.000 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          80.000 Pervious SCS Curve No."
"          0.294 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          6.350 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.869 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.071 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 201          Pervious Impervious Total Area "
"          Surface Area          0.049 0.211 0.260 hectare"
"          Time of concentration 19.795 2.235 3.528 minutes"
"          Time to Centroid      129.173 91.182 93.978 minutes"
"          Rainfall depth        40.476 40.476 40.476 mm"
"          Rainfall volume       20.00 85.24 105.24 c.m"
"          Rainfall losses       28.563 5.306 9.724 mm"
"          Runoff depth          11.913 35.170 30.751 mm"
"          Runoff volume         5.88 74.07 79.95 c.m"
"          Runoff coefficient     0.294 0.869 0.760 "
"          Maximum flow          0.002 0.071 0.071 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.071 0.071 0.000 0.000"
" 57          TRENCH Design d/s of 201"
"          0.071 Peak inflow"
"          79.954 Hydrograph volume"
"          343.000 Ground elevation"
"          342.000 Downstream trench invert"
"          0.550 Trench height"
"          341.000 Water table elevation"
"          3.800 Trench top width"
"          3.800 Trench bottom width"
"          54.500 Voids ratio (%)"
"          1.000 Hydraulic conductivity"
"          0.000 Trench gradient (%)"
"          19.200 Trench length"
"          1.000 Include base width"
"          21. Number of stages"
"          Level Discharge Volume"
"          342.000 0.000 0.0"
"          342.050 0.018 2.0"
"          342.100 0.026 4.0"
"          342.150 0.035 6.0"
"          342.200 0.045 8.0"
"          342.250 0.055 9.9"
"          342.300 0.064 11.9"
"          342.350 0.073 13.9"
"          342.400 0.081 15.9"
"          342.450 0.088 17.9"
"          342.500 0.095 19.9"
"          342.550 0.102 21.9"
"          342.600 0.108 21.9"
"          342.650 0.114 22.0"
"          342.700 0.119 22.0"
"          342.750 0.125 22.1"
"          342.800 0.130 22.2"
"          342.850 0.135 22.2"
"          342.900 0.140 22.3"
"          342.950 0.144 22.3"

```

```

"      343.000      0.320      22.4"
"  1. WEIRS"
"      Crest      Weir      Crest      Left      Right"
"      elevation coefficient breadth sideslope sideslope"
"      342.950      0.000      10.000      0.000      0.000"
"  1. TRENCH PIPES"
"      Downstream      Pipe      Pipe      Pipe Perf'ted?      Offset"
"      Invert      length      diam.      grade%      0=Yes      distance"
"      341.850      1.500      0.000      -0.533      1.000      0.000"
"  1. MANHOLE"
"      Access"
"      diameter"
"      1.200"
"  1. OUTFLOW PIPE"
"  0. Inflow at upstream end of trench: 1=True; 0=False"
"      Upstream Downstr'm      Pipe      Pipe      Manning      Entry"
"      invert      invert      Length      Diameter      'n'      loss Ke"
"      341.850      341.858      1.500      0.300      0.013      0.500"
"      Peak outflow      0.056      c.m/sec"
"      Outflow volume      79.618      c.m"
"      Peak exfiltration      0.000      c.m/sec"
"      Exfiltration volume      0.071      c.m"
"      Maximum level      342.256      metre"
"      Maximum storage      10.193      c.m"
"      Centroidal lag      1.608      hours"
"      Infiltration area 2 sides      9.844      sq.metre"
"      Infiltration Base area      72.960      sq.metre"
"      0.071      0.071      0.056      0.000 c.m/sec"
"  40 HYDROGRAPH Next link "
"      5 Next link "
"      0.071      0.056      0.056      0.000"
"  56 DIVERSION"
"      201 Node number"
"      0.068 Overflow threshold"
"      1.000 Required diverted fraction"
"      0 Conduit type; 1=Pipe;2=Channel"
"      Peak of diverted flow      0.000      c.m/sec"
"      Volume of diverted flow      0.000      c.m"
"      DIV00201.100hyd"
"      Major flow at 201"
"      0.071      0.056      0.056      0.000 c.m/sec"
"  40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Flows to College"
"      Maximum flow      0.056      c.m/sec"
"      Hydrograph volume      79.618      c.m"
"      0.071      0.056      0.056      0.056"
"  40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"

```

```

"      0.071      0.000      0.056      0.056"
"  33 CATCHMENT 202"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      202 Sheet draining to golf course - uncontrolled"
"      0.000 % Impervious"
"      0.019 Total Area"
"      25.000 Flow length"
"      15.000 Overland Slope"
"      0.019 Pervious Area"
"      25.000 Pervious length"
"      15.000 Pervious slope"
"      0.000 Impervious Area"
"      25.000 Impervious length"
"      15.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.293 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.000 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.002      0.000      0.056      0.056 c.m/sec"
"      Catchment 202      Pervious      Impervious      Total Area "
"      Surface Area      0.019      0.000      0.019      hectare"
"      Time of concentration      7.601      0.858      7.601      minutes"
"      Time to Centroid      110.885      88.815      110.885      minutes"
"      Rainfall depth      40.476      40.476      40.476      mm"
"      Rainfall volume      7.69      0.00      7.69      c.m"
"      Rainfall losses      28.598      6.952      28.598      mm"
"      Runoff depth      11.878      33.524      11.878      mm"
"      Runoff volume      2.26      0.00      2.26      c.m"
"      Runoff coefficient      0.293      0.000      0.293      "
"      Maximum flow      0.002      0.000      0.002      c.m/sec"
"  40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.002      0.002      0.056      0.056"
"  40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.002      0.002      0.002      0.056"
"  40 HYDROGRAPH Combine 2"
"      6 Combine "
"      2 Node #"
"      Total to the Golf Course"
"      Maximum flow      0.002      c.m/sec"

```

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"          Hydrograph volume          2.257    c.m"
"          0.002    0.002    0.002    0.002"
" 40      HYDROGRAPH Start - New Tributary"
"          2    Start - New Tributary"
"          0.002    0.000    0.002    0.002"
" 33      CATCHMENT 203"
"          1    Triangular SCS"
"          1    Equal length"
"          1    SCS method"
"          203    Draining to ROW - controlled
"
" 45.000    % Impervious"
" 0.059    Total Area"
" 50.000    Flow length"
" 2.000    Overland Slope"
" 0.032    Pervious Area"
" 50.000    Pervious length"
" 2.000    Pervious slope"
" 0.027    Impervious Area"
" 50.000    Impervious length"
" 2.000    Impervious slope"
" 0.250    Pervious Manning 'n'"
" 80.000    Pervious SCS Curve No."
" 0.295    Pervious Runoff coefficient"
" 0.100    Pervious Ia/S coefficient"
" 6.350    Pervious Initial abstraction"
" 0.015    Impervious Manning 'n'"
" 98.000    Impervious SCS Curve No."
" 0.869    Impervious Runoff coefficient"
" 0.100    Impervious Ia/S coefficient"
" 0.518    Impervious Initial abstraction"
"          0.009    0.000    0.002    0.002 c.m/sec"
"          Catchment 203    Pervious    Impervious    Total Area "
"          Surface Area    0.032    0.027    0.059    hectare"
"          Time of concentration    21.086    2.381    7.862    minutes"
"          Time to Centroid    131.102    91.463    103.078    minutes"
"          Rainfall depth    40.476    40.476    40.476    mm"
"          Rainfall volume    13.13    10.75    23.88    c.m"
"          Rainfall losses    28.552    5.313    18.094    mm"
"          Runoff depth    11.924    35.163    22.382    mm"
"          Runoff volume    3.87    9.34    13.21    c.m"
"          Runoff coefficient    0.295    0.869    0.553    "
"          Maximum flow    0.001    0.009    0.009    c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4    Add Runoff "
"          0.009    0.009    0.002    0.002"
" 40      HYDROGRAPH Copy to Outflow"
"          8    Copy to Outflow"
"          0.009    0.009    0.009    0.002"
" 40      HYDROGRAPH Combine 1"

```

```

"          6    Combine "
"          1    Node #"
"          Total Flows to College"
"          Maximum flow          0.063    c.m/sec"
"          Hydrograph volume          92.823    c.m"
"          0.009    0.009    0.009    0.063"
" 40      HYDROGRAPH Confluence 1"
"          7    Confluence "
"          1    Node #"
"          Total Flows to College"
"          Maximum flow          0.063    c.m/sec"
"          Hydrograph volume          92.823    c.m"
"          0.009    0.063    0.009    0.000"
" 54      POND DESIGN"
"          0.063    Current peak flow    c.m/sec"
"          0.025    Target outflow    c.m/sec"
"          92.8    Hydrograph volume    c.m"
"          3.    Number of stages"
"          0.000    Minimum water level    metre"
"          1.000    Maximum water level    metre"
"          0.000    Starting water level    metre"
"          0    Keep Design Data: 1 = True; 0 = False"
"          Level Discharge    Volume"
"          0.000    0.000    0.000"
"          0.5000    0.00937    45.000"
"          1.000    0.03575    90.000"
"          2.    ORIFICES"
"          Orifice    Orifice    Orifice Number of"
"          invert coefficie    diameter    orifices"
"          0.000    0.630    0.0800    1.000"
"          0.500    0.630    0.1250    1.000"
"          Peak outflow          0.012    c.m/sec"
"          Maximum level          0.558    metre"
"          Maximum storage          50.239    c.m"
"          Centroidal lag          2.918    hours"
"          0.009    0.063    0.012    0.000 c.m/sec"
" 40      HYDROGRAPH Combine 3"
"          6    Combine "
"          3    Node #"
"          Total to College"
"          Maximum flow          0.012    c.m/sec"
"          Hydrograph volume          92.831    c.m"
"          0.009    0.063    0.012    0.012"
" 40      HYDROGRAPH Start - New Tributary"
"          2    Start - New Tributary"
"          0.009    0.000    0.012    0.012"
" 33      CATCHMENT 204"
"          1    Triangular SCS"
"          1    Equal length"
"          1    SCS method"

```



```

"      204   Draining to ROW - uncontrolled
"
"      59.000   % Impervious"
"      0.026   Total Area"
"      4.500   Flow length"
"      1.500   Overland Slope"
"      0.011   Pervious Area"
"      4.500   Pervious length"
"      1.500   Pervious slope"
"      0.015   Impervious Area"
"      4.500   Impervious length"
"      1.500   Impervious slope"
"      0.250   Pervious Manning 'n'"
"      80.000   Pervious SCS Curve No."
"      0.294   Pervious Runoff coefficient"
"      0.100   Pervious Ia/S coefficient"
"      6.350   Pervious Initial abstraction"
"      0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"      0.810   Impervious Runoff coefficient"
"      0.100   Impervious Ia/S coefficient"
"      0.518   Impervious Initial abstraction"
"      0.007   0.000   0.012   0.012 c.m/sec"
"      Catchment 204   Pervious   Impervious   Total Area "
"      Surface Area   0.011   0.015   0.026   hectare"
"      Time of concentration   5.420   0.612   1.581   minutes"
"      Time to Centroid   107.447   88.977   92.697   minutes"
"      Rainfall depth   40.476   40.476   40.476   mm"
"      Rainfall volume   4.31   6.21   10.52   c.m"
"      Rainfall losses   28.579   7.698   16.259   mm"
"      Runoff depth   11.897   32.778   24.217   mm"
"      Runoff volume   1.27   5.03   6.30   c.m"
"      Runoff coefficient   0.294   0.810   0.598   "
"      Maximum flow   0.001   0.006   0.007   c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4   Add Runoff "
"      0.007   0.007   0.012   0.012"
" 40      HYDROGRAPH Copy to Outflow"
"      8   Copy to Outflow"
"      0.007   0.007   0.007   0.012"
" 40      HYDROGRAPH Combine 3"
"      6   Combine "
"      3   Node #"
"      Total to College"
"      Maximum flow   0.013   c.m/sec"
"      Hydrograph volume   99.127   c.m"
"      0.007   0.007   0.007   0.013"
" 40      HYDROGRAPH Start - New Tributary"
"      2   Start - New Tributary"
"      0.007   0.000   0.007   0.013"

```

```

" 47      FILEI_0 Read/Open DIV00201.100hyd"
"      1   1=read/open; 2=write/save"
"      2   1=rainfall; 2=hydrograph"
"      1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"      DIV00201.100hyd"
"      Major flow at 201"
"      Total volume   0.000   c.m"
"      Maximum flow   0.000   c.m/sec"
"      0.000   0.000   0.007   0.013 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4   Add Runoff "
"      0.000   0.000   0.007   0.013"
" 40      HYDROGRAPH Copy to Outflow"
"      8   Copy to Outflow"
"      0.000   0.000   0.000   0.013"
" 40      HYDROGRAPH Combine 2"
"      6   Combine "
"      2   Node #"
"      Total to the Golf Course"
"      Maximum flow   0.002   c.m/sec"
"      Hydrograph volume   2.257   c.m"
"      0.000   0.000   0.000   0.002"
" 40      HYDROGRAPH Confluence 2"
"      7   Confluence "
"      2   Node #"
"      Total to the Golf Course"
"      Maximum flow   0.002   c.m/sec"
"      Hydrograph volume   2.257   c.m"
"      0.000   0.002   0.000   0.000"
" 38      START/RE-START TOTALS 2"
"      3   Runoff Totals on EXIT"
"      Total Catchment area   0.364   hectare"
"      Total Impervious area   0.252   hectare"
"      Total % impervious   69.365"
" 19      EXIT"

```

```

"      MIDUSS Output ----->"
"      MIDUSS version          Version 2.25 rev. 473"
"      MIDUSS created          Sunday, February 7, 2010"
"      10      Units used:      ie METRIC"
"      Job folder:              Q:\61748_001\SWM"
"      Output filename:         61748_001_100yr_PostDev_V25.out"
"      Licensee name:           A"
"      Company                  "
"      Date & Time last used:    6/10/2026 at 4:50:42 PM"
" 31      TIME PARAMETERS"
"      5.000 Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"      1 Chicago storm"
"      953.290 Coefficient A"
"      0.000 Constant B"
"      0.711 Exponent C"
"      0.400 Fraction R"
"      180.000 Duration"
"      1.000 Time step multiplier"
"      Maximum intensity        303.569 mm/hr"
"      Total depth              71.260 mm"
"      6 100hyd Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      201 Draining to Infiltration Gallery"
"      81.000 % Impervious"
"      0.260 Total Area"
"      45.000 Flow length"
"      2.000 Overland Slope"
"      0.049 Pervious Area"
"      45.000 Pervious length"
"      2.000 Pervious slope"
"      0.211 Impervious Area"
"      45.000 Impervious length"
"      2.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.459 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.912 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.129 0.000 0.000 0.000 c.m/sec"
"      Catchment 201 Pervious Impervious Total Area "
"      Surface Area 0.049 0.211 0.260 hectare"
"      Time of concentration 13.269 1.832 3.039 minutes"
"      Time to Centroid 118.114 89.886 92.863 minutes"
"      Rainfall depth 71.260 71.260 71.260 mm"
"      Rainfall volume 35.20 150.07 185.28 c.m"
"      Rainfall losses 38.576 6.241 12.385 mm"
"      Runoff depth 32.684 65.020 58.876 mm"

```

```

"      Runoff volume 16.15 136.93 153.08 c.m"
"      Runoff coefficient 0.459 0.912 0.826 "
"      Maximum flow 0.007 0.127 0.129 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.129 0.129 0.000 0.000"
" 57      TRENCH Design d/s of 201"
"      0.129 Peak inflow"
"      153.077 Hydrograph volume"
"      343.000 Ground elevation"
"      342.000 Downstream trench invert"
"      0.550 Trench height"
"      341.000 Water table elevation"
"      3.800 Trench top width"
"      3.800 Trench bottom width"
"      54.500 Voids ratio (%)"
"      1.000 Hydraulic conductivity"
"      0.000 Trench gradient (%)"
"      19.200 Trench length"
"      1.000 Include base width"
"      21. Number of stages"
"      Level Discharge Volume"
"      342.000 0.000 0.0"
"      342.050 0.018 2.0"
"      342.100 0.026 4.0"
"      342.150 0.035 6.0"
"      342.200 0.045 8.0"
"      342.250 0.055 9.9"
"      342.300 0.064 11.9"
"      342.350 0.073 13.9"
"      342.400 0.081 15.9"
"      342.450 0.088 17.9"
"      342.500 0.095 19.9"
"      342.550 0.102 21.9"
"      342.600 0.108 21.9"
"      342.650 0.114 22.0"
"      342.700 0.119 22.0"
"      342.750 0.125 22.1"
"      342.800 0.130 22.2"
"      342.850 0.135 22.2"
"      342.900 0.140 22.3"
"      342.950 0.144 22.3"
"      343.000 0.320 22.4"
"      1. WEIRS"
"      Crest Weir Crest Left Right"
"      elevation coeffie breadth sideslope sideslope"
"      342.950 0.900 10.000 0.000 0.000"
"      1. TRENCH PIPES"
"      Downstream Pipe Pipe Pipe Perf'ted? Offset"
"      Invert length diam. grade% 0=Yes distance"
"      341.850 1.500 0.000 -0.533 1.000 1.750"
"      1. MANHOLE"
"      Access"
"      diameter"
"      1.200"
"      1. OUTFLOW PIPE"
"      0. Inflow at upstream end of trench: 1=True; 0=False"
"      Upstream Downstr'm Pipe Pipe Manning Entry"

```

	invert	invert	Length	Diameter	'n'	loss Ke"
	341.850	341.858	1.500	0.300	0.013	0.500"
	Peak outflow		0.092	c.m/sec"		
	Outflow volume		153.253	c.m"		
	Peak exfiltration		0.000	c.m/sec"		
	Exfiltration volume		0.121	c.m"		
	Maximum level		342.485	metre"		
	Maximum storage		19.289	c.m"		
	Centroidal lag		1.590	hours"		
	Infiltration area 2 sides		18.628	sq.metre"		
	Infiltration Base area		72.960	sq.metre"		
	0.129	0.129	0.092	0.000 c.m/sec"		
40	HYDROGRAPH Next link "					
	5	Next link "				
	0.129	0.092	0.092	0.000"		
56	DIVERSION"					
	201	Node number"				
	0.068	Overflow threshold"				
	1.000	Required diverted fraction"				
	0	Conduit type; 1=Pipe;2=Channel"				
	Peak of diverted flow		0.024	c.m/sec"		
	Volume of diverted flow		8.006	c.m"		
	DIV00201.100hyd"					
	Major flow at 201"					
	0.129	0.092	0.068	0.000 c.m/sec"		
40	HYDROGRAPH Combine 1"					
	6	Combine "				
	1	Node #"				
	Total Flows to College"					
	Maximum flow		0.068	c.m/sec"		
	Hydrograph volume		145.247	c.m"		
	0.129	0.092	0.068	0.068"		
40	HYDROGRAPH Start - New Tributary"					
	2	Start - New Tributary"				
	0.129	0.000	0.068	0.068"		
33	CATCHMENT 202"					
	1	Triangular SCS"				
	1	Equal length"				
	1	SCS method"				
	202	Sheet draining to golf course - uncontrolled				
	0.000	% Impervious"				
	0.019	Total Area"				
	25.000	Flow length"				
	15.000	Overland Slope"				
	0.019	Pervious Area"				
	25.000	Pervious length"				
	15.000	Pervious slope"				
	0.000	Impervious Area"				
	25.000	Impervious length"				
	15.000	Impervious slope"				
	0.250	Pervious Manning 'n'"				
	80.000	Pervious SCS Curve No."				
	0.459	Pervious Runoff coefficient"				
	0.100	Pervious Ia/S coefficient"				
	6.350	Pervious Initial abstraction"				
	0.015	Impervious Manning 'n'"				
	98.000	Impervious SCS Curve No."				

	0.000	Impervious Runoff coefficient"			
	0.100	Impervious Ia/S coefficient"			
	0.518	Impervious Initial abstraction"			
	0.005	0.000	0.068	0.068 c.m/sec"	
	Catchment 202	Pervious	Impervious	Total Area	"
	Surface Area	0.019	0.000	0.019	hectare"
	Time of concentration	5.095	0.704	5.095	minutes"
	Time to Centroid	105.276	88.212	105.276	minutes"
	Rainfall depth	71.260	71.260	71.260	mm"
	Rainfall volume	13.54	0.00	13.54	c.m"
	Rainfall losses	38.532	9.096	38.532	mm"
	Runoff depth	32.729	62.164	32.729	mm"
	Runoff volume	6.22	0.00	6.22	c.m"
	Runoff coefficient	0.459	0.000	0.459	"
	Maximum flow	0.005	0.000	0.005	c.m/sec"
40	HYDROGRAPH Add Runoff "				
	4	Add Runoff "			
	0.005	0.005	0.068	0.068"	
40	HYDROGRAPH Copy to Outflow"				
	8	Copy to Outflow"			
	0.005	0.005	0.005	0.068"	
40	HYDROGRAPH Combine 2"				
	6	Combine "			
	2	Node #"			
	Total to the Golf Course"				
	Maximum flow		0.005	c.m/sec"	
	Hydrograph volume		6.218	c.m"	
	0.005	0.005	0.005	0.005"	
40	HYDROGRAPH Start - New Tributary"				
	2	Start - New Tributary"			
	0.005	0.000	0.005	0.005"	
33	CATCHMENT 203"				
	1	Triangular SCS"			
	1	Equal length"			
	1	SCS method"			
	203	Draining to ROW - controlled			
	45.000	% Impervious"			
	0.059	Total Area"			
	50.000	Flow length"			
	2.000	Overland Slope"			
	0.032	Pervious Area"			
	50.000	Pervious length"			
	2.000	Pervious slope"			
	0.027	Impervious Area"			
	50.000	Impervious length"			
	2.000	Impervious slope"			
	0.250	Pervious Manning 'n'"			
	80.000	Pervious SCS Curve No."			
	0.460	Pervious Runoff coefficient"			
	0.100	Pervious Ia/S coefficient"			
	6.350	Pervious Initial abstraction"			
	0.015	Impervious Manning 'n'"			
	98.000	Impervious SCS Curve No."			
	0.915	Impervious Runoff coefficient"			
	0.100	Impervious Ia/S coefficient"			
	0.518	Impervious Initial abstraction"			
	0.017	0.000	0.005	0.005 c.m/sec"	


```

"      Catchment 203      Pervious  Impervious Total Area "
"      Surface Area      0.032    0.027    0.059    hectare"
"      Time of concentration 14.135    1.952    6.590    minutes"
"      Time to Centroid   119.420    90.104    101.264    minutes"
"      Rainfall depth     71.260    71.260    71.260    mm"
"      Rainfall volume    23.12     18.92    42.04     c.m"
"      Rainfall losses    38.476    6.073    23.894    mm"
"      Runoff depth       32.785    65.187    47.366    mm"
"      Runoff volume      10.64     17.31    27.95     c.m"
"      Runoff coefficient  0.460    0.915    0.665     "
"      Maximum flow       0.005     0.016    0.017     c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"          0.017    0.017    0.005    0.005"
" 40  HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"          0.017    0.017    0.017    0.005"
" 40  HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"          Total Flows to College"
"          Maximum flow      0.085    c.m/sec"
"          Hydrograph volume 173.193    c.m"
"          0.017    0.017    0.017    0.085"
" 40  HYDROGRAPH Confluence 1"
"      7 Confluence "
"      1 Node #"
"          Total Flows to College"
"          Maximum flow      0.085    c.m/sec"
"          Hydrograph volume 173.193    c.m"
"          0.017    0.085    0.017    0.000"
" 54  POND DESIGN"
"      0.085 Current peak flow c.m/sec"
"      0.025 Target outflow c.m/sec"
"      173.2 Hydrograph volume c.m"
"      3. Number of stages"
"      0.000 Minimum water level metre"
"      1.000 Maximum water level metre"
"      0.000 Starting water level metre"
"      0 Keep Design Data: 1 = True; 0 = False"
"          Level Discharge Volume"
"          0.000    0.000    0.000"
"          0.5000    0.00937    45.000"
"          1.000    0.03575    90.000"
"      2. ORIFICES"
"          Orifice Orifice Orifice Number of"
"          invert coefficie diameter orifices"
"          0.000    0.630    0.0800    1.000"
"          0.500    0.630    0.1250    1.000"
"          Peak outflow      0.030    c.m/sec"
"          Maximum level     0.898    metre"
"          Maximum storage    80.778    c.m"
"          Centroidal lag     2.659    hours"
"          0.017    0.085    0.030    0.000 c.m/sec"
" 40  HYDROGRAPH Combine 3"
"      6 Combine "
"      3 Node #"
"          Total to College"

```

```

"      Maximum flow      0.030    c.m/sec"
"      Hydrograph volume 173.291    c.m"
"          0.017    0.085    0.030    0.030"
" 40  HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"          0.017    0.000    0.030    0.030"
" 33  CATCHMENT 204"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      204 Draining to ROW - uncontrolled"
"      59.000 % Impervious"
"      0.026 Total Area"
"      4.500 Flow length"
"      1.500 Overland Slope"
"      0.011 Pervious Area"
"      4.500 Pervious length"
"      1.500 Pervious slope"
"      0.015 Impervious Area"
"      4.500 Impervious length"
"      1.500 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      80.000 Pervious SCS Curve No."
"      0.448 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      6.350 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.849 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"          0.013    0.000    0.030    0.030 c.m/sec"
"      Catchment 204      Pervious  Impervious Total Area "
"      Surface Area      0.011    0.015    0.026    hectare"
"      Time of concentration 3.633    0.502    1.342    minutes"
"      Time to Centroid   103.371    88.217    92.282    minutes"
"      Rainfall depth     71.260    71.260    71.260    mm"
"      Rainfall volume    7.60     10.93    18.53     c.m"
"      Rainfall losses    39.361    10.791    22.505    mm"
"      Runoff depth       31.899    60.469    48.755    mm"
"      Runoff volume      3.40     9.28     12.68     c.m"
"      Runoff coefficient  0.448    0.849    0.684     "
"      Maximum flow       0.003    0.011    0.013    c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"          0.013    0.013    0.030    0.030"
" 40  HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"          0.013    0.013    0.013    0.030"
" 40  HYDROGRAPH Combine 3"
"      6 Combine "
"      3 Node #"
"          Total to College"
"          Maximum flow      0.032    c.m/sec"
"          Hydrograph volume 185.967    c.m"
"          0.013    0.013    0.013    0.032"
" 40  HYDROGRAPH Start - New Tributary"

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"      2  Start - New Tributary"
"      0.013      0.000      0.013      0.032"
" 47  FILEI_0 Read/Open DIV00201.100hyd"
"      1  1=read/open; 2=write/save"
"      2  1=rainfall; 2=hydrograph"
"      1  1=runoff; 2=inflow; 3=outflow; 4=junction"
"      DIV00201.100hyd"
"      Major flow at 201"
"      Total volume      8.006      c.m"
"      Maximum flow      0.024      c.m/sec"
"      0.024      0.000      0.013      0.032 c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.024      0.024      0.013      0.032"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.024      0.024      0.024      0.032"
" 40  HYDROGRAPH Combine 2"
"      6  Combine "
"      2  Node #"
"      Total to the Golf Course"
"      Maximum flow      0.029      c.m/sec"
"      Hydrograph volume  14.224      c.m"
"      0.024      0.024      0.024      0.029"
" 40  HYDROGRAPH Confluence 2"
"      7  Confluence "
"      2  Node #"
"      Total to the Golf Course"
"      Maximum flow      0.029      c.m/sec"
"      Hydrograph volume  14.224      c.m"
"      0.024      0.029      0.024      0.000"
" 38  START/RE-START TOTALS 2"
"      3  Runoff Totals on EXIT"
"      Total Catchment area      0.364      hectare"
"      Total Impervious area      0.252      hectare"
"      Total % impervious      69.365"
" 19  EXIT"

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Appendix H

Water Balance



210-222 College Avenue East
WATER BALANCE (INFILTRATION) ANALYSIS
 Guelph, Ontario

Project Number: 61748_001
 Date: December 4, 2025

Design By: MLW
 File: Q:\61748_001\SWM\61748_001-Micro Drainage Analysis_2026-

Topography: Rolling Lands
 Coverage: Open Space - Urban Lawns + Some impervious
 Soil Type: CD Clay Loam

Weather Station: Guelph Arboretum
 Total Precipitation: 923

ET: 570
 Runoff: 212
 Infiltration: 141

INFILTRATION

Location	Pre-development			Post-development						Comments
	Area Draining to Location	Infiltration Rate	Infiltration Volume	Pervious			Impervious			
				Area Draining to Location	Infiltration Rate	Infiltration Volume	Area Draining to Location	Infiltration Rate	Infiltration Volume	
	ha	mm/yr/m ²	m ³ /yr	ha	mm/yr/m ²	m ³ /yr	ha	mm/yr/m ²	m ³ /yr	
Total Site - pervious	0.255	141	360							
Total Site - impervious	0.105	0	0							
Roofs + Landscaped Areas Uncontrolled Area				0.066	141	93	0.126 0.168	292 0	369 0	From roof and side yard drainage to ADS infiltration gallery
Total	0.360	141	360	0.066	141	93	0.294	292	369	

SUMMARY

Post-development Infiltration Volume

Pervious 93 m³/yr
 Impervious + 369 m³/yr
 462 m³/yr

Pre-development Infiltration Volume

- 360 m³/yr

Net Gain of Infiltration

103 m³/yr