Appendix J – yongeTOmorrow Environmental Assessment Study - Geotechnical and Environmental Investigation Factual Geotechnical Report

Englobe

City of Toronto

Englobe
Soils Materials Environment

STEER DAVIES GLEAVE NORTH AMERICA

P.O. NA-1101231
YONGE STREET
FROM RICHMOND STREET TO DAVENPORT ROAD, TORONTO
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION

December 10, 2020

Factual Geotechnical Report

01-P0013610.201-0101-GS-R-0001-00

FINAL REPORT

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Summary

Englobe Corp. (Englobe) was retained by Steer Davies Gleave North America (SDG) to complete a geotechnical and environmental investigation on Yonge Street from Richmond Street to Davenport Road, Toronto. This project was completed at the request of Andy Barker, Principal Consultant with SDG.

The purpose of the investigation was to determine the general existing pavement structure of the road, subgrade soil types and groundwater conditions within the project limits. Soil samples were collected for laboratory examination and tested to assess the type and moisture content of the granular base/subbase and subgrade. Representative soil samples were selected by Englobe and submitted for environmental analysis. Selected asphalt composite cores were tested to confirm if asbestos fibres were present in the existing asphalt concrete.

Production Team

Client

Principal Consultant	Andy Barker

Englobe Corp.

Team Leader	Alain Duclos, MASc., P.Eng.
Pavement Engineer	Sunil Ganesh, M.Eng., P.Eng.,PMP
Project Manager	Ana Maria Gutierrez, B.Sc., PMP
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Revision and Publication Register		
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00	December 10, 2020	Submission of Factual Geotechnical Report

Distribution	
1pdf	Andy Barker

Property and Confidentiality

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1 PROJECT METHODOLOGY

The geotechnical and pavement investigation for this project consisted of the following components.

At the start of the project, roadway occupancy permits and service clearances were obtained for all of the proposed borehole locations. This included going through the TTC technical review process as the boreholes were in close proximity to the underlying Yonge subway line. Prior to drilling, the, Road Disruption Activity Reporting System (RoDARS) was used to inform the public of planned roadway closures.

A total of thirty-one (31) boreholes were advanced to depths ranging from 0.9 m to 5.5 m below ground surface (mbgs) along the project limits. This included the twenty-five (25) boreholes which were part of the initial mandate as well as seven (7) supplemental boreholes which were recommended to be completed by Englobe based on the Phase I ESA report (128-P-0013610-0-01-200-SG-R-0001-0A) in order to investigate areas of potential environmental concern.

Initially, seven (7) of the boreholes, BH23 to BH29 were completed between June 19 and June 27, 2019. Prior to completing each borehole, the location was daylighted using a hydro-vac machine to a minimum of 1 m below the proposed drilling depth in order to expose the existing utilities and clear the drilling locations. During this process, several of the boreholes needed to be moved due to the uncovering of unmarked underground utilities and structures. Once the borehole was clear, the boring was completed using continuous flight solid-stem auger equipment (AC Drill Truck Mounted) at each of the borehole locations. The drilling equipment for these boreholes was supplied by Malone's Soil Samples Co. Ltd. and drilling works were completed under continuous supervision of an Englobe field technician.

In the second phase of work, twenty-four (24) boreholes, BH1 to BH22 (excluding BH20) and BH29 to BH32 were completed between the periods of March 9 to October 5, 2020 using hand auger equipment operated by Englobe Technicians. BH20 was not drilled because a previous BH was completed in the vicinity of the proposed location for a separate TTC project on September 2018 (BH-S2-17-002 which is in front of 433 Yonge Street) and it was decided that this BH did not need to be re-drilled. A copy of the borehole log is included in the borehole log Appendix.

It is important to outline for this project the technical review process with TTC as these reviews are critical in determining if one is able to advance boreholes along Yonge street above the subway line. During the services clearances request process, the TTC Rail Structures locates department requested the first technical review on March 26, 2019 for BH23 to BH29 which was submitted by Englobe on May 31, 2019. Comments were provided by TTC on June 27, 2019 and these boreholes were agreed to be completed to the proposed depths as they were determined not to interfere with any TTC rail structure.

For the remaining twenty-four (24) boreholes, the TTC technical review package was submitted on July 2, 2019, which resulted in a lengthy review and multiple (3) technical review submission packages to TTC (March 13, April 22, and June 3, 2020). Part of this extensive conversation included the need to evaluate vertical and horizontal clearance of the proposed boreholes to the subway tunnel using survey information provided in the INROAD software format. Englobe also obtained subway as-built cross section plans from the TTC itself to assist in determining the clearance. After many discussions, it was decided that the best way to move forward with the geotechnical investigation would be to significantly reduce the borehole sampling depths and to hand-dig at each of the sampling locations. This change in mandate was accepted by the City.

Thirty-two (32) asphalt concrete cores were recovered using a 100 mm diameter core drill in order to obtain samples of the existing asphalt concrete over the Portland cement concrete for lift thickness measurements, visual examination and asbestos testing. The location of the boreholes and cores are indicated on the attached Borehole and Core Location Drawings in Appendix 1, with the Borehole Logs provided in Appendix 2. The core summary table and the core logs photographs are provided in Appendix 3 and Appendix 4 respectively.

Granular base/subbase samples were collected from the auger flights during the course of the field work, and the thickness of each layer of the pavement structure (asphalt concrete, Portland cement concrete, granular base/subbase, etc.) was measured along the inside face of each borehole. At borehole location BH23 to BH29, subsoil samples were recovered at regular intervals of depth using a 50 mm O.D. split-barrel sampler driven into the subsoil in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). The recovered subsoil samples were visually examined in the field and then preserved and transported to Englobe Toronto laboratory for examination and testing. Groundwater observations were carried out in the open boreholes upon completion of the field work. The boreholes were then promptly backfilled upon completion in conformance with Ontario Regulation 903 requirements (as amended).

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the Project Engineer and moisture content determinations were carried out on all granular base/subbase and subgrade soil samples. The representative granular base/subbase samples were selected for sieve analysis testing and representative subgrade soil samples were selected for hydrometer testing. The detailed sieve analysis and hydrometer test results are provided in Appendix 5.

Sixty-two (62) representative subsoil samples were selected by Englobe and submitted to Eurofins Environmental Testing Canada Inc. (Eurofins) for environmental analysis in accordance with O.Reg.153/04 (as amended) for metals and inorganics. In addition, twenty (20) selected soil samples were also submitted to Eurofins for environmental analysis in accordance with Ontario Regulation 347 (as amended by O. Reg.558/00), TCLP Leachate Extraction Procedures, Metals and Inorganics and VOC for classification and disposal purposes. The complete environmental testing results, including Eurofins Certificates of Analysis are attached in Appendix 6.

Sixteen (16) asphalt cores were checked for the presence of asbestos mineral fibres and steel slag in the existing asphalt concrete. The asphalt cement was extracted from each lift of the asphalt concrete cores to carry out a visual examination of the retained material. The complete asbestos testing results are attached in Appendix 7.

2 PAVEMENT AND SUBSOIL CONDITIONS

2.1 BOREHOLE AND CORE INVESTIGATION

The borehole and core investigations were carried out between June 2019 and October 2020 to determine the existing pavement structure layer thicknesses and subsurface conditions. The location of the boreholes and cores are provided in Appendix 1 and the borehole logs are provided in Appendix 2. The core summary table and the core log photographs are provided in Appendix 3 and Appendix 4 respectively.

The boreholes were drilled on paved surfaces and composite pavement structures were observed at all the borehole locations along Yonge street within the project limits. The average asphalt thickness was 85 mm overlying an average of 210 mm of concrete. The base/subbase at the borehole locations consisted of crushed granular material with an average thickness of 500 mm. The in-situ moisture content of this material ranged from 4 to 12.4% (moist).

The average and range of the pavement structure thicknesses are summarized in Table 1.

Table 1 Summary of Pavement Structure Components

Roadway	Asphalt Concrete (mm)		Portland Cement Concrete		Granular Base/Subbase	
	Mean	Range	Mean	Range	Mean	Range
Yonge Street						
Richmond Street to Davenport Road	85	60 - 130	210	150 – 315	500	300 –1100

Below the granular subbase, fill material, predominantly consisting of gravelly sand to silty sand were encountered at the borehole locations. The fill was very loose to compact in relative density, having SPT ‘N’ values ranging from 3 to 29 blows per 300 mm of penetration. The in-situ moisture content of this material ranged from 4 to 31.4% (moist to saturated).

A fine grained native cohesive soil of clayey silt to silty clay stratum is present underneath the fill material in BH26, BH27, BH28 and BH29. The clayey silt to silty clay was firm to very stiff in consistency, having SPT ‘N’ values in the range of 5 to 21 blows per 300 mm penetration. The in-situ moisture content of this material ranged from 14.1 to 31.9 % (moist to saturated).

2.2 GROUNDWATER

Groundwater observations and measurements were carried out in the open boreholes. No water was encountered in any of the boreholes upon the completion of the drilling. Borehole

samples BH26-SS6, BH27-SS6, BH28-SS5 and BH29-SS5 were described as saturated with moisture contents ranging from 26.3 to 31.9 %. It is likely that this water is perched within the soils at these levels. Consequently, significant seepage of ground water into open excavations is not expected and should be controllable using conventional construction dewatering techniques (open pumping from properly constructed sumps and/or ditches). Provision for trench plugging should be considered in the tender documents in order to address the potential influx of water should adjacent utility bedding be contacted. A Permit to Take Water (PTTW) is not anticipated to be required for this project.

It is important to note that the groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary locally due to seasonal fluctuations, groundwater regimes encountered at the site or as a consequence of construction activities on the site or adjacent sites.

3 LABORATORY TESTING RESULTS

In Englobe laboratory, the moisture content testing was carried out on all recovered granular base/subbase and subgrade soil samples. Seven (7) sieve analysis tests were conducted on selected samples of the recovered granular base/subbase materials and compared to TS 1010 Granular A specifications. One (1) of the seven (7) samples tested met the TS 1010 Granular A specifications. In addition, nine (9) subgrade soil samples were tested for hydrometer analyses. A summary of the sieve analysis and hydrometer results is provided in Table 2 and Table 3 respectively. The complete laboratory testing for moisture content is provided in Appendix 2 and the hydrometer analysis and sieve analysis results are provided in Appendix 5.

Table 2 Summary of Sieve Analysis Testing Results on Granular Materials

Sample	TS 1010 Granular A
BH1–AS1	Meets TS 1010 requirements
BH5– AS1	Excessive material passing several sieves (11% passing 0.075 mm sieve, 44% passing 1.18 mm, 73.3% passing 4.75 mm, 88.4% passing 9.5 mm, and 90.6% passing 13.2 mm)
BH13–AS1	Excessive material passing several sieves (12.8% passing 0.075 mm sieve, 25.7% passing 0.30 mm sieve, 40.9% passing 1.18 mm, 59.8% passing 4.75 mm, 74% passing 9.5 mm, and 90.8% passing 26.5 mm)
BH14–AS1	Excessive material passing several sieves (11% passing 0.075 mm sieve and 24.1% passing 0.30 mm sieve)
BH16–AS1	Excessive material passing several sieves (11% passing 0.075 mm sieve and 22.7% passing 0.30 mm sieve)
BH19–AS1	Excessive material passing a sieve (92.4% passing 26.5 mm)
BH22–AS1	Excessive material passing several sieves (23.4% passing 0.075 mm sieve, 55.4% passing 0.30 mm sieve, 85.5% passing 1.18 mm, 89.6% passing 4.75 mm, 91.9% passing 9.5 mm, and 92.3% passing 13.2 mm)

Table 3 Summary of Hydrometer Testing Results

Sample	Description	Gravel %	Sand %	Silt %	Clay %
BH1–AS2	Gravelly Sand, some Silt, trace clay	29.4	54.5	12.6	3.5
BH3–AS2	Sand, some Gravel, some Silt trace Gravel	18.0	59.0	16.9	6.1
BH12–AS2	Sand, trace Gravel, trace Silt, trace Clay	7.4	84.4	7.4	0.8
BH14–AS2	Sand, some Gravel, some Silt, some Clay	13.7	62.4	13.1	10.8
BH16-AS2	Silty Sand, some Gravel, trace Clay	11.3	58.4	22.0	8.3
BH19-AS2	Silty Sand, trace Gravel, trace Clay	5.9	49.3	35.7	9.1
BH21-AS2	Sandy Silt, some Gravel, trace Clay	6.9	36.3	54.6	2.2
BH26-SS4	Silty Clay, some Sand	-	2.6	26.7	70.7
BH30-AS2	Gravelly Sand, trace Silt, trace Clay	22.3	69.7	5.7	2.3

4 ENVIRONMENTAL TESTING RESULTS

Sixty-two (62) subsoil samples were selected by Englobe and submitted to Eurofins for environmental analysis in accordance with Ontario Regulation 153/04 (as amended by Ontario Regulation 511/09) for Metals and Inorganics environmental analysis. The bulk analysis results were then compared with O.Reg.153/04 Table 3 Residential/Parkland criteria, as amended by O.Reg. 511/09 (Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for Residential/Parkland/Institutional Property Use). In addition, twenty (20) selected soil samples were submitted to Eurofins for environmental analysis in accordance with Ontario Regulation 347 (as amended by O.Reg.558/00), TCLP Leachate Extraction Procedures, Metals and Inorganics and VOC for classification for disposal purposes. Each soil samples obtained from BH23 was combined to conduct an individual O.Reg.558 test at this borehole locations; similarly, this was done from BH24 to BH29. The TCLP sample results were compared with Ontario Regulation 347 (as amended by O.Reg.558/00) Schedule 4 criteria (Leachate Quality Criteria).

None of the soil samples which were extracted from the boreholes exhibited any visible or olfactory evidence of chemical contamination.

A summary of the submitted samples and respective tests is provided in Table 4, with the parameters exceeding O.Reg.153/04 standards indicated. Table 4 indicates that fifty-six (56) of the sixty-two (62) soil samples tested exceeded the applicable MECP Standards for one or more of the following parameters: Electrical Conductivity and/or Sodium Absorption Ratio. The results did not indicate any exceedances in the other O.Reg.153/04 parameter tested for the other borehole samples. The elevated values can likely be attributed to the use of road salt on the roadway pavement structure. There were no exceedances of Schedule 4 Leachate Quality criteria and as such, any excess materials generated at the site would be classified as non-registrable and non-hazardous, for disposal purposes.

Table 4 Summary of Environmental Analysis

Soil Sample	Laboratory Analysis			Results	
	O.REG.153/04	O.REG.558/00		Exceedances for O.Reg. 153/04 (Table 3 – RPI/ICC Property Use)	Exceedances for O.Reg. 347 (Schedule 4)
	Metals and Inorganics	Metals and Inorganics	TCLP, VOC		
BH1-AS1	✓	-	-	EC, SAR	-
BH1-AS2	✓	✓	✓	EC, SAR	-
BH2-AS1	✓	-	-	EC, SAR	-
BH3-AS1	✓	-	-	EC, SAR	-
BH3-AS2	✓	✓	✓	EC, SAR	-
BH5-AS1	✓	-	-	EC, SAR	-
BH5-AS2	✓	✓	✓	EC, SAR	-
BH6-AS1	✓	-	-	EC, SAR	-
BH7-AS1	✓	-	-	EC, SAR	-
BH8-AS1	✓	-	-	SAR	-
BH8-AS2	✓	✓	✓	SAR	-
BH9-AS1	✓	✓	✓	-	-
BH10-AS1	✓	-	-	EC, SAR	-
BH11-AS1	✓	-	-	EC, SAR	-
BH11-AS2	✓	✓	✓	EC, SAR	-
BH12-AS1	✓	-	-	EC, SAR	-
BH12-AS2	✓	✓	✓	EC, SAR	-
BH13-AS1	✓	-	-	EC, SAR	-
BH13-AS2	✓	✓	✓	SAR	-
BH14-AS1	✓	-	-	SAR	-
BH14-AS2	✓	✓	✓	SAR	-
BH15-AS1	✓	-	-	SAR	-
BH15-AS2	-	✓	✓	-	-
BH18-AS1	✓	-	-	EC, SAR	-
BH18-AS2	✓	✓	✓	EC, SAR	-
BH21-AS1	✓	-	-	EC, SAR	-
BH22-AS1	✓	-	-	EC, SAR	-
BH22-AS2	✓	✓	✓	EC, SAR	-
BH23	✓	✓	✓	-	-
BH23-AS1	✓	-	-	-	-
BH23-AS6	✓	-	-	EC, SAR	-
BH23-SS2	✓	-	-	EC	-

Soil Sample	Laboratory Analysis			Results	
	O.REG.153/04	O.REG.558/00		Exceedances for O.Reg. 153/04 (Table 3 – RPI/ICC Property Use)	Exceedances for O.Reg. 347 (Schedule 4)
	Metals and Inorganics	Metals and Inorganics	TCLP, VOC		
BH23-SS3	✓	-	-	EC, SAR	-
BH23-SS4	✓	-	-	EC, SAR	-
BH23-SS5	✓	-	-	EC, SAR	-
BH24	✓	✓	✓	EC, SAR	-
BH24-SS5	✓	-	-	EC, SAR	-
BH24-SS6	✓	-	-	EC, SAR	-
BH25		✓	✓	-	
BH25-SS2	✓	-	-	EC, SAR	-
BH25-SS3	✓	-	-	EC, SAR	-
BH26		✓	✓	-	
BH26-SS2	✓	-	-	EC, SAR	-
BH26-SS3	✓	-	-	EC, SAR	-
BH26-SS4	✓	-	-	EC	-
BH26-SS5	✓	-	-	EC	-
BH26-SS6	✓	-	-	EC	-
BH27	✓	✓	✓	EC, SAR	-
BH27-AS1	✓	-	-	EC, SAR	-
BH27-SS2	✓	-	-	EC, SAR	-
BH27-SS3	✓	-	-	EC, SAR	-
BH27-SS4	✓	-	-	EC, SAR	-
BH27-SS5	✓	-	-	EC, SAR	-
BH27-SS6	✓	-	-	-	-
BH28		✓	✓	-	
BH28-SS5	✓	-	-	SAR	-
BH28-SS6	✓	-	-	EC, SAR	-
BH29	✓	✓	✓	EC	-
BH29-SS1	✓	-	-	SAR	-
BH29-SS2	✓	-	-	EC, SAR	-
BH29-SS3	✓	-	-	EC, SAR	-
BH29-SS4	✓	-	-	EC, SAR	-
BH29-SS5	✓	-	-	EC	-
BH29-SS6	✓	-	-	EC	-
BH29-SS7	✓	-	-	-	-

Soil Sample	Laboratory Analysis			Results	
	O.REG.153/04	O.REG.558/00		Exceedances for O.Reg. 153/04 (Table 3 – RPI/ICC Property Use)	Exceedances for O.Reg. 347 (Schedule 4)
	Metals and Inorganics	Metals and Inorganics	TCLP, VOC		
BH29-SS8	✓	-	-	-	-
BH30-AS1	✓	-	-	-	-
BH30-AS2	✓	✓	✓	-	-
BH32-AS1	✓	-	-	EC, SAR	-

The complete environmental analysis results, including the Eurofins Certificate of Analysis are given in Appendix 6.

5 SOIL MANAGEMENT PLAN

Every effort should be made during construction to reuse excavated soil material and minimize off-site disposal of soil. At the project site there is no adequate space for stockpiling of excavated materials. Therefore, a temporary storage facility will be required for the duration of the project to permit the reuse of the native material.

There were no exceedances of Schedule 4 Leachate Quality criteria, hence, no additional sampling is required for native material requiring off-site disposal at a MOECC licensed landfill facility. However, if any fill material is encountered that differs from the soil types identified in Section 4, additional samples for leachate testing may be required prior to landfill disposal. For the purpose of a soil management plan, Englobe assumes that the soil will be disposed of at a MOECC licensed landfill. As such, for off-site soil management decisions, the following MOECC standards and guidance documents are applicable: Schedule IV Leachate Quality Criteria, Ontario Regulation (O.Reg.) 558/00, General Waste Management, as amended.

The sampling and testing program should be considered as an environmental screening to determine if there are any general impacts along the project site. During construction, supplemental soil testing will be required in order to meet the number of tests required in O.Reg. 406.

6 STEEL SLAG AGGREGATE RESULTS

The asphalt concrete cores were visually examined for the presence of steel slag aggregates in the existing asphalt concrete samples. Steel slag aggregate were not observed in any of the asphalt concrete core samples. The complete steel slag aggregate results are provided in Appendix 7.

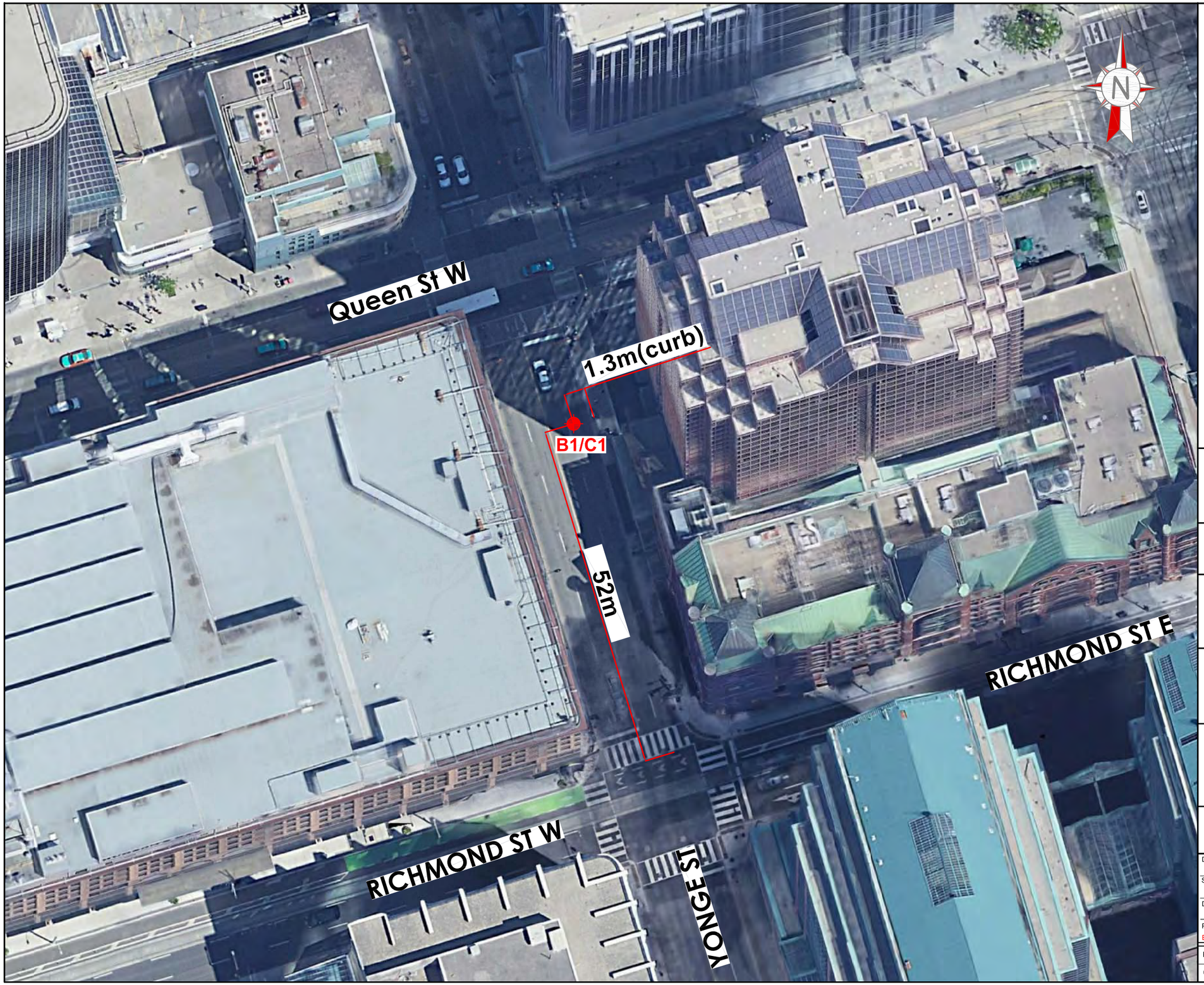
7 ASBESTOS FIBRE TESTING RESULTS

A total of sixteen (16) asphalt concrete cores were tested to determine if asbestos fibres were present in the existing asphalt concrete. For each core, one extraction was carried out on a composite of all of lifts to allow a visual examination of the retained material from any of the composite core samples. There were no asbestos fibres detected in any of the cores examined. The asbestos testing results are provided in Appendix 7.

8 GENERAL COMMENTS

The comments provided in this report have been developed to be used by SGD and the City of Toronto. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions between boreholes. Contractors bidding on, or undertaking the works, must conduct their own investigations, and interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

Appendix 1 Borehole and Core Location Drawings



Legend:

BOREHOLE/CORE LOCATION

Seal

Client

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Project

GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION
YONGE STREET - TORONTO, ONTARIO
From Richmond Street to Davenport Road

BOREHOLE AND CORE LOCATION PLAN

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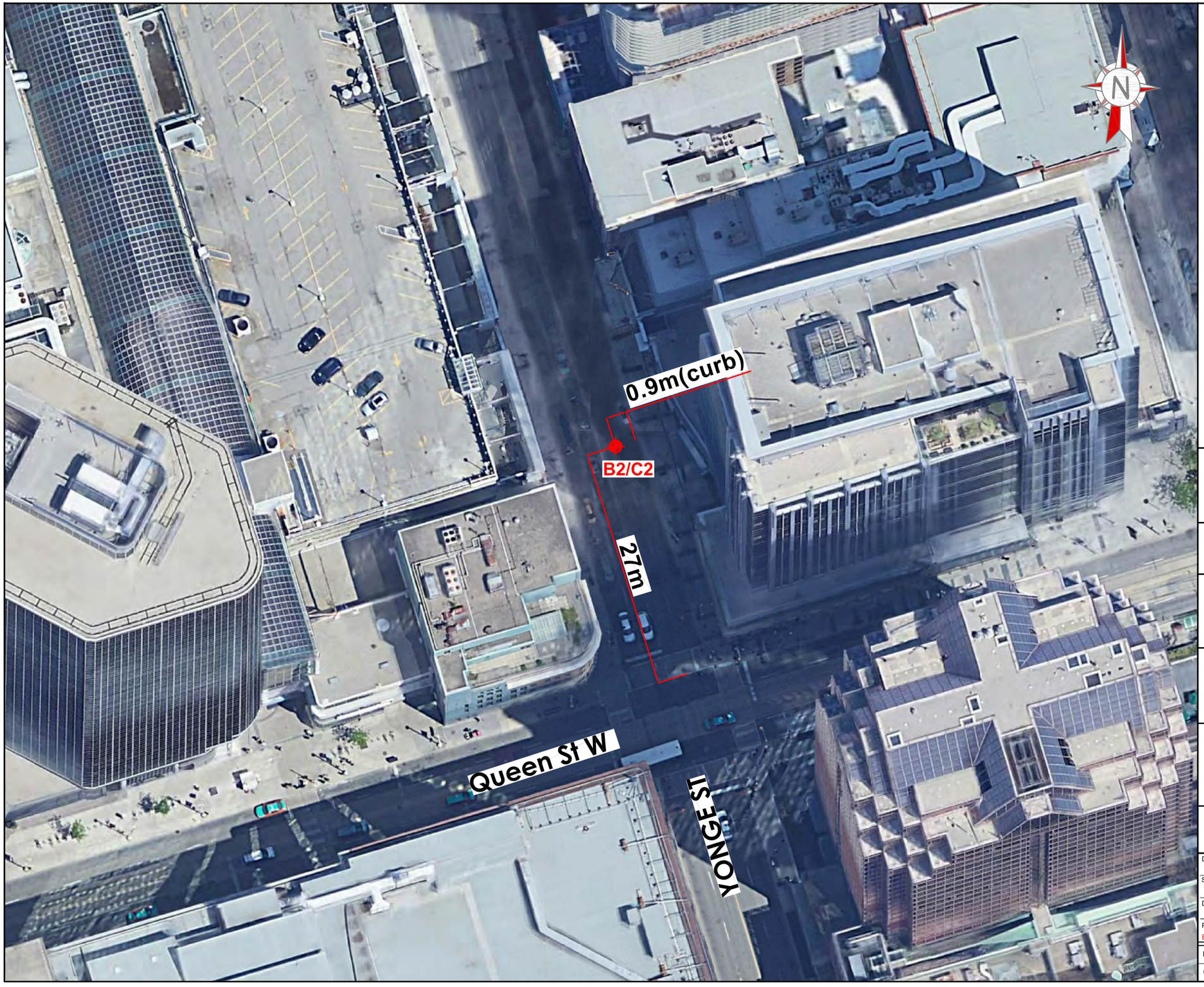

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BOREHOLE/CORE LOCATION

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
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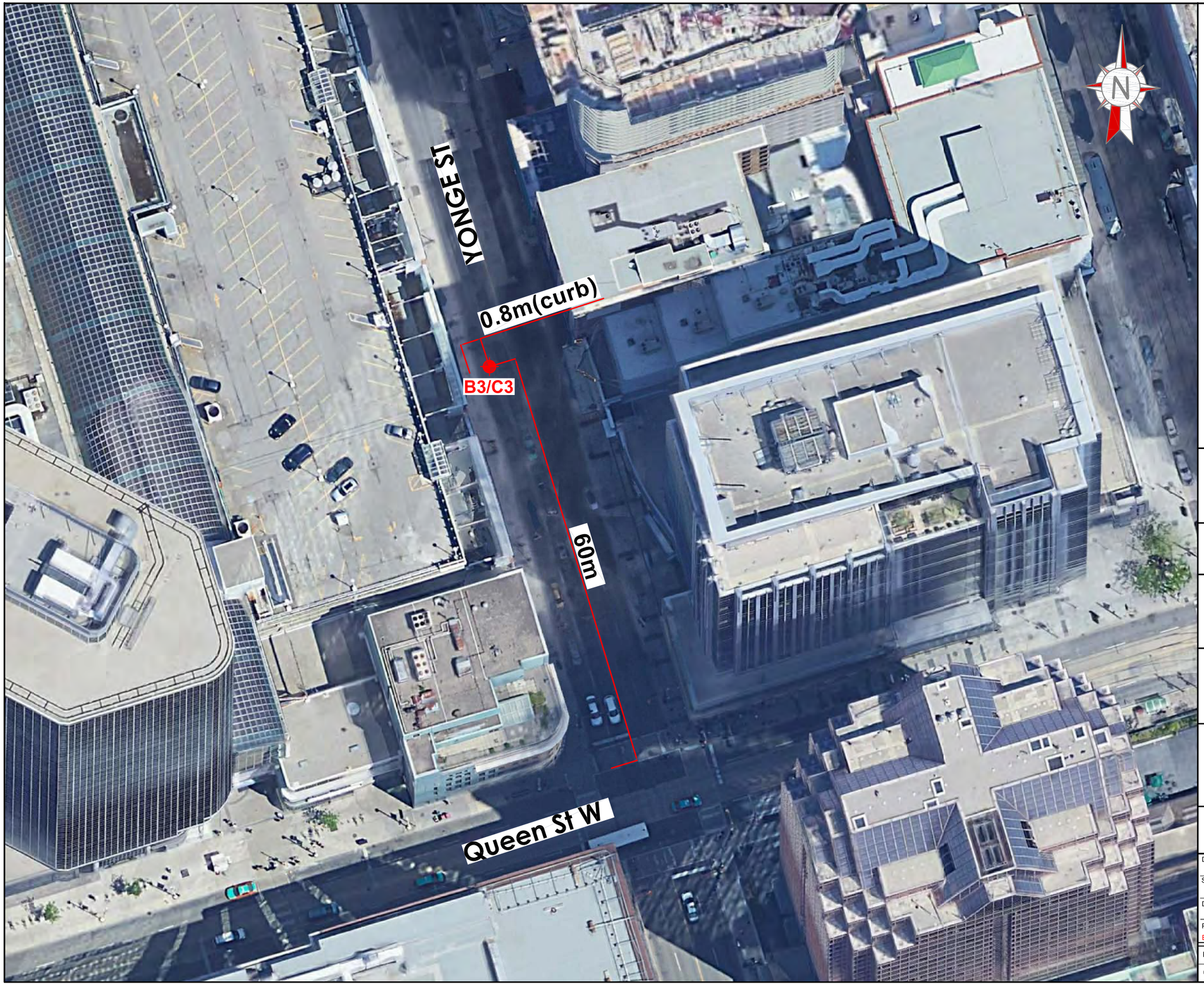

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BOREHOLE/CORE LOCATION

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
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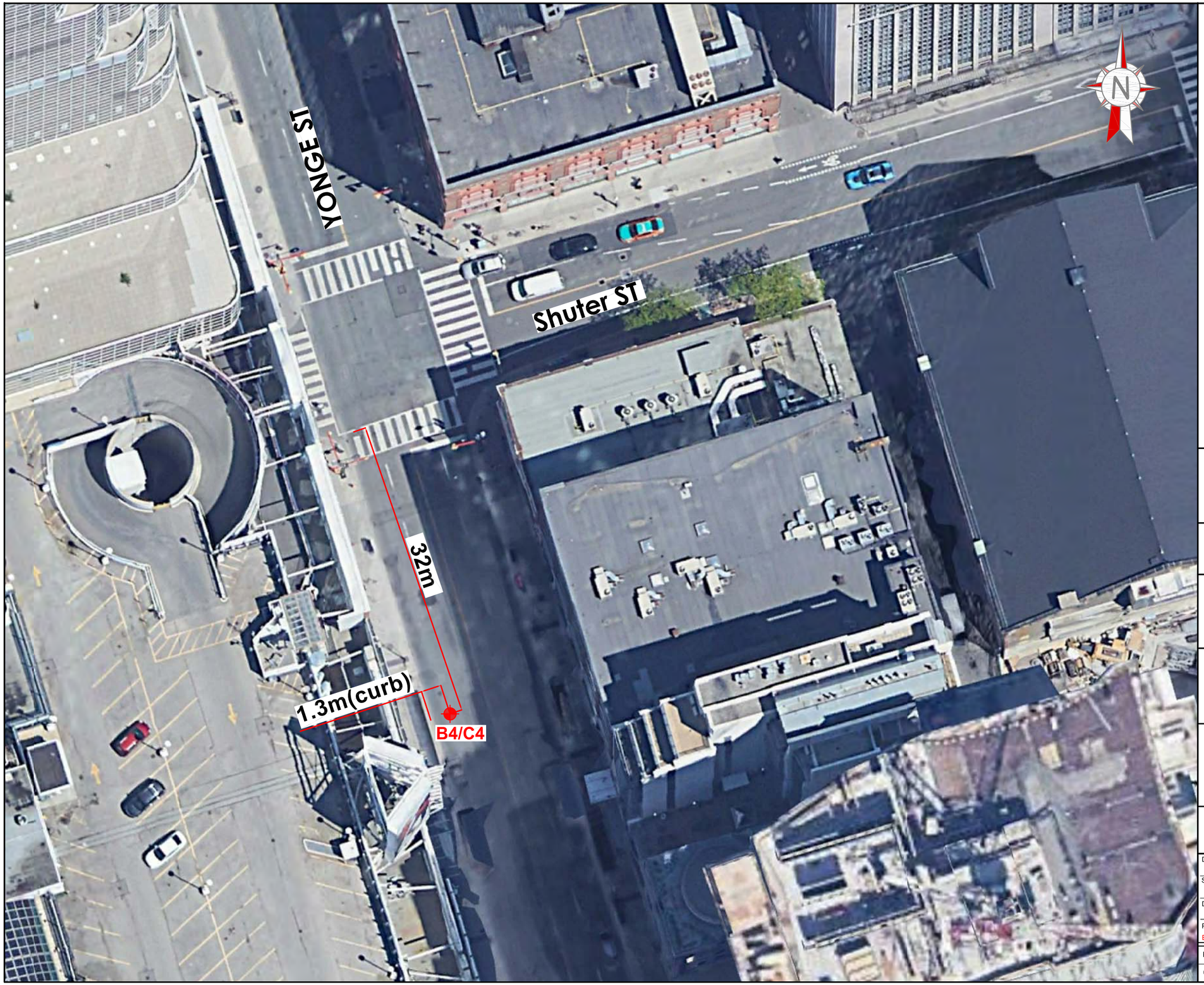

Legend:

BOREHOLE/CORE LOCATION

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Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
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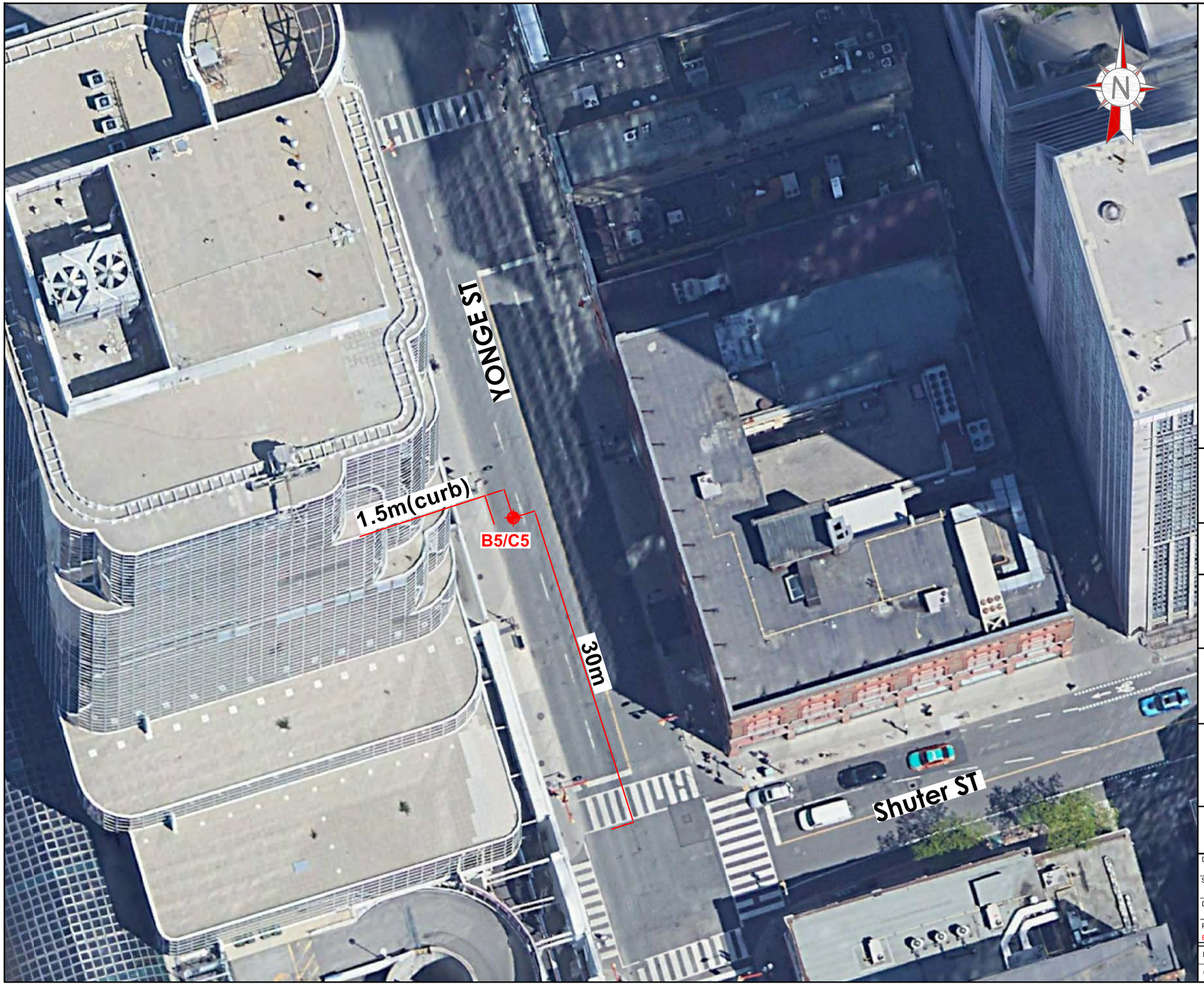

Legend:

BOREHOLE/CORE LOCATION

Seal

Client

STEER DAVIES GLEAVE NORTH AMERICA

Englobe

Englobe Corp.
1821, Albion Road, Unit 7
Toronto (Ontario) M9W 5W8
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Project

GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION
YONGE STREET - TORONTO, ONTARIO
From Richmond Street to Davenport Road

BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 05 of 31	
Page setup: BH5 - C5	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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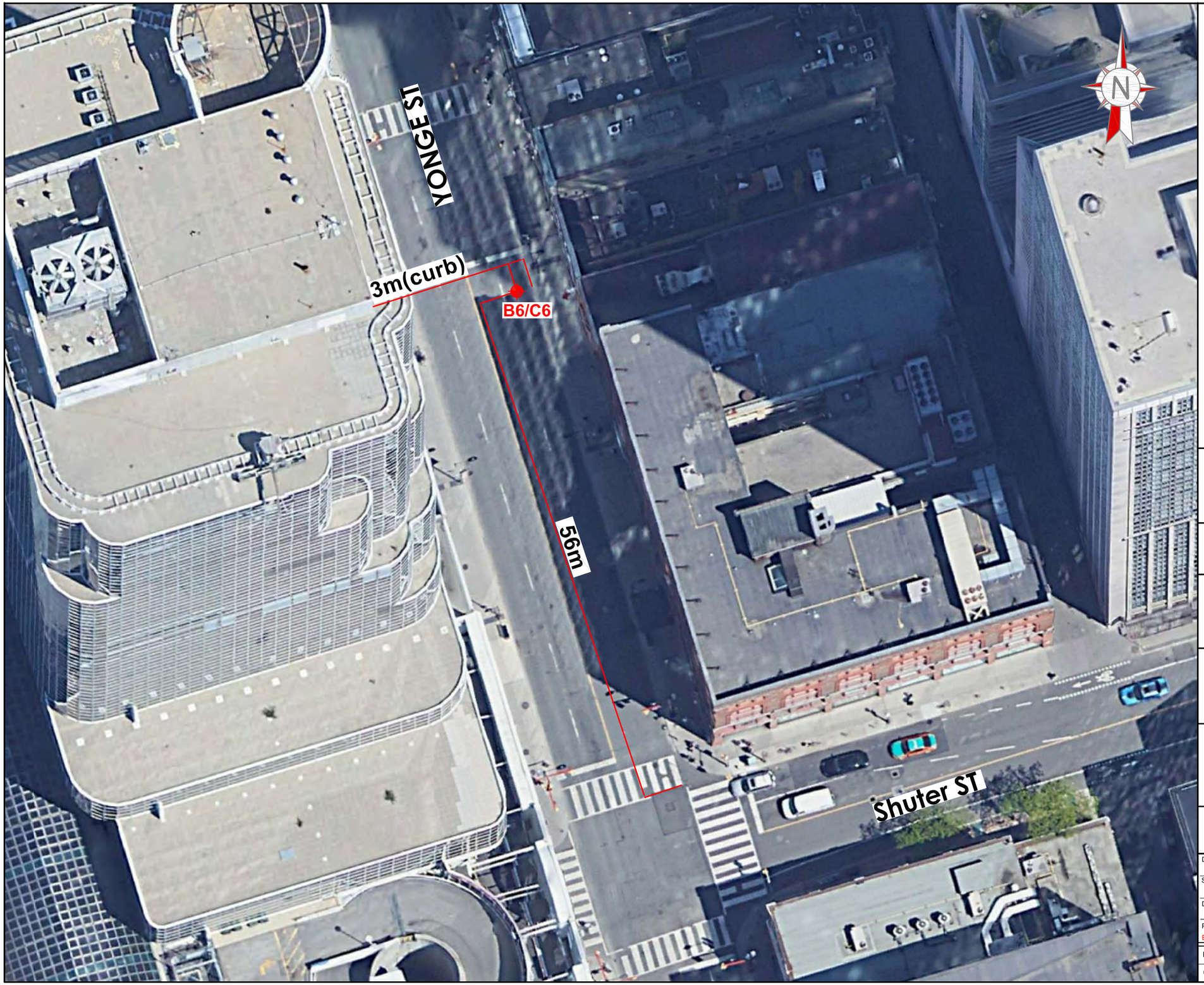

Legend:

BOREHOLE/CORE LOCATION

Seal

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YONGE STREET - TORONTO, ONTARIO
From Richmond Street to Davenport Road

BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 06 of 31	
Page setup: BH6 - C6	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

Resp.	Projet	OTP	Projet/ Disc	Phase/ Type	Réf. élec. / No.Dessin	Rév.
01	P0013610.201		GS	R	01	00

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YONGE STREET - TORONTO, ONTARIO
From Richmond Street to Davenport Road

BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 07 of 31	
Page setup: BH7 - C7	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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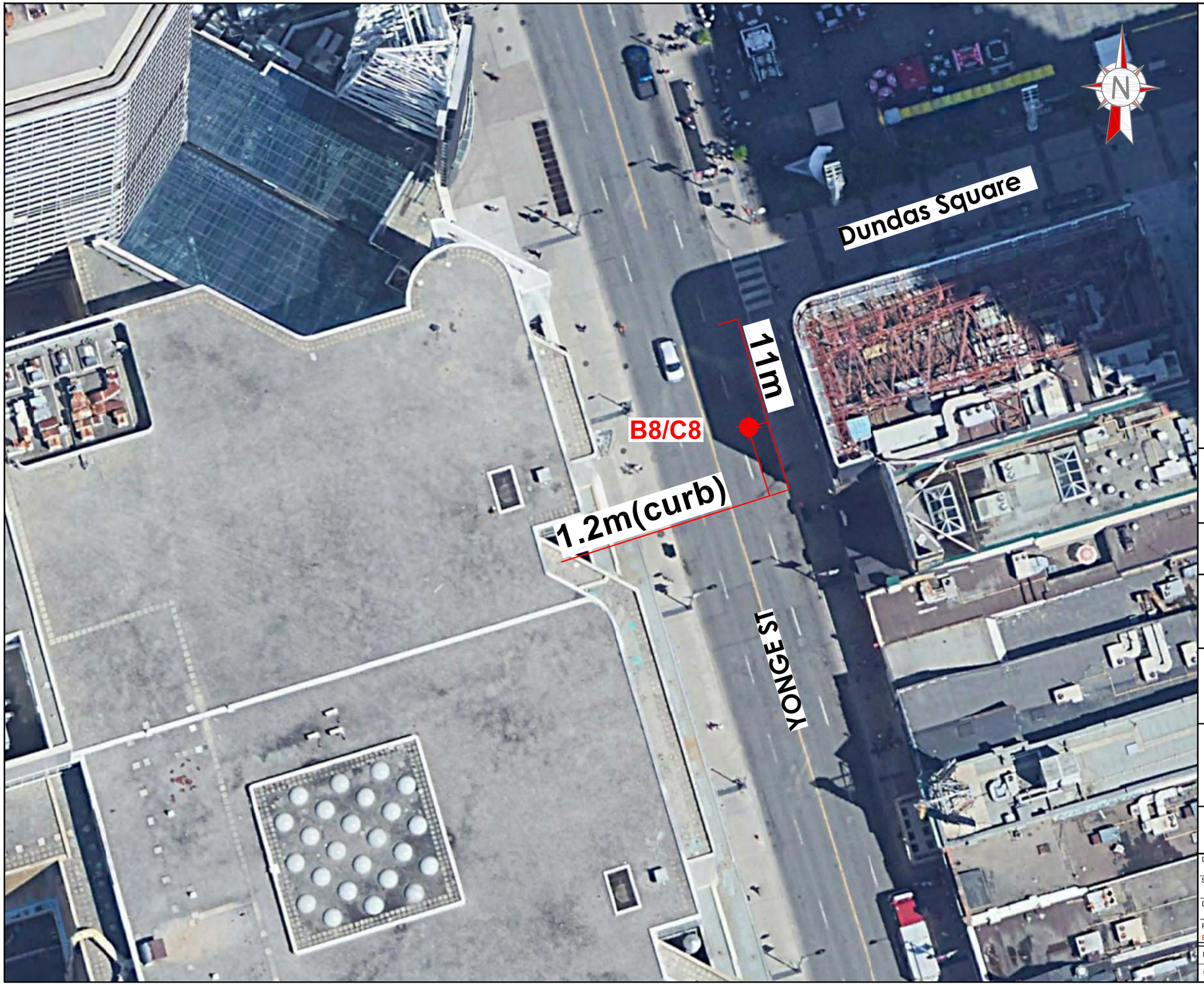

Legend:

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From Richmond Street to Davenport Road

BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 08 of 31	
Page setup: BH8 - C8	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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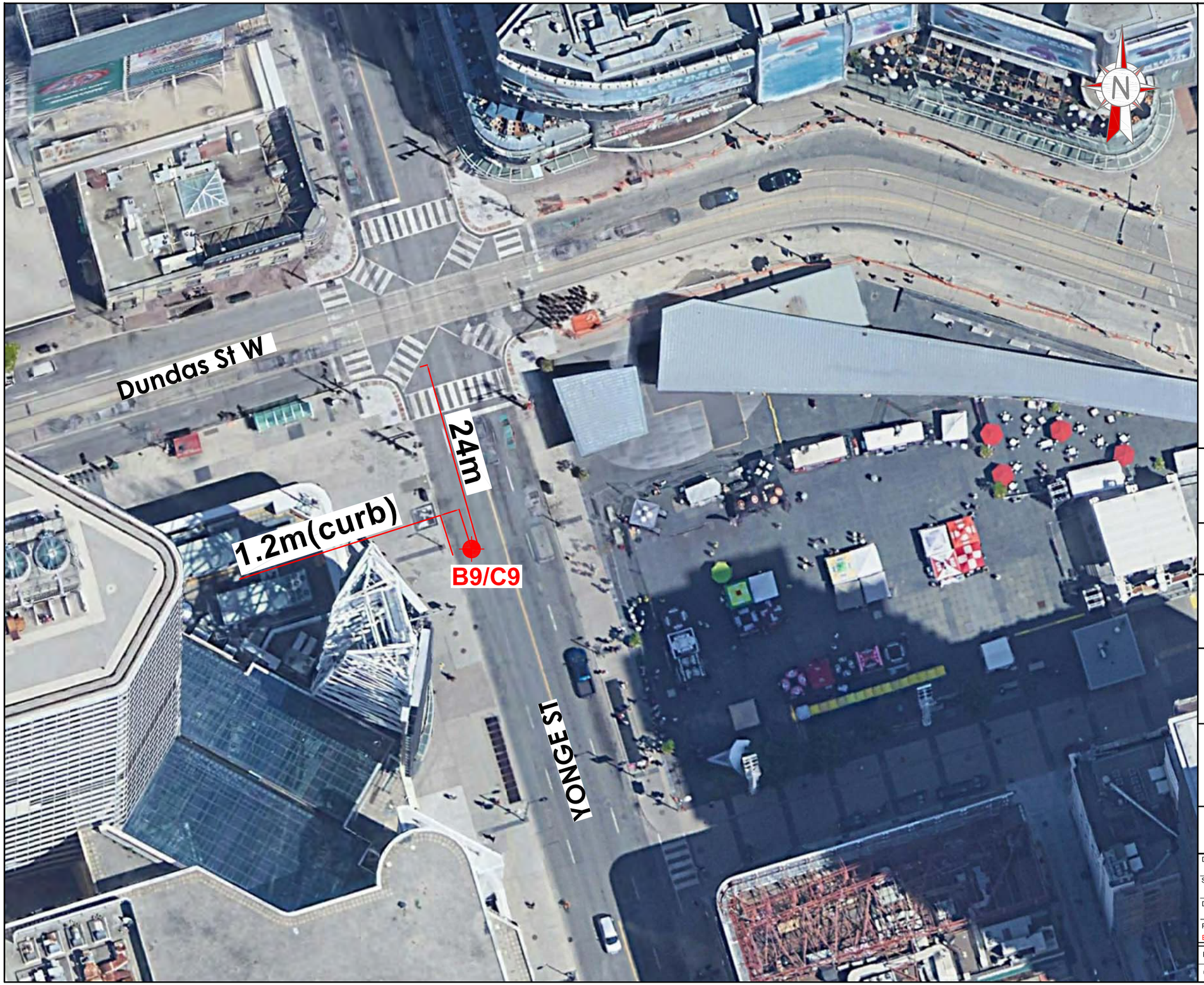

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 09 of 31	
Page setup: BH9 - C9	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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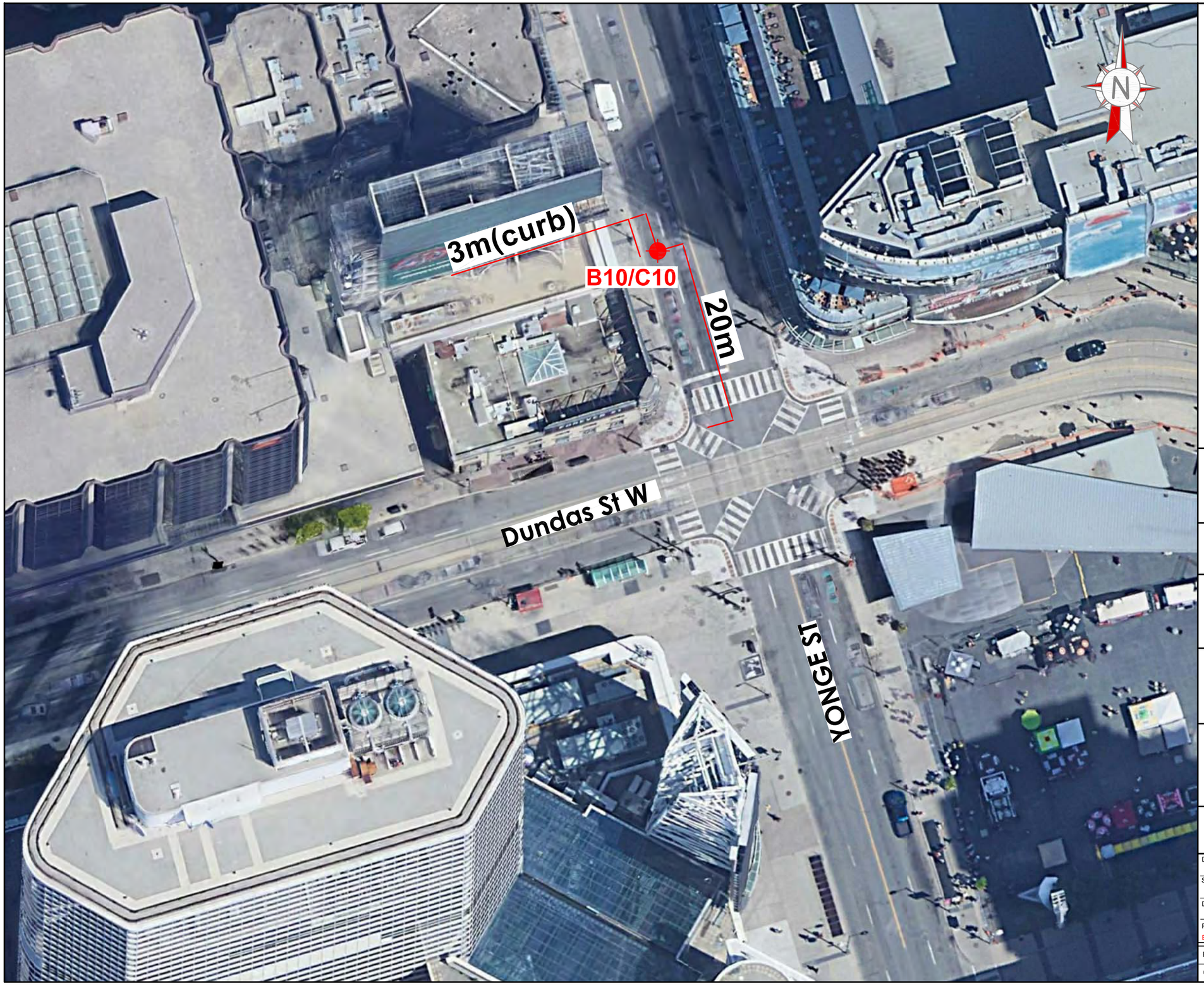

Legend:

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From Richmond Street to Davenport Road

BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 10 of 31	
Page setup: BH10 - C10	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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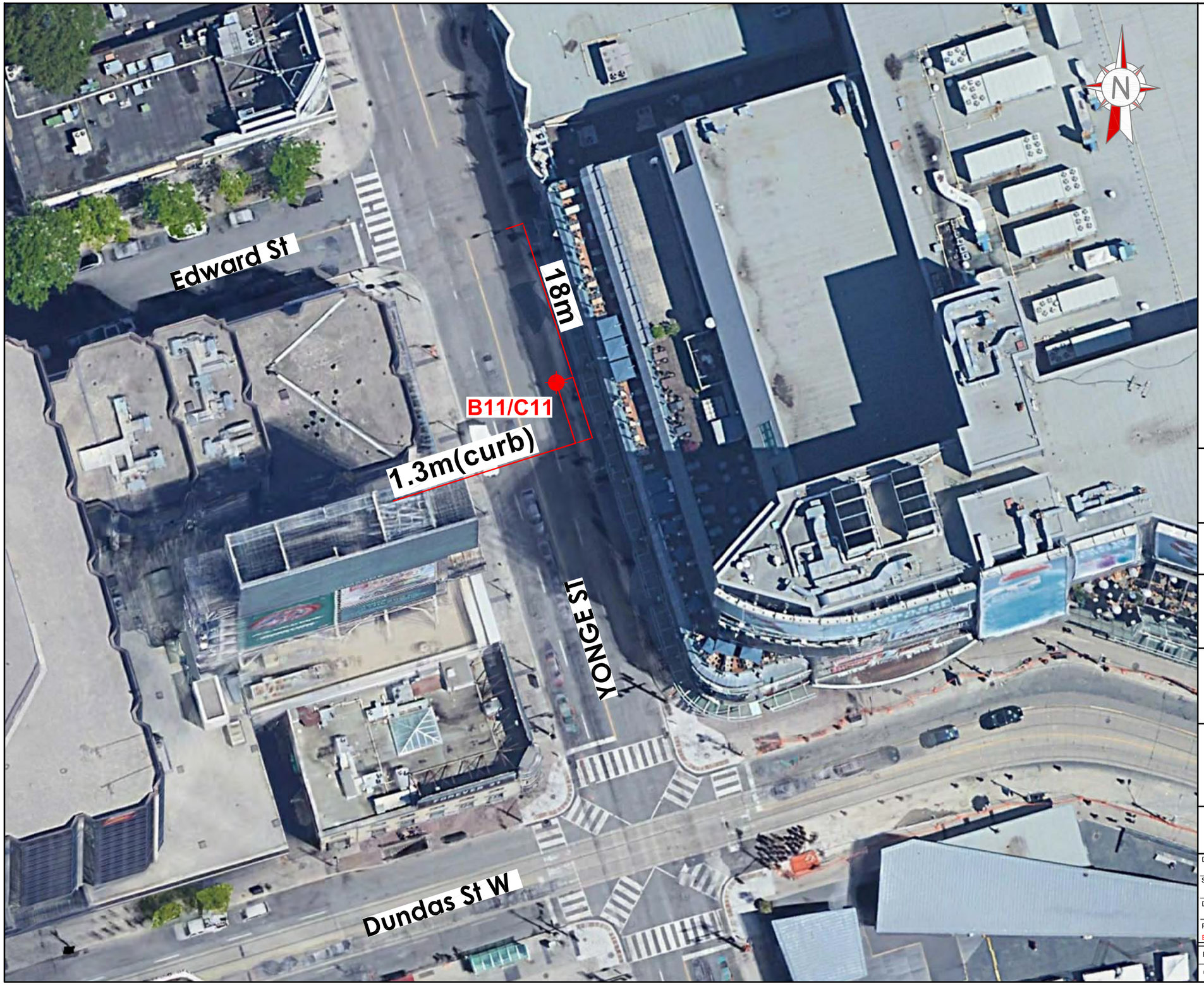

Legend:

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 11 of 31	
Page setup: BH11 - C11	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

Resp.	Projet	OTP	Projet/ Disc	Phase/ Type	Réf. élec. / No.Dessin	Rév.
01	P0013610.201		GS	R	01	00

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 12 of 31	
Page setup: BH12 - C12	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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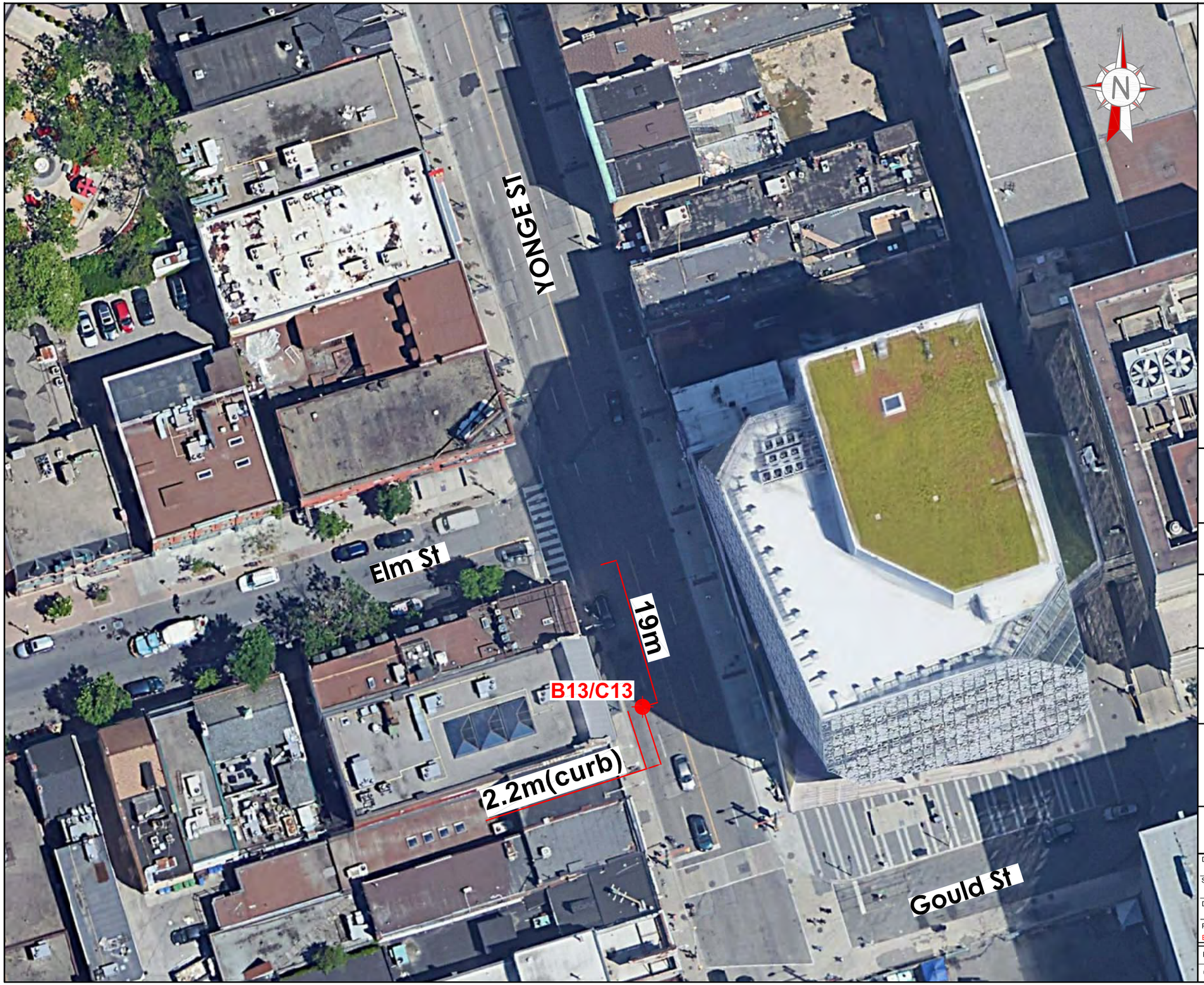

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Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 13 of 31	
Page setup: BH13 - C13	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

Resp.	Projet	OTP	Projet/ Disc	Phase/ Type	Réf. élec. / No.Dessin	Rév.
01	P0013610.201		GS	R	01	00

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 14 of 31	
Page setup: BH14 - C14	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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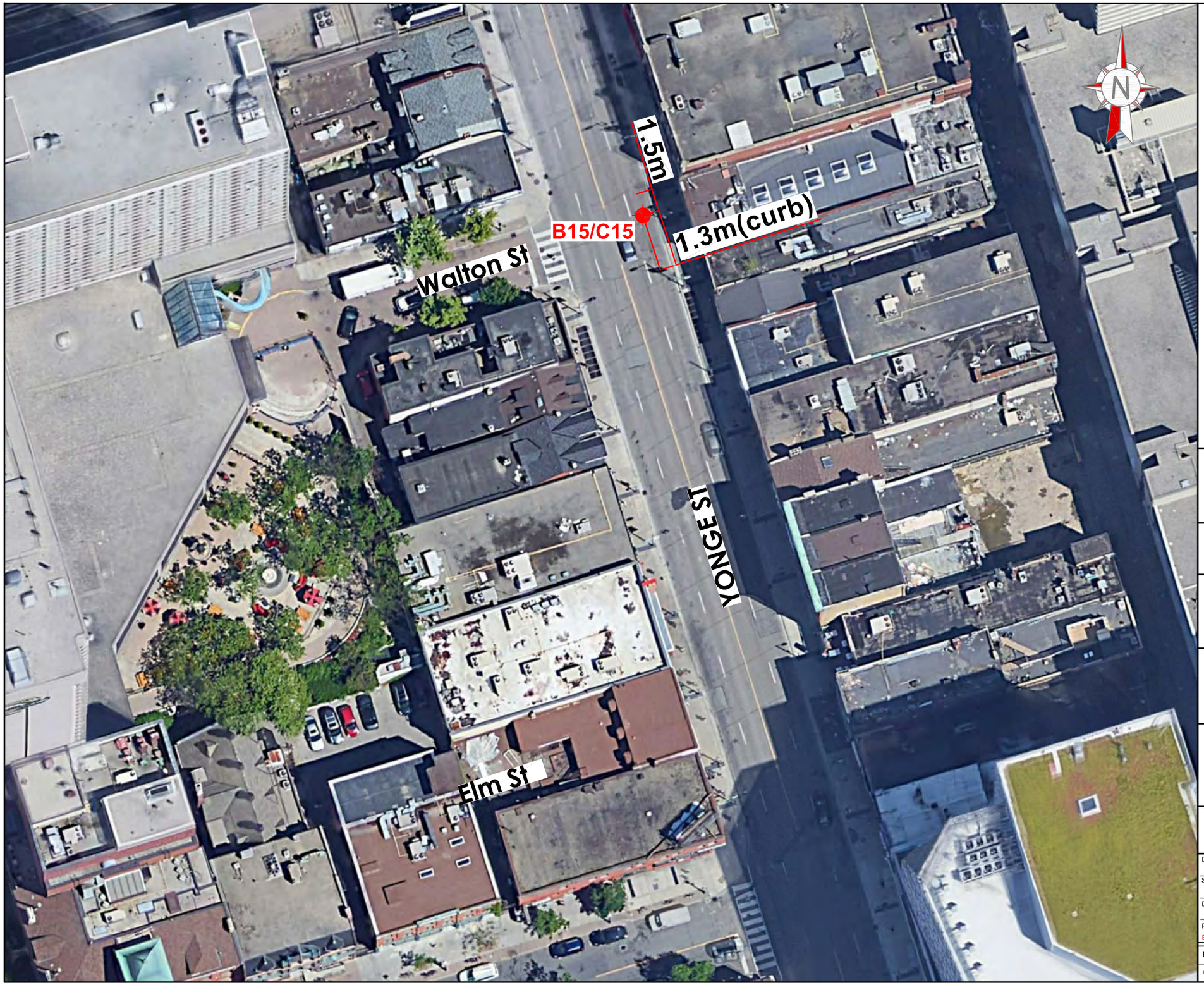

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 15 of 31	
Page setup: BH15 - C15	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

Resp.	Projet	OTP	Projet/ Disc	Phase/ Type	Réf. élec. / No.Dessin	Rév.
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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 16 of 31	
Page setup: BH16 -C16	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

Resp.	Projet	OTP	Projet/ Disc	Phase/ Type	Réf. élec. / No.Dessin	Rév.
01	P0013610.201		GS	R	01	00

Legend:

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BOREHOLE AND CORE LOCATION PLAN

Discipline: GEOSCIENCES		Prepared by: A. Al-absi	Verified by: S. Ganesh
Scale: No Scale		Drawned by: A. Al-absi	Approved by: A. Dudos
Date: 2020/11/27		Figure n°: 17 of 31	
Page setup: BH17 - C17	Paper format: ANSI full bleed B (17.00 x 11.00 Inches)	Register n°:	

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